Draft Environmental Assessment and Notice of Wetland Involvement

for the

Construction and Operation of a Proposed Cellulosic Biorefinery, Mascoma Corporation, Kinross Charter Township, Michigan

DOE/EA-1705

Prepared for:
U.S. Department of Energy
Energy Efficiency and Renewable Energy

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Executive Summary

Under the Energy Policy Act of 2005 (EPAct 2005), the United States (U.S.) Congress has directed the U.S. Department of Energy (DOE) to carry out a program to demonstrate the commercial application of integrated biorefineries for the production of ethanol from cellulosic feedstocks. Federal funding for cellulosic ethanol production facilities is intended to further the government's goal of rendering cellulosic ethanol cost-competitive with corn ethanol by 2012 and, along with increased automobile fuel efficiency, reducing gasoline consumption in the U.S. by 20% within 10 years.

In May 2007, pursuant to § 932 of EPAct 2005, DOE issued a Funding Opportunity Announcement (FOA) that requested applications to design, construct, build and operate/validate an integrated biorefinery demonstration employing terrestrial lignocellulosic feedstocks for the production of some combination of (i) liquid transportation fuel(s) that is a fungible replacement for liquid transportation fuels currently used in the existing infrastructure; (ii) biobased chemicals; and, (iii) substitutes for petroleum-based feedstocks and products. Use of a wide variety of lignocellulosic terrestrial feedstocks was encouraged other than feedstocks primarily grown for food. This FOA focused on potential integrated systems meeting the guidance in EPAct § 932(c) (1), (2) and (4). The proposed biorefinery demonstration scale was to be approximately one-tenth of the projected scale of a first-commercial facility. Mascoma Corporation (Mascoma) applied for and was selected to negotiate for an award of financial assistance to aid in the construction and operation of their planned cellulosic ethanol biorefinery that met these criteria.

Based on this selection, the DOE is proposing to provide up to $58.5 million in Federal funding to Mascoma Corporation (Mascoma) for the final design, construction, and operation of a cellulose-to-ethanol biorefinery, in Kinross Charter Township, Michigan (Frontier Project) on a 50% cost sharing basis. Frontier Kinross, LLC (Frontier), a subsidiary of Frontier Renewable Resources, LLC (jointly owned by Mascoma Corporation and J.M. Longyear, LLC) would develop and operate the planned biorefinery. Funding for this project is divided into two actions, Phase I funding of up to $16.5 million has been released to Mascoma to support final engineering design, environmental review, and site studies. In order to access the DOE Phase I funding, Frontier must also spend $16.5 million in private equity. The Phase II funding, up to $42.0 million, would be released following satisfactory completion of the environmental review, final engineering design evaluation, and economic analyses. The Phase II funding would also have to be matched by private equity from Frontier. Based on preliminary construction cost estimates, the total Frontier Project cost would be approximately $409 million.

In addition to the proposed grant, DOE's Office of Loan Programs is proposing to provide a loan guarantee for the Frontier project. This action is pursuant to Title XVII of the Energy Policy Act of 2005, as amended by Section 406 of the American Recovery and Reinvestment Act of 2009, which provide DOE the authority to issue loan guarantees to eligible projects that "avoid, reduce, or sequester air pollutants or anthropogenic emissions of greenhouse gases" and promote "job preservation and creation, infrastructure investment, energy efficiency and science, assistance to the unemployed, and State and local fiscal stabilization."

In accordance with DOE and National Environmental Policy Act (NEPA) implementing regulations, DOE is required to evaluate the potential environmental impacts of DOE facilities, operations, and related funding decisions. The proposal to use Federal funds to support the Frontier Project requires that DOE address NEPA requirements and related environmental documentation and permitting requirements. In compliance with NEPA (42 United States Code [USC] §§ 4321 et seq.) and DOE's NEPA implementing regulations (10 Code of Federal Regulations [CFR] Section 1021.330) and procedures, this environmental assessment and notice of wetland involvement (EA) examines the potential environmental impacts of DOE's Proposed Action and a No Action Alternative. This EA also addresses the requirements of Section 106 of the National Historic Preservation Act of 1966 (NHPA) revised regulations, "Protection of Historic Properties" (36 CFR Part 800) which became effective January 11, 2001.

The Frontier Project consists of the design, construction and operation of a biorefinery producing ethanol and other co-products from cellulosic materials utilizing a proprietary pretreatment and fermentation process. The overall Frontier Project is being developed to produce approximately 42.5 million gallons per year (mgy) of denatured ethanol (40 mgy of anhydrous ethanol) from about 1,540 bone dry short tons per day (BDTPD) of cellulosic materials consisting primarily of woody biomass (clean chips). The expected lifespan of the proposed Frontier Project is 40 years. This Environmental Assessment evaluated the potential impacts of this project.

The objectives of the Frontier Project are as follows:

- Design and construct a commercial scale biorefinery that utilizes advanced cellulose-to-ethanol conversion technologies; the cellulosic feedstock would be primarily hardwood pulpwood.
- Implement a sustainable biomass collection, storage, and delivery system to provide feedstock to the biorefinery.
- Maximize alternative energy production and minimize traditional energy usage.
- Operate the biorefinery systems to:
  - Validate the technology at commercial scale.
  - Validate the economics at commercial scale.
  - Enable replication of the technology at new cellulosic-to-ethanol facilities.

In compliance with the statutory mandate of EPAct 2005 § 932, DOE has implemented a program to demonstrate the commercial application of integrated biorefineries that produce ethanol from cellulosic feedstocks. The facility that would be constructed and operated as a result of the Proposed Action would meet the requirements of §932 by using renewable supplies of wood to produce fuel-grade ethanol. The Proposed Action also would support DOE's mission to reduce dependency on fossil fuels and commercialize cellulosic technologies as well as curb greenhouse gas (GHG) emissions. By providing financial assistance to support the construction of the proposed cellulosic ethanol production biorefinery, DOE would support national energy needs and the development of alternative fuel sources.

This report presents the EA prepared pursuant to the DOE NEPA process. This report provides information on:

- The proposed Frontier Project;
- The alternative sites considered;
- The No Action Alternative; and
- The potential environmental impacts/benefits of the Proposed Action including cumulative impacts.

The EA study areas include:

- Forest Resources
- Biological Resources
- Land Use
- Cultural Resources
- Air Quality and Meteorology
- Geology and Soils
- Water Resources
- Waste Management, Hazardous Materials, and Genetically Modified Organisms
- Hazard Review and Accident and Risk Analysis
- Occupational Health and Safety

- Infrastructure
- Noise
- Aesthetics
- Traffic
- Socioeconomics and Environmental Justice
- The Relationship Between Local Short-Term Uses of the Environment and the Maintenance and Enhancement of Long-Term Productivity
- Irreversible and Irretrievable Commitments of Resources
- Unavoidable Adverse Impacts

Frontier has made the following commitments to mitigate potential impacts that were identified during the preparation of this EA. These commitments would be completed if DOE issues a decision to implement the Proposed Action. These commitments would be incorporated and binding through the financial assistance award.

1. Mascoma would require Frontier to develop appropriate spill response, pollution prevention, and emergency response plans (ERPs) to address the medical and environmental hazards associated with the Frontier Project. The plans would include, at a minimum, a Pollution Incident Prevention Plan (PIPP), Spill Prevention, Control and Countermeasure (SPCC) Plan, a Storm Water Pollution Prevention Plan (SWPPP), and an ERP. The plans would be completed in accordance with Federal and Michigan Occupational Safety and Health Administration (OSHA) and United States Environmental Protection Agency (USEPA) and Michigan Department of Natural Resources and Environment (MDNRE) regulations and guidance.

2. Mascoma would require Frontier to develop a Soil Erosion and Sedimentation Control Plan (SESC) to prevent excess erosion or degradation of the site and to protect wetlands during construction activities. The construction contractor would be required to complete the permit application and SESC plan as required by Part 91 for submission to the Chippewa-East Mackinac Conservation District (CEMCD). The construction contractor would also be required to provide a State of Michigan certified storm water operator to inspect the construction activities one each week and 24 hours after a precipitation event to ensure that all soil erosion control measures are operating properly.

3. Mascoma would require Frontier to implement procedures so that the storm water control practices for the wood yard would conform to those set forth in the *Michigan Erosion & Sediment Control Handbook*. Runoff from the site would be routed by proper grading practices and other drainage mechanisms (ditches and culverts) to a sedimentation pond designed for a maximum storm event.

4. Mascoma would require Frontier to establish a timber procurement process equivalent to the requirements established by the Sustainable Forestry Initiative (SFI) certified procurement process. Frontier would, through its wood fiber procurement agreements and other supply relationships, work to encourage and influence private landowners and wood suppliers to participate in forest certification initiatives. Frontier would require verification of logger participation in Sustainable Forestry Education (SFE) professional logger training and certification programs and conformance to Michigan Best Management Practices.

5. Mascoma would require Frontier to submit an air permit modification application with an ambient air quality modeling analysis and Toxic Air Contaminant (TAC) analysis that demonstrates that the facility would meet all Federal and State regulatory limits, and would not cause or contribute to an exceedance of the National Ambient Air Quality Standards or Michigan TAC thresholds.

6. Mascoma would require Frontier to apply for and acquire a Joint Permit from the MDNRE and the USACE, and implement mitigation action as required by that permit for wetland impacts resulting from construction activities.

Acronyms, Abbreviations, and Terms

°F	Degrees Fahrenheit
µg/m^3	microgram per cubic meter
ATVs	All Terrain Vehicles
APHIS	Animal and Plant Health Inspection Service
AST	Aboveground storage tank
ATC	American Transmission Company
BDT	Bone Dry Ton
BDTPD	bone dry short tons per day
BSA	Biodiversity Stewardship Area
bgs	Below ground surface
CCPHD	Chippewa County Public Health Department
CFR	Code of Federal Regulations
CHP	Combined heat and power
CIP	clean-in-place
DAP	Diammonium phosphate
dBA	Decibels adjusted
DOE	U.S. Department of Energy
DOT	Department of Transportation
EA	Environmental Assessment
EAC	Early Action Compact
EPAct 2005	Energy Policy Act
ft^2	Square Feet
Frontier	Frontier Renewable Resources, LLC.
FSC	Forest Stewardship Council
GAFMP	Generally Accepted Forest Management Practices
GGPC	Gitchie Gumee Pellet Company
GMO	genetically modified organism
gpd	gallons per day
gpm	gallons per minute
GP	Georgia-Pacific
GTPD	Green Tons Per Day
GT	Green tons
HAP	Hazardous air pollutant
Inc.	Incorporated
Kinross	Kinross Charter Township

K_{sat}	Saturated Hydraulic Conductivity
kV	Kilovolt
Kw	Kilowatt
KOH	potassium hydroxide
lbs	Pounds
LLC	Limited Liability Corporation
MAP	Mitigation Action Plan
MCAN	Microbial Commercialization Activity Notice
MDEQ	Michigan Department of Environment Quality
MDNR	Michigan Department of Natural Resources
MDNRE	Michigan Department of Natural Resources and Environment (MDNRE formed in 2010 by combining MDNR & MDEQ)
MTU	Michigan Technological University
mg/m^3	milligram per cubic meter
mgd	Million gallons per day
mgy	Million gallons per year
MGT/yr	Million green tons per year
MMBTU	Million British Thermal Units
MNFI	Michigan Natural Features Inventory
NAAQS	National Ambient Air Quality Standards
NAIP	National Agriculture Imagery Program
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NIH	National Institutes of Health
NRCS	Natural Resources Conservation Service
NWI	National Wetland Inventory
NSPS	New Source Performance Standard
PGA	Peak Ground Acceleration
PM	Particulate Matter
PM_{10}	Particulate Matter Less Than 10 microns
$PM_{2.5}$	Particulate Matter less than 2.5 Microns
ppm	Part per Million
SIP	State Implementation Plan
SFE	Sustainable Forestry Education
SFI	Sustainable Forestry Initiative
SO_2	Sulfur Dioxide
SSURGO	NRCS Soils Survey Geographic Database

tpd	Ton per day
tpy	Ton per year
TSCA	Toxic Substance Control Act
$\mu g/m^3$	Microgram per Cubic Meter
UPEA	Upper Peninsula Engineers & Architects
U.S.	United States
USACE	United States Army Corps of Engineers
USC	United States Code
USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
VOC	Volatile Organic Compound
WWTP	Wastewater treatment plant

1.0 Introduction

1.1 Background

Under the Energy Policy Act (EPAct) of 2005, the United States (U.S.) Congress directed the U.S. Department of Energy (DOE) to carry out a program to demonstrate integrated biorefineries for the production of transportation fuel from lignocellulosic feedstocks. Federal funding for lignocellulosic fuel production facilities is intended to further the government's goal of rendering lignocellulosic fuel cost-competitive with fossil fuel by 2012 and, along with increased automobile fuel efficiency, reducing fossil fuel consumption in the U.S. by 20 percent within 10 years.

In May 2007, pursuant to §932 of EPAct 2005, DOE issued a Funding Opportunity Announcement (FOA) for applications to design, construct, build and operate/validate an integrated biorefinery demonstration employing terrestrial lignocellulosic feedstocks for the production of some combination of (i) liquid transportation fuel(s) that is a fungible replacement for liquid transportation fuels currently used in the existing infrastructure; (ii) biobased chemicals; and, (iii) substitutes for petroleum-based feedstocks and products. The objective of this FOA was to support demonstrations that will validate key process metrics and provide the kinds of continuous, operational data at the scale needed to lower the technical risks associated with financing a future commercial plant. Mascoma Corporation (Mascoma) applied to the FOA, and was selected to negotiate for an award of financial assistance to aid in the design, construction and operation of a cellulosic ethanol biorefinery in Kinross Charter Township (Kinross), Michigan (the Frontier Project).

DOE has authorized Mascoma to expend Federal funding for preliminary activities including preliminary engineering design, the completion of this Environmental Assessment (EA), permitting, and pilot scale testing. These activities are associated with the proposed project and do not significantly impact the environment nor represent an irreversible or irretrievable commitment of Federal funds in advance of the conclusion of this EA. DOE is currently proposing to authorize the expenditure of Federal funding for Mascoma to complete final design, construct, and initially operate the Frontier Project.

In addition, Mascoma has applied for a federal load guarantee from the DOE's Office of Loan Programs. Issuance of the loan guarantee would also be contingent on satisfactory completion of the environmental review, final engineering design evaluation, and economic analyses.

1.2 Proposed Project Overview

Mascoma, through its subrecipient, Frontier Kinross, LLC (Frontier), a subsidiary of Frontier Renewable Resources, LLC, is proposing to construct and operate a cellulose-to-ethanol biorefinery near Kinross, Michigan. Frontier is jointly owned by Mascoma Corporation and J.M. Longyear, LLC. Mascoma Corporation is a renewable fuels research and development company that has developed a process to produce commercial quantities of lignocellulosic ethanol from woody biomass. J.M. Longyear is a natural resource management and industrial project development company based in Marquette, Michigan. J.M. Longyear manages more than 100,000 acres of company-owned forestlands in Michigan and Canada. J.M. Longyear forestland management and harvest operations, including road construction and maintenance operations of its 72,000 acres within the U.S., are conducted within standards and guidelines of the Forest Stewardship Council (FSC) standard and have been certified as well managed forest lands by the FSC, Certificate Registration No. SW-FM/COC-003804. J.M. Longyear also purchases timber stumpage from other private and public forest landowners on which it conducts harvest operations under the same guidelines as used on J.M. Longyear forest lands.

The proposed project would utilize approximately 1,540 bone dry tons (BDT) per day of clean wood chips (from hardwood pulpwood) to produce up to approximately 42.5 million gallons per year (mgy) of denatured ethanol (or 40 mgy anhydrous ethanol). The expected lifespan of the proposed Frontier Project is 40 years.

All of the bark and most of the co-products, such as the lignin and spent cellulose from the process would be used to produce steam and electricity in a biomass boiler on-site. Excess co-products would be sold off-site as a fuel. . A stable market exists in Michigan for lignin as fuel.

The proposed Frontier Project site property is comprised of 355 acres in the Kinross Charter Township of Chippewa County, Michigan. The proposed biorefinery site is adjacent to the former Kincheloe U.S. Air Force base in Kinross. The site is predominantly wooded with no existing structures and limited unpaved trails present. A snowmobile trail borders approximately ¼ mile of the property along the northwest corner. Based on a review of soil maps and the National Wetland Inventory (NWI) maps, approximately 20 to 40% of the site may be classified as either forested or scrub-shrub wetlands. The land that the biorefinery would be situated on is currently zoned as Heavy Industrial. See Figure 1, Site Location Map, for an overview of the general property and access to area roads.

1.3 Purpose and Need

In compliance with the statutory mandate of EPAct 2005 § 932, DOE has implemented a program to demonstrate the commercial application of integrated biorefineries that produce ethanol from cellulosic feedstocks. The biorefinery that would be constructed and operated as a result of the Proposed Action would meet the requirements of §932 by using renewable supplies of biomass, primarily wood and wood waste to produce fuel-grade ethanol. The Proposed Action also would support DOE's mission to reduce dependency on fossil fuels and commercialize cellulosic technologies. By providing financial assistance to support the construction of the proposed biorefinery, DOE would support national energy needs and the development of alternative fuel sources.

1.4 Public Scoping

In accordance with the applicable regulations and policies, DOE sent scoping letters to potentially interested local, state, and Federal agencies, including the U.S. Fish and Wildlife Service (USFWS), the Michigan Department of Natural Resources and Environment (MDNRE), the Michigan Department of Transportation (MDOT), and the Michigan State Historic Preservation Office (SHPO). DOE sent scoping letters to other potentially interested individuals, organizations, the Inter-Tribal council of Michigan, and the Sault Ste. Marie Tribe of Chippewa Indians. DOE also published the Scoping Letter on-line at the DOE Golden Reading Room. The scoping letter described the Proposed Action and requested assistance in identifying potential issues that could be evaluated in the EA. In response to the scoping letters, DOE received comments and questions from individuals, organizations, or agencies regarding the Proposed Action. Comments received on the Scoping letter have been addressed as appropriate in this EA.

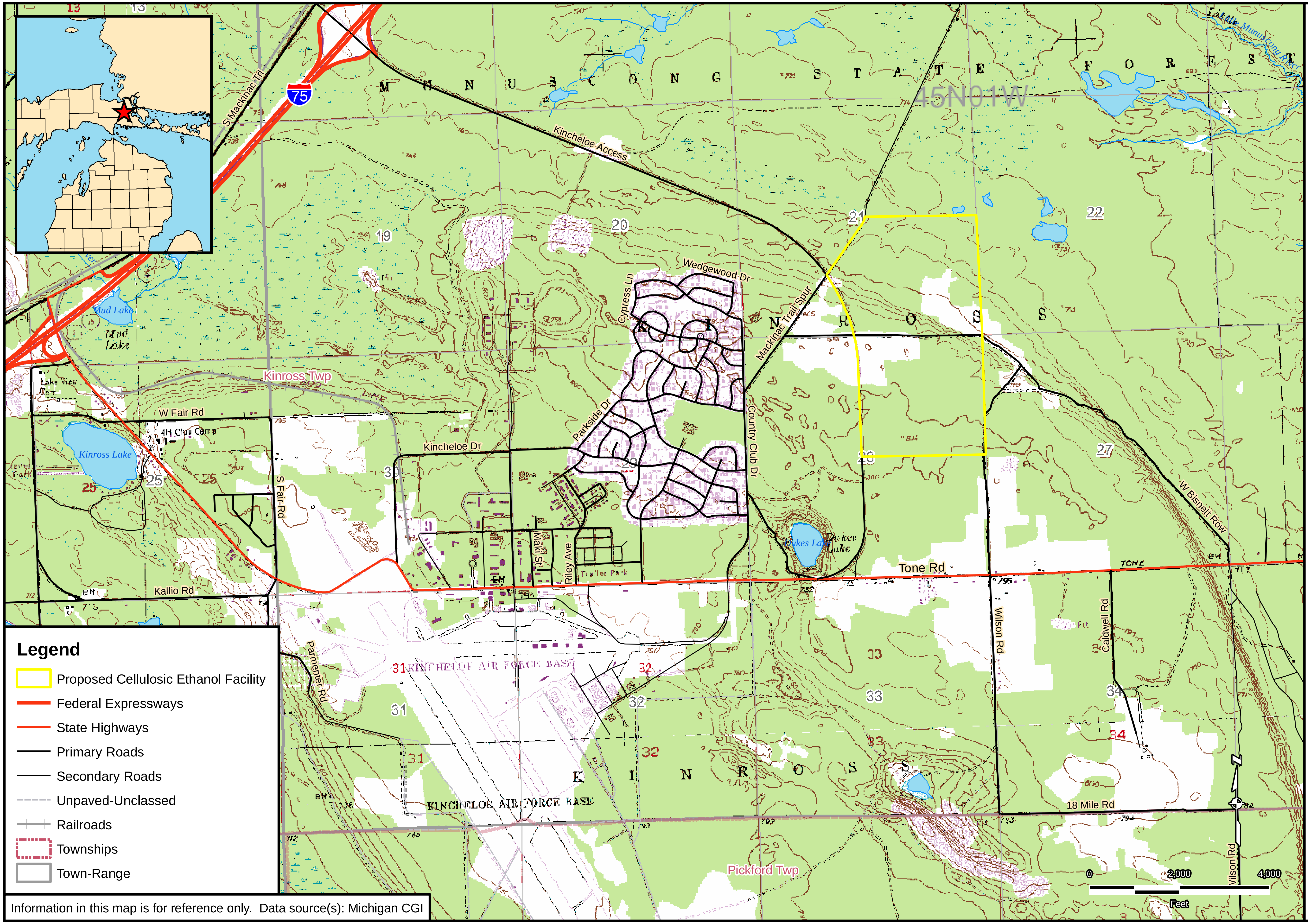
Appendix A contains a copy of the scoping letters, the scoping letter distribution list, a copy of the comments on the scoping letter and a summary table of the comments.

1.5 Report Content

This report presents the EA prepared pursuant to the DOE NEPA process. This report provides information on:

- The proposed Frontier Project;
- The alternative sites considered;
- The No Action Alternative; and
- The potential environmental impacts/benefits of the Proposed Action including cumulative impacts.

SITE LOCATION MAP
FRONTIER RENEWABLE RESOURCES, LLC
CELLULOSIC ETHANOL FACILITY
CHIPPEWA COUNTY, MICHIGAN



Information in this map is for reference only. Data source(s): Michigan CGI

AECOM

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Drawn:	JWW	2/17/2009
Approved:	LDK	2/17/2009
Scale:	1" = 2,000'	
PROJECT NUMBER	13375-001-0100	
FIGURE NUMBER	1	

The EA study areas include:

- Forest Resources
- Biological Resources
- Land Use
- Cultural Resources
- Air Quality and Meteorology
- Geology and Soils
- Water Resources
- Waste Management, Hazardous Materials, and Genetically Modified Organisms
- Hazard Review and Accident and Risk Analysis
- Occupational Health and Safety
- Infrastructure
- Noise
- Aesthetics
- Traffic
- Socioeconomics and Environmental Justice
- The Relationship Between Local Short-Term Uses of the Environment and the Maintenance and Enhancement of Long-Term Productivity
- Irreversible and Irretrievable Commitments of Resources
- Unavoidable Adverse Impacts

Mascoma has made the following commitments to mitigate potential impacts that were identified during the preparation of this EA. These commitments would be completed if DOE issued a decision to implement the Proposed Action. These commitments would be incorporated and binding through the financial assistance award.

1. Mascoma would require Frontier to develop appropriate spill response, pollution prevention, and emergency response plans (ERPs) to address the medical and environmental hazards associated with the Frontier Project. The plans would include, at a minimum, a Pollution Incident Prevention Plan (PIPP), Spill Prevention, Control and Countermeasure (SPCC) Plan, a Storm Water Pollution Prevention Plan (SWPPP), and an ERP. The plans would be completed in accordance with Federal and Michigan Occupational Safety and Health Administration (OSHA) and United States Environmental Protection Agency (USEPA) and Michigan Department of Natural Resources and Environment (MDNRE) regulations and guidance.

2. Mascoma would require Frontier to develop a Soil Erosion and Sedimentation Control Plan (SESC) to prevent excess erosion or degradation of the site and to protect wetlands during construction activities. The construction contractor would be required to complete the permit application and SESC plan as required by Part 91 for submission to the Chippewa-East Mackinac Conservation District (CEMCD). The construction contractor would also be required to provide a State of Michigan certified storm water operator to inspect the construction activities one each week and 24 hours after a precipitation event to ensure that all soil erosion control measures are operating properly.

3. Mascoma would require Frontier to implement procedures so that the storm water control practices for the wood yard would conform to those set forth in the *Michigan Erosion & Sediment Control*

Handbook. Runoff from the site would be routed by proper grading practices and other drainage mechanisms (ditches and culverts) to a sedimentation pond designed for a maximum storm event.

4. Mascoma would require Frontier to establish a timber procurement process equivalent to the requirements established by the SFI certified procurement process. Frontier would, through its wood fiber procurement agreements and other supply relationships, work to encourage and influence private landowners and wood suppliers to participate in forest certification initiatives. Frontier would require verification of logger participation in Sustainable Forestry Education (SFE) professional logger training and certification programs and conformance to Michigan Best Management Practices.

5. Mascoma would require Frontier to submit an air permit modification application with an ambient air quality modeling analysis and Toxic Air Contaminant (TAC) analysis that demonstrates that the facility would meet all Federal and State regulatory limits, and would not cause or contribute to an exceedance of the National Ambient Air Quality Standards or Michigan TAC thresholds.

6. Mascoma would require Frontier to apply for and acquire a Joint Permit from the MDNRE and the USACE, and implement mitigation action as required by that permit for wetland impacts resulting from construction activities.

2.0 Proposed Action and Project Alternatives

As required by Federal regulation, this EA addresses the possible environmental impacts of the Proposed Action and the No Action Alternative. Section 2.1 discusses the No Action Alternative. Section 2.2 describes the activities that would occur if DOE decides to authorize the expenditure Federal funding for the proposed project.

2.1 No Action Alternative

An evaluation of a No Action Alternative is required under Section 1502.14(d) of NEPA and DOE implementing regulations (40 CFR 1021.321[c]). Under the No Action Alternative, DOE would not authorize expenditure of Federal funds for the proposed project and Mascoma would not design, construct, or start-up the Frontier Project. Although this project could proceed if DOE decided not to provide financial assistance, the Department has assumed, for the purposes of comparison in this EA, that the project would not proceed without its assistance. If the project proceeded without DOE assistance, the potential impacts would be essentially identical to those under the DOE Proposed Action (that is, providing assistance that enables the project to proceed).

2.2 Proposed Action

DOE is proposing to authorize the expenditure of Federal funding (up to $59 million) for Mascoma to design, construct, and initially operate an integrated biorefinery in Kinross, Michigan (the Frontier Project). DOE has authorized Mascoma to use a percentage of their Federal funding for preliminary activities including engineering design, the completion of this Environmental Assessment (EA), permitting, and pilot scale testing. These activities are associated with the proposed project and do not significantly impact the environment nor represent an irreversible or irretrievable commitment of Federal funds in advance of the conclusion of this EA.

In addition to the proposed grant, DOE's Office of Loan Programs is proposing to provide a loan guarantee for the Frontier project. This action is pursuant to Title XVII of the Energy Policy Act of 2005, as amended by Section 406 of the American Recovery and Reinvestment Act of 2009, which provide DOE the authority to issue loan guarantees to eligible projects that "avoid, reduce, or sequester air pollutants or anthropogenic emissions of greenhouse gases" and promote "job preservation and creation, infrastructure investment, energy efficiency and science, assistance to the unemployed, and State and local fiscal stabilization."

This section will describe the different unit operations required to operate the Frontier Project, the waste streams generated, and the estimated workforce requirements. The basic components of the project would be:

- Cellulosic Material Collection, Receiving, and Handling
- Cellulosic Material Conversion to Sugars
- Fermentation of Cellulosic Sugars
- Ethanol Distillation
- Ethanol Storage and Loading
- Natural Gas Boilers
- Co-products production
- Supporting Infrastructure

2.2.1 Project Overview and Purpose

The objectives of the Frontier Project are as follows:

- Design and construct a commercial scale biorefinery that utilizes advanced cellulose-to-ethanol conversion technologies; the cellulosic feedstock would be primarily hardwood pulpwood.
- Implement a sustainable biomass collection, storage, and delivery system to provide feedstock to the biorefinery.
- Maximize alternative energy production and minimize traditional energy usage.
- Operate the biorefinery systems to:
  - Validate the technology at commercial scale.
  - Validate the economics at commercial scale.
  - Enable replication of the technology to increase the size of the Frontier facility at Kinross and also provide design and operational expertise that could be applied for other, new cellulosic-to-ethanol facilities that Mascoma or Frontier might build in the future.

2.2.2 Project Location and Site Plan

The proposed Frontier Project site property is comprised of 355 acres located approximately ½ mile northeast of Kinross. The proposed Frontier site consists of predominantly wooded land with no existing structures and limited unpaved trails used for recreational vehicles such as snowmobiles and All Terrain Vehicles (ATVs). The proposed cellulosic ethanol biorefinery will be constructed on approximately 50 acres located in the southernmost 160 acres of the property. See Figure 2, Site Layout Map. The study area for this EA is the 355 acre proposed site and a rail corridor from the proposed site to the existing rail mainline located west of I-75.

The official property description is:

> Chippewa County, Kinross Township, T45N, R01W, Sections 21 and 28: All that part of the S ½, of Section 21 lying E of the centerline of Gaines Highway, EXCEPT that part lying west of the easterly edge of State Designated Snowmobile Trail # 49 otherwise known as the Mackinac Trail Spur. AND, All that part of the North ½, of Section 28 lying E of the centerline of Gaines Highway, Excepting and reserving unto the State of Michigan an access easement to enable the State of Michigan to access an adjacent parcel described as: The NW ¼ of SE ¼ of Section 28 (benefited parcel).

A rail spur would be constructed from the existing rail line west of the proposal project site to the project site looping north of Kinross, See Figure 1, Site Location Map, for an overview of the general property and access to area roads and rail.

The 355-acre parcel of land proposed for the site was transferred from the State of Michigan effective March 5, 2009 in a land transfer agreement between J.M. Longyear and the State.

2.2.3 Process Description

The following paragraphs present a process description for the proposed project.

2.2.3.1 Wood Receiving and Processing

Whole hardwood pulpwood logs would be brought to the site via truck and rail from surrounding forest operations. An average of 3,260 green tons/day of logs (1,540 BDTPD of clean chips) would be required for the process. Wood receiving would generally take place approximately 24 hours per day, seven days per week. Since wood receiving would be suspended if required for “mud season” or due to road restrictions in the spring of each year, a sufficient stockpile of hardwood pulpwood would be maintained on-site to allow continuation of operations.

The biorefinery would also be designed to receive wood chips via truck. The chips would be off-loaded into a dump pit and mechanically conveyed to the chip storage bin.

The hardwood pulpwood logs would be de-barked on-site. The bark would be conveyed to an outdoor storage pile. All of the bark generated on-site would be used in a biomass boiler to generate steam and power for the project. Bark would be approximately 12–14% of the total wood received by weight.

The de-barked whole hardwood pulpwood logs would be chipped in one of two parallel chipping trains. Each train would have a capacity of 770 BDTPD. The chips would be screened and pneumatically conveyed to a cyclone for separation onto a mechanical conveyor. The chips would then be mechanically conveyed to a chip silo for storage.

Emissions from the wood receiving, chipping, and handling operations would include particulate matter (PM), particulate matter less than 10 micron (PM_{10}), volatile organic compounds (VOC), and hazardous air pollutants (HAPs).

Storm water control practices for the wood yard would conform to those set forth in the *Michigan Erosion & Sediment Control Handbook*. Runoff from the site would be routed by proper grading practices and other drainage mechanisms (ditches and culverts) to a sedimentation pond designed for a maximum storm event.

2.2.3.2 Feedstock – Pretreatment/ Hydrolysis

The pretreatment area would receive chips from chip storage system via mechanical conveyor. The pre-treatment would consist of three steps:

1. pre-steaming to heat the chips, remove air, and equalize moisture content;
2. maceration and injection into a high-pressure reactor for conditioning with steam at high temperatures for short periods of time.
3. mechanical processing and explosion across a blow valve to produce characteristics suitable for subsequent saccharification and fermentation.

Steam from the on-site boilers would be used in the pre-steaming and high pressure reactor system. Heat recovery systems and condensers would be used to reduce heat requirements.

The non-condensable gases from the pre-treatment process would be vented to a wet process scrubber for control of PM, PM_{10}, VOC and HAP emissions.

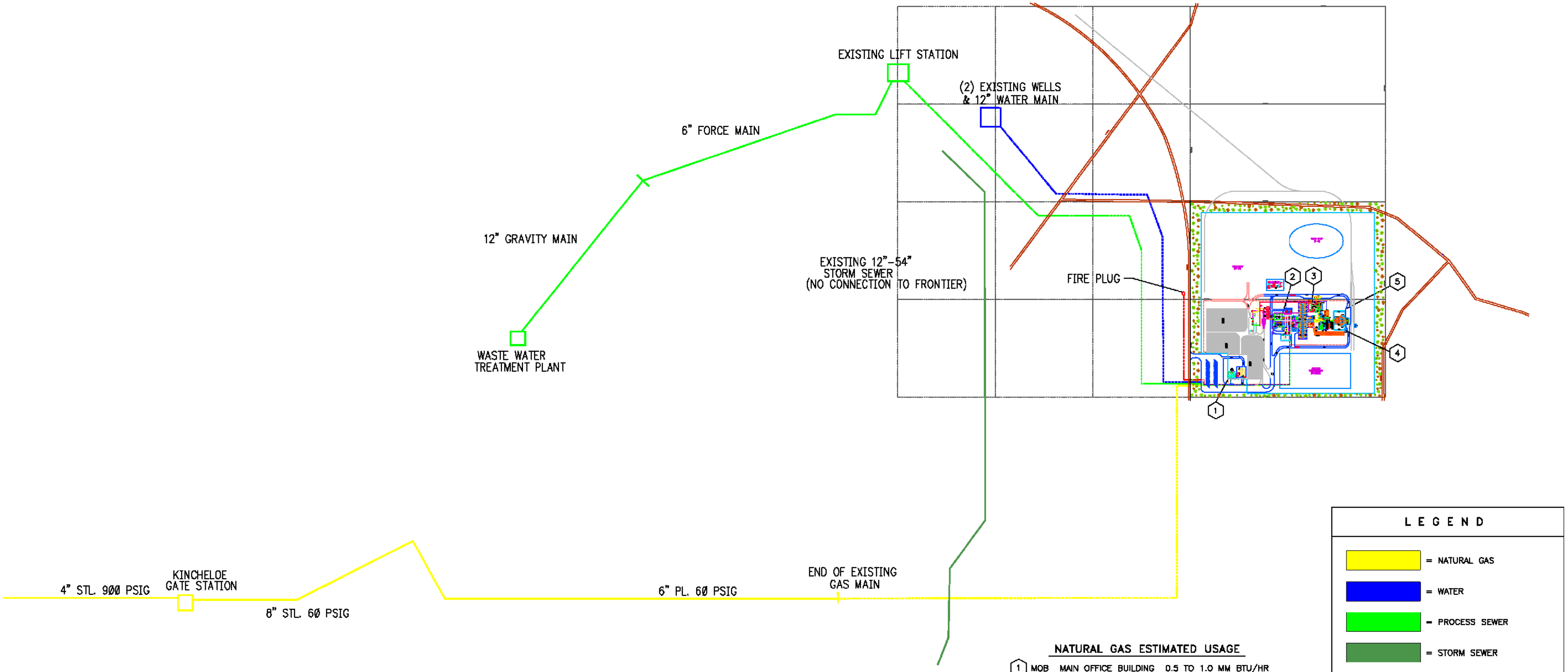
2.2.3.3 Yeast Propagation

Pure yeast culture would be loaded into seed tanks for inoculation. Yeast would be propagated in one of three yeast trains. Each train would consist of starter tanks and propagation tanks in series. CO_2 emissions from yeast propagation would be vented to one of the two process wet scrubbers for control of VOC and HAP emission.

2.2.3.4 Fermentation

Fermenters would be partially filled with water, yeast and enzymes (if needed). Pretreated feedstock would be fed to each fermenter. Following fermentation, the contents (beer) would be pumped to the Beer Column Feed Tank for further processing. CO_2 gas and VOCs evolved during fermentation would be vented to a wet scrubber to remove the VOCs from the vapor stream. Scrubbed CO_2 gas would be vented to the atmosphere, and the resulting scrubber water bearing the ethanol would be pumped to the beer column feed tank.

The various process tanks and Beer Column Feed Tank would operate at essentially atmospheric pressure. CO_2 vent gases from each vessel would be collected in a common header and taken to a wet scrubber for ethanol removal.



NATURAL GAS ESTIMATED USAGE

1	MOB	MAIN OFFICE BUILDING 0.5 TO 1.0 MM BTU/HR
2	MPB	MAIN PROCESS BUILDING 0.5 TO 1.0 MM BTU/HR
3	CHP	COMBINED HEAT & POWER 646 MM BTU/HR COLD START
4	FS	FLARE STACK 108 SCFM @ 7 PSIG
5	EBU	EMERGENCY BACK-UP UNIT 12MM BTU/HR/MEGAWATT ASSUME 50% LOAD OR 6MM BTU/HR @ POWER OUTAGE

NATURAL GAS DISTRIBUTION WITHIN BIOREFINERY IS 15 PSIG

LEGEND

🟨 = NATURAL GAS
🟦 = WATER
🟩 = PROCESS SEWER
🟩 = STORM SEWER
🟥 = FIRE PROTECTION

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SITE LAYOUT
FRONTIER RENEWABLE RESOURCES, LLC
CELLULOSIC ETHANOL FACILITY
KINROSS TOWNSHIP, CHIPPEWA COUNTY, MICHIGAN

Drawn:
Approved:
Scale:
PROJECT NUMBER 60140061
FIGURE NUMBER 2

As noted in the above paragraphs, VOC and HAP emissions would be controlled by one of three wet scrubber systems, one each on the two pretreatment trains and other process vessels and one on the fermentation system.

The containment area for the fermentation vessels would be designed to open outside the building to provide for ventilation of CO_2 if the lower manways of the vessels are removed. Failure to provide adequate ventilation of this area could present a safety hazard.

All process water used in the fermentation area would be evaporator condensate quality and would be disinfected to remove bacterial contamination. All leakage of seal or flush water to the outside would be collected and treated to kill genetically modified organisms. All water would be collected in the biorefinery wastewater tank and fed to the distillation system. All off-specification material containing genetically modified organisms would pass through a kill system before being slowly discharged to a waste treatment plant or disposed of in another manner.

2.2.3.5 Distillation

The distillation system would receive the beer from the Beer Column Feed Tank and remove and dehydrate the ethanol. The main equipment in the area would be composed of a beer column, a rectifying column, a molecular sieve unit, and a vent-scrubbing column together with the associated pumps and heat exchangers. Ethanol from the distillation system would be approximately 190 proof (95% alcohol).

A two bed molecular sieve unit would be designed for vapor phase operation to purify the ethanol from 190 proof to 200 proof. The molecular sieve systems would include the necessary exchangers for regeneration of the media and cooling of the product ethanol. The vent gases from each unit would be collectively passed through a common vent condenser, removing ethanol from the gas stream. The vent condenser would handle the vent stream from the distillation area only. Non-condensable gases from distillation would be vented to one of the two process wet scrubbers for control of VOC and HAP emissions.

2.2.3.6 Thin Stillage Evaporation and Evaporator Condensate Anaerobic Bio-treatment

Thin stillage (water and residual solids after distillation) from the distillation column would be concentrated in a stillage evaporator system to increase the solids content. The stillage concentrate (syrup) from the evaporator system would be stored in a syrup tank before being fed as liquid fuel to the biomass boiler described in Section 2.2.3.11.

Process condensate (condensed water with small amounts of organic compounds and organic acids) from the evaporator system would be stored in a process condensate tank. The condensate would be pumped to anaerobic bio treatment system to reduce the soluble organic acids and also other organic compounds that would sometimes present in trace quantities.

Two or more anaerobic bio treatment reactors, operating in parallel, would be used to treat the process condensate. The resulting treated water would be recycled within the plant. The excess treated water would be discharged to the Kinross Charter Township wastewater treatment facility.

Exhaust gas from the anaerobic bio treatment reactors would be rich in methane and would be burned in the biomass boiler described in Section 2.2.3.11. Sludge from the reactors would also be burned in the biomass boiler.

2.2.3.7 Ethanol Storage / Load Out

Product ethanol from the distillation area would be directed to one of four shift tanks for holding until testing of the product is complete. The anhydrous ethanol would be denatured with unleaded gasoline (maximum of RVP15) and transferred to one of two product storage tanks. Denatured product would be loaded into tank trucks for transportation off-site to customers.

The following storage tanks would be included in the ethanol storage area:

- Four (4) – Shifts tanks (35,000 gallons each)
- One (1) – Denaturant (gasoline) tank (50,000 gallons)
- Two (2) – Product storage tank (650,000 gallons each for 10 days total storage)

Emission control for VOC and HAP would be achieved through the use of storage tanks with floating roofs designed to comply with New Source Performance Standard (NSPS) 40 Code of Federal Regulations (CFR) Subpart Kb. VOC and HAP emissions from the truck load out would be controlled using an interlocked flare system.

2.2.3.8 Spent Solids Handling and Drying

After distillation, the spent solids, consisting primarily of lignin residue, would be separated from the liquid phase using centrifuges. The solids moisture content would be approximately 60%. The solids would be mechanically conveyed to a low temperature natural gas fired dryer. The dryer would use only pipeline quality natural gas to evaporate water from the solids to achieve a moisture content of as low as 30%. The dryer would operate at a temperature of approximately 85°C (185°F).

Emissions from the dryer would include VOC and HAP. No emission control system is planned for this source.

2.2.3.9 Genetically Modified Organisms and Control Techniques

Properties of the Frontier GMO

The intended organism for cellulosic ethanol production at Frontier would be *Saccharomyces cerevisiae*, commonly known as baker's or brewer's yeast, which has been genetically modified. *Saccharomyces cerevisiae* has an extensive history of use in the area of food processing. This yeast has been used for centuries as leavening for bread and as a fermenter of alcoholic beverages and has a prolonged history of industrial use.

The Food and Drug Administration rates Brewer's Yeast extract as Generally Recognized as Safe (FDA, 1986). Furthermore, the National Institutes of Health (NIH) in its Guidelines for Research Involving Recombinant DNA Molecules (DHHS, 1986) considers *S. cerevisiae* a safe organism. Most experiments involving *S. cerevisiae* have been exempted from the NIH Guidelines based on an analysis of safety.

Control of the GMO

The GMO would be stored for use in frozen vials of approximately 1.5 ml. Master vials would be provided by Mascoma Corporation and would be shipped or hand carried to Frontier on occasion, as needed. Chain of custody of these transported vials would be monitored and documented. Working stock vials may be made by trained Frontier personnel. All vials would be stored in secure freezers on-site, and potentially at secure freezers in an off-site location.

Initial propagation of the GMOs from the vials would occur in Frontier laboratory facilities in flasks. These activities would be conducted in facilities with limited access and would be done by trained personnel.

Trained personnel would transport the flasks with the propagated yeasts to the fermentation section of the factory, where they would be added to the propagation (seed) tanks. After a specified incubation time, the contents of the propagation tanks, containing the GMO yeasts would be transferred to the production fermenters though transfer piping.

After the specified incubation time in the production fermenters, the contents of the fermenters, including liquids and solids, containing the GMO yeasts would be transferred to a beer well tank or directly to the ethanol beer distillation column through transfer piping. During the boiling and distillation process, the yeast would be killed by heat.

The propagation tanks, fermenters, and transfer piping would be cleaned-in-place (CIP) with multiple cleaning cycles, including a caustic cleaning cycle. This step would purge residual yeast to a CIP waste tank. The contents of the CIP waste tank would be sent to the ethanol beer distillation column, where the yeast would be killed by heat.

Through these procedures, the majority of the GMO yeasts in the liquid and liquid/solid slurry waste streams would be killed in compliance with EPA regulatory requirements.

The scrubber water, which includes water from scrubbing the off-gas of the propagation tanks and fermenters, may contain low levels of GMO yeast due to aerosol formation in these tanks. The scrubber water would be sent to the distillation column for further heat deactivation prior to being discharged from the biorefinery.

There will be no other sources of wastewater in the biorefinery which would contain viable GMO yeast.

Catastrophic Failure

In the rare event of a catastrophic tank failure, grading would be such that the bulk of the tank contents would accumulate in an area with concrete barriers, enabling the sumping of much of the material to the beerwell, where it would be sent to distillation for inactivation. Remaining beer after sumping would be cleaned with chemical disinfectant application.

The safety profile of the yeast is such that release of GMO due to catastrophic equipment failure would result in negligible impact to workers and the environment. Industrial microorganisms in the environment are typically disadvantaged relative to native organisms. The GMO yeast in this process would likely be competitively disadvantaged, as the expression of the additional proteins provides a burden to rapid growth of the organism.

Frontier expects to qualify for a Tier I contained structure exemption and would notify EPA as required by the TSCA regulations. If in the unlikely case the requirements for a Tier 1 contained structure exemption could not be met, the alternative would be to submit a Microbial Commercialization Activity Notice (MCAN) application to the USEPA. Approval through this process can be granted by the USEPA after a 90 day review period if there are no objections. This approval would be expected to be straightforward given the safety profile of *S. cerevisiae*, as discussed above.

2.2.3.10 Clean-In-Place

A clean-in-place (CIP) system will be installed to clean vessels, piping, and heat exchangers and fermentation vessels of contaminated material. The clean-in-place system will use a hot solution of potassium hydroxide to kill contaminant organisms.

2.2.3.11 Steam and Power Generation

Frontier would construct a combined heat and power (CHP) system to provide electric power and process steam for the facility. The CHP would consist of a biomass boiler and a steam turbine. The biomass boiler would combust up to eight types of fuel to generate high pressure and temperature steam. The fuels would include:

1. Bark and waste wood from the debarking and chipping operation (hog fuel)
2. Dry lignin at 30% moisture content, from on-site storage
3. Un-dried lignin at 60% moisture content;
4. Evaporator syrup at 70% moisture content;
5. Methane-rich gas from the anaerobic bio treatment reactors;
6. Sludge from the anaerobic bio treatment reactors;
7. Natural gas, for cold boiler pre-heat and startup periods; and

8. Wood chips as supplemental fuel for process plant startup periods.

All of the bark and approximately 80% of the lignin generated on-site would be used in the biomass boiler. The facility would not need to import solid fuel for their operations. The high pressure steam from the biomass boiler would power a steam turbine to produce electricity. The turbine would produce approximately 15 MW of power. As discussed in Section 2.2.3.13, this would be sufficient power to meet the peak power needs of the facility. Excess power, when available, may be sold to the electric grid. Power for cold starts of the facility and a small portion of ongoing electrical usage would be purchased from Cloverland Electric.

Low pressure steam, from the outlet of the steam turbine, would be piped to the processing area for use in the pretreatment area, distillation system, and other process areas. The low pressure steam would also be used to heat water which would in turn heat the lignin dryer. The biomass boiler would be large enough to provide all of the process steam required by the facility.

2.2.3.12 Support Operations and Facilities

Cooling towers would be dry type systems that use electric fans to blow air across finned water tubes. No emissions would be associated with the cooling towers.

The biorefinery would have two natural gas fired emergency generators that would each operate at 2,000 kilowatt (KW) each for no more than 100 hours per year. The biorefinery would also have an emergency fire water pump that would use natural gas as the fuel which would operate at 500 HP for no more than 500 hours per year.

Other required support operations and facilities would include:

- Maintenance shop
- Aboveground storage tanks for process chemicals
- Administrative offices
- Laboratory
- Truck weighing scales
- Central control room
- Power distribution centers or Machine Control Centers
- Custody transfer station

2.2.3.13 Supporting Infrastructure

The following utilities would be required for biorefinery operation.

- Biorefinery Water Usage: 150 gpm – average
- Process Water Discharge: 100 gpm – average
- Biorefinery Steam Usage: 172,600 lb/hr. peak load per train, 345,200 lb/hr total
- Power: 21,681 – connected horsepower
- 17.7 MW – connected load
- 10.9 MW – estimated average load
- 14.1 MW – estimated peak load

Cloverland Electric Cooperative (Cloverland) owns and operates the electric distribution system in and around the Kinross Charter Township. Cloverland would be the provider of the electric power to the proposed Frontier Project. Frontier will contract with Cloverland to provide power for cold starts of the facility and a small portion of ongoing electrical usage. Cloverland is determining whether to feed the project site from the village or to construct a transmission line from the existing grid along I-75. Cloverland would be responsible for consultation and completion of any environmental review that might be required for the interconnect.

The proposed Frontier project site is currently undeveloped. Therefore, no municipal sewer services have been extended into the area. Kinross provides sewage collection and treatment services to the residential and commercial area immediately to the west of the Frontier site. A connection to the existing force main would be required to convey wastewater from the proposed site to the Kinross waste water treatment plant (WWTP). Modifications to the force main system, including upgrades of two lift stations would likely need to be completed to support the flow from the Frontier site. Due to regional topography, minimum pipe slope requirements and pipe bury depth requirement, it does not appear feasible to convey wastewater from the Frontier site solely via gravity. Frontier would be responsible for the costs associated with construction of the sewer system connection. No upgrades to the Kinross WWTP are anticipated to support the proposed project.

A connection to the existing Kinross water system will also be required to provide potable and process water to the proposed facility.

2.2.3.14 Start up, Shutdown, Maintenance, and Emergency Conditions

The Frontier Project would normally operate 24 hours per day, seven days per week. On an annual basis, it is expected that the biorefinery would operate approximately 347 days per year. Minor maintenance activities would be regularly scheduled throughout the operating year with an additional biorefinery-wide shutdown scheduled each year for major maintenance activities that require the entire biorefinery to be off-line. This would limit the number of times the biorefinery goes through a complete start up and shut down cycle.

Standard Operating Procedures (SOPs) would be developed for each operating system and the associated pollution control systems. SOPs would be developed for:

- Wood receiving and handling;
- Pretreatment and Hydrolysis;
- Filtration;
- Separation;
- Neutralization;
- Acid Reclamation;
- Fermentation, and distillation systems; and
- Ethanol and denaturant loading and storage.

The Frontier Project would shut down under emergency conditions such as power or process water loss. The Frontier Project would have emergency fire pumps in the event of a fire.

The pollution control systems associated with wood receiving, handling, and storage would be interconnected with the motor controls on the process equipment. Shutdown of the pollution control device would automatically shut down the associated process.

The Frontier Project fermentation and distillation systems would have wet scrubbers to remove ethanol and VOC from the vapor stream.

The unused lignin from the Frontier Project (approximately 20%) would be sold off-site. A stable market for the excess lignin exists in Michigan. Temporary on-site storage may be required during inclement weather or to accumulate sufficient spent lignin to accommodate efficient transportation methods. Long-term, on-site storage of the lignin is not anticipated to minimize the potential for odor impacts.

2.2.4 Construction

2.2.4.1 Preconstruction Surveying and Geotechnical Analysis

A limited geotechnical survey has been completed to facilitate development of preliminary site layout plans. A detailed site survey including full topographic analysis was completed during the spring of 2009. An additional geotechnical survey would be required to allow final design of building foundations, soil stability under parking areas and roadways.

2.2.4.2 Grading and Earthworks

The site grading design would be completed to minimize the impact to the surrounding environment. Site development practices would conform to those set forth in the *Michigan Erosion & Sediment Control Handbook*. Development of the site would be completed on approximately 50 acres located within the southern 160 acres of the site. Figure 1 shows the proposed site layout.

Frontier would apply for a Soil Erosion and Sedimentation Control (SESC) permit through Chippewa County, prior to starting construction. Since the overall earth disturbance would be greater than 5 acres, Frontier would apply for a Notice of Coverage through the MDNRE as part of the National Pollutant Discharge Elimination System (NPDES) for storm water discharges from construction activities. Frontier would utilize engineering and construction best management practices (BMPs) to control the amount of sedimentation and erosion created by the construction process. The BMPs would include but not be limited to:

- minimizing traffic and activity outside the construction area,
- using silt fencing, hay bales, rip rap and/or
- sedimentation ponds.

In accordance with Michigan's Part 91, Soil Erosion And Sedimentation Control (SESC), of the Natural Resources and Environmental Protection Act (NREPA), 1994 PA 451, as Amended, Frontier would routinely inspect the BMPs to ensure implementation and to evaluate whether additional measures would be required to prevent unnecessary impacts during construction.

2.2.4.3 Roads and Facility Access

The proposed Frontier site currently has access from the west by South Gaines Highway (Gaines Road) and an unpaved road bisecting the property called West Bisnett Road. As shown on the site location map (Figure 1), the main route serving this area is Interstate 75, which is within three miles of the proposed biorefinery site. M-80 and South Gaines Highway have exits from Interstate 75 and would likely serve as traffic routes to the proposed Frontier site. These roads are high volume and high tonnage roadways.

On average the proposed Frontier biorefinery would receive approximately 2 trucks per day delivering sawmill chips, 77 log trucks per day delivering hardwood pulpwood logs to supply biomass material for normal operations. Other deliveries would be expected to require 4 to 6 trucks per week for miscellaneous chemicals and supplies. The proposed Frontier biorefinery also would have approximately 70 passenger vehicles arriving per day for employees and visitors. Because of the current road configuration, none of the trucks or passenger vehicles would have to travel through Kinross, commercial or residential areas to reach the Frontier site.

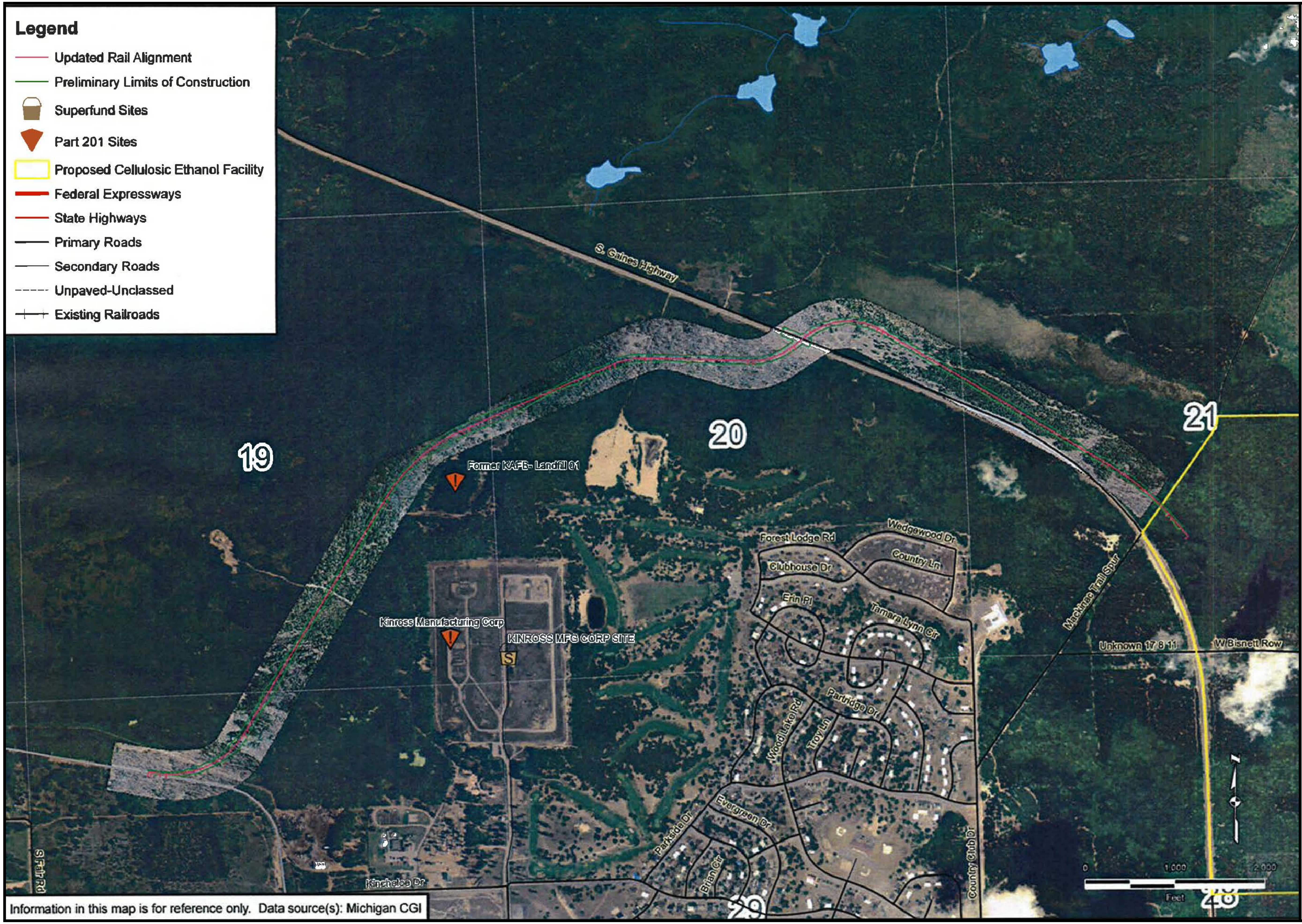
New turn lanes would be needed at the entrance to the Frontier site. Permits for the turn lanes may be required from the MDOT and/or Chippewa County.

All on-site roads would be designed for single loop traffic. All traffic would enter and exit the site via the main entrance guardhouse. After entering the site, all truck traffic would be routed away from employee and visitor traffic. The truck route would include two manned truck scales located inside the biorefinery security perimeter. Pulpwood and wood chip trucks would be weighed entering and exiting the biorefinery, as would all delivery trucks (chemical, fuel, etc.).

2.2.4.4 Rail Access

Rail service to the proposed site would be established by construction of a rail spur from the existing rail line located east of Kinross. Whole hardwood pulpwood logs would be delivered by rail. Lignin and denatured ethanol would be shipped from the biorefinery by rail and truck. As shown on Figure 3, the new rail spur would be routed north of Kinross and enter the proposed site from the north. An at-grade crossing would be constructed on the Gaines Highway. Sufficient track length would be constructed on-site to allow for staging of empty and full rail cars.

A maximum of two trains per day would use the spur for wood delivery and ethanol or lignin shipments. Each rail car delivery or shipment would replace two wood hauling trucks accessing the proposed site. Average daily rail delivery of pulpwood would be six railcars per day.



Information in this map is for reference only. Data source(s): Michigan CGI

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UPDATED RAIL ALIGNMENT
FRONTIER RENEWABLE RESOURCES, LLC
CELLULOSIC ETHANOL FACILITY
KINROSS TOWNSHIP, CHIPPEWA COUNTY, MICHIGAN

Drawn:	JWW	12/8/2009
Approved:	IM	12/8/2009
Scale:	1" = 1,000'	
PROJECT NUMBER	60140061	
FIGURE NUMBER	3	

2.2.4.5 Major Buildings and Structures

The Frontier biorefinery would require construction of a number of major buildings, process areas, and structures. These would include:

Table 2-1 – Major Buildings, Process Areas, and Structures

Site, Facility or Unit Operation	Description and Intended Use	Building Size
Wood Yard	Approximately 20 acres for whole log storage. Log piles would be up to 35 feet in height.	Not Applicable
Log Debarker and Bark Pile	Debarker, log conveyors, bark conveyor, and bark pile	Not Applicable
Wood Chipper Building	One wood chipping train including wood chippers, conveyors, screens, and separation cyclones	120'L x 60'W x 35'H
Chip Storage Area	Three chip storage silos and conveyors	Not Applicable
Pretreatment, Yeast Propagation, Fermentation and Chemical Storage Building	Pre-steaming vessels, high pressure reactors, biomass refiners and blow valves. Three yeast propagation trains with five tanks in each train. Bulk chemical storage tanks.	100'L x 127'W x 50'H
Fermentation Area	Sixteen fermenters, one beer well tank	50'diameter x 65'H each
Cooling Tower Area	Mechanical Fan Cooling Towers	36‘L x 36‘W x 50‘H
Utility Building	Electric Control Center Air Compressors Emergency Generators and Fire Pump	64‘L x 36‘W x 40‘H
Biomass Boiler Building	One biomass boiler and one steam turbine	125‘L x 100‘W x 50‘H
Distillation Building	Beer Column, Rectifier Column, Molecular Sieves	82‘L x 55‘W x 125‘H
Evaporator Building	Two evaporator trains	45‘L x 45‘W x 90‘H
Lignin Dryer Building	Lignin Dryer	23'L x 73'W x 65'H
Ethanol Storage and Load Out Area	Four ethanol shift tanks, Two Denatured ethanol storage tanks, one denaturant tank	Shift Tanks - 20'diameter x 15'H each Storage tanks – 50'diameter x 42'H each Denaturant Tank - 15'diameter x 15'H

2.2.4.6 Construction Schedule

Construction is proposed to begin in the second calendar quarter of 2011. Construction duration is expected to be approximately 18 to 24 months with first fermentation occurring in 2013.

2.2.4.7 Construction Staffing

Frontier would have full time construction management on-site throughout the entire duration of the project. Frontier would construct a contractor area near the construction-site where temporary job trailers and warehouses could be erected. Frontier would establish a temporary office on the site where all people entering the construction work zones would report. It would be Frontier policy for all construction labor to park their vehicles in the established contactor area. Only construction equipment and supervisor vehicles would be allowed in the construction zones.

Frontier would have appropriate project management staff on-site during all active construction time. Their primary role would be to monitor the overall performance and compliance of each individual contractor on-site. Frontier would not self-perform any of its own construction labor, so sub-contractors would be used throughout this process. By utilizing the sub-contractor supervision chain of command, Frontier employees could leverage their management to the entire work force. Additionally, Frontier management staff would visit the site on a regular basis to monitor installation and safety.

At the peak of construction, Frontier would employ approximately six people on-site full time. The sub-contractor labor force would be on average around 150.

2.2.5 Operations

2.2.5.1 Material Balance and Logistics

Table 2-2 summarizes resources and products that Frontier Project would require for the production of 42.5 mgy of denatured cellulosic ethanol. Additional details are presented in the following paragraphs.

Table 2-2 – Summary of Frontier Project Material Balance

Input Description	Frontier
Cellulosic material	971,600 green tons clean debarked wood chips per year 1,129,780 green tons of logs per year
Process Water	0.216 mgd
Potable Water	2,500 gpd
Yeast	Initial loading for yeast train only
Denaturant (gasoline or natural gas liquids)	2.5 mgy
Natural gas usage	0.1 MMSCF/year
Electricity	10.9 MW – estimated average load
Yeast Nutrients	Approximately 26,000 tons per year (tpy)
Process Chemicals	Approximately 7,500 tpy
Diesel Fuel (Wood Harvest)	Approximately 1.35 mgy
Diesel Fuel (Wood Transport)	Approximately 1.6 mgy
Diesel Fuel (Wood yard Usage)	Approximately 0.8 mgy

Bark (from on-site operations)	456 tpd
Lignin (from on-site operations)	420 tpd
Output Description	**Biorefinery Products**
Anhydrous Ethanol	40 mgy
Ethanol @ 5% Denaturant	42.5 mgy
Lignin	105 tpd
Waste Material Description	**Annual Production**
Cooling tower and boiler water discharge	0.14 mgd
Non-hazardous solid waste	25 tons/week
Hazardous Waste	<220 lb/month
Boiler Ash	44 tpd
Air Potential Emissions	
NO_X	229.3 tpy
VOC	145.2 tpy
CO	186.9tpy
PM	200.12 tpy
PM_{10}	140.9 tpy
$PM_{2.5}$	113.1 tpy
SO_2	42.6 tpy
GHGs	
CO_2	
Biogenic CO_2	458,484 tons/year
Anthropogenic CO_2	7,800 tons/year

2.2.5.2 Biomass Requirements

The raw material for the Frontier biorefinery would be in the form of mixed hardwood pulpwood and chips. For the purposes of raw material supply planning, the Frontier biorefinery would require 1,129,780 green tons of hardwood pulpwood logs per year (971,600 green tons clean, debarked chips per year). This volume would be sourced through the existing traditional hardwood pulpwood supply chain infrastructure in the Michigan's Eastern Upper Peninsula and Northern Lower Peninsula. Hardwood pulpwood would consist of aspen, hard and soft maple, oak and other hardwoods. The majority of biomass would be in the form of roundwood. Biomass, in the form of hardwood pulpwood chips, may also be sourced from lumber mills or other users that have excess chips available. The Frontier biorefinery would not use softwoods such as pine (jack, red or white), cedar or other softwoods. Also, the Frontier biorefinery would not use high value timber, such as saw logs or veneer logs.

The biomass for the proposed project would come from within a 150 mile radius of Kinross. Over the life of the facility, the approximate annual distribution of biomass harvest is shown in Table 2-3.

Table 2-3 Approximate Biomass Harvest Distribution

Pulpwood Supply Zone	Distribution of Volume by Zone	Delivered Wood Vol by Zone
(radius - miles)	(percent)	(Approximate Green Tons per Year)
0-30	10%	113,000
30-60	20%	226,000
60-90	25%	282,500
90-120	25%	282,500
120-150	20%	226,000

Biomass would be sourced from all types of forest ownerships in the region. These would include private forest lands, state owned and managed forest lands, and USFS National Forest Lands. Timber harvest is not allowed on National or State park lands. Therefore, these lands are not included in the biomass resource availability analysis. Additionally, forest resources from Canada were not included in the resource availability analysis because this is primarily a U.S. and Michigan based initiative and sufficient resource is clearly available from within Michigan. Therefore, Frontier is conservatively basing the project on that forest resource. Ultimately, some Canadian wood fiber may be utilized, but the viability of the project is not dependent upon Canadian pulpwood fiber. If Frontier were to utilize pulpwood from Canada, it would come from forest areas similar to those in Michigan, which have been historically managed and harvested sustainably for pulpwood and other timber products for many decades..

Timber harvests from National Forest lands would only be from tracts where compliance with the NEPA has been demonstrated. Timber harvests from Michigan state lands and forests are subject to environmental review processes, public notification and review, and the practices and procedures established in the Michigan State Forest Management Plan. Annual audits by an independent third party FSC auditor monitors compliance with the specified practices and procedures detailed in the Plan. Timber harvests from JM Longyear properties (or similar large land/forest resource management companies) are subject to the provisions of the forest management plan prepared as part of their FSC or Sustainable Forestry Initiative (SFI) certification. Annual audits by an independent third party FSC or SFI auditor monitors compliance with the specified practices and procedures detailed in the plan.

Frontier would establish a timber procurement process equivalent to the requirements established by the SFI certified procurement process. Frontier would, through its wood fiber procurement agreements and other supply relationships, work to encourage and influence private landowners and wood suppliers to participate in forest certification initiatives. Frontier would require verification of logger participation in Sustainable Forestry Education (SFE) professional logger training and certification programs and conformance to Michigan Best Management Practices.

2.2.5.3 Permits, Approvals, and Plans

The Frontier Project would require a number of environmental permits, approvals, and plans for construction and operation. The permits, plans, and approvals are included in Table 2-4 below:

Table 2-4 – Frontier Project Potentially Applicable Permits and Approvals

Need For	**Permit Name**	**Agency**	**Complete By**	**Notes**
Air Emissions	Permit to Install (PTI)	Michigan Department of Natural Resources and Environment (MDNRE)	Construction	The air Permit to Install has been issued by the MDNRE. Mascoma would ensure that Frontier would apply for a permit modification application for the biomass boiler CHP system.
Building Permits	For Construction activities	Chippewa County	Construction	For site development and buildings
Building Permits	Construction	State of Michigan	Construction	For electrical, mechanical and plumbing permits
Deliveries to Site	Overload Limit Permits – Construction deliveries	County and Michigan DOT as applicable.	Construction	Prior to start of construction & operations as necessary.
Fire Protection	Hazardous Material Inventory and Emergency Response Plan	Chippewa County Local Emergency Planning Commission	Operations	Consultation during design. Inspections during construction and operations.
Hazardous Material/Waste	Hazardous Waste Generator ID	USEPA EPA	Operations	TBD (for soiled rags, used oil, etc.)
Land Use Zoning	For planned use	Chippewa County	Construction	Property currently zoned industrial.
Site Access	Right of Way, Drive Way Permit	Chippewa County	Construction	Required before construction
Surface Water Resources	Stormwater Permit for General Construction	Chippewa-East Mackinac Conservation District (CEMCD)	Construction	Filing under General Permit. Submit Notice of Intent, Stormwater Pollution Prevention Plan, and fees prior to start of construction.

Need For	Permit Name	Agency	Complete By	Notes
Water Supply	Water use Permit	Kinross Charter Township	Construction	Approximately 200 gallons per minute of water would be provided to the biorefinery by the Kinross Charter Township
Water Discharge	Significant Discharge Permit	Kinross Charter Township	Operations	Required for wastewater discharge of more than 25,000 gallons per day
Alcohol Fuel Permit	For production and sale of fuel ethanol	Bureau of Alcohol, Tobacco & Firearms	Operations	
Wetlands	Joint Permit Application: USACE Section 404 Permit/ MDNRE Part 303 of NREPA, Act 451 of 1994	USACE- Detroit District, Soo Area Office/ MDNRE	Construction	Wetland impacts would be mitigated by constructing additional wetlands and/or purchasing wetland credits from an existing wetland mitigation bank.
Aboveground Storage Tanks (ASTs)	Installation of Aboveground Storage Tanks	MDNRE	Construction	Required for ASTs that contain a liquid with a flash point of <200 °F

2.2.5.4 Operational Workforce

The Frontier Project would employ approximately 70 full-time workers. Frontier expects to hire the necessary skilled personnel from existing local and/or regional resources.

2.2.5.5 Project Design Features to Minimize Threat from Intentional Destructive Activities

The Frontier Project would be designed to include measures to minimize potential threats or damages from intentional destructive acts (i.e. acts of sabotage or terrorism). The biorefinery design would include security fences, security lighting, and communication procedures with the local 911 emergency response system. In addition, the biorefinery would be manned 24 hours per day and equipped with automation that allows remote emergency shutdown and cutoff of process units and loading racks.

2.3 Alternative Sites Considered

In 2008, Mascoma evaluated a former Georgia Pacific site near Gaylord, Michigan for the proposed project. The site featured good access to infrastructure and, as a brownfield site, minimal potential environmental impacts. The site was rejected due to existing on-site contamination and the need for significant infrastructure upgrades.

Between April and June 2008 Mascoma and J.M. Longyear, LLC (prior to the formation of Frontier Renewable Resources or Frontier Kinross) evaluated three potential sites for development of the proposed Frontier biorefinery in the area of the former Kincheloe Air Force Base.

- Site #1: located south of Gaines Highway and north of the existing wastewater treatment plant and golf course.
- Site #2: located west of interstate I-75 approximately one mile north of the Gaines Highway exit ramp.
- Site #3: located northeast of the Kinross airport on the east side of Gaines Highway.

The analysis included evaluation of known natural and manmade features, as well as regulated natural resources, wildlife, and land developments in the area that would impact successful development of the proposed biorefinery. The evaluation was completed through the use of readily available data.

The project team considered the following data during the review:

- Biological resources, including wetlands and plant communities (wetland information from the National Wetland Inventory and the plant communities from the Michigan Natural Features Inventory).
- Land use.
- Electrical transmission and other infrastructure services (roads, rails, transmission lines, and substations).
- Any Federal lands or lands involving Federal funding.
- State and Federally listed threatened and endangered species (T&E information from the Michigan Natural Features Inventory.).
- Aerial orthophotography.
- Roads, rails, terminals, and ports.
- USGS 7.5-Minute Topoquadrangles.
- Hydrography (lakes, ponds, streams, and rivers).
- EPA Toxics Release Inventory (TRI).
- Waste management facilities.
- Superfund sites.
- Airports and private airstrips.
- Schools, churches, hospitals, nursing homes, and other sensitive community resources.
- Soils
- Geology, bedrock, and geologic landforms.
- Michigan Leaking Underground Storage Tanks, USTs, and Part 201.
- Drinking water wells.
- Estimated groundwater recharge.
- Water table depths.

- Water table contours.
- Wastewater treatment plant locations.

Following completion of the review, the Mascoma project team visited each of the three sites. The sites were ranked considering potential environmental impacts, community impacts, infrastructure requirements, transportation routes, and site access. The results of the evaluation identified the following:

- Site #1 features included good access to municipal utilities, transportation corridors for rail and truck access, and had only sparse wetland areas. Site #1 was rejected by Frontier because it was close to residential areas, included an environmental contamination site (Superfund site) and lacked sufficient acreage to allow flexibility in design and construction of the biorefinery.

- Site #2 features included good access to transportation corridors (adjacent to CN railway main line and I-75). The site was rejected because the area consisted primarily of wetlands with limited upland areas. Construction would have resulted in unacceptable environmental impacts. Additionally, the municipal utilities were the furthest away of the three sites.

- Site #3 features included over 300 acres of upland area with good access to transportation corridors (Gaines Highway to I-75). Municipal utilities were within a reasonable distance and would require only minor upgrades to support the proposed project. Sufficient land was available to allow flexibility to avoid adverse impacts to on-site wetlands. Site #3 was far enough from existing development to minimize impacts on the community from noise, odors, traffic, or visual impacts. Site #3 was selected for the proposed project.

As a result of the review process, Mascoma selected Site #3 for the proposed Frontier biorefinery. Mascoma identified Site #3 in its application to DOE, and accordingly this EA is evaluating Site #3. The other sites are not under consideration or evaluated in this EA.

3.0 Affected Environment and Environmental Consequences of the Alternatives

3.1 Forest Resources

3.1.1 Affected Environment

Mixed hardwood pulpwood and chips for the proposed Frontier Project would be sourced through the traditional hardwood pulpwood supply chain infrastructure existing in the Michigan's Eastern Upper Peninsula and Northern Lower Peninsula.

The first lumber mill was established in the Upper Peninsula of Michigan by the US Army in 1822. By 1863 over 1,600 mills were operating in Michigan. The peak timber harvest occurred in 1890 when 5.5 billion board feet of lumber were produced (Michigan Forest Products Council, 2011). Timber harvest has been a major industry in Michigan and the Upper Peninsula since.

Within 150 miles of the proposed Frontier site, there are approximately 8,313,000 acres of commercial forest lands. This is the portion of the total forest area which has traditionally been harvested and managed as timberlands since the late 1800's. It includes the timberlands of all major ownership groups Federal, State, large commercial, and large to small private forest lands. It is "second-growth", which in many cases has been harvested and re-grown multiple times over many decades. A significant portion of this forest is re-established on lands once cleared and farmed for decades and then later abandoned to return to a forested state.

Excluded from the forest resource analyzed for the intended supply for Frontier are all other forest lands which are in some form of protected status either by statute or special management restriction by designation in National Forest Plans or State Forest Plans, National Wildlife Refuge areas, National Seashore area, State and National Parks, and a myriad of other special status designations. By policy National Forest Plans must ensure that species and habitat diversity are addressed, not only at the broader forest-wide level, but also be a key consideration in the areas managed primarily for timber production.

Similarly, State Forests are managed under plans and policies which specifically balance timber production with protections to maintain natural diversity and specific habitats across the landscape. Additionally State Forests are dual certified by the Sustainable Forestry Initiative (SFI) and the Forest Stewardship Council FSC) systems; each of which contain specific criteria and indicators for maintaining biodiversity within managed forests. Large commercial owners are also certified under either SFI or FSC systems and subject to similar expectations to maintain key natural and diverse characteristics of forest ecosystems at a level appropriate to their level of effect on the overall landscape in a given region.

Smaller private landowners, while not generally participating in forest certification systems, are influenced by either consulting foresters assisting them with management planning or timber sale preparation, or certified loggers who are bound by their certification through the Sustainable Forest Education program to operate under the principals of sustainable forestry, and all regulations and guidelines regarding protection of water quality, protection of endangered species and habitats; and recognizing and maintaining unique ecological, historical, and cultural resource.

Frontier along with existing forest products industry members are committed to further broadening participation by smaller forest land owners in a form of forest certification which is appropriate to small landowners and small businesses.

According to the Timber Resources and Factors Affecting Timber Availability and Sustainability for Kinross, Michigan, Prepared for Feedstock Supply Chain Center of Energy Excellence, December 2010 (Timber Supply Report) net annual growth (total growth less mortality) of the timber resource is about 6,683 thousand green tons annually (thousand GT/yr) on growing stock trees within 150 miles of the proposed Frontier site.

This growth is 16% aspen, 31% maple, 10% oak, 6% other hardwoods, 20% pine, 17% other softwoods. Total net annual growth of all hardwoods is 4,187.8 thousand GT/yr.

Table 3-1 - Net Annual Growth

Species Group	<30 miles	30-60 miles	60-90 miles	90-120 miles	120-150 miles	Supply Area Total	Area Pct
Thousand GT/yr							
Aspen	79.8	64.6	190	288.9	425	1048.3	15.7%
Maple	97.6	203	459.7	627.7	654.6	2042.6	30.6%
Oak	9.4	-8	77.1	184.5	406.3	669.3	10.0%
Upland HW	-9.9	-5.5	126.2	126.7	44.5	282	4.2%
Lowland HW	-10	-2.5	11	72.4	74.7	145.6	2.2%
Total Hardwoods	166.9	251.6	864	1300.2	1605.1	4187.8	62.7%
Pine	65.2	63.4	183.5	407	647.4	1366.5	20.4%
Upland SW	63.6	66.2	57.9	107.7	136.4	431.8	6.5%
Lowland SW	97.9	105.3	98.7	141.7	253.5	697.1	10.4%
Softwoods	226.7	234.9	340.1	656.4	1037.3	2495.4	37.3%
All Species	393.5	486.6	1204.1	1956.5	2642.5	6683.2	100%
Green Tons/Acre	0.6	0.65	0.75	0.9	0.85	0.75	

As shown on Table 3-2, current annual removals of all species of growing stock timber are about 3,556.5 thousand GT/yr within 150 miles of Kinross. This volume was 17% aspen, 28% maple, 6% oak, 16% other hardwood, 22% pine, and 11% other softwood. Total current annual removal of mixed hardwood is about 2391.1thousand green tons.

Table 3-2 - Net Annual Removals

Species Group	<30 miles	30-60 miles	60-90 miles	90-120 miles	120-150 miles	Supply Area Total	Area Pct
Thousand GT/yr							
Aspen	54	23.9	109.6	144.6	272.8	604.9	17.0%
Maple	83.7	138.8	198	174.6	421	1016.1	28.6%
Oak	2	0	11.4	28.2	161	202.6	5.7%
Upland HW	11.7	85.3	148.3	124.4	140.6	510.3	14.3%
Lowland HW	15.9	0	10	6.8	24.5	57.2	1.6%
Total Hardwoods	167.3	248	477.3	478.6	1019.9	2391.1	67.2%
Pine	75.1	46.4	71.8	254.8	320.6	768.7	21.6%
Upland SW	54.1	41.4	54.9	57.3	49.4	257.1	7.2%
Lowland SW	18	13.3	13.3	17.7	77.3	139.6	3.9%
Softwoods	147.2	101.1	140	329.8	447.3	1165.4	32.8%
All Species	314.5	349.1	617.3	808.4	1467.2	3556.5	100%
Green Tons/Acre	0.5	0.25	0.4	0.35	0.55	0.41	

A realistic estimate of raw material supply, takes into account both the net growth on the forest, and the removals already occurring. Net annual growth less current annual removals or usage – *sustainable fiber supply* – is an assessment of the fiber that can be utilized over time without depleting the current growing stock inventory. This is shown below in Table 3-3 - Net Annual Growth Less Removals.

Harvest methods and techniques employed by pulpwood suppliers will be the same as those which have been used for decades in the region to supply current and former facilities that used hardwood pulpwood. The majority of the hardwood forest types will be thinned or harvested using tree selection methods or shelterwood methods. A minor portion of the pulpwood will be aspen harvested using the clearcut method. All harvesting in the region is subject to sustainable forest management and harvesting practices, monitored by both landowners, some of whom are certified under SFI or FSC systems, and certified procurement systems operated by all of the large pulpwood consuming facilities. All loggers who sell and deliver pulpwood to these facilities have been required achieve and maintain certification under the Sustainable Forestry Education (SFE) program. The SFE training and certification requirement has been in place in this region since the late 1990's.

Additionally, secondary fiber sources, such as sawmills capable of supplying clean residual chips would provide fiber to the biorefinery. The current potential for sawmill chips in the supply region within close proximity is approximately 20,000 tons, which could offset approximately 2 percent of the green pulpwood volume.

Since the analysis period for the timber supply report was 2004-2008, the data in Table 3-2 for removals does not fully account for the closure of the Georgia-Pacific (GP) Particle Board Mill at Gaylord, Michigan in March of 2006, the former S. D. Warren pulp and paper mill at Muskegon or the Menasha mill in Otsego, Michigan. The GP facility was within the 150 mile radius of the Frontier biorefinery site at Kinross. GP's annual wood fiber usage was approximately 740,000 GT/yr. The S. D. Warren mill used about 450,000 GT/yr, a portion of which came from within the proposed Frontier supply area. Menasha used about 480,000 GT/yr, a small portion of which came from within the proposed Frontier supply area.

All planning for raw material supply has excluded potentially available forest resources in Ontario, Canada because this is primarily a U.S. and Michigan based initiative and sufficient resource is clearly available from within Michigan. Therefore, Frontier is conservatively basing the project on that forest resource. Ultimately, some Canadian wood fiber may be utilized, but the viability of the project is not dependent upon Canadian pulpwood fiber. If Frontier were to utilize pulpwood from Canada, it would come from forest areas similar to those in Michigan, which have been historically managed and harvested sustainably for pulpwood and other timber products for many decades.

Table 3-3 - Net Annual Growth less Removals (Surplus Growth)

Species Group	<30 miles	30-60 miles	60-90 miles	90-120 miles	120-150 miles	Supply Area Total	Area Pct
				Thousand GT/yr			
Aspen	25.8	40.7	80.5	144.3	152.2	443.5	14.2%
Maple	13.9	64.3	261.7	453.2	233.6	1026.7	32.8%
Oak	7.3	-8	65.7	156.3	245.3	466.6	14.9%
Upland HW	-21.7	-90.8	-22	2.2	-96.1	-228.4	-7.3%
Lowland HW	-25.9	-2.5	0.9	65.6	50.2	88.3	2.8%
Total Hardwoods	-0.6	3.8	386.7	821.5	585.2	1796.6	57.5%
Pine	-9.9	17.1	111.6	152.2	326.8	597.8	19.1%
Upland SW	9.5	24.7	3	50.4	87	174.6	5.6%
Lowland SW	80	92	85.4	124	176.3	557.7	17.8%
Softwoods	79.5	133.8	200.1	326.6	590.1	1330.1	42.5%
All Species	79	137.5	586.8	1148.1	1175.3	3126.7	100%
Green Tons/Acre	0.1	0.4	0.4	0.5	0.3	0.34	

As discussed above the Timber Supply Report indicates that net annual hardwood growth exceeds current removals by all wood users within the supply area for the proposed Frontier biorefinery by approximately 1,797 thousand GT/yr.

The region around the Kinross currently has a minimal demand for hardwood pulpwood. The larger hardwood pulpwood using facilities are concentrated in the western Upper Peninsula, northern Wisconsin, and northeastern Minnesota all more than 150 miles from Kinross. The nearest hardwood pulp and paper mill in Canada is approximately 170 miles east in Espanola, Ontario. There will likely be minimal direct competition between Frontier and these existing hardwood using facilities for hardwood pulpwood.

The nearest softwood pulp and paper mill is St. Mary's Paper is located approximately 25 miles North in Sault Ste. Marie, Ontario, Canada. It uses softwood pulpwood as feedstock. There will be no direct competition between Frontier and this facility. It is more likely that the increased market for hardwood in the region would have a complementary affect on softwood pulpwood using facilities, as this facilitates the harvesting and or thinning of mixed species stands, and would likely increase softwood pulpwood availability.

One particle board operated by Louisiana-Pacific is located at Newberry, Michigan, approximately 50 miles west which uses aspen as its primary feedstock. The Weyerhaeuser particle board mill is located more than 150 miles south at Grayling, Michigan which also uses aspen as its primary feedstock. While Frontier can utilize aspen, it is not a necessary feedstock, as there is ample surplus mixed hardwood of other species within the region. It is not likely that Frontier will compete heavily for aspen pulpwood with either of the existing particle board mills in the region. It is more likely that an improved market for more mixed hardwood could be complementary to the aspen and softwood pulpwood using facilities, as this facilitates the harvesting and or thinning of mixed species stands.

One new forest products business company, the Gitchie Gumee Pellet Company (GGPC), began operations in Kinross Charter Township in June 2010. GGPC manufactures wood pellets for use a fuel on the former Kincheloe air force base. GGPC has the capacity to manufacture up to 20,000 tons of wood pellets per year. GGPC uses a combination of wood waste, forest-thinning, and sawdust to produce their pellets. It is likely that the increase market for hardwood in the region would make more wood waste and forest thinning available for GGPC. GGPC may also be a potential purchaser of lignin from the proposed Frontier Project.

Between 1996 and 2004, hardwood pulpwood and aspen prices were relatively stable at approximately $24.00 per GT. In 2004 and 2005 two conditions coincided to cause a sharp increase in the price to approximately $40 per GT for both hardwood pulpwood and aspen:

1. South African Paper Products, Inc. (SAPPI) of Cloquet, Minnesota had completed a large expansion of their hardwood processing capacity. In order to support their operations, SAPPI began sourcing hardwood pulpwood from the western Upper Peninsula of Michigan; and

2. A number of large forest products companies sold their timber lands. As a result, these companies entered the open market for forest resources.

In 2006 and 2007, the price of both aspen and hardwood pulpwood declined to less than $30 per GT as the market stabilized and a number of mills closed. This was followed by a short term increase in price to approximately $36 per GT in 2008 and 2009 that was driven primarily by the increase in the cost of diesel fuel. Buyers needed to offer a fuel cost offset to maintain deliveries of timber. Since the economic decline began in 2008, the price of aspen and hardwood pulpwood has been steadily declining as additional cutbacks have occurred in the forest products industries in the Upper Peninsula. The price for aspen in 2010 was approximately $28 per GT while hardwood pulpwood was approximately $32 per GT (Prentiss & Carlisle, 2009).

While, published long-term price trend data for the Kinross sub-region is not available from third party sources, experience data acquired by Longyear through long-term operational experience in the region, confirm that hardwood pulpwood pricing in and around Kinross is somewhat lower than State averages.

The existing forest lands have been managed, including the type of harvesting and frequency of harvest, for decades by various owner groups to supply pulpwood to the current and former mill facilities. Most of the forest area in the region has been harvested multiple times, has been regenerated successfully each time, and continues to grow and provide timber, habitat for wildlife, recreational opportunities, and other resources.

Four different land types/owners would be suppliers of pulpwood for the Frontier Project:

- National Forest Service lands
- Michigan State forest lands
- Private managed forest lands including timber owned and operated by JM Longyear; and
- Private lands owned and operated by other individuals, families and companies

Private managed forest lands are differentiated from other private lands in two primary ways.

1. Private forest lands are managed specifically to provide timber for commercial use; and

2. Private forest lands enrolled in certain state programs, such as the Commercial Forest program, which gives tax breaks for owners who keep their land open for recreation, are open to the public for hunting, fishing, and other recreational purposes.

Owners of other private lands may allow commercial timber harvest, but do not necessarily have that use as the primary purpose.

The Tribes that are signatory to the 1836 Treaty of Washington and the public have rights to hunt, fish and gather for personal use and subsistence on private forest lands enrolled in the above mentioned state programs. The public and Tribes do not have similar rights on other private lands unless granted by the owner.

3.1.1.1 National Forest Land Management

Timber harvest and sales are part of the forest management processes established by the US Forest Service. Prior to each timber sale, the Forest Service completes a multistep evaluation process. The first step is a detailed analysis of the appropriate forest management activities to be completed in each National Forest. If a timber sale is selected as an option for forest management, the Forest Service is required to complete an environmental review before the timber tract is sold. The environmental review process for the Forest Service is governed by the NEPA implementing regulations and Forest Service policies and procedures for environmental review.

The NEPA process begins with a Scoping document that describes the proposed timber sale and requests input from the public, other government agencies, and the Federally Recognized Tribes in the area on potential concerns or issues. The Forest Service reviews the responses to the Scoping document and utilizes that input to guide preparation of an EA or Environmental Impact Statement (EIS). Each EA or EIS addresses the following topics:

- Project Alternatives;
- Air Quality;
- Geology and Soils;
- Biological Resources, including threatened and endangered species, wildlife diversity, and habitat;
- Water Resources, including wetlands and surface water bodies;
- Cultural Resources, including historic and archeological resources;
- Land Use, including habitat conservation and sustainablility;
- Noise;
- Traffic, including access and harvest methods; and
- Economics

Other topics may be included depending on site specific needs or criteria.

The draft EA is provided to the public, government agencies and Tribes for review and comment. The draft EA is also posted electronically on the Forest Service website for easy access. If requested, a public hearing is conducted to accept additional input from the public. The Forest Service uses the information in the EA and the input from the public to make a determination if unmitigatable significant impacts would occur. If the EA process yields the conclusion that a Finding of No Significant Impact (FONSI) is appropriate, the Forest Service publishes the draft FONSI for review and comment by the public, government agencies and Tribes. If a FONSI is not appropriate, additional information is gathered or the sale process does not go forward for that tract.

3.1.1.2 Michigan State Forest Land Management

In accordance with Part 525, Sustainable Forestry on State Forest Lands, MDNRE is required to manage the state forest in a manner that is consistent with the principles of sustainable forestry, and to prepare and implement a management plan that states long-term management objectives and the means of achieving these objectives.

Part 525 also required the MDNRE to seek and maintain third party certification of the management of the state forest that satisfies sustainable forestry standards of at least one credible certification program. Subsequently, the MDNRE was certified under the standards of the FSC and the SFI. These standards also require the MDNRE to write, implement, and maintain forest management plans. Additional information on FSC Certification is contained in Section 3.1.1.3.

The MDNRE uses a 3-tiered planning structure for the management of Michigan's state forest resources: statewide, regional and forest management unit levels. The Michigan State Forest Management Plan and four Regional State Forest Management Plans (RSFMPs) provide landscape-level analyses and direction to enable tactical decisions for management of forest stands and compartments at the unit level. The aggregate of all forest prescriptions from compartment reviews are contained in the annual plan of work, which represents the tactical level of planning for state forest operations. The MDNRE is also developing strategic plans that will address all ownerships in a region (including all MDNRE lands – forests, parks and wildlife areas, other public plans, and private lands), which will be known as Ecoregional Resource Plans. Ecoregional Resource Plans will provide strategic goals and objectives that will also provide guidance for Regional State Forest Management Plans and other state planning efforts. (MDNRE 2008).

Michigan's nearly 3.9 million acres of State Forest Land are divided into 15 Forest Management Units Each of the state's 15 Forest Management Units are divided into blocks called compartments.

Using aerial photographs, land surveys, and other site specific information, MDNRE foresters visit, record biological data and map by tree species on all the state-owned land in each compartment. Based on this information, foresters make initial recommendations for forest treatments including clear cutting, selective thinning, prescribed fires, tree planting or no treatment at all.

The inventory and draft recommendations are then reviewed by Forest Recreation Specialists, and often Ecologists, Foresters, Wildlife Biologists, and Fisheries Biologists. This review results in management recommendations that have an ecosystem or holistic land management perspective. A broad range of biological, economic and social values and benefits are considered, including: campground management, fish habitat and river corridor protection, game species management, gas, mineral, oil, and timber management, historic and cultural resources, insect, disease, and invasive species management, rare or fragile species and natural community protection, soil protection, trail location and maintenance, wildfire control, and others.

The management draft recommendations are reviewed with the Tribes prior to the publication of the compartment report to solicit comments and address Tribal questions or concerns.

The management recommendations are then presented at Open Houses. As the name implies, Open Houses are informal sessions that give citizens an opportunity to speak with foresters, wildlife biologists, and other resource professionals. The inventories, compartment maps, and recommended management actions are available for the public to look at and to provide suggestions to MDNRE staff.

Modifications to the management recommendations are then incorporated into a finalized compartment plan to be presented at the "Compartment Review". The Compartment Review is a formal presentation that incorporates information from the initial inventory, the multi-disciplinary input period, and the open house. The presentation outlines the formal management plan for the compartment and includes an explanation of forest treatments if any are proposed. (www.michigan.gov/dnr, Reviewed November 2010)

In addition to the above programs, the MDNRE has established the Biodiversity Stewardship Area (BSA) program to identify and preserve areas of state and private land that exhibit exceptional biodiversity. The MDNRE would continue to evaluate State owned land through their existing BSA programs. Participation by private land owners is strictly voluntary. Private land owners would still be able to submit their property for participation in the BSA process. Candidate areas would be assessed by regional teams of DNRE staff and stakeholders. These teams would make a formal recommendation to the DNRE for a set of areas that should be included in the BSA network for their region. DNRE leadership (the DNRE's Statewide Council Certification Programs) would make the final decision after internal and public review. This process would not be affected by the proposed Frontier Project

As a result of widespread adoption of SFI certification by forest industry and many of the major land management entities within Michigan since the 1990's, training programs were established for loggers, foresters and other land management practitioners. All loggers and contractors who harvest timber on certified lands or sell timber products to certified mills, are required to acquire and maintain certification through the SFE program. SFE training includes both classroom training on sustainable and environmentally protective harvest methods as well as in-field training on practical applications and techniques to minimize impacts to forest lands, critical habitats, and environmentally sensitive areas. Annual refresher training is required to maintain the SFE certification.

3.1.1.3 J.M Longyear Managed Forest Lands

As noted in Section 1.3, JM Longyear is FSC certified on the lands they own and manage. (Certificate Registration No. SW-FM/COC-003804). The *FSC Principles and Criteria* (P&C) describe how the forests have to be managed to meet the social, economic, ecological, cultural and spiritual needs of present and future generations. They include managerial aspects as well as environmental and social requirements. The FSC P&C form the basis for all FSC forest management standards.

- ***Principle* 1.** Compliance with all applicable laws and international treaties
- ***Principle* 2.** Demonstrated and uncontested, clearly defined, long–term land *tenure* and use rights
- ***Principle* 3.** Recognition and respect of indigenous peoples' rights
- ***Principle* 4.** Maintenance or enhancement of long-term social and economic well-being of forest workers and local communities and respect of worker’s rights in *compliance* with International Labour Organisation (ILO) conventions
- ***Principle* 5.** Equitable use and sharing of benefits derived from the forest
- ***Principle* 6.** Reduction of environmental impact of logging activities and maintenance of the ecological functions and integrity of the forest
- ***Principle* 7.** Appropriate and continuously updated management plan
- ***Principle* 8.** Appropriate monitoring and assessment activities to assess the condition of the forest, management activities and their social and environmental impacts
- ***Principle* 9.** Maintenance of High Conservation Value Forests (HCVFs) defined as environmental and social values that are considered to be of outstanding significance or critical importance
- ***Principle* 10.** In addition to *compliance* with all of the above, plantations must contribute to reduce the pressures on and promote the restoration and conservation of natural forests.

FSC requires completion of a number of actions and studies before a company can be certified. These actions include:

- Surveying each parcel of timberland and determining the growth potential of timber on that parcel
- Identification of wetlands, stream corridors, and other surface water bodies;
- Identification of wildlife habitats;
- Identification of threatened and endangered species; and
- Identification of high value conservation areas.

FSC certification requires each company to develop a comprehensive forest resource management plan. The management plan must contain policies, procedures, monitoring actions, and recordkeeping actions for all aspects of operations. Specific actions include:

- Limiting harvest amount to ensure that harvest does not exceed growth;
- Establishing buffer zones for critical habitats, wetlands, and other sensitive areas;
- Establishing harvest restrictions to avoid nesting/mating areas and times for sensitive species;
- Avoiding high value conservation areas;

- Employing harvest practices that minimize soil impacts and erosion.
- Providing training to employees on legal requirements, conservation methods, habitat preservation, and sustainable forestry practices;
- Being an equal opportunity employer;
- Using non-discriminatory selection criteria for contractors; and
- Using SFE certified loggers and contractors.

FSC certification requires that the company participate in annual independent third party audits of their management plans and practices. The auditor must be certified by FSC through a separate process. If corrective actions are identified by the auditor, a schedule for addressing the corrective action must be established and documentation maintained to document completion.

3.1.1.4 Private Land Owners

Private landowners are generally too small and/or have a harvest frequency that makes certification through FSC or SFI impractical. The MDNRE has developed guidance documents, such as the Michigan Woody Biomass Harvesting Guidance (MDNRE, May 2010) and other processes to assist private landowners with developing a sustainable woody biomass harvest plan. This includes offering technical assistance to private forest owners through the Forest Stewardship Program. This program provides cost share assistance for the purpose of having a forest stewardship plan written. Information included in a forest stewardship plan includes unbiased information about the trees and vegetation currently growing on the land, potential forest stands that could be grown on the land, soils present and their qualities, wildlife habitat quality, any threatened and endangered species -any invasive species-or insect/diseases noticed, and management recommendations that would help the landowner meet their objectives for owning the land and keep the resource sustainable. Forest stewardship plans are written by professional foresters or certified natural resource professionals, as well as reviewed by a DNR Service Forester, to ensure that the information and recommendations made are sound (MDNRE 2011).

Additionally, SFI and FSC certification processes have been created for the purchasing company’s procurement systems. The procurement certification process requires companies to establish the practices and procedures to ensure that timber is purchased from individuals and companies who, although not certified through FSC or SFI, are following sustainable and environmentally protective harvesting practices.

Similar to the SFI and FSC certification process for timber lands, the procurement certification process requires preparation of a procurement plan that details the policies, practices, inspections, monitoring and recordkeeping a company is going to employ. The plan must include provisions for:

- Contractual obligations for the timber seller to harvest in an environmentally sound manner;
- Requirements to use trained loggers (such as SFE certified loggers and contractors);
- Stop work parameters for timber purchases in the event of non-compliance;
- Field verification of harvest practices on the private landowners parcels; and
- Participation in annual third party independent audits of the procurement system.

3.1.1.5 Biological Resources

Flora and fauna are impacted by existing timber harvest activities. Some species, such as understory vegetation, some bird species, and some mammals benefit from the change in cover and biological diversity. Other species, which prefer in mature forest stands, do not benefit from timber harvest activities.

As noted above, Federal, State and FSC/SFI certified forests are evaluated for potential impacts to flora and fauna prior any timber harvest. Those processes ensure that impacts to biological resources are minimized. The use of FSC procurements processes, SFE trained loggers, and/or Michigan forest stewardship plans provide the similar protections on private lands.

3.1.1.6 Air Quality

Timber harvest utilizing mechanical equipment use diesel fuel and have related air emissions. Dust emissions can also occur during harvest activities. These air emission sources are temporary within each harvest area, generally being present for less than one week in any location. Air emissions are minimized by following the Generally Accepted Forest Management Practices (GAFMPs) developed by the MDNRE as part of the Right to Forest Act of 2002 (MDNRE, 2006).

The Seney National Wildlife Refuge is located approximately 78 miles west of the proposed Frontier Project site. The Seney National Wildlife Refuge is defined as a Class I area for air quality regulation and protection. Class I areas are areas of special natural recreational, scenic, or historic value, such as national parks and wilderness areas. No other Class I areas are within the 150 harvest radius of the proposed Frontier Project.

As noted in Section 3.6, the Upper Peninsula of Michigan is in attainment for the National Ambient Air Quality Standards (NAAQS) established by the USEPA for all criteria pollutants. The NAAQS are established at a level that is protective of human health (including sensitive populations) and the environment.

3.1.1.7 Soils and Water Quality

Construction of temporary and permanent logging roads creates localized impacts to soil and can impact surface water. Compaction, cutting and/or placement of fill, construction of water crossings may occur during this construction. In accordance with existing Michigan regulations, numerous permits may be required prior to conducting timber harvest activities.

When constructing a new or upgrading an existing stream crossing, there are three specific statutes of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (NREPA), that always apply. These are: Part 31, Water Resources Protection; Part 91, Soil Erosion and Sedimentation Control; and Part 301, Inland Lakes and Streams. For each part, there are a legal set of rules and regulations that apply. In certain cases, Part 303, Wetlands Protection and Part 305, Natural Rivers, may also apply, if a stream crossing occurs in a wetland environment or on a stream within the watershed boundary of a legally designated Natural River system.

To be in compliance with Parts 31, 301 and 303, the responsible party must complete the MDNRE/United States Army Corps of Engineering (USACE) "Joint Permit Application" (JPA) package. The JPA covers permit requirements pursuant to State and Federal rules and regulations for construction activities where the land meets the water and including streams and wetlands. These types of areas are often referred to as the land/water interface.

Part 91, Soil Erosion and Sedimentation Control (SESC), of the Natural Resources and Environmental Protection Act, PA 451, 1994, as amended (NREPA), has the primary intent of protecting the waters of the State from the deposition of sediment and wind erosion as the result of earth change activities during construction. Specifically, a Part 91 permit is required for those activities involving earth changes that are one (1) or more acres in size or within 500 feet of a lake or stream (MDNRE, February 2009).

The MDNRE has developed a guidance manual, Sustainable Soil and Water Quality Practices on Forest Land (MDNRE, February 2009). The guidance manual contains best management practices (BMPs) in the context of those practices that not only protect surface water quality, but soil quality too. Properly applying these practices enables the responsible party or parties to meet pertinent environmental protection regulations. Voluntarily applying these practices will, under most weather conditions, prevent sediment or other nonpoint sources of pollution from going into a stream or other open water body.

As noted above, Federal, State and FSC/SFI certified forests are evaluated for potential impacts to surface water or soil prior any timber harvest. Those processes ensure that impacts to surface water and soils are minimized. The use of FSC procurements processes, SFE trained loggers, and/or Michigan forest stewardship plans provide similar protections on private lands.

3.1.1.8 Noise

Timber harvest is currently conducted within 150 miles of the proposed Frontier site using vehicle based mechanical equipment including processors, feller bunchers, forwarders, and haul trucks. Some manual cutting is also completed using chain saws.

Processors and feller bunchers emit noise from their saws and diesel engines. Forwarders and trucks emit noise from their diesel engines. Chain saws use a two cycle engine which also emits noise. These noise sources are temporary within each harvest area, generally being present for less than one week in any location. Noise impacts are minimized by following the GAFMPs developed by the MDNRE.

3.1.1.9 Hazardous Materials and Spill Prevention

The hazardous materials required for timber harvest include diesel fuel and maintenance fluids (hydraulic fluid, oil, grease, etc). Spills of these materials can occur during timber harvest activities. Chemical releases in Michigan are potentially reportable under one or more of twenty-six different State and Federal regulations. The "Release Notification Requirements in Michigan" table, compiled by the DEQ Environmental Science and Services Division, is designed to help owners and operators of facilities in Michigan, including vehicles and farms, determine their potential notification and reporting requirements, in the event of a chemical release.

Proper equipment maintenance, including routine checks of hoses and fittings, is the key to protecting surface water and ground water resources from the impacts of fuel and lubricant spills and leaks. Implementation of BMPs for spill prevention, such as having a spill prevention plan, locating fueling and maintenance areas away from water bodies, having a spill kit and trash disposal bins minimize the likelihood of a release and the potential for that release to impact soil or surface water. SFE training for loggers includes information on these reporting requirements and BMPS.

3.1.2 Environmental Consequences of the No Action Alternative

The No Action Alternative would result in no forest resources being utilized for the proposed Frontier Project. Forest resources within the proposed Frontier harvest area would continue to be harvested for existing facilities including wood products, pulp and paper manufacturing, and biomass fuel production. Current harvest techniques would not be modified on any of the land types within the proposed harvest area.

3.1.3 Environmental Consequences of the Proposed Action

3.1.3.1 Timber Harvest

As discussed in Section 2.2.5.1, a total of 1,129.8 thousand GT/yr of hardwood pulpwood would be required for the proposed Frontier Project at the 40 MGY production level. Approximately 71,000 acres of timber would be harvested annually to supply the fiber required for the proposed Frontier Project. As discussed in detail in the following paragraphs, the proposed Frontier Project would utilize approximately 63% of the hardwood annual growth in excess of current harvest levels.

As noted in Section 3.1.1, since the analysis period for the timber supply report was 2004-2008, the data for removals does not yet fully reflect the affects of the closure of several large mills during the 2005-2008 period, all of which used primarily hardwood pulpwood in their operations. The Georgia-Pacific (GP) Particle Board Mill at Gaylord, Michigan, which closed in March of 2006, is within the 150 mile radius of the Frontier biorefinery site at Kinross and had an annual wood fiber usage of approximately 740 thousand GT/yr. Additionally, the former S.D. Warren pulp and paper mill, which closed in the same timeframe used about 450 thousand GT/yr., a portion of which came from the Frontier supply area. The total amount of hardwood pulpwood used by these three mills from the harvest area for the Frontier Project would provide approximately 65 percent of the hardwood quantity required for the Frontier biorefinery.

Therefore, additional wood fiber previously used by just these two mills is now available over and above the surplus growth volume indicated in the resource study. The sustainable inventory level within 150 miles of the proposed Frontier site is estimated to be in excess of 220% of the projected hardwood pulpwood requirement at a production level of 42.5 mgy of denatured ethanol.

Utilizing pulpwood from the Eastern Upper Peninsula and Northern Lower Peninsula. forests to supply fiber for the Frontier Project would not constitute a new use of the resource. As noted above, a number of pulpwood end users have ceased operation in recent years in the harvest radius proposed for the Frontier Project. The Frontier Project's pulpwood usage would be similar in total volume, essentially replacing pulpwood previously used by those closed facilities. The effect on the total forest resource would be no different than that created by the harvest that supported the former mills.

As noted in Section 3.1.1, the region around the Kinross currently has a minimal demand for hardwood pulpwood due to the distance to the facilities in the western Upper Peninsula, northern Wisconsin, northeastern Minnesota and Canada, (all more than 150 miles from Kinross). There will likely be minimal direct competition between Frontier and these existing hardwood using facilities for hardwood pulpwood.

There will be no direct competition between Frontier and St. Mary's Paper in Sault Ste. Marie, Ontario, Canada as it uses softwood pulpwood as feedstock. It is more likely that the increased market for hardwood in the region would have a complementary affect on softwood pulpwood using facilities, as this facilitates the harvesting and/or thinning of mixed species stands, and would likely increase softwood pulpwood availability.

While Frontier can utilize aspen, it is not a necessary feedstock, as there is ample surplus mixed hardwood of other species within the region. It is not likely that Frontier will compete heavily for aspen pulpwood with either of the existing particle board mills, Louisiana-Pacific in Newberry, Michigan, or Weyerhaeuser in Grayling, Michigan. It is more likely that an improved market for more mixed hardwood could be complementary to the aspen and softwood pulpwood using facilities, as this facilitates the harvesting and or thinning of mixed species stands.

Timber harvests from National Forest lands would only be from tracts where the USFS completes the appropriate NEPA review.

Timber harvests from Michigan state lands and forests are subject to environmental review processes, public notification and review, and the practices and procedures established in the Michigan State Forest Management Plan. Annual audits by an independent third party FSC auditor monitors compliance with the specified practices and procedures detailed in the Plan.

Timber harvests from JM Longyear properties (or similar large land/forest resource management companies) are subject to the provisions of the forest management plan prepared as part of their FSC or SFI certification. Annual audits by an independent third party FSC or SFI auditor monitors compliance with the specified practices and procedures detailed in the plan.

Frontier would establish a timber procurement process equivalent to the requirements established by the SFI certified procurement process. Frontier would, through its wood fiber procurement agreements and other supply relationships, work to encourage and influence private landowners and wood suppliers to participate in forest certification initiatives. Frontier would require verification of logger participation in SFE professional logger training and certification programs and conformance to Michigan Best Management Practices.

3.1.3.2 Biological Resources, Air Quality, Soils and Water Quality, Noise, Hazardous Materials and Spill Prevention

As stated previously in section 3.1.3.1, the level of harvest necessary to supply the hardwood pulpwood feedstock for the Frontier facility does not constitute a new use of the forest resources in the region. The cumulative volume of hardwood used by recently closed pulpwood using mills in the harvest radius for the Frontier Project would be approximately 65% of the total needed for Frontier. Following long-standing practices within the region, the majority of volume will be produced from partial stand harvests using tree selection or shelterwood methods. A minor volume may come from clearcuts typically used to harvest and regenerate aspen, or for maintenance of specific habitat conditions which require early seral stages of aspen, oak or other forest types. This will not contribute to decline in mature northern hardwoods habitat. Rather, the additional market created for smaller pulpwood-sized hardwoods will encourage a higher level of thinning and stand improvement activities which facilitate the creation of hardwood stand structure and conditions with a greater component of larger trees. Also, since the forest inventory will still be increasing, the average age of the forest resource will increase across the region.

Harvesting and thinning promotes and maintains vigorous growth in most hardwood forest types, by removing damaged, diseased, and mature or over-mature slow growing trees, and re-allocating the now freed-up resources (i.e., growing space, nutrients, and sunlight) to remaining healthier, vigorous, dominant trees capable of more efficiently occupying the site and utilizing those resources, growing larger trees at an increased rate. This results in an increase in net growth of the residual stand of trees (gross growth minus losses due to rot, damage and mortality). More vigorous growth also results in more carbon accumulation in new wood, and less release from the break-down of dead, dying and rotting material, the majority of this volume having been removed in the harvest and thinning operations.

Harvesting and transportation of forest resources for the proposed Frontier Project would be completed by existing contractors using existing techniques. The Federal, State and local regulations, plans, and guidance documents would not be affected.

Timber harvests from National Forest lands would only be from tracts where the USFS has completed the appropriate NEPA review. Similarly, State Forests are managed under plans and policies which specifically balance timber production with protections to maintain natural diversity and specific habitats across the landscape. Additionally State Forests are dual certified by the Sustainable Forestry Initiative (SFI) and the Forest Stewardship Council (FSC) systems; each of which contain specific criteria and indicators for maintaining biodiversity within managed forests. Large commercial owners are also certified under either SFI or FSC systems and subject to similar expectations to maintain key natural and diverse characteristics of forest ecosystems at a level appropriate to their level of effect on the overall landscape in a given region. All of the above programs also specifically protect air quality, including air quality in Class I areas such as the Seney National Wildlife Area, water quality, wildlife, including threatened and endangered species, critical habitat, cultural resources, and establish best management practices to reduce the potential erosion, spills or other impacts to the soils. Based on the level and the protections offered by the existing environmental review processes, DOE does not expect any impacts to air quality, including air quality in Class I areas such as the Seney National Wildlife Area, water quality, wildlife, including threatened and endangered species, critical habitat, or cultural resources within the harvest area.

Smaller private landowners, while not generally participating in forest certification systems, are influenced by either consulting foresters assisting them with management planning or timber sale preparation, or certified loggers who are bound by their certification through the Sustainable Forest Education program to operate under the principals of sustainable forestry, and all regulations and guidelines regarding protection of water quality, protection of riparian habitat, protection of endangered species and habitats; and recognizing and maintaining unique ecological, historical, and cultural resource. Frontier along with existing forest products industry members are committed to further broadening participation by smaller forest land owners in a form of forest certification which is appropriate to small landowners and small businesses.

Therefore, with the level of commitment developed over the past decade throughout both the forest landowners, the loggers and wood producers, and consuming mills to managing, harvesting and operating in forest lands, within accepted regulations, guidelines, and principles of sustainability, there would be no expected change in impacts from those impacts presented in sections 3.1.1.5 through 3.1.1.8 to biological resources, air quality, soils and water quality, noise, hazardous materials and spill prevention related to harvest and transportation of forest resources for the Frontier Project.

3.2 Biological Resources

This section discusses the biological resources on the proposed Frontier site and rail spur. Forest resources were discussed in Section 3.1.

3.2.1 Affected Environment

The proposed Frontier site consists of approximately 355 acres of predominantly wooded land with no existing structures and limited unpaved trails used for recreational vehicles. The proposed cellulosic ethanol biorefinery would be constructed on approximately 50 acres located in the southernmost 160 acres of the property.

Frontier completed a wetland boundary delineation on the 355 acre Frontier Project area from April 27th to May 1st and June 1st through 4th, 2009 (*AECOM, August, 2009*) utilizing the U.S. Army Corps of Engineers (USACE) 1987 Wetland Delineation Methodology with respect to the definition of a wetland according to the State of Michigan. The USACE methodology requires that, under normal circumstances, hydric soils, wetland hydrology, and hydrophytic vegetation must be present for an area to be defined as a wetland. Upland and wetland determination plots were completed along the boundaries of all identified wetlands. For each wetland, pertinent information was recorded on field data sheets, and the wetland boundary was flagged and surveyed using a Trimble® GeoXT™ GPS surveying unit.

Frontier also completed a wetland delineation from August 31 to September 3, 2009 within a corridor of land contiguous to the project area that is the proposed location for the construction of a new railroad spur (*AECOM, November, 2009*). The rail spur would be used for shipment of raw materials to the site and ethanol and lignin from the site.

The wetland boundary delineations were completed with the following tasks and goals in mind:

- To identify, delineate and survey the boundaries of all wetlands located within the proposed project area;
- To characterize each wetland based on soil, hydrologic and vegetative features;
- To determine if current development plans for the site would cause immediate impact to existing on-site wetlands (i.e. if dredge or fill of wetlands would be required), and
- To state jurisdictional and regulatory requirements that may apply depending on planned activities within, or impacts to, the wetlands.

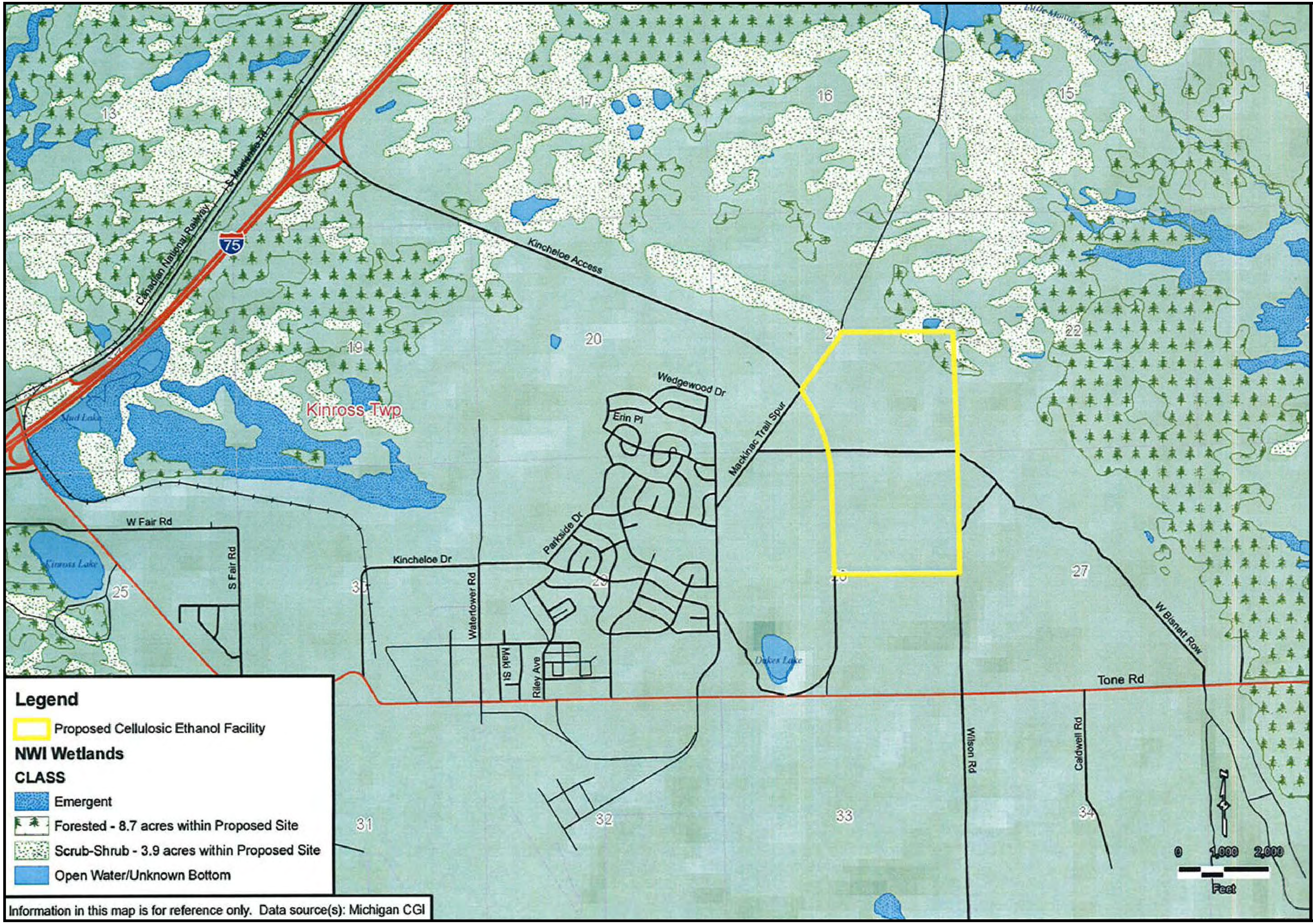
3.2.1.1 Frontier Project Area Wetlands

During the onsite investigation, no wetlands were identified within the boundaries of the southern 160 acres of the site. This was determined by walking equidistant transects across the area from east to west, and from south to north. These transects were roughly located along the boundaries and centerline of each 40-acre parcel. GPS points along with photographs were taken at various locations along the transects to document site conditions.

Five wetlands were identified and delineated within the 355 acre Frontier Project investigation area, all located within the two northernmost 40-acre parcels. Utilizing the USACE wetland delineation methodology with regard to the MDNRE definition of a wetland, the 5 delineated wetlands are jurisdictional under state and Federal law. Their relative sizes and locations are depicted on Figures 4 through 7. No wetlands were encountered within the rest of the project site.

<u>Wetland 1</u>

At approximately 13.7 acres in size, Wetland 1 is the largest and most extensive wetland found on the Frontier site. This wetland occupies areas nearest the northern project site boundary, and extends from the western site boundary to the eastern site boundary. The western half of this wetland can best be described as an elongated swale or drainage course. This drainage course contained standing water during both site visits in April and June, and likely obtains its hydrology from interconnection with the water table and/or surface connection with large wetlands to the west of the site. Given that the ground surface generally slopes to the east and northeast in this area, it is likely that water in this drainage course flows east towards the largest portion of Wetland 1 during rainfall events. This western portion of the wetland appears to be part of a dune-swale complex type setting that continues to the north. Data plots 3A-WET, 8-WET and 9A-WET were completed within this portion of Wetland 1. Some of the dominant vegetative species observed at these locations included red maple (*Acer rubrum* - FAC), black spruce (*Picea mariana* – FACW), balsam fir (*Abies balsamea* - FACW) and various sphagnum (*Sphagnum spp*. – OBL) and sedge species (*Carex spp.* – FAC to OBL). Soils encountered in the western half of Wetland 1 were found to be sands, silts and/or cobbles with muck or peat surface horizons. The predominant soil type mapped by NRCS in the western half of Wetland 1 is Kalkaska sand.



Information in this map is for reference only. Data source(s): Michigan CGI

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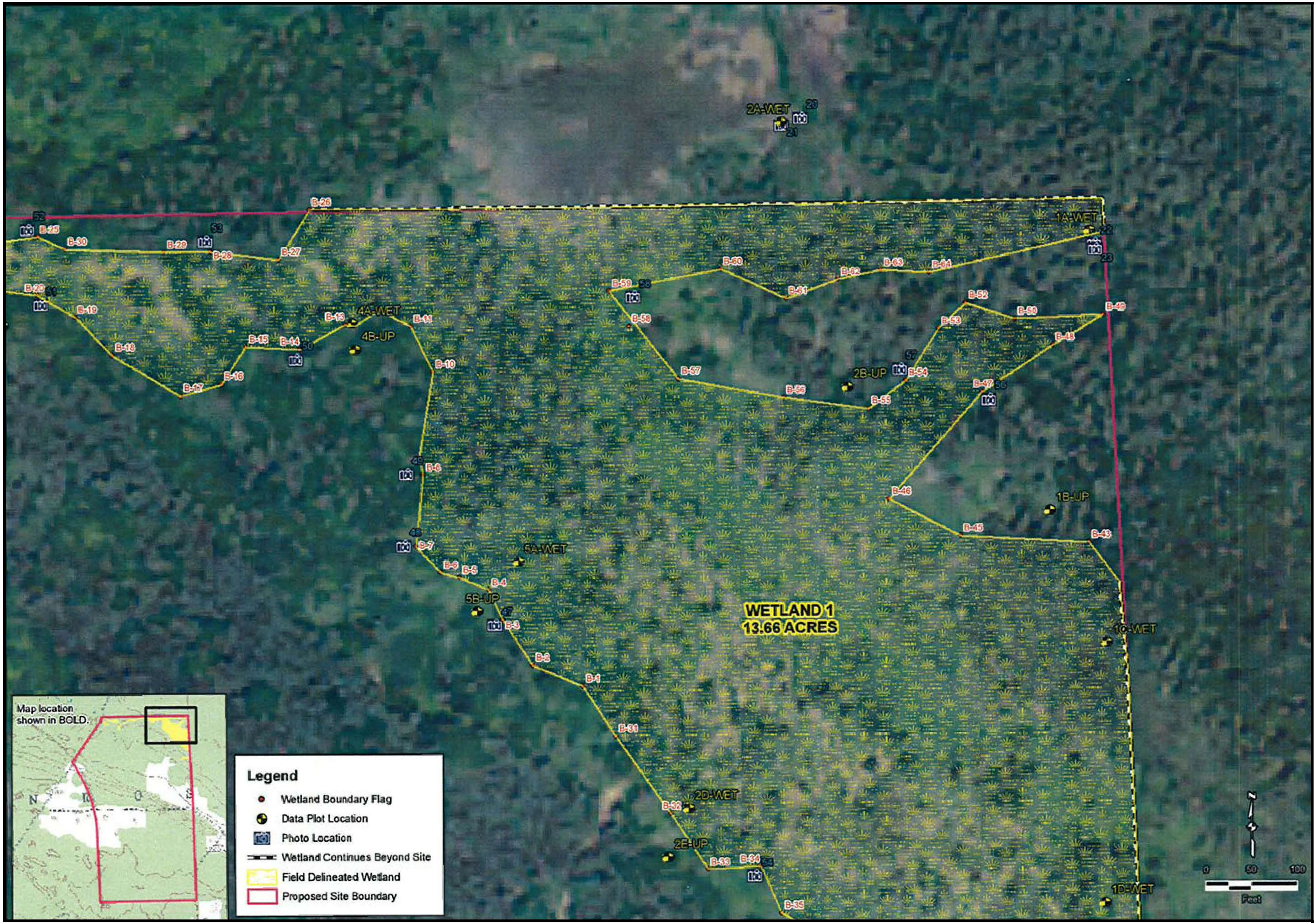
NATIONAL WETLANDS INVENTORY
WETLAND DELINEATION REPORT
FRONTIER RENEWABLE RESOURCES, LLC
CELLULOSIC ETHANOL FACILITY
KINROSS TOWNSHIP, CHIPPEWA COUNTY, MICHIGAN

Drawn:	JWW	2/17/2009
Approved:	LDK	2/17/2009
Scale:	1" = 2,000'	
PROJECT NUMBER	60140061	
FIGURE NUMBER	4	



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FIELD DELINEATED WETLANDS AND PHOTO POINTS
WETLAND DELINEATION REPORT
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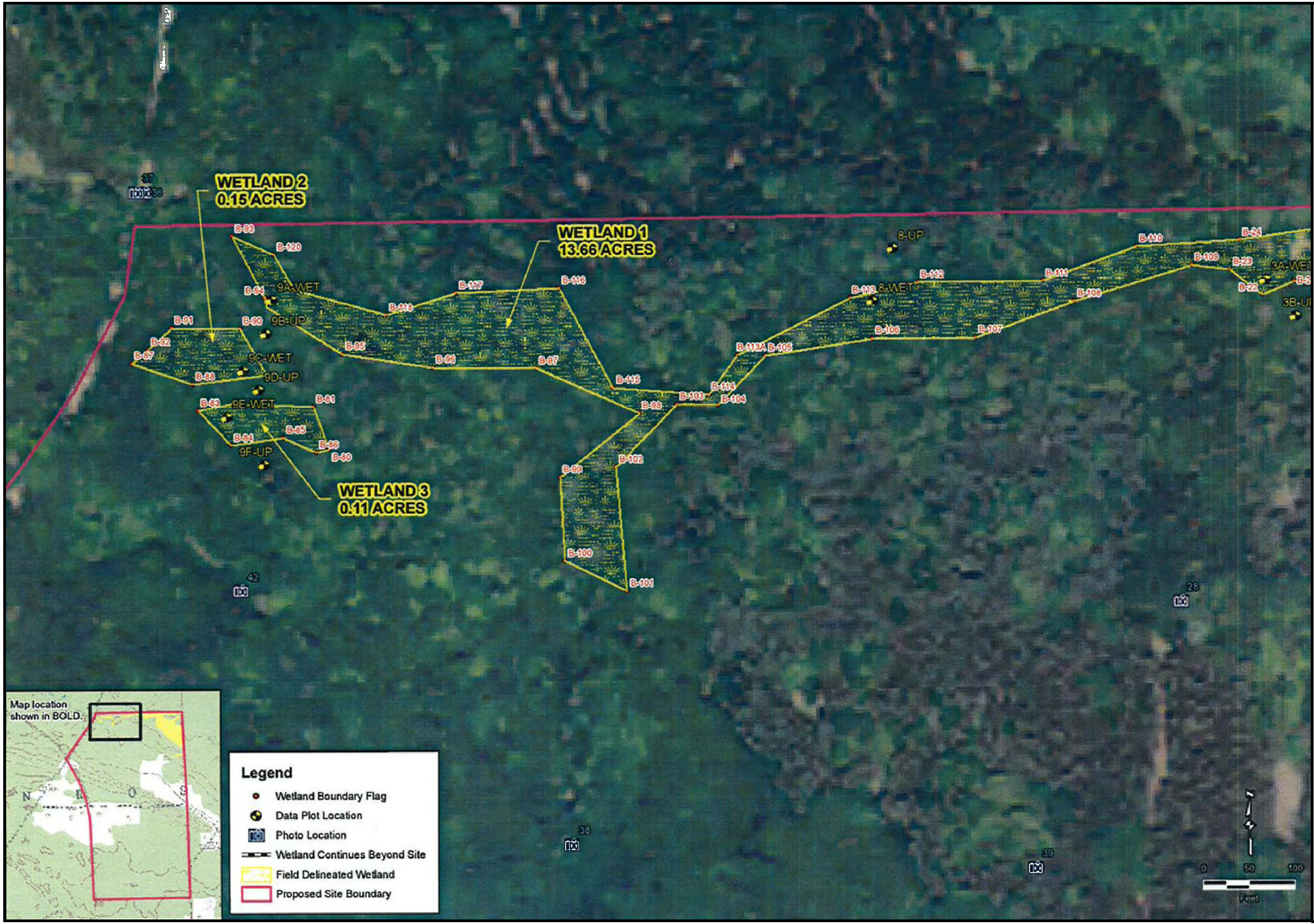
KINROSS TOWNSHIP, CHIPPEWA COUNTY, MICHIGAN

Drawn:	SJE	6/25/2009
Approved:	LDK	6/25/2009
Scale:	1" = 100'	
PROJECT NUMBER	60140061	
FIGURE NUMBER	5	



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Drawn:	SJE	6/25/2009
Approved:	LDH	6/25/2009
Scale:	1" = 100'	
PROJECT NUMBER	60140061	
FIGURE NUMBER	6	

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Drawn:	SJE	6/25/2009
Approved:	LDH	6/25/2009
Scale:	1" = 100'	
PROJECT NUMBER	60140061	
FIGURE NUMBER	7	

Near the center of the northern Frontier Project site boundary, Wetland 1 transitions from a generally isolated drainage course to a wider, more diverse wetland that occupies the northeastern corner of the project site. This eastern portion contains a mixture of open water, wet meadow, shrub swamp and tamarack swamp, and has a few small interspersed upland areas. This diverse combination of habitats can also be attributed to the dune-swale type ground surface present in the area, which allows for a variety of hydrologic conditions and establishment of various vegetative species. Data plots 1A-WET, 1C-WET, 1D-WET, 2D-WET, 4A-WET and 5A-WET were completed within the eastern portion of Wetland 1. Similar to the western portion of Wetland 1, plots 1A and 5A-WET were observed to have black spruce, red maple and balsam fir, as well as a relatively high dominance of tamarack (*Larix larcinea* – FACW). Data plots 1C and 4A-WET were shown to have similar species present, but were located in more shrub-scrub to open-water wetland areas. The predominance of leatherleaf (Chamaedaphne calyculata – OBL) was a general distinguishing factor. Similarly, the presence of northern white cedar (Thuja occidentalis – FACW) at data plots 1D and 2D-WET distinguished them from other portions of Wetland 1. Among all of the Wetland 1 data plots, hydrologic conditions varied from saturated within 1 foot of the surface to inundated for several inches. Soil conditions, however, stayed relatively consistent across the area with 7.5 YR 2.5/1 peat and/or muck surface layers over sandy to silty sub-horizons. The sandy or silty sub-horizons were observed to have colorations typically ranging from 7.5 YR 2.5/1 to 2.5/3 or 7.5 YR 5/1 to 5/2. Mapped soil types in the eastern portion of Wetland 1 include Croswell-AuGres sands, Dawson and Loxley peats, and Kinross-Wainola complex soils.

A few small, isolated upland areas were included in Wetland 1 as their size and extent were not significant, and did not warrant their identification and separation from the wetland.

Wetland 2

Wetland 2 is approximately 0.15 acres in size, and is located just south of the far western end of Wetland 1. This wetland exists in a relatively small, near-circular depression, and is separated from Wetland 1 by an elongated sandy ridge. The lowest ground surface elevation of this wetland is approximately the same as the lowest portions of Wetland 1, making it likely that the two wetlands are hydrologically connected via seepage through the sandy ridge. Data plot 9C-WET was completed within this small, wooded wetland. Dominant hydrophytic vegetation present included yellow birch (*Betula alleghaniensis* – FAC), balsam fir and red maple. Sphagnum moss was also present in the most saturated portions of the wetland. Standing water was observed at 2 inches below ground surface in a 16-inch deep soil pit, with saturation occurring up to the surface. Soils from 0 to 5 inches below ground surface were found to be 7.5 YR 2.5/2 mucky silts. Soils from 5 to 16 inches below ground surface were found to be 7.5 YR 5/1 sands that had a significant amount of organic streaking. The mapped soil type in this location is Croswell-Au Gres sands.

Wetland 3

Wetland 3 is located immediately to the south of Wetland 2, and is approximately 0.11 acres in size. Similar to Wetland 2, this wetland is located in a small depression, is wooded, and is separated from the adjacent wetlands by an elongated sandy ridge. Data plot 9E-WET was completed within Wetland 3. The dominant vegetative species were also the same as in Wetland 2: yellow birch, balsam fir, red maple and sphagnum moss. The herbaceous vegetative stratum was scant, if at all present, in Wetlands 2 and 3. In Wetland 3, free water was observed in a soil pit at 1 inch below the surface, with the soil saturated at the surface. Soils observed in the pit included a 7.5 YR 2.5/1 mucky loam from 0 to 3 inches below the surface. A 7.5 YR 4/1 sand was found below the mucky loam. Croswell-Au Gres sands are the mapped in the western portion of Wetland 3, and Kalkaska sands are mapped in the eastern portion of Wetland 3.

Wetland 4

Wetland 4 is the smallest of the wetlands documented on the Frontier site, and is approximately 917 square feet in size. This wetland is located along the eastern site boundary, immediately to the south of Wetland 1. Similar to Wetlands 2 and 3, Wetland 4 is located in a sandy depression that is wooded and is separated from adjacent wetlands by elongated sandy ridges. Data plot 6-WET was completed within this wetland. Dominant vegetation included red maple, black spruce and quaking aspen (Populus tremuloides – FAC). Sphagnum moss was also present in the most saturated areas of this wetland. Soil saturation was evident at the ground surface, and free water was observed in a 16-inch soil pit at 3 inches below the surface. Soils present at this location included 7.5 YR 2.5/1 loam with organics from 0 to 6 inches below the surface, and 7.5 YR 5/3 sand with common, distinct 7.5 YR 5/6 mottling from 6 to 16 inches. The mapped soil types in the area of Wetland 4 are Croswell-Au Gres sands.

Wetland 5

Wetland 5 is located immediately to the south of Wetland 4 and is approximately 0.35 acres in size. This wetland is also located in a sandy depression, but is more spread out and irregular shaped than Wetlands 2, 3 and 4. Data plot 7-WET was completed within the boundaries of Wetland 5. Here, vegetation differed only slightly from the other wetlands, with the addition of such species as starflower (*Trientalis borealis* – FAC+) and common blue violet (*Viola sororia* – FACW). Red maple and black spruce were the dominant hydrophytic tree species present. Again, soils at plot 7-WET were saturated at the surface, and free water was present in a 16-inch soil pit at 10 inches below the surface. Soils documented at this location included a 7.5 YR 2.5/1 sandy loam from 0 to 0.5 inches and a 5 YR 5/1 sand from 0.5 to 16 inches that had many prominent 7.5 YR 5/6 mottles.

3.2.1.2 Railroad Corridor

Rail service to the proposed site would be established by construction of a rail spur from the existing Canadian National Railway (CN) rail line located west of the proposed site. As shown on Figure 3, the new rail spur would be routed north of Kinross and enter the proposed site from the north. The Frontier railroad corridor can most easily be described by splitting it into two sections: the section that lies entirely north of the Kincheloe Access Road (a.k.a. Gaines Highway) (North Section), and the section that extends south from Kincheloe Access Road to the existing railroad track (South Section).

North Section: The North Section has ground surface topography that gently slopes away from Kincheloe Access Road to the north and northeast, towards an extensive, elongated wetland area. This wetland occupies approximately the northern one-half of the North Section, and is composed of a combination of sphagnum-tamarack bog areas, shrub-scrub areas and open water swamp. The transition between this wetland and the upland areas is very abrupt, and is made apparent by a very distinct rise in ground surface elevation, along with a sudden transition from peaty to sandy soils. The upland areas are sandy and gently sloping, with the majority being occupied by mature red pine stands. The pine stands are linear in nature, and have the appearance of a plantation or former restoration site. Understory vegetation is relatively sparse, with shrubby, shade-loving species such as beaked hazelnut being the most common. The far eastern and western ends of the North Section are vegetated with immature aspen stands, and other deciduous species that vary in maturity. Also, an existing two-track road and an all-terrain-vehicle (ATV) trail run the across the length of this corridor area, essentially parallel to the Kincheloe Access Road.

South Section: The South Section of the proposed Frontier rail corridor has a relatively diverse mixture of uplands and lowlands, deciduous and evergreen forests, and level to sloping ground surfaces. Ground surface elevations tend to be the highest in the east-central part of the South Section, with lower areas prevalent in the north, west and south. The higher upland areas tend to have sandy to loamy soils, while the lowest areas (commonly occupied by wetlands) typically have peat and organic soils. The north end of the South Section is primarily vegetated by thick, immature aspen stands that can be seen when driving by along the Kincheloe Access Road. Traveling south out of this area, thick spruce-fir forests and wooded wetlands can be found closest to the western corridor boundary, while mature, mixed upland stands of conifers and hardwoods are common along the eastern boundary. Roughly the southern one-third of the South Section is occupied by a relatively large wetland that transitions from spruce-tamarack peat bog in the north to an open water swamp lined with cattail stands in the south. This wetland extends across the entire corridor from east to west, and contains a few areas of upland “islands” that are distinguishable by their mature red and white pine stands.

The depths of these bog and marsh areas appeared to be several feet deep, and could not be navigated by foot. The southern-most end of the rail corridor contains sandy upland areas that transition abruptly to the large marsh wetland in a distinct east-west line. Immature aspen stands are present and are mixed with other, slightly more mature hardwood forests.

Other features to note in the South Section include an east-west running transmission line that is adjacent to the far southern corridor boundary, "two track" ATV trails that run beneath the transmission line as well as throughout the rest of the area, and the presence of a closed landfill in the east-central portion of the South Section. Several groundwater monitoring wells are located around the perimeter of the old landfill. These wells have painted protector pipes that are visible when traveling the nearby ATV trails.

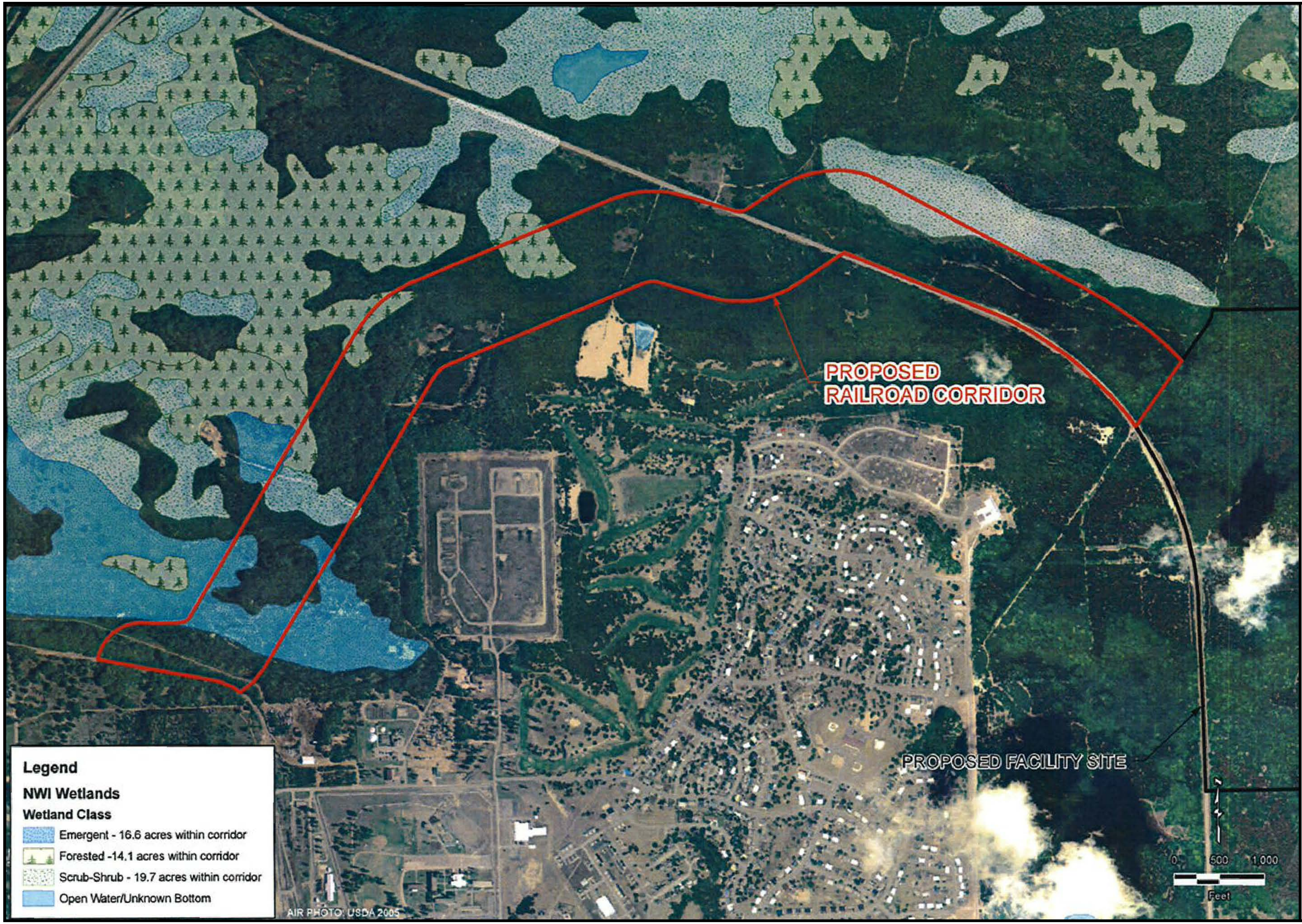
Utilizing the USACE wetland delineation methodology with regard to the MDNRE definition of a wetland, all 15 delineated wetlands are jurisdictional under state and/or Federal law. In accordance with Section 404 of the Clean Water Act and Part 303 of the NREPA, Act 451 of 1994, any impacts to these wetlands may require a Joint Permit Application (JPA)from the MDNRE and USACE. Fifteen wetlands were identified and delineated within the proposed Frontier rail corridor investigation area. The proposed location of the Frontier rail corridor is indicated over a 2005 aerial photo on Figure 8. The wetland locations and sizes are depicted in the attached Figures 9 through 12. These wetlands varied in vegetative and hydrologic characteristics, and were present in several locations throughout the corridor.

Wetland 1

Wetland 1 is approximately 41.8 acres in size and is by far the largest wetland present within the proposed rail corridor. Its southernmost boundary runs nearly parallel with the railroad track at the south end of the proposed corridor, and is offset from it by approximately 500 feet. Near this boundary, Wetland 1 is a large, open-water marsh containing patches of emergent vegetation such as cattails, along with some areas that appear to contain submergent vegetation. As described in Section 2.0, this marsh area is extensive, deep (4 feet or more) and contains a few upland "islands" that support stands of pine trees. Continuing north approximately 600 feet from the southern wetland boundary, the wetland begins to transition from marsh to peat bog. In these areas, it appears that several inches to more than a foot of saturated sphagnum moss may be present, along with a few intermixed upland "islands." These observations were made by looking south from the northernmost portion of Wetland 1, as travel by foot was not possible due to the depth of water. What could be observed in the bog areas was the type of tree or shrub vegetation present, which included black spruce (*Picea mariana* – FACW), tamarack (*Larix laricina* - FACW), Labrador tea (*Ledum groenlandicum* - OBL) and winterberry (*Ilex verticillata* – FACW+). Again, the upland islands were visible due to the small stands of red pines that could be seen through and above the tree canopy. This deep bog area extends for approximately 800 to 1,000 feet further to the north where the sphagnum mat still persists, but the depth to mineral soils becomes shallower making it possible to walk within the wetland by foot. Here, the types of tree and shrub-layer vegetation is very similar as to the south, with the exception of the presence of more ferns (typically of the royal fern family). These vegetative and hydrologic characteristics remain consistent up to the northernmost boundary of Wetland 1.

In addition to the natural hydrology most likely supplied by intersection with the water table, Wetland 1 also receives water from the discharge of the Kinross wastewater treatment plant.

Wetland 1 extends considerably to the east and west outside of the proposed Frontier rail corridor. Relocation of the corridor in these directions would not likely result in avoidance of the wetland.



