



September 14, 2021

Via E-filing

Ms. Lisa Felice
Michigan Public Service Commission
7109 W. Saginaw Hwy.
P. O. Box 30221
Lansing, MI 48909

RE: MPSC Case No. U-20763

Dear Ms. Felice:

The following are attached for paperless electronic filing:

- Direct Testimony and Exhibits of Dr. Karen M. Alofs on behalf of Bay Mills Indian Community
- Proof of Service

Sincerely,

Christopher R. Clark
cclark@earthjustice.org

STATE OF MICHIGAN
BEFORE THE MICHIGAN PUBLIC SERVICE COMMISSION

In the matter of the Application of Enbridge
Energy, Limited Partnership for Authority to U-20763
Replace and Relocate the Segment of Line 5
Crossing the Straits of Mackinac into a Tunnel ALJ Dennis Mack
Beneath the Straits of Mackinac, if Approval is
Required Pursuant to 1929 PA 16; MCL 483.1
et seq. and Rule 447 of the Michigan Public
Service Commission's Rules of Practice and
Procedure, R. 792.10447, or the Grant of other
Appropriate Relief

TESTIMONY OF DR. KAREN M. ALOFS
ON BEHALF OF
BAY MILLS INDIAN COMMUNITY

September 14, 2021

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I. INTRODUCTION & QUALIFICATIONS

Q. Please state for the record your name, job title, and business address.

A. My name is Karen M. Alofs. I am an Assistant Professor in the School for Environment and Sustainability at the University of Michigan, located at 440 Church St. Ann Arbor, MI.

Q. On whose behalf is this testimony being offered?

A. I am testifying on behalf of Bay Mills Indian Community (“BMC”). This testimony contains my independent scientific opinion based on my review of the relevant scientific literature and my research expertise. It is being provided in my individual capacity and not on behalf of my employer.

Q. Please summarize your work experience and educational background.

A. I have worked for the University of Michigan in my current position as Assistant Professor since 2018. Prior to this I was a Postdoctoral Researcher at the University of Toronto. I completed my Ph.D. in Ecology, Evolution and Behavior at the University of Texas at Austin (2010) and my AB in Biology at the University of Chicago (2002). My work experience is summarized in my CV, provided as Exhibit BMC-8.

Q. Please describe the focus of your academic research.

A. My research focuses on the impacts of environmental change on freshwater biodiversity, primarily in fish communities. I study the impacts of climate change, invasive species and habitat degradation. One of my lab’s focuses, right now, is understanding how temperature impacts juvenile walleye physiology (including growth, metabolism, tissue composition) and whether these impacts are different across populations or for fish reared at different

1 temperatures. A second focus is on understanding how temperature impacts the distribution
2 and abundance of fish species in inland lakes. This research involves examining historical
3 lake survey records and building statistical models to relate fish distributions to
4 temperature and other habitat and management factors.

5 **Q. Have you testified before this Commission or as an expert in any other proceeding?**

6 A. No. I have not previously testified before this Commission or as an expert in any other
7 proceeding.

8 **Q. What is the purpose of your testimony?**

9 A. It is my understanding that, in evaluating a project proposed by Enbridge Energy, the
10 Commission will be considering the potential impacts on climate change. I am testifying
11 on behalf of BMC regarding walleye in the Great Lakes Basin, including their food,
12 spawning, and habitat requirements, how their populations are influenced by climate
13 change and the mechanisms that control both observed and predicted impacts of climate
14 change on walleye in inland lakes and the Great Lakes.

15 **Q. What information did you review in preparing your testimony in this case?**

16 A. I am familiar with a lot of literature on the impacts of climate change on fishes and fisheries
17 management in the Great Lakes Region, but I reviewed the cited literature (list included as
18 Exhibit BMC-9) and searched scholarly databases for the most recent research publications
19 on the impact of climate change on walleye in the Great Lakes region.

20 **Q. Are you sponsoring any exhibits?**

21 A. Yes, I am sponsoring the following exhibits:

Exhibit BMC-8: Resume (or CV) of Dr. Karen M. Alofs

Exhibit BMC-9: Literature Cited in Direct Testimony of Dr. Karen M. Alofs.

II. THE EFFECTS OF CLIMATE CHANGE WILL HARM WALLEYE IN INLAND LAKES

Q. What fish species is the focus of your testimony?

A. This testimony focuses on walleye which are a fish that live in freshwater streams and lakes primarily across central North America. Walleye are a coolwater adapted species and their optimal temperature for growth is around 21 °C. As top predators, walleye can impact the structure and function of aquatic ecosystems by controlling productivity from the top down. In inland lakes—here I use this term to refer to lakes in the region that are not Lakes Superior, Michigan, Huron, Erie, and Ontario—managers use walleye predation to control the density and size structure of panfish species (like yellow perch and bluegill) and limit size stunting (Herbst et al. 2021). More recently, walleye have been proposed as a tool for biocontrol to limit populations of smaller non-native invasive fish species like rainbow smelt and round goby. Moreover, walleye are both culturally and economically important. In the Great Lakes Region and beyond, walleye support important recreational, commercial and subsistence fisheries. Walleye are often preferred targets by recreational anglers and tribal communities (McClanahan and Hansen 2005, Schmalz et al. 2011, Tingley et al. 2019) and in Michigan recreational fishing is estimated to contribute roughly 2.3 billion dollars in economic activity (Calantone et al. 2019, MUCC Report).

Q. What do walleye eat?

1 A. Walleye larvae initially feed on zooplankton (small invertebrates from the water column),
2 then switch to benthic (bottom-dwelling) invertebrates and will start eating other fishes
3 opportunistically at around 50 mm and sometimes earlier (Chipps and Graeb 2011). Adults
4 are piscivores, primarily consuming fish but also invertebrates, including crayfish.

5 **Q. Please describe the typical walleye habitat that is present in inland lakes.**

6 A. In inland lakes across the Great Lakes Region, walleye favor large and deep lakes, in cooler
7 climates with relatively short growing seasons, and cool and well-oxygenated surface
8 waters (Lester et al. 2004, Wehrly et al. 2012). In Michigan, these lakes, which include the
9 state's most robust inland walleye fisheries, are primarily in the Upper Peninsula and
10 northern Lower Peninsula (Herbst et al. 2021). Roughly, 26% of walleye populations
11 statewide have consistent natural reproduction to support viable populations and fishing.
12 Smaller and shallower lakes in the northern portion of the state are less likely to support
13 natural walleye reproduction and more likely to favor warmwater species like bluegill and
14 largemouth bass which are potential competitors for food resources and predators of young
15 walleye.

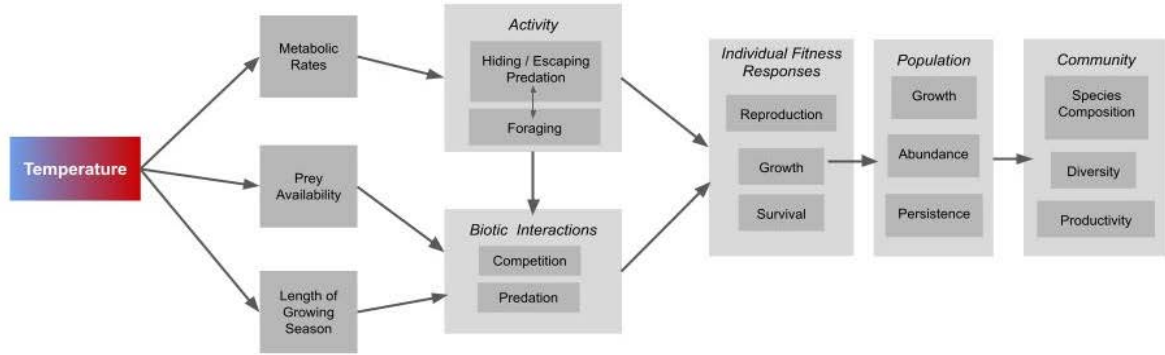
16 **Q. How does temperature impact fish?**

17 A. Temperature controls many biological rates, processes and patterns from biochemical
18 reactions and metabolism to species distributions and ecosystem productivity—because of
19 this, the impacts of climate change on biodiversity are expected to be profound.
20 Temperature changes may be particularly impactful for fish whose body temperatures are
21 directly controlled by the water they inhabit. Over evolutionary time scales, fish species
22 have adapted to specific habitat conditions suitable for each stage of their life; they require

1 appropriate food resources and refuge from predators as young and spawning habitat for
2 reproduction. Water temperature strongly determines the suitability of habitat and at large
3 scales is why some fish species will not survive in northern waters which are too cold or
4 southern waters which are too hot. Fish species vary in the minimum, maximum and
5 optimal temperatures for processes like spawning, egg development, growth and survival.
6 Temperate North American fishes are classified into three thermal guilds; those adapted to
7 warm-, cool- and cold-waters.

8 Scientists have expected that, in North America, climate change might favor warm water
9 adapted species (including bass species) and hinder cool- and cold-water adapted species
10 (including walleye and trout, salmon and whitefish) (e.g. Chu et al. 2005, Van Zuiden et
11 al. 2016). There is already evidence of changes in species growth, abundance and
12 distributions as climate has warmed in recent decades (reviewed in Lynch et al. 2016).
13 Understanding the impacts of climate change on fish species is, however, sometimes
14 complex and context or location dependent. Impacts may vary depending on whether
15 temperatures at individual locations are moving closer to an optima or are overshooting
16 that optima creating thermal-stress and reducing reproduction, growth or survival. Impacts
17 can be magnified by interactions with other environmental factors (like invasive species,
18 food availability, or water clarity) or mediated by the ability of populations to acclimate or
19 relocate.

20 **Figure 1.** This figure, which I created, depicts a few of the mechanisms by which
21 temperature can directly and indirectly impact fish populations and communities.



Q. Please describe how walleye spawn or reproduce.

A. Walleye have relatively narrow spawning habitat requirements. (Schneider et al. 2007). In lakes, adults concentrate on specific shoals of reefs which are from 1 to 4 feet deep with clean rock, cobble, or gravel which will protect eggs and larvae in crevices. Walleye will also migrate into large streams connected to lakes (tributaries), and congregate in specific areas, often below migration barriers like dams.

Walleye reproduction is strongly linked to temperature. Walleye begin to spawn when spring water temperatures reach between 6.7 – 8.9 °C (upper 40s °F); 10.3 °C has been reported as optimal (Bozek et al. 2011). Males reach spawning grounds first and are often more abundant than females which means that the abundance of females can limit a population's reproductive success. Walleye males mature at 2-13 years and females 4-14 years (longer further north). Over a life span of up to thirty years (in northern habitats), female walleye can produce 10,000 to 400,000 eggs each spring and larger females produce more eggs (Bozek et al. 2011).

Q. What factors can limit the sustainability of walleye populations?

1 Walleye reproduction and recruitment (survival from juveniles to adults) is variable across
2 populations and key to maintaining self-sustaining populations which support fisheries. For
3 walleye, and many other fish species, the first year of life is a critical period; on average,
4 one in 10,000 individuals survive from the egg stage to the end of their first year (Bozek et
5 al. 2011). Part of the reason for low survival during this period is that walleye have no
6 parental care, unlike bluegill for example where males will guard nests. In the three weeks
7 before hatching, eggs are vulnerable to weather changes, displacement by waves,
8 smothering by silt and predation (often by white sucker and bluegill; Schneider et al. 2007).

9 Weather conditions and the timing of spring warming are key not only for hatching success
10 but also for growth and survival of fry. The optimal temperature for egg development is
11 13.5 °C with 9-15° C producing greatest hatching success (Bozek et al. 2011). Within a
12 few days of hatching, fry require zooplankton prey of a certain size and type. Temperature
13 and prey availability remain important for walleye growth to juvenile fingerling stage and
14 are thus key to recruitment. Because fish predators of walleye are often limited to small
15 prey by their mouth size, rapid growth is important for survival of young walleye. Overall,
16 even in lakes with ideal physical spawning habitat, climate variability can cause large
17 annual variation in walleye recruitment by both direct (e.g. successful hatching) and
18 indirect mechanisms (e.g. prey availability or predation risk) (Schneider et al. 2007).

19 **Q. What are your primary concerns about climate change and its effects on walleye in**
20 **inland lakes?**

21 **A.** My primary concern is that as climate warms, walleye populations will become less
22 sustainable in the future. As suitable thermal habitat in lakes becomes smaller and less

1 common, these coolwater adapted fishes will be forced to live in temperatures beyond their
2 optimum (limiting growth, survival and reproduction) or populations will disappear.
3 Thermal stress on these fishes can also exacerbate other environmental stressors on walleye
4 populations. Declines in walleye will have impacts on recreational, commercial and
5 subsistence fisheries as well as lake ecosystems.

6 **Q. How has climate change affected walleye in inland lakes?**

7 A. In many northern temperate lakes, as climate has warmed over recent decades, walleye
8 abundance has declined (Hansen et al. 2015, reviewed in Raab et al. 2020). These walleye
9 declines are attributed to failed recruitment of juveniles to adults (Hansen et al. 2015).
10 Inland lake walleye populations are extensively monitored across the ceded territories in
11 northern Wisconsin where the percentage of lakes with self-sustaining, naturally
12 reproducing populations declined from 68% in 1993 to 37% in 2018 (Raab et al. 2020).
13 We are currently examining historical survey data in order to examine the impacts of
14 climate change on walleye across Michigan's inland lakes, where walleye face similar
15 threats.

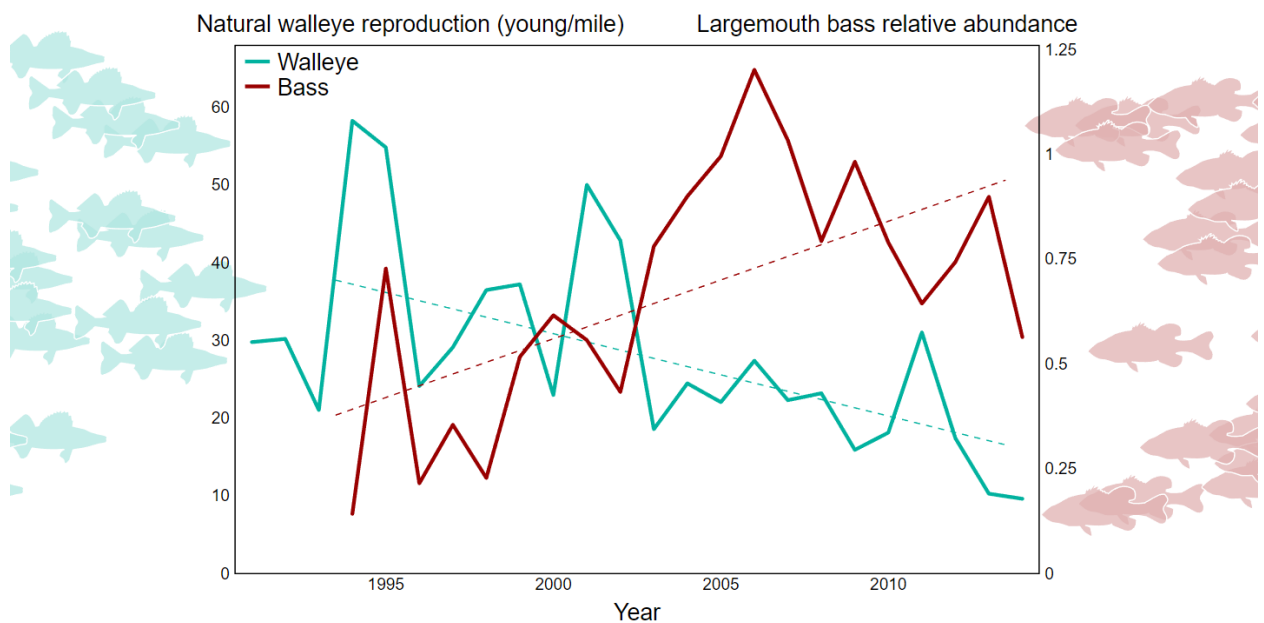
16 In lakes, climate influences fish reproduction, growth and survival through changes in
17 water temperature and ice duration which control productivity, food and habitat
18 availability, competition, and predation (Figure 1, Whitney et al. 2016, Lynch et al. 2016).
19 Globally, lake surface water temperatures have increased an average rate of 0.34 °C per
20 decade, between 1985 and 2009, which is similar to or in excess of air temperature trends
21 (O'Reily et al. 2015). Lakes in the Great Lakes region have warmed more than the global
22 average in this period (O'Reily et al. 2015). Long-term lake ice records from across the

1 Northern hemisphere suggest that lakes are freezing later and thawing earlier, with 19
2 fewer days of ice-coverage per century, and the most important driver of these changes is
3 air temperature (Imrit and Sharma 2021). Declines in inland lake walleye populations are
4 correlated with warming temperatures and declining ice cover, but the specific mechanisms
5 controlling declines are complex and can vary lake to lake. In addition to climate, walleye
6 are also impacted by environmental stressors like shoreline development, nutrient run-off,
7 invasive species, angling pressure, and watershed deforestation (Gutowsky et al. 2019).

8 The impact of climate change on inland lake walleye populations can depend on lake
9 specific contexts like location and interacting environmental factors. In some inland lakes,
10 when temperatures are lower than optimum, slight increases in temperature can increase
11 consumption and benefit growth (Neuheimer et al. 2011, Massie et al. 2021). But where
12 temperature surpasses the optimum, increased metabolic demands and insufficient
13 consumption can slow growth. Environmental factors like habitat quality, water clarity,
14 prey availability and competition can also control the strength of the effects of increasing
15 temperature on walleye. Declines in walleye recruitment are more prevalent in smaller
16 lakes, those with higher water clarity, and where bass abundance has increased (again
17 reviewed in Raab et al. 2020). A recent study of 61 Midwestern lakes suggested that climate
18 warming was more likely to reduce young walleye growth in clear lakes than in turbid lakes
19 (Massie et al. 2020). This may be because heat is trapped closer to the surface in turbid
20 lakes and walleye prefer to feed in shallow waters.

21 Over the last thirty years, and as natural walleye reproduction across hundreds of
22 Wisconsin's inland lakes has declined on average (as describe above), the relative

1 abundance of largemouth bass has increased (Hansen et al. 2017). Long term data indicates
2 that the impacts of climate on walleye recruitment can be mediated by the density of bass
3 (Hansen et al. 2018) which may reduce the survival of juvenile walleye by increasing
4 predation or competition for food resources. The impacts of bass on walleye could be
5 exaggerated by the extension of the ice-free growing season which would favor the
6 warmwater adapted bass (McMeans et al 2020).



7
8 **Figure 2.** Declines in walleye reproduction and increases in largemouth bass relative
9 abundance over 25 years in Wisconsin inland lakes (Hansen et al. 2017, figure from
10 <https://labs.waterdata.usgs.gov/visualizations/climate-change-walleye-bass/index.html>)

11 **Q. How is climate change likely to affect walleye in inland lakes in the future?**

12 A. The continued impact of climate change on walleye will depend on the pace and degree of
13 future changes and whether populations are managed to promote climate-resilience where

1 possible (e.g. improving habitat quality, managing fishing pressure, and supplementing
2 natural reproduction with stocking). Negative trends in walleye recruitment and further
3 population losses are expected under projected climate scenarios. While many recent
4 studies have taken place in Wisconsin and Ontario, walleye in Michigan lakes face similar
5 threats. Our current work with historical surveys will allow us to examine the impacts of
6 climate change on walleye in Michigan's inland lakes and develop related projections.

7 In Midwestern U.S. lakes, warming is expected to increase surface water temperatures by
8 roughly 3 degrees C during ice-free months and to decrease ice duration by approximately
9 24 days/year between 1982-2000 and 2081-2099 (predictions by lake and projection
10 scenarios in Winslow et al. 2017). In inland lakes, climate change is projected to generally
11 reduce the amount of thermally suitable habitat for coolwater adapted walleye, while
12 favoring warmwater adapted fishes, including bass which can compete with walleye for
13 food resources or predate young walleye (Van Zuiden et al. 2016, Hansen et al. 2017).
14 Using lake morphology, water chemistry and climate as predictors, Van Zuiden and
15 colleagues (2016) predicted a 22% decline in occurrence of walleye across Ontario lakes
16 by 2070. They also projected increased co-occurrence of smallmouth bass in Ontario lakes
17 indicating additional pressure on walleye populations. In Wisconsin lakes, Hansen and
18 colleagues (2017) likewise used climate change projections to predict the loss of walleye
19 recruitment in 33–75% over the next few decades in lakes with current natural recruitment
20 and a concurrent increase in number of lakes suitable for high largemouth bass abundance
21 (by 27-60%).

1 **III. CLIMATE CHANGE INDUCED ECOSYSTEM DISRUPTIONS MAY HARM**
2 **WALLEYE IN THE GREAT LAKES.**

3 **Q. Are walleye populations found in the Great Lakes?**

4 A. Yes, walleye are found in all five of the Great Lakes. Resident riverine populations,
5 outside of those directly connected to the Great Lakes, are relatively small and rare across
6 the region. However, rivers connected to the Great Lakes have essential spawning habitat
7 that is seasonally important. Overfishing, pollution, habitat degradation, loss of
8 connectivity to riverine spawning habitat and invasive species have historically contributed
9 to declines in walleye populations across the basin. In recent decades, extensive stocking
10 and restoration efforts (including enhanced fish passage, improved spawning habitat, and
11 increasing water quality) have promoted the development of key self-sustaining stocks. In
12 Lake Michigan, Green Bay supports the most prominent recreational walleye fishery and
13 contributes to tribal subsistence fishing in the 1836 treaty waters (Dembkowski et al. 2018).
14 Green Bay stocks are supported by spawning aggregations in the Fox, Menominee, Oconto,
15 and Peshtigo rivers. In Lake Superior, Black Bay historically supported more than 90% of
16 the lake's commercial walleye fishery but this stock collapsed in 1968 and has not
17 recovered despite a long-term fishing moratorium and stocking efforts (Garner 2013). Two
18 of the most abundant walleye populations are in Lake Huron and Lake Erie (their histories
19 were briefly reviewed in Hayden et al. 2018).

20 Recent recovery in Lake Huron walleye stocks is believed to be in part related to the crash
21 of non-native alewife (predators of walleye fry) in the lake (Johnson et al 2015). In Saginaw
22 Bay, stocking beginning in the 1970s and continuing to 2006 also aided the recovery of
23 walleye populations, which are now supported by natural reproduction and have led to

1 growth in recreational fishing. Recent work has shown that walleye migrate farther than
2 previously expected and fish originating in Saginaw Bay reach as far north as the Straits of
3 Mackinac (Hayden et al. 2014).

4 Walleye fisheries in Lake Erie were closed in 1970 due to declining catch rates and high
5 mercury levels. Recreational fisheries were reopened in 1973 and today there is a large
6 American recreational fishery and Canadian commercial fishery in Lake Erie. Across the
7 lake, walleye abundance in 2010-2015 was estimated to be greater than 20-25 million
8 adults. The rehabilitation of Lake Erie walleye populations has relied on natural
9 reproduction with spawning in stream tributaries and western basin lake reefs and shoals,
10 including large spawning aggregations in the Sandusky, Detroit and Maumee Rivers and
11 nearshore reef complexes (reviewed in Hayden et al. 2018).

12 **Q. What concerns do you have regarding the impact of climate change on walleye in the**
13 **Great Lakes?**

14 A. While walleye in inland lakes appear to be more threatened by climate change than in the
15 Great Lakes themselves, I am concerned that the indirect impacts of climate change on
16 walleye in the Great Lakes are not well understood or difficult to measure or predict.
17 Sustainable fisheries management relies upon accurate predictions of population dynamics
18 for setting catch limits and controlling the spatial distribution of fishing effort. The recovery
19 of walleye stocks in the Great Lakes (outlined above) have relied on substantial restoration
20 and stocking effort. I believe it is time for the management of Great Lakes resources to move
21 from reactive actions (e.g. following population crashes or ecological impairments) to
22 proactive actions with a focus on protection.

1 Walleye are dependent on coolwater habitat. Because the Great Lakes are large,
2 heterogeneous in depth and span roughly seven degrees of latitude, the impacts of climate
3 change on walleye in the Great Lakes will be variable across locations. In deeper and cooler
4 areas, suitable thermal habitat may expand; for example increasing by five days per decade
5 in Lake Superior from 1979-2006 (Cline et al. 2013). In contrast, shallow and warm waters
6 will become less available to walleye. A recent study demonstrated that in the Western
7 Lake Erie Basin, mean walleye recruitment is projected to be at or above the historical
8 median from 2020-2040, but reduced winter severity would reduce episodes of strong
9 recruitment that keep recreational and commercial fisheries viable (Dippold et al. 2020b).
10 A previous modeling analysis, focused on Lake Erie, demonstrated that temperature
11 increases could lead to declines in river-spawning populations but that projections strongly
12 varied when other conditions like potential changes in discharge were considered (Jones
13 et al. 2006). Overall, as climate continues to warm, patterns of walleye abundance will
14 shift, and harvest will decrease in some locations and increase in others. The sustainability
15 of Great Lakes fisheries will depend on reallocation of harvest quotas and the availability
16 of accurate stock assessments and projections (Dippold et al. 2020a).

17 Climate change can indirectly impact walleye through impacts on food resources. For
18 example, recent research has shown that reduced ice cover impacts zooplankton prey and
19 makes small prey that may be crucial for larval walleye less common (Huddleston 2018).
20 Walleye larvae may also be at increased risk of predation from species like invasive white
21 perch, which is projected to increase in abundance due to climate change and projected
22 decreases in non-point source nutrient pollution in the Western Lake Erie Basin (Dippold
23 et al. 2020b). Warming may also impact food resources for older walleye by limiting

1 coldwater adapted prey fish populations; coldwater adapted rainbow smelt and cisco appear
2 to support faster walleye growth than coolwater adapted yellow perch, and warmwater
3 adapted freshwater drum and white bass.

4 The Great Lakes ecosystems have been strongly impacted by human activities including
5 pollution and nutrient runoff influencing water quality, clarity; dredging and development
6 shrinking spawning habitat and wetland nurseries; and invasive species altering ecosystem
7 and food web-dynamics (Bunnell et al. 2014). In all of the Great Lakes but Erie and
8 Ontario, data from 1998 to 2010 show declines in small fish that serve as prey for adult
9 walleye, lake trout, salmon and other top predators. During this period, Lakes Superior,
10 Michigan and Huron have become clearer with lower phytoplankton biomass, through a
11 process called oligotrophication, which means that these lakes have lower productivity at
12 the base of the food webs. Invasive dreissenid mussels (zebra and quagga mussels) have
13 been implicated as underlying the declines in both phytoplankton and benthic invertebrates
14 (*Diporeia* spp.), while introduced water fleas (e.g. *Bythotrephes*) appear to have driven
15 zooplankton declines (Bunnell et al. 2014). Over recent decades, Lake Erie's western basin
16 has faced repeated harmful algal blooms (*Microcystis* algae) fed by nutrient runoff.
17 Simultaneously, the central basin has had more intense and longer summer stratification
18 depleting dissolved oxygen and contributing to hypoxic zones. Both increased nutrient
19 runoff and decreased oxygen availability can negatively impact fish populations and are
20 expected to be increasingly prevalent with future climate change in the Great Lakes region
21 (Collingsworth et al. 2017). It has been projected that the frequency of high rainfall events
22 in the region could double by 2100 and flashy storm events will increase nutrient runoff
23 and contribute to future algal blooms. In the same period, warmer temperatures are

1 expected to produce longer and more intense stratification and increases in summer
2 hypoxia. Climate change will also likely continue to interact with various stressors in ways
3 that are not yet fully understood and could make Great Lakes fish populations and
4 ecosystems more vulnerable to future disturbances.

5 **Q. Does that complete your testimony?**

6 **A.** Yes.

EXHIBIT BMC-8

KAREN M. ALOFS

CURRICULUM VITAE

kmalofs@umich.edu | <https://sites.google.com/umich.edu/alofs>

PROFESSIONAL APPOINTMENTS

2018- **Assistant Professor**, School for Environment and Sustainability and Program in the Environment, University of Michigan
2016-2017 **Research Associate**, Dept of Ecology and Evolutionary Biology, University of Toronto
2010-2016 **Postdoctoral Researcher**, Dept of Ecology and Evolutionary Biology, University of Toronto

AFFILIATIONS

2020- **Affiliate Faculty**, University of Michigan Museum of Zoology (UMMZ) and Department of Ecology and Evolutionary Biology (EEB)
2020- **Affiliate Faculty**, Michigan Institute for Data Science (MIDAS)
2019-2024 **Research Associate**, Ichthyology Section of the Department of Natural History, Royal Ontario Museum
2015-2019 **Departmental Associate**, Ichthyology Section of the Department of Natural History, Royal Ontario Museum

EDUCATION

2010 **PhD**, Ecology, Evolution and Behavior, University of Texas at Austin
2002 **BA**, Biology with Honors, specializing in Ecology and Evolution, University of Chicago

SELECTED GRANTS

2020-2021 “CHANGES: Collections, Heterogeneous data, and Next Generation Ecological Studies” Michigan Institute for Data Science (MIDAS) Propelling Original Data Science (PODS) Grant (US \$90,000) in collaboration with H. López-Fernández and A. Thomer)
2019 Conservation and Restoration Theme Funding, University of Michigan, School for Environment and Sustainability, (US \$20,000; in collaboration with H. López-Fernández and A. Cotel)
2019-2020 “The critical role of women in shifting local Guyanese communities from artisanal mining to conservation” University of Michigan Institute for Research on Women & Gender MCubed Research Incentives award (US \$7,000; in collaboration with H. López-Fernández and A. Cotel)
2018-2020 “Impacts of gold mining related habitat destruction on a highly endemic Tropical freshwater fish fauna” University of Michigan M-Cubed (US \$60,000; in collaboration with H. López-Fernández and A. Cotel)
2018-2019 Instructional Development Fund, University of Michigan Center for Research on Learning and Teaching, 2018 (US \$500)
2007-2010 Doctoral Dissertation Improvement Grant, National Science Foundation, (US \$11,998)

FELLOWSHIPS AND AWARDS

2020 Michigan Sustainability Cases, Gala Impact Case Award
2020 Nomination for SEAS Student Government Outstanding Teaching Award, University of Michigan

- 2020 Nomination for Provost's Teaching Innovation Prize (TIP) for Partnering with Practitioners for Curricular Innovation, University of Michigan
- 2019 Course Development Award, University of Michigan Transforming Learning Program (US \$500)
- 2011-2013 International Research Fellowship, National Science Foundation, (US \$98,500)
- 2008 Strategic Environmental Research and Development Program Student Travel Award, Annual Meeting of the Ecological Society of America, (US \$500)
- 2007 Ariel Appleton Fellowship, Research Ranch Foundation, (US \$2000)
- 2006-2009 Graduate Research Fellowship, National Science Foundation, (US \$121,500 total: US \$30,000 stipend and US \$10,500 education allowance, per year for 3 years)

University of Texas at Austin: Houston Livestock Show and Rodeo Fellowship, 2010 (US \$570); Bennett Fellowship, 2008 (US \$7,631); Hartman Graduate Fellowship, 2007 (US \$1,140); Bruton Fellowship, 2006, 2007 and 2008 (US \$1000 each year); Bennett Fellowship, 2006 (US \$700); Frank and Fern Blair Scholarship, 2005 (US \$420)

University of Chicago: Sigma Xi Award for Excellence in Science, 2002; Richter Fund Grant, 2001 (US \$1,000); Howard Hughes Medical Institute Summer Research Fellowship, 2001 (US \$4,000)

PUBLICATIONS

PEER-REVIEWED

Loewen CJG, Jackson DA, Chu C, **Alofs KM**, Hansen, GJA, Honsey AE, Minns CK and Wehrly KE. *In Review*. Bioregions are predominantly climatic for fishes of northern inland lakes. *Global Ecology and Biogeography*.

Alofs, KM. 2019. Landscape approaches to understanding invasions in inland lakes: Rainbow Smelt (*Osmerus mordax*) as a case study. Book Chapter in *Advances in Understanding Landscape Influences on Freshwater Habitats and Biological Assemblages*. RM Hughes, DM. Infante, L Wang, K Chen, BF Terra (eds). Symposium 90. American Fisheries Society, Bethesda MD.

Lamothe KA, **Alofs KM**, and C Chu. 2019. Evaluating functional diversity conservation for freshwater fishes resulting from terrestrial protected areas. *Freshwater Biology*. 64: 2057-2070. DOI: 10.1111/fwb.13395

Lamothe KA, **Alofs KM**, Jackson DA, and KM Somers. 2018. Functional diversity and redundancy of freshwater fish communities across biogeographic and environmental gradients. *Diversity & Distributions*. 24: 1612-1626. DOI: doi.org/10.1111/ddi.12812

Alofs KM. 2016. The influence of variability in species trait data on community level ecological prediction and inference. *Ecology and Evolution*. 6: 6345–6353. DOI: 10.1002/ece3.2385

Alofs KM and DA Jackson. 2015. The vulnerability of species to range expansions by predators can be predicted using historical species associations and body size. *Proceedings of the Royal Society B* 282: 20151211. DOI: 10.1098/rspb.2015.1211

Alofs KM and DA Jackson. 2015. The role of abiotic and biotic factors in the establishment of predatory fishes at their expanding northern range boundaries in Ontario, Canada. *Global Change Biology* 21: 2227-2237. DOI: 10.1111/gcb.12853

Melles SJ, Chu C, **Alofs KM** and DA Jackson. 2015. Potential spread of Great Lakes fishes given climate change and proposed dams; an approach using circuit theory to evaluate invasion risk. *Landscape Ecology* 30: 919-935. DOI: 10.1007/s10980-014-0114-z

- Alofs KM** and DA Jackson. 2014. Meta-analysis suggests biotic resistance in freshwater environments is driven by consumption rather than competition. *Ecology* 95: 3259-3270. DOI: 10.1890/14-0060.1
- Alofs KM**, González A and NL Fowler. 2014. Local native plant diversity responds to habitat loss and fragmentation over different time spans and spatial scales. *Plant Ecology* 215: 1139-1151. DOI: 10.1007/s11258-014-0372-5
- Alofs KM**, Jackson DA and N Lester. 2014. Ontario freshwater fish demonstrate differing range-boundary shifts in a warming climate. *Diversity and Distributions* 20: 123-136. DOI: 10.1111/ddi.12130
- Alofs KM**, Liverpool EA, Taphorn DC, Bernard CR and H López-Fernández. 2014. Mind the (information) gap: the importance of exploration and discovery for assessing conservation priorities for freshwater fish. *Diversity and Distributions* 20: 107-113. DOI: 10.1111/ddi.12127
- Alofs KM** and NL Fowler. 2013. Loss of native herbaceous species due to woody plant encroachment facilitates the establishment of an invasive grass. *Ecology* 94: 751-760. DOI: 10.1890/12-0732.1
- Winterbottom R, **Alofs KM** and A Marseu. 2011. Life span, growth and mortality in the western Pacific goby *Trimma benjamini*, and comparisons with *T. nasa*. *Environmental Biology of Fishes* 91: 295-301. DOI: 10.1007/s10641-011-9782-6
- Scott CE, **Alofs KM** and BA Edwards. 2011. Putting dark diversity in the spotlight. *Trends in Ecology and Evolution* 26: 263-264. DOI: 10.1016/j.tree.2011.03.008
- Alofs KM** and NL Fowler. 2010. Habitat fragmentation caused by woody plant encroachment inhibits the spread of an invasive grass. *Journal of Applied Ecology* 47: 338-347. DOI: 10.1111/j.1365-2664.2010.01785.x
- Alofs KM** and KM Polivka. 2004. Microhabitat-scale influences of resources and refuge on habitat selection by an estuarine opportunist fish. *Marine Ecology Progress Series* 271: 297-306. DOI: 10.3354/meps271297

OTHER PUBLICATIONS

- Alofs KM**, Siciliano P, Lisuk J and K Johnson-Lane. 2020. Great Lakes Invasive Species Control. *Michigan Sustainability Cases*. <https://www.learnkala.com/cases/great-lakes-invasive-species>
- Alofs KM** and Siciliano P. 2020. Great Lakes Nutrient Management. *Michigan Sustainability Cases*. <https://www.learnkala.com/cases/great-lakes-watershed-management>
- Seelbach P, Hobrla R, Lisuk J, Siciliano P, K Johnson-Lane and **Alofs KM**. 2020. Great Lakes Areas of Concern. *Michigan Sustainability Cases*. <https://www.learnkala.com/cases/areas-of-concern>
- Alofs KM**. 2021. Lake Levels Controls. *Michigan Sustainability Cases*. <https://www.learnkala.com/cases/lake-level-controls>
- Alofs KM**. 2021. Treaty Rights and Fisheries Management. *Michigan Sustainability Cases*. <https://www.learnkala.com/cases/treaty-fishing>
- Jackson S, Baker E, Craven D, Roseman E and **Alofs KM**. 2021. Restoring the Living Fossils of the Great Lakes. *Michigan Sustainability Cases*. <https://www.learnkala.com/cases/restoring-sturgeon>

PRESENTATIONS

INVITED TALKS & SEMINARS

2021 American Fisheries Society, Baltimore, MD *Abstract submitted, scheduled Nov 2021*
 2020 Department of Biological Sciences, University of North Texas, Denton, TX -*Virtual due to COVID-19*
 2019 Galaxy, University of Michigan, Ann Arbor, MI
 2018 [Food for Thought](#), University of Michigan, Ann Arbor, MI
 2018 American Fisheries Society, Atlantic City, NJ
 2018 Society for Freshwater Science Annual Meeting, Detroit, MI
 2017 Annual Meeting of the Ecological Society of America, Portland, OR
 2017 Society for Freshwater Science Annual Meeting, Raleigh, NC
 2016 Dept of Biological Sciences, University of Pittsburgh, Pittsburgh, PA
 2016 Dept of Natural Resources, Cornell University, Ithaca, NY
 2016 School of Natural Resources and Environment, University of Michigan, Ann Arbor, MI
 2016 Environment Canada and Fisheries and Oceans Canada, Burlington, ON
 2016 Dept of Ecology and Evolutionary Biology, U Tennessee Knoxville, Knoxville, TN
 2015 Dept of Integrative Biology, University of Guelph, Guelph, ON
 2014 'ROM Ideas' Research Colloquium, Royal Ontario Museum, Toronto, ON
 2014 Life Sciences Seminar Series, Trent U, Peterborough, ON
 2013 Dept of Ecology and Evolutionary Biology, U Toronto, Toronto, ON
 2012 Wildlife Conservation Society Climate Change Adaptation Workshop, Peterborough, ON
 2011 Diagnostic Tools for Inland Lakes Workshop, Ministry of Natural Resources, Peterborough, ON
 2008 Mini-Symposium: Research at the Balcones Canyonlands National Wildlife Refuge, U Texas Austin, Austin, TX

CONTRIBUTED TALKS

2021 IAGLR Conference on Great Lakes Research-*Virtual due to COVID-19*
 2020 Doris Duke Conservation Scholars Program, University of Michigan, Ann Arbor, MI -*Virtual due to COVID-19*
 2020 MIDAS-PODS Launch Meeting, University of Michigan, Ann Arbor, MI
 2020 Conservation Ecology Lightning Talks, University of Michigan, Ann Arbor, MI
 2019 [Conservation and Restoration Theme Lightning Talks](#), U Michigan, Ann Arbor, MI
 2016 Joint Meeting of Ichthyologists and Herpetologists, New Orleans, LA
 2015 Annual Meeting of the Ecological Society of America, Baltimore, MD
 2015 Canadian Conference for Fisheries Research, Ottawa, ON
 2014 Joint Aquatic Sciences Meeting, Portland, OR
 2013 Joint Meeting of Ichthyologists and Herpetologists, Albuquerque, NM
 2013 Canadian Conference for Fisheries Research, Windsor, ON
 2012 American Fisheries Society, St. Paul, MN
 2012 'Impacts of Climate Change on Limnetic Biodiversity and Fisheries in Ontario and Quebec' Strategic Grant Workshop, Toronto, ON
 2011 Annual Meeting of the Ecological Society of America, Austin, TX
 2011 Canadian Conference for Fisheries Research, Toronto, ON
 2010 Dept of Ecology and Evolutionary Biology, U Toronto, Toronto, ON
 2010 Annual Meeting of the Ecological Society of America, Pittsburgh, PA
 2010 Dept of Ecology, Evolution and Behavior, U Texas Austin, Austin, TX
 2009 Annual Meeting of the Ecological Society of America, Albuquerque, NM
 2009 Annual Meeting Southwestern Association of Naturalists, Monterrey, México
 2008 Annual Meeting of the Ecological Society of America, Milwaukee, WI
 2007 Central Texas Ecologists/Earth Scientists Meeting, USDA-ARS, Temple, TX
 2007 Texas Invasive Plant Conference, LBJ Wildflower Center, Austin, TX
 2007 Ecolunch, U Texas Austin, Austin, TX
 2007 Annual Meeting of the Ecological Society of America, San Jose, CA
 2007 Texas A&M Univ Ecological Integration Student Symposium, College Station, TX
 2006 3rd Annual EEB/Plant Bio Grad Student Symposium, U Texas Austin, Austin, TX

TEACHING EXPERIENCE

At U Michigan

COURSES TAUGHT

- 2020- 2021 EAS 507 *Interpreting Research in Conservation Ecology*
2019, 2020 EAS 501.025 *Science and Management of the Great Lakes* (co-taught with Dr. Paul Seelbach and Dr. Jennifer Read)
2018- 2021 EAS 409/ENV 409/EEB 447 *Ecology of Fishes*
2019 ENVIRON 463 *Michigan Fishes in Changing Environments* (co-taught at UM BioStation with Dr. Hernán López-Fernández)

GUEST LECTURES

- 2018- 2020 ENVIRON 427 *Biology of Fishes*, fall semesters
2019 EEB 410 *EEB Capstone Seminar*, winter semester
2019 EAS 741 *Research Paradigms*, winter semester

UNDERGRADUATE STUDENTS MENTORED

- 2019-2020 Kartik Tharwani (UROP, Cellular and Molecular Biomedical Science), fall/winter semesters
2019 Maria Gedris (MIDAS-UROP Scholar, Ecology and Evolutionary Biology), summer semester
2019-2020 Calla Beers (Lab assistant, Program in the Environment), fall/winter semesters
2019-2020 Cameron Leitz (Honors Thesis, Program in the Environment), fall/winter semesters, *thesis awarded highest honors*
2019 Syed Hussain (Doris Duke Conservation Scholar), summer semester
2019 Ryan Dapkus (Doris Duke Conservation Scholar), summer semester
2018-2019 Hannah Miller (Lab assistant, Ecology and Evolutionary Biology and Program in the Environment)
2018 Erika Perez (Doris Duke Conservation Scholar), summer semester
2018-2019 Michael Hostetler (Lab assistant and Independent Study, Ecology and Evolutionary Biology)
2018-2019 Maxwell LaCosse (Lab assistant, Civil and Environmental Engineering)
2018 Olivia Horwedel (Lab assistant, Program in the Environment), winter semester

GRADUATE STUDENTS MENTORED

MSc Advisees

- 2020- Megan Livingston (MSc Student)
2020- Hadijah 'Dede' Lawal (MSc Student)
2020- Alyssa Rausch (MSc Student)
2020- Hannah DeHetre (MSc Student)
2020- Lee Largaespada (MSc Student)
2020- Nicholas Hansen (MSc Student)
2020- Justin Huber (MSc Student)
2019 Michael Hostetler (MSc Student)
2019-2021 Emily Rau (MSc Student)
2018-2020 Seamus Harrison (MSc Student)
2018-2020 Sarah Brannon (MSc Student)
2018-2020 Matthew Sens (MSc Student)

MSc Thesis Students

- 2020- Cameron Leitz (MSc Thesis Student)
2020- Michael Grabda (MSc Thesis Student)
2019-2021 Ellary Marano (MSc Student, Co-Supervisor Dr. David "Bo" Bunnell, USGS-GLSC)
2018-2021 Jennifer Fuller (MSc Thesis Student, Co-Supervisor Dr. Johannes Foufopoulos)

2018-2020 Natalie Madden (MSc Thesis Student, Co-Supervisor with Dr. Neil Carter)
 2017-2019 Sara Prendergast (MSc Thesis Student, Co-Supervisor with Dr. Mark Rowe, NOAA-GLERL)

PhD Students

2019- Scott Jackson (PhD Candidate), “Intraspecific Variation Sources and Implications for Fishes in a Changing Environment”.

MASTERS PROJECTS MENTORED

2019-2020 “Planning and implementing monitoring during hydrologic restoration of the Shiawassee Flats floodplain ecosystem” Client: US Fish and Wildlife Service and Shiawassee National Wildlife Refuge; Students: Eliza Lugten, Kate Vogel, Matthew Puz, Matthew Sens, Olivia Mitchinson; Co-advised with Drs. Paul Seelbach and Catherine Riseng
 2020-2021 “Capturing and communicating the story of Shiawassee National Wildlife Refuge” Client: US Fish and Wildlife Service and Shiawassee National Wildlife Refuge; Students: Julie Dellick, Jon Gorter, Anna Greenberg, Xinmiao Liu, and Maria Salem; Co-advised with Dr. Paul Seelbach

POSTDOCTORAL RESEARCHERS MENTORED

2021- Dr. Katelyn King, CHANGES Project, Co-mentored with Drs. López-Fernández and Thomer
 2021- Dr. Viviana Astudillo, EEB Postdoc, Co-mentored with Drs. López-Fernández and Cotel
 2020- Dr. Andrew Miller, CIGLR Shoreline Restoration, Co-mentored with Dr. Bradley Cardinale
 2019- Dr. Kelsey Lucas, NSF Postdoctoral Fellow in Biology

COMMITTEE MEMBER

2021- Mingyu Zhang (MSc Student, SEAS, Committee Member)
 2020- Kaylin Jones (PhD Student, Civil and Environmental Engineering, Committee Member)
 2020- Samantha Iliff (PhD Student, Ecology and Evolutionary Biology, Committee Member)
 2019- Thomas Morgan (PhD Student, Ecology and Evolutionary Biology, Committee Member)
 2019- Susanna Campbell (PhD Candidate, Ecology and Evolutionary Biology, Committee Member)
 2019- Lais Petri (PhD Candidate SEAS, Committee Member)
 2018-2020 Sasha Bishop (PhD Candidate, Ecology and Evolutionary Biology, Committee Member)
 2018-2020 Katherine McLean (PhD Candidate, Ecology and Evolutionary Biology, Committee Member)
 2018-2019 Kenzo Esquivel (Frontiers MSc Student, Ecology and Evolutionary Biology, Committee Member)

TRAINING

2021 “Principles and Practices of Anti-Racist Pedagogy” CRLT Workshop, University of Michigan
 2020 “Designing and Facilitating Group Work for Blended/Online Courses” CRLT Workshop, University of Michigan.
 2019 “Workshop on Graduate Admissions for Excellence and Diversity”, Rackham Graduate School, University of Michigan
 2018 “STRIDE Faculty Recruitment Workshop”. University of Michigan
 2018 “Teaching Gamefully” CRLT Workshop, University of Michigan
 2018 “An Introduction to Case-Based Learning in the Classroom and Beyond” Michigan Sustainability Cases, University of Michigan
 2018 “Facilitating Discussions of Research Literature in STEM Courses” CRLT Workshop, University of Michigan

2018 “Leveraging Student Differences in Discussion” Workshop by Center for Research on Learning and Teaching (CRLT), University of Michigan

Outside U Michigan

LECTURER

2011- 2013 Course Instructor, *Community Ecology*, U Toronto, 3 fall semesters (co-taught with Dr. Megan Frederickson)

2006 Guest Lecturer, *Conservation Biology*, U Texas Austin, spring semester

TEACHING ASSISTANT

2005-2006 Teaching Assistant, *Human Biology*, U Texas Austin, fall and spring semesters

2005 Teaching Assistant, *Biostatistics*, U Texas Austin, spring semester

2004-2005 Teaching Assistant, *Genetics*, U Texas Austin, fall and summer semesters

2003 Graduate Student Instructor, *Natural History and Evolution*, U Michigan Biological Station, summer semester

STUDENT MENTORING

2021 Anjani Ramdjanamsingh (MSc Student, University of Suriname, Programme in Sustainable Management of Natural Resources, Co-supervisor with Dr. Jan Mol, ‘The effect of increased sedimentation from gold mining on the water quality of the Marowijne River, Suriname’)

2016-2017 Dana Berg (undergraduate research student EEB 498, U Toronto), *awarded best Ecology & Behavioral Ecology Poster in Undergraduate Research Fair*

2016-2017 Lucy Genua (postgraduate research assistant, U Toronto)

2016 Julia Bassi (NSERC Undergraduate Student Research Award, U Toronto)

2015-2016 Dana Berg (undergraduate work-study, U Toronto)

2015 Zoe Gozum (postgraduate lab assistant, U Toronto)

2014- 2017 Krisna Gajapersad (MSc Student, University of Suriname, Programme in Sustainable Management of Natural Resources, Co-supervisor with Dr. Jan Mol, ‘The effect of gold mining activities on the biological characteristics of the Marowijne River in Suriname’)

2014-2015 Stephanie Blain (undergraduate work-study, U Toronto)

2013 Charise Currier (undergraduate research assistant, U Toronto)

2007 Johnathan Rose (undergraduate lab assistant, U Texas Austin)

2007 Scott Meadows (undergraduate research student, BIO 377, U Texas Austin)

2007 Gabriela Casares (undergraduate summer field assistant, U Texas Austin)

2007 Linda Aguilar (undergraduate summer field assistant, U Texas Austin)

ADDITIONAL RESEARCH & FIELD EXPERIENCE

2019 Research Expedition to Upper Mazaruni River, Guyana

2017 Ichthyology Expedition with Royal Ontario Museum across Uruguay

2014 Ichthyology Expedition with Royal Ontario Museum to five river basins across Suriname

2005-2010 Field work in Central Texas Hill Country including Pedernales Falls State Park, Balcones Canyonlands National Wildlife Refuge, Freeman Ranch.

2009 Graduate Research Assistant, Rare plant habitat requirements, U Texas Austin

2004 Student Conservation Association Intern, Rare and invasive plant management, Chattahoochee River National Recreation Area

2003 Field Research Assistant, Evolutionary ecology of crop and weed plants, U Michigan Biological Station/Ohio State U

2003 Student Conservation Association Intern, Rare plant monitoring, Great Smoky Mountains National Park

2000-2001 Field Research Assistant, Population biology of estuarine fish, Big Beef Creek, WA/U
 Chicago

PROFESSIONAL AFFILIATIONS AND SERVICE

COMMITTEE MEMBERSHIP

At U Michigan

2021 CIGLR Director Search Committee, SEAS, U Michigan
 2020 COVID-19 Response Team, SEAS, U Michigan
 2019, 2020 Graduate Admission Committee, SEAS, U Michigan
 2018 Hydrologist Faculty Search Committee, SEAS representative, U Michigan.

Outside U Michigan

2021- Great Lakes [Coregenine Restoration Program](#) Science Team (Co-lead Habitat and Population
 Gap Analysis Team with Dr. Cory Brant, USGS-GLSC)
 2019- State of Michigan Fish Technical Advisory Committee for Species of Greatest Conservation
 Need

SOCIETY MEMBERSHIP

Ecological Society of America (*member since 2005, student section officer in 2009*), Society for
 Freshwater Science, American Fisheries Society, InFish

JOURNAL REFEREEING

Biological Conservation, Biological Invasions, Canadian Journal of Fisheries and Aquatic Sciences,
 Canadian Journal of Zoology, Diversity and Distributions, Ecography, Ecological Applications, Ecology,
 Ecology and Evolution, Ecology of Freshwater Fishes, Ecological Research, Écoscience, Ecosphere,
 Freshwater Biology, Global Change Biology, Invasive Plant Science and Management, Neotropical
 Ichthyology, Oecologia, Oikos, Plant Ecology, Proceedings of the Royal Society B, Nature Scientific
 Data

GRANT REFEREEING

Ad Hoc Reviewer U.S. National Science Foundation, Panelist U.S. National Science Foundation BIO
 Advisory, NERC Highlight Topics, NSERC Discovery Grants, MITACS Elevate Fellowships, MITACS
 Accelerate Research Grants, Sam Houston State University Internal Grants, U-M International Institute
 Fellowships, United States Fish and Wildlife Service Great Lakes Fish and Wildlife Restoration Act
 funding

OUTREACH

2021 Presentation for City Nature Challenge Kick-off, U-M Museum of Natural History, *Virtual
 due to COVID-19*
 2021 Zooniverse – crowd-sourced citizen-science project; [Angling for data on Michigan Fishes](#)
 (>1400 volunteers engaged)
 2020 Presentation for NJAS: New Jersey Aquarium Society, *Virtual due to COVID-19*
 2020 Engaging Students Remotely with Gala, Presentation and YouTube [Playlist](#)
 2020 [William R. Farrand Memorial Lecture](#), U-M Museum of Natural History, Lake Sturgeon:
 Past, present, and future of an ancient fish
 2019 Two presentations at North East Council of Aquarium Societies, Cromwell, CT
 2018, 2020 Panelist for Environmental Science Professionalism Seminar, U Texas at Austin
 2017 Big Trout Bay Intensive Science BioBlitz, Ontario BioBlitz
 2015 Research feature in ‘Hands on Biodiversity’ public exhibit at Royal Ontario Museum

- 2014 Research feature in ‘That’s a LOT of Fish! 100 years of collecting’ public exhibit at Royal Ontario Museum
- 2013, 2015 Volunteer Naturalist, Ontario BioBlitz
- 2008 Meeting Mentor, Strategies for Ecological Education, Development and Sustainability (SEEDS) Annual Meeting of the Ecological Society of America, Milwaukee, WI
- 2005 Meeting Mentor, National Science Foundation Undergraduate Mentoring in Environmental Biology (UMEB) Program, Annual Meeting of the Botanical Society of America, Austin, TX
- 2001-2002 Volunteer Instructor, GAIA (High School Environmental Education), U Chicago

POPULAR WRITING

Alofs KM. 2013. Fish on the Move – The ROM is playing a crucial role in assessing the effect of climate change on Ontario’s ecosystems. *Royal Ontario Museum Magazine* Winter 2013.

MEDIA COVERAGE & RESEARCH FEATURES

Web and Print – [Vice](#), [Detroit Free Press](#), U of T News, Fishsens Magazine, [Climate News Network](#), Tak Fur the Kaffe, Science World Report, [Phys.org](#), TerraDaily, [ScienceDaily](#), The Fish Site, [tvo.org](#), ABC Newspapers, [Great Lakes Echo](#), Stabroek News, CBC International

Radio and Television – [NPR Science Friday](#), Stateside on Michigan Radio, CBC Toronto, Here and Now; CBC Halifax, Mainstreet; CBC Calgary, Homestretch; CBC Montreal, Home Run; CBC Saskatchewan, Afternoon Edition; CBC New Brunswick, Shift; CBC St. Johns, On the Go; CBC Vancouver, On the Coast; CBC Sudbury/Thunder Bay, Up North; CBC Winnipeg, Up to Speed; CBC Edmonton, Radio Active; CBC Ottawa, All in Day; CBC International; [CTV News Toronto](#)

EXHIBIT BMC-9

Literature Cited

- Bozek, M., T. Haxton, and J. Raabe. 2011. Walleye and sauger habitat. Pages 133–197 in B. A. Barton, editor. *Biology, management, and culture of Walleye and Sauger*. Taylor & Francis, Bethesda, Maryland.
- Bunnell, D. B., R. P. Barbiero, S. A. Ludsin, C. P. Madenjian, G. J. Warren, D. M. Dolan, T. O. Brenden, R. Briland, O. T. Gorman, J. X. He, T. H. Johengen, B. F. Lantry, B. M. Lesht, T. F. Nalepa, S. C. Riley, C. M. Riseng, T. J. Treska, I. Tsehaye, M. G. Walsh, D. M. Warner, and B. C. Weidel. 2014. Changing ecosystem dynamics in the Laurentian Great Lakes: Bottom-up and top-down regulation. *BioScience* 64:26–39.
- Calantone, R., S. K. Vickery, F. Wang, and A. Bengal. 2019. Economic Impact of Hunting, Fishing, and trapping (H, F & T) in Michigan. Report for Michigan United Conservation Clubs.
- Chipps, S. R., and B. D. S. Graeb. 2011. Feeding ecology and energetics. Pages 303–319 in B. A. Barton, editor. *Biology, management, and culture of Walleye and Sauger*. Taylor & Francis, Bethesda, Maryland.
- Chu, C., N. E. Mandrak, and C. K. Minns. 2005. Potential impacts of climate change on the distributions of several common and rare freshwater fishes in Canada. *Diversity and Distributions* 11:299–310.
- Cline, T. J., V. Bennington, and J. F. Kitchell. 2013. Climate change expands the spatial extent and duration of preferred thermal habitat for Lake Superior fishes. *PLoS ONE* 8.
- Collingsworth, P. D., D. B. Bunnell, M. W. Murray, Y. Kao, Z. S. Feiner, R. M. Claramunt, B. M. Lofgren, T. O. Hook, and S. A. Ludsin. 2017. Climate change as a long-term stressor for the fisheries of the Laurentian Great Lakes of North America. *Reviews in Fish Biology and Fisheries* 27:363–391.
- Dembkowski, D. J., D. A. Isermann, S. R. Hogler, W. A. Larson, and K. N. Turnquist. 2018. Stock structure, dynamics, demographics, and movements of walleyes spawning in four tributaries to Green Bay. *Journal of Great Lakes Research* 44:970–978.
- Dippold, D. A., G. D. Adams, and S. A. Ludsin. 2020a. Spatial patterning of walleye recreational harvest in Lake Erie: Role of demographic and environmental factors. *Fisheries Research* 230:105676.
- Dippold, D. A., N. R. Aloysius, S. C. Keitzer, H. Yen, J. G. Arnold, P. Daggupati, M. E. Fraker, J. F. Martin, D. M. Robertson, S. P. Sowa, M. V. V. Johnson, M. J. White, and S. A. Ludsin. 2020b. Forecasting the combined effects of anticipated climate change and agricultural conservation practices on fish recruitment dynamics in Lake Erie. *Freshwater Biology* 65:1487–1508.

- Gutowksy, L. F. G., H. C. Giacomini, D. T. de Kerckhove, R. Mackereth, D. McCormick, and C. Chu. 2019. Quantifying multiple pressure interactions affecting populations of a recreationally and commercially important freshwater fish. *Global Change Biology* 25:1049–1062.
- Hansen, G. J. A., S. R. Carpenter, J. W. Gaeta, J. M. Hennessy, and M. J. Vander Zanden. 2015. Predicting walleye recruitment as a tool for prioritizing management actions. *Canadian Journal of Fisheries and Aquatic Sciences* 72:661–672.
- Hansen, G. J. A., S. R. Midway, and T. Wagner. 2018. Walleye recruitment success is less resilient to warming water temperatures in lakes with abundant largemouth bass populations. *Canadian Journal of Fisheries and Aquatic Sciences* 75:106–115.
- Hansen, G. J. A., J. S. Read, J. F. Hansen, and L. A. Winslow. 2017. Projected shifts in fish species dominance in Wisconsin lakes under climate change. *Global Change Biology* 23:1463–1476.
- Hayden, T. A., C. M. Holbrook, D. G. Fielder, C. S. Vandergoot, R. A. Bergstedt, J. M. Dettmers, C. C. Krueger, and S. J. Cooke. 2014. Acoustic telemetry reveals large-scale migration patterns of walleye in Lake Huron. *PLoS ONE* 9:1–19.
- Hayden, T. A., T. R. Binder, C. M. Holbrook, C. S. Vandergoot, D. G. Fielder, S. J. Cooke, J. M. Dettmers, and C. C. Krueger. 2018. Spawning site fidelity and apparent annual survival of walleye (*Sander vitreus*) differ between a Lake Huron and Lake Erie tributary. *Ecology of Freshwater Fish* 27:339–349.
- Herbst, S., D. Hayes, K. Wehrly, C. LeSage, D. Clapp, J. Johnson, P. Hanchin, E. Martin, F. Lupi, and T. Cwalinski. 2021. Management Plan for Walleye in Michigan's Inland Waters DRAFT.
- Huddleston, A. L. 2018. The Influence of Ice Cover on the Coupling between Lake Erie Larval Walleye and their Prey. The Ohio State University.
- Imrit, M. A., and S. Sharma. 2021. Climate change is contributing to faster rates of lake ice loss in lakes around the Northern Hemisphere. *Journal of Geophysical Research: Biogeosciences* 126:1–13.
- Johnson, J. E., J. X. He, and D. G. Fielder. 2015. Rehabilitation stocking of Walleyes and Lake Trout: restoration of reproducing stocks in Michigan waters of Lake Huron. *North American Journal of Aquaculture* 77:396–408.
- Jones, M. L., B. J. Shuter, Y. Zhao, and J. D. Stockwell. 2006. Forecasting effects of climate change on Great Lakes fisheries: Models that link habitat supply to population dynamics can help. *Canadian Journal of Fisheries and Aquatic Sciences* 63(2):457–468.
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- Lynch, A. J., B. J. E. Myers, C. Chu, L. A. Eby, J. A. Falke, R. P. Kovach, T. J. Krabbenhoft, T. J. Kwak, J. Lyons, C. P. Paukert, and J. E. Whitney. 2016. Climate change effects on North American inland fish populations and assemblages. *Fisheries* 41:346–361.
- Massie, D. L., G. J. A. Hansen, Y. Li, G. G. Sass, and T. Wagner. 2021. Do lake-specific characteristics mediate the temporal relationship between walleye growth and warming water temperatures? *Canadian Journal of Fisheries and Aquatic Sciences* 11:1–11.
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- McMeans, B. C., K. S. McCann, M. M. Guzzo, T. J. Bartley, C. Bieg, P. J. Blanchfield, T. Fernandes, H. C. Giacomini, T. Middel, M. D. Rennie, M. S. Ridgway, and B. J. Shuter. 2020. Winter in water: differential responses and the maintenance of biodiversity. *Ecology Letters*:922–938.
- Neuheimer, A. B., R. E. Thresher, J. M. Lyle, and J. M. Semmens. 2011. Tolerance limit for fish growth exceeded by warming waters. *Nature Climate Change* 1:110–113.
- Raabe, J. K., J. A. VanDeHey, D. L. Zentner, T. K. Cross, and G. G. Sass. 2020. Walleye inland lake habitat: considerations for successful natural recruitment and stocking in North Central North America. *Lake and Reservoir Management* 36:335–359.
- Schmalz, P., A. Fayram, D. Isermann, S. Newman, and C. Edwards. 2011. Harvest and Exploitation. Pages 375–397 in B. A. Barton, editor. Biology, management, and culture of Walleye and Sauger. Taylor & Francis, Bethesda, Maryland.
- Schneider, J. C., R. P. O’neal, and R. D. Clark. 2007. Ecology, Management, and Status of Walleye, Sauger, and Yellow Perch in Michigan:1–86.
- Tingley, R. W., J. F. Hansen, D. A. Isermann, D. C. Fulton, A. Musch, and C. P. Paukert. 2019. Characterizing angler preferences for Largemouth Bass, Bluegill, and Walleye fisheries in Wisconsin. *North American Journal of Fisheries Management* 39:676–692.
- Wehrly, K. E., J. E. Breck, L. Wang, and L. Szabo-Kraft. 2012. A landscape-based classification of fish assemblages in sampled and unsampled lakes. *Transactions of the American Fisheries Society* 141:414–425.
- Whitney, J. E., R. Al-Chokhachy, D. B. Bunnell, C. A. Caldwell, S. J. Cooke, E. J. Eliason, M. Rogers, A. J. Lynch, and C. P. Paukert. 2016. Physiological basis of climate change impacts on North American inland fishes. *Fisheries* 41:332–345.
- Winslow, L. A., G. J. A. Hansen, J. S. Read, and M. Notaro. 2017. Large-scale modeled contemporary and future water temperature estimates for 10774 Midwestern U.S. Lakes. *Scientific Data* 4:170053.

Van Zuiden, T. M., M. M. Chen, S. Stefanoff, L. Lopez, and S. Sharma. 2016. Projected impacts of climate change on three freshwater fishes and potential novel competitive interactions. *Diversity and Distributions* 22:603–614.

STATE OF MICHIGAN
BEFORE THE MICHIGAN PUBLIC SERVICE COMMISSION

In the matter of the Application of Enbridge Energy, Limited Partnership for the Authority to Replace and Relocate the Segment of Line 5 Crossing the Straits of Mackinac into a Tunnel Beneath the Straits of Mackinac, if Approval is Required Pursuant to 1929 PA 16; MCL 483.1 et seq. and Rule 447 of the Michigan Public Service Commission's Rules of Practice and Procedure, R 792.10447, or the Grant of other Appropriate Relief

U-20763

ALJ Dennis Mack

PROOF OF SERVICE

On September 14, 2021, an electronic copy of *Direct Testimony of Jacques LeBlanc Jr. on behalf of Bay Mills Indian Community* was served on the following parties:

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Date: September 14, 2021

By: Christopher R. Clark
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September 14, 2021

Via E-filing

Ms. Lisa Felice
Michigan Public Service Commission
7109 W. Saginaw Hwy.
P. O. Box 30221
Lansing, MI 48909

RE: MPSC Case No. U-20763

Dear Ms. Felice:

The following are attached for paperless electronic filing:

- **PUBLIC** Direct Testimony and Exhibits of Dr. Charles E. Cleland on behalf of Bay Mills Indian Community
- Proof of Service

Please note a CONFIDENTIAL unredacted testimony and exhibits for Dr. Charles E. Cleland are being served via email on counsel with an NDA on file for this matter.

Sincerely,

Christopher R. Clark
cclark@earthjustice.org

STATE OF MICHIGAN
BEFORE THE MICHIGAN PUBLIC SERVICE COMMISSION

In the matter of the Application of Enbridge
Energy, Limited Partnership for Authority to U-20763
Replace and Relocate the Segment of Line 5
Crossing the Straits of Mackinac into a Tunnel ALJ Dennis Mack
Beneath the Straits of Mackinac, if Approval is
Required Pursuant to 1929 PA 16; MCL 483.1
et seq. and Rule 447 of the Michigan Public
Service Commission's Rules of Practice and
Procedure, R. 792.10447, or the Grant of other
Appropriate Relief

TESTIMONY OF DR. CHARLES E. CLELAND

ON BEHALF OF

BAY MILLS INDIAN COMMUNITY

September 14, 2021

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1 **I. INTRODUCTION & QUALIFICATIONS**

2 **Q. Please state for the record your name, job title, and business address.**

3 A. My name is Charles E. Cleland, PhD, Distinguished Professor Emeritus, Michigan State
4 University. I am currently working as an independent consultant. My business address is
5 19899 Gennett Road, Charlevoix, Michigan.

6 **Q. On whose behalf is this testimony being offered?**

7 A. I am testifying on behalf of Bay Mills Indian Community (“BMC”). This testimony
8 contains my independent scientific opinion. It is being provided in my individual capacity
9 and not on behalf of any employer.

10 **Q. What is the purpose of your testimony?**

11 A. The purpose of this testimony is two-fold. My testimony will explain the significance of
12 the cultural and historical features located within and around the Straits of Mackinac and
13 the proposed tunnel project area. I will also explain how and why Enbridge’s proposed
14 undertaking at the Straits could impact these cultural and historical features which
15 include: treaty rights, spiritual traditions, underwater sites, and terrestrial archaeological
16 sites of both the prehistoric and historic eras.

17 **Q. Please summarize your educational background and training in history.**

18 A. I have earned the following degrees:

- 19 • 1958 BA in Biology, Denison University
- 20 • 1960 MS in Zoology, University of Arkansas

DR. CHARLES E. CLELAND – DIRECT TESTIMONY - CASE NO. U-20763

- 1 • 1964 MA in Anthropology, University of Michigan
- 2 • 1966 PhD in Anthropology, University of Michigan

3 My expertise is in the field of ethnohistory and I have taught this subject on the graduate
4 level. I have been involved in hundreds of hours of reading and collecting both
5 manuscript and microfilm documents in many historical archives. My expertise as an
6 ethnohistorian has been affirmed by federal judges in thirteen cases in which I have
7 testified both in the United States and Canada.

8 **Q. Please describe the focus of your academic research.**

9 A. The focus of my academic work is the cultures and histories of the native people of the
10 Upper Great Lakes area. I have published both books and articles on this topic and in
11 addition, taught courses on those subjects in both the Department of Anthropology and
12 the Department of Racial and Ethnic Studies at Michigan State University.

13 **Q. Have you published in your field of expertise?**

14 A. I have published seven books and nearly 100 articles in scholarly, peer reviewed journals
15 on this subject. They are listed on my Curriculum Vitae which is attached as Exhibit
16 BMC-31.

17 **Q. In addition to your publications have you written any other historical papers or**
18 **reports?**

1 A. Yes, I have written five academic books and two books of historical fiction as well as
2 many unpublished reports which, because they often contain proprietary information such
3 as specific hunting and fishing sites, remain uncirculated in the archives of many Tribes.

4 **Q. Have you received any distinction for your work?**

5 A. Yes. The Society for Historical Archaeology presented me in 2002 with its highest award
6 (the J.C. Harrington Medal) for a lifetime of contributing to scholarship in that field. In
7 1978 Michigan State University named me a Distinguished Professor of Anthropology in
8 recognition of “my outstanding contributions to the intellectual development of the
9 University.”

10 **Q. Please describe the types of historical projects you have worked on or are currently**
11 **working on.**

12 A. I am currently writing a book on the natural and cultural history of the “Traverse
13 Corridor” from 12,000 BP to the present. This work is centered on the Lake Michigan
14 littoral from the Straits of Mackinac to the south end of Grand Traverse Bay. I am also
15 studying the prehistoric cultures of northern Michigan and their changing adaptations to
16 the natural world including climate change.

17 In my past consulting work, I was involved in the following historic investigations:

- 18 • Prepared report in opposition to a sulfide copper mine in Crandon WI on behalf of the
19 Forest County Potawatomi, the Menominee Nation and the Mole Lake Ojibwe Band.
- 20 • Directed preparation of report of historic investigation of the obligation of Notre
21 Dame University to provide scholarships for Pokagon Potawatomi students.

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- 1 • Reviewed new casino locations on behalf of the Sault Ste. Marie Tribe of Chippewa
- 2 Indians and the Bay Mills Indian Community.
- 3 • Prepared report of the history of federal stewardship related to the Sault Ste. Marie
- 4 Tribe of Chippewa Indians and the Bay Mills Indian Community.
- 5 • Directed study and report on the geography and history of Indian land use on 1836
- 6 treaty land and water cessions.
- 7 • Prepared report of Saginaw Chippewa Tribe reservation claims.
- 8 • Researched reservation claim of Keweenaw Bay Indian Community.
- 9 • Researched Madeline Island fishing reserve ownership for Red Cliff Ojibwe.

10 **Q. Please summarize your work experience.**

11 A. From 1964 to 2000 I was employed by Michigan State University to teach both

12 undergraduate and graduate courses. I also was employed by the university to work as the

13 Curator of Anthropology and Great Lakes Ethnology at the University Museum where I

14 was responsible for collections in ethnology, historical and prehistoric archaeology, and

15 directing field projects in these areas. During this period, I directed excavations of Fort

16 Michilimackinac, Fort Brady, Fort Ouiatenon, Fort Gratiot, and three antebellum town

17 sites in Mississippi, and many dozens of prehistoric sites in northern Michigan.

18 During my career at MSU I directed dissertation work for approximately fifty graduate

19 students. In addition to my teaching and scholarly research, between 1974 and 2000 I

20 worked as an independent consultant in ethnohistory for many Great Lakes Indian tribes

21 on a variety of issues. My work experience is also summarized in my resume, provided as

22 Exhibit BMC-31.

1 **Q. Have you ever been qualified in legal proceedings as an expert witness in your field?**

2 A. Yes, I have been qualified in legal proceedings as an expert witness in the field of
3 ethnohistory in thirteen cases. The list appears as Exhibit BMC-32.

4 **Q. What types of expert testimony have you provided?**

5 A. I have provided ethnohistorical and archaeological expert testimony.

6 **Q. What information did you review in preparing your testimony in this case?**

7 A. In preparing my testimony in this case, I reviewed the following publications as listed in
8 Exhibit BMC-33.

9 **Q. Are you sponsoring any exhibits?**

10 A. Yes, I am sponsoring the following exhibits:

11 Exhibit BMC-31: Resume (or CV) of Dr. Charles E. Cleland

12 Exhibit BMC-32: List of Court Cases prepared or testified as expert witness

13 Exhibit BMC-33: List of information reviewed in preparing for this testimony

14 Exhibit BMC-34C: A Listing of Historical and Cultural Sites On or Near the

15 Straits of Mackinac on File with The Michigan State

16 Historic Preservation Office

17 Exhibit BMC-35 O'Shea to MacFarlane-Faes communication of February

18 12, 2020.

Exhibit BMC-36 Search Inc assessment of submerged cultural resources that
would be impacted by the construction of the proposed
tunnel

4 **II. FOUNDATIONAL PRINCIPLES OF HISTORIC PRESERVATION AND**
5 **ARCHAEOLOGY**

6 **Q. How would you define ethnohistory?**

A. Ethnohistory is a field of study which involves academic disciplines including history, anthropology, archaeology, linguistics, as well as other related disciplines. Ethnohistory grew out of the need to document Native American claims against the United States government under the Indian Claims Act of 1946. Today, the American Society for Ethnohistory has five hundred members, publishes the journal *Ethnohistory*, and holds an annual conference. Preliterate societies like Native Americans did not produce written records of their past. Therefore, records concerning the historic events of their societies were produced by people of other cultures whose understanding of the events they witnessed were, in most cases, based upon cultural bias. Ethnohistory aims to identify such misunderstandings in the documentary record and to use information from the social sciences to correct the cultural errors involved.

18 **Q. Why is historic preservation important?**

19 A. Since the passage of the National Historic Preservation Act by Congress in 1966 there
20 has been an acknowledgment that earth moving construction is often detrimental to our
21 understanding and appreciation of our common heritage due to the destruction of

1 elements that have survived from the past and by which we are able to learn and
2 appreciate the contribution of our ancestors.

3 These surviving elements of our past take many forms from features of the built
4 environment such as houses, industrial plants, roads, ships, cars, and wagon tracks. In
5 addition to these relics of modern culture that relate to Euro-American activities of the
6 16th through the 20th centuries some multi-component sites embody cultural remains of
7 both our Euro-American heritage and also the remains of much earlier cultural activities
8 of people who belonged to Native American societies. While the remains of Euro-
9 American societies are well described in the documentary record, those of preliterate, or
10 “prehistoric” societies are to be found in archaeological context alone. This fact means
11 that the loss or damage to prehistoric remains represents the total destruction of the only
12 existing evidence of their unique cultural history and it is for these reasons that
13 consideration of archaeological sites figures so prominently in assessing the damage of a
14 modern undertaking to the buried histories which archaeological sites contain.

15 As important as records of the past are in assessing the potential impact of an
16 undertaking, the historical records only reveal one of several interrelated impacts. An
17 undertaking such as the building of a tunnel to carry petroleum under the Straits of
18 Mackinac has potentially enormous environmental impacts, which in turn impacts
19 commercial fishing, which impacts the economy and treaty rights of Native Americans,
20 and specifically the Bay Mills Indian Community.

21 **Q. How are archaeological sites in the Straits of Mackinac reported or tracked?**

1 A. Many of these sites known to Michigan archaeologists have been reported to the state
2 archaeologist where they are assigned site numbers in a nationwide system developed by
3 the Smithsonian Institution. Each site is given a distinct numeration which makes up its
4 site number. Michigan is the 20th state alphabetically, so the site number of all Michigan
5 sites begin with the number 20. This is followed by an abbreviation of the county name
6 where it is located, such as CX for Charlevoix, and then finally, each site is given an
7 additional number in the order of its registry so, for example, the tenth site in Charlevoix
8 County would be designated as 20CX10. Besides acquiring a site number, each is further
9 analyzed for its type of site, period of use and details about its history, and geographic
10 location.

11 The purpose of the Smithsonian site numbering system is to provide an orderly way of
12 distinguishing the sites that have been discovered in the past. Beyond providing a means
13 to better manage archaeological sites, the system makes it possible to distinguish newly
14 discovered sites from those that had been previously discovered in the distant past and
15 this prevents double counting of known sites. In the present case, if a new site were to be
16 reported from Bois Blanc Island in the Straits of Mackinac, the state archaeologist's
17 office would be able to use the Smithsonian system to determine if it was indeed a new
18 site or if it was the Juntunen site that had been assigned number 20MK1 many decades
19 earlier.

20 In most states a record of the known archaeological sites is kept by the State Historic
21 Preservation Officer (SHPO) as a means of protecting and managing these non-renewable
22 resources for public benefit. In the case of Michigan, the State Historic Preservation

1 Officer has assigned this task to the state archaeologist who heads an office within the
2 office of the SHPO.

3 **Q. What do you mean by the term “culture”?**

4 A. “Culture” is a central concept and the object of study of the science of anthropology.
5 Although many definitions of culture have been advanced by anthropologists over the
6 years, for the purposes of my testimony the term “culture” shall mean the sum of the
7 beliefs, customs, social-political norms, morals, economy and technology, religion, art,
8 laws and other beliefs that are acquired by individuals by virtue of their membership in a
9 particular society and which are, in turn, passed on in some form to succeeding
10 generations.

11 **Q. What do you mean by the term “historic resources”?**

12 A. “Historic resources” are most often represented by features of the built environment,
13 including architectural structures of many sorts that have survived into fairly modern
14 times. These historical resources can often be investigated using both documentary as
15 well as archaeological data. This is not true, however, when “historical resources” refer to
16 prehistoric archaeological sites that are not represented in contemporary documents. In
17 such cases these sites must be understood on the basis of archaeological and ethnographic
18 information alone. In some cases, “historical resources” may be represented by features
19 of the natural landscape that are venerated in order to remind the people of a particular
20 culture of historic events or supernatural occurrences from their religious beliefs.

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1 In the case at hand, the Straits of Mackinac area was occupied in the past by people of
2 several native societies, particularly the Ojibwa (Chippewa) and the Odawa (Ottawa) and
3 more recently by modern Euro-Americans. In the case of Native American occupation
4 sites, they collectively contain a record of thousands of years of tribal history. This very
5 ancient history is preserved only in archaeological context. Such sites are non-renewable,
6 so that once they are damaged or destroyed, there are no alternative means of learning
7 about the lives of the native people who first settled and developed unique adaptations to
8 the natural environment in what is today northern Michigan.

9 In more recent times, the Straits area was also the scene of Euro-American settlement
10 during the eighteenth and nineteenth centuries; sites such as Fort Michilimackinac and
11 Fort Mackinac on Mackinac Island and the Pere Marquette Mission at St. Ignace as well
12 as their associated settlements are very valuable in Native American, American,
13 Canadian, French and British history as well as to the modern historic tourism industry.

14 Regretfully, the archaeological sites which incorporate so many details about the lives
15 and cultures of previous occupants of the Straits area have long been under dire threat of
16 destruction due to modern development, rendering those that remain intact of much
17 greater importance. Fortunately, many have been recognized by their listing on the
18 National Register of Historic Places and Sites which signifies their importance for our
19 national patrimony. It would be difficult, perhaps impossible, to find any other small area
20 of North America that has such a huge concentration of important historic sites.

21 Under the provisions of the National Historic Preservation Act of 1966, NHPA Pub L No.
22 89-665 as amended by PL No. 96-515, or Title 54 of USC Subtitle III division A, chapter

300101, and specifically, section 106 of this act, federal agencies responsible for any funding, licensing or permitting of an undertaking that may result in the potential damage or loss of sites listed on the National Register are required to locate and evaluate the potential damage or destruction of these sites by a proposed undertaking.

Q. What makes a resource “significant” under the National Historic Preservation Act?

A. The concept of “significance,” which is both implicitly and explicitly incorporated into the requirements of the National Historic Preservation Act, is centered on the built environment and the historical significance of that environment for the understanding of American history. In this context, significant features are most often the houses of prominent people or the location of events deemed to be historically important, such as Ben Franklin’s or Betsy Ross’s homes. This approach is usually sufficient to protect such structures from modern road building, urban renewal or similar undertakings.

Beyond this sense of history, significance is hard to define, say as in the context of Native American societies, where history is recorded through oral tradition and where different geographic concepts are used to remind members of these societies of their historical past. While this is true, the National Historic Preservation Act does not, in practice, ignore things and places enshrined in the traditions and oral history of American Indian cultures. Sacred mountains, caves or springs are commonly listed as significant sites worthy of listing on the National Register of Historic Places and thereby are protected under the National Historic Preservation Act.

1 **III. 1836 TREATY OF WASHINGTON.**

2 **Q. How is the 1836 Treaty of Washington impacted by the continued operation of**
3 **Enbridge’s Line 5 dual pipeline and the proposed Tunnel Project?**

4 A. In the early decades of the nineteenth century the fur trade, which had long formed the
5 basis of the Native American economy in the Upper Great Lakes region, fell into the
6 hands of the newly formed American Fur Company that operated and controlled the fur
7 trade through a credit system that functioned to bring furs into the ownership of the fur
8 company and also to keep Native People in perpetual debt to the company for the
9 provisions and trade items it provided such as woven clothing, blankets, guns, steel axes,
10 traps, and knives, glass beads and many useful items, as noted in my 1992 book *Rites of*
11 *Conquest The History and Culture of Michigan’s Native Americans* at pages 225-230. As
12 the population of fur bearing species fell after several centuries of trapping, the Native
13 People had only two ways to repay credit obligations: they could sell their land for cash
14 or negotiate treaties with the United States that contained a trader debt provision that set
15 aside a large amount of money to pay private trade debts. The Treaty of Washington in
16 1836 (“the Treaty”) provided both types of payments to the Native People, as reprinted in
17 Kappler, Charles (ed), 1972:450 *Indian Treaties 1778-1883*. Mattituck, NY: Amereon
18 House, or 7 Stat. 491.

19 Article 1 of the Treaty ceded thirteen million acres of land to the United States that now
20 composes most of the territory that is now Michigan, as well as the adjacent ceded waters
21 of Lakes Huron, Michigan, and Superior of approximately the same surface acreage.
22 Article 6 provided the then astounding sum of \$600,000 dollars to pay Native American

1 debts to traders. In order to agree to sign the Treaty, the tribes insisted that they retain the
2 right to hunt, fish, and gather over the land and water that had been ceded along with the
3 other privileges of occupancy until the land was required for settlement. This right was
4 codified by Article 13.

5 The 1836 Treaty was affirmed by the Senate, as required by the US Constitution, signed
6 by the president, and proclaimed on May 27, 1836. Indian signers included
7 representatives from all of the Ottawa (Odawa) and Chippewa (Ojibwe) bands of the
8 ceded territory. As I describe in my book, *Faith in Paper The Ethnohistory and Litigation*
9 *of Upper Great Lakes Indian Treaties*, pages 49-62, the successor tribes in northern
10 Michigan are today represented by federally recognized tribes including the Bay Mills
11 Indian Community, the Sault Ste. Marie Tribe of Chippewa Indians, the Little Traverse
12 Bands of Odawa Indians, the Grand Traverse Band of Ottawa and Chippewa Indians and
13 the Little River Band of the Ottawa Indians.

14 It is clear from the treaty itself that in 1836 the Indians anticipated their future
15 participation in a commercial fishery in the ceded waters including, importantly, the
16 Straits of Mackinac. Even after the State of Michigan began to regulate the Great Lakes
17 fishery at the turn of the twentieth century, members of the 1836 Treaty tribes strongly
18 insisted on their rights to hunt, fish, and gather under the terms stated in Article 13 of the
19 1836 Treaty. Attempts by the State of Michigan to enforce its usufruct regulations in the
20 first half of the twentieth century led the 1836 tribes to press their claims to treaty-based
21 harvest rights, which the white people of Michigan did not remember, but the Indian
22 people never forgot.

1 In the 1970s after a long bitter and expensive struggle in the federal courts, the lawsuit
2 *US v Michigan* was heard by federal district court Judge Noel Fox in the Western District
3 of Michigan, who, in 1978 ruled in favor of the tribes by affirming their treaty rights to
4 harvest fish in the treaty waters of the Great Lakes free of state interference. See Cleland,
5 Charles; *Faith in Paper The Ethnohistory and Litigation of Upper Great Lakes Indian*
6 *Treaties*, pages 88-93. This landmark decision gave rise to a large, annual, multi-million-
7 dollar tribal commercial fishery of which the resources of the Straits of Mackinac play an
8 important role.

9 An example is Jason Grondin who is a long time, experienced Sault Tribe commercial
10 fisherman. Mr. Grondin has fished in the Straits of Mackinac his entire life, as did his
11 father and grandfather before him. Mr. Grondin is teaching a young member of his
12 community to fish and worries that the continued operation of Enbridge's Line 5 and
13 proposed construction of the Tunnel Project will damage the Straits fishery and seriously
14 curtail the fishery for an extended period, would also disrupt the transfer of fishing
15 knowledge to the younger generations.

16 Both tribal commercial and sport fishers are licensed and regulated by the five 1836
17 Treaty tribes, which together highly value the right to fish secured to them by their
18 ancestors who, in negotiating the 1836 Treaty, in effect made usufructuary rights the quid
19 pro quo for the cession of much of the land and water which now makes up the State of
20 Michigan.

21 Since securing the treaty right to fish in the treaty waters of the Great Lakes in 1978, the
22 successor tribes to those who ceded the land in 1836 have developed a highly profitable

1 commercial fishing enterprise with an estimated annual worth of 61 million dollars that is
2 based not only on the right to fish, but also upon production of a safe and desirable
3 product. A catastrophic failure of Line 5 would most certainly not only reduce whitefish
4 and lake trout populations, but would also introduce hydrocarbon products into the fish
5 themselves, making them unfit for human consumption. Given these very undesirable
6 outcomes, the loss of market opportunities would abrogate the Treaty of 1836 which,
7 after all, was guaranteed to the fishing tribes as a matter of federal law.

8 **IV. CULTURAL AND HISTORIC RESOURCES AT RISK.**

9 **Q. How are the resources categorized for purposes of your testimony?**

10 A. For the purpose of describing the potential impact that may accrue to cultural and historic
11 resources, these resources are grouped into four categories: (1) cultural traditions, and (2)
12 prehistoric, (3) historic, and (4) underwater sites, where in most cases they share similar
13 exposures.

14 **Q. What is the spiritual and cultural significance of the Straits of Mackinac to the**
15 **Ojibwe and Odawa People?**

16 A. It is in this separate context of “significance” that we must examine the Straits of
17 Mackinac, namely in the context of its significance to the people of Ojibwe and Odawa
18 cultures. In their view, told and retold, for perhaps thousands of years, the Straits of
19 Mackinac represents the central location for the creation of the earth.

20 As they tell it, in the days before the dawn of present time, only four human brothers
21 lived upon space between the heavens and the underworld. One of the brothers was the

1 creator trickster named Nanaboozoo or Nanabush. See Johnston, B. 1996:11-15. *The*
2 *Manitous*. New York City: First Harper Perennial Press. Smith, T.S. 1995:158. *The*
3 *Island of the Anishnaabeg*. Moscow, ID: University of Idaho Press. Nanabush, in fact,
4 created the world itself. As the legend goes, Nanabush found himself floating in a giant
5 canoe full of animals in what is now called the Straits of Mackinac. There was, at that
6 time, no land in sight and this distressed Nanabush's animal companions. They implored
7 Nanabush to create dry land. Nanabush replied that in order to do so, he needed some soil
8 and requested amik (beaver) to dive to the bottom of the Straits and to bring back some
9 soil. Beaver dove down a great distance but could not reach the bottom since the straits
10 are very deep. Beaver drowned and his body floated to the surface. Not to be deterred,
11 nigig (otter) volunteered to dive for the soil. Regretfully otter had the same fate as beaver.
12 Then the little waazhashk (muskrat) stepped forward to make the attempt and Nanabush
13 gave his approval to the brave little creature. Muskrat dove and was gone a considerable
14 time, but eventually popped to the surface more dead than alive. Nanabush retrieved his
15 little body and there in his paw were several grains of sand. Nanabush blew on these sand
16 grains and to the great pleasure of all the animals, created a beautiful island that the
17 Ojibwe and Odawa people believe to be Mitchi Makinac (Big Turtle), or Mackinac Island
18 and to this day is venerated by them as a sacred spot, the primal soil of creation of the
19 entire earth as was brought forth from the bottomlands of the Straits of Mackinac. See,
20 Vogel, V. 1986:112. *Indian Names in Michigan*. Ann Arbor: The University of Michigan
21 Press.

22 Beyond geography and natural history in the sense of modern American culture, in the
23 cultural tradition of the Anishinaabeg, as the Ojibwe, Odawa, and Potawatomi call

1 themselves collectively, the natural world is also the realm of resident spirits that are
2 sensitive to the actions of humans, especially when these actions are damaging to the
3 balance of nature as it was left in the care of modern people who are expected to treat the
4 natural world with respect. By all measures the Straits of Mackinac and Mackinac Island
5 are of deep religious and cultural significance to the Odawa and Ojibwe people and
6 eligible for protection under the National Historic Preservation Act.

7 **Q. How might social and religious activities be impacted by the proposed Line 5 tunnel**
8 **project?**

9 A. On social and religious occasions among the Anishinaabeg such as naming ceremonies,
10 weddings, harvest festivals, ghost suppers and funerals, feasting is an important ritual.
11 Such feasts feature wild foods such as blueberries, venison, and fish, especially whitefish
12 and lake trout as well as corn soup and fry bread because these foods symbolize the all-
13 important relationship between people and the natural environment of which they are a
14 part. Traditional foods are for the Ojibwe and Odawa, crucial to the celebration of their
15 economic, social, and political bonds as native people. If any environmental catastrophe
16 renders fish unconsumable, it will strike a blow to the very social fabric of the native
17 people who are holders of unique cultural traditions with long standing cultural practices.

18 **Q. What are the most common and most at-risk archaeological sites in or near the**
19 **Straits of Mackinac?**

20 A. The most common and most at-risk archaeological sites in the Straits of Mackinac area
21 are terrestrial sites on the shores of Lakes Michigan and Huron and associated islands. In
22 order to obtain a complete listing of the terrestrial archaeological sites in the Straits of

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1 Mackinac, I asked the acting State Archaeologist, Stacy Tchorzynski, for a list of all the
2 known archaeological sites on or near the shores of the Straits of Mackinac as well as the
3 shores and islands of northern Lakes Michigan and Huron. Exhibit BMC-34C shows sites
4 located in this position from Norwood on the shore of Lake Michigan north to Mackinaw
5 City and then south along Lake Huron to Alpena. Likewise, the north shore of Lake
6 Michigan and the Straits east to the Les Cheneaux Islands of Lake Huron constitutes
7 another group of sites. In total, the sites listed in Exhibit BMC-34C represent all of the
8 known archaeological sites which might be impacted in the Straits of Mackinac.

9 Exhibit BMC-34C shows the number of each site, its period of occupation, its type based
10 on use, and whether it has been listed on the National Register of Historic Places,
11 whether it is eligible for listing, or if more information is needed to make this judgment
12 (MIN—more information needed to determine its eligibility for listing on the National
13 Register of Historic Places). A map showing the exact location of each site will not be
14 given here as a matter of professional policy, as well as state of Michigan regulations,
15 since experience has shown that detailed location information often attracts relic
16 collectors to sites and leads to destructive digging that only damages the potential for
17 trained archaeologists to learn from the all-important undisturbed context. It should be
18 noted that while much is known from the archaeological sites in the Straits area, many of
19 the known sites have not been completely excavated, so the unexcavated portions are still
20 of value. In addition, it is beyond doubt that an area so rich in human history has many
21 archaeological sites of all ages which remain undiscovered.

22 As may be seen by Exhibit BMC-34C the State of Michigan lists 141 terrestrial
23 archaeological sites that might be endangered by the continued operation of Line 5 dual

1 pipelines. Of these, nineteen are listed on the National Register of Historic Places, three
2 sites are part of Historic Archaeological Districts, and one site has been designated as a
3 National Historic Landmark.

4 Clearly the Straits of Mackinac area is a treasure trove of archaeological resources which
5 relate to its history, the culture of its Native American people, as well as the historic
6 tourism economy of the entire region of northern Michigan. The loss of even one of these
7 sites would cause harm to all of these interests.

8 The Straits of Mackinac region has been a place of human residence, industry, and
9 economy for 10,000 years and the sites of people engaged in these activities are
10 represented in both the archaeological, documentary, and oral historical records. In fact, it
11 would be difficult, if not impossible, to find any area of similar size in the United States
12 with as many such sites as well as the detailed contribution made to our understanding of
13 the American past than are extant today in and around the Straits of Mackinac. Likewise,
14 it can be said that there is not another area where wholesale destruction or damage to
15 cultural and historical resources would be quite so catastrophic.

16 **Q. Please describe in more detail some of the most significant sites.**

17 A. For the purpose of organizing the discussion of these sites that may be jeopardized by the
18 continued operation of Line 5 as well as associated activities with the construction of a
19 tunnel under the Straits, the cultural and historical sites have been grouped into four
20 types. As I referenced earlier in my testimony, these include 1) traditional cultural sites,
21 2) prehistoric terrestrial sites, 3) a prehistoric underwater site, and 4) terrestrial historical
22 archaeological sites.

1 In order to give the Commission a more qualitative view of the archaeological sites in the
2 Straits area, a description will be given in more detail of some of the most significant
3 sites. The 141 sites listed in Exhibit BMC-34C are of different sizes and types. The most
4 noticeable are large villages or fortifications, but there are also small sites that are
5 represented only by a scattering of flint chips or fire-cracked rocks, where ancient people
6 paused to make or sharpen a flint tool. All of the sites can tell us something about
7 prehistoric settlement patterns, technology, and the distribution of various activities and
8 more. For these reasons, it is the collective study of many different kinds of
9 archaeological sites that provides us with the most meaningful discoveries about the past
10 and why archaeologists are reluctant to lose any of them.

11 **Q. Please describe some of the endangered prehistoric terrestrial sites in or near the**
12 **Straits of Mackinac.**

13 A. The following five terrestrial sites are described in detail to give the tribunal a qualitative
14 sense of the range and content of these types of sites as a means to help understand their
15 value of historical resources.

16 **The Juntunen Site (20MK1).**

17 The Juntunen site is a stratified Late Woodland habitation and burial site on the west end
18 of Bois Blanc Island and on the east end of Round Island in the Straits of Mackinac. The
19 Juntunen site is 200' x 400' in extent, slightly above the level of Lake Huron and
20 approximately 600' from shore. This site was occupied at least six times between AD 800
21 and AD 1400 at all seasons except for winter. The excavation, undertaken in 1960
22 through 1963 by the Museum of Anthropology, University of Michigan, was under the

1 direction of Dr. Alan McPherron. See McPherron, Alan 1967 The Juntunen Site and the
2 Late Woodland Prehistory of the Upper Great Lakes Area. *Museum of Anthropology*,
3 *University of Michigan Anthropological Paper No. 30*, Ann Arbor.

4 The Juntunen site is the most important prehistoric Late Woodland site in northern
5 Michigan as it provides the sequence of dated ceramic types used to order and date all
6 other Woodland sites in northern Michigan. Unexcavated areas remain on Bois Blanc as
7 well as adjacent Round Island.

8
9 [[REDACTED]] Sites on [[REDACTED]]
10 [[REDACTED]].

11 None of these sites have been intensely investigated, but based upon surface finds they
12 appear to have been lightly occupied late in the Late Woodland period (AD 800 - AD
13 1400). They are likely related to the Les Cheneaux Ojibwe band of modern times. See
14 USFS files, Hiawatha National Forest, Escanaba.

15 **The [[REDACTED]] site.**

16 The [[REDACTED]] site located within [[REDACTED]] is a Late Woodland
17 occupation site (AD 800 - AD 1400) which was a workshop that turned out many
18 hundreds of quarter-sized slate discs that were engraved with elements of ancient Ojibwe
19 iconography. The purpose of these artifacts is unknown, but is likely related to religious
20 activities. Not a single slate disc manufactured at the [[REDACTED]] site has ever been
21 found in any other of the many dozens of northern Michigan sites occupied in the same
22 time period although one such disc was recovered from a Late Woodland site on the

1 Bruce Peninsula of Ontario. This unique and interesting site needs further archaeological
2 attention and would likely be damaged by an oil spill in the straits. [[REDACTED]]

3 [[REDACTED]]
4 [[REDACTED]]]

5 [[REDACTED]] Sites.

6 On the northwest coast of Lake Huron, [[REDACTED]] appears to have been a place of
7 great mystical significance to native people. In addition to the [[REDACTED]] site with its
8 mysterious discs, there are sites on [[REDACTED]]
9 which have puzzled archaeologists for years.

10 [[REDACTED]] only slightly above water level of
11 [[REDACTED]] there are a series of low rock walls of prehistoric origin which comprise
12 the [[REDACTED]] site [[REDACTED]]. The function and age of the [[REDACTED]] site has
13 been debated by archaeologists for years. The latest and perhaps most plausible
14 hypothesis is that the walls functioned during periods of high water to hold live sturgeon.
15 If this hypothesis is confirmed, the [[REDACTED]] site would be only the second such site
16 in the contiguous United States, the other being in coastal Florida.

17 On the [[REDACTED]] there are two sites of significance, one of which is the [[REDACTED]]
18 site [[REDACTED]] which is a Late Woodland prehistoric village site dating to the Juntunen
19 Phase (AD 1350 - AD 1650). The other site, as yet undiscovered, was reported by
20 Commissioner of Indian Affairs Thomas McKenney who was on his way to Lake
21 Superior to negotiate an Indian treaty in 1826. See McKenney, Thomas 1959:400-404.
22 *Tour to the Lakes*. Minneapolis: Ross Haines Inc. While crossing [[REDACTED]] in

1 stormy weather, Col. McKenney watched an Indian family in a canoe stop at a
2 [REDACTED] and leave an offering of thanks for a safe passage at
3 a rock as many had done before them. Although its location was well documented by
4 McKenney, the exact site and its assortment of offerings has not been accurately located
5 at this time.

6 **[REDACTED] Prehistoric Sites.**

7 [REDACTED]
8 [REDACTED]
9 [REDACTED] there are several prehistoric sites on or close to the boundary of
10 the park. These are known to park archaeologists but have only received cursory
11 investigation. One of these sites appears to be a Lake Woodland village (AD 800 – AD
12 1400) [REDACTED]
13 [REDACTED] These latter sites were occupied by people of the
14 Laurel Culture (AD 300 – AD 800) and link the Ojibwe of the Straits area north to Lake
15 Superior. Archeological analysis of these sites would add to our understanding of the
16 prehistoric cultural dynamics of the Straits area. All of the sites are on sandy soil and
17 only a few feet higher than Lake Huron and thus vulnerable to damage from petroleum
18 spills.

19 In total, there are one hundred forty-one known prehistoric and historic sites on the shore
20 of the straits and its islands. It is likely that there are many more as yet undiscovered.
21 Other prehistoric sites that are more distant and are likely to be impacted by a major oil
22 spill include large village sites at [REDACTED]

1

2

3 **Q. Please describe the known endangered underwater archeological prehistoric site.**

4 A. Professor John O'Shea, curator of Great Lakes Archaeology at the Museum of
5 Anthropological Archaeology at the University of Michigan, revealed in 2009 his
6 astonishing discovery of lineal stone features which now lie beneath Lake Huron. These
7 features date from the low water period associated with glacial Lakes Chippewa and
8 Stanley in the Lakes Michigan-Huron basins respectively, approximately 10,000 to 8,000
9 years ago. During this low water phase, most of the beds of modern Lakes Huron and
10 Michigan were completely dry and were covered by a mixed conifer forest except where
11 the two much smaller lakes were located and connected by a river that flowed through the
12 Straits of Mackinac. During this time, it is believed that Paleo-Indian caribou hunters
13 built a series of blinds and stone channeling structures, which though now flooded by
14 Lake Huron, are nearly identical to those built and used by modern caribou hunters in the
15 Arctic regions of North America. These structures were discovered and mapped using
16 sonar imagery technology, as reported in a 2009 article, O'Shea, John and G. Meadows
17 2009 Evidence for Early Hunters Beneath the Great Lakes *Proceedings of the National*
18 *Academy of Sciences* 106:25.

19 **Q. Are you aware of any potential underwater archaeological sites in the Straits of**
20 **Mackinac?**

21 A. On February 12, 2020, Dr. O'Shea wrote to Martha MacFarlane-Faes, Deputy State of
22 Michigan Historic Preservation Officer calling her attention to the fact that the

1 underwater cultural resource assessment of the proposed Line 5 tunnel under the Straits
2 of Mackinac submitted by Enbridge Energy was seriously flawed. Exhibit BMC-35. See
3 O'Shea to MacFarlane-Faes communication of February 12, 2020. Enbridge contracted
4 with Search Inc. to conduct an assessment of submerged cultural resources that would be
5 impacted by the construction of the proposed tunnel. Exhibit BMC-36.

6 According to the letter, Dr. O'Shea was told by a Search Inc. technician, who was
7 assigned to this job, that he was instructed to inspect existing sonar imagery and to only
8 look for shipwrecks; he was not directed to conduct new sonar surveys nor to look for
9 other sites of archaeological interest. Dr. John O'Shea's letter further reported that the
10 technician told him that he had observed linear stone alignments on the old sonar imagery
11 but was not able to confirm the prehistoric origins of the alignments nor their function.
12 This being the case, according to the letter, the technician asked his employers at Search
13 Inc. for permission to consult with Dr. O'Shea for help. He was denied such a
14 consultation and was soon after fired from the Straits project and not permitted to see the
15 final report submitted to Enbridge, as set out in the letter.

16 The stone alignment features reportedly seen in the sonar imagery by the Search Inc
17 technician likely represent a very rare and unusual opportunity to further investigate a
18 chapter of prehistoric life in the Straits of Mackinac area 10,000-8,000 years ago. These
19 features should be protected from impact from construction of the proposed tunnel that
20 would destroy the alignments.

21 **Q. What is the best way to investigate for underwater archaeological sites in the Straits**
22 **of Mackinac area?**

1 A. The best way to investigate this area for prehistoric sites is to conduct another side scan
2 sonar study of the proposed tunnel corridor and its surroundings well before any tunnel
3 construction is approved or initiated. This must follow a plan designed by a qualified
4 underwater archaeologist. If rock alignments are confirmed under the Straits, it would be
5 one of the most important sites in the State of Michigan.

6 **Q. Please describe the endangered underwater archeological historical shipwreck sites.**

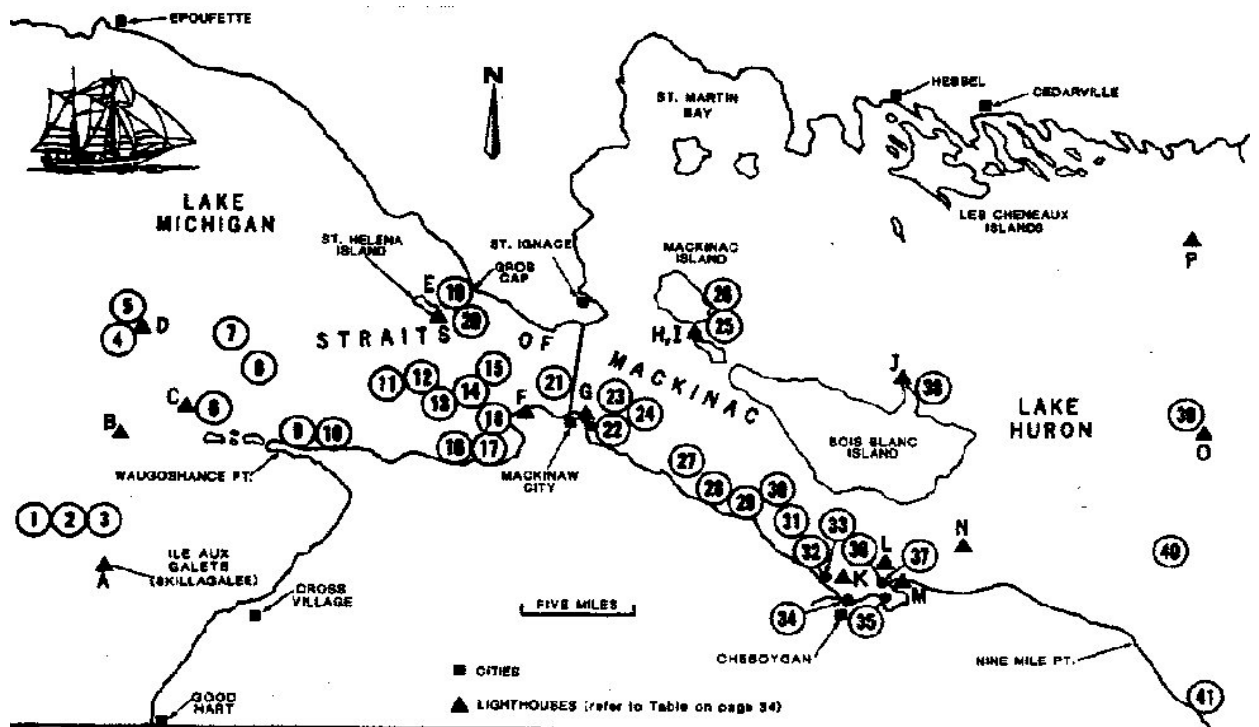
7 A. Within the discipline of historical archaeology, submerged shipwrecks are considered to
8 be archaeological sites. Such sites have several elements to add to our study of the
9 historic past. First and most importantly, they are time capsules; that is, none of the
10 artifacts recovered from a shipwreck can postdate the exact date of the wreck. Thus, for
11 example, we can know for certain that ceramics and bottle types recovered from a
12 shipwreck predate the downing of the ship.

13 Secondly, shipwrecks collectively represent a dated record of ship building technology.,
14 For example, shipwrecks inform us about the use of specific propulsion types from wind
15 to steam, to oil and coal to gasoline and diesel, as well as the technologies associated with
16 each. Ship design over time can also be studied from dated shipwreck sites.

17 The Straits of Mackinac with its ice, fog, and heavy shipping traffic has been the scene of
18 eighty-four shipwrecks. Forty-one have been discovered while forty-three wrecks are
19 known historically but their physical location remains unknown. See Feltner, Charles and
20 Jeri Feltner 1991 *Shipwrecks of the Straits of Mackinac* Dearborn, MI: SeaJay
21 Publications. To date there has been no adequate professional study of the effects of

tunnel construction or petroleum fouling on the shipwreck sites. Such a study by a competent underwater archaeologist should be made as expeditiously as possible.

A map of wrecks in the Straits of Mackinac shows that ten of these wrecks are located on, or very near, the proposed Enbridge Line 5 tunnel corridor (See Map 1). These ships include the CH Johnson, Fred McBrier, Chuck's Barge, Maitland, Northwest, Sandusky, Eber Ward, William Stone, George's Wreck, and Headlands Wreck.



Map 1. Map of Discovered Shipwrecks in the Straits of Mackinac and List of Wrecks in the Proposed Tunnel Corridor. See Ibid., 62-63.

11. Fred McBrier

16. William Stone

12. Maitland

17. George's Wreck

13. Northwest

18. Headlands Wreck

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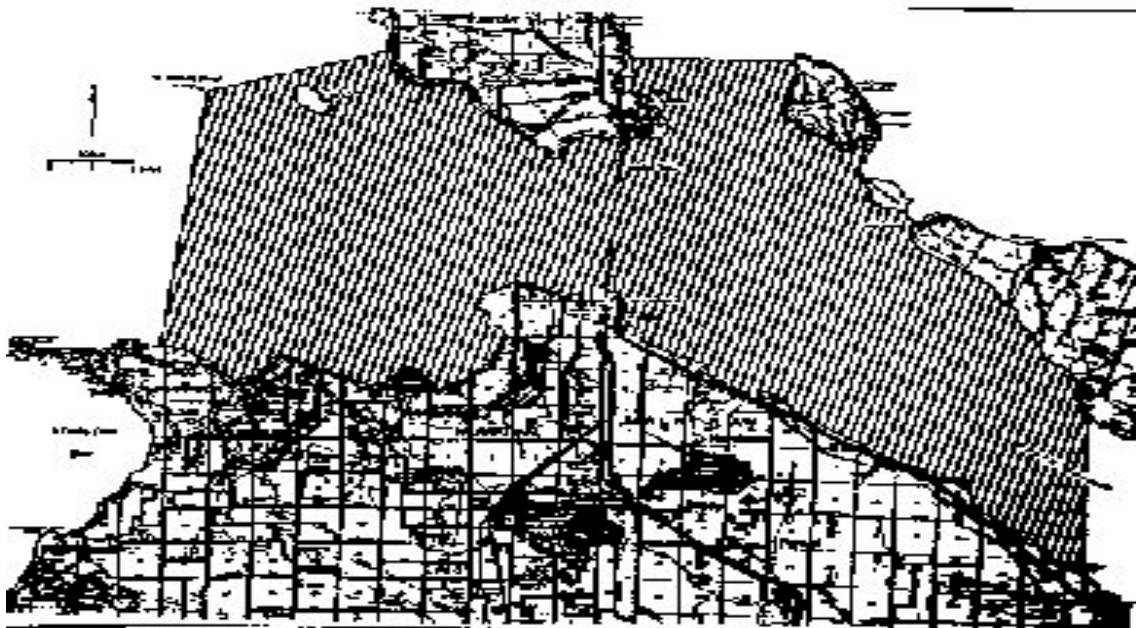
14. Sandusky

15. Eber Ward

Seven sailors died in the sinking of the Sandusky and five died in the sinking of the Ebner Ward. These two vessels should be recognized as cemeteries.

Although most of the known shipwrecks in the Straits are not in the Line 5 corridor, they are still subject to damage from oil spills, particularly for petroleum products that are heavy enough to sink and foul ships on the bottomlands which is not attractive nor safe for members of the substantial sports diving community.

When considering the bottomlands of the Straits of Mackinac and an undertaking which may affect archaeological sites including shipwrecks or even projects such that will transform the lakebed itself it is important to know that on July 2, 1980 the Michigan legislature designated the Straits of Mackinac as a Great Lakes State Bottomland Preserve by means of Public Act 184 which amended Public Act 173 of 1929. See Map 2. The Straits Bottomland Preserve protects one hundred forty-eight square miles of bottomlands including those intended or are currently being used by Enbridge Inc. to transport oil through Line 5. See Ibid, Appendix B:285-88.



Map 2. Straits of Mackinac Bottomlands Preserve Boundaries. Ibid, 285.

Q. Please describe the endangered historic archaeological sites.

A. Since the early eighteenth century, the Straits of Mackinac has been an important strategic location given that it sits astride the maritime passages between Lakes Huron and Michigan and a water passage to Lake Superior. This fact was not lost on either contemporary military planners nor commercial traders that established settlements and military posts on both sides of the Straits as well as on Mackinac and Drummond Islands. This pattern of settlement by Euro-Americans was already thousands of years old before the founding of Fort Michilimackinac in 1715, and the area was also in use by native people, namely the ancestors of the Odawa and the Ojibwe people who occupy both shores of the straits to this day. These sites collectively provide the details important for the historic record that links Michigan's past to its future as well as the basis of an annual

1 multi-million-dollar historic tourism industry with its Native American, French, British
2 and early American components.

3 Mackinac Island alone attracts over one million visitors annually, many of whom are
4 drawn to the island by historic attractions, restored, reconstructed and interpreted by the
5 Mackinac Island State Parks Commission, which, in addition, also operates Fort
6 Michilimackinac in Mackinaw City and the Historic Mill Creek site on the south shore of
7 the straits near Cheboygan.

8 **Fort Michilimackinac (20EM52).**

9 This important site was established on the south shore of the Straits by the French in 1715
10 and was occupied by them until 1763 when the fort was surrendered to the British who
11 used it for another seventeen years before moving it to Mackinac Island. Fort
12 Michilimackinac holds the distinction of being the longest site under continual
13 archaeological excavation, that is, each summer for sixty-two years. This record includes
14 the whole of North America and likely the entire world. Even so, the entire site has not
15 been excavated and will certainly reveal many more of its historical secrets.

16 This site is on sandy soil with the waters of the Straits reaching to its northern edge.

17 The fort—which is on the National Register is also a National Landmark site—is located
18 near the south end of the Mackinac Bridge. Fort Michilimackinac is owned and operated
19 by the Mackinac Island State Park Commission (MISPC) which employs Dr. Lynn
20 Evans, a highly qualified historic archaeologist to supervise excavations at their various
21 historic properties.

The Mill Creek Site.

The Mill Creek Archaeological Site is an eighteenth- century sawmill site that has been restored and, like Fort Michilimackinac and Fort Mackinac, is managed by the MISPC and is open to the public.

The Marquette Mission Site (20MK82) (20MK99).

Another historic site is the Marquette Mission Site that is on the National Register. This site, established by Father Marquette as a village and mission for Odawa and Huron refugees in 1671, was abandoned in 1705. This site, which is owned by the City of St Ignace, along with the adjacent Museum of Ojibwe Culture and History, is a tourist attraction. Although the Museum at Michigan State University has conducted extensive excavations at this site, there is much of the site area that has not been explored. The burial site of Father Marquette is thought to be somewhere on the unexcavated portion. See Brantsner, Susan, 1991 Decision-Making in a Cultural Contact Context: A Historical and Archaeological Perspective of the Tionontate Huron of Saint Ignace, Michigan, In *Entering the 90s: The North American Experience*. T.E. Schirer (ed), Sault Ste. Marie, MI: Lake Superior State University.

The Marquette Mission site is on sandy soil and is only a few feet above the waters of St. Martins Bay of Lake Huron and the Straits of Mackinac.

1 The [[REDACTED]] Cemetery [[REDACTED]]

2 The [[REDACTED]] Cemetery is an active cemetery [[REDACTED]] It is
3 [[REDACTED]] and was established adjacent to and overlapping with
4 a Native American cemetery that was in use by the mid-eighteenth century, if not earlier.

5 As such, this cemetery is likely the oldest cemetery in continuous use in the United
6 States. [[REDACTED]]

7 [[REDACTED]]
8 [[REDACTED]]
9 [[REDACTED]] Village [[REDACTED]]

10 This site, located just west of the [[REDACTED]] cemetery, was identified by archaeologists
11 from Michigan Tech University as part of their survey for sites [[REDACTED]]
12 [[REDACTED]] The site is known only from surface collection and has not
13 been excavated. It is thought that this village is contemporaneous with the Marquette
14 Mission occupation. It is a valuable site for exploring Odawa history.

15 **V. RISK OF ENVIRONMENTAL CATASTROPHE.**

16 **Q. What impacts must an archaeologist consider when assessing a project's impact on**
17 **cultural, historical and environmental resources?**

18 A. In assessing the potential impact on cultural, historical, and environmental resources it is
19 the duty of the experts to identify and consider the full range of possible outcomes which
20 might result from specific undertakings. Such considerations impose a moral and
21 scientific duty to assume the complete range of possible impacts.

1 For instance, it is my responsibility to consider the impacts on cultural and historical
2 resources caused by the leakage of petroleum products into the water of the Straits of
3 Mackinac that may result from the continued operation of the Line 5 dual pipelines
4 through the Straits of Mackinac during the construction of the proposed tunnel. It is
5 common sense that uncontained petroleum products adversely impact resources located
6 in proximity of a ruptured pipeline. Whether or not this turns out to be true for the
7 continued operation of the existing dual pipelines, it should not and cannot be eliminated
8 from consideration without calling into question the veracity of independent analyses of
9 the impacts of the undertaking.

10 **Q. How would an environmental catastrophe—such as an oil spill, failure of the tunnel**
11 **boring machine, explosion, etc.—impact cultural and historical sites generally?**

12 A. An environmental catastrophe would gravely harm terrestrial and underwater cultural and
13 pre-historic and historic archaeological sites. The most common and at-risk
14 archaeological sites in the Straits of Mackinac area are terrestrial sites on the shores of
15 Lakes Michigan and Huron and associated islands. Any spill of lighter- than-water crude
16 oil that floats would, as a result of currents and fluctuating water levels, eventually result
17 in the accumulation of petroleum product on these sites with the result that these non-
18 renewable resources would likely be lost forever.

19 Light fraction petroleum products that float on the water surface can be widely
20 distributed by the normal motion of lake water. Long waves, which measure from two to
21 four feet in height, are common and are driven by moderate winds of eleven to sixteen

1 knots. Prevailing westerly winds in the Straits of Mackinac area push long waves so that
2 floating oil would be deposited on beaches and associated archaeological sites.

3 One might reasonably wonder how an oil spill in the Straits of Mackinac could possibly
4 damage sites as far south as Thunder Bay on the Lake Huron coast which are well south
5 of the Straits on the west coast of Lake Huron. The distribution of floating oil is of course
6 greatly influenced by surface currents. Studies of currents in Lake Huron show that
7 surface as well as deep currents emerge from the east end of the Straits of Mackinac and
8 flow south along the west shore of Lake Huron as far south as Saginaw Bay. These
9 currents would easily carry oil to sites in Thunder Bay, which are one hundred miles
10 south of the Straits.

11 The Straits of Mackinac area has a great concentration of archaeological sites and most of
12 these are vulnerable to damage from an oil spill because during both prehistoric times as
13 well as in the time of early Euro-Americans, settlements were made on sandy shores near
14 the waterline. This is because transportation was primarily by water and particularly by
15 birch bark canoes. Landing such canoes on rocky shores would damage these fragile
16 watercrafts.

17 These conditions are the main reasons that these sites, now represented in the
18 archaeological record, are at-risk from floating oil. In order to assess the oil spill risk to
19 archaeological sites, it is important to know their soil types, their distance from Line 5
20 and the proposed tunnel, and the path of floating oil as indicated by existing currents.
21 Potential damage to prehistoric and historic archaeological terrestrial sites in the Straits
22 area would be similar in most respects.

1 **Q. What is “archaeological site attrition” and please give an example as to why it’s so**
2 **important to the sites located within or near the Straits of Mackinac?**

3 A. Archaeological sites are by their nature vulnerable resources since they are usually buried
4 and therefore not visible on the surface of the ground. Given their condition, many sites
5 have been and are being unintentionally destroyed by the modern construction of roads,
6 homes, and businesses. This renders those sites which remain intact all the more valuable
7 as non-renewable cultural resources.

8 An excellent example of the unintended attrition of archaeological sites in the Straits of
9 Mackinac area has recently presented itself when the Enbridge Energy Corporation
10 applied to the Bois Blanc Island Planning Commission for permission to build an
11 observation tower on the west end of the island. The tower was to provide an overlook of
12 the commercial shipping channel. Such a tower would require considerable earthmoving
13 for its construction.

14 It was likely unknown to Enbridge, since they performed no environmental impact study
15 for the tower site, that the area they sought for the tower is also the location of the
16 Juntunen archaeological site, which would be damaged and likely totally destroyed by the
17 requested construction and its subsequent use.

18 The Juntunen Site is perhaps the most important site of the Late Woodland era (AD 800 –
19 AD 1400) in the entire straits area, if not all of northern Michigan. Remains from the
20 Juntunen Site have been the basis for much of what we know about the lives and culture
21 of the prehistoric native American people relating to their subsistence, including gillnet
22 fishing for whitefish and lake trout, and in this manner it sets a baseline for understanding

1 changes in the fish populations to modern times. The Juntunen Site also informs us about
2 village life and burial modes in the Late Woodland period. The Juntunen Site was
3 occupied by at least four groups at different times during the Late Woodland. Each left
4 pottery sherds with their own distinctive modes of decoration and these ceramic patterns,
5 which have been carbon 14 dated, provide temporal markers when they are found on
6 other Late Woodland sites in northern Michigan and beyond.

7 Future archaeological excavation of the unexcavated portions of this site would certainly
8 reveal much more information unless it is destroyed by tower building. There are no
9 other means for discovering this information than that which still lies buried at the
10 Juntunen Site.

11 **Q. What additional actions do you think are necessary to completely assess the risk to**
12 **the cultural and historical sites posed by the tunnel project if permitted and**
13 **constructed?**

14 A. The enumeration and evaluation of the many historical and cultural sites of the Straits of
15 Mackinac of northern Lakes Michigan and Huron indicate a very large number of sites,
16 many of which are non-renewable. Likewise, consideration of the historic importance of
17 the Straits area to native people and their unique cultural perspective of the past brings to
18 our attention to the fact that the loss or damage to the historical and cultural sites of the
19 Straits of Mackinac falls disproportionately on the Odawa and Ojibwe people of this
20 region.

21 In considering possible mitigation measures that may correct or avoid damage done by an
22 undertaking which endangers or destroys sites of cultural or historical value, it is

1 necessary to know the location and characteristics of the site, the extent and nature of the
2 potential damage, and finally the practicality of the corrective measures themselves.

3 There are two types of sites that raise special mitigation concerns. First there are
4 archaeological sites, which are considered to have cultural and historic value that are
5 evaluated as non-renewable resources. These sites are unique in the sense that their
6 context cannot be duplicated in another site. Any earth-moving or other activity that
7 destroys or disturbs the stratigraphic context of such a site or impedes the proper
8 investigation of the sites themselves are actions which destroy a resource that cannot be
9 replaced. Since the information contained in the site cannot be duplicated, no remediation
10 is possible except not to disturb the site in the first place.

11 One potentially important non-renewable underwater archaeological site from early
12 prehistoric times that would be irreparably damaged in the construction of the proposed
13 Line 5 tunnel is discussed in some detail on pages 25-26 of my testimony but needs
14 further mention in these overall conclusions for several reasons. First its very existence as
15 a prehistoric site needs to be confirmed. This is especially true since, that if it is as
16 expected, a very old and very unusual site, it would add much to our knowledge of the
17 first inhabitants of our state and region. Other reasons for the attention of this site are that
18 it has not been sufficiently documented nor has any remediation been suggested. Current
19 information is in part based on the opinion of unqualified individuals using data of
20 questionable quality.

21 Before any permit could be given for timely construction the following step must be
22 taken to save and interpret this very important site. New side-scan sonar images must be

1 taken under the direction of qualified underwater archaeologist. As explained earlier in
2 this report, Dr. O'Shea, the discoverer of stone alignments under Lake Huron, is the only
3 person with the expertise in Michigan to obtain sonar images at the proper angle to show
4 rock alignments to best advantage. Further, Dr. O'Shea is also the only archaeologist who
5 has the expertise to identify and interpret rock alignments as cultural features. In view of
6 the resource we have in Dr. O'Shea, it is recommended that before any earth-moving
7 construction is permitted on the bottomlands of the Straits, that new side scan sonar
8 imaging be prepared under the supervision of Dr. O'Shea and that if rock alignments are
9 detected that he be provided with the time and monetary resources to study these features.

10 The second mitigation concern involves damage of the undertaking of cultural sites, and
11 values. In some cases, cultural sites may not have the kind of physical manifestation of
12 the kind that are directly damaged or destroyed by the undertaking. Places of note in
13 traditional oral historical events important in the context of Anishinaabeg cultures, such
14 as the Straits of Mackinac itself, is an example. Another would be action that could
15 damage the environment that hosts certain plants and animals. Some examples include
16 plants such as sweetgrass and cattails, and ash, maple and birch trees, all important to
17 Odawa and Ojibwe culture. Damage to eagle, wolf and fish populations are also in this
18 class. In Ojibwe and Odawa cultures many animals have special totemic importance to
19 kin groups such as clans, as well as to individuals who are members of these clans.

20 Disturbance to these natural populations would constitute substantial cultural harm for
21 the native people of the Straits area who would not be able to hunt, fish, or gather as
22 anticipated and has been guaranteed by the Treaty of 1836 and it is difficult to imagine
23 how such a situation could possibly be mitigated.

1 **Q.** Does that complete your testimony?

2 **A.** Yes.

EXHIBIT BMC-31

CURRICULUM VITA

Charles E. Cleland PhD, RPA
2021

Current Titles

Distinguished Professor Emeritus of Anthropology, Michigan State University
Curator Emeritus of Great Lakes Archaeology and Ethnology, MSU Museum
1964-2000

Address

19899 Gennett Road, Charlevoix, MI 49720
(231) 547-6220
e-mail: ccleland02@gmail.com

B.A. Biology, Denison University, Granville, OH 1958
M.S. Zoology, University of Arkansas, Fayetteville 1960
M.A. Anthropology, University of Michigan, Ann Arbor 1964
Ph.D. Anthropology, University of Michigan, Ann Arbor 1966

Professional Organizations

Society for American Archaeology
Society for Historical Archaeology (Founding member)
Conference on Michigan Archaeology (Founding member)
Michigan Archaeology Society
Registered Professional Archaeologist (Founding member)

Offices Held

President--Society for Historical Archaeology 1973
Chair--Michigan Historical Preservation Advisory Council 1970-1972
Member--Committee on the Recovery of Archaeological Remains, Society for American Archaeology 1974-1978
President--Society of Professional Archaeologists 1977-1978
Chair--Coordinating Council of National Archaeological Societies 1977
Grievance Coordinator--Society of Professional Archaeologists 1985-1987
Member--Executive Board of Society for Historical Archaeology 1982-84
Chair--Committee on Ethics, American Anthropological Association 1986
Member--Executive Committee, Society of Professional Archaeologists 1986-88
Member--Executive Committee, Society of Professional Archaeology 1993-1995

Honors

Distinguished Faculty Award--Michigan State University 1978
Distinguished Service Award 1991--Society of Professional Archaeologists
Presidential Recognition Award – 1997—Society of Professional Archaeologists
J.C. Harrington Medal – 2002—Society for Historical Archaeology
Distinguished Service Award – 2003 – Register of Professional Archaeologists

Presidential Recognition Award – 2004 – Register of Professional Archaeologists
Festschrift Volume – 2004- An Upper Great Lakes Archaeological Odyssey:
Essays in Honor of Charles E. Cleland. Edited by William A. Lovis. Detroit:
Wayne State University Press.

A conversation with Charles E. Cleland by Vergil Noble Historical Archaeology;
2011, 45(2) :113-131.

Field Research:

Two million dollars in grants for research on 20 major field projects [1967-2000].

Expert Witness Work:

United States v. Michigan Case No M26-73 C.A.

Testified as expert witness in case involving rights of Ottawa and Chippewa people to fish on the open water of Lakes Huron, Michigan, and Superior under the Treaty of 1836; 1979 decision. Prevailed.

The Crown v. Agwa.

Testified as expert witness in 1982 case involving the right of member of the Batchawana Chippewa First Nation to fish in Lake Superior under the Huron-Robinson Treaty of 1850. Prevailed.

Lac Courte Oreilles Band v. Wisconsin Case No 74-C-313.

Testified as expert witness in 1984 action brought by five Chippewa bands of northern Wisconsin to hunt and fish on the land and waterways ceded by the Treaties of 1837 and 1842. Prevailed in 1985 decision.

Keweenaw Bay Indian Community v. Michigan Case No 784F Supp 418, 487.

Testified as expert witness in 1989 case involving KBIC claims of certain jurisdictional prerogatives over land set aside as a reservation under the terms of the Treaty of 1854. Prevailed.

United States and Saginaw Chippewa v. Michigan.

In 1992 participated as an ethnohistoric expert in this reservation jurisdiction case involving the Chippewa of Saginaw, Black River and Swan Creek under the Treaties of 1819, 1837, 1855 and 1864. Appealed.

Fond du Lac v. Carlson.

1994 ethnohistorical report prepared for Fond du Lac's hunting and fishing rights under the Treaties of 1837 and 1854. Prevailed.

Menominee Indian Tribe of Wisconsin v. Thompson Case No 96-3596 and 96-3185.

Ethnohistorical report prepared in 1994 for the Menominee regarding their rights under the Treaties of 1831, 1836, 1848, and 1854. Case dismissed.

Mille Lacs Band of Chippewa Indians et al, v. State of Minnesota et al. Case No 4-90-605.

In 1994 appeared as an expert witness for the Mille Lacs Band in their claim for the right to hunt and fish over the territory ceded to the United States by the Treaty of 1837. Decision upheld by the United States Supreme Court in 1999. Prevailed.

The Chippewas of Sarnia First Nation v. the Crown.

Prepared and filed an affidavit for the Chippewas of Sarnia First Nation in 1996 regarding their claim rights to lands that were part of the Chippewa of Sarnia's original reserve. Appealed Ontario Supreme Court.

State of Wisconsin v. Stockbridge-Munsee Community and Robert Chicks Case No 98-C-0871. Prepared ethnohistorical report and gave expert witness testimony supporting tribe's claim of reservation boundary. Case denied in 2001 decision.

County of Mille Lacs v. Melanie Benjamin et al., Case No 02-CV-407.

Provided expert testimony in the Mille Lac's claim regarding their reservation boundary rights. 2003 decision upholding the tribe's rights.

Keweenaw Bay Indian Community v. Naftaly Case No 452F.3d 514, 527.

Provided expert testimony in KBIC's claim regarding tax assessment of their lands. Prevailed in 2005 decision.

United States v. Michigan Case No M26-73 C.A.

Prepared ethnohistorical report and provided depositions for Ottawa and Chippewa claim of inland rights as provided by the 1836 treaty. Tribes settled with state in 2006. Prevailed.

Publications:

1961

The Significance of Animal Bones from Archaeological Sites.
Newsletter of the Arkansas Archaeological Society 2(5):1-8. Fayetteville.

1963

A Late Archaic Burial from Washtenaw County, Michigan.
Michigan Archaeologist 9(3):41-44. Ann Arbor.

1964

(with R. Flanders) The Use of Animal Remains in Hopewell Burial Mounds, Kent County Michigan. The Jack-Pine Warbler 42(4):302-309.

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Reports on the Beta Activity of Bone Samples from Various Archaeological Sites. In A. Jelinek and J. Fitting, Studies in the Natural Radioactivity of Prehistoric Materials. Museum of Anthropology, University of Michigan, Anthropological Papers 25.

1965

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1966

(with J. Kearney) An Analysis of Animal Remains from the Schmidt Site. Michigan Archaeologist 12(2):81-83. Ann Arbor.

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1967

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- 1977**
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- 1985**
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1991

Cass and Sassaba: History, Ethnohistory and Historical Reality. In Entering the 90's: The North American Experience. Thomas Schirer (editor), Sault Ste. Marie: Lake Superior State University Press.

From Ethnohistory to Archaeology: Ottawa and Ojibwa Band Territories of the Northern Great Lakes. In Text Aided Archaeology. Barbara Little (editor), Caldwell, N.J.: The Telford Press.

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1992

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1993

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Editor and contributor. The Society for Historical Archaeology and Its First Twenty-Five Years. Historical Archaeology. 27(1).

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1995

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1996

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1997

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1998

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The Mason-Quimby Line Revisited (with M.B. Holman and J.A. Holman) in From the Northern Tier: Essays in Honor of Ronald J. Mason. ed by C. Cleland and R. Birmingham. Wisconsin Archaeologist 79(1) pp. 8-27.

1999

Traders, Indians, and Middlemen: the Foundations of the British North American Fur Trade in Old and New Worlds ed. by Geoff Egan and R. L. Michael. Oxbow Books: Oxford. pp. 322-330.

Cultural Transformations: the Archaeology of Historic Indian Sites in Michigan, 1670-1940 in Retrieving Michigan's Buried Past the Archaeology of the Great Lakes State ed. by John R. Halsey. Cranbrook Institute of Science: Bloomfield Hills. pp. 279-290.

2000

Preliminary Report of the Ethnohistorical Basis of Hunting, Fishing and Gathering Rights of the Mille Lacs Chippewa. In Fish in the Lakes, Wild Rice and Game in Abundance. Testimony on Behalf of Mille Lacs Ojibwe Hunting and Fishing Rights. J. M. McClurken compiler. Michigan State University Press: East Lansing, pp. 3-140.

Some Thoughts on the Importance of Material Culture, A Preface to Interpretations of Native North American Life: Material Contributions to Ethnohistory ed. by Michael Nassaney and Eric Johnson. University Press of Florida: Gainesville.

2001

The Place of the Pike (Gnoozhekaaning): The History of the Bay Mills Indian Community. University of Michigan Press: Ann Arbor. 146 pp., 125 photos, 9 maps.

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2002

Archaeological Survey of the Antrim Creek Natural Area, Antrim County, Michigan. Antrim Natural Area Commission, Bellaire, Michigan. 51 pp., 12 figures.

The Elders Speak: Natural Resource Use by the Forest County Potawatomi Community. (with Richard A. Carlson). The Forest County Potawatomi Community. Crandon, Wisconsin. 43 pp., 8 figures.

2004 Review of The Michigan Roadside Naturalist by J. Alan Holman and Margaret B. Holman. In Michigan Academician XXXV (4):493-494.

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2008 (with T. Majewski) James Ayres, Harrington Medal Award Recipient 2008. Historical Archaeology 42 (2):1-5.

2010 "Reminiscence of Archaeology at Fort Michilimackinac: The Early Years (1959-1975)" in "Archaeology at Michilimackinac: Looking Back on Fifty Years of Research." Compiled by Lynn M. Evans. Michigan Archaeologist. Ominibus Issue, Vols. 50-52, 200

- 2011** Faith in Paper - The Ethnohistory and Litigation of Indian Treaties in the Upper Great Lakes Region. Ann Arbor: University of Michigan Press. 391 pp., 29 figures.
- 2015** Beyond the Far Horizon: Adventures of a Fur Trader. Bloomington, Ind: Xlibris Press. 140pp.
- 2019** Further into the Wilderness: Adventure of a Fur Trader. Traverse City, MI: Mission Point Press. 116 pp., 6 figures.

EXHIBIT BMC-32

Court Case Preparation and Testimony as Expert Witness of Charles E. Cleland, PhD

United States v. Michigan Case No M26-73 C.A.

Testified as expert witness in case involving rights of Ottawa and Chippewa people to fish on the open water of Lakes Huron, Michigan, and Superior under the Treaty of 1836; 1979 decision. Prevailed.

The Crown v. Agwa.

Testified as expert witness in 1982 case involving the right of member of the Batchawana Chippewa First Nation to fish in Lake Superior under the Huron-Robinson Treaty of 1850. Prevailed.

Lac Courte Oreilles Band v. Wisconsin Case No 74-C-313.

Testified as expert witness in 1984 action brought by five Chippewa bands of northern Wisconsin to hunt and fish on the land and waterways ceded by the Treaties of 1837 and 1842. Prevailed in 1985 decision.

Keweenaw Bay Indian Community v. Michigan Case No 784F Supp 418, 487.

Testified as expert witness in 1989 case involving KBIC claims of certain jurisdictional prerogatives over land set aside as a reservation under the terms of the Treaty of 1854. Prevailed.

United States and Saginaw Chippewa v. Michigan.

In 1992 participated as an ethnohistoric expert in this reservation jurisdiction case involving the Chippewa of Saginaw, Black River and Swan Creek under the Treaties of 1819, 1837, 1855 and 1864. Appealed.

Fond du Lac v. Carlson.

1994 ethnohistorical report prepared for Fond du Lac's hunting and fishing rights under the Treaties of 1837 and 1854. Prevailed.

Menominee Indian Tribe of Wisconsin v. Thompson Case No 96-3596 and 96-3185.

Ethnohistorical report prepared in 1994 for the Menominee regarding their rights under the Treaties of 1831, 1836, 1848, and 1854. Case dismissed.

Mille Lacs Band of Chippewa Indians et al, v. State of Minnesota et al. Case No 4-90-605.

In 1994 appeared as an expert witness for the Mille Lacs Band in their claim for the right to hunt and fish over the territory ceded to the United States by the Treaty of 1837. Decision upheld by the United States Supreme Court in 1999. Prevailed.

The Chippewas of Sarnia First Nation v. the Crown.

Prepared and filed an affidavit for the Chippewas of Sarnia First Nation in 1996 regarding their claim rights to lands that were part of the Chippewa of Sarnia's original reserve.

Appealed Ontario Supreme Court.

State of Wisconsin v. Stockbridge-Munsee Community and Robert Chicks Case No 98-C-0871.

Prepared ethnohistorical report and gave expert witness testimony supporting tribe's claim of reservation boundary. Case denied in 2001 decision.

County of Mille Lacs v. Melanie Benjamin et al., Case No 02-CV-407.

Provided expert testimony in the Mille Lac's claim regarding their reservation boundary rights. 2003 decision upholding the tribe's rights.

Keweenaw Bay Indian Community v. Naftaly Case No 452F.3d 514, 527.

Provided expert testimony in KBIC's claim regarding tax assessment of their lands.

Prevailed in 2005 decision.

United States v. Michigan Case No M26-73 C.A.

Prepared ethnohistorical report and provided depositions for Ottawa and Chippewa claim of inland rights as provided by the 1836 treaty. Tribes settled with state in 2006. Prevailed.

EXHIBIT BMC-33

Literature Reviewed

Ayers, J.C., D.V. Anderson, D.C. Chandler and G.H. Lauff

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Bascom, Willard

1964 Waves and Beaches the dynamics of the ocean surface Garden City, NY: Anchor Books, Doubleday & Co., Inc.

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1991 Decision- making in a Cultural Contact Context: A Historical and Archaeological Perspective of the Tionontate Huron of Saint Ignace, Michigan. In *Entering the 90s: The North American Experience*, T.E. Schirer (ed), Sault Ste. Marie MI: Lake Superior State University.

Cleland, Charles E.

1966 The Prehistoric Animal Ecology and Ethnozoology of the Upper Great Lakes Region. Museum of Anthropology, University of Michigan, Anthropological Papers 29:304. Ann Arbor.

1971 The Lasanen Site: An Historic Burial Locality in Mackinac County, Michigan. Publications of the Michigan State University Museum Anthropological Series 1(1) East Lansing.

1973 The Piwangoning Historic District at Norwood Michigan Geology and the Environment Lansing MI: Basin Geological Society.

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1982 The Inland Shore Fishery of the Northern Great Lakes: Its Development and Importance in Prehistory American Antiquity 47(4):761-784.

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- 1985 Field notes from the Les Cheneaux Archaeological Survey, n.d. 1985.
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- 1970 Geology of Michigan. Ann Arbor: The University of Michigan Press.

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- 2003 Keys to the Past: Archaeological Treasures of Mackinac. Mackinac Island, MI: The
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2011 United States v. Michigan in Faith in Paper The Ethnohistory and Litigation of Indian Treaties in the Upper Great Lakes Region. Ann Arbor: The University of Michigan Press.

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1972 Indian Treaties 1778-1883. Mattiuck, NY: Amereon House.

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1959 Sketches of a Tour to the Lakes. Minneapolis: Ross Haines, Inc.

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1967 The Juntenen Site and the Late Woodland Prehistory of the Upper Great Lakes Area.
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O'Shea, John and G. Meadows

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2020 A Layered Approach for the Discovery and Mapping of Prehistoric Sites Beneath Lake Huron. Marine Technology Society Journal 54(3).

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2018 Oil Spill Economics: Estimates of the Economic Damage of an Oil Spill in the Straits of Mackinac in Michigan. Love of Water. Flowforward.org, Traverse City MI.

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1979 Mighty Mac: The Official Picture History of the Mackinac Bridge. Kiwanis Club of St. Ignace Michigan.

1998 Bridging the Straits. Detroit: Wayne State University Press.

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EXHIBIT BMC-34C

**A Listing of Historical and Cultural Sites
On or Near the Straits of Mackinac on File with
The Michigan State Historic Preservation Office**

APPENDIX A KEY

CX-Charlevoix County
EM-Emmet County
CN- Cheboygan County
PI-Presque Isle County
ST-Schoolcraft County
MK-Mackinac County
MIN-More Information Needed
(to determine National Register Eligibility)

Site No.	Function	Period	NRHP Status
[REDACTED]	Pi-wan-go-ning/ Norwood Quarry	Archaic Woodland Late Woodland	Listed
[REDACTED]	Camp	Late Woodland	MIN
[REDACTED]	Camp	Archaic Late Woodland	Listed
[REDACTED]	Village	Late Woodland	MIN
[REDACTED]	Village	19c Ottawa	MIN
[REDACTED]	Reported mound group, village cemetery	Prehistoric	MIN
[REDACTED]	Possible Burial Mound	Woodland	MIN
[REDACTED]	Village	19c Native American	MIN
[REDACTED]	Village	Prehistoric	MIN
[REDACTED]	Town and religious community	19-20c Ottawa, House of David	MIN
[REDACTED]	Undetermined	Prehistoric	MIN
[REDACTED]	Undetermined	Prehistoric	MIN
[REDACTED]	Village	Prehistoric	MIN
[REDACTED]	Undetermined	Late Archaic	Listed
[REDACTED]	Camp	Late Woodland	Listed
[REDACTED]	Habitation	Late Archaic Middle Woodland Late Woodland	Listed
[REDACTED]	Village	Woodland	MIN
[REDACTED]	Undetermined	Prehistoric	MIN
[REDACTED]	Village	Prehistoric	MIN
[REDACTED]	Undetermined	Woodland	MIN
[REDACTED]	Camp	Woodland	MIN
[REDACTED]	Camp	Woodland	MIN
[REDACTED]	Cemetery	Prehistoric	MIN
[REDACTED]	Undetermined	Prehistoric	MIN
[REDACTED]	Camp	Woodland	MIN
[REDACTED]	Undetermined	Prehistoric	MIN
[REDACTED]	Camp	Woodland	MIN
[REDACTED]	Undetermined	Prehistoric	MIN
[REDACTED]	Undetermined	Woodland	MIN
[REDACTED]	Village	Late Woodland	Eligible
[REDACTED]	Fishing camp	Late Woodland	Listed

[REDACTED]	Seasonal camp	Late Woodland	MIN
[REDACTED]	Village	19th Century Native American	MIN
[REDACTED]	Habitation	Prehistoric	MIN
[REDACTED]	Village (Ottawa)	18/19 th c	MIN
[REDACTED]	Undetermined	Woodland	MIN
[REDACTED]	Village	Prehistoric	MIN
[REDACTED]	Village	Prehistoric	MIN
[REDACTED]	Camp	Middle Woodland Late Woodland	MIN
[REDACTED]	Village	Prehistoric 19 th c Ottawa	MIN
[REDACTED]	Village	Prehistoric	MIN
[REDACTED]	Burial	Pre-1850 Prehistoric	MIN
[REDACTED]	Undetermined	Woodland	MIN
[REDACTED]	Chipping station	Prehistoric	MIN
[REDACTED]	Undetermined	Prehistoric	MIN
[REDACTED]	Village	Prehistoric	MIN
[REDACTED]	Undetermined	Prehistoric 1930+ Odawa	MIN
[REDACTED]	Storage pit	Prehistoric 1830-1899 Odawa	MIN
[REDACTED]	Mission settlement	Historic	MIN
[REDACTED]	Mission settlement	Historic	MIN
[REDACTED]	Mission settlement	Historic	MIN
[REDACTED]	Cemetery	1830+	Eligible
[REDACTED]	Undetermined Village	Prehistoric 1830-1890	MIN
[REDACTED]	Lithic scatter	Prehistoric	MIN
[REDACTED]	Farm	19/20 th c Odawa	MIN
[REDACTED]	Village	Woodland	MIN
[REDACTED]	Undetermined	Late Woodland	MIN
[REDACTED]	Village Village	Woodland 18/19 th c	MIN
[REDACTED]	Undetermined	Woodland	MIN
[REDACTED]	Cemetery	1740-1810	MIN
[REDACTED]	Undetermined	Prehistoric	MIN
[REDACTED]	Village	ca.1740-19 th c	MIN
[REDACTED]	Cemetery	Historic	MIN
[REDACTED]	Camp Habitation	Middle Woodland Late Woodland	Listed

	Habitation	17 th c	
[REDACTED]	Undetermined	Late Woodland	MIN
[REDACTED]	Village	Prehistoric	MIN
[REDACTED]	Mound Group	Woodland	MIN
[REDACTED]	Village	Prehistoric	MIN
[REDACTED]	Fort Michilimackinac	Middle-Late Woodland 1715-1780	Listed and National Historic Landmark
[REDACTED]	Burial	Late Archaic	MIN
[REDACTED]	Undetermined	Late Woodland	MIN
[REDACTED]	Village	Prehistoric	MIN
[REDACTED]	Undetermined Light station	Prehistoric 1880+	MIN
[REDACTED]	Undetermined	Woodland	MIN
[REDACTED]	FCR concentration	Prehistoric	MIN
[REDACTED]	Cemetery	Prehistoric	MIN
[REDACTED]	Burial mound	Woodland	MIN
[REDACTED]	Undetermined	Prehistoric	MIN
[REDACTED]	Cemetery Undetermined	Prehistoric Late Woodland	MIN
[REDACTED]	Camp Camp Camp	Paleo Middle Woodland Late Woodland	MIN
[REDACTED]	Fishing camp	Middle-Late Woodland	MIN
[REDACTED]	Lithic scatter	Prehistoric	MIN
[REDACTED]	Cache Fishing camp	Middle Woodland Late Woodland	MIN
[REDACTED]	Undetermined Lighthouse complex	Woodland 1894+	Listed
[REDACTED]	Camp	Late Woodland	MIN
[REDACTED]	Manitou (boulder)	19 th c	Eligible
[REDACTED]	Fishing camp	Late Woodland	MIN
[REDACTED]	Burial	Late Woodland	MIN
[REDACTED]	Camp	Late Woodland	MIN
[REDACTED]	Fishing camp	Late Woodland	MIN
[REDACTED]	Camp Camp	Middle Woodland Late Woodland	Listed
[REDACTED]	Burials	Undetermined, possibly prehistoric	MIN
[REDACTED]	Undetermined	Prehistoric	MIN

	Light Station midden	Historic	
[REDACTED]	Undetermined	Prehistoric	MIN
[REDACTED]	Camp Fishing camp Fishing Village	Middle Woodland Multiphase Late Woodland 1860s American	Listed
[REDACTED]	Burial	Prehistoric	MIN
[REDACTED]	Cemetery	Prehistoric	MIN
[REDACTED]	Undetermined	Woodland	MIN
[REDACTED]	Undetermined Undetermined	Prehistoric Historic	MIN
[REDACTED]	Village	Prehistoric	MIN
[REDACTED]	Ossuary	Prehistoric	MIN
[REDACTED]	Village	Prehistoric	MIN
	Trading post	1650-1850 Native American	MIN
[REDACTED]	Camp	Late Woodland	MIN
	Town	1840s Ottawa	MIN
[REDACTED]	Camp	Multiphase Late Woodland	Listed
[REDACTED]	Gros Cap Cemetery	18-20 th c Odawa and American	Listed
[REDACTED]	Undetermined Camp	Prehistoric 17-19 th c	Listed
[REDACTED]	Gros Cap Archaeological District	Multicomponent Prehistoric and Historic	Listed
[REDACTED]	Burial Mound	Prehistoric	MIN
[REDACTED]	Ossuary	Middle Woodland	MIN
[REDACTED]	Camp	Woodland	MIN
[REDACTED]	Camp	Woodland	MIN
[REDACTED]	Camp	Multiphase Late Woodland	MIN
[REDACTED]	Camp	Woodland	MIN
[REDACTED]	Undetermined	Archaic	MIN
[REDACTED]	Camp Village Burials	Late Woodland 17 th c Tionontate	MIN
[REDACTED]	Undetermined	Prehistoric	MIN
[REDACTED]	Village Undetermined Undetermined	Middle Woodland Late Woodland 17 th c	MIN
[REDACTED]	Burial Mound	Early Woodland	MIN
[REDACTED]	Secondary deposition	Archaic	MIN
[REDACTED]	Camp	Late Woodland	MIN
[REDACTED]	Undetermined	Middle Woodland	MIN

	Village Dump	17 th c 19th c	
[REDACTED]	Undetermined	Prehistoric	MIN
[REDACTED]	Marquette Mission	Multicomponent Prehistoric and Historic	Listed
[REDACTED]	Village	17-18th c Tionontate	Listed
[REDACTED]	Marquette Street Archaeological District	Multicomponent Prehistoric and Historic	Listed
[REDACTED]	Cemetery	Prehistoric	MIN
[REDACTED]	Camp	Middle-Late Woodland	MIN
[REDACTED]	Cemetery	19th c Native American	MIN
[REDACTED]	Undetermined	Prehistoric	MIN
[REDACTED]	Camp	Middle-Late Woodland	Eligible
[REDACTED]	Undetermined	Late Woodland	MIN
[REDACTED]	Camp	Middle Woodland and multiphase Late Woodland	Eligible
[REDACTED]	Cemetery	18-19th c Native American	MIN
[REDACTED]	village	1830s Native American	MIN
[REDACTED]	Cemetery	Prehistoric	MIN
[REDACTED]	Habitation	Woodland	MIN
[REDACTED]	Habitation	Woodland	MIN
[REDACTED]	Undetermined	Prehistoric	MIN

EXHIBIT BMC-35



12 February, 2020

Marth MacFarlane-Faes
Deputy State Historic Preservation Officer

Dear Ms. MacFarlane-Faes,

At the *Society for Historical Archaeology* meetings in January I was informed of some serious issues concerning a cultural resources assessment of the Line Five pipeline in the Straits of Mackinac and the proposed tunnel under the straits.

The company conducting the environmental assessment apparently subcontracted with *Search Inc.* to conduct an assessment of submerged cultural resources that would be impacted by the proposed tunnel. No new survey was conducted but instead the assessment was based on sonar imagery collected previously for other purposes. The technician assigned to the job was told only to consider shipwrecks. This is despite the now well established fact that there are significant prehistoric remains dating 10,000-8,000 BP on the lake bottom associated with the Lake Stanley/Chippewa lowstands and that the river that would have connected the Huron and Michigan basins at that point would be a prime location for prehistoric use. When the technician noticed linear stone alignments of the type documented in Lake Huron, he was told to ignore them. When he asked permission to consult with me about their potential cultural origin his request again was denied. He was subsequently removed from the project and was not allowed to see the final report.

This entire story is very disturbing. The cultural deposits which are very likely present and visible in the second hand sonar imagery are about as significant as a site could be, given the small number of sites from this time period on land, and would be unique as the first instances to be documented off and beyond the Alpena-Amberley Ridge in Lake Huron. At the same time, the sites are extremely vulnerable to disturbance and would be obliterated without a trace by the proposed tunneling. These are a unique piece of Michigan's past that should not simply be brushed aside and destroyed.

I have had no involvement with the cultural resources survey or the parties involved and have not seen the report, nor am I aware of whether it has actually been submitted to the State. Since it would presumably go through the State Historic Preservation Office, I am contacting you to inquire whether it has been submitted and, if submitted, has any action been taken on it? I would be grateful for any advice or help you can offer.

Respectfully,

John M. O'Shea
Professor/
Curator of Great Lakes Archaeology



EXHIBIT BMC-36



Stantec Consulting Services Inc.
1340 Poydras Street, Suite 1420
New Orleans, LA 70112-1274
Phone: 504-581-6900
Fax: 504-581-6909

February 8, 2019

Mr. Brian G. Grennell
Cultural Resources Management Specialist
Michigan State Housing Development Authority
State Historic Preservation Office
735 East Michigan Avenue
Lansing, Michigan 48909

**Reference: USACE FILE: LRE-2010-00463-56-A18, Maritime Archaeology Desktop
Assessment in Support of the Enbridge Line 5 Geotechnical Surveys Project,
Emmet and Mackinac Counties, Michigan**

Dear Mr. Grennell,

Please find enclosed a copy of the Maritime Archaeology Desktop Assessment in Support of the Enbridge Line 5 Geotechnical Surveys Project, by SEARCH, Inc. This is a follow-up to the electronic submission on February 8, 2019 for the same USACE file number (2010-00463-56-A18).

Please let me know if I can provide additional information.

Kindest Regards,

STANTEC CONSULTING SERVICES INC.

A handwritten signature in blue ink, appearing to read "Melissa Braud".

Melissa Braud, Regulatory
Specialist/Cultural Resource Specialist
504.430.7126

Enclosures as stated.

CC: Mr. Charles M. Simon, Detroit District, USACE
Mr. Paul Turner, Enbridge
Mr. Jeff Benefiel, Stantec



**MARITIME ARCHAEOLOGY DESKTOP ASSESSMENT
IN SUPPORT OF THE ENBRIDGE LINE 5 GEOTECHNICAL SURVEYS PROJECT,
EMMET AND MACKINAC COUNTIES, MICHIGAN**

CONSULTANT: SEARCH, 700 N. 9th Avenue, Pensacola, Florida 32501
PRINCIPAL INVESTIGATOR: Joseph Grinnan, MA, RPA
CONTRIBUTIONS BY: Abigail Bleichner, MA, RPA; Michael Hambacher, PhD;
Shawn Joy, MS; Allen Kent, PhD
CLIENT: Stantec Consulting Services, Inc.
DATE: February 2019

In January 2019, SEARCH completed a Desktop Assessment and review of processed side-scan sonar mosaic imagery in support of the Enbridge Line 5 Geotechnical Surveys Project in Emmet and Mackinac Counties, Michigan (**Figure 1**). Stantec Consulting Services, Inc. contracted SEARCH to assist with archaeological review of proposed geotechnical investigation along approximately 6.4 kilometers (km) (4.0 miles [mi]) of existing pipeline, which will include the placement of bores on land and offshore (**Figure 2**). Fourteen of the 28 proposed boring locations will be conducted offshore within the Straits of Mackinac adjacent to existing pipelines. The project Area of Potential Effects (APE) includes two pipeline corridors—East Pipeline and West Pipeline—with respective widths of 91 meters (m) (300 feet [ft]). The total pipeline length equates to approximately 9,300 linear m (35,000 linear ft) along the Straits of Mackinac between Point La Barbe and McGulpin Point.

Stantec contracted SEARCH to evaluate the APE with the purpose of identifying potential submerged cultural resources and documenting previously recorded historic properties that are listed, or may be eligible for listing, in the National Register of Historic Places (NRHP). SEARCH reviewed the archaeological site file database maintained at the Michigan Historic Preservation Program, a division of the Michigan State Housing Development Authority (MSHDA), to identify previous maritime archaeological surveys or previously recorded submerged cultural resources within 1.6 km (1.0 mi) of the APE. SEARCH also reviewed in-house databases and select historic maps to determine potential for submerged cultural resources within the APE. Databases reviewed include:

- The National Oceanic and Atmospheric Administration (NOAA) Automated Wreck and Obstruction Information System (AWOIS);
- NOAA's Electronic Navigational Charts (ENC);
- 2006 NOAA Aids to Navigations (NavAids) and the 2007 US Coast Guard (USCG) Hazards to Navigation database;
- The Global Maritime Wrecks Database (GMWD);
- MSHDA archaeological and shipwreck files; and
- Secondary sources relative to shipwrecks within the APE.

February 2019
Draft Report

Maritime Archaeology Desktop Assessment, Enbridge Line 5 Geotechnical Surveys, Emmet and Mackinac Counties, Michigan

SEARCH

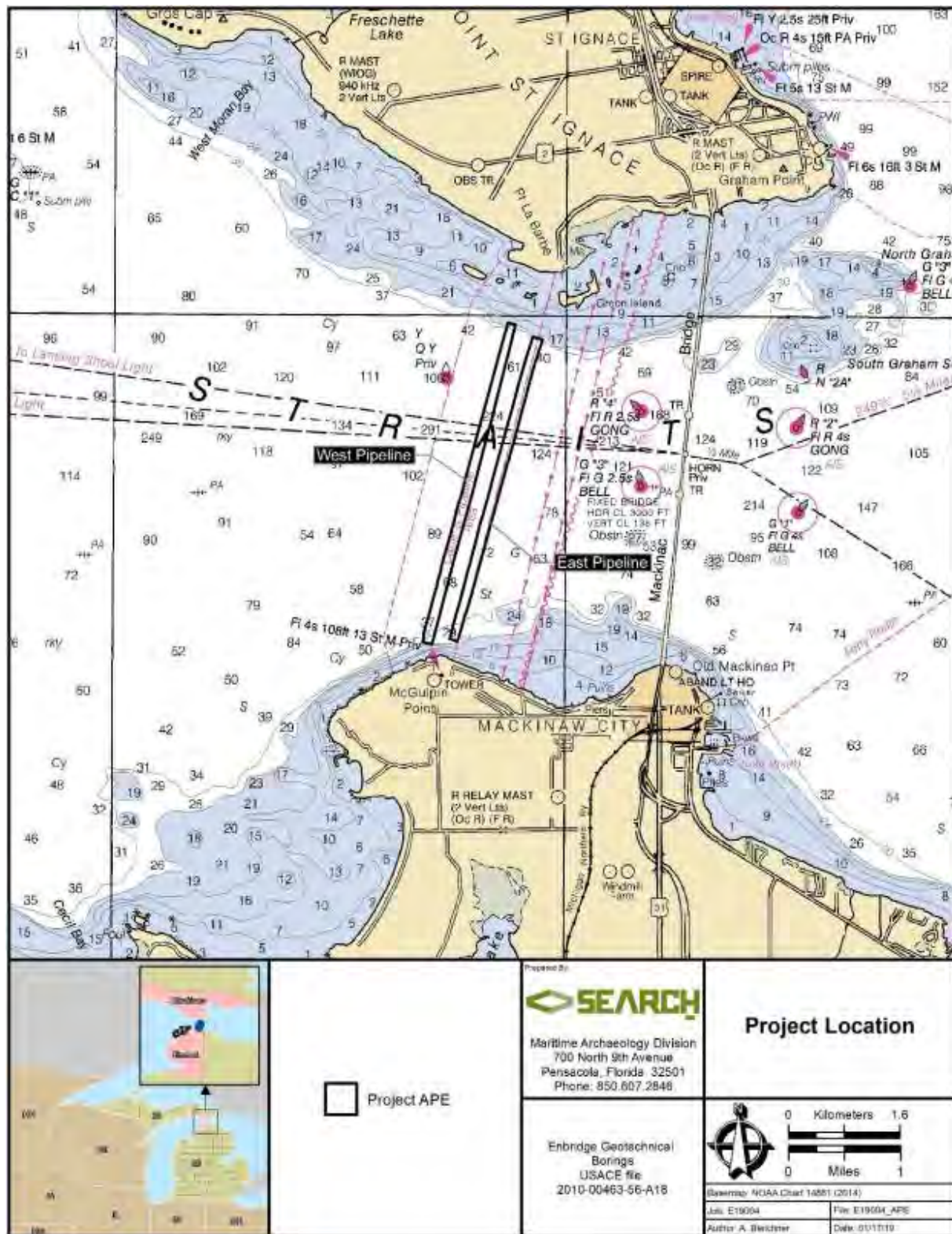


Figure 1. Project location, Emmet and Mackinac Counties, Michigan.



SEARCH also conducted an archaeological assessment of processed side-scan sonar mosaic imagery, provided by Ballard Marine Construction, in order to identify potential submerged cultural resources within the APE.

PROJECT ENVIRONMENT

The APE spans across the Straits of Mackinac and is oriented approximately north-south between Point La Barbe and McGulpin Point. The Straits of Mackinac, an approximately 8.0 km (5.0 mi) channel, connects Lake Michigan to Lake Huron between the Upper and Lower Peninsulas of Michigan. It is known as the “Crossroads of the Great Lakes” (Feltner and Feltner 1991). Point La Barbe is located near the city of Saint Ignace in Mackinac County, and McGulpin Point lies within the village of Mackinac City in Emmet County. The APE is located within the Straits of Mackinac Shipwreck Preserve, a state-established bottomland preserve, and is approximately 2.5 km (1.6 mi) due west of the Mackinac Bridge. Water depths range from 10 m (33 ft) to approximately 90 m (295 ft) within the APE.

The Straits of Mackinac is a historically volatile area of the Great Lakes. The Straits are susceptible to heavy currents, strong winds, and high swells (Wright 1998). During the winter months, violent winter storms push ice into the channel and can pile along the shores and shoals of the Straits. In addition to ice piling and rafting, ice scours the bottom of the Straits (Wright 1998). Such conditions, coupled with heavy ship traffic and inadequate navigational aids, created problems for mariners travelling through the Straits and caused numerous shipwrecks (Feltner and Feltner 1991).

The Straits of Mackinac are located in northern Michigan approximately 321 km (200 mi) north/northeast of Lansing and lie between two major physiographic regions of Michigan known as the Algonquin Lake Plain and Eastern Upper Peninsula Lowlands (Schaetzl et al. 2013). The Algonquin Lake Plain, which extends along the northern coast of the Lower Peninsula from Little Traverse Bay to the vicinity of Thunder Bay, is associated with the floor of Glacial Lake Algonquin. It is characterized by a low relief landscape of gravel and sand spits and drumlins (Michigan Geological Survey [MGS] 2018). The Eastern Upper Peninsula Lowlands extend from the easternmost point of the Upper Peninsula at Drummond Island and continue west into Dickinson and Marquette Counties. The region is defined by low elevation and low relief landscapes due to glacial deposition and processes with a variable soilscape (MGS 2018).

Paleoenvironment and Shoreline Reconstruction

Paleoenvironmental reconstructions of the Great Lakes region during the Late Pleistocene/Early Holocene are extremely complicated due to the vast differences in environments and the limited regional paleoenvironmental datasets. Pollen datasets indicate a mosaic of environments at 9000 calibrated before present (cal BP), ranging from patches of tundra, lichen

woodlands, boreal forest, deciduous areas, and zones of boreal/aspen parkland transitions (Julig and Beaton 2015).

The record for the region identifies four stages of vegetation succession after deglaciation and is summarized in **Figure 3** (Sonnenburg et al. 2015). Phases 1, 2a, and 2b occurred during the Lake Stanley lowstand. The environment transitioned between Phase 1 (spruce dominated) and Phase 2 (pine dominated), which represented the increasing aridity of the climate and the initial reduction in lake levels. During the lowstand, the landscape would have been similar to modern prairie parkland with spruce, tamarack, and cedar, along with scrubby brush and grasslands (Sonnenburg et al. 2015).

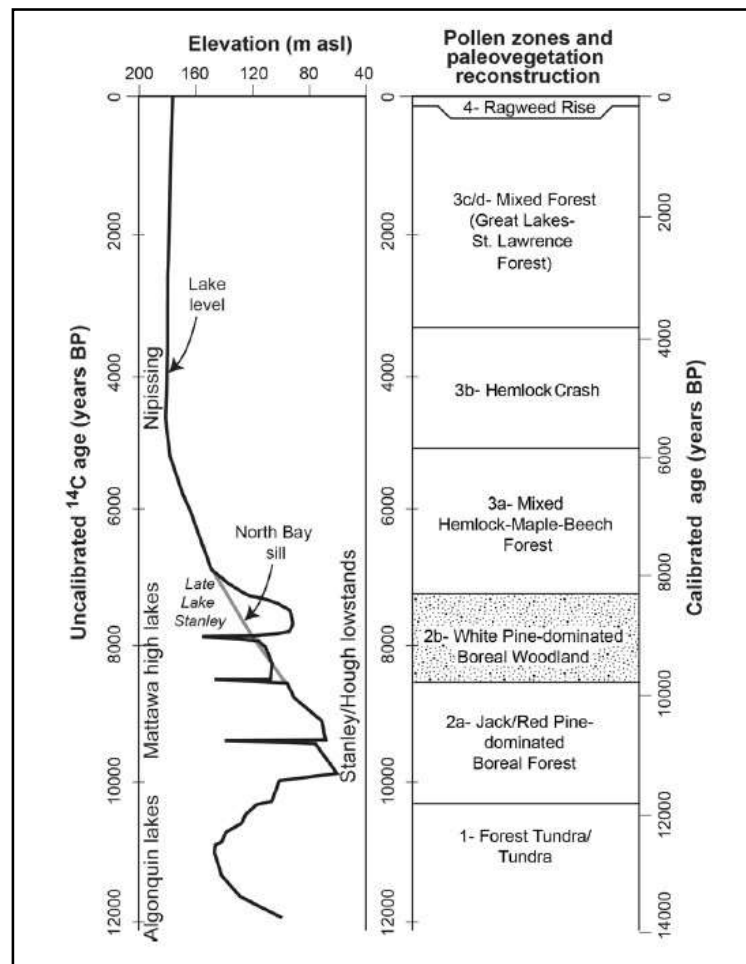


Figure 3. Vegetation succession after deglaciation (Sonnenburg et al. 2015:14)

The following climatic shift took place from Phase 2a (jack/red pine) to Phase 2b (white pine) and was the result of increased precipitation throughout the region, which caused an rise in water levels (Sonnenburg et al. 2015). The transition from Phase 2b to Phase 3 was marked by a nearly 40-percent increase in mean annual precipitation values. This generational scale increase in precipitation dramatically changed the landscape and water levels. This allowed mesic taxa like hemlock, sugar maple, and beech to dominate, and thus reduced the area of boreal conifer forests to the north.

Lake Levels

Water levels within the Great Lakes had tremendous oscillations since the last glacial maximum. One of the most extreme, and most relevant for this project, is the Lake Stanley period water level drop. Levels dropped as much as 140 m (459 ft) spanning from approximately 11,500 to 8300 cal BP (Lewis et al. 2005; Sonnenburg et al. 2015). During this lowstand, more than 250,000 hectares (ha) (617,763 acres [ac]) of land were exposed for human habitation. With lake levels 140 m (459 ft) below modern levels, the Straits of Mackinac would have been mostly dry land with a major river drainage system bisecting the straits. Several preserved tree stumps

and roots have been identified within the area in depths of water up to 18 m (59 ft). Radiocarbon dates on those trees are reported from 7920 to 7180 cal BP (Hunter et al. 2006). The chronology for the fluctuations in lake levels began at 13,000 cal BP as the Laurentide ice sheets receded from the area. The glacial melt water formed Lake Algonquin. Lake levels began to recede at approximately 11,500 cal BP during the Lake Stanley period (**Figure 4**).

After the weight of the glaciers receded from the lithosphere, the depression caused by the ice began to rebound to modern levels. The isostatic rebound caused dramatic fluctuations in water levels from -140 m (-459 ft) to -40 to -60 m (-131 to -196 ft) below modern levels (Lewis et al. 2005; McCarthy et al. 2015; Sonnenburg et al. 2015). These fluctuations are referred to as the Mattawa high stands. As the landscape fully rebounded, water levels within the lakes began to rise at roughly 6000 cal BP during the Nipissing transgression. The Nipissing transgression flooded not only the now-submerged paleolandscape, but also flooded the modern shoreline up to 5 m (16 ft) above modern levels (Hansel et al. 1985).

NATIVE AMERICAN CULTURE HISTORY

A number of authors, most notably Fitting (1975), Halsey (1999), and Lovis (1990a), summarized Michigan's pre-contact and historic Native American and Euro-American archaeological record. Although investigation of Michigan's archaeological record has continued since these works were completed, their comprehensive nature remains unparalleled in the available literature. Michigan, consisting of two peninsulas surrounded to the north, east, and west by the Upper Great Lakes, is juxtaposed between northerly- and southerly-based cultural traditions. This area has long been a nexus of cultural interaction between local populations and those located further afield. Because of the unique configuration of the state and its natural environment, Michigan features a number of places that were not only focal points of pre-contact and historic period cultural development, but also pivotal locations for interactions between different local and extra-local cultural groups. Along with areas such as the Saginaw Valley and the Traverse Corridor, the Straits of Mackinac is one of those places.

Paleoindian Period

The initial colonizing populations of Michigan are referred to as the Paleoindians. This period in Michigan was characterized by an environment recovering from the effects of deglaciation. Tundra and spruce habitats prevailed, and the configuration of proglacial waterbodies in what would become the Great Lakes was markedly different than today. As the Late Wisconsin ice front retreated from northern Michigan, the tundra conditions at the glacial front were followed by spruce-fir forests, muskeg swamps, and barren glacial outwash plains across much of the region. Fluctuating post-glacial lake levels also affected the environment. With the final withdrawal of ice from the Straits of Mackinac area around 11,000 BP, the water of Lake Algonquin became confluent between the Lake Huron and Lake Michigan basins. Because of

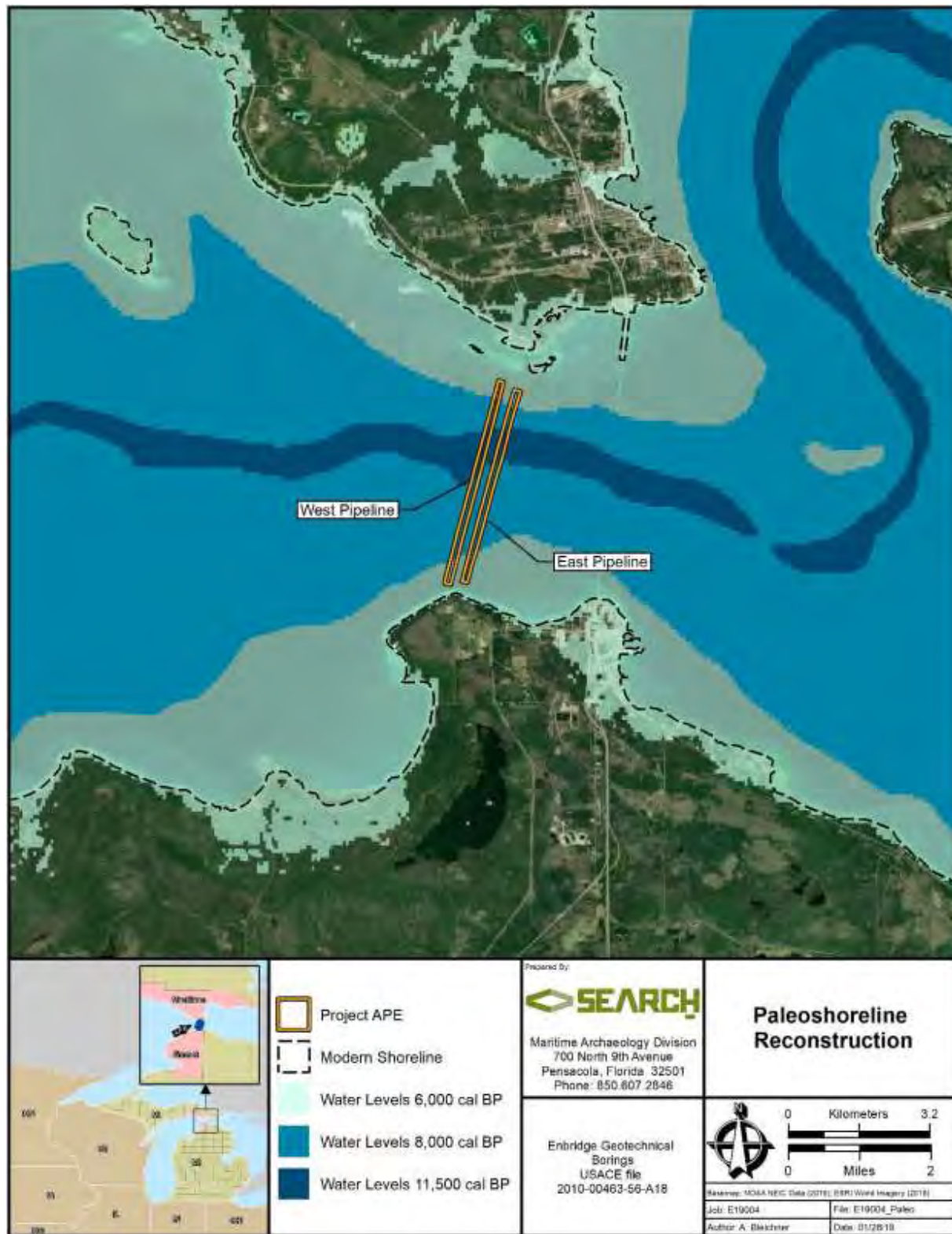


Figure 4. Paleoshoreline reconstruction of the Straits of Mackinac.

higher lake levels, much of the eastern Upper Peninsula and northernmost part of the Lower Peninsula flooded, leaving only an archipelago of scattered large and small islands (Futyma 1981; Larsen 1985a:93; Schaetzl et al. 2002).

The Paleoindian period is typically divided into Early (ca. 12,500–10,000 BP) and Late (10,000–8000 BP) stages. The Early Paleoindians are distinguished by the use of distinct fluted lanceolate projectile points with concave bases, large bifaces used for chopping and cutting, end scrapers with graving spurs, and large unifacial scrapers. These groups appear to have been organized into small, highly mobile, multi-family bands whose subsistence economy focused on hunting large migratory game, such as caribou, elk, and mammoth, as well as mastodons in the more southerly parts of the Upper Great Lakes. Small numbers of isolated fluted points have been identified in northern Lower Michigan (Brunett 1966; Cleland et al. 1998; Dekin 1966; Ochsner 1989), but no clear base camps have been identified. The presence of isolated fluted points is rumored in the Upper Peninsula, but to date, none have been identified.

The primary tool kit characteristic that distinguished the Late Paleoindians from the earlier stage was the use of lanceolate points that lacked fluting. In most respects, the lifestyle of these peoples is thought to resemble that of early Paleoindians. While the mainstay of the subsistence economy appeared to remain focused on hunting large game, there was also likely an expansion of resources exploited at least on an opportunistic basis (Cleland 1983; Kelly and Todd 1988; Kuehn 1998; Mason 1981; Meinholz and Kuehn 1996). In the northern Lower Peninsula, the only major site of this period is the Samel's Field site in Grand Traverse County (Cleland and Ruggles 1996). Situated on a post-Algonquian upper group beach, the Samel's Field site post-dates ca. 10,000 BP. The lithic assemblage consists of collaterally flaked Agate Basin style projectiles, large scrapers, and leaf-shaped bifaces. A mix of Norwood chert from northwestern Lower Michigan and Bayport chert from the circum-Saginaw Bay region reflect a high degree of mobility for these late Paleoindian peoples.

Further north, as the final remnants of glacial ice left the Great Lakes basin, early populations continued their northward expansion into the Lake Superior, northern Lake Michigan, and Lake Huron basins (Greenman and Stanley 1943; Julig 1984, 2002; Mason 1986; Mason and Irwin 1960; Salzer 1974). Among the most prominent of the Late Paleoindian sites in the Upper Peninsula are a series of occupations represented by Scottsbluff projectile points and an array of quartzite tools associated with a series of inland lakes in central Marquette County, Michigan (Anderton et al. 2004; Buckmaster and Paquette 1989, 1996). Along with the habitation sites are possible sites of former cremation burials that included heat-fractured projectile points and other stone tools. Although the high lake levels of Lake Algonquin had receded from the Straits area by about 10,500 BP, they were replaced by historically low lake levels that reduced the Straits area to a river occupying a deep channel several hundreds of feet below the modern lake level; this is a factor that may well have affected the attractiveness of the area to Late Paleoindian peoples.

