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INFRASTRUCTURE SOLUTIONS + CONSULTING

Village of Ontonagon Drinking Water State Revolving Fund Project Plan

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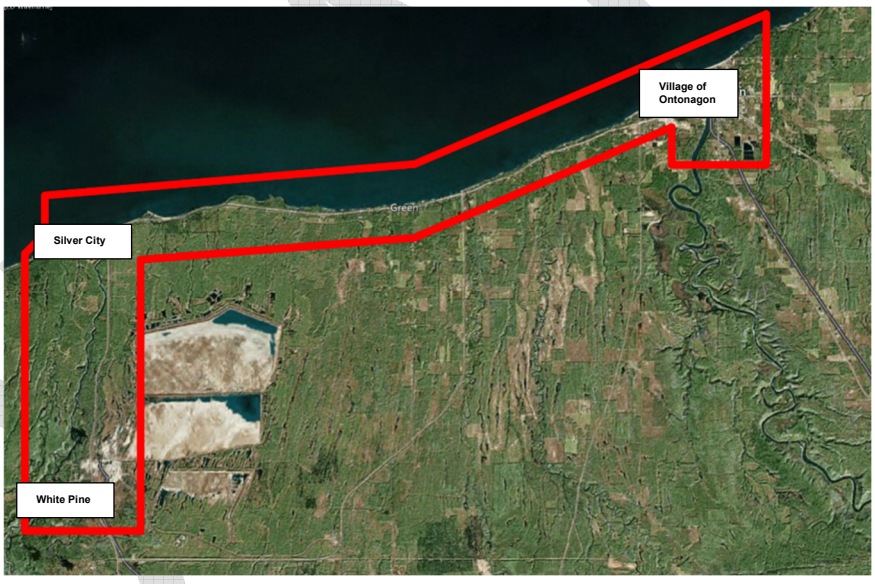
Project Background

The Ontonagon Regional Water System is looking to obtain funding through Michigan's Drinking Water State Revolving Fund program. The regional water system needs to update aging and deteriorating assets to help protect the system from failure. This plan was created following the guidance provided by the Michigan Department of Environment Great Lakes, and Energy (EGLE) to meet the requirements to fulfill application for the loan request.

A. Study and Service

The Ontonagon Regional Water System spans over 15,000 acres and serves multiple communities. The communities within the system are the Village of Ontonagon, White Pine CDP, Carp Lake Township, and Silver City. The system resides within Ontonagon County and as of the 2020 Census, the population was 5,656, making it Michigan's third-least populous counties. The county was set off in 1843 and organized in 1848. In 1843, Michigan's Upper Peninsula was divided into Mackinac, Chippewa, Marquette, Schoolcraft, Delta, and Ontonagon Counties. In 1845, a portion of Ontonagon County was partitioned to be part of Houghton County. In 1846, the village of Ontonagon was named as the county seat of Ontonagon County. Figure 1 below shows the water system area.



Ontonagon Regional Water System Location Map

Original growth of the area centered around the copper mines that were developed in the area. Much of the area had been established for miners as housing communities for them and their families. This growth continued until the Copper Range Company's mine stopped operations in 1995. Since that time, there has been little to no growth in the population and water system usage for the residents. Residential development is concentrated mostly in the existing residential areas and there is limited commercial and industrial development found in the incorporated areas. No foreseeable changes in the land use patterns are predicted.

Since the decline in the mining industry, the timber, tourism, and health service industries have taken up most of the slack. The unemployment rate of the area is greatly affected by the seasons, with rates typically higher than the state average in the winter, and rates lower than the state average in the summer months. Median annual household incomes throughout the project area are generally classified as low to moderate. In EGLE's most recent Fiscal Year 2024 Median Household Income List, the Median Household Income for the Village of Ontonagon is $42,500 and $43,875 for Carp Lake Township.

The socioeconomic environment is that of an aging community with a gradual population decline. The one of the largest employers within the study area include the Trident Maritime Systems industrial facility.

For the purpose of this 20-year project, the study area will be delineated as the highlighted area in Figure 1 above and will use the respective communities to differentiate the area. The water system provides water service to 1,412 customers throughout the area with over 220,000 linear feet of distribution main.

The Village of Ontonagon is zoned and broken into 7 districts. The districts are R-1, Residential, R-2, Residential, DT-2, Downtown Business, DT-3, Downtown Business, GC, Gateway Corridor Business, W-MU, Waterfront – Multi Use, and I, Industrial. The R-1 Residential district is for single-lot development and open space preservation and cluster development. R-2 Residential is for SF Residential Duplexes, Multi-residential, and non-residential or mixed-use settings. The W-MU Waterfront Mixed use is for R-2 Residential categories that reside in waterfront areas. The I, Industrial district is designated for industrial uses. The DT-2 and 3 are the areas designated downtown in the heart of the village. The GC Gateway Corridor is for R-2 Residential categories located directly off of M-38 and M-64.

B. Population

In Table 1 below, it shows the projected population for the next 20 years. Due to lack of information, the Silver City and HWY M-64 area populations were unattainable. While the projected residential population shows that it will be in a steady decline, there is the seasonal influx in the population due to tourism. One reason for the influx is the massive 3,100 miles of Michigan-designated trails for ORVs throughout the Upper Peninsula. Tourists from all over come to ride and enjoy the system year-round. This requires the facilities to continue to be updated and fixed to be able to handle the mass amounts of tourists that travel throughout the year for the city's attractions. Airbnb and other vacation rentals are located within the area that are used throughout the year as well. The population projections below only had available data for Ontonagon up to 2040. There are individual projections posted in the table below.

Table 1: Population

Year	Village of Ontonagon	White Pine	Ontonagon Township	Carp Lake Township	Ontonagon County
1950	2,307	N/A	N/A	N/A	10,282
1960	2,358	N/A	N/A	N/A	10,584
1970	2,432	N/A	N/A	N/A	10,548
1980	2,182	N/A	N/A	N/A	9,861
1990	2,040	895	3,253	1195	8,854
2000	1,769	616	2,954	891	7,825

2010	1,494	474	2,979	722	6,780
2020	1,285	446	2,253	580	5,656
2030	1,198	410	2,122	561	4,586
2040	1,117	377	1,998	542	3,555
2050	1,041	319	1,881	524	3,370

Sources: U.S. Census Bureau, State of Michigan Projected population numbers were calculated by following the general trend from the average of the known population numbers and projected onto future years.

C. Existing Environment Evaluation

1. Cultural Resources

The Ontonagon Regional Water System has a past with a large variety of historical, archeological, and tribal resources.

The NPS Historic Places Register shows there being five listed historical sites. There is the Bergland Administrative Site, the Ontonagon County Courthouse, the Ontonagon Harbor Piers Historic District, the Ontonagon School, and the Ontonagon Lighthouse, which is part of the lighthouses the Upper Peninsula is known for.

In Ontonagon County, the Ontonagon Indian Reservation resides. This is a former branch of the Lake Superior Chippewa Tribe and since the Indian Reorganization Act of 1934, is a member of the Keweenaw Bay Indian Community. The reservation is located in the northeastern portion of Ontonagon Township and is approximately 12.5 miles northeast of Ontonagon. There is no expected impact on the reservation during construction of the project.

The project does not expect to impact the historical site areas and there were no other sites to be preserved found through State historical Preservation Office, Tribal Historic Preservation Office, or local historic societies.

There is a restrictive covenant on the White Pine Mine property that limits land use in certain situations. The proposed project does not fall into one of the restricted situations, therefore the restrictive covenant should not be an issue. If any actions fall into the category requiring action, all remedial and cleanup criteria shall be followed as required by the restrictive covenant.

2. Natural Environment

i. Air Quality

The air quality in the water system area has an average annual Air Quality Index of around 30. The proposed project is not projected to influence the air quality drastically in the surrounding area during construction and is not projected to attract new users, commercial or residential. The only air quality change might be some short-term air pollution caused by construction equipment. Therefore, the air quality index is not estimated to be impacted by the project.

ii. Wetlands

The wetland area for the project limits primarily consists of sugar maple with white pine or hemlock forests. There are also some lowland hardwood wetlands. The project will be following existing roadside right-of-way and is not expected to have any long-term impacts. The Big Iron River is a Type 3 trout stream according to the MDNR and is located within the study area. A map of the wetland areas can be found in Figure 10 of Appendix A.

iii. Coastal Zones

Lake Superior is located in the Northern portion of the study area and includes a small portion of the system within the coastal zone. EGLE mapping shows that the very beginning of the transmission line is located within a coastal zone based on EGLE's boundary extent generally being approximately 1,000 feet inland. The project starts at approximately 700 feet inland, so around 300 feet of mainline is within the coastal boundary. Any required permitting will be obtained prior to construction. The mapping provided through EGLE is provided in Appendix A and shows the project location and where the coastal boundary is.

iv. Floodplains

The area in which the proposed project is located participates in the FEMA Floodplain program. The FEMA floodplain mapping for the Village of Ontonagon, Ontonagon Township, and Carp Lake Township can be found in Appendix A.

v. Natural or Wild and Scenic Rivers

There are no rivers within the project area that contribute to the Natural or Wild and Scenic River System.

vi. Major Surface Waters

There are many surface waters throughout the regional system consisting of Lake Superior, the Big Iron River, the Mineral River, and a few branches off the Mineral River. Although there are significant quantities of surface water in the area, proper erosion control, environmental mitigation, and restoration measures will be employed during construction. Therefore, major surface waters are not anticipated to be significantly affected by this project.

The water supply source for the regional system is the surface water of Lake Superior.

vii. Recreational Facilities

Throughout the study area, there are numerous recreational facilities such as parks, campgrounds, beaches, falls, as well as others. There is the Bonanza Falls Park that is located near the project area and may have some short-term impacts for entry to the parking area when immediate construction is going on, but there should be no other significant impacts to the areas.

viii. Topography

Relief in the general study area is pretty vast in elevations ranging from around 550 feet near the edge of the coastal zone to around 1,200 feet when moving inland (USGS DATUM). The project will restore any disturbed terrain to its original features.

ix. Geology

There are no problematic geologic structures or formations in the pathway of the project.

x. Soils

The soils in Ontonagon were formed during the time of Pleistocene glaciation and are mostly of fine texture. Although the underlying bedrock did influence the development of present-day soils, glacial debris gathered up, ground transported and dumped, forming the dominant parent material of these soils. This glacial veneer contains a great variety of mineral materials arranged in many topographic expressions under all conditions of drainage and modified by long term variations in cover and climate. A myriad of different soil types has evolved from the heterogeneous glacial parent materials and the individual conditions governing soil profile development. The soils of Ontonagon County consist of very deep, and poorly drained soils formed in clayey deposits. Permeability is very slow and slopes range throughout the area from 0 to 2 percent on average.

A soil report for the project area generated by the United States Department of Agriculture can be found in Appendix G.

xi. Agricultural Resources

There are no prime or unique farmlands in the study area.

xii. Fauna and Flora

Northern hardwoods dominate Ontonagon County. Representative species include various pine, hemlock, balsam, aspen, birch and maple. Most of the residential area is built-up, sparsely vegetated, and covered with various grass species. There should be little to no construction impacts due to most of the project being in existing road rights-of-way. The surrounding area is rich in wildlife, both in number and species. Representative species of wildlife in the immediate area include small game such as rabbits, whitetail deer, black bear, coyotes and songbirds. There is also a large variety of fish throughout the area. There is only one endangered species within the project area. The gray wolf, Canis Lupus, is considered to be an endangered species according to the US EPA Endangered Species program. The project does not anticipate any disturbances to the wolf habitat as most of the construction of mainline piping is going to be done in existing road right-of-way and will follow the existing line.

D. Existing System

Below is a table identifying the major assets of the water system for the Ontonagon Regional Water System as provided in the Village of Ontonagon's Asset Management Plan (AMP) prepared by Michigan Rural Water Association (MRWA) in 2021. A map showing the location of the existing facilities is found in Appendix A.

Table 2: Existing System

Asset	Age		Amount		Units
Village of Ontonagon Facilities	**Average Age**		**Pipe Length**		
Total Pipe Inventory	38		220,655		**FEET**
Water Storage Facilities	**Installation Date**		**Ground Storage**	**Elevated Storage Tank**	**GAL**
	2001	2002	850,000	150,000	
Hydrants	**Average Age**		184		**EACH**
	66				
Valves	46		180		**EACH**
Water Treatment Plant	**Installation Date**		1		**EACH**
	2001				
White Pine Mainline Diameter	**6"**	**8"**	**10"**	**12"**	**IN**
Pipe Length	22,100	21,500	6,350	3,300	**FEET**
Elevated Storage Tank	Installation Date		Capacity		**GAL**
	N/A		250,000		

Meter Size	Village of Ontonagon	White Pine	M-64	State of Michigan	Units
¾	833	345	159	0	EACH
1	16	4	15	0	EACH
1 ½	14	10	5	0	EACH
2	3	1	1	0	EACH
3	2	0	0	0	EACH
4	2	0	1	1	EACH
Total =	**870**	**360**	**181**	**1**	**1,412**

1. General

The Asset Inventory of the existing facilities is broken down into three (3) separate inventories: Village of Ontonagon, which includes the Village system, water treatment plant, intake structure and transmission mains; Silver City (or M64); and White Pine. Below is a summary of the water system asset values.

Total estimated value for the system is $31,610,605. The average life remaining for the Village of Ontonagon portion of the system is approximately 11%. The system serves 1,412 customers with billing based on per 1,000 gallons. The calculated Residential Equivalent Units (REU's) based on meter size for the regional system is 1,563. The REU's were calculated by taking American Water Works Association's meter rates and converting all meter sizes to a ¾ inch meter. This is the preferred way for determining REUs according to EGLE's disadvantaged community guidelines.

The Superintendent of Water Treatment maintains the records and makes changes to the inventory as needed. The following asset were identified in the water system AMP: 2 water towers, ground storage tank, valves, fire hydrants, water mains, water meters, and curb stops. Microsoft Excel spreadsheets are used to track the inventory.

2. Watermain Piping

The mainlines of the Village of Ontonagon's sector of piping spans over 220,000 linear feet. The piping age is approximately 38 years old on average with sizing varying from 2" all the way to 42". Approximately 2% of the piping is asbestos-cement, 11% is concrete, 23% is cast iron, and 64% of piping is ductile iron. Only around 44% of the mainline piping is less than 35 years old which means that the piping continues to age and deteriorate.

The distribution system for White Pine encompasses approximately 53,000 linear feet of mainline with sizing ranging from 6" to 12".

3. Water Source

The water system currently obtains water through Lake Superior through the use of an intake tunnel located at the mouth of the Big Iron River. Raw water is pumped from the Raw Water Pump Station in Silver City to the water treatment plant located in White Pine through a 42-inch pipeline. Finished water is then supplied from the treatment plant through a 36-inch concrete pipe back to Silver City, then through a 16-inch main to the Village of Ontonagon. Water is supplied to the Village of White Pine directly from the treatment plant via high-lift pumps in the treatment plant.

4. Storage Tanks

The Village of Ontonagon has two (2) storage tanks with one (1) being an elevated storage tank located near the southeast sector of the village off of M-38 on Giesau Dr. The other tank is a ground storage tank that is located off of M-64. The elevated storage tank was installed in 2002 and has a capacity of 150,000 gallons. The tower provides pressure for the community and has cathodic protection. The ground storage tank has a capacity of 850,000 gallons and is gravity fed from the water treatment plant which stores water to fill the Ontonagon elevated storage tank via the booster pump station. The ground storage tank and booster pump station were installed in 2001.

White Pine currently has a 250,000-gallon elevated storage tank located off of Maple Street in the southwest portion of White Pine. The tank was inspected in 2018 and has inadequacies related to the foundation, structural steel, coatings, corrosion protection, and appurtenances that were identified as essential for tank integrity and need to be addressed.

E. Need for the Project

The purpose of the project is to replace the aged 36-inch concrete transmission main with approximately 24,500 linear feet of 16-inch transmission main from the Water Treatment Plant in White Pine to the Raw Water Pump Station located in Silver City. This concrete transmission main was installed in the 1950's and has experienced leaks and breaks over the years. These issues are getting worse with age and are both very difficult and costly to repair. The risk of contamination is significantly increased when failures cause shutdowns to the system due to loss of pressure. Any failure of this line would be catastrophic and would result in the entire Ontonagon Water System to be without water for an extended period. The Army Corps of Engineers has a recommended design life of 70-100 years for concrete piping and with the line already being at 70 years with no backup, this line needs to be replaced.

Based on EGLE's Ontonagon Water System Sanitary Survey completed in January of 2022, there are multiple issues requiring immediate action within their water system. The White Pine elevated storage tank is deteriorating and requires either replacement or repair as well as having a mixer installed due to turbidity issues. A transmission line from the Water Treatment Plant to Silver City is an aging and oversized line that is approaching 20% of useful life left. The line is a critical asset as it is the only line that distributes water from the treatment plant to Silver City. Based on the Village of Ontonagon's Asset Management Plan done back in 2018, the line is in unserviceable condition and is a critical factor in the event of failure. The Sanitary Survey Letter can be found in Appendix E.

The Village recently completed a Capital Improvements Plan (CIP) in 2023. After analyzing EGLE's Sanitary Survey Letter, the Village prioritized the two significant deficiencies identified in the storage element. The Village also prioritized one of the required action recommendations from EGLE through construction of a second intake to the pump station. An excerpt of the CIP that covers the proposed project can be found in Appendix F.

1. Elevated Water Storage Tank Replacement/Improvements

White Pine's elevated storage tank has reached the end of its useful life. As per EGLE's recommendation, it is not to be cost-effective to repair the tank and recommended this tank be replaced all together with a smaller capacity tank to improve the water quality in White Pine. The tank had multiple code violations that must be taken care of. Continued deterioration of the structure puts the system's customers at risk.

The project looks to add a tank mixer for this project to help with water quality and alleviate freezing concerns during the long winter months.

2. Transmission Line Replacement

The 36-inch concrete transmission line from the Water Treatment Plant to the Raw Water Pump Station is aging and deteriorating and at the end of its useful life. With multiple leaks and breaks over the years, it is becoming a costly burden and significant threat to the water system. The project proposes to construct a new 16-inch transmission line that follows the road right-of-way from the pump station to the water treatment plant making this line more accessible for tapping and repairs if needed in the future. The existing 36" line can be kept in place as a backup to the system if ever needed.

F. Projected Future Needs

The Village of Ontonagon, which is a main part of the system that claims the transmission lines to and from the Treatment Plant, the Treatment Plant, pump station, and the village's water system completed an Asset Management Plan (AMP) in 2017 with criticality factors and useful life calculations. The recently updated Capital Improvements Plan (CIP) took these into consideration and identified several projects that need to be completed within the next 6 years which this Project Plan addresses. A copy of the CIP is available upon request.

New Water Supply Well Procedures

There are no new water supply systems being implemented as part of this project.

Analysis of Alternatives

A. Varying Construction Methods

For this project, a variety of construction methods were considered with the intention of saving on project costs. Aside from the open-cut method, rehabilitation efforts such as cured-in-place pipe (CIPP) and spray-on coatings were evaluated.

CIPP involves placing resin into a precut liner which is then inserted into the damaged water pipe and inflated using forced are or water. Connections to pipe laterals and intersecting pipes are reinstated by cutting holes into pipe walls. Spray-on coating offered similar services as the CIPP. These rehabilitation techniques were eliminated due to the age of the existing pipe. The pipe included in the selected alternative is outdated and in need of full replacement. It is suggested that it be fully replaced. Therefore, CIPP is not conducive for this project.

B. No Action

Failing to follow through with the proposed project and continuing with the existing system in a "no action" alternative will cause continued issues such as breaks and failures that will increase in frequency as time goes on and the system continues to age. Without the project, the system will fall out of compliance with Public Act 399. Without the replacement of the transmission line, the entire system will be compromised. The line is a critical asset that must be kept in serviceable condition.

C. Optimum Performance of Existing System

There are no feasible strategies, equipment upgrades, or personnel training that will further enhance the existing system performance and eliminate the need for the system upgrades.

The system is operating efficiently with the current system due to the simple design and adding new items for increased performance would be a costly addition. The system has proven efficiency due to the system's procedures and the staff that operate it. The staff are educated on the system and are properly trained to monitor and maintain the current operations.

D. Regionalization

The alternative has already been implemented as the Ontonagon System encompasses the Village of Ontonagon, White Pine CDP, Silver City, and some of the residential locations along M-64. The system population has been steadily decreasing throughout the years and it is most likely that the system has a higher capacity than needed, so no increase is necessary.

Of all the communities that encompass the Ontonagon System, none have their own infrastructure for a water treatment plant. Since this is the case, the regional study will not be discussed any further.

E. Principal Alternative

The system relies on a 36-inch transmission line that is roughly 24,500 linear feet in length and distributes water from the Water Treatment Plant at the White Pine Mine location back to Silver City where treated water is provided to the distribution system. This line is an aged and deteriorating line being installed in 1953 that is essential to the system due to it being the only transmission line with no backup available. It is proposed to be replaced to keep the system from total failure.

The White Pine elevated storage tank is currently failing and is in need of replacement. EGLE recommended in their latest Sanitary Survey that since the existing tank does not meet specifications, it is believed to be a risk to the sanitary safety of the customers in the system, it needs to be replaced. EGLE recommended that considering how bad of shape the storage tank is, it would be more beneficial to replace rather than repair as the costs will most likely end up being less cost-effective in repair. A tank mixer was found to be a necessary addition to the water treatment system in the equipment category. Due to the turbidity that comes seasonally, a mixer will help in eliminating the current need for the system to reduce its treatment rate during the periods of high turbidity and will help keep the plant's capacity at what it was rated for. Updating to the White Pine elevated storage tank is also a necessary since the existing one does not meet specifications and is believed to be a risk to the sanitary safety of the customers in the system.

The Opinion of Probable Project Costs for this alternative is **$8,785,000**.

F. Monetary Evaluation

The present worth analysis done takes into consideration the cost-effectiveness, environmental impacts, implement ability, and the technical considerations for each principal alternative.

A present worth cost analysis was performed on each alternative for evaluation. For the evaluations, a planning period of 20 years was assumed per the DWSRF Project Planning Guidance provided by EGLE. All construction and mitigation costs were included, and a discount rate used to calculate present worth was obtained from the Federal Office of Management and Budget (OMB) Appendix C of OMB Circular A-94. All formulas for calculations were taken from EGLE's Monetary Evaluation section and the calculations are provided in Appendix B.

Table 3: Total Project Monetary Evaluation		
EPA Discount Rate[1]		0.40%
Planning Period (yrs)		20
High Priority Capital Improvements		
Total Project Cost (Capital Cost) ==>	$	8,785,000
Subtotal Present Worth:	**$**	**8,110,900**
Salvage Value at End of Planning Period:	$	4,866,500
Present Worth of Salvage Value:	$	4,493,100
TOTAL PRESENT WORTH OF ALTERNATIVE ==>	**$**	**4,292,000**

Table 4: Optimum Performance Monetary Evaluation		
EPA Discount Rate[1]		0.40%
Planning Period (yrs)		20
Optimum Performance		
Total Project Cost (Capital Cost) ==>	$	0
Subtotal Present Worth:	**$**	**0**
Salvage Value at End of Planning Period:	$	0
Present Worth of Salvage Value:	$	0
TOTAL PRESENT WORTH OF ALTERNATIVE ==>	**$**	**0**

Table 5: No Action Monetary Evaluation		
EPA Discount Rate[1]		0.40%
Planning Period (yrs)		20
No Action		
Total Project Cost (Capital Cost) ==>	$	0
Subtotal Present Worth:	**$**	**0**
Salvage Value at End of Planning Period:	$	0
Present Worth of Salvage Value:	$	0
TOTAL PRESENT WORTH OF ALTERNATIVE ==>	**$**	**0**

The total project costs for each alternative were estimated using costs from similar items/projects from previous years and accounting for construction costs. This included costs of materials, construction, construction contingencies, application, engineering, planning, and legal/bonding costs. The present worth of each alternative was used to determine the salvage value of the project at the end of the 20-year planning period.

G. Environmental Evaluation

The environmental impacts for each alternative are found in the table below.

Table 6: Environmental Evaluation		
Alternative	**Positive Impacts**	**Negative Impacts**
Full Project	System will be more reliable and less susceptible to outbursts, contamination, flooding, etc; Construction areas will be restored; eliminate catastrophic failure of water system; eliminate thermal stratification and icing; Eliminate storage tank issues	Disturbing ground in previously constructed areas; Exposed work area can be susceptible to contamination during runoff periods; More ground will be disturbed in this alternative due to the larger scope of work
No Action	No ground disturbances; no new vegetation introduced by restoration	High probability for localized flooding from bursting pipes; leaking; Longer water interruptions; Thermal stratification and icing; Possibility of catastrophic failure to system; Storage tank issues
Optimum Performance of Existing Facilities	No ground disturbances; no new vegetation introduced by restoration	High probability for localized flooding from bursting pipes; leaking; Longer water interruptions; Thermal stratification and icing; Possibility of catastrophic failure to system; Storage tank issues

H. Technical Considerations

All alternatives comply with Act 399 and are designed to meet standard recommended guidelines established in the "Recommended Standards for Waterworks" as published by the Great Lakes and Upper Mississippi Board of State Sanitary Engineers. Following construction, system reliability will demonstrate sufficient pumping capacity, stand-by-power, wells and treatment facility units, and storage volume.

I. New/Increased Water Withdrawals

There are no new/increased water withdrawals proposed in the alternatives listed. The population of residents in the regional system along with any other usage demands are not projected to increase. Therefore, new withdrawals are not necessary.