Legend

NWI Wetlands

Wetland Class

- ▨ Emergent - 16.6 acres within corridor
- ▨ Forested -14.1 acres within corridor
- ▨ Scrub-Shrub - 19.7 acres within corridor
- 🟦 Open Water/Unknown Bottom

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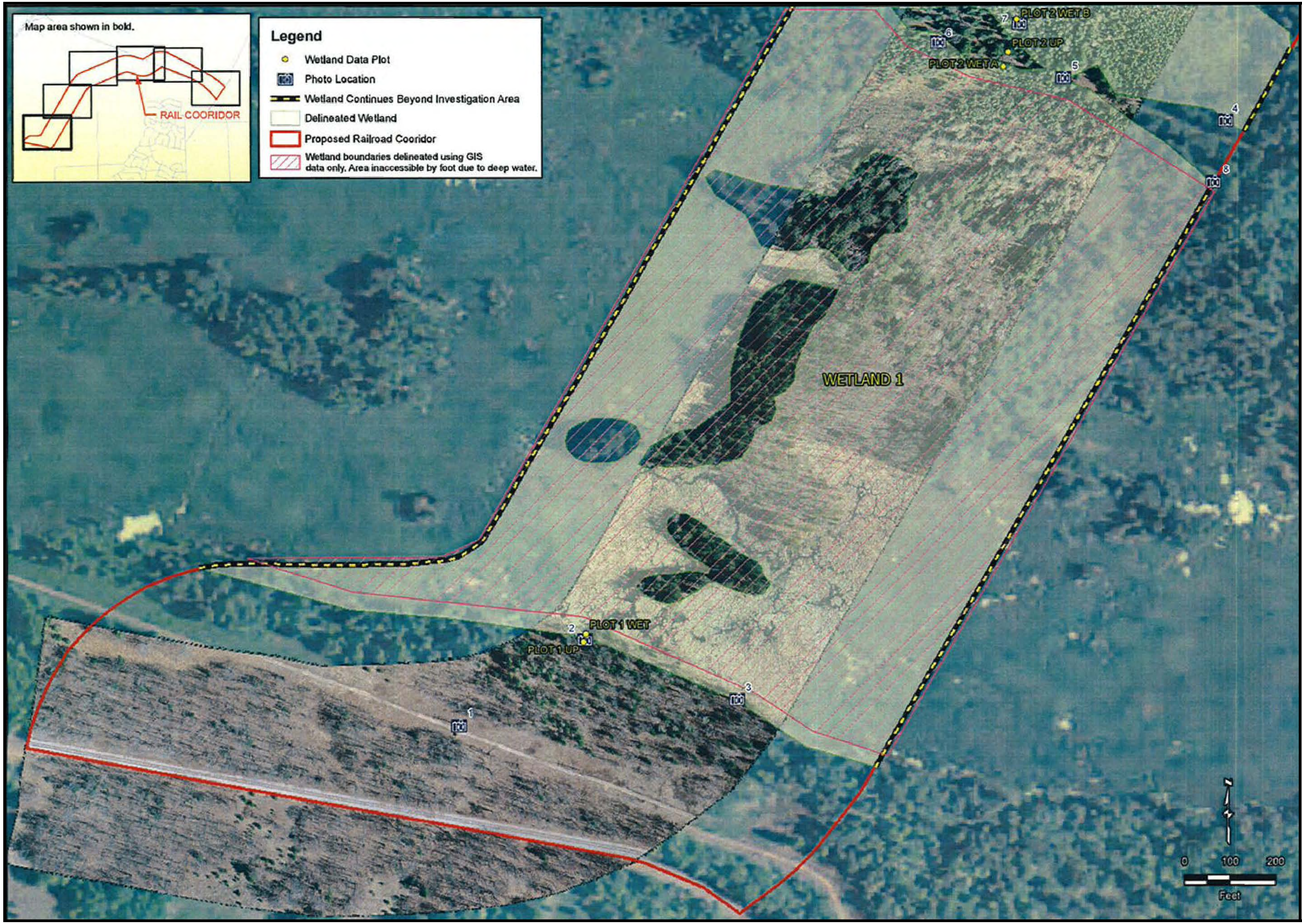
NATIONAL WETLAND INVENTORY MAP
WETLAND DELINEATION REPORT
FRONTIER RENEWABLE RESOURCES, LLC
PROPOSED RAILROAD CORRIDOR
KINROSS TOWNSHIP, CHIPPEWA COUNTY, MICHIGAN

Drawn:	SJE	10/21/2009
Approved:	LDH	10/21/2009
Scale:	1" = 1,000'	
PROJECT NUMBER	60140061	
FIGURE NUMBER	8	



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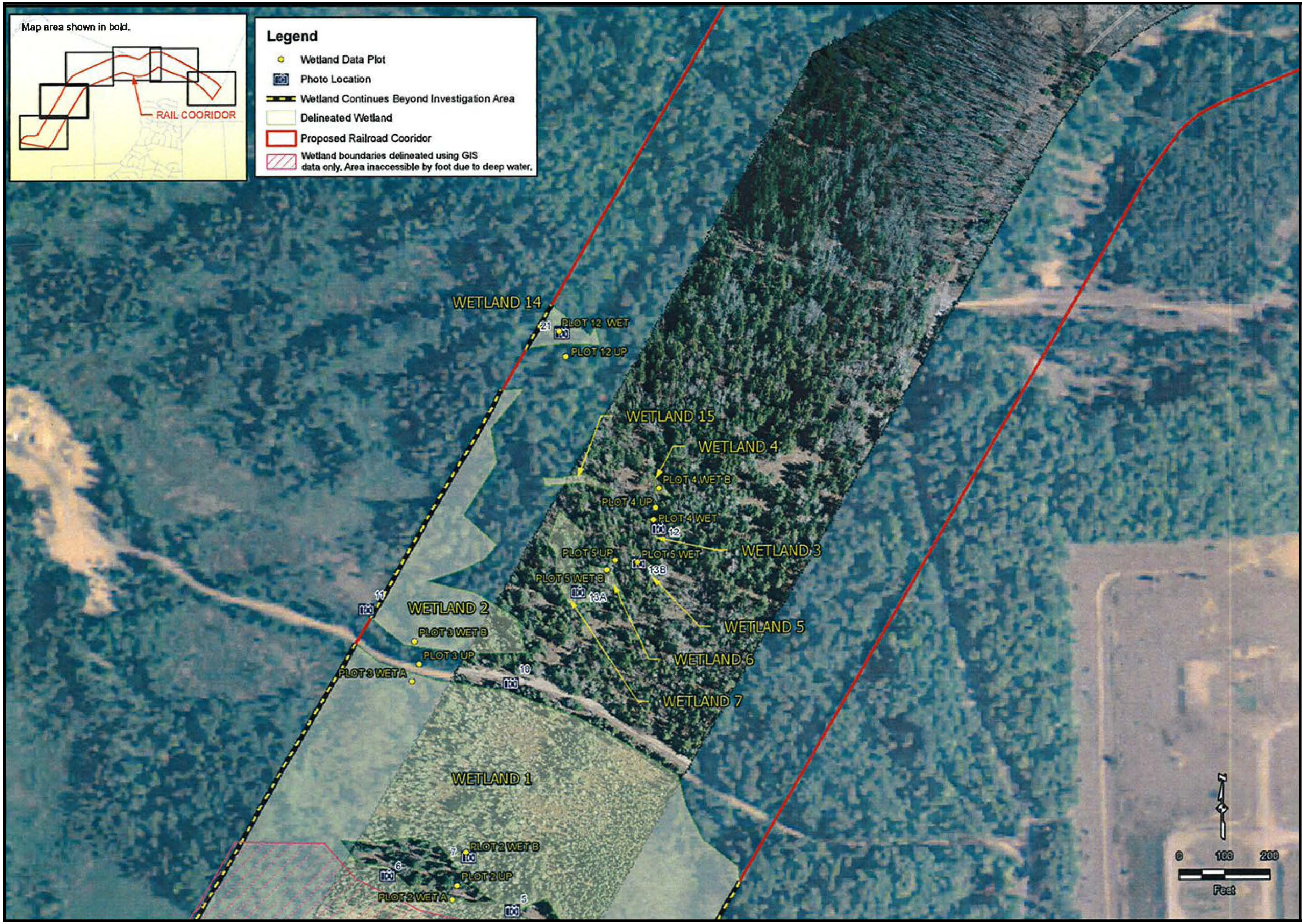
KINROSS TOWNSHIP, CHIPPEWA COUNTY, MICHIGAN

Drawn:	SJE	10/21/2009
Approved:	LDH	10/21/2009
Scale:	1" = 200'	
PROJECT NUMBER	60140061	
FIGURE NUMBER	9	



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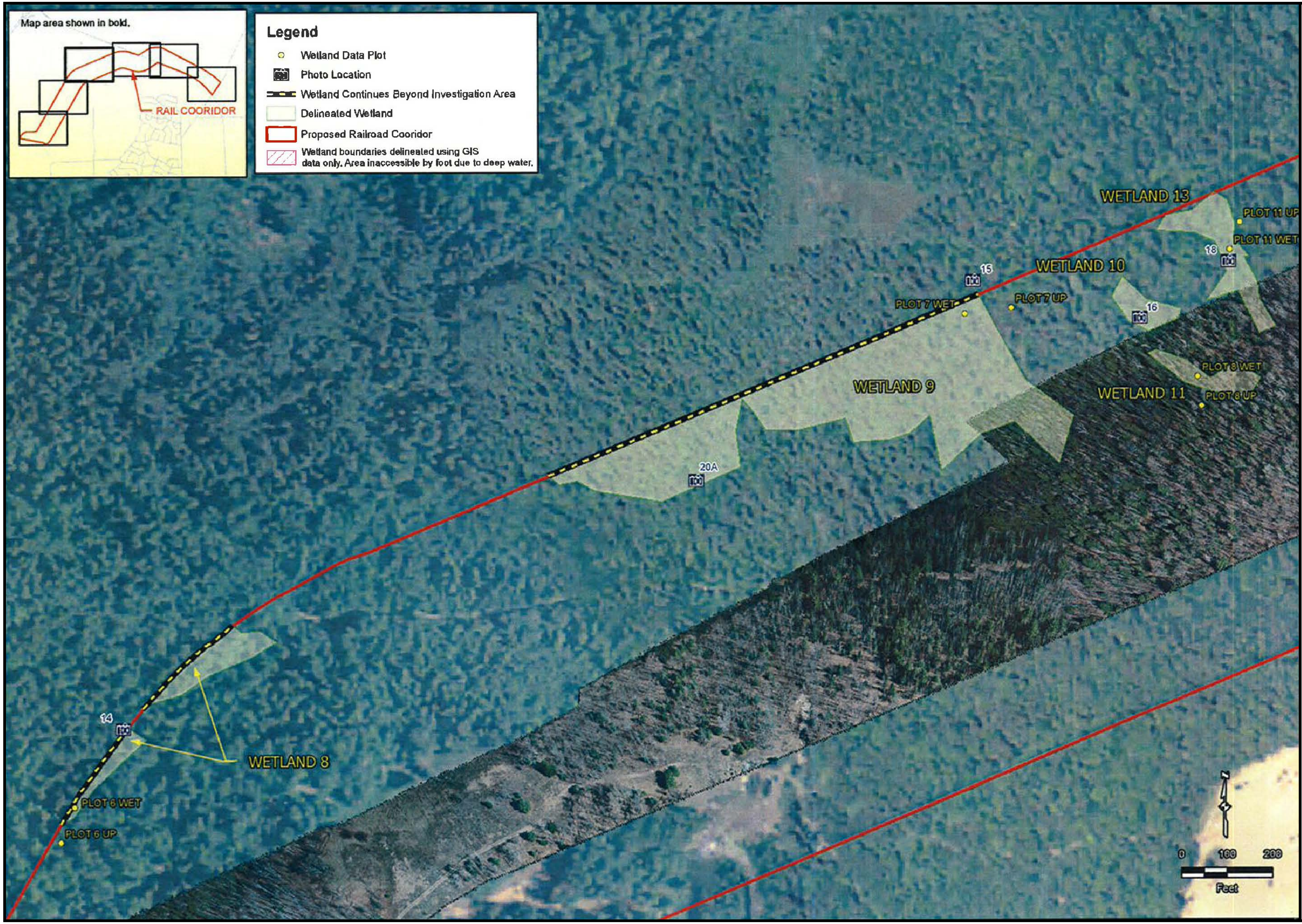
Drawn:	SJE	10/21/2009
Approved:	LDH	10/21/2009
Scale:	1" = 200'	
PROJECT NUMBER	60140061	
FIGURE NUMBER	10	



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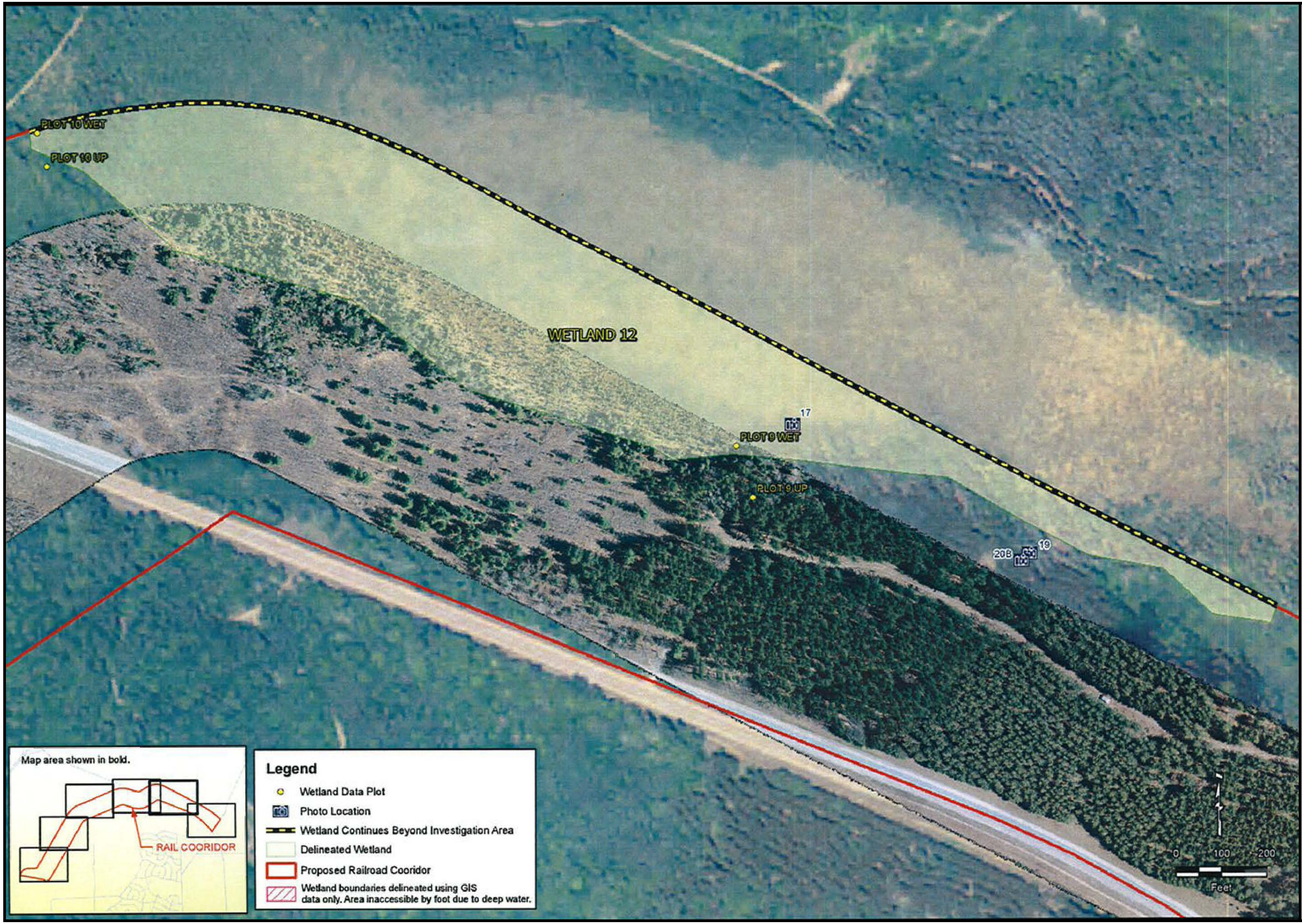
Drawn:	SJE	10/21/2009
Approved:	LDH	10/21/2009
Scale:	1" = 200'	
PROJECT NUMBER	60140061	
FIGURE NUMBER	11	



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Drawn:	SJE	10/21/2009
Approved:	LDH	10/21/2009
Scale:	1" = 200'	
PROJECT NUMBER	60140061	
FIGURE NUMBER	12	

Wetland 2

Wetland 2 is approximately 1.75 acres in size, and is located directly north of Wetland 1 along the western corridor boundary. This wetland is separated from Wetland 1 by a sandy dirt road that runs east to west across the proposed rail corridor. Upon observation of the soil, hydrologic and vegetative characteristics of Wetland 2, it is obvious that Wetland 2 was at one time an extension or part of Wetland 1, and has only become separated due to placement of the dirt road. Wetland 2 continues to have the characteristic peat mat (approximately one foot deep), and black spruce-tamarack mixture similar to Wetland 1. Labrador tea and leatherleaf (*Chamaedaphne calyculata* – OBL) are dominant within the shrub layer of Wetland 2, along with a few other species typical of wet meadows such as Canada bluejoint (*Calamagrostis Canadensis* – OBL). Mottled sandy soils were present immediately below the 1-foot layer of peat and organics. The source of hydrology for Wetland 2 appears to be primarily from intersection with the water table, although runoff from ground surface slopes to the east may also contribute, especially during spring snow melt.

Wetlands 3, 4, 5, 6, 7 & 8

Wetlands 3, 4, 5, 6, 7 and 8 are all relatively small in size (all <0.06 acres except Wetland 7), and are located in a cluster to the north of Wetland 1 and to the east of Wetland 2. The following are the respective sizes of each wetland:

- Wetland 3 = 1,049 sq.ft.
- Wetland 4 = 665 sq.ft.,
- Wetland 5 = 1,168 sq.ft.
- Wetland 6 = 1,649 sq.ft.
- Wetland 7 = 9,927 sq.ft.
- Wetland 8 = 2,448 sq.ft.

These wetlands are being described collectively as they are all located in the same general area, are relatively close in size, and have similar geomorphic, hydrologic, soil and vegetative characteristics. These wetlands exist in a grouping of small ground surface depressions, and can be described as wet meadows. Each of these wetlands has a relatively thin layer (3-5 in.) of peaty or organic soils above sandy mineral soils, and exhibit saturation from 12 inches below to just above the ground surface. Vegetation common to all or most of these wetlands included Canada bluejoint, blue flag iris (*Iris versicolor* – OBL), sphagnum moss (*Sphagnum* spp. – OBL), red maple (*Acer rubrum* – FAC), and white birch (*Betula papyrifera* – FACU+). The discontinuity of these wetland areas, their thin organic soil layers, and their location between higher ground surface elevations (to the north and east) and lower surface elevations (to the south), indicates that they are transitional in nature and may not be saturated as often as Wetland 1 to the south. This further supports the likely possibility that these "depressional" wetlands are just skimming the surface of the groundwater table, it being their primary source of hydrology.

Wetland 9

Wetland 9 is 0.17 acres in size and is located directly north of Wetland 2 along the western corridor boundary. This wetland supports similar vegetation as Wetlands 3 through 8 (sphagnum and Canada bluejoint), although has a more prevalent shrub layer of speckled alder (*Alnus incana ssp. rugosa*[1] – OBL). This wetland exists in a distinct ground surface depression that is located in the center of a red pine stand. Also similar to Wetlands 3 through 8, wetland 9 exhibited a 4-inch layer of peat and organics over sandy soils, and saturation at the surface. Again, the primary source of hydrology is most likely connectivity to the groundwater table.

---

[1] Naming per www.plants.usda.gov for "speckled alder."

Wetland 10

Wetland 10 is located north of wetland 2 along the western corridor boundary where the corridor bends slightly toward the northeast. It appears that this wetland is comprised of two separate areas. These two areas are actually connected on the west side of the corridor boundary (outside of the investigation area), and are part of one continuous wetland. The total area that Wetland 10 occupies within the corridor boundaries is 0.33 acres. This wetland is a mixture of alder thickets and meadow-like openings that support patches of sphagnum and various herbaceous species. Prevalent species identified within Wetland 10 included speckled alder, blue flag iris, red maple and low bush blueberry (*Vaccinium angustifolium* – FACU). Soil and hydrologic conditions typical of Wetland 10 were approximately 8 inches of peat and organics over low-chroma sands, with saturation occurring up to the surface. As the entire soil profile (from 0 to 16 inches) was saturated at this location, it was again indicative of wetland hydrology being supported by connectivity to the groundwater table.

Wetland 11

Wetland 11 is located in the west-central portion of the proposed rail corridor, and also abuts the western corridor boundary. It is 4.24 acres in size, and is thickly forested. Trees here vary in maturity from sapling to canopy-height. Species include speckled alder, balsam fir (*Abies balsamea* – FACW), red maple, black spruce and white birch. Sphagnum moss is also prevalent throughout this wetland, as well as blue flag iris and Canada bluejoint. The transition zone between this wetland and the upland areas to the east is extremely gradual, and occurs in an area where the ground surface has several slight undulations. These undulations are so marginal in nature (wetland-wise) that upland species are present on the tops of the “humps,” while wetland species are present in the low areas between them. The boundaries of Wetland 11 were delineated in locations where either the transition zone was very narrow, or, at the point where the low dips covered more ground surface than the upland “humps.” These sandy, undulating ground surfaces are typical of pre-historic lake beds, and are similar to those identified on an adjacent property. Soils present in Wetland 11 were similar to those in many of the previously described wetlands, with approximately 6 inches of organics layered over low-chroma sands. Observation of wetland hydrology indicated saturation at the ground surface and up to 1 or 2 inches of inundation. As this wetland delineation was completed in the driest part of the growing season, it can be assumed that water depths may typically be greater, and further supports hydrologic support of the groundwater table (versus rainfall runoff).

Wetlands 12, 13 & 14

Similar to Wetlands 3 through 8, Wetlands 12, 13 and 14 are being described collectively as they are comparable in size, are located in a grouping, and have similar characteristics. These wetlands are located directly northeast of Wetland 11, adjacent to the western corridor boundary, and have the following sizes:

- Wetland 12 = 0.24 acres
- Wetland 13 = 0.20 acres
- Wetland 14 = 0.49 acres

These wetlands exist in a group of isolated ground surface depressions, and have vegetative and soil characteristics similar to Wetland 11. Hydrophytic tree species observed in these wetlands include red maple, quaking aspen (*Populus tremuloides* – FAC) and balsam fir. Other species identified included sphagnum, Canada bluejoint and cinnamon fern (*Osmunda cinnamome*a – FACW). Soil saturation levels were generally at the ground surface, with soil textures continuing to match other wetland areas: 3 to 4 inches of peat and organics over low-chroma sands (chroma of 1 or 2). As the ground surface elevations of these wetlands are similar to that of Wetland 11, it is likely their source of hydrology is the same (groundwater).

Wetland 15

Wetland 15 is the second largest and northernmost wetland delineated within the proposed Frontier rail corridor. It is 15.99 acres in size and extends to the north beyond the northernmost corridor boundary. The portions of this wetland that lie within the proposed corridor are primarily tamarack swamp. Features exemplary of this wetland type are: a several inch to several foot- thick mat of sphagnum supporting scattered tamarack and black spruce, along with interspersed shrub species such as Labrador tea and leatherleaf. Moving to the east outside of the corridor, dominant vegetation transitions to more of a shrub-carr regime, where standing water and shrub-layer species are prevalent. Within the corridor, the transition from upland pine stands to tamarack swamp is extremely abrupt, and is marked by a distinct drop in ground surface elevation that runs parallel with the northern corridor boundary. Here, dry sandy soils convert to peaty soils that are either saturated or inundated. The depth of peat observed near the middle of the delineated corridor boundary was approximately 6 inches, and was underlain by sands with chromas of 1 to 2. Along this wetland transition, as well as near the boundaries of several other wetlands on the site, low bush blueberry seemed to be the most prevalent indicator of change from upland to wetland. As the geomorphic and soil conditions within, and near, Wetland 15 are similar to those of other delineated wetlands, it is assumed that the source of hydrology for this wetland is also connectivity with the groundwater table. This is also supported by the fact that this wetland was highly saturated during the driest months of the year, and does not appear to be connected to, or contiguous with any water bodies such as lakes or rivers.

3.2.1.3 Protected Species

In order to determine if Federal or state endangered, threatened, special concern species, exemplary natural plant communities or unique natural features exist within the boundaries of the Frontier project site, Frontier consulted with the U.S. Fish and Wildlife Service (USFWS), Michigan Department of Natural Resources (MDNR) and Michigan Natural Features Inventory (MNFI).

On February 13, 2009, a consultation was completed with the MDNR through their on-line Endangered Species Assessment program[2]. This resulted in the generation of letters from MDNR stating that the following endangered species may be present in Chippewa County:

- piping plover;
- dwarf lake iris;
- Houghton's goldenrod;
- Pitcher's thistle;
- American Hart's tongue fern;
- Canada lynx;
- gray wolf; and
- Kirtland's warbler.

However, since the Frontier site does not contain appropriate habitat for the listed plant species; the gray wolf, Canada Lynx, and Kirtland’s warbler have a very large territories; and Canada lynx has not been seen in Chippewa County since 2004, the MDNR concluded that “…project activities may proceed. It has been determined that Federal or state endangered, threatened, special concern species, exemplary natural plant communities or unique natural features are not known to occur at or near the location specified.” The MDNR consultation was completed for Sections 21 and 28, T45N, R1W. The MDNR response letters are included in Appendix C.

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[2] http://www.mcgi.state.mi.us/esa/

A consultation letter was submitted to the USFWS on February 17, 2009 regarding the potential presence of threatened and endangered species for the Frontier project site. The USFWS response concurred with the MDNR regarding the potential presence of threatened and endangered species. The consult letter and USFWS e-mail response are included in Appendix C.

Lastly, MNFI database data was reviewed to determine if threatened, endangered or special concern species, unique plant communities or natural features exist or have been documented within the Frontier Project boundaries and the proposed railroad corridor. The results of this database search are displayed in Figure 13, which indicates species/community/natural feature occurrences and likelihoods and also depicts the boundaries of the Frontier Project site and the proposed railroad corridor. Recently documented occurrences are indicated with squares marked with an “S” for special concern, “T” for threatened and an “E” for endangered. The map indicates no occurrences are documented within the proposed project boundaries. The MNFI occurrences nearest the proposed Frontier biorefinery lie approximately 5 miles away from the biorefinery boundaries and approximately 1 mile from the proposed railroad corridor. Species, habitat and feature “likelihoods” are also indicated on Figure 17. These “high,” “medium,” and “low” likelihood areas represent locations in which threatened or endangered species were once identified, but are not currently confirmed to be present. The level of likelihood is generally based on how long ago the identification occurred. Similar to the other data sets, the Frontier project area and proposed railroad corridor have “no status” for species likelihood, indicating no endangered, threatened or special concern species, communities or features were recorded at that location (MNFI, 2009).

During the wetland delineations of the proposed Frontier site and the proposed railroad corridor, the sites were also surveyed for the presence of potentially protected plant species. No threatened, endangered, or special concern plant species were encountered during the wetland delineation.

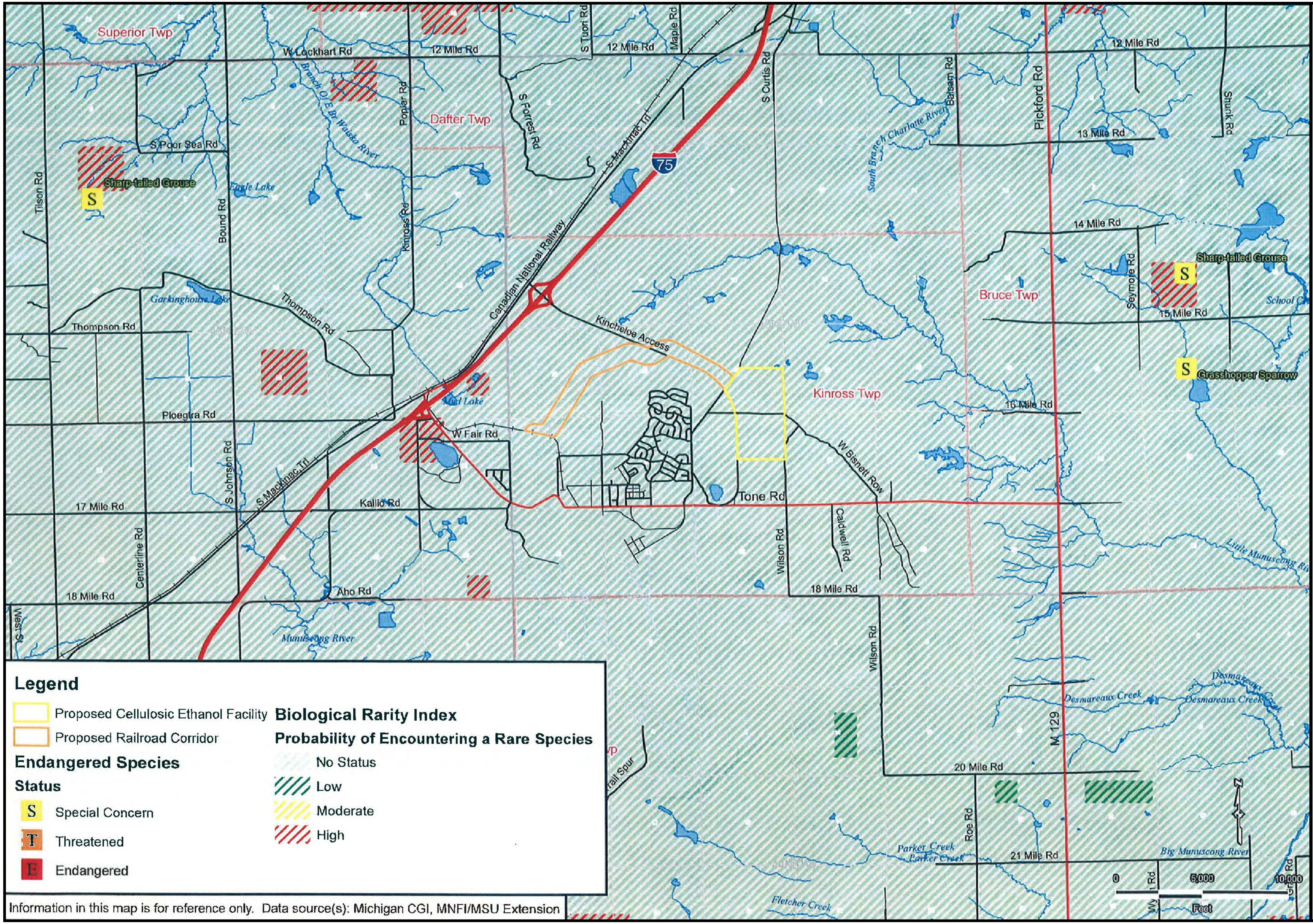
Special Ecological Sites or Geologic Features

Special ecological sites and geologic features that occur in Michigan are documented within the MNFI database. The search of the database for the Frontier project area indicated that these types of features are not located within or near the project area.

Federal and State Wildlife Areas

Various maps of the Frontier project vicinity were developed to determine if any Federal or state nature or wildlife preserves, scenic rivers or state parks are located in close proximity to the site. The following are the results of this search:

- The Munuscong Wildlife Management Area is the nearest nature or wildlife preserve to the Frontier project site. This area lies approximately 7 miles to the southeast on Munuscong Lake, and is a state managed wildlife area.
- The nearest Federal or state scenic river is the Carp River Scenic Area. It lies approximately 27 miles to the southwest near the town of Charles, Michigan.
- The nearest state park to the Frontier project site is the Munuscong River State Forest Campground, which is located in the Munuscong Wildlife Management Area. A private campground, Clear Lake Campground, is located 3-4 miles to the north of the project site on county road H63.
- Various tracts of the Lake Superior State Forest surround the Kincheloe and Chippewa County Airport areas.



Information in this map is for reference only. Data source(s): Michigan CGI, MNFI/MSU Extension

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BIOLOGICAL RARITY INDEX
FRONTIER RENEWABLE RESOURCES, LLC
CELLULOSIC ETHANOL FACILITY
KINROSS TOWNSHIP, CHIPPEWA COUNTY, MICHIGAN

Drawn:	JWW	2/17/2009
Approved:	LDK	2/17/2009
Scale:	1" = 1 MILE	
PROJECT NUMBER	60140061	
FIGURE NUMBER	13	

The Eastern portion of the Hiawatha National Forest lies 7 to 8 miles to the west of the project site. This portion of the Hiawatha National Forest reaches from the shore of Lake Superior to the shores of Lakes Huron and Michigan. It is most likely the largest Federal holding of land near the Frontier project area.

Champion Trees

No champion trees are located within the Frontier project boundaries or within several miles. A champion tree is the largest trees of each registered species in the State or Nation. State and National Champion trees are determined by a point system, based on three measurements. The number of points is obtained by adding the circumference of the trunk, in inches, 4.5 feet above the ground to the height in feet and 1/4 of the average crown spread in feet. The only champion trees ever documented within Chippewa County were identified on Sugar Island which is northeast of Kincheloe near Sault Ste. Marie, Michigan. (Michigan Botanical Association, 2006).

Breeding or Non-Breeding Animal Populations

On February 18, 2009, AECOM contacted MDNR wildlife biologist Erynn Call of the Sault Ste. Marie district office regarding potential breeding or non-breeding animal populations in the vicinity of the Frontier project site. She indicated that no site-specific data had been collected or was available for the Frontier site, as well as for the Kincheloe area. The only site-specific data on hand was from the MNFI database (Call, Erynn).

Wildlife species that are native to northern Michigan, and may be present in the Frontier project area include: white-tailed deer, raccoon, skunk, porcupine, red and gray squirrel, chipmunks, coyotes, bobcat, black bear, short-tailed weasel, pine marten, fisher, various frogs such as the wood frog, spring peeper or eastern gray tree frog, small rodents such as mice, shrews and voles, turtles such as the box turtle or snapping turtle, grass snake, pine snake, bats and various bird species ranging from downy and pileated woodpeckers to songbirds.

3.2.2 Environmental Consequences of the No Action Alternative

The No Action Alternative would not affect wetlands in the Frontier project area or the proposed railroad corridor. No threatened or endangered species were identified at the project location or the proposed railroad corridor.

The No Action Alternative would result in no forest resources being utilized for this project.

3.2.3 Environmental Consequences of the Proposed Action

3.2.3.1 Frontier Project Area

At the Frontier project site, no wetlands were encountered within the four southernmost 40-acre parcels, which is the proposed location of the cellulosic ethanol biorefinery. All five wetlands identified at the biorefinery site are located in the northernmost property parcels. The northernmost parcels would not be developed or disturbed for the construction of the proposed Frontier biorefinery. Frontier would develop a SESC Plan to protect these wetlands during construction activities. Requirements of the SESC plan are discussed in Section 3.6.3.3. The biorefinery would be designed and operated such that impact to the five wetlands is avoided. Therefore, no impacts to the wetlands on the proposed site would be expected as a result of the Proposed Action.

It is expected that mammals and birds would avoid the construction area. Any construction noise that may disturb birds would be limited to the immediate Project area. Mammals and birds would be able to find sufficient habitats for food and water in the surrounding areas during construction.

3.2.3.2 Railroad Corridor

Frontier has completed and submitted a rail corridor alternatives analysis to the MDNRE for the proposed rail corridor (Alternatives Analysis for Proposed Rail Corridor - Frontier Cellulosic Ethanol Facility, Frontier Renewable Resources, LLC; Kinross Township, Chippewa County, Michigan, AECOM 2010). The alternatives analysis included three potential routes for the rail line.

- **Route #1** – Route #1 would be constructed off of the existing railroad track to the west of the town of Kincheloe, and would continue to the north and east, passing through forested state lands. The route would cross the Gaines Highway to the west of the proposed Frontier facility and enter the site at its northwest corner.

- **Route #2 –** Route #2 would connect to existing railway at a "dead end" that is located immediately to the west of the town of Kincheloe, just east of Kincheloe Drive. This route would then continue south and east, and follow along the north side of Tone Road/Highway M-80 to the east side of town, where it would turn north southeast of Duke's Lake. It would then enter the proposed Frontier ethanol facility from the south.

- **Route #3** – Route #3 would connect to the existing railway at the same "dead end" as Route #2, and would also primarily follow Tone Road/Highway M-80 to the east. The primary difference is that Route #3 would run along the south side of Tone road/M-80, instead of the north side, and would therefore require two crossings of the highway itself. Route #3 would also enter the Frontier facility from the south, the same as Route #2.

Route #3 would require construction of 2 highway crossings, 4 street crossings, and 4 driveway crossings. Route #3 would potentially block access and/or emergency egress from the Kinross Township Fire Department and the Chippewa County Correctional Facility. Approximately 4 buildings in Kinross would have to be removed or relocated to provide sufficient clearance for rail right of way. An underground natural gas pipeline would likely have to be relocated or rebuilt at a greater depth and an existing electric line would likely have to be relocated or rebuilt to provide clearance for rail cars. Finally, construction of Route #3 would require a substantial revision of the Kinross Charter Township downtown re-development plan.

Route #2 would require eight (8) city street crossings and one (1) crossing of the Gains Highway. Additionally, it would require crossing of nine (9) existing driveway entrances. Route #2 would otherwise mirror the potential impacts discussed above for Route #3.

Route #1 would require one (1) crossing of the Gains Highway north of Kinross. No buildings or utility corridors would be impacted. No other impacts would occur in Kinross. Route #1 would go through an area where wetlands are present. A 1,000 foot wide corridor was examined for rail bed location along Route #1.

Of the 15 wetlands identified within the proposed Route #1, it is anticipated that four wetlands would be affected by construction of a new railroad grade. These include Wetlands 1, 4, 5 and 6. Wetland 1 (approximately 41.8 acres) spans the entire width of the southern end of the proposed corridor, as well as beyond the corridor to the east and west. Wetlands 4, 5, and 6 (all less than 1 acre in size) lie directly to the north of Wetland 1, and would be skirted on their western edges by the proposed railroad right-of-way (ROW). The total proposed impact area for each wetland is estimated to be the following:

- Wetland 1 = 136,270 sq. ft. (3.13 ac)

- Wetland 4 = 22 sq. ft.

- Wetland 5 = 661 sq. ft.

- Wetland 6 = 6 sq. ft.

Wetland 1 has the greatest total impact area. In accordance with Section 404 of the Clean Water Act and Part 303 of NREPA, Act 451 of 1994, any impacts to wetlands may require a joint permit from the MDNRE and USACE. When a project total of greater than 0.33 acres of wetland impacts are anticipated, the MDNRE may impose compensatory wetland mitigation as a condition of the permit issuance. The purpose of compensatory wetland mitigation, commonly referred to as wetland mitigation, is the replacement of unavoidably lost wetland resources with created, or restored wetlands, with the goal of replacing as fully as possible the functions and public benefits of the lost wetland. In accordance with the administrative rules for Part 303, the MDNRE can consider wetland mitigation only after all of the following conditions are met:

- The wetland impacts are otherwise permit table under sections 30302 and 30311 of the act;
- No feasible and prudent alternative to avoid wetland impacts exists;
- An applicant has used all practical means to minimize impacts to wetlands. This may include the permanent protection of wetlands on the site not directly impacted by the proposed activity.

The amount of compensatory mitigation required by MDNRE depends on two factors: 1) which wetlands are under the jurisdiction of the MDNRE and 2) the type of wetland being impacted. State of Michigan wetland jurisdiction depends on connectivity/proximity to a lake, river or stream, proximity to the Great Lakes (not applicable to the Frontier wetlands), and being greater than 5 acres in size. Additionally, Michigan regulators have the authority to regulate wetlands less than 5 acres in size depending on wetland quality and value. Therefore, some or all of the wetlands within the proposed Frontier railroad corridor may be regulated.

The type of wetland impacted affects the amount of required compensatory mitigation in the following manner:

- Ratio of 5:1 (5 acres created/restored for every 1 acre impacted) is required for impact of rare or imperiled wetlands;
- Ratio of 2:1 for impact of forested wetlands;
- Ratio of 1.5:1 for all other wetlands.

For the purpose of estimating the amount of wetland mitigation that would be required, the following assumptions, determinations and calculations were made:

1. MDNRE would take regulatory jurisdiction of all wetlands proposed for impact;
2. There are no rare or imperiled wetlands present within the proposed railroad corridor (based on evaluation by AECOM);
3. The amount of forested and non-forested acres planned for impact are as follows:
    a. Forested = 108,522 sq. ft. (2.49 ac)
    b. Non-forested = 24,838 sq. ft. (0.65 ac)

According to the MDNRE's mitigation ratios, the following amount of required compensatory wetland mitigation would required.

Total Acres Required = [2.0 x (2.49 acres)] + [1.5 x (0.65 acres)] = **5.955 acres**

In addition to the construction of new wetlands as a form of mitigation, the MDNRE will also allow restoration of existing impacted wetlands, as well as the purchase of established mitigation bank credits. Restoration of existing wetlands is preferred by MDNRE over the creation of new wetlands, while purchase of mitigation bank credits are the least preferred option. The option that Frontier and MDNRE would proceed with depends on factors such as the location, size and proximity of: impacted wetlands, available land for creation of wetlands, and existing mitigation banks.

As with all wetland delineations, permitting and mitigation, MDNRE will make the final determination regarding jurisdiction, locations of wetland boundaries, and permitting and mitigation requirements.

3.3 Land Use

This section discusses land use for the proposed Frontier site. Land use associated with forest resources was discussed in Section 3.1.

3.3.1 Affected Environment

As shown on Figure 14, the entirety of the Frontier project site consists of various types of forestland: deciduous, evergreen, mixed and wooded wetland. The 355-acre parcel of land proposed for the site was transferred from the State of Michigan effective March 5, 2009 in a land transfer agreement between J.M. Longyear and the State. The areas to the north and northeast of the site consist mainly of wooded and emergent wetland areas, with intermixed upland evergreen forest, ponds, lakes and streams. Land to the south and southeast of the project site is similar to the project site itself, with a consistent mixture of deciduous and evergreen forest, along with sparse areas of wooded wetland. This type of mixed woodland is typical of the majority of Chippewa County, with agriculture being the second most common land use in the county (Maps.com, 2008). The only city of significant size in Chippewa County is Sault Ste. Marie, which is the county seat.

Kinross occupies the land directly to the west and southwest of the proposed Frontier biorefinery. This unincorporated town consists of several residential, commercial, industrial and institutional facilities. Low- and high-density residential areas are present within and around the network of streets that lie directly west of the Frontier site. Nearby commercial, industrial and institutional sites include the Kincheloe and Chippewa Correctional Facilities, the Chippewa County Airport, the Kinross wastewater treatment plant and various commercial businesses. The Kincheloe Memorial Golf Course lies immediately west of the residential and commercial area that is north of the airport. The nearest residence to the proposed Frontier site is 2,600 feet south of the southernmost property boundary.

3.3.2 Environmental Consequences of No Action Alternative

The No Action Alternative would have no impact to the land use on the proposed site.

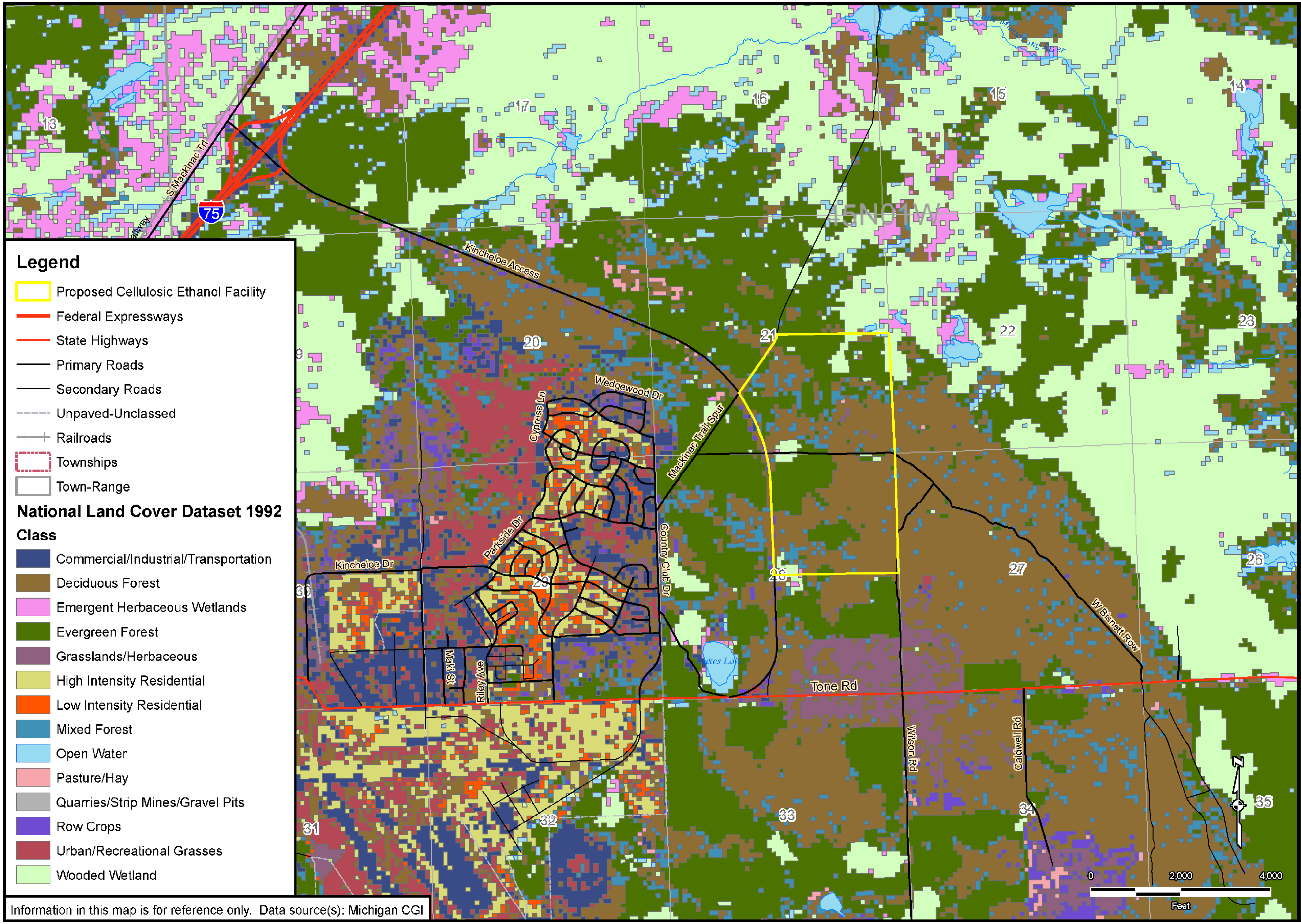
3.3.3 Environmental Consequences of Proposed Action

Proposed Site

The proposed cellulosic ethanol biorefinery would be constructed on approximately 50 acres located in the southernmost 160 acres of the property. Approximately 10 to 15 acres of the property would be covered by buildings, structures, or other impervious surfaces such as roads. Additionally, approximately 15 acres of the site, the log yard would be converted to a gravel covered area for storage of whole logs. Other grading activities would be completed to create storm water drainage systems. No wetlands or sensitive receptors would be impacted by the on-site construction.

Construction of the on-site rail siding would result in clearing of forested land across the site to the wood yard with a loop around the south end of the site to the ethanol load-out area.

The construction of the rail spur would result in permanent clearing of forested land between the rail main line to the site along a corridor ranging from 100 to 160 feet wide by 2.7 miles long. Approximately 3.14 acres of existing wetland would be impacted by the construction of the rail corridor. The impacts to the wetlands would be mitigated as described in Section 3.5.3.2.



Legend

- 🟨 Proposed Cellulosic Ethanol Facility
- Federal Expressways
- State Highways
- Primary Roads
- Secondary Roads
- Unpaved-Unclassed
- Railroads
- Townships
- Town-Range

National Land Cover Dataset 1992

Class

- Commercial/Industrial/Transportation
- Deciduous Forest
- Emergent Herbaceous Wetlands
- Evergreen Forest
- Grasslands/Herbaceous
- High Intensity Residential
- Low Intensity Residential
- Mixed Forest
- Open Water
- Pasture/Hay
- Quarries/Strip Mines/Gravel Pits
- Row Crops
- Urban/Recreational Grasses
- Wooded Wetland

Information in this map is for reference only. Data source(s): Michigan CGI

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1992 NATIONAL LAND COVER DATASET
FRONTIER RENEWABLE RESOURCES, LLC
CELLULOSIC ETHANOL FACILITY
KINROSS TOWNSHIP, CHIPPEWA COUNTY, MICHIGAN

Drawn:	JWW 2/17/2009
Approved:	LDK 2/17/2009
Scale:	1" = 2,000'
PROJECT NUMBER	60140061
FIGURE NUMBER	14

3.4 Cultural Resources

3.4.1 Affected Environment

In addition to NEPA, DOE is required to comply with Section 106 of the National Historic Preservation Act (NHPA) of 1966 (16 U.S.C § 470 et seq., as amended). Section 106 of NHPA and the implementing regulations, 36 CFR Part 800, require Federal agencies to take into account the effects of their undertakings on historic properties that are included in, or eligible for inclusion in, the National Register of Historic Places (NRHP), which is the Nation's official list of cultural resources worthy of preservation. The National Register is part of a national program to coordinate and support public and private efforts to identify, evaluate, and protect historic and archeological resources. Properties listed in the National Register include districts, sites, buildings, structures, and objects that are significant in American history, architecture, archeology, engineering, and culture. The National Register is administered by the National Park Service, which is part of the U.S. Department of the Interior. The implementing regulations identify the criteria for evaluating the eligibility of properties for listing in the National Register (36 CFR § 60.4).

DOE has determined that the proposed Federal funding for the Frontier Project constitutes an undertaking under the NHPA. The remainder of this section discusses and documents DOE's compliance with NHPA's requirements.

Given the location of the Frontier Project, DOE determined that Michigan's State Historic Preservation Office (SHPO) is a mandatory consulting party and initiated consultation with the SHPO on July 21, 2010 by submitting a letter describing the project along with an Application for Section 106 Review (which is contained in Appendix E). DOE described the Area of Potential Affects as "the 160 acre project site plus the rail corridor from the site to the existing rail line," and sought the SHPO's concurrence with its finding that "there are no know historic properties within the proposed project's Area of Potential Effects." DOE also informed the SHPO that the consultation correspondence would be included in the draft EA for the project, which would be provided to the SHPO for comment.

On August 4, 2010, the SHPO sent a letter to DOE (contained in Appendix E) stating that "[i]t appears that for this project there will be no historic properties affected in regard to above-ground resources," but that, given that several archaeological sites are known to exist in the project area, "an archaeological survey should be conducted and submitted to this office so that we may complete our review." In the Fall of 2010, Frontier completed a Phase I Archeological Survey (Survey) of the proposed project site and rail spur. (Phase I Archaeological Investigation, Frontier Renewable Resources, Kinross Charter Township, Chippewa County, Michigan, AECOM October 2010). A copy of the Survey is contained in Appendix E.

Because the internal review of the Office of the State Archaeologist (OSA) determined that no listed or known eligible cultural resources where present in the APE above the ground surface, the Survey focused on buried, significant, and intact archaeological resources. Prior to initiating the Survey, the SHPO was consulted and concurred with the DOE's definition of the Area of Potential Effects (APE) as the 160 acres in the northeast quarter of Section 28 and the 2.5-mile-long railroad spur right of way (ROW). The APE consists of wooded and marshy, undeveloped lands.

Background research and records review was completed at the OSA in Lansing, Michigan on August 25, 2010 and September 8, 2010 to determine if any previous cultural or archeological surveys had been conducted in immediate area of the APE and specifically within the APE. The background research also determined what type of cultural resources where typically found in Chippewa County, in what context, and at what frequency. Based on the background research, current Michigan cultural resource survey work methods, and standard archeological survey practices, a predictive model was developed to guide the Survey field activities for the entire APE, using the following definitions:

- High-probability area (HPA) – less than or equal to 300 meters from surface water and 0-10% slopes.

- Moderate-probability area (MPA) – less than 300 meters from surface water <u>and</u> slopes greater than 10%.
- Low-probability area (LPA) - Disturbed previously (e.g., gravel or sand pits) <u>or</u> existing wetlands <u>or</u> slopes greater than 10%.

The Survey included a pedestrian survey in the APE, with shovel testing in locations defined as HPAs and MPAs for buried, significant, and intact archaeological resources. AECOM's predictive model eliminated from subsurface testing the LPAs in the APE. Almost the entire 160-acre parcel was defined as a MPA, except for a small portion in the northeast corner that was a LPA. Survey field work was completed on the APE in sections 28 and 30 on September 20-23, 2010. Shovel tests were excavated 50 meters apart along the first transect in the 160-acre parcel, which was along the south boundary of the parcel; no archaeological resources were found in any of the shovel test locations or identified on the ground surface. Therefore, the shovel-test interval was expanded to 100 meters throughout the remainder of the 160-acre parcel.

The western terminus of the proposed railroad spur was defined in the model as a HPA, ending at a LPA marshland. Therefore, AECOM's shovel-test interval was 15 meters apart along the proposed rail spur.

AECOM excavated a total of 73 shovel tests in the APE – 60 shovel tests in the 160-acre parcel and 13 at the west end of the proposed railroad spur. No cultural resources were encountered in any of the shovel tests. The only cultural resource observed during the Survey was a small surface scatter of miscellaneous transportation-related debris, such as modern oil filters.

The Survey report was submitted to the SHPO for review.

Beyond consultation with the Michigan SHPO, DOE has engaged in consultation and communication with numerous tribes in Michigan, Wisconsin, and Minnesota. Also, Frontier has represented that, over the past year, it has met with tribal representatives in the area of the proposed Frontier project—including an August 2010 meeting with the Inter-Tribal Council of Michigan (ITCM, which is a non-profit corporation located in Sault Ste. Marie, Michigan that represents eleven of the twelve Federally recognized tribes in Michigan, including all of the Federally-recognized tribes in Michigan's Upper Peninsula)—in order to gather information regarding tribal concerns about the project, including potential effects on cultural resources, and discuss those concerns. In addition to the representatives of the ITCM, representatives of the Sault Ste. Marie Tribe of Chippewa Indians, Hannahville Indian Community, and U.S. EPA Region 5 were present at the meeting.

On December 22, 2009, DOE's scoping letter was sent to the Sault St. Marie Tribe of Chippewa Indians and the Inter-Tribal Council of Michigan. On January 19, 2010, Darwin (Joe) McCoy, Tribal Chairman for the Sault St. Marie Tribe of Chippewa Indians sent a letter in response to the notice (included in Appendix E) and indicated the tribe's interest in the project and the EA. As part of the letter, Chairman McCoy also inquired about the potential impact of the project on cultural resources and other natural resources within the 1836 Treaty of Washington ceded territory.

On July 22, 2010, DOE initiated consultation with all Federally recognized tribes in Michigan regarding the Section 106 NHPA process, including:

- Bay Mills Indian Community
- Grand Traverse Band of Ottawa and Chippewa Indians
- Hannahville Indian Community
- Keweenaw Bay Indian Community
- Lac Vieux Desert Band of Lake Superior Chippewa Indians
- Little River Band of Ottawa Indians
- Little Traverse Bay Band of Odawa Indians
- Match-e-be-nash-se-wish Band of Pottawatomi Indians

- Nottawaseppi Huron Band of the Potawatomi
- Pokagon Band of Potawatomi Indians
- Saginaw Chippewa Indian Tribe of Michigan
- Sault Ste. Marie Tribe of Chippewa Indians of Michigan

DOE also initiated consultation with the following Federally-recognized tribes in Minnesota and Wisconsin:

- Bad River Band of Lake Superior Chippewa
- Bois Forte Band of Chippewa
- Fond du Lac Band of Lake Superior Chippewa
- Grand Portage Band of Lake Superior Chippewa
- Lac Courte Oreilles Band of Lake Superior Chippewa Indians of Wisconsin
- Leech Lake Band of Ojibwe
- Mille Lacs Band of Ojibwe
- Minnesota Chippewa Tribe
- Red Cliff Band of Lake Superior Chippewa Indians
- Red Lake Band of Chippewa Indians of Minnesota
- Sokaogon Chippewa Community
- St. Croix Chippewa Indians of Wisconsin
- White Earth Band of Ojibwe

The DOE informed the tribes about the proposed project and solicited information from them about properties of traditional religious and cultural significance within the vicinity of the proposed facility and any concerns about the potential for the project to affect those properties. In all, DOE sent consultation letters to 25 tribes. Copies of the DOE's tribal consultation letters are contained in Appendix E.

Thus far, the DOE has received written responses from five tribes, copies of which are contained in Appendix E.

The Lac Vieux Desert Band (LVD) of the Lake Superior Chippewa Indians Ketegitigaaning Ojibwe Nation Tribal Historic Preservation office (THPO) responded that "[t]he LVD Tribal Historic Preservation Office has no interests documented at this time in the proposed project areas. LVD has conducted its database research, file research and find no sites within the project area at this time." The LVD THPO requested and was provided with a copy of the Survey for their information, review and analysis.

The Leach Lake Band of the Ojibwe THPO responded that "after careful consideration of our records, I have determined that the Leech Lake Band of the Ojibwe does not have any concerns regarding sites of religious or cultural importance in these areas."

The Bois Forte Band of the Chippewa THPO responded that it was "not aware of historic or cultural properties associated with the Band within the APE."

The Little River Band of the Ottawa Indians responded that "after a careful review of our information the Little River Band of Ottawa Indians has determined . . . that this project will not affect any religious, cultural or historic Little River Band of the Ottawa Indians sites of which we are currently aware."

The Little Traverse Bay Bands of Odawa Indians submitted a declaration signed by nine Tribal Council members in opposition to the Frontier Project based primarily on concerns about the potential impact of the project on the environment and the tribe's use of public lands in the 1836 treaty ceded territory "for hunting for subsistence and gathering of medicines." The declaration does not identify any particular properties of traditional religious and cultural significance within the vicinity of the proposed facility.

With respect to the concerns expressed by the Little Traverse Bay Bands of Odawa Indians and the Sault St. Marie Tribe of Chippewa Indians about the potential impact of the project on tribal use of public lands in the ceded territory, DOE notes that this issue is beyond the purview of Section 106 of NHPA.

While the tribal responses to DOE's consultation letters received do not indicate the existence of any cultural resources in the APE that would be eligible for listing in the NRHP, DOE is continuing its consultation efforts with the Tribes by inviting any additional information relating to cultural resources in the APE that may be of significance as DOE works to complete its review in compliance with Section 106 of NHPA.

Further, as discussed in more detail elsewhere in the EA, the Frontier Project will not significantly impact tribal use of the 1836 treaty ceded territory because:

1. the project will not materially increase the amount of wood that would otherwise be harvested on public lands within the ceded territory;

2. any harvesting of wood for the project from Federal lands within the ceded territory can only occur after the Federal government has approved the bidding of such lands in compliance with applicable Federal laws, including NEPA;

3. the State of Michigan maintains a FSC and a SFI certification; therefore, any timber sales on state-owned lands within the ceded territory are conducted within the FSC and SFI standards and guidelines, which include consideration of potential impacts on tribal resources; and.

4. J.M. Longyear also maintains a FSC certification for their managed forest lands.

Absent new or additional information from the tribes with which DOE has been consulting, the DOE has determined that no NRHP-listed sites or known NHRP-eligible sites are located on the proposed project site or on the proposed rail corridor #1. A total of 30 listed sites are located in Chippewa County, most in Sault Ste. Marie. Sault Ste. Marie is approximately 18 miles north of the proposed Frontier site. The nearest NRHP listed site to the proposed Frontier site is the Kinross Township Hall and School, located at 7305 West Kinross Road, Kinross Township. This site is approximately 2 miles east of the proposed Frontier site.

On November 3, 2010, the SHPO issued a letter stating that based on its review of the Survey report and other information provided, "it is the opinion of the State Historic Preservation Officer (SHPO) that **no historic properties are affected** within the area of potential effects of this undertaking." A copy of the SHPO letter is contained in Appendix E.

3.4.2 Environmental Consequences of the No Action Alternative

The No Action Alternative would have no impact on cultural resources in the project area.

3.4.3 Environmental Consequences of the Proposed Action

No cultural resources were identified within the APE. Cultural resources on Federal and State land and private forest lands would be protected by existing processes and procedures. The Proposed action would not have an impact on cultural resources.

3.5 Meteorology

This section discusses meteorology in the overall proposed Frontier project area.

3.5.1 Affected Environment

Meteorology for the eastern portion of the upper peninsula of Michigan features weather patterns with large ranges of temperatures between summer and winter which, is greatly influenced by Lake Superior. The temperatures in the eastern Upper Peninsula of Michigan are moderated by the so called lake effect, as this land lies directly south of Lake Superior. (Schaetzl, 2002).

Climate data for Kinross and the surrounding area, based upon data from Rudyard, Michigan, which is located approximately 13 miles southwest of Kinross, shows that average monthly mean temperature ranges from 14.3°F in January to 64.3°F in July. Winter months (December through February) are the coldest with average monthly low temperatures ranging from 5.5°F to 13.2°F and high temperatures ranging from 23.0°F to 28.1°F. The warmest months are the summer months of June through August. During those months average monthly temperature ranges from 59.6°F to 64.3°F and high temperatures range from 73°F to 77.2°F. Average annual precipitation is approximately 30.39 inches. January through March have the lowest precipitation rates with an average of 1.86, 0.99, and 1.59 inches, respectively, most of which is in the form of snowfall of 24.2, 12.9, and 11.5 inches (Midwestern Regional Climate Center, 2009).

Wind data from the Michigan Department of Environmental Quality (MDEQ) for Chippewa County International Airport located in Kincheloe approximately 2.5 miles southwest of the proposed biorefinery shows that the prevailing winds are from the northwest and southeast. (Figure 15, Chippewa County International Airport Wind Rose, MDNRE, 2008).

3.5.2 Environmental Consequences of the No Action Alternative

No aspect of the No Action Alternative would affect the climate or weather of the region.

3.5.3 Environmental Consequences of the Proposed Action

No aspect of the Proposed Action would affect the climate or weather of the region. No impacts to meteorology would be expected to occur under the Proposed Action due to the Frontier Project.

Severe weather, such as thunderstorms or snow storms, may temporarily impact operations by limiting delivery of supplies, impeding shipments of ethanol, or causing disruption of electrical or water service. These types of impacts would be expected to last for less than 24 hours but could extend for up to several days. Although these impacts may occur in any given year, operational planning would allow for normal operations to resume with minimal impacts. Frontier would modify its ERP, as necessary, to protect their employees and the public in the event of severe weather.

3.6 Air Quality

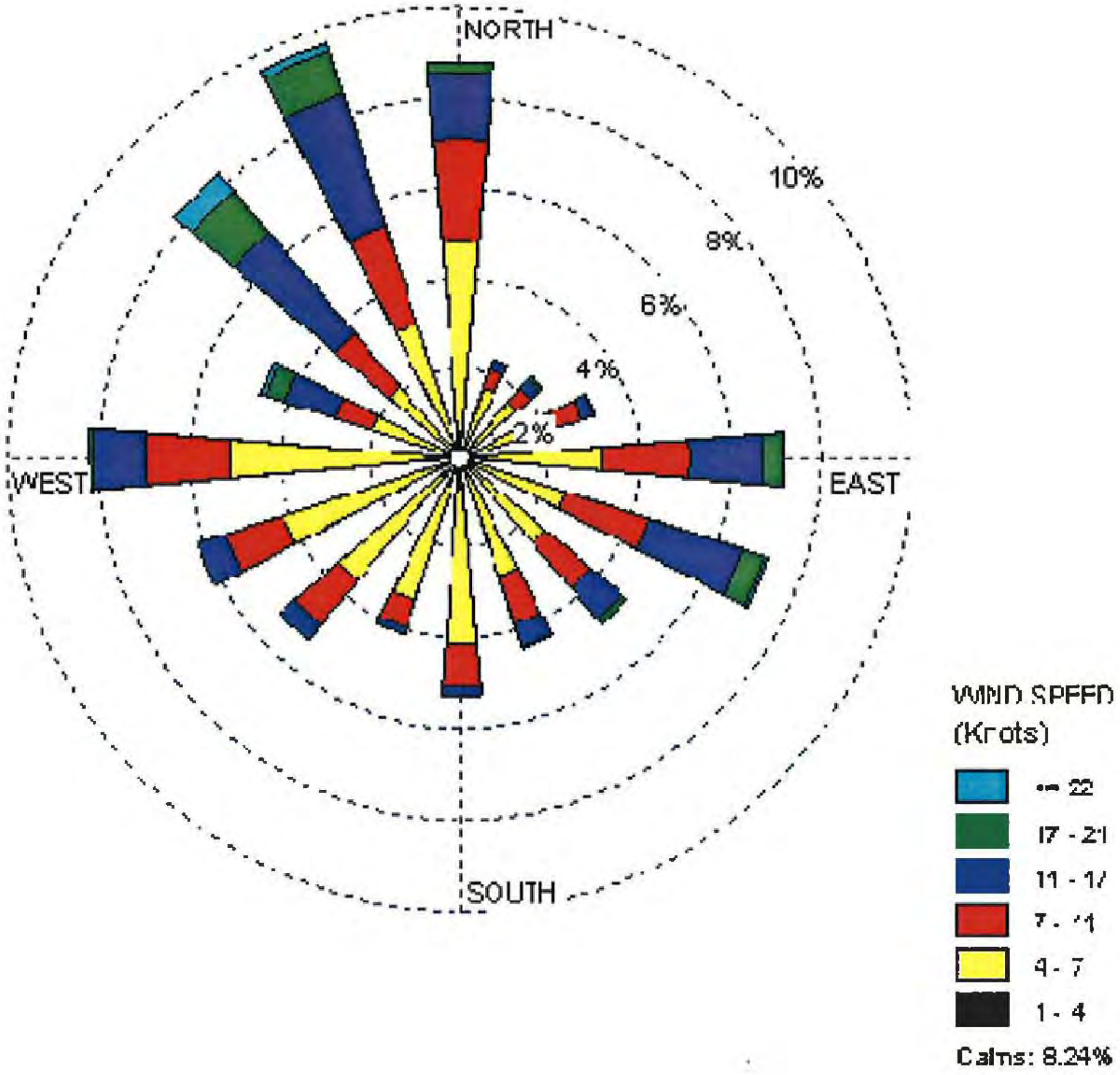
This section discusses air quality in the overall proposed Frontier project area.

3.6.1 Affected Environment

3.6.1.1 Ambient Air Quality

The Clean Air Act (CAA) required the USEPA to set National Ambient Air Quality Standards (NAAQS) for pollutants considered harmful to public health and the environment. NAAQS include two types of air quality standards. Primary standards protect public, including the health of sensitive populations such as asthmatics, children and the elderly. Secondary standards protect public welfare, including protection against decreased visibility, damage to animals, crops, vegetation, and buildings (USEPA, 2009a). USEPA has established and Michigan has adopted NAAQS for seven principal pollutants, which are called “criteria pollutants”.

CHIPPEWA INTERNATIONAL AIRPORT – 2006



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Drawn: KLM 1/18/2011
Approved:
Scale: NA
PROJECT NUMBER 60140061
FIGURE NUMBER 15

Table 3-4 - National Ambient Air Quality Standards

Pollutant	Primary Standards	Averaging Times	Secondary Standards
Carbon Monoxide	9 ppm (10 mg/m^3)	8-hour(1)	None
	35 ppm (40 mg/m^3)	1-hour(1)	None
Lead	1.5 µg/m^3(2)	Quarterly Average	Same as Primary
Nitrogen Dioxide[9]	0.053 ppm (100 µg/m^3)	Annual (Arithmetic Mean)	Same as Primary
	0.1 ppm (188 µg/m^3)	1-hour	None
PM_{10}	150 µg/m^3	24-hour(3)	Same as Primary
$PM_{2.5}$	15.0 µg/m^3	Annual(4) (Arithmetic Mean)	Same as Primary
	35 µg/m^3	24-hour(5)	Same as Primary
Ozone	0.075 ppm (2008 std)	8-hour(6)	Same as Primary
	0.08 ppm (1997 std)	8-hour (7)	Same as Primary
	0.12 ppm	1-hour(8) (Applies only in limited areas)	Same as Primary
Sulfur Dioxide (SO_2)	0.03 ppm	Annual (Arithmetic Mean)	-------
	0.14 ppm	24-hour(1)	-------
	-------	3-hour(1)	0.5 ppm (1300 µg/m^3)
	0.075 ppm (196 µg/m^3)	1-hour	-------

Table obtained from USEPA, 2009a.

(1) Not to be exceeded more than once per year.

(2) Final rule signed October 15, 2008.

(3) Not to be exceeded more than once per year on average over 3 years.

(4) To attain this standard, the 3-year average of the weighted annual mean $PM_{2.5}$ concentrations from single or multiple community-oriented monitors must not exceed 15.0 µg/m^3.

(5) To attain this standard, the 3-year average of the 98th percentile of 24-hour concentrations at each population-oriented monitor within an area must not exceed 35 µg/m^3 (effective December 17, 2006).

(6) To attain this standard, the 3-year average of the fourth-highest daily maximum 8-hour average ozone concentrations measured at each monitor within an area over each year must not exceed 0.075 ppm. (effective May 27, 2008)

(7) (a) To attain this standard, the 3-year average of the fourth-highest daily maximum 8-hour average ozone concentrations measured at each monitor within an area over each year must not exceed 0.08 ppm.

(b) The 1997 standard—and the implementation rules for that standard—will remain in place for implementation purposes as EPA undertakes rulemaking to address the transition from the 1997 ozone standard to the 2008 ozone standard.

(8) (a) The standard is attained when the expected number of days per calendar year with maximum hourly average concentrations above 0.12 ppm is < 1.

(b) As of June 15, 2005 EPA revoked the 1-hour ozone standard in all areas except the 8-hour ozone nonattainment Early Action Compact (EAC) Areas.

(9) The 1-hours NO_2 standard is based on the three year average of the 98th percentile of the annual distribution of the daily hourly maximum 1-hour concentrations.

Areas that meet the air quality standards for the criteria pollutants are designated as being in attainment. Areas that do not meet the air quality standard for one or more of the criteria pollutants may be subject to the formal rule-making process and designated as being in nonattainment for that standard. Chippewa County is in attainment for all criteria air pollutants (USEPA 2009b). The USEPA maintains a database of selected ambient air quality data. According to the USEPA Air Data County Air Quality Report for Chippewa County, Michigan, air quality data was only available for $PM_{2.5}$ (USEPA 2009c).

Table 3-5 - Chippewa County Ambient Air Quality Data

Pollutant	Averaging Period	Chippewa County Ambient Air Quality Data			
		2005	**2006**	**2007-2008**	
Particulate Matter less than 2.5 Micron ($PM_{2.5}$)	24-hour	28.3 µg/m^3	36.1 µg/m^3	No Data Available	Near U.S. average
	Annual	9.29 µg/m^3	8.99 µg/m^3	No Data Available	Near U.S. average

The MDNRE requires any new potential source of significant air emissions to acquire a permit to install permit prior to beginning construction. Table 3-6 lists the sources identified in the USEPA Envirofacts Database with air releases within 15 miles of the proposed biorefinery (USEPA 2009d).

Table 3-6 - Air Emission Sources within 15 miles of the Proposed Biorefinery

Source	Relative Location to Proposed Biorefinery	Description
American Fabricators 426 Dolan St. Kinross, MI 49752	2 miles southwest	Minor source, potential emissions less than 100 tons per year.
Chippewa Animal Clinic 1554 E 3 Mile Road Sault Ste. Marie, MI 49783	14 miles northeast	Minor source, potential emissions less than 100 tons per year.
Dafter Sanitary Landfill, Inc. 3962 West 12 Mile road Dafter, MI 49724	3.5 miles north-northwest	Potential emissions greater than 100 tons per year. Emissions of VOC's from landfill.
Forestply Ind Inc. 436 Quay St. Kincheloe, MI 49788	2 miles southwest	Minor source, potential emissions less than 100 tons per year.
MI Department of Corrections Bldg 115 Kinross Heating Plant Kincheloe, MI 49788	2 miles southwest	Potential emissions greater than 100 tons per year. Facility heating plant.
Montgomery Aggregate Products 7151 South M-129 Sault Ste. Marie, MI 49783	9 miles north-northeast	Minor source, potential emissions less than 100 tons per year.
Montgomery Concrete 40 E 3 Mile Road Sault Ste. Marie, MI 49783	12 miles north-northeast	Minor source, potential emissions less than 100 tons per year.
Norris Contracting Inc. Portable Asphalt Plant Sault Ste. Marie, MI 49783	11 miles north-northeast	Minor source, potential emissions less than 100 tons per year.
Northern Sand and Gravel 1200 W 3 mile Road Sault Ste. Marie, MI 49783	12 miles north-northeast	Minor source, potential emissions less than 100 tons per year.

Source	Relative Location to Proposed Biorefinery	Description
Olofsson Fabrication Services Inc. Bldg. 434 Dolan St. Kincheloe, MI 49788	2 miles southwest	Minor source, potential emissions less than 100 tons per year.
Payne and Dolan Inc. M 129 and 15 MI Road Junction Sault Ste. Marie, MI 49783	3.5 miles east-northeast	Minor source, potential emissions less than 100 tons per year.
Robinson Fence Co. Clegg Rd Rte 1 Pickford, MI 49774	10 miles south-southeast	Minor source, potential emissions less than 100 tons per year.
Sadler Motors, Inc. 3055 S Mackinac Trail Sault Ste. Marie, MI 49783	12.5 miles north-northeast	Minor source, potential emissions less than 100 tons per year.

A summary report regarding local air issues in the Sault Ste. Marie area prepared in part for the USEPA and MDNRE describes the two major sources listed in Table 3-6, Dafter Sanitary Landfill, a VOC source, and the Michigan Department of Corrections, a SO_2 and PM source (Potvin Air Management Consulting, 2006). The other sources are minor sources are not expected to contribute to air quality issues at the proposed project site.

3.6.1.2 Odor

Other than the Dafter Sanitary Landfill, Inc., the nearby sources as described above are expected to generate a minimal amount of odor associated with their operations. The Dafter Sanitary Landfill is 3.5 miles from the proposed site, so it would not be expected to contribute odors to the proposed project site.

3.6.1.3 Forest Sequestration of CO_2

Terrestrial carbon sequestration is the process through which CO_2 from the atmosphere is absorbed by trees, plants and crops through photosynthesis, and stored as carbon in biomass (tree trunks, branches, foliage and roots) and soils. The term "sinks" is also used to refer to forests, croplands, and grazing lands, and their ability to sequester carbon. Agriculture and forestry activities can also release CO_2 to the atmosphere. Therefore, a carbon sink occurs when carbon sequestration is greater than carbon releases over some time period.

There are three general means by which forestry practices can reduce greenhouse gases:

1. avoiding emissions by maintaining existing carbon storage in trees and soils;
2. increasing carbon storage by, e.g., tree planting; and
3. substituting bio-based fuels and products for fossil fuels, such as coal and oil, and energy-intensive products that generate greater quantities of CO_2 when used.

Carbon sequestration rates vary by tree species, soil type, regional climate, topography and management practice. In the U.S., fairly well-established values for carbon sequestration rates are available for most tree species. Changes in forest management (e.g., lengthening the harvest-regeneration cycle) generally result in less carbon sequestration on a per acre basis.

Carbon accumulation in forests and soils eventually reaches a saturation point, beyond which additional sequestration is no longer possible. This happens, for example, when trees reach maturity, or when the organic matter in soils builds back up to original levels before losses occurred. Even after saturation, the trees would need to be sustained to maintain the accumulated carbon and prevent subsequent losses of carbon back to the atmosphere.

Table 3-7 - Representative Carbon Sequestration Rates and Saturation Periods for Key Forestry Practices

Activity	**Representative carbon sequestration rate in U.S.**(Metric tons of C per acre per year)	**Time over which sequestration may occur before saturating** (Assuming no disturbance, harvest or interruption of practice)	**References**
Afforestation [a)]	0.6 – 2.6 [b)]	90 – 120+ years	Birdsey 1996
Reforestation [c)]	0.3 – 2.1 [d)]	90 – 120+ years	Birdsey 1996
Changes in forest management	0.6 – 0.8 [e)]	If wood products included in accounting, saturation does not necessarily occur if C continuously flows into products	Row 1996
	0.2 [f)]		IPCC 2000

a) Values are for average management of forest after being established on previous croplands or pasture.

b) Values calculated over 120-year period. Low value is for spruce-fir forest type in Lake States; high value for Douglas Fir on Pacific Coast. Soil carbon accumulation included in estimate.

c) Values are for average management of forest established after clearcut harvest.

d) Values calculated over 120-year period. Low value is for Douglas Fir in Rocky Mountains; high value for Douglas Fir in Pacific Coast. No accumulation in soil carbon is assumed.

e) Select examples, calculated over 100 years. Low value represents change from 25-year to 50-year rotation for loblolly pines in Southeast; high value is change in management regime for Douglas Fir in Pacific Northwest. Carbon in wood products included.

f) Forest management here encompasses regeneration, fertilization, choice of species and reduced forest degradation. Average estimate here is not specific to U.S., but averaged over developed countries.

g) Any associated changes in emissions of methane (CH_4) nitrous oxide (N_2O) or fossil CO_2 are not included.

Afforestation is planting seeds or trees to make a forest on land which has not been a forest recently, or which has never been a forest. Reforestation is the reestablishment of a forest after removal, for example from a timber harvest.

3.6.2 Environmental Consequences of the No Action Alternative

3.6.2.1 Ambient Air Quality

The proposed property would remain undeveloped and the beneficial production of cellulosic ethanol would not occur. No changes in air quality would occur.

3.6.2.2 Odor

The proposed property would remain undeveloped, and the beneficial production of cellulosic ethanol would not occur. No changes in odor would occur.

3.6.2.3 Greenhouse Gases

Point Source GHG Analysis

The proposed property would remain undeveloped, and the beneficial production of cellulosic ethanol would not occur. The sequestration of approximately 30,000 tons of CO_2e due to reforestation and the reduction of up to 333,247 tons of biogenic CO_2e per year would not occur.

3.6.3 Environmental Consequences of the Proposed Action

Section 176(c) of the CAA (42 U.S.C. 7506(c)) requires any entity of the Federal government that engages in, supports, or in any way provides financial support for, licenses or permits, or approves any activity to demonstrate that the action conforms to the applicable State Implementation Plan required under Section 110(a) of the CAA (42 U.S.C. 7410(a)) before the action is otherwise approved. In this context, conformity means that such Federal actions must be consistent with a State Implementation Plan's (SIP) purpose of eliminating or reducing the severity and number of violations of the NAAQS and achieving expeditious attainment of those standards. Each Federal agency must determine that any action that is proposed by the agency and that is subject to the regulations implementing the conformity requirements will, in fact, conform to the applicable SIP before the action is taken. The proposed project is sponsored and supported by DOE and must therefore be reviewed for general conformity. Because the proposed project would be in an area that is in attainment for all criteria pollutants, it would meet the conformity requirements of the *Clean Air Act*.

The environmental impacts as a result of the Proposed Action due to the construction and operation of the Frontier project would be an increase in the amount of air pollutants emitted. As discussed in the paragraphs below, the increase in emissions would not cause or contribute to an exceedance of the NAAQS nor would the emissions of Toxic Air Contaminants (TACs) exceed existing Michigan standards.

Emissions during construction would consist primarily of fugitive dust generated by site grading and vehicles moving on the site and exhaust emissions from construction equipment and trucks. The primary risks from blowing dust particles relate to human health and human nuisance values. Fugitive dust can contribute to respiratory health problems and create an inhospitable working environment. Deposition on surfaces can be a nuisance to those living or working downwind. Dust emissions would be minimized by using appropriate fugitive dust control measures, such as road watering, temporary vegetative cover, or dust suppressants, as needed. Therefore, impacts to air quality during the construction phase of the project would be minor and temporary.

Potential emissions during operations would come from several sources. Fugitive dust would be generated by vehicle traffic hauling raw materials and finished products to and from the site. These emissions would be minimized by paving, enforcing a 10 mile per hour speed limit, and by maintaining the roads as needed. Fugitive dust would also be generated from the wood chip receiving, and lignin loadout operations and would be reduced by best operating practices such as unloading the wood chips inside the chipping building or the use of water to suppress dust on roads.

Trains bringing materials to and from the facility would not cause fugitive emissions. Emissions would be generated from combustion of fuel. However, each rail car would displace at least two trucks. Therefore, analysis of truck traffic and impacts represents the worst case scenario.

The fermentation and ethanol distillation systems would generate emissions of VOC and HAPs, including acetaldehyde, formaldehyde, and methanol. These pollutants would be controlled by venting the exhaust gases from these processes through wet scrubbers that would remove approximately 98% of the VOC and 75% of the HAPs. Ethanol storage and loadout operations would also generate emissions of VOC and HAPs. Storage tank emission would be controlled by use of floating roof design where required. Loadout emissions would be controlled by a flare.

Approximately 50 gpm of water would be evaporated from the process and discharged to the air. However, water vapor is not a pollutant and is not regulated by the MDNRE or USEPA.

The biomass boiler and generators would generate PM, PM_{10}, NO_X, SO_X, CO, VOC, and HAPs from combustion. The lignin dryer would generate PM, PM_{10}, CO, VOC, and HAPs from the drying operations. Table 3-8 summarizes the potential to emit from the Frontier Project.

Table 3-8 - Summary of the Frontier Project Potential to Emit

Pollutant	Frontier Renewable Resources
NO_X	229.3 tpy
VOC	145.2 tpy
CO	186.9 tpy
PM	200.1 tpy
PM_{10}	140.9 tpy

Pollutant	Frontier Renewable Resources
$PM_{2.5}$	113.1 tpy
SO_2	42.6 tpy
Acetaldehyde	9.49 tons/year
Total HAPs	21.27 tons/year

As noted in Section 3.3.1.1, the USEPA has established and the MDNRE has adopted under its SIP the NAAQS for criteria air pollutants. The NAAQS include two types of air quality standards. Primary standards protect public, including the health of sensitive populations such as asthmatics, children, and the elderly. Secondary standards protect public welfare, including protection against decreased visibility, damage to animals, crops, vegetation, and buildings (USEPA, 2009A). The MDNRE requires new facilities that would have air pollutant emissions to acquire an air permit to construct prior to beginning construction for sources that are not exempt by MDNRE rules. The MNDRE issued an air permit for the proposed Frontier Project in 2010. Since that date, Frontier has revised the project plan to include use of a biomass CHP system. A modification application to the air permit would be required. The application would be submitted to the MDNRE for review. As part of the permitting process, the MDNRE would require that an ambient air quality modeling analysis be completed.

Frontier completed a refined dispersion modeling analysis, for the initial project configuration, to determine if the net emissions increase from the proposed project would have a significant impact on ambient air quality. Significant impacts were modeled for PM_{10}, SO_2, and NO_2, but not CO. Therefore, CO was not included in the NAAQS analysis. As shown on Table 3-9 the NAAQS analysis demonstrated that the Frontier Project would not cause or contribute to an exceedance of the NAAQS. A VOC analysis is not included in this analysis because NAAQS have not been established for this pollutant.

Table 3-9 – Summary of Ambient Air Quality Impacts from the Frontier Project

Pollutant	Primary Standards	Averaging Times	Frontier Project Results
Nitrogen Dioxide	100 µg/m^3	Annual (Arithmetic Mean)	14.9 µg/m^3
PM_{10}	150 µg/m^3	24-hour	20.7 µg/m^3
$PM_{2.5}$	15.0 µg/m^3	Annual (Arithmetic Mean)	3.7 µg/m^3
	35 µg/m^3	24-hour	20.7 µg/m^3
Sulfur Oxides	78 µg/m^3	Annual (Arithmetic Mean)	7.5 µg/m^3
	364 µg/m^3	24-hour	68.0 µg/m^3
	1300 µg/m^3	3-hour	244.9 µg/m^3

As part of the air permit modification application, a supplemental NAAQS modeling analysis would be completed. A modified permit would not be issued by the MDNRE unless the modeling analysis shows that the modified facility would not cause or contribute to an exceedance of the NAAQS.

Michigan requires that all facilities that emit Toxic Air Pollutants (TACs) complete an analysis to demonstrate compliance with the State rule that prohibits the emission of any TAC in excess of a rate that results in a maximum ambient impact which is more than a health-based screening level. Based on a combination of screening level analysis and refined modeling analysis, Frontier demonstrated compliance with the TAC requirements for the TACs listed in Table 3-10.

Table 3-10 - List of Toxic Air Contaminants Emitted

Acetaldehyde	Cumene	Mercury
Acrolein	Ethanol	Methanol
Arsenic	Ethylbenzene	Napththalene
Benzene	Formaldehyde	Nickel
Beryllium	Gasoline	Propionaldehyde
Cadmium	Hexane	Selenium
Carbon Disulfide	Lead	Toluene
Chromium	Manganese	Xylenes
Cobalt		

3.6.3.1 Odor

This project would have potential odor sources including green biomass storage, lignin drying, and the fermentation system. The potential odors from green biomass storage would be from the degradation of the wood due to moisture and bacterial/fungal action. The Frontier Project would control these odors by minimizing the amount and duration of green wood chip storage. Under normal operations, green wood chips would be stored for less than 3 days which is not enough time for odors from degradation to become noticeable off-site.

The potential odors from lignin drying are VOCs. VOC emissions from lignin drying are directly related to the temperature in the dryer and moisture content of the lignin. Frontier would control odors from lignin drying by limiting the temperature of the dryer to approximately 185°F and the moisture content of the lignin to approximately 30%.

The potential odors from the fermentation system are VOCs. These compounds would be controlled using a wet scrubber similar to a conventional ethanol facility. The control system assures that VOCs and the associated odors would not be released into the atmosphere during normal operations.

The combination of pollution control equipment operation, operating procedures, and the distance to the nearest residence (2,600 feet south of the southernmost property boundary) would effectively manage odors from the biorefinery.

3.6.3.2 Greenhouse Gases

Point Source GHG Analysis

The Frontier Project would generate GHGs from the fuel combustion in boilers and the fermentation system. Combustion of biomass results in biogenic CO_2 emissions. Combustion of natural gas results in emissions of anthropogenic CO_2. CO_2 emissions from fermentation are biogenic sources of CO_2 emissions. Biogenic sources are natural sources of CO_2 and are typically considered part of the natural carbon cycle and, therefore, not an increase in global GHG emissions.

Table 3-11 summarizes the potential emissions of GHGs from the Frontier Project. Combustion emissions do not include the emergency generators.

Table 3-11 - Summary of Current Potential to Emit for Greenhouse Gases

Greenhouse Gases	Combustion (Anthropogenic)	Fermentation (Biogenic)	Total
CO_2	7,600 tons/year	458,484 tons/year	466,284 tons/year
Methane	36 tons/year	0 tons/year	36 tons/year
N_2O	0.6 tons/year	0 tons/year	0.6 tons/year

Emissions of combustion GHGs are a function of the amount of fuel combusted. The emissions of process related GHGs are a function of the amount of ethanol produced. Therefore, emissions of GHGs are not expected to be higher during start up or shut down conditions than during normal operations.

Life Cycle GHG Analysis

Michigan Technological University (MTU) completed a life cycle analysis for GHG emissions from the proposed Frontier Project using the most recent version of the SimaPro LCA program and database (Pre' Consultants v7.2, 2010). The analysis was conducted on a biomass harvest to ethanol end use basis. Emission of all greenhouse gases (CO_2, CH_4, N_2O, refrigerants, and solvents) were weighted according to their 100-year global warming potentials (GWPs) to arrive at the final GHG results. The LCA information was presented as CO_2 equivalent emission per gallon of ethanol produced (CO_2e/gal). Included in the analysis was:

1. Fuel and miscellaneous chemical (lubricants, hydraulic oil, etc) use for the harvest of wood;
2. Fuel and miscellaneous chemical use for transportation of wood from the harvest area to the proposed Frontier site;
3. Fuel and miscellaneous chemical use in the wood yard at the proposed Frontier site to handle, store and move the wood into the process;
4. GHG emissions for purchased electric power using a Michigan specific blend of power production and related GHG emission factors;
5. Fuel used in the ethanol production process;
6. Transport and use of process chemicals and yeast nutrients;
7. Transport of denaturant to the proposed Frontier site;
8. Transport of ethanol to the blending facility in Traverse City, MI; and
9. Transport and end use of the bark and spent lignin from the process.

The Frontier Project was modeled based on the production of 40 mgy of anhydrous ethanol (42.5 mgy denatured ethanol). The model assumed that all of the bark and 80% of the spent lignin was used for on-site steam production and electric power production. The remaining 20% of the spent lignin was assumed to be sold off-site as a fuel to power and/or steam production facilities to offset use of coal as a fuel. In accordance with current LCA practices biogenic CO_2e emissions were not included in the analysis.

The proposed Frontier Project yields a net reduction of CO_2e emissions of 1.34 lbs CO_2e/gal anhydrous ethanol or 26,822 tons per year.

Forest Sequestration of CO_2

The expectation is that the biomass for the Frontier project would be derived from existing, previously harvested forest resources and that existing agricultural land would not be converted to forest. The assumed harvest rotation and re-entry for the species of interest is assumed to be approximately 15 to 20 years. Natural regeneration of the forest would result in a net sequestration of approximately 30,000 tons of CO_2 per year.

3.7 Geology and Soils

This section discusses only the geology and soils on or related to the proposed project site and rail corridor. Due to the existing environmental review and protection processes for the harvest area discussed in Section 3.1, no impacts to geology and soils are expected to occur in the harvest areas for the feedstock.

3.7.1 Affected Environment

3.7.1.1 Geology

The ground surface of eastern Chippewa County was shaped by glacial processes during the Pliestocene age. The glacial drift of the Wisconsin Age is the youngest and most completely preserved of the deposits from at least four glacial advances during the Pliestocene. The deposits of Wisconsin age consist of moraine, outwash, and lacustrine deposits in eastern Chippewa County. Much of eastern Chippewa County was covered by waters of glacial Lake Algonquin. This lake was an early stage of the modern great lakes system, and was present during the final retreat of the glacial ice from the area. Glacial deposits consist of till, outwash sand and gravel, lacustrine sand, gravel, and clay, and peat and muck.

At the project site, the glacial deposits have been mapped (Farrand and Bell, 1982) as coarse-textured glacial till and lacustrine sand and gravel. These deposits are described as:

> *Coarse-textured glacial till* – gray, grayish brown or reddish brown, non-sorted glacial debris; matrix is dominantly sandy clay loam, sandy loam, or loamy sand texture, locally resembles outwash except for sporadic occurrences of non-sorted clayey or silty lenses and lack of stratification; variable amounts of cobbles and boulders. Occurs as ground moraine, till plain or undifferentiated ground moraine-end moraine complexes.
>
> *Lacustrine sand and gravel* – pale brown to pale reddish brown, fine to medium sand, commonly including beds or lenses of small gravel, chiefly quartz sand, but gravel is rich in igneous and metamorphic rocks. Occurs chiefly as former beach and near-offshore littoral deposits of glacial Great Lakes, and may include intercalated lacustrine clay.

The unconsolidated glacial deposits have been determined to be between 100 and 200 feet thick.
Bedrock beneath the site consists of shale and limestone formations, located on the northern portion of the Michigan Basin. The rocks within the Michigan Basin consist of sandstones, limestone, dolomite, shale, and associated evaporate rocks (salt, gypsum), and rest unconformably on crystalline igneous and metamorphic rocks of Precambrian age. In this portion of the Michigan Basin (eastern Chippewa County), rocks dip gently to the south, toward the center of the basin. Precambrian rocks outcrop to the north of Sault Ste. Marie, north of the international border. The bedrock beneath the eastern portion of Chippewa County becomes progressively younger to the south, and consists (north to south) of Precambrian basement, sandstones of Cambrian age, limestone and sandstone formations of early to middle Ordovician age, shale and limestone of late Ordovician age, and limestones and dolomites of early to middle Silurian age.

The bedrock beneath the project site consists of shale and limestone of middle to late Ordovician age. Rocks are predominantly shale, and are part of the Collingwood/Utica Shale Formation. No bedrock is exposed, and is covered by unconsolidated glacial deposits between 100 and 200 feet thick. These rocks consist of a sequence of black to dark brown thin-bedded bituminous and gray limey to dolomitic shales. Thickness of the formation averages approximately 250 feet beneath eastern Chippewa County. Limestone of the Trenton

Group (middle Ordovician age) underlie the shales, and shaley limestone and limestone of the Stonington Formation overlie the shales to the south.

Areas of karst are present in the eastern Upper Peninsula of Michigan. These areas are located mainly in Mackinac, Schoolcraft, and Delta Counties. Some karst features are also developed in extreme southwestern Chippewa County, as well as far southeastern Chippewa County, near the eastern tip of the peninsula, near Drummond Island. The closest areas of karst terrain are more than 20 miles from the project site. All of the karst terrain in upper Michigan is developed in limestone and dolomite of Silurian age. These rocks are younger in age, and do not occur beneath the project site. The rocks beneath the project site are not favorable to the development of karst features. Therefore, hazards related to karst topography should not be expected at the project location.

Earthquakes are rare in Michigan, but do occur. Over the past 140 years, only about a dozen earthquakes have occurred in the state. Of these, the disturbances located within the Upper Peninsula have been located in the Keweenaw Peninsula, and were attributed to underground mining activities. Several earthquakes have occurred in the southern half of the Lower Peninsula, with the most recent occurring in 1994 near Lansing. Therefore, the overall probability of an earthquake in Michigan is very low. The United States Geological Survey (USGS) National Seismic Hazard Maps estimate the likely shaking for a given area. These maps indicate that Upper Michigan is in the lowest hazard rating, with a level of shaking of 0 to 4% g (acceleration of a falling object due to gravity) that have a 2-in-100 chance of shaking within a 50-year period.

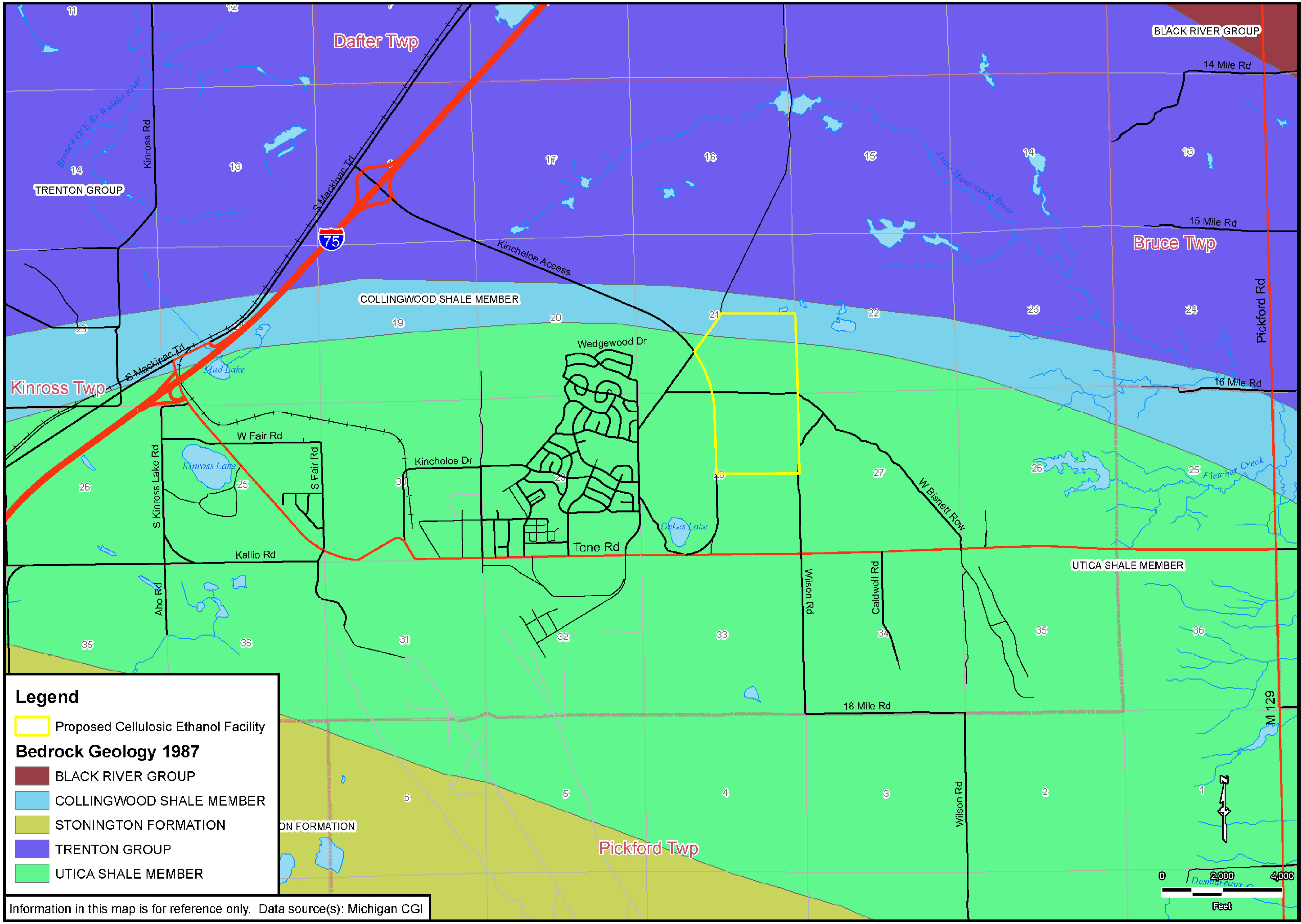
Figures 16 and 17 provide maps of bedrock and quaternary geology of the Frontier project site.

3.7.1.2 USDA Mapped Soil Conditions

According to the Natural Resource Conservation Service (NRCS) SSURGO Geographic Soil Database for Chippewa County, Michigan, soil series' found within the project site boundaries include Rousseau fine sand (0-6% slopes), Alcona loamy very fine sand (0-6% slopes), Kalkaska sand (0-6% slopes), Croswell-Au Gres sands (0-3% slopes), Dawson and Loxley peats, and Kinross-Wainola Complex soils (0-3% slopes) (NRCS, 2008). Figure 18 depicts the project location overlain on the NRCS soils map and the 2005 aerial photo. Also provided in Figure 7 is a table indicating the percent of hydric soils that area contained in each map unit, its ponding frequency and drainage class. No prime farmlands are present on the proposed site or rail corridor.

Rousseau soils are by far the most prevalent soil type on the Frontier project site, covering all areas except the northeastern and northwestern corners, a small north-central region, and the extreme southeast and southwest property corners. Rousseau soils are well-drained, nearly level to gently sloping fine sands that are generally encountered on till-floored lake plains and outwash plains. The soil profile is consistently fine sand from 0 to 60+ inches below ground surface. Rousseau soils have a high saturated hydraulic conductivity (K_{sat}) and are not frequently subject to ponding (0-14% of the time). This soil is not described as hydric by NRCS, and does not contain inclusions of hydric soils. Native vegetation generally includes upland deciduous and evergreen forest species such as maple, hemlock and woodfern (NRCS, 2008).

Alcona loamy very fine sands are found solely in an isolated area in the north-central portion of the project site. These soils are moderately well-drained, nearly level to gently sloping, loamy very fine sands. They are commonly found on dissected moraines and till-floored lake plains. The Alcona series soil profile is stratified loamy very fine sands and very fine sandy loams from 0 to 55 inches, with stratified fine sands and silty clay loams found from 55 to 60+ inches. Due to the significant depth of the silty clay loam layers (potential limiting layer), and moderately high to high K_{sat}, Alcona soils are not commonly subject to ponding (0-14% of the time). Saturated zones can occur between 30 and 72 inches below ground surface. This information lends itself to the fact that NRCS does not designate Alcona soils as hydric, and they are not found to contain hydric soil inclusions. Vegetation commonly encountered in Alcona soil regions are the same to those found in Rousseau soil regions (deciduous and evergreen upland forest) (NRCS, 2008).



Information in this map is for reference only. Data source(s): Michigan CGI

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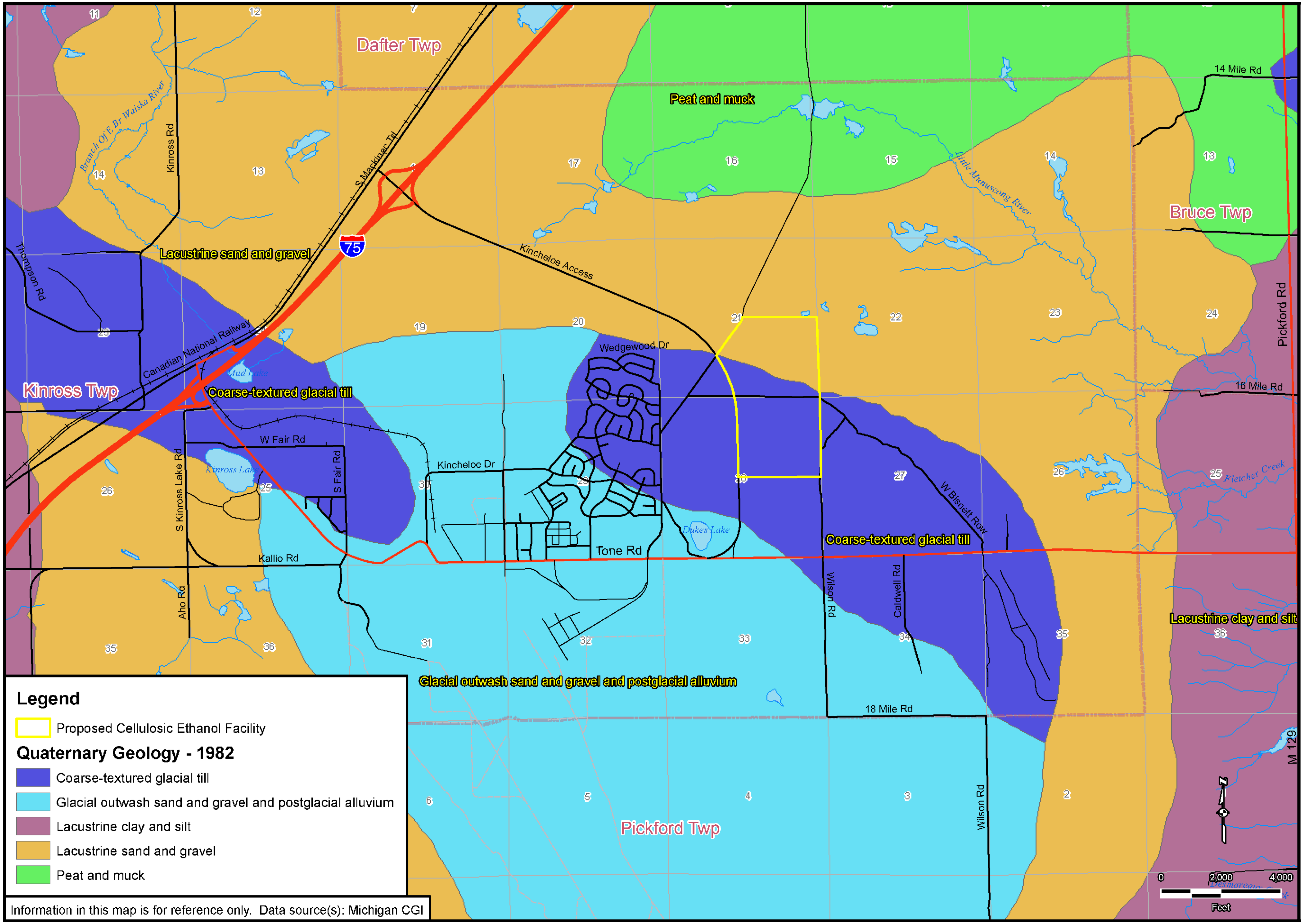
BEDROCK GEOLOGY
FRONTIER RENEWABLE RESOURCES, LLC
CELLULOSIC ETHANOL FACILITY
KINROSS TOWNSHIP, CHIPPEWA COUNTY, MICHIGAN

Drawn: JWW 2/17/2009
Approved: LDK 2/17/2009
Scale: 1"=3,000'
PROJECT NUMBER 60140061
FIGURE NUMBER 16



Legend

☐ Proposed Cellulosic Ethanol Facility

Quaternary Geology - 1982

- 🟦 Coarse-textured glacial till
- ▨ Glacial outwash sand and gravel and postglacial alluvium
- 🟪 Lacustrine clay and silt
- 🟧 Lacustrine sand and gravel
- 🟩 Peat and muck

Information in this map is for reference only. Data source(s): Michigan CGI

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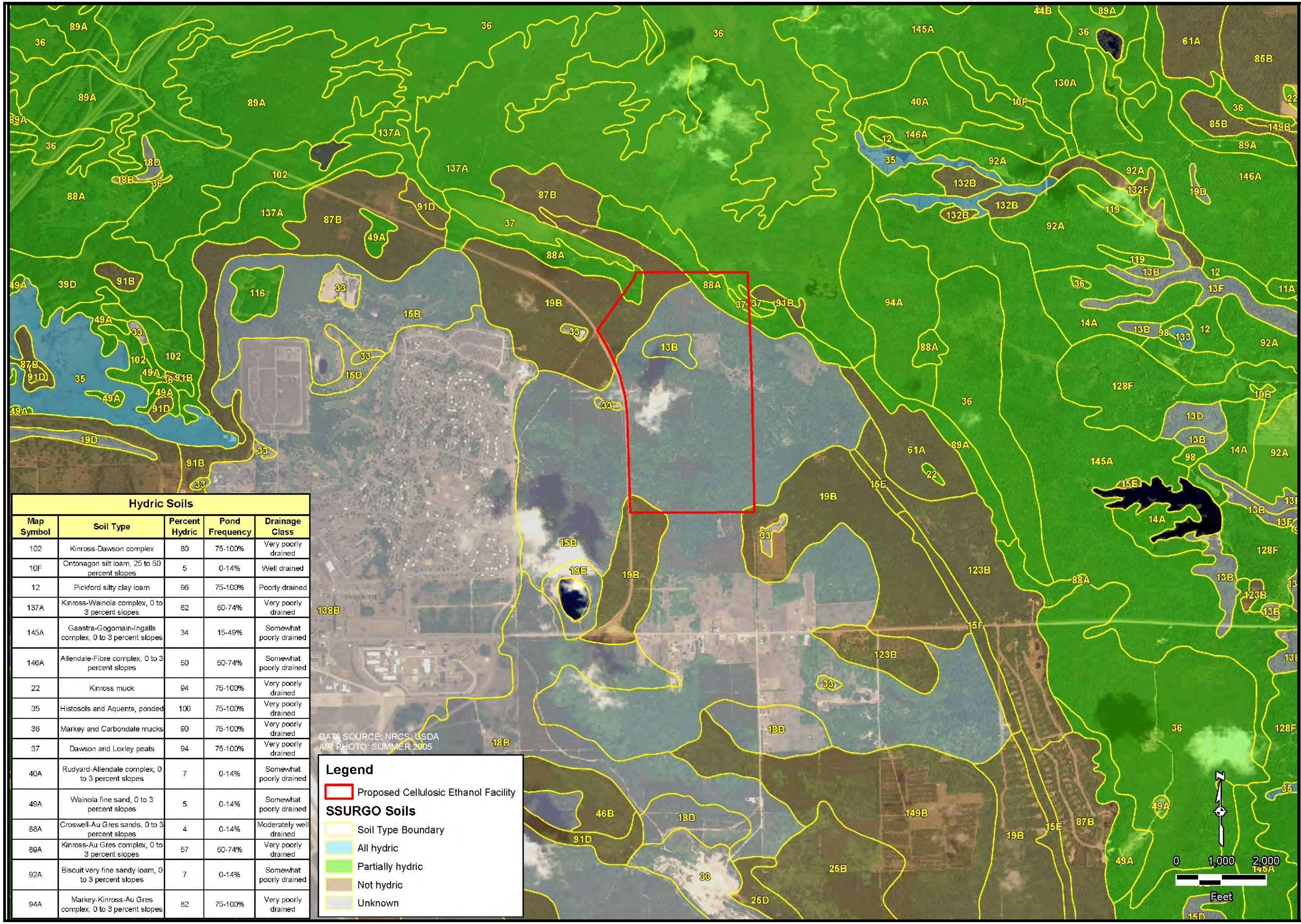
QUATERNARY GEOLOGY
FRONTIER RENEWABLE RESOURCES, LLC
CELLULOSIC ETHANOL FACILITY
KINROSS TOWNSHIP, CHIPPEWA COUNTY, MICHIGAN

Drawn:	JWW	2/17/2009
Approved:	LDK	2/17/2009
Scale:	1" = 3,000'	
PROJECT NUMBER	60140061	
FIGURE NUMBER	17	



DATA SOURCE: NRCS, USDA
AIR PHOTO: SUMMER 2005

Hydric Soils

Map Symbol	Soil Type	Percent Hydric	Pond Frequency	Drainage Class
102	Kinross-Dawson complex	80	75-100%	Very poorly drained
10F	Ontonagon silt loam, 25 to 50 percent slopes	5	0-14%	Well drained
12	Pickford silty clay loam	96	75-100%	Poorly drained
137A	Kinross-Wainola complex, 0 to 3 percent slopes	62	50-74%	Very poorly drained
145A	Gaastra-Gogomain-Ingalls complex, 0 to 3 percent slopes	34	15-49%	Somewhat poorly drained
146A	Allendale-Fibre complex, 0 to 3 percent slopes	50	50-74%	Somewhat poorly drained
22	Kinross muck	94	75-100%	Very poorly drained
35	Histosols and Aquents, ponded	100	75-100%	Very poorly drained
36	Markey and Carbondale mucks	90	75-100%	Very poorly drained
37	Dawson and Loxley peats	94	75-100%	Very poorly drained
40A	Rudyard-Allendale complex, 0 to 3 percent slopes	7	0-14%	Somewhat poorly drained
49A	Wainola fine sand, 0 to 3 percent slopes	5	0-14%	Somewhat poorly drained
88A	Croswell-Au Gres sands, 0 to 3 percent slopes	4	0-14%	Moderately well drained
89A	Kinross-Au Gres complex, 0 to 3 percent slopes	57	50-74%	Very poorly drained
92A	Biscuit very fine sandy loam, 0 to 3 percent slopes	7	0-14%	Somewhat poorly drained
94A	Markey-Kinross-Au Gres complex, 0 to 3 percent slopes	82	75-100%	Very poorly drained

Legend

🟥 Proposed Cellulosic Ethanol Facility

SSURGO Soils

☐	Soil Type Boundary
▨	All hydric
🟩	Partially hydric
▨	Not hydric
▨	Unknown

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NRCS SOIL SURVEY MAP
FRONTIER RENEWABLE RESOURCES, LLC
CELLULOSIC ETHANOL FACILITY
KINROSS TOWNSHIP, CHIPPEWA COUNTY, MICHIGAN

Drawn:	SJE	2/13/2009
Approved:	LDK	2/13/2009
Scale:	1" = 2,000'	
PROJECT NUMBER	60140061	
FIGURE NUMBER	18	

Found in the far northwestern portion of the Frontier project site, as well as the extreme southwestern and southeastern property corners, Kalkaska soils are an even more well-drained sandy soil than Rousseau or Alcona soils. This can be attributed to the courser texture of this soil (sand versus fine sand) and the general lack of loamy fines. Kalkaska soils are described by NRCS as somewhat excessively drained and nearly level to gently sloping. This soil type is commonly encountered in undulating areas on outwash terraces, outwash plains, and moraines. The soil profile is consistently sand from 0 to 60+ inches, with the exception of a zone of loamy sand from 7 to 9 inches. Saturation is not encountered within the documented soil profile (0 to 60 inches), which contributes to Kalkaska's high to very high K_{sat}. This soil's ponding frequency is very low at 0 to 14 percent. Additionally, this soil is not designated as hydric by NRCS, nor does it contain inclusions of soils that are hydric. Native vegetation generally includes upland deciduous and evergreen forest species such as maple, hemlock and woodfern (NRCS, 2008).

An elongated strip of Croswell-Au Gres sands are mapped across the far northeastern corner of the Frontier project site. These soils are nearly level, moderately well-drained to somewhat poorly drained sands that are commonly found on outwash plains, outwash terraces, and till-floored lake plains. The soil profile of this series is consistently sand from 0 to 60 inches. This soil's hydraulic conductivity falls within the high to very high ranges, with saturation occurring at approximately 6 to 42 inches below the surface. Surface water ponding on Croswell-Au Gres soils is not frequent at 0 to 14 percent. This soil series is not, in itself, considered to be hydric. However, this soil series can contain up to 4 percent Kinross soils, which are known to be hydric by NRCS. Vegetation common to the Croswell-Au Gres soils areas include hemlock and mayflower (NRCS, 2008).

Dawson and Loxley peat soils can be found in the far northeastern corner of the project site, to the northeast of the Croswell-Au Gres soil area. These soils are nearly level, very poorly drained peat and muck. They are commonly found in bogs and depressions on lake plains, moraines, and outwash plains. The soil profile of the Dawson series has 18 inches of peat and muck overlying a fine sand layer from 19 to 60 inches. The Loxley portion of the soil series has a profile that contains peat from 0 to 10 inches, and muck from 10 to 60+ inches, with the difference between muck and peat being the level of decomposition that has occurred to the soil's organic matter (muck is more decomposed and does not have visible organic components such as roots, wood, etc.). The water table is commonly at the surface in both Dawson and Loxley soils, and they are both frequently ponded (75-100% of the time). Their hydraulic conductivity ranges from high to moderately high. Additionally, both of these soils are considered hydric by NRCS. Up to 4 percent of the Dawson and Loxley soil series can contain Kinross soils, which is also considered hydric. Vegetation found growing within these soils are typical of bog habitats and include spruce, leatherleaf and sphagnum (NRCS, 2008).

The extreme northeastern corner of the Frontier project site contains areas of Kinross-Wainola Complex soils, intermixed among the Dawson and Loxley soil areas. Kinross-Wainola soils are nearly level, somewhat to very poorly drained soils that are commonly found in depressions and drainageways on outwash plains, moraines, and till-floored lake plains. This soil series contains approximately 60 percent Kinross soils and 37 percent Wainola and other soils. The Kinross soil profile contains 5 inches of muck on top of sand that is consistent in texture and composition, and extends to 60+ inches below ground surface. Wainola soils are finer in texture (fine sands) and remain consistent from the surface to 60+ inches below the surface. Both soil types have high to very high hydraulic conductivity, and typically have a water depth from 18 to 0 inches below the surface. Kinross-Wainola complex soils are ponded 50 to 74 percent of the time. The Kinross portion of the soil complex is considered hydric by NRCS, and comprises approximately 60 percent of the map unit's area. Wainola soils are not listed as hydric. However, this soil series can also contain up to 4 percent Dawson soils, which are also considered hydric. Vegetation typically encountered in Kinross-Wainola soil regions include hemlock, cedar, mayflower and threeleaf goldthread (NRCS, 2008).

3.7.1.3 Site Subsurface Exploration

Subsurface exploration of the Frontier site was completed by U.P. Engineers and Architects (UPEA) from December 15 to 18, 2008. This included completion of a total of 16 borings that ranged from 30 to 100 feet in depth. Standard split-spoon samples were collected at 2.5-foot intervals from 0 to 10 feet below the ground surface (bgs), and at 5-foot intervals from 10 feet bgs to the boring end depth. All 16 borings were found to have consistent mixtures of medium to fine sands that were clean and uniform. Some of these sands were found to have traces of gravels, silts or clays, and in one location, organics (SB-2). The water table was not encountered in any of the borings, including the boring of 100-foot depth. These findings generally coincide with the map-based findings of Sections 2.4.1 and 2.4.2 above. The report, including soil boring logs and soil boring location maps, are provided in Appendix B.

3.7.2 Environmental Consequences of the No Action Alternative

The No Action Alternative would not affect the geology and soils of the area.

3.7.3 Environmental Consequences of the Proposed Action

The Frontier project would include development of approximately 50 acres of the 355 acre site, currently vacant wooded area. This would require grading, excavating, and site development activities. Frontier would develop a Soil Erosion and Sedimentation Control Plan (SESC) to prevent excess erosion or degradation of the site during construction activities. Requirements of the SESC plan are discussed in Section 3.6.3.3.

Upon completion of all construction activities, disturbed areas would be seeded with native grass mix. Additional topsoil may be imported and placed to aid in the establishment of stable surface vegetation. Areas that were cleared of trees and brush to allow for construction will be stabilized, graded, and contoured as appropriate to match the surrounding environment and allowed to reforest naturally.

3.8 Water Resources

This section discusses only the water resources on or related to the proposed project site and rail corridor. Due to the existing environmental review and protection processes for the harvest area discussed in Section 3.1, no impacts to water resources are expected to occur in the harvest area for the feedstock.

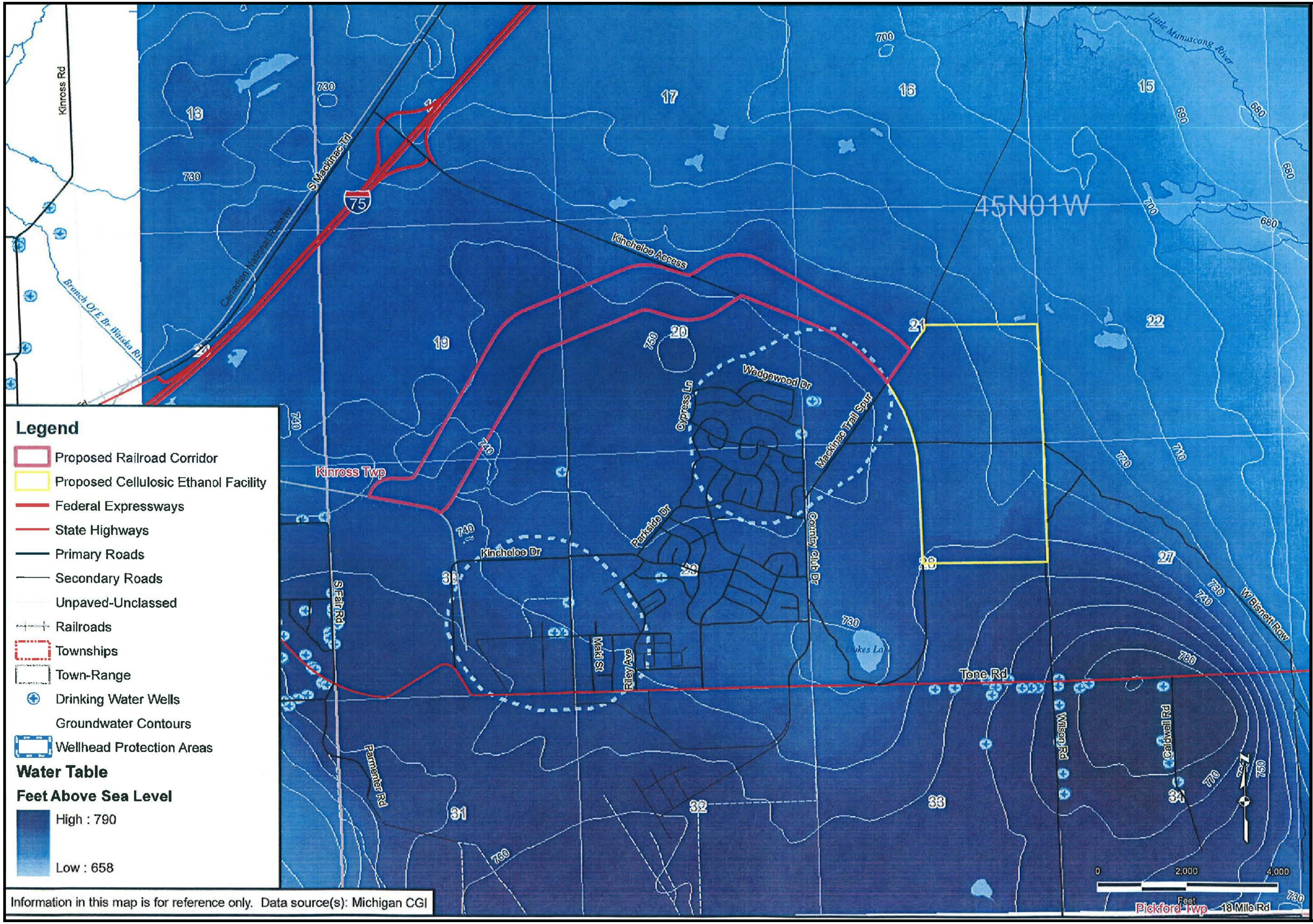
3.8.1 Affected Environment

3.8.1.1 Groundwater

Groundwater in the Frontier project area is used for municipal, residential and agricultural purposes. Private wells are drilled into sand and gravel layers within the area’s till and lacustrine deposits. Most wells are 80 to 120 feet deep, and obtain water from sand and gravel aquifers (Vanlier and Deutsch, 1958). Figure 19 provides the water table elevation of the glacial aquifer in the project area, as well as the locations of known private wells. As can be seen from this figure, the majority of local private wells are clustered in residential areas along Tone Road and to the west of the Frontier project site. The water table elevation in the project area ranges from 720 to 740 feet above sea level. The resulting depth to water table varies from >75 feet in the southern project area to 0-15 feet in the northern project area (MDNRE, 2006). Based on contour shape and configuration, it appears that groundwater flow is in a north to northeast direction across the project site. The highest nearby water table elevations occur near the intersection of Tone and Caldwell Roads (to the southeast of the project site). Water table elevations decrease in all directions from this location.

Based on this information and topographic map data, it appears that the glacially deposited hill that the project site occupies is a recharge area for groundwater. The lowland lacustrine deposits to the north are likely discharge areas to surface water features.

Additional groundwater aquifer information was obtained from the MDNRE’s “Interactive Groundwater Map Viewer.” According to MDNRE, the glacial aquifer yield at the project site ranges from 200 to 1,400 gallons per minute (gpm). Glacial transmissivity can range from 2,000 to 30,300 sq.ft./day. The indicated yield and transmissivity of the local bedrock aquifer are <10 gpm and <500 sq.ft./day, respectively (MDNRE, 2006).



Information in this map is for reference only. Data source(s): Michigan CGI

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WATER TABLE WITH CONTOURS IN FEET
FRONTIER RENEWABLE RESOURCES, LLC
CELLULOSIC ETHANOL FACILITY
KINROSS TOWNSHIP, CHIPPEWA COUNTY, MICHIGAN

Drawn:	JWW	2/17/2009
Approved:	LDK	2/17/2009
Scale:	1" = 2,000'	
PROJECT NUMBER	60140061	
FIGURE NUMBER	19	

Kinross's water distribution system serves the commercial and residential areas immediately to the west of the Frontier project site, as well as the Chippewa County Airport area. This system covers approximately four square miles and serves approximately 6,600 people. This includes approximately 5,300 prison inmates located at the Kinross State Correctional Facility and the Chippewa County correctional facility.

The township currently operates five (5) wells ranging in production from 450 gpm to 900 gpm and depths from 175 to 212 feet. The theoretical firm rated capacity of the system is approximately 2,300 gpm (wells 2, 5 and 6 combined) for a production capacity of 3.312 mgd. The MDNRE firm rated capacity (firm rated capacity as determined by the MDNRE is the maximum system production with the largest well out of service) is 2,000 gpm (wells 2, 5 and 7) or 2.88 mgd. Table 3-12 summarizes the existing wells currently on the system.

Table 3-12 - Existing Kinross Charter Township Well Data

Well Number	Year Constructed	Rated Capacity (GPM)
1	1959	450
2	1959	500
5	1964	900
6	1999	900
7	1999	600

The township reported the annual maximum day condition occurred in 2001 in which 1.75 mgd was consumed. Current community water usage is approximately 1.2 mgd. The theoretical firm rated capacity of the system is approximately 2,300 gpm for a production capacity of 3.312 mgd. The MDNRE firm rated capacity (firm rated capacity as determined by the MDNRE is the maximum system production with the largest well out of service) is 2,000 gpm or 2.88 mgd. Using the firm rated capacity, an excess water system capacity of 1.68 mgd remains (AECOM, 2009).

Overall water quality is very high. In 2002, the Michigan American Water Works Association local chapter awarded the township the best tasting water in Michigan's Upper Peninsula. Hardness, as CaCO3, varies in the source well from 83 mg/L to 96 mg/L. Nitrate as N and Sulfates are present in nominal amounts. There are also trace amounts of constituents such as chloroform and Total Trihalomethanes presents as well.

Wellhead protection zones have been established through MDNRE for all five of the Kinross public supply wells. There are two separate zones established for each group of wells. The nearest wellhead protection zone is adjacent to the Frontier site's northwest property boundary. The locations of these zones are depicted on Figure 18. Two municipal wells were installed by the township in 1999 in the wellhead protection zone adjacent to the Frontier site.

Based on information from the MDNRE office in Newberry, Michigan, fourteen sites of contamination are present in the vicinity of Kinross, the majority of which are related to the former Kincheloe AFB. Two identified environmental sites (State ID#s 17000141 [Kinross Manufacturing] and 171000034 [Former Kincheloe AFB Landfill 01]) are approximately 1.5 miles west of the Frontier site. No other sites of contamination were identified north, east, or south within a 2 mile radius of the Frontier site.

Groundwater potentiometric surface maps from the MDNRE indicate that groundwater flows in an easterly to southeasterly flow direction at the former AFB. Kinross took into consideration the possibility of migration of contamination from sites 1700141 and 17100034 during installation of the two new municipal wells in 1999. Multiple sentinel wells are installed between these two contaminated sites and the new township wells to monitor potential groundwater contaminant migration in the township wells' pumping zone. The sentinel wells are monitored on an annual basis. According to Mr. Scott Schaefer MDNRE Newberry, the sentinel wells have never displayed contaminants which would threaten the water supply wells. According to Mr. Schaefer contamination from these sites is not expected to migrate to the municipal wells.

3.8.1.2 Surface Water

The majority of the Frontier project site is located within the Little Munuscong River watershed, with surface water drainage flowing towards the river and wetlands to the north and east. Small portions of the site near its southern end may drain to the south towards the Munuscong River, but they are unlikely to be significant in size. Both of these rivers flow to the east and drain into Munuscong Lake (the Saint Mary's River) approximately 10 miles to the east. The Little Munuscong River and Demoreaux Creek, a northern tributary of the Munuscong River, are classified as trout streams. Dukes Lake, located less than 0.5 miles to the south is also classified as a trout lake. The nearest portion of the Little Munuscong River, an unnamed tributary, lies approximately 0.7 miles to the northeast of the site. The nearest portion of the Munuscong River, Demoreaux Creek, is approximately 5 miles to the southeast (MDNRE, 2006).

The proposed Frontier project site does not have any naturally occurring water bodies. Neither the Frontier site or rail corridor is in a flood plain.

3.8.1.3 Storm Water

The southern two-thirds of the Frontier project site exist on an elongated glacial deposit that has a surface elevation approximately 8 to 10 feet higher than the northern one-third of the site. The majority of the site has clean, sandy soils that are conducive to high rates of surface water infiltration. The soils in the far northern portion generally have very low infiltration rates and are commonly subject to ponding (NRCS, 2008). As stated previously, it is likely that the majority of rainfall reaching the site would infiltrate into the higher, sandier areas and then discharge in the lower, northern areas. During summer and fall months, significant amounts of surface water runoff may only occur during storm events that are relatively intense, or during prolonged storm events with high rainfall totals. Springtime runoff may be significant due to melting snow and/or rainfall events occurring when the ground surface is still frozen.

Table 3-13 provides a listing of soil types that may be encountered at the Frontier site, along with their corresponding NRCS hydrologic groups. These hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups (A, B, C, D) according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms (NRCS, 2008).

Table 3-13 - Hydrologic Soil Groups Occurring on the Frontier Site (NRCS, 2008)

Soil Series	Hydro Group	Description
Rousseau (15B)	A	High Infiltration Rate, Low Runoff Potential
Alcona (13B)	A	High Infiltration Rate, Low Runoff Potential
Kalkaska (19B)	A	High Infiltration Rate, Low Runoff Potential
Croswell-Au Gres (88A)	A, B	Moderate to High Infiltration Rate, Medium to Low Runoff Potential
Dawson & Loxley Peats (37)	A/D	High Infiltration Rate in Drained Areas (A), Very Slow Infiltration Rate in Undrained Areas (D)
Kinross-Wainola (137A)	A/D, B	High Infiltration Rate in Drained Areas (A), Very Slow to Moderate Infiltration Rate in Undrained Areas (B, D)

The rail corridor contains a mixture of soils described above and some wetland areas as described in Section 3.2. Stormwater from the rail corridor would likely flow into the wetland areas, or into the stormwater ditch adjacent to the Gaines Highway.

3.8.1.4 Wastewater

As the existing Frontier project site is currently undeveloped, no municipal sewer services have been extended into the area. However, Kinross provides sewage collection and treatment services to the residential and commercial area immediately to the west of the Frontier site. The township's wastewater treatment plant is located at the Department of Public Works on Kincheloe Drive west of Water Tower Drive. The treatment system includes removal of large materials with primary screens and a grit chamber, primary sedimentation tanks to remove suspended solids, two stages of trickling filters, chemical flocculent addition (ferric chloride), secondary sedimentation tanks to remove the flocculent following chemical addition and disinfection using chlorine following secondary sedimentation. The WWTP discharges to Hutton Creek under National Pollutant Discharge Elimination System (NPDES) permit #MI0057776 issued to Kinross. Kinross monitors the following parameters in their effluent to demonstrate compliance with the permit.

- Dissolved Oxygen – Quarterly
- BOD – Quarterly
- Suspended Solids – Quarterly
- pH – Quarterly
- Flow – Continuous
- Nitrogen, Ammonia Total – Quarterly
- Phosphorous, Total – Quarterly
- Copper – Biannually
- Residual Chlorine – Quarterly
- Mercury – Quarterly
- Fecal coliform – Quarterly

The existing WWTP underwent $4.5 million in major capital improvements in 1994. The WWTP is permitted by the MDNRE for treatment of a maximum daily flow of 1.1 mgd. At present, treatment of sewage at the WWTP averages 0.85 mgd, leaving an excess capacity of approximately 0.25 mgd. The peak hydraulic surge capacity of the facility is 2.5 mgd (UPEA, 2009). Due to diurnal variances, a significant amount of effluent is recycled to maintain filter efficiency. During these low flow periods, effluent discharge is reduced to increase recycled flows.

3.8.2 Environmental Consequences of the No Action Alternative

The No Action Alternative would have no impact on water resources.

3.8.3 Environmental Consequences of the Proposed Action

3.8.3.1 Groundwater

Frontier would connect to Kinross's municipal water system for potable and process water. The anticipated water demand for the ethanol production capacity would be 150 gpm or 216,000 gpd (0.216 mgd), which would bring the average daily water demand (both municipal and Frontier demands) up to approximately 1.39 mgd. This demand is within the firm rated capacity of 2.88 mgd of the existing system without modification.

Under a maximum day demand scenario, an expected worst case condition of 1.75 mgd for the municipal water system plus the demand of the proposed Frontier biorefinery of 0.216 mgd equates to a total of 1.97

mgd. Thus, even on a peak demand day, the Kinross water system would have an excess capacity of approximately 900,000 gpd.

The existing municipal water sources and elevated water storage offer capacities adequate to serve Kinross Charter Township and Frontier's water demands through a twenty year projected planning period. The water system's five wells produce very high quality water at rates in excess of the current daily averages and in excess of the twenty year projected population water demands. The volume of elevated water storage and the production capacity would sufficiently provide potable water to the proposed Frontier biorefinery.

Preliminary water demand and water system requirements for the proposed Frontier biorefinery are detailed in *The Preliminary Engineering Report for Provision of Municipal Water and Wastewater Services to Frontier Renewable Resources, LLC Cellulosic Ethanol Production Facility*, AECOM, October 2009.

The only potential impacts to the surficial aquifer on-site are accidental releases of hazardous materials from biorefinery operations. The Frontier Project would have operational policies and procedures to manage and store such materials, so that accidental releases should not occur. If an accidental release should occur, the biorefinery would have an SPCC plan to contain, manage, and cleanup the release. These procedures are expected to minimize, to the extent possible, any potential impacts to the surficial aquifer.

Additional mitigation measures for preventing soil and ground water contamination include the development of both a construction SWPPP and an operational SWPPP, for construction and operation of the Frontier Project.

3.8.3.2 Surface Water

There is no naturally occurring surface water on the Frontier project site. Storm water from the project site would be conveyed to the Kinross storm sewer system. Surface water bodies associated with the proposed Frontier biorefinery's storm water collection system (retention or detention ponds, drainage ditches, etc.) may be located on the site.

Therefore, no impacts to surface water are expected as a result of the Proposed Action.

3.8.3.3 Wastewater

With the permitted effluent discharge limit of 1.1 mgd and the current average effluent discharge is 0.85 mgd, there is an excess treatment capacity of approximately 0.25 mgd available. The proposed Frontier biorefinery would discharge approximately 0.14 mgd to the WWTP. Therefore, the current WWTP has the capacity to treat the Frontier effluent without modification provided that the effluent is "Normal Sewage Strength". The remaining process water, about 50 gallon per minute, would be evaporated form the process evaporators or the lignin dryer.

Modifications to the force main system, including upgrades of two lift stations would likely need to be completed to support the flow from Frontier. Due to regional topography, minimum pipe slope requirements and pipe bury depth requirement, it does not appear feasible to convey wastewater from the Frontier site solely via gravity.

The expected wastewater characteristics will be at or below "Normal Sewage Strength" as defined by Kinross as wastewater exhibiting, at the maximum, the characteristics summarized in Table 3-14.

Table 3-14 – Expected Wastewater Effluent Characteristics

Biological Oxygen Demand (BOD) (mg/L)	Suspended Solids (SS) (mg/L)	Total Phosphorous (mg/L)	pH
315	270	8	6.5-9

Kinross will be responsible for monitoring and maintaining compliance with the terms and conditions of their discharge permit. Frontier would need a Significant Discharge Permit from Kinross for their discharge to the WWTP. The Significant Discharge permit would contain the requirements and limits for Frontier's discharge. Mascoma is collecting and analyzing wastewater generated at the Rome, New York pilot plant.

Mascoma Corporation will determine the strength and treatability of the process effluent at their pilot plant in Rome, New York to confirm the ability of the WWTP to adequately treat the Frontier effluent. If the Frontier biorefinery wastewater discharge exceeds allowable discharge rates, it may be necessary to construct an on-site pre-treatment or treatment plant to allow for reuse as service water or discharge as a permitted effluent. Alternatively, it may be permissible to retain Frontier wastewater flows for off-peak discharge to attenuate peaks and valleys in daily flow variations at the Kinross WWTP.

Preliminary wastewater system requirements for the proposed Frontier biorefinery are detailed in the *Preliminary Engineering Report for Provision of Municipal Water and Wastewater Services to Frontier Renewable Resources, LLC Cellulosic Ethanol Production Facility*, AECOM, October 2009.

3.8.3.4 Stormwater

Construction activities would require clearing, grubbing, grading and excavation on the proposed 50 acre biorefinery site and associated rail corridor, currently undeveloped wooded land. These construction activities would expose the soil to stormwater and have the potential to cause sedimentation in the drainage ditches, local tributary to the wetland and the wetland drain and onto South Access Road.

NREPA, 1994 PA 451, Part 91 Soil Erosion and Sedimentation Control require a permit application (including a SESC plan) for all earth change activities which disturb one or more acres of land, or if the earth change is within 500 feet of a lake or stream. A Notice of Coverage under NPDES is also required for disturbances over five acres. Since more than five acres of land would be disturbed for construction of the Frontier biorefinery, a SESC permit and a Notice of Coverage would be required. The Chippewa-East Mackinac Conservation District (CEMCD) is the permitting authority for the MDNRE under Part 91.

The construction contractor would be required to complete the permit application and SESC plan as required by Part 91 for submission to the CEMCD. The construction contractor would also be required to provide a State of Michigan certified storm water operator to inspect the construction activities one each week and 24 hours after a precipitation event to ensure that all soil erosion control measures are operating properly.

The SESC Plan would incorporate best management practices (BMPs) to prevent sedimentation impacts. These BMPs may include:

- Installation of silt fencing
- Installation of hay bales for sediment control
- Construction of temporary, storm water retention ponds
- Retention of vegetative cover where practical.

The proposed Frontier biorefinery would connect to Kinross's storm sewer system. The final design for the proposed Frontier biorefinery would include storm water control structures, drainage, and piping for connection to the Kinross system.

During operation of the Frontier biorefinery, discharge of storm water from the site would require a general permit for discharge of storm water per NPDES regulations. The MDNRE administers the NPDES program in the State of Michigan. General permits are available to facilities that have point source storm water discharges associated with industrial activities. A "point source" is defined as any discernible, confined, and discrete conveyance including, but not limited to, any pipe, ditch, channel, tunnel, conduit, or anything that conveys storm water into surface waters. In most cases, land graded to convey storm water off or across a piece of property would create a point source.

As part of the general permit, Frontier would develop a Storm Water Pollution Prevention Plan (SWPPP). The SWPPP would have three major components:

1. Identification of significant materials that exist at the permitted site and can contaminate storm water.
2. Measures to prevent storm water at the site from becoming contaminated with significant materials, and
3. Control of storm water that may have become contaminated through contact with significant materials at the site.

As required by the general permit, Frontier would have an MDNRE certified storm water operator to implement the SWPPP and to ensure the storm water control measures are effective.

During operation, the wood storage pile, haul roads, lignin storage pile and product load-out areas would be potential sources of contaminants to the surface and storm water. Haul roads on the site would be paved with concrete or asphalt to minimize potential for sediment generation. Road cleaning would be completed as necessary. Storm water control systems would be designed to control storm water run-off, allow sediments to settle out, and to eliminate soil erosion. The storm water ponds, such as storm water retention ponds would be equipped with manual overflow valves that are normally closed. This would allow inspection of the storm water before allowing discharge to occur. It would also allow the ponds to function as a final spill control measure in the event of a catastrophic release of ethanol or other hazardous material on-site. Frontier would manually open the valves during overflow conditions and discharge from the storm water ponds would flow to the Kinross storm water drain system.

3.9 Waste Management, Hazardous Materials and Genetically Modified Organisms

This section discusses only the waste management, hazardous materials and genetically modified organism resources on or related to the proposed project site. Since these types of materials would not be used off of the project site, no impacts due to these materials are expected to occur elsewhere.

3.9.1 Affected Environment

3.9.1.1 Solid and Hazardous Waste

Solid waste from the proposed Frontier site would be disposed at the Dafter Sanitary Landfill. The Dafter Sanitary Landfill is located near the Village of Dafter in Chippewa County, on 12 Mile Road near Mackinac Trail. Dafter Sanitary Landfill is approximately 3.5 miles north of the proposed Frontier site. The landfill facility contains four landfill cells: A, B, C, and D. Cell A is closed, Cells B, C, and D are active. On February 12, 2004, the DEQ Waste and Hazardous Materials Division issued a new Construction Permit to the Dafter Sanitary Landfill that increased the total permitted waste capacity from 1,322,000 cubic yards to 5,312,000 cubic yards. The Dafter Sanitary Landfill receives approximately 72,000 cubic yards of mixed municipal and industrial solid waste per year. As of 2005, the remaining capacity of the landfill was approximately 4,108,000 cubic yards, enough for approximately 57 years.

3.9.1.2 Hazardous Materials

The following chemicals, additives & nutrients would be utilized and stored at the biorefinery:

- Four (4) – Ethanol Shift Tanks (35,000 gallons each)
- One (1) – Denaturant (gasoline) Tank (48,000 gallons)
- Two (2) – Product Storage Tanks (650,000 gallons each)
- 50% potassium hydroxide - Tank capacity 30,000-gallon based on a minimum of one-week storage with a maximum of 42 CIP cycles per week (5,000 gallons of 5% caustic per cycle)
- Sugar source received in liquid form as 50% solids, Tank capacity 20,000-gallons.

- Diammonium phosphate (DAP) would be received as a solid in pellet form and unloaded from palletized truck in 60-lb bags or supersacks.
- Solid DAP pellets would be diluted with water in one 500-gallon makedown tank to provide a 30% DAP solution.
- Aqua ammonia 10% - 35% as NH3 (21% - 72% as NH4OH).storage tank = 10,000 gallons.
- Magnesium sulfate received in liquid form as 25% solids. Tank capacity 20,000-gallons.
- Zinc sulfate received in liquid form as 25% solids. Tank capacity 20,000-gallons.
- Phosphoric acid received in 300-gallon tote bins provided by phosphoric acid supplier
- Antibiotics received in 55-gallon drums provided by antibiotics supplier

In addition to the chemicals identified above, the following chemicals will be needed. The quantities to be stored on-site will be determined during final design.

- Enzymes - for hydrolysis
- Phosphoric acid, if needed for pH adjustment
- Oxygen scavenger for removing oxygen from boiler feedwater
- Condensate treatment for neutralizing carbonate, bi-carbonate, and hydroxyl alkalinity
- Scale inhibitor to protect the boiler tubes
- Deposit control for evaporative condenser cooling
- Biocides for cooling water biological control

3.9.1.3 Genetically Modified Organisms

The intended organism for cellulosic ethanol production at the Frontier biorefinery would be *Saccharomyces cerevisiae*, commonly known as baker's or brewer's yeast, which has been genetically modified. *S. cerevisiae* is ubiquitous in nature, being present naturally on fruits and vegetables particularly those fruits with high levels of fermentable sugars. People come into contact with *S. cerevisiae* on a daily basis through the foods they eat and through inhalation. *S. cerevisiae* is not considered by the FDA or USEPA as a pathogenic microorganism.

The genetic modifications made to the *S. cerevisiae* proposed for use at the Frontier biorefinery involve the expression of several enzymes. The modifications allow the *S. cerevisiae* to ferment the xylose sugar generated from the pretreatment of the biomass. The yeast also expresses and secretes several enzymes that aid in the breakdown of the pretreated biomass. These biomass-degrading enzymes have similar, or in some cases, identical activities to enzymes that are already components of commercial products used in such industries as textile and pulp and paper.

GMO's used in non-health care related industries are regulated by the USEPA via the Toxic Substance Control Act (TSCA). The low-risk safety profile of the GMO that would be used at Frontier is such that regulatory compliance can be achieved by what is known as a "Tier I contained structure exemption". The GMO can be scaled-up to commercial use without a formal application and review by the USEPA if it meets several requirements, which include:

1. The recipient (host) organism must be on the acceptable list or organisms which have a long-history of safe use at large scale and have a benign safety profile,

2. The introduced genetic material must be well-characterized, limited in size, have a low probability of being transferred to other organisms, and free of certain sequences known to code for toxins, and

3. The use of the GMO will be in a "contained structure" which has been defined by the EPA.

3.9.2 Environmental Consequences of No Action Alternative

Under the No Action Alternative, no new waste materials would be generated and no hazardous materials would be stored on-site. No new hazardous materials or genetically modified organisms would be generated or used on-site.

3.9.3 Environmental Consequences of Proposed Action

3.9.3.1 Solid and Hazardous Waste

During construction Frontier would generate paper waste from office operations and construction debris. Construction debris would include, scrap metal, wood, paper, plastic products, and empty containers for construction supplies. Some waste concrete may also be generated. Frontier and its contractors would recycle their waste products to the extent practical. Construction debris that could not be recycled would be disposed in the Dafter Sanitary Landfill

The Frontier Project would generate approximately 25 tons per week of paper waste from office operations and non-hazardous solid wastes including scrap metal, wood, plastic products, paper from biorefinery operations, and empty containers (i.e., drums, totes, and boxes) (approximately 1300 tons per year). Frontier would also generate approximately 44 tons per day of ash from boiler operations. Frontier would recycle their non-hazardous waste products to the extent practical. Boiler ash may be beneficially used as a soil amendment, however, a market for the ash has not been identified. In the event the boiler ash cannot be beneficially used, it will be disposed in the Dafter Sanitary Landfill. The Dafter Sanitary Landfill is permitted to accept this waste stream. At current waste disposal rates plus the solid waste from the Frontier project, the Dafter Sanitary Landfill would have an expected lifespan of approximately 39.5 years.

The Frontier Project would be a small quantity generator of hazardous waste. The hazardous waste consists primarily of flammable liquids and laboratory chemicals. The hazardous wastes would be transported off-site by a licensed hazardous waste transportation company to a licensed hazardous waste treatment, storage, and disposal facility. The biorefinery would generate universal wastes including used oil, fluorescent and high intensity discharge (HID) light bulbs, and batteries. The universal wastes would be transported off-site by a licensed universal waste transportation company to a licensed disposal facility.

3.9.3.2 Hazardous Materials

The Frontier Project would store and use various hazardous materials. The storage tanks located outside would be designed and constructed with secondary containment structures sufficient to hold the contents of the largest tanks plus sufficient additional volume for rain fall. Tanks located inside the buildings may also be located in secondary containment if determined to be necessary for employee safety or protection of the environment. Each storage tank would be constructed using materials compatible with the chemical being stored

Frontier would develop appropriate spill response, pollution prevention, and ERPs to address the medical and environmental hazards associated with the Frontier Project. The plans would include, at a minimum, a Pollution Incident Prevention Plan (PIPP), Spill Prevention, Control and Countermeasure (SPCC) Plan, a Storm Water Pollution Prevention Plan (SWPPP), and an ERP. The plans would be completed in accordance with Federal and Michigan Occupational Safety and Health Administration (OSHA) and USEPA and MDNRE regulations and guidance. Spill equipment kits would be acquired as needed. Spill response training would be provided to employees working with the hazardous materials stored and used on-site. These measures would prevent impacts from spills of hazardous materials. Therefore, it is expected that the Proposed Action will have minimal to no impacts attributed to hazardous materials.

3.9.3.3 Genetically Modified Organisms

The GMO would be stored on-site in frozen vials of approximately 1.5 ml. Working stock vials may be made on-site by trained Frontier personnel. All vials would be stored in secure freezers on-site, and potentially at secure freezers in an off-site location.

Propagation of the GMOs would occur on-site in the laboratory and yeast propagation trains. The GMOs would be used in the fermentation process to ferment the xylose sugars to ethanol. The GMOs from fermentation would be deactivated (killed) in the fermentation process by heat. GMOs contained in water from cleaning operations of tanks and piping would also be killed by pumping the CIP water to the distillation system.

In the rare event of a catastrophic tank failure, site grading would be contoured to direct the bulk of the tank contents to an area with concrete barriers, enabling the sumping of much of the material to the beerwell, where it would be sent to distillation for inactivation. Remaining beer after sumping would be cleaned with chemical disinfectant application.

The proposed process configuration would prevent a release of GMO to the environment by deactivating the GMO in the distillation system. Industrial microorganisms in the environment are typically disadvantaged relative to native organisms. The GMO yeast in this process would likely be competitively disadvantaged, as the expression of the additional proteins provides a burden to rapid growth of the organism.

The Food and Drug Administration rates Brewer's Yeast extract as Generally Recognized as Safe (FDA, 1986). Furthermore, the National Institutes of Health in its Guidelines for Research Involving Recombinant DNA Molecules (DHHS, 1986) considers *S. cerevisiae* a safe organism. Most experiments involving *S. cerevisiae* have been exempted from the NIH Guidelines based on an analysis of safety. Finally, under the USEPA TSCA regulations, the proposed GMO is considered to be eligible for a Tier I exemption because *S. cerevisiae* is listed in and meets requirements specified in 40 CFR 725.420, the genetic material introduced into the GMO meets the criteria of 40 CFR 725.421 and the physical containment and control technologies employed in the Frontier biorefinery will meet the criteria under 40 CFR 725.422. Owing to the safety profile of the GMO, release of GMO due to catastrophic equipment failure would result in negligible impact to workers and the environment. Therefore, the Proposed Action is expected to have minimal to no impacts attributed to GMOs .

The genetically modified yeast is subject to the review and permitting process of the USDA through the Animal and Plant Health Inspection Service (APHIS), which regulates plant pests and pathogens. USDA has determined that *Saccharomyces cerevisiae* is not a plant pathogen. As required by law, an application covering use of the GMO, which expresses a limited number of well-defined, non-pathogenic genes, will be submitted to APHIS prior to commercial use.

3.10 Hazard Review and Accident and Risk Analysis

This section discusses only the hazard review and risk analysis related to the proposed project site. Since no hazardous materials associated with the proposed project would be used off-site, no impacts due to these materials are expected to occur elsewhere.

3.10.1 Affected Environment

The proposed site is currently undeveloped land with no storage or use of hazardous materials. The surrounding community of Kinross contains residential, commercial and industrial properties. In addition, approximately 5,300 prison inmates are located at the Kinross State Correctional Facility and the Chippewa County correctional facility near the proposed site.

3.10.2 Environmental Consequences of No Action Alternative

The No Action Alternative would have no impact on hazards at the property or in the community.

3.10.3 Environmental Consequences of Proposed Action

As described in Section 3.7.3.1, the proposed biorefinery would store and handle various flammable liquids including ethanol and gasoline, and hazardous materials including acids and bases in liquid and solid form.

Storage and handling of hazardous materials would have the potential for release to the environment. In the event of a catastrophic release of hazardous materials, the public could be affected.

As described in Section 3.7.5, Frontier would design the biorefinery using compatible storage tanks and appropriate secondary containment structures to prevent a release to the environment. Frontier would develop appropriate contingency plans for the proposed project site that would:

- Analyze the potential for spills or releases of ethanol, petroleum products, and other hazardous materials. This analysis includes spills or releases from equipment failures, human error, natural disasters, and intentional destructive acts;
- Outline steps to prevent releases or spills from occurring;
- Evaluate the potential impacts of releases should they occur; and
- Describe response actions that should be taken in the event of a release.

The plans would include, at a minimum, a PIPP, SPCC Plan, a SWPPP, and an ERP. Frontier would provide training to their personnel on the site specific spill prevention and response measures contained in the contingency plans. Frontier would meet with the local fire and emergency response providers to discuss potential emergencies, determine capabilities, and establish communication protocols and responsibilities.

3.11 Safety and Occupational Health

This section discusses only the safety and occupational health on or related to the proposed project site. Harvesting and transportation of forest resources would be completed by existing contractors using current safety practices. Therefore, there would be no expected change in off-site safety and occupational health issues.

3.11.1 Affected Environment

The Frontier Project would be located northeast of Kinross, Michigan. Emergency services in the area are provided by Kinross Police and Fire Departments. Both are within 5 miles of the proposed project site.

The fire protection systems for the Frontier Project would be designed to limit personal injury, loss of life, property loss, and biorefinery downtime from fire or explosion. The Frontier Project would have the following fire protection systems:

- Fire Hydrant/Hose Stations - Adequate numbers of fire hydrants and hose stations would be provided throughout the biorefinery to ensure sufficient coverage of the process areas. Water would be supplied from an aboveground fire fighting water system with a full capacity electric driven fire water pump and a full capacity natural gas powered fire water pump serving as a backup. Frontier would also incorporate provisions for a fire fighting foam system in the biorefinery design. The following would be protected with the foam system in case of a fire:

    1. Distillation facilities

    2. Ethanol dehydration facilities

    3. Ethanol loading station

- Storage tanks containing flammable materials would be designed and constructed in accordance with the National Fire Code.

- Operating and maintenance personnel would be trained to effectively deal with biorefinery emergencies involving fire, explosion, or accidental spills. Ongoing training would be administered to maintain the effectiveness of the on-site fire brigade.

- Local Fire Protection Service - The Frontier Project would also rely upon the local fire department or emergency response teams in the event of a serious fire. These local authorities would be made familiar with the layout of the ethanol facilities, the hazards of materials handled on the premises, places where personnel would normally work, and possible evacuation routes. A Fire Protection Plan for the biorefinery would be created and updated to detail the project information necessary to ensure that safe and effective fire fighting measures are used at the biorefinery.

In addition to the fire hydrants and foam systems, the biorefinery will be equipped with hand held fire extinguishers, temperature detectors, smoke detectors, and other fire detection devices as required by fire codes and the Chippewa County or the Office of the State Fire Marshal.

Occupational health services are provided by the War Memorial Hospital located in Sault Ste. Marie, Michigan approximately 19 miles from Kinross. The War Memorial Hospital has both occupational health and 24 hour emergency care capabilities. The War Memorial Hospital operates the ambulance service that services Kinross.

Chippewa County has an Emergency Preparedness Department. The Emergency Preparedness Department's role is to provide an organized and coordinated response to any natural or human-caused emergency which contains an actual or potential public health hazard, including communicable disease outbreaks, environmental sanitation hazards, emergencies involving toxic and hazardous materials and other chemical, biological and radiological incidents.

The Frontier Project would develop appropriate spill control, pollution prevention, and Emergency Response Plans (ERPs) for the biorefinery that describe planning and procedures to be followed in the event of an emergency including:

- Spills or releases of hazardous materials,
- Fire/Explosion,
- Tornadoes,
- Severe Weather,
- Medical Emergency, and
- Bomb Threat.

Frontier would also establish safety and emergency response procedures for construction activities, excavation and trenching, electrical, hazardous chemicals, hot work permits, fall prevention, proper equipment usage, confined space entry, fire protection and prevention, and hearing and respiratory protection for employees, contractors, and visitors.

3.11.2 Environmental Consequences of the No Action Alternative

The No Action Alternative would have no affect on existing emergency response capabilities of Kinross and/or Chippewa County.

3.11.3 Environmental Consequences of the Proposed Action Alternative

The chemicals and chemical processes used to produce ethanol create a potential for health and safety hazards. The hazards related to hazardous material storage and handling are further discussed in Section 3.7. However, in summary, the hazardous materials generally fall into two categories, flammable or corrosive. The ethanol and denaturant (gasoline) are flammable. Many of the process chemicals are corrosive, i.e. acids or bases.

Frontier would develop appropriate spill response, pollution prevention, and ERPs to address the medical and environmental hazards associated with the Frontier Project. The plans would include, at a minimum, a

Pollution Incident Prevention Plan (PIPP), Spill Prevention, Control and Countermeasure (SPCC) Plan, a Storm Water Pollution Prevention Plan (SWPPP), and an ERP. The plans would be completed in accordance with Federal and Michigan Occupational Safety and Health Administration (OSHA) and USEPA and MDNRE regulations and guidance.

Frontier would also establish safety and emergency response procedures for construction activities, excavation and trenching, electrical, hazardous chemicals, hot work permits, fall prevention, proper equipment usage, confined space entry, fire protection and prevention, and hearing and respiratory protection for employees, contractors, and visitors.

The existing emergency response capabilities of Kinross and Chippewa County are expected to remain in place and available to the Frontier Project, if needed. Additional training may be required for local responders; however, the proposed action would not be expected to have an effect on the mission or capabilities of the Chippewa County Emergency Preparedness Department.

3.12 Infrastructure

This section discusses only the infrastructure on or related to the proposed project site. Harvesting and transportation of forest resources would be completed by existing contractors using existing infrastructure. Therefore, there would be no expected change in off-site infrastructure related to harvest and transportation of forest resources.

3.12.1 Affected Environment

Water would be obtained from the Kinross water system. As noted in Section 3.6, the MDNRE firm rated capacity of the Kinross system (firm rated capacity as determined by the MDNRE is the maximum system production with the largest well out of service) is 2,000 gpm or 2.88 mgd. Current community water usage is approximately 1.2 mgd with a peak summer usage of approximately 1.75 mgd. Using the firm rated capacity, an excess water system capacity of 1.68 mgd remains (AECOM, 2009). The water system does not currently extend to the proposed Frontier site.

Wastewater disposal would be through the Kinross WWTP via an existing force main. As noted in Section 3.6 with the permitted effluent discharge limit of 1.1 mgd and the current average effluent discharge of 0.85 MGD, there is an excess treatment capacity of approximately 0.25 mgd available at the Kinross WWTP. The existing force main system does not currently extend to the proposed Frontier site.

Natural gas is available via a 2-inch high pressure on site for supply via Kinross. The gas line is located west and adjacent to the proposed project site along the access road, see Figure 2.

Cloverland owns and operates the electric distribution system in and around the Kinross Charter Township. Cloverland would be the provider of the electric power to the proposed Frontier project. ATC owns the existing 69 kV electrical transmission line that runs approximately parallel to Interstate 75 from St. Ignace to Sault St. Marie.

3.12.2 Environmental Consequences of No Action Alternative

The No Action Alternative would have no affect on the infrastructure of Kinross and/or Chippewa County.

3.12.3 Environmental Consequences of Proposed Action

Frontier would use potable water at a proposed rate of 150 gallons per minute via a connection with the existing water main located to the west of the proposed site. A new 12-inch diameter water line would be constructed from the existing main to the proposed site. The main would be approximately 10,720 lineal feet long. No modifications would be required to the production well field or production system.

Municipal wastewater systems improvements at the very minimum will include construction of a lift station near the Frontier site and force main installation to connect the lift station to the municipal collection system.

The anticipated total length of force main installation is 5,720 linear ft. No modifications will be required to the WWTP.

Due to Cloverland's acquisition of Edison Sault Electric Company in May 2010, Frontier would have two options for their power supply. Option #1 would be the construction of an approximately 2-mile long interconnect line from the ATC transmission line to the Frontier site. Option #2 would be to connect to the existing Cloverland electric infrastructure in Kinross. The options will be reviewed and one selected early in the final design stages of the project. The potential route for each option has not been determined. Additional environmental analysis may be required depending on the route selected. Cloverland would be responsible for that analysis. Cloverland would be responsible for completion of an environmental review, if any were required. DOE would participate in that review or complete additional NEPA review, as necessary.