Recently, archaeologists have identified more than 60 submerged hunting features constructed from local stone boulders, potential habitation areas, and storage facilities 24 to 40 m (80 to 130 ft) below Lake Huron (Lemke and O'Shea 2017; Sonnenburg et al. 2015). These sites are the oldest evidence of hunting structures in the world (O'Shea et al. 2014). Paleoindian camp sites are also associated with the glacial lake shores due to the shore's abundance of smaller game and fish, which were also important dietary contributors (McNett 1985; Storck 1982). The submerged Paleoindian settlement pattern follows modelled caribou migration routes across Lake Huron (Vitale et al. 2011).

Early and Middle Archaic Periods

The Early Archaic period began about 10,000 BP and took place during a time of continued environmental change as the landscape recovered from the after-effects of glaciation. The spruce and pine forests that once dominated the region were replaced by a mixed deciduous-coniferous forest by about 8000 BP, and then by essentially modern forests by approximately 7500 BP (Davis 1983; Kapp 1999; Webb et al. 1983). Fluctuations in the levels of the Great Lakes also continued with the replacement of the historic low lake level in the Lake Huron and Lake Michigan basins with gradual rising of lake levels that culminated in higher than modern levels of the Nipissing stage around 5000 BP (Anderton 1993; Larsen 1985a, 1985b; Monaghan and Lovis 2005). The large migratory game that the earlier Paleoindians relied on disappeared and were replaced with a wider array of large-, medium-, and small-sized game, as well as a broad variety of plant resources.

Due to changed environmental conditions, the tool kit used by Early and Middle Archaic populations in the region expanded to include a number of tool forms designed for efficient exploitation of the new suite of resources that emerged. A variety of notched and barbed projectile points, wider scrapers and bifaces, and other innovative tools replaced lanceolate points. Early and Middle Archaic populations began to use copper and a variety of groundstone tools such as axes, adzes, and gouges.

The Middle Archaic Period (ca. 5000–3200 BP) is distinguished by the manufacture of large, side-notched projectile points; an increase in the use of copper for making tools and ornaments; and continued use of groundstone tools. The Old Copper culture, primarily a burial complex, developed in northern Wisconsin and the Western Upper Peninsula during this time (Fitting 1975; Mason 1981; Ritzenthaler 1957; Stoltman 1986, 1997). Some of the Middle Archaic sites excavated in the region associated with the Old Copper culture produced a wide variety of tools and ornaments and provided possible evidence for the use of cemeteries. Recurrent burial ground sites like Riverside, Reigh, and Oconto suggest that people were less mobile than previous periods and began to better define the territories in which they lived. While a mobile lifestyle that followed seasonally available resources probably typified this period, the manufacture of copper fishing gear suggests that fish were a new and important addition to the economy. The occurrence of few known sites in major river valleys also points to an increase in the importance of riverine and wetland resources during this period.

Little evidence exists for Early and Middle Archaic sites in the eastern Upper Peninsula. In the northern Lower Peninsula, evidence for Early Archaic occupation is largely limited to a small number of isolated finds. For example, a single St. Charles or dovetail point (ca. 10,000–8000 BP [Justice 1987:57-58]) was reported from the Pine River Channel site (20CX19) located in the city of Charlevoix (Holman 1978:342-343). A second unprovenienced specimen also came from Presque Isle County (Michigan State University Museum, Division of Anthropology site file). The succeeding Middle Archaic period is also poorly represented in northern Lower Michigan. Projectile points similar to the Middle Archaic Raddatz side-notched type were recently reported from the Skegemog Point site in Grand Traverse County (Hambacher 1992) and from the Point Arcadia site (20MT120) in Manistee County (Hambacher n.d.). It is not currently possible to assess the structure of the settlement, subsistence, and social systems of these early populations. This lack of evidence for Early and Middle Archaic occupations is attributed to a number of factors, including a decline in population due to unfavorable environmental conditions (Fitting 1975), inundation of many of the sites as lake levels recovered from the historic lows, and/or the inability to adequately identify and differentiate the sites due to the lack of diagnostic artifacts and associated radiocarbon dates (Stoltman 1986:213). Based on information from more southern parts of the Great Lakes, it is believed that Early Archaic peoples continued to live highly mobile lifestyles with economies that emphasized hunting and incorporated a broader array of wild plant resources.

Late Archaic Period

Evidence for the Late Archaic period (ca. 3200–2000 BP) across northern Lower Michigan and the eastern Upper Peninsula is more abundant, although the number of known and excavated sites is still relatively small (Fitting 1975; Lovis 2009; Mason 1981; Robertson et al. 1999). This is attributed to an increase in the size of the resident population as the forest communities reached modern configurations (Fitting 1975). Late Archaic cultures are differentiated from earlier Archaic cultures primarily by changes in projectile point styles in which there is a proliferation of small- and medium-sized notched, expanding stemmed, and stemmed types (Robertson et al. 1999). There is little evidence for the importation of goods from other areas aside from small quantities of high-quality cherts and orthoquartzites; however, the use of native copper continued and was probably traded outside of the region.

Late Archaic sites have been identified at a number of locations across Michigan's Upper Peninsula, most of which occur in the western and central parts of the peninsula (Anderton 1993; Benchley et al. 1988; Dunham and Anderton 1999; Franzen 1987; Robertson et al. 1995). Known occupations dating to this period in the eastern Upper Peninsula are largely limited to a few small lithic scatters in the St. Mary's River area (Conway 1980). In St. Ignace, the Nelson site produced small notched points and copper artifacts diagnostic of the Late Archaic period (Fitting 1974). The Medora Street burial, a Red Ochre burial of a young individual accompanied by a large number of Onondaga chert cache blades, also included a blade made from Hixton silicified sandstone from western Wisconsin (Anderson et al. 1999).

A number of small Late Archaic occupation sites were recorded in the northern Lower Peninsula from surveys of the Sleeping Bear Dune area (Lovis et al. 1976), Fisherman's Island State Park (Lovis 1976), and the Inland Waterway (Lovis and Cleland 1979). The Screaming Loon site (Lovis 1990b) on the Crooked River in Emmet County dates to between 3637 and 3591 BP. The site produced an assemblage that suggests the site was a residential base camp occupied in the spring. This site could easily be a counterpart to one of the numerous smaller logistic or special function locales, which characterize the riverine and coastal contexts of the region.

In general, Late Archaic lifeways were characterized by diffuse adaptation based on scheduled use of a variety of plant and animal resources; fish were an abundant, highly productive, and reliable resource (Cleland 1976, 1982). Available information indicates that the annual economy focused on hunting; populations moved to coastal areas during the spring and summer to spear shallow-water spawning fish, hunt waterfowl and mammals in adjacent wetlands, and collect wild plant foods. In the winter, groups likely split into smaller family-sized units and moved into interior lake and other near-wetland settings where hunting was a primary activity (Dunham and Anderton 1999). Using survey data from northern Michigan, Cleland (1974) suggested a similar general model for the structure of Late Archaic settlement and economic systems. Through the examination of site size and locational information, Cleland concluded that the "Archaic is characterized by many large sites on interior rivers, a few large sites on interior lakes, and many small sites on the coast" (Cleland 1974:5). In other words, the Late Archaic was predominantly an inland adaptation that was generally comprised of bands that occupied regular base camps, such as the Screaming Loon site, as part of a seasonal cycle. The seasonal cycle allowed the people of the Grand Traverse region to take advantage of the multiple environments and resources. Large sites, such as the Late Archaic component at Eastport at the north end of Torch Lake, are probably attributable to their association with a particular resource, as is the case of Eastport and its association with chert deposits and processing (Binford and Papworth 1963).

Early Woodland Period

The Early Woodland period is distinguished by the introduction of ceramics. In Michigan, this technological innovation occurred at different times in southern Lower Michigan and the remainder of the state. North of the Carolinian-Canadian transition zone, ceramics did not appear until ca. AD 1 or a little earlier, while in southern Lower Michigan, they appeared as early as 2600 BP (Fitting 1972; Garland and Beld 1999; Ozker 1982). The Early Woodland period, therefore, was a phenomenon primarily associated with the Muskegon River drainage, the Saginaw Valley, and southwestern and southeastern Michigan. Recognition of components that would typically be associated with the more southerly based Early Woodland period relies primarily on projectile points and other non-ceramic artifacts.

Components that could be characterized as associated with the Early Woodland period are rare within the northernmost part of the Lower Peninsula. The northernmost concentration of Early Woodland components occurs in the Croton-Newaygo area of the central Muskegon River valley (Prah 1970). While it may be tempting to interpret this as a result of a general

abandonment of the region during this time period, the actual reasons for this situation remain unclear. At the Dunn Farm site in Leelanau County, a cremation burial containing a variety of diagnostic southern-related Early Woodland artifacts, including Adena and Kramer style projectile points, a blocked end tubular pipe, a birdstone, and marine shell beads, has been dated to ca. 2800 BP (Ford and Brose 1975), although more recent consideration of this burial suggests that it was further manipulated during the Middle Woodland period (Brose and Hambacher 1999). This site also provided some of the earliest evidence for the exploitation of wild rice in the Upper Great Lakes region. Other isolated Early Woodland aged materials reported for the region include a series of stemmed projectile points and a fragmentary Turkey Tail point from the Pine River Channel site in Charlevoix County (Holman 1978:319-323, 342-343) and several Adena/Kramer-like stemmed projectile points from the Point Arcadia site (20MT120) in Manistee County (Hambacher n.d.).

Initial and Middle Woodland Periods

The lag in ceramic introduction north of the Carolinian-Canadian transition zone makes the Woodland period in this northern region coeval with the onset of the Middle Woodland period to the south. To accommodate this the term, “Initial Woodland” has been used across the Upper Peninsula of Michigan and, to a lesser extent, in the northern parts of the Lower Peninsula.

During the Initial and Middle Woodland periods (AD 1–500), there is a marked increase in the number of identified components in comparison to earlier periods. In the Upper Peninsula and extending down the coasts of the northern Lower Peninsula, these cultural groups have been associated with the Lake Forest (Fitting 1975) or Northern Tier (Mason 1966, 1981) tradition that is closely related to the Laurel tradition centered in the region further to the west and north (Brose and Hambacher 1999; Janzen 1968). Ceramic vessels associated with this period have wide mouths, gently constricted necks, conoidal bases, and are decorated with multiple rows of vertical and oblique stamped and impressed motifs that often extend onto the shoulder of the vessel. Distinctive lithic tools include large corner-notched projectile points, “thumbnail” end scrapers, and an array of fishing gear made from bone, antler, and copper. This also is the first period when regional differentiation of groups across the broader region becomes evident in the material culture (Brose and Hambacher 1999).

The subsistence economy of these societies focused on seasonal fishing, particularly the exploitation of spring spawning species, hunting, and foraging with an increased emphasis on the use of aquatic resources through time. Large warm season, coastal, or near-coastal occupations have been identified at sites such as Summer Island (Brose 1970), Winter (Richner 1973), and Naomikong point (Janzen 1968). Smaller interior sites located on lakes appear to represent either short-term exploitative camps or winter sites used by small groups of people. By the end of the Initial Woodland period, coastal sites are also being increasingly located in areas with access to deep-water, fall-spawning fish, such as lake trout and whitefish. More recently, evidence from ceramic vessel residues indicate that some quantities of maize were being incorporated into the diet early in the Initial Woodland period (Albert et al. 2018).

Numerous Initial Woodland sites have been identified in the eastern Upper Peninsula and northern Lower Peninsula of Michigan. Major components have been identified at the Gyftakis and McGregor sites in St. Ignace, Fort Brady, and other locales in the St. Mary's River drainage, Ekdahl-Goodreau west of the Straits of Mackinac, and Fort Michilimackinac in Mackinaw City. Extending down the northwest coast of the Lower Peninsula through the Traverse Corridor significant Middle Woodland components include sites such as Portage on Little Traverse Bay, Wycamp Creek, Sawdust Pile, Johnson, Columbus Beach, McNeal, and Site 20GT58. While many of the sites in the Traverse Corridor exhibit clear affinities with northern Initial Woodland adaptations, scattered occurrences of ceramics with more southerly Middle Woodland affiliations have also been documented, indicating a degree of interaction between these two major cultural traditions (Brose and Hambacher 1999).

A number of the sites in the Straits of Mackinac region have provided ceramic evidence for continuity in populations from the Initial Woodland through the early Late Woodland period. First identified at the Pine River Channel site (Holman 1978, 1984), Pine River is a transitional ceramic ware between the Initial Woodland Laurel wares and the early Late Woodland Mackinac wares. This ware not only retains a number of Initial Woodland manufacturing and surface treatment characteristics, as well as simplified versions of the decorative motifs, it also provides a logical order to the stylistic changes seen between ca. AD 600 and AD 800. As with the preceding Laurel ceramics, sites containing Pine River ware ceramics are primarily located in the northern portions of the Traverse Corridor, the Inland Waterway, and the Straits of Mackinac regions (Holman 1984).

The increase in the number of Initial Woodland sites and a shift in their locational characteristics are generally viewed as reflective of changes in the subsistence economies and technological systems. Lovis and Holman (1976) have argued that it is at this time that a shift towards a more coastal and lacustrine orientation occurred. Furthermore, Cleland (1966:66, 1982:774) has argued that an increasing reliance on net and/or weir technologies, along with increased exploitation of shallow-water, spring-spawning species was a primary factor in these economic and subsistence shifts. Thus, these Middle Woodland economies can be characterized as a mix of hunting-fishing-collecting activities fluctuating in their intensity on a seasonal basis.

Late Woodland Period

The succeeding Late Woodland period is a time of major changes in the structure of the pre-contact cultures of the Upper Great Lakes region and is among the best documented (Fitting 1975; Mason 1981). The adaptive changes witnessed with the initiation of the Late Woodland period have been largely attributed to shifts in the subsistence base and in the technological repertoires (Lovis 1990a:19). In the north, these changes appear to have revolved around an intensification of the Initial Woodland subsistence pattern (Lovis and Holman 1976; Holman 1978). This process leads to the development of the Inland Shore Fishery (Cleland 1982, 1989; Martin 1989) with its focus on the seasonally dense and abundant fall-spawning fish. Holman (1978) developed two alternate mobility models for the Mackinac Phase. These models

propose movement along the coastal areas during the warm seasons with dispersal into smaller, winter residential sites located on the interior lakes. One model incorporates the Straits of Mackinac region into the seasonal round, while the other focuses on the shores of Lake Michigan (Lovis 1990a:20). These general patterns appear to continue throughout the course of the Late Woodland, although McHale-Milner and O'Shea (1990:2) have recently suggested that a "significant reorientation of the subsistence-settlement system beginning in the fifteenth century" is indicated by changes in ceramic decorative styles and site locations. While these propositions require more extensive examination, they are, nonetheless, thought provoking.

The basic chronology for the Straits of Mackinac region and the northern Lower Peninsula was initially developed by McPherron (1967) at the Juntunen site on the western end of Bois Blanc Island. Through time, the shifts in the pottery styles reflect a shift in major cultural orientation from more western Blackduck affiliation during the early part of the Late Woodland period to an eastern Iroquoian influence after about AD 1100. Appearing around AD 800, Mackinac wares represent the initial Late Woodland ceramic ware. Types comprising Mackinac ware are characterized by subconoidal-shaped vessels with straight to sharply everted rims, cordmarked surfaces, frequently splayed lips, and a wide variety of corded decorations (McPherron 1967:86-97). Declining around AD 1000, Mackinac ware is replaced by Bois Blanc ware, which persists until about AD 1200. Vessels of this ware type are distinguished by the presence of folded over or appliqued rim strips, low castellations, globular bodies, and a variety of rather complex decorative motifs employing a variety of cord-wrapped objects (McPherron 1967:104-110).

Juntunen wares complete the ceramic sequence defined for the general Straits of Mackinac region. This phase is generally dated to between AD 1200 and AD 1500 (Fitting 1975; Mason 1981; Lovis 1990a). These vessels are characterized by the predominance of smoothed surfaces, moderate degrees of rim eversion, well-developed castellations, and nearly always collared rims (McPherron 1967:111-116). Decorative motifs are largely composed of geometric motifs employing plats of horizontal and vertical punctuated, stab-drag or cord-impressed lines often interrupted by chevrons below the castellations (Lovis 1990a:21). After approximately AD 1500, a series of curvilinear and broadly trailed motifs are incorporated into the decorative repertoire along with a decrease in certain other decorative attributes such as rim interior, lip, and shoulder decoration (Lovis 1973, 1990a; McHale-Milner and O'Shea 1990). Lovis (1973, 1990c) first identified the appearance of curvilinear motifs as a late phenomenon at the stratified O'Neill site (20CX18), where it has been formally proposed as the O'Neill Phase. McHale-Milner and O'Shea (1990), however, consider these trends to be a late manifestation of the Juntunen phase.

In addition to the indigenous Mackinac, Bois Blanc, and Juntunen wares, sites in the Straits of Mackinac area, as well as across the eastern Upper Peninsula and southward through the Traverse Corridor, show evidence for the presence of and interaction with more easterly-based Iroquoian populations, more westerly-based Oneota groups, and makers of Skegemog and Traverse wares to the south. The occurrence of these different wares also is seen as an

indication that the Straits area was a crossroads for cultural interaction and was a culturally dynamic area by the later parts of the Late Woodland period.

HISTORICAL OVERVIEW

French explorations of the New World commenced in the 1520s, beginning with Giovanni da Verrazzano's voyages along the eastern seaboard, covering coastal land from the American Southeast up through Nova Scotia, and continued with the arrival of Jacques Cartier in the 1530s. Cartier established New France, and the explorers began a fur trade with local Native American groups while continuing to probe into the interior of the new continent in search of riches, new passages, and areas for potential settlement. Cartier and others tried to establish settlements during the sixteenth century, including the first attempt at permanent settlement at today's Quebec City, but these were all failed ventures (Gordon 2010).

In the early seventeenth century, permanent colonization of New France began in earnest. Samuel de Champlain arrived to bolster the fur trading empire and continue the exploration of the continent. He also ordered the construction of new forts and founded some of the earliest settlements, including Quebec in 1608. By the 1630s, under the control of the Company of New France, more French settlers came to the region in an effort to further establish the French presence in the New World. This effort included further exploration into the interior of the continent, with the hope of a Northwest Passage to the Pacific (Laramie 2012).

Jean Nicolet was the first European to cross through the Straits of Mackinac and see Lake Michigan in 1634. He reached Green Bay, Wisconsin, which he named for its green waters. After Nicolet's exploration of the area, French fur traders began setting up posts along the straits in the late 1640s, most specifically the area that later became Fort Michilimackinac and today's Mackinaw City (Bieder 1995; Cleland 1992, 1993, 1999; Stone and Chaput 1978). The Straits would prove to play an important role in the fur trade in the coming decades, linking French settlements in the east with a passageway to new territory (Jung 2018; Wright 1998).

During this period, much of French settlement continued to revolve around the fur trade, though missionary work by the Jesuits became an important part of the French presence. Father Jacques Marquette founded Mission St. Ignace north of the straits in 1671, and Fort de Baude was built in the vicinity in 1688. Soon after the founding of the mission, explorers Louis Jolliet and Jacques Marquette departed from this area on their exploration of the Mississippi River in 1673, opening new territory for New France that stretched from the coasts of Newfoundland to the Gulf of Mexico. In between, the Straits connected the two expanses of French territory in the New World (Saint Ignace Public Library 2008; Wright 1998). Numerous habitation and burial sites have been archaeologically investigated, including the Tionontate Huron village (1670–1705) associated with the Marquette Mission (Branstner 1987, 1989; Fitting 1976, 1980; Stone 1972), the Lasanen cemetery (Cleland 1971), the Gros Cap cemetery (Nern and Cleland 1974), and the Richardson site (Greenman 1958).

France was frequently at war with England over its northern territories throughout the eighteenth century as the British expanded their influence on the Atlantic coast. In 1701 Fort Pontchartrain was established in Detroit. Additionally, the Jesuits abandoned and burned the Marquette Mission in 1705, prompting the reestablishment of settlements near the Straits including the construction of Fort Michilimackinac on the south side of the Straits in 1715 (Cleland 1999). The origins of Fort Michilimackinac's namesake may be a reference to the turtle-like shape of Mackinac Island, while others believe it refers to glacial faults (Adie 2012). This fort served as the main entry point for the fur trade in the Upper Great Lakes throughout its existence under French control. Fort Michilimackinac (20EM52) is listed on NRHP and is designated a National Historic Landmark.

As a result of the French and Indian War, part of the Seven Years' War of the late 1750s and early 1760s, France surrendered most of its North American territory to Britain in 1761, including the land around and passages of the Straits of Mackinac. The British took possession of Fort Michilimackinac. The fort, by this time a major point of trade and defense for the region, was the site of a Native American attack during Pontiac's War against the British in 1763; neighboring tribes used the diversion of playing a game (similar to today's lacrosse) to storm and take over the fort. By the 1780s, the British moved the fort to Mackinac Island (Adie 2012; Middleton 2007; Saint Ignace Public Library 2008; Wright 1998).

Frequent territorial disputes for control of modern-day Michigan occurred between Britain and the United States following the American Revolutionary War. As Detroit and Michilimackinac were major trading posts in a fur trade that continued to prosper, they played important roles in those discussions and arguments. By the 1790s, the British withdrew from these posts, making them US territories. However, British influence remained in the area of the Straits of Mackinac, particularly in terms of trading and Native American relations. The Straits continued to serve as a major passageway for trade, travel, and migration that connected settlements along Lake Michigan to the more populated centers in eastern Canada and the United States. During the War of 1812, the British regained parts of Michigan, although the United States solidified its grasp on this territory by the conflict's conclusion (Rubenstein and Ziewacz 2014; Wright 1998).

Michigan joined the Union in 1837. The McGulpin Point Lighthouse is one of several historic lighthouses along the Straits of Mackinac. The completion of the Erie Canal in 1825 greatly increased vessel traffic within the straits, especially around the dangerous shoals of McGulpin Point; therefore, the US Congress acquired the land to build the McGulpin Point Lighthouse in 1867 (McGulpin Point 2019). During the 1840s and 1850s, the shipment of goods and the transport of people in the Great Lakes region was largely accomplished by boat. Maritime commerce was crucial to the development of settlements along Lake Michigan, Lake Huron, and others; additionally, the use of water transport brought an influx of new settlers to the State of Michigan in the nineteenth century. The most important industries in the region were mining, lumber, agriculture, and commercial fishing, all of which frequently used water transport to move goods to eastern markets. Maritime transport in the region continued to

prosper in this era, particularly for bulk materials such as mined products and lumber, even though development of the railroad in the late 1850s threatened its dominance (Wright 1998).

In the Great Lakes region, maritime shipment of goods was on the decline by the turn of the twentieth century. Improvements to railroad transportation and the continued construction of these routes began to prove more effective, in terms of timing and cost. In 1900, there were nearly 11,265 km (7,000 mi) of railroad tracks in Michigan, mostly on the Lower Peninsula (Michigan Department of Transportation 2014). Railroad lines connected settlements along the Straits of Mackinac by the 1880s; this included the Detroit, Mackinac, and Marquette that connected with the Straits near St. Ignace, as well as the Michigan Central, Grand Rapids, and Indiana, which ended at Mackinaw City. Transportation of people via waterways in the Great Lakes region continued to be popular in the late nineteenth century, even as freight travel via railroad increased. Travel by vessel peaked during the first decade of the twentieth century, giving way to the popularity of automobile transportation by the 1920s (Gaertner 2009; Rubenstein and Ziewacz 2014; Wright 1998).

Movement across the Straits of Mackinac, however, particularly between St. Ignace and Mackinaw City, still required the use of boats. Railcars and automobiles crossed the Straits onboard ferries from the 1880s through the 1950s. Frequent freezing of waterways was a major problem for this method of transport, often creating difficult and sometimes treacherous conditions. Limitations to maritime travel during winter months was one of the reasons shipping via the lakes and Straits waned in this period. Because of this, the first ferries constructed for this passage, starting with the *Algomah* in the early 1880s, were built with ice-breaking capability. The railroad ferries began carrying four cars at a time, increasing to 12 and then 18 by 1893. By 1923, automobile ferries were helping to connect the new highway systems of the Lower and Upper Peninsulas, again traveling between Mackinaw City and St. Ignace. By the 1950s, five ferries carried cars between the two settlements (Rubenstein and Ziewacz 2014; Wright 1998).

Construction of the Mackinac Bridge was completed in 1957, which was a long-awaited event and considered necessary for twentieth-century transportation. The Mackinac Bridge covers the 8.0-km (5.0-mi) stretch across the Straits of Mackinac and connects the two long-standing settlements of Mackinaw City and St. Ignace, allowing automobile transport between the two peninsulas of Michigan. David B. Steinman designed and oversaw the construction of the landmark, also known as “Big Mac” and “Mighty Mac,” which was considered a feat of modern engineering. On November 1, 1957, the bridge officially opened, closing a long chapter on maritime transport across the Straits (Mackinac Bridge Authority 2019; Wright 1998).

In 1983, the State of Michigan designated roughly 383 square kilometers (sq km) (148 square miles [sq mi]) of Lake Michigan, Lake Huron, and connecting straits bottomlands as the Straits of Mackinac Shipwreck Preserve (Straits of Mackinac Shipwreck Preserve 2019). The shipwreck preserve, managed by the Michigan Department of Natural Resources, contains 12 shipwrecks with known locations and numerous shipwrecks with unknown locations (Straits of Mackinac Shipwreck Preserve 2019). Shipwrecks within the preserve range in age from a mid-nineteenth-

century brig to a 1960s bulk carrier. In addition to shipwrecks, the preserve contains a number of underwater geologic formations.

Map Review of the APE

SEARCH analyzed historic charts of the APE and surrounding areas. **Figure 5** is an inset of the 1854 US Lake Survey (USLS) Navigation Chart. The chart depicts water depths and bottom composition within the APE. Old Fort Mackinac is present on the chart southeast of the APE; additionally, St. Ignace is depicted northeast of the APE. Water depths within the APE range from 12 to 66 m (40 to 216 ft) and the bottom is composed of gravel, stone, and clay. Two shipping lanes intersect the APE perpendicularly across the main strait.

Figure 6 is an 1897 nautical chart similar to the 1854 chart, but depicts more detail and development than the previous version. The McGulpin Point Lighthouse, built in 1869, is visible to the south of the APE. Mackinaw City also appears on the chart as a developed area with gridded roads, structures, and two railroad lines leading into the city, the Michigan Central and Grands Rapids & Indiana Railways. To the north, St. Ignace expanded along East Moran Bay. Depth soundings for deeper portions of the Straits of Mackinac are included on the map, as well as shipping lanes. The chart shows a maximum water depth of 92 m (302 ft) west of the APE.

The first underwater cable shows across the Straits as development surrounding Mackinaw City and St. Ignace intensified at the turn of the century. The Michigan Telephone Company Cable line can be seen in the USLS 1906 nautical chart east of the APE (**Figure 7**). There is little change within the vicinity of the APE until 1936 when another submarine cable appears across the strait between McGulpin Point and Point La Barbe, in between the east and west pipeline sections of the APE (**Figure 8**). **Figure 9** is a 1955 USLS nautical chart of the Straits of Mackinac. By this time, the east and west sections of Line 5 are visible on the chart after installation of the lines in 1953 (Enbridge 2018). To the east of the APE, the Mackinac Bridge is under development, but is complete by 1961 (**Figure 10**). By 1981, the area within the vicinity of the APE appears similar to the current settings of the Straits of Mackinac (**Figure 11**).

PREVIOUSLY RECORDED SUBMERGED ARCHAEOLOGICAL SITES AND SURVEYS

Archaeological Record Review

SEARCH reviewed various databases, including the MSHDA archaeological and shipwreck files, in order to identify known and potential submerged cultural resources within a 1.6 km (1.0 mi) radius of the APE. Additional sources include the following:

- Global GIS Data Services, LLC, GMWD
- NOAA's AWOIS
- NOAA nautical charts
- SEARCH shipwreck database (assembled from various sources)

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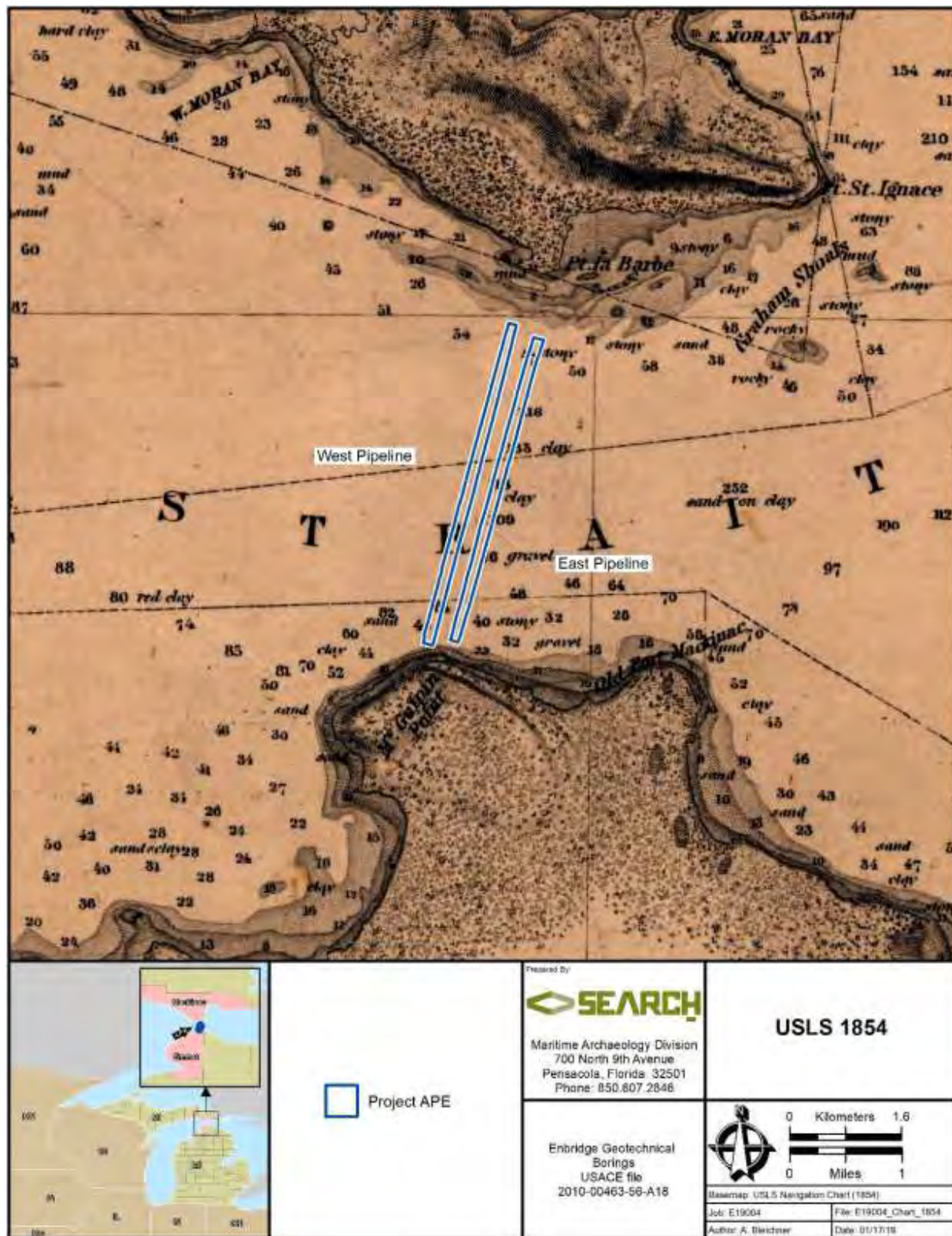


Figure 5. 1854 USLS nautical chart.

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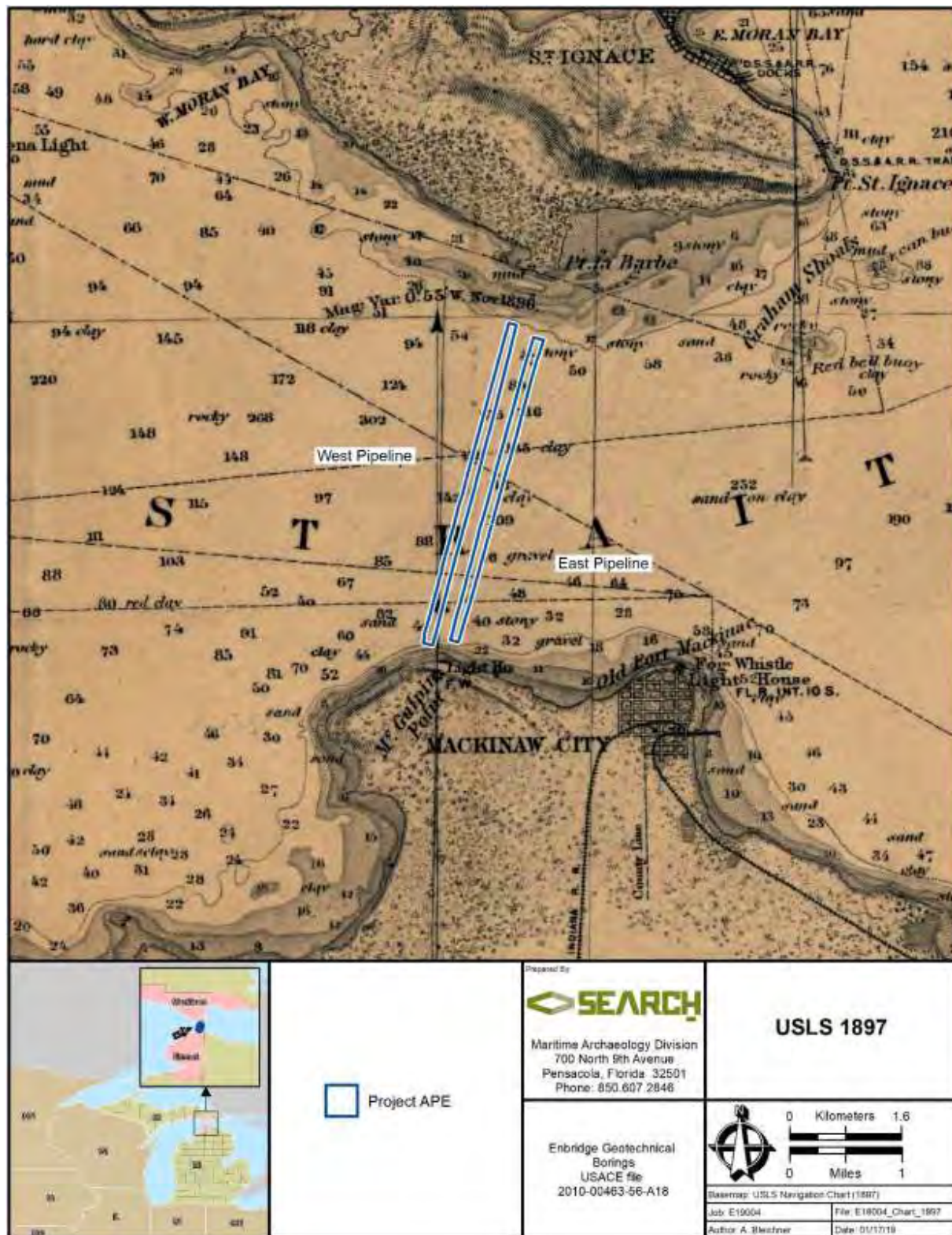


Figure 6. 1897 USLS nautical chart.

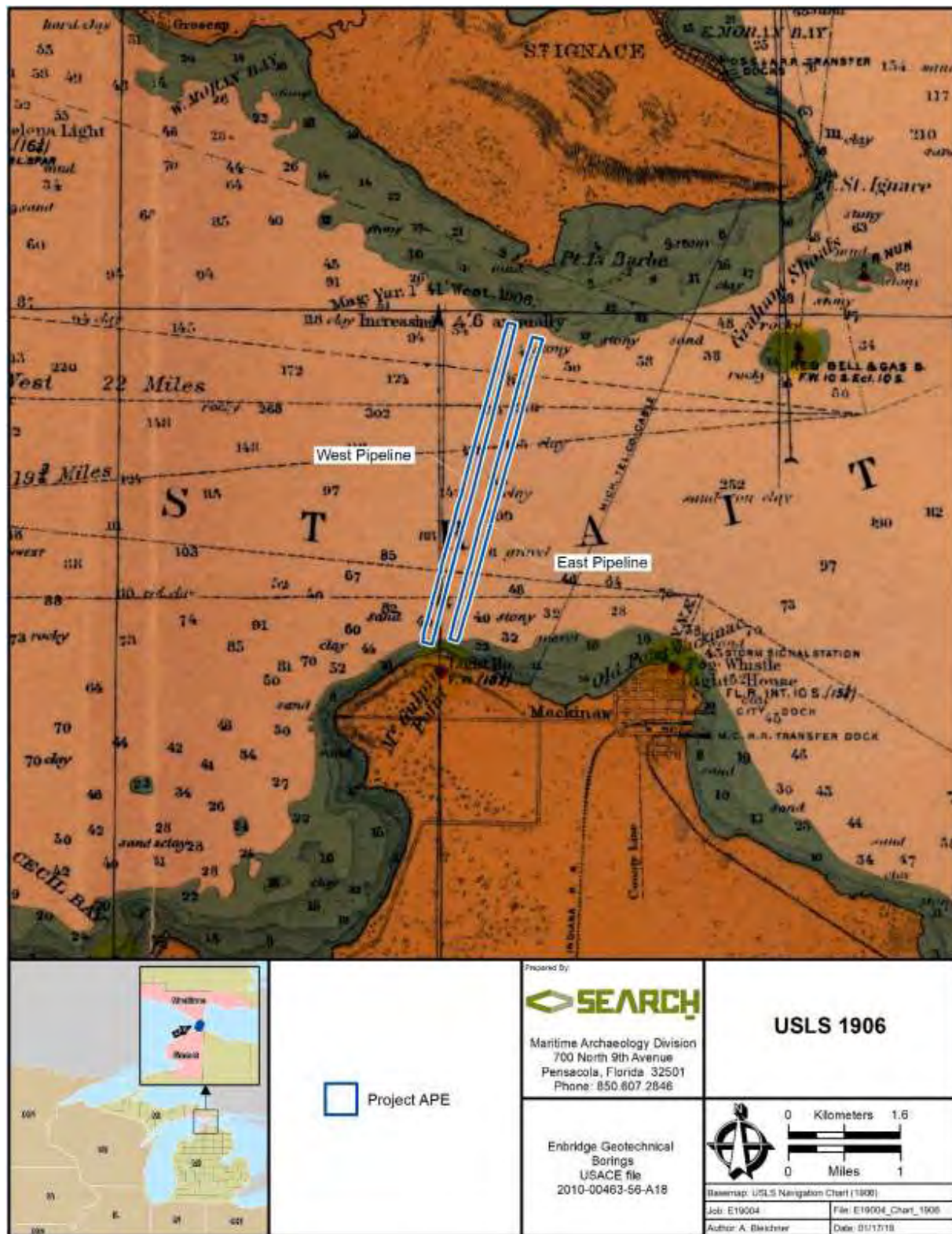


Figure 7. 1906 USLS nautical chart.

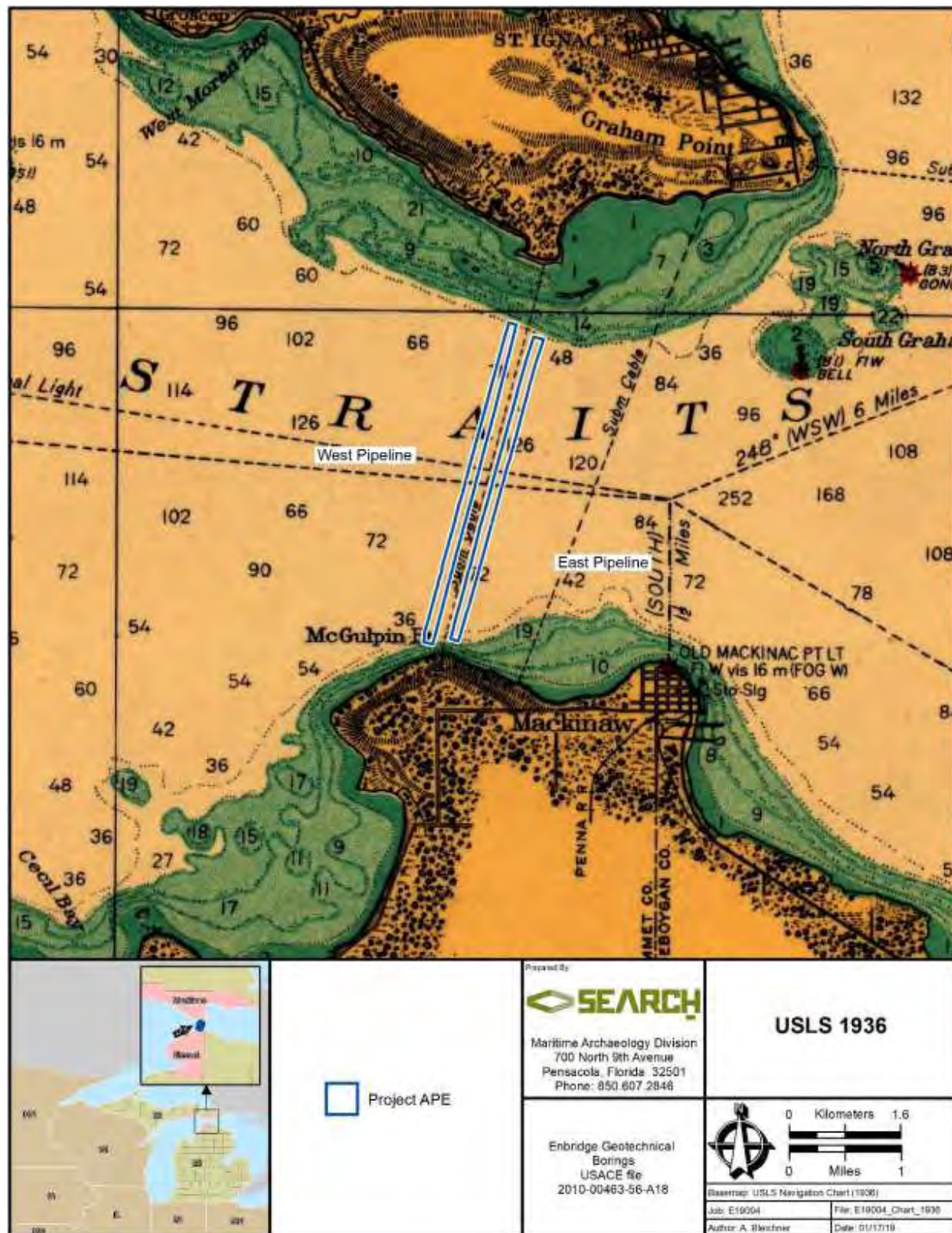


Figure 8. 1936 USLS nautical chart.

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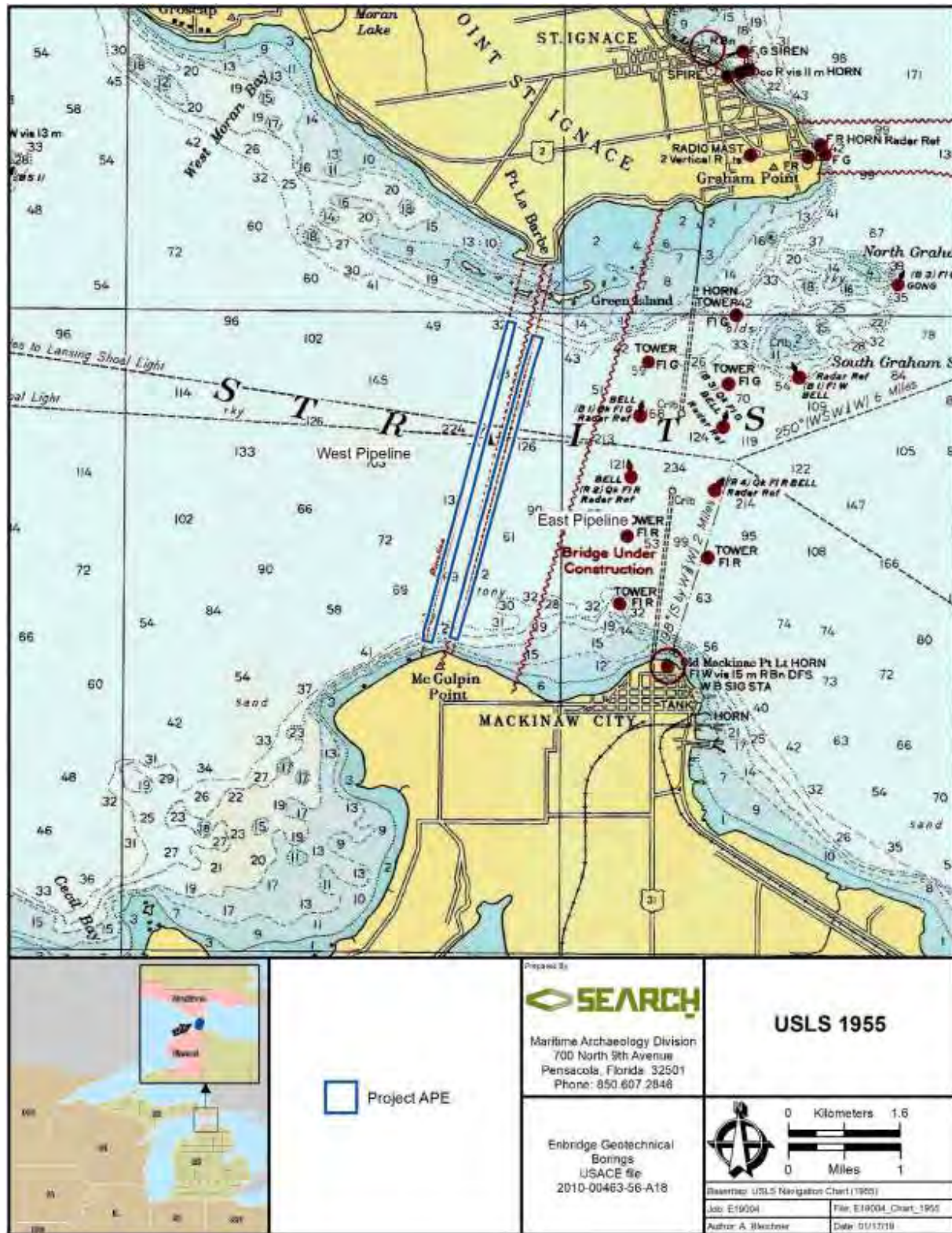


Figure 9. 1955 USLS nautical chart.

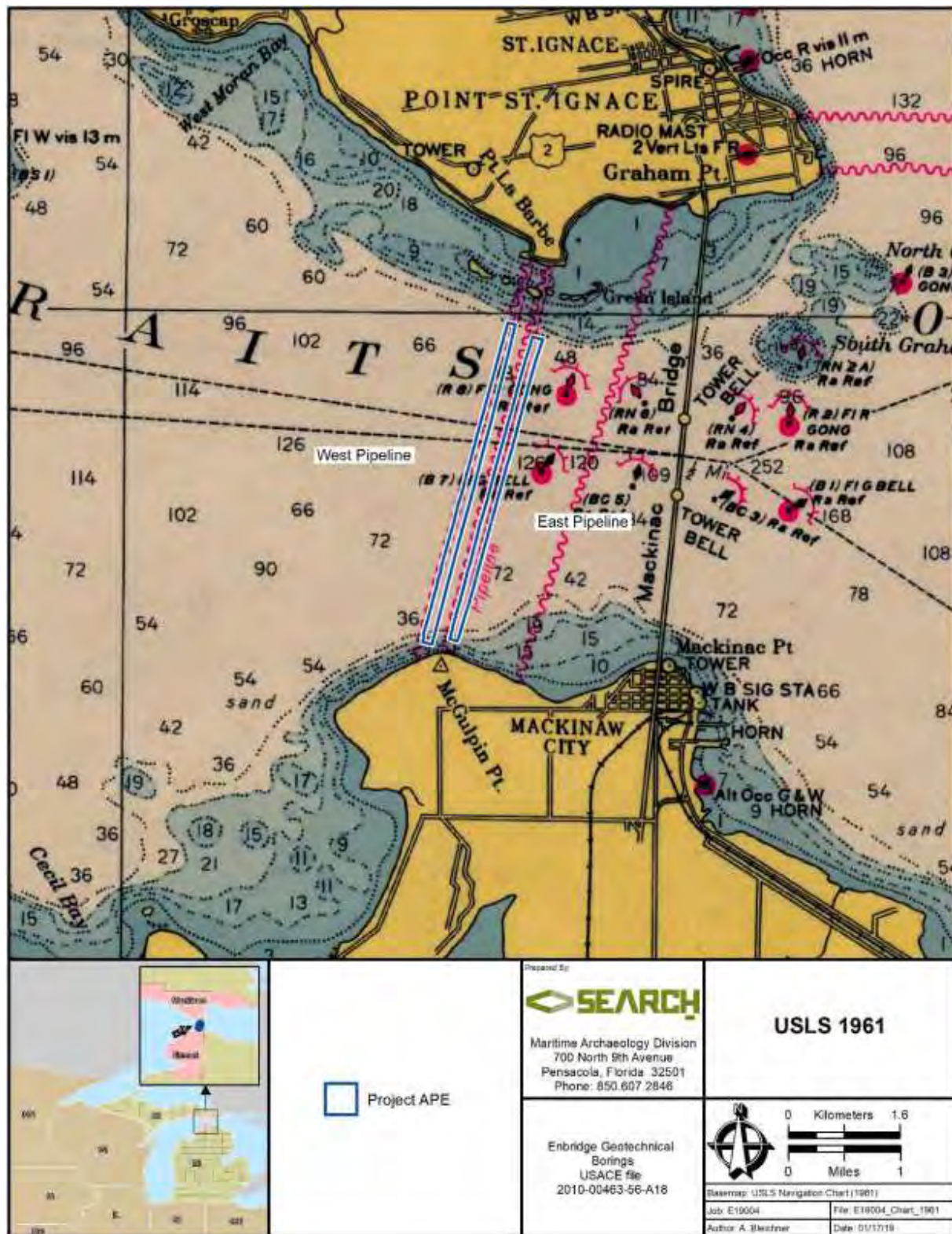


Figure 10. 1961 USLS nautical chart.

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Figure 11. 1981 USLS nautical chart.

The MSHDA database identifies no previously recorded submerged cultural resources within the boundaries of the APE. Research revealed no previously recorded submerged archaeological sites within 1.6 km (1.0 mi) of the APE. The MSHDA records indicate that one underwater cultural resource survey has been conducted with 1.6 km (1.0 mi) of the APE (**Table 1**). Phillip J. Wright of Mount McGovern Co. Ltd. conducted the only underwater archaeological investigation within 1.6 km (1.0 mi) of the APE for IMA Consulting, Inc (IMA) in 1997. **Figure 12** depicts the area of the Wright (1998) survey (MSHDA No. B99-71).

Table 1. Previous Submerged Cultural Resource Surveys within 1.6 km (1.0 mi) of the APE.

MSHDA No.	Title	Date	Author
B99-71 (ER97-434c)	Underwater Archaeological Survey of the Great Lakes Gas Transmission Corridor at the Straits of Mackinac	1998	Wright, Phillip J.

In 1997, Wright was contracted by IMA to conduct an underwater archaeological survey upon expansion of the existing Great Lakes Gas Transmission Limited Partnership natural gas line across the Straits of Mackinac. The project was limited to an approximately 16-sq km (6.0-sq mi)) area surrounding the existing Line A Easterly Gas Pipeline Crossing. The investigation utilized side-scan and sector-scan sonars to document the project area. Researchers identified six acoustic contacts, one of which was located outside of the study area (Wright 1998). Of the five contacts within the study area, four were identified as rock features. Archaeologists also conducted pedestrian survey parallel to the shoreline and within the shoals using 1.8-m (6.0-ft) transect intervals. Diver investigations of limited zones of the study area also confirmed the absence of cultural resources (Wright 1998). Target #6, the only cultural feature identified during survey, was found using pedestrian visual survey along the shoreline at the northwestern tip of Green Island. Sonar imagery of Target #6 and diver investigations revealed the feature was a modern wooden crib structure. No contacts identified during the 1997 survey are located within the current APE (Wright 1998).

SHIPWRECK INVENTORY

Figure 13 depicts the locations of shipwrecks and obstructions reported within 1.6 km (1.0 mi) of the APE, as well as the Straits of Mackinac Shipwreck Preserve. The eight shipwrecks depicted in **Figure 13** have been verified through a variety of sources, including Kohl (2008) and Feltner and Feltner (1991). SEARCH obtained additional shipwreck information from the Straits of Mackinac Shipwreck Preserve website (2019). Although no shipwrecks have been documented within 1.6 km (1.0 mi) of the APE, two obstructions exist approximately 1.0 km (0.6 mi) southwest of the APE (**Table 2**). No vessels or obstructions (see **Figure 13**) are reported within the APE. The closest shipwreck to the APE is 2.0 km (1.2 mi) southwest of the West Pipeline (**Table 3**). Known locally as *Aching Heart*, the shipwreck may be a work barge associated with the construction of the State Ferry Dock in 1923 (MSHDA Site File 2019).

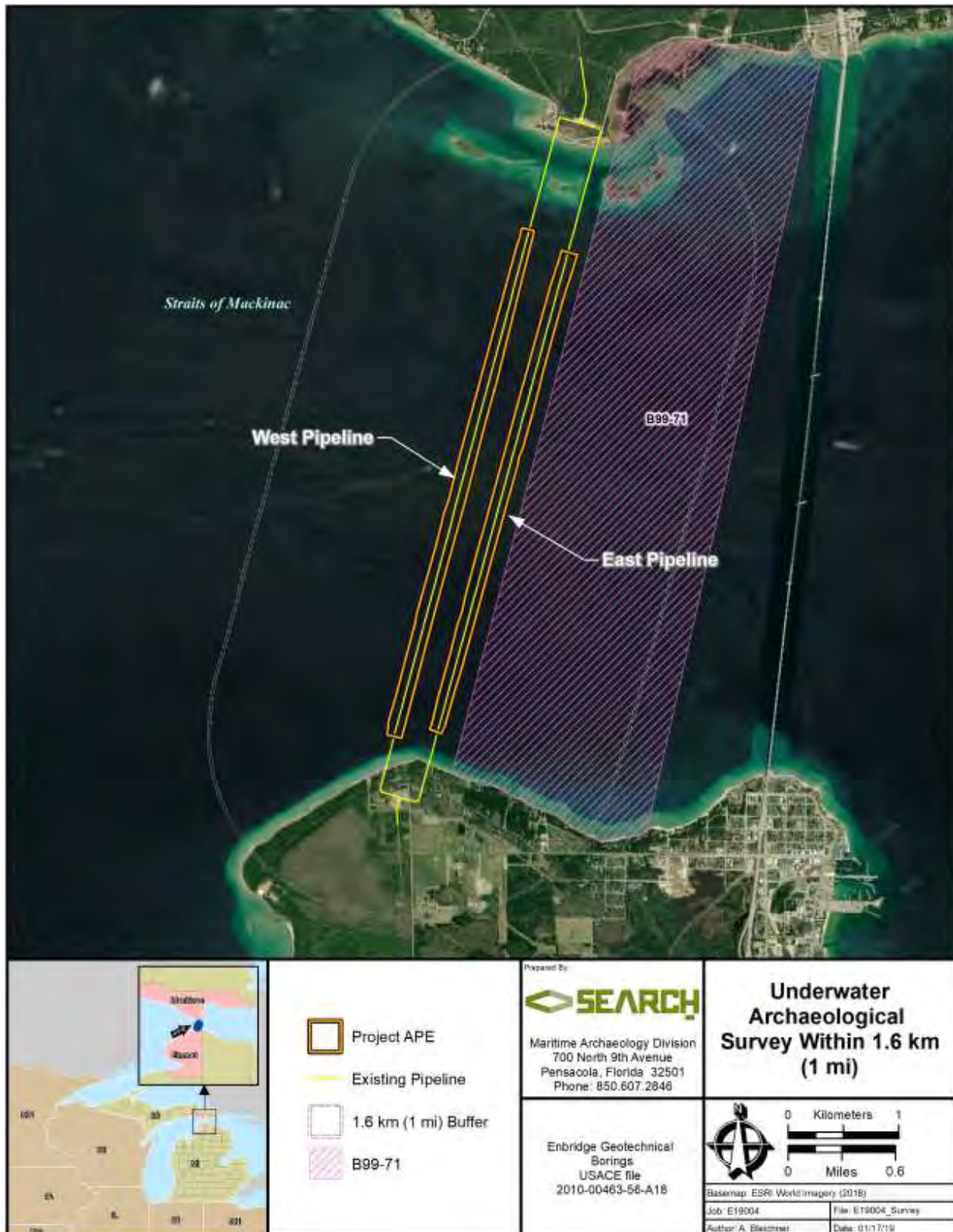


Figure 12. Archaeological survey (B99-71) within 1.6 km (1.0 mi) of the APE.



Figure 13. Shipwrecks and obstructions reported within 1.6 km (1.0 mi) of the APE.

Table 2. Obstructions within 1.6 km (1.0 mi) of the APE.

Vessel	Year Lost	Comment	ID (Source)
Unknown	Unknown	Obstruction	5692 (US Graph Chart DD4940)
Unknown	Unknown	Obstruction	9415 (US Graph Chart DD4940)

Source: NOAA AWOIS Obstructions

Table 3. Known Historic Shipwrecks Lost in the Vicinity of the APE.

Vessel Name	Type	Date Lost	Where Lost
<i>Sandusky</i>	Brigantine, two-mast	September 18, 1856	Straits of Mackinac
<i>M. Stalker</i>	Schooner, two-mast	November 5, 1886	Straits of Mackinac
<i>William A. Young</i>	Schooner Barge, two-mast	October 5, 1891	Straits of Mackinac
<i>Minneapolis</i>	Propeller	April 4, 1894	Straits of Mackinac
<i>Charles H. Johnson</i>	Schooner	September 23, 1895	Old Mackinac Point
<i>Eber Ward</i>	Bulk Freighter	April 9, 1909	Straits of Mackinac
<i>Aching Heart</i>	Propeller	1923 (possible)	Mackinaw City
<i>Algomah</i>	Ferry	1945	Mackinaw City

Source: Feltner and Feltner 1991; MSHDA/Lusardi 2019; Straits of Mackinac Shipwreck Preserve 2019

The MSHDA provided SEARCH with a list of at least 36 potential shipwrecks within or near the Straits of Mackinac. Shipwreck locations are based on historic research and documentation (Wayne Lusardi, personal communication 2019). **Table 4** lists ships lost within the vicinity of the Straits of Mackinac. Most of the shipwrecks have not been relocated, and their current whereabouts are unknown. Feltner and Feltner (1991) suggest that more than 75 shipwrecks may rest within the Straits, some of which have been confirmed. It is important to note that locational accuracy for historic shipwrecks is tentative at best in most instances. Many shipwrecks are reported in multiple databases, sometimes with varying positions. Historic shipwrecks are generally plotted based on contemporary records, maps, or oral histories. It must be assumed, therefore, that **Table 4** does not constitute an exhaustive list of reported shipwrecks within or near the APE.

Table 4. Potential Historic Shipwrecks Lost in the Vicinity of the APE.

Vessel Name	Type	Date Lost	Where Lost
<i>Alert</i>	Brig, two-mast	1844	Waugoschance Point
<i>A. D. Patchin</i>	Paddle Wheeler	September 17, 1850	Skillagalee
<i>Garden City</i>	Steamer	May 16, 1854	Les Cheneaux (Martin)
<i>Julia Dean</i>	Brigantine, two-mast	October 6, 1855	Skillagalee
<i>Asia</i>	Scow Schooner, two-mast	September 22, 1855	Skillagalee
<i>Arabian</i>	Brig, two-mast	1856	Goose Island, Port Dolomite
<i>J. E. Shaw</i>	Schooner, two-mast	September 22, 1856	St. Ignace
<i>Leander</i>	Schooner, two-mast	November 17, 1857	Gros Cap
<i>Clarion</i>	Brigantine, two-mast	October 30, 1860	Skillagalee
<i>Condor</i>	Schooner	November 1862	Skillagalee
<i>Hattie Johnson</i>	Schooner	November 9, 1879	Goose Island Shoal
<i>Anglo Saxon</i>	Schooner Barge	1887	Mackinaw City
<i>J. A. Smith</i>	Schooner Barge, two-mast	September 8, 1887	Station Point, Mackinaw City
<i>Senator Blood</i>	Schooner	November 12, 1896	Goose Island
<i>Lettie May</i>	Schooner, two-mast	October 4, 1905	Skillagalee
<i>Jura</i>	Schooner, three-mast	October 4, 1911	Cross Village

Table 4. Potential Historic Shipwrecks Lost in the Vicinity of the APE.

Vessel Name	Type	Date Lost	Where Lost
<i>Mary N. Bourke</i>	Schooner Barge, four-mast	September 20, 1914	St. Ignace
<i>Peerless</i>	Unknown	Unknown	Mackinac Island
<i>Elva</i>	Unknown	Unknown	Mackinaw City
<i>Milwaukee</i>	Unknown	Unknown	Mackinaw City
<i>Canisteo</i>	Unknown	Unknown	Mackinaw City
<i>J. H. Tiffany</i>	Unknown	Unknown	Mackinaw City
<i>Lorain</i>	Unknown	Unknown	Harbor Springs
<i>Uganda</i>	Unknown	Unknown	Mackinaw City
<i>A. H. J.</i>	Unknown	Unknown	Harbor Springs
<i>Dolphin</i>	Unknown	Unknown	Mackinaw City
<i>Francis Palm</i>	Unknown	Unknown	Mackinaw City
<i>Free State</i>	Unknown	Unknown	Mackinaw City
<i>Gertrude</i>	Unknown	Unknown	Mackinaw City
<i>Lawrence</i>	Unknown	Unknown	St. Ignace
<i>Island Queen</i>	Unknown	Unknown	Mackinaw City
<i>Ida M. Torrent</i>	Unknown	Unknown	Harbor Springs
<i>Energy</i>	Unknown	Unknown	Harbor Springs
<i>Harold B.</i>	Unknown	Unknown	Mackinaw City
<i>Ada L.</i>	Unknown	Unknown	St. Ignace
<i>Commodore Lawrence</i>	Unknown	Unknown	St. Ignace

Source: MSHDA/Lusardi 2019

REMOTE-SENSING DATA REVIEW

Ballard Marine Construction collected multibeam echosounder, single-beam echosounder, magnetometer, and side-scan sonar datasets within the APE. Surveyors collected multibeam data within the APE in water depths greater than 10 m (33 ft). Multibeam data produces similar imagery to side-scan sonar imagery; therefore, multibeam data was not assessed. Additionally, MSHDA's recommended methodology for underwater archaeological survey does not include the analysis of multibeam data. Magnetometer data were collected within the APE; however, due to line space intervals of 152 m (500 ft), the data are insufficient for archaeological analysis.

SEARCH did analyze the provided processed side-scan sonar mosaic imagery for the purposes of archaeological review (**Figure 14**). The imagery covered an area of approximately 1.3 sq km (0.5 sq mi) along roughly 9.3 km (5.8 mi) of existing pipeline. Imagery was provided in the form of high-resolution (0.1-m/pixel [0.3-ft/pixel]) geo-rectified mosaics. The data were collected using an integrated autonomous underwater vehicle (AUV) side-scan sonar system, flown at an altitude of 6.0 m (20 ft) off the bottom and in water depth greater than 10 m (33 ft).

SEARCH identified 32 acoustic contacts within the mosaicked imagery of the APE, including natural, pipeline-related, and unknown features. None of the 32 contacts are likely to



Figure 14. Side-scan sonar mosaic of the APE.

represent a submerged cultural resource. SEARCH identified at least 10 natural features in the imagery, including rocks, sand ripples, and other geologic features (**Figure 15**). SEARCH also noted potential ice scours in the imagery closest to shore, a feature also identified in the Wright 1998 survey.

SEARCH identified 17 anthropogenic contacts in the APE. Many of these contacts are likely associated with pipeline construction. The East and West Pipelines are imaged in the side-scan sonar record in the approximate center of each side of the APE. Rock piles and modern debris exist along the pipeline routes, which are likely associated with initial construction and/or recent improvements to secure the pipelines to the lake bottom. SEARCH also identified a buoy mooring block along the East Pipeline (**Figure 16**), as well as a transmission cable located approximately 1,200 m (3,937 ft) parallel to the East Pipeline (**Figure 17**). Five contacts are unknown, but are not likely to represent submerged cultural resources.

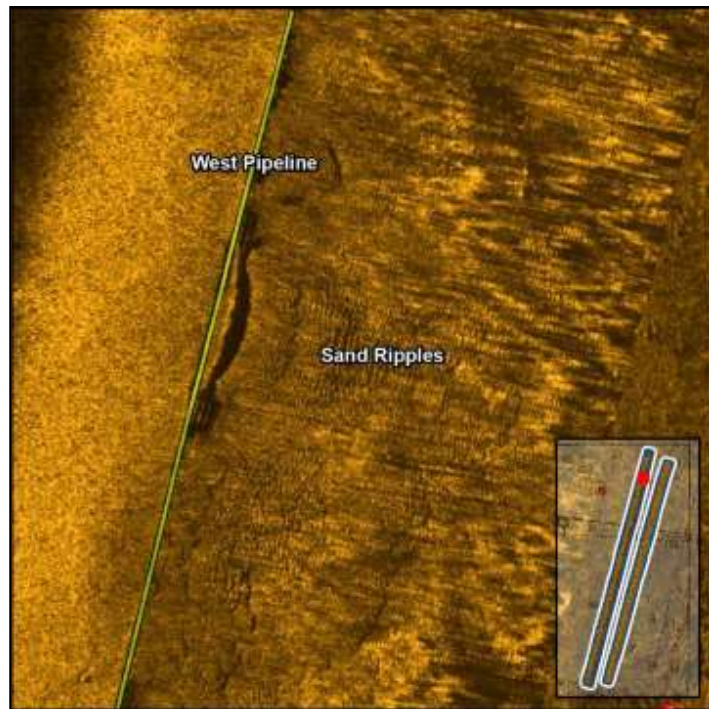


Figure 15. Sand ripples along the northern portion of the West Pipeline.

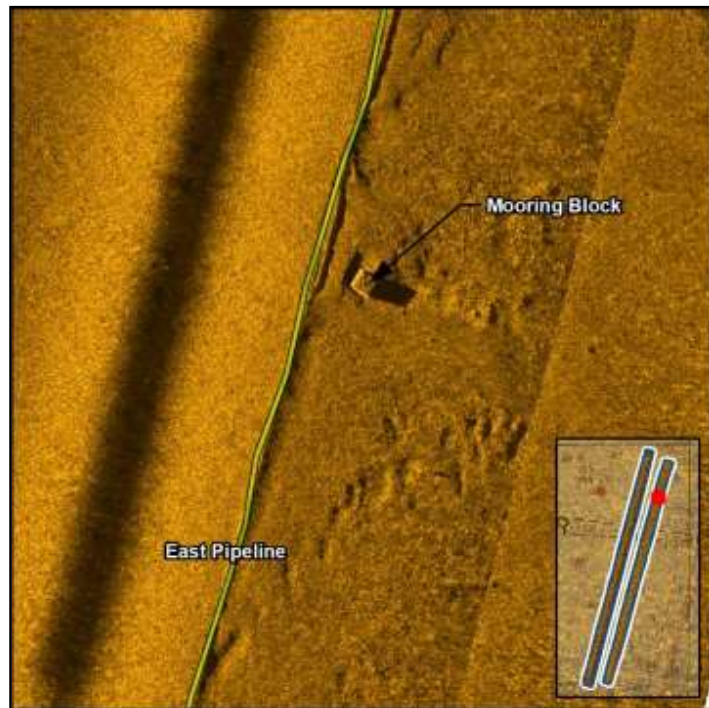


Figure 16. Mooring block along the northern portion of the East Pipeline.

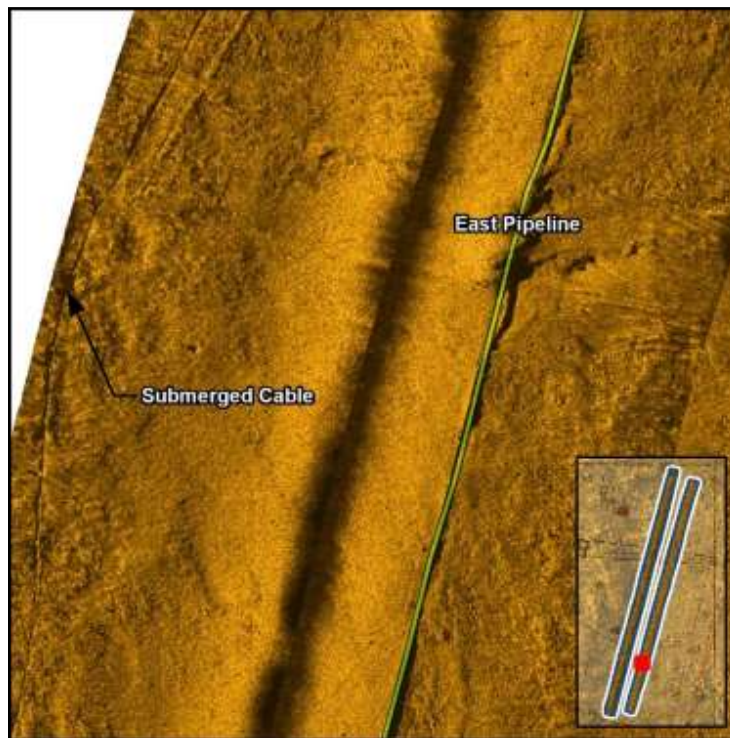


Figure 17. Submerged cable parallel to the East Pipeline.

CONCLUSION

SEARCH conducted the Desktop Assessment and review of processed side-scan sonar mosaic imagery on behalf of Stantec to determine the potential for submerged cultural resources that may be located within the APE. MSHDA indicates that at least 36 shipwrecks have been reported in the vicinity of the APE, although Feltner and Feltner (1991:56) suggest this number may be as many as 75 shipwrecks lost within the Straits. Most of these shipwrecks have not been relocated, and their current whereabouts are unknown. The earliest known shipwreck within the Straits of Mackinac may date to 1844; however, it is possible that smaller pre-contact or early vernacular watercraft may be found within or in the vicinity of the APE (Feltner and Feltner 1991). Numerous terrestrial pre-contact sites are recorded in the vicinity, and the occurrence of these pre-contact deposits suggests that humans may have been active in the APE when lake levels were lower than today. SEARCH identified one Phase I maritime archaeological investigation within the vicinity of the APE; however, the APE has not been subjected to archaeological investigation.

SEARCH reviewed processed side-scan sonar mosaic imagery, provided by Ballard Marine Construction, acquired along both pipeline routes in water depths greater than 10 m (33 ft). SEARCH identified no acoustic contacts indicative of potential submerged cultural resources within the provided mosaic imagery.

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STATE OF MICHIGAN
BEFORE THE MICHIGAN PUBLIC SERVICE COMMISSION

In the matter of the Application of Enbridge Energy, Limited Partnership for the Authority to Replace and Relocate the Segment of Line 5 Crossing the Straits of Mackinac into a Tunnel Beneath the Straits of Mackinac, if Approval is Required Pursuant to 1929 PA 16; MCL 483.1 et seq. and Rule 447 of the Michigan Public Service Commission's Rules of Practice and Procedure, R 792.10447, or the Grant of other Appropriate Relief

U-20763

ALJ Dennis Mack

PROOF OF SERVICE

On September 14, 2021, an electronic copy of **PUBLIC** *Direct Testimony and Exhibits of Dr. Charles E. Cleland on behalf of Bay Mills Indian Community* was served on the following parties:

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Date: September 14, 2021

By: Christopher R. Clark
Christopher R. Clark
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September 14, 2021

Via E-filing

Ms. Lisa Felice
Michigan Public Service Commission
7109 W. Saginaw Hwy.
P. O. Box 30221
Lansing, MI 48909

RE: MPSC Case No. U-20763

Dear Ms. Felice:

The following are attached for paperless electronic filing:

- Direct Testimony and Exhibits of Frank Ettawageshik on behalf of Bay Mills Indian Community and Little Traverse Bay Bands
- Proof of Service

Sincerely,

Christopher R. Clark
cclark@earthjustice.org

STATE OF MICHIGAN
BEFORE THE MICHIGAN PUBLIC SERVICE COMMISSION

In the matter of the Application of Enbridge
Energy, Limited Partnership for Authority to U-20763
Replace and Relocate the Segment of Line 5
Crossing the Straits of Mackinac into a Tunnel ALJ Dennis Mack
Beneath the Straits of Mackinac, if Approval is
Required Pursuant to 1929 PA 16; MCL 483.1
et seq. and Rule 447 of the Michigan Public
Service Commission's Rules of Practice and
Procedure, R. 792.10447, or the Grant of other
Appropriate Relief

TESTIMONY OF FRANK ETTAWAGESHIK
ON BEHALF OF
BAY MILLS INDIAN COMMUNITY
AND
LITTLE TRAVERSE BAY BANDS OF ODAWA INDIANTS

September 14, 2021

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I. INTRODUCTION & BACKGROUND

Q. Please state your name, occupation, and business address.

A. My name is Frank Ettawageshik. I am currently the Executive Director of the United Tribes of Michigan. My business address is 5453 Hughston Road, Harbor Springs, MI 49740.

Q. On whose behalf is this testimony being offered?

A. I am testifying on behalf of the Bay Mills Indian Community (“Bay Mills”) and the Little Traverse Bay Bands of Odawa Indians (“LTBB”). This testimony reflects my experiences as a citizen of LTBB, my leadership roles in tribal government, and my work to address the impacts of climate change.

Q. Please summarize your experience in tribal government.

A. I am an Odawa (Ottawa) Indian from northern Lower Michigan and a citizen of LTBB. I was elected to the board of LTBB and served as Vice-Chairman until April 1991, when I became Tribal Chairman. As Tribal Chairman, I was the chief executive officer of the tribal administration and I represented LTBB in its dealings with the governments of other Tribes, the State of Michigan, and the United States. During my tenure as a leader, LTBB successfully ended a 120-year legal dispute with the U.S. Government with the passage of Public Law 103-324, which reaffirmed the political relationship between LTBB and the United States. I served as Tribal Chairman until July 1999.

In 2003 I was once again elected as Tribal Chairman, and, upon the implementation of a new tribal constitution in August 2005, I was elected to a four-year term as the first Tribal Chairman under that new Tribal constitution. In that capacity, I served as the head of the Executive Branch under the new constitutional structure until the end of my term in

FRANK ETTAWAGESHIK – DIRECT TESTIMONY - CASE NO. U-20763

1 September 2009, shortly after which I assumed my current position as the Executive
2 Director of the United Tribes of Michigan.

3 Also, in 2018, I was appointed to a six-year term to the LTBB appellate court.

4 Additional detail about my experience and accomplishments in tribal government is
5 included in my resume, provided as Exhibit BMC-16 (ETT-1).

6 **Q. What is your current position or occupation?**

7 A. I am currently the Executive Director of the United Tribes of Michigan. I was hired as the
8 Executive Director in September 2009, after leaving office as the Tribal Chairman of
9 LTBB. The United Tribes of Michigan is an organization founded by the federally
10 recognized tribes in Michigan to join forces to advance, protect, preserve, and enhance the
11 mutual interests, treaty rights, sovereignty and cultural way of life of the sovereign tribes
12 of Michigan throughout the next seven generations.

13 As Executive Director, I organize meetings and coordinate email communications with
14 Tribal leaders on issues of interest to Michigan Tribes, and organize an annual legislative
15 reception at the state capitol. I also represent the United Tribes at inter-tribal, local, state,
16 national, and international meetings.

17 Additional details about my work as the Executive Director of the United Tribes of
18 Michigan are described below and on my resume, provided as Exhibit BMC-16 (ETT-1).

Q. Have you testified about Bay Mills’ or LTBB’s interests before this Commission or in any other proceeding?

A. I have not previously testified before this Commission. In my role as LTBB Tribal Chairman and, subsequently as United Tribes of MI Executive Director, I have testified in the following proceedings:

- 19920708 US House Committee on Interior and Insular Affairs re HR 3958, a bill that would reaffirm the federal relationship of the Little Traverse Bay Bands of Odawa Indians, written testimony
- 19990415 US House Subcommittee on FY2000 Budget
- 20060316 US Senate Environment and Public Works Committee, re: funding for Great Lakes Regional Collaboration report
- 20070307 US House subcommittee on Water Resources and the Environment, re Aquatic Invasive Species and the effects on treaty reserved fishing rights
- 20070328 USDHHS Budget hearing, Child Welfare funding, for National Indian Child Welfare Association
- 20091104 US Senate Committee on Indian Affairs, Fixing the Federal Acknowledgment Process, on behalf of the National Congress of American Indians
- 20110609 US Senate Committee on Indian Affairs, the Domestic Policy Implications of the Implementation of the United Nations Declaration on the Rights of Indigenous Peoples re Federal Recognition and Climate Change, on behalf of the National Congress of American Indians

Depositions

- 20070308 US vs MI, Hunting, Fishing and Gathering case
- 20180613 Little Traverse Bay Bands Reservation Boundary case

Q. What is the purpose of your testimony?

A. I am testifying on behalf of Bay Mills and LTBB about why Tribes are deeply concerned about climate and why it is important to take immediate steps to address climate change for the wellbeing of the State's ecosystem, and all the species that depend on it. This testimony reflects the considerable experience that Tribes have in contributing to local, national, and international climate change policy and my direct involvement in that work.

Q. What information did you review in preparing your testimony in this case?

A. In addition to my review of the materials that I am sponsoring as exhibits, I also reviewed my testimony before the US Senate Committee on Indian Affairs regarding Federal Recognition and Climate Change as these issues affect tribes in the implementation of the UN Declaration on the Rights of Indigenous Peoples (6-9-2011).

Q. Are you sponsoring any exhibits?

A. Yes, I am sponsoring the following exhibits:

Exhibit BMC-16 (ETT-1): Resume of Frank Ettawageshik

Exhibit BMC-17 (ETT-2): Resolution #SD-15-007

Exhibit BMC-18 (ETT-3): Resolution #KAN-18-006

FRANK ETTAWAGESHIK – DIRECT TESTIMONY - CASE NO. U-20763

1	Exhibit BMC-19 (ETT-4):	Resolution #REN-19-005
2	Exhibit BMC-20 (ETT-5):	Resolution #MOH-17-053
3	Exhibit BMC-21 (ETT-6):	Indigenous Call to Action from 2008 Convening of
4		Indigenous Peoples For the Healing of Mother Earth
5	Exhibit BMC-22 (ETT-7):	Final Report from Native Homelands Climate
6		Change Workshop
7	Exhibit BMC-23 (ETT-8):	COP 21 Complete Statement
8	Exhibit BMC-24 (ETT-9):	Michigan Climate Action Council Climate Action
9		Plan
10	Exhibit BMC-25 (ETT-10):	Executive Directive No. 2009-4
11	Exhibit BMC-26 (ETT-11):	Intergovernmental Accord between Tribal Leaders
12		and Governor of Michigan to Address the Crucial
13		Issue of Climate Change
14	Exhibit BMC-27 (ETT-12):	Inland Consent Decree
15	Exhibit BMC-28 (ETT-13):	Inland Consent Decree FAQ
16	Exhibit BMC-29 (ETT-14):	Headline Statements from the Summary for
17		Policymakers of IPCC's Working Group 1
18	Exhibit BMC-30 (ETT-15):	LTBB Kyoto Protocol Resolution

1 **II. BACKGROUND INFORMATION ABOUT INVOLVEMENT IN CLIMATE**
2 **CHANGE ADVOCACY.**

3 **Q. How did you first become involved in advocacy about climate change issues?**

4 A. My interest and involvement in, and knowledge about, climate change issues stems from a
5 core teaching that was instilled in me by my father and tribal elders—to leave every place
6 cleaner than how I found it. So, from a young age, I became aware of our impact on the
7 environment. This is a principle that has guided much of my work for my entire life.

8 And, as a young tribal leader, I was charged by tribal elders to protect the water, fish, land,
9 animals, and plants so that we can maintain and protect the relationship we have with the
10 natural world.

11 These core teachings informed, influenced, and directed my work as a tribal leader. In that
12 capacity, I became increasingly aware of the effect that greenhouse gas emissions and
13 climate change were having on our planet. It became apparent to me that it was imperative
14 that we work collaboratively to address the impacts of climate change. I became deeply
15 concerned about the ways in which climate change threatened our way of life. I began
16 reading as much as I could about the subject to understand how Indigenous Peoples could
17 best address the threat.

18 One significant moment in my involvement in working collectively to address climate
19 change issues occurred in the late 1990's when I participated on a panel at a meeting of the
20 National Congress of American Indians that included Professor James Hansen, a leading
21 scholar about climate science. The panel discussed the importance of addressing climate

1 change issues and the experience further fueled my passion to address the impacts of
2 climate change.

3 **Q. What is the National Congress of American Indians and how have you been involved**
4 **with the organization?**

5 A. The National Congress of American Indians (“NCAI”) is an organization established in
6 1944 in response to the termination and assimilation policies the U.S. government forced
7 upon tribal governments in contradiction of their treaty rights and status as sovereign
8 nations. It is a membership organization comprised of tribal governments.

9 Climate change has long been an issue priority for NCAI, and NCAI has passed several
10 important resolutions about the topic. See, for example:

- 11 • Resolution #SD-15-007 (Calling on the United Nations Framework Convention on
12 Climate Change to Adopt an Agreement that Upholds the Rights of Indigenous Peoples),
13 adopted at the 2015 Annual Session of NCAI, October 18-23, 2015,), provided as Exhibit
14 BMC-17 (ETT-2).
- 15 • Resolution #KAN-18-006 (Implementation of the Indigenous Peoples’ Traditional
16 Knowledge Platform within the United Nations Framework Convention on Climate
17 Change), adopted at the 2018 Midyear Session of NCAI, June 3-6, 2018, provided as
18 Exhibit BMC-18 (ETT-3).
- 19 • Resolution #REN-19-005 (Response to IPCC 1.5° C Report on Climate Change), adopted
20 at the 2019 Midyear Session of NCAI, June 24-27, 2019, provided as Exhibit BMC-19
21 (ETT-4).
- 22 • Resolution #MOH-17-053 (Continued Support for the Paris Climate Agreement and

1 Action to Address Climate Change), initially adopted at the 2017 Midyear Session of
2 NCAI on June 12-15, 2017 and then amended and adopted at the 2020 Annual Session of
3 NCAI, November 8-13, 2020, provided as Exhibit BMC-20 (ETT-5).

4 I have been actively involved with NCAI. As Tribal Chairman for LTBB, I was elected to
5 be the Midwest Regional alternate Vice President, a position that placed me on NCAI's
6 Executive Committee. In that capacity, I regularly attended meetings of the organization.
7 In addition, I served as an international liaison for the Board, a position that allowed me to
8 attend important meetings and conferences around the world about, among other things,
9 the rights of indigenous people and climate change. I became recognized as a leading
10 advocate and spokesperson on climate change issues.

11 **III. INTERNATIONAL CLIMATE CHANGE ADVOCACY**

12 **Q. What are some examples of the international work you have done on climate change?**

13 The 2008 Convening of Indigenous Peoples For The Healing of Mother Earth

14 A. In 2008, as an international liaison for the executive board of NCAI, I attended the
15 Convening of Indigenous Peoples for the Healing of Mother Earth, a four-day meeting in
16 the cultural territory of the Maya in Palenque, Chiapas, Mexico. Approximately 150 leaders
17 and representatives of indigenous communities from Canada, the United States and Mexico
18 attended the convening to address the need for intervention and action to heal Mother Earth
19 to ensure a healthy future for coming generations. Climate change was an important topic
20 at the meeting. The participants issued a call to action to Indigenous peoples and to all
21 peoples of the world to take immediate action. This call to action is attached as Exhibit

1 BMC-21 (ETT-6).

2 The 2009 Native Peoples – Native Homelands Climate Change Workshop II

3 In 2009, I attended the “Native Peoples – Native Homelands: Climate Change Workshop
4 II,” a four-day meeting in Minnesota of more than 400 Native leaders, scholars, scientists,
5 and elders, as well as non-Native scientists. The purpose of the conference, which was
6 funded by the National Aeronautics and Space Administration, was to discuss and propose
7 strategies for addressing the impacts of climate change on Native Peoples and Native
8 Homelands. I worked in collaboration with the attendees of the conference to draft “The
9 Mystic Lake Declaration,” in which we concluded: “In recognizing the root causes of
10 climate change, participants call upon the industrialized countries and the world to work
11 towards decreasing dependency on fossil fuels.” The Declaration further states: “We take
12 this position and make this recommendation based on our concern over the
13 disproportionate social, cultural, spiritual, environmental and climate impacts on
14 Indigenous Peoples, who are the first and the worst affected by the disruption of intact
15 habitats, and the least responsible for such impacts.” A copy of the Final Report from the
16 Workshop is attached as Exhibit BMC-22 (ETT-7). Two weeks after the meeting, the
17 Declaration was presented to the 2009 United Nations Framework Convention on Climate
18 Change (“UNFCC”), Council of the Parties 15 (“COP-15”).

19 UNFCC is an international environmental treaty to combat dangerous interference with the
20 climate system in part by stabilizing greenhouse gas concentrations in the atmosphere. The

Council of the Parties (“COP”) is the supreme decision-making body of the UNFCCC.

2015 COP-21 in Paris, France

I was an NCAI delegate to COP-21, held in Paris, France in 2015. At the Paris conference, the parties agreed to limit global warming to less than 2 degrees Celsius, relative to pre-industrial levels, and to try to limit the increase to 1.5 degrees Celsius (the “Paris Agreement”). At the Paris meeting, I worked closely with other members of the International Indigenous Peoples Forum on Climate Change, the caucus of indigenous peoples at COP-21, in urging adoption of the Paris Agreement. At COP-21, I delivered a statement at the closing plenary on behalf of the caucus. In that address, I stated on behalf of the caucus: “Indigenous Peoples are those who least contribute to climate change, having safeguarded our traditional lands, territories and resources for millennia.” A copy of the complete statement is attached Exhibit BMC-23 (ETT-8).

Since 2015, I have attended all but one of the annual UNFCCC COP meetings, as well as several intersessional meetings.

IV. CLIMATE CHANGE ADVOCACY IN MICHIGAN

Q. What work have you done in Michigan to address climate change?

A. Governor Jennifer Granholm appointed me to the Michigan Climate Action Council in 2007. The Council consisted of 35 representatives from public interest groups, environmental organizations, utilities, the manufacturing sector and other key industries, universities, and state, local, and tribal government. I was the tribal representative on the Council. The Governor charged the Council with producing a greenhouse gas emissions

1 inventory and forecast, developing a comprehensive Climate Action Plan with
2 recommended greenhouse gas (“GHG”) reduction goals and potential actions to mitigate
3 climate change in various sectors of the economy, and advising state and local governments
4 on measures to address climate change.

5 In March 2009, the Council issued its comprehensive Climate Action Plan, which is
6 submitted as Exhibit BMC-24 (ETT-9). In the Climate Action Plan, the Council proposed
7 that Michigan set a goal to achieve a 20% reduction of GHGs below 2005 levels by 2020
8 and an 80% reduction below 2005 levels by 2050. The Climate Action Plan included 54
9 specific policy recommendations to achieve this goal.

10 Governor Granholm implemented the recommendations of the Council in Executive
11 Directive No. 2009-4, which is submitted as Exhibit BMC-25 (ETT-10).

12 As a member of the Council and a tribal leader, I also helped to draft and negotiate the
13 Intergovernmental Accord between the Tribal Leaders of the Federally Recognized Indian
14 Tribes in Michigan and the Governor of the State of Michigan to Address the Crucial Issue
15 of Climate Change, which is submitted as Exhibit BMC-26 (ETT-11). In the Accord, the
16 Governor and the leaders of the Michigan-based tribes affirmed their joint commitment to
17 combat global warming through the reduction of GHG emissions.

18 **Q. What is the Inland Consent Decree and how did climate change concerns influence**
19 **the negotiation of the Decree?**

20 A. The 2007 Inland Consent Decree is a settlement negotiated between the State of Michigan,
21 five sovereign Michigan tribes that are signatories to the 1836 Treaty of Washington, and

1 the United States. The Decree defines the extent of tribal rights—including the right to
2 hunt, fish and gather—on land and inland waters ceded to the United States in 1836. It also
3 describes how the State and the tribes will cooperatively manage natural resources.

4 Concerns about climate change influenced how the tribes approached the negotiations
5 about the terms of the 2007 Inland Consent Decree. It was important to the tribes that the
6 Consent Decree not be too “species-specific” because we knew that climate was changing
7 and, as a result, we knew that some of the fish, animals and plants that we were currently
8 harvesting might not be available to us in the future due to the effects of the changing
9 climate. We wanted the Consent Decree to reflect the understanding that the tribes could
10 use the natural world as we found it, not as it was some time in the past. A copy of the
11 Inland Consent Decree is submitted as Exhibit BMC-27 (ETT-12). A Frequently Asked
12 Questions Document about the Decree is attached as Exhibit BMC-28 (ETT-13).

13 **V. CLIMATE CHANGE AND ITS IMPACT ON TRIBES, FIRST NATIONS, AND**
14 **INDIGENOUS PEOPLE**

15 **Q. Based on your extensive experience working on climate change policy, please explain**
16 **why Tribes are deeply concerned about climate change?**

17 A. We live in the natural world and we are part of the natural world. As the natural world has
18 changed and will continue to change as a result of our changing climate, it will affect how
19 we live our lives and how we gather our medicines and our foods. Our way of life – from
20 a cultural, spiritual and subsistence perspective – is closely tied to the Earth. As a result,
21 we are often the first to notice the alarming changes that are happening in our natural

1 environment.

2 Climate change has a direct impact on the foods we eat and whether we will be able to
3 continue to consume our traditional foods. It has a direct impact on how we work. Native
4 people around the world who work outside have to change their schedules and their work
5 because of the rising temperature.

6 We have an agreement as native people. According to our beliefs, we (humans) were the
7 last to be created. We joined a natural world that had already been created. We cannot exist
8 without the rest of the world, but the rest of the world can exist without us. We are
9 dependent on the other beings who were here before us. The other beings in the natural
10 world have gifts that they share with us freely, but our responsibility is to take care of them.

11 In other words, we have a reciprocal relationship, with the natural world. We have a
12 responsibility to take care of the natural world, as it takes care of us. For example, when
13 fish reproduce, they produce much more than they need to survive. They produce more to
14 feed many others including eagles, osprey, and people. We have a responsibility to honor
15 this relationship by taking only what we need and to protect the well-being of the fish and
16 their environment.

17 Native people view this as a sacred reciprocal agreement with the natural world. It is
18 important for us to continue our actions to fulfill our responsibilities as we honor that
19 agreement.

20 Because our reciprocal relationship with the natural world is so intrinsic to our beliefs, our
21 way of life and who we are as a people, climate change is of paramount concern to native

1 people.

2 **Q. What is the Intergovernmental Panel on Climate Change and what is its Sixth**
3 **Assessment Report?**

4 The Intergovernmental Panel on Climate Change (“IPCC”) is the United Nations body for
5 assessing the science related to climate change. IPCC periodically prepares assessment
6 reports and is currently working on its Sixth Assessment Report. In August 2021, IPCC’s
7 Working Group I, which addresses the physical science basis of climate change, released
8 its contribution to the Sixth Assessment Report.

9 **Q. What did the IPCC’s Working Group I conclude about the current physical**
10 **understanding of the climate system and climate change?**

11 A. IPCC’s Working Group I concluded that it is unequivocal that human influence has
12 warmed the atmosphere, ocean and land and that recent changes across the climate system
13 are unprecedented over many centuries to many thousands of years. It further concluded
14 that human-induced climate change is already affecting weather and climate extremes in
15 every region across the globe. And global surface temperatures are projected to continue
16 to increase until at least the mid-century under all emissions scenarios considered.

17 According to IPCC’s Working Group I, many changes due to past and future greenhouse
18 gas emissions are irreversible for centuries to millennia.

19 The Headline Statements from the Summary for Policymakers of IPCC’s Working Group

1 is submitted as Exhibit BMC-29 (ETT-14).

2 **Q. How does the recent IPCC report influence how you think about the concerns native**
3 **indigenous people have about climate change?**

4 A. The recent report underscores why native people are so alarmed about climate change. This
5 report is yet another example of how Western science is recording what native people have
6 observed for decades—that our climate is changing, to the detriment of our planet and all
7 its inhabitants. We are seeing the concerns that native people have had for decades
8 confirmed in increasingly alarming scientific reports.

9 **VI. LTBB's EFFORTS TO COMBAT CLIMATE CHANGE**

10 **Q. Under your leadership, what measures did LTBB take to minimize the effects of**
11 **climate change?**

12 A. The tribal council was, and is, very concerned about climate change. On April 17, 2005,
13 LTBB passed a resolution to hold ourselves to the goals in the Kyoto Protocol. A copy of
14 the resolution is attached as Exhibit BMC-30 (ETT-15). The Kyoto Protocol is an
15 international agreement in which 192 nation states committed to limit and reduce GHG
16 emissions in accordance with agreed individual targets. Although the United States did not
17 sign or ratify the Kyoto Protocol, we felt it was important for LTBB to commit to the
18 Protocol's goals.

19 Consistent with this resolution, LTBB's Environmental Services Department conducted a
20 survey of, and sent information to, our tribal households about the measurement of a
21 household's carbon footprint and what steps can be taken to reduce it.

1 In recent years, LTBB has begun an initiative to create biodiesel from the used cooking oil
2 from our casino and our tribal center kitchens. We have also put in some wind and solar
3 operations.

4 Over the past decade, we have also made some changes in our operations, particularly in
5 our casino, that have achieved energy efficiencies. These have included the use of more
6 efficient motors and LED lightbulbs. We have estimated that, over a ten-year period, we
7 have saved over 85 metric tons of carbon due to these efficiencies.

8 LTBB believes that it is important that tribes do everything they can to reduce their carbon
9 footprint and lessen the production of GHG emissions.

10 **Q. Q. Does that complete your testimony?**

11 **A.** Yes.

EXHIBIT BMC-16

Resume: Frank Ettawageshik, September 2021
5453 Hughston Rd., Harbor Springs, MI 49740
Telephone: 231-242-0957 Cell: 517-802-8650 Email: fettawa@charter.net

Frank Ettawageshik lives in Harbor Springs, Michigan, with his wife, Rochelle. They have four adult children and eight grandchildren. An Odawa (Ottawa) Indian from northern Lower Michigan, he grew up in Harbor Springs, on Little Traverse Bay, in the Odawa homeland of Waganakising (the Crooked Tree). He opened Pipigwa Pottery & Gallery in 1974 in Traverse City, Michigan.

In 1989 Frank was elected to the board of the Little Traverse Bay Bands of Odawa Indians (LTBB) serving as Vice-chairman until April of 1991 at which time he became Tribal Chairman. In 1994, the LTBB successfully ended a 120-year legal dispute with the US Government with the passage of Public Law 103-324 which reaffirmed the political relationship between the LTBB and the United States. While Tribal Chairman, Frank was the CEO of the tribal administration and he represented the LTBB in its dealings with the governments of other Tribes, the State of Michigan and the United States. He served as the Tribal Chairman until July of 1999.

In 2002, Frank became a founding partner in Michigan Tribal Advocates (MTA), established to advocate for tribal governments to the State of Michigan. Frank also served as the Chairman of the tribe's Economic Development Commission 2002-2003. He sold his share in MTA upon his reelection as Tribal Chairman in 2003. In August 2005 he was elected to a four-year term as the first Tribal Chairman serving as the head of the Executive Branch of the Tribal Government under a new Tribal constitution adopted on February 1, 2005. In September of 2009, following this four-year term of office, Frank became the Executive Director for the United Tribes of Michigan, a position in which he currently serves.

February 2018, after being nominated by the LTBB Tribal Chair and confirmed by the Tribal Council, Frank was sworn in as a member of the LTBB Appellate Court.

As an artist, Frank has worked to revive the making of the traditional Indian pottery of the Great Lakes area. After years of research and experimentation his pots are virtually indistinguishable from the pots once made in Michigan. Not only was his goal to make the pots that his ancestors had made, but also to revive traditional pottery making as a contemporary art form in the Indian communities of Michigan. His pottery is in public and private collections throughout the world. In addition to making pottery, Frank is a traditional storyteller. His father, Fred, was a well-known storyteller throughout Michigan. Many of the stories told by Frank are ones that have been passed down from his father.

Each year since 1974 Frank has given numerous demonstrations, lectures, workshops and in-service training programs on stoneware pottery, Indian pottery, Indian culture and storytelling. He has also worked as a consultant for several universities, museums and private organizations. Frank was a 2010 Fellow at the Native Nations Institute Indigenous Leaders Fellowship Program at the University of Arizona.

Current Positions

- Executive Director, United Tribes of Michigan
- Appellate Court Justice, Little Traverse Bay Bands of Odawa Indians, Petoskey, MI
- Owner, Pipigwa Pottery, Harbor Springs, MI

Non-Profit Boards

- Member, Great Lakes Advisory Board, US Environmental Protection Agency, Washington, DC
- Member, Great Lakes Water Quality Board, International Joint Commission, Washington DC / Ottawa, CA
- Board Member, Archangel Ancient Tree Archive, Copemish, MI
- Board Member, Michigan Indian Education Council, Lansing, MI
- Board President, Association on American Indian Affairs, Washington, DC
- University-Community Senior Fellow, Office of Outreach and Engagement, Michigan State University, E. Lansing, MI
- Member Erb Foundation External Advisory Board, University of MI Graham Sustainability Institute, Ann Arbor MI
- Board of Directors Secretary, Native Governance Center, St. Paul, MN
- Member Stewardship Committee, Little Traverse Conservancy, Petoskey, MI
- Research Associate, Michigan State University Museum, East Lansing, MI
- Board of Advisors, National Trust for Historic Preservation, Wash., DC
- Board of Regents (emeritus), Great Lakes Leadership Academy, E. Lansing, MI

Education

2004 February 18-20 National Native American Tribal Finance Conference, Palm Springs, CA

2000 August 7 & 8, Journey to Healing Conference on Indian Health, Mt. Pleasant, MI

1999 February 10, Training workshop by the National Indian Gaming Commission on the new Minimum Internal Control Standards (MICS) for Indian Gaming, Prairie Island, MN

1998 August 5 & 6, White House Conference on Building Economic Self-Determination in Indian Communities

1997 Tribal Program Directors Training, certificate program through Bay Mills Community College

1989-1992 Studied the Odawa Indian language at Northwestern Michigan College in Traverse City, MI.

1991 February, Received genealogy training at the regional office of the Bureau of Indian Affairs in Sault Ste. Marie, MI

1985 October Studied with Acoma Indian potter Lucy Lewis and her family at a workshop at Pewabic Pottery in Detroit, MI.

1972 Pottery apprentice at Depot Pottery in Ann Arbor, MI.

1967-1970 Attended University of Michigan, Ann Arbor (English major)

1967 Graduated from Marion High School in Marion, MI.

Publications

2020 “Stakeholder to Rights-Holder”, co-author with Emma Norman of chapter in the book “ First Century of the International Joint Commission”, edited by Daniel MacFarlane and Murry Clamen, University of Calgary Press

2015 forward for *Ottawa Stories from the Springs*, translated and edited by Howard Webkamigad, Michigan State University Press, East Lansing, MI

2013 contributing author for the article, *Climate Change Impacts on Water Resources of American Indians and Alaska Natives in the U.S.*, published in the journal [Climate Change](#), October 2013, Volume 120, [Issue 3](#), pp 569-584, Springer.com

2012 forward for *The Place Where the Crooked Tree Stood*, by Jane Cardinal and Connie Cobb, Crooked Tree Book Company, Good Hart, MI

2009 Summer, Proceedings of the Panel titled *The Boundary Waters Treaty and Protecting Freshwater Resources in North America*, 1909 Boundary Waters Centennial Symposium, The Wayne Law Review, Wayne State University, Detroit, MI

2009 June 1st, forward to *The Art of Tradition*, by Kurath, Ettawageshik and Ettawageshik, Michigan State University Press, East Lansing, MI

2009 forward to the new edition of *Gah Baeh Jhagwah Buk, (The Way It Happened)*, MI State University Museum, East Lansing, MI

2009 jacket note for the book *Old Wing Mission*, edited by Robert P. Swierenga and William Van Appledorn, Wm. B. Eerdmans Publishing Co., Grand Rapids, MI

2006 Article titled *Walking for the Great Lakes: The Grandmother Water Walkers*, in the State of the Great Lakes Annual Report 2004, published by the Office of the Great Lakes, MI Department of Environmental Quality, Lansing, MI

1999 Introductory essay titled “My Father’s Business” in the volume Unpacking Culture: Art and Commodity in Colonial and Postcolonial Worlds, edited by Ruth B. Phillips and

Christopher B. Steiner, University of California Press.

1996 Introduction to Anishnaabek: Artists of Little Traverse Bay,. Marsha MacDowell, ed. East Lansing, Michigan: Michigan State University Museum in collaboration with the Little Traverse Bay Bands of Odawa Indians

1992 Essay on Ghost Suppers in the program for the Michigan Folk Festival, MI State University.

Work Experience

2018 to present, Appointed to a six-year term to the Little Traverse Bay Bands of Odawa Indians Appellate Court.

2009 September to present, Executive Director for the United Tribes of Michigan

1974 to present, owner of Pipigwa Pottery (sales, demonstrations, lectures, and consulting)

1991-1999 and 2003-2009 Tribal Chairman, Little Traverse Bay Bands of Odawa Indians, Petoskey, MI

2002-2003, co-founder of Michigan Tribal Advocates (lobbying on behalf of Tribal Interests), Lansing, MI.

1999-2002 contractual ethnohistorical research for James McClurken & Associates, Lansing, MI

1991 & 1992 April through August Consultant and presenter for the Indian Artists Workshop at Northwestern Michigan College in Traverse City, MI., sponsored by the Great Lakes Indian Artists Association.

1990-1994 Paid consultant for the Public Museum of Grand Rapids for the "Anishinaabek - People of this Place", a major permanent exhibit in the new museum building

1987 & 1988 (summer terms) Part-time instructor, independent study in Indian pottery at Northwestern Michigan College in Traverse City, MI.

1973-1976 Pottery instructor at Pathfinder School, Traverse City, MI

1973 Pottery instructor at Keweenaw Bay Indian Tribal Center, in Baraga, Michigan.

1972 Bus driver for Ann Arbor Transportation Authority, Ann Arbor, MI.

1969-1971 Delivered pizzas for Thompson's Pizzeria, Ann Arbor, MI.

1967-1969 Worked summers at Michigan Gas Storage Co. in Marion, MI.

1966-1969 Self-employed disc jockey for local teen dances, Marion, MI.

1965-1967 Tweedee Tree Farm, seasonal work, Marion, MI

Public Service

2021 Appointed to the Environmental Protection Agency's Great Lakes Advisory Board, Great Lakes Office, Chicago, IL

2019 Appointed to the State of Michigan Water Use Advisory Council, Department of Environment, Great Lakes, and Energy, Lansing, MI

2017 Appointed by MI Governor Snyder for a one-year term to the Michigan Environmental Justice Workgroup

2016 Appointed to the Great Lakes Water Quality Board, International Joint Commission, Ottawa, CA/Washington DC

2015 Appointed to the LTBB Zoning Board of Appeals

2013 - 2018, Water Use Advisory Council, MI Dept. of Environmental Quality

2009 – 2010, appointed by Governor Granholm to the Michigan Great Lakes Offshore Wind Council

2009 – 2012, Public Interest Advisory Group, International Upper Great Lakes Study, International Joint Commission, Washington DC/Ottawa, CA

2009 – present, Board Member, Association on American Indian Affairs, currently serving as President of the Board, Washington, D.C.

2009 – 2014, Board Member, Historical Society of Michigan, East Lansing, MI

2007 – 2011, Board of Regents, Great Lakes Leadership Academy, Lansing, MI

2006 – 2013, appointed by Governor Granholm to the Michigan Travel Commission, reappointed to a second term May 2010

2002-present, Board of Advisors (emeritus since 2010) for the National Trust for Historic Preservation, Washington, DC

1996 – present, a founding member of the Board of Directors of the Michigan Indian Education Council

2008- 2010, appointed by Governor Granholm to the Michigan Groundwater Conservation Advisory Council

2008-09 appointed by Governor Granholm to the Michigan Climate Action Council

2003- 2009 Tribal Chairman for Little Traverse Bay Bands of Odawa Indians, Harbor Springs, MI

2000 – 2009, 2010- 2019, Board of Directors of the Little Traverse Conservancy, Petoskey, MI

2001-2004 Appointed by Governor John Engler to the Michigan Quarter Commission

2001- 2003 Chairperson of the Michigan Humanities Council

2000 – 2006, Board of Directors of the Tip of the Mitt Watershed Council, Petoskey, MI

2000- 2003, Little Traverse Bay Bands of Odawa Indians Economic Development Commission, elected as chairman in 2002, Harbor Springs, MI

1991-1999 Tribal Chairman for the Little Traverse Bay Bands of Odawa Indians (two terms)

1999- 2000 Little Traverse Bay Bands of Odawa Indians Odawa Property Managers

1998 Reappointed to the Michigan Humanities Council for a four-year term.

1978-1997 Grant Township Board of Review member, serving as chairman 1984-1997.

1989-1996 Loon Ranger for the Michigan Loon Watch program.

1991-1992 Scoutmaster of Boy Scout Troop 20, Interlochen, MI.

1989-1991 Assistant Scoutmaster of Boy Scout Troop 20, Interlochen, MI.

1991-1994 Member of the Community Advisory Board for the Dennon Museum Center at Northwestern Michigan College in Traverse City, MI

1990-1994 served a four-year term on the Michigan Humanities Council.

1981-1990 Member of the Board of Northwestern Michigan Artists and Craftsmen, in Traverse City, MI. Serving as President of the Board in '84, '85 and '90.

1980-1989 Member of Grant Township Zoning Board, serving as chairman from 1986 through 1989.

1989 July Elected to the board of Little Traverse Bay Bands of Odawa Indians, serving as Vice-chairman.

1986-1989 Member of the Community Advisory Council for the Interlochen Elementary School, Interlochen, MI.

1989 March Appointed to the board of The Little Traverse Bay Bands of Odawa Indians, Cross Village, MI.

1986-1987 Member of the Grand Traverse County Agency for The Michigan Sesquicentennial Celebration.

1985-1987 Board member Interlochen Area Chamber of Commerce, Interlochen, MI.

1985, 1986 chairman of the Traverse Bay Outdoor Art Fair in Traverse City, MI.

1982, 1983, 1984 Co-chairman of the Karlin Fall Festival, raising money for the Green Lake Township Volunteer Fire Department.

1978-1980 Grant Township Zoning Administrator.

1975-1976 Member of the Board of Directors of Third Level Crisis Intervention Center, serving as fundraising chairman.

Awards

2021 The Helen and William Milliken Distinguished Service Award for environmental work, Michigan Environmental Council, Ann Arbor, MI

2020 Michigan State University College of Agriculture and Natural Resources, Distinguished Service Award, East Lansing, MI

2019 William Milliken Leadership for the Common Good Award, MI State University Great Lakes Leadership Academy, East Lansing, MI

2018 Outstanding Service Award, Michigan Indian Education Council, Okemos, MI

2016 Taimi Lynne Hoag Award for Environmental Stewardship, US EPA Region 5 Tribal Operations Committee, Chicago, IL

2014 National Friend of Extension Award, Epsilon Sigma Phi (Extension Professionals' Organization), Indianapolis, IN

2013 State Friend of Extension Award, Michigan State University Extension Service, East Lansing, MI

2013 University-Community Senior Fellow, Office of Outreach and Engagement, Michigan State University, East Lansing, MI

2010 Fellow, Native Nations Institute's Indigenous Leadership Fellows Program, University of Arizona, Tucson, Arizona

2009 September 15, Glenn Miller Tribal Leader Award, Native American Fish and Wildlife Society, Midwest Region, awarded for outstanding leadership on environmental issues and the protection of Indian hunting and fishing rights through the successful negotiation of the Inland Consent Decree for the US vs. MI Treaty Rights Case.

2009 November 24, Ingham County Board of Commissioners, Mason, MI, resolution honoring me for many years of tribal, state and local public service and leadership in environmental and social issues.

2007 Great Lakes Guardian Award from Clean Water Action for work in protecting and preserving the Great Lakes

2001 Master/Apprenticeship Grant awarded by the Michigan State University Traditional Arts Program for me to teach Indian pottery to my son, Joseph Ettawageshik

2000 University of Michigan, Martin Luther King, Jr.-Cesar Chavez-Rosa Parks Visiting Professorship

1999 May 21 Michigan Commission on Indian Affairs Special Tribute for accomplishments in Indian art and public service

1998 May Midwest Alliance of Sovereign Tribes (MAST) "Door Knocker" Award for effective lobbying during MAST Impact week in Washington, DC

1993 Santa Fe Indian Market, 3rd Place in unpainted traditional pottery

1993 Master/Apprenticeship Grant awarded by the Michigan State University Traditional Arts Program for me to teach Indian pottery to Sandy Dyer

1992 Wayne County, MI, Artistic Excellence and Community Commitment Award for my work in Indian art

1992 Dayton Indian Market, Dayton, OH First, Second and Third Place, and Best of Classification in traditional pottery.

1991 Dayton Indian Market, Dayton , OH Second Place and Third Place in traditional pottery.

1990 Dayton Indian Market, Dayton, OH. Second Place in traditional pottery.

1990 Beulah Art Fair, Beulah, MI. First Place in pottery (stoneware and Indian pottery).

1990 Sault Ste. Marie Art Fair, Sault Ste. Marie, MI. Best of Craft (Indian pottery).

1989 Interlochen Chamber of Commerce, Member of the Year award.

1987 Sault Ste. Marie Art Fair, Sault Ste. Marie, MI. Fine Art Award (Indian pottery).

1985 Sault Ste. Marie Art Fair, Sault Ste. Marie, MI. Pottery award (Indian pottery).

1983 Northwestern Michigan Artists and Craftsmen Juried Show, First Place (stoneware pottery).

1982 Sault Ste. Marie Art Fair, Sault Ste. Marie, MI. Crafts award (stoneware pottery).

Governmental Experience

United Tribes of Michigan

While LTBB Tribal Chairman in 2007 to 2009 I served as the United Tribes Treasurer. After leaving office as the Tribal Chairman, I was hired as the United Tribes Executive Director in September of 2009. In this position I organize quarterly meetings, conference-call meetings as necessary, coordinate email communications with Tribal leaders on issues of interest to Michigan Tribes, and organize an annual Legislative Reception at the state capitol. I also represent the United Tribes at inter-tribal, local, state, national, and international meetings.

2021 May 30 – June 17 UNFCCC Intersessional virtual meeting.

2020 -2021 During COVID 19 pandemic. Attended several virtual meetings for UNFCCC and WIPO.

2019 November 26 – December 14, NCAI Delegate to the United Nations Framework Convention on Climate Change, Council of the Parties 25, Madrid, Spain.

2018 December 8 – December 15, NCAI Delegate to the World Intellectual Property Organization, Intergovernmental Council 38, Geneva, Switzerland.

2018 November 29 – December 7, NCAI Delegate to the United Nations Framework Convention on Climate Change, Council of the Parties 24, Katowice, Poland.

2018 August 24 – 31, NCAI Delegate to the World Intellectual Property Organization, Intergovernmental Council 37, Geneva, Switzerland.

2018 April 29 – May 12, NCAI Delegate to the United Nations Framework Convention on Climate Change, Intersessional Meeting, Bonn, Germany.

2018 February and March – participated in a conference call and in a Listening Session with NCAI, NARF, USDOJ, USDOL, USDOS, USPTO regarding the World Intellectual Property Organization's work on an international instrument regarding genetic resources. This is to prepare for presentations at the WIPO's annual meeting in Geneva, Switzerland in May.

2017 November 6 to 18 – NCAI Delegate to the United Nations Framework Convention on Climate Change, Council of the Parties 23, Bonn, Germany. Presented on climate change effects on traditional culture at the Indigenous Peoples Pavilion.

2016 September through 2017 April -- Attended several meetings and hearings on implementation of provisions of the United Nations Declaration on the Rights of Indigenous Peoples in Bangkok, Thailand and at the United Nations in New York City.

2015 November 29 - December 12 -- Delegate to United Nations Framework Convention on Climate Change, Council of the Parties 21, Paris, France. I attended as a delegate for the National Congress of American Indians. I presented the International Indigenous Caucus statement at the closing plenary session.

2014 September 20 to 24 – delegate to the United Nations High Level Plenary Session known as the World Conference on Indigenous Peoples, United Nations Headquarters, New York City, New York

2013 June 7 to 15 – delegate for the National Congress of American Indians to The World Preparatory Conference for the September 2014 United Nations Plenary Session to be Known as The World Conference on Indigenous Peoples, Alta, Norway

2011 June 9 - Provided testimony on the Federal Acknowledgement Process and Climate Change before an oversight hearing of the US Senate Committee on Indian Affairs titled: *Setting the Standards: The Domestic Policy Implications of the United Nations Declaration on The Rights of Indigenous Peoples*

2009 November 4 – Provided testimony on behalf of the National Congress of American Indians before the US Senate Committee on Indian Affairs at an oversight hearing regarding the Federal Acknowledgement Process

Little Traverse Bay Bands of Odawa Indians (LTBB) (1989 to 2024)

- Appellate Court Justice, 2018 - 2024
- Tribal Council Member, Vice Chairman 1989-1991
- Tribal Chairman 1991-1999
- Odawa Property Managers 1999-2000
- Economic Development Commission 2000-2003
- Tribal Chairman 2003- 2009
 - Middle Village Park Management Committee, 2005-09
 - National Congress of American Indians, Executive Board, Alternate Midwest Area Vice President, 2007-2009
 - Midwest Alliance of Sovereign Tribes, Treasurer 2005-08, VP 2008-09
 - United Tribes of Michigan, Treasurer 2007-09
 - Intertribal Council of Michigan, Chairman 2008-09
- National Congress of American Indians, Co-chair of the Federal Acknowledgement Task Force, 2005-present
- Waganakising Odawa Development, Inc, President of the Board, 2008-2014
- Nimkee Technologies, LLC, Chairman of the Board, 2008-2011
- Zoning Board of Appeals member, 2016 to January 2018

Provided leadership in the passage of reaffirmation legislation by the US Congress for the LTBB. Worked with LTBB Tribal Council Members to develop and implement tribal governmental structures, programs and funding (by both federal legislative appropriation and grants). Worked to help envision, write and adopt tribal legislation. Supervised the growth of the tribal budget from a few thousand dollars to several million dollars over a 14 year period. Served as the LTBB's representative on the MI Intertribal Council, the United Tribes of Michigan, the Midwest Alliance of Sovereign Tribes, and the National Congress of American Indians. Worked on regional and national Tribal environmental and economic development issues

2009 Jan - June, proposed and helped successfully negotiate the Intergovernmental Accord Between the Tribal Leaders of Federally Recognized Indian Tribes in Michigan and the Governor of the State of Michigan Concerning Climate Change, signed on June 10, 2009

2008, helped to successfully negotiate a court supervised settlement of the Club Keno law suit State of Michigan vs. LTBB and LRB.

2008 March, attended the Convening of Indigenous People for the Healing of Mother Earth, Palenque, Chiapas, Mexico, at which representatives of the indigenous peoples of Canada, United States, and Mexico drafted and negotiated *The Message of the Living Spirit from the Convening of Indigenous Peoples for the Healing of Mother Earth at the*

Traditional Territory of the Maya.

2007 September, helped to successfully negotiate a permanent consent decree for a court supervised settlement of the inland rights portion of US vs. MI Hunting and Fishing Rights case.

2007 August 1, Participated in the final negotiation and signing ceremony for the United League of Indigenous Nations Treaty at the Lummi Nation, Bellingham, WA.

2007 March 7, Testified on a panel on behalf of the Chippewa Ottawa Resource Authority before the US House of Representatives Committee on Transportation and Infrastructure, Subcommittee on Water Resources and the Environment, regarding Aquatic Invasive Species and the threat to the Great Lakes.

2006 March 16, Testified on a panel with Ohio Governor Taft before the US Senate Committee on Environment and Public Works regarding the Great Lakes Regional Collaboration plan for Restoration and Preservation of the Great Lakes.

2005 August, elected as the first Tribal Chairman to serve under the new Tribal Constitution adopted on February 1, 2005

2005 Jan -- May, proposed and helped successfully negotiate the Intergovernmental Accord Between the Tribal Leaders of Federally Recognized Indian Tribes in Michigan and the Governor of the State of Michigan Concerning Economic Development Interests, signed by all parties on May 13.

2005 April 14 and 15, Panelist at the 30th Annual Federal Bar Association Indian Law Conference in Albuquerque, NM, on Tribal Water Rights.

2004-2009 December, chosen as the Tribal Presider to represent the Great Lakes Tribes at the Conveners Meeting of the Great Lakes Regional Collaboration regarding water quality issues, serving with representatives of the Great Lakes Governors, Mayors, Congressional Caucus, and the Environmental Protection Agency. Continued as the Tribal Representative on the Executive Board until August of 2009.

2004 November, proposed, drafted and successfully negotiated for signing the Tribal and First Nations Great Lakes Water Accord amongst representatives of over 120 Indian Tribes and Canadian First Nations within the Great Lakes Basin, signed in Sault Sainte Marie, MI on November 23.

2004 Jan – May, proposed, drafted and successfully negotiated for signing the Intergovernmental Accord Between the Federally Recognized Indian Tribes in Michigan and Governor of the State of Michigan Concerning Protection of Shared Water Resources, signed by all parties on May 12.

2003 July, reelected Tribal Chairman for LTBB.

2002 January, elected Chairman of the LTBB Economic Development Commission.

2000 July Appointed and sworn in as the first member of LTBB Economic Development Commission.

1999 July Successful negotiation of agreement with MI Governor John Engler regarding the opening of the LTBB Victories Casino in Petoskey, MI.

1999 June Appointed and sworn in as a member of LTBB Odawa Property Managers.

1998 December, Conclusion of successful lobbying effort to gain passage of a concurrent resolution of the MI legislature supporting Tribal/State Gaming Compacts signed by four MI tribes.

1997 Oral and written testimony before a MI Senate Committee regarding a concurrent resolution to support Tribal/State Gaming Compacts signed by four MI tribes as required by the federal Indian Gaming Regulatory Act.

1995 March 9 Oral and written testimony before a Michigan House committee regarding continued funding for the Michigan Indian Tuition Waiver program.

1995 January through September, Participated in the successful negotiation of Tribal/State Gaming Compacts between Michigan Governor John Engler and 4 Michigan Indian tribes.

1994 September 21 Presidential signing ceremony in the White House Oval Office for Public Law 103-324 which reaffirmed the government-to-government relationship between the Little Traverse Bay Bands of Odawa Indians and the United States.

1994 February 10 Oral and written testimony before the US Senate Committee on Indian Affairs regarding a bill to reaffirm the government-to-government relationship between the United States and Little Traverse Bay Bands of Odawa Indians

1993 Sept 17 Written and oral testimony before the US House of Representatives Subcommittee on Indian Affairs regarding a bill to reaffirm the government-to-government relationship between the US and LTBB.

1992 July 8 Written testimony before the US House of Representatives Subcommittee on Indian Affairs regarding a bill to reaffirm the government-to-government relationship between the US and LTBB.

United States

2021- present: appointed to the EPA Great Lakes Advisory Board, Great Lakes

Office, Chicago, IL

2016 – present: appointed to a three-year term on the Great Lakes Water Quality Board, International Joint Commission, Ottawa, CA/Washington DC (reappointed in 2019)

2009- 2012: member of the Public Interest Advisory Group, International Upper Great Lakes Study, International Joint Commission, Washington DC/Ottawa, CA

State of Michigan

2019- present Water Use Advisory Council, Michigan Department of Environment, Great Lakes, and Energy, Lansing, MI

2013 – 2018 Water Use Advisory Council, Michigan Department of Environmental Quality, Lansing, MI

2017 – 2018 Environmental Justice Workgroup, Appointed by MI Governor Rick Snyder

2006-2013 Michigan Travel Commission: Appointed by Governor Jennifer Granholm for a three year term, reappointed in 2010.

2008-2009 Michigan Climate Action Council: Appointed by Governor Jennifer Granholm for a one-year term which ended with the submission of a final report in February 2009.

2008-2009 Michigan Groundwater Conservation Advisory Council: Appointed by Governor Jennifer Granholm. This council was created by the implementing legislation that was enacted at the same time as the Michigan Legislature's approval of the Great Lakes Interstate Compact which controls bulk groundwater withdrawals and diversions of water from the Great Lakes.

2009-2010 Michigan Great Lakes Offshore Wind Council: Appointed by Governor Jennifer Granholm. This council's charge was to assess the criteria for the placement of wind turbines in offshore locations in the Michigan waters of the Great Lakes and to develop criteria for the determining optimum locations and locations that should be prohibited for placement. Reappointed for a second year in the fall of 2009.

2001-2002 Quarter Commission: Appointed by Governor John Engler to the Michigan Quarter Commission. This twenty-five member body reviewed and selected designs for the twenty-five cent piece representing the State of Michigan in the statehood series by the US mint.

Grant Township, Grand Traverse County, MI

Zoning Administrator 1978-1980
Zoning Board Member 1980-1989 (Chair 86-89)
Board of Review Member 1978-1997 (Chair 84-97)

Served as the Grant Township representative to the Traverse Bay Regional Planning Commission during the transition by Grand Traverse County to a County Planning Commission.

Chaired the Grant Township Zoning Board during a complete revision and adoption of the township zoning and sign ordinances

EXHIBIT BMC-17



NATIONAL CONGRESS OF AMERICAN INDIANS

The National Congress of American Indians Resolution #SD-15-007

TITLE: Calling on the United Nations Framework Convention on Climate Change to Adopt an Agreement that Upholds the Rights of Indigenous Peoples

EXECUTIVE COMMITTEE

PRESIDENT
Brian Cladoosby
Swinomish Tribe

FIRST VICE-PRESIDENT
Randy Noka
Narragansett Tribe

RECORDING SECRETARY
Aaron Payment
Sault Ste. Marie Tribe of Chippewa Indians of Michigan

TREASURER
W. Ron Allen
Jamestown S'Klallam Tribe

REGIONAL VICE-PRESIDENTS

ALASKA
Jerry Isaac
Native Village of Tanacross

EASTERN OKLAHOMA
Joe Byrd
Cherokee Nation

GREAT PLAINS
Leander McDonald
Spirit Lake Nation

MIDWEST
Roger Rader
Pokagon Band of Potawatomi

NORTHEAST
Lance Gumbs
Shinnecock Indian Nation

NORTHWEST
Fawn Sharp
Quinalt Indian Nation

PACIFIC
Jack Potter, Jr.
Redding Rancheria

ROCKY MOUNTAIN
Darrin Old Coyote
Crow Nation

SOUTHEAST
Larry Townsend
Lumbee Tribe

SOUTHERN PLAINS
Liana Onnen
Prairie Band of Potawatomi Nation

SOUTHWEST
Joe Garcia
Ohkay Owingeh Pueblo

WESTERN
Bruce Ignacio
Ute Indian Tribe

EXECUTIVE DIRECTOR
Jacqueline Pata
Tlingit

NCAI HEADQUARTERS
1516 P Street, N.W.
Washington, DC 20005
202.466.7767
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WHEREAS, we, the members of the National Congress of American Indians of the United States, invoking the divine blessing of the Creator upon our efforts and purposes, in order to preserve for ourselves and our descendants the inherent sovereign rights of our Indian nations, rights secured under Indian treaties and agreements with the United States, and all other rights and benefits to which we are entitled under the laws and Constitution of the United States, to enlighten the public toward a better understanding of the Indian people, to preserve Indian cultural values, and otherwise promote the health, safety and welfare of the Indian people, do hereby establish and submit the following resolution; and

WHEREAS, the National Congress of American Indians (NCAI) was established in 1944 and is the oldest and largest national organization of American Indian and Alaska Native tribal governments; and

WHEREAS, climate change is one of the greatest threat facing the peoples of the world today; and

WHEREAS, the United Nations Special Rapporteur on the Right to Food stated in 2010 that Climate Change is the single biggest threat to global food security in the future; and

WHEREAS, the Intergovernmental Panel on Climate Change (IPCC), composed of thousands of scientists from around the world, has found that Indigenous Peoples are among the peoples most vulnerable to climate change and are disproportionately affected by it; and

WHEREAS, Indigenous Peoples depend upon the health of their ecosystems and natural resources for social, economic, and cultural vitality; and climate change threatens to destroy indigenous ways of life that have been sustainable for thousands of years; and

WHEREAS, climate change thus poses a serious threats to the inherent and Treaty rights of Indigenous Peoples as affirmed in the United Nations Declaration on the Rights of Indigenous Peoples, including, *inter alia*, rights to subsistence, traditional lands and resources, health, productive capacity of the environment, cultural heritage, sacred sites and free prior and informed consent; and

WHEREAS, the Parties to the United Nations Framework Convention on Climate Change (UNFCCC) will meet in Paris at the end of 2015 to reach a universally binding agreement to address climate change; and

WHEREAS, the goal of the UNFCCC as stated in its Article 2 is: “to achieve . . . stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. . . .;” and

WHEREAS, that goal as presently contemplated by States is to keep temperature rise within 2 degrees C, however, Indigenous Peoples and many scientists consider this goal to be inadequate to protect the ways of life of Indigenous Peoples as well as the survival of small island states and Peoples; and

WHEREAS, in connection with an ongoing review of the adequacy of the 2 degree C goal, the Structured Expert Dialog, (SED) report concludes that at 2 degrees C of warming, “...indigenous people[s] would be at risk of loss of land and cultural and natural heritage, and cultural practices embedded in livelihoods would be disrupted”; therefore Indigenous Peoples are calling for that goal to be lowered to no more than 1.5 degrees C of warming at COP 21.

NOW THEREFORE BE IT RESOLVED, that the National Congress of American Indians (NCAI) calls on the Parties to the UNFCCC at the 21st Conference of the Parties (COP 21) in Paris to adopt an agreement with a strong human rights based approach reflected in the operative provisions of the agreement and which covers all aspects of the agreement such as mitigation, adaptation, finance, technology transfer, transparency and capacity building, and specifically recognizes the rights of Indigenous Peoples; and

BE IT FURTHER RESOLVED, that NCAI calls on the State Parties to adopt a goal of a temperature rise of no more than 1.5 degrees C of warming, with a review to ascertain if that should be further lowered to no more than 1 degree C of warming; and

BE IT FURTHER RESOLVED, that NCAI calls upon the States Parties to recognize in the final agreement respect for and use, with free, prior, and informed consent and full participation, of Indigenous Peoples’ traditional ecological knowledge; and

BE IT FURTHER RESOLVED, that any Conference Of the Parties (COP) decision at Paris should acknowledge the obligation to guarantee full and effective participation of Indigenous Peoples in all processes, programs and actions at all levels, including *inter alia* access to funding mechanisms, financing, capacity building, monitoring, reporting and verification (MRV) and guaranteed and enforceable safeguards and all other evolving climate change-related mechanisms; and

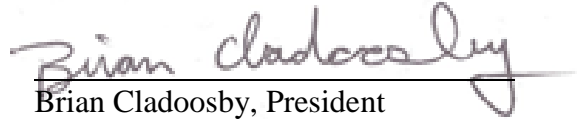
BE IT FURTHER RESOLVED, that any funds created through the United Nations for Indigenous People’s for mitigation and adaptation to climate change be available on an equal basis for Indigenous Peoples from all regions, including North America; and

BE IT FURTHER RESOLVED, that the Intended Nationally Determined Contributions (INDCs) to be submitted prior to Paris as each Party's commitment to address climate change should include, along with commitments to reduce emissions, commitments on adaptation, finance, technology transfer, and capacity building as well as indicators on the extent to which Indigenous Peoples' rights and safeguards are respected, and non-carbon benefits, including cultural, spiritual and subsistence values are ensured; and

BE IT FINALLY RESOLVED, that this resolution shall be the policy of NCAI until it is withdrawn or modified by subsequent resolution.

CERTIFICATION

The foregoing resolution was adopted by the General Assembly at the 2015 Annual Session of the National Congress of American Indians, held at the Town and Country Resort, San Diego, CA, October 18-23, 2015, with a quorum present.


Brian Cladoosby, President

ATTEST:


Aaron Payment, Recording Secretary

EXHIBIT BMC-18



The National Congress of American Indians Resolution #KAN-18-006

TITLE: Implementation of the Indigenous Peoples' Traditional Knowledge Platform within the United Nations Framework Convention on Climate Change

WHEREAS, we, the members of the National Congress of American Indians of the United States, invoking the divine blessing of the Creator upon our efforts and purposes, in order to preserve for ourselves and our descendants the inherent sovereign rights of our Indian nations, rights secured under Indian treaties and agreements with the United States, and all other rights and benefits to which we are entitled under the laws and Constitution of the United States and the United Nations Declaration on the Rights of Indigenous Peoples, to enlighten the public toward a better understanding of the Indian people, to preserve Indian cultural values, and otherwise promote the health, safety and welfare of the Indian people, do hereby establish and submit the following resolution; and

WHEREAS, the National Congress of American Indians (NCAI) was established in 1944 and is the oldest and largest national organization of American Indian and Alaska Native tribal governments; and

WHEREAS, numerous prior NCAI resolutions have recognized that Climate change constitutes one of the greatest threats facing the peoples of the world today, and that Indigenous Peoples are often the most severely impacted by the effects of climate change and are facing immediate and significant impacts on their ways of life from climate change; and

WHEREAS, the Outcome Document of the World Conference on Indigenous Peoples provides in paragraph 36 that “indigenous peoples' knowledge and strategies to sustain their environment should be respected and taken into account” in the development of “national and international approaches on climate change mitigation and adaptation;” and

WHEREAS, at the Twenty-First Session of the Conference of the Parties (COP21) of the United Nations' Framework Convention on Climate Change (UNFCCC), 196 Parties adopted the Paris Agreement beginning a new age of international efforts to combat climate change; and

WHEREAS, in resolution MOH-17-053, NCAI reiterated our ongoing support for the Paris Agreement despite the decision of the United States to withdraw; and

WHEREAS, the Paris Agreement called upon States to respect, promote and consider their respective human rights obligations, including the rights of Indigenous Peoples, when taking action on climate change; and

WHEREAS, Article 7, paragraph 5 of the Paris Agreement recognizes that adaptation actions should, as appropriate, be based on and guided by “traditional knowledge, knowledge of indigenous peoples, and local knowledge systems;” and

WHEREAS, Paragraph 135 of the Paris Decision “Recognizes the need to strengthen knowledge, technologies, practices and efforts of local communities and indigenous peoples related to addressing and responding to climate change, and establishes a platform for the exchange of experiences and sharing of best practices on mitigation and adaptation in a holistic and integrated manner;” and

WHEREAS, at the Twenty-Third Conference of the Parties (COP23), the Parties adopted a decision on the Local Communities and Indigenous Peoples Platform, identifying a new pathway for its further operationalization at COP24 to take place in December 2018 in Katowice, Poland; and

WHEREAS, the Parties agreed on the objectives of the Platform:

- 1) **Knowledge**: the platform should provide a space for documenting and sharing experience and best practices, respecting the unique nature of and need to safeguard indigenous and local community knowledge systems;
- 2) **Climate change policies and actions**: the platform should facilitate the integration of indigenous and local knowledge systems as well as the engagement of indigenous peoples and local communities in relevant climate change related actions, programs and policies; and
- 3) **Capacity for engagement**: the platform should help to build the capacities of indigenous peoples and local communities to help enable their engagement in and support the UNFCCC process, including the implementation of the Paris Agreement, and other climate - related processes; and

WHEREAS, Indigenous peoples traditional knowledge, teachings, innovations and practices of sustainable management and conservation can serve as positive contributions in addressing climate change adaption and mitigation strategies; and

WHEREAS, NCAI recognizes that the creation of the traditional knowledge platform, in addition to providing the opportunity to strengthen indigenous knowledge and to help Indigenous Peoples influence climate policies and actions, also poses potential dangers to the rights of Indigenous to safeguard their traditional knowledge, and that it is therefore crucial to ensure that the inherent rights affirmed in the UN Declaration on the Rights of Indigenous Peoples, including, among others, rights to the lands, territories and resources they have traditionally owned, occupied or otherwise used or acquired A26); the right to maintain, protect, control and develop their cultural heritage (A 31); the right to the recognition, observance and enforcement of Treaties and Agreements (A 37); and the right to Free Prior and Informed Consent in various articles are respected and protected in this process; and

WHEREAS, NCAI affirms the vital important of ensuring the input of Tribal leaders and traditional knowledge holders into this process at all stages to ensure that these rights are protected and that traditional knowledge is respected, protected and properly used; and

WHEREAS, NCAI also underscores the importance of Indigenous Peoples' independent efforts to ensure resiliency and mitigate the impacts of Climate Change through strengthening and restoring their traditional practices, continuing intergenerational knowledge transmission and creating opportunities to exchange experiences and methods with other Tribal Nations and knowledge holders, as agreed and appropriate.

NOW THEREFORE BE IT RESOLVED, that the National Congress of American Indians (NCAI) calls on the Parties to the United Nations' Framework Convention on Climate Change (UNFCCC) to support all efforts, including changing the draft rules of procedure, to ensure the full and effective participation of Indigenous Peoples in the UNFCCC processes, particularly traditional knowledge holders; equal status, including in leadership positions; the self-selection of representatives; and adequate funding for Indigenous Peoples' participation; and

BE IT FURTHER RESOLVED, that NCAI commits to continuing to work with the IIPFCC to achieve a platform that best serves indigenous peoples and preserves and shares traditional knowledge in a way that upholds and protects the rights of Indigenous Peoples to self-determination, cultural heritage, and lands, territories, and natural resources; and

BE IT FINALLY RESOLVED, that this resolution shall be the policy of NCAI until it is withdrawn or modified by subsequent resolution.

CERTIFICATION

The foregoing resolution was adopted by the General Assembly at the 2018 Midyear Session of the National Congress of American Indians, held at the Marriott Kansas City Downtown, June 3-6, 2018, with a quorum present.


Jefferson Keel, President

ATTEST:


Juana Majel Dixon, Recording Secretary

EXHIBIT BMC-19



The National Congress of American Indians Resolution #REN-19-005

TITLE: Response to IPCC 1.5° C Report on Climate Change

EXECUTIVE COMMITTEE

PRESIDENT
Jefferson Keel
Chickasaw Nation

FIRST VICE-PRESIDENT
Aaron Payment
*Sault Ste. Marie Tribe of Chippewa
Indians of Michigan*

RECORDING SECRETARY
Juana Majel-Dixon
Pauma Band Mission Indians

TREASURER
W. Ron Allen
Jamestown S'Klallam Tribe

REGIONAL VICE- PRESIDENTS

ALASKA
Rob Sanderson, Jr.
*Tlingit & Haida Indian Tribes of
Alaska*

EASTERN OKLAHOMA
Joe Byrd
Cherokee Nation

GREAT PLAINS
Larry Wright, Jr.
Ponca Tribe of Nebraska

MIDWEST
Shannon Holsey
*Stockbridge Munsee Band of
Mohicans*

NORTHEAST
Lance Gumbs
Shinnecock Indian Nation

NORTHWEST
Leonard Forsman
Suquamish Tribe

PACIFIC
Brian Poncho
Bishop Paiute Tribe

ROCKY MOUNTAIN
VACANT

SOUTHEAST
Nancy Carnley
Ma-Chis Lower Creek Indians

SOUTHERN PLAINS
Zach Pahmahmie
Prairie Band of Potawatomi Nation

SOUTHWEST
Joe Garcia
Ohkay Owingeh Pueblo

WESTERN
Quintin C. Lopez
Tohono O'odham Nation

CHIEF EXECUTIVE OFFICER
KEVIN ALLIS
*FOREST COUNTY POTAWATOMI
COMMUNITY*

NCAI HEADQUARTERS
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202.466.7767
202.466.7797 fax
www.ncai.org

WHEREAS, we, the members of the National Congress of American Indians of the United States, invoking the divine blessing of the Creator upon our efforts and purposes, in order to preserve for ourselves and our descendants the inherent sovereign rights of our Indian nations, rights secured under Indian treaties and agreements with the United States, and all other rights and benefits to which we are entitled under the laws and Constitution of the United States and the United Nations Declaration on the Rights of Indigenous Peoples, to enlighten the public toward a better understanding of the Indian people, to preserve Indian cultural values, and otherwise promote the health, safety and welfare of the Indian people, do hereby establish and submit the following resolution; and

WHEREAS, the National Congress of American Indians (NCAI) was established in 1944 and is the oldest and largest national organization of American Indian and Alaska Native tribal governments; and

WHEREAS, the Paris Decision, which adopted the Paris Agreement on addressing climate change, recognizes that climate change represents an “urgent and possibly irreversible threat to human societies and the planet”; and

WHEREAS, the Intergovernmental Panel on Climate Change (IPCC) has found that Indigenous Peoples are among the most vulnerable to the effects of climate change and are disproportionately affected by it; and

WHEREAS, the parties to the Paris Agreement agreed in Article 2 to hold “the increase in the global average temperature to well below 2° Celsius (C) above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5° C above pre-industrial levels”; and

WHEREAS, in 2015, the Structured Expert Dialogue (SED) report concluded that at 2° C of warming “...indigenous people[s] would be at risk of loss of land and cultural and natural heritage, and cultural practices embedded in livelihoods would be disrupted”; and

WHEREAS, Paragraph 21 of the Paris Decision invited the IPCC “to provide a special report in 2018 on the impacts of global warming of 1.5° C above pre-industrial levels”; and

WHEREAS, the IPCC issued its report on the effects of global warming of 1.5° C in October of 2018, finding that even at that level, the consequences of climate change will be severe, and drastically worse at 2° C; and

WHEREAS, the recent report of the United Nations (UN) on Biodiversity and Ecosystem Services finds that one million species are at risk of extinction, and that climate change is one of the five greatest direct drivers of this loss of biodiversity and is increasingly exacerbating the effect of other drivers; and

WHEREAS, that same report found that “Nature managed by indigenous peoples...is under increasing pressure. Nature is generally declining less rapidly in indigenous peoples’ land than in other lands, but is nevertheless declining, as is the knowledge of how to manage it”; and

WHEREAS, the IPCC report found that drastic and unprecedented action in the next twelve years is necessary to stay within a 1.5° C increase; and

WHEREAS, the 2018 Emissions Gap Report from the UN Environmental Program stated that greenhouse gas production had actually increased, indicating that global actions to reduce greenhouse gas emissions are falling far short of what is required to meet the essential 1.5° C goal of the Paris Agreement; and

WHEREAS, the IPCC now predicts a temperature rise of 3° C or more at the current rate, which means 2-3 times higher in the Arctic, with devastating impacts for Indigenous Peoples around the world including American Indian and Alaska Native Tribal Nations in the United States; and

WHEREAS, American Indian and Alaska Native Tribal Nations in the U.S. are already experiencing the impacts of climate change on their lands and waters, including diminishing animal and plant species vital for nutrition and cultural practices, extreme weather events (floods, tornados, blizzards and droughts), changing weather and temperature patterns, among others; and

WHEREAS, climate change thus poses a serious threat to the inherent treaty rights of Indigenous Peoples as affirmed in the United Nations Declaration on the Rights of Indigenous Peoples, including, *inter alia* rights to subsistence, traditional lands and resources, health, productive capacity of the environment, cultural heritage, sacred sites, and free prior and informed consent.

NOW THEREFORE BE IT RESOLVED, that the National Congress of American Indians (NCAI) reconfirms its commitment to the Paris Agreement, reminds Parties of their obligation to respect the rights of Indigenous Peoples in all climate actions, and in light of the IPCC Report on 1.5° C, stresses that 1.5° C must be the absolute maximum target; that 2° C is unacceptable, and that action must be taken at the tribal, local, state, federal, regional, and international levels to have any hope of meeting the 1.5° C goal; and

BE IT FURTHER RESOLVED, that NCAI will continue to support and be engaged in the work of the Facilitative Working Group for the Local Communities and Indigenous Peoples Platform (LICPP) created by the UNFCCC COP 24 in Katowice, Poland in December 2018, will continue to participate as a member of the North America Indigenous Peoples Working Group on Climate Change, and endorses the calls of this Working Group for the establishment of safeguards for Indigenous Peoples’ rights to cultural heritage, traditional knowledge and Free Prior and Informed Consent, as well as adequate support for the direct involvement of Indigenous traditional knowledge holders and practitioners in the work of the Platform; and

BE IT FURTHER RESOLVED, that NCAI calls upon the U.S. federal government as well as the United Nations Green Climate Fund to provide support and direct funding to tribal nations to carry out the above disaster relief and just transition programs; and

BE IT FINALLY RESOLVED, that this resolution shall be the policy of NCAI until it is withdrawn or modified by subsequent resolution.

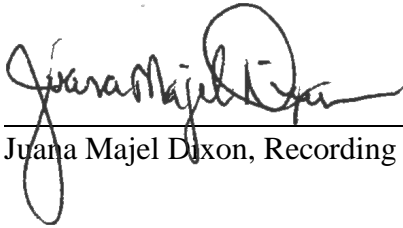
CERTIFICATION

The foregoing resolution was adopted by the General Assembly at the 2019 Mid-Year Session of the National Congress of American Indians, held at the Nugget Casino Resort, June 24-27, 2019, with a quorum present.



Jefferson Keel, President

ATTEST:



Juana Majel Dixon, Recording Secretary

EXHIBIT BMC-20



The National Congress of American Indians Resolution #MOH-17-053

TITLE: Continued Support for the Paris Climate Agreement and Action to Address Climate Change

WHEREAS, we, the members of the National Congress of American Indians of the United States, invoking the divine blessing of the Creator upon our efforts and purposes, in order to preserve for ourselves and our descendants the inherent sovereign rights of our Indian nations, rights secured under Indian treaties and agreements with the United States, and all other rights and benefits to which we are entitled under the laws and Constitution of the United States and the UN Declaration on the Rights of Indigenous Peoples, to enlighten the public toward a better understanding of the Indian people, to preserve Indian cultural values, and otherwise promote the health, safety and welfare of the Indian people, do hereby establish and submit the following resolution; and

WHEREAS, the National Congress of American Indians (NCAI) was established in 1944 and is the oldest and largest national organization of American Indian and Alaska Native tribal governments; and

WHEREAS, climate change is one of the greatest threats facing the peoples of the world today, and Indigenous peoples are often the most severely impacted by the effects of climate change and are facing immediate and significant impacts from climate change; and

WHEREAS, Indigenous Peoples depend upon the health of their ecosystems and natural resources for social, economic, and cultural vitality; and climate change threatens to destroy indigenous ways of life that have been sustained for thousands of years; and

WHEREAS, climate change poses a serious threat to the inherent and Treaty rights of Indigenous Peoples as affirmed in the United Nations Declaration on the Rights of Indigenous Peoples, including, inter alia, rights to subsistence, traditional lands and resources, health, productive capacity of the environment, cultural heritage, sacred sites, and free prior and informed consent; and

WHEREAS, hundreds of Indigenous communities are facing relocation and losing homes, hunting and fishing ecosystems are changing drastically, and changes in weather patterns are adversely affecting the harvesting of plant-based foods and medicines; and

WHEREAS, the Parties to the United Nations Framework Convention on Climate Change (UNFCCC) met in Paris at the end of 2015 to reach a universally binding agreement to address climate change; and

WHEREAS, the goal of the Paris Climate Agreement as stated in Article 2 is “to strengthen the global response to the threat of climate change . . .;” and

WHEREAS, the U.S. became a signatory of the Paris Climate Agreement in April 2016, ratified the agreement in September 2016, and such agreement took effect with respect to the U.S. in November 2016; and

WHEREAS, on June 1, 2017, the U.S. announced its intent to withdraw from the Paris Climate Agreement; and

WHEREAS, American Indian and Alaska Natives tribes are leaders on the protection of ecosystems and the environment since time immemorial and have a sacred responsibility to protect our resources and ways of life for generations to come; and

WHEREAS, adequate response to the threat of climate change requires action by all governments, including Tribal, national, state, and local governments; and

WHEREAS, On November 4, 2020, the U.S. formally withdrew from the Paris Climate Agreement in accordance with the provisions of Article 28 of the Agreement.

NOW THEREFORE BE IT RESOLVED, that the National Congress of American Indians calls on the President to fully rejoin the Agreement as soon as possible; and

BE IT FURTHER RESOLVED, that the National Congress of American Indians (NCAI) does hereby declare its continued support of the Paris Climate Agreement in furtherance of the sacred responsibility of American Indians and Alaska Natives to protect our resources and ways of life for generations to come; and

BE IT FURTHER RESOLVED, that NCAI will continue to support and advocate for initiatives intended to reduce greenhouse gas emissions and promote climate resiliency that include but are not limited to:

- increased investment and use of renewable energy resources, like wind and solar, which will also promote economic development, clean power generation, and new workforce opportunities;
- efforts to increase energy efficiency planning and implementation that will protect the environment, reduce energy costs, and enhance quality of life in Indian Country and around the world;
- efforts to educate the public on current and emerging climate change impacts affecting Indian Country;
- implementation and improvement of the processes and planning associated with preparing for and mitigating impacts of climate change, such as the increased incidence and magnitude of events that require emergency management and disaster response; and
- further actions of Tribal Nations in the exercise of their inherent sovereignty to combat climate change; and

BE IT FURTHER RESOLVED, that NCAI calls on all Tribal nations, states, and local governments to commit to working to uphold the Paris Climate Agreement; and

BE IT FINALLY RESOLVED that this resolution shall be the policy of NCAI until it is withdrawn or modified by subsequent resolution.

CERTIFICATION

The foregoing resolution was amended by the General Assembly at the 2020 Annual Session of the National Congress of American Indians, held virtually, November 8-13, 2020, with a quorum present.

Fawn Sharp, President

ATTEST:

Juana Majel Dixon, Recording Secretary

EXHIBIT BMC-21



THE CONVENING OF INDIGENOUS PEOPLES FOR THE HEALING OF MOTHER EARTH

Dear Friends,

It is a great honor to share the “*Message of the Living Spirit of the Convening of Indigenous Peoples for the Healing of Mother Earth*,” the outcome of the Convening that took place in the Cultural Territory of the Maya in Palenque, Chiapas, Mexico on March 10-13, 2008. At the direction of the participants at this gathering, this message is a Call To Action to Indigenous peoples, and to all peoples of the world.

The *Convening for the Protection of Mother Earth* was planned by and for Indigenous peoples from North America to bring together Indigenous leaders, including spiritual and traditional healers, elders, wisdom keepers, and practitioners, to address the need for immediate intervention and action, based upon our original teachings, in order to ensure a healthy future for coming generations. We recognize that our current and future actions must not be based upon the same worldview that has brought such global destruction to Mother Earth. We must reclaim and revitalize the wisdom passed on to us from our Ancestors about how to be responsible to each other and to the Natural World.

This Message was created through ceremony and prayer, but it is up to each of us to find ways to give this Message life and meaning as we all take steps to protect the Natural World. It is intended to be a living document that serves as a source of inspiration to Indigenous peoples, governments, and civil society, to take our responsibilities to protect Mother Earth seriously, and to provide some guidance for moving forward.

Finally, we wish to acknowledge the participation and deliberations of the Indigenous peoples, representing Indigenous nations and communities from throughout North America, and gratefully thank the following organizations for their generous contributions and support including: U.S. Environmental Protection Agency, Health Canada, The Mexican Secretariat of Environment and Natural Resources, The Mexican National Commission for the Development of Indigenous Peoples, and the Commission for Environmental Cooperation.

Please visit the *Convening for the Protection of Mother Earth* website for further information at: www.indigenousconvening.com.

Message of the Living Spirit of the *Convening of Indigenous Peoples for the Healing of Mother Earth* at the Cultural Territory of the Maya

March 10-13, 2008
Palenque, Chiapas, Mexico

INTRODUCTION

Having been welcomed to convene in ceremony at the sacred site of Palenque (*Cerco de Estacas*) to heed the call of Mother Earth and honor the sacred elements of water, air, earth and fire in unity as Indigenous Peoples of Lak Ná Lum upon the traditional territory of the Maya People on the 10 -13 of March 2008, we commit in unity to the Message of the Living Spirit.

We the Indigenous Nations, Peoples, tribes, pueblos, communities, villages, situated within the geopolitical boundaries claimed by the nation-states of Mexico, Canada, and the United States hereby make this declaration and urgent message to the world on the basis of our spirituality and the natural biological Laws of Life on Mother Earth, the Sacred Life-Giver. It is our inherent birthright and responsibility as the original free and independent Peoples of Turtle Island to care for Mother Earth in keeping with our Original Instructions from Creation.

These natural laws are inclusive of Honor, Respect, Love, Compassion, Peace, and Friendship. It is in keeping with these natural laws and Indigenous values that the traditional knowledge and wisdom bequeathed to us by our ancestors, and carried today by our Elders, teaches us how to live in balance with the Four Sacred Elements of Life: Earth, Water, Air, and Fire. We are the guardians of these elements of Life.

Fire is meant to ignite and unite the spirit of humanity. Water is the life blood of all living things. Air is the sacred breath of life. Earth is the Mother that nurtures us all. Beyond the tangible aspect of our relationships with all the sacred elements, there is intangible interaction. The role of the sacred elements is central in our customs, traditions, stories, songs, and dances.

The Indigenous prophecies foretell the urgent environmental crisis we face today. The Indigenous Peoples have the responsibility to provide our traditional knowledge to the world. The ancestral ways of Indigenous peoples have the power to heal our Mother Earth. We demand that the nation-state and state governments stop the destruction and violations against the four elements of Life.

Western legal and religious histories, philosophies and laws have totally disrupted our ways of life. Our traditional spiritual ways and knowledge systems honor the interconnections and interrelationships of the Web of Life, and sustain, not destroy Mother Earth.

Message of the Living Spirit of the *Convening of Indigenous Peoples for the Protection of Mother Earth* - March 13, 2008 - www.indigenousconvening.com

VISION

As caretakers of Mother Earth, speaking with one spirit, one mind, one heart and as one family, utilizing the original teachings given to human beings by the Creator, we will restore balance and harmony to Mother Earth and all her children.

Guided by the wisdom and vision of our ancestors in the spirit world, elders, spiritual leaders and traditional and Indigenous community leaders, we understand the Natural Law given to us by the Creator guides our traditional way of life in harmony with all creation upon the land and waters of Mother Earth.

THE PAIN OF MOTHER EARTH

As the peoples of the land, we are the first to hear, see, feel, taste and spiritually sense the pain of Mother Earth. She is dying and we hear her cry. Her heart is wounded and her pain is our pain, her illness is our illness, our survival is dependent upon her survival.

As Indigenous peoples, we have a spiritual and familial relationship to the sacred elements of water, air, earth and fire, and understand their holistic and inseparable relationship with each other. Through the western claim of asserting ownership over these sacred elements their spiritual interdependence is being destroyed.

Water

Minan ja 'Minan kuxtal.
Without water, there is no life.

The water represents the life-blood and the sustenance of all life. The purity and natural flow of water is necessary for maintaining the interdependent balance between all forms of life. Our sacred birthright includes the rivers, streams, natural springs, hot waters, lakes, underground aquifers, seas, bays, inlets, oceans, ice, snow, rain and all forms of and bodies of water.

Deforestation and the removal of flora and fauna have resulted in the destruction of water sources. Organic and inorganic waste, refuse, and industrial wastewater are dumped directly into rivers and water sources that people need for drinking. As a result of toxins and pollutants, and industrial wastes many sources of water are unfit to drink and lead to serious and deadly health problems for humans and other forms of life. Indigenous peoples are often in the situation of

Message of the Living Spirit of the *Convening of Indigenous Peoples for the
Protection of Mother Earth* - March 13, 2008 - www.indigenousconvening.com

having to choose between thirst and the possibility of serious illness or death from drinking polluted and contaminated water.

Dams and hydroelectric projects pose a massive problem for the integrity of ecosystems and the ability of Indigenous Peoples to maintain their traditional ways of life, hunting, fishing, trapping, and harvesting. As a result of diversion and depletion of pristine water sources, many Indigenous Peoples do not have access to water. Regulatory frameworks also infringe upon Indigenous peoples' rights to, use of, and access to water. The privatization and commodification of water is a critical issue. No one owns water.

Air

The air is the Messenger that announces the rains, it is a voice of our ancestors, and it is the central element for the preservation of cultures. The main causes of air pollution are industrialization, militarization, electricity generation, energy generation from nonrenewable sources, means of transport and inadequate management of toxic wastes. This situation threatens the health of our ecosystems, putting life at risk. Air pollution caused by automobile exhaust, has great impacts on the respiratory health of all peoples, particularly in urban areas. The pollution carried by the wind from coal-fire plants emit toxins negatively impact peoples at great distances. The burning of oil, gas, and coal ("fossil fuels") causing the global warming is the primary source of human-induced climate change.

Earth

Our sacred lands are under siege. The Western world improperly asserts that they have a right to extract the natural resources from our lands and territories without regard for our rights. This extraction has left in its wake a legacy of contamination, waste and loss of life. Indigenous peoples are facing the negative impacts of pollution, mining, deforestation, logging, oil prospecting, dumping of toxic waste, genetic engineering, fertilizers and pesticides, and soil erosion, all of which contribute to a severe loss of biodiversity. All of these threaten food security, subsistence lifestyles, human health and our ability to sustain our peoples. Our peoples are suffering from high rates of cancers, diabetes, heart disease and other serious diseases previously unknown to our peoples. In the name of conservation of biodiversity, Indigenous Peoples have been displaced from our territories designated as protected areas. There is a direct correlation between the health of the land and the holistic health and well-being of the people. This has particular and significant impact on Indigenous Women - the rape and desecration of Mother Earth is reflected in what has happened to Indigenous Women.

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Fire

The fire that sparks life is being disrespected by technology of the industrialized world that allows it to take life such as the fire in the coal-fired powered plants, the toxic waste incinerators, the fossil-fuel combustion engine and other polluting technologies that add to greenhouse gases, a primary cause of climate change. The abuse of the sacred element of fire conflicts with Indigenous knowledge and practices. Human beings are using fire in an exploitive, manipulative, destructive and deadly manner. The culturally inappropriate use of fire is manifested in the atomic bomb, military weaponry and warfare, nuclear power and radioactive waste, the extractive energy industries of coal, oil and gas, and the burning of forests and grasslands that result in the extinction of flora and fauna within our ancestral territories.

THE HEALING OF MOTHER EARTH

Based on our inherent sovereignty and consistent with our inherent birthright to self-determination in international law, including the United Nations Declaration on the Rights of Indigenous Peoples, we affirm our responsibility to protect water, air, earth and fire. Because of our relationship with our lands, waters and natural surroundings since time immemorial, we carry the knowledge, ideas and solutions that the world needs today. We know how to live with Mother Earth because we are her children. We commit to sharing certain teachings of our peoples to all humanity so that they can find their original, sacred relationship to Mother Earth, Father Sky, and all Creation. It is our responsibility given to us by the Creator to speak for the plants, for the animals, and all life to bring their message to all of peoples and nations of the world.

Traditional knowledge can aid in providing accurate ecological baselines embedded in and carried in Indigenous languages, including in traditional names of places, stories and oral narratives that reveal the original roles of natural habitats as given to us by the Creator. These baselines are critical for societal adaptation to environmental change, land use change and climate change, as well as indigenous cultural survival in the face of these detrimental changes in the world we live in today.

Call to Action to Indigenous Peoples

Based on our inherent sovereignty and consistent with our right of self-determination in international law, we affirm our inherent birthright to water, air, earth and fire. We call upon our Indigenous brothers and sisters to fulfill our responsibilities bequeathed by our ancestors to secure a healthy environment for present and future generations. We know how to live with Mother Earth because we are her children. We are a powerful spiritual people. It is this spiritual

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connection to Mother Earth, Father Sky, and all Creation that the rest of the World must respect. Our extended family includes our Mother Earth, Father Sky, and our brothers and sisters, the animal and plant life, therefore, it is the responsibility given to us by the Creator to speak for the plants, for the animals, for the rest of Creation, for the future of all the children, for the future of Mother Earth and Father Sky. We commit to continue our traditional practices for the environment based on standards consistent with the Natural Laws of the Creator for the benefit of future generations.

We call upon all Indigenous Peoples to:

Honor and defend all the sacred elements by conducting their traditional ceremonies and prayers revitalizing and perpetuating traditional values and knowledge systems and applying them to today's realities. We the Indigenous Peoples at this Convening, offer to share the following gifts of knowledge through our own skills that have been developed and through proven best practices/successful indigenous practices or knowledge that have been successful:

- Develop recycling capabilities for plastic, paper, glass and metals in our own communities, ending the use of plastic;
 - Exercise traditional ways of growing crops; and
 - Plant more trees to clean the air and water, a holistic reforestation with endemic plants.
- Educate Indigenous Peoples and non-Indigenous people beginning with our children and including individuals, communities, governments, institutions and the media about the role of these sacred elements in our world and our livelihoods.
 - Create and develop an Indigenous education circle without borders, based on traditional knowledge using appropriate tools of science to protect our sacred elements. This network can include traditional practices, research experience, development of curriculum for our children, and a library of knowledge that can be shared with all of our Peoples.
 - Collaborate and organize events, gatherings and conferences for the protection of the sacred elements.
 - Acknowledge the ancestral time in uniting "All Nations, All Faiths, One Prayer" on June 21st to pray for united healing.

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- Assert and exercise our inherent, prior and collective rights to manage, maintain and protect our lands and territories.
- Express our full support for the existing Indigenous organizations and associations which are currently advocating for the protection, stewardship and sustainability of water as a resource and as a part of Indigenous identity, spirituality, culture and nationhood.
- There are numerous documents, resources, tools, instruments, treaties, agreements and other constructive arrangements that have been created by or in partnership with Indigenous Peoples. We encourage more Indigenous Peoples to create such tools in accordance with their respective customs, protocols and laws, to articulate, implement or enforce our inherent rights and in exercising self determination. We also urge Indigenous Peoples to share such tools, skills, knowledge and resources with each other.
- Exercise the right of free, prior and informed consent to any actions that may affect their lands and territories.

Call to Action to the Global Community

Acknowledging the dignity of all life, peoples and nations, we call upon the global community to unite with Indigenous Peoples to learn the teachings and wisdom as bestowed to us by the Creator in order to heal Mother Earth. The realization of this Call to Action will only occur with the full, active and collaborative partnership of all peoples and nations. We call upon Leaders of all Nations of the World at all levels of decision making, to accept responsibility for the welfare of future generations. Living by the traditional principles and values of Honor, Respect, Love, Compassion, Peace and Friendship, we call upon the Global Community:

International

- Fully implement the United Nations Declaration on the Rights of Indigenous Peoples.
- Protect Indigenous peoples from the negative impacts of trade agreements.
- Recognize the rights of Indigenous Peoples consistent with the United Nations Declaration on the Rights of Indigenous Peoples and other international law, in the implementation of international treaties, conventions and agreements relevant to the environment, trade, and human rights including:
 - Convention on Biological Diversity, including Articles 8(j) and 10.
 - United Nations Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol

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- International Labour Organization Convention (ILO) 107 and 169
- Organization of American States
- OAS Proposed Declaration on the Rights of Indigenous Peoples
- Universal Declaration of Human Rights
- International Convention on the Elimination of All Forms of Racial Discrimination
- International Covenant on Economic, Social and Cultural Rights
- International Covenant on Civil and Political Rights
- Declaration on the Granting of Independence to Colonial Countries and Peoples
- General Assembly resolution 1803 (XVII) of 14 December 1962, “Permanent sovereignty over natural resources”
- Declaration on the Elimination of All Forms of Intolerance and of Discrimination Based on Religion or Belief

National

- Commit to the full implementation at the domestic level of the United Nations Declaration on the Rights of Indigenous Peoples.
- That all levels of nation-state and state governments live up to their commitments to Indigenous Peoples by recognizing our inherent rights, cultural rights and rights held pursuant to treaties, agreements and other constructive arrangements.
- Implement a system of legislation, regulation, fines or taxation for excessive use or abuse of any of the four sacred elements.
- Enter into a collaborative, and active partnership with Indigenous Peoples to protect, sustain and maintain sacred sites of Indigenous Peoples.
- Governments should guarantee the restructuring and repair of the damage done to the cultural patrimony and territory of Indigenous Peoples.

Non-Governmental and Civil Society

- Civil society and non-governmental organizations to involve and support Indigenous Peoples in the protection of our lands, territories and rights. This includes advocacy concerning any activity impacting the four sacred elements.

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- Encourage civil society, and non-governmental organizations to respect and honor the roles and responsibilities of Indigenous Peoples in carrying out their mandates and roles;

Private Sector and State Corporations

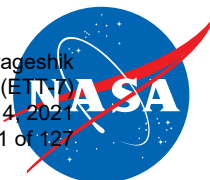
- Indigenous laws governing the four sacred elements must be respected by the private sector, in addition to relevant international, and national laws that are consistent with the United Nations Declaration on the Rights of Indigenous Peoples in carrying out their business or projects.
- Ensure the free, prior and informed consent of Indigenous Peoples prior to commencing any undertaking which impacts the four sacred elements, including assessments or exploration, and involving the participation of governments if necessary.

DECLARATION

We, the Convening of Indigenous Peoples for the Healing of Mother Earth, support the spirit and intent of this message and send it out to all Indigenous peoples and to the World as a living document.

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EXHIBIT BMC-22



NATIVE PEOPLES - NATIVE HOMELANDS CLIMATE CHANGE WORKSHOP II

FINAL REPORT
NANCY G. MAYNARD, EDITOR



NOVEMBER 18-21, 2009
MYSTIC LAKE ON THE HOMELANDS OF THE
SHAKOPEE MDEWAKANTON SIOUX COMMUNITY
PRIOR LAKE, MINNESOTA

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To download a pdf of this workshop report, please go to:

<http://neptune.gsfc.nasa.gov/csb/index.php?section=278>

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Partners



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It is hoped that this workshop report gives the reader an appreciation of the extensive amount of wisdom, observations, energy, and hard work of all the Native Peoples who gathered at Mystic Lake in 2009 to contribute their collective knowledge of the current impacts of climate change on Native Peoples and their lands in the US as well as possible future strategies. A special tribute to the workshop participants is the outcome that, as this report goes to print, it is clear that some of the discussions which took place at this NP/NH workshop have since that time laid the groundwork for direct contribution to the new US National Climate Assessment - expected to be published in 2014 because it includes an entire chapter devoted to "Indigenous Peoples, Lands, and Resources."

Other Notes

- To provide some background and context to students and other readers of this workshop report who might not be familiar with issues associated with Native America and climate change, certain portions of Chapter 12 of the U.S. National Climate Assessment 2001 "Foundation Report" have been reprinted in this report for the reader's reference. (Chapter 12 was written based upon discussions from the first Native Peoples-Native Homelands Climate Change Workshop in 1998.) Chapter 12 reference:

Schuyler Houser, Verna Teller, Michael MacCracken, Robert Gough, and Patrick Spears. 2001. "Potential Consequences of Climate Variability and Change for Native Peoples and Homelands." In: National Assessment Synthesis Team. Climate Change Impacts on the United States: The Potential Consequences of Climate Variability and Change. Pp. 351-377. Cambridge University Press, Cambridge UK.
- In addition, to highlight some of the regional concerns identified in other workshops held as part of the U.S. National Assessment, selected regional information from those workshops is reprinted here to provide background and context for consideration of Native Peoples and Homelands issues and concerns.
- The workshop was organized in order to hear from as many Native participants as possible, and while we tried to capture and transcribe most presentations for the report, the large numbers of excellent speakers exceeded our recording capabilities, so we must offer our apologies to those whose talks are not fully transcribed in the report. Instead, it became necessary to compile the essence of many discussions throughout the workshop in shorthand listings of "bullets" during the sessions.

Acknowledgements

To the many partners who helped organize the workshop and collect/create the various pieces of this report: our grateful acknowledgement and thank you! Thanks to Robert Kilgore of NASA Goddard Space Flight Center, Technical Information and Management Services Branch, for his special efforts in the final publication of the report. And, a very special thanks to NASA's Tribal Colleges and Universities Project (TCUP) and NASA's Earth Sciences Division for their support, which made this workshop possible."

EXECUTIVE SUMMARY

The Native Peoples Native Homelands (NP/NH) Climate Change Workshop II was convened November 18-21, 2009, on the homelands of the Shakopee Mdewakanton Sioux Community at the Mystic Lake Casino Hotel, Prior Lake, Minnesota to discuss and propose strategies for addressing the impacts of climate change on Native Peoples and Native Homelands. National Aeronautics and Space Administration (NASA), through its Tribal Colleges and Universities Project and Earth Science Division, along with its partners sponsored this important collaborative and comprehensive national gathering of more than 400 Native leaders, scholars, scientists, elders, tribal college students and faculty, as well as a number of other scientists.

The workshop, coming a decade after the first U.S. Native Peoples-Native Homelands Climate Change Workshop in 1998, was designed to update the findings conducted in conjunction with the 2009 U.S. National Assessment of the Potential Consequences of Climate Variability and Change. This NP/NH workshop was critically needed and timely because the just-released 2009 U.S. National Assessment of Global Climate Change Impacts in the United States did not have the opportunity to include an in-depth consideration of American Indians, Alaska Natives, or Native Hawaiians and their lands. Thus, this workshop served to provide the US National Assessment process with an update of climate impacts and adaptation strategies from US Native communities.

Under the leadership of co-chairs Dr. Dan Wildcat (Haskell Indian Nations University) and Winona LaDuke (Honor the Earth), the 2009 Native Peoples Native Homelands Workshop, like the first, examined the impacts of climate change and extreme weather variability on Native Peoples and their homelands from an Indigenous cultural, spiritual, and scientific perspective. In addition to considering impacts, the goals of this second workshop were also to develop response and adaptation actions and proactive recommendations to help ensure the longer-term survival of Indigenous communities.

More than ten years after the first U.S. Workshop on Climate Change Impacts on Native People Native Homelands, it is now known unequivocally (IPCC, 2007) that significant warming of the Earth is occurring along with the increasing levels of atmospheric CO₂. Global warming scenarios point to significant increased and disproportionate impacts on Native Peoples because of their unique relationship to the land, the prevalence of subsistence land-based economies and the deep cultural and spiritual significance of place. Compounding these issues, many reservations and tribal lands are located in remote areas where substandard housing and poverty prevail, making Native communities especially vulnerable to weather extremes and peak oil issues.

“Indian reservations represent significant land holdings containing indigenous species that provide key indicators to monitor and document climate change,” said Dr. Dan Wildcat, Workshop Co-Chair and Director of Haskell Indian Nations University’s Environmental Research Center. “Our knowledge and work must be included in a meaningful and central way in any assessment of climate change. We need a legitimate seat at the table in policy discussions.”

“Climate change impacts Indigenous peoples first and foremost,” said Winona LaDuke, Workshop Co-Chair and Executive Director of Honor the Earth. “We will be in a very difficult position as Indigenous peoples if we do not act now to build resilience in our communities. This means shifting the energy paradigm so that we develop efficiency and produce our own clean energy, and it means growing our own traditional varieties of food. It means returning to self-sufficiency by creating energy and food sovereignty that can provide a bright future for the generation yet to come.”

This second Native Peoples Native Homelands Climate Change Workshop was an opportunity for Native people to contribute input to the development of future national and international policy and agendas at this very critical time in history. During the workshop, participants met in frequent plenary sessions for discussions of matters of general applicability as well as in breakout sessions organized by both geographic regions and issue areas. A special White House “Listening Session” was conducted by three representatives of the White House Council on Environmental Quality (CEQ) specifically to hear the direct experiences and concerns of Native Peoples.

In addition, NP/NH workshop attendees worked long hours to create a special document, "The Mystic Lake Declaration," which was presented – two weeks later - to a key meeting of world leaders from more than 190 countries on climate change at the 2009 UN Climate Change Conference in Copenhagen, Denmark (The 15th session of the Conference of the Parties to the UN Framework Convention on Climate Change). The Declaration, presented at the UN climate conference by Tom Goldtooth and a delegation from the Indigenous Environmental Network (IEN) contributed a powerful, unified indigenous voice on the importance of indigenous science and knowledge for addressing environmental and climate issues.

The workshop was supported by NASA's Tribal Colleges & Universities Project and Earth Science Division, working with partners from the American Indian Higher Education Consortium (AIHEC), Haskell Indian Nations University, Honor the Earth, the Indigenous Environmental Network, Intertribal Council on Utility Policy, the National Oceanic and Atmospheric Administration (NOAA), and many others. Areas of impact and adaptation considered in the workshop included water, agriculture and food, traditional plants and medicines, sacred lands and sites, subsistence economies, energy, housing, transportation, sustainable infrastructure, disaster planning and more.

Current and future American Indian, Alaska Native, and Native Hawaiian tribal leaders and practitioners, tribal elders, tribal college and university presidents, faculty, staff and students, national and international climate scientists and scholars, Indigenous leaders in climate related issues, government agencies, and university scholars all joined together to strengthen the voice of US indigenous people in the climate discussions at this very crucial time in history.

CHINOOK BLESSING LITANY

Initial Testimony of Frank Ettawageshik
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WE CALL upon the Earth, our planet home, with its beautiful depths and soaring heights, its vitality and abundance of life, and together we ask that it

Teach us, and show us the way

WE CALL upon the mountains, the Cascades and the Olympics, the high green valleys and meadows filled with wild flowers, the snows that never melt, the summits of intense silence, and we ask that they

Teach us, and show us the way

WE CALL upon the waters that rim the Earth, horizon to horizon, that flow in our rivers and streams, that fall upon our gardens and fields and we ask that they

Teach us, and show us the way

WE CALL upon the land which grows our food, the nurturing soil, the fertile fields, the abundant gardens and orchards and we ask that they

Teach us, and show us the way

WE CALL upon the forests, the great trees reaching strongly into the sky with Earth in their roots and the heavens in their branches, the fir and the pine and the cedar, and we ask them to

Teach us, and show us the way

WE CALL upon the creatures of the fields and the forests and the seas, our brothers and sisters the wolves and the deer, the eagle and dove, the great whales and the dolphin, the beautiful Orcas and salmon who share our Northwest home, we ask them to

Teach us, and show us the way

WE CALL upon those who have lived on this Earth, our ancestors and our friends, who dreamed the best for future generations, and upon whose lives our lives are built, and with thanksgiving, we call upon them to

Teach us, and show us the way

And lastly, WE CALL upon all that we hold most sacred, the presense and power of the Great Spirit of Love and Truth which flows through all the Universe ... to be with us to

Teach us, and show us the way

Chinook Blessing Litany

(Published in: "The Way: An Ecological World-View," Edward Goldsmith, University of Georgia, 1998, Author unknown).



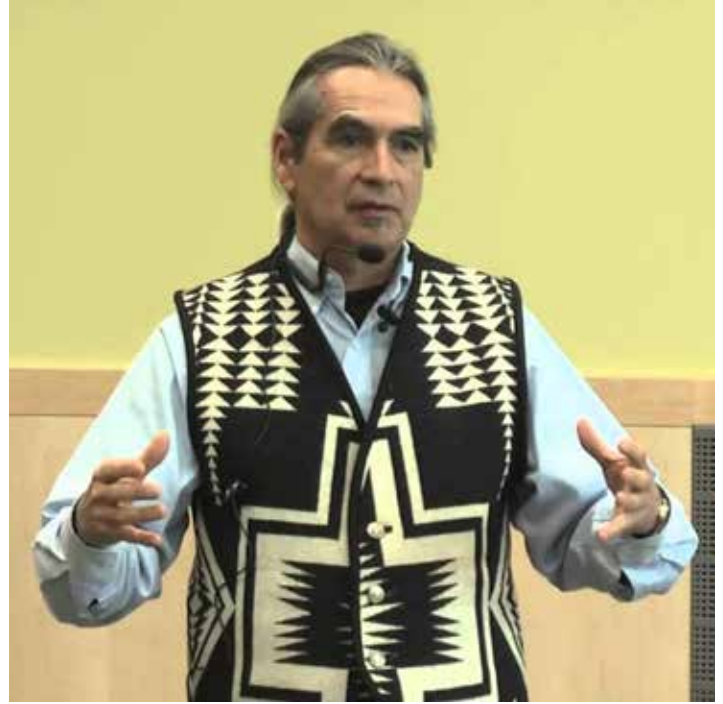
WELCOME FROM WORKSHOP CO-CHAIR - DR. DANIEL WILDCAT

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Dr. Daniel Wildcat (Yuchi member of the Muscogee Nation of Oklahoma) is a professor at Haskell Indian Nations University in Lawrence, Kansas. He is Director of the American Indian Studies Program, Co-director and co-founder of the Haskell Environmental Research Studies Center, and heads the American Indian and Alaska Native Climate Change Working Group. Dr. Wildcat is a scholar on indigenous knowledge, environment, and education. Dr. Wildcat has authored several books including his latest: Red Alert! Saving the Planet with Indigenous Knowledge.

"On behalf of my co-chair Winona LaDuke and the organizing committee, I want to welcome all of you to the Native Peoples – Native Homelands II workshop. It is incredible to see so many of our Peoples, friends and allies gathered here for fellowship, inspiration and, let's be honest, hard work. We have much to do in the face of accelerating climate change. Your work here - sharing what you are observing in your homelands and what you are doing to address the changes to the ecosystems and environments we acknowledge as consisting of relatives not resources, as Oren Lyons constantly reminds us - is important and much needed today.

Only eleven years ago, in the fall of 1998, the first Native Peoples – Native Homelands Climate Change Workshop was convened in Albuquerque as the first US National Assessment of the Potential Consequences of Climate Variability and Change was being developed. We now face a situation on the planet much worse than any scientific climate change forecasters predicted eleven years ago, but entirely consistent with centuries old prophecies and forecast by our Indigenous wisdom-keepers. It is now time for Indigenous Peoples and our allies to reconvene – gather as we have always done when situations required concerted action – to address the very real climate change threats our Peoples and homelands face. In 1998 almost no one in the scientific community of the United States made the fundamental connection between Native Peoples and Native Homelands and climate change – not only with regard to impacts but more tellingly with respect to the deep knowledges and wisdom that resided in native homelands and with native peoples. We have a situation on the planet – our Mother Earth – that requires Native People to come together so we can acknowledge our inalienable responsibility to care for the beautiful and diverse life of our



Dr. Daniel Wildcat, Workshop Co-chair

blue green Mother Earth. We must make sure the national governments of the world and their agencies, the United Nations, NGOs and the private sector recognize tremendous practical knowledge about the planet's situation and what might be done to address this already deadly global phenomena residing among American Indian and Alaska Native peoples who find their culture and identity emergent from the landscapes and seascapes they call home.