Selected Alternative

A. Design Parameters

The project design will improve various aspects of the Regional Water System and will utilize as guidelines; ASTM, AWWA, ANSI, and Michigan Safe Drinking Water Act standards for the design process. Distribution system pressures will follow parameters found in the guidelines provided by these entities. Minimum system pressures of 35 psi during normal operating conditions and 20 psi during emergencies will be met during the design. Minimum pipe diameters will be analyzed for each respective section and placed according to proper standards.

The replacement of the aged and deteriorated concrete transmission line shall cover a new area of travel to keep the original line will be used as a potential backup in severe emergency conditions. The line is a 24,500 foot transmission line that will follow the right-of-way along Highway M-64. The piping will be smaller in diameter for the replacement line due to inadequate need for a 36-inch transmission line. During project design the size of the line will be further evaluated for proper sizing. The elevated water tower in White Pine is oversized and deteriorating. An inspection was done in 2018 by Nelson Tank Engineering & Consulting that confirmed deficiencies in the evaluation. There will be installation of a proposed, smaller capacity tower at the same location as the existing. A mixer will also be installed to improve water quality during certain seasonal times.

B. Useful Life

By comparing the useful life suggestions provided for salvage value calculations to the useful life estimations from manufacturers, it is estimated that the useful life for all assets included in the proposed project will be 50 years.

C. Water and Energy Efficiency

The selected alternative is an update to existing transmission line, elevated water stroage tank repalcement, and valve installation. The current facilities are aging and cause leaks and loss of product. With the current scarcity of valves, there is a higher loss of water during breaks and construction repairs. The project will help with water loss and will increase water use efficiency.

D. Schedule for Design and Construction

The estimated schedule for the selected project alternative is shown in Table 7.

Table 7: Estimated Project Schedule

Year	Estimated Start	Estimated Duration
DWSRF Application Submittal	June 2023	4 Months
DWSRF Acceptance	Fall 2023	NA
Funding Commitment	Fall 2023	NA
Project Design	Winter 2023/2024	5 Months

Preliminary Engineering/Permitting/Plan Approval	Winter 2023/2024	2 Months
Project Letting/Bidding	Spring 2024	1 Month
Contract Awarded	Spring 2024	NA
Construction Begin	Spring 2024	1 Year
Project Completion/Close Out	Fall 2025	4 Months

E. Cost Summary

The total cost summary is located in Table 8 below and covers the costs associated with project planning, design, and construction for the proposed project.

Table 8: Estimated Project Costs

Items	Cost
Construction	$ 6,885,000
Admin, Legal, Bonding, Engineering, Contingencies, Permits, Misc	$ 1,900,000
Total	**$ 8,785,000**

As per EGLE's DWSRF application, the regional water system is planning on obtaining funding based on being overburdened. The table below shows the rate increases depending on the grant percentage granted for the project proposed.

Table 9: Increase in Resident Monthly Water Service Charge

Project Cost	Current Monthly Charge / EDU	REU's	Project Useful Life	Increase per month	Projected Total Monthly Charge / EDU
$8,785,000	$34.73	1,563	20 Years	**$28.30**	**$63.03**

The Village of Ontonagon currently charges a minimum monthly water rate of $34.73 per month base rate. An additional $10 charge is added for each additional 1,000 gallons used. The minimum monthly cost accounts for all associated expenses for the system including the Region's operating and maintenance (OM&R), pension, clerical, and water fund. The Regional system has 1563 residental equivalent users (REU). The water rates for customers in White Pine, Silver City, and M-64 slightly vary.

If the Regional System were to receive no DWSRF grant funding and the project was funded only as a loan, the regional customers would repay the project loan over the next 20-years by increasing each resident's monthly water usage bill. The bill would increase $28.30 per month per resident. This number identifies the increase in the monthly water bill per resident if this project receives no funding. Funding received by the DWSRF program would lower or reduce this increase.

F. Overburdened Community

The Overburdened Community Status Determination Worksheet is included in Appendix C, below. The Ontonagon Regional Water System has been categorized as an overburdened community per the Community Status Determination Requirements and based on their current median annual household income, projected debt service, and user rate.

G. Implementability

The estimated project scope along with a summary of the DWSRF program was presented during village board meetings where the public had an opportunity prior to advancing with the project plans. The project was approved and there was no public disagreement.

This project is within the internal means of the Ontonagon Water System regarding legal authority, managerial capability, and financial means. The current financial arrangement is to fund the project through the DWSRF in areas of qualification and to use the Village water system funding for additional areas. Constructing in areas of private property and wetland areas will require compliance with proper agency procedures.

H. Residuals

There are no residuals to be expected form the alternatives of this project.

I. Contamination

Contamination identified during any part of the project will be removed and handled using proper precautions. Contamination will be considered during the planning and design of the project to mitigate its impact on the project.

Environmental and Public Health Impacts

A. Direct Impacts

1. Construction Impacts

Construction activities are planned to be of common practice for utility work. Customary construction site disturbance mitigation measures will be included in contract documents to minimize dust, noise, site contamination, and storm runoff. A minimum of one lane of traffic will be open at all times possible and detours will direct traffic when needed. The low traffic volumes and surplus of alternate routes in the project area will cause the construction project to minimally impact traffic and residential areas. The project area crosses one potential haul route on M-64 where traffic will be rerouted if needed.. Groundwater is expected to be encountered at the two river crossings where the pipe will be directionally bored across the rivers to minimize the disturbance in the wetted area. Tree removal is only expected in areas where directional boring is not available. In the area from the elevated storage

tank to the well house, there is a wooded area that may require tree removal due to root depth. All other areas are not estimated to require tree removal.

Digging shall be done by typical means through excavation and normal trenching methods. During trenching, the width of the trench shall be at 3 feet as per MDOT minimum trench width specifications R-83-C. The piping will have a minimum of 5 feet of cover with an anticipated depth of approximately 7 feet. Customary construction site disturbance mitigation measures will be included in contract documents to minimize dust, noise, site contamination, and storm runoff. All required permitting will be obtained through the proper state and federal agencies prior to construction start. There is very little to no tree removal or vegetation anticipated for this project.

There is only one endangered species within the project area. The gray wolf, Canis Lupus, is an endangered species according to the US EPA Endangered Species program. The project does not anticipate any disturbances to the wolf habitat as most of the construction of mainline piping is going to be done within existing road right-of-way.

Directional boring underneath MDOT roadways shall follow MDOT specifications regarding minimum cover depth correlating to pipe diameter.

There is only one endangered species within the project area. The gray wolf, Canis Lupus, is considered to be an endangered species according to the US EPA Endangered Species program. The project does not anticipate any disturbances to the wolf habitat as most of the construction of mainline piping is going to be done in existing right-of-way within the roadway.

2. Traffic Impacts

A minimum of one lane of traffic will be open when possible and detours will direct traffic when needed. There may be some short-term impacts to the project areas due to the requirement of heavy construction equipment causing some noise pollution. Since much of the system is located within the Village's public rights-of-way, short-term traffic congestion, delays, and detours may occur.

Construction Haul Routes shall follow typical roadways considering there should be no excessive equipment or truck load sizes for this project.

3. Operational Impacts

The groundwater and surface water will not be significantly impacted from this project. Construction near rivers and other waterways will be intensely monitored for contamination, taking all necessary precautionary measures to mitigate polluting the river. Excavation revealing water will be handled using proper procedures for dewatering and reimplementation of the water. Dewatering for this project will be minimal and will require little contamination mitigation. There are no chemicals or excessive odors that are anticipated and should not cause any issues. Project construction will create short term disruption to residential areas near the construction. These areas will experience increased noise levels, dust and debris, travel restrictions, and other construction related complications. Disturbances will occur during operational hours permitted by local ordinances. There will be measures to mitigate chemical/fuel spills.

4. Historical/Archaeological/ Tribal resources

This project is not expected to impact any historical, archaeological, or tribal resources as there are no documented sites in areas of planned construction. In the case of unveiling archaeological artifacts, project activities will stop until given approval to continue. All historical mine sites within the project limits are outside of excavation areas, therefore there will be no disturbances. No tribal sites were identified in the project limits.

5. Water Quality

The groundwater and surface water will not be significantly impacted from this project. Construction near the Big Iron River and the Mineral River will be intensely monitored for contamination, taking all necessary precautionary measures to mitigate polluting the river. Excavation revealing water will be handled using proper procedures dewatering and reimplement the water. Dewatering for this project will be minimal and will require little contamination mitigation.

6. Land/Water

The project calls for replacing pipe at two separate river crossings. All construction in these areas will follow EGLE guidelines for construction in wetland areas. Other construction will occur in areas that have been previously excavated. All land will be improved or returned to its existing condition following construction.

7. Endangered Species

There is only one endangered species within the project area. The gray wolf, Canis Lupus, is an endangered species according to the US EPA Endangered Species program. The project does not anticipate any disturbances to the wolf habitat as most of the construction of mainline piping is going to be done within existing road right-of-way. Any unlisted endangered species discovered during the project will be identified and handled per MDNR or US Fish and Wildlife Service recommendations.

8. Agricultural Land

There is no land associated with agricultural use within the project limits.

9. Social/Economic Impact

The project will provide short term employment opportunities for construction related positions. Residents in the project area may be forced to reroute their travel for short term periods but will be otherwise unaffected. Project areas will be identified with signage to protect the community's public safety. The City is not projected to experience increases in their water costs from the project.

B. Indirect Impacts

1. Development

There are no expected changes in the rate, density, or type of development projected in the project area following construction. Population in the regional system is expected to decline steadily which is likely to also minimize the businesses starting up in the area.

2. Land Use

Land use is estimated to remain the same within the project limits following project completion. The project will replace existing features without encouraging increased development.

3. Air/Water Quality

Air quality will be ultimately unaffected following construction. During construction, exhaust and dust can be expected but will terminate post construction. This project will have no lasting effect on the air and water systems in the area by using proper mitigation techniques.

C. Sensitive Areas

There are no sensitive natural areas in the way of the project. All areas to be constructed have previously disturbed and contain no concerning features.

D. Aesthetic Features

With the proposed construction being in previously disturbed areas, it will not impact any aesthetic features of the area. Construction near the water will include directional boring that will minimize disturbances near the Iron River, which is an aesthetic feature of the area. All other aesthetic features unaccounted for will be handled separately and it will be protected.

E. Cumulative Impacts

There are no other significant projects planned to take place in the surrounding area, aside from the proposed. Therefore, the effects on local businesses and residential travel will be temporary and relatively subtle. The proposed project involves a remove and replace scope of work that will not impact areas outside of those previously constructed. The natural areas surround project areas will not be impacted by the construction.

Aside from this, long term impacts result from this project. There will be a more efficient and sound system underground, providing water to the Ontonagon Regional System customers. The new system will minimize the amount of the system to be updated as the proposed project is projected to update the remaining critical parts of the system. This system will be safer for the regional system and require less maintenance in the years to come, allowing traffic to flow freely without interruption.

Mitigation

A. Short-Term Construction-Related Mitigation

In the instance where there is a possibility of adverse impacts to the project area, the Contract Documents will provide explanations and requirements for mitigation of said impacts. All mitigation efforts will be reviewed and approved by the proper officials.

1. General Construction

Depending on the project start date, spring season construction may require heavier permitting with runoff volumes. The Iron River, as well as other waterways, will flow near its high-water line and wetlands will be flooded from runoff requiring extra precaution of erosion control on construction sites and proper EGLE permitting processes to be completed. Spring construction is a common practice in this region and will not cause complications as contractors are aware of mitigation practices necessary for this time of year. All permits will be obtained prior to beginning construction.

2. Traffic

Most of the mainline and valve portions of the project will occur in or near road rights-of-way where traffic influence minimization measures will need to take place. Detours or flagging operations will be enacted during the construction in the roadways with partial width restrictions. For construction where detours are required, alternate routes will be designated. Some portions of the project may require construction vehicles/equipment to be parked on the shoulder of the roadway. In these instances, advanced warning signage will be utilized to warn traffic of potential obstruction ahead.

3. Safety

All construction will comply with the safety standards of local, state, and federal laws and regulations. Standards listed by Occupational Safety and Health Administration (OSHA) should be used as minimum guidelines.

4. Dust and Noise

Measures will be taken to minimize dust and noise caused by construction in order to maintain a safe and controlled work site.

5. Erosion

Project construction may require a Soil Erosion and Construction Storm Water permit. Typical sediment and erosion control measures will be enacted during construction.

6. Restoration

All areas disturbed by construction processes will be returned to their original condition or an approved equivalent following construction completion using MDOT 2020 Standards for Construction as guidance.

7. Utilities

All utilities will be identified and located prior to construction, as necessary. Disrupting utilities will be avoided when possible. The Village will be notified when construction is in progress to allow coordination with utility companies looking to update or replace assets during this time. Short term interference with water service lines is expected. Any long term interference will require temporary service lines to provide service to local residences and businesses.

8. Construction Disposal

Construction disposal will not be discarded in wetlands, floodplains, or other areas where it could harm the natural environment. All disposals will be in approved locations and will utilize approved techniques.

9. Permitting

All necessary permits will be acquired from EGLE and local authorities prior to project construction.

10. Endangered Species

There is only one endangered species within the project area. The gray wolf, Canis Lupus, is an endangered species according to the US EPA Endangered Species program. The project does not anticipate any disturbances to the wolf habitat as most of the construction of mainline piping is going to be done within existing road right-of-way.

11. River Crossing

In instances of river crossings, directional boring is to be suggested as it will involve the least amount of environmental impact and disturbances to the surrounding area. EGLE permitting will be acquired for any boring in wetland areas. Restoration shall follow completion of the project.

12. Wetlands

The only wetland impact expected revolves around the river crossings discussed above.

B. Mitigation of Long-Term Impacts

1. Siting Decisions

As shown in Appendix A, construction follow existing rights-of-way and will be in previously constructed areas which will limit the long-term impacts of construction. Any disturbances outside of the proposed locations will be evaluated by the contractor and project supervisors to determine mitigation measures.

2. Operational Impacts

The project will not impact the Village's water distribution service for long periods. In the case of long-term impacts, temporary services will be implemented to provide services to the Village.

C. Mitigation of Indirect Impacts

1. Master Plan and Zoning

The project will not be impacting any areas with zoning in place and therefore, will not impact the zoning plan.

2. Ordinances

The Village of Ontonagon NO. 2011-01 covers water utility for the village area. All ordinances shall be followed during construction operations.

3. Staging of Construction

Construction staging will be conducted to minimize the impact to surrounding residents, businesses, and travelers throughout the project area.

Public Participation

The following section illustrates how the public was kept informed and involved on the project and how their input was taken into consideration and used regarding the selection of the proposed alternative.

A. Public Meeting

The alternatives detailed above were discussed with the Village of Ontonagon Council and the public at the meeting on May 22, 2023 at the village hall. The discussions at this meeting were used in the selection of the proposed alternative. Copies of the meeting notice and meeting minutes are included in Appendix D.

B. Public Meeting Advertisement

A notice was posted in the Ontonagon Herald on May 10th, 2023 regarding the proposed project for the Ontonagon Regional Water system. The post announced the date and time of the meeting for where discussion on all possible alternatives will take place. A copy of the advertisement can be found in Appendix D.

C. Public Meeting Summary

The public meeting to adopt an alternative for the Ontonagon Regional Water System discussed the required items for discussion found in the DWSRF Project Planning Guidance. A written narrative outlining the required items was handed to all meeting attendees prior to the discussion. A copy of the information presented to the public during the meeting can be found in Appendix D.

D. Adoption of the Project Planning Document

Following the conclusion of the public hearing, the Village Council voted to adopt a resolution in support of submitting the project plans with designating _____ as the authorized representative. The resolution to adopt the project plans can be found in appendix D.

Appendix A:

Figure 1: Existing System 36” Transmission Line

Figure 2: Existing System Village of Ontonagon

Figure 3: Existing System White Pine

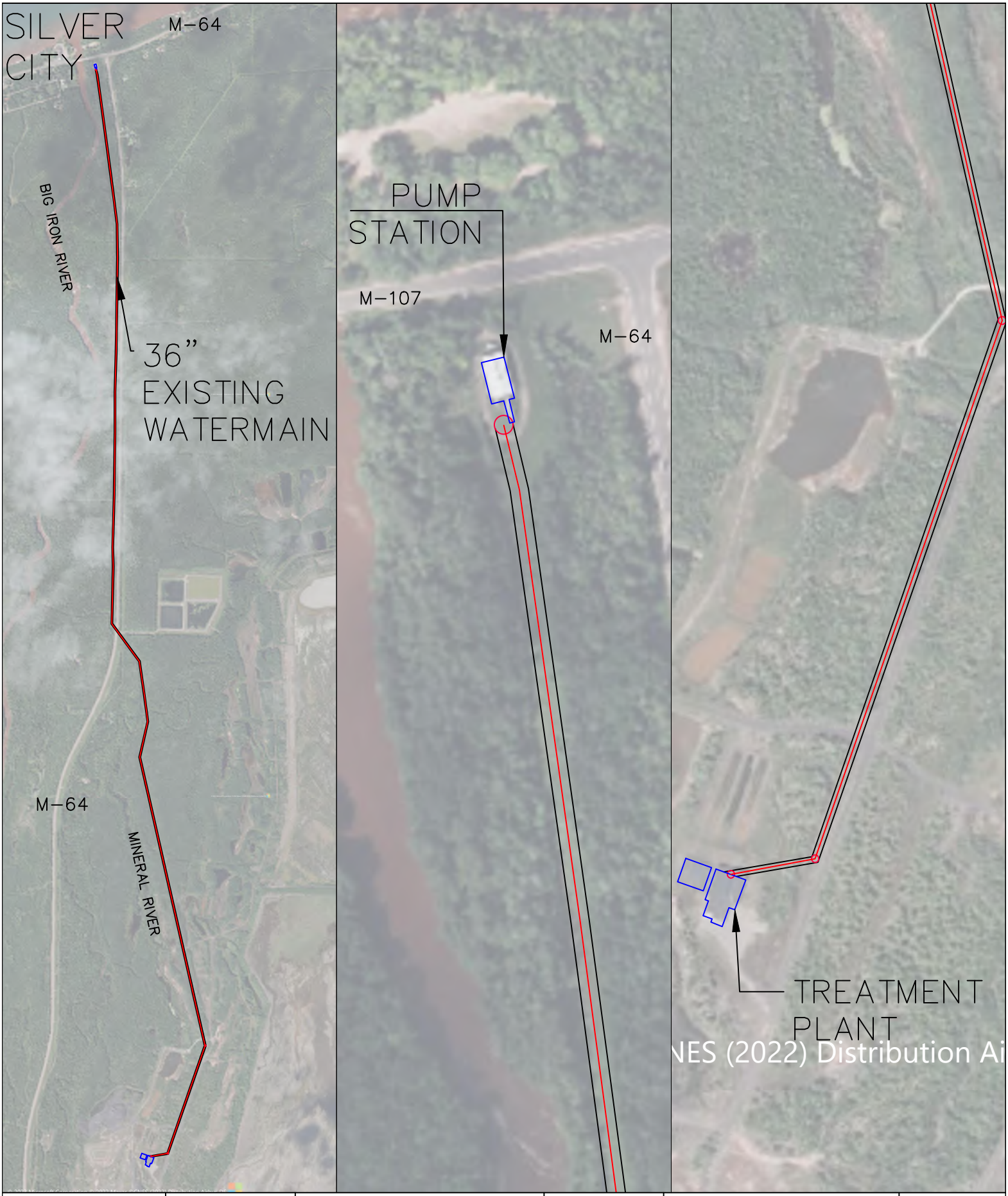
Figures 4-9: Proposed Transmission Line

Figure 10: EGLE Wetland Map

Figures 11-12: FEMA Floodplain Mapping

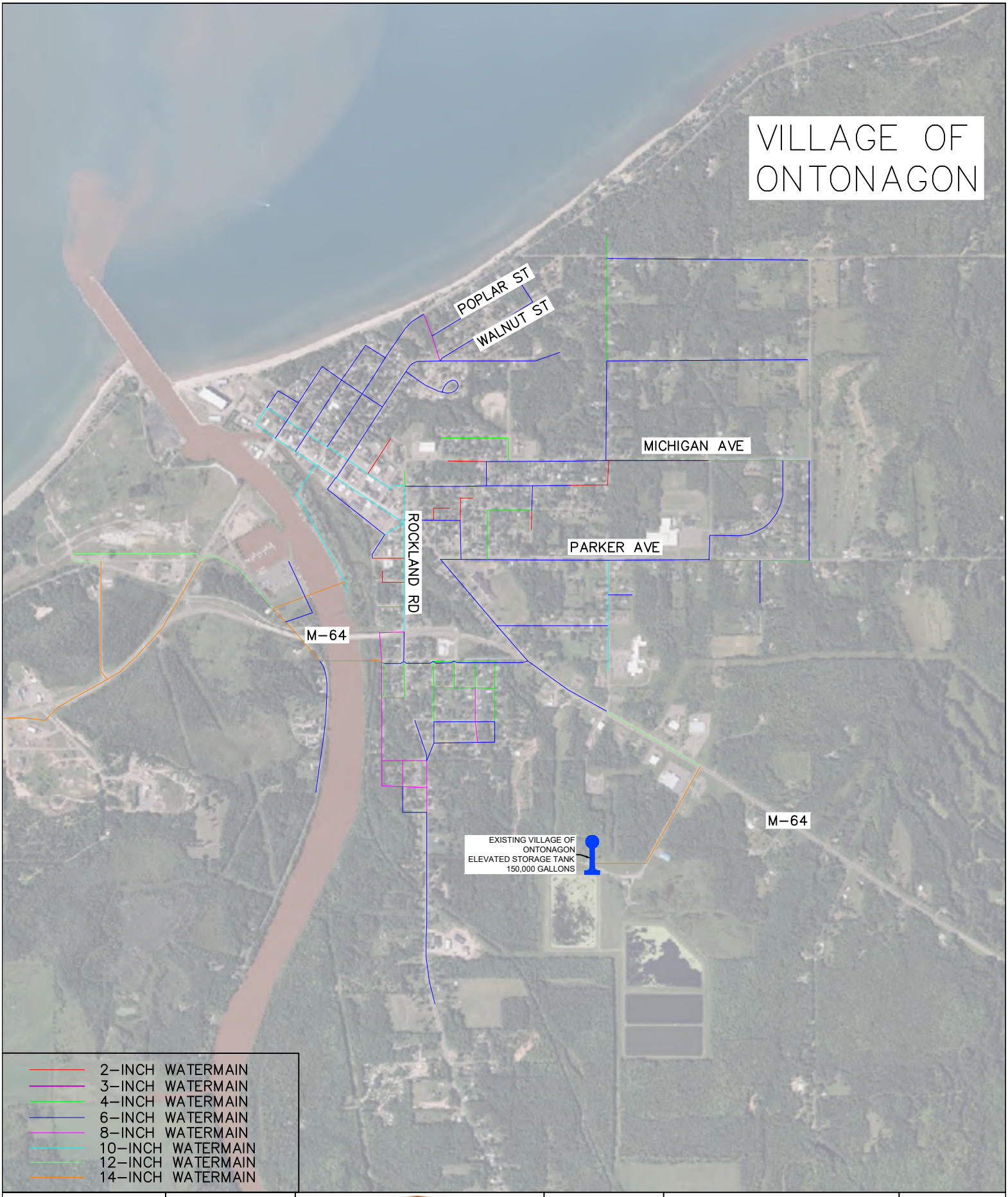
Figures 13-14: EGLE Coastal Boundary Mapping

Figure 15: Village of Ontonagon Zoning Districts

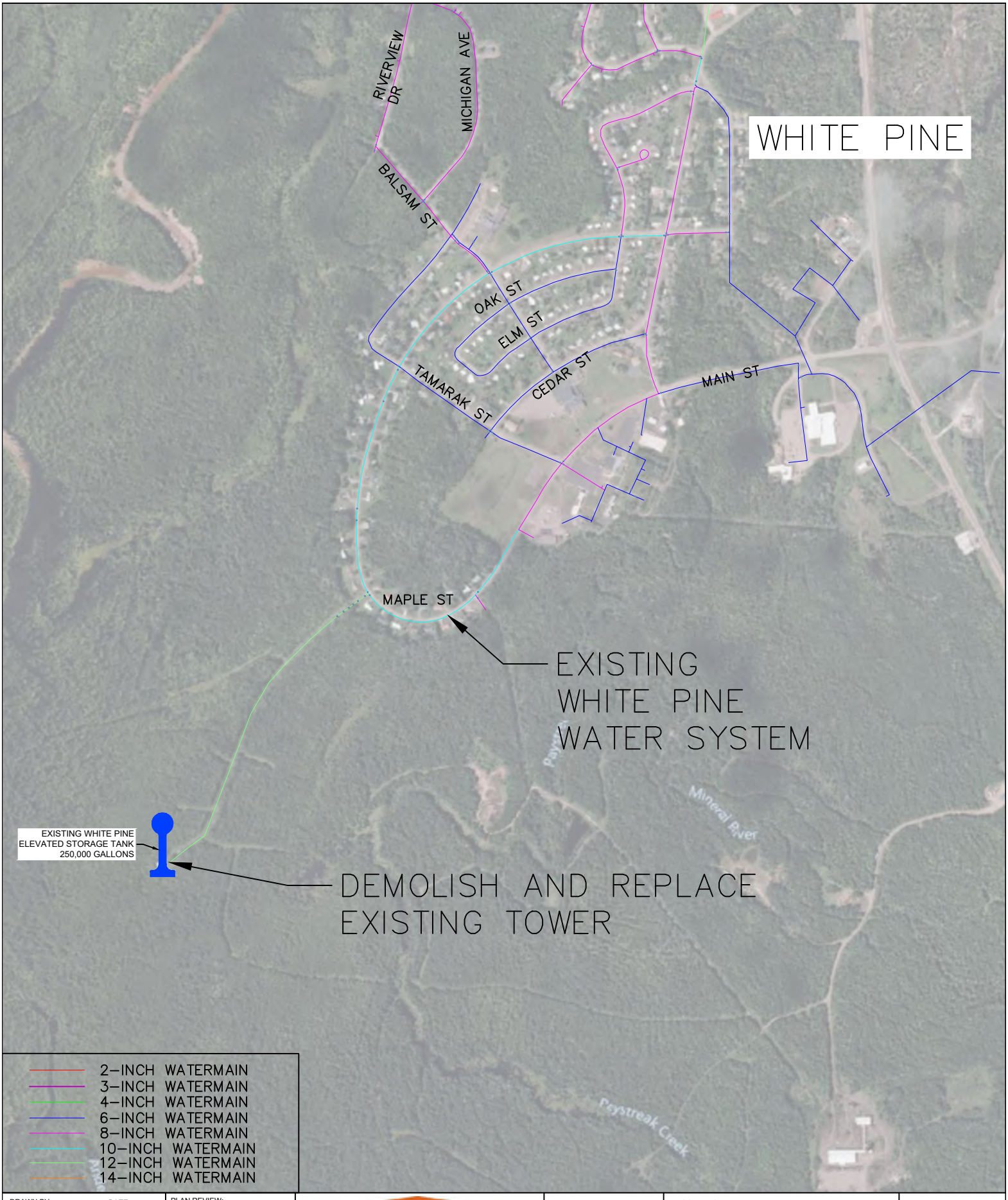


DRAWN BY: DATE:	PLAN REVIEW:	WICKWIRE	WICKWIRE, P.C. 715 Selden Rd Iron River, MI 49935 Phone: 906-265-9865 wickwiresolutions.com	DESCRIPTION: ONTONAGON EXISTING 36-INCH TRANSMISSION LINE	JOB NO.
REVIEWED BY: DATE:	REVISION 1:				DRAWING NO.
NOTES: DWSRF	REVISION 2:				SHEET NO. 1
	REVISION 3:				SCALE:
	REVISION 4:				