The upgrade of the ATC 69kV transmission line is being completed independent of the proposed Frontier Project and is therefore not a connected action for this EA.

A new utility substation would be installed at the west edge of the Frontier property sized for the biorefinery requirements. This substation would be owned and maintained by Cloverland.

Temporary impacts would occur during construction of the various pipelines for water, wastewater, and natural gas. Wetlands and sensitive areas would be avoided, where possible, during construction to minimize the impacts. Mitigation would be completed for impacted wetlands in accordance with Michigan and the USACE regulations and permitting processes.

3.13 Noise

This section discusses only the noise on or related to the proposed project site and rail corridor.

3.13.1 Affected Environment

The Frontier site is currently wooded, non-residential property with a residential area located about 2000 feet to the south southwest. The Chippewa County International Airport is located in Kinross approximately 1-mile southwest of the proposed Frontier site.

Noise sources in rural areas are mostly from natural sources including insects, birds, mammals, and flowing water. Background noise levels in wilderness areas are about 35 dBA Day-Night Sound Level (L_{dn}). Cars and agricultural equipment provide additional noise in rural residential and agricultural areas. Background noise levels are approximately 40 dBA in rural residential areas, 44-dBA in agricultural cropland with equipment operating and 51 dBA in a wooded residential area (EPA 1978).

Background noise levels in industrial areas typically range between 75 and 90 decibels (dB) and noise levels in wooded residential areas are approximately 50 dB (EPA 1978).

3.13.2 Environmental Consequences of the No Action Alternative

The No Action Alternative would have no impact on noise from the proposed site.

3.13.3 Environmental Consequences of the Proposed Action

Noise would be generated continuously during normal operations related primarily to mechanical equipment operations. Much of the mechanical equipment at the site would be related to the raw material and product-handling operations, including debarking equipment, feed stock conveyors; production activities, including the cooling towers, and other equipment. Noise would also be generated by trucks and rail operations for the transport of raw materials and final product, as well as some industrial equipment (front-end loader, etc.) for on-site product movement.

Noise studies at ethanol plants in Minnesota have indicated that the equipment with the highest noise levels are the cooling towers (~80) dBA and the conveyor systems (~78 dBA). (APEC 2007). The readings were taken at 11 feet from each of the above sources. Noise levels from the Frontier Project are expected to be similar or less than a conventional ethanol plant because their equipment would be located inside a building.

Noise levels from adjacent sources are added using a logarithmic addition. Table 3-15 shows a simple way to add noise levels.

Table 3-15 - Addition of Decibels

Numerical difference between two noise levels [dBA]	Amount to be added to the higher of the two noise levels [dB or dBA]
0	3.0
1	2.5
2	2.0
3	1.8
4	1.5
5	1.2
6	1.0
7	0.8
8	0.6
9	0.5
10	0.4
11	0.3
12	0.3
13	0.2
14	0.1
15	0.1
Step 1: Determine the difference between the two levels and find the corresponding row in the left hand column. **Step 2**: Find the number [dB or dBA] corresponding to this difference in the right hand column of the table. **Step 3**: Add this number to the higher of the two decibel levels.	

Source: Casella Undated

Using the above table, the logarithmic addition of the potential noise sources that will be present at the biorefinery gives a total predicted noise contribution of 82 dBA at 11 feet from the equipment.

Noise loss from the noise source to the nearest sensitive area (NSA) is calculated using the equation (Beranek et. al. 1992):

SPL 2 = SPL 1 + 20 Log $_{10}$ (d_1/d_2).

Where:

SPL 2 is the sound pressure level at the NSA,
SPL 1 is the sound pressure level contribution from the noise source,
d_1 is the distance from the noise source that the reading was taken (11 feet), and
d_2 is the distance to the NSA.

Currently there are no residences on the subject property. The NSA is a residence located approximately 2,600 feet south of the southernmost property boundary. Therefore, the noise impact from the Frontier Project on the NSA is estimated to be 34.0 dBA. This noise level is within the normal background level for wooded residential areas.

A maximum of two trains per day are projected to arrive on-site. Noise from trains is dependent on many factors, including train speed and rail design. A diesel freight train would generate noise at approximately 88 dBA (Harris Miller Miller & Hanson Inc., Undated) measured at 50 feet from the tracks. This noise level would last for less than 30 minutes to allow transit from the CN mainline to the Frontier site. The train horn would generate approximately 100 dBA for a few seconds when crossing the Gaines Highway (90 dBA measured at 500 feet). The proposed rail corridor runs north of the Kinross Township and the penitentiary. At its closest approach, the rail corridor is on the opposite side of the Gaines Highway from the NSA is approximately 1,600 feet north. Therefore, the noise impact from train traffic going to the Frontier Project on the NSA is estimated to be 58.0 dBA which is approximately equivalent to a normal conversation. The noise level from the train whistle at the NSA would be 80 dBA, which is equivalent to a telephone dial tone.

A typical train would include more than 50 cars. Since each rail car equals approximately two trucks and the rail line follows the Gaines Highway, which would be the primary route for truck traffic. Truck traffic from diesel trucks generates approximately 90 dBA (Galen Carol, 2011), therefore no incremental increase in noise from trains is expected.

3.14 Aesthetics

This section discusses only the aesthetics on or related to the proposed project site. Harvesting and transportation of forest resources would be completed by existing contractors using existing techniques. Therefore, there would be no expected change in off-site aesthetics related to harvest and transportation of forest resources.

3.14.1 Affected Environment

The Frontier Project would be located in a relatively undeveloped wooded area approximately 2,600 feet from the nearest residence. The nearest residence to the proposed rail line would be approximately 1,700 feet to the south, southwest.

3.14.2 Environmental Consequences of the No Action Alternative

The No Action Alternative would have no impact on site aesthetics.

3.14.3 Environmental Consequences of Proposed Action

Wood yards and wood processing systems are common property uses and activities in the upper peninsula of Michigan. The proposed buildings and structures would be similar to other wood yards and processing facilities in the area.

The biorefinery would have three primary areas that have potential aesthetic affects:

- Biomass receiving and storage;

- ethanol production; and
- ethanol storage tanks.

As shown on Figure 20, the biomass receiving and storage area would include a log storage yard, biomass processing building, biomass storage building, bark storage piles, associated handling equipment and a wood chip silo. The wood chip silo would be one of the tallest structures at 105 feet. The distillation tower would be approximately 125 feet tall. The ethanol production area would include the fermentation, distillation and dehydration buildings and structures.

Table 3-16 – Proposed Building Sizes

Building Information	Length (feet) E-W	Width (feet) N-S	Height (feet)
Chemical, Pretreatment, Lab and Fermentation Building.	100	127	50
Water Cooler Buildings	36	36	50
Utility Building	64	36	40
Biomass Boiler Building	125	100	50
Evaporator Building	45	45	90
Distillation Building	82	55	125
Drying Building	23	73	65

The ethanol storage tank farm would contain two large ethanol AST and five smaller ASTs. The large AST will be approximately 50 feet in diameter and 42 feet tall. A large potable water tank of approximately the same size and the large ethanol storage tank would be constructed on-site. The biomass boiler stack would be visible at 60 to 80 feet above grade.

A water vapor plume may be visible from the lignin dryer stack from varying distances, depending on weather conditions. The biorefinery would use dry cooling towers, so no vapor plume would be visible from them. No other visible emissions are expected.

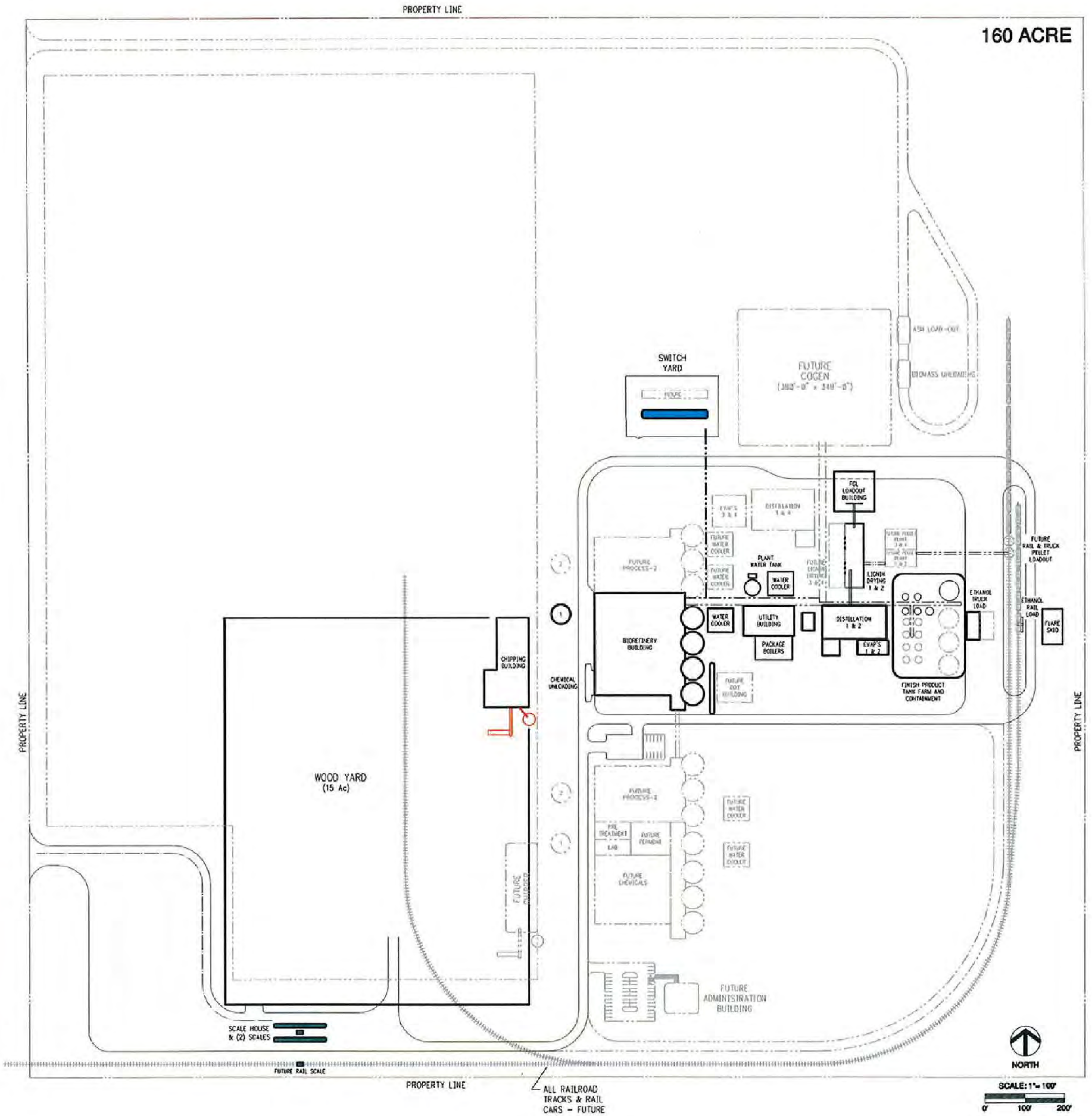
The proposed biorefinery is expected to operate 24 hours per day, 7 days per week. Since production will be continuous, lighting will be required to support operations and to provide security. Lighting will consist of low-level lighting around exit areas and general outside areas, including ground-level operating areas, stairs, platforms, roadways, storage areas, and parking areas. The lighting will be provided for purposes of general operator access and safety under regular operating conditions.

Outdoor lights will be a combination of pole-mounted and structure-mounted lights. Spot lighting will be provided to illuminate operating equipment or access roadways where needed. This lighting is higher in intensity than general outside lighting, but will be limited to specific areas and usage as needed.

The proposed ethanol process buildings, fermenters, and storage tanks are not common to the existing surrounding area. However, the nearest structure, a residence, is approximately 0.5 miles away across heavily wooded terrain. Other residential areas are over 1.0 mile away to the west, also across heavily wooded terrain. Given the distance to the nearest building and the terrain, the biorefinery would not be readily visible.

The rail corridor is approximately 1,700 feet from the nearest residence across heavily wooded area. Therefore, although the rail line would parallel the Gaines highway, the rail line would not be readily visible from existing residences.

Any aesthetic impact attributable to the Proposed Action would be negligible.



FRONTIER SITE MASTER PLAN 2009

355 ACRE

RAASCH ASSOCIATES
ENGINEERS + ARCHITECTS

ITEM #	Building Description	AREA	Building Dimensions	Number of Floors	Square Ft.
1	Chipping Building	100	220'Lx80'Wx35'-6"H	1	17,600
2	Biorefinery Building	210-420	Sub buildings below	See Below	See Below
2a	Pre-Treatment Building	210	93'Lx46'Wx115'H	8	4,278 per foor
2b	Primary Fermentation	300	95'Lx92'-8"Wx36' H	1	8,788
2c	Primary Fermentation Penthouse	300	83'6Lx75-6"Wx51"H	1	5,393
2d	Employee Facilities	300	92'Lx96'Wx35'-6"H	2	8,834 per foor
2e	Secondary Fermentation	300	290'Lx40'Wx26' H	1	10,617
2f	Chemical Storage	420	169'Lx158'-6"Wx26'H	1	25,512
5	Distillation Building	500	157'-8"x82'-8"x35'H	2	14,800 per foor

Item #	PERSONNEL DESCRIPTION	NO OF PERSONNEL	1st	2nd	3RD
1	PLANT MANAGER	1	1		
2	MAINTENANCE MANAGER	1	1		
3	PROCESS MANAGER/ENGINEER	1	1		
4	OPERATIONS MANAGER	1	1		
5	LAB MANAGER	1	1		
6	SAFETY MANAGER	1	1		
7	MAINTENANCE TECHNICIANS	8	4	2	2
8	MAINTENANCE - LUBE TECH	4	2	1	1
9	MAINTENANCE - YARD	1	1		
10	OPERATORS	16	6	6	4
11	LAB TECHNICIANS	2	1	1	
12	SCALE HOUSE	1	1		
13	ADMINISTRATION	0	0		
14	***TOTAL PERSONNEL***	***38***	***21***	***10***	***7***

Item #	TRUCK CONTENTS	NO OF TRUCKS/DAY	DAYS/WEEK	TOTAL USAGE VOL/DAY	TOTAL STORAGE VOLUME	COMMENTS
1	CHIPS / LOGS (@ 25 ton/truck)	62	5	770 BDTPD	1 @ 124,000 cu ft	49' dia x 82' tall
2	BARK	6	0	77 BDTPD	direct to trucks	
3	ASH	0	0	20 BDTPD	phase on NG	tbd
4	FGL OUTBOUND	24	7	586.4 BDTPD	@ 60% solids	rolling stock
5	Enzyme 1 (1.42 % v/v)	1 per month	7	800 GPD	40,000 gallons	2 @ 16' dia x 18' ssw
6	SUGAR SOURCE	1 per month	7	0 GPD	20,000 gallons	16' dia x 18' ssw
7	AMMONIUM HYDROXIDE - UREA	1 per month	7	0 GPD	20,000 gallons	16' dia x 18' ssw
8	Magnesium Sulfate Heptahydrate	1 per month	7	187 GPD	20,000 gallons	16' dia x 18' ssw
9	Zinc Sulfate	1 per month	7	187 GPD	20,000 gallons	16' dia x 18' ssw
10	POTASSIUM HYDROXIDE - KOH	1	7	? GPD	30,000 gallons	18' dia x 18' ssw
11	Sanitization (CIP) Chemistry	1 per month	7	tbd	20,000 gallons	16' dia x 18' ssw
12	ANTI FOAM - PROCESS	0	7	unknown	200 gal tote	vendor owned
13	ANTIBIOTIC	0	7	unknown	200 gal tote	vendor owned
14	COOLING SCALE CONTROL	0	7	unknown	mini bulk	vendor owned
15	COOLING BIOCIDE 1	0	7	unknown	mini bulk	vendor owned
16	COOLING BIOCIDE 2	0	7	unknown	mini bulk	vendor owned
17	BOILER DEPOSIT CONTROL/DISP	0	7	unknown	mini bulk	vendor owned
18	OXYGEN SCAVENGER	0	7	unknown	mini bulk	vendor owned
19	DENATURANT	2 per week	0.2	1212 gallons	50,000 gallons	tank lasts 40+ days
20	ETHANOL (out bound 4500 gal/truck)	14	7	60,600 gallons	140,000 gallons	1,200,000 gal in bulk
21						
22						
23						
24	comments	nutrient feed rates are all to be determined from Rome Pilot plant				
25						
26						
27						
28						
29						
30	***TOTAL AVERAGE TRUCKS / DAY***	103				

12

E	02/20/09	UPDATE FOR LOAN APP
D	02/17/09	FOR LOAN APPLICATION
C	02/13/09	FOR LOAN APPLICATION
B	02/06/09	ISSUED FOR REVIEW

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FRONTIER PLOT PLAN
FRONTIER RENEWABLE RESOURCES, LLC
CELLULOSIC ETHANOL FACILITY
KINROSS TOWNSHIP, CHIPPEWA COUNTY, MICHIGAN

Drawn:

Approved:

Scale:

PROJECT NUMBER 60140061

FIGURE NUMBER 20

3.15 Traffic

This section discusses the traffic impacts on the roads in and around Kinross due to the proposed project.

3.15.1 Affected Environment

3.15.1.1 Roads

The proposed Frontier site currently has access from the west by South Gaines Highway (Gaines Road) and an unpaved road bisecting the property called West Bisnett Road. As shown on the site location map (Figure 2), the main route serving this area is Interstate 75, which is within three miles of the proposed biorefinery site. M-80 and South Gaines Highway have exits from Interstate 75 and would likely serve as traffic routes to the proposed Frontier site. These roads are high volume and high tonnage roadways. No significant industrial facilities are located in Kinross Charter Township. Therefore, no significant truck traffic has an end destination at or near the proposed Frontier site. Vehicle and commercial vehicle traffic is common on I-75 and on M-80. Vehicle and commercial vehicle traffic is common on I-75 and on M-80 as shown in Tables 3-17, 3-18, and 3-19 (MDOT 2009).

Table 3-17– Annual Average Daily Traffic Interstate 75 (vehicles per day)

Year	Route I-75 JCT M-48 to JCT M-80	Route I-75 JCT M-80 to Barbeau Road
2005	4,273	4,518
2006	3,745	4,102
2007	3,640	3,987

Table 3-18 – Annual Average Daily Traffic State Highway M-80 (vehicles per day)

Year	Route M-80 JCT I-75 to Gaines Road	Route M-80 JCT 1-75 to JCT M-129
2005	2,873	1,868
2006	2,795	1,818
2007	3,033	1,918
2008	2,824	1,786

Table 3-19 – Commercial Annual Average Daily Traffic (vehicles per day)

Year	Route I-75 JCT M-48 to JCT M-80	Route I-75 JCT M-80 to Barbeau Road	Route M-80 JCT. I-75 to Gaines Road
2005	718	718	100
2006	650	650	100
2007	490	490	100

3.15.1.2 Rail Lines

An existing Canadian National Railway (CN) rail line runs southwest to northeast parallel to west side of I-75. An existing rail spur splits from the CN main line and crosses under I-75 at the Tone Road overpass. The existing spur runs east then south to the Kincheloe International Airport property.

3.15.2 Environmental Consequences of the No Action Alternative

3.15.2.1 Traffic

The biorefinery would not be constructed and no change in traffic would occur.

3.15.3 Environmental Consequences of the Proposed Action

At the peak of construction, Frontier would employ approximately six people on-site full time. The sub-contractor labor force would be on average around 150 employees. It is expected that an average of 150 cars per day would be associated with construction staff. Truck traffic for deliveries is expected to be approximately 17 trucks per day with an average of 11 trucks per day. It is expected the traffic would use I-75 to the South Gaines Highway to access the site. This would be the shortest distance and would avoid all residential areas and businesses in Kinross. Construction would take approximately 12 to 14 months.

As a worst case scenario it is assumed all deliveries and shipments would occur by road. Due to the greater capacity of railcars it is expected the use of rail transportation would result in less impacts to the environment than worst case scenario analyzed in the EA.

On average the proposed Frontier biorefinery would receive approximately 2 trucks per day delivering sawmill chips, 77 log trucks per day delivering hardwood pulpwood logs to supply biomass material for normal operations. Other deliveries would be expected to require 4 to 6 trucks per week for miscellaneous chemicals and supplies. The proposed Frontier biorefinery also would have approximately 70 passenger vehicles arriving per day for employees and visitors. It is expected the most if not all of the traffic would use I-75 to the South Gaines Highway to access the site. This would generally be the shortest distance and would avoid all residential areas and businesses in Kinross.

Based on the traffic volumes shown in Section 3.14.1.1, the additional traffic on I-75 would be an increase of less than 1%. An additional 10 to 15 trucks per hour would use the Gaines Highway compared to current levels. This would be well below the design criteria for this high volume and high tonnage roadway.

Frontier anticipates that new turn lanes would need to be constructed on the Gaines Highway to allow safe access to the proposed site. This construction would result in a temporary disruption of traffic on the Gaines Highway that would last approximately one to two months until the turn lanes were completed. The turn lanes would be constructed within the existing right of way for the Gaines Highway.

3.16 Socioeconomics and Environmental Justice

This section discusses only the socioeconomics and environmental justice related to the proposed project site. Harvesting and transportation of forest resources would be completed by existing contractors. The overall regional socioeconomics will improve due to additional economic opportunities and no environmental justice issues associated with forest resource harvest and transportation are anticipated.

3.16.1 Affected Environment

Kinross Charter Township is not within any defined metropolitan statistical area. Kinross Charter Township has been experiencing growth greater than that of Chippewa County, the State of Michigan and the United States in recent years. The 2008 estimate of the population of Chippewa County and Kinross Charter Township was 38,971 and 8,797 individuals, respectively. This represented a population increase of 1.1% for the county and 8.1% for the township from 2000 to 2008 (estimate). The State of Michigan and the United

States have experienced population increases of 6.5% and 6.0%, respectively in the same time period (US Bureau of Census, 2009).

Since 1980, Kinross Charter Township has increased the size of its' population by 364.7% compared to 8.0% increase for the State of Michigan as a whole. Chippewa County and the United States have increased their populations by 34.3% and 31.7%, respectively during the same time period. Table 3-20 (below) summarizes the population changes for Kinross Charter Township, Chippewa County, the State of Michigan and the United States.

The population of Kinross Charter Township is heavily influenced by its' prison population. For example, the 8,140 residents in Kinross Charter Township identified in the 2000 census, 4,535 were prisoners of the State of Michigan in five institutions located in Kinross Charter Township (Dorothy Johnson, Deputy Supervisor, Kinross Charter Township, Personal Communication, October 2, 2009). Although the five institutions have recently been reduced to two institutions (Kinross Charter Correctional Facility and Chippewa Correctional Facility), the number of prisoners within Kinross Charter Township has not been affected (Dorothy Johnson, Deputy Supervisor, Kinross Charter Township, Personal Communication, October 8, 2009). In addition, the prison population as a percentage of the total population has been consistent since 1980 (Dorothy Johnson, Deputy Supervisor, Kinross Charter Township, Personal Communication, October 8, 2009).

Table 3-20 - Population Changes for Kinross Charter Township, Chippewa County, Michigan and the United States 1980-2008

Political Unit	1980 Population	1990 Population	1980-1990 % Change	2000 Population	1990-2000 % Change	2008 Population	2000-2008 % Change	1980-2008 % Change
Kinross Charter Township	1,893	6,566	+246.9%	8,140	+30.0%	8,797	+8.1%	+364.7%
Chippewa County	29,029	34,604	+19.2%	38,543	+11.4%	38,971	+1.1%	+34.3%
Michigan	9,262,078	9,295,297	+0.4%	9,938,444	+6.9%	10,003,422	+6.5%	+8.0%
United States	226,545,805	248,709,873	+9.8%	281,421,906	+13.2%	298,362,973	+6.0%	+31.7%

Source: U.S. Bureau of Census; 2009

The home ownership rate of 52.9% for Kinross Charter Township was below the County, State and National averages of 74%, 73.8% and 66.2%, respectively. In addition, the property values for both the township and the county were below the State and National averages with median values of owner-occupied homes of $72,600 and $77,300 for Kinross Charter Township and Chippewa County, respectively compared to the State and National averages of $115,600 and $119,600, respectively.

Labor statistics are unavailable for either Kinross Charter Township or Chippewa County. However, occupational information is available for the Upper Peninsula of Michigan (Upper Peninsula. In 2009, there were approximately 116,000 jobs in the Upper Peninsula. The majority of the jobs were in office and administrative support, food preparation and serving and sales (U.S. Bureau of Labor Statistics, 2011).

There are over 1,400 forest products manufacturing facilities in Michigan with an additional 1,700 business unites related to forest product manufacturing. Currently the Michigan forest products industry has approximately 162,000 direct and indirect jobs and a $5.6 billion annual payroll. The direct sales from forest and forest related industries is approximately $13.8 billion in annual sales that yields approximately $51.8 billion (direct and indirect) economic impact to Michigan

The forest products industry has suffered as a direct result of the economic downturn in manufacturing. The direct result of this down turn has been the loss off over 20,000 jobs, $700 million in wages and over 300 individual businesses from the forest products industry. These numbers lag and therefore do not reflect the full impact of the 2009-2010 economic recession.

The median household incomes for Kinross Charter Township and Chippewa County of $36,525 and $34,464, respectively were below the State and National averages of $44,667 and $41,994, respectively. (US Bureau of Census, 2009 (2000 Census data)).

3.16.1.1 Environmental Justice

Environmental justice is the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. “Fair treatment” means that no group, including racial, ethnic, or socioeconomic groups, should bear a disproportionate share of the adverse environmental consequences resulting from industrial, municipal, or commercial operations or the execution of Federal, State, local, and tribal programs and policies.

In February 1994, President Clinton, issued Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations (59 Fed. Reg. 7629 (1994)). This order directs Federal agencies to incorporate environmental justice as part of their missions. Federal agencies are specifically directed to identify and, as appropriate, to address disproportionately high and adverse human health or environmental effects of their programs, policies, and activities on minority populations and low-income populations.

The CEQ has issued guidance to Federal agencies to assist them with their NEPA procedures so that environmental justice concerns are effectively identified and addressed (CEQ, 1997). In this guidance, the Council encouraged Federal agencies to supplement the guidance with their own specific procedures tailored to particular programs or activities of an agency. DOE has prepared a document titled Environmental Justice Strategy (DOE, May 2008). The guidance is based on Executive Order 12898 and the CEQ environmental justice guidance. Among other things, the DOE draft guidance states that even for actions that are at the low end of the sliding scale with respect to the significance of environmental impacts, some consideration (which could be qualitative) is needed to show that DOE considered environmental justice concerns. DOE needs to demonstrate that it considered apparent pathways or uses of resources that are unique to a minority of low-income community before determining that, even in light of these special pathways or practices, there are no disproportionately high and adverse impacts on the minority or low-income populations.

The racial make-up of Kinross Charter Township (including the prison population) is 64.6% white, 17.2% black, 11.3% American Indian and Alaska Native persons, 0.6% Asian, and 5.4% persons of more than one race (U.S. Bureau of Census, 2009 (2000 Census data)). In addition, 2.7% of the population also describe themselves as Latino decent. However, the racial components of Kinross Charter Township excluding the prison population likely mimics the racial make-up of Rudyard Schools (the school system serving the township) which is 69.2% white, 1.6% black, 26.7% American Indian and Alaska Native persons, 1.2% Asian and 1.25 Hispanic (Dorothy Johnson, Deputy Supervisor, Kinross Charter Township, Personal Communication, October 2, 2009).

The racial make-up of Chippewa County is 75.9% white, 5.5% black, 13.3% American Indian and Alaska Native persons, 0.5% Asian, and 4.4% persons of more than one race (U.S. Bureau of Census, 2009 (2000 Census data)). In addition, 1.6% of the population also describe themselves as Latino decent.

The harvest area for the biomass needed to support the proposed Frontier project is largely located within the area of the 1836 Treaty of Washington. Article 13 of the 1836 Treaty of Washington, along with the 2007 Inland Consent Decree provide the Tribes that are signatory to the 1836 Treaty of Washington the right to hunt, fish, and gather natural resources for personal use and subsistence on public lands and certain private forest lands that are required to be open to the public by law or other agreement. The 1836 Treaty of

Washington does not provide for commercial harvest of forest resources or apply to private lands that are not otherwise required to be open to the public.

3.16.1.2 Socioeconomics

The poverty rates for individuals in Kinross Charter Township and Chippewa County are 16.4% and 12.8%, respectively. The poverty rate for Kinross Charter Township and Chippewa County exceed the State and National rates of 10.5% and 12.4%, respectively (U.S. Bureau of Census, 2009).

The employment rates for Kinross Charter Township and Chippewa County are 33.5% and 53.6%, respectively. The employment rate for Kinross Charter Township and Chippewa County are lower than the State and National rates of 64.6% and 63.9%, respectively (U.S. Bureau of Census, 2009).

While recent unemployment data for Kinross Charter Township was not available at the time of this assessment, the unemployment rate of 11.6% for Chippewa County exceeds the National unemployment rate of 9.7% but is below the State unemployment rate of 15.2% (U.S. Bureau of Labor Statistics, 2009 (August, 2009 data)). Table 3-21 (below) summarizes the poverty, labor force, and unemployment status for the Township, County, State, and Country.

Table -3-21 - Individual Poverty Status, Labor Force, and Unemployment for Kinross Charter Township, Chippewa County, Michigan, and the United States

Political Unit	Individual Poverty Status*	Labor Force* (percent)	Unemployment** (percent)
Kinross Charter Township	16.4%	33.5%	Not Available
Chippewa County	12.8%	53.6%	11.6%
Michigan	10.5%	64.6%	15.2%
United States	12.4%	63.9%	9.7%

*Source: US Bureau of Census (2000 data)

**Source: US Bureau of Labor Statistics (August, 2009 data)

3.16.2 Consequences of No Action Alternative

The No Action Alternative would have no impact on socioeconomics and/or environmental justice.

3.16.3 Consequences of Proposed Action

The construction personnel and permanent employees for the Frontier biorefinery are expected to come from existing skilled workers in the region. Frontier would employ approximately six people on-site full time. The sub-contractor labor force would be on average around 150 employees.

A total of approximately 50 full time employees would be required for biorefinery operation. Approximately an additional 700 additional jobs would be created in the manufacturing, agriculture, transportation, and timber industries in Michigan as a result of the Frontier Project (MEDC, 2011). At 2010 prices procurement of hardwood pulpwood alone would add between $35 and $40 million per year to the local economy. Purchases of other goods and services would add to that amount.

Because feedstock is within the sustainable tonnage of annual growth, the Frontier biorefinery would not be expected to put any other hardwood industry in the area at risk.

Based on the minority populations for Kinross Charter Township, Chippewa County, and the State of Michigan, no disproportionately high percentage of minority residents would be directly impacted by construction and operation of the proposed project. Additionally, the prison population would not be impacted to any greater or lesser degree than the local population.

The economic benefits of the biorefinery to the county which were discussed above would likely benefit the minority population of the area to some degree, either directly by offering new jobs or indirectly through secondary job creation and increased services from the increased tax revenue. Jobs created would include salaried positions in management and engineering, hourly jobs for operators and maintenance staff, as well as, independent contractor jobs including truck drivers and loggers, etc.

Frontier expects that the employees for the biorefinery will be hired from the local population. The local area has existing forest resource companies supply companies. Although, the Frontier Project would cause higher employment in these sectors, a large number of new residents moving to the Kinross area is not anticipated. Therefore, there would not be a need for additional schools or service infrastructure nor impacts to those facilities.

Kinross Charter Township and Chippewa County have a higher percentage of individuals below the poverty level than that of the general population of Michigan. However, the Frontier biorefinery and the associated rail corridor would be located away from any concentration of residences, its construction and operation would not adversely affect any economic subgroup. Therefore, no disproportionately high percentage of low income residents would be impacted by the Proposed Action. As has been shown in previous sections, there are only minor adverse environmental impacts associated with the Proposed Action, and none of these impacts would disproportionately impact minority or low income populations. The economic benefits of the biorefinery to the county, which were discussed above, would likely also benefit those currently living below the poverty level to some degree, either directly by offering new jobs or indirectly through secondary job creation and increased services from the increased tax revenue.

Because the Frontier biorefinery would be located away from any concentration of residences or any areas where children would congregate, its construction and operation would not pose direct environmental health and safety risks to children in Kinross Charter Township or Chippewa County. There are only minor adverse environmental impacts associated with the Proposed Action and none of these minor impacts would create any environmental health and safety risks to children.

The harvest of timber within the boundaries of the lands ceded under the 1836 Treaty of Washington has been occurring for over one hundred years. As discuss in Section 3.1, the timber harvest for the Frontier project would essentially replace the harvest amounts that were used by the now closed (GP) Particle Board Mill at Gaylord, Michigan, the S. D. Warren pulp and paper mill at Muskegon and the Menasha mill in Otsego, Michigan. The Tribes who were signatories to the 1836 Treaty of Washington will retain their rights to hunt, fish or gather natural resources for personal use or subsistence on Federal and State forest lands and on certain private forest lands that have enrolled in state programs such as the Commercial Forest Program. No abrogation of the Tribes rights under the 1836 Treaty of Washington will occur as a result of the Frontier Project. Additionally, the practices and procedures established under FSC and SFI certification programs specifically implement plans that respect the rights of the Tribes.

3.17 The Relationship Between Local Short-Term Uses of the Environment and the Maintenance and Enhancement of Long-Term Productivity

Council on Environmental Quality regulations require consideration of “the relationship between short-term uses of man's environment and the maintenance and enhancement of long-term productivity” (40 CFR 1502.16). Construction and operation of the facility would require short-term uses of land and other resources. Short-term use of the environment, as used here, is that used during the life of the project (estimated at 40 years), whereas long-term productivity refers to the period of time after the project has been decommissioned, the equipment removed, and the land reclaimed and stabilized. The short-term use of the project site for the proposed facility would not affect the long-term productivity of the area. If it is decided at some time in the future that the project has reached its useful life, the facility and foundations could be decommissioned and removed, and the site reclaimed and re-vegetated to resemble a similar habitat to the pre-disturbance conditions.

The environmental review processes and timber harvest practices established by the Forest Service and MDNRE for Federal and State lands are designed to maintain a sustainable ecosystem. FSC and SFI certified forest resource companies, such as J.M. Longyear, are required to maintain a healthy and sustainable forest inventory. Finally, SFI certified procurement practices are designed to minimize the potential for over harvest of timber resources by non-certified resource owners through contractual and purchasing decisions by the end user (e.g. Frontier). Continued implementation of these practices and procedures will ensure the long term productivity of the forest resources through and beyond the lifespan of the proposed facility.

The proposed Frontier project would require use of approximately 300,000 gallons of water per day. This water would be extracted from existing water wells owned and operated by Kinross Township, used by Frontier and discharged to the Kinross waste water treatment facility. Chemicals would be used to treat the water before use and again at the waste water treatment plant. The Kinross water system is currently capable of providing the required amount of water without modification.

3.18 Irreversible and Irretrievable Commitments of Resources

The proposed project would not cause an irretrievable commitment of land required for construction and operation of the new facility. As noted in Section 3.17, the facility and foundations could be decommissioned and removed, and the site reclaimed and re-vegetated to resemble a similar habitat to the pre-disturbance conditions.

There would be an irreversible commitment of energy and construction materials used to construct the facility and utility lines. DOE would also have expended the finances associated with the funding for the proposed project.

The forest resources are currently growing at a rate that is greater than the current or planned harvest rate. Additionally, natural regeneration and some re-forestation will result in re-growth of the harvested forest lands to current conditions within the lifespan of the proposed facility. Thus, the proposed project will not result in an irreversible or irretrievable commitment of forest resources.

Construction of the rail spur would result in the irreversible filling of 3.14 acres of jurisdictional forested wetlands. Mitigation for the impacted wetlands would be completed by creation of new wetlands in a quantity greater than those filled.

The proposed Frontier project would require use of approximately 143.9 MMSCF/year of natural gas and 350,000 MWH of electricity for process operations. Since approximately 70% of the power production in Michigan is from non-renewable resources, the fuel used to produce the majority of the electric power for the proposed Frontier project would be irretrievable.

Approximately 50 gpm (0.076 mgd) of water would be evaporated from the process into the atmosphere. This water would eventually condense and return to the earth in the form of rainfall. However, this would not occur in the immediate area of Kinross. Therefore, this would be an irretrievable use of the resource.

3.19 Unavoidable Adverse Impacts

Construction and operation of the proposed facility would cause unavoidable emissions of some criteria air pollutants. However, air pollutant concentrations would not exceed significance thresholds established by the USEPA and MDNRE. Short-term adverse impacts from noise generated during the construction of the proposed facility would occur; however, activities would comply with all local noise ordinances. The need for construction materials, such as steel and concrete would be unavoidable, but would represent a small fraction of available materials. Traffic increases would occur on the Gaines Highway, but would be well within its capacity

Construction of the rail spur would result in the irreversible filling of 3.14 acres of jurisdictional forested wetlands. Mitigation for the impacted wetlands would be completed by creation of new wetlands in a quantity greater than those filled.

4.0 Cumulative Impacts

4.1 Existing and Reasonably Foreseeable Projects

The CEQ regulations implementing NEPA require the consideration of cumulative impacts as part of the process (40 CFR 1508.7):

> *"Cumulative impact" is the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions. Cumulative impacts can result from individually minor, but collectively significant actions, taking place over a period of time."*

This section analyzes potential cumulative impacts to selected resource areas described throughout Chapter 3. The effects associated with the proposed project are analyzed in combination for their incremental contribution to cumulative effects when added to impacts from other planned and reasonably foreseeable actions. For an affected resource area, each reasonably foreseeable future action, including the Proposed Action, adds an increment to the total (cumulative) impact. For this analysis, the past and present effects are accounted for in the existing baseline of the affected environment section of this EA.

The overall Frontier Project is being developed to produce approximately 42.5 million gallons per year (mgy) of denatured ethanol (40 mgy of anhydrous ethanol) from about 1,540 bone dry short tons per day (BDTPD) of cellulosic materials consisting primarily of woody biomass (clean chips). Capacity expansion beyond 42.5 mgy is not a reasonably foreseeable action and is not addressed in this EA.

The Upper Peninsula of Michigan has been an active location for logging, wood products facilities and paper mills for more than a century. The pulpwood logging and transportation infrastructure is well established throughout the supply area, and is expected to recover sufficiently to supply the whole logs and chips for the Frontier project.

One new forest products business company, the Gitchie Gumee Pellet Company (GGPC), began operations in Kinross Charter Township in June 2010. GGPC manufactures wood pellets for use as a fuel on the former Kincheloe air force base. GGPC has the capacity to manufacture up to 20,000 tons of wood pellets per year. GGPC uses a combination of wood waste, forest-thinning, and sawdust to produce their pellets. The proposed Frontier Project would not complete for these forest resources as their biomass requirements would be met through the use of green logs and/or green chips. Rather, it is likely that the increase market for hardwood in the region would make more wood waste and forest thinning available for GGPC. GGPC may also be a potential purchaser of excess lignin from the proposed Frontier Project. If GGPC were to modify their process to utilize green logs rather than wood waste, forest thinning, and sawdust, the available forest resource in excess of a sustainable harvest level within 150 miles of Kinross is sufficient to meet their needs.

One other cellulosic ethanol facility, the Alpena Prototype Biorefinery (APB), is under construction within 150 miles of the proposed Frontier site. The APB facility is being constructed by American Process, Inc. adjacent to the existing Decorative Panels, Incorporated facility in Alpena, Michigan. The APB project will use washwater rich in wood sugars from the DPI manufacturing process as the feedstock for the biorefinery. No additional forest resources will be harvested by Decorative Panels, Inc. to support the APB project.

5.0 References

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Draft Environmental Assessment and Notice of Wetland Involvement for the Construction and Operation of a Proposed Cellulosic Biorefinery, Mascoma Corporation, Kinross Charter Township, Michigan

DOE/EA 1705

Appendix A - Scoping Letters and Scoping Letter Distribution List

Tribal Contacts

Sault Ste. Marie Tribe of Chippewa Indians
Attn: Tribal Chairman
523 Ashmun Street
Sault Ste. Marie, MI 49783
Phone: 906.635.6050

Inter-Tribal Council of Michigan, Inc.
Att: Dwight Sargent
2956 Ashmun Street
Sault Ste. Marie, MI 49783
DwightS@ITCMI.org
Phone: 906.635.4208

State of Michigan

Michigan Department of Natural Resources
Attn: Lori Sargent
Nongame Wildlife Biologist
Wildlife Division
PO Box 30180
Lansing, MI 48909
SargentL@michigan.gov
Phone: 517.373.9418

Michigan Department of Environmental Quality
Attn: Steve Casey
District Supervisor – Water Bureau
Upper Peninsula District Office
420 5th Street
Gwinn, MI 49841
caseys@michigan.gov
Phone: 906.346.8535

Michigan Department of Transportation
Attn: Dan Hamlin
Superior Region and Escanaba TSC
1818 3rd Avenue North
Escanaba, MI 49829
hamlinda@michigan.gov
Phone: 906.786.1830 ext. 314

State Historic Preservation Office
Attn: Environmental Review Coordinator
Michigan Historical Center
P.O. Box 30740
702 W. Kalamazoo St.
Lansing, MI 48909-8240

Local Government

Kinross Township
Attn: Larry Palma
4884 W. Curtis Street

P.O. Box 175
Kincheloe, MI 49788

Chippewa County Economic Development Corporation
Attn: Kathy Noel
5019 W. Airport Drive
Kincheloe, MI 49788
Phone: 906.495.5631

Federal Agencies

Hiawatha National Forest
Attn: Sue Alexander
2727 N. Lincoln Road
Escanaba, MI 49829
Phone: 906.789.3327

U.S. Fish & Wildlife Service
Attn: Craig Czarnecki, Field Supervisor
East Lansing Field Office
2651 Coolidge Rd., Suite 101
East Lansing, MI 48823
Phone: 517.351.6236

Local Library

Bayliss Public Library
541 Library Drive
Sault St. Marie, MI 49783
Phone: 906.632.9331

Summary of DOE Scoping Letter Responses and Comments/Location Where Questions are Addressed

Environmental

Water

How much water will be used to produce ethanol?	Addressed in Section 2.2.5.1
From where would the water come throughout the anticipated period of biorefinery operation?	Addressed in Section 2.2.3.13, and 3.8.3
Is the water source able to supply the biorefinery's average and maximum demand over the anticipated period of biorefinery operation, in addition to the current water uses?	Addressed in Section 3.8.1 and 3.8.3
At the biorefinery's average and minimum water demand, and over the anticipated period of biorefinery operation, what would be the effects on the water table, local wells, ground water (including the interaction between bedrock and glacial drift aquifers), and surface water?	Addressed in Section 3.8
EA should evaluate the potential for the increased water system demand and well withdrawal to accelerate any plume movement toward the township wells.	Addressed in Section 3.8.1 and 3.8.3

Wastewater

What water emissions will come from building and expanding the biorefinery and Kinross Township utilities?	Addressed in Section 3.8.1.4 and 3.8.3.3
What specific pollutants will be in the biorefinery wastewater?	Addressed in Section 3.8.3.3
How will the wastewater be handled?	Addressed in Section 3.8.3.3
Is the Kinross Township wastewater treatment plant currently able to handle the added volume of wastewater? If not, what environmental impacts will result from the WWTP expansion?	Addressed in Section 3.8.1.4 and 3.8.3.3
EA should evaluate impacts on the wastewater treatment system, including a Maximum Allowable Headwork Loading analysis for contaminants of concern.	Addressed in Section 3.8.3.3
What processes will the wastewater treatment plant follow in filtering each pollutant from the biorefinery wastewater?	Addressed in Section 3.8.1.4 and 3.8.3.3
What water quality standards will the treated water be required to meet before being discharged by the wastewater treatment plant? Who will oversee monitoring and enforcement of these standards?	Addressed in Section 3.8.1.4 and 3.8.3.3
Given this cellulosic process is new and has not been used on large scale, how can it be assured that this large amount of water can be made clean enough to release into the Little Munuscong River watershed?	Addressed in Section 3.8.3.3
Where will treated water be discharged and what will be the impacts on ground water, surface water (including level/temp of Little Munuscong River), well water, and the human, fish, and wildlife populations that rely on those waters?	Addressed in Section 3.8.3

Air

What air emissions will come from building and expanding the biorefinery and Kinross Township utilities?	Addressed in Section 3.6.3
What will be the annual air emissions and pollution from hardwood harvest, transportation, and biorefinery processes (including everything down to the wearing of brake pads on hauling trucks at the furthest extent of the 150-mile radius)?	Addressed in Section 3.6.3
What effect would the emissions (primarily CO2 and odors) have on air quality?	Addressed in Section 3.6.3
Transportation in (supplies) and out (finished product) will diminish the air quality.	Numerous EPA and other studies have concluded that production and use of biofuels, including ethanol reduce overall emissions from vehicles.
If 200 gallons/day of water will be used and 100 gallons/day will be discharged to the wastewater treatment plant, it must mean 100 gallons will be discharged into the air via evaporation. What will this do to air quality and will there be an odor?	Addressed in Section 3.6.3
What will removing the large number of required trees within the 150-mile radius do to air quality?	Addressed in Section 3.1
Does the project assess irreparable harm should bacteria become airborne?	Addressed in Section 3.9.3.3

Solid Waste / Hazardous Materials

If hazardous and/or solid wastes are generated at the facility, they must be handled, transported and disposed of in compliance with Part 111, Part 121 and Part 115 of PA 451 and rules administered there under.	Solid, hazardous and universal waste from construction and operation would be disposed in accordance with Federal, State and Local laws and regulations.
What will happen to the solid waste produced?	Addressed in Section 3.9.1
Can the solid waste be economically used for making pellets for stoves or have some other use?	No
Will there be any hazardous waste materials?	Addressed in Section 3.9.1

Tribal Considerations

What will be the impacts on the survival and availability of fish, wildlife, and plants used by the Anishinaabek people for medicines, food, and products?	Addressed in Section 3.1.1, 3.1.1.1, 3.1.1.2, 3.16.1.1, and 3.16.3
How many Anishinaabek archeological sites will be impacted by resource acquisition?	The cultural resources of all Tribes will continue to be protected by existing Federal, State and Industry programs (including the Forest Stewardship Council Certification Programs Certification Programs and Sustainable Forestry Initiative, Addressed in Section 3.4

Will the Michigan Anishinaabek Cultural Preservation and Repatriation Alliance be consulted?	The DOE has initiated consultation with all Federally Recognized Tribes in Michigan, as well as, many federally recognized tribes in Wisconsin and Minnesota. Addressed in Section 3.4
How will the Tribal signatories of the 1836 Treaty of Washington be consulted throughout the EA, permitting, construction, monitoring, enforcement, and shut-down processes?	The DOE has initiated consultation with all Federally Recognized Tribes in Michigan, as well as, many federally recognized tribes in Wisconsin and Minnesota. Addressed in Section 3.4
Wildlife	
If all this hardwood is cut, what happens to our wildlife?	Addressed in Section 3.1, Forest resource harvest requirements for the proposed Frontier Project would result in harvest of less than 1% of the commercially available forest land and substantially less than 1% the total forest land within 150 miles of the project site annually. Wildlife habitat and diversity will continue to be protected by existing Federal, State and Industry programs (including the Forest Stewardship Council Certification Programs Certification Programs and Sustainable Forestry Initiative)
What would be the effect on local fish and wildlife dependent on ground and surface water?	Addressed in Section 3.1, Wildlife habitat and diversity will continue to be protected by existing Federal, State and Industry programs (including the Forest Stewardship Council Certification Programs and Sustainable Forestry Initiative)
How will fish and wildlife populations be impacted by the process of changing local infrastructure?	Addressed in Section 3.1
How will the proposed project impact the wildlife in the area?	Addressed in Section 3.1
Electrical transmission line may adversely impact the federally endangered Hine's emerald dragonfly (more detail to be provided by 2/26/2010)	The proposed Frontier Project will generate its own power and not cause a need to upgrade or rebuild the existing ATC transmission line.
Organisms	
What are the consequences of using "experimental", GMO organisms?	Addressed in Section 3.9.1.3 and 3.9.3.3
Describe how the engineered bacteria and yeast used in the CBP process will be guaranteed to not survive the wood-to-ethanol process.	Addressed in Section 3.9.3.3
Will the bacteria likely mutate over time? If not, why not.	The proposed Frontier Project would use a modified brewer's yeast, not a bacteria. Addressed in Section 3.9.3.3
If the bacteria or enzymes used in the process do mutate, is there an adequate monitoring system to detect mutations?	Addressed in Section 3.9.3.3
If the bacteria or enzymes survive the CBP process and are introduced to the surrounding environment, is there a contingency plan, including short-term and long-term mitigation for the land and water table? Please describe.	Addressed in Section 3.9.3.3
If the bacteria survives and is introduced into nature, what affects will it have?	Addressed in Section 3.9.3.3
Does the wastewater treatment facility planned for the project include a contingency plan for dealing with bio-engineered bacteria or enzymes?	No wastewater treatment system is planned for the proposed project. Addressed in Section 3.8.1.4 and 3.8.3.3.
What is the possibility of an accidental release of bio-engineered enzymes?	Addressed in Section 3.9.3.3
Land Use	
The existence of heavy industry where a wooded area owned by the State of Michigan once existed represents environmental injustice. It is unjustifiable for this corporation to acquire a piece of state forest when there is privately owned, cleared land in Kinross, adjacent to I-75 and railroad. This represents an irreversible and irretrievable commitment of public land for private use.	The proposed Frontier site was acquired through a trade of land where in the State of Michigan received land that they determined was of sufficient value to warrant the transaction.
Other Environmental	
How much noise/dust would result from project (day and night)? (M-80 has residential and small business areas)	Address in Section 3.6.3 and 3.13.3
What permits will be required for changes in local infrastructure?	Addressed in Section 2.2.4.3 and 2.2.5.3
Regarding the statement: "Lignin residue would be pumped to the solids handling area for dewatering" -- what is dewatering? Where will the removed liquid go (i.e., will it leach into the ground)? What will it contain?	Water is removed from the lignin using a centrifuge, filter press or similar device. The water would be reused in the process or discharged to the Kinross waste water treatment plant for treatment. Addressed in Section 2.2.3
The size and scope of the potential effects of this project warrant a full EIS, rather than simply an EA	In accordance with NEPA regulations an environmental assessment is completed to determine whether an EIS is warranted.
If the "No Action" alternative is chosen, will this project continue to move forward?	Addressed in Section 2.1

Feedstock

Sustainability / Availability

With all the uses for wood (current and proposed), is the process of using large quantities of wood sustainable? Describe process/method of determining sustainability.	Addressed in Section 3.1
Describe the affects of this project on the existing wood supply.	Addressed in Section 3.1
What is the planned radius for the procurement circle? (would help in the sustainability question)	Addressed in Section 3.1
Is there 1,800 cords per day of excess hardwood capacity available locally? If not, what impact will consuming 1,800 cords of hardwood per day have on wood prices?	Addressed in Section 3.1
Within the 150-mile radius, exactly where will the hardwood pulpwood logs come from? If available, provide data to show location and adequacy of supply.	Addressed in Section 2.2.5.2 and 3.1
How many cords of the targeted hardwood species are the working forests within the 150-mile radius capable of producing without creating new measurable impacts?	Addressed in Section 3.1
How will the increased demand for hardwood resources impact forest management practices within the 150-mile radius?	Addressed in Section 3.1
Will the increased demand from the biorefinery increase the use of forest management practices with short harvest rotation times?	Addressed in Section 3.1
How will the acreage of late succession northern hardwood and northern mesic hardwood forest stands change in response to biorefinery demand within the 150-mile radius?	Addressed in Section 3.1
What happens to the project if it cannot get adequate supply within 150 miles?	Addressed in Section 3.1
Will forest resources beyond the 150-mile radius be used? If so, all questions directed toward the 150-mile radius resources should address forest resources and impacts beyond that area.	Frontier has determined the economic resource area to be 150 miles from the proposed Frontier Project site as sufficient resources exist within that harvest radius to support the project. Addressed in Section 3.1
Prior to DOE funding and project permitting, will a guidance document for handling biomass uses of State Forest Lands be created? If so, who, when, and with what public input and Tribal consultation will it be created?	Addressed in Section 3.1
Concerns about an age class gap being created from the use of hardwood pulpwood logs and the impact from reducing the number of sawlogs available for furniture, etc.	Addressed in Section 3.1.1 and 3.1.3
Public statements from developers of the project have used "growth over harvest" figures in their attempts to demonstrate sufficient availability of wood. This assumes harvesting all growth annually is sustainable. Please address in response to sustainability.	Addressed in Section 3.1.1 and 3.1.3
Address how this project, as well as other projects using large amounts of wood (i.e., cumulative effects), will affect forests recovering from massive cutting a century ago and their current move towards more natural age class and seral stage distribution.	Addressed in Section 3.1.1 and 3.1.3
How many other biomass projects are proposed for the wood gathering area of this project? What will the cumulative effects be on wood prices, sustainability, etc.?	Addressed in Section 4.0
How will this project be affected by the state of Michigan taking significant areas of state forest out of timber production through its Biodiversity Stewardship Area program? How will the ability of the state to designate and manage these areas for biodiversity conservation be affected by the increased demand?	The MDNRE would continue to evaluate State owned land through their existing BSA programs. Participation by private land owners is strictly voluntary. Private land owners would still be able to submit their property for participation in the BSA process. Candidate areas would be assessed by regional teams of DNRE staff and stakeholders. These teams would make a formal recommendation to the DNRE for a set of areas that should be included in the BSA network for their region. DNRE leadership (the DNRE's Statewide Council Certification Programs) would make the final decision after internal and public review. This process would not be affected by the proposed Frontier Project. Addressed in Section 3.1.1

Type

How is "hardwood pulpwood" defined?	Addressed in Section 2.2.5.2
What species are included and at what percentage in the mix? (i.e., if it is 90% hard maple, then different sustainability exercise than any percentage of hardwood)	Addressed in Section 2.2.5.2 and 3.1.1
What are the quality specifications for the wood? (i.e., min/max diameter, % rot, etc. - would help define the % of the resources the mill can use)	The forest resource assessment completed by Michigan Technological University for the Frontier Project specifically addressed the amount of available timber that was compatible with this project.
What is the final furnish quality specification? (would help determine the % of delivered volume for consumption). Would the furnish specifications remain the same with any expansion in plant capacity?	DOE has determined that this question is outside the scope of the analysis of this Environmental Assessment.
What is the age class distribution of the wood?	The age distribution of wood is dependent on the species. Harvest would come from existing resources and historically typical age ranges. Addressed in Section 3.1.1

Usage/Quantity	
What is the volume in cord equivalents? 571,000 cords?	Addressed in Section 3.1.3
Is waste/residual material included in the use estimate?	Addressed in Section 3.1.3
Will the biomass boiler use additional wood or only the non-usable portion of the roundwood feedstock? (would help determine the total wood consumption impact as well as indicate impact to residual markets)	Addressed in Section 2.2.3.11
To meet the demands of this project, how many acres will need to be harvested annually in addition to current hardwood forest uses within the 150-mile radius? What percentage of total forest growth in the area will be consumed by the project?	Addressed in Section 3.1.3
Industry/Market Impact	
What is impact on wood pellet industry starting up at Kincheloe Air Force Base?	Addressed in Section 4.1.
What effect will the plant have on the price and availability of fuel wood for heating homes?	Firewood typically comes from small private operations rather than commercial harvesters. Also, the resource base for firewood can include forest residue such as tree limbs and culls that would not be suitable for use at the proposed Frontier Project. The Frontier Project should have either no impact or a small beneficial impact on the availability and cost of firewood.
How will the increased demand for hardwood socially and economically impact Michigan businesses and communities that currently rely on those same hardwood resources, including but not limited to sawmills, timber producers, furniture businesses, biomass electric generating units, maple syrup producers, hunters and trappers? Include impact on wood prices.	Addressed in Section 3.1.1 and 3.1.3.
This project will likely drive up the price of pulpwood and negatively impact the Newberry OSB factory and several UP paper plants. Will these plants close, resulting in job loss?	Addressed in Section 3.1.1 and 3.1.3.
Environmental Impact	
What effect will the use of large quantities of pulpwood have on the forest ecosystem?	Addressed in Section 3.1.3
How will the wood usage affect wildlife, old growth forests, and other ecosystem components?	Wildlife habitat and diversity will continue to be protected by existing Federal, State and Industry programs (including the Forest Stewardship Council Certification Programs and Sustainable Forestry Initiative). Addressed in Section 3.1.3
How will increased demand for hardwoods impact sensitive vegetation that grows in the northern and mesic northern hardwood communities within the 150-mile radius?	Addressed in Section 3.1.3
What will be the cumulative effects from current and proposed hardwood resource uses, including this biorefinery and other proposed biomass facilities?	Addressed in Section 4..0
What will be the effect on species (e.g., Northern Goshawk) that require older, later successional, closed canopy habitat?	Wildlife habitat and diversity will continue to be protected by existing Federal, State and Industry programs (including the Forest Stewardship Council Certification Programs and Sustainable Forestry Initiative). Addressed in Section 3.1.3
Carbon	
Will the project be required to be carbon-positive?	The proposed Frontier Project would substantially reduce generation of anthropogenic CO2 on a short terms and life cycle basis. The resulting biofuels would meet the strict standards for advanced biofuels established by the USEPA in the Renewable Fuels Standard. Addressed in Section 3.6.1.3 and 3.6.3.2
Will the project be allowed to be carbon-negative at any point?	See above. Addressed in Section 3.6.1.3 and 3.6.3.2
How will the ability of the forests to act as carbon sinks be impacted by biorefinery forest resource demand and use?	Addressed in Section 3.6.1.3 and 3.6.3.2
How much carbon is captured per year currently by resources within the 150-mile radius (and beyond, if applicable) and how will that annual rate change through the anticipated operation of the biorefinery?	Addressed in Section 3.6.1.3 and 3.6.3.2
Alternative Feedstock	
Why can't canary grass, sawdust, old hay, willows, sedges, or other plant material be used instead of pulpwood? These don't have much current market use.	The listed biomass are not available in sufficient quantities in the project area to sustain a commercial scale facility. Additionally, each different biomass requires different pre-treatment and processing techniques making use economically infeasible .

Local Area Impact

Community Cost/Benefit

Would our area receive any revenue from the project?	Addressed in Section 3.16.3.
How would the biomass generation affect our current cost of electricity?	Electric rates are set by the Michigan Public Service Commission. Rate hearings are open to the public. The proposed Frontier project would generate enough electricity to meets it own needs. Frontier might sell excess electricity to the grid. Therefore, the proposed Frontier Project is expected to have no impact on local electricity costs.
The overall cost to the community will be greater than the gains.	The project would contribute both direct and indirect economic benefits to the community.
Will the treated water discharged into Little Munuscong River affect the wildlife and the sport hunting and fishing activities, which are an important part of local economy?	Existing MDNRE regulations prohibit the discharge of water from municipal waste water treatment plants (WWTPs) that would adversely impact the local surface water. The Kinross Charter Township has a permit for their WWTP that has limits on the pollutants that may be discharged. The Proposed Frontier Project would discharge water to the Kinross WWTP for treatment. The Kinross WWTP has the capacity to treat the Frontier discharge and maintain compliance with their permit limits. Addressed in Section 3.8.3.3
Will there be any irreparable harm to the people of Kinross Township if rate-payers are required to issue a bond for expansion of the township wastewater treatment project?	An expansion of the Kinross WWTP is not required to support the proposed Frontier Project.
In the event of a project failure, will the Kinross Township rate-payers be responsible for paying off any bonds or loans?	No bonds are required for the proposed Frontier Project.
Who will pay for increased road and other infrastructure maintenance costs throughout the anticipated operation of the biorefinery, and what will those costs be?	Frontier would pay for connection fees to the Kinross water and sewer systems. Frontier would also pay normal rates for the water and sewer services, thus adding to the Kinross Township budget.
How will the additional infrastructure be maintained after the life of the biorefinery?	This question is outside the scope of an Environmental Assessment
What is the expected project life cycle?	Project life expectency is 40 years or greater

Job Creation

How many people will be working at the plant? (i.e., direct, non-construction jobs created)	Addressed in Section 2.2.5.4
Socio-economic questions should be addressed before jeopardizing hundreds of existing jobs for 30-40 new jobs.	Per the NEPA regulations, DOE includes a socio-economic analysis in this environmental assessment. Addressed in Section 3.16.
How many cords of wood will be required for each job created (not counting construction jobs)?	DOE has determined that this is not a standard way to measure socio-economic or environmental impacts and is not addressed in the EA.
How many more jobs could be created using the same amount of wood for value-added products (e.g., furniture, etc.)?	DOE is required to evaluate the biofuels project being proposed and the cumulative effects of other projects in the same area. DOE cannot evaluate cumulative effect of non-existent projects or facilities or projects for which no proposal has been developed.

Traffic

How will the increased traffic and heavy trucks impact the conditions and maintenance of Chippewa County and other road networks within the 150-mile radius?	Addressed in Section 3.12.3
There will be increased traffic and noise in the nearby residential community of Woodside.	Addressed in Section 3.13.3 and 3.15.3

Plant Specifications and Operations

Plant Capacity

Are there expansion plans? If so, to what total consumption level? How will expansion affect economic, feedstock, etc. cumulative effects on the region?	Capacity expansion beyond 42.5 mgal/yr is not a reasonably foreseeable action and is not addressed in this EA.
Is a capacity expansion considered necessary for economic viability?	No
What does "up to 40MMGY per year" realistically mean? How optimistic is this figure?	Addressed in Executive Summary and Section 1.2
What percentage of Michigan's gasoline usage will be produced by this plant (i.e., gallons undenatured ethanol divided by Michigan total gasoline usage)?	Projected gasoline sales for 2009 are 4,265.0 mgal, down from 4,352.9 mgal gallons in 2008. The last year in which gasoline use increased was 2004. The proposed Frontier Project would provide approximately 1% of the fuel used in Michigan.

Electricity Usage

How much energy will be used to produce each gallon of ethanol (including the entire process - i.e., feedstock to fuel pump)?	Addressed in Section 2.2.5.1
Where will the extra electricity supply come from?	Addressed in Section 2.2.3.11
Can burning fossil fuel to generate electricity to produce ethanol be rationally justified based on efficiency and cost?	Natural gas would be used for cold boiler pre-heat and during plant start up. Thereafter, the biomass boiler would provide steam to generate electricity.
Is the energy used to construct and operate the biorefinery a wise use?	In its NEPA review, DOE will consider the impacts of the energy used to construct and operate the proposed Frontier facility.

Process

How efficient is the process of producing ethanol from wood?	Addressed in Section 2.2.5.1
What will be done with the bark after it's removed from the logs?	Addressed in Section 2.2.3.11

Safety

Given that the local fire and hazmat protection is volunteer-based, will there be adequate training and staffing to attend to any fire or chemical accident associated with the biorefinery and related developments?	Addressed in Section 3.10.3 and 3.11.3

Transportation

How many rail cars and trucks will be required to transport the ethanol produced?	Addressed in Section 3.15
What will be the fuel needs for transportation of hardwood products and supplies to the proposed project site and ethanol from the proposed site (i.e., total fuel usage)?	Addressed in Section 2.2.5.1

Project Financing

Government Support

Is the viability of the project dependent on the current proposed subsidy and any expected future government market interference?	DOE has determined that this question is outside the scope of the analysis of this Environmental Assessment.
Will this grant analysis include the efficacy of previous federal grants to this project? If so, please include analysis.	DOE's involvement in the proposed Frontier Project prior to this Assessment is addressed in the Proposed Action description. Overall economics of the proposed Frontier Project are part of DOE's evaluation process.
Have previous grants to the project fulfilled obligations and assumptions made by grantees?	DOE has determined that this question is outside the scope of the analysis of this Environmental Assessment.
Will there be public disclosure obligations in the grant to allow the public to identify uses of the grant?	While this question is outside the scope of the EA, the public may request such information through the Freedom of Information Act which is applicable to financial assistance awards, subject to certain exemptions.
Will the grant include requirements for analysis of the use of the grant and steps in the granting process to allow public analysis?	DOE has determined that this question is outside the scope of the analysis of this Environmental Assessment.
If grantees do not perform, are there personal guarantees for grant repayment from Frontier ownership group? What are non-performance descriptions?	DOE has determined that this question is outside the scope of the analysis of this Environmental Assessment.
Will any part of the grant be used for personal salaries? If yes, by whom? Describe.	DOE has determined that this question is outside the scope of the analysis of this Environmental Assessment.
What will be the minimum amount produced that will make it economically feasible to keep the plant in operation? (i.e., will more government assistance be needed?)	While this question is outside the scope of the EA, overall economics of the proposed Frontier Project are part of DOE's evaluation process.
If the project will continue to move forward in the event of a "No Action" alternative, how can there be any "need" for the DOE funding?	Although this project could proceed if DOE decided not to provide financial assistance, the Department has assumed, for the purposes of comparison in this EA, that the project would not proceed without its assistance.

Other Funding Sources

Who is paying for this project? Provide public and private sources and amounts.	The overall project cost has been estimated to be $409MM. The State of Michigan Economic Development Corporation has provided a grant of $20MM, plus a Community Development Block Grant of $3.5MM. The DOE grant would be up to $58.5MM on a 50% cost matching basis. Debt and private equity would make up the remaining $327MM.
Is this grant being matched by private equity? If so, describe.	See above.
If this project is a great idea, why aren't private investors putting more into it relative to the local financial assistance?	See above.

Structure

How does present grant request of $32 million link to other financial assets of the ownership-partnership? (i.e., how will it be used on their balance sheet?)	See above.
Is the $32 million grant being leveraged by the owners for private financing? If so, describe.	See above.
Are the owners of the partnership personally securing debt, including bonds for the project?	DOE has determined that this question is outside the scope of the analysis of this Environmental Assessment.

Markets

Ethanol

Is there a market for ethanol and will there continue to be demand when the plant becomes operational?	There is an existing market for fuel ethanol. Demand for advanced biofuels, such as would be produced by Frontier, is greater than the demand for corn based ethanol due to the Climate Action Registry regulations in California.
How many plants (similar to the proposed) exist? How are they doing?	DOE has determined that this question is outside the scope of the analysis of this Environmental Assessment.
Is hardwood-based cellulosic ethanol a viable long-term option for fuel production in Michigan?	Yes, resource and economic analysis have continued to support development.
If we continue to produce more fuel efficient vehicles and vehicles that run on electricity or other innovative forms of power, the demand for ethanol will drop.	DOE has determined that this statement is outside the scope of the analysis of this Environmental Assessment.

Lignin

What is the present market for lignin?	A stable market exists for the lignin as fuel.
What are the realistic possibilities of selling the lignin and spent cellulose as fuel?	A stable market exists for the lignin as fuel.

-----Original Message-----
From: Casey, Steve (DEQ) [mailto:CASEYS@michigan.gov]
Sent: Friday, January 08, 2010 12:46 PM
To: Kerwin, Kristin
Cc: Clark, Clif (DEQ); Brady, Brian (DEQ); Schmeling, Rob (DEQ); DeGrand, Don (DEQ); North, Deana (DEQ); Gustafson, Cary (DEQ)
Subject: FW: Scanned Document

Ms. Kerwin;

This is in response to the attached December 22, 2009 “Notice of Scoping” for the Frontier Renewable Resources Biorefinery Project in Kinross, MI.

The MDEQ Gwinn District Office has the following comments:

1. The EA should evaluate the potential for the increased water system demand and well withdrawal to accelerate any plume movement toward the township wells.

2. The EA should evaluate impacts on the wastewater treatment system, including a Maximum Allowable Headwork Loading analysis for contaminants of concern.

3. If hazardous and/or solid wastes are generated at the facility they must be handled, transported and disposed of in compliance with Part 111, Part 121 and Part 115 of PA 451 and rules administered there under.

4. Is there 1,800 cords per day of excess hardwood capacity available locally? If not, what impact will consuming 1,800 cords of hardwood per day will have on wood prices? Will this impact existing lumber and paper mills? These socio economic questions should be addressed before jeopardizing hundreds of existing jobs for 30-40 new ones.

Steve

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Government Services

Membership Services

January 19, 2010

Kristin Kerwin
NEPA Compliance Officer
Department of Energy
1617 Cole Boulevard
Golden, Colorado 80401

RE: Notice of Scoping - Frontier Renewable Resources Cellulose-to-Ethanol Biorefinery Project, Kinross, Michigan (DOE/EA 1705)

The Sault Ste. Marie Tribe of Chippewa Indians (Sault Tribe) received a Notice of Scoping document from the Department of Energy on December 30, 2009. Please accept this letter as the Sault Tribe's indication of interest in the Department of Energy funding and Environmental Assessment of Frontier Renewable Resources cellulose-to-ethanol biorefinery project in Kinross, Michigan. The Sault Tribe has identified the following issues and potential impacts of the biorefinery for inclusion in the DOE's EA.

The Notice of Scoping estimated that 1,440 bone dry tons of hardwood pulpwood would be used per day, from a 150-mile radius area within Michigan. The 150-mile radius includes over 82% of the public lands in the 1836 Treaty of Washington Ceded Territory, which are subject to the 2007 Inland Consent Decree between the U.S. Government, five Tribes in Michigan, and the State of Michigan.
What are the targeted species of hardwood trees for the process?
How many cords of the targeted hardwood species are the working forests within the 150-mile radius capable of producing without creating new measurable impacts?
To meet the demands of this project, how many acres will need to be harvested annually in addition to current hardwood forest uses within the 150 mile radius?
Will forest resources beyond the 150 mile radius be used? If so, all questions directed toward the 150 mile radius resources should address forest resources and impacts beyond that area.
How will the ability of the forests to act as carbon sinks be impacted by biorefinery forest resource demand and use? How much carbon is captured per year currently by resources within the 150 mile radius (and beyond of those forest resources are used) and how will that annual rate change through the anticipated operation of the biorefinery?
What will the annual air emissions be from hardwood harvest, transportation, and biorefinery processes?
What will the pollution be from hardwood harvest, transportation, and biorefinery processes? This would include everything down to the wearing of brake pads on hauling trucks at the furthest extent of the 150-mile radius.
What will the gasoline needs for transportation of hardwood products to the proposed project site?

What will be the impacts on the survival and availability of fish, wildlife, and plants used by Anishinaabek people for medicines, food, and products?

How many Anishinaabek archeological sites will be impacted by resource acquisition?

Will the Michigan Anishinaabek Cultural Preservation and Repatriation Alliance be consulted?

How will the Tribal signatories of the 1836 Treaty of Washington be consulted throughout the EA, permitting, construction, monitoring, enforcement, and shut-down processes?

Forest biodiversity is essential to Tribal natural resource users within the 150-mile radius.

How will the increased demand for hardwood resources impact forest management practices within the 150 mile radius?

Will the increased demand from the biorefinery increase the use of forest management practices with short harvest rotation times?

How will the acreage of late succession northern hardwood and northern mesic hardwood forest stands change in response to biorefinery demand within the 150 mile radius?

How will increased demand for hardwoods impact sensitive vegetation that grows in the northern and mesic northern hardwood communities within the 150 mile radius?

According to the 2008 Michigan Forest Certification Audit on State Forest Lands, there is no guidance document for handling biomass uses of State Forest Lands. This guidance document is necessary for adequate planning, funding, and permitting biomass uses of State lands.

Prior to DOE funding and project permitting, will a guidance document for handling biomass uses of State Forest Lands be created? Who will accomplish this, when, and with what public input and Tribal consultation?

What will the cumulative effects be from current and proposed hardwood resource uses, including this biorefinery and other proposed biomass facilities?

How will the increased demand for hardwood socially and economically impact businesses and communities in Michigan that currently rely on those same hardwood resources, including but not limited to furniture businesses, biomass electric generating units, maple syrup producers, hunters and trappers?

The Notice of Scoping estimated that 200 gallons of water would be required per minute for biorefinery operations.

From where would the water come throughout the anticipated period of biorefinery operation?

Is the water source able to supply the biorefinery's average and maximum demand over the anticipated period of biorefinery operation, in addition to current water uses?

At the biorefinery's average and maximum water demand, and over the anticipated period of biorefinery operation, what would the effects be on local wells, ground water (including the interaction between bedrock and glacial drift aquifers), and surface water? What would the effects be on local fish and wildlife dependant on those ground and surface waters?

The Notice of Scoping estimated that 100 gallons per minute of wastewater would be discharged from the facility to the Kinross Township waste water treatment plant.

Is the Kinross Township WWTP currently able to handle the added volume of wastewater? If not, what environmental impacts will result from the WWTP expansion?

What specific pollutants will be in the biorefinery waste water?

What processes will the WWTP follow in filtering each pollutant from the biorefinery waste water?

What water quality standards will the treated water be required to meet before being discharged by the WWTP? Who will oversee monitoring and enforcement of these standards?

Where will treated waters be discharged and what will the impacts be on ground water, surface water, well water, and the human, fish, and wildlife populations that rely on those waters?

The Notice of Scoping includes substantial changes in infrastructure.

What air and water emissions will come from building and expanding the biorefinery and Kinross Township utilities?

What permits will be required for changes in local infrastructure?

How will fish and wildlife populations be impacted by the process of changing local infrastructure?

How will the increased traffic and heavy trucks impact the conditions and maintenance of Chippewa County and other road networks within the 150-mile radius?

Who will pay for increased road and other infrastructure maintenance costs throughout the anticipated operation of the biorefinery, and what will those costs be?

How will the additional infrastructure be maintained after the life of the biorefinery?

The current local fire and hazardous materials protection is volunteer-based.

Will there be adequate training and staffing to attend to any fire or chemical accident associated with the biorefinery and related developments?

Perhaps the most relevant questions are:

Is hardwood-based cellulosic ethanol a viable long-term option for fuel production in Michigan?

Is 40 million gallons of ethanol worth the annual costs of 1,440 dry tons of Michigan hardwoods and related long term social, cultural, economic, and natural resource impacts of the biorefinery?

Should this project proceed, many of the adverse environmental effects discussed in this letter may not be avoided. Short-term and long-term impacts should be researched, quantified, and considered prior to project funding and permitting. Because Michigan's hardwood resources would require over fifty years to replace once harvested, the commitment of these resources may indeed be irreversible and irretrievable.

Sault Tribe would encourage a public meeting to discuss these and other important matters.

Miigwech.

Darwin (Joe) McCoy
Tribal Chairman

Jh/

CC: J. Holt
C. Kachur
C. Pavlat
E. Clark
C. Bole
R. Clark
A. Bosak

Frontier/mascoma

DOE will make this letter available to all interested federal, state and local agencies to provide input on issues to be addressed in the EA. Agencies are invited to identify the issues, within their statutory responsibilities that should be considered in the EA. The general public is also invited to submit comments on the scope of the EA.

No formal public scoping meeting is currently planned for this project. The proposed project is described in detail in the attachment to this letter. This letter as well as the draft EA, when it is available, will be posted in the DOE Golden Field Office online reading room: http://www.eere.energy.gov/golden/reading room.aspx.

The DOE Golden Field Office welcomes your input throughout our NEPA process. Please provide any comments on this scoping letter on or before **January 26, 2010** to:

Kristin Kerwin
NEPA Compliance Officer
Department of Energy
1617 Cole Boulevard
Golden, Colorado 80401
kristin.kerwin@go.doe.gov

We look forward to hearing from you.

Sincerely,

Kristin Kerwin

Kristin Kerwin
NEPA Compliance Officer

Gerald Radecki
2148 W M80 Kinross

Enclosure

* Here are a few questions I have as a home owner in the area.
Who is paying for all this? Is there a market for the product?
How many plants like this are there, how are they doing?
How many people will be working at the plant? Do we have enough hardwood in our area? Could water use be a problem?
Being close on M-80, how much noise dust would result? (day + night)
Would our area receive any revenue from this?
By the time it gets built will there be the need for ethanol?
Would the bio mas generation help or hurt our present cost of electricty?
What would this do to the wood pellet industry now starting up at K.A.F.B.?
If all this hardwood is cut, what happens to all the wild life up here?

Patrick K. Egan 23806 Lakeshore Dr. Brimley, MI 49715
(pegan@up.net)

January 20, 2010

Kristin Kerwin
NEPA Compliance Officer
Department of Energy
1617 Cole Bvd.
Golden, CO 80401

Ms. Kerwin;

Subject: Notice of Scoping- Frontier Renewable Resources Cellulose-to-Ethanol Bio-refinery Project, Kinross Michigan (DOE/EA

I am listing my concerns in three areas: Process, Finance and Supply

Process:
1) Describe how the engineered bacteria and yeast used in the CBP process will be guaranteed to not survive the wood-to-ethanol process.
2) Will the bacteria likely mutate over time? If not, why not.
3) If the bacteria or enzymes used in the process do mutate, is there an adequate monitoring system to detect mutations?
4) If the bacteria or enzymes survive the CBP process and are introduced to the surrounding environment is there a contingency plan. Please describe.
5) Does the wastewater treatment facility planned for the project include a contingency plan for dealing with bio-engineered bacteria or enzymes?
6) If the bacteria survives and is introduced into nature, what affects will it have? Describe.
7) Are there contingency plans for both short term and long term mitigation, should engineered bacteria or enzymes accrete to both the water table and land?
8) Does the project assess irreparable harm should bacteria become airborne?

Financial:
1) Will this grant analysis include the efficacy of previous federal grants to this project? If so, please include analysis.
2) Have previous grants to project fulfilled obligations and assumptions made by grantees.
3) How does present grant request of $32 million link to other financial assets of the ownership-partnership? (i.e. how will it be used on their balance-sheet? Secondly, is this grant being leveraged by the owners for private financing? If so describe.

4) Is the viability of the project contingent on this grant
5) Is this grant being matched by private equity. If so, please describe.
6) Will there be public discloser obligations in the grant to allow the public to identify uses of the grant?
7) Will the grant include requirements for analysis of the use of the grant and steps in the granting process to allow public analysis?
8) If grantees do not perform are there personal guarantees for grant repayment from Frontier ownership group? What are non-performance descriptions?
9) Will any part of the grant be used for personal salaries. If yes, by whom? Describe.
10) Will there be any irreparable harm to the people of Kinross Township if rate-payers are required to issue a bond for expansion of the township waste-water treatment project. In the vent of a project failure will the Kinross Township ratepayers be responsible for paying off any bonds or loans?
2) Are the owners of the partnership personally securing debt, including bonds for the project?

Supply
1) Describe the complete affect of this project on the existing water table.
2) Describe the affects of this project on the existing wood supply.
3) Will the project be required to be carbon-positive?
4) If the project requires supply from a 150 mile radius, will existing supply last long enough for new supply, such as tree farms and new planting?
5) What happens to the project if it cannot get adequate supply within 150 miles? Will the project be allowed to be carbon-negative at any point?
6) Assess irreparable harm to existing sawmills and timber producers who depend on supply from the same 150 mile radius.

Thank you for your consideration.

Yours respectfully,

Patrick K - Egan

Patrick K Egan
(906-437-5526)

-----Original Message-----
From: Kurt Chamberlain [mailto:Kurt.Chamberlain@lpcorp.com]
Sent: Thursday, January 21, 2010 10:11 AM
To: Kerwin, Kristin
Subject:

Kristin,

I'm forwarding the following questions in response to the DOE request for same as it pertains to a grant request by Frontier Renewable Resources Cellulose-to-Ethanol Biorefinery Project and it's potentially locating this operation to Kinross, Michigan. These questions likely fall under the "Biological Resources" or "Socioeconomics" section of the EA request

1. Definition of "Hardwood Pulpwood"
    -What species are included and at what %'age in the mix? i.e. if it is 90% Hard Maple, that's a different sustainability exercise then any %'age of any hardwood.
    -Quality specifications for the wood? i.e. min & max diameter, % rot, etc would help define the % of the resource the mill can use.
    -What volume in cord equivalents, looks like 571,000 cords to me.
    -What is the final furnish quality specification? would help determine the % of delivered volume for consumption. Are they including waste/residual mat'l in the use estimate.

2. Planned radius for the procurement circle?
    - Would help in the sustainability question.

3. Consumption of the "bio-mass" boiler.
    - Mentioned in paragraph 1 of the attachment. Will it use additional wood or only the non-usable portion of the roundwood they buy.
    would help determine the total wood consumption impact as well as indicate what it will do to residual markets.

4. Are there plans to expand?
    - If so to what total consumption level?
    - Is the expansion considered necessary for economic viability?
    - Would the furnish specifications remain the same with any expansion?

5. Is the viability of the project dependant on the current proposed subsidy and any expected future government market interference?

6. How many jobs does the project create, less the construction phase?

Thank you for considering these questions as part of the Frontier Renewable Resources Cellulose-to-Ethanol Biorefinery Project grant request decision making process.

Kurt Chamberlain Plant Manager
SmartSide Siding
Louisiana-Pacific Corporation
Newberry. Michigan 49868
Telephone (906) 293.4512

Carol E. Ward
23632 Olson/Ward ROW
Brimley, MI 49715
January 25, 2010

Kristin Kerwin
NEPA Compliance Officer
Department of Energy
1617 Cole Boulevard
Golden, CO 80401

Dear Ms Kerwin:

Please accept the following comments regarding the proposed Frontier Cellulose- to – Ethanol Biorefinery Project.

I am familiar with the area which will be affected by this project. I formerly lived in Kinross and taught in an elementary school in that community. I then lived in the nearby town of Rudyard for a few years before moving to my present home which is about 35 miles from Kinross. This proposed project will not only affect Kinross, nearby towns such as Rudyard, and the immediately surrounding area, but the Upper Peninsula of Michigan , andall parts of the lower peninsula and Canada which are within a 150 mile radius..

The proposed project site is now forested and used by local residents for recreational purposes. Until acquired through a land swap by Longyear Corporation, a ¼ partner in this project, and the State of Michigan, it was part of the Lake Superior State Forest. To accommodate the proposed facility the zoning was changed from Forested/ Recreational to Heavy Industry. How will the proposed project impact the wildlife in the area? Not only will the area be fenced off but it will be drastically changed with the earth moving, site clearing, and construction of the plant There will be constant noise, a change in the air quality and disruption of the continuity of the area . If a railroad spur is constructed additional forested areas will have to be cleared and the area will be further fragmented. For this corporation to acquire a piece of a state forest when there is privately owned, cleared land in Kinross, adjacent to both I-75 and the railroad is unjustifiable. This represents an irreversible and irretrievable commitment of public land for private use.

Within the 150 mile radius, exactly where will the hardwood pulpwood logs come from? Is there any data to show specifically how much will come from where? When this project was first proposed, all I heard from the proponents was "Don't worry, there's plenty there". There must be some exact accounting of this.

What will removing the large number of required trees within the 150 mile radius do to air quality? Can the harvesting be done in a sustainable manner if the hardwood pulpwood is constantly being removed year after year?

?

If hardwood pulpwood logs are to be used in this cellulose to ethanol process, an age class gap will be created. In the future there will be many fewer sawlog size hardwoods available to meet the demand for that product, Hardwood sawlogs are valuable to our economy because the can be used to make furniture and other items that will create more jobs in the future Any probable short term gain will be minimal when compared to the great loss of long term productivity of the forested areas used .

. How much energy will be used to produce each gallon of ethanol? This figure must include every step of the process from cutting the tree to putting the ethanol produced into the tank of a vehicle. The construction of the cellulose-to-ethanol plant will consume a huge amount of energy. If all this is considered is this a wise use of energy?

What does "up to 40 million gallons per year" realistically mean? How optimistic is this figure? What will be the minimum amount produced that will make it economically feasible to keep the plant in operation? More government assistance may be needed in the form of subsidies.
Fuel prices and demand fluctuate. If we continue to produce more fuel efficient vehicles and vehicles that run on electricity or other innovative forms of power the demand for ethanol will drop.

What are the realistic possibilities of selling the lignin and spent cellulose as fuel? Where is the present market for it?

Will there be any hazardous waste materials?

What will happen to the bark removed from the logs? What will be done with it?.

If 200 gallons per day of water will be used and 100 gallons discharged into the wastewater treatment plant it must mean that 100 gallons will be discharged into the air via evaporation. What will this do to air quality? It will probably have an odor, how much of an odor?

What is the possibility of an accidental release of bioengineered enzymes/

Is there any assurance that the wastewater facility will remove all residues from the discharged water? If this cellulose to ethanol process is new, has not been tried on any large scale, how can it be assured that this large amount of water can be made clean enough to release into the Little Munuscong River watershed into which it will go? What will happen to the level and temperature of the river? The Little Munuscong River and it's watershed is important to wildlife and the sport hunting and fishing activities dependent upon it. A large part of our economy is based on these activities.

The description of the proposed project states "Lignin residue would be pumped to the solids handling area for dewatering". If this area is on the soil there will be liquid leaching into the ground. What is meant by "dewatering"? Where will this removed liquid go and what will it contain besides water?

The Proposed Project Description states M80 and South Gaines Highway have exits from I-75 and would likely serve as traffic routes to the proposed Frontier site.
If M-80 is used as a route between I- 75 and the facility, traffic will go through a residential area and a small business area.

How much noise will be produced by the constant, 24 hours a day 7 days a week activity in the plant ? The trucks coming and going will also produce noise around the clock. This is noise pollution.

If the ethanol is to be trucked out, how many trucks will be required? If removed by rail, how many rail cars will be needed to move each day's production of ethanol?
The exhaust from the 68 trucks per day or diesel train engines bringing in supplies and the unknown number taking out the ethanol will diminish the air quality resulting in air pollution.

.

The demand for pulpwood created by this project will probably negatively affect the oriented strand board factory in nearby Newberry and several paper plants in the Upper Peninsula by raising the pulpwood price. These businesses have been here for some time and have provided steady employment for many more workers than the proposed project plans to employ. Will they stay if the price of pulpwood goes up? In 2008 I spoke with a manager at the oriented strand board plant and he expressed some concern regarding an escalation in the price of pulpwood if this proposed ethanol plant is built It is not right for this proposed cellulose to ethanol project, using public funds, to endanger the existence of businesses that did not require government money to get started.

The Frontier Project is seeking township help, in the form of a citizen backed bond, to create a wastewater treatment system .It has received a 12 year property tax waiver from Chippewa County and is pressing regional planners to apply for additional grants for infrastructure and construction of what is described as a $200-$300 million project.. The project is also seeking government help to build a transmission line from the Central Upper Peninsula, described as a $40 to $80 million project. Taxpayers are being asked for too much. If this project is such a great idea, why aren't private investors putting more into it?

There will be ongoing costs to taxpayers. One of these will be the funds required to maintain and repair I-75 and Gaines Highway. There will be increased traffic and noise in the nearby residential community of Woodside caused by truck and train traffic. The existence of heavy industry where a wooded area owned by the State of Michigan once existed represents environmental injustice. The area may gain at the most 75 jobs in the plant and additional ones for the transporting of materials to the plant and ethanol out of the plant .

The costs will be greater than the gains.

Sincerely,
Carol E Ward
Carol E. Ward

January 26, 2010

Kristin Kerwin
NEPA Compliance Officer
Department of Energy
1617 Cole Boulevard
Golden, CO 80401
kristin.kerwin.doe.gov

Dear Ms. Kerwin:

The following are some questions regarding the proposed Mascoma Corp. ethanol producing plant for Kinross, Michigan.

We attended a meeting in Sault Ste. Marie last December. Questions could not and were not adequately addressed. It seems like the project is one for producing jobs and obtaining federal money for the State of Michigan rather than a carefully planned and thought out process.

1. How efficient is the process of producing ethanol from wood? Can burning fossil fuel to generate electricity to produce ethanol be rationally justified based on efficiency and cost?

2. How much electricity will be needed to produce ethanol; where will the extra demand come from?

3. How much water will be used to produce ethanol? What effect will extensive water use have on the water table?

4. How will the waste water be handled? What effect will wastewater disposal have on surroundings wetlands and water quality?

5. What effect would the emissions (primarily carbon dioxide producing and odors) have on air quality.

6. What effect will the use large quantities of pulpwood have on the forest ecosystem? With all of the uses for wood (current and proposed), is the process of using large quantities of wood sustainable? How will it affect wildlife, old growth forests, and other ecosystem components?

7. Lots of people burn wood to heat their homes. What effect will the plant have on the price and availability of fuel wood?

8. Why can't canary grass, sawdust, old hay, willows, sedges, or other plant material be used instead of pulpwood? These don't have much of a current market use.

9. What will happen to all of the solid waste produced? Can the waste be economically used for making pellets for stoves or have some other use?

10. One presenter spoke of genetically engineered enzymes used as part of the process. What are the consequences of using GMO organisms? He referred to their use as "experimental".

Sincerely,

Bonnie M. Weise

Bonnie M. Weise

Thomas F. Weise

Thomas F. Weise

12751 S. Shunk Road
Dafter, MI 49724

January 26, 2010

Kristen Kerwin
NEPA Compliance Officer
Department of Energy
1617 Cole Boulevard
Golden, CO 80401
kristin.kerwin@go.doe.gov

From:
Marvin Roberson
Sierra Club
1094 Ortman Rd.
Marquette, MI 49855
marvin.roberson@sierraclub.org
(906) 360-0288
(907)
Submitted by email

Re: Frontier Renewable Resources Cellulost-to-Ethanol Biorefinery Project, Kinross, Michigan (DOE/EA 1705)

Please accept the following comments regarding the Scoping Notice for the above referenced project.

1) We believe that the size and scope of the potential effects of this project warrant a full EIS, rather than simply an EA.

2) If the "No Action" Alternative is chosen, will this project continue to move forward?

3) If the project will continue to move forward in the event of a "No Action" alternative, how can there be any "need" for the DOE funding?

4) How many cords of wood will this project use?

5) What will be the species and age class distribution of this wood?

6) How will the analysis determine whether there is sufficient available wood which can be harvested in a sustained manner?

7) Public statements from the developers of the project have used "growth over harvest" figures in their attempts to demonstrate sufficient availability of wood. This assumes that harvesting all growth annually is sustainable. Please provide information that this is true in answering question #6.

8) In the absence of such information, please provide the methods for determining sustainability which will be used.

9) Michigan’s forests in this region are largely artificially skewed towards younger age class and seral stage components, as a result of the massive cutting a century ago. Please address how this project, as well as other projects using large amounts of wood (cumulative effects) will affect these recovering forests and their current move towards more natural age class and seral stage distribution.

10) How will this large new demand for wood affect wood prices in the area?

11) How many other biomasss using projects are proposed for teh wood gathering area of this project? What will the cumulative effects of these projects be on questions 6-10?

12) How much private funding (not Federal, not State, not Michigan Economic Development Corp. funding) is proposed for this project?

13) How will this increased demand for wood affect other industrial wood users in the area?

14) The state of Michigan is in the process of designating Biodiversity Stewardship Areas through the state’s Biodiversity Conservation Planning Process. This will take significant areas of State Forest in the area out of timber production. How will this project be affected by that process?

15) Conversely, how will the ability of the state to designate and manage these areas for Biodiversity Conservation in the face of this increased demand?

16) What will the effect of this and related projects be on species (such as Northern Goshawk) which require older, later successional, closed canopy habitat?

17) What percentage of total forest growth in the area will be consumed by this project?

18) What percentage of Michigan’s gasoline usage will be produced by this plant. Please note - this is not a question about how much blended fuel will be produced when this project’s product is blended with gasoline. The question is - how many gallons will this project *produce*, and how many gallong of fuel does Michigan use annually.

19) How many gallons of fuel will be used in total by this project, for wood procurement, shipping, etc?

20) In determining Cumulative Effects for all question, please address possible expansion plans or related new projects should this project prove financially successful.

21) How many cords of wood will be required for each job created (not counting construction jobs)?

22) How many jobs at other wood users in the area will potentially be lost if this project moves forward?

23) What is the expected life cycle of this project?

24) How many more jobs could be created using the same amount of wood for value-added products such as furniture, etc?

Thank You. If you have any questions, please feel free to contact me at the above information.

Marvin Roberson
Sierra Club Forest Ecologist.

-----Original Message-----
From: Christie_Deloria@fws.gov [mailto:Christie_Deloria@fws.gov]
Sent: Monday, February 01, 2010 2:35 PM
To: Kerwin, Kristin
Subject: U.S. FWS intending to comment on DOE/EA 1705

Hi Kristin -

The U.S. Fish and Wildlife Service is intending to provide comment on the Scoping Notice for Frontier Renewable Resources Cellulose-to-Ethanol Biorefinery Project, Kinross, Michigan (DOE/EA 1705). Unfortunately, due to workload issues, we were not able to provide comments prior to your January 26th deadline. We respectfully ask for an extension of time to February 26th.

We have been working with American Transmission Company over the past 6+ months and were made aware that an upgrade to their electrical transmission line (St. Ignace to Rudyard) is necessary to provide enough energy for the above referenced project. The line upgrade may have the potential to adversely impact the federally endangered Hine's emerald dragonfly. Under section 7 of the Endangered Species Act, the upgrade may be considered an interdependent activity. As such, it may make sense to incorporate the line upgrade into your proposed action.

We need further time to review the proposed action and articulate our comments. Please let me know if the above time extension is acceptable to you or if you have any questions.

Thanks.

Christie

Christie Deloria-Sheffield
Fish & Wildlife Biologist

U.S. Fish & Wildlife Service
Upper Peninsula Sub-Office
Ecological Services
3090 Wright Street
Marquette, MI 49855
(906) 226-1240 Telephone
(906) 226-3632 FAX
(906) 360-1811 Mobile

LITTLE TRAVERSE BAY BANDS OF ODAWA INDIANS
7500 ODAWA CIRCLE
HARBOR SPRINGS, MI 49740

DECLARATION 082210-002

Statement in Opposition to the Frontier Energy Project Because of the Devastating Impact on Tribe's Culture

A Declaration is a formal written public statement in support or opposition of an issue or matter. One or more Tribal Councilors may sign onto a Declaration as individual Councilors. A Declaration shall not obligate or commit the Tribal Council in any manner. Declarations do not require formal action by the Tribal Council.

The Waganakising Odawak is a nation of citizens with inherent sovereignty and right to self-governance; and

The Little Traverse Bay Bands of Odawa Indians is a federally recognized Indian Tribe under Public Law 103-324, and is a party to numerous Treaties with the United States the most recent of which being the Treaty of Washington of March 28, 1836 (7 Stat. 491) and the Treaty of Detroit of 1855 (11 Stat. 621); and

In accordance with the Little Traverse Bay Bands of Odawa Indians Constitution:

> *" IN THE WAYS OF OUR ANCESTORS, to perpetuate our way of life for future generations, we the Little Traverse Bay Bands of Odawa Indians, called in our own language the WAGANAKISING ODAWAK, a sovereign, self-governing people who follow the Anishinaabe Traditions, Heritage, and Cultural Values, set forth within this Constitution the foundation of our governance.*
>
> *We will work together in a constructive, cooperative spirit to preserve and protect our lands resources and Treaty Rights, ... In keeping faith with our Ancestors, we shall preserve our Heritage while adapting to the present world around us ... "* and

The Little Traverse Bay Bands of Odawa Indians Tribal Government and staff have been active in work to protect the environment for both our present citizens and coming generations through approval and implementation of a body of tribal laws and regulations; and

The Tribe has concerns about the potential impact that Frontier energy project will have on land, air and water impacting the culture of the Tribe; and

This project will take wood from approximately a 150 mile radius. This radius would encompass 80 percent of the public lands with in the 1836 Ceded Territory Treaty area which the Tribe uses for hunting for subsistence and gathering of medicines; and

The Tribe has a concern as to whether the use of hard woods to sustain the Frontier energy project will impact the wildlife and plant medicines found within the forests; and

The Tribe has concerns about the amount of water that will be used to sustain the Frontier energy project along with the potential discharge of water into the Munuscong Watershed that may contain containments; and

The Tribe is concerned about the potential toxics that might be emitted into the air by the Frontier energy project including such contaminants as NOx, CO, VOC, PM, SO2, and other Toxic Air Contaminants already in the area; and.

The undersigned Tribal Councilors declare that they understand the sacred relationship between the Tribes the lands and waters of their Ancestors and declare that the Frontier energy project will have an impact on the cultural traditions of the Tribe and without further information we are unable to support this project.

Regina Gasco Bentley
Tribal Councilor Regina Gasco Bentley

Date: 8-22-10

Tribal Councilor Aaron Otto

Date: 8-22-10

Rita Shananaquet

Date: 08·22·10

Tribal Councilor Rita Shananaquet

John Bott
Date: 8-22-10

Tribal Councilor John Bott

Julie Shananaquet
Date: 8-22-10

Tribal Councilor Julie Shananaquet

Date: 8/22/10

Tribal Councilor Gerald V. Chingwa

Date: 8/22/10

Tribal Councilor Melvin L. Kiogima

Date: 8-22-10

Tribal Councilor Belinda Bardwell

Marvin Mulholland
Date: 8-22-10

Tribal Councilor Marvin P. Mulholland

A copy of this Declaration is on file at the Tribal Council Legislative Office.

ps

Department of Energy
Golden Field Office
1617 Cole Boulevard
Golden, Colorado 80401-3393

RECEIVED
JUL 2[illegible] 2010
By LK [illegible]

July 22, 2010

Mr. Ken Harrington, Chairman
Little Traverse Bay Band of Odawa Indians
7500 Odawa Circle
Harbor Springs, MI 49740-9692

Dear Mr. Harrington,

The U. S. Department of Energy is proposing to provide Federal funding to Mascoma Corporation for the final design, construction, and operation of a cellulose-to-ethanol biorefinery near the City of Kinross, Michigan in Chippewa County. Frontier Renewable Resources, LLC, a joint venture between Mascoma Corporation and J.M. Longyear, LLC, would develop and operate the proposed facility. The proposed facility is intended to further the government's goal of rendering cellulosic ethanol cost-competitive with corn ethanol by 2012. .

The proposed biorefinery would utilize approximately 1,440 bone dry tons per day of hardwood pulpwood to eventually produce up to 40 million gallons per year of anhyrdrous ethanol. Co-products, such as the lignin and spent cullose from the process, would either be sold or used to produce steam and electricity in a biomass boiler. Feedstock would consist of hardwood pulpwood within the Michigan counties with a 150-mile radius of the site.

The proposed project site comprises a 355 acre plot of land in Kinross Township of Chippewa County, Michigan, Township 45 North, Range 01 West, Sections 21 and 28. It lies approximately one-half mile northeast of Kinross. The attached Site Location Map (Figure 1) provides an overview of the general property and access to area roads. Frontier plans to construct the plant on approximately 50 acres located within the southern 160 acres.

The proposed site is adjacent to the former Kincheloe U.S. Air Force base in Kinross. The site is predominantly wooded with no existing structures and limited unpaved trails. A snowmobile trail runs along the west boundary of the property and cross a small portion of the northwest corner. Figure 2 presents the Site Location Map with a 2005 Aerial Photo.

An environmental assessment (EA) is currently being prepared for the proposed Project by the Department's Golden Field Office to meet the requirements of the *National Environmental Policy Act*. DOE will include correspondence with your tribe in an appendix to the EA. This letter as well as the draft EA, when it is available, will be posted in the DOE Golden Field Office online reading room: http://www.eere.energy.gov/golden/reading room.aspx. At this time we anticipate a 15-day public comment period for this proposed project. You will receive a notice of the availability of the draft EA. Please contact DOE if you would like to receive a hardcopy of the draft EA.

DOE is initiating consultation and requesting information your tribe may have on properties of traditional religious and cultural significance within the vicinity of the proposed facility and any comments or concerns you have on the potential for this proposed project to affect those properties. This information is being requested to aid in the preparation of that Environmental Assessment and to meet our obligations under Section 106 of the National Historic Preservation Act and the Native American Graves Protection

Frontier Declaration:

and Repatriation Act of 1990. If you have any such information, require additional information, or have any questions or comments about that project, please contact me at the following address:

Ms. Kristin Kerwin
U.S. Department of Energy
1617 Cole Boulevard
Golden, Colorado
Email: kristin.kerwin@go.doe.gov
Phone: 303-275-4968

Please provide your comments within 30-days of receipt of this letter. Thank you in advance for your consideration.

Sincerely,

Kristin Ker

Kristin Kerwin
NEPA Compliance Officer

Attachments
Figure 1. Site Location Map
Figure 2. Site Location Map with a 2005 Aerial Photo.

CC: Ms. Winnay Wemigwase, Director
Cultural Preservation and Archives
Little Traverse Bay Band of Odawa Indians
7500 Odawa Circle
Harbor Springs, MI 49740-9692

cc: Tribal Chair

Draft Environmental Assessment and Notice of Wetland Involvement for the Construction and Operation of a Proposed Cellulosic Biorefinery, Mascoma Corporation, Kinross Charter Township, Michigan

DOE/EA 1705

Appendix B – Wetland Delineation Reports

AECOM

Proposed Railroad Corridor Wetland Boundary Delineation Report

Provided as Supplement to:
Frontier Cellulosic Ethanol Facility
Environmental Assessment
Kinross Township
Chippewa County, Michigan

AECOM Project No. 13375001
October 20, 2009

Prepared by:
AECOM Environment

Linda Hansen, P.E.	Patrick Kilkenny
Project Engineer	Assistant Project Scientist
(906) 231-7130	(906) 226-4822

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1.0 Introduction

Frontier Renewable Resources, LLC (Frontier) retained AECOM Environment (AECOM) to complete a wetland boundary delineation within a corridor of land that is contiguous to the site of their proposed cellulosic ethanol facility located near the community of Kincheloe, Michigan. This corridor is the proposed location for the construction of a new railroad spur that will be used for the transportation of raw materials into the site. This wetland delineation and report are being completed for use in future environmental permitting, as well as for inclusion in an overall Environmental Assessment (EA) that is being conducted to evaluate potential impacts of construction and operation of the entire ethanol facility.

This wetland boundary delineation was completed with the following tasks and goals in mind:

- To identify, delineate and survey the boundaries of all wetlands located within the proposed railroad corridor;
- To characterize each wetland based on soil, hydrologic and vegetative features;
- To conclude if current development plans for the site will cause immediate impact to existing on-site wetlands (i.e. if dredge or fill of wetlands will be required), and,
- To state jurisdictional and regulatory requirements that may apply depending on planned activities within, or that may impact wetlands.

This report presents the resulting data and conclusions associated with these tasks and goals.

2.0 Site Description

The Frontier railroad corridor can most easily be described by splitting it into two sections: the section that lies entirely north of the Kincheloe Access Road (North Section), and the section that extends south from Kincheloe Access Road to the existing railroad track (South Section).

> North Section: The North Section has ground surface topography that gently slopes away from Kincheloe Access Road to the north and northeast, towards an extensive, elongated wetland area. This wetland occupies approximately the northern one-half of the North Section, and is comprised of a combination of sphagnum-tamarack bog areas, shrub-scrub areas and open water swamp. The transition between this wetland and the upland areas is very abrupt, and is made apparent by a very distinct rise in ground surface elevation, along with a sudden transition from peaty to sandy soils. The upland areas are sandy and gently sloping, with the majority being occupied by mature red pine stands. The pine stands are linear in nature, and have the appearance of a plantation or former restoration site. Understory vegetation is relatively sparse, with shrubby, shade-loving species such as beaked hazelnut being the most common. The far eastern and western ends of the North Section are vegetated with immature aspen stands, and other deciduous species that vary in maturity. Also, an existing two-track road and an all-terrain-vehicle (ATV) trail run the across the length of this corridor area, essentially parallel to the Kincheloe Access Road.
>
> South Section: The South Section of the Frontier rail corridor has a relatively diverse mixture of uplands and lowlands, deciduous and evergreen forests, and level to sloping ground surfaces. Ground surface elevations tend to be the highest in the east-central part of the South Section, with lower areas prevalent in the north, west and south. The higher upland areas tend to have sandy to loamy soils, while the lowest areas (commonly occupied by wetlands) typically have peat and organic soils. The north end of the South Section is primarily vegetated by thick, immature aspen stands that can be seen when driving by along the Kincheloe Access Road. Traveling south out of this area, thick spruce-fir forests and wooded wetlands can be found closest to the western corridor boundary, while mature, mixed upland stands of conifers and hardwoods are common along the eastern boundary. Roughly the southern one-third of the South Section is occupied by a relatively large wetland that transitions from spruce-tamarack peat bog in the north to an open water swamp lined with cattail stands in the south. This wetland extends across the entire corridor from east to west, and contains a few areas of upland “islands” that are distinguishable by their mature red and white pine stands.
>
> The depths of these bog and marsh areas appeared to be several feet deep, and could not be navigated by foot. The southern-most end of the rail corridor contains sandy upland areas that transition abruptly to the large marsh wetland in a distinct east-west line. Here immature aspen stands are present and are mixed with other, slightly more mature hardwood forests.
>
> Other features to note in the South Section include an east-west running transmission line that is adjacent to the far southern corridor boundary, “two track” ATV trails that run beneath the transmission line as well as throughout the rest of the area, and the presence of a closed landfill in the east-central portion of the South Section. Several groundwater monitoring wells are located around the perimeter of the old landfill. These wells have painted protector pipes that are visible when traveling the nearby ATV trails.

3.0 Literature Review

Prior to the on-site field investigation, AECOM completed a review of available map data in order to obtain information on general site characteristics, and to identify potential wetland areas for field investigation. Items reviewed included the USGS topographic quadrangle map, 2005 aerial photo, the Natural Resource Conservation Service (NRCS) soil survey map and the National Wetland Inventory (NWI) map.

3.1 USGS Topographic Map

The proposed Frontier railroad corridor boundaries are indicated over a USGS topographic map in the attached Figure 1. Wetlands are indicated in these lower areas in the South Section of the corridor as well as along the northern edge of the North Section.

3.2 Aerial Photo

The proposed location of the Frontier rail corridor is indicated over a 2005 aerial photo in the attached Figure 2. The source of the photo is the U.S. Department of Agriculture National Agriculture Imagery Program (NAIP). Figures 5.1 through 5.6, that include the wetland delineation results, were prepared from Spring 2009 aerial photos prepared for Frontier. These photos have greater clarity because they were photographed using 1-meter resolution.

Beginning at the southern end of the South Section, the aerial photos indicate deciduous forest areas that abruptly transition to coniferous forest. To the north of this more coniferous area, a large swamp or marsh is evident that contains a few small islands of upland that are populated with pine trees. Continuing to the north, the swamp then transitions to a partially forested area that may be a bog. On the northern boundary of the bog is an east-west running dirt road. Continuing north from this road are relatively contiguous deciduous and coniferous forests, with a few exceptions for road openings and small meadows.

This forest regime appears to continue northward to the Kincheloe Access Road. The photos of the North Section show deciduous forest on its western and far eastern ends, with a pine plantation extending in between. A large bog or swamp is also visible that extends across the north boundary of the North Section.

3.3 NRCS Soils Map

A portion of the NRCS soils map for Chippewa County, Michigan is attached to this report as Figure 3. Using color coding, this map indicates which soil series are hydric with a blue coloration and “partially hydric” with a green coloration. Partially hydric soils (soils that have hydric inclusions) and hydric soils are mapped in both the North Section and South Section of the corridor. The predominant partially hydric and hydric soil types that are present in the North Section are Croswell-Au Gres sands (88A), and Dawson and Loxley peats (37).

The three partially hydric and hydric soil types mapped in the north half of the South Section are Wainola fine sand, 0-3% (49A), Kinross-Wainola complex soils (137A) and Udorthents (116). Udorthents are typically soils that have been disturbed through man-made causes. Partially hydric soils that are mapped in the south half of the South Section of the corridor include Kinross-Wainola complex soils (137A), Kinross-Dawson complex (102), Wainola fine sand (49A) and Markey and Carbondale mucks (36). Bordering these soils to the south is a soil type indicated to be “all hydric” in blue. This soil type is Histosols & Aquents, ponded (35). This soil map unit is typically associated with marshes, and is known to have standing water throughout the year. Histosols and Aquents themselves are an order and suborder (respectively) of soil types, and represent groups of several similar soil series’.

By definition, areas containing partially hydric or hydric soils are the most likely to contain wetlands, as they are regularly saturated near or above the surface and contain specific soil features that result from repeated saturation.

3.4 NWI Map

An NWI map of the investigation area is provided as Figure 4. The NWI map indicates the presence of various types of wetlands throughout the proposed railroad corridor area. These include scrub-shrub wetlands that are mapped in both the North and South, forested wetlands mapped along the western boundary of the South Section, and an emergent wetland that reaches across the far southern end of the South Section.

Scrub-shrub wetlands are characterized by a dominance of shrubby vegetation and a general lack of mature trees. Alternatively, forested wetlands are characterized by a dominance of mature deciduous or evergreen trees, and a significantly lower presence of shrubby or herbaceous vegetation. Emergent wetlands are characterized by regular hydrologic inundation, and a dominance of emergent herbaceous vegetation such as cattails, iris and sweet flag.

It should be noted that, on an NWI map, areas lacking mapped wetlands do not automatically imply a lack of wetland presence in the field. NWI maps are created through the use of several data sets, and are most often not field verified. Therefore, NWI maps are best used as an indication of where wetlands *might* be, instead of as an indication of where they *are*.

4.0 Methodology

On August 31st to September 3rd, 2009, AECOM completed wetland boundary delineations within the Frontier rail corridor project investigation area utilizing the U.S. Army Corps of Engineers (COE) 1987 Wetland Delineation Methodology, and methods outlined in the Michigan Department of Environmental Quality's (MDEQ) Wetland Identification Manual. The COE methodology requires that, under normal circumstances, hydric soils, wetland hydrology, and hydrophytic vegetation must be present for an area to be defined as a wetland. The method outlined in the MDEQ manual states that only two parameters, wetland vegetation and wetland hydrology, are required to confirm the presence of wetlands under Michigan law.

AECOM completed upland and wetland determination plot sets or transects along the boundaries of wetlands delineated at the site. A set of two determination plots (one on each side of the boundary) was used for most wetland areas, while a transect of three plots was used in areas where small strips of upland existed between wetlands. In this scenario, the "WET" or "UP" plot that was completed twice was assigned an "a" or "b" to distinguish between the two.

In all cases, wetland plot locations were marked with labeled pin flags, and wetland boundaries were marked with pink wetland ribbon. Boundary point and data plot locations were surveyed using a sub-meter Trimble® GeoXT™ GPS surveying unit. Routine On-Site Determination Forms were completed for each plot location, and are included in the Appendix. The locations of delineated wetland boundaries and determination plots are indicated in the attached Figures 5.1 through 5.6.

The locations of photos taken on site were also surveyed and are indicated on Figures 5.1 to 5.6. These photos are provided in the photo log included in the Appendix.

5.0 Results

In total, AECOM identified and delineated 15 wetlands within the proposed Frontier rail corridor investigation area. Their locations and sizes are depicted in the attached Figures 5.1 through 5.6. These wetlands varied in vegetative and hydrologic characteristics, and were present in several locations throughout the corridor.

In order to more quickly characterize each of the 15 wetlands that were identified, brief descriptions are provided below for each that include the wetland ID number, size, location, a general description and apparent source of hydrology. Information collected from data plots can be found on the Routine On-Site Determination forms that are attached to this report in the Appendix. These forms describe dominant vegetation, hydrologic and soil observations, as well as the mapped soil type (as indicated by NRCS) at the plot location.

Wetland 1

Wetland 1 is approximately 41.8 acres in size and is by far the largest wetland present within the proposed rail corridor. Its southernmost boundary runs nearly parallel with the railroad track at the south end of the proposed corridor, and is offset from it by approximately 500 feet. Near this boundary, Wetland 1 is a large, open-water marsh containing patches of emergent vegetation such as cattails, along with some areas that appear to contain submergent vegetation. As described in Section 2.0, this marsh area is extensive, deep (4 feet or more) and contains a few upland “islands” that support stands of pine trees. Continuing north approximately 600 feet from the southern wetland boundary, the wetland begins to transition from marsh to peat bog. In these areas, it appears that several inches to more than a foot of saturated sphagnum moss may be present, along with a few intermixed upland “islands.” These observations were made by looking south from the northernmost portion of Wetland 1, as travel by foot was not possible due to the depth of water. What could be observed in the bog areas was the type of tree or shrub vegetation present, which included black spruce (*Picea mariana* – FACW), tamarack (*Larix laricina* - FACW), Labrador tea (*Ledum groenlandicum* - OBL) and winterberry (*Ilex verticillata* – FACW+). Again, the upland islands were visible due to the small stands of red pines that could be seen through and above the tree canopy. This deep bog area extends for approximately 800 to 1,000 feet further to the north where the sphagnum mat still persists, but the depth to mineral soils becomes shallower making it possible to walk within the wetland by foot. Here, the types of tree and shrub-layer vegetation is very similar as to the south, with the exception of the presence of more ferns (typically of the royal fern family). These vegetative and hydrologic characteristics remain consistent up to the northernmost boundary of Wetland 1.

It should be noted that Wetland 1 extends considerably to the east and west outside of the proposed Frontier rail corridor, and that relocation of the corridor in these directions will not likely result in avoidance of the wetland.

An additional observation made by AECOM was that, in addition to the natural hydrology most likely supplied by intersection with the water table, Wetland 1 also receives water from the discharge of the Kinross Township wastewater treatment plant.

Wetland 2

Wetland 2 is approximately 1.75 acres in size, and is located directly north of Wetland 1 along the western corridor boundary. This wetland is separated from Wetland 1 by a sandy dirt road that runs east to west across the proposed rail corridor. Upon observation of the soil, hydrologic and vegetative characteristics of Wetland 2, it is obvious that Wetland 2 was at one time an extension or part of Wetland 1, and has only become separated due to placement of the dirt road. Wetland 2 continues to have the characteristic peat mat (approximately one foot deep), and black spruce-tamarack mixture similar to Wetland 1. Labrador tea and leatherleaf (*Chamaedaphne calyculata* – OBL) are dominant within the shrub layer of Wetland 2, along with a few other species typical of wet meadows such as Canada bluejoint (*Calamagrostis Canadensis* – OBL). Mottled sandy soils were present immediately below the 1-foot layer of peat and organics. The source of hydrology for Wetland 2 appears to be primarily from intersection with the water table, although runoff from ground surface slopes to the east may also contribute, especially during spring snow melt.

Wetlands 3, 4, 5, 6, 7 & 8

Wetlands 3, 4, 5, 6, 7 and 8 are all relatively small in size (all <0.06 acres except Wetland 7), and are located in a cluster to the north of Wetland 1 and to the east of Wetland 2. The following are the respective sizes of each wetland:

- Wetland 3 = 1,049 sq.ft.
- Wetland 4 = 665 sq.ft.,
- Wetland 5 = 1,168 sq.ft.
- Wetland 6 = 1,649 sq.ft.
- Wetland 7 = 9,927 sq.ft.
- Wetland 8 = 2,448 sq.ft.

These wetlands are being described collectively as they are all located in the same general area, are relatively close in size, and have similar geomorphic, hydrologic, soil and vegetative characteristics. These wetlands exist in a grouping of small ground surface depressions, and can be described as wet meadows. Each of these wetlands has a relatively thin layer (3-5 in.) of peaty or organic soils above sandy mineral soils, and exhibit saturation from 12 inches below to just above the ground surface. Vegetation common to all or most of these wetlands included Canada bluejoint, blue flag iris (*Iris versicolor* – OBL), sphagnum moss (*Sphagnum* spp. – OBL), red maple (*Acer rubrum* – FAC), and white birch (Betula papyrifera – FACU+). The discontinuity of these wetland areas, their thin organic soil layers, and their location between higher ground surface elevations (to the north and east) and lower surface elevations (to the south), indicates that they are transitional in nature and may not be saturated as often as Wetland 1 to the south. This further supports the likely possibility that these “depressional” wetlands are just skimming the surface of the groundwater table, it being their primary source of hydrology.

Wetland 9

Wetland 9 is 0.17 acres in size and is located directly north of Wetland 2 along the western corridor boundary. This wetland supports similar vegetation as Wetlands 3 through 8 (sphagnum and Canada bluejoint), although has a more prevalent shrub layer of speckled alder (*Alnus incana ssp. rugosa*[1] – OBL). This wetland exists in a distinct ground surface depression that is located in the center of a red pine stand. Also similar to Wetlands 3 through 8, wetland 9 exhibited a 4-inch layer of peat and organics over sandy soils, and saturation at the surface. Again, the primary source of hydrology is most likely connectivity to the groundwater table.

Wetland 10

Wetland 10 is located north of wetland 2 along the western corridor boundary where the corridor bends slightly toward the northeast. When looking at Figure 5.3, it appears that this wetland is comprised of two separate areas. These two areas are actually connected on the west side of the corridor boundary (outside of the investigation area), and are part of one continuous wetland. The total area that Wetland 10 occupies within the corridor boundaries is 0.33 acres. This wetland is a mixture of alder thickets and meadow-like openings that support patches of sphagnum and various herbaceous species. Prevalent species identified within Wetland 10 included speckled alder, blue flag iris, red maple and low bush blueberry (*Vaccinium angustifolium* – FACU). Soil and hydrologic conditions typical of Wetland 10 were approximately 8 inches of peat and organics over low-chroma sands, with saturation occurring up to the surface. As the entire soil profile (from 0 to 16 inches) was saturated at this location, it was again indicative of wetland hydrology being supported by connectivity to the groundwater table.

Wetland 11

Wetland 11 is located in the west-central portion of the proposed rail corridor, and also abuts the western corridor boundary. It is 4.24 acres in size, and is thickly forested. Trees here vary in maturity from sapling to canopy-height. Species include speckled alder, balsam fir (*Abies balsamea* – FACW), red maple, black spruce and white birch. Sphagnum moss is also prevalent throughout this wetland, as well as blue flag iris and Canada bluejoint. The transition zone between this wetland and the upland areas to the east is extremely gradual, and occurs in an area where the ground surface has several slight undulations. These undulations are so marginal in nature (wetland-wise) that upland species are present on the tops of the “humps,” while wetland species are present in the low areas between them. The boundaries of Wetland 11 were delineated in locations where either the transition zone was very narrow, or, at the point where the low dips covered more ground surface than the upland “humps.” These sandy, undulating ground surfaces are typical of pre-historic lake beds, and are similar to those identified on an adjacent property. Soils present in Wetland 11 were similar to those in many of the previously described wetlands, with approximately 6 inches of organics layered over low-chroma sands. Observation of wetland hydrology indicated saturation at the ground surface and up to 1 or 2 inches of inundation. As this wetland delineation was completed in the driest part of the growing season, it can be assumed that water depths may typically be greater, and further supports hydrologic support of the groundwater table (versus rainfall runoff).

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[1] Naming per www.plants.usda.gov for “speckled alder.”

Wetlands 12, 13 & 14

Similar to Wetlands 3 through 8, Wetlands 12, 13 and 14 are being described collectively as they are comparable in size, are located in a grouping, and have similar characteristics. These wetlands are located directly northeast of Wetland 11, adjacent to the western corridor boundary, and have the following sizes:

- Wetland 12 = 0.24 acres
- Wetland 13 = 0.20 acres
- Wetland 14 = 0.49 acres

These wetlands exist in a group of isolated ground surface depressions, and have vegetative and soil characteristics similar to Wetland 11. Hydrophytic tree species observed in these wetlands include red maple, quaking aspen (*Populus tremuloides* – FAC) and balsam fir. Other species identified included sphagnum, Canada bluejoint and cinnamon fern (*Osmunda cinnamome*a – FACW). Soil saturation levels were generally at the ground surface, with soil textures continuing to match other wetland areas: 3 to 4 inches of peat and organics over low-chroma sands (chroma of 1 or 2). As the ground surface elevations of these wetlands are similar to that of Wetland 11, it is likely their source of hydrology is the same (groundwater).

Wetland 15

Wetland 15 is the second largest and northernmost wetland delineated within the proposed Frontier rail corridor. It is 15.99 acres in size and extends to the north beyond the northernmost corridor boundary. The portions of this wetland that lie within the proposed corridor are primarily tamarack swamp. Features exemplary of this wetland type are: a several inch to several foot- thick mat of sphagnum supporting scattered tamarack and black spruce, along with interspersed shrub species such as Labrador tea and leatherleaf. Moving to the east outside of the corridor, dominant vegetation transitions to more of a shrub-carr regime, where standing water and shrub-layer species are prevalent. Within the corridor, the transition from upland pine stands to tamarack swamp is extremely abrupt, and is marked by a distinct drop in ground surface elevation that runs parallel with the northern corridor boundary. Here, dry sandy soils convert to peaty soils that are either saturated or inundated. The depth of peat observed near the middle of the delineated corridor boundary was approximately 6 inches, and was underlain by sands with chromas of 1 to 2. Along this wetland transition, as well as near the boundaries of several other wetlands on the site, low bush blueberry seemed to be the most prevalent indicator of change from upland to wetland. As the geomorphic and soil conditions within, and near, Wetland 15 are similar to those of other delineated wetlands, it is assumed that the source of hydrology for this wetland is also connectivity with the groundwater table. This is also supported by the fact that this wetland was highly saturated during the driest months of the year, and does not appear to be connected to, or contiguous with any water bodies such as lakes or rivers.

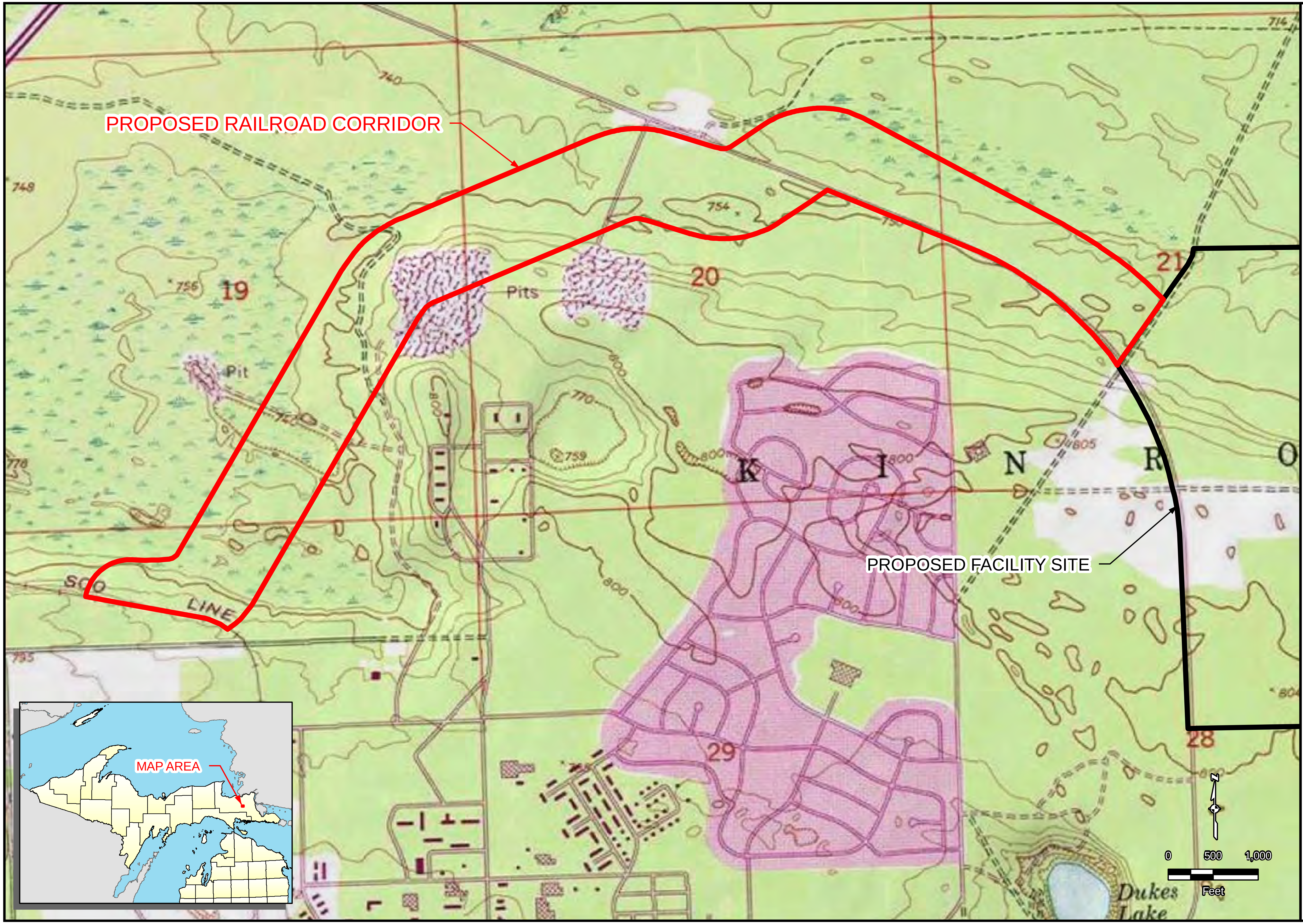
6.0 Anticipated Impacts

As the width of the actual railroad spur to be constructed will be much less than the width of the investigation area, it will be possible to avoid the majority of wetlands identified by AECOM. The only exception to this may be Wetland 1 as it spans the entire width of the southern end of the proposed corridor, as well as beyond the corridor to the east and west. Ground surface impacts, by area, will be minimal compared to the overall size and extensiveness of Wetland 1. However, caution will need to be used when planning the size and number of culverts and/or bridges, so that the hydrologic regime of the wetland is not significantly altered.

7.0 Summary

Based on our observation of August 31st to September 3rd, 2009, and utilizing the COE wetland delineation methodology with regard to the MDEQ definition of a wetland, it is the opinion of AECOM that all 15 delineated wetlands are jurisdictional under state and/or federal law. In accordance with Section 404 of the Clean Water Act and Part 303 of the Natural Resources and Environmental Protection Act (NREPA), Act 451 of 1994, any impacts to these wetlands may require a permit from the MDEQ and/or COE. Please note that, as with all wetland delineations, these agencies make final determinations regarding jurisdiction and the locations of wetland boundaries. Boundary verifications (completed by MDEQ) are recommended whenever impacts are anticipated within or near identified wetlands.

Figures



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SITE LOCATION MAP
WETLAND DELINEATION REPORT
FRONTIER RENEWABLE RESOURCES, LLC
PROPOSED RAILROAD CORRIDOR
CHIPPEWA COUNTY, MICHIGAN

Drawn:	SJE	10/21/2009
Approved:	LDH	10/21/2009
Scale:	AS SHOWN	
PROJECT NUMBER	13375-001	
FIGURE NUMBER	1	

AIR PHOTO: USDA 2005

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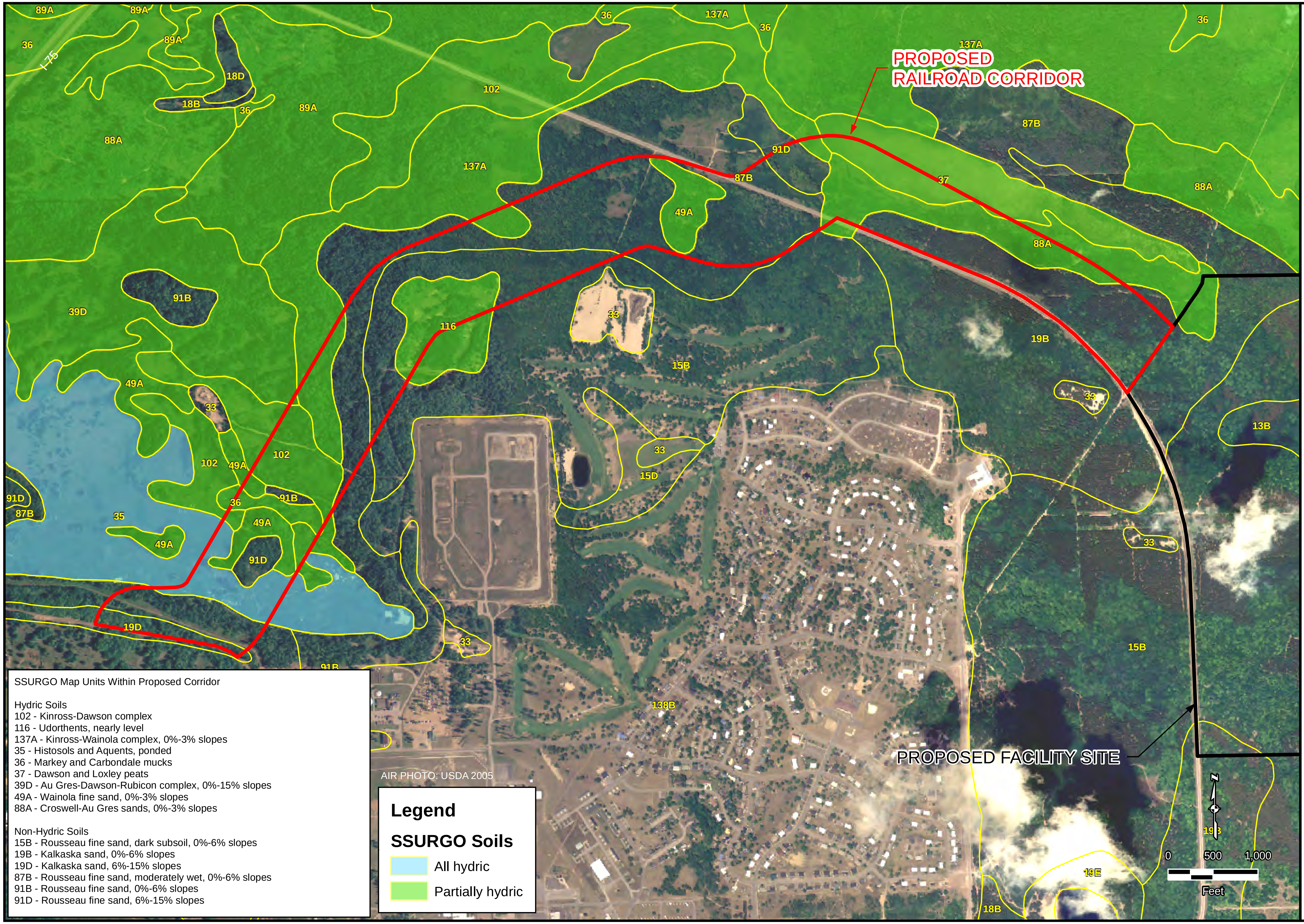
SITE LOCATION MAP WITH 2005 AERIAL PHOTO
WETLAND DELINEATION REPORT
FRONTIER RENEWABLE RESOURCES, LLC
PROPOSED RAILROAD CORRIDOR
CHIPPEWA COUNTY, MICHIGAN

Drawn:	SJE	10/21/2009
Approved:	LDH	10/21/2009
Scale:	AS SHOWN	
PROJECT NUMBER	13375-001	
FIGURE NUMBER	2	



SSURGO Map Units Within Proposed Corridor

Hydric Soils
102 - Kinross-Dawson complex
116 - Udorthents, nearly level
137A - Kinross-Wainola complex, 0%-3% slopes
35 - Histosols and Aquents, ponded
36 - Markey and Carbondale mucks
37 - Dawson and Loxley peats
39D - Au Gres-Dawson-Rubicon complex, 0%-15% slopes
49A - Wainola fine sand, 0%-3% slopes
88A - Croswell-Au Gres sands, 0%-3% slopes

Non-Hydric Soils
15B - Rousseau fine sand, dark subsoil, 0%-6% slopes
19B - Kalkaska sand, 0%-6% slopes
19D - Kalkaska sand, 6%-15% slopes
87B - Rousseau fine sand, moderately wet, 0%-6% slopes
91B - Rousseau fine sand, 0%-6% slopes
91D - Rousseau fine sand, 6%-15% slopes

Legend

SSURGO Soils

- 🟦 All hydric
- 🟩 Partially hydric

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NRCS SOIL SURVEY MAP
WETLAND DELINEATION REPORT
FRONTIER RENEWABLE RESOURCES, LLC
PROPOSED RAILROAD CORRIDOR
CHIPPEWA COUNTY, MICHIGAN

Drawn:	SJE	10/21/2009
Approved:	LDH	10/21/2009
Scale:	AS SHOWN	
PROJECT NUMBER	13375-001	
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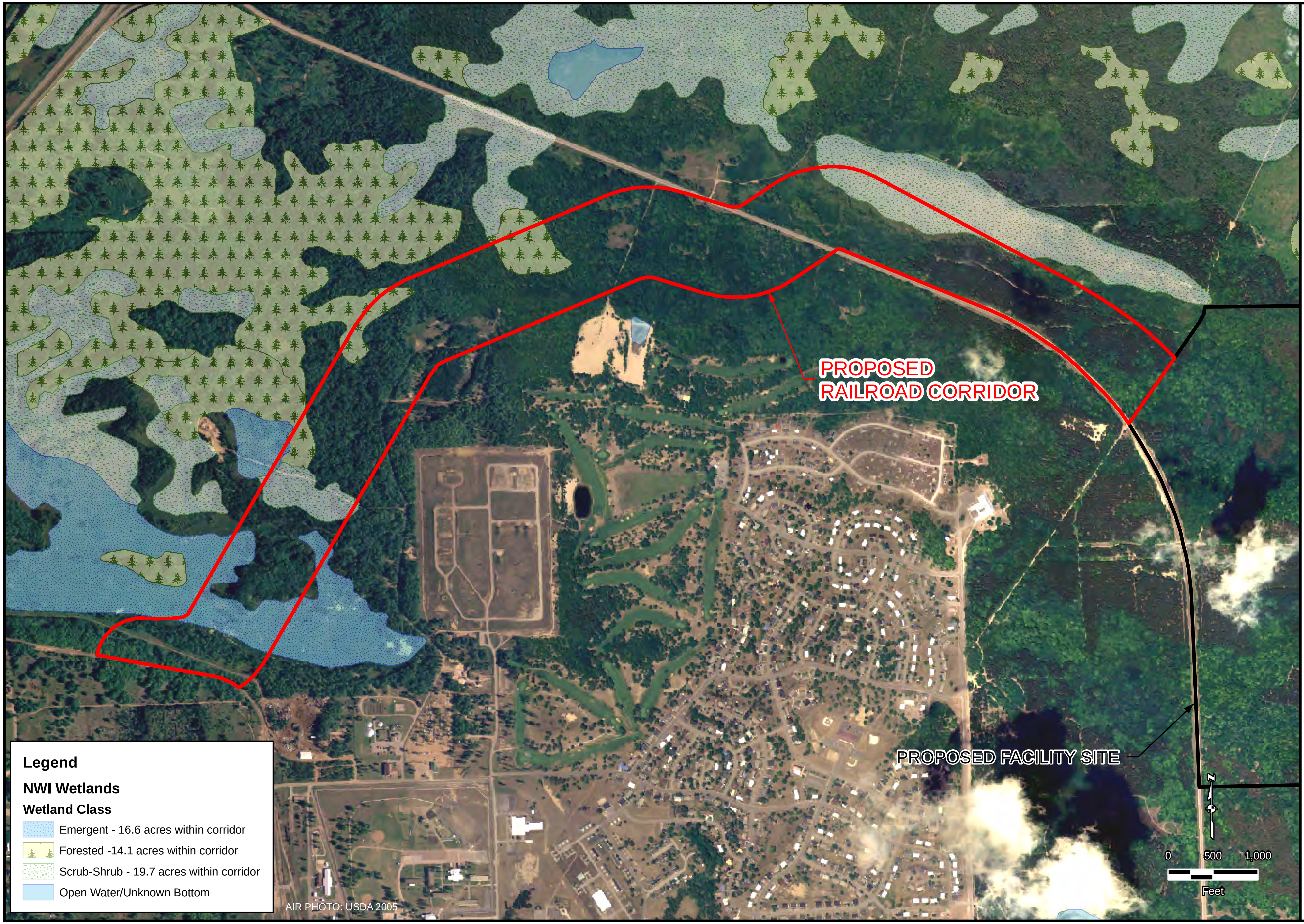

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NATIONAL WETLAND INVENTORY MAP
WETLAND DELINEATION REPORT
FRONTIER RENEWABLE RESOURCES, LLC
PROPOSED RAILROAD CORRIDOR
CHIPPEWA COUNTY, MICHIGAN

Drawn:	SJE	10/21/2009
Approved:	LDH	10/21/2009
Scale:	AS SHOWN	
PROJECT NUMBER	13375-001	
FIGURE NUMBER	4	

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DELINEATED WETLANDS AND PHOTO LOCATIONS
FRONTIER RENEWABLE RESOURCES, LLC
PROPOSED RAILROAD CORRIDOR
CHIPPEWA COUNTY, MICHIGAN

Drawn:	SJE	10/21/2009
Approved:	LDH	10/21/2009
Scale:	AS SHOWN	
PROJECT NUMBER	13375-001	
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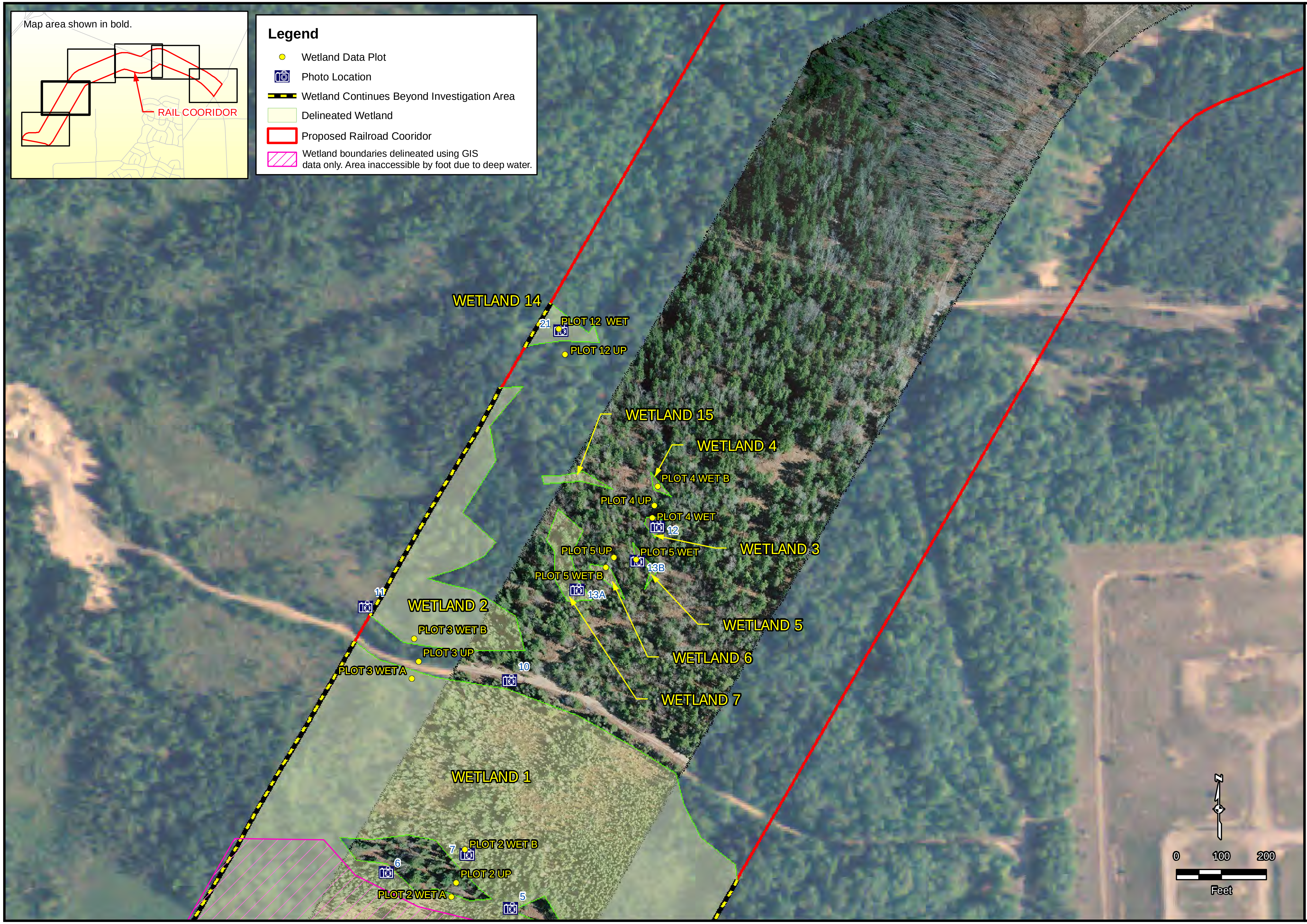

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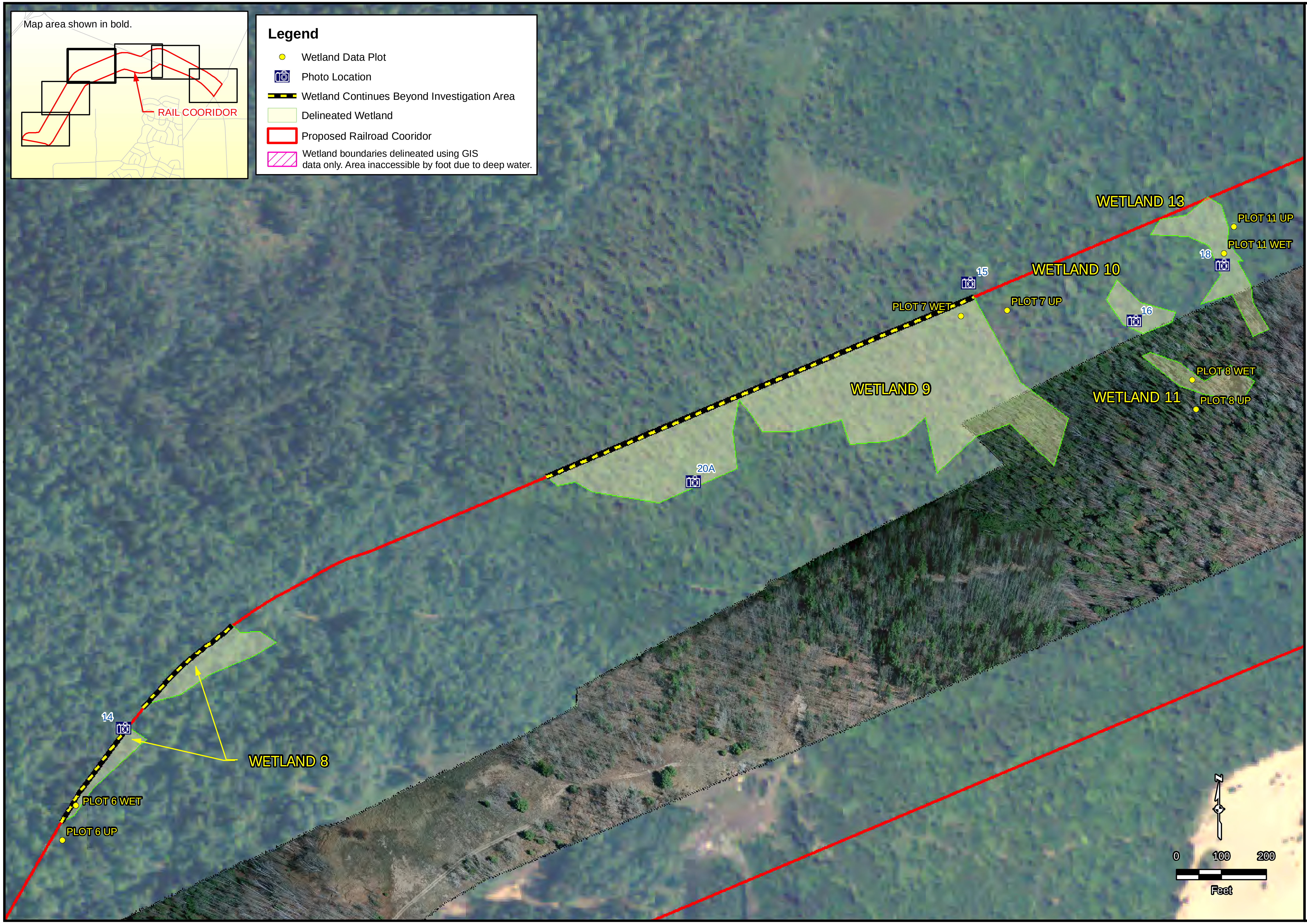
DELINEATED WETLANDS AND PHOTO LOCATIONS
FRONTIER RENEWABLE RESOURCES, LLC
PROPOSED RAILROAD CORRIDOR
CHIPPEWA COUNTY, MICHIGAN

Drawn:	SJE	10/21/2009
Approved:	LDH	10/21/2009
Scale:	AS SHOWN	
PROJECT NUMBER	13375-001	
FIGURE NUMBER	5.2	



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DELINEATED WETLANDS AND PHOTO LOCATIONS
FRONTIER RENEWABLE RESOURCES, LLC
PROPOSED RAILROAD CORRIDOR
CHIPPEWA COUNTY, MICHIGAN

Drawn:	SJE	10/21/2009
Approved:	LDH	10/21/2009
Scale:	AS SHOWN	
PROJECT NUMBER	13375-001	
FIGURE NUMBER	5.3	

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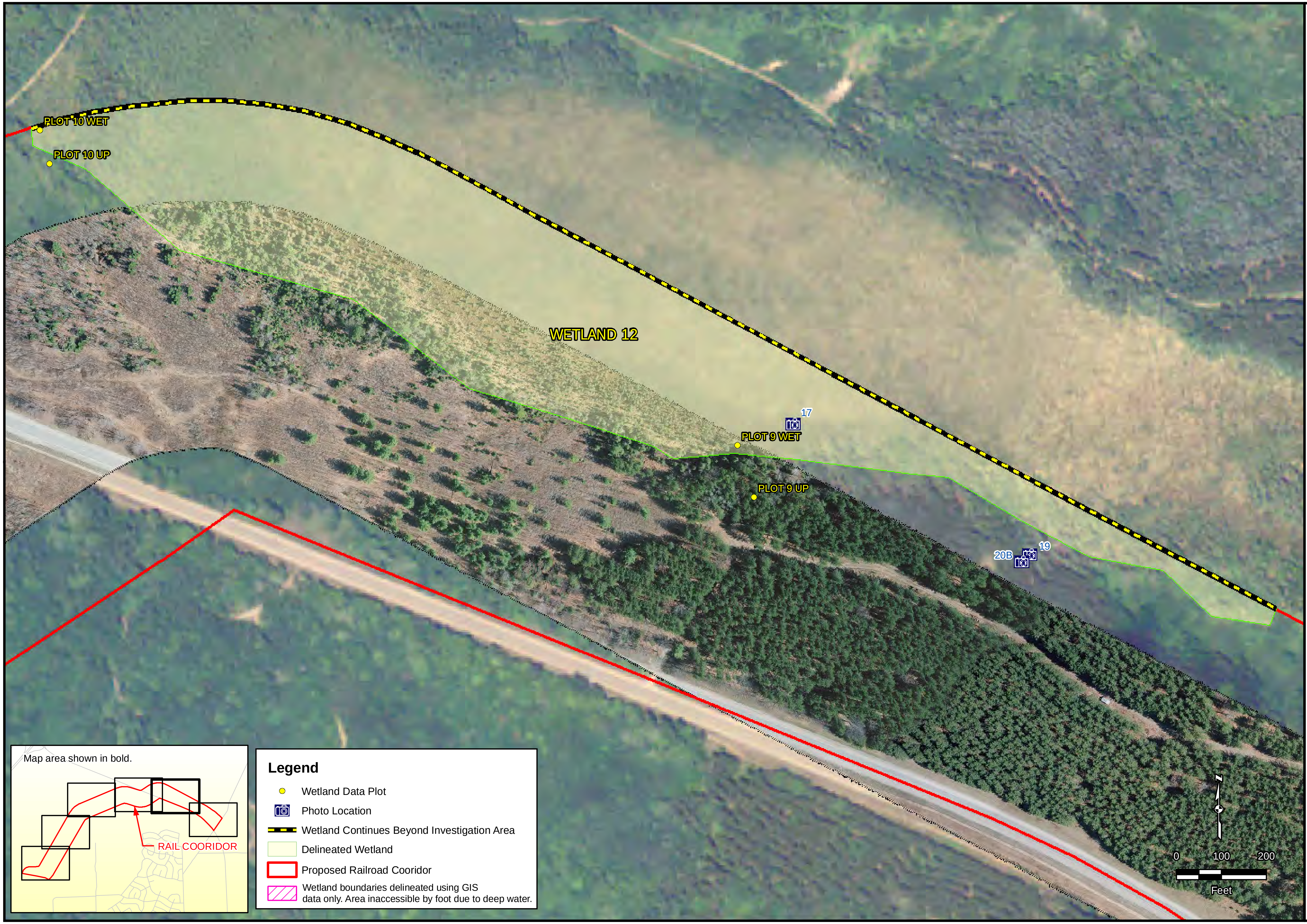
DELINEATED WETLANDS AND PHOTO LOCATIONS
FRONTIER RENEWABLE RESOURCES, LLC
PROPOSED RAILROAD CORRIDOR
CHIPPEWA COUNTY, MICHIGAN

Drawn:	SJE	10/21/2009
Approved:	LDH	10/21/2009
Scale:	AS SHOWN	
PROJECT NUMBER	13375-001	
FIGURE NUMBER	5.4	



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DELINEATED WETLANDS AND PHOTO LOCATIONS
FRONTIER RENEWABLE RESOURCES, LLC
PROPOSED RAILROAD CORRIDOR
CHIPPEWA COUNTY, MICHIGAN

Drawn:	SJE	10/21/2009
Approved:	LDH	10/21/2009
Scale:	AS SHOWN	
PROJECT NUMBER	13375-001	
FIGURE NUMBER	5.5	

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DELINEATED WETLANDS AND PHOTO LOCATIONS
FRONTIER RENEWABLE RESOURCES, LLC
PROPOSED RAILROAD CORRIDOR
CHIPPEWA COUNTY, MICHIGAN

Drawn:	SJE	10/21/2009
Approved:	LDH	10/21/2009
Scale:	AS SHOWN	
PROJECT NUMBER	13375-001	
FIGURE NUMBER	5.6	

Appendix A

Routine On-Site Wetland Determination Forms

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site: Frontier Railroad Spur Cooridor
Applicant/Owner: Mascoma
Investigator: PMK/LDK

Date: 8/31/2009
County: Chippewa
State: MI

Do Normal Circumstances exist on the site? [✓ Yes] No
Is the site significantly disturbed (Atypical Situation)? Yes [✓ No]
Is the area a potential Problem Area? Yes [✓ No]
(If needed, explain on reverse.)

