8. AESTHETIC RESOURCES

The Powerhouse occupies a spectacular location at the mouth of the Elk River. Due to high levels of limestone in the lakes, the waters in the area are a vibrant Caribbean blue of a hue rarely seen this far north. The Village has preserved a small town feel that hearkens back to an earlier era. The Powerhouse makes an integral contribution to the Village's historic look and feel. Its low brick profile nestles comfortably into the landscape, flanked by the masts of the boats at rest in the harbor and the magnificent water and sky. Photos of the Project and the surrounding area are scattered throughout this PAD (see list of photos). Additional photos are provided in this section (Photos 8.1-8.5).

9. CULTURAL RESOURCES

The Village of Elk Rapids was established in the 1850s. While the Village has a rich historic past, few original buildings remain from its first years. Like the other boom towns that sprang up along the mouths of northern Michigan's rivers, Elk Rapids was sited to be able to harvest and process the area's natural resources and ship the semi-finished iron and lumber to the large cities to the south.

One company in particular, the Dexter-Noble Company, quickly bought up land and timber rights. Once it merged with the Elk Rapids Iron Company, Dexter-Noble had a virtual monopoly on all commerce and industry within the Village (Ruggles 1998). By 1873, the now-named Elk Rapids Iron Company had set up an industrial park on the east side of the Elk River. The complex consisted of a chemical works, charcoal kilns, and a pig iron blast furnace. Shut down during World War I, the only evidence of these factories today is a part of the furnace's brick hearth with a Michigan State Historic Marker stating that the furnace was "one of the nation's greatest producers of charcoal iron." (Ruggles 2007, Neumann 2007).

Hydropower has been an intrinsic part of the Village's economic life since the very beginning. The first water-powered saw mill was installed in the early 1850s on the site of the Project's current bypass spillway (Neumann 2008). By 1871, the Elk Rapids Iron Company had also constructed a water powered, four-story grist mill and wooden powerhouse at the site. The saw mill went through a number of rebuilds and upgrades before being relocated to the site of the current Powerhouse. In its heyday, the saw mill produced 15 million board feet of lumber annually. The mill was razed in 1915 as the supply of Northern Michigan White pine became exhausted. The Powerhouse supplied electricity and pumped water for the company's iron works on the east side of the Elk River. Like the sawmill, the powerhouse and grist mill were both razed by 1915.

9.1. PROJECT POWERHOUSE

The lower level of the present Powerhouse was constructed in 1916. It had a brick superstructure and housed just two generation units located in the two south bays. Bay #2's equipment was installed in 1918. In 1920, Bay #1 received the turbine from the Elk Rapids Iron Company's old wooden powerhouse. Bay #3 received a wooden superstructure and a turbine-generating unit in 1923. In 1929-1930, the brick and wood superstructure was removed and the current, more elaborate building was built to cover all four bays. At the time, the turbines in the four bays provided a total of 1,845 horsepower.

Photo 8.1 Aerial View of the Village of Elk Rapids (Photo: Jim Anderson 2005)
The Project powerhouse can be seen spanning the river in the middle left, above Edward C. Grace Memorial Harbor. The village center continues off the right of the photo.

Photo 8.2 The Powerhouse in Autumn (Photo: ERHP 2009)

Photo 8.3 Downtown Elk Rapids (Photo: ERHP 2009)

Photos 8.4 and 8.5 Detailing on many signs and buildings use styles reminiscent of an earlier age (Source: ERHP 2009)

According to the Project's 1981 License, the U.S. Department of the Interior recommended that the State Historic Preservation Officer (SHPO) be contacted to discuss listing the Project powerhouse in the National Register of Historic Places. The SHPO was contacted during the preparation of the Environmental Report for the Project's 1981 License Application. While the SHPO did not recommend that the building be listed in the National Register, the agency did recommend that the County follow the Secretary of Interior's Standard for Historic Preservation when "improving the exterior appearance of the powerhouse superstructure and site." These standards were following during preparation of the rehabilitation plans for the building (FERC 1981). In a letter dated August 28, 2010 to Lee Emery, FERC, the SHPO confirmed that no historic properties are affected by the Project. A copy of this letter is included as Appendix H. Even though the Powerhouse is not a listed building, the County's current maintenance and repair activities on the Powerhouse continue to seek to preserve the building's historic look and feel.

9.2. Other Historic Structures Near the Project

Two other structures of historic interest still remain in the Village. Both structures have Michigan State Historic Markers designating their historic and functional significance.

9.2.1 Island House

Edwin S. Noble (1838-1922), of the Dexter-Noble Company, designed and built Island House for his family in 1865 on the island that lies between the Elk River's north and south channels. He covered the four-acre sand dune with clay and dark loam, planted over 60 species of trees, and built a bridge over the river to connect Island House to the Village. The lush oasis that he created is a favorite spot for locals and visitors. In 1949, a part of Island House became the town's public library (Photos 9.1 and 9.2).

9.2.2 Township Hall

Designed by Charles H. Peale and built in 1883, Elk Rapids Township Hall served as the Village's social and political center for over 90 years. The hall has hosted countless theatrical, patriotic, school and township activities. The Elk Rapids Area Historical Society currently uses its facilities.

9.3. Existing Discovery Measures for Historic and Archaeological Resources

While the Michigan Natural History Division has stated there were numerous archaeological sites in the area, these sites have been poorly documented and few can be precisely located. As noted in Section 9.1, SHPO has confirmed that no historic or archeological properties are affected by the Project (Appendix H).

9.4. Identification of Indian Tribes That May Attach Significance to Historic Properties within the Project Boundary or in the Project Vicinity

See Section 11 Tribal Resources.

10. SOCIO-ECONOMIC RESOURCES

10.1. General Land Use Patterns Around the Powerhouse

The Project's physical structures are wholly located within the Village, an urbanized area. The land uses adjacent to the Project consist of residential, commercial, and open space uses.

Photo 9.1 Island House (Photo: ERHP 2009)

Photo 9.2 Island House Bridge (Photo: ERHP 2009)

Recognizing that the area's natural resources are key contributors to its social and economic sustainability, the community wishes to maintain an ecologically sound balance between human activities and the environment (Village of Elk Rapids 2007a).

In 2007, the Village completed a revision of its Master Plan. This revision included the development of new zoning categories for future land use. Under the new zoning scheme, the property on which the Project's physical structures are located has been zoned Conservation/ Recreation. The shores of the Elk River have been rezoned as Mixed Residential, Conservation/ Recreation and Conservation/Residential. This represents a simplification of the former zoning categories around the Powerhouse but does not constitute a major rezoning (Figure 10.1).

10.1.1 Conservation/Recreation.

The land adjacent to the Powerhouse falls within this category. This zone is designed to protect existing recreation property, areas planned for future recreation use, environmentally sensitive areas, and other natural resources. Limited, low intensity recreation development may occur, provided it is consistent with conservation uses and existing recreational uses. Consequently, it is not expected that the lands adjacent to the Powerhouse will be further developed.

10.1.2 Conservation/Residential

This special zone category is intended to protect wetlands and other environmentally sensitive areas. Development in these areas will continue to be restricted by environmental conditions. The south shoreline of the Elk River's north channel well above the Project headrace falls within this category.

10.1.3 Mixed Residential

This zone accommodates higher density residential uses, such as apartments, but limits the maximum recommended density to no more than eight dwelling units per acre. The Elk River shoreline north of Fourth Street lies within this category.

10.1.4 Village Commercial

This zoning category is focused on existing and future retail and service sector businesses. The land across Dexter Road from the Powerhouse falls within this zoning category. This area is currently in transition from a former residential area. The Master Plan recommends preserving the existing street character as the area develops by permitting residential uses to remain, keeping the buildings set back from the street to create a feeling of open space, and focusing on low impact businesses that operate during standard business hours. Landscaping, screening and buffering are also recommended for this area (Village of Elk Rapids 2007a).

10.2. Population Patterns in the Project Vicinity

According to the 2010 Census, the population growth in the Project Vicinity was largely slow to flat, with the exception being Grand Traverse County. However, population growth in Whitewater Township, the only portion of Grand Traverse County within the Project Vicinity, was in line with the rest of the Project Vicinity. Table 10.1 shows population numbers for the Project Vicinity's jurisdictions from the 2000 and 2010 censuses. Growth projections have also been included where available, but based on the most recent population trends, the jurisdictions' projected growth numbers are probably overestimated.

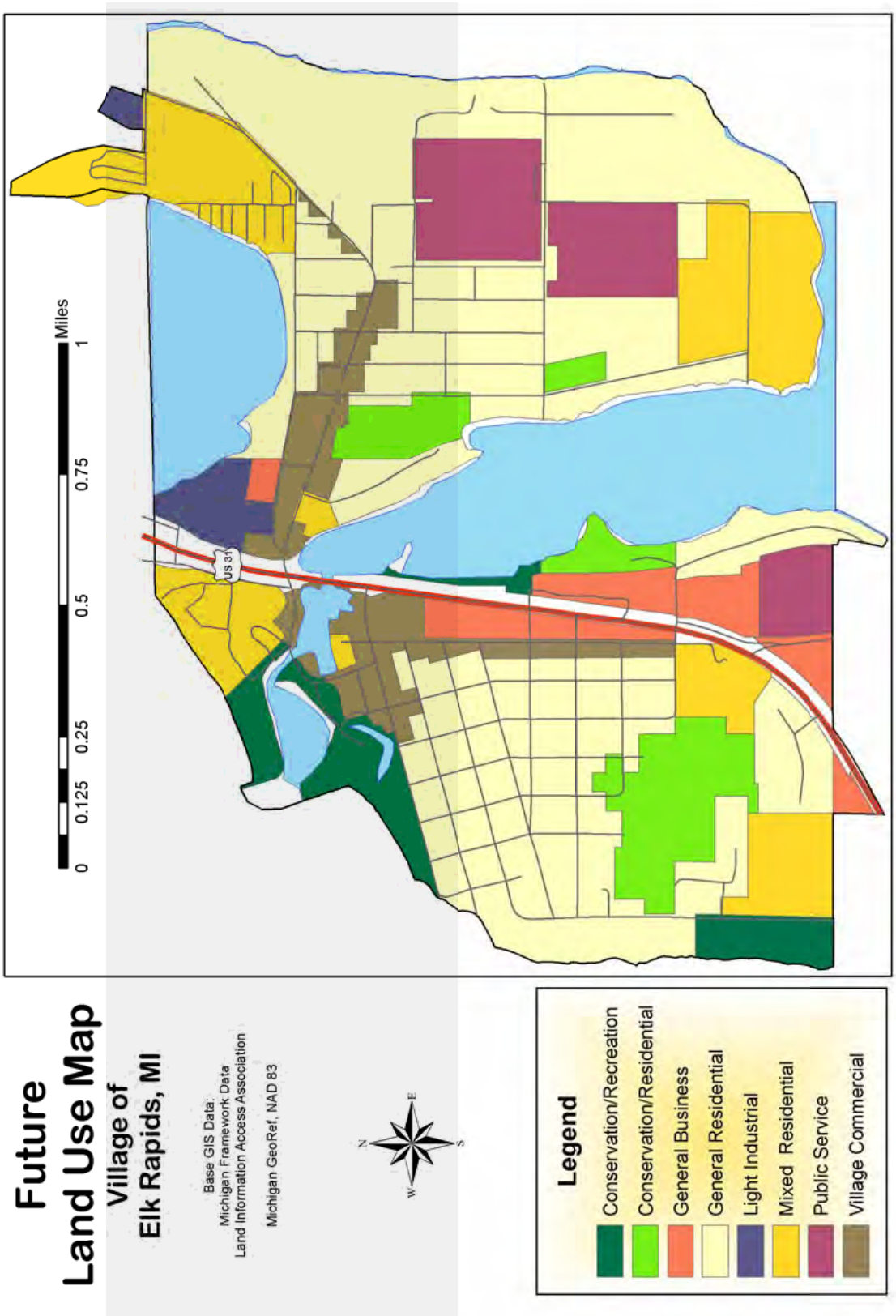


Figure 10.1 Future Land Use Map (Source: Village of Elk Rapids 2007a)

Census data does not give a complete picture of population patterns within the area. Like much of northern Michigan, populations fluctuate seasonally. For example, of the Village's total housing stock, 22.8% is seasonal, recreational or occasional use residences. The numbers for Elk Rapids Township and Antrim County (both of which numbers also include the Village) are 27.5% and 34.1% respectively. Seasonal homes generally have a higher household size of 4-6 people. Based on these assumptions, the County estimates that the residential population in the

Jurisdiction	Population 2000	Population 2010	Projected Population
Antrim County	23,100	23,580	26,000 had been projected for 2010. Thus, the County's population is growing more slowly than projected.
Township of Elk Rapids	2,741	2,631	No projections provided. The Township has lost residents since 2000.
Village of Elk Rapids	1,700	1,700	1,710 had been projected for 2005. While the Village is not losing residents, it is also not growing at present.
Milton Township	2,072	2,204	3,280 is projected for 2020. Based on the rate of growth between 2000 and 2010 (about 6%), this estimate may be high.
Kalkaska County	16,571	17,153	21,153 is projected for 2020. Based on the rate of growth between 2000 and 2010 (about 4%), this estimate may be high.
Clearwater Township	2,382	2,444	2,932 is projected for 2020. Based on the rate of growth between 2000 and 2010 (about 3%), this estimate may be high.
Grand Traverse County	77,654	86,986	127,408 is projected for 2025. Based on the rate of growth between 2000 and 2010 (about 12%), this estimate may be high.
Whitewater Township	2,467	2,597	5,546 is projected for 2025. Based on the rate of growth between 2000 and 2010 (about 5%), this estimate may be high.

Table E.10.1 Past, Current and Projected Populations Around the Impoundment (Source: US Census Bureau 2000 and 2010, Planning Documents from the Jurisdictions 2002-2010)

County, and consequently in the Village, during the summer months roughly doubles (Antrim County 2006). These estimates are in line with what other jurisdictions around the Impoundment have noted in their Master Plans and Recreation Plans (Recreation Study 2012).

The Village population's age distribution roughly reflects that of the Township of Elk Rapids and the County. The population runs slightly older than the state. Working age people (ages 25-44) make up 23.2% of the population and are likely to have school age children at home. About

24.8% of the population is school age children, while empty nesters and middle aged people make up 27.5% of the population. Retirees, the 65 and older age group, make up 19.9% of the population. The population's racial make-up is relatively homogenous and white (Village of Elk Rapids 2007a).

10.3. Sources of Employment in the Project Vicinity

The primary economic generators within the Project Vicinity are tourism, agriculture and manufacturing. Tourist-related businesses and services are the leading industry within Antrim County (Antrim County 2005). Tourism and its associated accommodations, seasonal homes, rentals, services, and recreational activities peak in August, resulting in a cyclical economic employment pattern. According to the Antrim County Economic Development Corporation and Michigan State University, the value of the seasonal tourism business within the County is well over 50 million dollars per year (Antrim County 2006, Michigan State University 2001).

While tourism is an essential component in the regional economy, both Antrim County and the Village wish to develop a stronger year-round business base in order to create a more stable economy. Outside of tourism, manufacturing is a major employment and revenue source within the County. While agriculture employs relatively few people, it is an important revenue source. The County predicts that retail trade will also continue to be an important component in the County's economy (Antrim County 2006). Tables E.10.2 and E.10.3 provide employment and economic value data by industry for the County.