NES (2022) Distribution Ai

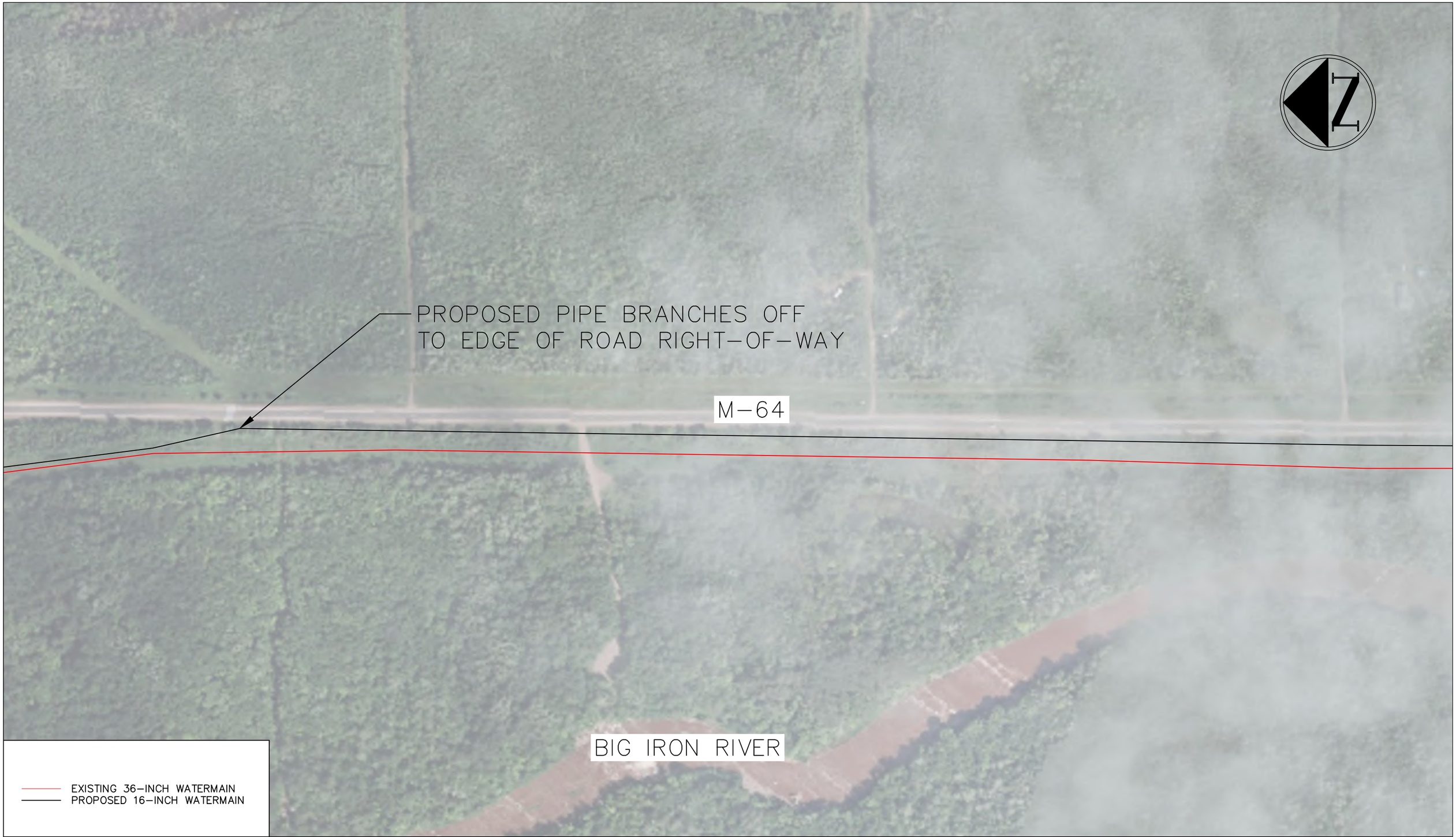


DRAWN BY: DATE:	PLAN REVIEW:	WICKWIRE, P.C. 715 Selden Rd Iron River, MI 49935 Phone: 906-265-9865 wickwiresolutions.com	DESCRIPTION: VILLAGE OF ONTONAGON EXISTING SYSTEM
REVIEWED BY: DATE:	REVISION 1:		JOB NO.
NOTES: DWSRF	REVISION 2:		DRAWING NO.
	REVISION 3:		SHEET NO. 2
	REVISION 4:		SCALE:

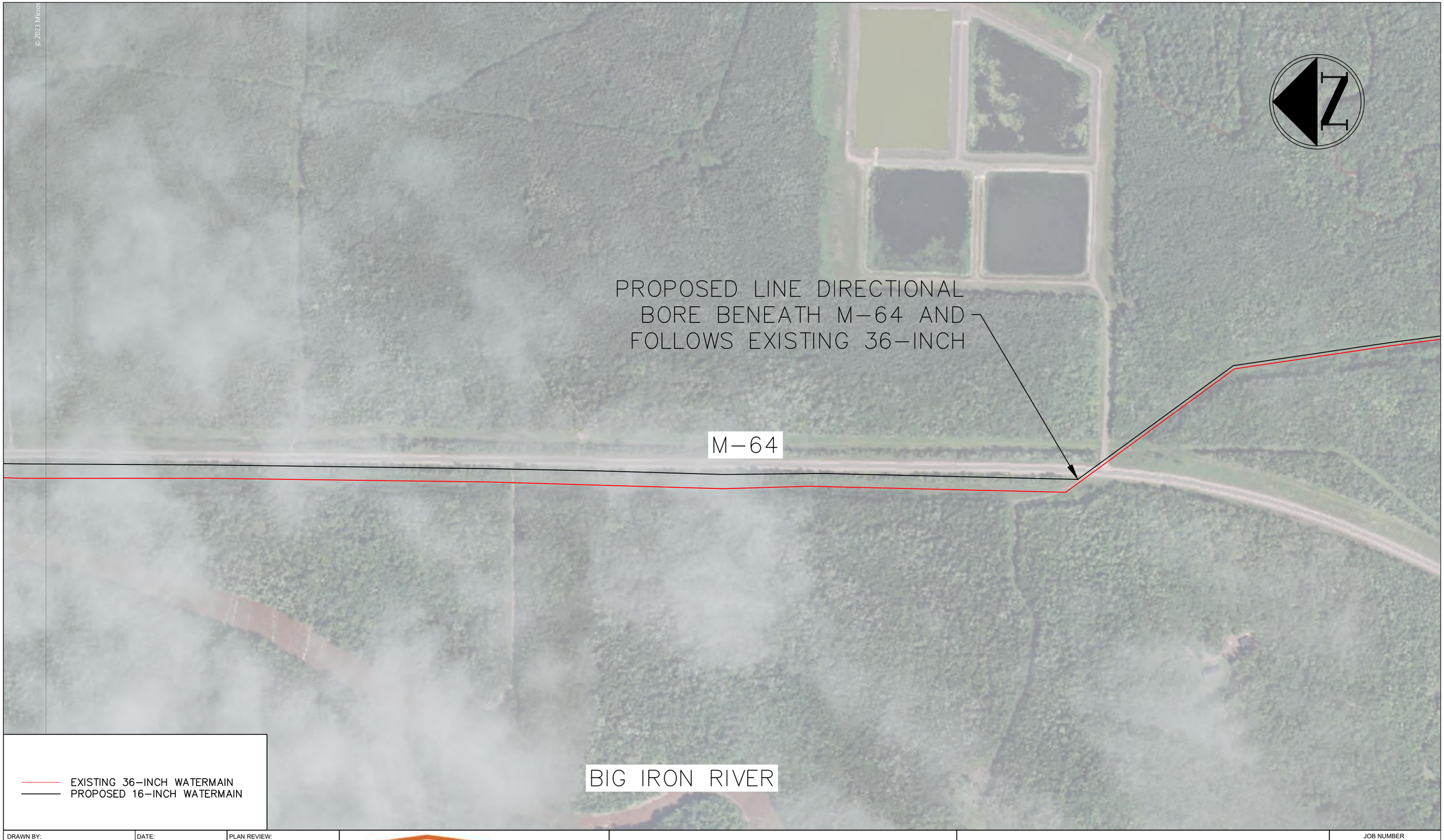


DRAWN BY: DATE:	PLAN REVIEW:		WICKWIRE, P.C. 715 Selden Rd Iron River, MI 49935 Phone: 906-265-9865 wickwiresolutions.com	DESCRIPTION: WHITE PINE EXISTING SYSTEM	JOB NO.
REVIEWED BY: DATE:	REVISION 1:				DRAWING NO.
NOTES: DWSRF	REVISION 2:				SHEET NO. 3
	REVISION 3:				SCALE:
	REVISION 4:				

DRAWN BY:	DATE:	PLAN REVIEW:	WICKWIRE, P.C. 715 Selden Rd Iron River, MI 49935 Phone: 906-265-9865 wickwiresolutions.com	PROPOSED TRANSMISSION LINE	1	JOB NUMBER
REVIEWED BY:	DATE:	REVISION 1:				DRAWING NO.
NOTES: DWSRF		REVISION 2: REVISION 3: REVISION 4:				SHEET NO. 4



DRAWN BY:	DATE:	PLAN REVIEW:	WICKWIRE, P.C. 715 Selden Rd Iron River, MI 49935 Phone: 906-265-9865 wickwiresolutions.com	PROPOSED TRANSMISSION LINE		JOB NUMBER
REVIEWED BY:	DATE:	REVISION 1:				DRAWING NO.
NOTES: DWSRF		REVISION 2: REVISION 3: REVISION 4:				SHEET NO. 5



DRAWN BY:	DATE:	PLAN REVIEW:	WICKWIRE, P.C. 715 Selden Rd Iron River, MI 49935 Phone: 906-265-9865 wickwiresolutions.com	PROPOSED TRANSMISSION LINE		JOB NUMBER
REVIEWED BY:	DATE:	REVISION 1:				DRAWING NO.
NOTES: DWSRF		REVISION 2: REVISION 3: REVISION 4:				SHEET NO. 6

PROPOSED LINE DIRECTIONAL BORE BENEATH MINERAL RIVER AND FOLLOWS EXISTING 36–INCH

MINERAL RIVER

M–64

EXISTING 36–INCH WATERMAIN
PROPOSED 16–INCH WATERMAIN

DRAWN BY:	DATE:	PLAN REVIEW:
REVIEWED BY:	DATE:	REVISION 1:
NOTES: DWSRF		REVISION 2:
		REVISION 3:
		REVISION 4:

WICKWIRE, P.C.
715 Selden Rd
Iron River, MI 49935
Phone: 906-265-9865
wickwiresolutions.com

PROPOSED TRANSMISSION LINE

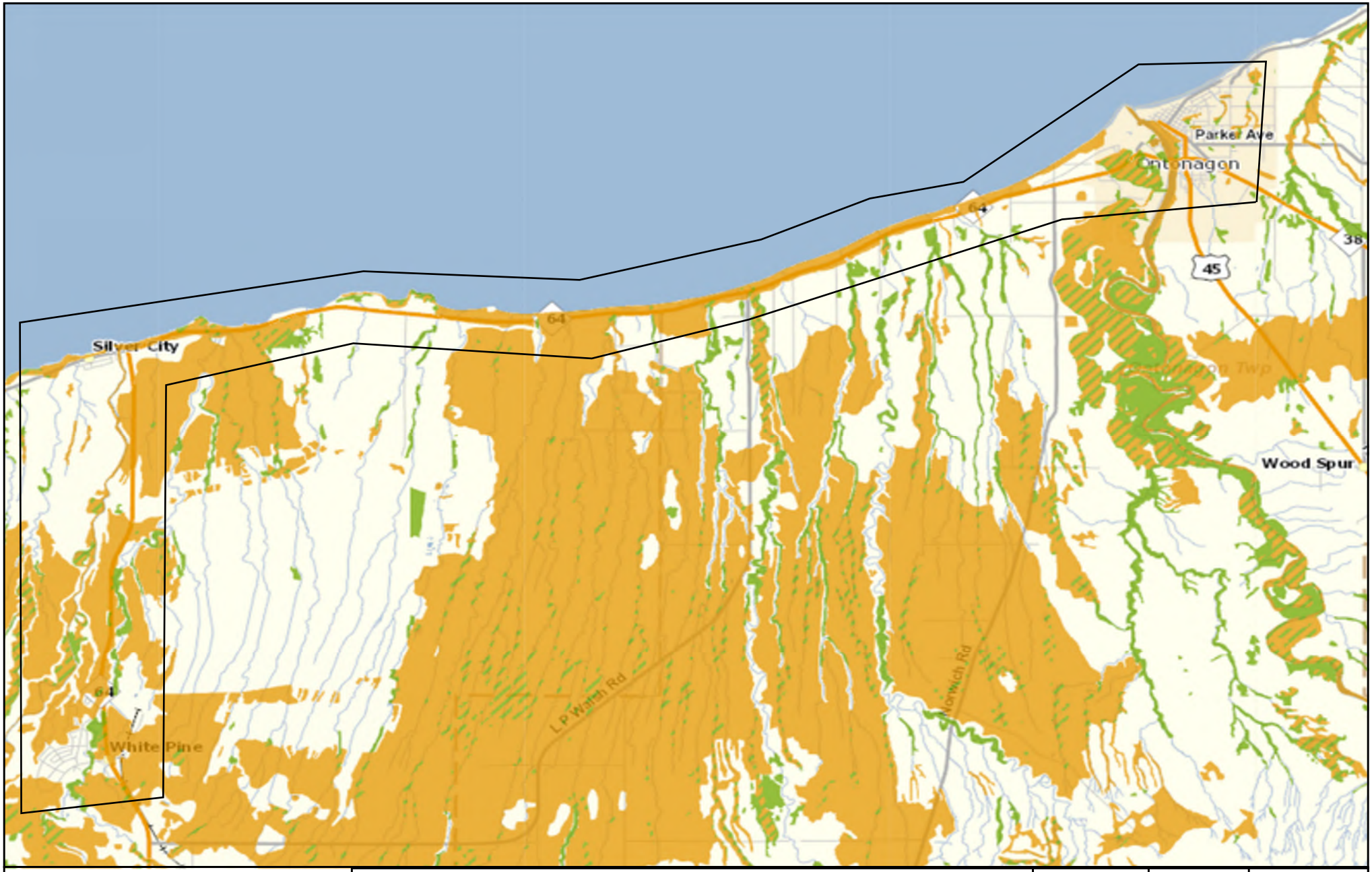
JOB NUMBER

DRAWING NO.

SHEET NO. 7

DRAWN BY:	DATE:	PLAN REVIEW:	WICKWIRE, P.C. 715 Selden Rd Iron River, MI 49935 Phone: 906-265-9865 wickwiresolutions.com	PROPOSED TRANSMISSION LINE	JOB NUMBER
REVIEWED BY:	DATE:	REVISION 1:			DRAWING NO.
NOTES: DWSRF		REVISION 2: REVISION 3: REVISION 4:			SHEET NO. 8

DRAWN BY:	DATE:	PLAN REVIEW:	WICKWIRE, P.C. 715 Selden Rd Iron River, MI 49935 Phone: 906-265-9865 wickwiresolutions.com	PROPOSED TRANSMISSION LINE	JOB NUMBER
REVIEWED BY:	DATE:	REVISION 1:			DRAWING NO.
NOTES: DWSRF		REVISION 2: REVISION 3: REVISION 4:			SHEET NO. 9



WICKWIRE

EGLE Ontonagon Wetland Mapper
DWSRF

Drawn By	CAB	
Checked By		
Figure	10	


KEY TO MAP
EXPLANATION OF ZONE DESIGNATIONS
NATIONAL FLOOD INSURANCE PROGRAM
FIRM
FLOOD INSURANCE RATE MAP
VILLAGE OF
ONTONAGON,
MICHIGAN
ONTONAGON COUNTY
(ONLY PANEL PRINTED)
COMMUNITY-PANEL NUMBER
260309 0001 B
EFFECTIVE DATE:
NOVEMBER 2, 1983
Federal Emergency Management Agency

FIG. 11


LAKE SUPERIOR
ZONE A
ONTONAGON
OTTAWA
NATIONAL
FOREST
TOWNSHIP OF
CARP LAKE,
MICHIGAN
ONTONAGON COUNTY
CONVERTED BY LETTER
EFFECTIVE 7/1/97

FIG. 12

Ontonagon County
Carp Lake Township, T51N R44W, T51N R43W, T51N R42W,
T50N R43W and T50N R44W

The heavy red line is the ***Coastal Zone Management Boundary***
The red hatched area is the ***Coastal Zone Management Area***

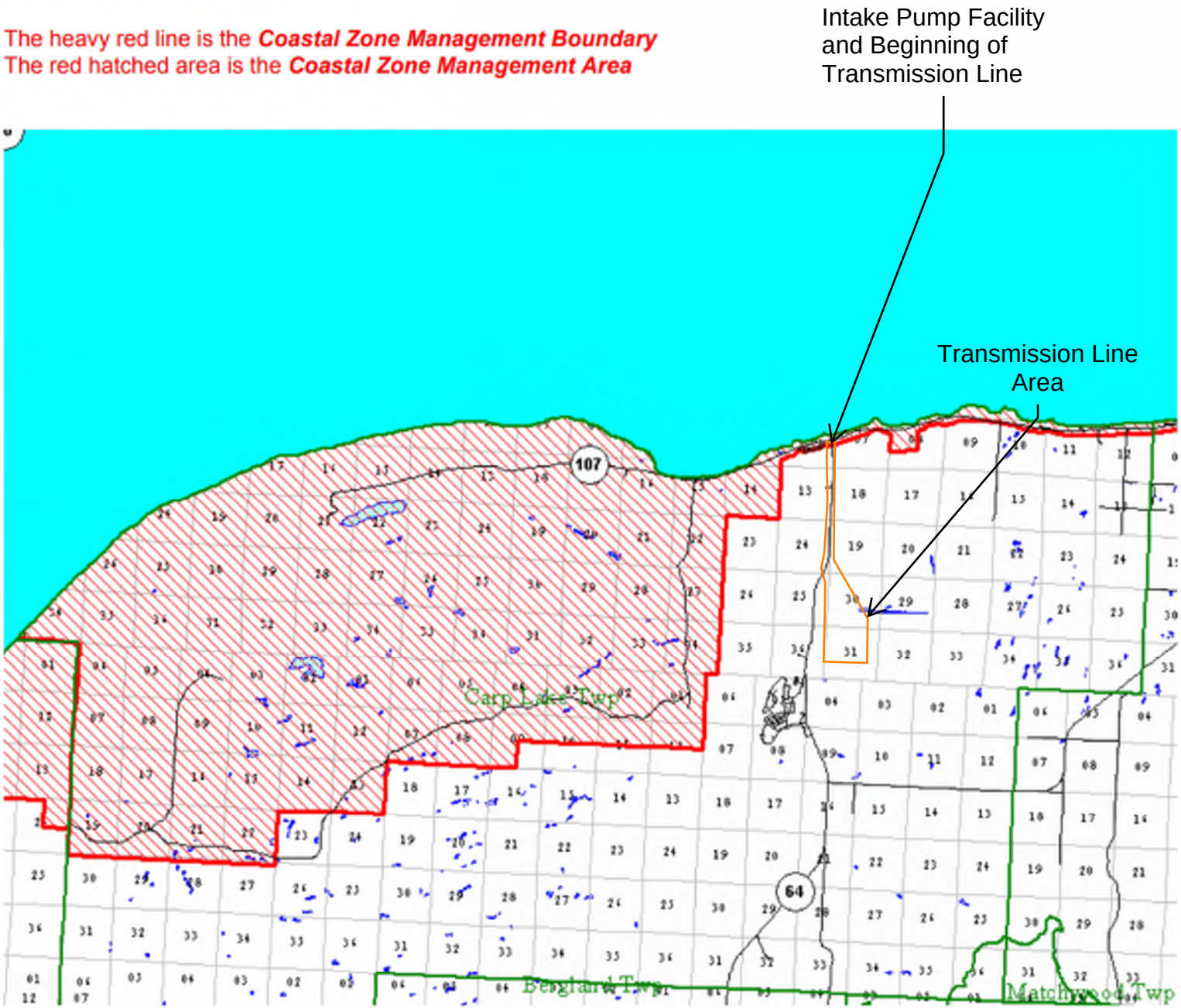


FIG. 13

Ontonagon County
West Part of Ontonagon Township, T51N R40W, T52N R40W, T52N R39W, T53N R39W and T53N R38W

The heavy red line is the ***Coastal Zone Management Boundary***
The red hatched area is the ***Coastal Zone Management Area***