Several scientists did make the connection and with the leadership of Dr. Nancy Maynard worked mightily to bring the resources together to convene the first Native Peoples – Native Homelands Climate Change Workshop in the fall of 1998. The results of the first Native Peoples – Native Homelands Workshop were many: a recognition that Native voices and the wisdom and knowledges they conveyed were important, **The Albuquerque Declaration**, and a final report **Native Peoples – Native Homelands Climate Change: Circles of Wisdom**. However, with a growing recognition that indigenous knowledges are the result of deep experiential spatial knowledges of a people and place this second workshop will capitalize on one of the most overlooked sources of wealth - our tribal colleges and universities.

The climate has indeed changed in the past decade in a social institutional and atmospheric sense. Tribal colleges and universities are now facilitating research on climate change-related issues and preparing our students to provide the critically needed professional and scientific expertise to serve our nations. In partnership with federal agencies, national scientific research centers, NGO's, and larger research universities tribal colleges and universities are creating the next generation of indigenous leaders, entrepreneurs, planners, scientists and teachers. Consequently, this second Native Peoples – Native Homelands Workshop will highlight the role of tribal colleges and universities (TCUs) in preparing our American Indian and Alaska Native peoples to address the dramatic climate change impacts many Native People have been observing on their landscapes and seascapes for decades.

Our Workshop goal is to analyze and examine climate change impacts on our Peoples and their Native homelands and, just as importantly, share sustainable strategies and technologies for addressing these climate changes. Our own indigenous languages and cultures hold great insight on how humankind might live well on this beautiful Mother Earth - even in dramatically changing conditions. Our histories are rich in examples of practical exercises of indigenous ingenuity – ***Indigenuity***.

So let us roll-up our sleeves and get to work. After our workshop a report will be completed and hopefully a "Mystic Lake Declaration" like the "Albuquerque Declaration" created at the last Native Peoples – Native Homelands workshop can be crafted by the workshop's end to help governmental agencies and the public understand indigenous insights and perspectives on climate change. This report and your first-person testimonies of what is happening "on the ground" where you live will also serve as useful guides for our indigenous nations' policy-making and program development and for governmental agencies and non-governmental organizations who want to work with our Peoples. Such documents will add a necessary addendum to the recently released national climate report. Thank you for traveling to join us. As the late Vine Deloria, Jr. noted, difficult problems require the engagement of our Spirit and Reason, so let's draw on both and get to work."

Indians have a shot at doing something great. Young Indians must take that chance and be brave, be strong. There is a war out there. You build something – like community gardens and wind turbines – and you liberate yourself and the Indians become the people they are supposed to be."

Winona LaDuke (Anishinaabe from the White Earth reservation, Minnesota) is a Native American activist, environmentalist, economist, and writer. In 1996 and 2000, she ran for vice president as the nominee of the United States Green Party, on a ticket headed by Ralph Nader. Ms. LaDuke is Co-Chair of the Native Peoples - Native Homelands Climate Change Workshop, and executive director of both Honor the Earth and White Earth Land Recovery Project.

Winona LaDuke directed her comments mostly to the young people present and admonished them to be guided by their hearts and spirits, to use their brains because their communities – including those with wings and roots – need them.

“The impact of fossil fuels on our communities is a tough reality. But environmental problems could be worse; they would be worse if activism in the past had not stopped a 1979 proposal for 1,000 nuclear power plants by 2000 or a plan for a liquefied natural gas terminal off the coast of Santa Barbara, California, or the turning of a Hawaiian village into a tourist attraction.

It’s time for Indians to reload. But this is not all about a battle. It is also about great love, and about where we are going. Indians are instructed to remember who they are and have that beauty way.

Because of sea level rise, the people of Tuvalu in the Pacific are shopping for a new island. Eleven thousand people have to find a new place to live. They are already refugees. They need new land.

A prophecy tells of a choice between two paths, one well-worn and scorched; the other green and not well worn. Almost every indigenous community has a similar prophecy at this time. Colonization has had an impact: Indians have become the indigenous people who want to consume more. But they are selling their land for it. Steve Newcomb had explained that the root “colon” in “colonization” means “to digest.” Colonization is the digestion of one culture by another. Indians are at various levels of colonization, but they all have the power to liberate themselves, to know the difference between the green path and the scorched one. The pretense that nuclear power and carbon sequestration are green is the scorched path.



Winona LaDuke, Co-Chair

Indians must be the ones who go for the other path. They must remember who they are, create alternatives in their own communities, and be self-determining. The Creator intended for us to determine our destinies, not wait for permission from someone in Washington to control our destinies. Some tribes have taken control: The Little Traverse Band signed onto the Kyoto Protocol as a tribe. And the Navajo Nation passed the Navajo Green Economy Bill by grassroots efforts. Some tribes are putting up wind power projects. The leadership for that is coming from tribes.

What the next world will look like: We will not be an empire. We will remember who we are. Cultural diversity is essential in a sustainable future. Empire, which seeks to make more than is needed and to conquer, is not sustainable. Even indigenous people have to deconstruct their own ideas of empire, to go back to restoring what they take. A lot of the 50 million acres of Indian land that has been leased out could be recovered for organic farming, which returns carbon from the atmosphere to the soil, and for prairie. Deb Echohawk, who has Pawnee seeds and is growing them out, went back to Nebraska, from where

the Pawnee were forced out, and is working with the people there to grow corn from that native seed. That is how you make just relations with people. You give people a shot at redemption. Our seeds and plants like that.

Many Indian communities are growing seeds. They need to do it in greater quantities, with many varieties. Old varieties are drought resistant, pre-industrial, not addicted to fossil fuels. White Earth Reservation has a farm-to-school program, providing garden-grown food for schools. That means exercising jurisdiction over food. That's the answer. There is more pride in growing it than in buying it.

We are going to cut our consumption, take no more than we need. Consuming one-third of the world's resources, as the United States does, requires constant interventions into other people's countries and constant violations of other people's human rights. We have consumed half the world's oil and the rest of it is inaccessible. So we have to cut our consumption.

Food economy and energy economy studies on White Earth Reservation show that the community spends \$8 million on food and 25% of its economy on energy. The result of spending this money off reservation is that the reservation loses half its economy. The answer: consume less and buy local. Solar heating panels installed on White Earth Reservation have cut down fuel bills. They are made locally. Young people are part of the effort; the community's intellectual capital is developed as they learn the work. Renewables are the future. Reservations are windy. There is plenty of solar. It's a rebooting of the reservation economy.

The reservation community needs 3.8 million wind turbines. That takes about as much land as Manhattan. Renewable energy is democratized, in that it is often locally owned, in solar panels and such things. The result of transforming the least efficient economy based on renewables will be people who have jobs and are not in jail.

Wind and solar technology is appropriate technology. We can have the intellectual capital for this energy economy, but training is needed. There are many Indian veterans of the U.S. military who have the technical knowledge needed to make it work. These things need to be taught at tribal colleges.

Indians have a shot at doing something great. Young Indians must take that chance and be brave, be strong. There is a war out there. You build something – like community gardens and wind turbines – and you liberate yourself and the Indians become the people they are supposed to be.”

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FOREWARD FROM CO-CHAIR OF 1998 NPNH 1 WORKSHOP

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Bob Gough, Secretary, Intertribal Council On Utility Policy

"Nature has no mercy; it has laws."

~ Chief Oren Lyons, FaithKeeper of the Onondaga.

"Humans may not be fully responsible for all of the sources of global warming, but we may well be the swing vote and our own best interests may be critically at stake."

~ Patrick Spears, President, Intertribal COUP

Given the involvement of the Intertribal Council On Utility Policy in both Native Peoples workshops, I greatly appreciate this opportunity to share some observations of that journey. This report shows some of the strides America's indigenous and federally recognized tribal sovereign communities have made in addressing the risks, uncertainties and extremes associated with the consequences of our placing our collective carbon blackened fingerprints on the firmament.

In early November 1997, Pat Spears, president of the Intertribal COUP and I traveled the ice-glazed county highways across open Dakota prairies to present on tribal concerns at the Northern Great Plains regional climate change workshop convened by the Upper Midwest Aerospace Consortium (UMAC) at the University of North Dakota, organized by its director, a most down-to-Earth astronomer named Dr. George Seielstad, and coordinated by NASA's indefatigable Dr. Nancy Maynard. Few tribal people attended, as there was little official concern for the scientific topic in reservation circles, though all experienced weather related impacts increasing at an accelerated pace. On the last day Pat spoke on tribal sustainable resource practices in the opening panel and at the end of the day I was in a break-out session on tribal and federal lands, discussing the contributions Native communities can make to adaptation strategies given the tremendously long histories of indigenous peoples on these lands.

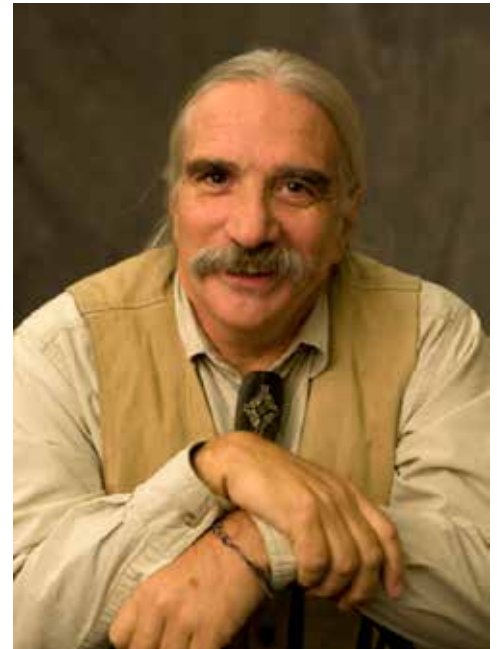
New to the climate science community, we had come a long way learning their frameworks and sharing insights from ours. We were welcomed for our perspectives and informed about changes likely to occur in this century should humans continue on our ecocidal carbon energy path. Over the past two millennia the world's climate has been relatively calm and steady except for the two most recent centuries. However, due to accelerated

warming from the increased combustion of fossil fuels, we have changed the very chemistry of our atmosphere, creating far greater risk of weather uncertainty, variability and extremes than we have ever collectively faced

With the close of this eye-opening workshop on that cold Friday night

at a hotel blackjack table in Grand Forks, not seven months after the destructive spring flood left major parts of downtown in ashes and mud, the first "Native Peoples" workshop was conceived. In less than a year nearly 200 natives from homelands in Alaska, Hawaii, the U.S., Canada and Mexico would convene with climate scientists in Albuquerque, as Hurricane Mitch ravaged the Gulf coasts of North and Central Americas.

In Grand Forks we expressed our concern about the lack of government-to-government interaction with Tribes and tribal communities on climate issues. We sought broader participation from the federal treaty partners beyond only the Bureau of Indian Affairs, and proposed a series of comments and recommendations which made it into the Proceedings of the Northern Great Plains Regional Workshop (1998). We personally committed to a year-long run of activities supported by NASA aimed at attending as many of the remaining USGCRP regional workshops as possible, alerting Tribes and indigenous groups about the growing climate crisis and urging participation in both the remaining regional meetings and in the first NPNH gathering to be held at the end of October 1998, designated as the twentieth (and last) of the "regional workshops" of the U.S. Global Change Program series. Our "region" was Indian Country, encompassing virtually all of North America, where tribal communities could be found. Tribes -- lodged in the Rocky



Bob Gough, 1998 NPNH 1 Workshop Co-chair

Mountains and along the Gulf Coast; along the New England seacoasts, the Pacific Northwest and throughout Alaska, surrounding the Great Lakes, across the Great Plains, and in the desert Southwest – are as variable as they are vulnerable to the consequences of a warming planet. The gathering in Albuquerque was no small accomplishment and its proceedings can be found at:

<http://www.usgcrp.gov/usgcrp/Library/nationalassessment/native.pdf>

NPNH I helped tribal communities better understand the scientific explanations for changes, while often holding traditional cultural beliefs and understandings that can surpass the culturally bound mainstream beliefs in human superiority, our dependence upon technology and at times an apparent willful blindness to the consequences our actions and activities are having upon the very fabric of the long evolved ecosystems which have nourished and support life on this planet

During the planning of NPNH II, Pat Spears and I were engaged in a training program in building a demonstration high-performance straw bale house on the Sinte Gleska University campus on the Rosebud, where faculty from six tribal colleges worked with students over the summer to construct a two-bedroom home that would use 70% less energy to heat and cool. The passive, straw bale insulated house is one example of a hopeful strategy for an adaptive path for all peoples in the Great Plains, and one that can help bring resolution to some of the current crises in Indian Country, ranging from climate, energy, housing, health and unemployment.

Pat always emphasized the need to address not only how we can contribute to a sustainable economy for our children and communities, but also how we can contribute to the overall restoration of the Earth. When the call went out to convene Native Peoples, Native Homelands II, tribal colleges were the primary focus, with students and faculty making up a good portion of the 400+ participants. We reached out to over 30 tribal colleges and universities in the hope that our tribal youth could harness both the traditional and contemporary tribal values along with the necessary scientific skills and training to be of service to their communities, for theirs is the monumental task of identifying the vulnerabilities threatening cultural sustainability and survival. They must build the capacity to promote community resilience in the face of the new normals already loaded in the climate pipeline for decades to come.

At the close of those same six decades, my Kola and Partner on the COUP Trail for over twenty year began this journey in this life on the last weekend in June 2012, as a derecho, swept through DC. This fast-moving, long-lived, large and powerful thunderstorm complex, reminded many in our Nation's capital, as Pat did, of the many on this Planet who lack the technological advances that surround and comfort us and that our over-dependence on such technology will ultimately not shield us from the Natural Forces that abound on this Planet. It has been my honor to work with many fine people on issues of water, energy, indigenous rights, climate and environmental protection and restoration. As the visionary Pierre Teilhard de Chardin once said: "The future belongs to those who give the next generation reason for hope." Few had higher hopes for the indigenous peoples of this land. None will I miss more than my Kola Pat Spears.

*Wopila Kola Pat! I honor your spirit in this work we have done.
Hecel Lena Oyate Ki. Nipi Kte! -- So That the People May Live!*





BACKGROUND INFORMATION & CONTEXT FOR WORKSHOP DISCUSSIONS

NATIVE PEOPLES - NATIVE HOMELANDS – THE NAME

The term “Native” was deliberately chosen to use in the title “Native Peoples-Native Homelands Climate Change Workshop.” While American Indians and Alaska Natives are the largest and perhaps most widely recognized indigenous people living in North America, they are not the only indigenous people with geographic and political ties to traditional homelands within the political sphere of the United States of America, and thus, within the scope of the National Assessment on Climate Change. Although this Workshop pays particular attention to the issues raised by American Indians in Indian Country and Alaska Natives, it does so to highlight the nature of concerns and opportunities originating throughout indigenous America, so as not to exclude other participating indigenous groups, such as Native Hawaiian and various Caribbean or Pacific Islanders whose histories, cultures and climatic risk warrant thoughtful consideration in the National Assessment.

Native Peoples

Native Peoples, encompassing American Indians and the indigenous peoples of Alaska, Hawaii, and the Pacific and Caribbean Islands, currently comprise almost 1% of the US population. Another 0.7 percent of the population are those who reported a combination of races (e.g., Native American plus another race or races). A total of both American Indians and Native Alaskans alone or in combination is 1.7% of the population. (2010 Census Brief: Overview of Race and Hispanic Origin, Table 3.) Formal Tribal enrollments total approximately two million individuals, of which more than half live on or adjacent to hundreds of reservations throughout the country, while the rest live in cities, suburbs, and small rural communities outside the boundaries of reservations. The federal government recognizes the unique status of more than 566 Tribal and Alaska Native governments as “domestic dependent nations.” <http://www.bia.gov/WhatWeDo/index.htm> OR <http://www.bia.gov/FAQs/index.htm> The relationships between tribes and the federal government are determined by treaties, executive orders, Tribal legislation, acts of Congress, and decisions of the federal courts. These actions cover a range of issues that will be important in adapting to climate change, from responsibilities and governance to use and maintenance of land and water resources.

The number of Native Americans and Native Alaskans depends on the definition that is used. As a result, the number of those counted as Native Americans and Native Alaskans can vary based on differences, and even changes in federal, Tribal, and state legislation, and the policies of governments at several levels. For example, the U.S. Bureau of the Census counts as American Indian anyone who identifies him or herself as such. As in asking about other ancestral connections, census enumerators require no proof of Indian identity. Thus, census data include individuals who may identify themselves culturally and socially as American Indian, but who are not formally enrolled as a member of a particular tribe. As a result, the census produces a comparatively high count of the number of American Indian people in the United States (U.S. Bureau of the Census, 2010). The Bureau of Indian Affairs (BIA), on the other hand, counts only individuals with a sufficient blood quantum of 25% or more and who are officially enrolled as members of federally recognized tribes.

Each tribe has the right to establish its own criteria for enrollment. Most tribes require that a certain percentage of the individual’s ancestors must have been members of that tribe. Some tribes recognize only affiliation through one parent’s family. Still other tribes have residency requirements indicating that the individual must live on the tribe’s reservation for a specified number of years. In the latest BIA report, “American Indian Population and Labor Force” (2005), the total number of enrolled members of

the (then) 561 federally recognized tribes was shown to be less than half the Census number, or 1,978,059 (Bureau of Indian Affairs, 1996; <http://www.bia.gov/FAQs/index.htm>) thus yields a lower number of American Indians. As a further complication, some tribes are recognized by state governments, but not by the Bureau of Indian Affairs (e.g., the Lumbee of North Carolina). Members of these tribes are, therefore, recognized as Indian by some levels and agencies of government, but not by others. Periodically, a tribe may succeed in completing the BIA's rigorous process for obtaining federal recognition, thus increasing the number of Indian people recognized as such by the Department of the Interior. Further, descendants of the original inhabitants of the Hawaiian Islands have, using the Department of the Interior's own criteria, made credible claim for federal recognition as Native Americans (Bordewich, 1996).

The presence of non-Native Americans on reservation lands was largely prevented until passage by the Congress in 1887 of the Dawes Severalty Act, commonly called the Allotment Act. Prior to this law, reservation lands were held corporately by an entire tribe and no particular individual held title to any particular tract of land. Furthermore, no outsiders, except government officials and soldiers, were permitted to live within reservation borders. The Allotment Act, however, mandated that each member of a tribe receive an individual allotment of land. The allotments varied in size from 80 to 1,040 acres, depending on the particular reservation. After each head of household and family member had received an allotment, the remaining unassigned lands within the boundaries of each reservation could be opened to non-Indian homesteaders.¹ These settlers were granted clear title to the lands on which they settled if they fulfilled the normal conditions of homesteading. Land that was conveyed in this way to homesteaders was simply subtracted from the total lands that had been originally reserved for the tribe. As a result, until the passage of the Indian Reorganization Act in 1934, significant amounts of reservation lands passed out of Indian ownership even though they were within the original boundaries of reservation.

Native Homelands

Tribal land holdings in the 48 contiguous states currently total about 56 million acres, or about 3% of the land. Additionally, Alaska Native corporations hold approximately 44 million acres of land. Despite the relatively extensive total land holdings, most individual reservations are small, supporting communities with populations of less than 2,000. Larger reservation populations are exceptional, but range as high as 200,000 people living on the Navajo Reservation. The geographic distribution of American Indian and Native Alaskans are concentrated in the West with 41 percent of the American Indian and Alaska Native alone-or-in-combination population. The second-largest proportion is the South, then the Midwest and the Northeast. (2010 Census Brief, "The American Indian and Alaska Native Population: 2010").

The federal government has recognized that tribes and Tribal governments also have legal rights in territories that lie beyond the boundaries of their respective reservations. For example, treaties in the Pacific Northwest and the north-central states of Minnesota, Wisconsin, and Michigan recognize rights of tribes to fish, hunt, and gather off-reservation. Further, federal legislation has recognized Tribal interests in historical and cultural interest areas beyond reservation boundaries. These interest areas cover a significant fraction of the 48 contiguous states, generally matching the “Native Homelands” that Native Peoples inhabited prior to or since European settlement.

With the beginning of clearly observable climate change, and because of the relationships of plants, water, and migrating wildlife with ecosystems outside reservation boundaries, the potential consequences of climate change create significant interest among Native Peoples. These interests arise because the consequences will affect both their reservation lands and the much larger land areas encompassed in the concept of Native Homelands. While each tribe will face its own challenges, this workshop focused on a few general issues facing large numbers of Native Peoples, particularly American Indians. More region-specific issues are covered in the various regional sections of the assessment report, notably in those dealing with the Northwest, Alaska, and the Pacific and Caribbean Islands.

Note: More data on American Indian and Alaska Native populations can be found on <http://factfinder.census.gov/home/aian/index.html> (Census Bureau Guide, "A Compass for Understanding and Using American Community Survey Data: What Users of Data for American Indians and Alaska Natives Need to Know, October 2009.)

1 Many tribes were able to avoid the allotment of Tribal lands. The reservations of the Red Lake Chippewa in Minnesota, the Menominee Nation of Wisconsin, several Pueblo tribes and a large portion of the Navajo Nation remain undivided and intact within their original borders.

INTRODUCTION AND BACKGROUND INFORMATION

U.S. NATIONAL ASSESSMENT

Initial Testimony of Frank Ettawageshik
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Reprinted from the USGCRP "Background Information" for the Climate Change Impact on the United States called for by a 1990 law, U.S. National Assessment Coordination Office, available at <http://www.globalchange.gov/publications/reports/scientific-assessments/first-national-assessment>

Why a National Assessment?

To Prepare the Nation for Future Change: To assure that the United States is prepared for future change, the United States Global Change Research Program (USGCRP) initiated a national assessment on the potential consequences of climate variability and change for the nation. The national assessment process analyzed and evaluated what is known about the potential consequences of climate variability and change for the nation, in the context of other pressures on the public, the environment, and the nation's resources.

Responsive to Congressional Needs: The USGCRP is mandated by statute with the responsibility to undertake scientific assessments of the potential consequences of global change for the United States in the "Global Change Research Act of 1990" (P.L. 101-606), which states the federal interagency committee for global change research of the National Science and Technology Council "shall prepare and submit to the President and the Congress an assessment which –

- integrates, evaluates, and interprets the findings of the Program and discusses the scientific uncertainties associated with such findings;
- analyzes the effects of global change on the natural environment, agriculture, energy production and use, land and water resources, transportation, human health and welfare, human social systems, and biological diversity; and
- analyzes current trends in global change, both human-induced and natural, and projects major trends for the subsequent 25 to 100 years."

Providing Input Into the Intergovernmental Panel on Climate Change: The [first] national assessment was timed to provide input to the Third Assessment Report of the UNEP/WMO Intergovernmental Panel on Climate Change (IPCC), which has been working to integrate more regional detail into its analyses.

Involving Stakeholders from a Broad Spectrum of Society: The national assessment process has involved a broad spectrum of stakeholders from state, local, Tribal, and Federal governments; business; labor; academia; non-profit organizations; and the general public.

Linking Scientists and Stakeholders: The assessment is linking research by scientists to specific needs of the stakeholders; and is providing planners, managers, organizations, and the public with the information needed to increase resilience to climate variability and cope with climate change.

Scientific Excellence Combined with an Open and Participatory Approach: The national assessment has been founded on the principles of scientific excellence and openness, and will be integrative and iterative.

To help prepare the nation for climate variability and change, the USGCRP, in cooperation with the Office of Science and Technology Policy (OSTP), has engaged in a comprehensive planning effort to implement a national assessment process. These efforts began in early 1997 with a series of regional workshops, and have included a National Forum, intensive sessions of team leaders and advisory bodies, and extensive discussions among federal agencies, the science community, stakeholder communities, and the interagency committee for global change research. A high priority was placed on the process of engaging a network of stakeholders in a dialogue about vulnerabilities and coping mechanisms. The goal was to begin a two way process of interaction: scientists gain input from the stakeholders about their information needs, and the stakeholders learn from the scientists about climate change projections, and possible consequences in the region.

The U. S. National Assessment & Native Peoples and Native Homelands

In the late 1990s, the planning efforts resulted in the first comprehensive “National Assessment of the Potential Consequences of Climate Variability and Change in the United States.” Between 2004 and 2009, the Climate Change Science Program (CCSP), which incorporated the USGCRP, produced a series of 21 reports called Synthesis and Assessment Products (SAPs) all of which addressed critical aspects of climate change in the United States. One of the most significant documents produced by the USGCRP, “Climate Change Impacts on the United States: The Potential Consequences of Climate Variability and Change” (The Foundation Report), provided the scientific underpinnings for all aspects of the US National Climate Assessment in 2001. This document is of special significance for Native peoples because a full chapter in that report is devoted to “Potential Consequences of Climate Variability and Change for Native Peoples and Homelands,” which was based upon the discussions which took place at the Native Peoples Native Homelands Climate Change Workshop in 1998. (Houser et al, 2001).

The second Native Peoples Native Homelands workshop in 2009 was designed to contribute new and updated information to the U.S. National Assessment process and to the international climate assessments and discussions on the impacts of climate change and extreme weather on Native Peoples and their homelands and to propose strategies for addressing the impacts of these changes. It is clear that some of the discussions which took place at the NP/NH workshop laid the groundwork for direct contribution to the new U.S National Climate Assessment – to be published in 2014 - because it includes an entire chapter in the new assessment on “Indigenous Peoples, Lands, and Resources.” Furthermore, the “Mystic Lake Declaration,” written by workshop participants, promoting a more sustainable world using indigenous science and knowledge, was officially presented 2 weeks after the workshop at a key UN climate change conference of world leaders from more than 190 countries in Copenhagen, Denmark, “the 15th Sessions of the Conference of the Parties to the UN Framework Convention on Climate Change.”

Reprinted from Chapter 12 of Climate Change Impacts on the United States: The Potential Consequences of Climate Variability and Change, Houser et al (2001).

Over the last 500 years, essential environmental balances that had sustained Native peoples in North America for many millennia began to rapidly shift. Forests were cut for homesteads and farming. Alien plants displaced grasslands. Dry lands flooded, rivers changed their courses, and ponds and swamps drained away as watercourses were dammed and channeled. Important providers of nourishment and protection – buffalo, salmon, eagle, wolf, and shad – were pushed to near extinction. New and strange creatures – horse, cow, pig, sheep, and pheasant – shoved aside indigenous species and came to dominate local economies. Exotic new diseases eradicated whole villages. Tribal social, political, cultural, and spiritual relationships throughout entire regions collapsed. Spiritual leaders lost their followers. Communities – even entire Tribal nations – were extinguished or forced to relocate.

Five hundred years ago, the population of Native peoples in North America is thought to have ranged between about 10 and 18 million. By 1890, the population of Native peoples on the continent had dropped to only 228,000 and was declining at an average rate of between 500,000 and 850,000 individuals each 20-year generation between 1500 and 1890 (Snipp, 1991). Some thoughtful leaders predicted that Native people would soon disappear. However, those who predicted the ‘vanishing of the Red Man’ substantially underestimated the endurance and adaptability of Native peoples, and the strength of Native perspectives and values. Over the last 100 years, the population of Native peoples has grown almost ten-fold as Native communities have been rebuilt, artists and craft workers and writers have created a renaissance of beauty and meaning, and economic development has accelerated (Cornell, 1998). The environmental changes that drastically altered the lives and circumstances of Native peoples as a whole between 1492 and the present did not arise from changes in the global climate, although there were some influences at the regional level. However, as Native peoples were displaced and national development occurred (Brown, 1991), Native peoples experienced continental-scale changes in their surroundings that are not unlike the types of changes that all Americans, indeed, all peoples may face in coming decades. The changes were substantial in magnitude, surprising in their occurrence, unmanageable by available technologies and existing forms of government, and irreversible. In those respects, the changes may provide insights of the kinds of transformations – cultural, economic, and social – that global changes in climate may bring, both for Native peoples and for America as a whole.

Reprinted from Chapter 12 of Climate Change Impacts on the United States: The Potential Consequences of Climate Variability and Change, Houser et al (2001).

The lands held by Native peoples are extensive. In addition to the 40 million acres of land held by Alaska Natives, Tribal lands in the rest of the US currently total about 56 million acres (Department of the Interior, 1996). The lands outside Alaska amount to about 3% of the land area of the 48 contiguous states, or approximately the size of the state of Minnesota. The largest portion of Indian lands are held on reservations, so named because they consist of lands that were reserved for the sole use and occupancy of Indian peoples from the vast expanses of land which were ceded to the United States government (Brown, 1991). Property ownership by Native peoples of the Pacific and Caribbean islands varies greatly because of the variety of situations, including traditional rights and historical legal rights. As indicated in the Islands chapter, however, on some islands lands are overseen by clans with responsibility for stewardship on behalf of their members whereas on other islands there are no longer reserved land rights.

By far the majority of reservations are small, both geographically and demographically, with populations less than 2,000 (Tiller, 1996). These lands, although they are owned by tribes or individual Indian people, are held in trust for the owners by the Federal Government, in the same way that a trustee might hold property for an heir until that individual comes of age and can take personal management of the property. One result of this system of trusteeship is that tribes and individual Indian people have had very limited control over the use, environmental management, or profits of their own lands. For much of the 20th century, in fact, many of the decisions over these matters rested with the Federal Government, not with the tribes themselves. Only in the last several decades have Tribal governments taken over more control of and responsibility for their lands.

From the most basic perspectives of the American legal system, reservations may be viewed as jurisdictional islands, largely exempt from the laws of the states that surround them due to the fact that the federal trust relationship preempts state law, unless states have been specifically delegated governmental authority by Congress. Tribal governments hold the authority within the reservations to levy taxes, regulate commerce, pass and enforce civil and criminal codes and, in principle, regulate the use of Tribal lands and water. While federal laws prevail, state authorities generally have no rights of enforcement within these jurisdictional islands.

However, from the perspective of Tribal environmental and land management policies and practices, the paradigm of reservations as islands is inadequate. First, the paradigm is inadequate environmentally because these 'islands' are surrounded not by oceans, but by land, and so these lands are intimately tied to the forests, grasslands, watersheds, and other ecosystems surrounding them; thus, the changes on Native and surrounding lands will be closely coupled. Second, because many reservations have considerable populations of non-Indians residing within the exterior borders of reservations the paradigm is inadequate administratively. Third, throughout the country, non-Indians also work on Indian lands because of the leasing of Tribal lands to non-Indian farmers and ranchers – or, in the case of Agua Caliente, near Palm Springs, California, for example, for commercial development. The leasing of reservation lands is a long-standing practice and a vital source of income to the Indian landowners (Lawson, 1982). Complicating matters further, a major portion of the lands that were allotted to Indian heads of household are now managed either by the BIA or by the appropriate Tribal government. This land is also frequently leased to non-Indian farmers or ranchers with the proceeds from the leases then being divided among the descendants of the original allottee. Maps of land ownership and Tribal jurisdiction on many individual reservations thus resemble checkerboards, greatly complicating planning efforts.

At the same time, judicial decisions have sharply limited the jurisdiction of Tribal governments and Tribal courts over the activities of non-Indians.

As a result, many tribes face severe legal difficulties in creating or enforcing comprehensive plans for land and natural resource management, a situation that will complicate planning for climate change. For example, if a Tribal government creates an environmental code, enforcement over an entire watershed or forest may be impossible without the voluntary consent of non-Indian owners of property within and outside of reservation boundaries. If a tribe leases cropland, grazing rights, or timber to non-Indians, environmental regulations can conceivably be written into the terms of the leases, although long-term traditions are likely to be difficult to change and the practical job of enforcing new regulations is likely to stretch the resources of small and understaffed Tribal governments (Getches, 1998; Pevar, 1992).

Tribal governments also have some legal rights in lands beyond the boundaries of reservations – rights that may establish precedents for collaboration on issues involving climate and environmental changes. For example, the Federal Government has recognized historical and cultural interests of tribes and Tribal governments in broader regions, often called “Native Homelands,” which include lands occupied by Native peoples at present or in the past. Within the pre-determined boundaries of historical and cultural interest areas (generally homeland areas inhabited by a particular Native people prior to contact with Europeans), tribes are entitled, for example, to establish claims to human remains if evidence of kinship or ancestry can be established. These historical and cultural interest areas cover a significant fraction of the 48 contiguous states widening greatly the areas of interests of Native peoples.

Reprinted from Chapter 12 of Climate Change Impacts on the United States: The Potential Consequences of Climate Variability and Change, Houser et al (2001).

Native homelands are present in all of the major ecosystems across the US, including the unique environments represented by Alaska and the islands of the Pacific and Caribbean regions, and Native peoples have been experiencing the vagaries of climate on this continent for many thousands of years. The resource-rich environments created by the woodlands of the northeastern, southeastern, and Great Lakes regions, especially the presence of deer, rabbit, beaver, fish, berries, and many other resources, allowed tribes to occupy particular regions for long periods through the establishment of villages. The Great Plains provided a source of buffalo, deer, berries, and grains, along with fish and other resources, but the wide range of climate extremes, the migration of the herds and differential availability of plant resources, caused these tribes to need to be relatively mobile in order to survive. The western US provided a wide array of environments, from coastlines to mountains and river valleys to deserts, and are now home to the greatest number of Indian reservations. The Native peoples of Alaska have developed a lifestyle that depends, in large part, on there being very cold winters. Those living on islands depend on the reliability of the rains, being adversely affected by both too much and too little precipitation.

These adaptations, and the histories of the experiences and the lessons that have been learned about coping with climate fluctuations, have sustained Native cultures through many generations. Native oral histories are now being linked with past climate data derived from tree rings and other sources in ways that enrich our understanding of past climatic conditions. Oral histories often correlate with events identified in the geological record, such as periods with high or low rainfall, periods of warm or cold winters, and periods of flooding or drought (e. g., Deloria, 1997). What makes these histories especially valuable is that they often record not only the consequences of these climate fluctuations for people and for the environment around them, but also the responses that helped the communities to adjust and survive. Thus, where elements of traditional culture are still strong, the retelling of these events by Tribal elders over generations has created a populace that is relatively well informed about how to adapt and is generally well prepared to accept that extreme climate fluctuations are likely to recur.

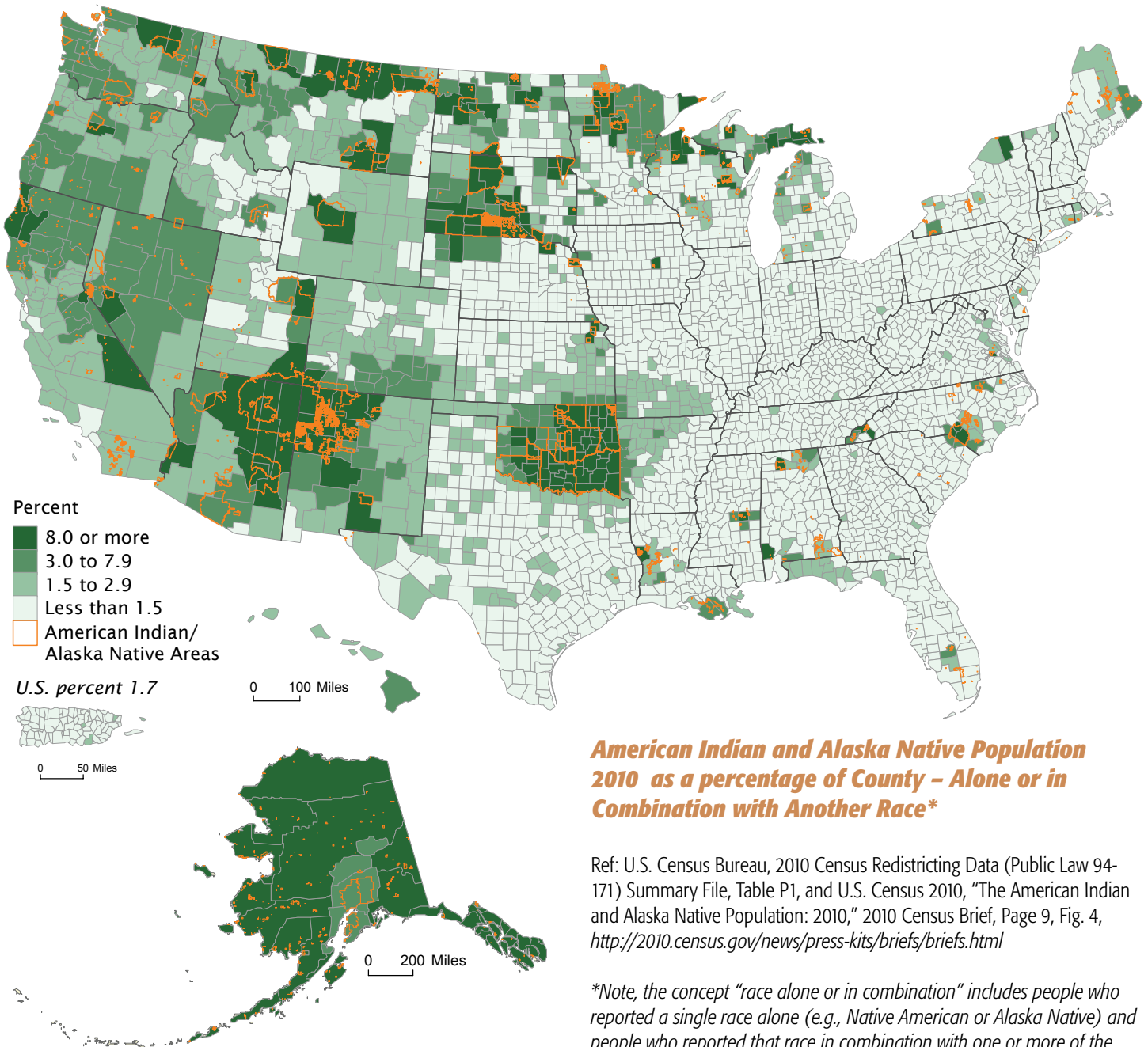
There is, however, one key change that will limit the application of some of the lessons to the issue of climate change and is likely to create greater vulnerability than in the past. Earlier coping strategies of Native peoples, on which many of their histories and traditions are based, relied on shifting and moving, sometimes from one food source to another, sometimes from one place to another, or sometimes to find alternative sources of food and water or to intersect with the annual migrations of wildlife. In the Southwest, archeological evidence and Native oral histories indicate that the great regional drought of the 13th century caused the ancestral Pueblo People to abandon their permanent homes in the mesas and valleys of marginal areas. When the ability to cope in one place was exceeded, Native peoples moved, later returning if and when climate permitted.

Over recent decades, Native peoples have been observing that changes in the environment have been occurring, some due to regional to global-scale changes in the climate and some due to changing practices of land management and use. These changes are indicated as much by how Native peoples are changing their practices as by observations of the changes themselves. In north-western Alaska, for example, elders lament that winter temperatures have become so warm (now typically only -20°F instead of -70°F) that the traditional ecosystem on which they have depended for generations is deteriorating and is no longer able to provide the needed resources. In the Southwest, recollections by elders (corroborated by Army records from the early 1800s) are of valleys full of tall sacaton grasslands, whereas the region now is scarred by deep arroyos and supports only sparse vegetation, likely as a result of overgrazing and subsequent drought. All across North America, Tribal histories indicate that change is occurring. Native peoples today feel increasingly vulnerable to significant environmental changes because they are no longer able to cope easily with changes by relocating. Few contemporary tribes can afford the purchase of large tracts of new land, and federal laws

hinder the transfer or expansion of Tribal jurisdiction. Tribes therefore see their traditional cultures directly endangered by the magnitude of the projected climate change. Had the ancient Anasazi been compelled to remain in place, the culture and way of life of an indigenous people that can be traced back thousands of years would likely have been lost forever. This history provides a context for thinking about the potential consequences of future changes in the climate.



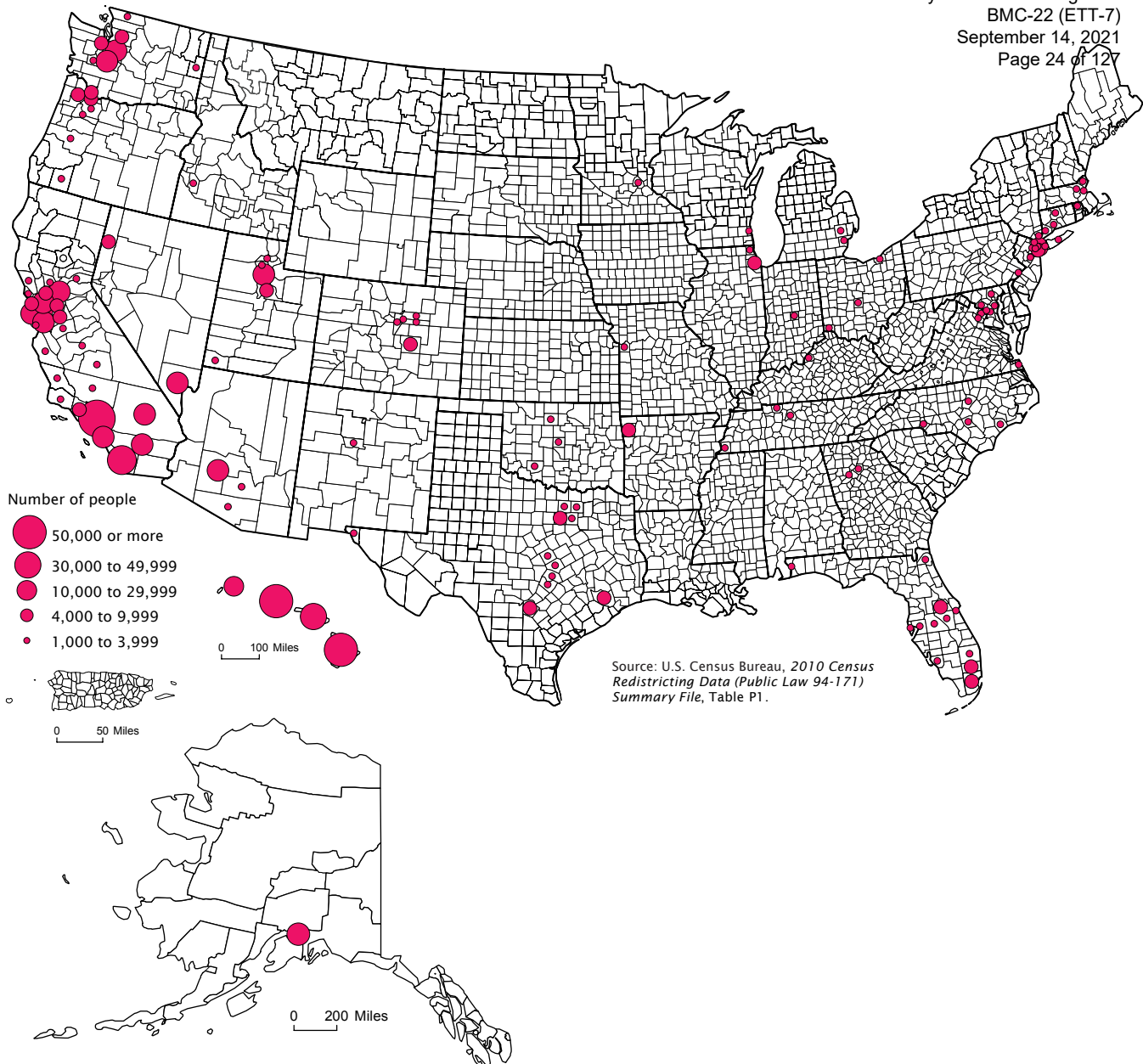
MAPS



American Indian and Alaska Native Population 2010 as a percentage of County – Alone or in Combination with Another Race*

Ref: U.S. Census Bureau, 2010 Census Redistricting Data (Public Law 94-171) Summary File, Table P1, and U.S. Census 2010, "The American Indian and Alaska Native Population: 2010," 2010 Census Brief, Page 9, Fig. 4, <http://2010.census.gov/news/press-kits/briefs/briefs.html>

**Note, the concept "race alone or in combination" includes people who reported a single race alone (e.g., Native American or Alaska Native) and people who reported that race in combination with one or more of the other major race groups. The concept "race alone or in combination," therefore, represents the maximum number of people who reported as that major race group, either alone, or in combination with another race(s).*



Native Hawaiian and Other Pacific Islander Alone or in Combination by County: 2010

Counties with a Native Hawaiian and Other Pacific Islander population of at least 1,000 are included in the map. For information on confidentiality protection, nonsampling error, and definitions, see www.census.gov/news/prod/cen2010/doc/pl94-171.pdf

* The concept "race alone or in combination" includes people who reported a single race alone (e.g., Native American or Alaska Native) and people who reported that race in combination with one or more of the other major race groups. The concept "race alone or in combination," therefore, represents the maximum number of people who reported as that major race group, either alone, or in combination with another race(s).



WORKSHOP FORMAT

The Native Peoples-Native Homelands Climate Change Workshop II was designed to significantly increase the Native stakeholder contribution to the ongoing US National Climate Assessment process and discussions, by bringing together Native expertise and information from across the entire United States and various Pacific and Caribbean Islands.

Plenary & Breakout Sessions

During the workshop, participants met in frequent plenary sessions for discussions of matters of general applicability as well as in breakout sessions organized by both geographic regions and issue areas. The geographic regions selected were the same regions designated by the US National Climate Assessment so that the observations and information from this workshop could be easily utilized by future US National Assessments. Due to the fact that this workshop attracted primarily Native participants from only several of the US Assessment major regions in the US, the breakout groups combined a number of the regions in several cases for efficiency of discussions. The primary issue area breakout groups were: water resources, food production, sacred sites, protection of habitats, clean energy (solar, wind), transportation, housing and sustainable community development, and education and training.

Discussions were focused around 4 questions:

1. What are the current stresses and concerns in tribal and Native lands across the country?
2. How might climate variability and change impact these stresses?
3. What kinds of coping options and adaptation strategies are available?
4. What is needed in your region to implement these coping and adaptation strategies?

White House “Listening Session”

A special White House “Listening Session” was conducted as a follow-up to the White House Tribal Summit in November of 2009 to hear the direct experiences of Native Peoples disproportionately suffering the adverse effects of climate change. Three representatives of the White House Council on Environmental Quality (CEQ) listened to the concerns of a large number of attendees, which ranged from sustainable housing and energy to indigenous food production to federal policies and adaptation strategies.

“Mystic Lake Declaration”

Throughout the workshop, many of the attendees also participated in the collaborative production of a powerful, unified document, the “Mystic Lake Declaration”, to offer indigenous perspectives and solutions that can help tribal communities and policy makers formulate plans to address growing climate change impacts that severely threaten the traditional cultures and life ways of indigenous peoples. The Declaration, released on the last day of the workshop, was formally presented two weeks later to a key meeting of world leaders from more than 190 countries on climate change at the 2009 UN Climate Change Conference in Copenhagen, Denmark.

The results of these meetings, discussions, and writing sessions are summarized in the following pages.



AN ALASKAN PERSPECTIVE

"CLIMATE CHANGE IMPACTS IN THE ARCTIC" – CAPTAIN EUGENE BROWER



"I appreciate the opportunity to speak with you today. It means a lot to me and to the people I represent, because it gives us a chance to share an Arctic Alaska Native perspective that you might not hear very often. And it allows me to tell you about our experiences as observers and stewards of the environment along the northern coast of Alaska, which is the story of traditional Inupiat Eskimo knowledge and western scientific knowledge coming together to inform public policy."

Captain Eugene Brower

Captain Eugene Brower has an extensive background in subsistence whaling and, because of this experience, was appointed to the US Delegation to the International Whaling Commission (IWC) on which he has served for many years.

I appreciate the opportunity to speak with you today. It means a lot to me and to the people I represent because it gives us a chance to share an Arctic Alaska Native perspective that you might not hear very often. And it allows me to tell you about our experiences as observers and stewards of the environment along the northern coast of Alaska, which is the story of traditional Inupiat Eskimo knowledge and western scientific knowledge coming together to inform public policy.

Briefly regarding my background, I was born in Barrow Alaska to the late Harry and Annie Brower Sr. in 1948. Harry and Annie had ten children. I was raised 40 miles south of Barrow along the Inaru River in a sod home living a subsistence lifestyle. Four other families lived in the area. Subsistence hunting and fishing followed a seasonal cycle; it was a hard but satisfying life. In the mid-1950s the Federal Government required compulsory education for all Alaskans. The family moved to Barrow when I was around seven years old, so I and my siblings could get an education. My father supported his family by continually going out hunting marine mammals, hunting and trapping and generally living off the land and rivers.

Since there were no high schools in Barrow, I went 1000 miles south to the Mt. Edgecumbe boarding school in Sitka, Alaska. After finishing high school in 1967, I went on to Haskell Institute, now known as Haskell Indian Nations University. I majored in electronics and graduated in 1969 and went to work for Argonne National Laboratories in Idaho Falls, Idaho. After a short time I returned home to Barrow and went to work for FAA as an electronic technician in 1970 and worked until fall of 1975 when I went to work for the newly formed North Slope Borough as a heavy equipment operator. I quickly rose in different positions within the Borough and was elected Mayor in 1981. I went on to work for different construction companies then returned back to work for the North Slope Borough to the Fire Department. I again worked up through the ranks to become Fire Chief until I retired in 2005.

I have been a subsistence hunter all my life. Starting at the age of eight, I joined my father's whaling crew and had to learn all aspects of whaling: sea ice formations and movements, sea currents, whale behavior, mushing, and many other things. My Captain and co-captain grilled me each whaling season asking if I remembered what I had been taught the year before. Whaling is learned by seeing and doing. Because of my background in subsistence whaling, I was appointed to the US Delegation to the International Whaling Commission (IWC) and have served for many years.

Let me start with some quick background about the Inupiat Eskimo people and the North Slope Borough for many of you here today who I'm guessing are not very familiar with northern Alaska. Then, I'll talk about our local observations with respect to climate change. Finally, I'll talk about the need for interaction between western researchers and local people to work together now that scientific and public attention is focused on the Arctic; and I'll give some concluding statements.

As most of you know, the Inupiat have lived along the Arctic coast for thousands of years. Nobody told my ancestors about the four basic food groups – the ones we learned about as kids in school. Three of those food groups were tough to find in the Arctic – dairy, grains, and fruits and vegetables. For the Inupiat, survival depended almost entirely on the nutritional value of bowhead whales, caribou, fish, migratory birds and other wildlife. So our people became keen observers of the natural world in the far north. From generation to generation, they handed down all kinds of practical information about the habits and migratory patterns of the animals that sustained them. They witnessed the effects of unusual weather or shifting ice conditions and variations in snowfall or temperature over the years, and they passed it on to the young people.

As some of you may know, the North Slope Borough is the largest municipality in the United States, in terms of landmass. It was established as a first class borough in 1972 and a Home Rule Charter was adopted in 1974. The Borough is the regional government

for the eight villages within the 89,000 square miles of northern Alaska, from the Brooks Mountain Range north to the Arctic Ocean. The populations of our villages range from 260 in Pt. Lay to about 4,500 in Barrow. In total we have approximately 7,500 residents, of which 70 percent are Inupiat.

Oil and gas resource development projects are the greatest source of property tax revenues for my region. With these revenues, the Borough has provided many services to our residents that had been taken for granted in most areas of the country and in urban Alaska for decades, if not longer. These include improvements in sanitation, water and sewer systems, education, public safety, and health and cultural services. In addition to providing public services and jobs, the Borough has always taken on as a primary responsibility the protection of our subsistence resources, their habitats, and the traditional Inupiat way of life.

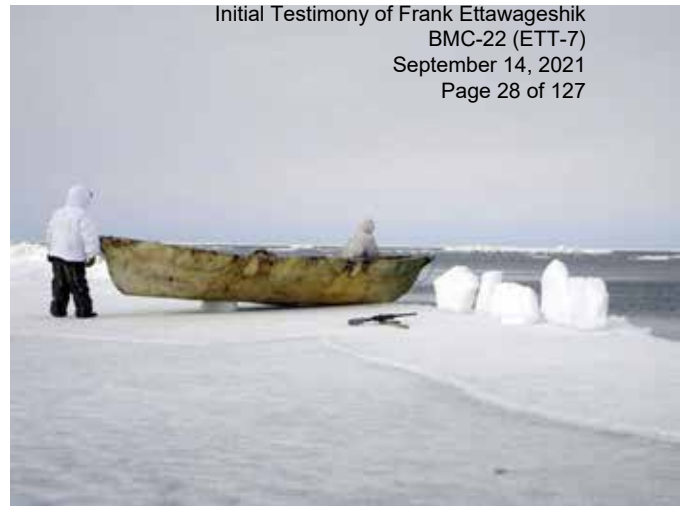
The practical environmental knowledge I spoke of earlier has merged with our cultural practices through the centuries to create a different sort of management plan – a set of rules that reflect both science and spirituality. It really shouldn't even be called 'management', because that suggests that humans are in control. Stewardship of the environment is built into our culture, because for centuries we were almost entirely dependent on wildlife for food and clothing. The original Inupiat environmentalism had its roots in a spiritual connection to the animals our ancestors hunted. Because of this profound connection, our hunters observed the animals very closely and developed an environmental knowledge that passed from generation to generation. Traditional Eskimo belief regards the wildlife as our equals and as partners in the hunt, because they give themselves to us. So hunting is not just a harvest, it's a relationship of respect between the hunter and the hunted. Our subsistence practices are based on centuries of careful observation and a profound appreciation for the animals and the natural forces that have allowed our people to survive in one of the toughest places on earth.

This is fundamentally different from western science. As you know, western science gets its authority by being detached and observational. On the other hand, traditional knowledge is engaged and participatory. It contains information that is useful to western science, but it is actively connected to our cultural values.

This difference has made it difficult for scientists to figure out how to make use of indigenous knowledge. And the detachment of western science made it difficult for Native people to appreciate the useful applications of science in our world.

But western science and traditional Native knowledge have important similarities. When it comes to wildlife management, western science is based on the principle that wildlife should be available for future generations. That's why scientists study these various animal species. Traditional Native knowledge has the same motivation. Protection is the underlying value in both cultures, and that is where we come together.

Sometimes it's also where we split apart. In 1977, the International Whaling Commission declared a moratorium on aboriginal subsistence hunting of bowhead whales. I'm sure you can imagine how that news was received by our people. If you want to start a war in Eskimo country, just tell people they can't go whaling. The IWC's decision was based on the best available scientific estimates of the size and health of the bowhead whale population. The problem is those estimates weren't very good, because very little scientific research had been done on the bowhead. The observations of our whalers suggested that the IWC's population estimates were way too low.



At the same time, our harvest levels in the late 1970s were pretty high by local historical standards, so there was a legitimate reason to take a hard look at the long-term health of the herd. But we had no formal, ongoing communication with the scientific community, so there was no way to bring together these two different ways of understanding and interpreting knowledge.

That 1977 bowhead harvest crisis was a real turning point for science, for policymaking and for cross-cultural communication in the Arctic. It led to international acceptance of a unique management agreement between the federal government and the Alaska Native whaling community. The Alaska Eskimo Whaling Commission – AEWC – was formed as a vehicle for local management of the aboriginal hunt by the whalers themselves. The International Whaling Commission established a quota system, and the AEWC monitored the hunt and enforced the quota.

It was a very smart solution. As whaling captains, we knew that if we didn't do the job right, the feds would be forced to take over the program. The feds supported this self-management plan because they didn't particularly want to manage the hunt along 1,000 miles of ice-infested coastline. And the IWC accepted the arrangement as long as the federal government took ultimate responsibility for it.

That experience was a real wake-up call for us. It convinced us that we had to begin talking to the international community in a language it understood and accepted – the language of science. So the North Slope Borough established a Department of Wildlife Management and hired biologists to gather data and conduct research on the wildlife populations in our region. We partnered with the federal and state governments whenever possible, and we took responsibility for building a scientific record that has attracted the respect of the international policymaking community.

At the same time, we encouraged our scientists to talk to local Native experts – the people who had been tracking animal behavior, climate change, and other natural phenomena for years. At first, the scientists and the local experts didn't quite know what to make of each other. There was suspicion on the part of local people, and confusion on the part of scientists. But because the scientists lived in the community and took the time to get to know the hunters as people – not just as scientific informants – they gradually became accepted in the community. The same biologists kept showing up at fish camps and whale landings, and after a while the hunters realized that our biologists were serious about life in the Arctic – they weren't just passing through and taking notes – and over time a mutual respect evolved.

That's one of the most important things I can tell you about doing science in Native communities – you can't do it from a distance. You can't just blow into town, gather some data, and then blow out again. You'll never gain the trust of local people that way. You've got to remember that they've seen more researchers and public officials and consultants and industry representatives than you can shake a stick at. They've had their fill of fancy promises and rosy forecasts – to the point where any stranger getting off the plane with a briefcase looks like a carpetbagger. That's probably the biggest reason for the success of the North Slope Borough's science program – the scientists and the hunters and elders have learned to work together. That means you get science that conforms to western standards but also benefits from Native knowledge. It's the best of both worlds.

In recent years, we've seen a lot more interest from the scientific community in studying the Arctic. This is primarily because the polar region serves as an early warning system for global climate change. The federal government has funded construction of a research center in Barrow for visiting scientists. I hope these scientists will take advantage of our local expertise. There's a lot to learn from people who have witnessed at close range the changes in ice conditions, permafrost, erosion and other phenomena.

With a growing body of scientific research and a solid record of cooperation between researchers and local experts, we are positioned better than ever to make informed public policy decisions in the Arctic. As a regional government in the state of Alaska, the North Slope Borough is empowered with a great deal of local authority over land use decisions. Our municipal charter gives us a very important place at the table as individual projects are being planned. We are able to some extent to watch out for the

larger public interests – like protection of migratory routes or access to hunting grounds – that sometimes come in conflict with project plans in a region where there is so much oil and gas activity.

But whether we're talking about management of coastal areas or input on oil and gas projects, our authority is often trumped by state or federal interests. It's very discouraging when agencies ignore research that they may have helped to pay for. It's frustrating for local policymakers, just as it is for scientists.

I'm not sure what we can do to change that, but it seems like everyone could benefit from better science communication with the general public. One problem with science is that it gets recorded as data and explained in technical reports and journal articles. None of that is tailored to a general audience. I just wonder if a little science education in the popular press might not go a long way. In our region alone, there are so many stories to tell about all that has been learned through research. It's not what scientists are paid to do, but someone needs to do it if we are going to get the full value of all the important scientific work that is done.

Another strategy might be to include more general public outreach at science conferences or other events. Even a single session dedicated to telling important research stories in a more accessible style could get people more interested in what science has to offer in the realm of policy.

There are so many pressures in the policymaking process that it's easy for science to get lost or ignored. Communicating the important work of scientific research will never be easy, but if you can make a connection with people who are affected by the science, and if you can draw them in to the process – the way our scientists and our hunters came together as partners in the research effort – then your work will be noticed and appreciated at the ground level.

So, with all of that as background, I want to highlight some of our local observations and concerns regarding the dramatic warming trend we are now seeing in our northern region.

- Arctic residents are very concerned about changing sea ice conditions. We have observed firsthand ice conditions are changing and becoming less predictable. This is not new information to coastal North Slope residents. Our hunters have seen the changes, and have recognized the need to be more cautious when out on the ice and when boating. You pay attention to these things when your safety and the ability to put food on the table for your family are at stake. Subsistence hunting activities have already been affected.
- Sea ice is literally the foundation from which many important subsistence activities take place such as the spring harvest and butchering of the bowhead whale, and the harvest of bearded seal, walrus, polar bear, and other resources. It is also the foundation for the maintenance of healthy populations of marine wildlife. Decreased sea ice can affect population levels of species at all levels of the food chain.
- It also increases risk to our hunters. Sea ice is forming later in the fall, is thinner, becomes more ridged with more movement and storm activity, and thaws earlier in the spring. It provides a less stable and less safe base for spring whaling, travel, and other subsistence activities. Less stable or rougher ice increasingly blocks hunters' access to open water and key resources. With greater frequency in recent years, lives have been threatened and equipment lost when sudden fractures in the ice have left hunters stranded offshore. Open water leads are less predictable and are less effective in channeling migrating bowhead whales and other resources within the safe reach of the hunters.
- Our subsistence harvest quota for bowhead whales is derived in large part from census data obtained using visual and acoustic observations made from a sea ice study camp. Continued changes in the stability of the sea ice could alter the carefully developed and accepted methods for conducting the bowhead census. Any change in established management practices here at home is

likely to impact how the quota is determined at the international level. Especially if the warming trend that affects our ability to census bowheads is also seen as placing additional pressure on the species, perhaps through increased arctic commercial shipping, we have great fear that an IWC guided by caution might reduce our harvest quota. This would be devastating to the Inupiat culture and the health of our people.

- Violent storms are occurring earlier and later in the year than had been the case just a decade ago. They are more frequent, more intense, and last longer. Without ice acting as a buffer, and with thawing coastal permafrost, erosion of shorelines and bluffs due to fall and spring storms has increased. In all of our coastal villages, houses, roads, other buildings, boats and boat ramps, airstrips, landfills, other critical infrastructure, and archeological and cultural sites are increasingly threatened.
- The primary concern of our residents in a changing Arctic is the continuance of their traditional lifestyle. Our culture revolves around a continuing opportunity to harvest healthy wild resources for food. The Inupiat have always been an adaptable people. In some ways now, however, faced with radical and rapid changes in our very landscape, our historic ability to adapt is complicated by the relatively new permanence and comfort of our modern communities. We can never go back to being nomadic hunters living only off of the land and sea, but how can we take on Mother Nature over the long term?
- Residents are also concerned how subsistence resources will respond to the changing Arctic. Let's look at caribou. Many people believe that warming weather will make more food for the caribou but at the same time will significantly increase the presence of mosquitoes and bot flies. If this scenario is true, how will this impact the hunters' success in harvesting caribou? Some elders who thought they knew what a bad insect year was are telling us it's getting worse out there. Others believe that warming will decrease the availability of food for caribou as the tundra becomes brushier, with low plants taking over from the mosses and lichen that now dominate. Will the changing Arctic change the migration patterns, distribution, and the health of the caribou? The Nunamiut are heavily dependent on the spring and fall migrations of caribou through Anaktuvuk Pass. If the caribou don't come nearby or stop coming altogether, then this community will experience a disaster and may not survive. Residents can't simply go to the store to buy fresh meat for the year. The only meat you can buy in Anaktuvuk Pass is frozen meat (usually freezer burned) that costs three times as much as it does in urban Alaska.
- We are concerned about the long-term stability and distribution of the caribou herds, waterfowl, and fish that feed our people. The tundra is changing and changing fast. Our hunters are seeing some areas become drier. There is concern that the small temporary streams that allow fish to move between lakes during different stages of their lifecycles will vanish. Other areas are becoming grassier. Elders from Wainwright who have never seen grass around the village taller than their ankles have seen it grow thigh-high in recent years. Birds can't nest and can't see approaching foxes and other predators.
- Residents are of course concerned about expanding industrialization of our lands and waters. To lessen impacts to the environment, many exploratory and other operations take place during the winter months when travel can be accomplished via ice roads. Ice roads are being constructed in November and are being used until early May. In recent years, however, the winter freeze up has been later and the spring melt has come sooner. This is occurring at a time when drilling prospects are being explored farther and farther away from existing infrastructure, requiring longer ice roads. Additional coastal staging areas are being required. We fear that we will see in coming years a system of industrial nodes all along our coast and in Barrow.
- Here again, coastal erosion is a concern. We believe that agencies and industry are not requiring or providing sufficient coastal buffers to insulate newly constructed industrial facilities and transitions of offshore pipelines to land from the long-term effects of coastal erosion. Take the case of the JW Dalton Test Well #1 in the NPR-A north of Teshekpuk Lake. The well was first drilled in 1979 by Husky Oil. I've heard that up to a thousand feet of coastal erosion occurred in a one year period, and a breach in the reserve pit was letting drilling waste enter the Beaufort Sea. BLM was forced to undertake an emergency remediation in the spring of 2005. The effort involved 45 trailers, heavy equipment, transport sleds, and living quarters. More than 3000 cubic yards

of drilling waste was excavated and removed. Approximately 9900 gallons of diesel was removed from the well and transported off-site for disposal. More than 7 tons of cement was poured down the well casing. The total cost was \$5.5 million. How many more ticking time bombs are out there? We don't want new facilities constructed along the Beaufort Sea shore that will have to be armored and defended against increasingly harsh coastal forces for decades to come, at great cost, with the noise and disruption that comes with such activity, and with possibly devastating impacts to the environment.

- We are also concerned about the integrity and safety of industrial facilities with respect to the thawing of permafrost that is accelerating. Our hunters have seen pipeline VSMs and well heads that seem to be tilting. We can only expect that these structures and larger facilities will continue to settle and face heightened stresses and engineering challenges.
- North Slope residents are increasingly concerned with an expansion of oil production into the marine environment, with the potential for noise and oil spills to adversely impact subsistence resources and harvests. Oil facilities designed to deal with existing or prior conditions may not be able to withstand more extreme conditions brought about by a changing climate. More extreme storm surges, ice movements, wave action, permafrost thawing, and other conditions may damage facilities and pipelines, and cause the release of oil into the marine environment. The noise associated with increased maintenance and repair operations may also significantly impact marine resources and subsistence harvests.
- Another concern is the potential use of increasingly ice-free arctic waters as a transportation route for oil and other hazardous substances, for the movement of other products, and for tourism. Spills could devastate the region's environment and noise from increased vessel traffic alone could significantly impact subsistence resources and the subsistence success.
- On land, residents of some villages have seen a thawing of permafrost, which has rendered traditional ice cellars unusable. A loss of the ability to store large amounts of harvested game requires more frequent hunting efforts to supply food throughout the year. Costs increase with wear and tear on equipment and with fuel prices through the roof. Risks to hunters increase. Social disruptions increase as hunters are more frequently away from jobs and families.
- I'd like to stress the importance of collecting baseline data in the Arctic wherever and as intensively as it can be done. There's long history of research on the North Slope, so there is a lot of data out there. We look to the NSSI and other entities to gather and assess the value of these data, to prioritize research, to solicit and capture local traditional and contemporary knowledge, and to responsibly utilize the information to monitor changes in the Arctic and inform future decision making. What we do not want to see is an invasion of well-intentioned researchers who do not consult with each other, duplicate efforts, fail to recognize or answer key questions, don't effectively communicate with local residents in the design of research and don't report back on their results. We have seen all of that before. I would also strongly encourage all researchers operating in our region to work with our schools. All who have worked with our kids before have found enthusiastic research partners.

Conclusions

To wrap things up, the Arctic environment is rapidly changing. I gave you several examples of how things are changing such as spring breakup being earlier and fall freeze-up much later than only 30 years ago.

The wildlife and our traditional subsistence cycle have been disrupted and we are headed into an unpredictable future.

Oil and Gas Development and Arctic Shipping are big concerns for us and have the potential to harm marine wildlife and lifestyle.

We Inupiat may be few in number but we want to protect our unique lifestyle. We're not mainstream America and our lifestyle is directly dependent on a healthy environment – both land and sea.

As I mentioned, we need good scientific research in the Arctic, but also we need to turn that research into action – and do more than just study things. We need to have practical means for protecting the Arctic and our hunting areas.

We are faced with some tough questions, and who decides what is most important? How important is our Inupiat culture and for instance polar bears to the rest of the world?

In closing, I want to thank the organizers for inviting me and allowing me to give this presentation about climate change and our unique Arctic Inupiat lifestyle. As you know, the Arctic is now ground zero for offshore oil and gas activity and climate change. The US Government's estimate is that there are 30 billion barrels of oil in our arctic waters making it the largest oilfield left in the US. It is also the place where there has been the greatest temperature change anywhere on the Planet- and we see the sea ice retreating. We need to work closely with our Congressional delegations and the Department of Interior to strengthen regulations and mitigation measures to protect our environment, marine resources, and way of life. We have nowhere else to go and live off the land and depend on the Chukchi and Beaufort Seas for our subsistence lifestyle. We Inupiat are very adaptable and have always dealt with change – but these changes are coming hard and fast and there are limits to what we can adapt to.

We don't have the inclination or resources to relocate to a big city – the bottom line is we are going to stay in the Arctic and live and die with these environmental changes.

We cherish our lifestyle. The Good Lord gave us these resources and animals to live off and we want them here for our grandchildren.

Quyanakpuk!





REPORTS FROM BREAKOUT GROUPS

INTRODUCTION AND BACKGROUND

The geographic regions selected for discussions were the same regions designated by the US National Climate Assessment (USGCRP) so that the observations and information from this workshop could be easily utilized by future US National Assessments. However, due to the fact that this workshop attracted primarily Native participants from only some of the US Assessment major regions in the US (and we did not have representation from some regions), the breakout groups combined attendees from a number of the regions. The following section summarizes the discussions in the Breakout Groups based upon both the oral discussions as well as the hand-written comments that many workshop participants chose to submit.

The Breakout Groups combined geographic regions into the following groups:

- Great Lakes/Northeast
- Great Plains
- Southwest/California/Great Basin
- Alaska/Pacific Northwest/Islands



Selected information from earlier US National Climate Assessment workshop reports is reprinted throughout the workshop report to provide the geographic context for the discussions and comments regarding Native issues and concerns on the impacts of climate change in these regions.



GREAT LAKES/NORTHEAST BREAKOUT GROUP REPORTS - COMMENTS FROM PARTICIPANTS

Initial Testimony of Frank Ettawageshik
BMC-22 (ETT-7)
September 14, 2021
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“With the change in climate, nations are forced to use the Earth’s resource as intended – sparingly. Natives will be on the forefront of the green movement.”

Unidentified participant

“The reason we are in here is to become aware and do what our ancestors did—survive. We have to get our minds around this. Look at the past to the strength of our ancestors.” *Beau Mitchell, Presenter*

Great Lakes Region

Key Characteristics

(from Native Peoples-Native Homelands Climate Change Workshop Report, 1998)

“The Woodland Tribes and Nations have occupied an area of the United States most easily understood as east of the Mississippi River for thousands of years. Due to the historical circumstances of earlier occasions of contact from the east along the Atlantic Ocean, followed by northern Euro-American settlement occurring primarily from east to west, many of the northeastern Tribal nations moved westward in advance of settlement, or were later removed to the western extreme of the Woodlands, to join the resident Indian nations of that area. Known at the time as the Old Northwest Territory, this area embraces the Mid-West (Heartlands) and the Western or Upper Great Lakes regions and includes some twelve (12) level III eco-regions. Despite subsequent settlement of the rich agricultural lands of the mid-west, a significant number of tribes have continued their Woodland cultural and ecological adaptations, particularly in the more forested regions of the Upper Great Lakes. Native peoples here have continued with a greater reliance on the remaining game (deer and rabbit), fish (inland lake, river, and Great Lake freshwater fisheries) and plants (maple sugar, paper birch, wild rice, berries, fruits, corn, beans, squash, and other medicine plants).

The resident Native nations have already survived the in-migration of the relocating Woodland tribes and subsequent Euro-American settlement. As a group, the Native peoples of the Great Lakes have weathered resettlement and the environmental transformation of their homelands, with an extreme loss of both territory and resources, in excess of the climate changes expected from global warming. However, with critically diminished homelands, Great Lakes tribes, which still depend primarily upon the resources of the natural Woodlands habitat, have a greatly reduced capacity to adjust as they have done in the past. Existing changes in agriculture, industry, pollution, and population growth in the region, which have reduced and transformed their historic woodland environment into its present state, continue and today contribute to the causes identified with global warming.”

Regional Climate Change Stresses (Midwest): (from US GCRP Global Climate Change Impacts in the United States 2009 Report)

“Average temperatures in the Midwest have risen in recent decades, with the largest increases in winter. The length of the frost-free or growing season has been extended by one week, mainly due to earlier dates for the last spring frost. Heavy downpours are now twice as frequent as they were a century ago. Both summer and winter precipitation have been above average for the last three decades, the wettest period in a century. The Midwest has experienced two record-breaking floods in the past 15 years. There has also been a decrease in lake ice, including on the Great Lakes. Since the 1980s, large heat waves have become more frequent than anytime in the last century, other than the Dust Bowl years of the 1930s. The observed patterns of temperature increases and precipitation changes are projected to continue, with larger changes expected under higher emissions scenarios.

During the summer, public health and quality of life, especially in cities, will be negatively affected by increasing heat waves, reduced air quality, and increasing insect and waterborne diseases. In the winter, warming will have mixed impacts, but waves that are more frequent, more severe, and longer-lasting are projected. The frequency of hot days and the length of the heat-wave season will both be more than twice as great under a higher emissions scenario than a lower one (see full report for information on emission scenarios). Insects such as ticks and mosquitoes that carry disease will survive winters more easily and produce larger populations in a warmer Midwest.

Significant reductions in Great Lakes water levels, which are projected under higher emissions scenarios, lead to impacts on shipping, infrastructure, beaches, and ecosystems.

Higher temperatures will mean more evaporation and hence a likely reduction in Great Lakes water levels. Reduced lake ice increases evaporation in winter, contributing to the decline. This will affect shipping, ecosystems, recreation, infrastructure, and dredging requirements. Costs will include lost recreation and tourism dollars and increased repair and maintenance costs.

The likely increase in precipitation in winter and spring, more heavy downpours, and greater evaporation in summer would lead to more periods of both floods and water deficits. The projected pattern of increasing precipitation in winter and spring and heavy downpours is expected to lead to more frequent flooding, increasing infrastructure damage, and impacts on human health. Heavy downpours can overload drainage systems and water treatment facilities, increasing the risk of waterborne diseases. In summer, with increasing evaporation and longer periods between rainfalls, the likelihood of drought will increase and water levels in rivers and wetlands are likely to decline.

While the longer growing season provides the potential for increased crop yields, increases in heat waves, floods, droughts, insects, and weeds will present increasing challenges to managing crops, livestock, and forests.

Spring flooding is likely to delay planting. An increase in disease-causing pathogens, insect pests, and weeds cause additional challenges for agriculture. Livestock production is expected to become more costly as higher temperatures stress livestock, decreasing productivity and increasing costs associated with the needed ventilation and cooling equipment.

Native species are very likely to face increasing threats from rapidly changing climate conditions, pests, diseases, and invasive species moving in from warmer regions. All major groups of animals including birds, mammals, amphibians, reptiles, and insects will be affected by climate change impacts on local populations and by competition from species moving into the Midwest. The potential for animals to shift their ranges to keep pace with the changing climate will be inhibited by major urban areas and the presence of the Great Lakes."

Key Issues (Midwest):

(from USGCRP: 2009 Global Climate Change Impacts in the US Report

- During the summer, public health and quality of life, especially in cities, will be negatively affected by increasing heat waves, reduced air quality, and insect and waterborne diseases. In the winter, warming will have mixed impacts
- The likely increase in precipitation in winter and spring, more heavy downpours, and greater evaporation in summer would lead to more periods of both floods and water deficits
- While the longer growing season provides the potential for increased crop yields, increases in heat waves, floods, droughts, insects, and weeds will present increasing challenges to managing crops, livestock, and forests

- Native species are very likely to face increasing threats from rapidly changing climate conditions, pests, diseases, and invasive species moving in from warmer regions

Northeast Region

Key Characteristics (from 1998 report)

"The Woodland Tribes and Nations have historically occupied the eastern third of the United States. The area east of the Mississippi River consists of some twenty-nine (29) Level III Eco-Regions. For purposes of the NP-NH Climate Workshop, this large cultural area was divided into three sub-areas: The focus of this section is the Eastern Woodlands of the Northeast, including ten (10) distinct level III eco-regions; the more western Great Lakes area, embracing eleven (11) level III eco-regions, which is treated separately; and the eleven (11) level III eco-regions of the Southeastern Woodlands area which is not treated as a separate region due to the limited workshop participation from that region. The Eastern Woodlands area has a climate that may be described as humid continental with relatively short summers to the north. Vegetation in the Eastern Woodland area is primarily broadleaf with mixed coniferous forests in the northern extreme. The eastern coastal area has historically received from 40 to 80 inches of rainfall per year, with the interior receiving only about half as much.

Due to the historical circumstances of contact and Euro-American settlement, many of the Tribal nations of the northeastern, middle Atlantic, and southeastern Woodlands were wiped out or forcibly removed to the west of the Mississippi. However, a significant number of nations, particularly in the northern and southern extremes, have withstood the cultural and ecological onslaughts of the past five centuries on or near their home ground. These nations have already survived environmental transformations of their homelands, altered ecologies, and the loss of control of their traditional resources far exceeding the potential changes expected from climate change and global warming. Dramatic changes in their social and natural physical environments from diseases borne in the early sporadic coastal contacts, to the agriculture, industry, pollution and population growth have transformed their historically forested homelands into their present conditions. From the local Native perspective, human induced climate variability and change are viewed as the ongoing, logical consequence of such long-term transformative activities upon the land, water and now atmospheric resources of this continent.

The Eastern Woodlands area is heavily urban and sub-urbanized, particularly along the Atlantic coast. The inland areas, from New England through the southern Appalachian Mountains, are extensively forested. Energy, manufacturing, agriculture, and tourism are identified as the primary industries in New England and New York, with coal mining included in Appalachia. The interior Southeast provides vegetables, fruits, fish, shellfish, and wood products. Numerous industrial and commercial activities are carried on throughout this area."

Regional Climate Change Stresses (Northeast): (From US GCRP)

"Northeast annual average temperature has increased by 2°F since 1970, with winter temperatures rising twice this much. Warming has resulted in many other climate-related changes including more frequent very hot days, a longer growing season, an increase in heavy downpours, less winter precipitation falling as snow and more as rain, reduced snowpack, earlier break-up of winter ice on lakes and rivers, earlier spring snowmelt resulting in earlier peak river flows, rising sea surface temperatures, and rising sea level. These trends are projected to continue, with more dramatic changes under higher emissions scenarios compared to lower emissions scenarios. Some of the extensive climate-related changes projected for the region could significantly alter the region's economy, landscape, character, and quality of life.

Extreme heat and declining air quality are likely to pose increasing problems for human health, especially in urban areas. By late this century under higher emissions scenarios, hot summer conditions would arrive three weeks earlier and last three weeks

longer into fall. Cities that currently experience just a few days above 100°F each summer would average 20 such days per summer. Cities like Hartford and Philadelphia would average nearly 30 days over 100°F per summer. In addition, cities that now experience air quality problems would see those problems worsen with rising temperatures, if no additional controls were placed on ozone-causing pollutants.

Agricultural production, including dairy, fruit, and maple syrup, are likely to be adversely affected as favorable climates shift. Large portions of the Northeast are likely to become unsuitable for growing popular varieties of apples, blueberries, and cranberries under higher emissions scenarios. The climate conditions suitable for maple/beech/birch forests are projected to shift dramatically northward, eventually leaving only a small portion of the Northeast with a maple sugar business and the colorful fall foliage that is part of the region's iconic character.

Severe flooding due to sea-level rise and heavy downpours is likely to occur more frequently. The densely populated coasts of the Northeast face substantial increases in the extent and frequency of storm surge, coastal flooding, erosion, property damage, and loss of wetlands. New York state alone has more than \$2.3 trillion in insured coastal property. Much of this coastline is exceptionally vulnerable to sea-level rise and related impacts.

The projected reduction in snow cover will adversely affect winter recreation and the industries that rely upon it. The length of the winter snow season would be cut in half across northern New York, Vermont, New Hampshire, and Maine, and reduced to just a week or two in southern parts of the region by late this century under a higher emissions scenario. Winter snow and ice sports, which contribute \$7.6 billion annually to the region's economy, will be particularly affected by warming.

The center of lobster fisheries is projected to continue its northward shift and the cod fishery on Georges Bank is likely to be diminished. Lobster catches in the southern part of the region have declined dramatically in the past decade, associated with a temperature-sensitive bacterial shell disease. Analyses also suggest that lobster survival and settlement in northern regions of the Gulf of Maine could increase under warmer conditions. Cod populations, also subject to overfishing and other stresses, are likely to be adversely affected as temperatures continue to rise."

Key Issues (Northeast): (from 2009 Global Climate Change Impacts in the US Report, PP. 108-110)

- Extreme heat and declining air quality are likely to pose increasing problems for human health, especially in urban areas.
- Agricultural production, including dairy, fruit, and maple syrup, are likely to be adversely affected as favorable climates shift.
- Severe flooding due to sea-level rise and heavy downpours is likely to occur more frequently.
- The projected reduction in snow cover will adversely affect winter recreation and the industries that rely upon it.
- The center of lobster fisheries is projected to continue its northward shift and the cod fishery on Georges Bank is likely to be diminished.

The Great Lakes/Northeast Cultural Area Breakout Group Report – Comments from Participants

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CURRENT STRESSES: What are the current stresses affecting the social systems, natural resources and economic sectors in your Cultural Area?

<ul style="list-style-type: none"> • Poverty, especially rural poverty • Ill-informed, under-informed education in school system • Energy security • Food security • Animals getting sick • Invasive species: Emerald ash borer, Pine weevil, Oak wilt, Gypsy moth • Continued expansion; lack of smart growth • Encroachment of mineral companies • Overdevelopment, population growth • Some housing is dilapidated • Highly fragmented communities on scarce land base – • Long commutes between villages • Poor food quality, contributing to diabetes • Respiratory disease (asthma, chronic obstructive pulmonary disease) • Mental health (stress because of poverty, limited resources, etc.) • Pollution – toxic waste contamination • Ineffective government • Misappropriation of funds • Internal oppression • Lack of passion, lack of organization, lack of resources and leadership – lack of information that is understood by local people • Lack of concern for well-being of people 	<ul style="list-style-type: none"> • High unemployment; seasonal jobs • Lack of education/awareness about climate change • Lack of a sustainable food source • Loss of native species • Increased number of insects • Threats to existence of sacred plants, making it difficult to practice customs • Buildings encroaching on Native habitats • Contaminated and diminishing natural resources • Overcrowding: demand exceeds inventory; there is not enough housing for growing population • Some housing has mold problems; e.g., old Air Force Base homes • Water quality; mercury in water • Cardiovascular disease (stroke, heart attacks) • Diabetes • Chemical dependency • Ozone air quality alerts spreading • Dependency on government funding • Culture loss • Spiritual disconnection • Pressure on reservations to allow mining and oil and gas activities, especially for tar sands, or to accommodate oil pipelines • Selling out to big oil
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CLIMATE IMPACT: Consider how weather extremes, climate change and variability might either amplify or dampen these stresses, or create new ones?

<ul style="list-style-type: none"> • The oil pipelines in our regions are destroying habitats, making the environment less sustainable for agriculture and limiting sites and resources • Food resources (deer, beaver) migrating out due to warming • There is increased competition between native and non-native species • Weather changes are happening and impacting operations – getting to work, construction, roads • Polluted resources may create health problems • Climate change will increase community building and community bonds 	<ul style="list-style-type: none"> • No-flow streams impacting spawning habitats for subsistence fishing and hunting and gathering used by majority of communities to feed their families • There are more insects. • Increasing cost of resources will diminish funds available for housing • There is greater competition from non-tribal neighbors for “greenspace” and water access • Climate change is likely to exacerbate health issues (cardiovascular disease, respiratory disease, and stress)
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ACTION STRATEGIES: What coping or action strategies might address the additional stresses created by extreme weather events, climate variability and climate change, as well as helping to address existing non-climate stresses?

<ul style="list-style-type: none"> • Education and training to increase jobs and opportunities • Change focus from capitalist education to humanities. Debunk the American Dream myth • Wind power • Improved energy efficiency • Investment by governing bodies in energy-efficient housing and in energy sources • Utilization of local resources • Native/local harvest • Growing organic food • Protecting watersheds as a whole, holistically accounting and protecting water, air and land, protecting life of all two- and four-leggeds, swimmers, winged ones, creepers, and spiritual ones • Expanding operations using green methods Food source, using old retention beds for native wild rice beds • Protecting our water with ordinances; banning boats • Don't pollute • Utilize local resources, e.g., water, energy, labor, food production • Energy-efficient homes with natural light, heat, ventilation, and cooling • Plant more trees as a carbon catchment • Build houses to be sustainable, using the practice of permaculture • Apply indigenous knowledge 	<ul style="list-style-type: none"> • Design a curriculum for our future generations that emphasizes our connection with Mother Earth • Solar power • Low-impact hydroelectric power • Renewable housing materials • Lower speed limits • Food security • Growing our own food • Renewed emphasis on sustainable agriculture • Upgrading fisheries to recycle the tanks' water rather than continuously pumping water from ground resource • Maintaining sustainable forests and resources • Utilizing local resources • Recycle • Create and maintain migration corridors for our non-human relatives • Efficient prairie solar housing • Build houses to be spiritual, simple, and stout • Revitalize the knowledge of wigwams and using new home designs: earthships, treehouses, straw-bale homes
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INFORMATIONAL NEEDS: What new or additional information would allow people to better understand the linkage between the current stresses and weather extremes, climate variability and change?

<ul style="list-style-type: none"> • Teaching tools for best models/practices • Grants/funding for green jobs and job training • Better education and awareness for decision makers at tribal and federal levels • More awareness. We must educate our most impoverished and vulnerable • Renewable energy/efficiency • Safer water • Community volunteers, green methods, and clean air • Encouraging Native traditions 	<ul style="list-style-type: none"> • Assistance in developing plans • Education, awareness, and action, especially at the community level • Cooperating with school boards and educating them about adopting a sustainable curriculum • Passing knowledge about the environment, climate, and solutions on to future generations • More efficiency in building; utilization of thermal and solar techniques • Better living without fear of damaging our bodies • Protection of sacred sites, including all that is natural • Community involvement
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"Listen to Mother Earth and apply to our lives what She is telling you."

Unidentified participant

**Key Characteristics: (from Native Peoples-Native
Homelands Climate Change Workshop Report, 1998)**

"The northern, central, and southern Great Plains of the United States is largely a prairie grassland ecosystem, an area of approximately 400 million acres, stretching at its northern end from the Canadian province of Saskatchewan to northern Mexico in the south and from the Rocky Mountains in the west to the woodlands of Wisconsin in the east. The Great Plains includes portions of Montana, Wyoming, North Dakota, South Dakota, Nebraska, Colorado, Kansas, Oklahoma, New Mexico, and Texas, occupying the central third of the U.S. continental land mass. The Culture Area is drained and nourished with rivers, streams, and creeks that make up lush riparian areas and fish and wildlife habitat.

It is a former seabed that drained at the time when the Rocky Mountains surfaced. Deeper topsoil is found in the eastern portions due to glaciations from the last Ice Age, which extended into the central areas. The prairie consists of three distinct types of native grasses, the short grass in the west, the mid-grass, and the tall-grass in the east. The temperate areas within the Great Plains are further defined by the amounts of moisture that precipitate eastward traveling storms. The Great Plains are characterized by extremes of climate. The land areas within the larger Culture Area are also well defined by traditional hunting grounds and agrarian areas near water of the Tribal Nations that occupied the lands and were later recognized by treaties with the U.S. government. The Native people existed in a close symbiotic and spiritual relationship with the buffalo that also lived in the Great Plains and maintained the balance of creation. In addition to national parks and monuments, the majority of the remaining contiguous native grasslands are home to the Native people on the islands established by the government and called reservations.

Characteristics of the region include major human transformation of land by extensive and mechanized agriculture, increasing population shifts from rural to urban areas, thriving trade activities, and an increase of high-tech farm enterprises. The major land uses are agriculture and livestock; these are restricted by variability in temperature and precipitation. Over 90% is in farms and ranches and 75% is cultivated. The five major production systems are range livestock, crop fallow, groundwater irrigation (aquifer dependent), river valley (snow-melt dependent) and confined livestock feeding. In addition, water availability is becoming limited because of over subscription due to multiple demands for drinking water, agriculture, and wildlife conservation."

Regional Climate Change Stresses:

(from: US GCRP Global Climate Change Impacts in the United States 2009 Report))

"Over the last few decades, average temperatures have risen throughout the Great Plains, with the largest increases occurring in the winter months and over the northern states. Relatively cold days are becoming less frequent and relatively hot days more frequent.

In the future, temperatures are projected to continue to increase with larger changes under scenarios of higher heat-trapping emissions as compared to lower. Summer increases are projected to be larger than those in winter in the southern and central Great Plains. Precipitation is also expected to change, particularly in winter and spring. Conditions are expected to become wetter in the north and drier in the south. Projected changes include more frequent extreme events such as heat waves, droughts, and heavy rainfall. Projected increases in temperature, evaporation, and drought frequency add to concerns about the region's declining

water resources. Most of the region's water comes from the High Plains aquifer (also referred to by the name of its largest formation, the Ogallala aquifer) from which water withdrawals already outpace recharge. Rising temperatures, faster evaporation rates, and more sustained drought brought on by climate change will add more stress to overtaxed water resources. Agriculture, ranching, and natural lands, already under pressure due to an increasingly limited water supply, are very likely to also be stressed by rising temperatures. Agriculture covers 70 percent of the Great Plains. As temperatures continue to rise, the optimal zones for growing certain crops will shift. Pests will spread northward and milder winters and earlier springs will encourage greater numbers and earlier emergence of insects. Projected increases in precipitation are unlikely to be sufficient to offset decreasing soil moisture and water availability due to rising temperatures and aquifer depletion.

Climate change is likely to affect native plant and animal species by altering key habitats such as the wetland ecosystems known as prairie potholes or playa lakes. Climate change is likely to combine with other human-induced stresses to further increase the vulnerability of ecosystems to pests, invasive species, and loss of native species. Breeding patterns, water and food supply, and habitat availability will all be affected by climate change. Grassland and plains birds, already stressed by habitat fragmentation, could experience significant shifts and reductions in their ranges.

Ongoing shifts in the region's population from rural areas to urban centers will interact with a changing climate, resulting in a variety of consequences. As young adults move out of small, rural communities, the towns are increasingly populated by a vulnerable demographic of the very old and the very young, placing them more at risk for health issues that are projected to increase with climate change. The region is also home to 65 Native American tribes; the people on tribal lands have limited capacities to respond to climate change. Many reservations already face severe problems with water quality and quantity and these problems are likely to be exacerbated by climate change."

Key Issues:

(from: USGCRP Global Climate Change Impacts in the United States 2009 Report)

- Projected increases in temperature, evaporation, and drought frequency add to concerns about the region's declining water resources
- Agriculture, ranching, and natural lands, already under pressure due to an increasingly limited water supply, are very likely to also be stressed by rising temperatures
- Climate change is likely to affect native plant and animal species by altering key habitats such as the wetland ecosystems known as prairie potholes or playa lakes
- Ongoing shifts in the region's population from rural areas to urban centers will interact with a changing climate, resulting in a variety of consequences

Breakout Group Reports - Comments from Participants

Initial Testimony of Frank Ettawageshik

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CURRENT STRESSES: What are the current stresses affecting the social systems, natural resources and economic sectors in your Cultural Area?

<ul style="list-style-type: none"> • Socioeconomic ills are common on the reservation • People are unaware of climate change and its impacts • A lot of reservation land is closely interwoven with privately owned land • Houses are moldy and not weatherized • Water Quality: Pollution is common • Human/environmental disease vectors • Mental health issues are also increasing due to poverty and hopelessness • Apathy: there are growing feelings of hopelessness 	<ul style="list-style-type: none"> • Jobs are needed • There is a disconnect between tribal colleges and tribal members • There are not enough houses for tribal members • Roads are difficult to maintain; funding for them is lacking • Water Quantity: The Ogallala Aquifer is being drawn down • Cardiovascular and respiratory diseases • Tribal government is not proactive in matters of the environment • The Tribal voice is not heard or respected in the science community
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ACTION STRATEGIES: What coping or action strategies might address the additional stresses created by extreme weather events, climate variability and climate change, as well as helping to address existing non-climate stresses?

<ul style="list-style-type: none"> • Create jobs, especially green ones • Develop climate change programs at Tribal Colleges • Publish scientific results regarding climate change impacts on Native Peoples and our lands in peer-reviewed journals to gain respect and credibility in the science community • Raise community awareness; train tribal members to go green • Provide sustained local training in developing and maintaining renewable energy • Explore bio-fuels as an economic and mitigation strategy • Support local producers, farmers' markets, and community gardens • Establish tribal seed banks • Practice restoration ecology • Build more homes • Examine alternative forms of housing, like straw bale and earth homes • Develop public transit between communities on reservations • Use the Ogallala Aquifer for drinking water only • Work with the Indian Health Service on the impacts of climate change • Muster the political will to address adaptations • Talk to our congressional delegations about climate change legislation. Visit them often and bring friends and relatives • Select adaptation and mitigation measures that are practical • Establish local climate adaptation and mitigation resource centers where community members can get information and assistance • Establish agreements among Tribal government, tribal colleges and universities, and Tribal communities • Develop local resource center for adaptation strategies • Develop a strategy for monitoring drought: drought mitigation and adaptation plans • Apply for American Reinvestment and Recovery Act of 2009 and other sources of federal funds • Strengthen tribal codes of ethics, so people can be activist and not fear for their jobs • Let tribal spirituality play a role in adaptation 	<ul style="list-style-type: none"> • Teach climate change throughout the school years, from pre-school through college • Fully fund and support Tribal Colleges and Universities as the education and workforce development vehicle • Communicate with all sectors of the tribes - community members and councils • Develop tribal energy producers – wind, solar, and geothermal – and control them tribally • Green up tribal communities • Develop community gardens • Grow your own food • Adjust agricultural practices to match changed climate conditions • Reduce pesticide use • Apply for recovery funds for weatherization and retrofitting old housing • Create community education forums on how to save energy at home by choosing the right light bulbs, putting plastic over windows, and turning off lights • Establish and enforce more stringent tribal and federal water use policies • As water becomes scarce, increase understanding of tribal treaty rights to protect water resources • Eat better food - see "Food and Agriculture" • Be more proactive in environmental protection • Adopt Tribal and federal policies to minimize our carbon footprint and mitigate climate impacts • Organize holistically; include tribal spirituality in mitigation and adaptation standards • Keep honest, open dialogue with all stakeholders, respecting each stakeholder's values • Work with the Southern Climate Impacts Planning Program (SCIIPP) in its effort to develop adaptation strategies for region. Communicate these resources and make them available locally • Develop emergency management plans to address emergencies such as tornadoes, earthquakes, flooding, and drought adapt to climate change and mitigate its impacts • Establish policies and enforcement protocols for sacred sites • Participate in sustainable carbon sequestration strategies • Utilize our Native knowledge and intellect to work more harmoniously with the environment. Listen to Mother Earth and apply to our lives what She is telling you • Protect sacred sites
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INFORMATIONAL NEEDS: What new or additional information would allow people to better understand the linkage between the current stresses and weather extremes, climate variability and change?

<ul style="list-style-type: none">• Food production depends on increasingly scarce water• Mining on Dine and Hopi lands creates pollution• Water is scarce and population growth is making it scarcer• The fence between Arizona and Mexico cuts through the Tohono O'Odham Nation	<ul style="list-style-type: none">• Salmon people depend on fisheries and subsistence fishing. When water is too hot, fish are not there• Health consequences from water pollution and radiation resulting from mining• Flow in the Colorado River is decreasing
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SOUTHWEST/CALIFORNIA/GREAT BASIN BREAKOUT GROUP REPORTS - COMMENTS FROM PARTICIPANTS

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"Create a vision of a sustainable community." Unidentified conference participant

"Water is life. Treat it reverently." Unidentified conference participant

Key Characteristics: (from: 1998 Native Peoples Native Homelands Climate Change Workshop Report)

"This region includes Arizona, New Mexico, and parts of California, Colorado, Nevada, and Utah, and includes the climate workshop regions of the Southwest and Southwest Border areas. This area includes eight (8) distinct Level III eco-regions. The arid nature of much of the West combined with rapid population growth and increasing demand for water resources, means that this area is vulnerable to climate change and climate variability. The economy is a mix of ranching, dryland and irrigated agriculture, mining, tourism, retail, manufacturing, and high technology industries."

"Much of the region is sparsely populated, with perhaps a dozen major, and very rapidly growing, high-density urban centers. These urban and economic systems are based on a rich mix of ecosystems including alpine mountains, deserts, and many fertile valleys riparian ecosystems, all of which will potentially be affected by climate variability and change."

(From: USGCRP Global Climate Change Impacts in the United States 2009 Report)

"The Southwest region stretches from the southern Rocky Mountains to the Pacific Coast. Elevations range from the lowest in the country to among the highest, with climates ranging from the driest to some of the wettest. Past climate records based on changes in Colorado River flows indicate that drought is a frequent feature of the Southwest, with some of the longest documented "megadroughts" on Earth. Since the 1940s, the region has experienced its most rapid population and urban growth. During this time, there were both unusually wet periods (including much of 1980s and 1990s) and dry periods (including much of 1950s and 1960s).² The prospect of future droughts becoming more severe as a result of global warming is a significant concern, especially because the Southwest continues to lead the nation in population growth.

"Droughts are a long-standing feature of the Southwest's climate. The droughts of the last 110 years pale in comparison to some of the decades-long "megadroughts" that the region has experienced over the last 2000 years.¹³ During the closing decades of the 1500s, for example, major droughts gripped parts of the Southwest.¹⁴ These droughts sharply reduced the flow of the Colorado River^{12,15} and the all-important Sierra Nevada headwaters for California,¹⁶ and dried out the region as a whole. As of 2009, much of the Southwest remains in a drought that began around 1999. This event is the most severe western drought of the last 110 years, and is being exacerbated by record warming.¹⁷

"Water is already a subject of contention in the Southwest, and climate change – coupled with rapid population growth – promises to increase the likelihood of water-related conflict. Projected temperature increases, combined with river-flow reductions, will increase the risk of water conflicts between sectors, states, and even nations. In recent years, negotiations regarding existing water supplies have taken place among the seven states sharing the Colorado River and the two states (New Mexico and Texas) sharing the Rio Grande. Mexico and the United States already disagree on meeting their treaty allocations of Rio Grande and Colorado River water.

"In addition, many water settlements between the U.S. Government and Native American tribes have yet to be fully worked out. The Southwest is home to dozens of Native communities whose status as sovereign nations means they hold rights to the water for use on their land. However, the amount of water actually available to each nation is determined through negotiations and

litigation. Increasing water demand in the Southwest is driving current negotiations and litigation of tribal water rights. While several nations have legally settled their water rights, many other tribal negotiations are either currently underway or pending. Competing demands from treaty rights, rapid development, and changes in agriculture in the region, exacerbated by years of drought and climate change, have the potential to spark significant conflict over an already over-allocated and dwindling resource.

Regional Climate Change Stresses: (from: USGCRP Global Climate Change Impacts in the United States 2009 Report)

"Recent warming in the Southwest has been among the most rapid in the nation. This is driving declines in spring snowpack and Colorado River flow. Projections of future climate change indicate continued strong warming in the region, with much larger increases under higher emissions scenarios compared to lower. Projected summertime temperature increases are greater than the annual average increases in parts of the region and are likely to be exacerbated by expanding urban heat island effects. Further water cycle changes are projected, which combined with increasing temperatures signal a serious water supply challenge in the decades and centuries ahead. The prospect of future droughts becoming more severe due to warming is a significant concern, especially because the Southwest continues to lead the nation in population growth.

Water is vital to agriculture, hydroelectric power production, the growing human population, and ecosystems. Water supplies in some areas are already becoming limited. Large reductions in spring precipitation are projected for the Southwest. Continued temperature increases combined with river flow reductions and rapid population growth will increase competition for water supplies.

Impacts of climate change on the landscape of the Southwest are likely to be substantial, threatening biological diversity, protected areas, and ranching and agricultural lands. Temperature increases have made the current drought in the region more severe than the natural droughts of the last several centuries. Record-setting wildfires are resulting from the rising temperatures and related reductions in spring snowpack and soil moisture.

Rapid landscape transformation due to vegetation die-off, wildfire, and loss of wetlands along rivers reduces flood-buffering capacity. Decreased snow cover on the lower slopes of high mountains and the increased fraction of winter precipitation falling as rain and therefore running off more rapidly also increases flood risk.

Rising temperatures will adversely affect winter activities such as downhill and cross-country skiing, snowshoeing, and snowmobiling. Later snow and less snow coverage are projected for ski resort areas, particularly those in the southern part of the region. Decreases from 40 to almost 90 percent are likely in end-of-season snowpack under high emissions scenarios in counties with major ski resorts from New Mexico to California.

With more intense, longer-lasting heat waves projected to occur over this century, demands for air conditioning are expected to deplete electricity supplies, increasing risks of brownouts and blackouts. Much of the region's agriculture will experience detrimental impacts in a warmer future, particularly specialty crops in California such as apricots, almonds, artichokes, figs, kiwis, olives, and walnuts. These and other such crops require a minimum number of hours below a chilling temperature threshold in the winter to set fruit for the following year."

Key Issues: (From USGCRP Global Climate Change Impacts in the United States 2009 Report)

- Water supplies will become increasingly scarce, calling for trade-offs among competing uses, and potentially leading to conflict
- Increasing temperature, drought, wildfire, and invasive species will accelerate transformation of the landscape
- Increased frequency and altered timing of flooding will increase risks to people, ecosystems, and infrastructure
- Unique tourism and recreation opportunities are likely to suffer
- Cities and agriculture face increasing risks from a changing climate

Comments from Participants

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CURRENT STRESSES: What are the current stresses affecting the social systems, natural resources and economic sectors in your Cultural Area?

<ul style="list-style-type: none"> • Food production depends on increasingly scarce water • Mining on Dine and Hopi lands creates pollution • Water is scarce and population growth is making it scarcer • The fence between Arizona and Mexico cuts through the Tohono O'Odham Nation 	<ul style="list-style-type: none"> • Salmon people depend on fisheries and subsistence fishing. When water is too hot, fish are not there • Health consequences from water pollution and radiation resulting from mining • Flow in the Colorado River is decreasing
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CLIMATE IMPACT: Consider how weather extremes, climate change and variability might either amplify or dampen these stresses, or create new ones?

<ul style="list-style-type: none"> • With climate change, the Sonoran Desert, home to a variety of unique plants and animals, is becoming even hotter and dryer • Warming means drying, making water even scarcer 	<ul style="list-style-type: none"> • With less snow and more rain, chemicals are more likely to percolate into the ground, potentially contaminating lakes, rivers, streams, and aquifers • Droughts leave trees less able to fight infestation
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ACTION STRATEGIES: What coping or action strategies might address the additional stresses created by extreme weather events, climate variability and climate change, as well as helping to address existing non-climate stresses?

<ul style="list-style-type: none"> • Taxing companies for the use of tribal land • Education in a setting in which the knowledge of elders – knowledge about the different plants and what environments will make seeds thrive – is valued and made part of the curriculum. Blend Native perspectives with science • Work on the Navajo Nation with Chapter Houses to educate the young • Create less energy waste. Outreach programs on energy consumption • Regulate discharges from coal power plants, e.g. mandating “air scrubbers” that can cut the amount of pollutants that reach our air • Buy local • Have foods labeled with a nutritional index. • Adopt tribally sustainable building codes • Harvest rainwater, as families in Tucson do • Natives knowing their allies, Native and non-Native • A multi-cultural alliance for a safe environment • Review laws that affect indigenous people; change what is detrimental • Native perspective: this is Mother Earth. You do not dig or remove what is inside Mother Earth • More climate change classes, like the one at Tohono O'Odham Community College, at tribal colleges and universities, as well as classes in renewable energy and environmental science 	<ul style="list-style-type: none"> • Blending of science and Native knowledge, as is done at Dine College • Acknowledge that even Natives are part of the problem • Increase renewable energy – there are alternatives to coal • Develop sustainable communities • Pay attention to ingredients in food • Use gardening techniques to conserve water like those used 400 years ago – e.g.: terracing, stone grids to cool water, crop rotation, planting alfalfa, not tilling land, permaculture, drip irrigation, grow plants that are compatible with the environment. • Create living buildings in symbiosis with the natural environment • Use energy-efficient building design: LEED (green building accreditation, Leadership in Energy and Environmental Design) buildings • Make water a free resource for all – do not bottle it • Natives knowing what is happening in government, both federal and tribal • Knowledge of climate change • Effect on spiritual heritage • Protect sacred sites
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INFORMATIONAL NEEDS: What new or additional information would allow people to better understand the linkage between the current stresses and weather extremes, climate variability and change?

<ul style="list-style-type: none"> • More Native American scientists with traditional knowledge and the trust of communities should work for the indigenous community • Native Americans should help each other stay informed about happenings in government, both federal and Tribal • Tribes should know their allies, both Native and non-Native 	<ul style="list-style-type: none"> • Natives should communicate issues to the non-Native community to capture their votes, communicating climate change knowledge to everyone from the Native perspective • Communities should embrace renewable energy, step up to the plate and admit that we too are part of the problem and help to correct it
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Additional Points from Breakout Group Discussions

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There is a huge migration of people from the east to the west, bringing with it demand for electricity and water. At the same time, climate in the West is warming. There is less snow and less rain. Seasonal stream flow in the Colorado Basin is occurring earlier. Drought is increasing and the river is getting warmer. In the Southwest, water is critical. The increase in population has increased the demand for water from the Colorado River. Food and habitat depend on the availability of water. In the Lake Tahoe-Reno region, there is competition for water resources. Water is increasingly saline.

In Northern California, the coast is hot and the salmon population is impacted; because the indigenous people are salmon people, impact on salmon translates into impact on their daily lives. The world is out of balance: fires are larger and more frequent, air quality is bad, and the smoke after a fire creates health problems, especially asthma; more animals are deformed. Because of chemicals used, cancer rates and mortality rates are high. Global warming is impacting the people's spiritual well-being as well: Connectivity with nature and the species is affected.

In an indigenous community in Arizona, the fruits that can be grown are not the same; changes are occurring in traditional huts and in special wine for the rain ceremony. Some traditional animals have not visited for four years. Rain is coming from a different direction than in the past. The changing climate is inconsistent with the traditional calendar.

Because of mining, future generations in the Grand Canyon area are at risk of exposure to contaminated water. In Southern Arizona the St. Peter River is going dry and beavers are in danger of extinction.

Near the border with Mexico, security searches and the security fence are an environmental hazard. Animals are not able to migrate across the border. Women are not able to work on their baskets, because the materials they need cannot be found on this side of the border.

The water on some Hopi lands has been polluted by coal mining. Some streams are dry and plants are dying. Sacred mountains are being massacred by uranium mining.

On Navajo lands, water quality is not being safeguarded as it should be. Farmers depend on precipitation.

Drying is expected over the Sonoran Desert, the hottest part of North America—100 degrees in the summer, 60 degrees in the winter. The creation stories of the Saguaran people depend on climate. The Sonoran Desert, the most diverse in the world, contains a variety of unique plants and animals, such as the saguaro cactus. The saguaro cactus is an important source of food and shelter for many indigenous people in the Sonoran Desert; many still gather saguaro fruits as their ancestors have for hundreds of years so they depend on climate.



ALASKA/PACIFIC NORTHWEST/ISLANDS BREAKOUT GROUP REPORTS - COMMENTS FROM PARTICIPANTS

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“Violent storms are occurring earlier and later in the year than had been the case just a decade ago. They are more frequent, more intense, and last longer. Without ice acting as a buffer, and with thawing coastal permafrost, erosion of shorelines and bluffs due to fall and spring storms has increased. In all of our coastal villages, houses, roads, other buildings, boats and boat ramps, airstrips, landfills, other critical infrastructure, and archeological and cultural sites are increasingly threatened.”

“The primary concern of our residents in a changing Arctic is the continuance of their traditional lifestyle. Our culture revolves around a continuing opportunity to harvest healthy wild resources for food.” *Captain Eugene Brower*

Alaska

Key Characteristics (from the National Network of Libraries of Medicine: <http://nnlm.gov/pnr/characteristics/alaska.html>)

“Alaska is the largest state in the United States encompassing 656,425 square miles. It is one fifth the size of the entire lower 48 states, and larger than the next three largest states combined. Alaska holds the record for the coldest temperature in the US: -80°F on January 23, 1971 in Prospect Creek, and for the highest point, Mt McKinley, at 20,300 feet above sea level. Alaska is organized into 16 boroughs instead of counties. Remote areas not included in the boroughs are divided into census areas. The capital of Alaska is Juneau. Despite its grand geographical presence, Alaska ranks 48th in population with approximately 670,000 people according to the 2006 U.S. Bureau of the Census Population Estimates Program. While over 40% of the residents live in the largest city of Anchorage, most of the rest of the state is sparsely populated or uninhabited with communities separated by vast distances. 52.3% of the state population lives in frontier areas. Residents are 67% white, 16% Alaska Native and American Indian, 4.6% Asian, and 3.7% African American with 4.7% of the population reporting more than one ethnicity. The Alaska Native population represents eleven distinct cultures who speak twenty different languages.” (from: <http://www.alaskascenes.com/alaskamap.html>)

Regional Climate Change Stresses:

(From: US GCRP 2009 Global Climate Change Impacts in the US Report)

“Over the past 50 years, Alaska has warmed at more than twice the rate of the rest of the United States. Its annual average temperature has increased 3.4°F, while winters have warmed by 6.3°F. The higher temperatures are already causing earlier spring snowmelt, reduced sea ice, widespread glacier retreat, and permafrost warming. The observed changes are consistent with climate model projections of greater warming over Alaska, especially in winter, as compared to the rest of the country. Climate models also project increases in precipitation over Alaska. Simultaneous increases in evaporation due to higher air temperatures, however, are expected to lead to drier conditions overall, with reduced soil moisture. Average annual temperatures are projected to rise between 5 and 13°F by late this century, with lower emissions scenarios yielding increases at the lower end of this range and higher emissions yielding increases near the high end of the range. Between 1970 and 2000, the snow-free season increased by about 10 days across Alaska, primarily due to earlier snowmelt in the spring. A longer growing season has potential benefits, such as a longer season for summer tourism and agriculture. However, the white spruce forests in Alaska’s interior are experiencing declining growth due to drought stress and continued warming could lead to widespread death of trees. The decreased soil moisture also suggests that agriculture might not benefit from the longer growing season.

During the 1990s, south-central Alaska experienced the largest outbreak of spruce beetles in the world as rising temperatures allowed the beetle to survive the winter and to complete its life cycle in half the usual time. Drought-stressed trees were unable to fight off the infestation. Fires are also increasing. By the end of this century, the area burned in Alaska is projected to triple under a moderate greenhouse gas emissions scenario and to quadruple under a higher emissions scenario. Across the southern two-thirds of Alaska, the area of closed-basin lakes (lakes without stream inputs or outputs) has decreased over the past 50 years. This is likely due to the greater evaporation and thawing of permafrost that result from warming. These wetlands provide breeding habitat for millions of waterfowl and shorebirds and are important hunting and fishing grounds for Native People. A continued decline in the area of surface water would present challenges for ecosystems, natural resources, and the people who depend upon them.

As permafrost thaws, the land can sink and collapse, damaging forests, homes, and infrastructure. Economists estimate that thawing permafrost will add billions of dollars in repair costs to public infrastructure (costs to private property have not yet been estimated). Alaska has more coastline than the other 49 states combined. These coastlines are increasingly threatened by a combination of losing their protective sea ice buffer, increasing storm activity, and thawing coastal permafrost. The ground beneath some communities is literally crumbling into the sea. The rate of erosion along Alaska's northeastern coastline has doubled over the past 50 years. Climate change is altering marine ecosystems in ways that affect commercial fisheries. The world's largest single fishery is the Bering Sea pollock fishery, which has undergone major declines in recent years. Air and sea temperatures have increased, and sea ice has declined in this region."

Key Issues: (from USGCRP 2009 U.S. Global Climate Change Impacts in the United States)

- Longer summers and higher temperatures are causing drier conditions, even in the absence of strong trends in precipitation
- Insect outbreaks and wildfires are increasing with warming
- Lakes are declining in area
- Thawing permafrost damages roads, runways, water and sewer systems, and other infrastructure
- Coastal storms increase risks to villages and fishing fleets
- Displacement of marine species will affect key fisheries

Pacific Northwest

Key Characteristics: (from Impacts of Climate Variability and change in the Pacific Northwest (1999),
<http://www.usgcrp.gov/usgcrp/Library/nationalassessment/pnw.pdf>)

"The Pacific Northwest (PNW) region is defined as the states of Idaho, Oregon, and Washington, and for some purposes we also consider the adjoining areas of the Columbia River Basin. The PNW has an exceptional diversity of natural resources and ecosystems, including coastal salt marshes and lowland freshwater wetlands, sandy beaches and rocky headlands, upland forest, and high mountain alpine environments. The interior landscape of the PNW includes wheatlands and sagebrush desert in the eastern parts of Oregon and Washington; and the Rocky Mountains, high desert, and lava fields of Idaho. The natural environment of the region provides a large variety of outdoor recreation opportunities such as hiking, bicycling, boating, fishing, hunting, and skiing. The natural vegetation of the region can be characterized by three main vegetation types [74]: forest, shrub-steppe, and alpine, but climatic variation across the PNW gives rise to many different plant communities and landscape patterns within these main vegetation types. Forests, for example, range from those that thrive in damp climates, like coastal Sitka spruce, to those that thrive in dry climates, like ponderosa pine and juniper. The degree of geographic and ecosystem complexity found in the PNW is unusual in the United States. The Cascade mountain range divides the region geographically and climatically, and this divide plays a huge role in the water resources, salmon, and forests of the PNW.

Annual average temperature over the Northwest region as a whole rose about 1.5°F over the past century, with some areas experiencing increases up to 4°F. The region's average temperature is projected to rise another 3 to 10°F in this century, with higher emissions scenarios resulting in warming in the upper end of this range. Increases in winter precipitation and decreases in summer precipitation are projected by many climate models, though these projections are less certain than those for temperature. Impacts related to changes in snowpack, streamflows, sea level, forests, and other important aspects of life in the Northwest are already underway, with more severe impacts expected over the coming decades in response to continued and more rapid warming.

The Northwest is highly dependent on temperature-sensitive springtime snowpack to meet growing and often competing water demands such as municipal and industrial uses, agricultural irrigation, hydropower production, navigation, recreation, and in-stream flows that protect aquatic ecosystems including threatened and endangered species. Higher temperatures are causing more winter precipitation to fall as rain rather than snow and are contributing to earlier snowmelt. Further declines in snowpack are projected, reducing the amount of water available during the warm season.

Higher summer temperatures and earlier spring snowmelt are expected to increase the risk of forest fires by increasing summer moisture deficits; this pattern has already been observed in recent decades. Drought stress and higher temperatures will decrease tree growth in most low- and mid-elevation forests and will also increase the frequency and intensity of mountain pine beetle and other insect attacks, further increasing fire risk and reducing timber production, an important part of the regional economy.

Northwest salmon populations are already at historically low levels due to variety of human-induced stresses. Climate change affects salmon throughout their life stages and poses an additional stress. Studies suggest that about a third of the current habitat for the Northwest's salmon and other coldwater fish will no longer be suitable for them by the end of this century due to climate change.

Key Issues: (from USGCRP 2009 U.S. Global Climate Change Impacts in the United States)

- Declining springtime snowpack leads to reduced summer streamflows, straining water supplies
- Increased insect outbreaks, wildfires, and changing species composition in forests will pose challenges for ecosystems and the forest products industry
- Salmon and other coldwater species will experience additional stresses as a result of rising water temperatures and declining summer streamflows
- Sea-level rise along vulnerable coastlines will result in increased erosion and the loss of land

The Islands

Key Characteristics: (From USGCRP 2009 Global Climate Change Impacts in the US Report)

"The U.S. affiliated Pacific Islands are home to approximately 1.7 million people in the Hawaiian Islands; Palau; the Samoan Islands of Tutuila, Manua, Rose, and Swains; and islands in the Micronesian archipelago, the Carolinas, Marshalls, and Marianas.⁵³⁰ These include volcanic, continental, and limestone islands, atolls, and islands of mixed geologies.⁵³⁰ The degree to which climate change and variability will affect each of the roughly 30,000 islands in the Pacific depends upon a variety of factors, including the island's geology, area, height above sea level, extent of reef formation, and the size of its freshwater aquifer.⁵³¹ In addition to Puerto Rico and the U.S. Virgin Islands, there are 40 island nations in the Caribbean that are home to approximately 38 million people.⁵³² Population growth, often concentrated in coastal areas, escalates the vulnerability of both Pacific and Caribbean island communities to the effects of climate change, as do weakened traditional support systems. Tourism and fisheries, both of which are climate-sensitive, play a large

economic role in these communities.⁵³⁰ Small islands are considered among the most vulnerable to climate change. Extreme events have major impacts on them. Changes in weather patterns and the frequency and intensity of extreme events, sea-level rise, coastal erosion, coral reef bleaching, ocean acidification, and contamination of freshwater resources by salt water are among the impacts small islands face.⁵³³ “

Regional Climate Change Stresses: (From: US GCRP 2009 Global Climate Change Impacts in the US Report)

Climate change presents U.S.-affiliated islands with unique challenges. Small islands are vulnerable to sea-level rise, coastal erosion, extreme weather events, coral reef bleaching, ocean acidification, and contamination of freshwater resources with saltwater. The islands have experienced rising temperatures and sea level in recent decades. Projections for the rest of this century suggest continued increases in air and ocean surface temperatures in both the Pacific and Caribbean, an overall decrease in rainfall in the Caribbean, an increased frequency of heavy downpours nearly everywhere, and increased rainfall during the summer months (rather than the normal rainy season in the winter months) for the Pacific islands. Hurricane wind speeds and rainfall rates are likely to increase with continued warming. Island coasts will be at increased risk of inundation due to sea-level rise and storm surge with major implications for coastal communities, infrastructure, natural habitats, and resources. Most island communities in the Pacific and Caribbean have limited sources of freshwater. Many islands depend on freshwater lenses below the surface, which are recharged by precipitation. Changes in precipitation, such as the significant decreases projected for the Caribbean, are thus a cause of great concern. Sea-level rise also affects islands water supplies by causing saltwater to contaminate the freshwater lens and by causing an increased frequency of flooding due to storm high tides. Water pollution (such as from agriculture or sewage), exacerbated by storms and floods, can contaminate freshwater supplies, affecting public health.

Flooding will become more frequent and coastal land will be permanently lost as the sea inundates low-lying areas and the shorelines erode. Loss of land will affect living things in coastal ecosystems. For example, the Northwestern Hawaiian Islands, which are low-lying and therefore at great risk from rising sea level, have a high concentration of threatened and endangered species, some of which exist nowhere else. Hurricanes and other storm events cause major impacts to island communities including loss of life, damage to infrastructure and other property, and contamination of freshwater supplies. With further warming, hurricane and typhoon peak wind intensities and rainfall are likely to increase, which, combined with sea-level rise, would cause higher storm surge levels.

Coral reefs are particularly sensitive to the impacts of climate change as even small increases in water temperature can cause coral bleaching. Ocean acidification due to rising carbon dioxide levels poses an additional threat to coral reefs and rich ecosystems they support. Fisheries feed island people and island economies. Nearly 70 percent of the world's annual tuna harvest comes from the Pacific Ocean. Climate change is projected to cause a decline in tuna stocks and an eastward shift in their location.

Key Issues: (from USGCRP 2009 U.S. Global Climate Change Impacts in the United States)

- The availability of freshwater is likely to be reduced, with significant implications for island communities, economies, and resources
- Island communities, infrastructure, and ecosystems are vulnerable to coastal inundation due to sea-level rise and coastal storms
- Climate changes affecting coastal and marine ecosystems will have major implications for tourism and fisheries

The Alaska/Pacific Northwest/Islands Cultural Area Breakout Group Report - Participants' Comments

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CURRENT STRESSES: What are the current stresses affecting the social systems, natural resources and economic sectors in your Cultural Area?

Alaska

<ul style="list-style-type: none"> • Expansion of offshore oil and gas development • Wild fires are increasing • Community displacements and village relocation are becoming necessary due to sea level rise and loss of village lands to erosion and permafrost thaw. • Insect infestations (e.g., spruce beetle) • Leaking of sewers • Increase in temperature, leading to decrease in salmon weight 	<ul style="list-style-type: none"> • Scouring of salmon reeds • Sudden melting of snow, causing floods • Unpredictable and extreme weather • Loss of snow reserve and earlier Spring melt • Scarcity of water • Not enough housing for the population. Some of the housing that is available requires a lot of energy to heat
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Pacific Islands

<ul style="list-style-type: none"> • Coastal inundation of homelands • Drainage problems, sewage overflow • Coastal erosion • Forest fires – increased wildfire on grasslands • Species habitat is shifting outside of treaty areas. High-elevation species and ecosystems are being lost • Infrastructure problems • Mercury pollution increases • Destruction of culture • Lack of respect for elders who are not educated in the outside culture • Infrastructure problems • Not enough land to meet the people's needs • Northward movement of disease vectors • Government (tribal) system 	<ul style="list-style-type: none"> • Ocean acidification • Inability to move forward and grow because of need for repair and maintenance • Sedimentation • Invasive species threaten native species • Hypoxia makes some areas along the coast into dead zones for fish and crabs • Lack of water storage systems • Treaty rights • Inter-tribal conflict, which makes indigenous people participants in their own oppression • Destruction of traditional cultural properties • Poor economy/seasonal jobs • Checkerboard land: Tribal land is too much interwoven with privately owned land • Increasing conditions for diseases such as heart disease, diabetes, cancer
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CLIMATE IMPACT: Consider how weather extremes, climate change and variability might either amplify or dampen these stresses, or create new ones?

Alaska

<ul style="list-style-type: none"> • Displacement of moose because of lack of ice scour • Changes in insect population numbers and distribution, increasing harassment of animals, people and allowing conditions for new species of vector borne and infectious diseases • Danger from melting ice in travel corridors • Changing snow and ice conditions impacting predictable and safe fishing, hunting • Mental anguish due to impacts to loss of traditional life ways and relocation. 	<ul style="list-style-type: none"> • Diseases in fish • Damage to infrastructure from flooding, erosion, and new freeze-thaw cycles. • The thawing of ice cellars threatens food storage • Damage to barge transportation • Unpredictable weather and thinning sea ice is creating dangerous travel and hunting conditions and can trap people far from home • Thawing permafrost and erosion causing damage to infrastructure in villages (e.g., water and sanitation) and resulting increased potential for disease
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<ul style="list-style-type: none"> • Diversion of funding from ongoing needs to disaster relief • Loss of land when sea level rises • Increase in disease-bearing insects • In some areas, salmon are more abundant and diverse. Certain species of salmon may be increasing in response to longer ice-free times • Food: The majority of the indigenous community relies on subsistence hunting and gathering to feed their families. Stream flows are decreasing; some streams are drying up altogether. Food animals are migrating because of climate change, and species and ecosystems at the highest elevations are becoming lost 	<ul style="list-style-type: none"> • Loss of ecosystems that supply food • Erosion of cultural and sacred lands • Climate change could make it even harder for remote communities to get fuel to heat and power their homes • Sea level rise will make it necessary for many coastal communities to relocate.
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ACTION STRATEGIES: What coping or action strategies might address the additional stresses created by extreme weather events, climate variability and climate change, as well as helping to address existing non-climate stresses?

<ul style="list-style-type: none"> • Natural resources are indigenous culture! Climate change makes longstanding issues a matter of life and death. Climate change may be a vehicle to address these problems. • Plan according to the seventh generation principle: Consider the effect of today's decisions seven generations into the future. • Set expectations high. If indigenous peoples demand the best worldwide, their collective voice will be loud. • Focus on adaptability and local ingenuity • Disseminate the indigenous model of sustainability to audiences in the region • Capitalize on renewable energy for all power: lights, heat, and transportation • Learn to exploit new species for subsistence • Use retention beds for native wild rice and more fish beds to compensate food loss due to climate change • Design for the environment. Use more passive energy • Plan long term. Design new infrastructure to sustain the community and to withstand climate change • Include Native people at the table in all federal agency climate change initiatives. Encourage tribal college students to seek hiring in government agencies. • Use benchmark measurements, e.g. measurements of air quality on reservations, to be able to give a real response to the world • End the blood quantum policy. • Establish regional agreements for response to natural disasters • Communicate with people to the south for knowledge of what flora and fauna are coming your way • Hold every federal agency to its responsibility • Build partnerships around sustainable development • Implement policy driven by research 	<ul style="list-style-type: none"> • Maintain indigenous ceremonial practices and spiritual knowledge, even in the face of displacement from homelands • Validate and reaffirm indigenous values with leaders, both of the tribes and of the U.S. government• Cooperate, rather than compete, both locally and regionally • Close the gap between Native and Western science. Support different ways of knowing; incorporate traditional ecological knowledge into mainstream research • Pursue best practices and be models for the rest of the United States and for the world • Upgrade fisheries to recycle the water they use in fish tanks, instead of pumping water from ground resources • Environment: Maintain native flora and fauna; maintain biodiversity • To improve energy efficiency, modify traditional housing for modern needs using local materials • Include Native Americans and Alaska Natives in the Intergovernmental Panel on Climate Change (IPCC); make sure they are recognized as stakeholders • Decide specifically what is needed – e.g., what limit must be set on temperature rise – and what the community is willing to sacrifice for the greater good • As a model of commitment, the Micronesia Challenge: An initiative to facilitate more effective conservation of marine and forest resources in Micronesia • Make affirmative declarations not to contribute to climate change • Establish partnerships through memorandum of agreement or treaty. Develop language reflective of the true intent from Northwest/Alaska region. Language that involves conflict resolution, not a waiver of sovereignty. • Communicate between communities to spread ideas for energy independence • Obtain true and honest cooperation from government officials: Insist on accountability • Make sure policies are heard internationally • Encourage elders to teach stories, traditions, and practices • Work for global acceptance of indigenous knowledge and values
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INFORMATIONAL NEEDS: What new or additional information would allow people to better understand the linkage between the current stresses and weather extremes, climate variability and change?

<ul style="list-style-type: none"> • Media action to raise public awareness about climate change and the need to reduce carbon dioxide emissions • Access to resources to develop sustainable and renewable energy projects that reduce carbon dioxide emissions • Funding needed for protection of cultural resources and land • The rights enumerated in treaties and historical agreements • Enforcement of rules reducing fossil fuel emissions. 	<ul style="list-style-type: none"> • Policy that allows government to distribute knowledge and values internationally • Knowledge of climate change's effects. How fast will the sea level rise? What new species are expected to be available for subsistence? • Funding needed for infrastructure and housing • The support of government at all levels: tribal, local, state, and federal • Regulation of offshore activity that may have negative impacts on marine resources
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WHITE HOUSE LISTENING SESSION

In response to a request by NASA and the organizers of the workshop, the White House sent three representatives from the Council on Environmental Quality (CEQ) and the Environmental Protection Agency (EPA) to the workshop to conduct a “listening session”. The purpose of the session was to hear the direct experiences and observations of Native peoples who are disproportionately suffering the adverse effects of climate change. The representatives were Maria Blair Deputy Associate Director at the White House Council on Environmental Quality (CEQ), Karen Metchis, Senior Climate Advisor, EPA Office of Water, and Dr. Anthony Socci, Senior Advisor, EPA Climate and Energy Program.

Meeting participants expressed their views on environmental stressors and on climate change, its impacts and effects while sharing their proposed solutions and recommendations. A brief summary of their comments is listed below.

The session began with a summary statement that climate change has a disproportionate effect on Native Americans, Alaska Natives, and Pacific Islanders and some have compared them to the canary in the coal mine. Climate change is causing habitats to shift upward and northward. For example, the habitat of sugar maples, central to certain Native cultures, is shifting. Tribes are concerned about environmental justice aspects of climate change and pollution on Native peoples’ health, and culture. Federal agencies have a responsibility to hear Native voices and to include their input about issues that affect Native lands. A consistent theme was that Indigenous people strongly believe that we are all relatives and the people in the White House should consider themselves related to the whole country.

The session continued for over 6 hours, with contributions from a large number of the Native participants. For the reader’s convenience, in order to include as many of the participants’ comments as possible, this workshop report has grouped comments into 2 sections: (1) issues of concern and (2) regional concerns.

White House Listening Session – Participants Comments by Issue

Agriculture and Food

- A spiritual life is based on agriculture. Traditional crops need protection from genetically modified crops. Lack of access to land and the inability to grow food has caused health problems such as diabetes in the Native American population. Things of value like health and happiness should be factored into the agricultural economic equation.
- There is a need for suitable agriculture and gardening techniques. The use of ancient ways such as grid terraces, three Sisters plants (corn/beans/squash planted at same time), crop rotation plus cover crops, no-till plus drill seeding, organic feed pastures for nitrogen as well as the use of beef cattle operation for green fertilizer in the spring. These techniques are green and more sustainable.
- Sustainable agriculture needs to be promoted in order to protect traditional seeds. Tribes are losing traditional foods.

- Wild rice, salmon, and white corn restoration initiatives are needed. It is important to think about the natural world as a relative to everyone.

- Consider the use of grid terraces and snow fences as examples of sustainable agriculture. Grid terraces at 6550-8500 ft. elevation provide seasonal extensioning with stones absorbing heat which in turn gains two weeks in both spring and fall. A one month extension of growing season is gained. Promote efforts to harvest winter snow as in snow fences. Peccary's pueblos, Kowhai pueblo, as well as other groups in Guatemala have started doing this.
- There is a concern for protection of Native rights. For example, hate crimes are occurring in some regions in which hunters are shooting at Native Americans. The federal government should work with states to ensure they do not take native resources and to enforce protection of Native rights.
- There are concerns about nutrition in Native communities. Promote discontinuing genetic engineering and additives into foods.
- It is recommended that the U.S. create programs that teach self-sufficiency for people so they may grow their own food. Local food production reduces CO2 emissions, mileage, and increases nutritional quality.
- The federal government should provide green labeling of foods including greenhouse gases per unit on labels, water intensity labels, and length of distance food traveled.

Communication and Consultation

- Tribes desire greater communication with CEQ and other related groups to communicate how traditional knowledge is being incorporated in decision-making, and to be able to share information from the White House into their own communities.
- The visions of the participants in this meeting need to be heard more often. The tribes need improved communication with the White House Council on Environmental Quality and other agencies. We need to be consulted in a more formal, regionally organized way, with ongoing dialogue rather than just isolated requests for input, and with respect for indigenous knowledge and culture. A more formal means is needed to address the loss of culture and biodiversity on which the culture depends. In addition, a means is needed for non-native people to be educated about Native issues.
- There should be a protocol for this kind of listening session; instead, there is a fear of sharing, which, in turn, creates concerns about how the continuation of this type of dialogue will be addressed in the future.
- There is a need for more consultation. The federal government should hold conferences with non-elected officials as well as elected officials. There is a need for building alliances with non-Native groups such as mayors, hunters, fishermen, and physicians to build healthier communities.
- The federal government should consider recruiting a small group of tribes to work with CEQ, EPA, and others to discuss national concerns. Initial contact has been made with EPA, USGS, NOAA and BIA.
- In law and policy, there is still a sense of non-Natives' dominance of Indian land. The United States needs to work with Natives as colleagues rather than as dependents. Research should be with, rather than about, Natives Americans. Indigenous nations need to be heard internationally; specifically, we need a vote at the coming climate summit in Copenhagen.
- Overall 565 Indian Nations desire to reduce CO2 and find ways to share that information.

Education and Capacity Building

- There is a real need for a means by which for non-natives can be educated on Indigenous issues. U.S. citizens should spend one year living in a Native community to better understand Native Americans and Indigenous ways of life.
- Sovereignty is a nation's ability to control its own destiny, but can't achieve it without control over power, land, and resources. U.S. people need to be adaptable. As land changes, people need to be able to change. Native people need the opportunity to become more educated about science and climate change.
- Tribal colleges and universities need more funding for infrastructure for sustainable approaches, like gray water recycling, green roofing, and solar power for personal computers and wireless devices. Sustainable development can provide for future generations; the U.S. government should support it on both Native and non-Native lands.
- More resources are needed for Native elementary and secondary education to support Native communities in getting into technical fields that require post-secondary education. Native Americans are significantly underrepresented in these areas. Tribal colleges and universities need funding for research, to address issues of local interest..
- There is a need to inspire tribal governments, empowering tribal communities through dissemination of climate change information. Educating tribal communities could be done by tribal colleges working with tribal governments. Outreach should include rural and isolated tribes.
- There is a need for diversity not monoculture. Demonstration projects are recommended and should be arranged for tribes or tribal colleges to arrange a package to be developed thus producing sustainability and diversity.
- There is a need for more extensive training in tribal communities, including environmental justice, to address local issues and it also is important to train communities in Traditional Ecological Knowledge (TEK).

Energy and Mining

- The federal government must stop unsustainable projects and further adopt wind, solar, and tidal energy. With offshore and coal, communities cannot survive. We must take serious reduction of emissions now.
- The federal government should implement a moratorium on any new oil gas and coal energy development on or near Indigenous lands.
- There is a need to conduct environmental epidemiology studies on energy development and health impacts in areas relevant to Native peoples such as the Emory River TVA spill.
- The Dine people have seen increases in cancer rates due to pollution from mining.
- Mining can put important archeological sites at risk and can do great harm to the physical world.
- White House should pressure senators to revisit the Environmental Justice Control Act to give Indigenous communities resources.
- Restoration sites for tribes need legislative support. It is recommended that a trust be put in place to allow access. Tribes The U.S. has an obligation to ensure that resources are available and recovered. Tribes are focusing on recovery and need it to be put into legislation.

- The federal government should support sustainable development of native and non-native communities including the 7th generation amendment to the U.S. constitution to protect air, water, and land for future generations. The only pockets of natural resources are on Indian lands because they manage for generations to come.
- The White House should look at examples of sustainable housing ideas in Indian country such as green roofs, water recycling, independent power, and wireless internet protocol. In Thunder Valley, Pine Ridge, youth led a sustainable development corporation creating a sustainable community.
- The U.S. government needs to examine the impacts of buildings on the environment. Buildings take 50%-70% of resources. Should consider source of our materials. Sustainability is about meeting needs of people today, and for future generations. In order to plan for the future; the opportunity is now to do something sustainably. We should create living buildings in symbiosis with surroundings, e.g., modular, climate responsive, low cost, biodegradable, elder friendly, and trendy.
- A shared community vision on sustainability should include support, sustainable materials, growing capacity locally, using local colleges, respecting rights of individual, utilizing power of community, creating a forum to share best practices, and designing with the principle that 'water is life. For example, Greensburg Kansas was destroyed in 1997 and rebuilt as a green community.
- There is a need for more incentives for tribal business to create matching requirements .
- EPA, DOT, and HUD have created model sustainable communities which are good models for creating a new cluster of ecological development. Agencies want to present these models as blueprints for other sustainable housing. The White House needs to find a way to convince the non-Native population to develop differently using sustainable approaches.
- HUD housing for tribes has decreased. On the Rosebud Reservation, only 20% of tribes are eligible for HUD housing while the other 80% of those who need it are disqualified, partly based on income and this results in homelessness. Maintenance is needed, while ¾ of money taken away such as DOE money for energy efficiency used.

Intellectual Property

- Intellectual property is knowledge of a community and a generational creation. There is a need to safeguard indigenous nations' stories, ceremonial information, carvings and songs through intellectual property right laws.
- It is advised that the U.S. adopt indigenous rules by going to Office of Patents to get permanent protection to guide land use recovery.
- There is a need to be able to integrate traditional and western science in a way to protect culture. Tribes are the best avenue.
- The U.S. should reexamine grants in order to protect traditional knowledge.

Language

- Languages are a repository of accumulated knowledge. Boarding schools performed Linqusticide and the U.S. government should assist with revitalizing indigenous languages. Languages carry a sacred and religious responsibility out to traditional territories, larger than reservations.

- The federal government should reexamine the 1954 Teehiton Legal Brief on title to land, which indigenous peoples were considered only “occupants”.

- Native American languages are the repository of thousands of years of knowledge about the land, and Native people have a sacred responsibility to their traditional territories, but the U.S. government destroyed languages and the attachment to the land.

Mitigation and Sustainable Energy

- There is a need to disseminate information for wind energy development. When starting up, tribes did not know whom to contact for information regarding projects and development.
- Wind in the west and solar in the southwest is not enough. There is a need for alternatives like hydrogen fuel cell technology. Nuclear power, carbon sequestration, and the Reducing Emissions from Deforestation and Forest Degradation (REDD) schemes currently being formulated under the United Nations Framework Convention on Climate Change are false solutions. These programs fail to safeguard the future of and the environment and the rights of indigenous peoples.
- The real remedy is to reduce emissions to stabilize carbon dioxide in the atmosphere at 350 parts per million. The way to do that is through renewable energy and sustainable development. In sustainable development, the Native community has set a good example. At his inauguration, President Obama said wind and solar power are not enough; e.g., hydrogen fuel cells need to be developed.
- The Central Arizona Project (canal) focuses on a solar cap which would produce energy and reduce evaporation. A proposal is in the works. Also, BuRec built CAP for Phoenix irrigation, although, there is never enough funding or water for Indian lands.
- Blackfoot Tribal College was the first to put up a wind project in 1995. They are planning an off-grid system, not allowed to have more than 50% off grid, which would train faculty & students at the same time and promote understanding of local co-op policies.
- Every federal agency should analyze their CO2 footprint which should include wind power systems. To remedy this, a green federal power grid system should be established.
- The Environmental Justice project concerning flooding of Missouri River was selected by the federal government to make use of Western Area Power Administration which markets power. This will include nine of ten top wind states. It is designed to carry hydro, but WAPA is now buying coal power to meet hydro contracts. The U.S. should model “buy wind” power for hydro supplement rather than coal.
- There is a need for energy audits for aged buildings. The U.S. government should implement this.

Water

- Water has rights - it is an integral part of everyone. Water has many uses such as sacred uses and the hydrologic cycle. The U.S. should promote these in western science; it is lacking in this in this area.
- To understand water, we must use indigenous knowledge and look from beginning to end. There is a concern for the Mississippi River. At headwaters, it is clear, but, by the time it reaches Kansas, it is tainted, and at the mouth of the Mississippi, it is a dead zone.

- Tribal and treaty rights to water are being violated. USACoE is refusing to recognize Lakota rights to the Mississippi River. Tribes have advised the U.S. government to reexamine tribal rights to the Colorado River as well.

- The Muscogee Tribe has recommended improving water quality standards in the Penobscot River and Kansas River and increasing monitoring of nonpoint source pollution to identify sources of pollution.
- Tribes are concerned with the protection of the Baker Wetlands in Lawrence, Kansas. The Kansas Department of Transportation is planning to build a road through the natural wetlands environment. The Baker Wetlands are an essential part of the U.S. natural resources as well as the Lawrence community.
- There is a growing concern about drought and water quality. The U.S. needs to improve irrigation and water rights for food security. There needs to be better policies in place to keep the Nation's food supply secure. The Bashes Tribe went bankrupt now the groups have to drive long distances to get food and water.
- In the Southwest area of the nation, drought continues to grow and the need for tribes to haul water frequently is increasing.
- In another example of increasing water shortages, on the Santee Sioux reservation drinking water has to be purchased, because there is no source. We need to develop models of climate change impacts on Native Americans to bring attention to such issues and to create strategies to address them.

Science

- Native Americans are taking charge of own research and legal matters. They have their own tribal scholars, traditional knowledge and science. Native Nations are not dependent nations, but colleagues. The U.S. should consult Indigenous tribes as well as bring their research to the table; the research should not about us but with us.
- The U.S. Government and agencies like CEQ have failed to protect our culture and lands. There is a need to update NEPA to protect our culture and the species related to our culture. We feel that NEPA does not give justice to tribes.
- Discussions should include traditional ecological knowledge (TEK) as well as science and data. US government agencies need more formal consultation. Communities have a great role in their loss of culture and biodiversity and they are reliant on it.
- President Obama told the tribal people they are no longer victims yet there is no place for native scientists and their research.
- There is a need for studies of relocation, looking at examples of others across the world. This is not properly addressed and there is a need to look at this with more cultural sensitivity.
- Traditional epistemologies and Indigenous knowledge need to be integrated into western science regimes. Indigenous knowledge includes information that western science is lacking.
- There is a need for the federal government to break the boundaries on needed research(among science, culture, and intellectual property) and include funding tribes' research.

EPA Region Five

• **Michigan**

This area was the first nation near the St. Clair River of documented gender imbalance from pollution.

• **Minnesota**

- East Coast tribes such as the Miox, Ojibwa, and Dakota migrated inland. There is a melding of indigenous cultures through loss of sacred sites from development. The people cannot access lands due to energy development. U.S. needs to uphold treaty resource rights to empower them.
- There is a need for an indigenous co-chair in the Air and Waste Management Association to encourage the improvement of air quality over Native lands.
- Lake Superior Chippewa Tribe in the Arrowhead Region of Minnesota has endured a hundred years of mining and extraction of iron ore, gold and palladium on an area over a hundred miles long.
- Lake Superior is a third of the world's fresh water source but it is contaminated by sulfide mining and continues to be impacted by additional aggressive mining activities.
- ACoE, Minnesota DNR are viewed as cooperators yet Native Americans' comments are included as 'footnotes'. Federal government has fiduciary responsibility to protect property rights of Native Americans.

EPA Region Six

• **New Mexico**

- The Navajo Tribe insists research on contribution to carbon dioxide of non-cleaned up areas as New Mexico is the potential target of restoration.
- The Navajo Tribe and other tribes of the Four Corners area are at risk for health problems and even survival. Mining pollution contamination from coal, oil, gas, and uranium has left the land is devastated and people dying from cancer, leukemia, etc.
- Peabody Coal, BHD agreements were made a hundred years which allowed eighteen hundred more oil wells that San Juan County agreed to has created high opposition by tribes.
- A new power plant is going up next to two others that are the worst polluters; one of which is the Desert Rock power plant so please help us stop it. Remand air permit transmission. Additionally, the plant has applied for carbon capture and storage which will contaminate groundwater.
- Fossil fuel projects were set up through the early 1900's agreements when Native Americans did not understand any English and were uneducated on the processes. The contracts are outdated. There is a need to renegotiate agreements and contracts to include informed Native input.
- The Navajo Nation requires federal funding for roads. There are very few paved roads in the area. For the first time, they had a child get an asthma attack due to the poor roads systems and resulting poor air quality.

• Iowa

- Coal fired power is the main source of energy for the area. It is a significant threat to public health and the environment and affects our overall quality of life. Consider Indigenous peoples as a sentinel species - we cannot separate environment from health. We need clean water and air.
- We recommend for health care reform that you oppose expansion of coal in the plains. At this time, it appears that the hearing process is a rubber stamp for development

• Nebraska

- The Sandista Nation is concerned about the low levels of the Missouri River as well as the back-up water which is due to sedimentation created by a lake. The people cannot drink the water due to pesticide and flooded pumps. All houses had water in the basement, and many in the area had to relocate twenty years ago.
- We recommend that you remove the dams or improve their operations.

EPA Region Eight**• Montana**

- Hunting and gathering has been affected tremendously. For example, elk and deer are moving to new areas, making it harder to hunt and huckleberries are moving to higher elevations and no longer getting the rain they need.
- The Flathead and Salish are becoming poorer tribes. They have to buy gas to go further to hunt and gather because there is less food available.

• South Dakota

- Drought and environmental justice is an emphasis for Native American people. Overall, water management has been poorly handled. Tribes were told that the U.S. built the dams to move barges yet no barges have ever been brought to the area.
- In 2004 through 2005, the Standing Rock Sioux Tribe faced drought. The people went thirty days with no water so the ACoE extended the pipeline to the Missouri River.
- There was a drought in the area in 2006, but in the town of Bismarck, people were wasting water.

• Wyoming

- The Northern Arapaho Tribe needs quicker turn around on water quality and air quality standards. In their area, coal bed methane creates 'produced' water. The area is surrounded by energy development which needs to be done in an environmentally sound manner.

- Jonah Gas Field is the second largest area and it produces the most degraded air quality. Water is extracted and disposed of in this area and discharged water produces a sodium film on the soil, therefore, groundwater inspection is substantial.
- Coal is on every reservation.

EPA Region Nine

• Arizona

- Peabody Coal has a 'life of mine' permit dated up to the year 2040. The Hopi Tribe conducted an EIS on the area but the permit was signed without their knowledge and told it was "too late".
- The Black Mesa Trust, Forest Service Hopi Energy Team and Office of Surface Mining Archeological Inventory - adhering to only 10% (40 of 400) yet succeeded in stopping a coal slurry plant.

• Hawaii

- Coastal species and archeological sites will be lost to sea level rise.
- Hawaii is home to many endangered species, including medicinal plants, but these species are not protected from invasive species brought in by people.
- Shell fishing and seaweed harvesting have declined from impacts of climate change.
- Mosquitoes in Hawaii could migrate to higher elevations endangering birds; loss of bird pollinators could affect plants.
- We recommend relocating communities on smaller pacific islands; creating new solar farms; creating energy, education, work, and training opportunities in Hawaii; creating wind farms with underwater cables and geothermal; and developing models of climate change impacts on Native Americans.
- Create energy, education, work, and training opportunities in Hawaii.
- Develop models of climate change impacts on Native Americans in all US locations.

EPA Region Ten

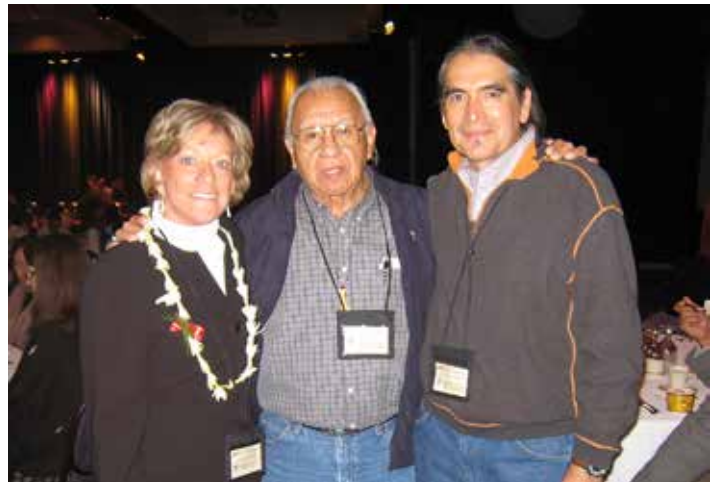
• Alaska

- In Alaska, most large-scale development of profit-based, carbon-based energy – natural gas, offshore drilling, and coal – is within the lands and waters of indigenous people. Reservations are being mined for coal and may in future be mined for tar sands; these processes are polluting.

- Climate change impacts are very severe where sea ice is receding and there are steep rises in temperatures.
- There is a need for financing of infrastructure for such support as reliable village drinking/washing water supplies, sanitation systems, fuel storage, and waste disposal sites – which will withstand permafrost thaw and erosion from sea level rise and strong storms.
- Mitigation of tribal lands, agriculture, and forests is occurring in Alaska. In Alaska, Pacific basins and islands are being displaced. Preparation for the effects of such displacement is needed.
- Research collaboration between indigenous knowledge and science, ensures that the best knowledge is available for Arctic problem-solving.
- There is a need for an increase in international communication of values.
- Alaska is 'ground zero' for U.S. energy policy.
- There is a need for large scale development for resources in territories of Indigenous Peoples, e.g., Yukon Flats, Outer Continental Shelf, Beaufort, Chukchi, Cook Inlet, and the North Slope.
- Alaska produces a third of the nation's coal yet it is on the forefront of climate impacts; the canary is on life support.
- In Barrow, there is a concern about DOI Offshore leasing. The Department of Commerce is doing enforcement and cleanup 4,000 miles away from Alaska from Washington, DC so these concerns cannot be heard.
- Create a streamline process of communication with Alaska Natives and make them part of the system, don't just meet them in court.
- We recommend that all parties create partnerships through regional agreements such as memorandum of understanding, memorandum of agreement, and reinforcing treaties as well as language with conflict resolution; enforcement of mitigation and global acceptance of value of sustainable practices is needed.



PERSPECTIVES FROM THE COMMUNITY



The workshop was organized to hear from as many Native participants as possible, and while we tried to capture and transcribe most presentations for the report, the large numbers of excellent speakers exceeded our recording capabilities, so we must offer our apologies to those whose statements are not fully transcribed in the report. Instead, it became necessary to compile the essence of many discussions throughout the workshop in shorthand listings of “bullets” during the sessions.

“Sustainable agriculture may contribute to the effort to reverse climate change. Studies indicate that, with organic agriculture, soils become more alive and hold more carbon and that cycling of organic matter in the soil will help sequester a lot of carbon in the atmosphere.” Clayton Brascoupe

**Clayton Brascoupe,
Traditional Native American Farmers Association**

Mr. Brascoupe represents the Traditional Native American Farmers Association (TNAFA), which was formed in 1991 out of a meeting hosted by a seed conservation group of indigenous farmers, primarily from New Mexico and Arizona, talking about issues with which they were faced. As early as 1991 some elders at the meetings said they had seen the weather patterns changing over the course of their lives.

“When the TNAFA started, young people seemed to be losing interest in farming. The Association set out to try to reverse that trend and has been fairly successful. TNAFA does training and sometimes brings people to workshops in areas related to sustainable community living. Workshop topics include home building, designing communities, and alternative energy.

There was a drought starting about 1996 that lasted 11 or 12 years. My children (who were small when the drought began and are now adults) recognized that our farm’s productivity has only recently returned to what it was before the drought. The forecast is that drought cycles will be longer and more frequent. In between those hotter and dryer times, it may be cooler and wetter. In farming terms these are limiting factors; strategies to address them will be needed so that people can continue eating well, raising families and growing communities.

Sustainable agriculture may contribute to the effort to reverse climate change. Studies indicate that, with organic agriculture, soils become more alive and hold more carbon and that cycling of organic matter in the soil will help sequester a lot of carbon in atmosphere.

As farmers and herders and ranchers, Indians in the past did not rely on just one type of seed; varieties that thrived under various conditions helped them get through changing climate cycles. They embraced biodiversity and learned about it. In the United States now there are just four varieties of corn being grown commercially. In indigenous communities, there are thousands of land races of corn. When the drought began in 1996, many crop varieties had been lost; this made surviving the drought that much harder. Now there is an effort to grow as many varieties as possible. As part of this effort, I share my seed with anyone who asks for it. TNAFA encourages people and their communities and farm projects to grow as much as possible and to learn about growing specifically for seeds, developing seed libraries.”

“You hear that Indian Country is the victim of a colonial policy, a system set up to make it possible to get the resources out of Indian Country with little regard for what was left behind. The legacy left behind was not only environmental issues but also psychological issues, resulting in intergenerational trauma. You hear about this as the past, but it is continuing.” Michael Connolly

**Michael Connolly,
Laguna Resource Services Inc.,
Utility Scale Wind Development**

Mr. Connolly is a former aerospace engineer and has worked for his tribe at the Campo Indian Reservation since the early 1990s, in the reservation’s environmental regulatory program, environmental consulting and renewable energy. He talked about wind power on Indian reservations and about government policies that exploit Indians.

“The Campo Indian Reservation is located in the southeast corner of San Diego County. It is small, about 25 square miles, with 350 people of the Kumeyaay Tribe. The United States is in the third surge of a renewable energy push. The first surge started with the oil embargo in the 1970s and ended when President Reagan took office and incentives to switch to renewables were undercut. The second surge occurred in the 1990s partly as a result of the Gulf War. Then, subsidies also went to both renewables and fossil fuels, with the result that many companies providing renewable energy did not have sufficient competitive advantage to survive. After 2000 a third push for renewable energy started. It continues, and seems to be building momentum.

In 2005, the Campo Reservation signed a lease with Superior Energy for a wind energy project: twenty-five, 2-megawatt turbines. These projects are complex, with a lot of technical issues. They require, among other things, road access, a substation nearby, and the right wind characteristics.

For this initial project, the benefit to the tribe is about \$300,000 – \$400,000 per year, depending on performance. Environmental problems that these types of projects bring can include bird deaths – especially near major flyways – bat deaths, noise, visual impacts (flickers from sunlight), aesthetic issues (do you want to look at turbines?), and limitations that turbines may impose on future development.

It has been said that Indian Country is the victim of a colonial policy, a system set up to make it possible to get the resources out of Indian Country with little regard for what was left behind. This system continues to this day. The tribes’ ability to exercise economic control over their territory is hampered by the requirement to pay state sales and property tax. States have the right to collect property tax on reservations for property owned by non-Indians and to collect sales tax for sales to non-Indians, even though the services for which these taxes are supposed to provide – water, sewer, fire – are provided by the reservation, which does not benefit from the taxes.

Additionally, Indian Tribes are not allowed to float tax-exempt bonds, except for essential governmental services, like sewage treatment and water plants that service local population. Therefore, this good source of money is not usually available to tribes, although the stimulus bill has created an exception. Wind energy offers tax incentives, up to 60% of the value of the project – but, because tribal governments don’t pay taxes, that saving is lost.

The current economic structure pushes tribes toward passive lease arrangements with the effect that outside corporations realize the bulk of the project profitability. Tribal control and ownership can create project losses that could cripple or kill a project.

This is colonialism, continuing to this day.”

“Fecundity and fertility lie at the center of continuous creation that is reflected in our ideas about sovereignty. The area of sovereignty having to do with the control of production and reproduction - not just the reproduction of human beings, but also the reproduction of culture - is interwoven with issues of resilience and adaptation.” Katsi Cook

**Katsi Cook,
Mohawk midwife**

Katsi Cook, a Mohawk midwife, mother, and grandmother is a highly respected women’s health activist and advocate for environmental restoration in her community of Akwesasne. She shared some special thoughts about her community, traditional knowledge, and working at the intersection of reproductive justice and environmental justice.

“Fecundity and fertility lie at the center of continuous creation that is reflected in our ideas about sovereignty. The area of sovereignty having to do with the control of production and reproduction - not just the reproduction of human beings, but also the reproduction of culture - is interwoven with issues of resilience and adaptation.”

The social knowledge of Indigenous people is part of traditional environmental knowledge. Consider this story from my Mohawk community at Akwesasne:

One day black ash basket maker Tehokwirathe (A Tree That Stands Out) was in his yard pounding black ash logs to make splints for baskets. With the back of a heavy axe, he would pound up and down in rhythmic movement on the thick black ash log. A group of men had gathered around him, sitting on thick tree stumps, just visiting and watching Tehokwirathe pound his logs. Every now and then Tehokwirathe would look up from his work. Several times he stopped pounding, standing quietly, wiping his brow. He would turn his head a full 180 degrees, scanning the horizon, listening then resuming his pounding against the loosening strips of the log. After several breaks like this, he suddenly dropped his axe and walked back into his house, abandoning his work. ‘It’s not a good day to pound logs’, was all he said to his puzzled visitors before disappearing into his house.

When I heard this story recently, I wondered why Tehokwirathe had suddenly stopped his work. What indicators in the environment told him all those years ago that it wasn’t a good day to pound logs to make baskets? Was it the weather? Were there too many mosquitoes? I was puzzled, and the storyteller - who had sat among the men gathered around Tehokwirathe that early morning long ago - had no idea either.

Later, on the same day that I heard this story, I was visiting my daughter-in-law’s mother, Susan Rourke, who grew up in St.Regis Village, in her home just across the river from where Tehokwirathe lived at Spaghetti Corners. I mentioned this puzzling story to Sue because our new grandson had been given Tehokwirathe’s name by his paternal great- grandfather Joe Rourke. Tehokwirathe had built Joe’s home using only a hammer, a saw and nails. The memory of the skilled and versatile Tehokwirathe would live on in our little grandson.

Sue Rourke’s childhood memory held the key to the mystery. She recalled that there were a number of basket makers who thrived at Akwesasne in Tehokwirathe’s day. She remembered waking in the morning to the sound of Tehokwirathe’s pounding – ‘duum, duum, duum...’ in sequential rhythm that carried through the air across the river.

‘Soon’, Sue said, ‘another basketmaker would start pounding logs, then another, until the pounding of logs joining Tehokwirathe’s

rhythm grew into a synchrony of the sound of black ash logs being pounded, resounding through the village, and across the river from Snye where Tehokwirathe lived.'

This was the solution to the mystery. Tehokwirathe was a lead oscillator, a pacemaker, a sender and receiver of signals within a community of basketmakers. He had been listening for the sound of other basketmakers with whom to co-create a synchrony of pounding - 'duum, duum, duuum...' - like pacemaker cells in the heart or a group of fireflies flashing in darkness along the river. This had been Tehokwirathe's indicator for a good day to pound black ash logs to make the splints needed for the baskets Mohawks are renowned for. When he did not hear this social network of log pounders join in around him, he knew it was not a good day to pound logs.

These kinds of social networks are the key to our community continuity, sustainability and resiliency. Together, we reproduce culture. In sync, like a skein of sundancers, we are able to achieve more, together.

My sister-in-law, Loretta Afraid-of-Bear Cook, has shared with me the spiritual knowledge embedded in her ancestors' Lakota language, of doing things in what she terms, a Kapemni way, a family way of doing things together for a purpose:

When you have your family, when you're doing something in a Kapemni way, in a circular way, you are doing something for a purpose. You throw prayer to the universe and it comes back to you as protection, as holiness that you have to have so that you feel confident again to do these things... So, within that triangle circle, you need to teach that whatever you throw out to each of the Four Directions, you're throwing it out with purpose. You're throwing it out and it's going to come back to you, so you're ready for it. That's what Kapemni means.

In honor of the women and of life, I offer a prayer song that comes from her Afraid-of-Bear relatives. The song, Anpo inajji ki, is sung between 3 and 4 am on June 17 through June 21 at the American Horse/Afraid-of-Bear Family Sundance at the Wild Horse Sanctuary - the place where the Four Directions meet - in the Black Hills of South Dakota. The song acknowledges the morning star standing on the horizon with its promise of the breaking dawn:

*The morning is standing
Look at it
All over the world
the morning is standing
Look at it
Hold this moment close.*

*Thank you Earth. You know the way.
Thank you, Grandfather Sun. You love the people.*

“Increased sustainability is an exercise in Tribal sovereignty. It’s the Tribal government acting to preserve its assets for generations using its own culture and its own inherent powers. Tribal governments have the unique ability to couple tradition and culture with science and technology to provide a future more secure than what science and technology alone would provide.”

“The match between science and a broad view of how the world works is worth a lot.” *Bob Ellison*

**Bob Ellison,
Director of Land and Natural Resources for the
Shakopee-Mdewakanton Indian Reservation**

Bob Ellison is the Director of Land and Natural Resources for the Shakopee-Mdewakanton Indian Reservation. He spoke about the Shakopee-Mdewakanton Reservation, home of the conference, and the community’s sustainability initiatives. He thanked participants for coming to work on the climate change issue, which will have a disproportionate influence on Indian Country. “Increased sustainability is the Tribal government acting to preserve its assets for generations using its own culture and its own powers. Tribal governments are uniquely able to couple tradition and culture with science and technology to provide a future more secure than what science and technology alone provide.

The staff at Shakopee have created a sustainability plan and started to implement it. Sustainability begins with environmental protection, and environmental protection begins with resource assessment. This entails gathering information from elders and other community members, reviewing historical records, and doing surveys of habitat, flora, and fauna.

The next step in a sustainability plan is habitat restoration. Some places, like wetlands, are set aside, not to be built on. This produces lots of benefits: increased native flora and fauna, carbon sequestration, a reduction in the heat island effect, and retaining the cultural landscape that the specific culture of that tribe is based on. Prairie has been restored on steep slopes, to grow grass for buffalo and to grow fuel for nearby Koda Energy.

Finally, there is systems improvement. Examples at Shakopee are:

- The Tribe has put up a wind turbine that generates 1.5 MW and generates enough power for the reservation.
- Fuel is produced from food waste (vegetable oil).
- The community’s wastewater plant is designed to have a small footprint. It uses new technology developed in Europe. It produces no odors or noises, and its effluent is used for groundwater recharge. Limits are met easily in all effluent parameters. The water irrigates the golf course.
- Pervious paving directs runoff from contaminated parking lots into an underground storage chamber from which it is taken to a bioremediation site where it is treated.
- The fire station has been retrofitted with solar water heaters, sky lights, and light sensors.

Mr. Ellison's department has 12 employees, primarily technical staff. The green economy has lots of jobs. For example, the wind turbine requires maintenance and wastewater plant requires operation. Most tribes hire two or three interns.

Mr. Ellison said students should not have to be told to study science. That should be just what people do, especially if they do it as part of their culture. The match between science and a broad view of how the world works is worth a lot."

"If you want people to represent you, it takes money and time, and you have to give them the space to be able to do so."

"Tribal governments can be moved in the proper direction if you ask, if you demand, if you participate. These [treaties] are proof that it was done in the old days and it is done today yet." *Frank Ettawageshik*

**Frank Ettawageshik,
Executive Director, United Tribes of Michigan**

Frank Ettawageshik is the Tribal Chairman of the Little Traverse Bay Bands of Odawa Indians and has been working to help protect and restore Great Lakes ecosystems in a way that is also faithful to the Nation's treaty obligations and trust responsibilities toward Tribal communities. Mr. Ettawageshik talked about Tribal government and its relationship to the people, as well as inter-Tribal treaties, citing current and historical examples.

"A broad range of tribal representatives from all over the United States are attending this conference and, yet, there are very few elected tribal officials in attendance. 'Where are our leaders?' 'Why don't they care?' These two questions were raised by other speakers. It is truly important for Tribal leaders to attend international meetings so that Indian Nation constituencies have representation. Some tribes have addressed this issue in their governing documents. In the constitution of the Waganakising Odawak (Little Traverse Bay Bands of Odawa Indians) of Michigan, the Tribal Chairman's first duty is ambassadorial. Yet Tribal leaders often get complaints that they are spending too much money traveling. They are accused of not being in their Tribal office and not being accessible enough to the people they represent. Balancing these two responsibilities is one of the toughest dilemmas for an elected official.

To be able to attend meetings, Tribal leaders need the support of their communities. They need community members to ask them to go to meetings, to support them at budget hearings, to support the inclusion of funds for travel, and to understand, if a leader is not accessible at home, that he or she may be away at an important national or international meeting. In other words, leaders need time, money, support and space to represent their people.

I will now cite examples of Tribal treaties starting with a 1791 peace treaty amongst the Ottawa, Chippewa, Lakota, Nakota, and Dakota. This was, according to Vine Deloria's scholarship, the first written treaty between Tribal governments. This treaty served as evidence in 1992 for the Little Traverse and Little River Tribes when they were seeking federal acknowledgement before the U.S. Congress. As this example shows, treaties are not all with the United States – a treaty between Tribal nations is no less an international agreement. In other examples, three Michigan tribes granted each other reciprocal hunting rights; a May 2009 agreement with the governor of Michigan addressed climate change; a 2004 Tribal and First Nations Great Lakes Water Accord was signed by representatives of 140 nations; the United League of Indigenous Nations Treaty was signed by 84 indigenous nations from Australia, Canada, New Zealand, and the United States since it was drafted and first signed at the Lummi Nation in 2007.

In conclusion, Tribal governments can be guided to respond not only to domestic issues but also to international ones. Tribal governments can be moved in the proper direction if you ask, if you demand, if you participate. These treaties are not dead. It was done in the old days and it is still done today.

“Indians are not leaving this planet. This is where we live and raise up children, listen to Henrietta Mann talk and sing, listen to the drum, and dance, and make baskets and do our prayers. This is our hunting and gathering and harvesting area. It has to be protected.” *Billy Frank*

Keynote
Billy Frank
Chairman, Northwest Indian Fisheries Commission

Billy Frank, Jr. of the Nisqually Indian Tribe is the dedicated, long-time Chairman of the Northwest Indian Fisheries Commission, representing the 20 treaty Indian tribes in Western Washington and promoting cooperative management of natural resources – a strong environmental leader and treaty rights activist.

“We are the treaty Indian tribes in Western Washington. We are salmon people. We have lived here for thousands of years. We depend on the natural resources of the Pacific Northwest to sustain our way of life. We are co-managers of this precious resource.

For more than 150 years, we have fought countless battles to protect the salmon and the fishing rights that we reserved in treaties with the United States. We are natural resources co-managers with the state of Washington of this precious resource and leaders in salmon recovery. For us, the fight to save the salmon continues where we live – every day in every watershed. I am a Grass Roots activist and have been involved in acts of indigenous resistance when needed for my people, such as fish-ins in opposition to state authorities. The Supreme Court Boldt Decision was a landmark decision that affirmed the rights of most of the tribes in the U.S. state of Washington to continue to harvest salmon and my people’s treaty rights to catch 50% of the fish in our rivers. We are co-managers of this planet and natural resources like the salmon. When President Obama got elected, the Tribes were elated. He promised to pass some laws for us. We, the Tribes, want to help him. We want to make him successful.

Listening is one thing. Doing it is another thing. We listen to the mountains, prairies—that’s who we are. We all fought for who we are to protect ourselves. We remember running from the U.S. cavalry and white people. We’ve got to make things happen. Whose going to take our place? We can sit on the Supreme Court on every bench. We can be the President of the United States. I’ve been waiting for 78 years for this President to come along. President Obama being our President started in the 1960s with the Civil Rights Movement. We marched with Martin Luther King for treaty and aboriginal rights. Today we can’t forget why we are here. We are here for survival and survival not just for Indian people. The climate is changing. That is real. We live on every one of the rivers along the Pacific Coast. We manage 200 miles of ocean. We sit at important tables, yet we are left out of a lot of tables where key decisions that affect indigenous people and this planet are made. Whenever it is good for us, the Federal government, corporate and other interests will talk to us. When something is done against us, we do not sit at the table.

Natural resources is who we are. How important a cedar is to us, prayers, bundles we have to carry, and our children. President Eisenhower passed the 1954 Termination Act, which was signed into law and which terminated federal control of and federal benefits for many tribes. We fought that and drove it back. This country was trying to get rid of us in the past and is trying to get rid of us today. We are stronger than ever. We went through 10 Presidents and 7 governors in the state of Washington to appeal for our rights. We don’t have room for more people in the state of Washington, yet they come. Trees are cut which hold water for all of us. The U.S. Government told our Indian Tribes that the government is suing us.

We are told we must now make agreements with local governments and states. The agreements have no funds for Tribes. In the Southwest, water rights for indigenous people are going nowhere. Corporations are the greed of our country. Tell it like it is. When

the U.S. Government got organized in our country, they tried to kill us off. We gathered, got education, and got things right legally. Corporations took over the country and run the land. We want the law to be enforced. It is not being enforced. The Supreme Court, nobody on the bench talks on behalf of Indian Nations. Nobody is educated on the Supreme Court about who American Indian/Alaska Native people are. It is not right. We are seeing a brighter side with President Obama.

When we talk about climate change, the Pacific Ocean is poisoned. 300 miles of it is a dead zone. There is no oxygen in the sea here anymore. The U.S. Environmental Protection Agency (EPA) asks for comment on the toxic world we live in. We drew a poison map. It relates to the Yukon oil spill. Nobody is showing the Poison Map because it tells the truth. Nobody in this country tells the truth anymore. We talk. We are the messengers for all of us. Rivers at spring time are low as can be. Today we have flooding and 70-80 m.p.h. winds. Tides are going lower.

Tribes have answers. Tribal people know what they are talking about because we live close to nature and observe nature every day. The U.S. government, universities, and corporations say: "I'm the expert." Corporations talk about natural resources in terms of "western science" and "money and marketing." Vine Deloria, Jr.'s vision about the moon, water, and the whole world was spiritual and true. Only you, the American Indian, Native Alaska, Native Hawaiian and other indigenous peoples have this vision. The white world is going to be coming through our doors. Native students need to get their master's and doctoral degrees in natural resources. Tell us how to balance the world now. The ship has been off course a long time. Our President is trying to bring the ship on course. Who is in charge? Not the U.S. President, Governors, nor Legislators. The U.S. Army took 2/3 of the Nisqually Reservation and has been shooting over our reservation since 1919. We have got about 25 years to do something. We and our children can start putting balance back in Mother Earth.

Indians are not leaving this planet. This is where we live and raise up children, listen to Henrietta Mann talk and sing, listen to the drum, and dance, and make baskets and do our prayers. This is our hunting and gathering and harvesting area. It has to be protected."

"Developing countries say there is a historic ecological debt, that they are paying a lot of the price of climate change, a problem they did not cause."
Tom Goldtooth

Tom Goldtooth,
Executive Director, Indigenous Environmental Network

Tom Goldtooth is a prominent leader for environmental and economic justice and the Executive Director of the Indigenous Environmental Network (IEN) – a global alliance for indigenous peoples focused on climate justice, pollution, and globalization.

"The concentration of greenhouse gases is becoming serious. The continuation of dumping carbon into the atmosphere is alarming, to the point where Mother Earth cannot absorb more. Carbon capture sequestration and storage, and other quick fixes like cloud seeding, ocean fertilization, carbon markets (offsets) – these are all false solutions.

The way to challenge this global crisis is through carbon emission reduction targets by industrialized countries. Indian nations are sovereign nations; they can put pressure on the United States through the State Department and demand that the United States go to Copenhagen and beyond with some very clear and stringent positions on reducing carbon emissions by 2020.

Industrialized countries are not stepping forward and making a commitment. Developing countries say there is a historic ecological debt, that they are paying a lot of the price of climate change, a problem they did not cause. Some countries have made specific demands for reductions by industrialized countries; for example, Bolivian President Evo Morales has demanded that by 2020 industrialized countries reduce emissions 49% from 1990. Pending legislation in the United States proposes 20% reduction from 2005 levels by 2020 – but that is just 10% below 1990 levels, and it is not good enough.

Any treaty agreed to in Copenhagen to reduce carbon emissions must also recognize the UN Declaration on the Rights of Indigenous Peoples, as well as the standard of free, prior, and informed consent. The U.S. delegation will protest that language in Copenhagen.

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We demand climate justice now. Keep the fire going. Keep our ceremonies going.”

“Indian leaders, especially warriors, need to be at these meetings [where legally binding rules are negotiated about genetic resources and indigenous knowledge] to defend the rights of indigenous people, that indigenous people are the owners, stewards, protectors of not only the life around us but also our knowledge systems.” *Dr. Debra Harry*

**Dr. Debra Harry,
Director of the Indigenous Peoples Council on
Biocolonialism**

Dr. Debra Harry, Northern Paiute from Pyramid Lake, Nevada, is the Executive Director of the Indigenous Peoples Council on Biocolonialism (IPCB), to assist indigenous peoples in the protection of their genetic resources, indigenous knowledge, and cultural and human rights from the negative effects of biotechnology. Dr. Harry spoke about the worldwide effort to commodify life and traditional knowledge.

“Current international discussions may lead to treaties over the ownership of traditional knowledge. The World Intellectual Property Organization (WIPO) has a mandate to promote and perpetuate intellectual property rights around the world and to develop an international, legally binding protocol that governs genetic resources (the genetic codes of living organisms), traditional knowledge, and traditional cultural expressions, with the goal of making both life forms and indigenous knowledge market ready, so that companies may profit. Similarly, in the Convention on Biological Diversity (an international agreement on biological issues), there is not one state that does not agree with the notion of commercializing life. In negotiations on these documents, getting recognition of the rights of indigenous peoples is virtually impossible. States are operating from the framework that they hold national sovereignty over genetic resources.

There has been no indigenous leadership in these discussions. Indian leaders, especially warriors, need to be at these meetings [where legally binding rules are negotiated about genetic resources and indigenous knowledge] to defend the rights of indigenous people, that indigenous people are the owners, stewards, protectors of not only the life around us but also our knowledge systems. The United Nations Food and Agricultural Organization is asserting ownership or control over all food-related genetic resources, meaning seeds, making them available to others to develop new products, typically genetically modified seeds, perhaps with terminator technology. This amounts to the imposition of intellectual property rights over both life forms and traditional knowledge. Now, in the climate change discussion, indigenous peoples can trade traditional knowledge in carbon-trading schemes. It is important to know the end result before participating in these commercialization schemes.

That end result is to alienate whatever goes into the marketplace. What was cultural knowledge and heritage becomes a market commodity put on a one-way train out of the community, forever to be lost. The post-protection period of an intellectual property right is the “public domain” period, when the property belongs to nobody and is available for free and open access.

I propose including language in the declaration that asserts an indigenous position against genetically modified seeds and organisms and rejects the imposition of intellectual property rights over living organisms and over indigenous knowledge, and that reaffirms Indians’ rights to protect these things within their own systems on their own terms, that is, to protect them in the Indian sense of seven generations and beyond, not to “protect” them in the commodifiers’ sense of stealing what belongs to

Indians. I urge you to get educated and get involved, and to get Tribal leadership involved. Indians have to assert the right to protect what is theirs on their own terms.”

Initial Testimony of Frank Edwards, Assistant to the Deputy Director for Policy, Evaluation, and Post Secondary Programs in the Bureau of Indian Education (BIE)

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“It is often times hard to walk the two roads that we all have to walk. Many of us are traditional Indian people while, at the same time, we are responsible professionals. We have to remain committed to the future of our Indian people and work within systems that at times challenge that vision.” Stanley Holder, Gus Claymore

Special Assistant to the Deputy Director for Policy, Evaluation, and Post Secondary Programs in the Bureau of Indian Education (BIE)

Gus Claymore, Education Specialist for Policy, Evaluation, and Post Secondary Programs in the Bureau of Indian Education (BIE)

Stanley Holder (Special Assistant to the Deputy Director for Policy, Evaluation, and Post Secondary Programs in the Bureau of Indian Education) and colleague, Gus Claymore (Education Specialist in charge of Partnerships for the BIE), spoke about climate change education.

“I appreciate the work that Dr. Dan Wildcat has carried out in the area of climate change. He is a valued member of the faculty and management at Haskell.

It is often times hard to walk the two roads that we all have to walk. Many of us are traditional Indian people while, at the same time, we are responsible professionals. We have to remain committed to the future of our Indian people and work within systems that at times challenge that vision. Very often the controversy between advancing technology and preserving the environment present the same contradictions.

I had attended a gathering at Pawhuska, Oklahoma, some years ago. There was an elder from the Six Nations Confederacy that told of a prophecy of two snakes that landed on the East Coast of the Turtle Islands or United States. There was a black snake and a white snake. The snakes were beautiful and the people were attracted to them. However, wherever the snakes crawled, the land was left uninhabitable and the snakes’ breath was poison and killed people that breathed it in. The elders’ interpretation of the prophecy, and some that heard it, was that the snakes represented the British Government and the U.S. Government.