Community ID: Wetland 1
Transect ID:
Plot ID: Plot 1 UP

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
1. *Populus tremuloides*	SH 5%	FAC	9. *Picea mariana*	TR 10%	FACW
2. ***Pteridium aquilinum***	**HB 50%**	**FACU**	10. ***Picea mariana***	**SH 20%**	**FACW**
3. *Quercus ellipsoidalis*	SH 10%	NI	11.		
4. ***Vaccinium angustifolium***	**SH 20%**	**FACU**	12.		
5. *Populus tremuloides*	TR 10%	FAC	13.		
6. ***Gaultheria procumbens***	**HB 70%**	**FACU**	14.		
7. ***Acer rubrum***	**TR 30%**	**FAC**	15.		
8. ***Acer rubrum***	**SH 20%**	**FAC**	16.		

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-) 50 %

Remarks: Located on upland slope above cattail swamp.

HYDROLOGY

___ Recorded Data (Describe in Remarks):
 ___ Stream, Lake or Tide Gauge
 ___ Aerial Photographs
 ___ Other
___ No Recorded Data Available

Field Observations:

Depth of Surface Water 0 in.

Depth to Free Water in Pit: none in.

Depth to Saturated Soil: none in.

Wetland Hydrology Indicators:
 Primary Indicators:
 ____ Inundated
 ____ Saturated in Upper 12 inches
 ____ Water Marks
 ____ Drift Lines
 ____ Sediment Deposits
 ____ Drainage Patterns in Wetlands
 Secondary Indicators (2 or more required):
 ____ Oxidized Root Channels in Upper 12 inches
 ____ Water -Stained Leaves
 ____ Local Soil Survey Data
 ____ FAC-Neutral Test
 ____ Other (Explain in Remarks)

Remarks:

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

SOILS

Map Unit Name
(Series and Phase): Kalkaska Sand

Drainage Class: Somewhat excessively drained

Field Observations
Confirm Mapped Type? Yes [✓ No]

Taxonomy (Subgroup): Typic Haplorthods

Profile Description:

Depth (Inches)	Horizon	Matrix Color Munsell Moist	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0-6	1	7.5YR 2.5/2			Organics
6-12	2	7.5YR 5/1			Sand
12-16+	3	7.5YR 4/6			Sand

Hydric Soils Indicators:

- ☐ Histosol
- ☐ Histic Epipedon
- ☐ Sulfidic Odor
- ☐ Aquic Moisture Regime
- ☐ Reducing Conditions
- ☐ Gleyed or Low-Chroma Colors
- ☐ Concretions
- ☐ High Organic Content in Surface Layer in Sandy Soils
- ☐ Organic Streaking in Sandy Soils
- ☐ Listed on Local Hydric Soils List
- ☐ Listed on National Hydric Soils List
- ☐ Other (Explain in Remarks)

Remarks: small amounts of sand mixed with organics in horizion 1.

WETLAND DETERMINATION

Hydrophytic Vegetation Present? Yes [✓ No] (Circle)
Wetland Hydrology Present? Yes [✓ No]
Hydric Soils Present? Yes [✓ No] Unknown

Is this Sampling Point within a Wetland? (Circle) Yes [✓ No]

Remarks: Sandy upland area, higher topography than cattail swamp.

Approved by HOUSACE 3/92
WSJ2-X

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site: Frontier Railroad Spur Cooridor
Applicant/Owner: Mascoma
Investigator: PMK/LDK

Date: 8/31/2009
County: Chippewa
State: MI

Do Normal Circumstances exist on the site? [✓ Yes] No
Is the site significantly disturbed (Atypical Situation)? Yes [✓ No]
Is the area a potential Problem Area? Yes [✓ No]
(If needed, explain on reverse.)

Community ID: Wetland 1
Transect ID:
Plot ID: Plot 1 Wet

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
1. ***Typha latifolia***	**HB 40%**	**OBL**	9. *Acer rubrum*	TR 10%	FAC
2. *Abies balsamea*	TR 10%	FACW	10. ***Acer rubrum***	**SH 40%**	**FAC**
3. ***Calamagrostis canadensis***	**HB 60%**	**OBL**	11.		
4. ***Dryopteris carthusinana***	**HB 20%**	**FACW-**	12.		
5. *Populus tremuloides*	TR 10%	FAC	13.		
6. ***Vaccinium angustifolium***	**SH 20%**	**FACU**	14.		
7. *Vaccinium angustifolium*	SH 10%	FACU	15.		
8.			16.		

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-) 60 %

Remarks: Plot located on edge of emergent (cattail) wetland and forested upland area.

HYDROLOGY

__ Recorded Data (Describe in Remarks):
- __ Stream, Lake or Tide Gauge
- __ Aerial Photographs
- __ Other

__ No Recorded Data Available

Field Observations:

Depth of Surface Water 0 in.

Depth to Free Water in Pit: 5 in.

Depth to Saturated Soil: surface in.

Wetland Hydrology Indicators:
Primary Indicators:
- ____ Inundated
- x Saturated in Upper 12 inches
- ____ Water Marks
- ____ Drift Lines
- ____ Sediment Deposits
- ____ Drainage Patterns in Wetlands

Secondary Indicators (2 or more required):
- ____ Oxidized Root Channels in Upper 12 inches
- ____ Water -Stained Leaves
- ____ Local Soil Survey Data
- ____ FAC-Neutral Test
- ____ Other (Explain in Remarks)

Remarks: High organic matting in top layer of soil.

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

SOILS

Map Unit Name
(Series and Phase): Kalkaska Sand

Drainage Class: Somewhat excessively drained

Field Observations
Confirm Mapped Type? Yes [✓ No]

Taxonomy (Subgroup): Typic Haplorthods

Profile Description:

Depth (Inches)	Horizon	Matrix Color Munsell Moist	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0-8	1	7.5YR 2.5/1			Organics/Peat
8-16	2	7.5YR 4/3			Sand

Hydric Soils Indicators:

__ Histosol
x Histic Epipedon
__ Sulfidic Odor
__ Aquic Moisture Regime
__ Reducing Conditions
__ Gleyed or Low-Chroma Colors
__ Concretions
__ High Organic Content in Surface Layer in Sandy Soils
__ Organic Streaking in Sandy Soils
__ Listed on Local Hydric Soils List
__ Listed on National Hydric Soils List
__ Other (Explain in Remarks)

Remarks: Field characterized as a Histic Epipedon - NRCS indicator A2

WETLAND DETERMINATION

Hydrophytic Vegetation Present? [✓ Yes] No (Circle)
Wetland Hydrology Present? [✓ Yes] No
Hydric Soils Present? [✓ Yes] No Unknown

(Circle)
Is this Sampling Point within a Wetland? [✓ Yes] No

Remarks: Very large cattail swamp, see NWI layer and aerial photo.

Approved by HOUSACE 3/92
WSJ2-X

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site: Frontier Railroad Spur Cooridor
Applicant/Owner: Mascoma
Investigator: PMK/LDK

Date: 8/31/2009
County: Chippewa
State: MI

Do Normal Circumstances exist on the site? [✓ Yes] No
Is the site significantly disturbed (Atypical Situation)? Yes [✓ No]
Is the area a potential Problem Area? Yes [✓ No]
(If needed, explain on reverse.)

Community ID: Wetland 1
Transect ID:
Plot ID: Plot 2 UP

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
1. ***Pteridium aquilinum***	**HB 70 %**	**FACU**	9.		
2. ***Picea mariana***	**TR 20%**	**FACW**	10.		
3. ***Gaultheria procumbens***	**HB 20%**	**FACU**	11.		
4. ***Acer rubrum***	**TR 25%**	**FAC**	12.		
5. ***Pinus resinosa***	**TR 25%**	**FACU**	13.		
6. ***Vaccinium angustifolium***	**SH 20%**	**FACU**	14.		
7.			15.		
8.			16.		

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-) 33 %

Remarks:

HYDROLOGY

__ Recorded Data (Describe in Remarks):
- __ Stream, Lake or Tide Gauge
- __ Aerial Photographs
- __ Other

__ No Recorded Data Available

Field Observations:

Depth of Surface Water 0 in.

Depth to Free Water in Pit: none in.

Depth to Saturated Soil: none in.

Wetland Hydrology Indicators:
Primary Indicators:
- ____ Inundated
- ____ Saturated in Upper 12 inches
- ____ Water Marks
- ____ Drift Lines
- ____ Sediment Deposits
- ____ Drainage Patterns in Wetlands

Secondary Indicators (2 or more required):
- ____ Oxidized Root Channels in Upper 12 inches
- ____ Water -Stained Leaves
- ____ Local Soil Survey Data
- ____ FAC-Neutral Test
- ____ Other (Explain in Remarks)

Remarks:

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

SOILS

Map Unit Name
(Series and Phase): Kinross-Dawson Complex

Drainage Class: Very Poorly Drainied
Field Observations
Confirm Mapped Type? Yes [✓ No]

Taxonomy (Subgroup): Typic Endoaquods (Kinross)
Terric Borosaprists (Dawson)

Profile Description:

Depth (Inches)	Horizon	Matrix Color Munsell Moist	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0-2	1	7.5YR 2.5/1			Organics
2-4	2	7.5YR 4/1			Sand
4-9	3	7.5YR 5/4			Sand
9-16+	4	7.5 YR 4/6			Sand

Hydric Soils Indicators:

__ Histosol
__ Histic Epipedon
__ Sulfidic Odor
__ Aquic Moisture Regime
__ Reducing Conditions
__ Gleyed or Low-Chroma Colors

__ Concretions
__ High Organic Content in Surface Layer in Sandy Soils
__ Organic Streaking in Sandy Soils
__ Listed on Local Hydric Soils List
__ Listed on National Hydric Soils List
__ Other (Explain in Remarks)

Remarks:

WETLAND DETERMINATION

Hydrophytic Vegetation Present? Yes [✓ No] (Circle)
Wetland Hydrology Present? Yes [✓ No]
Hydric Soils Present? Yes [✓ No] Unknown

(Circle)
Is this Sampling Point within a Wetland? Yes [✓ No]

Remarks: Sandy upland area, higher topography than cattail swamp.

Approved by HOUSACE 3/92
WSJ2-X

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site: Frontier Railroad Spur Cooridor
Applicant/Owner: Mascoma
Investigator: PMK/LDK

Date: 8/31/2009
County: Chippewa
State: MI

Do Normal Circumstances exist on the site? [✓ Yes] No
Is the site significantly disturbed (Atypical Situation)? Yes [✓ No]
Is the area a potential Problem Area? Yes [✓ No]
(If needed, explain on reverse.)

Community ID: Wetland 1
Transect ID:
Plot ID: Plot 2 WET-A

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
1. ***Osmunda regalis***	**HB 40%**	**OBL**	9.		
2. ***Abies balsamea***	**TR 40%**	**FACW**	10.		
3. ***Pteridium aquilinum****	**HB 40%**	**FACU**	11.		
4. ***Acer rubrum***	**SH 20%**	**FAC**	12.		
5. *Sambucus canadensis*	SH 5%	FACW-	13.		
6. ***Ledum groenladicum***	**SH 25%**	**OBL**	14.		
7. ***Ilex verticillata***	**SH 40%**	**FACW+**	15.		
8.			16.		

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-) 83 %

Remarks: *Bracken located on adjacent upland slope.

HYDROLOGY

___ Recorded Data (Describe in Remarks):
  ___ Stream, Lake or Tide Gauge
  ___ Aerial Photographs
  ___ Other
___ No Recorded Data Available

Field Observations:

Depth of Surface Water 0 in.

Depth to Free Water in Pit: 12 in.

Depth to Saturated Soil: surface in.

Wetland Hydrology Indicators:
Primary Indicators:
____ Inundated
x Saturated in Upper 12 inches
____ Water Marks
____ Drift Lines
____ Sediment Deposits
____ Drainage Patterns in Wetlands
Secondary Indicators (2 or more required):
____ Oxidized Root Channels in Upper 12 inches
____ Water -Stained Leaves
____ Local Soil Survey Data
____ FAC-Neutral Test
____ Other (Explain in Remarks)

Remarks:

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

SOILS

Map Unit Name
(Series and Phase): Kinross-Dawson Complex

Drainage Class: Very Poorly Drainied
Field Observations
Confirm Mapped Type? Yes [✓ No]

Taxonomy (Subgroup): Typic Endoaquods (Kinross)
Terric Borosaprists (Dawson)

Profile Description:

Depth (Inches)	Horizon	Matrix Color Munsell Moist	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0-10	1	7.5YR 2.5/1			peat
10-14	2	5 YR 2.5/2			mucky peat
14-16+	3	7.5 YR 5/1	7.5 YR 5/4-5/6	few, prominent	sand

Hydric Soils Indicators:

__ Histosol
x Histic Epipedon
__ Sulfidic Odor
__ Aquic Moisture Regime
__ Reducing Conditions
__ Gleyed or Low-Chroma Colors

__ Concretions
__ High Organic Content in Surface Layer in Sandy Soils
__ Organic Streaking in Sandy Soils
__ Listed on Local Hydric Soils List
__ Listed on National Hydric Soils List
__ Other (Explain in Remarks)

Remarks: NRCS indicator A2

WETLAND DETERMINATION

Hydrophytic Vegetation Present? [✓ Yes] No (Circle)
Wetland Hydrology Present? [✓ Yes] No
Hydric Soils Present? [✓ Yes] No Unknown

(Circle)
Is this Sampling Point within a Wetland? [✓ Yes] No

Remarks: Sphagnum bog transitioning into cattail swamp in some areas.

Approved by HOUSACE 3/92
WSJ2-X

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site: Frontier Railroad Spur Cooridor
Applicant/Owner: Mascoma
Investigator: PMK/LDK

Date: 8/31/2009
County: Chippewa
State: MI

Do Normal Circumstances exist on the site? [✓ Yes] No
Is the site significantly disturbed (Atypical Situation)? Yes [✓ No]
Is the area a potential Problem Area? Yes [✓ No]
(If needed, explain on reverse.)

Community ID: Wetland 1
Transect ID:
Plot ID: Plot 2 WET-B

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
1. ***Sphagnum sp.***	**HB 80%**	**OBL**	9.		
2. ***Ledum groenladicum***	**SH 20%**	**OBL**	10.		
3. *Maianthemum canadense*	HB 5%	FAC	11.		
4. *Cornus canadensis*	HB 10%	FAC	12.		
5. ***Picea mariana***	**TR 70%**	**FACW**	13.		
6. *Acer rubrum*	SH 5%	FAC	14.		
7.			15.		
8.			16.		

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-) 100 %

Remarks: Plot located on edge of sphagnum bog.

HYDROLOGY

___ Recorded Data (Describe in Remarks):
  ___ Stream, Lake or Tide Gauge
  ___ Aerial Photographs
  ___ Other
___ No Recorded Data Available

Field Observations:

Depth of Surface Water 0 in.

Depth to Free Water in Pit: 12 in.

Depth to Saturated Soil: surface in.

Wetland Hydrology Indicators:
 Primary Indicators:
  ___ Inundated
  x Saturated in Upper 12 inches
  ___ Water Marks
  ___ Drift Lines
  ___ Sediment Deposits
  ___ Drainage Patterns in Wetlands
 Secondary Indicators (2 or more required):
  ___ Oxidized Root Channels in Upper 12 inches
  ___ Water -Stained Leaves
  ___ Local Soil Survey Data
  ___ FAC-Neutral Test
  ___ Other (Explain in Remarks)

Remarks:

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

SOILS

Map Unit Name
(Series and Phase): Kinross-Dawson Complex

Drainage Class: Very Poorly Drainied

Field Observations
Confirm Mapped Type? Yes [✓ No]

Taxonomy (Subgroup): Typic Endoaquods (Kinross)
Terric Borosaprists (Dawson)

Profile Description:

Depth (Inches)	Horizon	Matrix Color Munsell Moist	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0-4	1	7.5YR 2.5/1			peat
4-14	2	7.5 YR 5/1	7.5 YR 7/1	few, distinct	sand
14-16+	3	7.5 YR 2.5/2			sand

Hydric Soils Indicators:

- __ Histosol
- __ Histic Epipedon
- __ Sulfidic Odor
- __ Aquic Moisture Regime
- __ Reducing Conditions
- x Gleyed or Low-Chroma Colors
- __ Concretions
- __ High Organic Content in Surface Layer in Sandy Soils
- __ Organic Streaking in Sandy Soils
- __ Listed on Local Hydric Soils List
- __ Listed on National Hydric Soils List
- __ Other (Explain in Remarks)

Remarks: Sandy Redox - NRCS Indicator S5

WETLAND DETERMINATION

Hydrophytic Vegetation Present? [✓ Yes] No (Circle)
Wetland Hydrology Present? [✓ Yes] No
Hydric Soils Present? [✓ Yes] No Unknown

Is this Sampling Point within a Wetland? (Circle) [✓ Yes] No

Remarks:

Approved by HOUSACE 3/92
WSJ2-X

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site: Frontier Railroad Spur Cooridor
Applicant/Owner: Mascoma
Investigator: PMK/LDK

Date: 9/1/2009
County: Chippewa
State: MI

Do Normal Circumstances exist on the site? [✓ Yes] No
Is the site significantly disturbed (Atypical Situation)? Yes [✓ No]
Is the area a potential Problem Area? Yes [✓ No]
(If needed, explain on reverse.)

Community ID: Wetlands 1 & 2
Transect ID:
Plot ID: Plot 3 UP

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
1. ***Pteridium aquilinum***	**HB 20 %**	**FACU**	9.		
2.			10.		
3.			11.		
4.			12.		
5.			13.		
6.			14.		
7.			15.		
8.			16.		

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-) 0 %

Remarks: Plot Location is upland dirt roadside between bog areas.

HYDROLOGY

___ Recorded Data (Describe in Remarks):
  __ Stream, Lake or Tide Gauge
  __ Aerial Photographs
  __ Other
___ No Recorded Data Available

Field Observations:

Depth of Surface Water 0 in.

Depth to Free Water in Pit: none in.

Depth to Saturated Soil: none in.

Wetland Hydrology Indicators:
  Primary Indicators:
    ____ Inundated
    ____ Saturated in Upper 12 inches
    ____ Water Marks
    ____ Drift Lines
    ____ Sediment Deposits
    ____ Drainage Patterns in Wetlands
  Secondary Indicators (2 or more required):
    ____ Oxidized Root Channels in Upper 12 inches
    ____ Water -Stained Leaves
    ____ Local Soil Survey Data
    ____ FAC-Neutral Test
    ____ Other (Explain in Remarks)

Remarks:

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

SOILS

Map Unit Name
(Series and Phase): Kinross-Dawson Complex

Drainage Class: Very Poorly Drainied

Field Observations
Confirm Mapped Type? Yes [✓ No]

Taxonomy (Subgroup): Typic Endoaquods (Kinross)
Terric Borosaprists (Dawson)

Profile Description:

Depth (Inches)	Horizon	Matrix Color Munsell Moist	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0-3	1	10 YR 4/4			sand
3-16+	2	10 YR 5/6			sand

Hydric Soils Indicators:

- __ Histosol
- __ Histic Epipedon
- __ Sulfidic Odor
- __ Aquic Moisture Regime
- __ Reducing Conditions
- __ Gleyed or Low-Chroma Colors
- __ Concretions
- __ High Organic Content in Surface Layer in Sandy Soils
- __ Organic Streaking in Sandy Soils
- __ Listed on Local Hydric Soils List
- __ Listed on National Hydric Soils List
- __ Other (Explain in Remarks)

Remarks:

WETLAND DETERMINATION

Hydrophytic Vegetation Present? Yes [✓ No] (Circle)
Wetland Hydrology Present? Yes [✓ No]
Hydric Soils Present? Yes [✓ No] Unknown

(Circle)
Is this Sampling Point within a Wetland? Yes [✓ No]

Remarks: Sandy upland area, higher topography than cattail swamp.

Approved by HOUSACE 3/92
WSJ2-X

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site: Frontier Railroad Spur Cooridor
Applicant/Owner: Mascoma
Investigator: PMK/LDK

Date: 9/1/2009
County: Chippewa
State: MI

Do Normal Circumstances exist on the site? [✓ Yes] No
Is the site significantly disturbed (Atypical Situation)? Yes [✓ No]
Is the area a potential Problem Area? Yes [✓ No]
(If needed, explain on reverse.)

Community ID: Wetland 1
Transect ID:
Plot ID: Plot 3 WET-A

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
1. *Larix laricina*	SH 10%	FACW	9. *Picea mariana*	SH 5%	FACW
2. *Picea mariana*	TR 10%	FACW	10. *Carex sterilis*	HB 2%	OBL
3. *Pinus banksiana*	TR 10%	FACU	11. *Scirpus cyperinus*	HB 2%	OBL
4. ***Larix laricina***	**TR 25%**	**FACW**	12. ***Sphagnum sp.***	**HB 100%**	**OBL**
5. ***Pinus resinosa***	**TR 20%**	**FACU**	13.		
6. *Betula papyrifera*	SH 5%	FACU+	14.		
7. ***Ledum groenladicum***	**SH 70%**	**OBL**	15.		
8. ***Ilex verticillata***	**SH 20%**	**FACW+**	16.		

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-) 80 %

Remarks: Plot located on edge of shrub-scrub swamp.

HYDROLOGY

__ Recorded Data (Describe in Remarks):
  __ Stream, Lake or Tide Gauge
  __ Aerial Photographs
  __ Other
__ No Recorded Data Available

Field Observations:

Depth of Surface Water 0 in.

Depth to Free Water in Pit: 1 in.

Depth to Saturated Soil: surface in.

Wetland Hydrology Indicators:
Primary Indicators:
____ Inundated
x Saturated in Upper 12 inches
____ Water Marks
____ Drift Lines
____ Sediment Deposits
____ Drainage Patterns in Wetlands
Secondary Indicators (2 or more required):
____ Oxidized Root Channels in Upper 12 inches
____ Water -Stained Leaves
____ Local Soil Survey Data
____ FAC-Neutral Test
____ Other (Explain in Remarks)

Remarks:

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

SOILS

Map Unit Name
(Series and Phase): Kinross-Dawson Complex

Drainage Class: Very Poorly Drainied

Field Observations
Confirm Mapped Type? Yes [✓ No]

Taxonomy (Subgroup): Typic Endoaquods (Kinross)
Terric Borosaprists (Dawson)

Profile Description:

Depth (Inches)	Horizon	Matrix Color Munsell Moist	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0-16+	1	7.5YR 2.5/1			peat

Hydric Soils Indicators:

- x Histosol
- __ Histic Epipedon
- __ Sulfidic Odor
- __ Aquic Moisture Regime
- __ Reducing Conditions
- x Gleyed or Low-Chroma Colors
- __ Concretions
- __ High Organic Content in Surface Layer in Sandy Soils
- __ Organic Streaking in Sandy Soils
- __ Listed on Local Hydric Soils List
- __ Listed on National Hydric Soils List
- __ Other (Explain in Remarks)

Remarks: NRCS indicator A1

WETLAND DETERMINATION

Hydrophytic Vegetation Present? [✓ Yes] No (Circle)
Wetland Hydrology Present? [✓ Yes] No
Hydric Soils Present? [✓ Yes] No Unknown

(Circle)
Is this Sampling Point within a Wetland? [✓ Yes] No

Remarks:

Approved by HOUSACE 3/92
WSJ2-X

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site: Frontier Railroad Spur Cooridor
Applicant/Owner: Mascoma
Investigator: PMK/LDK

Date: 9/1/2009
County: Chippewa
State: MI

Do Normal Circumstances exist on the site? [✓ Yes] No
Is the site significantly disturbed (Atypical Situation)? Yes [✓ No]
Is the area a potential Problem Area? Yes [✓ No]
(If needed, explain on reverse.)

Community ID: Wetland 2
Transect ID:
Plot ID: Plot 3 WET-B

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
1. ***Sphagnum sp.***	**HB 90%**	**OBL**	9. ***Pinus banksiana***	**TR 20%**	**FACU**
2. *Ledum groenladicum*	SH 10%	OBL	10. *Pinus resinosa*	TR 10%	FACU
3. *Cornus alternifolia*	SH 2%	FAC-	11. *Vaccinium angustifolium*	SH 15%	FACU
4. *Pteridium aquilinum*	HB 5%	FACU	12.		
5. *Calamagrostis canadensis*	HB 2%	OBL	13.		
6. *Gaultheria procumbens*	HB 5%	FACU	14.		
7. **Chamaedaphne calyculata**	**HB 20%**	**OBL**	15.		
8. ***Picea mariana***	**TR 30%**	**FACW**	16.		

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-) 75 %

Remarks: Plot located in shrub-scrub / bog area on opposite side of road from plot 3 WET A.

HYDROLOGY

___ Recorded Data (Describe in Remarks):
  ___ Stream, Lake or Tide Gauge
  ___ Aerial Photographs
  ___ Other
___ No Recorded Data Available

Field Observations:

Depth of Surface Water 0 in.

Depth to Free Water in Pit: 6 in.

Depth to Saturated Soil: surface in.

Wetland Hydrology Indicators:
Primary Indicators:
  ___ Inundated
  _x_ Saturated in Upper 12 inches
  ___ Water Marks
  ___ Drift Lines
  ___ Sediment Deposits
  ___ Drainage Patterns in Wetlands
Secondary Indicators (2 or more required):
  ___ Oxidized Root Channels in Upper 12 inches
  ___ Water -Stained Leaves
  ___ Local Soil Survey Data
  ___ FAC-Neutral Test
  ___ Other (Explain in Remarks)

Remarks:

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

SOILS

Map Unit Name
(Series and Phase): Kinross-Dawson Complex

Drainage Class: Very Poorly Drainied

Field Observations
Confirm Mapped Type? Yes [✓ No]

Taxonomy (Subgroup): Typic Endoaquods (Kinross)
Terric Borosaprists (Dawson)

Profile Description:

Depth (Inches)	Horizon	Matrix Color Munsell Moist	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0-12	1	7.5YR 2.5/1			peat/moss
12-16+	2	7.5 YR 5/1	7.5 YR 6/6	few, faint	sand

Hydric Soils Indicators:

__ Histosol
x Histic Epipedon
__ Sulfidic Odor
__ Aquic Moisture Regime
__ Reducing Conditions
x Gleyed or Low-Chroma Colors

__ Concretions
x High Organic Content in Surface Layer in Sandy Soils
__ Organic Streaking in Sandy Soils
__ Listed on Local Hydric Soils List
__ Listed on National Hydric Soils List
__ Other (Explain in Remarks)

Remarks: NRCS indicator A2

WETLAND DETERMINATION

Hydrophytic Vegetation Present? [✓ Yes] No (Circle)
Wetland Hydrology Present? [✓ Yes] No
Hydric Soils Present? [✓ Yes] No Unknown

(Circle)
Is this Sampling Point within a Wetland? [✓ Yes] No

Remarks:

Approved by HOUSACE 3/92
WSJ2-X

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site: Frontier Railroad Spur Cooridor
Applicant/Owner: Mascoma
Investigator: PMK/LDK

Date: 9/1/2009
County: Chippewa
State: MI

Do Normal Circumstances exist on the site? [✓ Yes] No
Is the site significantly disturbed (Atypical Situation)? Yes [✓ No]
Is the area a potential Problem Area? Yes [✓ No]
(If needed, explain on reverse.)

Community ID: Wetlands 3 & 4
Transect ID:
Plot ID: Plot 4 UP

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
1. *Cornus canadensis*	HB 15%	FAC	9. *Pinus strobus*	TR 5%	FACU
2. *Gaultheria procumbens*	HB 15%	FACU	10.		
3. ***Abies balsamea***	**TR 20%**	**FACW**	11.		
4. *Pteridium aquilinum*	HB 10%	FACU	12.		
5. *Vaccinium angustifolium*	SH 10%	FACU	13.		
6. ***Acer Rubrum***	**TR 20%**	**FAC**	14.		
7. ***Picea mariana***	**TR 20%**	**FACW**	15.		
8. *Betula papyrifera*	TR 5%	FACU	16.		

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-) 66 %

Remarks: Plot located in upland hump between wetland depressional areas.

HYDROLOGY

___ Recorded Data (Describe in Remarks):
  ___ Stream, Lake or Tide Gauge
  ___ Aerial Photographs
  ___ Other
___ No Recorded Data Available

Field Observations:

Depth of Surface Water 0 in.

Depth to Free Water in Pit: none in.

Depth to Saturated Soil: none in.

Wetland Hydrology Indicators:
Primary Indicators:
- ___ Inundated
- ___ Saturated in Upper 12 inches
- ___ Water Marks
- ___ Drift Lines
- ___ Sediment Deposits
- ___ Drainage Patterns in Wetlands

Secondary Indicators (2 or more required):
- ___ Oxidized Root Channels in Upper 12 inches
- ___ Water -Stained Leaves
- ___ Local Soil Survey Data
- ___ FAC-Neutral Test
- ___ Other (Explain in Remarks)

Remarks:

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

SOILS

Map Unit Name
(Series and Phase): Kinross-Wainola Complex

Drainage Class: Somewhat to very poorly drained

Field Observations
Confirm Mapped Type? Yes [✓ No]

Taxonomy (Subgroup): Typic Endoaquods (Kinross)
Typic Endoaquods (Wainola)

Profile Description:

Depth (Inches)	Horizon	Matrix Color Munsell Moist	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0-2	1	7.5YR 2.5/1			Organics/Silt
2-14	2	7.5YR 5/1			Sand
14-16	3	7.5YR 2.5/3			Consolidated Sand

Hydric Soils Indicators:

- __ Histosol
- __ Histic Epipedon
- __ Sulfidic Odor
- __ Aquic Moisture Regime
- __ Reducing Conditions
- __ Gleyed or Low-Chroma Colors
- __ Concretions
- __ High Organic Content in Surface Layer in Sandy Soils
- __ Organic Streaking in Sandy Soils
- __ Listed on Local Hydric Soils List
- __ Listed on National Hydric Soils List
- __ Other (Explain in Remarks)

Remarks:

WETLAND DETERMINATION

Hydrophytic Vegetation Present? [✓ Yes] No (Circle)
Wetland Hydrology Present? Yes [✓ No]
Hydric Soils Present? Yes [✓ No] Unknown

(Circle)
Is this Sampling Point within a Wetland? Yes [✓ No]

Remarks: Upland area located between two wetland depressions.

Approved by HOUSACE 3/92
WSJ2-X

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site: Frontier Railroad Spur Cooridor
Applicant/Owner: Mascoma
Investigator: PMK/LDK

Date: 9/1/2009
County: Chippewa
State: MI

Do Normal Circumstances exist on the site? [✓ Yes] No
Is the site significantly disturbed (Atypical Situation)? Yes [✓ No]
Is the area a potential Problem Area? Yes [✓ No]
(If needed, explain on reverse.)

Community ID: Wetland 3
Transect ID:
Plot ID: Plot 4 WET-A

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
1. ***Calamagrostis canadensis***	**HB 40%**	**OBL**	9.		
2. ***Typha latifolia***	**HB 25%**	**OBL**	10.		
3. ***Scirpus cyperinus***	**HB 20%**	**OBL**	11.		
4. ***Sphagnum sp.***	**HB 60%**	**OBL**	12.		
5. *Salix interior*	SH 15%	OBL	13.		
6. *Iris versicolor*	HB 5%	OBL	14.		
7.			15.		
8.			16.		

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-) 100 %

Remarks: Sphagnum moss filled depression located in upland area.

HYDROLOGY

___ Recorded Data (Describe in Remarks):
  ___ Stream, Lake or Tide Gauge
  ___ Aerial Photographs
  ___ Other
___ No Recorded Data Available

Field Observations:

Depth of Surface Water 0 in.

Depth to Free Water in Pit: 15 in.

Depth to Saturated Soil: 1 in.

Wetland Hydrology Indicators:
Primary Indicators:
  ___ Inundated
  x Saturated in Upper 12 inches
  ___ Water Marks
  ___ Drift Lines
  ___ Sediment Deposits
  ___ Drainage Patterns in Wetlands
Secondary Indicators (2 or more required):
  ___ Oxidized Root Channels in Upper 12 inches
  ___ Water -Stained Leaves
  ___ Local Soil Survey Data
  ___ FAC-Neutral Test
  ___ Other (Explain in Remarks)

Remarks:

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

SOILS

Map Unit Name
(Series and Phase): Kinross-Wainola Complex

Drainage Class: Somewhat to very poorly drained
Field Observations
Confirm Mapped Type? Yes [✓ No]

Taxonomy (Subgroup): Typic Endoaquods (Kinross)
Typic Endoaquods (Wainola)

Profile Description:

Depth (Inches)	Horizon	Matrix Color Munsell Moist	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0-5	1	7.5YR 2.5/3			Peat
5-9	2	7.5YR 2.5/1			Muck
9-14	3	7.5YR 4/1			Sand
14-16	4	7.5YR 2.5/2			Sand to Consolidated Sand

Hydric Soils Indicators:

- ☐ Histosol
- ☐ Histic Epipedon
- ☐ Sulfidic Odor
- ☐ Aquic Moisture Regime
- ☐ Reducing Conditions
- ☒ Gleyed or Low-Chroma Colors
- ☐ Concretions
- ☐ High Organic Content in Surface Layer in Sandy Soils
- ☐ Organic Streaking in Sandy Soils
- ☐ Listed on Local Hydric Soils List
- ☐ Listed on National Hydric Soils List
- ☐ Other (Explain in Remarks)

Remarks: Low chroma colors throughout layers.

WETLAND DETERMINATION

Hydrophytic Vegetation Present? [✓ Yes] No (Circle)
Wetland Hydrology Present? [✓ Yes] No
Hydric Soils Present? [✓ Yes] No Unknown

(Circle)
Is this Sampling Point within a Wetland? [✓ Yes] No

Remarks:

Approved by HOUSACE 3/92
WSJ2-X

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site: Frontier Railroad Spur Cooridor

Applicant/Owner: Mascoma

Investigator: PMK/LDK

Date: 9/1/2009

County: Chippewa

State: MI

Do Normal Circumstances exist on the site? [✓ Yes] No

Is the site significantly disturbed (Atypical Situation)? Yes [✓ No]

Is the area a potential Problem Area? Yes [✓ No]
(If needed, explain on reverse.)

Community ID: Wetland 4

Transect ID:

Plot ID: Plot 4 WET-B

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
1. ***Sphagnum sp.***	**HB 30%**	**OBL**	9. *Pinus strobus*	TR 5%	FACU
2. *Trientalis borealis*	HB 10%	FAC+	10.		
3. *Populus deltoides*	TR 2%	FAC+	11.		
4. *Cornus canadensis*	HB 5%	FAC-	12.		
5. ***Cornus sericea***	**SH 20%**	**FACW**	13.		
6. *Vaccinium angustifolium*	SH 10%	FACU	14.		
7. ***Acer rubrum***	**TR 50%**	**FAC**	15.		
8. ***Betula papyrifera***	**TR 20%**	**FACU**	16.		

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-) **75** %

Remarks: Small wetland depression located within upland forested area.

HYDROLOGY

___ Recorded Data (Describe in Remarks):
  __ Stream, Lake or Tide Gauge
  __ Aerial Photographs
  __ Other
___ No Recorded Data Available

Field Observations:

Depth of Surface Water 0 in.

Depth to Free Water in Pit: 0 in.

Depth to Saturated Soil: surface in.

Wetland Hydrology Indicators:
Primary Indicators:
____ Inundated
x Saturated in Upper 12 inches
____ Water Marks
____ Drift Lines
____ Sediment Deposits
____ Drainage Patterns in Wetlands
Secondary Indicators (2 or more required):
____ Oxidized Root Channels in Upper 12 inches
____ Water -Stained Leaves
____ Local Soil Survey Data
____ FAC-Neutral Test
____ Other (Explain in Remarks)

Remarks:

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

SOILS

Map Unit Name
(Series and Phase): Kinross-Wainola Complex

Drainage Class: Somewhat to very poorly drained

Field Observations
Confirm Mapped Type? Yes [✓ No]

Taxonomy (Subgroup): Typic Endoaquods (Kinross)
Typic Endoaquods (Wainola)

Profile Description:

Depth (Inches)	Horizon	Matrix Color Munsell Moist	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0-3	1	7.5YR 2.5/2			Moss/Peat/Organics
3-16	2	7.5YR 5/1			Sand

Hydric Soils Indicators:

- __ Histosol
- __ Histic Epipedon
- __ Sulfidic Odor
- __ Aquic Moisture Regime
- __ Reducing Conditions
- __ Gleyed or Low-Chroma Colors
- __ Concretions
- x High Organic Content in Surface Layer in Sandy Soils
- __ Organic Streaking in Sandy Soils
- __ Listed on Local Hydric Soils List
- __ Listed on National Hydric Soils List
- __ Other (Explain in Remarks)

Remarks: Upper layer 0-3" high in organic content.

WETLAND DETERMINATION

Hydrophytic Vegetation Present? [✓ Yes] No (Circle)
Wetland Hydrology Present? [✓ Yes] No
Hydric Soils Present? [✓ Yes] No Unknown

(Circle)
Is this Sampling Point within a Wetland? [✓ Yes] No

Remarks:

Approved by HOUSACE 3/92
WSJ2-X

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site: Frontier Railroad Spur Cooridor

Applicant/Owner: Mascoma

Investigator: PMK/LDK

Date: 9/1/2009

County: Chippewa

State: MI

Do Normal Circumstances exist on the site? [✓ Yes] No

Is the site significantly disturbed (Atypical Situation)? Yes [✓ No]

Is the area a potential Problem Area? Yes [✓ No]
(If needed, explain on reverse.)

Community ID: Wetland 5

Transect ID:

Plot ID: Plot 5 WET-A

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
1. ***Calamagrostis canadensis***	**HB 30%**	**OBL**	9.		
2. ***Iris versicolor***	**HB 20%**	**OBL**	10.		
3. ***Vaccinium angustifolium***	**SH 30%**	**FACU**	11.		
4. ***Pinus strobus***	**TR 20%**	**FACU**	12.		
5. ***Acer rubrum***	**TR 30%**	**FAC**	13.		
6. *Betula papyrifera*	TR 10%	FACU	14.		
7. *Sphagnum sp.*	HB 10%	OBL	15.		
8.			16.		

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-) **60** %

Remarks: Weland depression/pocket located within forested upland area.

HYDROLOGY

___ Recorded Data (Describe in Remarks):
- ___ Stream, Lake or Tide Gauge
- ___ Aerial Photographs
- ___ Other

___ No Recorded Data Available

Field Observations:

Depth of Surface Water 0 in.

Depth to Free Water in Pit: 12 in.

Depth to Saturated Soil: surface in.

Wetland Hydrology Indicators:

Primary Indicators:
- ___ Inundated
- x Saturated in Upper 12 inches
- ___ Water Marks
- ___ Drift Lines
- ___ Sediment Deposits
- ___ Drainage Patterns in Wetlands

Secondary Indicators (2 or more required):
- ___ Oxidized Root Channels in Upper 12 inches
- ___ Water -Stained Leaves
- ___ Local Soil Survey Data
- ___ FAC-Neutral Test
- ___ Other (Explain in Remarks)

Remarks:

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

SOILS

Map Unit Name
(Series and Phase): Kinross-Wainola Complex

Drainage Class: Somewhat to very poorly drained

Field Observations
Confirm Mapped Type? Yes [✓ No]

Taxonomy (Subgroup): Typic Endoaquods (Kinross)
Typic Endoaquods (Wainola)

Profile Description:

Depth (Inches)	Horizon	Matrix Color Munsell Moist	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0-4	1	7.5YR 2.5/1			Organics
4-10	2	7.5YR 4/1			Sand
10-16	3	7.5YR 5/1	7.5YR 5/4	Few/Prominent	Sand

Hydric Soils Indicators:

☐ Histosol
☐ Histic Epipedon
☐ Sulfidic Odor
☐ Aquic Moisture Regime
☐ Reducing Conditions
☐ Gleyed or Low-Chroma Colors

☒ Concretions
☐ High Organic Content in Surface Layer in Sandy Soils
☒ Organic Streaking in Sandy Soils
☐ Listed on Local Hydric Soils List
☐ Listed on National Hydric Soils List
☐ Other (Explain in Remarks)

Remarks: Mottles and organic streaking within sandy soils.

WETLAND DETERMINATION

Hydrophytic Vegetation Present? [✓ Yes] No (Circle)
Wetland Hydrology Present? [✓ Yes] No
Hydric Soils Present? [✓ Yes] No Unknown

(Circle)
Is this Sampling Point within a Wetland? [✓ Yes] No

Remarks:

Approved by HOUSACE 3/92
WSJ2-X

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site: Frontier Railroad Spur Cooridor
Applicant/Owner: Mascoma
Investigator: PMK/LDK

Date: 9/1/2009
County: Chippewa
State: MI

Do Normal Circumstances exist on the site? [✓ Yes] No
Is the site significantly disturbed (Atypical Situation)? Yes [✓ No]
Is the area a potential Problem Area? Yes [✓ No]
(If needed, explain on reverse.)

Community ID: Wetland 6
Transect ID:
Plot ID: Plot 5 WET-B

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
1. ***Iris versicolor***	**HB 20%**	**OBL**	9. ***Sphagnum sp.***	**HB 50%**	**OBL**
2. ***Calamagrostis canadensis***	**HB 30%**	**OBL**	10.		
3. ***Alnus incana***	**SH 20%**	**OBL**	11.		
4. *Populus tremuloides*	SH 5%	FACU	12.		
5. *Pinus strobus*	TR 10%	FACU	13.		
6. ***Populus tremuloides***	**TR 20%**	**FACU**	14.		
7. ***Acer rubrum***	**TR 20%**	**FAC**	15.		
8. *Abies balsamea*	TR 5%	FACW	16.		

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-) 83 %

Remarks: Weland depression/pocket located within forested upland area.

HYDROLOGY

___ Recorded Data (Describe in Remarks):
- __ Stream, Lake or Tide Gauge
- __ Aerial Photographs
- __ Other

___ No Recorded Data Available

Field Observations:

Depth of Surface Water 0 in.

Depth to Free Water in Pit: 12 in.

Depth to Saturated Soil: surface in.

Wetland Hydrology Indicators:
Primary Indicators:
- ____ Inundated
- x Saturated in Upper 12 inches
- ____ Water Marks
- ____ Drift Lines
- ____ Sediment Deposits
- ____ Drainage Patterns in Wetlands

Secondary Indicators (2 or more required):
- ____ Oxidized Root Channels in Upper 12 inches
- ____ Water -Stained Leaves
- ____ Local Soil Survey Data
- ____ FAC-Neutral Test
- ____ Other (Explain in Remarks)

Remarks:

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

SOILS

Map Unit Name
(Series and Phase): Kinross-Wainola Complex

Drainage Class: Somewhat to very poorly drained

Field Observations
Confirm Mapped Type? Yes [✓ No]

Taxonomy (Subgroup): Typic Endoaquods (Kinross)
Typic Endoaquods (Wainola)

Profile Description:

Depth (Inches)	Horizon	Matrix Color Munsell Moist	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0-3	1	7.5YR 2.5/1			Organics
3-12	2	7.5YR 5/1			Sand
12-16	3	7.5YR 2.5/2			Consolidated Sand

Hydric Soils Indicators:

__ Histosol
__ Histic Epipedon
__ Sulfidic Odor
__ Aquic Moisture Regime
__ Reducing Conditions
__ Gleyed or Low-Chroma Colors

__ Concretions
__ High Organic Content in Surface Layer in Sandy Soils
x Organic Streaking in Sandy Soils
__ Listed on Local Hydric Soils List
__ Listed on National Hydric Soils List
__ Other (Explain in Remarks)

Remarks: Oxidized rhizospheres in horizon 2.

WETLAND DETERMINATION

Hydrophytic Vegetation Present? [✓ Yes] No (Circle)
Wetland Hydrology Present? [✓ Yes] No
Hydric Soils Present? [✓ Yes] No Unknown

Is this Sampling Point within a Wetland? (Circle) [✓ Yes] No

Remarks:

Approved by HOUSACE 3/92
WSJ2-X

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site: Frontier Railroad Spur Cooridor

Applicant/Owner: Mascoma

Investigator: PMK/LDK

Date: 9/1/2009

County: Chippewa

State: MI

Do Normal Circumstances exist on the site? [✓ Yes] No

Is the site significantly disturbed (Atypical Situation)? Yes [✓ No]

Is the area a potential Problem Area? Yes [✓ No]
(If needed, explain on reverse.)

Community ID: Wetlands 5, 6 & 7

Transect ID:

Plot ID: Plot 5 UP

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
1. ***Pteridium aquilinum***	**HB 60%**	**FACU**	9.		
2. ***Vaccinium angustifolium***	**SH 20%**	**FACU**	10.		
3. ***Abies balsamea***	**TR 30%**	**FACW**	11.		
4. *Betula papyrifera*	TR 10%	FACU	12.		
5. ***Pinus strobus***	**TR 20%**	**FACU**	13.		
6. ***Acer rubrum***	**TR 25%**	**FAC**	14.		
7. *Hammamelis virginiana*	SH 5%	FACU	15.		
8. *Quercus rubra*	TR 5%	FACU	16.		

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-) 40 %

Remarks: Heavily forested area with intersperced small wetlands.

HYDROLOGY

___ Recorded Data (Describe in Remarks):
  __ Stream, Lake or Tide Gauge
  __ Aerial Photographs
  __ Other
___ No Recorded Data Available

Field Observations:

Depth of Surface Water 0 in.

Depth to Free Water in Pit: 0 in.

Depth to Saturated Soil: 0 in.

Wetland Hydrology Indicators:
Primary Indicators:
____ Inundated
____ Saturated in Upper 12 inches
____ Water Marks
____ Drift Lines
____ Sediment Deposits
____ Drainage Patterns in Wetlands
Secondary Indicators (2 or more required):
____ Oxidized Root Channels in Upper 12 inches
____ Water -Stained Leaves
____ Local Soil Survey Data
____ FAC-Neutral Test
____ Other (Explain in Remarks)

Remarks:

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

SOILS

Map Unit Name
(Series and Phase): Kinross-Wainola Complex

Drainage Class: Somewhat to very poorly drained

Field Observations
Confirm Mapped Type? Yes [✓ No]

Taxonomy (Subgroup): Typic Endoaquods (Kinross)
Typic Endoaquods (Wainola)

Profile Description:

Depth (Inches)	Horizon	Matrix Color Munsell Moist	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0-3	1	7.5YR 2.5/1			Organics
3-16	2	7.5YR 4/1			Sand

Hydric Soils Indicators:

- __ Histosol
- __ Histic Epipedon
- __ Sulfidic Odor
- __ Aquic Moisture Regime
- __ Reducing Conditions
- __ Gleyed or Low-Chroma Colors
- __ Concretions
- __ High Organic Content in Surface Layer in Sandy Soils
- __ Organic Streaking in Sandy Soils
- __ Listed on Local Hydric Soils List
- __ Listed on National Hydric Soils List
- __ Other (Explain in Remarks)

Remarks:

WETLAND DETERMINATION

Hydrophytic Vegetation Present? Yes [✓ No] (Circle)
Wetland Hydrology Present? Yes [✓ No]
Hydric Soils Present? Yes [✓ No] Unknown

(Circle)
Is this Sampling Point within a Wetland? Yes [✓ No]

Remarks:

Approved by HOUSACE 3/92
WSJ2-X

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site: Frontier Railroad Spur Cooridor
Applicant/Owner: Mascoma
Investigator: PMK/LDK

Date: 9/1/2009
County: Chippewa
State: MI

Do Normal Circumstances exist on the site? [✓ Yes] No
Is the site significantly disturbed (Atypical Situation)? Yes [✓ No]
Is the area a potential Problem Area? Yes [✓ No]
(If needed, explain on reverse.)

Community ID: Wetland 8
Transect ID:
Plot ID: Plot 6 WET

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
1. ***Sphagnum sp.***	**HB 80%**	**OBL**	9.		
2. ***Alnus incana***	**SH 30%**	**OBL**	10.		
3. *Iris versicolor*	HB 5%	OBL	11.		
4. *Pteridium aquilinum*	HB 5%	FACU	12.		
5. ***Acer rubrum***	**TR 30%**	**FAC**	13.		
6. *Vaccinium angustifolium*	SH 10%	FACU	14.		
7. ***Pinus strobus***	**TR 30%**	**FACU**	15.		
8. *Betula papyrifera*	TR 5%	FACU	16.		

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-) 75 %

Remarks: Alder/bog area.

HYDROLOGY

___ Recorded Data (Describe in Remarks):
- __ Stream, Lake or Tide Gauge
- __ Aerial Photographs
- __ Other

___ No Recorded Data Available

Field Observations:

Depth of Surface Water 0 in.
Depth to Free Water in Pit: 0 in.
Depth to Saturated Soil: surface in.

Wetland Hydrology Indicators:

Primary Indicators:
- ____ Inundated
- x Saturated in Upper 12 inches
- ____ Water Marks
- ____ Drift Lines
- ____ Sediment Deposits
- ____ Drainage Patterns in Wetlands

Secondary Indicators (2 or more required):
- ____ Oxidized Root Channels in Upper 12 inches
- ____ Water -Stained Leaves
- ____ Local Soil Survey Data
- ____ FAC-Neutral Test
- ____ Other (Explain in Remarks)

Remarks:

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

SOILS

Map Unit Name
(Series and Phase): Rousseau Fine Sand, moderately wet

Drainage Class: Moderately well drained
Field Observations
Confirm Mapped Type? Yes [✓ No]

Taxonomy (Subgroup): Entic Haplorthods

Profile Description:

Depth (Inches)	Horizon	Matrix Color Munsell Moist	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0-8	1	7.5YR 2.5/1			moss/peat
9-16	2	7.5YR 5/1			sand

Hydric Soils Indicators:

- __ Histosol
- __ Histic Epipedon
- __ Sulfidic Odor
- __ Aquic Moisture Regime
- __ Reducing Conditions
- x Gleyed or Low-Chroma Colors
- __ Concretions
- __ High Organic Content in Surface Layer in Sandy Soils
- x Organic Streaking in Sandy Soils
- __ Listed on Local Hydric Soils List
- __ Listed on National Hydric Soils List
- __ Other (Explain in Remarks)

Remarks: Organic streaking in horizon 2. Low chroma colors in horizion 1 and 2.

WETLAND DETERMINATION

Hydrophytic Vegetation Present? [✓ Yes] No (Circle)
Wetland Hydrology Present? [✓ Yes] No
Hydric Soils Present? [✓ Yes] No Unknown

(Circle)
Is this Sampling Point within a Wetland? [✓ Yes] No

Remarks:

Approved by HOUSACE 3/92
WSJ2-X

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site: Frontier Railroad Spur Cooridor

Applicant/Owner: Mascoma

Investigator: PMK/LDK

Date: 9/1/2009

County: Chippewa

State: MI

Do Normal Circumstances exist on the site? [✓ Yes] No

Is the site significantly disturbed (Atypical Situation)? Yes [✓ No]

Is the area a potential Problem Area? Yes [✓ No]
(If needed, explain on reverse.)

Community ID: Wetland 8

Transect ID:

Plot ID: Plot 6 UP

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
1. ***Pteridium aquilinum***	**HB 70%**	**FACU**	9.		
2. *Huperzia Lucidula*	HB 10%	FAC+	10.		
3. *Acer rubrum*	SH 10%	FAC	11.		
4. ***Acer rubrum***	**TR 20%**	**FAC**	12.		
5. ***Pinus strobus***	**TR 30%**	**FACU**	13.		
6.			14.		
7.			15.		
8.			16.		

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-) 33 %

Remarks: Located adjacent to and upslope from Plot 6 WET.

HYDROLOGY

___ Recorded Data (Describe in Remarks):
- ___ Stream, Lake or Tide Gauge
- ___ Aerial Photographs
- ___ Other

___ No Recorded Data Available

Field Observations:

Depth of Surface Water 0 in.

Depth to Free Water in Pit: 0 in.

Depth to Saturated Soil: 0 in.

Wetland Hydrology Indicators:

Primary Indicators:
- ____ Inundated
- ____ Saturated in Upper 12 inches
- ____ Water Marks
- ____ Drift Lines
- ____ Sediment Deposits
- ____ Drainage Patterns in Wetlands

Secondary Indicators (2 or more required):
- ____ Oxidized Root Channels in Upper 12 inches
- ____ Water -Stained Leaves
- ____ Local Soil Survey Data
- ____ FAC-Neutral Test
- ____ Other (Explain in Remarks)

Remarks:

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

SOILS

Map Unit Name
(Series and Phase): Rousseau Fine Sand, moderately wet

Drainage Class: Moderately well drained

Taxonomy (Subgroup): Entic Haplorthods

Field Observations
Confirm Mapped Type? Yes [✓ No]

Profile Description:

Depth (Inches)	Horizon	Matrix Color Munsell Moist	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0-2	1	7.5YR 3/1			Organics/Sand
2-14	2	7.5YR 5/2			Sand
14-16	3	7.5YR 2.5/2			Sand to Consolidated Sand

Hydric Soils Indicators:

- __ Histosol
- __ Histic Epipedon
- __ Sulfidic Odor
- __ Aquic Moisture Regime
- __ Reducing Conditions
- x Gleyed or Low-Chroma Colors
- __ Concretions
- __ High Organic Content in Surface Layer in Sandy Soils
- __ Organic Streaking in Sandy Soils
- __ Listed on Local Hydric Soils List
- __ Listed on National Hydric Soils List
- __ Other (Explain in Remarks)

Remarks:

WETLAND DETERMINATION

Hydrophytic Vegetation Present? Yes [✓ No] (Circle)
Wetland Hydrology Present? Yes [✓ No]
Hydric Soils Present? Yes [✓ No] Unknown

(Circle)
Is this Sampling Point within a Wetland? Yes [✓ No]

Remarks:

Approved by HOUSACE 3/92
WSJ2-X

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site: Frontier Railroad Spur Cooridor

Applicant/Owner: Mascoma

Investigator: PMK/LDK

Date: 9/1/2009

County: Chippewa

State: MI

Do Normal Circumstances exist on the site? [✓ Yes] No

Is the site significantly disturbed (Atypical Situation)? Yes [✓ No]

Is the area a potential Problem Area? Yes [✓ No]

(If needed, explain on reverse.)

Community ID: Wetland 9

Transect ID:

Plot ID: Plot 7 WET

VEGETATION

Dominant Plant Species	Stratum	Indicator
1. ***Abies balsamea***	**TR 30%**	**FACW**
2. ***Calamagrostis canadensis***	**HB 20%**	**OBL**
3. *Iris versicolor*	HB 5%	OBL
4. ***Acer rubrum***	**TR 40%**	**FAC**
5. *Acer rubrum*	SH 5%	FAC
6. ***Betula papyrifera***	**TR 20%**	**FACU**
7. *Pteridium aquilinum*	HB 15%	FACU
8. *Cornus canadensis*	HB 10%	FACW
9. ***Sphagnum sp.***	**HB 20%**	**OBL**
10. *Picea mariana*	TR 10%	FACW
11.		
12.		
13.		
14.		
15.		
16.		

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-) 80 %

Remarks: Wetland is forested mix of alder, balsam, spruce, maple with rolling transistion area along the edge.

HYDROLOGY

___ Recorded Data (Describe in Remarks):
- ___ Stream, Lake or Tide Gauge
- ___ Aerial Photographs
- ___ Other

___ No Recorded Data Available

Field Observations:

Depth of Surface Water 1/2 - 1 in.

Depth to Free Water in Pit: 0 in.

Depth to Saturated Soil: 0 in.

Wetland Hydrology Indicators:

Primary Indicators:
- x Inundated
- ___ Saturated in Upper 12 inches
- ___ Water Marks
- ___ Drift Lines
- ___ Sediment Deposits
- ___ Drainage Patterns in Wetlands

Secondary Indicators (2 or more required):
- ___ Oxidized Root Channels in Upper 12 inches
- ___ Water -Stained Leaves
- ___ Local Soil Survey Data
- ___ FAC-Neutral Test
- ___ Other (Explain in Remarks)

Remarks:

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

SOILS

Map Unit Name
(Series and Phase): Rousseau Fine Sand, moderately wet

Taxonomy (Subgroup): Entic Haplorthods

Drainage Class: Moderately well drained
Field Observations
Confirm Mapped Type? Yes [✓ No]

Profile Description:

Depth (Inches)	Horizon	Matrix Color Munsell Moist	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0-6	1	7.5YR 2.5/1			Organics/Sandy loam
6-16	2	7.5YR 6/2			Sand

Hydric Soils Indicators:

__ Histosol
__ Histic Epipedon
__ Sulfidic Odor
__ Aquic Moisture Regime
__ Reducing Conditions
x Gleyed or Low-Chroma Colors

__ Concretions
__ High Organic Content in Surface Layer in Sandy Soils
__ Organic Streaking in Sandy Soils
__ Listed on Local Hydric Soils List
__ Listed on National Hydric Soils List
__ Other (Explain in Remarks)

Remarks: Soils contains low chroma colors.

WETLAND DETERMINATION

Hydrophytic Vegetation Present? [✓ Yes] No (Circle)
Wetland Hydrology Present? [✓ Yes] No
Hydric Soils Present? [✓ Yes] No Unknown

(Circle)
Is this Sampling Point within a Wetland? [✓ Yes] No

Remarks:

Approved by HOUSACE 3/92
WSJ2-X

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site: Frontier Railroad Spur Cooridor
Applicant/Owner: Mascoma
Investigator: PMK/LDK

Date: 9/1/2009
County: Chippewa
State: MI

Do Normal Circumstances exist on the site? [✓ Yes] No
Is the site significantly disturbed (Atypical Situation)? Yes [✓ No]
Is the area a potential Problem Area? Yes [✓ No]
(If needed, explain on reverse.)

Community ID: Wetland 9
Transect ID:
Plot ID: Plot 7 UP

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
1. ***Abies balsamea***	**TR 30%**	**FACW**	9.		
2. *Pteridium aquilinum*	HB 10%	FACU	10.		
3. ***Acer rubrum***	**TR 30%**	**FAC**	11.		
4. *Cornus canadensis*	HB 5%	FACW-	12.		
5. ***Populus tremuloides***	**TR 20%**	**FACU**	13.		
6. ***Abies balsamea***	**SH 20%**	**FACW**	14.		
7. *Acer rubrum*	SH 5%	FAC	15.		
8.			16.		

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-) 75 %

Remarks: Upland area with mature balsam fir and thin understory.

HYDROLOGY

___ Recorded Data (Describe in Remarks):
  __ Stream, Lake or Tide Gauge
  __ Aerial Photographs
  __ Other
___ No Recorded Data Available

Field Observations:

Depth of Surface Water 0 in.

Depth to Free Water in Pit: 0 in.

Depth to Saturated Soil: 0 in.

Wetland Hydrology Indicators:
Primary Indicators:
____ Inundated
____ Saturated in Upper 12 inches
____ Water Marks
____ Drift Lines
____ Sediment Deposits
____ Drainage Patterns in Wetlands
Secondary Indicators (2 or more required):
____ Oxidized Root Channels in Upper 12 inches
____ Water -Stained Leaves
____ Local Soil Survey Data
____ FAC-Neutral Test
____ Other (Explain in Remarks)

Remarks:

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

SOILS

Map Unit Name
(Series and Phase): Rousseau Fine Sand, moderately wet

Taxonomy (Subgroup): Entic Haplorthods

Drainage Class: Moderately well drained
Field Observations
Confirm Mapped Type? Yes [✓ No]

Profile Description:

Depth (Inches)	Horizon	Matrix Color Munsell Moist	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0-3	1	7.5YR 2.5/1			Organics
3-12	2	7.5YR 6/2			Sand
12-16	3	7.5YR 3/3			Sand to Consolidated Sand

Hydric Soils Indicators:

- __ Histosol
- __ Histic Epipedon
- __ Sulfidic Odor
- __ Aquic Moisture Regime
- __ Reducing Conditions
- __ Gleyed or Low-Chroma Colors
- __ Concretions
- __ High Organic Content in Surface Layer in Sandy Soils
- __ Organic Streaking in Sandy Soils
- __ Listed on Local Hydric Soils List
- __ Listed on National Hydric Soils List
- __ Other (Explain in Remarks)

Remarks: No organic streaking in sandy soils.

WETLAND DETERMINATION

Hydrophytic Vegetation Present? [✓ Yes] No (Circle)
Wetland Hydrology Present? Yes [✓ No]
Hydric Soils Present? Yes [✓ No] Unknown

Is this Sampling Point within a Wetland? (Circle) Yes [✓ No]

Remarks:

Approved by HOUSACE 3/92
WSJ2-X

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site: Frontier Railroad Spur Cooridor

Applicant/Owner: Mascoma

Investigator: PMK/LDK

Date: 9/1/2009

County: Chippewa

State: MI

Do Normal Circumstances exist on the site? [✓ Yes] No

Is the site significantly disturbed (Atypical Situation)? Yes [✓ No]

Is the area a potential Problem Area? Yes [✓ No]
(If needed, explain on reverse.)

Community ID: Wetland 11

Transect ID:

Plot ID: Plot 8 WET

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
1. ***Sphagnum sp.***	**HB 90%**	**OBL**	9.		
2. *Calamagrostis canadensis*	HB 5%	OBL	10.		
3. *Acer rubrum*	SH 15%	FAC	11.		
4. *Abies balsamea*	TR 10%	FACW	12.		
5. ***Acer rubrum***	**TR 30%**	**FAC**	13.		
6. *Betula papyrifera*	SH 10%	FACU	14.		
7. *Pinus strobus*	TR 15%	FACU	15.		
8.			16.		

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-) 100 %

Remarks: Sphagnum sp. filled depression within heavily forested area.

HYDROLOGY

___ Recorded Data (Describe in Remarks):
- ___ Stream, Lake or Tide Gauge
- ___ Aerial Photographs
- ___ Other

___ No Recorded Data Available

Field Observations:

Depth of Surface Water 0 in.

Depth to Free Water in Pit: 8 in.

Depth to Saturated Soil: surface in.

Wetland Hydrology Indicators:

Primary Indicators:
- ___ Inundated
- x Saturated in Upper 12 inches
- ___ Water Marks
- ___ Drift Lines
- ___ Sediment Deposits
- ___ Drainage Patterns in Wetlands

Secondary Indicators (2 or more required):
- ___ Oxidized Root Channels in Upper 12 inches
- ___ Water -Stained Leaves
- ___ Local Soil Survey Data
- ___ FAC-Neutral Test
- ___ Other (Explain in Remarks)

Remarks:

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

SOILS

Map Unit Name
(Series and Phase): Rousseau Fine Sand, moderately wet

Drainage Class: Moderately well drained

Taxonomy (Subgroup): Entic Haplorthods

Field Observations
Confirm Mapped Type? Yes [✓ No]

Profile Description:

Depth (Inches)	Horizon	Matrix Color Munsell Moist	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0-6	1	7.5YR 2.5/1			Peat/Moss
6-16	2	7.5YR 5/1			Sand

Hydric Soils Indicators:

__ Histosol
__ Histic Epipedon
__ Sulfidic Odor
__ Aquic Moisture Regime
__ Reducing Conditions
__ Gleyed or Low-Chroma Colors
__ Concretions
__ High Organic Content in Surface Layer in Sandy Soils
__ Organic Streaking in Sandy Soils
__ Listed on Local Hydric Soils List
__ Listed on National Hydric Soils List
__ Other (Explain in Remarks)

Remarks: No organic streaking in sandy soils.

WETLAND DETERMINATION

Hydrophytic Vegetation Present? [✓ Yes] No (Circle)
Wetland Hydrology Present? [✓ Yes] No
Hydric Soils Present? [✓ Yes] No Unknown

(Circle)
Is this Sampling Point within a Wetland? [✓ Yes] No

Remarks:

Approved by HOUSACE 3/92
WSJ2-X

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site: Frontier Railroad Spur Cooridor
Applicant/Owner: Mascoma
Investigator: PMK/LDK

Date: 9/1/2009
County: Chippewa
State: MI

Do Normal Circumstances exist on the site? [✓ Yes] No
Is the site significantly disturbed (Atypical Situation)? Yes [✓ No]
Is the area a potential Problem Area? Yes [✓ No]
(If needed, explain on reverse.)

Community ID: Wetland 11
Transect ID:
Plot ID: Plot 8 UP

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
1. *Cornus canadensis*	HB 2%	FACW-	9.		
2. *Maianthemum canadense*	HB 10%	FAC	10.		
3. *Pteridium aquilinum*	HB 10%	FACU	11.		
4. *Abies balsamea*	SH 15%	FACW	12.		
5. ***Abies balsamea***	**TR 25%**	**FACW**	13.		
6. ***Acer rubrum***	**TR 25%**	**FAC**	14.		
7. ***Populus tremuloides***	**TR 25%**	**FACU**	15.		
8. *Betula papyrifera*	TR 10%	FACU	16.		

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-) 66 %

Remarks: Forested area consisting mainly of Balsam Fir and Red Maple.

HYDROLOGY

___ Recorded Data (Describe in Remarks):
  __ Stream, Lake or Tide Gauge
  __ Aerial Photographs
  __ Other
___ No Recorded Data Available

Field Observations:

Depth of Surface Water 0 in.

Depth to Free Water in Pit: 0 in.

Depth to Saturated Soil: 0 in.

Wetland Hydrology Indicators:
Primary Indicators:
  ____ Inundated
  ____ Saturated in Upper 12 inches
  ____ Water Marks
  ____ Drift Lines
  ____ Sediment Deposits
  ____ Drainage Patterns in Wetlands
Secondary Indicators (2 or more required):
  ____ Oxidized Root Channels in Upper 12 inches
  ____ Water -Stained Leaves
  ____ Local Soil Survey Data
  ____ FAC-Neutral Test
  ____ Other (Explain in Remarks)

Remarks:

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

SOILS

Map Unit Name
(Series and Phase): Rousseau Fine Sand, moderately wet

Drainage Class: Moderately well drained

Taxonomy (Subgroup): Entic Haplorthods

Field Observations
Confirm Mapped Type? Yes [✓ No]

Profile Description:

Depth (Inches)	Horizon	Matrix Color Munsell Moist	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0-2	1	7.5YR 5/1			Organics
2-16	2	7.5YR 5/1			Sand

Hydric Soils Indicators:

__ Histosol
__ Histic Epipedon
__ Sulfidic Odor
__ Aquic Moisture Regime
__ Reducing Conditions
__ Gleyed or Low-Chroma Colors
__ Concretions
__ High Organic Content in Surface Layer in Sandy Soils
__ Organic Streaking in Sandy Soils
__ Listed on Local Hydric Soils List
__ Listed on National Hydric Soils List
__ Other (Explain in Remarks)

Remarks: No organic streaking in sandy soils.

WETLAND DETERMINATION

Hydrophytic Vegetation Present? [✓ Yes] No (Circle)
Wetland Hydrology Present? Yes [✓ No]
Hydric Soils Present? Yes [✓ No] Unknown

(Circle)
Is this Sampling Point within a Wetland? Yes [✓ No]

Remarks:

Approved by HOUSACE 3/92
WSJ2-X

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site: Frontier Railroad Spur Cooridor

Applicant/Owner: Mascoma

Investigator: PMK/LDK

Date: 9/2/2009

County: Chippewa

State: MI

Do Normal Circumstances exist on the site? [✓ Yes] No

Is the site significantly disturbed (Atypical Situation)? Yes [✓ No]

Is the area a potential Problem Area? Yes [✓ No]

(If needed, explain on reverse.)

Community ID: Wetland 12

Transect ID:

Plot ID: Plot 9 WET

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
1. ***Sphagnum sp.***	**HB 90%**	**OBL**	9. ***Vaccinium angustifolium***	**SH 20%**	**FACU**
2. ***Calamagrostis canadensis***	**HB 30%**	**OBL**	10. *Gaultheria hispioula*	HB 5%	FACW
3. *Ilex verticillata*	SH 15%	FACW+	11. *Osumunda cinnamomea*	HB 2%	FACW
4. *Salix exigua*	SH 10%	OBL	12. *Picea mariana*	SH 10%	FACW
5. ***Picea mariana***	**TR 20%**	**FACW**	13.		
6. *Cornus canadensis*	HB 2%	FACW	14.		
7. *Betula papyrifera*	SH 15%	FACU	15.		
8. *Acer rubrum*	SH 5%	FAC	16.		

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-) 75 %

Remarks: Plot located on the edge of a sphagnum bog.

HYDROLOGY

___ Recorded Data (Describe in Remarks):

- __ Stream, Lake or Tide Gauge
- __ Aerial Photographs
- __ Other

___ No Recorded Data Available

Field Observations:

Depth of Surface Water 0 in.

Depth to Free Water in Pit: 0-12 in.

Depth to Saturated Soil: surface in.

Wetland Hydrology Indicators:

Primary Indicators:

- ____ Inundated
- x Saturated in Upper 12 inches
- ____ Water Marks
- ____ Drift Lines
- ____ Sediment Deposits
- ____ Drainage Patterns in Wetlands

Secondary Indicators (2 or more required):

- ____ Oxidized Root Channels in Upper 12 inches
- ____ Water -Stained Leaves
- ____ Local Soil Survey Data
- ____ FAC-Neutral Test
- ____ Other (Explain in Remarks)

Remarks:

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

SOILS

Map Unit Name
(Series and Phase): Dawson and Loxley Peats

Drainage Class: Very poorly drained
Field Observations
Confirm Mapped Type? Yes [✓ No]

Taxonomy (Subgroup): Terric Borosaprists (Dawson)
Dysic Typic Borosaprists (Loxley)

Profile Description:

Depth (Inches)	Horizon	Matrix Color Munsell Moist	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0-6	1	7.5YR 2.5/2 - 2.5/1			Moss/Peat-Mucky Peat
6-14	2	7.5YR 6/1			Sand
14-16	3	7.5YR 3/3			Sand to Consolidated Sand

Hydric Soils Indicators:

__ Histosol
__ Histic Epipedon
__ Sulfidic Odor
__ Aquic Moisture Regime
__ Reducing Conditions
__ Gleyed or Low-Chroma Colors
__ Concretions
__ High Organic Content in Surface Layer in Sandy Soils
__ Organic Streaking in Sandy Soils
__ Listed on Local Hydric Soils List
__ Listed on National Hydric Soils List
__ Other (Explain in Remarks)

Remarks: Horizon 1 contains 6" of Moss/Peat.

WETLAND DETERMINATION

Hydrophytic Vegetation Present? [✓ Yes] No (Circle)
Wetland Hydrology Present? [✓ Yes] No
Hydric Soils Present? [✓ Yes] No Unknown

(Circle)
Is this Sampling Point within a Wetland? [✓ Yes] No

Remarks:

Approved by HOUSACE 3/92
WSJ2-X

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site: Frontier Railroad Spur Cooridor
Applicant/Owner: Mascoma
Investigator: PMK/LDK

Date: 9/2/2009
County: Chippewa
State: MI

Do Normal Circumstances exist on the site? [✓ Yes] No
Is the site significantly disturbed (Atypical Situation)? Yes [✓ No]
Is the area a potential Problem Area? Yes [✓ No]
(If needed, explain on reverse.)

Community ID: Wetland 12
Transect ID:
Plot ID: Plot 9 UP

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
1. *Pteridium aquilinum*	HB 10%	FACU	9.		
2. *Populus deltoides*	SH 5%	FAC+	10.		
3. *Quercus rubra*	SH 5%	FACU	11.		
4. ***Pinus resinosa***	**TR 60%**	**FACU**	12.		
5.			13.		
6.			14.		
7.			15.		
8.			16.		

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-) 0 %

Remarks: Large red pine stand adjacent to large wetland bog.

HYDROLOGY

___ Recorded Data (Describe in Remarks):
  __ Stream, Lake or Tide Gauge
  __ Aerial Photographs
  __ Other
___ No Recorded Data Available

Field Observations:

Depth of Surface Water 0 in.

Depth to Free Water in Pit: 0 in.

Depth to Saturated Soil: 0 in.

Wetland Hydrology Indicators:
Primary Indicators:
____ Inundated
____ Saturated in Upper 12 inches
____ Water Marks
____ Drift Lines
____ Sediment Deposits
____ Drainage Patterns in Wetlands
Secondary Indicators (2 or more required):
____ Oxidized Root Channels in Upper 12 inches
____ Water -Stained Leaves
____ Local Soil Survey Data
____ FAC-Neutral Test
____ Other (Explain in Remarks)

Remarks:

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

SOILS

Map Unit Name
(Series and Phase): Croswell-Au Gres Sands, 0-3% slopes

Drainage Class: Moderately well drained to Somewhat poorly drained

Field Observations
Confirm Mapped Type? Yes [✓ No]

Taxonomy (Subgroup): Typic Endoaquods (Au Gres)
Oxyaquic Haplorthods (Croswell)

Profile Description:

Depth (Inches)	Horizon	Matrix Color Munsell Moist	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0-2	1	7.5YR 2.5/1			Organics
2-16	2	7.5YR 5/2			Sand

Hydric Soils Indicators:

__ Histosol
__ Histic Epipedon
__ Sulfidic Odor
__ Aquic Moisture Regime
__ Reducing Conditions
__ Gleyed or Low-Chroma Colors

__ Concretions
__ High Organic Content in Surface Layer in Sandy Soils
__ Organic Streaking in Sandy Soils
__ Listed on Local Hydric Soils List
__ Listed on National Hydric Soils List
__ Other (Explain in Remarks)

Remarks: No organic streaking in sand.

WETLAND DETERMINATION

Hydrophytic Vegetation Present? Yes [✓ No] (Circle)
Wetland Hydrology Present? Yes [✓ No]
Hydric Soils Present? Yes [✓ No] Unknown

(Circle)
Is this Sampling Point within a Wetland? Yes [✓ No]

Remarks:

Approved by HOUSACE 3/92
WSJ2-X

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site: Frontier Railroad Spur Cooridor
Applicant/Owner: Mascoma
Investigator: PMK/LDK

Date: 9/2/2009
County: Chippewa
State: MI

Do Normal Circumstances exist on the site? [✓ Yes] No
Is the site significantly disturbed (Atypical Situation)? Yes [✓ No]
Is the area a potential Problem Area? Yes [✓ No]
(If needed, explain on reverse.)

Community ID: Wetland 12
Transect ID:
Plot ID: Plot 10 WET

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
1. ***Sphagnum sp.***	**HB 80%**	**OBL**	9. ***Abies balsamea***	**TR 20%**	**FACW**
2. ***Calamagrostis canadensis***	**HB 40%**	**OBL**	10. *Picea mariana*	TR 10%	FACW
3. ***Rubus pubescens***	**HB 20%**	**FACW+**	11. *Chamaedaphne calculata*	HB 5%	OBL
4. *Osumunda cinnamomea*	HB 5%	FACW	12. ***Acer rubrum***	**TR 20%**	**FAC**
5. *Carex stricta*	HB 5%	OBL	13.		
6. ***Betula papyrifera***	**SH 20%**	**FACU**	14.		
7. ***Acer rubrum***	**SH 30%**	**FAC**	15.		
8. *Salix nigra*	SH 10%	OBL	16.		

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-) 85 %

Remarks: Located near the edge of a sphagnum bog.

HYDROLOGY

___ Recorded Data (Describe in Remarks):
  ___ Stream, Lake or Tide Gauge
  ___ Aerial Photographs
  ___ Other
___ No Recorded Data Available

Field Observations:

Depth of Surface Water 0 in.

Depth to Free Water in Pit: 3 in.

Depth to Saturated Soil: surface in.

Wetland Hydrology Indicators:
Primary Indicators:
  ___ Inundated
  x Saturated in Upper 12 inches
  ___ Water Marks
  ___ Drift Lines
  ___ Sediment Deposits
  ___ Drainage Patterns in Wetlands
Secondary Indicators (2 or more required):
  ___ Oxidized Root Channels in Upper 12 inches
  ___ Water -Stained Leaves
  ___ Local Soil Survey Data
  ___ FAC-Neutral Test
  ___ Other (Explain in Remarks)

Remarks:

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

SOILS

Map Unit Name
(Series and Phase): Kinross-Dawson Complex

Drainage Class: Very Poorly Drainied
Field Observations
Confirm Mapped Type? Yes [✓ No]

Taxonomy (Subgroup): Typic Endoaquods (Kinross)
Terric Borosaprists (Dawson)

Profile Description:

Depth (Inches)	Horizon	Matrix Color Munsell Moist	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0-5	1	7.5YR 2.5/1			Moss/Peat
5-16	2	7.5YR 5/1			Sand

Hydric Soils Indicators:

- __ Histosol
- __ Histic Epipedon
- __ Sulfidic Odor
- __ Aquic Moisture Regime
- __ Reducing Conditions
- x Gleyed or Low-Chroma Colors
- __ Concretions
- __ High Organic Content in Surface Layer in Sandy Soils
- x Organic Streaking in Sandy Soils
- __ Listed on Local Hydric Soils List
- __ Listed on National Hydric Soils List
- __ Other (Explain in Remarks)

Remarks: Organic streaking in horizon 2. Low chroma colors in horizons 1 and 2.

WETLAND DETERMINATION

Hydrophytic Vegetation Present? [✓ Yes] No (Circle)
Wetland Hydrology Present? [✓ Yes] No
Hydric Soils Present? [✓ Yes] No Unknown

(Circle)
Is this Sampling Point within a Wetland? [✓ Yes] No

Remarks:

Approved by HOUSACE 3/92
WSJ2-X

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site: Frontier Railroad Spur Cooridor
Applicant/Owner: Mascoma
Investigator: PMK/LDK

Date: 9/2/2009
County: Chippewa
State: MI

Do Normal Circumstances exist on the site? [✓ Yes] No
Is the site significantly disturbed (Atypical Situation)? Yes [✓ No]
Is the area a potential Problem Area? Yes [✓ No]
(If needed, explain on reverse.)

Community ID: Wetland 12
Transect ID:
Plot ID: Plot 10 UP

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
1. ***Vaccinium angustifolium***	**SH 60%**	**FACU**	9.		
2. ***Pteridium aquilinum***	**HB 60%**	**FACU**	10.		
3. ***Acer rubrum***	**SH 30%**	**FAC**	11.		
4. ***Abies balsamea***	**TR 30%**	**FACW**	12.		
5. ***Populus tremuloides***	**TR 25%**	**FACU**	13.		
6. *Quercus rubra*	SH 5%	FACU	14.		
7. ***Acer rubrum***	**TR 30%**	**FAC**	15.		
8.			16.		

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-) 50 %

Remarks: Located within a bracken fern meadow.

HYDROLOGY

___ Recorded Data (Describe in Remarks):
  __ Stream, Lake or Tide Gauge
  __ Aerial Photographs
  __ Other
___ No Recorded Data Available

Field Observations:

Depth of Surface Water 0 in.

Depth to Free Water in Pit: 0 in.

Depth to Saturated Soil: 0 in.

Wetland Hydrology Indicators:
Primary Indicators:
- ____ Inundated
- ____ Saturated in Upper 12 inches
- ____ Water Marks
- ____ Drift Lines
- ____ Sediment Deposits
- ____ Drainage Patterns in Wetlands

Secondary Indicators (2 or more required):
- ____ Oxidized Root Channels in Upper 12 inches
- ____ Water -Stained Leaves
- ____ Local Soil Survey Data
- ____ FAC-Neutral Test
- ____ Other (Explain in Remarks)

Remarks:

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

SOILS

Map Unit Name
(Series and Phase): Rousseau Fine Sand

Drainage Class: Well drained

Taxonomy (Subgroup): Entic Haplorthods

Field Observations
Confirm Mapped Type? Yes [✓ No]

Profile Description:

Depth (Inches)	Horizon	Matrix Color Munsell Moist	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0-4	1	7.5YR 2.5/1			Organics/Loam
4-10	2	7.5YR 4/1			Sand
10-16	3	7.5YR 4/6			Sand to Consolidated Sand

Hydric Soils Indicators:

- __ Histosol
- __ Histic Epipedon
- __ Sulfidic Odor
- __ Aquic Moisture Regime
- __ Reducing Conditions
- __ Gleyed or Low-Chroma Colors
- __ Concretions
- __ High Organic Content in Surface Layer in Sandy Soils
- __ Organic Streaking in Sandy Soils
- __ Listed on Local Hydric Soils List
- __ Listed on National Hydric Soils List
- __ Other (Explain in Remarks)

Remarks: No organic streaking within sand layers.

WETLAND DETERMINATION

Hydrophytic Vegetation Present? Yes [✓ No] (Circle)
Wetland Hydrology Present? Yes [✓ No]
Hydric Soils Present? Yes [✓ No] Unknown

(Circle)
Is this Sampling Point within a Wetland? Yes [✓ No]

Remarks:

Approved by HOUSACE 3/92
WSJ2-X

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site: Frontier Railroad Spur Cooridor
Applicant/Owner: Mascoma
Investigator: PMK/LDK

Date: 9/2/2009
County: Chippewa
State: MI

Do Normal Circumstances exist on the site? [✓ Yes] No
Is the site significantly disturbed (Atypical Situation)? Yes [✓ No]
Is the area a potential Problem Area? Yes [✓ No]
(If needed, explain on reverse.)

Community ID: Wetland 13
Transect ID:
Plot ID: Plot 11 WET

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
1. ***Acer rubrum***	**TR 70%**	**FAC**	9.		
2. *Osumunda cinnamomea*	HB 5%	FACW	10.		
3. *Calamagrostis canadensis*	HB 15%	OBL	11.		
4. *Ciburnum lentago*	SH 5%	FAC+	12.		
5. ***Pinus strobus***	**TR 20%**	**FACU**	13.		
6. ***Populus tremuloides***	**TR 20%**	**FACU**	14.		
7. ***Sphagnum sp.***	**HB 20%**	**OBL**	15.		
8.			16.		

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-) 50 %

Remarks: Forested wetland depression.

HYDROLOGY

___ Recorded Data (Describe in Remarks):
- ___ Stream, Lake or Tide Gauge
- ___ Aerial Photographs
- ___ Other

___ No Recorded Data Available

Field Observations:

Depth of Surface Water 0 in.

Depth to Free Water in Pit: 0 in.

Depth to Saturated Soil: surface in.

Wetland Hydrology Indicators:
Primary Indicators:
- ___ Inundated
- x Saturated in Upper 12 inches
- ___ Water Marks
- ___ Drift Lines
- ___ Sediment Deposits
- ___ Drainage Patterns in Wetlands

Secondary Indicators (2 or more required):
- ___ Oxidized Root Channels in Upper 12 inches
- ___ Water -Stained Leaves
- ___ Local Soil Survey Data
- ___ FAC-Neutral Test
- ___ Other (Explain in Remarks)

Remarks:

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

SOILS

Map Unit Name
(Series and Phase): Rousseau Fine Sand, moderately wet

Drainage Class: Moderately well drained

Field Observations
Confirm Mapped Type? Yes [✓ No]

Taxonomy (Subgroup): Entic Haplorthods

Profile Description:

Depth (Inches)	Horizon	Matrix Color Munsell Moist	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0-4	1	7.5YR 2.5/1			Organics/Loam
4-9	2	7.5YR 3/1			Sand
9-16	3	10YR 3/3			Sand

Hydric Soils Indicators:

- __ Histosol
- __ Histic Epipedon
- __ Sulfidic Odor
- __ Aquic Moisture Regime
- __ Reducing Conditions
- __ Gleyed or Low-Chroma Colors
- __ Concretions
- __ High Organic Content in Surface Layer in Sandy Soils
- x Organic Streaking in Sandy Soils
- __ Listed on Local Hydric Soils List
- __ Listed on National Hydric Soils List
- __ Other (Explain in Remarks)

Remarks: Organic streaking within sand layers.

WETLAND DETERMINATION

Hydrophytic Vegetation Present? [✓ Yes] No (Circle)
Wetland Hydrology Present? [✓ Yes] No
Hydric Soils Present? [✓ Yes] No Unknown

(Circle)
Is this Sampling Point within a Wetland? [✓ Yes] No

Remarks:

Approved by HOUSACE 3/92
WSJ2-X

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site: Frontier Railroad Spur Cooridor
Applicant/Owner: Mascoma
Investigator: PMK/LDK

Date: 9/2/2009
County: Chippewa
State: MI

Do Normal Circumstances exist on the site? [✓ Yes] No
Is the site significantly disturbed (Atypical Situation)? Yes [✓ No]
Is the area a potential Problem Area? Yes [✓ No]
(If needed, explain on reverse.)

Community ID: Wetland 13
Transect ID:
Plot ID: Plot 11 UP

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
1. ***Pteridium aquilinum***	**HB 60%**	**FACU**	9.		
2. ***Prunus virginiana***	**SH 20%**	**FAC-**	10.		
3. ***Populus grandidentata***	**SH 70%**	**FACU**	11.		
4. *Corylus cornuta*	SH 10%	FACU	12.		
5. ***Fragaria sp.***	**HB 20%**	**FACU**	13.		
6.			14.		
7.			15.		
8.			16.		

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-) 0 %

Remarks: Plot located in upland aspen stand.

HYDROLOGY

___ Recorded Data (Describe in Remarks):
- __ Stream, Lake or Tide Gauge
- __ Aerial Photographs
- __ Other

___ No Recorded Data Available

Field Observations:

Depth of Surface Water 0 in.

Depth to Free Water in Pit: 0 in.

Depth to Saturated Soil: 0 in.

Wetland Hydrology Indicators:
Primary Indicators:
- ____ Inundated
- ____ Saturated in Upper 12 inches
- ____ Water Marks
- ____ Drift Lines
- ____ Sediment Deposits
- ____ Drainage Patterns in Wetlands

Secondary Indicators (2 or more required):
- ____ Oxidized Root Channels in Upper 12 inches
- ____ Water -Stained Leaves
- ____ Local Soil Survey Data
- ____ FAC-Neutral Test
- ____ Other (Explain in Remarks)

Remarks:

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

SOILS

Map Unit Name
(Series and Phase): Rousseau Fine Sand, moderately wet

Drainage Class: Moderately well drained
Field Observations
Confirm Mapped Type? Yes [✓ No]

Taxonomy (Subgroup): Entic Haplorthods

Profile Description:

Depth (Inches)	Horizon	Matrix Color Munsell Moist	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0-1	1	7.5YR 2.5/1			Organics
1-3	2	7.5YR 4/1			Sand
3-16	3	7.5YR 5/8			Sand

Hydric Soils Indicators:

__ Histosol
__ Histic Epipedon
__ Sulfidic Odor
__ Aquic Moisture Regime
__ Reducing Conditions
__ Gleyed or Low-Chroma Colors

__ Concretions
__ High Organic Content in Surface Layer in Sandy Soils
__ Organic Streaking in Sandy Soils
__ Listed on Local Hydric Soils List
__ Listed on National Hydric Soils List
__ Other (Explain in Remarks)

Remarks: No organic streaking within sand layers.

WETLAND DETERMINATION

Hydrophytic Vegetation Present? Yes [✓ No] (Circle)
Wetland Hydrology Present? Yes [✓ No]
Hydric Soils Present? Yes [✓ No] Unknown

(Circle)
Is this Sampling Point within a Wetland? Yes [✓ No]

Remarks:

Approved by HOUSACE 3/92
WSJ2-X

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site: Frontier Railroad Spur Cooridor
Applicant/Owner: Mascoma
Investigator: PMK/LDK

Date: 9/3/2009
County: Chippewa
State: MI

Do Normal Circumstances exist on the site? [✓ Yes] No
Is the site significantly disturbed (Atypical Situation)? Yes [✓ No]
Is the area a potential Problem Area? Yes [✓ No]
(If needed, explain on reverse.)

Community ID: Wetland 14
Transect ID:
Plot ID: Plot 12 WET

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
1. ***Prunus virginiana***	**SH 20%**	**FAC-**	9.		
2. ***Alnus incana***	**SH 40%**	**OBL**	10.		
3. ***Calamagrostis canadensis***	**HB 60%**	**OBL**	11.		
4. ***Sphagnum Sp.***	**HB 90%**	**OBL**	12.		
5. *Iris versicolor*	HB 10%	OBL	13.		
6.			14.		
7.			15.		
8.			16.		

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-) 75 %

Remarks: Wetland depression surrounded by large pine stand.

HYDROLOGY

___ Recorded Data (Describe in Remarks):
- ___ Stream, Lake or Tide Gauge
- ___ Aerial Photographs
- ___ Other

___ No Recorded Data Available

Field Observations:

Depth of Surface Water 0 in.

Depth to Free Water in Pit: 6 in.

Depth to Saturated Soil: surface in.

Wetland Hydrology Indicators:

Primary Indicators:
- ___ Inundated
- x Saturated in Upper 12 inches
- ___ Water Marks
- ___ Drift Lines
- ___ Sediment Deposits
- ___ Drainage Patterns in Wetlands

Secondary Indicators (2 or more required):
- ___ Oxidized Root Channels in Upper 12 inches
- ___ Water -Stained Leaves
- ___ Local Soil Survey Data
- ___ FAC-Neutral Test
- ___ Other (Explain in Remarks)

Remarks:

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

SOILS

Map Unit Name
(Series and Phase): Kinross-Wainola Complex

Drainage Class: Somewhat to very poorly drained

Field Observations
Confirm Mapped Type? Yes [✓ No]

Taxonomy (Subgroup): Typic Endoaquods (Kinross)
Typic Endoaquods (Wainola)

Profile Description:

Depth (Inches)	Horizon	Matrix Color Munsell Moist	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0-4	1	7.5YR 2.5/1			Peat/Muck
4-16	2	7.5YR 4/1			Sand

Hydric Soils Indicators:

__ Histosol
__ Histic Epipedon
__ Sulfidic Odor
__ Aquic Moisture Regime
__ Reducing Conditions
__ Gleyed or Low-Chroma Colors

__ Concretions
__ High Organic Content in Surface Layer in Sandy Soils
__ Organic Streaking in Sandy Soils
__ Listed on Local Hydric Soils List
__ Listed on National Hydric Soils List
__ Other (Explain in Remarks)

Remarks: Peat/Muck in horizon 1.

WETLAND DETERMINATION

Hydrophytic Vegetation Present? [✓ Yes] No (Circle)
Wetland Hydrology Present? [✓ Yes] No
Hydric Soils Present? [✓ Yes] No Unknown

(Circle)
Is this Sampling Point within a Wetland? [✓ Yes] No

Remarks:

Approved by HOUSACE 3/92
WSJ2-X

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site: Frontier Railroad Spur Cooridor
Applicant/Owner: Mascoma
Investigator: PMK/LDK

Date: 9/3/2009
County: Chippewa
State: MI

Do Normal Circumstances exist on the site? [✓ Yes] No
Is the site significantly disturbed (Atypical Situation)? Yes [✓ No]
Is the area a potential Problem Area? Yes [✓ No]
(If needed, explain on reverse.)

Community ID: Wetland 14
Transect ID:
Plot ID: Plot 12 UP

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
1. ***Vaccinium angustifolium***	**SH 20%**	**FACU**	9.		
2. *Acer rubrum*	SH 5%	FAC	10.		
3. *Gaultheria procumbens*	HB 15%	FACU	11.		
4. ***Pteridium aquilinum***	**HB 60%**	**FACU**	12.		
5. ***Pinus strobus***	**TR 50%**	**FACU**	13.		
6. ***Picea mariana***	**TR 20%**	**FACW**	14.		
7. *Quercus rubra*	SH 5%	FACU	15.		
8.			16.		

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-) 25 %

Remarks: Wetland depression surrounded by large pine stand.

HYDROLOGY

____ Recorded Data (Describe in Remarks):
  ____ Stream, Lake or Tide Gauge
  ____ Aerial Photographs
  ____ Other
____ No Recorded Data Available

Field Observations:

Depth of Surface Water 0 in.

Depth to Free Water in Pit: 0 in.

Depth to Saturated Soil: 0 in.

Wetland Hydrology Indicators:
Primary Indicators:
  ____ Inundated
  ____ Saturated in Upper 12 inches
  ____ Water Marks
  ____ Drift Lines
  ____ Sediment Deposits
  ____ Drainage Patterns in Wetlands
Secondary Indicators (2 or more required):
  ____ Oxidized Root Channels in Upper 12 inches
  ____ Water -Stained Leaves
  ____ Local Soil Survey Data
  ____ FAC-Neutral Test
  ____ Other (Explain in Remarks)

Remarks:

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

SOILS

Map Unit Name
(Series and Phase): Kinross-Wainola Complex

Drainage Class: Somewhat to very poorly drained
Field Observations
Confirm Mapped Type? Yes [✓ No]

Taxonomy (Subgroup): Typic Endoaquods (Kinross)
Typic Endoaquods (Wainola)

Profile Description:

Depth (Inches)	Horizon	Matrix Color Munsell Moist	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0-1	1	7.5YR 2.5/1			Loamy Sand/Sand
1-10	2	7.5YR 4/1			Sand
10-16	3	7.5YR 4/6			Sand

Hydric Soils Indicators:

- __ Histosol
- __ Histic Epipedon
- __ Sulfidic Odor
- __ Aquic Moisture Regime
- __ Reducing Conditions
- __ Gleyed or Low-Chroma Colors
- __ Concretions
- __ High Organic Content in Surface Layer in Sandy Soils
- __ Organic Streaking in Sandy Soils
- __ Listed on Local Hydric Soils List
- __ Listed on National Hydric Soils List
- __ Other (Explain in Remarks)

Remarks:

WETLAND DETERMINATION

Hydrophytic Vegetation Present? Yes [✓ No] (Circle)
Wetland Hydrology Present? Yes [✓ No]
Hydric Soils Present? Yes [✓ No] Unknown

(Circle)
Is this Sampling Point within a Wetland? Yes [✓ No]

Remarks:

Approved by HOUSACE 3/92
WSJ2-X

Appendix B

Photo Log

PHOTO LOG
Wetland Delineation
Proposed Frontier Railroad Corridor
8/30/09 – 9/3/09

Photo 1 – Taken facing northwest on two-track road near transmission line corridor, immediately north of the existing railroad grade.

Photo 2 – Taken facing north from southernmost boundary of Wetland 1. Note cattail stand and pine-inhabited upland “island” in far back, right.

Photo 3 – Photo taken facing north along southern boundary of Wetland 1, approximately 500 feet to the East of photo 1.

Photo 4 – Photo taken facing north near the northeast boundary of an upland “peninsula” within Wetland 1. Note the transition to a wooded wetland of mature black spruce and balsam fir.

Photo 5 – Taken in northern portion of Wetland 1 facing west. This area is a small strip of wetland located between two upland ridges. Winterberry and cinnamon fern were prevalent here.

Photo 6 – Taken facing southwest within the northern portion of Wetland 1. Note extensive mat of sphagnum moss and mature black spruce.

Photo 7 – Photo taken facing northwest near Plot 2 WET-B.
Prevalence of sphagnum and black spruce continues here.

Photo 8 – Taken facing southeast near the northern portion of Wetland 1.
Here, wetland and transitional wetland/upland continues outside of the rail corridor boundary.

Photo 10 – **(Photo 9 omitted.)** Taken facing south at far northern boundary of Wetland 1.

Photo 11 – Photo taken facing north along western corridor boundary within Wetland 2.

Photo 12 – Photo taken in center of Wetland 3 facing southwest. This wetland is located in a small ground surface depression that predominantly vegetated with Canada bluejoint.

Photo 13A – Taken facing northwest near center of Wetland 7. Note the vegetative similarity of this wetland those shown in photos 12 and 13.

Photo 13B – Taken facing north near center of Wetland 5.

Photo 14 – Photo taken facing southwest along western corridor boundary within Wetland 8.

Photo 15 – Photo taken along northwest boundary of Wetland 9 facing north. Note depressions with darkened leaves and organic matter from frequent inundation.

Photo 16 – Photo of Wetland 10 taken facing northeast.

Photo 17 – Photo of Wetland 12 taken facing north. This portion of Wetland 12 is a black spruce and tamarack swamp similar to the northern portions of Wetland 1.

Photo 18 – Photo of Wetland 13 taken facing east.

Photo 19 – Photo of red pine forest, taken facing north towards Wetland 12. The edge of the wetland can be seen in the far background of this photo.

Photo 20A – Photo taken facing south in southern portion of Wetland 9.

Photo 20B – Photo taken in red pine forest near photo 19, facing south.

Photo 21 – Photo taken facing southeast in Wetland 14.

Wetland Boundary Delineation Report
Provided as Supplement to:
Frontier Cellulosic Ethanol Facility Environmental Assessment
Kinross Township
Chippewa County, Michigan

AECOM Project No. 13375001

August, 2009

Prepared by:
AECOM Environment

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Contents

1.0 INTRODUCTION

Frontier Renewable Resources, LLC (Frontier) retained AECOM Environment (AECOM) to complete a wetland boundary delineation on approximately 355 acres to assist with their planning of a proposed cellulosic ethanol facility in Kinross Township, Michigan. This delineation was completed to support an Environmental Assessment (EA) that is being conducted to evaluate potential impacts of construction and operation of the proposed facility. The wetland boundary delineation was completed with the following tasks and goals in mind:

- To identify, delineate and survey the boundaries of all wetlands located within the proposed project area;
- To characterize each wetland based on soil, hydrologic and vegetative features;
- To determine if current development plans for the site will cause immediate impact to existing on-site wetlands (i.e. if dredge or fill of wetlands will be required), and
- To state jurisdictional and regulatory requirements that may apply depending on planned activities within, or impacts to, the wetlands.

This report presents the resulting data and conclusions associated with these tasks and goals.

2.0 SITE DESCRIPTION

The delineation area consisted of approximately 355 acres located in the Southeast ¼ and the Eastern ½ of the Southwest ¼ of Section 21, T45N, R1W and the Northeast ¼ of Section 28, T45N, R1W, Kinross Township, Chippewa County, Michigan. The site location and proposed boundaries are indicated on portions of the United States Geological Survey (USGS) topographic maps entitled “Dafter, Pickford NW, Rudyard, and Kinross, Michigan” provided as Figure 1 – Site Location Map. The site boundaries are also indicated over the 2005 aerial photo on the attached Figure 2 – Site Location Map with 2005 Aerial Photo.

The Frontier site as a whole is bordered by the Kincheloe Access Road on its entire western side, the Mackinac Trail Spur on its northwestern boundary, and undeveloped woodlands and wetlands on its remaining boundaries. The West Bisnett Right-of-Way (ROW) is a combination gravel and “two-track” road that runs east to west through the center of the Frontier site, separating the four northern forty-acre parcels from the four southern forty-acre parcels. This road connects to a series of other two-track roads and all terrain vehicle (ATV) trails that run in a network throughout the project site. Use of the property for ATV and dirt bike recreation is popular, and is demonstrated by the presence of a small dirt bike track that is located in the northeast portion of the site. To the south of the track are a few cleared areas with scattered trees and meadows that was at one time a homestead site. It was also apparent during AECOM’s field investigation that this property has been commonly used for deer hunting. Several deer stands, blinds and cleared shooting lanes were observed throughout the site.

The Frontier project site is most easily characterized by referring to the southern two-thirds and northern third of the site separately. The southern two-thirds of the site has nearly level to gently sloping ground surface topography, consistently sandy soils and upland forested areas. These upland forests are by majority hardwood, but a few evergreen stands exist in the central and northeastern portions. Overstory tree species common to the hardwood areas include red oak, pin oak, red maple, sugar maple and quaking aspen. Serviceberry and beaked hazelnut were some of the species most common to the understory. The evergreen stands consisted of row-planted red pine, white spruce and/or balsam fir. As the Frontier site has been owned by the State of Michigan for several years, these woodlands show evidence of recent forest management. Selective harvesting appears to be most prevalent, where relatively mature trees can be found interspersed among mid- to new-growth trees (saplings).

This high, sandy, southern “plateau” of sorts transitions to mesic and lowland areas in the north via a distinct bluff. This bluff has slopes ranging from approximately 6 to 15%, and runs in a northwest to southeast direction across the site. Continuing to the north of the bluff, ground surface slopes become nearly level with slopes rarely exceeding 2 to 3%. However, in the northernmost portion of the site, the ground surface begins to show a slight undulation that is characteristic of former lake bed areas. Areas such as these include dune-swale complexes, which are relatively common in the Great Lakes region. The presence of former lake bed is further reinforced by the fact that soils in these areas are generally sandy.

Similar to the southern portion of the site, the majority of the northern portion is forested with a combination of hardwood and evergreen trees. In this case however, the evergreen trees are intermixed throughout, rather than occurring in a few patchy stands. Vegetation in mesic and upland areas is similar to that occurring in the southern half of the site, with mature red pine being very common on upland "humps." There are also a few mesic areas where mature eastern hemlock is dominant. Low, wetland areas in the northeastern portion of the site are generally tamarack swamps that support a mixture of tamarack, black spruce, white birch and leatherleaf. Sphagnum moss and snowberry are also common on ground surfaces in these areas. These swamp areas appear to be hydrologically supported by an elongated drainage system that reaches across the far northern portion of the site. This drainage system appears to originate from a large shrub swamp that is located just off of the western property corner.

3.0 LITERATURE REVIEW

Prior to on-site field investigation, AECOM completed a review of available map data in order to obtain information on general site characteristics, and to identify potential wetland areas for field investigation. Items reviewed included the USGS topographic map, 2005 aerial photo, the Natural Resource Conservation Service (NRCS) soils map and the National Wetland Inventory (NWI) map.

3.1 USGS Topographic Map

The Frontier site's boundaries are indicated over a USGS topographic map in the attached Figure 1. The map indicates that the southern two-thirds of the project site are located on the top of a large, elongated hill that has a surface elevation approximately 8 to 10 feet higher than the ground surface in the northern one-third of the project site. Wetlands and a pond are indicated just outside of the site's northern boundaries; however they do not extend into the site. Ground surface contours in the northwestern portion of the site identify the presence of the drainage system extending from west to the northeast.

3.2 Aerial Photo

The project site boundaries are indicated over the 2005 National Agriculture Imagery Program (NAIP) aerial photo in the attached Figure 2. The aerial photo indicates the presence of dense, continuous deciduous and evergreen forests over the majority of the project site. A small cleared area exists in the north-central portion of the site that appears to be barren and/or grass upland. An elongated "strip" of wetlands appears to be present that crosses the northeast corner of the site and extends to the north and west outside of the project boundaries. Additional wetland areas are visible outside of, but adjacent to, the project boundaries to the northeast, north and northwest. This includes a small pond/open-water wetland just off of the northeast site boundary.

3.3 NRCS Soils Map

A portion of the NRCS soils map for Chippewa County, Michigan is also attached to this report as Figure 3. Using color coding, this map indicates which soil series are hydric with a blue coloration and "partially hydric" with a green coloration. Partially hydric soils (soils that have hydric inclusions) are present in the far northwestern and northeastern portions of the Frontier site. These include Croswell-Au Gres sands (88A), Dawson and Loxley peats (37), and Kinross-Wainola complex soils (137A). These areas are the most likely to contain wetlands as, by definition, hydric soils are regularly saturated near the surface and contain specific soil features that result from repeated saturation.

The central and southern portions of the site are less likely to contain wetlands as the mapped soil types are not hydric, and the ground surface elevation is significantly higher than in the lower, hydric soil areas. Table 1.0, below, presents a summary of characteristics for each of the soil types mapped within the Frontier project boundaries. These characteristics include: primary soil texture of near-surface horizons, typical ground surface slope, drainage classification, percent hydric soil inclusions and where each soil type can be found on site.

Table 1.0 – Site Soils Characteristics

Soil Name	Primary Texture	Slope %	Drainage Class	% Hydric	Portion of Site
Croswell-Au Gres sands (88A)	sand	0-3	MWD	4	NW and NE Corners of Site
Dawson and Loxley peats (37)	peat, muck	0-2	VPD	90	Far NE Corner
Kinross-Wainola complex soils (137A)	muck, sand	0-2	VPD	62	Far NE Corner
Rousseau fine sand (15B)	fine sand	0-6	WD	0	Majority of Site Except Far Northern Areas
Kalkaska sand (19B)	sand	0-6	ED	0	NW Portion of Site, Extreme SW & SE Corners
Alcona loamy very fine sand (13B)	loamy v. fine sand	0-6	MWD	0	Isolated Area in North-central Portion of Site

Drainage Class Key:
ED = Excessively Drained; WD = Well Drained; MWD = Moderately Well Drained; VPD = Very Poorly Drained.

3.4 NWI Map

The NWI map indicates the presence of scrub-shrub and forested wetlands in the far northeastern corner of the project site. It also indicates an elongated scrub-shrub wetland just outside of the far northwestern property corner. Scrub-shrub wetlands are characterized by a dominance of shrubby vegetation and a general lack of mature trees. Alternatively, forested wetlands are characterized by a dominance of mature deciduous or evergreen trees, and a significantly lower presence of shrubby or herbaceous vegetation.

An NWI map of the investigation area is provided as Figure 4.

4.0 METHODOLOGY

On April 27th to May 1st and June 1st through 4th, 2009, AECOM completed wetland boundary delineations within the Frontier project site utilizing the U.S. Army Corps of Engineers (COE) 1987 Wetland Delineation Methodology, and methods outlined in the Michigan Department of Environmental Quality's (MDEQ) Wetland Identification Manual. The COE methodology requires that, under normal circumstances, hydric soils, wetland hydrology, and hydrophytic vegetation must be present for an area to be defined as a wetland. The method outlined in the MDEQ manual states that only two parameters, wetland vegetation and wetland hydrology, are required to confirm the presence of wetlands under Michigan law.

AECOM completed upland and wetland determination plots in transects through wetland and upland areas, as well as along wetland boundaries. A set of two determination plots (one on each side of the boundary) was used for smaller or more narrow wetland areas, rather than entire transects with 3 or more data plot locations. Transects were labeled alphanumerically, with the number being the transaction number, and the letter representing the individual plot. For example: Transect 1, Plot C (completed in an upland) would be labeled "1C-UP." Or, Transect 4, Plot D (completed in a wetland) would be labeled "4D-WET." After wetland boundary locations were determined, the boundaries were staked and/or flagged, with each point labeled as "B-1, B-2, B-3…etc.," with B representing "Boundary." In most cases, survey lathe only (tied with pink wetland ribbon) was used to stake the boundary points. In some areas, such as where boundaries formed relatively straight lines (no curves or corners), wetland flagging in trees or on shrubs was alternated with staking. Boundary point names were written on the stakes and/or ribbon, as well as entered into the Trimble® GeoXT™ GPS surveying unit used to survey boundary and data plot locations. Routine On-Site Determination Forms of data plot information are included in the Appendix. The delineated wetland boundaries and determination plot locations are indicated in the attached Figures 5 through 11. For future reference, Table 2.0 below provides a list of data plot names and their GPS coordinate locations.

Table 2.0 – Data Plot GPS Coordinates

Plot Name	Northing	Easting
1A-WET	556703.112	26897373.484
1B-UP	556395.563	26897329.804
1C-WET	556248.603	26897392.176
1D-WET	555961.391	26897389.414
1E-UP	555713.726	26897291.804
2A-WET	556825.115	26897035.367
2B-UP	556532.601	26897107.567
2D-WET	556068.608	26896931.464
2E-UP	556014.408	26896909.085
3A-WET	556643.903	26896145.285
3B-UP	556603.953	26896177.797
4A-WET	556604.245	26896562.981
4B-UP	556576.029	26896567.151
5A-WET	556341.449	26896745.291
5B-UP	556286.266	26896700.041
6-UP	555642.906	26897392.958
6-WET	555618.707	26897440.576
7-UP	555610.367	26897368.732
7-WET	555540.491	26897371.637
8-UP	556680.338	26895736.793
8-WET	556622.562	26895715.082
9A-WET	556625.523	26895057.490
9B-UP	556588.584	26895051.203
9C-WET	556547.860	26895025.822
9D-UP	556526.429	26895042.936
9E-WET	556496.918	26895007.881
9F-UP	556444.623	26895049.568

*Coordinates provided in NAD 1983 Michigan State Plane North, International Feet.

In areas that appeared to be totally devoid of wetlands (entirely upland), transects were walked in north-to-south and east-to-west directions along the boundaries of each 40-acre parcel, and through their centers. In this way, AECOM ensured that all portions of the site were examined for the presence of wetlands.

The attached photo log provides photos of each wetland identified by AECOM. Also included are photos taken while walking transects through upland areas, and during general site inspection. These photos are included in order to provide some characterization of the upland areas, as well as to support the determination that no wetlands are present within them.

5.0 RESULTS

In total, AECOM identified and delineated five wetlands within the Frontier project investigation area. Their relative sizes and locations are depicted in the attached Figures 5 through 11. Wetlands were encountered within the two northernmost 40-acre parcels only. **No wetlands were encountered within the rest of the project site. This includes the southern two-thirds of the project site (four southernmost 40-acre parcels).**

Wetland 1

At approximately 13.7 acres in size, Wetland 1 is the largest and most extensive wetland found on the Frontier site. This wetland occupies areas nearest the northern project site boundary, and extends from the western site boundary to the eastern site boundary. The western half of this wetland can best be described as an elongated swale or drainage course. This drainage course contained standing water during both site visits in April and June, and likely obtains its hydrology from interconnection with the water table and/or surface connection with large wetlands to the west of the site. Given that the ground surface generally slopes to the east and northeast in this area, it is likely that water in this drainage course flows east towards the largest portion of Wetland 1 during rainfall events. This western portion of the wetland appears to be part of a dune-swale complex type setting that continues to the north. Data plots 3A-WET, 8-WET and 9A-WET were completed within this portion of Wetland 1. Some of the dominant vegetative species observed at these locations included red maple (*Acer rubrum* - FAC), black spruce (*Picea mariana* – FACW), balsam fir (*Abies balsamea* - FACW) and various sphagnum (*Sphagnum spp*. – OBL) and sedge species (*Carex spp.* – FAC to OBL). Soils encountered in the western half of Wetland 1 were found to be sands, silts and/or cobbles with muck or peat surface horizons. The predominant soil type mapped by NRCS in the western half of Wetland 1 is Kalkaska sand.

Near the center of the northern Frontier project site boundary, Wetland 1 transitions from a generally isolated drainage course to a wider, more diverse wetland that occupies the northeastern corner of the project site. This eastern portion contains a mixture of open water, wet meadow, shrub swamp and tamarack swamp, and has a few small interspersed upland areas. This diverse combination of habitats can also be attributed to the dune-swale type ground surface present in the area, which allows for a variety of hydrologic conditions and establishment of various vegetative species. Data plots 1A-WET, 1C-WET, 1D-WET, 2D-WET, 4A-WET and 5A-WET were completed within the eastern portion of Wetland 1. Similar to the western portion of Wetland 1, plots 1A and 5A-WET were observed to have black spruce, red maple and balsam fir, as well as a relatively high dominance of tamarack (*Larix larcinea* – FACW). Data plots 1C and 4A-WET were shown to have similar species present, but were located in more shrub-scrub to open-water wetland areas. The predominance of leatherleaf (*Chamaedaphne calyculata* – OBL*)* was a general distinguishing factor. Similarly, the presence of northern white cedar (*Thuja occidentalis* – FACW) at data plots 1D and 2D-WET distinguished them from other portions of Wetland 1. Among all of the Wetland 1 data plots, hydrologic conditions varied from saturated within 1 foot of the surface to inundated several inches. Soil conditions, however, stayed relatively consistent across the area with 7.5 YR 2.5/1 peat and/or muck surface layers over sandy to silty sub-horizons. The sandy or silty sub-horizons were observed to have colorations typically ranging from 7.5 YR 2.5/1 to 2.5/3 or 7.5 YR 5/1 to 5/2. Mapped soil types in the eastern portion of Wetland 1 include Croswell-AuGres sands, Dawson and Loxley peats, and Kinross-Wainola complex soils.

A few small, isolated upland areas were included in Wetland 1 as it was the opinion of AECOM that their size and extent were not significant, and did not warrant their identification and separation from the wetland. Currently, the proposed Frontier project development plan does not call for any impact to the wetland or lands near the wetland, and therefore issues such as mitigation ratios are not a concern. Currently the delineated boundaries are serving as guidance for avoidance of impact only.

Wetland 2

Wetland 2 is approximately 0.15 acres in size, and is located just south of the far western end of Wetland 1 (see Figure 6). This wetland exists in a relatively small, near-circular depression, and is separated from Wetland 1 by an elongated sandy ridge. The lowest ground surface elevation of this wetland is approximately the same as the lowest portions of Wetland 1, making it likely that the two wetlands are hydrologically connected via seepage through the sandy ridge. Data plot 9C-WET was completed within this small, wooded wetland. Dominant hydrophytic vegetation present included yellow birch (*Betula alleghaniensis* – FAC), balsam fir and red maple. Sphagnum moss was also present in the most saturated portions of the wetland. Standing water was observed at 2 inches below ground surface in a 16-inch deep soil pit, with saturation occurring up to the surface. Soils from 0 to 5 inches below ground surface were found to be 7.5 YR 2.5/2 mucky silts. Soils from 5 to 16 inches below gorund surface were found to be 7.5 YR 5/1 sands that had a significant amount of organic streaking. The mapped soil type in this location is Croswell-Au Gres sands.

<u>Wetland 3</u>

Wetland 3 is located immediately to the south of Wetland 2, and is approximately 0.11 acres in size. Similar to Wetland 2, this wetland is located in a small depression, is wooded, and is separated from the adjacent wetlands by an elongated sandy ridge. Data plot 9E-WET was completed within Wetland 3. The dominant vegetative species were also the same as in Wetland 2: yellow birch, balsam fir, red maple and sphagnum moss. The herbaceous vegetative stratum was scant, if at all present, in Wetlands 2 and 3. In Wetland 3, free water was observed in a soil pit at 1 inch below the surface, with the soil saturated at the surface. Soils observed in the pit included a 7.5 YR 2.5/1 mucky loam from 0 to 3 inches below the surface. A 7.5 YR 4/1 sand was found below the mucky loam. Croswell-Au Gres sands are the mapped in the western portion of Wetland 3, and Kalkaska sands are mapped in the eastern portion of Wetland 3.

<u>Wetland 4</u>

Wetland 4 is the smallest of the wetlands documented on the Frontier site, and is approximately 917 square feet in size. This wetland is located along the eastern site boundary, immediately to the south of Wetland 1. Similar to Wetlands 2 and 3, Wetland 4 is located in a sandy depression that is wooded and is separated from adjacent wetlands by elongated sandy ridges. Data plot 6-WET was completed within this wetland. Dominant vegetation included red maple, black spruce and quaking aspen (Populus tremuloides – FAC). Sphagnum moss was also present in the most saturated areas of this wetland. Soil saturation was evident at the ground surface, and free water was observed in a 16-inch soil pit at 3 inches below the surface. Soils present at this location included 7.5 YR 2.5/1 loam with organics from 0 to 6 inches below the surface, and 7.5 YR 5/3 sand with common, distinct 7.5 YR 5/6 mottling from 6 to 16 inches. The mapped soil types in the area of Wetland 4 are Croswell-Au Gres sands. It should be noted that Wetland 4 extends past the eastern frontier project boundary.

<u>Wetland 5</u>

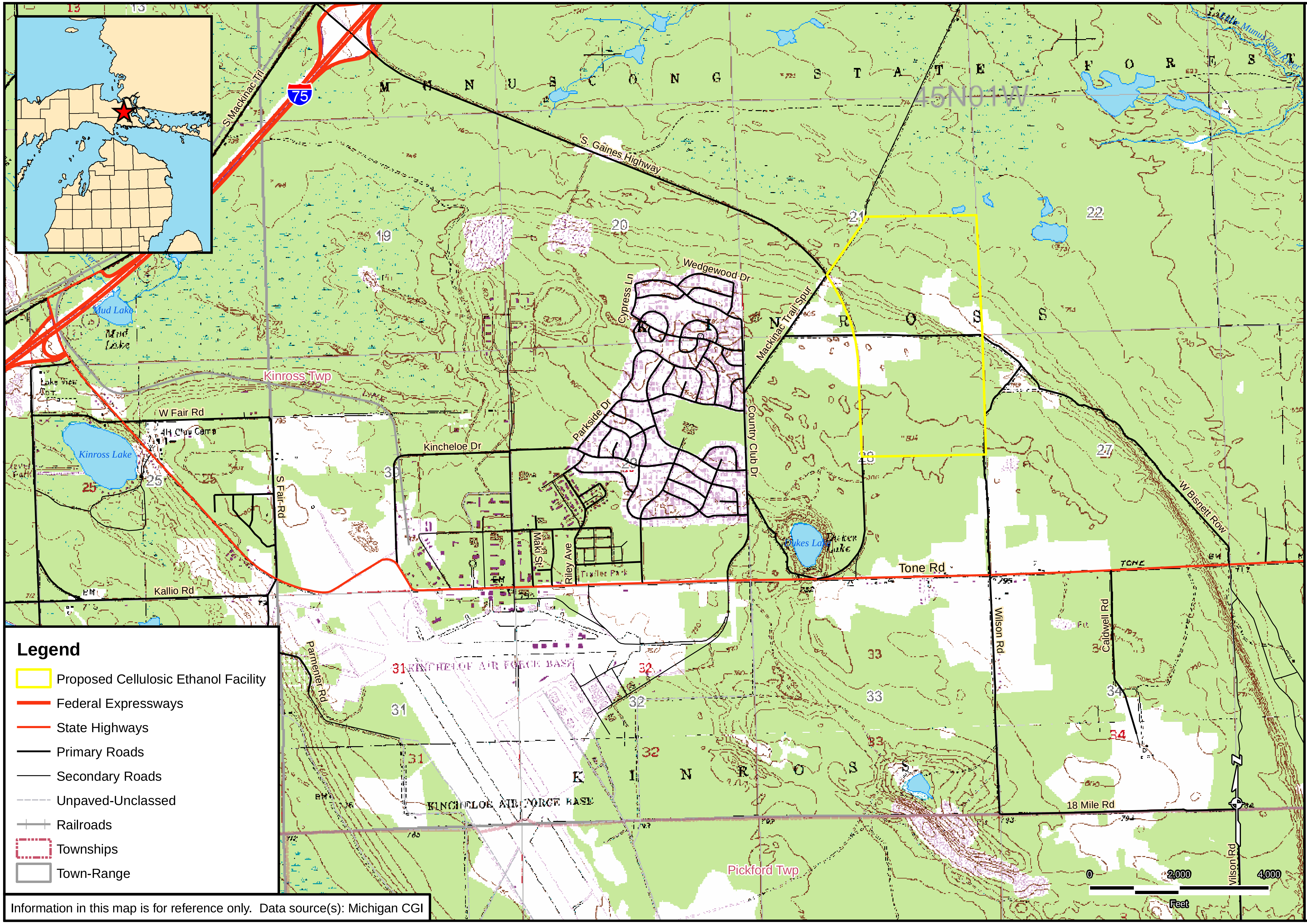
Wetland 5 is located immediately to the south of Wetland 4 and is approximately 0.35 acres in size. This wetland is also located in a sandy depression, but is more spread out and irregular shaped than Wetlands 2, 3 and 4. Data plot 7-WET was completed within the boundaries of Wetland 5. Here, vegetation differed only slightly from the other wetlands, with the addition of such species as starflower (*Trientalis borealis* – FAC+) and common blue violet (*Viola sororia* – FACW). Red maple and black spruce were the dominant hydrophytic tree species present. Again, soils at plot 7-WET were saturated at the surface, and free water was present in a 16-inch soil pit at 10 inches below the surface. Soils documented at this location included a 7.5 YR 2.5/1 sandy loam from 0 to 0.5 inches and a 5 YR 5/1 sand from 0.5 to 16 inches that had many prominent 7.5 YR 5/6 mottles.

6.0 ANTICIPATED IMPACTS

At the time of this wetland delineation report, Frontier is proposing construction of the cellulosic ethanol facility in the four southernmost 40-acre parcels of the property. No wetlands were identified within this 160-acre area. Frontier plans to use this delineation to assist with the design layout of their proposed facility and minimize wetland impact.

7.0 SUMMARY

Based on our observation of April 27th to May 1st and June 1st through 4th, 2009, and utilizing the COE wetland delineation methodology with regard to the MDEQ definition of a wetland, it is the opinion of AECOM that all 5 delineated wetlands are jurisdictional under state and federal law. In accordance with Section 404 of the Clean Water Act and Part 303 of the Natural Resources and Environmental Protection Act (NREPA), Act 451 of 1994, any impacts to these wetlands may require a permit from the MDEQ and/or COE. Please note that, as with all wetland delineations, these agencies make final determinations regarding jurisdiction and the locations of wetland boundaries. Boundary verifications (completed by MDEQ) are recommended whenever impacts are anticipated within or near identified wetlands.



Information in this map is for reference only. Data source(s): Michigan CGI

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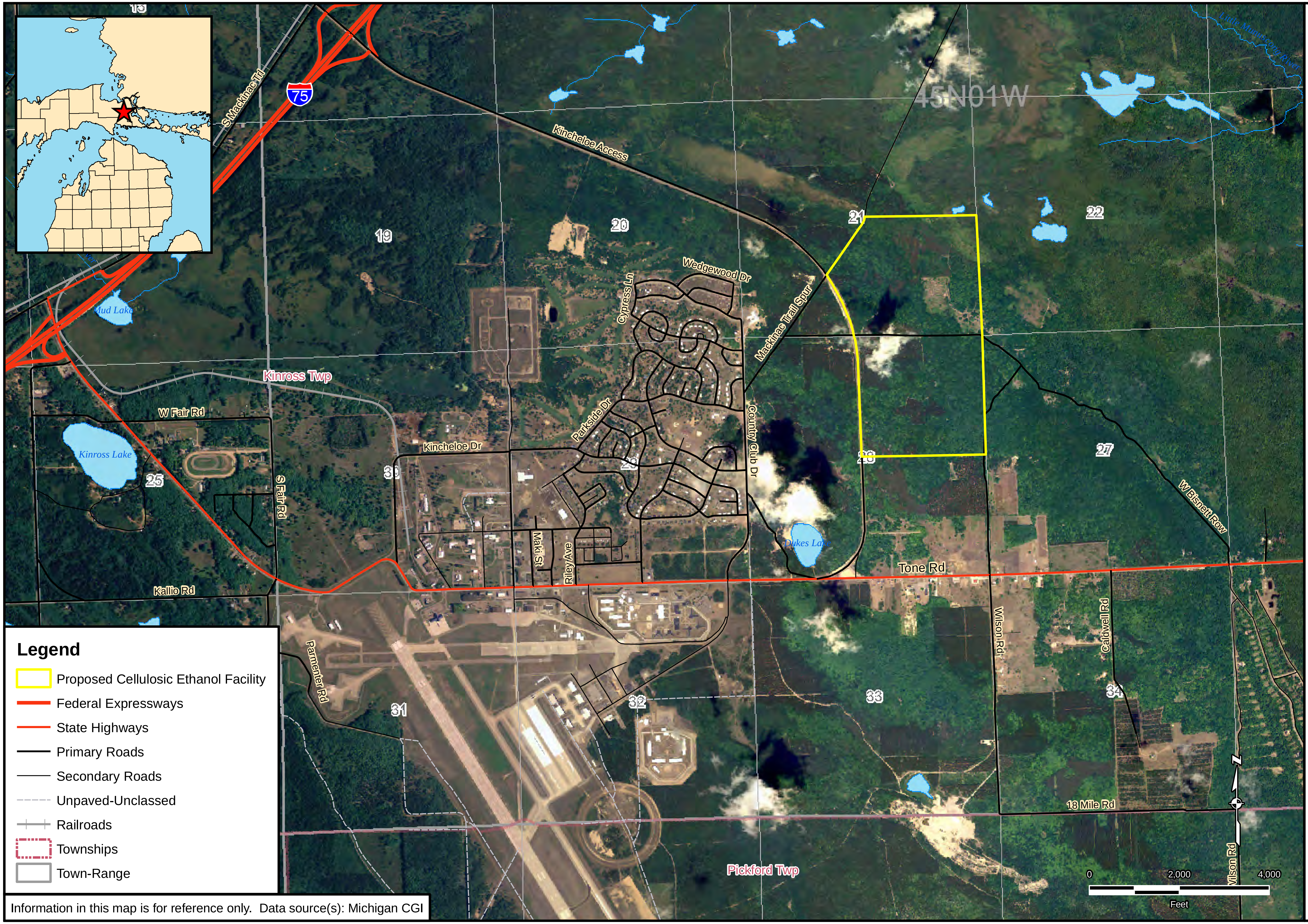
SITE LOCATION MAP
WETLAND DELINEATION REPORT
FRONTIER RENEWABLE RESOURCES, LLC
CELLULOSIC ETHANOL FACILITY
CHIPPEWA COUNTY, MICHIGAN

Drawn:	JWW	2/17/2009
Approved:	LDK	2/17/2009
Scale:	1" = 2,000'	
PROJECT NUMBER	13375-001-0100	
FIGURE NUMBER	1	



Information in this map is for reference only. Data source(s): Michigan CGI

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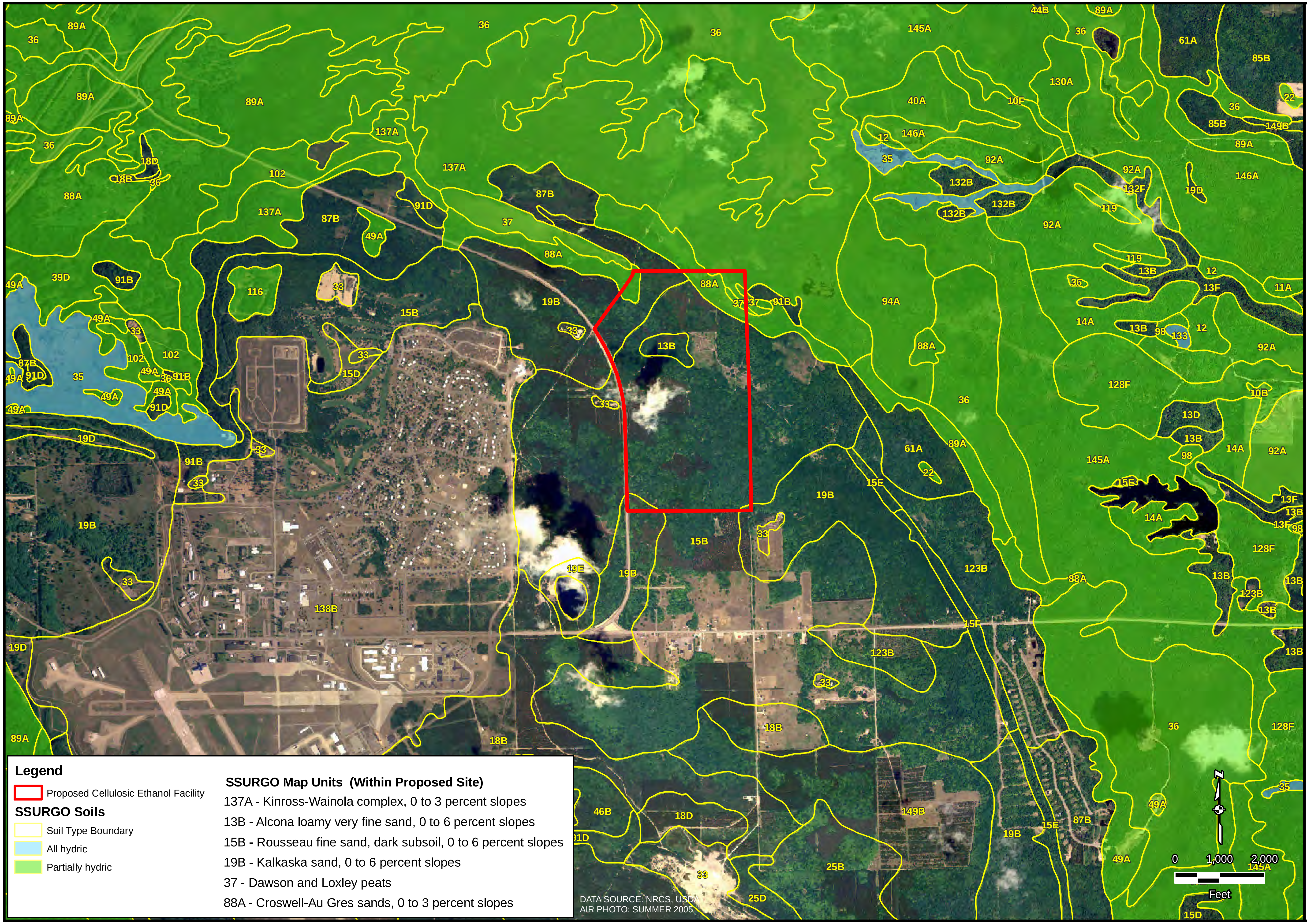
SITE LOCATION MAP WITH 2005 AERIAL PHOTO
WETLAND DELINEATION REPORT
FRONTIER RENEWABLE RESOURCES, LLC
CELLULOSIC ETHANOL FACILITY
CHIPPEWA COUNTY, MICHIGAN

Drawn: JWW 2/17/2009
Approved: LDK 2/17/2009
Scale: 1" = 2,000'
PROJECT NUMBER 13375-001-0100
FIGURE NUMBER 2



DATA SOURCE: NRCS, USDA
AIR PHOTO: SUMMER 2005

Legend

🟥 Proposed Cellulosic Ethanol Facility

SSURGO Soils

☐ Soil Type Boundary

🟦 All hydric

🟩 Partially hydric

SSURGO Map Units (Within Proposed Site)

137A - Kinross-Wainola complex, 0 to 3 percent slopes

13B - Alcona loamy very fine sand, 0 to 6 percent slopes

15B - Rousseau fine sand, dark subsoil, 0 to 6 percent slopes

19B - Kalkaska sand, 0 to 6 percent slopes

37 - Dawson and Loxley peats

88A - Croswell-Au Gres sands, 0 to 3 percent slopes

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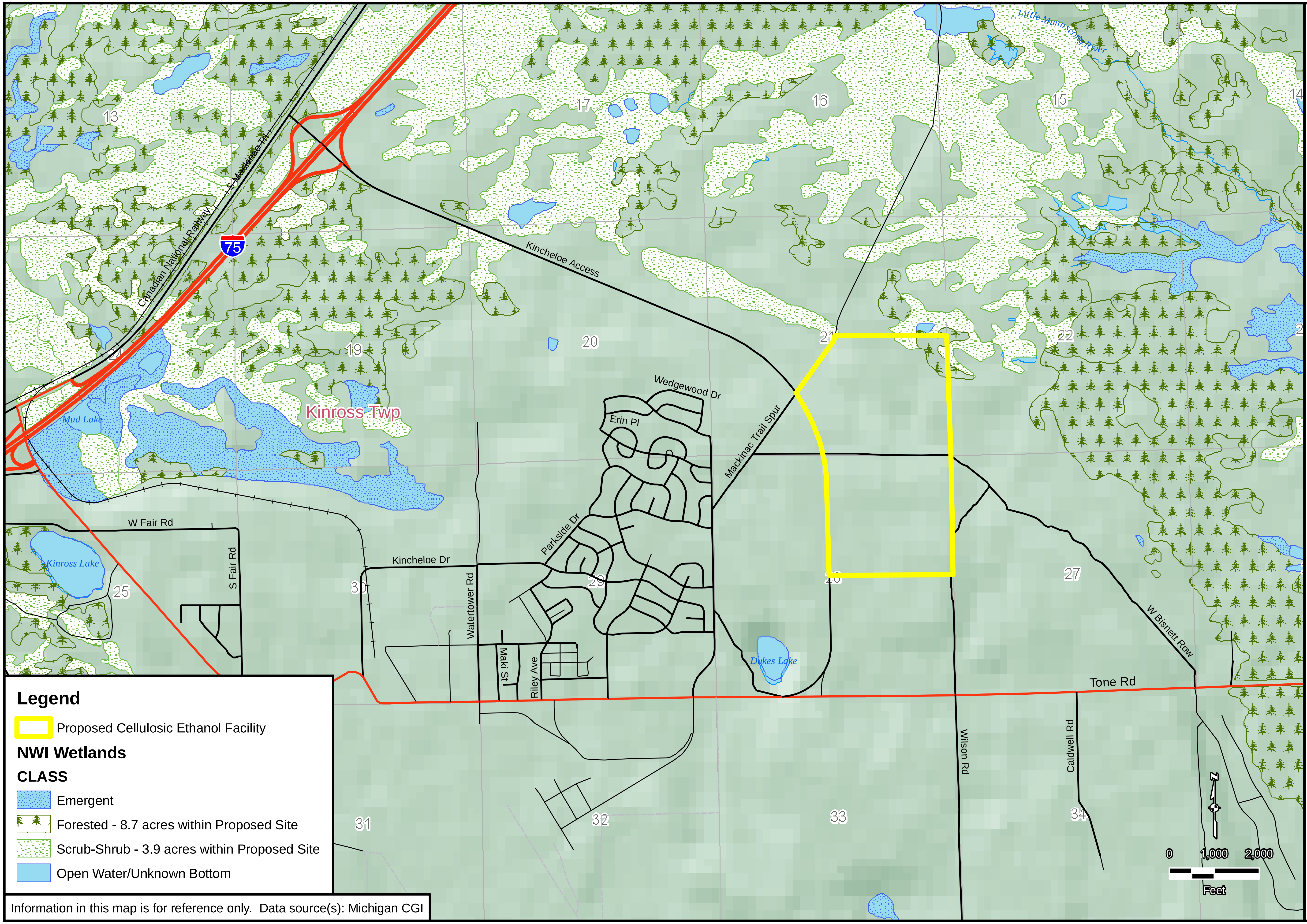
NRCS SOIL SURVEY MAP
WETLAND DELINEATION REPORT
FRONTIER RENEWABLE RESOURCES, LLC
CELLULOSIC ETHANOL FACILITY
CHIPPEWA COUNTY, MICHIGAN

Drawn: SJE 6/25/2009
Approved: LDK 6/25/2009
Scale: AS SHOWN
PROJECT NUMBER 13375-001-0100
FIGURE NUMBER 3



Legend

▭ Proposed Cellulosic Ethanol Facility

NWI Wetlands

CLASS

- ▨ Emergent
- ▨ Forested - 8.7 acres within Proposed Site
- ▨ Scrub-Shrub - 3.9 acres within Proposed Site
- ▨ Open Water/Unknown Bottom

Information in this map is for reference only. Data source(s): Michigan CGI

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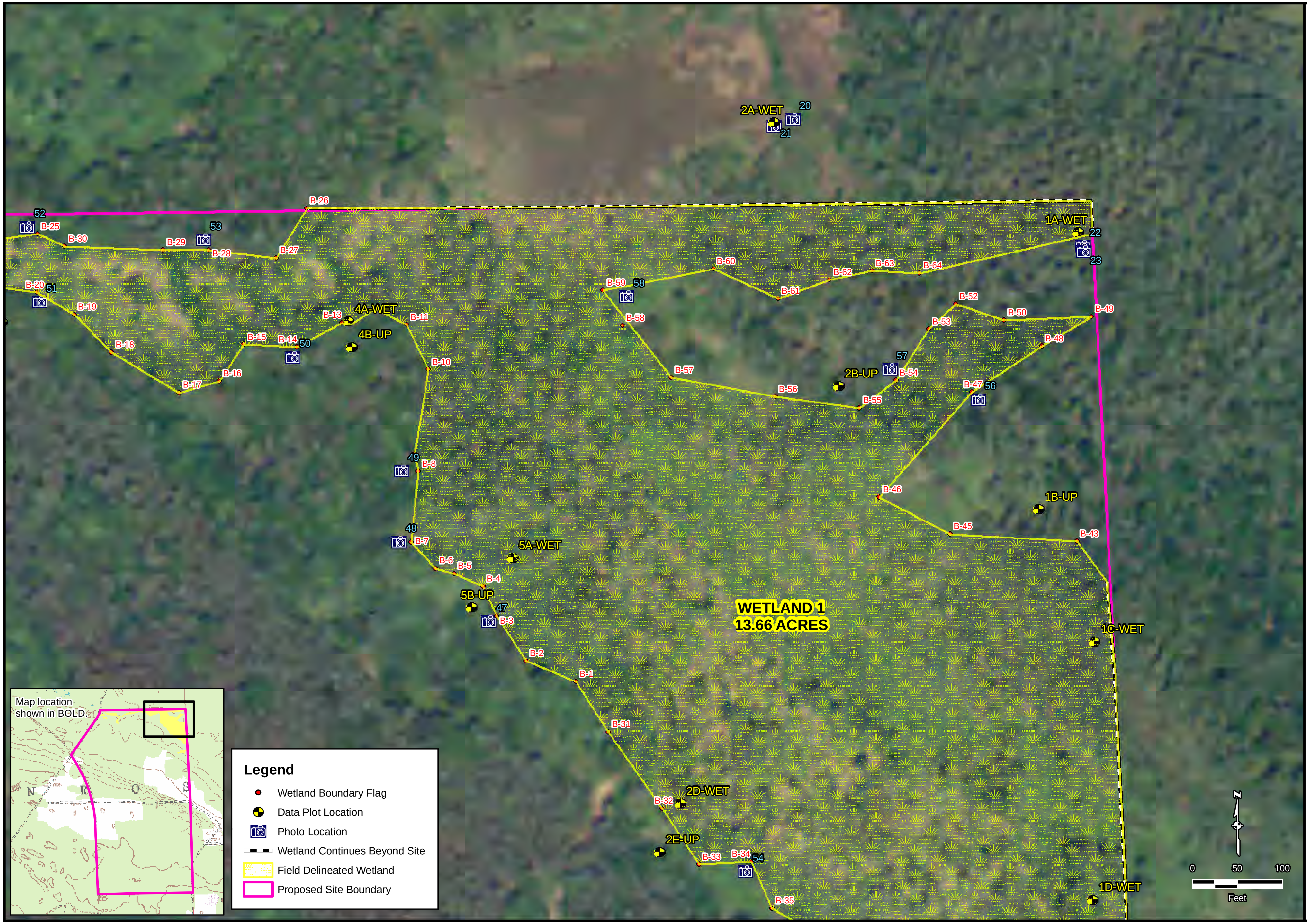
NATIONAL WETLANDS INVENTORY
WETLAND DELINEATION REPORT
FRONTIER RENEWABLE RESOURCES, LLC
CELLULOSIC ETHANOL FACILITY
CHIPPEWA COUNTY, MICHIGAN

Drawn:	JWW	2/17/2009
Approved:	LDK	2/17/2009
Scale:	AS SHOWN	
PROJECT NUMBER	13375-001-0100	
FIGURE NUMBER	4	



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FIELD DELINEATED WETLANDS AND PHOTO POINTS
WETLAND DELINEATION REPORT
FRONTIER RENEWABLE RESOURCES, LLC
CELLUOSIC ETHANOL FACILITY
CHIPPEWA COUNTY, MICHIGAN

Drawn:	SJE	6/25/2009
Approved:	LDK	6/25/2009
Scale:	AS SHOWN	
PROJECT NUMBER	13375-001-0100	
FIGURE NUMBER	5	

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FIELD DELINEATED WETLANDS AND PHOTO POINTS
WETLAND DELINEATION REPORT
FRONTIER RENEWABLE RESOURCES, LLC
CELLUOSIC ETHANOL FACILITY
CHIPPEWA COUNTY, MICHIGAN

Drawn: SJE 6/25/2009
Approved: LDK 6/25/2009
Scale: AS SHOWN
PROJECT NUMBER 13375-001-0100
FIGURE NUMBER 6

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FIELD DELINEATED WETLANDS AND PHOTO POINTS
WETLAND DELINEATION REPORT
FRONTIER RENEWABLE RESOURCES, LLC
CELLUOSIC ETHANOL FACILITY
CHIPPEWA COUNTY, MICHIGAN

Drawn:	SJE	6/25/2009
Approved:	LDK	6/25/2009
Scale:	AS SHOWN	
PROJECT NUMBER	13375-001-0100	
FIGURE NUMBER	7	

Legend

- ● Wetland Boundary Flag
- ◐ Data Plot Location
- 📷 Photo Location
- ▬ Wetland Continues Beyond Site
- 🟨 Field Delineated Wetland
- ☐ Proposed Site Boundary

AECOM

FIELD DELINEATED WETLANDS AND PHOTO POINTS
WETLAND DELINEATION REPORT
FRONTIER RENEWABLE RESOURCES, LLC
CELLUOSIC ETHANOL FACILITY
CHIPPEWA COUNTY, MICHIGAN

Drawn:	SJE	6/25/2009
Approved:	LDK	6/25/2009
Scale:	AS SHOWN	
PROJECT NUMBER	13375-001-0100	
FIGURE NUMBER	8	

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FIELD DELINEATED WETLANDS AND PHOTO POINTS
WETLAND DELINEATION REPORT
FRONTIER RENEWABLE RESOURCES, LLC
CELLUOSIC ETHANOL FACILITY
CHIPPEWA COUNTY, MICHIGAN

Drawn:	SJE	6/25/2009
Approved:	LDK	6/25/2009
Scale:	AS SHOWN	
PROJECT NUMBER	13375-001-0100	
FIGURE NUMBER	9	

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WETLAND DELINEATION REPORT
FRONTIER RENEWABLE RESOURCES, LLC
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Drawn:	SJE	6/25/2009
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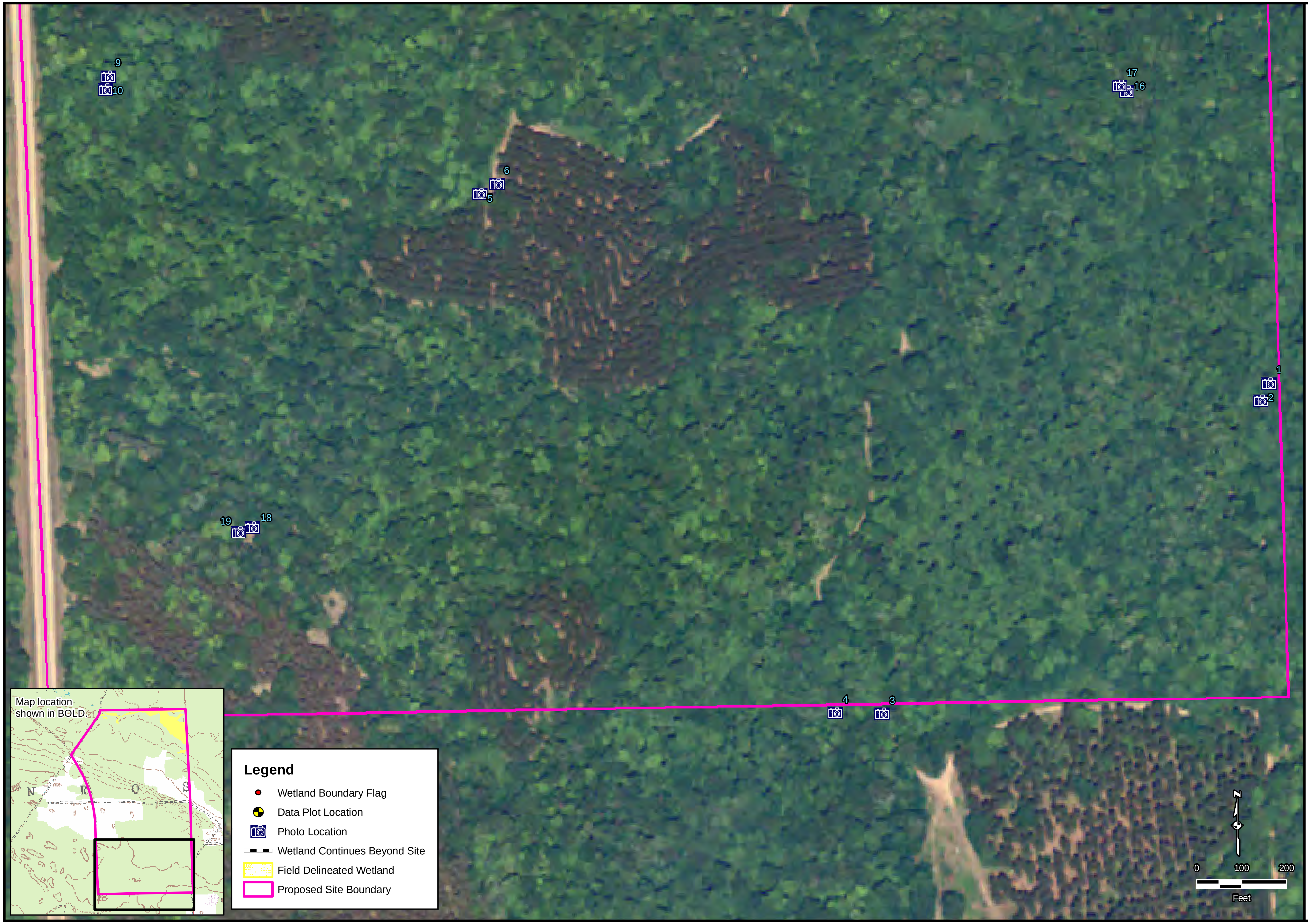
Scale:	AS SHOWN	
PROJECT NUMBER	13375-001-0100	
FIGURE NUMBER	10	



Legend

● Wetland Boundary Flag

● Data Plot Location

📷 Photo Location

Wetland Continues Beyond Site

🟨 Field Delineated Wetland

▭ Proposed Site Boundary

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WETLAND DELINEATION REPORT
FRONTIER RENEWABLE RESOURCES, LLC
CELLUOSIC ETHANOL FACILITY
CHIPPEWA COUNTY, MICHIGAN

Drawn:	SJE	6/25/2009
Approved:	LDK	6/25/2009
Scale:	AS SHOWN	
PROJECT NUMBER	13375-001-0100	
FIGURE NUMBER	11	

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site: Frontier Renewable Resources
Applicant/Owner: Mascoma/JM Longyear
Investigator: LDK, PK

Date: 4/28/2009
County: Chippewa
State: MI

Do Normal Circumstances exist on the site? [✓ Yes] No
Is the site significantly disturbed (Atypical Situation)? Yes [✓ No]
Is the area a potential Problem Area? Yes [✓ No]
(If needed, explain on reverse.)

Community ID: Wetland 1
Transect ID: 1
Plot ID: Plot 1A WET

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
1. *Picea marina*	TR 60%	FACW	9.		
2. *Abies balsamea*	TR 1%	FACW	10.		
3. *Acer rubrum*	TR 1%	FAC	11.		
4. *Pteridium aquilinum*	HB 2%	FACU	12.		
5.			13.		
6.			14.		
7.			15.		
8.			16.		

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-) 100 %

Remarks: Ground surface is varying ridges and depressions;bracken fern and red maple on high rolling tops

HYDROLOGY

__ Recorded Data (Describe in Remarks):
  __ Stream, Lake or Tide Gauge
  __ Aerial Photographs
  __ Other
__ No Recorded Data Available

Field Observations:

Depth of Surface Water 0 in.

Depth to Free Water in Pit: 12 in.

Depth to Saturated Soil: 9 in.

Wetland Hydrology Indicators:
Primary Indicators:
__ Inundated
x Saturated in Upper 12 inches
__ Water Marks
__ Drift Lines
__ Sediment Deposits
__ Drainage Patterns in Wetlands
Secondary Indicators (2 or more required):
__ Oxidized Root Channels in Upper 12 inches
__ Water -Stained Leaves
__ Local Soil Survey Data
__ FAC-Neutral Test
__ Other (Explain in Remarks)

Remarks:

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

SOILS

Map Unit Name
(Series and Phase): Kinross-Wainola complex, 0 to 3 percent slopes
Drainage Class: Very poorly drained
Field Observations
Confirm Mapped Type? Yes [✓ No]
Taxonomy (Subgroup): Typic Endoaquods

Profile Description:

Depth (Inches)	Horizon	Matrix Color Munsell Moist	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0-5	1	7.5YR 2.5/1			silty/organics
5-15	2	7.5YR 5/2			sand
15-16	3	7.5YR 2.5/3			sand to consolidated sand

Hydric Soils Indicators:

- __ Histosol
- __ Histic Epipedon
- __ Sulfidic Odor
- __ Aquic Moisture Regime
- __ Reducing Conditions
- x Gleyed or Low-Chroma Colors
- __ Concretions
- x High Organic Content in Surface Layer in Sandy Soils
- __ Organic Streaking in Sandy Soils
- x Listed on Local Hydric Soils List
- __ Listed on National Hydric Soils List
- __ Other (Explain in Remarks)

Remarks: Organics and silt in top 5."

WETLAND DETERMINATION

Hydrophytic Vegetation Present? [✓ Yes] No (Circle)
Wetland Hydrology Present? [✓ Yes] No
Hydric Soils Present? [✓ Yes] No Unknown

Is this Sampling Point within a Wetland? (Circle) [✓ Yes] No

Remarks:

Approved by HOUSACE 3/92
WSJ2-X

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site: Frontier Renewable Resources
Applicant/Owner: Mascoma/JM Longyear
Investigator: LDK, PK

Date: 4/28/2009
County: Chippewa
State: MI

Do Normal Circumstances exist on the site? [✓ Yes] No
Is the site significantly disturbed (Atypical Situation)? Yes [✓ No]
Is the area a potential Problem Area? Yes [✓ No]
(If needed, explain on reverse.)

Community ID: Wetland 1
Transect ID: 1
Plot ID: Plot 1 B UP

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
1. *Picea marina*	TR 20%	FACW	9.		
2. *Picea marina*	SH 5%	FACW	10.		
3. *Pteridium aquilinum*	TR 100%	FACU	11.		
4. *Betula papyrifera*	TR 2%	FACU+	12.		
5.			13.		
6.			14.		
7.			15.		
8.			16.		

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-) 50 %

Remarks: Area of consistently higher land, but still contains black spruce on wetland fringe.

HYDROLOGY

___ Recorded Data (Describe in Remarks):
  ___ Stream, Lake or Tide Gauge
  ___ Aerial Photographs
  ___ Other
___ No Recorded Data Available

Field Observations:

Depth of Surface Water 0 in.

Depth to Free Water in Pit: 0 in.

Depth to Saturated Soil: 16+ in.