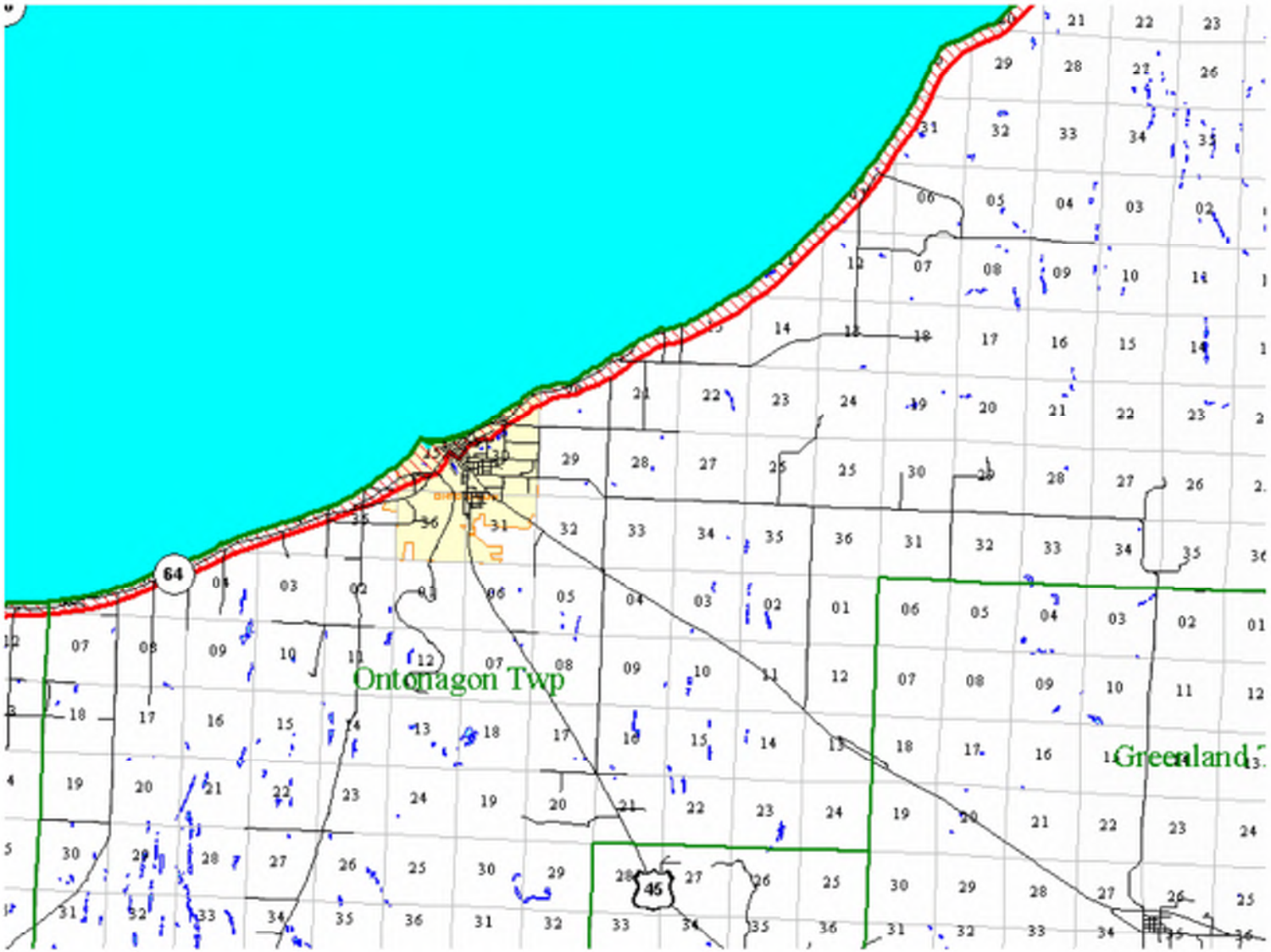
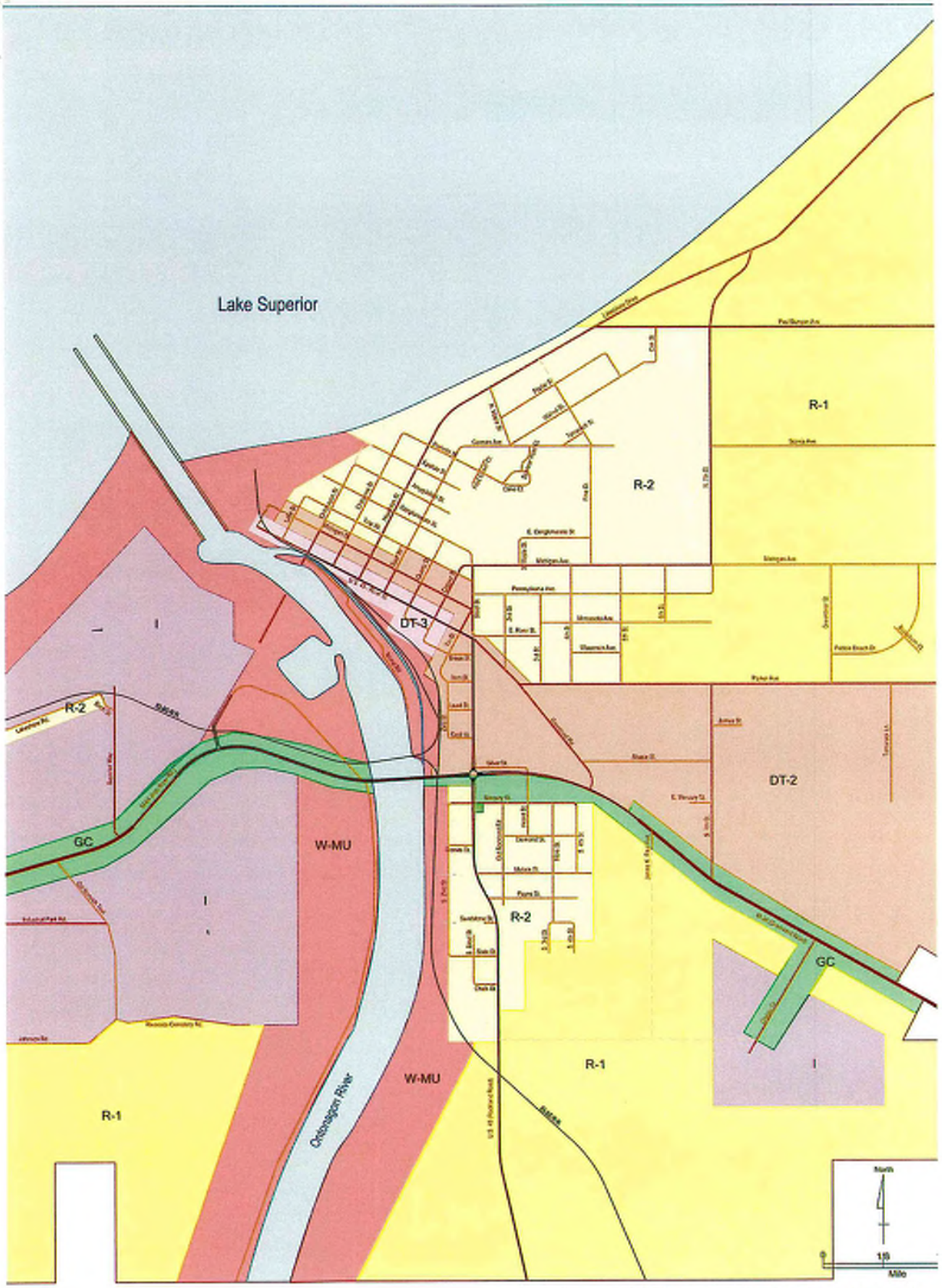


FIG. 14



Village of Ontonagon Zoning Map Legend

- R-1 Residential
- R-2 Residential
- DT-2 Downtown Business
- DT-3 Downtown Business
- GC Gateway Corridor Business
- W-MU Waterfront - Multi Use
- I Industrial

Current Zoning Districts

Pamela Loey 1-23-23

FIG. 15

Appendix B:

Table 1: Present Worth Calculations

Table 2: Selected Alternative Projected Bond Schedule

Table 3: Rate Increase Calculations

OMB Discount Rates

Useful Life Documentation

Ontonagon Regional Water System **PRESENT WORTH CALCULATIONS**
DWSRF
WICKWIRE, P.C. PROJECT NO. 22023

PRESENT WORTH ONE-TIME EXPENDITURES (CAPITAL COSTS AND SALVAGE VALUE)

Number of Periods(n)
FUTURE VALUE (F) / ESTIMATED COST
DISCOUNT RATE(i)
Formula= PW=F*(1/(1+i)^n)

ESTIMATED USEFUL LIFE	YRS
LAND=	PERMANENT
WATER SUPPLY CONVEYANCE=	50
OTHER STRUCTURES=	30-50
PROCESS EQUIPMENT	15-20
AUXILARY EQUIPMENT	15-20

CAPITAL

F=	$ 8,785,000.00
i=	0.40%
n=	20
PW=	$ 8,110,871.29

ESTIMATED USEFUL LIFE (YEARS)=	50
STRAIGHT LINE DEPRECIATION AMT=	162217.426

STRAIGHT LINE DEPRECIATION=	
1	$ 7,948,653.86
2	$ 7,786,436.44
3	$ 7,624,219.01
4	$ 7,462,001.59
5	$ 7,299,784.16
6	$ 7,137,566.73
7	$ 6,975,349.31
8	$ 6,813,131.88
9	$ 6,650,914.46
10	$ 6,488,697.03
11	$ 6,326,479.61
12	$ 6,164,262.18
13	$ 6,002,044.75
14	$ 5,839,827.33
15	$ 5,677,609.90
16	$ 5,515,392.48
17	$ 5,353,175.05
18	$ 5,190,957.62
19	$ 5,028,740.20
20	$ 4,866,522.77

SALVAGE

F=	$ 4,866,522.77
i=	0.40%
n=	20
PW=	$ 4,493,083.65

TOTAL PRESENT WORTH=	$ 4,291,916.35

Bond Schedule

Borrower Name: **Village of Ontonagon**
Interest Rate: 1.875%
Yrs Deferred Principle 0
Principal: **$8,785,000** (round to nearest $1000)
Ammort. Factor 0.0604
Ammortized Payment: $530,803

Year	1st Interest	2nd Interest	Principal Paid	Total Year Payment	Loan Balance	Monthly Service Charge Increase
					8,785,000	
1	82,359	82,359	366,000	530,719	8,419,000	$ 28.30
2	78,928	78,928	373,000	530,856	8,046,000	$ 28.30
3	75,431	75,431	380,000	530,863	7,666,000	$ 28.30
4	71,869	71,869	387,000	530,738	7,279,000	$ 28.30
5	68,241	68,241	394,000	530,481	6,885,000	$ 28.28
6	64,547	64,547	402,000	531,094	6,483,000	$ 28.32
7	60,778	60,778	409,000	530,556	6,074,000	$ 28.29
8	56,944	56,944	417,000	530,888	5,657,000	$ 28.30
9	53,034	53,034	425,000	531,069	5,232,000	$ 28.31
10	49,050	49,050	433,000	531,100	4,799,000	$ 28.32
11	44,991	44,991	441,000	530,981	4,358,000	$ 28.31
12	40,856	40,856	449,000	530,713	3,909,000	$ 28.30
13	36,647	36,647	458,000	531,294	3,451,000	$ 28.33
14	32,353	32,353	466,000	530,706	2,985,000	$ 28.30
15	27,984	27,984	475,000	530,969	2,510,000	$ 28.31
16	23,531	23,531	484,000	531,063	2,026,000	$ 28.31
17	18,994	18,994	493,000	530,988	1,533,000	$ 28.31
18	14,372	14,372	502,000	530,744	1,031,000	$ 28.30
19	9,666	9,666	511,000	530,331	520,000	$ 28.28
20	4,875	4,875	521,000	530,750	-1,000	$ 28.30
				10,616,900		566.0535295
			Average=	**530,845**	**Average=**	**$ 28.30**

Ontonagon Water System
Rate Increases for DWSRF Project
WICKWIRE, P.C. PROJECT NO. 22023

REU's	1563					
Total Project =	$ 8,785,000.00					
Loan Duration =	20	Years				
Annual Loan Interest	1.875%	**Monthly Interest**	0.15625%			
Grant %	100%	75%	50%	25%	0%	
Amount Owed	$ -	$ 2,196,250.00	$ 4,392,500.00	$ 6,588,750.00	$ 8,785,000.00	
Monthly Cost	$ -	$ 10,980.91	$ 21,961.83	$ 32,942.74	$ 43,923.66	
Resident Monthly Cost	$ -	$ 7.03	$ 14.05	$ 21.08	$ 28.30	

APPENDIX C
(Revised March 15, 2022)

DISCOUNT RATES FOR COST-EFFECTIVENESS, LEASE PURCHASE, AND RELATED ANALYSES

Effective Dates. This appendix is updated annually. This version of the appendix is valid for calendar year 2022. A copy of the updated appendix can be obtained in electronic form through the OMB home page at https://www.whitehouse.gov/wp-content/uploads/2022/05/Appendix-C.pdf. The text of the Circular is found at www.whitehouse.gov/wp-content/uploads/legacy_drupal_files/omb/circulars/A94/a094.pdf, and a table of past years' rates is located at https://www.whitehouse.gov/wp-content/uploads/2022/05/discount-history.pdf. Updates of the appendix are also available upon request from OMB's Office of Economic Policy (202-395-3585).

Nominal Discount Rates. A forecast of nominal or market interest rates for calendar year 2022 based on the economic assumptions for the 2023 Budget is presented below. These nominal rates are to be used for discounting nominal flows, which are often encountered in lease-purchase analysis.

Nominal Interest Rates on Treasury Notes and Bonds of Specified Maturities (in percent)

3-Year	5-Year	7-Year	10-Year	20-Year	30-Year
1.3	1.6	1.9	2.1	2.5	2.6

Real Discount Rates. A forecast of real interest rates from which the inflation premium has been removed and based on the economic assumptions from the 2023 Budget is presented below. These real rates are to be used for discounting constant-dollar flows, as is often required in cost-effectiveness analysis.

Real Interest Rates on Treasury Notes and Bonds of Specified Maturities (in percent)

3-Year	5-Year	7-Year	10-Year	20-Year	30-Year
-1.2	-0.6	-0.3	0.0	0.4	0.5

Analyses of programs with terms different from those presented above may use a linear interpolation. For example, a four-year project can be evaluated with a rate equal to the average of the three-year and five-year rates. Programs with durations longer than 30 years may use the 30-year interest rate.

Benefits of Ductile Iron Pipe

Ductile iron pipe is resilient, safe, and reliable – with a service life of over 100 years. It is an environmentally superior pipe due to its longer service life, resilience, energy savings while in service, recycled content, and its own recyclability. Ductile iron pipe is a key component of a clean energy future and modern, resilient water infrastructure. Ductile iron pipe has proven itself to stand the test of time, is made in America, and supports domestic jobs in communities across the country.

Environmentally Superior Pipe

Ductile iron pipes are natural, safe, and sustainable. Ductile iron pipes contain at least 90% recycled materials with the pipes themselves being 100% recyclable.[2, 6]

Better Value

Ductile iron pipe is a better value than plastic pipe because it lasts longer and saves money over time. According to a University of Michigan report, Ductile iron pipe is the more cost-effective material over a pipeline's service life with lower operational and maintenance costs and lower energy costs.[1]

Lower Emissions and Less Energy

Ductile iron pipe has better environmental performance due to its lower greenhouse gas emissions in both the production and operation phases. From cradle-to-grave, Ductile iron pipe is superior environmentally, as it requires less energy to pump water and has a lower environmental impact.[5]

Resilient

Ductile iron pipe is resilient through extreme weather events, natural disasters, soil contamination, and unpredictable situations. With its strength and durability, Ductile iron is the pipe of choice to protect against wildfires, earthquakes, floods, hurricanes, extreme temperatures, and the regular, ongoing stresses facing water utility systems. [2, 3, 4]

Health and Safety

Production of Ductile iron pipe does not release dangerous chemicals like vinyl chloride, dioxin or ethylene dichloride. Ductile iron pipe does not absorb toxins like plastic pipe and provides better protection against drinking water contamination. Ductile iron pipe is safer to install and maintain than plastic pipe, which is more prone to catastrophic installation and operational failures causing injuries to workers and damage to property.[2, 7]

Longer Life Cycle

Ductile iron pipe requires very little maintenance and has an expected service life of at least 100 years. Ductile iron pipe provides significant cost savings and benefits compared to plastic pipe, which has an average service life of 55 years.[8] A longer life cycle saves money and is better for the environment. It also means fewer interruptions, fewer replacements, and more peace of mind for local communities.[1,5]

dipra
Ductile Iron Pipe Research Association

[1] https://www.dipra.org/ductile-iron-pipe-resources/downloadable-brochures/lcca-brochure

[2] https://www.dipra.org/ductile-iron-pipe/benefits

[3] https://www.dipra.org/phocadownload/Applications-SeismicConsiderations.pdf

[4] https://www.dipra.org/phocadownload/new/CorrosionControl-DesignDecisionModel.pdf

[5] https://www.dipra.org/ductile-iron-pipe/dipra-facts-and-figures/benefits-of-ductile-iron-pipe

[6] https://www.dipra.org/ductile-iron-pipe/dipra-facts-and-figures/environmental-benefits

[7] https://www.dipra.org/ductile-iron-pipe/dipra-facts-and-figures/dangers-of-using-pvc

[8] BURIED NO LONGER: Confronting America's Water Infrastructure Challenge

dipra
Ductile Iron Pipe
Research Association

ABOUT DUCTILE IRON PIPE

LONGEVITY

This strong, safe and reliable product has the longevity to last 100+ years.

DUCTILE IRON PIPE

Generations of Water Delivery for Communities Across the Nation

A century ago, dedicated American engineers installed iron pipes to create the country's water systems. This strong, safe, and reliable product has stood the test of time. Modern Ductile iron pipe is made to last 100+ years and is an environmentally preferable product due to its recycled content, energy savings while in service, its durability, its recyclability, and the commitment of the Ductile iron pipe industry.

Elevated Water Storage Tanks

Elevated water storage tanks are used to store water for fire protection and potable drinking water within a designated area or community. Elevated tanks allow the natural force of gravity to produce consistent water pressure throughout the system. Based on the intended application and needs of the distribution area, elevated water tanks can be engineered using a broad range of shapes, sizes, and materials.

For more than 100 years, Pittsburg Tank & Tower Group (PTTG) has been a dedicated steel tank fabricator and provider of quality above-ground storage and elevated tanks for customers throughout the US. Our elevated storage tanks are engineered, manufactured, and constructed within American Water Works Association and National Fire Protection Association (AWWA and NFPA) guidelines, and are built to meet location-specific industry requirements and regulations.

Elevated Storage Tank Types

Elevated water storage tanks are typically manufactured by tank builders from carbon steel, which is inexpensive to form and exceptionally durable. Carbon steel is easy to maintain, and steel elevated tanks have been known to last up to 60 years. Below is a list of some of the most common tank designs.

WHAT IS THE SERVICE LIFE OF CONCRETE PIPE?

The Army Corps of Engineers recommends a design life of 70-100 years for precast concrete pipe, and there are countless examples of installations that surpass those numbers. This means the expectation for precast concrete's functional life is at least twice as long as alternate materials. The reasons for this go far beyond concrete's innate strength. Concrete also won't burn, rust, tear, buckle, deflect, and it's immune to the attack of most elements, whether the pipe is buried or exposed.

Appendix C:

Overburdened Determination Worksheet

REU Calculations

AWWA Meter Flow Rates

MICHIGAN DEPARTMENT OF ENVIRONMENT, GREAT LAKES, AND ENERGY

OVERBURDENED AND SIGNIFICANTLY OVERBURDENED COMMUNITY STATUS DETERMINATION WORKSHEET

The following data is required from each State Revolving Fund (SRF) applicant requesting a determination for overburdened and significantly overburdened community status.

The most recent census and tax data are available in a searchable table on EGLE's State Revolving Fund – Overburdened Community Definition and Scoring Criteria Development webpage along with an excel worksheet to help determine blended Median Annual Household Income (MAHI) and blended taxable value per capita for regional systems. The MAHI and taxable value per capita table will be used to make all FY24 determinations. Applicants are encouraged to visit this page prior to completing this form to see if they qualify based on MAHI (blended MAHI if applicable) or taxable value per capita (blended taxable value per capita if applicable) alone. If so, they only need to fill out lines 1 and 2 of this form, electronically sign it on page 2, and submit.

Alternately, **if the applicant's MAHI or blended MAHI is above the state average - $63,498 for FY24 – they cannot be determined as being overburdened or significantly overburdened for FY24 funding and should not complete or turn in this form**.

For applicants whose MAHI or blended MAHI is below $63,498 but do not automatically qualify based on MAHI or taxable value per capita alone, please complete the entire form and return to:

Mark Conradi
conradim@michigan.gov

Name of Applicant

Village of Ontonagon

Please check the box indicating which funding source this determination is for:

DWSRF ☑

CWSRF ☐

1. Is this a regional system? A regional system refers to any system that serves more than one municipality (cities, townships, and/or villages)

Yes ☑
No ☐

If yes, refer to the instructions at the end of this form to complete calculations for a blended MAHI and blended taxable value per capita. Additionally, page 3 of this form will also need to be completed.

2. Median Annual Household Income from table on the overburdened webpage (blended if applicable)

   $43,153

3. Taxable Value Per Capita from table on the overburdened webpage (blended if applicable)

   $37,016

4. Total amount of anticipated debt for the proposed project (amount of loan requested for FY24 loan)

   $8,785,000

5. Annual payments on the existing debt for the system

   $340,010

6. Total operation, maintenance, and replacement expenses (OM&R) for the system on an annual basis

   $584,367

7. Number of residential equivalent users (REUs) in the system

   1563

***I (_____) hereby certify that the information in this form is complete, true, and correct to the best of my knowledge.**

Signature Date

For determinations made using anticipated debt, a final determination will be made based upon the awarded loan amount and not the anticipated amount provided on this form.

Regional System Breakdown (If applicable)

Name of municipality	Percentage of flow
Carp Lake Township	47.46
Name of municipality	Percentage of flow
Ontonagon Village	52.54
Name of municipality	Percentage of flow
Name of municipality	Percentage of flow
Name of municipality	Percentage of flow
Name of municipality	Percentage of flow
Name of municipality	Percentage of flow
Name of municipality	Percentage of flow
Name of municipality	Percentage of flow
Name of municipality	Percentage of flow
Name of municipality	Percentage of flow
Name of municipality	Percentage of flow
Name of municipality	Percentage of flow
Name of municipality	Percentage of flow
Name of municipality	Percentage of flow

If more spaces are needed, please include them in the email along with this submission. Percentages of flow must add up to 100%.

OVERBURDENED AND SIGNIFICANTLY OVERBURDENED COMMUNITY STATUS INSTRUCTIONS AND GUIDANCE

The following instructions provide guidance to fill out the overburdened and significantly overburdened determination community status worksheet. Systems across the state use many types of methods for billing and some include items that others do not. The purpose of the determination is to put all systems on a level playing field by breaking down system debt, expenses, and number of customers in the same manner. The instructions address each question in the order they are presented on the worksheet.

1. **Regional systems (if applicable) – Blended MAHI and taxable value per capita calculations**

   The definition of overburdened and significantly overburdened communities first requires "(a) Users within the area served by a proposed drinking water project, sewage treatment works project, or stormwater treatment project are directly assessed for the costs of construction." That means that the calculations need to be based on who is paying for the proposed SRF loan.

   For systems that serve more than one municipal entity a blended MAHI and taxable value per capita calculation must be completed. Page 3 of the worksheet includes spaces for a system to list all the municipalities (cities, townships, and/or villages) and the percentage of flow they provide to the system. The flow percentages should be based on the most recent data available.

   The reason flow is used is because most systems add debt costs to customers' bills and those are determined by flow. In rare cases there might be municipal agreements that vary slightly from this method and those will require the applicant to contact EGLE and provide the data separate from this worksheet. EGLE will take each municipality's MAHI and taxable value per capita and multiply it by the percentage of flow and then add them all together to come up with the blended number to be used in the determination (e.g., (municipality A MAHI * flow) + (municipality B MAHI * flow) + (municipality C MAHI * flow = Blended MAHI for the system)). The same formula will be repeated swapping out taxable value per capita for MAHI to determine a blended taxable value per capita.

   The most recent census and tax data are available in a searchable table on EGLE's State Revolving Fund – Overburdened Community Definition and Scoring Criteria Development webpage. This table will be used to make all FY24 determinations. Use the excel FY24 Overburdened Calculation Template also located on the State Revolving Fund – Overburdened Community Definition and Scoring Criteria Development webpage. Tab 1 titled, "Blended MAHI and TVPC calcs" will allow the applicant to input the names of the municipalities, their percentage of flow, the MAHI for each found in the table listed above, and the taxable value per capita for each in the table listed above, to calculate a blended MAHI and blended taxable value per capita of the regional system. **If the blended MAHI is above $63,498 the project cannot qualify for overburdened or significantly overburdened status and the rest of the form should not be filled out or turned in.**

2. **Median Annual Household Income**

   Use the "Fiscal Year 2024 Overburdened Median Annual Household Income (MAHI) and Taxable Values List for SRF Projects; the State of Michigan MAHI is $63,498 for FY24 Projects" searchable table located on the State Revolving Fund – Overburdened Community Definition and Scoring Criteria Development webpage. Search for the system's MAHI and enter it. **If the**

MAHI is above $63,498 the project cannot qualify for overburdened or significantly overburdened status and the rest of the form should not be filled out or turned in.

For regional systems that serve more than on municipality (cities, townships, and/or villages), refer to the instructions for regional systems in step 1 if you have not already completed calculating a blended MAHI for the system. Once the blended MAHI is determined, enter it on line 2 of the worksheet.

3. **Taxable Value Per Capita**

   This data is found in the same location as the MAHI data and was likely already entered by the applicant while completing line 2. If not, repeat the directions for step 2 and enter the taxable value per capita from the table.

   For regional systems that serve more than on municipality (cities, townships, and/or villages), refer to the instructions for regional systems in step 1 if you have not already completed calculating a blended taxable value per capita for the system. Once the blended taxable value per capita is determined, enter it on line 3 of the worksheet.

4. **Total amount of anticipated debt for the proposed project**

   Fill in the total amount of the proposed loan for the project requesting State Revolving Loan financing in FY24.

   EGLE will amortize this amount to determine a yearly cost to the applicant. The excel FY24 Overburdened Calculation Template, also located on the State Revolving Fund – Overburdened Community Definition and Scoring Criteria Development webpage, has this calculation built in so the applicant only needs to enter full FY24 the loan amount when completing that as well.

   Note that this loan amount is an estimate and often changes after project plans are submitted and bids come in. EGLE will run this determination again prior to finalizing the Project Priority List (PPL). Changes in the loan amount can sometimes change an applicant's status from overburdened to not or vice versa if the initial calculation is close to the 1% MAHI threshold.

   Thus, if a system is determined to be overburdened or not based on annual user costs being greater than 1% of system's MAHI vs being determined overburdened by MAHI or state taxable value per capita alone, a loan amount will be provided to the applicant that provides the cutoff loan value to either gain or lose overburdened status.

5. **Annual Payments on the existing debt of the system**

   Fill in the yearly total of any current debt payments for the system. If coming in for a CWSRF project only include debt payments for the wastewater system and if coming in for a DWSRF project only include debt payments for the drinking water system.

   In a regional system the additional debt payments of connected systems may be added if the connected systems are included in the blended MAHI and taxable value per capita calculations and there is no double-counting. For example, if a regional treatment system is coming in for the loan, a connected collection system could add any additional annual debt costs that the

collection system passes onto its customers after paying all debt and expenses to the regional treatment system. This is to account for the fact that the MAHI and state taxable values are being blended so the annual debt payments of the regional system can be blended as well to determine the average user cost of the regional system.

6. Total operation, maintenance, and replacement (OM&R) expenses for the system on an annual basis

As with the annul debt payments, the amount listed here should include only wastewater OM&R for CWSRF loans and only drinking water OM&R for DWSRF loans. If the accounting is combined split the costs as accurately as possible.

The OM&R costs should reflect all annual expenses for the system that are recovered annually through rates. This means that if a community makes an annual contribution of $50,000 a year to a capital improvement fund, they could add that number to the yearly OM&R costs. If they have accumulated $250,000 in that account and plan on using all in the calendar year they are applying for the loan, they cannot claim that amount as it is not a yearly expense; only the $50,000 is. This is also true for depreciation expenses with no cash value or yearly contribution. They cannot be included.