I believe that the snakes actually represent fossil fuel technology and atomic technology. This prophecy demonstrates that Indian people have always realized a responsibility to protect the environment for future generations and have had concern about the impact of technology that is not controlled. Indian people have been distracted from this responsibility by the pressure of poverty, and the pressure of providing food and housing, and surviving in often dysfunctional environments.

The challenge for the Indian community is to protect the environment through research, constantly observing and evaluating it, and working to make improvements to sustain our lives and the quality of life for future generations. This can be accomplished by building a base of people steeped in research, the scientific method, and committed to perpetuating Indian culture that supports a healthy environment. In recent years, due to the emphasis placed on reading, math, and language arts by No Child Left Behind, science and STEM-based curriculum and programs have diminished. To address climate change and other issue related to the environment, interest in science and environmental responsibilities needs to be reemphasized and, in some cases, reintroduced.

Tribal colleges, including Southwest Indian Polytechnic Institute and Haskell Indian Nations University, have brought opportunities to remote areas and populations that otherwise would not have access to post secondary education. How can we use technology

to advance and enhance education and provide STEM-based programs to remote populations of Indian students. One answer is distance learning, which helps educators share thoughts, teaching strategies, as well as sharing the concerns of Tribal people for education. Education and employment systems are needed in Indian country that give Indian children the opportunity to become scientists, economists, technicians, engineers, and mathematicians and to have the employment opportunities to stay in Indian communities and work with Indian populations.

President Obama has opened the door for a dialogue with Tribal people. This is an opportunity to develop an educational agenda that supports science and STEM-based programs in Indian country.

The BIE has developed a partnership with NASA that offers a two-week pre-service training program for teachers in the summer. NASA also provides distance learning opportunities to BIE schools for teachers and students. NASA is looking for ways to help parents and others responsible for families to be involved in these programs. The BIE has developed other partnerships, such as with Argonne National Laboratory, to support science and the development of green technology at BIE schools.

Preserving the environment is part of our culture and our responsibility. I appreciate the opportunity to participate in the Native Peoples/Native Homelands Climate Change conference and to make these comments."

"The needs are known. People cannot respond to them alone, in isolation, but must form partnerships. Natives hope to be the ones directing the partnerships, saying what needs to be done and how to do it, with partners following Natives' lead." Dr. Cynthia Lindquist

**Dr. Cynthia Lindquist,
President of Cankdeska Cikana Community College (Little Hoop) and Executive Committee member of the American Indian Higher Education Consortium (AIHEC)**

Dr. Lindquist is the President of Cankdeska Cikana Community College and an advocate for Indian women's health, community medicine, and rural health. Dr. Lindquist spoke for Carrie Billie, AIHEC president, whose arrival had been delayed. She thanked her listeners for making the trip to attend the conference. She expressed appreciation for the way the conference had opened: with Native American songs, prayers, and music, signifying conference participants' relationship with each other and with Mother Earth.

Dr. Lindquist welcomed participants on behalf of AIHEC. AIHEC serves about 30,000 students across the country, about 80% of them Indians. Most tribal colleges and universities (TCUs) are reservation-based and serve a respective Tribal Nation. Dr. Lindquist thanked NASA, Dr. Maynard, and Mr. Spears, as well as the Intertribal Council on Utility Policy, Honor the Earth, and the Indigenous Environmental Network, for the conference.

"The needs are known. People cannot respond to them alone, in isolation, but must form partnerships. Natives hope to be the ones directing the partnerships, saying what needs to be done and how to do it, with partners following Natives' lead.

Climate change is a serious issue, and a complex one; there is also complexity in the possible responses. Many Natives do not understand how climate change relates to everything about the way we live, from plastic bottles to recycling to what goes into reservation landfills and how that potentially affects the water table. Addressing this requires strong partnerships and building collaborations is what this conference is about.

People in Dakota/Lakota country are concerned about the seventh generation to come. Tribal college students exemplify that kind of concern. Across the country, Tribal colleges are teaching traditional knowledge and applying it to climate change. Members of

the indigenous community need to help each other, to go forward in a good way. The relationship with NAG is a good one; it is what is meant by "We are all related."

I invite participants to enjoy themselves, meet one another, build networks, enjoy the deliberations, and keep growing and learning together.

Mitakuye oyasin...we are all related."

"Through our ceremonies there is healing, and in our prophecies the healing has begun. Indians will heal together, we will come together in spirit, because this is a crucial time, a time when Indians will be a voice for all – two-legged ones, four-legged ones, winged ones, and the ones that swim and crawl. Let prayers, not global disaster, bring people together with a good heart and a good mind." *Chief Arvol Looking Horse*

Chief Arvol Looking Horse, Dinner/Blessing/Remarks

Chief Arvol Looking Horse is the 19th Generation Keeper of the Sacred White Buffalo Calf Woman Chanupa and is widely recognized as chief and spiritual leader of all three branches of the Sioux tribe.

Chief Looking Horse talked about being born and raised on the Cheyenne Reservation and said that those were dark times, because Indian ways were outlawed. Indian children were sent to boarding school with the philosophy "Kill the Indian and save the man." When Chief Looking Horse was 12, in 1966, he was given the responsibility of being the 19th Generation Keeper of the Sacred White Buffalo Calf Woman Chanupa. They said people should not speak out of anger or hatred that they must speak from their hearts and sing from their hearts.

Chief Arvol Looking Horse wished peace and blessings on his listeners. He began with a statement that was made in 1996 on sacred sites: "We are at the crossroads. Either be faced with a lot of chaos – disasters, tears from our relatives' eyes – or we can unite spiritually and globally." Then he continued.

"It is sad to see what is happening upon Unci Maka, Mother Earth. American Indians and indigenous people from other places have the same message: that Mother Earth is sick. In prophecies, there was talk about big winds, sicknesses, a time when the animal nation would show its sacred color. In the story, the White Buffalo Calf Woman bringing the sacred bundle to the people said, in time to come, she would return and stand upon Mother Earth, as a white buffalo calf. Then there would be great changes, Earth changes, climate changes, and people would go back to the sacred sites and pray where the spirits live, the sacred sites, sacred to the Great Spirit. On June 21, the longest day of the year, sacred sites are honored. On that day those who pray can create an energy shift upon Mother Earth.

Participants in the Native Peoples Native Homelands conference are seen as leaders. Indians are key in this new millennium. Indians have many prophecies. When I was young, I was told the elders' words: that life is beautiful, everything upon the Earth; that everything that moves has a spirit; and that Indians cherish life, especially Grandmother Earth.

A man without spirit is sad and will hurt many people. But, through our ceremonies there is healing, and in prophecies the healing has begun. Indians will heal together, will come together in spirit, because this is a crucial time, a time when Indians will be a voice for all – two-legged ones, four-legged ones, winged ones, and the ones that swim and crawl. Let prayers, not global disaster, bring people together with a good heart and good mind. I ask you to bring a message with one prayer: that the Tribes can be as one to the Creator, can create an energy shift, because, in their spiritual ways as First Nations, they have their dreams and

faith. Now we have a President who recognizes Indians as Native American people and who says, "I believe in change. I ask you to come together in prayer on June 21, stop using styrofoam cups, and think about the environment: each of us can make this environment beautiful. I wish blessings on all of you."

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"Humans are but a small part of the whole, and are not gods. As such they are responsible for the space they occupy on the great sacred circle of life. They exist as co-equal partners with everything in the universe, upon which they depend for their very existence. All life, is not only related, but it is interdependent, as well." Dr. Henrietta Mann

Dr. Henrietta Mann

Dr. Henrietta Mann, Cheyenne enrolled with the Cheyenne-Arapaho Tribe, the Founding President of the Cheyenne and Arapaho Tribal College and currently serves as Emeritus Professor of Native American Studies and Special Assistant to the President at Montana State University, Bozeman, is a strong leader in preserving Native American language, culture, traditions and land.

"I would like to begin with this expression of gratitude for:

Life: the ability to see, hear, touch, smell, and taste

The spirits of this place

This beautiful day

Our grandparents

You, and especially for

Traditional knowledge, which provides the power for our journeys on Earth.

We have been blessed with being indigenous, xamma-voestaneo'o, the natural, ordinary simple people of Earth. What a blessing and a responsibility. For proper context, let me share a brief excerpt from Cheyenne Creation about this Earth, upon which we live out our lives: In that long ago time, Ma'heo'o created Earth, named her 'grandmother', as oldest woman, first woman, the mother of everything that is. Ma'heo'o viewed Earth in all her glory, and thinking with the heart, proclaimed her to be the most beautiful of the entire creation.

All things are her: Her skin is the soil of Earth, the land. Trees and plants are her hair; sweet grass, sage, cedar, and juniper are her natural perfumes that are used as sacred incense. Flowers are the colorful and beautiful ornaments with which she decorates her hair. Rocks are her bones, her skeleton or protective skeletal framework that provides geologic form and structure. Water is her blood that flows throughout an immense circulatory system, which in humans is referred to as the 'oceans or rivers within'. Her internal organs include coal, petroleum, and natural gas, as well as other valuable elements such as gold, silver, and copper.

Many indigenous people know this Earth to be female, a loving being who has nurtured life continuously and inexhaustibly since creation. All life comes from her. She is first mother - there is no other, and she is alive.

Quoting once again from Cheyenne creation: Not wanting Earth to be alone, Ma'heo'o created two beings, South Man and North Woman. Too powerful to dwell together, however, they alternately came and went across the surface of earth bringing the four seasons, in a predictable cycle. Depending upon which of them was with Earth, they brought either the rains or the warmth of spring and summer or the yellow leaves of fall and the cold and snow of winter. Earth was still alone, so Ma'heo'o created human beings to keep Earth company, and who were to live in interdependence with all of creation. They were a happy people at the sunrise of creation.

The further the people walked the Road of Life, however, the more difficult it became. They began to experience conflict, lawlessness, epidemics, and starvation. Ma'heo'o took pity upon them when they were facing famine and the possibility of extinction by sending a prophet to each of the two groups of Cheyennes. Having received their covenants and accompanying ceremonies, the prophets instructed them in their proper care, which are their greatest resources against starvation and extinction. Through the ceremonies they annually renew themselves and the entire world. Their survival is guaranteed so long as they care for their sacred objects, observe their ceremonial duties, and remember the prophets' teachings. The prophets came to the Cheyennes to save them.

After living with them for four long lives of a person, one of the prophets, Sweet Medicine, sadly gave his farewell prophecies. Included among them are two that bear upon climate change and global warming, which were to occur sometime after the coming of the strangers from the East. He predicted the Earth would burn, which is the Cheyenne way of describing global warming, the place we have now reached on the Road of Life. He also warned them about weather changes, and that they needed to be vigilant and watch for these changes from the windows and doors of their homes.

Native peoples are keen observers and are aware of their environment. Since our ancestors have lived long on this land, and handed down through the generations their valued ancestral and tradition knowledge, we know that something is wrong. Climate Change is upon us, and it seems to be everywhere and accelerating, in what has been described as 'fast-forward'. Water is a shrinking natural resource, and there are fearful predictions of water shortages. Indigenous people must guard their water resources. However, bottled water has become quite a business. According to Beverage Marketing Corporation, last year alone, Americans drank 8.7 billion gallons of bottled water, down from 8.8 billion for the previous year. According to Food & Water Watch, more than 17 million barrels of oil - enough to fuel one million cars for a year - are needed to produce the plastic water bottles sold in the United States annually.

Water shortages are causing droughts, which also mean the expansion of deserts. Currently, deserts cover about one-third of the Earth's land surface. The Great Basin Desert of North America ranks as the tenth largest desert of the world. How much larger will it become with global warming?

We are experiencing more frequent, abrupt, and severe heat waves. The New York Times reported on November 14, 2009 that the Leatherback Sea Turtles of Costa Rica, who have dwelt in the Pacific for 150 million years, are casualties of global warming. Gender is determined by the egg's temperature during development; consequently, water temperatures higher than 89.6 degrees can result in an all-female population, and ultimate extinction.

Ice caps and glaciers are melting at a quicker rate than projected. This is affecting the polar bear people, who have to swim further out into the sea to find food, and without stable ice floes, some of them are drowning.

Sea levels are rising with resultant erosion and disappearance of coastlines. This is adversely impacting some Alaskan villages, which are literally falling into the ocean. The cost of relocation is astronomical. For example, relocating the village of Kivalina, population estimate 399, could cost \$54 million.

Permafrost is thawing. Thawing permafrost has caused what is referred to as 'drunken trees' or 'drunken forests'. Their under-developed, shallow roots are weakening, which is causing the trees to tilt at radically different angles. It also is causing house and building foundations to buckle and heave, making them uninhabitable or unusable. Dug into permafrost, some native ice cellars have water dripping down into their food stores, which is an uncommon situation.

There are predictions of more intense storms, such as hurricanes. What more need be said since our country has already experienced the devastating toll of Hurricane Katrina in New Orleans.

Another unusual weather phenomenon that was sighted in March 2008 in northern India is called 'Thunder Snowstorm'. It is essentially a thunderstorm, but it is accompanied by snow rather than rain. The snowfall suppresses the sound of thunder, but the lightening is still visible. Thundersnow is fairly rare, and an average of only three such events is reported per year.

Climate change is also causing the extinction of plant and animal species and the loss of biodiversity. What is just as alarming as the loss of biodiversity is the loss of linguistic diversity. Studies have shown that English is declining as a first language, but it appears to be the language of science. With the mass relocation of millions of environmental 'refugees', it is difficult to imagine the pressure that is going to be placed upon languages as cultures are blended. This will place a heavy burden upon education systems, as well. Many relocated people will be forced to learn the new language spoken in their sanctuary, or become multilingual. Their unique ways of life and expression will be lost. It is not enough that native languages have had to withstand the historic eradication attempts of the federal government, church, and school, now climate change is posing even more of a threat. Indigenous peoples were given their divine and unique languages at creation. Languages and culture are intertwined and one cannot have one without the other. Language is used to express people's understandings of this titanic universe and their relationship to their environment. This knowledge is usually passed by word of mouth down through the generations. Can any of us understand the pain ISHI must have felt when he had to live with the horrendous silence imposed by being the last person to speak his mother tongue?

Thus, when a tribal elder dies, essential knowledge of the world is lost forever, because it lives only in the mind of that individual. Sadly, the traditional knowledge base becomes so badly eroded that it will never to be regained, and we are diminished beyond imagination. National Geographic News reports that a new study has identified five global hotspots where languages are vanishing most rapidly. Included along with eastern Siberia, northern Australia, and central South America are Oklahoma and the Pacific Northwest, both of which have significant native populations. Native peoples have known for some time that their languages are at risk, but it has now escalated globally to a language crisis along with the climate crisis.

Languages and culture are inseparable twins, and indigenous cultures have evolved over time on this Earth. Native peoples are Earthborn. They come from the Earth. They are Earth. They live out their lives on Earth, and ultimately, they return to Earth. Earth is an altar, the place from which they send their prayers out to the universe. Native spirituality is Earth-based.

To reiterate, for xamma-voestaneo'o , the natural, ordinary people of this land, Earth is either mother or grandmother. Indigenous people are her kinfolk; they are related to her in much the same way they are related to each other and to everything in this vast universe. According to native philosophy:

Water is life. Life is Water.

You are water.

You are earth.

You are air.

You are fire.

Everyone and everything else is made up of the same four basic elements. They live in a vast universal ocean of relations, from the smallest microbe to the enormous ball of fire known as the sun, and everything in between. The Earth's moon and only natural satellite also is a relative, and is viewed as a universal grandmother. She influences women's menstrual cycles and initiates Earth's ocean tides with her gravitational tidal force. On October 9, 2009, the U.S. launched a moon bomb, and about a month later, NASA announced the discovery of proof that water exists on the moon.

I can only ask what the impact will be upon the ocean's tides and marine life, upon the gestational processes of women, and upon climate change. We must truly be committed to maintaining ecological integrity.

Humans are but a small part of the whole, and are not gods. As such they are responsible for the space they occupy on the great sacred circle of life. They exist as co-equal partners with everything in the universe, upon which they depend for their very existence. All life, is not only related, but it is interdependent, as well. We depend upon all life forms for our continued existence - we depend upon water for life. Mutuality and reciprocity are indigenous hallmarks.

Indigenous children are beloved. They deserve an environmental stress-free future. Looking to the current generations of Earth, it is appropriate that those of us here have accepted the challenge of our lifetime. Indigenous knowledge traditions can contribute different cultural understandings and perspectives on climate change. Just as Sweet Medicine came with new teachings, let us embrace and create new knowledge, accepting the fact that knowledge is power, and teach the world to become environmentally literate. Just as there is the technology to fire-proof or water-proof, we must climate-proof all our relatives.

"The nation needs a paradigm shift."

"I urge all of us, especially the students to do every little thing you can in your own life. That is what we need to do to shift this country." *Kandi Mossett*

**Kandi Mossett,
Indigenous Environmental Network,
Campus Climate Challenge**

Kandi Mossett has been an international activist in environmental and health issues and leader in the Indigenous Environmental Network (IEN), where she initiated the Tribal Campus Climate Challenge, to do within the Tribal community what the Campus Climate Challenge does elsewhere: work within schools to encourage more environmentally sustainable policies. Ms. Mossett spoke about the importance of everyone making some improvement, however small, in living in an environmentally responsible way. "Special program issues in the Tribal community include very small student bodies – Tribal college enrollments range from 32 to about 1,000 students – and include students who have many other responsibilities, such as children to take care of, or who are poor.

Global warming is so overwhelming that students may avoid thinking about it. I, myself, had the experience of being stuck in apathy about climate change shortly after I completed my master's degree in environmental management in 2006 because the problem seemed too big. My answer: You have to start somewhere. It's been said that you have to do more than change light bulbs – but changing light bulbs may be a good place to start for those who don't know what to do. Some girls' and boys' clubs have had tree plantings, where students get the community involved. At community gardens, elders and youth come together and work in the gardens and talk to each other.

Instead of buying plastic water bottles, one can get a refillable container and use it. Instead of using Styrofoam coffee cups, one can carry one's own coffee cup. Each person has the power to make changes in the way he or she lives. These changes are not easy but they do make a difference because production is driven by demand: companies will continue to supply products that are detrimental to the environment as long as customers continue to buy them.

Plastics do not break down. There are huge piles of garbage in the ocean, one the size of Texas. The nation needs a paradigm shift. Each person needs to look at his or her carbon footprint. It is hard, but each person needs to do every little thing possible in his or her own life to cut down on carbon dioxide emissions, in order to shift the country. The United States makes up only 5% of the world's population, but we produce 25% of the world's pollution, and carbon dioxide emissions continue to rise. Atmospheric carbon dioxide is now at 387 parts per million, the highest level in human history. It is people that have changed things.

To get carbon dioxide back down, part of the answer is to shift away from coal. The Northern Cheyenne are fighting against coal development; this effort has been complicated by tribal politics. Tribal people are being targeted for mining because they have

resources – coal, oil, uranium, natural gas – on their lands. Native Americans suffer most from the effects of mining, with cancer and other diseases. The water in North Dakota is contaminated with mercury, which comes from coal. Tribal leaders have allowed mining because it has seemed economically necessary, but it does not have to be that way: reservations have wind resources, solar resources, and traditional knowledge.

Replacing just one light bulb will save over 3,000 lb of carbon dioxide every year from going into the atmosphere. Tribal college students are onboard, but there is a lack of funding, and they are spread out all over. The essential element that is missing is school administrations and Tribal governments. A few exceptional Tribal governments – including the Blackfeet and the Menominee – are doing many good things like preparing greenhouse gas inventories.

Things can start at a small scale. For example, Henry Red Cloud did solar panel installations; seeing them, other people wanted them. People can start their own gardens, and go back to canning foods. It takes work. Fifty years from now, things will be very different. We may be having wars over water. Indigenous peoples should prepare for it. People need to start living sustainably and to get back to localized, sustainable economies. Start by taking baby steps – stay away from the plastic water bottles; take your own coffee cup on the road; buy a power strip so you can easily turn everything off at night; turn lights off when you are not in room.

Nuclear power is not an answer, because it means digging up uranium.”

Ms. Mossett thanked her listeners for allowing her to speak to them and apologized for speaking in front of elders. She suggested forward thinking, signing the conference declaration and taking it to Copenhagen, including taking students to Copenhagen and making indigenous voices heard.

“NIARI’s study pointed out a shared sense of community within indigenous peoples. As the impacts of climate change bear down, the community needs to strengthen these ties and to consider what kinds of steps can be taken to protect communities.” Alan Parker

**Alan Parker,
Northwest Indian Applied Research Institute**

Alan Parker, Chippewa-Cree, is Director of the Northwest Indian Applied Research Institute (NIARI) and an Evergreen State College faculty member with extensive experience in Indian legal and policy issues.

“Several years ago NIARI carried out a study on the impacts of climate change on indigenous peoples of the Pacific Rim. They found that huge glaciers in the area have declined rapidly in the past 10 years, many disappearing entirely; that climate change has had an impact on salmon and shellfish, which were the basis of the lives of tribal people in the Pacific Northwest; and that climate change has degraded the habitat that these species depend on, while new species, some of them dangerous, have moved north into the Pacific Northwest.

What can be done about climate change on a cooperative basis, within the leadership of the Tribal nations? A strategy was developed several years ago under sponsorship of the National Congress of American Indians, with delegates from U.S. tribes, First Nations (Canadian Indians), and Southwest Australian aborigines working at the Lummi Reservation. These delegates agreed to create a United League of Indigenous Nations, a group focused on climate change impacts and the united effort they could make. The work done under the United League’s sponsorship was presented recently at National Congress of the American Indians, with the participation of the national leader of the Assembly of First Nations, Grand Chief Shawn Atleo. The week before the Native Peoples Native Homelands conference, the National Conference of American Indians and the Assembly of First Nations sent to President Obama and to Canadian Prime Minister Stephen Harper a letter asking for representation in climate change deliberations. President

Obama's representatives replied, saying Tribal political leadership would be included in the United States delegation to the November United Nations Climate Change Conference in Copenhagen. It is important to be at the table.

NIARI's study pointed out a shared sense of community within indigenous peoples. As the impacts of climate change bear down, the community needs to strengthen these ties and to consider what kinds of steps can be taken to protect communities. AIHEC is in a position to be engaged and to lead at the community level.

The study's recommendations are to:

1. Establish a focal point in the community to gather relevant information as scientific work is done and findings are released;
2. Take steps to secure, use, and access water supplies;
3. Take steps to secure food sources, both traditional food supplies and other possible stable sources of food at the community level, and consider arriving new species and how to make use of them for food;
4. Reach out to surrounding non-Native communities and work with them to plan and protect; and
5. Pursue renewable energies.

For more detailed info on United League of Indigenous Nations Treaty, go to www.indigenousnationtreaty.org and www.uln-web.org.

"The young generation must look to the past to look forward. People once lived sustainably. It was a hard way of life, but we took only what we needed."

Nick Tilsen, Scott Moore

**Nick Tilsen,
Thunder Valley Community Development Corporation, and Scott Moore, BNIM Architects**

Nick Tilsen, Oglala Lakota, is the Executive Director of the Thunder Valley Community Development Corporation, a grassroots sustainable development organization, and an activist community organizer. Scott Moore is an architect and project coordinator on Pine Ridge with BNIM Architects of Kansas City, concentrating on sustainable communities. They spoke about sustainable community and housing in the Native American community.

Nick Tilsen:

"The young generation must look to the past to look forward. People once lived sustainably. It was a hard way of life, but we took only what we needed. The idea of Manifest Destiny was the start of overconsumption, creating conflicts over resources and over our way of life. The things done to destroy us led to the industrial revolution, which started the planet's warming, while our culture was attacked and our identity as Native People was taken from us. The Earth was being destroyed while we were being destroyed. We have started a movement to break out of that, to be proud to be indigenous. Young people have been returning to traditional ceremonies, which give them a sense of identity and empowerment.

In a ceremony the ancestors asked us how long we would let other people decide the future for our children. They admonished us to quit operating from a place of fear. Then we started an organization of young people and created a vision for the future: a healthy, safe community with young people learning our culture, and we created a mission statement: 'Empowering Lakota youth and families to improve the health, culture, and environment of our communities through the healing and strengthening of cultural identity.' Using local volunteers and donated money, we built the Thunder Valley Community House, a cultural center. We also started a youth entrepreneur project. We got young people active in community, in culture. All our efforts focused on self empowerment, passing culture on to the young, promoting a healthy lifestyle, putting up teepees. Ultimately we decided to move

away from individual projects and instead to create a whole community. Our plan is to create a community using renewables, thinking of the health of the community and the environment.”

Then Scott Moore spoke:

“BNIM has been part of the movement toward green architecture. It uses an integrated approach to creating buildings and communities, on the theory that whatever we build affects human life directly. BNIM has become involved with sustainability projects. A BNIM project started the Leadership in Energy and Environmental Design (LEED) green building rating system. Beyond sustainability, BNIM looks to restoration – for example, improving energy efficiency. Sustainable design meets the needs of the present without compromising the ability of future generations to meet their own needs, keeping in mind the welfare of people, the planet, and prosperity. Thunder Valley CDC is trying to create a model that stands for something different, a new way of thinking.

There is a correlation between the healing of indigenous people and the healing of the planet. This community is healthy for the bodies, the culture, and the environment of the children it raises.”

“If we are going to save the Earth, we need to communicate with creation. I advise you to go back to creation. Talk to them. The only way we can save our grandmother the Earth is to get reattached. I admonish young people not to wait. It’s good to be free. It’s good to communicate with your relatives.”

Albert White Hat

**Albert White Hat,
Professor Emeritus, Lakota Studies, Sinte Gleska University**

Albert White Hat is Professor Emeritus of Lakota Studies at Sinte Gleska University in South Dakota as well as distinguished educator, author, linguist, tribal and spiritual leader. “Before I came to this workshop, I prayed about the wisdom to give tonight. I remembered being at a Sun Dance, a time of renewal for both the tribe and all the People and the Earth. And an elder woman cried and said: “Look how pitiful our Grandmother (Earth) looks. We must do something.” We took care of this land for centuries. We know how to do it.

In 1880, I couldn’t be an Indian. The Federal Government enforced non-Indian policies on Indian people in many different ways. If we practiced any traditional ceremonies, when we died we were buried outside the cemetery. The preachers would tell you how difficult hell was to put fear in you. In Kent, South Dakota, there was an insane asylum. Medicine Men who practiced our traditional religions were put there. These kinds of things undermined our way of life. But my grandfather always told stories about our way of life. He had visions of riding across the prairie. He mentioned a word which he said means “to greet and embrace a relative”. The missionaries took the word and changed it to the word “prayer.” You bow, kneel and you worship a Supreme Being. When you learn this way of praying, you only focus on one imaginary God you expect to do everything. You forget your relatives. Words are important. How you forget your language. Our traditional language is a beautiful language. I cry in it, dance it, express joy in it, and pray in it.

Medicine Men were practicing secretly in the time of repression. I sat in ceremonies. I sang to the Spirits coming in to the lodge. We didn’t lose any of our ceremonies and ways and songs. We still have everything. Some of our people who were Catholic or Episcopalian said to forget our language and get modern. That’s when I decided I would bring the language back.

With Global Warming, we do what we must do every season. We take action. On the Spring Equinox, we go to Harney Peak Rock and we welcome the Thunder back. In April we go to a place in a canyon of the Black Hills where we have an altar. We go and we

wipe the tears of relatives who are grieving and mourning. We pray for all creation that is grieving so when the Spring comes, they will be ready to go embrace life again. The next step is in May when we do a ceremony with the Stone Nations. We take stones from there to the Devil's Tower and use them in the Sun Dance. When you do these things, you become closer to Creator. I am not a Medicine Man but I have been Sundancing over 30 years and I practice what I believe, what I can. Even if it's just you, dance! Some years ago, I saw the biggest flock of birds over my backyard in the sky. They were all hawks. Different colors, different sizes but all hawks. I talked to a Medicine Man who told me, "Yes, our Grandfather says that you are lucky if you witness a gathering of Nations. Every species will do this from time to time to renew relations among themselves. We people of all colors and Nations have the hardest time doing that. We are the only species that are dangerous. We need to review our relations among ourselves."

People helped me in my life. My mother died when I was 4 years old. My father died when I was 16. That's what Mitakuye Oyasin means—all my relations. Every part of creation is related.

At the Sun Dance, I was told if a Medicine Man runs the Sun Dance, people will transfer to him the responsibility to tell other Lakota people there how to be a Lakota. Each Lakota person has to find their own way to what it means to be Lakota.

When I come to a tree, I say, "Thank you." The tree says, "Come back." Creation is waiting for us. A retired forest ranger once accompanied me to a summer institute ceremony. Afterward, the ranger left a note saying "I'm glad I am not crazy. For thirty-something years, I've talked to the trees and the animals." We are so bound by regulations and policies that we cannot communicate freely with Creation. If we are going to save the Earth, we need to communicate with Creation. Open up, go back to Creation. Talk to them. It is the only way we can save our Grandmother, to be attached. Don't wait. We can't wait any longer. It's good to be free and communicate with your relatives.

"Our shellfish and fish are dying. The acidity comes from the change in conditions on the ocean floor. Off San Diego, methane is being released from the ocean floor. The acidic nature of the shift is killing the shellfish."

"Many people do not want to believe climate change is real, even as other people are dying because of it. We need to figure out what to do and we need to start now." Terry Williams

**Terry Williams,
Commissioner of Fish & Wildlife for the Tulalip Tribes**

Terry Williams of the Tulalip Tribe is Commissioner of Fish & Wildlife for the Tulalip Tribes and widely known for his leadership in natural resource and environmental management and for working to increase tribal sovereignty through tribal environmental regulatory and programmatic development.

"A good portion of our country does not believe climate change exists. It is clear that helpful federal legislation cannot be expected. To survive, Tribes must do something quickly. There is no sign of laws coming to protect the things that support Tribal culture – the ability to gather plants, to hunt and fish to interact with the landscape in a way that allows the relationship with the Creator to occur.

Some government agencies have come to the Tribes asking what to do. They know the Tulalip have been in the Northwest since before the glaciers there melted. The Tulalip knowledge must be captured.

Some things that are important to the Tulalip are not going to be there anymore. Some plant species are already disappearing. Some fish species in inland water are changing. Animals are changing: beaver are going to places in Alaska where people have no names for them. Huge shifts in animal and plant species, and changes in water conditions will take place. How will a Tribal culture survive?

The Tribe cannot shift. It must stay within boundaries or lose everything that supports it. Then how can the Tribes hold onto the things that allow them to be who they are – in the Northwest, those things are canoes and the ability to fish and hunt.

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The Tulalip Tribe did the first climate change model for Puget Sound, now known as the Salish Sea. There is a lot of recovery to do. The spring thaw is now happening as much as two months early, creating a sudden change in timing that salmon have adjusted to for 10,000 years. Now the salmon are getting pushed out into the estuary far too early. The salmon reach the brackish water too early; their bodies are not ready and they die. Hundreds of thousands to millions of salmon are being lost.

The Tulalip could not build their salmon hatchery just where the salmon were when they spawned, because that was off the reservation, so instead they “bent” the salmon’s genetics: they kept only the fish that were closest to spawn upon arrival at the facility. Now the fish are timed to the facility. Perhaps this kind of bending can be done with plants as well. I discussed this question with a man from the Department of Agriculture and now the Department of Agriculture is starting to think this way, and it is the Tribe that is causing them to do it.

Water is a huge problem – it is disappearing fast. The ocean is disappearing, changing its chemical makeup, turning acidic, and becoming polluted. Shellfish and fish are dying. The acidity comes from the change in conditions on the ocean floor. Off San Diego, methane is being released from the ocean floor. The acidic nature of the shift is killing the shellfish. Dairy farms near the Tulalip were creating waste, polluting water, and killing fish. Now the waste is processed and used to create electricity. The solution lies in shifting impact and making it into recovery.

In Washington State, it is predicted that the population will double in the next 20 years. That means pollution-related problems will double. Government will not solve those problems, so people on the ground have to do it.

The Tulalip are working with the White House and federal agencies and individuals who want to make a difference. Many people do not want to believe climate change is real, even as other people are dying because of it. We need to figure out what to do and we need to start now.”

A SPECIAL NOTE ON NASA AND BOMBING/IMPACTING THE MOON

On October 9, 2009, NASA's Lunar Crater Observation and Sensing Satellite (LCROSS) created twin impacts as it crashed on the Moon's surface in a search for water ice. The satellite travelled 5.6 million miles during a 113-day mission that ended in the Cabeus crater, a permanently shadowed region near the Moon's South Pole. LCROSS was designed to collect and relay data from the impact and debris plume resulting from the launch vehicle's spent Centaur upper stage crashing into crater Cabeus. The LCROSS mission discovered a significant amount of water during this mission, and the presence of lunar ice fields uncovered by NASA's Moon mission suggested that the quantity of water on the Moon could be greater than expected. Scientists believe that this discovery opened a new chapter in our understanding of the Moon, and that finding water on the Moon is important for the future of space exploration, for discussions about potential colonies on the Moon, and for the study of the solar system.

The announcement by NASA just before the workshop in early October 2009 about the LCROSS bombing/impacting of the Moon to search for water created grave concern among many Native participants at the workshop and illustrates the importance of and need for increased information exchange and improved cultural awareness when scientists and indigenous peoples work together on issues of mutual concern. Apparently, there was not a strong awareness of the important cultural significance of the Moon to many indigenous peoples by the agency during the mission. While on the one hand, like many science agencies, NASA was conducting basic scientific research; on the other hand, most Native Americans historically have a special relationship with the Moon – and view it with the greatest respect and honor. The Moon is regarded as especially important because of its role in natural Earth cycles such as female reproductive cycles, oceanic tides, agriculture, ceremonies, etc. From the discussions at the

workshop, it became clear that there is a large education gap that needs to be addressed so that agencies such as NASA, states, and other non-Native entities can be better informed about cultural sensitivities of various activities regarding sacred places and components of the entire Earth system, including the Moon.

Throughout the workshop, participants provided some thoughtful comments regarding the bombing of the Moon and a number of these comments have been collected here to help underscore this need for improved communications among indigenous peoples and the scientific community.

- All tribes have a special relationship with the Moon and the Moon is held in the greatest of respect and honor.
- There is concern about NASA's bombing the Moon, because of the strong impacts on women and their reproductive cycles, the tides in the oceans, and other important cycles that may be aggravated by bombing.
- The Moon has rights and does not belong to the US – who determines the right for countries to carry out activities on the Moon?
- Although NASA is funding both Earth and space research, we feel that there is a need to direct more efforts toward our Earth sciences and, in particular, climate change.
- There is a wish that scientists seek less invasive scientific investigations to collect data on lunar phenomena.

WORKSHOP AGENDA

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Wednesday, November 18, 2009 Theme: Setting The Stage Convener: Pat Spears – President, Intertribal COUP		
10:00 am – 11:00 am		Registration
11:00 am – 12:00 pm		Light Lunch
12:00 pm – 1:00 pm		Opening Ceremonies Invocation Welcome Song: Midnite Express Welcome Dr. Nancy Maynard – NASA Tribal College & University Program Carrie Billy – President/CEO American Indian Higher Education Consortium (AIHEC)
1:00 pm – 1:30 pm		The Road to Mystic Lake: The 1998 Inaugural Workshop and the Albuquerque Declaration Pat Spears & Bob Gough - Intertribal Council On Utility Policy (COUP) Dr. Nancy Maynard – NASA Tribal College & University Program
1:30 pm – 4:30 pm		Concurrent Sessions
ISSUE AREA 1	Exhibits Open	WATER RESOURCES, FOOD SOURCES & PROTECTION OF HABITAT
		1:30-2:30 Climate Change and Water Resources in Indian Country Frank Ettawageshik – United Tribes of Michigan, Vernon Masayesva - Black Mesa Trust, Gary Collins - Indigenous Waters Network, TCU Facilitator
		2:30-3:30 Envisioning Sustainable Ecosystems: Buffalo and Salmon Restoration Dr. Ed Valandra – American Indian Studies, USD, Susan Masten - Women Empowering Women for Indian Nations (WEWIN) and National Center for American Indian Enterprise Development, TCU Facilitator
		3:30-4:30 Indigenous Agriculture Vicki Karhu - Msvkoke Food Sovereignty Initiative, Diane Wilson - Dream of Wild Health, TCU Facilitator
ISSUE AREA 2		SUSTAINABLE COMMUNITY DEVELOPMENT
		1:30-2:30 Housing and Sustainable Infrastructure Hazel James & Roberto Nutlious - Indigenous Community Enterprises (ICE), Bill Schumacher – COUP/Sustainable, Affordable and Efficient (SAFE) Homes, TCU Facilitator
		2:30 - 3:30: The Process of Building Resilient Local Economies and Jobs Nick Tilsen & Scott Moore -Thunder Valley Community Development, Anna Frazier & Erma Long – Dine’ CARE, Navajo Green Jobs Coalition, TCU Facilitator,

		<p style="text-align: right;">Initial Testimony of Frank Ettawageshik BMC-22 (ETT-7) September 14, 2021 Page 90 of 127</p> <p>3:30-4:30 Gaming and Economic Development</p> <p>Margaret Stevens & Roger Fraqua – <i>National Indian Gaming Association (NIGA)</i></p>
ISSUE AREA 3		CLEAN ENERGY
		<p>1:30-2:30 Solar Energy</p> <p>Henry Red Cloud – <i>Lakota Solar Enterprises</i>, Gerardo Ruiz - <i>Solar Leasing Options</i>, Debbie Tewa, <i>Renewable and Tribal Energy Coordinator, Arizona Dept. of Commerce</i>, TCU Facilitator,</p>
		<p>2:30-3:30 Wind Energy</p> <p>Moderators: TCU Facilitator, Pat Spears - <i>Intertribal Wind Development</i>, Camille Greene - <i>Sisseton-Wahpeton Community Wind Project</i>, Nellis Kennedy - <i>Honor the Earth</i></p>
		<p>3:30-4:30 Transportation</p> <p>Connie Fredenberg - <i>TDX Corporation, St. Paul Island Electric Vehicle Project</i>, Representative - SMSC Biodiesel Project, TCU Facilitator</p>
ISSUE AREA 4		EDUCATIONAL RESOURCES
		<p>1:30-2:30 Computer Instruction</p> <p>Christopher Philipp - <i>Immersive Visualization (3DE)</i>, TCU Facilitator</p>
		<p>2:30-3:30 Special Educational/Outreach Initiatives</p> <p>Carolyn Jacobs - <i>WGBH Teachers' Domain</i>; Doug Herman – <i>National Museum of the American Indian</i>, TCU Facilitator</p>
		<p>3:30-4:30 Training, Externships & Curricula</p> <p>Bull Bennett – <i>North Dakota Association of Tribal Colleges</i> Dr. Nancy Maynard – <i>NASA Tribal College & University Program</i> Al Kuslikis – <i>AIHEC</i>, TCU Facilitator</p>
4:30 pm – 4:45pm		<p>Shakopee Mdewakanton Sioux Community (SMSC) Sustainable Projects Tour Presentation and Sign-ups for Community Tours - Stan Ellison - <i>SMSC Land Office</i></p>
4:45 pm - 6:00 pm		Tribal Colleges and Universities Poster Exhibits
6:00 pm		<p>Dinner/Blessing/Remarks: Albert White Hat, <i>Professor Emeritus, Lakota Studies, SGU</i> Keynote Address: Captain Eugene Brower, <i>President, Whaling Captains Association</i></p>

Thursday, November 19, 2009 Theme: Strategies and Solutions
Convener: Dr. Daniel Wildcat – Director, Haskell Environmental Research Studies Center

8:30 am – 8:45 am	Welcome and Opening Prayer				
8:45 am – 9:00 am	Exhibits Open	Announcements			
9:00 am – 9:30 am		State of the Science on Climate Change The U.S. National Assessment Tom Karl – National Oceanic and Atmospheric Administration (NASA)			
9:30 am-10:30 am		Indigenous Perspectives: Confronting Climate Change in Indian Country Alan Parker –Northwest Indian Applied Research Institute (NIARI) - The Climate Change and Pacific Rim Indigenous Nations Project: What has been done? http://academic.evergreen.edu/g/grossmaz/climate.html Terry Williams – Commissioner of Fish & Wildlife for the Tulalip Tribes: What remains to do? Kandi Mossett - IEN Campus Climate Challenge Coordinator: Issues in organizing around the climate challenge at Tribal Colleges & Universities			
10:30 am – 10:45 am		Break			
10:45 am – 11:15 am		Keynote: Dr. Daniel Wildcat - Director of the Haskell Environmental Research Studies Center Tribal Colleges and Universities: Lessons Learned From the Past Decade And Models For Curriculum Development			
11:15 am – 12:00 pm		Open Discussion with Above Panel, Keynote & Attendees: How Can Tribal Colleges & Universities Contribute to A Climate Change Research Agenda?			
12:00 pm – 1:15 pm		Luncheon: Blessing & Remarks: Dr. Henrietta Mann - President, Cheyenne & Arapaho Tribal College			
1:15 pm – 2:30pm		Panel Discussion: Securing Healthy Food, Clean Energy & Sustainable Housing Ted Skenadore -Tsyunhehkwa Agricultural, Oneida Tribe of Wisconsin Debby Tewa- Renewable and Tribal Energy Coordinator, Arizona Dept. of Commerce Hazel James - Indigenous Community Enterprises (ICE)			
2:30 pm – 3:00pm		Break			
3:00 pm – 5:30 pm		Geographic Regional Breakout Sessions 1. What are the current stresses and concerns in tribal lands across the country? 2. How might climate variability and change impact these stresses?			
6 : 0 0 p m		Alaska/Coastal/Maritime/ Islands		Great Lakes/ Northeast	Great Plains
				Southwest/California/ Great Basin	
	Dinner/Blessing /Remarks: Chief Arvol Looking Horse – 19 th Generation Keeper of the Sacred White Buffalo Calf Woman Chanupa Keynote Speaker: Billy Frank – Chairman, Northwest Indian Fish Commission Tribal Colleges and Universities Videos				

Friday, November 20, 2009 Theme: From Conventional To Resilience
Convener: Winona LaDuke – Executive Director, Honor The Earth

8:30 am – 8:40 am	Welcome and Opening Prayer			
8:45 am – 10:15 am	Exhibits Open	Plenary Discussion: The Need to Shift Away From Conventional Centralized Energy and Towards the Development of Green Economics. Anna Frazier - <i>Dine' CARE</i> Erma Long - <i>Citizen Against Ruining the Environment (Dine' CARE)</i> Gail Small - <i>Native Action, Coal and Coal Bed Methane</i> Manny Pino - <i>Director of American Indian Studies, SCC, Uranium Issues</i> Kandi Mossett - <i>IEN, Tar Sands, Refineries and Pipelines</i> Faith Gemmill - <i>RedOIL, The Frontlines of Alaskan Oil Issues</i>		
10:15 am – 10:30 am		Break		
10:30 am – 11:00 am		Keynote Address: Winona LaDuke – Executive Director, Honor the Earth Reaffirming Our Affinity to the Land		
11:00 am – 11:45 am		Open Discussion with Above Panel, Keynote & Attendees: How can Tribal Colleges and Universities Contribute to Building Resilient Tribal Communities?		
11:45 am – 12:00 pm		Break		
12:00 pm – 1:15 pm		Luncheon Blessing: Katsi Cook – Woman is the First Environment Luncheon Speaker: Nick Tilsen – Thunder Valley Community Development Planning A Healthy & Sustainable Community		
1:15 pm – 2:45 pm		Panel: Securing Healthy Food, Clean Energy and Sustainable Housing Clayton Brascoupe - <i>Traditional Native American Farmers Association</i> Michael Connolly - <i>Laguna Resource Services Inc., Utility Scale Wind Development</i> Pat Spears - <i>Intertribal COUP, Straw Bale SAFE Homes</i>		
2:45 pm – 3:00 pm		Break		
3:00 pm – 4:15 pm		Breakout Sessions By Issue 3. What kinds of coping options and adaptation strategies are available? 4. What is needed in your region to implement these coping and adaptation strategies? Breakout Session Topics		
		Clean Energy	Housing and Sustainable	Education & Training
				Water Resources/Food

		Clean Energy	Housing and Sustainable Community Development	Education & Training	Initial Testimony of Frank Ettawageshik BMC-22 (E-14-7) Water Resources/ Food Production/ Sacred Sites/ Habitat September 4, 2021 Page 93 of 127
4:15 pm – 4:30 pm		Break			
4:30 pm – 5:30 pm		<p align="center">Presentation of Draft Mystic Lake Accord for Review and Approval Panel Presentation: On the Red Road to Copenhagen</p> <p>Tom Goldtooth - Executive Director, Indigenous Environmental Network, Frank Ettawageshik - Executive Director, United Tribes of Michigan, Dr. Debra Harry - Director of the Indigenous Peoples Council on Bio-colonialism and Dr. Anthony Socci – Senior Advisor on Climate and Energy, Office of International Affairs, Environmental Protection Agency</p>			
5:30 pm		Adjourn			
6:30 pm		Reception			
7:00 pm – 9:00 pm		Bunky Echo Hawk Art Performance			

Saturday, November 21, 2009 Theme: Moving Forward
Convener: Dr. Daniel Wildcat – Director, Haskell Environmental Research Studies Center

8:00 am – 9:00 am	<p>Special Presentation by WGBH & “Teachers Domain” Video & Other Digital Media Support</p> <p>Carolyn Jacobs - <i>WGBH Teachers’ Domain</i> Gus Claymore & Stan Holder - <i>Bureau of Indian Education</i></p>
9:00 am – 10:15 am	<p>Opening Prayer: Oren Lyons - <i>Faithkeeper of the Turtle Clan, Onondaga Council of Chiefs of the Haudenosaunee</i></p> <p>Strategies and Solutions Recommended from Geographic Breakout Sessions</p> <p>Alaska/Coastal/Maritime/ Islands Great Lakes /Northeast Great Plains Southwest/ California/Great Basin</p>
10:15 am – 10:30 am	Break
10:30 am – 11:15 am	<p>Strategies and Solutions Recommended from Key Issues Sessions</p> <p>Issue 1 Water Resources, Food Sources & Protection of Habitat Issue 2 Housing and Sustainable Community Development Issue 3 Clean Energy Issue 4 Educational Resources</p>
11:15 pm – 12:00 pm	<p>Keynote Speaker: Oren Lyons – <i>Faithkeeper of the Turtle Clan, Onondaga Council of Chiefs of the Haudenosaunee</i></p> <p>The Mystic Lake Accord and Future of Climate Change in Indian Country Closing Ceremonies Traveling Song: Midnite Express</p>
12:00 pm – 1:00 pm	Lunch



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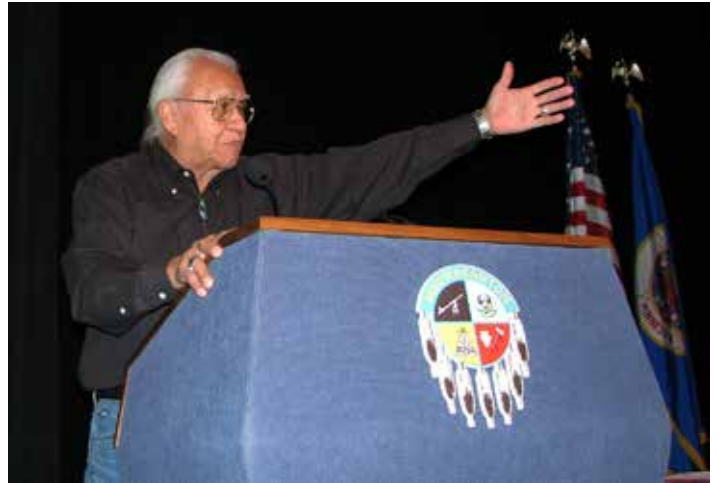
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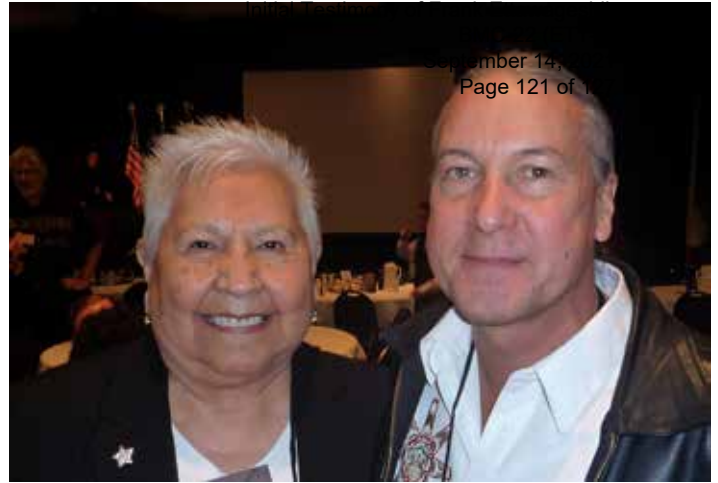
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SAVE THE DATE

Native Peoples Native Homelands

Climate Change Workshop II
Indigenous Perspectives and Solutions

"LET US PUT OUR MINDS
TOGETHER AND SEE
WHAT WE CAN
CREATE FOR OUR
CHILDREN."
- SITTING BULL

Mystic Lake Casino Hotel, Prior Lake, Minnesota

On the homelands of the Shakopee Mdewakanton Sioux Community

November 18-21, 2009

Co-Chairs: Dr. Dan Wildcat (Haskell Indian Nations University)
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For more information or to register: www.nativepeoplesnativehomelands.org

THE MYSTIC LAKE DECLARATION



FROM THE NATIVE PEOPLES NATIVE HOMELANDS CLIMATE CHANGE WORKSHOP II: INDIGENOUS PERSPECTIVES AND SOLUTIONS

*At Mystic Lake on the Homelands of the Shakopee
Mdewakanton Sioux Community, Prior Lake, Minnesota
November 21, 2009*

As community members, youth and elders, spiritual and traditional leaders, Native organizations and supporters of our Indigenous Nations, we have gathered on November 18-21, 2009 at Mystic Lake in the traditional homelands of the Shakopee Mdewakanton Dakota Oyate. This Second Native Peoples Native Homelands Climate Workshop builds upon the Albuquerque Declaration and work done at the 1998 Native Peoples Native Homelands Climate Change Workshop held in Albuquerque, New Mexico. We choose to work together to fulfill our sacred duties, listening to the teachings of our elders and the voices of our youth, to act wisely to carry out our responsibilities to enhance the health and respect the sacredness of Mother Earth, and to demand Climate Justice now.

We acknowledge that to deal effectively with global climate change and global warming issues all sovereigns must work together to adapt and take action on real solutions that will ensure our collective existence. We hereby declare, affirm, and assert our inalienable rights as well as responsibilities as members of sovereign Native Nations. In doing so, we expect to be active participants with full representation in United States and international legally binding treaty agreements regarding climate, energy, biodiversity, food sovereignty, water and sustainable development policies affecting our peoples and our respective Homelands on Turtle Island (North America) and Pacific Islands.

We are of the Earth. The Earth is the source of life to be protected, not merely a resource to be exploited. Our ancestors' remains lie within her. Water is her lifeblood. We are dependent upon her for our shelter and our sustenance. Our lifeways are the original "green economies." We have our place and our responsibilities within Creation's sacred order. We feel the sustaining joy as things occur in harmony. We feel the pain of disharmony when we witness the dishonor of the natural order of Creation and the degradation of Mother Earth and her companion Moon.

We need to stop the disturbance of the sacred sites on Mother Earth so that she may heal and restore the balance in Creation. We ask the world community to join with the Indigenous Peoples to pray on summer solstice for the healing of all the sacred sites on Mother Earth. The well-being of the natural environment predicts the physical, mental, emotional and spiritual longevity of our Peoples and the Circle of Life. Mother Earth's health and that of our Indigenous Peoples are intrinsically intertwined. Unless our homelands are in a state of good health our Peoples will not be truly healthy. This inseparable relationship must be respected for the sake of our future generations. In this Declaration, we invite humanity to join with us to improve our collective human behavior so that we may develop a more sustainable world – a world where the inextricable relationship of biological, and environmental diversity, and cultural diversity is affirmed and protected.

We have the power and responsibility to change. We can preserve, protect, and fulfill our sacred duties to life with respect in this wonderful Creation. However, we can also forget our responsibilities, disrespect Creation, cause disharmony, and imperil our future and the future of others.

At Mystic Lake, we reviewed the reports of indigenous science, traditional knowledge and cultural scholarship in cooperation with non-native scientists and scholars. We shared our fears, concerns and insights. If current trends continue, native trees will no longer find habitable locations in our forests, fish will no longer find their streams livable, and humanity will find their homelands flooded or drought-stricken due to the changing weather. Our Native Nations have already disproportionately suffered the negative compounding effects of global warming and a changing climate.

The United States and other industrialized countries have an addiction to the high consumption of energy. Mother Earth and her natural resources cannot sustain the consumption and production needs of this modern industrialized society and its dominant economic paradigm, which places value on the rapid economic growth, the quest for corporate and individual accumulation of wealth, and a race to exploit natural resources. The non-regenerative production system creates too much waste and toxic pollutions. We recognize the need for the United States and other industrialized countries to focus on new economies, governed by the absolute limits and boundaries of ecological sustainability, the carrying capacities of the Mother Earth, a more equitable sharing of global and local resources, encouragement and support of self sustaining communities, and respect and support for the rights of Mother Earth and her companion Moon.

In recognizing the root causes of climate change, participants call upon the industrialized countries and the world to work towards decreasing dependency on fossil fuels. We call for a moratorium on all new exploration for oil, gas, coal and uranium as a first step towards the full phase-out of fossil fuels, without nuclear power, with a just transition to sustainable jobs, energy and environment. We take this position and make this recommendation based on our concern over the disproportionate social, cultural, spiritual, environmental and climate impacts on Indigenous Peoples, who are the first and the worst affected by the disruption of intact habitats, and the least responsible for such impacts.

Indigenous peoples must call for the most stringent and binding emission reduction targets. Carbon emissions for developed countries must be reduced by no less than 40%, preferably 49% below 1990 levels by 2020 and 95% by 2050. We call for national and global actions to stabilize CO₂ concentrations below 350 parts per million (ppm) and limiting temperature increases to below 1.5°C.

We challenge climate mitigation solutions to abandon false solutions to climate change that negatively impact Indigenous Peoples' rights, lands, air, oceans, forests, territories and waters. These include nuclear energy, large-scale dams, geo-engineering techniques, clean coal technologies, carbon capture and sequestration, bio-fuels, tree plantations, and international market-based mechanisms such as carbon trading and offsets, the Clean Development Mechanisms and Flexible Mechanisms under the Kyoto Protocol and forest offsets. The only real offsets are those renewable energy developments that actually displace fossil fuel-generated energy. We recommend the United States sign on to the Kyoto Protocol and to the United Nations Declaration of the Rights of Indigenous Peoples.

We are concerned with how international carbon markets set up a framework for dealing with greenhouse gases that secure the property rights of heavy Northern fossil fuel users over the world's carbon-absorbing capacity while creating new opportunities for corporate profit through trade. The system starts by translating existing pollution into a tradable commodity, the rights to which are allocated in accordance with a limit set by States or intergovernmental agencies. In establishing property rights over the world's carbon dump, the largest number of rights is granted (mostly for free) to those who have been most responsible for pollution in the first place. At UN COP15, the conservation of forests is being brought into a property right issue concerning trees and carbon. With some indigenous communities it is difficult and sometimes impossible to reconcile with traditional spiritual

beliefs the participation in climate mitigation that commodifies the sacredness of air (carbon), trees and life. Climate change mitigation and sustainable forest management must be based on different mindsets with full respect for nature and not solely on market-based mechanisms.

We recognize the link between climate change and food security that affects Indigenous traditional food systems. We declare our Native Nations and our communities, waters, air, forests, oceans, sea ice, traditional lands and territories to be “Food Sovereignty Areas,” defined and directed by Indigenous Peoples according to our customary laws, free from extractive industries, unsustainable energy development, deforestation, and free from using food crops and agricultural lands for large scale bio-fuels.

We encourage our communities to exchange information related to the sustainable and regenerative use of land, water, sea ice, traditional agriculture, forest management, ancestral seeds, food plants, animals and medicines that are essential in developing climate change adaptation and mitigation strategies, and will restore our food sovereignty, food independence, and strengthen our Indigenous families and Native Nations.

We reject the assertion of intellectual property rights over the genetic resources and traditional knowledge of Indigenous peoples which results in the alienation and commodification of those things that are sacred and essential to our lives and cultures. We reject industrial modes of food production that promote the use of chemical substances, genetically engineered seeds and organisms. Therefore, we affirm our right to possess, control, protect and pass on the indigenous seeds, medicinal plants, traditional knowledge originating from our lands and territories for the benefit of our future generations.

We can make changes in our lives and actions as individuals and as Nations that will lessen our contribution to the problems. In order for reality to shift, in order for solutions to major problems to be found and realized, we must transition away from the patterns of an industrialized mindset, thought and behavior that created those problems. It is time to exercise desperately needed Indigenous ingenuity – Ingenuity – inspired by our ancient intergenerational knowledge and wisdom given to us by our natural relatives.

We recognize and support the position of the International Indigenous Peoples Forum on Climate Change (IIPFCC), operating as the Indigenous Caucus within the United Nations Framework Convention on Climate Change (UNFCCC), that is requesting language within the overarching principles of the outcomes of the Copenhagen UNFCCC 15th Session of the Conference of the Parties (COP15) and beyond Copenhagen, that would ensure respect for the knowledge and rights of indigenous peoples, including their rights to lands, territories, forests and resources to ensure their full and effective participation including free, prior and informed consent. It is crucial that the United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP) is entered into all appropriate negotiating texts for it is recognized as the minimum international standard for the protection of rights, survival, protection and well-being of Indigenous Peoples, particularly with regard to health, subsistence, sustainable housing and infrastructure, and clean energy development.

As Native Nations and Indigenous Peoples living within the occupied territories of the United States, we acknowledge with concern, the refusal of the United States to support negotiating text that would recognize applicable universal human rights instruments and agreements, including the UNDRIP, and further safeguard principles that would ensure their full and effective participation including free, prior and informed consent. We will do everything humanly possible by exercising our sovereign government-to-government relationship with the U.S. to seek justice on this issue.

Our Indian languages are encoded with accumulated ecological knowledge and wisdom that extends back through oral history to the beginning of time. Our ancestors created land and water relationship systems premised upon the understanding that all life forms are relatives – not resources. We understand that we as human beings have a sacred and ceremonial responsibility to care for and maintain, through our original instructions, the health and well-being of all life within our traditional territories and Native Homelands.

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We will encourage our leadership and assume our role in supporting a just transition into a green economy, freeing ourselves from dependence on a carbon-based fossil fuel economy. This transition will be based upon development of an indigenous agricultural economy comprised of traditional food systems, sustainable buildings and infrastructure, clean energy and energy efficiency, and natural resource management systems based upon indigenous science and traditional knowledge. We are committed to development of economic systems that enable life-enhancement as a core component. We thus dedicate ourselves to the restoration of true wealth for all Peoples. In keeping with our traditional knowledge, this wealth is based not on monetary riches but rather on healthy relationships, relationships with each other, and relationships with all of the other natural elements and beings of creation.

In order to provide leadership in the development of green economies of life-enhancement, we must end the chronic underfunding of our Native educational institutions and ensure adequate funding sources are maintained. We recognize the important role of our Native K-12 schools and tribal colleges and universities that serve as education and training centers that can influence and nurture a much needed Indigenuity towards understanding climate change, nurturing clean renewable energy technologies, seeking solutions and building sustainable communities. The world needs to understand that the Earth is a living female organism – our Mother and our Grandmother. We are kin. As such, she needs to be loved and protected. We need to give back what we take from her in respectful mutuality. We need to walk gently. These Original Instructions are the natural spiritual laws, which are supreme. Science can urgently work with traditional knowledge keepers to restore the health and well-being of our Mother and Grandmother Earth.

As we conclude this meeting we, the participating spiritual and traditional leaders, members and supporters of our Indigenous Nations, declare our intention to continue to fulfill our sacred responsibilities, to redouble our efforts to enable sustainable life-enhancing economies, to walk gently on our Mother Earth, and to demand that we be a part of the decision-making and negotiations that impact our inherent and treaty-defined rights. Achievement of this vision for the future, guided by our traditional knowledge and teachings, will benefit all Peoples on the Earth.

Approved by Acclamation and Individual Sign-ons.



NATIVE PEOPLES - NATIVE HOMELANDS CLIMATE CHANGE WORKSHOP II

EXHIBIT BMC-23

International Indigenous Peoples Forum on Climate Change
Statement at Closing Plenary of UNFCCC COP21
Paris, France December 12, 2015

Presented by Frank Ettawageshik, supported by Chief Bill Erasmus, Hindou Ourmou Ibrahim, and
Saoudata Aboubacrine

Aanii, Nakwegeshik N'diznikas. Pipigwa Ododem. Waganakising n'doonjibaa. (Hello. Noonday is my name. The Sparrow Hawk is the mark of my family. I am from the Land of the Crooked Tree.)

Mr President, I greeted you in my native language. My name is Frank Ettawageshik and I represent the National Congress of American Indians. Thank you for this opportunity to address you on behalf of the International Indigenous Peoples Forum on Climate Change. Indigenous Peoples are those who least contribute to climate change, having safeguarded our traditional lands, territories and resources for millennia. Because our lives are inextricably and intimately related to the natural world, every adverse effect on that world acutely affects our lives.

The members of our caucus come from all the regions of the world. Indigenous peoples came here with three key messages. We are pleased that during these negotiations all of our points were addressed to some degree.

1. It is essential that the rights of indigenous peoples be recognized, protected and respected within a broad human rights framework. We sought such assurance in the operative section of the Agreement. We are keenly disappointed that the Parties did not see fit to accommodate this request in which we joined with a broad constituency. The Parties do recognize the importance of such rights in the Preamble and we intend to insist on our rights at every turn. We are sovereign governments with international treaties and rights to land territories, and resources toward which we have a sacred duty which we intend to fulfill.

2. A temperature goal of no more than 1.5 degrees Celsius. We are disappointed this was not adopted as the Structured Expert Dialog stated that our traditional livelihoods will be severely affected at two degrees. However, we are thankful that the vital importance of achieving the 1.5 degree Celsius goal is recognized in the agreement language.

3. Recognition, respect for, and use of our traditional knowledge, with our free, prior, and informed consent. We appreciate that a provision appears in the operative section under adaptation, but it should apply everywhere in the Agreement and Decision without the qualification "where appropriate".

We must remember we are here as nations to uphold the future for our children! We recognize the hope in all children's eyes and we work so that this hope will remain through the future generations.

Miigwetch (Thank You), Merci Beaucoup

EXHIBIT BMC-24

Michigan Climate Action Council

Climate Action Plan



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Members of the Michigan Climate Action Council

The Michigan Climate Action Council (MCAC) comprises 35 representatives from public interest groups, environmental organizations, utilities, the manufacturing sector and other key industries, universities, and state, local, and tribal government. Governor Granholm appointed the following individuals to the MCAC:

Jon Allan, Manager, Next Generation, Consumers Energy
Jeff Andresen, Ph.D., State of Michigan Climatologist, Department of Geography, Michigan State University
Guy Bazzani, President, Bazzani & Associates
Dr. Rosina Bierbaum, Ph.D., Dean, School of Natural Resources and Environment, University of Michigan; (**Duncan Callaway**, alternate)
Skiles Boyd, Vice President, Environmental Management and Resources, DTE Energy
Dwight Brady, Ph.D., Department of Communication, Northern Michigan University
Jim Byrum, President, Michigan Agri-Business Association
Steve Chester, Director, Department of Environmental Quality
Norman Christopher, Director of Sustainability, Grand Valley State University
Keith Cooley, Chief Executive Officer, NextEnergy
Dana Debel, Delta Air Lines
Doug Parks, representing **Jim Epolito**, President and CEO, Michigan Economic Development Corporation
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George Heartwell, Mayor, City of Grand Rapids
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Monica Martinez, Commissioner, Michigan Public Service Commission
Reginald Modlin, Director of Environmental and Energy Planning, Chrysler, LLC
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Lana Pollack, Former President, Michigan Environmental Council
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Lisa Webb Sharpe, Director, Department of Management and Budget
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Al Weverstad, Executive Director, Environment and Energy Public Policy Center, General Motors Corporation

Willa Williams, Interim Director, Department of Environmental Affairs, City of Detroit

Dr. Gregg Zank, Vice President, Chief Technology Officer and Executive Director of Science and Technology, Dow Corning

The following individuals were appointed by Governor Granholm and served on the MCAC for a portion of its tenure:

Karen Cooper-Boyer, Denso Manufacturing

Pete Madden, Senior Resources Manager, Michigan Operations, Plum Creek Timber Company

Dr. Vincent Nathan, Ph.D., M.P.H., Director, Department of Environmental Affairs, City of Detroit

Acronyms and Abbreviations

\$/kWh	dollars per kilowatt-hour
\$MM	millions of dollars
\$/MWh	dollars per megawatt-hour
\$/t	dollars per metric ton
\$/tCO ₂ e	dollars per metric ton of carbon dioxide equivalent
ACEEE	American Council for an Energy Efficient Economy
AEO 2007	<i>Annual Energy Outlook 2007</i>
AEO 2008	<i>Annual Energy Outlook 2008</i>
AES	alternative energy supplier
AEZ	alternative energy zone
AFV	alternative-fuel vehicle
AFW	Agriculture, Forestry, and Waste Management
All	Athena Institute International
AIS	aquatic invasive species
AMI	advanced metering infrastructure
ANL	Argonne National Laboratory
APU	auxiliary power unit
ASAs	Agricultural Security Areas
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers
ATRI	American Transportation Research Institute
BACT	best available control technology
BAU	business as usual
Btu	British thermal unit
C	Carbon
C&D	construction and demolition
C&T	cap and trade
CCI	Cross-Cutting Issues
CCS	Center for Climate Strategies
CCSR	carbon capture and storage/sequestration or reuse
CCX	Chicago Climate Exchange
CH ₄	Methane
CHP	combined heat and power
CO ₂	carbon dioxide
CO ₂ e	carbon dioxide equivalent
COD	commercial operation date
COEE	Centers of Energy Excellence
COLA	combined operating and licensing application
CREP	Conservation Reserve Enhancement Program [USDA]
CRP	Conservation Reserve Program [USDA]
CTIC	Conservation Technology Information Center

DG	distributed generation
DOE	[United States] Department of Energy
DSM	demand-side management
Dth	decatherms
E10	fuel blend of 10% ethanol and 90% gasoline
E85	fuel blend of 85% ethanol and 15% gasoline
EE	energy efficiency
EERE	[Office of] Energy Efficiency and Renewable Energy [US DOE]
eGRID	Emissions & Generation Resource Integrated Database [US EPA]
EIA	Energy Information Administration [US DOE]
EISA	Energy Independence and Security Act of 2007
EO	energy optimization
EOR	enhanced oil recovery
EOS	energy optimization standard
EPA	[United States] Environmental Protection Agency
ES	Energy Supply
ESCO	energy service company
FACTA	Food, Agriculture, Conservation, and Trade Act of 1990
FEED	front-end engineering and design
FERC	Federal Energy Regulatory Commission
FHWA	Federal Highway Administration
FIA	Forest Inventory and Analysis [USFS]
FJD	First Jurisdiction Deliverer
FRPP	Farm and Ranch Lands Protection Program
g	gram
gal	gallon
GHG	greenhouse gas
GIS	geographic information system
GPO	[United States] Government Printing Office
REET	Greenhouse [gases] Regulated Emissions and Energy [use in] Transportation [model]
Gt	gigatons
GWh	gigawatt-hour [one million kilowatt-hours]
HB	House Bill
HDPE	high-density polyethylene
HFC	hydrofluorocarbon
I&F	inventory and forecast
IECC	International Energy Conservation Code
IGCC	integrated gasification combined cycle
IOGCC	Interstate Oil and Gas Compact Commission
IOU	investor-owned utility
IPCC	Intergovernmental Panel on Climate Change
IPP	independent power provider
IRP	integrated resource planning

ISO	International Standard Organization
ITS	intelligent transportation system
kg	kilogram
kV	kilovolt
kW	kilowatt
kWh	kilowatt-hour
lb	pound
LCA	life-cycle analysis
LDPE	low-density polyethylene
LED	light-emitting diode
LEED	Leadership in Energy and Environmental Design [Green Building Rating System™]
LFG	landfill gas
LFGcost	landfill gas cost model
LFGTE	landfill gas-to-energy
LIEEF	Low-Income and Energy Efficiency Fund
LMOP	Landfill Methane Outreach Program [US EPA]
LPG	liquefied petroleum gas
LRR	low-rolling-resistance [tires]
MAC	[California] Market Advisory Committee
MAEAP	Michigan Agriculture Environmental Assurance Program
MAHB	Michigan Association of Home Builders
MAREC	Michigan Alternative and Renewable Energy Center
MBP	Market-Based Policies
MCAC	Michigan Climate Action Council
MCF	thousand cubic feet
MCCI	Michigan Conservation and Climate Initiative
MCCP	Michigan Climate Challenge Program
MCLs	Michigan Compiled Laws
MDA	Michigan Department of Agriculture
MDEQ	Michigan Department of Environmental Quality
MDELEG	Michigan Department of Energy, Labor and Economic Growth
MDMB	Michigan Department of Management and Budget
MDNR	Michigan Department of Natural Resources
MDOT	Michigan Department of Transportation
MEDC	Michigan Economic Development Corporation
metric ton	1,000 kilograms or 22,051 pounds
MGA	Midwestern Governors Association
MIFFS	Michigan Food & Farming Systems
MISO	Midwest Independent Transmission System Operator
MM	million
MMBtu	million British thermal units
MMtC	million metric tons of carbon

MMtCO ₂	million metric tons of carbon dioxide
MMtCO ₂ e	million metric tons of carbon dioxide equivalent
MPO	metropolitan planning organization
MPSC	Michigan Public Service Commission
MRCSP	Midwest Regional Carbon Sequestration Partnership
MSU	Michigan State University
MSW	municipal solid waste
MUEC	Michigan Uniform Energy Code
MW	megawatt [one thousand kilowatts]
MWh	megawatt-hour [one thousand kilowatt-hours]
N	nitrogen
N ₂ O	nitrous oxide
N/A	not applicable
NASS	National Agricultural Statistics Service [USDA]
NGO	nongovernmental organization
NO _x	oxides of nitrogen
NPV	net present value
NQ	not quantified
NRC	[United States] Nuclear Regulatory Commission
NRCS	Natural Resources Conservation Service [USDA]
NREL	National Renewable Energy Laboratory [US DOE]
NREPA	Natural Resources and Environmental Protection Act
NRI	National Resources Inventory [USDA]
NSR	New Source Review
O&M	operation and maintenance
OEM	original equipment manufacturer
ORNL	Oak Ridge National Laboratory
P2 Loans	[Small Business] Pollution Prevention Loan Program
PA	Public Act
PCORP	Plains CO ₂ Reduction Partnership
PET	polyethylene terephthalate
PFC	perfluororocarbon
PHEV	plug-in hybrid electric vehicle
PLA	polylactic acid
PM	particulate matter
PSD	Prevention of Significant Deterioration
psi	pounds per square inch
PTC	production tax credit
PV	photovoltaic
R&D	research and development
RBEG	Rural Business Enterprise Grant

RCDG	Rural Cooperative Development Grant
RBOG	Rural Business Opportunity Grant
RCI	Residential, Commercial, and Industrial
REC	renewable energy credit
REP	renewable energy payment
RFP	request for proposal
REFIT	renewable energy feed-in tariff
RETAP	Retired Engineers Technical Assistance Program
RFC	[Michigan] Renewable Fuels Commission
RGGI	Northeast Regional Greenhouse Gas Initiative
ROI	return on investment
RPS	renewable portfolio standard
SB	Senate Bill
SO ₂	sulfur dioxide
SRWC	short-rotation woody crop
t	metric ton
TBD	to be determined
tC	metric tons of carbon
tCO ₂ e	metric tons of carbon dioxide equivalent
tCO ₂ e/MWh	metric tons of carbon dioxide equivalent per megawatt-hour
TCR	The Climate Registry
TDR	transfer of development rights
TLU	Transportation and Land Use
TSE	truck-stop electrifications
TTI	Texas Transportation Institute
TWG	Technical Work Group
TWh	terawatt-hours
UIC	underground injection control
USACE	United States Army Corps of Engineers
USDA	United States Department of Agriculture
US DOE	United States Department of Energy
US EPA	United States Environmental Protection Agency
USFS	United States Forest Service [USDA]
VMT	vehicle miles traveled
WARM	Waste Reduction Model [US EPA]
WCI	Western Climate Initiative
WTO	World Trade Organization
yr	year

Michigan Climate Action Council's Recommended Policy Positions on Michigan Climate Action Strategy

Michigan is in a period of extraordinary transition and faces unprecedented challenges. Among the most compelling of these challenges is the urgent need to reduce greenhouse gas (GHG) emissions to address climate change and its impact on our health, our natural resources and our way of life. As part of this challenge, the economic core of our prosperity, the automobile industry, is undergoing tumultuous change as we move from a high carbon to a low carbon economy and a new energy future. Revenues to address government services are declining and are expected to do so in the foreseeable future. In addressing these issues, in response to climate change, we have the unique opportunity to also encourage deployment of new investment and technologies, save energy and money, create new jobs and income, promote energy independence and sustainability, and diversify and grow our economy. The magnitude of the challenge will require a remarkable level of cooperation among all levels of government.

The policy direction is clear. Michigan should seize this moment and take a leadership role in formulating and promoting efficient, effective national, regional and state policies to address climate change. These policies should holistically address the economy, renewable energy, climate change, energy efficiency and independence.

There are two integrated parts to Michigan's Climate Action Strategy. The first is based on state-based advocacy for strong national and international action on climate change. A framework describing the key elements of a national climate policy is summarized in Part One below.

The second part requires integration of national climate action policies and efforts with those that the Michigan Climate Action Council (MCAC) recommends for implementation in Michigan to achieve significant reductions in GHG emissions. This represents a call to action by State government, business, and the general public to confront the issue of climate change. It contains actions that we can take now within our state to simultaneously address climate change while transitioning our economy by, promoting new technology development, improving energy efficiency, conserving natural resources, and developing clean and renewable energy sources. These two policy trajectories are essential, coequal and intertwined.

Part One: Michigan Platform on Climate Change

The purpose of this platform is to assist Governor Granholm and other Michigan leaders as they represent Michigan in various forums on the topic of climate change. This includes the New Administration, U.S. Congress as well as the existing and emerging industry-based, non-governmental, and multi-state alliances on global warming.

- Michigan should take action now to address climate change. That action should take two forms: 1) specific actions to reduce GHG emissions in the state and region, and 2) active engagement in the development of a national climate policy.
- Governor Granholm is already taking steps to diversify Michigan's economy using alternative energy to create and retain jobs. Michigan should pursue policies and programs that leverage the State's existing knowledge and expertise to strengthen the auto and other manufacturing sectors and to further diversify the economic base of the State in the renewable energy, energy efficiency and natural resource conservation sectors.
- A national commitment to make significant reductions in GHG emissions will require a transformation of our energy, manufacturing and transportation systems. There will be economic costs and benefits associated with this transformation. Therefore, it is critical that a national climate policy optimizes economic efficiency, equity, and cost effectiveness. Michigan should advocate for the development of such a policy within the framework of a federal-state partnership. While the design, implementation and integration of federal, state and local GHG reduction policies present important issues to be resolved by federal and state policymakers, there is broad agreement that, in our system of government, all levels of government must work together in partnership if the nation is to effectively address this challenge.
- Although national climate policy could be based on alternatives to or additions to "cap and trade" (such as tax, subsidy, standards, and technical assistance policies), federal legislation is most likely to focus on a cap and trade and sector based programs.¹ Michigan therefore should advocate for a national cap and trade program that is efficient, equitable, economy wide, and based on a federal-state partnership. This should include sector based policies and measures that reduce market and institutional barriers to GHG reduction. The state should press for enactment of this legislation by 2010.
- Federal legislation should include national emission reduction targets.
- Federal legislation must be structured in a manner that drives immediate GHG reductions.

¹Although the New Administration and Congress are likely to pursue a nationwide cap and trade policy, other options remain available. The alternative most often mentioned is a carbon tax. If this alternative becomes the preferred approach, the comments and recommendations made herein also largely apply to a carbon tax, i.e., it must be fair from a revenue standpoint, efficient, equitable and effective, and not place Michigan residents and businesses at a disadvantage.

- Federal legislation should ensure GHG emissions are truly reduced and not just shifted from one state or region to another nor from one sector to another.
- The national program should encourage rapid technology development and deployment through the adoption of technology supporting and inducing policies. Cost efficiency and co-benefits should also be considered in achieving reductions of GHG emissions to assure that the timing of reductions coincides with the successful commercialization of emerging technologies. Major reductions from certain sectors may most effectively be accomplished if based on aggressive yet appropriate lead times that allow the necessary infrastructure to be put in place. Examples include carbon sequestration, low-carbon fuels, and commercial viability of high-density energy storage systems.
- While the need for action is now, there are remaining uncertainties regarding the pace at which technologies and markets will develop. Instead of waiting to act, the federal legislation should provide for periodic review so that adjustments can be made based on evolving knowledge of technologies, markets, emission reduction needs and other circumstances.
- Recognizing that effective measures to address climate change depend on international action, the United States should take the lead in facilitating global participation.
- Market forces and current federal legislation already are increasing vehicle fuel economy. Any federal policies adopted should not put the domestic auto industry at a competitive disadvantage.
- To the extent reasonably practical and feasible, the costs and benefits of achieving varying degrees of GHG reductions should be fully disclosed and discussed as part of a deliberative process in the State and nationally, including health, environment, energy and economic impacts, as well as recognition of both monetized and non-monetized impacts.
- A national cap-and-trade program should include appropriate measures to provide a degree of long-term cost certainty and temper wide fluctuations in the price of allowances that would be economically harmful to the U.S. while guarding against any negative impact on GHG emission reductions targets and timetables. Without approving any particular measure, the MCAC notes that examples of such potential measures are identified in Market Based Policy -1.
- Care should be taken to avoid unintended consequences. For example, the national program should not result in actions that make it more difficult to protect human health and the environment through attaining national air quality standards or is hampered by inconsistent policies in other areas.
- Revenue derived from the regulation of GHGs should be used to assist with the transformation to a low carbon economy through appropriate incentives and subsidies for the development and deployment of GHG-reducing technologies and to mitigate increased costs to the consumers. The revenues that exit the state should return at the same proportion, with the exception of that percentage dedicated to technology research, development, and deployment at the national level.

Part Two: Michigan Emission Reduction Proposals

1. The Michigan Climate Action Council (MCAC) has developed a comprehensive list of policy recommendations to reduce GHG emissions in Michigan. Michigan should take immediate steps to implement the policy recommendations of the MCAC establishing priorities to significantly reduce GHG emissions in the State. To begin this, the State should immediately calculate and publish the expected GHG reductions expected from the recent comprehensive energy legislation related to the Renewable Portfolio Standard (RPS) and Energy Efficiency programs as well as other recent and planned actions.
2. The MCAC also recommends that public education be a top priority in the State's climate action plan. A number of the MCAC recommendations are achievable in the short run. However, success is predicated on the will of the public to change its behavior. Michigan should aggressively move to inform the public of its choices for achieving GHG reductions and the cost of those choices. The public should be encouraged to participate in order to reduce costs. The success or failure of this effort should be tracked as part of evolving implementation of the State's climate change efforts, and the results should be disclosed to the public.
3. The MCAC further suggests that Michigan leverage the resources of its outstanding higher education system to promote international cooperative research pacts for the development of alternative energy sources and energy efficiency technologies.
4. Additionally, the MCAC recommends a multi-year strategy for inventorying, tracking and verifying GHG emissions and progress against state goals and targets must be developed and implemented so that progress towards state goals and targets can be accurately assessed.

Executive Summary

Background

Governor Jennifer Granholm signed Executive Order 2007-42 creating the Michigan Climate Action Council (MCAC) on November 14, 2007. The MCAC was charged with producing a Greenhouse Gas (GHG) emissions inventory and forecast, compiling a comprehensive Climate Action Plan with recommended GHG reduction goals and potential actions to mitigate climate change in various sectors of the economy, and advising state and local governments on measures to address climate change.

The MCAC began its deliberations in December 2007. The MCAC held eight meetings leading to this Final Report which constitutes the Michigan Climate Action Plan (Climate Action Plan).

In order to provide a broad range of technical expertise and stakeholder involvement in development of the Climate Action Plan, the MCAC formed six Technical Work Groups (TWGs) to assist in the process. The six TWGs considered information and potential options in the following sectors:

- Energy Supply (ES);
- Market Based Policies (MBP);
- Residential, Commercial and Industrial (RCI);
- Transportation and Land Use (TLU);
- Agriculture, Forestry, and Waste Management (AFW); and
- Cross-Cutting Issues (CCI) (i.e., issues that cut across the above sectors).

The Center for Climate Strategies (CCS) provided facilitation and technical assistance to the MCAC and each of the TWGs. The TWGs served as advisors to the MCAC and consisted of MCAC members and additional individuals with interest and expertise. Members of the public were invited to observe and provide input at all meetings of the MCAC and TWGs. The TWGs assisted the MCAC by generating initial Michigan-specific policy options to be added to the catalog of existing states actions; developing priority policy options for analysis; drafting proposals on the design characteristics and quantification of the proposed policy options; reviewing specifications for analysis of draft policy options (including best available data sources, methods and assumptions); and evaluating the other key elements of policy option proposals, including related policies and programs, key uncertainties, co-benefits and costs, feasibility issues, and potential barriers to consensus.

Key Elements and Recommendations

The MCAC developed this Climate Action Plan as an initial step in establishing a basis for moving forward on the implementation of climate change policies in Michigan. Evaluation of key factors such as cost effectiveness, economic impacts, and harmonization with other Michigan programs and policies will be critical to the next stage of climate policy implementation.

The following key elements and recommendations were identified by the MCAC during this initial process:

- The MCAC's proposed GHG reduction goals for Michigan are to achieve a 20% reduction of GHGs below 2005 levels by 2020 and an 80% reduction below 2005 levels by 2050. These goals are consistent with goals being considered by the Midwestern Governors Regional Greenhouse Gas Reduction Accord process. The MCAC recommends that they be officially established as the states' GHG reduction goals.
- MCAC reviewed over 330 multi-sector policy options and approved for inclusion in this report a package of 54 policy recommendations to reduce GHG emissions and address related energy and commerce issues in Michigan. 52 of these 54 recommendations were approved unanimously and only one option was rejected. The recommended policy options cover a wide range of costs and GHG reduction potentials.
- In moving towards implementation to achieve these goals, Michigan must prioritize these 54 policy recommendations during 2009 in order to set the stage for strategic implementation of the most promising options. The prioritization should take into account the GHG reduction potential, costs and savings, feasibility, co-benefits, and a macro-economic analysis of selected recommendations, and consistency with other Michigan programs and policies.
- The MCAC approved policy recommendations are estimated to generate a net cumulative savings of about \$10 billion between 2009 and 2025. The weighted-average cost-effectiveness of these policies is estimated to be approximately a \$10.2/ tCO₂e cost savings. Those policy options that show negative costs¹ (i.e. benefits) should be evaluated as quickly as possible. All policy options, particularly those that show a net cost, should be evaluated thoroughly, using tools such as regional economic modeling, before being implemented.
- The MCAC recommends periodic review of Michigan's progress with appropriate adjustments made in the Climate Action Plan to assure the approaches taken and GHG reductions are on target. Michigan's GHG Inventory and Forecast has been prepared which outlines historical conditions for 1990-2005 and projected emissions through 2025

¹ Policy options that are "negative cost" are not necessarily better than other potential investments. In capital constrained situations only a limited number of investments can be made. There may be structural or policy barriers to the adoption of options identified as negative cost.

based upon a business as usual scenario. These documents were completed prior to the severe downturn in the global economy. To account for fluctuations such as changes in the economy, updates to this inventory should be performed annually with the projections evaluated every three years.

- The MCAC recommends that Michigan further analyze actions needed for adaptation. The MCAC was unable to examine the impacts of climate change on Michigan's natural resources and the Great Lakes due to time and resource constraints. Therefore, the MCAC recommends that Michigan conduct additional analyses of the state's vulnerability to the impacts of climate change and develop specific adaptation plans for key sectors.
- MCAC recommends that Michigan position itself as a leader in the national and regional dialogue on climate change policy as described in the MCAC's Recommended Policy Positions Section of this report.

Michigan GHG Emissions Inventory and Reference Case Projections

The Center for Climate Strategies (CCS) prepared the Michigan Inventory and Forecast Report for the Michigan Department of Environmental Quality (MDEQ). The report presents an assessment of Michigan's greenhouse gas (GHG) emissions and anthropogenic sinks (carbon storage) from 1990 to 2025. The preliminary draft inventory and forecast estimates in January 2008 served as a starting point for the Michigan Climate Action Council (MCAC) and Technical Work Groups (TWGs). The inventory and forecast were revised to address the comments received. The final Inventory and Forecast Report was approved by the MCAC at the November 2008 meeting and is available at:

http://www.miclimatchange.us/Inventory_Forecast_Report.cfm.

The inventory and projections cover the six types of gases included in the United States (US) Greenhouse Gas Inventory: carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF₆). Emissions of these GHGs are presented using a common metric, CO₂ equivalence (CO₂e), which indicates the relative contribution of each gas, per unit mass, to global average radiative forcing on a global warming potential- (GWP-) weighted basis².

As illustrated in Figure ExS-1, below, activities in Michigan accounted for approximately 248 million metric tons (MMt) of gross³ CO₂e emissions (consumption basis) in 2005, an amount

² Changes in the atmospheric concentrations of GHGs can alter the balance of energy transfers between the atmosphere, space, land, and the oceans. A gauge of these changes is called radiative forcing, which is a simple measure of changes in the energy available to the Earth-atmosphere system (IPCC, 2001). Holding everything else constant, increases in GHG concentrations in the atmosphere will produce positive radiative forcing (i.e., a net increase in the absorption of energy by the Earth), See: Boucher, O., et al. "Radiative Forcing of Climate Change." Chapter 6 in *Climate Change 2001: The Scientific Basis*. Contribution of Working Group 1 of the Intergovernmental Panel on Climate Change. Cambridge University Press. Cambridge, United Kingdom. Available at: http://www.grida.no/climate/ipcc_tar/wg1/212.htm.

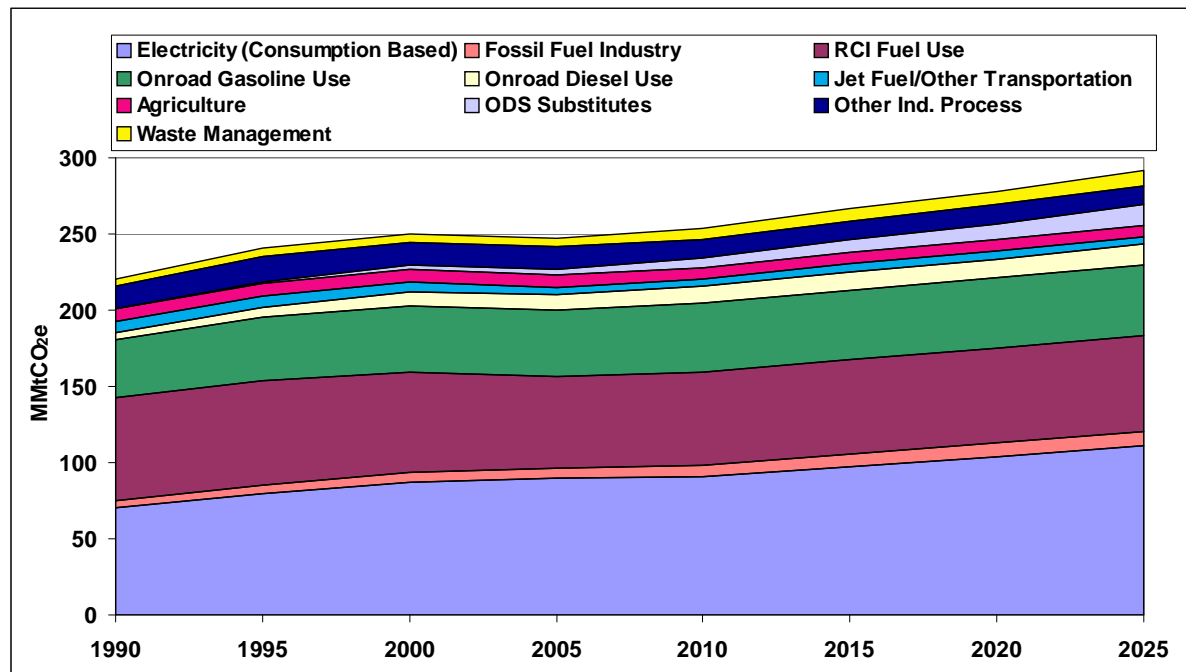
³ Excluding GHG emissions removed due to forestry and other land uses and excluding GHG emissions associated with exported electricity.

equal to about 3.5% of total US gross GHG emissions (based on 2005 US data).⁴ Gross emissions exclude carbon sinks, such as forests. Michigan's gross GHG emissions are rising slower than those of the nation as a whole. From 1990 to 2005, Michigan's gross GHG emissions increased by about 12%, while national emissions rose by 16%. The growth in Michigan's emissions was primarily associated with electricity consumption and the transportation sector.

The principal sources of Michigan's GHG emissions are electricity consumption; residential, commercial, and industrial (RCI) fuel use; and transportation accounting for 36, 24, and 24% of Michigan's gross GHG emissions in 2005, respectively.

Also illustrated in Figure ExS-1 under the reference case projections, Michigan's gross GHG emissions are projected to continue growing, to approximately 292 MMtCO₂e by 2025, 32% above 1990 levels. While these projections are made over the long term (e.g. to 2025), they do not account for the current severe global economic downturn and how this will impact future growth projections.

Figure ExS-1. Gross GHG emissions by sector, 1990–2025: historical and projected (consumption-based approach) business as usual / base case



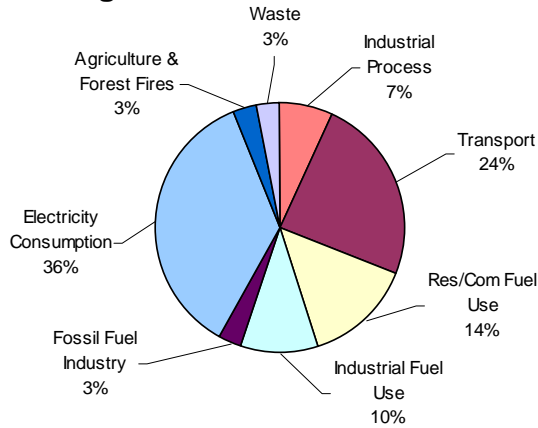
MMtCO₂e = million metric tons of carbon dioxide equivalent; RCI = direct fuel use in residential, commercial, and industrial sectors; ODS = ozone-depleting substance; Ind. = industrial.

Figure ExS-2 depicts the 2005 distribution of sources in Michigan and the United States (U.S.)

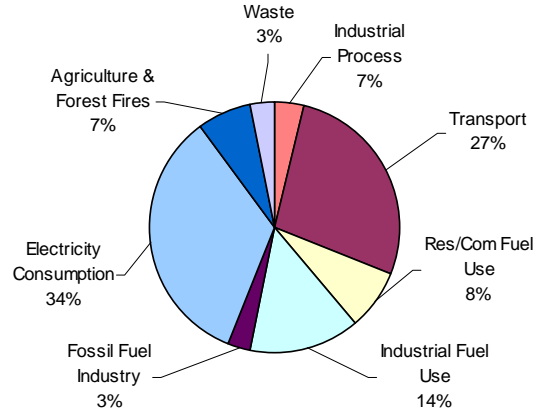
⁴ The national emissions used for these comparisons are based on 2005 emissions from *Inventory of US Greenhouse Gas Emissions and Sinks: 1990-2006*, April 15, 2008, US EPA #430-R-08-005, (<http://www.epa.gov/climatechange/emissions/usinventoryreport.html>).

Figure ExS-2. Gross GHG emissions by sector, 2005: Michigan and U.S.

Michigan



US



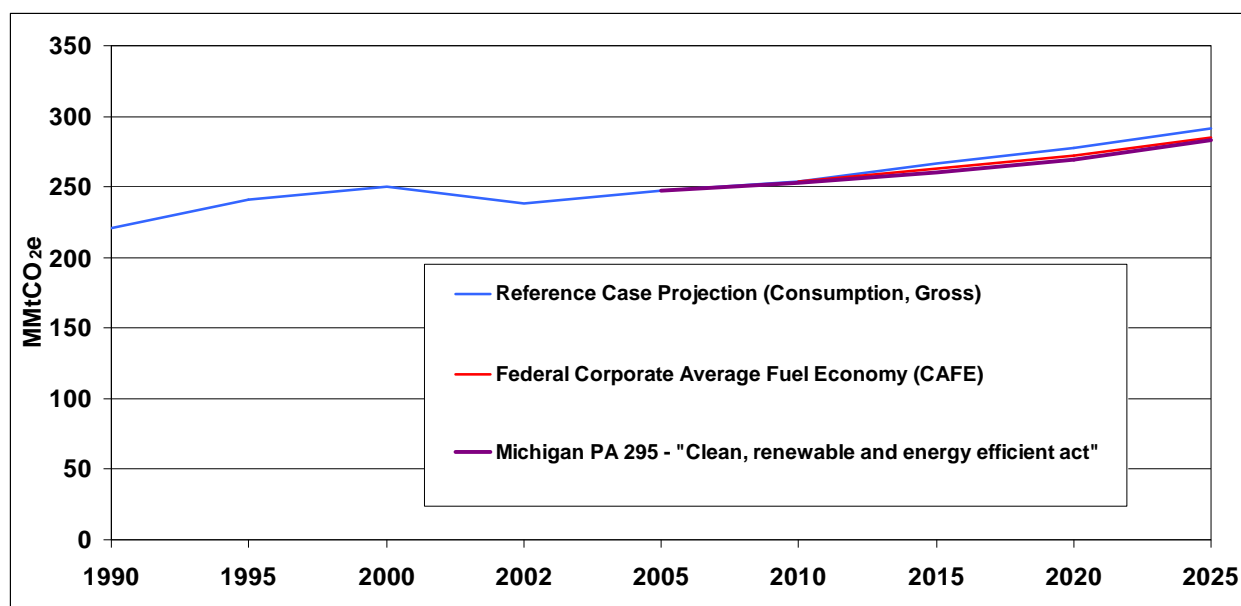
Recent Actions

GHG Reductions Associated With Recent Federal and State Actions

The MCAC identified recent actions undertaken in Michigan that will reduce GHG emissions while conserving energy and promoting the development and use of renewable energy sources. One such action was the adoption of PA 295⁵. The resultant emission reductions were estimated. Reductions associated with federal actions, such as the federal Energy Independence and Security Act (EISA) of 2007 and the implementation of the Act's Corporate Average Fuel Economy (CAFE) requirements, were also estimated. A total reduction of about 8.9 MMtCO₂e (3.1%) in 2025 from the business-as-usual reference case emissions is projected. These GHG emission reductions are summarized in Figure ExS-3.

⁵ PA 295 The Clean Renewable and Energy Efficient Act of 2008

Figure ExS-3. Estimated emission reductions associated with the effect of recent federal and state actions in Michigan (consumption-basis, gross emissions)



MMtCO_{2e} = million metric tons of carbon dioxide equivalent.

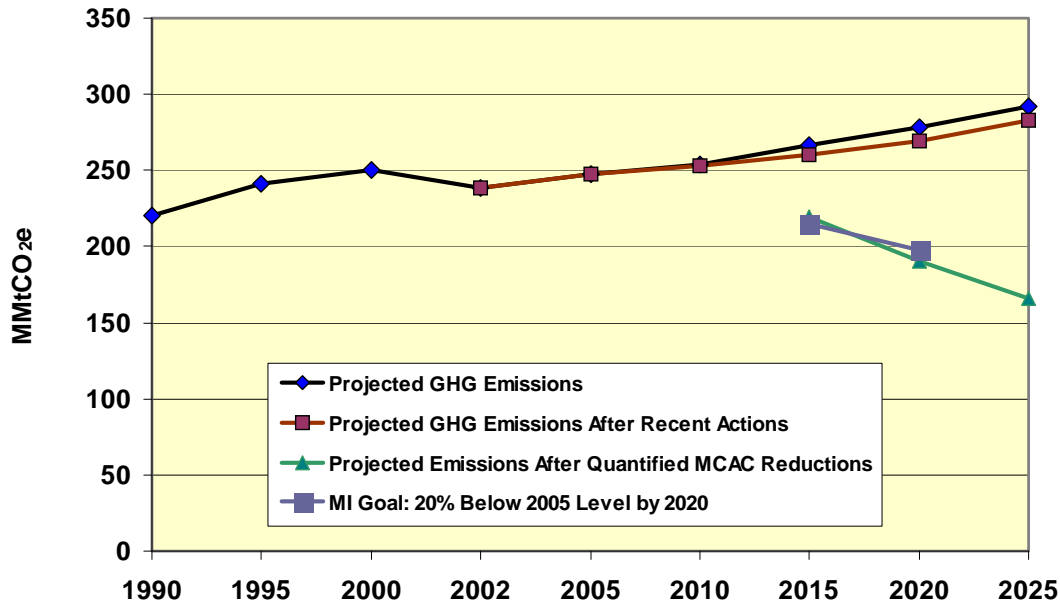
MCAC Policy Recommendations (Beyond Recent Actions)

The MCAC approved 54 policy recommendations for action in Michigan. Of these, 33 were analyzed quantitatively to calculate both emission reductions and either costs or savings. Based on this analysis, the 33 quantified policies have the cumulative effect of reducing annual GHG emissions by approximately 41 million metric tons of carbon dioxide equivalent (MMtCO_{2e}) in 2015 and by 117 MMtCO_{2e} in 2025. The additional policy recommendations were not readily quantifiable but are considered valuable recommendations to support the overall Climate Action Plan. Several of the non-quantified policy recommendations may have the potential to achieve GHG emission reductions.

Figure ExS-4 presents a graphical summary of the potential cumulative emission reductions associated with the 33 quantified policy options and federal actions relative to the business-as-usual reference case projections.

- The blue line shows actual (for 1990, 1995, 2000, and 2005) and projected (for 2010, 2015, 2020 and 2025) levels of Michigan's gross GHG emissions on a business as usual basis.
- The red line shows the projected emissions adjusted for the recent state and federal actions described in Figure ExS-3.
- The green line shows the projected emissions if all of the MCAC's 33 recommended options are implemented and the estimated reductions are fully achieved. It is important to note, to yield these emission reductions from the 33 MCAC recommended options, implementation must be timely, aggressive, and thorough.

Figure ExS-4. Annual GHG emissions: reference case projections and MCAC recommendations (consumption basis, gross emissions)



MMtCO₂e = million metric tons of carbon dioxide equivalent; GHG = greenhouse gas; MCAC = Michigan Climate Action Council.

Table ExS-1, below, provides the numeric estimates underlying Figure ES-4. In summary, if all of the Policy Recommendations are fully implemented and successful in achieving all of the GHG reductions projected then MI should over-achieve its GHG reduction goals by 7.3 MMtCO₂e in 2020. Another way to look at this is that the MCAC package of policy recommendations entails a surplus of GHG reductions of about 7.3MMTCo₂e.

Table ExS-1. Annual emissions: reference case projections and impact of MCAC options (consumption basis, gross emissions)

Consumption Basis - Gross Emissions							
	1990	2000	2005	2010	2015	2020	2025
Projected GHG Emissions	220.7	250.0	247.5	253.8	266.4	278.0	291.6
Reductions from Recent Actions			0.0	0.7	6.2	8.3	8.9
Projected GHG Emissions After Recent Actions			247.5	253.1	260.2	269.6	282.7
GHG Reduction Goal Recommended by MCAC					NA	198.0	NA
Total GHG Reductions from MCAC Policies					41.2	78.9	116.6
Difference Between MCAC 2020 Goal & Remaining Emissions after Reductions					NA	7.3	NA
Projected Emissions After Quantified MCAC Reductions					219.0	190.7	166.1

GHG = greenhouse gas; MCAC = Michigan Climate Action Council; N/A = not applicable.

Reductions from recent actions include the EISA of 2007, Title III. GHG reductions from Titles IV and V of this Act have not been quantified because of the implementation uncertainties.

Table ExS-2 depicts the final policy recommendations of the Council and their associated GHG reductions and costs or savings for each sector.

What do the numbers mean? In Table ExS-2 and throughout the Climate Action Plan, positive cost figures (\$) indicate costs; negative cost (- \$) figures indicate cost savings. For example, in Table ExS-2 the column totals for the Net Present Value (NPV) of (-\$10,093 million) portrays a cost savings of \$10,093,000,000 over the 2009- 2025 period of analysis.

Table ExS-2. Summary by sector of estimated impacts of implementing all of the MCAC recommended options (cumulative reductions and costs/savings)

Sector	GHG Reductions (MMtCO ₂ e)			Net Present Value 2009–2025 (Million \$)	Cost-Effectiveness (\$/tCO ₂ e)
	2015	2025	Total 2009–2025		
Residential, Commercial and Industrial	21.9	65.1	524.6	–\$13,014	–\$25
Energy Supply	8.1	23.6	220.3	\$7,980	\$36
Transportation and Land Use	4.8	10.5	95.1	–\$3,425	–\$36
Agriculture, Forestry, and Waste Management	6.4	17.4	147.0	–\$1,634	–\$11.1
Cross-Cutting Issues	Non-quantified, enabling options				
TOTAL (includes all adjustments for overlaps)	41.2	116.6	987.0	–\$10,093	–\$10.2

GHG = greenhouse gas; MMtCO₂e = million metric tons of carbon dioxide equivalent; \$/tCO₂e = dollars per metric ton of carbon dioxide equivalent.

Notes for Table ExS-2 are continued on the next page.

Negative values in the Net Present Value and the Cost-Effectiveness columns represent net cost savings associated with the policy options.

Within each sector, values have been adjusted to eliminate double counting for policies or elements of policies that overlap. In addition, values associated with policies or elements of policies within a sector that overlap with policies or elements of policies in another sector have been adjusted to eliminate double counting. Appendix F (for the ES sectors), Appendix H (for the RCI sectors), Appendix I (for the TLU sectors), and Appendix J (for the AFW sectors) of this report provide documentation of how sector-level emission reductions and costs (or cost savings) were adjusted to eliminate double counting associated with overlaps between policies.

Table ExS-3, which begins below and continues through page ES-14, depicts the MCAC policy recommendations and the associated GHG reductions and costs/savings for each sector.

Note: The numbering used to denote the policy recommendation in Table ExS-3 and in other parts of this report is for reference purposes only; it does not reflect prioritization among these important recommendations. Negative numbers indicate cost savings.

Table ExS-3 Summary List of MCAC Policy Recommendations for all Sectors
Energy Supply (ES) Policy Recommendations

Policy No.	Policy Recommendation	GHG Reductions (MMtCO ₂ e)			Net Present Value 2009–2025 (Million \$)	Cost-Effectiveness (\$/tCO ₂ e)	Level of Support
		2015	2025	Total 2009–2025			
RECENT ACTION	PA 295, Clean, Renewable, and Efficient Energy Act	2.7	2.0	30.8	\$1,024	\$33	N/A
ES-1	Renewable Portfolio Standard and Distributed Generation "Carve-Out"	5.0	14.6	137.5	\$6,600	\$48.00	Unanimous
	Renewable Portfolio Standard (RPS)	4.6	13.7	129.5	\$5,546	\$42.83	
	Wind	3.7	10.3	100.4	\$4,748	\$47.31	
	Biomass	0.9	2.7	25.2	\$376	\$15	
	Solar Photovoltaic (PV)	0.0	0.4	2.6	\$392	\$152	
	Plasma Gasification	0.0	0.3	1.3	\$29	\$22	
	Distributed Generation "Carve-Out"	0.4	0.9	8.0	\$1,054	\$131.51	
	Solar Hot Water	0.0	0.2	1.2	\$26	\$22.27	
	Geothermal	0.1	0.2	1.5	\$82	\$55	
	Wind (distributed)	0.1	0.3	2.7	\$503	\$186	
	Solar PV (distributed)	0.1	0.2	1.84	\$508	\$276	
	Biogas	0.1	0.2	2.3	\$17	\$7	
ES-3	Energy Optimization Standard	0.0	13.6	86.3	–\$1,632	–\$19	Unanimous
ES-5	Advanced Fossil Fuel Technology (e.g., IGCC, CCSR) Incentives, Support, or Requirements	Not Quantifiable					Unanimous
ES-6	New Nuclear Power	0.0	6.3	38.5	\$1,001	\$25.98	Majority ⁶
ES-7	Integrated Resource Planning (IRP), Including Combined Heat & Power (CHP)	Not Quantifiable					Unanimous
ES-8	Smart Grid, Including Advanced Metering	Not Quantifiable					Unanimous
ES-9	CCSR Incentives, Requirements, R&D, and/or Enabling Policies	Not Quantifiable					Unanimous
ES-10	Technology-Focused Initiatives (Biomass Co-firing, Energy Storage, Fuel Cells, Etc.), Including Research, Development, & Demonstration						Majority ⁷
	Co-firing at 5%	0.2	0.2	3.3	\$34.48	\$10.6	
	Co-firing at 10%	0.5	0.5	6.5	\$69.43	\$10.7	
	Co-firing at 20%	0.9	0.9	13.0	\$134.09	\$10.3	

⁶ 6 opposing votes [Pollack, Ettawageshik, Garfield, Heifje, Bazzani, Overmeyer] and 2 abstentions [Martinez and Calloway for Bierbaum]

⁷ 3 opposing votes [Garfield, Pollack and Heifje]

Policy No.	Policy Recommendation	GHG Reductions (MMtCO ₂ e)			Net Present Value 2009–2025 (Million \$)	Cost-Effective-ness (\$/tCO ₂ e)	Level of Support
		2015	2025	Total 2009–2025			
ES-11	Power Plant Replacement, Energy Efficiency, and Repowering	2.5	2.0	33.2	\$313	\$9.4	Unanimous
ES-12	Distributed Renewable Energy Incentives, Barrier Removal, and Development Issues, Including Grid Access	<i>ES-12 Fully incorporated in distributed generation "carve-out" under ES-1.</i>					Unanimous
ES-13	Combined Heat and Power (CHP) Standards, Incentives and/or Barrier Removal	0.4	0.5	7.8	\$31.91	\$4.09	Unanimous
ES-15	Transmission Access and Upgrades	<i>Not Quantifiable</i>					Unanimous
	Sector Totals	8.1	37.2	306.6	\$6,348	\$22	
	Sector Total After Adjusting for Overlaps	8.1	23.6	220.3	\$7,980	\$36	
	Reductions From Recent Actions	2.7	1.9	30.1	\$1,025	\$34	
	Sector Total Plus Recent Actions	10.8	25.5	250.4	\$9,005	\$36	

MMtCO₂e = millions of metric tons of carbon dioxide equivalent; \$/tCO₂e = dollars per metric tons of carbon dioxide equivalent; CCI = Cross-Cutting Issues; CCSR = carbon capture and storage or reuse; GHG = greenhouse gas; IGCC = integrated gasification combined cycle; MCAC = Michigan Climate Action Council; N/A = not applicable; PA = Public Act; R&D = research and development.

Market Based Policy (MBP) Recommendations

No.	Policy Recommendations	GHG Reductions (MMtCO ₂ e)			Net Present Value 2009–2025 (Million \$)	Cost-Effective-ness (\$/tCO ₂ e)	Level of Support
		2020	2025	Total 2009–2025			
MBP-1	20% below 2005 by 2020 (<i>Free-Granting Allowances</i>) ⁸	92.48				–\$25.83	Unanimous
	20% Below 2005 by 2020 (<i>Auctioning Allowances</i>) ⁹	92.48				–\$19.33	
MBP-3	Michigan Joins Chicago Climate Exchange	<i>Not Quantified</i>					Unanimous
MBP-6	Market Advisory Group	<i>Not Quantifiable</i>					Unanimous

⁸ These results include the direct cost of reducing emissions, plus costs associated with purchase of emissions allowances from entities outside of Michigan, minus revenues from the sale of allowances to entities outside Michigan.

⁹ These results include the direct cost of reducing emissions, but do not include payments by Michigan to entities for the purchase of allowances at auction, nor do they include revenues to the state from the sale of those allowances. The full cost and revenue implications of allowance distribution by auction can be found in Table G-1-2 and Annex G-1.

Transportation and Land Use (TLU) Policy Recommendations

Policy No.	Policy Option	GHG Reductions (MMtCO ₂ e)			Net Present Value 2009–2025 (Million \$)	Cost-Effectiveness (\$/tCO ₂ e)	Level of Support
		2015	2025	Total 2009–2025			
TLU-1 ¹⁰	Promote Low-Carbon Fuel Use in Transportation	2.6	5.9	53	\$820	\$16	Unanimous
TLU-2	Eco-Driver Program	1.1	2.2	22	–\$3,921	–\$176	Unanimous
TLU-3	Truck Idling Policies	0.36	0.76	7.0	–\$596	–\$85	Unanimous
TLU-4	Advanced Vehicle Technology	0.01	0.03	0.19	\$281	\$1,458	Unanimous
TLU-5	Congestion Mitigation	0.08	0.18	1.7	–\$135	–\$81	Unanimous
TLU-6	Land Use Planning and Incentives	0.14	0.43	3.2	–\$598	–\$189	Unanimous
TLU-7	Transit and Travel Options	0.13	0.54	3.5	\$655	\$185	Unanimous
TLU-8	Increase Rail Capacity, and Address Rail Freight System Bottlenecks	0.10	0.19	2.0	\$69	\$35	Unanimous
TLU-9	Great Lakes Shipping	0.24	0.27	2.5	NQ	NQ	Unanimous
	Sector Totals	4.76	10.5	95.1	–\$3,425	–\$36	N/A
	Sector Total After Adjusting for Overlaps	4.76	10.5	95.1	–\$3,425	–\$36	N/A
	Reductions From Recent Actions	0	0	0	\$0	\$0	N/A
	Sector Total Plus Recent Actions	4.76	10.5	95.1	–\$3,425	–\$36	N/A

¹⁰ TLU-1 addresses the consumption of biofuels in Michigan. The quantification results for AFW-2 (biofuel production volumes and costs), were used as inputs to the estimates for low-carbon fuel use in TLU-1.

Residential, Commercial and Industrial (RCI) Policy Recommendations

	Policy Option	GHG Reductions (MMtCO ₂ e)			Net Present Value 2009–2025 (Million \$)	Cost-Effectiveness (\$/tCO ₂ e)	Level of Support
		2015	2025	Total 2009–2025			
RCI-1	Utility Demand-Side Management for Electricity and Natural Gas	0.0	13.6	86.3	–1,632	–19	Unanimous
RCI-2	Existing Buildings Energy Efficiency Incentives, Assistance, Certification, and Financing	17.6	53.8	428.6	–12,107	–28	Unanimous
RCI-3	Regulatory (PSC) Changes to Remove Disincentives and Encourage Energy Efficiency Investments by IOUs	<i>Not Quantifiable</i>					Unanimous
RCI-4	Adopt More Stringent Building Codes for Energy Efficiency	3.6	9.8	82	–2,865	–35	Unanimous
RCI-5	MI Climate Challenge & Related Consumer Education Programs	<i>Not Quantifiable</i>					Unanimous
RCI-6	Incentives to Promote Renewable Energy Systems Implementation	0.7	1.5	14.0	1,958	140	Unanimous
RCI-7	Promotion and Incentives for Improved Design and Construction in the Private Sector	15.6	47.6	380	–11,693	–31	Unanimous
RCI-8	Net Metering for Distributed Generation	Fully incorporated into RCI-6					Unanimous
RCI-9	Training & Education for Bldg. Design, Construction, and Operation	<i>Not Quantifiable</i>					Unanimous
RCI-10	Water Use and Management	<i>Not Quantifiable</i>					Unanimous
	Sector Total After Adjusting for Overlaps*	21.8	64.9	523.9	–13,014	–24.8	
	Reductions From Recent Actions	Figures adjusted include recent actions					
	Sector Total Plus Recent Actions	21.8	64.9	523.9	–13,014	–24.8	

PSC = Public Service Commission; IOU = investor-owned utility.

*The figures listed show totals for the options net of recent legislation. Negative numbers indicate cost savings.

Agriculture, Forestry and Waste (AFW) Management Policy Recommendations

Policy No.	Policy Recommendation		GHG Reductions (MMtCO ₂ e)			Net Present Value 2009–2025 (Million 2005\$)	Cost-Effectiveness (\$/tCO ₂ e)	Level of Support
			2015	2025	Total 2009–2025			
AFW-1	Expanded Use of Biomass Feedstocks for Electricity, Heat, or Steam Production		3.3	10	79	\$1,649	\$21	Unanimous
AFW-2*	In-State Liquid Biofuels Production		<i>Included in the Results of TLU-1</i>					Unanimous
AFW-3	Methane Capture and Utilization From Manure and Other Biological Waste		0.09	0.14	1.5	\$4.7	\$3	Unanimous
AFW-4	Expanded Use of Bio-based Materials	A. Use of Bio-based Products	.08	.21	1.7	–\$108	–\$62	Unanimous
		B. Utilization of Solid Wood Residues	<i>Not Quantified</i>					Unanimous
AFW-5	Land Use Management That Promotes Permanent Cover	A. Increase in Permanent Cover Area	0.08	0.21	1.8	\$63	\$34	Unanimous
		B. Retention of Lands in Conservation Programs [†]	0.05	0.11	1.1	\$24	\$23	Unanimous
		C. Retention/Enhancement of Wetlands	<i>Not Quantified</i>					Unanimous
AFW-6	Forestry and Agricultural Land Protection	A. Agricultural Land Protection	0.46	1.1	10	\$864	\$85	Unanimous
		B. Forested Land Protection	<i>Not Quantified</i>					Unanimous
		C. Peatlands/Wetlands Protection	<i>Not Quantified</i>					Unanimous
AFW-7**	Promotion of Farming Practices That Achieve GHG Benefits	A. Soil Carbon Management	0.7	1.7	15	–\$200	–\$13	Unanimous
		B. Nutrient Efficiency	0.05	0.12	1.1	–\$27	–\$26	Unanimous
		C. Energy Efficiency	0.13	0.32	2.9	–\$102	–\$35	Unanimous
		D. Local Food	<i>Not Quantified</i>					Unanimous
AFW-8	Forest Management for Carbon Sequestration and Biodiversity	A. Enhanced Forestland Management	0.53	1.42	12.05	\$800	\$66	Unanimous
		B. Urban Forest Canopy	1.2	2.9	26	–\$346	–\$13	Unanimous
		C. Reduce Wildfire	<i>Not Quantified</i>					Unanimous
AFW-9**	Source Reduction, Advanced Recycling, and Organics Management							Unanimous

Policy No.	Policy Recommendation	GHG Reductions (MMtCO ₂ e)			Net Present Value 2009–2025 (Million 2005\$)	Cost-Effectiveness (\$/tCO ₂ e)	Level of Support
		2015	2025	Total 2009–2025			
	In-State GHG Reductions	1.4	3.0	28	–\$3,136	–\$112	
	Full Life-Cycle Reductions	14.5	35.3	314	–\$3,136	–\$10	
AFW-10	Landfill Methane Energy Programs	0.91	2.7	22	–\$35	–\$2	Unanimous
	Sector Totals[†]	9	23	201	–\$548	–\$3	
	Sector Total After Adjusting for Overlaps^{††}	6	17	147	–\$1,634	–\$11	
	Reductions From Recent Actions	N/A	N/A	N/A	N/A	N/A	
	Sector Total Plus Recent Actions	6	17	147	–\$1,634	–\$11	

N/A = not applicable. Note that negative costs represent a monetary savings.

* The quantification results for AFW-2 (biofuel production volumes and costs) were used as inputs to the quantification of the results of TLU-1, which covers consumption of biofuels in Michigan.

** The analyses for AFW-5, AFW-7, and AFW-9 include the full life-cycle costs of the policies. In the case of AFW-9, it is estimated that a significant fraction of the reductions will occur out of state. In-state reductions refer only to those occurring from reduced landfilling and waste combustion (these are broken out separately in the table above).

[†] The reductions from AFW-5B (Retention of Lands in Conservation Programs) have been left out of the sector totals, since they relate to a soil carbon protection measure where the estimated emissions (from conservation acres being returned to active cultivation) are not included in the business as usual (BAU) inventory and forecast (I&F). The costs have been included in the sector totals, since these will be incurred in order to retain the level of emissions in the BAU I&F. For AFW-5, AFW-7, and AFW-9, these include the reductions that are expected to occur within the state.

^{††} See the section below for discussion of overlap adjustments.

Cross Cutting Issues (CCI) Policy Recommendations

No.	Policy Recommendation	GHG Reductions (MMtCO ₂ e)			Net Present Value 2009–2025 (Million \$)	Cost Effective-ness (\$/tCO ₂ e)	Level of Support
		2015	2025	Total 2009–2025			
CCI-1	GHG Inventories, Forecasting, Reporting, and Registry	Not Quantified					Unanimous
CCI-2	Statewide GHG Reduction Goals and Targets	Not Quantified					Unanimous
CCI-3	State, Local, and Tribal Government GHG Emission Reductions (Lead-by-Example)	Not Quantified					Unanimous
CCI-4	Comprehensive Local Government Climate Action Plans (Counties, Cities, Etc.)	Not Quantified					Unanimous
CCI-5	Public Education and Outreach	Not Quantified					Unanimous
CCI-6	Tax and Cap/ Cap and Trade	MCAC approved creation of a new Market-Based Policies Technical Work Group as the lead for this policy recommendation.					Transferred to MBP TWG
CCI-7	Seek Funding for Implementation of MCAC Recommendations	Not Quantified					Unanimous
CCI-8	Adaptation and Vulnerability	Not Quantified					Unanimous
CCI-9	Participate in Regional, Multi-State, and National GHG Reduction Efforts	Not Quantified					Unanimous
CCI-10	Enhance and Encourage Economic Growth and Job Creation Opportunities Through Climate Change Mitigation	Not Quantified					Unanimous
CCI-11	Enhance and Encourage Community Development Through Climate Change Mitigation: Address Environmental Justice	Not Quantified					Unanimous

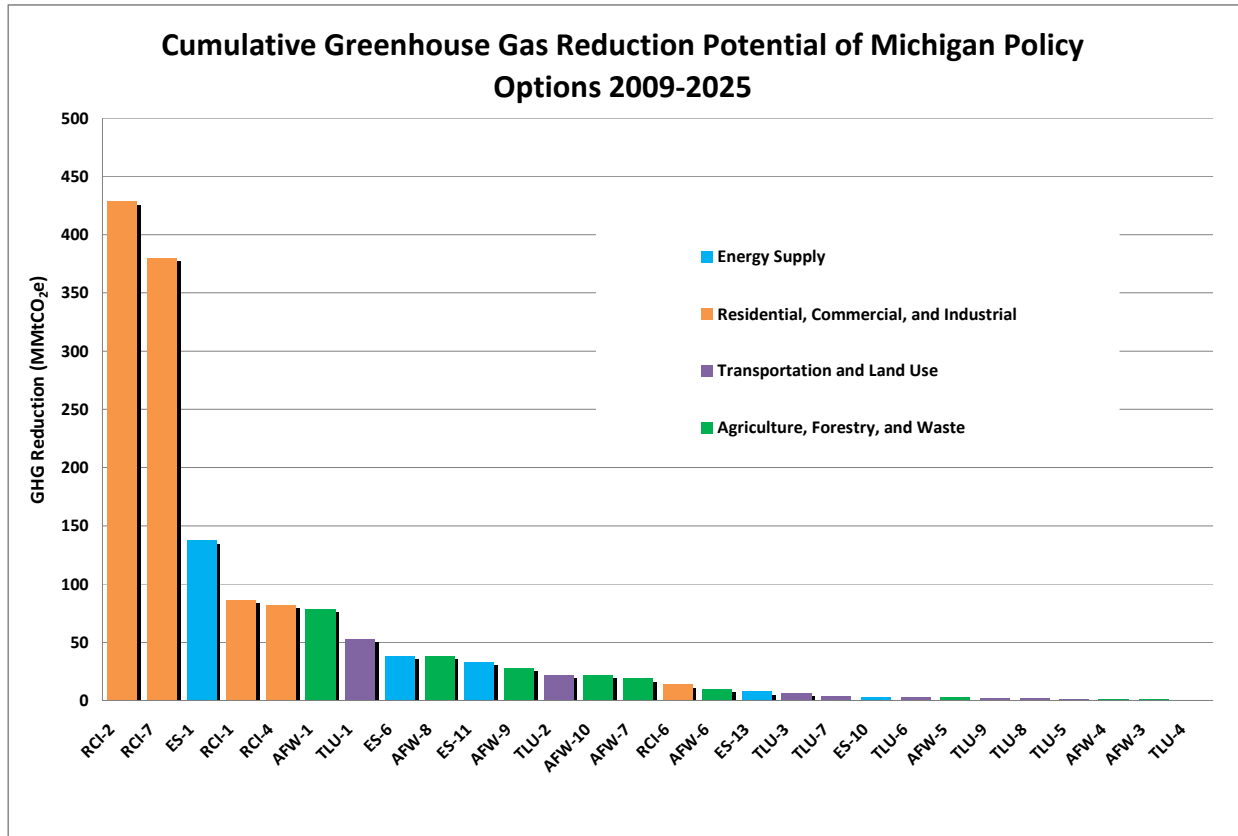
GHG = greenhouse gas; MMtCO₂e = million metric tons of carbon dioxide equivalent; \$/tCO₂e = dollars per metric ton of carbon dioxide equivalent

As explained previously, the MCAC considered the estimates of the GHG reductions that could be achieved and the costs (or cost savings) for the 33 options that were quantifiable. Figure ExS-5, below, presents the estimated tons of GHG emission reductions for each of these policy recommendations, expressed as a cumulative figure for the period 2009–2025.

Figure ExS-6 presents the estimated dollars-per-ton cost (or cost savings, depicted as a negative number) for each quantified policy recommendation. The dollars per ton value is calculated by dividing the net present value of the cost of the policy recommendation by the cumulative GHG reductions, all for the period 2009–2025.

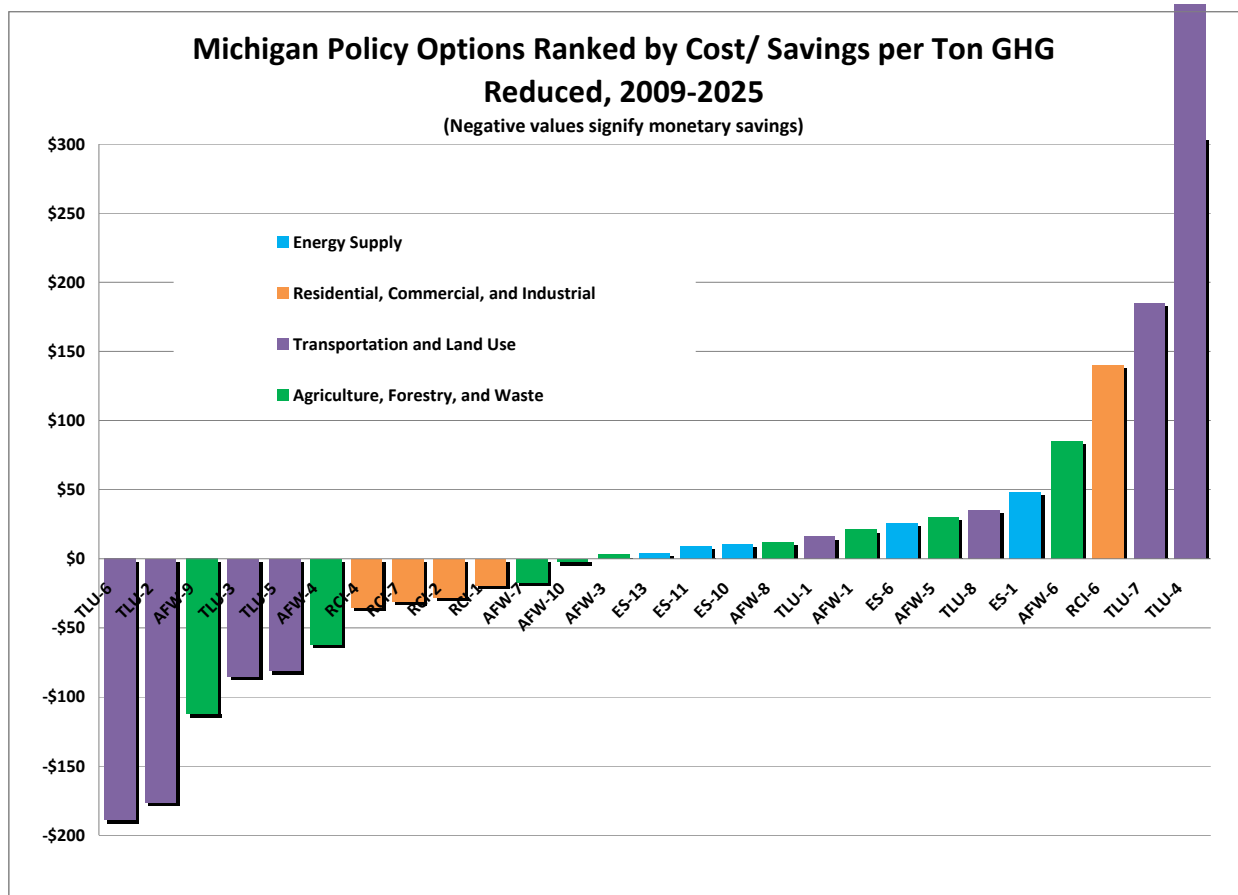
It is important to note that there is some level of uncertainty in projecting GHG reductions and estimating exact costs (or cost savings) per ton of reductions achieved for the time periods of this analysis.

Figure ExS-5. MCAC policy recommendations ranked by cumulative (2009–2025) GHG reduction potential



GHG = greenhouse gas; MMtCO₂e = million metric tons of carbon dioxide equivalent; AFW = Agriculture, Forestry, and Waste Management; ES = Energy Supply; TLU = Transportation and Land Use; RCI = Residential, Commercial and Industrial

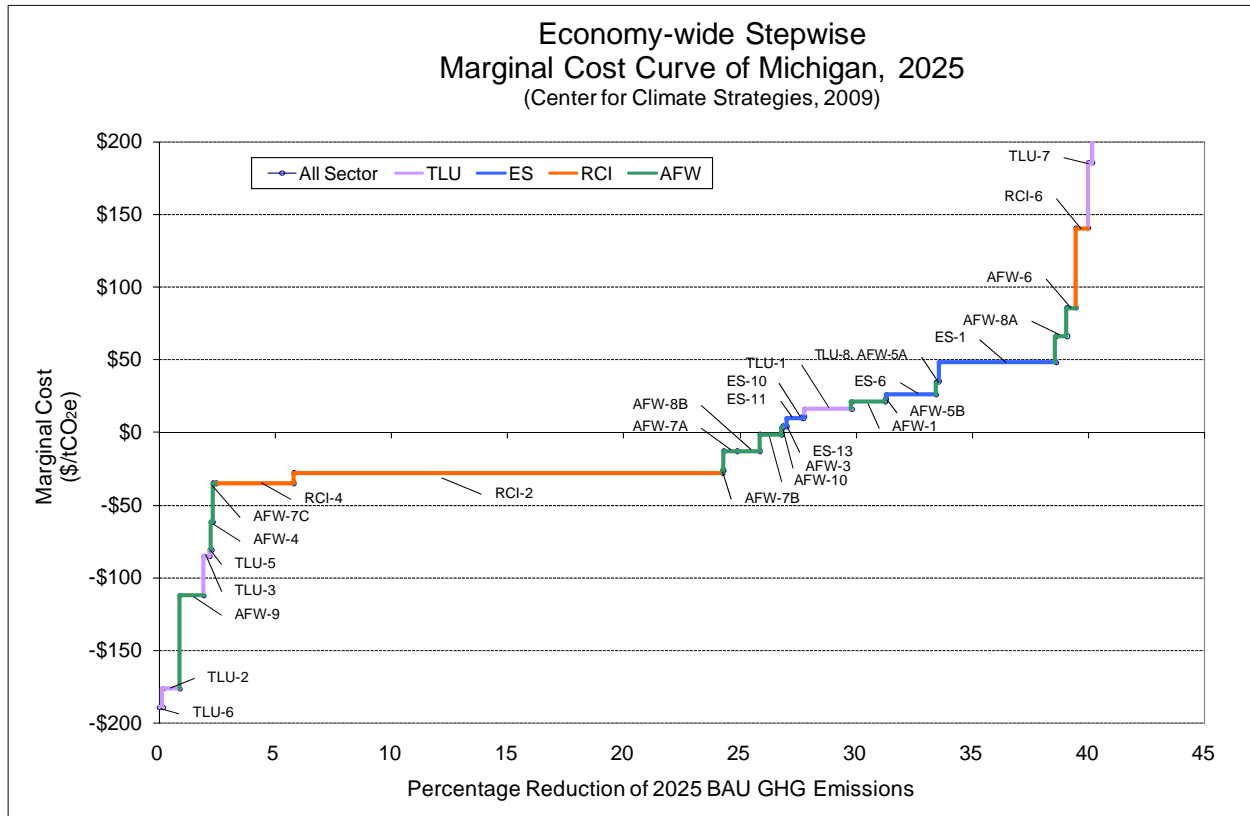
Figure ExS-6. MCAC policy recommendations ranked by cumulative (2009–2025) net cost/cost savings per ton of GHG removed



GHG = greenhouse gas; MMtCO₂e = million metric tons of carbon dioxide equivalent; AFW = Agriculture, Forestry, and Waste Management; ES = Energy Supply; TLU = Transportation and Land Use; RCI = Residential, Commercial and Commercial, Industrial

Figure ExS-7, below, presents a stepwise marginal cost curve for Michigan. The horizontal axis represents the percentage of GHG emissions reduction in 2025 for each option relative to the business as usual (BAU) forecast. The vertical axis represents the marginal cost of mitigation (expressed as the cost-effectiveness of each policy option on a cumulative basis, 2009-2025). In the figure, each horizontal segment represents an individual policy. The width of the segment indicates the GHG emission reduction potential of the option in percentage terms. The height of the segment relative to the horizontal x-axis shows the average cost (saving) of reducing one MMtCO₂e of GHG emissions through implementation of the option. For instance, for RCI-2-Energy Efficiency- this policy recommendation should result in approximately a 54 MMtCO₂e (19%) reduction of GHG emissions in 2025 below the BAU reference case with an average cost savings of approximately \$28/ton.

Figure ExS-7. Stepwise marginal cost curve for Michigan, 2025



BAU = business as usual; GHG = greenhouse gas; tCO₂e = metric tons of carbon dioxide equivalent; AFW = Agriculture, Forestry, and Waste Management; ES = Energy Supply; TLU = Transportation and Land Use; RCI = Residential, Commercial and Industrial

Negative values represent net cost savings and positive values represent net costs associated with the policy option.

Note: Results have been adjusted to remove overlaps between policies. For example, RCI-7 reductions overlap with both RCI-2 and RCI-4 assuming all three policies are implemented. The curve, therefore, includes RCI-2 and RCI-4 but not RCI-7 to avoid overstating the combined benefits of the recommendations.

Chapter 1

Background and Overview

Creation of the Michigan Climate Action Council (MCAC)

On November 14, 2007, Governor Jennifer M. Granholm signed Executive Order 2007-42 establishing the Michigan Climate Action Council (MCAC). The purpose of the MCAC is to assist Michigan in identifying the best opportunities to mitigate and adapt to climate change, reduce costs associated with climate change activities, and foster economic growth in Michigan. Governor Granholm charged the advisory group to:

- Produce an inventory and forecast of Greenhouse Gas (GHG) sources and emissions from 1990-2020.
- Consider potential state and multi-state actions to mitigate and adapt to climate change in various sectors including energy supply, residential, commercial and industrial, transportation, land use, agriculture, forestry, and waste management.
- Compile a comprehensive climate action plan with specific goals and recommendations for reducing GHG emissions in Michigan by state and local units of government, businesses, and Michigan residents to minimize climate change and better prepare for the effects of climate change in Michigan.
- Advise state and local government on measures to address climate change.

MCAC's Response

In fulfillment of the requirements of this Executive Order, the MCAC held eight meetings over the last fifteen months. Additionally, the Council formed six Technical Work Groups (TWGs) to assist the MCAC in formulating options. These TWGs met numerous times between the MCAC meetings. The MCAC developed this Climate Action Plan as an initial step in establishing a basis for moving forward on the implementation of climate change policies in Michigan. Evaluation of key factors such as cost effectiveness, economic impacts, and harmonization with other Michigan programs and policies will be critical to the next stage of climate policy implementation.

The following key elements and recommendations were identified by the MCAC during this initial process:

- MCAC reviewed over 330 multi-sector policy options and approved for inclusion in this report a package of 54 policy recommendations to reduce GHG emissions and address related energy and commerce issues in Michigan. 52 of these 54 recommendations were approved unanimously and only one option was rejected. The recommended policy options cover a wide range of costs and GHG reduction potentials.
- In moving towards implementation to achieve these goals, Michigan should prioritize these 54 policy recommendations during 2009 in order to set the stage for strategic implementation of the most promising options. The prioritization should take into

account the GHG reduction potential, costs and savings, feasibility, co-benefits, a macro-economic analysis of the selected recommendations, public health and safety and consistency with other Michigan programs and policies.

- The MCAC approved policy recommendations are estimated to generate a net cumulative savings of about \$10 billion between 2009 and 2025. The weighted-average cost-effectiveness of these policies is estimated to be approximately a \$10.2/ tCO₂e cost savings. Those policy options that show negative costs¹ (i.e. benefits) should be evaluated as quickly as possible, for implementation. All policy options, particularly those that show a net cost, should be evaluated thoroughly, using tools such as regional economic modeling, before being implemented.
- The MCAC recommends periodic review of Michigan's progress with appropriate adjustments made in the Climate Action Plan to assure the approaches taken and GHG reductions are on target. Michigan's GHG Inventory and Forecast has been prepared which outlines historical conditions for 1990-2005 and projected emissions through 2025 based upon a business as usual scenario. These documents were completed prior to the severe downturn in the global economy. To account for fluctuations such as changes in the economy, updates to this inventory should be performed annually with the projections evaluated every three years.
- The MCAC recommends that Michigan further analyze actions needed for adaptation. The MCAC was unable to examine the impacts of climate change on Michigan's natural resources and the Great Lakes due to time and resource constraints. Therefore, the MCAC recommends that Michigan conduct additional analyses of the state's vulnerability to the impacts of climate change and develop specific adaptation plans for key sectors.
- MCAC recommends that Michigan position itself as a leader in the national and regional dialogue on climate change policy as described in the MCAC Recommended Policy Positions section.

Recent Actions

GHG Reductions Associated With Recent Federal and State Actions

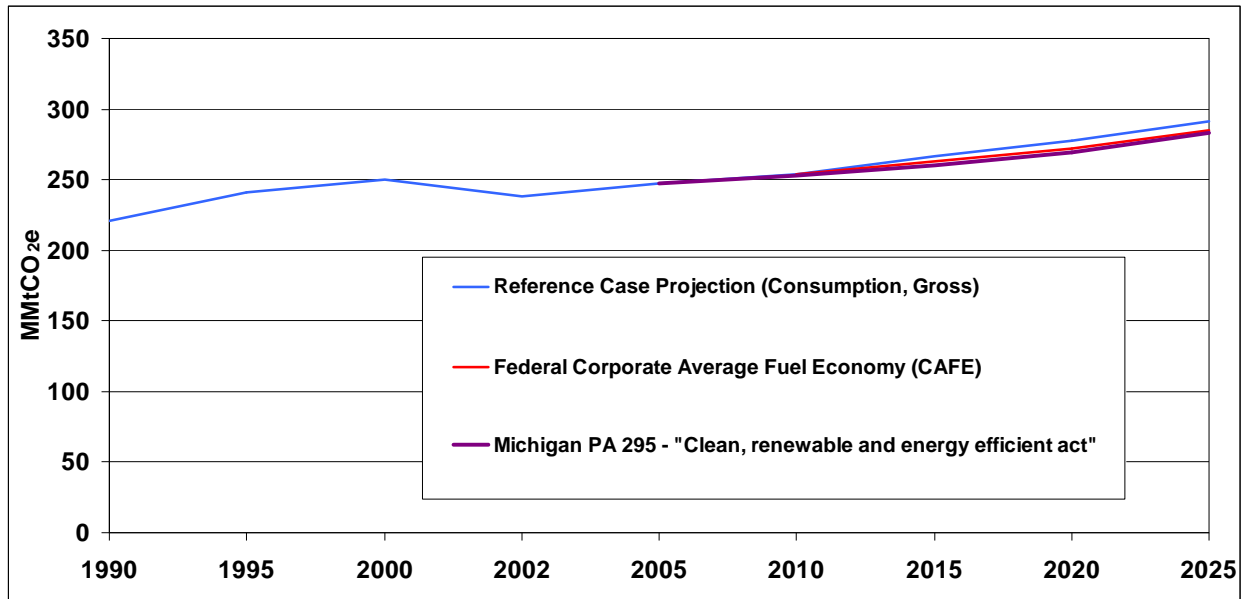
The MCAC identified recent actions undertaken in Michigan that will reduce GHG emissions while conserving energy and promoting the development and use of renewable energy sources. One such action was the adoption of Public Act (PA) 295². The resultant emission reductions were estimated. Reductions associated with federal actions, such as the federal Energy Independence and Security Act (EISA) of 2007 and the implementation of the Act's Corporate Average Fuel Economy (CAFE) requirements, were also estimated. A total reduction of about

¹ Policy options that are "negative cost" are not necessarily better than other potential investments. In capital constrained situations only a limited number of investments can be made. There may be structural or policy barriers to the adoption of options identified as negative cost.

² Public Act 295 is The Clean Renewable and Energy Efficient Act of 2008

8.9 MMtCO₂e (3.1%) in 2025 from the business-as-usual reference case emissions is projected. These GHG emission reductions are summarized in Figure 1-1.

Figure 1-1. Estimated emission reductions associated with the effect of recent federal and state actions in Michigan (consumption-basis, gross emissions)



MMtCO₂e = million metric tons of carbon dioxide equivalent.

Table 1-1. Estimated GHG emission reductions associated with the effect of recent federal and state actions in Michigan (consumption-basis, gross emissions)

Reductions from Existing Action		1990	2005	2010	2015	2020	2025
Recent Actions							
Federal CAFÉ		0.00	0.00	0.18	3.55	6.22	6.92
Michigan PA 295 - "Clean, renewable and energy efficient act"		0.00	0.00	0.51	2.65	2.13	2.01
Totals		0.00	0.00	0.69	6.20	8.34	8.92

	1990	2005	2010	2015	2020	2025
Reference Case Projection (Consumption, Gross)	220.7	247.5	253.8	266.4	278.0	291.6
Federal Corporate Average Fuel Economy (CAFE)			253.6	262.9	271.7	284.7
Federal Improved Standards for Appliances and Lighting			253.6	262.9	271.7	284.7
Michigan PA 295 - "Clean, renewable and energy efficient act"		247.5	253.1	260.2	269.6	282.7

The MCAC Process

The MCAC began its deliberative process at its first meeting on December 12, 2007. MCAC met in person a total of seven times, with the final decisional meeting held on January 28, 2009. A teleconference meeting was held on February 26, 2009 exclusively for the review of this report. An additional 74 teleconference meetings of MCAC's six supporting Technical Work Groups were also held to identify and analyze various potential policy actions in advance of the MCAC's January 28, 2009 final decisional meeting.

The six TWGs considered information and potential options in the following sectors:

- Energy Supply(ES);
- Market Based Policies (MBP);
- Residential, Commercial and Industrial (RCI);
- Transportation and Land Use (TLU);
- Agriculture, Forestry, and Waste Management (AFW); and
- Cross-Cutting Issues (CCI) (i.e., issues that cut across the above sectors).

The Center for Climate Strategies (CCS) provided facilitation and technical assistance to the MCAC and each of the TWGs, based on a detailed proposal approved by the MDEQ. The TWGs served as advisors to the MCAC and consisted of MCAC members and additional individuals with interest and expertise. Members of the public were invited to observe and provide input at all meetings of the MCAC and TWGs. The TWGs assisted the MCAC by generating initial options on Michigan-specific policy options to be added to the catalog of existing states actions; Where members of a TWG did not fully agree on the recommendations to the MCAC, the summary of their efforts was reported to the MCAC as a part of its consideration and actions. The MCAC reviewed the TWGs' proposals, modified the proposals, if necessary, and made final decisions on the items before them.

The MCAC process employed a model of informed self-determination through a facilitated, stepwise, fact-based, and consensus-building approach. As noted, the process was facilitated by the Center for Climate Strategies (CCS), an independent, expert facilitation and technical analysis team. It was based on procedures that CCS has used in a number of other state climate change planning initiatives since 2000, but was adapted specifically for Michigan. The MCAC process sought but did not mandate consensus, and it explicitly documented the level of MCAC support for policies and key findings through a voting process established in advance, including barriers to full consensus where they existed on final consideration of proposed actions.

The 54 policy recommendations (out of more than 330 potential options considered) adopted by the MCAC and presented in this report were developed through a stepwise approach that included: (1) expanding a list of existing states actions to include additional Michigan-specific actions; (2) developing a set of "priority for analysis" options for further development; (3) fleshing these proposals out for full analysis by development of "straw proposals" for level of effort, timing and parties involved in implementation; (4) developing and applying a common framework of analysis for options, including sector-specific guidance and detailed specifications for options that include data sources, methods and key assumptions; (5) reviewing results of

analysis and modifying proposals as needed to address potential barriers to consensus; (6) finalizing design and analysis of options to remove barriers to final agreement; and (7) developing other key elements of policy proposals such as implementation mechanisms, co-benefits, and feasibility considerations. At Meetings # 6 and 7, policy recommendations receiving unanimous support, a super majority or majority support (defined as less than half of those present objecting) from the MCAC members present were adopted by the MCAC and included in this report. The TWGs' options to the MCAC were documented and presented at each MCAC meeting. All of the MCAC and TWG meetings were open to the public and all materials for and summaries of the MCAC and TWG meetings were posted on the MCAC Web site (www.miclimatchange.us). A detailed description of the deliberative process is included in Appendix B.

Analysis of Policy Recommendations

With CCS providing facilitation and technical analysis, the six TWGs submitted policy recommendations for MCAC consideration using a "policy option template" conveying the following key information:

- Policy Description
- Policy Design (Goals, Timing, Parties Involved)
- Implementation Mechanisms
- Related Policies/Programs in Place
- Type(s) of GHG Reductions
- Estimated GHG Reductions and Net Costs or Cost Savings
- Key Uncertainties
- Additional Benefits and Costs
- Feasibility Issues
- Status of Group Approval
- Level of Group Support
- Barriers to Consensus

In its deliberations, the MCAC reviewed, modified, and reached group agreement on various policy recommendations. The final versions for each sector, conforming to the policy recommendation templates, appear in Appendices F through K and constitute the most detailed record of decisions of the MCAC. Appendix E describes the methods used for quantification of the 33 policy options that were analyzed quantitatively. The quantitative analysis produced estimates of the GHG emission reductions and direct net costs (or cost savings) of implementation of various policies, in terms of both a net present value from 2009 to 2025 and a dollars-per-ton cost (i.e., cost-effectiveness). The key methods are summarized below.

Estimates of GHG Reductions: Using the projection of future GHG emissions (see below) as a starting point, 33 policy options were analyzed by CCS to estimate GHG reductions attributable to each policy in the individual years of 2015 and 2025 and cumulative reductions over the period 2009–2025. The years 2015 and 2025 were chosen as the target years for quantification

and analysis as part of the *MCAC Interim Report to the Governor*, in April 2008.³ The estimates were prepared in accordance with guidance by the appropriate TWG and the MCAC, which later reviewed the estimates and, in some cases, directed that they be revised with respect to such elements as goals, data sources, assumptions, sensitivity analysis, and methodology. Some policies were estimated to affect the quantity or type of fossil fuel combusted. Other policies affected methane or carbon dioxide (CO₂) being sequestered. Sequestered means the gas is stored in plant materials or geologic formations so it is not contributing to global warming. Among the many assumptions involved in this task was identification of the appropriate GHG accounting framework—namely, the choice between taking a “production-based” approach versus a “consumption-based” approach to various sectors of the economy.⁴

Estimates of Costs/Cost Savings: The analyses of 33 policy recommendations included estimates of the direct cost of those policies, in terms of both net costs or cost savings during 2009–2025 and a dollars-per-ton cost (i.e., cost-effectiveness). Following is a brief summary of the approach used to estimate the costs or cost savings associated with the policy recommendations:

- *Discounted and annualized costs or cost savings*—Standard approaches were taken here. The net present value of costs or cost savings was calculated by applying a real discount rate of 5%. Dollars-per-ton estimates were derived as an annualized cost per ton, dividing the present value cost or savings by the cumulative GHG reduction measured in tons. As was the case with GHG reductions, the period 2009–2025 was analyzed.
- *Cost savings*—Total net costs or savings were estimated through comparison of monetized costs and savings of policy implementation over time, using discounting. These net costs could be positive or negative. Negative costs indicated that the policy saved money or produced “cost savings.” Many policies were estimated to create net financial cost savings (typically through fuel savings and electricity savings associated with new policy actions).
- *Direct vs. indirect effects*—Estimates of costs and cost savings were based on “direct effects” (i.e., those borne by the entities implementing the policy).⁵ Implementing entities could be individuals, companies, and/or government agencies. In contrast, conventional cost-benefit analysis takes the “societal perspective” and tallies every conceivable impact on every entity in society (and quantifies these wherever possible).

Additional Costs and Benefits: The MCAC options were guided by four decision criteria that included GHG reductions and monetized costs and cost savings of various policies, as well as other potential co-benefits and costs (e.g., social, economic, and environmental) and feasibility

² “MCAC Interim Report to the Governor,” April 30, 2008

³ A production-based approach estimates GHG emissions associated with goods and services produced within the state, and a consumption-based approach estimates GHG emissions associated with goods and services consumed within the state. In some sectors of the economy, these two approaches may not result in significantly different numbers. However, the power sector is notable, in that it is responsible for large quantities of GHG emissions, and states often produce more or less electricity than they consume (with the remainder attributable to power exports or imports).

⁴ “Additional benefits and costs” were defined as those borne by entities other than those implementing the policy option. These indirect effects were quantified on a case-by-case basis, depending on magnitude, importance, need, and availability of data.

considerations. The TWGs were asked to examine the latter two in qualitative terms where deemed important and quantify them on a case-by-case basis, as needed, depending on need and where data were readily available. It should be noted that some of these un-quantified co-benefits and costs could be quite significant and merit further investigation.

Implementation Mechanisms: The analysis for each option (see Appendices F through K) of the MCAC includes guidance on the policy instruments or “mechanisms” that were prescribed or assumed for the policy action. This includes a range of potential mechanisms including, for instance, funding incentives, codes and standards, voluntary and negotiated agreements, market based instruments, information and education, reporting and disclosure, and other instruments. In some cases, the recommended instruments are precise. In other cases, they are more general and envision further work to develop concrete programs and steps to achieve the goals recommended by the MCAC.

Michigan GHG Emissions Inventory and Reference Case Projections

The Center for Climate Strategies (CCS) prepared the Michigan Inventory and Forecast Report⁶ for the Michigan Department of Environmental Quality (MDEQ). The report presents an assessment of the State’s greenhouse gas (GHG) emissions and anthropogenic sinks (carbon storage) from 1990 to 2025. The preliminary draft inventory and forecast estimates in January 2008 served as a starting point for the Michigan Climate Action Council (MCAC) and Technical Work Groups (TWGs). The MCAC and TWGs reviewed, discussed, and evaluated the draft inventory and methodologies and offered alternative data and approaches for improving the draft GHG inventory and forecast. The inventory and forecast were revised to address the comments received. The final Inventory and Forecast Report was approved by the MCAC at the November 2008 meeting and is available at:

http://www.miclimatchange.us/Inventory_Forecast_Report.cfm.

The inventory and projections cover the six types of gases included in the United States (US) Greenhouse Gas Inventory: carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF₆). Emissions of these GHGs are presented using a common metric, CO₂ equivalence (CO₂e), which indicates the relative contribution of each gas, per unit mass, to global average radiative forcing on a global warming potential- (GWP-) weighted basis.⁷

The inventory and reference case projections included detailed coverage of all economic sectors and GHGs in Michigan, including future emission trends and assessment issues related to energy, the economy, and population growth. It is important to note that the emission estimates

⁶ “Final Michigan Greenhouse Gas Inventory and Reference Case Projections, 1990- 2025,” Center for Climate Strategies, November 2008.

⁷ Changes in the atmospheric concentrations of GHGs can alter the balance of energy transfers between the atmosphere, space, land, and the oceans. A gauge of these changes is called radiative forcing, which is a simple measure of changes in the energy available to the Earth-atmosphere system (IPCC, 2001). Holding everything else constant, increases in GHG concentrations in the atmosphere will produce positive radiative forcing (i.e., a net increase in the absorption of energy by the Earth), See: Boucher, O., et al. “Radiative Forcing of Climate Change.” Chapter 6 in *Climate Change 2001: The Scientific Basis*. Contribution of Working Group 1 of the Intergovernmental Panel on Climate Change Cambridge University Press, Cambridge, United Kingdom. Available at: http://www.grida.no/climate/ipcc_tar/wg1/212.htm.

reflect the GHG emissions associated with the electricity sources used to meet Michigan's demands, corresponding to a consumption-based approach to emissions accounting. Another way to look at electricity emissions is to consider the GHG emissions produced by electricity generation facilities in the state—a production-based method. The study covers both methods of accounting for emissions, but for consistency, all total results are reported as consumption-based.

As illustrated in Figure 1-2, activities in Michigan accounted for approximately 248 million metric tons (MMt) of *gross*⁸ CO₂e emissions (consumption basis) in 2005, an amount equal to about 3.5% of total US gross GHG emissions (based on 2005 US data).⁹ Gross emissions exclude carbon sinks, such as forests. Michigan's gross GHG emissions are rising slower than those of the nation as a whole. From 1990 to 2005, Michigan's gross GHG emissions increased by about 12%, while national emissions rose by 16%. The growth in Michigan's emissions from 1990 to 2005 is primarily associated with the electricity consumption and transportation sectors.

The principal sources of Michigan's GHG emissions are electricity consumption; residential, commercial, and industrial (RCI) fuel use; and transportation accounting for 36, 24, and 24% of Michigan's gross GHG emissions in 2005, respectively.

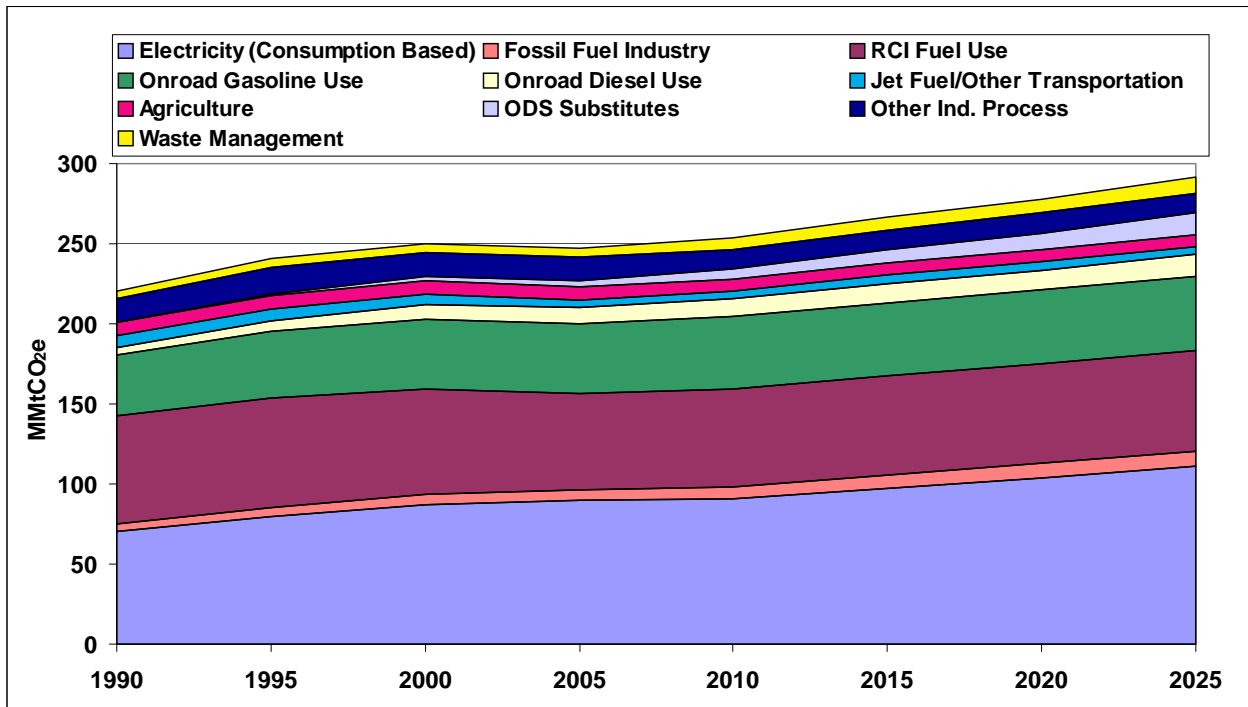
As illustrated in Figure 1-2, below, under the reference case projections, Michigan's gross GHG emissions continue to grow, and are projected to climb to about 292 MMtCO₂e by 2025, reaching 32% above 1990 levels. While these projections are made over the long term (e.g. to 2025), they do not account for the current severe global economic downturn and how this will impact future growth projections.

Emissions associated with electricity consumption are projected to be the largest contributor to future GHG emissions growth, followed by emissions associated with the transportation sector. Other sources of emissions growth include the RCI fuel use sector and the increasing use of HFCs and PFCs as substitutes for ozone-depleting substances in refrigeration, air conditioning, and other applications. The agriculture sector is the only sector in which emissions are projected to decrease from 2005 to 2025. Figure 1-3 depicts the 2005 distribution of sources in Michigan compared to the US.

⁸ Excluding GHG emissions removed due to forestry and other land uses and excluding GHG emissions associated with exported electricity.

⁹ The national emissions used for these comparisons are based on 2005 emissions from *Inventory of US Greenhouse Gas Emissions and Sinks: 1990-2006*, April 15, 2008, US EPA #430-R-08-005, (<http://www.epa.gov/climatechange/emissions/usinventoryreport.html>).

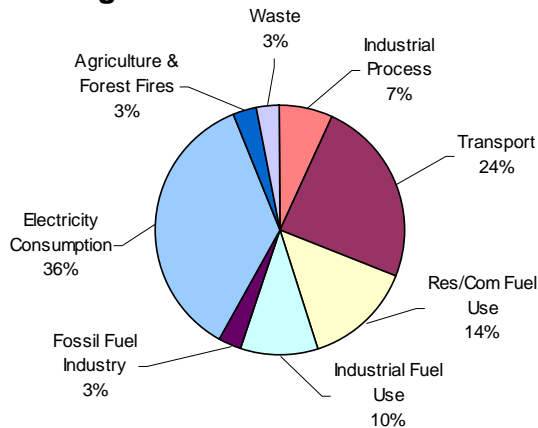
Figure 1-2. Gross GHG emissions by sector, 1990–2025: historical and projected (consumption-based approach) business as usual / base case



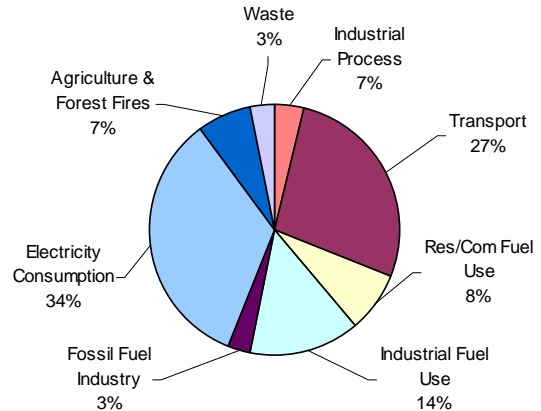
MMtCO₂e = million metric tons of carbon dioxide equivalent; RCI = direct fuel use in residential, commercial, and industrial sectors; ODS = ozone-depleting substance; Ind. = industrial.

Figure 1-3. Gross GHG emissions by sector, 2005: Michigan and U.S.

Michigan



US



MCAC Policy Recommendations (Beyond Recent Actions)

The MCAC approved 54 policy recommendations for consideration of further action in Michigan. Of these, 33 were analyzed quantitatively to calculate both emission reductions and

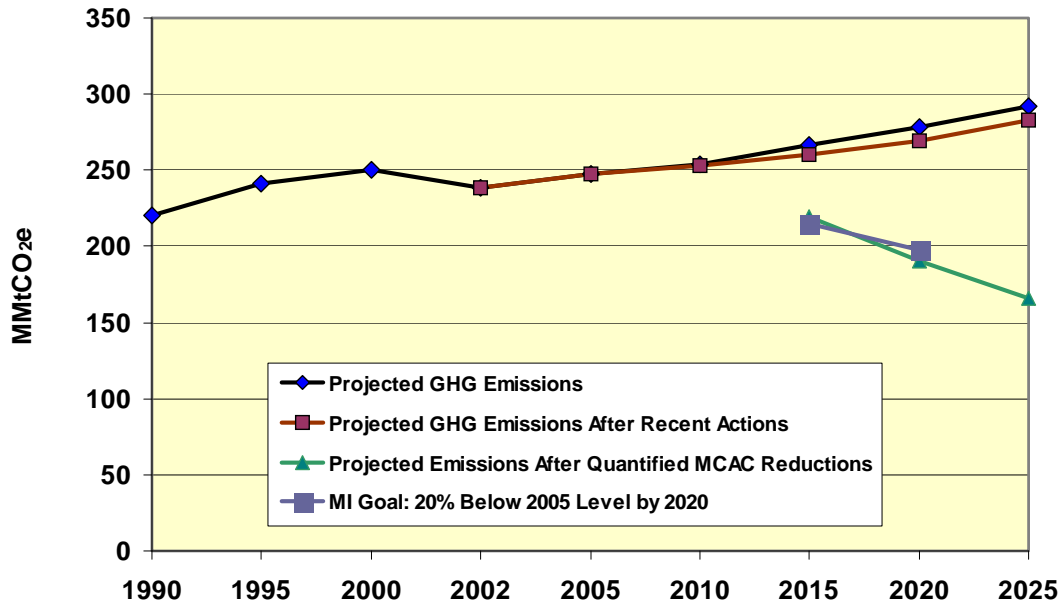
costs or savings. Based on this analysis, the 33 quantified policies have the cumulative effect of reducing annual GHG emissions by approximately 41 million metric tons of carbon dioxide equivalent (MMtCO₂e) in 2015 and by 117 MMtCO₂e in 2025. The additional policy recommendations were not quantifiable but are considered valuable recommendations to support the overall Climate Action Plan. Several of the non-quantified policy recommendations may have the potential to achieve GHG emission reductions.

Figure 1-4 presents a graphical summary of the potential cumulative emission reductions associated with the 33 policy options and federal actions relative to the business-as-usual reference case projections.

- The blue line shows actual (for 1990, 1995, 2000, and 2005) and projected (for 2010, 2015, 2020 and 2025) levels of Michigan's gross GHG emissions on a business as usual basis. This consumption-based approach accounts for emissions associated with the generation of electricity in Michigan to meet the state's demand for electricity.
- The red line shows the projected emissions adjusted for the recent state and federal actions described in Table 1.1.
- The green line shows the projected emissions if all of the MCAC's 33 recommended options are implemented and the estimated reductions are fully achieved. While the other MCAC options have the effect of reducing emissions, those reductions were not quantified and are not reflected in the green line.

It is important to note, to yield these emission reductions from the 33 MCAC recommended options, implementation must be timely, aggressive, and thorough. Evaluation of key factors such as cost effectiveness, economic impacts, and harmonization with other Michigan programs and policies will be critical to the next stage of climate policy implementation.

Figure 1-4. Annual GHG emissions: reference case projections and MCAC recommendations (consumption basis, gross emissions)



MMtCO₂e = million metric tons of carbon dioxide equivalent; GHG = greenhouse gas; MCAC = Michigan Climate Action Council.

Table 1-2 provides the numeric estimates underlying Figure 1-4. In summary, if all of the Policy recommendations are fully implemented and successful in achieving all of the GHG reductions projected then MI should over-achieve its GHG reduction goals by 7.3 MMtCO₂e in 2020. Another way to look at this is that the MCAC package of policy recommendations entails a surplus of GHG reductions of about 7.3MMTCo₂e.

Table 1-2. Annual emissions: reference case projections and impact of MCAC recommended options (consumption basis, gross emissions)

Consumption Basis - Gross Emissions							
	1990	2000	2005	2010	2015	2020	2025
Projected GHG Emissions	220.7	250.0	247.5	253.8	266.4	278.0	291.6
Reductions from Recent Actions			0.0	0.7	6.2	8.3	8.9
Projected GHG Emissions After Recent Actions			247.5	253.1	260.2	269.6	282.7
GHG Reduction Goal Recommended by MCAC					NA	198.0	NA
Total GHG Reductions from MCAC Policies					41.2	78.9	116.6
Difference Between MCAC 2020 Goal & Remaining Emissions after Reductions					NA	7.3	NA
Projected Emissions After Quantified MCAC Reductions					219.0	190.7	166.1

GHG = greenhouse gas; MCAC = Michigan Climate Action Council; N/A = not applicable.
Notes continued next page.

Reductions from recent actions include the Energy Independence and Security Act of 2007, Title III. GHG reductions from Titles IV and V of this Act have not been quantified because of the uncertainties in how they will be implemented.

Table 1-3 depicts the final policy recommendations of the Council and their associated GHG reductions and costs or savings for each sector.

In Table 1-3 and throughout the Climate Action Plan, negative cost (- \$) figures indicate cost savings. For example, in Table 1-3 the column totals for the Net Present Value (NPV) of (- \$10,093 million) portrays a cost savings of \$10,093,000,000 over the 2009- 2025 period of analysis.

Table 1-3. Summary by sector of estimated impacts of implementing all of the MCAC recommended options (cumulative reductions and costs/savings)

Sector	GHG Reductions (MMtCO ₂ e)			Net Present Value 2009–2025 (Million \$)	Cost-Effectiveness (\$/tCO ₂ e)
	2015	2025	Total 2009–2025		
Residential, Commercial and Industrial	21.9	65.1	524.6	–\$13,014	–\$25
Energy Supply	8.1	23.6	220.3	\$7,980	\$36
Transportation and Land Use	4.8	10.5	95.1	–\$3,425	–\$36
Agriculture, Forestry, and Waste Management	6.4	17.4	147.0	–\$1,634	–\$11.1
Cross-Cutting Issues	Non-quantified, enabling options				
TOTAL (includes all adjustments for overlaps)	41.2	116.6	987.0	–\$10,093	–\$10.2

GHG = greenhouse gas; MMtCO₂e = million metric tons of carbon dioxide equivalent; \$/tCO₂e = dollars per metric ton of carbon dioxide equivalent.

Negative values in the Net Present Value and the Cost-Effectiveness columns represent net cost savings associated with the policy options.

Within each sector, values have been adjusted to eliminate double counting for policies or elements of policies that overlap. In addition, values associated with policies or elements of policies within a sector that overlap with policies or elements of policies in another sector have been adjusted to eliminate double counting. Appendix F (for the ES sectors), Appendix H (for the RCI sectors), Appendix I (for the TLU sectors), and Appendix J (for the AFW sectors) of this report provide documentation of how sector-level emission reductions and costs (or cost savings) were adjusted to eliminate double counting associated with overlaps between policies.

Table 1-4 Summary List Policy Recommendations for all Sectors

Energy Supply (ES) Policy Recommendation

Policy No.	Policy Recommendation	GHG Reductions (MMtCO ₂ e)			Net Present Value 2009–2025 (Million \$)	Cost-Effectiveness (\$/tCO ₂ e)	Level of Support
		2015	2025	Total 2009–2025			
RECENT ACTION	PA 295, Clean, Renewable, and Efficient Energy Act	2.7	2.0	30.8	\$1,024	\$33	N/A
ES-1	Renewable Portfolio Standard and Distributed Generation "Carve-Out"	5.0	14.6	137.5	\$6,600	\$48.00	Unanimous
	Renewable Portfolio Standard (RPS)	4.6	13.7	129.5	\$5,546	\$42.83	
	Wind	3.7	10.3	100.4	\$4,748	\$47.31	
	Biomass	0.9	2.7	25.2	\$376	\$15	
	Solar Photovoltaic (PV)	0.0	0.4	2.6	\$392	\$152	
	Plasma Gasification	0.0	0.3	1.3	\$29	\$22	
	Distributed Generation "Carve-Out"	0.4	0.9	8.0	\$1,054	\$131.51	
	Solar Hot Water	0.0	0.2	1.2	\$26	\$22.27	
	Geothermal	0.1	0.2	1.5	\$82	\$55	
	Wind (distributed)	0.1	0.3	2.7	\$503	\$186	
	Solar PV (distributed)	0.1	0.2	1.84	\$508	\$276	
	Biogas	0.1	0.2	2.3	\$17	\$7	
ES-3	Energy Optimization Standard	0.0	13.6	86.3	–\$1,632	–\$19	Unanimous
ES-5	Advanced Fossil Fuel Technology (e.g., IGCC, CCSR) Incentives, Support, or Requirements	Not Quantifiable					Unanimous
ES-6	New Nuclear Power	0.0	6.3	38.5	\$1,001	\$25.98	Majority ¹⁰
ES-7	Integrated Resource Planning (IRP), Including combined heat & power.	Not Quantifiable					Unanimous
ES-8	Smart Grid, Including Advanced Metering	Not Quantifiable					Unanimous
ES-9	CCSR Incentives, Requirements, R&D, and/or Enabling Policies	Not Quantifiable					Unanimous
ES-10	Technology-Focused Initiatives (Biomass Co-firing, Energy Storage, Fuel Cells, Etc.), Including Research, Development, & Demonstration						Majority ¹¹
	Co-firing at 5%	0.2	0.2	3.3	\$34.48	\$10.6	
	Co-firing at 10%	0.5	0.5	6.5	\$69.43	\$10.7	
	Co-firing at 20%	0.9	0.9	13.0	\$134.09	\$10.3	

¹⁰ 6 opposing votes [Pollack, Ettawageshik, Garfield, Heifje, Bazzani, Overmeyer] and 2 abstentions [Martinez and Calloway for Bierbaum]

¹¹ 3 opposing votes [Garfield, Pollack and Heifje]

Policy No.	Policy Recommendation	GHG Reductions (MMtCO ₂ e)			Net Present Value 2009–2025 (Million \$)	Cost-Effective-ness (\$/tCO ₂ e)	Level of Support
		2015	2025	Total 2009–2025			
ES-11	Power Plant Replacement, Energy Efficiency, and Repowering	2.5	2.0	33.2	\$313	\$9.4	Unanimous
ES-12	Distributed Renewable Energy Incentives, Barrier Removal, and Development Issues, Including Grid Access	<i>ES-12 Fully incorporated in distributed generation "carve-out" under ES-1.</i>					Unanimous
ES-13	Combined Heat and Power (CHP) Standards, Incentives and/or Barrier Removal	0.4	0.5	7.8	\$31.91	\$4.09	Unanimous
ES-15	Transmission Access and Upgrades	<i>Not Quantifiable</i>					Unanimous
	Sector Totals	8.1	37.2	306.6	\$6,348	\$22	
	Sector Total After Adjusting for Overlaps	8.1	23.6	220.3	\$7,980	\$36	
	Reductions From Recent Actions	2.7	1.9	30.1	\$1,025	\$34	
	Sector Total Plus Recent Actions	10.8	25.5	250.4	\$9,005	\$36	

\$/tCO₂e = dollars per metric tons of carbon dioxide equivalent; CCI = Cross-Cutting Issues; CCSR = carbon capture and storage or reuse; CHP = combined heat and power; GHG = greenhouse gas; IGCC = integrated gasification combined cycle; IRP = integrated resource planning; MCAC = Michigan Climate Action Council; MMtCO₂e = millions of metric tons of carbon dioxide equivalent; N/A = not applicable; PA = Public Act; R&D = research and development.

Note: The numbering used to denote all the policy recommendations in Table 1-4 and in other parts of this report is for reference purposes only; it does not reflect prioritization among these important recommendations.

Table 1-4 (cont'd.) Market Based Policy (MBP) Recommendations

No.	Policy Recommendations	GHG Reductions (MMtCO ₂ e)			Net Present Value 2009–2025 (Million \$)	Cost-Effective-ness (\$/tCO ₂ e)	Level of Support
		2020	2025	Total 2009–2025			
MBP-1	Cap and Trade 20% below 2005 by 2020 (<i>Free-Granting Allowances</i>) ¹²	92.48				–\$25.83	Unanimous
	20% Below 2005 by 2020 (<i>Auctioning Allowances</i>) ¹³	92.48				–\$19.33	
MBP-3	MI Joins Chicago Climate Exchange	<i>Not Quantified</i>					Unanimous
MBP-6	Market Advisory Group	<i>Not Quantifiable</i>					Unanimous

¹² These results include the direct cost of reducing emissions, plus costs associated with purchase of emissions allowances from entities outside of Michigan, minus revenues from the sale of allowances to entities outside Michigan.

¹³ These results include the direct cost of reducing emissions but do not include payments by Michigan entities for the purchase of allowances at auction, nor do they include revenues to the state from the sale of those allowances. The full cost and revenue implications of allowance distribution by auction can be found in Table G-1-2 and Annex G-1.

Table 1-4 (cont'd.) Transportation and Land Use (TLU) Policy Recommendations

Policy No.	Policy Option	GHG Reductions (MMtCO ₂ e)			Net Present Value 2009–2025 (Million \$)	Cost-Effectiveness (\$/tCO ₂ e)	Level of Support
		2015	2025	Total 2009–2025			
TLU-1	Promote Low-Carbon Fuel Use	2.6	5.9	53	\$820	\$16	Unanimous
TLU-2	Eco-Driver Program	1.1	2.2	22	–\$3,921	–\$176	Unanimous
TLU-3	Truck Idling Policies	0.36	0.76	7.0	–\$596	–\$85	Unanimous
TLU-4	Advanced Vehicle Technology	0.01	0.03	0.19	\$281	\$1,458	Unanimous
TLU-5	Congestion Mitigation	0.08	0.18	1.7	–\$135	–\$81	Unanimous
TLU-6	Land Use Planning and Incentives	0.14	0.43	3.2	–\$598	–\$189	Unanimous
TLU-7	Transit and Travel Options	0.13	0.54	3.5	\$655	\$185	Unanimous
TLU-8	Increase Rail Capacity, and Address Rail Freight System Bottlenecks	0.10	0.19	2.0	\$69	\$35	Unanimous
TLU-9	Great Lakes Shipping	0.24	0.27	2.5	NQ	NQ	Unanimous
	Sector Totals	4.76	10.5	95.1	–\$3,425	–\$36	N/A
	Sector Total After Adjusting for Overlaps	4.76	10.5	95.1	–\$3,425	–\$36	N/A
	Reductions From Recent Actions	0	0	0	\$0	\$0	N/A
	Sector Total Plus Recent Actions	4.76	10.5	95.1	–\$3,425	–\$36	N/A

GHG = greenhouse gas; MMtCO₂e = million metric tons of carbon dioxide equivalent; \$/tCO₂e = dollars per metric ton of carbon dioxide equivalent. Note: Negative numbers indicate cost savings.

Table 1-4 (cont'd.) Residential, Commercial and Industrial (RCI) Policy Recommendations

	Policy Option	GHG Reductions (MMtCO ₂ e)			Net Present Value 2009–2025 (Million \$)	Cost-Effectiveness (\$/tCO ₂ e)	Level of Support
		2015	2025	Total 2009–2025			
RCI-1	Utility Demand-Side Management for Electricity and Natural Gas	0.0	13.6	86.3	–1,632	–19	Unanimous
RCI-2	Existing Buildings Energy Efficiency Incentives, Assistance, Certification, and Financing	17.6	53.8	428.6	–12,107	–28	Unanimous
RCI-3	Regulatory (PSC) Changes to Remove Disincentives and Encourage Energy Efficiency Investments by IOUs	<i>Not Quantifiable</i>					Unanimous
RCI-4	Adopt More Stringent Building Codes for Energy Efficiency	3.6	9.8	82	–2,865	–35	Unanimous
RCI-5	MI Climate Challenge & Related Consumer Education Programs	<i>Not Quantifiable</i>					Unanimous
RCI-6	Incentives to Promote Renewable Energy Systems Implementation	0.7	1.5	14.0	1,958	140	Unanimous
RCI-7	Promotion and Incentives for Improved Design and Construction in the Private Sector	15.6	47.6	380	–11,693	–31	Unanimous
RCI-8	Net Metering for Distributed Generation	Fully incorporated into RCI-6					Unanimous
RCI-9	Training & Education for Bldg. Design, Construction, and Operation	<i>Not Quantifiable</i>					Unanimous
RCI-10	Water Use and Management	<i>Not Quantifiable</i>					Unanimous
	Sector Total After Adjusting for Overlaps*	21.8	64.9	523.9	–13,014	–24.8	
	Reductions From Recent Actions	Figures adjusted include recent actions					
	Sector Total Plus Recent Actions	21.8	64.9	523.9	–13,014	–24.8	

GHG = greenhouse gas; MMtCO₂e = million metric tons of carbon dioxide equivalent; \$/tCO₂e = dollars per metric ton of carbon dioxide equivalent; PSC = Public Service Commission; IOU = investor-owned utility.

Note: The numbering is for reference purposes only; it does not reflect prioritization among these policy options. Negative net present values and cost effectiveness numbers above reflect “negative costs” or net savings.

*The figures listed show totals for the options net of recent legislation.