In general, income levels within Northern Michigan fall below those of the state as a whole. Per capita personal income (PCPI) within Antrim County in 2009 was $30,981. This PCPI ranked 32nd out of 83 counties in the state and was 90% of the state average ($34,315) and 78% of the national average ($39,635). This PCPI reflected an increase of 25% from 2000, compared to an increase of 17% for the state and 30% for the nation. PCPI for the Traverse City Micropolitan area (which includes Grand Traverse, Kalkaska, Leelanau, and Benzie Counties) was $34,619 in 2009 (U.S. Department of Commerce 2012).Within the year-round resident population, households within the Village have lower incomes than those within the Township, County or state. The median family income within the Village is $28,529 (Village of Elk Rapids 2009).

In 2011, the annual unemployment rate for Antrim County was 13.1%, compared to 10.3% for the State (U.S. Bureau of Labor Statistics 2012). Statistics for the Village and Township of Elk Rapids are not available. Recessions and unemployment cycles in the area tend to begin earlier than those in the rest of the state and last longer. However, informal conversations with tourism-related business owners suggest that the Village's tourism-based industries have held steady through the current recession, at least as compared to other villages and towns nearby.

The Project itself is a small, but consistent year-round contributor to the local economy. ERHP employs a local farmer as a part-time caretaker; one of ERHP's principals and his wife will also be relocating to the Village. Local businesses and local products are used for restoration, repair and maintenance activities wherever possible. ERHP also contributes to local events and fund raisers. ERHP's estimated yearly contribution to the local economy to date has been about $15,000, a number that will increase over time as the company becomes more entrenched in

CA25N - Total full-time and part-time employment by NAICS industry Antrim County, MI		
	(number of jobs)	
LineCode	**LineTitle**	**2009**
10	Total employment	10838
20	Wage and salary employment	5668
40	Proprietors employment	5170
50	Farm proprietors employment	347
60	Nonfarm proprietors employment 2/	4823
70	Farm employment	497
80	Nonfarm employment	10341
90	Private employment	9044
100	Forestry, fishing, and related activities	(D)
200	Mining	(D)
300	Utilities	(D)
400	Construction	1053
500	Manufacturing	915
600	Wholesale trade	134
700	Retail trade	943
800	Transportation and warehousing	(D)
900	Information	118
1000	Finance and insurance	527
1100	Real estate and rental and leasing	838
1200	Professional, scientific, and technical services	625
1300	Management of companies and enterprises	0
1400	Administrative and waste management services	594
1500	Educational services	(D)
1600	Health care and social assistance	(D)
1700	Arts, entertainment, and recreation	292
1800	Accommodation and food services	1174
1900	Other services, except public administration	684
2000	Government and government enterprises	1297
2001	Federal, civilian	82
2002	Military	43
2010	State and local	1172
2011	State government	90
2012	Local government	1082

Last updated April 21, 2011; (1) Estimates of employment are based on the 2007 North American Industry Classification System; (2) Excludes limited partners; (D) Not shown to avoid disclosure of confidential information, but estimates are included in totals.

Table E.10.2 Employment by Economic Sector, Antrim County (Source: US Department of Commerce 2012)

Economic Sector	Economic Value
Agriculture	$15,854,000
Manufacturing	$202,448,000
Accommodation and Food Service	$24,043,000
Retail Trade	$119,375,000
Education, Health and Social Services	$11,829,000
Arts, Entertainment and Recreation	$6,377,000

Table E.10.3 Economic Value by Sector, Antrim County (Source: Northwest Michigan Council of Governments 2002 and 2002a)

the community and as maintenance of equipment and improvement and renovation of Project structures occur.

10.4. Value of the Project to the Local Economy and Culture

The socio-economic importance of the Project to the local community cannot be overstated and goes a long way to explain why the community overwhelmingly supports the Project's continued operation. According to the local tax jurisdictions, there are 1,262 private riparian owners on Elk and Skegemog Lakes alone, with a total of 1,434 parcels located along the lakes' shoreline when publicly-owned parcels are included. If the Project's dam was removed and the level of Elk and Skegemog Lakes reduced accordingly, many of these properties would lose their waterfront entirely. Homes located near shoreline drop-offs would be less affected, but most homes would suddenly be anywhere from 50 feet to hundreds of yards away from the lakeshore, depending on their parcel's location. The channels between all the lakes below the Bellaire Dam, which currently allow navigation between Elk Lake, Skegemog Lake, Torch Lake, Clam Lake and Lake Bellaire, would become impassable rapids. Removal of the dam would not return the system to pre-development conditions, due to the changes in land use that have occurred over the past 150 years based on the expectation that the dam would remain in place. In order to maintain any recreation on the lakes, a massive infrastructure investment would be required to relocate boat ramps, access points, private docks, and the like.

At the County's request, Mr. William White, the tax assessor for Elk Rapids Township, selected ten riparian properties on Elk Lake that he believed represented a fair cross section of typical homes and properties bordering the Elk and Skegemog Lakes. Mr. White compared these properties to similar properties that are not located on Elk Lake in order to calculate how much of a riparian home's property value derives from its waterfront location on Elk Lake (Table E.10.4).

For a community the size of Elk Rapids, the dollar amounts are staggering. The figures show a decrease of over $533,000,000 in total property values for all private riparian properties along the lake, were these properties to lose their lakefront locations. In discussing his figures, Mr. White observed that it was important to note that the sampling was done on assessed values, which are customarily less than actual market value. Consequently, he believes the loss of value would be much greater than his sampling suggests. The waterfront properties in public ownership are also not included in these calculations.

	Current Assessed Value	Assessed Value without Waterfront	Property Value Decrease	Property Value Decrease (by %)
Property #1	$868,795.00	$346,539.00	$522,256.00	60.11%
Property #2	$660,620.00	$277,059.00	$383,561.00	58.06%
Property #3	$705,521.00	$197,938.00	$507,583.00	71.94%
Property #4	$425,998.00	$138,821.00	$287,177.00	67.41%
Property #5	$1,268,556.00	$417,661.00	$850,895.00	67.08%
Property #6	$384,834.00	$107,326.00	$277,508.00	72.11%
Property #7	$658,850.00	$203,408.00	$455,442.00	69.13%
Property #8	$457,298.00	$87,448.00	$369,850.00	80.88%
Property #9	$317,987.00	$124,233.00	$193,754.00	60.93%
Property #10	$518,233.00	$141,171.00	$377,062.00	72.76%
AVERAGES	**$626,669.20**	**$204,160.40**	**$422,508.80**	**68.04%**
Average Decrease in Parcel Value			**$422,508.80**	
Number of Riparian Properties			**1262**	
TOTAL RIPARIAN VALUE ELIMINATED			**$533,206,105.60**	

Table E.10.4 Property Value Contributed by Shoreline Location on Elk Lake (Source: White 2009)

Publicly owned recreational facilities in the area are discussed in Section 7.8. However, the majority of the recreational activity within the area occurs in the private sector. Virtually all the waterfront homes on Elk and Skegemog Lakes, plus the thousands of additional waterfront homes on Torch Lake, Clam Lake and Lake Bellaire, maintain at least one boat and dock. Dozens of waterside businesses are distributed throughout the area that cater to these boaters, including marinas, restaurants, gas stations, convenience stores, and tackle shops. Five villages and settlements maintain transient slips for boaters within walking distance to their commercial districts and hold regular festivals and events to attract crowds.

For those boaters who don't live on the lakes or have their own dock, the marinas offer approximately 520 slips for seasonal rental. In addition, the marinas offer another 650 indoor dry racks and even more outdoor boat storage for customers who only use their boats periodically. Each marina, as well as a number of off-water companies who use public boat launches, rent a variety of watercraft. Based on an informal survey of rental operators, over 2,300 rental days are transacted in the area each boating season.

The marinas also offer new and used boats for sale, sell fuel, and offer boat and engine service, dock and hoist sales and service, and ship stores. The four major marinas alone employ 35 full-time employees and 43 part-time employees in an average year. Although some of the boating activity would continue even in the event of a drop of in lake levels due to the loss of the Project dam, none of the existing marinas would be able to operate in their current locations. Every commercial waterfront parcel in the chain of lakes below the Bellaire Dam, including those adjacent to the village commercial districts, are located in areas where boaters would be unable to dock nearby without the maintenance of the legally established lake level, and boater-generated commerce would be effectively eliminated in these villages.

In short, the disruptive effect of the loss of the Project dam would deeply damage the desirability of the region as a recreational destination and reverberate through every sector of the local and regional economy. Thousands of local residents rely on the economic activity generated by waterfront residents and vacationers for their livelihood. The local tourism dependent economy has, for all practical purposes, grown up around the dam since the mid-nineteenth century. As expressed in the resolution passed unanimously by both the Village and the Township of Elk Rapids, it is a matter of public policy that "the hydroelectric operation at the Elk Rapids Dam directly supports the good maintenance and upkeep" of this critical facility.

11. TRIBAL RESOURCES

There are two local tribes in the area, the Ottawa (Odawa) and the Chippewa (Ojibwa). Both tribes are now incorporated under the Grand Traverse Band of Ottawa and Chippewa Indians, which was officially recognized by the federal government in 1980.

There are no federal or Indian reservation lands within the Project Boundary, nor are there any sites of tribal significance. Additionally, the Project's operation does not affect tribal cultural or economic interests.

However, the Project Vicinity and larger watershed are rich in historic gathering places, nomenclature, culture, and artifacts relating to the area's Native American inhabitants. Evidence of early peoples in the ERCOL dates back to 8000-1000 BC. From 1000 BC – 1650 AD, the ERCOL marked the northern end of the Hopewellian Tradition, a culture of Native American peoples that had extensive trading routes and bartering systems across the region (Cleland 1992). The ancestors of the Ottawa and Chippewa were known as the Anishnaabek, or "true," "first", or "original people." They were fishermen, trappers and hunters, but also farmers who cultivated corn, beans, pumpkins and potatoes. Skegemog Point, which is the south point that forms the Narrows between Elk Lake and Skegemog Lake, was a favored landing, gathering and camping site. The Point contains several 3-5 feet high burial mounds (Ruggles 1998).

Around 1890, Frank Samels, one of the early white settlers, bought Skegemog Point. While farming over the years, he turned up many arrow points, axe heads and other artifacts. Starting in the 1920s, Wilbert Hinsdale of the University of Michigan began investigating and documenting the site. This work was continued by Charles Cleland of Michigan State University in 1965. In 1972, Skegemog Point was placed on the National Register of Historic Places for its significance in tribal culture and history. The Samels farm is designated a Centennial Farm and has an extensive collection of antique farming equipment. The property is managed by the Samels Family Heritage Society with a lease agreement with the Archaeological Conservancy (Grand Traverse Regional Community Foundation 2009).

Many locations within the area retain their original Indian names, including Skegemog (meeting of the waters) and Meguzee Point (from Ojibwa Chief Megisee - eagle). Torch Lake is a translation of Was-wa-gon-ong (place of the torches). Much notice went with the death of Chief Ke-Way-Din (northwest wind) in 1884. He was renowned in the area as a great hunter and was also present at the Battle of Frenchtown on the River Raisin in 1813. He lived in the Indian village of We-qua-ge-mog at the north end of Elk Lake. This village was renamed in his honor and is now known today as the Village of Kewadin.

The Grand Traverse Band also owns a 78 acre parcel about a mile east of Elk Lake that they are developing for residences. Currently, four families have built homes there. The U.S. Department of the Interior announced in December, 2009 that this parcel will be taken into trust for the Grand Traverse Band, thus expanding the reservation and allowing 22 additional housing sites for tribal members (Bailey 2009).

12. GEOLOGICAL FEATURES AND SURFICIAL GEOLOGY

12.1. Bedrock Geology

Bedrock within the Project Boundary and the surroundiing area is Ellsworth Shale. Bedrock in the southern portion of the Project Vicinity below Skegemog Lake is Antrim and Coldwater Shales (Figure E.12.1). The bedrock layers have the following characteristics (Nicholson 2004):

Ellsworth Shale. Averages about 152m thick in the westernmost parts of the basin, but elsewhere it is typically 91-152m thick. Predominantly a silty shale of gray, greenish gray or more commonly green color. Siltstone and sandstone are minor components and are most abundant in the westernmost and southwestern parts of the basin.

Antrim Shale. Dark gray or brown to largely black, highly carbonaceous, thinly laminated shale with meager fossil content except for profuse algal spores. Large dark brown, bituminous and pyritic limestone concretions occur in the lower Antrim and are typically from 9.6-1.5m in diameter.

Coldwater Shale. The Coldwater conformably overlies the Ellsworth Shales. Fossils in the uppermost portion of the Coldwater in the western part of the basin are Osagean in age. Maximum thickness is about 168m in the western third of the basin. The unit consists predominantly of gray to bluish gray shale. Its clay minerals are chiefly illite and kaolinite with minor chlorite. Other lithologies occur in the Coldwater and their distributions divide the formation into distinct eastern and western facies. In the western half of the basin, the Coldwater shales are more calcareous and beds of glauconitic, fossiliferous limestone and dolostone occur frequently, especially in the middle and upper portions of the formation. Two marker beds can be traced over long distances: the Lime and the Red Rock beds. The Lime occurs throughout the western part of the basin and is commonly 6-10m thick. The Red Rock is more extensive and occurs in all parts of the basin except the extreme northeast. It is typically 3-6m thick and locally reaches 15m.

12.2. Surficial Geology

Surficial geology south of the Project is broad moraine ridges, till plains or upland drumlin fields of medium-textured glacial till, composed of non-sorted glacial debris, with a predominantly loam and silt loam texture and variable amounts of cobbles and boulders. Surficial geology north of the Project and around much of Elk and Skegemog Lakes is flat lake plain with sandy, loamy sand or sandy loam with lacustrine sand and gravel. The shoreline at the southern ends of both lakes is flat lake plain of very poorly drained peat or muck (Figure E.12.2).

Surficial geology at the Project site consists of end moraines of medium textured till and lacustrine sand and gravel (Antrim County 1981).