In a regional system the additional OM&R expenses of connected systems may be added if the connected systems are included in the blended MAHI and taxable value per capita calculations, there is no double-counting, and the expenses follow the same OM&R rules listed above. For example, if a regional treatment system is coming in for the loan, a connected collection system could add any additional annual OM&R costs that the collection system passes onto its customers after paying all debt and expenses to the regional treatment system. This is to account for the fact that the MAHI and state taxable values are being blended so the annual OM&R expenses of the regional system can be blended as well to determine the average user cost of the regional system.

7. Number of residential equivalent users (REUs) in the system

REUs refer to number of standard household hookups in a system. In a bedroom community, with little to no commercial or industrial customers, this number clear. However, most systems have a combination of customer types. The purpose of this form is to determine the average bill for a typical residential customer to determine if it is high enough to pose a burden on the ratepayer.

There are two standard ways of determining REUs: meter size and average flow.

- Meter size

  This is the preferred method as it eliminates most variables that using flow may have. To determine the number of REUs in a system take all the systems' meters and convert them down to 5/8^{ths}-inch or ¾-inch (whichever is the system's standard residential size). Use the capacity of the pipe to convert down (e.g., a 2-inch meter would be equivalent to about 8, 5/8^{ths}-inch meters, a 4-inch meter would be equivalent to about 25, 5/8^{ths}-inch meters, etc.). The resulting number of equivalent 5/8^{ths}-inch or ¾-inch meters would be the number of REUs in the system.

- Average flow

  The average flow method requires the system to determine the average yearly flow for a typical residential household (i.e., a 5/8^{ths}-inch or ¾-inch connection). The system takes the most recent yearly flow data of the entire system and divides by the average household usage number to come up with the number of REUs.

EGLE will look at the numbers provided and may have questions based on the population size vs number of REUs. EGLE will reach out and ask to see the calculations in some instances. Applicants are encouraged to include an excel sheet with these calculations along with the submittal of this form to reduce any back-and-forth communications.

Signature

A typed name and accompanying electronic signature are required for the form to be accepted. If this section is left blank the form will be returned to the sender and not reviewed until it has been signed and sent back.

Final Determination

If the system's MAHI or blended MAHI (if applicable) is over the state average - $63,498 for FY24 – it cannot be determined as being overburdened or significantly overburdened for FY24 funding.

EGLE will take the information provided on this form and enter it into the FY24 Overburdened Calculation Template spreadsheet to calculate the average yearly cost per REU. If a community or system is not determined to be overburdened or significantly overburdened based on MAHI or taxable value per capita alone, this calculation will determine if the costs are greater than 1% of the system's MAHI.

The FY24 Overburdened Calculation Template spreadsheet with the calculations and final determination will be sent to the applicant after the review has been completed by EGLE. A blank version is available on the State Revolving Fund – Overburdened Community Definition and Scoring Criteria Development webpage. Ideally the applicant has already completed the calculations using the instructions above prior to submitting. If the applicant completes the worksheet and determines they do not qualify for overburdened status it is requested that they do not submit the completed worksheet unless they have questions. The applicant's preliminary findings using the FY24 Overburdened Calculation Template are not official until they have been reviewed by EGLE as discrepancies and/or questions about some of the numbers may arise. However, EGLE is providing the template to allow applicants to have a good idea of how the determination will result prior to hearing back officially from EGLE.

Please contact Mark Conradi (conradim@michigan.gov) with any questions on the completion of the form.

If you need this information in an alternate format, contact EGLE-Accessibility@Michigan.gov or call 800-662-9278.

EGLE does not discriminate on the basis of race, sex, religion, age, national origin, color, marital status, disability, political beliefs, height, weight, genetic information, or sexual orientation in the administration of any of its programs or activities, and prohibits intimidation and retaliation, as required by applicable laws and regulations. Questions or concerns should be directed to the Nondiscrimination Compliance Coordinator at EGLE-NondiscriminationCC@Michigan.gov or 517-249-0906.

This form and its contents are subject to the Freedom of Information Act and may be released to the public.

ONTONAGON REGIONAL WATER SYSTEM
DWSRF
ESTIMATED REU's
WICKWIRE, P.C. PROJECT NO. 22023

Meter Size	GPM	Factor
0.75	25	1
1	40	1.6
1.5	60	2.4
2	100	4
3	200	8
4	400	16
6	800	32

METER SIZE	NUMBER OF METERS				REU Factor	Equivalent REU's
	Village of Ontonagon	White Pine	M-64	Silver City		
0.75 in	833	345	159	0	1	1337
1 in	16	4	15	0	1.6	56
1.5 in	14	10	5	0	2.4	69.6
2 in	3	1	1	0	4	20
3 in	2	0	0	0	8	16
4 in	2	0	1	1	16	64
					REU's	1562.6

TOTAL ESTIMATED REU's ==> 1563

*NOTE
METER FLOW RATE TAKEN FROM AMERICAN WATER WORKS ASSOCIATION TYPE I (ANSI/AWWA C715)

Electromagnetic and Ultrasonic Meters for Revenue Applications, Type I (ANSI/AWWA C715)

Size	Maximum Rate (All Meters)				Intermediate Rate (All Meters)				Minimum Rate (New and Rebuilt)				Minimum (Repaired)
	Flow Rate†	Test Quantity††		Accuracy Limits	Flow Rate**	Test Quantity††		Accuracy Limits	Flow Rate§§	Test Quantity††		Accuracy Limits§§	Accuracy Limits
in.	*gpm*	*gal*	*ft³*	*percent*	*gpm*	*gal*	*ft³*	*percent*	*gpm*	*gal*	*ft³*	*percent*	*percent (min)*
1/2	8	100	10	98.5–101.5	0.35	10	1	98.5–101.5	0.11 (0.18)	10	1	95–105 (98.5–101.5)	—
5/8	15	100	10	98.5–101.5	0.4	10	1	98.5–101.5	0.13 (0.20)	10	1	95–105 (98.5–101.5)	—
3/4	25	100	10	98.5–101.5	1	10	1	98.5–101.5	0.15 (0.5)	10	1	95–105 (98.5–101.5)	—
1	40	100	10	98.5–101.5	1.5	10	1	98.5–101.5	0.3 (0.75)	10	1	95–105 (98.5–101.5)	—
1½	60	100	10	98.5–101.5	4	100	10	98.5–101.5	0.6 (2)	100	10	95–105 (98.5–101.5)	—
2	100	100	10	98.5–101.5	5	100	10	98.5–101.5	1 (2.5)	100	10	95–105 (98.5–101.5)	—
3	200	500	50	98.5–101.5	15	100	10	98.5–101.5	2.5 (7.5)	100	10	95–105 (98.5–101.5)	—
4	400	1,000	100	98.5–101.5	20	500	50	98.5–101.5	3.5 (10)	300	40	95–105 (98.5–101.5)	—
6	800	2,000	200	98.5–101.5	40	1,000	100	98.5–101.5	9 (20)	300	40	95–105 (98.5–101.5)	—
8	1,000	5,000	500	98.5–101.5	80	3,000	400	98.5–101.5	18 (40)	2,000	300	95–105 (98.5–101.5)	—

Continued

Appendix D

Resolution to Adopt Planning Document

Public Meeting Discussion Topics

Public Meeting Minutes/Public Comments

Public Meeting Sign In Sheet

Public Meeting Notice Advertisement

Appendix E

Sanitary Survey Letter

STATE OF MICHIGAN
DEPARTMENT OF
ENVIRONMENT, GREAT LAKES, AND ENERGY
BAY CITY DISTRICT OFFICE

GRETCHEN WHITMER
GOVERNOR

LIESL EICHLER CLARK
DIRECTOR

February 1, 2022

Mr. William DuPont, Acting Manager
Village of Ontonagon
315 Quartz Street
Ontonagon, MI 49953

WSSN: 5030
County: Ontonagon

Dear Mr. DuPont:

SUBJECT: Village of Ontonagon Water System Sanitary Survey (Survey)

This letter confirms the Department of Environment, Great Lakes, and Energy's (EGLE) staff meeting with you, Mr. Jeremy Graff, and Mr. Jerry Roehm on November 2, 2021, to complete a Survey of the Village of Ontonagon (Village) water system, and to present the final findings, discuss areas for improvement, and identify timelines for corrective action where appropriate. The purpose of a Survey is to evaluate the water supply system with respect to the requirements of the Michigan Safe Drinking Water Act, 1976 PA 399, as amended (Act 399). It is also an opportunity to update EGLE's records, provide technical assistance, and identify potential risks that may adversely affect drinking water quality.

Since the last survey, EGLE acknowledges the Village has completed the following water system improvements:

1. Completed critical equipment repairs and upgrades at the water treatment plant.
2. Implemented new water rates in accordance with a water system asset management plan (AMP).
3. Completed an inspection of the treated water storage tanks at the water treatment plant.
4. Completed a comprehensive evaluation of the filter media.

The following table summarizes EGLE's final findings from the Survey of the water system:

Survey Element	Findings
Source	Recommendations made
Treatment	Recommendations made
Distribution System	Deficiencies identified
Storage	**Significant Deficiencies identified**
Pumps	No Deficiencies/Recommendations
Monitoring & Reporting	Deficiencies identified
Management & Operations	Recommendations made
Operator Compliance	No Deficiencies/Recommendations
Security	Recommendations made

Financial	No Deficiencies/Recommendations
Other	No Deficiencies/Recommendations

Significant Deficiencies:

Significant deficiencies represent an immediate health risk to consumers of water and indicate non-compliance with one or more Act 399 requirements. Significant deficiencies are serious sanitary deficiencies identified in water systems which include, but are not limited to, defects in design, operation, maintenance, or a failure or malfunction of the sources; treatment, storage, or distribution systems that are determined to be causing, or have the potential to cause, contamination into the public water supply (PWS).

Significant deficiencies must be corrected within 120 days of the date of this letter, or a Corrective Action Plan, approved by EGLE, must be completed within 120 days of the date of this letter. Failure to meet the 120-day deadline is a treatment technique violation.

During the Survey, one significant deficiency was identified:

1. **R325.11112: Storage tanks generally**
   Rule 1112 states storage tanks shall have no unprotected openings. Per Ten States Standards, section 7.0.7, overflow pipes shall be fitted with twenty-four mesh non-corrodible screen. Per section 7.0.8, access hatches to the tank's wet interior shall be protected with a watertight seal. The White Pine elevated storage tank access hatch does not have a watertight seal. The Ontonagon elevated storage tank access hatch does not have a watertight seal and the overflow pipe has a torn/displaced screen. To return to compliance, watertight gaskets must be installed at both tanks and the overflow screen at the Ontonagon tank must be replaced if damaged and returned to its proper position within 120 days of the date of this letter or the Village must develop a Corrective Action Plan and schedule approved by this office. Please contact this office within 30 days of the date of this letter to discuss appropriate corrective action. You must also notify EGLE, in writing, within 30 days of correcting the significant deficiency.

Deficiencies:

Deficiencies indicate non-compliance with Act 399. The following deficiencies were identified during the survey:

1. **R 325.10720: Filtration and disinfection; filtration sampling requirements**
   Rule 720 requires the monitoring of turbidity and the proper calibration of turbidimeters. EPA guidance dictates that turbidimeters must be calibrated (or must have the calibration verified) at least quarterly using an approved procedure. The procedure that is currently used for the water plant's on-line turbidimeters does not meet EGLE requirements. To resolve this deficiency, begin using an approved procedure and notify EGLE when the approved procedure is implemented.

2. 325.11403: Cross-connection prohibited

Rule 1403 prohibits cross connections for all customer classes, including residential customers. R325.11404 requires a local cross connection control program, which includes a schedule for inspection and reinspection of all customers for cross connections. Rule 1404 requires water supplies to develop a comprehensive control program for the elimination and prevention of all cross connections. It is not known whether the existing cross-connection control program and ordinance are enforceable with customers located outside the Village limits. The Village does not consistently ensure compliance when a customer fails to have a backflow prevention assembly tested or fails to take the required corrective actions when a cross connection is discovered during an inspection. The current program has no residential component. To resolve this deficiency, the following actions are required by August 1, 2022:

a. Update the cross-connection program and ordinance and submit a copy to EGLE for review and approval. Execute agreements with other jurisdictions or directly with customers located outside the Village if necessary to fully carry out the cross-connection program in your entire service area.
b. Develop and implement a plan to follow up with customers who fail to provide proof of backflow assembly tests or fail to complete required corrective actions.
c. Develop and implement a residential cross connection control program.

<u>Required Actions:</u>

The required actions listed below are not a deficiency but must be completed by the date indicated to avoid a future deficiency or significant deficiency designation.

1. The White Pine elevated storage tank was professionally inspected in 2018. The inspection report recommended one immediate action (replacement of the vent screen) which was promptly completed. Several additional actions related to the foundation, structural steel, coatings, corrosion protection, and appurtenances were identified as essential to ensure the integrity of the tank. EGLE believes failure to address these concerns may create a sanitary risk to your customers and lead to failure of the tank or its components. Based on the 2018 inspection report, it may not be cost-effective to repair the existing tank, and construction of a new tank should be considered. Because of the significant cost to repair or replace the tank, it is unlikely the necessary work could be completed quickly. The following actions related to the White Pine elevated tank are required:
    a. Submit a plan by August 1, 2022 for repairing or replacing the White Pine elevated tank.
    b. Have the tank professionally inspected in 2022 and ensure that any immediate actions dictated by the inspection report are promptly completed.
    c. Beginning in 2023 and continuing until the tank is repaired or replaced, inspect the tank annually. At least one inspection every three years must be completed by a professional engineer or tank consultant, and the remaining inspections may be completed by Village staff. Ensure that any immediate actions dictated by the inspections are promptly completed.

2. Seasonally, the water plant experiences elevated raw water turbidity which is difficult to remove through the normal treatment process. Currently it is common practice to reduce the water plant's treatment rate during these periods to minimize turbidity carryover to the filters. If proper treatment cannot be achieved without reducing the treatment rate, it may be necessary to reduce the plant's rated capacity. Investigate options for improved turbidity removal. Options to consider include the seasonal/as-needed use of a settling aid and changes to mixing practices. If conducted as part of the evaluation, jar testing should be scheduled to coincide with a period of high-turbidity raw water. Your findings should be submitted to EGLE within 90 days of the end of the evaluation.
3. Prepare and submit an updated general plan of the water system within 6 months of the date of this letter.
4. Prepare and submit an updated water system reliability study within 6 months of the date of this letter. Alternatively, you may provide appropriate justification and request that the requirement to update the study be waived.
5. Develop a succession plan to ensure a properly certified operator is placed in responsible charge of the distribution system upon Jerry Roehm's retirement. Specifically, an operator with S-3 or higher certification is needed, and the operator must be given authority to operate the distribution system and direct the activities of the other distribution system operators.
6. There is a single raw water intake line, and the shore well for the raw water pumps is located across the highway and approximately 700 feet from the lake shore. Develop a contingency plan by December 31, 2022, to ensure an adequate quantity of raw water can be delivered to the plant if the intake is restricted/unusable. Options to consider in the contingency plan include a temporary, mobile pumping arrangement between the lake shore and the raw water pumping station (RWPS), construction of raw water storage at the water plant site, and construction of a second intake and connection to the RWPS.
7. Properly seal openings in the chlorine storage totes and the soda ash mixing tank to prevent the entrance of contaminants.
8. Purchase a spare soda ash solution mixer or equivalent replacement parts to ensure reliability of your corrosion control (soda ash) treatment equipment.

Recommendations:

The following are recommendations the Village should consider to enhance its operations and to avoid future deficiencies:

1. Conduct routine filter surface evaluations annually, and more comprehensive filter media evaluations every five years. As the filter media continues to age, it may be necessary to increase the frequency of comprehensive evaluations.
2. Consider cameras or other security measures at the ground-level treated water storage facilities.
3. Purchase a copy of AWWA Standard C651-14. This standard provides industry best practices for disinfection of new water mains and disinfection after the repair of existing mains.
4. Verify the accuracy of the continuous chlorine residual analyzer at least weekly.
5. Develop a routine valve exercising program. Your asset management plan (AMP) indicates a Level of Service goal of turning all valves within a three-year period.

Please contact this office within **60 days** of receiving this letter to acknowledge its receipt and respond to the above required actions and recommendations.

If you have any questions, please feel free to contact me at the phone number listed below or by email at LondonR@Michigan.gov.

Sincerely,

Bob London
Surface Water Treatment Specialist
Engineering Unit
Drinking Water and Environmental Health Division
989-450-7834

Enclosure
cc/enc: Mr. Jeremy Graff, Village of Ontonagon

Appendix F

Village of Ontonagon Capital Improvements Plan Excerpt

Harbor Town

Fire Fund

Project Name	Description	Justification	Fund (Grants)	Funds (Local)	Total Cost	23-24	24-25	25-26	26-27	27-28	28-29
Pump Truck	Replace Pump Truck		$ 500,000.00		$ 500,000.00	$ 500,000.00					
Fire Hydrants	Replace all Hydrants in Village		$ 275,000.00		$ 275,000.00		$ 275,000.00				
					$ 775,000.00	$ 500,000.00	$ 275,000.00				

Sewer Fund

Project Name	Description	Justification	Fund (Grants)	Funds (Local)	Total Cost	23-24	24-25	25-26	26-27	27-28	28-29
Michigan Street Storm Drain	Repair storm drains			$ 35,000.00	$ 35,000.00	$ 35,000.00					
North-South Road Parker to Alsace	New mains		$ 45,000.00	$ 5,000.00	$ 50,000.00		$ 50,000.00				
Sanitary Sewer & Treatment System Rehabilitation	System wide improvements		$ 5,600,000.00		$ 5,600,000.00			$ 1,866,666.67	$ 1,866,666.67	$ 1,866,666.66	
					$ 5,685,000.00	$ 35,000.00	$ 50,000.00	$ 1,866,666.67	$ 1,866,666.67	$ 1,866,666.66	

Water Fund

Project Name	Description	Justification	Fund (Grants)	Funds (Local)	Total Cost	23-24	24-25	25-26	26-27	27-28	28-29
Water Telemetry	Water Infastructure		$ 563,403.00		$ 563,403.00	$ 281,701.50	$ 281,701.50				
DWSRF Transmission Watermain & WP Water Tower Replacement			$ 8,785,000.00		$ 8,785,000.00		$ 2,196,250.00	$ 2,196,250.00	$ 2,196,250.00	$ 2,196,250.00	
North-South Road Parker to Alsace	New mains		$ 45,000.00	$ 5,000.00			$ 50,000.00				
DWAM - AMP			$ 386,284.00		$ 386,284.00	$ 128,761.00	$ 128,761.00	$ 128,762.00			
DWAM - DSMI			$ 176,869.00		$ 176,869.00	$ 132,651.00	$ 44,218.00				
					$ 9,911,556.00	$ 543,113.50	$ 2,700,930.50	$ 2,325,012.00	$ 2,196,250.00	$ 2,196,250.00	

Equipment Fund

Project Name	Description	Justification	Fund (Grants)	Funds (Local)	Total Cost	23-24	24-25	25-26	26-27	27-28	28-29
Grader	Replace		$ 300,000.00		$ 300,000.00				$ 300,000.00		
Snow Plow Truck	Replace		$ 251,000.00		$ 251,000.00		$ 251,000.00				
Vactor Truck	Replace		$ 145,000.00		$ 145,000.00			$ 145,000.00			
					$ 696,000.00		$ 251,000.00	$ 145,000.00	$ 300,000.00		

Other Funds

Project Name	Description	Justification	Fund (Grants)	Funds (Local)	Total Cost	23-24	24-25	25-26	26-27	27-28	28-29
Marina Office Roof	Roof Replacement			$ 7,200.00	$ 7,200.00	$ 7,200.00					
Greenland Road School Roof Repairs			$ 259,000.00		$ 259,000.00	$ 129,500.00	$ 129,500.00				
DDA Lake Shore Park Lookout Deck	ADA		$ 25,000.00		$ 25,000.00	$ 25,000.00					
					$ 291,200.00	$ 161,700.00	$ 129,500.00				

Appendix G

Ontonagon Regional Water System Soil Survey

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Ontonagon County, Michigan

April 13, 2023

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Map Unit Polygons

Soil Map Unit Lines

Soil Map Unit Points

Special Point Features

Blowout

Borrow Pit

Clay Spot

Closed Depression

Gravel Pit

Gravelly Spot

Landfill

Lava Flow

Marsh or swamp

Mine or Quarry

Miscellaneous Water

Perennial Water

Rock Outcrop

Saline Spot

Sandy Spot

Severely Eroded Spot

Sinkhole

Slide or Slip

Sodic Spot

Spoil Area

Stony Spot

Very Stony Spot

Wet Spot

Other

Special Line Features

Water Features

Streams and Canals

Transportation

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

Background

Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Ontonagon County, Michigan
Survey Area Data: Version 13, Aug 29, 2022

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Jan 1, 1999—Dec 31, 2003

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
14B	Annalake loam, 0 to 4 percent slopes	561.3	6.6%
14D	Annalake loam, 4 to 18 percent slopes	9.6	0.1%
16A	Arnheim mucky silt loam, 0 to 1 percent slopes, frequently flooded	40.3	0.5%
18A	Au Gres sand, 0 to 3 percent slopes	3.1	0.0%
20B	Belding fine sandy loam, 0 to 4 percent slopes	213.7	2.5%
29A	Croswell sand, 0 to 3 percent slopes	81.5	1.0%
30A	Deford and Leafriver soils, 0 to 2 percent slopes	6.8	0.1%
33	Dumps and Pits, mine	201.0	2.4%
36A	Ingalls loamy fine sand, 0 to 3 percent slopes	137.9	1.6%
46A	Dawson, Greenwood, and Loxley soils, 0 to 1 percent slopes	2.1	0.0%
48A	Histosols and Aquents, 0 to 1 percent slopes, ponded	79.0	0.9%
50B	Kalkaska sand, 0 to 6 percent slopes	125.5	1.5%
50D	Kalkaska sand, 6 to 15 percent slopes	1.6	0.0%
54D	Keweenaw loamy sand, 6 to 18 percent slopes, very stony	5.2	0.1%
57D	Liminga fine sand, 8 to 15 percent slopes	22.1	0.3%
59A	Lupton and Tawas mucks, 0 to 1 percent slopes	3.2	0.0%
60B	Morganlake loamy fine sand, 0 to 6 percent slopes	1.8	0.0%
63B	Moquah-Arnheim complex, 0 to 3 percent slopes, frequently flooded	105.7	1.3%
67B	Nonesuch loam, 1 to 6 percent slopes, very stony	162.5	1.9%
81E	Rubicon sand, 15 to 35 percent slopes	20.4	0.2%
86A	Slickens, 0 to 1 percent slopes	52.3	0.6%
90A	Deford-Tawas complex, 0 to 1 percent slopes	10.3	0.1%

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
91A	Tonkey silt loam, 0 to 2 percent slopes	20.0	0.2%
93B	Loggerhead loam, 1 to 8 percent slopes	243.9	2.9%
94A	Udorthents, loamy, nearly level	577.5	6.8%
95F	Udorthents-Alfic Udarents-Epiaquents complex, loamy, nearly level and steep	128.4	1.5%
97B	Waiska loamy sand, 1 to 8 percent slopes, stony	3.6	0.0%
99F	Watton silt loam, 35 to 70 percent slopes	252.8	3.0%
100B	Flintsteel loam, 1 to 8 percent slopes	78.0	0.9%
100D	Flintsteel loam, 8 to 15 percent slopes	4.7	0.1%
101B	Big Iron silt loam, 0 to 4 percent slopes	189.7	2.2%
102A	Trap Falls clay loam, 0 to 1 percent slopes	40.4	0.5%
103D	Big Iron-Flintsteel-Gull Point, frequently flooded, complex, dissected, 1 to 15 percent slopes	1,985.4	23.5%
108A	Greenstone silt loam, 0 to 3 percent slopes	221.6	2.6%
109	Dumps, sanitary landfill	6.5	0.1%
119A	Moquah loam, 0 to 3 percent slopes, occasionally flooded	41.9	0.5%
120D	Croswell-Au Gres-Tawas complex, 0 to 18 percent slopes	843.3	10.0%
121B	Deer Park sand, 0 to 6 percent slopes	134.8	1.6%
121D	Deer Park sand, 6 to 15 percent slopes	62.2	0.7%
123A	Mishwabic silt loam, 0 to 2 percent slopes	35.8	0.4%
124F	Zandi loamy very fine sand, 35 to 70 percent slopes	19.7	0.2%
125F	Rockland-Moquah, frequently flooded-Watton complex, 0 to 70 percent slopes	351.7	4.2%
127A	Big Iron-Trap Falls complex, 0 to 3 percent slopes	47.1	0.6%
129F	Karlin-Sporley complex, 1 to 70 percent slopes	31.8	0.4%
140E	Loggerhead-Big Iron-Belding complex, dissected, 1 to 35 percent slopes	3.7	0.0%

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
149	Pits, sand and gravel	3.8	0.0%
150B	Siskiwit loamy sand, 1 to 6 percent slopes	85.2	1.0%
8104F	Zandi-Morganlake complex, dissected, 25 to 60 percent slopes	12.9	0.2%
8307	Lupton and Cathro soils, 0 to 1 percent slopes	85.5	1.0%
8309	Cathro muck, drainageway, 0 to 1 percent slopes	5.9	0.1%
W	Water	167.6	2.0%
Totals for Area of Interest		**8,453.6**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or

landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Ontonagon County, Michigan

14B—Annalake loam, 0 to 4 percent slopes

Map Unit Setting

National map unit symbol: 1kwhf
Elevation: 590 to 1,800 feet
Mean annual precipitation: 25 to 34 inches
Mean annual air temperature: 37 to 43 degrees F
Frost-free period: 100 to 140 days
Farmland classification: Not prime farmland

Map Unit Composition

Annalake and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Annalake

Setting

Landform: Outwash terraces, outwash plains
Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Stratified loamy glaciofluvial deposits