Wetland Hydrology Indicators:
 Primary Indicators:
  ___ Inundated
  ___ Saturated in Upper 12 inches
  ___ Water Marks
  ___ Drift Lines
  ___ Sediment Deposits
  ___ Drainage Patterns in Wetlands
 Secondary Indicators (2 or more required):
  ___ Oxidized Root Channels in Upper 12 inches
  ___ Water -Stained Leaves
  ___ Local Soil Survey Data
  ___ FAC-Neutral Test
  ___ Other (Explain in Remarks)

Remarks:

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

SOILS

Map Unit Name
(Series and Phase): Kinross-Wainola complex, 0 to 3 percent slopes

Drainage Class: Very poorly drained

Taxonomy (Subgroup): Typic Endoaquods

Field Observations
Confirm Mapped Type? Yes [✓ No]

Profile Description:

Depth (Inches)	Horizon	Matrix Color Munsell Moist	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0-3	1	7.5YR 2.5/1			organics
3-15	2	7.5YR 7/2			sand
15-16	3	7.5YR 2.5/3			sand to consolidated sand

Hydric Soils Indicators:

- __ Histosol
- __ Histic Epipedon
- __ Sulfidic Odor
- __ Aquic Moisture Regime
- __ Reducing Conditions
- x Gleyed or Low-Chroma Colors
- __ Concretions
- __ High Organic Content in Surface Layer in Sandy Soils
- __ Organic Streaking in Sandy Soils
- x Listed on Local Hydric Soils List
- __ Listed on National Hydric Soils List
- __ Other (Explain in Remarks)

Remarks:

WETLAND DETERMINATION

Hydrophytic Vegetation Present? [✓ Yes] No (Circle)
Wetland Hydrology Present? Yes [✓ No]
Hydric Soils Present? [✓ Yes] No Unknown

Is this Sampling Point within a Wetland? (Circle) Yes [✓ No]

Remarks: Vegetation and soils are borderline wetland. However, predominance of bracken fern seems to indicate a lack of repeated saturation within 1' of the surface.

Approved by HOUSACE 3/92
WSJ2-X

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site: Frontier Renewable Resources
Applicant/Owner: Mascoma/JM Longyear
Investigator: LDK, PK

Date: 4/28/2009
County: Chippewa
State: MI

Do Normal Circumstances exist on the site? [✓ Yes] No
Is the site significantly disturbed (Atypical Situation)? Yes [✓ No]
Is the area a potential Problem Area? Yes [✓ No]
(If needed, explain on reverse.)

Community ID: Wetland 1
Transect ID: 1
Plot ID: Plot 1C WET

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
1. *Chamaedaphne calyculata*	SH 80%	OBL	9.		
2. *Larix laricina*	TR 5%	FACW	10.		
3. *Picea marina*	TR 2%	FACW	11.		
4. *Betula papyrifera*	TR 2%	FACU+	12.		
5. *Acer rubrum*	TR 0.5%	FAC	13.		
6. *Sphagnum sp.*	HB 100%	OBL	14.		
7. *Calamagrostis canadensis*	HB 5%	OBL	15.		
8.			16.		

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-) 100 %

Remarks: Surface saturated bog/marsh area near eastern investigation boundary. Dominated by Tamarac, balsam fir and black spruce.

HYDROLOGY

___ Recorded Data (Describe in Remarks):
  ___ Stream, Lake or Tide Gauge
  ___ Aerial Photographs
  ___ Other
___ No Recorded Data Available

Field Observations:

Depth of Surface Water 1 in.

Depth to Free Water in Pit: surface in.

Depth to Saturated Soil: surface in.

Wetland Hydrology Indicators:
Primary Indicators:
___ Inundated
x Saturated in Upper 12 inches
___ Water Marks
___ Drift Lines
___ Sediment Deposits
___ Drainage Patterns in Wetlands
Secondary Indicators (2 or more required):
___ Oxidized Root Channels in Upper 12 inches
___ Water -Stained Leaves
___ Local Soil Survey Data
___ FAC-Neutral Test
___ Other (Explain in Remarks)

Remarks:

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

SOILS

Map Unit Name
(Series and Phase): Dawson and Loxley peats

Drainage Class: Very poorly drained

Field Observations
Confirm Mapped Type? [✓ Yes] No

Taxonomy (Subgroup): Terric/Typic Borosaprists

Profile Description:

Depth (Inches)	Horizon	Matrix Color Munsell Moist	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0-3	1	7.5YR 2.5/1			moss
3-16	2	7.5YR 2.5/1			peat/muck

Hydric Soils Indicators:

- ☒ Histosol
- ☐ Histic Epipedon
- ☐ Sulfidic Odor
- ☐ Aquic Moisture Regime
- ☐ Reducing Conditions
- ☒ Gleyed or Low-Chroma Colors
- ☐ Concretions
- ☐ High Organic Content in Surface Layer in Sandy Soils
- ☐ Organic Streaking in Sandy Soils
- ☒ Listed on Local Hydric Soils List
- ☐ Listed on National Hydric Soils List
- ☒ Other (Explain in Remarks)

Remarks: Deep peat/muck/moss layers in soil pit.

WETLAND DETERMINATION

Hydrophytic Vegetation Present? [✓ Yes] No (Circle)
Wetland Hydrology Present? [✓ Yes] No
Hydric Soils Present? [✓ Yes] No Unknown

(Circle)
Is this Sampling Point within a Wetland? [✓ Yes] No

Remarks:

Approved by HOUSACE 3/92
WSJ2-X

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site: Frontier Renewable Resources
Applicant/Owner: Mascoma/JM Longyear
Investigator: LDK, PK

Date: 4/29/2009
County: Chippewa
State: MI

Do Normal Circumstances exist on the site? [✓ Yes] No
Is the site significantly disturbed (Atypical Situation)? Yes [✓ No]
Is the area a potential Problem Area? Yes [✓ No]
(If needed, explain on reverse.)

Community ID: Wetland 1
Transect ID: 1
Plot ID: Plot 1D WET

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
1. *Populus tremuloides*	TR 20%	FAC	9.		
2. *Abies balsamea*	TR 10%	FACW	10.		
3. *Abies balsamea*	SH 40%	FACW	11.		
4. *Acer rubrum*	TR 20%	FAC	12.		
5. *Pinus strobus*	TR 20%	FACU	13.		
6. *Pteridium aquilinum*	HB 90%	FACU	14.		
7. *Thuja occidentalis*	TR 5%	FACW	15.		
8.			16.		

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-) 60 %

Remarks: Rolling terrain within definite wetland area.

HYDROLOGY

___ Recorded Data (Describe in Remarks):
  ___ Stream, Lake or Tide Gauge
  ___ Aerial Photographs
  ___ Other
___ No Recorded Data Available

Field Observations:

Depth of Surface Water 0 in.

Depth to Free Water in Pit: 15 in.

Depth to Saturated Soil: 6 in.

Wetland Hydrology Indicators:
Primary Indicators:
- ___ Inundated
- x Saturated in Upper 12 inches
- ___ Water Marks
- ___ Drift Lines
- ___ Sediment Deposits
- ___ Drainage Patterns in Wetlands

Secondary Indicators (2 or more required):
- ___ Oxidized Root Channels in Upper 12 inches
- ___ Water -Stained Leaves
- ___ Local Soil Survey Data
- ___ FAC-Neutral Test
- ___ Other (Explain in Remarks)

Remarks:

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

SOILS

Map Unit Name
(Series and Phase): Dawson and Loxley peats

Drainage Class: Very poorly drained

Field Observations
Confirm Mapped Type? Yes [✓ No]

Taxonomy (Subgroup): Terric/Typic Borosaprists

Profile Description:

Depth (Inches)	Horizon	Matrix Color Munsell Moist	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0-3	1	7.5YR 2.5/1			organics
3-5	2	7.5YR 5/1			sand
5-9	3	7.5YR 5/2			sand
9-16	4	7.5YR 5/2	7.5YR 4/4	common/distinct	sand

Hydric Soils Indicators:

__ Histosol
__ Histic Epipedon
__ Sulfidic Odor
__ Aquic Moisture Regime
__ Reducing Conditions
x Gleyed or Low-Chroma Colors

x Concretions
__ High Organic Content in Surface Layer in Sandy Soils
__ Organic Streaking in Sandy Soils
x Listed on Local Hydric Soils List
__ Listed on National Hydric Soils List
__ Other (Explain in Remarks)

Remarks: Concretions within upper 9"

WETLAND DETERMINATION

Hydrophytic Vegetation Present? [✓ Yes] No (Circle)
Wetland Hydrology Present? [✓ Yes] No
Hydric Soils Present? [✓ Yes] No Unknown

Is this Sampling Point within a Wetland? (Circle) [✓ Yes] No

Remarks: Rolling area withing large wetland. Soils, vegetation, and hydrology all indicate wetland.

Approved by HOUSACE 3/92
WSJ2-X

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site: Frontier Renewable Resources

Applicant/Owner: Mascoma/JM Longyear

Investigator: LDK, PK

Date: 4/29/2009

County: Chippewa

State: MI

Do Normal Circumstances exist on the site? [✓ Yes] No

Is the site significantly disturbed (Atypical Situation)? Yes [✓ No]

Is the area a potential Problem Area? Yes [✓ No]
(If needed, explain on reverse.)

Community ID: Wetland 1

Transect ID: 1

Plot ID: Plot 1E UP

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
1. *Pteridium aquilinum*	HB 80%	FACU	9.		
2. *Abies balsamea*	TR 10%	FACW	10.		
3. *Picea marina*	TR 80%	FACW	11.		
4. *Lycopodium obscurum*	HB 5%	FACU	12.		
5.			13.		
6.			14.		
7.			15.		
8.			16.		

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-) 50 %

Remarks: Slight hillside adjacent to wetland. Ground surface elevated 3-4' higher than wetland.

HYDROLOGY

__ Recorded Data (Describe in Remarks):
  __ Stream, Lake or Tide Gauge
  __ Aerial Photographs
  __ Other
__ No Recorded Data Available

Field Observations:

Depth of Surface Water 0 in.

Depth to Free Water in Pit: 16 in.

Depth to Saturated Soil: 0 in.

Wetland Hydrology Indicators:
Primary Indicators:
____ Inundated
____ Saturated in Upper 12 inches
____ Water Marks
____ Drift Lines
____ Sediment Deposits
____ Drainage Patterns in Wetlands
Secondary Indicators (2 or more required):
____ Oxidized Root Channels in Upper 12 inches
____ Water -Stained Leaves
____ Local Soil Survey Data
____ FAC-Neutral Test
____ Other (Explain in Remarks)

Remarks:

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

SOILS

Map Unit Name
(Series and Phase): Croswell-Au Gres sands, 0 to 3 percent slopes

Drainage Class: Moderately well drained

Taxonomy (Subgroup): Typic Endoaquods/
Oxyaquic Haplorthods

Field Observations
Confirm Mapped Type? Yes [✓ No]

Profile Description:

Depth (Inches)	Horizon	Matrix Color Munsell Moist	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0-2	1	7.5YR 2.5/1			organics
2-6	2	7.5YR 5/3			sand
6-15	3	7.5YR 3/3			sand
15-16	4	7.5YR 3/3			consolidated sand

Hydric Soils Indicators:

__ Histosol
__ Histic Epipedon
__ Sulfidic Odor
__ Aquic Moisture Regime
__ Reducing Conditions
__ Gleyed or Low-Chroma Colors
__ Concretions
__ High Organic Content in Surface Layer in Sandy Soils
__ Organic Streaking in Sandy Soils
__ Listed on Local Hydric Soils List
__ Listed on National Hydric Soils List
__ Other (Explain in Remarks)

Remarks: Upland area located within large wetland area.

WETLAND DETERMINATION

Hydrophytic Vegetation Present? [✓ Yes] No (Circle)
Wetland Hydrology Present? Yes [✓ No]
Hydric Soils Present? Yes [✓ No] Unknown

(Circle)
Is this Sampling Point within a Wetland? Yes [✓ No]

Remarks:

Approved by HOUSACE 3/92
WSJ2-X

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site: Frontier Renewable Resources
Applicant/Owner: Mascoma/JM Longyear
Investigator: LDK, PK

Date: 4/28/2009
County: Chippewa
State: MI

Do Normal Circumstances exist on the site? [✓ Yes] No
Is the site significantly disturbed (Atypical Situation)? Yes [✓ No]
Is the area a potential Problem Area? Yes [✓ No]
(If needed, explain on reverse.)

Community ID: Wetland 1
Transect ID: 2
Plot ID: Plot 2A WET

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
1. *Aster spp.*	HB 40%	FACW*	9.		
2. *Sphagnum sp.*	HB 90%	OBL	10.		
3. *Rubus idaeus*	SH 10%	FACW-	11.		
4.			12.		
5.			13.		
6.			14.		
7.			15.		
8.			16.		

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-) 100 %

Remarks: Edge of relatively large bog/open water wetland. *Aster species difficult to identify as it was early in the season. Assun
aster novae-angliae (FACW).

HYDROLOGY

___ Recorded Data (Describe in Remarks):
  ___ Stream, Lake or Tide Gauge
  ___ Aerial Photographs
  ___ Other
___ No Recorded Data Available

Field Observations:

Depth of Surface Water: none in.

Depth to Free Water in Pit: 10 in.

Depth to Saturated Soil: surface in.

Wetland Hydrology Indicators:
Primary Indicators:
  ___ Inundated
  x Saturated in Upper 12 inches
  ___ Water Marks
  ___ Drift Lines
  ___ Sediment Deposits
  ___ Drainage Patterns in Wetlands
Secondary Indicators (2 or more required):
  ___ Oxidized Root Channels in Upper 12 inches
  ___ Water -Stained Leaves
  ___ Local Soil Survey Data
  ___ FAC-Neutral Test
  ___ Other (Explain in Remarks)

Remarks:

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

SOILS

Map Unit Name
(Series and Phase): Kinross-Wainola complex, 0 to 3 percent slopes

Drainage Class: Very poorly drained

Taxonomy (Subgroup): Typic Endoaquods

Field Observations
Confirm Mapped Type? Yes [✓ No]

Profile Description:

Depth (Inches)	Horizon	Matrix Color Munsell Moist	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0-8	1	7.5 YR 3/1			loamy sand w/ organics
8-10	2	7.5 YR 4/1			sand
10-16+	3	7.5 YR 5/1			sand

Hydric Soils Indicators:

- __ Histosol
- __ Histic Epipedon
- __ Sulfidic Odor
- __ Aquic Moisture Regime
- __ Reducing Conditions
- x Gleyed or Low-Chroma Colors
- __ Concretions
- __ High Organic Content in Surface Layer in Sandy Soils
- __ Organic Streaking in Sandy Soils
- x Listed on Local Hydric Soils List
- __ Listed on National Hydric Soils List
- __ Other (Explain in Remarks)

Remarks:

WETLAND DETERMINATION

Hydrophytic Vegetation Present? [✓ Yes] No (Circle)
Wetland Hydrology Present? [✓ Yes] No
Hydric Soils Present? [✓ Yes] No Unknown

(Circle)
Is this Sampling Point within a Wetland? [✓ Yes] No

Remarks:

Approved by HOUSACE 3/92
WSJ2-X

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site: Frontier Renewable Resources
Applicant/Owner: Mascoma/JM Longyear
Investigator: LDK, PK

Date: 4/29/2009
County: Chippewa
State: MI

Do Normal Circumstances exist on the site? [✓ Yes] No
Is the site significantly disturbed (Atypical Situation)? Yes [✓ No]
Is the area a potential Problem Area? Yes [✓ No]
(If needed, explain on reverse.)

Community ID: Wetland 1
Transect ID: 2
Plot ID: Plot 2B UP

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
1. *Pteridium aquilinum*	HB 70%	FACU	9.		
2. *Picea marina*	TR 70%	FACW	10.		
3. *Cornus stolonifera*	SH 5%	FACW	11.		
4. *Acer rubrum*	TR 5%	FAC	12.		
5.			13.		
6.			14.		
7.			15.		
8.			16.		

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-) 50 %

Remarks: Large, rolling upland area between wetlands.

HYDROLOGY

___ Recorded Data (Describe in Remarks):
  ___ Stream, Lake or Tide Gauge
  ___ Aerial Photographs
  ___ Other
___ No Recorded Data Available

Field Observations:

Depth of Surface Water none in.

Depth to Free Water in Pit: 0 in.

Depth to Saturated Soil: 0 in.

Wetland Hydrology Indicators:
Primary Indicators:
___ Inundated
___ Saturated in Upper 12 inches
___ Water Marks
___ Drift Lines
___ Sediment Deposits
___ Drainage Patterns in Wetlands
Secondary Indicators (2 or more required):
___ Oxidized Root Channels in Upper 12 inches
___ Water -Stained Leaves
___ Local Soil Survey Data
___ FAC-Neutral Test
___ Other (Explain in Remarks)

Remarks:

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

SOILS

Map Unit Name
(Series and Phase): Kinross-Wainola complex, 0 to 3 percent slopes

Drainage Class: Very poorly drained

Taxonomy (Subgroup): Typic Endoaquods

Field Observations
Confirm Mapped Type? Yes [✓ No]

Profile Description:

Depth (Inches)	Horizon	Matrix Color Munsell Moist	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0-2	1	7.5 YR 2.5/1			organics & sandy loam
2-4	2	7.5 YR 4/1			sand
4-12	3	7.5 YR 5/2			consolidated sand
12-16+	4	5 YR 3/4			consolidated sand

Hydric Soils Indicators:

- __ Histosol
- __ Histic Epipedon
- __ Sulfidic Odor
- __ Aquic Moisture Regime
- __ Reducing Conditions
- x Gleyed or Low-Chroma Colors
- __ Concretions
- __ High Organic Content in Surface Layer in Sandy Soils
- __ Organic Streaking in Sandy Soils
- __ Listed on Local Hydric Soils List
- __ Listed on National Hydric Soils List
- __ Other (Explain in Remarks)

Remarks: Dry, sandy soils in upland area. Sand referred to as consolidated is very dry, dense and compacted.

WETLAND DETERMINATION

Hydrophytic Vegetation Present? [✓ Yes] No (Circle)
Wetland Hydrology Present? Yes [✓ No]
Hydric Soils Present? Yes [✓ No] Unknown

(Circle)
Is this Sampling Point within a Wetland? Yes [✓ No]

Remarks:

Approved by HOUSACE 3/92
WSJ2-X

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site: Frontier Renewable Resources
Applicant/Owner: Mascoma/JM Longyear
Investigator: LDK, PK

Date: 4/29/2009
County: Chippewa
State: MI

Do Normal Circumstances exist on the site? [✓ Yes] No
Is the site significantly disturbed (Atypical Situation)? Yes [✓ No]
Is the area a potential Problem Area? Yes [✓ No]
(If needed, explain on reverse.)

Community ID: Wetland 1
Transect ID: 2
Plot ID: Plot 2D WET

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
1. *Thuja occidentalis*	TR 25%	FACW	9.		
2. *Picea marina*	TR 10%	FACW	10.		
3. *Sphagnum sp.*	HB 100%	OBL	11.		
4. *Abies balsamea*	TR 15%	FACW	12.		
5. *Gaultheria hispidula*	HB 2%	FACW	13.		
6.			14.		
7.			15.		
8.			16.		

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-) 100 %

Remarks: Peaty area with mature cedars.

HYDROLOGY

___ Recorded Data (Describe in Remarks):
  __ Stream, Lake or Tide Gauge
  __ Aerial Photographs
  __ Other
___ No Recorded Data Available

Field Observations:

Depth of Surface Water: none in.

Depth to Free Water in Pit: 12 in.

Depth to Saturated Soil: surface in.

Wetland Hydrology Indicators:
Primary Indicators:
- ____ Inundated
- x Saturated in Upper 12 inches
- ____ Water Marks
- ____ Drift Lines
- ____ Sediment Deposits
- ____ Drainage Patterns in Wetlands

Secondary Indicators (2 or more required):
- ____ Oxidized Root Channels in Upper 12 inches
- ____ Water -Stained Leaves
- ____ Local Soil Survey Data
- ____ FAC-Neutral Test
- ____ Other (Explain in Remarks)

Remarks:

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

SOILS

Map Unit Name
(Series and Phase): Croswell-Au Gres sands, 0 to 3 percent slopes

Drainage Class: Moderately well drained

Field Observations
Confirm Mapped Type? Yes [✓ No]

Taxonomy (Subgroup): Typic Endoaquods/
Oxyaquic Haplorthods

Profile Description:

Depth (Inches)	Horizon	Matrix Color Munsell Moist	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0-5	1	7.5 YR 2.5/1			peat
5-6	2	7.5 YR 2.5/1			muck
6-16+	3	7.5 YR 4/3			loamy sand

Hydric Soils Indicators:

__ Histosol
__ Histic Epipedon
__ Sulfidic Odor
__ Aquic Moisture Regime
__ Reducing Conditions
x Gleyed or Low-Chroma Colors

__ Concretions
__ High Organic Content in Surface Layer in Sandy Soils
__ Organic Streaking in Sandy Soils
__ Listed on Local Hydric Soils List
__ Listed on National Hydric Soils List
__ Other (Explain in Remarks)

Remarks: Large upland area sloping into large wetland. Peat transitions to muck - layer 2 inches short of black histic.

WETLAND DETERMINATION

Hydrophytic Vegetation Present? [✓ Yes] No (Circle)
Wetland Hydrology Present? [✓ Yes] No
Hydric Soils Present? [✓ Yes] No Unknown

Is this Sampling Point within a Wetland? (Circle) [✓ Yes] No

Remarks:

Approved by HOUSACE 3/92
WSJ2-X

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site: Frontier Renewable Resources
Applicant/Owner: Mascoma/JM Longyear
Investigator: LDK, PK

Date: 4/29/2009
County: Chippewa
State: MI

Do Normal Circumstances exist on the site? [✓ Yes] No
Is the site significantly disturbed (Atypical Situation)? Yes [✓ No]
Is the area a potential Problem Area? Yes [✓ No]
(If needed, explain on reverse.)

Community ID: Wetland 1
Transect ID: 2
Plot ID: Plot 2E UP

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
1. *Pteridium aquilinum*	HB 80%	FACU	9.		
2. *Picea marina*	TR 70%	FACW	10.		
3. *Quercus rubra*	TR 5%	FACU	11.		
4. *Acer rubrum*	TR 5%	FAC	12.		
5. *Gaultheria procumbens*	HB 5%	FACU	13.		
6.			14.		
7.			15.		
8.			16.		

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-) 50 %

Remarks: Upland slope adjacent (south) to wetland.

HYDROLOGY

___ Recorded Data (Describe in Remarks):
  ___ Stream, Lake or Tide Gauge
  ___ Aerial Photographs
  ___ Other
___ No Recorded Data Available

Field Observations:

Depth of Surface Water 0 in.

Depth to Free Water in Pit: 0 in.

Depth to Saturated Soil: 0 in.

Wetland Hydrology Indicators:
Primary Indicators:
  ____ Inundated
  ____ Saturated in Upper 12 inches
  ____ Water Marks
  ____ Drift Lines
  ____ Sediment Deposits
  ____ Drainage Patterns in Wetlands
Secondary Indicators (2 or more required):
  ____ Oxidized Root Channels in Upper 12 inches
  ____ Water -Stained Leaves
  ____ Local Soil Survey Data
  ____ FAC-Neutral Test
  ____ Other (Explain in Remarks)

Remarks:

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

SOILS

Map Unit Name
(Series and Phase): Croswell-Au Gres sands, 0 to 3 percent slopes

Drainage Class: Moderately well drained

Field Observations
Confirm Mapped Type? Yes [✓ No]

Taxonomy (Subgroup): Typic Endoaquods/
Oxyaquic Haplorthods

Profile Description:

Depth (Inches)	Horizon	Matrix Color Munsell Moist	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0-2	1	7.5YR 2.5/2			organics
2-3	2	7.5YR 2.5/1			loamy sand
3-9	3	7.5YR 5/3			sand
9-16	4	7.5YR 5/6			sand

Hydric Soils Indicators:

__ Histosol
__ Histic Epipedon
__ Sulfidic Odor
__ Aquic Moisture Regime
__ Reducing Conditions
__ Gleyed or Low-Chroma Colors

__ Concretions
__ High Organic Content in Surface Layer in Sandy Soils
__ Organic Streaking in Sandy Soils
__ Listed on Local Hydric Soils List
__ Listed on National Hydric Soils List
__ Other (Explain in Remarks)

Remarks: Large upland area sloping into large wetland.

WETLAND DETERMINATION

Hydrophytic Vegetation Present? [✓ Yes] No (Circle)
Wetland Hydrology Present? Yes [✓ No]
Hydric Soils Present? Yes [✓ No] Unknown

(Circle)
Is this Sampling Point within a Wetland? Yes [✓ No]

Remarks:

Approved by HOUSACE 3/92
WSJ2-X

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site: Frontier Renewable Resources
Applicant/Owner: Mascoma/JM Longyear
Investigator: LDK, PK

Date: 4/29/2009
County: Chippewa
State: MI

Do Normal Circumstances exist on the site? [✓ Yes] No
Is the site significantly disturbed (Atypical Situation)? Yes [✓ No]
Is the area a potential Problem Area? Yes [✓ No]
(If needed, explain on reverse.)

Community ID: Wetland 1
Transect ID: 3
Plot ID: Plot 3A WET

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
1. *Acer rubrum*	TR 20%	FAC	9.		
2. *Picea marina*	TR 20%	FACW	10.		
3. *Sphagnum sp.*	HB 100%	OBL	11.		
4. *Abies balsamea*	TR 20%	FACW	12.		
5. *Cornus racemosa*	SH 40%	FACW-	13.		
6. *Carex stricta*	HB 70%	OBL	14.		
7.			15.		
8.			16.		

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-) 100 %

Remarks: Marshy area near northern boundary. Upland areas exist to the north and south. Early in season- hard to determine e
carex species.

HYDROLOGY

___ Recorded Data (Describe in Remarks):
  __ Stream, Lake or Tide Gauge
  __ Aerial Photographs
  __ Other
___ No Recorded Data Available

Field Observations:

Depth of Surface Water: none in.
Depth to Free Water in Pit: surface in.
Depth to Saturated Soil: surface in.

Wetland Hydrology Indicators:
Primary Indicators:
- ____ Inundated
- x Saturated in Upper 12 inches
- ____ Water Marks
- ____ Drift Lines
- ____ Sediment Deposits
- ____ Drainage Patterns in Wetlands

Secondary Indicators (2 or more required):
- ____ Oxidized Root Channels in Upper 12 inches
- ____ Water -Stained Leaves
- ____ Local Soil Survey Data
- ____ FAC-Neutral Test
- ____ Other (Explain in Remarks)

Remarks:

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

SOILS

Map Unit Name
(Series and Phase): Croswell-Au Gres sands, 0 to 3 percent slopes

Drainage Class: Moderately well drained

Taxonomy (Subgroup): Typic Endoaquods/
Oxyaquic Haplorthods

Field Observations
Confirm Mapped Type? Yes [✓ No]

Profile Description:

Depth (Inches)	Horizon	Matrix Color Munsell Moist	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0-10	1	7.5 YR 2.5/1			organics/peat
10-16+	2	--			rock/cobbles

Hydric Soils Indicators:

- ☐ Histosol
- ☒ Histic Epipedon
- ☐ Sulfidic Odor
- ☐ Aquic Moisture Regime
- ☐ Reducing Conditions
- ☒ Gleyed or Low-Chroma Colors
- ☐ Concretions
- ☐ High Organic Content in Surface Layer in Sandy Soils
- ☐ Organic Streaking in Sandy Soils
- ☐ Listed on Local Hydric Soils List
- ☐ Listed on National Hydric Soils List
- ☐ Other (Explain in Remarks)

Remarks:

WETLAND DETERMINATION

Hydrophytic Vegetation Present? [✓ Yes] No (Circle)
Wetland Hydrology Present? [✓ Yes] No
Hydric Soils Present? [✓ Yes] No Unknown

Is this Sampling Point within a Wetland? (Circle) [✓ Yes] No

Remarks:

Approved by HOUSACE 3/92
WSJ2-X

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site: Frontier Renewable Resources
Applicant/Owner: Mascoma/JM Longyear
Investigator: LDK, PK

Date: 4/29/2009
County: Chippewa
State: MI

Do Normal Circumstances exist on the site? [✓ Yes] No
Is the site significantly disturbed (Atypical Situation)? Yes [✓ No]
Is the area a potential Problem Area? Yes [✓ No]
(If needed, explain on reverse.)

Community ID: Wetland 1
Transect ID: 3
Plot ID: Plot 3B UP

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
1. *Acer rubrum*	TR 20%	FAC	9.		
2. *Pteridium aquilinum*	HB 90%	FACU	10.		
3. *Piscea mariana*	TR 20%	FACW	11.		
4. *Abies balsamea*	TR 60%	FACW	12.		
5. *Abies balsamea*	SH 20%	FACW	13.		
6. *Dendrolycopodium*			14.		
7. *obscurum*	HB 30%	FACU	15.		
8.			16.		

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-) 66 %

Remarks: Very large, rolling upland area located south of plot 3A WET.

HYDROLOGY

___ Recorded Data (Describe in Remarks):
  __ Stream, Lake or Tide Gauge
  __ Aerial Photographs
  __ Other
___ No Recorded Data Available

Field Observations:

Depth of Surface Water 0 in.

Depth to Free Water in Pit: none in.

Depth to Saturated Soil: none in.

Wetland Hydrology Indicators:
Primary Indicators:
____ Inundated
____ Saturated in Upper 12 inches
____ Water Marks
____ Drift Lines
____ Sediment Deposits
____ Drainage Patterns in Wetlands
Secondary Indicators (2 or more required):
____ Oxidized Root Channels in Upper 12 inches
____ Water -Stained Leaves
____ Local Soil Survey Data
____ FAC-Neutral Test
____ Other (Explain in Remarks)

Remarks:

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

SOILS

Map Unit Name
(Series and Phase): Croswell-Au Gres sands, 0 to 3 percent slopes

Drainage Class: Moderately well drained

Field Observations
Confirm Mapped Type? Yes [✓ No]

Taxonomy (Subgroup): Typic Endoaquods/
Oxyaquic Haplorthods

Profile Description:

Depth (Inches)	Horizon	Matrix Color Munsell Moist	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0-2	1	7.5 YR 2.5/1			organics
2-15	2	7.5 YR 5/3			sand
15-16+	3	7.5 YR 5/8			sand/consolidated sand

Hydric Soils Indicators:

__ Histosol
__ Histic Epipedon
__ Sulfidic Odor
__ Aquic Moisture Regime
__ Reducing Conditions
__ Gleyed or Low-Chroma Colors
__ Concretions
__ High Organic Content in Surface Layer in Sandy Soils
__ Organic Streaking in Sandy Soils
__ Listed on Local Hydric Soils List
__ Listed on National Hydric Soils List
__ Other (Explain in Remarks)

Remarks:

WETLAND DETERMINATION

Hydrophytic Vegetation Present? [✓ Yes] No (Circle)
Wetland Hydrology Present? Yes [✓ No]
Hydric Soils Present? Yes [✓ No] Unknown

(Circle)
Is this Sampling Point within a Wetland? Yes [✓ No]

Remarks:

Approved by HOUSACE 3/92
WSJ2-X

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site: Frontier Renewable Resources
Applicant/Owner: Mascoma/JM Longyear
Investigator: LDK, PK

Date: 4/29/2009
County: Chippewa
State: MI

Do Normal Circumstances exist on the site? [✓ Yes] No
Is the site significantly disturbed (Atypical Situation)? Yes [✓ No]
Is the area a potential Problem Area? Yes [✓ No]
(If needed, explain on reverse.)

Community ID: Wetland 1
Transect ID: 4
Plot ID: Plot 4A WET

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
1. *Larix laricina*	TR 15%	FACW	9.		
2. *Pteridium aquilinum*	HB 10%	FACU	10.		
3. *Piscea mariana*	TR 30%	FACW	11.		
4. *Abies balsamea*	TR 50%	FACW	12.		
5. *Dendrolycopodium obscrum*	HB 5%	FACU	13.		
6.			14.		
7.			15.		
8.			16.		

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-) 100 %

Remarks: Swamp/open water wetland edge.

HYDROLOGY

___ Recorded Data (Describe in Remarks):
  __ Stream, Lake or Tide Gauge
  __ Aerial Photographs
  __ Other
___ No Recorded Data Available

Field Observations:

Depth of Surface Water none in.

Depth to Free Water in Pit: 12 in.

Depth to Saturated Soil: 5-Apr in.

Wetland Hydrology Indicators:
Primary Indicators:
____ Inundated
x Saturated in Upper 12 inches
____ Water Marks
____ Drift Lines
____ Sediment Deposits
____ Drainage Patterns in Wetlands
Secondary Indicators (2 or more required):
____ Oxidized Root Channels in Upper 12 inches
____ Water -Stained Leaves
____ Local Soil Survey Data
____ FAC-Neutral Test
____ Other (Explain in Remarks)

Remarks:

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

SOILS

Map Unit Name
(Series and Phase): Croswell-Au Gres sands, 0 to 3 percent slopes

Drainage Class: Moderately well drained

Taxonomy (Subgroup): Typic Endoaquods/ Oxyaquic Haplorthods

Field Observations
Confirm Mapped Type? Yes [✓ No]

Profile Description:

Depth (Inches)	Horizon	Matrix Color Munsell Moist	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0-2	1	7.5 YR 2.5/1			organics
2-14	2	7.5 YR 5/2			sand
14-16+	3	7.5 YR 3/3			sand

Hydric Soils Indicators:

- ☐ Histosol
- ☐ Histic Epipedon
- ☐ Sulfidic Odor
- ☐ Aquic Moisture Regime
- ☐ Reducing Conditions
- ☒ Gleyed or Low-Chroma Colors
- ☐ Concretions
- ☐ High Organic Content in Surface Layer in Sandy Soils
- ☐ Organic Streaking in Sandy Soils
- ☐ Listed on Local Hydric Soils List
- ☐ Listed on National Hydric Soils List
- ☐ Other (Explain in Remarks)

Remarks:

WETLAND DETERMINATION

Hydrophytic Vegetation Present? [✓ Yes] No (Circle)
Wetland Hydrology Present? [✓ Yes] No
Hydric Soils Present? [✓ Yes] No Unknown

(Circle)
Is this Sampling Point within a Wetland? [✓ Yes] No

Remarks:

Approved by HOUSACE 3/92
WSJ2-X

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site: Frontier Renewable Resources

Applicant/Owner: Mascoma/JM Longyear

Investigator: LDK, PK

Date: 4/29/2009

County: Chippewa

State: MI

Do Normal Circumstances exist on the site? [✓ Yes] No

Is the site significantly disturbed (Atypical Situation)? Yes [✓ No]

Is the area a potential Problem Area? Yes [✓ No]

(If needed, explain on reverse.)

Community ID: Wetland 1

Transect ID: 4

Plot ID: Plot 4B UP

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
1. *Dendrolycopodium obscurum*	HB 10%	FACU	9.		
2. *Pteridium aquilinum*	HB 20%	FACU	10.		
3. *Piscea mariana*	TR 30%	FACW	11.		
4. *Abies balsamea*	TR 40%	FACW	12.		
5.			13.		
6.			14.		
7.			15.		
8.			16.		

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-) 66 %

Remarks: Rolling upland edge- balsam/red maple forest.

HYDROLOGY

___ Recorded Data (Describe in Remarks):
  ___ Stream, Lake or Tide Gauge
  ___ Aerial Photographs
  ___ Other
___ No Recorded Data Available

Field Observations:

Depth of Surface Water none in.

Depth to Free Water in Pit: none in.

Depth to Saturated Soil: none in.

Wetland Hydrology Indicators:
Primary Indicators:
  ___ Inundated
  ___ Saturated in Upper 12 inches
  ___ Water Marks
  ___ Drift Lines
  ___ Sediment Deposits
  ___ Drainage Patterns in Wetlands
Secondary Indicators (2 or more required):
  ___ Oxidized Root Channels in Upper 12 inches
  ___ Water -Stained Leaves
  ___ Local Soil Survey Data
  ___ FAC-Neutral Test
  ___ Other (Explain in Remarks)

Remarks:

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

SOILS

Map Unit Name
(Series and Phase): Croswell-Au Gres sands, 0 to 3 percent slopes

Drainage Class: Moderately well drained
Field Observations
Confirm Mapped Type? Yes [✓ No]

Taxonomy (Subgroup): Typic Endoaquods/
Oxyaquic Haplorthods

Profile Description:

Depth (Inches)	Horizon	Matrix Color Munsell Moist	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0-3	1	7.5 YR 2.5/1			organics
3-16+	2	7.5 YR 5/2			sand

Hydric Soils Indicators:

__ Histosol
__ Histic Epipedon
__ Sulfidic Odor
__ Aquic Moisture Regime
__ Reducing Conditions
__ Gleyed or Low-Chroma Colors
__ Concretions
__ High Organic Content in Surface Layer in Sandy Soils
__ Organic Streaking in Sandy Soils
__ Listed on Local Hydric Soils List
__ Listed on National Hydric Soils List
__ Other (Explain in Remarks)

Remarks:

WETLAND DETERMINATION

Hydrophytic Vegetation Present? [✓ Yes] No (Circle)
Wetland Hydrology Present? Yes [✓ No]
Hydric Soils Present? Yes [✓ No] Unknown

(Circle)
Is this Sampling Point within a Wetland? Yes [✓ No]

Remarks:

Approved by HOUSACE 3/92
WSJ2-X

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site: Frontier Renewable Resources
Applicant/Owner: Mascoma/JM Longyear
Investigator: LDK, PK

Date: 4/29/2009
County: Chippewa
State: MI

Do Normal Circumstances exist on the site? [✓ Yes] No
Is the site significantly disturbed (Atypical Situation)? Yes [✓ No]
Is the area a potential Problem Area? Yes [✓ No]
(If needed, explain on reverse.)

Community ID: Wetland 1
Transect ID: 5
Plot ID: Plot 5A WET

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
1. *Larix larcinia*	TR 10%	FACW	9.		
2. *Acer rubrum*	TR 20%	FAC	10.		
3. *Piscea mariana*	SH 15%	FACW	11.		
4. *Abies balsamea*	SH 10%	FACW	12.		
5. *Sphagnum sp.*	HB 90%	FACW	13.		
6.			14.		
7.			15.		
8.			16.		

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-) 100 %

Remarks: Tamarack/balsam/black spruce area.

HYDROLOGY

___ Recorded Data (Describe in Remarks):
- ___ Stream, Lake or Tide Gauge
- ___ Aerial Photographs
- ___ Other

___ No Recorded Data Available

Field Observations:

Depth of Surface Water: none in.

Depth to Free Water in Pit: 1 in.

Depth to Saturated Soil: surface in.

Wetland Hydrology Indicators:

Primary Indicators:
- ___ Inundated
- x Saturated in Upper 12 inches
- ___ Water Marks
- ___ Drift Lines
- ___ Sediment Deposits
- ___ Drainage Patterns in Wetlands

Secondary Indicators (2 or more required):
- ___ Oxidized Root Channels in Upper 12 inches
- ___ Water -Stained Leaves
- ___ Local Soil Survey Data
- ___ FAC-Neutral Test
- ___ Other (Explain in Remarks)

Remarks:

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

SOILS

Map Unit Name
(Series and Phase): Croswell-Au Gres sands, 0 to 3 percent slopes

Drainage Class: Moderately well drained

Taxonomy (Subgroup): Typic Endoaquods/
Oxyaquic Haplorthods

Field Observations
Confirm Mapped Type? Yes [✓ No]

Profile Description:

Depth (Inches)	Horizon	Matrix Color Munsell Moist	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0-1	1	7.5 YR 2.5/1			organics
1-16+	2	7.5 YR 5/1			sand

Hydric Soils Indicators:

- ☐ Histosol
- ☐ Histic Epipedon
- ☐ Sulfidic Odor
- ☐ Aquic Moisture Regime
- ☐ Reducing Conditions
- ☒ Gleyed or Low-Chroma Colors
- ☐ Concretions
- ☐ High Organic Content in Surface Layer in Sandy Soils
- ☐ Organic Streaking in Sandy Soils
- ☐ Listed on Local Hydric Soils List
- ☐ Listed on National Hydric Soils List
- ☐ Other (Explain in Remarks)

Remarks:

WETLAND DETERMINATION

Hydrophytic Vegetation Present? [✓ Yes] No (Circle)
Wetland Hydrology Present? [✓ Yes] No
Hydric Soils Present? [✓ Yes] No Unknown

(Circle)
Is this Sampling Point within a Wetland? [✓ Yes] No

Remarks:

Approved by HOUSACE 3/92
WSJ2-X

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site: Frontier Renewable Resources
Applicant/Owner: Mascoma/JM Longyear
Investigator: LDK, PK

Date: 4/29/2009
County: Chippewa
State: MI

Do Normal Circumstances exist on the site? [✓ Yes] No
Is the site significantly disturbed (Atypical Situation)? Yes [✓ No]
Is the area a potential Problem Area? Yes [✓ No]
(If needed, explain on reverse.)

Community ID: Wetland 1
Transect ID: 5
Plot ID: Plot 5B UP

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
1. *Acer rubrum*	TR 10%	FAC	9.		
2. *Pteridium aquilinum*	HB 100%	FACU	10.		
3. *Piscea mariana*	SH 5%	FACW	11.		
4. *Abies balsamea*	SH 5%	FACW	12.		
5.			13.		
6.			14.		
7.			15.		
8.			16.		

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-) 0 %

Remarks: Clearing with young red maple and bracken fern.

HYDROLOGY

___ Recorded Data (Describe in Remarks):
 __ Stream, Lake or Tide Gauge
 __ Aerial Photographs
 __ Other
___ No Recorded Data Available

Field Observations:

Depth of Surface Water none in.

Depth to Free Water in Pit: 15 in.

Depth to Saturated Soil: 8* in.

Wetland Hydrology Indicators:
Primary Indicators:
 ____ Inundated
 x Saturated in Upper 12 inches
 ____ Water Marks
 ____ Drift Lines
 ____ Sediment Deposits
 ____ Drainage Patterns in Wetlands
Secondary Indicators (2 or more required):
 ____ Oxidized Root Channels in Upper 12 inches
 ____ Water -Stained Leaves
 ____ Local Soil Survey Data
 ____ FAC-Neutral Test
 ____ Other (Explain in Remarks)

Remarks: *Saturation may be due to the fact that it is early spring and the proximity of the plot to the wetland. Dominance of bracken fern indicates that saturation within the upper 12" is not long-lasting.

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

SOILS

Map Unit Name
(Series and Phase): Croswell-Au Gres sands, 0 to 3 percent slopes

Drainage Class: Moderately well drained

Field Observations
Confirm Mapped Type? Yes [✓ No]

Taxonomy (Subgroup): Typic Endoaquods/
Oxyaquic Haplorthods

Profile Description:

Depth (Inches)	Horizon	Matrix Color Munsell Moist	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0-2	1	7.5 YR 2.5/1			organics
2-3	2	7.5 YR 5/2			sand
3-16+	3	7.5 YR 5/3			sand

Hydric Soils Indicators:

__ Histosol
__ Histic Epipedon
__ Sulfidic Odor
__ Aquic Moisture Regime
__ Reducing Conditions
__ Gleyed or Low-Chroma Colors

__ Concretions
__ High Organic Content in Surface Layer in Sandy Soils
__ Organic Streaking in Sandy Soils
__ Listed on Local Hydric Soils List
__ Listed on National Hydric Soils List
__ Other (Explain in Remarks)

Remarks: *Organic layer is not peat like nearby wetland area- mostly needles, etc. Although first 3 inches is low in chroma, the s
profile does not meet LRR "M" hydric indicator for sand.

WETLAND DETERMINATION

Hydrophytic Vegetation Present? Yes [✓ No] (Circle)
Wetland Hydrology Present? [✓ Yes] No
Hydric Soils Present? Yes [✓ No] Unknown

(Circle)
Is this Sampling Point within a Wetland? Yes [✓ No]

Remarks:

Approved by HOUSACE 3/92
WSJ2-X

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site: Frontier Renewable Resources
Applicant/Owner: Mascoma/JM Longyear
Investigator: LDK, PK

Date: 6/2/2009
County: Chippewa
State: MI

Do Normal Circumstances exist on the site? [✓ Yes] No
Is the site significantly disturbed (Atypical Situation)? Yes [✓ No]
Is the area a potential Problem Area? Yes [✓ No]
(If needed, explain on reverse.)

Community ID: Wetland 2
Transect ID: 6
Plot ID: Plot 6 UP

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
1. *Trientalis borealis*	HB 20%	FAC+	9.		
2. *Maianthemum canadense*	HB 15%	FAC	10.		
3. *Picea glauca*	TR 20%	FACU	11.		
4. *Abies balsamea*	TR 40%	FACW	12.		
5.			13.		
6.			14.		
7.			15.		
8.			16.		

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-) 66 %

Remarks: Clearing with young red maple and bracken fern.

HYDROLOGY

___ Recorded Data (Describe in Remarks):
  __ Stream, Lake or Tide Gauge
  __ Aerial Photographs
  __ Other
___ No Recorded Data Available

Field Observations:

Depth of Surface Water none in.

Depth to Free Water in Pit: none in.

Depth to Saturated Soil: none in.

Wetland Hydrology Indicators:
Primary Indicators:
____ Inundated
____ Saturated in Upper 12 inches
____ Water Marks
____ Drift Lines
____ Sediment Deposits
____ Drainage Patterns in Wetlands
Secondary Indicators (2 or more required):
____ Oxidized Root Channels in Upper 12 inches
____ Water -Stained Leaves
____ Local Soil Survey Data
____ FAC-Neutral Test
____ Other (Explain in Remarks)

Remarks:

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

SOILS

Map Unit Name
(Series and Phase): Croswell-Au Gres sands, 0 to 3 percent slopes

Drainage Class: Moderately well drained

Taxonomy (Subgroup): Typic Endoaquods/
Oxyaquic Haplorthods

Field Observations
Confirm Mapped Type? Yes [✓ No]

Profile Description:

Depth (Inches)	Horizon	Matrix Color Munsell Moist	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0-5	1	5 YR 3/1			sand
5-10	2	7.5 YR 5/3			sand
10-16+	3	2.5 YR 3/6			sand/consolidated sand

Hydric Soils Indicators:

- __ Histosol
- __ Histic Epipedon
- __ Sulfidic Odor
- __ Aquic Moisture Regime
- __ Reducing Conditions
- x Gleyed or Low-Chroma Colors
- __ Concretions
- __ High Organic Content in Surface Layer in Sandy Soils
- __ Organic Streaking in Sandy Soils
- __ Listed on Local Hydric Soils List
- __ Listed on National Hydric Soils List
- __ Other (Explain in Remarks)

Remarks: Although first 5 inches is low in chroma, the soil profile does not meet LRR "M" hydric indicator for sand.

WETLAND DETERMINATION

Hydrophytic Vegetation Present? [✓ Yes] No (Circle)
Wetland Hydrology Present? Yes [✓ No]
Hydric Soils Present? Yes [✓ No] Unknown

(Circle)
Is this Sampling Point within a Wetland? Yes [✓ No]

Remarks:

Approved by HOUSACE 3/92
WSJ2-X

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site: Frontier Renewable Resources
Applicant/Owner: Mascoma/JM Longyear
Investigator: LDK, PK

Date: 6/2/2009
County: Chippewa
State: MI

Do Normal Circumstances exist on the site? [✓ Yes] No
Is the site significantly disturbed (Atypical Situation)? Yes [✓ No]
Is the area a potential Problem Area? Yes [✓ No]
(If needed, explain on reverse.)

Community ID: Wetland 2
Transect ID: 6
Plot ID: Plot 6 WET

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
1. *Maianthemum canadense*	HB 5%	FAC	9.		
2. *Acer rubrum*	TR 30%	FAC	10.		
3. *Populus tremuloides*	TR 10%	FAC	11.		
4. *Abies balsamea*	TR 10%	FACW	12.		
5.			13.		
6.			14.		
7.			15.		
8.			16.		

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-) 100 %

Remarks: Shallow wooded depression.

HYDROLOGY

___ Recorded Data (Describe in Remarks):
  ___ Stream, Lake or Tide Gauge
  ___ Aerial Photographs
  ___ Other
___ No Recorded Data Available

Field Observations:

Depth of Surface Water none in.

Depth to Free Water in Pit: 3 in.

Depth to Saturated Soil: surface in.

Wetland Hydrology Indicators:
Primary Indicators:
___ Inundated
x Saturated in Upper 12 inches
___ Water Marks
___ Drift Lines
___ Sediment Deposits
___ Drainage Patterns in Wetlands
Secondary Indicators (2 or more required):
___ Oxidized Root Channels in Upper 12 inches
___ Water -Stained Leaves
___ Local Soil Survey Data
___ FAC-Neutral Test
___ Other (Explain in Remarks)

Remarks:

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

SOILS

Map Unit Name
(Series and Phase): Croswell-Au Gres sands, 0 to 3 percent slopes

Drainage Class: Moderately well drained

Field Observations
Confirm Mapped Type? Yes [✓ No]

Taxonomy (Subgroup): Typic Endoaquods/
Oxyaquic Haplorthods

Profile Description:

Depth (Inches)	Horizon	Matrix Color Munsell Moist	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0-6	1	7.5 YR 2.5/1			loam with organics
6-16+	2	7.5 YR 5/3	7.5 YR 5/6	few, distinct	sand

Hydric Soils Indicators:

- ☐ Histosol
- ☐ Histic Epipedon
- ☐ Sulfidic Odor
- ☐ Aquic Moisture Regime
- ☐ Reducing Conditions
- ☒ Gleyed or Low-Chroma Colors
- ☐ Concretions
- ☐ High Organic Content in Surface Layer in Sandy Soils
- ☐ Organic Streaking in Sandy Soils
- ☐ Listed on Local Hydric Soils List
- ☐ Listed on National Hydric Soils List
- ☐ Other (Explain in Remarks)

Remarks: Mottling in upper 12 inches.

WETLAND DETERMINATION

Hydrophytic Vegetation Present? [✓ Yes] No (Circle)
Wetland Hydrology Present? [✓ Yes] No
Hydric Soils Present? [✓ Yes] No Unknown

(Circle)
Is this Sampling Point within a Wetland? [✓ Yes] No

Remarks:

Approved by HOUSACE 3/92
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DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site: Frontier Renewable Resources
Applicant/Owner: Mascoma/JM Longyear
Investigator: LDK, PK

Date: 6/2/2009
County: Chippewa
State: MI

Do Normal Circumstances exist on the site? [✓ Yes] No
Is the site significantly disturbed (Atypical Situation)? Yes [✓ No]
Is the area a potential Problem Area? Yes [✓ No]
(If needed, explain on reverse.)

Community ID: Wetland 3
Transect ID: 7
Plot ID: Plot 7 UP

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
1. *Trientalis borealis*	HB 15%	FAC+	9.		
2. *Cornus canadensis*	HB 30%	FACW-	10.		
3. *Picea glauca*	TR 50%	FACU	11.		
4. *Abies balsamea*	TR 50%	FACW	12.		
5.			13.		
6.			14.		
7.			15.		
8.			16.		

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-) 66 %

Remarks: Upland area adjacent to wetland that is a few feet higher in elevation.

HYDROLOGY

___ Recorded Data (Describe in Remarks):
  __ Stream, Lake or Tide Gauge
  __ Aerial Photographs
  __ Other
___ No Recorded Data Available

Field Observations:

Depth of Surface Water none in.

Depth to Free Water in Pit: none in.

Depth to Saturated Soil: none in.

Wetland Hydrology Indicators:
Primary Indicators:
____ Inundated
____ Saturated in Upper 12 inches
____ Water Marks
____ Drift Lines
____ Sediment Deposits
____ Drainage Patterns in Wetlands
Secondary Indicators (2 or more required):
____ Oxidized Root Channels in Upper 12 inches
____ Water -Stained Leaves
____ Local Soil Survey Data
____ FAC-Neutral Test
____ Other (Explain in Remarks)

Remarks:

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

SOILS

Map Unit Name
(Series and Phase): Rousseau fine sand, dark subsoil
0 to 6 percent slopes
Taxonomy (Subgroup): Entic Haplorthods

Drainage Class: Well drained
Field Observations
Confirm Mapped Type? Yes [✓ No]

Profile Description:

Depth (Inches)	Horizon	Matrix Color Munsell Moist	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0-1	1	7.5 YR 2.5/1			organics
1-5	2	7.5 YR 5/1			sand
5-16+	3	7.5 YR 5/6			sand

Hydric Soils Indicators:

__ Histosol
__ Histic Epipedon
__ Sulfidic Odor
__ Aquic Moisture Regime
__ Reducing Conditions
x Gleyed or Low-Chroma Colors

__ Concretions
__ High Organic Content in Surface Layer in Sandy Soils
__ Organic Streaking in Sandy Soils
__ Listed on Local Hydric Soils List
__ Listed on National Hydric Soils List
__ Other (Explain in Remarks)

Remarks: Although first 5 inches is low in chroma, the soil profile does not meet LRR "M" hydric indicator for sand.

WETLAND DETERMINATION

Hydrophytic Vegetation Present? [✓ Yes] No (Circle)
Wetland Hydrology Present? Yes [✓ No]
Hydric Soils Present? Yes [✓ No] Unknown

(Circle)
Is this Sampling Point within a Wetland? Yes [✓ No]

Remarks:

Approved by HOUSACE 3/92
WSJ2-X

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site: Frontier Renewable Resources
Applicant/Owner: Mascoma/JM Longyear
Investigator: LDK, PK

Date: 6/2/2009
County: Chippewa
State: MI

Do Normal Circumstances exist on the site? [✓ Yes] No
Is the site significantly disturbed (Atypical Situation)? Yes [✓ No]
Is the area a potential Problem Area? Yes [✓ No]
(If needed, explain on reverse.)

Community ID: Wetland 3
Transect ID: 7
Plot ID: Plot 7 WET

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
1. *Corylus cornuta*	SH 30%	UPL	9.		
2. *Acer rubrum*	TR 30%	FAC	10.		
3. *Viola sororia*	HB 70%	FACW	11.		
4. *Trientalis borealis*	HB 5%	FAC+	12.		
5. *Piscea mariana*	TR 15%	FACW	13.		
6. *Carex pensylvanica*	HB 10%	NI	14.		
7.			15.		
8.			16.		

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-) 66 %

Remarks: Elongated swale-like depression.

HYDROLOGY

___ Recorded Data (Describe in Remarks):
  ___ Stream, Lake or Tide Gauge
  ___ Aerial Photographs
  ___ Other
___ No Recorded Data Available

Field Observations:

Depth of Surface Water: none in.

Depth to Free Water in Pit: 10 in.

Depth to Saturated Soil: surface in.

Wetland Hydrology Indicators:
Primary Indicators:
- ___ Inundated
- x Saturated in Upper 12 inches
- ___ Water Marks
- ___ Drift Lines
- ___ Sediment Deposits
- ___ Drainage Patterns in Wetlands

Secondary Indicators (2 or more required):
- ___ Oxidized Root Channels in Upper 12 inches
- ___ Water -Stained Leaves
- ___ Local Soil Survey Data
- ___ FAC-Neutral Test
- ___ Other (Explain in Remarks)

Remarks:

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

SOILS

Map Unit Name
(Series and Phase): Rousseau fine sand, dark subsoil
0 to 6 percent slopes
Taxonomy (Subgroup): Entic Haplorthods

Drainage Class: Well drained
Field Observations
Confirm Mapped Type? Yes [✓ No]

Profile Description:

Depth (Inches)	Horizon	Matrix Color Munsell Moist	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0-0.5	1	7.5 YR 2.5/1			sandy loam
0.5-16+	2	5 YR 5/1	7.5 YR 5/6	many, prominent	sand

Hydric Soils Indicators:

__ Histosol
__ Histic Epipedon
__ Sulfidic Odor
__ Aquic Moisture Regime
__ Reducing Conditions
x Gleyed or Low-Chroma Colors

__ Concretions
__ High Organic Content in Surface Layer in Sandy Soils
__ Organic Streaking in Sandy Soils
__ Listed on Local Hydric Soils List
__ Listed on National Hydric Soils List
__ Other (Explain in Remarks)

Remarks: Mottling/redox features in upper 12 inches. Meets NRCS Hydric Criteria S5 - Sandy Redox.

WETLAND DETERMINATION

Hydrophytic Vegetation Present? [✓ Yes] No (Circle)
Wetland Hydrology Present? [✓ Yes] No
Hydric Soils Present? [✓ Yes] No Unknown

(Circle)
Is this Sampling Point within a Wetland? [✓ Yes] No

Remarks:

Approved by HOUSACE 3/92
WSJ2-X

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site: Frontier Renewable Resources
Applicant/Owner: Mascoma/JM Longyear
Investigator: LDK, PK

Date: 6/3/2009
County: Chippewa
State: MI

Do Normal Circumstances exist on the site? [✓ Yes] No
Is the site significantly disturbed (Atypical Situation)? Yes [✓ No]
Is the area a potential Problem Area? Yes [✓ No]
(If needed, explain on reverse.)

Community ID: Wetland 1
Transect ID: 8
Plot ID: Plot 8 UP

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
1. *Pteridium aquilinum*	HB 30%	FACU	9.		
2. *Betula papyrifera*	TR 10%	FACU+	10.		
3. *Pinus resinosa*	TR 30%	FACU	11.		
4. *Quercus rubra*	TR 20%	FACU	12.		
5.			13.		
6.			14.		
7.			15.		
8.			16.		

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-) 0 %

Remarks: Plot location is elevated approximately 3-4' above wetland plot.

HYDROLOGY

___ Recorded Data (Describe in Remarks):
  __ Stream, Lake or Tide Gauge
  __ Aerial Photographs
  __ Other
___ No Recorded Data Available

Field Observations:

Depth of Surface Water none in.

Depth to Free Water in Pit: 0 in.

Depth to Saturated Soil: 0 in.

Wetland Hydrology Indicators:
Primary Indicators:
____ Inundated
____ Saturated in Upper 12 inches
____ Water Marks
____ Drift Lines
____ Sediment Deposits
____ Drainage Patterns in Wetlands
Secondary Indicators (2 or more required):
____ Oxidized Root Channels in Upper 12 inches
____ Water -Stained Leaves
____ Local Soil Survey Data
____ FAC-Neutral Test
____ Other (Explain in Remarks)

Remarks: Soil is composed mostly of dry sand.

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

SOILS

Map Unit Name
(Series and Phase): Kalkaska sand, 0 to 6 percent slopes

Drainage Class: Somewhat excessively drained

Taxonomy (Subgroup): Typic Haplorthods

Field Observations
Confirm Mapped Type? Yes [✓ No]

Profile Description:

Depth (Inches)	Horizon	Matrix Color Munsell Moist	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0-3	1	7.5YR 4/1			sand with organics
3-8	2	7.5YR 4/2			sand
8-16	3	7.5YR 5/6			sand

Hydric Soils Indicators:

__ Histosol
__ Histic Epipedon
__ Sulfidic Odor
__ Aquic Moisture Regime
__ Reducing Conditions
__ Gleyed or Low-Chroma Colors
__ Concretions
__ High Organic Content in Surface Layer in Sandy Soils
__ Organic Streaking in Sandy Soils
__ Listed on Local Hydric Soils List
__ Listed on National Hydric Soils List
__ Other (Explain in Remarks)

Remarks: Dry sandy soils.

WETLAND DETERMINATION

Hydrophytic Vegetation Present? Yes [✓ No] (Circle)
Wetland Hydrology Present? Yes [✓ No]
Hydric Soils Present? Yes [✓ No] Unknown

(Circle)
Is this Sampling Point within a Wetland? Yes [✓ No]

Remarks: Plot located in dry, sandy upland area.

Approved by HOUSACE 3/92
WSJ2-X

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site: Frontier Renewable Resources
Applicant/Owner: Mascoma/JM Longyear
Investigator: LDK, PK

Date: 6/3/2009
County: Chippewa
State: MI

Do Normal Circumstances exist on the site? [✓ Yes] No
Is the site significantly disturbed (Atypical Situation)? Yes [✓ No]
Is the area a potential Problem Area? Yes [✓ No]
(If needed, explain on reverse.)

Community ID: Wetland 1
Transect ID: 8
Plot ID: Plot 8 WET

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
1. *Iris versicolor*	HB 5%	OBL	9.		
2. *Sphagnum sp.*	HB 10%	OBL	10.		
3.			11.		
4.			12.		
5.			13.		
6.			14.		
7.			15.		
8.			16.		

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-) 100 %

Remarks: This portion of wetland is mainly devoid of vegetation. Wetland area located off of NW corner of site.

HYDROLOGY

___ Recorded Data (Describe in Remarks):
    __ Stream, Lake or Tide Gauge
    __ Aerial Photographs
    __ Other
___ No Recorded Data Available

Field Observations:

Depth of Surface Water none in.

Depth to Free Water in Pit: 1 in.

Depth to Saturated Soil: surface in.

Wetland Hydrology Indicators:
Primary Indicators:
____ Inundated
x Saturated in Upper 12 inches
____ Water Marks
____ Drift Lines
____ Sediment Deposits
____ Drainage Patterns in Wetlands
Secondary Indicators (2 or more required):
____ Oxidized Root Channels in Upper 12 inches
____ Water -Stained Leaves
____ Local Soil Survey Data
____ FAC-Neutral Test
____ Other (Explain in Remarks)

Remarks:

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

SOILS

Map Unit Name
(Series and Phase): Kalkaska sand, 0 to 6 percent slopes

Drainage Class: Somewhat excessively drained

Field Observations
Confirm Mapped Type? Yes [✓ No]

Taxonomy (Subgroup): Typic Haplorthods

Profile Description:

Depth (Inches)	Horizon	Matrix Color Munsell Moist	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0-5	1	7.5YR 2.5/1			Muck/Organics
4-16+	2	7.5YR 3/1			Silt

Hydric Soils Indicators:

- __ Histosol
- __ Histic Epipedon
- __ Sulfidic Odor
- __ Aquic Moisture Regime
- __ Reducing Conditions
- x Gleyed or Low-Chroma Colors
- __ Concretions
- __ High Organic Content in Surface Layer in Sandy Soils
- __ Organic Streaking in Sandy Soils
- __ Listed on Local Hydric Soils List
- __ Listed on National Hydric Soils List
- __ Other (Explain in Remarks)

Remarks: Meets NRCS Hydric Indicator F1 - Loamy mucky mineral.

WETLAND DETERMINATION

Hydrophytic Vegetation Present? [✓ Yes] No (Circle)
Wetland Hydrology Present? [✓ Yes] No
Hydric Soils Present? [✓ Yes] No Unknown

(Circle)
Is this Sampling Point within a Wetland? [✓ Yes] No

Remarks:

Approved by HOUSACE 3/92
WSJ2-X

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site: Frontier Renewable Resources
Applicant/Owner: Mascoma/JM Longyear
Investigator: LDK, PK

Date: 6/3/2009
County: Chippewa
State: MI

Do Normal Circumstances exist on the site? [✓ Yes] No
Is the site significantly disturbed (Atypical Situation)? Yes [✓ No]
Is the area a potential Problem Area? Yes [✓ No]
(If needed, explain on reverse.)

Community ID: Wetland 1
Transect ID: 9
Plot ID: Plot 9A WET

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
1. *Sphagnum sp.*	HB 5%	OBL	9.		
2. *Abies balsamea*	TR 30%	FACW	10.		
3. *Acer rubrum*	TR 20%	FAC	11.		
4. *Betula alleghaniensis*	TR 10%	FAC	12.		
5. *Tsuga canadensis*	TR 10%	FACU	13.		
6. *Populus tremuloides*	TR 10%	FAC	14.		
7. *Iris versicolor*	HB 5%	OBL	15.		
8.			16.		

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-) 100 %

Remarks: Elongated wetland drainage on the western end of wetland 1.

HYDROLOGY

___ Recorded Data (Describe in Remarks):
  __ Stream, Lake or Tide Gauge
  __ Aerial Photographs
  __ Other
___ No Recorded Data Available

Field Observations:

Depth of Surface Water: none in.

Depth to Free Water in Pit: 0.5 in.

Depth to Saturated Soil: surface in.

Wetland Hydrology Indicators:
Primary Indicators:
- ____ Inundated
- x Saturated in Upper 12 inches
- ____ Water Marks
- ____ Drift Lines
- ____ Sediment Deposits
- ____ Drainage Patterns in Wetlands

Secondary Indicators (2 or more required):
- ____ Oxidized Root Channels in Upper 12 inches
- ____ Water -Stained Leaves
- ____ Local Soil Survey Data
- ____ FAC-Neutral Test
- ____ Other (Explain in Remarks)

Remarks:

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

SOILS

Map Unit Name
(Series and Phase): Croswell-Au Gres sands, 0 to 3 percent slopes

Drainage Class: Moderately well drained

Field Observations
Confirm Mapped Type? Yes [✓ No]

Taxonomy (Subgroup): Typic Endoaquods/
Oxyaquic Haplorthods

Profile Description:

Depth (Inches)	Horizon	Matrix Color Munsell Moist	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0-6	1	7.5YR 2.5/1			organics and muck
6-16	2	7.5YR 3/3			sand

Hydric Soils Indicators:

- ☐ Histosol
- ☐ Histic Epipedon
- ☐ Sulfidic Odor
- ☐ Aquic Moisture Regime
- ☐ Reducing Conditions
- ☒ Gleyed or Low-Chroma Colors
- ☐ Concretions
- ☐ High Organic Content in Surface Layer in Sandy Soils
- ☐ Organic Streaking in Sandy Soils
- ☐ Listed on Local Hydric Soils List
- ☐ Listed on National Hydric Soils List
- ☐ Other (Explain in Remarks)

Remarks: Mucky soils with organics in upper 6". Meets Sandy Mucky Mineral Hydric Indicator? (S1)

WETLAND DETERMINATION

Hydrophytic Vegetation Present? [✓ Yes] No (Circle)
Wetland Hydrology Present? [✓ Yes] No
Hydric Soils Present? [✓ Yes] No Unknown

(Circle)
Is this Sampling Point within a Wetland? [✓ Yes] No

Remarks: Plot located in western end of wetland 1.

Approved by HOUSACE 3/92
WSJ2-X

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site: Frontier Renewable Resources
Applicant/Owner: Mascoma/JM Longyear
Investigator: LDK, PK

Date: 6/3/2009
County: Chippewa
State: MI

Do Normal Circumstances exist on the site? [✓ Yes] No
Is the site significantly disturbed (Atypical Situation)? Yes [✓ No]
Is the area a potential Problem Area? Yes [✓ No]
(If needed, explain on reverse.)

Community ID: Wetland 1
Transect ID: 9
Plot ID: Plot 9B UP

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
1. *Trientalis borealis*	HB 2%	FAC+	9.		
2. *Maianthemum canadense*	HB 5%	FAC	10.		
3. *Populus tremuloides*	TR 10%	FAC	11.		
4. *Abies balsamea*	TR 80%	FACW	12.		
5. *Acer rubrum*	TR 10%	FAC	13.		
6.			14.		
7.			15.		
8.			16.		

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-) 100 %

Remarks: Upland area with rolling/varying terrain and elevation. Very apparent upland area.

HYDROLOGY

___ Recorded Data (Describe in Remarks):
  __ Stream, Lake or Tide Gauge
  __ Aerial Photographs
  __ Other
___ No Recorded Data Available

Field Observations:

Depth of Surface Water none in.

Depth to Free Water in Pit: 0 in.

Depth to Saturated Soil: 14 in.

Wetland Hydrology Indicators:
Primary Indicators:
- ____ Inundated
- ____ Saturated in Upper 12 inches
- ____ Water Marks
- ____ Drift Lines
- ____ Sediment Deposits
- ____ Drainage Patterns in Wetlands

Secondary Indicators (2 or more required):
- ____ Oxidized Root Channels in Upper 12 inches
- ____ Water -Stained Leaves
- ____ Local Soil Survey Data
- ____ FAC-Neutral Test
- ____ Other (Explain in Remarks)

Remarks: Soil is composed of mostly sand.

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

SOILS

Map Unit Name
(Series and Phase): Croswell-Au Gres sands, 0 to 3 percent slopes

Drainage Class: Moderately well drained

Field Observations
Confirm Mapped Type? Yes [✓ No]

Taxonomy (Subgroup): Typic Endoaquods/
Oxyaquic Haplorthods

Profile Description:

Depth (Inches)	Horizon	Matrix Color Munsell Moist	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0-2	1	7.5YR 3/1			organics and loam
2-16	2	7.rYR 5/1			sand

Hydric Soils Indicators:

__ Histosol
__ Histic Epipedon
__ Sulfidic Odor
__ Aquic Moisture Regime
__ Reducing Conditions
__ Gleyed or Low-Chroma Colors

__ Concretions
__ High Organic Content in Surface Layer in Sandy Soils
__ Organic Streaking in Sandy Soils
__ Listed on Local Hydric Soils List
__ Listed on National Hydric Soils List
__ Other (Explain in Remarks)

Remarks: Dry sandy soils.

WETLAND DETERMINATION

Hydrophytic Vegetation Present? [✓ Yes] No (Circle)
Wetland Hydrology Present? Yes [✓ No]
Hydric Soils Present? Yes [✓ No] Unknown

(Circle)
Is this Sampling Point within a Wetland? Yes [✓ No]

Remarks: Plot located in dry, sandy upland area with rolling terrain.

Approved by HOUSACE 3/92
WSJ2-X

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site: Frontier Renewable Resources
Applicant/Owner: Mascoma/JM Longyear
Investigator: LDK, PK

Date: 6/3/2009
County: Chippewa
State: MI

Do Normal Circumstances exist on the site? [✓ Yes] No
Is the site significantly disturbed (Atypical Situation)? Yes [✓ No]
Is the area a potential Problem Area? Yes [✓ No]
(If needed, explain on reverse.)

Community ID: Wetland 2
Transect ID: 9
Plot ID: Plot 9C WET

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
1. *Sphagnum sp.*	HB 20%	OBL	9.		
2. *Abies balsamea*	TR 20%	FACW	10.		
3. *Acer rubrum*	TR 40%	FAC	11.		
4. *Betula alleghaniensis*	TR 20%	FAC	12.		
5.			13.		
6.			14.		
7.			15.		
8.			16.		

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-) 100 %

Remarks: Wetland depression area adjacent to wetlands 1 and 3.

HYDROLOGY

___ Recorded Data (Describe in Remarks):
__ Stream, Lake or Tide Gauge
__ Aerial Photographs
__ Other
___ No Recorded Data Available

Field Observations:

Depth of Surface Water none in.

Depth to Free Water in Pit: 2 in.

Depth to Saturated Soil: surface in.

Wetland Hydrology Indicators:
Primary Indicators:
____ Inundated
x Saturated in Upper 12 inches
____ Water Marks
____ Drift Lines
____ Sediment Deposits
____ Drainage Patterns in Wetlands
Secondary Indicators (2 or more required):
____ Oxidized Root Channels in Upper 12 inches
____ Water -Stained Leaves
____ Local Soil Survey Data
____ FAC-Neutral Test
____ Other (Explain in Remarks)

Remarks:

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

SOILS

Map Unit Name
(Series and Phase): Croswell-Au Gres sands, 0 to 3 percent slopes

Drainage Class: Moderately well drained

Taxonomy (Subgroup): Typic Endoaquods/ Oxyaquic Haplorthods

Field Observations
Confirm Mapped Type? Yes [✓ No]

Profile Description:

Depth (Inches)	Horizon	Matrix Color Munsell Moist	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0-5	1	7.5YR 2.5/2			silt and organics
5-16+	2	7.5YR 5/1			sand

Hydric Soils Indicators:

- __ Histosol
- __ Histic Epipedon
- __ Sulfidic Odor
- __ Aquic Moisture Regime
- __ Reducing Conditions
- x Gleyed or Low-Chroma Colors
- __ Concretions
- __ High Organic Content in Surface Layer in Sandy Soils
- x Organic Streaking in Sandy Soils
- __ Listed on Local Hydric Soils List
- __ Listed on National Hydric Soils List
- __ Other (Explain in Remarks)

Remarks: Organic streaking in sand layer (5-16").

WETLAND DETERMINATION

Hydrophytic Vegetation Present? [✓ Yes] No (Circle)
Wetland Hydrology Present? [✓ Yes] No
Hydric Soils Present? [✓ Yes] No Unknown

Is this Sampling Point within a Wetland? (Circle) [✓ Yes] No

Remarks: Plot located in wetland 2.

Approved by HOUSACE 3/92
WSJ2-X

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site: Frontier Renewable Resources
Applicant/Owner: Mascoma/JM Longyear
Investigator: LDK, PK

Date: 6/3/2009
County: Chippewa
State: MI

Do Normal Circumstances exist on the site? [✓ Yes] No
Is the site significantly disturbed (Atypical Situation)? Yes [✓ No]
Is the area a potential Problem Area? Yes [✓ No]
(If needed, explain on reverse.)

Community ID: Wetland 2
Transect ID: 9
Plot ID: Plot 9D UP

VEGETATION

Dominant Plant Species	Stratum	Indicator
1. *Gaultheria procumbens*	HB 5%	FACU
2. *Maianthemum canadense*	HB 20%	FAC
3. *Dendrolycopodium obscurum*	HB 5%	FACU
4. *Abies balsamea*	TR 50%	FACW
5. *Acer rubrum*	TR 20%	FAC
6. *Betula alleghaniensis*	TR 10%	FAC
7. *Tsuga canadensis*	TR 10%	FACU
8.		

Dominant Plant Species	Stratum	Indicator
9.		
10.		
11.		
12.		
13.		
14.		
15.		
16.		

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-) 100 %

Remarks: Upland area with rolling/varying terrain and elevation. Area located between wetlands 2 and 3.

HYDROLOGY

___ Recorded Data (Describe in Remarks):
- ___ Stream, Lake or Tide Gauge
- ___ Aerial Photographs
- ___ Other

___ No Recorded Data Available

Field Observations:

Depth of Surface Water: none in.
Depth to Free Water in Pit: 0 in.
Depth to Saturated Soil: 0 in.

Wetland Hydrology Indicators:

Primary Indicators:
- ___ Inundated
- ___ Saturated in Upper 12 inches
- ___ Water Marks
- ___ Drift Lines
- ___ Sediment Deposits
- ___ Drainage Patterns in Wetlands

Secondary Indicators (2 or more required):
- ___ Oxidized Root Channels in Upper 12 inches
- ___ Water -Stained Leaves
- ___ Local Soil Survey Data
- ___ FAC-Neutral Test
- ___ Other (Explain in Remarks)

Remarks: Soil is composed of mostly silt and sand.

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

SOILS

Map Unit Name
(Series and Phase): Croswell-Au Gres sands, 0 to 3 percent slopes

Drainage Class: Moderately well drained

Field Observations
Confirm Mapped Type? Yes [✓ No]

Taxonomy (Subgroup): Typic Endoaquods/ Oxyaquic Haplorthods

Profile Description:

Depth (Inches)	Horizon	Matrix Color Munsell Moist	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0-5	1	7.5YR 2.5/1			organics and silt
5-10	2	7.5YR 4/1			sand
10-16	3	7.5YR 4/6			sand to consolidated sand

Hydric Soils Indicators:

- __ Histosol
- __ Histic Epipedon
- __ Sulfidic Odor
- __ Aquic Moisture Regime
- __ Reducing Conditions
- x Gleyed or Low-Chroma Colors
- __ Concretions
- __ High Organic Content in Surface Layer in Sandy Soils
- __ Organic Streaking in Sandy Soils
- __ Listed on Local Hydric Soils List
- __ Listed on National Hydric Soils List
- __ Other (Explain in Remarks)

Remarks: Dry sand and silt soils.

WETLAND DETERMINATION

Hydrophytic Vegetation Present? [✓ Yes] No (Circle)
Wetland Hydrology Present? Yes [✓ No]
Hydric Soils Present? Yes [✓ No] Unknown

(Circle)
Is this Sampling Point within a Wetland? Yes [✓ No]

Remarks: Plot located in dry, sandy upland area with rolling terrain.

Approved by HOUSACE 3/92
WSJ2-X

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site: Frontier Renewable Resources
Applicant/Owner: Mascoma/JM Longyear
Investigator: LDK, PK

Date: 6/3/2009
County: Chippewa
State: MI

Do Normal Circumstances exist on the site? [✓ Yes] No
Is the site significantly disturbed (Atypical Situation)? Yes [✓ No]
Is the area a potential Problem Area? Yes [✓ No]
(If needed, explain on reverse.)

Community ID: Wetland 3
Transect ID: 9
Plot ID: Plot 9E WET

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
1. *Maianthemum canadense*	HB 20%	FAC	9.		
2. *Abies balsamea*	TR 5%	FACW	10.		
3. *Acer rubrum*	TR 40%	FAC	11.		
4. *Betula alleghaniensis*	TR 20%	FAC	12.		
5. *Sphagnum sp.*	HB 90%	OBL	13.		
6.			14.		
7.			15.		
8.			16.		

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-) 100 %

Remarks: Wetland depression area adjacent to wetlands 1, 2 and 3.

HYDROLOGY

___ Recorded Data (Describe in Remarks):
  ___ Stream, Lake or Tide Gauge
  ___ Aerial Photographs
  ___ Other
___ No Recorded Data Available

Field Observations:

Depth of Surface Water: none in.
Depth to Free Water in Pit: 1 in.
Depth to Saturated Soil: surface in.

Wetland Hydrology Indicators:
Primary Indicators:
- ___ Inundated
- x Saturated in Upper 12 inches
- ___ Water Marks
- ___ Drift Lines
- ___ Sediment Deposits
- ___ Drainage Patterns in Wetlands

Secondary Indicators (2 or more required):
- ___ Oxidized Root Channels in Upper 12 inches
- ___ Water -Stained Leaves
- ___ Local Soil Survey Data
- ___ FAC-Neutral Test
- ___ Other (Explain in Remarks)

Remarks:

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

SOILS

Map Unit Name
(Series and Phase): Croswell-Au Gres sands, 0 to 3 percent slopes

Drainage Class: Moderately well drained

Field Observations
Confirm Mapped Type? Yes [✓ No]

Taxonomy (Subgroup): Typic Endoaquods/
Oxyaquic Haplorthods

Profile Description:

Depth (Inches)	Horizon	Matrix Color Munsell Moist	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0-3	1	7.5YR 2.5/1			mucky loam
3-16+	2	7.5YR 4/1			sand

Hydric Soils Indicators:

- __ Histosol
- __ Histic Epipedon
- __ Sulfidic Odor
- __ Aquic Moisture Regime
- __ Reducing Conditions
- __ Gleyed or Low-Chroma Colors
- __ Concretions
- __ High Organic Content in Surface Layer in Sandy Soils
- x Organic Streaking in Sandy Soils
- __ Listed on Local Hydric Soils List
- __ Listed on National Hydric Soils List
- __ Other (Explain in Remarks)

Remarks: Organic streaking in sand layer (3-16"). Meets NRCS indicator S1.

WETLAND DETERMINATION

Hydrophytic Vegetation Present? [✓ Yes] No (Circle)
Wetland Hydrology Present? [✓ Yes] No
Hydric Soils Present? [✓ Yes] No Unknown

(Circle)
Is this Sampling Point within a Wetland? [✓ Yes] No

Remarks: Plot located in wetland 3.

Approved by HOUSACE 3/92
WSJ2-X

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site: Frontier Renewable Resources
Applicant/Owner: Mascoma/JM Longyear
Investigator: LDK, PK

Date: 6/3/2009
County: Chippewa
State: MI

Do Normal Circumstances exist on the site? [✓ Yes] No
Is the site significantly disturbed (Atypical Situation)? Yes [✓ No]
Is the area a potential Problem Area? Yes [✓ No]
(If needed, explain on reverse.)

Community ID: Wetland 3
Transect ID: 9
Plot ID: Plot 9F UP

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
1. *Pteridium aquilinum*	HB 15%	FACU	9.		
2. *Trientalis borealis*	HB 20%	FAC+	10.		
3. *Maianthemum canadense*	HB 15%	FAC	11.		
4. *Populus tremuloides*	SH 10%	FAC	12.		
5. *Abies balsamea*	TR 5%	FACW	13.		
6. *Quercus rubra*	TR 20%	FACU	14.		
7. *Acer rubrum*	TR 20%	FAC	15.		
8. *Betula alleghaniensis*	SH 15%	FAC	16.		

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-) 66 %

Remarks: Plot located south of wetland 3.

HYDROLOGY

___ Recorded Data (Describe in Remarks):
  __ Stream, Lake or Tide Gauge
  __ Aerial Photographs
  __ Other
___ No Recorded Data Available

Field Observations:

Depth of Surface Water none in.

Depth to Free Water in Pit: 0 in.

Depth to Saturated Soil: 0 in.

Wetland Hydrology Indicators:
Primary Indicators:
____ Inundated
____ Saturated in Upper 12 inches
____ Water Marks
____ Drift Lines
____ Sediment Deposits
____ Drainage Patterns in Wetlands
Secondary Indicators (2 or more required):
____ Oxidized Root Channels in Upper 12 inches
____ Water -Stained Leaves
____ Local Soil Survey Data
____ FAC-Neutral Test
____ Other (Explain in Remarks)

Remarks: Soil is composed mostly of dry sand.

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

SOILS

Map Unit Name
(Series and Phase): Croswell-Au Gres sands, 0 to 3 percent slopes

Drainage Class: Moderately well drained

Field Observations
Confirm Mapped Type? Yes [✓ No]

Taxonomy (Subgroup): Typic Endoaquods/
Oxyaquic Haplorthods

Profile Description:

Depth (Inches)	Horizon	Matrix Color Munsell Moist	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0-4	1	7.5YR 3/1			loamy organics
4-16	2	7.5YR 4/2			sand

Hydric Soils Indicators:

☐ Histosol
☐ Histic Epipedon
☐ Sulfidic Odor
☐ Aquic Moisture Regime
☐ Reducing Conditions
☐ Gleyed or Low-Chroma Colors

☐ Concretions
☐ High Organic Content in Surface Layer in Sandy Soils
☐ Organic Streaking in Sandy Soils
☐ Listed on Local Hydric Soils List
☐ Listed on National Hydric Soils List
☐ Other (Explain in Remarks)

Remarks: Dry sandy soils.

WETLAND DETERMINATION

Hydrophytic Vegetation Present? [✓ Yes] No (Circle)
Wetland Hydrology Present? Yes [✓ No]
Hydric Soils Present? Yes [✓ No] Unknown

Is this Sampling Point within a Wetland? (Circle) Yes [✓ No]

Remarks: Plot located in dry, sandy upland area with rolling terrain.

Approved by HOUSACE 3/92
WSJ2-X

PH-1 – Facing Northeast

PH-2 – Facing Southwest

PH-3 – Facing Southeast

PH-4 – Facing West

PH-5 – Facing East

PH-6 – Facing West

PH-7 – Facing South

PH-8 – Facing North

PH-9 – Facing North

PH-10 – Facing South

PH-14 – Facing East

PH-15 – Facing South

PH-16 – Facing Northwest

PH-17 – Facing South

PH-18 – Facing West

PH-19 – Facing East

PH-20 – Facing West

PH-21 – Facing North

PH-22 – Facing East

PH-23 – Facing North

PH-25 – Facing North

PH-26 – Facing West

PH-27 – Facing North

PH-28 – Facing Northwest

PH-29 – Facing North

PH-30 – Facing North

PH-31 – Facing East

PH-32 – Facing South

PH-33 – Facing South

PH-34 – Facing Southeast

PH-35 – Facing West

PH-36 – Facing East

PH-37 – Facing West

PH-38 – Facing South

PH-39 – Facing East

PH-40 – Facing North

PH-41 – Facing Southeast

PH-42 – Facing North

PH-43 – Facing Southwest

PH-44 – Facing East

PH-45 – Facing Southwest

PH-47 – Facing North (B-3)

PH-48 – Facing North (B-7)

PH-49 – Facing Northeast (B-8)

PH-50 – Facing East Northeast (B-14)

PH-51 – Facing North (B-20)

PH-52 – Facing South (B-25)

PH-53 – Facing South (B-28)

PH-54 – Facing Northeast (B-34)

PH-55 – Facing Northeast (B-41)

PH-56 – Facing South (B-47)

PH-57 – Facing Southeast (B-54)

PH-58 – Facing Northwest (B-59)

Plot 6 WET – Facing East

Plot 7 WET – Facing East

Plot 8 WET – Facing West Southwest

Plot 9A WET – Facing Northeast

Plot 9C WET – Facing Southwest

Plot 9E WET – Facing North

Photo Log Summary:

Photo Points 1-19, 22-35 and 38-45 indicate the lack of wetland hydrology, vegetation and soils in their respective areas. These photo points were collected using the transect method of wetland investigation/delineation.

Photo Points 20 and 21 show extensive wetland areas extending north and west past the investigation area.

Photo Points 36 and 37 show extensive wetland areas extending north and west past the investigation area.

Photo Points 47-58 show individual points throughout the flagged boundary (B-#) between wetland and upland areas.

Plot 6 WET - Plot 9E WET show individual plots within wetlands 2 and 3. These wetlands are located in the northwest corner of the site, and are non contiguous with wetlands 1, 4 and 5.

Draft Environmental Assessment and Notice of Wetland Involvement for the Construction and Operation of a Proposed Cellulosic Biorefinery, Mascoma Corporation, Kinross Charter Township, Michigan

DOE/EA 1705

Appendix C – Threatened and Endangered Species Agency

Correspondence

STATE OF MICHIGAN

JENNIFER M. GRANHOLM
GOVERNOR

DEPARTMENT OF NATURAL RESOURCES
LANSING

REBECCA A. HUMPHRIES
DIRECTOR

February 13, 2009

Ms Linda Kersten
AECOM Environment
1050 Wilson St.
Marquette MI 49855

RE: **Proposed Frontier Ethanol Plant**

Dear Ms Linda Kersten:

Thank you for using the Michigan DNR Endangered Species Assessment website. Based on the information you have provided, project activities may proceed. It has been determined that federal and state endangered, threatened, special concern species, exemplary natural plant communities, or unique natural features are **not known to occur** at or near the location specified:

Chippewa County, T45N R01W Section 21.

The location of the request was checked against known localities for rare species and unique natural features, which are recorded in a statewide database. This continuously updated database is a comprehensive source of information on Michigan's endangered, threatened and special concern species, exemplary natural communities and other unique natural features. Records in the database indicate that a qualified observer has documented the presence of special natural features at a site. The absence of records may mean that a site has not been surveyed. Records may not always be up-to-date. In some cases, the only way to obtain a definitive statement on the presence of rare species is to have a competent biologist perform a field survey.

Michigan's endangered and threatened species are protected under Part 365 of the Natural Resources and Environmental Protection Act, Act 451 of the Michigan Public Acts of 1994. Federally listed species are protected under the United States Endangered Species Act of 1973. Special concern species, exemplary natural communities and other unique natural features are not legally protected by state or federal endangered species legislation, but they are considered to be rare and should be protected to prevent future listing.

Thank you for your advance coordination in addressing the protection of Michigan's natural resource heritage. Responses and correspondence can be sent to: Endangered Species Review, Michigan Department of Natural Resources, Wildlife Division - Natural Heritage Program, PO Box 30180, Lansing, MI 48909. If you have further questions, please call 517-373-1263 or e-mail DNR-EndangeredSpecies@michigan.gov.

STEVENS T. MASON BUILDING * P.O. BOX 30028 * LANSING, MICHIGAN 48909-7528
www.michigan.gov * (517)373-2329

STATE OF MICHIGAN

JENNIFER M. GRANHOLM
GOVERNOR

DEPARTMENT OF NATURAL RESOURCES
LANSING

REBECCA A. HUMPHRIES
DIRECTOR

February 13, 2009

Linda Kersten
AECOM Environment
1050 Wilson St.
Marquette MI 49855

RE: **Proposed Frontier Ethanol Plant**

Dear Linda Kersten:

Thank you for using the Michigan DNR Endangered Species Assessment website. Based on the information you have provided, project activities may proceed. It has been determined that federal and state endangered, threatened, special concern species, exemplary natural plant communities, or unique natural features are **not known to occur** at or near the location specified:

Chippewa County, T45N R01W Section 28.

The location of the request was checked against known localities for rare species and unique natural features, which are recorded in a statewide database. This continuously updated database is a comprehensive source of information on Michigan's endangered, threatened and special concern species, exemplary natural communities and other unique natural features. Records in the database indicate that a qualified observer has documented the presence of special natural features at a site. The absence of records may mean that a site has not been surveyed. Records may not always be up-to-date. In some cases, the only way to obtain a definitive statement on the presence of rare species is to have a competent biologist perform a field survey.

Michigan's endangered and threatened species are protected under Part 365 of the Natural Resources and Environmental Protection Act, Act 451 of the Michigan Public Acts of 1994. Federally listed species are protected under the United States Endangered Species Act of 1973. Special concern species, exemplary natural communities and other unique natural features are not legally protected by state or federal endangered species legislation, but they are considered to be rare and should be protected to prevent future listing.

Thank you for your advance coordination in addressing the protection of Michigan's natural resource heritage. Responses and correspondence can be sent to: Endangered Species Review, Michigan Department of Natural Resources, Wildlife Division - Natural Heritage Program, PO Box 30180, Lansing, MI 48909. If you have further questions, please call 517-373-1263 or e-mail DNR-EndangeredSpecies@michigan.gov.

From: Hansen, Linda
Sent: Thursday, April 29, 2010 7:53 AM
To: White, Chris
Cc: Martysz, Ivan
Subject: FW: Informal ESA Section 7 Consultation - Frontier Railroad Spur Project

Hello Chris-

Please see the e-mail below which provides Section 7 Concurrence with our findings for T&E species in Chippewa County, MI (for the Frontier Rail Spur).
As you can see:

- They concurred that suitable habitat was not present for several species
- They concurred that effects on Gray Wolf & Canada Lynx would be discountable/insignificant
- They mention that the Bald Eagle is no longer federally protected under the endangered species act, but remains protected under 2 other acts. We understand that no further action is currently required for Bald Eagle, unless a nest is encountered on site during construction. In which case, measures must be taken to prevent impacts where possible, or get a permit for an incidental take.

We have filed the response below for record keeping purposes.

Thanks,

Linda D. Hansen, P.E.
Project Engineer
Environment
D 906.231.7130
linda.hansen@aecom.com

AECOM
1050 Wilson St.
Marquette, MI 49855
T: 906.228.2333 F: 906.226.8371
www.aecom.com

-----Original Message-----
From: Tameka_Dandridge@fws.gov [mailto:Tameka_Dandridge@fws.gov]
Sent: Wednesday, April 28, 2010 2:51 PM
To: Hansen, Linda
Subject: Informal ESA Section 7 Consultation - Frontier Railroad Spur Project

Ms. Linda D. Hansen
AECOM

Re: Informal Section 7 Consultation for the Frontier Railroad Spur Project:
Project #60140061, Kinchleloe, Kinross Township, Michigan

Dear Ms. Hansen:

We are responding to your April 6, 2010 letter requesting consultation under the section 7 of the Endangered Species Act of 1973, as amended (Act). Under this U.S. Department of Energy funded project, AECOM, a consultant for Frontier, is serving as a non-federal representative for purposes of the Act.

Frontier proposes to construct a railroad spur off an existing rail line that will extend 2.69 miles and will ultimately connect with the proposed Frontier Cellulosic Ethanol facility. In your endangered species effects analyses you described the action area as being composed of a mixture of open swamp, tamarack bog, wet meadows, deciduous forested wetlands, and maple-oak upland forests.

Your analyses addressed potential effects on the endangered gray wolf (Canis lupus), Kirtland's warbler (Dendroica kirtlandii), and piping plover (Charadrius melodus), and threatened Canada lynx (Lynx canadensis), American Hart's tongue fern (Asplenium scolopendrium var. americanum), dwarf lake iris (Iris lacustris), Houghton's goldenrod (Solidago houghtonii), and Pitcher's thistle (Cirsium pitcheri). You further concluded that suitable habitat was not present for Kirtland's warbler, piping plover, American Hart's tongue fern, dwarf lake iris, Houghton's goldenrod, and Pitcher's thistle and determined that this project will have no effect on these species.

Gray wolf

Gray wolves are present throughout the Upper Peninsula of Michigan and may be present near the action areas. We concur that the proposed action is not likely to adversely affect the gray wolf.

> Wolves could be disturbed as a result of noise and activities associated with the railroad spur construction and its operation. We expect that the wolves will respond to this increased disturbance by simply avoiding the project site while construction activities and operations are ongoing.
> Only a small area of land will be impacted by these projects when compared to the total area available for wolf foraging and breeding activities.
> Wolf prey availability or populations are unlikely to be affected by the project.

Based on this information, we expect any potential effects from this project on gray wolf to be insignificant.

Canada lynx

Currently, the best available information, including historic records and recent surveys, indicates that Canada lynx in the Upper Peninsula, if present, are likely limited to a small number of dispersing individuals. Based on the following information, we concur that the proposed action is not likely to adversely affect the lynx.

> The construction activities and operation of the railroad spur could directly disturb lynx that are within or adjacent to the action area. However, as previously discussed, lynx are extremely unlikely to be exposed to project activities because they are present in such low numbers, if at all, in the action area.
> If lynx were in the area, the construction will impact only a small

area when compared to the surrounding landscape. We expect Canada lynx, if in the area, to utilize other undisturbed areas.

Based on this information, we expect any potential effects from this project on Canada lynx would be discountable or insignificant.

Please note that bald eagles (Haliaeetus leucocephalus) could nest near the action area, provided suitable habitat is available. Although no longer federally listed under the Act, bald eagles, along with their foraging and winter roosting habitat, remain protected pursuant to the Bald and Golden Eagle Protection Act (BGEPA) and Migratory Bird Treaty Act (MBTA). Disturbance of these birds should be minimized and any resulting take must be permitted by the U.S. Fish and Wildlife Service (Service). The National Bald Eagle Management Guidelines offer guidance on minimizing any disturbance that may be caused by project activities near eagle nests.

Limited permits to disturb nesting eagles and, in some cases, remove nest trees are available from the Service. Applicants must meet the permit requirements as specified in the BGEPA and the resulting disturbance or take must be compatible with the ongoing preservation of the species, as determined by the Service. For more information on eagle protections, permit requirements, and to view the Bald Eagle Management Guidelines, please visit http://www.fws.gov/migratorybirds/baldeagle.htm. For technical assistance with assessing your project's impacts on bald eagles or applying for a permit, please contact Matt Stuber at 517-351-8469.

We appreciate the opportunity to cooperate with you in conserving endangered species. If you have any questions regarding these comments, please contact me at the below telephone number or email.

Sincerely,
Tameka Dandridge

****
Tameka Dandridge
U.S. Fish & Wildlife Service
East Lansing Field Office
2651 Coolidge Rd., Suite 101
East Lansing, MI 48823
517-351-8315
tameka_dandridge@fws.gov

Draft Environmental Assessment and Notice of Wetland Involvement for the Construction and Operation of a Proposed Cellulosic Biorefinery, Mascoma Corporation, Kinross Charter Township, Michigan

DOE/EA 1705

Appendix D - Phase I Archaeological Investigation, Frontier Renewable Resources, Kinross Charter Township, Chippewa County, Michigan, AECOM October 2010

Department of Energy
Golden Field Office
1617 Cole Boulevard
Golden, Colorado 80401-3393

July 21, 2010

Mr. Brian Grennell
Cultural Resource Protection Specialist
Michigan State Historic Preservation Office
P.O. Box 30740
Lansing, Michigan 48909-8240

Dear Mr. Grennell,

The U. S. Department of Energy is proposing to provide Federal funding to Mascoma Corporation for the final design, construction, and operation of a cellulose-to-ethanol biorefinery near the City of Kinross, Michigan in Chippewa County. Frontier Renewable Resources, LLC, a joint venture between Mascoma Corporation and J.M. Longyear, LLC, would develop and operate the proposed facility. The proposed facility is intended to further the government's goal of rendering cellulosic ethanol cost-competitive with corn ethanol by 2012.

The proposed biorefinery would utilize approximately 1,440 bone-dry tons per day of hardwood pulpwood to eventually produce up to 40 million gallons per year of anhyrdrous ethanol. Co-products, such as the lignin and spent cullose from the process, would either be sold or used to produce steam and electricity in a biomass boiler. Feedstock would consist of hardwood pulpwood within the Michigan counties with a 150-mile radius of the site.

The proposed project site comprises a 355 acre plot of land in Kinross Township of Chippewa County, Michigan, Township 45 North, Range 01 West, Sections 21 and 28. It lies approximately one-half mile northeast of Kinross. The attached Site Location Map (Exhibit 1) provides an overview of the general property and access to area roads. Frontier plans to construct the plant on approximately 50 acres located within the southern 160 acres.

The proposed site is adjacent to the former Kincheloe U.S. Air Force base in Kinross. The site is predominantly wooded with no existing structures and limited unpaved trails. A snowmobile trail runs along the west boundary of the property and cross a small portion of the northwest corner. Exhibit 2 presents the Site layout.

The expected Area of Potential Effects would be the 160 acre project site plus the rail corridor from the site to the existing rail line (Exhibit 3). The National Register of Historic Places (NRHP) lists 31 resources in Chippewa County, Michigan, mostly in Sault Saint Marie. DOE concludes that there are no known historic properties within the proposed project's Area of Potential Effects. The nearest listed site on the NRHP is the Kinross Township Hall and School, approximately two miles east of the proposed Frontier site.

In compliance with 36 CFR Part 800.4(d) (1), the Department of Energy asks the Michigan State Historic Preservation Office for its concurrence of this finding. Attached to facilitate your review is the requisite Michigan State Historic Preservation Office Section 106 Project Review Form.

DOE's Golden Office is preparing a draft environmental assessment (EA) for this project. DOE will include correspondence with your office in an appendix to the EA. The draft EA will be posted in the DOE Golden Field Office online reading room: http://www.eere.energy.gov/golden/reading room.aspx. DOE will send a Notice of Availability for the draft EA, when available, to your office and respond to any specific comments you may have. . Please contact DOE if you would like to receive a hardcopy of the draft EA. At this time we anticipate a 15-day public comment period for this proposed project.

Please forward the results of your review and any requests for additional information to me at the following address:

Ms. Kristin Kerwin
U.S. Department of Energy
Golden Field Office
1617 Cole Boulevard
Golden, Colorado
Email: kristin.kerwin@go.doe.gov
Phone: 303-275-4968

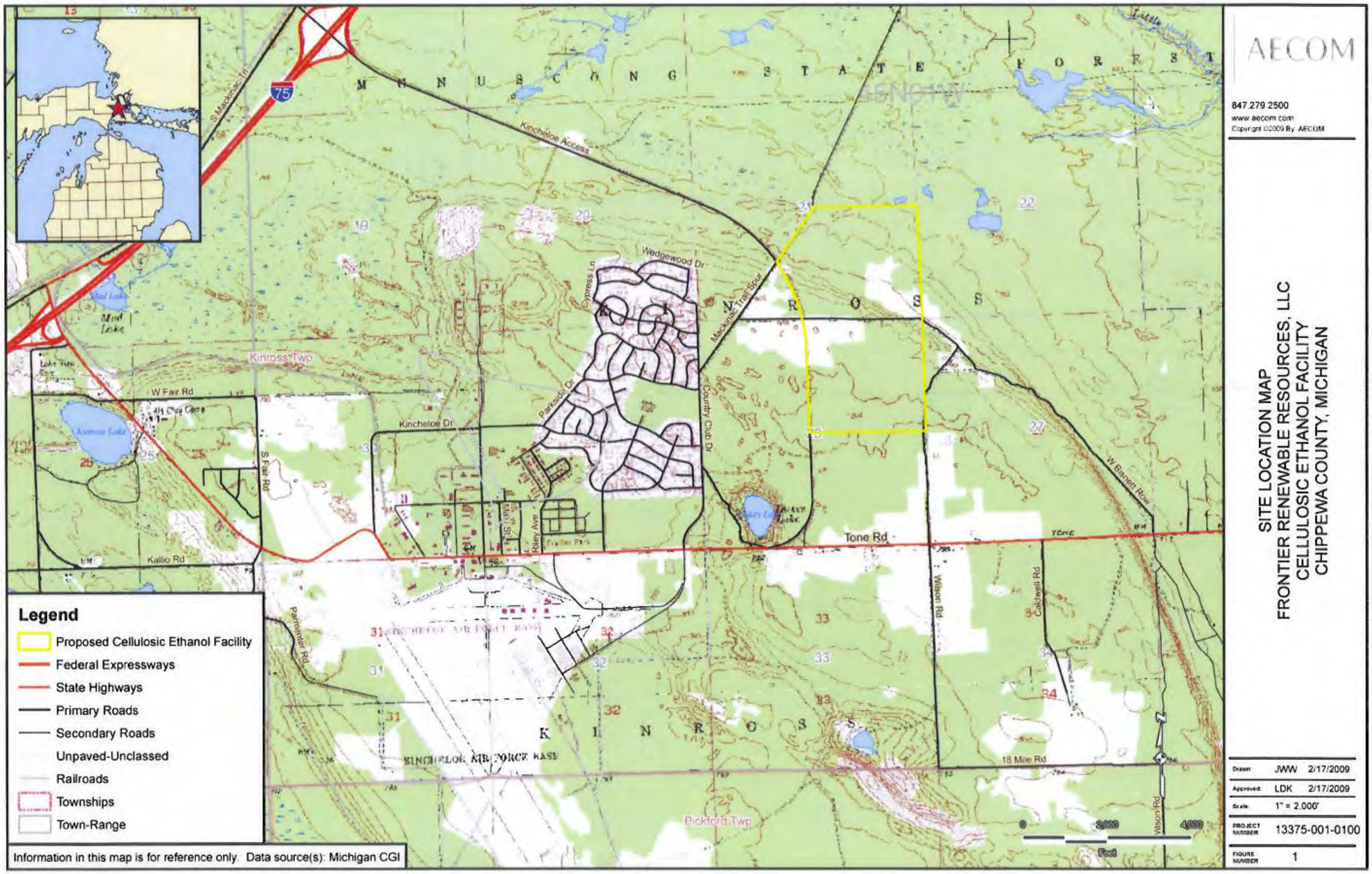
Thank you in advance for your consideration.

Sincerely,

Kristin Kerwin

Kristin Kerwin
NEPA Compliance Officer

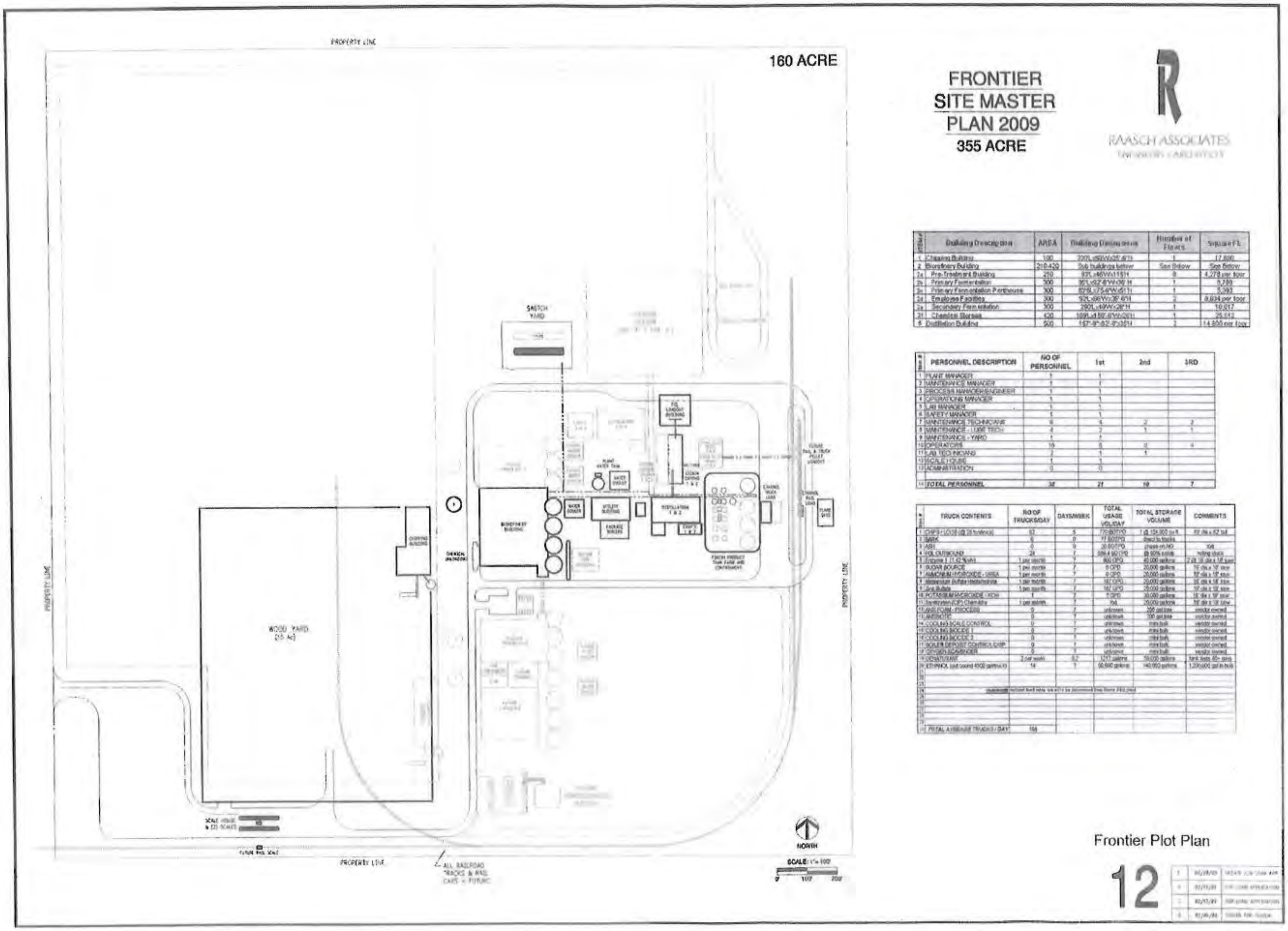
Attachments
Exhibit 1 – Site location map
Exhibit 2 – Site layout plan
Exhibit 3 – Proposed rail corridor
Michigan State Historic Preservation Office Section 106 Project Review Form



Source: AECOM. Site Location Map

1 Mascoma Location

Exhibit 1. Proposed project location.



FRONTIER
SITE MASTER
PLAN 2009
355 ACRE

RAASCH ASSOCIATES

ITEM #	Building Description	AREA	Building Dimensions	Number of Floors	Square Ft.
1	Chipping Building	100	220'L x 80'W x 25'-6"H	1	17,600
2	Biorefinery Building	210-420	Sub buildings below	See Below	See Below
2a	Pre-Treatment Building	210	93'L x 46'W x 115'H	8	4,278 per floor
2b	Primary Fermentation	300	95'L x 92'-6"W x 36'H	1	8,789
2c	Primary Fermentation Penthouse	300	70'8"L x 75'-6"W x 51'H	1	5,393
2d	Employee Facilities	300	92'L x 96'W x 36'-6"H	2	8,834 per floor
2e	Secondary Fermentation	300	290'L x 49'W x 28'H	1	10,017
2f	Chemical Storage	420	189'L x 135'-6"W x 20'H	1	25,612
4	Distillation Building	500	157'-9" x 92'-9" x 35'H	2	14,600 per floor

Item #	PERSONNEL DESCRIPTION	NO OF PERSONNEL	1st	2nd	3RD
1	PLANT MANAGER	1	1		
2	MAINTENANCE MANAGER	1	1		
3	PROCESS MANAGER/ENGINEER	1	1		
4	OPERATIONS MANAGER	1	1		
5	LAB MANAGER	1	1		
6	SAFETY MANAGER	1	1		
7	MAINTENANCE TECHNICIANS	8	4	2	2
8	MAINTENANCE - LUBE TECH	4	2	1	1
9	MAINTENANCE - YARD	1	1		
10	OPERATORS	16	6	6	4
11	LAB TECHNICIANS	2	1	1	
12	SCALE HOUSE	1	1		
13	ADMINISTRATION	0	0		
14	TOTAL PERSONNEL	38	21	10	7

Source: Raasch Associates, Frontier Site Master Plan 2009

2 Mascoma Site Plan

Exhibit 2. Proposed site plan.

Source: AECOM

3 Mascoma Rail

Exhibit 3. Proposed rail corridor.

STATE OF MICHIGAN
MICHIGAN STATE HOUSING DEVELOPMENT AUTHORITY
LANSING

JENNIFER GRANHOLM
GOVERNOR

GARY HEIDEL
EXECUTIVE DIRECTOR

November 3, 2010

RECEIVED NOV 0 5 2010

KRISTIN KERWIN
U S DEPARTMENT OF ENERGY
1617 COLE BOULEVARD
GOLDEN CO 80401

RE: ER-10-734 Frontier Renewable Resources Cellulose to Ethanol Biorefinery Project, Sections 19-21, 29 & 30, T45N, R1W, Kinross Charter Township, Chippewa County. (DOE)

Dear Ms. Kerwin:

Under the authority of Section 106 of the National Historic Preservation Act of 1966, as amended, we have reviewed the above-cited undertaking at the location noted above. Based on the information provided for our review, it is the opinion of the State Historic Preservation Officer (SHPO) that **no historic properties are affected** within the area of potential effects of this undertaking.

The views of the public are essential to informed decision making in the Section 106 process. Federal Agency Officials or their delegated authorities must plan to involve the public in a manner that reflects the nature and complexity of the undertaking, its effects on historic properties and other provisions per 36 CFR § 800.2(d). We remind you that Federal Agency Officials or their delegated authorities are required to consult with the appropriate Indian tribe and/or Tribal Historic Preservation Officer (THPO) when the undertaking may occur on or affect any historic properties on tribal lands. **In all cases**, whether the project occurs on tribal lands or not, Federal Agency Officials or their delegated authorities are also required to make a reasonable and good faith effort to identify any Indian tribes or Native Hawaiian organizations that might attach religious and cultural significance to historic properties in the area of potential effects and invite them to be consulting parties per 36 CFR § 800.2(c-f).

This letter evidences DOE's compliance with 36 CFR § 800.4 "Identification of historic properties", and the fulfillment of DOE's responsibility to notify the SHPO, as a consulting party in the Section 106 process, under 36 CFR § 800.4(d)(1) "No historic properties affected".

The State Historic Preservation Office is not the office of record for this undertaking. You are therefore asked to maintain a copy of this letter with your environmental review record for this undertaking. If the scope of work changes in any way, or if artifacts or bones are discovered, please notify this office immediately.

If you have any questions, please contact Brian Grennell, Cultural Resource Protection Specialist, at (517) 335-2721 or by email at ER@michigan.gov. **Please reference our project number in all communication with this office regarding this undertaking.** Thank you for this opportunity to review and comment, and for your cooperation.

Sincerely,

Martha MacFarlane Faes
Deputy State Historic Preservation Officer

for Brian D. Conway
State Historic Preservation Officer

MMF:DLA:nhn

Copy: Amy Ollendorf, AECOM Technical Services, Inc.

STATE HISTORIC PRESERVATION OFFICE
702 WEST KALAMAZOO STREET • P.O. BOX 30740 • LANSING, MICHIGAN 48909-8240
www.michigan.gov/shpo (517) 373-1630 FAX (517) 335 0348

Environment

Submitted to:
Frontier Renewable Resources LLC
Marquette, Michigan

Submitted by:
AECOM
Minneapolis, Minnesota
60140061
October 2010

Phase I Archaeological Investigation
Frontier Renewable Resources
Kinross Charter Township, Chippewa County, Michigan

Environment

Submitted to:
Frontier Renewable Resources LLC
Marquette, Michigan

Submitted by:
AECOM
Minneapolis, MN
60140061
October 12, 2010

Phase I Archaeological Investigation
Frontier Renewable Resources
Kinross Charter Township, Chippewa County, Michigan

Amy L. Ollendorf, Ph.D., P.G., R.P.A. and Michael M. Gregory, Ph.D.
Prepared By

Christopher White
Reviewed By

Contents

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List of Acronyms

aka	also known as
AECOM	AECOM Technical Services, Inc.
APE	Area of Potential Effect
cmbgs	centimeters below ground surface
CCC	Civilian Conservation Corps
DNRE	Michigan Department of Natural Resources & Environment
DOE	U.S. Department of Energy
EA	Environmental Assessment
ESA	Environmental Site Assessment
Frontier	Frontier Renewable Resources LLC
GIS	Geographic Information System
GLO	U.S. General Land Office
GPS	Global Positioning System
HIG	Historical Information Gatherers, Inc.
HIS	Hopewell Interaction Sphere
HPA	High-Probability Area
LPA	Low-Probability Area
MPA	Moderate-Probability Area
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NRCS	Natural Resource Conservation Service
NRHP	National Register of Historic Places
OSA	Office of the State Archaeologist
SHPO	State Historic Preservation Office

UP	Upper Peninsula of Michigan
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USFS	U.S. Forest Service

Executive Summary

AECOM Technical Services, Inc. (AECOM) was retained by Frontier Renewable Resources LLC (Frontier) to perform a Phase I archaeological survey for a proposed pulpwood-to-ethanol biorefinery in Kinross Township, Chippewa County, Michigan. The project area is comprised of a 355-acre parcel in sections 21 and 28, Township 45 North, Range 1 West in addition to an approximately 2.5-mile-long new railroad spur that will extend from the northern part of the 355-acre parcel in Section 21, west-east across Section 20, southwesterly through the southeast quarter of Section 19, and terminating at the existing railroad in the north half of the northwest quarter of Section 30.

Partial funding for the proposed biorefinery will be provided by the U.S. Department of Energy (DOE); AECOM is preparing an Environmental Assessment (EA) under separate cover for compliance with the National Environmental Policy Act of 1970. This Phase I archaeological survey was conducted on behalf of Frontier in support of the EA as well as for compliance with Section 106 of the National Historic Preservation Act (NHPA) of 1966, as amended. The DOE is responsible for government-to-government consultation with federally recognized American Indian tribes and stakeholder involvement. Mitigation of impacts to wetlands, if any, during project construction will be subject to the terms of a Section 404 permit applied for by Frontier under separate cover to the U.S. Army Corps of Engineers (USACE), Detroit District in compliance with the Clean Water Act of 1977.

The biorefinery is proposed to occupy approximately 80 acres in the south half of the northeast quarter of Section 28. The proposed width of the railroad spur's right-of-way (ROW) is 60 feet Some cutting and filling will be required on the rail spur and project site to establish final grades. The APE consists of wooded and marshy, undeveloped lands. The State Historic Preservation Office (SHPO) concurred with the DOE's definition of the Area of Potential Effects (APE) as the 160 acres in the northeast quarter of Section 28 and the 2.5-mile-long railroad spur ROW.

The only cultural resources observed during the 3.5-day-long Phase I archaeological survey was a small surface scatter of miscellaneous transportation-related debris, such as modern oil filters. AECOM excavated a total of 73 shovel tests across the MPA comprising almost the entire Lower 160 and the high- and moderate-probability areas comprising the West End. No cultural resources were encountered in any of the shovel tests. Because AECOM's Phase I archaeological field survey provided adequate coverage of high- and moderate-probability areas in the APE with unanimously negative findings for cultural resources, no further archaeological survey is recommended for the APE, including the three (3) remaining high-probability areas and two (2) moderate-probability areas in the proposed railroad spur on state-owned lands. Consequently, AECOM recommends a finding of "No Historic Properties Affected" and the proposed Frontier Renewable Resources biorefinery project should be allowed to proceed with no further archaeological field work.

1.0 Introduction

AECOM Technical Services, Inc. (AECOM) was retained by Frontier Renewable Resources LLC (Frontier) to perform a Phase I archaeological survey for a proposed pulpwood-to-ethanol biorefinery in Kinross Township, Chippewa County, Michigan. The project area is comprised of a 355-acre parcel in sections 21 and 28, Township 45 North, Range 1 West in addition to an approximately 2.5-mile-long new railroad spur that will extend from the northern part of the 355-acre parcel in Section 21, west-east across Section 20, southwesterly through the southeast quarter of Section 19, and terminating at the existing railroad in the north half of the northwest quarter of Section 30 (**Figure 1**).

Partial funding for the proposed biorefinery will be provided by the U.S. Department of Energy (DOE); AECOM is preparing an Environmental Assessment (EA) under separate cover for compliance with the National Environmental Policy Act of 1970. This Phase I archaeological survey was conducted on behalf of Frontier in support of the EA as well as for compliance with Section 106 of the National Historic Preservation Act (NHPA) of 1966, as amended. The DOE is responsible for government-to-government consultation with federally recognized American Indian tribes and stakeholder involvement. Mitigation of impacts to wetlands, if any, during project construction will be subject to the terms of a Section 404 permit applied for by Frontier under separate cover to the U.S. Army Corps of Engineers (USACE), Detroit District in compliance with the Clean Water Act of 1977.

The biorefinery is proposed to occupy approximately 80 acres in the south half of the northeast quarter of Section 28. The proposed width of the railroad spur's right-of-way (ROW) is 60 feet Some cutting and filling will be required on the rail spur and project site to establish final grades. The APE consists of wooded and marshy, undeveloped lands. The State Historic Preservation Office (SHPO) concurred with the DOE's definition of the Area of Potential Effects (APE) as the 160 acres in the northeast quarter of Section 28 and the 2.5-mile-long railroad spur ROW.

Land-ownership of the project area is divided among the State of Michigan, Kinross Charter Township, and Frontier (**Figure 2**). The Department of Natural Resources & Environment (DNRE) has jurisdiction over state-owned lands in the project area – portions of the proposed railroad spur. Kinross Charter Township owns the majority of the remainder of lands proposed for the railroad spur, but Frontier owns the land that will be utilized over a short segment at the western terminus of the spur and the land where the ethanol facility will be constructed. No federal or tribal lands comprise the project area. However, two consent decrees were issued by the U.S. District Court, Western District of Michigan, Southern Division to resolve legal claims of five federally recognized American Indian tribes against the State of Michigan in regard to access and management of lands and waters ceded to the U.S. in the 1836 *Treaty with the Ottawa, Etc.* The 2007 *Inland Consent Decree* and 2000 *Fishing Consent Decree* pertain to ceded lands and waters, respectively. Under the terms of these consent decrees, the DNRE coordinates with federally recognized tribes for access to lands and waters under the state's jurisdiction (i.e., DNRE and Kinross Charter Township lands and waterbodies in the APE.

AECOM completed background research and records review at the Office of the State Archaeologist (OSA) in Lansing, Michigan on August 25, 2010 and September 8, 2010. OSA research was completed

by Mr. Craig Simon of AECOM's Lansing office. Field work was completed on non-state-owned lands in sections 28 and 30 on September 20-23, 2010 while a DNRE *Permit to Perform Archaeological Exploration on State-Owned Lands* was pending. Field crew consisted of Mr. Dan Surface, Ms. Hilary Powell, Dr. Michael Gregory, and Dr. Ollendorf.

2.0 Environmental History

2.1.1 Geology

The Upper Peninsula (UP) of Michigan is bordered by three of the Great Lakes – Superior, Michigan, and Huron. The UP is located in the Interior Plains Physiographic Division of the Central Lowland Province, Eastern Lake Section, and Laurentian Physiographic Division of the Superior Upland Province (Jerome 2006). Elevations throughout the UP range from approximately 600 feet along the Great Lakes to 1,900 feet inland (Jerome 2006).

Interior Plains Physiographic Division

The Interior Plains originally formed when cratons collided and welded together 1.8–1.9 billion years ago during the Paleoproterozoic Era (2.5-1.0 billion years ago). Approximately 1.1 billion years ago, the plates again began to stir with a hot spot under what is now western Lake Superior, forcing the continental crust to split. The Midcontinent Rift formed and enormous quantities of basaltic lava spilled onto the surface. The rifting never fully pulled the continent apart and by the late Middle Proterozoic, about 1.0 billion years ago, the tectonism of the Lake Superior area halted, never to resume (Ottke 1999). Precambrian metamorphic and igneous rocks now form the basement of the Interior Plains and make up the stable nucleus of North America. Except for the Black Hills of South Dakota, the entire region has low relief, reflecting more than 500 million years of relative tectonic stability.

The Interior Plains were often covered by shallow inland seas. Sediments from the Canadian Shield and the Rocky Mountains were deposited in these seas over millions of years. Eventually the sediments were compressed by the weight of the layers above into sedimentary rock formations. Part of the sedimentary rock deposited in these areas consists of coral reefs that formed close to the surface of seas during the Paleozoic era.

Throughout the Paleozoic Era and subsequent Mesozoic Era, the mostly low-lying Interior Plains region remained relatively unaffected by the mountain-building tectonic collisions occurring on the western and eastern margins of the continent. During much of the Mesozoic, the North American continental interior was mostly well above sea level, with two major exceptions. During part of the Jurassic period, rising seas flooded the low-lying areas of the continent; in the Cretaceous period, much of the Interior Plains region lay submerged beneath the Western Interior Seaway.

The Interior Plains continued to receive deposits from the eroding Rocky Mountains to the west and Appalachian and Ozark/Ouachita Mountains to the east and south throughout the era. The flatness of the Interior Plains is a reflection of the platform of mostly flat-lying marine and stream deposits laid down in the Mesozoic and Cenozoic eras.

Laurentian Physiographic Division

This physiographic area is the oldest portion of the North American continent, the backbone so to speak. It is made up primarily of ancient Precambrian igneous, metamorphic, and sedimentary rock. With the exception of the river valleys and lacustrine basins, it is a rolling to mountainous peneplain that ranges from 800 feet to 1400 feet above sea level.

2.1.2 Landforms

Landforms in the UP are a product of glaciers that occupied the region during the last Ice Age (Pleistocene Epoch). During the Wisconsinan glacial stage, the entire UP was covered with a thick ice sheet that carried glacial drift. The variety of landforms visible on today's ground surface is the result of massive deposition of glacial drift as the ice sheet melted and receded northward. Approximately 9500 to 11,000, Glacial Lake Algonquin covered a large portion of the UP, including most of the eastern half of the UP (Jerome 2006). Numerous areas of sandy or clayey lacustrine deposits are sediments from this glacial lake (i.e., glaciolacustrine deposits). Some of the deposits were covered later by outwash from the melting glacier to the north (i.e., glaciofluvial deposits). Glacial Lake Nippising was the last lake stage to occupy the UP from 4,000 to 6,000 years ago (Jerome 2006). Its shoreline is the closest to the present Great Lakes - the easily recognized ridge or bluff near the present-day beach in many areas.

The landforms in the present APE are Outwash Plain and Lake Plain (Farrand and Bell 1982). According to Jerome (2006:24), the Outwash Plain is extensive and consists of sandy glaciofluvial materials, such as "sand and gravel in well-stratified layers." Soil series associated with the Outwash Plain that occur in the present APE are Kalkaska and Rubicon (see below). The Lake Plain is nearly level and occurs in areas that had been covered by Glacial Lake Algonquin. "In Chippewa and Mackinac counties it consists of well-sorted, fine-textured, stratified [glaciolacustrine] deposits" (Jerome 2006:24).

2.1.3 Flora and Fauna

In the past, the range of available faunal and floral resources associated with the eastern portion of Michigan's Upper Peninsula depended in large part upon prevailing climatic conditions, which at times have experienced significant changes during the past 10,000 years. Beginning approximately 13,000 years before present (B.P.), the climate began to warm as glaciers retreated, and conifers, together with megafauna such as mammoth, dominated much of the upper Midwest's landscape. The Eastern Upper Peninsula Ecoregion was glaciolacustrine-influenced (see above) and remains relatively flat today (Albert 1995).

During the following 2,000 years, the region continued to experience a warming trend that resulted in spruce showing a sharp decline in dominance in the Lower Peninsula where pines and a few hardwoods began to appear by 11,000 B.P. This trend would take another 1,200 years to reach northward into the eastern Upper Peninsula, where the spruce period would be ended by 9500 B.P. (Kapp 1999:51), to be replaced by jack and red pines. White pine would arrive in the area by 8300 B.P. and be followed by hemlock by approximately 6400 B.P. and beech by sometime before 3000 B.P. (Kapp 1999:53).

Across the eastern United States, the climate became even warmer and drier beginning circa 9500 B.P. This trend continued through 1500 B.P., having a significant influence on vegetation (Kapp 1999:53), although depending upon the characteristics of a locale's soil, the warmer and drier conditions could have either accentuated or ameliorated shifts in vegetation. In Michigan, the warmer, drier period dates from about 9000 B.P. to at least 2500 B.P., and while these conditions influenced cyclical changes between the more xerophytic oak forests and mesophytic beech-maple-basswood-mixed hardwood forests of southern Lower Michigan, in northern Lower Michigan and the Upper Peninsula, the period, even at its maximum, is not clearly marked in pollen records. In some areas, an increase in white pines appears to mark a period of dryness beginning about 8000 B.P. and lasting until approximately 5000 B.P. (Kapp 1999:55), but the presence of the pines may be attributed to other factors. An increase in pines across the eastern Upper Peninsula during the drier, warmer conditions may have restricted the availability of subsistence resources, and made the area less desirable to inhabit, especially if more abundant resources could be reaped along coastal zones.

Beginning between 3400 to 3000 B.P., a major vegetation shift occurred throughout the Upper Peninsula with northern hardwood forests (birch, hemlock, maple, and other deciduous species together with white pine) expanding into areas where soils accommodated the trees with good drainage but enough clay to retain moisture during droughts. In addition, a rising water table coupled with increased participation encouraged the creation of widespread marsh formation, as well as the creation of extensive, shallow peat deposits (Kapp 1999:57). This shift marks the onset of cooler conditions, which after 3000 B.P., resulted in the creation of a vegetative cover that existed until after the arrival of Euro-Americans, who prior to circa 1800, were primarily in interested in extracting furs. The original northern hardwood forests in the Eastern Upper Peninsula generally supported a greater diversity of conifers than today, providing structural complexity and a diversity of wildlife habitats (Albert 1995). "Smaller areas of fire-dependent ecosystems such as white pine-red pine forest and jack pine barrens also occurred within this ecoregion. The region continues to support a diversity of wetland natural communities including bog, northern fen, northern wet meadow, hardwood-conifer swamp, rich conifer swamp, and extensive areas of muskeg and patterned fen." Reconstruction from GLO survey data indicate the vegetation of the present project area ca. 1800 consisted of beech-sugar maple-hemlock forest, cedar swamp, and hemlock-white pine forest (Comer and Albert 1997). Only later, after the 1840s, did Euro-American settlers really begin to develop the area and subsequently remove much of the historic vegetation through agricultural and commercial activities, especially lumbering. Aerial photos of the project area taken during the late 1930s show an open landscape with some wooded areas, which have since expanded to fill-in the open landscape with secondary growth of oaks, maples, beech, hemlock, and pines (including pine plantations) observed during the current study.

Prior to, but certainly after circa 3,000 B.P., prehistoric and historical peoples found a rich range of floral and faunal subsistence resources available for use in the eastern Upper Peninsula. In season, forests yielded a range of nuts, seeds, tubers, berries, and raw materials to eat or to produce baskets, mats, and other needed material items. In addition, the area offered a range of faunal species consisting of mammals (bear, beaver, muskrat, raccoons, and white-tailed deer), birds (grouse, passenger pigeons, turkey, and various water fowl), aquatic species (whitefish, freshwater mussels, suckers, and turtles), and other animals that could be hunted and fished. Thus within Chippewa County and the proposed bio-fuel plant project tract in particular, prehistoric and historical peoples had the opportunity to exploit a range of floral and faunal resources associated with the regions physical setting.

Today's climate in the UP is influenced by the proximity of the Great Lakes (Jerome 2006). Average annual temperature is 39-43 degrees Fahrenheit. Average daily summer high is 71 degrees Fahrenheit; average daily winter low is19 degrees Fahrenheit. Average annual precipitation is 30-36 inches; average annual snowfall is 56-218 inches, although a lake-effect can result in annual snow of 350 inches. Growing season is 100-150 days (Jerome 2006). About 95% of the UP is forested, with approximately 42% of the forestland in federal or state ownership (Jerome 2006).

2.2 Soils of the APE

The U.S. Department of Agriculture (USDA)-Natural Resource Conservation Service (NRCS) has mapped various soil series throughout the APE. Soils in the APE are Spodosols, Histosols, and Entisols. According to the USDA-NRCS, *Spodosols* are soils in which amorphous mixtures of organic matter and aluminum, with or without iron, have accumulated. In undisturbed soils there is normally an overlying eluvial horizon, generally gray to light gray in color, more or less uncoated quartz. Most Spodosols have little silicate clay. The particle-size class is mostly sandy, sandy-skeletal, coarse-loamy, loamy, loamy- skeletal, or coarse-silty. *Histosols* are soils that are dominantly organic and are commonly called bogs, moors, or peats and mucks. A soil is classified as Histosols if it does not have permafrost and is dominated by organic soil materials. *Entisols* have little or no evidence of development of pedogenic horizons. Many are sandy or very shallow. **Table 1** summarizes the mapped soil series, their locations within the APE and their attributes.

Table 1. Soils of the APE as Mapped by the USDA-NRCS

Series	Class	Order	Description of Typical Pedon	Location in APE
Alcona	Alfic Haplorthods	Spodosol	Typical pedon: Fine sandy loam on 42% in forested area. Very deep, well-drained in stratified sandy & loamy glaciofluvial & glaciolacustrine deposits on lake plains, outwash plains, ground moraines, end moraines & stream terraces. Native vegetation primarily American basswood, American beech, red pine, eastern white pine, sugar maple & yellow birch. Horizons: Oe-E-Bs1-Bs2-Bs3-B/E-E/B-2C.	SE¼ S21
n/a	Aquents	Entisol	n/a	SW¼ S19

Table 1. Soils (continued).

Series	Class	Order	Description of Typical Pedon	Location in APE
Au Gres	Typic Endoaquods	Spodosol	Sand on 1% slope in forested area. very deep, somewhat poorly drained soils formed in sandy glacial drift on stream terraces, outwash plains, lake terraces, lake plains, and ground moraines. Natural forests are northern white cedar, balsam fir, hemlock, yellow birch, paper birch, aspen, and red maple. Horizons: Oe-A-E-Bhs-Bs1-Bs2-BC-C. 2% gravel in Bhs & Bs2. 1% gravel w/common masses of Fe accumulation in BC & C.	SE¼ S21, SW¼ S21
Carbondale	Hemic Haplosaprists	Histosol	Muck on < 1% slope in forested area. Very deep, very poorly drained in organic deposits > 51" thick on ground moraines, outwash plains & lake plains. Forests are mostly northern white cedar, balsam fir, black spruce & white birch. Horizons: Oa1-Oa2-Oa3-Oe.	SE¼ S19
Croswell	Oxyaquic Haplorthods	Spodosol	Sand on 2% slope in wooded area. Very deep, moderately well-drained in sandy glacial drift on stream terraces, lake terraces, low dunes, beach ridges, outwash plains, lake plains & ground moraines. Forests are mixed hardwoods & conifers, including quaking aspen, black cherry, paper birch, bigtooth aspen, red pine, eastern white pine, jack pine, northern red oak & red maple. Horizons: Oe-A-E-Bs1-Bs2-BC-C.	SE¼ S21, SW¼ S21
Dawson	Terric Haplosaprists	Histosol	Peat on 1% slope. Very dep, very poorly drained in herbaceous organic material 16-51" thick overlying sandy deposits in depressions on outwash plains, lake plains, ground moraines, end moraines & floodplains. Black spruce & tamarack trees w/ground cover of bog rosemary, cranberries, laurel, leatherleaf, sphagnum mosses & blueberries. Horizons: Oi-Oa-A-C.	SE¼ S19, C S21

Table 1. Soils (continued).

Series	Class	Order	Description of Typical Pedon	Location in APE
Kalkaska	Typic Haplorthods	Spodosol	Sand on 1% slope in forested area. Very deep, somewhat excessively drained in sandy deposits on outwash plains, valley trains, moraines & stream terraces. Sugar maple, American beech, red pine, quaking aspen, bigtooth aspen & eastern white pine are typical trees. Horizons: Oi-A-E-Bhs-Bs1-Bs2-BC-C. Approx. 5% gravel throughout; ortstein columns in Bs2 & BC.	NE¼ S20, SE¼ S21, NW¼ S30
Kinross	Typic Endoaquods	Spodosol	Muck on nearly level forested area. Very deep, poorly drained-very poorly drained in glaciofluvial material on outwash plains, stream terraces, lake plains, kames, disintegration & ground moraines. Trees are black spruce, tamarack, northern white cedar, balsam fir, red maple & quaking aspen; ground cover includes H2O-tolerant grasses & sedges, leatherleaf, sphagnum & bog rosemary. Horizons: Oa-E-Bhs-Bs-BC-C.	SE¼ S19, SE¼ S21
Loxley	Typic Haplosaprists	Histosol	Mucky peat in forested area. Very deep, poorly drained in herbaceous organic deposits > 51" thick in depressions on moraines, lake plains & outwash plains. Few scattered black spruce, jack pine, quaking aspen & tamarack with blueberry, leatherleaf, sphagnum & wintergreen as ground cover. Horizons: Oe1-Oe2-Oa1-Oa2.	SE¼ S21
Markey	Terric Haplosaprists	Histosol	Muck on 1% slope in bog w/marsh vegetation. Very deep, very poorly drained in herbaceous organic material <40-130 cm thick over sandy deposits in depressions on outwash plains, lake plains, floodplains, river terraces, valley trains & moraines. Forested areas are in black ash, quaking aspen, balsam fir, black spruce, tamarack, northern white cedar & paper birch; some areas in cattails, marsh grasses, reeds & sedges. Horizons: Oa1-Oa2-Oa3-Oa4-Cg.	SE¼ S19

Table 1. Soils (continued).

Series	Class	Order	Description of Typical Pedon	Location in APE
Rousseau	Entic Haplorthods	Spodosol	Fine sand on 6% slope in forested area. Well-drained in sandy Aeolian deposits on dunes, lake plains & outwash plains. Native forests included sugar maple, red maple, balsam fir, white birch, quaking aspen & American beech. Horizons: A-E-Bs1-Bs2-BC-C.	SE¼ S19, C S20, SE¼ S21, NE¼ S28
Rubicon	Entic Haplorthods	Spodosol	Sand on 3% slope in red pine plantation. Very deep, excessively drained soils formed in sandy deposits on disintegration, ground, end and kame moraines, lake plains, outwash plains, stream terraces, beach ridges, and sand dunes. Native & present vegetation is dominantly red pine and quaking aspen with some eastern white pine and jack pine; ground cover is blueberries, wintergreen, sweet fern & bracken fern. Horizons: A-E-Bs1-Bs2-BC-C.	NW¼ S30 along existing RR tracks
n/a	Udorthents	Entisol	n/a	SE¼ S19, NE¼ S 19,
Wainola	Typic Endoaquods	Spodosol	Fine sand in forested area. Deep, somewhat poorly drained in fine sandy glaciofluvial deposits on outwash plains, lake plains & glacial lake deltas. Forests are chiefly quaking aspen, white ash, red maple, northern red oak w/shrubs & grasses. Horizons: Oa-E-Bs1-Bs2-BC-C. Ortstein fragments in Bs1 & Bs2; masses of Fe accumulations throughout BC.	SE¼ S19

3.0 Culture History

Occupation or use of the general region of which the Frontier Bio-energy plant project area is a part spans the prehistoric through historical periods; however, this occupation is known only in general terms and few sites are known from the study tract and its surrounding area. Prehistoric people used the region as evidenced by a number of archaeological sites recorded in Chippewa and surrounding counties, but the greatest number of sites date to the historical period and represent lumber or Civilian Conservation Corps (CCC) camps, homesteads, cemeteries, and other loci where other Euro-American activities occurred. While past research demonstrates that the general region of which the bio-energy plant is a part has been used and occupied during the early prehistoric through historical periods, the lack of recorded sites within the vicinity of the APE prevents one from determining the nature and intensity of the local occupation. As a result of the lack of data and synthesized cultural studies about the area, one is able to discuss the local prehistoric and historical past in general or regional terms only.

3.1 Prehistory

3.1.1 Paleoindian Tradition: 13,400 B.P. to 10,000 B.P.

The earliest inhabitants of Michigan are recognized as nomadic hunters and gatherers, who archaeologists refer to as Paleoindians. This group's subsistence base was heavily slanted toward the exploitation of Pleistocene mega-fauna such as mammoth, mastodon, bison, and caribou. In addition, limited contextual data, combined with ethnographic data about extant hunter-gatherer groups (Cleland 1966:49), suggests that their diet also included significant proportions of native plant foods and a variety of small mammals, reptiles, birds, and fish.

Currently, the Paleoindian period is subdivided into Early and Late stages. The temporal division separating the two is based upon a transition from fluted-to-non-fluted, lanceolate points (Mason 1981:111-112, 1986:192, 1997:98). Frequent indicators of a Paleoindian association with an area are isolated finds of distinctive projectile point styles: Clovis, Folsom, Scotsbluff, Eden, Agate Basin, and several others. While the fluted Clovis and Folsom points define the present of Early Paleoindian inhabitants in many regions of North America, within Michigan, fluted points are further recognized as Enterline, Gainey, Barnes, Crowfield, or Holcombe points based on specific fluting and morphological attributes (Shott and Wright 1999:62-63). Much of what is known about Michigan's Paleoindian tradition is derived from sites reported from the state's lower peninsula (Shott and Wright 1999:63). As a result, archaeologists are not in a position to offer detailed discussions about Upper Peninsula regional subsistence, settlement, or land use practices. While no Paleoindian materials are reported for the immediate area of the proposed bio-fuel plant area, the presence of such materials in the surrounding countryside suggests Paleoindian people were acquainted with the area and its potential resource base. Whether early Native Americans actually traversed the area and utilized its resources remains unknown.

3.1.2 Archaic Tradition: 10,000 B.P. to 2500 B.P.

The Archaic tradition followed that of the Paleoindian and is marked by a subsistence shift oriented toward smaller game and a broader range of plant species. Archaeologically, Archaic sites are

frequently defined by the absence of pottery containers, the presence of burials in natural knolls or flat cemeteries as opposed to man-made mounds, and the recovery of faunal and floral remains representing a more generalized or diversified subsistence base (Stoltman 1986 and 1997). Changes in, or the broadening of the subsistence base is linked to climatic conditions, which became more moderate as glaciers retreated. This shift in resource utilization is frequently reflected in stone tool assemblages, which show a trend toward greater diversity of projectile point/knife styles and an increase in proportions of groundstone, woodworking, and seed and nut processing implements. In addition, more emphasis is placed on fishing and the harvesting of riverine shellfish. Finally, copper objects become more common. To facilitate discussion of these changes and the tradition in general, the Archaic tradition is often divided into three stages: Early (10,000 B.P.-8000 B.P.), Middle (8000 B.P.-5000 B.P.), and Late (5000 B.P.-2500 B.P.). These stages are defined primarily on changing projectile point/knife styles.

Settlement patterns associated with an Archaic tradition people exploiting a specific region resulted from mobility strategies coupled with paleo-environmental and demographic conditions. Across Michigan, Archaic peoples moved through the landscape pursuing residential or logistical mobility strategies and created settlement patterns that are currently poorly understood but partially reflected by recorded sites located in open-air settings. Site types consist of isolated finds, base camps, transient camps, faunal and floral resource procurement stations, and processing sites. While the defined site types span the entire tradition, the frequency of each type may have changed in response to shifting mobility strategies linked to evolving natural and social conditions. Through time, these conditions encouraged or discouraged the establishment of certain site types as people adapted to their changing environment.

The Archaic tradition associated with the Upper Peninsula is documented by isolated surface finds and sites dating from the Early through Late sub-traditions. Of the sites, several have been excavated west and south of Chippewa County, and a single isolated find, a copper projectile point, has been reported from the north shore of Chippewa County (Griffin 1972:35). Excavated sites include the Late Paleoindian/Early Archaic Gorto site (Buckmaster and Paquette 1988; Shott 1999:72), and the Late Archaic Popper, Trout Point 1, 20MQ90, 20MQ91, Miner’s Beach, Medore Street Burial, Ottawa North and Alligator Eye sites (Hill 1994:11; Robertson et al. 1999:98-99). Absent from the combined studies is an Upper Peninsula Middle Archaic presence, a sub-tradition that is best known from lower peninsula sites (Lovis 1999:87). The Late Archaic sites indicate that at least during the end of the Archaic tradition, people were utilizing both coastal and interior environments (Robertson et al. 1999:109), and were present in the region during summer and winter seasons (Fitting 1979:111; Hill 1994:48; Robertson et al. 1999:109). The reported copper point dates to the Late Archaic and is associated with the Old Copper Culture, which made extensive use of copper.

While the temporal distribution of sites indicates that the region was utilized by people during the entire Archaic period, the quantity and quality of the data provide few insights about group size, mobility, organization, or social interactions within the region. In summary, Archaic tradition people are known to have occupied and exploited the central and eastern portions of the Upper Peninsula just as Paleoindian groups did, but specific details about the nature and the intensity of the local Archaic occupation awaits further study.

3.1.3 Woodland Tradition: 2800 B.P. to 750-700 B.P.

Adaptations characterizing the Archaic tradition carried into that of the early Woodland, subsequently developing into a variety of behaviors responding to environmental, subsistence, and social conditions. Well defined traits marking the tradition are the presence of ceramics, the construction of earthen mounds for burials, and the cultivation of plants. In addition, during the temporal span of the tradition, population size increased, exotic goods reflecting extensive trade networks became more frequent, and burial customs grew more elaborate. Material culture reflects these changes with new projectile point types, distinctive ceramic forms, greater variety of trade goods, and more decorative elements placed on implements. In spite of these characteristics and innovations, subsistence practices remained rooted for a long period to cycles of hunting and gathering as horticulture became progressively more important and cultigens played a larger role in subsistence strategies. Coupled with this gradual shift toward cultigens came a movement away from seasonal, nomadic settlement patterns as people began to occupy large, semi-permanent villages in addition to seasonal resource procurement camps. Similar to the Archaic tradition, that of the Woodland may be divided into stages designated Early (2500 B.P.-2000 B.P.), Middle (2000 B.P.-1600 B.P.), and Late (1600 B.P.-400 B.P.).

Archaeologically, specific projectile point and ceramic styles often characterize the stages in the absence of radio-carbon dates. Within Michigan, the full temporal spectrum of Woodland tradition sites is present, but site distribution is uneven with segments of the tradition poorly understood in some areas, for example, the Early Woodland in the Upper Peninsula (Garland and Beld 1999:130), due to a lack of excavated sites and published reports. While numerous surface finds of diagnostic projectile point styles have been reported, and sites have been recorded, these data are area specific and cannot be used to synthesize an adequate regional perspective about Woodland subsistence, settlement, or land use practices. While characteristic mounds are present within the state, their number is few, and in the Upper Peninsula, the few mounds that are present are limited to the western portion of the peninsula.

Of the three stages that compose the Woodland tradition, the Middle and Late stages are more frequently represented by sites. As previously stated, Early Woodland stage sites are best known from the Michigan’s lower peninsula, but on the Upper Peninsula, when recognized, are marked by the presence of the oldest regional ceramic type known as Lake Nokomis Trailed and by projectile points that most frequently show contracting- or straight-stemmed forms, although other styles are known. These materials have also been used to define the Early/Middle Woodland transitional phase known as Nokomis (Salzer 1969 and 1974). More abundant and better documented are Middle Woodland sites, which are known from the Straits of Mackinac-Sault Ste. Marie region. These sites include Wycamp Creek, Holtz, Pine River Channel, Gyftakis and McGregor, as well as others reported along the St. Mary’s River and west of Sault Ste. Marie (Fitting 1979:109-110). The sites are predominantly coastal in distribution, and the nature of an interior occupation has yet to be adequately defined.

An apparent increase in Middle Woodland sites over those of stages that preceded or followed it, is attributed to the development of the loose trade and cultural network known at the Hopewell Interaction Sphere (HIS), which dominated much of the lower Ohio and Mississippi River valleys but extended north into Michigan. This network brought exotic goods and ideas to the area, as well as fueled the extraction of certain raw materials such as copper from it. The HIS stylistic influence was strongest during the earliest stages of the Middle Woodland (Fitting 1979:112), and then waned; however, as long as the HIS functioned, the regional extraction and export of copper brought people to the region, where they

created and left archaeological sites. With the decline of the HIS, utilization of the area appears to have declined. As a result, Late Woodland sites appear fewer in number.

Similar to Early and Middle stage sites, those of the Late stage are recognized primarily by distinctive ceramic styles. In order to distinguish Late Woodland sites of the Upper Peninsula and bordering areas from similar stage sites recorded in other parts of the western Great Lakes region, northern sites are further categorized as belonging to a sequence of phases exhibiting unique characteristics not associated with contemporary sites reported from other parts of the greater region. For the eastern portion of the Upper Peninsula, Late Woodland sites are not well understood, but are thought to exhibit characteristics that, during the early and mid-Late stage are related to the “Steiner”, Mackinac-Heins Creek, and Juntunen phases (Brose 1978:570-571; Fitting 1979:112). After circa 650 B.P., the occupation of the eastern portion of the Upper Peninsula appears to decline to the point of being all but abandoned by native peoples (Fitting 1979:112). This observation begins to reverse itself during the 17th century with the arrival of Europeans, who establish trade relations in the region, and begin to draw Native Americans to the area for economic reasons; a situation that may not be dissimilar to what happened during the Middle Woodland with the influence of the Hopewell Interaction Sphere (Fitting 1979:112).

The distribution of Woodland tradition sites across the Upper Peninsula’s eastern half suggests sites from all stages exist in the region. In addition, the sites indicate that Woodland people, as did people of traditions preceding them, knew about the region and the resources it offered, although the nature and intensity of the occupation or use remains poorly understood, especially as to the use of areas away from the coast. With the arrival of Europeans, use of the region by Native Americans was modified, and from the 17th century onward human use of the area is better documented and understood.

3.2 Historical Native American Occupation

At various times during the historical period, the eastern portion of the Upper Peninsula has been occupied or used by the Chippewa, Menominee, Winnebago (Ho-Chunk), Ojibwa, and Potawatomie, although traditionally, it is considered the home territory of the Chippewa and Ojibwa. Other groups may have made incursions into the region from time-to-time, and occasionally two or more groups may have occupied parts of it. Any attempt to understand the 16th- and early 17th-century use of the region by Native Americans is complicated by the likely depopulation of the area due to European introduced diseases and by the migration of eastern groups to the area. After the arrival of Europeans, the fur trade of the 17th and 18th centuries developed and fostered social and economic conditions that dictated the nature of the occupation, as did the shifting regional political claims by French, British, and American interests.

By the mid-19th century, Native American groups had ceded most of their claims to lands in the eastern portion of the Upper Peninsula to the U.S. government and withdrawn westward or settled on reservations. Much of the eastern portion of the Upper Peninsula as well as the northwestern portion of lower Michigan were ceded to the federal government by the 28 March 1836 *Treaty with the Ottawa* and Chippewa Nations of Indians, although the Ottawa and Chippewa reserved some rights to hunt and fish on lands until they were required for settlement. The 31 July 1855 Treaty with the Ottawa and Chippewa made provisions to allow the U.S. government to withdraw public lands not sold or conveyed to private interests, and offered these lands to the Ottawa and Chippewa for their use. Native American rights and access to land have been further expanded or re-enforced by 21st-century decrees upholding

Native Americans hunting and fishing rights on public lands. While historical Native American groups have occupied or used the eastern portion of the Upper Peninsula since the arrival of the first Europeans, in most cases, this history is best known from documentary sources because few published archaeological reports, beyond possible burial site reports, chronicle the presence and activities of historical Native Americans in the region during the 17th through early 20th centuries.

3.3 Euro-American Settlement and Development

Euro-American settlement of the area defined by the eastern portion of the Upper Peninsula occurred as the result of the fur trade, which encouraged well situated commerce/military centers occupied year round. Due to poor agricultural conditions, large scale farming was not widely pursued. Rather, the area was developed or exploited for its natural resources, which first included fur bearing animals, and later lumber. Through time, the French, British, and Americans took an interest in the economic benefits of the fur trade; however, it was only the Americans who attempted to bring order to the land and eventually take advantage of the region’s other natural resources.

The Michigan Territorial Legislature created Chippewa County during 1826, at which time the county—stretching to the Mississippi River--was considerably larger than it is today. The county as established today was created by a legislative act during 1843 (Western Historical Company 1983:209). County lands were formally surveyed by the General Land Office of the U.S. government during 1845, after which, residents and new comers could legally apply for land ownership. As the fur trade waned, commercial interest turned their attention to the forests which they lumbered, thereby further opening the land for agricultural improvement, which, again due to environmental conditions, did not fully develop, although efforts were certainly made to earn a livelihood from agriculture. Historical activity is evident in the vicinity but outside of the APE by sites 20CH0282, the Kinross logging camp, and 20CH0297, CCC Camp Munuscong. Today, the area, including that of the proposed biorefinery, remains in secondary growth, which serves recreational purposes (e.g., all-terrain vehicle trails and hunting grounds) or is being prepared for timbering (e.g., pine plantation in the APE).

4.0 Previous Investigations

The OSA's 2009 listing of *Archaeological Sites Per County* indicates that 385 archaeological sites had been recorded in Chippewa County. Of the 14 counties in the UP, Chippewa County has the 5th-largest number of recorded archaeological sites. Among the three easternmost counties in the UP, Chippewa County ranks a close 2nd place behind Mackinac County (n=404), but Luce County ranks a distant 3rd place with only 42 recorded archaeological sites.

Previous investigations consulted by AECOM were completed for a variety of projects outside of the present APE, some quite a distance away but still in Chippewa County. The previous investigations were conducted for pipeline projects (Dobbs and Nienow 2002; Weir 1981), a telecommunications project (Lillis-Warwick 2009), U.S. Forest Service (USFS) projects (Drake and Dunham 2008); and a National Park Service project (Brantsner 1993). Since none of these investigations were completed in the present APE, these reports were consulted for methodology (assumptions and field procedures) and expected site types and locations for Chippewa County. **Table 2** summarizes information from previous investigations that AECOM applied to the present investigation for a predictive model that illustrated areas of low, moderate, and high probability for prehistoric and historic archaeological sites.

Table 2. Previous Investigators' Definitions of High-Probability Areas, Methods, and Results

Previous Investigator	High-Probability Areas (HPAs)	Methodology	Results
Weir (1981)	Undefined	• Pedestrian survey along parallel transects in 75-foot-wide ROW (transects presumed to be 10 meters apart). • Shovel tests at maximum 20-meter intervals along parallel "transect corridors" within ROW "whenever possible." • Sampling interval of shovel tests varied "according to known or expected cultural resource sensitivity and physiographical conditions or obstacles." • No mention of subsurface testing in low- or moderate-probability areas.	Unknown since Results section of report not scanned/emailed, but presume sites found along 1,017-mile-long ROW.
Brantsner (1993)	• 100 meters of water OR • Along water-related geologic features (e.g., beach ridges).	• Walk-over and shovel-testing strategy coincident with USFS specifications. • Walk-over along transects at 30-meter intervals. • Shovel testing at 15-meter intervals in HPAs. • No mention of subsurface testing in low- or moderate-probability areas.	One newly recorded site.
Dobbs & Nienow (2002)	• Areas with surface evidence of archaeological properties OR • Standing structures OR • Topography or micro-topography of interest within 50 meters of existing water or ancient water features.	• Pedestrian survey to examine ground surface along transects spaced 15 meters apart parallel to pipeline. • Shovel testing at 15-meter intervals within HPAs. • No mention of subsurface testing in low- or moderate-probability areas.	One newly recorded site.
Drake & Dunham (2008)	• Habitable, level, and well-drained surfaces within 300 meters of riparian features and wetland edges. • Identifiable post-Pleistocene terraces, beaches, and strand lines. • Forest clearings and transportation features.	• Pedestrian survey along transects typically placed at 30-meter intervals when "surface visibility is good" (e.g., plowed agricultural field and other exposed areas) and in HPAs. • Parallel transects of 15-meter-interval shovel tests in HPAs. • No mention of subsurface testing in low- or moderate-probability areas.	25 newly recorded sites.