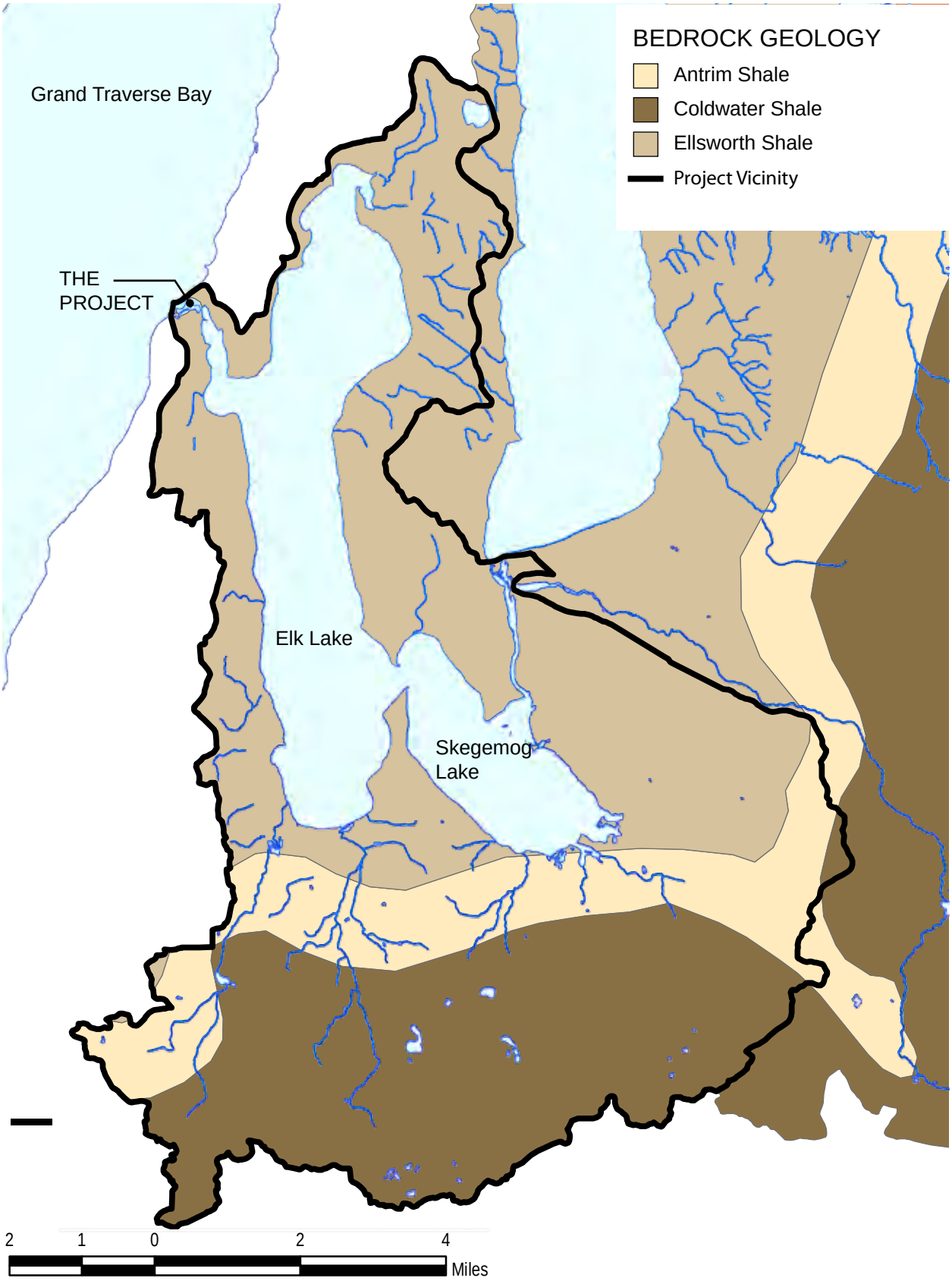


Figure E.12.1 Project Vicinity Bedrock Geology (Data Source: MGDL 2009)

12.3. Soils

Soils within the Project Vicinity tend to be sandy, acidic and low in fertility. The predominant upland soils are Emmet-Montcalm complexes, Kalkaska-Montcalm complexes, and Emmet-Onaway sandy loams. These soils are well-drained and nearly level to very steep, sandy soils on hills, ridges and knolls. Tawas-Ensley-Roscommon complexes are common along the rivers, streams and riparian areas around the lakes. These soils are very poorly drained, nearly level, mucky, loamy and sandy soils in depressions on plains (Natural Resources Conservation Service 2009). A soil map has been provided for the areas adjacent to the Project Powerhouse (Figure E.12.3). A soil map has not been provided for the Project Vicinity as a whole because the area covered is too large to be legible at the scale of this document. The major soil types in the Project Vicinity are described in more detail below (Table E.12.1).

Soils along the Elk River near the Project are primarily sands and loamy sands (Figure E.12.4). Soils adjacent to the Project within the Village consist of a number of well-drained, sloped areas with wet pockets in the lower lying areas. Village soils are dominated by Deer Park Sand. Soils at the Project site are Deer Park Sand (Table E.12.1), 2%-20% slopes and almost entirely granular in nature, with the exception of a few swampy areas (Antrim County 1981).

The Impoundment consists of Elk and Skegemog Lakes, which are two natural lake formations. The land mass between the Powerhouse and the Bypass spillway is about 400 feet long and forms a natural barrier about 250 feet wide between Elk River and Grand Traverse Bay. The shoreline along the Project headrace is armored on both sides with a concrete wall from the Powerhouse to about 100 feet upstream. The concrete wall on the south side of the headrace then adjoins a 460 foot long sheet steel piling wall (SSP) which wraps two sides of the land mass that splits the Project headrace off from the south fork of the Elk River. The shoreline of the south fork of the Elk River is armored on both sides with SSP for about 130 feet running downstream until it reaches the Bypass spillway (see Figure E.12.5).

Soil borings were drilled in connection with the installation of the SSP described above. The installation of the 460 foot SSP took place in 1988. Soil borings were done in three locations (Figure E.12.5). TH1 is at the Dexter Street Bridge, TH2 is at the point between the headrace and the Elk River, and TH3 is at Dexter Street adjacent to the Bypass spillway. The soil boring reports indicated that clay and penetration resistance was reached at about 15 feet (Figures E.12.6–E.12.8).

The second soil boring tests were conducted in 1994 in two locations (SB1 and SB4) in connection with the installation of the 130 SSP along the south fork of the Elk River. Borings were done along Dexter Street about 40 and 80 feet south of the Bypass spillway. The soil borings reports (Figures E.12.9 and E.12.10, with a composite in Figure E.12.11) show that penetration resistance and clay formations occur at about 25 feet.

These borings results indicate that the land mass between the Powerhouse and the south fork of the Elk River and on both sides of the Bypass spillway is stable, impermeable and able to contain the Impoundment.

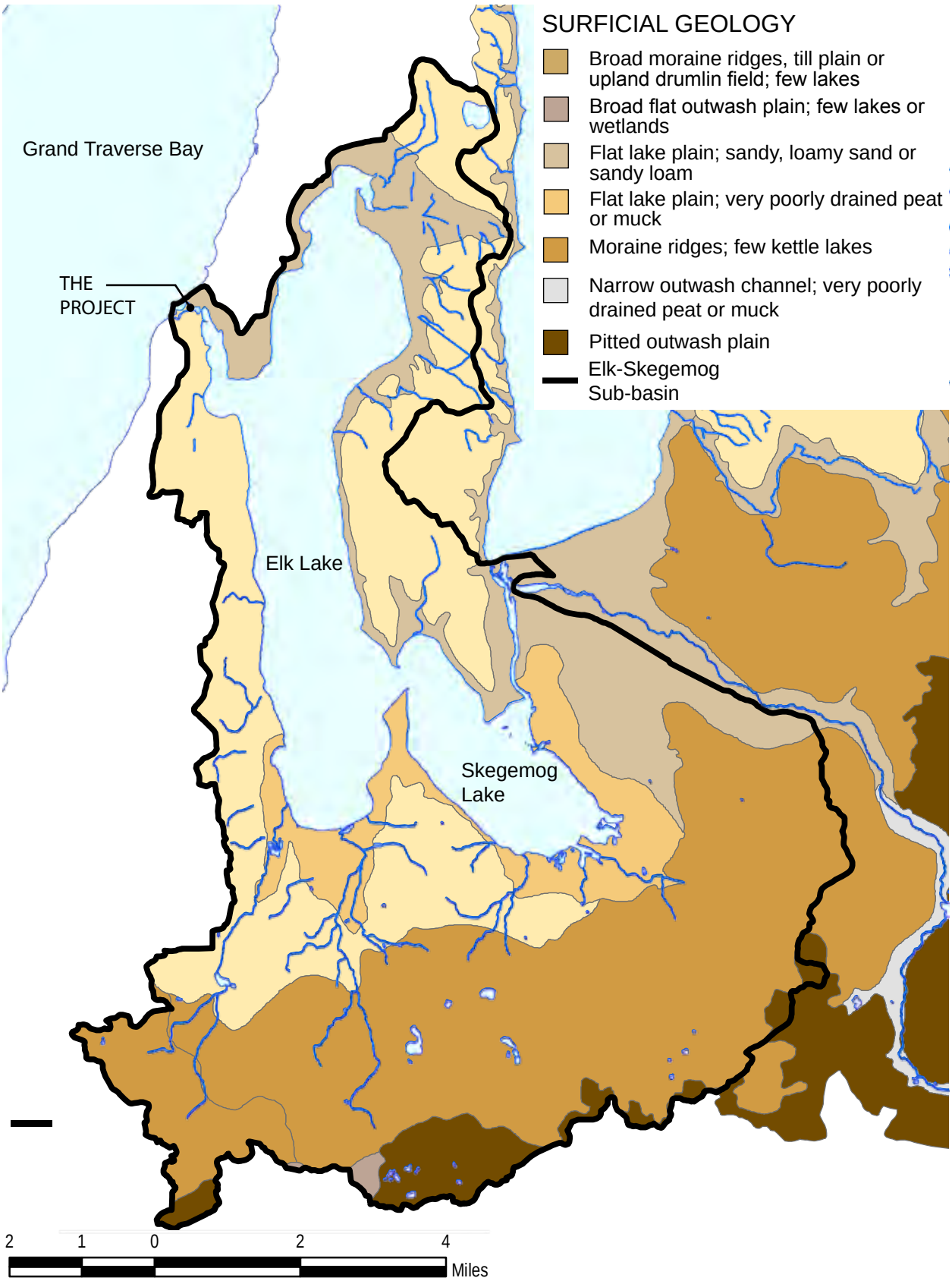


Figure E.12.2 Project Vicinity Surficial Geology (Data Source: MGDL 2009)

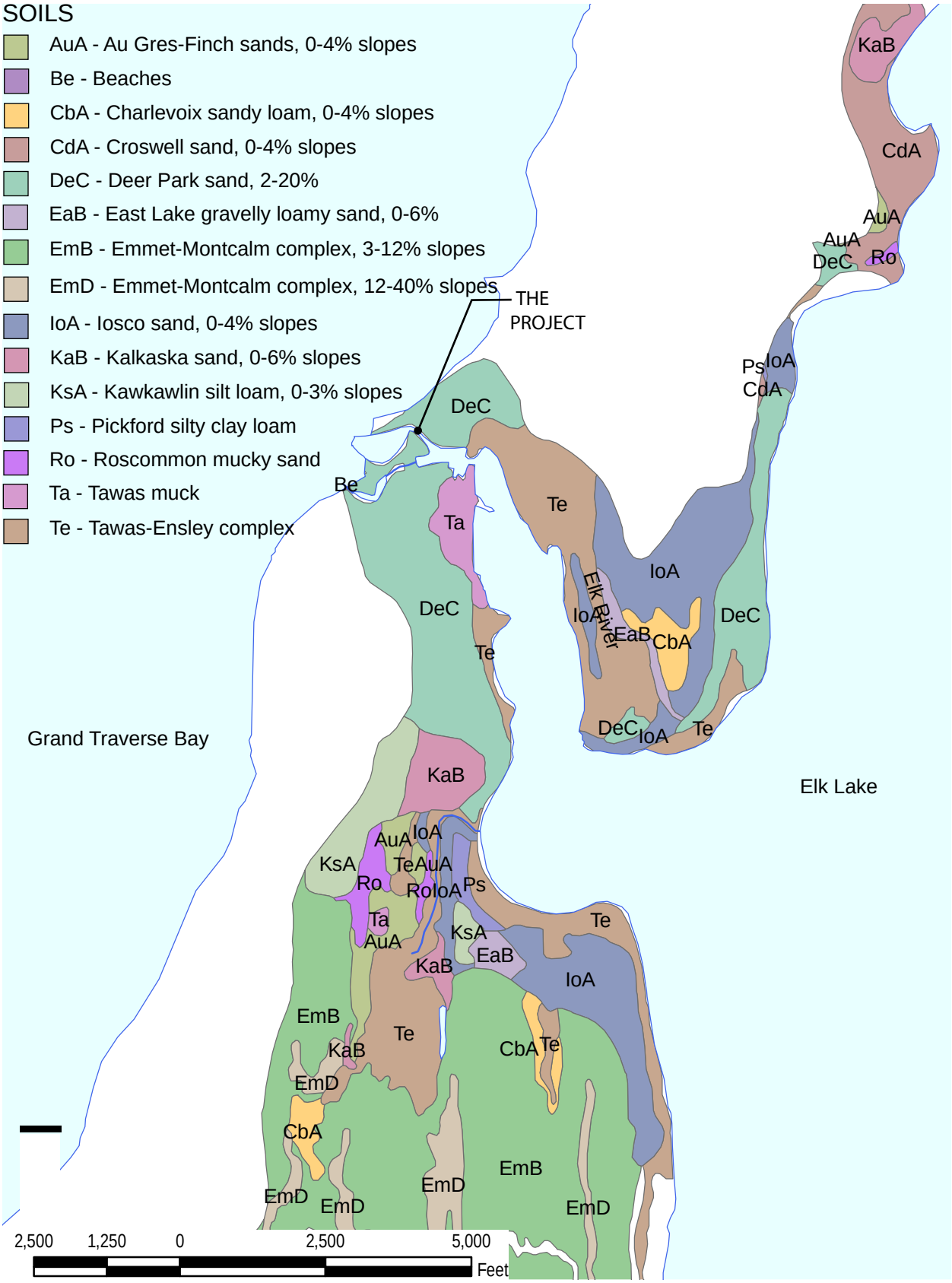


Figure E.12.3 Soils Near the Project (Data Source: Antrim County 2009)

EmB - Emmet-Montcalm Complex, 3-12% slopes; EmD - Emmet-Montcalm Complex, 12-40% slopes	
General Description	Gently sloping and moderately sloping, well drained and moderately well drained soils on upland hilltops. Drainageways and steeply sloping areas dissect many areas of these soils. Individual areas range from 40-100 acres or more in size and are made up of about 40% Emmet soils and 40% Montcalm soils.
Surface layer	Emmet Soils: 4 inches - black sandy loam Montcalm Soils: 3 inches - pinkish gray loamy sand
Subsurface layer	Emmet Soils: 3 inches - light brownish gray loamy sand
Subsoil Layer	Emmet Soils: 34 inches. Upper - multicolored, friable loamy sand; Middle- pinkish gray, very friable loamy sand and reddish brown, friable sandy loam; Lower - reddish brown, friable sandy clay loam. Montcalm Soils: 46 inches. Upper - multicolored, very friable loamy sand; Lower - thin, interbedded layers of light yellowish brown, very friable loamy sand and reddish brown, firm sandy loam.
Substratum	Emmet Soils: light brown, friable sandy loam Montcalm Soils: brown, friable loamy sand
Permeability	Emmet Soils: moderate Montcalm Soils: rapid
Available Water Capacity	Moderate
Runoff	Medium
Soil Reaction (ph)	6.1-6.5
Erosion Hazard	Low (K factor 0.2)
Depth to Water table (ft)	Emmet Soils: >2.5, Jan-April
	Montcalm Soils: >6.0
Depth to Bedrock	More than 60 inches
Potential for Frost Action	Emmet Soils: Moderate
	Montcalm Soils: Low
Shrink/Swell Potential	Low
Flooding Hazard	None