Table 1-4 (cont'd.) Agriculture, Forestry and Waste (AFW) Management Policy Recommendations

Policy No.	Policy Recommendation		GHG Reductions (MMtCO ₂ e)			Net Present Value 2009–2025 (Million 2005\$)	Cost-Effectiveness (\$/tCO ₂ e)	Level of Support
			2015	2025	Total 2009–2025			
AFW-1	Expanded Use of Biomass Feedstocks for Electricity, Heat, or Steam Production		3.3	10	79	\$1,649	\$21	Unanimous
AFW-2*	In-State Liquid Biofuels Production		<i>Included in the Results of TLU-1</i>					Unanimous
AFW-3	Methane Capture and Utilization From Manure and Other Biological Waste		0.09	0.14	1.5	\$4.7	\$3	Unanimous
AFW-4	Expanded Use of Bio-based Materials	A. Use of Bio-based Products	.08	.21	1.7	–\$108	–\$62	Unanimous
		B. Utilization of Solid Wood Residues	<i>Not Quantified</i>					Unanimous
AFW-5	Land Use Management That Promotes Permanent Cover	A. Increase in Permanent Cover Area	0.08	0.21	1.8	\$63	\$34	Unanimous
		B. Retention of Lands in Conservation Programs [†]	0.05	0.11	1.1	\$24	\$23	Unanimous
		C. Retention/Enhancement of Wetlands	<i>Not Quantified</i>					Unanimous
AFW-6	Forestry and Agricultural Land Protection	A. Agricultural Land Protection	0.46	1.1	10	\$864	\$85	Unanimous
		B. Forested Land Protection	<i>Not Quantified</i>					Unanimous
		C. Peatlands/Wetlands Protection	<i>Not Quantified</i>					Unanimous
AFW-7**	Promotion of Farming Practices That Achieve GHG Benefits	A. Soil Carbon Management	0.7	1.7	15	–\$200	–\$13	Unanimous
		B. Nutrient Efficiency	0.05	0.12	1.1	–\$27	–\$26	Unanimous
		C. Energy Efficiency	0.13	0.32	2.9	–\$102	–\$35	Unanimous
		D. Local Food	<i>Not Quantified</i>					Unanimous
AFW-8	Forest Management for Carbon Sequestration and Biodiversity	A. Enhanced Forestland Management	0.53	1.42	12.05	\$800	\$66	Unanimous
		B. Urban Forest Canopy	1.2	2.9	26	–\$346	–\$13	Unanimous

Policy No.	Policy Recommendation		GHG Reductions (MMtCO ₂ e)			Net Present Value 2009–2025 (Million 2005\$)	Cost-Effective-ness (\$/tCO ₂ e)	Level of Support
			2015	2025	Total 2009–2025			
		C. Reduce Wildfire	Not Quantified					Unanimous
AFW-9**	Source Reduction, Advanced Recycling, and Organics Management							Unanimous
	In-State GHG Reductions		1.4	3.0	28	–\$3,136	–\$112	
	Full Life-Cycle Reductions		14.5	35.3	314	–\$3,136	–\$10	
AFW-10	Landfill Methane Energy Programs		0.91	2.7	22	–\$35	–\$2	Unanimous
	Sector Totals [†]		9	23	201	–\$548	–\$3	
	Sector Total After Adjusting for Overlaps ^{††}		6	17	147	–\$1,634	–\$11	
	Reductions From Recent Actions		N/A	N/A	N/A	N/A	N/A	
	Sector Total Plus Recent Actions		6	17	147	-\$1,634	-\$11	

GHG = greenhouse gas; MMtCO₂e = million metric tons of carbon dioxide equivalent; \$/tCO₂e = dollars per metric ton of carbon dioxide equivalent; TLU = Transportation and Land Use; N/A = not applicable.

Note that negative costs represent a monetary savings.

* The quantification results for AFW-2 (biofuel production volumes and costs) were used as inputs to the quantification of the results of TLU-1, which covers consumption of biofuels in Michigan.

** The analyses for AFW-5, AFW-7, and AFW-9 include the full life-cycle costs of the policies. In the case of AFW-9, it is estimated that a significant fraction of the reductions will occur out of state. In-state reductions refer only to those occurring from reduced landfilling and waste combustion (these are broken out separately in the table above).

† The reductions from AFW-5B (Retention of Lands in Conservation Programs) have been left out of the sector totals, since they relate to a soil carbon protection measure where the estimated emissions (from conservation acres being returned to active cultivation) are not included in the business as usual (BAU) inventory and forecast (I&F). The costs have been included in the sector totals, since these will be incurred in order to retain the level of emissions in the BAU I&F. For AFW-5, AFW-7, and AFW-9, these include the reductions that are expected to occur within the state.

†† See the section below for discussion of overlap adjustments.

Table 1-4 (cont'd.) Cross Cutting Issues (CCI) Policy Recommendations

No.	Policy Recommendation	GHG Reductions (MMtCO ₂ e)			Net Present Value 2009–2025 (Million \$)	Cost Effective-ness (\$/tCO ₂ e)	Level of Support
		2015	2025	Total 2009–2025			
CCI-1	GHG Inventories, Forecasting, Reporting, and Registry	Not Quantified					Unanimous
CCI-2	Statewide GHG Reduction Goals and Targets	Not Quantified					Unanimous
CCI-3	State, Local, and Tribal Government GHG Emission Reductions (Lead-by-Example)	Not Quantified					Unanimous
CCI-4	Comprehensive Local Government Climate Action Plans (Counties, Cities, Etc.)	Not Quantified					Unanimous
CCI-5	Public Education and Outreach	Not Quantified					Unanimous
CCI-6	Tax and Cap/ Cap and Trade	MCAC approved creation of a new Market-Based Policies Technical Work Group as the lead for this policy recommendation.					Transferred
CCI-7	Seek Funding for Implementation of MCAC Recommendations	Not Quantified					Unanimous
CCI-8	Adaptation and Vulnerability	Not Quantified					Unanimous
CCI-9	Participate in Regional, Multi-State, and National GHG Reduction Efforts	Not Quantified					Unanimous
CCI-10	Enhance and Encourage Economic Growth and Job Creation Opportunities Through Climate Change Mitigation	Not Quantified					Unanimous
CCI-11	Enhance and Encourage Community Development Through Climate Change Mitigation: Address Environmental Justice	Not Quantified					Unanimous

GHG = greenhouse gas; MMtCO₂e = million metric tons of carbon dioxide equivalent; \$/tCO₂e = dollars per metric ton of carbon dioxide equivalent

Perspectives on Policy Options

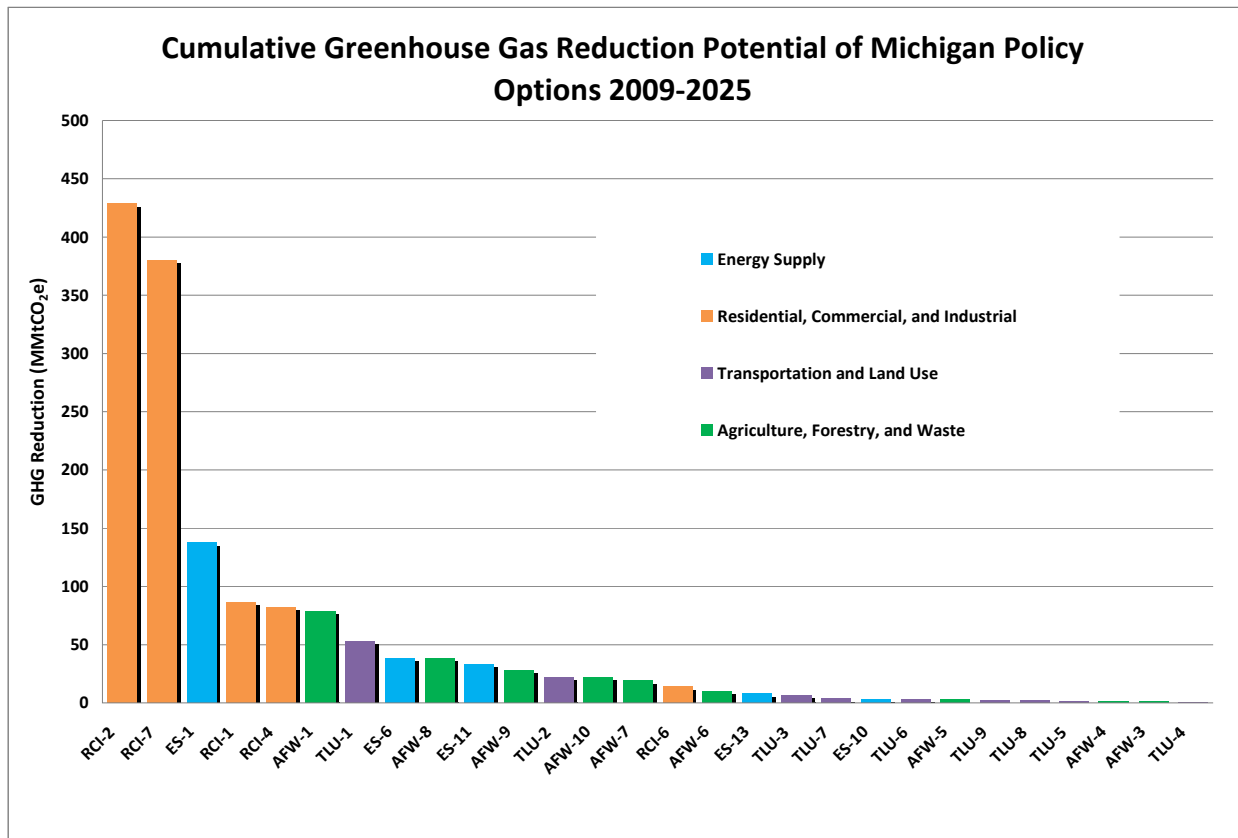
As explained previously, the MCAC considered the estimates of the GHG reductions that could be achieved and the costs (or cost savings) for the 33 options that were quantifiable. Figure 1-5, below, presents the estimated tons of GHG emission reductions for each of these policy recommendations, expressed as a cumulative figure for the period 2009–2025.

Figure 1-6 presents the estimated dollars-per-ton cost (or cost savings, depicted as a negative number) for each quantified policy recommendation. The dollars per ton value is calculated by

dividing the net present value of the cost of the policy recommendation by the cumulative GHG reductions, all for the period 2009–2025.

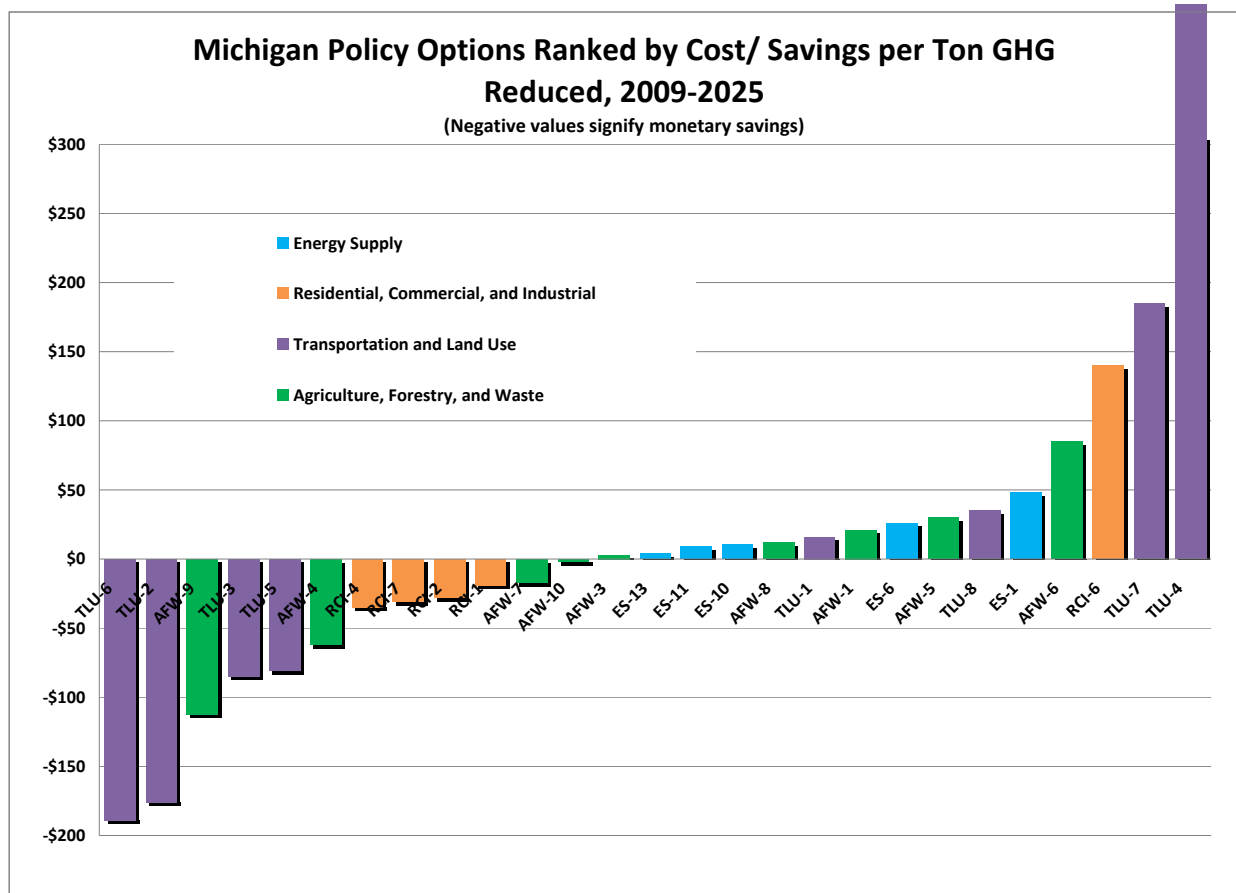
It is important to note that there is some level of uncertainty in projecting GHG reductions and estimating exact costs (or cost savings) per ton of reductions achieved for the time periods of this analysis.

Figure 1-5. MCAC policy recommendations ranked by cumulative (2009–2025) GHG reduction potential



GHG = greenhouse gas; MMtCO₂e = million metric tons of carbon dioxide equivalent; AFW = Agriculture, Forestry, and Waste Management; ES = Energy Supply; TLU = Transportation and Land Use; RCI = Residential, Commercial, Industrial

Figure 1-6. MCAC policy recommendations ranked by cumulative (2009–2025) net cost/cost savings per ton of GHG removed

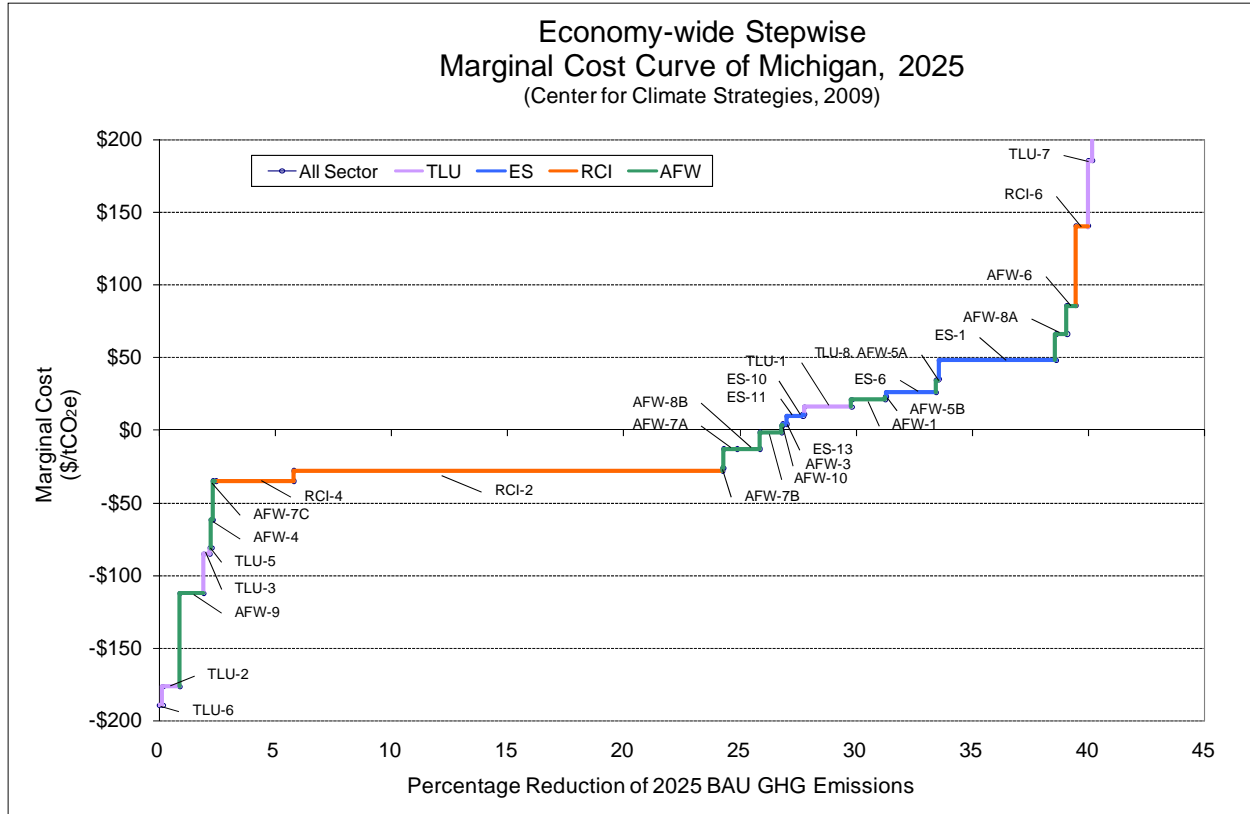


GHG = greenhouse gas; MMtCO₂e = million metric tons of carbon dioxide equivalent; AFW = Agriculture, Forestry, and Waste Management; ES = Energy Supply; TLU = Transportation and Land Use; RCI = Residential, Commercial, Industrial.

TLU 4 cost effectiveness is \$1458 per ton.

Figure 1-7, below, presents a stepwise marginal cost curve for Michigan. The horizontal axis represents the percentage of GHG emissions reduction in 2025 for each option relative to the business as usual (BAU) forecast. The vertical axis represents the marginal cost of mitigation (expressed as the cost-effectiveness of each policy option on a cumulative basis, 2009-2025). In the figure, each horizontal segment represents an individual policy. The width of the segment indicates the GHG emission reduction potential of the option in percentage terms. The height of the segment relative to the x-axis shows the average cost (saving) of reducing one MMtCO₂e of GHG emissions with the application of the option. For instance, for RCI-2-Energy Efficiency- this policy recommendation should result in approximately a 54 MMtCO₂e (19%) reduction of GHG emissions in 2025 below the BAU reference case with an average cost savings of approximately \$28/ton.

Figure 1-7. Stepwise marginal cost curve for Michigan, 2025



BAU = business as usual; GHG = greenhouse gas; tCO₂e = metric tons of carbon dioxide equivalent; AFW = Agriculture, Forestry, and Waste Management; ES = Energy Supply; TLU = Transportation and Land Use;

Negative values represent net cost savings and positive values represent net costs associated with the policy option.

Note: Results have been adjusted to remove overlaps between policies. For example, RCI-7 reductions overlap with both RCI-2 and RCI-4 assuming all three policies are implemented. The curve, therefore, includes RCI-2 and RCI-4 but not RCI-7 to avoid overstating the combined benefits of the recommendations.

Chapter 2

Inventory and Projections of Michigan's GHG Emissions

Introduction

This chapter summarizes Michigan's greenhouse gas (GHG) emissions and sinks (carbon storage) from 1990 to 2025. The Center for Climate Strategies (CCS) prepared a draft of Michigan's GHG emissions inventory and reference case projections for the Michigan Department of Environmental Quality (MDEQ). The draft inventory and reference case projections, completed in January 2008, provided the MDEQ with an initial, comprehensive understanding of current and possible future GHG emissions. The draft report was provided to the Michigan Climate Action Council (MCAC) and its Technical Work Groups (TWGs) to assist them in understanding past, current, and possible future GHG emissions in Michigan, and thereby inform the policy recommendation development process. The MCAC and TWGs have reviewed, discussed, and evaluated the draft inventory and methodologies, as well as alternative data and approaches for improving the draft GHG inventory and forecast. The inventory and forecast have since been revised to address the comments provided by the MCAC. The information in this chapter reflects the information presented in the final *Michigan Greenhouse Gas Inventory and Reference Case Projections* report (hereafter referred to as the Inventory and Projections report).¹

Historical GHG emission estimates (1990 through 2005)² were developed using a set of generally accepted principles and guidelines for state GHG emission inventories, relying to the extent possible on Michigan-specific data and inputs. The reference case projections (2006-2025) are based on a compilation of various existing projections of electricity generation, fuel use, and other GHG-emitting activities, along with a set of simple, transparent assumptions described in the final Inventory and Projections report.

The Inventory and Projections report covers the six types of gases included in the U.S. GHG inventory: carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF₆). Emissions of these GHGs are presented using a common metric, CO₂ equivalence (CO₂e), which indicates the relative contribution of each gas, per unit mass, to global average radiative forcing on a global warming potential-weighted basis.³

¹ Center for Climate Strategies. *Final Michigan Greenhouse Gas Inventory and Reference Case Projections: 1990–2025*. Prepared for the Michigan Climate Action Council. November 2008.

² The last year of available historical data for each sector varies between 2000 and 2005. The University of Michigan also prepared an inventory and forecast of GHG emissions in conjunction with the MDEQ in 2005.

³ Changes in the atmospheric concentrations of GHGs can alter the balance of energy transfers between the atmosphere, space, land, and the oceans. A gauge of these changes is called radiative forcing, which is a simple measure of changes in the energy available to the Earth–atmosphere system. Holding everything else constant, increases in GHG concentrations in the atmosphere will produce positive radiative forcing (i.e., a net increase in the absorption of energy by the Earth). See: Boucher, O., et al. "Radiative Forcing of Climate Change." Chapter 6 in *Climate Change 2001: The Scientific Basis*. Contribution of Working Group 1 of the Intergovernmental Panel on

It is important to note that the emission estimates reflect the GHG emissions associated with the electricity sources used to meet Michigan's demands, corresponding to a consumption-based approach to emissions accounting. Another way to look at electricity emissions is to consider the GHG emissions produced by electricity generation facilities in the state, a production-based method. The study covers both methods of accounting for emissions, but for consistency, all total results are reported as consumption-based.

Michigan GHG Emissions: Sources and Trends

Table 2-1 provides a summary of GHG emissions estimated for Michigan by sector for 1990, 2000, 2005, 2010, 2020, and 2025. As shown in this table, Michigan is estimated to be a net source of GHG emissions (positive, or gross, emissions). Michigan's forests serve as sinks of GHG emissions (removal of emissions, or negative emissions). Michigan's net emissions subtract the equivalent GHG reduction from emission sinks from the gross GHG emission totals. The following sections discuss GHG emission sources and sinks, trends, projections, and uncertainties.

Historical Emissions

Overview

In 2005, on a gross emissions consumption basis (i.e., excluding carbon sinks), Michigan accounted for approximately 248 million metric tons (MMt) of CO₂e emissions, an amount equal to 3.5% of total U.S. gross GHG emissions. On a net emissions basis (i.e., including carbon sinks), Michigan residents accounted for approximately 235 MMtCO₂e of emissions in 2005, an amount equal to 3.8% of total U.S. net GHG emissions.⁴ Michigan's GHG emissions are rising slower than those of the nation as a whole. From 1990 to 2005, Michigan's gross GHG emissions increased by 12%, while national gross emissions rose by 16%.⁵

On a per-capita basis, Michigan residents emitted about 24 metric tons (t) of gross CO₂e in 2005, similar to the national average of about 24 tCO₂e. Figure 2-1 illustrates the state's emissions per capita and per unit of economic output. Both Michigan and national per-capita emissions remained nearly constant from 1990 to 2005. This consistency in per-capita emission rates in Michigan results from growth in emissions from the electricity supply and transportation sectors, and decline in emissions from the industrial fuel use and industrial processes sectors. In both Michigan and the nation as a whole, economic growth exceeded emissions growth throughout the 1990 – 2005 period. From 1990 to 2005, emissions per unit of gross product dropped by 26% nationally, and by 23% in Michigan.⁶

Climate Change, Cambridge University Press, Cambridge, United Kingdom. Available at: http://www.grida.no/climate/ipcc_tar/wg1/212.htm.

⁴ The national emissions used for these comparisons are based on 2005 emissions from U.S. Environmental Protection Agency, *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2006*, April 15, 2008, EPA430-R-08-005. Available at: <http://www.epa.gov/climatechange/emissions/usinventoryreport.html>.

⁵ During this period, population grew by 10% in Michigan and by 19% nationally. However, Michigan's economy grew at the same rate as the nation on a per-capita basis (up 32%).

⁶ Based on real gross domestic product (millions of chained 2000 dollars) that excludes the effects of inflation. U.S. Department of Commerce, Bureau of Economic Analysis. "Gross Domestic Product by State." Available at: <http://www.bea.gov/regional/gsp/>.

Table 2-1. Michigan GHG emissions, historical and reference case projection, by sector*

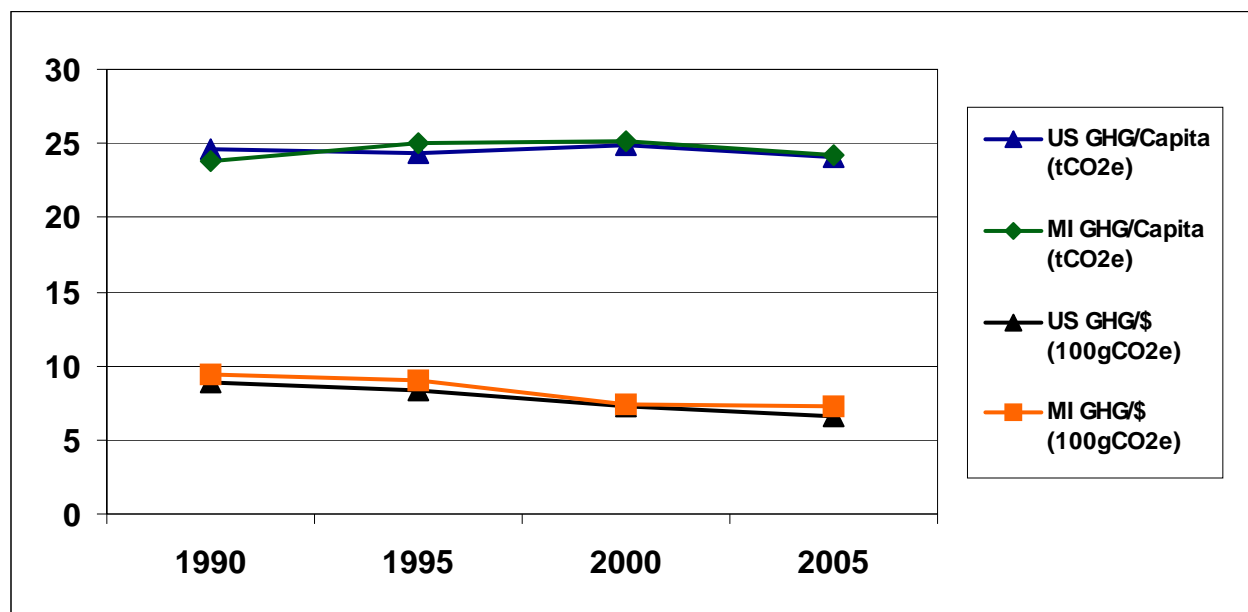
Sector	1990	2000	2005	2010	2020	2025
	MMtCO ₂ e					
Energy (Consumption Based)	192.5	218.6	214.7	220.2	238.7	248.5
Electricity Use (Consumption)	70.3	86.9	90.0	91.0	103.9	111.1
Electricity Production (in-state)	64.0	68.1	71.4	72.3	85.3	92.6
Coal	62.8	64.9	67.7	67.6	78.8	85.3
Natural Gas	0.46	1.77	2.38	3.67	5.40	6.06
Oil	0.66	0.99	0.71	0.48	0.48	0.57
MSW/Landfill Gas	0.12	0.38	0.34	0.39	0.44	0.46
Biomass	0.010	0.031	0.030	0.025	0.027	0.029
Other Wastes	0.009	0.029	0.16	0.19	0.21	0.22
Imported/Exported Electricity	6.22	18.8	18.7	18.7	18.6	18.5
Residential/Commercial/Industrial (RCI) Fuel Use	67.5	66.1	59.9	60.5	62.1	62.4
Coal	11.7	9.34	7.32	6.12	5.67	5.56
Natural Gas	42.8	43.7	40.4	42.6	44.4	44.8
Petroleum	12.8	12.9	12.0	11.6	11.9	11.8
Wood (CH ₄ and N ₂ O)	0.28	0.17	0.19	0.20	0.20	0.20
Transportation	49.7	59.4	58.2	61.4	64.0	65.3
On-road Gasoline	37.4	43.7	43.3	45.5	46.2	46.4
On-road Diesel	5.21	8.90	10.2	11.3	12.9	13.7
Rail, Natural Gas, LPG, Other	1.10	1.16	0.90	0.93	0.95	0.95
Marine Vessels	1.87	2.61	2.25	2.18	2.52	2.70
Jet Fuel and Aviation Gasoline	4.15	3.00	1.52	1.45	1.50	1.51
Fossil Fuel Industry	4.94	6.13	6.64	7.25	8.70	9.66
Natural Gas Industry	4.69	6.03	6.55	7.19	8.67	9.64
Oil Industry	0.25	0.10	0.086	0.061	0.032	0.024
Industrial Processes	15.3	18.1	18.4	18.9	23.3	26.4
Cement Manufacture (CO ₂)	2.27	2.26	2.13	2.12	2.10	2.09
Lime Manufacture (CO ₂)	0.43	0.48	0.41	0.41	0.41	0.41
Limestone and Dolomite Use (CO ₂)	0.24	0.25	0.31	0.31	0.31	0.31
Soda Ash (CO ₂)	0.10	0.094	0.088	0.084	0.076	0.072
Iron & Steel (CO ₂)	11.2	11.0	10.2	8.47	8.12	7.95
Taconite Production (CO ₂)	0.037	0.28	0.25	0.20	0.14	0.11
Magnesium Production (SF ₆)	0.18	0.45	0.45	0.70	1.16	1.50
ODS Substitutes (HFC, PFC)	0.012	2.84	4.16	6.18	10.6	13.6
Electric Power T&D (SF ₆)	0.82	0.47	0.40	0.37	0.34	0.33
Semiconductor Manufacturing (HFC, PFC, and SF ₆)	0.001	0.004	0.004	0.004	0.003	0.003
Waste Management	4.67	5.30	6.28	6.98	8.70	9.74
Waste Combustion	0.33	1.14	1.20	1.26	1.38	1.45
Landfills	3.16	2.86	3.75	4.34	5.82	6.73
Wastewater Management	1.17	1.30	1.33	1.38	1.50	1.56
Agriculture	8.33	7.99	8.07	7.71	7.25	7.03
Enteric Fermentation	1.53	1.36	1.40	1.38	1.33	1.31
Manure Management	0.92	0.97	1.09	1.07	1.01	0.99
Agricultural Soils	3.71	3.49	3.42	3.09	2.73	2.55
Agricultural Burning	0.022	0.026	0.029	0.030	0.034	0.036
Agricultural Soils (cultivation practices)	2.14	2.14	2.14	2.14	2.14	2.14

Sector	1990	2000	2005	2010	2020	2025
	MMtCO ₂ e					
Forest Wildfires and Prescribed Burning	0.020	0.020	0.020	0.020	0.020	0.020
Gross Emissions (Consumption Basis)	220.7	250.0	247.5	253.8	278.0	291.6
<i>Increase relative to 1990</i>		13%	12%	15%	26%	32%
Emissions Sinks	-37.9	-12.5	-12.7	-12.7	-12.7	-12.7
Forestry and Land Use	-37.9	-12.5	-12.7	-12.7	-12.7	-12.7
Forested Landscape	-27.8	-8.77	-8.77	-8.77	-8.77	-8.77
Urban Forestry and Land Use	-10.1	-3.69	-3.91	-3.91	-3.91	-3.91
Net Emissions (Consumption Basis) (including forestry and land use sinks)	182.9	237.5	234.8	241.1	265.3	278.9

MMtCO₂e = million metric tons of carbon dioxide equivalent; CH₄ = methane; N₂O = nitrous oxide; MSW = municipal solid waste; LPG = liquefied petroleum gas; ODS = ozone-depleting substance; HFC = hydrofluorocarbon; PFC = perfluorocarbon; SF₆ = sulfur hexafluoride; T&D = transmission and distribution.

* Totals may not equal exact sum of subtotals shown in this table due to independent rounding.

Figure 2-1. Michigan and U.S. gross GHG emissions, per-capita and per-unit gross product



GHG = greenhouse gas; tCO₂e = metric tons of carbon dioxide equivalent; g = grams.

The principal sources of Michigan's GHG emissions in 2005 are electricity consumption, residential, commercial, and industrial (RCI) fuel use, and transportation, accounting for 36%, 24%, and 24% of Michigan's gross GHG emissions, respectively, as shown in Figure 2-2. The next largest contributor is the industrial processes sector, accounting for 7% of gross GHG emissions in 2005; these emissions are rising due to the increasing use of HFCs and PFCs as substitutes for ozone-depleting chlorofluorocarbons.⁷ Other industrial process emissions include

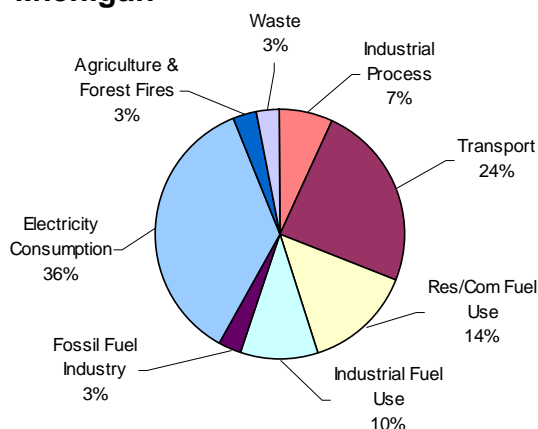
⁷ Chlorofluorocarbons are also potent GHGs; however, they are not included in GHG estimates because of concerns related to implementation of the Montreal Protocol on Substances That Affect the Ozone Layer. See Appendix I in the Final Inventory and Projections report for Michigan (<http://www.miclimatchange.us/stakeholder.cfm>).

CO₂ released by cement and lime manufacturing; CO₂ released during soda ash, limestone, and dolomite use; CO₂ released during taconite production and iron and steel production; SF₆ released during magnesium production and from transformers used in electricity transmission and distribution systems; and HFCs, PFCs, and SF₆ released during semiconductor manufacturing.

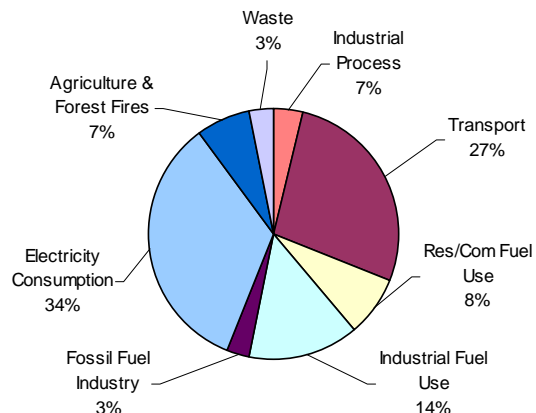
Figure 2-2 also shows that the agricultural and forest wildfire sectors together accounted for 3% of the gross GHG emissions in Michigan in 2005. These CH₄ and N₂O emissions primarily come from agricultural soils, enteric fermentation, manure management, and agricultural soil cultivation practices. Also, landfills and wastewater management facilities produce CH₄ and N₂O emissions that accounted for 3% of total gross GHG emissions in Michigan in 2005. Similarly, emissions associated with the production, processing, transmission, and distribution of fossil fuels accounted for 3% of the gross GHG emissions in 2005.

Figure 2-2. Gross GHG emissions by sector, 2005: Michigan and U.S.

Michigan



US



Notes: Res/Com = Residential and commercial fuel use sectors. Emissions for the residential, commercial, and industrial fuel use sectors are associated with the direct use of fuels (natural gas, petroleum, coal, and wood) to provide space heating, water heating, process heating, cooking, and other energy end-uses. The commercial sector accounts for emissions associated with the direct use of fuels by, for example, hospitals, schools, government buildings (local, county, and state) and other commercial establishments. The industrial processes sector accounts for emissions associated with manufacturing and excludes emissions included in the industrial fuel use sector. The transportation sector accounts for emissions associated with fuel consumption by all on-road and non-highway vehicles. Non-highway vehicles include jet aircraft, gasoline-fueled piston aircraft, railway locomotives, boats, and ships. Emissions from non-highway agricultural and construction equipment are included in the industrial sector. Electricity = Electricity generation sector emissions on a consumption basis, including emissions associated with electricity imported from outside of Michigan and excluding emissions associated with electricity exported from Michigan to other states.

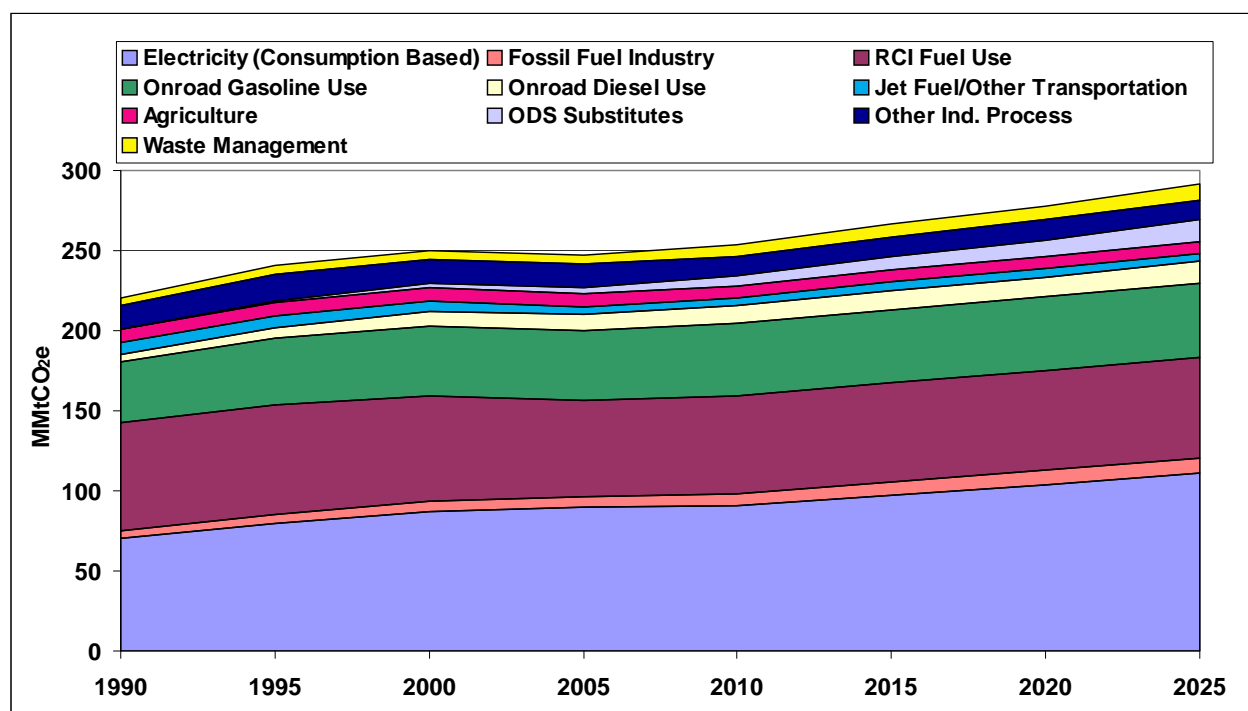
Forestry emissions refer to the net CO₂ flux⁸ from forested lands in Michigan, which account for about 53% of the state's land area.⁹ Michigan's forests are estimated to be net sinks of CO₂ emissions in the state, reducing net GHG emissions by 13 MMtCO₂e in 2005.

⁸ "Flux" refers to both emissions of CO₂ to the atmosphere and removal (sinks) of CO₂ from the atmosphere.

Reference Case Projections

Relying on a variety of sources for projections, as noted in the Inventory and Projections report, a simple reference case projection of GHG emissions through 2025 was developed. As illustrated in Figure 2-3 and shown numerically in Table 2-1, under the reference case projections, Michigan's gross GHG emissions continue to grow steadily, climbing to about 292 MMtCO₂e by 2025, or 32% above 1990 levels. This equates to a 0.8% annual rate of growth from 1990 to 2025. Relative to 2005, the share of emissions associated with electricity consumption and industrial processes both increase slightly to 38% and 9%, respectively, by 2025. The share of emissions from the transportation, RCI fuel use, and agriculture sectors all decrease slightly to 22%, 21%, and 2%, respectively. The emissions from the fossil fuel industries and the waste sector remain the same in 2025 as their shares in 2005.

Figure 2-3. Michigan gross GHG emissions by sector, 1990–2025: historical and projected



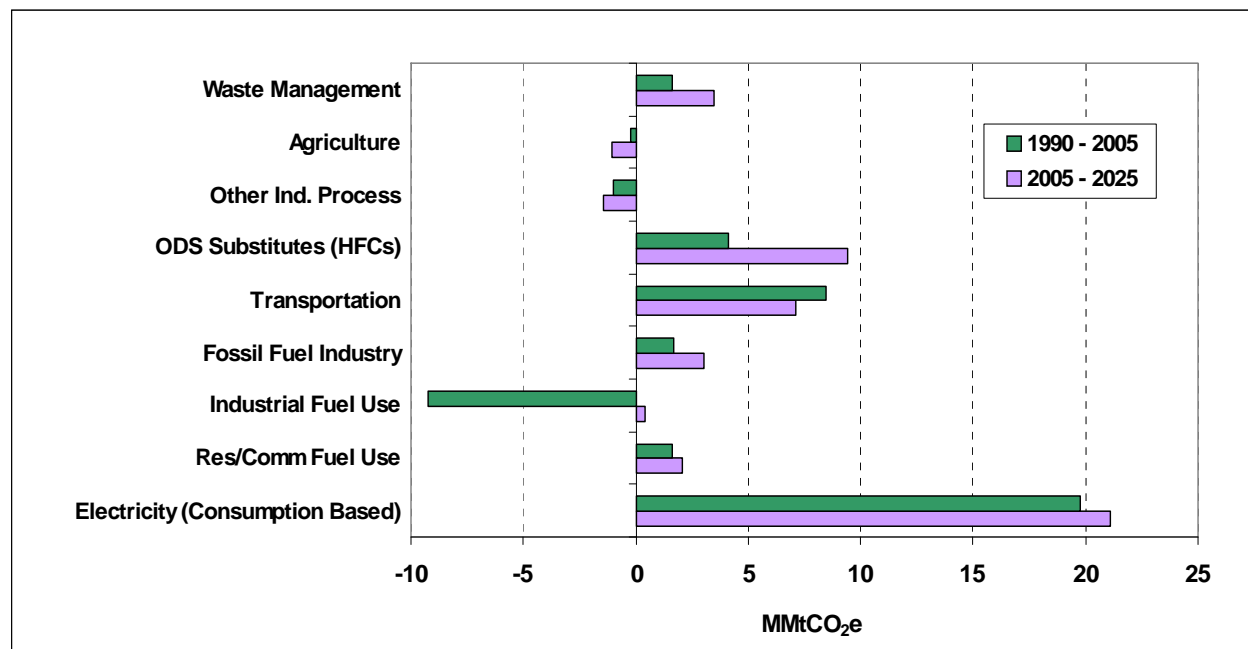
MMtCO₂e = million metric tons of carbon dioxide equivalent; RCI = direct fuel use in residential, commercial, and industrial sectors; ODS = ozone-depleting substance; Ind. = industrial.

Emissions associated with electricity consumption are projected to be the largest contributor to future GHG emissions growth, followed by emissions from ozone-depleting substance substitutes (HFCs), and then emissions associated with the transportation sector, as shown in Figure 2-4. Other sources of emissions growth include the fossil fuel industry, the RCI fuel use

⁹ Total forested acreage in Michigan is 19.3 million acres. For acreage by forest type, see: Richard A. Birdsey and George M. Lewis. "Carbon in United States Forests and Wood Products, 1987–1997: State-by-State Estimates." Michigan Estimate for 1987–1997. Available from the U.S. Department of Agriculture, Forest Service, Northern Global Change Research Program, at: <http://www.fs.fed.us/ne/global/pubs/books/epa/states/MI.htm>. The total land area in Michigan is 36 million acres (<http://www.50states.com/michigan.htm>).

sector, and the waste management sector. Table 2-2 summarizes the growth rates that drive the growth in the Michigan reference case projections, as well as the sources of these data.

Figure 2-4. Sector contributions to gross emissions growth in Michigan, 1990–2025: reference case projections



MMtCO₂e = million metric tons of carbon dioxide equivalent; ODS = ozone-depleting substance; HFCs = hydrofluorocarbons; Res/Comm = direct fuel use in the residential and commercial sectors.

Table 2-2. Key annual growth rates for Michigan, historical and projected

Annual Growth Rate	1990–2005	2005–2025	Sources
Population	0.63%	0.24%	Michigan population statistics for 1990 and 2000, compiled by Michigan Information Center from US Census Bureau, are available at http://www.michigan.gov/documents/PopByCty_26001_7.pdf . Population data for 2000 to 2004 are available from Michigan Department of History, Arts, and Libraries at http://www.michigan.gov/hal/0,1607,7-160-17451_28388_28392-106981--,00.html . Michigan projections (2005–2030) available from Michigan Department of History, Arts, and Libraries at http://www.michigan.gov/hal/0,1607,7-160-17451_28388_28392-116118--,00.html .
Electricity Sales			
Total Sales ^a	1.97%	0.99%	For 1990–2005, annual growth rate in total electricity sales for all sectors combined in Michigan calculated from EIA State Electricity Profiles (Table 8) http://www.eia.doe.gov/cneaf/electricity/st_profiles/michigan.html and sales by Michigan generators calculated by subtracting T&D losses from net generations collected from EIA Annual Electric Utility Data - 906/920 database. For 2005–2025, annual growth rates are based on data that Michigan utilities provided for gross electricity sales for 2006–2025 (see Appendix II, Table 15, page 101 of <i>Michigan's 21st Century Electric Energy Plan</i>).
Michigan Sales ^b	1.05%	1.27%	
Vehicle Miles Traveled	1.6%	0.37%	Based on historical VMT and projected VMT growth rates provided by Michigan Department of Transportation and the Southeast Michigan Council of Governments.

^a Represents annual growth in total sales of electricity by generators in Michigan to RCI sectors located within and outside of Michigan.

^b Represents annual growth in total sales of electricity by generators in Michigan to RCI sectors located within Michigan.

EIA = Energy Information Administration; SIT = State (GHG) Inventory Tool; T&D = transmission and distribution; VMT = vehicle miles traveled.

A Closer Look at the Three Major Sources: Electricity Supply, RCI Fuel Use, and Transportation

As shown in Figure 2-2, electricity use in 2005 accounted for 36% of Michigan's gross GHG emissions (about 90 MMtCO₂e), which was higher than the national average share of emissions from electricity consumption (32%).¹⁰ On a per-capita basis, Michigan's GHG emissions from electricity consumption are higher than the national average (in 2005, 8.8 tCO₂e per capita in Michigan, versus 8.1 tCO₂e per capita nationally). Electricity generation in Michigan is dominated by steam units, which are primarily powered by coal and nuclear fuel.

In 2005, emissions associated with Michigan's electricity consumption (90 MMtCO₂e) were about 19 MMtCO₂e higher than those associated with electricity production (71 MMtCO₂e). The higher level for consumption-based emissions reflects GHG emissions associated with net imports of electricity from other states to meet electricity demand.¹¹ Projections of electricity sales for 2005–2025 indicate that Michigan will remain a net importer of electricity. Emissions from electricity imports are projected to be constant (19 MMtCO₂e/yr) during the 2006–2025 period. The reference case projection indicates that production-based emissions (associated with electricity generated in-state) will increase by about 21 MMtCO₂e, and consumption-based emissions (associated with electricity consumed in-state) will also increase by about 21 MMtCO₂e from 2005 to 2025.

While estimates are provided for emissions from both electricity production and consumption, unless otherwise indicated, tables, figures, and totals in this report reflect electricity consumption emissions. The consumption-based approach can better reflect the emissions (and emission reductions) associated with activities occurring in the state, particularly with respect to electricity use (and efficiency improvements), and is particularly useful for decision making. Under this approach, emissions associated with electricity exported to other states would need to be covered in those states' inventories in order to avoid double counting or exclusions.

Activities in the RCI¹² sectors produce GHG emissions when fuels are combusted to provide space heating, process heating, and other applications. From 1990 to 2005, emissions from RCI decreased at an annual rate of 0.8%, largely due to the decrease in industrial fuel use. In 2005, combustion of oil, natural gas, coal, and wood in the RCI sectors contributed about 24% (about 60 MMtCO₂e) of Michigan's gross GHG emissions, slightly higher than the RCI sector contribution for the nation (22%).

¹⁰ For the United States as a whole, there is relatively little difference between the emissions from electricity use and emissions from electricity production, as the US imports only about 1% of its electricity, and exports even less.

¹¹ Estimating the emissions associated with electricity use requires an understanding of the electricity sources (both in-state and out-of-state) used by utilities to meet consumer demand. The current estimate reflects some very simple assumptions, as described in Appendix A of the Inventory and Projections report.

¹² The industrial sector includes emissions associated with agricultural energy use and fuel used by the fossil fuel production industry.

In 2005, the residential sector's share of total RCI emissions from direct fuel use was 39% (23.6 MMtCO₂e), the commercial sector accounted for 18% (11 MMtCO₂e), and the industrial sector's share of total RCI emissions from direct fuel use was 42% (25 MMtCO₂e). Overall, emissions for the RCI sectors (excluding those associated with electricity consumption) are expected to increase by 4.1% between 2005 and 2025. Emissions from the commercial sector are projected to increase more rapidly than the residential or industrial sectors, with an 18% increase from 2005 to 2025. In contrast, emissions from the residential and industrial sectors are expected to increase by only 0.5% and 1.6%, respectively, during the same period.

Like electricity emissions, GHG emissions from transportation fuel use rose steadily from 1990 to 2005, at an average annual growth rate of 1.1%. In 2005, gasoline-powered on-road vehicles accounted for about 74% of transportation GHG emissions; on-road diesel vehicles for 18%; marine vessels for 4%; aviation fuels, rail and other sources (natural gas- and liquefied petroleum gas-fueled vehicles used in transport applications) for the remaining 4%. As a result of Michigan's population and economic growth and an increase in total vehicle miles traveled, emissions from on-road gasoline use grew at a rate of 0.98% annually between 1990 and 2005. Meanwhile, emissions from on-road diesel use rose by 4.6% per year from 1990 to 2005, suggesting an even more rapid growth in freight movement within or across the state. Emissions from on-road gasoline vehicles in 2025 are projected to increase by 0.35% annually from 2005 levels, and emissions from on-road diesel vehicles are projected to increase by 1.5% annually from 2005 to 2025, with total transportation emissions expected to reach 65 MMtCO₂e by 2025.

MCAC Revisions

The following identifies the revisions that the MCAC made to the inventory and reference case projections, thus explaining the differences between the final Inventory and Projections report and the initial assessment completed in January 2008:

All Sectors: The initial assessment included GHG emission projections to 2020. This was revised to extend the GHG projections to 2025 for all sectors.

Electric Supply:

- Production-based (in-state) and consumption-based generation and emissions:
 - Excluded electricity that Donald Cook nuclear plant exports to other states.
 - Replaced this nuclear generation with electricity imports from outside the state.
- Emissions from pumped storage:
 - Set emissions to zero to avoid double counting of emissions (pumps are operated by electricity purchased from grid),
- Landfill gas (LFG)/municipal solid waste (MSW) and biomass emissions:
 - Added emissions for 1990–2000 (data for non-utilities inadvertently not included in the draft inventory and forecast).
 - For 1990–2000, only the aggregated non-utility generation (generation from independent power producers) can be obtained from the Energy Information Administration (EIA)

Web site (EIA Electric Power Annual 2006). To get the disaggregated generation of LFG, MSW, and biomass for 1990–2000 from the aggregated Other Renewable Generation number in Electric Power Annual (this number excludes hydro electricity), we applied the proportions by fuel and by plant type in 2001 to the aggregated renewable numbers of 1990–2000.

- Transmission & distribution (T&D) line losses of Michigan:
 - The T&D line losses used in the draft analysis were revised based on the data provided by the Michigan Public Service Commission. The T&D loss rate of Consumers Energy/METC, Detroit Edison/ITC, and Upper Peninsula were collected. The weighted-average T&D loss rate of Michigan was computed based on the 2007 peak load on the system in each of the three regions
- Forecast for biomass net generation:
 - The forecast of biomass in the draft inventory and forecast used EIA regional projections, which show big increases in biomass generation in the forecast years. The EIA regional projections could be influenced by the existing renewable portfolio standard (RPS) in other states of the region. The electricity generation from biomass has been flat over the past 10 years or so in Michigan, about 1% of the total generation of the state. Biomass generation would be unlikely to significantly increase in Michigan in the forecast years unless there are strong policy regulations, such as an RPS. Therefore, in this report, for the business-as-usual condition in the forecast years, we assumed the same generation capacity from biomass as the existing capacity indicates (an average level of 2001–2005).

Transportation: MCAC approved the use of a new set of vehicle miles traveled (VMT) growth rates (for 2005–2010, 2010–2015, 2015–2020, and 2020–2025), provided by the Michigan Department of Transportation; this replaces the previous VMT growth rates used in the draft inventory and forecast.

Industrial Process: The MCAC revised iron and steel emissions by replacing the default State Inventory Tool (SIT) steel production data with crude steel production data provided by MDEQ for 1990–2005.

Fossil Fuel Industry: The MCAC added new estimates of the CO₂, CH₄, and N₂O emissions from the combustion of natural gas by internal combustion engines used to operate pipeline compressor stations. These emissions were not included in the initial assessment. These pipeline natural gas fuel use emissions were estimated using SIT emission factors and Michigan 1990–2005 natural gas data from EIA.

Agriculture: Projections for livestock populations were revised based on feedback from the Agriculture, Forestry, and Waste TWG. Projections for beef cattle, swine, sheep, goats, and horses were estimated based on logarithmic forecasts of the historical 1990–2005 populations. Poultry populations were held at 2005 levels based on input from the poultry industry.¹³

¹³ C. Vollmer-Sanders, MI Farm Bureau, communicated to R. Anderson, CCS, via telephone, May 2008.

Waste Sector: In the initial assessment, CH₄ captured for flaring and use in landfill gas to energy (LFGTE) plants were estimated with SIT defaults. The revised estimates are based on waste emplacement data for controlled landfills and date of emission capture equipment installation. Information on controlled landfills was obtained from MDEQ and a database of LFGTE projects compiled by the U.S. Environmental Protection Agency (EPA).

Open burning of MSW at residential sites was not estimated in the initial assessment. The revised report includes these emissions, which were obtained from EPA's 2002 National Emissions Inventory for estimates of the quantity of waste burned at residential sites in Michigan.¹⁴

Forestry: CO₂ flux estimates for 1994–2005 were revised to be based on the average calculated flux during this period using the Carbon Calculation Tool. This was done to minimize the influence of estimates in individual years and shifts between U.S. Forest Service Forest Inventory and Analysis (FIA) measurements.

Key Uncertainties

Some data gaps exist in this inventory, particularly in the reference case projections. Key tasks for future refinement of this inventory and forecast include review and revision of key drivers, such as the transportation, electricity demand, and RCI fuel use growth rates that will be major determinants of Michigan's future GHG emissions (see Table 2-2 and Figure 2-4). These growth rates are driven by uncertain economic, demographic, and land-use trends (including growth patterns and transportation system impacts), all of which deserve closer review and discussion.

¹⁴ EPA, ftp://ftp.epa.gov/EmisInventory/2002finalnei/documentation/nonpoint/2002nei_final_nonpoint_documentation0206version.pdf.

Chapter 3 Energy Supply Sector

Overview of GHG Emissions

The energy supply (ES) sector includes greenhouse gas (GHG) emissions from the production, processing, transmission, and storage of electricity and fossil fuels. Electricity generation accounts for the vast majority of these emissions, representing 93% of Michigan's total ES sector emissions in 2005. Nearly all of the remainder comes from the production, processing, transmission, and distribution of natural gas. GHG emissions from the ES sector represented 45% of Michigan's total consumption-based emissions in 2005.

Michigan has historically been a net importer of electricity. Electricity imports increased from about 8,500 gigawatt-hours (GWh) in 1990 to about 25,000 GWh in 2000, which is comparable to total imports in 2005, or 21% of all electricity consumed in Michigan¹. GHG emissions from imported electricity represented the same percentage (21%) of total consumption in 2005.

In the absence of any mitigation efforts, GHG emissions from Michigan's ES sector are expected to increase from 2005 base year levels of 90 million metric tons of carbon dioxide equivalent (MMtCO₂e) to 111 MMtCO₂e in 2025, or about a 23.3% increase. Compared with estimated current (2009) emissions of 89.5 MMtCO₂e, a 26% increase is expected.² Projections of future electricity generation requirements are taken from *Michigan's 21st Century Electric Energy Plan*, prepared by the Michigan Public Service Commission (MPSC). Projections assume electricity imports throughout the forecast period will remain at 2005 levels, and that in-state and imported generation fuel mix will also remain unchanged. Figure 3-1 shows historical and projected GHG emissions from power generation by fuel source.

Key Challenges and Opportunities

The biggest challenge facing Michigan's ES sector is the state's high reliance on coal-fired generation, and the age of the coal generation fleet, which is the second oldest in the nation. GHG emissions from the combustion of coal for the generation of electricity represent 95% of all electricity emissions, with almost all of the remainder being natural gas. Figure 3-2 shows the breakdown of in-state gross electricity generation and in-state GHG emissions by fuel type for 2005. Another challenge is increasing demand, which is projected at 1% per year (2005–2025) and assumed to be fully met through new in-state generation. This rate incorporates the current demand-side management programs in Michigan.

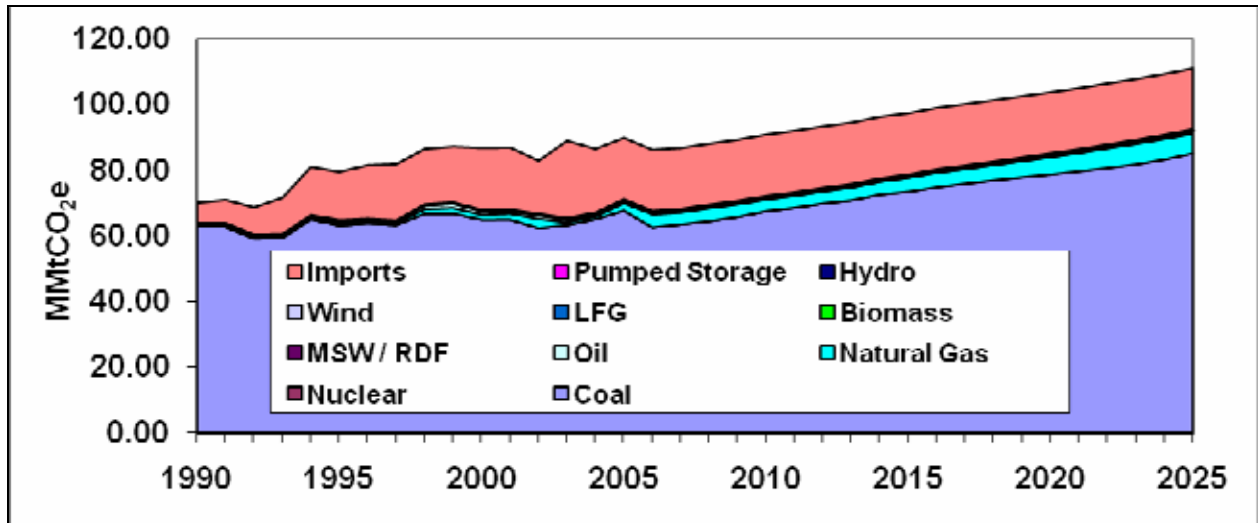
While the age of Michigan's coal-burning power generation fleet is a challenge, it is also an opportunity. Many plants will be candidates for retrofit or replacement within the forecast period, so the opportunity to move to lower-GHG fuels and advanced coal combustion technology is substantial. Michigan is blessed with significant wind and biomass generation

¹ Imports are estimated by taking the difference between the total electricity sales in Michigan and the sales from the in-state power generation. The data sources for the total electricity sales and the sales from in-state sources are EIA Annual Energy Outlook, 1996-2007 Editions.

² A more comprehensive treatment of Michigan's ES inventory and forecast projections can be found in Appendix A1 of the companion document, *Final Michigan Greenhouse Gas Inventory and Reference Case Projections 1990–2025*, Center for Climate Strategies, November 2008.

potential, and contains unusual geologic formations that offer significant potential for in-ground CO₂ storage. Several demand-side management, energy efficiency, and conservation measures recommended in the residential, commercial, and industrial sectors are detailed in Chapter 5 of this report.

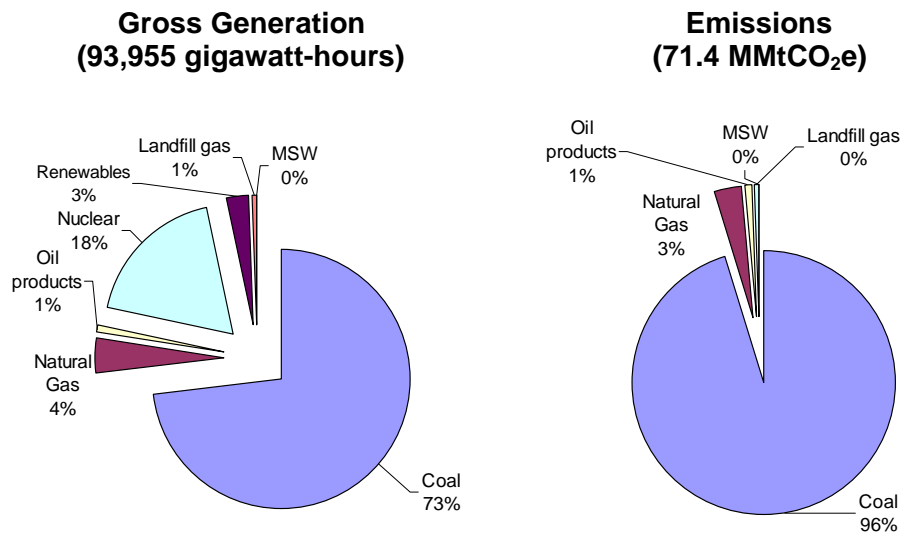
Figure 3-1. Recent and projected GHG emissions from the electricity sector, Michigan, 2005–2025 (consumption basis)



Source: *Final Michigan Greenhouse Gas Inventory and Reference Case Projections 1990–2025*, Center for Climate Strategies, November 2008.

LFG = landfill gas; MMtCO₂e = million metric tons of carbon dioxide equivalent; MSW = municipal solid waste, RDF = refuse-derived fuel.

Figure 3-2. Breakdown of Michigan in-state generation and CO₂ emissions—2005 base year



MMtCO₂e = million metric tons of carbon dioxide equivalent; MSW = municipal solid waste.

Overview of Policy Recommendations and Estimated Impacts

The Michigan Climate Action Council analyzed and is recommending several policies for the ES sector that offer the potential for significant GHG emission reductions, as summarized in Table 3-1.

Table 3-1. Summary results for energy supply policy recommendations and existing actions

Policy No.	Policy Recommendation	GHG Reductions (MMtCO ₂ e)			Net Present Value 2009–2025 (Million \$)	Cost-Effectiveness (\$/tCO ₂ e)	Level of Support
		2015	2025	Total 2009–2025			
RECENT ACTION	PA 295, Clean, Renewable, and Efficient Energy Act	2.7	2.0	30.8	\$1,024	\$33	N/A
ES-1	Renewable Portfolio Standard and Distributed Generation "Carve-Out"	5.0	14.6	137.5	\$6,600	\$48.00	Unanimous
	RPS	4.6	13.7	129.5	\$5,546	\$42.83	
	Wind	3.7	10.3	100.4	\$4,748	\$47.31	
	Biomass	0.9	2.7	25.2	\$376	\$15	
	Solar PV	0.0	0.4	2.6	\$392	\$152	
	Plasma Gasification	0.0	0.3	1.3	\$29	\$22	
	Distributed Generation "Carve-Out"	0.4	0.9	8.0	\$1,054	\$131.51	
	Solar Hot Water	0.0	0.2	1.2	\$26	\$22.27	
	Geothermal	0.1	0.2	1.5	\$82	\$55	
	Wind (distributed)	0.1	0.3	2.7	\$503	\$186	
	Solar PV (distributed)	0.1	0.2	1.84	\$508	\$276	
	Biogas	0.1	0.2	2.3	\$17	\$7	
ES-3	Energy Optimization Standard	0.0	13.6	86.3	–\$1,632	–\$19	Unanimous
ES-5	Advanced Fossil Fuel Technology (e.g., IGCC, CCSR) Incentives, Support, or Requirements	Not Quantifiable					Unanimous
ES-6	New Nuclear Power	0.0	6.3	38.5	\$1,001	\$25.98	Majority ³
ES-7	Integrated Resource Planning (IRP), Including CHP	Not Quantifiable					Unanimous
ES-8	Smart Grid, Including Advanced Metering	Not Quantifiable					Unanimous
ES-9	CCSR Incentives, Requirements, R&D, and/or Enabling Policies	Not Quantifiable					Unanimous
ES-10	Technology-Focused Initiatives (Biomass Co-firing, Energy Storage, Fuel Cells, Etc.), Including Research, Development, & Demonstration						Majority ⁴
	Co-firing at 5%	0.2	0.2	3.3	\$34.48	\$10.6	

³ 6 opposing votes [Pollack, Ettawageshik, Garfield, Heifje, Bazzani and Overmeyer] and 2 abstentions [Martinez and Calloway for Bierbaum]

⁴ 3 opposing votes [Garfield, Pollack and Heifje]

Policy No.	Policy Recommendation	GHG Reductions (MMtCO ₂ e)			Net Present Value 2009–2025 (Million \$)	Cost-Effectiveness (\$/tCO ₂ e)	Level of Support
		2015	2025	Total 2009–2025			
	Co-firing at 10%	0.5	0.5	6.5	\$69.43	\$10.7	
	Co-firing at 20%	0.9	0.9	13.0	\$134.09	\$10.3	
ES-11	Power Plant Replacement, EE, and Repowering	2.5	2.0	33.2	\$313	\$9.4	Unanimous
ES-12	Distributed Renewable Energy Incentives, Barrier Removal, and Development Issues, Including Grid Access - TOTAL	<i>ES-12 Fully incorporated in distributed generation "carve-out" under ES-1.</i>					Unanimous
ES-13	Combined Heat and Power (CHP) Standards, Incentives and/or Barrier Removal	0.4	0.5	7.8	\$31.91	\$4.09	Unanimous
ES-15	Transmission Access and Upgrades	<i>Not Quantifiable</i>					Unanimous
	Sector Totals	8.1	37.2	306.6	\$6,348	\$22	
	Sector Total After Adjusting for Overlaps	8.1	23.6	220.3	\$7,980	\$36	
	Reductions From Recent Actions	2.7	1.9	30.1	\$1,025	\$34	
	Sector Total Plus Recent Actions	10.8	25.5	250.4	\$9,005	\$36	

\$/tCO₂e = dollars per metric tons of carbon dioxide equivalent; CCI = Cross-Cutting Issues; CCSR = carbon capture and storage or reuse; CHP = combined heat and power; EE = energy efficiency; GHG = greenhouse gas; IGCC = integrated gasification combined cycle; IRP = integrated resource planning; MCAC = Michigan Climate Action Council; MMtCO₂e = millions of metric tons of carbon dioxide equivalent; N/A = not applicable; PA = Public Act; PV = photovoltaic; R&D = research and development.

Note: The numbering used to denote the policy recommendation is for reference purposes only; it does not reflect prioritization among these important recommendations.

These recommendations include efforts to extend and expand Public Act (PA) 295, the Clean, Renewable and Energy Efficiency Act (ES-1 and ES-3), promote the development and use of advanced fossil fuel technologies (ES-5 and ES-9), expand the use of nuclear power (ES-6), promote integrated resource planning and combined heat and power (ES-7 and ES-13), convert to a "smart grid" (ES-8), advance the use of emerging technologies (ES-10), promote improved efficiency or replacement of older generating units (ES-11), promote the expanded use of small-scale distributed generation, including renewable energy payments (ES-1 and ES-12), and improve transmission and distribution system efficiency and access. In addition to the recent actions contained in PA 295, these policy recommendations contribute to GHG emission reductions during 2009–2025, as outlined in Table 3-1.

Overall, the ES mitigation recommendations and recent actions yield annual GHG emission reductions from reference case projections of about 25.5 MMtCO₂e in 2025 and cumulative reductions of 250.4 MMtCO₂e from 2009 through 2025, at a net cost of approximately \$9 billion through 2025 on a net present value basis. The weighted-average cost of reduced carbon for the ES measures is about \$36/tCO₂e avoided. An overview of each policy recommendation is provided in this chapter. Additional details regarding the application of these recommendations to Michigan (targets, implementation mechanisms, parties involved, modeling approach, etc.) are provided in Appendix F.

Energy Supply Sector Policy Descriptions

The ES sector has several opportunities for mitigating GHG emissions from electricity generation, including mitigation activities associated with the generation, transmission, and distribution of electricity—whether generated through the combustion of fossil fuels, renewable energy sources in a centralized power station supplying the grid, or distributed generation facilities.

ES-1. Renewable Portfolio Standard (RPS)

A renewable portfolio standard (RPS) is a requirement that utilities supply a certain amount of annual retail sales from eligible renewable energy sources by a certain date and each year thereafter. This recommendation endorses the RPS contained within PA 295 through 2015, and then adopts the Midwestern Governors Association platform goals from 2015 through 2025. Beyond reducing utility-sector emissions of CO₂, benefits to Michigan would include lower emissions of smog and soot precursors, improved energy balance of trade, diversified fuel supply, and economic development potential. Twenty-four states plus the District of Columbia have adopted some form of an RPS. In the Midwest, these include Illinois (25% by 2025), Minnesota (27.4% by 2025), Ohio (12.5% by 2025), and Wisconsin (10% by 2015). This policy assumes that the provisions of ES-12, Distributed Generation (DG), are included here. The DG policy design in ES-12 is incorporated through a "carve-out," or guarantee, within ES-1 for both the 2015 and the 2025 goals.

ES-3. Energy Optimization Standard (EOS)

Energy optimization means energy efficiency, load management that reduces overall energy use, and related energy conservation. An energy optimization standard (EOS) requires energy savings as a percentage of total annual retail electricity sales in megawatt-hours and total annual retail natural gas sales in decatherms or equivalent thousand cubic feet in a specified year. To accomplish this, electric and natural gas providers are to develop energy optimization plans sufficient to ensure the achievement of applicable EOSs. In the Midwest, states that have adopted this policy mechanism include Minnesota (1.5% annual energy savings), Illinois (1% annual energy savings by 2011, 2% annual energy savings by 2015), and Ohio (1% annual energy savings by 2014, 2% annual energy savings by 2019). EOS goals mirror requirements under PA 295 through 2012, and then expand and extend the requirements through 2025.

ES-5. Advanced Fossil Fuel Technology

Advanced fossil fuel-based electric generation technologies include those that can be more efficient and thus lower emitting than current or older technologies. Advanced technologies combined with carbon capture and sequestration (and geostorage) or reuse (CCSR), may have the potential to materially lower CO₂ emissions associated with fossil fuel-based electricity

generation. Such technologies include (but are not limited to) circulating fluidized-bed combustors, integrated gasification combined-cycle units, and pulverized coal (advanced supercritical and ultra-supercritical units). The proposed policy has three elements: a post-combustion technology pilot and demonstration project applied to a single coal unit; analysis and report on a Michigan-specific comparison of the costs and benefits of advanced methods against existing coal technologies from a GHG reduction and cost perspective; and use of financial incentives, performance requirements, mandates, or other measures to encourage or require the early adoption of CCSR.

ES-6. New Nuclear Power

Nuclear power is a large-scale low-GHG, baseload source of electricity that could complement renewable energy resources in a mix of low-GHG-emitting electric generating options. *Michigan's 21st Century Electric Energy Plan* notes that nuclear power cannot meet the need for new generation for at least 12 years due to the extremely long lead time required to bring a new nuclear plant on line. Nuclear power can, however, play a significant role in reducing GHG emissions in conjunction with other low-GHG-emitting generating technologies in the time period beyond 2020. The issue of proper storage of both existing and new nuclear waste in the Great Lakes basin is a serious issue and must be addressed. Policies that address the barriers to implementation and encourage the licensing of new nuclear plants in Michigan, as well as relicensing of existing plants, may be considered. These policies could also address opportunities for reducing the long time frame required to license and construct a new nuclear power plant. Costs and GHG reduction benefits were calculated based upon a single new plant sized at 1,550 megawatts (MW) going on line in 2020. This recommendation was approved by a majority of the MCAC but was not unanimous. There were six opposing votes [Pollack, Ettawageshik, Garfield, Heifje, Bazzani and Overmeyer] and two abstentions [Martinez and Calloway for Bierbaum]

ES-7. Integrated Resource Planning (IRP), Including CHP

Integrated Resource Planning (IRP) is a process that develops plans to meet needs for electricity services in a manner that meets multiple objectives, such as least-cost generation, emission standards, fuel diversity, and RPS requirements. An IRP process includes the evaluation of all feasible options, from both the supply and the demand sides, in a fair and consistent manner. In the IRP process, companies or the state can highlight supply-side (generation capacity) options to meet a forecasted growth in electricity demand, and can also evaluate equally technology and policy options on the demand side to satisfy the anticipated demand. In this fashion, supply and demand analyses are paired and evaluated jointly in a least-cost planning environment.

ES-8. Smart Grid, Including Advanced Metering

Smart Grid systems promote efficiency through improvements in system monitoring, control technology, and systems integration. Combining advanced metering and two-way communication to end users with the Smart Grid technology provides a system where both the utility and the customer can engage in integrated decisions, thus enabling and improving energy

efficiency. In addition, a Smart Grid system allows enhanced opportunities for demand response and optimizes the deployment of distributed resources and renewable energy. This policy will provide guidelines to utilities for evaluating advanced metering infrastructure and Smart Grid technology projects, including cost-benefit analysis methodologies for determining the policy's GHG emissions benefits.

ES-9. Carbon Capture, Storage and Reuse Incentives, Requirements, R&D, and/or Enabling Policies

CCSR is a process that includes separation of CO₂ from industrial and energy-related sources, transport to a storage location, and permanent or long-term storage in isolation from the atmosphere. Michigan should initially encourage enhanced oil recovery and the accompanying modest carbon storage from this activity, and sequestration in depleted oil and gas fields within the 2–5-year time frame. By 2015, Michigan should encourage and support additional pilot/demonstration activity for deep carbon geostorage in several locations in the state. By 2020, Michigan should have a robust legal and policy framework consistent with national intent that enables full-scale industrial carbon geostorage capabilities. Some key implementation issues that will need to be explored regarding the establishment of a CCSR infrastructure include an infrastructure build-out that extends beyond Michigan, a legal and regulatory framework for geologic storage of CO₂, state-based incentives for CCSR, and comprehensive assessments of geologic reservoirs at the state and federal levels to determine CO₂ storage potential.

ES-10. Technology-Focused Initiatives

These initiatives focus on developing, promoting, and/or implementing one or more specific technologies that have the potential to reduce GHG emissions. Technologies could include (among others) hydrogen production and fuel cells for electricity storage, compressed air energy storage systems (to enable greater penetration of intermittent renewable technologies, such as wind), or biomass co-firing. This policy would provide state government and other private and public parties with resources and incentives for analysis, targeted research and development, market development, and adoption of GHG-reducing technologies that are not covered by other policies. The specific goal would be to maximize effective use of biomass for co-firing at appropriate coal plants as soon as practicable. This recommendation was approved by a majority of the MCAC but was not unanimous. There were three opposing votes [Garfield, Pollack and Heifje].

ES-11. Power Plant Replacement, EE, and Repowering

Michigan has the second-oldest fleet of power plants in the nation. The state will most likely be facing the retirement or repowering of a number of old, less efficient units within the time frame of this planning process. The opportunity to replace aging units and reduce GHG-intensive imports with more efficient in-state generation could offer a reduction in GHG emissions from this sector. Furthermore, existing coal-based generation technologies may benefit from additional technologies and upgrades to make their fuel burning more energy efficient (EE), resulting in more electric output for the amount of fuel burned. Policies to encourage generation efficiency

improvements, repowering of existing plants, or power plant replacement(s) could include incentives or regulations as described in other options, with adjustments for financing opportunities and emission rates of existing plants.

ES-12. Distributed Renewable Energy

This recommendation focuses on removing barriers to and providing incentives to encourage the development of distributed renewable energy throughout the state. Distributed renewable energy is generally defined as small scale (generally less than 10 MW), located at or near the point of end use, interconnected to the distribution (as opposed to transmission) system, and more likely to have homeowner or community ownership. Increasing the use of distributed renewable energy provides electricity reliability, security, and environmental benefits. The preferred policy design would include a well-designed and fully implemented renewable energy payment (REP) program. A REP program may be designed to promote and encourage development of renewable energy projects of all sizes, ranging from small residential up to the largest utility-scale projects. The costs and benefits of this policy are incorporated into the DG “carve-out” under ES-1.

ES-13. Combined Heat and Power (CHP)

Every business in Michigan that uses energy to heat and/or cool its buildings or as part of a production process is technically a candidate to simultaneously also generate electricity at its site, using one of several commercially proven and widely used combined heat and power (CHP) technologies. CHP technologies, also referred to as “co-generation,” include steam turbines with steam extraction or back pressure, gas turbines with waste heat recovery boilers, combined-cycle units, reciprocating engines with manifold exhaust and cooling heat recovery, as well as less proven technologies, such as fuel cells and Stirling engines. To achieve this goal, it will be necessary to revise regulatory policies and remove institutional barriers to allow distributed renewable energy and CHP systems to compete on a level playing field with other sources of electric and thermal energy.

ES-15a. Transmission Access and Upgrades

Various efficiency measures can be implemented to reduce transmission line losses of electricity. By reducing constraints in the transmission system, improved transmission facilities reduce congestion, hence reducing energy costs and GHG emissions and improving the efficiency of the transmission and generation system. To facilitate widespread adoption of renewable energy technologies, the current transmission system requires upgrades and additions. Renewable energy facilities may require the addition of new or improved transmission lines that must be seamlessly integrated into the transmission grid. Among other things, the policy calls for Michigan to implement a “transmission system efficiency study” to determine the most cost-effective measures to reduce line losses and improve overall system reliability and management, including improving access for new generation assets, such as renewable energy, CHP, and DG projects.

ES-15b. Distribution System Access and Upgrades

Various energy efficiency measures can be implemented to reduce distribution line losses of electricity. Regulations, incentives, and/or support programs can be applied to achieve greater efficiency of distribution system components. Such distribution system improvements will help reduce line losses and improve and manage outages, as well as enable renewable energy systems, including DG and CHP projects, to interconnect to the grid. Among other things, this policy calls for implementation of a distribution system efficiency study for Michigan to determine the most cost-effective measures to reduce line losses and improve overall distribution system reliability and management, including improving access for new generation assets, such as renewable energy, CHP, and DG projects.

Chapter 4

Market Based Policies

Overview of Market Based Policies

The Market Based Policies (MBP) technical working group (TWG) was created mid-way through the MCAC planning process in response to concerns from members of the Cross Cutting Issues (CCI) and Energy Supply (ES) TWGs that some of the policies under consideration in both TWGs required more time and attention than either could provide. After reviewing a variety of options, the MCAC decided to create a new Market Based Policies (MBP) TWG and transfer selected policies under the new group's jurisdiction. The policies of principle concern were the cap-and-trade proposal and the carbon tax proposal, but a handful of related policies were also moved. The MBP TWG renumbered and reorganized the transferred policies. The MBP TWG members were self-selected volunteers from the ES, CCI and Residential, Commercial and Industrial (RCI) TWGs.

These policies selected for approval by the MCAC are different from most other recommendations in that they are not sector-specific and they rely upon economic incentives to achieve GHG mitigation targets. One of the three recommendations requires interstate action and one is a process recommendation. During the TWG's discussions several options were merged. One policy option [a carbon tax] was not approved by a majority of the MCAC.

Key Challenges and Opportunities

Congress is expressing renewed interest in national cap-and-trade legislation, and President Obama has indicated his support for the approach. Three regions within the US are moving ahead with the development and implementation of interstate or international programs – the Northeastern Regional Greenhouse Gas Initiative (RGGI), the Western Climate Initiative (WCI) and the Midwestern Greenhouse Gas Reduction Accord (MGA).

Michigan is actively participating in the development of the Midwestern Regional Greenhouse Gas Reduction Accord. The policy issues confronting the Midwestern Accord Partners will need to be evaluated regionally and by each Partner jurisdiction, and then negotiated until agreement is reached. These recommendations are offered to advise Michigan on the key program design features that Michigan should support in these regional negotiations.

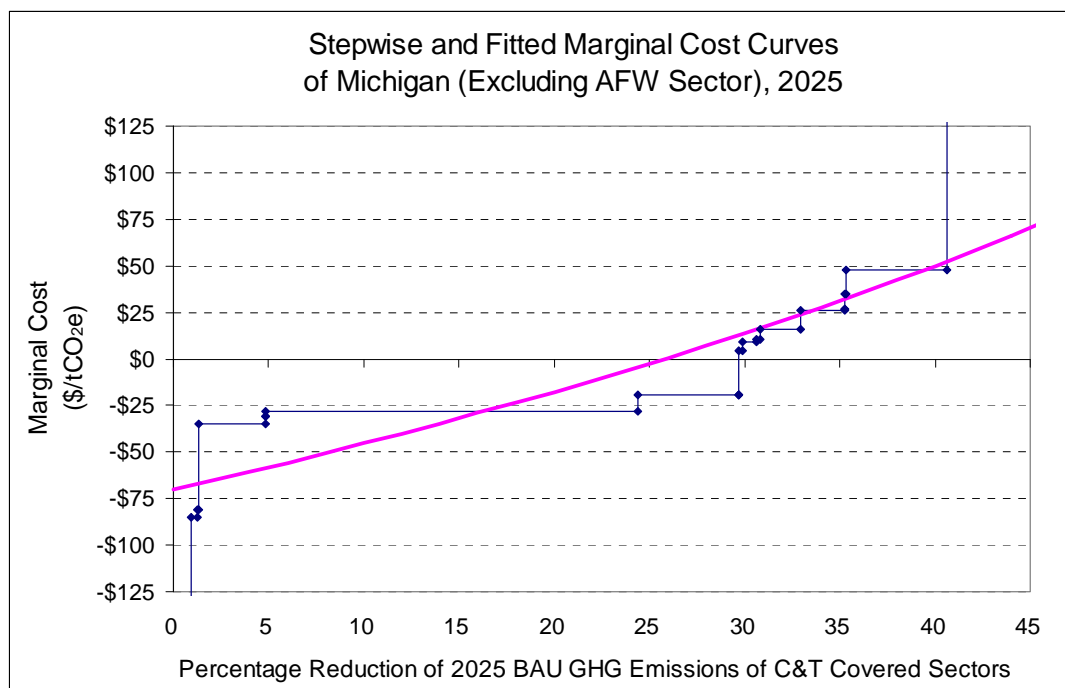
It is believed that Michigan and all other participating jurisdictions in the cap-and-trade program will benefit from the combination of non-market based policies and measures such as those proposed for the sectors and the cap-and-trade program. The cap-and-trade program allows the achievement of GHG mitigation goals (the “cap”) at lower cost than would otherwise be possible, and many of the non-market based policies and measures serve to remove barriers that otherwise would obstruct access to many of the low cost options. The cap also serves to ensure that GHG reduction goals are achieved even if the non-market based policies fail to perform as expected.

The relationship between the policies and measures recommended elsewhere in this report and the benefit offered by the overlay of a cap-and-trade program can be seen in a marginal cost curve as shown in Figure 4-1. This figure ranks each of the recommended policies from left to

right in ascending order of cost. The horizontal (x) axis represents the percentage of GHG emission reduction, and the vertical axis represents the measure's marginal cost or savings. In the figure, each horizontal segment represents an individual mitigation option. The width of the segment indicates the GHG emission reduction potential of the option in percentage terms. The height of the segment relative to the x-axis shows the average cost or saving of reducing one metric ton of GHG with the application of the policy. The figure indicates that, collectively, the reduction potential of recommended policies from all economic sectors (excluding Agriculture, Forestry and Waste Management in this example) can avoid about 40% of 2025 baseline emissions in Michigan.

When regulated sources have the opportunity to purchase and sell emissions credits through an interstate market, the relative costs and benefits from comparable mitigation measures in all participating states become fungible. Lower cost options in one state can be developed in surplus with funding coming from sources facing higher cost options in another state. The market 'seeks out and finds' the lowest cost mitigation necessary to achieve the cap. In this way, both the sources in the states with low cost mitigation opportunities, and the sources in the states with high cost mitigation realize an economic benefit from the transaction.

Figure 4-1. Stepwise and fitted marginal cost curve of Michigan (excluding AFW sector), 2025¹



AFW = agriculture, forestry, and waste management; BAU = business as usual; C&T = cap and trade; GHG = greenhouse gas.

¹ It should be noted that the data represented in this cost curve were derived from the Council's quantified policy recommendations, as approved. Due to the fact the Council included only a subset of all possible measures that could be taken to reduce CO₂, they do not represent the full range of potential policies for an economy-wide cost curve.

Overview of Policy Recommendations and Estimated Impacts

The MCAC analyzed and is recommending three market-based policies of which only MBP-1, Cap-and-Trade, was quantified. Cap-and-trade modeling is limited to a single year, therefore cumulative costs and benefits are not available. The analysis does, however, project the program's total net economic benefit to Michigan in the target year, cost effectiveness, the flow of emissions allowances (permits) between participating jurisdictions and the allowance price. Two initial allowance distribution scenarios were modeled: free granting of allowances to regulated sources (grandfathering) and the sale of 100% of allowances by auction. Table 4-1 gives Michigan's GHG reductions and cost savings in 2020 for both the free granting and auction cases. Note that auction-case costs do not include the payments from the bidder to the state for the purchase of allowances at auction. This information can be found in table G-1-2 and Annex-1 in Appendix G.

Table 4-1. Summary results for energy supply policy recommendations and existing actions

No.	Policy Recommendation	GHG Reductions (MMtCO ₂ e)			Net Present Value 2009–2025 (Million \$)	Cost-Effectiveness (\$/tCO ₂ e)	Level of Support
		2020	2025	Total 2009–2025			
MBP-1	Cap-and-trade: 20% below 2005 by 2020 (<i>free granting allowances</i>) ²	92.48				–\$25.83	Unanimous
	Cap-and-trade: 20% below 2005 by 2020 (<i>auctioning allowances</i>) ³	92.48				–\$19.33	
MBP-3	Michigan Joins Chicago Climate Exchange	Not Quantified					Unanimous
MBP-6	Market advisory group	Not Quantifiable					Unanimous

Note: The numbering used to denote the policy recommendation is for reference purposes only; it does not reflect prioritization among these important recommendations. (Gaps in numbers are due to merger of several MBP policies and rejection of one.)

Market Based Policy Descriptions

The three recommended MBP policies include the cap-and-trade program, a Michigan “lead-by-example” policy and a cap-and-trade supporting policy . They are summarized below and presented in greater detail in Appendix G.

² These results include mitigation costs, including payments or revenues resulting from the purchase or sale of allowances between MI emitters and out-of-state MGA partners.

³ These results include mitigation costs but do not include payments to the state by MI emitters for the purchase of allowances at auction. The cost and revenue implications of distribution of allowances by auction can be found in table G-1-2 and Annex-1 in Appendix G.

MBP-1. Cap-and-Trade

A cap-and-trade system works by setting an overall limit on emissions (the “cap”) and either selling or distributing, at no cost, emissions “allowances,” or permits, to regulated entities or sources. These regulated entities must periodically surrender enough allowances to match their reported emissions or face a penalty. Cap-and-trade creates a financial incentive for emitters to continually seek out new emission-reducing options and cut their emissions as much as possible. By creating a market for the allowances, regulated entities have the choice of either purchasing allowances or directly reducing emissions and, as a result, resources are directed to the most cost-effective emissions reduction investments. To achieve overall emissions reductions over time, programs gradually lower the emissions “cap” by reducing the total number of available allowances.

The MCAC encourages national action in the implementation of a cap and trade program for the regulation of greenhouse gas emissions. In lieu of national action, or in advance of future action, Michigan should continue to participate in and encourage the development of the Midwestern Accord program. Michigan should not seek to create its own one-state cap and trade program. It is recommended that the program have the broadest possible sector coverage as soon as possible to include the maximum possible number of low cost mitigation and sequestration options. The MCAC does not make a specific recommendation on the method by which allowances are initially distributed (free granting, auction, both, etc.), but regardless of distribution method, the MCAC agrees that the *value* represented by the allowance should benefit the residents of Michigan.

MBP-3. Michigan Joins the Chicago Climate Exchange (CCX)

The Chicago Climate Exchange (CCX), launched in 2003, is the world’s first and North America’s only active voluntary, legally binding integrated trading system to reduce emissions of all six major greenhouse gases (GHGs), with offset projects worldwide. CCX emitting Members make a voluntary but legally binding commitment to meet annual GHG emission reduction targets. Those who reduce below the targets have surplus allowances to sell or bank; those who emit above the targets comply by purchasing CCX Carbon Financial Instrument[®] (CFI[®]) contracts. The states of New Mexico and Illinois are Members of CCX.

By joining the CCX Michigan state government will lead by example. Michigan will inventory and quantify all greenhouse gas emissions from sources that result from state government operations and are under the control of state government. State government’s primary sources of GHG are typically energy usage in office buildings and transportation.

MBP-6. Market Advisory Group

GHG policies have broad based impacts and implications. As a result it is helpful to look at current and future policies from a variety of viewpoints. Some states have looked at forming groups of experts to help them evaluate both the intended and unintended consequences of GHG policies. The MCAC recommends the creation of a formal Market Advisory Group, appointed by the governor or appropriate agency head and approved by the Legislature, and working in

support of the governmental agency charged with the program. The advisory group would hold regular meetings and have defined responsibilities, to include looking at the economic feasibility of implementing GHG reduction policies. In addition to offering expert advice on the design of market-based policies, the group would catalog current policies and laws in state and local government, assess how each contributes to or reduce GHGs, and provide guidance to the state's policy makers on the design of any future compliance programs to manage GHG emissions.

Chapter 5

Residential, Commercial, and Industrial Sectors

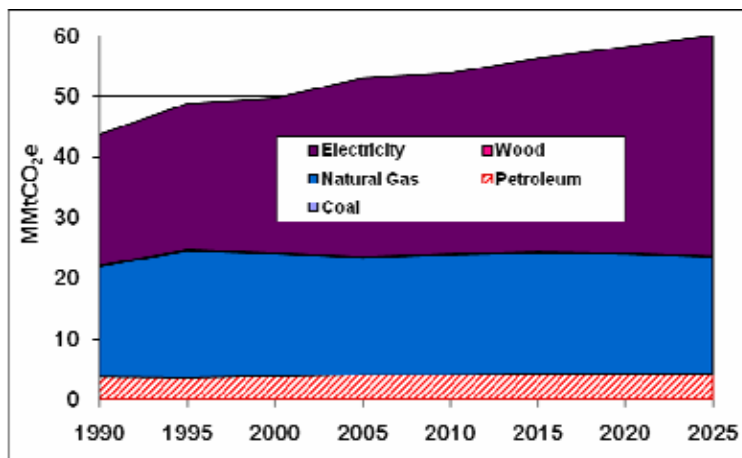
Overview of Greenhouse Gas Emissions

Activities in the residential, commercial, and industrial (RCI) sectors produce greenhouse gas (GHG) emissions when fuels are combusted to provide space heating, process heating, and other applications. In 2005, combustion of oil, natural gas, and coal in the RCI sectors contributed about 60 million metric tons of carbon dioxide equivalent (MMtCO₂e) to Michigan's gross GHG emissions. These sectors contributed 24% of the 248 MMt of GHG that the state emitted overall, slightly higher than the national average of 22% for these sectors. Residential sector emissions make up approximately 40% of RCI GHG emissions; commercial sector emissions, approximately 18%; and industrial sector emissions, approximately 42%.

Considering only the direct emissions that occur within buildings and industries, however, ignores the fact that nearly all electricity sold in Michigan is consumed for RCI activities. If the emissions from all three subsectors of RCI are included (i.e., direct fuel use, emissions associated with electricity consumption, and industrial processes), they total about 68% of the state's gross GHG emissions in 2005. Therefore, the state's future GHG emissions will depend heavily on future trends in the consumption of electricity and other fuels in the RCI sectors.

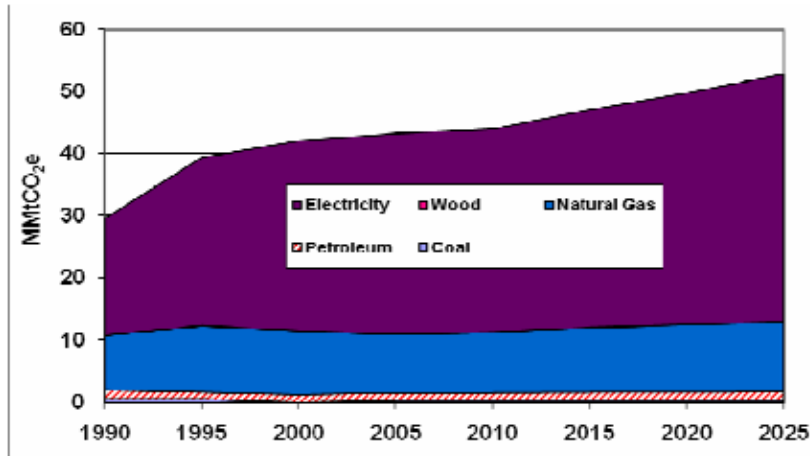
Figures 5-1 through 5-3 show the trend in GHG emissions from the RCI sectors through 2025. The figures also show the relative shares of GHG emissions, by fuel. Overall, emissions for the RCI sectors (excluding those associated with electricity consumption) are expected to increase by 4.1% between 2005 and 2025. For the 20-year period beginning in 2005 and ending in 2025, the fastest growth in GHG emissions is in the commercial sector, which is forecast to grow by 1.0% annually. GHG emissions in the residential and industrial sectors are expected to grow by 0.6% per year during this period.

Figure 5-1. Historical and projected residential greenhouse gas emissions in Michigan: 1990–2025*



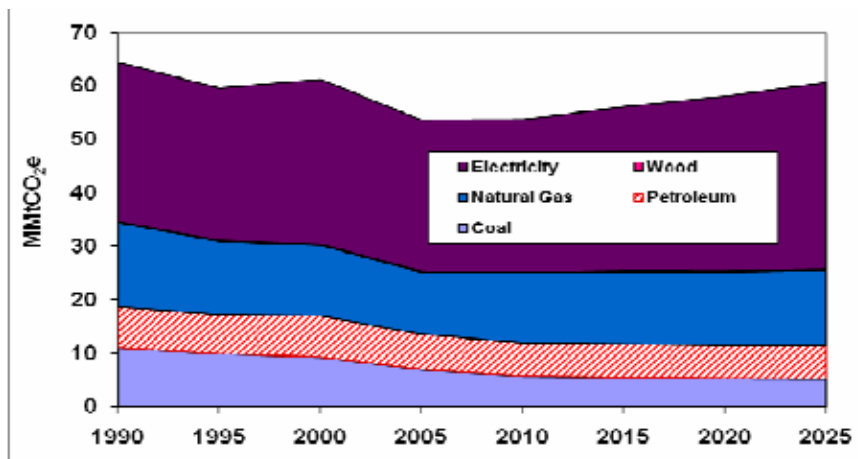
* Emissions associated with the direct use of natural gas, petroleum, coal, and wood and the consumption of electricity. Source: Consolidated Michigan Inventory and Forecast.

Figure 5-2. Historical and projected commercial sector greenhouse gas emissions in Michigan: 1990–2025*



* Emissions associated with the direct use of natural gas, petroleum, coal, and wood and the consumption of electricity. Source: Consolidated Michigan Inventory and Forecast.

Figure 5-3. Historical and projected industrial greenhouse gas emissions in Michigan: 1990–2025*



* Emissions associated with the direct use of natural gas, petroleum, coal, and wood and the consumption of electricity. Source: Consolidated Michigan Inventory and Forecast.

The projections for the period beginning in 2005 show almost no change in the overall shares of emissions that the different sectors produce. The residential sector produces 35% of total RCI GHG emissions in both 2005 and 2025; the commercial sector, produces 29% in 2005 and 30% in 2025; and the industrial sector, 36% in 2005 and 35% in 2025.

Much of the growth in GHG emissions over the period can be attributed to an average 0.94% annual growth in electricity demand over the 2005–2025 period for the RCI sectors. GHG emissions from electricity for each of the three sectors are projected to grow by 1.1% per year between 2005 and 2025.

Emissions associated with the generation of electricity to meet RCI demand account for about 55% of the emissions for the residential sector, 72% of the emissions for the commercial sector, and 52% of the emissions for the industrial sector, on average, over the 1990–2025 period. From 1990 to 2025, natural gas consumption is the next-highest source of emissions for the residential and commercial sectors, accounting, on average, for about 38% and 24% of total emissions, respectively. For the industrial sector, emissions associated with the combustion of coal, natural gas, and petroleum account for about 13%, 23%, and 12%, respectively, on average, from 1990 to 2025.

Key Challenges and Opportunities

The principal means to reduce RCI emissions include improving energy efficiency, substituting electricity and natural gas with lower-emission energy resources (such as biomass and wind), and various strategies to decrease the emissions associated with electricity production (see Chapter 3, Energy Supply Sectors). The state’s limited pursuit of energy efficiency until recent years offers abundant opportunities to reduce emissions through programs and initiatives to improve the efficiency of buildings, appliances, and industrial practices. The advantages of having “low-hanging fruit” in the form of low-cost energy efficiency opportunities in the RCI sectors are countered by an underdeveloped private sector that will likely be responsible for scoping, implementing, and evaluating energy efficiency projects. These “green collar” jobs require special training and equipment that will take time for firms within the state to acquire.

Michigan has recently embarked on statewide energy efficiency programs in response to concerns about energy costs and carbon emissions. Public Act (P.A.) 295, enacted in 2008, adopted a requirement that electric providers achieve annual incremental energy savings in 2012, 2013, 2014, and 2015, and each year thereafter, equivalent to 1% of total annual retail electricity sales in megawatt hours in the preceeding year. Additionally, natural gas providers must achieve annual incremental energy savings in 2012, 2013, 2014, and 2015, and each year thereafter, equivalent to 0.75% of total annual retail natural gas sales in decatherms or equivalent thousands of cubic feet (MCF) in the preceeding year. It should be noted that incremental energy savings begin ramping up in 2008 and continue through and beyond 2015 as stipulated in P.A. 295. Further, in order to ensure this outcome, each provider must file an annual report of its progress in meeting the energy optimization portfolio with the Michigan Public Service Commission. The Commission is now developing rules and guidance to implement these programs.

The Michigan Climate Action Council (MCAC) has identified significant opportunities for reducing GHG emissions growth attributable to the RCI sectors in the state. These include expanding or launching utility demand-side management programs for electricity and natural gas and removing disincentives to efficiency investments by utilities; adopting incentives, assistance, and updated building codes to increase energy efficiency in buildings; adopting incentives and net metering for renewable energy systems implementation; enhancing consumer education and professional training and certification programs; and devoting greater attention to the energy requirements associated with water use and management in the state. The MCAC has also identified significant opportunities to reduce GHG emissions through policies addressing electricity production; these are detailed in Chapter 3.

Overview of Policy Recommendations and Estimated Impacts

The MCAC unanimously recommends a set of 10 policies for the RCI sectors, several of them in close concert with parallel policies in the energy supply (ES) sector. These policies offer significant, cost-effective GHG emissions reductions within the state. These recommendations and results are summarized in Table 4.1. The GHG emission reductions and costs per ton of GHG reductions for five of these policies were quantified. The quantified policy recommendations could lead to emission savings from reference case projections of:

- 64.9 MMtCO₂e per year by 2025, and a cumulative savings of 523.9 MMtCO₂e from 2009 to 2025, and
- Net cost savings of over \$13 billion through 2025 on a net present value basis.¹ The weighted-average costs of these policies are a net savings of nearly \$25/tCO₂e.

Because most energy use occurs in buildings, the recommended policies center on improving energy efficiency in buildings. There is overlap among the policies as to the types of activities and equipment they cover, but the text following Table 5-1 provides general guidance on how the policies complement each other. In brief, however, the policies focus on the following:

- RCI-1 provides for utility-operated incentives for energy efficiency that will reduce energy use.
- RCI-2 and RCI-7 lay out a set of policies to reduce overall, statewide energy use in buildings.
- RCI-3 focuses on setting regulatory policies that will establish rate structures to incentivize utilities to invest in energy efficiency, or remove disincentives that are inherent in existing utility rate structures for utilities to invest in energy efficiency.
- RCI-4 focuses on making building energy codes more stringent.
- RCI-5 and RCI-9 increase the human capital component of energy efficiency by providing education and training for energy users and energy professionals across the state.
- RCI 6 and RCI-8 focus on encouraging small-scale renewable energy capacity and generation in the state.
- RCI-10 focuses on reducing energy use among water utilities in the state.

Table 5-1. Summary list of policy recommendations

Policy No.	Policy Recommendation	GHG Reductions (MMtCO ₂ e)			Net Present Value 2009–2025 (Million \$)	Cost-Effectiveness (\$/tCO ₂ e)	Level of Support
		2015	2025	Total 2009–2025			
RCI-1	Utility Demand-Side Management for Electricity and Natural Gas	0.0	13.6	86.3	–\$1,632	–\$19	Unanimous
RCI-2	Existing Buildings Energy Efficiency	17.6	53.8	428.6	–\$12,107	–\$28	Unanimous

¹ The net cost savings, shown in constant 2005 dollars, are based on fuel expenditures; operations, maintenance, and administrative costs; and amortized, incremental equipment costs. All net present value analyses here use a 5% real discount rate.

Policy No.	Policy Recommendation	GHG Reductions (MMtCO ₂ e)			Net Present Value 2009–2025 (Million \$)	Cost-Effectiveness (\$/tCO ₂ e)	Level of Support
		2015	2025	Total 2009–2025			
	Incentives, Assistance, Certification, and Financing						
RCI-3	Regulatory (PSC) Changes To Remove Disincentives and Encourage Energy Efficiency Investments by Investor Owned Utilities (IOUs)	Not Quantifiable					Unanimous
RCI-4	Adopt More Stringent Building Codes for Energy Efficiency	3.6	9.8	82	–\$2,865	–\$35	Unanimous
RCI-5	Michigan Climate Challenge and Related Consumer Education Programs	Not Quantifiable					Unanimous
RCI-6	Incentives To Promote Renewable Energy Systems Implementation	0.7	1.5	14.0	\$1,958	\$140	Unanimous
RCI-7	Promotion and Incentives for Improved Design and Construction in the Private Sector	15.6	47.6	380	–\$11,693	–\$31	Unanimous
RCI-8	Net Metering for Distributed Generation	Fully incorporated into RCI-6					Unanimous
RCI-9	Training and Education for Building Design, Construction, and Operation	Not Quantifiable					Unanimous
RCI-10	Water Use and Management	Not Quantifiable					Unanimous
	Sector Total After Adjusting for Overlaps*	21.8	64.9	523.9	–13,014	–24.8	
	Reductions From Recent Actions	Figures adjusted include recent actions					
	Sector Total Plus Recent Actions	21.8	64.9	523.9	–13,014	–24.8	

PSC = Public Service Commission; IOUs = Investor Owned Utilities; GHG = greenhouse gas; MMtCO₂e = million metric tons of carbon dioxide equivalent; \$/tCO₂e = dollars per metric ton of carbon dioxide equivalent.

Negative values in the Net Present Value and the Cost-Effectiveness columns represent net cost savings.

The numbering used to denote the above policy recommendations is for reference purposes only; it does not reflect prioritization among these important policy recommendations.

There is overlap in the expected emission reductions and costs among some of the policies within the RCI sectors, as well as between policies in the RCI and ES sectors. The goals laid out in RCI-2 for a 50% decrease in residential and commercial energy use and a 20% decrease in overall industrial energy use are more ambitious than similar, but smaller, goals laid out in RCI-1 and RCI-7. As a result, there is overlap among these three goals, and the most ambitious goals that are laid out in RCI-2 overlap completely with those in RCI-1 and RCI-7. The final accounting for emission reductions avoids double counting by subtracting emission reductions from RCI-1 and RCI-7 from the total. RCI-1 also overlaps with ES-3, but to avoid double counting, the emission reductions produced by ES-3 are subtracted from the total.

RCI-4, focusing on new building energy codes rather than financial incentives, does not overlap with other policies.

RCI-6, focusing on the effect of a renewable energy generation requirement from small-scale renewable energy resources, does not overlap with other policies.

There are two primary interactions between the RCI and ES sector policies, both concerning the clean energy portfolio components in policy recommendation ES-1 (Renewable Portfolio

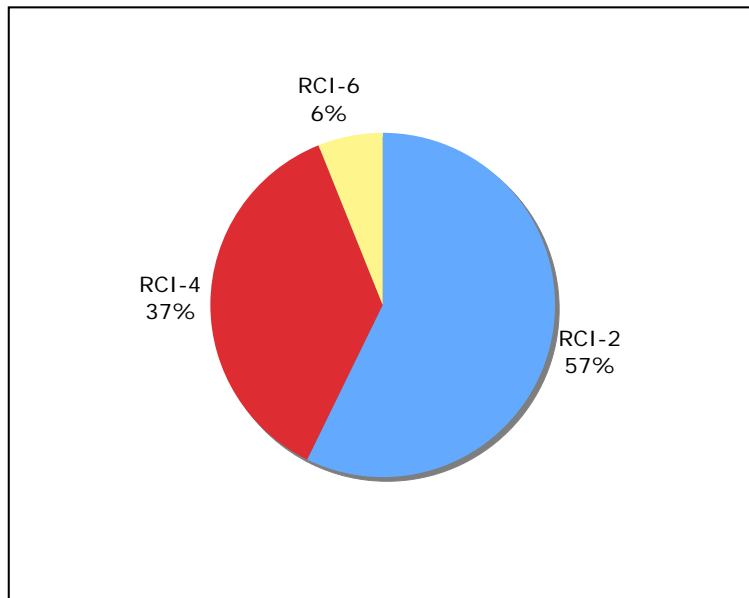
Standard). Most of the RCI policies (especially RCI-2) decrease overall electricity demand. As the renewable energy portfolio requirements are based on meeting a percentage of load with specific renewable energy, co-firing, or nuclear resources, the costs of ES-1 would be reduced by decreasing energy demand through these RCI policies. Also, an additional “feedback loop” effect is that certain ES policies (including ES-1) will have the effect of reducing GHG emissions associated with energy production, so that RCI policies that target electricity use will have a correspondingly lower impact on overall emissions. However, this impact has not been reflected in the analysis.

The policy recommendations for the RCI sectors are affected by both state and federal policies that incentivize or mandate more efficient use of energy. The federal Energy Independence and Security Act of 2007 was signed into law in December 2007. This law contains several requirements that will reduce GHG emissions as it is implemented over the next few years. These reductions were factored into the MCAC’s quantification of GHG emission reductions and costs or savings.

The GHG reductions for these savings are projected to be 73.7 MMtCO_{2e}, for 2025 using the RCI Technical Work Group's (TWG's) CO₂ methodology. In addition, through P.A. 295 of 2008, Michigan enacted energy efficiency programs that will reduce GHG emissions by 3.3 MMtCO_{2e} in 2015 using the RCI TWG CO₂ methodology and 24.6 MMtCO_{2e} in 2025. The GHG emission reductions reported here are *net of and additional to* these existing actions. Appendix I details the assumptions and approach used to estimate reductions from these existing actions in Michigan.

Figure 5-4 shows the cumulative emission reductions from the five policy recommendations that have been quantified for the entire planning period for 2009–2025, after accounting for overlaps among these policies. There is a great deal of variation in the emission reductions from the policy recommendations. RCI-2, with its ambitious targets for energy efficiency, will have by far the greatest effect. RCI-4 will be important, but because it applies only to new construction, will be limited in its overall effect. RCI-6 is focused most heavily on new, but small-scale, generation.

Figure 5-4. Aggregate cumulative GHG emission reductions: 2009–2025*



* These are the reductions from the policy recommendations, net of overlaps between recommendations. Note, options not shown in this chart were either unquantifiable or were not counted because of overlap. Also, results have been adjusted to remove overlaps between policies; for example, RCI-7 reductions overlap with both RCI-2 and RCI-4 assuming all three policies are implemented. The chart, therefore, includes RCI-2 and RCI-4 but not RCI-7 to avoid overstating the combined benefits of the recommendations.

The policy recommendations described briefly below, and in more detail in Appendix I, not only result in significant emission reductions and overall cost savings, but offer a host of additional benefits as well. These benefits include savings to consumers and businesses on energy bills, which can have macroeconomic benefits; reduction in spending on energy by low-income households; reduced peak demand, electricity system capital and operating costs, risk of power shortages, energy price increases, and price volatility; improved public health as a result of reduced pollutant and particulate emissions by power plants; reduced dependence on imported fuel sources and correspondingly greater energy security; and green collar employment expansion and economic development.

It is also important to note that while the GHG reductions and costs or savings of these policy recommendations have been developed according to best estimates, there remains some uncertainty (e.g., due to timing, technology development, and/or more refined analysis) regarding the actual GHG reductions and costs or savings that will be revealed in their ultimate implementation. This uncertainty should be considered in the course of the state's policy prioritization and implementation decisions.

For the RCI policies recommended by the MCAC to yield the levels of savings described here, they must be implemented in a timely, aggressive, and thorough manner. This means, for example, not only putting the policies themselves in place, but also attending to the development of supporting policies that are needed to help make the recommended policies effective. While the adoption of the recommended policies can result in considerable benefits to Michigan's

environment and citizens, careful, comprehensive, and detailed planning and implementation, as well as consistent support, of these policies will be required if these benefits are to be achieved.

Residential, Commercial, and Industrial Sectors Policy Descriptions

RCI-1. Utility Demand-Side Management for Electricity and Natural Gas

By unanimous consent, the MCAC recommends increasing investment in electricity and natural gas demand-side management (DSM) programs through programs run by investor owned, municipal, and co-operative utilities, as well as energy service companies, large customers, or others. Decreasing consumption will have immediate impacts on GHG emissions. DSM activities may be designed to work in tandem with other recommended strategies that can also encourage efficiency gains.

This policy recommendation focuses on improving energy efficiency through such DSM efforts as energy efficiency, energy conservation, and peak demand reduction actions. Energy efficiency and conservation are the lowest-cost resources for reductions in electricity and natural gas use by the RCI sectors and thus for reduction of GHGs. There is a long track record of cost-effective energy efficiency initiatives at the local, state, and regional levels around the country and in Michigan. There is vast potential for improving the energy efficiency of homes, appliances, businesses, and industry in Michigan. A number of DSM efforts are already underway or mandated in Michigan, and important new energy efficiency legislation—P.A. 295 of 2008—was adopted as the MCAC was concluding its efforts.

This policy recommendation considers energy-saving goals for electricity and natural gas, and the policy, program, and funding mechanisms that might be used to achieve these goals. It is intended to work in tandem with other RCI and ES policies recommended by the MCAC; in particular, it echoes ES-3, the Energy Optimization Standard.

The goal of this policy is to bring the *total overall* demand reduction of existing actions, recent actions (including notably newly adopted P.A. 295), plus new, additional DSM activities in Michigan to save in each year 2% of the prior year's electricity use and 0.75% of the prior year's natural gas use by the residential, commercial, institutional, municipal, and industrial sectors, compared to a 3-year, weather-normalized, business-as-usual forecast that does not incorporate these goals. The policy would be implemented in three phases between 2009 and 2015, followed by a fourth, long-term phase. This goal derives in part from the efficiency goal identified in the Midwestern Governors Association's November 15, 2007, Energy Security and Climate Stewardship Platform.

RCI-2. Existing Buildings Energy Efficiency Incentives, Assistance, Certification, and Financing

By unanimous consent, the MCAC recommends improving the energy efficiency of existing buildings in Michigan. Because Michigan has one of the weakest energy codes in the nation, and currently utilizes many of its World War II-era industrial buildings, energy efficiency improvements provide a significant opportunity to reduce Michigan's carbon footprint. This policy would reduce energy use in existing buildings by encouraging energy efficiency upgrades and operating improvements in existing institutional, municipal, commercial, residential, and industrial buildings. Incentives, rebates, and property tax abatements are imperative to foster state-wide participation in implementing energy-efficient measures to reduce future energy generation and GHG emissions. This policy is intended to support and work in conjunction with other policies (e.g., RCI-1) to help create a sustainable and cost-effective energy efficiency program for Michigan.

The recommended goal is to reduce energy consumption per square foot of floor space in existing residential, commercial, institutional, and municipal buildings by 50% from 2002 levels by 2030, and to reduce energy consumption in the industrial sector, where building systems and process systems are often intertwined, by 20% by 2030.

RCI-3. Regulatory (PSC) Changes To Remove Disincentives and Encourage Energy Efficiency Investments by Investor-Owned Utilities (IOUs)

The MCAC unanimously recommends that regulatory changes be implemented to remove disincentives and encourage energy efficiency investments by investor-owned utilities (IOUs). Economic regulation of IOUs by the Michigan Public Service Commission (MPSC) limits their earnings potential by determining an authorized level of earnings and by establishing the allowed earnings as a percentage of the utility rate base (i.e., the value of assets, such as power plants and distribution networks used in the business). In designing the rates charged to customers to recover the utility's "revenue requirement" (expenses plus investment return on the rate base), regulators typically assign most of the revenue requirement to predicted unit sales of gas or electricity. This method creates financial incentives for the utility to increase—not decrease—its unit sales and to make investments in the traditional physical assets of the business.

Successful energy conservation and efficiency programs reduce unit sales and could thus reduce utility revenues. If program costs are expensed, there can be no incremental earnings on the program investment, no matter how successful it is. Thus, an energy efficiency program offers limited "upside" potential to utilities and poses a significant risk of harming profitability. Cooperative and municipal systems apply a different earnings model, but may risk diminished cash flow from reduced sales. Utilities' financial incentives are to maximize unit sales, not reduce them.

This financial disincentive can be offset by: (1) providing a possible incentive financial benefit for a successful efficiency program; (2) changing the rate method so that expenses and earnings are recovered by a fixed-rate charge based on the number of customers, rather than units sold; (3) allowing sales figures to be updated between rate cases; and (4) applying a system benefits

charge to all distribution service customers to pay for the efficiency program. Items (2) and (3) are examples of “decoupling” revenue requirements from a projected unit sales level.

Decoupling utility unit sales from profits in rate setting and/or providing the opportunity to earn profits from successful program outcomes can realign incentives to encourage effective utility investment in DSM, energy efficiency, and conservation and reduce the incentive to maximize unit sales. Item (4) ensures that all customers receiving deliveries from the local distribution utility contribute to the program costs, since the benefits are societal.

This policy is not quantifiable at this time. Its goal is to have the MPSC undertake and complete as soon as possible, but no later than December 2010, a comprehensive study identifying disincentives to energy efficiency investments by utilities and ways to remove them, as well as opportunities to encourage additional energy efficiency investment by utilities. This should be conducted in close coordination with the MCAC’s ES policy recommendations, and in keeping with the provisions of P.A. 295.

RCI-4. Adopt More Stringent Building Codes for Energy Efficiency

The MCAC unanimously recommends that a higher energy standard should be required for newly constructed buildings in the state in order to reduce energy costs—the largest operations and maintenance expense. Newly constructed buildings today become the energy-consuming building stock of tomorrow. Strong building energy codes can be an effective way to eliminate the use of “least-efficient” energy practices in new or renovated buildings.

The 2030 Challenge is a global initiative that targets all new buildings and major renovations to reduce their fossil-fuel consumption by 50% by 2010 and incrementally increase this standard for new buildings to “carbon neutrality” in 2030. The 2030 Challenge has been adopted by the U.S. Conference of Mayors; National Association of Counties; American Institute of Architects; U.S. Green Building Council; International Council for Local Environmental Initiatives; Congress for the New Urbanism; states of Illinois, Minnesota, California, and New Mexico; and numerous counties and cities. Also, the 2030 Challenge is supported by the American Society of Heating, Refrigerating & Air-Conditioning Engineers. New building standards that meet the 2030 Challenge are currently being developed. To meet or exceed the 2030 Challenge for a 50% GHG reduction by 2010 would require Michigan to achieve a 30% improvement beyond the requirements of the 2006 International Energy Conservation Code (IECC).

The goal of this policy is to strengthen Michigan’s energy building codes for residential, commercial, institutional, municipal, and covered industrial construction to match those of the 2030 Challenge. To meet the initial 2030 Challenge goal of 50% GHG reduction by 2010, Michigan should adopt an energy code that requires 30% energy performance improvement beyond the requirements of the 2006 IECC. In addition, thermal envelope inspections should be mandatory for all new building construction to ensure that they are built as designed and energy efficiency performance objectives are met in the completed structures. Michigan’s current codes and standards can be used as baseline references; the baseline year for energy-saving comparisons should be 2008. Michigan should also adhere to periodic upgrades of the national standards for new residential, commercial, institutional, municipal, and industrial buildings, and review and upgrade existing state and local building codes accordingly.

RCI-5. Michigan Climate Challenge and Related Consumer Education Programs

The MCAC unanimously recommends that the state lead by example regarding education and outreach by fully implementing the Michigan Climate Challenge (MCC) as one of its key efforts in this area. Doing so would encourage Michigan businesses, institutions, local and regional governments, and the general public to make a voluntary public commitment to undertake actions to reduce GHG emissions in their communities.

The Michigan Department of Environmental Quality, working in conjunction and consultation with other state agencies, will develop and launch the MCC and include a Web-based “Online Pledge” to encourage voluntary GHG reductions throughout Michigan. The MCC will provide Web-based resources and information in the form of a “Climate Action Toolkit” for individuals and organizations to consider implementing. The toolkit will contain specific recommendations for reducing GHG emissions and identify measures that can minimize the impacts of climate change, so as to be better prepared to adapt to its effects.

Each local government official, small business owner, and citizen plays an integral part in this effort. Together, these individual actions will reduce the risks to the environment now and in the future. The MCC will provide the opportunity and resources for communities, organizations, businesses, and individuals to recognize climate change risks and commit to specific actions to reverse those changes, enabling Michigan to move forward in addressing climate change.

RCI-6. Incentives To Promote Renewable Energy Systems Implementation

By a unanimous vote, the MCAC recommends that Michigan set as a minimum target the addition of small-scale, customer-sited, renewable distributed generation (DG) consistent with its overall annual goals for renewable generation. Customer-sited DG powered by renewable energy sources provides electricity system benefits, such as avoided capital investment and avoided transmission and distribution losses, while also displacing fossil-fuel generation and thus reducing GHG emissions. Increasing the use of renewable DG in Michigan can be achieved through a combination of regulatory changes and incentives.

DG technologies exist across the spectrum of RCI facilities. Customer-sited renewable DG can include solar photovoltaic systems, wind power systems, biogas and landfill gas-fired systems, geothermal generation systems, and systems fueled by biomass wastes or biomass collected or grown as fuel. Policies to encourage and accelerate the implementation of customer-sited renewable DG can include direct incentives or requirements for power purchases, market incentives related to the pricing of electricity output by renewable DG, state goals or directives, and favorable rules for interconnecting renewable generation systems with the electricity grid. Incentives for non-electric renewable energy applications should also be included.

Supporting measures for this policy include training and certification of installers and contractors, net metering and other pricing arrangements, interconnection standards, and the creation or support of markets for biomass fuels. Through an educational campaign (see policy recommendations RCI-5 and Cross-Cutting Issues [CCI]-5), individuals and businesses can also

gain a better understanding of renewable energy options and of the requirements of the program ultimately adopted in Michigan.

The goal of this recommendation is to increase total annual electrical generation from small-scale, customer-sited distributed renewable sources in Michigan by 2% by 2025. This recommendation is designed to be accomplished in parallel with and as an addition to the 25% Renewable Portfolio Standard goal set out in policy recommendation ES-1. Total energy supply as a result of these two policies would be 27% from renewable sources.

RCI-7. Promotion and Incentives for Improved Design and Construction in the Private Sector

Revolving loan funds are proven and effective tools for promoting energy efficiency in state and local government facilities. The MCAC unanimously recommends that this tool should be utilized in the private sector as well. This recommendation would facilitate investment in energy efficiency improvements by providing zero-interest loans to local governments, which, in turn, would extend the program to private entities. Energy cost savings for private-sector participants would provide cash flow for repaying the principal, with the cost of the program for the local governments limited to interest payments and loan administration.

Incentives, such as permitting and fee advantages, tax credits, and financing incentives (e.g., “green mortgages” or property tax abatements for buildings certified to Leadership in Energy and Environmental Design standards) should be used to encourage retrofit of existing residential, commercial, institutional, municipal, and industrial buildings or the development of non-traditional, off-grid, low-carbon, and carbon-neutral energy sources. The state can work with financial institutions to develop loan tools for these programs. Eligibility for the loans would be based on the energy standards chosen. Michigan jurisdictions that have adopted enforceable standards will be eligible for managing the loans. The IECC, or alternative standard, must be enforced. This policy assumes a gradually increasing energy efficiency code for new construction, backed up by strong, consistent enforcement measures.

Encouraged by the incentives offered, the goal of this recommendation is to have all residential, commercial, institutional, municipal, and industrial buildings achieve 15% better energy efficiency than that required by the 2006 IECC by 2015 and 30% better efficiency than that required by the 2006 IECC by 2025.

RCI-8. Net Metering for Distributed Generation

By a unanimous vote, the MCAC recommends implementing aggressive net metering policies to encourage increased electric generation capacity from DG sources. Net metering enables individuals or businesses to obtain financial benefits from small electricity generators installed at their home or business location. It allows consumers to deliver any excess generation from their small generators to the utility through the standard energy meter, which runs both forward and backward during the billing period. The utility charges customer generators only for the net amount of energy they take from the utility during the period, recognizing at retail rates all the electricity the customer generators produce. There are several variations on this basic form of net metering that may be considered.

A voluntary, statewide net metering program was adopted by the MPSC in March 2005 (Case No. U-14346), but was limited to renewable energy facilities under 30-kilowatt (kW) capacity and was capped at 100 kW or 0.1% of a utility's peak load. Qualifying facilities could be sized no larger than necessary to meet the customer's needs. Several billing configurations are permitted at the option of the utility, starting with the basic net metering form, with credits for excess generation being for allowed up to one year. Any excess credits after one year go to the utility to offset program costs. All regulated investor-owned and cooperative electric utilities are participating. The federal Energy Policy Act of 2005 requires the state to consider adopting a new standard, whereby all public utilities would have to offer net metering service to their customers. The MPSC is considering whether to adopt this standard and is also considering other possible changes to the voluntary program described above.

The Michigan legislature is considering requiring a statewide program with larger size limits on the facilities and the total program cap, a mandate to use the basic net metering form, and related measures on interconnection of facilities. The goal of this recommendation is to have 392 megawatts (MW) of electric generation capacity from DG sources installed by 2015, increasing to 1,344 MW by 2025.

RCI-9. Training and Education for Building Design, Construction and Operation

The MCAC unanimously recommends that Michigan provide up-to-date building performance, code compliance, and mechanical equipment training, and develop a certification program for code officials, builders, and contractors and facility operators who successfully complete energy efficiency and related green building training programs. Such training programs should be offered to building code officials, homebuilders, commercial construction contractors, heating/ventilation/air conditioning contractors, electricians, plumbers, carpenters, remodelers, other construction trade professionals, and facility operators. Training programs should focus on: (1) proper construction and maintenance practices with building envelope and mechanical performance standards, as established in revised Michigan building energy codes (see recommendations RCI-4 and RCI-7); and (2) proper construction and maintenance practices with building envelope and mechanical performance standards, as identified in "beyond code" building programs.

Proactive education programs for building trade professionals are a necessary component for successfully improving energy-efficient construction practices. Improved construction standards resulting in energy-efficient buildings can only be accomplished if building code officials and building trade contractors, subcontractors, and facility operators are properly educated in building envelope and mechanical performance building and maintenance techniques. Properly trained building code officials, building trade professionals, and facility operators will help ensure consistent quality control and enforcement of Michigan's enhanced building codes and market-based building performance practices. Training programs are also needed to respond to periodic upgrades of national standards, as well as to changes in state and local building codes. Training should cover new RCI buildings, plus retrofits that are subject to building energy codes. The goal of this recommendation is to begin initial training under such a program in 2009.

RCI-10. Water Use and Management

By unanimous vote, the MCAC recommends that water utilities be required to track and report their energy use, and that a comprehensive study be conducted to identify and adopt potential energy efficiency improvements by water utilities. A considerable amount of energy is used to pump, treat, and deliver water across the state. However, too little is currently known about water utilities' energy use and how greater efficiency could be achieved. This recommendation aims to fill those knowledge voids and reduce energy consumption by: (1) reducing overall water use, and (2) improving the efficiency and management of the water supply and management facilities (wastewater treatment, potable water, irrigation, etc.) in the state.

The state's primary users of water are currently agricultural consumers, municipal consumers, and industrial users. Energy is necessary to pump this water from underground aquifers and open-water sources to users, and to treat it in wastewater facilities after it is used. Improved water use and handling efficiencies will reduce the amount of electricity used for water distribution, and thus reduce energy costs for users and associated GHG emissions from power plants.

Five specific recommendations are detailed in Appendix I: (1) accelerate investment in water use efficiency; (2) increase the energy efficiency of all water and wastewater treatment operations; (3) increase energy production by water and wastewater agencies from renewable sources, such as in-conduit hydropower and biogas; (4) encourage and create incentives for technologies with the capability to reduce water use associated with power generation; and (5) ensure that power plants use the best management practices and economically feasible technology available to conserve water (via siting, evaluation, permitting, or other processes).

The goal of this recommendation is to improve the average energy efficiency of water utilities in the state (in terms of kilowatt-hours used per gallon pumped) by 20% between 2010 and 2013, and to achieve a 10% overall water savings by 2025.

Chapter 6

Transportation and Land Use Sectors

Overview of Greenhouse Gas Emissions

The transportation sector, which includes light- and heavy-duty (on-road) vehicles, aircraft, rail engines, and marine engines, is one of the largest contributors of gross greenhouse gas (GHG) emissions in Michigan. This sector accounted for 24% of Michigan's gross GHG emissions in 2005, which was slightly under the national average of 27%. By 2025, the share of emissions associated with the transportation sector is anticipated to decrease slightly to 22%, primarily due to low growth in the number of vehicle miles traveled (VMT) and the more stringent fuel economy standards of the Energy Independence and Security Act.

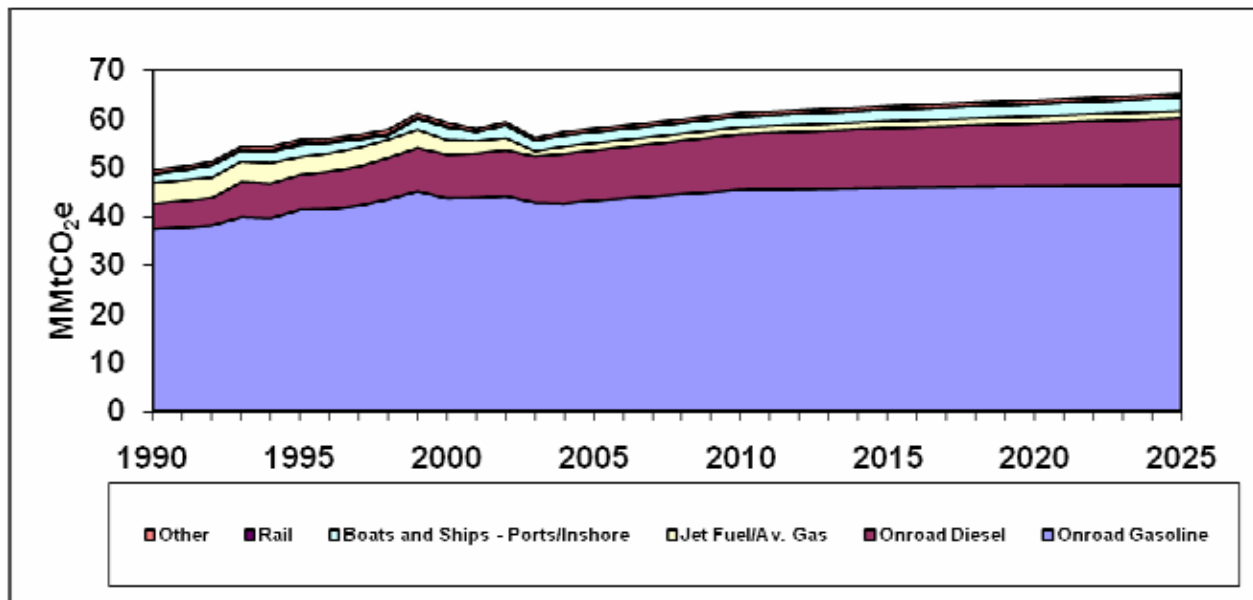
From 1990 to 2005, Michigan's GHG emissions from transportation fuel use have risen steadily at an average rate of about 1.1% annually. The GHG emissions associated with Michigan's transportation sector also rose accordingly, increasing by 8 million metric tons of carbon dioxide equivalent (MMtCO₂e) emissions during the same time period from about 50 MMtCO₂e to 58 MMtCO₂e.

Carbon dioxide (CO₂) accounts for about 98% of transportation GHG emissions, with most of the remaining transport-related GHG emissions coming from nitrous oxide (N₂O) emissions from gasoline engines. Emissions released from on-road gasoline consumption account for approximately 74% of the transportation sector's GHG emissions. This has historically been the largest share of transportation GHG emissions, and this trend is forecast to continue.

Figure 6-1 shows historic and projected transportation GHG emissions by fuel and source. As a result of an increase in total vehicle miles traveled (VMT), on-road gasoline consumption increased by about 16% between 1990 and 2005. Meanwhile, on-road diesel fuel consumption rose by 96% during that period, accounting for 18% of GHG emissions from the transportation sector in 2005, suggesting an even more rapid growth in freight movement within or across the state.

Growth in VMT is expected to be very low in Michigan, primarily due to limited economic and population growth in the future. GHG emissions from on-road gasoline consumption are projected to increase by about 7%, and GHG emissions from on-road diesel consumption are expected to increase by 34% between 2005 and 2025. The consumption of these fuels will significantly contribute to the projected 12% increase in transportation emission levels for the entire state of Michigan over 2005 levels by 2025.

Figure 6-1. Transportation GHG emissions by fuel source, 1990–2025



MMtCO₂e - million metric tons of carbon dioxide equivalent; av. gas = aviation gas.

Key Challenges and Opportunities

Michigan has substantial opportunities to reduce transportation emissions. The principal means to reduce emissions from transportation and land use (TLU) are:

- Improving vehicle operations efficiency,
- Replacing conventional gasoline and diesel with lower-emission fuels, and
- Reducing the growth of VMT.

The use of fuels with lower per-mile GHG emissions is growing in Michigan, and larger market penetration is possible. Conventional gasoline- and diesel-fired vehicles can use low-level blends of biofuels. Alternative-technology vehicles can also use higher-level blends of biofuels, as well as other types of alternative fuels, such as natural gas and hydrogen. The type of fuel used is a crucial determinant of impact on emissions, as some alternative fuels have relatively little GHG benefit. Currently, the most prevalent biofuel in Michigan is corn-based ethanol, which has minimal GHG benefit from a life-cycle perspective.¹ Key determinants of impact will be the development and deployment of fuel types. At present, fuel distribution infrastructure is a constraining factor.

Reducing the growth of VMT is crucial to mitigating GHG emissions from transportation. Developing smarter land-use and transportation development patterns that reduce trip length and support transit, ride sharing, biking, and walking can contribute substantially to this goal.

¹ Biofuels analysis was based on information from the Argonne National Laboratory's GREET model, version 1.8, which indicates a life-cycle emission reduction of 15.9% for E85 corn ethanol. See Appendix I for more details on assumed reduction factors for various types of biofuels.

Developing better planning methods and regulations, and increasing funding of multiple modes of transportation will be key components in achieving these goals.

Overview of Policy Recommendations and Estimated Impacts

The Michigan Climate Action Council (MCAC) recommends a set of 10 policies for the TLU sector that offer the potential for major economic benefits and emission savings. Implementing these policy recommendations could lead to emission reductions of:

- 10.5 MMtCO₂e per year by 2025, and
- 95.1 MMtCO₂e cumulative from 2009 through 2025.

The weighted-average cost effectiveness of the recommended policies is about $-\$36/\text{tCO}_2\text{e}$, representing a cost savings. This average value includes policies that have both much lower and much higher likely costs per ton.

The estimated impacts of the individual policies are shown in Table 6-1. The MCAC policy recommendations are described briefly here and in more detail in Appendix I of this report. The recommendations not only result in significant emission reductions, but offer a host of additional benefits as well. These benefits include reduced local air pollution; more livable, healthier communities; and economic development and job growth from in-state biofuel production. To yield the levels of savings described here, the recommended policies need to be implemented in a timely, aggressive, and thorough manner.

There are three complementary TLU policy options that serve to reduce single occupancy vehicle travel. Congestion mitigation (TLU-5) is designed to improve traffic flow and travel time via expanding the use of intelligent transportation systems. Land use planning and incentives (TLU-6) strategies include promoting and expanding regional growth management options that result in more compact, mixed-use, transit-oriented, walkable development as well as transportation system management and pricing that allows for greater investment in alternatives to the single occupancy vehicle, such as public transit. The transit and travel options of TLU-7 complement TLU-5 and TLU-6 by providing the increased public transit capacity and service improvements needed to achieve the aggressive statewide goals for increasing transit ridership as well as carpool and vanpool participation.

Two policy options recognize that Michigan can reduce GHG emissions in the transportation sector by encouraging more energy-efficient freight movement – (TLU-8) Increase Rail Capacity and Address Rail Freight System Bottlenecks, and (TLU-9) Great Lakes Shipping. These options seek to improve rail and marine infrastructure to take advantage of opportunities to move freight via the most efficient means of transport possible in the Midwest.

TLU-1 focuses on further developing biofuels and expanding the biofuels market can significantly reduce GHG emissions, while boosting the state's economy.

Table 6-1. Summary list of MCAC Transportation and Land Use (TLU) policy recommendations

Policy No.	Policy Option	GHG Reductions (MMtCO ₂ e)			Net Present Value 2009–2025 (Million \$)	Cost-Effectiveness (\$/tCO ₂ e)	Level of Support
		2015	2025	Total 2009–2025			
TLU-1	Promote Low-Carbon Fuel Use in Transportation	2.6	5.9	53	\$820	\$16	Unanimous
TLU-2	Eco-Driver Program	1.1	2.2	22	–\$3,921	–\$176	Unanimous
TLU-3	Truck Idling Policies	0.36	0.76	7.0	–\$596	–\$85	Unanimous
TLU-4	Advanced Vehicle Technology	0.01	0.03	0.19	\$281	\$1,458	Unanimous
TLU-5	Congestion Mitigation	0.08	0.18	1.7	–\$135	–\$81	Unanimous
TLU-6	Land Use Planning and Incentives	0.14	0.43	3.2	–\$598	–\$189	Unanimous
TLU-7	Transit and Travel Options	0.13	0.54	3.5	\$655	\$185	Unanimous
TLU-8	Increase Rail Capacity, and Address Rail Freight System Bottlenecks	0.10	0.19	2.0	\$69	\$35	Unanimous
TLU-9	Great Lakes Shipping	0.24	0.27	2.5	NQ	NQ	Unanimous
	Sector Totals	4.76	10.5	95.1	–\$3,425	–\$36	N/A
	Sector Total After Adjusting for Overlaps	4.76	10.5	95.1	–\$3,425	–\$36	N/A
	Reductions From Recent Actions	0	0	0	\$0	\$0	N/A
	Sector Total Plus Recent Actions	4.76	10.5	95.1	–\$3,425	–\$36	N/A

GHG = greenhouse gas; MMtCO₂e = million metric tons of carbon dioxide equivalent; \$/tCO₂e = dollars per metric ton of carbon dioxide equivalent; NQ = not quantified.

Note: Negative numbers indicate cost savings.

Michigan can achieve greater alternative fuel use through a combination of research and development, as well as through implementing voluntary and mandatory measures. Promoting Low-Carbon Fuel Use in Transportation (TLU-1) can help make biofuels more efficient and more available, while at the same time providing an economic benefit to the Michigan economy by promoting in-state development and production of these fuels.

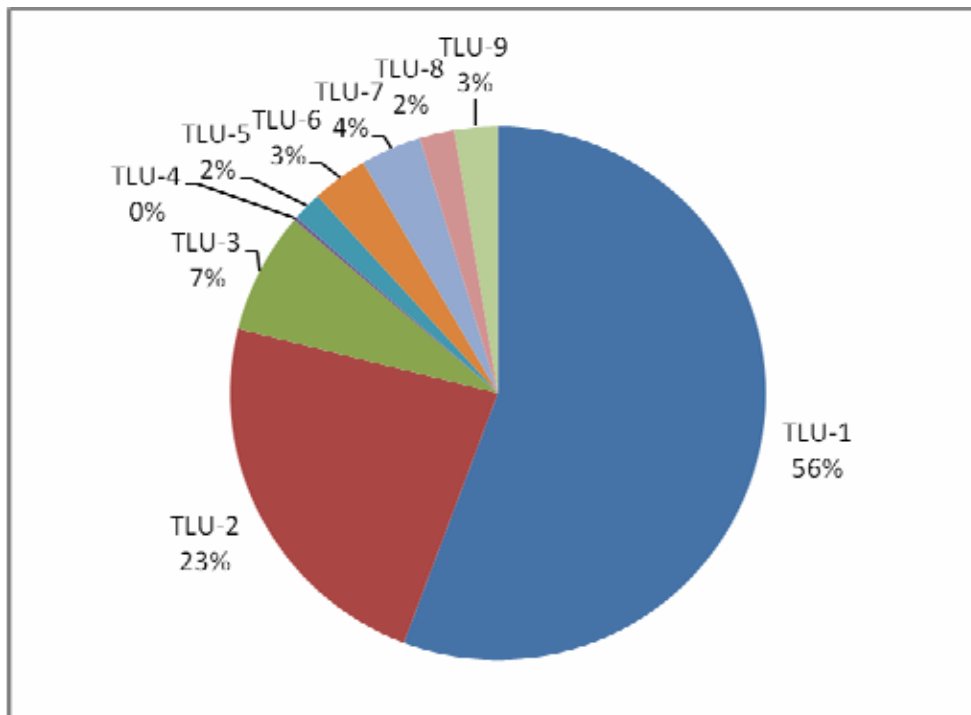
Public education, towards more efficient driving practices in TLU-2 (Eco-Driver Program), works in conjunction with a number of the other recommended policies. Educating citizens on how they can minimize their impact, operate their vehicle more efficiently, and cut their GHG emissions can be a key to the success of many of these policies. Reducing truck idling (TLU-3) can also serve to reduce the GHG impact of transportation without any change in VMT.

The advanced vehicle technology option (TLU-4) seeks to achieve per vehicle GHG emission benefits beyond those expected to be achieved via the new CAFÉ standards, by providing incentives for public fleet owners to purchase advanced technology vehicles. This policy could serve to strengthen Michigan as a leader of automotive research, which would have benefits

across the state. In addition, progress on advanced vehicle technology can have benefits beyond Michigan for energy security, economic growth and environmental quality.

Figure 6-2 shows the breakdown of the projected impacts of the recommended TLU policies, taken together, in terms of avoided GHG emissions. For the TLU policies recommended by the MCAC to yield the levels of savings described here, the policies must be implemented in a timely, aggressive, and thorough manner. This means, for example, not only putting the policies themselves in place, but also attending to the development of supporting policies that are needed to help make the recommended policies effective. While adoption of the recommended policies can result in considerable benefits to Michigan's environment and consumers, careful, comprehensive, and detailed planning and implementation, as well as consistent support of these policies will be required if these benefits are to be achieved.

Figure 6-2. Aggregate GHG emission reductions from all MCAC Transportation and Land Use (TLU) recommendations, 2009–2025



Transportation and Land Use Sectors Policy Descriptions

The policy recommendations summarized here not only result in significant emission reductions and cost savings but also offer a host of additional benefits, such as reduced local air pollution; more livable, healthier communities; and increased transportation choices.

TLU-1. Promote Low-Carbon Fuel Use in Transportation

This policy recommendation promotes low-carbon transportation fuels through a package of incentives, education, and standards, including recommendations by the Michigan Renewable Fuels Commission (RFC). The goal is to reduce the average “carbon intensity” of on-road transportation fuels sold within the state to achieve a 5% reduction of GHG emissions on a life cycle carbon dioxide basis by 2015 and 10% reduction by 2025. The policy follows the June 2007 report of the Michigan RFC that recommended a variety of actions to stimulate the production and use of renewable, low-carbon fuels within the state. These include: (1) a low-carbon fuels program to encourage federal policy in this area and consider establishing a state policy; (2) establish a next-generation renewable fuels feedstock program with a goal of achieving 10% use of renewable fuels by 2012 and 25% by 2025; and (3) create a green retailers program with tax incentives for E85 and biodiesel sales that rewards retail and wholesale outlets that attain benchmarks in the sale of biofuels.

TLU-2. Eco-Driver Program

Because driving behavior can significantly influence a vehicle’s fuel economy performance, this policy would establish an eco-driving program. This program would incorporate a wide range of initiatives that can help drivers maximize the fuel efficiency from their existing vehicles by better understanding the direct impact that driving style, driving patterns, vehicle technologies, and vehicle maintenance (such as proper tire inflation) have on a vehicle’s fuel economy. The primary focus of an eco-driving campaign would target light-duty vehicles, where driver education on eco-driving principles would have the greatest benefit. An integrated eco-driving program in Michigan would be designed to achieve a fuel-economy increase of at least 10% in the mid-term and up to 20% in the long-term.

A properly designed eco-driving program must move beyond a list of driver “tips” and focus on providing the appropriate tools and programs to systematically change driver behavior. Key eco-driving principles would cover: driving style, starting and idling, trip planning, vehicle drag/weight, proper maintenance and vehicle technology applications. The eco-driving program would include program initiatives on direct driver training, general eco-driving education, vehicle maintenance, and vehicle applications such as real-time fuel economy indicators. The program would also consider a low-rolling-resistance tire initiative, options to have currently licensed drivers to undergo additional driver training and options to incorporate direct eco-driver training in the process of commercial truck licensing.

TLU-3. Truck Idling Policies

This policy option aims to reduce GHG and other emissions from unnecessary idling of heavy-duty vehicles, including trucks and buses. Much of this idling takes place during mandatory rest periods to provide heating or cooling of the truck's cabin air. Additional idling occurs during vehicle operation, for example, when loading and unloading buses and trucks. The implementation of public and private fleet anti-idling policies and ordinances, targeted education of bus and truck operators, and creation of low-cost means to access available EPA-verified technologies will help encourage emissions reductions from heavy-duty diesel engines.

Heavy-duty engine idling can be reduced by (1) providing increased availability of electrification at privately owned truck stops or encouraging greater use of auxiliary power units (APUs; on-board generators) for heating, cooling, and other creature comforts on heavy-duty vehicles, (2) providing financial assistance (e.g., low-interest revolving loans) to truck-stop operators and truck owners/operators for infrastructure development or equipment purchase and (3) providing targeted educational activities as appropriate with truck, bus, and truck-stop owners and operators.

This policy has a goal of achieving diesel idling reductions from heavy-duty diesel engines of 40% by 2015 and 80% by 2025. It would also promote the adoption of a Michigan anti-idling law based on the EPA Model State Idling Law and/or encourage adoption of local ordinances to address idling during operation of buses and heavy trucks.

TLU-4. Advanced Vehicle Technology

This recommendation calls for the creation of a policy that will expand the development and use of more efficient vehicle design and/or hybrid propulsion systems. The goal is to make loans and subsidies available to municipalities, local governments, and waste management organizations to encourage more rapid adoption of advanced vehicles by public fleets (transit agencies and schools) to achieve the use of advanced vehicle technologies (hybrid or hydrogen technology) in 10% of the fleet by 2025.

This policy could serve to reestablish Detroit as a leader of automotive research, which would have benefits across the State. In addition, progress on advanced vehicle technology can have benefits for beyond the borders of Michigan in terms of energy security, economic growth, and environmental quality.

TLU-5. Congestion Mitigation

The goal of this policy recommendation is to improve traffic flow and travel time through expanding the use of intelligent transportation systems (ITS). In conjunction with expanding ITS, the following actions should also be considered: identifying and improving key bottlenecks, constructing modern roundabouts at appropriate intersections, and continuing the use of the MDOT courtesy patrol on congested roadways. A 4-day workweek and flex-time should be

encouraged to reduce congestion. All of these elements contribute to reducing travel delay for both recurring and nonrecurring congestion.

Promoting the development of intermodal freight terminals will facilitate freight shipment on rail and air thus reducing the volume of freight on Michigan roadways. By supporting these efforts, the congestion mitigation policy option will allow for more efficient travel and increased economic output.

The goals for this policy are to reduce travel time delay from recurring and nonrecurring congestion in Michigan's major urban areas (Metro Detroit and Grand Rapids) by 10% by 2025 and to reduce travel time related to nonrecurring congestion (i.e., road construction) by continuing to implement and refine the Michigan Work Zone Safety and Mobility Policy.

TLU-6. Land Use Planning and Incentives

State policies and programs need to be implemented that encourage local and regional planning and development strategies in order to reduce the projected growth of VMT and corresponding GHG emissions. The state will enable each region to adopt a unique mixture of policies to reach reduction goals in its own manner. Strategies include promoting and expanding regional growth management options that result in more compact mixed-use, transit-oriented, walkable development; transportation system management and pricing that allows for greater investment in alternatives to the single-occupancy vehicle, such as public transit; and use of other land-use-related economic development tools as recommended in the Michigan Land Use Leadership Council's Report (2003).

The goals are (1) to reduce low density development and the conversion of greenfield open land to development 25% by 2015, 50% by 2025, and 80% by 2050; (2) to encourage communities to utilize an "infill" approach for both new and redevelopment projects by focusing on areas where infrastructure already exists; and (3) to work to ensure that at least 60% of new/future statewide growth utilizes more compact development or transit-oriented development design.

These goals can be accomplished through: (1) multi-jurisdictional land use planning and zoning policies, tax base sharing, and providing state and local incentives; (2) market-based approaches in future land development and housing policies that focus investments toward achieving higher density, transit-oriented, and compact or mixed-use development; (3) integrated transportation policies, investments, system management, and pricing; and (4) enactment of a new Statewide Comprehensive Planning Law.

TLU-7. Transit and Travel Options

This policy recommendation focuses on reducing the number of single-occupant vehicle trips and improving the efficiency of daily travel by: (1) creating, enhancing, and promoting public transit options such as commuter rail, light rail, streetcars, and bus rapid transit; (2) enhancing transit service through route expansion, increased service frequency, longer service hours, and/or better system coordination; and (3) facilitating increased carpooling, vanpooling, biking, and walking. These actions will reduce GHG emissions by decreasing VMT, thus reducing fuel

consumption. The first goal is to double transit ridership by 2015 and double it again by 2025 (for longer line-haul systems). The second goal is to double the number of carpool and vanpool participants by 2015 and double again by 2025.

A number of actions are included to help achieve the goals, including amending the Michigan Constitution to provide a broader range of funding mechanisms for public transit, building additional park-and-ride lots, provide incentives for transit-oriented development, incorporate bike lanes into roadway construction/reconstruction, encourage/require sidewalks in new developments and encourage their addition in areas where they are now absent, implement metropolitan transit plans, pursue implementation of inter-city transit service where it is cost-effective and undertake a public education campaign to effectively communicate the benefits of public transit to people who are not current users.

TLU-8. Increase Rail Capacity and Address Rail Freight System Bottlenecks

This policy encourages more energy efficient freight movement via railroads, where it is practical to do so. Making or facilitating transportation infrastructure improvements that increase rail capacity, support connectivity, and reduce rail freight system bottlenecks will help accomplish this shift. For short hauls, truck freight is, and will likely continue to be, the mode of choice; intermodal rail freight tends to be most effective for trips of 700-800 miles or longer. This policy will reduce transportation sector GHG emissions from freight movement by making system improvements with the goal of increasing the tonnage of rail freight traveling to, through and from Michigan an additional 50% by 2020.

Freight tonnage for shipments to, through, and from Michigan is expected to increase on all freight modes, but by far the majority of this increase is anticipated to be truck freight. Increasing the projected tonnage of rail freight an additional 50% by 2020 potentially shifts million of tons of cargo that would otherwise travel by truck. It is important to recognize that shipping decisions are made by the private sector, and are not under the control of government. Investment to encourage greater use of rail lines and intermodal shipping must be made with that reality in mind. A variety of approaches are suggested to accomplish this, including construction of intermodal terminals, preserving existing service and preserving right-of-ways for future new service.

TLU-9. Great Lakes Shipping

This policy recommendation promotes the use of marine transportation as the most energy-efficient form of surface transportation to move cargo over long distances (150 miles or more). While Great Lakes shipping decisions and services are private sector responsibilities, the public sector has a role in providing navigation channels and related infrastructure. Actions include maintaining the existing marine infrastructure, maintaining federal navigation channels to their congressionally authorized depths, improving the marine infrastructure by deepening commercial navigation channels at selected commercial ports, encouraging the development or expansion of “short sea shipping” (also known as “marine highway”) within the Great Lakes, as well as considering the use of ferry boats to move people and cars and consider a biodiesel program at Michigan ports if it is feasible to burn this fuel in marine diesel engines. The focus of this policy

is on increasing shipping within the Great Lakes – not on increasing traffic through the St. Lawrence Seaway.

Chapter 7

Agriculture, Forestry, and Waste Management Sectors

Overview of GHG Emissions

The agriculture, forestry, and waste management (AFW) sectors are responsible for moderately low amounts of Michigan's current greenhouse gas (GHG) emissions. The total AFW contribution to carbon dioxide equivalent (CO₂e) gross emissions in 2005 was 14 million metric tons (MMt), or about 6% of the state's total. It is important to note that the AFW sector emissions exclude combustion-related GHGs, such as diesel fuel consumption in the agriculture sector. These fuel combustion emissions are included as part of the industrial fuel combustion sector (and covered in the Residential, Commercial, and Industrial Sectors chapter). The AFW contribution to net emissions in 2005 was less than 1% of the state's total after accounting for the net sequestration of carbon in the forestry sector.

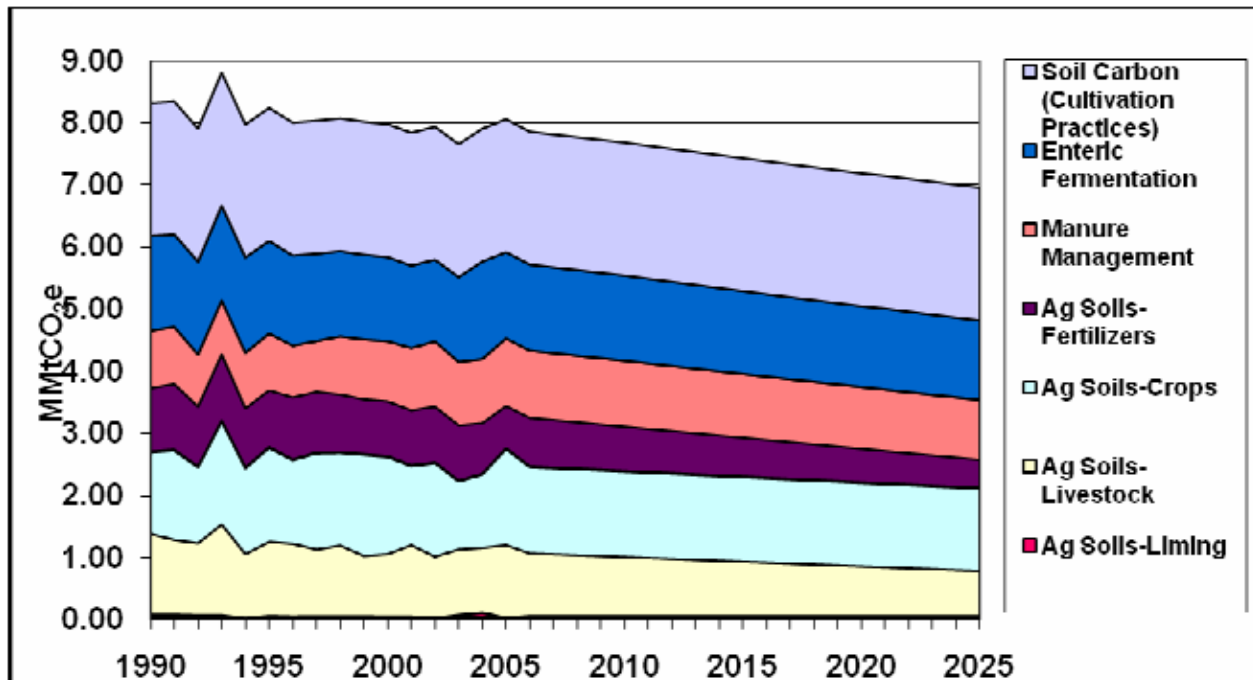
Agricultural emissions include methane (CH₄) and nitrous oxide (N₂O) emissions from enteric (intestinal) fermentation, manure management, agriculture soils, and agriculture residue burning. As shown in Figure 7-1, emissions from soil carbon losses from agricultural soils, livestock soils, manure management, enteric fermentation, and fertilizer application all make significant contributions to the sector totals. Emissions include CO₂ emissions from oxidized soil carbon, application of urea, and application of lime. Sector emissions also include (N₂O emissions resulting from activities that increase nitrogen in the soil, including fertilizer (synthetic and livestock manure) application, production of nitrogen-fixing crops (legumes), and agricultural burning activity.

Note that, in keeping with U.S. Environmental Protection Agency (EPA) methods and international reporting conventions, the Michigan inventory and forecast covers sources of GHGs from human activities. There could be some natural sources of GHGs that are not represented in the inventory and forecast; however these are not addressed in the Michigan Climate Action Council (MCAC) process. In the forestry sector, since all of the state's forests are managed in some way, all emissions are treated as "anthropogenic," or from human activities. GHG reporting conventions treat all managed forests as anthropogenic sources. Sources, such as CO₂ from forest fires and decomposing biomass, are captured within the inventory and forecast (as part of the carbon stock modeling performed by the U.S. Forest Service [USFS]). However, CH₄ emissions from decomposition of organic matter/biomass in forests are not currently captured due to a lack of data. This methane is from decomposition in oxygen-free (anaerobic) areas, particularly marshes and bogs.

The CO₂ emissions occurring from the cultivation of organic soils are a large contributor to the state's total agricultural GHG emissions. By 2025, the contribution from this source is estimated to be about 30% of the total agriculture emissions. The next-highest contributor in 2025 is estimated to be agricultural soils from crop production, at about 19% (including N₂O from decomposition of crop residue). Methane emissions from digestive processes in ruminant animals, known as enteric fermentation, are declining slightly due to lower animal populations; however, they are estimated to be the third-highest contributor to agriculture sector totals in 2025, also at around 19%.

Forestry and land use emissions refer to the net CO₂ flux¹ from forested lands in Michigan, which account for about 53% of the state's land area. The inventory is divided into two primary subsectors: the forested landscape and urban forestry and land use. Both subsectors capture net carbon sequestered in forest biomass, urban trees, landfills, and harvested wood products. In addition, other GHG sources, such as N₂O emissions from fertilizer application in urban areas and CH₄ and N₂O emissions from prescribed burns and wildfires, are included.

Figure 7-1. Historical and projected gross GHG emissions from the agriculture sector, Michigan, 1990–2025



MMtCO₂e = million metric tons Of carbon dioxide equivalent.

As shown in Table 7-1, USFS data suggest that Michigan's forests sequestered about 12.7 MMtCO₂e per year in 2005 (this excludes estimates of carbon flux from forest soils based on recommendations from the USFS). The negative numbers in Table 7-1 indicate a CO₂ sink rather than a source. Even after accounting for the GHG sources from urban soils and prescribed burns/wildfires, the forestry and land use sectors are still estimated to have been a net GHG sink. Hence, during this period, forest carbon losses due to forest conversion, wildfire, and disease were estimated to be smaller than the CO₂ sequestered in forest carbon pools, such as live trees, debris on the forest floor, and forest soils, as well as in harvested wood products (e.g., furniture and lumber) and the disposal into landfills of forest products. The forecast for the sector out to 2025 remains a net sequestration of –12.7 MMtCO₂e.

¹ "Flux" refers to both emissions of CO₂ to the atmosphere and removal (sinks) of CO₂ from the atmosphere stored in plant tissue or soils.

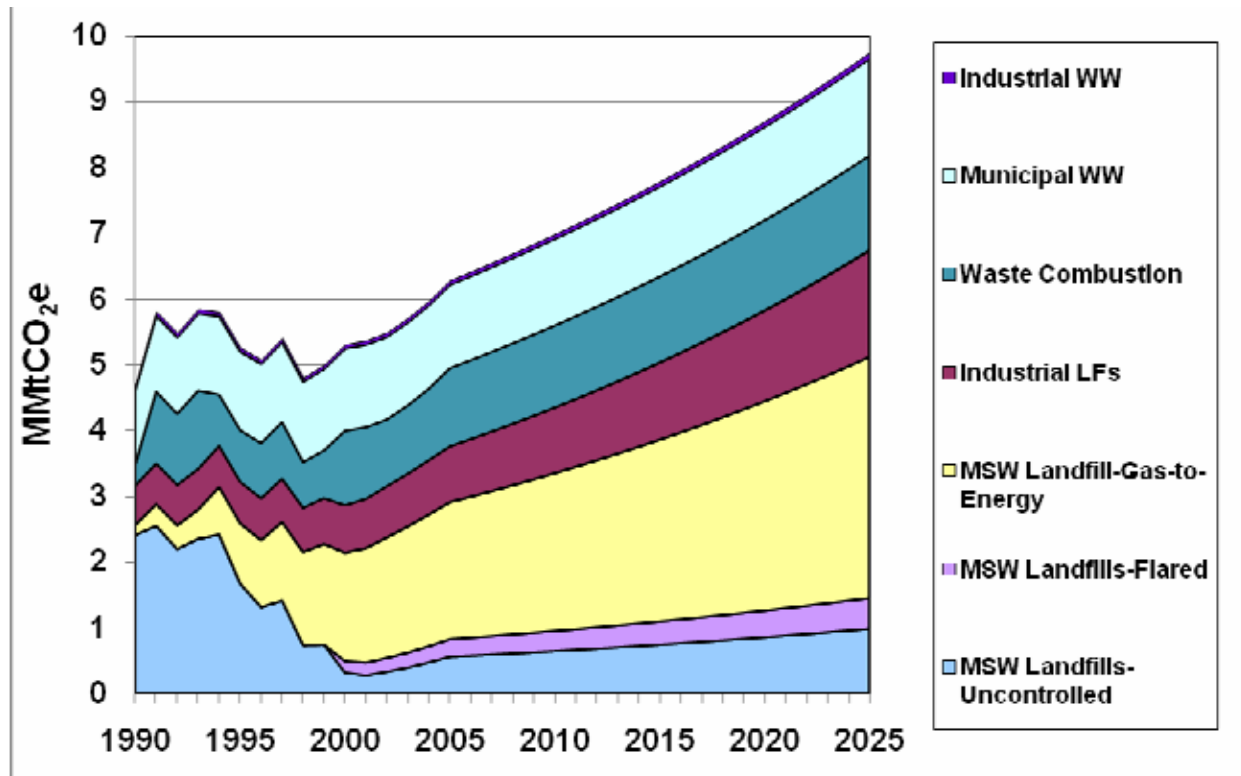
Table 7-1. Forestry and land use flux and reference case projections (MMtCO₂e)

Sector	1990	2000	2005	2010	2020	2025
Forested Landscape (excluding soil carbon)	-27.8	-8.77	-8.77	-8.77	-8.77	-8.77
Urban Forestry and Land Use	-10.1	-3.69	-3.91	-3.91	-3.91	-3.91
Forest Wildfires	0.02	0.02	0.02	0.02	0.02	0.02
Sector Total	-37.9	-12.4	-12.7	-12.7	-12.7	-12.7

Note: Positive numbers indicate net emission. Based on USFS input, emissions from soil organic carbon are left out of the forestry sector summary due to a high level of uncertainty.

Figure 7-2 shows estimated historical and projected emissions from the management and treatment of solid waste and wastewater. Emissions from waste management consist largely of CH₄ emitted from landfills, while emissions from wastewater treatment include both CH₄ and N₂O. Emissions are also included for municipal solid waste (MSW) combustion. Overall, the waste management sector accounted for about 3% of Michigan's total gross emissions in 2005. While emissions are expected to grow significantly by 2025, the contribution to the state's total is expected to remain at about 3%.

Figure 7-2. Estimated historical and projected GHG emissions from waste and wastewater management in Michigan, 1990–2025



MMtCO₂e = million metric tons of carbon dioxide equivalent; MSW = Municipal Solid Waste; LFs = landfills; WW = wastewater.

Key Challenges and Opportunities

Michigan has substantial opportunities to reduce emissions in the AFW sectors. The principal means to reduce emissions in these areas are:

- Improving methods for managing municipal solid waste,
- Adopting management practices to increase carbon sequestration in both forestlands and urban canopies,
- Improving production and utilization of biomass for use in both solid fuel and liquid fuel applications, and
- Promoting farming practices that result in GHG savings.

Opportunities for GHG mitigation in the AFW sectors involve measures that can reduce emissions within these sectors or reduce emissions in other sectors. Within these sectors, changes in crop cultivation can reduce GHG emissions by building soil carbon (indirectly sequestering carbon from the atmosphere) or through more efficient nutrient application (reducing N₂O emissions and embedded GHG emissions within those nutrients). The implementation of improved farming and harvesting techniques, as well as utilization of biomass for bio-based products, has the potential to reduce future emissions relative to current emissions from this sector and other sectors.

Enhanced management of the state's forests can lead to higher levels of carbon sequestration. These enhancements can be achieved through afforestation projects and enhanced stocking in existing forests. Conversion of land to development results in a loss of current and future carbon sequestration potential. Slowing or stemming conversion rates provides opportunities for carbon sequestration. In the waste management sector, waste reduction measures and landfill gas capture and utilization can reduce landfill CH₄ emissions.

Actions taken within the AFW sectors can also lead to GHG reductions outside the sectors: the establishment of short-rotation woody crops (for example, on marginal agricultural lands) for producing biomass energy feedstocks can replace fossil fuel consumption, including transportation fuels and fuels used to produce electricity or steam in the energy supply (ES) sector. Similarly, actions that promote solid waste reduction, recycling, or use of waste sources for energy or bio-based products can reduce emissions within the sector (future landfill CH₄ as noted above), as well as emissions associated with the production of products and packaging (recycled products often require less energy to produce than similar products from virgin materials). Finally, urban forestry projects can reduce energy consumption within buildings through shading and wind protection.

Overview of Policy Recommendations and Estimated Impacts

The MCAC recommends a set of 10 policies for the AFW sector that offer the potential for major economic benefits and emission savings. Implementing these policy recommendations could lead to emission reductions of:

- 17 MMtCO₂e per year by 2025, and

- 147 MMtCO₂e cumulative from 2009 through 2025, after adjusting for overlaps with other sectors.

The weighted-average cost-effectiveness of the recommended policies is about $-\$11/\text{tCO}_2\text{e}$, representing a cost savings. This average value includes policies that have both much lower and much higher likely costs per ton.

The 10 policy recommendations for the AFW sectors address a diverse array of activities capturing emission reductions both within and outside of these sectors (e.g., energy consumption in the ES and Transportation and Land Use [TLU] sectors). The estimated impacts of the individual policies are shown in Table 7-2. The MCAC policy recommendations are described briefly here and in more detail in Appendix J of this report. The recommendations not only result in significant emission reductions, but also offer a host of additional benefits, including protection of biodiversity, reduced local air pollution, and economic development and job growth. To yield the levels of savings described here, the recommended policies need to be implemented in a timely, aggressive, and thorough manner.

The following are primary opportunities for GHG mitigation identified by the MCAC:

- **Agricultural crop production:** Programs can be implemented with growers to utilize cultivation practices that build soil carbon and reduce nutrient consumption. By building soil carbon, CO₂ is indirectly sequestered from the atmosphere. New technologies in the area of precision agriculture offer opportunities to reduce nutrient application and fossil fuel consumption. Promotion of local food production could reduce the transportation miles and fossil fuel use associated with importing food products from other areas.
- **Production of liquid biofuels:** Production of renewable fuels, such as ethanol from crop residue, forestry biomass, or municipal solid waste and biodiesel from waste vegetable oils, can produce significant reductions when they are used to offset consumption of fossil fuels (e.g., gasoline and diesel in transportation and other combustion sources). This is particularly true when these fuels are produced using processes and/or feedstocks that have much lower fossil fuel inputs than those from conventional sources (sometimes referred to as “advanced” or “next generation” biofuels). The goals to produce more biofuels in-state are linked to the recommendations under TLU-1, Promote Low Carbon Fuel Use in Transportation. The costs and benefits of liquid biofuels production are combined with the TLU policy on biofuels consumption and presented with the results for that sector.
- **Expanded use of forest, agricultural, and MSW biomass:** Expanded use of renewable energy and bio-based products from biomass removed from forests, crop residues, lawn and garden waste, or MSW can achieve GHG benefits by offsetting fossil fuel consumption (to produce either electricity or heat/steam) and replacing fossil-based products. Programs to expand sustainably produced biomass fuel production will most likely be needed to supply a portion of the fuel mix for the renewable energy goals of policy recommendation ES-1, Renewable Portfolio Standard.
- **Enhancement/protection of forest carbon sinks:** Through a variety of programs, enhanced levels of CO₂ sequestration can be achieved and carbon can be stored in the state’s forest

biomass. These include afforestation² projects, reforestation programs (restocking of poorly stocked forests), urban tree programs, and wildfire risk reduction. Programs aimed at reducing the conversion of forested lands to non-forest cover will also be important to retain what is currently a net forest CO₂ sink in Michigan.

- **Changes in MSW management practices:** By promoting source reduction, advanced MSW recycling practices, improved organics management, and increased collection and utilization of landfill methane, the GHG emissions associated with collecting, transporting, and managing MSW can be reduced. The emissions reduced in this sector would come primarily from waste management but may also provide a reduction in the fossil fuel used to transport waste. When the life-cycle GHG reductions of source reduction/recycling/organics management are considered, the results are substantial: over 35 MMtCO₂e/yr could be reduced by 2025.

Table 7-2. Summary list of AFW policy recommendations

Policy No.	Policy Recommendation		GHG Reductions (MMtCO ₂ e)			Net Present Value 2009–2025 (Million 2005\$)	Cost-Effective-ness (\$/tCO ₂ e)	Level of Support
			2015	2025	Total 2009–2025			
AFW-1	Expanded Use of Biomass Feedstocks for Electricity, Heat, or Steam Production		3.3	10	79	\$1,649	\$21	Unanimous
AFW-2*	In-State Liquid Biofuels Production		<i>Included in the Results of TLU-1</i>					Unanimous
AFW-3	Methane Capture and Utilization From Manure and Other Biological Waste		0.09	0.14	1.5	\$4.7	\$3	Unanimous
AFW-4	Expanded Use of Bio-based Materials	A. Use of Bio-based Products	.08	.21	1.7	–\$108	–\$62	Unanimous
		B. Utilization of Solid Wood Residues	NQ					Unanimous
AFW-5	Land Use Management That Promotes Permanent Cover	A. Increase in Permanent Cover Area	0.08	0.21	1.8	\$63	\$34	Unanimous
		B. Retention of Lands in Conservation Programs [†]	0.05	0.11	1.1	\$24	\$23	Unanimous
		C. Retention/Enhancement of Wetlands	<i>Not Quantified</i>					Unanimous
AFW-6	Forestry and Agricultural Land Protection	A. Agricultural Land Protection	0.46	1.1	10	\$864	\$85	Unanimous
		B. Forested Land Protection	<i>Not Quantified</i>					Unanimous
		C. Peatlands/Wetlands Protection	<i>Not Quantified</i>					Unanimous

² Afforestation refers to the establishment of forest on lands that have not historically been under forest cover.

Policy No.	Policy Recommendation		GHG Reductions (MMtCO ₂ e)			Net Present Value 2009–2025 (Million 2005\$)	Cost-Effectiveness (\$/tCO ₂ e)	Level of Support
			2015	2025	Total 2009–2025			
AFW-7**	Promotion of Farming Practices That Achieve GHG Benefits	A. Soil Carbon Management	0.7	1.7	15	–\$200	–\$13	Unanimous
		B. Nutrient Efficiency	0.05	0.12	1.1	–\$27	–\$26	Unanimous
		C. Energy Efficiency	0.13	0.32	2.9	–\$102	–\$35	Unanimous
		D. Local Food	Not Quantified					Unanimous
AFW-8	Forest Management for Carbon Sequestration and Biodiversity	A. Enhanced Forestland Management	0.53	1.42	12.05	\$800	\$66	Unanimous
		B. Urban Forest Canopy	1.2	2.9	26	–\$346	–\$13	Unanimous
		C. Reduce Wildfire	Not Quantified					Unanimous
AFW-9**	Source Reduction, Advanced Recycling, and Organics Management							Unanimous
	In-State GHG Reductions		1.4	3.0	28	–\$3,136	–\$112	
	Full Life-Cycle Reductions		14.5	35.3	314	–\$3,136	–\$10	
AFW-10	Landfill Methane Energy Programs		0.91	2.7	22	–\$35	–\$2	Unanimous
	Sector Totals[†]		9	23	201	–\$548	–\$3	
	Sector Total After Adjusting for Overlaps^{††}		6	17	147	–\$1,634	–\$11	
	Reductions From Recent Actions		N/A	N/A	N/A	N/A	N/A	
	Sector Total Plus Recent Actions		6	17	147	–\$1,634	–\$11	

GHG = greenhouse gas; MMtCO₂e = million metric tons of carbon dioxide equivalent; \$/tCO₂e = dollars per metric ton of carbon dioxide equivalent; TBD = to be determined; N/A = not applicable

Note that negative costs represent a monetary savings.

* The quantification results for AFW-2 (biofuel production volumes and costs) were used as inputs to the quantification of the results of TLU-1, which covers consumption of biofuels in Michigan.

** The analyses for AFW-5, AFW-7, and AFW-9 include the full life-cycle costs of the policies. In the case of AFW-9, it is estimated that a significant fraction of the reductions will occur out of state. In-state reductions refer only to those occurring from reduced landfilling and waste combustion (these are broken out separately in the table above).

[†] The reductions from AFW 5B (Retention of Lands in Conservation Programs) have been left out of the sector totals, since they relate to a soil carbon protection measure where the estimated emissions (from conservation acres being returned to active cultivation) are not included in the business as usual (BAU) inventory and forecast (I&F). The costs have been included in the sector totals, since these will be incurred in order to retain the level of emissions in the BAU I&F. For AFW-5, AFW-7, and AFW-9, these include the reductions that are expected to occur within the state.

^{††} See below for discussion of overlap adjustments.

Overlap Discussion

The amount of GHG emissions reduced or sequestered and the costs of a policy recommendation within the AFW sectors in some cases overlap with other AFW policies or policies in other sectors. For the MCAC recommendations, overlap occurs between AFW-9 and AFW-10 in the waste management sector. One of the policy elements of AFW-9 covers enhanced management of organic wastes in the MSW sector. To the extent that these wastes are being diverted from landfills to other waste management facilities (e.g., composting facilities), less organic waste is available to generate landfill methane. This effect has been accounted for in the quantification of AFW-10; hence, the values shown for AFW-10 above assume successful implementation of AFW-9.

Overlap also occurs with some of the quantified benefits and costs of policy recommendations within other sectors. Every effort has been made to determine where those overlaps occur and to eliminate double counting. As displayed in the table above, the AFW sector totals have been adjusted accordingly, as follows:

- AFW-1 outlines how biomass may be utilized for energy production. The ES Technical Work Group (TWG) also quantified the use of biomass for energy production (specifically ES-1 and ES-10). AFW-1 utilizes a greater amount of biomass than the ES policies post-2011. The biomass demand requirements for ES (in millions of British thermal units) and the GHG reductions and costs associated with its use were removed from the AFW sector totals in the table above, as these were considered to be accounted for under the ES analyses.
- AFW-2 outlines how biofuels could be produced in-state to offset GHG emissions from fossil-based fuels (primarily in the transportation sector). The TLU TWG also quantified the benefits and costs of increased use of biofuels in TLU-1. To avoid double counting, the goals of biofuel production in AFW-2 and biofuel consumption in TLU-1 were aligned, and then the estimated AFW-2 biofuel production volumes and costs were used as input to the analysis of biofuel consumption under TLU-1. Hence, the benefits and costs of AFW-2 are captured in the overall results of TLU-1. To avoid confusion, those results are left out of the summary table above. The quantification of production volumes and costs is still included in the AFW-2 documentation shown in Appendix J.

Agriculture, Forestry, and Waste Management Sector Policy Descriptions

The AFW sectors include emission mitigation opportunities related to the use of biomass energy, protection and enhancement of forest and agricultural carbon sinks, control of agricultural N₂O emissions, production of renewable liquid fuels, afforestation and forest management, and lower municipal solid waste management emissions.

AFW-1. Expanded Use of Biomass Feedstocks for Electricity, Heat, or Steam Production

This policy dedicates a sustainable quantity of biomass from agricultural crop residue, wood industry process residues, unused forestry residues, and MSW biomass resources for efficient conversion to energy and economical production of heat, steam, or electricity. This biomass should be used in an environmentally acceptable and sustainable manner, considering proper facility siting and feedstock use, including co-location of production facilities with heat- and steam-utilizing facilities. The objective is to create concurrent reduction of CO₂ due to displacement of fossil fuels, considering life-cycle GHG emissions associated with viable collection, hauling, and energy conversion and distribution systems. This policy includes a recommendation for a complete inventory of the state's biomass resources. The primary goal of this policy is to produce 10% of total in-state electric generation from sustainable biomass feedstock by 2025.