5.0 Methodology

5.1 Background Research

AECOM began the Phase I archaeological investigation with Mr. Craig Simon of AECOM's Lansing, Michigan office conducting background research in the Office of the State Archaeologist (OSA) under the direct supervision of Dr. Barbara Mead, Assistant State Archaeologist and remote supervision of Dr. Amy Ollendorf, AECOM's Principal Investigator for archaeology. AECOM's background research, completed on August 25, 2010 and September 8, 2010, consisted of queries of the archaeological site files and reports databases. Mr. Simon scanned and emailed copies of site files and excerpts from previous investigations to Dr. Ollendorf for use throughout the investigation. AECOM also utilized a series of aerial photographs obtained previously for AECOM's Phase I Environmental Site Assessment (ESA) of the 355-acre parcel – 1939, 1953, 1964, 1982, 1991, and 2006 – as well as a series of aerial photographs obtained from Historical Information Gatherers, Inc. (HIG) for the proposed railroad spur – add dates here. AECOM also utilized historic, including the 1845 U.S. General Land Office (GLO) original plat (obtained at http://www.glorecords.blm.gov) along with the 1930 and 1970 plat maps for Kinross Charter Township (obtained from Chippewa County plat books) as well as 1951 and 1975 USGS 7.5' and 15' topographic maps (Drafter and Sault Sainte Marie quadrangles). Dr. Meade provided further historical information – the *Index of Michigan CCC Camps in the Upper Peninsula* and pages pertaining to the APE from Chippewa County's book of original land patents.

By reviewing the output of the background research, AECOM determined that the APE had not been surveyed previously by professional archaeologists. AECOM identified two previously recorded archaeological sites in the vicinity but outside of the APE. One site 20CH0282 is the "Kinross Camp," the remains of a ca. 1913-1925 logging camp recorded, delineated, and evaluated in the northeast quarter of Section 20 (Brantsner 1993). Site 20CH0282 was determined ineligible for nomination to the National Register of Historic Places (NRHP) by the OSA in 1996. The other known archaeological site, 20CH0297, is the "Munuscong CCC Camp" located in the northwest quarter of Section 33. To-date, this site has not been relocated and evaluated by a professional archaeologist for its NRHP eligibility. Other sites further afield and also outside of the APE pertain to tourism and recreation (20CH0280, "Dodge Brothers Camp") and logging (20CH0424, "SO5;" 20CH0425, "SO6;" and 20CH0426, "SO7").

5.2 Predictive Model

AECOM developed a predictive model from previous archaeological experience in Michigan and elsewhere in the Upper Midwest as well as from the methodological information summarized in Section 4.0 of this report. ESRI's ArcGIS™ was the software suite utilized to create the predictive model from the USGS topographic quadrangle as an active, base-mapping layer (**Figure 3**). The parameters for high-, moderate-, and low-probability areas and extent in the project area are summarized in **Table 3**. It should be noted that no indications of long-term historic occupation appear in the historic records, including aerial photographs and maps, for this particular APE. Therefore, the customized parameters in AECOM's predictive model are necessarily oriented toward prehistoric and protohistoric site-selection preferences.

Table 3. Predictive Model Parameters and Extents of Probability Areas

Probability Area	Parameter	Extent (acres)
High (HPA)	• Slope with 0-10% grade <u>and</u> • <u><</u> 300 meters from existing waterbody (e.g., only wetlands presently).	113.1
Moderate (MPA)	• Slope with 0-10% grade <u>and</u> • <u>></u> 300 meters from existing waterbody.	237.2
Low (LPA)	• Disturbed previously (e.g., gravel or sand pits) <u>or</u> • Existing wetlands or • Slope with grade <u>></u> 10%	28.4

Two parcels in the APE were accessible for AECOM's archaeological field survey in September 2010 – the 160 acres in the northeast quarter of Section 28 (aka the "Lower 160") and the western terminus of the proposed railroad spur (aka the "West End"). Virtually the entire Lower 160 was ranked MPA, except for a narrow sliver in the northeastern-most corner, which was ranked LPA (**Figure 3**). The entire West End was ranked HPA.

5.3 Field Methods

AECOM's field crew conducted pedestrian reconnaissance and shovel testing along parallel transects (**Figure 4** and **Figure 5**) from September 20 through mid-morning of September 23, 2010. Over the 3.5-day timeframe, AECOM excavated a total of 73 shovel tests. Shovel testing was hampered by weather, deep soils, and thick vegetation.

Each shovel test was approximately 0.5-meter in diameter; maximum depths ranged from 40 centimeters below the ground surface (cmbgs) to 93 cmbgs. Abandonment of shovel tests occurred because of negative findings, impenetrable roots, rocks, or concretions (e.g., cementing material of illuviated sesquioxides and organic matter, known as ortstein). All excavated sediment was sieved through portable archaeological screens fitted with ¼-inch hardware mesh; all shovel tests were backfilled before abandonment. The field crew utilized Munsell soil color charts and USDA-NRCS soil terminology and classification to characterize the excavated soil. All observations were recorded on standardized shovel-test logs and in the PI's daily journal, and the project area was photo-documented with a digital single-lens reflex camera. The locations of all shovel tests were recorded with Trimble GeoXH™ handheld Global Positioning System (GPS) capable of sub-meter accuracy. After the completion of the field survey, all GPS data were downloaded into the Geographic Information System (GIS) created for the project.

Vegetation generally was thick with little-to-no ground-surface visibility in the Lower 160 (**Figure 6**), except in the pine plantations (**Figure 7**). Logging and recreational trails were evident throughout. One hunter's deer stand with a light scatter of modern debris was observed in the Lower 160. Vegetation typically was not as thick in the West End (**Figure 8**) as in the Lower 160. The West End is bifurcated by an overhead electrical transmission line (**Figure 9**) that is utilized by hunters (e.g., a hunter's "blind" was situated in the ROW).

The following sections describe specific field methods and conditions in each of the portions of the APE surveyed by AECOM.

5.3.1 Lower 160

On September 20, the weather was sunny, clear, and dry with temperatures ranging from the 40s-60s degrees Fahrenheit (4-16 degrees Celsius). Field survey began along the southern-most boundary of the APE. Transect 1 was comprised of 16 shovel tests spaced 50 meters apart from east to west (**Figure 4**). All of these first shovel tests were negative for cultural materials. Consequently, the shovel-testing interval was expanded to 100 meters for the subsequent transects in the Lower 160 (**Figure 4**). AECOM calculated that a total of eight (8) parallel transects spaced 100 meters apart would cover the entire Lower 160. A total of 24 shovel tests were completed along transects 1 and 2 on September 20.

Field work on September 21 occurred along transects 3 and 4, but the work day was punctuated and then truncated by thunderstorms. Temperatures were in the mid-upper 60s degrees Fahrenheit (16+ degrees Celsius). AECOM completed a total of 16 shovel tests.

Field work on September 22 began in the West End (see below) and then continued along transects 7 and 8 in the Lower 160 where 16 additional shovel tests were excavated. Ground conditions dried as the day progressed; temperatures were in the upper 60s-low 70s (16-21+ degrees Celsius) under sunny to variable cloudy skies.

Field work on September 23 was curtailed by heavy and constant rain throughout the day. Temperatures were cool - high 50s to low 60s degrees Fahrenheit (10-16+ degrees Celsius). A total of only four (4) shovel tests were completed. Heavy rain was predicted to continue through September 24, which led to the PI’s decision to end the field survey. As such, AECOM completed a total of 6.5 transects and a total of 60 shovel tests in the Lower 160 over the 3.5-day period.

5.3.2 West End

AECOM completed the field survey in this portion of the APE by excavating a total of 13 shovel tests at 15-meter intervals along one transect during the morning of September 22 (**Figure 5**).

6.0 Results

The only cultural resources observed during the 3.5-day-long Phase I archaeological survey was a small surface scatter of miscellaneous transportation-related debris, such as modern oil filters (**Figure 10**). AECOM excavated a total of 73 shovel tests across the MPA comprising almost the entire Lower 160 and the HPA and MPA comprising the West End. No cultural resources were encountered in any of the shovel tests. Shovel-test profiles encountered in both subareas of the APE were typical of Spodosol soils (i.e., Kalkaska, Rousseau, and Rubicon soils as mapped by the USDA-NRCS). A typical pedon encountered in the Lower 160 and West End is illustrated in **Figure 11**.

7.0 Recommendations

AECOM's Phase I archaeological field survey provided adequate coverage of MPAs and a HPA in the APE with unanimously negative findings for cultural resources. AECOM has tested and verified the predictive model and found no historic properties. Consequently, no further archaeological survey is recommended for the APE, including the three (3) remaining HPAs and two (2) MPAs in the proposed railroad spur on state-owned lands. AECOM recommends a finding of "No Historic Properties Affected" and the proposed Frontier Renewable Resources biorefinery project should be allowed to proceed with no further archaeological field work.

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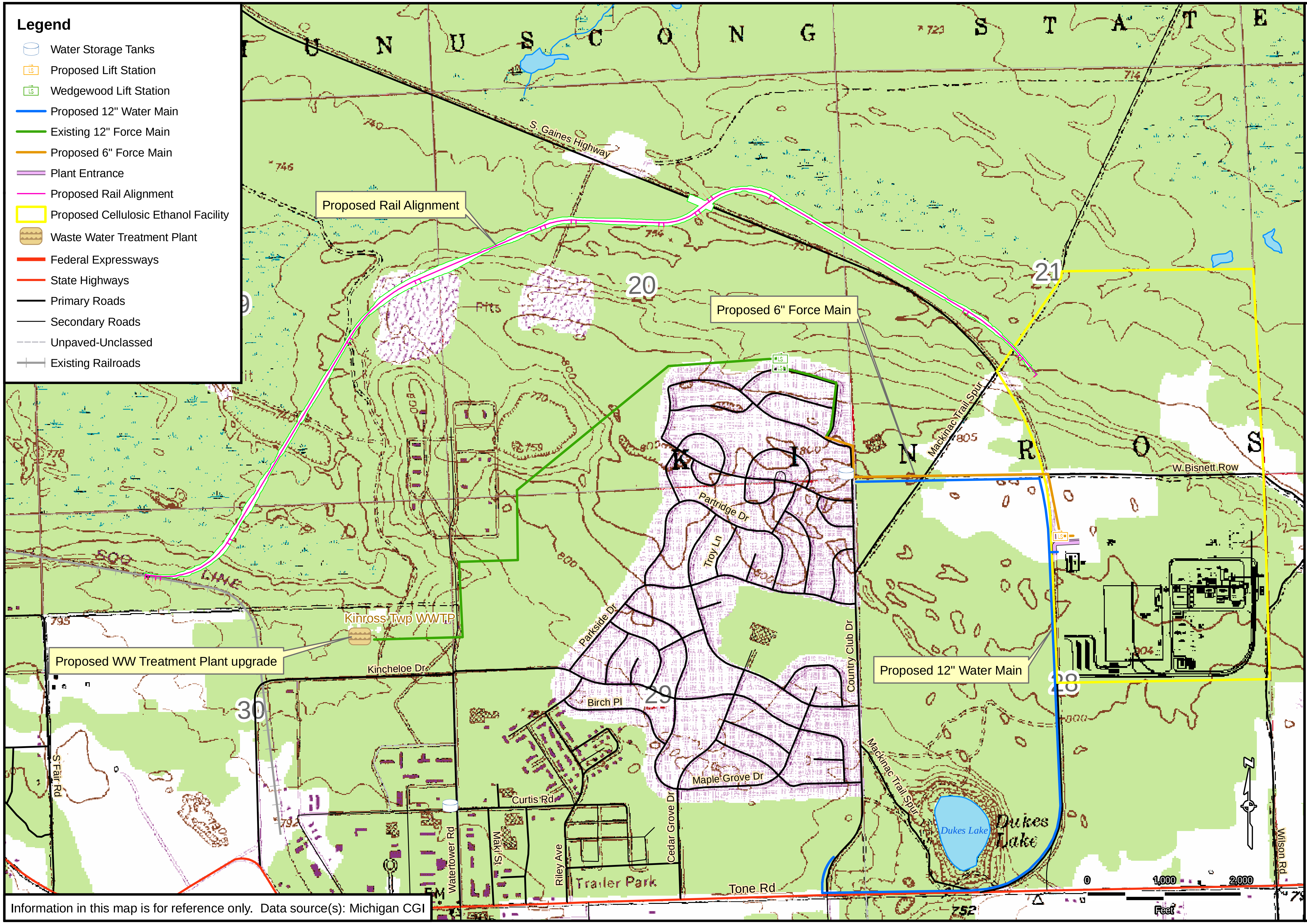
Appendix A

Figures



Legend

- Water Storage Tanks
- Proposed Lift Station
- Wedgewood Lift Station
- Proposed 12" Water Main
- Existing 12" Force Main
- Proposed 6" Force Main
- Plant Entrance
- Proposed Rail Alignment
- Proposed Cellulosic Ethanol Facility
- Waste Water Treatment Plant
- Federal Expressways
- State Highways
- Primary Roads
- Secondary Roads
- Unpaved-Unclassed
- Existing Railroads

Information in this map is for reference only. Data source(s): Michigan CGI

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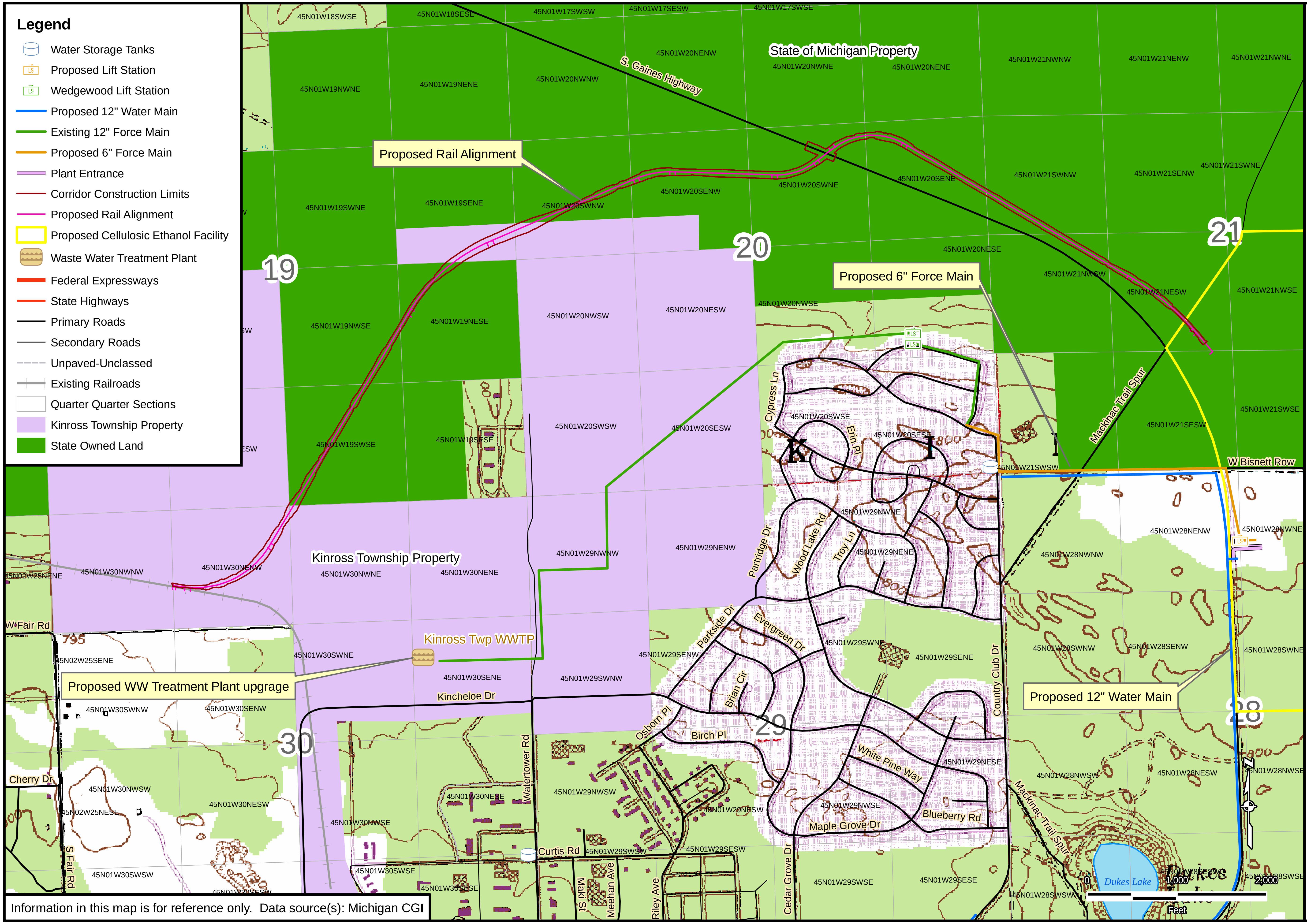
PROPOSED RAIL ALIGNMENT AND WATER INFRASTRUCTURE
FRONTIER RENEWABLE RESOURCES, LLC
CELLULOSIC ETHANOL FACILITY
KINROSS TOWNSHIP, CHIPPEWA COUNTY, MICHIGAN

Drawn:	JWW	8/18/2010
Approved:	IM	8/18/2010
Scale:	AS SHOWN	
PROJECT NUMBER	60140061	
FIGURE NUMBER	1	



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KINROSS TOWNSHIP, CHIPPEWA COUNTY, MICHIGAN

Drawn:	JWW	8/18/2010
Approved:	IM	8/18/2010
Scale:	1" = 1,000'	
PROJECT NUMBER	60140061	
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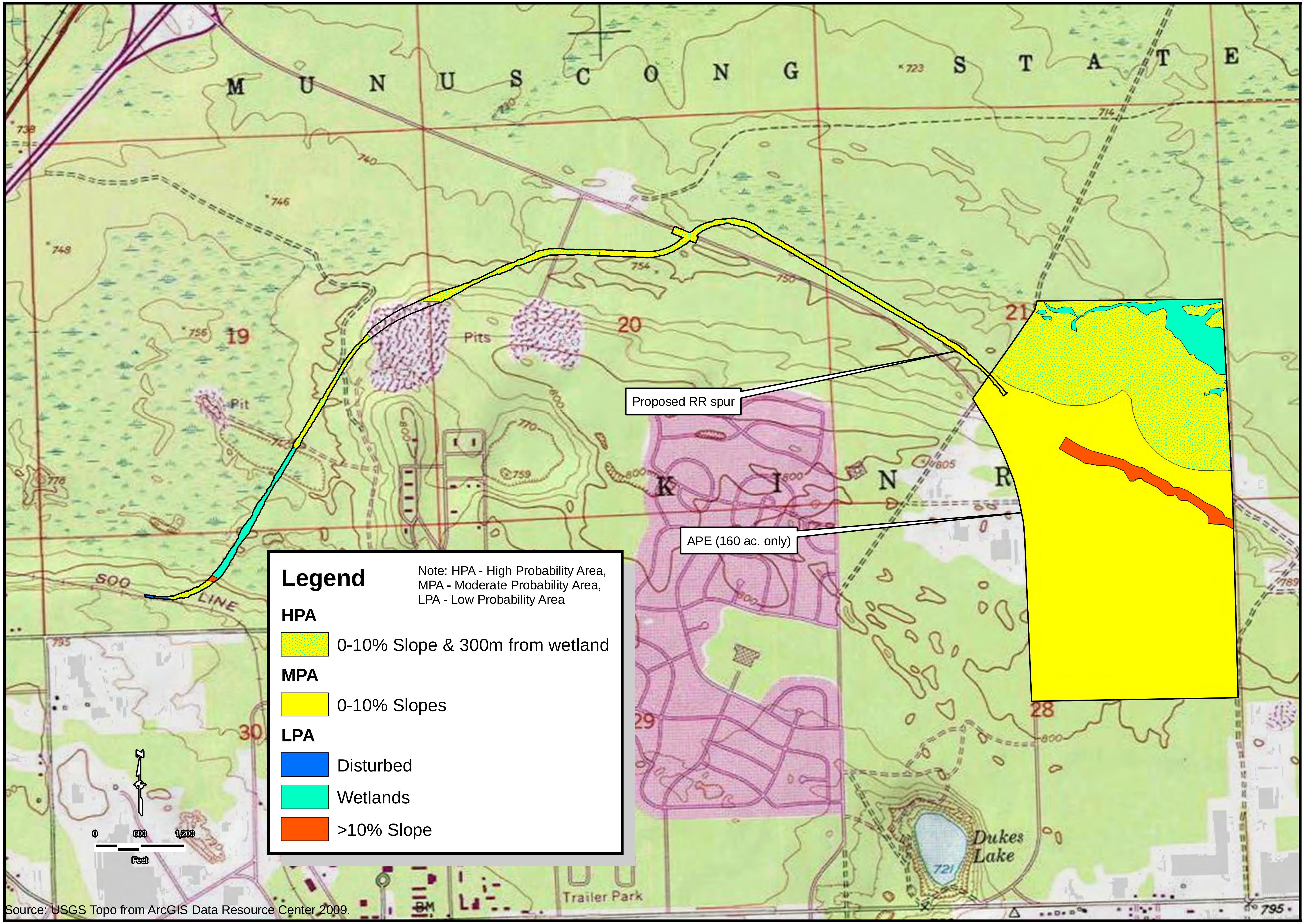

Source: USGS Topo from ArcGIS Data Resource Center 2009.

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PREDICTIVE MODEL
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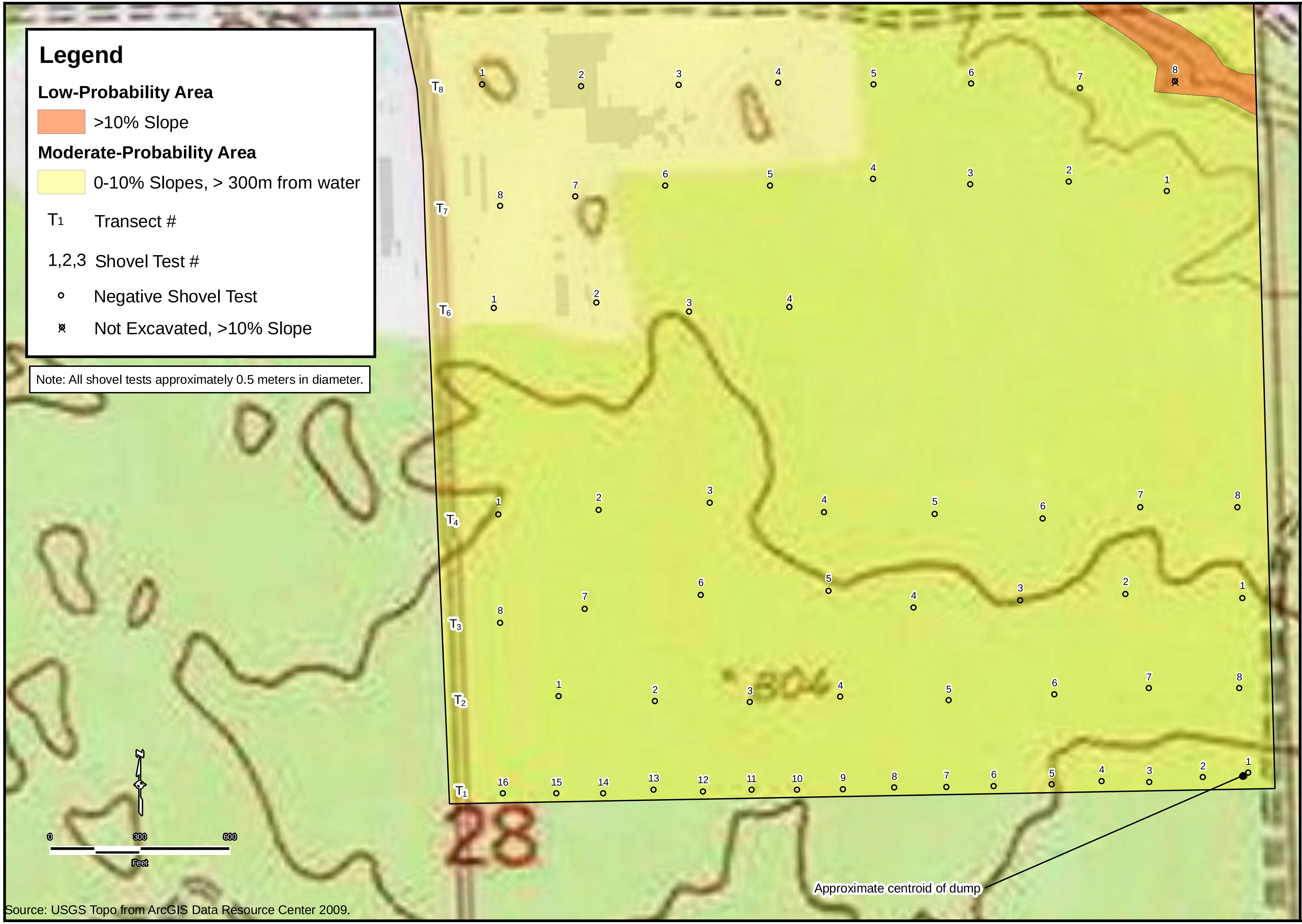
Drawn: KLM 9/16/2010
Approved:
Scale: 1" = 1,200'
PROJECT NUMBER 60140061
FIGURE NUMBER 3



Note: All shovel tests approximately 0.5 meters in diameter.

Source: USGS Topo from ArcGIS Data Resource Center 2009.

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SURVEY RESULTS IN "LOWER 160"
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Scale: 1" = 300'
PROJECT NUMBER 60140061
FIGURE NUMBER 4

Note: All shovel tests approximately 0.5 meters in diameter.

Source: USGS Topo from ArcGIS Data Resource Center 2009.

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SURVEY RESULTS IN "WEST END"
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FIGURE NUMBER	5

Figure 6. Photograph of Vegetation and Coverage Typical in Lower 160
View looking east at Transect 3, Shovel Test 8.

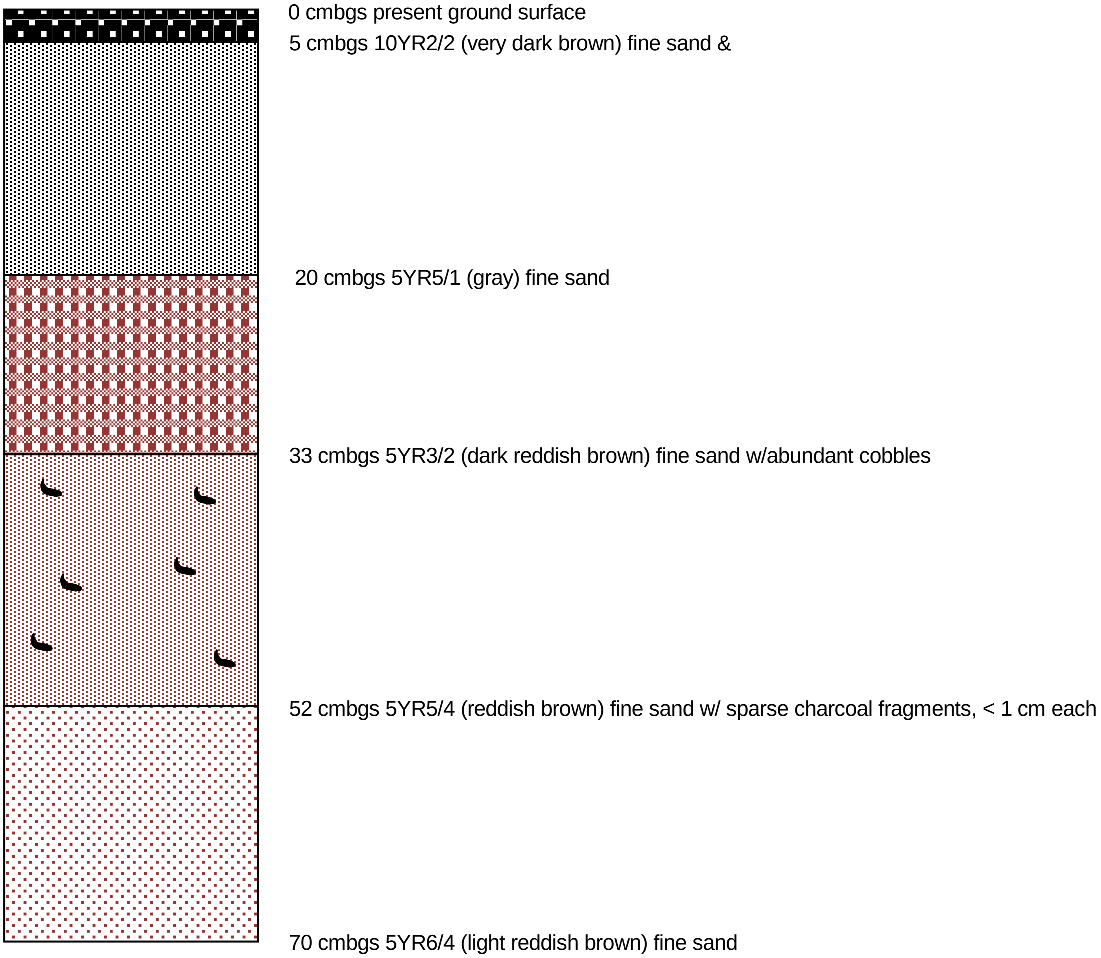
Figure 7. Photograph of Vegetation and Coverage in Pine Plantation Portion of APE
View looking east at Transect 4, Shovel Test 3.

Figure 8. Photograph of Vegetation and Coverage Typical in the West End
View looking east at Transect 1RR, Shovel Test 1.

Figure 9. Photograph Under Powerline Bifurcating West End Portion of the APE
View looking east from approximate center of Transect 1RR.
Note "hunter's blind"on left side of ROW.

Figure 10. Photograph of Modern Transportation-Related Debris Pile
View looking west, approximately 9 feet in diameter.

Figure 11. Typical Shovel-Test Profile
Transect 1, Shovel Test 6 (in the Lower 160)



Draft Environmental Assessment and Notice of Wetland Involvement for the Construction and Operation of a Proposed Cellulosic Biorefinery, Mascoma Corporation, Kinross Charter Township, Michigan

DOE/EA 1705

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November 2, 2010

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Tribal Historic Preservation Office
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SUBJECT: MASCOMA FRONTIER BIOREFINERY PROJECT KINROSS, MICHIGAN

Dear Ms. Cohen,

We appreciate your offer to help us to fulfill our responsibilities under the National Historic Preservation Act and the Native American Graves Protection and Repatriation Act. We have delayed replying to your response to our inquiry, so that we could provide as much useful information to you as possible. We just received the attached Phase I Archeological Investigation of the proposed site, which may be an important part of your review.

In your reply you asked for four items:

- a short summary of the proposed ground disturbing activity,
- a legal description of the Area of Potential Effects,
- topographic maps identifying the proposed area, and
- copies of any studies that have already been conducted regarding cultural resources and archaeology in their full format, including reports on archaeological and cultural sites identified.

The replies to your request are on the attached page. Also attached are the copy of the requested archeological report and payment of the fee for your initial review of the proposed project.

Per your earlier reply, we understand that you will review the project documents to determine whether or not any sites of religious or cultural significance occur within the Area of Potential Effects and, if so, what these effects may be. Kindly let us know the results of your review.

Thank you for your assistance. We look forward to hearing from you.

Sincerely,

Kristin Kerwin
NEPA Compliance Officer

Mascoma: Frontier Resources Cellulose-to-Ethanol Biorefinery Project. Kinross, MI

A. Short Summary of the proposed ground disturbing activity.

Site Background

Historically, the Frontier site consisted of undeveloped land until the development of a homestead in the 1920s in the Southeast ¼ of Section 21. The homestead contained a house, barn, and farmland which were lost to a fire in the 1930s-40s. The proposed plant site was part of the former U.S. Air Force (USAF) base in the Township of Kinross. Construction of the Air Force Base (AFB) began in 1943. The air base expanded throughout the 1950s, and in September 1959 it was officially renamed Kincheloe AFB. The base was inactivated on September 30, 1977 following the end of the Vietnam War. Today the airport and community of Kincheloe, Michigan are located on the site of the base.

Ground Disturbing Activity

The project consists of the design, construction and operation of a biorefinery producing ethanol and other co-products from cellulosic materials utilizing a proprietary pretreatment and fermentation process. Development would be completed on the southern 160 acres of the 355-acre proposed project site. Figure 1 shows the proposed project site layout on a topographic map. It also shows the main route serving this area is Interstate 75, which is within three miles of the proposed plant site. No permanent roads would be constructed since access presently exists from existing roads. Figure 2 provides a site location map imposed on an aerial photo. The proposed rail service to the proposed project area would be established by construction of a rail spur from the existing rail line located east of Kinross as shown in Figure 3.

Ground disturbing activities for the proposed facility would require construction of a number of major buildings, process areas, and structures plus the rail spur. These include an approximately 15 acre wood yard; log and conveyors, a wood chipper building; a chemical, pretreatment, lab and fermentation building; water cooler buildings; a utility building; a package boiler building; an evaporator building; a distillation building; and a drying building. A site master plan is presented in Figure 4.

B. Legal description of the Area of Proposed Effects.

The proposed plant site is comprised of 355 acres in sections 21 and 28, Township 45 North, Range 01 West in Kinross Township, Chippewa County, Michigan. The official property description is:
the parts of the south half of Section 21 lying east of the centerline of Gaines Highway, except that part lying west of the easterly edge of State Designated Snowmobile Trail #49 (otherwise known as the Mackinac Trail Spur) and all that part of the north half of Section 28 lying east of the centerline of Gaines Highway, excepting and reserving unto the State of Michigan an access easement to enable the State to access an adjacent parcel described as the northwest quarter of the southeast quarter of Section 28 (benefited parcel).

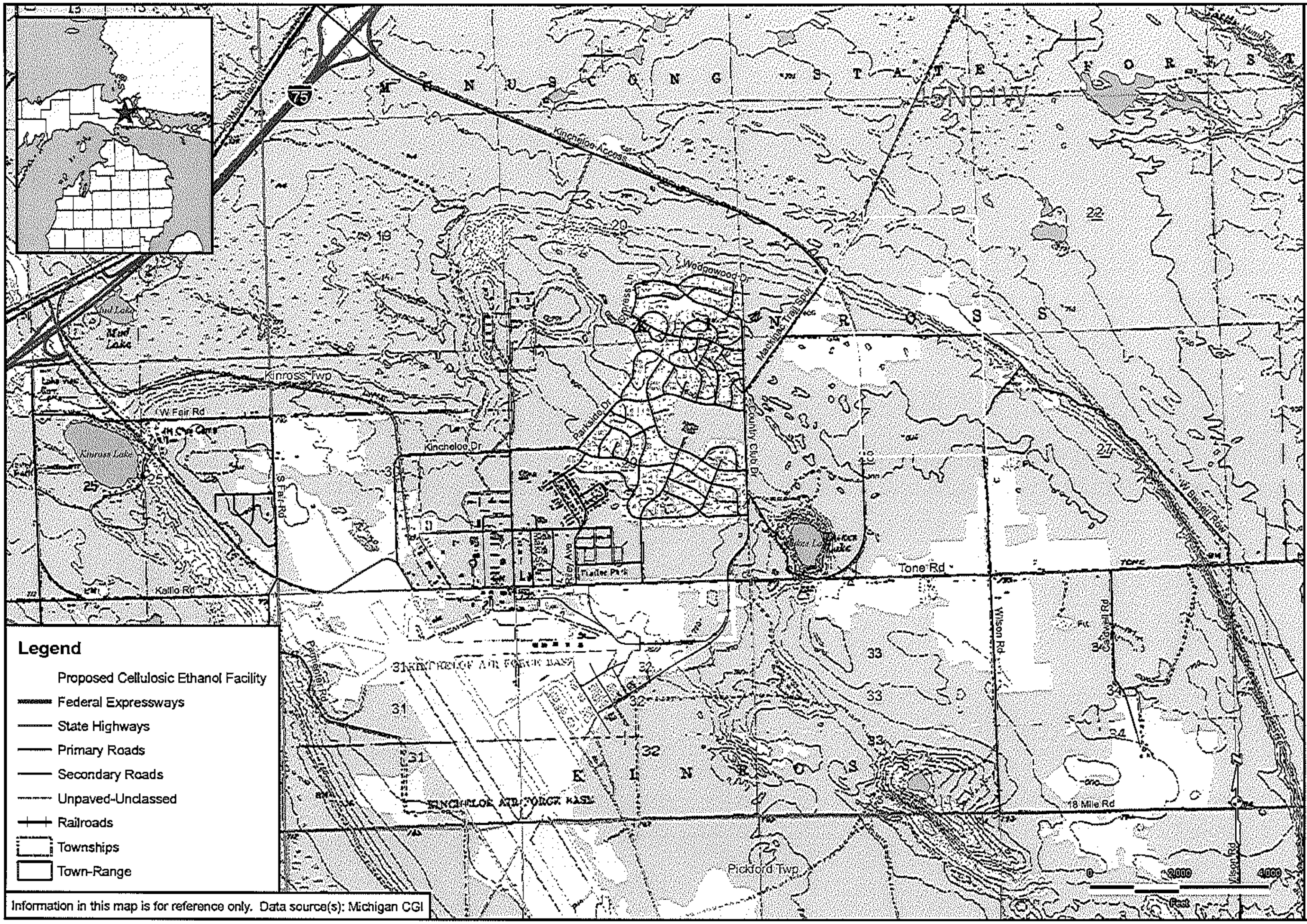
The APE would be 160 acres in the northeast quarter of Section 28 and the 2.5-mile-long railroad spur right-of-way.

C. Topo maps identifying the proposed area.

Please see Figure 1 which includes the site location on a topo map.

D. Copies of any studies that have been conducted regarding cultural resources and archeology in their full format, including reports on archeological and cultural sites identified.

Attached please find the report *Phase 1 Archaeological Investigation*, the only study of cultural resources and archaeology prepared about the proposed project site.



Information in this map is for reference only. Data source(s): Michigan CGI

AECOM

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www.aecom.com

FIGURE 1
SITE LOCATION MAP
FRONTIER RENEWABLE RESOURCES, LLC
CELLULOSIC ETHANOL FACILITY
CHIPPEWA COUNTY, MICHIGAN

Drawn:	JWW	2/17/2009
Approved:	LDK	2/17/2009
Scale:	1" = 2,000'	
PROJECT NUMBER	13375-001-0100	
FIGURE NUMBER	1	

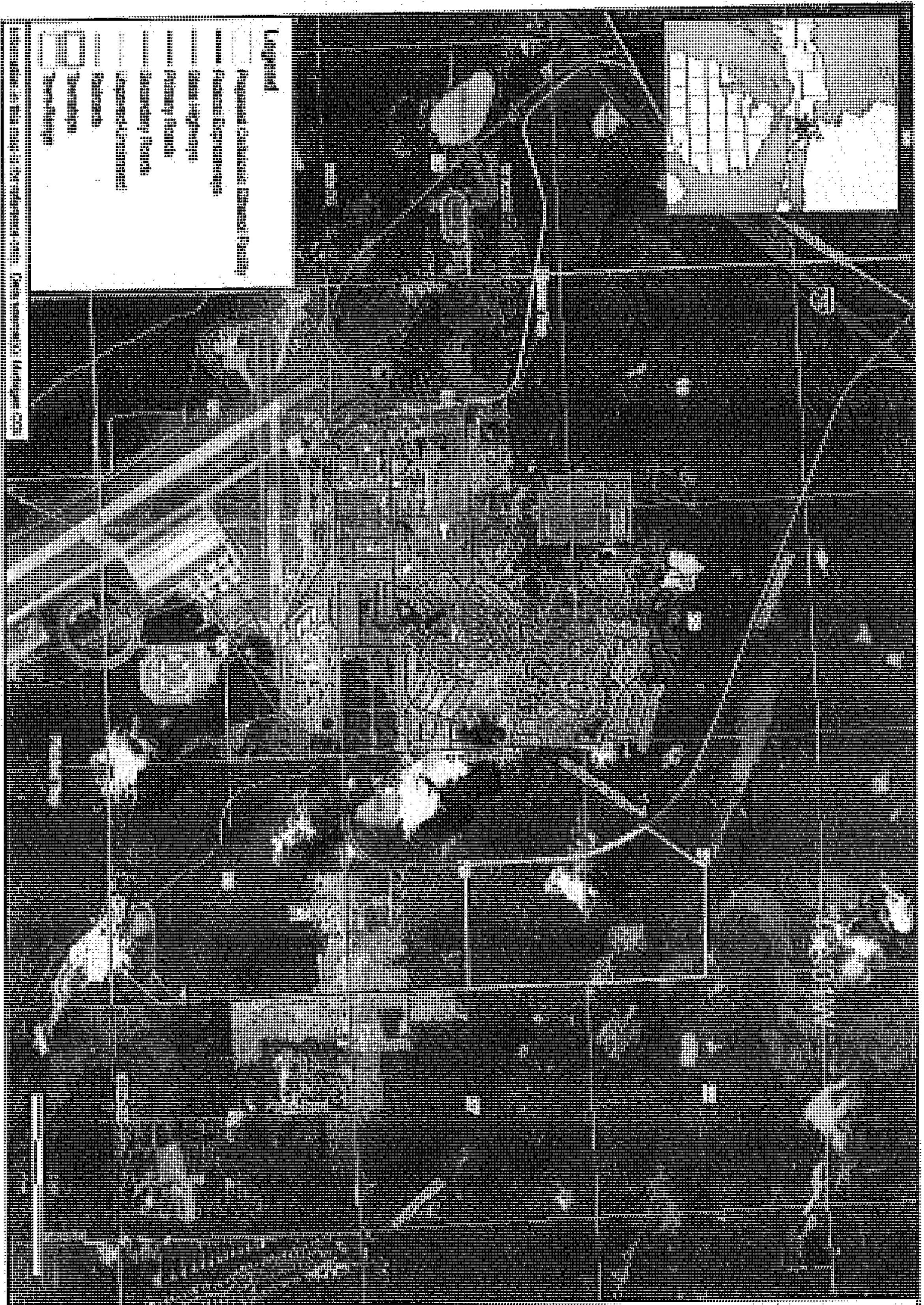
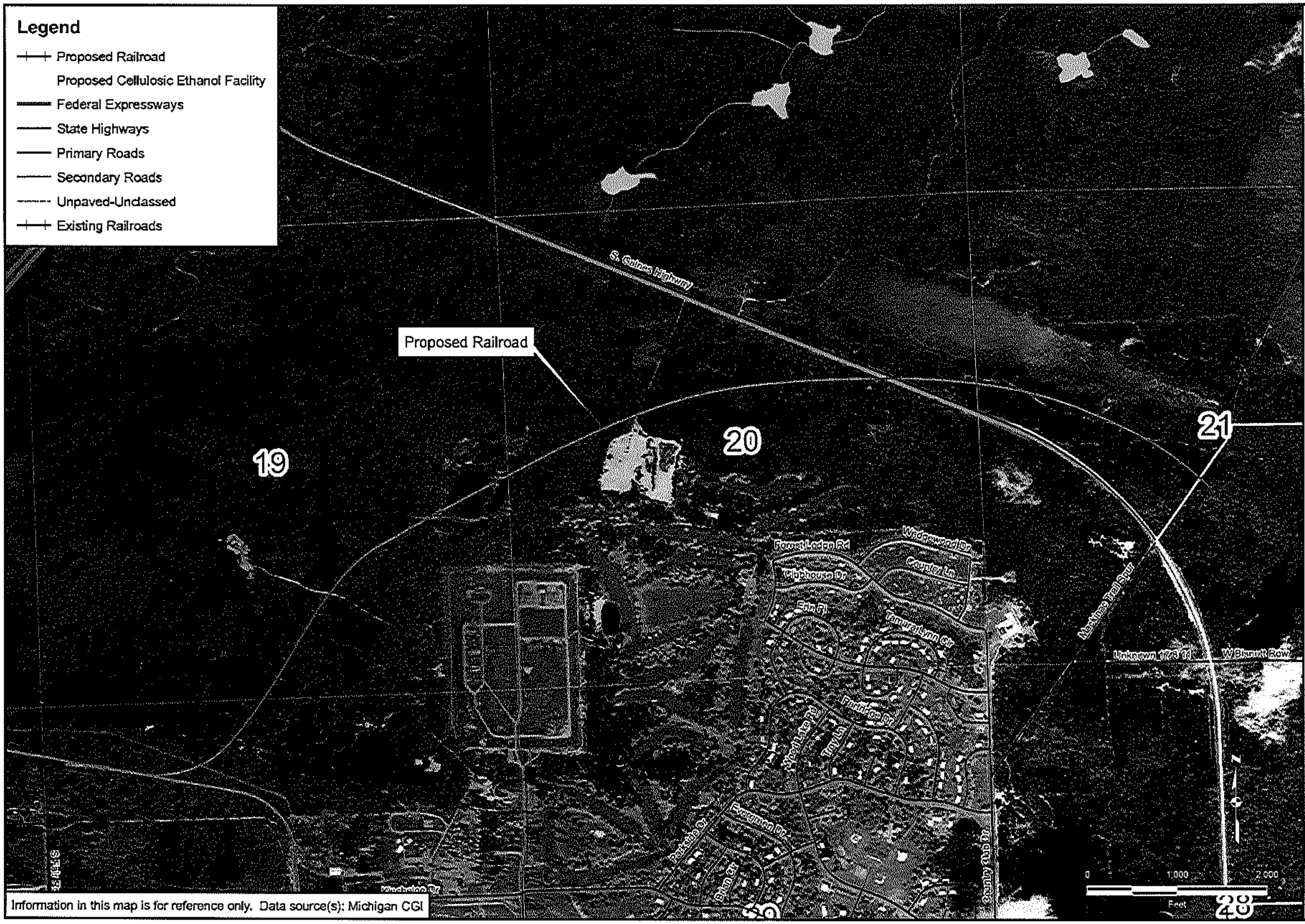


FIGURE 2
SITE LOCATION MAP WITH 2005 AERIAL PHOTO
FRONTIER RENEWABLE RESOURCES, LLC
CELLULOSIC ETHANOL FACILITY
CHIPPEWA COUNTY, MICHIGAN

AECOM



Information in this map is for reference only. Data source(s): Michigan CGI

AECOM

847.279.2500
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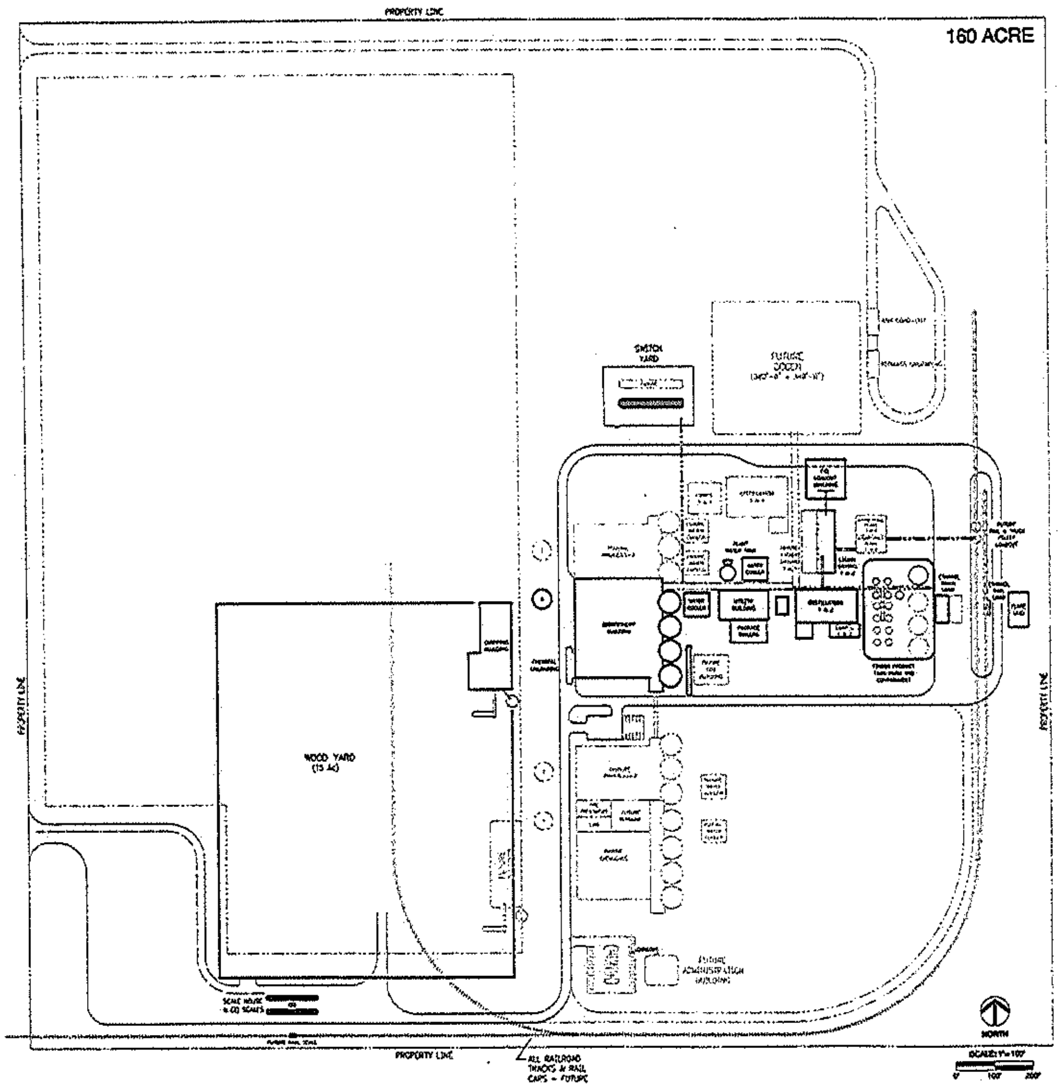
FIGURE 3
PROPOSED RAILROAD
FRONTIER RENEWABLE RESOURCES, LLC
CELLULOSIC ETHANOL FACILITY
KINROSS TOWNSHIP, CHIPPEWA COUNTY, MICHIGAN

Drawn: JWW 7/13/2009
Approved: IM 7/13/2009
Scale: 1" = 1,000'
PROJECT NUMBER 13375-004
FIGURE NUMBER 2



FRONTIER
SITE MASTER
PLAN 2009
355 ACRE

RAASCH ASSOCIATES
ENGINEERS • ARCHITECTS

ITEM	Building Description	AREA	Building Dimensions	Number of Floors	Square Ft.
1	Chipping Building	100	[illegible]	1	17,600
2	Operations Building	210-420	Sub buildings below	See Below	See Below
2a	Pre-Treatment Building	210	[illegible]	6	[illegible] per floor
2b	Primary Fermentation	300	[illegible]	1	[illegible]
2c	Primary Fermentation Pumphouse	320	[illegible]	1	[illegible]
2d	Employee Facilities	220	[illegible]	2	[illegible] per floor
2e	Secondary Fermentation	330	[illegible]	1	[illegible]
2f	Chemical Storage	420	[illegible]	1	[illegible]
3	Distillation Building	500	[illegible]	2	14,600 per floor

ITEM	PERSONNEL DESCRIPTION	NO OF PERSONNEL	1st	2nd	3RD
1	PLANT MANAGER	1	1		
2	MAINTENANCE MANAGER	1	1		
3	PROCESS MANAGER/ENGINEER	1	1		
4	OPERATIONS MANAGER	1	1		
5	LAB MANAGER	1	1		
6	SAFETY MANAGER	1	1		
7	MAINTENANCE TECHNICIAN	8	4	2	2
8	MAINTENANCE - LEAD TECH	4	2	1	1
9	MAINTENANCE - YARD	1	1		
10	OPERATORS	[illegible]	[illegible]	[illegible]	[illegible]
11	LAB TECHNICIAN	2	1	1	
12	SCALE HOUSE	1	1		
13	ADMINISTRATION	[illegible]	[illegible]		
14	TOTAL PERSONNEL	[illegible]	[illegible]	[illegible]	[illegible]

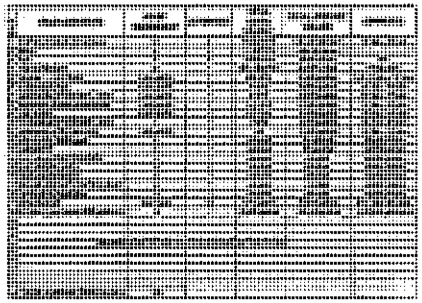


Figure 4 Frontier Plot Plan

C	07/28/09	UPDATE FOR LOAN APP
[illegible]	[illegible]	FOR LOAN APPLICATION
C	[illegible]	FOR LOAN APPLICATION
B	[illegible]	STAMPED FOR REVIEW

Environment

Submitted to:
Frontier Renewable Resources LLC
Marquette, Michigan

Submitted by:
AECOM
Minneapolis, MN
60140061
October 12, 2010

Phase I Archaeological Investigation
Frontier Renewable Resources
Kinross Charter Township, Chippewa County, Michigan

Amy L. Ollendorf, Ph.D., P.G., R.P.A. and Michael M. Gregory, Ph.D.
Prepared By

Christopher White
Reviewed By

Contents

List of Appendices

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List of Acronyms

aka	also known as
AECOM	AECOM Technical Services, Inc.
APE	Area of Potential Effect
cmbgs	centimeters below ground surface
CCC	Civilian Conservation Corps
DNRE	Michigan Department of Natural Resources & Environment
DOE	U.S. Department of Energy
EA	Environmental Assessment
ESA	Environmental Site Assessment
Frontier	Frontier Renewable Resources LLC
GIS	Geographic Information System
GLO	U.S. General Land Office
GPS	Global Positioning System
HIG	Historical Information Gatherers, Inc.
HIS	Hopewell Interaction Sphere
HPA	High-Probability Area
LPA	Low-Probability Area
MPA	Moderate-Probability Area
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NRCS	Natural Resource Conservation Service
NRHP	National Register of Historic Places
OSA	Office of the State Archaeologist
SHPO	State Historic Preservation Office

UP	Upper Peninsula of Michigan
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USFS	U.S. Forest Service

Executive Summary

AECOM Technical Services, Inc. (AECOM) was retained by Frontier Renewable Resources LLC (Frontier) to perform a Phase I archaeological survey for a proposed pulpwood-to-ethanol biorefinery in Kinross Township, Chippewa County, Michigan. The project area is comprised of a 355-acre parcel in sections 21 and 28, Township 45 North, Range 1 West in addition to an approximately 2.5-mile-long new railroad spur that will extend from the northern part of the 355-acre parcel in Section 21, west-east across Section 20, southwesterly through the southeast quarter of Section 19, and terminating at the existing railroad in the north half of the northwest quarter of Section 30.

Partial funding for the proposed biorefinery will be provided by the U.S. Department of Energy (DOE); AECOM is preparing an Environmental Assessment (EA) under separate cover for compliance with the National Environmental Policy Act of 1970. This Phase I archaeological survey was conducted on behalf of Frontier in support of the EA as well as for compliance with Section 106 of the National Historic Preservation Act (NHPA) of 1966, as amended. The DOE is responsible for government-to-government consultation with federally recognized American Indian tribes and stakeholder involvement. Mitigation of impacts to wetlands, if any, during project construction will be subject to the terms of a Section 404 permit applied for by Frontier under separate cover to the U.S. Army Corps of Engineers (USACE), Detroit District in compliance with the Clean Water Act of 1977.

The biorefinery is proposed to occupy approximately 80 acres in the south half of the northeast quarter of Section 28. The proposed width of the railroad spur's right-of-way (ROW) is 60 feet Some cutting and filling will be required on the rail spur and project site to establish final grades. The APE consists of wooded and marshy, undeveloped lands. The State Historic Preservation Office (SHPO) concurred with the DOE's definition of the Area of Potential Effects (APE) as the 160 acres in the northeast quarter of Section 28 and the 2.5-mile-long railroad spur ROW.

The only cultural resources observed during the 3.5-day-long Phase I archaeological survey was a small surface scatter of miscellaneous transportation-related debris, such as modern oil filters. AECOM excavated a total of 73 shovel tests across the MPA comprising almost the entire Lower 160 and the high- and moderate-probability areas comprising the West End. No cultural resources were encountered in any of the shovel tests. Because AECOM's Phase I archaeological field survey provided adequate coverage of high- and moderate-probability areas in the APE with unanimously negative findings for cultural resources, no further archaeological survey is recommended for the APE, including the three (3) remaining high-probability areas and two (2) moderate-probability areas in the proposed railroad spur on state-owned lands. Consequently, AECOM recommends a finding of "No Historic Properties Affected" and the proposed Frontier Renewable Resources biorefinery project should be allowed to proceed with no further archaeological field work.

1.0 Introduction

AECOM Technical Services, Inc. (AECOM) was retained by Frontier Renewable Resources LLC (Frontier) to perform a Phase I archaeological survey for a proposed pulpwood-to-ethanol biorefinery in Kinross Township, Chippewa County, Michigan. The project area is comprised of a 355-acre parcel in sections 21 and 28, Township 45 North, Range 1 West in addition to an approximately 2.5-mile-long new railroad spur that will extend from the northern part of the 355-acre parcel in Section 21, west-east across Section 20, southwesterly through the southeast quarter of Section 19, and terminating at the existing railroad in the north half of the northwest quarter of Section 30 (**Figure 1**).

Partial funding for the proposed biorefinery will be provided by the U.S. Department of Energy (DOE); AECOM is preparing an Environmental Assessment (EA) under separate cover for compliance with the National Environmental Policy Act of 1970. This Phase I archaeological survey was conducted on behalf of Frontier in support of the EA as well as for compliance with Section 106 of the National Historic Preservation Act (NHPA) of 1966, as amended. The DOE is responsible for government-to-government consultation with federally recognized American Indian tribes and stakeholder involvement. Mitigation of impacts to wetlands, if any, during project construction will be subject to the terms of a Section 404 permit applied for by Frontier under separate cover to the U.S. Army Corps of Engineers (USACE), Detroit District in compliance with the Clean Water Act of 1977.

The biorefinery is proposed to occupy approximately 80 acres in the south half of the northeast quarter of Section 28. The proposed width of the railroad spur's right-of-way (ROW) is 60 feet Some cutting and filling will be required on the rail spur and project site to establish final grades. The APE consists of wooded and marshy, undeveloped lands. The State Historic Preservation Office (SHPO) concurred with the DOE's definition of the Area of Potential Effects (APE) as the 160 acres in the northeast quarter of Section 28 and the 2.5-mile-long railroad spur ROW.

Land-ownership of the project area is divided among the State of Michigan, Kinross Charter Township, and Frontier (**Figure 2**). The Department of Natural Resources & Environment (DNRE) has jurisdiction over state-owned lands in the project area – portions of the proposed railroad spur. Kinross Charter Township owns the majority of the remainder of lands proposed for the railroad spur, but Frontier owns the land that will be utilized over a short segment at the western terminus of the spur and the land where the ethanol facility will be constructed. No federal or tribal lands comprise the project area. However, two consent decrees were issued by the U.S. District Court, Western District of Michigan, Southern Division to resolve legal claims of five federally recognized American Indian tribes against the State of Michigan in regard to access and management of lands and waters ceded to the U.S. in the 1836 *Treaty with the Ottawa, Etc.* The 2007 *Inland Consent Decree* and 2000 *Fishing Consent Decree* pertain to ceded lands and waters, respectively. Under the terms of these consent decrees, the DNRE coordinates with federally recognized tribes for access to lands and waters under the state's jurisdiction (i.e., DNRE and Kinross Charter Township lands and waterbodies in the APE.

AECOM completed background research and records review at the Office of the State Archaeologist (OSA) in Lansing, Michigan on August 25, 2010 and September 8, 2010. OSA research was completed

by Mr. Craig Simon of AECOM's Lansing office. Field work was completed on non-state-owned lands in sections 28 and 30 on September 20-23, 2010 while a DNRE *Permit to Perform Archaeological Exploration on State-Owned Lands* was pending. Field crew consisted of Mr. Dan Surface, Ms. Hilary Powell, Dr. Michael Gregory, and Dr. Ollendorf.

2.0 Environmental History

2.1.1 Geology

The Upper Peninsula (UP) of Michigan is bordered by three of the Great Lakes – Superior, Michigan, and Huron. The UP is located in the Interior Plains Physiographic Division of the Central Lowland Province, Eastern Lake Section, and Laurentian Physiographic Division of the Superior Upland Province (Jerome 2006). Elevations throughout the UP range from approximately 600 feet along the Great Lakes to 1,900 feet inland (Jerome 2006).

Interior Plains Physiographic Division

The Interior Plains originally formed when cratons collided and welded together 1.8–1.9 billion years ago during the Paleoproterozoic Era (2.5-1.0 billion years ago). Approximately 1.1 billion years ago, the plates again began to stir with a hot spot under what is now western Lake Superior, forcing the continental crust to split. The Midcontinent Rift formed and enormous quantities of basaltic lava spilled onto the surface. The rifting never fully pulled the continent apart and by the late Middle Proterozoic, about 1.0 billion years ago, the tectonism of the Lake Superior area halted, never to resume (Ottke 1999). Precambrian metamorphic and igneous rocks now form the basement of the Interior Plains and make up the stable nucleus of North America. Except for the Black Hills of South Dakota, the entire region has low relief, reflecting more than 500 million years of relative tectonic stability.

The Interior Plains were often covered by shallow inland seas. Sediments from the Canadian Shield and the Rocky Mountains were deposited in these seas over millions of years. Eventually the sediments were compressed by the weight of the layers above into sedimentary rock formations. Part of the sedimentary rock deposited in these areas consists of coral reefs that formed close to the surface of seas during the Paleozoic era.

Throughout the Paleozoic Era and subsequent Mesozoic Era, the mostly low-lying Interior Plains region remained relatively unaffected by the mountain-building tectonic collisions occurring on the western and eastern margins of the continent. During much of the Mesozoic, the North American continental interior was mostly well above sea level, with two major exceptions. During part of the Jurassic period, rising seas flooded the low-lying areas of the continent; in the Cretaceous period, much of the Interior Plains region lay submerged beneath the Western Interior Seaway.

The Interior Plains continued to receive deposits from the eroding Rocky Mountains to the west and Appalachian and Ozark/Ouachita Mountains to the east and south throughout the era. The flatness of the Interior Plains is a reflection of the platform of mostly flat-lying marine and stream deposits laid down in the Mesozoic and Cenozoic eras.

Laurentian Physiographic Division

This physiographic area is the oldest portion of the North American continent, the backbone so to speak. It is made up primarily of ancient Precambrian igneous, metamorphic, and sedimentary rock. With the exception of the river valleys and lacustrine basins, it is a rolling to mountainous peneplain that ranges from 800 feet to 1400 feet above sea level.

2.1.2 Landforms

Landforms in the UP are a product of glaciers that occupied the region during the last Ice Age (Pleistocene Epoch). During the Wisconsinan glacial stage, the entire UP was covered with a thick ice sheet that carried glacial drift. The variety of landforms visible on today's ground surface is the result of massive deposition of glacial drift as the ice sheet melted and receded northward. Approximately 9500 to 11,000, Glacial Lake Algonquin covered a large portion of the UP, including most of the eastern half of the UP (Jerome 2006). Numerous areas of sandy or clayey lacustrine deposits are sediments from this glacial lake (i.e., glaciolacustrine deposits). Some of the deposits were covered later by outwash from the melting glacier to the north (i.e., glaciofluvial deposits). Glacial Lake Nippising was the last lake stage to occupy the UP from 4,000 to 6,000 years ago (Jerome 2006). Its shoreline is the closest to the present Great Lakes - the easily recognized ridge or bluff near the present-day beach in many areas.

The landforms in the present APE are Outwash Plain and Lake Plain (Farrand and Bell 1982). According to Jerome (2006:24), the Outwash Plain is extensive and consists of sandy glaciofluvial materials, such as "sand and gravel in well-stratified layers." Soil series associated with the Outwash Plain that occur in the present APE are Kalkaska and Rubicon (see below). The Lake Plain is nearly level and occurs in areas that had been covered by Glacial Lake Algonquin. "In Chippewa and Mackinac counties it consists of well-sorted, fine-textured, stratified [glaciolacustrine] deposits" (Jerome 2006:24).

2.1.3 Flora and Fauna

In the past, the range of available faunal and floral resources associated with the eastern portion of Michigan's Upper Peninsula depended in large part upon prevailing climatic conditions, which at times have experienced significant changes during the past 10,000 years. Beginning approximately 13,000 years before present (B.P.), the climate began to warm as glaciers retreated, and conifers, together with megafauna such as mammoth, dominated much of the upper Midwest's landscape. The Eastern Upper Peninsula Ecoregion was glaciolacustrine-influenced (see above) and remains relatively flat today (Albert 1995).

During the following 2,000 years, the region continued to experience a warming trend that resulted in spruce showing a sharp decline in dominance in the Lower Peninsula where pines and a few hardwoods began to appear by 11,000 B.P. This trend would take another 1,200 years to reach northward into the eastern Upper Peninsula, where the spruce period would be ended by 9500 B.P. (Kapp 1999:51), to be replaced by jack and red pines. White pine would arrive in the area by 8300 B.P. and be followed by hemlock by approximately 6400 B.P. and beech by sometime before 3000 B.P. (Kapp 1999:53).

Across the eastern United States, the climate became even warmer and drier beginning circa 9500 B.P. This trend continued through 1500 B.P., having a significant influence on vegetation (Kapp 1999:53), although depending upon the characteristics of a locale's soil, the warmer and drier conditions could have either accentuated or ameliorated shifts in vegetation. In Michigan, the warmer, drier period dates from about 9000 B.P. to at least 2500 B.P., and while these conditions influenced cyclical changes between the more xerophytic oak forests and mesophytic beech-maple-basswood-mixed hardwood forests of southern Lower Michigan, in northern Lower Michigan and the Upper Peninsula, the period, even at its maximum, is not clearly marked in pollen records. In some areas, an increase in white pines appears to mark a period of dryness beginning about 8000 B.P. and lasting until approximately 5000 B.P. (Kapp 1999:55), but the presence of the pines may be attributed to other factors. An increase in pines across the eastern Upper Peninsula during the drier, warmer conditions may have restricted the availability of subsistence resources, and made the area less desirable to inhabit, especially if more abundant resources could be reaped along coastal zones.

Beginning between 3400 to 3000 B.P., a major vegetation shift occurred throughout the Upper Peninsula with northern hardwood forests (birch, hemlock, maple, and other deciduous species together with white pine) expanding into areas where soils accommodated the trees with good drainage but enough clay to retain moisture during droughts. In addition, a rising water table coupled with increased participation encouraged the creation of widespread marsh formation, as well as the creation of extensive, shallow peat deposits (Kapp 1999:57). This shift marks the onset of cooler conditions, which after 3000 B.P., resulted in the creation of a vegetative cover that existed until after the arrival of Euro-Americans, who prior to circa 1800, were primarily in interested in extracting furs. The original northern hardwood forests in the Eastern Upper Peninsula generally supported a greater diversity of conifers than today, providing structural complexity and a diversity of wildlife habitats (Albert 1995). "Smaller areas of fire-dependent ecosystems such as white pine-red pine forest and jack pine barrens also occurred within this ecoregion. The region continues to support a diversity of wetland natural communities including bog, northern fen, northern wet meadow, hardwood-conifer swamp, rich conifer swamp, and extensive areas of muskeg and patterned fen." Reconstruction from GLO survey data indicate the vegetation of the present project area ca. 1800 consisted of beech-sugar maple-hemlock forest, cedar swamp, and hemlock-white pine forest (Comer and Albert 1997). Only later, after the 1840s, did Euro-American settlers really begin to develop the area and subsequently remove much of the historic vegetation through agricultural and commercial activities, especially lumbering. Aerial photos of the project area taken during the late 1930s show an open landscape with some wooded areas, which have since expanded to fill-in the open landscape with secondary growth of oaks, maples, beech, hemlock, and pines (including pine plantations) observed during the current study.

Prior to, but certainly after circa 3,000 B.P., prehistoric and historical peoples found a rich range of floral and faunal subsistence resources available for use in the eastern Upper Peninsula. In season, forests yielded a range of nuts, seeds, tubers, berries, and raw materials to eat or to produce baskets, mats, and other needed material items. In addition, the area offered a range of faunal species consisting of mammals (bear, beaver, muskrat, raccoons, and white-tailed deer), birds (grouse, passenger pigeons, turkey, and various water fowl), aquatic species (whitefish, freshwater mussels, suckers, and turtles), and other animals that could be hunted and fished. Thus within Chippewa County and the proposed bio-fuel plant project tract in particular, prehistoric and historical peoples had the opportunity to exploit a range of floral and faunal resources associated with the regions physical setting.

Today's climate in the UP is influenced by the proximity of the Great Lakes (Jerome 2006). Average annual temperature is 39-43 degrees Fahrenheit. Average daily summer high is 71 degrees Fahrenheit; average daily winter low is19 degrees Fahrenheit. Average annual precipitation is 30-36 inches; average annual snowfall is 56-218 inches, although a lake-effect can result in annual snow of 350 inches. Growing season is 100-150 days (Jerome 2006). About 95% of the UP is forested, with approximately 42% of the forestland in federal or state ownership (Jerome 2006).

2.2 Soils of the APE

The U.S. Department of Agriculture (USDA)-Natural Resource Conservation Service (NRCS) has mapped various soil series throughout the APE. Soils in the APE are Spodosols, Histosols, and Entisols. According to the USDA-NRCS, *Spodosols* are soils in which amorphous mixtures of organic matter and aluminum, with or without iron, have accumulated. In undisturbed soils there is normally an overlying eluvial horizon, generally gray to light gray in color, more or less uncoated quartz. Most Spodosols have little silicate clay. The particle-size class is mostly sandy, sandy-skeletal, coarse-loamy, loamy, loamy- skeletal, or coarse-silty. *Histosols* are soils that are dominantly organic and are commonly called bogs, moors, or peats and mucks. A soil is classified as Histosols if it does not have permafrost and is dominated by organic soil materials. *Entisols* have little or no evidence of development of pedogenic horizons. Many are sandy or very shallow. **Table 1** summarizes the mapped soil series, their locations within the APE and their attributes.

Table 1. Soils of the APE as Mapped by the USDA-NRCS

Series	Class	Order	Description of Typical Pedon	Location in APE
Alcona	Alfic Haplorthods	Spodosol	Typical pedon: Fine sandy loam on 42% in forested area. Very deep, well-drained in stratified sandy & loamy glaciofluvial & glaciolacustrine deposits on lake plains, outwash plains, ground moraines, end moraines & stream terraces. Native vegetation primarily American basswood, American beech, red pine, eastern white pine, sugar maple & yellow birch. Horizons: Oe-E-Bs1-Bs2-Bs3-B/E-E/B-2C.	SE¼ S21
n/a	Aquents	Entisol	n/a	SW¼ S19

Table 1. Soils (continued).

Series	Class	Order	Description of Typical Pedon	Location in APE
Au Gres	Typic Endoaquods	Spodosol	Sand on 1% slope in forested area. very deep, somewhat poorly drained soils formed in sandy glacial drift on stream terraces, outwash plains, lake terraces, lake plains, and ground moraines. Natural forests are northern white cedar, balsam fir, hemlock, yellow birch, paper birch, aspen, and red maple. Horizons: Oe-A-E-Bhs-Bs1-Bs2-BC-C. 2% gravel in Bhs & Bs2. 1% gravel w/common masses of Fe accumulation in BC & C.	SE¼ S21, SW¼ S21
Carbondale	Hemic Haplosaprists	Histosol	Muck on < 1% slope in forested area. Very deep, very poorly drained in organic deposits > 51" thick on ground moraines, outwash plains & lake plains. Forests are mostly northern white cedar, balsam fir, black spruce & white birch. Horizons: Oa1-Oa2-Oa3-Oe.	SE¼ S19
Croswell	Oxyaquic Haplorthods	Spodosol	Sand on 2% slope in wooded area. Very deep, moderately well-drained in sandy glacial drift on stream terraces, lake terraces, low dunes, beach ridges, outwash plains, lake plains & ground moraines. Forests are mixed hardwoods & conifers, including quaking aspen, black cherry, paper birch, bigtooth aspen, red pine, eastern white pine, jack pine, northern red oak & red maple. Horizons: Oe-A-E-Bs1-Bs2-BC-C.	SE¼ S21, SW¼ S21
Dawson	Terric Haplosaprists	Histosol	Peat on 1% slope. Very dep, very poorly drained in herbaceous organic material 16-51" thick overlying sandy deposits in depressions on outwash plains, lake plains, ground moraines, end moraines & floodplains. Black spruce & tamarack trees w/ground cover of bog rosemary, cranberries, laurel, leatherleaf, sphagnum mosses & blueberries. Horizons: Oi-Oa-A-C.	SE¼ S19, C S21

Table 1. Soils (continued).

Series	Class	Order	Description of Typical Pedon	Location in APE
Kalkaska	Typic Haplorthods	Spodosol	Sand on 1% slope in forested area. Very deep, somewhat excessively drained in sandy deposits on outwash plains, valley trains, moraines & stream terraces. Sugar maple, American beech, red pine, quaking aspen, bigtooth aspen & eastern white pine are typical trees. Horizons: Oi-A-E-Bhs-Bs1-Bs2-BC-C. Approx. 5% gravel throughout; ortstein columns in Bs2 & BC.	NE¼ S20, SE¼ S21, NW¼ S30
Kinross	Typic Endoaquods	Spodosol	Muck on nearly level forested area. Very deep, poorly drained-very poorly drained in glaciofluvial material on outwash plains, stream terraces, lake plains, kames, disintegration & ground moraines. Trees are black spruce, tamarack, northern white cedar, balsam fir, red maple & quaking aspen; ground cover includes H2O-tolerant grasses & sedges, leatherleaf, sphagnum & bog rosemary. Horizons: Oa-E-Bhs-Bs-BC-C.	SE¼ S19, SE¼ S21
Loxley	Typic Haplosaprists	Histosol	Mucky peat in forested area. Very deep, poorly drained in herbaceous organic deposits > 51" thick in depressions on moraines, lake plains & outwash plains. Few scattered black spruce, jack pine, quaking aspen & tamarack with blueberry, leatherleaf, sphagnum & wintergreen as ground cover. Horizons: Oe1-Oe2-Oa1-Oa2.	SE¼ S21
Markey	Terric Haplosaprists	Histosol	Muck on 1% slope in bog w/marsh vegetation. Very deep, very poorly drained in herbaceous organic material <40-130 cm thick over sandy deposits in depressions on outwash plains, lake plains, floodplains, river terraces, valley trains & moraines. Forested areas are in black ash, quaking aspen, balsam fir, black spruce, tamarack, northern white cedar & paper birch; some areas in cattails, marsh grasses, reeds & sedges. Horizons: Oa1-Oa2-Oa3-Oa4-Cg.	SE¼ S19

Table 1. Soils (continued).

Series	Class	Order	Description of Typical Pedon	Location in APE
Rousseau	Entic Haplorthods	Spodosol	Fine sand on 6% slope in forested area. Well-drained in sandy Aeolian deposits on dunes, lake plains & outwash plains. Native forests included sugar maple, red maple, balsam fir, white birch, quaking aspen & American beech. Horizons: A-E-Bs1-Bs2-BC-C.	SE¼ S19, C S20, SE¼ S21, NE¼ S28
Rubicon	Entic Haplorthods	Spodosol	Sand on 3% slope in red pine plantation. Very deep, excessively drained soils formed in sandy deposits on disintegration, ground, end and kame moraines, lake plains, outwash plains, stream terraces, beach ridges, and sand dunes. Native & present vegetation is dominantly red pine and quaking aspen with some eastern white pine and jack pine; ground cover is blueberries, wintergreen, sweet fern & bracken fern. Horizons: A-E-Bs1-Bs2-BC-C.	NW¼ S30 along existing RR tracks
n/a	Udorthents	Entisol	n/a	SE¼ S19, NE¼ S 19,
Wainola	Typic Endoaquods	Spodosol	Fine sand in forested area. Deep, somewhat poorly drained in fine sandy glaciofluvial deposits on outwash plains, lake plains & glacial lake deltas. Forests are chiefly quaking aspen, white ash, red maple, northern red oak w/shrubs & grasses. Horizons: Oa-E-Bs1-Bs2-BC-C. Ortstein fragments in Bs1 & Bs2; masses of Fe accumulations throughout BC.	SE¼ S19

3.0 Culture History

Occupation or use of the general region of which the Frontier Bio-energy plant project area is a part spans the prehistoric through historical periods; however, this occupation is known only in general terms and few sites are known from the study tract and its surrounding area. Prehistoric people used the region as evidenced by a number of archaeological sites recorded in Chippewa and surrounding counties, but the greatest number of sites date to the historical period and represent lumber or Civilian Conservation Corps (CCC) camps, homesteads, cemeteries, and other loci where other Euro-American activities occurred. While past research demonstrates that the general region of which the bio-energy plant is a part has been used and occupied during the early prehistoric through historical periods, the lack of recorded sites within the vicinity of the APE prevents one from determining the nature and intensity of the local occupation. As a result of the lack of data and synthesized cultural studies about the area, one is able to discuss the local prehistoric and historical past in general or regional terms only.

3.1 Prehistory

3.1.1 Paleoindian Tradition: 13,400 B.P. to 10,000 B.P.

The earliest inhabitants of Michigan are recognized as nomadic hunters and gatherers, who archaeologists refer to as Paleoindians. This group's subsistence base was heavily slanted toward the exploitation of Pleistocene mega-fauna such as mammoth, mastodon, bison, and caribou. In addition, limited contextual data, combined with ethnographic data about extant hunter-gatherer groups (Cleland 1966:49), suggests that their diet also included significant proportions of native plant foods and a variety of small mammals, reptiles, birds, and fish.

Currently, the Paleoindian period is subdivided into Early and Late stages. The temporal division separating the two is based upon a transition from fluted-to-non-fluted, lanceolate points (Mason 1981:111-112, 1986:192, 1997:98). Frequent indicators of a Paleoindian association with an area are isolated finds of distinctive projectile point styles: Clovis, Folsom, Scotsbluff, Eden, Agate Basin, and several others. While the fluted Clovis and Folsom points define the present of Early Paleoindian inhabitants in many regions of North America, within Michigan, fluted points are further recognized as Enterline, Gainey, Barnes, Crowfield, or Holcombe points based on specific fluting and morphological attributes (Shott and Wright 1999:62-63). Much of what is known about Michigan's Paleoindian tradition is derived from sites reported from the state's lower peninsula (Shott and Wright 1999:63). As a result, archaeologists are not in a position to offer detailed discussions about Upper Peninsula regional subsistence, settlement, or land use practices. While no Paleoindian materials are reported for the immediate area of the proposed bio-fuel plant area, the presence of such materials in the surrounding countryside suggests Paleoindian people were acquainted with the area and its potential resource base. Whether early Native Americans actually traversed the area and utilized its resources remains unknown.

3.1.2 Archaic Tradition: 10,000 B.P. to 2500 B.P.

The Archaic tradition followed that of the Paleoindian and is marked by a subsistence shift oriented toward smaller game and a broader range of plant species. Archaeologically, Archaic sites are

frequently defined by the absence of pottery containers, the presence of burials in natural knolls or flat cemeteries as opposed to man-made mounds, and the recovery of faunal and floral remains representing a more generalized or diversified subsistence base (Stoltman 1986 and 1997). Changes in, or the broadening of the subsistence base is linked to climatic conditions, which became more moderate as glaciers retreated. This shift in resource utilization is frequently reflected in stone tool assemblages, which show a trend toward greater diversity of projectile point/knife styles and an increase in proportions of groundstone, woodworking, and seed and nut processing implements. In addition, more emphasis is placed on fishing and the harvesting of riverine shellfish. Finally, copper objects become more common. To facilitate discussion of these changes and the tradition in general, the Archaic tradition is often divided into three stages: Early (10,000 B.P.-8000 B.P.), Middle (8000 B.P.-5000 B.P.), and Late (5000 B.P.-2500 B.P.). These stages are defined primarily on changing projectile point/knife styles.

Settlement patterns associated with an Archaic tradition people exploiting a specific region resulted from mobility strategies coupled with paleo-environmental and demographic conditions. Across Michigan, Archaic peoples moved through the landscape pursuing residential or logistical mobility strategies and created settlement patterns that are currently poorly understood but partially reflected by recorded sites located in open-air settings. Site types consist of isolated finds, base camps, transient camps, faunal and floral resource procurement stations, and processing sites. While the defined site types span the entire tradition, the frequency of each type may have changed in response to shifting mobility strategies linked to evolving natural and social conditions. Through time, these conditions encouraged or discouraged the establishment of certain site types as people adapted to their changing environment.

The Archaic tradition associated with the Upper Peninsula is documented by isolated surface finds and sites dating from the Early through Late sub-traditions. Of the sites, several have been excavated west and south of Chippewa County, and a single isolated find, a copper projectile point, has been reported from the north shore of Chippewa County (Griffin 1972:35). Excavated sites include the Late Paleoindian/Early Archaic Gorto site (Buckmaster and Paquette 1988; Shott 1999:72), and the Late Archaic Popper, Trout Point 1, 20MQ90, 20MQ91, Miner's Beach, Medore Street Burial, Ottawa North and Alligator Eye sites (Hill 1994:11; Robertson et al. 1999:98-99). Absent from the combined studies is an Upper Peninsula Middle Archaic presence, a sub-tradition that is best known from lower peninsula sites (Lovis 1999:87). The Late Archaic sites indicate that at least during the end of the Archaic tradition, people were utilizing both coastal and interior environments (Robertson et al. 1999:109), and were present in the region during summer and winter seasons (Fitting 1979:111; Hill 1994:48; Robertson et al. 1999:109). The reported copper point dates to the Late Archaic and is associated with the Old Copper Culture, which made extensive use of copper.

While the temporal distribution of sites indicates that the region was utilized by people during the entire Archaic period, the quantity and quality of the data provide few insights about group size, mobility, organization, or social interactions within the region. In summary, Archaic tradition people are known to have occupied and exploited the central and eastern portions of the Upper Peninsula just as Paleoindian groups did, but specific details about the nature and the intensity of the local Archaic occupation awaits further study.

3.1.3 Woodland Tradition: 2800 B.P. to 750-700 B.P.

Adaptations characterizing the Archaic tradition carried into that of the early Woodland, subsequently developing into a variety of behaviors responding to environmental, subsistence, and social conditions. Well defined traits marking the tradition are the presence of ceramics, the construction of earthen mounds for burials, and the cultivation of plants. In addition, during the temporal span of the tradition, population size increased, exotic goods reflecting extensive trade networks became more frequent, and burial customs grew more elaborate. Material culture reflects these changes with new projectile point types, distinctive ceramic forms, greater variety of trade goods, and more decorative elements placed on implements. In spite of these characteristics and innovations, subsistence practices remained rooted for a long period to cycles of hunting and gathering as horticulture became progressively more important and cultigens played a larger role in subsistence strategies. Coupled with this gradual shift toward cultigens came a movement away from seasonal, nomadic settlement patterns as people began to occupy large, semi-permanent villages in addition to seasonal resource procurement camps. Similar to the Archaic tradition, that of the Woodland may be divided into stages designated Early (2500 B.P.-2000 B.P.), Middle (2000 B.P.-1600 B.P.), and Late (1600 B.P.-400 B.P.).

Archaeologically, specific projectile point and ceramic styles often characterize the stages in the absence of radio-carbon dates. Within Michigan, the full temporal spectrum of Woodland tradition sites is present, but site distribution is uneven with segments of the tradition poorly understood in some areas, for example, the Early Woodland in the Upper Peninsula (Garland and Beld 1999:130), due to a lack of excavated sites and published reports. While numerous surface finds of diagnostic projectile point styles have been reported, and sites have been recorded, these data are area specific and cannot be used to synthesize an adequate regional perspective about Woodland subsistence, settlement, or land use practices. While characteristic mounds are present within the state, their number is few, and in the Upper Peninsula, the few mounds that are present are limited to the western portion of the peninsula.

Of the three stages that compose the Woodland tradition, the Middle and Late stages are more frequently represented by sites. As previously stated, Early Woodland stage sites are best known from the Michigan's lower peninsula, but on the Upper Peninsula, when recognized, are marked by the presence of the oldest regional ceramic type known as Lake Nokomis Trailed and by projectile points that most frequently show contracting- or straight-stemmed forms, although other styles are known. These materials have also been used to define the Early/Middle Woodland transitional phase known as Nokomis (Salzer 1969 and 1974). More abundant and better documented are Middle Woodland sites, which are known from the Straits of Mackinac-Sault Ste. Marie region. These sites include Wycamp Creek, Holtz, Pine River Channel, Gyftakis and McGregor, as well as others reported along the St. Mary's River and west of Sault Ste. Marie (Fitting 1979:109-110). The sites are predominantly coastal in distribution, and the nature of an interior occupation has yet to be adequately defined.

An apparent increase in Middle Woodland sites over those of stages that preceded or followed it, is attributed to the development of the loose trade and cultural network known at the Hopewell Interaction Sphere (HIS), which dominated much of the lower Ohio and Mississippi River valleys but extended north into Michigan. This network brought exotic goods and ideas to the area, as well as fueled the extraction of certain raw materials such as copper from it. The HIS stylistic influence was strongest during the earliest stages of the Middle Woodland (Fitting 1979:112), and then waned; however, as long as the HIS functioned, the regional extraction and export of copper brought people to the region, where they

created and left archaeological sites. With the decline of the HIS, utilization of the area appears to have declined. As a result, Late Woodland sites appear fewer in number.

Similar to Early and Middle stage sites, those of the Late stage are recognized primarily by distinctive ceramic styles. In order to distinguish Late Woodland sites of the Upper Peninsula and bordering areas from similar stage sites recorded in other parts of the western Great Lakes region, northern sites are further categorized as belonging to a sequence of phases exhibiting unique characteristics not associated with contemporary sites reported from other parts of the greater region. For the eastern portion of the Upper Peninsula, Late Woodland sites are not well understood, but are thought to exhibit characteristics that, during the early and mid-Late stage are related to the "Steiner", Mackinac-Heins Creek, and Juntunen phases (Brose 1978:570-571; Fitting 1979:112). After circa 650 B.P., the occupation of the eastern portion of the Upper Peninsula appears to decline to the point of being all but abandoned by native peoples (Fitting 1979:112). This observation begins to reverse itself during the 17th century with the arrival of Europeans, who establish trade relations in the region, and begin to draw Native Americans to the area for economic reasons; a situation that may not be dissimilar to what happened during the Middle Woodland with the influence of the Hopewell Interaction Sphere (Fitting 1979:112).

The distribution of Woodland tradition sites across the Upper Peninsula's eastern half suggests sites from all stages exist in the region. In addition, the sites indicate that Woodland people, as did people of traditions preceding them, knew about the region and the resources it offered, although the nature and intensity of the occupation or use remains poorly understood, especially as to the use of areas away from the coast. With the arrival of Europeans, use of the region by Native Americans was modified, and from the 17th century onward human use of the area is better documented and understood.

3.2 Historical Native American Occupation

At various times during the historical period, the eastern portion of the Upper Peninsula has been occupied or used by the Chippewa, Menominee, Winnebago (Ho-Chunk), Ojibwa, and Potawatomie, although traditionally, it is considered the home territory of the Chippewa and Ojibwa. Other groups may have made incursions into the region from time-to-time, and occasionally two or more groups may have occupied parts of it. Any attempt to understand the 16th- and early 17th-century use of the region by Native Americans is complicated by the likely depopulation of the area due to European introduced diseases and by the migration of eastern groups to the area. After the arrival of Europeans, the fur trade of the 17th and 18th centuries developed and fostered social and economic conditions that dictated the nature of the occupation, as did the shifting regional political claims by French, British, and American interests.

By the mid-19th century, Native American groups had ceded most of their claims to lands in the eastern portion of the Upper Peninsula to the U.S. government and withdrawn westward or settled on reservations. Much of the eastern portion of the Upper Peninsula as well as the northwestern portion of lower Michigan were ceded to the federal government by the 28 March 1836 *Treaty with the Ottawa* and Chippewa Nations of Indians, although the Ottawa and Chippewa reserved some rights to hunt and fish on lands until they were required for settlement. The 31 July 1855 Treaty with the Ottawa and Chippewa made provisions to allow the U.S. government to withdraw public lands not sold or conveyed to private interests, and offered these lands to the Ottawa and Chippewa for their use. Native American rights and access to land have been further expanded or re-enforced by 21st-century decrees upholding

Native Americans hunting and fishing rights on public lands. While historical Native American groups have occupied or used the eastern portion of the Upper Peninsula since the arrival of the first Europeans, in most cases, this history is best known from documentary sources because few published archaeological reports, beyond possible burial site reports, chronicle the presence and activities of historical Native Americans in the region during the 17th through early 20th centuries.

3.3 Euro-American Settlement and Development

Euro-American settlement of the area defined by the eastern portion of the Upper Peninsula occurred as the result of the fur trade, which encouraged well situated commerce/military centers occupied year round. Due to poor agricultural conditions, large scale farming was not widely pursued. Rather, the area was developed or exploited for its natural resources, which first included fur bearing animals, and later lumber. Through time, the French, British, and Americans took an interest in the economic benefits of the fur trade; however, it was only the Americans who attempted to bring order to the land and eventually take advantage of the region's other natural resources.

The Michigan Territorial Legislature created Chippewa County during 1826, at which time the county—stretching to the Mississippi River--was considerably larger than it is today. The county as established today was created by a legislative act during 1843 (Western Historical Company 1983:209). County lands were formally surveyed by the General Land Office of the U.S. government during 1845, after which, residents and new comers could legally apply for land ownership. As the fur trade waned, commercial interest turned their attention to the forests which they lumbered, thereby further opening the land for agricultural improvement, which, again due to environmental conditions, did not fully develop, although efforts were certainly made to earn a livelihood from agriculture. Historical activity is evident in the vicinity but outside of the APE by sites 20CH0282, the Kinross logging camp, and 20CH0297, CCC Camp Munuscong. Today, the area, including that of the proposed biorefinery, remains in secondary growth, which serves recreational purposes (e.g., all-terrain vehicle trails and hunting grounds) or is being prepared for timbering (e.g., pine plantation in the APE).

4.0 Previous Investigations

The OSA's 2009 listing of *Archaeological Sites Per County* indicates that 385 archaeological sites had been recorded in Chippewa County. Of the 14 counties in the UP, Chippewa County has the 5th-largest number of recorded archaeological sites. Among the three easternmost counties in the UP, Chippewa County ranks a close 2nd place behind Mackinac County (n=404), but Luce County ranks a distant 3rd place with only 42 recorded archaeological sites.

Previous investigations consulted by AECOM were completed for a variety of projects outside of the present APE, some quite a distance away but still in Chippewa County. The previous investigations were conducted for pipeline projects (Dobbs and Nienow 2002; Weir 1981), a telecommunications project (Lillis-Warwick 2009), U.S. Forest Service (USFS) projects (Drake and Dunham 2008); and a National Park Service project (Brantsner 1993). Since none of these investigations were completed in the present APE, these reports were consulted for methodology (assumptions and field procedures) and expected site types and locations for Chippewa County. **Table 2** summarizes information from previous investigations that AECOM applied to the present investigation for a predictive model that illustrated areas of low, moderate, and high probability for prehistoric and historic archaeological sites.

Table 2. Previous Investigators' Definitions of High-Probability Areas, Methods, and Results

Previous Investigator	High-Probability Areas (HPAs)	Methodology	Results
Weir (1981)	Undefined	• Pedestrian survey along parallel transects in 75-foot-wide ROW (transects presumed to be 10 meters apart). • Shovel tests at maximum 20-meter intervals along parallel "transect corridors" within ROW "whenever possible." • Sampling interval of shovel tests varied "according to known or expected cultural resource sensitivity and physiographical conditions or obstacles." • No mention of subsurface testing in low- or moderate-probability areas.	Unknown since Results section of report not scanned/emailed, but presume sites found along 1,017-mile-long ROW.
Brantsner (1993)	• 100 meters of water OR • Along water-related geologic features (e.g., beach ridges).	• Walk-over and shovel-testing strategy coincident with USFS specifications. • Walk-over along transects at 30-meter intervals. • Shovel testing at 15-meter intervals in HPAs. • No mention of subsurface testing in low- or moderate-probability areas.	One newly recorded site.
Dobbs & Nienow (2002)	• Areas with surface evidence of archaeological properties OR • Standing structures OR • Topography or micro-topography of interest within 50 meters of existing water or ancient water features.	• Pedestrian survey to examine ground surface along transects spaced 15 meters apart parallel to pipeline. • Shovel testing at 15-meter intervals within HPAs. • No mention of subsurface testing in low- or moderate-probability areas.	One newly recorded site.
Drake & Dunham (2008)	• Habitable, level, and well-drained surfaces within 300 meters of riparian features and wetland edges. • Identifiable post-Pleistocene terraces, beaches, and strand lines. • Forest clearings and transportation features.	• Pedestrian survey along transects typically placed at 30-meter intervals when "surface visibility is good" (e.g., plowed agricultural field and other exposed areas) and in HPAs. • Parallel transects of 15-meter-interval shovel tests in HPAs. • No mention of subsurface testing in low- or moderate-probability areas.	25 newly recorded sites.

5.0 Methodology

5.1 Background Research

AECOM began the Phase I archaeological investigation with Mr. Craig Simon of AECOM's Lansing, Michigan office conducting background research in the Office of the State Archaeologist (OSA) under the direct supervision of Dr. Barbara Mead, Assistant State Archaeologist and remote supervision of Dr. Amy Ollendorf, AECOM's Principal Investigator for archaeology. AECOM's background research, completed on August 25, 2010 and September 8, 2010, consisted of queries of the archaeological site files and reports databases. Mr. Simon scanned and emailed copies of site files and excerpts from previous investigations to Dr. Ollendorf for use throughout the investigation. AECOM also utilized a series of aerial photographs obtained previously for AECOM's Phase I Environmental Site Assessment (ESA) of the 355-acre parcel – 1939, 1953, 1964, 1982, 1991, and 2006 – as well as a series of aerial photographs obtained from Historical Information Gatherers, Inc. (HIG) for the proposed railroad spur – add dates here. AECOM also utilized historic, including the 1845 U.S. General Land Office (GLO) original plat (obtained at http://www.glorecords.blm.gov) along with the 1930 and 1970 plat maps for Kinross Charter Township (obtained from Chippewa County plat books) as well as 1951 and 1975 USGS 7.5' and 15' topographic maps (Drafter and Sault Sainte Marie quadrangles). Dr. Meade provided further historical information – the *Index of Michigan CCC Camps in the Upper Peninsula* and pages pertaining to the APE from Chippewa County's book of original land patents.

By reviewing the output of the background research, AECOM determined that the APE had not been surveyed previously by professional archaeologists. AECOM identified two previously recorded archaeological sites in the vicinity but outside of the APE. One site 20CH0282 is the "Kinross Camp," the remains of a ca. 1913-1925 logging camp recorded, delineated, and evaluated in the northeast quarter of Section 20 (Brantsner 1993). Site 20CH0282 was determined ineligible for nomination to the National Register of Historic Places (NRHP) by the OSA in 1996. The other known archaeological site, 20CH0297, is the "Munuscong CCC Camp" located in the northwest quarter of Section 33. To-date, this site has not been relocated and evaluated by a professional archaeologist for its NRHP eligibility. Other sites further afield and also outside of the APE pertain to tourism and recreation (20CH0280, "Dodge Brothers Camp") and logging (20CH0424, "SO5;" 20CH0425, "SO6;" and 20CH0426, "SO7").

5.2 Predictive Model

AECOM developed a predictive model from previous archaeological experience in Michigan and elsewhere in the Upper Midwest as well as from the methodological information summarized in Section 4.0 of this report. ESRI's ArcGIS™ was the software suite utilized to create the predictive model from the USGS topographic quadrangle as an active, base-mapping layer (**Figure 3**). The parameters for high-, moderate-, and low-probability areas and extent in the project area are summarized in **Table 3**. It should be noted that no indications of long-term historic occupation appear in the historic records, including aerial photographs and maps, for this particular APE. Therefore, the customized parameters in AECOM's predictive model are necessarily oriented toward prehistoric and protohistoric site-selection preferences.

Table 3. Predictive Model Parameters and Extents of Probability Areas

Probability Area	Parameter	Extent (acres)
High (HPA)	• Slope with 0-10% grade <u>and</u> • < 300 meters from existing waterbody (e.g., only wetlands presently).	113.1
Moderate (MPA)	• Slope with 0-10% grade <u>and</u> • < 300 meters from existing waterbody.	237.2
Low (LPA)	• Disturbed previously (e.g., gravel or sand pits) <u>or</u> • Existing wetlands or • Slope with grade > 10%	28.4

Two parcels in the APE were accessible for AECOM's archaeological field survey in September 2010 – the 160 acres in the northeast quarter of Section 28 (aka the "Lower 160") and the western terminus of the proposed railroad spur (aka the "West End"). Virtually the entire Lower 160 was ranked MPA, except for a narrow sliver in the northeastern-most corner, which was ranked LPA (**Figure** 3). The entire West End was ranked HPA.

5.3 Field Methods

AECOM's field crew conducted pedestrian reconnaissance and shovel testing along parallel transects (**Figure** 4 and **Figure 5**) from September 20 through mid-morning of September 23, 2010. Over the 3.5-day timeframe, AECOM excavated a total of 73 shovel tests. Shovel testing was hampered by weather, deep soils, and thick vegetation.

Each shovel test was approximately 0.5-meter in diameter; maximum depths ranged from 40 centimeters below the ground surface (cmbgs) to 93 cmbgs. Abandonment of shovel tests occurred because of negative findings, impenetrable roots, rocks, or concretions (e.g., cementing material of illuviated sesquioxides and organic matter, known as ortstein). All excavated sediment was sieved through portable archaeological screens fitted with ¼-inch hardware mesh; all shovel tests were backfilled before abandonment. The field crew utilized Munsell soil color charts and USDA-NRCS soil terminology and classification to characterize the excavated soil. All observations were recorded on standardized shovel-test logs and in the PI's daily journal, and the project area was photo-documented with a digital single-lens reflex camera. The locations of all shovel tests were recorded with Trimble GeoXH™ handheld Global Positioning System (GPS) capable of sub-meter accuracy. After the completion of the field survey, all GPS data were downloaded into the Geographic Information System (GIS) created for the project.

Vegetation generally was thick with little-to-no ground-surface visibility in the Lower 160 (**Figure 6**), except in the pine plantations (**Figure 7**). Logging and recreational trails were evident throughout. One hunter's deer stand with a light scatter of modern debris was observed in the Lower 160. Vegetation typically was not as thick in the West End (**Figure 8**) as in the Lower 160. The West End is bifurcated by an overhead electrical transmission line (**Figure 9**) that is utilized by hunters (e.g., a hunter's "blind" was situated in the ROW).

The following sections describe specific field methods and conditions in each of the portions of the APE surveyed by AECOM.

5.3.1 Lower 160

On September 20, the weather was sunny, clear, and dry with temperatures ranging from the 40s-60s degrees Fahrenheit (4-16 degrees Celsius). Field survey began along the southern-most boundary of the APE. Transect 1 was comprised of 16 shovel tests spaced 50 meters apart from east to west (**Figure 4**). All of these first shovel tests were negative for cultural materials. Consequently, the shovel-testing interval was expanded to 100 meters for the subsequent transects in the Lower 160 (**Figure 4**). AECOM calculated that a total of eight (8) parallel transects spaced 100 meters apart would cover the entire Lower 160. A total of 24 shovel tests were completed along transects 1 and 2 on September 20.

Field work on September 21 occurred along transects 3 and 4, but the work day was punctuated and then truncated by thunderstorms. Temperatures were in the mid-upper 60s degrees Fahrenheit (16+ degrees Celsius). AECOM completed a total of 16 shovel tests.

Field work on September 22 began in the West End (see below) and then continued along transects 7 and 8 in the Lower 160 where 16 additional shovel tests were excavated. Ground conditions dried as the day progressed; temperatures were in the upper 60s-low 70s (16-21+ degrees Celsius) under sunny to variable cloudy skies.

Field work on September 23 was curtailed by heavy and constant rain throughout the day. Temperatures were cool - high 50s to low 60s degrees Fahrenheit (10-16+ degrees Celsius). A total of only four (4) shovel tests were completed. Heavy rain was predicted to continue through September 24, which led to the PI's decision to end the field survey. As such, AECOM completed a total of 6.5 transects and a total of 60 shovel tests in the Lower 160 over the 3.5-day period.

5.3.2 West End

AECOM completed the field survey in this portion of the APE by excavating a total of 13 shovel tests at 15-meter intervals along one transect during the morning of September 22 (**Figure 5**).

6.0 Results

The only cultural resources observed during the 3.5-day-long Phase I archaeological survey was a small surface scatter of miscellaneous transportation-related debris, such as modern oil filters (**Figure 10**). AECOM excavated a total of 73 shovel tests across the MPA comprising almost the entire Lower 160 and the HPA and MPA comprising the West End. No cultural resources were encountered in any of the shovel tests. Shovel-test profiles encountered in both subareas of the APE were typical of Spodosol soils (i.e., Kalkaska, Rousseau, and Rubicon soils as mapped by the USDA-NRCS). A typical pedon encountered in the Lower 160 and West End is illustrated in **Figure 11**.

7.0 Recommendations

AECOM's Phase I archaeological field survey provided adequate coverage of MPAs and a HPA in the APE with unanimously negative findings for cultural resources. AECOM has tested and verified the predictive model and found no historic properties. Consequently, no further archaeological survey is recommended for the APE, including the three (3) remaining HPAs and two (2) MPAs in the proposed railroad spur on state-owned lands. AECOM recommends a finding of "No Historic Properties Affected" and the proposed Frontier Renewable Resources biorefinery project should be allowed to proceed with no further archaeological field work.

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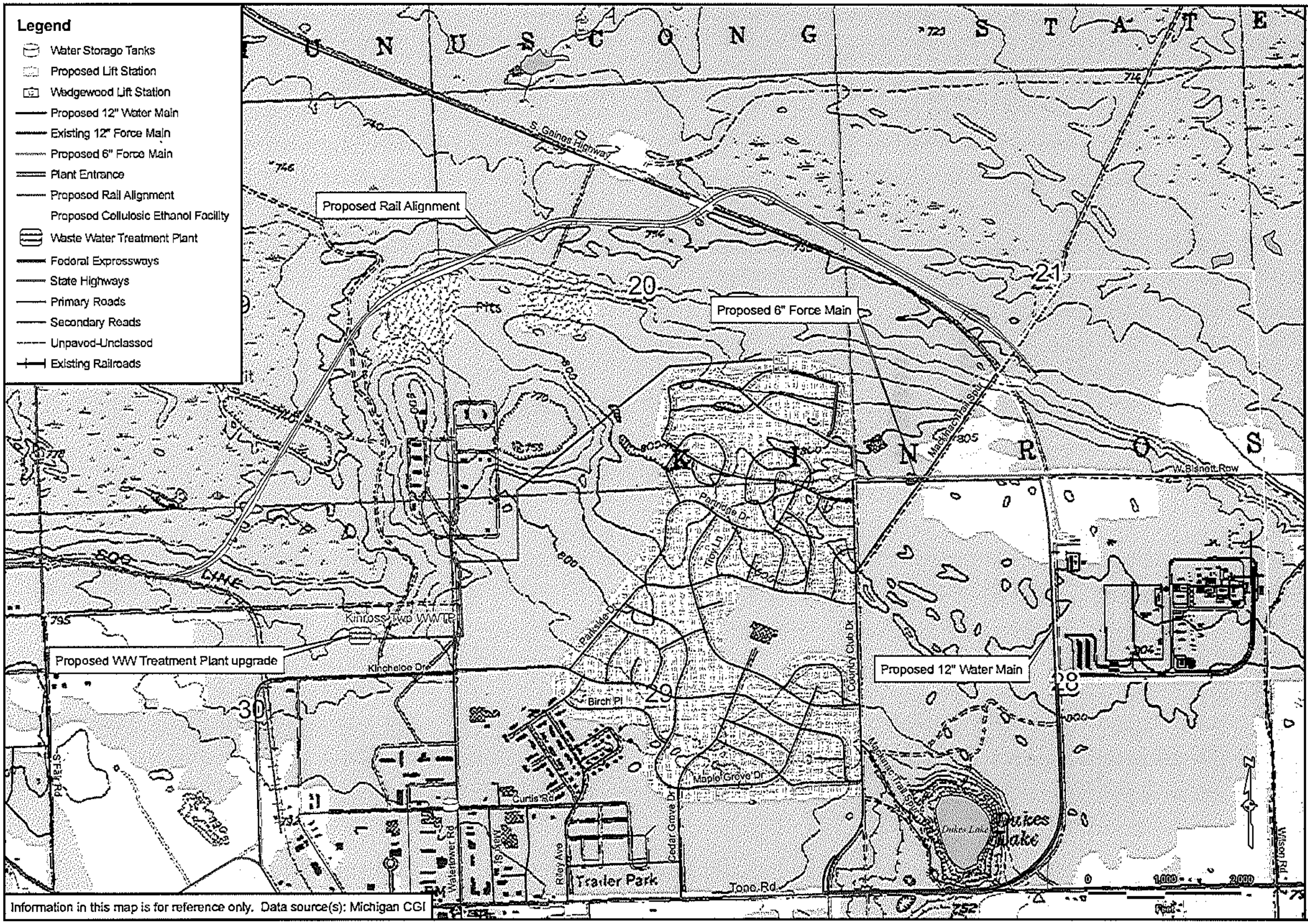
Appendix A

Figures



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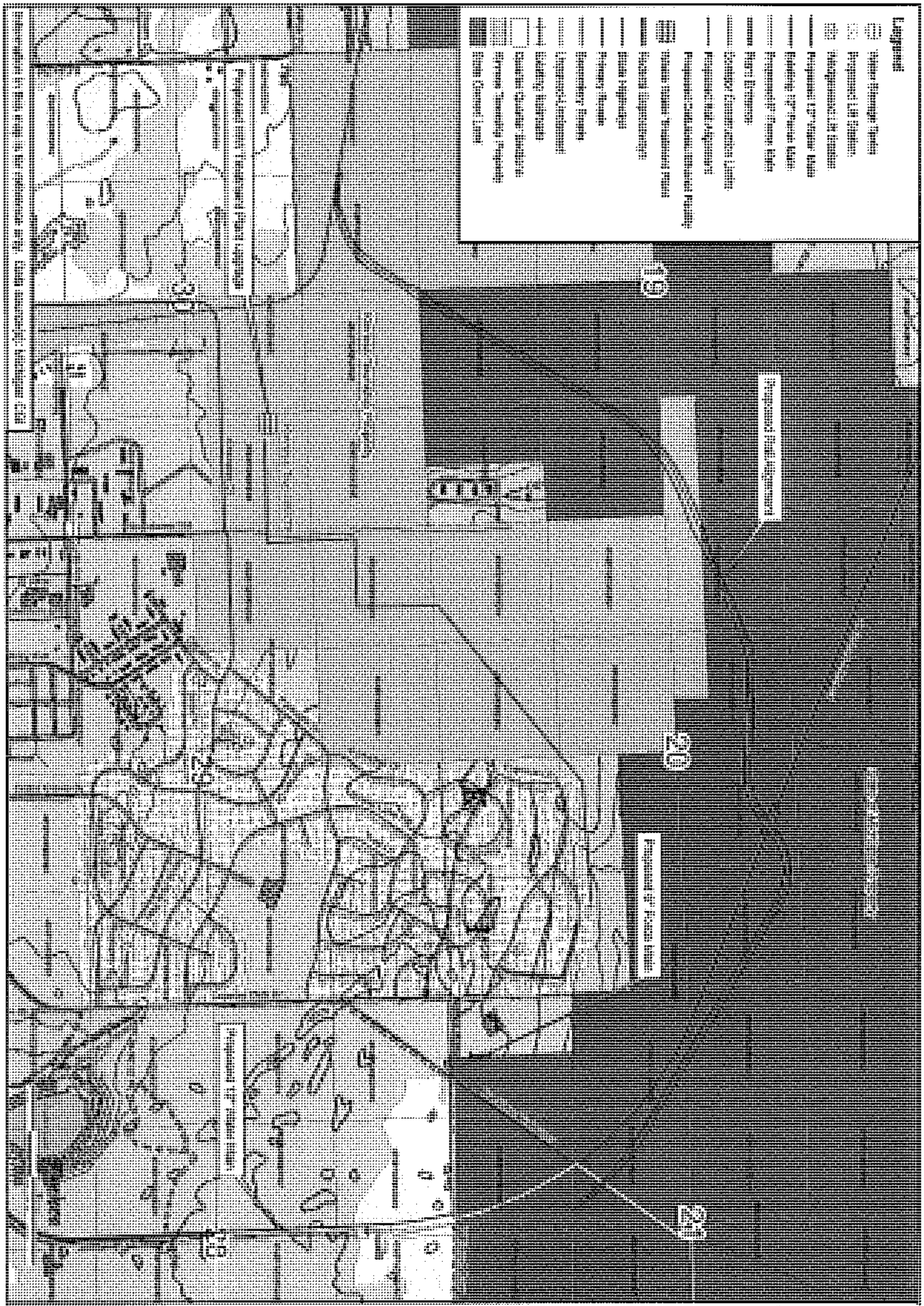
PROPOSED RAIL ALIGNMENT AND WATER INFRASTRUCTURE
FRONTIER RENEWABLE RESOURCES, LLC
CELLULOSIC ETHANOL FACILITY
KINROSS TOWNSHIP, CHIPPEWA COUNTY, MICHIGAN

Drawn:	JWW	8/18/2010
Approved:	IM	8/18/2010
Scale:	AS SHOWN	
PROJECT NUMBER	60140061	
FIGURE NUMBER	1	



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PROPOSED RAIL ALIGNMENT AND WATER INFRASTRUCTURE
FRONTIER RENEWABLE RESOURCES, LLC
CELLULOSIC ETHANOL FACILITY
KINROSS TOWNSHIP, CHIPPEWA COUNTY, MICHIGAN

Source: USGS Topo from ArcGIS Data Resource Center 2009

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Suite 500
Minneapolis, MN 55441
T: 763-852-4200
F: 763-473-0400
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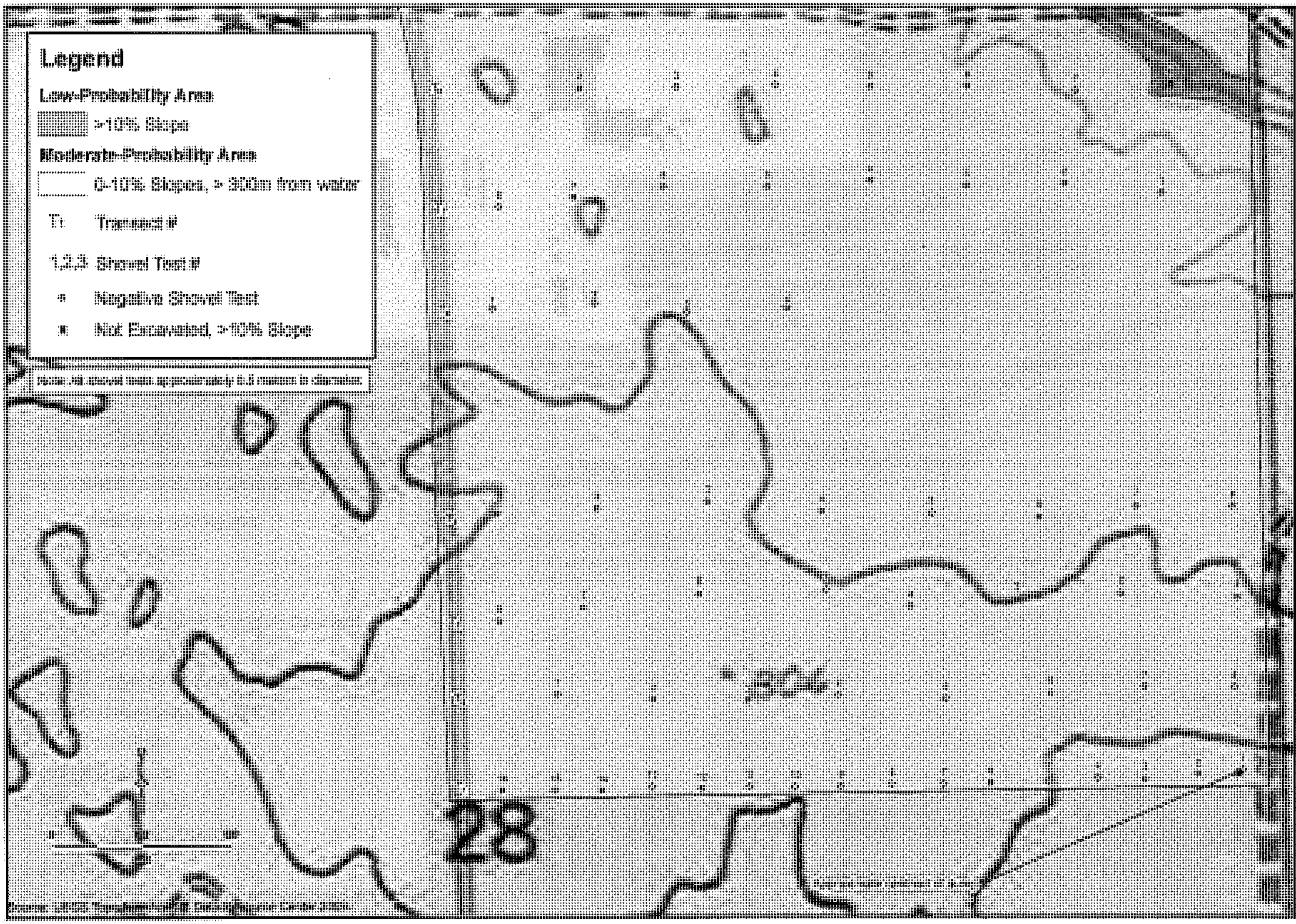
PREDICTIVE MODEL
PHASE I ARCHAEOLOGY
FRONTIER RENEWABLE RESOURCES, LLC
KINROSS TOWNSHIP, CHIPPEWA COUNTY, MICHIGAN

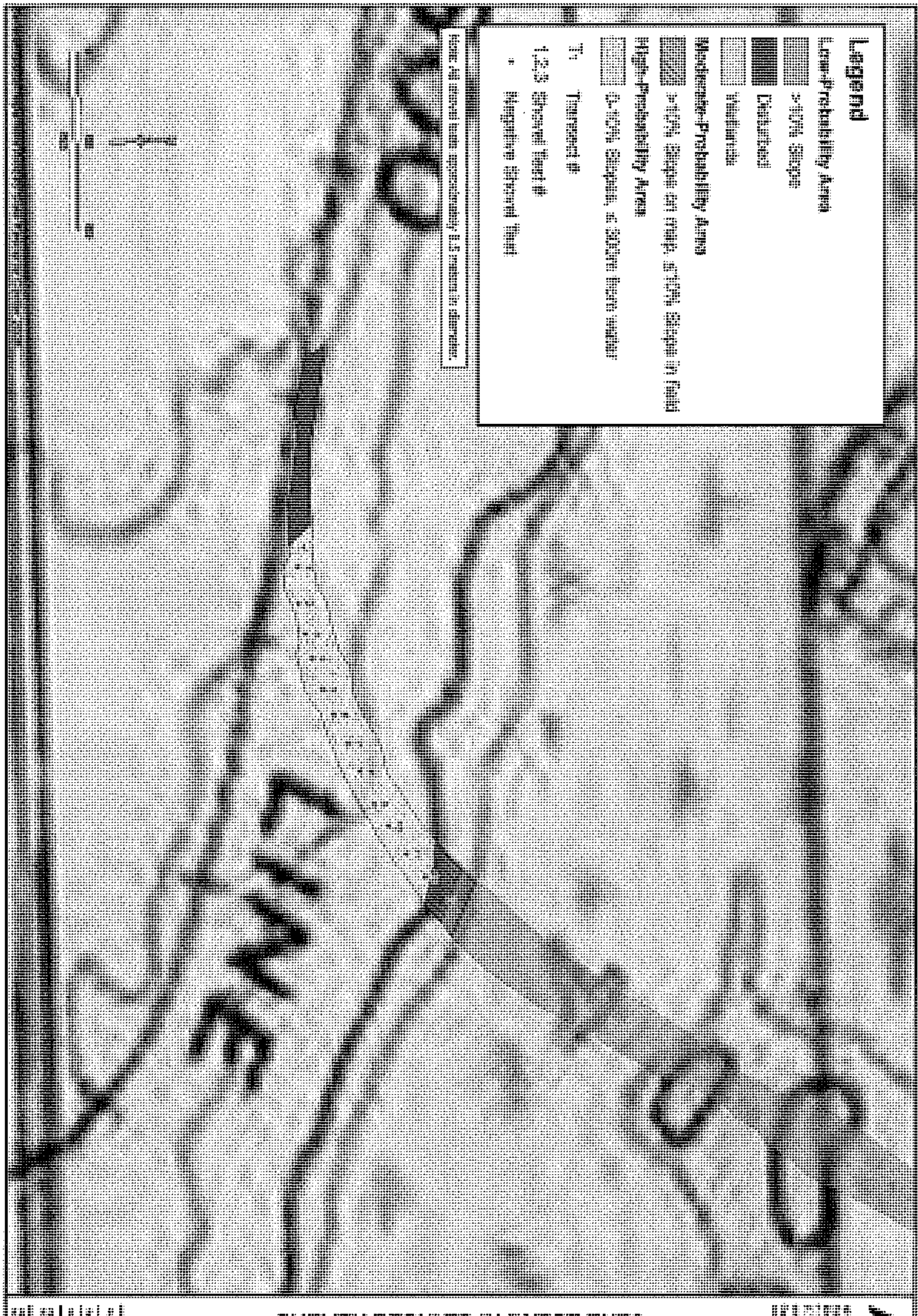
Drawn: KLM 9/16/2010
Approved:
Scale: 1" = 1,200'
PROJECT NUMBER 60140061
FIGURE NUMBER 3



AECOM

SURVEY RESULTS IN "LOWER 160"

PHASE I ARCHAEOLOGY
FRONTIER RENEWABLE RESOURCES, LLC
KINROSS TOWNSHIP, CHIPPEWA COUNTY, MICHIGAN



AECOM

SURVEY RESULTS IN "WEST END"
PHASE I ARCHAEOLOGY
FRONTIER RENEWABLE RESOURCES, LLC
KINROSS TOWNSHIP, CHIPPEWA COUNTY, MICHIGAN

Figure 6. Photograph of Vegetation and Coverage Typical In Lower 160 View looking east at Transect 3, Shovel Test 8.

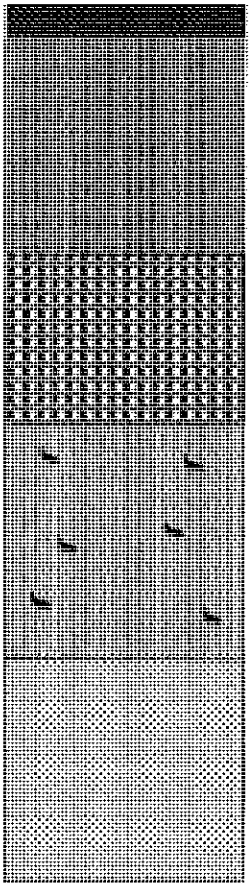
Figure 7. Photograph of Vegetation and Coverage in Pine Plantation Portion of APE
View looking east at Transect 4, Shovel Test 3.

Figure 8. Photograph of Vegetation and Coverage Typical in the West End
View looking east at Transect 1RR, Shovel Test 1.

Figure 9. Photograph Under Powerline Bifurcating West End Portion of the APE
View looking east from approximate center of Transect 1RR.
Note "hunter's blind"on left side of ROW.

Figure 10. Photograph of Modern Transportation-Related Debris Pile
View looking west, approximately 9 feet in diameter.

Figure 11. Typical Shovel-Test Profile
Transect 1, Shovel Test 6 (in the Lower 160)



0 cmbgs present ground surface
5 cmbgs 10YR2/2 (very dark brown) fine sand &

20 cmbgs 5YR5/1 (gray) fine sand

33 cmbgs 5YR3/2 (dark reddish brown) fine sand w/abundant cobbles

52 cmbgs 5YR5/4 (reddish brown) fine sand w/ sparse charcoal fragments, < 1 cm each

70 cmbgs 5YR6/4 (light reddish brown) fine sand

LAC VIEUX DESERT BAND OF LAKE SUPERIOR CHIPPEWA INDIANS

Ketegitigaaning Ojibwe Nation Tribal Historic Preservation

P.O. Box 249, E23857 Poplar Circle Watersmeet, MI 49969
Phone: 906-358-0137 or 0138 Fax: 906-358-4850

Date: August 5, 2010

REF: DOE, Chippewa County/City of Kinross Cellulose-to-Ethanol Biorefinery
Booshoo,

The Ketegitigaaning Ojibwe Nation THPO (Lac Vieux Desert Chippewa) received your requests for comments or interest concerning the National Historic Preservation Act, Section 106 request for review and comment to the effect on historic and cultural sites within the proposed project area. The LVD Tribal Historic Preservation Office has no interests documented at this time in the proposed project areas. LVD has conducted its database research, file research and find no sites within the project area at this time. However that does not mean that they do not exist. It is LVD's belief that many prehistoric sites and Indian historic sites in the area have not yet been identified or documented. LVD is among the many Tribes initiating the process of assisting in this endeavor. LVD urges you to consult other Indian Tribes in your immediate area that may have interests in your project area, if you have not already done so.

If the scope of work changes in any way, or if artifacts or human remains are discovered, please notify LVD immediately so we can assist in making an appropriate determination. LVD urges you to consult other Indian Tribes in your immediate area that may have interests in your project area, if you have not already done so.

Please forward any future request for review of historic and cultural properties according to the National Historic Preservation Act Section 106 to giiwegiizhigookway Martin, Officer, Tribal Historic Preservation Office. Please keep us informed of future projects as LVD plans to increase our efforts to identify and document sites in the area.

Miigwetch,

Giiwegiizhigookway Martin

giiwegiizhigookway Martin

giiwegiizhigookway Martin, THPO
Ketegitigaaning Ojibwe Nation
Tribal Historic Preservation Office
P.O. 249
E23857 Poplar Circle
Watersmeet, Michigan 49969
Phone: 906-358-0137
Fax: 906-358-4850

email: gmartin@lvdtribal.com

Department of Energy
Golden Field Office
1617 Cole Boulevard
Golden, Colorado 80401-3393

November 2, 2010

giiwegiizhigookway Martin, THPO
Ketegitigaaning Ojibwe Nation
P.O. Box 249
Watersmeet, Michigan 49969-0249

SUBJECT: MASCOMA FRONTIER BIOREFINERY PROJECT KINROSS, MICHIGAN

Dear Ms. Martin,

We appreciate your offer to help us to fulfill our responsibilities under the National Historic Preservation Act and the Native American Graves Protection and Repatriation Act. We have delayed replying to your response to our inquiry, so that we could provide as much useful information to you as possible. We just received the attached Phase I Archeological Investigation of the proposed site, which may be an important part of your review.

In your reply you asked for four items:

- a short summary of the proposed ground disturbing activity,
- a legal description of the Area of Potential Effects,
- topographic maps identifying the proposed area, and
- copies of any studies that have already been conducted regarding cultural resources and archaeology in their full format, including reports on archaeological and cultural sites identified.

The replies to your request are on the attached page. Also attached are the copy of the requested archeological report and payment of the fee for your initial review of the proposed project.

Per your earlier reply, we understand that you will review the project documents to determine whether or not any sites of religious or cultural significance occur within the Area of Potential Effects and, if so, what these effects may be. Kindly let us know the results of your review.

Thank you for your assistance. We look forward to hearing from you.

Sincerely,

Kristin Ken

Kristin Kerwin
NEPA Compliance Officer

Mascoma: Frontier Resources Cellulose-to-Ethanol Biorefinery Project. Kinross, MI

A. Short Summary of the proposed ground disturbing activity.

Site Background

Historically, the Frontier site consisted of undeveloped land until the development of a homestead in the 1920s in the Southeast ¼ of Section 21. The homestead contained a house, barn, and farmland which were lost to a fire in the 1930s-40s. The proposed plant site was part of the former U.S. Air Force (USAF) base in the Township of Kinross. Construction of the Air Force Base (AFB) began in 1943. The air base expanded throughout the 1950s, and in September 1959 it was officially renamed Kincheloe AFB. The base was inactivated on September 30, 1977 following the end of the Vietnam War. Today the airport and community of Kincheloe, Michigan are located on the site of the base.

Ground Disturbing Activity

The project consists of the design, construction and operation of a biorefinery producing ethanol and other co-products from cellulosic materials utilizing a proprietary pretreatment and fermentation process. Development would be completed on the southern 160 acres of the 355-acre proposed project site. Figure 1 shows the proposed project site layout on a topographic map. It also shows the main route serving this area is Interstate 75, which is within three miles of the proposed plant site. No permanent roads would be constructed since access presently exists from existing roads. Figure 2 provides a site location map imposed on an aerial photo. The proposed rail service to the proposed project area would be established by construction of a rail spur from the existing rail line located east of Kinross as shown in Figure 3.

Ground disturbing activities for the proposed facility would require construction of a number of major buildings, process areas, and structures plus the rail spur. These include an approximately 15 acre wood yard; log and conveyors, a wood chipper building; a chemical, pretreatment, lab and fermentation building; water cooler buildings; a utility building; a package boiler building; an evaporator building; a distillation building; and a drying building. A site master plan is presented in Figure 4.

B. Legal description of the Area of Proposed Effects.

The proposed plant site is comprised of 355 acres in sections 21 and 28, Township 45 North, Range 01 West in Kinross Township, Chippewa County, Michigan. The official property description is:
the parts of the south half of Section 21 lying east of the centerline of Gaines Highway, except that part lying west of the easterly edge of State Designated Snowmobile Trail #49 (otherwise known as the Mackinac Trail Spur) and all that part of the north half of Section 28 lying east of the centerline of Gaines Highway, excepting and reserving unto the State of Michigan an access easement to enable the State to access an adjacent parcel described as the northwest quarter of the southeast quarter of Section 28 (benefited parcel).

The APE would be 160 acres in the northeast quarter of Section 28 and the 2.5-mile-long railroad spur right-of-way.

C. Topo maps identifying the proposed area.

Please see Figure 1 which includes the site location on a topo map.

D. Copies of any studies that have been conducted regarding cultural resources and archeology in their full format, including reports on archeological and cultural sites identified.

Attached please find the report *Phase 1 Archaeological Investigation*, the only study of cultural resources and archaeology prepared about the proposed project site.

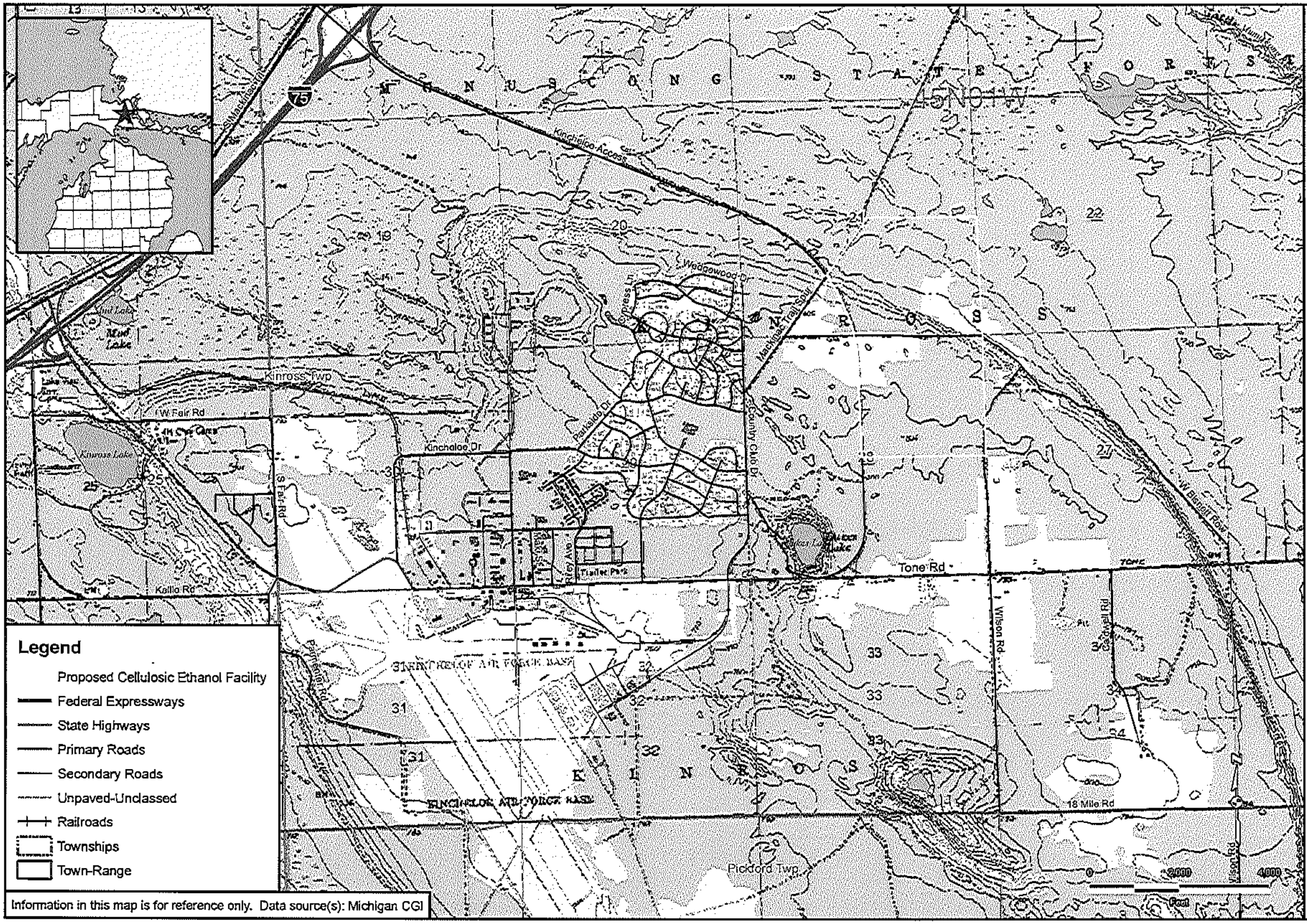


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FIGURE 1
SITE LOCATION MAP
FRONTIER RENEWABLE RESOURCES, LLC
CELLULOSIC ETHANOL FACILITY
CHIPPEWA COUNTY, MICHIGAN

Drawn:	JWW	2/17/2009
Approved:	LDK	2/17/2009
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PROJECT NUMBER	13375-001-0100	
FIGURE NUMBER	1	

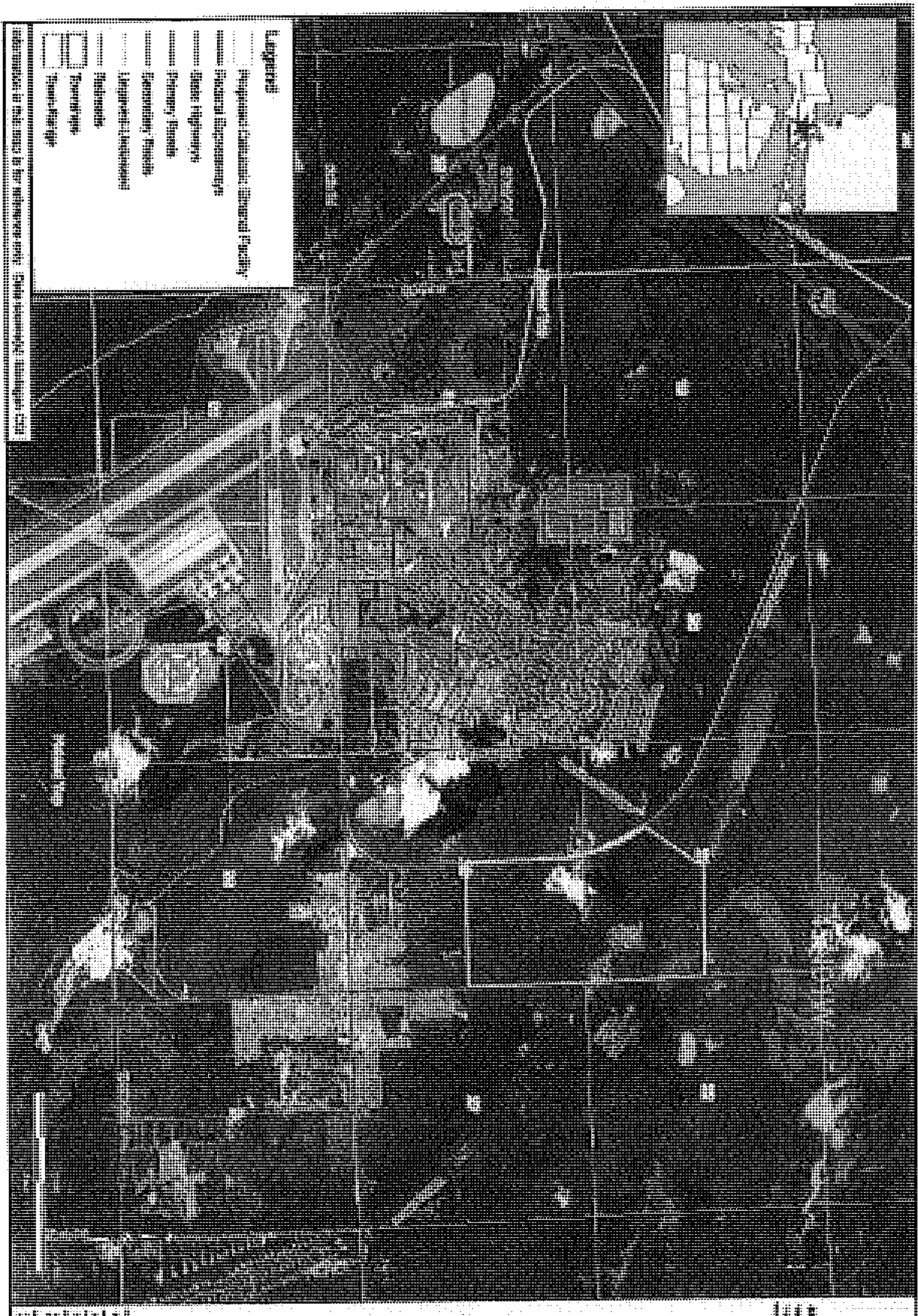

FIGURE 2
SITE LOCATION MAP WITH 2005 AERIAL PHOTO
FRONTIER RENEWABLE RESOURCES, LLC
CELLULOSIC ETHANOL FACILITY
CHIPPEWA COUNTY, MICHIGAN

AECOM

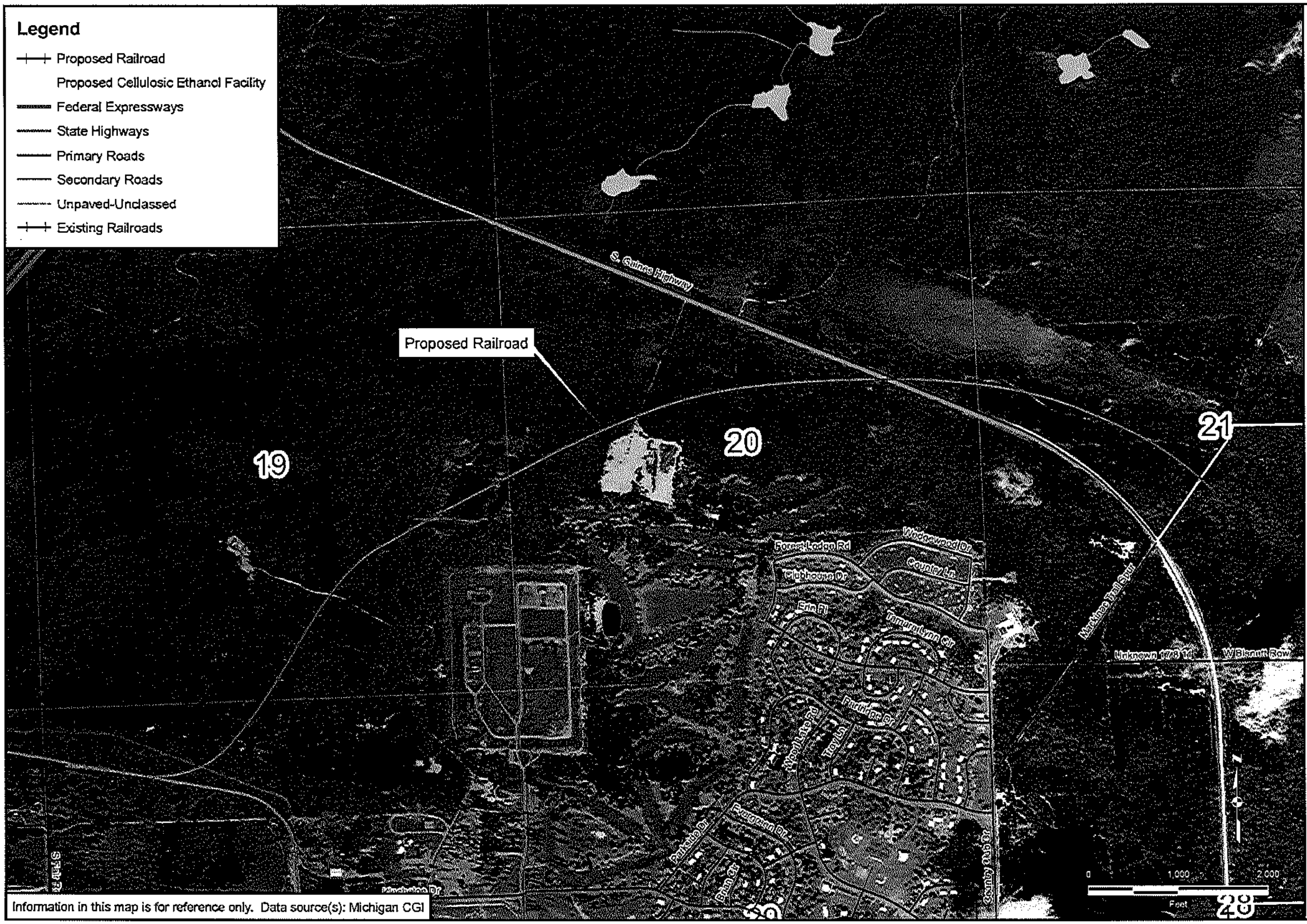

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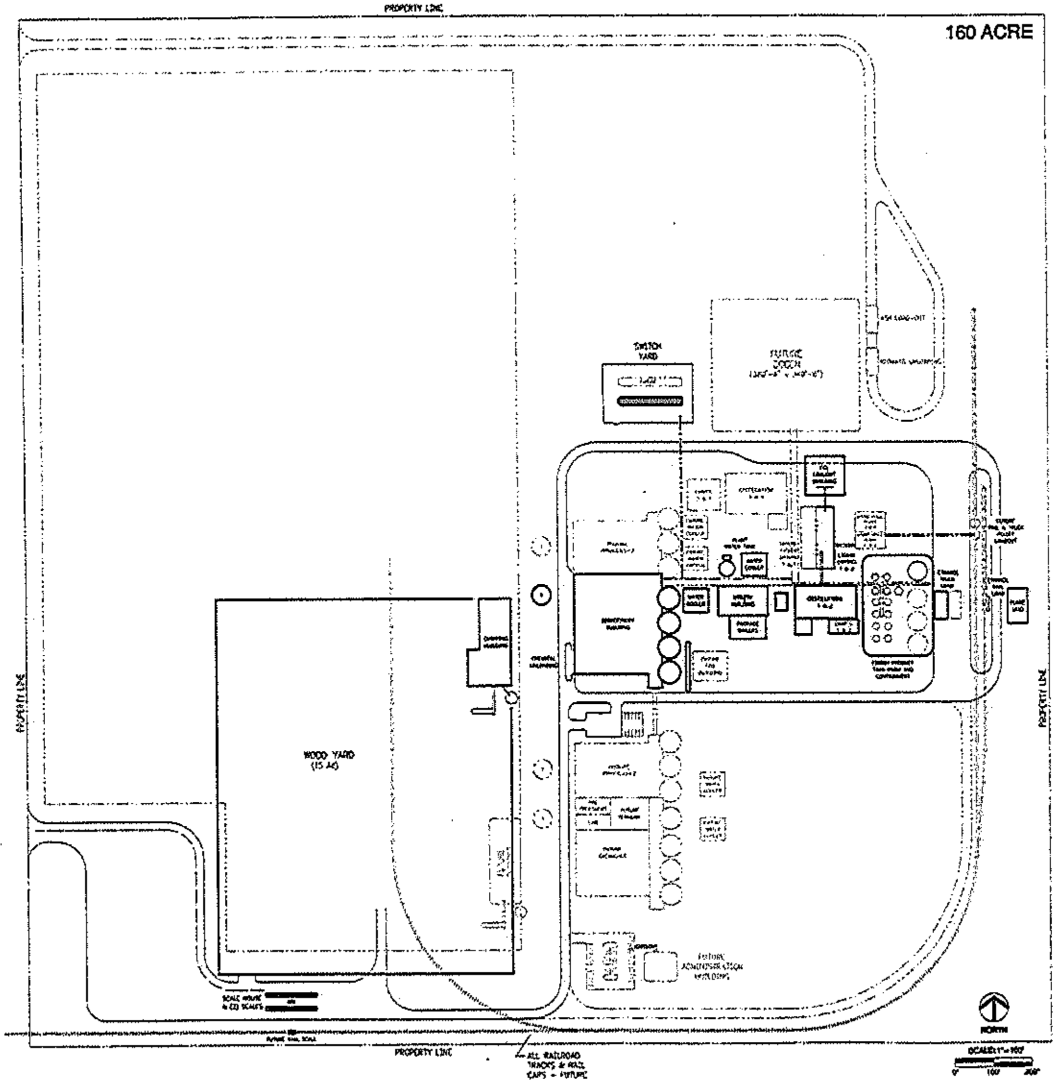
FIGURE 3
PROPOSED RAILROAD
FRONTIER RENEWABLE RESOURCES, LLC
CELLULOSIC ETHANOL FACILITY
KINROSS TOWNSHIP, CHIPPEWA COUNTY, MICHIGAN

Drawn:	JWW 7/13/2009
Approved:	IM 7/13/2009
Scale:	1" = 1,000'
PROJECT NUMBER	13375-004
FIGURE NUMBER	2



FRONTIER
SITE MASTER
PLAN 2009
355 ACRE

RAASCH ASSOCIATES
ENGINEERS + ARCHITECTS

ITEM #	Building Description	AREA	Building Dimensions	Number of Floors	Square Ft.
1	Chipping Building	100	[illegible]	1	17,600
2	Biorefinery Building	210-420	Sub buildings below	See Below	See Below
2a	Pre-treatment Building	210	[illegible]	[illegible]	[illegible] per floor
2b	Primary Fermentation	300	[illegible]	1	[illegible]
2c	Primary Fermentation Containment	310	[illegible]	1	[illegible]
2d	Employee Facilities	[illegible]	[illegible]	2	[illegible] per floor
2e	Secondary Fermentation	[illegible]	[illegible]	1	[illegible]
2f	Chemical Storage	420	[illegible]	1	[illegible]
[illegible]	Distillation Building	500	[illegible]	2	14,[illegible] per floor

ITEM #	PERSONNEL DESCRIPTION	NO OF PERSONNEL	1st	2nd	3RD
1	PLANT MANAGER	1	1		
2	MAINTENANCE MANAGER	1	1		
3	PROCESS MANAGER/ENGINEER	1	1		
4	OPERATIONS MANAGER	1	1		
5	LAB MANAGER	1	1		
6	SAFETY MANAGER	1	1		
7	MAINTENANCE TECHNICIAN	[illegible]	[illegible]	2	2
8	MAINTENANCE - [illegible] TECH	[illegible]	2	1	1
9	MAINTENANCE - YARD	1	1		
10	OPERATORS	[illegible]	[illegible]	[illegible]	[illegible]
11	LAB TECHNICIAN	2	1	1	
12	SCALE HOUSE	1	1		
13	ADMINISTRATION	[illegible]	[illegible]		
14	TOTAL PERSONNEL	[illegible]	[illegible]	[illegible]	[illegible]

Figure 4 Frontier Plot Plan

12

[illegible]	[illegible]	UPDATE FOR LOAN APP
[illegible]	[illegible]	FOR LOAN APPLICATION
C	[illegible]	FOR LOAN APPLICATION
[illegible]	[illegible]	ISSUED FOR REVIEW

AECOM Environment

Submitted to:
Frontier Renewable Resources LLC
Marquette, Michigan

Submitted by:
AECOM
Minneapolis, MN
60140061
October 12, 2010

Phase I Archaeological Investigation
Frontier Renewable Resources
Kinross Charter Township, Chippewa County, Michigan

Amy L. Ollendorf, Ph.D., P.G., R.P.A. and Michael M. Gregory, Ph.D.
Prepared By

Christopher White
Reviewed By

Contents

List of Appendices

Appendix A Figures

List of Tables

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List of Acronyms

aka	also known as
AECOM	AECOM Technical Services, Inc.
APE	Area of Potential Effect
cmbgs	centimeters below ground surface
CCC	Civilian Conservation Corps
DNRE	Michigan Department of Natural Resources & Environment
DOE	U.S. Department of Energy
EA	Environmental Assessment
ESA	Environmental Site Assessment
Frontier	Frontier Renewable Resources LLC
GIS	Geographic Information System
GLO	U.S. General Land Office
GPS	Global Positioning System
HIG	Historical Information Gatherers, Inc.
HIS	Hopewell Interaction Sphere
HPA	High-Probability Area
LPA	Low-Probability Area
MPA	Moderate-Probability Area
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NRCS	Natural Resource Conservation Service
NRHP	National Register of Historic Places
OSA	Office of the State Archaeologist
SHPO	State Historic Preservation Office

UP	Upper Peninsula of Michigan
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USFS	U.S. Forest Service

Executive Summary

AECOM Technical Services, Inc. (AECOM) was retained by Frontier Renewable Resources LLC (Frontier) to perform a Phase I archaeological survey for a proposed pulpwood-to-ethanol biorefinery in Kinross Township, Chippewa County, Michigan. The project area is comprised of a 355-acre parcel in sections 21 and 28, Township 45 North, Range 1 West in addition to an approximately 2.5-mile-long new railroad spur that will extend from the northern part of the 355-acre parcel in Section 21, west-east across Section 20, southwesterly through the southeast quarter of Section 19, and terminating at the existing railroad in the north half of the northwest quarter of Section 30.

Partial funding for the proposed biorefinery will be provided by the U.S. Department of Energy (DOE); AECOM is preparing an Environmental Assessment (EA) under separate cover for compliance with the National Environmental Policy Act of 1970. This Phase I archaeological survey was conducted on behalf of Frontier in support of the EA as well as for compliance with Section 106 of the National Historic Preservation Act (NHPA) of 1966, as amended. The DOE is responsible for government-to-government consultation with federally recognized American Indian tribes and stakeholder involvement. Mitigation of impacts to wetlands, if any, during project construction will be subject to the terms of a Section 404 permit applied for by Frontier under separate cover to the U.S. Army Corps of Engineers (USACE), Detroit District in compliance with the Clean Water Act of 1977.

The biorefinery is proposed to occupy approximately 80 acres in the south half of the northeast quarter of Section 28. The proposed width of the railroad spur's right-of-way (ROW) is 60 feet Some cutting and filling will be required on the rail spur and project site to establish final grades. The APE consists of wooded and marshy, undeveloped lands. The State Historic Preservation Office (SHPO) concurred with the DOE's definition of the Area of Potential Effects (APE) as the 160 acres in the northeast quarter of Section 28 and the 2.5-mile-long railroad spur ROW.

The only cultural resources observed during the 3.5-day-long Phase I archaeological survey was a small surface scatter of miscellaneous transportation-related debris, such as modern oil filters. AECOM excavated a total of 73 shovel tests across the MPA comprising almost the entire Lower 160 and the high- and moderate-probability areas comprising the West End. No cultural resources were encountered in any of the shovel tests. Because AECOM's Phase I archaeological field survey provided adequate coverage of high- and moderate-probability areas in the APE with unanimously negative findings for cultural resources, no further archaeological survey is recommended for the APE, including the three (3) remaining high-probability areas and two (2) moderate-probability areas in the proposed railroad spur on state-owned lands. Consequently, AECOM recommends a finding of "No Historic Properties Affected" and the proposed Frontier Renewable Resources biorefinery project should be allowed to proceed with no further archaeological field work.

1.0 Introduction

AECOM Technical Services, Inc. (AECOM) was retained by Frontier Renewable Resources LLC (Frontier) to perform a Phase I archaeological survey for a proposed pulpwood-to-ethanol biorefinery in Kinross Township, Chippewa County, Michigan. The project area is comprised of a 355-acre parcel in sections 21 and 28, Township 45 North, Range 1 West in addition to an approximately 2.5-mile-long new railroad spur that will extend from the northern part of the 355-acre parcel in Section 21, west-east across Section 20, southwesterly through the southeast quarter of Section 19, and terminating at the existing railroad in the north half of the northwest quarter of Section 30 (**Figure 1**).