EoB - Emmet-Onaway Sandy Loams, 3-12% slopes	
General Description	Gently sloping and moderately sloping, well drained and moderately well drained soils on upland ridgetops. Steep areas dissect many areas of these soils. Individual areas are 40-100 acres or more in size and are made up of about 50% Emmet soils and 30% Onaway soils.
Surface layer	Emmet Soils: 4 inches - black sandy loam Onaway Soils: 8 inches - very dark grayish brown sandy loam
Subsurface layer	Emmet Soils: 3 inches - light brownish gray loamy sand
Subsoil Layer	Emmet Soils: 34 inches. Upper - reddish brown, friable sandy loam; Middle - pinkish gray, very friable loamy sand and reddish brown, friable sandy loam; Lower - reddish brown, friable sandy clay loam. Onaway Soils: 15 inches. Upper - dark brown and brown, very friable fine sandy loam; Lower - reddish brown, firm clay loam

Table E.12.1 Soils within the Project Vicinity (Source: National Cooperative Soil Survey 1978)

EoB - Emmet-Onaway Sandy Loams, 3-12% slopes (cont'd)	
Substratum	Emmet Soils: light brown, friable sandy loam Onaway Soils: light brown, firm loam
Permeability	Emmet Soils: moderate Onaway Soils: moderate to moderately slow
Available Water Capacity	Emmet Soils: moderate Onaway Soils: high
Runoff	Medium
Soil Reaction (ph)	Emmet Soils: 6.1-6.5 Onaway Soils: 2.0-6.0
Erosion Hazard	Low (K factor 0.2)
Depth to Water table (ft)	Emmet Soils: >2.5, Jan-April Onaway Soils: >2.5, March-May
Depth to Bedrock	More than 60 inches
Potential for Frost Action	Moderate
Shrink/Swell Potential	Low
Flooding Hazard	None

KmB - Kalkaska Montcalm Complex, 0-12% slopes, KmD - Kalkaska Montcalm Complex,12-40% slopes	
General Description	0-12% slopes areas are nearly level to moderately sloping, somehwat excessively drained and well drained soils on uplands. Some areas have simple slopes while some have complex slopes. This complex is commonly on hilltops, in valleys between hills and on foot slopes of steep hills. Areas are 20-80 acres or more in size and most are irregularly shaped. 12-40% sloped areas are strongly sloping and rolling to steep, somehwat excessively drained and well drained soils on uplands. Areas are about 40-100 acres or more in size and in most places are irregularly shaped. This complex is about 40% Kalkaska soils, 30% Montcalm soils and 30% other soils.
Surface layer	Kalkaska Soils: 1 inch - black sand Montcalm Soils: 3 inches - pinkish gray loamy sand
Subsurface layer	Kalkaska Soils: 7 inches - light brownish gray
Subsoil Layer	Kalkaska Soils: 26 inches. Upper: dark reddish brown and yellowish red, very friable sand; Lower - yellowish brown, loose sand Montcalm Soils: 46 inches. Upper: multicolored, very friable loamy sand; Lower - thin, interbedded layers of light yellowish brown, very friable loamy sand and reddish brown, firm sandy loam.
Substratum	Kalkaska Soils: light yellowish brown loose sand Montcalm Soils: brown, friable loamy sand
Permeability	Rapid
Available Water Capacity	Kalkaska Soils: low Moncalm Soils: moderate
Runoff	Slow

Table E.12.1 Soils within the Project Vicinity, cont'd (Source: National Cooperative Soil Survey 1978)

KmB - Kalkaska Montcalm Complex, 0-12% slopes; KmD - Kalkaska Montcalm Complex, 12-40% slopes (cont'd)	
Soil Reaction (ph)	Kalkaska Soils: 4.5-6.0 Montcalm Soils: 5.1-6.5
Erosion Hazard	Low (K factor 0.15/0.17)
Depth to Water table (ft)	>6
Depth to Bedrock	More than 60 inches
Potential for Frost Action	Low
Shrink/Swell Potential	Low
Flooding Hazard	None
Ro - Roscommon Mucky Sand	
General Description	Nearly level, poorly drained and very poorly drained soil on lowlands. It is in depressions and adjacent to bogs and waterways. This soil is subject to frequent flooding. The areas are commonly 10 to 40 acres or more in size.
Surface layer	5 inches - black mucky sand
Substratum	to 60 inches - multicolored loose sand
Permeability	Rapid
Available Water Capacity	Low
Runoff	Very slow or ponded
Soil Reaction (ph)	6.1-7.8
Erosion Hazard	Low (K factor 0.17)
Depth to Water table (ft)	0-1, Sept.-June
Depth to Bedrock	More than 60 inches
Potential for Frost Action	Moderate
Shrink/Swell Potential	Low
Flooding Hazard	Frequent, brief, Sept.-May

Te - Tawas-Ensley Complex	
General Description	Nearly level, poorly drained and very poorly drained soils in swamps and waterways. Subject to frequent flooding. Invididual areas range from 80-200 acres or more in size.
Surface layer	Tawas Soils: 16 inches - black muck Ensley Soils: 8 inches - very dark gray mucky sandy loam
Subsoil Layer	Tawas Soils: 15 inches - dark reddish brown muck Ensley Soils: 28 inches. Upper - light brownish gray, mottled, very friable sandy loam; Lower: light reddish brown, mottled, firm loam.
Substratum	Tawas Soils: grayish brown sand. Ensley Soils: to 60 inches - light brownish gray sandy loam and pale brown gravelly loamy sand.

Table E.12.1 Soils within the Project Vicinity, cont'd (Source: National Cooperative Soil Survey 1978)

Te - Tawas-Ensley Complex (cont'd)	
Permeability	Tawas Soils: moderately slow to moderately rapid in muck layers, rapid in the underlying sand Ensley Soils: moderately slow to moderately rapid in muck layers, moderate in the underlying sand
Available Water Capacity	Tawas Soils: high Ensley Soils: moderate
Runoff	Slow to ponded
Soil Reaction (ph)	Tawas Soils: 4.5-8.4 Ensley Soils: 6.1-8.4
Erosion Hazard	Tawas Soils: None (K factor 0) Ensley Soils: Low (K factor 2.0)

DeC - Deer Park Sand, 2-20 % slopes	
General Description	Gently sloping to moderately steep, excessively drained soil on ridges adjacent to Lake Michigan. Areas are commonly irregularly shaped and more than 10 acres in size.
Surface layer	9 inches - light gray sand
Subsoil Layer	Multicolored loose sand
Substratum	Multicolored loose sand
Permeability	Rapid
Available Water Capacity	Low
Runoff	Slow
Soil Reaction (ph)	5.1-6.5
Erosion Hazard	Low (K factor 0.15)
Depth to Water table (ft)	>6.0
Depth to Bedrock	More than 60 inches
Potential for Frost Action	Low
Shrink/Swell Potential	Low
Flooding Hazard	None

Table E.12.1 Soils within the Project Vicinity, cont'd (Source: National Cooperative Soil Survey 1978)

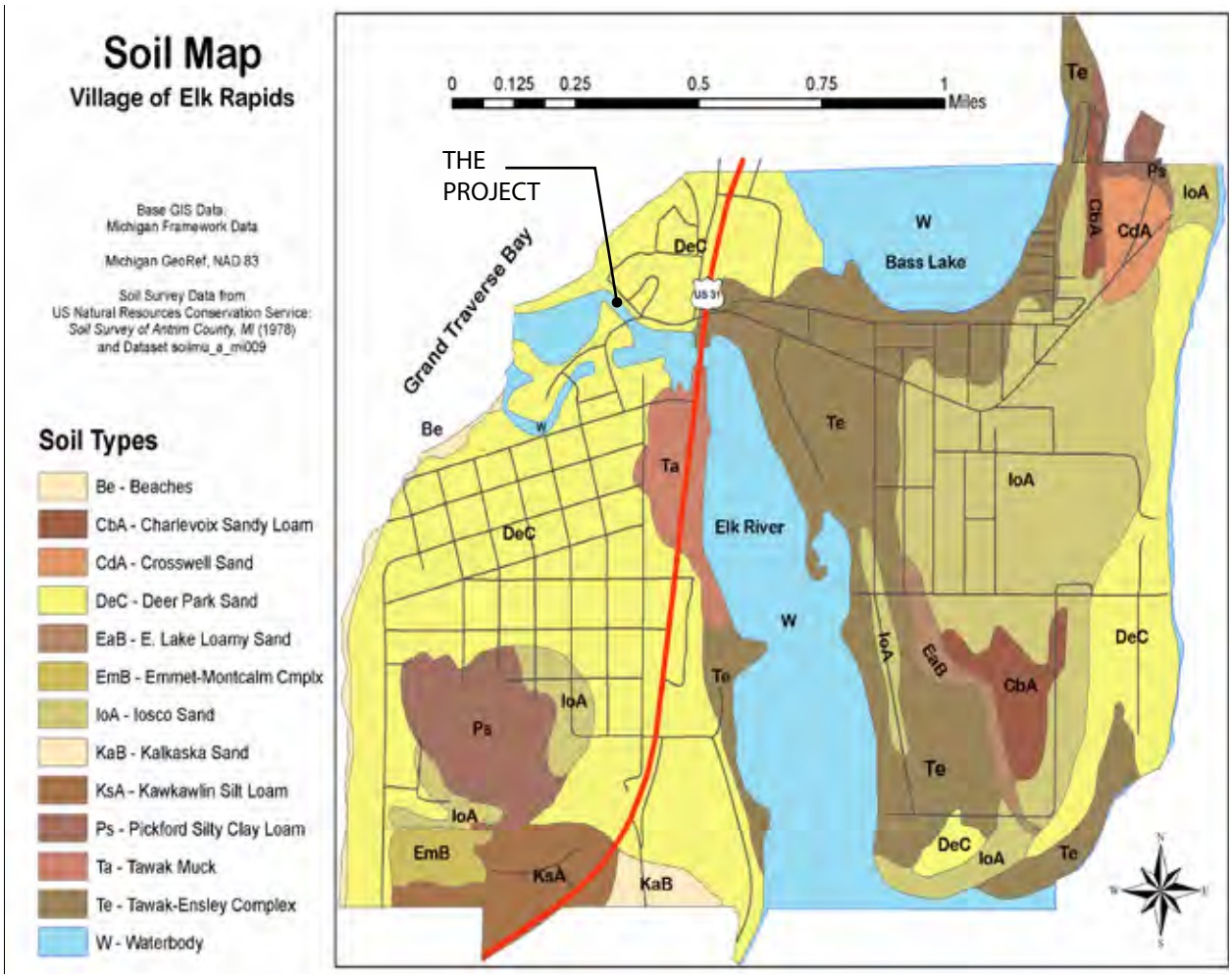


Figure E.12.4 Soils within the Village of Elk Rapids (Source: Village of Elk Rapids 2007)

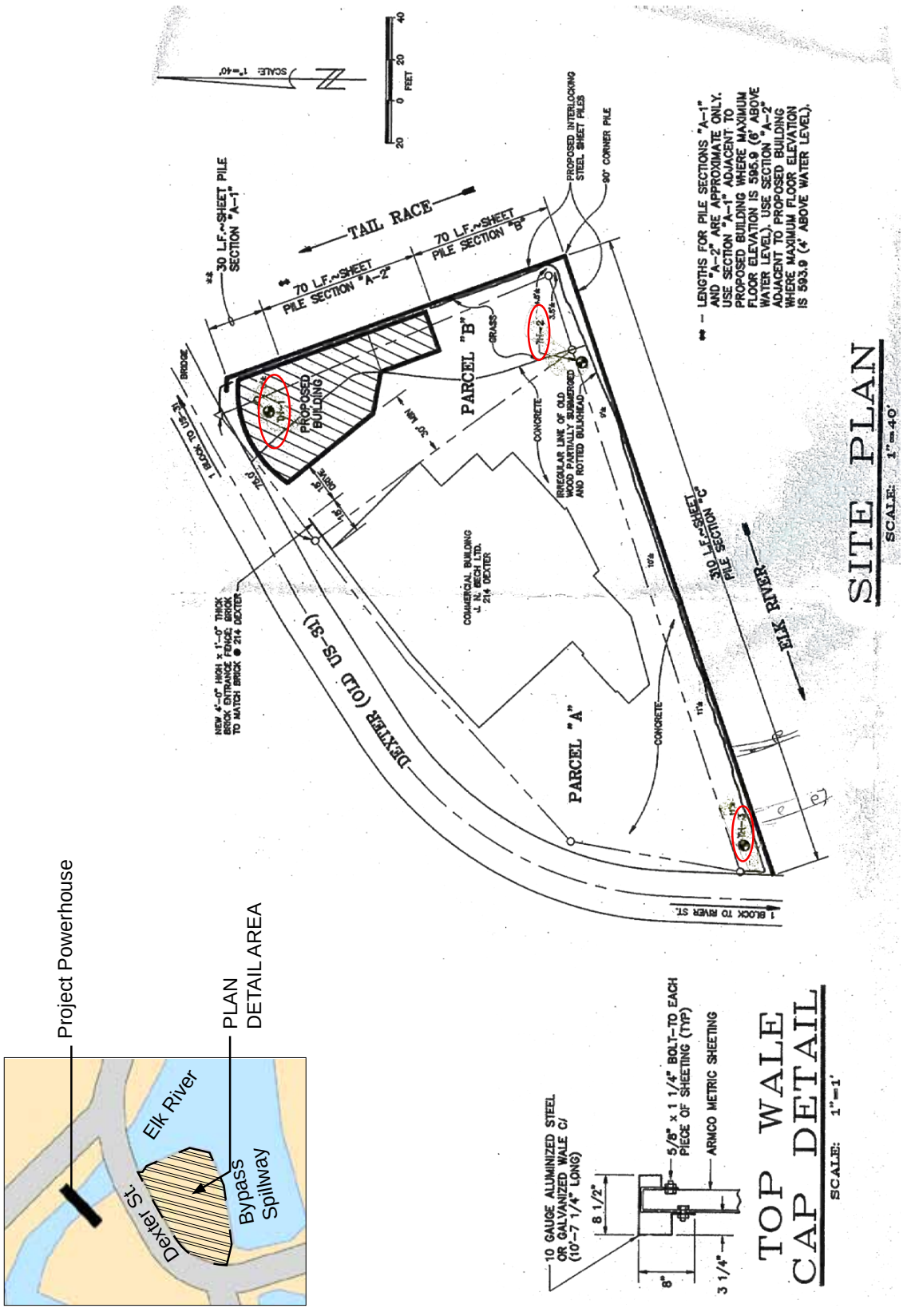


Figure E.12.5 Location of Soil Boring Tests TH-1 to TH-3 (Source: Gosling, Czubak 1988, ERNP 2012)

Gosling Czubak Associates

Engineers
Surveyors

Gosling Czubak Associates, P.C.
525 West Fourteenth
Traverse City, MI 49684
616 946-9191