AFW-2. In-State Liquid Biofuels Production

This recommendation promotes sustainable in-state production and consumption of transportation biofuels from agriculture, forestry, and MSW feedstocks to displace the use of gasoline and diesel. This recommendation also promotes the in-state development of feedstocks, such as cellulosic material, and production facilities to produce either liquid or gaseous biofuels with low carbon content. As with AFW-1, production of biomass for biofuel production must be done in a sustainable manner. Adoption of biofuel production must be done in a way that maintains the sustainability of feedstock, food, and other commodity supplies and natural resources. Upon successful implementation of this policy, Michigan consumption of biofuels produced in-state will result in better GHG benefits than these same fuels obtained from a national or international market due to lower embedded CO₂ (resulting from out-of-state fuels produced using feedstocks/production methods with lower GHG benefits, and from transportation of biodiesel, ethanol, other fuels, or their feedstocks from distant sources). Successful implementation of AFW-1 and AFW-2 will also lead to higher levels of in-state energy expenditures remaining in Michigan.

AFW-3. Methane Capture and Utilization From Manure and Other Biological Waste

This policy seeks to reduce the amount of methane emissions and recapture energy from organic waste materials from livestock, agricultural residues, and solid waste through the promotion of anaerobic digestion, gasification, and other similar technologies. Co-mingling of organic wastes with manure can substantially increase biogas production, while providing a sustainable method for treatment and disposal. In addition, co-products may be created by these technologies, such as stable fertilizer products and building materials. These technologies make a twofold contribution to climate protection: the usual discharge of methane into the atmosphere is prevented, and the burning of fossil fuels is replaced with renewable energy (biogas). The goal of this policy is to reduce GHG emissions from handling, treatment, and storage of livestock manure and organic waste by 15% by 2015 and 25% by 2025 through improved manure management practices and methane utilization.

AFW-4. Expanded Use of Bio-based Materials

This policy seeks to promote the manufacture, use, recycling, and reuse of materials made from biological products, such as wood, fiber, wheat board, agricultural by-products, biodegradable plastics, and green chemistry applications. These products reduce GHG emissions by sequestering carbon and displacing the production of fossil-based products. Additional GHG reductions can be achieved by promoting the use of Michigan-produced materials, which results in lower transport-associated emissions. This policy does not refer to energy uses, such as electricity or ethanol production, which are covered in AFW-1 and AFW-2. The goals associated with this policy are to utilize 100,000 tons of bio-based products annually by 2025, and to reclaim 150,000 tons of solid wood residues from manufacturing processes, deconstruction sites, and urban/suburban trees annually by 2025.

AFW-5. Promote Continuous Vegetative Cover

This recommendation is the maintenance and promotion of continuous vegetative cover, such as wind breaks and winter cover crops to prevent soil erosion, increase carbon sequestration, and provide new biomass sources. It also promotes the planting of cover crops with higher carbon content than current cover on marginal lands, including buffer strips, roadsides, on-off ramp areas, and transportation medians. GHG savings occur from carbon sequestration in the vegetative cover, indirect sequestration via carbon accumulation in soil, and reduced fertilizer application. The goals associated with this policy are to increase the acreage of lands with permanent cover by 10% by 2025 (existing land that is not under forest cover); retain 90% of lands coming out of the federal Conservation Reserve Program by 2025 in some type of permanent cover; and reduce rates of carbon loss by restoring or enhancing the maximum feasible percentage of wetlands by 2025.

AFW-6. Forestry and Agricultural Land Protection

This policy seeks to reduce the rate at which agricultural and forestlands and wetlands are converted to developed uses. The protection of these lands through conservation tools, such as land grants and easements and tax benefits, will retain the above- and below-ground carbon on these lands, as well as the future carbon sequestration potential of these lands. Markets for natural products from agriculture, forests, and wetlands also serve as incentives to keep these lands in their current state rather than convert them to development. GHG reductions come from the prevention of release of carbon from conversion of these lands. Additionally, indirect benefits occur through the reduction of urban sprawl, thus avoiding additional emissions from vehicle miles traveled. The goals associated with this policy are to reduce the rate of conversion from agriculture to developed use by 50% by 2025; maintain or increase forestland acreage by 2025, without converting agricultural land to forest, unless it has higher carbon sequestration potential; and protect and restore northern peatlands and other wetlands to prevent releases of GHGs, which will allow existing peatlands to continue to sequester carbon.

AFW-7. Promotion of Farming Practices That Achieve GHG Benefits

This recommendation addresses both agricultural soil carbon management, as well as nutrient management to achieve GHG benefits. For soil carbon management, conservation-oriented management of agricultural lands, cropping systems, crop management, and agricultural practices may regulate the net flux of CO₂ from soil. This recommendation has four separate elements: (1) soil carbon management, where CO₂ reductions occur indirectly via the building of soil carbon levels; (2) nutrient management, where GHG reductions occur through more efficient use of fertilizer, which lowers fossil fuel use through lower application energy requirements in addition to reduced N₂O emissions following application; also, life-cycle GHG reductions associated with the production and transportation of fertilizers are reduced; (3) an energy efficiency element that seeks to reduce GHG emissions by reducing the amount of fossil fuel consumed by farming and harvesting practices through improved technologies and increases in efficiency; and (4) the promotion of locally produced food, which reduces fossil fuel consumption by reducing food miles. The specific goals associated with these four policy elements are: increase conservation tillage farming to 4 million acres by 2025; adopt soil management and nutrient management practices on 5 million acres by 2025; reduce the net on-farm fossil fuel energy consumption by 50% by 2025; and increase the local/regional purchasing of locally grown agricultural produce and products by 50% by 2025.

AFW-8. Forest Management for Carbon Sequestration and Biodiversity

This recommendation focuses on the state's existing forested lands, recognizing the significant role that Michigan's forests play in lowering the state's net GHG emissions (a sink of ~13 MMtCO₂e/yr) and that management could be enhanced to achieve greater net GHG benefits. The goals associated with this policy are: enhance forestland management (including improved stocking of understocked stands) across the state on 1 million acres through afforestation and reforestation by 2025; achieve 40% canopy cover in urban communities by 2025 (this element also provides energy savings through shading and wind protection); and implement wildfire reduction community-wide protection plans for 10–12 identified communities at risk by 2025 (reducing wildfire risk protects forest carbon stores and maintains forest carbon sequestration levels).

AFW-9. Source Reduction, Advanced Recycling, and Organics Management

This recommendation seeks to improve the GHG profile of MSW management in the state by reducing waste generation, increasing recycling, and improving organics management. GHG savings occur through the reduction in landfill methane generation due to lower amounts of waste being landfilled in the future. Even more important from a GHG reduction perspective are the life-cycle emission reductions achieved via source reduction and recycling. Reducing or recycling products and packaging reduces the GHG emissions associated with their manufacture and transport, leading to significant overall reductions. While a large portion of these reductions would occur out of state, the MCAC recognizes the importance of this recommendation in achieving net GHG benefits. The policy goals are to achieve a 75% MSW recycling and

enhanced organics management rate by 2025, and a 50% recycling rate for industrial, commercial, and new construction waste by 2025.

AFW-10. Landfill Methane Energy Programs

The renewable energy (methane) created at landfills during anaerobic degradation of wastes unable to be utilized in recycling and compost programs can be used to displace fossil fuel through the installation of methane control and collection systems. The goal of this policy is to implement controls or waste management options at MSW landfills, such that 50% of the methane emissions are avoided by 2025 that would be generated under business-as-usual conditions.

Chapter 8

Cross-Cutting Issues

Overview of Cross-Cutting Issues

Some issues relating to climate policy cut across multiple sectors. The Michigan Climate Action Council (MCAC) addressed such issues explicitly in a separate Cross-Cutting Issues (CCI) Technical Work Group (TWG). Cross-cutting recommendations typically encourage, enable, or otherwise support emission mitigation activities and/or other climate actions. The types of policies considered for this sector are not readily quantifiable in terms of greenhouse gas (GHG) reductions and costs or cost savings. Nonetheless, if successfully implemented, they help build a foundation for other recommendations and will contribute to GHG emission reductions and implementation of the MCAC's policy recommendations described in Chapters 3–7 of this report.

The CCI TWG developed recommendations for 10 policies (see Table 8-1) that were then reviewed, revised, and ultimately adopted by the MCAC members present and voting. Nine of the recommendations are focused on enabling GHG emission reductions and mitigation activities, while one (CCI-8–Adaptation and Vulnerability) addresses adaptation to the changes expected from the effects of GHGs that will remain in the atmosphere for decades.

Key Challenges and Opportunities

The MCAC was charged with developing proposed GHG reduction goals for Michigan, along with a set of policy recommendations designed to achieve such goals. The MCAC established 2005 as the baseline year and identified a mid-term goal of reducing the 2005 GHG baseline by 20% by 2020 and a long-term goal of an 80 % reduction by 2050.

The MCAC based its recommendations on its review of the potential overall emission reduction estimates (as compared to the GHG emissions inventory and forecast for business as usual) for 33 of 54 policy recommendations for which emission reductions were quantified. It also considered the goals and targets adopted by several other states in its deliberations. While 21 other MCAC policy recommendations were not readily quantifiable, some of them would most likely achieve or contribute to additional reductions, including several of the CCI policy recommendations.

A key challenge for the state in seeking to achieve these GHG reduction goals will be to identify available resources needed to implement many of the initiatives outlined in this report, particularly given the struggling economic conditions in the state and across the country. The MCAC will need to work closely with other state, local, federal, and tribal governmental entities, the private sector, institutions of higher education, citizens, and others to examine these opportunities.

Another key challenge for the state is the need to proactively engage with the federal government in developing appropriate federal programs and policies, while simultaneously working with other state and regional entities to design and implement strategies most effectively employed at this level.

In spite of these challenges, the nexus between seeking a new energy economy and significantly reducing GHG emissions in the state offers a rare opportunity for Michigan to be a leader in developing selected renewable energy technologies and enhancing economic and employment conditions.

Table 8-1. Summary list of CCI policy recommendations

Policy No.	Policy Recommendation	GHG Reductions (MMtCO ₂ e)			Net Present Value 2009–2025 (Million \$)	Cost Effective-ness (\$/tCO ₂ e)	Level of Support
		2015	2025	Total 2009–2025			
CCI-1	GHG Inventories, Forecasting, Reporting, and Registry	Not Quantified					Unanimous
CCI-2	Statewide GHG Reduction Goals and Targets	Not Quantified					Unanimous
CCI-3	State, Local, and Tribal Government GHG Emission Reductions (Lead by Example)	Not Quantified					Unanimous
CCI-4	Comprehensive Local Government Climate Action Plans (Counties, Cities, Etc.)	Not Quantified					Unanimous
CCI-5	Public Education and Outreach	Not Quantified					Unanimous
CCI-6	Tax and Cap/ Cap and Trade	MCAC approved creation of new Market-Based Policies Technical Work Group as the lead for this policy.					Transferred
CCI-7	Seek Funding for Implementation of MCAC Recommendations	Not Quantified					Unanimous
CCI-8	Adaptation and Vulnerability	Not Quantified					Unanimous
CCI-9	Participate in Regional, Multi-State, and National GHG Reduction Efforts	Not Quantified					Unanimous
CCI-10	Enhance and Encourage Economic Growth and Job Creation Opportunities Through Climate Change Mitigation	Not Quantified					Unanimous
CCI-11	Enhance and Encourage Community Development Through Climate Change Mitigation: Address Environmental Justice	Not Quantified					Unanimous

GHG = greenhouse gas; MCAC = Michigan Climate Action Council; MMtCO₂e = million metric tons of carbon dioxide equivalent; \$/tCO₂e = dollars per metric ton of carbon dioxide equivalent.

Overview of Policy Recommendations and Estimated Impacts

Cross-cutting issues include policies that apply across the board to all sectors and activities. Cross-cutting recommendations typically encourage, enable, or otherwise support emission mitigation activities and/or other climate actions. The MCAC recommends that 10 such policies

be adopted and implemented in Michigan. All are enabling policies that are not quantified in terms of metric tons of GHG reduction or costs.

Detailed descriptions of the individual CCI policy recommendations as presented to and approved by the MCAC can be found in Appendix K of this report. Following are highlights of some of the policies recommended by MCAC:

Michigan is currently participating in the multi-state Climate Registry. The state needs to institute formal GHG inventory, forecast, and reporting functions to be carried out by a state agency. Using standardized protocols, the state should prepare annual inventories of emission sinks and sources and should develop forecasts of future GHG emissions in at least 5- and 10-year increments extending at least 20 years into the future. The state should also develop reporting protocols for facility-level reporting of all significant GHG emissions. Where possible, the state should coordinate these efforts with other states, regions, tribes, and the federal government.

Table 8-2 presents the MCAC's proposed GHG reduction goals for Michigan. These goals are consistent with goals being considered by the Midwestern Governors Regional Greenhouse Gas Reduction Accord process: achieve a 20% reduction of GHGs below 2005 levels by 2020 and an 80% reduction below 2005 levels by 2050. The MCAC recommends that these goals be established through executive or legislative action. The state should also develop a tracking system to measure progress over time in achieving GHG reductions against its recommended goals.

Table 8-2. MCAC-recommended goals for GHG reduction

Year	Reduction From 2005 Levels
2005	Baseline
2020	20%
2050	80%

The MCAC encourages other governmental entities and academic institutions to establish GHG reduction goals for their respective jurisdictions, and to develop plans, programs, and other initiatives to achieve their respective goals. The state is already engaged in numerous “Lead by Example” initiatives to find additional energy efficiencies and GHG reductions in state procurements for buildings, vehicle fleets, and office equipment. These initiatives, which are detailed in CCI-3, Appendix K, should be compiled, tracked, and shared among entities in Michigan. This should help stimulate private-sector and individual citizen actions as well.

A public education and outreach effort will be a key to building a broad base of awareness and support for the recommendations of this report. The MCAC has identified numerous strategies over several years to do so in conjunction with academic, business, local government, and other partners in this process. These outreach efforts are spelled out in CCI-5, Appendix K and are targeted to the following audiences: state government, policymakers, future generations, community leaders and community-based organizations, citizens, industrial and economic sectors, and tribal governments.

While many of the MCAC recommendations will save resources over the next 11 years, as documented through this MCAC process, some policy recommendations will require additional resources to implement. The state should immediately seek and establish capital investments and other funding sources for the implementation of the MCAC's recommendations. State government should lead the efforts to generate investment and financial support. Other sectors, including local government, industry, services, agriculture, consumers, and higher education, should also be involved. The state should examine alternative financing mechanisms, such as those listed in CCI-7, Appendix K, and develop proposals to implement those that are the most promising.

Given Michigan's vulnerability to impacts of climate change, the state should undertake a comprehensive planning effort to assess and address the impact of climate change on the Great Lakes, the state's natural resources, and wildlife and fisheries. The state should start by developing a scoping document that identifies technical and financial resources and research needed to undergo a comprehensive planning process in 2009. When applicable and feasible, the scoping document should identify ongoing and intended research efforts that could contribute to the planning process. A multi-agency and diverse stakeholder team should be formed to follow through with the planning process in 2009 and beyond. A detailed list of tasks is included in CCI-8, Appendix K.

The state is a participant in the Midwestern Governors Regional Greenhouse Gas Reduction Accord and Energy Security and Climate Stewardship Platform. The state should continue this proactive engagement with other states in the region in developing cost-effective, multi-state reduction strategies. At the same time, the state will be pushing for progressive action at the federal level to address climate change. Michigan will also work with the 12 federally recognized tribes in the state to help coordinate local climate change strategies (see CCI-9, Appendix K). This will be accomplished through either existing agencies or a designated state entity charged with climate change issues, and through the use of existing agreements between the Michigan Department of Environmental Quality (MDEQ) and tribes, such as the Water Accord, or newly created mechanisms that allow government-to-government dialog on environmental issues of mutual interest. Likewise, Michigan will welcome and seek out a mechanism to coordinate its climate change and GHG reduction efforts with national tribal organizations, such as the climate mitigation and adaptation dialog recently initiated by the National Congress of American Indians, the Council of Energy Resource Tribes, and others. Michigan should also further investigate, and if it is determined to be in the state's best interest, join The Climate Registry (TCR) and the Chicago Climate Exchange (CCX).

It has been demonstrated that there are numerous economic and employment opportunities associated with implementation of many of the MCAC-recommended GHG reduction policies. The MCAC recommends that the state implement robust measures to retain existing clean tech business and attract new investment. Some categories for attention may include: provide more attractive financial incentives, implement policies that enhance and encourage economic growth, seek more federal support, utilize Michigan's existing resources and economic opportunities, protect water resources, invest in walk-able neighborhoods and transportation mode choices, support a diverse agricultural base, maintain traditional support for Michigan's excellent public research universities, and encourage and facilitate Michigan's strong social infrastructure. Appendix K, CCI-10 presents numerous additional examples and details about these initiatives.

Finally, there is an opportunity to enhance sustainable community development and address environmental justice issues in Michigan as climate change mitigation is addressed at the local level. To do so, the state needs a collaborative planning process—transformational responses that allow for distribution of costs and benefits and opportunities for change. Numerous examples and initiatives to do so are outlined in CCI-11, Appendix K.

Cross-Cutting Issues Policy Descriptions

CCI-1. Inventories, Forecasting, Reporting, and Registry

GHG emission *inventories* track statewide emission trends and quantify emissions from individual sources and sinks (both anthropogenic and natural). They can be used to inform state leaders and the public and to verify GHG reductions associated with GHG reduction programs.

GHG *forecasts* are scenario-based predictions of future emission trends built on inventories and projected economic trends. These forecasts are useful for identifying the factors that affect trends and highlighting opportunities for mitigating emissions or enhancing sinks.

Detailed GHG *reporting* is needed from all major GHG sources¹ in order to develop accurate inventories. Reporting is also required for sources to participate in GHG reduction programs, such as market-based systems like cap and trade and carbon taxation. Participation in a reporting program prior to the establishment of a GHG reduction program establishes an early baseline that can be used to avoid disincentives to abate emissions prior to establishment of the reduction program.

A GHG *registry* enables recording of GHG emission reductions in a central repository. Registries can establish “ownership” of emission reductions, protect baselines, and provide a mechanism for regional cooperation. Registries can also provide a foundation for future trading programs and facilitate the identification of opportunities for reductions.

CCI-2. Statewide GHG Reduction Goals and Targets

In Executive Order No. 2007-42, the Governor directed the MCAC to recommend specific short-term, mid-term, and long-term GHG reduction goals or targets for Michigan. Additionally, the Midwestern Regional Greenhouse Gas Reduction Accord, signed by Governor Granholm on November 15, 2007, establishes a requirement for its staff and appropriate state agency

¹ According to The Climate Registry, individual sources are defined either as “entities” (i.e., any corporation, institution, or organization) recognized under U.S. law, or as “facilities” (i.e., any installation or establishment located on a single site or on contiguous or adjacent sites that are owned or operated by an entity). See <http://www.theclimateregistry.org/downloads/GRP.pdf> for additional details. The official definition of a “source” is left to MDEQ, but facility-level reporting is strongly recommended.

representatives to set regional GHG reduction targets that are consistent with member states' targets. The establishment of a Michigan statewide goal or target can provide vision and direction, a framework within which implementation of MCAC policy recommendations can proceed effectively, and a basis of comparison for periodic assessments of progress. GHG reduction goals or targets recommended by the MCAC should be consistent with the parallel goal of an efficient, robust Michigan economy. In pursuit of similar climate progress, approximately 20 other states have established GHG reduction goals or targets.

The Intergovernmental Panel on Climate Change (IPCC) determined that atmospheric GHGs must remain below 400–450 parts per million of carbon dioxide equivalent (CO₂e) to have a reasonable chance of staying below 2°F of warming. This concentration is considered the stabilization target. The IPCC further calculated that the industrialized nations' cumulative emissions over the 2000–2050 period must remain less than 700 gigatons (Gt) of CO₂e. This means that the world's industrialized nations must reduce emissions 70%–80% below 2000 levels by 2050 to help prevent global temperature increases. For its share, the United States needs to reduce its GHG emissions by about 80% by 2050 in order to stay within its estimated “safe” range of 160–265 GtCO₂e for that same 50-year period. That comes to a 20% per decade reduction, or 2% per year.

The target years and GHG reduction goals included in this policy recommendation reflect a high level of uncertainty regarding the costs and benefits of implementing GHG reduction policies in Michigan. These goals have been examined in the second phase of the process and considered in combination with the results of the modeling and evaluation of the selected policy recommendations.

In accordance with the *Michigan Climate Action Council Interim Report*, “the strategy development process must evaluate and consider economic and environmental impacts, including the implementation costs or cost savings for individuals, communities, businesses, and jobs in Michigan.” The policy recommendations detailed by the six TWGs (Agriculture, Forestry, and Waste Management; Energy Supply; Residential, Commercial, and Industrial; Transportation and Land Use; Cross-Cutting Issues; and Market-Based Policies) include policies to reduce GHG emissions at low net cost, and identify opportunities for substantial net savings. Implementation of carefully crafted policy recommendations should bring significant economic benefits to the Michigan economy, by reducing fuel costs through efficiency measures, by reducing the export of capital from the state, and by stimulating the Michigan economy through the creation of new opportunities and jobs in energy efficiency, clean energy technologies, renewable energy development, transportation, and land-use planning.

The MCAC has modified the preliminary target year and GHG reduction goals from those originally proposed in the MCAC Interim Report to those consistent with the goals being considered by the Midwestern Governors Association. They are presented in Table 8-2. The policies recommended by the MCAC appear to be able to achieve a 20% reduction below 2005 levels by 2020. To do so, however, it will be necessary for the state to move expeditiously forward with near-term implementation of the policy initiatives outlined in this MCAC Final Report. This includes instituting formal mechanisms to monitor and verify GHG reduction progress and periodically adjusting reduction goals and strategies when needed.

The MCAC also recommends that a formal performance tracking mechanism be developed to gauge progress in Michigan toward achievement of the goals and targets.

CCI-3. State, Local, and Tribal Government GHG Emissions (Lead by Example)

The state of Michigan and many local and tribal governments have undertaken various policy and program actions in several key areas to obtain GHG emission reductions and improve energy efficiency. Many of these ongoing and future efforts can provide practical and working examples of what can be done by nongovernmental organizations, academic institutions, and even private citizens to reduce GHG emissions. Much more effort is planned and should be undertaken to further improve Michigan's energy efficiency and reduce our carbon dependency and emission rate, as outlined in Appendix K of this report.

State, local, and tribal governments are responsible for providing a multitude of services for the public that are delivered through very diverse operations. This also makes them responsible for overseeing wide-ranging GHG emission activities and provides leadership opportunities to work with universities, nonprofit organizations, and the private sector to reduce emissions and increase energy efficiency. For example, the state of Michigan is a major consumer of electricity and, as such, can promote the development of environmentally benign generation and purchase a significant portion of its power through a certified “green power” program.

While the incentive for this action will be, in part, market driven as energy costs increase, it will only be achievable through a continued comprehensive analysis of current operations, identification of significant GHG sources, and implementation of changes in technology, procedures, behavior, operations, and the services provided. State, local, and tribal governments must find ways to encourage and provide incentives for reducing GHG emissions in a variety of ways. One of the most important is to link GHG reductions to energy expenditures, and demonstrate that reduction in one leads to reduction in the other.

CCI-4. Comprehensive Local Government Climate Action Plans

A number of local and regional cities and municipalities in Michigan have already taken steps and initiated programs and activities to mitigate climate change in their communities. Many of these cities and communities—23 in Michigan and over 900 cities nationwide—are also signatories to the U.S. Mayors Climate Protection Agreement, and have a stated goal of reducing CO₂ emissions by 7% below 1990 baseline levels by 2012. Furthermore, cities and communities in Michigan are helping to develop and support additional climate change accountability programs, such as the Midwestern Regional Greenhouse Gas Reduction Accord, TCR, and the Michigan Renewable Energy Program.

The state and tribal governments, regional metropolitan councils (e.g., the Grand Valley Metro Council), Michigan Municipal League, and others could all help create awareness about climate change issues and lead by example in developing climate change programs that are coordinated with the MCAC. Additionally, these organizations and entities could help communicate best practices and success stories through a variety of outlets, such as workshops, conferences, summit meetings, a Web site clearinghouse, education and outreach to public and municipal

officials, as well as recognizing local government GHG and CO₂ emission reduction achievements.

CCI-5. Public Education and Outreach

Public education and outreach is essential to cultivating broad support for GHG reduction activities. Education and outreach will target at least seven specific audiences in Michigan according to policy recommendations made by MCAC members. These efforts will seek to create awareness of climate change issues, along with providing justification for policies designed to reduce GHG emissions. Public education and outreach efforts should build upon existing work being done by state, tribal, and local agencies, utility companies, and nonprofit organizations.

CCI-6. Tax and Cap Policies / Cap and Trade

The lead for developing this policy recommendation was transferred by the MCAC to the Market-Based Policies TWG (see Chapter 4).

CCI-7. Seek Funding and Financing for Implementation of MCAC Recommendations

Michigan will seek and stimulate funding and investment to implement the MCAC climate solution recommendations. Accordingly, Michigan will position itself to successfully compete for federal and international assistance and matching funds in adaptation and mitigation of climate change impacts. Funding decisions will take into account both economic and environmental impacts, including the implementation costs or cost savings for individuals, communities, and businesses, as well as similar funding actions made by other Midwest states and regions. As Michigan allocates funding for MCAC recommendations, the state will work to identify choices that provide the best opportunities for mitigation of, and adaptation to, climate change. Concurrently, Michigan will implement initial funding investments that require few long-term costs. In addition, Michigan aims to reduce the costs associated with climate change activities, while fostering economic growth within the state.

CCI-8. Adaptation and Vulnerability

Climate change is a potentially serious threat to communities, natural resources, and wildlife in Michigan, the United States, and around the world. While addressing the source of climate change and related GHG mitigation options is critical, it is also important that decision makers and the citizens of Michigan understand how climate change is affecting and will affect the natural resources and natural resource-based economic activity in the state. Additional attention, research, and funding are needed to assess the impact of climate change on Michigan's fisheries and wildlife and help them adapt, while also reducing the other stressors on their habitats and ecosystems. Communications, research, and funding are also needed to assess and moderate climate change's impact on Michigan's land and other natural resource-based industries (forestry, agriculture, tourism, and recreation).

The state of Michigan should undertake a comprehensive planning effort to assess and address the state's vulnerability to climate change and adaptation opportunities. Various organizations and agencies in the state are already collecting some of the information needed for such an assessment and efforts should be made to coordinate and consolidate these information-gathering activities.

CCI-9. Participate in Regional, Multi-State, and National GHG Reduction Efforts

The MCAC recognizes that collaboration is a key to the successful implementation of the state climate change strategies. Because the execution of policies designed to reduce climate change affects all sectors of society, actions must be broad-based and inclusive. For this reason, collaborative regional and multi-state reduction efforts offer promising possibility for accomplishing the MCAC's target goals. Joint regional, multi-state, multi-province, and in some cases, national approaches to GHG emission reductions and energy efficiency options can provide greater opportunities for success, particularly because the issue of climate change is not constrained to political boundaries. Accordingly, Michigan recognizes, has considered, and has joined other regional and national, market-based GHG reduction strategies. Such strategies propose to mitigate and adapt to climate change in various sectors, including energy supply, residential, commercial, industrial, transportation, land use, agriculture, forestry, and waste management.

The current initiatives include the state's membership in the Midwestern Regional Greenhouse Gas Reduction Accord, whereby the member governors and Canadian prime minister agreed to establish a midwestern GHG reduction program with targets and time frames that are consistent with state policies. Also included in this initiative is the development of a market-based, multi-sector cap-and-trade program to achieve reductions. An additional joint initiative is MDEQ's participation on the Steering Committee for the development of TCR. The multi-state TCR was designed to be an essential piece of infrastructure for the development of state and federal climate change programs by forming a partnership to produce a protocol for measuring GHG emissions. A third significant initiative offering opportunities for multi-state collaboration is the CCX. Michigan, as well as all other members of the CCX, must achieve a minimum 6% reduction in GHG emissions from 2000 levels by 2010. This goal is in accordance with Michigan reduction targets.

These developments will be continued and will function as models to form the basis of future Michigan GHG reduction programs. Michigan should consider developing supplementary or ancillary registry capacities or opportunities to meet all of the state's needs. Michigan will continue to examine the decisions made by other states and regions, particularly in the Midwest states and in Canada, to identify opportunities for collaboration with other GHG reduction efforts. Michigan will also implement regional climate reduction initiatives, such as a regional carbon cap-and-trade system (unless a national system supersedes this need).

The Governor and the Michigan legislature should aggressively push for and continue to encourage federal action to reduce GHG emissions and to ensure that Michigan is well represented and protected at the federal level. An aggressive approach to GHG reductions within the United States will have a significant effect on the international reductions needed to begin

reversing global warming trends. Ultimately, many of the climate protection issues need to be addressed at the national level. Michigan must help shape these national initiatives.

CCI-10. Enhance and Encourage Economic Growth and Job Creation Opportunities Through Climate Change Mitigation

Michigan's response to climate change can serve as a catalyst for increasing economic activity, in addition to reducing GHG emissions. Michigan is already home to two of the world's leading solar power manufacturers, and over 25 businesses provide components for the growing commercial wind energy industry. Investors in the clean tech sector are constantly seeking locations that offer the most advantageous markets. Texas, Colorado, New York, and Pennsylvania have recently added thousands of green collar jobs by offering start-up capital, tax breaks, and energy policy that welcomes clean energy. Michigan has a capable workforce, engineering expertise, and substantial manufacturing capacity. The state also possesses considerable natural resources that could establish it as a leader in renewable energy. Given the intense competition from other states and nations, however, additional incentives and supportive government policies will be necessary to maximize investment in Michigan.

CCI-11. Enhance and Encourage Community Development Through Climate Change Mitigation: Address Environmental Justice

Climate change is predicted to cause significant changes in both the atmosphere and the natural environment, including increases in extreme weather events and droughts, as well as rises in sea level in some regions and lower water levels in the Great Lakes.

Although all segments of Michigan's population and economy will be affected by climate change, certain communities run the risk of being disproportionately burdened by costs and challenges, particularly poor communities and communities of color. As evidenced by the impact of Hurricane Katrina in New Orleans, communities in the United States continue to be unprepared—socially, financially, and environmentally—for major natural events.

Even in the absence of major natural disasters, climate change has the potential to devastate an unprepared economy. Transitional costs will likely be regressive and could further burden populations already suffering from economic hardship with unbearable costs.

To encourage community development through climate change mitigation and ensure that vulnerable communities are protected, the state must engage a range of communities in a collaborative planning process that works toward a transformational response to climate change. This response must be tailored to the regressive costs posed by climate change, and must act to address the economic and health impacts of a warming climate.

EXHIBIT BMC-25

EXECUTIVE DIRECTIVE No. 2009 - 4

IMPLEMENTATION OF RECOMMENDATIONS OF THE MICHIGAN CLIMATE ACTION COUNCIL

WHEREAS, Section 1 of Article V of the Michigan Constitution of 1963 vests the executive power of the State of Michigan in the Governor;

WHEREAS, under Section 8 of Article V of the Michigan Constitution of 1963, each principal department of state government is under the supervision of the Governor unless otherwise provided by the Constitution;

WHEREAS, the world's scientific community has concluded with a very high level of confidence that emissions of carbon dioxide, methane, and other greenhouse gases are causing the Earth's climate to warm;

WHEREAS, a warmer climate could have severe economic and environmental impacts on this state;

WHEREAS, the State of Michigan can play an important role in meeting the challenge of global climate change while simultaneously spurring economic growth;

WHEREAS, Michigan has the natural resources, industrial and technology infrastructure, and skilled workforce to be a worldwide exporter of the solutions necessary to transition to a low carbon economy;

WHEREAS, the Michigan Climate Action Council that was created under Executive Order 2007-42 has compiled and submitted to the Governor a comprehensive Climate Action Plan that includes, among other things, specific recommendations for reducing greenhouse gas emissions in Michigan;

WHEREAS, the actions recommended by the Michigan Climate Action Council for reducing greenhouse gas emissions in Michigan can achieve positive economic and environmental benefits for the state, including, but not limited to, reduced costs, increased energy efficiency, improved air and water quality, the conservation of natural resources, and the creation of jobs and diversification of Michigan's economy;

WHEREAS, it is estimated that the recommendations of the Michigan Climate Action Council could also result in overall net cumulative savings in Michigan of more than \$10 billion between 2009 and 2025, with additional significant cost savings between 2020 and 2050;

WHEREAS, the magnitude and the urgency of the challenge of global climate change will require action on the part of government, business, and the general public;

NOW, THEREFORE, I, Jennifer M. Granholm, Governor of the State of Michigan, by virtue of the power and authority vested in the Governor by the Michigan Constitution of 1963 and Michigan law, direct:

I. DEFINITIONS

As used in this Directive:

A. "Climate Action Plan" means the comprehensive final report developed by the Michigan Climate Action Council and submitted to the Governor under Executive Order 2007-42.

B. "Department of Environmental Quality" or "Department" means the principal department of state government created under Executive Order 1995-18, MCL 324.99903.

C. "Greenhouse gas" means a gas from a human-generated activity that traps heat within the atmosphere of the earth causing climate change, including, but not limited to, carbon dioxide, methane, nitrous oxide, ozone, and fluorinated gases.

D. "Michigan Climate Action Council" means the council created under Executive Order 2007-42.

II. GREENHOUSE GAS EMISSIONS REDUCTION GOALS

A. As recommended by the Michigan Climate Action Council in its Climate Action Plan, it shall be the goal of the State of Michigan to achieve a 20% reduction in greenhouse gas emissions below 2005 baseline levels by 2020 and an 80% reduction in greenhouse gas emissions below 2005 baseline levels by 2050.

B. The Department of Environmental Quality shall develop a formal performance tracking mechanism to gauge progress toward achieving the greenhouse gas emissions reduction goals identified above. Beginning in July 2012, and annually thereafter, the Department will report in writing to the Governor and the Legislature on the progress of the State of Michigan in attaining the greenhouse gas emission reduction goals in Section II.A of this Directive.

III. IMPLEMENTATION OF CLIMATE ACTION PLAN RECOMMENDATIONS

A. Consistent with the recommendations of the Michigan Climate Action Council in its Climate Action Plan, the State of Michigan can and shall take the following actions to address the adverse impacts of climate change on our state and economy:

1. In consultation with the Michigan Economic Development Corporation, the Department of Environmental Quality shall conduct, or have conducted on its behalf, a macro-economic analysis of the recommendations identified by the Michigan Climate Action Council in its Climate Action Plan through the use of

regional economic modeling and other appropriate evaluative tools. The macro-economic analysis will provide valuable information in prioritizing the recommendations identified in the Climate Action Plan.

2. The Department of Energy, Labor, and Economic Growth will accelerate plans to revise existing building codes to adopt higher energy efficiency standards for existing and newly constructed industrial, institutional, municipal, commercial and residential buildings.

3. The Department of Transportation will continue to implement and expand on Congestion Mitigation programs to reduce vehicular congestion in major urban areas, including, to the maximum extent feasible, expanding the use of Intelligent Transportation Systems, identifying and improving key bottlenecks, constructing modern roundabouts where justified by traffic volumes and safety needs, and promoting the development of intermodal freight terminals.

4. The Department of Management and Budget and the Department of Transportation will together develop a Truck Idling Program for the state fleet of motor vehicles, buses and heavy-duty equipment.

5. With the assistance of the Department of Environmental Quality, the Department of Management and Budget will develop an Eco-Driver Program for all employees using state vehicles. This program will include the development of written and electronic education and training materials designed to maximize vehicle fuel economy by educating drivers on how driving patterns, vehicle technologies, and vehicle maintenance can impact a vehicle's fuel economy. The Eco-Driver Program should be developed to serve as a model for the later development of an Eco-Driver Program that can be made available to the general public.

6. The Michigan Department of Agriculture will expand, to the maximum extent feasible, the Michigan Conservation & Climate Initiative and expand the advice offered by its conservation technical corps to include implementation of carbon sequestration practices.

7. The Department of Environmental Quality shall pursue federal and other available sources of funding to conduct, or have conducted on its behalf, analyses on adaptation and, based on this research, determine the need for developing adaptation plans for Michigan.

8. The Department of Environmental Quality shall endeavor to partner with one or more signatory communities to the United States Conference of Mayors Climate Protection Agreement to co-host a conference on climate change. This conference should provide information about the Climate Action Plan, increase awareness of climate change issues, and provide guidance on the development of local climate change programs and initiatives.

9. The Departments of Environmental Quality and Natural Resources shall designate appropriate representatives to participate in the Tribal-State Climate Change Forum established under the June 11, 2009 Intergovernmental Accord between the Tribal Leaders of the Federally Recognized Indian Tribes in Michigan and the Governor of the State of Michigan to Address the Crucial Issue of Climate Change. The purpose of the Forum is to share information, develop analyses, and propose action plans to address global warming through methods including, but not limited to, pollution control, alternative clean energy technologies, and conservation.

IV. MISCELLANEOUS

A. The Department of Environmental Quality shall coordinate state efforts to implement this Directive.

B. All departments, committees, commissioners, or officers of this state or of any political subdivision of this state shall give to the Department, or to any member or representative of the Department, any necessary assistance required by the Department, or any member or representative of the Department, in the performance of the duties of the Department so far as is compatible with its, his, or her duties. Free access shall also be given to any books, records, or documents in its, his, or her custody, relating to matters within the scope of inquiry, study, or investigation of the Department.

C. Any suit, action, or other proceeding lawfully commenced by, against, or before any entity affected by this Directive shall not abate by reason of the taking effect of this Directive.

D. The invalidity of any portion of this Directive shall not affect the validity of the remainder of the Directive.

This Directive is effective immediately.

Given under my hand this 29th day of July in the year of our Lord, two thousand nine.

JENNIFER M. GRANHOLM
GOVERNOR

EXHIBIT BMC-26

**Intergovernmental Accord
between
the Federally Recognized Indian Tribes in Michigan
and
the Governor of the State of Michigan
Concerning Protection of Shared Water Resources**

**Entered into on May 12, 2004
Lansing, Michigan**

Whereas the federally recognized Indian Tribes in Michigan and the Governor of the state of Michigan each recognize the essential role of the Great Lakes and of Michigan's inland lakes, rivers, streams, and groundwater (hereinafter termed "water resources") in their past, their present, and their shared destiny;

Whereas the Tribes historically resided in the Great Lakes Region in harmony with the natural environment since well before the arrival of Europeans and have depended upon the water resources of the Great Lakes Region for food, water, and transportation for hundreds of years;

Whereas the Great Lakes and Michigan's inland lakes, rivers, streams, and groundwater remain the cornerstone of the culture and the physical and spiritual well-being of the Tribes and preserving the environmental quality and quantity of those water resources for the present and for the next seven generations is absolutely essential to the Tribes;

Whereas the Great Lakes and inland waters are the state of Michigan's most vital resources and figuratively and literally define the state; the citizens of the state rely on these water resources for their subsistence, health, recreation, and for their aesthetic value; and those water resources also underpin Michigan's economy due to their importance for tourism, agriculture, industry, and transportation;

Whereas the future well-being of all of the residents of the state of Michigan depends on the preservation and enhancement of the quality and quantity of its water resources;

Whereas Michigan's water resources are subject to degradation from numerous sources including toxic substances such as pesticides, mercury and other heavy metals from a variety of agricultural, industrial and municipal sources; and the introduction of exotic species such as lamprey and zebra mussels strain the Great Lakes ecosystem;

Whereas the very presence of the water is imminently threatened by the desire of governments and private companies to divert or export Great Lakes waters outside the Great Lakes basin;

Whereas many activities such as dredging, wetland development, and inadequate wastewater treatment strain the natural recuperative powers of the water resources to maintain diverse ecosystems which depend on water quality and quantity for their very existence;

Whereas past, present and future utilization of water resources by governmental units and private individuals and entities is subject to oversight and regulation under a complex framework of federal, state and tribal law;

Whereas the grandeur and beauty of the Great Lakes create a facade of endless abundance but the Great Lakes and inland waters are in reality delicate and finite;

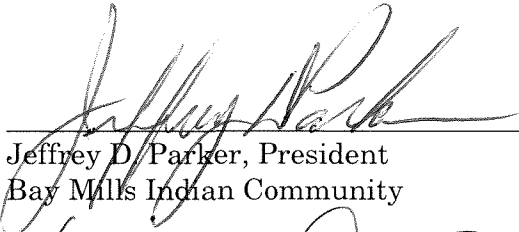
Whereas protection of these magnificent resources for the present and future generations requires the constant commitment, vigilance, and cooperation of all governments that have jurisdiction over them;


Whereas the undersigned parties wish to enhance and strengthen the government-to-government relationship among the Tribes and between the Tribes and the state of Michigan;


NOW, THEREFORE, the Governor and the undersigned Tribes affirm their joint commitment to the preservation, restoration and enhancement of the Great Lakes ecosystem and pledge to work together to clean-up the pollutants now present, eliminate exotic species, maintain and preserve diverse water resource habitats, and prevent future contaminants, exotics and depletion of these waters. They further commit to sending representatives to meet at least twice a year to review the quantity and quality of our water resources and to develop strategies for protecting those resources including recommendations for state, federal and tribal legislation, and international treaties, coordination of permitting activities, and cooperation on enforcement of water protection laws.

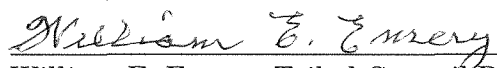
**Intergovernmental Accord
between
the Federally Recognized Indian Tribes in Michigan
and
the Governor of the State of Michigan
Concerning Protection of Shared Water Resources**

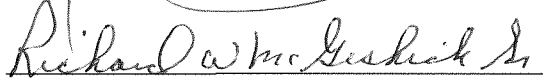
**Entered into on May 12, 2004
Lansing, Michigan**

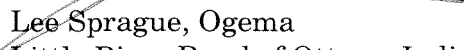

Jeffrey D. Parker, President
Bay Mills Indian Community

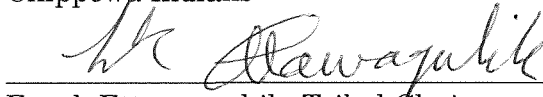

Robert Kewaygoshkum, Tribal Chairman
Grand Traverse Band of Ottawa and
Chippewa Indians

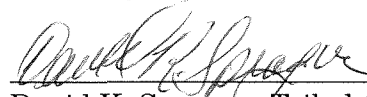

Kenneth Meshigaud, Chairperson
Hannahville Indian Community

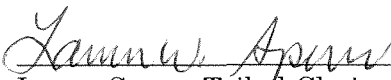

William E. Emery, Tribal Council President
Keweenaw Bay Indian Community

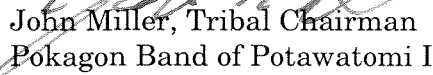

Richard McGeshick, Sr., Tribal Chairman
Lac Vieux Desert Band of Lake Superior
Chippewa Indians

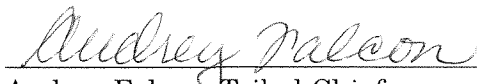

Lee Sprague, Ogema
Little River Band of Ottawa Indians

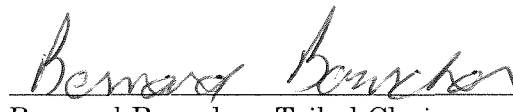

Frank Ettawageshik, Tribal Chairman
Little Traverse Bay Bands of Odawa Indians


David K. Sprague, Tribal Chairman
Match-E-Be-Nash-She-Wish Band of
Pottawatomi Indians


Laura Spurr, Tribal Chairman
Nottawaseppi Huron Band of Potawatomi Indians


John Miller, Tribal Chairman
Pokagon Band of Potawatomi Indians


Audrey Falcon, Tribal Chief
Saginaw Chippewa Indian Tribe of Michigan


Bernard Bouschor, Tribal Chairman
Sault Ste. Marie Tribe of Chippewa Indians


Jennifer M. Granholm, Governor
State of Michigan

EXHIBIT BMC-27

UNITED STATES DISTRICT COURT
FOR THE WESTERN DISTRICT OF MICHIGAN
SOUTHERN DIVISION

UNITED STATES OF AMERICA,

Plaintiff,

File No. 2: 73 CV 26
Hon. Richard A. Enslen

BAY MILLS INDIAN COMMUNITY,
SAULT STE. MARIE TRIBE OF
CHIPPEWA INDIANS, GRAND
TRAVERSE BAND OF OTTAWA AND
CHIPPEWA INDIANS, LITTLE RIVER
BAND OF OTTAWA INDIANS, and
LITTLE TRAVERSE BAY BANDS OF
ODAWA INDIANS,

Plaintiff-Intervenors / Counter-Defendants,

vs.

STATE OF MICHIGAN, REBECCA
HUMPHRIES, DIRECTOR,
DEPARTMENT OF NATURAL
RESOURCES, CHIEF, FISHERIES
DIVISION, DEPARTMENT OF
NATURAL RESOURCES, CHIEF,
WILDLIFE DIVISION, DEPARTMENT
OF NATURAL RESOURCES, CHIEF,
LAW ENFORCEMENT DIVISION,
DEPARTMENT OF NATURAL
RESOURCES, RESOURCE
MANAGEMENT DEPUTY DIRECTOR,
DEPARTMENT OF NATURAL
RESOURCES, AND THE MICHIGAN
NATURAL RESOURCES COMMISSION,

Defendants / Counter-Claimants.

CONSENT DECREE

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FINDINGS AND ORDER

The Court hereby FINDS:

A. Defendants/Counter-Claimants State of Michigan, Michigan Natural Resources Commission, Michigan Department of Natural Resources (“MDNR”) Director, MDNR Fisheries Division Chief, MDNR Wildlife Division Chief, MDNR Law Enforcement Division Chief and MDNR Resource Management Deputy Director (collectively, “State”) filed a counterclaim in this action, *United States v. Michigan*, No. 2:73 CV 26 (W.D. Mich.) (“Litigation”), against Plaintiff-Intervenors/Counter-Defendants Bay Mills Indian Community, Sault Ste. Marie Tribe of Chippewa Indians, Grand Traverse Band of Ottawa and Chippewa Indians, Little River Band of Ottawa Indians, and Little Traverse Bay Bands of Odawa Indians (collectively, “Tribes”), seeking a declaration that, with limited exceptions, the Tribes no longer retain the right to hunt, and the other usual privileges of occupancy, secured by Article 13 of the 1836 Treaty of Washington on lands and inland waters within the boundaries of the territory ceded in the 1836 Treaty (“Inland Article 13 Rights”) (Dkt. No. 1473), and the Tribes filed a joint reply denying the State’s claim (Dkt. No. 1477). With the exception of disputed areas lying generally between the Ford and Escanaba Rivers in the Upper Peninsula and on the Thunder Bay Peninsula in Alpena County, the lands and inland Waters within the boundaries of the territory ceded in the 1836 Treaty are depicted in Appendix A, which is attached hereto and made a part hereof.

B. Plaintiff United States filed a supplemental complaint in the Litigation seeking a declaration that the Tribes retain Inland Article 13 Rights on lands and inland waters within the boundaries of the 1836 Ceded Territory that have not been required for settlement (Dkt. No. 1504), and the State filed an answer denying the United States’ claim (Dkt. No. 1516).

C. The Parties explored settlement of their respective claims regarding Inland Article 13 Rights, reached an agreement in principle on the terms and conditions of such a settlement, and have now stipulated to the entry of this Decree, which is intended to resolve conclusively such claims, and to provide for the protection of the resources in the 1836 Ceded Territory.

D. The Parties were represented by attorneys of their own choosing in negotiating and drafting this Decree, which was the product of arms-length negotiations by Parties of equal bargaining power. Accordingly, the Parties have agreed that any ambiguities in this Decree shall not be construed against any Party on the basis of the status of the Parties or by virtue of the fact that such Party drafted or assisted in the drafting of the relevant portion of this Decree. The Parties have further agreed that, in the event of any inconsistency between the terms of this Decree and the Parties' agreement in principle, the terms of this Decree shall be controlling.

E. Representatives of Amici Curiae (Michigan United Conservation Clubs, Coalition to Protect Michigan's Resources ("CPMR") [formerly Michigan Fisheries Resource Conservation Coalition ("MFRCC")], U.P. Whitetails Association, Inc. and Bays de Noc Great Lakes Sportsfishermen, Inc.) and applicants for intervention (MFRCC, Stuart Cheney, Robert Andrus and the Walloon Lake Trust and Conservancy) attended the Parties' settlement discussions and support the Parties' efforts to settle the Parties' respective claims regarding Inland Article 13 Rights on the terms and conditions set forth in this Decree. The Parties' Agreement in Principle set forth an agreement among the Parties and the applicants relating to intervention motions, the terms of which are set forth in Appendix M, which is attached hereto and made a part hereof.

F. This Decree is a fair and equitable resolution of the Parties' respective claims regarding Inland Article 13 Rights.

NOW, THEREFORE, it is hereby ORDERED, ADJUDGED, AND DECREED that this Decree shall be entered as the Court's Judgment and Decree fully and finally resolving the Parties' respective claims regarding Inland Article 13 rights. Each Party shall be responsible for its own expenses incurred in procuring this Decree, including its attorneys' fees and costs. The Clerk is directed to enter Judgment accordingly.

I. JURISDICTION

1.1 This Court has jurisdiction over the subject matter of the State's counterclaim and the United States' supplemental complaint pursuant to 28 U.S.C. §§ 1331, 1345, and 1346. This Decree implements the settlement of the Parties' respective claims with respect to Inland Article 13 rights under the 1836 Treaty of Washington.

1.2 This Court also has personal jurisdiction over the Parties. The Parties waive all objections and defenses that they may have with respect to the personal jurisdiction of the Court or to venue in this District for purposes of the entry, interpretation, modification or enforcement of this Decree.

1.3 The Court shall retain jurisdiction over the Parties and subject matter of this action to enforce this Decree and to resolve disputes arising under this Decree, subject to Section XXVII (Dispute Resolution), and to consider modifications of this Decree under Section XXVIII (Modifications).

II. PARTIES BOUND

This Decree shall apply to and be binding upon the Parties, their officers, employees, agencies, subdivisions, successors, and assigns and shall remain binding notwithstanding any future rulings or determinations in any jurisdiction that may be inconsistent with the provisions of this Decree.

III. DEFINITIONS

As used in this Decree, the following terms shall have the meanings ascribed to them in this Section III:

3.1 “1836 Ceded Territory” means the territory ceded in the 1836 Treaty of Washington, 7 Stat. 491.

3.2 “2000 Great Lakes Consent Decree” means the 2000 Consent Decree pertaining to the Tribes’ Great Lakes fishing rights (Dkt. No. 1458), as heretofore or hereafter amended.

3.3 “Bow” means a bow and arrow or a crossbow and bolt.

3.4 “CFA” means Michigan’s Commercial Forest Act, Mich. Comp. Laws, § 324.51101 *et seq.*

3.5 “Fish” or “Fishing” means the pursuing, capturing, catching, killing, or taking of fish, and includes attempting to pursue, capture, catch, kill, or take fish.

3.6 “Gather” or “Gathering” means to take or acquire possession of any wild plant or part thereof or other natural resource, and includes attempting to take or acquire possession of any wild plant or part thereof or other natural resource, but does not include Hunting, Trapping or Fishing.

3.7 “Hand Net” means a net or wire mesh bag of any circumference with a handle that can be lifted by one person.

3.8 “Handicapped Hunter” means a hunter who is unable to walk due to being a paraplegic or an amputee, or unable to walk unassisted due to a permanent disability caused by other condition, disease or injury.

3.9 “Harvesting Activities” means Hunting, Trapping, Fishing, or Gathering or any combination thereof.

3.10 “Hook-and-Line Gear” means any standard angling gear that uses a hook imbedded in natural bait or an artificial lure to attract and take fish by hooking them in the mouth and that is attached to a line to pull fish in for capture. Hook-and-Line Gear includes rods and reels and tip-ups fished in open water or through the ice, but does not include a trotline.

3.11 “Hunt” or “Hunting” means shooting, shooting at, pursuing, taking, catching, Trapping, or killing any wild animal or animals.

3.12 “Impoundment Nets” means trap nets or fyke nets, which are stationary nets attached to the lake bottom that capture fish by guiding them into enclosures.

3.13 “Inland Article 13 Rights” means the right to hunt, and the other usual privileges of occupancy, secured by Article 13 of the 1836 Treaty of Washington, 7 Stat. 491, on lands and inland waters within the boundaries of the territory ceded in the 1836 Treaty.

3.14 “Lake” or “Lakes” means an inland lake or lakes of any size, including natural and artificial lakes and drowned river mouths, except where the context clearly refers to the Great Lakes.

3.15 “Lake System” means an inland Lake and its tributaries.

3.16 “Long Seine” means a seine that is at least 12 feet in length but no more than 30 feet in length, and no more than four feet in depth.

3.17 “MDNR” means the Michigan Department of Natural Resources, its successor entities, and those authorized persons or entities acting on its behalf.

3.18 “Non-Walleye Lake System” means a Lake System that is not a Walleye Lake System.

3.19 “Parties” means, collectively, the United States, the State and the Tribes, and “Party” means any one of them.

3.20 “Protected Streams” means the Streams and Stream segments identified in subparagraphs c(i) and (c)(ii) of Paragraph 11.7 of this Decree, subject to any modifications in such Streams or Stream segments under subparagraph (i) of Paragraph 11.7 of this Decree.

3.21 “Short Seine” means a seine that is less than 12 feet in length, and no more than four feet in depth.

3.22 “Spear” means a hand, rubber, or spring-propelled spear.

3.23 “Specially Regulated Fishing Methods” means the use of Impoundment Nets or Long Seines at any time of the year to harvest any species of fish and the use of Spears, Bows, Hand Nets and Hook-and-Line Gear to harvest walleye in a Walleye Lake System during the Walleye Spawning Season for that Lake System.

3.24 The terms “State” or “State of Michigan” mean, collectively, the State of Michigan, the Michigan Department of Natural Resources, the Michigan Natural Resources Commission, MDNR Director, MDNR Fisheries Division Chief, MDNR Wildlife Division Chief, MDNR Law Enforcement Division Chief, MDNR Resource Management Deputy, and their successors and any authorized representatives acting on their behalf, or any one of them.

3.25 “Streams” means all rivers, streams, creeks and flowages.

3.26 “Trap” or “Trapping” means the taking of wild furbearing animals by means of a trap.

3.27 “Tribes” means, collectively, the Bay Mills Indian Community, the Sault Ste. Marie Tribe of Chippewa Indians, the Grand Traverse Band of Ottawa and Chippewa Indians, the Little River Band of Ottawa Indians, and the Little Traverse Bay Bands of Odawa Indians; “Tribe” means any one of them; and “Tribal” means of or pertaining to a Tribe.

3.28 “Walleye Lake System” means any Lake System known to have a walleye population maintained either by natural reproduction or stocking of cultured fish.

3.29 “Walleye Spawning Season” means the time of year when walleye reproduce. For purposes of this Decree, the Walleye Spawning Season is March 15 to the Friday before the last Saturday in April in Walleye Lake Systems in the Lower Peninsula and April 1 to May 14 in Walleye Lake Systems in the Upper Peninsula, unless changed under Paragraph 12.6 of this Decree.

3.30 “Waters” means inland Lakes and Streams.

IV. RECOGNITION OF TREATY RIGHTS

For the purpose of resolving the dispute as to the continued existence of the Tribes' Article 13 Rights, this Decree recognizes the existence of, and defines the extent of, the Tribes' Inland Article 13 Rights on the following lands and Waters within the boundaries of the 1836 Ceded Territory:

(a) Public lands and Waters (including, but not limited to, federal and State lands, which currently comprise, approximately, over 4,500,000 acres in the 1836 Ceded Territory);

(b) Private lands and Waters that are required to be open to the public under federal or State law, such as lands enrolled in the State's Commercial Forest Act (“CFA”) program (lands and waters that are open to the public under the Michigan Recreational Trespass Act because they are not fenced or posted in accordance with that Act are not required to be open under State law and are therefore not within this category of lands and Waters);

(c) Lands and Waters owned by a Tribe, a Tribal member, or the spouse of a Tribal member;

(d) Other private lands and Waters, including lands that are open to the public under the Michigan Recreational Trespass Act, which are not enrolled in the CFA program or another program pursuant to which they are required to be open to the public under federal or State law; and

(e) All other Waters that are open to the public for Fishing under federal or state law, including such Waters open to the public that are accessible through public rights-of-way and public road crossings or otherwise accessible to Tribal members by permission granted by the landowner or authorized lessee.

V. REGULATION OF TREATY RIGHTS

Each of the Tribes has the right to regulate its members' exercise of Inland Article 13 Rights, the extent of which is defined in this Decree. The State is prohibited from regulating or otherwise interfering with the exercise of such rights except as provided in this Decree. The State is also prohibited from prosecuting Tribal members for alleged Hunting and Fishing violations that preceded entry of this Decree, *provided* that the State may refer such alleged violations to the appropriate Tribe for prosecution under Tribal law.

VI. DEFINITION OF THE EXTENT OF INLAND ARTICLE 13 RIGHTS

6.1 This Decree defines the extent of the Tribes' Inland Article 13 Rights and imposes certain limitations on where, when, and how the Tribes may exercise those rights. The provisions of this Decree apply only to Inland Article 13 Rights; they do not: limit or expand the extent or exercise of the Tribes' Article 13 rights in the Great Lakes; limit or expand any provision of the 2000 Great Lakes Consent Decree; limit or expand any right (other than Inland Article 13 Rights) that a Tribe may have to authorize or engage in any activity on Tribal or trust land; or limit or expand the right of the Tribes or their members to undertake any other activity

pursuant to any other applicable law. The extent of the Tribes' Inland Article 13 Rights and the limitations on the exercise of those rights are set forth in this Decree.

6.2 Except as otherwise specifically provided below, the extent of the Tribes' Inland Article 13 Rights is defined as follows:

(a) Tribal members: (i) may Hunt, Fish, Trap, and Gather natural resources, without limitation as to the species (including non-native and artificially propagated species) targeted for harvest, the season or method of harvest, or the use of the resource harvested; (ii) may engage in other historically traditional activities (such as the construction and use of sweat lodges); and (iii) may obtain assistance from non-Tribal members to engage in the foregoing activities, as provided in Appendix C, which is attached hereto and made a part hereof; and

(b) Each of the Tribes may regulate the foregoing treaty-right activities of its members and enforce regulations pertaining to such activities. The Tribes may also engage in natural resources assessment, enhancement, and restoration activities as provided in Section XXI (Assessment Activities) and Section XXII (Restoration, Reclamation, and Enhancement Projects).

VII. LANDS AND WATERS ON WHICH TRIBAL MEMBERS MAY EXERCISE INLAND ARTICLE 13 RIGHTS

Except as otherwise provided below, Tribal members may exercise Inland Article 13 Rights, to the extent defined in Paragraph 6.2, on the following lands and Waters within the boundaries of the 1836 Ceded Territory, as depicted in Appendix A, *provided* that the Tribes shall not exercise Inland Article 13 Rights in disputed areas lying generally between the Ford and Escanaba Rivers in the Upper Peninsula or on the Thunder Bay Peninsula in Alpena County unless and until the dispute as to such areas is resolved by mutual agreement of the Parties or Court order:

(a) Public lands and Waters that are open to the public under federal or State law for the particular activity (*e.g.*, Hunting, Fishing, Trapping or Gathering), notwithstanding any species, season, method or use limitations in federal or State law, *provided that* in State, county and municipal parks, State wildlife refuges, formally designated State wildlife research areas, and formally designated State fisheries research areas, Tribal regulations shall only permit Hunting and Fishing in such areas where and at such times when the parks, refuges, and research areas are open to the public for Hunting and Fishing, and shall be no less restrictive than other State regulations limiting Hunting and Fishing in such areas, *and provided further* that such limitations shall not apply to a new or expanded park, wildlife refuge or wildlife or fisheries research area if the creation or expansion of the area was intended to limit treaty harvesting opportunities, and *provided further* that the State shall consult with the Tribes before creating a new or expanding an existing State park, wildlife refuge, wildlife research area or fisheries research area and shall attempt to avoid or minimize any adverse impact on the exercise of the Tribes' rights under this Decree as a result of such designation or expansion;

(b) Private lands and Waters that are required to be open to the public under federal or state law for the particular activity, such as Hunting and Fishing (but not Gathering) on lands enrolled in the State's CFA program, notwithstanding any species, season, method or use limitations in federal or state law, *provided that*, in the interests of social harmony, the Tribes or their members shall obtain permission from a CFA landowner in order to Hunt or Fish on his or her CFA lands outside State seasons and methods if the CFA landowner owns, in the aggregate, less than 1,000 acres in the CFA program, and *provided further that* generally applicable provisions of State law regarding the liability of CFA landowners arising from the activities of hunters or fishers on CFA lands, and generally applicable provisions of the CFA program

allowing CFA landowners to limit access to CFA lands subject to active timber harvesting operations shall apply to Hunting and Fishing by Tribal members on CFA lands, and *provided further that* nothing herein shall be construed to authorize the use of snowmobiles, all-terrain vehicles, or other motor vehicles on CFA lands if such use is otherwise prohibited under applicable law;

(c) Lands and Waters owned by a Tribe, a Tribal member or the spouse of a Tribal member;

(d) Other private lands and Waters owned by non-Tribal members, with permission from the owner or authorized lessee, *provided that*, in the case of private Waters, *i.e.*, a non-navigable Lake with no public access or a non-navigable stream segment on a parcel or parcels of private property, the grant of permission by a riparian owner does not violate the Michigan common law rights of any other riparian owners, and *provided further that*, except for special needs subsistence or ceremonial permits, which shall be limited in number, the Tribes shall restrict Hunting and Trapping on such lands and Waters in a manner consistent with State seasons and methods, and *provided further that*, during State seasons, permission shall be implied on lands and Waters open to the public for Hunting and Fishing under the Michigan Recreational Trespass Act, Mich. Comp. Laws, § 324.73101 *et seq.*, as now in force or hereafter amended, and *provided further that*, when permission is not implied, the Tribes shall require their members to possess written evidence of permission from the landowner or authorized lessee, or the name and phone number of the landowner or authorized lessee from whom they obtained permission, while Hunting on such lands; and

(e) All other Waters that are open to the public for Fishing under federal or State law notwithstanding any species, season, method or use limitations in federal or State law,

including such Waters open to the public that are accessible through public rights-of-way and public road crossings or otherwise accessible to Tribal members by permission granted by the landowner or authorized lessee, but only for purposes of Fishing in such Waters, *provided* that Tribal members exercising Fishing rights within the scope of subparagraph (a) of Paragraph 6.2 of this Decree shall not place Impoundment Nets on privately owned bottom lands if doing so is in violation of the Michigan common law riparian rights of the private bottom land owner. Nothing herein shall be construed as recognizing a right to Fish on private Waters not open to the public except those owned by a Tribe, a Tribal member or the spouse of a Tribal member or on which permission is obtained from a riparian owner as provided in subparagraph (d) of this Section VII (Lands and Waters on Which Tribal Members May Exercise Article 13 Rights).

VIII. COMMERCIAL HARVESTS

The Tribes shall not authorize their members to harvest for commercial purposes or sell wildlife, fish or other aquatic species, amphibians, reptiles, or timber, except for those species, other than timber, for which the State authorizes inland commercial harvests. Notwithstanding the foregoing, the Tribes may authorize their members: to commercially harvest fish that the State is targeting for eradication or reduction from a particular water body, and which the State does not intend to use for other fisheries management purposes, pursuant to clause (a) of Paragraph 11.2 of this Decree, *provided* that there is a mutually agreeable mechanism to assure that the harvested fish are from that particular water body; to engage in informal trade and barter within Tribal communities of any species lawfully harvested under Tribal regulations, *provided* that nothing herein shall authorize the re-sale of any fish or wildlife subject to such trade or barter; to commercially harvest furbearers and to sell furs; to Gather plants and the products thereof, such as wild berries, mushrooms, nuts and fruits, for sale or for use in producing salable

commodities, such as maple syrup, subject to the restrictions set forth in Section XX (Use of State Lands) regarding State lands; and to use the parts of harvested animals and plants for the manufacture of handicrafts and to sell such handicrafts. Except as otherwise provided in this section, the Tribes shall not authorize their members to sell parts of harvested animals contrary to State and federal laws and regulations.

IX. SALE OR TRADE OF LIVE ANIMALS

The Tribes shall not authorize their members to engage in the sale or trade of live wild animals except in accordance with federal or State law.

X. RESTRICTIONS ON HUNTING AND FISHING AT PARTICULAR LOCATIONS

10.1 The Tribes shall prohibit their members from Hunting with firearms and bows within 150 yards of an occupied building, house, cabin, or any barn or other building used in a farm operation, except with the consent of the owner or authorized lessee.

10.2 The Tribes shall limit their members' use of firearms to shotguns in that part of the 1836 Ceded Territory that lies within the shotgun zone designated by the State as of October 2006 (as set forth in Appendix D, which is attached hereto and made a part hereof), as long as the State imposes such a limitation on non-Tribal members. The Tribes shall consider whether to limit their members' use of firearms to shotguns in additional parts of the 1836 Ceded Territory that the State may designate as shotgun zones in the future, in light of the State's purpose for such designations and the effect of the limitation on Tribal members' treaty Hunting opportunities.

10.3 The Tribes shall adopt regulations that are no less restrictive than State regulations prohibiting Fishing within 300 feet of any of the State's salmon and steelhead egg collection weirs to the extent such regulations apply to Waters and shall prohibit Fishing for

Coho salmon within 300 feet of the lower weir on the Platte River as long as the State prohibits harvests of Coho salmon in such Waters. If the State adopts an emergency regulation prohibiting harvests of Coho salmon in other portions of the Platte River below the upper State-owned hatchery weir, in order to ensure adequate egg collections at that weir in a particular year, the Tribes shall adopt a parallel prohibition, which shall remain in effect during that year, but only until the State rescinds its prohibition or until sufficient egg collection is assured for that year, whichever occurs first. Except as otherwise agreed between the State and the Tribes, the Tribes shall prohibit the spearing of Atlantic salmon in the Torch Lake watershed. The Tribes shall also adopt regulations that: (a) are no less restrictive than State regulations prohibiting Fishing in Rock River (Alger County) between Rock River Dam and the foot bridge downstream from M-28; (b) except as otherwise provided under subparagraph (i) of Paragraph 11.7 of this Decree, prohibit the use of Spears and Bows to harvest steelhead in the Little Manistee River from the mouth of the Little Manistee River at its confluence with Manistee Lake upstream to 300 feet downstream from the Little Manistee River Weir; (c) prohibit the take or possession of northern pike in Potagannising River (Chippewa County) below the Potagannising Dam downstream to Maxton Road from April 15 to May 15; and (d) are no less restrictive than State regulations prohibiting Fishing within 100 feet of electrical lamprey control devices while in operation and the lamprey control barrier on the Betsie River. The Tribes may authorize their members to harvest Chinook salmon in the Little Manistee River from the mouth of the Little Manistee River at its confluence with Manistee Lake upstream to 300 feet downstream from the Little Manistee River Weir in accordance with subparagraphs (a) through (e) of this Paragraph 10.3.

(a) Any permits that are issued for the harvest of Chinook salmon in the portions of the Little Manistee River described above shall include bag and possession limits.

(b) Each year, the total harvest limit for Chinook salmon for Tribal fishers using Spears, Bows, dip nets or hands in the portions of the Little Manistee River described above shall be 10% of the lower 95% confidence limit for the average number of Chinook salmon returning to the Little Manistee River Weir in the previous four years. The Tribes shall only permit their members to use such gear from September 1 through November 14. During this period, the Tribes shall limit their members' harvest of Chinook salmon using such gear in the portions of the Little Manistee River described above in each consecutive 7-day period to: 15% or less of the total harvest limit for the season in each of the first three 7-day periods; 20% or less of the total harvest limit for the season in the fourth 7-day period; and 30% or less of the total harvest limit for the season in each of the remaining 7-day periods. If the State meets its egg-take quota for the year, the State shall immediately notify the Tribes that the total harvest limit for the season and the 7-day harvest limits may be rescinded for the current year.

(c) The Tribes shall prohibit Fishing using Hook-and-Line Gear from September 6 through October 15, or Spears at any time, in the southern end of Manistee Lake in the vicinity of the Little Manistee River at its confluence with Manistee Lake. The closed area is defined by a line extending from a squared red post located 100 feet southeast of the launch ramp at the MDNR Public Access Site on the east shore, extending southwesterly to a squared red post on the west shore located near the southern end of the Packaging Corporation of America's plant. If the State meets its egg-take quota for the year, the State shall immediately notify the Tribes that the Fishing closure may be rescinded for the current year.

(d) In order to provide sufficient egg-take to assure future statewide fish runs and to provide adequate harvest levels for all users over the long-term, the State and the Tribes shall confer in a timely manner about appropriate adjustments to State and Tribal harvests in

Waters in which fish destined for the State's egg-collection facilities are harvested if the State has concerns about securing adequate egg collection for Chinook salmon. In the event that the State demonstrates that adequate egg collection is threatened in a particular year, the Tribes shall prohibit harvest of Chinook salmon by their members in the portions of the Little Manistee River described above until such time as sufficient egg collection is assured for that year, as long as the State also prohibits the harvest of Chinook salmon by State-licensed fishers in that portion of the Little Manistee River during that period of time.

(e) The State and the interested Tribes shall review the appropriateness of the harvest estimation methodology, harvest limits, and weekly harvest distributions described in subparagraph (b) of this Paragraph 10.3 every 5 years to determine the adequacy of harvest opportunities for Tribal needs and the impact on egg collection, and make appropriate adjustments.

(f) The limitations on Tribal harvests in this Paragraph 10.3 shall be operative only to the extent the State imposes similar or more restrictive limits on State-licensed fishers.

10.4 The Tribes shall adopt regulations that are no less restrictive than State regulations for Fishing on trout Streams designated as Types 5, 6 or 7 as of October 2006 (as set forth in Appendix E, which is attached hereto and made a part hereof), as long as the State maintains the same or more restrictive regulations for non-Tribal members. The State shall consult with the Tribes prior to designating additional miles under its authorization to designate up to 212 miles of trout Streams as Types 5, 6 or 7. The Tribes shall consider adopting regulations that are no less restrictive than State regulations for Fishing on additional trout Streams designated as Types 5, 6 or 7 on a case-by-case basis (up to a total of 212 designated miles statewide) in light of the State's purpose for such designations and the effect of such

regulations on Tribal members' treaty Fishing opportunities. In the event that the current designation of Types 5, 6, or 7 is changed in name only, this provision shall be applicable to the successor designation.

10.5 The Tribes shall prohibit the use of Spears to take fish on Lakes designated by the State as Type D as of October 2006 (as set forth in Appendix F, which is attached hereto and made a part hereof), and shall adopt hook-and-line regulations on such Lakes that are no less restrictive than State regulations for such Lakes, as long as these are trout-only Lakes and the State imposes such prohibitions and regulations on non-Tribal members. The State shall consult with the Tribes prior to designating additional Type D Lakes. The Tribes shall consider adopting regulations that are no less restrictive than State regulations for Fishing on additional Type D lakes in light of the State's purpose for such designations and the effect of such regulations on Tribal members' treaty Fishing opportunities. In the event that the current designation of Type D Lakes is changed in name only, this provision shall be applicable to the successor designation.

10.6 The Tribes shall prohibit or restrict spearing of northern pike and muskellunge in a manner that is no less restrictive than 2006 State spearing restrictions with respect to these two species as set forth in Note 8 to Table 2 of the 2006 Michigan Fishing Guide (at p. 10) (as set forth in Appendix G, which is attached hereto and made a part hereof), as long as the State imposes similar or more restrictive limitations on non-Tribal members. The State shall consult with the Tribes prior to adopting additional restrictions on spearing of northern pike or muskellunge. The Tribes shall consider adopting regulations that are no less restrictive than such additional State regulations on a case-by-case basis in light of the State's purpose for such regulations and the effect of such regulations on Tribal members' treaty Fishing opportunities.

10.7 The Tribes shall adopt regulations that are no less restrictive than State Fishing regulations existing as of October 2006 (as set forth in Appendix H, which is attached hereto and made a part hereof) on the following designated quality Lakes: in Crawford County, Jones and Wakeley Lakes, and in Montmorency County, North and South Blue Lakes and Robarge (Pike) Lake, as long as the State imposes similar or more restrictive regulations on non-Tribal members. The Tribes shall consider adopting regulations that are no less restrictive than State regulations for Fishing on quality Lakes that may be designated in the future on a case-by-case basis in light of the State's purpose for such designations and the effect of such regulations on Tribal members' treaty Fishing opportunities.

10.8 The Tribes shall implement emergency closures of their members' harvesting activities that are no less restrictive than State emergency closures of harvesting activities by State licensees based on biological or public health or safety concerns. In order to implement this provision, the State shall provide notice to the Tribes as soon as practicable when such concerns arise and shall consult with the Tribes regarding the need for such closures. In the event that the Tribes enact emergency closures of their members' harvesting activities based on biological or public health or safety concerns, the Tribes shall notify the State as soon as practicable when such concerns arise and shall consult with the State regarding the need for closures of harvesting activities by State licensees. In the event the Parties disagree about the need for an emergency closure, they shall jointly commit to expedited dispute resolution. A Tribe objecting to the emergency closure shall have the burden to show that it is not necessary to close its members' harvesting activities to address the biological or public health or safety concerns identified by the State. As used in this Decree, "public health or safety concerns" do

not include concerns arising from social or political opposition to the exercise of Indian treaty rights.

10.9 Except as otherwise provided in this Paragraph 10.9, Tribal seasons shall be no less restrictive than State seasons for Hook-and-Line Gear Fishing for walleye in Streams tributary to the bays de Noc. The Tribes may authorize Hook-and-Line Gear Fishing and spearing for walleye between March 15 and May 15 on the Sturgeon River, a tributary to Big Bay de Noc in Delta County, the Escanaba River, a tributary to Little Bay de Noc in Delta County, the Days River, a tributary to Little Bay de Noc in Delta County, and the Rapid River, a tributary to Little Bay de Noc in Delta County. The Tribes that authorize Hook-and-Line Gear Fishing outside State seasons and spearing for walleye on these tributaries shall establish a permit system for such Fishing, which shall include the following provisions:

(a) The Tribal annual harvest of walleye using Hook-and-Line Gear outside State seasons and Spears under this Paragraph 10.9 shall not exceed 2,500 fish, except as provided in subparagraph (g) of this Paragraph.

(b) Tribal regulations for Hook-and-Line Gear Fishing outside State seasons and spearing for walleye under this Paragraph 10.9 shall include a field possession limit not to exceed twice the bag limit or 10 fish, whichever is less, a minimum size limit of at least 14 inches, and a daily bag limit not to exceed 10 fish. Tribal regulations shall require that walleye under the minimum size that are speared under this Paragraph must be retained as part of the daily bag limit without penalty to the fisher.

(c) The total number of permits issued for Hook-and-Line Gear Fishing outside State seasons and spearing for walleye under this Paragraph 10.9 shall be distributed among the four tributaries open to such Fishing such that no more than 20% of the total permits

issued shall be available for the Sturgeon River. In order to avoid concentration of harvest, the Tribes shall make reasonable efforts to distribute the harvest among the remaining tributaries open to Hook-and-Line Gear Fishing outside State seasons and spearing by Tribal members.

(d) The permits required under this Paragraph 10.9 shall be limited to Hook-and-Line Gear Fishing or spearing (but not both), shall include the name of the Tribal member, the date on which the permit is effective, the tributary for which the permit is issued, and the authorized method of harvest. The Tribes shall require their members to have a permit in possession when Fishing under the provisions of this Paragraph. The Tribes shall not issue more than one such permit to any member for any day under this Paragraph.

(e) The Tribes shall provide notice to the State before any use of Hook-and-Line Gear outside State seasons or any use of Spears may take place under this Paragraph 10.9, in accordance with a protocol adopted by the Parties under Paragraph 23.2 of this Decree. The notice provided to the State shall identify the body of water, the number of fishers, and the date on which Hook-and-Line Gear or Spears will be used, and shall be provided at least seven hours (and before 1:00 pm of the same day) before the use of Hook-and-Line Gear or Spears. The State and the Tribes shall share information on Waters where the use of Spears is permitted in accordance with a protocol adopted by the Parties under Paragraph 23.2 of this Decree.

(f) The Tribes shall require their members to submit harvest reports for the use of Hook-and-Line Gear outside State seasons or spearing of walleye under this Paragraph 10.9 within seven days after the harvest. The harvest reports shall indicate the date of harvest, the tributary where the harvest took place, and the number of walleye harvested. Final reports detailing the walleye harvest under this Paragraph 10.9 that include the information identified in this sub-paragraph shall be submitted to the State no later than June 30.

(g) Except for the Whitefish River, a tributary to Little Bay de Noc in Delta County, the Tacoosh River, a tributary to Little Bay de Noc in Delta County, and the four tributaries identified as open for Tribal Hook-and-Line Gear Fishing outside State seasons or spearing for walleye under this Paragraph 10.9, if a future estimate of abundance of adult walleye in any other tributary to the bays de Noc suggests that Tribal members may harvest walleye using Hook-and-Line Gear outside State seasons or Spears on such tributary, the State and the Tribes may mutually agree to such harvest, *provided* that it shall not exceed 5% of the estimated abundance of adult walleye in that particular tributary.

(h) The State and the Tribes agree to review, consult on, and as appropriate modify by mutual agreement, the provisions of this Paragraph 10.9 every 15 years, taking into consideration walleye abundance in the tributaries to the bays de Noc, the adequacy of Tribal harvest opportunities, and other relevant factors.

10.10 In applying the walleye protocol described in Section XII (The Use of Specially Regulated Fishing Methods in Inland Lakes and Their Tributaries), the Muskegon River and its tributaries between the Croton Dam and Muskegon Lake shall be considered part of the Muskegon Lake system. In determining maximum allowable exploitation rates and harvest levels for the Muskegon Lake system, the State and the Tribes shall allow sufficient escapement for walleye population rehabilitation and egg collection. The Tribes shall regulate their members' harvest of walleye in a manner that ensures that no more than 50% of the Tribes' allowable harvest in the Muskegon Lake system will be taken in the Muskegon River and its tributaries between the Croton Dam and Muskegon Lake.

10.11 As long as the State imposes similar or more restrictive limitations on State-licensed fishers, the Tribes shall prohibit their members' possession of brook and brown trout in

Streams designated Types 1, 2 or 4 as of October 2006 (as set forth in Appendix I, which is attached hereto and made a part hereof): (a) from October 15 through November 30 in the Lower Peninsula; and (b) from October 1 through November 15 in the Upper Peninsula.

XI. GEAR AND METHODS OF TAKE

11.1 The Tribes shall: prohibit their members from Hunting with artificial lights, except when Hunting for species for which the State permits the use of artificial lights, such as coyote and raccoon; prohibit the use of toxins, live decoys, pitfalls, explosives, fully automatic firearms, and exploding bullets; and prohibit Hunting from aircraft, snowmobiles, motorized vehicles, and motorized vessels under power, *provided* that the Tribes may permit Hunting from standing motorized vehicles by Handicapped Hunters. The Tribes shall prohibit the molestation or breaking open of the house, hole, nest, burrow, or den of a badger, beaver, mink, muskrat, or raccoon, whether occupied or not. The Tribes shall also prohibit the setting of a trap on a beaver dam or lodge unless the trap is fully submerged below the water. The Tribes shall impose the prohibitions in this Paragraph 11.1 as long as the State imposes similar or more restrictive limitations on State-licensed hunters.

11.2 The Tribes shall prohibit their members from using gill nets or Impoundment Nets except that: (a) the Tribes may authorize the use of Impoundment Nets to harvest fish species that the State is targeting for eradication or reduction from a particular water body and may use gill nets to harvest such species if the State is targeting all fish species for eradication from a particular water body; (b) the Tribes may authorize the use of Impoundment Nets in inland Lakes in accordance with Section XII (The Use of Specially Regulated Fishing Methods in Inland Lakes and Their Tributaries); and (c) the Tribes may authorize the use of gill nets or Impoundment Nets in authorized assessment activities under Section XXI (Assessment

Activities), *provided* that under the foregoing exceptions to the prohibition of the use of gill nets and Impoundment Nets, gill nets and Impoundment Nets shall only be in the water during the authorized duration of the activities in question. Nothing in this provision shall require the Tribes to prohibit the use of seines, Hand Nets, or dip nets, *provided* that the Tribes' authorization of the use of such gear shall be subject to other applicable provisions in this Decree. The Tribes shall impose the prohibitions required in this Paragraph 11.2 as long as the State imposes similar or more restrictive prohibitions on State-licensed fishers.

11.3 The Tribes shall regulate their members' Fishing activities through the use of daily bag limits, possession limits, size limits and seasons, as well as any additional measures that may be necessary to address biological concerns. Except when engaged in spearing through the ice, the Tribes shall require their members to submit harvest reports for trout, salmon, walleye, northern pike, or muskellunge within seven days after the harvest when spearing, Bow Fishing, impoundment netting, seining, Fishing with hands, trot line Fishing or dip netting. The Tribes shall require that the harvest reports indicate the date of harvest, body of water where the harvest took place, and the number of fish harvested by species. Information on lengths and weights, and, if possible, sex of fish harvested by Tribal members shall be obtained by Tribal biological staff through sub-sampling of the harvest as appropriate, taking into consideration the need for such information and the costs of such sub-sampling, after consultation with the State through an annual review process.

11.4 Except in Streams, the Tribes may authorize the use of seines (but not purse seines), *provided* that Tribal regulations shall: (a) be no less restrictive than State regulations for harvesting minnows or other bait fish with the use of seines as of October 2006 (as set forth in Appendix J, which is attached hereto and made a part hereof); (b) include a two-gallon bag limit

for harvesting smelt with the use of seines if the State adopts a two-gallon bag limit or less for the harvest of smelt under State regulations; (c) be consistent with applicable provisions of Section XII (The Use of Specially Regulated Fishing Methods in Inland Lakes and Their Tributaries) for harvesting of other species; (d) limit seines to a maximum dimension of 30 feet by 4 feet; and (e) establish a maximum stretch mesh size of one and one-half (1.5) inches for Long Seines constructed of monofilament materials. The limitations on the use of seines in this Paragraph 11.4 shall be operative only to the extent the State imposes similar or more restrictive limits on State-licensed fishers, *provided* that the Tribes may issue a limited number of special ceremonial permits for the use of seines in Streams between December 1 and March 31, subject to the other provisions of this Paragraph.

11.5 As long as the State imposes similar or more restrictive limits on State-licensed fishers, the Tribes shall: (a) prohibit the use of more than four Fishing lines during open water Fishing conditions and the use of more than seven lines when ice Fishing; (b) require that tip-ups be identified by name; and (c) prohibit unattended tip-ups.

11.6 Except as provided in Paragraph 10.3, the Tribes may authorize the spearing of salmon, provided that Tribal regulations shall include a daily bag limit and a possession limit for spearing.

11.7 The Tribes may authorize spearing of steelhead, *provided* that Tribal regulations shall include a daily bag limit and a possession limit for spearing. The Tribes may open all Streams and Stream segments to their members for the spearing of steelhead, *provided* that Tribal regulations governing spearing for steelhead in Protected Streams shall be subject to the provisions of the protocol described in subparagraph (b) of this Paragraph 11.7 and the initial protections for adult steelhead identified in subparagraphs (c) through (e) of this Paragraph,

subject to any modification of those provisions under subparagraph (i) of this Paragraph. As used in this Paragraph, the term “Protected Streams” refers to the Streams and Stream segments identified in subparagraph (c)(i) and (c)(ii) of this Paragraph, subject to any modification in such Streams or Stream segments under subparagraph (i) of this Paragraph.

(a) The State desires to achieve self-sustaining steelhead populations through natural reproduction. In order to achieve this goal, the State provides protection for natural reproduction of steelhead by closing Types I and II Streams to harvest from October 1 through the last Saturday in April and by closing certain stream segments during the steelhead spawning season. These closures are a recognition of the fact that optimal habitat for juvenile steelhead is provided in Streams that have intrinsic habitat characteristics, which include a significant contribution of groundwater and favorable temperature conditions for juvenile survival and growth. The State believes that, in Michigan, the number of highly productive Streams or Stream segments with optimal habitat is limited and must be protected in order to provide wild fish for future generations.

(b) The State and the Tribes shall provide protections for steelhead that spawn in Streams or Stream segments in each watershed where juvenile steelhead are most likely to become smolts and thus provide recruits to future steelhead populations. In order to identify Streams of high production potential for steelhead smolts and to protect steelhead that spawn in such Streams, the Tribes and State agree to use and to continue the development of a protocol that includes: (a) a predictive model of the abundance of age-1 juveniles and thus future smolts as a scoping guide; (b) empirical information from field surveys and stream temperature information; (c) the protection of adult steelhead that spawn in these Streams; (d) realistic goals for natural production of steelhead consistent with the management objectives of the Lake

Committees for lakes Michigan, Huron, and Superior; and (e) any other relevant scientific information related to steelhead. The State and the Tribes shall provide for periodic peer review of the model(s) and data being used pursuant to the protocol described in this subparagraph to ensure that the model(s) and data are scientifically valid. The initial protections to be provided by the State and the Tribes under the protocol are those described in subparagraphs (a) and (c) through (e) of this Paragraph.

(c) Based on the protocol described in subparagraph (b) of this Paragraph 11.7, the State has identified the following locations, initially, as potentially highly valuable Streams for producing and maximizing survival to smolting of juvenile steelhead. Unless otherwise noted, stream segments under protection begin at the downstream confluence of the watershed with the Lake to which the watershed is a tributary.

(i) Within the following four Upper Peninsula groups of stream segments, the Tribes shall prohibit spearing of steelhead except from April 1 to April 15 and shall prohibit harvest of steelhead by all other methods from April 1 to the last Saturday of April (except for such methods with which, and at such times at which, the State permits steelhead harvests by State-licensed fishers):

1. Black River mainstem and tributaries upstream of the confluence of Peters Creek (Mackinac County, Lake Michigan Basin);

2. North Branch of the Pine River and its tributaries upstream of the Highway 40 bridge and mainstem of the Pine River and its tributaries upstream of the confluence with the North Branch of the Pine River (Mackinac and Chippewa counties, Lake Huron Basin);

3. North Branch of Carp River and its tributaries, and South Branch of Carp River and its tributaries (Mackinac County, Lake Huron Basin); and

4. Sucker River mainstem and its tributaries upstream of Seney Road Bridge (Alger County, Lake Superior Basin);

(ii) Within the following 11 Lower Peninsula groups of stream segments, the Tribes shall prohibit spearing of steelhead except from April 1 to April 15 and shall prohibit harvest of steelhead by all other methods from March 15 to the last Saturday of April (except for such methods with which, and at such times at which, the State permits steelhead harvests by State-licensed fishers):

1. Cedar Creek and its tributaries upstream from River Road and Bigelow Creek and its tributaries in the Muskegon River watershed (Lake Michigan Basin, Muskegon and Newaygo counties);

2. Skeel Creek and its tributaries and North Branch of the White River above Arthur Road in the White River watershed (Lake Michigan Basin, Oceana and Muskegon counties);

3. Baldwin River and its tributaries and all tributaries upstream of M-37 in the Pere Marquette watershed (Lake Michigan Basin, Lake and Newaygo counties);

4. Little Manistee River mainstem from Spencer's Bridge upstream, including all tributaries (Lake Michigan Basin, Lake County);

5. Above County Road 600, Bear Creek mainstem and tributaries in the Manistee River watershed (Lake Michigan Basin, Manistee County);

6. Dair Creek and its tributaries and Little Betsie River and its tributaries in the Betsie River watershed (Lake Michigan Basin, Benzie and Manistee counties);

7. The mainstem of the Platte River from the upper State-owned hatchery weir downstream to Platte Lake (Lake Michigan Basin, Benzie County), *provided* that this stream segment shall be considered a Protected Stream only if the State permits passage of steelhead past the upper State-owned hatchery weir;

8. The mainstem Jordan River and all tributaries above Graves Crossing (Lake Michigan Basin, Antrim County);

9. Little Ocqueoc River and its tributaries and Silver Creek and its tributaries in the Ocqueoc River watershed (Lake Huron Basin, Presque Isle County);

10. The mainstem Pigeon River and its tributaries upstream of Webb Road (Mullett Lake, Lake Huron Basin, Otsego County); and

11. The mainstem Sturgeon River upstream of Afton Rd (a.k.a. Webb Road or Wolverine Road near Wolverine) and the West Branch of the Sturgeon River and its tributaries (Burt Lake, Cheboygan and Otsego counties).

(d) Except as modified under subparagraph (i) of this Paragraph 11.7, the Tribal annual harvest of steelhead using Spears in Protected Streams shall not exceed 450 fish. Tribal regulations for the spearing of steelhead in such stream segments shall include a daily field possession limit not to exceed twice the daily bag limit, a minimum size limit of at least 16 inches, and a daily bag limit not to exceed three fish. Tribal regulations shall require that steelhead under the minimum size limit that are speared in such stream segments must be retained as part of the daily bag limit without penalty to the fisher.

(e) Except as modified under subparagraph (i) of this Paragraph 11.7, the total number of permits issued for spearing of steelhead in Protected Streams shall be distributed among the groups of Protected Streams in a manner that ensures that no more than 30 steelhead will be available for harvest from any one of the identified groups of Protected Streams. In order to avoid concentration of harvest, reasonable efforts should be made to evenly distribute the available permits among the stream segments within each of the identified groups of stream segments.

(f) The permits required for Protected Streams shall include the name of the Tribal member, the date on which the permit is effective, and the stream segment(s) for which the permit is issued. The Tribes shall require their members to have a permit in possession when spearing for steelhead in such stream segments. The Tribes shall not issue more than one such permit to any member for any day in such stream segments, and shall limit each permit to stream segment(s) within a particular group of Protected Streams.

(g) The Tribes shall provide notice to the State before any use of spears to harvest steelhead may take place in Protected Streams, in accordance with a protocol adopted by the Parties under Paragraph 23.2 of this Decree. The notice provided to the State shall identify the body of water, the number of fishers, and the date on which spears will be used to harvest steelhead, and shall be provided at least seven hours (and before 1:00 pm of the same day) before the use of spears. The State and the Tribes shall share information on Waters where the use of spears to harvest steelhead is permitted in accordance with a protocol adopted by the Parties under Paragraph 23.2 of this Decree.

(h) Unless the State and the Tribes mutually agree otherwise, the Tribes shall require their members to submit harvest reports for spearing of steelhead in accordance with

Paragraph 11.3 of this Decree, including the particular stream segment on which each fish is harvested. Information on lengths and weights, and, if possible, sex of steelhead harvested by Tribal members in Protected Streams shall be obtained by Tribal biological staff through sub-sampling of the harvest as appropriate, taking into consideration the need for such information and the costs of such sub-sampling, after consultation with the State through an annual review process.

(i) The State and the Tribes shall annually review, consult on, and as appropriate modify by mutual agreement the protocol described in subparagraph (b) of this Paragraph 11.7 and the specific provisions set forth in subparagraphs (a) and (c) through (e) of this Paragraph, based upon the results of the periodic peer review as required in subparagraph (b) of this Paragraph, additional information obtained through research or assessment by either the Tribes or the State regarding smolt production and/or abundance of adults within any stream, the effects of downstream (including Great Lakes) harvests or post-spawning harvests, or any other relevant scientific information related to steelhead, *provided* that the Tribes shall not be required to impose any additional restrictions on their members' harvests of steelhead in the following Streams in the Manistee River watershed: (1) Pine Creek and its tributaries and (2) below County Road 600, Bear Creek and its tributaries, including Cedar and Beaver Creeks and their tributaries, unless the State and the Tribes determine, by mutual agreement, that such restrictions should be adopted in exchange for mutually agreeable Tribal opportunities to harvest steelhead with Spears and Bows in the portion of the Little Manistee River described in Paragraph 10.3 of this Decree.

11.8 The Tribes shall adopt the following standards applicable to Impoundment Nets that may be used in inland Lake Systems.

(a) The Tribes shall prohibit the use of monofilament material in any part of an Impoundment Net.

(b) The Tribes shall prescribe the following maximum dimensions for Impoundment Nets:

(i) Pots shall not exceed eight feet in length by five feet in width by six feet in height.

(ii) Leads shall not exceed 150 feet in length or six feet in height.

11.9 As long as the State imposes similar or more restrictive limitations on State-licensed fishers, the Tribes shall close the following tributaries to Lake Superior to spearing: (a) Chocoday River; (b) Mosquito River; (c) Big Two Hearted River; (d) Little Two Hearted River; and (e) Anna River from its mouth upstream to the railroad crossing by Wagner Falls in Section 14, Township 46 North, Range 19 West.

11.10 The Tribes shall prohibit their members from snagging fish or retaining a fish not hooked in the mouth while engaged in Hook-and-Line Gear Fishing.

XII. THE USE OF SPECIALLY REGULATED FISHING METHODS IN INLAND LAKES AND THEIR TRIBUTARIES

12.1 The Tribes may authorize their members to use Specially Regulated Fishing Methods in all Waters as provided in this Section XII, *provided* that the Tribes shall not authorize their members to use Impoundment Nets or Long Seines in tributaries to inland Lakes except where the use of such gear is permitted by State law or Paragraph 11.4 of this Decree. Nothing in this Section XII shall restrict the Tribes' authorization of their members' use of Short Seines.

12.2 Except as provided in Paragraph 12.7 of this Decree, the Tribes' authorization of their members' use of Specially Regulated Fishing Methods in Walleye Lake Systems shall be

subject to the provisions of the protocol set forth in Appendix B1, which is attached hereto and made a part hereof. The Tribes and the State shall manage their respective fisheries for walleye in Walleye Lake Systems in accordance with the protocol set forth in Appendix B1.

12.3 The Tribes' authorization of their members' use of Impoundment Nets and Long Seines in non-Walleye Lake Systems shall be subject to the provisions of the protocol set forth in Appendix B2, which is attached hereto and made a part hereof.

12.4 The Tribes shall require all Impoundment Nets used by a Tribal member for Fishing to be marked with at least two buoys, one attached to the end of the lead and the other attached to the pot. In addition, if the nets have wings, the Tribes shall require additional buoys to be attached to the end of each wing. The Tribes shall require the member's Tribal affiliation and identification number to be displayed on the buoys.

12.5 The Tribes shall provide notice to the State before any use of Spears in a Walleye Lake System during the Walleye Spawning Season for that Lake System or any use of Impoundment Nets may take place under a Tribal permit in accordance with the procedures set forth in a protocol adopted by the Parties under Paragraph 23.2 of this Decree. The notice provided to the State shall identify the body of water, the number of fishers, and the date(s) and 24-hour period(s) during which such gear may be used, and such notice shall be provided at least seven hours (and before 1:00 pm of the same day), prior to the use of Spears and at least 24 hours prior to the use of Impoundment Nets. The State and the Tribes shall share information on waters where the use of Spears or Impoundment Nets is permitted in accordance with a protocol adopted by the Parties under Paragraph 23.2 of this Decree.

12.6 The Walleye Spawning Season for Walleye Lake Systems in the Lower Peninsula or the Upper Peninsula may be changed by mutual agreement between the State and the Tribes.

12.7 The Tribes' authorization of their members' use of Spears, Bows, Hand Nets, or Hook-and-Line Gear to harvest salmon, steelhead, or sturgeon in accordance with other provisions of this Decree shall not be subject to any restrictions in this Section XII or in the protocols set forth in Appendix B1 and Appendix B2. The Tribes' authorization of their members' use of Spears or Hook-and-Line Gear to harvest walleye in tributaries to the bays de Noc in accordance with Paragraph 10.9 shall not be subject to any restrictions in this Section XII or in the protocols set forth in Appendix B1 and Appendix B2.

XIII. DISEASE CONTROL

As long as the State enforces the following prohibitions, the Tribes shall prohibit their members from: (a) using bait as a method of take in the Hunting of deer and elk where prohibited by the State for the purpose of controlling disease; (b) importing live deer or elk into the State; (c) importing the carcass of a deer or elk into the State from a state or province in which Chronic Wasting Disease has been documented (unless the carcass is boned out and carved up); or (d) importing live turkeys, mute swans, skunks, or raccoons into the State. The Tribes shall also adopt regulations that are no less restrictive than State regulations that restrict the movement of ash products from emerald ash borer quarantine and eradication areas. In the event that fish or wildlife resources are threatened by diseases in the future, the Parties shall work cooperatively to take necessary measures to address the problem.

XIV. TAGGING AND REPORTING REQUIREMENTS

The Tribes shall impose tagging and reporting requirements for bobcat, otter, fisher and marten, as long as the State imposes such requirements. The State shall cooperate with the Tribes in insuring that the Tribes have sufficient CITES tags for species subject to the

Convention on International Trade in Endangered Species, as listed in 50 C.F.R. Part 23, Appendices I, II, and III.

XV. DEER HUNTING

15.1. Except as provided below, the Tribes shall impose the following restrictions on deer Hunting by their members as long as the State imposes similar or more restrictive limits on State-licensed hunters: (a) deer Hunting shall be limited to the period commencing the day after Labor Day and ending on the Sunday of the first full weekend in January (the “Tribal Deer Hunting Season”); (b) deer Hunting with firearms shall be prohibited during the period commencing on November 1 and ending on November 14; (c) each Tribal member shall be limited to a bag limit of five deer, no more than two of which may be antlered deer (*i.e.*, deer with at least one antler of three inches or more), during the Tribal Deer Hunting Season as a whole; and (d) each tribal member shall be limited to a firearm bag limit of two deer, no more than one of which may be an antlered deer, during the period commencing the day after Labor Day and ending on October 31. Notwithstanding the foregoing, the Bay Mills Indian Community may annually establish a collective bag limit for the total number of deer that may be harvested by Tribal members, which shall not exceed five times the number of Tribal members authorized by the Tribe to harvest the species. Another Tribe may adopt a quota number applicable to all of its licensed hunters in lieu of the foregoing bag limits, but only after further consultation with and agreement of the State.

15.2 Notwithstanding the foregoing, the Tribes may issue a reasonably limited number of special needs permits for subsistence deer Hunting and a reasonably limited number of special ceremonial permits that authorize their members to harvest deer for ceremonies (including, by way of example but not limitation, ghost suppers, weddings, or funerals) at any time. Deer

harvested pursuant to special ceremonial permits shall not count toward the bag limits set forth above.

XVI. WILD TURKEY HUNTING

The Tribes may authorize a spring male only wild turkey season beginning no earlier than April 15 and closing no later than June 15. For the fall either sex season, the Tribes may authorize a beginning date of no earlier than October 1 and a closing date of no later than November 14. The Tribes may authorize additional wild turkey harvest opportunities if the State authorizes such additional opportunities for State-licensed hunters. In addition, the Tribes may issue a reasonably limited number of special ceremonial permits that authorize their members to harvest wild turkey for ceremonies (including, by way of example but not limitation, ghost suppers, weddings, or funerals) at any time.

XVII. SPECIES IN NEED OF ALLOCATION

The Tribes shall limit their members' harvests of certain species for which current population levels necessitate an allocation of harvest opportunities, as provided in this Section XVII.

17.1 **Elk.** The State currently limits the harvest of elk through the issuance of a limited number of permits each year in designated elk management units. Each permit authorizes the opportunity to harvest a single animal; some of the permits are for either sex and some are for cows only. Except as otherwise provided below, the Tribes shall limit their members' harvest of elk in a given year to: (a) the number of elk of either sex equal to 10% of the either-sex permits issued by the State in such year; and (b) the number of female elk equal to 10% of the number of cows-only permits issued by the State in a year. Fractional numbers shall be rounded up to the next whole number in applying this provision. If the State issues less than a total of 101 permits

but more than 50, then the Tribes shall limit their members' harvest to a maximum of five elk of either sex and five female elk. If the State issues less than a total of 51 permits, the Tribes shall limit their members' harvest to a maximum of five elk in the same ratio of either-sex and cow-only permits that are issued by the State. The Tribes shall adopt regulations that are no less restrictive than State regulations governing the elk hunt, *provided* that the Tribes may allow tribal members to Hunt elk for up to 15 days after the closure of the State's last elk season. The Tribes may also transfer Tribal elk Hunting permits among Tribal members. The Tribes shall consult with the State before issuing Tribal elk permits in order to ensure that the geographical distribution of the permits is consistent with the State's management objectives.

17.2 **Bear.** The State authorizes harvests of limited numbers of bears in designated bear management units. The State and the Tribes shall consult regarding appropriate harvest levels for each bear management unit that encompasses lands within the 1836 Ceded Territory and make best efforts to achieve a consensus regarding such levels. The Tribes shall authorize their members to take no more than 10% of the available harvest in each such unit, *provided* that, if tribal members harvest 10% of the available harvest in any such unit in any year, the Tribes may authorize their members to take up to 12 ½% of the available harvest in that unit in subsequent years. The Tribes shall limit the harvest of bears to a season commencing no sooner than the beginning of the State's bear season and ending no later than the last day of the State's bear season. The Tribes may transfer Tribal bear permits among tribal members. Notwithstanding any other provision in this Paragraph 17.2, each Tribe may permit the harvest of up to two bears per year for ceremonial/medicinal purposes, which shall not count against the harvest limits set forth above. The Tribes may permit bears harvested for such

ceremonial/medicinal purposes to be harvested at any time (except that the Tribes shall not permit bears to be harvested in dens or in the visible vicinity of a cub).

17.3 **Lake Sturgeon.** The State of Michigan has a State-approved Lake Sturgeon Rehabilitation Strategy that outlines the status of lake sturgeon populations and recommends management actions, and the Little River Band has a Tribally approved Nmé (Lake Sturgeon) Stewardship Plan for the Manistee River that recommends management actions for reclamation and restoration activities. The State and the Tribes shall discuss strategies for rehabilitating sturgeon populations and, except as otherwise provided below, shall negotiate allocations of sturgeon harvest when sturgeon recovery provides for such harvest, including an allocation of sturgeon harvest in Black Lake when the sturgeon population, as determined by Tribal and State biologists, includes 750 mature fish (*i.e.*, 750 fish capable of breeding). The Tribes may authorize their members to harvest sturgeon in Otsego Lake as long as they impose a bag limit that does not exceed the bag limit imposed by the State. If a harvestable sturgeon population is developed in the Manistee River, the Tribes may authorize their members to take up to 50% of the harvestable amount.

17.4 For any species subject to allocation under this Section XVII, or for any species determined in the future to require allocation, each Tribe shall be entitled to one-fifth of the Tribal allocation, *provided* that the Tribes shall develop mechanisms to share the available Tribal harvest when a Tribe is unable to fully utilize its one-fifth share.

XVIII. MIGRATORY BIRDS

The Tribes shall regulate their members' harvests of migratory birds in accordance with the processes established for regulating Indian treaty harvests under the Migratory Bird Treaty

Act, 16 U.S.C. §§ 703-712, and its implementing regulations, as now in force or hereafter amended.

XIX. THREATENED AND ENDANGERED SPECIES UNDER STATE LAW

The Tribes shall provide for the protection of species listed as threatened or endangered under state law. This provision shall not prevent the Tribes from authorizing their members to harvest threatened or endangered plants for personal use for medicinal, ceremonial, or subsistence purposes.

XX. USE OF STATE LAND

20.1 ***Gathering.*** The Tribes may authorize their members to Gather plant materials and other natural resources on State lands for personal, medicinal, cultural, or traditional craft use, *provided* that such natural resources Gathered on State lands shall not be used for commercial purposes except as specifically provided in this Paragraph 20.1, and *provided further* that nothing herein shall authorize the excavation or mining of sand, gravel or other minerals on State lands. As described below, the State and the Tribes shall seek to avoid user conflict and other resource concerns arising from certain Gathering activities on State lands through a consultative process involving the local offices of the MDNR and the Tribes.

(a) Maple Sap/Sugar Bushes.

(i) The Tribes and the State shall work cooperatively through local MDNR and Tribal offices to determine the location of areas suited for the collection of maple sap and the production of maple sugar or maple syrup (collectively, “sugar bush operations”) on State Forest land.

(ii) The Tribes and the State shall work cooperatively to designate mutually acceptable areas for sugar bush operations through the use of the MDNR “Special

Conservation Area” (SCA) program. The Parties recognize that SCA designations for sugar bush operations may change over time. If a Tribe and the State are unable to designate mutually acceptable areas for such operations through the SCA program, they shall make good faith efforts to identify other mechanisms to designate areas for such operations. The designation of areas under the SCA program or another mechanism for sugar bush operations shall not preclude the use of such areas for other activities, such as MDNR timber and wildlife management practices, Hunting and Fishing, and other management activities.

(iii) The Tribes shall not permit their members to engage in sugar bush operations on State lands other than those designated under subparagraph (a)(ii) of this Paragraph 20.1, except as otherwise agreed by one or more Tribes and the State to accommodate one-time or occasional (as opposed to annual) use of a limited number of trees (no more than a total of twelve).

(iv) The Tribes shall require their members to obtain a Tribal permit before engaging in sugar bush operations on State Forest land. The Tribes shall develop and adopt regulations detailing the permit process. Before issuing permits for sugar bush operations involving more than a total of twelve trees, a Tribe shall negotiate with MDNR an agreed number of permits to issue, the number of trees and trees per acre that can be tapped, and the number of temporary structures that may be erected.

(v) Tribal regulations for sugar bush operations on State lands shall: prohibit the use of tubing; prohibit construction of new trails to access sugar bushes; prohibit permanent structures; and require that temporary structures be removed by the end of the maple syrup season.

(vi) The State shall not charge a fee for sugar bush operations pursuant to permits issued by the Tribes.

(vii) The Tribes may authorize their members to engage in personal sale of modest levels of maple sugar and/or maple syrup produced from State lands.

(b) Firewood.

(i) The Tribes and the State shall work cooperatively through local MDNR and Tribal offices to designate areas suitable for firewood collection, and to determine local restrictions that apply within MDNR Forest Management Units. The designation of areas for firewood collection under this subparagraph shall not preclude the use of such areas for other purposes.

(ii) The Tribes shall not permit their members to collect firewood on State lands other than those designated under subparagraph (b)(i) of this Paragraph 20.1.

(iii) The Tribes shall require their members to obtain a Tribal permit before collecting firewood on State lands. The Tribes shall develop and adopt regulations detailing the permitting process.

(iv) Tribal regulations for collecting firewood on State lands shall: prohibit Tribal members from cutting or Gathering trees except those that are dead and down; prohibit firewood collection within State timber sale contract areas unless written permission is obtained from the timber sale contractor; prohibit cutting or Gathering of trees marked with paint; prohibit cutting or Gathering of cedar and hemlock trees, *provided* that this provision shall not prohibit Gathering of cedar or hemlock boughs as provided below; provide that the collection of firewood is for personal use only and prohibit the sale of firewood; provide that firewood permits shall be issued for five standard cords per permit, and that only one permit per household

per year shall be issued; and require that Tribal members have a Tribal permit in their possession when collecting firewood.

(v) The State shall not charge a fee for collecting firewood pursuant to permits issued by the Tribes.

(c) Conifer Boughs.

(i) The Tribes and the State shall work cooperatively through local MDNR and Tribal offices to designate areas suitable for conifer bough collection. The designation of areas for conifer bough collection under this subparagraph shall not preclude the use of such areas for other purposes.

(ii) The Tribes shall not permit their members to collect conifer boughs on State lands other than those designated under subparagraph (c)(i) of this Paragraph 20.1.

(iii) The Tribes shall require their members to obtain a Tribal permit before collecting conifer boughs on State lands. The Tribes shall develop and adopt regulations detailing the permitting process.

(iv) Tribal regulations for collecting conifer boughs on State lands shall: prohibit collection of conifer boughs within 20 feet of the edge of roads, designated trails, or Streams; prohibit the establishment of new trails or roads to access collection areas; prohibit Tribal members from cutting down trees for the purpose of Gathering conifer boughs, removing boughs from trees less than 12 feet in height, or removing boughs from the upper half of a tree; prohibit Tribal members from Gathering cedar or hemlock boughs except for modest quantities for personal medicinal or limited ceremonial uses; prohibit collection of boughs for commercial

use, except for individuals making traditional handcraft items; and require that Tribal members have a Tribal permit in their possession when collecting conifer boughs.

(v) The State shall not charge a fee for collecting conifer boughs pursuant to permits issued by the Tribes.

(d) Black Ash, Basswood and Ironwood.

(i) The Tribes and the State shall work cooperatively through local MDNR and Tribal offices to designate areas suitable for collection of black ash, basswood and ironwood.

(ii) The Tribes shall not permit their members to collect black ash, basswood or ironwood on State lands other than those designated under subparagraph (d)(i) of this Paragraph 20.1.

(iii) The Tribes shall require their members to obtain a Tribal permit before collecting black ash, basswood or ironwood on State lands. The Tribes shall develop and adopt regulations detailing the permitting process.

(iv) Before issuing permits for the collection of black ash, basswood or ironwood on State lands, the Tribes shall negotiate with MDNR an agreed number of permits to issue, and the number of trees and trees per acre that can be used.

(v) Tribal regulations for the collection of black ash, basswood and ironwood on State lands shall: prohibit commercial use, except for individuals making traditional handcraft products; and require that Tribal members have a Tribal permit in their possession when collecting black ash, basswood, or ironwood.

(vi) The State shall not charge a fee for collecting black ash, basswood or ironwood pursuant to permits issued by the Tribes.

(e) White Birch Bark.

(i) The Tribes and the State shall work cooperatively through local MDNR and Tribal offices to designate areas suitable for white birch bark collection.

(ii) The Tribes shall not permit their members to collect white birch bark on State lands other than those designated under subparagraph (e)(i) of this Paragraph 20.1.

(iii) The Tribes shall require their members to obtain a Tribal permit before collecting white birch bark on State lands. The permits shall contain provisions to prevent permanent damage to the trees, such as seasonal limitations and limitations on the quantity of bark that may be removed. The Tribes shall develop and adopt regulations detailing the permit process. The Tribes shall provide copies of permits issued for the collection of white birch bark to the MDNR.

(iv) Before issuing permits for the collection of white birch bark on State lands, the Tribes shall negotiate with MDNR an agreed number of permits to issue, and the number of trees and trees per acre that can be used to collect white birch bark.

(v) Tribal regulations for the collection of white birch bark on State lands shall: prohibit collection of white birch bark within 33 feet of the edge of roads or designated trails; prohibit collection of white birch bark for commercial use, except for individuals making traditional handicraft items; and require that Tribal members have in their possession a Tribal permit when collecting white birch bark.

(vi) The State shall not charge a fee for collecting white birch bark pursuant to permits issued by the Tribes.

(vii) The Tribes and the MDNR shall annually review the impact to the resource resulting from this activity, and shall determine whether modification of birch bark harvest is required to protect birch trees on State land.

(f) Collection of ground vegetation and shrubs.

(i) The Tribes shall provide for the protection of species listed as threatened or endangered under state law, as provided in Section XIX (Threatened and Endangered Species under State Law).

(ii) Tribal members may Gather plants and the products thereof, such as wild berries, mushrooms, pine cones, nuts and fruits, for producing modest levels of commodities for personal sale and may use the parts of harvested plants for the manufacture and sale of handicraft products.

20.2 Access.

(a) The Tribes shall require their members to follow MDNR general camping registration procedures, including payment of camping fees, and all other applicable rules and regulations when camping in a developed campsite within a State Park or State Forest campground.

(b) The Tribes may authorize dispersed camping on State Forest land at least one-half mile away from a State Forest campground or the boundary of a State Park, except in those areas specifically closed to all camping by order of the Director of the MDNR. The Tribes shall require their members to post a cost-free MDNR camping permit on site and to follow State land use rules when camping on State Forest lands. The MDNR shall provide such permits to the Tribes at no charge for issuance to their members.

(c) In areas where the only public access to a Lake or Stream segment is located on lands owned or managed by MDNR, and a Tribal member is engaged in the exercise of a Tribal treaty-related Hunting, Trapping, Fishing, or Gathering right, the State shall waive any fees or launch costs associated with the Tribal member's use of such facilities, provided that space is available. To be eligible for the fee waiver, the Tribes shall require their members to:

(i) provide Tribal identification at the entrance to the area and post an approved Tribal identification placard or sticker in the window of their vehicle; and

(ii) comply with all applicable rules and regulations for the launch site.

(d) In a Michigan State Park where a Tribal member is engaged in the exercise of a Tribal treaty-related right (consistent with the terms of this Decree) the State shall waive any entrance fees associated with the Tribal member's use of such facilities. At other times and for other purposes, fees shall be required. To be eligible for the fee waiver, the Tribes shall require their members to:

(i) provide Tribal identification at the State Park entrance and post an approved Tribal identification placard or sticker in the window of their vehicle; and

(ii) comply with all applicable rules and regulations for the site.

(e) State park rangers may enforce State park regulations within State parks.

(f) The MDNR shall notify and consult with the Tribes before permanently closing an approved access road or trail. In the event that the MDNR establishes a program for seasonal closures of approved access roads or trails, the MDNR shall notify and consult with the Tribes before implementing any such seasonal closure.

20.3 Temporary Structures. The Tribes shall only authorize their members to place structures on State lands as provided in this Paragraph 20.3.

(a) With the exception of Hunting blinds, the Tribes shall not authorize their members to construct any structure on State lands from non-native, processed materials, such as dimensional lumber, plywood, siding or roofing, *provided* that the Tribes may authorize their members to use canvas tarps and the like on temporary structures if removed from the site after use.

(b) The Tribes may authorize their members to construct a temporary structure, such as a sweat lodge, which occupies up to 100 square feet, using on-site native materials, on State Forest lands, *provided* that the Tribes shall require their members to post a cost-free dispersed camping permit on site in accordance with subparagraph (b) of this Paragraph 20.2.

(c) The Tribes may authorize their members to construct a temporary structure, which occupies more than 100 square feet, using on-site native materials, on State Forest lands, *provided* that the Tribes shall require their members to post a cost-free dispersed camping permit on site in accordance with Paragraph 20.2, subparagraph b , and *provided further* that the Tribes shall not issue such permits to their members under this subparagraph without first consulting with and obtaining the concurrence of the local MDNR forest manager.

(d) The Tribes shall not permit their members to leave a temporary structure on State Forest lands for 15 days or more unless the Tribes first consult with and obtain the concurrence of the local MDNR forest manager.

(e) The Tribes may authorize their members to use Hunting blinds on State land in accordance with the following provisions:

(i) The Tribes shall require Hunting blinds of man-made materials on state land to legibly display, in letters at least 2” high, the name and an indication of Tribal

membership of the owner (as mutually agreed by the State and the Tribes). The Tribes shall not permit non-portable ground deer blinds utilizing man-made materials to be placed on State lands before November 6. The Tribes shall require that deer blinds be removed from State land within 10 days of the end of the last open day for Tribal firearm deer Hunting.

(ii) The Tribes shall not permit the placement of blinds of man-made materials in State Parks.

(iii) The Tribes shall require that portable blinds be removed from State land at the end of each day's Hunt.

XXI. ASSESSMENT ACTIVITIES

The Parties recognize that the Tribes may desire to engage in assessment activities within the inland portion of the 1836 Ceded Territory in addition to, or in coordination with, assessment activities conducted by the State. The Parties shall meet at least annually to review State and Tribal assessment activities in order to minimize or avoid duplication of effort and to prevent interference with such activities. The State may object to a proposed Tribal assessment activity, *provided* that the State shall not object to such a proposed assessment activity without fully consulting with the Tribes and articulating a legitimate State interest for doing so within 60 days of being notified of the proposed activity. For purposes of this Section XXI, a "legitimate State interest," which might form the basis of the State's objection to such a proposed assessment activity, is limited to the following: (a) material biological harm to a resource; (b) a threat to public health or safety; (c) material interference with ongoing research projects; or (d) unreasonable redundancy of effort. In the event the State makes such an objection after fully consulting with the Tribes, the Parties shall jointly refer the matter to binding arbitration to be resolved within the next 60 days. The issue in the arbitration shall be whether the State has a

“legitimate State interest” for objecting to the proposed activity as defined in this Section XXI.

The Tribes shall defer commencement of a proposed assessment activity during the 60-day period in which the State might object to such activities and, if the State does object, pending resolution of the objection by arbitration (but need not defer implementation pending an appeal of the arbitration award, unless otherwise ordered by the Court). An arbitration award under this Section may be vacated, modified or corrected on appeal only on the grounds set forth in the Federal Arbitration Act, 9 U.S.C. §§ 10-11, as now in force or hereafter amended. In carrying out assessment activities, the State and the Tribes shall utilize qualified biologists or other appropriately trained personnel. Tribal and State assessment activities shall be conducted in a manner consistent with accepted scientific principles using non-lethal methods whenever appropriate.

XXII. RESTORATION, RECLAMATION, AND ENHANCEMENT PROJECTS

The Parties recognize that the Tribes may desire to engage in activities designed to restore, reclaim, or enhance fish, wildlife or other natural resources within the inland portion of the 1836 Ceded Territory through stocking, rearing, habitat improvement, or other methods. The Parties shall meet annually in order to minimize or avoid duplication of, or interference with, restoration, reclamation, and enhancement activities. With the exception of habitat projects on federal lands, which shall be subject to federal approval under applicable law, or on lands that are owned by the Tribes or their members, the Tribes shall not undertake new restoration, reclamation, or enhancement projects without State approval, *provided* that the State shall not withhold its approval without fully consulting with the Tribes and articulating a legitimate State interest for doing so within 60 days of being notified of the proposed project. In carrying out restoration, reclamation, and enhancement projects, the Tribes shall utilize qualified biologists or

other appropriately trained personnel. Restoration, reclamation, or enhancement projects that involve stocking or rearing of fish that migrate to the Great Lakes and back into streams, such as the Little River Band's Manistee River sturgeon enhancement project, shall be subject to the provisions of the 2000 Great Lakes Consent Decree and any successor thereto, rather than this Decree, *provided* that the State and the Tribes shall provide each other with a reasonable opportunity to review and comment on any proposal to initiate, alter or discontinue a restoration, reclamation or enhancement project that may affect harvest opportunities under this Decree.

XXIII. CONSULTATION AND EXCHANGE OF INFORMATION

23.1 The State and the Tribes shall establish one or more committees to facilitate consultation and the exchange of information among the Parties. In addition to those matters set forth above, the State and the Tribes shall at least annually exchange: proposals for assessment activities; the results of assessment activities; a summary of State and Tribal licenses and permits issued and harvest and effort data pertaining to the inland portion of the 1836 Ceded Territory; and a summary of any other data and a copy of any reports regarding the condition of the resources in the inland portion of the 1836 Ceded Territory.

23.2 The Parties shall develop a protocol for these purposes, which shall provide for at least one annual meeting among the Parties or their representatives. The initial protocol to be adopted by the Parties is set forth in Appendix L, which is attached hereto and made a part hereof. The Parties may amend the protocol from time-to-time in accordance with its terms. The protocol, as initially adopted or hereafter amended, shall be enforceable as a component of this Decree.

23.3 The State and the Tribes shall work in good faith to coordinate resource assessment, restoration, enhancement, and harvest monitoring activities.

23.4 The State and the Tribes shall notify each other at least annually of proposed regulatory changes (including changes in management units or methodologies for determining the allowable harvest of any species) before they take effect (except where, due to an emergency or other matter beyond the control of the Parties it is not possible to provide advance notice) and seek to resolve any concerns arising from such changes before implementing them. Upon request, the State and the Tribes shall share information regarding the rationale for such changes and their anticipated effects (*e.g.*, changes in species abundance, distribution, or age or sex ratios). Upon request, the State and the Tribes shall provide similar information for any existing regulation, management unit or allowable-harvest methodology. The information provided shall be sufficiently detailed to enable the other Parties to fully understand the regulation, management unit or allowable-harvest methodology at issue and any underlying data associated with it, and to enable them to make constructive suggestions for improvements to such regulation, management unit or harvestable surplus methodology.

XXIV. LAW ENFORCEMENT

24.1 As a general principle, prosecutions of alleged violations of fish and game laws and regulations by Tribal members in the inland portion of the 1836 Ceded Territory shall be heard in a Tribal forum. This provision is predicated on: (a) the enactment of Tribal fish and game laws and regulations that are consistent with this Decree; and (b) the existence of a Tribal forum with subject matter jurisdiction to hear prosecutions of alleged violations of fish and game laws and regulations. As used in this Section XXIV, Tribal forum means either a Tribal Court or another mutually acceptable Tribal tribunal. In any Tribal forum in which such a prosecution is heard, upon request of a law enforcement agency whose officer will be a witness, the law

enforcement officer's testimony shall be presented by a tribal prosecutor or other trained legal advocate.

24.2 Except for the categories of violation specifically otherwise noted in this Decree, if the predicate requirements are met, the State shall be precluded from initiating prosecutions of the Tribes' members in State courts for violations of State law or regulations pertaining to Hunting, Trapping, , otherwise taking any species of wildlife, Fishing, or Gathering, when such acts are within the scope of this Decree or subject to Tribal regulations that are consistent herewith. This preclusion shall apply to the following statutes and their implementing regulations, as now in force or hereafter amended, and other similar statutes and regulations:

(a) endangered species protection [Part 365 of Art. III, Chap. I, Natural Resources and Environmental Protection Act (NREPA), Mich. Comp. Laws, § 324.36501 *et seq.*];

(b) wildlife conservation [Part 401, Art. III, Chap. II, NREPA, Mich. Comp. Laws, § 324.40101 *et seq.*];

(c) Hunting and Fishing licenses [Part 435, Art. III, Chap. II, NREPA, Mich. Comp. Laws, § 324.43501 *et seq.*];

(d) Fishing with Hook and Line Gear [Part 453, Art. III, Chap. II, NREPA, Mich. Comp. Laws, § 324.45301 *et seq.*];

(e) frogs [Part 455, Art. III, Chap. II, NREPA, Mich. Comp. Laws, § 324.45501 *et seq.*];

(f) mussels [Part 457, art. III, Chap. II, NREPA, Mich. Comp. Laws, § 324.45701 *et seq.*];

(g) fish shanties [Part 465, Art. III, Chap. II, NREPA, Mich. Comp. Laws, § 324.46501 *et seq.*]; and

(h) spearing fish in Houghton Lake [Part 485, Article III, Chap. II, NREPA, Mich. Comp. Laws, § 324.48501]

(i) sport Fishing [Part 487, Art. III, Chap. II, NREPA, Mich. Comp. Laws, § 324.48701 *et seq.*].

24.3 This Decree does not preclude the State from prosecuting in State court alleged violations by Tribal members of the provisions of the Michigan Penal Code, Mich. Comp. Laws, § 750.1 to 750.568, as now in force or hereafter amended. Violations of State or Tribal law pertaining to safety zone closures near occupied dwellings, trespass or recreational trespass, and hunter harassment, as defined in State or Tribal law or regulations consistent with this Decree, shall be concurrently enforceable by State and Tribal officers, with prosecution to occur in either State or Tribal courts, *provided* that nothing herein shall be construed as creating a right of a defendant to seek removal of a prosecution from State court to Tribal court or from Tribal court to State court, and *provided further* that Tribal members shall not be prosecuted in State court under circumstances in which non-Tribal members would not be prosecuted for the same offense. If the State issues a citation to a Tribal member for a violation of State law under this Paragraph 24.3 or Paragraph 24.5 of this Decree, it shall provide notice of the citation to the Tribal member's Tribe on the next business day or as soon thereafter as practicable. In the event that it is not practicable to provide notice of the citation to the Tribal member's Tribe on the next business day, the State shall explain in writing the reasons that the provision of such notice was impracticable. Notwithstanding the foregoing, the State's failure to provide notice of a citation

or a written explanation for such failure to the Tribal member's Tribe shall not constitute a defense to the citation.

24.4 Tribal members operating off-road vehicles, snowmobiles, boats or other vessels who are engaged in the exercise of a treaty-related Hunting, Trapping, Fishing or Gathering activity, shall not be subject to State vehicle or vessel registration requirements, provided that the Tribal member satisfies Tribal license requirements for the activity in question, is in compliance with applicable Tribal Hunting, Trapping or Fishing season limitations in Tribal law adopted pursuant to this Decree, and possesses evidence of being currently engaged in Hunting, Trapping, Fishing or Gathering, such as fish, game or common items related to Hunting, Trapping, Fishing or Gathering such as Fishing rods, tip-ups, firearms, traps, or nets.

24.5 On non-Tribally owned lands, operation of an off-road vehicle, snowmobile, or boat or vessel by a Tribal member in a manner that creates a threat to public safety or damage to the environment is enforceable by both State and Tribal officers under provisions of State or Tribal law or regulation, with concurrent jurisdiction in both State and Tribal court.

24.6 The provisions set forth in subparagraphs (a) through (c) of this Paragraph 24.6, by which State law enforcement officers shall have the authority to enforce Tribal regulations on non-Tribal lands, shall be effective only if, and only for so long as, the Parties are able to identify a mechanism by which Tribal law enforcement officers shall have the authority to: stop hunters and fishermen in the field in order to determine whether they are Tribal members; enforce Tribal regulations with respect to Tribal members; and, to the extent they are deputized under applicable law, enforce State regulations with respect to non-Tribal members. The State shall not be liable for the acts or omissions of Tribal law enforcement officers in the performance of their duties under this Decree and the Tribes shall not be liable for the acts or omissions of the

State's law enforcement officers in the performance of their duties under this Decree. Moreover, nothing in this Decree shall be construed to mean either that Tribal law enforcement officers are agents of the State or that State law enforcement officers are agents of the Tribes.

(a) Conservation officers of the MDNR are authorized to enforce a Tribe's regulations pertaining to Inland Article 13 Rights on non-Tribal lands and to institute proceedings in a Tribal forum through the issuance of a citation upon satisfaction of the following requirements:

- (i) certification as a law enforcement officer by MCOLES, or its successor agency; and
- (ii) successful completion of a cultural awareness program approved by the State and the Tribes.

MDNR shall provide the Tribes with updated lists of officers meeting these criteria.

(b) In order to assure professional, fair, and reasonable enforcement of the Tribes' regulations, any Tribe subject to this Decree may initiate a complaint of unprofessional conduct against a Michigan conservation officer, by means of filing the standard form available from the Law Enforcement Division of the MDNR. In order to assure transparency in the investigation of such charges, the chief law enforcement officer of the Tribe initiating a complaint shall be invited to:

- (i) participate in the investigation of such charges; and
- (ii) participate as a member of the review board that reviews the investigation, determines the validity of such charges and establishes any corrective or disciplinary actions that may be appropriate if officer misconduct is established.

(c) A MDNR conservation officer may:

(i) conduct routine inspections of boats, wagons, trailers, vehicles, snowmobiles, containers, packages, or other containers utilized by a person in a Harvesting Activity authorized by Tribal law;

(ii) stop and board any boat and stop any vehicle or snowmobile if the officer reasonably suspects there is a violation of Tribal law;

(iii) execute any process for enforcement of the provisions of Tribal law;

(iv) with or without a warrant, open, enter and examine boats, wagons, trailers, vehicles, snowmobiles and packages and other containers, in which the officer has probable cause to believe that contraband wild plants, wild animals, fish, or carcasses or parts thereof may be contained, or as part of a routine inspection authorized under subparagraph (c)(i) of this Paragraph 24.6; and

(v) if a violation occurs in the officer's presence, seize, with or without a warrant, any article which is subject to forfeiture under applicable Tribal law, or which may be required as evidence of a violation of applicable Tribal law, *provided* that any article so seized shall be delivered within 5 working days of the time of seizure into the custody of the Tribal member's Tribal forum, unless said article is immediately delivered into the custody of an officer of the Tribal member's Tribe. Officers shall exhaust all other practical means of gathering required evidence prior to seizing an article under this subparagraph.

24.7 The records of a Tribal court related to State or Tribal citations or arrests of Tribal members for alleged violations related to Hunting and Fishing under this Decree, including records of court dispositions of such citations or arrests, shall be accessible to MDNR conservation officers during normal business hours.

24.8 Each Tribe shall prepare an annual summary of citations and arrests of Tribal members for alleged violations related to Hunting and Fishing under this Decree, showing the date of violation, the agency initiating the citation or arrest, the location by county of the alleged violation, the charge filed, and the status or disposition of each incident. The report shall be provided to the State no later than the last day in February of the following year. Upon request, the State shall provide a Tribe comparable data for Hunting and Fishing violations prosecuted by the State.

24.9 If Michigan law is amended or modified in the future to provide the opportunity for the deputization of Tribal conservation officers by the MDNR, the State and the Tribes shall work together to develop a process to provide for deputization of such officers.

XXV. WILDLIFE SPECIES FOR WHICH THE STATE DOES NOT CURRENTLY PERMIT HUNTING

Except as otherwise provided in Section XVIII (Migratory Birds), the Tribes shall not authorize their members to harvest wildlife species that cannot lawfully be harvested under State law as of October 2006 (as set forth in Appendix K, which is attached hereto and made a part hereof), *provided* that if any such species is biologically capable of withstanding harvest and the Tribes express interest in such harvest, the State and the Tribes shall make best efforts to reach consensus regarding Tribal harvest of such species, and *provided further* that in the event such consensus is not obtained, the Parties shall utilize the dispute resolution process under this Decree to determine whether Tribal harvests may be permitted. For species designated as game species under Michigan law as of October 2006 (as also set forth in Appendix K), the issue shall be whether the State has a reasonable basis for prohibiting such harvests taking into consideration the Tribes' interest in allowing such harvests, *provided* that no harvest of moose shall be permitted by the State or the Tribes unless the State and the Tribes agree that such

harvest is appropriate and agree on an allocation of such harvest. For all other species, the issue shall be whether the State has a basis for objecting to the Tribes' proposed harvest regulations under Paragraph 26.2 of this Decree. Notwithstanding the foregoing, if in the future the State permits the harvest of any species that cannot lawfully be harvested under State law as of October 2006, the Tribes may also permit the harvest of such species. The State agrees to consult with the Tribes on issues of mutual concern regarding such species, including allocation.

XXVI. CHANGES TO REGULATIONS

26.1 The Parties agree that management and regulation of fish, wildlife and other natural resources must be dynamic and respond to changing conditions. Accordingly, from time to time the State and the Tribes may change their harvesting regulations, provided that all such changes shall be consistent with the provisions of this Decree. The State and the Tribes agree to consult with each other about such changes in accordance with this Section XXVI and Section XXIII (Consultation and Exchange of Information).

26.2 The State may object to a proposed Tribal regulatory change, *provided* that the State shall not object to such a change unless, within 60 days of being notified of the proposed change, it consults with the Tribes and demonstrates that: (a) the change would cause demonstrable harm to the conservation of the resource at issue or a demonstrable threat to public health or safety; and (b) prohibiting the change is reasonable and necessary to prevent such conservation harm or public health or safety threat. If the State makes such an objection after fully consulting with the Tribes, the Parties shall jointly refer the matter to binding arbitration to be resolved within the next 60 days. The issue in the arbitration shall be whether the State has satisfied the foregoing standards. The Tribe or Tribes proposing the regulatory change shall defer implementation of the proposed change during the 60-day period in which the State might

object to the change and, if the State does object, pending resolution of the objection by arbitration (but need not defer implementation pending an appeal of the arbitration award, unless otherwise ordered by the Court). An arbitration award under this Paragraph 26.2 may be vacated, modified or corrected on appeal only on the grounds set forth in the Federal Arbitration Act, 9 U.S.C. §§ 10-11, as now in force or hereafter amended.

26.3 In the event that a reduction in fish or game populations requires more restrictive State regulations, the Tribes and the State shall consult regarding appropriate adjustments, if any, in Tribal regulations. The State may object to a Tribe's decision not to make such an adjustment in its regulations, *provided* that the State shall not make such an objection without consulting with the Tribes and demonstrating that: (a) a failure to make the adjustment would cause demonstrable harm to the conservation of the resource at issue; and (b) the adjustment is reasonable and necessary to prevent such conservation harm. If the State makes such an objection after fully consulting with the Tribes, the Parties shall jointly refer the matter to binding arbitration to be resolved within the next 60 days. The issue in the arbitration shall be whether the State has satisfied the foregoing standards. An arbitration award under this Paragraph 26.3 may be vacated, modified or corrected on appeal only on the grounds set forth in the Federal Arbitration Act, 9 U.S.C. §§ 10-11, as now in force or hereafter amended.

XXVII. DISPUTE RESOLUTION

27.1 Any dispute relating to the interpretation, application or enforcement of this Decree shall be resolved by the procedures set forth in this Section XXVII. However, the decision of a Party not to agree or not to give its consent with respect to a matter identified in this Decree as requiring the mutual agreement or consent of the State and one or more of the Tribes shall not be subject to dispute resolution under this Section.

27.2 Negotiation

(a) It is the intent of the Parties that any dispute be resolved informally and promptly through good faith negotiations among the Parties. Should any dispute or controversy arise, the steps outlined in this Paragraph 27.2 shall immediately be taken.

(b) If the dispute involves any matter which is subject to an information sharing or consultation provision under this Decree or which is addressed by the Information Sharing and Consultation Protocol entered into pursuant to Paragraph 23.2 of this Decree, the Party raising the dispute must first comply with the applicable information sharing and consultation requirements and attempt to achieve consensus. If consensus on the matter is not achieved, or if consensus on components of the dispute does not resolve the entire dispute, the Party may proceed with the next step in dispute resolution under this Section.

(c) Any Party may initiate negotiation proceedings by sending written notice to the other Parties setting forth the particulars of the dispute, the provision of this Decree involved, and a suggested resolution of the problem. The recipient Parties involved in the dispute must respond within 20 days of receipt with an explanation and response to the proposed resolution, which response shall be sent to all other Parties.

(d) If correspondence does not resolve the dispute, the Parties involved in the dispute and any other Parties who desire to attend shall meet on at least one (1) occasion within fifteen (15) days after the response by the recipient Parties and attempt to resolve the matter.

(e) If the dispute is not resolved by negotiations within fifteen (15) days after the Parties' first meeting, or within any extended period of time to which the Parties agree, the matter shall be referred to the Executive Council established under the Information Sharing and Consultation Protocol entered into pursuant to Paragraph 23.2 of this Decree. The Executive

Council shall meet either in person or by teleconference within thirty (30) days of the referral to address the matter.

27.3 Mediation

(a) In the event that the entire dispute is not resolved at the meeting of the Executive Council, the Party raising the dispute may proceed to mediation. Unless the Parties agree to a different mediation procedure, Voluntary Facilitative Mediation (“VFM”), pursuant to W.D. Mich. LCivR 16.3, as now in force or hereafter amended, shall govern the mediation process; provided, however, that notwithstanding those rules: (i) the Parties hereby consent to mediation in accordance with this Section; and (ii) the Parties may agree to select a mediator with background and experience in the subject matter which gave rise to the dispute, even if said agreed-upon mediator is not on the list of Court-certified mediators.

(b) In the event the Parties cannot agree upon a mediator within ten (10) days after the party invoking mediation has initiated the process by written notice to all Parties, the mediator shall be selected by the Court’s ADR Administrator.

27.4 Judicial Resolution

(a) If the Parties do not resolve the matter through mediation, or if the Parties agree to waive mediation, a Party or Parties may seek relief from the Court as provided by the Federal Rules of Civil Procedure and the Local Rules of the Western District of Michigan.

(b) A Party desiring to initiate judicial resolution of the dispute shall file a notice pleading with the Court containing a concise description of the matters in dispute, a certification that the Party seeking relief has complied with the dispute resolution procedures of this Decree, and a description of the relief requested. The other Parties may file a responsive pleading within thirty (30) days.

(c) Unless the Parties agree that the dispute can be resolved by motion without the need for discovery or an evidentiary hearing, they shall request a scheduling conference under W. D. Mich. LCivR 16.1, as now in force or hereafter amended, to establish a timetable for disposition of the dispute.

(d) In the event of an emergency involving this Decree posing a threat of immediate irreparable harm to a resource or a Party, a Party may seek immediate or temporary relief under Fed. R. Civ. P. 65, as now in force or hereafter amended, and applicable local court rules without following the procedural steps set forth in this Section.

27.5 Arbitration.

(a) The provisions in Paragraphs 27.1 through 27.4 of this Decree shall not apply to disputes that are subject to binding arbitration under Section XXVI (Changes to Regulations) or Section XXI (Assessment Activities). However, a Party must comply with the applicable information sharing and consultation provisions of Section XXVI, Section XXI, and the Information Sharing and Consultation Protocol adopted under Paragraph 23.2 of this Decree, before invoking arbitration. If a Party invokes binding arbitration under Section XXVI or Section XXI, the arbitration shall be conducted pursuant to W.D. Mich. LCivR 16.6, as now in force or hereafter amended; provided, however, that notwithstanding those Rules: (i) the Parties hereby consent to binding arbitration whenever this Decree calls for arbitration, which arbitration shall be final, binding and non-appealable; (ii) the provisions of the Federal Arbitration Act, 9 U.S.C. §§ 10-11, as now in force or hereafter amended, shall apply to any arbitration award or decree; and (iii) the Parties may agree to select an arbitrator with background and experience in the subject matter which gave rise to the dispute, even if said agreed-upon arbitrator is not on the list of Court-certified arbitrators.

(b) In the event the Parties cannot agree upon an arbitrator within 20 days after the Party invoking arbitration has initiated the process by written notice to all Parties, the arbitrator shall be selected by the Court's ADR Administrator. The arbitration proceedings shall be concluded within the time period specified in this Decree.

XXVIII. MODIFICATIONS

Except as otherwise provided by federal law applicable to the modification of consent decrees, modifications to this Decree shall be made only by mutual agreement among the Parties and approval by this Court. In the event the Parties desire to modify this Decree, the Parties shall present to this Court for its consideration a stipulation and a proposed order for modification of the Decree.

XXIX. FEDERAL LANDS AND FEDERAL LAW

29.1 To the extent a particular activity on federal land under the jurisdiction and control of the U.S. Forest Service, the U.S. Fish and Wildlife Service, the National Park Service, or any successor agency is otherwise subject to State regulation, the exercise of Inland Article 13 Rights on such lands shall be governed by the terms of this Decree and applicable federal laws and regulations. To the extent a particular activity on those federal lands would not otherwise be subject to State regulation, the exercise of Inland Article 13 Rights on those lands shall be governed by memoranda of understanding between the Tribes and the Forest Service, Fish and Wildlife Service, or Park Service, or any successor agency, respectively, and by applicable federal laws and regulations. The exercise of Inland Article 13 Rights on lands under the jurisdiction and control of any other federal agency shall be governed by memoranda of understanding between the Tribes and the agency or its successor and applicable federal laws and regulations.

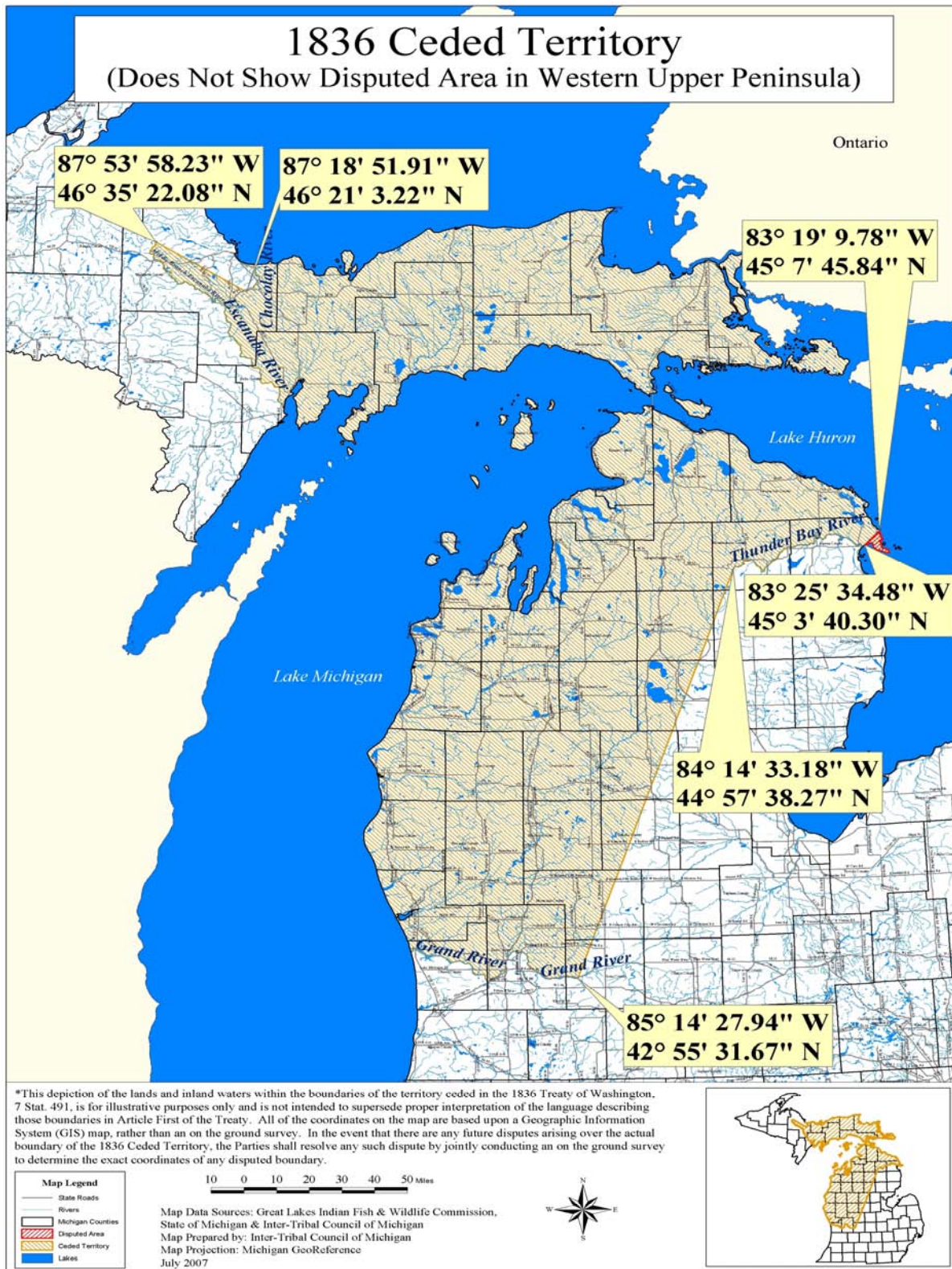
29.2 Issues concerning the applicability of particular federal laws or regulations to the Tribes' Inland Article 13 Rights shall be determined in accordance with prevailing law governing the applicability of federal law to Indian treaty rights. The Parties do not intend this Decree to limit or expand the application of federal law, including but not limited to the Endangered Species Act, to Indian treaty rights as determined under prevailing law.

Dated: _____

RICHARD ALAN ENSLEN
SENIOR UNITED STATES DISTRICT
JUDGE

Appendix A

LANDS AND INLAND WATERS WITHIN THE BOUNDARIES OF THE TERRITORY CEDED IN THE 1836 TREATY



Appendix B1

PROTOCOL FOR THE TRIBES' AUTHORIZATION OF THEIR MEMBERS' USE OF SPECIALLY REGULATED FISHING METHODS AND FOR MANAGEMENT OF TRIBAL AND STATE WALLEYE FISHERIES IN WALLEYE LAKE SYSTEMS

This Protocol is adopted in accordance with Section XII of the Decree. The provisions of this Protocol are intended to facilitate implementation of Section XII of the Decree but shall not relieve any party of any obligation it has under the Decree. In the event of any inconsistency between the provisions of the Decree and the provisions of this Protocol, the provisions of the Decree shall be controlling. Except as authorized by this Protocol or otherwise authorized in the Decree or by mutual agreement of the Tribes and the State, the Tribes shall prohibit their members from using Specially Regulated Fishing Methods in Walleye Lake Systems. However, notwithstanding any other provision of this Protocol, if the State permits State licensees to use Specially Regulated Fishing Methods in Walleye Lake Systems: (1) the Tribes may permit their members to use Specially Regulated Fishing Methods in Walleye Lake Systems subject to regulations that are no less restrictive than applicable State regulations; and (2) the Tribes and the State shall make appropriate adjustments, as may be necessary, to the provisions of this Protocol.

I. INTRODUCTION

1.1. **Use of Specially Regulated Fishing Methods in Walleye Lake Systems.** In accordance with Paragraphs 12.1 and 12.2 of the Decree, the Tribes may authorize their members to use Specially Regulated Fishing Methods in Walleye Lake Systems as provided in this Protocol, *provided* that the Tribes shall not authorize their members to use Impoundment Nets or Long Seines in tributaries to Walleye Lake Systems, except where the use of such gear is

permitted by State law or Paragraph 11.4 of the Decree. Short Seines are not subject to the provisions in this Protocol.

1.2. **Tribal and State Management of Walleye Fisheries.** The Tribes and State shall use this Protocol to manage their respective walleye fisheries in Walleye Lake Systems located within the 1836 Ceded Territory when use of Specially Regulated Fishing Methods is authorized. This Protocol is intended to provide the State and the Tribes with flexibility in managing their respective fisheries in Walleye Lake Systems and to provide a mechanism for modification as biological, environmental, and social circumstances might require.

1.3. **Management Procedures for Specially Regulated Fishing Methods.** The Tribes' authorization of their members' use of Specially Regulated Fishing Methods in a Walleye Lake System shall be subject to either the Threshold Level Procedures described in Section VI of this Protocol, or the Allocation-Based Procedures described in Section VII of this Protocol. The foremost objective for each of these management procedures is to maintain the total annual exploitation rate of Adult Walleyes in a Walleye Lake System by Tribal and State-licensed fishers at or below the agreed upon Total Allowable Annual Exploitation Rate, and to provide equivalent protections for other species of fish in a Walleye Lake System, as may be necessary, although the procedures differ in how this foremost objective is accomplished. Threshold Level Procedures require moderate management effort in accounting for harvest and Fishing activity and do not require population assessments. Allocation-Based Procedures require rigorous management by the State and the Tribes, including comprehensive monitoring of harvest and Fishing activity and population assessments.

1.4. **Choice of Management Procedures; Fishing Effort Limitations under Threshold Level Procedures.** The amount of Fishing Effort using Specially Regulated Fishing

Methods that the Tribes authorize in a particular Walleye Lake System shall determine whether Allocation-Based Procedures or Threshold Level Procedures shall be used in that Walleye Lake System. This Protocol establishes a Threshold Harvest Level applicable to the use of Specially Regulated Fishing Methods by Tribal members for each Walleye Lake System at a level that minimizes the risk that Tribal and State-licensed fishers will exceed the Total Allowable Annual Exploitation Rate for that Walleye Lake System. Unless one or more of the Tribes invokes Allocation-Based Procedures in a particular Walleye Lake System, the Tribes must limit their members' use of Specially Regulated Fishing Methods in that Walleye Lake System in accordance with Paragraph 6.5 of this Protocol. The Fishing Effort restrictions in Paragraph 6.5 of this Protocol are designed to ensure that the total harvest of Adult Walleyes with Specially Regulated Fishing Methods in a Walleye Lake System is below the Threshold Harvest Level for that Walleye Lake System.

1.5. Tribal Authorization of Fishing with Methods Other Than Specially Regulated Fishing Methods Not Limited. Except as provided in Section VIII of this Protocol, the Tribes' authorization of their members' use of fishing methods other than Specially Regulated Fishing Methods in Walleye Lake Systems is not limited by this Protocol, but Tribal members' harvests of Adult Walleye using such other methods shall be estimated and taken into account under Allocation-Based Procedures as set forth in Paragraphs 7.3 and 7.4(c) of this Protocol.

II. DEFINITIONS

As used in this Protocol, the terms defined in Section III (Definitions) of the Decree shall have the meanings ascribed to them in that Section. In addition, the following terms shall have the meanings ascribed to them in this Section II:

2.1. “Adult Walleye” means a walleye that is at least 15 inches in length or a walleye of any size for which sex can be determined by extruding gametes.

2.2. “Fishing Effort” means the amount of time spent Fishing using a specified type of Fishing gear or method.

2.3. “Total Allowable Annual Exploitation Rate” means the proportion of fish that can safely be harvested from a fish population during a one-year period.

2.4. “Natural Recruitment Walleye Lake System” means a Walleye Lake System in which the population of Adult Walleyes is comprised of 50% or more walleyes that are naturally produced or in which the population of Adult Walleyes is comprised of unknown percentages of naturally produced and stocked walleyes.

2.5. “Overfishing” means the harvest of fish of any species by State and/or Tribal fishers at an annual exploitation rate that is greater than the Total Allowable Annual Exploitation Rate for that species in a particular Lake System.

2.6. “Stocked Walleye Lake System” means a Walleye Lake System in which the population of Adult Walleyes is comprised of more than 50 percent walleyes that are stocked.

2.7. “Threshold Exploitation Level” means the maximum annual exploitation rate for Adult Walleyes using Specially Regulated Fishing Methods in a Walleye Lake System that is allowed under Threshold Level Procedures.

2.8. “Threshold Harvest Level” means the maximum annual number of Adult Walleyes that can be authorized for harvest by the Tribes with the use of Specially Regulated Fishing Methods in a Walleye Lake System under Threshold Level Procedures. The Threshold Harvest Level is equal to the estimated number of adult fish times the Threshold Exploitation Level.

III. WALLEYE LAKE SYSTEMS

Table 1 of this Protocol contains an initial list of Walleye Lake Systems in the 1836 Ceded Territory. The Tribes and the State shall add additional Lake Systems to the list of Walleye Lake Systems upon request of any Tribe or the State if those Lake Systems meet the definition of a Walleye Lake System in Paragraph 3.28 of the Decree. Similarly, the Tribes and the State shall remove Lake Systems from the list of Walleye Lake Systems upon request of any Tribe or the State if those Lake Systems no longer meet the definition of a Walleye Lake System in Paragraph 3.28 of the Decree. A request to add a Lake System to or remove a Lake System from the list of Walleye Lake Systems, including the supporting biological documentation, shall be made in writing and sent to the State and all Tribes by July 1 of the year preceding the year in which Lake System is to be added to or removed from the list of Walleye Lake Systems, or by such other date as may be mutually agreed upon by the State and the Tribes. The list of Walleye Lake Systems shall be updated with any changes by December 15 of the year the request was received.

IV. WALLEYE POPULATION ESTIMATES

Walleye population estimates are essential to the proper management of walleye harvest under this Protocol. Walleye population estimates shall be calculated according to the following methods.

4.1. **Walleye Population Regression Equations.** Except as provided in Paragraph 4.2, the Tribes and the State agree to use the following regression equations to estimate the Adult Walleye population in each Walleye Lake System. In addition, the Tribes and the State shall review these equations and any substitute equations every five years and may change them by mutual agreement.

Equation 1 -- Adult Population Estimate for a Natural Recruitment Walleye Lake System:

$$\ln(N) = 1.519 + 0.956 \times \ln(A)$$

Equation 2 -- Adult Population Estimate for a Stocked Walleye Lake System:

$$\ln(N) = 1.037 + 0.897 \times \ln(A)$$

where for both equations,

N = estimate of the Adult Walleye population, *i.e.*, the number of Adult Walleyes on the spawning grounds, and

A = surface area of the Walleye Lake System in acres, excluding tributaries.

The Tribes and the State shall collaborate in a project to develop criteria for determining the classification of Walleye Lake Systems (*i.e.*, Natural Recruitment Walleye Lake Systems versus Stocked Walleye Lake Systems, including sub-classifications if appropriate) and regression equations for each classification type that are specific to Michigan, based upon empirical estimates of population sizes of Adult Walleyes derived for Walleye Lake Systems in the 1836 Ceded Territory. The design of the project shall commence within two years of the entry of the Decree by the Court. Upon mutual agreement of the State and the Tribes that a Michigan regression equation or equations developed in this project provides more accurate estimates than the corresponding Equation 1 or Equation 2 above, the Tribes and the State shall use the Michigan regression equation or equations in place of the corresponding Equation 1 or Equation 2 above. If such mutual agreement is not attainable by the State and the Tribes, the State and the Tribes shall each select an independent expert to determine the accuracy of a Michigan regression equation or equations developed in this project. If the selected experts are unable to agree, they shall jointly select a third expert to resolve the matter. In addition, the Tribes and the State shall continue to update the Michigan regression equation or equations with any new

empirical estimates of population sizes of Adult Walleyes derived for Walleye Lake Systems in the 1836 Ceded Territory.

4.2. **Empirical Population Estimates of Adult Walleyes.** The Tribes and the State shall develop a mutually agreeable protocol for conducting walleye population assessments. An Adult Walleye population estimate derived from a walleye population assessment in a Walleye Lake System shall be used in place of the regression equations described in Paragraph 4.1. An empirical population estimate of Adult Walleyes for a Walleye Lake System shall be recorded and shall be used for five years, or until an empirical population estimate of Adult Walleyes is calculated from a new population assessment to replace it. After five years, an empirical population estimate of the Adult Walleyes for a Walleye Lake System shall be discarded and shall be replaced with the population estimate of Adult Walleyes using the applicable regression equation under Paragraph 4.1 of this Protocol.

4.3. **Alternative Methods.** Upon mutual agreement of the Tribes and the State, an alternative method for estimating the Adult Walleye population in a Walleye Lake System may be implemented. If the alternative method is not based on empirical population estimates from Walleye Lake Systems in Michigan, then the Tribes and the State shall determine and apply, as set forth in Paragraph 7.2 of this Protocol, mutually agreeable percentage reductions for the value of N in Equation 3, when Fishing under Allocation-Based Procedures in Walleye Lake Systems of 1,000 surface acres or more (excluding tributaries).

4.4. **Initial Estimates.** Table 1 of this Protocol sets forth the initial Adult Walleye population estimate in each Walleye Lake System listed in Table 1, using the methodologies set forth in Paragraphs 4.1 and 4.2 of this Protocol and available information on the surface area of Walleye Lake Systems (excluding tributaries) and the source of Adult Walleye recruitment in

such Systems. The Tribes and the State shall revise the Adult Walleye population estimates in Table 1 in accordance with Paragraphs 4.2 and 4.3 of this Protocol and/or on the basis of additional information on the surface area of Walleye Lake Systems (excluding tributaries) or the source of Adult Walleye recruitment in such Systems, as appropriate. A request to revise an Adult Walleye population estimate for a Walleye Lake System, including the supporting information, shall be made in writing and sent to the State and all Tribes by July 1 of the year preceding the year in which the revised estimate is to take effect or by such other date as may be mutually agreed upon by the Tribes and the State. The Adult Walleye population estimate shall be revised by December 15 of the year the request was received.

V. TOTAL ALLOWABLE ANNUAL EXPLOITATION RATES AND TOTAL HARVEST LEVELS

The Tribes and State shall manage their respective fisheries in accordance with this Protocol to prevent the combined harvest by Tribal and State-licensed fishers from exceeding the Total Allowable Annual Exploitation Rates and Total Harvest Levels for Adult Walleyes in Walleye Lake Systems.

5.1. **Total Allowable Annual Exploitation Rates.** The Total Allowable Annual Exploitation Rate for Adult Walleyes in each Walleye Lake System shall be 35% of the estimated Adult Walleye population in that Walleye Lake System, *provided* that the Total Allowable Annual Exploitation Rate for Adult Walleyes is subject to change on any Walleye Lake System by mutual agreement of the Tribes and the State. A request to change the Total Allowable Annual Exploitation Rate for Adult Walleyes in a Walleye Lake System, including the supporting biological documentation and duration of the proposed change, shall be submitted in writing to all Tribes and the State by July 1 of the year preceding the effective date of the proposed change, or by such other date as may be mutually agreed upon by the State and the

Tribes, and shall be reviewed by State and Tribal biologists to ensure that the change shall protect the walleye population in that Walleye Lake System and that the change shall comply with the objectives and rules of this Protocol. The Tribes and the State shall declare whether or not they agree with a requested change by December 15 of the year the request was received. If the Tribes and the State agree to change the Total Allowable Annual Exploitation Rate for a Walleye Lake System, then the new Total Allowable Annual Exploitation Rate for that Walleye Lake System shall be recorded and used in future management for the agreed upon duration or until changed by mutual agreement of the Tribes and the State under this Paragraph 5.1.

5.2. **Total Harvest Levels.** The Total Harvest Level for Adult Walleyes in any Walleye Lake System shall be calculated as shown in Equation 3.

Equation 3 -- Total Harvest Level for Adult Walleyes:

$$H_{tot} = N \times E_{tot}$$

where,

H_{tot} = Total Harvest Level for Adult Walleyes;

N = the estimated number of Adult Walleyes in the Walleye Lake System determined in accordance with Section IV of this Protocol; and

E_{tot} = Total Allowable Annual Exploitation Rate as defined in Paragraph 5.1 of this Protocol.

VI. THRESHOLD LEVEL PROCEDURES FOR WALLEYE LAKE SYSTEMS

6.1. **Use of Threshold Level Procedures.** Unless one or more of the Tribes invokes Allocation-Based Procedures for a particular Walleye Lake System, the Threshold Level Procedures set forth in this Section VI shall be used if one or more Tribes authorizes its members to use Specially Regulated Fishing Methods in that Walleye Lake System.

6.2. Objectives of Threshold Level Procedures; Methods for Achieving

Objectives. As set forth above, the foremost objective of Threshold Level Procedures is to maintain the total annual exploitation rate of Adult Walleyes by Tribal and State-licensed fishers in a Walleye Lake System at or below the Total Allowable Annual Exploitation Rate for that Walleye Lake System. A second objective is to maintain the total annual exploitation rates of other fish species in Walleye Lakes Systems at acceptable levels. A third objective of Threshold Level Procedures is to ensure that Tribal members have an opportunity to use Specially Regulated Fishing Methods in a Walleye Lake System to harvest Adult Walleyes and other fish species in that Walleye Lake System without requiring implementation of the more rigorous management practices required under Allocation-Based Procedures. These objectives are accomplished by: (1) setting a Threshold Exploitation Level with a corresponding Threshold Harvest Level in each Walleye Lake System, as set forth in Paragraphs 6.3 and 6.4 of this Protocol; (2) implementing a permit system that (a) controls harvest by limiting annual Fishing Effort by Tribal members using Specially Regulated Fishing Methods on each Walleye Lake System, such that the number of Adult Walleyes allowed for harvest using Specially Regulated Fishing Methods shall not exceed the Threshold Harvest Level for Adult Walleyes and (b) limits the use of Impoundment Nets and Long Seines to protect species other than walleye, both as set forth in Paragraph 6.5 of this Protocol; (3) applying daily bag limits, possession limits, and size limits, as set forth in Paragraph 11.3 of the Decree and Paragraph 6.5 and Section VIII of this Protocol; and (4) utilizing appropriate State management of State-licensed fishers to limit exploitation rates on Adult Walleyes by such fishers to the difference between the Total Allowable Annual Exploitation Rate for Adult Walleyes and the Threshold Exploitation Level, in the event that, on the basis of available information, the combined exploitation rates by State-

licensed fishers and Tribal fishers are expected to exceed the Total Allowable Annual Exploitation Rate.

6.3. Threshold Exploitation Levels. Except as provided below, the Threshold Exploitation Level for each Walleye Lake System, which shall be used to limit the annual Fishing Effort by Tribal members using Specially Regulated Fishing Methods, is:

(a) Ten percent (10%) of the estimated Adult Walleye population in Walleye Lake Systems of 1,000 surface acres or more, excluding tributaries, *provided* that, if the estimated Adult Walleyes population is *not* based on a Michigan regression equation under Paragraph 4.1 of this Protocol, an empirical population estimate under Paragraph 4.2 of this Protocol, or an alternative method under Paragraph 4.3 of this Protocol, the Threshold Exploitation Level for such lakes shall be six percent (6%) of the estimated Adult Walleye population in 2008, eight percent (8%) of the estimated Adult Walleye population in 2009, and ten percent (10%) of the estimated Adult Walleye population in 2010 and thereafter, and

(b) Five percent (5%) of the estimated Adult Walleye population in Walleye Lake Systems of less than 1,000 surface acres, excluding tributaries, in all years.

The Threshold Exploitation Level in a Walleye Lake System can be adjusted up or down by mutual agreement between the State and the Tribes. Requests for such an adjustment shall include the duration of the proposed change and the supporting biological documentation that demonstrates that the proposed change to the Threshold Exploitation Level will not result in a total annual exploitation rate that exceeds the Total Allowable Annual Exploitation Rate for Adult Walleyes. If a Tribe elects to fund a creel survey to obtain such information, the State shall cooperate in conducting the study. Requests to adjust a Threshold Exploitation Level shall be submitted in writing to the State and all Tribes by July 1 of the year preceding the effective

date of the proposed adjustment, or by such other date as may be mutually agreed upon by the State and the Tribes. Requests for an adjustment to a Threshold Exploitation Level shall be reviewed by State and Tribal biologists to ensure that any adjustment will protect the walleye population and populations of other fish species in that Walleye Lake System and complies with the objectives and rules of this Protocol. The Tribes and the State shall declare whether or not they agree with a requested adjustment to the Threshold Exploitation Level for a Walleye Lake System by December 15 of the year the request was received. If the Tribes and the State agree to adjust a Threshold Exploitation Level, the new level shall be recorded and shall be used in future management for the agreed-upon duration or until changed by the State and the Tribes under this Paragraph.

6.4. **Threshold Harvest Levels.** In order to apply the Fishing Effort limitations set forth in Paragraph 6.5 of this Protocol, the Threshold Exploitation Level for a Walleye Lake System shall be converted to a Threshold Harvest Level for that Walleye Lake System (*i.e.*, the number of Adult Walleyes that the Tribes can authorize their members to harvest using Specially Regulated Fishing Methods in that Walleye Lake System under Threshold Level Procedures). The calculation of the Threshold Harvest Level for a Walleye Lake System is shown in Equation 4.

Equation 4 -- Threshold Harvest Level:

$$H_{thl} = N \times E_{thl}$$

where,

H_{thl} = Threshold Harvest Level;

N = the estimated number of Adult Walleye in the Walleye Lake System, as determined in accordance with Section IV of this Protocol, and

E_{thl} = the Threshold Exploitation Level for that Walleye Lake System, as determined in accordance with Paragraph 6.3.

6.5. Fishing Effort Limitations under Threshold Level Procedures.

(a) The Tribes shall limit their members' Fishing Effort for walleyes with Specially Regulated Fishing Methods in each Walleye Lake System subject to Threshold Level Procedures so that the number of Adult Walleyes allowed for harvest by Tribal members using such methods does not exceed the Threshold Harvest Level established for that Walleye Lake System under Paragraph 6.4. To achieve this objective, the Tribes shall require their members to obtain a Tribal permit for the use of Specially Regulated Fishing Methods that is specific to a Walleye Lake System and that specifies the starting date and time of each 24-hour period during which the permit is valid and a daily walleye bag limit. The number of walleyes allowed for harvest under each permit issued in accordance with this Subparagraph 6.5(a) shall equal the number of 24-hour periods for which the permit is valid times the daily walleye bag limit specified in the permit. The Tribes shall maintain a running tally of the number of walleyes allowed for harvest under such permits in each Walleye Lake System and, when the number of walleyes allowed for harvest under all such permits for a particular Walleye Lake System reaches the Threshold Harvest Level for that Walleye Lake System, the Tribes shall cease issuing permits for the use of Specially Regulated Fishing Methods to harvest walleyes in that Walleye Lake System.

(b) In addition to the limitation on the issuance of permits in Subparagraph 6.5(a), the Tribes shall limit the use of Impoundment Nets and Long Seines in each Walleye Lake System as provided in this Subparagraph 6.5(b). The Tribes shall limit each permit for the use of Impoundment Nets or Long Seines to the use of a single Impoundment Net

or a single Long Seine during one or more 24-hour periods. The total number of such 24-hour periods in all such permits in a particular Walleye Lake System shall be limited as follows:

i. No more than three (3) 24-hour periods per 100 surface acres per year in Walleye Lake Systems of 1,000 surface acres or more, excluding tributaries, rounded to the nearest whole number; and

ii. No more than one and one-half (1.5) 24-hour periods per 100 surface acres per year in Walleye Lake Systems of less than 1,000 surface acres, excluding tributaries, and rounded to the nearest whole number.

The Tribes shall maintain a running tally of the number of 24-hour periods in such permits for each Walleye Lake System and, when the number of such 24-hour periods under all such permits for a particular Walleye Lake System reaches the limit for that Walleye Lake System, the Tribes shall cease issuing permits for the use of Impoundment Nets or Long Seines for that Walleye Lake System.

(c) The provisions in Subparagraph 6.5(b) are intended to limit the amount of Fishing Effort with Impoundment Nets and Long Seines in order to protect species of fish other than walleyes. The Tribes and the State may by mutual agreement provide for an alternative mechanism to protect species of fish other than walleye in lieu of those provisions. A proposal to adopt an alternative mechanism to protect species of fish other than walleyes in a particular Walleye Lake System or Systems, including the supporting biological documentation and proposed duration of the alternative mechanism, shall be made in writing and sent to the State and all Tribes by July 1 of the year preceding the year in which the alternative mechanism is to be implemented, or by such other date as may be mutually agreed upon by the State and the Tribes. The Tribes and the State shall declare whether they agree to implement the proposal by

December 15 of the year the proposal was made. If the Tribes and the State agree to implement the proposal, the alternative mechanism shall be used for the particular Walleye Lake System(s) for which it was proposed for the agreed-upon duration or until changed by the State and the Tribes under this Paragraph.

(d) The permit system, running tally of walleyes authorized for harvest, and running tally of 24-hour periods under Impoundment Net and Long Seine permits shall be coordinated among the Tribes to ensure that the combined Tribal harvest of walleyes that is authorized using Specially Regulated Fishing Methods does not exceed the Threshold Harvest Level for a Walleye Lake System and that the number of 24-hour periods in which Impoundment Nets or Long Seines may be used does not exceed the applicable limitation under Subparagraph 6.5(b).

(e) In determining whether to cease issuing permits for a specific Walleye Lake System, the Tribes may take into consideration reliable information regarding the actual harvest of walleyes in a Walleye Lake System. Reliable information, with respect to Tribal harvests with Specially Regulated Fishing Methods, as used in this Paragraph, is limited to: (1) the release or cancellation of a permit before the effective date of the permit; (2) information verified on-site by professional biological or law enforcement personnel; or (3) other information as mutually agreed by the Tribes and the State. In issuing permits under the provisions of this Paragraph 6.5, the Tribes may determine on a case-by-case basis the walleye bag limit of each permit in order to best achieve Tribal management objectives.

6.6. Permit Requirements under Threshold Level Procedures. The permits required under Threshold Level Procedures shall include the name of the Tribal member, the date(s) and 24- hour period(s) during which the permit is effective, the Walleye Lake System for

which the permit is issued, and the walleye bag limit for each 24-hour period authorized under the permit. The permits and the walleye bag limits shall be consistent with the management objectives of the Tribal permit system and the Threshold Level Procedures. The Tribes shall require their members to have such permits in possession when Fishing under the provisions of the Threshold Level Procedures. The Tribes shall not issue more than one such permit per member for use in any Walleye Lake System during a 24-hour period.

6.7. Monitoring Harvest under Threshold Level Procedures. The Tribes shall require that Tribal members report harvests using Specially Regulated Fishing Methods under Threshold Level Procedures as a condition of receiving a fishing permit. The Tribes shall provide an annual summary of those harvest reports to the State and all Tribes by January 31 of the year following the harvests, or by such other date as may be mutually agreed upon by the State and the Tribes. This annual summary shall include the number of permits issued and the total number of fish harvested by species, gear type, and Tribe for each Walleye Lake System.

6.8. Monitoring Fishing Activity under Threshold Level Procedures. The Tribes shall monitor Fishing activity by Tribal members using Specially Regulated Fishing Methods under Threshold Level Procedures as necessary to ensure compliance with Tribal Fishing regulations and Tribal permits. The Tribes shall use professional biological or law enforcement personnel when monitoring of Fishing activity is deemed necessary under this Paragraph 6.8. If violations are detected, they shall be handled in accordance with law enforcement procedures described in Section XXIV (Law Enforcement) of the Decree.

6.9. Monitoring Fish Populations under Threshold Level Procedures. Biological surveys of the population of Adult Walleyes are not required under Threshold Level Procedures.

VII. ALLOCATION-BASED PROCEDURES

7.1. **Use of Allocation-Based Procedures.** If one or more of the Tribes seeks to authorize its members to use Specially Regulated Fishing Methods in a Walleye Lake System in excess of the Threshold Harvest Level for that Walleye Lake System, or if one or more of the Tribes seeks to authorize Fishing Effort with Impoundment Nets or Long Seines for species other than walleyes in excess of the limitations set forth under Subparagraph 6.5(b) of this Protocol or those adopted under Subparagraph 6.5(c) of this Protocol, then Allocation-Based Procedures shall be used in that Walleye Lake System in accordance with this Section VII. The primary goal of Allocation-Based Procedures is to protect fish populations from Overfishing so that fishery resources are maintained in a healthy condition for the benefit of all current and future State and Tribal users, while at the same time providing the Tribes and the State with flexibility in managing Fishing activity of Tribal and State fishers and enabling the Tribes and the State each to harvest a specific species of fish in a Walleye Lake System at up to 50% of the Total Allowable Annual Exploitation Rate for that species .

7.2. **Objectives of Allocation-Based Procedures; Methods for Achieving Objectives.** As set forth above, the foremost objective of Allocation-Based Procedures is to maintain the total annual exploitation rate of Adult Walleyes by Tribal and State-licensed fishers in a Walleye Lake System at or below the Total Allowable Annual Exploitation Rate for that Walleye Lake System. A second objective is to maintain the total annual exploitation rates of other fish species in Walleye Lakes Systems at acceptable levels. A third objective of Allocation-Based Procedures is to enable Tribal members to harvest Adult Walleyes and other species of fish using Specially Regulated Fishing Methods in a Walleye Lake System in excess

of the Threshold Harvest Level for that Walleye Lake System. These objectives are accomplished by: (1) determining the Total Harvest Level that can occur in a Walleye Lake System in accordance with Section V of this Protocol, except that, if the estimated number of Adult Walleyes is *not* based on a Michigan regression equation under Paragraph 4.1 of this Protocol, an empirical population estimate under Paragraph 4.2 of this Protocol, or an alternative method that does not require the application of a percentage reduction for the value of N in Equation 3 when Fishing under Allocation-Based Procedures in Walleye Lake Systems of 1,000 surface acres or more (excluding tributaries) under Paragraph 4.3 of this Protocol, the value of “N” in Equation 3 shall be 70% of the estimated number of Adult Walleyes for lakes of 1,000 surface acres or more (excluding tributaries) and 50% of the estimated number of Adult Walleyes for lakes of less than 1,000 surface acres (excluding tributaries); (2) setting harvest limits for Tribal members using Specially Regulated Fishing Methods and for State-licensed fishers using other fishing methods, as set forth in Paragraph 7.4 of this Protocol; (3) completely monitoring harvests to ensure compliance with such harvest limits, as set forth in Paragraph 7.6 of this Protocol; and (4) applying daily bag limits, possession limits, and size limits, as set forth in Paragraph 11.3 of the Decree and Section VIII of this Protocol. In the event that the State or one or more Tribes believe these methods are insufficient to protect walleye or other species of fish in a Walleye Lake System, it shall propose additional methods to protect such fish, and the State and the Tribes shall consult for the purpose of developing such methods as provided in Paragraph 7.3 of this Protocol.

7.3. Invoking Allocation-Based Procedures. One or more Tribes may invoke Allocation-Based Procedures for any individual Walleye Lake System by declaring its intention to authorize the use of Specially Regulated Fishing Methods to harvest a number of Adult

Walleyes that exceeds the Threshold Harvest Level for that Walleye Lake System. Under Allocation-Based Procedures, the Tribes may declare their intent to authorize the use of Specially Regulated Fishing Methods to harvest up to 50% of the Total Harvest Level for a Walleye Lake System, less a reasonable estimate (based on information obtained under Subparagraph 7.6(b) of this Protocol) of the harvest by Tribal members using other fishing methods. The Tribe(s) shall notify the State of its intention to invoke Allocation-Based Procedures on any Walleye Lake System by July 1 of the year preceding the year in which the proposed harvests are to occur, or by such other date as may be mutually agreed upon by the State and the Tribes. Upon delivery and receipt of such notice, the State and the Tribes shall prepare to implement the Allocation-Based Procedures described in this Section VII, including, if necessary, the development of methods to protect species of fish other than walleye in Walleye Lake Systems.

7.4. Harvest Regulations under Allocation-Based Procedures.

(a) **State and Tribal Regulations.** After one or more Tribes declare its intent to invoke Allocation-Based Procedures in a Walleye Lake System, the State and the Tribes shall confer to determine the appropriate levels of harvest for Adult Walleyes and other species of fish by Tribal fishers using Specially Regulated Fishing Methods and by State-licensed fishers, including, if necessary, reductions in harvests by State-licensed fishers. Such levels of harvest for Adult Walleyes and other species of fish shall be based on: (1) the Total Harvest Level that can occur in a Walleye Lake System as determined in accordance with Section V and Paragraph 7.2 of this Protocol; and (2) the percentage of the Total Harvest Level declared by the Tribes under Paragraph 7.3 of this Protocol. In order to protect the resource, the State and the Tribes shall then take steps to regulate harvests by their respective fishers to remain within their

designated harvest levels, and to assess the walleye population, as necessary. The Parties understand that in all likelihood it may take up to three years to modify existing regulations governing State-licensed fishers to achieve the appropriate harvest levels for such fishers; however, best efforts shall be made to phase-in the necessary regulations as quickly as possible during any such period.

(b) **Non-Participating Tribes.** In the event that a Tribe decides not to participate in the additional management actions required under Allocation-Based Procedures, that Tribe shall restrict its members' Fishing Effort with Specially Regulated Fishing Methods in that Walleye Lake System in the manner set forth in Paragraph 6.5 of this Protocol so that the number of walleye allowed for harvest by its members using Specially Regulated Fishing Methods does not exceed one-fifth of the Threshold Harvest Level for that Walleye Lake System, *provided* that in applying Subparagraph 6.5(e) of this Protocol under these circumstances, "reliable information" shall be limited to: (1) the release or cancellation of a permit before the effective date of the permit; and (2) information obtained through voluntary compliance with the monitoring provisions set forth in Subparagraph 7.6(a) of this Protocol.