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The biorefinery is proposed to occupy approximately 80 acres in the south half of the northeast quarter of Section 28. The proposed width of the railroad spur's right-of-way (ROW) is 60 feet Some cutting and filling will be required on the rail spur and project site to establish final grades. The APE consists of wooded and marshy, undeveloped lands. The State Historic Preservation Office (SHPO) concurred with the DOE's definition of the Area of Potential Effects (APE) as the 160 acres in the northeast quarter of Section 28 and the 2.5-mile-long railroad spur ROW.

Land-ownership of the project area is divided among the State of Michigan, Kinross Charter Township, and Frontier (**Figure 2**). The Department of Natural Resources & Environment (DNRE) has jurisdiction over state-owned lands in the project area – portions of the proposed railroad spur. Kinross Charter Township owns the majority of the remainder of lands proposed for the railroad spur, but Frontier owns the land that will be utilized over a short segment at the western terminus of the spur and the land where the ethanol facility will be constructed. No federal or tribal lands comprise the project area. However, two consent decrees were issued by the U.S. District Court, Western District of Michigan, Southern Division to resolve legal claims of five federally recognized American Indian tribes against the State of Michigan in regard to access and management of lands and waters ceded to the U.S. in the 1836 *Treaty with the Ottawa, Etc.* The 2007 *Inland Consent Decree* and 2000 *Fishing Consent Decree* pertain to ceded lands and waters, respectively. Under the terms of these consent decrees, the DNRE coordinates with federally recognized tribes for access to lands and waters under the state's jurisdiction (i.e., DNRE and Kinross Charter Township lands and waterbodies in the APE.

AECOM completed background research and records review at the Office of the State Archaeologist (OSA) in Lansing, Michigan on August 25, 2010 and September 8, 2010. OSA research was completed

by Mr. Craig Simon of AECOM's Lansing office. Field work was completed on non-state-owned lands in sections 28 and 30 on September 20-23, 2010 while a DNRE *Permit to Perform Archaeological Exploration on State-Owned Lands* was pending. Field crew consisted of Mr. Dan Surface, Ms. Hilary Powell, Dr. Michael Gregory, and Dr. Ollendorf.

2.0 Environmental History

2.1.1 Geology

The Upper Peninsula (UP) of Michigan is bordered by three of the Great Lakes – Superior, Michigan, and Huron. The UP is located in the Interior Plains Physiographic Division of the Central Lowland Province, Eastern Lake Section, and Laurentian Physiographic Division of the Superior Upland Province (Jerome 2006). Elevations throughout the UP range from approximately 600 feet along the Great Lakes to 1,900 feet inland (Jerome 2006).

Interior Plains Physiographic Division

The Interior Plains originally formed when cratons collided and welded together 1.8–1.9 billion years ago during the Paleoproterozoic Era (2.5-1.0 billion years ago). Approximately 1.1 billion years ago, the plates again began to stir with a hot spot under what is now western Lake Superior, forcing the continental crust to split. The Midcontinent Rift formed and enormous quantities of basaltic lava spilled onto the surface. The rifting never fully pulled the continent apart and by the late Middle Proterozoic, about 1.0 billion years ago, the tectonism of the Lake Superior area halted, never to resume (Ottke 1999). Precambrian metamorphic and igneous rocks now form the basement of the Interior Plains and make up the stable nucleus of North America. Except for the Black Hills of South Dakota, the entire region has low relief, reflecting more than 500 million years of relative tectonic stability.

The Interior Plains were often covered by shallow inland seas. Sediments from the Canadian Shield and the Rocky Mountains were deposited in these seas over millions of years. Eventually the sediments were compressed by the weight of the layers above into sedimentary rock formations. Part of the sedimentary rock deposited in these areas consists of coral reefs that formed close to the surface of seas during the Paleozoic era.

Throughout the Paleozoic Era and subsequent Mesozoic Era, the mostly low-lying Interior Plains region remained relatively unaffected by the mountain-building tectonic collisions occurring on the western and eastern margins of the continent. During much of the Mesozoic, the North American continental interior was mostly well above sea level, with two major exceptions. During part of the Jurassic period, rising seas flooded the low-lying areas of the continent; in the Cretaceous period, much of the Interior Plains region lay submerged beneath the Western Interior Seaway.

The Interior Plains continued to receive deposits from the eroding Rocky Mountains to the west and Appalachian and Ozark/Ouachita Mountains to the east and south throughout the era. The flatness of the Interior Plains is a reflection of the platform of mostly flat-lying marine and stream deposits laid down in the Mesozoic and Cenozoic eras.

Laurentian Physiographic Division

This physiographic area is the oldest portion of the North American continent, the backbone so to speak. It is made up primarily of ancient Precambrian igneous, metamorphic, and sedimentary rock. With the exception of the river valleys and lacustrine basins, it is a rolling to mountainous peneplain that ranges from 800 feet to 1400 feet above sea level.

2.1.2 Landforms

Landforms in the UP are a product of glaciers that occupied the region during the last Ice Age (Pleistocene Epoch). During the Wisconsinan glacial stage, the entire UP was covered with a thick ice sheet that carried glacial drift. The variety of landforms visible on today's ground surface is the result of massive deposition of glacial drift as the ice sheet melted and receded northward. Approximately 9500 to 11,000, Glacial Lake Algonquin covered a large portion of the UP, including most of the eastern half of the UP (Jerome 2006). Numerous areas of sandy or clayey lacustrine deposits are sediments from this glacial lake (i.e., glaciolacustrine deposits). Some of the deposits were covered later by outwash from the melting glacier to the north (i.e., glaciofluvial deposits). Glacial Lake Nippising was the last lake stage to occupy the UP from 4,000 to 6,000 years ago (Jerome 2006). Its shoreline is the closest to the present Great Lakes - the easily recognized ridge or bluff near the present-day beach in many areas.

The landforms in the present APE are Outwash Plain and Lake Plain (Farrand and Bell 1982). According to Jerome (2006:24), the Outwash Plain is extensive and consists of sandy glaciofluvial materials, such as "sand and gravel in well-stratified layers." Soil series associated with the Outwash Plain that occur in the present APE are Kalkaska and Rubicon (see below). The Lake Plain is nearly level and occurs in areas that had been covered by Glacial Lake Algonquin. "In Chippewa and Mackinac counties it consists of well-sorted, fine-textured, stratified [glaciolacustrine] deposits" (Jerome 2006:24).

2.1.3 Flora and Fauna

In the past, the range of available faunal and floral resources associated with the eastern portion of Michigan's Upper Peninsula depended in large part upon prevailing climatic conditions, which at times have experienced significant changes during the past 10,000 years. Beginning approximately 13,000 years before present (B.P.), the climate began to warm as glaciers retreated, and conifers, together with megafauna such as mammoth, dominated much of the upper Midwest's landscape. The Eastern Upper Peninsula Ecoregion was glaciolacustrine-influenced (see above) and remains relatively flat today (Albert 1995).

During the following 2,000 years, the region continued to experience a warming trend that resulted in spruce showing a sharp decline in dominance in the Lower Peninsula where pines and a few hardwoods began to appear by 11,000 B.P. This trend would take another 1,200 years to reach northward into the eastern Upper Peninsula, where the spruce period would be ended by 9500 B.P. (Kapp 1999:51), to be replaced by jack and red pines. White pine would arrive in the area by 8300 B.P. and be followed by hemlock by approximately 6400 B.P. and beech by sometime before 3000 B.P. (Kapp 1999:53).

Across the eastern United States, the climate became even warmer and drier beginning circa 9500 B.P. This trend continued through 1500 B.P., having a significant influence on vegetation (Kapp 1999:53), although depending upon the characteristics of a locale's soil, the warmer and drier conditions could have either accentuated or ameliorated shifts in vegetation. In Michigan, the warmer, drier period dates from about 9000 B.P. to at least 2500 B.P., and while these conditions influenced cyclical changes between the more xerophytic oak forests and mesophytic beech-maple-basswood-mixed hardwood forests of southern Lower Michigan, in northern Lower Michigan and the Upper Peninsula, the period, even at its maximum, is not clearly marked in pollen records. In some areas, an increase in white pines appears to mark a period of dryness beginning about 8000 B.P. and lasting until approximately 5000 B.P. (Kapp 1999:55), but the presence of the pines may be attributed to other factors. An increase in pines across the eastern Upper Peninsula during the drier, warmer conditions may have restricted the availability of subsistence resources, and made the area less desirable to inhabit, especially if more abundant resources could be reaped along coastal zones.

Beginning between 3400 to 3000 B.P., a major vegetation shift occurred throughout the Upper Peninsula with northern hardwood forests (birch, hemlock, maple, and other deciduous species together with white pine) expanding into areas where soils accommodated the trees with good drainage but enough clay to retain moisture during droughts. In addition, a rising water table coupled with increased participation encouraged the creation of widespread marsh formation, as well as the creation of extensive, shallow peat deposits (Kapp 1999:57). This shift marks the onset of cooler conditions, which after 3000 B.P., resulted in the creation of a vegetative cover that existed until after the arrival of Euro-Americans, who prior to circa 1800, were primarily in interested in extracting furs. The original northern hardwood forests in the Eastern Upper Peninsula generally supported a greater diversity of conifers than today, providing structural complexity and a diversity of wildlife habitats (Albert 1995). "Smaller areas of fire-dependent ecosystems such as white pine-red pine forest and jack pine barrens also occurred within this ecoregion. The region continues to support a diversity of wetland natural communities including bog, northern fen, northern wet meadow, hardwood-conifer swamp, rich conifer swamp, and extensive areas of muskeg and patterned fen." Reconstruction from GLO survey data indicate the vegetation of the present project area ca. 1800 consisted of beech-sugar maple-hemlock forest, cedar swamp, and hemlock-white pine forest (Comer and Albert 1997). Only later, after the 1840s, did Euro-American settlers really begin to develop the area and subsequently remove much of the historic vegetation through agricultural and commercial activities, especially lumbering. Aerial photos of the project area taken during the late 1930s show an open landscape with some wooded areas, which have since expanded to fill-in the open landscape with secondary growth of oaks, maples, beech, hemlock, and pines (including pine plantations) observed during the current study.

Prior to, but certainly after circa 3,000 B.P., prehistoric and historical peoples found a rich range of floral and faunal subsistence resources available for use in the eastern Upper Peninsula. In season, forests yielded a range of nuts, seeds, tubers, berries, and raw materials to eat or to produce baskets, mats, and other needed material items. In addition, the area offered a range of faunal species consisting of mammals (bear, beaver, muskrat, raccoons, and white-tailed deer), birds (grouse, passenger pigeons, turkey, and various water fowl), aquatic species (whitefish, freshwater mussels, suckers, and turtles), and other animals that could be hunted and fished. Thus within Chippewa County and the proposed bio-fuel plant project tract in particular, prehistoric and historical peoples had the opportunity to exploit a range of floral and faunal resources associated with the regions physical setting.

Today's climate in the UP is influenced by the proximity of the Great Lakes (Jerome 2006). Average annual temperature is 39-43 degrees Fahrenheit. Average daily summer high is 71 degrees Fahrenheit; average daily winter low is19 degrees Fahrenheit. Average annual precipitation is 30-36 inches; average annual snowfall is 56-218 inches, although a lake-effect can result in annual snow of 350 inches. Growing season is 100-150 days (Jerome 2006). About 95% of the UP is forested, with approximately 42% of the forestland in federal or state ownership (Jerome 2006).

2.2 Soils of the APE

The U.S. Department of Agriculture (USDA)-Natural Resource Conservation Service (NRCS) has mapped various soil series throughout the APE. Soils in the APE are Spodosols, Histosols, and Entisols. According to the USDA-NRCS, *Spodosols* are soils in which amorphous mixtures of organic matter and aluminum, with or without iron, have accumulated. In undisturbed soils there is normally an overlying eluvial horizon, generally gray to light gray in color, more or less uncoated quartz. Most Spodosols have little silicate clay. The particle-size class is mostly sandy, sandy-skeletal, coarse-loamy, loamy, loamy- skeletal, or coarse-silty. *Histosols* are soils that are dominantly organic and are commonly called bogs, moors, or peats and mucks. A soil is classified as Histosols if it does not have permafrost and is dominated by organic soil materials. *Entisols* have little or no evidence of development of pedogenic horizons. Many are sandy or very shallow. **Table 1** summarizes the mapped soil series, their locations within the APE and their attributes.

Table 1. Soils of the APE as Mapped by the USDA-NRCS

Series	Class	Order	Description of Typical Pedon	Location In APE
Alcona	Alfic Haplorthods	Spodosol	Typical pedon: Fine sandy loam on 42% in forested area. Very deep, well-drained in stratified sandy & loamy glaciofluvial & glaciolacustrine deposits on lake plains, outwash plains, ground moraines, end moraines & stream terraces. Native vegetation primarily American basswood, American beech, red pine, eastern white pine, sugar maple & yellow birch. Horizons: Oe-E-Bs1-Bs2-Bs3-B/E-E/B-2C.	SE¼ S21
n/a	Aquents	Entisol	n/a	SW¼ S19

Table 1. Soils (continued).

Series	Class	Order	Description of Typical Pedon	Location in APE
Au Gres	Typic Endoaquods	Spodosol	Sand on 1% slope in forested area. very deep, somewhat poorly drained soils formed in sandy glacial drift on stream terraces, outwash plains, lake terraces, lake plains, and ground moraines. Natural forests are northern white cedar, balsam fir, hemlock, yellow birch, paper birch, aspen, and red maple. Horizons: Oe-A-E-Bhs-Bs1-Bs2-BC-C. 2% gravel in Bhs & Bs2. 1% gravel w/common masses of Fe accumulation in BC & C.	SE¼ S21, SW¼ S21
Carbondale	Hemic Haplosaprists	Histosol	Muck on < 1% slope in forested area. Very deep, very poorly drained in organic deposits > 51" thick on ground moraines, outwash plains & lake plains. Forests are mostly northern white cedar, balsam fir, black spruce & white birch. Horizons: Oa1-Oa2-Oa3-Oe.	SE¼ S19
Croswell	Oxyaquic Haplorthods	Spodosol	Sand on 2% slope in wooded area. Very deep, moderately well-drained in sandy glacial drift on stream terraces, lake terraces, low dunes, beach ridges, outwash plains, lake plains & ground moraines. Forests are mixed hardwoods & conifers, including quaking aspen, black cherry, paper birch, bigtooth aspen, red pine, eastern white pine, jack pine, northern red oak & red maple. Horizons: Oe-A-E-Bs1-Bs2-BC-C.	SE¼ S21, SW¼ S21
Dawson	Terric Haplosaprists	Histosol	Peat on 1% slope. Very dep, very poorly drained in herbaceous organic material 16-51" thick overlying sandy deposits in depressions on outwash plains, lake plains, ground moraines, end moraines & floodplains. Black spruce & tamarack trees w/ground cover of bog rosemary, cranberries, laurel, leatherleaf, sphagnum mosses & blueberries. Horizons: Oi-Oa-A-C.	SE¼ S19, C S21

Table 1. Soils (continued).

Series	Class	Order	Description of Typical Pedon	Location in APE
Kalkaska	Typic Haplorthods	Spodosol	Sand on 1% slope in forested area. Very deep, somewhat excessively drained in sandy deposits on outwash plains, valley trains, moraines & stream terraces. Sugar maple, American beech, red pine, quaking aspen, bigtooth aspen & eastern white pine are typical trees. Horizons: Oi-A-E-Bhs-Bs1-Bs2-BC-C. Approx. 5% gravel throughout; ortstein columns in Bs2 & BC.	NE¼ S20, SE¼ S21, NW¼ S30
Kinross	Typic Endoaquods	Spodosol	Muck on nearly level forested area. Very deep, poorly drained-very poorly drained in glaciofluvial material on outwash plains, stream terraces, lake plains, kames, disintegration & ground moraines. Trees are black spruce, tamarack, northern white cedar, balsam fir, red maple & quaking aspen; ground cover includes H2O-tolerant grasses & sedges, leatherleaf, sphagnum & bog rosemary. Horizons: Oa-E-Bhs-Bs-BC-C.	SE¼ S19, SE¼ S21
Loxley	Typic Haplosaprists	Histosol	Mucky peat in forested area. Very deep, poorly drained in herbaceous organic deposits > 51" thick in depressions on moraines, lake plains & outwash plains. Few scattered black spruce, jack pine, quaking aspen & tamarack with blueberry, leatherleaf, sphagnum & wintergreen as ground cover. Horizons: Oe1-Oe2-Oa1-Oa2.	SE¼ S21
Markey	Terric Haplosaprists	Histosol	Muck on 1% slope in bog w/marsh vegetation. Very deep, very poorly drained in herbaceous organic material <40-130 cm thick over sandy deposits in depressions on outwash plains, lake plains, floodplains, river terraces, valley trains & moraines. Forested areas are in black ash, quaking aspen, balsam fir, black spruce, tamarack, northern white cedar & paper birch; some areas in cattails, marsh grasses, reeds & sedges. Horizons: Oa1-Oa2-Oa3-Oa4-Cg.	SE¼ S19

Table 1. Soils (continued).

Series	Class	Order	Description of Typical Pedon	Location in APE
Rousseau	Entic Haplorthods	Spodosol	Fine sand on 6% slope in forested area. Well-drained in sandy Aeolian deposits on dunes, lake plains & outwash plains. Native forests included sugar maple, red maple, balsam fir, white birch, quaking aspen & American beech. Horizons: A-E-Bs1-Bs2-BC-C.	SE¼ S19, C S20, SE¼ S21, NE¼ S28
Rubicon	Entic Haplorthods	Spodosol	Sand on 3% slope in red pine plantation. Very deep, excessively drained soils formed in sandy deposits on disintegration, ground, end and kame moraines, lake plains, outwash plains, stream terraces, beach ridges, and sand dunes. Native & present vegetation is dominantly red pine and quaking aspen with some eastern white pine and jack pine; ground cover is blueberries, wintergreen, sweet fern & bracken fern. Horizons: A-E-Bs1-Bs2-BC-C.	NW¼ S30 along existing RR tracks
n/a	Udorthents	Entisol	n/a	SE¼ S19, NE¼ S 19,
Wainola	Typic Endoaquods	Spodosol	Fine sand in forested area. Deep, somewhat poorly drained in fine sandy glaciofluvial deposits on outwash plains, lake plains & glacial lake deltas. Forests are chiefly quaking aspen, white ash, red maple, northern red oak w/shrubs & grasses. Horizons: Oa-E-Bs1-Bs2-BC-C. Ortstein fragments in Bs1 & Bs2; masses of Fe accumulations throughout BC.	SE¼ S19

3.0 Culture History

Occupation or use of the general region of which the Frontier Bio-energy plant project area is a part spans the prehistoric through historical periods; however, this occupation is known only in general terms and few sites are known from the study tract and its surrounding area. Prehistoric people used the region as evidenced by a number of archaeological sites recorded in Chippewa and surrounding counties, but the greatest number of sites date to the historical period and represent lumber or Civilian Conservation Corps (CCC) camps, homesteads, cemeteries, and other loci where other Euro-American activities occurred. While past research demonstrates that the general region of which the bio-energy plant is a part has been used and occupied during the early prehistoric through historical periods, the lack of recorded sites within the vicinity of the APE prevents one from determining the nature and intensity of the local occupation. As a result of the lack of data and synthesized cultural studies about the area, one is able to discuss the local prehistoric and historical past in general or regional terms only.

3.1 Prehistory

3.1.1 Paleoindian Tradition: 13,400 B.P. to 10,000 B.P.

The earliest inhabitants of Michigan are recognized as nomadic hunters and gatherers, who archaeologists refer to as Paleoindians. This group's subsistence base was heavily slanted toward the exploitation of Pleistocene mega-fauna such as mammoth, mastodon, bison, and caribou. In addition, limited contextual data, combined with ethnographic data about extant hunter-gatherer groups (Cleland 1966:49), suggests that their diet also included significant proportions of native plant foods and a variety of small mammals, reptiles, birds, and fish.

Currently, the Paleoindian period is subdivided into Early and Late stages. The temporal division separating the two is based upon a transition from fluted-to-non-fluted, lanceolate points (Mason 1981:111-112, 1986:192, 1997:98). Frequent indicators of a Paleoindian association with an area are isolated finds of distinctive projectile point styles: Clovis, Folsom, Scotsbluff, Eden, Agate Basin, and several others. While the fluted Clovis and Folsom points define the present of Early Paleoindian inhabitants in many regions of North America, within Michigan, fluted points are further recognized as Enterline, Gainey, Barnes, Crowfield, or Holcombe points based on specific fluting and morphological attributes (Shott and Wright 1999:62-63). Much of what is known about Michigan's Paleoindian tradition is derived from sites reported from the state's lower peninsula (Shott and Wright 1999:63). As a result, archaeologists are not in a position to offer detailed discussions about Upper Peninsula regional subsistence, settlement, or land use practices. While no Paleoindian materials are reported for the immediate area of the proposed bio-fuel plant area, the presence of such materials in the surrounding countryside suggests Paleoindian people were acquainted with the area and its potential resource base. Whether early Native Americans actually traversed the area and utilized its resources remains unknown.

3.1.2 Archaic Tradition: 10,000 B.P. to 2500 B.P.

The Archaic tradition followed that of the Paleoindian and is marked by a subsistence shift oriented toward smaller game and a broader range of plant species. Archaeologically, Archaic sites are

frequently defined by the absence of pottery containers, the presence of burials in natural knolls or flat cemeteries as opposed to man-made mounds, and the recovery of faunal and floral remains representing a more generalized or diversified subsistence base (Stoltman 1986 and 1997). Changes in, or the broadening of the subsistence base is linked to climatic conditions, which became more moderate as glaciers retreated. This shift in resource utilization is frequently reflected in stone tool assemblages, which show a trend toward greater diversity of projectile point/knife styles and an increase in proportions of groundstone, woodworking, and seed and nut processing implements. In addition, more emphasis is placed on fishing and the harvesting of riverine shellfish. Finally, copper objects become more common. To facilitate discussion of these changes and the tradition in general, the Archaic tradition is often divided into three stages: Early (10,000 B.P.-8000 B.P.), Middle (8000 B.P.-5000 B.P.), and Late (5000 B.P.-2500 B.P.). These stages are defined primarily on changing projectile point/knife styles.

Settlement patterns associated with an Archaic tradition people exploiting a specific region resulted from mobility strategies coupled with paleo-environmental and demographic conditions. Across Michigan, Archaic peoples moved through the landscape pursuing residential or logistical mobility strategies and created settlement patterns that are currently poorly understood but partially reflected by recorded sites located in open-air settings. Site types consist of isolated finds, base camps, transient camps, faunal and floral resource procurement stations, and processing sites. While the defined site types span the entire tradition, the frequency of each type may have changed in response to shifting mobility strategies linked to evolving natural and social conditions. Through time, these conditions encouraged or discouraged the establishment of certain site types as people adapted to their changing environment.

The Archaic tradition associated with the Upper Peninsula is documented by isolated surface finds and sites dating from the Early through Late sub-traditions. Of the sites, several have been excavated west and south of Chippewa County, and a single isolated find, a copper projectile point, has been reported from the north shore of Chippewa County (Griffin 1972:35). Excavated sites include the Late Paleoindian/Early Archaic Gorto site (Buckmaster and Paquette 1988; Shott 1999:72), and the Late Archaic Popper, Trout Point 1, 20MQ90, 20MQ91, Miner's Beach, Medore Street Burial, Ottawa North and Alligator Eye sites (Hill 1994:11; Robertson et al. 1999:98-99). Absent from the combined studies is an Upper Peninsula Middle Archaic presence, a sub-tradition that is best known from lower peninsula sites (Lovis 1999:87). The Late Archaic sites indicate that at least during the end of the Archaic tradition, people were utilizing both coastal and interior environments (Robertson et al. 1999:109), and were present in the region during summer and winter seasons (Fitting 1979:111; Hill 1994:48; Robertson et al. 1999:109). The reported copper point dates to the Late Archaic and is associated with the Old Copper Culture, which made extensive use of copper.

While the temporal distribution of sites indicates that the region was utilized by people during the entire Archaic period, the quantity and quality of the data provide few insights about group size, mobility, organization, or social interactions within the region. In summary, Archaic tradition people are known to have occupied and exploited the central and eastern portions of the Upper Peninsula just as Paleoindian groups did, but specific details about the nature and the intensity of the local Archaic occupation awaits further study.

3.1.3 Woodland Tradition: 2800 B.P. to 750-700 B.P.

Adaptations characterizing the Archaic tradition carried into that of the early Woodland, subsequently developing into a variety of behaviors responding to environmental, subsistence, and social conditions. Well defined traits marking the tradition are the presence of ceramics, the construction of earthen mounds for burials, and the cultivation of plants. In addition, during the temporal span of the tradition, population size increased, exotic goods reflecting extensive trade networks became more frequent, and burial customs grew more elaborate. Material culture reflects these changes with new projectile point types, distinctive ceramic forms, greater variety of trade goods, and more decorative elements placed on implements. In spite of these characteristics and innovations, subsistence practices remained rooted for a long period to cycles of hunting and gathering as horticulture became progressively more important and cultigens played a larger role in subsistence strategies. Coupled with this gradual shift toward cultigens came a movement away from seasonal, nomadic settlement patterns as people began to occupy large, semi-permanent villages in addition to seasonal resource procurement camps. Similar to the Archaic tradition, that of the Woodland may be divided into stages designated Early (2500 B.P.-2000 B.P.), Middle (2000 B.P.-1600 B.P.), and Late (1600 B.P.-400 B.P.).

Archaeologically, specific projectile point and ceramic styles often characterize the stages in the absence of radio-carbon dates. Within Michigan, the full temporal spectrum of Woodland tradition sites is present, but site distribution is uneven with segments of the tradition poorly understood in some areas, for example, the Early Woodland in the Upper Peninsula (Garland and Beld 1999:130), due to a lack of excavated sites and published reports. While numerous surface finds of diagnostic projectile point styles have been reported, and sites have been recorded, these data are area specific and cannot be used to synthesize an adequate regional perspective about Woodland subsistence, settlement, or land use practices. While characteristic mounds are present within the state, their number is few, and in the Upper Peninsula, the few mounds that are present are limited to the western portion of the peninsula.

Of the three stages that compose the Woodland tradition, the Middle and Late stages are more frequently represented by sites. As previously stated, Early Woodland stage sites are best known from the Michigan's lower peninsula, but on the Upper Peninsula, when recognized, are marked by the presence of the oldest regional ceramic type known as Lake Nokomis Trailed and by projectile points that most frequently show contracting- or straight-stemmed forms, although other styles are known. These materials have also been used to define the Early/Middle Woodland transitional phase known as Nokomis (Salzer 1969 and 1974). More abundant and better documented are Middle Woodland sites, which are known from the Straits of Mackinac-Sault Ste. Marie region. These sites include Wycamp Creek, Holtz, Pine River Channel, Gyftakis and McGregor, as well as others reported along the St. Mary's River and west of Sault Ste. Marie (Fitting 1979:109-110). The sites are predominantly coastal in distribution, and the nature of an interior occupation has yet to be adequately defined.

An apparent increase in Middle Woodland sites over those of stages that preceded or followed it, is attributed to the development of the loose trade and cultural network known at the Hopewell Interaction Sphere (HIS), which dominated much of the lower Ohio and Mississippi River valleys but extended north into Michigan. This network brought exotic goods and ideas to the area, as well as fueled the extraction of certain raw materials such as copper from it. The HIS stylistic influence was strongest during the earliest stages of the Middle Woodland (Fitting 1979:112), and then waned; however, as long as the HIS functioned, the regional extraction and export of copper brought people to the region, where they

created and left archaeological sites. With the decline of the HIS, utilization of the area appears to have declined. As a result, Late Woodland sites appear fewer in number.

Similar to Early and Middle stage sites, those of the Late stage are recognized primarily by distinctive ceramic styles. In order to distinguish Late Woodland sites of the Upper Peninsula and bordering areas from similar stage sites recorded in other parts of the western Great Lakes region, northern sites are further categorized as belonging to a sequence of phases exhibiting unique characteristics not associated with contemporary sites reported from other parts of the greater region. For the eastern portion of the Upper Peninsula, Late Woodland sites are not well understood, but are thought to exhibit characteristics that, during the early and mid-Late stage are related to the "Steiner", Mackinac-Heins Creek, and Juntunen phases (Brose 1978:570-571; Fitting 1979:112). After circa 650 B.P., the occupation of the eastern portion of the Upper Peninsula appears to decline to the point of being all but abandoned by native peoples (Fitting 1979:112). This observation begins to reverse itself during the 17th century with the arrival of Europeans, who establish trade relations in the region, and begin to draw Native Americans to the area for economic reasons; a situation that may not be dissimilar to what happened during the Middle Woodland with the influence of the Hopewell Interaction Sphere (Fitting 1979:112).

The distribution of Woodland tradition sites across the Upper Peninsula's eastern half suggests sites from all stages exist in the region. In addition, the sites indicate that Woodland people, as did people of traditions preceding them, knew about the region and the resources it offered, although the nature and intensity of the occupation or use remains poorly understood, especially as to the use of areas away from the coast. With the arrival of Europeans, use of the region by Native Americans was modified, and from the 17th century onward human use of the area is better documented and understood.

3.2 Historical Native American Occupation

At various times during the historical period, the eastern portion of the Upper Peninsula has been occupied or used by the Chippewa, Menominee, Winnebago (Ho-Chunk), Ojibwa, and Potawatomie, although traditionally, it is considered the home territory of the Chippewa and Ojibwa. Other groups may have made incursions into the region from time-to-time, and occasionally two or more groups may have occupied parts of it. Any attempt to understand the 16th- and early 17th-century use of the region by Native Americans is complicated by the likely depopulation of the area due to European introduced diseases and by the migration of eastern groups to the area. After the arrival of Europeans, the fur trade of the 17th and 18th centuries developed and fostered social and economic conditions that dictated the nature of the occupation, as did the shifting regional political claims by French, British, and American interests.

By the mid-19th century, Native American groups had ceded most of their claims to lands in the eastern portion of the Upper Peninsula to the U.S. government and withdrawn westward or settled on reservations. Much of the eastern portion of the Upper Peninsula as well as the northwestern portion of lower Michigan were ceded to the federal government by the 28 March 1836 *Treaty with the Ottawa* and Chippewa Nations of Indians, although the Ottawa and Chippewa reserved some rights to hunt and fish on lands until they were required for settlement. The 31 July 1855 Treaty with the Ottawa and Chippewa made provisions to allow the U.S. government to withdraw public lands not sold or conveyed to private interests, and offered these lands to the Ottawa and Chippewa for their use. Native American rights and access to land have been further expanded or re-enforced by 21st-century decrees upholding

Native Americans hunting and fishing rights on public lands. While historical Native American groups have occupied or used the eastern portion of the Upper Peninsula since the arrival of the first Europeans, in most cases, this history is best known from documentary sources because few published archaeological reports, beyond possible burial site reports, chronicle the presence and activities of historical Native Americans in the region during the 17th through early 20th centuries.

3.3 Euro-American Settlement and Development

Euro-American settlement of the area defined by the eastern portion of the Upper Peninsula occurred as the result of the fur trade, which encouraged well situated commerce/military centers occupied year round. Due to poor agricultural conditions, large scale farming was not widely pursued. Rather, the area was developed or exploited for its natural resources, which first included fur bearing animals, and later lumber. Through time, the French, British, and Americans took an interest in the economic benefits of the fur trade; however, it was only the Americans who attempted to bring order to the land and eventually take advantage of the region's other natural resources.

The Michigan Territorial Legislature created Chippewa County during 1826, at which time the county—stretching to the Mississippi River--was considerably larger than it is today. The county as established today was created by a legislative act during 1843 (Western Historical Company 1983:209). County lands were formally surveyed by the General Land Office of the U.S. government during 1845, after which, residents and new comers could legally apply for land ownership. As the fur trade waned, commercial interest turned their attention to the forests which they lumbered, thereby further opening the land for agricultural improvement, which, again due to environmental conditions, did not fully develop, although efforts were certainly made to earn a livelihood from agriculture. Historical activity is evident in the vicinity but outside of the APE by sites 20CH0282, the Kinross logging camp, and 20CH0297, CCC Camp Munuscong. Today, the area, including that of the proposed biorefinery, remains in secondary growth, which serves recreational purposes (e.g., all-terrain vehicle trails and hunting grounds) or is being prepared for timbering (e.g., pine plantation in the APE).

4.0 Previous Investigations

The OSA's 2009 listing of *Archaeological Sites Per County* indicates that 385 archaeological sites had been recorded in Chippewa County. Of the 14 counties in the UP, Chippewa County has the 5th-largest number of recorded archaeological sites. Among the three easternmost counties in the UP, Chippewa County ranks a close 2nd place behind Mackinac County (n=404), but Luce County ranks a distant 3rd place with only 42 recorded archaeological sites.

Previous investigations consulted by AECOM were completed for a variety of projects outside of the present APE, some quite a distance away but still in Chippewa County. The previous investigations were conducted for pipeline projects (Dobbs and Nienow 2002; Weir 1981), a telecommunications project (Lillis-Warwick 2009),.U.S. Forest Service (USFS) projects (Drake and Dunham 2008); and a National Park Service project (Brantsner 1993). Since none of these investigations were completed in the present APE, these reports were consulted for methodology (assumptions and field procedures) and expected site types and locations for Chippewa County. **Table 2** summarizes information from previous investigations that AECOM applied to the present investigation for a predictive model that illustrated areas of low, moderate, and high probability for prehistoric and historic archaeological sites.

Table 2. Previous Investigators' Definitions of High-Probability Areas, Methods, and Results

Previous Investigator	High-Probability Areas (HPAs)	Methodology	Results
Weir (1981)	Undefined	• Pedestrian survey along parallel transects in 75-foot-wide ROW (transects presumed to be 10 meters apart). • Shovel tests at maximum 20-meter intervals along parallel "transect corridors" within ROW "whenever possible." • Sampling interval of shovel tests varied "according to known or expected cultural resource sensitivity and physiographical conditions or obstacles." • No mention of subsurface testing in low- or moderate-probability areas.	Unknown since Results section of report not scanned/emailed, but presume sites found along 1,017-mile-long ROW.
Brantsner (1993)	• 100 meters of water OR • Along water-related geologic features (e.g., beach ridges).	• Walk-over and shovel-testing strategy coincident with USFS specifications. • Walk-over along transects at 30-meter intervals. • Shovel testing at 15-meter intervals in HPAs. • No mention of subsurface testing in low- or moderate-probability areas.	One newly recorded site.
Dobbs & Nienow (2002)	• Areas with surface evidence of archaeological properties OR • Standing structures OR • Topography or micro-topography of interest within 50 meters of existing water or ancient water features.	• Pedestrian survey to examine ground surface along transects spaced 15 meters apart parallel to pipeline. • Shovel testing at 15-meter intervals within HPAs. • No mention of subsurface testing in low- or moderate-probability areas.	One newly recorded site.
Drake & Dunham (2008)	• Habitable, level, and well-drained surfaces within 300 meters of riparian features and wetland edges. • Identifiable post-Pleistocene terraces, beaches, and strand lines. • Forest clearings and transportation features.	• Pedestrian survey along transects typically placed at 30-meter intervals when "surface visibility is good" (e.g., plowed agricultural field and other exposed areas) and in HPAs. • Parallel transects of 15-meter-interval shovel tests in HPAs. • No mention of subsurface testing in low- or moderate-probability areas.	25 newly recorded sites.

5.0 Methodology

5.1 Background Research

AECOM began the Phase I archaeological investigation with Mr. Craig Simon of AECOM's Lansing, Michigan office conducting background research in the Office of the State Archaeologist (OSA) under the direct supervision of Dr. Barbara Mead, Assistant State Archaeologist and remote supervision of Dr. Amy Ollendorf, AECOM's Principal Investigator for archaeology. AECOM's background research, completed on August 25, 2010 and September 8, 2010, consisted of queries of the archaeological site files and reports databases. Mr. Simon scanned and emailed copies of site files and excerpts from previous investigations to Dr. Ollendorf for use throughout the investigation. AECOM also utilized a series of aerial photographs obtained previously for AECOM's Phase I Environmental Site Assessment (ESA) of the 355-acre parcel – 1939, 1953, 1964, 1982, 1991, and 2006 – as well as a series of aerial photographs obtained from Historical Information Gatherers, Inc. (HIG) for the proposed railroad spur – add dates here. AECOM also utilized historic, including the 1845 U.S. General Land Office (GLO) original plat (obtained at http://www.glorecords.blm.gov) along with the 1930 and 1970 plat maps for Kinross Charter Township (obtained from Chippewa County plat books) as well as 1951 and 1975 USGS 7.5' and 15' topographic maps (Drafter and Sault Sainte Marie quadrangles). Dr. Meade provided further historical information – the *Index of Michigan CCC Camps in the Upper Peninsula* and pages pertaining to the APE from Chippewa County's book of original land patents.

By reviewing the output of the background research, AECOM determined that the APE had not been surveyed previously by professional archaeologists. AECOM identified two previously recorded archaeological sites in the vicinity but outside of the APE. One site 20CH0282 is the "Kinross Camp," the remains of a ca. 1913-1925 logging camp recorded, delineated, and evaluated in the northeast quarter of Section 20 (Brantsner 1993). Site 20CH0282 was determined ineligible for nomination to the National Register of Historic Places (NRHP) by the OSA in 1996. The other known archaeological site, 20CH0297, is the "Munuscong CCC Camp" located in the northwest quarter of Section 33. To-date, this site has not been relocated and evaluated by a professional archaeologist for its NRHP eligibility. Other sites further afield and also outside of the APE pertain to tourism and recreation (20CH0280, "Dodge Brothers Camp") and logging (20CH0424, "SO5;" 20CH0425, "SO6;" and 20CH0426, "SO7").

5.2 Predictive Model

AECOM developed a predictive model from previous archaeological experience in Michigan and elsewhere in the Upper Midwest as well as from the methodological information summarized in Section 4.0 of this report. ESRI's ArcGIS™ was the software suite utilized to create the predictive model from the USGS topographic quadrangle as an active, base-mapping layer (**Figure 3**). The parameters for high-, moderate-, and low-probability areas and extent in the project area are summarized in **Table 3**. It should be noted that no indications of long-term historic occupation appear in the historic records, including aerial photographs and maps, for this particular APE. Therefore, the customized parameters in AECOM's predictive model are necessarily oriented toward prehistoric and protohistoric site-selection preferences.

Table 3. Predictive Model Parameters and Extents of Probability Areas

Probability Area	Parameter	Extent (acres)
High (HPA)	• Slope with 0-10% grade <u>and</u> • ≤ 300 meters from existing waterbody (e.g., only wetlands presently).	113.1
Moderate (MPA)	• Slope with 0-10% grade <u>and</u> • ≤ 300 meters from existing waterbody.	237.2
Low (LPA)	• Disturbed previously (e.g., gravel or sand pits) <u>or</u> • Existing wetlands or • Slope with grade ≥ 10%	28.4

Two parcels in the APE were accessible for AECOM's archaeological field survey in September 2010 – the 160 acres in the northeast quarter of Section 28 (aka the "Lower 160") and the western terminus of the proposed railroad spur (aka the "West End"). Virtually the entire Lower 160 was ranked MPA, except for a narrow sliver in the northeastern-most corner, which was ranked LPA (**Figure 3**). The entire West End was ranked HPA.

5.3 Field Methods

AECOM's field crew conducted pedestrian reconnaissance and shovel testing along parallel transects (**Figure 4** and **Figure 5**) from September 20 through mid-morning of September 23, 2010. Over the 3.5-day timeframe, AECOM excavated a total of 73 shovel tests. Shovel testing was hampered by weather, deep soils, and thick vegetation.

Each shovel test was approximately 0.5-meter in diameter; maximum depths ranged from 40 centimeters below the ground surface (cmbgs) to 93 cmbgs. Abandonment of shovel tests occurred because of negative findings, impenetrable roots, rocks, or concretions (e.g., cementing material of illuviated sesquioxides and organic matter, known as ortstein). All excavated sediment was sieved through portable archaeological screens fitted with ¼-inch hardware mesh; all shovel tests were backfilled before abandonment. The field crew utilized Munsell soil color charts and USDA-NRCS soil terminology and classification to characterize the excavated soil. All observations were recorded on standardized shovel-test logs and in the PI's daily journal, and the project area was photo-documented with a digital single-lens reflex camera. The locations of all shovel tests were recorded with Trimble GeoXH™ handheld Global Positioning System (GPS) capable of sub-meter accuracy. After the completion of the field survey, all GPS data were downloaded into the Geographic Information System (GIS) created for the project.

Vegetation generally was thick with little-to-no ground-surface visibility in the Lower 160 (**Figure 6**), except in the pine plantations (**Figure** 7). Logging and recreational trails were evident throughout. One hunter's deer stand with a light scatter of modern debris was observed in the Lower 160. Vegetation typically was not as thick in the West End (**Figure 8**) as in the Lower 160. The West End is bifurcated by an overhead electrical transmission line (**Figure 9**) that is utilized by hunters (e.g., a hunter's "blind" was situated in the ROW).

The following sections describe specific field methods and conditions in each of the portions of the APE surveyed by AECOM.

5.3.1 Lower 160

On September 20, the weather was sunny, clear, and dry with temperatures ranging from the 40s-60s degrees Fahrenheit (4-16 degrees Celsius). Field survey began along the southern-most boundary of the APE. Transect 1 was comprised of 16 shovel tests spaced 50 meters apart from east to west (**Figure 4**). All of these first shovel tests were negative for cultural materials. Consequently, the shovel-testing interval was expanded to 100 meters for the subsequent transects in the Lower 160 (**Figure 4**). AECOM calculated that a total of eight (8) parallel transects spaced 100 meters apart would cover the entire Lower 160. A total of 24 shovel tests were completed along transects 1 and 2 on September 20.

Field work on September 21 occurred along transects 3 and 4, but the work day was punctuated and then truncated by thunderstorms. Temperatures were in the mid-upper 60s degrees Fahrenheit (16+ degrees Celsius). AECOM completed a total of 16 shovel tests.

Field work on September 22 began in the West End (see below) and then continued along transects 7 and 8 in the Lower 160 where 16 additional shovel tests were excavated. Ground conditions dried as the day progressed; temperatures were in the upper 60s-low 70s (16-21+ degrees Celsius) under sunny to variable cloudy skies.

Field work on September 23 was curtailed by heavy and constant rain throughout the day. Temperatures were cool - high 50s to low 60s degrees Fahrenheit (10-16+ degrees Celsius). A total of only four (4) shovel tests were completed. Heavy rain was predicted to continue through September 24, which led to the PI's decision to end the field survey. As such, AECOM completed a total of 6.5 transects and a total of 60 shovel tests in the Lower 160 over the 3.5-day period.

5.3.2 West End

AECOM completed the field survey in this portion of the APE by excavating a total of 13 shovel tests at 15-meter intervals along one transect during the morning of September 22 (**Figure 5**).

6.0 Results

The only cultural resources observed during the 3.5-day-long Phase I archaeological survey was a small surface scatter of miscellaneous transportation-related debris, such as modern oil filters (**Figure 10**). AECOM excavated a total of 73 shovel tests across the MPA comprising almost the entire Lower 160 and the HPA and MPA comprising the West End. No cultural resources were encountered in any of the shovel tests. Shovel-test profiles encountered in both subareas of the APE were typical of Spodosol soils (i.e., Kalkaska, Rousseau, and Rubicon soils as mapped by the USDA-NRCS). A typical pedon encountered in the Lower 160 and West End is illustrated in **Figure 11**.

7.0 Recommendations

AECOM's Phase I archaeological field survey provided adequate coverage of MPAs and a HPA in the APE with unanimously negative findings for cultural resources. AECOM has tested and verified the predictive model and found no historic properties. Consequently, no further archaeological survey is recommended for the APE, including the three (3) remaining HPAs and two (2) MPAs in the proposed railroad spur on state-owned lands. AECOM recommends a finding of "No Historic Properties Affected" and the proposed Frontier Renewable Resources biorefinery project should be allowed to proceed with no further archaeological field work.

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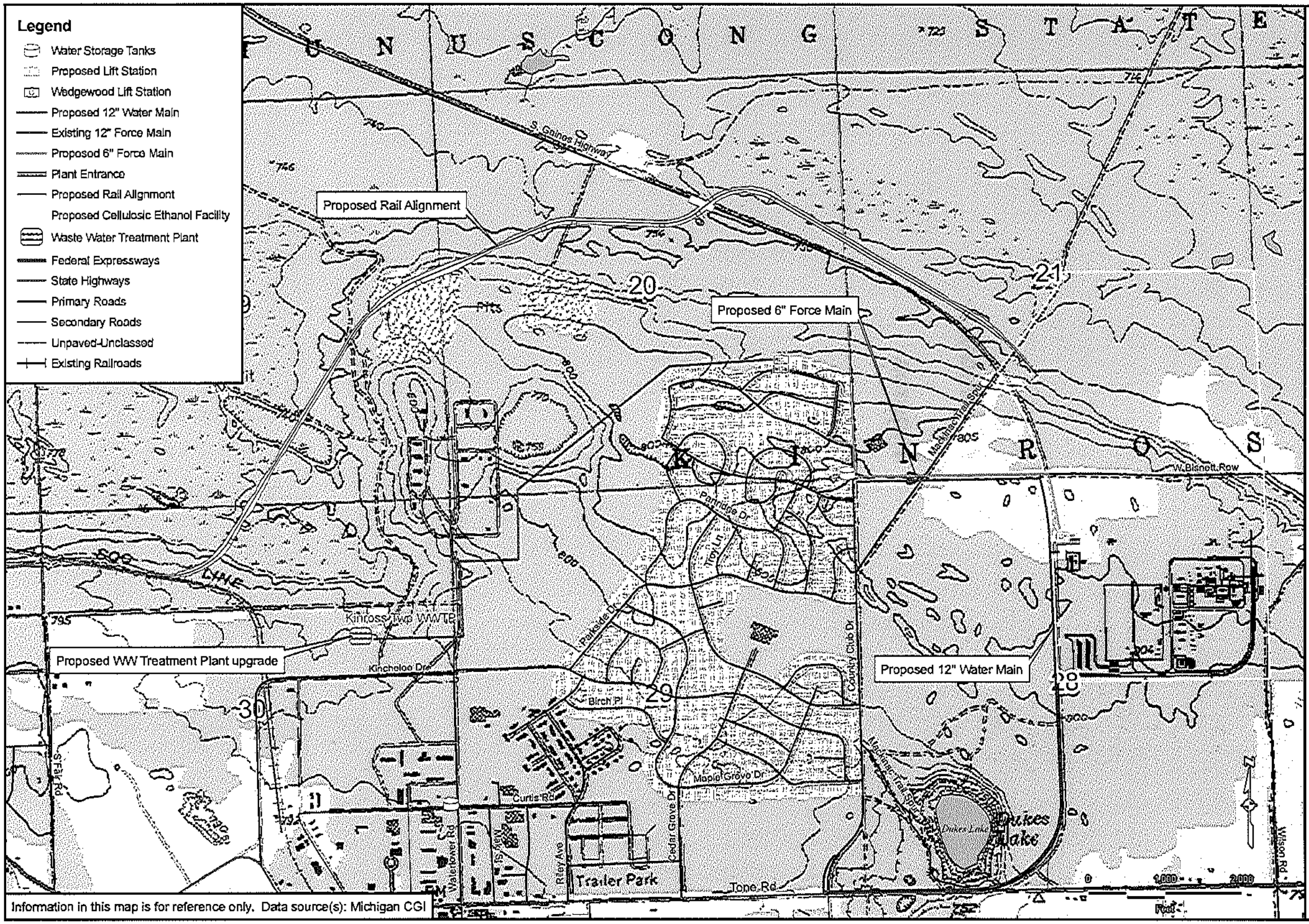
Appendix A

Figures



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PROPOSED RAIL ALIGNMENT AND WATER INFRASTRUCTURE
FRONTIER RENEWABLE RESOURCES, LLC
CELLULOSIC ETHANOL FACILITY
KINROSS TOWNSHIP, CHIPPEWA COUNTY, MICHIGAN

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Approved:	IM	8/18/2010
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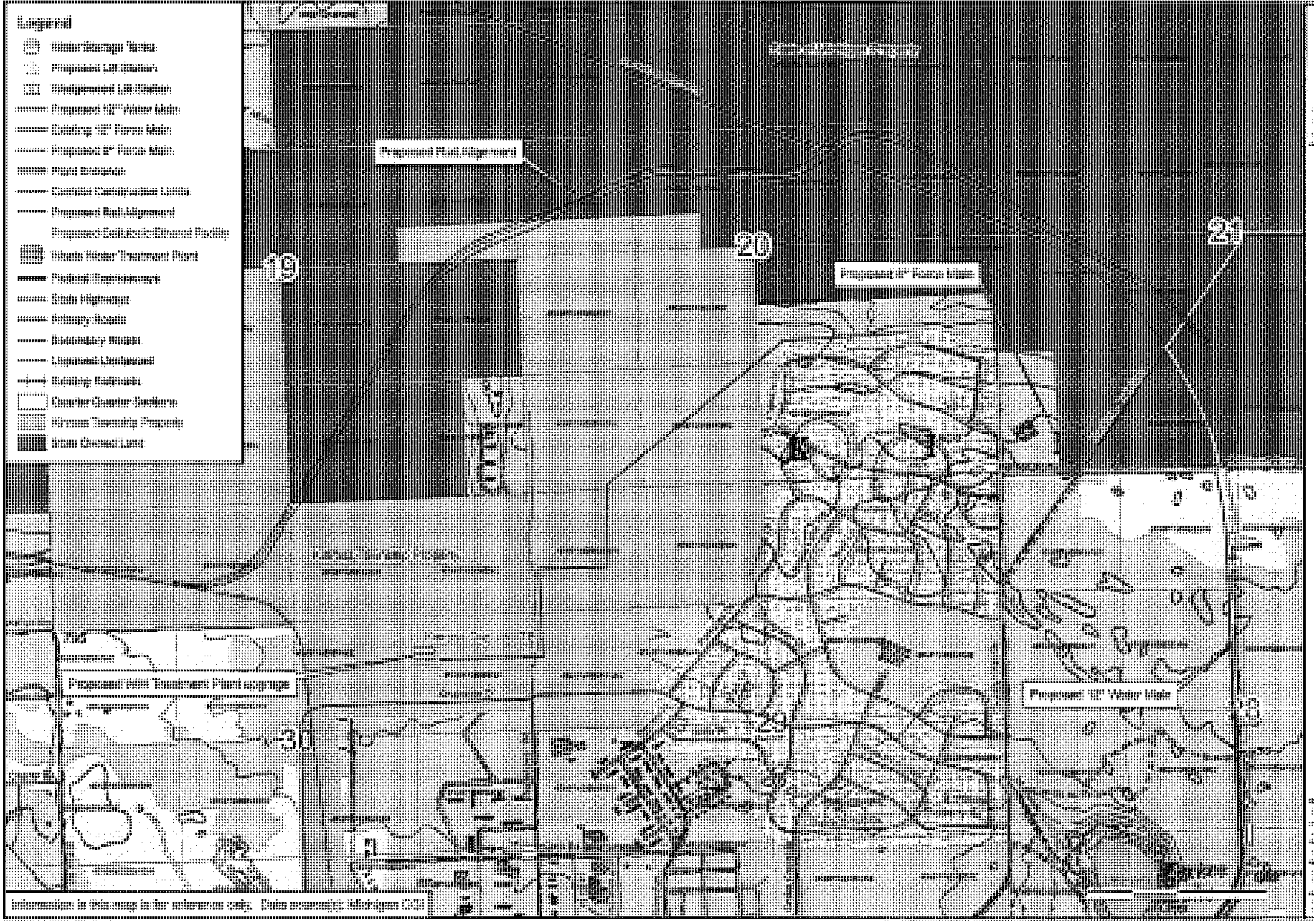

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PROPOSED RAIL ALIGNMENT AND WATER INFRASTRUCTURE
FRONTIER RENEWABLE RESOURCES, LLC
CELLULOSIC ETHANOL FACILITY
KINROSS TOWNSHIP, CHIPPEWA COUNTY, MICHIGAN

Drawn: JWW 8/15/2018
Approved: W 8/15/2018
Scale: 1"=1,000'
Project Number: 60140651
Sheet Number: 2

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PREDICTIVE MODEL
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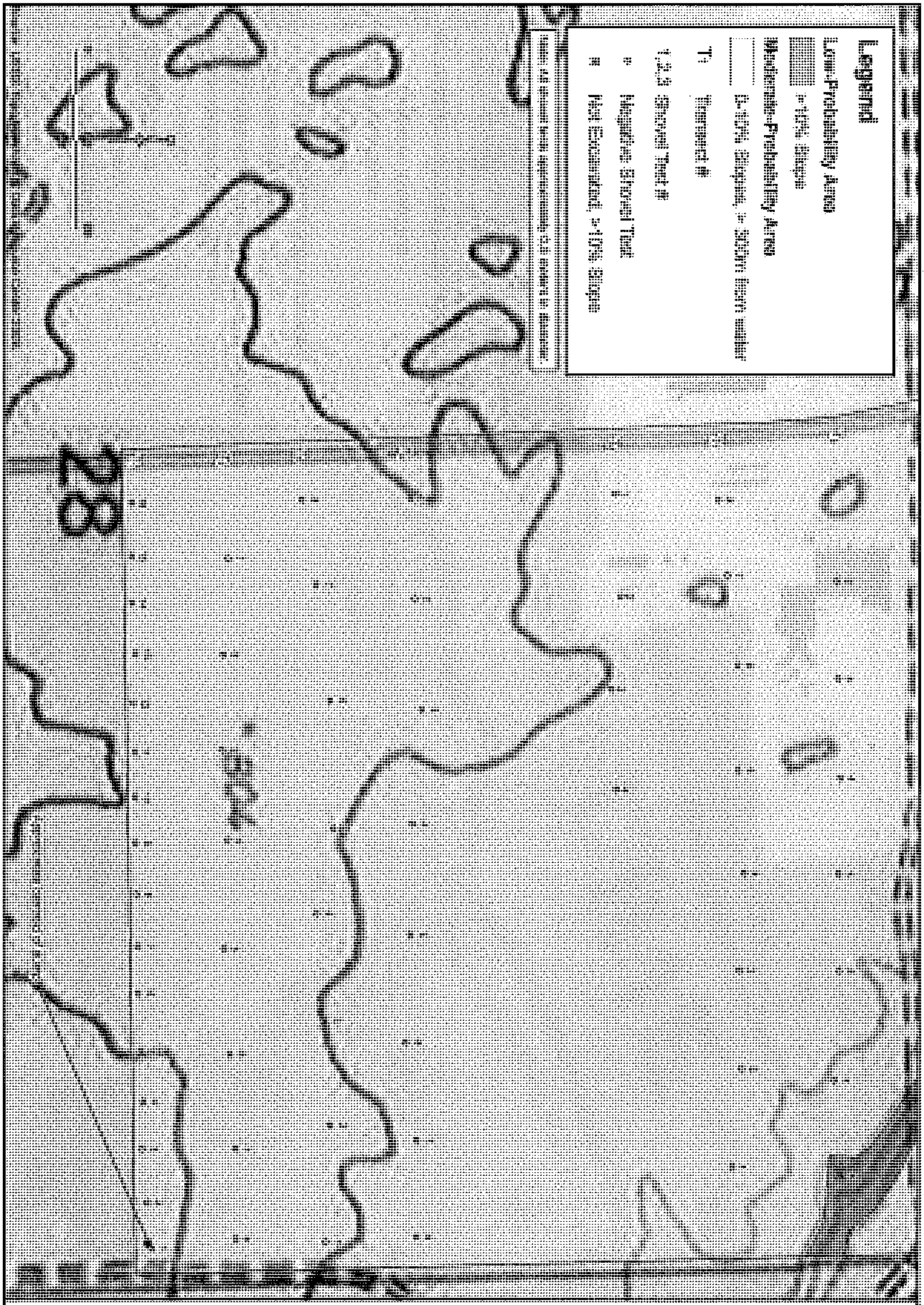
FRONTIER RENEWABLE RESOURCES, LLC
KINROSS TOWNSHIP, CHIPPEWA COUNTY, MICHIGAN



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SURVEY RESULTS IN "LOWER 160"
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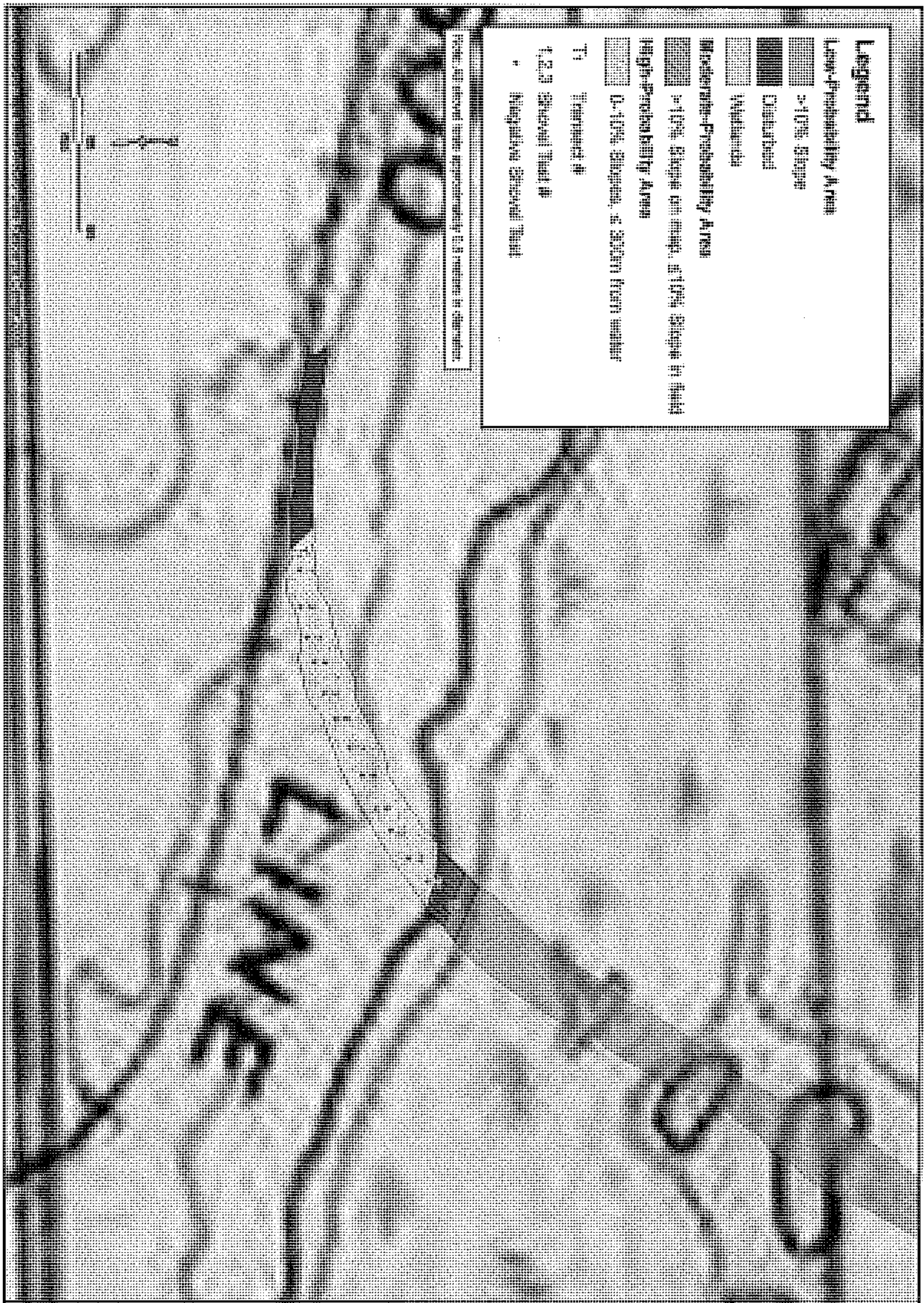
FRONTIER RENEWABLE RESOURCES, LLC
KINROSS TOWNSHIP, CHIPPEWA COUNTY, MICHIGAN



SURVEY RESULTS IN "WEST END"
PHASE I ARCHAEOLOGY
FRONTIER RENEWABLE RESOURCES, LLC
KINROSS TOWNSHIP, CHIPPEWA COUNTY, MICHIGAN

Figure 6. Photograph of Vegetation and Coverage Typical In Lower 160
View looking east at Transect 3, Shovel Test 8.

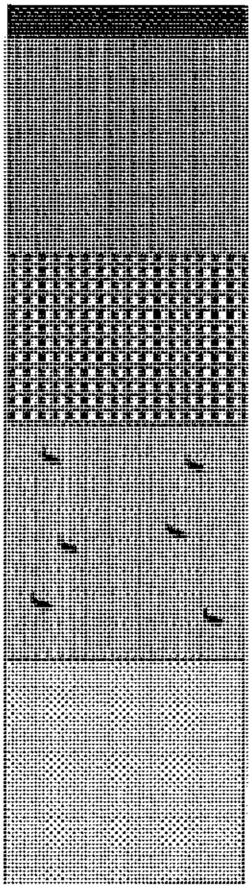
Figure 7. Photograph of Vegetation and Coverage in Pine Plantation Portion of APE View looking east at Transect 4, Shovel Test 3.

Figure 8. Photograph of Vegetation and Coverage Typical in the West End
View looking east at Transect 1RR, Shovel Test 1.

Figure 9. Photograph Under Powerline Bifurcating West End Portion of the APE
View looking east from approximate center of Transect 1RR.
Note "hunter's blind"on left side of ROW.

Figure 10. Photograph of Modern Transportation-Related Debris Pile
View looking west, approximately 9 feet in diameter.

Figure 11. Typical Shovel-Test Profile
Transect 1, Shovel Test 6 (in the Lower 160)



0 cmbgs present ground surface
5 cmbgs 10YR2/2 (very dark brown) fine sand &

20 cmbgs 5YR5/1 (gray) fine sand

33 cmbgs 5YR3/2 (dark reddish brown) fine sand w/abundant cobbles

52 cmbgs 5YR5/4 (reddish brown) fine sand w/ sparse charcoal fragments, < 1 cm each

70 cmbgs 5YR6/4 (light reddish brown) fine sand

Department of Energy
Golden Field Office
1617 Cole Boulevard
Golden, Colorado 80401-3393

July 22, 2010

Arthur LaRose, Chairman
Leech Lake Reservation Tribal Council
6530 US HWY #2 NW
Cass Lake, MN 55633

Dear Mr. LaRose,

The U. S. Department of Energy is proposing to provide Federal funding to Mascoma Corporation for the final design, construction, and operation of a cellulose-to-ethanol biorefinery near the City of Kinross, Michigan in Chippewa County. Frontier Renewable Resources, LLC, a joint venture between Mascoma Corporation and J.M. Longyear, LLC, would develop and operate the proposed facility. The proposed facility is intended to further the government's goal of rendering cellulosic ethanol cost-competitive with corn ethanol by 2012.

The proposed biorefinery would utilize approximately 1,440 bone dry tons per day of hardwood pulpwood to eventually produce up to 40 million gallons per year of anhyrdrous ethanol. Co-products, such as the lignin and spent cullose from the process, would either be sold or used to produce steam and electricity in a biomass boiler. Feedstock would consist of hardwood pulpwood within the Michigan counties with a 150-mile radius of the site.

The proposed project site comprises a 355 acre plot of land in Kinross Township of Chippewa County, Michigan, Township 45 North, Range 01 West, Sections 21 and 28. It lies approximately one-half mile northeast of Kinross. The attached Site Location Map (Figure 1) provides an overview of the general property and access to area roads. Frontier plans to construct the plant on approximately 50 acres located within the southern 160 acres.

The proposed site is adjacent to the former Kincheloe U.S. Air Force base in Kinross. The site is predominantly wooded with no existing structures and limited unpaved trails. A snowmobile trail runs along the west boundary of the property and cross a small portion of the northwest corner. Figure 2 presents the Site Location Map with a 2005 Aerial Photo.

An environmental assessment (EA) is currently being prepared for the proposed Project by the Department's Golden Field Office to meet the requirements of the *National Environmental Policy Act*. DOE will include correspondence with your tribe in an appendix to the EA. This letter as well as the draft EA, when it is available, will be posted in the DOE Golden Field Office online reading room: http://www.eere.energy.gov/golden/reading_room.aspx. At this time we anticipate a 15-day public comment period for this proposed project. You will receive a notice of the availability of the draft EA. Please contact DOE if you would like to receive a hardcopy of the draft EA.

DOE is initiating consultation and requesting information your tribe may have on properties of traditional religious and cultural significance within the vicinity of the proposed facility and any comments or concerns you have on the potential for this proposed project to affect those properties. This information is being requested to aid in the preparation of that Environmental Assessment and to meet our obligations under Section 106 of the National Historic Preservation Act and the Native American Graves Protection

and Repatriation Act of 1990. If you have any such information, require additional information, or have any questions or comments about that project, please contact me at the following address:

Ms. Kristin Kerwin
U.S. Department of Energy
1617 Cole Boulevard
Golden, Colorado
Email: kristin.kerwin@go.doe.gov
Phone: 303-275-4968

Please provide your comments within 30-days of receipt of this letter. Thank you in advance for your consideration.

Sincerely,

Kristin Ker

Kristin Kerwin
NEPA Compliance Officer

Attachments
Figure 1. Site Location Map
Figure 2. Site Location Map with a 2005 Aerial Photo.

CC: Ms. Gina Lemon
Tribal Historic Preservation Officer
Leech Lake Band of the Minnesota Chippewa Tribe
6530 US HWY #2 NW
Cass Lake, MN 55633

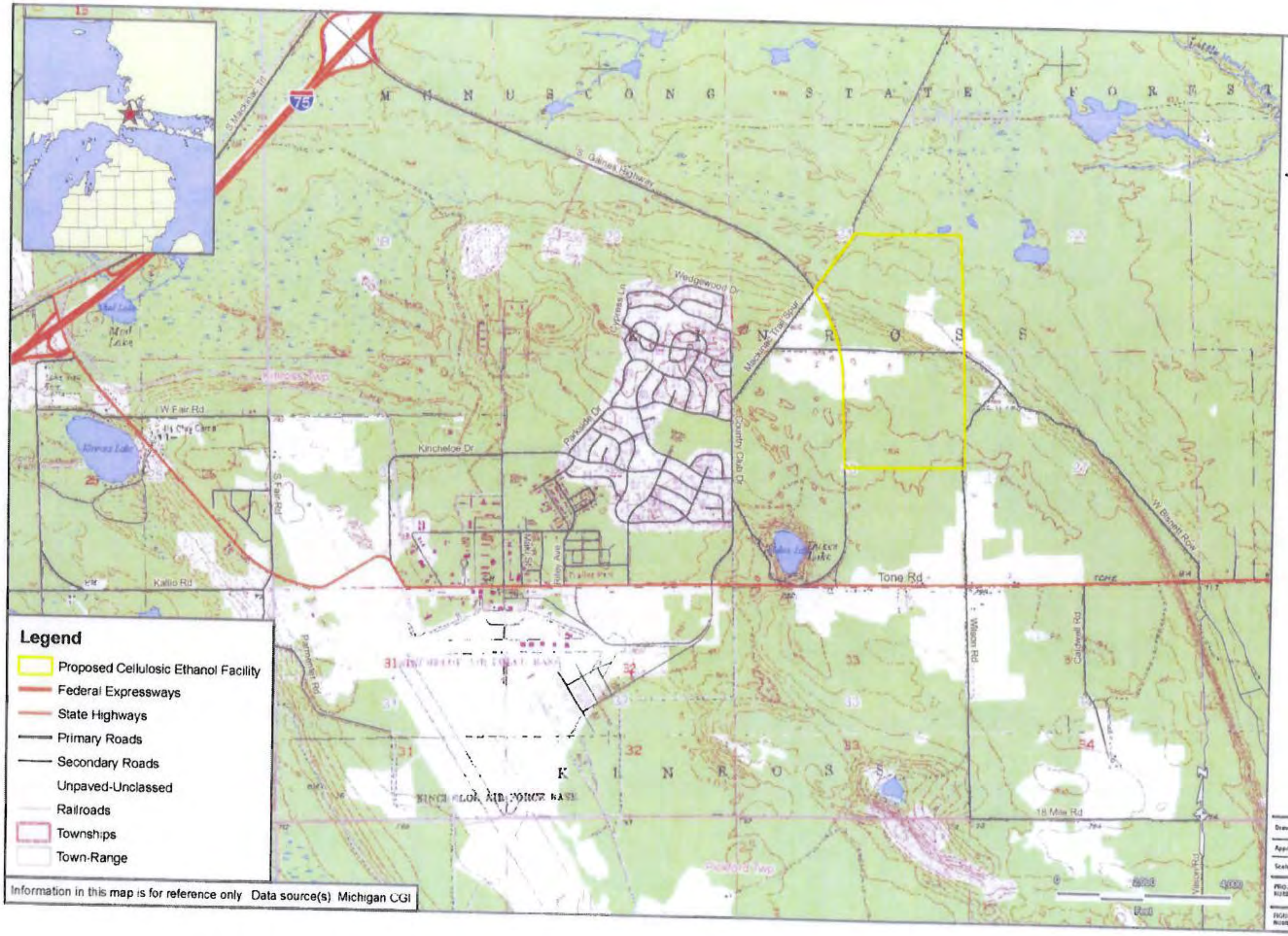


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FIGURE 1
SITE LOCATION MAP
FRONTIER RENEWABLE RESOURCES, LLC
CELLULOSIC ETHANOL FACILITY
CHIPPEWA COUNTY, MICHIGAN

Drawn:	JWW	2/17/2009
Approved:	LDK	2/17/2009
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PROJECT NUMBER	13375-001-0100	
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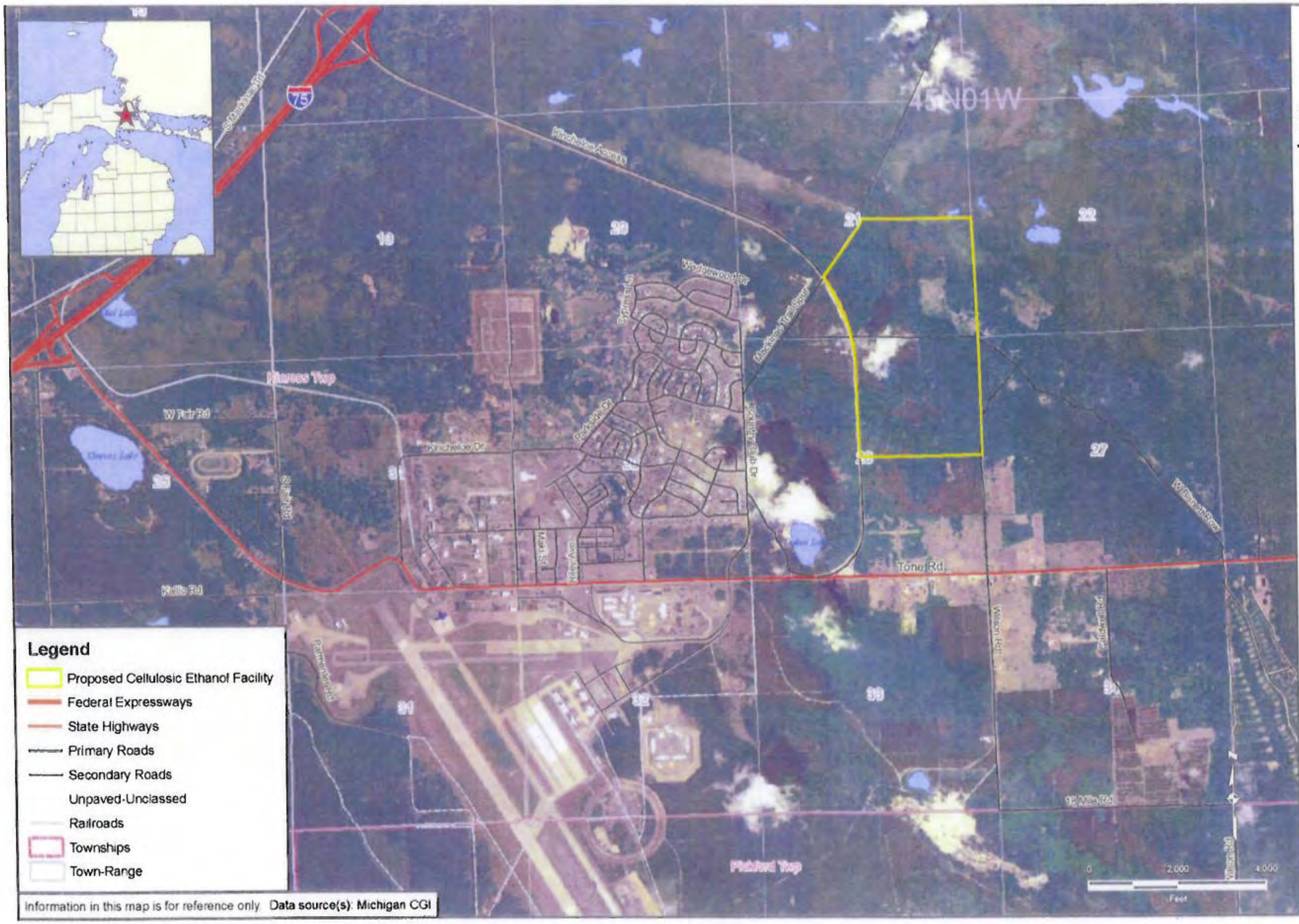

Information in this map is for reference only **Data source(s):** Michigan CGI

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FIGURE 2
SITE LOCATION MAP WITH 2005 AERIAL PHOTO
FRONTIER RENEWABLE RESOURCES, LLC
CELLULOSIC ETHANOL FACILITY
CHIPPEWA COUNTY, MICHIGAN

Drawn:	JWW	2/17/2009
Approved:	LDK	2/17/2009
Scale:	1" = 2,000'	
PROJECT NUMBER	13375-001-0100	
FIGURE NUMBER	2	

Department of Energy
Golden Field Office
1617 Cole Boulevard
Golden, Colorado 80401-3393

July 22, 2010

Mr. Darwin "Joe" McCoy, Chairperson
Sault Ste. Marie Tribe of Chippewa Indians of Michigan
523 Ashmun Strret
Sault Ste. Marie, MI 49783-1907

Dear Mr. McCoy,

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and Repatriation Act of 1990. If you have any such information, require additional information, or have any questions or comments about that project, please contact me at the following address:

Ms. Kristin Kerwin
U.S. Department of Energy
1617 Cole Boulevard
Golden, Colorado
Email: kristin.kerwin@go.doe.gov
Phone: 303-275-4968

Please provide your comments within 30-days of receipt of this letter. Thank you in advance for your consideration.

Sincerely,

Kristin Kerwin

Kristin Kerwin
NEPA Compliance Officer

Attachments
Figure 1. Site Location Map
Figure 2. Site Location Map with a 2005 Aerial Photo.

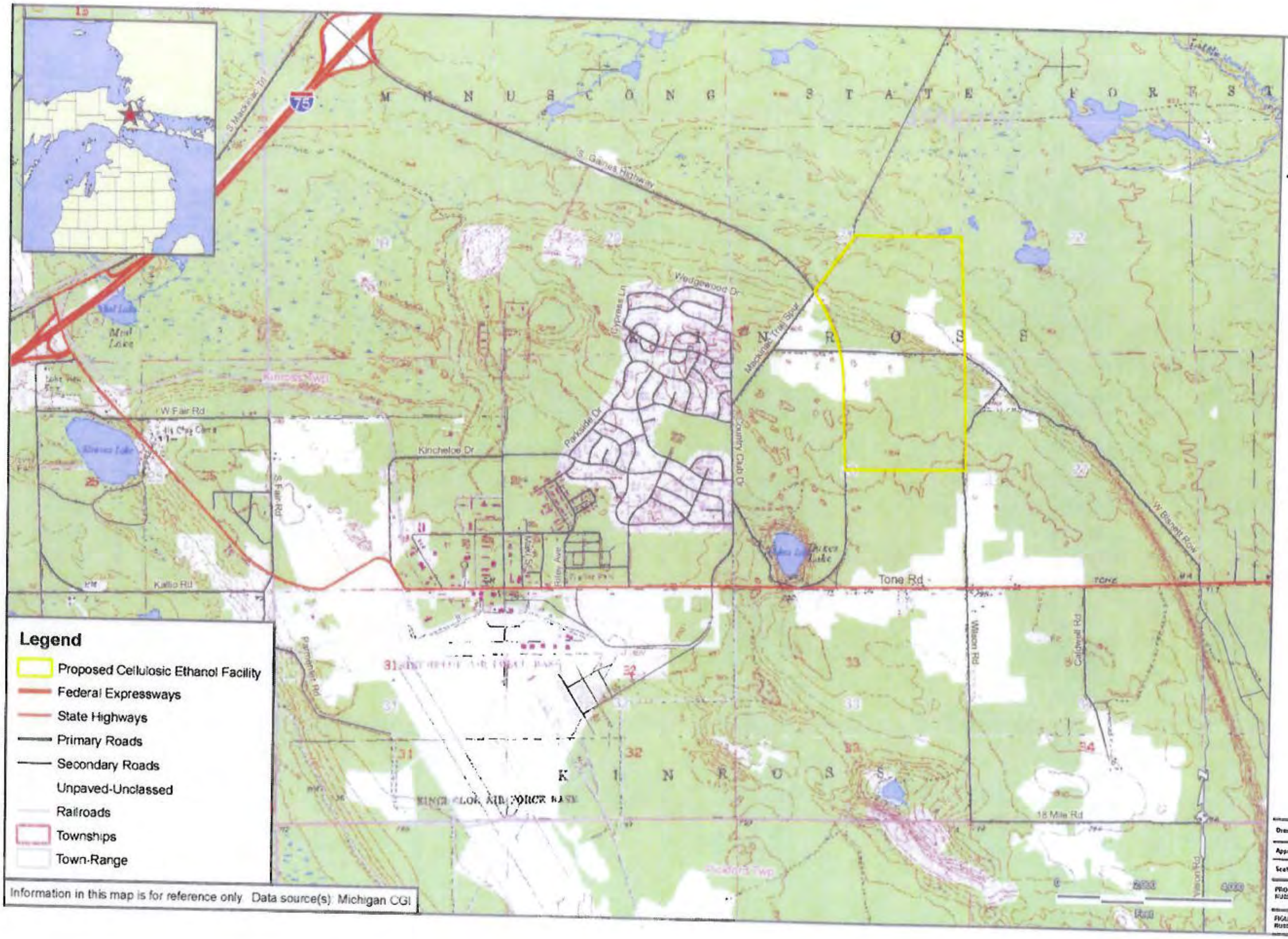

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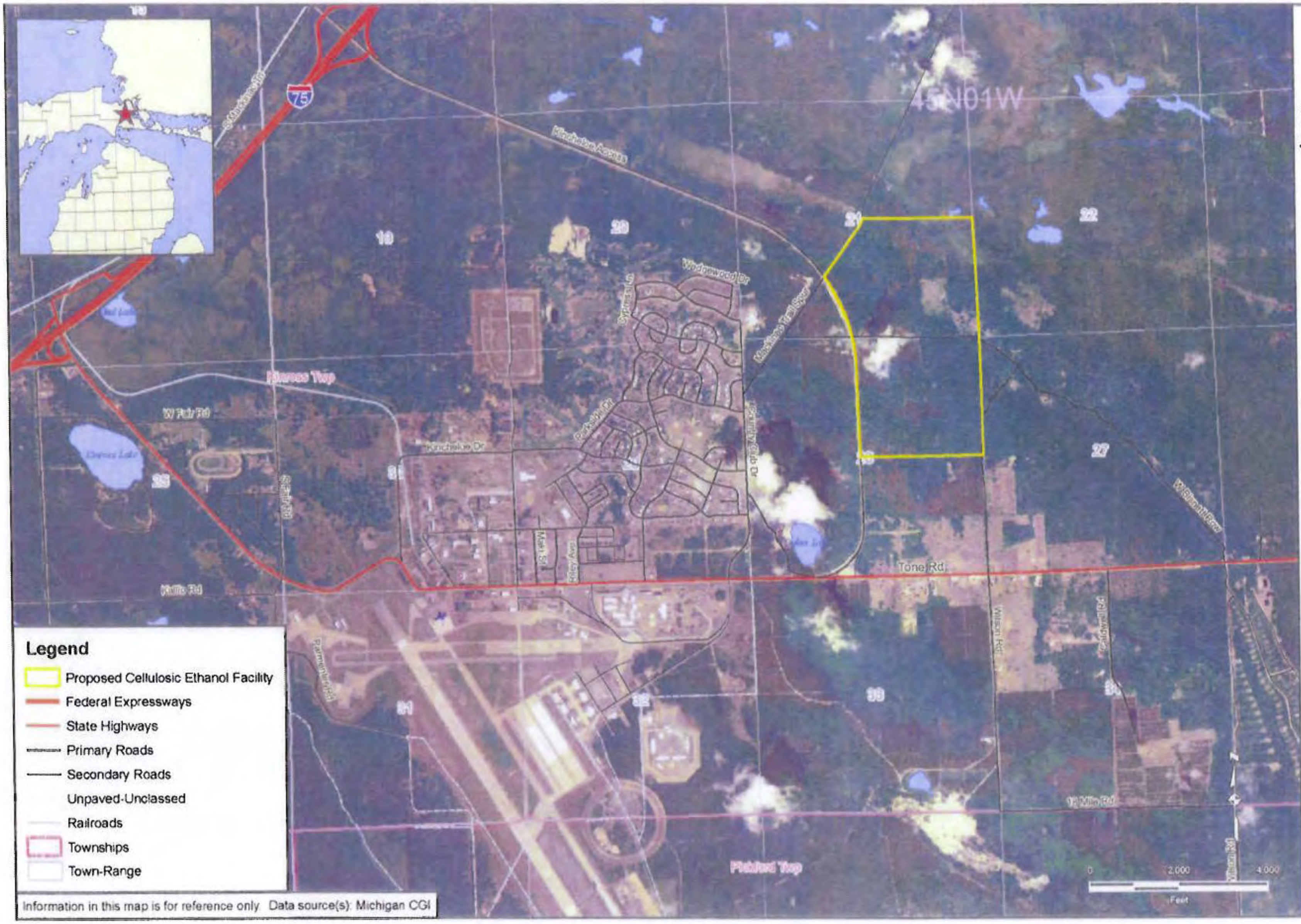
FIGURE 1
SITE LOCATION MAP
FRONTIER RENEWABLE RESOURCES, LLC
CELLULOSIC ETHANOL FACILITY
CHIPPEWA COUNTY, MICHIGAN

Drawn:	JWW	2/17/2009
Approved:	LDK	2/17/2009
Scale:	1" = 2,000'	
PROJECT NUMBER	13375-001-0100	
FIGURE NUMBER	1	



Information in this map is for reference only. Data source(s): Michigan CGI

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www.aecom.com

FIGURE 2
SITE LOCATION MAP WITH 2005 AERIAL PHOTO
FRONTIER RENEWABLE RESOURCES, LLC
CELLULOSIC ETHANOL FACILITY
CHIPPEWA COUNTY, MICHIGAN

Drawn:	JWW	2/17/2009
Approved:	LDK	2/17/2009
Scale:	1" = 2,000'	
PROJECT NUMBER	13375-001-0100	
FIGURE NUMBER	2	

Department of Energy

Golden Field Office
1617 Cole Boulevard
Golden, Colorado 80401-3393

July 22, 2010

Mr. David C. Sprague, Chairperson
Match-e-be-nash-se-wish Band of Pottawatomi Indians
P.O. Box 218
Dorr, MI 49233-0218

Dear Mr. Sprague,

The U. S. Department of Energy is proposing to provide Federal funding to Mascoma Corporation for the final design, construction, and operation of a cellulose-to-ethanol biorefinery near the City of Kinross, Michigan in Chippewa County. Frontier Renewable Resources, LLC, a joint venture between Mascoma Corporation and J.M. Longyear, LLC, would develop and operate the proposed facility. The proposed facility is intended to further the government's goal of rendering cellulosic ethanol cost-competitive with corn ethanol by 2012.

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and Repatriation Act of 1990. If you have any such information, require additional information, or have any questions or comments about that project, please contact me at the following address:

Ms. Kristin Kerwin
U.S. Department of Energy
1617 Cole Boulevard
Golden, Colorado
Email: kristin.kerwin@go.doe.gov
Phone: 303-275-4968

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Sincerely,

Kristin Kerwin

Kristin Kerwin
NEPA Compliance Officer

Attachments
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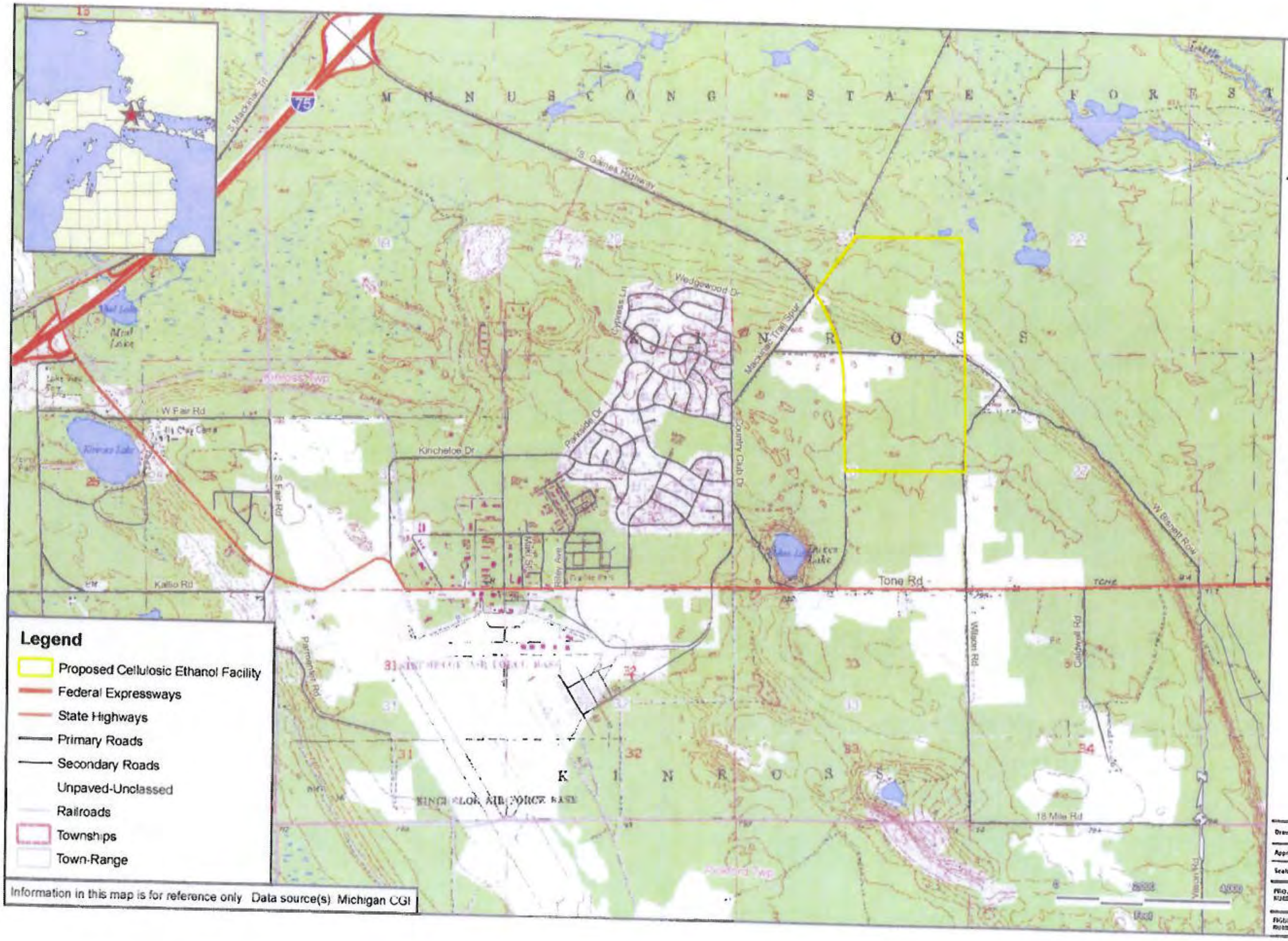

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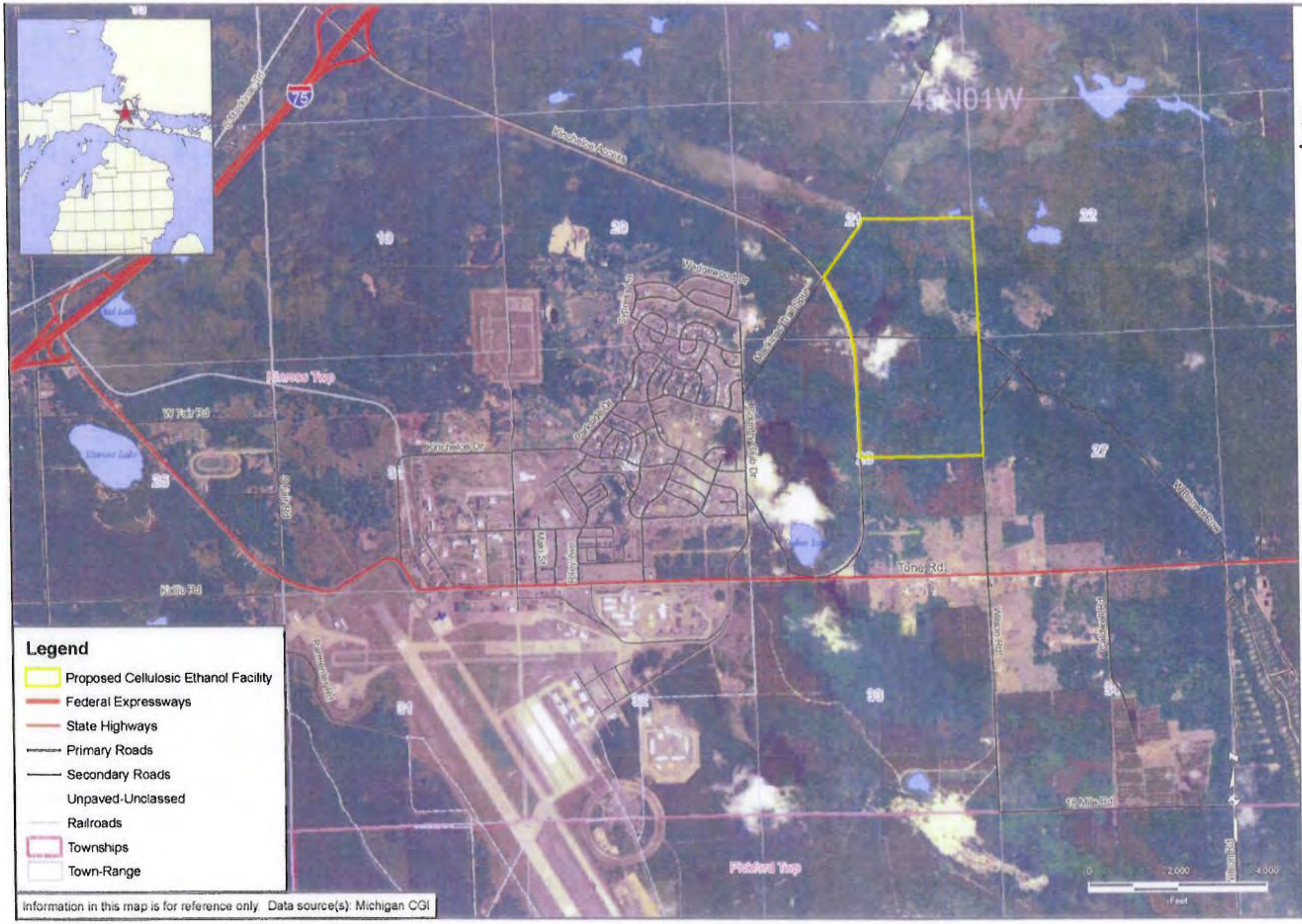
SITE LOCATION MAP
FRONTIER RENEWABLE RESOURCES, LLC
CELLULOSIC ETHANOL FACILITY
CHIPPEWA COUNTY, MICHIGAN

Drawn:	JWW	2/17/2009
Approved:	LDK	2/17/2009
Scale:	1" = 2,000'	
PROJECT NUMBER	13375-001-0100	
FIGURE NUMBER	1	



Information in this map is for reference only Data source(s): Michigan CGI

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FIGURE 2
SITE LOCATION MAP WITH 2005 AERIAL PHOTO
FRONTIER RENEWABLE RESOURCES, LLC
CELLULOSIC ETHANOL FACILITY
CHIPPEWA COUNTY, MICHIGAN

Drawn:	JWW	2/17/2009
Approved:	LDK	2/17/2009
Scale:	1" = 2,000'	
PROJECT NUMBER	13375-001-0100	
FIGURE NUMBER	2	

Department of Energy

Golden Field Office
1617 Cole Boulevard
Golden, Colorado 80401-3393

July 22, 2010

Mr. Dennis V. Kequom, Sr., Chief
Saginaw Chippewa Indian Tribe of Michigan
7070 East Broadway Road
Mt. Pleasant, MI 48858-8970

Dear Mr. Kequom,

The U. S. Department of Energy is proposing to provide Federal funding to Mascoma Corporation for the final design, construction, and operation of a cellulose-to-ethanol biorefinery near the City of Kinross, Michigan in Chippewa County. Frontier Renewable Resources, LLC, a joint venture between Mascoma Corporation and J.M. Longyear, LLC, would develop and operate the proposed facility. The proposed facility is intended to further the government's goal of rendering cellulosic ethanol cost-competitive with corn ethanol by 2012.

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and Repatriation Act of 1990. If you have any such information, require additional information, or have any questions or comments about that project, please contact me at the following address:

Ms. Kristin Kerwin
U.S. Department of Energy
1617 Cole Boulevard
Golden, Colorado
Email: kristin.kerwin@go.doe.gov
Phone: 303-275-4968

Please provide your comments within 30-days of receipt of this letter. Thank you in advance for your consideration.

Sincerely,

Kristin Kerwin

Kristin Kerwin
NEPA Compliance Officer

Attachments
Figure 1. Site Location Map
Figure 2. Site Location Map with a 2005 Aerial Photo.

CC: Ms. Shannon Martin
Tribal Historic Preservation Officer
7070 East Broadway Road
Mt. Pleasant, MI 48858-8970

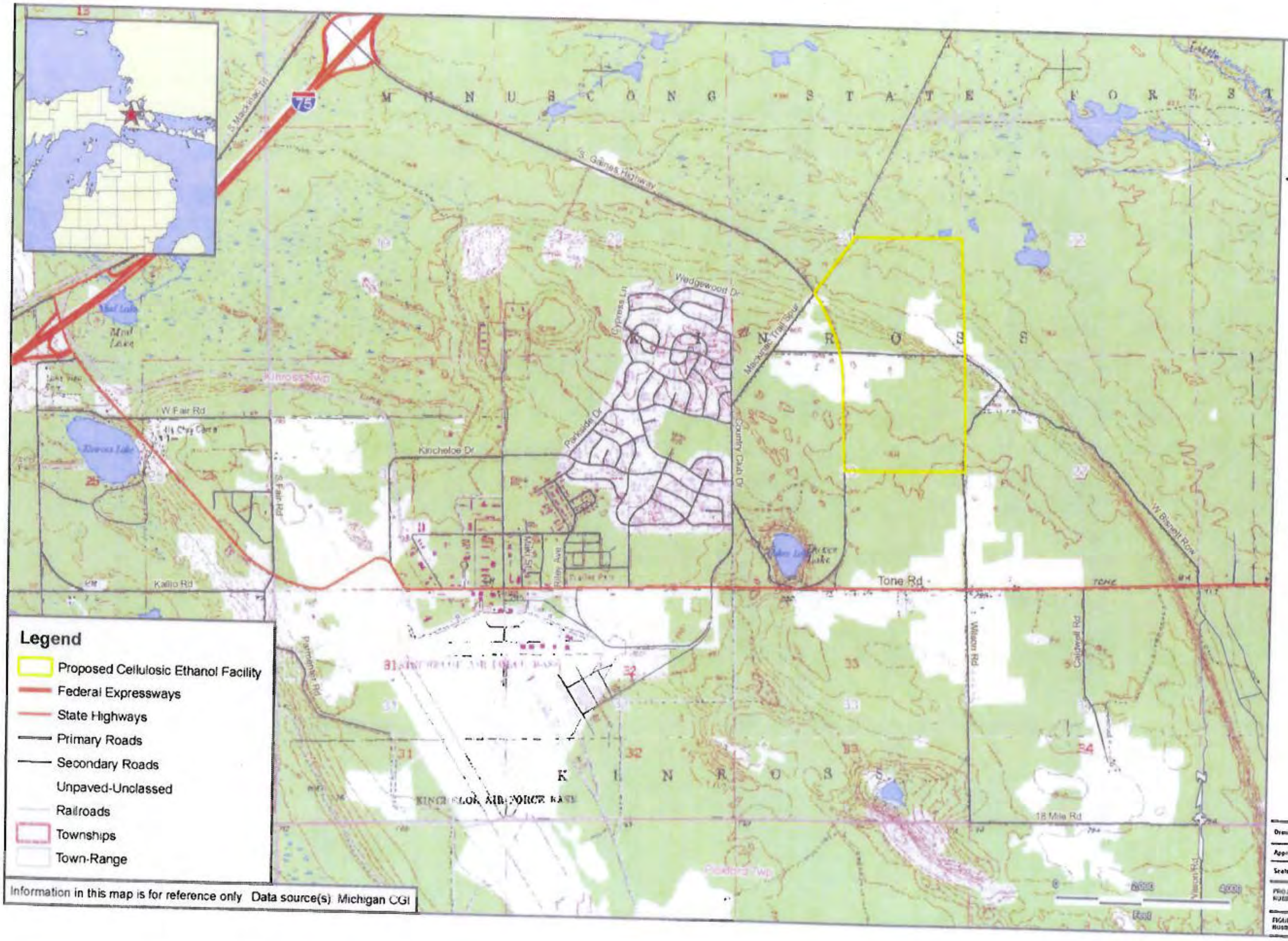

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FIGURE 1
SITE LOCATION MAP
FRONTIER RENEWABLE RESOURCES, LLC
CELLULOSIC ETHANOL FACILITY
CHIPPEWA COUNTY, MICHIGAN

Drawn:	JWW	2/17/2009
Approved:	LDK	2/17/2009
Scale:	1" = 2,000'	
PROJECT NUMBER	13375-001-0100	
FIGURE NUMBER	1	

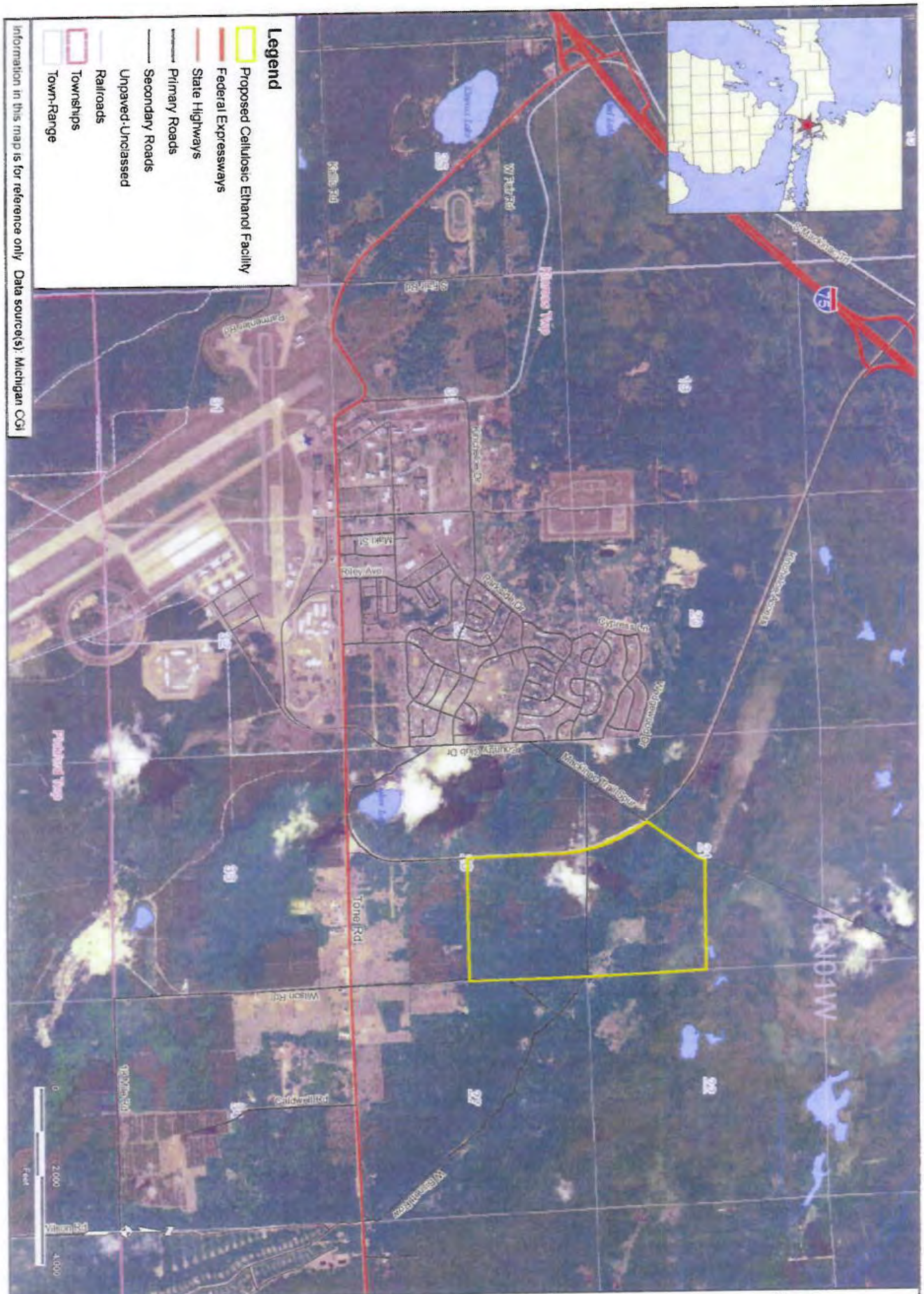

FIGURE 2
SITE LOCATION MAP WITH 2005 AERIAL PHOTO
FRONTIER RENEWABLE RESOURCES, LLC
CELLULOSIC ETHANOL FACILITY
CHIPPEWA COUNTY, MICHIGAN

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Drawn: JWW 2/17/2009
Approved: LDK 2/17/2009
Scale: 1" = 2,000'
PROJECT NUMBER: 13375-001-0100
FIGURE NUMBER: 2

Department of Energy
Golden Field Office
1617 Cole Boulevard
Golden, Colorado 80401-3393

July 22, 2010

Mr. Derek J. Bailey, Chairman
Grand Traverse Band of Ottawa and Chippewa Indians
2605 N.W. Bayshore Drive
Peshawbestown, MI 49682-9275

Dear Mr. Bailey,

The U. S. Department of Energy is proposing to provide Federal funding to Mascoma Corporation for the final design, construction, and operation of a cellulose-to-ethanol biorefinery near the City of Kinross, Michigan in Chippewa County. Frontier Renewable Resources, LLC, a joint venture between Mascoma Corporation and J.M. Longyear, LLC, would develop and operate the proposed facility. The proposed facility is intended to further the government's goal of rendering cellulosic ethanol cost-competitive with corn ethanol by 2012.

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Ms. Kristin Kerwin
U.S. Department of Energy
1617 Cole Boulevard
Golden, Colorado
Email: kristin.kerwin@go.doe.gov
Phone: 303-275-4968

Please provide your comments within 30-days of receipt of this letter. Thank you in advance for your consideration.

Sincerely,

Kristin Ker

Kristin Kerwin
NEPA Compliance Officer

Attachments
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CC:
Mark Russell
Museum Director
Grand Traverse Band of Ottawa and Chippewa Indians
2605 N.W. Bayshore Drive
Peshawbestown, MI 49682-9275

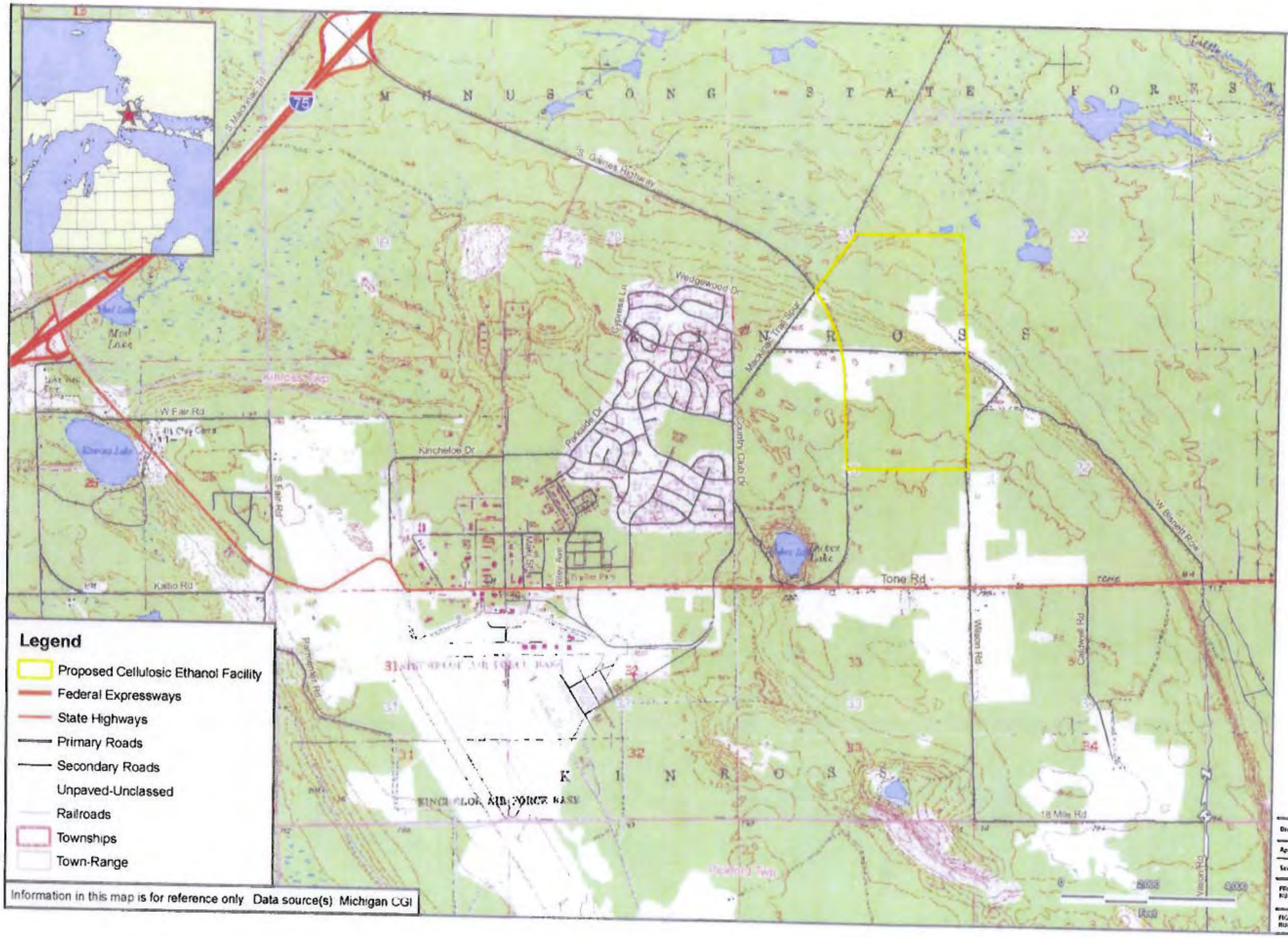

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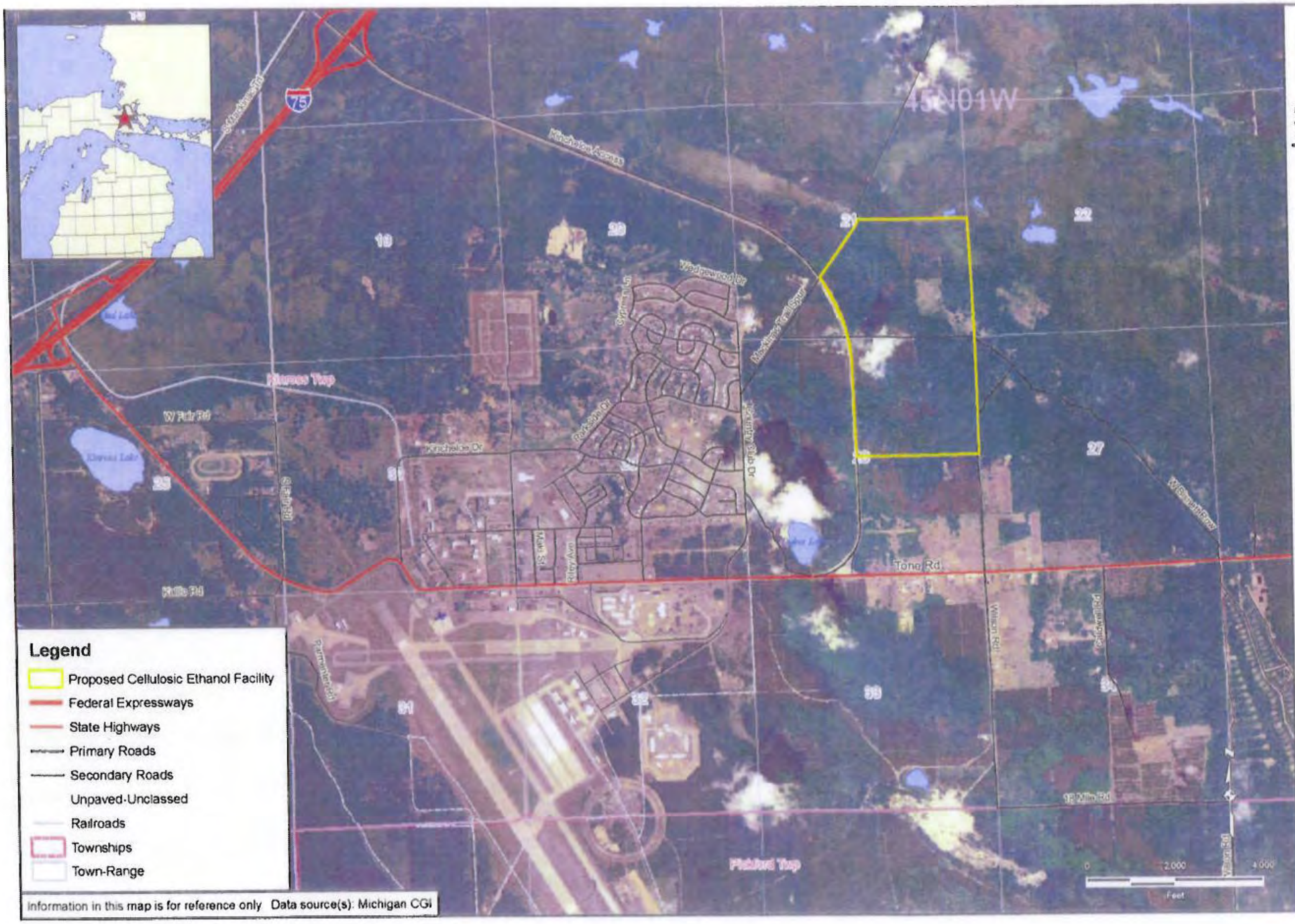
FIGURE 1
SITE LOCATION MAP
FRONTIER RENEWABLE RESOURCES, LLC
CELLULOSIC ETHANOL FACILITY
CHIPPEWA COUNTY, MICHIGAN

Drawn:	JWW	2/17/2009
Approved:	LDK	2/17/2009
Scale:	1" = 2,000'	
PROJECT NUMBER	13375-001-0100	
FIGURE NUMBER	1	



Legend

- 🟨 Proposed Cellulosic Ethanol Facility
- 🟥 Federal Expressways
- State Highways
- Primary Roads
- Secondary Roads
- Unpaved-Unclassed
- Railroads
- ☐ Townships
- ☐ Town-Range

Information in this map is for reference only Data source(s): Michigan CGI

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FIGURE 2
SITE LOCATION MAP WITH 2005 AERIAL PHOTO
FRONTIER RENEWABLE RESOURCES, LLC
CELLULOSIC ETHANOL FACILITY
CHIPPEWA COUNTY, MICHIGAN

Drawn:	JWW	2/17/2009
Approved:	LDK	2/17/2009
Scale:	1" = 2,000'	
PROJECT NUMBER	13375-001-0100	
FIGURE NUMBER	2	

Department of Energy
Golden Field Office
1617 Cole Boulevard
Golden, Colorado 80401-3393

July 22, 2010

Erma Vizenor, Chairwoman
White Earth Reservation Tribal Council
P.O. Box 418
White Earth, MN 56591-0418

Dear Ms. Vizenor,

The U. S. Department of Energy is proposing to provide Federal funding to Mascoma Corporation for the final design, construction, and operation of a cellulose-to-ethanol biorefinery near the City of Kinross, Michigan in Chippewa County. Frontier Renewable Resources, LLC, a joint venture between Mascoma Corporation and J.M. Longyear, LLC, would develop and operate the proposed facility. The proposed facility is intended to further the government's goal of rendering cellulosic ethanol cost-competitive with corn ethanol by 2012.

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U.S. Department of Energy
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Golden, Colorado
Email: kristin.kerwin@go.doe.gov
Phone: 303-275-4968

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Sincerely,

Kristin Ker

Kristin Kerwin
NEPA Compliance Officer

Attachments
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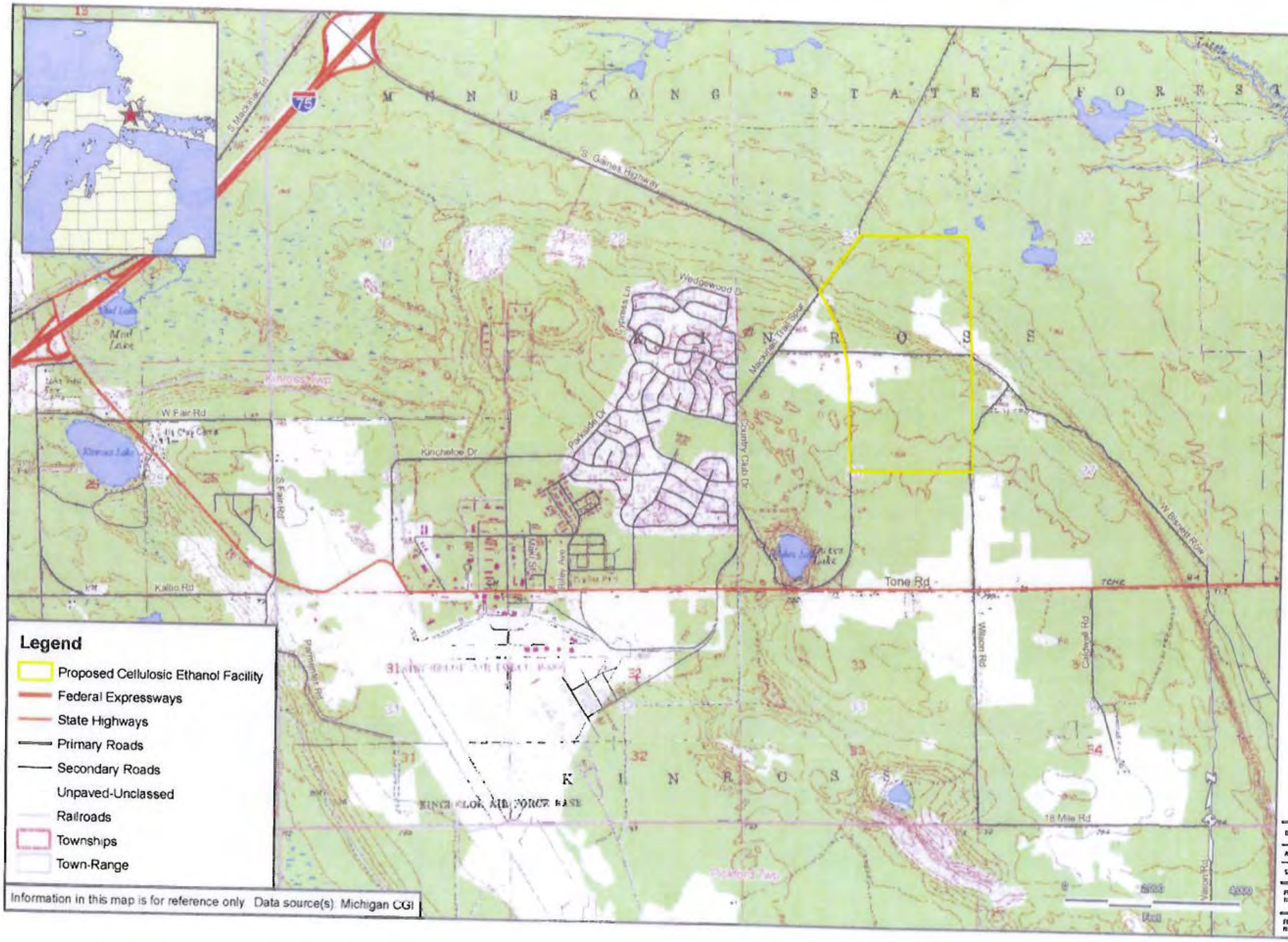
Figure 2. Site Location Map with a 2005 Aerial Photo.

CC: Thomas McCauley
Tribal Historic Preservation Officer
White Earth Band of the Minnesota Chippewa Tribe
P.O. Box 418
White Earth, MN 56591-0418



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FRONTIER RENEWABLE RESOURCES, LLC
CELLULOSIC ETHANOL FACILITY
CHIPPEWA COUNTY, MICHIGAN

Drawn:	JWW	2/17/2009
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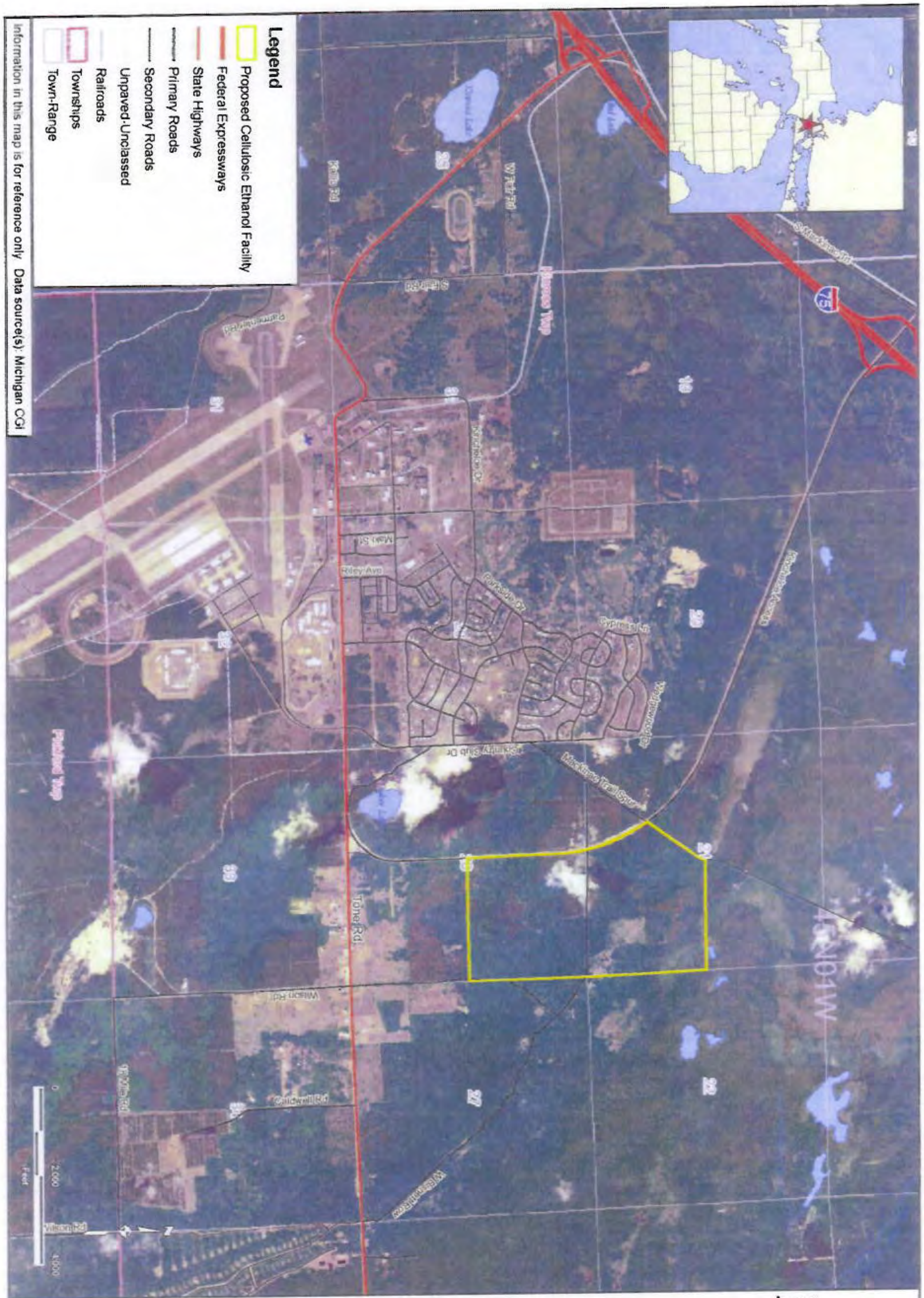
Scale:	1" = 2,000'	
PROJECT NUMBER	13375-001-0100	
FIGURE NUMBER	1	



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SITE LOCATION MAP WITH 2005 AERIAL PHOTO
FRONTIER RENEWABLE RESOURCES, LLC
CELLULOSIC ETHANOL FACILITY
CHIPPEWA COUNTY, MICHIGAN

Drawn: JWW 2/17/2009
Approved: LDK 2/17/2009
Scale: 1" = 2,000'
PROJECT NUMBER 13375-001-0100
FIGURE NUMBER 2

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Department of Energy
Golden Field Office
1617 Cole Boulevard
Golden, Colorado 80401-3393

July 22, 2010

Floyd Jourdain, Chairman
Red Lake Band of Chippewa Indians of Minnesota
P.O. Box 550
Red Lake, MN 56671-0550

Dear Ms. Jourdain,

The U. S. Department of Energy is proposing to provide Federal funding to Mascoma Corporation for the final design, construction, and operation of a cellulose-to-ethanol biorefinery near the City of Kinross, Michigan in Chippewa County. Frontier Renewable Resources, LLC, a joint venture between Mascoma Corporation and J.M. Longyear, LLC, would develop and operate the proposed facility. The proposed facility is intended to further the government's goal of rendering cellulosic ethanol cost-competitive with corn ethanol by 2012.

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U.S. Department of Energy
1617 Cole Boulevard
Golden, Colorado
Email: kristin.kerwin@go.doe.gov
Phone: 303-275-4968

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Sincerely,

Kristin Ker

Kristin Kerwin
NEPA Compliance Officer

Attachments
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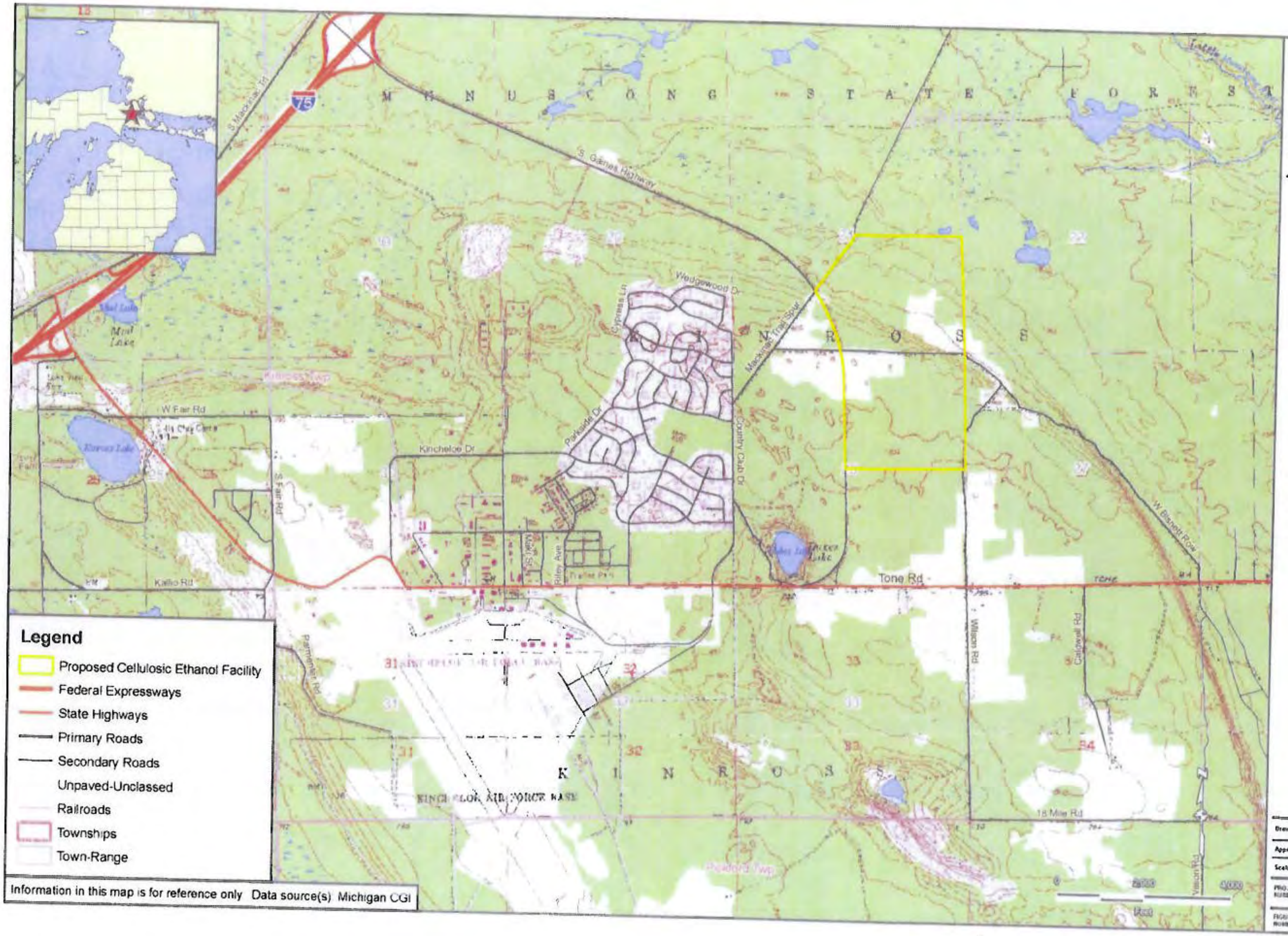
Figure 2. Site Location Map with a 2005 Aerial Photo.

CC: Al Pemberton, Director
Department of Natural Resources
Red Lake Band of Chippewa Indians of Minnesota
P.O. Box 550
Red Lake, MN 56671-0550



Information in this map is for reference only Data source(s) Michigan CGI

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FIGURE 1
SITE LOCATION MAP
FRONTIER RENEWABLE RESOURCES, LLC
CELLULOSIC ETHANOL FACILITY
CHIPPEWA COUNTY, MICHIGAN

Drawn:	JWW	2/17/2009
Approved:	LDK	2/17/2009
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PROJECT NUMBER	13375-001-0100	
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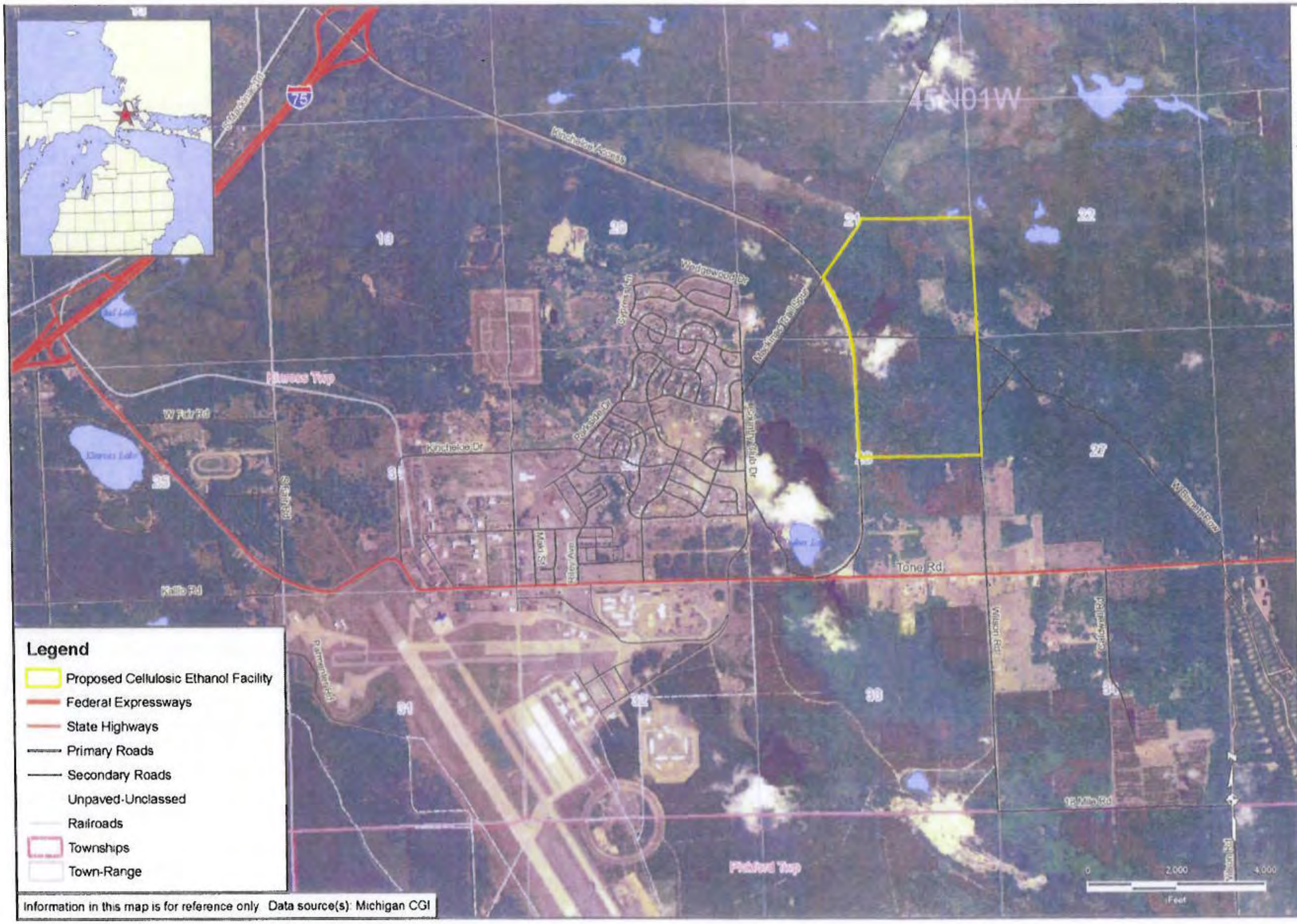

Information in this map is for reference only   Data source(s): Michigan CGI

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FIGURE 2
SITE LOCATION MAP WITH 2005 AERIAL PHOTO
FRONTIER RENEWABLE RESOURCES, LLC
CELLULOSIC ETHANOL FACILITY
CHIPPEWA COUNTY, MICHIGAN

Drawn:	JWW	2/17/2009
Approved:	LOK	2/17/2009
Scale:	1" = 2,000'	
PROJECT NUMBER	13375-001-0100	
FIGURE NUMBER	2	

Department of Energy
Golden Field Office
1617 Cole Boulevard
Golden, Colorado 80401-3393

July 22, 2010

Garland T. McGeshick, Chairman
Sokaogon Chippewa Community
Mole Lake Band of Lake Superior Indians
3051 Sand Lake Road
Crandon, WI 54520-8815

Dear Mr. McGeshick,

The U. S. Department of Energy is proposing to provide Federal funding to Mascoma Corporation for the final design, construction, and operation of a cellulose-to-ethanol biorefinery near the City of Kinross, Michigan in Chippewa County. Frontier Renewable Resources, LLC, a joint venture between Mascoma Corporation and J.M. Longyear, LLC, would develop and operate the proposed facility. The proposed facility is intended to further the government's goal of rendering cellulosic ethanol cost-competitive with corn ethanol by 2012.

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and Repatriation Act of 1990. If you have any such information, require additional information, or have any questions or comments about that project, please contact me at the following address:

Ms. Kristin Kerwin
U.S. Department of Energy
1617 Cole Boulevard
Golden, Colorado
Email: kristin.kerwin@go.doe.gov
Phone: 303-275-4968

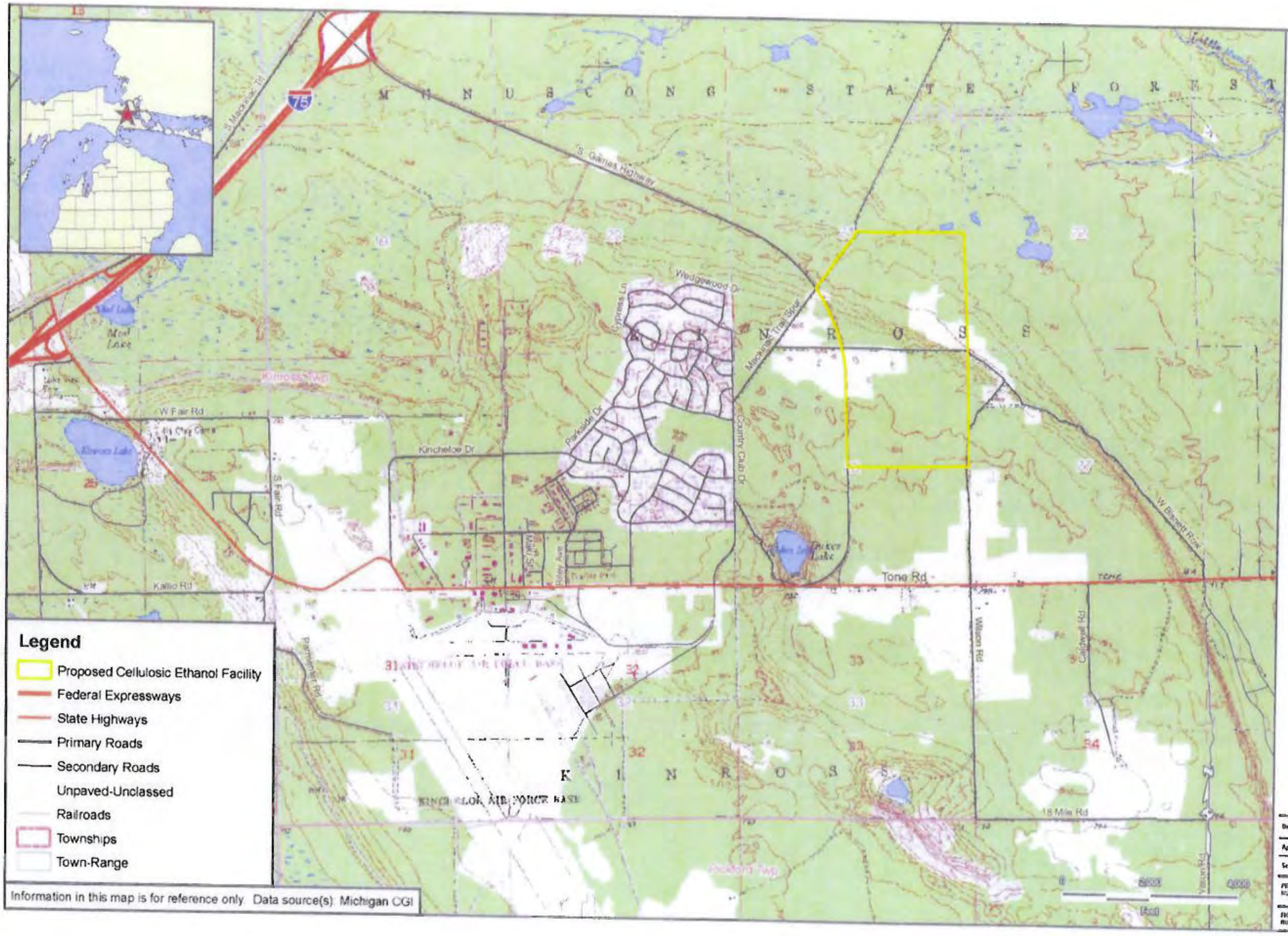
Please provide your comments within 30-days of receipt of this letter. Thank you in advance for your consideration.

Sincerely,

Kristin Kerwin

Kristin Kerwin
NEPA Compliance Officer

Attachments
Figure 1. Site Location Map
Figure 2. Site Location Map with a 2005 Aerial Photo.



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CELLULOSIC ETHANOL FACILITY
CHIPPEWA COUNTY, MICHIGAN

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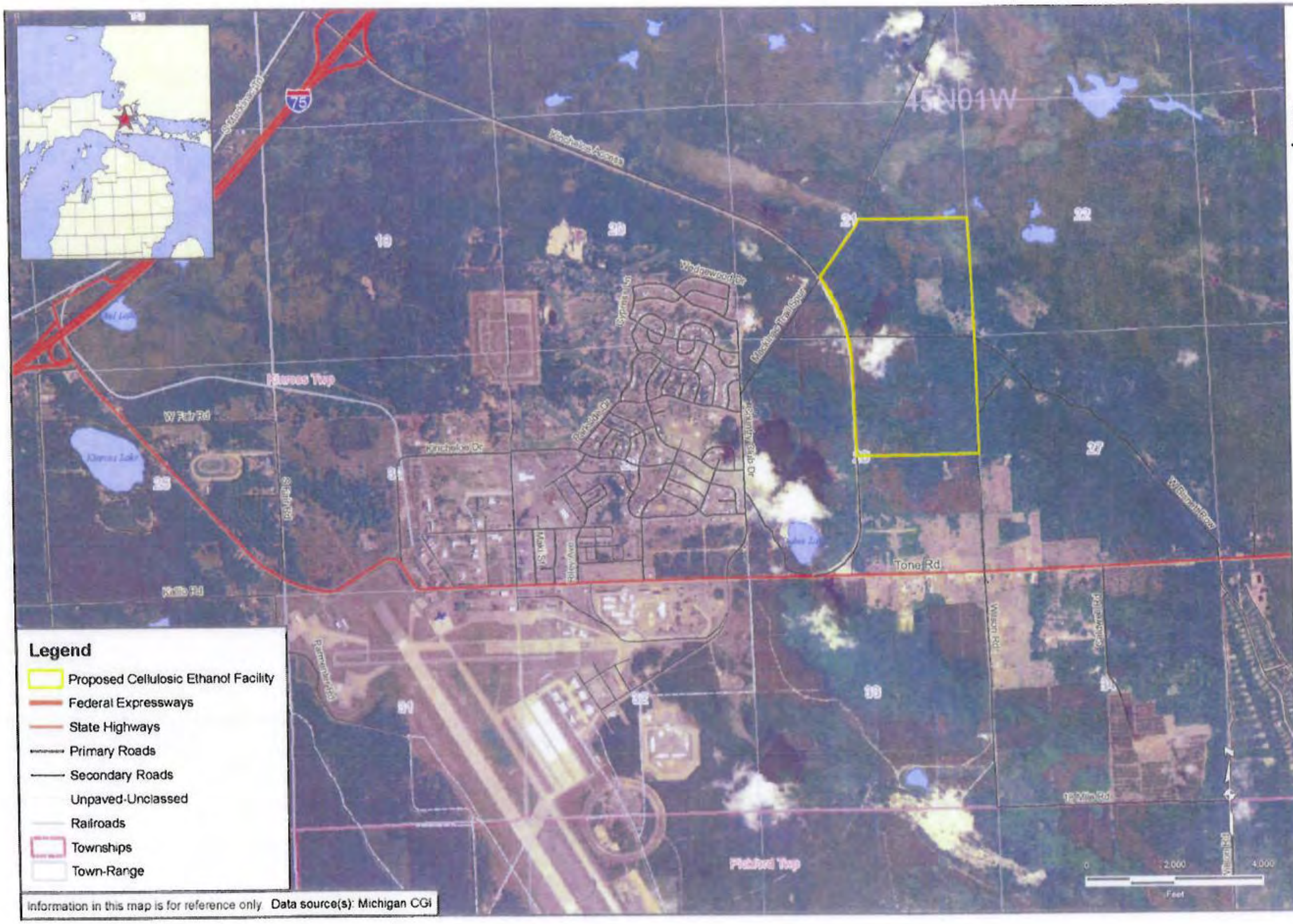

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CHIPPEWA COUNTY, MICHIGAN

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PROJECT NUMBER	13375-001-0100	
FIGURE NUMBER	2	

Department of Energy
Golden Field Office
1617 Cole Boulevard
Golden, Colorado 80401-3393

July 22, 2010

Mr. Homer Mandoka, Chairman
Nottawaseppi Huron Band of the Potawatomi
2221 1-1/2 Mile Road
Fulton, MI 49052-9602

Dear Mr. Mandoka,

The U. S. Department of Energy is proposing to provide Federal funding to Mascoma Corporation for the final design, construction, and operation of a cellulose-to-ethanol biorefinery near the City of Kinross, Michigan in Chippewa County. Frontier Renewable Resources, LLC, a joint venture between Mascoma Corporation and J.M. Longyear, LLC, would develop and operate the proposed facility. The proposed facility is intended to further the government's goal of rendering cellulosic ethanol cost-competitive with corn ethanol by 2012.

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Ms. Kristin Kerwin
U.S. Department of Energy
1617 Cole Boulevard
Golden, Colorado
Email: kristin.kerwin@go.doe.gov
Phone: 303-275-4968

Please provide your comments within 30-days of receipt of this letter. Thank you in advance for your consideration.

Sincerely,

Kristin Ker

Kristin Kerwin
NEPA Compliance Officer

Attachments
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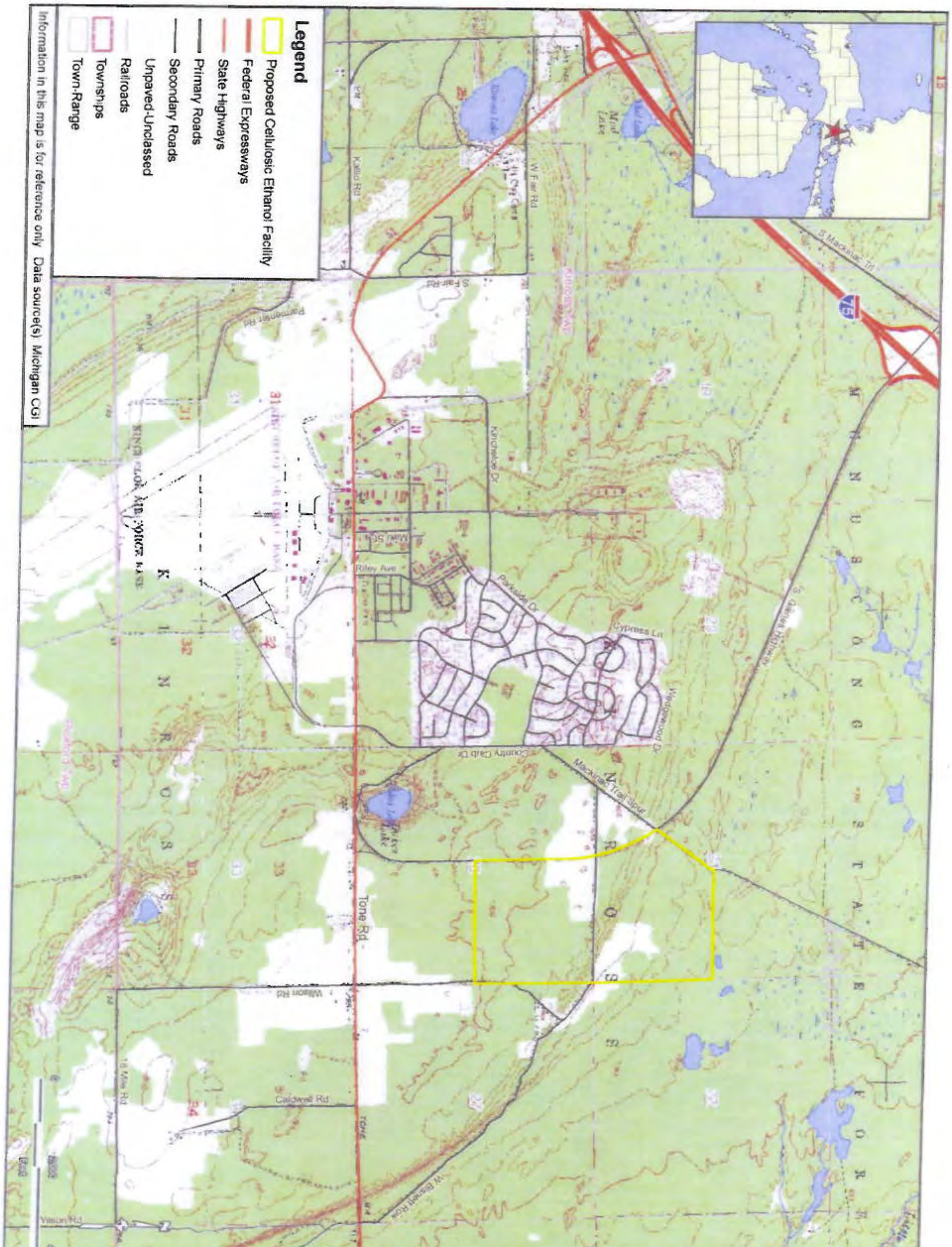
CC: Mr. John Rodwan
Environmental Director
Nottawaseppi Huron Band of the Potawatomi
2221 1-1/2 Mile Road
Fulton, MI 49052-9602



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FRONTIER RENEWABLE RESOURCES, LLC
CELLULOSIC ETHANOL FACILITY
CHIPPEWA COUNTY, MICHIGAN

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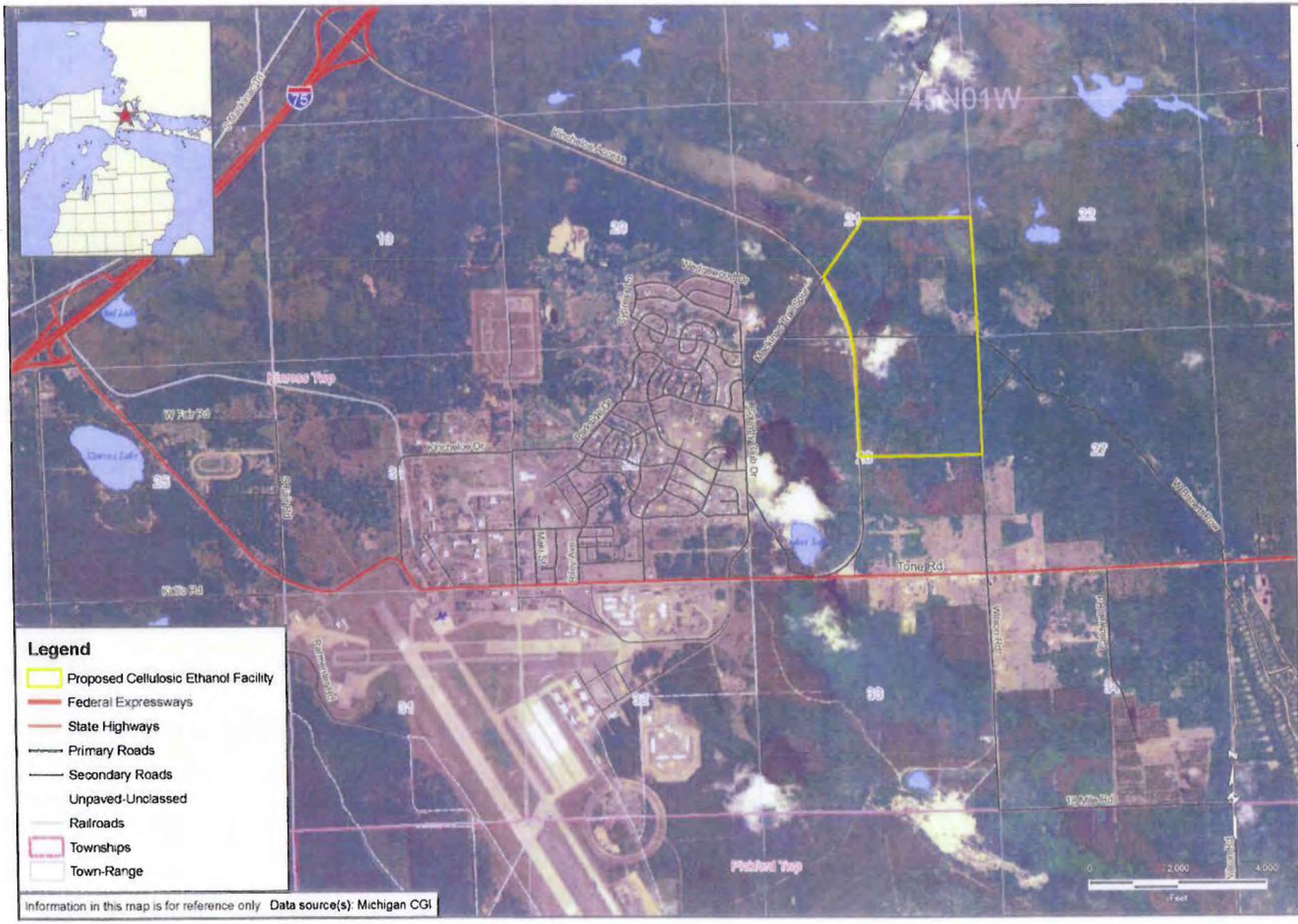

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CELLULOSIC ETHANOL FACILITY
CHIPPEWA COUNTY, MICHIGAN

Drawn:	JWW	2/17/2009
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PROJECT NUMBER	13375-001-0100	
FIGURE NUMBER	2	

Department of Energy
Golden Field Office
1617 Cole Boulevard
Golden, Colorado 80401-3393

July 22, 2010

Mr. James Williams, Jr., Chairman
Lac Vieux Desert Band of Lake Superior Chippewa Indians
P.O. Box 249
Watersmeet, MI 49969-0249

Dear Mr. Williams,

The U. S. Department of Energy is proposing to provide Federal funding to Mascoma Corporation for the final design, construction, and operation of a cellulose-to-ethanol biorefinery near the City of Kinross, Michigan in Chippewa County. Frontier Renewable Resources, LLC, a joint venture between Mascoma Corporation and J.M. Longyear, LLC, would develop and operate the proposed facility. The proposed facility is intended to further the government's goal of rendering cellulosic ethanol cost-competitive with corn ethanol by 2012.