PROJECT Proposed Seawall
LOCATION Elk Rapids
CLIENT Johan Bech

DATE STARTED 6-20-88
DATE COMPLETED 6-20-88
DRILLER BRK HELPER JH

BORING NO. 1
Ground Surface Elev. 595 +-
Plugging Method Excavated soil

Weather Clear and hot
Water Data 5.5' +-
Job Number 88023.01

DEPTH	SAMPLE	SAMPLING METHOD	PENETRATION RESISTANCE	SOIL CLASSIFICATION
				Black sandy topsoil & stone (fill)
5			23-8-7	Brown medium SAND
10			4-8-7	
				Gray medium SAND, trace CLAY
15			5-5-4	Gray CLAY, trace SAND
20			10-14-18	
25			8-8-14	

Figure E.12.6 Soil Boring Results (Source: Gosling, Czubak 1988)

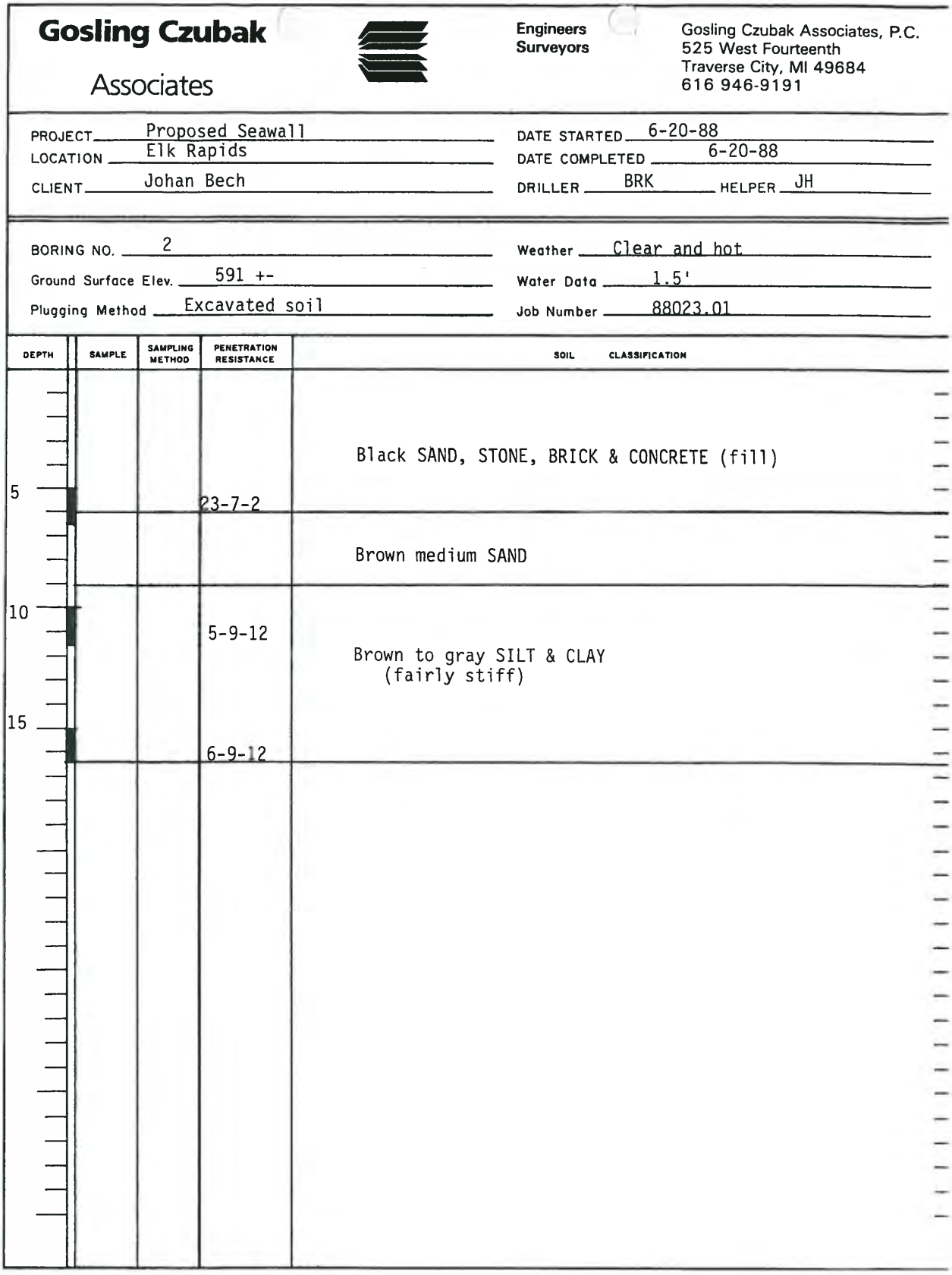


Figure E.12.7 Soil Boring Results (Source: Gosling, Czubak 1988)

Gosling Czubak Associates

Engineers
Surveyors

Gosling Czubak Associates, P.C.
525 West Fourteenth
Traverse City, MI 49684
616 946-9191

PROJECT Proposed Seawall
LOCATION Elk Rapids
CLIENT Johan Bech

DATE STARTED 6-20-88
DATE COMPLETED 6-20-88
DRILLER BRK HELPER PAC

BORING NO. 3
Ground Surface Elev. 592+-
Plugging Method Excavated soil

Weather Clear and hot
Water Data 2.5' +-
Job Number 88023.01

DEPTH	SAMPLE	SAMPLING METHOD	PENETRATION RESISTANCE	SOIL CLASSIFICATION
				4" Concrete
				Black SAND & STONE, CINDERS (fill)
5			6-2-2	Brown medium SAND
10			2-6-5	
15			4-9-15	Gray CLAY, trace SILT, trace SAND (fairly stiff)

Figure E.12.8 Soil Boring Results (Source: Gosling, Czubak 1988)

12.4. Shorelines and Topography

Topography within the Project Vicinity is generally low, ranging from flat marshy areas to rolling hills. The lowest elevation is about 580 feet above sea level along the shore of Lake Michigan; the highest elevations are patches of steep areas about 1,100 feet above sea level located in the southeast part of the Project Vicinity (Figure E.12.12).

About 80% of the shorelines of Elk and Skegemog Lakes are developed (USGS 2009a). Most of this development is seasonal homes and second homes. As a result, these shorelines have been highly modified from natural conditions, although there are extensive wetlands along portions of the shorelines.

Slopes along the shoreline of Skegemog Lake generally range between 0% and 12% (Figure E.12.13). Over seven miles of the eastern shoreline is the Skegemog Swamp, one of the largest wetland complexes in the region. This state-owned area is known as the Skegemog Lake Wildlife Area and managed by MDNR.

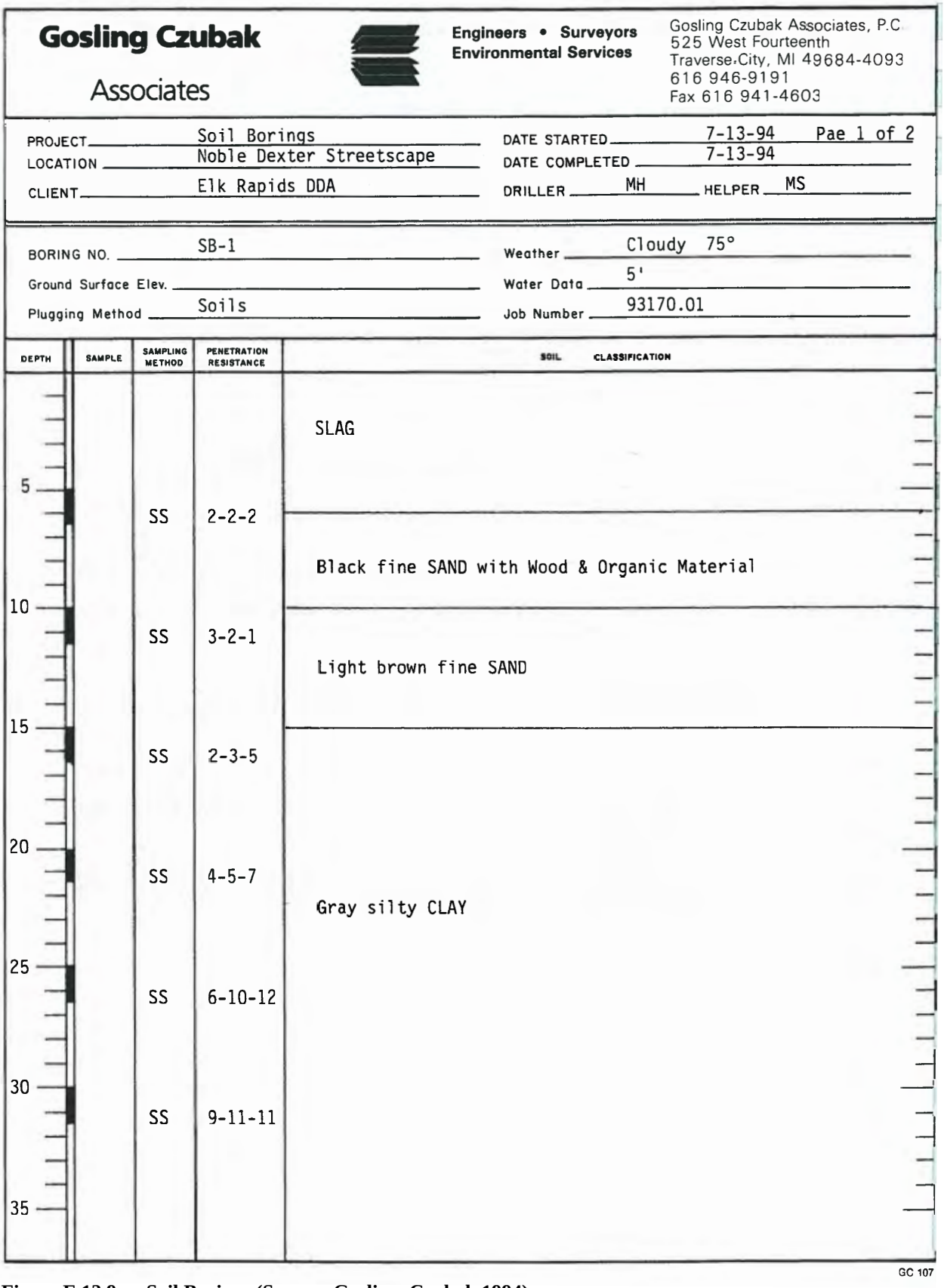
Slopes along the eastern edge of Elk Lake are generally steeper than the rest of the lake's shoreline (>12% vs. 2-12%). Elk Lake has extensive wetland complexes along the northeast shore near Kewadin and around Battle Creek along the southwest shore (Figures E.12.14 and E.12.15).

The Project sits on the low, flat bluffs of the Elk River (Figure E.12.16). Between Spencer's Bay in Elk Lake and the Project site, the Elk River is crossed by three bridges (U.S. 31, Dexter Street, and Cedar Street) as it winds through the Village. About a mile of the river's south shore along Millers Park Road contains wetlands. The water is very shallow and there are many stumps from the trees that were flooded when the first dam was constructed in the 1850s. The rest of Elk River's shorelines are primarily concrete retaining walls and rip rap. Residential and commercial development cover the river's north shore, as well as the south shore below Miller Park Road. The shoreline immediately upstream and downstream of the powerhouse is completely armored to protect against erosion (Photo E.12.1 and E.12.2). The shoreline on the south side of the river, beyond the tailrace, transitions from gently sloping lawn to cobble and sand beach with slopes of about 3-7%, while the shoreline on the north side below the tailrace is composed of sloping rip-rap on slopes of about 5-9% (Photo E.12.2).

Erosion and flooding due to Project operations are not a concern as the lake levels are maintained year round. According to Antrim County's Soil Erosion Officer, there are no problems with mass soil movement. This is due to two facts: (1) the lakes and rivers have had 150 years to adjust to the dam's presence, and (2) virtually all the shorelines are developed, with individual property owners protecting their shorelines against erosion. Were the Project to cease operation and the dam to be removed, there would be large amounts of mass soil movement and extensive erosion and sedimentation until the channel stabilized. (Lang 2009, Brown 2009).

13. DESCRIPTION OF EXPECTED ENVIRONMENTAL IMPACTS (18 CFR §4.61(d)(2))

There are no expected enviornmental impacts from the Project's continued operation. As noted with respect to particular resources below, the Project's operation is generally considered to help preserve and sustain the ERCOL's unique environmental resources.



Gosling Czubak
Associates

Engineers • Surveyors
Environmental Services

Gosling Czubak Associates, P.C.
525 West Fourteenth
Traverse City, MI 49684-4093
616 946-9191
Fax 616 941-4603

PROJECT: Soil Borings
LOCATION: Noble Dexter Streetscape
CLIENT: Elk Rapids DDA

DATE STARTED: 7-13-94 Pae 1 of 2
DATE COMPLETED: 7-13-94
DRILLER: MH HELPER: MS

BORING NO.: SB-1
Ground Surface Elev.:
Plugging Method: Soils

Weather: Cloudy 75°
Water Data: 5'
Job Number: 93170.01

DEPTH	SAMPLE	SAMPLING METHOD	PENETRATION RESISTANCE	SOIL CLASSIFICATION
5		SS	2-2-2	SLAG
				Black fine SAND with Wood & Organic Material
10		SS	3-2-1	Light brown fine SAND
15		SS	2-3-5	
20		SS	4-5-7	Gray silty CLAY
25		SS	6-10-12	
30		SS	9-11-11	
35				

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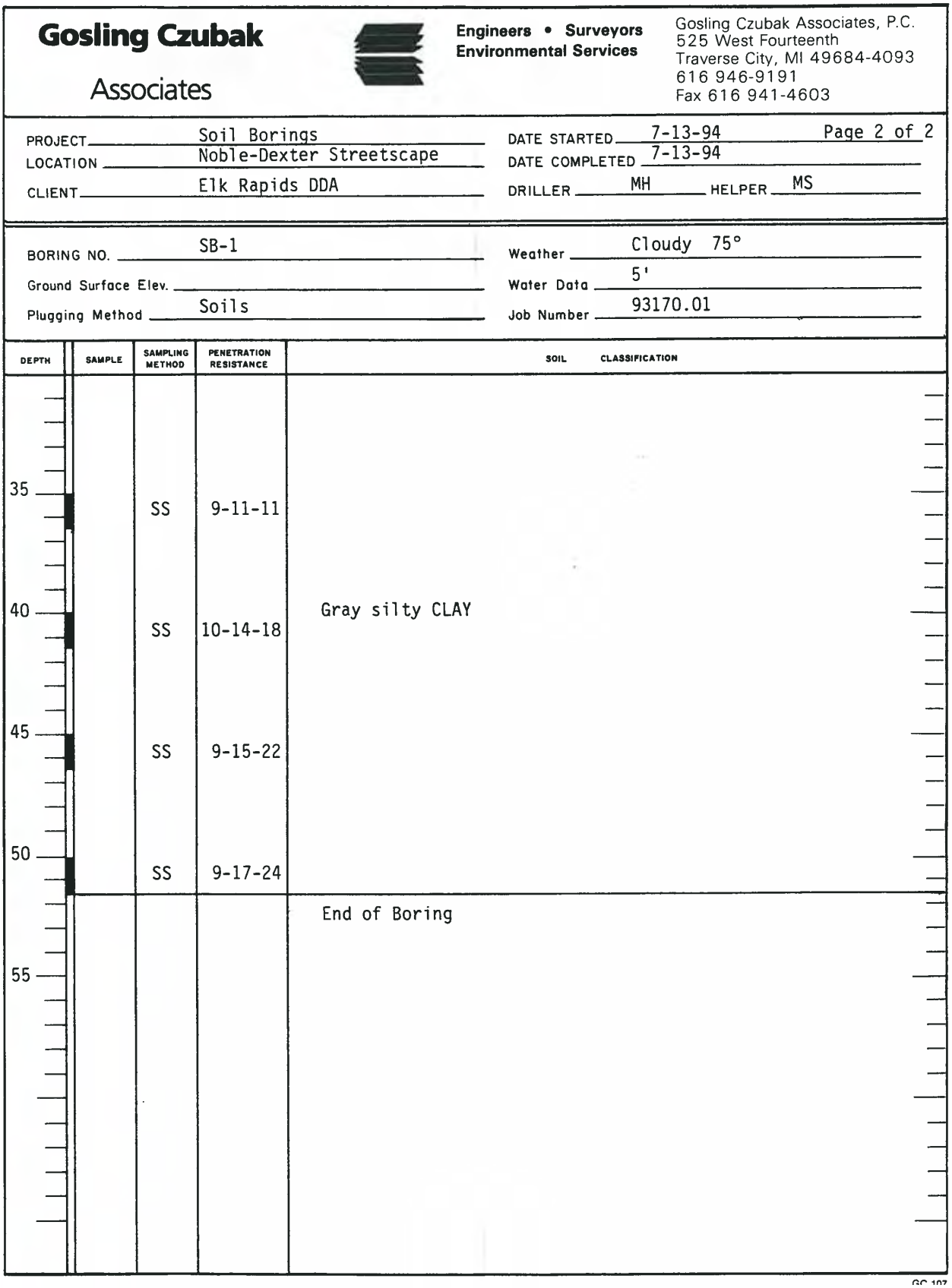
Figure E.12.9 Soil Borings (Source: Gosling, Czubak 1994)