Typical profile

Ap - 0 to 9 inches: loam
Bs - 9 to 16 inches: fine sandy loam
E and Bt1 - 16 to 31 inches: stratified loamy very fine sand to silt loam to loamy fine sand
E and Bt2 - 31 to 48 inches: stratified sand to fine sand to loamy fine sand to silt loam
B and Et - 48 to 61 inches: stratified sand to fine sand to loamy fine sand to silt loam
C - 61 to 80 inches: stratified fine sand to loamy fine sand to silt loam to silt

Properties and qualities

Slope: 0 to 4 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: About 30 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 8.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: C
Ecological site: R092XY014WI - Loamy Uplands

Other vegetative classification: Acer Viola Osmorhiza (AVO_1), Acer Tsuga Dryopteris (ATD_1)
Hydric soil rating: No

Minor Components

Manido
Percent of map unit: 5 percent
Landform: Till-floored lake plains
Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R092XY013WI - Sandy Uplands
Other vegetative classification: Tsuga Maianthemum Coptis (TMC_1)
Hydric soil rating: No

Loggerhead
Percent of map unit: 5 percent
Landform: Till plains
Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope
Landform position (three-dimensional): Interfluve, head slope, nose slope, side slope, base slope, crest
Down-slope shape: Linear
Across-slope shape: Convex, linear
Ecological site: R092XY014WI - Loamy Uplands
Other vegetative classification: Acer Viola Osmorhiza (AVO_1), Acer Tsuga Dryopteris (ATD_1)
Hydric soil rating: No

Wainola
Percent of map unit: 5 percent
Landform: Outwash plains
Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R092XY010WI - Moist Sandy Lowlands
Other vegetative classification: Tsuga Maianthemum Coptis - Vaccinium (TMC-Vac_1)
Hydric soil rating: No

14D—Annalake loam, 4 to 18 percent slopes

Map Unit Setting
National map unit symbol: 1kwhg
Elevation: 590 to 1,800 feet
Mean annual precipitation: 25 to 34 inches
Mean annual air temperature: 37 to 43 degrees F
Frost-free period: 100 to 140 days
Farmland classification: Not prime farmland

Map Unit Composition

Annalake and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Annalake

Setting

Landform: Outwash terraces, outwash plains
Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope
Landform position (three-dimensional): Interfluve, head slope, nose slope, side slope, crest, base slope
Down-slope shape: Convex, linear
Across-slope shape: Concave, convex
Parent material: Stratified loamy glaciofluvial deposits

Typical profile

Ap - 0 to 9 inches: loam
Bs - 9 to 16 inches: fine sandy loam
E and Bt1 - 16 to 31 inches: stratified loamy very fine sand to silt loam to loamy fine sand
E and Bt2 - 31 to 48 inches: stratified sand to fine sand to loamy fine sand to silt loam
B and Et - 48 to 61 inches: stratified sand to fine sand to loamy fine sand to silt loam
C - 61 to 80 inches: stratified fine sand to loamy fine sand to silt loam to silt

Properties and qualities

Slope: 4 to 18 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: About 30 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 8.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: C
Ecological site: R092XY014WI - Loamy Uplands
Other vegetative classification: Acer Viola Osmorhiza (AVO_1), Acer Tsuga Dryopteris (ATD_1)
Hydric soil rating: No

Minor Components

Loggerhead

Percent of map unit: 5 percent
Landform: Till plains
Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope

Landform position (three-dimensional): Interfluve, head slope, nose slope, side slope, crest, base slope
Down-slope shape: Linear
Across-slope shape: Convex, linear
Ecological site: R092XY014WI - Loamy Uplands
Other vegetative classification: Acer Viola Osmorhiza (AVO_1), Acer Tsuga Dryopteris (ATD_1)
Hydric soil rating: No

Manido

Percent of map unit: 5 percent
Landform: Till-floored lake plains
Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R092XY013WI - Sandy Uplands
Other vegetative classification: Tsuga Maianthemum Coptis (TMC_1)
Hydric soil rating: No

Ingalls

Percent of map unit: 5 percent
Landform: Lake plains
Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R092XY011WI - Moist Loamy Lowlands
Other vegetative classification: Tsuga Maianthemum Coptis - Dryopteris (TMC-D_1)
Hydric soil rating: No

16A—Arnheim mucky silt loam, 0 to 1 percent slopes, frequently flooded

Map Unit Setting

National map unit symbol: 1kwhl
Elevation: 590 to 1,800 feet
Mean annual precipitation: 25 to 34 inches
Mean annual air temperature: 37 to 43 degrees F
Frost-free period: 100 to 140 days
Farmland classification: Not prime farmland

Map Unit Composition

Arnheim and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Arnheim

Setting

Landform: Flood plains
Parent material: Loamy alluvium

Typical profile

A - 0 to 5 inches: mucky silt loam
Cg - 5 to 10 inches: silt loam
C - 10 to 80 inches: stratified very fine sandy loam to silt loam to loamy fine sand to fine sandy loam

Properties and qualities

Slope: 0 to 1 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: About 0 inches
Frequency of flooding: FrequentNoneOccasional
Frequency of ponding: Frequent
Available water supply, 0 to 60 inches: High (about 11.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7w
Hydrologic Soil Group: B/D
Ecological site: R092XY005WI - Wet Floodplains
Other vegetative classification: Fraxinus Impatiens (FI_1), Fraxinus Mentha Carex (FMC_1)
Hydric soil rating: Yes

Minor Components

Moquah

Percent of map unit: 8 percent
Landform: Flood plains
Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R092XY004WI - Seasonally Dry Floodplains
Other vegetative classification: Acer Osmorhiza Caulophyllum (AOC), Acer-Viola-Osmorhiza (AVO_2)
Hydric soil rating: No

Cathro

Percent of map unit: 5 percent
Landform: Drainageways, depressions, swamps
Ecological site: F090AY002WI - Mucky Swamp
Other vegetative classification: Fraxinus Impatiens (FI_1), Tsuga-Thuja-Mitella (TTM_2)
Hydric soil rating: Yes

Schaat creek

Percent of map unit: 2 percent
Landform: Flood plains
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R092XY005WI - Wet Floodplains
Other vegetative classification: Fraxinus Mentha Carex - Caltha (FMC-C)

Hydric soil rating: Yes

18A—Au Gres sand, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 2xxht
Elevation: 570 to 1,820 feet
Mean annual precipitation: 28 to 37 inches
Mean annual air temperature: 39 to 45 degrees F
Frost-free period: 80 to 160 days
Farmland classification: Not prime farmland

Map Unit Composition

Au gres and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Au Gres

Setting

Landform: Till-floored lake plains, flats, terraces, drainageways, flats
Landform position (three-dimensional): Tread, talf
Down-slope shape: Linear
Across-slope shape: Linear, concave
Parent material: Sandy glaciofluvial deposits

Typical profile

Oa - 0 to 2 inches: highly decomposed plant material
E - 2 to 8 inches: sand
Bhs - 8 to 11 inches: sand
Bs1 - 11 to 14 inches: sand
Bs2 - 14 to 28 inches: sand
C - 28 to 79 inches: sand

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 6.00 in/hr)
Depth to water table: About 0 to 12 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 4.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4w
Hydrologic Soil Group: A/D
Ecological site: F090AY009WI - Moist Sandy Lowland

Forage suitability group: Low AWC, high water table (G090AY001WI)
Other vegetative classification: Tsuga-Maianthemum-Coptis/Tsuga-Maianthemum-Coptis, Vaccinium phase (TMC/TMC-V), Low AWC, high water table (G090AY001WI)
Hydric soil rating: No

Minor Components

Kinross

Percent of map unit: 5 percent
Landform: Depressions, drainageways, depressions, drainageways
Down-slope shape: Concave, linear
Across-slope shape: Concave
Ecological site: F090AY005WI - Wet Sandy Lowland
Other vegetative classification: Mod AWC, high water table (G090AY004WI), Not Assigned (wet mineral soils) (Nmin)
Hydric soil rating: Yes

Croswell

Percent of map unit: 5 percent
Landform: Flats, till-floored lake plains, terraces, flats
Landform position (three-dimensional): Tread, rise
Down-slope shape: Linear
Across-slope shape: Convex, linear
Ecological site: F090AY013WI - Sandy Upland
Other vegetative classification: Low AWC, adequately drained (G090AY002WI), Acer rubrum-Quercus/Vaccinium (ArQV), Pinus/Maianthemum-Vaccinium (PMV)
Hydric soil rating: No

Deford

Percent of map unit: 3 percent
Landform: Drainageways, depressions, drainageways, depressions
Down-slope shape: Linear, concave
Across-slope shape: Concave
Ecological site: F093BY004MI - Wet Lowlands
Other vegetative classification: Low AWC, high water table (G095AY001WI), Not Assigned (wet mineral soils) (Nmin)
Hydric soil rating: Yes

Rubicon

Percent of map unit: 2 percent
Landform: Flats, beach ridges, hillslopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope, rise
Down-slope shape: Convex
Across-slope shape: Convex
Ecological site: F090AY019WI - Dry Sandy Uplands
Other vegetative classification: Acer-Quercus-Vaccinium/Quercus-Acer-Epigea (AQV/QAE), Low AWC, adequately drained (G090AY002WI)
Hydric soil rating: No

20B—Belding fine sandy loam, 0 to 4 percent slopes

Map Unit Setting

National map unit symbol: 1kwhp
Elevation: 590 to 1,800 feet
Mean annual precipitation: 25 to 34 inches
Mean annual air temperature: 37 to 43 degrees F
Frost-free period: 100 to 140 days
Farmland classification: Not prime farmland

Map Unit Composition

Belding and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Belding

Setting

Landform: Ground moraines
Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Coarse-loamy till over fine-loamy till

Typical profile

Oa - 0 to 1 inches: highly decomposed plant material
A1 - 1 to 4 inches: fine sandy loam
A2 - 4 to 9 inches: fine sandy loam
E - 9 to 14 inches: fine sandy loam
Bs1 - 14 to 19 inches: fine sandy loam
Bs2 - 19 to 22 inches: fine sand
2Bt - 22 to 34 inches: silty clay loam
2BCd - 34 to 36 inches: silty clay loam
2Cd - 36 to 80 inches: silty clay loam

Properties and qualities

Slope: 0 to 4 percent
Depth to restrictive feature: 30 to 60 inches to densic material
Drainage class: Somewhat poorly drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: About 6 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 20 percent
Available water supply, 0 to 60 inches: Low (about 5.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: C/D
Ecological site: R092XY011WI - Moist Loamy Lowlands
Other vegetative classification: Tsuga Maianthemum Coptis - Dryopteris (TMC-D_1), Acer Viola Osmorhiza - Circaea Impatiens (AVO-CI_3)
Hydric soil rating: No

Minor Components

Loggerhead
Percent of map unit: 5 percent
Landform: Till plains
Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope
Landform position (three-dimensional): Interfluve, head slope, nose slope, side slope, base slope, crest
Down-slope shape: Linear
Across-slope shape: Convex, linear
Ecological site: R092XY014WI - Loamy Uplands
Other vegetative classification: Acer Viola Osmorhiza (AVO_1), Acer Tsuga Dryopteris (ATD_1)
Hydric soil rating: No

Trap falls
Percent of map unit: 5 percent
Landform: Depressions on till plains
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R092XY007WI - Wet Loamy or Clayey Lowlands
Other vegetative classification: Fraxinus Impatiens (FI_1), Fraxinus Mentha Carex (FMC_1)
Hydric soil rating: Yes

Ubly
Percent of map unit: 5 percent
Landform: Till plains
Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope
Landform position (three-dimensional): Interfluve, head slope, nose slope, side slope, base slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Concave, convex
Ecological site: R092XY014WI - Loamy Uplands
Other vegetative classification: Acer Viola Osmorhiza (AVO_1), Acer Tsuga Dryopteris (ATD_1)
Hydric soil rating: No

29A—Croswell sand, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 2xtn4
Elevation: 570 to 1,800 feet
Mean annual precipitation: 28 to 37 inches
Mean annual air temperature: 39 to 45 degrees F
Frost-free period: 80 to 160 days
Farmland classification: Not prime farmland

Map Unit Composition

Croswell and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Croswell

Setting

Landform: Flats, terraces, flats
Landform position (three-dimensional): Tread, rise
Down-slope shape: Linear
Across-slope shape: Convex, linear
Parent material: Sandy glaciofluvial deposits

Typical profile

Oe - 0 to 2 inches: moderately decomposed plant material
E - 2 to 4 inches: sand
Bs1 - 4 to 8 inches: sand
Bs2 - 8 to 18 inches: sand
BC - 18 to 31 inches: sand
C - 31 to 79 inches: sand

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): High to very high (6.00 to 20.00 in/hr)
Depth to water table: About 18 to 30 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 4.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4s
Hydrologic Soil Group: A
Ecological site: F093BY007MI - Sandy Uplands
Forage suitability group: Low AWC, adequately drained (G090AY002WI)

Other vegetative classification: Low AWC, adequately drained (G090AY002WI), Acer rubrum-Quercus/Vaccinium (ArQV), Pinus/Maianthemum-Vaccinium (PMV)
Hydric soil rating: No

Minor Components

Au gres
Percent of map unit: 8 percent
Landform: Flats, terraces, drainageways, flats
Landform position (three-dimensional): Tread, talf
Down-slope shape: Linear
Across-slope shape: Linear, concave
Ecological site: F093BY005MI - Moist Lowlands
Other vegetative classification: Low AWC, high water table (G090AY001WI), Tsuga-Maianthemum-Coptis/Tsuga-Maianthemum-Coptis, Vaccinium phase (TMC/TMC-V)
Hydric soil rating: No

Rubicon
Percent of map unit: 5 percent
Landform: Beach ridges, hillslopes, flats
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope, rise
Down-slope shape: Convex
Across-slope shape: Convex
Ecological site: F093BY011MI - Dry Uplands
Other vegetative classification: Low AWC, adequately drained (G090AY002WI), Acer-Quercus-Vaccinium/Quercus-Acer-Epigea (AQV/QAE)
Hydric soil rating: No

Kinross
Percent of map unit: 2 percent
Landform: Drainageways, depressions, drainageways, depressions
Down-slope shape: Linear, concave
Across-slope shape: Concave
Ecological site: F093BY004MI - Wet Lowlands
Other vegetative classification: Mod AWC, high water table (G090AY004WI), Not Assigned (wet mineral soils) (Nmin)
Hydric soil rating: Yes

30A—Deford and Leafriver soils, 0 to 2 percent slopes

Map Unit Setting
National map unit symbol: 2xxj3
Elevation: 570 to 1,770 feet
Mean annual precipitation: 28 to 37 inches
Mean annual air temperature: 39 to 45 degrees F
Frost-free period: 80 to 160 days
Farmland classification: Not prime farmland

Map Unit Composition

Deford and similar soils: 50 percent
Leafriver and similar soils: 35 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Deford

Setting

Landform: Drainageways, depressions, flats, drainageways, depressions
Landform position (three-dimensional): Talf
Down-slope shape: Linear, concave
Across-slope shape: Concave, linear
Parent material: Sandy glaciofluvial deposits

Typical profile

Oa - 0 to 6 inches: muck
A - 6 to 8 inches: mucky loamy sand
Cg - 8 to 14 inches: sand
C1 - 14 to 28 inches: sand
C2 - 28 to 79 inches: sand

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 6.00 in/hr)
Depth to water table: About 0 to 6 inches
Frequency of flooding: None
Frequency of ponding: Frequent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 5.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6w
Hydrologic Soil Group: A/D
Ecological site: F093BY004MI - Wet Lowlands
Forage suitability group: Low AWC, high water table (G095AY001WI)
Other vegetative classification: Tsuga-Maianthemum-Coptis/Tsuga-Thuja-Sphagnum (TMC/TTS), Low AWC, high water table (G095AY001WI)
Hydric soil rating: Yes

Description of Leafriver

Setting

Landform: Depressions, depressions
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Organic material over sandy glaciofluvial deposits

Typical profile

Oe - 0 to 2 inches: mucky peat
Oa - 2 to 12 inches: muck
Cg1 - 12 to 28 inches: sand

Cg2 - 28 to 79 inches: sand

Properties and qualities

Slope: 0 to 1 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Very poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 6.00 in/hr)
Depth to water table: About 0 to 6 inches
Frequency of flooding: None
Frequency of ponding: Frequent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Moderate (about 7.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6w
Hydrologic Soil Group: A/D
Ecological site: F093BY004MI - Wet Lowlands
Other vegetative classification: Fraxinus-Impatiens (FI)
Hydric soil rating: Yes

Minor Components

Tawas

Percent of map unit: 8 percent
Landform: Depressions, depressions
Down-slope shape: Concave
Across-slope shape: Concave
Ecological site: F093BY002MI - Mucky Swamps
Other vegetative classification: Tsuga Thuja Mitchella (TTM_1), Tsuga Thuja Sphagnum (TTS_1)
Hydric soil rating: Yes

Au gres

Percent of map unit: 5 percent
Landform: Flats, terraces, flats
Landform position (three-dimensional): Tread, talf
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: F094DY009WI - Wet Sandy Drainageways
Other vegetative classification: Tsuga-Maianthemum-Coptis/Tsuga-Maianthemum-Coptis, Vaccinium phase (TMC/TMC-V), Low AWC, high water table (G090AY001WI)
Hydric soil rating: No

Croswell

Percent of map unit: 2 percent
Landform: Flats, terraces, flats
Landform position (three-dimensional): Tread, rise
Down-slope shape: Linear
Across-slope shape: Convex, linear
Ecological site: F093BY007MI - Sandy Uplands
Other vegetative classification: Low AWC, adequately drained (G090AY002WI), Acer rubrum-Quercus/Vaccinium (ArQV), Pinus/Maianthemum-Vaccinium (PMV)
Hydric soil rating: No

33—Dumps and Pits, mine

Map Unit Setting

National map unit symbol: 1kwj1
Elevation: 590 to 1,800 feet
Mean annual precipitation: 27 to 38 inches
Mean annual air temperature: 36 to 45 degrees F
Frost-free period: 70 to 170 days
Farmland classification: Not prime farmland

Map Unit Composition

Dumps, mine: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Minor Components

Flintsteel

Percent of map unit: 5 percent
Landform: Till plains
Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope
Landform position (three-dimensional): Interfluve, head slope, nose slope, side slope, base slope, crest
Down-slope shape: Linear
Across-slope shape: Convex, linear
Ecological site: F093BY009MI - Alfic Loamy Uplands
Other vegetative classification: Acer Viola Osmorhiza (AVO_1), Tsuga Acer Mitchella (TAM_1)
Hydric soil rating: No

36A—Ingalls loamy fine sand, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 1kwj5
Elevation: 590 to 1,800 feet
Mean annual precipitation: 25 to 34 inches
Mean annual air temperature: 37 to 43 degrees F
Frost-free period: 100 to 140 days
Farmland classification: Not prime farmland

Map Unit Composition

Ingalls and similar soils: 85 percent

Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Ingalls

Setting

Landform: Lake plains
Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Sandy outwash over stratified lacustrine deposits

Typical profile

Oi - 0 to 1 inches: slightly decomposed plant material
Oe - 1 to 3 inches: moderately decomposed plant material
Oa - 3 to 5 inches: highly decomposed plant material
E - 5 to 13 inches: loamy fine sand
Bs1 - 13 to 17 inches: loamy fine sand
Bs2 - 17 to 26 inches: fine sand
BC - 26 to 43 inches: fine sand
2C - 43 to 80 inches: stratified very fine sand to loamy very fine sand to silt loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat poorly drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: About 12 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: High (about 9.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: A/D
Ecological site: R092XY011WI - Moist Loamy Lowlands
Other vegetative classification: Tsuga Maianthemum Coptis - Dryopteris (TMC-D_1)
Hydric soil rating: No

Minor Components

Wainola

Percent of map unit: 10 percent
Landform: Outwash plains
Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R092XY010WI - Moist Sandy Lowlands
Other vegetative classification: Tsuga Maianthemum Coptis - Vaccinium (TMC-Vac_1)
Hydric soil rating: No

Annalake

Percent of map unit: 3 percent
Landform: Outwash terraces, outwash plains
Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R092XY014WI - Loamy Uplands
Other vegetative classification: Acer Viola Osmorhiza (AVO_1), Acer Tsuga Dryopteris (ATD_1)
Hydric soil rating: No

Tonkey

Percent of map unit: 1 percent
Landform: Depressions on till plains
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R092XY007WI - Wet Loamy or Clayey Lowlands
Other vegetative classification: Fraxinus Impatiens (FI_1)
Hydric soil rating: Yes

Cathro

Percent of map unit: 1 percent
Landform: Drainageways, depressions, swamps
Ecological site: F090AY002WI - Mucky Swamp
Other vegetative classification: Fraxinus Impatiens (FI_1), Tsuga-Thuja-Mitella (TTM_2)
Hydric soil rating: Yes

46A—Dawson, Greenwood, and Loxley soils, 0 to 1 percent slopes

Map Unit Setting

National map unit symbol: 1kwjq
Elevation: 1,100 to 1,900 feet
Mean annual precipitation: 27 to 38 inches
Mean annual air temperature: 36 to 45 degrees F
Frost-free period: 70 to 170 days
Farmland classification: Not prime farmland

Map Unit Composition

Dawson and similar soils: 40 percent
Greenwood and similar soils: 35 percent
Loxley and similar soils: 20 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Dawson

Setting

Landform: Bogs, depressions

Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Dip
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Herbaceous organic material over sandy outwash

Typical profile

Oi - 0 to 6 inches: peat
Oe - 6 to 10 inches: mucky peat
Oa1 - 10 to 18 inches: muck
Oa2 - 18 to 30 inches: muck
A - 30 to 34 inches: sand
C - 34 to 80 inches: sand

Properties and qualities

Slope: 0 to 1 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Very poorly drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 6.00 in/hr)
Depth to water table: About 0 inches
Frequency of flooding: None
Frequency of ponding: Frequent
Available water supply, 0 to 60 inches: Very high (about 15.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7w
Hydrologic Soil Group: A/D
Ecological site: F094DY004WI - Mucky Peat Bogs
Other vegetative classification: Picea-Chamadaphne-Spagnum/Tsuga-Maianthemum-Coptis, Vaccinium phase (PCS/TMC-V)
Hydric soil rating: Yes

Description of Greenwood

Setting

Landform: Depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Dip
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Mossy organic material

Typical profile

Oi - 0 to 8 inches: peat
Oa - 8 to 11 inches: muck
Oe1 - 11 to 65 inches: mucky peat
Oe2 - 65 to 80 inches: mucky peat

Properties and qualities

Slope: 0 to 1 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Very poorly drained
Runoff class: Negligible

Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 6.00 in/hr)
Depth to water table: About 0 inches
Frequency of flooding: None
Frequency of ponding: Frequent
Available water supply, 0 to 60 inches: Very high (about 30.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7w
Hydrologic Soil Group: A/D
Ecological site: F094DY001WI - Peat Bogs
Other vegetative classification: Picea-Chamadaphne-Sphagnum (PCS)
Hydric soil rating: Yes

Description of Loxley

Setting

Landform: Depressions, bogs
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Dip, talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Herbaceous organic material

Typical profile

Oi - 0 to 5 inches: peat
Oa1 - 5 to 26 inches: muck
Oa2 - 26 to 45 inches: muck
Oe - 45 to 80 inches: mucky peat

Properties and qualities

Slope: 0 to 1 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Very poorly drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 6.00 in/hr)
Depth to water table: About 0 inches
Frequency of flooding: None
Frequency of ponding: Frequent
Available water supply, 0 to 60 inches: Very high (about 26.5 inches)

Interpretive groups

Land capability classification (irrigated): 7w
Land capability classification (nonirrigated): 7w
Hydrologic Soil Group: A/D
Ecological site: F094DY004WI - Mucky Peat Bogs
Forage suitability group: Frequently flooded, organics (G090AY010WI)
Other vegetative classification: Frequently flooded, organics (G090AY010WI), Picea Chamaedaphne Sphagnum (PCS_2)
Hydric soil rating: Yes

Minor Components

Kinross

Percent of map unit: 5 percent

Landform: Depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Dip, talf
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: F094DY010WI - Wet Sandy Depressions
Other vegetative classification: Tsuga Thuja Sphagnum (TTS_1), not specified (PCS_1)
Hydric soil rating: Yes

48A—Histosols and Aquents, 0 to 1 percent slopes, ponded

Map Unit Setting

National map unit symbol: 1kwjs
Elevation: 600 to 1,800 feet
Mean annual precipitation: 25 to 34 inches
Mean annual air temperature: 37 to 43 degrees F
Frost-free period: 100 to 140 days
Farmland classification: Not prime farmland

Map Unit Composition

Histosols, ponded, and similar soils: 60 percent
Aquents, ponded, and similar soils: 40 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Histosols, Ponded

Setting

Landform: Marshes
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Dip
Down-slope shape: Linear
Across-slope shape: Linear

Typical profile

Oa - 0 to 51 inches: muck
C - 51 to 80 inches: variable

Properties and qualities

Slope: 0 to 1 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Very poorly drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): Very low to high (0.00 to 6.00 in/hr)
Depth to water table: About 0 inches
Frequency of flooding: None
Frequency of ponding: Frequent

Available water supply, 0 to 60 inches: Very high (about 20.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8w
Hydrologic Soil Group: A/D
Ecological site: R092XY002WI - Mucky Swamps
Hydric soil rating: Yes

Description of Aquents, Ponded

Setting

Landform: Marshes
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Dip
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Sandy or loamy alluvium

Typical profile

C - 0 to 80 inches: variable

Properties and qualities

Slope: 0 to 1 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Very poorly drained
Runoff class: Negligible
Depth to water table: About 0 inches
Frequency of flooding: None
Frequency of ponding: Frequent