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Ms. Kristin Kerwin
U.S. Department of Energy
1617 Cole Boulevard
Golden, Colorado
Email: kristin.kerwin@go.doe.gov
Phone: 303-275-4968

Please provide your comments within 30-days of receipt of this letter. Thank you in advance for your consideration.

Sincerely,

Kristin Ker

Kristin Kerwin
NEPA Compliance Officer

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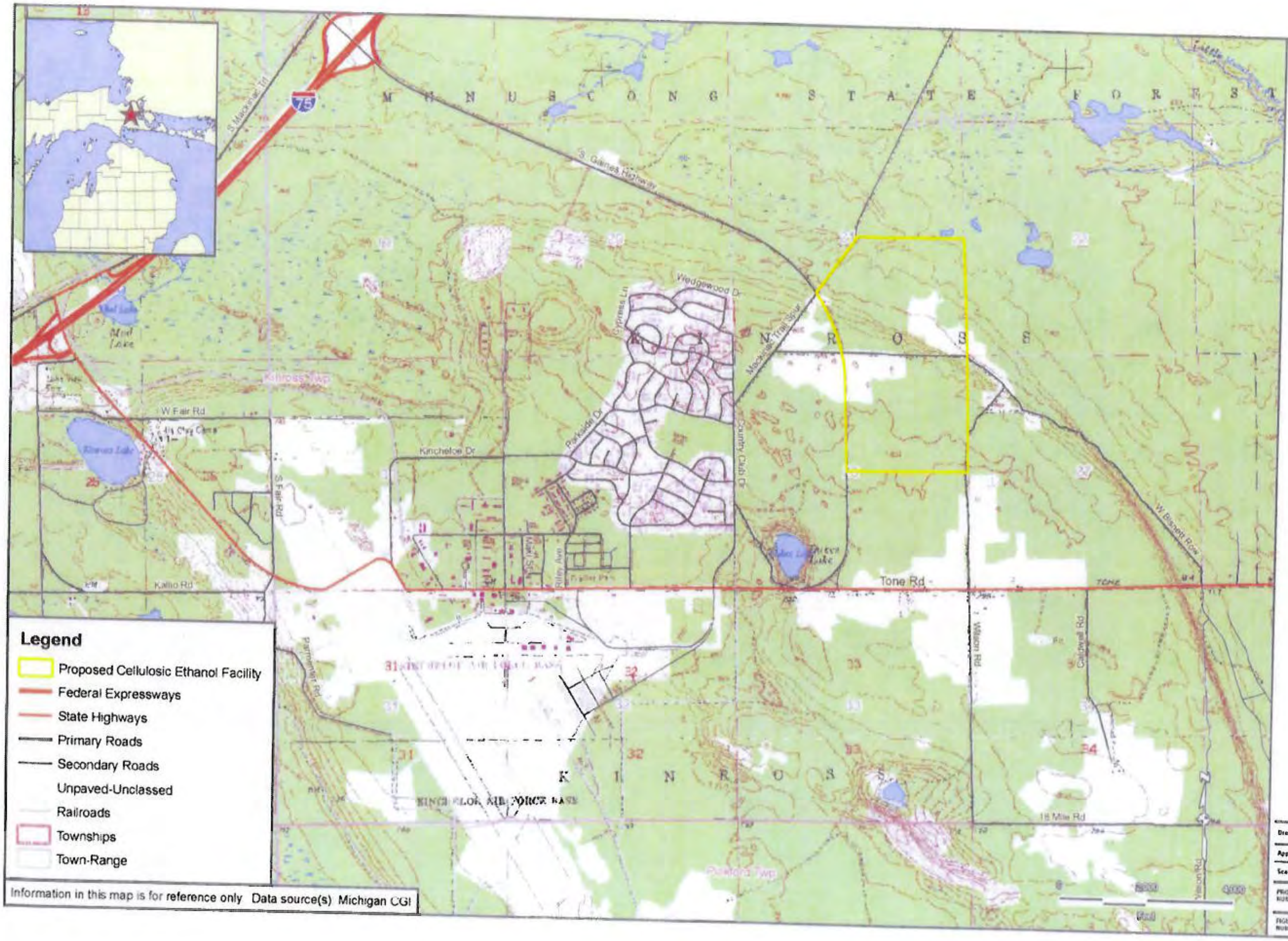
CC: Ms. Giiwe Martin
Tribal Historic Preservation Officer
Lac Vieux Desert Band of Lake Superior Chippewa Indians
P.O. Box 249
Watersmeet, MI 49969-0249



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FRONTIER RENEWABLE RESOURCES, LLC
CELLULOSIC ETHANOL FACILITY
CHIPPEWA COUNTY, MICHIGAN

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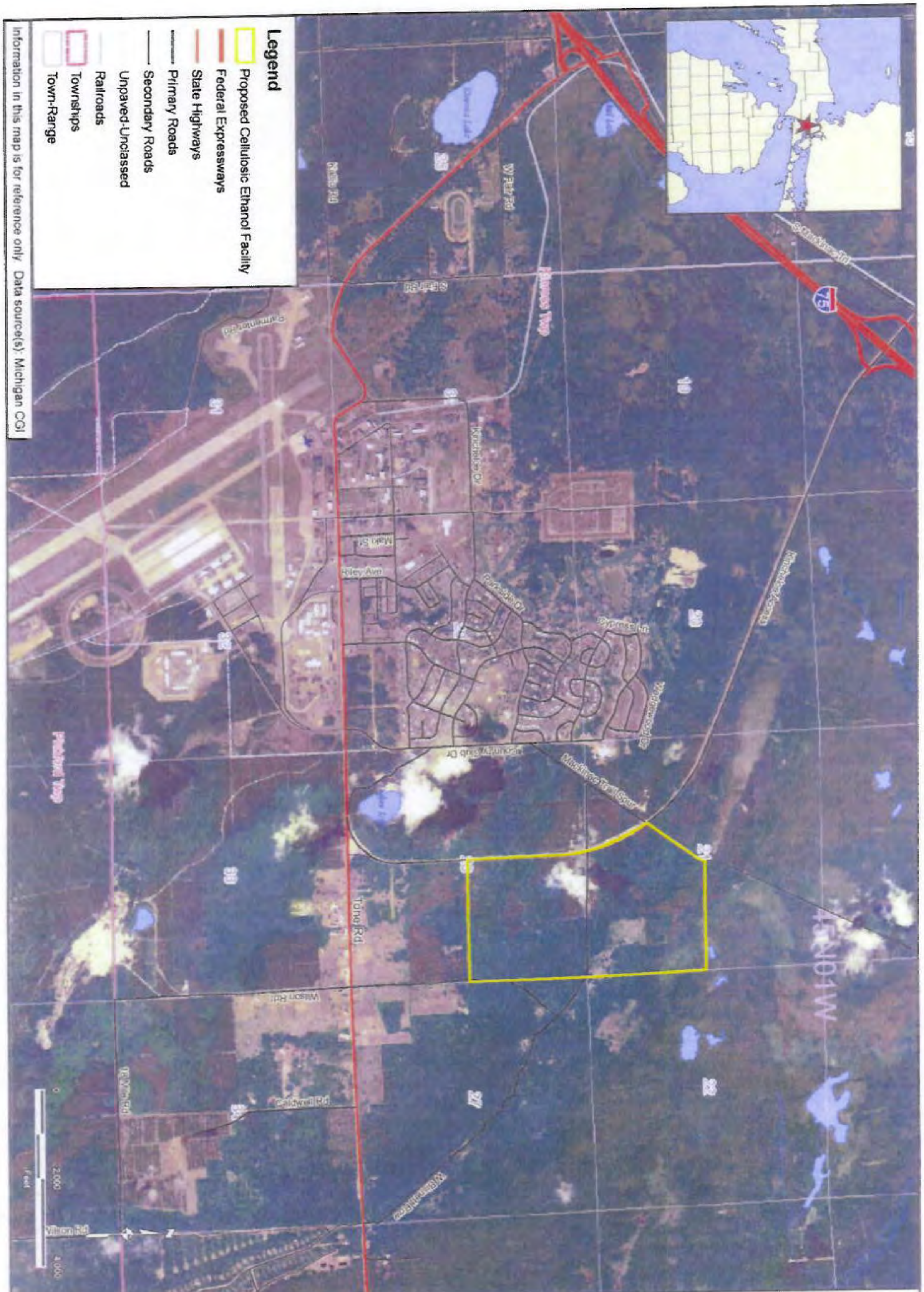

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CELLULOSIC ETHANOL FACILITY
CHIPPEWA COUNTY, MICHIGAN

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FIGURE NUMBER	2	

Department of Energy

Golden Field Office
1617 Cole Boulevard
Golden, Colorado 80401-3393

July 22, 2010

Mr. Jeffrey D. Parker, President
Bay Mills Indian Community
12140 W. Lakeshore Drive
Brimley, MI 49715-9319

Dear Mr. Parker,

The U. S. Department of Energy is proposing to provide Federal funding to Mascoma Corporation for the final design, construction, and operation of a cellulose-to-ethanol biorefinery near the City of Kinross, Michigan in Chippewa County. Frontier Renewable Resources, LLC, a joint venture between Mascoma Corporation and J.M. Longyear, LLC, would develop and operate the proposed facility. The proposed facility is intended to further the government's goal of rendering cellulosic ethanol cost-competitive with corn ethanol by 2012.

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U.S. Department of Energy
1617 Cole Boulevard
Golden, Colorado
Email: kristin.kerwin@go.doe.gov
Phone: 303-275-4968

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Kristin Kerwin

Kristin Kerwin
NEPA Compliance Officer

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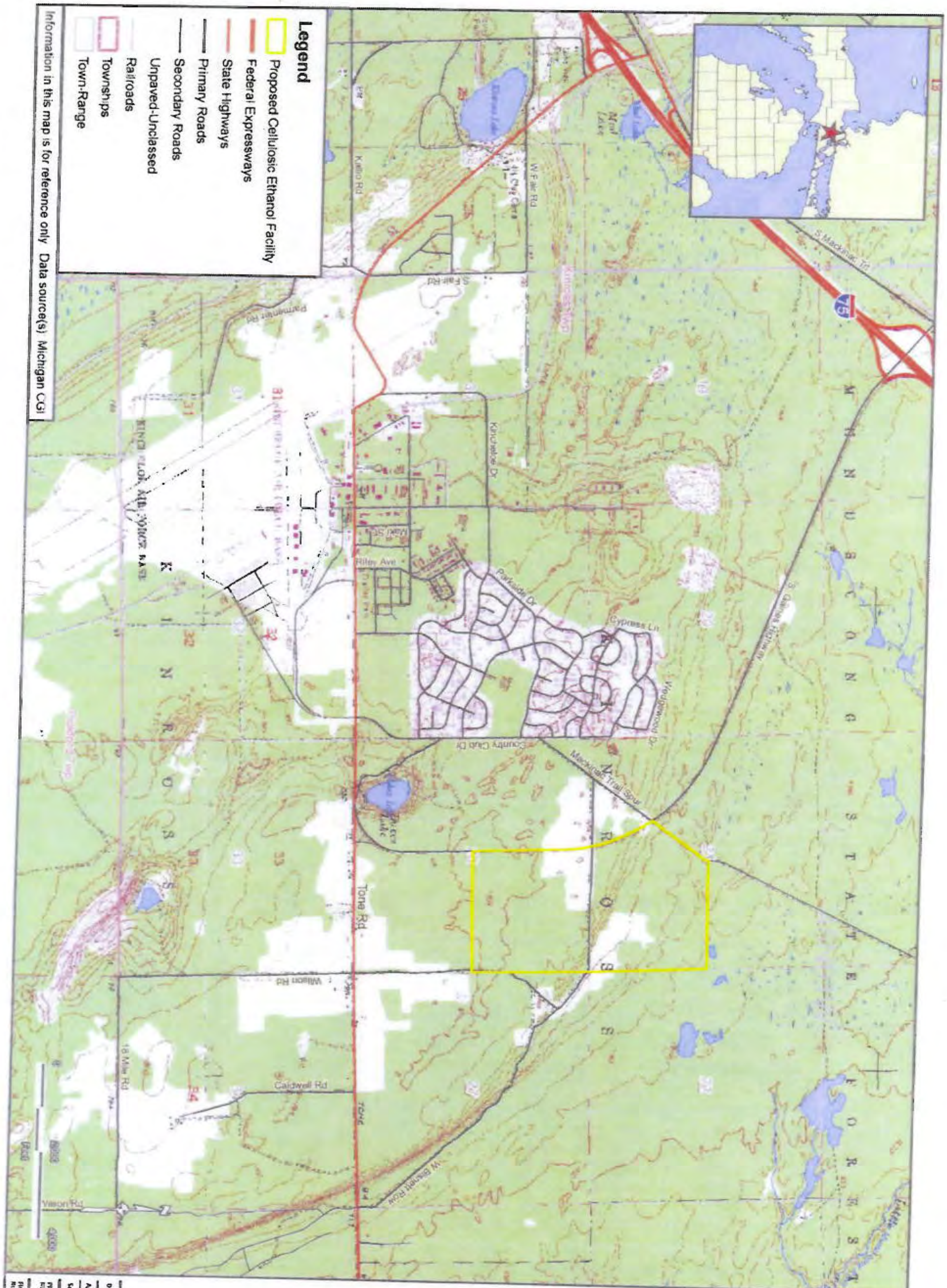
CC: Wanda Perron
Tribal Historic Preservation Officer
Bay Mills Indian Community
12140 W. Lakeshore Drive
Brimley, MI 49715-9319



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CHIPPEWA COUNTY, MICHIGAN

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Drawn: JWW 2/17/2009
Approved: LDK 2/17/2009
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Project Number: 13375-001-0100
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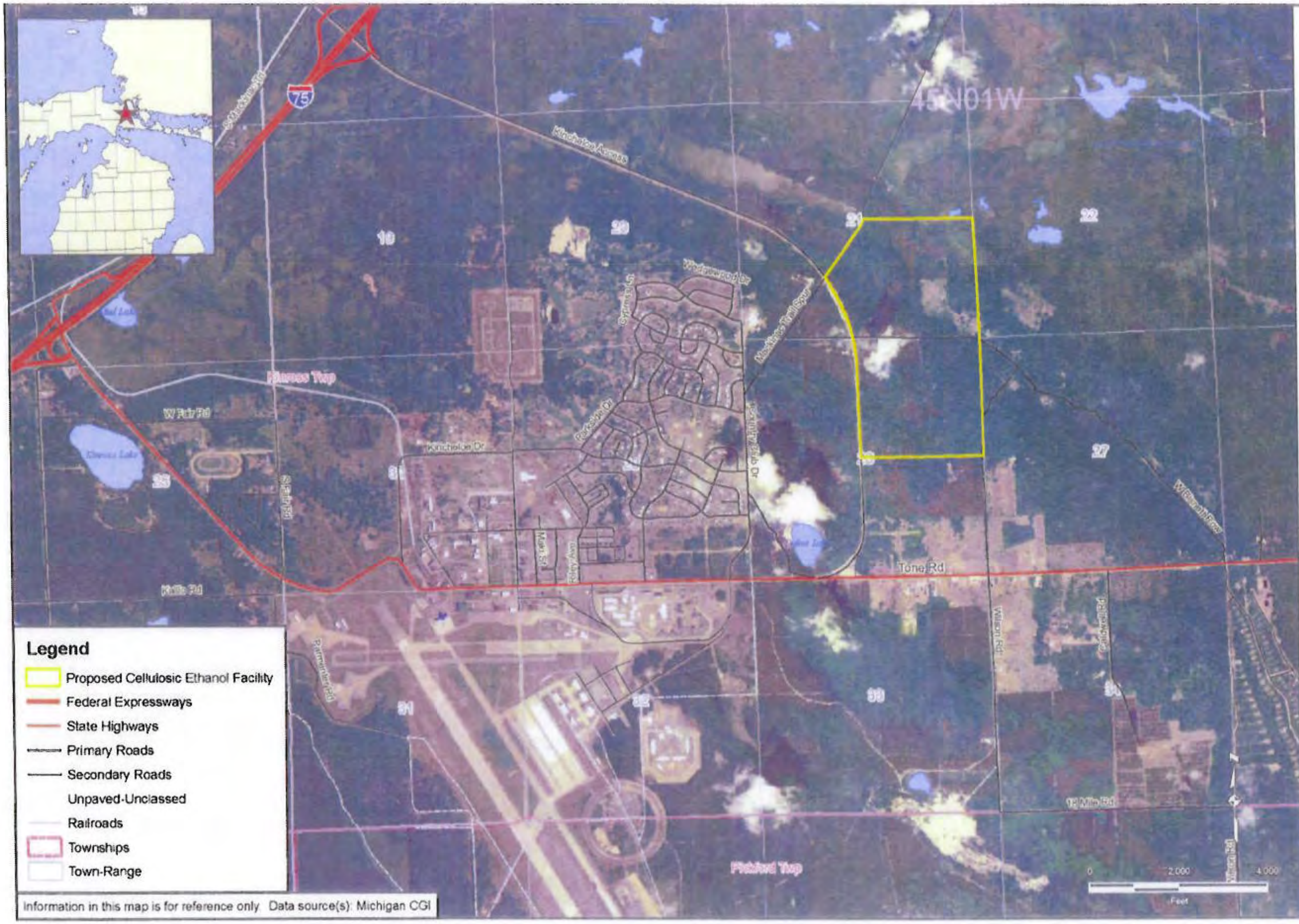

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CELLULOSIC ETHANOL FACILITY
CHIPPEWA COUNTY, MICHIGAN

Drawn:	JWW	2/17/2009
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PROJECT NUMBER	13375-001-0100	
FIGURE NUMBER	2	

Department of Energy

Golden Field Office
1617 Cole Boulevard
Golden, Colorado 80401-3393

July 22, 2010

Karen Diver, Chairwoman
Fond du Lac Tribal Council
1720 Big Lake Road
Cloquet, MN 55720-9702

Dear Ms. Diver,

The U. S. Department of Energy is proposing to provide Federal funding to Mascoma Corporation for the final design, construction, and operation of a cellulose-to-ethanol biorefinery near the City of Kinross, Michigan in Chippewa County. Frontier Renewable Resources, LLC, a joint venture between Mascoma Corporation and J.M. Longyear, LLC, would develop and operate the proposed facility. The proposed facility is intended to further the government's goal of rendering cellulosic ethanol cost-competitive with corn ethanol by 2012.

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Kristin Ker

Kristin Kerwin
NEPA Compliance Officer

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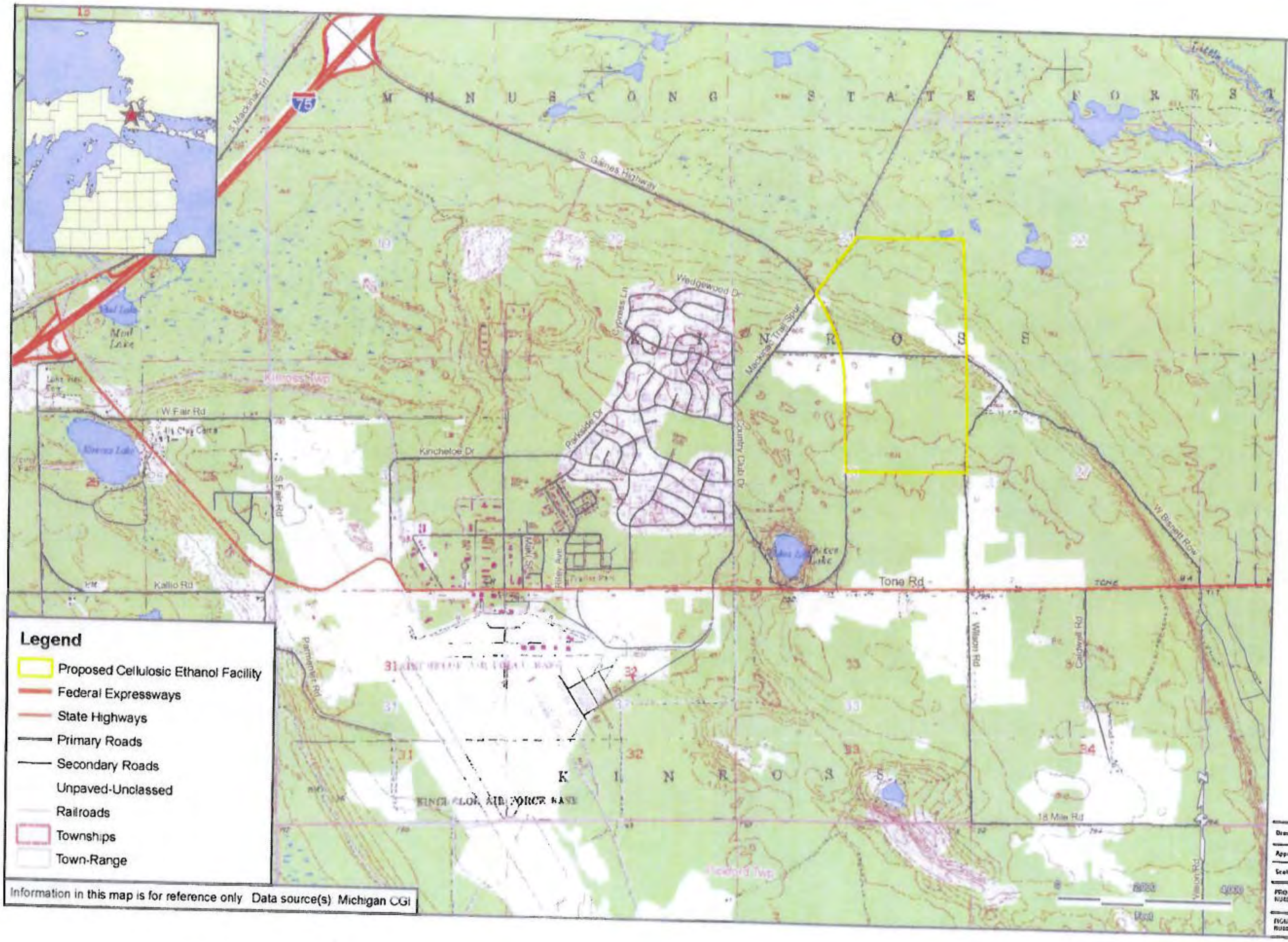
CC: Jeff Savage
Tribal Historic Preservation Officer
Fond du Lac Band of the Minnesota Chippewa Tribe
1720 Big Lake Road
Cloquet, MN 55720-9702



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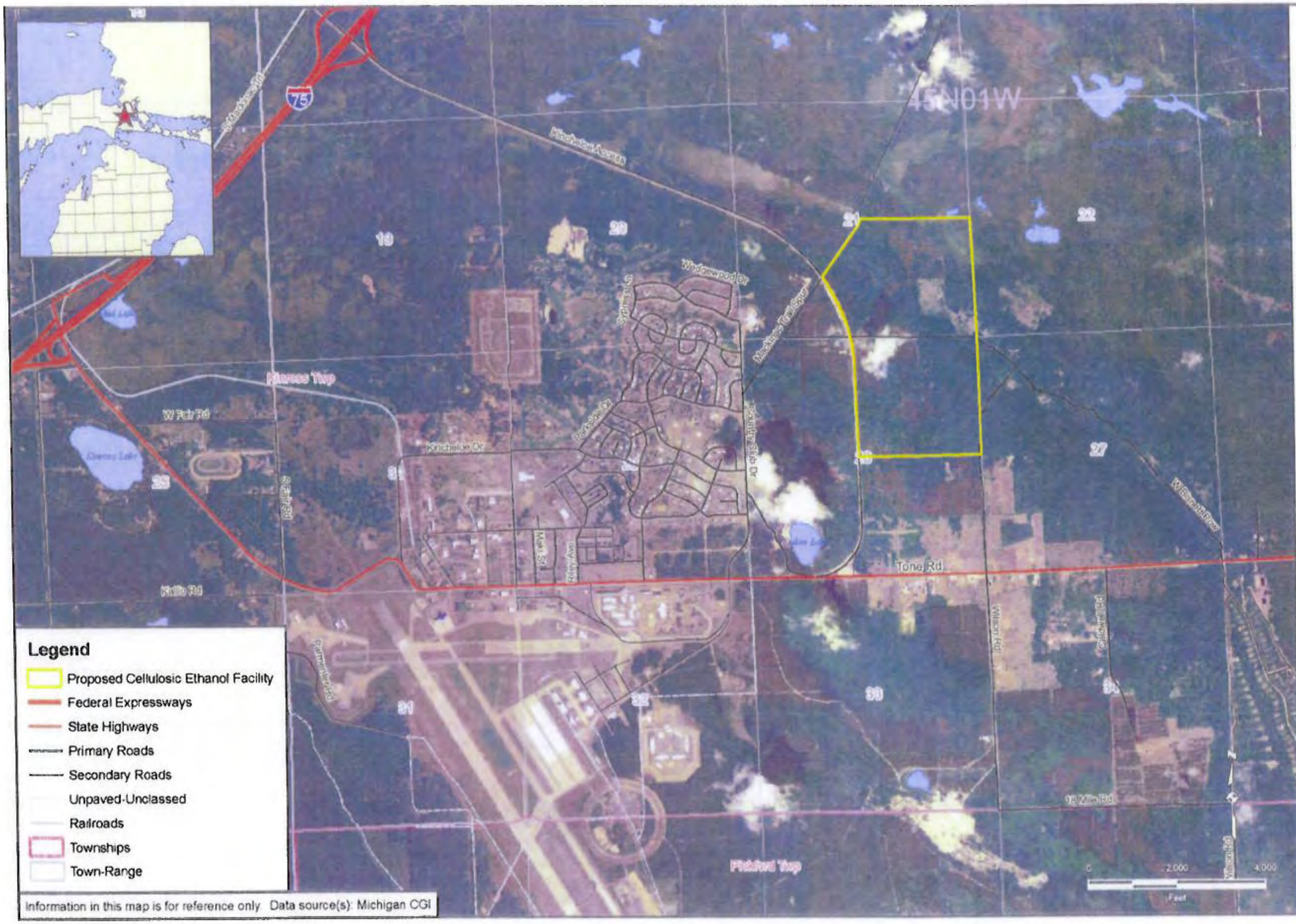

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CELLULOSIC ETHANOL FACILITY
CHIPPEWA COUNTY, MICHIGAN

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Department of Energy
Golden Field Office
1617 Cole Boulevard
Golden, Colorado 80401-3393

July 22, 2010

Mr. Ken Harrington, Chairman
Little Traverse Bay Band of Odawa Indians
7500 Odawa Circle
Harbor Springs, MI 49740-9692

Dear Mr. Harrington,

The U. S. Department of Energy is proposing to provide Federal funding to Mascoma Corporation for the final design, construction, and operation of a cellulose-to-ethanol biorefinery near the City of Kinross, Michigan in Chippewa County. Frontier Renewable Resources, LLC, a joint venture between Mascoma Corporation and J.M. Longyear, LLC, would develop and operate the proposed facility. The proposed facility is intended to further the government's goal of rendering cellulosic ethanol cost-competitive with corn ethanol by 2012.

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NEPA Compliance Officer

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CC: Ms. Winnay Wemigwase, Director
Cultural Preservation and Archives
Little Traverse Bay Band of Odawa Indians
7500 Odawa Circle
Harbor Springs, MI 49740-9692

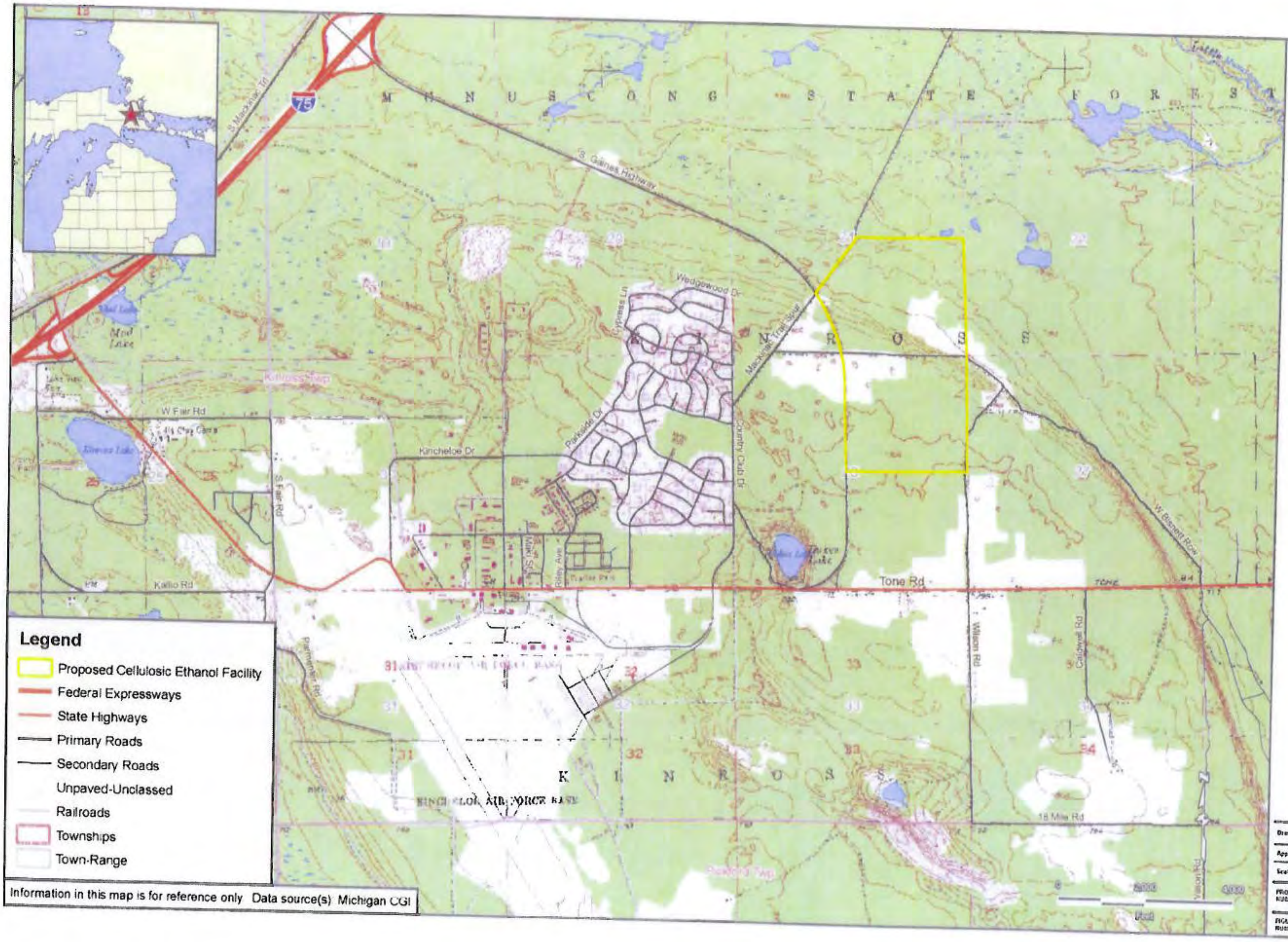

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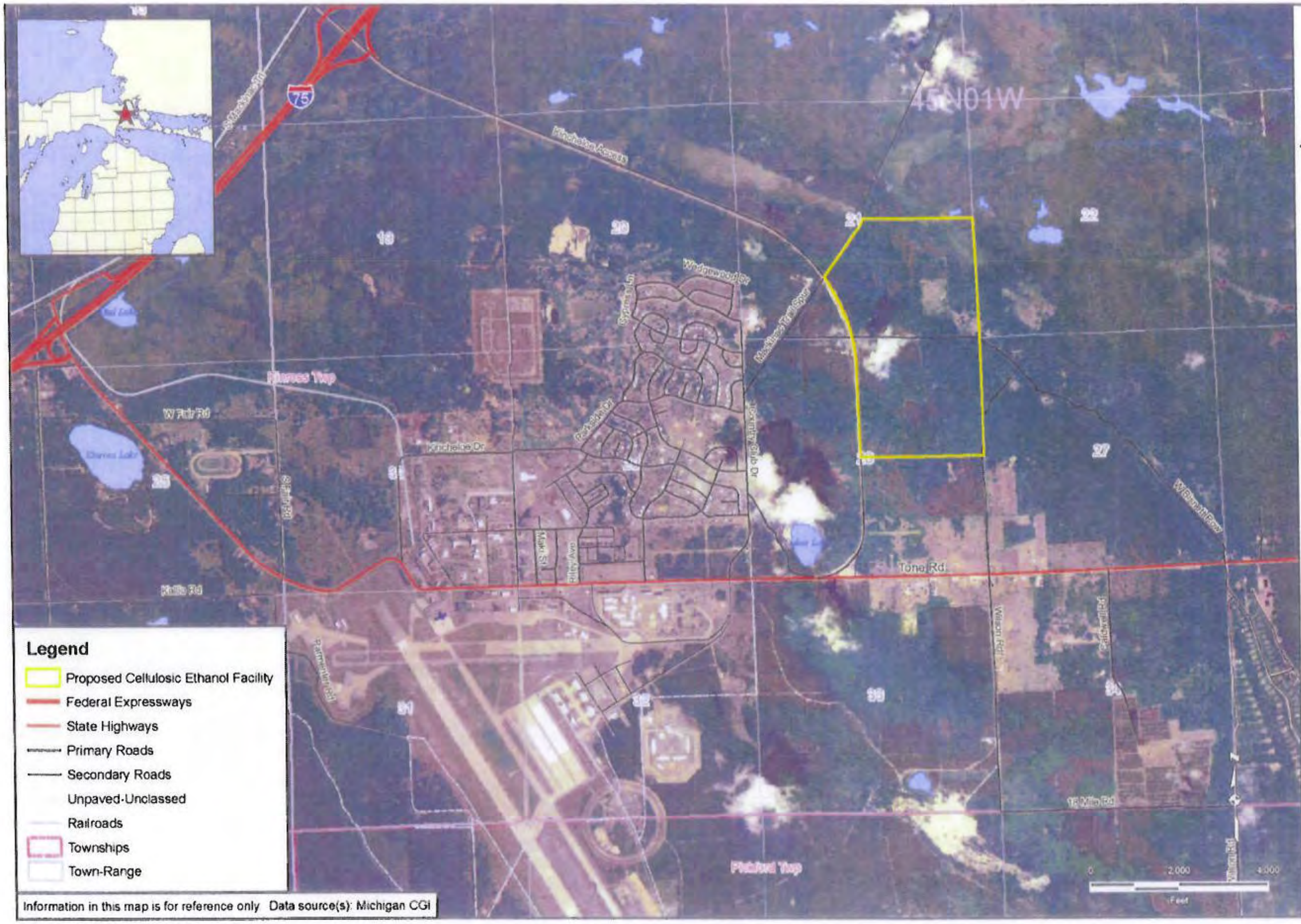
FIGURE 1
SITE LOCATION MAP
FRONTIER RENEWABLE RESOURCES, LLC
CELLULOSIC ETHANOL FACILITY
CHIPPEWA COUNTY, MICHIGAN

Drawn:	JWW	2/17/2009
Approved:	LDK	2/17/2009
Scale:	1" = 2,000'	
PROJECT NUMBER	13375-001-0100	
FIGURE NUMBER	1	



Information in this map is for reference only Data source(s): Michigan CGI

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FIGURE 2
SITE LOCATION MAP WITH 2005 AERIAL PHOTO
FRONTIER RENEWABLE RESOURCES, LLC
CELLULOSIC ETHANOL FACILITY
CHIPPEWA COUNTY, MICHIGAN

Drawn: JWW 2/17/2009
Approved: LDK 2/17/2009
Scale: 1" = 2,000'
PROJECT NUMBER 13375-001-0100
FIGURE NUMBER 2

Department of Energy
Golden Field Office
1617 Cole Boulevard
Golden, Colorado 80401-3393

July 22, 2010

Kenneth Meshigaud, Chairperson
Hannahville Indian Community
N14911 Hannahville B1 Road
Wilson, MI 49896-9728.

Dear Mr. Meshigaud,

The U. S. Department of Energy is proposing to provide Federal funding to Mascoma Corporation for the final design, construction, and operation of a cellulose-to-ethanol biorefinery near the City of Kinross, Michigan in Chippewa County. Frontier Renewable Resources, LLC, a joint venture between Mascoma Corporation and J.M. Longyear, LLC, would develop and operate the proposed facility. The proposed facility is intended to further the government's goal of rendering cellulosic ethanol cost-competitive with corn ethanol by 2012.

The proposed biorefinery would utilize approximately 1,440 bone dry tons per day of hardwood pulpwood to eventually produce up to 40 million gallons per year of anhyrdrous ethanol. Co-products, such as the lignin and spent cullose from the process, would either be sold or used to produce steam and electricity in a biomass boiler. Feedstock would consist of hardwood pulpwood within the Michigan counties with a 150-mile radius of the site.

The proposed project site comprises a 355 acre plot of land in Kinross Township of Chippewa County, Michigan, Township 45 North, Range 01 West, Sections 21 and 28. It lies approximately one-half mile northeast of Kinross. The attached Site Location Map (Figure 1) provides an overview of the general property and access to area roads. Frontier plans to construct the plant on approximately 50 acres located within the southern 160 acres.

The proposed site is adjacent to the former Kincheloe U.S. Air Force base in Kinross. The site is predominantly wooded with no existing structures and limited unpaved trails. A snowmobile trail runs along the west boundary of the property and cross a small portion of the northwest corner. Figure 2 presents the Site Location Map with a 2005 Aerial Photo.

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and Repatriation Act of 1990. If you have any such information, require additional information, or have any questions or comments about that project, please contact me at the following address:

Ms. Kristin Kerwin
U.S. Department of Energy
1617 Cole Boulevard
Golden, Colorado
Email: kristin.kerwin@go.doe.gov
Phone: 303-275-4968

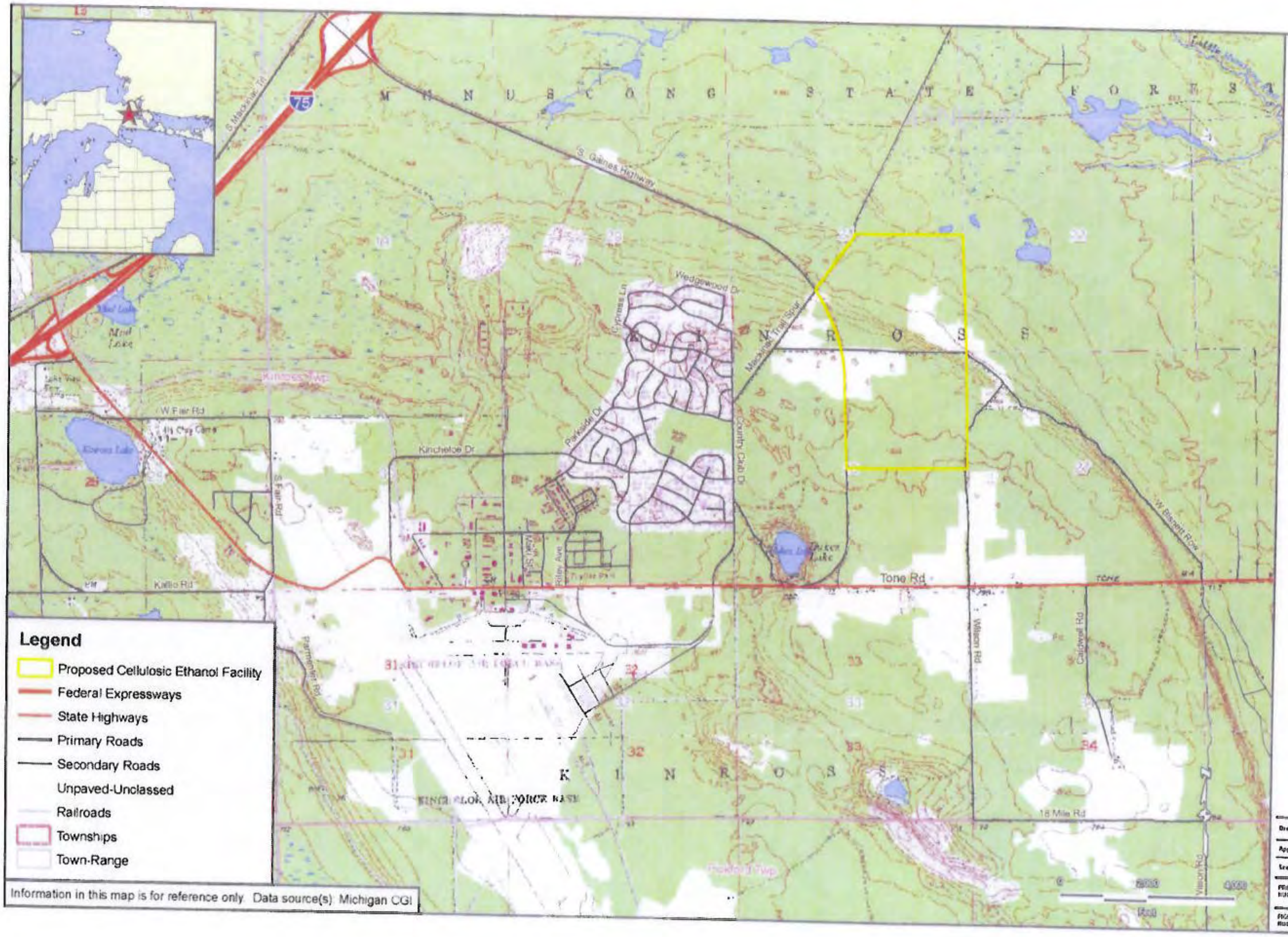
Please provide your comments within 30-days of receipt of this letter. Thank you in advance for your consideration.

Sincerely,

Kristin Kerwin

Kristin Kerwin
NEPA Compliance Officer

Attachments
Figure 1. Site Location Map
Figure 2. Site Location Map with a 2005 Aerial Photo.



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SITE LOCATION MAP
FRONTIER RENEWABLE RESOURCES, LLC
CELLULOSIC ETHANOL FACILITY
CHIPPEWA COUNTY, MICHIGAN

Drawn:	JWW	2/17/2009
Approved:	LDK	2/17/2009
Scale:	1" = 2,000'	
PROJECT NUMBER	13375-001-0100	
FIGURE NUMBER	1	

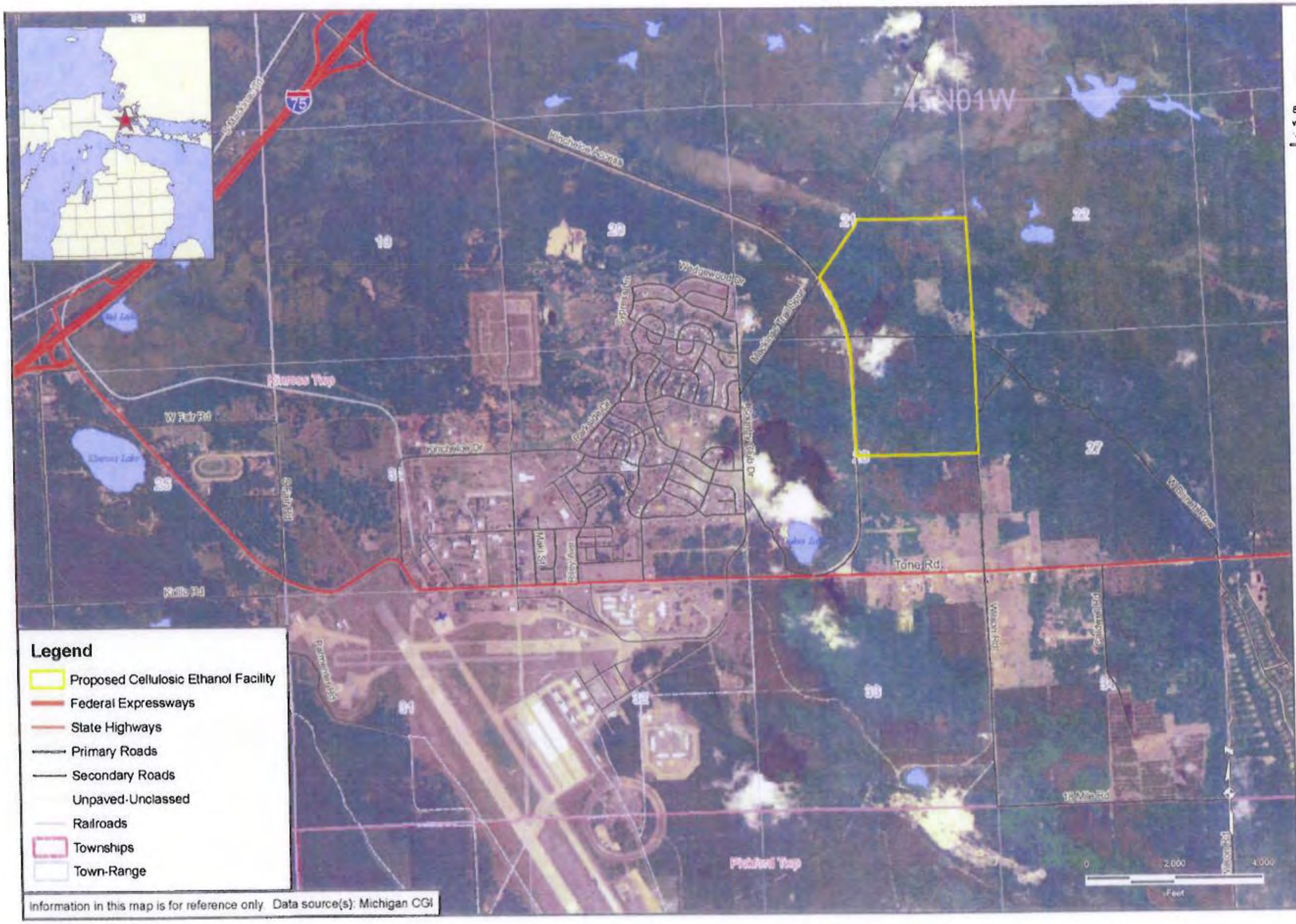

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FIGURE 2
SITE LOCATION MAP WITH 2005 AERIAL PHOTO
FRONTIER RENEWABLE RESOURCES, LLC
CELLULOSIC ETHANOL FACILITY
CHIPPEWA COUNTY, MICHIGAN

Drawn: JWW 2/17/2009
Approved: LDK 2/17/2009
Scale: 1" = 2,000'
PROJECT NUMBER 13375-001-0100
FIGURE NUMBER 2

Department of Energy
Golden Field Office
1617 Cole Boulevard
Golden, Colorado 80401-3393

July 22, 2010

Kevin Leecy, Chairman
Bois Forte Reservation Tribal Council
P.O. Box 16
Nett Lake, MN 55772-0016

Dear Mr. Leecy,

The U. S. Department of Energy is proposing to provide Federal funding to Mascoma Corporation for the final design, construction, and operation of a cellulose-to-ethanol biorefinery near the City of Kinross, Michigan in Chippewa County. Frontier Renewable Resources, LLC, a joint venture between Mascoma Corporation and J.M. Longyear, LLC, would develop and operate the proposed facility. The proposed facility is intended to further the government's goal of rendering cellulosic ethanol cost-competitive with corn ethanol by 2012.

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The proposed project site comprises a 355 acre plot of land in Kinross Township of Chippewa County, Michigan, Township 45 North, Range 01 West, Sections 21 and 28. It lies approximately one-half mile northeast of Kinross. The attached Site Location Map (Figure 1) provides an overview of the general property and access to area roads. Frontier plans to construct the plant on approximately 50 acres located within the southern 160 acres.

The proposed site is adjacent to the former Kincheloe U.S. Air Force base in Kinross. The site is predominantly wooded with no existing structures and limited unpaved trails. A snowmobile trail runs along the west boundary of the property and cross a small portion of the northwest corner. Figure 2 presents the Site Location Map with a 2005 Aerial Photo.

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and Repatriation Act of 1990. If you have any such information, require additional information, or have any questions or comments about that project, please contact me at the following address:

Ms. Kristin Kerwin
U.S. Department of Energy
1617 Cole Boulevard
Golden, Colorado
Email: kristin.kerwin@go.doe.gov
Phone: 303-275-4968

Please provide your comments within 30-days of receipt of this letter. Thank you in advance for your consideration.

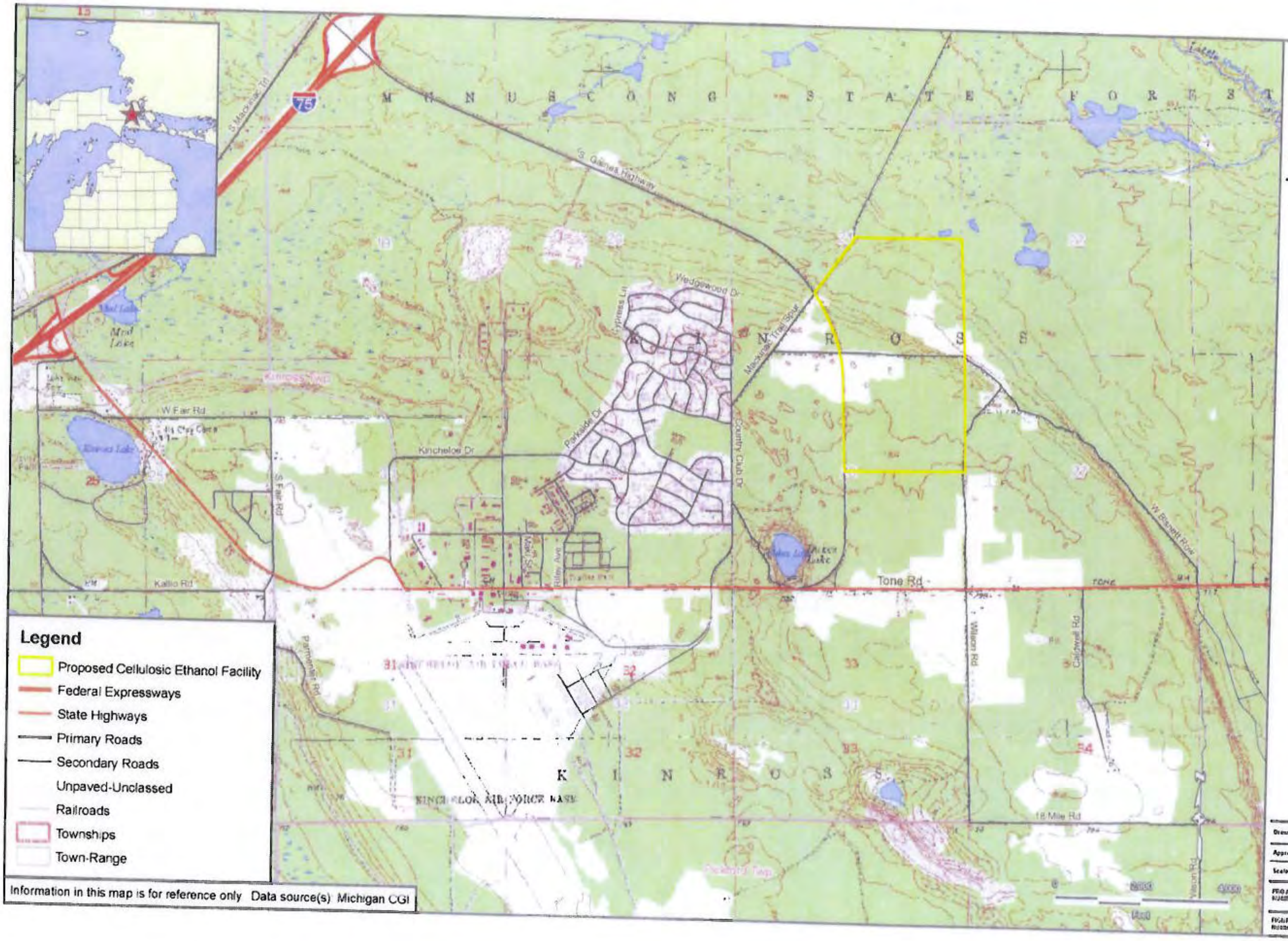
Sincerely,

Kristin Kerw

Kristin Kerwin
NEPA Compliance Officer

Attachments
Figure 1. Site Location Map
Figure 2. Site Location Map with a 2005 Aerial Photo.

CC: Rose Berens
Bois Forte Heritage Center
1500 Bois Forte Road
Tower, MN 55790-7800



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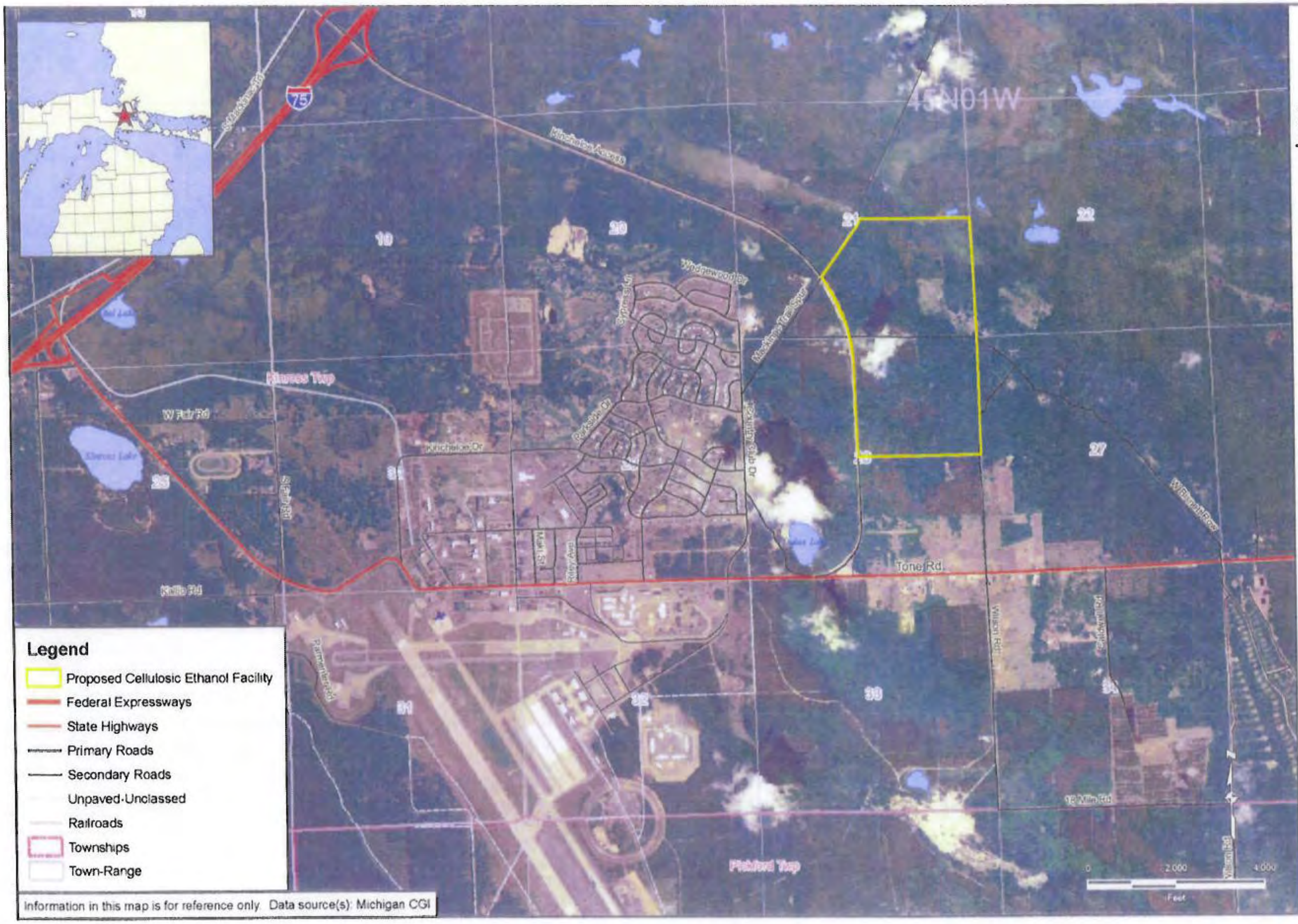
FRONTIER RENEWABLE RESOURCES, LLC
CELLULOSIC ETHANOL FACILITY
CHIPPEWA COUNTY, MICHIGAN

Drawn:	JWW	2/17/2009
Approved:	LDK	2/17/2009
Scale:	1" = 2,000'	
PROJECT NUMBER	13375-001-0100	
FIGURE NUMBER	1	



Information in this map is for reference only. Data source(s): Michigan CGI

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FIGURE 2
SITE LOCATION MAP WITH 2005 AERIAL PHOTO
FRONTIER RENEWABLE RESOURCES, LLC
CELLULOSIC ETHANOL FACILITY
CHIPPEWA COUNTY, MICHIGAN

Drawn:	JWW	2/17/2009
Approved:	LDK	2/17/2009
Scale:	1" = 2,000'	
PROJECT NUMBER	13375-001-0100	
FIGURE NUMBER	2	

Department of Energy
Golden Field Office
1617 Cole Boulevard
Golden, Colorado 80401-3393

July 22, 2010

Mr. Larry Romanelli, Ogema
Little River Band of Ottawa Indians
375 River Street
Manistee, MI 49660

Dear Mr. Romaneli,

The U. S. Department of Energy is proposing to provide Federal funding to Mascoma Corporation for the final design, construction, and operation of a cellulose-to-ethanol biorefinery near the City of Kinross, Michigan in Chippewa County. Frontier Renewable Resources, LLC, a joint venture between Mascoma Corporation and J.M. Longyear, LLC, would develop and operate the proposed facility. The proposed facility is intended to further the government's goal of rendering cellulosic ethanol cost-competitive with corn ethanol by 2012.

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Ms. Kristin Kerwin
U.S. Department of Energy
1617 Cole Boulevard
Golden, Colorado
Email: kristin.kerwin@go.doe.gov
Phone: 303-275-4968

Please provide your comments within 30-days of receipt of this letter. Thank you in advance for your consideration.

Sincerely,

Kristin Kerw

Kristin Kerwin
NEPA Compliance Officer

Attachments
Figure 1. Site Location Map
Figure 2. Site Location Map with a 2005 Aerial Photo.

CC: Mr. Jay Sam
Tribal Historic Preservation Officer
Little River Band of Ottawa Indians
375 River Street
Manistee, MI 49660

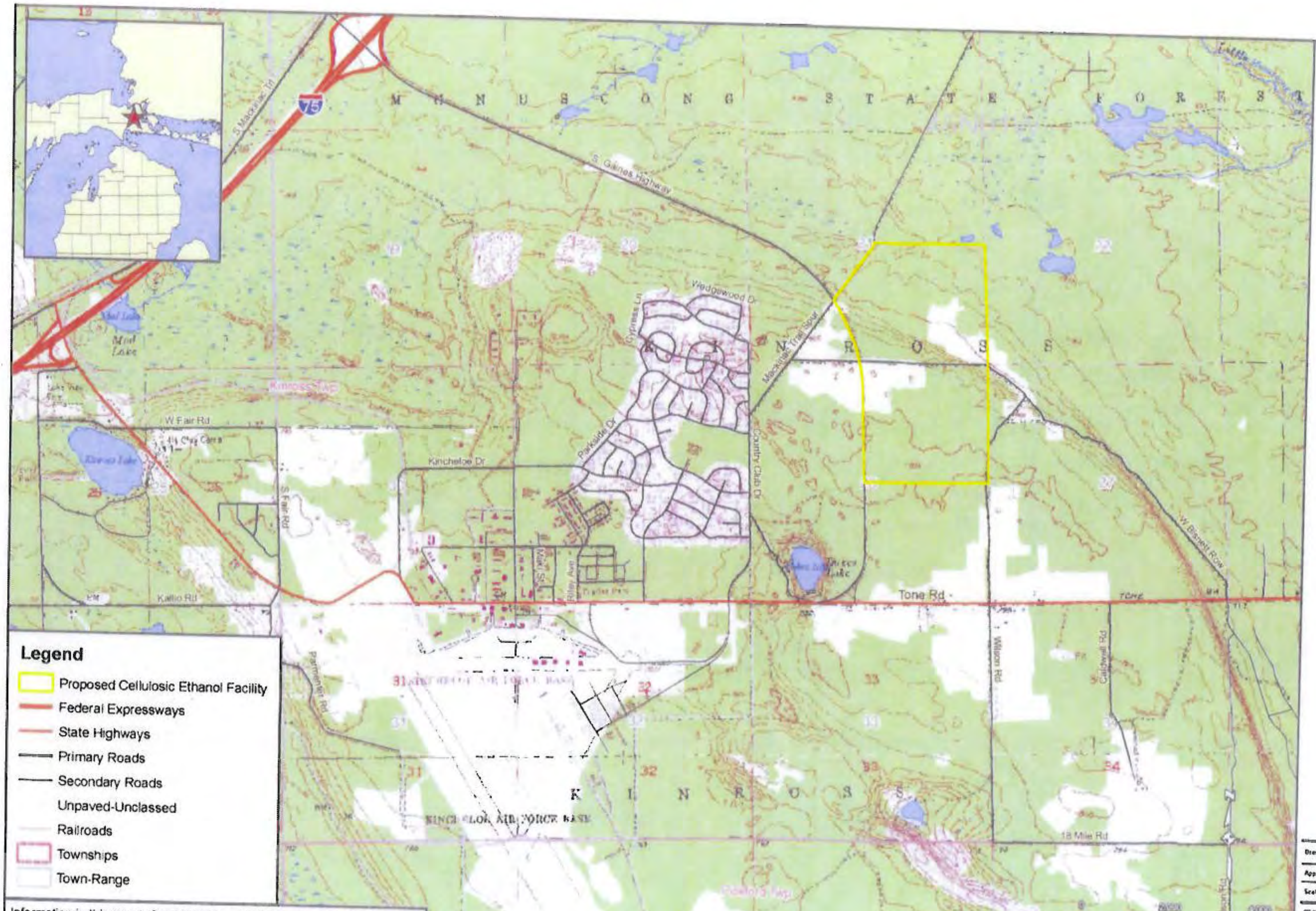

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FIGURE 1
SITE LOCATION MAP
FRONTIER RENEWABLE RESOURCES, LLC
CELLULOSIC ETHANOL FACILITY
CHIPPEWA COUNTY, MICHIGAN

Drawn:	JWW	2/17/2009
Approved:	LDK	2/17/2009
Scale:	1" = 2,000'	
PROJECT NUMBER	13375-001-0100	
FIGURE NUMBER	1	

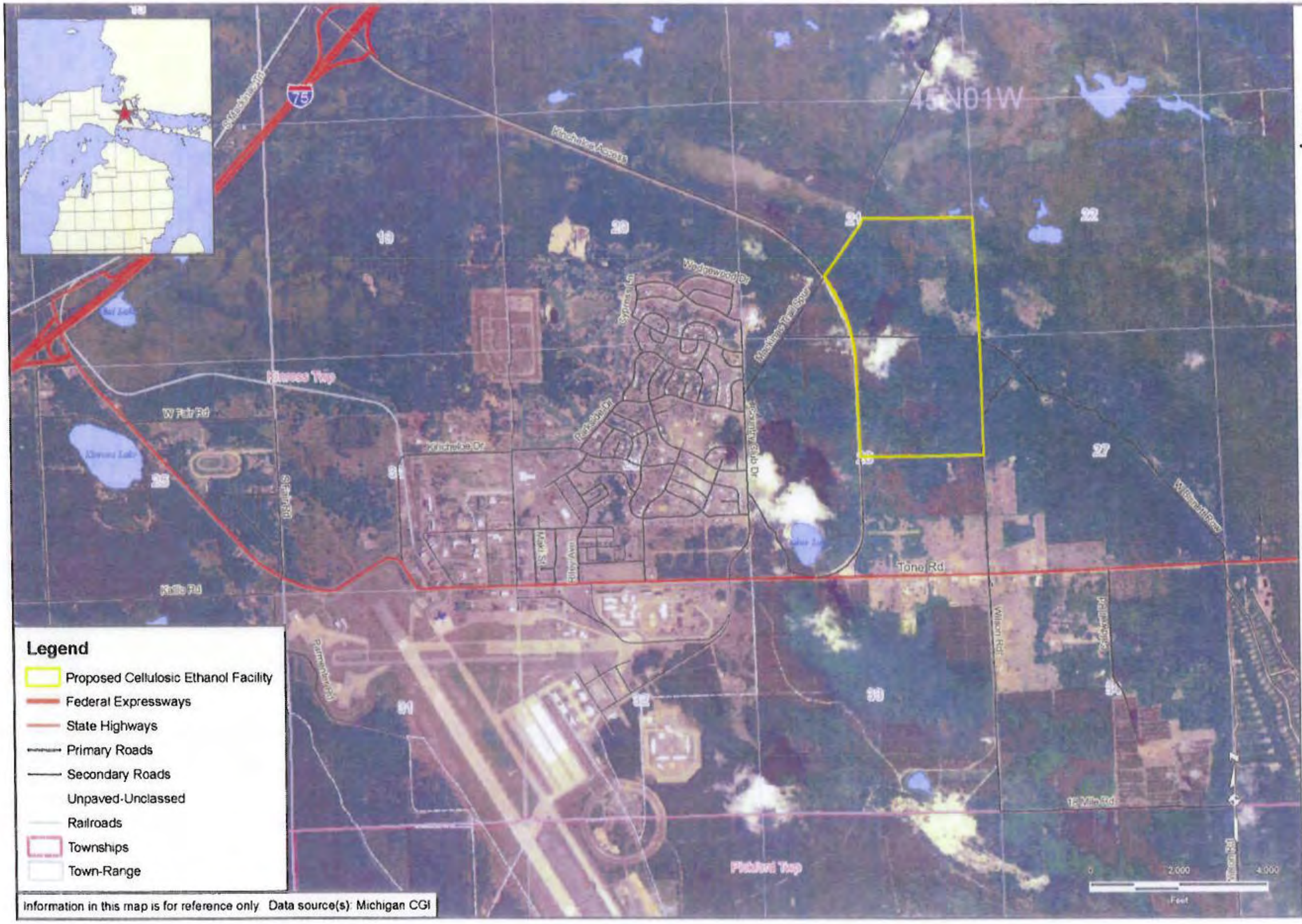

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FIGURE 2
SITE LOCATION MAP WITH 2005 AERIAL PHOTO
FRONTIER RENEWABLE RESOURCES, LLC
CELLULOSIC ETHANOL FACILITY
CHIPPEWA COUNTY, MICHIGAN

Drawn:	JWW	2/17/2009
Approved:	LDK	2/17/2009
Scale:	1" = 2,000'	
PROJECT NUMBER	13375-001-0100	
FIGURE NUMBER	2	

Department of Energy

Golden Field Office
1617 Cole Boulevard
Golden, Colorado 80401-3393

July 22, 2010

Mr. Lewis Taylor, President
St. Croix Chippewa Indians of Wisconsin
P.O. Box 45287
24663 Angeline Avenue
Hertel, WI 54845

Dear Mr. Taylor,

The U. S. Department of Energy is proposing to provide Federal funding to Mascoma Corporation for the final design, construction, and operation of a cellulose-to-ethanol biorefinery near the City of Kinross, Michigan in Chippewa County. Frontier Renewable Resources, LLC, a joint venture between Mascoma Corporation and J.M. Longyear, LLC, would develop and operate the proposed facility. The proposed facility is intended to further the government's goal of rendering cellulosic ethanol cost-competitive with corn ethanol by 2012.

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Ms. Kristin Kerwin
U.S. Department of Energy
1617 Cole Boulevard
Golden, Colorado
Email: kristin.kerwin@go.doe.gov
Phone: 303-275-4968

Please provide your comments within 30-days of receipt of this letter. Thank you in advance for your consideration.

Sincerely,

Kristin Kerwin

Kristin Kerwin
NEPA Compliance Officer

Attachments
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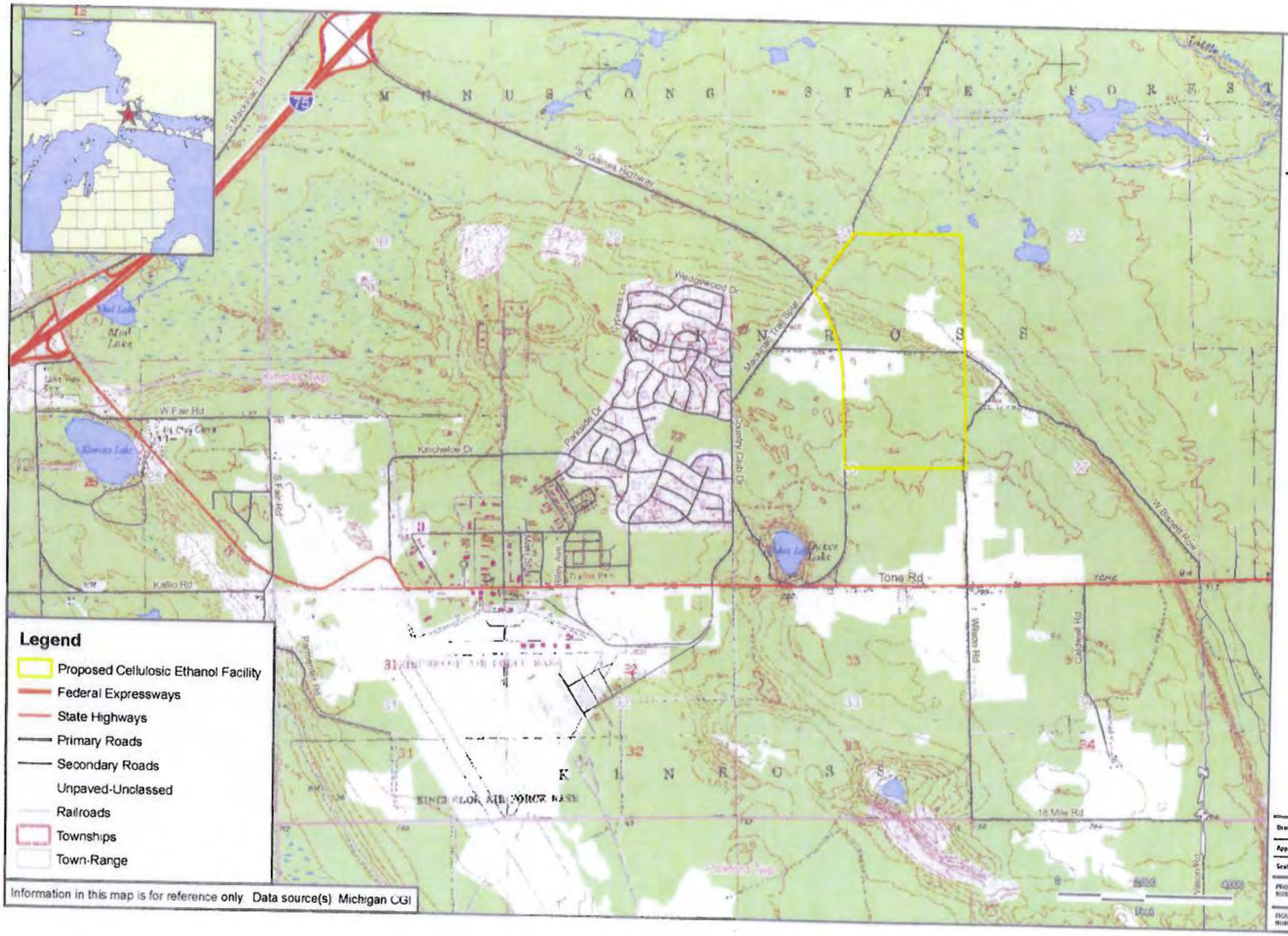
Figure 2. Site Location Map with a 2005 Aerial Photo.

CC: Ms. Wanda McFagen
Tribal Historic Preservation Officer
St. Croix Chippewa Indians of Wisconsin
P.O. Box 45287
24663 Angeline Avenue
Hertel, WI 54845



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CELLULOSIC ETHANOL FACILITY
CHIPPEWA COUNTY, MICHIGAN

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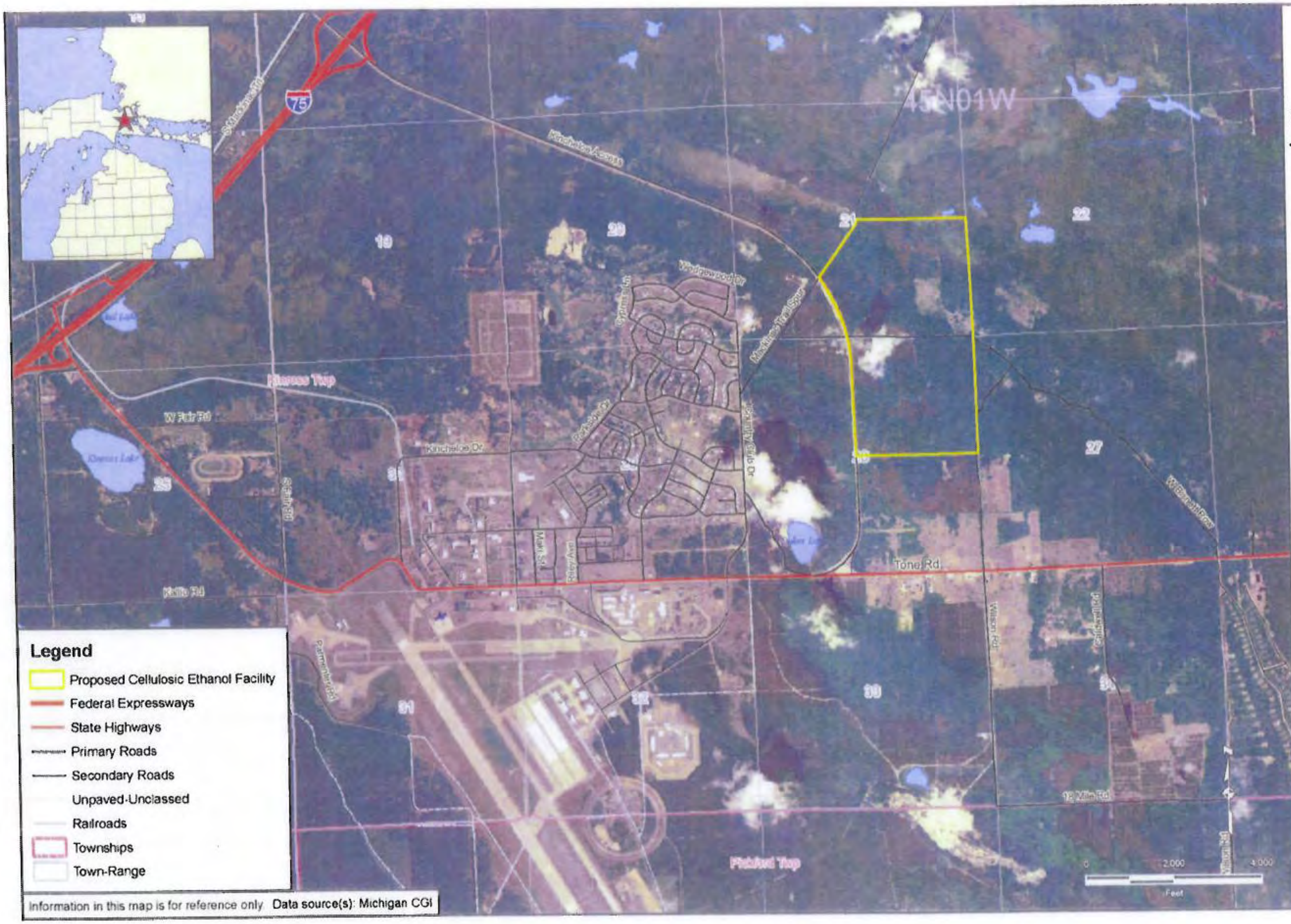

Information in this map is for reference only. Data source(s): Michigan CGI

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FIGURE 2
SITE LOCATION MAP WITH 2005 AERIAL PHOTO
FRONTIER RENEWABLE RESOURCES, LLC
CELLULOSIC ETHANOL FACILITY
CHIPPEWA COUNTY, MICHIGAN

Drawn:	JWW	2/17/2009
Approved:	LDK	2/17/2009
Scale:	1" = 2,000'	
PROJECT NUMBER	13375-001-0100	
FIGURE NUMBER	2	

Department of Energy
Golden Field Office
1617 Cole Boulevard
Golden, Colorado 80401-3393

July 22, 2010

Mr. Louis Taylor, Chairperson
Lac Courte Oreilles Band of Lake Superior Chippewa Indians of Wisconsin
13394 W. Trapania Rd. Bldg No. 1
Hayward, WI 54843-2186

Dear Mr. Taylor,

The U. S. Department of Energy is proposing to provide Federal funding to Mascoma Corporation for the final design, construction, and operation of a cellulose-to-ethanol biorefinery near the City of Kinross, Michigan in Chippewa County. Frontier Renewable Resources, LLC, a joint venture between Mascoma Corporation and J.M. Longyear, LLC, would develop and operate the proposed facility. The proposed facility is intended to further the government's goal of rendering cellulosic ethanol cost-competitive with corn ethanol by 2012.

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Ms. Kristin Kerwin
U.S. Department of Energy
1617 Cole Boulevard
Golden, Colorado
Email: kristin.kerwin@go.doe.gov
Phone: 303-275-4968

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Sincerely,

Kristin Ker

Kristin Kerwin
NEPA Compliance Officer

Attachments
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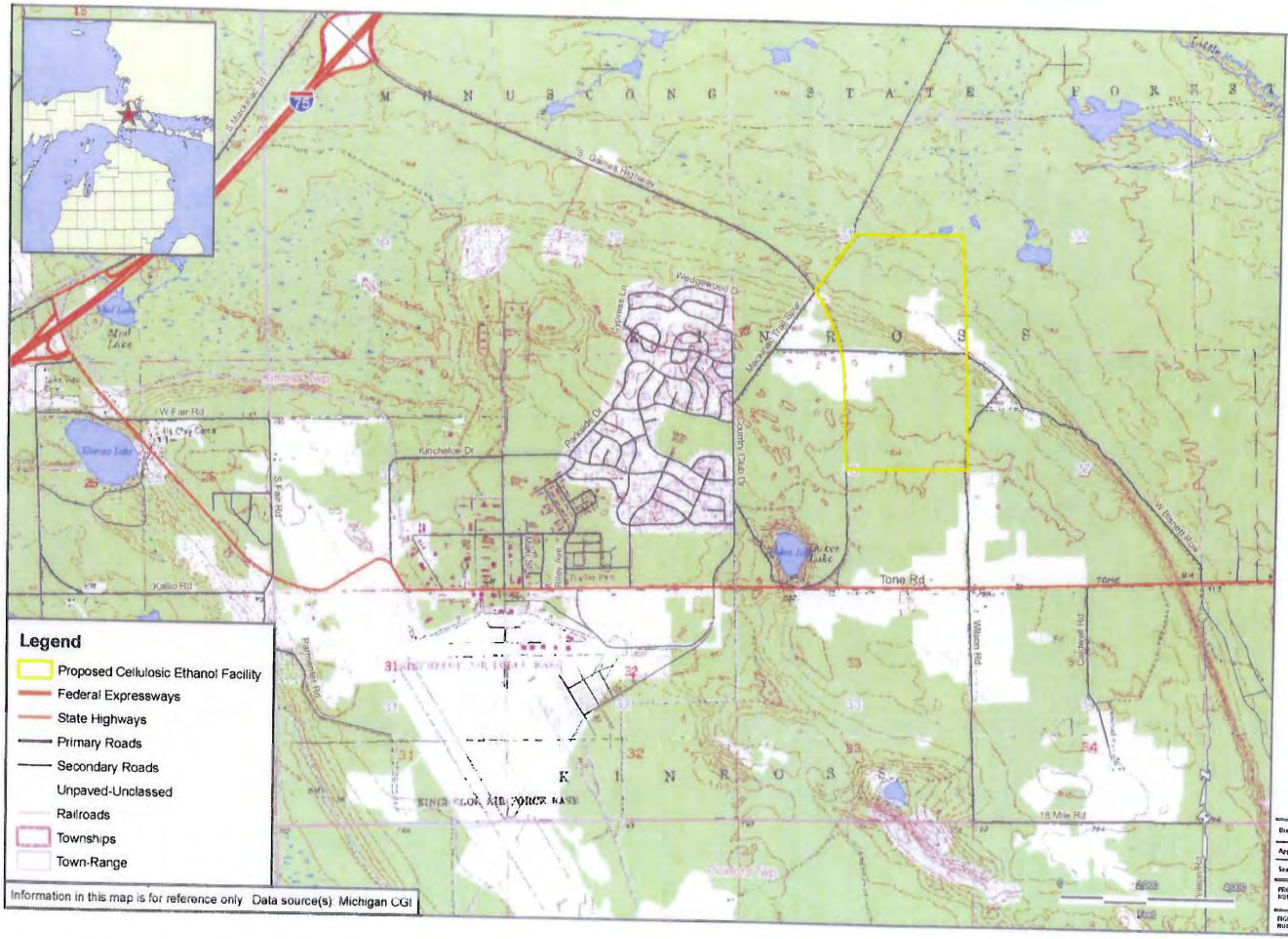
Figure 2. Site Location Map with a 2005 Aerial Photo.

CC: Mr. Jerry Smith
Tribal Historic Preservation Officer
Lac Courte Oreilles Band of Lake Superior Chippewa Indians of Wisconsin
13394 W. Trapania Rd. Bldg No. 1
Hayward, WI 54843-2186



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FRONTIER RENEWABLE RESOURCES, LLC
CELLULOSIC ETHANOL FACILITY
CHIPPEWA COUNTY, MICHIGAN

Drawn:	JWW	2/17/2009
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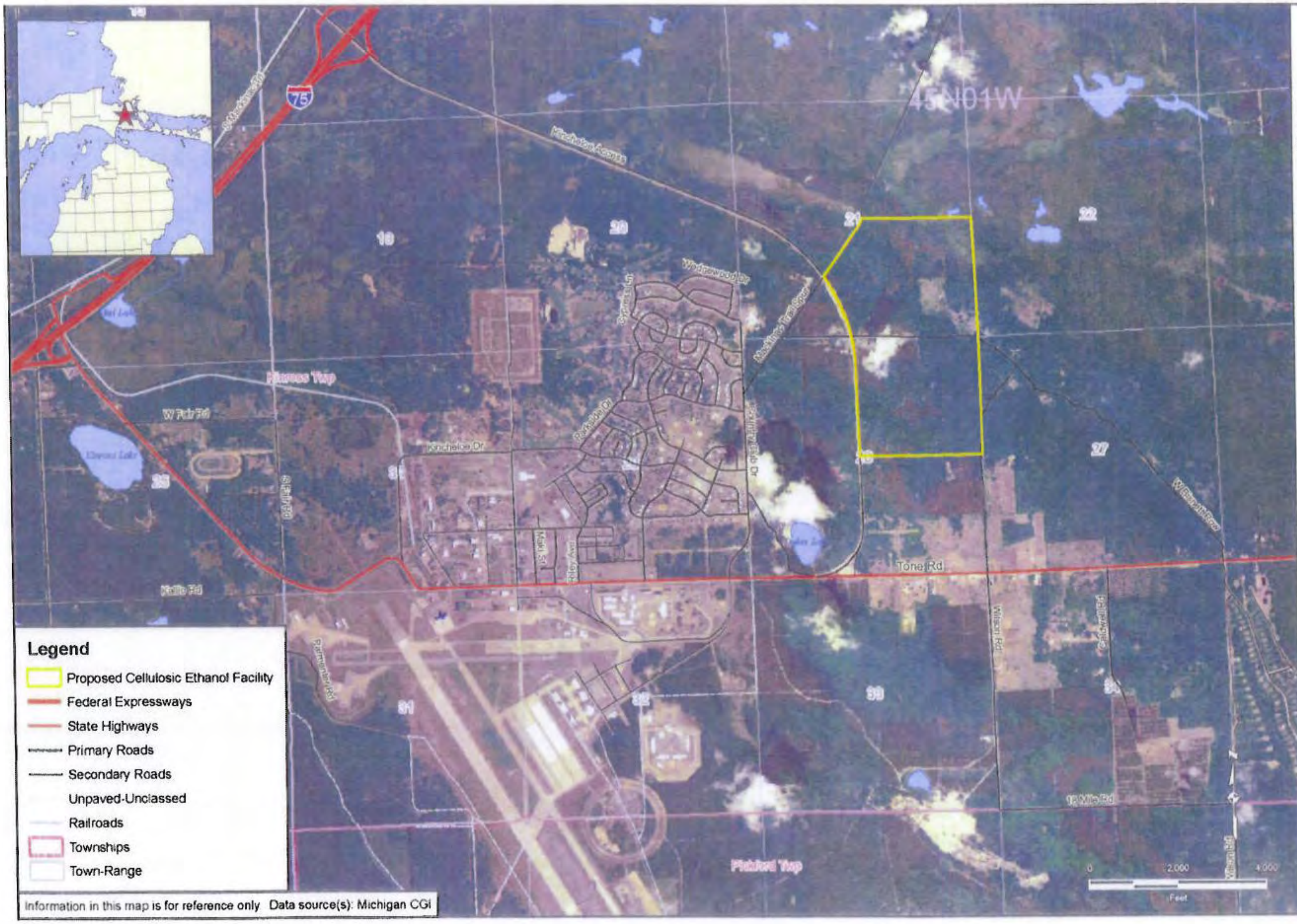

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FIGURE 2
SITE LOCATION MAP WITH 2005 AERIAL PHOTO
FRONTIER RENEWABLE RESOURCES, LLC
CELLULOSIC ETHANOL FACILITY
CHIPPEWA COUNTY, MICHIGAN

Drawn:	JWW	2/17/2009
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PROJECT NUMBER	13375-001-0100	
FIGURE NUMBER	2	

Department of Energy
Golden Field Office
1617 Cole Boulevard
Golden, Colorado 80401-3393

July 22, 2010

Marge Anderson, Chief Executive
Mille Lacs Band Assembly
43408 Oodena Drive
Onamia, MN 56359-2236

Dear Ms. Anderson,

The U. S. Department of Energy is proposing to provide Federal funding to Mascoma Corporation for the final design, construction, and operation of a cellulose-to-ethanol biorefinery near the City of Kinross, Michigan in Chippewa County. Frontier Renewable Resources, LLC, a joint venture between Mascoma Corporation and J.M. Longyear, LLC, would develop and operate the proposed facility. The proposed facility is intended to further the government's goal of rendering cellulosic ethanol cost-competitive with corn ethanol by 2012.

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and Repatriation Act of 1990. If you have any such information, require additional information, or have any questions or comments about that project, please contact me at the following address:

Ms. Kristin Kerwin
U.S. Department of Energy
1617 Cole Boulevard
Golden, Colorado
Email: kristin.kerwin@go.doe.gov
Phone: 303-275-4968

Please provide your comments within 30-days of receipt of this letter. Thank you in advance for your consideration.

Sincerely,

Kristin Kerwin

Kristin Kerwin
NEPA Compliance Officer

Attachments
Figure 1. Site Location Map
Figure 2. Site Location Map with a 2005 Aerial Photo.

CC: Ms. Elisse Aune
Tribal Historic Preservation Officer
Mille Lacs Band of the Minnesota Chippewa Tribe
43408 Oodena Drive
Onamia, MN 56359-2236

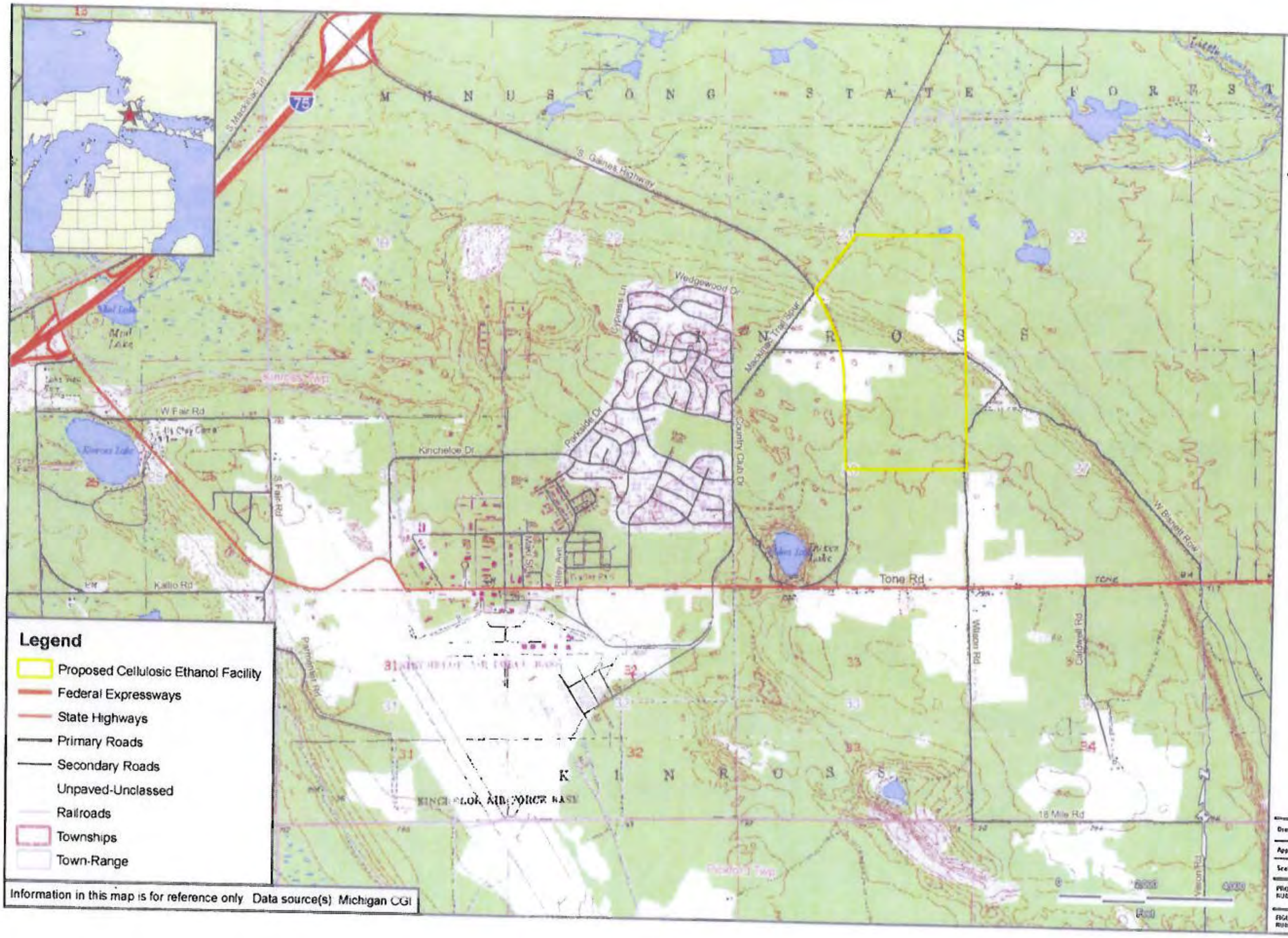

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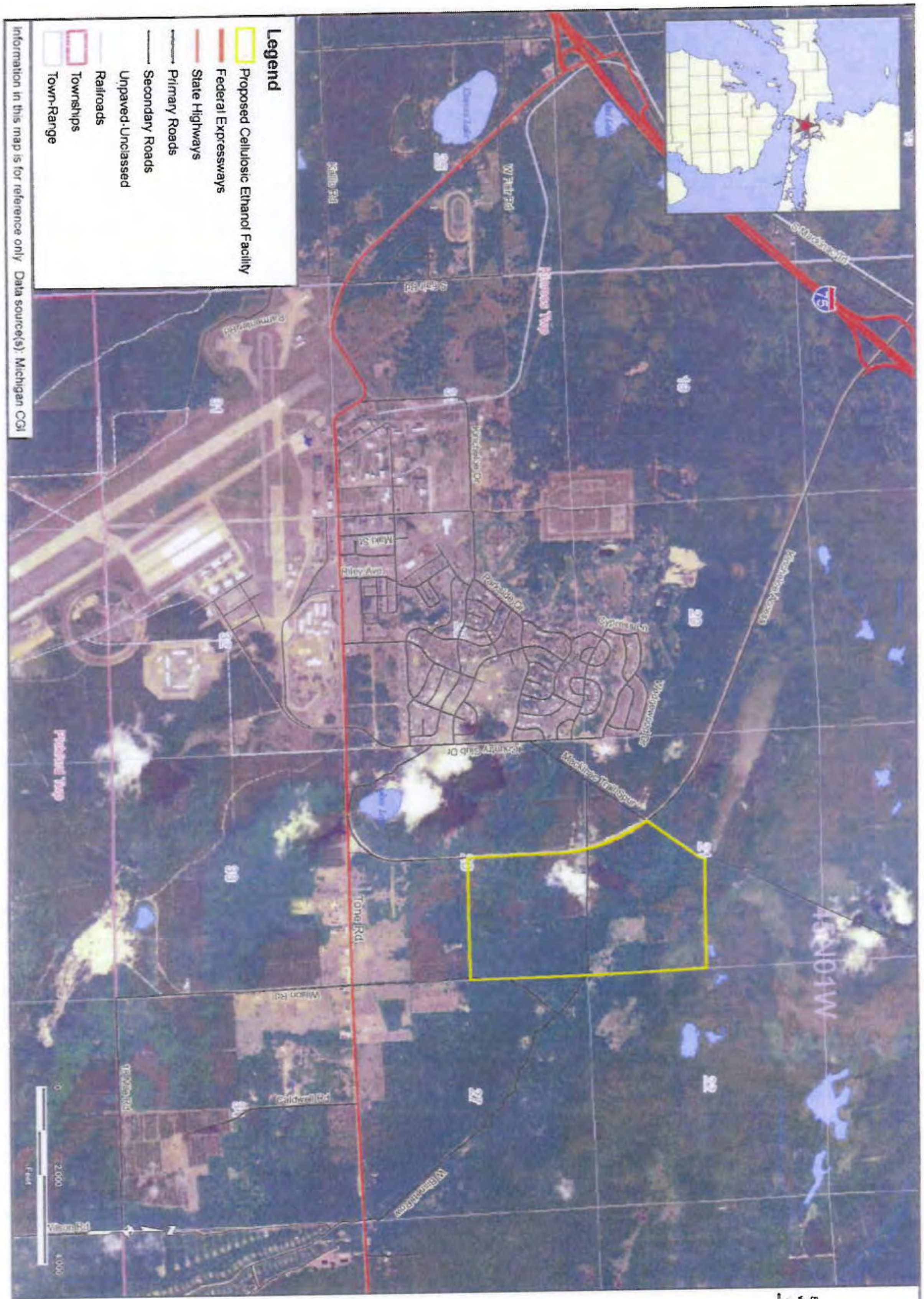
FIGURE 1
SITE LOCATION MAP
FRONTIER RENEWABLE RESOURCES, LLC
CELLULOSIC ETHANOL FACILITY
CHIPPEWA COUNTY, MICHIGAN

Drawn:	JWW	2/17/2009
Approved:	LDK	2/17/2009
Scale:	1" = 2,000'	
PROJECT NUMBER	13375-001-0100	
FIGURE NUMBER	1	



Information in this map is for reference only Data source(s): Michigan CGI

FIGURE 2
SITE LOCATION MAP WITH 2005 AERIAL PHOTO
FRONTIER RENEWABLE RESOURCES, LLC
CELLULOSIC ETHANOL FACILITY
CHIPPEWA COUNTY, MICHIGAN

AECOM
847.279.2500
www.aecom.com

Drawn:	JWW	2/17/2009
Approved:	LDK	2/17/2009
Scale:	1" = 2,000'	
PROJECT NUMBER	13375-001-0100	
FIGURE NUMBER	2	

Department of Energy
Golden Field Office
1617 Cole Boulevard
Golden, Colorado 80401-3393

July 22, 2010

Mr. Matthew Wesaw, Chairman
Pokagon Band of Potawatomi Indians
P.O. Box 180
Dowagiac, MI 49047-0180

Dear Mr. Wesaw,

The U. S. Department of Energy is proposing to provide Federal funding to Mascoma Corporation for the final design, construction, and operation of a cellulose-to-ethanol biorefinery near the City of Kinross, Michigan in Chippewa County. Frontier Renewable Resources, LLC, a joint venture between Mascoma Corporation and J.M. Longyear, LLC, would develop and operate the proposed facility. The proposed facility is intended to further the government's goal of rendering cellulosic ethanol cost-competitive with corn ethanol by 2012.

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Ms. Kristin Kerwin
U.S. Department of Energy
1617 Cole Boulevard
Golden, Colorado
Email: kristin.kerwin@go.doe.gov
Phone: 303-275-4968

Please provide your comments within 30-days of receipt of this letter. Thank you in advance for your consideration.

Sincerely,

Kristin Kerwin

Kristin Kerwin
NEPA Compliance Officer

Attachments
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Figure 2. Site Location Map with a 2005 Aerial Photo.

CC: Mr. Mark Parrish
Environmental Coordinator
Pokagon Band of Potawatomi Indians
P.O. Box 180
Dowagiac, MI 49047-0180

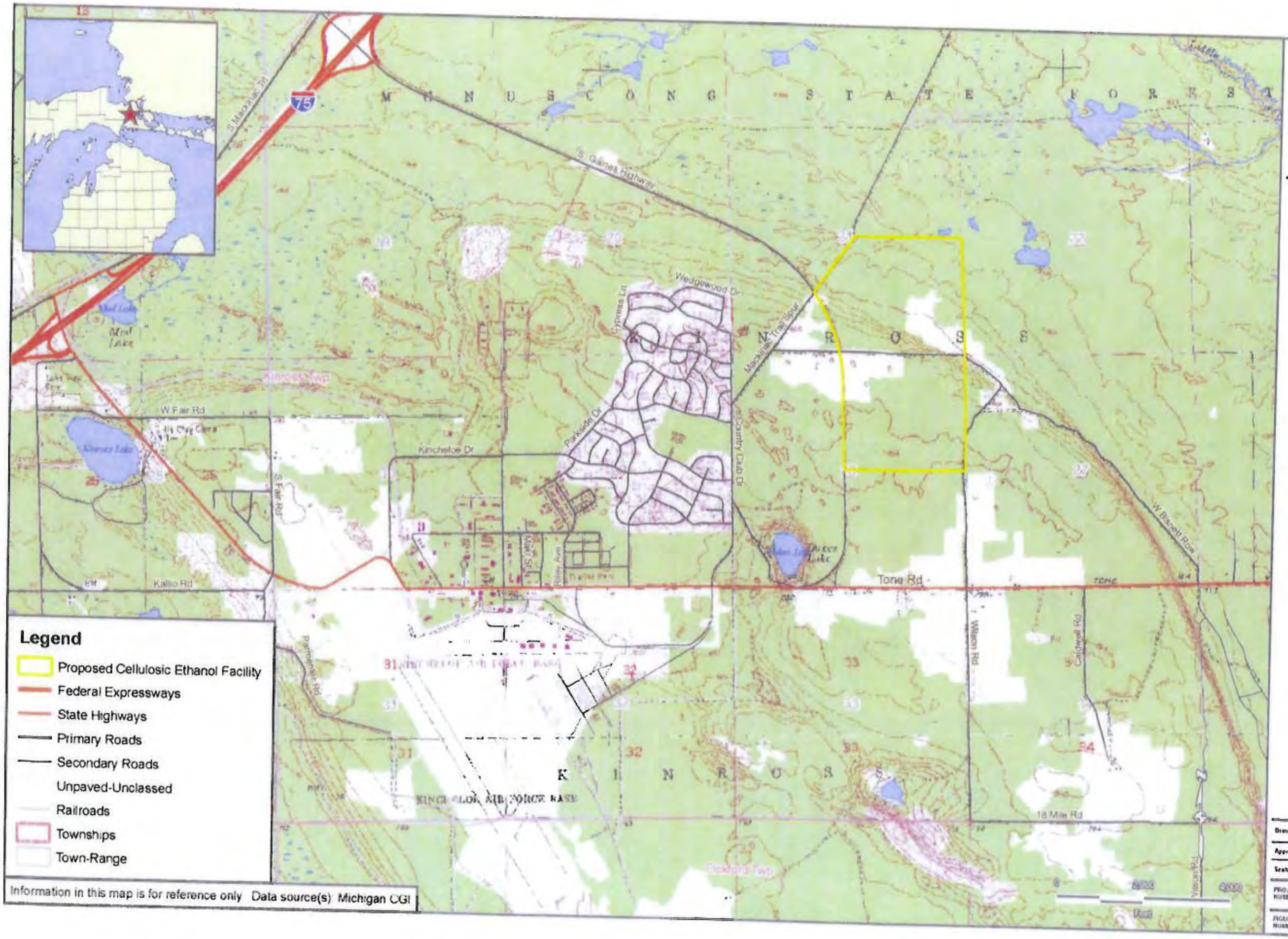

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FIGURE 1
SITE LOCATION MAP
FRONTIER RENEWABLE RESOURCES, LLC
CELLULOSIC ETHANOL FACILITY
CHIPPEWA COUNTY, MICHIGAN

Drawn:	JWW	2/17/2009
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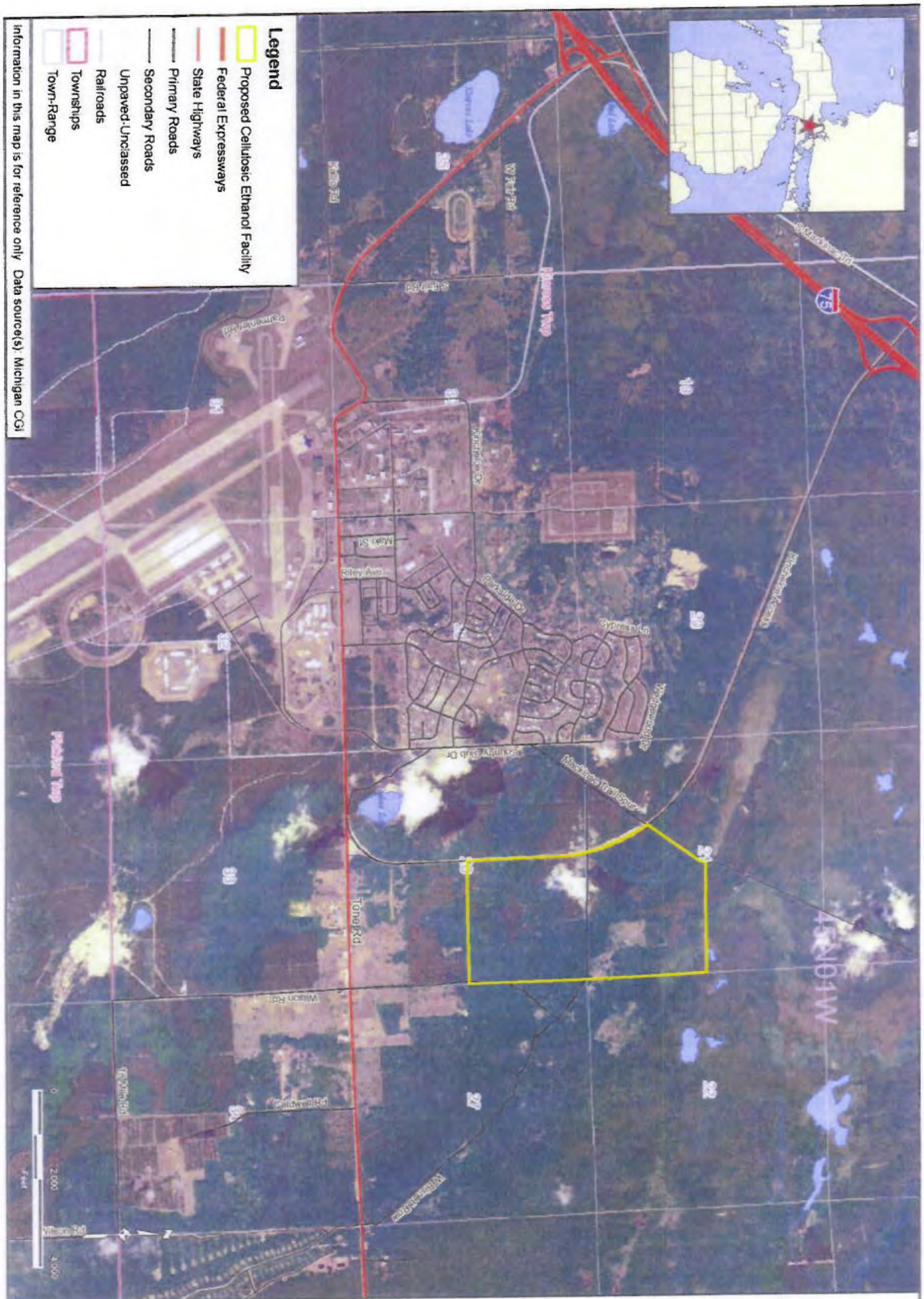
Scale:	1" = 2,000'	
PROJECT NUMBER	13375-001-0100	
FIGURE NUMBER	1	



Information in this map is for reference only Data source(s): Michigan CGI

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FIGURE 2
SITE LOCATION MAP WITH 2005 AERIAL PHOTO
FRONTIER RENEWABLE RESOURCES, LLC
CELLULOSIC ETHANOL FACILITY
CHIPPEWA COUNTY, MICHIGAN

Drawn: JWW 2/17/2009
Approved: LDK 2/17/2009
Scale: 1" = 2,000'
PROJECT NUMBER 13375-001-0100
FIGURE NUMBER 2

Department of Energy

Golden Field Office
1617 Cole Boulevard
Golden, Colorado 80401-3393

July 22, 2010

Mr. Mike Wiggins, Jr., Chairperson
Bad River Band of Lake Superior Chippewa
P.O. Box 39
Odanah, WI 54861-0039

Dear Mr. Wiggins,

The U. S. Department of Energy is proposing to provide Federal funding to Mascoma Corporation for the final design, construction, and operation of a cellulose-to-ethanol biorefinery near the City of Kinross, Michigan in Chippewa County. Frontier Renewable Resources, LLC, a joint venture between Mascoma Corporation and J.M. Longyear, LLC, would develop and operate the proposed facility. The proposed facility is intended to further the government's goal of rendering cellulosic ethanol cost-competitive with corn ethanol by 2012.

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Ms. Kristin Kerwin
U.S. Department of Energy
1617 Cole Boulevard
Golden, Colorado
Email: kristin.kerwin@go.doe.gov
Phone: 303-275-4968

Please provide your comments within 30-days of receipt of this letter. Thank you in advance for your consideration.

Sincerely,

Kristin Kerwin
NEPA Compliance Officer

Attachments
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Figure 2. Site Location Map with a 2005 Aerial Photo.

CC: Ms. Edith Leoso
Tribal Historic Preservation Officer
Bad River Band of Lake Superior Chippewa
P.O. Box 39
Odanah, WI 54861-0039

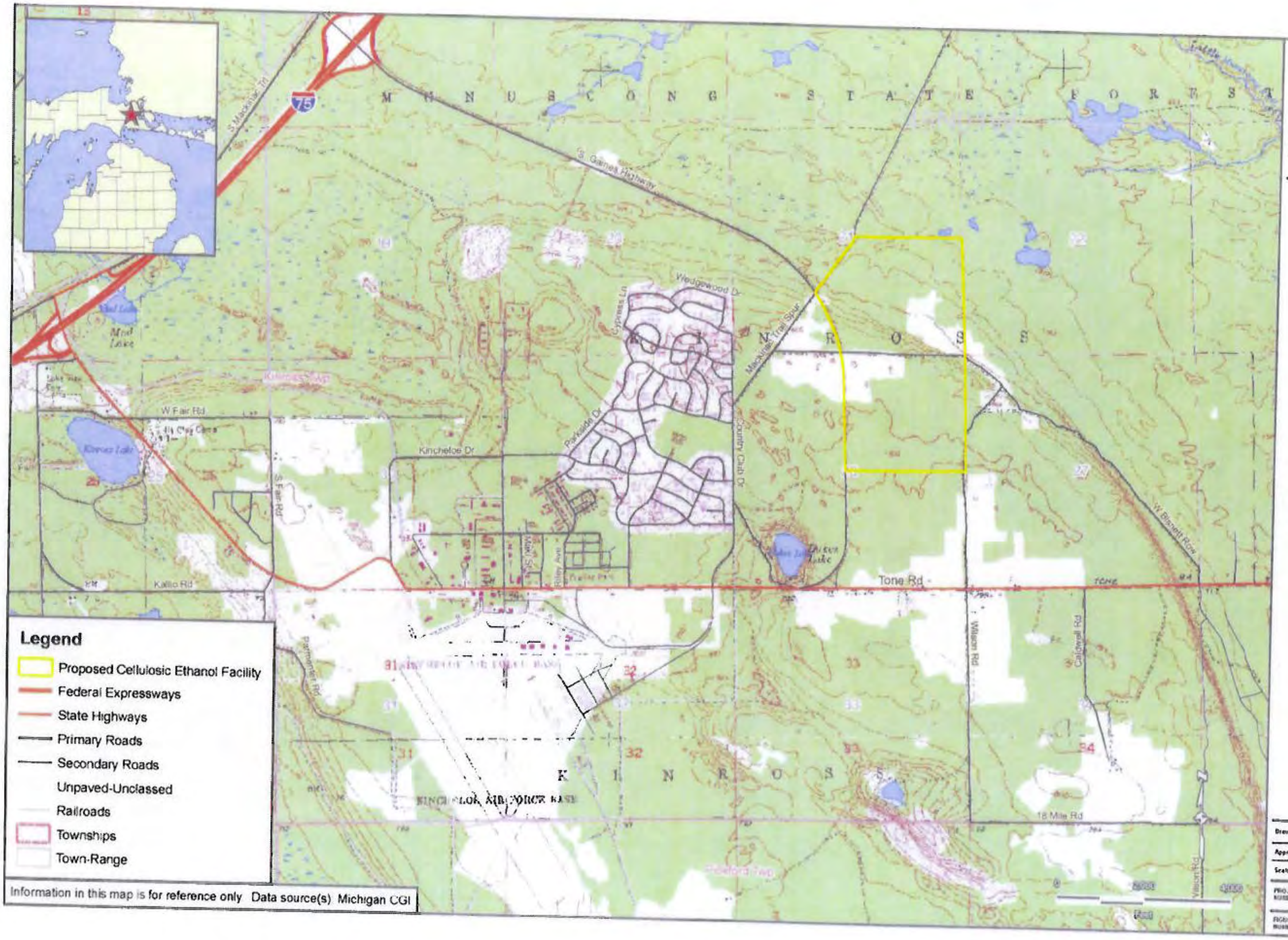

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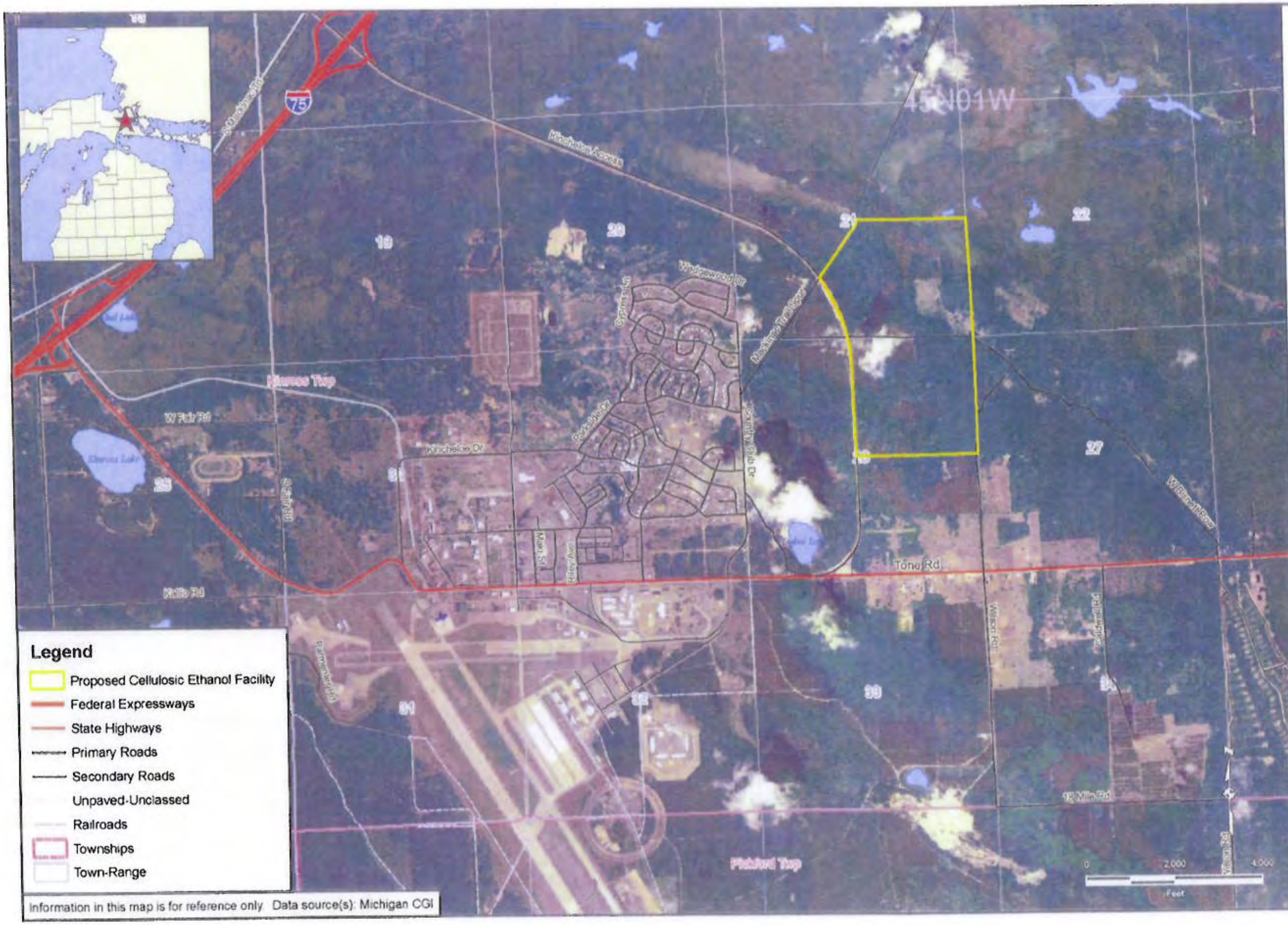
FIGURE 1
SITE LOCATION MAP
FRONTIER RENEWABLE RESOURCES, LLC
CELLULOSIC ETHANOL FACILITY
CHIPPEWA COUNTY, MICHIGAN

Drawn:	JWW	2/17/2009
Approved:	LDK	2/17/2009
Scale:	1" = 2,000'	
PROJECT NUMBER	13375-001-0100	
FIGURE NUMBER	1	



Information in this map is for reference only. Data source(s): Michigan CGI

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FIGURE 2
SITE LOCATION MAP WITH 2005 AERIAL PHOTO
FRONTIER RENEWABLE RESOURCES, LLC
CELLULOSIC ETHANOL FACILITY
CHIPPEWA COUNTY, MICHIGAN

Drawn:	JWW	2/17/2009
Approved:	LDK	2/17/2009
Scale:	1" = 2,000'	
PROJECT NUMBER	13375-001-0100	
FIGURE NUMBER	2	

Department of Energy
Golden Field Office
1617 Cole Boulevard
Golden, Colorado 80401-3393

July 22, 2010

Mr. Norman Deschampe, President
Minnesota Chippewa Tribe
P.O. Box 217
Cass Lake, MN 56633-0217

Dear Mr. Deschampe,

The U. S. Department of Energy is proposing to provide Federal funding to Mascoma Corporation for the final design, construction, and operation of a cellulose-to-ethanol biorefinery near the City of Kinross, Michigan in Chippewa County. Frontier Renewable Resources, LLC, a joint venture between Mascoma Corporation and J.M. Longyear, LLC, would develop and operate the proposed facility. The proposed facility is intended to further the government's goal of rendering cellulosic ethanol cost-competitive with corn ethanol by 2012.

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U.S. Department of Energy
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Golden, Colorado
Email: kristin.kerwin@go.doe.gov
Phone: 303-275-4968

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Sincerely,

Kristin Kerwin

Kristin Kerwin
NEPA Compliance Officer

Attachments
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CC: Jim Jones, Cultural Resource Specialist
Minnesota Indian Affiars Council
3801 Bemidji Ave N. Ste 5
Bemidji, MN 56601-4236

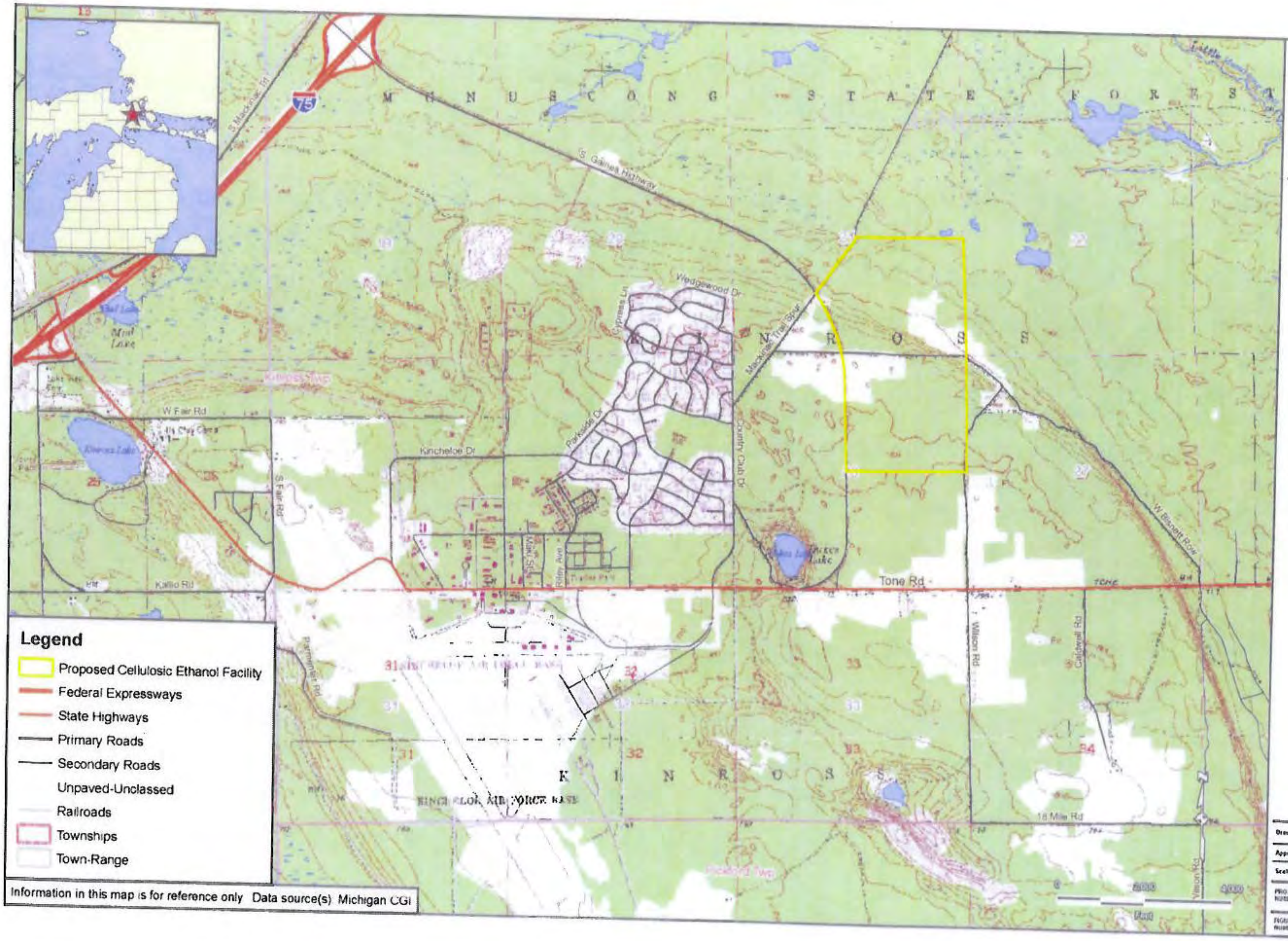

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FIGURE 1
SITE LOCATION MAP
FRONTIER RENEWABLE RESOURCES, LLC
CELLULOSIC ETHANOL FACILITY
CHIPPEWA COUNTY, MICHIGAN

Drawn:	JWW	2/17/2009
Approved:	LDK	2/17/2009
Scale:	1" = 2,000'	
PROJECT NUMBER	13375-001-0100	
FIGURE NUMBER	1	

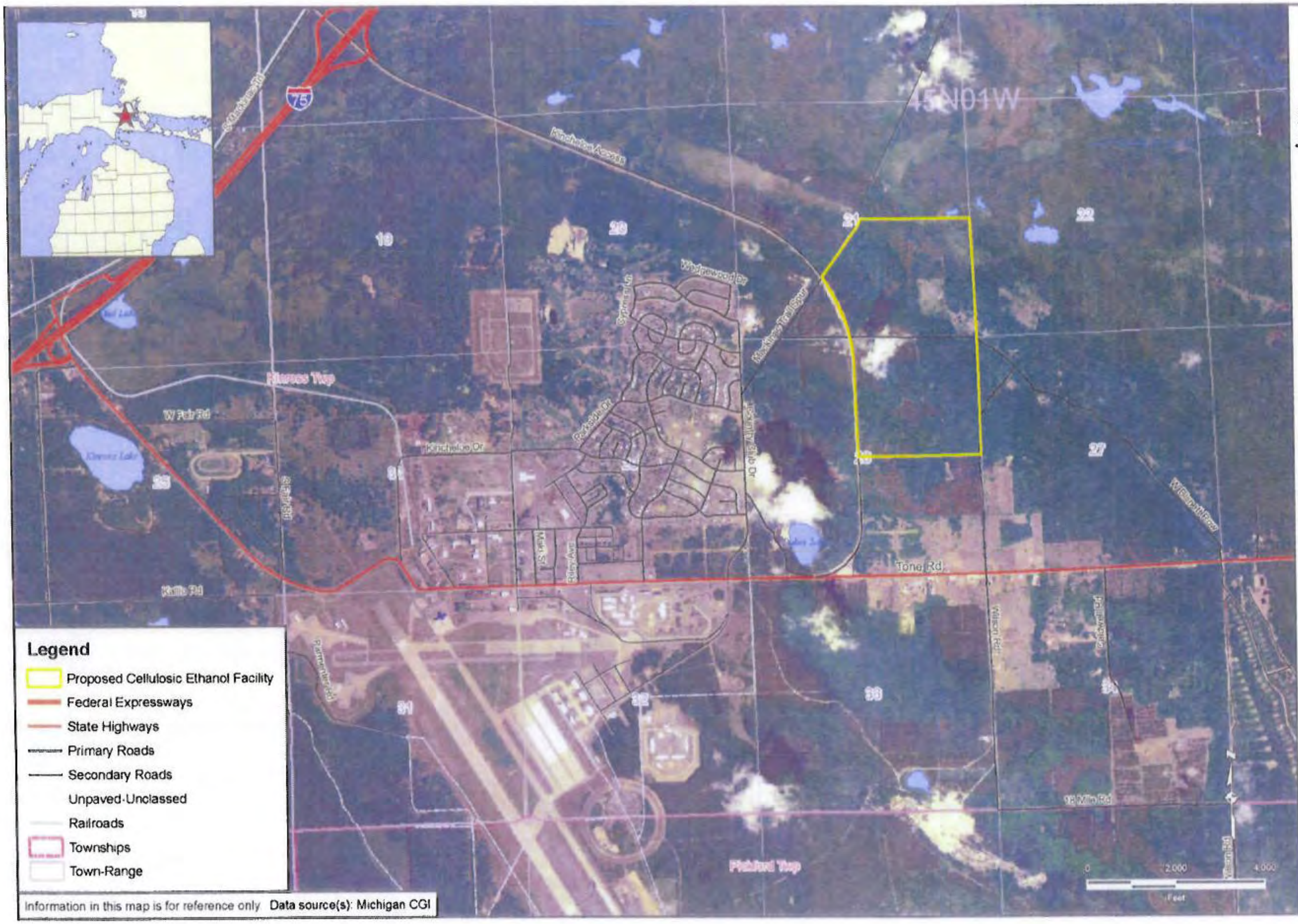

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FIGURE 2
SITE LOCATION MAP WITH 2005 AERIAL PHOTO
FRONTIER RENEWABLE RESOURCES, LLC
CELLULOSIC ETHANOL FACILITY
CHIPPEWA COUNTY, MICHIGAN

Drawn:	JWW	2/17/2009
Approved:	LDK	2/17/2009
Scale:	1" = 2,000'	
PROJECT NUMBER	13375-001-0100	
FIGURE NUMBER	2	

Department of Energy
Golden Field Office
1617 Cole Boulevard
Golden, Colorado 80401-3393

July 22, 2010

Ms. Rose Soulier, Chairperson
Red Cliff Band of Lake Superior Chippewa Indians
88385 Pike Road, Hwy 13
Bayfield, WI 54814-4818

Dear Ms. Soulier,

The U. S. Department of Energy is proposing to provide Federal funding to Mascoma Corporation for the final design, construction, and operation of a cellulose-to-ethanol biorefinery near the City of Kinross, Michigan in Chippewa County. Frontier Renewable Resources, LLC, a joint venture between Mascoma Corporation and J.M. Longyear, LLC, would develop and operate the proposed facility. The proposed facility is intended to further the government's goal of rendering cellulosic ethanol cost-competitive with corn ethanol by 2012.

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Golden, Colorado
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Phone: 303-275-4968

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Sincerely,

Kristin Kerwin

Kristin Kerwin
NEPA Compliance Officer

Attachments
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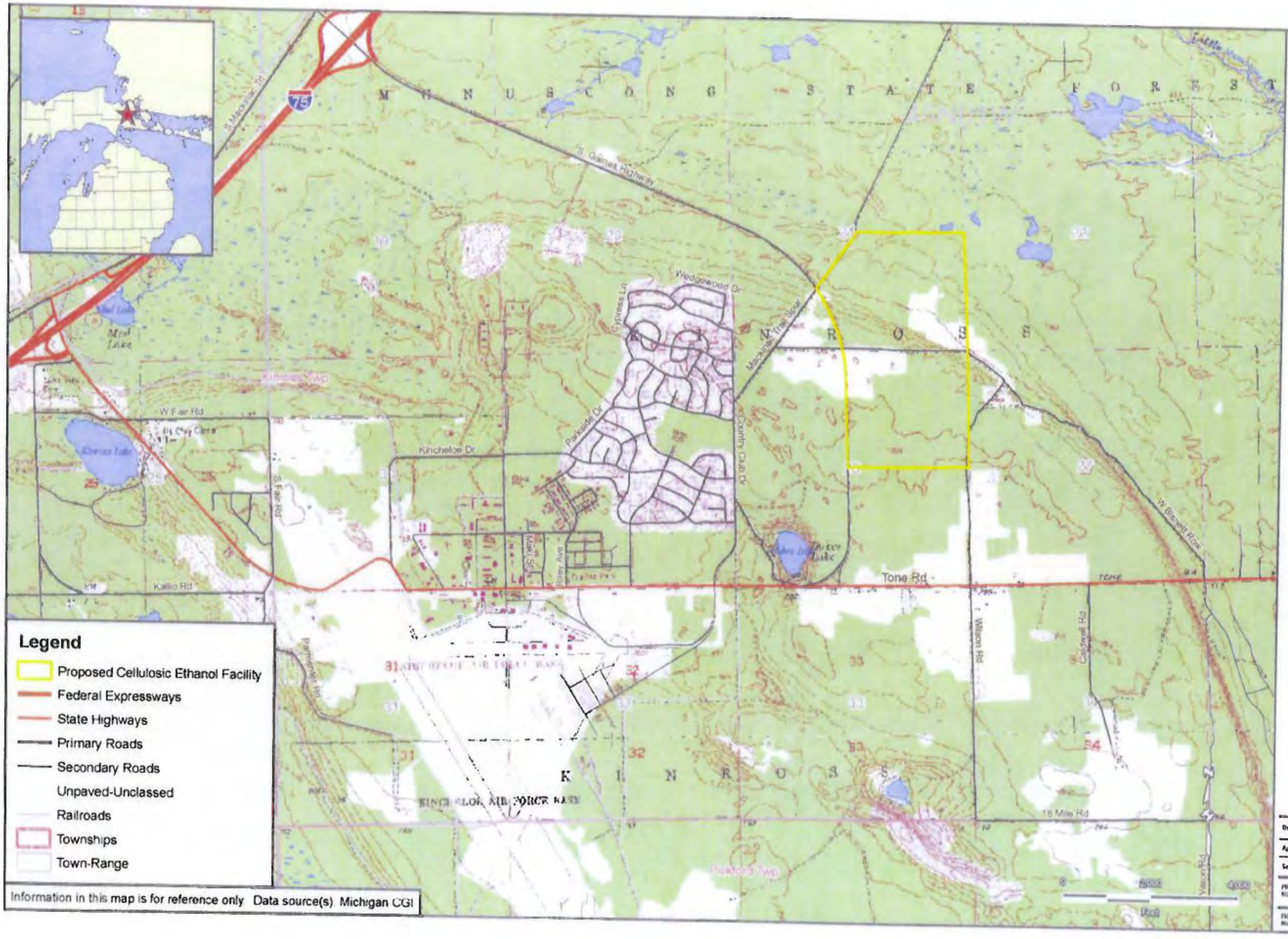
Figure 2. Site Location Map with a 2005 Aerial Photo.

CC: Larry Balber
Tribal Historic Preservation Officer
Red Cliff Band of Lake Superior Chippewa Indians
88385 Pike Road, Hwy 13
Bayfield, WI 54814-4818



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FRONTIER RENEWABLE RESOURCES, LLC
CELLULOSIC ETHANOL FACILITY
CHIPPEWA COUNTY, MICHIGAN

Drawn:	JWW	2/17/2009
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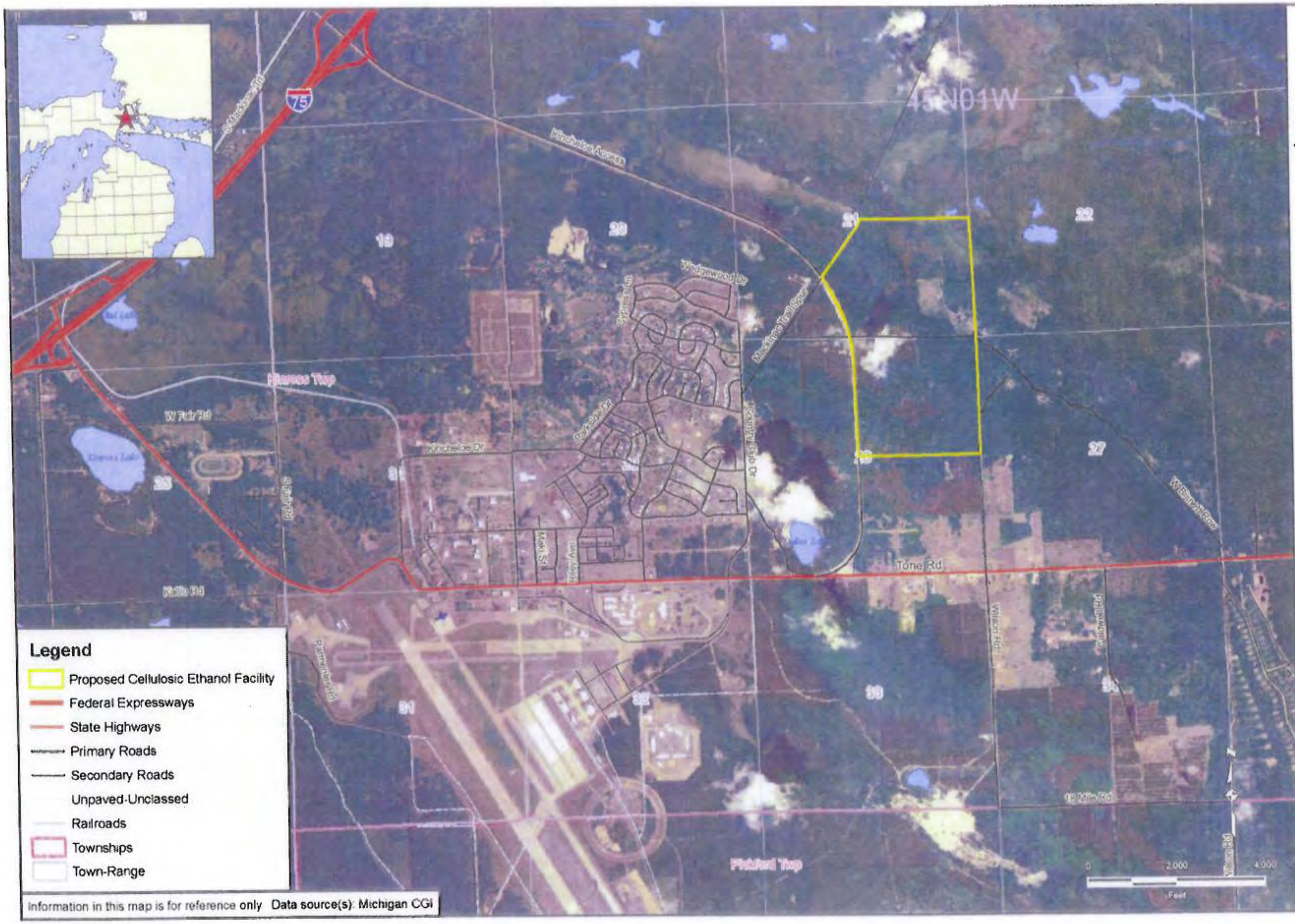

Information in this map is for reference only Data source(s): Michigan CGI

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FIGURE 2
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FRONTIER RENEWABLE RESOURCES, LLC
CELLULOSIC ETHANOL FACILITY
CHIPPEWA COUNTY, MICHIGAN

Drawn:	JWW	2/17/2009
Approved:	LDK	2/17/2009
Scale:	1" = 2,000'	
PROJECT NUMBER	13375-001-0100	
FIGURE NUMBER	2	

Department of Energy
Golden Field Office
1617 Cole Boulevard
Golden, Colorado 80401-3393

July 22, 2010

Mr. Warren C. Swartz, Jr., President
Keweenaw Bay Indian Community
16429 Beartown Road
Baraga, MI 49908-9210

Dear Mr. Swartz,

The U. S. Department of Energy is proposing to provide Federal funding to Mascoma Corporation for the final design, construction, and operation of a cellulose-to-ethanol biorefinery near the City of Kinross, Michigan in Chippewa County. Frontier Renewable Resources, LLC, a joint venture between Mascoma Corporation and J.M. Longyear, LLC, would develop and operate the proposed facility. The proposed facility is intended to further the government's goal of rendering cellulosic ethanol cost-competitive with corn ethanol by 2012.

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Phone: 303-275-4968

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Sincerely,

Kristin Kerwin

Kristin Kerwin
NEPA Compliance Officer

Attachments
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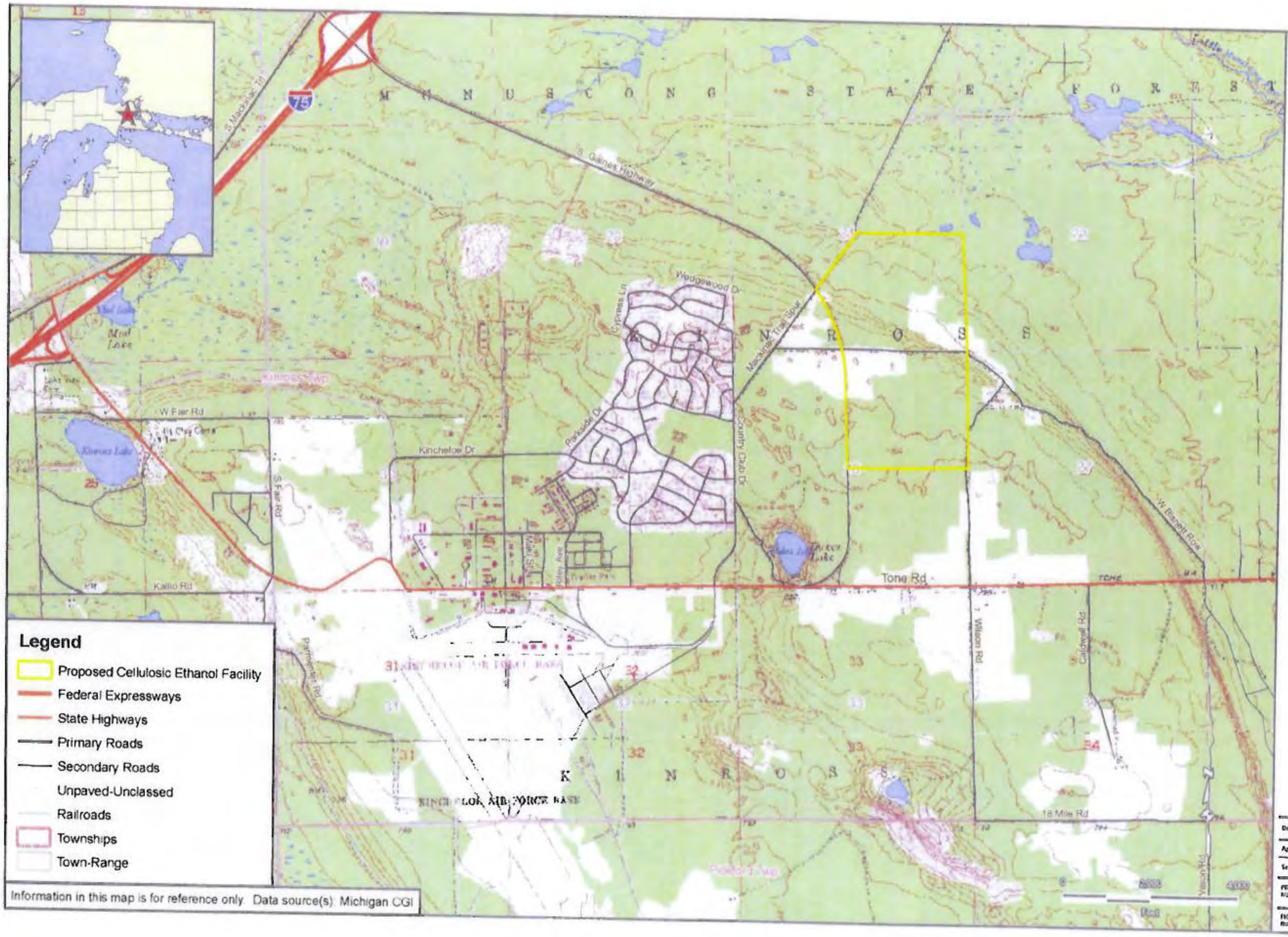
Figure 2. Site Location Map with a 2005 Aerial Photo.

CC: Ms. Summer Cohen
Tribal Historic Preservation Officer
Keweenaw Bay Indian Community
16429 Beartown Road
Baraga, MI 49908-9210



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SITE LOCATION MAP
FRONTIER RENEWABLE RESOURCES, LLC
CELLULOSIC ETHANOL FACILITY
CHIPPEWA COUNTY, MICHIGAN

Drawn:	JWW	2/17/2009
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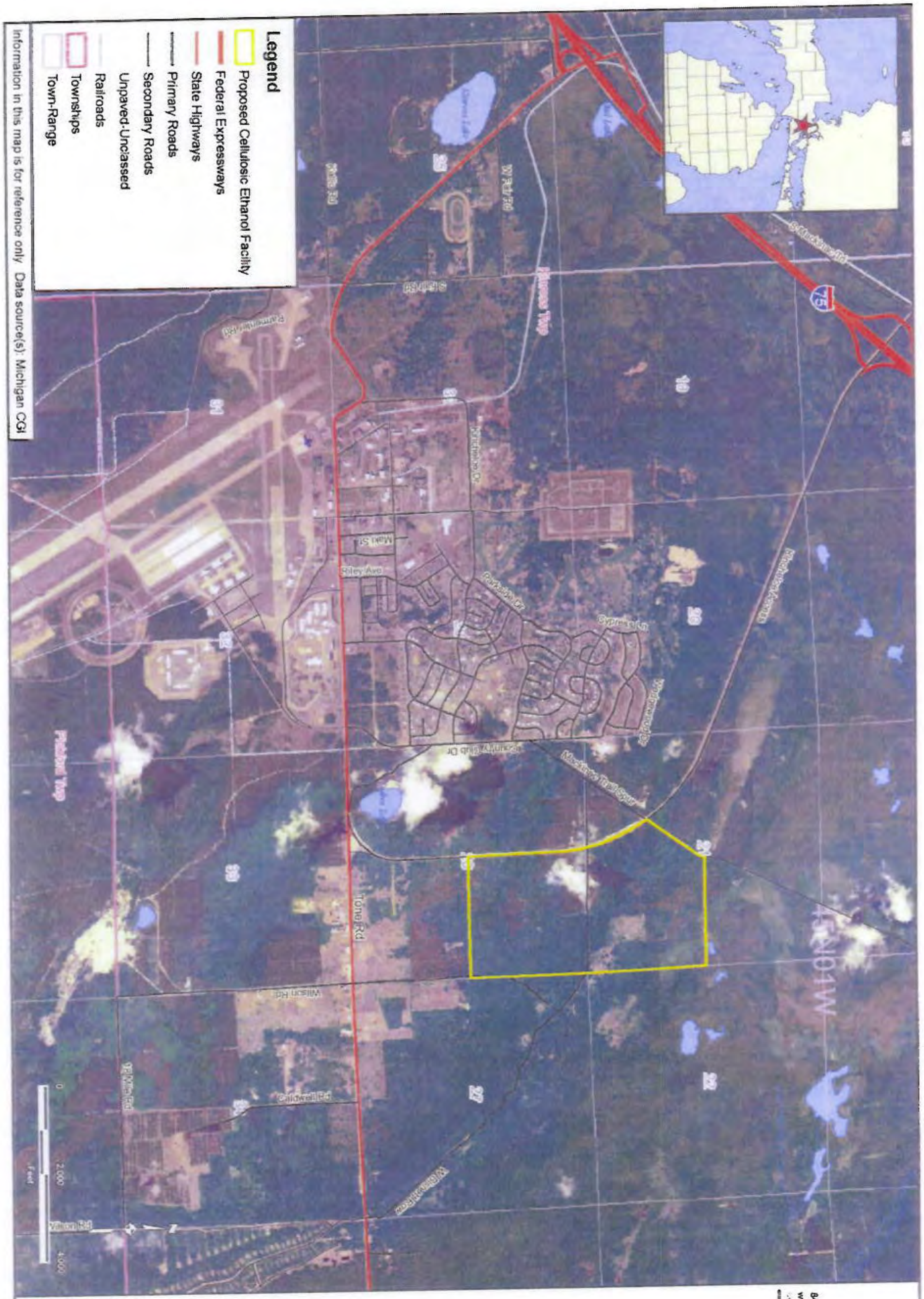

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FRONTIER RENEWABLE RESOURCES, LLC
CELLULOSIC ETHANOL FACILITY
CHIPPEWA COUNTY, MICHIGAN

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847.279.2500
www.aecom.com

Drawn: JWW 2/17/2009
Approved: LOK 2/17/2009
Scale: 1" = 2,000'
PROJECT NUMBER 13375-001-0100
FIGURE NUMBER 2

"LEGEND HOUSE"

August 4, 2010

Kristin Kerwin
US Department of Energy
1617 Cole Blvd
Golden, CO 80401-3393

RE: Frontier Renewable Resources, LLC, Cellulosic Ethanol Facility
Chippewa County, MI

Dear Ms Kerwin;

The Bois Forte Band is in receipt of your letter notifying us of the Frontier Renewable Resources, LLC's, plans for a Cellulose to Ethanol facility in Chippewa County, Michigan. The Bois Forte Tribal Historic Preservation Office is not aware of historic or cultural properties associated with the Band within the APE.

Please feel free to contact me at blatady@boisforte-nsn.gov or 218-753-6017 if you have any questions.

Sincerely;

Bill Latady
Deputy THPO

cc: Rose Berens, THPO

BOIS FORTE HERITAGE CENTER 1500 BOIS FORTE RD TOWER, MN 55790 PHONE: 218-753-6017

BOIS FORTE
HERITAGE CENTER
1500 BOIS FORTE RD
TOWER, MN 55790

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Ms. Kirsten Kerwin
US Department of Energy
1617 Cole Blvd
Golden CO 80401-3393

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Leech Lake Band of Ojibwe

Arthur "Archie" Larose, Chairman
Michael Bongo, Secretary/Treasurer

District I Representative
Ms. Robbie Howe

District II Representative
Steve White

District III Representative
Eugene "Ribs" Whitebird

August 3, 2010

US Department of Energy
Attn: Ms. Kristin Kerwin
1617 Cole Boulevard
Golden, CO 80401-3393

RE: **Proposed construction and operation of a cellulose-to-ethanol biorefinery**
Kinross, Chippewa County, Michigan
LL-THPO Number: 10-177-NCRI

Dear Ms. Kerwin:

Thank you for the opportunity to comment on the above-referenced projects. They have been reviewed pursuant to the responsibilities given the Tribal Historic Preservation Officer (THPO) by the National Historic Preservation Act of 1966, as amended in 1992 and the Procedures of the Advisory Council on Historic Preservation (38CFR800).

I have reviewed the documentation; after careful consideration of our records, I have determined that the Leech Lake Band of Ojibwe does not have any concerns regarding sites of religious or cultural importance in these areas.

Should any human remains or suspected human remains be encountered, all work shall cease and the following personnel should be notified immediately in this order: County Sheriff's Office and Office of the State Archaeologist. If any human remains or culturally affiliated objects are inadvertently discovered this will prompt the process to which the Band will become informed.

Please note: The above determination does not "exempt" future projects from Section 106 review. In the event of any other tribe notifying us of concerns for a specific project, we may re-enter into the consultation process.

You may contact me at (218) 335-2940 if you have questions regarding our review of these projects. Please refer to the LL-THPO Number as stated above in all correspondence with this project.

Respectfully submitted,

Gina M. Lemon
Tribal Historic Preservation Officer

Leech Lake Tribal Historic Preservation Office * Established in 1996
An office within the Division of Resource Management
115 Sixth Street NW, Suite E * Cass Lake, Minnesota 56633
(218) 335-2940 * FAX (218) 335-2974
glemon@live.com or www.nathpo.org (Active Members since 1998)

Tribal Historic Preservation Office
Leech Lake Band of Ojibwe
115 SIXTH ST. NW, SUITE E
CASS LAKE, MINNESOTA 56633

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US Department of Energy
Attn: Ms. Kristin Kerwin
1617 Cole Boulevard
Golden, CO 80401-3393

80401$3305 C030

LAC VIEUX DESERT BAND OF LAKE SUPERIOR CHIPPEWA INDIANS

Ketegitigaaning Ojibwe Nation Tribal Historic Preservation

P.O. Box 249, E23857 Poplar Circle Watersmeet, MI 49969
Phone: 906-358-0137 or 0138 Fax: 906-358-4850

Date: August 5, 2010

REF: DOE, Chippewa County/City of Kinross Cellulose-to-Ethanol Biorefinery

Booshoo,

The Ketegitigaaning Ojibwe Nation THPO (Lac Vieux Desert Chippewa) received your requests for comments or interest concerning the National Historic Preservation Act, Section 106 request for review and comment to the effect on historic and cultural sites within the proposed project area. The LVD Tribal Historic Preservation Office has no interests documented at this time in the proposed project areas. LVD has conducted its database research, file research and find no sites within the project area at this time. However that does not mean that they do not exist. It is LVD's belief that many prehistoric sites and Indian historic sites in the area have not yet been identified or documented. LVD is among the many Tribes initiating the process of assisting in this endeavor. LVD urges you to consult other Indian Tribes in your immediate area that may have interests in your project area, if you have not already done so.

If the scope of work changes in any way, or if artifacts or human remains are discovered, please notify LVD immediately so we can assist in making an appropriate determination. LVD urges you to consult other Indian Tribes in your immediate area that may have interests in your project area, if you have not already done so.

Please forward any future request for review of historic and cultural properties according to the National Historic Preservation Act Section 106 to giiwegiizhigookway Martin, Officer, Tribal Historic Preservation Office. Please keep us informed of future projects as LVD plans to increase our efforts to identify and document sites in the area.

Miigwetch,

Giiwegiizhigookway Martin

giiwegiizhigookway Martin

giiwegiizhigookway Martin, THPO
Ketegitigaaning Ojibwe Nation
Tribal Historic Preservation Office
P.O. 249
E23857 Poplar Circle
Watersmeet, Michigan 49969
Phone: 906-358-0137
Fax: 906-358-4850

email: gmartin@lvdtribal.com

Little River Band of Ottawa Indians
Tribal Historic Preservation
375 River Street
Manistee, MI 49660
1-888-723-8288

August 12, 2010

Department of Energy
1617 Cole Boulevard
Golden, CO 80401

Dear Ms. Kerwin:

The Tribe has received your Letter of July 22, 2010, referencing the cellulose-to-ethanol bio-refinery near the City of Kinross, MI and requesting a determination as to whether or not the proposed project will affect Indian religious sites. Thank you for ensuring that we received notification. This letter is the Tribe's formal answer to your request.

In reply to the above cited letter, I can reply by stating that the site listed is located in a region of the state of Michigan that Little River Band of Ottawa Indians did not occupy significantly. Further, after a careful review of our information the Little River Band of Ottawa Indians has determined there that this project will not affect any religious, cultural or historic Little River Band of Ottawa Indians sites of which we are currently aware.

The Tribe would, however, appreciate work stopping and being contacted should there be something of a cultural, religious or historic nature discovered so as to assist in mitigation of the discovered site.

Signed

Jonnie Sam II, Director
Historic Preservation Department
Little River Band of Ottawa Indians

Little River Band of Ottawa Indians
Historic Preservaton Department
375 River Street
Manistee, MI 49660

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AUG13 2010
MAILED FROM ZIPCODE 49660

Department of Energy
1617 Cole Boulevard
Golden, CO 80401

Attn: Kristen Kerwin

80401+3305