Gosling Czubak Associates

Engineers • Surveyors
Environmental Services

Gosling Czubak Associates, P.C.
525 West Fourteenth
Traverse City, MI 49684-4093
616 946-9191
Fax 616 941-4603

PROJECT: Soil Borings
LOCATION: Noble-Dexter Streetscape
CLIENT: Elk Rapids DDA

DATE STARTED: 7-13-94 Page 2 of 2
DATE COMPLETED: 7-13-94
DRILLER: MH HELPER: MS

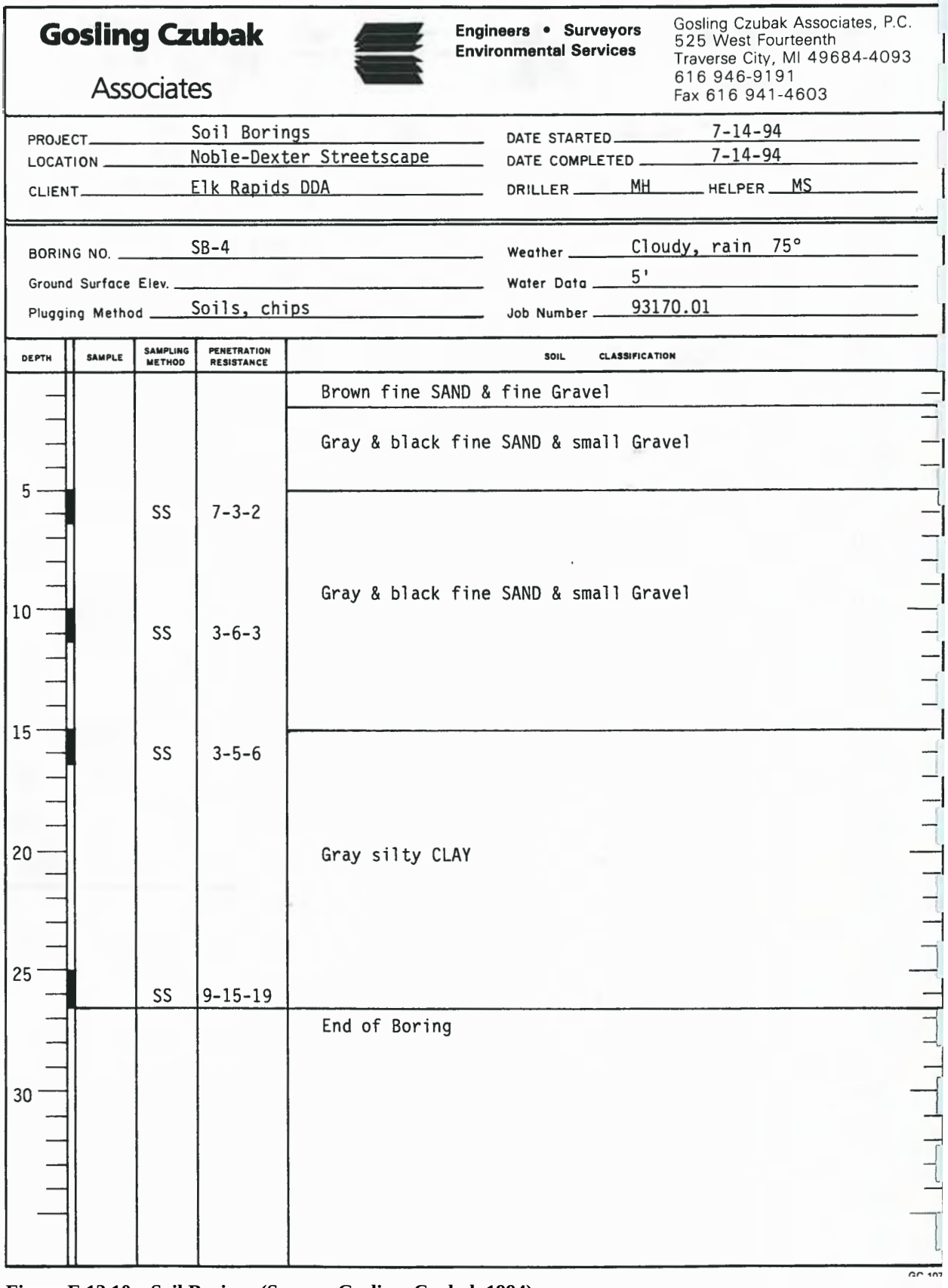
BORING NO.: SB-1
Ground Surface Elev.:
Plugging Method: Soils

Weather: Cloudy 75°
Water Data: 5'
Job Number: 93170.01

DEPTH	SAMPLE	SAMPLING METHOD	PENETRATION RESISTANCE	SOIL CLASSIFICATION
35		SS	9-11-11	
40		SS	10-14-18	Gray silty CLAY
45		SS	9-15-22	
50		SS	9-17-24	
55				End of Boring

GC 107

Figure E.12.9 Soil Borings, cont'd (Source: Gosling, Czubak 1994)



Gosling Czubak Associates

Engineers • Surveyors
Environmental Services

Gosling Czubak Associates, P.C.
525 West Fourteenth
Traverse City, MI 49684-4093
616 946-9191
Fax 616 941-4603

PROJECT: Soil Borings
LOCATION: Noble-Dexter Streetscape
CLIENT: Elk Rapids DDA

DATE STARTED: 7-14-94
DATE COMPLETED: 7-14-94
DRILLER: MH HELPER: MS

BORING NO.: SB-4
Ground Surface Elev.:
Plugging Method: Soils, chips

Weather: Cloudy, rain 75°
Water Data: 5'
Job Number: 93170.01

DEPTH	SAMPLE	SAMPLING METHOD	PENETRATION RESISTANCE	SOIL CLASSIFICATION
				Brown fine SAND & fine Gravel
				Gray & black fine SAND & small Gravel
5		SS	7-3-2	
				Gray & black fine SAND & small Gravel
10		SS	3-6-3	
15		SS	3-5-6	
20				Gray silty CLAY
25		SS	9-15-19	
				End of Boring
30				

Figure E.12.10 Soil Borings (Source: Gosling, Czubak 1994)

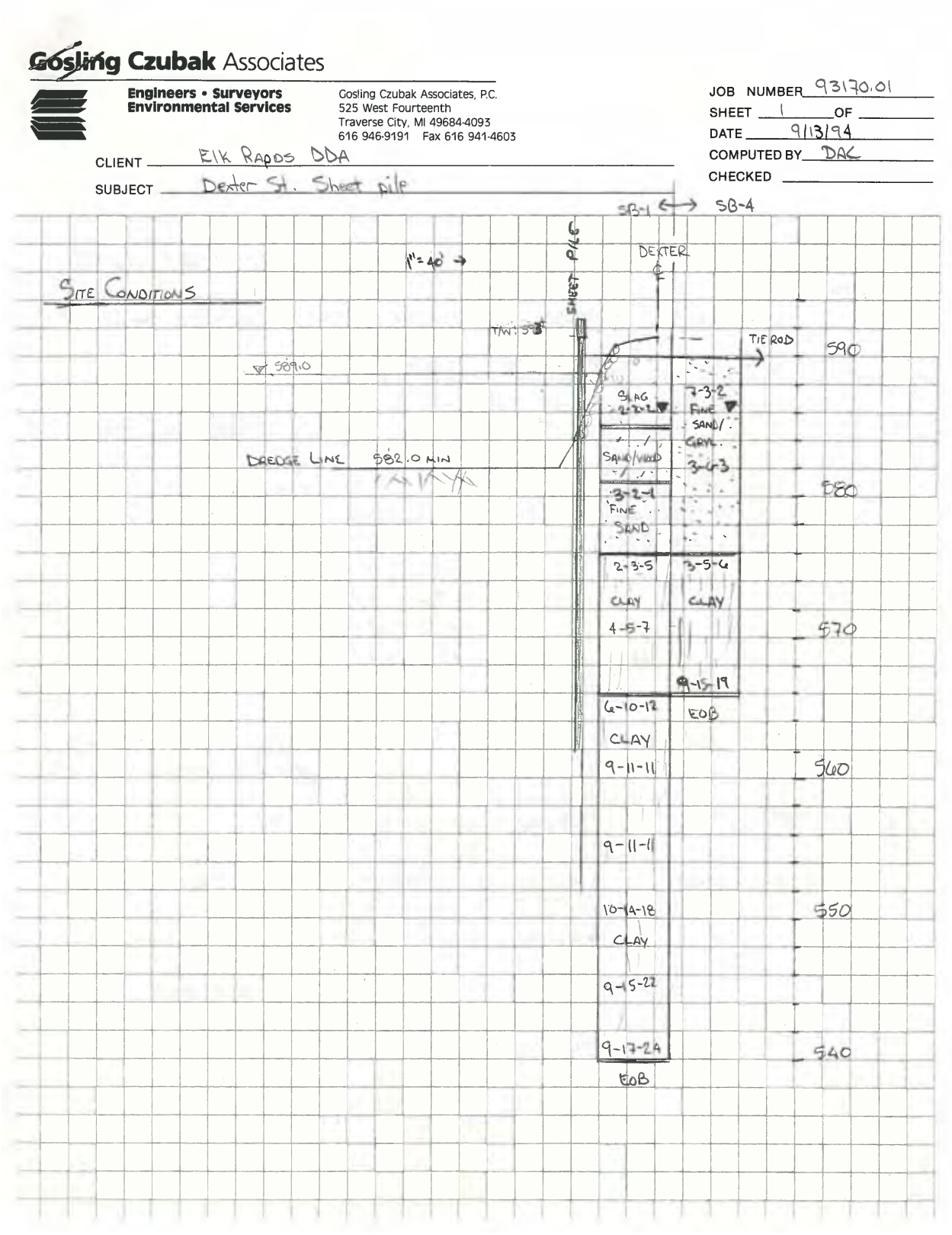


Figure E.12.11 Soil Boring Results Composite (Source: Gosling, Czubak 1994)

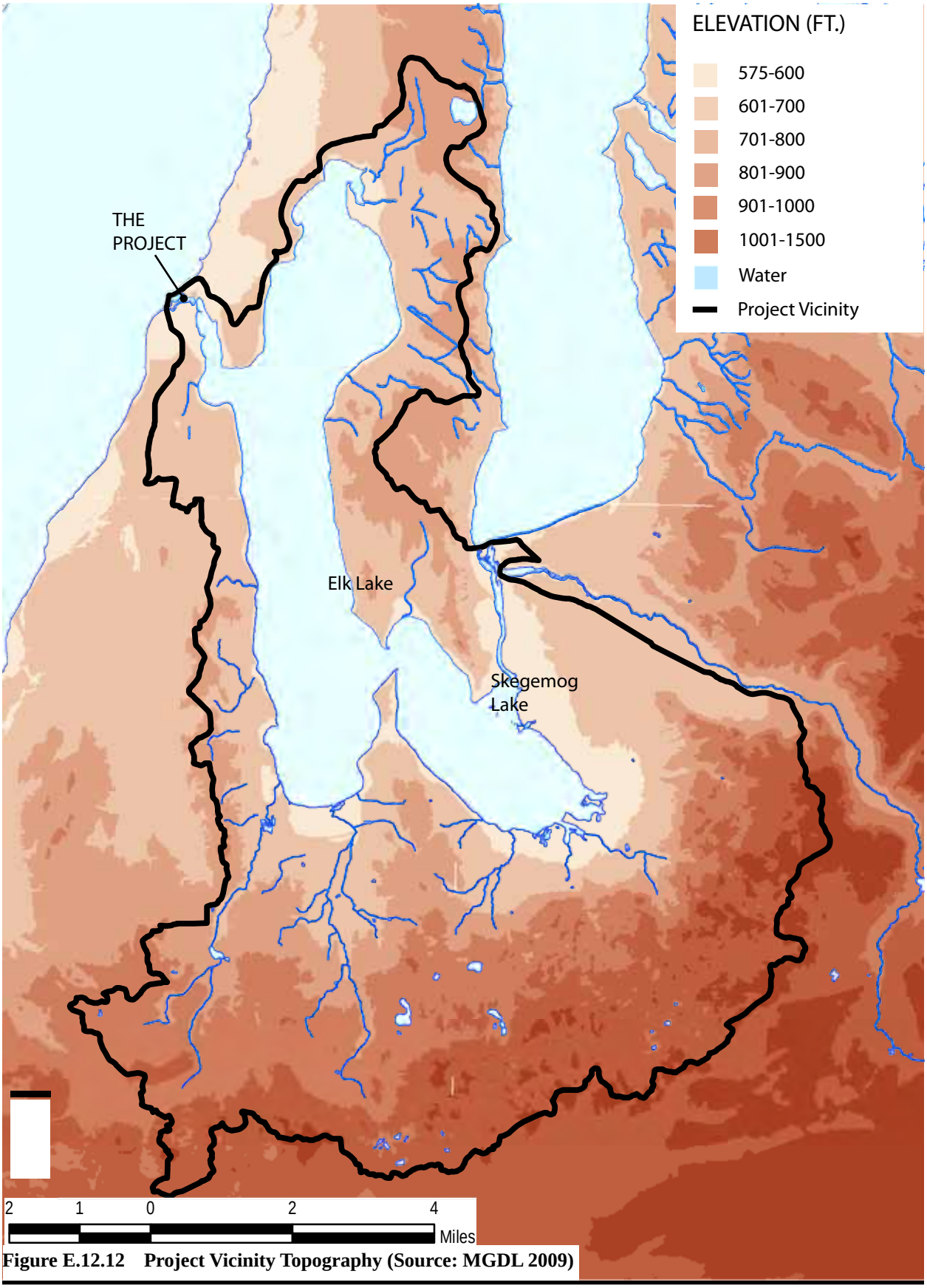


Figure E.12.12 Project Vicinity Topography (Source: MGDL 2009)