(c) **List of Lakes Subject to Allocation-Based Procedures.** A final list of all Walleye Lake Systems declared for management under Allocation-Based Procedures shall be developed by February 15 of the year in which Fishing under Allocation-Based Procedures will occur, or by such other date as may be mutually agreed upon by the State and the Tribes. The list shall indicate the maximum number of Adult Walleyes available for harvest by Tribal members using Specially Regulated Fishing Methods and other fishing methods, and the maximum number of Adult Walleyes that will be available for harvest by State-licensed fishers in each year that a Walleye Lake System is on the list. The Tribes are responsible for

determining allocations among the Tribes on Walleye Lake Systems declared for management under Allocation-Based Procedures. Annual allocations among the Tribes of harvests with Specially Regulated Fishing Methods can vary as the Tribes desire, but the sum of such allocations cannot exceed 50% of the Total Harvest Level less a reasonable estimate (based on information obtained under Subparagraph 7.6(b) of this Protocol) of the harvest by Tribal members using other Fishing methods.

(d) Removal of Walleye Lake Systems from Allocation-Based Procedures.

Walleye Lake Systems shall be removed automatically from the Allocation-Based Procedures list for the upcoming year if the Tribes do not declare their intention to harvest Adult Walleyes in excess of the Threshold Harvest Level using Specially Regulated Fishing Methods by July 1 of the year preceding the year in which the proposed harvests are to occur, or by such other date as may be mutually agreed upon by the State and the Tribes. In addition, if Tribal members did not attempt to harvest walleyes using Specially Regulated Fishing Methods from a Walleye Lake System that had been declared for Allocation-Based Procedures in the previous year, that Walleye Lake System shall be automatically removed from the Allocation-Based Procedures list for the following year. When a Walleye Lake System is removed from the Allocation-Based Procedures list, it reverts to being managed under Threshold Level Procedures.

7.5. Permit System under Allocation-Based Procedures. The Tribes shall require their members to obtain permits to fish with Specially Regulated Fishing Methods under Allocation-Based Procedures. The permits shall include the name of the Tribal member, the starting date and time of the 24-hour period(s) during which the permit is effective, the Walleye Lake System for which the permit is issued, and the walleye bag limit for each 24-hour period authorized under the permit. The permits and the walleye bag limit shall be consistent with the

management objectives of the Tribal permit system and the Allocation-Based Procedures. The Tribes shall require their members to have such permits in possession when Fishing under the provisions of the Allocation-Based Procedures. The Tribes shall not issue more than one such permit per member for use in any Walleye Lake System during a 24-hour period.

7.6. Monitoring Harvest under Allocation-Based Procedures.

(a) **Fish Harvested with Specially Regulated Fishing Methods.** The Tribe or Tribes that invokes Allocation-Based Procedures for a Walleye Lake System shall be responsible for monitoring the Fishing activity and harvests of the members of all the Tribes Fishing under Allocation-Based Procedures in that Walleye Lake System with Specially Regulated Fishing Methods. On each Walleye Lake System that is being managed under Allocation-Based Procedures, the responsible Tribe(s) shall identify specific sites on the shore of the Walleye Lake System being Fished where all Tribal fishers of the Tribes that invoked Allocation-Based Procedures shall check in before Fishing and check out after Fishing. At the time of check out, all Tribal fishers of the Tribes that invoked Allocation-Based Procedures shall present for examination all fish harvested. All fish harvested by Tribal members using Specially Regulated Fishing Methods under Allocation-Based Procedures shall be identified by species, counted, and recorded, and a sample of fish of each species harvested each day shall be measured, by professional biological or law enforcement personnel of the Tribe(s) that invoked Allocation-Based Procedures.

(b) **Fish Harvested with Fishing Methods Other Than Specially Regulated Fishing Methods.** The State shall conduct creel surveys to estimate fish harvested with Hook and Line Gear, whether by Tribal or State-licensed fishers, on Walleye Lake Systems declared for Allocation-Based Procedures, with the same frequency as the fish population

assessments required under Paragraph 7.7. The Tribes shall encourage and facilitate their members' cooperation with such surveys. The Tribes shall estimate the number of fish harvested by their members who use Fishing methods other than Specially Regulated Fishing Methods or Hook-and-Line-Gear in accordance with Paragraph 11.3 of the Decree.

(c) **Data Sharing.** The Tribes and the State shall share data regarding the total annual harvest by all Tribal and State-licensed fishers and information regarding the Fishing methods used by January 31 of the year following harvest, or by such other date as may be mutually agreed upon by the State and the Tribes.

7.7. Monitoring Fish Populations under Allocation-Based Procedures. Empirical population estimates of Adult Walleyes must be conducted as frequently as determined necessary by the Tribes and the State on Walleye Lake Systems declared for Allocation-Based Procedures by one or more Tribes. If an empirical population estimate of Adult Walleyes is deemed necessary, then the Tribe(s) that invoked Allocation-Based Procedures and the State shall share equally in obtaining the empirical population estimate of Adult Walleyes, unless otherwise mutually agreed upon by the Tribes and State. Surveys shall be conducted by professional biological personnel of the State and those Tribe(s) that invoked Allocation-Based Procedures. Unless the State and the Tribes mutually agree otherwise, they shall use the empirical population estimate of the Adult Walleye population in such Walleye Lake Systems in accordance with Section IV of this Protocol, except that an empirical population estimate of Adult Walleyes for a Walleye Lake System shall be recorded and shall be used for four years, or until an empirical population estimate of Adult Walleyes is calculated from a new population assessment to replace it. After four years, an empirical population estimate of the Adult Walleyes for a Walleye Lake

System shall be discarded and shall be replaced with the population estimate of Adult Walleyes using the procedures as set forth in Paragraph 4.1 of this Protocol.

VIII. BAG, POSSESSION, AND SIZE LIMITS AND SEASONS

The Tribes shall use bag, possession, and size limits and seasons to regulate their members' harvest of Adult Walleyes and other species of fish with Specially Regulated Fishing Methods in a Walleye Lake System in accordance with Paragraph 11.3 of the Decree, including daily bag and minimum size limits for the harvest of trout, bass, northern pike, and muskellunge and daily bag and possession limits for the harvest of bluegill, sunfish, crappie, lake whitefish, and yellow perch. In addition, the Tribes and the State shall impose at least a 14-inch minimum size limit on all walleye harvests. The Tribes shall require Tribal members who inadvertently spear walleyes that are less than the minimum size limit to retain them as part of the daily bag limit without penalty to the fisher, except that the Tribes shall prohibit the intentional targeting of walleyes below the legal size limit. The minimum size limit required by this Section VIII may be changed by mutual agreement of the Tribes and the State.

Table 1. – List of Walleye Lake Systems in the 1836 Ceded Territory with the initial determination of the source of recruitment and the Threshold Harvest Levels.

Walleye Lake System Name	County	Lake Surface Area (Acres)	Estimated Number of Adult Walleyes ¹	Source of Recruitment ²	Threshold Harvest Level (Numbers of Adult Walleyes)
Lakes ≥ 1,000 acres					
Houghton Lake	Roscommon	20,075	59,297	n	5,930
Burt Lake	Cheboygan	17,395	42,032 ³	n	4,203
Charlevoix, Lake	Charlevoix	17,268	9,859 ³	s	986
Mullett Lake	Cheboygan	16,704	49,740	n	4,974
Big Manistique Lake	Mackinac	10,346	11,856 ³	n	1,186
Black Lake	Cheboygan	10,113	14,013 ³	n	1,401
Indian Lake	Schoolcraft	8,647	26,506	n	2,651
Leelanau, Lake	Leelanau	8,607	54,665 ³	n	5,467
Grand Lake	Presque Isle	5,822	4,641 ³	n	464
Long Lake	Alpena	5,342	3,695 ³	n	370
Hamlin Lake	Mason	4,622	5,467	s	547
Brevoort Lake	Mackinac	4,315	5,140	s	514
Muskegon Lake	Muskegon	4,232	37,890 ³	s	3,789
South Manistique Lake	Mackinac	4,133	7,898 ³	n	790
Crooked-Pickerel lakes	Emmet	3,434	10,963	n	1,096
Long Lake	Grand Traverse	2,911	9,361	n	936
Hardy Dam Pond	Newaygo	2,773	8,936	n	894
Skegemog, Lake	Kalkaska/ Grand Traverse	2,766	3,449	s	345
Mitchell, Lake	Wexford	2,649	8,554	n	855
White Lake	Muskegon	2,535	3,190	s	319
Platte Lake	Benzie	2,532	3,186	s	319
Portage Lake	Manistee	2,116	2,712	s	271
Missaukee, Lake	Missaukee	2,035	2,619	s	262
Milakokia Lake	Mackinac	2,031	6,635	n	664
Otsego Lake	Otsego	2,013	2,594	s	259
Margrethe, Lake	Crawford	1,922	2,488	s	249
Paradise, Lake	Emmet	1,912	6,263	n	626
Bear Lake	Manistee	1,873	2,431	s	243
Bellaire, Lake	Antrim	1,789	5,877	n	588
North Manistique Lake	Luce	1,709	1,527 ³	n	153
Intermediate Lake	Antrim	1,571	2,077	s	208
Hodenpyl Dam Pond	Wexford	1,530	5,061	n	506
Au Train (Cleveland Cliffs) Basin	Alger	1,489	4,932	n	493
McDonald Lake	Schoolcraft	1,441	1,922	s	192
West Twin Lake	Montmorency	1,306	1,759	s	176
Cadillac, Lake	Wexford	1,172	3,923	n	392
Croton Dam Pond	Newaygo	1,129	3,785	n	379
Millecoquins Lake	Mackinac	1,123	1,537	s	154
Tippy Dam Pond	Manistee	1,086	3,647	n	365 ⁴

Table 1. – Continued.

Walleye Lake System Name	County	Lake Surface Area (Acres)	Estimated Number of Adult Walleyes ¹	Source of Recruit- ment ²	Threshold Harvest Level (Numbers of Adult Walleyes)
Lakes ≥ 1,000 acres					
Manistee Lake	Manistee	1,051	3,535	n	354
Lakes < 1000 acres					
Big Star Lake	Lake	890	1,247	s	62
Gulliver Lake	Schoolcraft	881	1,236	s	62
Manistee Lake	Kalkaska	874	1,227	s	61
Au Train Lake	Alger	845	2,869	n	143
Caribou Lake	Chippewa	829	2,817	n	141
Fremont Lake	Newaygo	825	1,165	s	58
East Twin Lake	Montmorency	820	1,159	s	58
Chippewa Lake	Mecosta	791	1,122	s	56
Beaver Lake	Alger	783	2,668	n	133
Muskallonge Lake	Luce	762	2,599	n	130
Silver Lake	Oceana	672	969	s	48
Mona Lake	Muskegon	656	949	s	47
Silver Lake	Grand Traverse	609	887	s	44
Fife Lake	Grand Traverse	606	884	s	44
Pere Marquette Lake	Mason	606	884	s	44
Upper Herring Lake	Benzie	572	839	s	42
Trout Lake	Chippewa	568	1,963	n	98
Big Whitefish Lake	Montcalm	502	746	s	37
Crooked Lake	Missaukee	490	730	s	37
Round Lake	Delta	482	720	s	36
Pentwater Lake	Oceana	482	1,678	n	84
Lake Geneserath	Charlevoix	480	717	s	36
Straits/Corner/Deep/ Skeels Lake Chain	Delta	472	706	s	35
Beaufort Lake	Baraga	467	699	s	35
Little Lake	Marquette	460	690	s	35
Lower Herring Lake	Benzie	450	677	s	34
Spider Lake	Grand Traverse	445	1,554	n	78
Horsehead Lake	Mecosta	443	667	s	33
Lincoln Lake	Kent	417	632	s	32
Eight Point Lake	Clare	416	1,457	n	73
Long Lake	Cheboygan	379	494 ³	n	25
Rose Lake	Osceola	373	572	s	29
Sixmile Lake	Antrim	369	566	s	28
Round Lake	Emmet	353	544	s	27
Big Bear Lake	Otsego	344	532	s	27
Rogers Impoundment	Mecosta	337	1,192	n	60

Table 1. – Continued.

Walleye Lake System Name	County	Lake Surface Area (Acres)	Estimated Number of Adult Walleyes ¹	Source of Recruit- ment ²	Threshold Harvest Level (Numbers of Adult Walleyes)
Lakes < 1000 acres					
Big Blue Lake	Muskegon	336	521	s	26
Stella Lake	Alger	332	515	s	26
Thunder Lake	Schoolcraft	331	514	s	26
Birch Lake	Antrim	325	505	s	25
Lake Esau	Presque Isle	319	497	s	25
Boardman Lake	Grand Traverse	317	494	s	25
Lake Mecosta	Mecosta	312	1,107	n	55
Pickerel Lake	Newaygo	308	481	s	24
Pike Lake	Luce	286	1,019	n	51
Coldwater Lake	Isabella	285	449	s	22
Long Lake	Montmorency	279	995	n	50
Bodi Lake	Luce	275	435	s	22
Bass Lake	Marquette	273	432	s	22
Deer Lake	Alger	266	422	s	21
Lake Sapphire	Missaukee	246	394	s	20
Schweitzer Cr Flowage	Marquette	245	392	s	20
Hart Lake	Oceana	236	379	s	19
Wolf Lake	Muskegon	225	363	s	18
Big Lake	Osceola	212	344	s	17
Long Lake	Clare	211	762	n	38
Rainy Lake	Presque Isle	202	730	n	37
Bills Lake	Newaygo	200	327	s	16
Clifford Lake	Montcalm	195	320	s	16
Petes Lake	Schoolcraft	194	703	n	35
Bass Lake	Kent	188	682	n	34
School Section Lake	Oceana	187	308	s	15
Frenchmans Lake	Chippewa	185	305	s	15
Little Whitefish Lake	Montcalm	180	297	s	15
Monocle Lake	Chippewa	172	626	n	31
Little Brevoort Lake	Mackinac	163	595	n	30
Nichols Lake	Newaygo	153	257	s	13
Bass Lake	Luce	144	529	n	26
Littlefield Lake	Isabella	140	237	s	12
Steuben Lake	Schoolcraft	136	231	s	12
Robinson Lake	Oceana	134	228	s	11
Pleasant Lake	Wexford	130	222	s	11
Gooseneck Lake	Delta	128	219	s	11
Gemini Lakes	Schoolcraft	128	219	s	11
East Lake	Luce	125	214	s	11
Ocqueoc Lake	Presque Isle	125	462	n	23
Big Lake	Otsego	124	213	s	11

Table 1. – Continued.

Walleye Lake System Name	County	Lake Surface Area (Acres)	Estimated Number of Adult Walleyes ¹	Source of Recruit- ment ²	Threshold Harvest Level (Numbers of Adult Walleyes)
Lakes < 1000 acres					
School Section Lake	Mecosta	122	210	s	11
Kingston Lake	Alger	122	451	n	23
Hackert Lake	Mason	120	207	s	10
Ess Lake	Montmorency	119	440	n	22
Pretty Lake	Mecosta	116	201	s	10
Long Lake	Mason	107	398	n	20
Boot Lake	Schoolcraft	106	185	s	9
Lake Twentyseven	Otsego	106	394	n	20
Crockery Lake	Ottawa	104	182	s	9
Culhane Lake	Luce	100	176	s	9
Totals	1836 Territory	218,343	508,507		47,713

¹ Unless otherwise indicated, the estimates of population size are based on 2007 Wisconsin Regression Equations for lakes with walleye populations in which the primary recruitment sources are either natural reproduction or stocked fish, whichever is appropriate.

² n = walleye recruitment is 50% or more from natural reproduction or walleye recruitment composition from naturally produced and stocked walleyes is unknown; s = walleye recruitment is more than 50% from stocked walleyes.

³ Estimate of population size was based on a recent biological survey conducted by the Michigan Department of Natural Resources or the Tribes within the past 5 years.

⁴ The State and the Little River Band of Ottawa Indians agree to cooperate in jointly conducting a population assessment at Tippy Dam Pond within two years of the entry of this Decree.

Appendix B2

PROTOCOL FOR THE TRIBES' AUTHORIZATION OF THEIR MEMBERS' USE OF IMPOUNDMENT NETS AND LONG SEINES IN NON-WALLEYE LAKE SYSTEMS

This Protocol is adopted in accordance with Section XII of the Decree. The provisions of this Protocol are intended to facilitate implementation of Section XII of the Decree but shall not relieve any party of any obligation it has under the Decree. In the event of any inconsistency between the provisions of the Decree and the provisions of this Protocol, the provisions of the Decree shall be controlling. Except as authorized by this Protocol or otherwise authorized in the Decree or by mutual agreement of the Tribes and the State, the Tribes shall prohibit their members from using Impoundment Nets or Long Seines in Non-Walleye Lake Systems. However, notwithstanding any other provision of this Protocol, if the State permits State licensees to use Impoundment Nets or Long Seines in Non-Walleye Lake Systems: (1) the Tribes may permit their members to use Impoundment Nets or Long Seines subject to regulations that are no less restrictive than applicable State regulations; and (2) the Tribes and the State shall make appropriate adjustments, as may be necessary, to the provisions of this Protocol.

I. INTRODUCTION

1.1. **Use of Impoundment Nets and Long Seines in Non-Walleye Lake Systems.** In accordance with Paragraphs 12.1 and 12.3 of the Decree, the Tribes may authorize their members to use Impoundment Nets and Long Seines throughout Non-Walleye Lake Systems as provided in Protocol described in this Appendix B2, *provided* that the Tribes shall not authorize their members to use Impoundment Nets or Long Seines in tributaries to Non-Walleye Lake Systems except where the use of such gear is permitted by State law or Paragraph 11.4 of the Decree. Short Seines are not subject to the provisions of this Protocol.

1.2. Tribal Authorization of Fishing with Methods Other Than Impoundment

Nets and Long Seines Not Restricted. Except as provided in Section VI of this Protocol, the Tribes' authorization of their members' use of fishing methods other than Impoundment Nets and Long Seines in Non-Walleye Lake Systems is not limited by this Protocol.

II. DEFINITIONS

As used in this Protocol, the terms defined in Section III (Definitions) of the Decree shall have the meanings ascribed to them in that Section and the terms defined in Section II (Definitions) of Appendix B1 shall have the meanings ascribed to them in that Section.

III. NON-WALLEYE LAKE SYSTEMS

All Lake Systems that are not being managed as Walleye Lake Systems under Section III (Walleye Lake Systems) of Appendix B1 shall be managed as Non-Walleye Lake Systems under this Appendix B2.

IV. INTERIM THRESHOLD LEVEL PROCEDURES FOR THE TRIBES' AUTHORIZATION OF THEIR MEMBERS USE OF IMPOUNDMENT NETS OR LONG SEINES IN NON-WALLEYE LAKE SYSTEMS

4.1. Application of Interim Threshold Level Procedures. Unless one or more of the Tribes invokes Allocation-Based Procedures for a Non-Walleye Lake System, the Tribes' authorization of their members' use of Impoundment Nets or Long Seines in Non-Walleye Lake Systems shall be subject to the Interim Threshold Level Procedures set forth in this Section IV.

4.2. Objectives of the Interim Threshold Level Procedures; Methods for Achieving Objectives. The foremost objective of Interim Threshold Level Procedures is to maintain the total annual exploitation rate of all species of fish in Non-Walleye Lake Systems at acceptable levels. A second objective of Interim Threshold Level Procedures is to ensure that Tribal members have an opportunity to use Impoundment Nets and Long Seines to harvest fish

in Non-Walleye Lake Systems without requiring implementation of the more rigorous management practices that will be required under Allocation-Based Procedures. These objectives are accomplished by: (1) implementing a permit system that controls harvest by limiting annual Fishing Effort by Tribal members using Impoundment Nets and Long Seines on each Non-Walleye Lake System, as set forth in Paragraph 4.4 of this Protocol; and (2) applying daily bag limits, possession limits, and size limits, as set forth in Paragraph 11.3 of the Decree and Section VI of this Protocol.

4.3. Fishing Effort Limitations under Interim Threshold Level Procedures. The Tribes shall limit their members' Fishing Effort with Impoundment Nets and Long Seines in each Non-Walleye Lake System in order to protect the fish populations in those Systems. The premise for these Fishing Effort limitations is that the Fishing Effort limitations under the Threshold Level Procedures, as set forth in Section VI of Appendix B1, are adequate to protect non-walleye species in Walleye Lake Systems and should likewise be adequate to protect non-walleye species in Non-Walleye Lake Systems. To achieve this objective, the Tribes shall require their members to obtain a Tribal permit for the use of Impoundment Nets and Long Seines that is specific to a Non-Walleye Lake System and that specifies the starting date and time of each 24-hour period during which the permit is valid. Fishing Effort with Impoundment Nets and Long Seines on a Non-Walleye Lake System shall be limited in accordance with Paragraph 4.4.

4.4. Fishing Effort Limitations under Interim Threshold Level Procedures. The Tribes shall limit the use of Impoundment Nets and Long Seines in each Non-Walleye Lake System as set forth in this Paragraph 4.4. The Tribes shall limit each permit for the use of Impoundment Nets or Long Seines to the use of a single Impoundment Net or a single Long

Seine during one or more 24-hour period(s). The total number of such 24-hour periods in all such permits in a particular Non-Walleye Lake System shall be limited as follows:

a. No more than three (3) 24-hour periods per 100 surface acres per year in Non-Walleye Lake Systems of 1,000 surface acres or more, excluding tributaries, rounded to the nearest whole number; and

b. No more than one and one-half (1.5) 24-hour periods per 100 surface acres per year in Non-Walleye Lake Systems of less than 1,000 surface acres, excluding tributaries, and rounded to the nearest whole number.

The Tribes shall maintain a running tally of the number of 24-hour periods in such permits for each Non-Walleye Lake System and, when the number of such 24-hour periods under all such permits for a particular Non-Walleye Lake System reaches the limit for that Non-Walleye Lake System, the Tribes shall cease issuing permits for the use of Impoundment Nets or Long Seines for that Non-Walleye Lake System.

4.5. **Permit Requirements.** The Tribes shall require their members to obtain a permit for the use of Impoundment Nets or Long Seines in a Non-Walleye Lake System that is specific to that Non-Walleye Lake System and that specifies the 24-hour period(s) during which the permit is valid. The permit shall include the name of the Tribal member, the date(s) and times during which the permit is effective, and the name of the Non-Walleye Lake System for which the permit is issued. The permit shall be consistent with the management objectives of the Tribal permit system and these Interim Threshold Level Procedures. The Tribes shall require their members to have such permits in possession when Fishing under the provisions of these Interim Threshold Level Procedures. The Tribes shall not issue more than one such permit per member for use in any Non-Walleye Lake System during a 24-hour period.

4.6. **Monitoring Harvest under Interim Threshold Procedures.** The Tribes shall require that Tribal members report harvests using Impoundment Nets or Long Seines under these Interim Threshold Level Procedures as a condition of receiving a permit. The Tribes shall provide an annual summary of these harvest reports to the State and all Tribes by January 31 of the year following the harvests, or by such other date as may be mutually agreed upon by the State and the Tribes. This annual summary shall include the number of permits issued and the total number of fish harvested by species, gear type, and Tribe for each Non-Walleye Lake System.

4.7. **Monitoring Fishing Activity under Interim Threshold Level Procedures.** The Tribes shall monitor Fishing activity by Tribal members using Impoundment Nets or Long Seines under Interim Threshold Level Procedures as necessary to ensure compliance with Tribal fishing regulations and Tribal permits. The Tribes shall use professional biological or law enforcement personnel when monitoring of Fishing activity is deemed necessary under this Paragraph. If violations are detected, they shall be handled in accordance with law enforcement procedures described in Section XXIV (Law Enforcement) of the Decree.

4.8 **Future Changes to Interim Threshold Level Procedures.** The State and the Tribes may modify these Interim Threshold Level Procedures by mutual agreement. Requests for such a modification, including the supporting biological documentation and the duration of the proposed change, shall be submitted in writing to the State and all Tribes by July 1 of the year preceding the effective date of the proposed modification, or by such other date as may be mutually agreed upon by the State and the Tribes. Requests for a modification to Interim Threshold Level Procedures shall be reviewed by State and Tribal biologists to ensure that the modification will protect the fish species in the affected Non-Walleye Lake System and complies

with the objectives and rules of this Protocol. The Tribes and the State shall declare whether or not they agree with a requested modification to Interim Threshold Level Procedures for a Non-Walleye Lake System by December 15 of the year the request was received. If the Tribes and the State agree to change Interim Threshold Level Procedures, the new procedures shall be recorded and shall be used for the particular Non-Walleye Lake System(s) for which it was proposed for the agreed-upon duration or until changed by the State and the Tribes under this Paragraph.

V. ALLOCATION-BASED PROCEDURES

If one or more Tribes desires to authorize Fishing Effort in excess of the limitations set forth under Section IV of this Protocol, the Tribes and the State shall develop Allocation-Based Procedures to prevent the combined harvest by State and Tribal fishers from exceeding a mutually acceptable harvest level for any species. The primary goal of Allocation-Based Procedures is to protect fish populations from Overfishing so that fishery resources are maintained in a healthy condition for the benefit of all current and future State and Tribal users, while at the same time providing the Tribes and the State with flexibility in managing the Fishing activity of Tribal and State fishers. Under such Allocation-Based Procedures, the Tribes may declare their intent to authorize the use of Impoundment Nets and/or Long Seines to harvest up to 50% of the mutually acceptable harvest levels for any species in a Non-Walleye Lake System, less a reasonable estimate (based on information obtained under Paragraph 7.6(b) of Appendix B1 for that Non-Walleye Lake System) of the harvest by Tribal members using other fishing methods. A Tribe seeking to authorize Fishing Effort in excess of the limitations set forth under Section IV of this Protocol shall provide written notice to the State and all other Tribes at least one year preceding the year in which the Fishing Effort is to occur.

VI. BAG, POSSESSION, AND SIZE LIMITS AND SEASONS

The Tribes shall use bag, possession, and size limits and seasons to regulate their members' harvest of species of fish with Impoundment Gear or Long Seines in a Non-Walleye Lake System in accordance with Paragraph 11.3 of the Decree, including daily bag, possession, and minimum size limits for the harvest of trout, bass, northern pike, and muskellunge and daily bag and possession limits for the harvest of bluegill, sunfish, crappie, lake whitefish, and yellow perch.

Appendix C

NON-MEMBER ASSISTANCE

General Principle 1. A Tribal member may engage in Hunting, Fishing, Trapping, or Gathering with any other person who is not a member of an 1836 Treaty Tribe, provided that the non-member possesses a license from, and complies with, the laws of the State of Michigan governing the subject activity.

General Principle 2. No Tribal member may be assisted in carrying out a usufructuary activity by a person who is not a member of an 1836 Treaty Tribe, unless the non-member is the spouse, parent, grandparent, child, grandchild, or sibling of the Tribal member, and the Tribal member is physically present during the activity.

General Principle 3. Permitted assistance by authorized non-members (as defined in General Principle 2) shall not include using a Spear or other gear to harvest fish, using a firearm or Bow, setting or placing traps or snares, uprooting a plant, or removing parts of plant from a plant left growing.

General Principle 4. Any person may assist a Tribal member holding a Disabled Hunter's Permit, but shall not Hunt or carry a firearm or Bow unless authorized to do so by Tribal or Michigan law.

Appendix D

STATE SHOTGUN ZONE AS OF OCTOBER 2006

The dividing line between the northern rifle deer hunting zone and the southern shotgun zone is as follows: Starting at a point on the Lake Michigan shoreline directly west of M-46, then easterly to M-46, then easterly along M-46 to US-131 at Cedar Springs, southerly on US-131 to M-57, easterly on M-57 to Montcalm Road on the Kent-Montcalm county line, southerly on Montcalm Road and the Kent-Ionia county line to M-44, easterly on M-44 to M-66, northerly on M-66 to M-57, easterly on M-57 to M-52 near Chesaning, northerly on M-52 to M-46, easterly on M-46 to M-47, northerly on M-47 to US-10 west of Bay City, easterly on US-10 to I-75, northerly on I-75 and US-23 to Beaver Road (about 1 mile north of Kawkawlin), easterly to Saginaw Bay, north 50 degrees east to the International Boundary.

Appendix E

STREAMS DESIGNATED TYPES 5, 6 & 7 AS OF OCTOBER 2006

<u>County</u>	<u>Streams</u>
Alger	None
Alpena	None
Antrim	None
Benzie	None
Charlevoix	None
Cheboygan	None
Chippewa	None
Clare	None
Crawford	AuSable Mainstream , from Burton's Landing downstream to Wakeley Bridge, Manistee River , from M-72 downstream to CCC Bridge; North Branch AuSable River , from Sheep Ranch downstream to confluence with Mainstream, South Branch AuSable River , from Lower High Banks downstream to confluence with Mainstream, South Branch AuSable River , from Chase Bridge downstream to Lower High Banks.
Delta	Escanaba River , from Boney Falls Dam downstream to mouth of Silver Cr. (T40N, R23W, Sec. 11)
Emmet	None
Grand Traverse	None
Ionia	None
Isabella	None
Kalkaska	Manistee River , from M-72 downstream to CCC Bridge.
Kent	None
Lake	Little Manistee River , from Spencer's Bridge (T19N, R13W, Sec. 5) downstream to Johnson's Bridge (T20N, R14W, Sec. 24), Pere Marquette River , from M-37 downstream to Gleason's Landing (T17N, R13W, Sec. 18).
Leelanau	None

Luce	None
Mackinac	None
Manistee	None
Marquette.....	None
Mason	None
Mecosta.....	None
Missaukee	None
Montcalm.....	None
Montmorency	None
Muskegon	None
Newaygo.....	None
Oceana	None
Osceola	None
Oscoda.....	None
Otsego.....	None
Ottawa	None
Presque Isle.....	None
Roscommon	None
Schoolcraft.....	None
Wexford.....	None

Appendix F

LAKES DESIGNATED TYPE D AS OF OCTOBER 2006

<u>County</u>	<u>Lakes</u>
Alger	None
Alpena	None
Antrim	None
Benzie	None
Charlevoix	None
Cheboygan	Twin Lake #1
Chippewa	None
Clare	None
Crawford	None
Delta	None
Emmet	None
Grand Traverse	Sand Lake #2
Ionia	None
Isabella	None
Kalkaska	None
Kent	None
Lake	None
Leelanau	None
Luce	Deer Lake, Moon Lake, Sid Lake
Mackinac	None
Manistee	None
Marquette	Keyhole Lake (East), S. Kidney Lake (T45N, R26W, Sec 28), Pauls Lake (North), Pauls Lake (South), Rockingchair Lake (North), Rockingchair Lake (South), Strawberry Lake
Mason	None
Mecosta	None
Missaukee	None
Montcalm	None
Montmorency	None
Muskegon	None
Newaygo	None
Oceana	None
Osceola	None
Oscoda	None
Otsego	None
Ottawa	None
Presque Isle	None

RoscommonNone
Schoolcraft.....**Dutch Fred Lake, Ned’s Lake,
Twilight Lake**
Wexford.....None

Appendix G

NOTE 8 TO TABLE 2 OF THE 2006 MICHIGAN FISHING GUIDE (p. 10)

The following lakes are closed to spearing of northern pike and muskellunge, except that northern pike may be speared on waters as marked (*) from Jan. 1 – end of February.

<u>County</u>	<u>Lakes</u>
Alger.....	None
Alpena	Fletcher Floodwaters
Antrim	None
Benzie.....	None
Charlevoix	None
Cheboygan.....	Cornwall Impoundment
Chippewa.....	Caribou Lake
Clare	Budd Lake
Crawford.....	None
Delta	*Dana Lake
Emmet	None
Grand Traverse.....	None
Ionia.....	None
Isabella.....	None
Kalkaska	None
Kent	Campau Lake and Murray Lake
Lake.....	None
Leelanau	None
Luce.....	None
Mackinac	Brevoort Lake
Manistee	None
Marquette.....	Fish Lake
Mason	None
Mecosta.....	None
Missaukee	None
Montcalm.....	None
Montmorency.....	Fletcher Floodwaters and West Twin Lakes
Muskegon	Mona Lake
Newaygo.....	None
Oceana	None
Osceola	None
Oscoda.....	None
Otsego.....	Big Bear Lake and Otsego Lake
Ottawa	Lake Macatawa

Presque Isle.....None
RoscommonNone
Schoolcraft.....**Big Bass Lake, Grassy Lake, and
McKeever Lake**
Wexford.....None

Appendix H

STATE FISHING REGULATIONS EXISTING AS OF OCTOBER 2006 APPLICABLE TO CERTAIN DESIGNATED QUALITY LAKES

Crawford County, Jones Lake: open season June 1 – Sept. 30, catch and release Fishing with artificial lures; live bait in possession is unlawful.

Crawford County, Wakeley Lake: open season June 15-Aug. 31, catch and release Fishing with artificial lures; live bait in possession is unlawful.

Montmorency County, North and South Blue Lakes and Robarge (Pike) Lake: open season is the last Saturday in April – Sept. 30, catch and release only, artificial lures only.

Appendix I

STREAMS DESIGNATED TYPES 1, 2, & 4 AS OF OCTOBER 2006

Except as otherwise noted, Type 1 Streams are not listed in this Appendix. A complete list of streams designated Type 1 as of October 2006 is being filed separately with the Court.

<u>County</u>	<u>Streams</u>
Alger.....	Anna River , from Railroad Bridge (T46N, R19W, Sec. 14) downstream to Lake Superior, Au Train River , from Powerhouse below M-94 downstream to Lake Superior, Indian River , from “Wide Waters” (T44N, R19W, Sec. 13) downstream to Indian Lake, Laughing Whitefish River , from Forks (T47N, R22W, Sec. 22) downstream to Lake Superior, Miner’s River , from Miner’s Falls downstream to Lake Superior, Rock River , from Railroad Bridge (T47N, R21W, Sec. 22) downstream to Lake Superior, Sable Creek , Sucker River , upstream limit is Old Grand Marais/Seney Road Bridge.
Alpena	Devils River , from U.S. 23 Bridge downstream to Lake Huron, Long Lake Creek , downstream limit is Lake Huron.
Antrim	Elk River Bypass , from Bypass Dam downstream to Lake Michigan, Grass River (inc. Clam Lake and Clam River) , from Lake Bellaire downstream to Torch Lake, Intermediate River , from Intermediate Dam downstream to Lake Bellaire, Jordon River , from Graves Crossing downstream to Lake Charlevoix, Manistee River , from Headwaters downstream to M-72.
Benzie.....	Betsie River , from Kurick Rd. downstream to M-22, Platte River , from US 31 East of Honor downstream to Lake Michigan.
Charlevoix	Boyne River , from P.H. Dam downstream to Lake Charlevoix, Jordon River , from Graves Crossing downstream to Lake Charlevoix.
Cheboygan.....	Black River , from Tin Shanty Bridge Road downstream to Tower Dam, Maple River , from Dam (T36N, R4W, Sec. 10) in Emmet County downstream to mouth, Mill Creek , Pigeon River , from Dam (T32N, R1W, Sec. 19) downstream to

M-68 Bridge, **Pigeon River**, from M-68 Bridge downstream to mouth, **Sturgeon River**, from Afton Rd. (Also Called Webb Rd. or Wolverine Rd.) downstream to mouth.

Chippewa..... **Albany Creek**, from bridge below lamprey weir to Lake Huron, **E. Br. Tahquamenon River**, downstream limit is North Hulbert Road (T46N, R07W, Sec. 9) Bridge, **Halfaday Creek**, from Lakeshore Drive downstream to Lake Superior, **Pendill's Creek**, from Second Dam (T47N, R4W, Sec. 28) downstream to Lake Superior.

Clare None

Crawford..... **AuSable River Mainstream**, from Grayling City Dam downstream to Burton's Landing, **AuSable River Mainstream**, from Wakeley Bridge downstream to Rainbow Bend Powerline (T26N, R2E, Sec 4), **Manistee River**, from Headwaters downstream to M-72.

Delta **Bark River**, from 9 Road (Section Line Between T38N, R24W, Sec. 20 & 29) downstream to Lake Michigan, **Big Fishdam River**, from County Road 2222 Bridge (T41N, R18W, Sec. 9) downstream to Lake Michigan, **Days River**, from Highway M-35 Bridge downstream to Lake Michigan, **Escanaba River**, from the mouth of the W. Br. Escanaba R. (T43N, R25W, Sec. 3) downstream to Boney Falls Dam (T41N, R24W, Sec. 2), **Ford River**, from T43N, R27W, S. 35 (Dickenson County) downstream to L. Michigan, **Rapid River**, from County Road S-15 (T42N, R21W, Sec. 19) downstream to Lake Michigan, **Sturgeon River**, from County Road 442 Bridge (T42N, R20W, Sec. 13) downstream to Lake Michigan, **Tacoosh River**, from 29th Lane (County Road G-24) downstream to Lake Michigan, **Whitefish River**, from 38th Road (U.S.F.S. 2236) downstream to Lake Michigan.

Emmet **Maple River**, from Dam T36N, R4W, Sec. 10, Emmet County downstream to mouth.

Grand Traverse..... None

Ionia..... **Dickerson Creek, Fish Creek**, from Sidney Rd. downstream to confluence with Maple River, **Prairie Creek, Sebewa Creek and Tributaries**.

Isabella..... None

Kalkaska **Manistee River**, from CCC Bridge (T26N, R6W, Sec 26) downstream to US 131, **Rapid River**, from Antrim (Rugg) Pond downstream to Torch River,

Torch River, from Torch Lake downstream to Lake Skegemog.

Kent **Ball Creek**, downstream limit is confluence with Rogue River, **Buck Creek**, downstream limit is confluence with Grand River, **Coldwater River**, from Freeport Rd. downstream to confluence with Thornapple River, **Nash Creek**, downstream limit is confluence with Rogue River, **Rogue River**, downstream limit is confluence with Grand River.

Lake **Little Manistee River**, from Johnson's Bridge downstream to Manistee Lake, **Pere Marquette River**, from Gleason's Landing (T17N, R13W, Sec. 18) downstream to Indian Bridge (Reek Rd.), **Pine River**, From Elm Flats Public Access Site to confluence with Tippy Dam backwaters, **Baldwin River** (Type 1).

Leelanau None

Luce **Blind Sucker River**, upstream limit is Blind Sucker Flooding Dam, **E. Br. Fox River, including tributaries**, downstream limit is M-28, **Two-Hearted River**, upstream limit is Reed & Green Bridge.

Mackinac **Black River**, upstream limit is Peters Truck Trail Footbridge, **Brevoort River**, upstream limit is Brevoort Lake, **Carp River**, mainstream only, **Crow River**, upstream limit is Outfall of Amadon Pond, **Milakokia River**, upstream limit is Inland-Limestone Co. Railroad Bridge (T41N, R13W, Sec 1), **Millecoquins River**, upper limit is H-40 Bridge, **Pine River**, from H-40 Bridge downstream to Lake Huron.

Manistee **Betsie River**, from Kurick Rd. downstream to M-22, **Little Manistee River**, from Johnson's Bridge downstream to Manistee Lake, **Manistee River**, from Hodenpyl Res. downstream to Red Bridge, **Pine River**, from Elm Flats Public Access Site to confluence with Tippy Dam backwaters.

Marquette..... **Big Garlic River**, from Forks (T49N, R27W, Sec. 12) downstream to Lake Superior, **Carp River**, from Deer Lake Dam (T48N, R27W, Sec. 27) downstream to Morgan Creek, **Dead River**, from Hoist Dam (T48N, R26W, Sec. 9) downstream to County Rd. 510 Bridge (T48N, R26W, Sec. 15), **Escanaba River**, from the mouth of the W. Br. Escanaba R. (T43N, R25W, Sec. 3) downstream to Boney Falls Dam (T41N, R24W, Sec. 2), **Ford**

River, from T43N, R27W, S.33 (Dickinson County) downstream to L. Michigan, **Harlow Creek**, from Railroad Bridge (T49N, R26W, Sec. 24) downstream to Lake Superior, **Iron River**, from Lake Independence Dam to Lake Superior.

Mason **Big S. Branch Pere Marquette River**, from confluence of Beaver/Winnepesaug Creeks downstream to confluence with Pere Marquette River, **Little Manistee River**, from Johnson's Bridge downstream to Manistee Lake, **Pere Marquette River**, from Gleason's Landing (T17N, R13W, Sec. 18) downstream to Indian Bridge (Reek Rd.), **Sable River**, from Freesoil Rd. (T20N, R15W, Sec. 21) downstream to Hamlin Lake.

Mecosta..... **Little Muskegon River, Muskegon River**, from US-10 downstream to River Bend Bluffs Public Access site (T15N, R9W, S31).

Missaukee **Clam River**, from Lachance Rd. (T22N, R8W, Sec. 21) downstream to Blue Rd (T22N, R8W, Sec. 27).

Montcalm..... **Dickerson Creek.**

Montmorency..... None

Muskegon **White River**, from Hesperia Dam downstream to Lake Michigan.

Newaygo..... **Big S. Branch Pere Marquette River**, from confluence of Beaver/Winnepesaug Creeks downstream to confluence with Pere Marquette River, **Little S. Br. Pere Marquette River**, from Carlson Bridge (16 Mile Rd.) downstream to Oxbow Bridge (Forman Rd.), **Muskegon River**, from Croton Dam downstream to Bridge Street (New Bridge T12N, R13W, S24) Garfield Twp., **Tamarack Creek, White River**, from Six Mile Rd. downstream to Baseline Rd.

Oceana **North Branch Pentwater River**, from Oceana Dr. downstream to confluence with mainstream of Pentwater River, **North Branch White River**, from Arthur Rd. downstream to confluence with White River, **Pentwater River**, from Hart Dam downstream to confluence with Pentwater Lake.

Osceola **Muskegon River**, from US-10 downstream to River Bend Bluffs Public Access Site (T15N, R9W, S31).

Oscoda **AuSable River Mainstream**, from Wakeley Bridge downstream to Rainbow Bend powerline (T26N, R2E, Sec. 4), **AuSable River Mainstream**, from Mio Dam down to the Mio Powerline at (T26N,

R3E, S. 7), **AuSable River Mainstream**, from McKinley Bridge downstream to 4001 Bridge).

Otsego..... **Black River**, from Tin Shanty Bridge downstream to Tower Dam, **Manistee River**, from Headwaters downstream to M-72, **Pigeon River**, from Dam (T32N, R1W, Sec. 19) downstream to M-68 Bridge.

Ottawa **Crockery Creek Mainstream Only**, from Moore Rd (T10N, R13W, Sec. 4) in Muskegon County downstream to confluence with Grand River (Ottawa County), **Sand Creek**.

Presque Isle..... **Ocqueoc River**, from Barnhart Lake downstream to Lake Huron.

Roscommon None

Schoolcraft..... **Indian River**, from “Wide Waters” (T44N, R19W, Sec. 13) downstream to Indian Lake, **Manistique River**, upstream limit is Papermill Dam, **Thompson Creek (Type 1)**.

Wexford..... **Manistee River**, from CCC Bridge downstream to US 131, **Manistee River**, from US 131 downstream to M-115, **Pine River**, from Elm Flats Public Access Site to confluence with Tippy Dam backwaters.

Appendix J

STATE REGULATIONS FOR HARVESTING MINNOWS OR OTHER BAIT FISH WITH THE USE OF SEINES AS OF OCTOBER 2006

Long Seines shall not be used for the harvesting of minnows and other bait fish. Short Seines shall not be used to take minnows from trout streams or from Big Glen L. or any of its tributaries for ½ mile above their mouths.

Appendix K

BIRDS NOT PROTECTED BY THE MIGRATORY BIRD TREATY ACT (16 U.S.C. §§ 703-712) AND MAMMALS THAT CANNOT LAWFULLY BE HARVESTED UNDER STATE LAW AS OF OCTOBER 2006

I. BIRDS

<u>Species</u>	<u>Game Species</u>
Gray Partridge, <i>Perdix perdix</i> [Accidental]	Yes
Spruce Grouse, <i>Falcipennis canadensis</i>	No
Sharp-tailed Grouse, <i>Tympanuchus phasianellus</i>	Yes
Greater Prairie-Chicken, <i>Tympanuchus cupido</i> [Extirpated, last recorded 1981]	No
Eurasian Jay, <i>Garrulus glandarius</i> [Accidental]	No
European Goldfinch, <i>Carduelis carduelis</i> [Casual]	No
Greenfinch, <i>Carduelis chloris</i> [Accidental]	No
Linnet, <i>Carduelis cannabina</i> [Accidental]	No
Eurasian Tree Sparrow, <i>Passer montanus</i> [Accidental]	No
Red-cheeked Cordonbleu, <i>Uraeginthus bengalus</i> [Accidental]	No

II. MAMMALS

<u>Species</u>	<u>Game Species</u>
Least Shrew, <i>Cryptotis parva</i>	No
Big Brown Bat, <i>Eptesicus fuscus</i>	No
Silver-haired Bat, <i>Lasionycteris noctivagans</i>	No
Red Bat, <i>Lasiurus borealis</i>	No
Hoary Bat, <i>Lasiurus cinereus</i>	No
Little Brown Bat / Little Brown Myotis, <i>Myotis lucifugus</i>	No
Northern Bat / Northern Myotis, <i>Myotis septentrionalis</i>	No
Indiana Bat / Indiana Myotis, <i>Myotis sodalis</i>	No
Evening Bat, <i>Nycticeius humeralis</i>	No
Eastern Pipistrelle, <i>Pipistrellus subflavus</i>	No
Cougar, <i>Felis concolor</i>	No
Canada Lynx, <i>Lynx canadensis</i>	No
Gray Wolf, <i>Canis lupus</i>	No
Wolverine, <i>Gulo gulo</i>	No
Moose, <i>Alces alces</i>	Yes
Prairie Vole, <i>Microtus ochrogaster</i>	No

Appendix L

INFORMATION SHARING AND CONSULTATION PROTOCOL

This Information Sharing and Consultation Protocol (“Protocol”) is adopted in accordance with the Decree, including, but not limited to, Paragraphs 23.1 and 23.2 thereof. Each term defined in the Decree shall have the meaning ascribed to such term in the Decree when used in this Protocol.

The provisions of this Protocol are intended to facilitate implementation of the Decree, but shall not relieve any Party of any obligation it has under the Decree. Further, nothing in this Protocol shall preclude consultation or information sharing among the Parties in addition to the consultation and information sharing provided for herein.

In the event of any inconsistency between the provisions of the Decree and the provisions of this Protocol, the provisions of the Decree shall be controlling.

The Parties shall review the terms of this Protocol every five years, and may modify it at any time by mutual agreement.

I. EXECUTIVE COUNCIL

1.1 The Parties hereby establish the Executive Council to facilitate consultation and exchange of information among the Parties under the Decree.

1.2 The Executive Council shall consist of the chairpersons of the Tribes, the Director of MDNR, and the Secretary of the Interior, or their duly authorized representatives.

1.3 The Executive Council shall meet and confer as necessary, but in no event less than annually, to review the status of inland resources, the implementation of the Inland Consent Decree, and any matters appropriate for consideration by the Parties at the policy level.

1.4 The Executive Council shall provide a forum for policy-level discussions, but shall not have any decision-making authority unless otherwise expressly agreed by all of the Parties.

II. CONSULTATION REGARDING CREATION OR EXPANSION OF CERTAIN SPECIAL USE AREAS

2.1 The State shall notify the Tribes and the United States in writing as soon as possible of any proposal made or undergoing substantive review by the State to create a new or expand an existing State park, wildlife refuge, formally designated wildlife research area or formally designated fisheries research area in the 1836 Ceded Territory, and in any event shall notify the Tribes and the United States at least 90 days before approving any such proposal.

2.2 Upon the written request of any Tribe, the State shall respond in writing to any questions the Tribes may have regarding the proposal. Further, within 30 days of receiving notice from the State under Paragraph 2.1 of this Protocol, any Tribe may request a meeting with the State in order to discuss the proposal and its effects on the exercise of the Tribes' rights under the Decree. The meeting shall take place within 30 days of the date of the Tribe's request for a meeting under this Paragraph 2.2. Upon the request of any Tribe, the MDNR Director, or his or her authorized representative, shall attend the meeting. The Tribes may request the assistance of the United States in any discussions with the State under this Paragraph 2.2.

2.3 The notices required under Paragraphs 2.1 and 2.2 of this Protocol shall be sent via first class and electronic mail to the persons and addresses identified in Section XVIII (Notices) of this Protocol.

III. FISH BEING TARGETED FOR ERADICATION OR REDUCTION

3.1 The State shall notify the Tribes and the United States in writing of any plans to target any species or stock of fish from a particular water body for eradication or reduction under

Section VIII (Disease Control) or Paragraph 11.2(a) of the Decree, provided that nothing in this Paragraph shall be construed to require the State to provide notice to the Tribes and the United States of an emergency eradication or reduction of fish from a particular water body. When required, such notice of eradication or reduction plans may be provided through the transmission of work plans by May 1 of each year or by other means so long as the notice is provided at least 90 days notice before such eradication or reduction plans are carried out. The State shall also notify the Tribes and the United States of any plans to rescind a plan to target any species or stock of fish from a particular water body for eradication or reduction under Section VIII (Disease Control) or Paragraph 11.2(a) of the Decree. The notices required by this Paragraph shall be sent via first class and electronic mail to the persons and addresses identified in Section XVIII (Notices) of this Protocol.

3.2 The Tribes shall notify the State and the United States in writing at least 45 days in advance if they intend to authorize their members to commercially harvest fish identified in a notice provided under Paragraph 3.1 of this Protocol and/or to use impoundment nets or gill nets to harvest such fish. The notices required under this Paragraph shall be sent via first class and electronic mail to the persons and addresses identified in Section XVIII (Notices) of this Protocol.

3.3 If one or more Tribes notify the State that they intend to authorize their members to commercially harvest fish identified in a notice provided under Paragraph 3.1 of this Protocol, the State and the affected Tribes shall develop a mutually agreeable mechanism to assure that the harvested fish are from the particular water body identified in the notice in the period before the Tribal authorization becomes effective. In the event of a disagreement regarding such a mechanism, and upon the request of any Tribe, the MDNR Director or his or her authorized

representative shall consult with the Tribes in effort to resolve such disagreement. The Tribes may request the assistance of the United States in the development of such a mechanism and in any discussions with the State under this Paragraph 3.3.

IV. EMERGENCY PROHIBITIONS OF COHO HARVESTS IN THE PLATTE RIVER

4.1 The State shall inform the Tribes as soon as possible of an impending emergency regulation prohibiting harvests of Coho salmon in portions of the Platte River and shall provide written notice to the Tribes and the United States in the event it adopts such an emergency regulation in accordance with Paragraph 10.3 of the Decree, and shall document the basis for such emergency regulation. The notice required under this Paragraph shall be sent via facsimile and electronic mail to the persons and addresses identified in Section XVIII (Notices) of this Protocol.

4.2 Upon receipt of a notice provided under Paragraph 4.1 of this Protocol, the Tribes shall adopt an emergency regulation prohibiting harvests of Coho salmon in portions of the Platte River in accordance with Paragraph 10.3 of the Decree on the next business day or as soon thereafter as practicable, but in any event within three business days of receipt of such notice.

4.3 The State shall notify the Tribes and the United States if it rescinds its prohibition or if sufficient egg collection is assured for the year, whichever occurs first, as provided in Paragraph 10.3 of the Decree. The notice required by this Paragraph shall be delivered to the Tribes and the United States within 24 hours of such rescission or assurance, and shall be sent via facsimile and electronic mail to the persons and addresses identified in Section XVIII (Notices) of this Protocol.

V. TRIBAL CHINOOK HARVESTS IN PORTIONS OF THE LITTLE MANISTEE RIVER

5.1 On or before June 30 of each year, the State shall notify the Tribes and the United States in writing of the number of Chinook salmon returning to the Little Manistee River weir in the preceding year. The notice required under this Paragraph shall be sent via first class and electronic mail to the persons and addresses identified in Section XVIII (Notices) of this Protocol.

5.2 On or before July 31 of each year, the State and the Tribes shall confer regarding the seasonal and weekly harvest limits prescribed in subparagraph 10.3(b) of the Decree for the current year, and seek to resolve any disagreement with respect thereto. In the event they are unable to resolve any such disagreement, the MDNR Director and the Little River Band's Natural Resources Director or their authorized representatives, as well as representatives from other interested Tribes, shall confer in an effort to resolve the disagreement. The Tribes may request the assistance of the United States in any discussions with the State under this Paragraph 5.2.

5.3 The State shall send the notices required by Subparagraphs 10.3(b) and 10.3(c) of this Protocol within 24 hours of meeting its egg-take quota for the year via facsimile and electronic mail to the persons and addresses identified in Section XVIII (Notices) of this Protocol.

5.4 If the State seeks to prohibit the harvest of Chinook salmon by Tribal members in portions of the Little Manistee River in a particular year under Subparagraph 10.3(d) of the Decree, it shall provide written notice to the Tribes and the United States that it intends to prohibit the harvest of Chinook salmon by State-licensed fishers and document the basis for its concern that adequate egg collection is threatened in that year. The notices required by this

Paragraph shall be sent via facsimile and electronic mail to the persons and addresses identified in Section XVIII (Notices) of this Protocol. Upon the request of any Tribe, the State and the Tribes shall meet as soon as practicable, and in any event within one week of the date of receipt of such notice, to discuss the need for such a prohibition. The Tribes may request the assistance of the United States in any discussions with the State under this Paragraph 5.4.

5.5 The five-year review provided for in Subparagraph 10.3(e) of the Decree shall take place at or in conjunction with a meeting of the Executive Council. The State and the Tribes shall notify each other and the United States in writing of any questions or concerns they have regarding the harvest estimation methodology, harvest limits, and weekly harvest distributions described in Subparagraph 10.3(b) of the Decree or their impacts on harvest opportunities for Tribal members or egg collection at least 90 days in advance of the designated meeting, and shall respond in writing to any such questions and provide a copy of any such response to the United States at least 30 days in advance of the meeting. The notices and responses required by this Paragraph shall be sent via first class and electronic mail to the persons and addresses identified in Section XVIII (Notices) of this Protocol. The Tribes may request the assistance of the United States in any discussions with the State under this Paragraph 5.5.

VI. LONG-TERM EGG COLLECTION FOR CHINOOK SALMON

6.1 The State and the Tribes shall notify each other and the United States in writing if they have concerns regarding adequate egg collection for Chinook salmon to provide for future statewide fish runs and adequate harvest levels for all users over the long-term. The notices required by this Paragraph shall identify the basis for the concerns and possible solutions, and

shall be sent via first class and electronic mail to the persons and addresses identified in Section XVIII (Notices) of this Protocol.

6.2 Upon receipt of a notice under Paragraph 6.1 of this Protocol, the State and the Tribes shall meet and confer in a timely manner about appropriate adjustments to State and Tribal harvests in Waters in which fish destined for the State's egg-collection facilities are harvested. The Tribes may request the assistance of the United States in any discussions with the State under this Paragraph 6.2.

VII. SPECIAL FISHING DESIGNATIONS AND REGULATIONS

7.1 The State shall notify the Tribes and the United States in writing as soon as possible of any proposal: (a) to designate additional trout streams as Types 5, 6 or 7; (b) to designate additional Type D lakes; (c) to adopt additional restrictions on spearing of northern pike or muskellunge; or (d) to designate additional quality lakes under Paragraphs 10.4, 10.5, 10.6 or 10.7 of the Decree, and in any event shall notify the Tribes and the United States at least 90 days before approving any such proposal. The notices required under this Paragraph shall be sent via first class and electronic mail to the persons and addresses identified in Section XVIII (Notices) of this Protocol.

7.2 Upon the request of any Tribe, the State shall respond in writing to any questions the Tribes may have regarding the proposal, and shall meet with the Tribes upon request of any Tribe to discuss the proposal and its effects on the exercise of the Tribes' rights under the Decree. The meeting shall take place within 60 days of the date of the notice provided to the Tribes and the United States under Paragraph 7.1 of this Protocol. The Tribes may request the assistance of the United States in any discussions with the State under this Paragraph 7.2.

7.3 If the State adopts any such proposal, the Tribes shall consider adopting regulations that are no less restrictive than those adopted by the State in accordance with Paragraphs 10.4, 10.5, 10.6 and 10.7 of the Decree.

VIII. TRIBAL NOTICE OF CERTAIN FISHING ACTIVITIES

The Tribes shall provide the notices of Fishing activities required by Subparagraphs 10.9(e) (certain walleye harvests in bays de Noc tributaries), 11.7(g) (certain steelhead harvests in Protected Streams) and 12.5 (certain uses of Spears or Impoundment Nets) of the Decree to the State by electronic mail or other mutually agreeable methods to the persons and addresses identified in Section XVIII (Notices) of this Protocol, within the time frames specified in the Decree.

IX. TRIBAL WALLEYE HARVESTS IN TRIBUTARIES TO THE BAYS DE NOC

9.1 The Tribes shall provide the final harvest reports required by Subparagraph 10.9(f) of the Decree to the State by first class and electronic mail to the persons and addresses identified in Section XVIII (Notices) of this Protocol.

9.2 The Tribes and the State shall notify each other and the United States by July 1 of the year preceding the year in which the harvest is to occur if they believe an estimate of abundance of adult walleye in a tributary subject to Subparagraph 10.9(g) of the Decree suggests that Tribal members may harvest walleye using Hook-and-Line Gear outside State seasons or Spears on such tributary. The notices required by this Paragraph shall explain the basis for the estimate of abundance and any proposal for such harvests and shall be sent via first class and electronic mail to the persons and addresses identified in Section XVIII (Notices) of this Protocol.

9.3 Upon request of the State or any Tribe, the State and Tribes shall meet to discuss whether to implement the proposed harvest. The meeting shall take place before December 1 of the year in which the notice was provided under Paragraph 9.2 of this Protocol. The Tribes may request the assistance of the United States in any discussions with the State under this Paragraph 9.3.

9.4 The fifteen-year review provided for in Subparagraph 10.9(h) of the Decree shall take place at or in conjunction with a meeting of the Executive Council or at such other time that is convenient for the State and the Tribes. The State and the Tribes shall notify each other and the United States in writing of any questions or concerns they have regarding walleye abundance in tributaries to the bays de Noc, the adequacy of Tribal harvest opportunities, and other relevant factors at least 120 days in advance of the designated meeting, and shall respond in writing to any such questions at least 30 days in advance of the meeting. The notices and responses required under this Paragraph shall be sent via first class and electronic mail to the persons and addresses identified in Section XVIII (Notices) of this Protocol.

X. STEELHEAD

The annual review and consultation required by Subparagraph 11.7(i) of the Decree shall take place at or in conjunction with the annual meeting of the Executive Council or at such other time that is convenient for the State and the Tribes. The State and the Tribes shall notify each other and the United States in writing of the results of the periodic peer review required under Subparagraph 11.7(b) of the Decree, additional information obtained through research or assessment by the State or the Tribes regarding smolt production and/or abundance of adult steelhead within any stream, the effects of downstream (including Great Lakes) harvests or post-spawning harvest, or any other relevant scientific information relevant to steelhead, at least 60

days before the meeting. The notices required under this Paragraph shall be sent via first class and electronic mail to the persons and addresses identified in Section XVIII (Notices) of this Protocol.

XI. ELK AND BEAR HARVESTS

11.1 By May 30 of each year, the State shall notify the Tribes and the United States of the numbers and geographic distribution of either-sex and cow-only elk permits it intends to issue in the coming year. The notices shall be sent via facsimile and electronic mail to the persons and addresses identified in Section XVIII (Notices) of this Protocol.

11.2 Within 30 days of receipt of the notices required by Paragraph 11.1 of this Protocol, the Tribes shall notify the State and the United States of the number and geographical distribution of either-sex and cow-only elk permits they intend to issue in the coming year. The notices required under this Paragraph shall be sent via facsimile and electronic mail to the persons and addresses identified in Section XVIII (Notices) of this Protocol.

11.3 If the State has concerns about the geographic distribution of Tribal elk permits, the State and the Tribes shall consult to resolve such concerns in order to ensure that the geographic distribution of the permits is consistent with the State's management objectives, as provided in Paragraph 17.2 of the Decree. Upon the request of any Tribe, the MDNR Director or his or her authorized representative shall meet with Tribal representatives to seek to resolve such concerns. The Tribes may request the assistance of the United States in any discussions with the State under this Paragraph 11.3.

11.4 On or before January 1 of each year, the State and the Tribes shall meet to discuss appropriate bear management within the 1836 Ceded Territory, including harvest levels and the geographic distribution of the harvest for the upcoming year, and shall make best efforts to

achieve a consensus regarding such levels and distribution as provided in Paragraph 17.2 of the Decree. Upon request of any Tribe, the State shall provide a written summary of the basis for its management strategy to the Tribes and the United States at least 30 days in advance of such meeting. The Tribes may request the assistance of the United States in any discussions with the State under this Paragraph 11.4.

XII. LAKE STURGEON

12.1 The State and the Tribes shall discuss strategies for rehabilitating lake sturgeon populations at the meeting provided for in Paragraph 15.2 of this Protocol. The Tribes may request the assistance of the United States in any discussions with the State under this Paragraph 12.1.

12.2 If the State or any Tribe believes that lake sturgeon recovery allows for harvest of a lake sturgeon population in the 1836 Ceded Territory, it shall notify all other Parties of the basis for its position and propose a regulation and/or allocation to allow for such harvest. The notices required by this Paragraph shall be sent via first class and electronic mail to the persons and addresses identified in Section XVIII (Notice) of this Protocol.

12.3 Upon the request of the State or any Tribe, the State and the Tribes shall meet within 30 days of receipt of a notice provided under Paragraph 12.2 of this Protocol to discuss whether the lake sturgeon population identified in the notice can withstand harvest and, if so, an appropriate regulation and/or allocation to allow for such harvest. The Tribes may request the assistance of the United States in any discussions with the State under this Paragraph 12.3.

XIII. EMERGENCY CLOSURES

13.1 The State and the Tribes shall notify each other and the United States in writing as soon as practicable when concerns arise regarding the need for emergency closures of Harvesting

Activities under Paragraph 10.8 of the Decree. The notices required by this Paragraph shall identify with specificity the biological or public health or safety concerns giving rise to a need for an emergency closure and the extent of the proposed closure, provide appropriate supporting documentation, and be sent via facsimile and electronic mail to the persons and addresses identified in Section XVIII (Notices) of this Protocol.

13.2 Upon receipt of a notice provided under Paragraph 13.1 of this Protocol, the State and the Tribes shall meet as soon as practicable to consult regarding the need for such closures. Upon the request of any Tribe, the MDNR Director or his or her authorized representative shall attend the meeting. The Tribes may request the assistance of the United States in any discussions with the State under this Paragraph 13.2.

XIV. USE OF STATE LANDS

14.1 The Tribes and the State shall meet within 90 days of entry of the Decree to discuss and determine the location of those State lands that are suitable for each of the following activities by Tribal members: (a) collection of maple sap and production of maple sap and sugar; (b) firewood collection; (c) conifer bough collection; (d) collection of black ash, basswood and ironwood; and (e) collection of white birch bark.

14.2 The State lands designated for each of the activities listed in Paragraph 14.1 of this Protocol shall be reviewed by the Tribes and the State at least every five (5) years to determine whether such lands continue to be suitable for the activity.

14.3 On or before February 1 of each year, the Tribes and the State shall meet to determine: (a) for sugar bush activities involving more than 12 trees on State lands, the number of Tribal permits to be available, the number of trees and trees per acre that may be tapped, and the number of temporary structures that may be erected; (b) the number of Tribal permits

available for harvest of black ash, basswood, or ironwood on State lands, whether separate permits are required for each species, and the total number of trees and trees per acre that may be harvested by Tribal permittees on State lands; (c) the number of Tribal permits available for the harvest of white birch bark on State lands, and the total number of trees and trees per acre that may be harvested by Tribal permittees on State lands; and (d) the impact of white birch bark collection on State lands to the resource and the need to revise collection restrictions on State lands.

14.4. The Tribes shall conduct the meetings and discussions required by Paragraphs 14.1 through 14.3 of this Protocol with the local office of the MDNR with management responsibility for the State lands at issue. If the Tribes and the local office of the MDNR are unable to reach agreement on the matters under discussion, the MDNR Director or his or her authorized representative shall consult with the Tribes in an effort to resolve the matter. The Tribes may request the assistance of the United States in the meetings and discussions required under Paragraphs 14.1 through 14.3 of this Protocol or in any consultations under this Paragraph 14.4.

14.5 The State shall notify the Tribes and the United States in writing as soon as possible of any proposal to permanently close an approved access road or trail, and in any event shall notify the Tribes and the United States at least 90 days before approving any such proposal. The notices required under this Paragraph shall be sent via first class and electronic mail to the persons and addresses identified in Section XVIII (Notices) of this Protocol. Upon the request of any Tribe, the State shall respond in writing to any questions the Tribes may have regarding the proposal, and shall meet with the Tribes to discuss the proposal, its effects on the exercise of the Tribes' rights under the Decree, and possible alternatives to the proposal. The meeting shall take

place within 60 days of the date of the notice provided to the Tribes and the United States under this Paragraph. Upon the request of any Tribe, the MDNR Director or his or her authorized representative shall attend the meeting. The Tribes may request the assistance of the United States in any discussions with the State under this Paragraph. In the event that the State establishes a program for seasonal closures of approved access roads or trails, the State shall notify the Tribes and the United States of any proposed seasonal closures and consult with the Tribes regarding such proposals in accordance with the provisions of this Paragraph 14.5.

14.6 A Tribe shall consult with the local MDNR forest manager before issuing a permit to construct a temporary structure on State Forest land if the structure is larger than 100 square feet. The Tribe shall consider the concerns of the local MDNR forest manager, and make such revisions to the proposed temporary structure permit as are needed to address the expressed concerns. The Tribe shall not issue such a permit without the concurrence of the local MDNR forest manager. However, if the Tribe and the local MDNR forest manager are unable to reach agreement regarding the permit, upon request of the Tribe the MDNR Director or his or her authorized representative shall consult with the Tribe in an effort to resolve the matter.

XV. INFORMATION SHARING AND CONSULTATION REGARDING ASSESSMENT, RESTORATION, RECLAMATION, AND ENHANCEMENT ACTIVITIES

15.1 On or before April 1 each year and at other times as necessary, the State and the Tribes shall notify each other and the United States in writing of new proposals for assessment, restoration, reclamation, and enhancement activities relating to wildlife and plant resources in the inland portion of the 1836 Ceded Territory for the 12-month period starting October 1 of such year. On or before March 1 each year and at other times as necessary, the State and the Tribes shall notify each other and the United States in writing of new proposals for assessment, restoration, reclamation, and enhancement activities relating to fisheries resources in the inland

portion of the 1836 Ceded Territory for the 12-month period starting April 1 of such year. The notices required under this Paragraph shall be sent via first class and electronic mail to the persons and addresses identified in Section XVIII (Notices) of this Protocol.

15.2 Within 60 days of receipt of the notices required under Paragraph 15.1 of this Protocol, the State and the Tribes shall meet to review new proposals for State and Tribal assessment, restoration, reclamation, and enhancement activities in order to minimize or avoid duplication of effort and to prevent interference with such activities. The Tribes may request the assistance of the United States in any discussions with the State under this Paragraph 15.2.

15.3 If the State intends to object to a Tribal proposal for an assessment, restoration, reclamation, or enhancement activity under Section XXI (Assessment Activities) or Section XXII (Restoration, Reclamation, and Enhancement Projects) of the Decree, it shall notify the affected Tribe or Tribes and the United States of its objection at least two weeks in advance of the meeting provided for in Paragraph 15.2 above, and the MDNR Director or his or her authorized representative shall either attend the meeting or consult with the affected Tribe or Tribes regarding the objection thereafter. The affected Tribes may request the assistance of the United States in any discussions with the State under this Paragraph 15.3.

15.4 In the event of a change in the State's or the Tribes' assessment plans after the meeting provided for in Paragraph 15.2, the State and the Tribes shall notify each other of such changes as soon as practicable but no later than 24 hours before conducting the changed activity. The notices required under this Paragraph shall be sent via facsimile and electronic mail to the persons and addresses identified in Section XVIII (Notices) of this Protocol.

XVI. INFORMATION SHARING AND CONSULTATION REGARDING NATURAL RESOURCES, HARVEST DATA, AND HARVEST REGULATIONS

16.1 Unless otherwise provided in the Decree, the State and the Tribes shall exchange and provide to the United States in writing the following information pertaining to the inland portion of the 1836 Ceded Territory at least 60 days before the annual meeting of the Executive Council: (a) the results of assessment activities; (b) a summary of State and Tribal permits issued and harvest and effort data; (c) a summary of any other data and a copy of any reports regarding the condition of the resources; and (d) proposals for regulatory changes (including proposed changes in management units or methodologies for determining the allowable harvest of any species, and proposals to authorize harvests of species that could not lawfully be harvested under State law as of October 2006). In addition, upon request of the State or any Tribe, the State and the Tribes shall provide the information required in Paragraph 23.4 of the Decree regarding any existing regulation, management unit, or allowable harvest methodology. The foregoing information shall be sent via first class and electronic mail to the persons and addresses identified in Section XVIII (Notices) of this Protocol.

16.2 At or in conjunction with the annual meeting of the Executive Council, the State and the Tribes shall meet and consult regarding the information exchanged under Paragraph 16.1 of this Protocol. The Tribes may request the assistance of the United States in any discussions with the State under this Paragraph 16.2.

16.3 If the State intends to object to a Tribal proposal for a regulatory change under Paragraph 26.2 of the Decree or a Tribe's refusal to make a regulatory change requested by the State under Paragraph 26.3 of the Decree, it shall notify the affected Tribe or Tribes and the United States of the basis for its objection at least 14 days in advance of the meeting provided for

in Paragraph 16.2 of this Protocol, and the MDNR Director or his or her authorized representative shall attend the meeting.

16.4 A Party producing data or reports under Paragraph 16.1 of this Protocol shall retain ownership of such data and reports and no other Party shall publish or otherwise disseminate such data or reports without the prior written approval of the producing Party, except as required by law or as necessary in connection with the resolution of a dispute under the Decree, *provided* that if the producing Party makes such data or reports available to the public, the other Parties may use such data or reports in a manner consistent with applicable copyright protections.

XVII. WILDLIFE SPECIES FOR WHICH THE STATE DOES NOT CURRENTLY PERMIT HUNTING

17.1 If a Tribe desires to authorize its members to harvest a wildlife species that cannot lawfully be harvested under State law as of October 2006, the Tribe shall notify the State, the other Tribes, and the United States of its desire to do so in accordance with Section XXV (Wildlife Species for Which the State Currently Does Not Permit Hunting) of the Decree. The notice shall set forth the bases for the Tribe's belief that the species is biologically capable of withstanding harvest, the Tribe's proposed harvest regulations for the species, and, if the species is a game species under Michigan law as of October 2006, the Tribe's interest in harvesting the species and shall include appropriate supporting documentation. The notices required under this Paragraph shall be sent via first class and electronic mail to the persons and addresses identified in Section XVIII (Notices) of this Protocol.

17.2 The State shall respond in writing to a notice provided under Paragraph 17.1 of this Protocol within 60 days of receipt of the notice and shall provide a copy of its response to all of the Tribes and the United States. If the State intends to object to the Tribe's proposal to

authorize harvest of the species or the Tribe's proposed harvest regulations, the State shall set forth the bases for its objection and any proposed alternative harvest regulations for the species in its response and shall include appropriate supporting documentation. The State's response shall be sent via first class and electronic mail to the persons and addresses identified in Section XVIII (Notices) of this Protocol.

17.3 Upon request, the State and the Tribes shall meet within 60 days after the Tribes receive the State's response to discuss the Tribes' proposal and the State's response, and the State and the Tribes shall make best efforts to reach consensus regarding the Tribe's proposed harvest. The Tribes may request the assistance of the United States in any discussions with the State under this Paragraph 17.3.

XVIII. NOTICES

18.1 Unless changed in accordance with Paragraph 18.2 of this Protocol, the notices required by this Protocol shall be provided to the following persons and addresses:

Bay Mills Indian Community:

All notices shall be sent to:

President, Executive Council
Bay Mills Indian Community
12140 W. Lakeshore Dr.
Brimley, MI 49715
phone: (906) 248 3241
fax: (906) 248 3283

Tribal Attorney
Bay Mills Indian Community
12140 W. Lakeshore Dr.
Brimley, MI 49715
phone: (906) 248 3241
fax: (906) 248 3283

Biological Services Director
Great Lakes Indian Fish & Wildlife Commission

P.O. Box 9
Odanah, WI 54861
phone: (715) 682 6619
fax: (715) 682 9294

Grand Traverse Band of Ottawa and Chippewa Indians:

All notices shall be sent to:

Tribal Chair
Grand Traverse Band of Ottawa and Chippewa Indians
2605 N. West Bay Shore Drive
Peshawbestown, MI 49682
phone: (231) 534-7750
fax: (231) 534-7010

Natural Resources Department
Grand Traverse Band of Ottawa and Chippewa Indians
2605 N. West Bay Shore Drive
Peshawbestown, MI 49682
phone: (231) 534-7500
fax: (231) 534-7576

Legal Department
Grand Traverse Band of Ottawa and Chippewa Indians
2605 N. West Bay Shore Drive
Peshawbestown, MI 49682
phone: (231) 534-7610
fax: (231) 534-7600

William Rastetter
Of Counsel to Olson, Bzdok & Howard, P.C.
420 East Front Street
Traverse City, MI 49686
phone: (231) 946-0044
fax: (231) 946-4807

Little River Band of Ottawa Indians:

All notices shall be sent to:

Director, Natural Resources Department
Little River Band of Ottawa Indians
159 Brick Yard Rd.
Manistee, MI 49660
phone: (231) 398 2183

fax: (231) 398 8873

Senior Inland Fish Biologist
Little River Band of Ottawa Indians
159 Brick Yard Rd.
Manistee, MI 49660
phone: (231) 398 2193
fax: (231) 398 8873

Senior Wildlife Biologist
Little River Band of Ottawa Indians
159 Brick Yard Rd.
Manistee, MI 49660
phone: (231) 398 2187; (231) 398 2188
fax: (231) 398 8873

Little Traverse Bay Bands of Odawa Indians:

All notices should be sent to:

Tribal Chairperson
7500 Odawa Circle
Harbor Springs, MI 49740
phone: (231) 242 1402
fax: (231) 242 1412

LTBB Natural Resources Director
7845 Odawa Circle
Harbor Springs, MI 49740
phone: (231) 242 1678
fax: (231) 242 1690

LTBB General Counsel
7500 Odawa Circle
Harbor Springs, MI 49740
phone: (231) 242 1405
fax: (231) 242 1415

Sault Ste. Marie Tribe of Chippewa Indians:

All notices shall be sent to:

Tribal Chairperson

523 Ashmun Street
Sault Ste. Marie, MI 49783
phone: (906) 635 6050
fax: (906) 632 6587

Conservation Committee Chairperson
523 Ashmun Street
Sault Ste. Marie, MI 49783
phone: (906) 635 6050
fax: (906) 632 6587

General Counsel
523 Ashmun Street
Sault Ste. Marie, MI 49783
phone: (906) 635 6050
fax: (906) 632 6587

State of Michigan:

All Notices shall be sent to the Director of the MDNR; the appropriate MDNR Division Chief; and the Department of Attorney General, Division Chief of the Environment, Natural Resources, and Agriculture Division.

MDNR Director
Mason Building – 6th Floor
P.O. Box 30028
Lansing, MI 48909
Phone: (517) 335-4873
Telefax: (517) 335-4242

Chief of MDNR Fisheries Division
Mason Building – 8th Floor
P.O. Box 30446
Lansing, MI 48909
Phone: (517) 373-3375
Telefax: (517) 373-0381

Chief of MDNR Wildlife Division
Mason Building – 4th Floor
P.O. Box 30444
Lansing, MI 48909
Phone: (517) 373-9311
Telefax: (517) 373-6705

Chief of MDNR Law Enforcement Division
Mason Building – 4th Floor
P.O. Box 30031
Lansing, MI 48909
Phone: (517) 335-3427
Telefax: (517) 373-6816

Chief of MDNR Forest, Mineral, and Fire Management Division
Mason Building – 5th Floor
P.O. Box 30452
Lansing, MI 48909
Phone: (517) 372-1246
Telefax: (517) 373-2443

Chief of MDNR Parks and Recreation Division
Mason Building – 3rd Floor
P.O. Box 30257
Lansing, MI 48909
Phone: (517) 335-4827
Telefax: (517) 373-4625

Michigan Department of Attorney General
Division Chief - Environment, Natural Resources, and Agriculture Division
(ENRA Division)
G. Mennen Williams Building – 6th Floor
P.O. Box 30755
Lansing, MI 48909
Phone: (517) 373-3540
Telefax: (517) 373-1610

United States:

All notices shall be sent to:

Secretary of the Interior
1849 C Street NW
MS 6100
Washington, D.C. 20240

Regional Director
U.S. Fish and Wildlife Service, Region 3
Bishop Henry Whipple Federal Building
1 Federal Drive
Fort Snelling, MN 55111

Regional Director
Bureau of Indian Affairs, Midwest Regional Office
Bishop Henry Whipple Federal Building, Room 550
1 Federal Drive
Fort Snelling, MN 55111

Field Solicitor
Office of the Solicitor
Bishop Henry Whipple Federal Building, Room 686
Fort Snelling, MN 55111

18.2 The Parties shall exchange and update email addresses for each person identified in this Section XVIII (Notices). Any Party may change the persons through or addresses at which it is to receive notices under this Protocol by notifying all other Parties in writing of the change. A notice under this Paragraph 18.2 shall be sent via first class and electronic mail to the persons and addresses identified under this Section XVIII (Notices).

Appendix M

AGREEMENT AMONG THE PARTIES AND PROPOSED INTERVENORS

The Parties' agreement in principle set forth the following agreement among the Parties and the Michigan Fisheries Resource Conservation Coalition ("MFRCC"), Stuart Cheney, Robert Andrus and the Walloon Lake Trust and Conservancy relating to intervention motions:

“MFRCC, the Walloon Lake Trust and Conservancy, Stuart Cheney and Robert Andrus (“Proposed Intervenor”) previously have sought and been denied intervention in this case and presently have an appeal pending in the Court of Appeals for the Sixth Circuit from the denial of their most recent motion to intervene. The United States and the Tribes have opposed Proposed Intervenor’s motions to intervene; the State has not. In furtherance of a settlement on the terms and conditions set forth in this Agreement: (1) the Proposed Intervenor agree to voluntarily dismiss their pending appeal pursuant to Fed. R. App. P. 42(b), with the Parties to bear their own costs and attorneys fees, and not to file a new motion to intervene at this time; and (2) the Parties agree that if, in the future, the Proposed Intervenor file a new motion to intervene, the Parties will not claim that they have been prejudiced by, or that such a future motion is untimely because of, the Proposed Intervenor’s withdrawal of their pending appeal or their failure to file a new motion to intervene at this time. Nothing herein shall preclude any party from opposing such a future motion to intervene on any other grounds.”

EXHIBIT BMC-28



2007 Inland Consent Decree FAQs

1. What is the 2007 Inland Consent Decree?

The 2007 Inland Consent Decree is a settlement negotiated between the State of Michigan, five sovereign Michigan tribes that are signatory to the 1836 Treaty of Washington, and the United States. While the U.S. District Court ruled in 1979 that tribes reserved their treaty right to fish in the Great Lakes, the scope of treaty rights with respect to the inland territory of ceded lands were not resolved at that time. In September 2003, the State filed a claim in federal court to resolve the issue of the inland treaty rights to hunt, fish, and gather on land ceded to the United States in 1836. The 2007 Inland Consent Decree is a legal document that defines the extent of tribal rights and describes how the State and the tribes will cooperatively manage natural resources.

2. What is the background of the 1836 Treaty of Washington?

The 1836 treaty involved a territory purchase between the United States and Ottawa and Chippewa Indian Tribes of the northern Lower Peninsula and the eastern Upper Peninsula of Michigan. Treaties such as this often contained clauses in which tribes reserved hunting, fishing, and gathering rights. In the 1836 treaty, Article 13 provided that the Indians reserved the "right to hunt and the usual privileges of occupancy until the land is required for settlement." These usufructuary rights (rights that allow the use of a property owned by someone else) were retained even though the land and waters were ceded to the United States and in that regard are similar to mineral rights which can be retained by individuals even when surface land is sold. Federal courts, including the United States Supreme Court, have consistently held that the passage of time cannot erode the rights retained when these treaties were signed. In these Indian treaty cases, federal courts have ruled that under the Supremacy clause of the United States Constitution, that State laws must give way to Indian treaties.

3. Why was a negotiated settlement necessary?

Although the court in 1979 addressed tribal treaty rights with respect to Great Lakes fishing, the issue of the validity of treaty rights with respect to inland hunting, fishing, and gathering remained unresolved and uncertain. The tribes believed that these inland rights were still valid and that they did not need to adhere to State hunting and fishing laws and regulations. Accordingly, the tribes adopted their own hunting and fishing regulations for their members. Under these circumstances, the State believed judicial resolution of these issues was necessary to remove the legal uncertainty of the issue and to provide long-term stability to a legal issue that was formerly uncertain and confusing.

4. Which tribes are involved in the 2007 Inland Consent Decree and how much territory is involved?

The tribes that are included in the Consent Decree are the Sault Ste. Marie Tribe of Chippewa Indians, the Bay Mills Indian Community, the Grand Traverse Band of Ottawa and Chippewa Indians, the Little Traverse Bay Bands of Odawa Indians, and the Little River Band of Ottawa Indians. The agreement covers 13,837,207 acres of lands and inland waters within the

boundaries of the 1836 treaty area, which is located in the eastern half of the Upper Peninsula and the northwest one third of the Lower Peninsula.

5. Who besides the State, the tribes, and the United States were included in the negotiations that led to the Consent Decree?

Numerous conservation groups were involved as proposed intervenors, including the Michigan United Conservation Clubs, the Coalition to Protect Michigan's Resources representing several conservation organizations, the Walloon Lake Trust and Conservancy, the U.P. Whitetails Association, and the Bays de Noc Great Lakes Sports Fishermen.

6. Why did the State negotiate the 2007 Inland Consent Decree rather than go to trial?

The risks of litigation were significant since previous court rulings had already determined that the Article 13 treaty rights were still valid for Great Lakes tribal fishing. The court's 1979 ruling, together with the applicable judicial rules for interpreting disputed Indian treaty language, presented the State with substantial obstacles. Also, the experience of other states provided a clear lesson as to what the risks of litigation would be. In Wisconsin and Minnesota, federal courts upheld similar Indian treaty right claims. Thus, the State determined that the more prudent and responsible course of action was to explore the possibilities of reaching a settlement with the five tribes in order to better control the outcome in a manner that protected the interests of the State and its resources and the interests of property owners and of non-tribal hunters and fishers, but that also addressed the needs of the tribes in preserving their traditional subsistence activities.

7. How are Michigan's natural resources managed under the 2007 Inland Consent Decree?

The Michigan Department of Natural Resources manages Michigan's resources based on the principles of sound scientific management and continues to do so under the Inland Consent Decree. In the 1836 treaty-ceded territory, the DNR and the tribes coordinate research and assessment activities, restoration, reclamation, and enhancement projects, and regularly consult and exchange information with one another. These cooperative efforts and sharing of information have led to a high degree of transparency among the State and tribes. The Inland Consent Decree also defines harvest levels for various species, which ensures the availability of sufficient resources for tribal and non-tribal fishers and hunters in the future. Any changes to the decree require approval of all seven parties.

8. Has the Inland Consent Decree affected the opportunities of State-licensed hunters and fishers?

Under the 2007 Inland Consent Decree, the tribes have seasons and bag limits that differ somewhat from State regulations. However, tribal hunting and fishing is for personal subsistence use and not commercial use and therefore has limited effect on the resources in question, especially in view of the small number of tribal hunters and fishers relative to the large number of non-tribal hunters and fishers.

9. How are tribal hunting, fishing, and gathering activities regulated?

Generally, tribal members' hunting, fishing, and gathering activities are subject to tribal regulations. However, the Inland Consent Decree contains specific hunting regulations for some species such as deer, elk, bear, and turkey and specific fishing regulations for salmon,

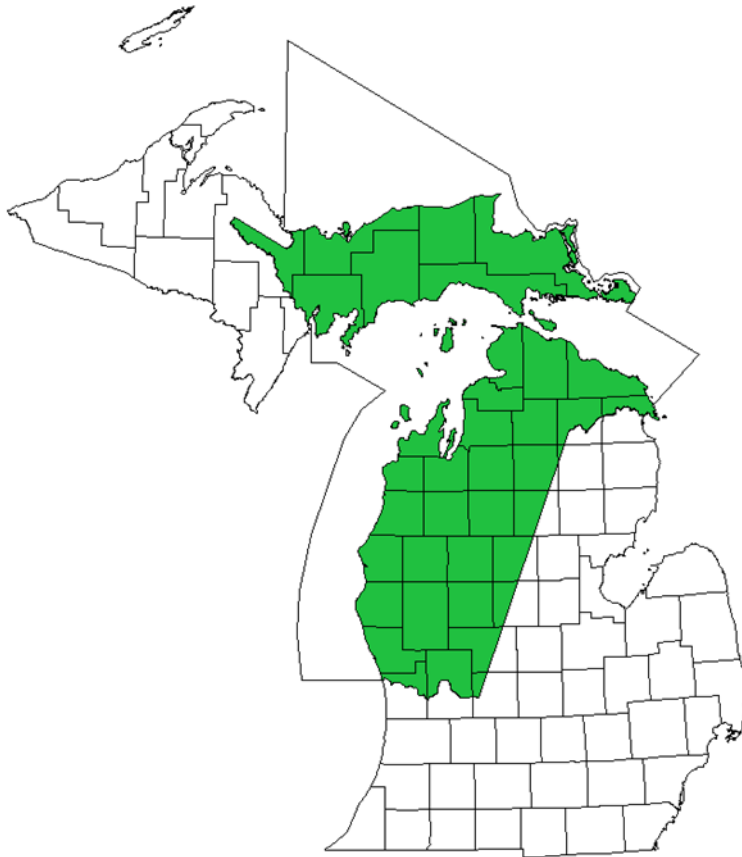
steelhead, and walleye when traditional tribal methods such as spearing are used in order to protect the resources being harvested by staying within available surpluses.

10. Where may tribal members engage in hunting, fishing, and gathering activities under the Inland Consent Decree?

Tribal members may engage in hunting, fishing, and gathering activities on tribal lands and lands that are open to the public for those activities. The Inland Consent Decree does not open private land for such activities without permission, unless the private land, such as Commercial Forest Act (CFA) land, is open to the public. Additionally, on CFA lands smaller than 1,000 contiguous acres, tribal members may only hunt during State seasons unless they have permission from the CFA landowner.

11. How are the provisions of the Inland Consent Decree enforced?

All parties to the 2007 Inland Consent Decree maintain law enforcement staff that enforce the provisions.



1836 Treaty-ceded inland territory.

EXHIBIT BMC-29

Headline Statements from the Summary for Policymakers

9 August 2021 (subject to final copy-editing)

A. The Current State of the Climate

- A.1** It is unequivocal that human influence has warmed the atmosphere, ocean and land. Widespread and rapid changes in the atmosphere, ocean, cryosphere and biosphere have occurred.
- A.2** The scale of recent changes across the climate system as a whole and the present state of many aspects of the climate system are unprecedented over many centuries to many thousands of years.
- A.3** Human-induced climate change is already affecting many weather and climate extremes in every region across the globe. Evidence of observed changes in extremes such as heatwaves, heavy precipitation, droughts, and tropical cyclones, and, in particular, their attribution to human influence, has strengthened since the Fifth Assessment Report (AR5).
- A.4** Improved knowledge of climate processes, paleoclimate evidence and the response of the climate system to increasing radiative forcing gives a best estimate of equilibrium climate sensitivity of 3°C, with a narrower range compared to AR5.

B. Possible Climate Futures

- B.1** Global surface temperature will continue to increase until at least the mid-century under all emissions scenarios considered. Global warming of 1.5°C and 2°C will be exceeded during the 21st century unless deep reductions in carbon dioxide (CO₂) and other greenhouse gas emissions occur in the coming decades.
- B.2** Many changes in the climate system become larger in direct relation to increasing global warming. They include increases in the frequency and intensity of hot extremes, marine heatwaves, and heavy precipitation, agricultural and ecological droughts in some regions, and proportion of intense tropical cyclones, as well as reductions in Arctic sea ice, snow cover and permafrost.
- B.3** Continued global warming is projected to further intensify the global water cycle, including its variability, global monsoon precipitation and the severity of wet and dry events.
- B.4** Under scenarios with increasing CO₂ emissions, the ocean and land carbon sinks are projected to be less effective at slowing the accumulation of CO₂ in the atmosphere.
- B.5** Many changes due to past and future greenhouse gas emissions are irreversible for centuries to millennia, especially changes in the ocean, ice sheets and global sea level.

C. Climate Information for Risk Assessment and Regional Adaptation

- C.1** Natural drivers and internal variability will modulate human-caused changes, especially at regional scales and in the near term, with little effect on centennial global warming. These modulations are important to consider in planning for the full range of possible changes.
- C.2** With further global warming, every region is projected to increasingly experience concurrent and multiple changes in climatic impact-drivers. Changes in several climatic impact-drivers would be more widespread at 2°C compared to 1.5°C global warming and even more widespread and/or pronounced for higher warming levels.
- C.3** Low-likelihood outcomes, such as ice sheet collapse, abrupt ocean circulation changes, some compound extreme events and warming substantially larger than the assessed *very likely* range of future warming cannot be ruled out and are part of risk assessment.

D. Limiting Future Climate Change

- D.1** From a physical science perspective, limiting human-induced global warming to a specific level requires limiting cumulative CO₂ emissions, reaching at least net zero CO₂ emissions, along with strong reductions in other greenhouse gas emissions. Strong, rapid and sustained reductions in CH₄ emissions would also limit the warming effect resulting from declining aerosol pollution and would improve air quality.
- D.2** Scenarios with low or very low greenhouse gas (GHG) emissions (SSP1-1.9 and SSP1-2.6) lead within years to discernible effects on greenhouse gas and aerosol concentrations, and air quality, relative to high and very high GHG emissions scenarios (SSP3-7.0 or SSP5-8.5). Under these contrasting scenarios, discernible differences in trends of global surface temperature would begin to emerge from natural variability within around 20 years, and over longer time periods for many other climatic impact-drivers (*high confidence*).

EXHIBIT BMC-30

LITTLE TRAVERSE BAY BANDS OF ODAWA INDIANS
7500 Odawa Circle
Harbor Springs, MI 49740

RESOLUTION #051505-01
Adoption of Kyoto Protocol and Renewable Energy Standards

- WHEREAS** the Little Traverse Bay Bands of Odawa Indians (“LTBB” or “Tribe”) is a Federally recognized Indian Tribe reaffirmed by the United States Congress on September 21, 1994 in Public Law 103-324, as amended, which exercises sovereign governmental authority over the people, land, and water within its jurisdiction and administers a wide range of governmental programs;
- WHEREAS** the Little Traverse Bay Bands of Odawa Indians Tribal Council is the elected governing body of the Tribe;
- WHEREAS** the Tribe holds sacred its responsibility to protect Mother Earth for the next seven generations;
- WHEREAS** scientific consensus has developed that carbon dioxide (CO₂) and other greenhouse gases released into the atmosphere have a profound effect of the Earth’s climate;
- WHEREAS** it has been shown that human activities and energy consumption are increasingly altering the Earth’s climate and that natural influences cannot explain the rapid increase in near-surface temperatures observed during the second half of the 20th century;
- WHEREAS** the 2001 Third Assessment Report from the International Panel on Climate Change (IPCC) and the 2000 U.S. Global Change Research Program’s (USGCRP) First National Assessment indicate that global warming has begun;
- WHEREAS** global warming poses significant threats to indigenous and non-indigenous communities across the world in the form of heat waves, drought, shrinking water supplies and snow pack, catastrophic fires, floods and storms, coastal erosion, new diseases, and loss of traditional plant and animal life;
- WHEREAS** we believe that is our right and our duty to institute a new energy economy, one whose foundation is built on the efficient and profitable use of clean energy that supports our tribal self-sufficiency and sovereignty;
- WHEREAS** 128 countries have signed onto the Kyoto Protocol, an international agreement requiring countries to reduce their greenhouse gas emissions by the period 2008-2012, and more than 150 cities have volunteered to meet the provisions of the Kyoto Protocol as independent municipalities and in the spirit of protection of the environment and their economies;
- WHEREAS** in March 2001, the United States officially refused to ratify the Kyoto Protocol and take responsibility for the greenhouse gas emissions the nation is responsible for;

WHEREAS energy consumption, specifically the burning of fossil fuels, accounts for more than 80% of U.S. greenhouse gas emissions;

WHEREAS tribal lands represent a vast amount of renewable energy potential, including wind and solar power that can meet the energy needs of both local tribes and surrounding communities;

WHEREAS wind power blowing through Indian reservations in just four northern Great Plains states could support almost 200,000 MW of power, enough to reduce output from coal plants by 30% and reduce our electricity base global warming pollution by 25%, and Great Lakes Indian nations could similarly produce alternative non-polluting renewable energy for our tribal communities and for export;

WHEREAS actions taken to reduce greenhouse gas emissions and increase energy efficiency provide multiple local benefits by decreasing air pollution, creating jobs, reducing energy expenditures, and saving money for the community;

THEREFORE BE IT RESOLVED that the Little Traverse Bay Bands of Odawa Indians commits to meeting the requirements of the Kyoto Protocol and, in doing so, will strive to obtain 25% percent of our total energy from renewable energy sources by 2020.

Certification

As Tribal Chairman and Tribal Secretary, we certify that this Resolution was duly adopted by the Tribal Council of the Little Traverse Bay Bands of Odawa Indians at a regular meeting of the Tribal Council held on ***** at which a quorum was present, by a vote of 7 in favor, 0 opposed, 0 abstentions, and 0 absent as recorded by this roll call.

	In Favor	Opposed	Abstained	Absent
Frank Ettawageshik	x			
Beatrice Law	x			
Alice Yellowbank	x			
Dexter McNamara	x			
Fred Harrington, Jr.	x			
Rita Shananaquet	x			
Regina Bentley	x			

Date: May 15, 2005

Frank Ettawageshik, Tribal Chairman

Dexter McNamara, Tribal Secretary

STATE OF MICHIGAN
BEFORE THE MICHIGAN PUBLIC SERVICE COMMISSION

In the matter of the Application of Enbridge Energy, Limited Partnership for the Authority to Replace and Relocate the Segment of Line 5 Crossing the Straits of Mackinac into a Tunnel Beneath the Straits of Mackinac, if Approval is Required Pursuant to 1929 PA 16; MCL 483.1 et seq. and Rule 447 of the Michigan Public Service Commission's Rules of Practice and Procedure, R 792.10447, or the Grant of other Appropriate Relief

U-20763

ALJ Dennis Mack

PROOF OF SERVICE

On September 14, 2021, an electronic copy of *Direct Testimony and Exhibits of Frank Ettawageshik on behalf of Bay Mills Indian Community and Little Traverse Bay Bands* was served on the following parties:

Name/Party	E-Mail Address
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Nottawaseppi Huron Band of Potawatomi Indians Amy L. Wesaw John S. Swimmer	Amy.wesaw@nhbp-nsn.gov John.swimmer@nhbp-nsn.gov
Little Traverse Bay Bands of Odawa Indians James A. Bransky	jbransky@chartermi.net

Date: September 14, 2021

By: Christopher R. Clark
Christopher Clark
cclark@earthjustice.org



September 14, 2021

Via E-filing

Ms. Lisa Felice
Michigan Public Service Commission
7109 W. Saginaw Hwy.
P. O. Box 30221
Lansing, MI 48909

RE: MPSC Case No. U-20763

Dear Ms. Felice:

The following are attached for paperless electronic filing:

- Direct Testimony and Exhibits of Pres. Whitney B. Gravelle on behalf of Bay Mills Indian Community
- Proof of Service

Sincerely,

Christopher R. Clark
cclark@earthjustice.org

STATE OF MICHIGAN
BEFORE THE MICHIGAN PUBLIC SERVICE COMMISSION

In the matter of the Application of Enbridge
Energy, Limited Partnership for Authority to U-20763
Replace and Relocate the Segment of Line 5
Crossing the Straits of Mackinac into a Tunnel ALJ Dennis Mack
Beneath the Straits of Mackinac, if Approval is
Required Pursuant to 1929 PA 16; MCL 483.1
et seq. and Rule 447 of the Michigan Public
Service Commission's Rules of Practice and
Procedure, R. 792.10447, or the Grant of other
Appropriate Relief

TESTIMONY OF PRES. WHITNEY B. GRAVELLE

ON BEHALF OF

BAY MILLS INDIAN COMMUNITY

September 14, 2021

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PRES. WHITNEY B. GRAVELLE - DIRECT TESTIMONY - CASE NO. U-20763

I. INTRODUCTION & BACKGROUND

Q. Please state for the record your name, job title, and business address.

A. My name is Whitney B. Gravelle. I am the duly elected President of Gnoozhekaaning, “Place of the Pike,” or the Bay Mills Indian Community, which is a federally recognized Indian Tribe with a government organized under the provisions of the Indian Reorganization Act of 1934, 25 U.S.C. §5101, et seq. Bay Mills Indian Community is located at 12140 West Lakeshore Drive in Brimley, MI 49715.

Additionally, as a woman of Anishinaabe culture, I am a water keeper, which means I am responsible for maintaining and protecting water for my people, praying to the water, and caring for the water during ceremonies. Women carry sacred water teachings and pass them on to the next generation. I actively seek teachings with elders and medicine carriers within Bay Mills Indian Community, and help coordinate cultural trainings, sweat lodges, feasts, and opportunities to gather traditional medicines amongst our tribal community.

Q. Please state your educational background.

A. I earned a Bachelor of Arts of Interdisciplinary Studies in Social Science from Michigan State University with an emphasis in Political Science and East Asian Studies. I earned my juris doctor, cum laude, from Michigan State University Law School. I also completed an indigenous law certificate.

Q. On whose behalf is this testimony being offered?

PRES. WHITNEY B. GRAVELLE - DIRECT TESTIMONY - CASE NO. U-20763

1 A. I am testifying on behalf of Bay Mills Indian Community. This testimony reflects my
2 experiences as a lifelong citizen of Bay Mills, as former Chief Judge of Bay Mills Tribal
3 Court and in-house counsel, as well as the current President of Bay Mills.

4 **Q. Please summarize your experience in tribal government.**

5 A. I have worked in tribal government for five years. On March 18, 2021, I was elected
6 President of Bay Mills, and I was sworn into office on March 19, 2021. Prior to being
7 elected President, I served as in-house counsel for Bay Mills from December 2018 to
8 March 2021. I also served as chief judge for the Bay Mills Tribal Court from November
9 2017 to December 2018. I have been teaching tribal law at Bay Mills Community College
10 since 2019.

11 In my role as President, I represent Bay Mills by serving on the Chippewa Ottawa Resource
12 Authority, the Great Lakes Indian Fish and Wildlife Commission, the Inter-Tribal Council
13 of Michigan, the United Tribes of Michigan, and also represent indigenous communities
14 and perspectives by sitting on the Michigan Women's Commission and the Michigan
15 Advisory Council on Environmental Justice.

16 **Q. Have you testified about Bay Mills' interests before this Commission or in any other**
17 **proceeding?**

18 A. I have not previously testified before this Commission. In my role as President of Bay
19 Mills, I have testified before Michigan Senate's Energy and Technology Committee.

20 **Q. What is the purpose of your testimony?**

PRES. WHITNEY B. GRAVELLE - DIRECT TESTIMONY - CASE NO. U-20763

1 A. I am testifying on behalf of Bay Mills regarding Bay Mills' interests in protecting treaty
2 rights and cultural and natural resources from risk and harm associated with the Line 5
3 Tunnel Project. Bay Mills and its citizens will be directly affected by the Commission's
4 decision in this matter. I will testify that the proposed route for the Line 5 Tunnel Project
5 is unreasonable because it would be constructed through and operate in an environmentally
6 sensitive area of profound cultural and spiritual significance to Bay Mills. I will also testify
7 that the proposed Line 5 Tunnel Project is likely to impair, pollute, and/or destroy natural
8 resources and species because of the Project's contributions to climate change. I will
9 highlight species that hold economic, subsistence, and cultural significance to Bay Mills:
10 lake whitefish, walleye, loons, wild rice, and sugar maple.

11 **Q. Are you sponsoring any exhibits?**

12 A. Yes, I am sponsoring the following exhibits:

13 Exhibit BMC-1: Resolution No. 21-05-01A

14 Exhibit BMC-2: Resolution No. 15-3-16-B

15 Exhibit BMC-3: Tribal Comments on Dynamic Risk Draft Alternatives
16 Analysis, Aug. 1, 2017

17 Exhibit BMC-4: Letter, President Bryan Newland to Governor Snyder, Feb.
18 7, 2018

19 Exhibit BMC-5: Letter, President Bryan Newland to Governor Whitmer,
20 May 10, 2019

21 Exhibit BMC-6: Map of Ceded Territory

22 Exhibit BMC-7: Albert LeBlanc Fishing Citation

II. THE BAY MILLS INDIAN COMMUNITY

Q. Describe the Bay Mills Indian Community.

A. The Bay Mills Indian Community is a federally recognized tribe and sovereign nation. The Bay Mills Indian Community was first recognized by Congress in the treaty of Sault Ste. Marie in 1820 and was officially recognized by an Act of Congress on June 19, 1860. Bay Mills is one of several Anishinaabe (Ojibwe, Odawa, and Pottawatomi) tribal nations with a deep connection to the lands and waters of the Upper Great Lakes, who have lived several hundreds of years around the Whitefish Bay, the falls of the St. Mary River and the bluffs overlooking Tahquamenon Bay, all on Lake Superior, most of which still encompass their present-day homeland. The Anishinaabe are a group of culturally related people that live in both Canada and the United States, concentrated around the Great Lakes.

There are 2,236 citizens of Bay Mills. The tribal government structure as it exists today was created under the Indian Reorganization Act in 1934, with a formal Constitution adopted in 1936. Bay Mills Indian Community is comprised of five of the six bands of Sault Ste. Marie bands of Chippewa Indians. However, the ancestors of the people of the Bay Mills inhabited the current boundaries and surrounding areas for hundreds of years prior. The boundaries of the Bay Mills reservation span the surrounding townships of Bay Mills and Superior Townships. In addition, the Bay Mills Indian Community also includes 607 acres on the southwest shore of Sugar Island, an Island between the Michigan mainland and Canadian Province of Ontario.

The Bay Mills reservation is located in the eastern part of Michigan's Upper Peninsula, and tribal citizens live throughout Chippewa, Mackinac, and Luce Counties.

PRES. WHITNEY B. GRAVELLE - DIRECT TESTIMONY - CASE NO. U-20763

1 **Q. What does it mean to be a sovereign nation?**

2 **A.** As a sovereign nation, Bay Mills has an inherent right to self-governance and self-
3 determination. Bay Mills has a government-to-government relationship with both the
4 United States and the state of Michigan.

5 As a sovereign entity, the Bay Mills is fully responsible for its own operations as a
6 governmental unit, including public safety/law enforcement, judicial system, health care,
7 and economic development.

8 **Q.** **Was that government-to-government relationship respected at the time the Line 5**
9 **pipeline was initially constructed?**

10 **A.** No. Bay Mills was an independent sovereign nation then, but the tribal nation was not
11 consulted about the original route or construction of the pipeline.

12 **III. CONCERNS ABOUT THE ROUTE OF THE LINE 5 TUNNEL PROJECT**

13 **Q.** **What is your opinion of the proposed route for the Line 5 Tunnel Project?**

14 **A.** I am deeply concerned about the proposed route for the Line 5 Tunnel Project. It is
15 dangerous to construct a tunnel and route a pipeline through lands and waters that are
16 central to our existence as indigenous people and as a Tribal Nation. The Line 5 dual
17 pipelines and tunnel project have the potential to significantly affect, and indeed pose
18 serious threats to, the exercise of our reserved treaty rights, our ability to preserve cultural
19 resources, our cultural and religious interests in the Great Lakes, our economy, and the
20 health and welfare of our tribal citizens. The Straits of Mackinac is a place of deep spiritual
21 and cultural meaning to my people, where there are important cultural and historic

PRES. WHITNEY B. GRAVELLE - DIRECT TESTIMONY - CASE NO. U-20763

1 resources still being learned of, and where Bay Mills and other Tribal Nations have Treaty
2 rights.

3 As the Bay Mills Indian Community recognized when the Executive Council requested the
4 decommissioning of Line 5 at the Straits of Mackinac in Resolution No. 15-3-16, the
5 human and natural ecosystems of the Straits of Mackinac are both too complex and too
6 fragile for a replacement pipeline for Line 5 to be successfully sited and constructed. The
7 continued operation of Line 5 may lead to a rupture and catastrophic damage to the waters
8 of the northern Lakes Michigan and Huron and the people who depend on them for their
9 economic livelihood, their quality of life, their cultural and aesthetic wellbeing, and their
10 existence. For this reason, Bay Mills has both banished the existing Line 5 dual pipelines
11 from our reservation and the lands and waters of our ceded territory, in Resolution No. 21-
12 05-01A, and sought the decommissioning of Line 5, in Resolution No. 15-3-16-B (attached
13 as Exhibits BMC-1 and Exhibit BMC-2, respectively). Bay Mills leadership has long
14 advocated for the protection of the Straits of Mackinac from the continued operation of the
15 Line 5 oil pipeline (see, e.g., Exhibits BMC-3, BMC-4, BMC-5, etc).

16 **Q. What is banishment?**

17 A. Banishment is a traditional, historical, and customary form of tribal law that has existed
18 since time immemorial and is only exercised by Bay Mills when egregious acts and
19 misconduct have harmed our tribal citizens, treaty rights, territories, and resources.
20 Banishment is a permanent and final action.

**A. THE BAY MILLS INDIAN COMMUNITY HAS A DEEP CONNECTION
TO THE STRAITS OF MACKINAC.**

Q. What is Bay Mills' connection to the Straits of Mackinac?

A. Bay Mills recognizes the Straits of Mackinac as the center of creation. The Straits of Mackinac are also home to many species, natural resources, treaty resources, and cultural resources that are important to Bay Mills. The Straits of Mackinac and the Great Lakes are central to Bay Mills' cultural, traditional, and spiritual identity.

Q. Describe how the Straits of Mackinac are part of Bay Mills' creation story.

A. According to our oral histories, the creation of North America began with a flooded Earth. The animals received instructions from the Creator to swim deep beneath the water and collect soil that would be used to recreate the world. All of the animals failed, but the body of the muskrat, the last animal that tried, resurfaced carrying a small handful of wet soil in its paws. It is believed that the Creator used the soil collected and rubbed it on the Great Turtle's back, forming the land that became known as Turtle Island, the center of creation for all of North America. According to history, the Great Turtle emerged from the flood in the Straits of Mackinac. The word "Mackinac" is derived from the original name of the Great Turtle from the Ojibwe story of Creation. The Straits are more than a waterway; they are a place of ongoing spiritual significance to the way of life of Bay Mills since time immemorial.

Q. Describe Bay Mills' present relationship with the Straits of Mackinac.

A. For Bay Mills, water is life. The Straits of Mackinac waters are part of our fishery. Over half of Bay Mills' citizen households rely on fishing for some or all of their income. Fish and fishing are not only part of our citizens' subsistence and livelihoods, but traditional

PRES. WHITNEY B. GRAVELLE - DIRECT TESTIMONY - CASE NO. U-20763

1 fishing knowledge is part of our culture, passed from generation to generation, and fish are
2 an important food used in our ceremonies. Lake Whitefish, Lake Trout, and other fish are
3 used in our cultural traditions for naming and for feasting in celebration of children, ghost
4 suppers, burial ceremonies, and other cultural traditions.

5 Bay Mills also views the ceded territory, including the Straits of Mackinac, as one, cohesive
6 traditional cultural landscape or traditional cultural property. Our interconnected
7 relationship with land and water as indigenous people is also dependent on the exercise of
8 our treaty rights, and that those treaty rights remain meaningful and available to Tribal
9 Nations, such as by guaranteeing tribal citizens continued access to waters and lands where
10 they hold rights, as well as by preserving the resources—like fish populations and
11 habitats—upon which the treaty rights depend. Further, each of the Great Lakes has a water
12 spirit—a water being—that protects the lake and its resources or helps guide and direct
13 how water is used. Our cultural teachings instruct that the details of the water beings are
14 only talked about at certain times of the year.

15 **B. THE BAY MILLS INDIAN COMMUNITY HAS TRIBAL TREATY**
16 **RIGHTS TO RESOURCES IN THE STRAITS OF MACKINAC AND**
17 **THROUGHOUT THE GREAT LAKES REGION.**

18 **Q. Is Bay Mills a signatory to a treaty with the United States government?**

19 A. The Bay Mills Indian Community is the modern-day successor in interest to the bands of
20 Ojibwe people who were identified by the negotiators for the United States as living near
21 Sault Ste. Marie in the Treaty of Sault Ste. Marie of June 16, 1820; the Treaty of
22 Washington of March 28, 1836, 7 Stat. 491; the Treaty of Detroit of July 30, 1855; and the
23 Treaty of Detroit of August 2, 1855.

PRES. WHITNEY B. GRAVELLE - DIRECT TESTIMONY - CASE NO. U-20763

1 **Q. Describe the 1836 Treaty and how it came about.**

2 A. At the time of the Treaty, the bands relied heavily on the fishery resources found in the
3 Upper Great Lakes for their subsistence, and as an item of commerce with the citizens of
4 the United States.

5 Band representatives joined with Ojibwe and Ottawa band representatives in Washington,
6 D.C. in early March 1836 at the request of the United States to negotiate a treaty of cession.

7 The Ojibwe and Ottawa signed the Treaty on March 28th and ceded to the federal
8 government over 14 million acres of land and, in addition, the waters of Lake Superior
9 lying eastward of the Chocolay River, the northern portion of Lake Huron to the mouth of
10 the Thunder Bay River, and the waters of Lake Michigan from Ford River south of
11 Escanaba to Grand Haven on Lake Michigan's southeastern shore, and including all the
12 waters connecting the three lakes.

13 Although our ancestors were willing to provide land to the United States, they carefully
14 protected the traditional lifeway and its reliance on the environment's natural resources for
15 food, shelter, medicines, and for trade. This was embodied in Article Thirteenth of the
16 Treaty, which reserved the right to hunt, and the other usual privileges of occupancy until
17 the land was required for settlement.

18 **Q. What is the "ceded territory"?**

19 A. The ceded territory is the approximately 14 million acres of land and inland waters and
20 approximately 13 million acres in Lakes Michigan, Huron, and Superior that the tribal
21 signatories to the 1836 Treaty ceded to the United States, paving the way for Michigan's

PRES. WHITNEY B. GRAVELLE - DIRECT TESTIMONY - CASE NO. U-20763

1 statehood. The ceded territory includes a large part of Michigan's Upper and Lower
2 Peninsulas and the Straits of Mackinac, and the Line 5 pipeline runs through the ceded
3 territory. A map of the ceded territory is Exhibit BMC-6.

4 The tribes only agreed to this vast cession of our ancestral home upon assurance that we
5 would have the continued ability to exercise our inherent rights, reserved by the Treaty, to
6 hunt, fish, and gather throughout the ceded territory.

7 **Q. How has Bay Mills protected its 1836 Treaty rights?**

8 A. The Treaty right to fish has been fiercely protected by the Bay Mills Indian Community
9 and its members, including litigation regarding: the continued existence of the Treaty right;
10 the member's right to use traditional fishing gear such as gillnets; and the limitations on
11 the State's power to regulate the exercise of the treaty right to fish. The first round of
12 litigation ended in the 1976 decision of the Michigan Supreme Court that the right to fish
13 in the ceded waters of Michigan's Great Lakes, expressly reserved by Article Thirteenth,
14 continue to exist, and that the State's power to regulate treaty-protected fishermen was
15 limited to those restrictions exclusively necessary to protect the resource from depletion.
16 The case is *People v. LeBlanc*, 399 Mich. 31; 248 NW2d 199 (1976). This dispute began
17 with a call from my grandfather, Bay Mills citizen Albert LeBlanc ("Big Abe") to the local
18 DNR office in 1972, stating that he had set a gill net in Lake Superior. Mr. LeBlanc was
19 issued a citation for using an illegal fishing device and the battle began (attached as Exhibit
20 BMC-7).

21 The next round was waged in federal court and began in 1973 with the filing of a lawsuit
22 against the State of Michigan by the United States, as trustee for the Bay Mills Indian

PRES. WHITNEY B. GRAVELLE - DIRECT TESTIMONY - CASE NO. U-20763

1 Community, which asserted that the State's regulation of treaty-protected fishing activities
2 by the Tribe's fishers impaired and interfered with the Tribe's treaty rights, in
3 contravention of the laws and treaties of the United States. That litigation, known as *United*
4 *States v. Michigan*, Case No. 2:73 -cv- 26 (W.D. Mich.) resulted in a decision in 1979 in
5 which the Tribe's treaty rights were held paramount to the fishing regulations of the State;
6 the case is reported at 471 F. Supp. 192 (W.D. Mich. 1979). The case has been on-going
7 since then, as additional Tribes were federally recognized, and management and regulatory
8 frameworks were developed through a combination of negotiated agreements and court
9 orders. The United States, the Tribes and the State are currently engaged in negotiations
10 for a new management and allocation agreement which will replace the current one.

11 I share the legal history of the Treaty fishing controversies not only to emphasize the
12 existence of Tribal rights regarding the fishery, but also to serve as evidence that the right
13 to fish, and the need for a natural environment in which fish can thrive, is of the utmost
14 importance to the Tribe and its members, and will be fiercely protected. Commercial and
15 subsistence fishing is the primary occupation of Bay Mills tribal citizens, and it has been
16 from Treaty times until the present day. Tribal commercial and subsistence fishers are
17 licensed and regulated by the Tribal Nation. Today, over half of our citizen households rely
18 on fishing for all or a portion of their annual income.

19 In addition to the management and allocation agreements arising from that litigation, which
20 primarily concern the Great Lakes fisheries, Bay Mills also collaborates with other Tribal
21 Nations and the state of Michigan on the management and allocation of inland waters and
22 land resources.

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1 Bay Mills also is a member of and works with intertribal bodies including the Chippewa
2 Ottawa Resource Authority (“CORA”) and Great Lakes Indian Fisheries and Wildlife
3 Commission (“GLIFWC”) to study, manage, and protect the resources upon which our
4 Treaty rights depend.

5 **Q. What resources are protected by the 1836 Treaty?**

6 A. The 1836 Treaty protects a lifeway or way of life. The right to fish, hunt, and gather as
7 identified in the Treaty is then protected as part of that way of life. The activity of fishing
8 goes much further than just fishing, it is about maintaining a relationship with fish – to
9 sing, dance, and play with fish as our customs and culture dictate. This includes the
10 teachings, stories, history, and culture that are also passed down between elder and child
11 when engaging in a traditional lifeway such as fishing. In order to continue our lifeway,
12 we need access to clean water and a healthy ecosystem.

13 **Q. In your opinion, will the Line 5 Tunnel Project affect the rights and resources**
14 **protected by the 1836 Treaty if constructed and operated along the proposed route?**

15 A. Yes.

16 **Q. In your opinion, how will the Line 5 Tunnel Project affect the rights and resources**
17 **protected by the 1836 Treaty if constructed and operated along the proposed route?**

18 A. In my opinion, the Line 5 Tunnel Project is a threat to Treaty resources and the natural
19 resources of Michigan.

20 The Line 5 Tunnel Project, if constructed, will perpetuate the flow of oil to, through, and
21 from the Straits of Mackinac. This carries the risk of an oil spill into the Straits into the

PRES. WHITNEY B. GRAVELLE - DIRECT TESTIMONY - CASE NO. U-20763

1 future. It also carries the risk of an oil spill elsewhere in the ceded territory or, because
2 many of the region's waters are connected, into the Straits and Great Lakes indirectly. Such
3 a spill would be catastrophic for our people's economic livelihood and cultural wellbeing.
4 Further, by perpetuating the flow of oil, I am concerned about the Line 5 Tunnel Project's
5 contribution to climate change.

6 **C. CULTURAL RESOURCES IN THE STRAITS OF MACKINAC.**

7 **Q. Describe cultural resources that are present in the Straits of Mackinac.**

8 A. The Straits are part of our ceded territory, which contains bottomland and terrestrial
9 archaeological sites that are significant to our people. These are submerged paleo-
10 landscapes, cemeteries, and isolated human burials of our ancestors, many of which are
11 eligible for listing on the National Register of Historic Places, a recognition that they are
12 important to our national patrimony.

13 **Q. What do you mean by a cultural landscape?**

14 A. By cultural landscape, I mean that damage, destruction, or contamination of one part of the
15 landscape damages the entire landscape. In fact, Bay Mills is pursuing the nomination of
16 the Straits of Mackinac as a Traditional Cultural Property ("TCP") for inclusion on the
17 National Register of Historic Places.

18 Due to Bay Mills Indian Community's significant and critical connection to the Straits of
19 Mackinac, the Great Lakes, and the inland lands and waters that are part of the ceded
20 territory, we have been deeply involved in the various permit processes for the Line 5
21 Tunnel Project.

1 IV. CONCERNS ABOUT CLIMATE CHANGE AND THE LINE 5 TUNNEL
2 PROJECT.

3 Q. Broadly, what concerns do you have regarding climate change and the future of Bay
4 Mills?

5 A. As the effects of climate change continue to grow larger and more pronounced, the people,
6 land, and resources of indigenous communities in the United States are threatened by
7 various climate change impacts and vulnerabilities. The indigenous way of life that has
8 persisted for thousands of years will be undermined as current and projected climate change
9 impacts take their toll. Key vulnerabilities include the loss of traditional knowledge in the
10 face of rapidly changing ecological conditions, increased food insecurity due to reduced
11 availability of traditional foods, changing water availability, arctic sea ice loss, permafrost
12 thaw, and relocation from historic homelands.

13 Climate change is already greatly harming the Great Lakes, and the fisheries, habitats, and
14 ecosystems and accordingly, having a negative impact on tribal sovereignty, economies,
15 and cultures the Great Lakes now sustain and have sustained since time immemorial.

16 A necessary precondition to sustainable fisheries or sustainable hunting and harvesting is
17 a healthy Great Lakes ecosystem. Sustainable fish production requires dynamic and diverse
18 habitats with biological, chemical, and physical features that continually meet
19 reproductive, growth, and survival integrity standards. A healthy Great Lakes ecosystem
20 also benefits commerce, the hospitality industry, recreational activities, and a myriad of
21 other beneficial activities essential to quality of life for those fortunate enough to call the
22 Great Lakes region home. Accordingly, strong self-sustaining fish populations are not only

PRES. WHITNEY B. GRAVELLE - DIRECT TESTIMONY - CASE NO. U-20763

1 indicators of healthy ecosystems and healthy environmental conditions, but they also
2 support associated fisheries in the Great Lakes, which provide inherent societal values.

3 **Q. Describe the Bay Mills Indian Community's teachings that guide how you think about**
4 **climate change.**

5 A. Our people – the Anishinaabe – also have a teaching that says the decisions we make today
6 should result in a sustainable world seven generations into the future. It reminds us to
7 understand that the decisions we make are not limited by the immediate concerns of today,
8 but instead have implications long after we are gone.

9 **Q. Can you elaborate on a few specific resources that are important to Bay Mills?**

10 A. Yes. For purposes of this testimony, I will discuss lake whitefish, walleye, wild rice, loons,
11 and sugar maple. These are not the only species of importance to Bay Mills.

12 **Q. Please describe the significance of lake whitefish.**

13 A. As mentioned previously, within the Straits of Mackinac are numerous spawning grounds
14 for different fish species – including Lake Whitefish – which our people hold in sacred
15 regard. According to Tribal Nations' oral histories, during a time of famine and desolation,
16 the eight traditional clans Bear, Turtle, Deer, Loon, Crane, Marten, Bird, and Whitefish
17 came together to discuss how to save the Anishinaabe throughout the Great Lakes Region.
18 After much debate and discussion, the Whitefish clan chose to sacrifice itself to provide
19 for the wellbeing of the people. The Whitefish clan submerged itself in the Great Lakes
20 and became the Lake Whitefish that the Tribal Nations fish and eat today, as a sole source
21 and means to provide for the prosperity of the Anishinaabe.

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1 Lake Whitefish are the primary commercial and subsistence fish that tribal fishers rely on
2 to make an annual income. Tribal fishers can sell Lake Whitefish for more money per
3 pound than they can sell any other fish. Unfortunately, Lake Whitefish are a coldwater fish
4 species. It is widely recognized that climate change leads to the warming of their habitat
5 and may lead to ecosystem disruptions in the Great Lakes region.

6 **Q. Please describe the significance of wild rice.**

7 A. To the Anishinaabe of the Great Lakes Region, wild rice (“manoomin”) is much more than
8 food, it is a culture, it is a history, and it is a livelihood. According to the oral traditions of
9 the Anishinaabe, many centuries ago the Creator told the Anishinaabe people to travel west
10 and find the lands where the “food grows on water” or the Anishinaabe people would
11 perish. The word manoomin is derived from two words in Anishinaabemowin language,
12 “manidoo” which means spirit and “miin” which means seed. Together they create
13 manoomin, which translates into the “good spirit seed” in the Anishinaabemowin language.
14 Wild rice is a food that is considered sacred and essential to the culture and traditions of
15 the Anishinaabe in the Great Lakes region. Wild rice defines what it means to be
16 Anishinaabe, it is the keeper of a culture, and to this day wild rice plays a significant role
17 in the history and cultural traditions of the Anishinaabe. In fact, wild rice is a traditional
18 gift of appreciation.

19 **Q. Describe the significance of wild rice.**

20 A. Wild rice is a traditional food source and part of the traditional diet of the Bay Mills
21 citizens. Wild rice continues to be harvested in the ceded territory today in areas near Tribal
22 Nations’ reservations in Michigan.

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1 **Q. Please describe the significance of loons.**

2 A. The Anishinaabe people believe that Creator gifted the clan system to maintain societal
3 order on Earth. Each clan has roles, talents, and responsibilities to contribute to the overall
4 wellbeing of the entire nation. There are seven primary clans of the Anishinaabe people;
5 Loon, Crane, Fish, Bird, Bear, Marten, and Deer. Traditionally, the Loon (“maang”), clan
6 worked together with the Crane clan as eloquent leaders and orators. They were skilled
7 planners, negotiators, & upheld the Seven Teachings. If ever there was a conflict between
8 the Loon & Crane clans, the fish clan helped mediate the situation.

9 **Q. Please describe the significance of sugar maple.**

10 A. Sugar maple is the species of trees that the Anishinaabe use to harvest maple syrup
11 (“zhiiwaagamizigan”), during the months of March and April. Maple syrup is considered
12 one of the first medicines given by the Creator during a time of year when it was difficult
13 to hunt or harvest. Maple syrup is treated by the Anishinaabe as a gift that ended starvation
14 and was a sign and beginning for a new season of life.

15 **Q. Does that complete your testimony?**

16 A. Yes.

EXHIBIT BMC-1

BAY MILLS INDIAN COMMUNITY
"GNOOZHEKAANING" PLACE OF THE PIKE

BAY MILLS TRIBAL ADMINISTRATION
12140 West Lakeshore Drive
Brimley, Michigan 49715



PHONE: (906) 248-3241
FAX: (906) 248-3283

RESOLUTION NO. 21-05-10A

Banishment of Enbridge Energy, Inc. Line 5 Dual Pipelines from the 1836 Treaty of Washington Ceded Territory, waters of the Great Lakes, and the Straits of Mackinac

WHEREAS: The Gnoozhekaaning, *Place of the Pike*, or Bay Mills Indian Community is a federally recognized Indian Tribe with a Constitution enacted pursuant to the Indian Reorganization Act of 1934, as amended, 25 U.S.C. 5101, *et seq.*; and

WHEREAS: The Bay Mills Indian Community is the recognized successor to the Sault Ste. Marie area bands which signed the Treaty of March 28, 1836 (7 Stat. 491), which reserved for all time the right to fish, hunt, and gather in the ceded land and waters of the State of Michigan – including the ceded waters of Lake Superior, Huron, and Michigan including the Straits of Mackinac; and

WHEREAS: The Bay Mills Indian Community acknowledges although our ancestors were willing to provide land and water to the United States for the creation of the State of Michigan, they carefully preserved and protected our traditional lifeways and our reliance on the environment's natural resources, which is embodied in Article Thirteenth of the 1836 Treaty of Washington; and

WHEREAS: The United States Constitution (Article VI.C2.1.1.1) makes clear that all treaties made with Tribal Nations shall be the supreme law of the land; and

WHEREAS: The right to fish, hunt, and gather throughout the ceded territory under the 1836 Treaty of Washington is dependent upon the ability of the Great Lakes and inland ecosystems to support viable and stable treaty resources; and

WHEREAS: Commercial and subsistence fishing is the primary occupation of the Bay Mills Indian Community tribal citizens from treaty times until present day, and over half of our citizen households rely on fishing for all or a portion of their annual income; and

WHEREAS: These treaty rights have been fiercely protected by Bay Mills Indian Community and its citizens, including litigation regarding the continued existence of the treaty right, the citizen's right to use traditional fishing gear such as gillnets, and the limitations on the State of Michigan's power to regulate the exercise of the treaty right, (see *People v. Leblanc*, 399 Mich 31; 248 NW2d 199 (1976); *United States v. Michigan* 471 F. Supp. 192 W.D. Mich. (1979)); and

WHEREAS: The Straits of Mackinac area is one of the most strategically located areas in the Great Lakes region and has been the center for cultural contact and interaction for thousands of years, which is sensitive for the presence of terrestrial and bottomland archaeological sites, submerged paleo landscapes, cemeteries and isolated human burials, significant architecture and objects, and historic districts; and

WHEREAS: Bay Mills Indian Community acknowledges the Straits of Mackinac as a Traditional Cultural Landscape and Property that is eligible for inclusion in the National Register of Historic Places based on its associations with the cultural practices, traditions, histories, beliefs, lifeways, arts, and social institutions of our living community; and

WHEREAS: Banishment is a traditional, historical, and customary form of tribal law that has existed since time immemorial and is only exercised by Bay Mills Indian Community when egregious acts and misconduct have harmed our tribal citizens, treaty rights, territories, and resources; and

WHEREAS: Since 1953 Enbridge Energy, Inc. and its predecessor companies have operated a 645 mile, 30-inch diameter pipeline, named Line 5, that runs through the State of Michigan and Bay Mills Indian Community's treaty ceded territory, which transports a variety of petroleum products; and

WHEREAS: The Line 5 dual pipelines were designed to function for a 50-year period, which has already expired, and is already subject to small ruptures amounting in more than 1,100,000 gallons of oil and natural gas products that have spilled along the upland portion of the Line, directly impacting resources which the Bay Mills Indian Community has a treaty-protect right to enjoy; and

WHEREAS: The Environmental Protection Agency has fined Enbridge Energy, Inc. \$6.5 million dollars for failure to maintain and for failure to repair of thousands of dents, cracks, and metal loss along the Lakehead Pipeline System including the Line 5 dual pipelines; and

WHEREAS: Enbridge Energy, Inc. has demonstrated through various actions it does not honor the rights and interest of Tribal Nations by: altering underwater archeological reports (see Letter from Professor John M. O'Shea, Curator of Great Lakes Archaeology, to Ms. MacFarlane-Faes, Deputy State Historic Preservation Officer (February 12, 2020)); utilizing traditional cultural practices against Tribal Nations; and attempting to initiate non-expert cultural survey work of the Straits of Mackinac without informing or engaging permitting authorities; and

WHEREAS: Continued operation of Line 5 dual pipelines will ultimately result in a rupture of the pipeline, causing catastrophic damage to the lands and waters near the Straits of Mackinac, destruction of our Tribal Nation's treaty rights, and harm the people who depend on the Great Lakes for their economic livelihood, their quality of life, their cultural wellbeing, and their very existence.

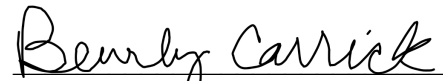
NOW, THEREFORE IT BE RESOLVED, that the Executive Council of the Bay Mills Indian Community hereby banishes Enbridge Energy, Inc.'s Line 5 dual pipelines from the Bay Mills Indian Community reservation and the lands and waters of our ceded territory – including the Straits of Mackinac.

AND BE IT FURTHER RESOLVED, the Executive Council hereby requests that any regulatory body with oversight authority, including the Chippewa Ottawa Resource Authority, Grand Traverse Band of Ottawa and Chippewa Indians, Little River Band of Ottawa Indians, Little Traverse Bay Bands of Odawa Indians, Sault Ste. Marie Tribe of Chippewa Indians, the State of Michigan, and the United States mandate and enforce the banishment of Enbridge Energy, Inc.'s Line 5 dual pipelines from the 1836 Treaty of Washington ceded territory.

APPROVED:

ATTEST:

Whitney B. Gravelle, President
Executive Council
Bay Mills Indian Community


Beverly A. Carrick, Secretary
Executive Council
Bay Mills Indian Community

CERTIFICATION

I, the undersigned, as Secretary of the Bay Mills Indian Community Executive Council, do hereby certify that the above Resolution was adopted and approved at a Special Meeting of the Bay Mills Executive Council held at Bay Mills, Michigan on the 10 day of May 2021, with a vote of 4 for, 0 against, 0 absent and 1 abstaining. As per provisions of the Bay Mills Constitution, the Tribal President must abstain except in the event of a tie.

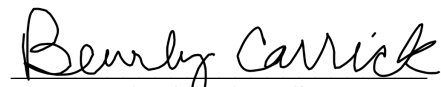

Beverly A. Carrick, Secretary
Bay Mills Executive Council

EXHIBIT BMC-2

DIR00043



Bay Mills Indian Community

12140 West Lakeshore Drive
Brimley, Michigan 49715
(906) 248-3241 Fax-(906) 248-3283



RESOLUTION NO. 15-3-16-B

Support for Decommission of Enbridge Line 5 Oil Pipeline under the Straits of Mackinac

- WHEREAS: The Bay Mills Indian Community is the recognized successor to Sault Ste. Marie area bands which signed the Treaty of March 28, 1836 (7 Stat. 491), by which the right to fish in the ceded waters of Lakes Superior, Huron and Michigan--including the Straits of Mackinac-- was expressly reserved for all time, and
- WHEREAS: Enbridge Pipelines, Inc., operates a 645-mile, 30-inch diameter pipeline, named Line 5, which was constructed in 1953 and transports a variety of petroleum products, and
- WHEREAS: Line 5 splits into two 20-inch diameter parallel underground pipelines upon reaching the northern shore of the Straits of Mackinac, which cross the Straits west of the Mackinac Bridge for a distance of 4.6 miles, and which at any given time contains nearly one million gallons of crude oil, and
- WHEREAS: The Tribe is concerned about any discharge of petroleum products into the Straits, as it would adversely affect fishery shoaling, spawning and nursery areas in both Lakes Michigan and Huron which encompass the most productive fishing areas in the 1836 Treaty ceded waters, and
- WHEREAS: A catastrophic oil spill into the Straits would devastate the aquatic ecosystem, damage the shoreline of Lakes Huron and Michigan for hundreds of miles, and disrupt, degrade and diminish the tribal fishery reserved by treaty, and
- WHEREAS: Line 5 was designed to function for a 50-year period, which has already expired, and it is already subject to small ruptures, which have been documented as occurring along the upland portion of the Line, resources which the Bay Mills Indian Community has a treaty-protected right to enjoy, and
- WHEREAS: Enbridge has failed to adequately monitor and maintain its pipelines in this State, as is demonstrated by the 2010 pipeline rupture of oil into the Kalamazoo River, which contaminated 40 miles of that body of water, and

Resolution No. 15-3-16-B

WHEREAS: Continued operation of Line 5 will ultimately result in a rupture of the pipeline, causing catastrophic damage to the waters of northern Lakes Michigan and Huron and the people who depend on them for their economic livelihood, their quality of life, their cultural and esthetic well being and their very existence, and

WHEREAS: The human and natural ecosystems of the Straits of Mackinac are both too complex and too fragile for a replacement pipeline for Line 5 to be successfully sited and constructed within the reasonably foreseeable future.

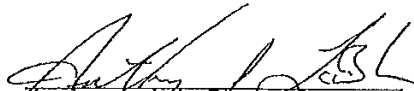
NOW, THEREFORE BE IT RESOLVED, that the Executive Council of the Bay Mills Indian Community hereby requests the Michigan Petroleum Pipelines Task Force to recommend that the Enbridge Line 5 Pipeline underlying the Straits of Mackinac be decommissioned.

AND BE IT FURTHER RESOLVED, that the Executive Council hereby requests that any regulatory body with oversight authority over the subject matter and/or geographic area to take any and all actions reasonable and necessary to mandate and enforce the decommissioning of Line 5 at the Straits of Mackinac

APPROVED:


Levi D. Carrick Sr., President
Bay Mills Indian Community
Executive Council

ATTEST:


Anthony J. LeBlanc, Secretary
Bay Mills Indian Community
Executive Council

CERTIFICATION

I, the undersigned, as Secretary of the Bay Mills Indian Community, do hereby certify that the above Resolution was adopted and approved at a meeting of the Executive Council held at Bay Mills, Michigan, on the 16th day of March, 2015, with a vote of 3 for, 0 opposed, 1 absent, and 1 abstaining. As per provisions of the Bay Mills Constitution, the President must abstain except in the event of a tie.


Anthony J. LeBlanc, Secretary
Bay Mills Indian Community
Executive Council

EXHIBIT BMC-3



August 1, 2017

Hon. Rick Snyder, Governor
State of Michigan
Post Office Box 30013
Lansing, Michigan 48909

Hon. Bill Schuette, Attorney General
Michigan Department of Attorney General
Post Office Box 30212
Lansing, Michigan 48909

Hon. C. Heidi Grether, Director
Michigan Department
of Environmental Quality
Post Office Box 30473
Lansing, Michigan 48909

Hon. Keith Creagh, Director
Michigan Department of Natural Resources
Post Office Box 30028
Lansing, Michigan 48909

Hon. Valerie Brader, Executive Director
Michigan Agency for Energy
Post Office Box 30221
Lansing, Michigan 48909

RE: Tribal Comments on Dynamic Risk Draft Alternatives Analysis

Dear Governor Snyder, Attorney General Schuette, Director Grether, Director Creagh, and Executive Director Brader,

The Straits of Mackinac occupy a hallowed place in the history of the Indian and non-Indian peoples of Michigan. They are at once an iconic symbol of the State and a sacred wellspring of Anishinaabe life and culture. They have served as a focal point of our shared history for centuries.

In response to the State's invitation, Michigan's twelve federally-recognized Tribes submit these comments regarding the June 27, 2017, Draft Alternatives Analysis for the Straits Pipelines prepared by Dynamic Risk ("Draft Report"). We do so in the spirit of our cherished partnership with the State as co-stewards of the Straits, which while mighty are also vulnerable, and which serve so powerfully as an emblem of our entwined past, present, and future.¹

¹ Individual Tribes signatory to these comments may also submit additional comments on their own behalf.

Tribal Comments on Dynamic Risk Draft Alternatives Analysis
August 1, 2017
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Key Takeaways from the Draft Report

- In its February 22, 2016, Request for Information and Proposals (Independent Alternatives Analysis for the Straits Pipelines) (“RFP”), the State, quoting from the Michigan Petroleum Pipeline Task Force Report, declared:

Decisions about the future of the Straits Pipelines must be informed by an independent, comprehensive analysis of alternatives . . . [requiring] a study by relevant experts of the feasibility, costs, including the specific costs to Michigan, and public risks and benefits of alternatives to the existing Straits Pipelines.

RFP at 2 (emphasis in original) (quoting Task Force Report at 50). The RFP accordingly sought an alternatives analysis, the “overall objective of [which] is to provide the State of Michigan and other interested parties with an independent, comprehensive analysis of alternatives to the existing Straits Pipelines, and the extent to which each alternative promotes the public health, safety and welfare and protects the public trust resources of the Great Lakes.” RFP at 5.

- Dynamic Risk’s Draft Report evaluates a range of alternatives with respect to the Straits Pipelines, including maintenance of the status quo. While the Draft Report’s discussion of those alternatives is subject to significant criticism – some of which is outlined below – there are two critical points growing out of the Draft Report that bear emphasis at the outset and should not be obscured by its flaws.
- First, the odds of a rupture of the Straits Pipelines are undeniably high. The Draft Report discusses those odds in mathematical/engineering terms that are somewhat obscure. *See* Draft Report at 2-105 – 2-108. However, at the July 6, 2017, meeting in Holt, Michigan, the project’s Chief Engineer stated clearly that, based on the figures set forth in the Draft Report, the odds of a spill from the Straits Pipelines in the next 35 years are not one in a million, or one in a thousand, or even one in a hundred. They are *one in sixty*.² This projection stands as an unacceptable threat to an iconic resource, especially when considered in conjunction with the catastrophic consequences that would follow from such a spill. And there exists substantial reason to believe that the actual risk is considerably higher than Dynamic Risk has stated it.

² *See* Statements of James Mihell, P. Eng., at July 6, 2017, Information Meeting at Holt, Michigan, at 3:11:00–3:12:00. Available online at <https://mipetroleumpipelines.com/event/watch-video-july-6-public-information-session-holt>. Last visited July 29, 2017.

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- Second, decommissioning the Pipelines would best serve Michigan interests. In addition to its discussion of the risks posed by the Pipelines, the Draft Report contains two critical additional facts leading to this vitally important conclusion:

Fact: Michigan consumers and businesses rely on only a modest amount of the crude oil and natural gas liquids transported by Line 5, the significant majority of which is transported through the State and ends up in Canada or beyond.

Fact: Feasible alternatives for supplying the amount of Line 5 product and capacity relied on in Michigan are readily available, such that the Straits Pipelines can be decommissioned with little disruption or increased cost to Michigan consumers and businesses.

Conclusion: Thus, exposing the Straits of Mackinac to the risk of a catastrophic oil spill through the continued operation of the Straits Pipelines is not justified by significant interests of the State, the Tribes, or their citizens. That risk is instead being borne by the people of Michigan for the benefit of out-of-state interests.

- The Draft Report establishes the first of these facts in unambiguous terms: “The majority of Line 5 throughput is delivered to the Sarnia, Ontario terminal in Canada where it is then transported to refineries across eastern Canada and the U.S. . . . Of the NGLs transported on Line 5, less than 5% are delivered into Rapid River [in the Upper Peninsula]. Lewiston oil injections are also less than 5% of Line 5 current throughput and do not appear to be increasing.” Draft Report at 4-4 and 4-5. In other words, the Michigan portion of Line 5 is largely a thoroughfare for the transportation of product to the benefit of commercial, government, and consumer interests elsewhere, including, of course, to the benefit of Enbridge.
- The Draft Report establishes the second of these facts in discussing Alternative 6. *See id.* at 4-6 – 4-24. That Alternative considers the options that will be available to Michigan consumers and businesses to meet their energy and energy transport needs if the Straits Pipelines are decommissioned. The analysis confirms that there are feasible options presently available (1) for delivering an adequate supply of propane to Upper Peninsula customers by truck, *see id.* at 4-6 – 4-13; (2) for transporting Michigan-derived crude oil from Lewiston to refineries by truck, *id.* at 4-14 – 4-16; and (3) for providing significant alternative sources of crude oil for the Detroit and Toledo refineries, *id.* at 4-16 – 4-21.
- The Draft Report concludes that utilizing such alternatives will increase fuel prices for Michigan consumers, but only by modest amounts that fall well within the ambit of typical

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fluctuations in price. With respect to Upper Peninsula propane consumers, data in the Draft Report evidences that prices will increase by no more than 10 cents per gallon, whereas a “range of 10 cents/gal to 35 cents/gal . . . is similar to the year-to-year volatility experienced during normal seasonal fluctuations.” *Id.* at 4-13; *see also id.* at 4-6 (propane price variation between the winter of 2015-2016 and 2016-2017 was 10 to 25 cents per gallon).³

- With respect to gasoline and other distillates, the Draft Report concludes that “[i]n addition to crude oil supply from [elsewhere in] the Enbridge System, the Detroit and Toledo refineries would access additional supplies from the Mid-Valley Pipeline (total capacity of 240 kbbl/d) as well as through truck and rail deliveries,” *id.* at 4-17, with a projected increase in consumer prices of no more than 2.13 cents per gallon, *id.* at 4-20 – 4-21, an amount well within the range of normal fluctuations in cost. *See id.* at 4-21 (Table 4-5).
- The Draft Report, then, contains ample support for the conclusion that the Straits Pipelines can be decommissioned with little disruption and cost to the State, its citizens, and the Tribes. The continuing risk of an oil spill through the continued operation of the Straits Pipelines is simply not justified by Michigan interests.
- This should be a marquee finding in the Draft Report. It is instead omitted entirely from the executive summary and thereafter buried within the Draft Report’s voluminous and detailed focus on the viability of the other alternatives. Even there its implications are never acknowledged, much less developed with the clarity that they obviously warrant. Alternative 6 comes across in the Draft Report as an afterthought when it should be the centerpiece. This is because, as explained next, much of the Draft Report rests on a faulty premise.

³ The Draft Report explores four alternative sources of propane for Upper Peninsula consumers. *See id.* at 4-6 – 4-13. Trucking from Superior, Wisconsin, is the least expensive of these, and according to the Draft Report would result in an additional cost of 10 cents per gallon. *Id.* at 4-12 – 4-13. While the other options explored would be more costly (up to an additional 35 cents per gallon), the Draft Report provides no indication that the Superior option is infeasible, and hence 10 cents per gallon is the realistic upper bound of impact. Indeed, the Tribes understand that the State may receive comments from other sources indicating that even this figure is too high. The Tribes, of course, have many members living in the Upper Peninsula. They have no interest in seeing the costs of alternative propane supplies understated. But neither do they have an interest in seeing them overstated in a manner that may distort a proper assessment of the pipeline alternatives.

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Key Shortcomings in the Draft Report

A. The Faulty Premise

- The Draft Report focuses the bulk of its analysis on Alternatives 1-5. In doing so, it does not assess the extent to which each of those alternatives would serve *Michigan* interests (including the interests of the State, its citizens, and the Michigan Tribes), as provided for in the RFP, and as was the expectation for the Draft Report of the public generally and the Tribes specifically.
- Instead, the Draft Report imposes on each of those Alternatives the limitation that they must maintain undiminished Enbridge's existing Line 5 product flow between Superior, Wisconsin, and the refineries in Sarnia, Ontario. *See, e.g.*, Draft Report at TS-3 ("For this study, the alternatives described are designed to provide equivalent capacity and deliveries to that of the existing Line 5."); *id.* at 6-1 ("Alternative 1 considers the construction of one or more new pipelines . . . to transport the volume of petroleum products that are currently transported by Enbridge Line 5 from its terminal at Superior, Wisconsin to its terminus in Sarnia, Ontario" (emphasis added)); *id.* at 5-1 (same for Alternative 2 (use of existing pipeline infrastructure)); *id.* at 7-1 (same for Alternative 3 (use of alternative transportation methods)). By contrast, the Draft Report evaluates Alternative 6 with the requirement of replicating the amount of Line 5 flow in fact relied upon by Michigan citizens and businesses. *See id.* at 4-6 – 4-24. In the Final Report, that should be the measure by which all of the alternatives are framed and evaluated.
- The Draft Report nowhere provides an explanation as to why the commercial needs of Enbridge should serve as the measure for evaluating the viability of all but one of the proposed alternatives to the Straits Pipelines. The absence of any such explanation diminishes the potential of the Draft Report to be used as a tool for reaching consensus regarding the best interests of Michigan, its citizens, and the Tribes with respect to the future of the Straits Pipelines.
- The Draft Report's approach could lead a casual reader to conflate those critical public interests with Enbridge's private interest in maintaining Line 5's product flow undiminished. But the interests of Michigan and those of Enbridge are not co-extensive. As noted, Line 5 largely carries its products through Michigan to the benefit of commercial, government and consumer interests elsewhere. *See id.* at 4-4 and 4-5 (stating that "[t]he majority of Line 5 throughput is delivered to . . . refineries across eastern Canada and the U.S.," and "less than 5%" of Line 5 NGLs go to the Upper Peninsula, and "Lewiston oil injections are also less than 5% of Line 5 current throughput"). The Draft Report does not reconcile that fundamental fact with its insistence that viable alternatives to the Straits Pipelines must replicate 100% of Line 5's throughput unabated.

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- The Draft Report's unexplained solicitude for Enbridge's commercial needs over Michigan-specific interests leads to a skewed focus on, and favoring of, alternatives that best serve Enbridge's needs. Perhaps the starkest example comes with the Draft Report's summary dismissal of Alternative 2, which was supposed to address the use of existing pipeline infrastructure. Instead, the Draft Report summarily dispenses with this option after concluding that the existing infrastructure cannot convey all 540,000 barrels of oil per day presently transported by Line 5. *See id.* at 5-1 – 5-4 (discussing same); *see also id.* at MS-2 (“[T]he option of using existing pipeline infrastructure was removed from further detailed analysis.”).
- The Report discards this alternative from further consideration despite acknowledging that there presently exists significant excess capacity on Enbridge's existing Line 78, which extends from Griffith, Indiana (near Chicago), across southern Michigan, to Sarnia, *see id.* at 5-2, and despite further acknowledging that the Mid-Valley Pipeline could supply much of the remaining needs of the Detroit and Toledo refineries, *id.* at 4-7. An analysis focused on Michigan interests would have fleshed out these facts in detail. Instead, because of its focus on non-Michigan concerns, the Draft Report fails to complete the analysis.
- Fortunately, while some calculations remain to be done, much of the analysis is, as canvassed above, already contained in the discussion of Alternative 6 (decommissioning). *See id.* at 4-6 – 4-22. The Final Report should accordingly be able to address the ability of the existing pipeline infrastructure to satisfy Michigan needs without having to re-invent the wheel.

B. Failure to Properly Account for Costs to Michigan and the Tribes

- While focusing on the commercial needs of Enbridge, the Draft Report fails to properly consider the costs of the various alternatives to Michigan's citizens generally and to the Tribes specifically. For example, the Draft Report acknowledges that it “does not provide a separate valuation estimate for subsistence, commercial or cultural values associated with the use of resources by tribes.” *Id.* at 1-9. As a result, while Tribal interests, including Tribal treaty rights, are mentioned at occasional junctures in the Draft Report, the costs associated with alternatives affecting tribal interests “are not necessarily fully accounted for,” as acknowledged (in what can only be characterized as a significant understatement) by the project's economist at the July 6, 2017, Holt presentation.⁴
- These omissions are evident in the Draft Report's conclusion that the total cost of an oil spill in the Straits of Mackinac – which, in addition to all the other costs for Michigan and its citizens, would almost certainly wipe out a significant swath of the Tribes' treaty-guaranteed fishing, hunting and gathering activities for years – would be no more than 103-128 million

⁴ Statements of Jack Ruitenbeek, PhD, at July 6, 2017, Information Meeting at Holt, Michigan, at 3:46:00–3:47:30. Available online at <https://mipetroleumpipelines.com/event/watch-video-july-6-public-information-session-holt>. Last visited July 29, 2017.

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dollars (with an environmental damages component of 62-76 million dollars). *See id.* at 2-104 – 2-105. These are stunningly low figures, and the Draft Report makes no attempt to reconcile them with the fact that the Marshall oil spill has, to date, resulted in 1.2 billion dollars in remediation and other costs due to its impact on the Kalamazoo River and surrounding communities.⁵

- The Tribes understand that the State will be receiving detailed comments from other sources about the Draft Report’s failure to model worst-case spill scenarios, despite the State’s explicit instruction that it do so, and regarding other flaws in the Draft Report’s modeling and costs analysis. The Tribes will not duplicate those arguments here but will simply underscore that the Draft Report’s analysis vastly understates the effects of a Straits spill on Tribal economies, cultures, and ways of life.
- The on- and off-reservation fishing, hunting, and gathering rights retained by a number of the undersigned Tribes in treaties with the United States were of vital importance to them as they ceded vast swaths of land to the government in the 19th century. The exercise of those rights was essential to their very survival, as well as to the maintenance of a way of life and cultural practices dating back to time immemorial. In *United States v. Michigan*, 471 F. Supp. 192 (W.D. Mich. 1979), the court explained that in negotiating the 1836 Treaty of Washington, 7 Stat. 491, the Tribes reserved the right “to hunt, fish, gather fruits of the land and use all land and water resources of the ceded area . . . [i]ndefinitely,” *id.* at 236, and that this right “was extremely important to the Indians” because it meant that “they could continue living the way they had been living,” *id.* at 235. With respect to fishing rights in particular, “the vital right to fish in the Great Lakes was something that the Indians understood would not be taken from them[.]” *Id.* at 253. “[T]he Indians were too heavily dependent upon fish as a food source and for their livelihood to ever relinquish this right.” *Id.* at 259.
- The Tribes’ reliance on their ancient fisheries, including in particular their fisheries in the Straits of Mackinac, is well documented. In *United States v. Michigan*, the court found that “[t]hroughout the period from first contact to the 1830’s [when the Treaty of Washington was signed], missionaries, explorers, traders, and military and governmental officials wrote of the Indian gill net fishery in the Great Lakes and of its importance to the Indian inhabitants. For example, the Frenchman Joutel wrote [a] detailed description of Indian gill netting at the Straits of Mackinac in 1687.” *Id.* at 222. The court further found that “[s]ubsistence fishing continued to be tremendously important to the Indians of the treaty area in the 1830’s. The introduction of the market economy, the fur trade and the dependence of the Indians on trade goods did not alter the subsistence dependence of Indians on the fishery; to the contrary, as

⁵ *See* Garrett Ellison, MLive.com, *New price tag for Kalamazoo River oil spill cleanup: Enbridge says \$1.21 billion*, May 20, 2016. Available online at: http://www.mlive.com/news/grand-rapids/index.ssf/2014/11/2010_oil_spill_cost_enbridge_1.html. Last visited July 30, 2017.

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Fitting reported in his 'Patterns of Acculturation at the Straits of Mackinac,' those factors actually [i]ncreased and amplified the importance of fishing." *Id.* at 224.

- As these passages suggest, firsthand accounts of the importance of the fisheries to the Tribes, including in the Straits of Mackinac in particular, abound. Those accounts make clear that it was the abundance of fish in the Straits that had led a number of the Michigan Tribes to reside there. The explorer Antoine de la Mothe Cadillac authored one of the most poignant of these in describing the Ottawa fisheries at Mackinac circa 1695:

The great abundance of fish and the convenience of the place for fishing have caused the Indians to make a fixed settlement in those parts. It is a daily manna, which never fails; there is no family which does not catch sufficient fish during the course of the year for its subsistence. Moreover, better fish can not be eaten and they are bathed and nourished in the purest water, the clearest and the most pellucid you could see anywhere.

W. Vernon Kinietz, *The Indians of the Western Great Lakes: 1615-1760* (1965), at 239-40.

- And it was this same abundance of fish that led the Tribes to insist, when they ceded their lands, that their treaty reservations be located near the Straits and adjacent waters. As the court explained in *United States v. Michigan*:

All Indians of the Upper Great Lakes, including the Ottawa and Chippewa, were fishing peoples. The settlement patterns of native peoples of the Upper Great Lakes, including the treaty Indians in the case at bar, were strongly influenced by available resources, especially fish. It is no mere coincidence that the [1836 reservations] are all located on the Great Lakes and all adjacent to important fishing grounds. It is also noteworthy that most major archaeological sites in the Upper Great Lakes are near or within [the 1836 reservations]. In order to reach a conclusion that the Indians were not dependent upon this valuable fishery resource, the court would have to ignore hundreds of years of recorded testimony and thousands of years of prehistoric information.

471 F. Supp. at 256.

- In the years since Cadillac wrote his account, and since the treaties were signed, much has changed. The waters, the fisheries, and the game have all suffered tremendously. But the Tribes have fought vigorously to retain their way of life and to restore those natural resources to some small measure of their former bounty. And the State, in recognition of the tremendous importance of those resources to all Michigan citizens, and to the very identity of the State, has worked in partnership with the Tribes towards that end.

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- The continuing importance of the Straits to the Tribes cannot be gainsaid. The Tribes have continued to reside and to maintain significant commercial and subsistence fisheries there. As a tribal Great Lakes fishery biologist recently declared:

Northern Lake Michigan and Northern Lake Huron are very productive areas for lake whitefish [the most important commercial species] with biomass levels typically exceeding 10 million pounds annually. . . . Lake whitefish harvests from Northern Lake Michigan and Northern Lake Huron made up 37% to 76% of the total annual [Chippewa Ottawa Resource Authority] commercial lake whitefish harvest from the 1836 ceded waters and averaged 58% during 1986-2014.”⁶

- In addition, to compensate for shortfalls in the fisheries from historic levels, the Tribes have invested enormous amounts of time, effort, and resources to develop other aspects of their economies, including tourism-related activities, that are likewise predicated on the health of the Straits.
- The Draft Report mentions little of this, and the paltry figure it attaches to the physical and cultural carnage that would result from an oil spill in the Straits fails to adequately capture or respect the importance of the Straits to the history and very identity of the Tribes and the State. It may well be that the central role that healthy Straits have played and continue to play in the life of the Michigan Tribes and their non-Indian neighbors cannot be adequately quantified. If Dynamic Risk’s models do not allow for the monetization of that value it should forthrightly acknowledge that fact in its Final Report and eliminate any implication that it has fully captured the true cost of the harm that would result from a rupture of the Straits Pipelines.

C. Flawed Emphasis on Alternatives 5 (Status Quo) and 4 (Tunneling and Trenching)

- Ultimately, as a result of its unexplained focus on the commercial needs of Enbridge, the Report leaves the impression that the most prudent and reasonable alternative is to maintain Line 5 in place (Alternative 5), potentially with a revised Straits crossing via trench or tunnel (Alternative 4). But the Draft Report does not identify any interests of the State, its citizens, or the Tribes that would be advanced by these options.
- To the contrary, it is clear that Tribal interests, along with closely related interests of Michigan and its non-Indian citizens, have not been fully accounted for in the Draft Report’s favorable discussion of the possibility of trenching or tunneling the Straits Pipelines. The Draft Report acknowledges that both trenching and tunneling will have significant

⁶ See Attachment A (Declaration of Mark P. Ebener, Great Lakes fishery biologist for Chippewa Ottawa Resource Authority (“Ebener Decl.”) at 4. Filed in *National Wildlife Federation v. Administrator of PHMSA*, Case No. 2:16-cv-11727, United States District Court, E.D. Mich. (July 14, 2016)).

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socioeconomic impacts in the Straits region. *See* Draft Report at 3-17 – 3-20 and Appendix Q. Trenching, which would not eliminate the risks of an oil spill posed by the Straits Pipelines,

will require disruption of water traffic through the Straits. The Straits is an important link between Lake Michigan and Lake Huron. Important to recreational boating and fishing, it is a fundamental part of the tourism attraction to the region. It is also part of the area's tribal treaty waters, and important for tribal commercial and subsistence fisheries. The impacts of any disruption to water traffic needs careful assessment with area tribes, the MDNR Fisheries Division, and others affected by lake traffic in the area.

Id. at 3-20. In addition, "[a]djacent shoreline areas will be temporarily transformed into worksites for materials delivery and machinery installation." *Id.* at 3-17.

- Tunneling (projected to extend over at least a 27-month period) will involve, among other things, "considerable disturbance on the shoreline at both ends of the tunnel." *Id.* "Tunneling operations in particular require the extraction and trucking of large amounts of rock and soil; dust and noise will impact community residents and visitors." *Id.* at 3-20. And either of the proposed tunneling methods will quite predictably have significant disruptive effects on the bottomlands and on water quality. *See* Appendix E.3 for a description of the tunnel boring and drill and blast methods.
- Even on the face of the Draft Report, then, and without anything approaching a full exploration of the issues, it is clear that trenching or tunneling the Straits Pipelines will have significant, negative impacts on the Tribes' treaty-protected activities. Any degradation in water quality will threaten the already fragile fisheries. Moreover, the significant shoreline disturbances mentioned in the Draft Report are of great concern given that "lake whitefish spawning is concentrated in shallow rock and gravel areas adjacent to the shorelines," Ebener Decl. at 3, that "young lake whitefish occupy very shallow sandy areas less than 5 ft. deep adjacent to the spawning shoals," *id.* at 4, and that lake trout also "spawn to a lesser extent in shallow rocky areas along the shoreline of both [lakes]," *id.* at 5.
- Tunneling or trenching could also result in major disturbances to the waterfowl, migratory birds, aquatic furbearers, and other resources to which Tribal treaty rights attach, and to both the water and shoreline sites (potentially including Tribal trust and reservation lands) that Tribal members use to gain access to their treaty resources. They would further render off-limits additional portions of the bottomlands on which the Tribes have set their nets since time immemorial.
- The Final Report should properly reflect the vast disruption that would be entailed by tunneling or trenching and should make clear that these options are unnecessary to satisfy

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any significant interests of the State, the Tribes, or their citizens, but would instead be undertaken largely for the benefit of out-of-state interests.

D. Failure to Conduct an Apples-to-Apples Comparison of Risk

- The Draft Report's comparison of the risks presented by the various Alternatives is summarized at Table ES-2, which is found at page 23 of the Technical Summary (TS-23). Even a cursory glance at the Table suggests that something is amiss. According to the Table, the total economic risk of a spill from the utilization of a state-of-the-art pipeline constructed along the existing southern route (Alternative 1), which largely avoids exposure to the Great Lakes, is 46.26 times higher than the total economic risk of maintaining the Straits Pipelines in place, while the monetized environmental risk is 33.77 times higher (the numbers are even starker for the tunneling or trenching options). This is impossible to fathom, given that the pipeline industry in general, and the Draft Report itself, consistently tout the reduction in risk resulting from continual technological improvements in pipeline design, construction and installation, *see, e.g.*, Draft Report at 3-1, 3-6, 3-25, 3-27, and 6-3 – 6-4, and given the extremely sensitive nature of the Straits crossing.
- The explanation lies in another fundamental flaw in the Draft Report – its failure to conduct an apples-to-apples comparison of risk. Table ES-2 summarizes the Draft Report's assessment of the relative risks presented by the 4.5 mile Straits crossing against those presented by the *entire* 762 miles of a new southern pipeline (226 miles of which would fall in Michigan). *See* TS-23 (Table ES-2); *see also* 6-14 ("The failure likelihood component of the risk expression" for the southern route applies to "the segment of pipeline that would be used to bypass the Straits segment of Line 5."). No valid reason is provided for such an unbalanced comparison, and none exists. If the Straits crossing remains in place, so too will the rest of Line 5, and an accurate assessment of relative risk would therefore compare the risks and consequences of a spill along Line 5 in its entirety with those related to the replacement route. Or, to focus more precisely on Michigan interests, an accurate assessment would compare the risks and consequences of a rupture along Line 5 that could affect Michigan lands and waters with those associated with the replacement route. The Final Report should correct what is otherwise a highly misleading comparison of risk.
- The Draft Report likewise overstates the consequences of a southern route spill compared to a spill at the Straits. The former are calculated using incident data from 2010-2016, which sweeps in the disastrous Enbridge spills at Marshall and near Romeoville, Illinois in 2010. *See* Draft Report at 6-14 – 6-16. By contrast, those spills are nowhere factored into the Draft Report's assessment of the consequences of a Straits spill. The illogic of this is apparent. The results of failures of Enbridge's older pipelines are used to skew the risk analysis in favor of maintaining another aged pipeline under the Straits as opposed to constructing a new, state-of-the-art pipeline in an existing right-of-way far removed from the Straits. Dynamic Risk should rethink its approach to its comparison of relative risks, which at present is not defensible.

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The State's Obligation to Act

- The foregoing comments, and others submitted to the State, including by members of the State's own Pipeline Safety Advisory Board, reflect significant shortcomings in the Draft Report. Dynamic Risk can and should fix those flaws. But regardless of whether it does, the Draft Report contains ample evidence establishing the State's obligations to decommission the Straits Pipelines under two cardinal, and in this context closely related, legal doctrines.

The Public Trust Doctrine

- The Draft Report's focus on the commercial needs of Enbridge is not simply deficient as a matter of fact and policy, but also as a matter of law. For whatever may be Enbridge's private interests, or the interests of other jurisdictions, in maintaining the Straits Pipelines (whether in their present or in tunneled or trenched form), the interests of the people of Michigan and of the Tribes in protecting the Straits and its resources are paramount under the public trust doctrine.
- Pursuant to that doctrine, certain natural resources held in common by the public constitute "the public trust." These resources specifically include "the waters of the Great Lakes and their submerged lands[.]" *Glass v. Goeckel*, 473 Mich. 667, 694 (2005). The State, as trustee, has an affirmative obligation to protect such public resources against impairment. *See id.* That obligation is enshrined in the Michigan Constitution. *See* Mich. Const. art. IV, § 52. As the Michigan Attorney General, citing seminal authority from the United States Supreme Court, explained in 2004, under the public trust doctrine the State has "not only the authority *but an affirmative obligation* to protect the public interest in navigable waters." Mich. Op. Att'y Gen. 7162 (2004), 2004 Mich. AG LEXIS 18, at *5 (citing *Ill. Cent. R.R. Co. v. Illinois*, 146 U.S. 387 (1892)) (emphasis added).
- Because of the paramount nature of the public's rights in the Straits, the 1953 easement presents no obstacle to the State's full exercise of its public trust authority with respect to the Straits. Indeed, the State did not surrender even a fraction of that authority – or the affirmative duties that underpin it – when it granted the easement. "The state, as sovereign, cannot relinquish this duty to preserve public rights in the Great Lakes and their natural resources." *Glass*, 473 Mich. at 679. To the contrary, the easement was issued fully "subject to the public trust" at its inception. *Id.* In other words, a state's conveyance of property rights "to private parties leaves intact public rights in the lake and its submerged land. . . . Under the public trust doctrine, the sovereign never had the power to eliminate those rights, so any subsequent conveyances . . . remain subject to those public rights." *Id.* at 679, 681 (emphasis added). *See also, e.g., Nedtweg v. Wallace*, 237 Mich. 14, 17 (1927) (stating that public trust "is an inalienable obligation of sovereignty" and "[t]he State may not, by grant, surrender such public rights" in favor of private interests). These are not mere academic concepts. As the Michigan Supreme Court has recently explained, "the public trust doctrine is alive and well in Michigan[.]" *Glass*, 473 Mich. at 681.

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- Accordingly, the State does *not* need to find a violation of the 1953 easement to revoke it and order the decommissioning of the Straits Pipelines. Because the easement was issued “subject to the public trust,” *id.* at 679, it issued subject to the understanding that the State could unilaterally revoke it based on subsequent understandings (as opposed to those prevailing in 1953) of the threat to the public trust posed by the Pipelines. As the United States Supreme Court, in a seminal public trust decision oft-cited by the Michigan Supreme Court, has explained, “[t]here can be no irrevocable contract in a conveyance of property by a [sovereign] in disregard of [the] public trust[.]” *Ill. Cent. R.R. Co.*, 146 U.S. at 460. Thus, any grant of property rights (*e.g.*, an easement) in public trust resources

is necessarily revocable, and the exercise of the trust by which the property was held by the State can be resumed at any time. . . . [T]he power to resume the trust whenever the State judges best is . . . incontrovertible.

Id. at 455. *See also id.* at 461-62 (recognizing power of the state under public trust doctrine “to resume control of the resources and property” based on subsequent “consideration of public policy” and stating that state’s power to do so “is unquestionable”).⁷

- Furthermore, the State not only has the authority under the public trust doctrine to revoke the easement, it has the *duty* to do so. Attorney General Bill Schuette has stated that “[c]ertainly the Straits Pipelines would not be built today[.]”⁸ That is unquestionably true. Laying private crude oil pipelines in the Straits of Mackinac (of all places) for the primary benefit of out-of-state commercial interests simply cannot, based on what is known today, be squared with Michigan’s paramount obligations to safeguard the public trust in the Straits and surrounding lands and waters. If the State would not permit the Straits Pipelines to be installed today because of their threat to the public trust, there exists no basis – and indeed *no authority* – to acquiesce in their continued operation. Again, the State’s public trust obligations are affirmative. As the Michigan Supreme Court has made clear, “the state . . . may permit only those private uses that do not interfere with . . . the public trust.” *Glass*, 473 Mich. at 694 (emphasis added). The trenching or tunneling of the Straits or the maintenance of the existing pipelines – in light of the known risks of catastrophic consequences identified in the Draft Report, and the known disruption that trenching or tunneling would cause – are private uses that would unquestionably interfere with public rights in that iconic resource. The Draft Report identifies no Michigan-based interests that would purport to justify such interference.

⁷ The State would not be subject to a claim for compensation under the Takings Clause if it revoked the Straits easement in absence of a violation. *See, e.g., Hilt v. Weber*, 252 Mich. 198, 225 (1930) (where private property rights are withdrawn by a state for public use, “compensation must be made, unless the use has a real and substantial relation to a paramount trust purpose.” (citing *Illinois Central*) (emphasis added)).

⁸ Public statement made on July 14, 2015. Available online at <http://www.michigan.gov/ag/0,4534,7-164-46849-359349--,00.html>. Last visited July 30, 2017.

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Tribal Treaty Rights and the Supremacy Clause

- As discussed above, the Tribes have well-established treaty rights to fish, hunt, and gather in the lands and waters surrounding the Straits of Mackinac, and the vitality of those rights depends on the health and quality of those resources. The ever-present risk of a spill from the Straits Pipelines, and the destruction that would be caused by the tunneling or trenching alternatives, pose unacceptable threats to those rights.
- Similar to its obligations under the public trust doctrine to treat certain natural resources as “paramount” and to protect them against impairment, the State is firmly bound under the Supremacy Clause of the United States Constitution, art. VI, cl. 2, to honor the Tribes’ treaty rights and to refrain from impairing, or from permitting the impairment of, the resources to which those rights attach. “[A] treaty made under the authority of the United States becomes the supreme law of the land . . . [and] maintains the same status as a federal statute[.]” *United States v. Michigan*, 471 F. Supp. at 217. *See also Menominee Tribe of Indians v. United States*, 391 U.S. 404, 411 n.12 (1968) (stating that treaties are “the supreme law of the land” and that rights “guaranteed to the tribe by the Federal Government [are not] subject” to abrogation by a state (internal quotation marks omitted)). That States may not act in derogation of rights guaranteed by Indian treaties is accordingly a “fundamental principle of federal constitutional law,” 471 F. Supp. at 265, and it is one that the State of Michigan has respected for decades.
- In the case of the Straits Pipelines, the State’s paramount public trust obligations and its constitutional duty to refrain from impairing the Tribes’ treaty rights are firmly aligned, and both point to decommissioning the Pipelines. Indeed, the State and the Tribes have cooperated extensively in recent years in efforts to protect and enhance the fish, game, and plant-based resources on which Tribal members and Michigan’s non-Indian citizens alike depend for subsistence, commercial, recreational, and cultural purposes. Their shared recognition of the incomparable value of such resources should underpin the decisions made by the State about the future of the Straits Pipelines.

* * *

The State of Michigan – with wisdom and courage commensurate with its paramount public trust and treaty obligations and its history of environmental leadership – should decommission the Straits Pipelines. When the State determines to do so, the Tribes and their members will stand shoulder-to-shoulder with the State and our non-Indian neighbors in defense of our shared legacy.

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cc: David Nyberg, Tribal Liaison, Governor's Marquette Office
Matthew Goddard, Energy Liaison, MDEQ
Teresa Seidel, MDEQ
S. Peter Manning, MDAG
Robert Reichel, MDAG
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EXHIBIT BMC-4



Bay Mills Indian Community

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(906) 248-3241 Fax-(906) 248-3283



Dear Governor Snyder,

I am writing on behalf of the Bay Mills Indian Community ("Bay Mills") regarding the State of Michigan's recent agreement with Enbridge Energy, LLP ("Enbridge") regarding the operation of the Line 5 Pipeline beneath the Straits of Mackinac.

Bay Mills is concerned about the process used to reach this agreement, its potential to allow the Line 5 Pipeline to continue to operate beneath the Straits of Mackinac, and the risks it poses for our Tribe's right to fish in the Great Lakes under the 1836 Treaty of Washington.

Background

Bay Mills is one of the signatories to the 1836 Treaty of Washington, which ceded territory to the United States for the creation of the State of Michigan. In exchange for the agreement to cede the territory to the United States, the Tribes reserved the right to hunt and fish throughout that territory – including in the Great Lakes (and the Straits of Mackinac).

In 1953, the State of Michigan granted an easement to the Lakehead Pipe Line Company to operate an oil and gas pipeline beneath the Straits of Mackinac. To the best of our knowledge, neither the Bay Mills Indian Community nor any other signatory to the 1836 Treaty of Washington was consulted about the decision to allow the pipeline to be constructed on the lakebed beneath the Straits. Enbridge has acquired ownership of that pipeline, which may include interest in the easement beneath the Straits.

In 1971, Michigan conservation officers cited Bay Mills tribal member Albert "Abe" LeBlanc for violating state fishing regulations. Several years later, in 1976, the Michigan Supreme Court held that Bay Mills, along with several other tribes, had retained the right to fish in the Great Lakes pursuant to the 1836 Treaty of Washington. The United States brought a lawsuit against the State of Michigan on behalf of the Tribes to enforce that treaty right; and, the United States District Court for the Western District of Michigan upheld the Tribes' treaty rights in a famous 1979 decision now known as the "Fox Decision."

In 1985, the State of Michigan and the signatory tribes to the 1836 Treaty entered into a consent judgment regarding management of the Great Lakes fishery. That agreement affirmed that the State and the Tribes must work together to protect the Tribes' treaty fishing rights and manage the Great Lakes fishery in a manner that respected tribal and state interests. The Tribes and the State have worked together to protect the Great Lakes ever since.

In 2000, the State and the Tribes negotiated a second iteration of the consent judgment, which was intended to last until August 2020. We have recently begun the work necessary to negotiate a new consent judgment in the ongoing litigation between the State and the Tribes under the Fox Decision.

In 2010, Enbridge's Line 6 pipeline ruptured in a tributary of the Kalamazoo River, causing more than 1.2 million gallons of oil to spill into Michigan's waterways. It was the largest on-shore oil spill in the history of the United States. Since that time, Enbridge has been subjected to closer scrutiny of its pipelines - including the Line 5 Pipeline beneath the Straits of Mackinac. That increased scrutiny has revealed a number of serious safety concerns with the Line 5 Pipeline, which include concerns about Enbridge's safety record and practice of failing to disclose important information.

Discussion

There is no doubt that Bay Mills, along with several other tribes, has a protected legal interest in the fishery resource in the upper Great Lakes - including in the waters of the Straits of Mackinac under the 1836 Treaty of Washington. Bay Mills has worked cooperatively with the State to manage the Great Lakes fishery for the past thirty years. Bay Mills, the Chippewa Ottawa Resource Authority, and the other tribal parties to the 1836 Treaty have expressed grave concerns about the continued operation of the Line 5 Pipeline beneath the Straits of Mackinac; and, we have offered to work with the State to find ways to address those concerns.

With this long history of a cooperative relationship, we were disappointed to learn that the State had worked to come to terms with Enbridge that allow them to resolve this matter without further consultation with Bay Mills or any of the other tribes that have demonstrated an interest in this issue.

Neither Bay Mills nor any of the other 1836 Treaty Tribes were aware that the State was negotiating an agreement with Enbridge regarding the Line 5 Pipeline, despite the State's assurances that it would consult with the Tribes regarding the future of the Line 5 Pipeline. The State's new agreement with Enbridge goes so far as to assert that it is intended to protect tribal interests:

WHEREAS, the State and Enbridge recognize that the Straits Crossing and the St. Clair River Crossing are located in the Great Lakes and connecting waters that include and are in proximity to unique ecological and natural resources that are of vital significance to the State and its residents, ***to tribal governments and their members***, to public water supplies, and to the regional economy.... (emphasis added)

Despite the acknowledgment that Enbridge's Line 5 Pipeline affects "resources that are of vital significance...to tribal governments and their members," tribal governments were not made aware of the negotiations, or provided with an opportunity to help craft its terms.

Bay Mills, along with its fellow treaty tribes, continues to urge for the decommissioning of the Line 5 Pipeline beneath the Straits. Nevertheless, our position does not mean that we intend to cede our interest (and legal right) in ensuring that the operation of the Line 5 Pipeline does not destroy resources that are so fundamental to our culture and economy.

Bay Mills relies heavily upon commercial fishing and tourism to support our local economy. Our treaty fishery accounts for 100 direct and indirect jobs. Our tribally-licensed fishermen supply markets across northern Michigan; they also purchase fuel, goods, and services from small businesses across the region. Our continued livelihood depends upon successful cooperative management of the Great Lakes with the State of Michigan. The State's recent agreement with Enbridge does not embody cooperative management.

Moreover, our regional economy is heavily dependent upon tourism and outdoor recreation. A rupture of the Line 5 Pipeline, whether beneath the Straits or at other locations in our treaty-ceded territory, would be catastrophic – causing lasting damage to natural resources that drive our regional economy. In addition, a spill (and corresponding cleanup and repair work) could affect areas that have significant cultural and religious value.

Conclusion

Bay Mills does not concede that the Governor had the legal authority to enter into this agreement with Enbridge. Nevertheless, we want to continue to work together to find a solution to our concerns. To that end, Bay Mills is urging the State to take the following steps to acknowledge and protect tribal treaty rights.

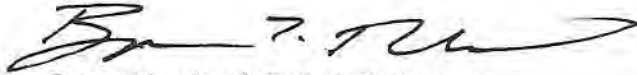
1. Meet directly with the 1836 Treaty Tribes to explain how the State's November 27, 2017 Agreement with Enbridge affects cooperative management of the Great Lakes fishery under the 1836 Treaty of Washington;
2. Modify the November 27, 2017 Agreement with Enbridge to ensure that the 1836 Treaty Tribes have the ability to receive and review safety information supplied by Enbridge, and to participate in the enforcement of the Agreement; and,
3. Modify the November 27, 2017 Agreement to acknowledge (a) the existing consent decree between the State of Michigan and the 1836 Treaty Tribes, and (b) the State's paramount obligation to abide by that decree, and the treaty rights recognized therein, in any State decisions and enforcement related to the Line 5 Pipeline.