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8w
Ecological site: R092XY007WI - Wet Loamy or Clayey Lowlands
Hydric soil rating: Yes

50B—Kalkaska sand, 0 to 6 percent slopes

Map Unit Setting

National map unit symbol: 2v8dn
Elevation: 570 to 1,970 feet
Mean annual precipitation: 28 to 37 inches
Mean annual air temperature: 39 to 45 degrees F
Frost-free period: 80 to 160 days
Farmland classification: Not prime farmland

Map Unit Composition

Kalkaska and similar soils: 93 percent
Minor components: 7 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Kalkaska

Setting

Landform: Hillslopes
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Side slope, rise
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Outwash

Typical profile

Oe - 0 to 1 inches: moderately decomposed plant material
E - 1 to 5 inches: sand
Bhs - 5 to 9 inches: sand
Bs - 9 to 16 inches: sand
BC - 16 to 33 inches: sand
C - 33 to 79 inches: sand

Properties and qualities

Slope: 0 to 6 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 4.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4s
Hydrologic Soil Group: A
Ecological site: F093BY007MI - Sandy Uplands
Other vegetative classification: Acer-Tsuga-Dryopteris, Dryopteris phase (ATD-D)
Hydric soil rating: No

Minor Components

Kinross

Percent of map unit: 2 percent
Landform: Depressions, depressions
Landform position (three-dimensional): Talf
Down-slope shape: Concave
Across-slope shape: Linear
Ecological site: F094DY010WI - Wet Sandy Depressions
Other vegetative classification: Tsuga-Thuja-Sphagnum (TTS)
Hydric soil rating: Yes

Finch

Percent of map unit: 2 percent
Landform: Rims on depressions, flats
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Dip
Down-slope shape: Concave

Across-slope shape: Linear
Ecological site: F093BY005MI - Moist Lowlands
Other vegetative classification: Tsuga-Maianthemum-Coptis, Vaccinium phase (TMC-V)
Hydric soil rating: No

Manido

Percent of map unit: 2 percent
Landform: Flats
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: F093BY006MI - Alfic Sandy Uplands
Other vegetative classification: Tsuga Maianthemum Coptis (TMC_1)
Hydric soil rating: No

Manistee

Percent of map unit: 1 percent
Landform: Flats, flats
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Rise
Down-slope shape: Convex
Across-slope shape: Linear, convex
Ecological site: F093BY006MI - Alfic Sandy Uplands
Other vegetative classification: Acer-Tsuga-Dryopteris (ATD)
Hydric soil rating: No

50D—Kalkaska sand, 6 to 15 percent slopes

Map Unit Setting

National map unit symbol: 2v8dr
Elevation: 570 to 1,970 feet
Mean annual precipitation: 28 to 37 inches
Mean annual air temperature: 39 to 45 degrees F
Frost-free period: 80 to 160 days
Farmland classification: Not prime farmland

Map Unit Composition

Kalkaska and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Kalkaska

Setting

Landform: Beach ridges, hillslopes, hillslopes
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex

Across-slope shape: Convex
Parent material: Outwash

Typical profile

Oe - 0 to 1 inches: moderately decomposed plant material
E - 1 to 5 inches: sand
Bhs - 5 to 9 inches: sand
Bs - 9 to 16 inches: sand
BC - 16 to 33 inches: sand
C - 33 to 79 inches: sand

Properties and qualities

Slope: 6 to 15 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 4.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: A
Ecological site: F093BY007MI - Sandy Uplands
Other vegetative classification: Acer-Tsuga-Dryopteris, Dryopteris phase (ATD-D)
Hydric soil rating: No

Minor Components

Keweenaw

Percent of map unit: 4 percent
Landform: Till plains
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Ecological site: F094DY012WI - Steep Loamy-Mantled Ridges
Other vegetative classification: Acer-Tsuga-Dryopteris, Dryopteris phase/Tsuga-Maianthemum (ATD-D/TM)
Hydric soil rating: No

Pence

Percent of map unit: 2 percent
Landform: Hillslopes
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Ecological site: F094DY011WI - Loamy-Mantled Uplands
Other vegetative classification: Acer-Quercus-Vaccinium/Tsuga-Maianthemum-Vaccinium (AQV/TMV)
Hydric soil rating: No

Wallace

Percent of map unit: 2 percent
Landform: Hillslopes
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Ecological site: F093BY007MI - Sandy Uplands
Other vegetative classification: Tsuga-Maianthemum (TM)
Hydric soil rating: No

Kinross

Percent of map unit: 2 percent
Landform: Depressions on lake plains, depressions
Landform position (three-dimensional): Talf
Down-slope shape: Concave, linear
Across-slope shape: Linear
Ecological site: F094DY012WI - Steep Loamy-Mantled Ridges
Other vegetative classification: Tsuga-Thuja-Sphagnum (TTS)
Hydric soil rating: Yes

54D—Keweenaw loamy sand, 6 to 18 percent slopes, very stony

Map Unit Setting

National map unit symbol: 1kwk6
Elevation: 600 to 1,800 feet
Mean annual precipitation: 25 to 34 inches
Mean annual air temperature: 37 to 43 degrees F
Frost-free period: 100 to 140 days
Farmland classification: Not prime farmland

Map Unit Composition

Keweenaw, very stony, and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Keweenaw, Very Stony

Setting

Landform: Till plains, moraines
Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope
Landform position (three-dimensional): Interfluve, head slope, nose slope, side slope, base slope, crest, rise
Down-slope shape: Linear, convex
Across-slope shape: Convex, linear
Parent material: Sandy glaciofluvial deposits

Typical profile

Oa - 0 to 2 inches: highly decomposed plant material

E - 2 to 4 inches: loamy sand
Bhs - 4 to 6 inches: loamy fine sand
Bs - 6 to 25 inches: loamy fine sand
E/B - 25 to 45 inches: stratified sand to fine sand to loamy fine sand to loamy very fine sand
B/E - 45 to 56 inches: stratified loamy fine sand to fine sand to fine sandy loam
E/B' - 56 to 71 inches: stratified loamy fine sand to fine sand to fine sandy loam
B/E' - 71 to 90 inches: loamy fine sand

Properties and qualities

Slope: 6 to 18 percent
Surface area covered with cobbles, stones or boulders: 1.5 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 3.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: A
Ecological site: F093BY006MI - Alfic Sandy Uplands
Other vegetative classification: Acer Tsuga Dryopteris - Dryopteris (ATD-D_1), Tsuga Maianthemum (TM_1)
Hydric soil rating: No

Minor Components

Mcmillan, very stony

Percent of map unit: 5 percent
Landform: Moraines
Landform position (two-dimensional): Summit, shoulder, backslope, footslope
Landform position (three-dimensional): Side slope, base slope, rise
Down-slope shape: Concave, convex
Across-slope shape: Linear, convex
Ecological site: F093BY006MI - Alfic Sandy Uplands
Other vegetative classification: Acer Viola Osmorhiza (AVO_1)
Hydric soil rating: No

Zandi, very stony

Percent of map unit: 5 percent
Landform: Till-floored lake plains
Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope
Landform position (three-dimensional): Interfluve, head slope, nose slope, side slope, base slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Concave, convex
Ecological site: F093BY010MI - Loamy Uplands
Other vegetative classification: Acer Tsuga Dryopteris (ATD_1), Tsuga Maianthemum (TM_1)

Hydric soil rating: No

Ubly, very stony

Percent of map unit: 3 percent
Landform: Till plains
Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope
Landform position (three-dimensional): Interfluve, head slope, nose slope, side slope, base slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Concave, convex
Ecological site: F093BY009MI - Alfic Loamy Uplands
Other vegetative classification: Acer Viola Osmorhiza (AVO_1), Acer Tsuga Dryopteris (ATD_1)
Hydric soil rating: No

Waiska, very stony

Percent of map unit: 2 percent
Landform: Eskers, outwash plains, stream terraces, lake terraces
Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope
Landform position (three-dimensional): Interfluve, head slope, nose slope, side slope, base slope, crest, riser, tread, rise, talf
Down-slope shape: Linear, concave
Across-slope shape: Convex, linear
Ecological site: F093BY011MI - Dry Uplands
Other vegetative classification: Acer Viola Osmorhiza (AVO_1), Acer Tsuga Dryopteris (ATD_1)
Hydric soil rating: No

57D—Liminga fine sand, 8 to 15 percent slopes

Map Unit Setting

National map unit symbol: 1kwkg
Elevation: 600 to 1,800 feet
Mean annual precipitation: 27 to 38 inches
Mean annual air temperature: 36 to 45 degrees F
Frost-free period: 70 to 170 days
Farmland classification: Not prime farmland

Map Unit Composition

Liminga and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Liminga

Setting

Landform: Outwash plains

Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope
Landform position (three-dimensional): Interfluve, head slope, nose slope, side slope, base slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Concave, convex
Parent material: Sandy glaciofluvial deposits

Typical profile

Oe - 0 to 1 inches: moderately decomposed plant material
E - 1 to 8 inches: fine sand
Bhs - 8 to 10 inches: fine sand
Bs - 10 to 18 inches: fine sand
BC - 18 to 26 inches: fine sand
C - 26 to 80 inches: fine sand

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 4.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: A
Ecological site: R092XY013WI - Sandy Uplands
Other vegetative classification: Tsuga/Maianthemum (TM), Tsuga Maianthemum Vaccinium (TMV_1)
Hydric soil rating: No

Minor Components

Toivola

Percent of map unit: 10 percent
Landform: Outwash plains
Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope
Landform position (three-dimensional): Interfluve, head slope, nose slope, side slope, base slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Concave, convex
Ecological site: F093BY006MI - Alfic Sandy Uplands
Other vegetative classification: Acer Tsuga Dryopteris - Dryopteris (ATD-D_1), Tsuga Maianthemum (TM_1)
Hydric soil rating: No

Manido

Percent of map unit: 10 percent
Landform: Till-floored lake plains
Landform position (two-dimensional): Footslope

Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: F093BY006MI - Alfic Sandy Uplands
Other vegetative classification: Tsuga Maianthemum Coptis (TMC_1)
Hydric soil rating: No

59A—Lupton and Tawas mucks, 0 to 1 percent slopes

Map Unit Setting

National map unit symbol: 1kwkl
Elevation: 590 to 1,800 feet
Mean annual precipitation: 25 to 34 inches
Mean annual air temperature: 37 to 43 degrees F
Frost-free period: 100 to 140 days
Farmland classification: Not prime farmland

Map Unit Composition

Lupton and similar soils: 51 percent
Tawas and similar soils: 49 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Lupton

Setting

Landform: Swamps on till plains
Landform position (three-dimensional): Dip
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Highly decomposed organic material

Typical profile

Oa1 - 0 to 20 inches: muck
Oa2 - 20 to 80 inches: muck

Properties and qualities

Slope: 0 to 1 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Very poorly drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 6.00 in/hr)
Depth to water table: About 0 inches
Frequency of flooding: None
Frequency of ponding: Frequent
Available water supply, 0 to 60 inches: Very high (about 23.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6w
Hydrologic Soil Group: A/D

Ecological site: F093BY002MI - Mucky Swamps
Other vegetative classification: Tsuga Thuja Mitchella (TTM_1), Tsuga Thuja Sphagnum (TTS_1)
Hydric soil rating: Yes

Description of Tawas

Setting

Landform: Swamps on till plains
Landform position (three-dimensional): Dip
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Highly decomposed organic material over sandy drift

Typical profile

Oa - 0 to 22 inches: muck
C1 - 22 to 42 inches: sand
C2 - 42 to 80 inches: gravelly sand

Properties and qualities

Slope: 0 to 1 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Very poorly drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 in/hr)
Depth to water table: About 0 inches
Frequency of flooding: None
Frequency of ponding: Frequent
Available water supply, 0 to 60 inches: High (about 11.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6w
Hydrologic Soil Group: A/D
Ecological site: F093BY002MI - Mucky Swamps
Other vegetative classification: Tsuga Thuja Mitchella (TTM_1), Tsuga Thuja Sphagnum (TTS_1)
Hydric soil rating: Yes

60B—Morganlake loamy fine sand, 0 to 6 percent slopes

Map Unit Setting

National map unit symbol: 1kwkm
Elevation: 600 to 1,800 feet
Mean annual precipitation: 25 to 34 inches
Mean annual air temperature: 37 to 43 degrees F
Frost-free period: 100 to 140 days
Farmland classification: Not prime farmland

Map Unit Composition

Morganlake and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Morganlake

Setting

Landform: Outwash plains on till plains
Landform position (two-dimensional): Footslope, summit, shoulder, backslope, toeslope
Landform position (three-dimensional): Interfluve, head slope, nose slope, side slope, base slope, crest, talf
Down-slope shape: Linear, convex
Across-slope shape: Linear, concave, convex
Parent material: Sandy outwash over loamy till

Typical profile

Oe - 0 to 2 inches: moderately decomposed plant material
E - 2 to 9 inches: loamy fine sand
Bhs - 9 to 16 inches: fine sand
Bs - 16 to 35 inches: sand
2B/E - 35 to 40 inches: silty clay loam
2Bt - 40 to 50 inches: silty clay loam
2C - 50 to 80 inches: loam

Properties and qualities

Slope: 0 to 6 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 2.00 in/hr)
Depth to water table: About 24 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 20 percent
Available water supply, 0 to 60 inches: Moderate (about 8.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: B
Ecological site: R092XY014WI - Loamy Uplands
Other vegetative classification: Acer Viola Osmorhiza (AVO_1), Acer Tsuga Dryopteris (ATD_1)
Hydric soil rating: No

Minor Components

Big iron

Percent of map unit: 5 percent
Landform: Till plains
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Rise, talf
Down-slope shape: Linear

Across-slope shape: Linear
Ecological site: R092XY011WI - Moist Loamy Lowlands
Other vegetative classification: Tsuga Thuja Petasites (TTP_1), Tsuga Acer Mitchella - Equisetum (TAM-Eq)
Hydric soil rating: No

Belding

Percent of map unit: 5 percent
Landform: Till plains
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Rise, talf
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R092XY011WI - Moist Loamy Lowlands
Other vegetative classification: Tsuga Maianthemum Coptis - Dryopteris (TMC-D_1), Acer Viola Osmorhiza - Circaea Impatiens (AVO-CI_3)
Hydric soil rating: No

Flintsteel

Percent of map unit: 5 percent
Landform: Till plains
Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope
Landform position (three-dimensional): Interfluve, head slope, nose slope, side slope, base slope, crest
Down-slope shape: Linear
Across-slope shape: Convex, linear
Ecological site: R092XY014WI - Loamy Uplands
Other vegetative classification: Acer Viola Osmorhiza (AVO_1), Tsuga Acer Mitchella (TAM_1)
Hydric soil rating: No

63B—Moquah-Arnheim complex, 0 to 3 percent slopes, frequently flooded

Map Unit Setting

National map unit symbol: 1kwkr
Elevation: 600 to 1,800 feet
Mean annual precipitation: 25 to 34 inches
Mean annual air temperature: 37 to 43 degrees F
Frost-free period: 100 to 140 days
Farmland classification: Not prime farmland

Map Unit Composition

Moquah, frequently flooded, and similar soils: 55 percent
Arnheim, frequently flooded, and similar soils: 30 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Moquah, Frequently Flooded

Setting

Landform: Flood plains
Landform position (two-dimensional): Footslope, toeslope
Landform position (three-dimensional): Base slope, rise, talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Coarse-loamy alluvium

Typical profile

A - 0 to 5 inches: loam
C1 - 5 to 19 inches: stratified loamy fine sand to loamy very fine sand to silt loam
C2 - 19 to 48 inches: stratified fine sand to very fine sandy loam to silt loam
C3 - 48 to 55 inches: stratified silt loam
C4 - 55 to 80 inches: stratified sand to fine sand to loamy fine sand to silt loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: About 42 inches
Frequency of flooding: FrequentRareNone
Frequency of ponding: None
Available water supply, 0 to 60 inches: High (about 10.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: A
Ecological site: R092XY004WI - Seasonally Dry Floodplains
Forage suitability group: High AWC, adequately drained (G090AY008WI)
Other vegetative classification: Acer Osmorhiza Caulophyllum (AOC), Acer Viola Osmorhiza (AVO_1), High AWC, adequately drained (G090AY008WI)
Hydric soil rating: No

Description of Arnheim, Frequently Flooded

Setting

Landform: Flood plains
Landform position (two-dimensional): Footslope, toeslope
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loamy alluvium

Typical profile

A - 0 to 5 inches: mucky silt loam
Cg - 5 to 10 inches: silt loam
C1 - 10 to 15 inches: very fine sandy loam
C2 - 15 to 24 inches: silt loam
C3 - 24 to 80 inches: stratified very fine sandy loam to silt loam to loamy fine sand to fine sandy loam

Properties and qualities

Slope: 0 to 1 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: About 0 inches
Frequency of flooding: FrequentNoneOccasional
Frequency of ponding: Frequent
Available water supply, 0 to 60 inches: High (about 10.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7w
Hydrologic Soil Group: B/D
Ecological site: R092XY005WI - Wet Floodplains
Forage suitability group: Frequently flooded, organics (G090AY010WI)
Other vegetative classification: Frequently flooded, organics (G090AY010WI), Fraxinus Impatiens (FI_1), Fraxinus Mentha Carex (FMC_1)
Hydric soil rating: Yes

Minor Components

Schaat creek, frequently flooded

Percent of map unit: 5 percent
Landform: Flood plains on flood plains
Landform position (two-dimensional): Footslope, toeslope
Landform position (three-dimensional): Talf, dip
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R092XY005WI - Wet Floodplains
Other vegetative classification: Fraxinus Mentha Carex - Caltha (FMC-C)
Hydric soil rating: Yes

Gull point, frequently flooded

Percent of map unit: 5 percent
Landform: Flood plains on till plains
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope, dip, talf
Down-slope shape: Linear
Across-slope shape: Concave, linear
Ecological site: R092XY005WI - Wet Floodplains
Other vegetative classification: Fraxinus Impatiens (FI_1), Fraxinus Mentha Carex (FMC_1)
Hydric soil rating: Yes

Cathro, frequently flooded

Percent of map unit: 5 percent
Landform: Drainageways, depressions, swamps
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Dip, talf
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: F093BY002MI - Mucky Swamps

Other vegetative classification: Fraxinus Impatiens (FI_1), Tsuga-Thuja-Mitella (TTM_2)
Hydric soil rating: Yes

67B—Nonesuch loam, 1 to 6 percent slopes, very stony

Map Unit Setting

National map unit symbol: 1kwkt
Elevation: 590 to 1,800 feet
Mean annual precipitation: 25 to 34 inches
Mean annual air temperature: 37 to 43 degrees F
Frost-free period: 100 to 140 days
Farmland classification: Not prime farmland

Map Unit Composition

Nonesuch and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Nonesuch

Setting

Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Coarse-loamy till

Typical profile

Oi - 0 to 1 inches: slightly decomposed plant material
A - 1 to 4 inches: loam
Bs - 4 to 11 inches: channery loam
Bt1 - 11 to 16 inches: very gravelly fine sandy loam
Bt2 - 16 to 23 inches: gravelly sandy loam
B/Ex - 23 to 34 inches: silt loam
Crt - 34 to 50 inches: silt loam
2R - 50 to 80 inches: bedrock

Properties and qualities

Slope: 1 to 6 percent
Surface area covered with cobbles, stones or boulders: 0.0 percent
Depth to restrictive feature: 16 to 30 inches to fragipan; 20 to 40 inches to paralithic bedrock; 20 to 60 inches to lithic bedrock
Drainage class: Moderately well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: About 12 inches
Frequency of flooding: None
Frequency of ponding: None

Available water supply, 0 to 60 inches: Low (about 3.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4s
Hydrologic Soil Group: D
Ecological site: R092XY009WI - Loamy Sandstone Uplands
Other vegetative classification: Acer Viola Osmorhiza (AVO_1), Acer Tsuga Dryopteris (ATD_1)
Hydric soil rating: No

Minor Components

Greenstone

Percent of map unit: 10 percent
Landform: Till plains
Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R092XY009WI - Loamy Sandstone Uplands
Other vegetative classification: Tsuga Maianthemum Coptis - Dryopteris (TMC-D_1), Acer Viola Osmorhiza - Circaea Impatiens (AVO-CI_3)
Hydric soil rating: No

Flintsteel

Percent of map unit: 5 percent
Landform: Till plains
Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope
Landform position (three-dimensional): Interfluve, head slope, nose slope, side slope, crest, base slope
Down-slope shape: Linear
Across-slope shape: Convex, linear
Ecological site: R092XY014WI - Loamy Uplands
Other vegetative classification: Acer Viola Osmorhiza (AVO_1), Tsuga Acer Mitchella (TAM_1)
Hydric soil rating: No

81E—Rubicon sand, 15 to 35 percent slopes

Map Unit Setting

National map unit symbol: 1kwll
Elevation: 590 to 1,800 feet
Mean annual precipitation: 25 to 34 inches
Mean annual air temperature: 37 to 43 degrees F
Frost-free period: 100 to 140 days
Farmland classification: Not prime farmland

Map Unit Composition

Rubicon and similar soils: 85 percent

Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Rubicon

Setting

Landform: Beach ridges
Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope
Landform position (three-dimensional): Interfluve, head slope, nose slope, side slope, base slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Concave, convex
Parent material: Eolian sands

Typical profile

Oe - 0 to 1 inches: moderately decomposed plant material
E - 1 to 6 inches: sand
Bs - 6 to 25 inches: sand
BC - 25 to 37 inches: sand
C - 37 to 80 inches: sand

Properties and qualities

Slope: 15 to 35 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Excessively drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 4.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: A
Ecological site: R092XY001WI - Sandy Shore Complex
Other vegetative classification: Tsuga Maianthemum Vaccinium (TMV_1), Acer Quercus Vaccinium (AQV_1)
Hydric soil rating: No

Minor Components

Liminga

Percent of map unit: 10 percent
Landform: Outwash plains
Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope
Landform position (three-dimensional): Interfluve, head slope, nose slope, side slope, base slope, crest
Down-slope shape: Linear
Across-slope shape: Convex, linear
Ecological site: R092XY013WI - Sandy Uplands
Other vegetative classification: Tsuga/Maianthemum (TM), Tsuga Maianthemum Vaccinium (TMV_1)

Hydric soil rating: No

Kalkaska

Percent of map unit: 4 percent
Landform: Outwash plains
Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope
Landform position (three-dimensional): Interfluve, head slope, nose slope, side slope, base slope, crest
Down-slope shape: Linear
Across-slope shape: Convex, linear
Ecological site: R092XY013WI - Sandy Uplands
Other vegetative classification: Acer Tsuga Dryopteris - Dryopteris (ATD-D_1), Tsuga Maianthemum (TM_1)
Hydric soil rating: No

Deford

Percent of map unit: 1 percent
Landform: Interdunes
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R092XY006WI - Wet Sandy Lowlands
Other vegetative classification: Tsuga Thuja Sphagnum (TTS_1), Tsuga-Thuja-Mitella (TTM_2)
Hydric soil rating: Yes

86A—Slickens, 0 to 1 percent slopes

Map Unit Setting

National map unit symbol: 1kwls
Elevation: 590 to 1,800 feet
Mean annual precipitation: 25 to 34 inches
Mean annual air temperature: 37 to 43 degrees F
Frost-free period: 100 to 140 days
Farmland classification: Not prime farmland

Map Unit Composition

Slickens: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Slickens

Setting

Landform position (three-dimensional): Dip
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Sandy and silty mine spoil or earthy fill

90A—Deford-Tawas complex, 0 to 1 percent slopes

Map Unit Setting

National map unit symbol: 1kwlx
Elevation: 600 to 1,800 feet
Mean annual precipitation: 27 to 38 inches
Mean annual air temperature: 36 to 45 degrees F
Frost-free period: 70 to 170 days
Farmland classification: Not prime farmland

Map Unit Composition

Deford and similar soils: 50 percent
Tawas and similar soils: 35 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Deford

Setting

Landform: Outwash plains on till plains
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Dip
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Sandy glaciofluvial deposits

Typical profile

Oa - 0 to 4 inches: muck
E - 4 to 10 inches: sand
Bw - 10 to 36 inches: sand
C1 - 36 to 55 inches: fine sand
2C2 - 55 to 80 inches: gravelly coarse sand

Properties and qualities

Slope: 0 to 1 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 6.00 in/hr)
Depth to water table: About 0 inches
Frequency of flooding: None
Frequency of ponding: Frequent
Available water supply, 0 to 60 inches: High (about 10.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: A/D
Ecological site: R092XY006WI - Wet Sandy Lowlands

Other vegetative classification: Tsuga Thuja Sphagnum (TTS_1), Tsuga-Thuja-Mitella (TTM_2)
Hydric soil rating: Yes

Description of Tawas

Setting

Landform: Swamps on till plains
Landform position (two-dimensional): Footslope, toeslope
Landform position (three-dimensional): Dip
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Highly decomposed organic material over sandy drift

Typical profile

Oa - 0 to 22 inches: muck
C1 - 22 to 42 inches: sand
C2 - 42 to 80 inches: gravelly sand

Properties and qualities

Slope: 0 to 1 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Very poorly drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 6.00 in/hr)
Depth to water table: About 0 inches
Frequency of flooding: None
Frequency of ponding: Frequent
Available water supply, 0 to 60 inches: High (about 11.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6w
Hydrologic Soil Group: A/D
Ecological site: R092XY002WI - Mucky Swamps
Other vegetative classification: Tsuga Thuja Mitchella (TTM_1), Tsuga Thuja Sphagnum (TTS_1)
Hydric soil rating: Yes