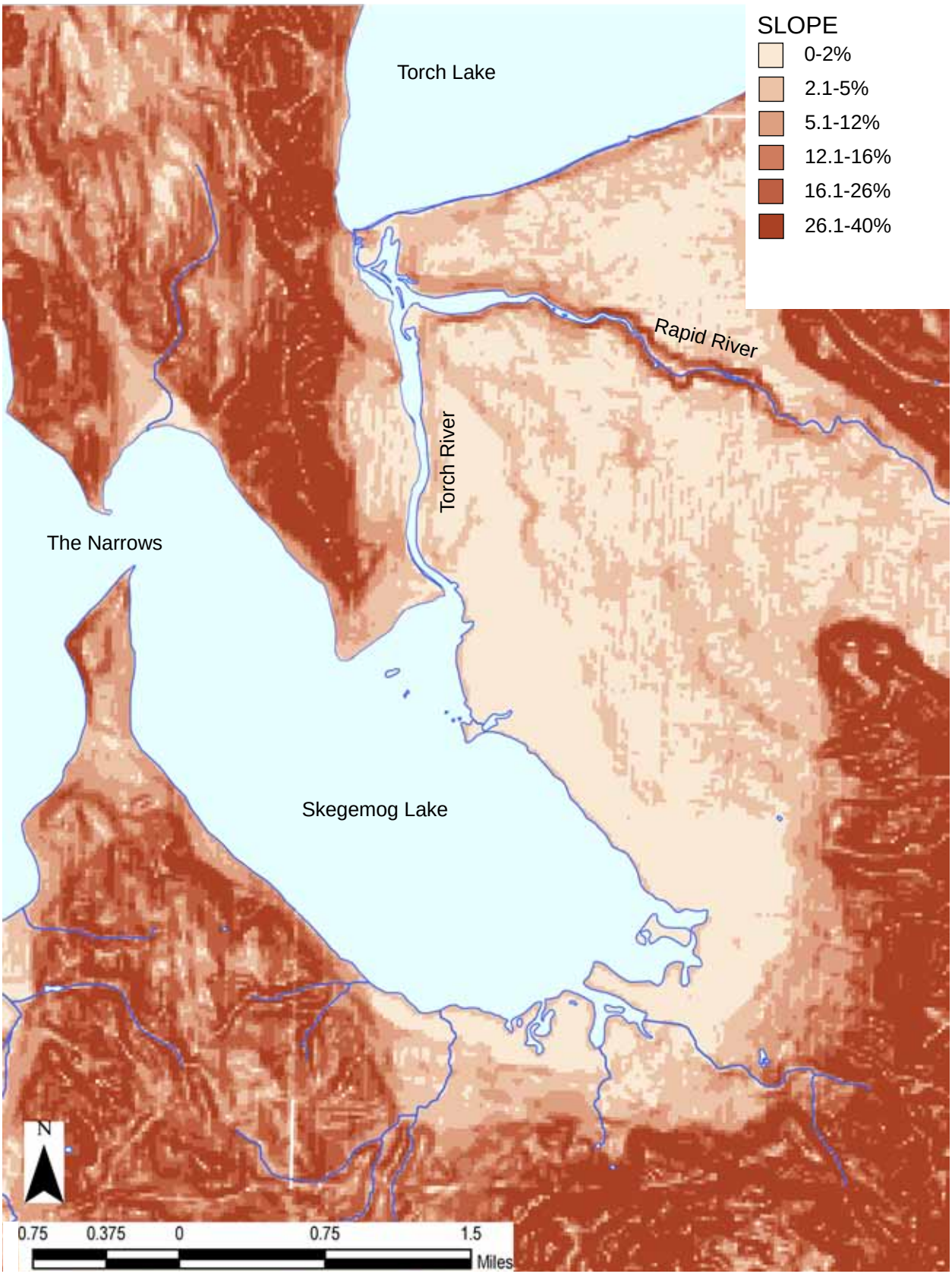


Figure E.12.13 Skegemog Lake Slopes (Source: MGDL 2009)

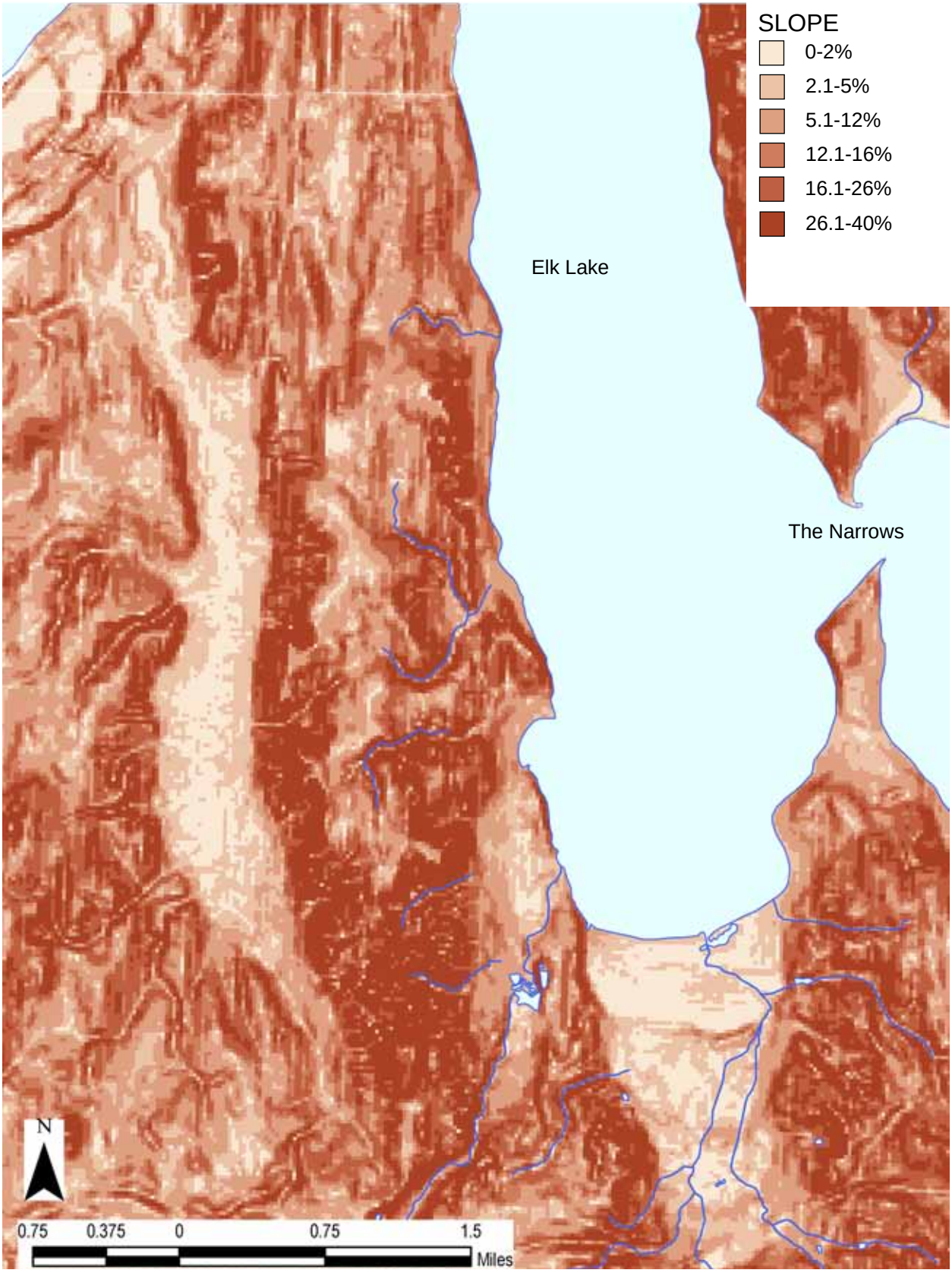


Figure E.12.14 Lower Elk Lake Slopes (Source: MGDL 2009)

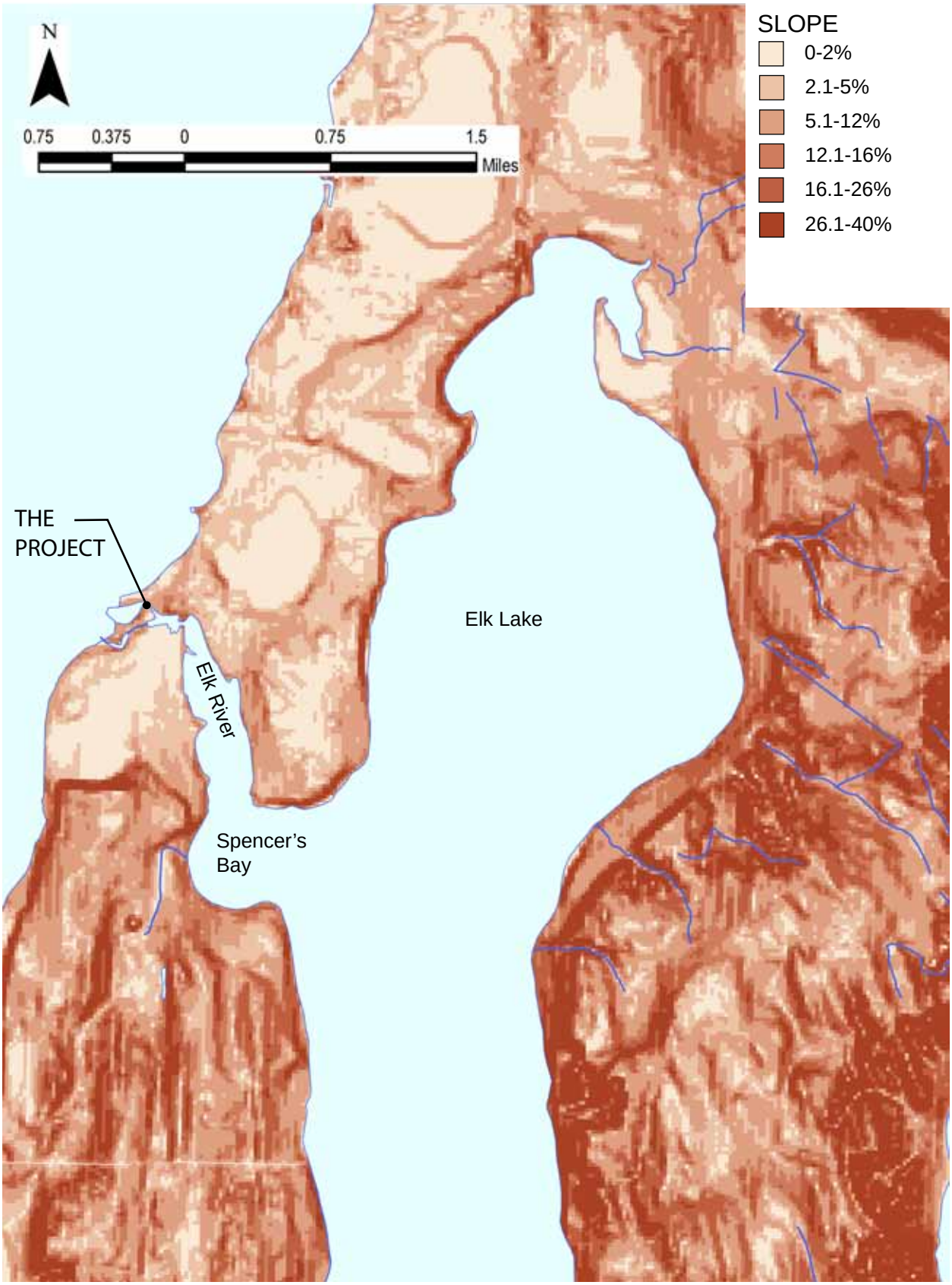


Figure E.12.15 Upper Elk Lake Slopes (Source: MGDL 2009)

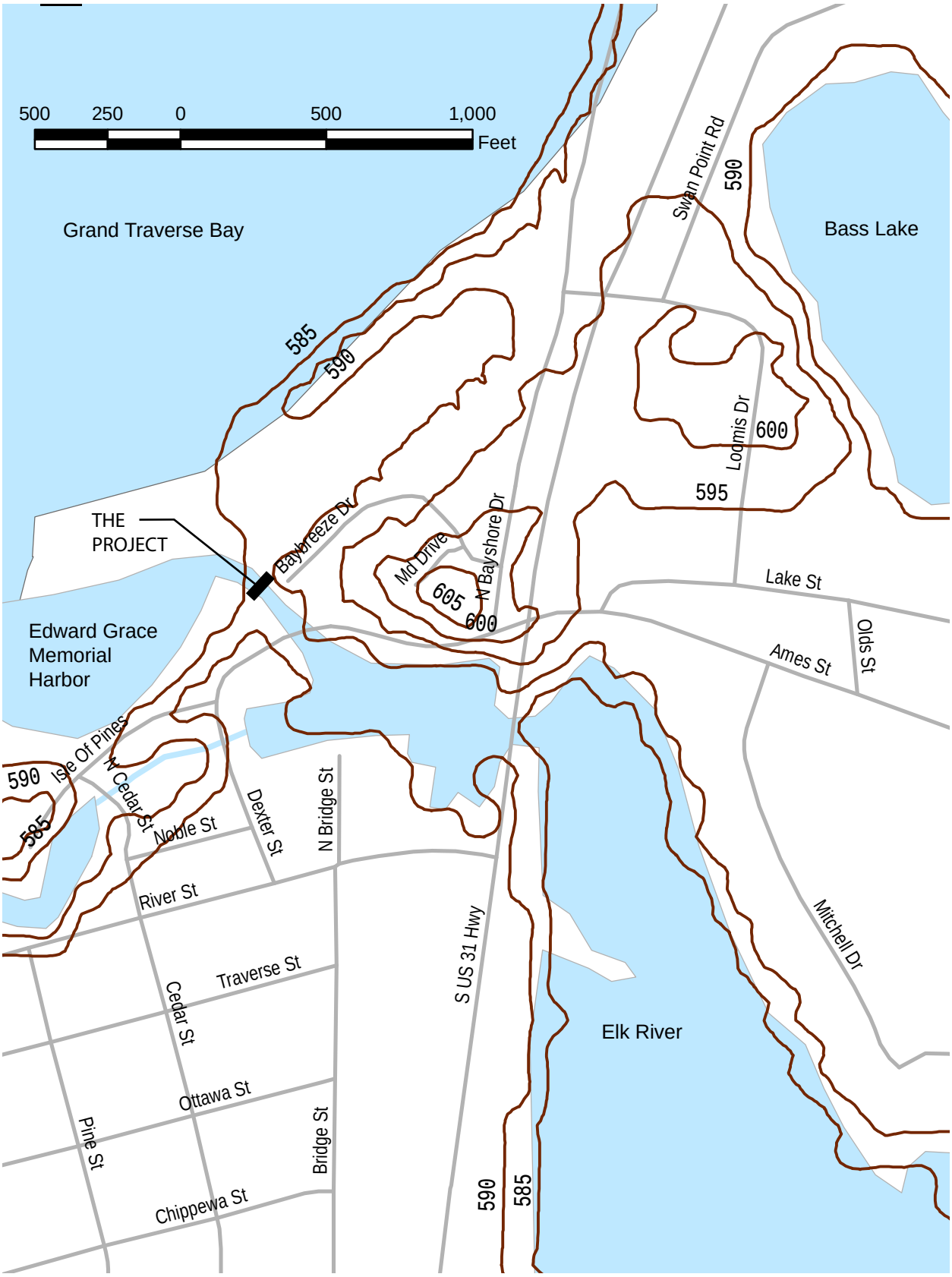


Figure E.12.16 Topography near the Project Site (Data Source: Antrim County 2009)

Photo E.12.1 Armored Shoreline at the Headrace (Photo: ERHP 2009)

Photo E.12.2 Armored Tailrace and the Shoreline Beyond (Photo: ERHP 2009)

13.1. Water Resources

The Project is operated in run-of-the-river mode. MDNR and the County have entered into the Offer of a Settlement dated XX, 2012 (the "MDNR Agreement"), under which the County shall continue to monitor and verify the Project's run of the river operation based on plant statistics (output, headwater elevations, gate settings, etc.) and shall continue to use the calibrated set of rating curves for the Project's units and utility metered generation data to calculate stream outflow (see Appendix I).