If the State is unable or unwilling to modify its November 27, 2017 Agreement with Enbridge, I am requesting that the State enter into a separate agreement with the 1836 Treaty Tribes to ensure that the 1836 Treaty Tribes have the ability to receive and review safety information supplied by Enbridge relative to the Line 5 Pipeline's operation within the ceded territory. Bay Mills also wants to ensure that all State decisions related to the Line 5 Pipeline are formulated and implemented in a manner that protects our legal

interests, which include both treaty and cultural rights, and that for so long as it remains in place, the Pipeline is operated and maintained in such a way as to safeguard those rights to the maximum extent possible.

Bay Mills has enjoyed a positive relationship with the State over the years, even when seeking to resolve areas of disagreement. I sincerely hope that will be the case here. Thank you for your consideration, and I look forward to your response.

Sincerely,

A handwritten signature in black ink, appearing to read "Bryan Newland", written in a cursive style.

Bryan Newland, Tribal Chairman
Bay Mills Indian Community

Cc: Grand Traverse Band of Ottawa and Chippewa Indians
Little River Band of Ottawa Indians
Little Traverse Bay Bands of Odawa Indians
Sault Ste. Marie Tribe of Chippewa Indians

EXHIBIT BMC-5



Bay Mills Indian Community

12140 West Lakeshore Drive
Brimley, Michigan 49715
(906) 248-3241 Fax-(906) 248-3283



May 10, 2019

Hon. Gretchen Whitmer, Governor
State of Michigan
George W. Romney Building
111 South Capitol Avenue
Lansing, Michigan 48909

Re: Operation and Future of Enbridge's Line 5 Pipeline

Dear Governor Whitmer:

I am writing on behalf of the Bay Mills Indian Community to transmit its response to your solicitation of tribal comments and views on the present and future operation of Enbridge's Line 5 within the State of Michigan.

I am grateful that your Administration has pledged to consult with Bay Mills, and other sovereign tribal nations, on a government-to-government basis on the development of the State of Michigan's approach to dealing with the Line 5 Pipeline. As a sovereign government with responsibility for managing and protecting the Great Lakes, the Tribe believes that a government-to-government approach is important to develop policies that account for our respective sovereign interests.

The Tribe's positions, comments, questions and recommendations are attached to this letter. In addition, you are invited to visit the Straits of Mackinac with representatives of Bay Mills and other Tribes to observe, first hand, its importance to our way of life.

Bay Mills has enjoyed a positive relationship with the State over the years, even when seeking to resolve areas of disagreement. I sincerely hope that will be the case here. I am grateful for your invitation to provide our views, and am hopeful that this process will be more respectful of our sovereign interests than previous actions related to Line 5. We look forward to your response.

Sincerely,

Bryan T. Newland
Bryan T. Newland
President, Executive Council

BTN/kt

cc: CORA Member Tribes
Katie Otanez, USACE Detroit Office
Regional Administrator, Environmental Protection Agency
Steven Willey, U.S. Department of Justice

cc: Tara Sweeney, Assistant Secretary of Interior--Indian Affairs
Patrick Nelson, Cmdr. Sector Sault, U.S. Coast Guard

I. Position of the Bay Mills Indian Community on Continued Operation of Line 5 in the State of Michigan

Bay Mills Indian Community has serious concerns regarding the safety of continued operation of the Line 5 Pipeline in the Straits of Mackinac and on/near other bodies of water in our treaty-ceded territory. We believe that it is in the best interest of Bay Mills, the people of Michigan, and the United States, to decommission the Line 5 Pipeline and establish an alternative means for Enbridge to transport its oil from western Canada to Sarnia, Ontario.

II. Cultural Significance of Straits of Mackinac to the Great Lakes

Every culture and religion in the world shares the story of the Great Flood. In Ojibwe oral traditions and cultures, the creation of North America also begins with a flooded Earth.

According to our oral histories, the animals that survived the flood received instructions from the Creator to swim deep beneath the water and collect soil that would be used to recreate the world. One by one the animals tried, but one by one they failed. The muskrat, as the last animal that tried, dove underneath the water and did not emerge. When the muskrat's body resurfaced, it carried a small handful of wet soil in its paws. The journey took the muskrat's life, but with its sacrifice the Creator used the soil collected and rubbed it on the Great Turtle's back. This land became known as Turtle Island, the center of creation for all of North America.

For the Ojibwe, the Great Turtle emerged from the flood in the Straits of Mackinac. Because the creation of North America took place in the Great Lakes, the Great Lakes are considered the heart of Turtle Island and as such - the heart of North America. The State of Michigan shares this history with the Ojibwe as well, and there are still signs of it in modern times. Mackinac City, Mackinac Island, Fort Michilimackinac, and the Straits of Mackinac were all named and established because of this shared history together.

In the Ojibwe language, "michi" is an old dialect for "gichi, which means "great." The Ojibwe word for water is "nibi," which is an inanimate word that shows no signs of life or movement. However, the word for the Great Lakes are "gichi gumee." Only things that are alive and have a spirit are assigned the word "gichi" or "michi." In addition, the Ojibwe word for turtle is "miikinaak." By combining these words together, you learn that Michlimackinac, and the word Mackinac are all derivations of the original name of the Great Turtle from the Ojibwe story of Creation.

In sharing these teachings, Bay Mills Indian Community emphasizes the cultural, traditional, spiritual, and historical significance of the Great Lakes to the Tribes and to the State of Michigan itself. Since time immemorial, the Great Lakes have been an integral part to Bay Mills' way of life, and they will continue to be an integral part of culture and traditions for many generations to come. By failing to consider the cultural significance of the Great Lakes to Bay Mills, and the dangers the Line 5 Pipeline poses to treaty-fishing rights, culture, and traditions of the Ojibwe - the State of Michigan risks killing the heart of North America, the heart of Turtle Island.

III. Historical Background

A. The Treaty of Washington (7 Stat. 491)

Bay Mills is one of the signatories to the 1836 Treaty of Washington, which ceded territory to the United States for the creation of the State of Michigan. In exchange for the agreement to cede the territory to the United States, the Tribes reserved the right to hunt and fish throughout that territory – including in the Great Lakes (and the Straits of Mackinac).

In 1953, the State of Michigan granted an easement to the Lakehead Pipe Line Company to operate an oil and gas pipeline beneath the Straits of Mackinac. To the best of our knowledge, neither the Bay Mills Indian Community nor any other signatory to the 1836 Treaty of Washington was consulted about the decision to allow the pipeline to be constructed on the lakebed beneath the Straits. Enbridge has acquired ownership of that pipeline, which may include interest in the easement beneath the Straits.

In 1971, Michigan conservation officers cited Bay Mills tribal member Albert “Abe” LeBlanc for violating state fishing regulations. Several years later, in 1976, the Michigan Supreme Court held that Bay Mills, along with several other tribes, had retained the right to fish in the Great Lakes pursuant to the 1836 Treaty of Washington. The United States brought a lawsuit against the State of Michigan on behalf of the Tribes to enforce that treaty right; and, the United States District Court for the Western District of Michigan upheld the Tribes’ treaty rights in a famous 1979 decision now known as the “Fox Decision.”

In 1985, the State of Michigan and the signatory tribes to the 1836 Treaty entered into a consent judgment regarding management of the Great Lakes fishery. That agreement affirmed that the State and the Tribes must work together to protect the Tribes’ treaty fishing rights and manage the Great Lakes fishery in a manner that respected tribal and state interests. The Tribes and the State have worked together to protect the Great Lakes ever since.

In 2000, the State and the Tribes negotiated a second iteration of the consent judgment, which was intended to last until August 2020. We have recently begun the work necessary to negotiate a new consent judgment in the ongoing litigation between the State and the Tribes under the Fox Decision.

B. Timeline of Events Related to Tribal Interest in Line 5 Pipeline Operations

It is important to place our concerns in context of interactions that have taken place between tribes, federal agencies, state agencies, and Enbridge in recent years. Therefore, we have set forth a recitation of some of those key events:

July 2010 – Enbridge’s Line 6B ruptures near Marshall, and spilled 800,000 gallons of oil into a tributary of the Kalamazoo River. The cost of the cleanup for this incident has exceeded \$1 Billion.

July 2016 – The United States Department of Justice and Environmental Protection Agency files a lawsuit against Enbridge for environmental harm resulting from the Line 6B oil spill, and published notice of a draft Consent Decree with Enbridge. Without any prior notice to any of the tribes in Michigan, the draft Consent Decree included provisions relating to Enbridge's Line 5 crossing at the Straits of Mackinac (mandating that Enbridge take certain actions).

August 3, 2016 – The State of Michigan issues a letter to Enbridge notifying them of violating the 1953 Easement due to unsupported spans of Line 5 exceeding 75 feet. Exactly two months later, DEQ issues permit to Enbridge for the installation of four screw anchors on the Line 5 Pipeline crossing in the Straits of Mackinac. Prior to this date, the State had never notified Bay Mills of Enbridge's anchor construction activities in the Straits of Mackinac.

November 27, 2017 – Michigan Governor Rick Snyder signs an agreement between the State of Michigan and Enbridge setting forth some interim requirements for the operation of the Line 5 Pipeline in the Straits of Mackinac, and contemplating a replacement for the span beneath the Straits. While the agreement states that Enbridge's Line 5 Pipeline impacted tribal interests, neither the Governor nor any Michigan agency notified Bay Mills that it was negotiating an agreement with Enbridge.

March 2018 – Bay Mills participates in a meeting with leadership from the MDNR and MDEQ in Lansing to discuss the State's ongoing efforts relating to the Line 5 Pipeline. The Director of the MDNR rejects a request from Bay Mills to amend the November 2017 agreement with Enbridge to make Tribes a party to that agreement; or, to enter into an agreement with Tribes to provide information relating to the safety of the Line 5 Pipeline. In rejecting our request, the Director of the MDNR told Bay Mills representatives to, "get your own agreement with Enbridge."

April 1, 2018 – Enbridge's Line 5 pipeline is damaged by an anchor drag/strike from a commercial vessel in the Straits of Mackinac. That same incident caused damage to electrical cables along the bottom of the Straits owned by American Transmission Company, resulting in several hundred gallons of toxic chemicals spilling into the water. Due to adverse weather conditions, federal and state agencies were unable to assess the scope of the chemical spill for several days.

April 2018 – Bay Mills, and other tribes, become aware that the U.S. Department of Justice is negotiating an amendment to its 2016 settlement agreement with Enbridge regarding the Line 5 Pipeline. Federal agencies did not provide Bay Mills, or other tribes, with notice of these negotiations until they were substantially completed.

May 15, 2018 – Bay Mills hosts representatives from Enbridge and the 1836 Treaty Tribes for a discussion about a potential agreement relating to information-sharing

about the Line 5 Pipeline. Enbridge refuses to provide the Tribes with the same information it provides to the State of Michigan relating to the condition of the pipeline.

June 28, 2018 – Bay Mills participates in a consultation with the U.S. Army Corps of Engineers regarding Enbridge's application for the installation of several dozen anchor supports along the Line 5 Pipeline. The U.S. Army Corps indicates that it will perform an Environmental Assessment of Enbridge's application, instead of granting the permit under a nationwide permit (pursuant to previous practice). This is the first time Enbridge's applications relating to the Line 5 Pipeline have been subjected to scrutiny under the National Environmental Policy Act.

August 7, 2018 – Bay Mills participates in a consultation with the U.S. Department of Justice and Environmental Protection Agency in Traverse City, regarding proposed amendments to the 2016 consent decree. Attorneys with the U.S. Department of Justice informed tribal representatives that Enbridge was not in compliance with its easement with the State of Michigan. The DOJ and EPA filed the proposed amendments with the Court less than 24 hours after the meeting, and did not provide any substantive responses to tribal comments/concerns. Notably, the State of Michigan did not comment on the proposed amendments, despite ongoing negotiations with Enbridge.

October 3, 2018 – Michigan Governor Rick Snyder enters into a second agreement with Enbridge regarding the continued operation of the Line 5 Pipeline in the Straits of Mackinac. Among other things, the new agreement requires Enbridge to take immediate steps to repair/improve the Line 5 Pipeline at two different water crossings in the Upper Peninsula. Tribes were not provided any opportunity to participate in the State's negotiations, or otherwise comment on the State's proposals. Tribes were not provided any prior notice that the two water crossings referenced in this agreement were matters of concern, despite prior requests to the State to receive information regarding the condition of Enbridge's Line 5 Pipeline.

November 2018 – Michigan's Legislature introduces and immediately moves legislation authorizing the construction of a multi-utility tunnel beneath the Straits of Mackinac, and establishing an independent government body to regulate that tunnel. Michigan Governor Rick Snyder signs the legislation into law and immediately appoints members to the governmental body. Bay Mills, and other tribes, were not consulted during this process. In response to Bay Mills' request for government-to-government consultation, the Director of the MDNR responds that, "we don't need to consult with you because we already know your position."

December 2018 – Outside Legal Counsel for Michigan's Governor engages in discussions with representatives for several tribes regarding an intergovernmental agreement that provides for joint tribal-state participation in monitoring and improving the condition of the Line 5 Pipeline at other water crossings in the State

of Michigan. The discussions expire at the conclusion of the Michigan Governor's term on December 31, 2018.

March 28, 2019 – Michigan's Attorney General issues a formal opinion stating that the 2018 legislation authorizing a multi-utility tunnel beneath the Straits of Mackinac and establishing an independent governing body for its oversight is unconstitutional.

April 30, 2019 – The Vice-President for American Transmission Company issues a letter to the Executive Director of the Chippewa Ottawa Resource Authority stating that a multi-utility tunnel beneath the Straits of Mackinac may not be feasible. The letter also states, "ATC does not believe that installing high voltage electric lines in close proximity to high pressure oil or gas lines is a good idea."

May 3, 2019 – Representatives from several state agencies participate in a formal government-to-government consultation with tribal representatives in Mackinaw City regarding the State of Michigan's approach to Enbridge's Line 5 Pipeline.

As this timeline of events shows, Bay Mills (and other tribes) have been consistently and repeatedly excluded from any governmental process relating to Enbridge's Line 5 Pipeline, despite repeated requests to participate; and, despite our treaty-protected interest in the Straits of Mackinac.

In a number of instances, the State (and federal) government ignored tribal questions on matters that came to public light later – such as the condition of other water crossings for the Line 5 Pipeline, and the feasibility of a multi-utility tunnel beneath the Straits of Mackinac.

IV. Questions and Concerns of the Bay Mills Indian Community Regarding Line 5

The State of Michigan is considering taking actions to allow Enbridge to take further steps to stabilize the Line 5 dual pipelines in the Straits of Mackinac, to improve Line 5 water crossings of other water bodies in Michigan, and to construct a multi-utility tunnel beneath the Straits of Mackinac. All of these actions would occur within our treaty-ceded territory, where we manage natural resources in coordination with the State of Michigan and the United States under a series of judicially-binding consent decrees in the case of *United States v. Michigan*.

At present, we lack important information that would allow us to protect our interests, and provide the State with valuable insights that can inform its decision-making process. We have requested much of this information from the State in the past, without receiving substantive responses. We have set forth our outstanding questions below, along with additional questions for the State. The Tribe respectfully requests a formal and substantive response to these questions within 45 days:

1. *Does Enbridge shut down (vacate and depressurize) the Line 5 Pipeline beneath the Straits of Mackinac during maintenance activities?*

Enbridge has clearly demonstrated that completing maintenance activities on the Straits segment of Line 5 can result in damage to the Line. For the protection of our Great Lakes resources, Bay Mills requests that the State make this a conditional requirement to any additional permits being administered for maintenance on the Line 5 Pipeline.

2. *How did the State determine the 8-foot wave height threshold for “adverse weather conditions” in its November 27, 2017 agreement with Enbridge, Inc.?*

The November 27, 2017 agreement between the State of Michigan and Enbridge, Inc. establishes an 8-foot wave height threshold for the occurrence of “adverse weather conditions,” during which Enbridge, Inc. must shut down the Line 5 Pipeline beneath the Straits of Mackinac. Federal agencies, including the Coast Guard have indicated that they were not formally consulted by the State of Michigan in developing this standard, and have indicated to Tribes that they may not be able to respond to an oil spill when wave heights exceed four feet.

3. *Does the State of Michigan have a plan in place for response to an oil spill in the Straits of Mackinac? Does the State of Michigan have any agreements in place with federal, tribal, or local governmental agencies to respond to an oil spill in the Straits of Mackinac?*

At present, Enbridge does not have a federally-approved spill response plan for the Line 5 Pipeline. In posing this question to State agencies in the past, officials have indicated that federal, state, and local agencies would respond to a spill pursuant to intergovernmental agreements. But, the State has not provided copies of any such agreements. To our knowledge, there are no intergovernmental agreements in place that address a response to an oil spill in the Straits of Mackinac.

4. *Given recent events with American Transmission Company’s spill in the Straits, is the State confident that it (or any responding agency) can sufficiently protect our resources in the Straits by responding to a spill during ice cover?*

5. *Does the State of Michigan know how many times the Line 5 Pipeline has been struck or damaged by a vessel anchor? If so, can the State of Michigan please provide Bay Mills with records of those incidents?*

In 2018, a vessel anchor struck and damaged the Line 5 Pipeline in the same incident in which a vessel anchor damaged American Transmission Company's electric transmission lines. Enbridge self-reported the anchor strike, but has not provided the public with any information on previous anchor strikes on the Line 5 Pipeline.

6. *Does the State of Michigan have a mechanism in place for Enbridge to report damage to the Line 5 Pipeline that occurs due to maintenance and/or construction activities? How many times has Enbridge's maintenance and/or construction activities caused damage to the Line 5 Pipeline in the Straits of Mackinac and at other water crossings?*
7. *In light of the American Transmission Company's April 30, 2018 letter to the Chippewa Ottawa Resource Authority, does the State of Michigan believe that it is safe to place high-voltage power lines in close proximity to high-pressure oil pipelines in an enclosed tunnel beneath the Straits of Mackinac? Does American Transmission Company's recent letter change or alter the State's views on whether such a tunnel is technically and economically feasible?*
8. *Has the State of Michigan identified any other Line 5 Pipeline water crossings that are of immediate concern, beyond those specified in the October 3, 2018 agreement between the State and Enbridge?*
9. *Does the installation of additional screw anchors on the Line 5 Pipeline in the Straits of Mackinac increase the risk of an anchor-strike or anchor-"hook"?*
10. *Does the State view the lack of a federally-approved response plan as required by the Oil Pollution Act of 1990, a violation of the 1953 Easement with the State of Michigan.*
11. *Given that the coal tar coating of Line 5 is known to be highly toxic, has any data been collected on the presence of contaminants in sediments surrounding Line 5?*

We asked this question in our July 31, 2017 letter to the State of Michigan regarding Enbridge's permit application for 22 anchor supports. The same question was asked of the United States Army Corps of Engineers in letters dated July 31, 2017 and December 19, 2017. To date we have not received a substantive response from any agency.

12. *If a spill in the Straits were to happen today, what current baseline data on the aquatic resources of the Straits does the State have that would inform the Natural Resources Damage Assessment process?*

V. Bay Mills Indian Community Requests and Recommendations to the Governor

In addition to the questions above, Bay Mills Indian Community requests that the State of Michigan take the following steps to protect our shared sovereign interests in the waters of the Great Lakes:

- 1. Immediately halt or suspend any consideration of further permits related to the Line 5 Pipeline until Enbridge has received federal approval for its spill response plan.**

Enbridge (belatedly) disclosed that its earlier construction activities have damaged the Line 5 Pipeline beneath the Straits. Construction of several dozen new anchor supports increases the potential for a pipeline rupture and oil spill. It would be reckless to allow Enbridge to conduct activities that place the Great Lakes at risk of an oil spill without having an approved spill-response plan in place.

- 2. Execute intergovernmental agreements with federal, tribal, and state agencies for pipeline monitoring and response to an oil spill in the Straits of Mackinac or other bodies of water within the State of Michigan.**
- 3. Resume negotiations with tribal governments regarding the integrity of the Line 5 Pipeline at other water crossings within the State of Michigan.**
- 4. Reach a determination that the installation of anchor supports along the Line 5 Pipeline in the Straits of Mackinac do not increase the risk of a structural failure in the pipeline or an anchor strike prior to issuing any permit for installation of such supports.**
- 5. Undertake a comprehensive risk analysis by independent experts of decommissioning the Straits segment of Line 5, and with the alternative scenarios limited to the continued operation of the existing infrastructure.**
- 6. Include Bay Mills (and other 1836 Treaty tribes) in any negotiations with Enbridge and/or government agencies regarding the potential for a tunnel beneath the Straits of Mackinac.**
- 7. Include Bay Mills (and other Treaty Tribes) in any discussions with Enbridge and/or government agencies regarding the condition of inland portions of Line 5, especially at water-crossings and sensitive habitats.**

The Bay Mills Indian Community is a sovereign Indian tribe with governmental interests. Enbridge is not; it is a private, for-profit company. The Bay Mills Indian Community has rights to the waters of the upper Great Lakes that are expressly reserved through a treaty with the United States. Enbridge does not. The Bay Mills

Indian Community is party to litigation with the State of Michigan and the United States concerning the protection and exercise of those rights. Enbridge is not.

Therefore, it is wholly inappropriate for the Bay Mills Indian Community to be excluded from any agreement concerning the impacts of the Line 5 Pipeline on our treaty-reserved rights.

Conclusion

The Bay Mills Indian Community is appreciative of the opportunity to express its concerns and recommendations to the Governor in this extremely important matter.

EXHIBIT BMC-6

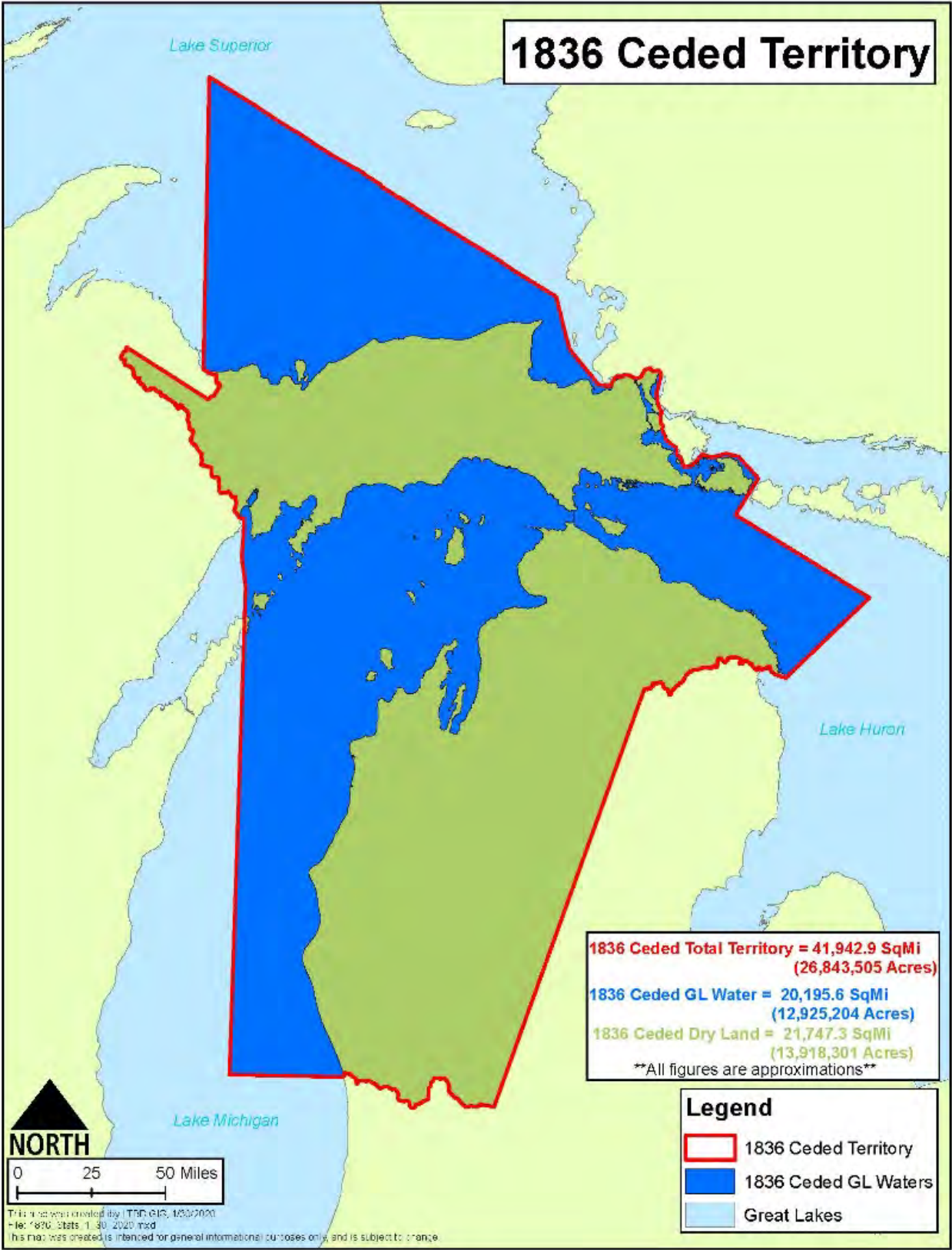


EXHIBIT BMC-7

R-9120-1
APPEARANCE TICKET
STATE OF MICHIGAN
County of Chippewa
☐ City ☐ Village ☒ Township
of Bay Mills
In the 91 District Court of the City of Sault Ste Marie
Michigan, the undersigned complainant, upon his oath, deposes and says:
that on the 28 day of Sept, 1921, at 12:05 ^{a.m.} p.m.
Defendant's Name Albert E. LeBlanc
Residence Bay Mills Cr. Box 170 A
Brimley, Michigan
Eyes _____ Ht. _____ Wt. _____ Sex _____ Race _____ D.O.B. May 16, 1924
Oper's. License

--	--	--	--	--

 State _____
Soc. Security No.

--	--	--	--	--

DID UNLAWFULLY IN THE CITY, VILLAGE, TOWNSHIP AND COUNTY
AFORESAID THEN AND THERE COMMIT THE FOLLOWING OFFENSE:
Fish 4 1/2" Pig flesh in closed
waters
In that said Defendant at the time and place aforesaid did
Fish 500 to 600 ft of Gill Net
4 1/2" flesh in L. Superior Spring
1 1/2 miles east of Bay Mills Cr.
In violation of Sec. 1, Chapter 284, P.A. 1929,
as amended, of State Law.
You are notified that the officer or other complainant whose name
appears below will file a sworn complaint in the court charging you
with the offense set forth above.
NOTICE: Read the back of this ticket. BRING THIS COPY WITH YOU.
TO: Albert E. LeBlanc:
You are hereby notified to appear before J. Lambros
of the 91 District Court at Sault
Ste Marie Michigan, on the 29 day of Sept,
1921, at 10 ^{a.m.} p.m. to answer to a complaint to be filed in said court
charging you with the offense designated above.
Wm. L. Andrews
SIGNATURE OF ISSUING OFFICER OR OTHER COMPLAINANT

STATE OF MICHIGAN
BEFORE THE MICHIGAN PUBLIC SERVICE COMMISSION

In the matter of the Application of Enbridge Energy, Limited Partnership for the Authority to Replace and Relocate the Segment of Line 5 Crossing the Straits of Mackinac into a Tunnel Beneath the Straits of Mackinac, if Approval is Required Pursuant to 1929 PA 16; MCL 483.1 et seq. and Rule 447 of the Michigan Public Service Commission's Rules of Practice and Procedure, R 792.10447, or the Grant of other Appropriate Relief

U-20763

ALJ Dennis Mack

PROOF OF SERVICE

On September 14, 2021, an electronic copy of *Direct Testimony of Jacques LeBlanc Jr. on behalf of Bay Mills Indian Community* was served on the following parties:

Name/Party	E-Mail Address
Administrative Law Judge Hon. Dennis W. Mack	Mackd2@michigan.gov
Counsel for Enbridge Energy, Limited Partnership Michael S. Ashton Shaina Reed Jennifer Utter Heston	mashton@fraserlawfirm.com sreed@fraserlawfirm.com jheston@fraserlawfirm.com
Counsel for MPSC Staff Spencer A. Sattler Benjamin J. Holwerda Nicholas Q. Taylor	sattlers@michigan.gov holwerdab@michigan.gov taylorn10@michigan.gov
Counsel for Attorney General Robert P. Reichel	Reichelb@michigan.gov

Counsel for Michigan Environmental Council, and National Wildlife Federation Christopher M. Bzdok Lydia Barbash-Riley	chris@envlaw.com lydia@envlaw.com
Counsel for Grand Traverse Band of Ottawa and Chippewa Indians William Rastetter Christopher M. Bzdok Lydia Barbash-Riley	bill@envlaw.com chris@envlaw.com lydia@envlaw.com
Counsel for Environmental Law & Policy Center Margrethe Kearney Esosa Aimufua Kiana Courtney Howard Learner	mkearney@elpc.org eaimufua@elpc.org kcourtney@elpc.org hlearner@elpc.org
For Love Of Water James Olson	jim@flowforwater.org
Counsel for Bay Mills Indian Community Christopher M. Bzdok Kathryn Tierney Debbie Musiker Chizewer Christopher Clark David Gover Matt Campbell Mary Rock Megan Condon Adam Ratchenski	chris@envlaw.com candyt@bmic.net dchizewer@earthjustice.org cclark@earthjustice.org dgover@narf.org mcampbell@narf.org mrock@earthjustice.org mcondon@narf.org aratchenski@earthjustice.org
Counsel for Tip of the Mitt Watershed Council Christopher M. Bzdok Lydia Barbash-Riley Abigail Hawley	chris@envlaw.com lydia@envlaw.com abbie@envlaw.com
Counsel for Makinac Straits Corridor Authority Raymond O. Howd Leah J. Brooks	howdr@michigan.gov brooks16@michigan.gov

Michigan Propane Gas Association (MPGA) Paul D. Bratt Daniel P. Ettinger Troy M. Cummings Margaret C. Stalker	pbratt@wnj.com dettinger@wnj.com tcummings@wnj.com mstalker@wnj.com
Michigan Laborers' District Stuart M. Israel Christopher P. Legghio Lauren Crummel	israel@legghioisrael.com cpl@legghioisrael.com crummel@legghioisrael.com
Nottawaseppi Huron Band of Potawatomi Indians Amy L. Wesaw John S. Swimmer	Amy.wesaw@nhbp-nsn.gov John.swimmer@nhbp-nsn.gov
Little Traverse Bay Bands of Odawa Indians James A. Bransky	jbransky@chartermi.net

Date: September 14, 2021

By: Christopher R. Clark
Christopher R. Clark
cclark@earthjustice.org



September 14, 2021

Via E-filing

Ms. Lisa Felice
Michigan Public Service Commission
7109 W. Saginaw Hwy.
P. O. Box 30221
Lansing, MI 48909

RE: MPSC Case No. U-20763

Dear Ms. Felice:

The following are attached for paperless electronic filing:

- Direct Testimony and Exhibits of Dr. Inés Ibáñez on behalf of Bay Mills Indian Community
- Proof of Service

Sincerely,

A handwritten signature in cursive script that reads "Christopher R. Clark".

Christopher R. Clark
cclark@earthjustice.org

STATE OF MICHIGAN
BEFORE THE MICHIGAN PUBLIC SERVICE COMMISSION

In the matter of the Application of Enbridge
Energy, Limited Partnership for Authority to U-20763
Replace and Relocate the Segment of Line 5
Crossing the Straits of Mackinac into a Tunnel ALJ Dennis Mack
Beneath the Straits of Mackinac, if Approval is
Required Pursuant to 1929 PA 16; MCL 483.1
et seq. and Rule 447 of the Michigan Public
Service Commission's Rules of Practice and
Procedure, R. 792.10447, or the Grant of other
Appropriate Relief

TESTIMONY OF DR. INÉS IBÁÑEZ

ON BEHALF OF

BAY MILLS INDIAN COMMUNITY

September 14, 2021

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I. INTRODUCTION & QUALIFICATIONS

Q. Please state for the record your name, job title, and business address.

A. My name is Inés Ibáñez. I am a Professor at the School for Environment and Sustainability, University of Michigan located at 440 Church St, Ann Arbor, MI 48109.

Q. On whose behalf is this testimony being offered?

A. I am testifying on behalf of Bay Mills Indian Community (BMC). This testimony contains my independent scientific opinion. It is being provided in my individual capacity and not on behalf of my employer.

Q. Please summarize your work experience and educational background.

A. I have worked for San Diego State University, Duke University, University of Connecticut, and University of Michigan. I completed my undergraduate studies at Universidad Complutense de Madrid. I completed my graduate studies at Utah State University (MS) and Duke University (PhD). My work experience is also summarized in my CV, provided as Exhibit BMC-10 (IBA-1).

Q. Please describe the focus of your academic research.

A. I am a forest ecologist. My research agenda focuses on the study of tree species responses to the complex environment that forest ecosystems will be encountering in the next few decades, including climate change. My research seeks to inform management decisions and optimize conservation, restoration, and sustainable practice efforts for a wide range of ecosystems. My priority focus areas are forest ecosystems of the Great Lakes region. In my research lab we study the main tree species (+12 species) naturally growing in the

1 region; this includes sugar maple, *Acer saccharum* Marsh. Across forests in Michigan's
2 Lower and Upper peninsulas, we collect observational data on seed production, seedling
3 establishment, growth, and survival, and sapling and adult trees spatial distribution, growth
4 and survival. We also perform experimental work, transplants, with tree seedlings,
5 including sugar maple. We used both observational and experimental data to model tree
6 responses to environmental conditions, e.g., temperature, soil moisture, drought, light,
7 nutrients, pollution, as well as responses to biotic factors, e.g., competition among
8 individuals, seed predation, herbivory, and pest and pathogen impacts. Model outputs are
9 aimed at forecasting forest responses to environmental change.

10 **Q. Have you testified before this Commission or as an expert in any other proceeding?**

11 A. I have not previously testified before this Commission or in any other proceeding.

12 **Q. What is the purpose of your testimony?**

13 A. I am testifying on behalf of BMC regarding tree species responses to climate change,
14 specifically performance of sugar maple (*Acer saccharum*). It is my understanding that the
15 Commission is considering evidence regarding the effects of climate change as it considers
16 the proposed project.

17 **Q. What information did you review in preparing your testimony in this case?**

18 A. In preparing my testimony in this case, I drew upon my education, research, and work
19 experience. I am familiar with the literature addressing the impacts of climate change on
20 sugar maple. In addition to my knowledge and experience, I also reviewed a number of
21 peer reviewed scientific publications. A scientific bibliography is attached as Exhibit
22 BMC-11 (IBA-2).

1 **Q. Are you sponsoring any exhibits?**

2 A. Yes, I am sponsoring the following exhibits:

3 Exhibit BMC-10 (IBA-1): CV of Inés Ibáñez

4 Exhibit BMC-11 (IBA-2): Scientific References

5 **II. THE EFFECTS OF CLIMATE CHANGE WILL NEGATIVELY IMPACT SUGAR**
6 **MAPLE.**

7 **Q. What species is the focus of your testimony?**

8 A. This testimony focuses on sugar maple (*Acer saccharum* Marsh.) which is a tree species
9 that lives in North American eastern forests. Sugar maple is important for high quality
10 timber, maple syrup production, high ornamental and scenic value, tribal practices, and the
11 forest ecosystem. Sugar maple provides ecosystem benefits such as high-quality browse
12 and seed production for wildlife, nesting habitat for birds, and high-quality litter (i.e.,
13 organic material such as fallen leaves and dead roots that contribute to the top layer of soil
14 and a more productive forest ecosystem). As a tree species dominant or codominant in
15 many North America eastern forests, it also contributes to the provision of numerous
16 ecosystem services, e.g., climate regulation, carbon sequestration, soil development, water
17 infiltration and purification, landslide protection, timber, and cultural and recreational
18 value.

19 **Q. What is the current distribution of sugar maple?**

20 A. Sugar maple is distributed across temperate forests in eastern North America. In the United
21 States, it grows from New England to the Southern Appalachians section in North Carolina
22 and Tennessee. Its southwestern distribution reaches Missouri and parts of Kansas, and its

central and northwestern limit runs along the eastern part of Iowa and Minnesota. Figure 1 shows the current distribution and abundance of sugar maple in the United States.

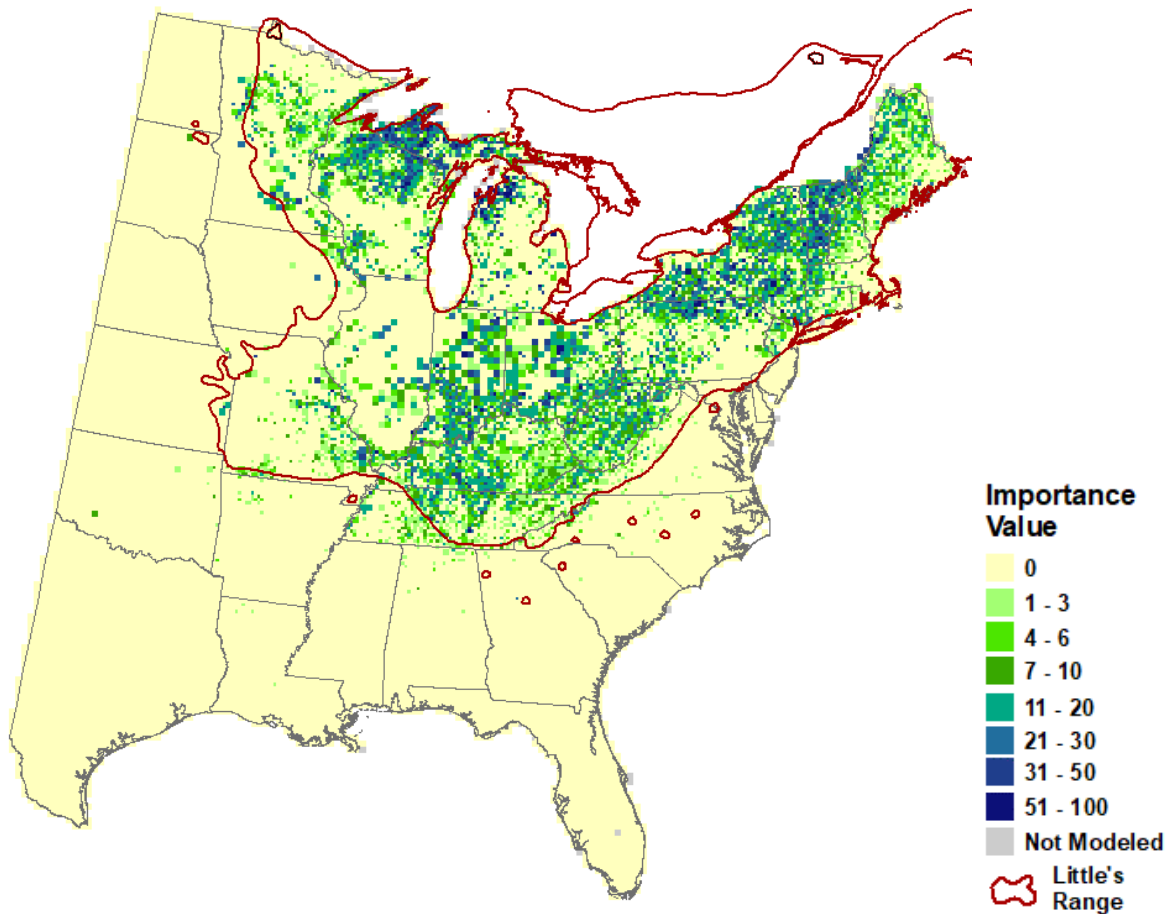


Figure 1: Current Forest Inventory and Analysis under Current Conditions. Source: Forest Service Tree Atlas Climate Change: <https://www.fs.fed.us/nrs/atlas/tree/>.

In Figure 1, the red outline (“Little’s Range”) shows the range of the sugar maple as it likely was before European settlement in North America. The “Importance Values” reflected in Figure 1 are measures of how dominant a species is in a given forest area. Importance value is a standard tool used by foresters to inventory a forest. A high importance value indicates that the species is well represented in the area.

1 As Figure 1 shows, sugar maples are very abundant in the northern part of their
2 distributional range, including in the Upper Peninsula.”

3 **Q. Please describe the typical habitat for sugar maple in the Michigan’s Upper**
4 **Peninsula/the Upper Great Lakes region.**

5 A. Sugar maple mostly grows in rich and moist (mesic) soils, from sand to clay textures. It
6 can also grow in drier soils if high precipitation compensates for lack of water holding
7 capacity of the soil, which is the case in Michigan’s Upper Peninsula. It is highly shade-
8 tolerant, very slow-growing, and long-lived.

9 **Q. Please describe the life cycle of sugar maple, including reproduction process.**

10 A. Sugar maples are slow growing and start flowering around 22 years old. Depending on the
11 local temperature, flowering takes place between mid-March to mid-May. Fruits develop
12 over a period of 16 weeks and disperse in the fall. Crops are light in younger, smaller trees
13 (40-60 year old trees), moderate in 70-100 year old trees, and very abundant in older trees.

14 Sugar maple trees reproduce through the synchronized massive production of seed – a
15 process known as mast – every 2 to 5 years. Sugar maple can also reproduce by growing
16 stump sprouts.

17 Seeds germinate after being exposed to cold, slightly above freezing, moist conditions for
18 35 to 90 days. The optimal temperature for germination is 34 °F (1 °C). Seedlings are very
19 shade tolerant and can survive many years under low light conditions, although survival at
20 this stage is low. Few seedlings survive to adulthood because seedlings are very susceptible
21 to desiccation (i.e., drying out), and this is the main cause of seedling mortality. Most of

1 their growth takes place in the spring. Saplings and adult trees are slow growing, reaching
2 300-400 years of age.

3 **Q. How do changes in temperature impact sugar maple?**

4 A. Sugar maple requires cold winters for proper dormancy, and cold springs for germination
5 (below 50 °F [10 °C]), as a result it is only dominant north of the 42nd parallel, USDA
6 growing zones 2-3. In the southern part of its range, USDA zone 6, it only grows in stands
7 that can keep moist soils during the summer. Sugar maple syrup production also requires
8 cold temperatures and only takes place in the northern part of its distributional range.

9 At its northern distributional range, growth and survival of sugar maple is constrained by
10 cold temperatures; thus, in this region, higher temperature is associated with higher
11 performance of this species. However, the beneficial effects of warmer temperatures only
12 take place if sufficient soil moisture is maintained.

13 Heat waves affect leaf shedding and photosynthetic rates. Sugar maple may lose 64% of
14 leaf area (leaf area index) and experience temporal depressed photosynthesis when exposed
15 to unusually high spring temperature.

16 The negative effect of increasing temperature, other than affecting dormancy and
17 germination, is that at higher temperatures there is an increase in water demand. Sugar
18 maple is very sensitive to drought conditions, especially during the early stages
19 (germinating seeds and seedlings), so if changes in precipitation do not compensate for the
20 increase in water demand at higher temperatures, its growth and survival will be negatively
21 affected.

1 **Q. How do changes in precipitation impact sugar maple?**

2 A. Sugar maple can only grow in soils that keep moist during the whole growing season. Sugar
3 maple is highly sensitive to drought conditions and shows reduced growth rates in years
4 with lower water availability. Increased precipitation during the winter and springs, as has
5 been forecasted, do not compensate for the effects of drought during the summer as this
6 species needs moist soils during the entire growing season. Under drought conditions, to
7 avoid losing water this species closes its stomate (i.e., leaf pores that allow the movement
8 of air in and out of the leaf; leaves need access to the air's carbon dioxide molecules to
9 perform photosynthesis). Closure of the stomate reduces the plant's photosynthetic
10 capacity affecting growth and maple syrup production (which depends on stored carbon).

11 **Q. What are the primary threats to sugar maple?**

12 A. Currently, the major threat to sugar maple is associated with climate change. Lack of snow
13 cover protection over the winter, a consequence of warmer temperatures, negatively affects
14 the roots. Roots freeze without the protecting snow layer. Increasing growing season
15 temperatures are associated with an increased risk of desiccation in seedlings and of growth
16 reduction in adults due to lack of sufficient moisture.

17 Other threats include pests, disease, and pollution. Different pests, i.e., bud miners,
18 defoliators, borers, scale, and suckling insects, can affect growth and timber quality but
19 only together with other agents will pests kill the tree. Disease agents, i.e., wilts, attack and
20 may kill sugar maple. Winter deer browsing does not affect growth, but continual browsing
21 reduces sugar maple competitive ability. Sugar maple is also susceptible to pollution.

Q. What are your primary concerns about climate change and its effects on sugar maple?

A. The changes in temperature and precipitation as a result of climate change are a primary concern for sugar maple. With warmer conditions there is an increase in water demand for this species to survive and maintain current growth rates. Current and predicted higher precipitation will not be enough to compensate for the drying effect of warmer temperatures. Most studies point at sugar maple growth responding negatively to summer moist stress.

Figure 2, below, shows Predicted Change in Habitat Quality by the end of the century.

Figure 2 is based on the average of three Global Climate models – GFDL, CCSM4 and HadleyCM3 – under a high emissions scenario (RCP.8.5). The version of the models used in Figure 2 is based on the 2013 Intergovernmental Panel on Climate Change (“IPCC”). If updated to use data from the most recent (2021) IPCC report, I anticipate there would be minor changes, for the worse for the species, to the expected habitat quality changes. Yellow-orange colors indicate a decline in habitat quality.

Sugar maple habitat will decline by the end of the century, in both extent and quality.

Under current conditions the average Importance Value of sugar maple is 8.6 (with a sum of 26,735, where the sum is all Importance Values where sugar maple is or is predicted to be). Averaging the predictions of the three models, the Importance Value will decrease to 4.1 under a low emissions scenario (RCP 4.5) (with a sum of 17,400). Under a high emissions scenario (RCP 8.5), the Importance Value will decrease to 2.7 (with a sum 10,227).

As Figure 2 shows, habitat quality is expected to decline in Michigan's Upper Peninsula. Declines in Michigan Upper Peninsula are due to predicted climate for the region. Increases in temperature and changes in precipitation that do not compensate for the associated increase in water demand are predicted to drive the decline in habitat quality in Michigan's Upper Peninsula. The predictions take into account the local soils and high sand content in these soils. Where habitat quality declines, the species will likely decline.

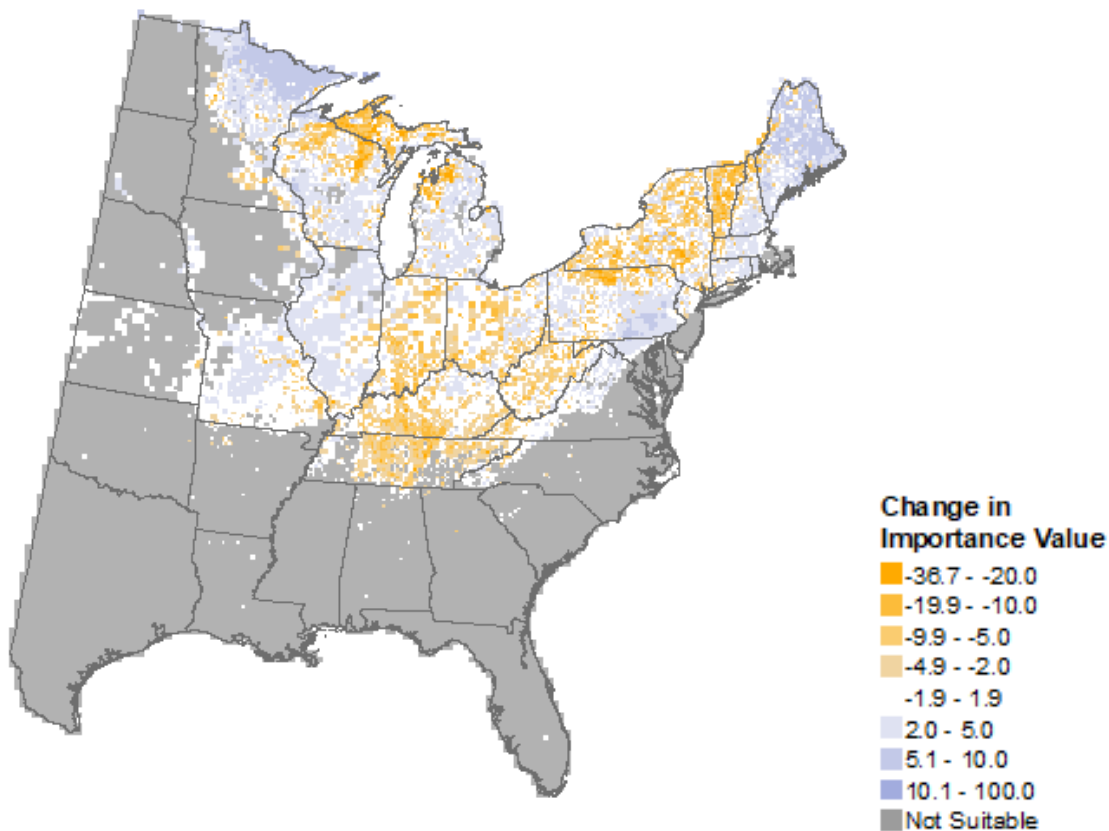


Figure 2: Predicted Change in Habitat Quality (under a high emissions scenario). Source: Forest Service Tree Atlas Climate Change: <https://www.fs.fed.us/nrs/atlas/tree/>.

Q. How has climate change already affected sugar maple?

A. Studies of tree growth in the last few decades, using tree rings, show decreased sugar maple growth in years with lower water availability (a combination of precipitation and

1 temperature which drives water demand). Studies of seedling recruitment also show very
2 high seedling mortality in years with higher-than-normal temperatures.

3 My research shows that even if adult trees are coping, i.e., can survive drought years,
4 there will be no new recruits. Thus, the forest as such may not persist in the long term.

5 **Q. How is climate change likely to affect sugar maple in the future?**

6 A. Given experimental and empirical evidence on sugar maple adult, sapling and seedling
7 growth, on adult and sapling photosynthetic activity, and on seedling survival, it is highly
8 likely that sugar maple will be negatively affected by warmer temperatures. Specifically,
9 there will likely be less recruitment – i.e., fewer new trees added to the population –
10 which will reduce the overall population size and range of sugar maple.

11 **Q. Does that complete your testimony?**

12 A. Yes.

EXHIBIT BMC-10

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PUBLICATIONS-JOURNALS:

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Clark, J.S., Dietze, M., Chakraborty, S., Agarwal, P., **Ibáñez, I.,** LaDeau, S., and Wolosin, M. 2007. Resolving the biodiversity paradox. *Ecology Letters*:10: 647-662.

Ibáñez, I., Clark, J.S., Dietze, M.C., Feeley, K., Hersh, M., LaDeau, S., McBride, A., Welch, N.E., and Wolosin, M.S. 2006. Predicting biodiversity change: Outside the climate envelope, beyond the species-area curve. *Ecology* 87(8):1896-1906.

Clark, J. S., S. LaDeau, and I. **Ibáñez**. 2004. Fecundity of trees and the colonization of competition hypothesis, *Ecological Monographs* 74(3):415-442.

Clark, J. S., Mohan, J. Dietze, M. and **Ibáñez**, I. 2003. Coexistence: How to identify trophic trade-offs. *Ecology* 84(1):17-31.

Ibáñez, I., Schupp, E.W. 2002. Effects of litter, soil surface conditions, and microhabitat on *Cercocarpus ledifolius* Nutt. Seedling emergence and establishment. *Journal of Arid Environments* 52(2):209-221.

Ibáñez, I., Schupp, E.W. 2001. Positive and negative interactions between environmental conditions affecting *Cercocarpus ledifolius* seedling survival. *Oecologia* 129(4):543-550.

Ibáñez, I. and Burgaz, A.R. 1998. Epiphytic species of the *Lecanora subfusca* group (Lecanoraceae) in Spain. *Nova Hedwigia* 67: 45-58.

Ibáñez, I. and Burgaz, A.R. 1995. Líquenes epífitos de Barco de Ávila (Ávila, España). *Botanica Complutensis* 20: 9-18.

Martínez, I., **Ibáñez**, I., and Aragón, G. 1995. Fragmenta Chorologica Occidentalia, Lichenes. *Ana. Jar. Bot. Madrid* 52: 201-205.

PUBLICATIONS-BOOKS:

National Academies of Sciences, Engineering, and Medicine. 2019. *Forest Health and Biotechnology: Possibilities and Considerations*. Washington, DC: The National Academies Press. doi: <https://doi.org/10.17226/25221>. Authors: Briscoe, J., Chhatre, V.E., Delborne, J.A., Difazio, S., Gordon, D.R., **Ibáñez, I.**, Jaffe, G., Laney, K., Needham, M.D., Offutt, S.E. (Chair), Palmer, C., Romreo-Severson, J., Sederoff, R.R., Six, D.L., Sinezko, R.A.

PUBLICATIONS-BOOK CHAPTERS:

Reeves, M., **I. Ibáñez**, Blumenthal, D., Chen, G., Guo, Q., Jarnevich, C., Koch, J., Sapio, F., Schwartz, M.K., Meentemeyer, R., Whyllie, B.K., and Boyte, S. 2021. Tools and technologies for quantifying spread and impacts of invasive species. Pp: 243-266. In: Poland, T.M., Patel-Weynand, T, Finch, D., Ford Miniati, C., Hayes, D.C., and

Lopez, V. (eds.) *Invasive Species in Forests and Grasslands of the United States*. *Comprehensive Science Synthesis for the United States Forest Sector*. Springer Verlag, Cham, Switzerland. https://doi.org/10.1007/978-3-030-45367-1_11

Clark, J.S., D. Bell, M. Dietze, M. Hersh, **I. Ibáñez**, S. LaDeau, S. McMahon, J. Metcalf, E. Moran, L. Pangle, and M. Wolosin. 2010. Models for demography of plant populations. In T. O'Hagan and M. West (eds.) *Handbook of Bayesian Analysis*, Oxford University Press. pp. 431-481.

Clark J. S, Beckage B, HilleRisLambers J, **Ibáñez I**, LaDeau S, MacLachlan J, Mohan J, Rocca M. 2002. Dispersal and plant migration. In: Mooney H, Canadell J, editors. *Encyclopedia of Global Environmental Change*, Vol. 3. Chichester UK: Wiley and Sons. p. 81-93.

PUBLICATIONS-PROCEEDINGS AND REPORTS:

McDowell, N. Hanson, P.J., **Ibáñez, I.**, Phillips, R.P., Ryan, M.G. 2016 Physiological Responses of Forests to Future Drought. In J. Vose, C. Luce, and J.S. Clark (eds). *The National Assessment of Drought Impacts on Forests*.

Clark, J.S., L. Iverson, C. W. Woodall, C. D. Allen, D. M. Bell, D. Bragg, A. D'Amato, F. W. Davis, M. Hersh, **I. Ibanez**, S. T. Jackson, S. Matthews, N. Pederson, M. Peters, M. W. Schwartz, K. Waring, and N. E. Zimmermann. 2016. The impacts of increasing drought on forest dynamics, structure, diversity, and management. In J. Vose, C. Luce, and J.S. Clark (eds). *The National Assessment of Drought Impacts on Forests*.

Handler, S. et al. 2014. Michigan Forest Ecosystem Vulnerability Assessment and Synthesis: A report from the Northwoods Climate Change Response Framework. Gen. Tech. Rep. NRS-129. Newtown Square, PA; U.S. Department of Agriculture, Forest Service, Northern Research Station.

Silander, J.A.Jr., **Ibáñez, I.** and Merhoff, L.J. 2007. The Biology and Ecology of Invasive Species – the Importance of International Collaboration in Predicting the Spread of Invasive Species. Proceedings of the NIAES International Symposium (Tsukuba, Japan): 8-17.

Ibáñez, I., Schupp, E.W., and Boettinger, J.L. 1999. Successional History of a Curleaf Mountain Mahogany Stand: a Hypothesis. In: McArthur, E.D.; Ostler, W.K.; Wambolt, C.L. comps. 1999. Proceedings: Shrubland Ecotones. 1998 August 12-14, Ephraim,

UT. Proceedings RMRS-P-000. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station.

CURRENT GRANTS (PI OR CO-PI):

June 2021-May 2023. PI "OPUS - Enhancing capabilities through synthesis for forecasting tree species population trajectories under changing environments." NSF-DEB. \$349,000.

October 2020-September 2022. PI "Towards a mechanistic prediction of forest functioning under climate change" USDA-Forest Service McIntire-Stennis. \$150,000.

October 2019 - November 2021. Co-PI "The other side of invasibility: vulnerability of recipient ecosystems" NCEAS-NSF Working group. \$105,000

August 2020 - July 2021. PI "Forest Vulnerability and Resilience: Assessments and Solutions. " Working group. SEAS Themes \$84,000.

January 2019 - May 2023. Co-PI "Institute for Global Change Biology" University of Michigan \$2.1 M.

October 2018 - September 2021. Co-PI "Impacts of Socio-Ecological Adaptation to Global Change on Forests Ecosystems " USDA McIntire-Stennis \$138,800.

PAST GRANTS (PI OR CO-PI):

January-June 2020. Elisabeth Crosby Faculty Grants Program. \$15,000.

April 2019 - March 2020. Co-PI "Reframing invasions: from the invader to the invaded, a focus on vulnerability" Workshop. SEAS Themes \$15,000.

July 2013 - August 2020. PI "The emergence of novel regeneration niches: forecasting tree species recruitment dynamics in a time of change." NSF-CAREER \$749,994.

October 2016 - September 2018. PI "Establishing a Network of Forest Inventory Plots

across U. Michigan Properties to Assess and Inform About Forest Performance Under
Global Change " USDA McIntire-Stennis \$139,022.

January 2018-August 2018. PI " Providing solutions to address the risk and impact of
biological invasion under climate change" Graham Sustainability Institute \$10,000.

June 2014 - September 2016. PI "Assessing forest species resilience to drought:
implications for forest conservation and management." USDA McIntire-Stennis
\$67,151.

April 2012 - September 2014. PI "Forests and forests pests: the next big challenge in
forest conservation and management." USDA McIntire-Stennis \$60,903.

January 2012- PI "Showcasing SNRE research at Saginaw Forest: A proposal to
enhance local formal and informal environmental science education opportunities to
strengthen the "Broader Impacts" of SNRE research." SNRE seed Award amount:
\$20,668. CoPI-Michaela Zint.

January 2011 - PI "Assessing the effectiveness of incentive programs to preserve
forest health: biodiversity and forest regeneration surveys." Elizabeth Crosby
Program-UM. Award amount: \$ 12,845.

August 2010 - PI "Evaluating the impact of land use on the adaptation potential of
tree species to global warming." McIntire-Stennis USDA. Award amount: \$62,229.

May 2010 - PI "Phenological responses to climate change in Japan." UM Center for
Japanese Studies. Award amount: \$3,500.

August 2009 - PI "The Role of Plant-Soil Feedbacks on Species Potential to Expand
their Distributional Ranges in Response to Climate Change." NSF-EAGER. Award
amount: \$247,752.

March 2009 - CoPI "Spatiotemporal models of phenology: Integrating the effects of
climate change in plants and animals." NSF-DEB \$700,000, award amount to Ibáñez
at UM: \$179,837.

September 2009 - PI "The impact of land use on the adaptation potential of tree
species to global warming." McIntire-Stennis USDA. Award amount: \$25,321.

October 2008 - PI "Plant-soil feedback effects on colonization potential of migrant tree species tracking global warming." McIntire-Stennins USDA. Award amount: \$59,684.

October 2008 - PI "Evaluating the Colonization of Great Lakes Trees Species Under Climate Change." Seed Grant University of Michigan. SNRE seed. Award amount: \$10,020.

January 2008 - CoPI "A multi-scale approach to the forecast of potential distributions of invasive plant species." USDA. \$545,000.

TEACHING EXPERIENCE AND TRAINING:

Instructor: UMich - NRE 549- *Analysis and Modeling of Ecological Data*, a graduate level course. This course will consist on an overview of standard and innovative techniques in ecological data analysis and modeling. Topics will include: linear regression, mixed effects models (fixed and random effects), maximum likelihood, general linear models and general additive models, survival analysis, time series, spatial analysis and Bayesian and hierarchical Bayesian approaches. The course will be a combination of lectures and computer labs, for which we will be using two open source programs. This course is designed for students to work on their own data, or simulated data, related to their research projects or scientific interests. While reviewing the major statistical techniques, students will work on their projects and will be presenting their work to the class along the semester, these presentations will consist on: initial exploratory data analysis, selection of statistical analysis or modeling approach, implementation, and results.

Instructor: UMich - NRE 547- *Forest Ecology in a Changing World*, a graduate level course. In this course we cover from the basic concepts in ecology that apply to forests to the challenges that forests face due to global change (climate change, landscape fragmentation, pollution, introduced species). We study the ecological mechanisms behind individuals, populations, communities and whole ecosystems together with the dynamic processes associated to forests (succession, disturbances). We also review the role and impact of humans on these communities. Field and computer labs are implemented during the semester, during those sessions students learn to formulate research questions, design data collection protocols, use field equipment and analyze the data.

Instructor: UMich – NRE 436- *Woody Plants*, a graduate and upper level undergraduate course. This is an intensive field- and lecture-based learning experience, in which students learn to identify trees, shrub and vine species that are important in Michigan environments. They learn about their taxonomy, distribution, habitat associations, and biogeographic history and how to identify them in their leafless winter condition. The lab component (see web page on field sites) consists of weekly field trips in the Ann Arbor area, which include riparian and floodplain habitats, glacial lakes, moraines, bogs, fens and mesic forests. The lectures cover elementary aspects of plant identification, taxonomy and ecology; however, the broader themes include biogeographic history and the assembly of Michigan plant communities, both before and after major glaciations, ecological specialization, and impacts of global warming and other anthropogenic environmental changes.

Outreach Co-PI and Ecology consultant: *Down to the Core*, a two-week lesson plan for 7th grade students, students learn about plant growth and the use of mathematical models to predict plant growth responses to varying environmental conditions. Based on the PI's research.

Co-instructor: UConn-EEB 482 - *Hierarchical Bayes*, an introduction developing Hierarchical Bayesian models with ecological and bio-geographical data.

Workshop Co-organizer: Ogle, K., Ibáñez, I., and Hille Ris Lambers, J. *A brief introduction to hierarchical Bayesian modeling in ecology* Ecological Society of America, Annual Meeting August 6th, 2006, August 5th, 2007, August 3th, 2008, August 1st, 2010, August 7th, 2011, August 5th, 2012 and AEET meeting October 18, 2009.

Invited Lecturer: Teachers Institute – Global Change. Michigan Technological University. July 2009.

ADVISEES (*Degree/project completed):

Postdoctoral researchers: Jeff Diez*, Sarah Neumann*, Juan Miguel Requena-Mullor

PhD students: Dan Katz*, Ben Lee*, Laís Petri (exp 2024)

MS thesis students: Zack Brym*, Ben Connor Barrie*, Liana May*, Samantha Wolf*, Drew Peltier*, Elan Margulies*, Natalie Tonn*, Teegan McClung*, Chris Karounos*,

Edith Juno*, Caleb McCollum*, Kirk Acharya*, Sam Morrison-Schaffer*, Xiaomeng Wang*.

Undergraduate Honor Thesis: Bhavya Sridhar*, Hannah Zonneville*.

AFFILIATIONS:

-Ecological Society of America, ESA, SEEDS program
-UROP, Undergraduate Research Opportunity Program at the University of Michigan.
Mentor.

FELLOWSHIPS AND AWARDS:

- Biology grant-in-aid, Department of Biology, Duke University, three times, 2002-04.

- Fulbright Fellowship to pursue a M.A. degree in Utah State University, Logan, Rangeland Resources Department, September 1995 to February 1998.

- University of Helsinki Fellowship, Department of Botany, February 1994 to June 1994. Research with Professor T. Ahti in "Ecology, Physiology, and Taxonomy of Lichens."

- ERASMUS Fellowship to attend the University of Wales, Bangor, School of Biological Sciences. October 1993 to February 1994. Project "Lichens and Pollution."

PROFESSIONAL ACTIVITIES:

-Since 2020 Deputy coordinator IUFRO
-Since 2018 handling editor for PLOS ONE.
-National Academies of Sciences, Engineering and Medicine. Committee member in report " The Potential for Biotechnology to Address Forest Health" 2017-2018.
-January 2017-January 2021 handling editor for Diversity and Distributions.
-January 2012-December 2017 handling editor for Oecologia.
-NSF grant proposal reviewer 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015.
-NSF panelist 2010, 2014, 2015, 2016, 2020.
-NICRR grant proposal reviewer and panelist 2009.

- DOD grant proposal reviewer 2011, 2013, 2015, 2017.
- US-Israel Binational Science -Foundation proposal reviewer 2017, 2018.
- Spain- Agencia Estatal de Investigación reviewer and panelist 2017.
- AAUW reviewer and panelist 2018.
- AXA grant proposal reviewer 2009, 2010, 2011, 2012, 2013.
- Government of the Netherlands grant proposal reviewer 2009.
- Government of Chile grant proposal reviewer 2009 (2).
- BioDiversa proposal reviewer 2013.
- Cooper Award Committee, Ecological Society of America, 2006-2008.

REVIEWS FOR:

American Journal of Botany, Annals of Botany, Biological Conservation, Biological Invasions, Biotropica, Canadian Journal of Forestry Research, Climate Change, Conservation Biology, Conservation Genetics, Diversity and Distributions, Ecography, Ecology, Ecological Applications, Ecological Monographs, Ecology Letters, Ecosciences, Environmental Research Letters, Forest Ecology and Management, Forests, Frontiers in Ecology and the Environment, Global Change Biology, Global Ecology and Biogeography, International Journal of Biodiversity Science and Management, Invasive Plant Science and Management, Journal of Applied Ecology, Journal of Biogeography, Journal of Ecology, Journal of Environmental Management, Journal of Plant Ecology, Journal of Theoretical Biology, Journal of Vegetation Science, Methods in Ecology and Evolution, Nature Climate Change, Nature Communications, Nature Ecology and Evolution, Nature Plants, Oecologia, Oikos, Philosophical Transactions of the Royal Society B: Biological Sciences, Plant Ecology, PNAS, PLOSONe, Proceedings of the Royal Society, Scientific Reports.

LANGUAGES:

English, Spanish.

INVITED SPEAKER:

- .Department of Biological Sciences. Mississippi State University. November 2020.
Virtual.
- .Department of Biometrics and Environmental Systems Analysis, Statistics Seminar Series. University of Freiburg, February 2020.
- .National Center for Ecological Analysis and Synthesis, Santa Barbara, October 2019.
- .New Horizons Conference, Chicago, April 2019.
- .Department of Plant Biology, Michigan State University, East Lansing, March 2019.
- .Department of Botany, Charles University, Prague, April 2016.
- .German Centre for Integrative Biodiversity Research (iDiv) Halle-Jena-Leipzig, Leipzig, April 2016.
- .Plant Ecology and Nature Conservation, Institute of Biochemistry and Biology, University of Potsdam, April 2016.
- .EEB Department, University of Michigan. February 2015.
- .Department of Forestry-Michigan State University. February 2014.
- .EEB Department -Rice University. January 2014.
- .Biology Department-Eastern Michigan University. March 2013.
- .EEB Department-University of Tennessee. Students' elected speaker. January 2013.
- .RNC FORECAST New Investigators Conference. Woods Hole, MA. October 2012.
- .Biology Department-Howard University. March 2012.
- .CIFOR INIA-Center for International Forestry Research _ Spain INIA Instituto Nacional de Investigación y Tecnología Agraria and Alimentaria. Madrid, Spain, July 2011.
- .NCEAS-National Center for Ecological Analysis and Synthesis. Santa Barbara, CA. January 2011.
- .EBD-CSIC Estación Biológica the Doñana, Seville, Spain, May 2010.
- .EEB Department Iowa State University. November 2009.
- .EEB Department, University of Toronto. November 2009.
- .CIES Cary Institute of Ecosystem Studies. November 2009.
- .INIA Instituto Nacional de Investigaciones Agrarias, Madrid, Spain. December 2008.
- .Department of Forestry, Michigan State University. October 2008.
- .Department of Ecology and Evolutionary Biology, University of Michigan. March 2008.
- .Biology Department, Boston University. October 2007.
- .Department of Ecology, Evolution, and Environmental Biology, Columbia University. September 2007.
- .Harvard Forest Seminar Series, Harvard University. April 2007.

- .School of Natural Resources and the Environment, University of Michigan. March 2007.
- .Ecology and Evolutionary Biology, Departmental Seminar. University of Connecticut. December 2006.
- .Plant Ecology Seminar. University of Connecticut. October 2006.
- .University Program in Ecology Seminar Series, Duke University. April 2006.
- .Population Biology Group, Duke University. March 2005.
- .Department of Botany Seminar Series, Duke University. October 1999.
- .Department of Range Land Resources Seminar Series, Utah State University. January 1998.

CONFERENCE PRESENTATIONS

"Integrating data across scales to predict native community vulnerability to plant invasion" ESA 2020, Salt Lake City, Utah - Virtual

"Assessing trends on tree species diversity and biomass change across human-dominated tropical forests" ESA 2019, Louisville, Kentucky

"Imminent threats to forest health from insect pests and pathogens," Organized session and panel discussion, AAAS 2019, Washington D.C.

"Neighborhood effects on early survival and growth of restored woody plant communities" SERE 2018, Reykjavik, Island.

"Forecasting the impact of phenological shifts on ectotherm species" Organized oral session, ESA 2017, Portland, OR.

"Accounting for ontogenetic and population variability among tree seedlings to predict recruitment dynamics in novel environments" Organized oral session, ESA 2016, Fort Lauderdale, FL.

"Chronic nitrogen deposition alters tree allometric relationships and growth resilience to drought: Implications for biomass production and carbon storage under global change" Organized oral session, ESA 2015, Baltimore, MD.

"Integrating data sources to assess biological invasions: from individual performance to species distributions." IALE 2013, Austin, TX.

"Using effect size to assess non-native and native species sensitivity to future conditions." Organized oral session, ESA 2012, Portland, OR.

"Life on the frontier: assessing tree species competitive interactions at their migratory front." Organized oral session, ESA 2011, Austin, TX.

"Beyond their ranges, outside their niches: Assessing the adaptation and migratory potential of temperate forests to global warming." Symposium presentation (organizer). ESA 2010, Pittsburg, PA.

"Forecasting Phenology Under Global Warming." International Phenology and Climate Change Workshop, June 6, 2010. Jeju Island, South Korea.

"Plant-soil feedback effects on the colonization of tree species tracking climate change." Oral presentation. IALE 2010, Athens, GA.

"Forecasting species phenological responses to global warming". Oral presentation. IALE 2009, Snowbird, UT.

"Invasive species: Identifying hotspots and focuses of further spread." Oral presentation. ESA, 2008, Milwaukee, WI.

"Identifying focal points of invasive species spread." Oral presentation. US-IALE, 2008, Madison, WI.

"Spatio-temporal mismatches in species responses to climate change." Poster presentation. NSF Workshop on Data-Model Assimilation, October 2007, Norman, OK.

"Challenges of modeling invasive species spread." Oral presentation. Ecological Society of America, 2007. San Jose, CA.

"Modeling patterns of future plant invasions in the New England region." Oral presentation. Colonization versus Invasion. Ascona, Switzerland. February 2007.

"Predicting tree seedling recruitment of resident and potential immigrant species under climate change." Oral presentation. Ecological Society of America, 2005. Montreal, Canada.

"Interannual variability and tree species recruitment. Implications under global change." Poster presentation. Winemiller Symposium, 2004. Columbia, MO.

"Regional and temporal variability on habitat suitability for seedling establishment." Poster presentation. ESA 2004. Portland, OR.

"Role of climatic variability on tree species recruitment." Poster presentation. ESA, 2003. Savanna, GA.

"Role of environmental gradients on tree species recruitment. Comparisons within and between sites." Poster presentation. ESA, 2002. Tucson, AZ.

"The role of seed fall patterns vs environmental resources in the spatial distribution of tree seedlings." Poster presentation. ESA, 2001. Madison, WI.

"Effects of seed rain and fecundity variability on the successional dynamics of neighboring communities." Poster presentation. ESA, 2000. Snowbird, UT.

"Long-term photosynthetic response of Southern California Chaparral to elevated CO₂." Poster presentation. ESA, 1999. Spokane, WA.

"Successional History of a Curleaf Mountain Mahogany Stand: a Hypothesis." Poster presentation. Shrublands Ecotones, 1998. Ephraim, UT.

"Environmental conditions affecting emergence and seedling establishment of the tree *Cercocarpus ledifolius* during the first growing season." ESA, 1998. Baltimore, MD.

"Contribución al conocimiento de la flora liquénica epífita de Barco de Ávila (Ávila, España)." Poster presentation. X Simposio Nacional de Botánica Criptogámica, 1994. Tenerife, Spain.

WORKSHOP PARTICIPANT/ORGANIZER

SEAS "Reframing invasions: from the invader to the invaded, a focus on vulnerability" February 2020, Co-organizer.

RISCC "Invasive species and climate change" July 2018, Participant.

RNC Forecasting, "Coupling demography and physiology to forecast species responses to novel conditions" January 2015. Organizer.

NCEAS, "Climate change and invasive species," January 2011 February 2012, Participant.

NIACS, "Vulnerability Assessment of Great Lakes forests", September 2012. Consultant.

Cary Institute for Ecosystems Studies "Climate Change and Species Interactions", November 2012. Panel facilitator.

Duke University "Macrosystems Forest Group", May 2013. Consultant.

EXHIBIT BMC-11

Scientific References:

- Barnes BV and Wagner WH (2004) Michigan trees. Ann Arbor, MI: The University of Michigan Press.
- Bose AK, Weiskittel A, and Wagner RG (2017) A three decade assessment of climate-associated changes in forest composition across the north-eastern USA. *Journal of Applied Ecology* 54: 1592-1604
- Ellsworth DS and Reich PB (1992) Water relations and gas exchange of *Acer saccharum* seedlings in contrasting natural light and water regimes. *Tree Physiology* 10: 1-20
- Filewod B and Thomas SC (2014) Impacts of a spring heat wave on canopy processes in a northern hardwood forest. *Global Change Biology* 20: 360-371
- Foster JR, Finley AO, D'Amato AW, Bradford JB, and Banerjee S (2016) - Predicting tree biomass growth in the temperate-boreal ecotone: Is tree size, age, competition, or climate response most important? *Global Change Biology* 22: 2138-2151
- Godman, Richard M.; Yawney, Harry W.; Tubbs, Carl H. (1990). "[Acer saccharum](#)". In Burns, Russell M.; Honkala, Barbara H. (eds.). [Hardwoods](#). Silvics of North America. [Washington, D.C.: United States Forest Service \(USFS\), United States Department of Agriculture \(USDA\)](#). 2 – via [Southern Research Station \(www.srs.fs.fed.us\)](#)
- Gunderson CA, Norby RJ, and Wullschleger SD (2000) Acclimation of photosynthesis and respiration to simulated climatic warming in northern and southern populations of *Acer saccharum*: laboratory and field evidence. *Tree Physiology* 20: 87-96
- Ibáñez I, Katz DSW, and Lee BR (2017) The contrasting effects of short-term climate change on the early recruitment of tree species. *Oecologia* 184: 701-713.
- Ibáñez I, Zak DR, Burton AJ, and Pregitzer KS (2018) Anthropogenic nitrogen deposition ameliorates the decline in tree growth caused by a drier climate. *Ecology* 99: 411-420
- Maciver D.C., Karsh M., Comer N., Klaassen J., Auld H., Fenech A. (2006) Atmospheric Influences on the Sugar Maple Industry in North America. Occasional Paper 7. Adaptation And Impacts Research Division (Aird). Environment Canada.
- McClung T and Ibáñez I (2018) Quantifying the synergistic effects of impervious surface and drought on radial tree growth. *Urban Ecosystems* 21: 147-155
- Tierney GL, Fahey TJ, Groffman PM, Hardy JP, Fitzhugh RD, and Driscoll CT (2001) Soil Freezing Alters Fine Root Dynamics in a Northern Hardwood Forest. *Biogeochemistry* 56: 175-190
- U.S. Forest Service). Tree Atlas - Climate Change Atlas - Northern Research Station, USDA Forest Service. <https://www.fs.fed.us/nrs/atlas/tree/> Accessed 18 Aug. 2021.
- U.S. Forest Service. *Acer Saccharum* Marsh-Sugar Maple. www.srs.fs.usda.gov/pubs/misc/ag_654/volume_2/acer/saccharum.htm. Accessed 18 Aug. 2021.

U.S. Forest Service-Fire Effects Information System. *Acer saccharum*. Index of Species Information. <https://www.fs.fed.us/database/feis/plants/tree/acesac/all.html>. Accessed 18 Aug. 2021.

STATE OF MICHIGAN
BEFORE THE MICHIGAN PUBLIC SERVICE COMMISSION

In the matter of the Application of Enbridge Energy, Limited Partnership for the Authority to Replace and Relocate the Segment of Line 5 Crossing the Straits of Mackinac into a Tunnel Beneath the Straits of Mackinac, if Approval is Required Pursuant to 1929 PA 16; MCL 483.1 et seq. and Rule 447 of the Michigan Public Service Commission's Rules of Practice and Procedure, R 792.10447, or the Grant of other Appropriate Relief

U-20763

ALJ Dennis Mack

PROOF OF SERVICE

On September 14, 2021, an electronic copy of *Direct Testimony and Exhibits of Dr. Inés Ibáñez on behalf of Bay Mills Indian Community* was served on the following parties:

Name/Party	E-Mail Address
Administrative Law Judge Hon. Dennis W. Mack	Mackd2@michigan.gov
Counsel for Enbridge Energy, Limited Partnership Michael S. Ashton Shaina Reed Jennifer Utter Heston	mashton@fraserlawfirm.com sreed@fraserlawfirm.com jheston@fraserlawfirm.com
Counsel for MPSC Staff Spencer A. Sattler Benjamin J. Holwerda Nicholas Q. Taylor	sattlers@michigan.gov holwerdab@michigan.gov taylorn10@michigan.gov
Counsel for Attorney General Robert P. Reichel	Reichelb@michigan.gov

Counsel for Michigan Environmental Council, and National Wildlife Federation Christopher M. Bzdok Lydia Barbash-Riley	chris@envlaw.com lydia@envlaw.com
Counsel for Grand Traverse Band of Ottawa and Chippewa Indians William Rastetter Christopher M. Bzdok Lydia Barbash-Riley	bill@envlaw.com chris@envlaw.com lydia@envlaw.com
Counsel for Environmental Law & Policy Center Margrethe Kearney Esosa Aimufua Kiana Courtney Howard Learner	mkearney@elpc.org eaimufua@elpc.org kcourtney@elpc.org hlearner@elpc.org
For Love Of Water James Olson	jim@flowforwater.org
Counsel for Bay Mills Indian Community Christopher M. Bzdok Kathryn Tierney Debbie Chizewer Christopher Clark David Gover Matt Campbell Mary Rock Megan Condon Adam Ratchenski	chris@envlaw.com candyt@bmic.net dchizewer@earthjustice.org cclark@earthjustice.org dgover@narf.org mcampbell@narf.org mrock@earthjustice.org mcondon@narf.org aratchenski@earthjustice.org
Counsel for Tip of the Mitt Watershed Council Christopher M. Bzdok Lydia Barbash-Riley Abigail Hawley	chris@envlaw.com lydia@envlaw.com abbie@envlaw.com
Counsel for Makinac Straits Corridor Authority Raymond O. Howd Leah J. Brooks	howdr@michigan.gov brooks16@michigan.gov

Michigan Propane Gas Association (MPGA) Paul D. Bratt Daniel P. Ettinger Troy M. Cummings Margaret C. Stalker	pbratt@wnj.com dettinger@wnj.com tcummings@wnj.com mstalker@wnj.com
Michigan Laborers' District Stuart M. Israel Christopher P. Legghio Lauren Crummel	israel@legghioisrael.com cpl@legghioisrael.com crummel@legghioisrael.com
Nottawaseppi Huron Band of Potawatomi Indians Amy L. Wesaw John S. Swimmer	Amy.wesaw@nhbp-nsn.gov John.swimmer@nhbp-nsn.gov
Little Traverse Bay Bands of Odawa Indians James A. Bransky	jbransky@chartermi.net

Date: September 14, 2021

By: Christopher R. Clark
Christopher R. Clark
cclark@earthjustice.org



September 14, 2021

Via E-filing

Ms. Lisa Felice
Michigan Public Service Commission
7109 W. Saginaw Hwy.
P. O. Box 30221
Lansing, MI 48909

RE: MPSC Case No. U-20763

Dear Ms. Felice:

The following are attached for paperless electronic filing:

- Direct Testimony and Exhibits of Dr. Daniel Larkin on behalf of Bay Mills Indian Community
- Proof of Service

Sincerely,

A handwritten signature in cursive script that reads "Christopher R. Clark".

Christopher R. Clark
cclark@earthjustice.org

STATE OF MICHIGAN
BEFORE THE MICHIGAN PUBLIC SERVICE COMMISSION

In the matter of the Application of Enbridge
Energy, Limited Partnership for Authority to U-20763
Replace and Relocate the Segment of Line 5
Crossing the Straits of Mackinac into a Tunnel ALJ Dennis Mack
Beneath the Straits of Mackinac, if Approval is
Required Pursuant to 1929 PA 16; MCL 483.1
et seq. and Rule 447 of the Michigan Public
Service Commission's Rules of Practice and
Procedure, R. 792.10447, or the Grant of other
Appropriate Relief

TESTIMONY OF DR. DANIEL LARKIN

ON BEHALF OF

BAY MILLS INDIAN COMMUNITY

September 14, 2021

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I. INTRODUCTION & QUALIFICATIONS

Q. Please state for the record your name, job title, and business address.

A. My name is Daniel Larkin. I am an associate professor and extension specialist in the Department of Fisheries, Wildlife and Conservation Biology at the University of Minnesota-Twin Cities, located at 135 Skok Hall, 2003 Upper Buford Circle, St. Paul, MN 55108.

Q. On whose behalf is this testimony being offered?

A. I am testifying on behalf of Bay Mills Indian Community (BMC). This testimony contains my independent scientific opinion. It is being provided in my individual capacity and not on behalf of my employer.

Q. Please summarize your work experience and educational background.

A. I have been a faculty member at the University of Minnesota for 6 years, where I lead a research team of graduate students, postdoctoral researchers, and professional staff. Prior to that, I was a conservation scientist at Chicago Botanic Garden and a faculty member at Northwestern University for 7 years. I completed my Ph.D. in Botany at the University of Wisconsin-Madison; undergraduate studies in Biology at the University of California, Santa Cruz; and a postdoctoral fellowship at Loyola University-Chicago. In total, I have 20 years of post-undergraduate training and professional experience in plant and aquatic ecology. My work experience is also summarized in my CV, provided as Exhibit BMC-12 (LAR-1).

1 **Q. Please describe the focus of your academic research.**

2 A. I am a plant ecologist working on applied challenges in biodiversity conservation,
3 particularly (1) the effects of anthropogenic stressors on plant communities and (2)
4 developing strategies for improving outcomes of habitat management and ecological
5 restoration. My research focuses on wetlands, lakes, woodlands, and prairies of the Upper
6 Midwest. I have expertise in biology and management of aquatic plant species: my doctoral
7 and postdoctoral training focused on wetland ecosystems, my current position was created
8 to increase regional and national capacity in aquatic plant management and restoration, and
9 I am internationally recognized for my work on the ecology of freshwater plants. To date,
10 I have authored 64 peer-reviewed publications (58 journal articles, 6 book chapters), and
11 received 9 million dollars in competitive research funding.

12 My research program includes working to predict the impacts of climate change on
13 freshwater ecosystems in general and on wild rice in particular. Wild rice is an active area
14 of research in my lab which is currently supported by two federal grants. In addition to my
15 research activity, I hold an appointment as an extension specialist, through which I lead
16 outreach, citizen science, and professional training programs related to aquatic invasive
17 species, lake management, and ecological restoration. In this role, I interact with many
18 members of the public and natural resource professionals representing local, state, tribal,
19 and federal agencies; non-governmental organizations; and the private sector.

20 **Q. Have you testified before this Commission or as an expert in any other proceeding?**

21 A. No. I have not previously testified before this Commission. I have not previously testified
22 as an expert in any proceedings.

1 **Q. What is the purpose of your testimony?**

2 A. I am testifying on behalf of BMC regarding the effects of climate change on wild rice. I
3 understand that the Commission is considering evidence regarding the effects of climate
4 change as it considers the proposed project.

5 **Q. What information did you review in preparing your testimony in this case?**

6 A. In preparing my testimony in this case, I drew upon my education, research, and work
7 experience. I drew upon the last four years of my scholarly activity in particular, during
8 which wild rice has been a central focus of my research. With respect to wild rice, I have
9 been involved in leading and/or co-leading multiple successful research proposals;
10 collecting, analyzing, and preparing for publication data addressing relationships between
11 wild rice and its environment; mentoring graduate and undergraduate students engaged in
12 wild rice research; and participating in dozens of meetings on wild rice with tribal and non-
13 tribal resource managers involved in its stewardship. Additionally, in preparing this
14 testimony, I reviewed dozens of scientific publications related to wild rice, climate change,
15 and aquatic plant ecology. Publications of particular relevance to this testimony are listed
16 in a scientific references document included as Exhibit BMC-13 (LAR-2).

17 **Q. Are you sponsoring any exhibits?**

18 A. Yes, I am sponsoring the following exhibits:

19 Exhibit BMC-12 (LAR-1): CV of Daniel Larkin

20 Exhibit BMC-13 (LAR-2): Scientific References

II. THE EFFECTS OF CLIMATE CHANGE WILL NEGATIVELY AFFECT WILD RICE.

Q. What species is the focus of your testimony?

A. This testimony focuses on wild rice (manoomin in Ojibwe, scientific name: *Zizania palustris* L. [synonyms: *Zizania aquatica* L. var. *angustifolia* Hitchc., *Zizania aquatica* L. ssp. *angustifolia* (Hitchc.) Tzvelev]). Wild rice is an aquatic annual grass with a primary distribution today in northern-tier states from the Upper Midwest to New England and in southern Canada (Manitoba, Ontario, and Quebec). In the U.S., wild rice is now most abundant, in descending order, in Minnesota, Wisconsin, and Michigan. Wild rice is central to many Native people throughout the Upper Midwest and Great Lakes region, for whom it is an irreplaceable cultural, spiritual, nutritional, and commercial resource and sacred relative. Wild rice is also important to non-Native people, including harvesters for whom it provides recreational benefits and consumers who value it as a food. Furthermore, wild rice is a critical component of aquatic ecosystems, where it contributes to primary production, nutrient cycling, and habitat structure. Its shoots and grain are important food resources for a range of wildlife, notably waterfowl.

In specifying which species is the focus of my testimony, it is important to note that wild rice has also been domesticated through breeding for mechanized agricultural production. Such “paddy rice” is grown commercially in Minnesota and California. Domesticated wild rice is distinct in numerous ways from the unmodified strains that occur naturally in aquatic habitats—and are still harvested today using traditional, non-mechanized methods (see below). Throughout my testimony, when I refer to wild rice, it will be regarding natural wild rice, not domesticated wild rice.

1 **Q. Please describe the typical habitat for wild rice in the Upper Great Lakes region.**

2 A. The typical habitat for wild rice in the Upper Great Lakes region (including Michigan,
3 Wisconsin, and Minnesota) comprises shallow lakes and slow-flowing rivers and streams.

4 Like all plant species, wild rice can occur across some range of environmental conditions
5 that constitute its fundamental ecological “niche”—conditions under which it can survive
6 and reproduce. Within this environmental niche, conditions can range from marginal
7 (where a species might persist but only barely) to optimal (ideal conditions for survival,
8 growth, and reproduction). For human use of wild rice, it is important to have near-optimal
9 conditions that can support extensive beds of dense, healthy wild rice sufficient to yield
10 abundant grain during harvest (see below for description of harvesting methods). Thus, it
11 is not just a matter of whether there are conditions sufficient for survival and reproduction
12 of *any* wild rice (e.g., marginal conditions supporting scattered stems) but whether
13 conditions are adequate for robust growth and high reproductive success.

14 Ideal conditions for wild rice are clear waters of relatively stable, shallow depths (~15-90
15 cm or ~1-3 feet) and “mucky” substrates (rich in organic matter). First, shallow, clear water
16 is important so that young plants have adequate light availability to photosynthesize below
17 the water surface during early life stages. Second, relatively stable water is important to
18 wild rice because fast-flowing or quickly rising water can damage and uproot young plants.
19 Some water movement is beneficial for wild rice and can help knock back competing
20 vegetation. Third, water depth of about 1 to 3 feet is preferred because the water depth
21 must be sufficient to provide wetland/aquatic habitat and physically support (buoy) plants
22 during an intermediate “floating-leaf” stage on the water’s surface, but if water levels are

1 too high, or rise too rapidly, young plants can be drowned. Fourth, mucky substrates enable
2 developing plants to adequately root and have their nutritional requirements met—though
3 substrates that are too mucky or flocculent can be associated with poor growth of wild rice.

4 I think of wild rice as a “Goldilocks” species that needs water levels and sediments that are
5 “just right”—not too high, not too low, mucky but not too mucky.

6 Finally, but crucially, there are several stressors or disturbances to wild rice that can kill or
7 displace the species. These include disturbances associated with climate change and
8 corresponding temperature and precipitation changes, as well as lakeshore development
9 (shoreline hardening, damage from motorboats, physical or chemical aquatic plant
10 control), elevated sulfides from iron ore mining which are deadly to wild rice, hydrologic
11 disturbances that change water levels (e.g., dams, flooding, watershed development), and
12 attack by other organisms (e.g., common carp [*Cyprinus carpio*], an invasive bottom-
13 feeding fish that kills plants and degrades water quality; wild rice worms, a larval stage of
14 the *Apamea apamiformis* moth that eats developing grain; and brown spot disease caused
15 by the fungus *Bipolaris oryzae*). In addition, both native and invasive *perennial* aquatic
16 plants (species with multi-year lifespans; recall that wild rice is an annual species) can be
17 favored by anthropogenic changes to historic wild rice habitats. When these longer-lived,
18 clonally spreading species become dominant, wild rice no longer has access to the open
19 habitat that it requires to form large beds—in essence, it is displaced by stronger
20 competitors.

1 **Q. Please describe the lifecycle of wild rice.**

2 A. If we watched the full annual lifespan of a wild rice plant using time-lapse photography,
3 we would first see a single leaf emerge from the germinating seed in spring (May). The
4 young seedling would be nourished by resources provided in the seed as it began to form
5 roots so that it could acquire nutrients from the substrate and photosynthesize to acquire
6 the carbon it will need for growth (hence the importance of water that is clear and not too
7 deep, as photosynthetically active radiation rapidly decreases with water turbidity
8 [murkiness] and depth). We would see the plant elongate and rise up in the water column
9 (June). When it reached the surface of the water, it would continue to lengthen, now with
10 ribbon-like leaves floating on the surface to boost photosynthesis. Throughout its journey
11 from seedling to the floating-leaf stage, the plant would be vulnerable to uprooting or
12 drowning by fast-moving or rapidly rising water from spring floods. Having acquired
13 sufficient carbon, the plant would start to send rigid stalks above the water (late June).
14 Stalks and leaves would lengthen as the plant reached a large, robust “emergent” growth
15 stage. In time, the plant would flower (July). Wild rice is a *monoecious* species (“one
16 house”) with both male and female flowers present on individual plants. So we would see
17 both emerge on the plant, with female flowers at the tips of stalks and male flowers below
18 them. If reproduction was successful, seeds would begin to develop (August) and, after
19 ripening (September), would fall into the water. These offspring would lie dormant through
20 fall and under the ice in winter, ready for spring thaw and warming water temperatures to
21 restart the process the following growing season.

1 **Q. Please describe how wild rice is harvested and/or conditions for harvesting wild rice.**

2 A. Natural stands of wild rice are harvested by Native and non-Native ricers using traditional
3 methods that have been practiced for centuries. When grain is ripened—no longer green
4 and now easy to dislodge from plants—harvesters travel through beds in canoes using
5 paddles or push poles. They use ricing sticks (a.k.a., knocking sticks; long, thin, tapering
6 sticks usually carved from lightweight cedar) to knock grains off of plants into canoes. As
7 some of the grains fall into the bottom of the canoe, others land in the water, leaving seed
8 behind to support the following year’s crop. These human-powered methods are not
9 destructive to the rice bed and foster its continued health. For these reasons, they are often
10 mandated by state and/or tribal regulations. Because harvesting in this manner is labor-
11 intensive, conditions of the rice bed need to be such that the effort is worthwhile. Factors
12 influencing harvestability include the size of the bed, the density of plants, the quality of
13 the grain (e.g., “filled” seeds undestroyed by rice worms), and water levels that are high
14 enough for navigation by canoe.

15 **Q. Please describe how wild rice reproduces.**

16 A. Despite individual wild rice plants having both male and female flowers, almost all seed
17 production comes from wind-pollinated outcrossing with other plants (as opposed to self-
18 pollination). Wind-borne pollen lands upon and fertilizes female flowers. Thus, larger
19 populations with more plants have greater odds of pollen landing on receptive female
20 flowers, and thus reproductive success. Each plant will typically have multiple stalks and
21 inflorescences (clusters of flowers). Production of viable seed—the rich nutritious grain
22 that makes wild rice so valued—depends on the number of inflorescences, the number of

1 seeds per inflorescence, and the number of seeds that are filled. When the seeds are fully
2 ripened, those that are not harvested by people or eaten by birds will fall back into the water
3 and overwinter in the sediment. Evolution in northern climates has adapted wild rice to
4 long, cold winters so that seeds exposed to long cold periods under ice are more likely to
5 germinate. This adaptation helps prevent the reproductive failure that would occur if seeds
6 germinated too early, as during a brief thaw, leading to seedlings being killed when
7 freezing temperatures returned. It is better to wait and make sure that spring has truly
8 arrived, and wild rice has evolved to do so.

9 **Q. Please describe typical population variability for wild rice.**

10 A. Wild rice and other annual plant species are characterized by greater interannual population
11 variability than longer-lived, perennial species that are less sensitive to years with poor
12 growth due to inhospitable weather or other factors. Wild rice populations naturally cycle
13 in abundance over a span of roughly 4 years. This has been attributed to factors such as
14 higher spring water levels (associated with lower production) and periods of elevated
15 nitrogen released from prior years' growth (associated with higher production). Thus,
16 interannual variability in reproduction is a natural feature of wild rice and not an inherent
17 cause for concern. However, what is concerning is sustained downward trends in the
18 geographic distribution and local abundance of wild rice that have been observed over
19 decades. These reductions reflect sustained reproductive failures. In many cases,
20 historically productive beds no longer yield harvestable quantities of grain, or wild rice has
21 been eliminated entirely.

Q. Accounting for normal variations in population, has wild rice declined in population?

Yes, wild rice has declined in population. There are multiple lines of evidence for this decline. First, analysis of changes in wild rice distribution based on agency monitoring data, license sales, and harvest records (principally from the Minnesota Department of Natural Resources, Great Lakes Indian Fish and Wildlife Commission, and 1854 Treaty Authority) shows that many watersheds in the Upper Great Lakes region have lost wild rice since the early 1900s. Second, tribes have long histories of harvesting wild rice from the same waterbodies over time. The direct observations of elder harvesters tell us that key wild rice waters have declined (Drewes 2008, Waheed 2021). This decline encompasses both waters that are less productive than they were historically and waters that are no longer harvestable at all. Third, tribes and intertribal treaty organizations monitor wild rice abundance on reservation and in ceded territories and record sizes of harvests each year. These data show downward trends in wild rice populations in recent decades. In sum, tribal knowledge, monitoring data, and other records spanning from today to over 100 years ago clearly demonstrate that wild rice populations have declined. The magnitude and time scale of this decline far exceeds what can be explained by natural population variability. Of relevance to the present case, Michigan is recognized as having suffered the most precipitous loss of wild rice among Michigan, Wisconsin, and Minnesota.

Q. What are your primary concerns about climate change and its effects on wild rice?

A. I have strong concerns about climate change and its effects on wild rice. These include both direct effects of changes in temperature and precipitation on wild rice and indirect effects of climate change on wild rice through intermediate pathways, particularly

1 increased threats from pathogens, pests, and competitors. All of these threats should be
2 interpreted in light of wild rice being an annual species (i.e., one that completes its full life
3 cycle within a single year), which makes it inherently more vulnerable to population
4 declines than longer-lived plant and animal species.

5 **Q. Please describe how temperature changes associated with climate change will affect**
6 **wild rice.**

7 A. Wild rice is a cold-adapted species. Climate change will lead to warmer temperatures in
8 the Upper Great Lakes region. Warmer temperatures during both the winter and the
9 summer are likely to harm wild rice.

10 As with other plant species of north-temperate and boreal regions, long, cold winters prime
11 its seeds to germinate. As winter temperatures warm with climate change, wild rice seeds
12 will receive weaker cues for germination, which could contribute to population reductions
13 and conditions less conducive to harvest, e.g., smaller beds and lower stem density.

14 In addition, winters that are substantially warmer will have longer periods without ice
15 cover. While exposure to cold temperatures is a good thing, water under ice is maintained
16 at a cold but not freezing temperature of 4° C (39.2° F). Where there is not ice cover or
17 standing water, seeds in exposed substrates can be subjected to desiccation and deadly
18 freezing following sudden drops in temperature, or loss of protection from severe winter
19 storms. Thus, warmer winters could expose wild rice seed to both insufficient duration of
20 buffered cold (under ice) or excess cold and damage (in absence of ice).

1 Temperatures are also projected to increase with climate change during summer. Higher
2 summer temperatures degrade water quality in lakes and other inland waters by increasing
3 algal growth. This leads to lower water clarity and lower availability of photosynthetically
4 active radiation in the water column, reducing fitness and abundance of aquatic plants.
5 Wild rice is reliant on clear waters to grow, and waters become less clear with rising
6 summer temperatures. In addition, warmer summer temperatures and associated increases
7 in relative humidity in wild rice waters will likely worsen the severity of brown spot disease
8 (see below).

9 **Q. Please describe how precipitation changes associated with climate change will affect**
10 **wild rice.**

11 **A.** I am most concerned about the effects on wild rice of climate-change induced alterations
12 to precipitation regimes. As described above, the life cycle of wild rice depends upon a
13 fairly narrow range of hospitable water levels. In the Upper Great Lakes region, most
14 hydrological models predict increases in total precipitation and intensity of precipitation,
15 leading to increases in streamflow and shifts in the timing of peak and low flows.
16 Anticipated higher water levels and flooding intensity in spring, during the critical early
17 stages of wild rice growth (see life cycle above), could lead to young plants being damaged,
18 uprooted, and drowned. If such years occur infrequently, as they did historically, wild rice
19 populations can rebound and persist. But populations of an annual plant species can only
20 remain viable for so long. If down years with reproductive failure stack up, individual wild
21 rice beds could have declining population sizes, making them less harvestable and, in
22 severe cases, causing them to be lost entirely.

1 In general, climate change in the Midwest is predicted to increase overall precipitation. But
2 this is due mainly to higher winter and spring precipitation. Drought conditions later in the
3 growing season are projected to increase in frequency and spatial extent. This could lead
4 to a mismatch in timing of water levels for wild rice, with more precipitation during early
5 life stages, when wild rice is vulnerable to flooding and high water levels, and lower water
6 levels later in the growing season, which could impede harvesting. Furthermore, with
7 severe late-season droughts, wild rice beds could enter into winter without enough standing
8 water to ensure that seeds are protected and cold-primed under ice (see temperature effects
9 above).

10 **Q. Please describe your concerns about the indirect effects of climate change on wild**
11 **rice.**

12 The indirect effects I am most concerned about are species that are better adapted to climate
13 change proliferating in ways that will harm wild rice. Wild rice is strongly affected by other
14 organisms with which it interacts. Ecologists recognize that climate change will have both
15 “winners” and “losers.” Unfortunately, I expect wild rice to be among the biggest losers
16 because of its specific habitat requirements, annual life cycle, and vulnerabilities to direct
17 effects of changes in temperature and precipitation.

18 I further expect wild rice’s losses to be compounded by increasing negative effects from
19 widespread, disturbance-tolerant winners that are better-adapted to a changing climate and
20 likely to increase in their geographic ranges and population sizes. For example, common
21 carp have extreme negative effects on wild rice but have not yet invaded the northernmost
22 waters in its range. With increasing temperatures and lake productivity, it is likely that

1 common carp will expand into and cause damage in new wild rice waters. In addition,
2 several invasive and native perennial aquatic plant species (e.g., *Typha* spp., cattails;
3 *Phragmites australis*, common reed; *Pontederia cordata*; pickerelweed; *Hydrocharis*
4 *morsus-ranae*, common frogbit) are better-adapted to withstand the higher temperatures
5 and hydrologic changes associated with climate change and, in some cases, will grow more
6 due to fertilization effects of elevated carbon dioxide concentrations. This will likely lead
7 to the “playing field” of many waterbodies tilting more toward longer-lived, stronger
8 competitors that can usurp the open habitat that wild rice depends on.

9 Additionally, there is significant risk that climate change will worsen pathogen and pest
10 infestations of wild rice. *Bipolaris oryzae*, the fungus that causes brown spot disease in
11 wild rice, also infects Asian or common rice (*Oryza sativa*, a close relative of wild rice
12 within the same taxonomic subtribe, Oryzinae). Research has shown that the severity of
13 brown spot disease in *O. sativa* strongly increases with temperature and humidity
14 (Dallagnol et al. 2011, Sunder et al. 2014, Schwank et al. 2015). As the air in wild rice
15 stands becomes warmer and more humid in the summer with climate change, it is likely
16 that damage to wild rice from brown spot disease will increase. I am not aware of research
17 addressing the effects of climate change on *Apamea apamiformis*, the moth whose larvae
18 attacks wild rice. However, many insect pests of cereals (grain-producing grasses) are
19 expected to cause greater crop losses with climate change due to higher overwintering
20 survival, increased population sizes, and range expansions.

1 **Q. Has climate change affected wild rice?**

2 A. It is highly likely that climate change has already negatively impacted wild rice. How much
3 climate change has affected wild rice to date has not been quantified. While wild rice has
4 clearly declined, it is difficult to separate the impacts of climate change from other stressors
5 that wild rice has been subjected to (e.g., wetland loss, watershed development, agricultural
6 intensification). However, the biology of wild rice, as described above, suggests that it is
7 likely to be particularly sensitive to climate change. Tribally led assessments of species'
8 vulnerability to climate change that have integrated indigenous knowledge, monitoring
9 data, and contemporary climate science have identified wild rice as among the most
10 vulnerable of key plant and animal species protected under treaty rights (ITCM 2016, Stults
11 et al. 2016, Panci et al. 2018). Another assessment, of the vulnerability of plant species of
12 Great Lakes coastal wetlands to climate change, identified wild rice as the most vulnerable
13 species out of 88 that were evaluated (Mortsch et al. 2006). Thus, I consider it highly likely
14 that wild rice has already been negatively affected by climate change.

15 Determining how much climate-driven loss of wild rice has already occurred may be
16 impossible. But an analysis of the distribution of wild rice in Minnesota and Wisconsin
17 from 1900-2006 found that watersheds with wild rice have declined by 32% since the early
18 1900s (Drewes and Silbernagel 2012). Notably, the watersheds that have lost wild rice
19 during this period are concentrated in the southern parts of the region. This is consistent
20 with what would be expected from climate change impacts: wild rice in the colder climates
21 of the northern and boreal regions of these states has been less impacted, while wild rice
22 has contracted in the warmer southern portion of its range during this period of warming.

1 That wild rice has declined more in Michigan than in Wisconsin or Minnesota is also
2 consistent with this pattern: Michigan has higher average temperatures and milder winters
3 than Wisconsin or Minnesota. In sum, that there has already been climate-change driven
4 loss of wild rice is highly probable but difficult to quantify. From a conservation and
5 resource management perspective, it is critical to protect the wild rice populations that
6 remain while we also work to improve our ability to restore wild rice where it has been
7 lost.

8 **Q. How is climate change likely to affect wild rice in the future?**

9 A. It is my personal scientific opinion that projected changes in climate will have catastrophic
10 effects on wild rice in the coming decades. A large body of scientific knowledge is
11 consistent with wild rice being acutely sensitive to changes in precipitation and
12 temperature—direct effects likely to be compounded by indirect effects of climate change
13 through other pathways, e.g., increases in ranges and populations of organisms that damage
14 wild rice or usurp its habitat. If the severe effects of future climate change that have been
15 predicted are not prevented, I have high confidence that wild rice will be less widespread
16 throughout the Upper Great Lakes region and will be composed of smaller, less productive
17 beds where it does persist. Even where wild rice does persist, in many cases it will not do
18 so in quantities that make it a harvestable resource.

19 **Q. Does that complete your testimony?**

20 A. Yes.

EXHIBIT BMC-12

Daniel J. Larkin – Biographical Sketch

Department of Fisheries, Wildlife, and Conservation Biology
 University of Minnesota–Twin Cities, St. Paul, MN 55108
 Phone: 612-625-6350 • Email: djlarkin@umn.edu • Web: larkinlab.cfans.umn.edu

A. Professional Preparation

University of California, Santa Cruz, Biology, BA, 1998
 University of Wisconsin–Madison, Botany, PhD, 2006
 Loyola University Chicago (Postdoctoral), Biology, 2006–2008

B. Appointments

Associate Professor & Extension Specialist, University of Minnesota	2020–
Assistant Professor & Extension Specialist (2015–2020)	
Faculty Fellow, Minnesota Aquatic Invasive Species Research Center	
Associate, Institute on the Environment	
Graduate Faculty: Conservation Sciences; Ecology, Evolution and Behavior; Natural Resources Science and Management; Water Resources Science	
Adjunct Asst. Professor, Plant Biology & Conservation, Northwestern Univ.	2008–2015
Assistant/Associate Conservation Scientist & David Byron Smith Family Curator of Native Habitats, Chicago Botanic Garden	2008–2015
Postdoctoral Fellow, Department of Biology, Loyola University Chicago	2006–2008

C. Selected Publications

Mentored co-authors: Undergraduate*, Graduate student†, Postdoc‡

10 representative publications (of 64 peer-reviewed publications)

- Thomas, S. M.[‡], M. R. Verhoeven[†], J. R. Walsh, **D. J. Larkin**, and G. J. A. Hansen. 2021. Species distribution models for invasive Eurasian watermilfoil highlight the importance of data quality and limitations of discrimination accuracy metrics. *Ecology and Evolution* DOI: 10.1002/ece3.8002.
- Matson, L., G.-H. C. Ng, M. Dockry, M. Nyblade, H. J. King, M. Bellcourt, J. Bloomquist, P. Bunting, E. Chapman, D. Dalbotten, M. Davenport, K. Diver, M. Duquain†, W. Graveen, K. Hagsten, K. Hedin, S. Howard, T. Howes, J. Johnson, S. Kesner, E. Kojola, R. LaBine, **D. J. Larkin**, M. Montano, S. Moore, A. Myrbo, M. Northbird, M. Porter, R. Robinson, C. Santelli, R. Schmitter, R. Shimek, N. Schuldt, A. Smart, D. Strong, J. Torgeson, D. Vogt, A. Waheed. 2021. Transforming research and relationships through collaborative tribal-university partnerships on Manoomin (wild rice). *Environmental Science and Policy* 115: 108–115.
- Winikoff, S. G.†, **D. J. Larkin**, S. L. Meier, and J. C. Finlay. 2020. Vegetation trajectories of restored agricultural wetlands following sediment removal. *Restoration Ecology* 28:612–622.
- Larkin, D. J.**, M. W. Beck, and P. G. Bajer. 2020. An invasive fish promotes invasive plants in Minnesota lakes. *Freshwater Biology* 65:1608–1621.
- Barak, R. S.†, T. Lichtenberger, A. Wellman-Houde*, A. T. Kramer, and **D. J. Larkin**. 2018. Cracking the case: seed traits and phylogeny predict time to germination in prairie restoration species. *Ecology and Evolution* 8:5551–5562.
- Muthukrishnan, R.‡, N. Hansel-Welch, and **D. J. Larkin**. 2018. Environmental filtering and competitive exclusion drive biodiversity-invasibility relationships in shallow lake plant communities. *Journal of Ecology* 106:2058–2070.
- Romero-Alvarez, D., L. E. Escobar, S. Varela, **D. J. Larkin**, and N. B. D. Phelps. 2017. Forecasting distributions of an aquatic invasive species (*Nitellopsis obtusa*) under future climate scenarios. *PLoS ONE* 12(7): e0180930.
- Vander Stelt, E.†, J. B. Fant, S. Masi, and **D. J. Larkin**. 2017. Assessing threats to a rare ephemeral wetland plant species, *Isoetes butleri* Engelm. *Aquatic Botany* 138:74–81.
- Fant, J. B., A. L. Price†, and **D. J. Larkin**. 2016. The influence of habitat disturbance on genetic structure and reproductive strategies within stands of native and non-native *Phragmites australis* (common reed). *Diversity and Distributions* 22:1301–1313.

Barak, R. S.[†], A. L. Hipp, J. Cavender-Bares, W. D. Pearse, S. C. Hotchkiss, J. C. Callaway, E. A. Lynch, R. Calcote, and **D. J. Larkin**. 2016. Taking the long view: Integrating recorded, paleoecological, and evolutionary information into ecological restoration. *International Journal of Plant Sciences* 177:90–102.

D. Synergistic Activities

Mentoring

I have mentored numerous postdoctoral (5), graduate (19), and undergraduate researchers (33) and served as PI and Co-PI on two renewals of a National Science Foundation (NSF) Research Experiences for Undergraduates Site. I currently advise 2 PhD and 6 MS students and co-advise 2 postdoctoral researchers. Three PhD and 10 MS degrees have been completed under my supervision and I have served on 22 graduate committees. I have been a research mentor for 33 undergraduates, including 8 REUs, 5 underrepresented minorities, and 19 women. I mentored 8 undergraduates on preparation of two grant proposals funded by the U.S. EPA.

Peer Review

I have served on NSF panels for Biology REU Sites, Coupled Human and Natural Systems, the Graduate Research Fellowship Program, and Major Research Instrumentation and have been an *ad-hoc* reviewer for Population and Community Ecology, Ecosystem Studies, and OPUS. I have reviewed manuscripts for 50 journals, including *Biology Letters*, *BioScience*, *Ecological Applications*, *Ecology*, *Journal of Ecology*, and *Journal of Environmental Management*.

Service and Extension

My service and extension bridge research and management. I lead aquatic invasive species and ecological restoration Extension programs that have received 4 national awards (Association of Natural Resource Extension Professionals) and 2 UMN awards. I also received the 2020 UMN Extension Dean's Distinguished Campus-Based Faculty Award. I was Treasurer and on the Executive Committee of the Board of Directors for the Society for Ecological Restoration–Midwest/Great Lakes, on the Scientific Advisory Committee for The Nature Conservancy in Illinois, on the Steering Committee and Research Subcommittee for the Great Lakes *Phragmites* Collaborative, Chair of the Research Subcommittee for the Midwest Marsh Bird Working Group, on the Steering Committee for the Northeast Illinois Invasive Plant Partnership, and a Symposium Organizer for the Society for Ecological Restoration and Ecological Society of America.

E. Research Funding

I have received \$9.0M in competitive research grants (excluding student awards), including \$4.5M as a Principal Investigator (PI) and \$4.6M in federal funds.

Current grants

1. PI. Effects of stand characteristics, landscape context, and vegetation management on diversity and abundance of vegetation, pollinators, and grassland birds in CRP-enrolled lands. USDA Farm Services Agency. \$474,575 (2022–24)
2. PI. Impacts of climate change on vegetation, ecohydrology, and management of manoomin (wild rice) watersheds. USGS Northeast Climate Adaptation Science Center. \$566,859 (2021–23)
3. PI. Evaluating native *Phragmites* as a wastewater treatment alternative. Minnesota Aquatic Invasive Species Research Center (MAISRC). \$355,122 (2021–2022)
4. PI. Nonnative *Phragmites* in wastewater treatment facilities. U.S. EPA/Minnesota Dept. Natural Resources. \$160,382 (2021–22)
5. Co-PI. Integrating professional and citizen monitoring to improve surveillance. MAISRC. \$307,862 (2021–22)
6. Co-PI. Enhancing habitat and diversity in cattail-dominated shorelines. MAISRC. \$338,066 (2021–22)
7. Co-PI. CNH2-L: “First we must consider manoomin” (wild rice): a flagship for co-creating socio-ecological knowledge to support Indigenous resource sovereignty. National Science Foundation. \$1,499,906 (2021–25)
8. Co-PI. Will property values cool as AIS heat up? MAISRC. \$211,021 (2019–21)
9. Co-PI. Understanding the benefits and limitations of using goats for invasive plant control. Minnesota Invasive Terrestrial Plants and Pests Center. \$445,533 (2018–22)
10. PI. Collaborative Research: Testing the effects of phylogenetic diversity on restoration outcomes in tallgrass prairie. NSF. \$318,738 (2014–21)

EXHIBIT BMC-13

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STATE OF MICHIGAN
BEFORE THE MICHIGAN PUBLIC SERVICE COMMISSION

In the matter of the Application of Enbridge Energy, Limited Partnership for the Authority to Replace and Relocate the Segment of Line 5 Crossing the Straits of Mackinac into a Tunnel Beneath the Straits of Mackinac, if Approval is Required Pursuant to 1929 PA 16; MCL 483.1 et seq. and Rule 447 of the Michigan Public Service Commission's Rules of Practice and Procedure, R 792.10447, or the Grant of other Appropriate Relief

U-20763

ALJ Dennis Mack

PROOF OF SERVICE

On September 14, 2021, an electronic copy of *Direct Testimony and Exhibits of Dr. Daniel Larkin on behalf of Bay Mills Indian Community* was served on the following parties:

Name/Party	E-Mail Address
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Date: September 14, 2021

By: Christopher R. Clark
Christopher Clark
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September 14, 2021

Via E-filing

Ms. Lisa Felice
Michigan Public Service Commission
7109 W. Saginaw Hwy.
P. O. Box 30221
Lansing, MI 48909

RE: MPSC Case No. U-20763

Dear Ms. Felice:

The following are attached for paperless electronic filing:

- Direct Testimony of Jacques LeBlanc Jr. on behalf of Bay Mills Indian Community
- Proof of Service

Sincerely,

Christopher R. Clark
cclark@earthjustice.org

STATE OF MICHIGAN
BEFORE THE MICHIGAN PUBLIC SERVICE COMMISSION

In the matter of the Application of Enbridge
Energy, Limited Partnership for Authority to U-20763
Replace and Relocate the Segment of Line 5
Crossing the Straits of Mackinac into a Tunnel ALJ Dennis Mack
Beneath the Straits of Mackinac, if Approval is
Required Pursuant to 1929 PA 16; MCL 483.1
et seq. and Rule 447 of the Michigan Public
Service Commission's Rules of Practice and
Procedure, R. 792.10447, or the Grant of other
Appropriate Relief

TESTIMONY OF JACQUES LEBLANC JR.

ON BEHALF OF

BAY MILLS INDIAN COMMUNITY

September 14, 2021

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1 **I. INTRODUCTION**

2 **Q. Please state your name for the record.**

3 A. My name is Jacques LeBlanc Jr. I am a tribal citizen of Gnoozhekaaning, “Place of the
4 Pike,” or Bay Mills Indian Community, in the Upper Peninsula of Michigan. Since my
5 birth in 1982, I have lived on or adjacent to the Bay Mills Indian Community reservation
6 in Brimley, Michigan.

7 **Q. On whose behalf is this testimony being offered?**

8 A. I am testifying on behalf of Bay Mills Indian Community (BMC).

9 **Q. Have you previously testified before this Commission or in another court proceeding?**

10 A. No. I have not previously testified before this Commission or in any other court proceeding.

11 **Q. What is the purpose of your testimony?**

12 A. I am a Bay Mills fisher. I am testifying before this Commission to explain the economic,
13 cultural, and traditional importance of fishing to Bay Mills and its people.

14 **Q. Are you sponsoring any exhibits?**

15 A. No.

1 **II. FISHING IS AN ACTIVITY OF IMMENSE ECONOMIC, CULTURAL, AND**
2 **TRADITIONAL IMPORTANCE TO BAY MILLS AND ITS PEOPLE**

3 **Q. Where do you fish?**

4 A. I primarily fish within the ceded territory on waters of the Great Lakes and inland lakes.

5 **Q. What is the “ceded territory”?**

6 A. The ceded territory is the approximately 14 million acres of land and inland waters and
7 approximately 13 million acres in Lakes Michigan, Huron, and Superior that the tribal
8 signatories to the 1836 Treaty ceded to the United States, paving the way for Michigan’s
9 statehood. The ceded territory includes a large part of Michigan’s Upper and Lower
10 Peninsulas and the Straits of Mackinac. A map of the ceded territory is Exhibit BMC-6
11 (GRA-6).

12 The Tribes only agreed to this vast cession of our ancestral home upon assurance that we
13 would have the continued ability to exercise our inherent rights, reserved by the Treaty, to
14 hunt, fish, and gather throughout the ceded territory.

15 **Q. How long have you been fishing on waters within the ceded territory?**

16 A. I began commercial and subsistence fishing at the age of five. My father, Jacques LeBlanc,
17 Sr., and others taught me the fundamentals of fishing, including how to prepare nets and
18 how to filet fish so my immediate and extended family could eat fresh whitefish or lake
19 trout for various meals. Throughout my childhood we ice-fished in the Straits when the
20 lake iced over. By age twelve, I was a commercial fisherman, providing for my family, and

JACQUES LEBLANC JR. – DIRECT TESTIMONY - CASE NO. U-20763

1 fishing while working for my uncle. Fishing was our primary source of income. I received
2 my first captain's license when I was eighteen years old, when I first owned a boat.

3 I currently own and operate a gill net fishing outfit and commercially fish the ceded waters
4 of the Great Lakes in various locations, including at the Straits of Mackinac. Depending on
5 the season and weather, I drive hundreds of miles to find the best location to launch my
6 boat and catch fish to support my family.

7 My family has a long history of fishing in the State of Michigan and on the Great Lakes
8 waters. We primarily fish whitefish, which constitutes more than 90% of our target (i.e.,
9 the type of fish we are trying to catch). At other times of the year, we also fish for smelt,
10 trout, and walleye. Whitefish has historically been the most abundant species, and it is one
11 of the easiest to target. Whitefish is the king for business, trade, and retail. There is a
12 lucrative market for whitefish from restaurants and retail establishments.

13 **Q. Do you fish recreationally?**

14 A. Yes. I also fish recreationally within the ceded territory. When doing so, I target whitefish,
15 salmon, pike, menominee (round whitefish), smallmouth bass, largemouth bass, walleye,
16 and perch.

17 **Q. What is the typical fishing season?**

18 A. As a child, I fished year-round: ice-fishing in the winter and open water fishing the rest of
19 the year. Due to both environmental and economic factors, I no longer do this, just as many
20 other fishers have stopped doing this. Year-round fishing is hard and expensive, and due

JACQUES LEBLANC JR. – DIRECT TESTIMONY - CASE NO. U-20763

1 to depleting fish stocks from major environmental impacts such as zebra mussels, quagga
2 mussels, and climate change, it is no longer economically viable to fish year-round.
3 Currently, I fish in the spring after the ice thaws, and I continue fishing through the summer
4 and fall, until either winter forces us out, or it is no longer economically beneficial. My
5 fishing season generally ends around early December.

6 **Q. Why is fishing important?**

7 A. Fishing is an engrained tradition within the Bay Mills Indian Community and is considered
8 a traditional and cultural practice by many throughout my Tribe. My fishing outfit does
9 more than just support my family. Through my own commercial operation, I have
10 employed several dozen tribal citizens throughout the years who also exercise their treaty
11 right as a means to support their family financially.

12 In addition to supporting my family and my community, a large part of why I fish is because
13 of the efforts of my grandfather and father, and the way that we were brought up. I hold
14 fishing very near and dear to my heart. It is not just part of my history; it is who I am. I
15 take my children fishing and have done so their entire lives. Through fishing, they have
16 learned our Tribe's history and it has become a part of who they are. In fact, they frequently
17 ask me to go on the lake.

18 **Q. What is some of the work that is involved with fishing?**

19 A. Fishing requires preparation of equipment including a vehicle, the boat, motors, nets, rope,
20 and anchors, as well as working closely with staff. This work includes building new
21 equipment, making new nets, and fixing, mending, and sewing new or used nets. We spread

JACQUES LEBLANC JR. – DIRECT TESTIMONY - CASE NO. U-20763

1 our nets to prepare them, sew and fix old nets, and make new nets. Gill net repair is labor-
2 intensive and difficult, because once the twine breaks you can't replace it with a single
3 piece of twine; instead, we have to cut the netting out and resew it, which requires a lot of
4 work at home.

5 The net comes as a ready-made mesh of a certain length and height, but it doesn't have any
6 of the weights or the floats for the net to stay in place in the water. We sew the floats and
7 weights onto the nets. The mesh size varies depending on what kind of fish we're targeting.
8 We also use nets of different thickness when targeting different species of fish.

9 I know how to prepare and fish with a gill net because of the knowledge that has been
10 passed down through the generations and the experience that I have gained since beginning
11 to fish at the age of 5.

12 **Q. Will your children take over your fishing operation once you are finished?**

13 A. Part of me hopes not, but part of me hopes so. If they can do it out of love and respect, I
14 would hope so. That would make me very proud. Unfortunately, the entire landscape of
15 fishing in the Great Lakes is changing due to climate change and environmental stressors,
16 and I don't want to see my children struggle economically to do this. At the same time, I
17 wish they would be able to carry on this legacy and tradition and carry on the love and
18 respect for it that I have.

1 **Q. How was your family involved in the effort to protect treaty fishing rights for the Bay**
2 **Mills Indian Community?**

3 A. My grandfather, “Big Abe” LeBlanc, was instrumental in helping protect the treaty fishing
4 rights for the Bay Mills Indian Community. My ancestors, including my grandfather, have
5 a history of gill net fishing going back hundreds of years. This way of life came under
6 attack when the State of Michigan began issuing citations to fisherman for using gill nets,
7 including Tribal fishers. In a planned, strategic effort to stop the state from interfering with
8 our traditional practices, my grandfather agreed to be the test case to challenge the State’s
9 power to prohibit a type of gear by Tribal fishers, when the right to do so was reserved in
10 a treaty with the United States since 1836. My grandfather set a gill net in Pendill’s Bay
11 of Lake Superior, and called the local DNR office to let them know he was fishing with a
12 gill net. He was issued a citation (marked as Exhibit BMC-7 (GRA-7)) for using an illegal
13 fishing device, and the court battle to protect our use of gill nets and exercise our treaty
14 rights began.

15 Throughout the legal fight, my grandfather enjoyed the support of our family and the
16 community. This round of litigation ended after the Michigan Supreme Court ruled in 1976
17 that the right to fish in the ceded waters of Michigan’s Great Lakes, reserved in the 1836
18 Treaty, continued to exist and the State’s power to regulate treaty-protected fishing activity
19 was limited to those restrictions exclusively necessary to protect the resource from
20 depletion (the so-called “conservation standard”).

21 My grandfather’s legacy means the world to me. When I am on the lake, I regularly think
22 about those who stood up for us to have these fishing rights. Fishing has been part of Bay

JACQUES LEBLANC JR. – DIRECT TESTIMONY - CASE NO. U-20763

1 Mills' lifeway since time immemorial. Our people reserved the right to fish in the treaty
2 and have protected these rights through sacrifices like my grandfather's – a sacrifice he
3 made at a time when some other Tribes were not formally recognized by the United States.

4 **Q. Why was it important to protect those rights?**

5 A. It was important to protect our treaty fishing rights in order to preserve traditional lifeways,
6 and to support commercial and subsistence fishing. It was important to ensure that future
7 generations have the opportunity to continue our traditions and way of life as Anishinaabe
8 people. We have an inherent, intimate connection with Mother Earth, who gives us our
9 food, resources, and all we need to live.

10 **Q. How are you involved in protecting natural resources, including the fishery?**

11 A. I serve on the Bay Mills Conservation Committee. My term expires in November 2021.

12 **Q. What is the Bay Mills Conservation Committee?**

13 A. The Conservation Committee is an elected nine-member committee of the Bay Mills Indian
14 Community with the authority and responsibility for regulation of all matters pertaining to
15 hunting, trapping, and fishing. This responsibility spans the ceded territory. The way we've
16 managed our lands, waters, and animals is to regard them as neighbors, not a resource.
17 Every animal has a purpose in life, and we pay attention to it and honor it. We don't waste
18 things; we aim to ensure our efforts aren't based on greed. We did not have to be taught
19 resource management; it is simply a way of life for us.

1 **Q. Why do you serve on the Bay Mills Conservation Committee?**

2 A. I began serving on the Conservation Committee because I wanted to be involved in our
3 decision-making processes. I wanted to have a voice for myself and the community. I
4 wanted to serve my community and help in the ways that I could at that time.

5 **Q. What are your concerns about the Line 5 pipeline tunnel project?**

6 A. I am very concerned that the pipeline and the tunnel project will harm the Great Lakes
7 ecosystem and other inland resources. Running a pipeline through and across waters puts
8 those waters, and all animal species and humans that rely on those waters, at risk. This
9 project would not only damage the Straits of Mackinac and surrounding area, it would also
10 allow the pipeline to continue to operate throughout the ceded territory, where it crosses
11 many more rivers and streams that flow into the Great Lakes.

12 Additionally, I am concerned that this project will continue our reliance on fossil fuels. We
13 already know that climate change is harming our environment and disrupting the
14 ecosystems that we rely on. This project will perpetuate that harm and threaten our
15 traditional fishing lifeways. Of the many things I have learned during my numerous years
16 fishing, it is that the Great Lakes are the gate keepers of habitat management for the
17 different species of fish that are available for harvest. Any harm to the Great Lakes will
18 inevitably harm the fish. These waters are too culturally and economically important to put
19 at risk.

1 **Q. If there were an event that damaged the fishery, what effect would that have on you,**
2 **your family, and Bay Mills fisherpersons?**

3 A. If the fishery resources were significantly harmed, it would be devastating. The Great
4 Lakes and connecting waters are key, and they are interconnected to all of our environment:
5 plants, animals, medicines (both land-based and sea-based). The threat that the pipeline
6 imposes on that entire system is not at all worth the risk. If the Great Lakes ecosystem is
7 harmed, I will have no means to continue supporting my family through treaty subsistence
8 and commercial fishing, or harvesting of medicines and animals.

9 Successful commercial fishing is a complex enterprise. Knowing when, how, and where to
10 fish all involve special knowledge that has been passed down through multiple generations
11 of fisherman. Beyond the harm that an oil spill or other event would have on the health of
12 lake trout and whitefish, any disruption of the fishery for an extended period would stifle
13 the transfer of fishing knowledge to younger generations. This could be devastating.

14 The scope of impact of a large oil spill, or other catastrophe, would go far beyond myself,
15 my family, or indigenous people. It would impact everyone. It would change the entire
16 flow of environmental growth for an immeasurable amount of time, eradicate some species,
17 change spawning seasons, change entire future generations of land and sea species. It
18 would impact things that we cannot measure. A major oil spill would be an epic catastrophe
19 beyond comprehension.

20 **Q. Does that conclude your testimony?**

21 A. Yes.

STATE OF MICHIGAN
BEFORE THE MICHIGAN PUBLIC SERVICE COMMISSION

In the matter of the Application of Enbridge Energy, Limited Partnership for the Authority to Replace and Relocate the Segment of Line 5 Crossing the Straits of Mackinac into a Tunnel Beneath the Straits of Mackinac, if Approval is Required Pursuant to 1929 PA 16; MCL 483.1 et seq. and Rule 447 of the Michigan Public Service Commission's Rules of Practice and Procedure, R 792.10447, or the Grant of other Appropriate Relief

U-20763

ALJ Dennis Mack

PROOF OF SERVICE

On September 14, 2021, an electronic copy of *Direct Testimony of Jacques LeBlanc Jr. on behalf of Bay Mills Indian Community* was served on the following parties:

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Date: September 14, 2021

By: Christopher R. Clark

Christopher R. Clark

cclark@earthjustice.org



September 14, 2021

Via E-filing

Ms. Lisa Felice
Michigan Public Service Commission
7109 W. Saginaw Hwy.
P. O. Box 30221
Lansing, MI 48909

RE: MPSC Case No. U-20763

Dear Ms. Felice:

The following are attached for paperless electronic filing:

- Direct Testimony and Exhibits of Dr. Alec R. Lindsay on behalf of Bay Mills Indian Community
- Proof of Service

Sincerely,

Christopher R. Clark
cclark@earthjustice.org

STATE OF MICHIGAN

BEFORE THE MICHIGAN PUBLIC SERVICE COMMISSION

In the matter of the Application of Enbridge
Energy, Limited Partnership for Authority to
Replace and Relocate the Segment of Line 5 U-20763
Crossing the Straits of Mackinac into a Tunnel
Beneath the Straits of Mackinac, if Approval is
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et seq. and Rule 447 of the Michigan Public
Service Commission's Rules of Practice and
Procedure, R. 792.10447, or the Grant of other
Appropriate Relief

TESTIMONY OF DR. ALEC R. LINDSAY

ON BEHALF OF

BAY MILLS INDIAN COMMUNITY

September 14, 2021

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I. INTRODUCTION & QUALIFICATIONS

Q. Please state for the record your name, job title, and business address.

A. My name is Alec R. Lindsay. I am a Professor of Biology at Northern Michigan University, located at 1401 Presque Isle Avenue, Marquette, MI 49855.

Q. On whose behalf is this testimony being offered?

A. I am testifying on behalf of Bay Mills Indian Community (“BMC”). This testimony contains my independent scientific opinion. It is being provided in my individual capacity and not on behalf of my employer.

Q. Please summarize your work experience, educational background, and any awards you have received.

A. I have worked for Northern Michigan University for 19 years. I completed my undergraduate studies at the University of Wisconsin-Madison in 1994, double majoring in Zoology and Classical Humanities. I completed my graduate studies at the University of Michigan, achieving a Ph.D. in Ecology and Evolutionary Biology. I have worked in the field with birds for the past 25 plus years, including field work with loons that has taken me from Alaska to Michigan to Scotland. Along with multiple grant awards for the study of loons, I was awarded NMU’s Distinguished Faculty award in 2013. In 2014 I was awarded the Michigan Distinguished Professor of the Year Award by the Michigan State Universities’ President’s Council. My educational background and work experience is also summarized in my CV, provided as Exhibit BMC-14.

Q. Please describe the focus of your academic research.

DR. ALEC LINDSAY – DIRECT TESTIMONY - CASE NO. U-20763

1 A. My research interests are broadly focused on studies of evolution, animal behavior and
2 conservation, incorporating data gathered from molecular genetic methods and detailed
3 field studies. I am interested in evolutionary theory and its application to animal behavior,
4 molecular evolution and conservation. My research has predominantly focused on studies
5 of genetics and behavior of Holarctic birds, but I have published additional work with
6 students and other collaborators on varied taxa like Omura's whales, black flies, and blood
7 parasites of wild birds.

8 **Q. Have you testified before this Commission or as an expert in any other proceeding?**

9 A. I have not previously testified before this Commission. I have testified as an expert in an
10 administrative proceeding once before. That case was *Petitions of the Keweenaw Bay*
11 *Indian Community, Huron Mountain Club, National Wildlife Federation, and Yellow Dog*
12 *Watershed Environmental Preserve, Inc., on the permits issued to Kennecott Eagle*
13 *Minerals Co.*, 2010 WL 276664 (Jan. 14, 2010) (Mich.Dept.Nat.Res.).

14 **Q. What is the purpose of your testimony?**

15 A. I am testifying on behalf of BMC regarding the effects of climate change on the common
16 loon (*Gavia immer*). It is my understanding that the Commission is considering evidence
17 regarding the effects of climate change as it considers the proposed project.

18 **Q. What information did you review in preparing your testimony in this case?**

19 A. In preparing my testimony in this case, I drew upon my education, research, and work
20 experience. I am familiar with the literature addressing the impacts of climate change on
21 many birds, including loons. In addition to my knowledge and experience, I relied upon

the literature cited below (and listed in Exhibit BMC-15) in the preparation of this testimony.

Q. Are you sponsoring any exhibits?

A. Yes, I am sponsoring the following exhibits:

Exhibit BMC-14: Resume (or CV) of Dr. Alec R. Lindsay

Exhibit BMC-15: References Cited in Direct Testimony of Alec R. Lindsay.

II. THE EFFECTS OF CLIMATE CHANGE WILL HARM LOONS.

Q. What bird species is the focus of your testimony?

A. Although there are five species of loons (Aves: Gaviiformes) in the world, this testimony focuses on the common loon (*Gavia immer*) - the only species of loon that breeds in Michigan and is regularly found in the Great Lakes region. Throughout this testimony I will use the terms common loons and “loons” interchangeably to refer to common loons, recognizing there are other species of loon with different biological characteristics that are not relevant to this testimony. The common loon is a large waterbird species that breeds in high latitude lakes of North America. A charismatic icon of the “northwoods,” common loons are socially important for the wilderness experience of human residents and visitors, they are economically important for tourism, and they are ecologically important as top trophic-level predators in lake habitats. Much of the basic biology of loons covered below can be confirmed by the species account of Paruk et al. (2021).

Q. Please describe the typical habitat for North American common loons during the summer months.

1 A. Adult (>3 years old) loons use two different classes of freshwater habitats in the summer
2 months depending on their breeding status.

3 ***Breeding birds:*** When adult loons return to the higher latitudes of North America each
4 spring, they are predominantly seeking habitats that are suitable for breeding. Loons breed
5 on large (>24ha), clearwater lakes that tend to have irregular shorelines and an ample fish
6 prey-base. Breeding lakes preferably have islands, which serve as prime sites for their
7 ground-built nest. Breeding loon pairs (pairs are socially and genetically monogamous)
8 will routinely defend whole lakes as their breeding territory, although large lakes with
9 abundant fish may support multiple pairs. Loon pairs on multi-pair lakes will “parcel” out
10 the lake into defensible regions. Territorial pairs can also defend multiple lakes as a single
11 territory, especially when lakes are small and the nesting lake has a small prey-base.
12 Breeding loon pairs rarely nest on Great Lake shorelines, presumably due to the damaging
13 effects of large waves on their near-shore nests. The cases where loons breed on the waters
14 of the Great Lakes are nearly always restricted to protected bays or inlets, like those found
15 on Isle Royale in Lake Superior.

16 ***“Floater” birds:*** When adult loons do not secure suitable habitat for nesting with a mate,
17 they predominantly become “floater” birds that do not defend territories, and instead spend
18 time on multiple water bodies. The home range of “floater” loons is thus considerably
19 larger than the typical home range of territorial breeding loons and the quality of habitats
20 used by “floater” loons is more varied. During the breeding season, “floater” loons can be
21 found on large inland lakes, on lakes with heavier human development, and on Great Lakes
22 shorelines. Loons rarely are found on rivers during the breeding season (they use rivers

1 more frequently while migrating). Periodically, “floater” loons will intrude on the
2 territories of breeding pairs, usually resulting in aggressive interactions between territory
3 holders and intruders.

4 **Q. Please describe the migration process for North American common loons.**

5 A. On a most basic level, loons fly north to their breeding regions in the spring and south to
6 their wintering regions in the autumn. Loons are fast fliers (120km/hr) and when flying
7 over land have been observed migrating at an altitude of 1500-2700m above sea level
8 (when over water, loons typically fly lower). Migration is inherently difficult to study,
9 because birds in flight are hard to track in large numbers. Still, data from migration count
10 sites, genetic analyses, and satellite telemetry provide an increasingly clear picture of the
11 routes and timing of migration. The particulars of flight paths and timing vary with
12 different populations, and even within populations there can be some variability. For
13 instance, some loons that breed in northern Minnesota fly east to their wintering grounds
14 in the mid-Atlantic, while other loons that breed in the same region fly south to winter in
15 the Gulf of Mexico.

16 ***Vernal Migration:*** Generally, in March or April, once the molt of flight feathers is
17 complete (see below), loons will begin their journey northward. In the Great Lakes region,
18 where we know arguably the most about loon migration, loons fly north typically following
19 ice-out as it moves north with the warming weather. Breeding pairs will often appear on
20 territorial lakes within 24-48 hours of open patches of water appearing on the lake. The
21 pressure to “stake-out” territory leaves little room for deviation, so spring migration is
22 fairly stereotyped and individual birds tend to follow the same routes each spring.

1 *Autumnal migration:* Loon pairs that were successful breeders usually stay on their
2 breeding territory for the 14-15 weeks it takes to successfully raise 1-2 loon chicks. As the
3 developing loon chicks get closer to fledging, adults may start to wander from the territory.
4 Eventually they fly off the breeding lake, leaving their now self-sufficient offspring behind.
5 Usually within 7-14 days the offspring will also leave their natal lake territory. Adults
6 migrate independent of each other and of their chicks. Migrating birds will fly hundreds of
7 kilometers in a single day, stopping periodically on larger bodies of water to forage and
8 rest. Recent genetic analysis (Larison et al., 2021) and satellite-telemetry data (Kenow et
9 al., 2021) show that the Great Lakes are an important stopover site for migrating loons,
10 including those that breed as far away as the province of Alberta and Quebec. Loons can
11 remain on their stopover sites for days or weeks before continuing their journey southward
12 to their final overwintering waters.

13 **Q. Please describe the typical habitat for North American common loons during the**
14 **winter months.**

15 **A.** During the winter months, adult common loons go through a complete and synchronous
16 replacement of their flight feathers (“molt”), rendering them flightless for 4-6 weeks. As
17 such, loons require habitats that have ample prey-base to sustain them over long periods of
18 time while flightless. Thus, most loons spend their winter months on the nearshore or
19 offshore coastlines of North America where water is relatively clear, the prey-base is
20 ample, and the depth is less than 35m. Some birds will overwinter on large reservoirs
21 (typically in the southern United States) or on large slow-moving rivers of warmer climates
22 (i.e. the Columbia River). Loons rarely overwinter on the Great Lakes. Hatch-year loons

(<3 yrs) migrate to these same types of habitats after fledging and remain in those habitats until they reach sexual maturity (>3 yrs).

Q. During which time of year are common loons found in Michigan?

A. Common loons are among the earliest migratory waterbirds observed in Michigan, being regularly sighted on the Great Lakes in late March and early April. Breeding takes place on inland lakes in Michigan from April to October. During autumn migration birds can be commonly seen in Michigan into October and November. Loons are rarely seen in Michigan from December-February, and if they are seen it is almost always on the Great Lakes.

Q. Has climate change already affected common loons?

A. Yes. One study of a population of breeding loons (Bianchini et al., 2020) found that in the last 38 years loon productivity declined in Ontario, and attributed that decline to “climate change-induced stress, acting through multiple interacting pathways.” As to changes in loon migration, data collected over the last 30 years at Whitefish Point Bird Observatory (“WPBO”) on Lake Superior demonstrate that:

- loons are migrating north earlier in the spring (Figure 1)
- numbers of migrating loons are declining in the spring (Figure 2)
- loons are migrating south later in the fall (Figure 3)

[N.B. The three figures included below were generated using compiled data collected from WPBO over 30 years. These data were used with permission from WPBO and Michigan

Audubon. Raw data are shared for this testimony, but should not be used without express permission of Michigan Audubon and A. R. Lindsay.]

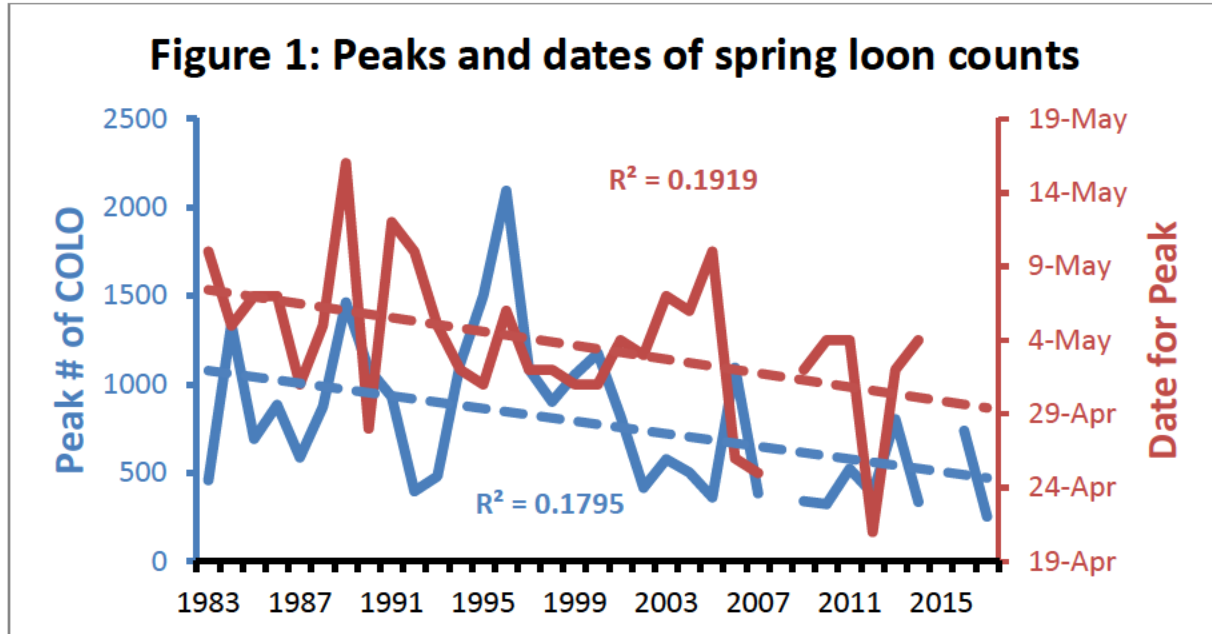


Figure 1. This graph shows the peak number of loons that migrated past WPBO waterbird counters each spring over 30 years, and the dates that those peak counts occurred. The declines in both peak number of loons and the date of the peaks (earlier over the period) were significant.

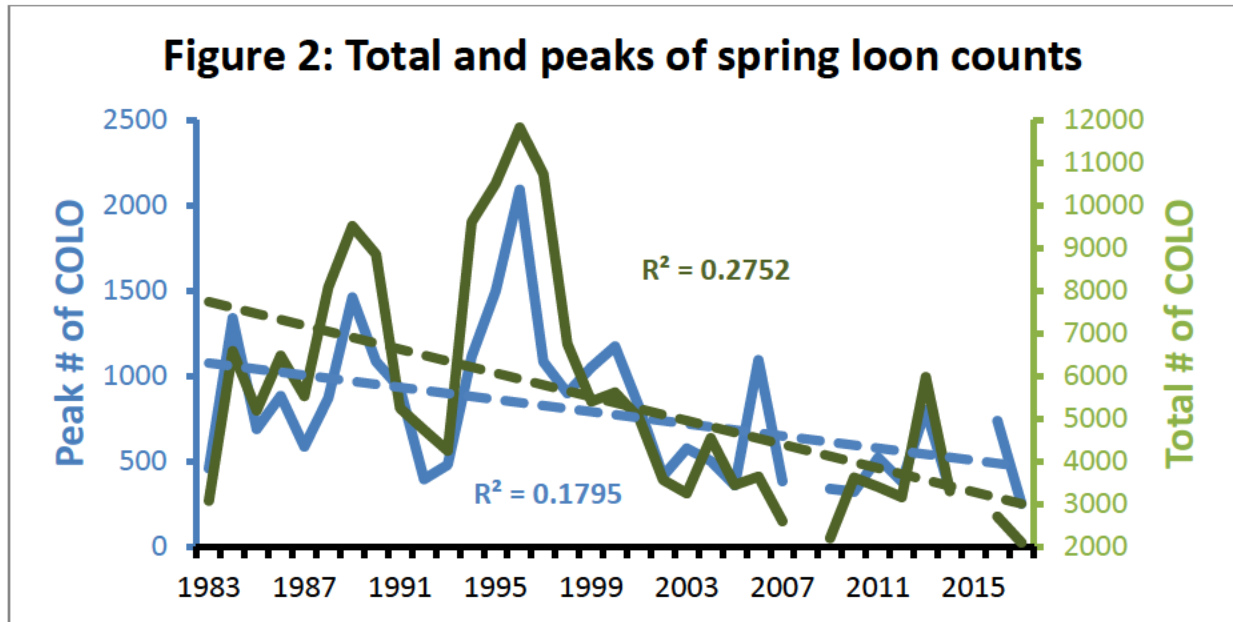


Figure 2. This graph shows the peak and total number of loons that migrated past WPBO waterbird counters each spring over 30 years. The declines in both peak number of loons and the total number of loons over the period were significant.

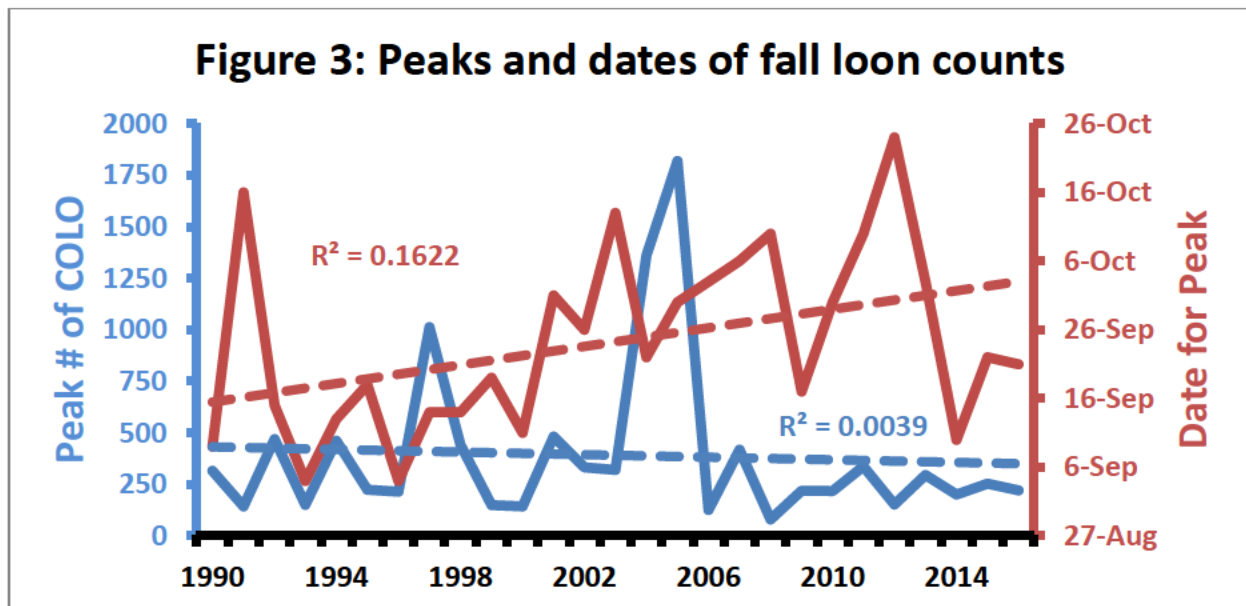


Figure 3. This graph shows the peak number of loons that migrated past WPBO waterbird counters each autumn over 30 years, and the dates that those peak counts occurred. Neither

1 the peak numbers nor total numbers of loons significantly declined across years, but the
2 peaks did occur significantly later across the period.

3 **Q. What are your primary concerns about climate change and its effects on common**
4 **loons?**

5 A. I am concerned about the impact of climate change on loons. My primary concerns are the
6 loss of breeding habitats in Michigan associated with the overall loss of breeding range of
7 loons, and the direct loss of individuals due to more frequent and intense botulism type E
8 outbreaks than have been experienced in the past.

9 **Q. How will climate change impact common loon breeding habitats?**

10 A. It is projected that climate change will alter water levels in both the Great Lakes (Angel &
11 Kunkel, 2010; Hayhoe et al., 2010) and inland breeding lakes (Magnuson et al., 1997), and
12 also change the total number of ice-free days in many inland breeding lakes (Mishra et al.,
13 2011). Changing water levels in loon habitats are of significant importance to loons, since
14 loons are not merely waterbirds, they are water-bound birds. Many other species of birds
15 that are considered “waterbirds” (mallard, great blue heron, herring gull, etc.) are
16 dependent on water, but will spend longer periods in terrestrial habitats. Like penguins or
17 puffins, loons are among the most aquatic of birds. Unless they are flying (or sick or
18 injured), loons will only set their webbed feet onto land to copulate (very brief) or to nest.
19 Unlike nearly all other waterbirds, loons cannot effectively stand on land. Once a chick
20 hatches from an egg it will enter the water within 48 hours and it will likely not go onto
21 land again until it is an adult, paired with a mate, and ready to nest. Emphasizing the water-

1 dependence of loons is important because the fundamental way climate change will affect
2 loons is through climate-induced changes in lakes and coastal oceans (lake temperatures,
3 lake levels, ice-out, hydrological cycles, coastal food webs, etc.).

4 **Q. Will climate change reduce the abundance of common loons in Michigan?**

5 Yes. Climate change will drastically reduce the abundance of, and may even eliminate,
6 common loons in Michigan. With a 3°C global temperature change by 2080, common loons
7 will be extirpated from Michigan and have an anticipated breeding range loss of 97%
8 within the lower 48 states and a nearly 30% loss of population across their entire range
9 (Bateman et al., 2020). Studies of hydrological dynamics of lakes under climate change
10 scenarios predict increased warming of lake surface water and changes in lake levels due
11 to alterations of evapotranspiration from lake surfaces. Although some models have
12 predicted dramatic losses of Great Lakes water levels (Angel & Kunkel, 2010; Hayhoe et
13 al., 2010), more parameterized models show less of a decline in lake levels, but still warn
14 of more dramatic fluctuations in water levels (MacKay & Seglenieks, 2013; Music et al.,
15 2015). In smaller lakes of Michigan where loons breed, this will result in losses of lake
16 volumes due to less ice-cover which leads to increased evaporation (Magnuson et al., 1997;
17 Mishra et al., 2011). As lake volumes decrease, their salinities and nutrient (and
18 contaminant) concentrations will change, leading to shifts in species compositions that will
19 affect the trophic webs in which loons are embedded (Collingsworth et al., 2017;
20 Magnuson et al., 1997; Murdoch et al., 2000; Noyes et al., 2009). These changes are
21 predicted to occur on the Great Lakes (Hayhoe et al., 2010) and on smaller inland breeding
22 lakes of the Great Lakes region (Magnuson et al., 1997). A recent study (Saunders et al.,

2021) demonstrated that the North Atlantic Oscillation (NAO) generates climatic variation that correlates with diminished loon productivity and survival, and the authors show that “...the steepest declines [in the loon population] were projected under positive NAO trends, as anticipated with ongoing climate change.”

Q. What is botulism type E and how has it affected loons?

A. In the autumn, loons that migrate through the Great Lakes face an additional danger - being poisoned by botulism type E. Botulism type E outbreaks in the Great Lakes have killed an estimated 100,000 waterbirds in the last 50 years, with an estimated 10,000+ common loons being killed in the Great Lakes over that period (Chipault et al., 2015; USGS, Web Informatics and Mapping (WIM), online). Botulism type E is a neurotoxin produced by a strain of the naturally occurring bacterial species, *Clostridium botulinum*. There are seven different strains of *C. botulinum*, and the toxins produced by these strains tend to occur in different environments and affect different types of organisms. While botulism types A, B, E, and F have been associated with cases of human botulism, botulism types C and E are primarily associated with outbreaks in wild birds (Rocke & Friend, 1999). In the last 30 years nearly all of the botulism-killed birds on the Great Lakes have been associated with botulism type E (Chipault et al., 2015; Lafrancois et al., 2011; Princé et al., 2018). The spores of *C. botulinum* are quite ubiquitous in the environment (Espelund & Klaveness, 2014; Pérez-Fuentetaja et al., 2006).

Q. How will climate change impacts make common loons more susceptible to botulism outbreaks?

1 **A.** Climate change will alter limnological (temperature, stratification) and ecological (algal
2 growth and decomposition) conditions in lakes such that the conditions will encourage the
3 growth of the anerobic bacteria that produce the botulism toxin. The limnological and
4 ecological interactions that lead to loons (and some other waterbirds) ingesting and being
5 killed by the toxin are still being delineated, but it is clear that the invasive zebra and
6 quagga mussels (*Dreissena* spp.), the invasive round goby (*Neogobius melanostomus*), and
7 native *Cladophora* sp. algae are all players in this phenomenon (Essian et al., 2016; Kenow
8 et al., 2018; Lafrancois et al., 2011; Pennuto et al., 2012; Tozer & Beck, 2019). Botulism
9 type E outbreaks do not occur every autumn, but are more likely to occur in those years
10 when the water is unusually warm, anoxic, and unmixed (Lafrancois et al., 2011). Models
11 of climate change in the Great Lakes predict that surface temperatures will warm, lake
12 levels will likely decline, and mixing will be diminished (Trumpickas et al., 2009). The
13 analysis of Lafrancois et al. (2011) indicates that those conditions will lead to an increase
14 in the incidence of botulism outbreaks, potentially killing thousands of more loons in each
15 outbreak.

16 **Q.** **Does that complete your testimony?**

17 **A.** Yes.

EXHIBIT BMC-14

Alec R. Lindsay, Ph.D.
Curriculum Vitae

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 Northern Michigan University
 Marquette, MI 49855-5341
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EDUCATION

2002 Ph.D., Department of Ecology and Evolutionary Biology, University of Michigan
 1994 B.S., Double Major: Zoology and Classical Humanities, University of Wisconsin-Madison

PROFESSIONAL POSITIONS & AWARDS

2014-Present Professor, Department of Biology, Northern Michigan University
 2014 Michigan Distinguished Professor of the Year Award. State Universities' President's Council
 2013 Distinguished Faculty Award. Northern Michigan University.
 2007-2014 Associate Professor, Department of Biology, Northern Michigan University (Tenured)
 2012 Visiting Researcher, Department of Biology, Boston University
 2002-2007 Assistant Professor, Department of Biology, Northern Michigan University
 1996-2002 Graduate Student Instructor, Department of Biology, University of Michigan
 2001 Instructor, Howard Hughes Medical Foundation/University of Michigan
 2001 Research Assistantship, Genomic Diversity Laboratory, University of Michigan
 2000 Research Assistantship, Division of Birds, University of Michigan Museum of Zoology

TEACHING (Undergraduate(U) and Graduate(G)) Semesters Taught:

Introductory Biology (U)	W2009, F2009, W2010, F2010, W2011, F2012, W2013, F2013, W2014, F2014, F2015, W2016, F2017, F2018, W2019, F2019
Introduction to Cell and Molecular Biology (U)	W2003, W2004, F2005, W2006, F2006, W2007, F2007
Conservation Biology (U)	W2003, F2004
Ecology of the Northern Forest (U)	F2002, F2003, S2006, F2008
Field Ornithology (U)	S2010, S2016
Genetics (U)	F2005, W2006, F2012
Evolution (U)	F2002, F2003, F2004, W2007, F2007, F2008, W2009, W2011
Hot Topics: Evolution and Intelligent Design (U)	W2006
Field Studies of Zambia (U)	S2007, S2011, S2014, S2017, S2019
Ornithology (U & G)	S2005, W2008, W2010, W2013, W2014, W2016, W2018
Systematics (G)	F2004, F2006
Seminar: Conservation Genetics (G)	W2003
Seminar: Planning and Proposing Science (G)	F2008, F2009
Teaching Assistant Training (G)	F2013, F2014, F2015

PUBLICATIONS (in print, in press or in review) - * denotes NMU student co-authors

Larison, Brenda, **Alec R. Lindsay**, Christen Bossu, Michael D. Sorenson, Joseph D. Kaplan, David C. Evers, James Paruk, Jeffrey M. DaCosta, Thomas B. Smith, and Kristen Ruegg. (2021) Leveraging genomics to understand threats to migratory birds. *Evolutionary Applications* 14, no. 6: 1646-1658.
 Gayk, Zach*, Diana Le Duc, Jeffrey Horn, **Alec Lindsay**. (2018) Genomic Insights into Natural Selection in the Common Loon (*Gavia immer*): Evidence for Aquatic Adaptation. *BMC Evolutionary Biology* 18, no. 1 64.
 Neri, Christopher M., Nova MacKentley, Zach A. Dykema*, Emily M. Bertucci*, **Alec R. Lindsay**, (2018) Different Audiolures Lead to Different Sex-biases in Capture of Northern Saw-whet Owls (*Aegolius acadicus*). *Journal of Raptor Research*. 52(2): 245-249

- Cerchio, Salvatore, Boris Andrianantenaina, **Alec R. Lindsay**, Melinda Rekdahl, Norbert Andrianarivelo, Tahina Rasoloarijao. 2015. Omura's whales (*Balaenoptera omurai*) off northwest Madagascar: ecology, behaviour and conservation needs. *Royal Society Open Science*, 2, DOI: 10.1098/rsos.150301.
- Debiak, Abigail L. *, Damon L. McCormick, Joseph D. Kaplan, Keren B. Tischler and **Alec R. Lindsay**. 2014. A molecular genetic assessment of sex ratios from breeding, migratory and overwintering common loons. *Waterbirds* 37: 6-15
- Lindsay, Alec R.** and C. Skye Haas*. 2013. DNA from feces and museum specimens confirms a first state record bird. *University of Michigan Museum of Zoology, Occasional Papers Series*. 742: 1-10
- Weinandt, Meggin L. *, Michael Meyer, Mac Strand, **Alec R. Lindsay**. 2012. Cues used by the blackfly, *Simulium annulus*, for attraction to the common loon (*Gavia immer*). *Journal of Vector Ecology*. 37(2): 359-364
- Gayk, Zachary* and **Alec R. Lindsay**. 2012. Winter Microhabitat Foraging Preferences of Sympatric Boreal and Black-capped chickadees in Michigan's Upper Peninsula. *Wilson Bulletin*. 124 (4): 820-824
- Lindsay, Alec R.** 2012. Black-Capped Chickadee. in *Michigan Breeding Bird Atlas II*. Allen Chartier, Ed.
- Lerner, Heather R. L., Jeff A. Johnson, **Alec R. Lindsay**, Lloyd F. Kiff and David P. Mindell. 2009. It's not too late for the harpy eagle (*Harpia harpyja*): high levels of genetic diversity and differentiation can fuel conservation programs. *PLoS One* 4(10): e7336. doi:10.1371/journal.pone.0007336
- Lindsay, Alec R.** 2009. Invited Book Review of: "Ecology and Evolution of Chickadees and Titmice: an Integrated Approach" (2007, Oxford University Press, Oxford UK. Ken Otter, Editor) *Wilson Bulletin*. 121(4): 851-853
- Lindsay, Alec R.** and Jerrold L. Belant. 2008. A simple and improved PCR-based technique for white-tailed deer (*Odocoileus virginianus*) sex identification. *Conservation Genetics*. 9: 443-447
- Graves, Brent M., Mac Strand, **Alec R. Lindsay**. 2006. A reassessment of sexual dimorphism in human senescence: theory, evidence and causation. *American Journal of Human Biology*. 18: 161-168
- Lindsay, Alec R.**, Sandra S. Gillum, Michael W. Meyer. 2002. Differences in avian assemblages on developed and undeveloped lakes in a northern hardwood forest. *Biological Conservation*. 107 (1): 1-11
- Lindsay, Alec R.** 2002. Invited Book Review of "Introduction to Conservation Genetics" (2002, Cambridge University Press: R. Frankham, J. D. Ballou, D. A. Briscoe authors). *Endangered Species Update*. 19(6): 238-240

INVITED RESEARCH PRESENTATIONS (Last 7 years): 21 Presentations with 17 student co-authors

- 2019 American Ornithological Society, Anchorage, AK
- 2019 American Society of Mammalogists, Washington, D.C.
- 2019 International Giraffid Conference, Columbus, OH
- 2017 American Ornithological Society, East Lansing MI
- 2017 Inland Bird Banding Association, Kalamazoo, MI
- 2016 North American Ornithological Congress, Washington DC.
- 2014 North American Loon Symposium, Sigurd Olson Environmental Institute, Ashland, WI
- 2013 Gavia Workshop, Tvärminne Zoological Station, Finland
- 2013 Evolution 2013: SSE, SSB, ASN Joint meeting, Snowbird Utah
- 2012 American Ornithologist's Union, Vancouver, British Columbia, Canada
- 2012 Michigan Bird Conservation Initiative, Tustin Michigan

GRANTS, AWARDS & HONORS

- 2018 Giraffe Conservation International. Dynamics of South Luangwa Giraffe Population. *In collaboration with* **Zambian Carnivore Programme. \$7100**
- 2017 NMU Faculty Grants. The JP Chickadee Project. **\$7000**
- 2017 Giraffe Conservation International. Dynamics of South Luangwa Giraffe Population. *In collaboration with* **Zambian Carnivore Programme. \$7100**
- 2015 PRIME Award: Genetic Diversity of Blue Wildebeest Populations in Zambia and Southern Africa. Co-PIs: Kate Teeter (NMU Biology), Jeff Horn (NMU-Computer Science). Collaborator: **Zambian Carnivore Programme - \$20,000**
- 2014 Michigan Distinguished Professor of the Year Award. Michigan State Universities' President's Council
- 2013 Distinguished Faculty Award. Northern Michigan University.
- 2012 Peter White Scholar Award. Conservation Genomics of the Common Loon. - **\$17,000**

- 2011 Visiting Researcher Award. National Science Foundation (Research Opportunity Supplement Award with Michael D. Sorenson, Boston University) – “RAD-Tag” approach for next-gen sequencing of loon genome to describe 3000+ single nucleotide polymorphism loci - **\$10,352**
- 2009 Alec Lindsay and Patrick Brown. Developed a coordinated environmental summer program at NMU. Northern Michigan University - Wildcat Innovation Fund. **\$15,000**
- 2006 Alec Lindsay and Jerry Belant. “Assessing non-invasive sampling techniques and conservation genetic models with white-tailed deer (*Odocoileus virginianus*).” Christine Stevens Wildlife Award. **\$10,000**
- 2006 Alec Lindsay. Designing a simple and improved PCR-based technique for white-tailed deer (*Odocoileus virginianus*) sex identification. US-National Park Service. **\$1,800**
- 2005 Alec Lindsay. DNA Variation, immunogenetics and mercury: genetically assessing the conservation status of common loons (*Gavia immer*). NMU Faculty Grants Program. **\$6,960**
- 2004 Alec Lindsay. Return rates of banded common loons (*Gavia immer*) in early spring. WI-DNR. **\$9,978**
- 2003 Alec Lindsay. Conservation genetics of common loon (*Gavia immer*) populations. NMU Faculty Grants Program. **\$7,000**

PROFESSIONAL WORKSHOPS

2012 – ConGen 2012: Recent Advances in Conservation Genetics: Smithsonian Tropical Research Institute, Panama; organized by Steven J. O’Brien
 2012, 2007 – Animal Diversity Web, sponsored by National Science Foundation, Stages I & II
 2009 – Biodiversity Synthesis Center of the Encyclopedia of Life, Curator Synthesis Meeting

Thesis Direction (graduate)

Major advisor:

- Amy Munes: Thesis co-advisor, NMU Biology Masters Student, 2020-present
- Rachel Weisbeck: Thesis co-advisor, NMU Biology Masters Student, 2019-present
- Carly Paget: Thesis advisor, NMU Biology Masters Student, 2017-present
- Samantha Phillips: Thesis advisor, NMU Biology Masters Student, 2017-present
- Emily Griffith: Thesis co-advisor, NMU Biology Masters Student, 2019-2021
- Steph Szarmach: Thesis co-advisor, NMU Biology Masters Student, 2017-2020
- Connor Gable: Thesis advisor, NMU Biology Masters Student, 2017-2019
- James VanOrman: Thesis advisor, NMU Biology Masters Student, 2016-2019
- Katie Bjornen: Thesis advisor, NMU Biology Masters Student, 2015-2017
- Zach Gayk: Thesis advisor, NMU Biology Masters Student, 2014-2015
- Quentin Sprengelmeyer: Thesis advisor, NMU Biology Masters Student, 2012-2014
- Gary Palmer: Thesis advisor, NMU Biology Masters Student, 2010-2014
- Sayako Iwanaga: Thesis advisor, NMU Biology Masters Student, 2010-2012
- Abigail Debiak: Thesis advisor, NMU Biology Masters Student, 2010-2012
- Grant Slusher: Thesis advisor, NMU Biology Masters Student, 2007-2011
- Meggin Weinandt: Thesis advisor, NMU Biology Masters Student, 2004-2006

****Graduate Committee member for over 20+ graduate students at NMU and other institutions****

Research mentorship (undergraduate)

Aubrey Parsons (2002-2003)
 David Hoffelder (2002-2004)
 Justin Segula (2002-2004)
 Nikole Goldsmith (2002-2004)
 Leah Stoner (2002-2004)
 Nick Squires (2002-2004)
 Tom Pedersen (2002-2004)
 John Elwell (2003-2004)
 Stephanie Jones (2003)

Andrew Moriarity (2003-2005)
 Jonelle Korhonen (2003-2004)
 Mike Weirda (2003-2005)
 Zeko McKenzie (2003-2007)
 Ellen Lawrence (2003-2007)
 Jane Stieber (2003-2005)
 Steve Caird (2004-2007)
 Grant Slusher (2005-2007)
 Viktoria Koskenoja (2005-2007)

Julian Dupuis (2005-2009)
Sarah Hagle (2006-2009)
Kaitlyn Uren (2007-2010)
Danielle Hernandez (2007-2009)
Emily Durkin (2007-2009)
Katie Stamerjohn (2007-2009)
Kala Erickson (2007-2009)
David Pavlik (2006-2010)
Zach Gayk (2010-2012)
Brittney Dodge (2009-2012)
Chloe Apelgren (2012-2013)
Genevieve Haas (2012-2013)
Charlotte Cialek (2012-2013)
Kelsey Huisman (2012-2013)
Mariah Beaman (2012-2013)
Nicholas Vetter (2013-2014)
Dana Gilbertson (2013-2015)
Emily Bertucci (2014-2017)
Zack Dykema (2014-2017)
Abbie Persoon (2015-2018)

Alyssa Peterson (2015-2016)
Danielle Dershem (2015-2018)
Ellen Michels (2015-2018)
Ellie Ewald (2015-2017)
Eric Krause (2015-2016)
Jason Verbal (2015-2017)
Natalie Yeck (2015-2016)
Nathan Martineau (2015-2016)
Samantha Phillips (2015-2017)
Thomas Sofka (2015-2017)
Veronica Snow (2015-2017)
Zack Hancock (2015-2016)
Clara Churchill (2017-2018)
Chase Fair (2017-2018)
Joseph Kurtz (2017-present)
Kyra Brazell (2017-present)
Marissa Trombley (2017-present)
Nathan Martineau (2017-present)
Carlo Estupigan (2017-2019)
Megan Quinn (2018-present)

SERVICE

Northern Michigan University

- Chair of the Academic Senate, 2017-present
- Dean of Arts & Sciences Search Committee, 2018-2019
- Academic Senator for Biology Department, NMU Academic Senate, 2014-present
- AAUP Negotiating Team Member, 2009
- AAUP Bargaining Council Representative – Dept. of Biology, 2009-2011
- Graduate Coordinator, Department of Biology, 2009-2011
- Senate Executive Committee Member & Secretary, NMU Academic Senate, 2007-2008
- Academic Senator for Biology Department, NMU Academic Senate, 2006-2008
- Executive Committee Chair, Department of Biology, 2007-2009
- Risk Assessment and Management Committee, International Studies, 2007-2011
- Executive/Evaluation Committee, Department of Biology, 2003-2005, 2012-present
- President of Sigma Xi, NMU Chapter, 2004-2005
- Honors Board Member, 2005-2006
- Graduate Committee, Department of Biology, 2003-2005
- Seminar and Library Committee, Department of Biology 2002-2007

Michigan Audubon Society

- Chair & Executive Committee Member, March 2013-2017
- Vice Chair & Executive Committee Member, March 2012-2013
- Board of Directors, July 2011-2017

EXHIBIT BMC-15

Literature Cited

- Angel, J. R., & Kunkel, K. E. (2010). The response of Great Lakes water levels to future climate scenarios with an emphasis on Lake Michigan-Huron. *Journal of Great Lakes Research*, 36, 51–58. <https://doi.org/10.1016/j.jglr.2009.09.006>
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Magnuson, J. J., Webster, K. E., Assel, R. A., Bowser, C. J., Dillon, P. J., Eaton, J. G., Evans, H. E., Fee, E. J., Hall, R. I., Mortsch, L. R., Schindler, D. W., & Quinn, F. H. (1997).

Potential Effects of Climate Changes on Aquatic Systems: Laurentian Great Lakes and Precambrian Shield Region. *Hydrological Processes*, 11(8), 825–871.

[https://doi.org/10.1002/\(SICI\)1099-1085\(19970630\)11:8<825::AID-HYP509>3.0.CO;2-G](https://doi.org/10.1002/(SICI)1099-1085(19970630)11:8<825::AID-HYP509>3.0.CO;2-G)

Mishra, V., Cherkauer, K. A., Bowling, L. C., & Huber, M. (2011). Lake Ice phenology of small lakes: Impacts of climate variability in the Great Lakes region. *Global and Planetary Change*, 76(3), 166–185. <https://doi.org/10.1016/j.gloplacha.2011.01.004>

Murdoch, P. S., Baron, J. S., & Miller, T. L. (2000). Potential Effects of Climate Change on Surface-Water Quality in North America. *JAWRA Journal of the American Water Resources Association*, 36(2), 347–366. <https://doi.org/10.1111/j.1752-1688.2000.tb04273.x>

Music, B., Frigon, A., Lofgren, B., Turcotte, R., & Cyr, J.-F. (2015). Present and future Laurentian Great Lakes hydroclimatic conditions as simulated by regional climate models with an emphasis on Lake Michigan-Huron. *Climatic Change*, 130(4), 603–618. <https://doi.org/10.1007/s10584-015-1348-8>

Noyes, P. D., McElwee, M. K., Miller, H. D., Clark, B. W., Van Tiem, L. A., Walcott, K. C., Erwin, K. N., & Levin, E. D. (2009). The toxicology of climate change: Environmental contaminants in a warming world. *Environment International*, 35(6), 971–986. <https://doi.org/10.1016/j.envint.2009.02.006>

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- Saunders, S. P., Piper, W., Farr, M. T., Bateman, B. L., Michel, N. L., Westerkam, H., & Wilsey, C. B. (2021). Interrelated impacts of climate and land-use change on a widespread waterbird. *Journal of Animal Ecology*, 90(5), 1165–1176. <https://doi.org/10.1111/1365-2656.13444>
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Trumpickas, J., Shuter, B. J., & Minns, C. K. (2009). Forecasting impacts of climate change on Great Lakes surface water temperatures. *Journal of Great Lakes Research*, 35(3), 454–463. <https://doi.org/10.1016/j.jglr.2009.04.005>

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STATE OF MICHIGAN
BEFORE THE MICHIGAN PUBLIC SERVICE COMMISSION

In the matter of the Application of Enbridge Energy, Limited Partnership for the Authority to Replace and Relocate the Segment of Line 5 Crossing the Straits of Mackinac into a Tunnel Beneath the Straits of Mackinac, if Approval is Required Pursuant to 1929 PA 16; MCL 483.1 et seq. and Rule 447 of the Michigan Public Service Commission's Rules of Practice and Procedure, R 792.10447, or the Grant of other Appropriate Relief

U-20763

ALJ Dennis Mack

PROOF OF SERVICE

On September 14, 2021, an electronic copy of *Direct Testimony of Dr. Alec R. Lindsay on behalf of Bay Mills Indian Community* was served on the following parties:

Name/Party	E-Mail Address
Administrative Law Judge Hon. Dennis W. Mack	Mackd2@michigan.gov
Counsel for Enbridge Energy, Limited Partnership Michael S. Ashton Shaina Reed Jennifer Utter Heston	mashton@fraserlawfirm.com sreed@fraserlawfirm.com jheston@fraserlawfirm.com
Counsel for MPSC Staff Spencer A. Sattler Benjamin J. Holwerda Nicholas Q. Taylor	sattlers@michigan.gov holwerdab@michigan.gov taylorn10@michigan.gov
Counsel for Attorney General Robert P. Reichel	Reichelb@michigan.gov

Counsel for Michigan Environmental Council, and National Wildlife Federation Christopher M. Bzdok Lydia Barbash-Riley	chris@envlaw.com lydia@envlaw.com
Counsel for Grand Traverse Band of Ottawa and Chippewa Indians William Rastetter Christopher M. Bzdok Lydia Barbash-Riley	bill@envlaw.com chris@envlaw.com lydia@envlaw.com
Counsel for Environmental Law & Policy Center Margrethe Kearney Esosa Aimufua Kiana Courtney Howard Learner	mkearney@elpc.org eaimufua@elpc.org kcourtney@elpc.org hlearner@elpc.org
For Love Of Water James Olson	jim@flowforwater.org
Counsel for Bay Mills Indian Community Christopher M. Bzdok Kathryn Tierney Debbie Musiker Chizewer Christopher Clark David Gover Matt Campbell Mary Rock Megan Condon Adam Ratchenski	chris@envlaw.com candyt@bmic.net dchizewer@earthjustice.org cclark@earthjustice.org dgover@narf.org mcampbell@narf.org mrock@earthjustice.org mcondon@narf.org aratchenski@earthjustice.org
Counsel for Tip of the Mitt Watershed Council Christopher M. Bzdok Lydia Barbash-Riley Abigail Hawley	chris@envlaw.com lydia@envlaw.com abbie@envlaw.com
Counsel for Makinac Straits Corridor Authority Raymond O. Howd Leah J. Brooks	howdr@michigan.gov brooks16@michigan.gov

Michigan Propane Gas Association (MPGA) Paul D. Bratt Daniel P. Ettinger Troy M. Cummings Margaret C. Stalker	pbratt@wnj.com dettinger@wnj.com tcummings@wnj.com mstalker@wnj.com
Michigan Laborers' District Stuart M. Israel Christopher P. Legghio Lauren Crummel	israel@legghioisrael.com cpl@legghioisrael.com crummel@legghioisrael.com
Nottawaseppi Huron Band of Potawatomi Indians Amy L. Wesaw John S. Swimmer	Amy.wesaw@nhbp-nsn.gov John.swimmer@nhbp-nsn.gov
Little Traverse Bay Bands of Odawa Indians James A. Bransky	jbransky@chartermi.net

Date: September 14, 2021

By: Christopher R. Clark
Christopher R. Clark
cclark@earthjustice.org