There are no known issues with respect to water quality. As discussed in Section 2.9, water quality within the Project Vicinity has been monitored for years and is considered to be excellent. The Project's run-of-the river operation ensures that dissolved oxygen concentrations and temperatures within the river remains at least the same as, if not better than, conditions upstream. There are also no known contributors of contamination into Project waters. The Project has received a Certification under Section 401 of the Federal Clean Water Act from the MDEQ, a copy of which is attached as Appendix J.

13.2. Fish and Aquatic Resources

13.2.1 Community Composition

Even though the Project has been in place for over 100 years and has been generating hydroelectric power for much of that time, there have been no documented negative impacts from the Project on fish and aquatic communities upstream or downstream. As discussed in Section 3.3 above, fish community composition and species diversity has remained stable in the water bodies below the Bellaire Dam after their initial adjustment to the first dam installation 150 years ago. The aquatic species mix within the ERCOL has remained largely unchanged for at least the past 60 years. Thirteen of the 15 tributary streams within this area are classified as trout streams, meaning that they are maintaining the water quality and habitat necessary to support trout and other fish populations.

13.2.2 Fish Migration

While it is true that the Project's presence prevents migration between Lake Michigan and the ERCOL by Great Lakes muskellunge, Lake trout, Lake sturgeon and the five introduced non-native Salmon species, the Project has also prevented the invasive aquatic species that have devastated Lake Michigan's fisheries from entering the ERCOL. In fact, the Great Lakes, which are already dealing with the impacts of over 180 invasive species, are currently facing a threat that could completely devastate their ecosystems and destroy their states' lake-related economies; Lake Michigan alone accounts for $7 billion in lake-related leisure and tourism revenues and supports a $7 billion fishery (Associated Press 2009).

In November, 2009, it was learned that the over $9 million spent to construct an electric fish barrier across the Chicago Ship Canal to keep Asian carp (Bighead and Silver carp) out of the Great Lakes may have been for naught. Asian carp are prolific. They can grow up to four feet long and 100 pounds and eat up to 5-10% of their body weight per day in plankton, the base of the Great Lakes' food web. In some areas of the Mississippi River basin, Asian Carp now make up 97% of fish biomass (Hansen 2011). On November 21, 2009, scientists found evidence of the carp within seven miles of the Great Lakes, beyond the electric barrier that had been called

"the last line of defense for the Great Lakes" (Janega 2009). During the first week of December, the Army Corps of Engineers poured a toxin into the canal to kill all fish within a six mile stretch. One Bighead carp was found among the thousands of fish killed. (Associated Press 2009). In July 2010, the states of Michigan, Minnesota, Ohio, Pennsylvania and Wisconsin filed suit against the U.S. Army Corps of Engineers and the Chicago Water District demanding that the Corps and the Water District put in place a permanent ecological separation between the Mississippi River and the Great Lakes to prevent Asian carp from entering the Great Lakes. On August 24, 2011, even though the court noted that the states' lawsuit had a substantial likelihood of prevailing on the merits, the U.S. Court of Appeals for the 7th District declined to issue an immediate injunction to compel the Corps to speed up their study of the problem and to install nets in key locations. In October 2011, the states appealed to the U.S. Supreme Court. Their petition asked the court to overturn the 7th Circuit decision and to (a) require the Corps to install block nets in the Little Calumet and Grand Calumet rivers, two open pathways between the Mississippi River and Great Lakes basins that are vulnerable to Asian carp invasion; and (b) require the Corps to expedite the completion of its study of permanent ecological separation between the Great Lakes and Mississippi River basins, so that the part of the study focused on the Chicago Area Waterway would be completed within 18 months, not five years. On February 27, 2012, the Supreme Court denied the states' request. At this point, it is anyone's guess whether Asian carp will enter the Great Lakes before the Corps implements effective measures to prevent such a migration; in fact, it may already be too late.

The introduction of invasive aquatic species is considered to be one of the greatest threats to the ERCOL (TWC 2005). As has been seen in the Great Lakes, the introduction of invasive species into the ERCOL would substantially degrade the ERCOL's ecosystems and the local economies that depend on them. Their presence would change species composition and reduce the size and viability of native fish populations. The introduction of invasive filter feeders would increase the rate of cladophora growth and increase water clarity, which in turn would increase water temperature. These types of ecosystem changes tend to cascade and feed back on one another, leading to low biodiversity, the prominence of the undesirable exotic species and often substantial unexpected impacts.

The introduction of invasive aquatic species into the watershed would also likely lead to disastrous effects on bald eagle and loon populations. A USFWS Study has shown that bald eagles that feed off the Great Lakes' fisheries have substantially reduced breeding results due to toxic contaminants carried by the fish. At present, USFWS is recommending that the foremost dams all along the Great Lake maintain their status as barriers to fish passage to prevent contamination of inland eagle foraging areas (USFWS 2012). The increase in contaminated fish within the ERCOL would also be likely to lead to an increase in avian botulism, which in turn would negatively impact the viable population of nesting common loons, a Michigan threatened species.

As noted in Section 10, water-related tourism forms the backbone of the economy in the communities around the Impoundment, contributing over $50 million/year to the local economy. The impacts of invasive species on the Impoundment would substantially reduce the value of the Impoundment's native and non-native sports fisheries and wildlife-related tourism, with concomitant impacts to local economies.

Once they have entered a watershed, the costs to control invasive species can be extremely high. For example, in 2011, the Great Lakes Fishery Commission received about $30 million from the Federal government and Canada to control Sea lamprey populations in the Great Lakes. In 2011, the goverment announced that it would be cutting $3 million from its contribution to the Sea lamprey control program, sending fear throughout the Great Lakes charter boat industry that Sea lamprey populations will begin to rise, sending charter boats out of business: "We used to find lampreys attached to fish – there would be as many as three Sea lamprey attached to one salmon," said Terry Walsh, president of the Charter Boat Association. "If Sea lampreys bounce back, we will end up with a situation that will get out of control." (Schepeler 2011) If sea lampreys enter the ERCOL, the region will need Federal assistance to control the invasion at a time when the Federal government has fewer and fewer resources to spend. There are currently no effective controls for Asian carp. The most efficient and cost-effecitve way to combat the impacts of invasive species on the Impoundment and the ERCOL is to prevent their introduction in the first place. The Project and its dam serve as an impenetrable physical barrier to the entrance of invasive species into the Impoundment without any cost to local communities, the County, the state or the Federal government.

Local stakeholders, including local environmental groups who are usually opposed to the presence of hydroelectric projects on waterways, credit the Project's presence as a crucial factor in maintaining the watershed's health and aquatic community diversity. Indeed, ESLA and the communities adjacent to the Project are strongly opposed to the installation of fish ladders, fish elevators or other fishways at the Project that would permit species from the Great Lakes to enter the Impoundment.

13.2.3 Fish Mortality

As discussed in Section 3.7, fish entrainment and mortality at the Project is estimated to be little to non-existent. Even so, the MDNR Agreement provides that the County will pay MDNR an annual deposit of 0.5 mils per kWh of net generated energy from the Project for the first twenty-five (25) years of the new FERC license. These funds will be used for fish habitat improvement projects around the Impoundment.

13.2.4 Large Woody Debris

The Project prevents the passage of large woody debris into Grand Traverse Bay. However, the presence of Edward C. Grace Memorial Harbor directly downstream from the Project means that the passage of large woody debris would likely create a navigation hazard. MDNR has indicated that it does not require the County to develop a large woody debris management plan and does not have a use for the large woody debris collected in the Project's trashracks (Kalish 2011).

13.3. Wildlife and Botanical Resources

There are no known issues with respect to wildlife resources. In any event, because the Project's lands are very small, the County has little ability to enhance Project lands for terrestrial wildlife.

13.4. Wetlands, Riparian and Littoral Habitat

As discussed in Section 4.4.1, Purple loosestrife (*Lythrum salicaria*) is widespread throughout the ERCOL. While it has not been seen on Project lands, it may appear there in the future.

Eurasian milfoil (*Myriophyllum spicatum*) and Curly-leaf pondweed (*Potamogeton crispus*) have been found in lakes throughout the ERCOL. The presence of these species within the watershed is not a result of the Project's operation. Neither plant has been observed around the Project powerhouse, although both species are present in Elk and Skegemog Lakes. In the MDNR Agreement, the County has agreed to monitor the land around the Project powerhouse and the headrace and tailrace for the presence of Purple loosestrife (*Lythrum salicaria*), Eurasian milfoil (*Myriophyllum spicatum*) and Curly-leaf pondweed (*Potamogeton crispus*) and to develop an invasive vegetation management plan to deal with these species if discovered.

There are no other issues with respect to wetlands, riparian and littoral habitat. Local stakeholders cite the Project's management of lake levels as an important contributor to the health of the extensive wetlands that lie within the Project Vicinity.

13.5. Rare, Threatened and Endangered Species

There are no issues with respect to rare, threatened or endangered species or state species of concern, other than the prevention of Lake sturgeon migration. However, as noted in Section 6.5.4, it is uncertain whether Lake sturgeon are still present in the Project Vicinity or in Torch Lake and the Project Vicinity is not considered a priority location for the rehabilitation or enhancement of Lake sturgeon habitat.

13.6. Recreation and Land Use

There are no issues with respect to recreation or land use. Existing recreational access points are considered sufficient to meet current and future needs.

13.7. Aesthetic Resources

There are no issues.

13.8. Cultural Resources

There are no issues.

13.9. Socio-Economic Resources

Since there are no issues.

13.10. Tribal Resources

There are no issues.

13.11. Geology and Soils

The Project's presence and consistent management of lake levels helps stabilize the shorelines adjacent to the Project Boundary and minimizes the risk of mass soil erosion.

13.12. Relevant Comprehensive Waterway Plans

Based on FERC's List of Comprehensive Management Plans for the State of Michigan dated April 2012, the following Comprehensive Management Plans pertain to the Project vicinity (FERC 2012). The County is in compliance with all plans as they relate to the Project.

- Michigan Office of the Great Lakes. 2002. Michigan's Aquatic Nuisance Species State Management Plan Update. Lansing, Michigan. October 2002. 50pp. – this is the update to

the 1996 Plan on FERC's list.

- O'Neal, R.P. and G. J. Sillier. 2006. Conservation Guidelines for Michigan Lakes and Associated Natural Resources. Michigan Department of Natural Resources, Fisheries Special Report 38. Ann Arbor, Michigan. March 2006. 105pp. – these guidelines have replaced the 1994 MDNR Fisheries Division Strategic Plan on FERC's list.
- Michigan Department of Natural Resources. 2008-2012. Michigan Statewide Comprehensive Outdoor Recreation Plan (SCORP). Lansing, Michigan. 217 pp.
- U.S. Fish and Wildlife Service, Canadian Wildlife Service, SEMARNAT. North American Waterfowl Management Plan – Strengthening the Biological Foundation. 2004. Arlington, Virginia. December 2004. 36pp. – this plan updates the 1986 plan on FERC's list.

13.13. Relevant Resource Management Plans

The following resource management plans and programs pertain to the Project Vicinity. The County is in compliance with all plans as they relate to the Project.

- Antrim County. 2005. Community Recreation Plan. Bellaire, Michigan. March 2005.
- Antrim County. 2006. Antrim County Master Plan. Bellaire, Michigan.
- Antrim County. 2010. Community Recreation Plan. Bellaire, Michigan.
- Clearwater Township. 2008. Community Recreation Plan 2008-2013. Clearwater, Michigan.
- Clearwater Township. 2005. Master Plan Update. Clearwater, Michigan.
- Conservation Resource Alliance. 2004. Elk River Chain of Lakes Watershed Management Plan. Traverse City, Michigan.
- Grand Traverse County, 2007. Grand Traverse County Comprehensive Plan Implementation Strategies. Traverse City, Michigan.
- Grand Traverse County. 2002. Grand Traverse County Comprehensive Plan. Traverse City, Michigan.
- Kalkaska County. 2010. Kalkaska County Master Plan 2010-2015 Update. Kalkaska, Michigan.
- Kalkaska County. 2003. Kalkaska County Master Plan 2003-2008. Kalkaska, Michigan.
- Michigan Department of Natural Resources. 2008 Northern States Bald Eagle Recovery Plan. Lansing, Michigan.
- Michigan Department of Natural Resources. 2009. Large Lakes Program
- Michigan Department of Natural Resources. 2008. Skegemog Lake Wildlife Area Management Plan. Lansing, Michigan.
- Michigan Department of Natural Resources. 2005. Michigan's Wildlife Action Plan - Aquatic Systems. Lansing, Michigan.
- Michigan Department of Natural Resources. 2005. Michigan's Wildlife Action Plan - Terrestrial Systems: Northern Lower Peninsula. Lansing, Michigan.
- Milton Township. 2006. Master Plan. Milton, Michigan.
- Milton Township. 1997. Recreation Plan 1997-2002. Milton, Michigan.
- The Watershed Center Grand Traverse Bay. 2005. Grand Traverse Bay Watershed Protection Plan. Traverse City, Michigan.
- Township of Elk Rapids. 2007. Master Plan. Elk Rapids, Michigan.
- Village of Elk Rapids. 2007. Community Recreation Plan. Elk Rapids, Michigan.

- Village of Elk Rapids. 2007. Master Plan. Elk Rapids, Michigan.
- Whitewater Township. 1999. Master Plan. Whitewater, Michigan.
- Whitewater Township. Recreation Plan 2003-2008. Whitewater, Michigan.
- Whitewater Township. 2008. Battle Creek Natural Area Management Plan. Williamsburg, Michigan.
- Whitewater Township. 2008. Skegemog Lake Wildlife Area Management Plan. Lansing, Michigan.