Minor Components

Kinross

Percent of map unit: 10 percent
Landform: Depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Dip, talf
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: F093BY004MI - Wet Lowlands
Other vegetative classification: Tsuga Thuja Sphagnum (TTS_1), Tsuga Maianthemum Coptis - Sphagnum (TMC-Sphag)
Hydric soil rating: Yes

Au gres

Percent of map unit: 5 percent
Landform: Depressions on till plains

Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Rise, talf
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: F093BY005MI - Moist Lowlands
Other vegetative classification: Tsuga Maianthemum Coptis - Vaccinium (TMC-Vac_1), Tsuga Maianthemum Coptis (TMC_1)
Hydric soil rating: No

91A—Tonkey silt loam, 0 to 2 percent slopes

Map Unit Setting

National map unit symbol: 1kwly
Elevation: 590 to 1,800 feet
Mean annual precipitation: 25 to 34 inches
Mean annual air temperature: 37 to 43 degrees F
Frost-free period: 100 to 140 days
Farmland classification: Not prime farmland

Map Unit Composition

Tonkey and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Tonkey

Setting

Landform: Depressions on till plains
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Stratified loamy and sandy glaciofluvial deposits

Typical profile

A - 0 to 8 inches: silt loam
Bg1 - 8 to 13 inches: very fine sandy loam
Bg2 - 13 to 28 inches: stratified fine sandy loam to loamy sand to silt loam to sandy loam
C - 28 to 80 inches: stratified fine sandy loam to sandy loam to silt loam to loamy sand

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: About 0 inches

Frequency of flooding: None
Frequency of ponding: Frequent
Available water supply, 0 to 60 inches: High (about 9.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: B/D
Ecological site: R092XY007WI - Wet Loamy or Clayey Lowlands
Other vegetative classification: Fraxinus Impatiens (FI_1)
Hydric soil rating: Yes

Minor Components

Deford

Percent of map unit: 5 percent
Landform: Interdunes
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R092XY006WI - Wet Sandy Lowlands
Other vegetative classification: Tsuga Thuja Sphagnum (TTS_1), Tsuga-Thuja-Mitella (TTM_2)
Hydric soil rating: Yes

Cathro

Percent of map unit: 5 percent
Landform: Drainageways, depressions, swamps
Ecological site: F090AY002WI - Mucky Swamp
Other vegetative classification: Fraxinus Impatiens (FI_1), Tsuga-Thuja-Mitella (TTM_2)
Hydric soil rating: Yes

Robago

Percent of map unit: 5 percent
Landform: Lake plains, ground moraines
Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R092XY011WI - Moist Loamy Lowlands
Other vegetative classification: Tsuga Maianthemum Coptis - Dryopteris (TMC-D_1), Acer Viola Osmorhiza - Circaea Impatiens (AVO-CI_3)
Hydric soil rating: No

93B—Loggerhead loam, 1 to 8 percent slopes

Map Unit Setting

National map unit symbol: 1kwm0
Elevation: 600 to 1,800 feet
Mean annual precipitation: 25 to 34 inches
Mean annual air temperature: 37 to 43 degrees F

Frost-free period: 100 to 140 days
Farmland classification: Farmland of local importance

Map Unit Composition

Loggerhead and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Loggerhead

Setting

Landform: Till plains
Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope
Landform position (three-dimensional): Interfluve, head slope, nose slope, side slope, crest, base slope
Down-slope shape: Linear
Across-slope shape: Convex, linear
Parent material: Coarse-loamy till over loamy till

Typical profile

A - 0 to 4 inches: loam
E - 4 to 5 inches: gravelly fine sandy loam
Bs - 5 to 15 inches: gravelly loam
E/B - 15 to 36 inches: gravelly fine sandy loam
2B/E - 36 to 56 inches: gravelly fine sandy loam
2Bt - 56 to 80 inches: loam

Properties and qualities

Slope: 1 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: About 12 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: High (about 9.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C/D
Ecological site: F093BY009MI - Alfic Loamy Uplands
Other vegetative classification: Acer Viola Osmorhiza (AVO_1), Acer Tsuga Dryopteris (ATD_1)
Hydric soil rating: No

Minor Components

Annalake

Percent of map unit: 5 percent
Landform: Till plains, outwash plains, outwash terraces
Landform position (two-dimensional): Summit, backslope, footslope
Landform position (three-dimensional): Base slope, riser, tread, rise
Down-slope shape: Convex, linear

Across-slope shape: Linear
Ecological site: F093BY009MI - Alfic Loamy Uplands
Other vegetative classification: Acer Viola Osmorhiza (AVO_1), Acer Tsuga Dryopteris (ATD_1)
Hydric soil rating: No

Flintsteel

Percent of map unit: 5 percent
Landform: Till plains
Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope
Landform position (three-dimensional): Interfluve, head slope, nose slope, side slope, crest, base slope
Down-slope shape: Linear
Across-slope shape: Convex, linear
Ecological site: F093BY009MI - Alfic Loamy Uplands
Other vegetative classification: Acer Viola Osmorhiza (AVO_1), Tsuga Acer Mitchella (TAM_1)
Hydric soil rating: No

Belding

Percent of map unit: 5 percent
Landform: Till plains
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Rise, talf
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: F093BY005MI - Moist Lowlands
Other vegetative classification: Tsuga Maianthemum Coptis - Dryopteris (TMC-D_1), Acer Viola Osmorhiza - Circaea Impatiens (AVO-CI_3)
Hydric soil rating: No

94A—Udorthents, loamy, nearly level

Map Unit Setting

National map unit symbol: 1kwm2
Elevation: 590 to 1,800 feet
Mean annual precipitation: 25 to 34 inches
Mean annual air temperature: 37 to 43 degrees F
Frost-free period: 100 to 140 days
Farmland classification: Not prime farmland

Map Unit Composition

Udorthents and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Udorthents

Setting

Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loamy mine spoil or earthy fill

Typical profile

C - 0 to 80 inches: silt loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: 0 to 10 inches to densic material
Drainage class: Moderately well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: About 18 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 15 percent
Available water supply, 0 to 60 inches: Very low (about 0.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8s
Hydrologic Soil Group: C/D
Other vegetative classification: Acer Viola Osmorhiza (AVO_1)
Hydric soil rating: No

Minor Components

Flintsteel

Percent of map unit: 5 percent
Landform: Till plains
Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope
Landform position (three-dimensional): Interfluve, head slope, nose slope, side slope, base slope, crest
Down-slope shape: Linear
Across-slope shape: Convex, linear
Ecological site: R092XY014WI - Loamy Uplands
Other vegetative classification: Acer Viola Osmorhiza (AVO_1), Tsuga Acer Mitchella (TAM_1)
Hydric soil rating: No

Annalake

Percent of map unit: 3 percent
Landform: Outwash terraces, outwash plains
Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R092XY014WI - Loamy Uplands
Other vegetative classification: Acer Viola Osmorhiza (AVO_1), Acer Tsuga Dryopteris (ATD_1)

Hydric soil rating: No

Loggerhead

Percent of map unit: 2 percent
Landform: Till plains
Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope
Landform position (three-dimensional): Interfluve, head slope, nose slope, side slope, base slope, crest
Down-slope shape: Linear
Across-slope shape: Convex, linear
Ecological site: R092XY014WI - Loamy Uplands
Other vegetative classification: Acer Viola Osmorhiza (AVO_1), Acer Tsuga Dryopteris (ATD_1)
Hydric soil rating: No

95F—Udorthents-Alfic Udarents-Epiaquents complex, loamy, nearly level and steep

Map Unit Setting

National map unit symbol: 1kwm3
Elevation: 590 to 1,800 feet
Mean annual precipitation: 25 to 34 inches
Mean annual air temperature: 37 to 43 degrees F
Frost-free period: 100 to 140 days
Farmland classification: Not prime farmland

Map Unit Composition

Udorthents and similar soils: 60 percent
Alfic udarents: 20 percent
Epiaquents: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Udorthents

Setting

Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope
Landform position (three-dimensional): Interfluve, head slope, nose slope, side slope, base slope, crest
Down-slope shape: Linear
Across-slope shape: Convex, linear
Parent material: Loamy mine spoil or earthy fill

Typical profile

Cd - 0 to 80 inches: silt loam

Properties and qualities

Slope: 0 to 8 percent
Depth to restrictive feature: 0 to 10 inches to densic material
Drainage class: Moderately well drained

Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: About 18 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 15 percent
Available water supply, 0 to 60 inches: Very low (about 0.0 inches)

Interpretive groups
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8s
Hydrologic Soil Group: C/D
Other vegetative classification: Acer Viola Osmorhiza (AVO_1)
Hydric soil rating: No

Description of Epiaquents

Setting
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loamy mine spoil or earthy fill

Typical profile
Cd - 0 to 80 inches: silt loam

Properties and qualities
Slope: 0 to 4 percent
Depth to restrictive feature: 0 to 10 inches to densic material
Drainage class: Very poorly drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: About 0 inches
Frequency of ponding: Frequent
Calcium carbonate, maximum content: 15 percent
Available water supply, 0 to 60 inches: Very low (about 0.0 inches)

Interpretive groups
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8w
Other vegetative classification: Fraxinus Mentha Carex - Caltha (FMC-C), Fraxinus Mentha Carex (FMC_1)
Hydric soil rating: Yes

Description of Alfic Udarents

Setting
Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope
Landform position (three-dimensional): Interfluve, head slope, nose slope, side slope, base slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Concave, convex
Parent material: Loamy mine spoil or earthy fill

Typical profile

C - 0 to 80 inches: fine sandy loam, loam, silt loam

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: B
Other vegetative classification: Acer Osmorhiza Caulophyllum (AOC)
Hydric soil rating: No

97B—Waiska loamy sand, 1 to 8 percent slopes, stony

Map Unit Setting

National map unit symbol: 1nbgr
Elevation: 590 to 1,800 feet
Mean annual precipitation: 25 to 34 inches
Mean annual air temperature: 37 to 43 degrees F
Frost-free period: 100 to 140 days
Farmland classification: Not prime farmland

Map Unit Composition

Waiska and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Waiska

Setting

Landform: Kames, eskers, outwash plains, kame terraces
Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope
Landform position (three-dimensional): Interfluve, head slope, nose slope, side slope, base slope, crest
Down-slope shape: Linear
Across-slope shape: Convex, linear
Parent material: Gravelly and sandy glaciofluvial deposits

Typical profile

A - 0 to 2 inches: loamy sand
E - 2 to 5 inches: gravelly loamy sand
Bhs - 5 to 18 inches: very gravelly sand
Bs - 18 to 32 inches: extremely gravelly sand
C1 - 32 to 62 inches: extremely gravelly sand
C2 - 62 to 80 inches: extremely gravelly coarse sand

Properties and qualities

Slope: 1 to 8 percent
Surface area covered with cobbles, stones or boulders: 0.1 percent
Depth to restrictive feature: More than 80 inches

Drainage class: Excessively drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): High to very high (6.00 to 20.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Very low (about 1.7 inches)

Interpretive groups

Land capability classification (irrigated): 6s
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: A
Ecological site: R092XY013WI - Sandy Uplands
Other vegetative classification: Acer Viola Osmorhiza (AVO_1), Acer Tsuga Dryopteris (ATD_1)
Hydric soil rating: No

Minor Components

Toivola

Percent of map unit: 10 percent
Landform: Outwash plains
Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope
Landform position (three-dimensional): Interfluve, head slope, nose slope, side slope, base slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Concave, convex
Ecological site: R092XY013WI - Sandy Uplands
Other vegetative classification: Acer Tsuga Dryopteris - Dryopteris (ATD-D_1), Tsuga Maianthemum (TM_1)
Hydric soil rating: No

Manido

Percent of map unit: 5 percent
Landform: Till-floored lake plains
Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R092XY013WI - Sandy Uplands
Other vegetative classification: Tsuga Maianthemum Coptis (TMC_1)
Hydric soil rating: No

99F—Watton silt loam, 35 to 70 percent slopes

Map Unit Setting

National map unit symbol: 1kwmc
Elevation: 590 to 1,800 feet
Mean annual precipitation: 25 to 34 inches

Mean annual air temperature: 37 to 43 degrees F
Frost-free period: 100 to 140 days
Farmland classification: Not prime farmland

Map Unit Composition

Watton and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Watton

Setting

Landform: Till plains
Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope
Landform position (three-dimensional): Interfluve, head slope, nose slope, side slope, base slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Concave, convex
Parent material: Fine-loamy till

Typical profile

A - 0 to 3 inches: silt loam
E/B - 3 to 6 inches: silt loam
B/E - 6 to 23 inches: silt loam
Bt - 23 to 44 inches: silt loam
BC - 44 to 56 inches: silt loam
Cd - 56 to 81 inches: silt loam

Properties and qualities

Slope: 35 to 70 percent
Depth to restrictive feature: 40 to 60 inches to densic material
Drainage class: Well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: About 12 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 11 percent
Available water supply, 0 to 60 inches: Moderate (about 7.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: C/D
Ecological site: R092XY014WI - Loamy Uplands
Other vegetative classification: Acer Viola Osmorhiza (AVO_1), Tsuga Acer Mitchella (TAM_1)
Hydric soil rating: No

Minor Components

Ubly

Percent of map unit: 10 percent
Landform: Till plains

Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope
Landform position (three-dimensional): Interfluve, head slope, nose slope, side slope, base slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Concave, convex
Ecological site: R092XY014WI - Loamy Uplands
Other vegetative classification: Acer Viola Osmorhiza (AVO_1), Acer Tsuga Dryopteris (ATD_1)
Hydric soil rating: No

Rockland

Percent of map unit: 3 percent
Landform: Slumps
Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope
Landform position (three-dimensional): Interfluve, head slope, nose slope, side slope, base slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Concave, convex
Ecological site: R092XY014WI - Loamy Uplands
Other vegetative classification: Acer Osmorhiza Caulophyllum (AOC), Acer Viola Osmorhiza (AVO_1)
Hydric soil rating: No

Morganlake

Percent of map unit: 2 percent
Landform: Till plains
Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope
Landform position (three-dimensional): Interfluve, head slope, nose slope, side slope, base slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Concave, convex
Ecological site: R092XY014WI - Loamy Uplands
Other vegetative classification: Acer Viola Osmorhiza (AVO_1), Acer Tsuga Dryopteris (ATD_1)
Hydric soil rating: No

100B—Flintsteel loam, 1 to 8 percent slopes

Map Unit Setting

National map unit symbol: 1kwmd
Elevation: 590 to 1,800 feet
Mean annual precipitation: 25 to 34 inches
Mean annual air temperature: 37 to 43 degrees F
Frost-free period: 100 to 140 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Flintsteel and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Flintsteel

Setting

Landform: Till plains
Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope
Landform position (three-dimensional): Interfluve, head slope, nose slope, side slope, base slope, crest
Down-slope shape: Linear
Across-slope shape: Convex, linear
Parent material: Fine-loamy till

Typical profile

Oi - 0 to 1 inches: slightly decomposed plant material
A - 1 to 5 inches: loam
E - 5 to 9 inches: loam
Bw - 9 to 12 inches: fine sandy loam
E/B - 12 to 16 inches: loam
B/E - 16 to 22 inches: loam
Bt - 22 to 36 inches: silt loam
BCd - 36 to 48 inches: silt loam
Cd - 48 to 80 inches: silt loam

Properties and qualities

Slope: 1 to 8 percent
Depth to restrictive feature: 25 to 40 inches to densic material
Drainage class: Moderately well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: About 12 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 20 percent
Available water supply, 0 to 60 inches: Moderate (about 7.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C/D
Ecological site: R092XY014WI - Loamy Uplands
Other vegetative classification: Acer Viola Osmorhiza (AVO_1), Tsuga Acer Mitchella (TAM_1)
Hydric soil rating: No

Minor Components

Big iron

Percent of map unit: 10 percent
Landform: Till plains
Landform position (three-dimensional): Rise

Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R092XY011WI - Moist Loamy Lowlands
Other vegetative classification: Tsuga Thuja Petasites (TTP_1), Tsuga Acer Mitchella - Equisetum (TAM-Eq)
Hydric soil rating: No

Loggerhead

Percent of map unit: 3 percent
Landform: Till plains
Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope
Landform position (three-dimensional): Interfluve, head slope, nose slope, side slope, base slope, crest
Down-slope shape: Linear
Across-slope shape: Convex, linear
Ecological site: R092XY014WI - Loamy Uplands
Other vegetative classification: Acer Viola Osmorhiza (AVO_1), Acer Tsuga Dryopteris (ATD_1)
Hydric soil rating: No

Manido

Percent of map unit: 2 percent
Landform: Till-floored lake plains
Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R092XY013WI - Sandy Uplands
Other vegetative classification: Tsuga Maianthemum Coptis (TMC_1)
Hydric soil rating: No

100D—Flintsteel loam, 8 to 15 percent slopes

Map Unit Setting

National map unit symbol: 1kwmf
Elevation: 590 to 1,800 feet
Mean annual precipitation: 25 to 34 inches
Mean annual air temperature: 37 to 43 degrees F
Frost-free period: 100 to 140 days
Farmland classification: Not prime farmland

Map Unit Composition

Flintsteel and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Flintsteel

Setting

Landform: Till plains

Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope
Landform position (three-dimensional): Interfluve, head slope, nose slope, side slope, base slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Concave, convex
Parent material: Fine-loamy till

Typical profile

Oi - 0 to 1 inches: slightly decomposed plant material
A - 1 to 5 inches: loam
E - 5 to 9 inches: loam
Bw - 9 to 12 inches: fine sandy loam
E/B - 12 to 16 inches: loam
B/E - 16 to 22 inches: loam
Bt - 22 to 36 inches: silt loam
BCd - 36 to 48 inches: silt loam
Cd - 48 to 80 inches: silt loam

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: 25 to 40 inches to densic material
Drainage class: Moderately well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: About 12 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 20 percent
Available water supply, 0 to 60 inches: Moderate (about 7.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: C/D
Ecological site: R092XY014WI - Loamy Uplands
Other vegetative classification: Acer Viola Osmorhiza (AVO_1), Tsuga Acer Mitchella (TAM_1)
Hydric soil rating: No

Minor Components

Big iron

Percent of map unit: 10 percent
Landform: Till plains
Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R092XY011WI - Moist Loamy Lowlands
Other vegetative classification: Tsuga Thuja Petasites (TTP_1), Tsuga Acer Mitchella - Equisetum (TAM-Eq)
Hydric soil rating: No

Loggerhead

Percent of map unit: 3 percent
Landform: Till plains

Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope
Landform position (three-dimensional): Interfluve, head slope, nose slope, side slope, base slope, crest
Down-slope shape: Linear
Across-slope shape: Convex, linear
Ecological site: R092XY014WI - Loamy Uplands
Other vegetative classification: Acer Viola Osmorhiza (AVO_1), Acer Tsuga Dryopteris (ATD_1)
Hydric soil rating: No

Manido

Percent of map unit: 2 percent
Landform: Till-floored lake plains
Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R092XY013WI - Sandy Uplands
Other vegetative classification: Tsuga Maianthemum Coptis (TMC_1)
Hydric soil rating: No

101B—Big Iron silt loam, 0 to 4 percent slopes

Map Unit Setting

National map unit symbol: 1kwmg
Elevation: 590 to 1,800 feet
Mean annual precipitation: 25 to 34 inches
Mean annual air temperature: 37 to 43 degrees F
Frost-free period: 100 to 140 days
Farmland classification: Farmland of local importance

Map Unit Composition

Big iron and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Big Iron

Setting

Landform: Till plains
Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Fine-loamy till

Typical profile

Oi - 0 to 1 inches: slightly decomposed plant material
A - 1 to 3 inches: silt loam
E - 3 to 4 inches: silt loam
Bw - 4 to 11 inches: loam

E/B - 11 to 17 inches: loam
Bt - 17 to 47 inches: silt loam
BCd1 - 47 to 66 inches: loam
BCd2 - 66 to 80 inches: gravelly silt loam

Properties and qualities

Slope: 0 to 4 percent
Depth to restrictive feature: 40 to 60 inches to densic material
Drainage class: Somewhat poorly drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: About 6 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 20 percent
Available water supply, 0 to 60 inches: Moderate (about 8.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: C/D
Ecological site: R092XY011WI - Moist Loamy Lowlands
Other vegetative classification: Tsuga Thuja Petasites (TTP_1), Tsuga Acer Mitchella - Equisetum (TAM-Eq)
Hydric soil rating: No

Minor Components

Trap falls

Percent of map unit: 10 percent
Landform: Depressions on till plains
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R092XY007WI - Wet Loamy or Clayey Lowlands
Other vegetative classification: Fraxinus Impatiens (FI_1), Fraxinus Mentha Carex (FMC_1)
Hydric soil rating: Yes

Belding

Percent of map unit: 10 percent
Landform: Ground moraines
Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R092XY011WI - Moist Loamy Lowlands
Other vegetative classification: Tsuga Maianthemum Coptis - Dryopteris (TMC-D_1), Acer Viola Osmorhiza - Circaea Impatiens (AVO-CI_3)
Hydric soil rating: No

102A—Trap Falls clay loam, 0 to 1 percent slopes

Map Unit Setting

National map unit symbol: 1kwmh
Elevation: 590 to 1,800 feet
Mean annual precipitation: 25 to 34 inches
Mean annual air temperature: 37 to 43 degrees F
Frost-free period: 100 to 140 days
Farmland classification: Not prime farmland

Map Unit Composition

Trap falls and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Trap Falls

Setting

Landform: Depressions on till plains
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Fine-loamy till

Typical profile

Oi - 0 to 1 inches: peat
A - 1 to 10 inches: clay loam
Bt1 - 10 to 18 inches: clay loam
Bt2 - 18 to 31 inches: clay loam
2C - 31 to 55 inches: loam
2Cd - 55 to 80 inches: gravelly fine sandy loam

Properties and qualities

Slope: 0 to 1 percent
Depth to restrictive feature: 40 to 60 inches to densic material
Drainage class: Poorly drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately high (0.00 to 0.20 in/hr)
Depth to water table: About 0 inches
Frequency of flooding: None
Frequency of ponding: Frequent
Calcium carbonate, maximum content: 10 percent
Available water supply, 0 to 60 inches: High (about 9.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: C/D
Ecological site: R092XY007WI - Wet Loamy or Clayey Lowlands

Other vegetative classification: Fraxinus Impatiens (FI_1), Fraxinus Mentha Carex (FMC_1)
Hydric soil rating: Yes

Minor Components

Cathro
Percent of map unit: 10 percent
Landform: Drainageways, depressions, swamps
Ecological site: F090AY002WI - Mucky Swamp
Other vegetative classification: Fraxinus Impatiens (FI_1), Tsuga-Thuja-Mitella (TTM_2)
Hydric soil rating: Yes

Big iron
Percent of map unit: 3 percent
Landform: Till plains
Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R092XY011WI - Moist Loamy Lowlands
Other vegetative classification: Tsuga Thuja Petasites (TTP_1), Tsuga Acer Mitchella - Equisetum (TAM-Eq)
Hydric soil rating: No

Gull point
Percent of map unit: 2 percent
Landform: Flood plains on till plains
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope, talf
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R092XY005WI - Wet Floodplains
Other vegetative classification: Fraxinus Impatiens (FI_1), Fraxinus Mentha Carex (FMC_1)
Hydric soil rating: Yes

103D—Big Iron-Flintsteel-Gull Point, frequently flooded, complex, dissected, 1 to 15 percent slopes

Map Unit Setting
National map unit symbol: 1kwmj
Elevation: 590 to 1,800 feet
Mean annual precipitation: 25 to 34 inches
Mean annual air temperature: 37 to 43 degrees F
Frost-free period: 100 to 140 days
Farmland classification: Farmland of local importance

Map Unit Composition
Big iron and similar soils: 40 percent

Flintsteel, dissected, and similar soils: 30 percent
Gull point and similar soils: 15 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Big Iron

Setting

Landform: Till plains
Landform position (two-dimensional): Footslope, toeslope
Landform position (three-dimensional): Side slope, base slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Fine-loamy till

Typical profile

Oi - 0 to 1 inches: slightly decomposed plant material
A - 1 to 3 inches: silt loam
E - 3 to 4 inches: silt loam
Bw - 4 to 11 inches: loam
E/B - 11 to 17 inches: loam
Bt - 17 to 47 inches: silt loam
BCd1 - 47 to 66 inches: loam
BCd2 - 66 to 80 inches: gravelly silt loam

Properties and qualities

Slope: 1 to 3 percent
Depth to restrictive feature: 40 to 60 inches to densic material
Drainage class: Somewhat poorly drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: About 6 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 20 percent
Available water supply, 0 to 60 inches: Moderate (about 8.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: C/D
Ecological site: R092XY011WI - Moist Loamy Lowlands
Other vegetative classification: Tsuga Thuja Petasites (TTP_1), Tsuga Acer Mitchella - Equisetum (TAM-Eq)
Hydric soil rating: No

Description of Flintsteel, Dissected

Setting

Landform: Till plains
Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope
Landform position (three-dimensional): Interfluve, head slope, nose slope, side slope, base slope, crest
Down-slope shape: Linear
Across-slope shape: Convex, linear

Parent material: Fine-loamy till

Typical profile

Oi - 0 to 1 inches: slightly decomposed plant material
A - 1 to 5 inches: loam
E - 5 to 9 inches: loam
Bw - 9 to 12 inches: fine sandy loam
E/B - 12 to 16 inches: loam
B/E - 16 to 22 inches: loam
Bt - 22 to 36 inches: silt loam
BCd - 36 to 48 inches: silt loam
Cd - 48 to 80 inches: silt loam

Properties and qualities

Slope: 1 to 15 percent
Depth to restrictive feature: 25 to 40 inches to densic material
Drainage class: Moderately well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: About 12 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 20 percent
Available water supply, 0 to 60 inches: Moderate (about 7.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: C/D
Ecological site: R092XY014WI - Loamy Uplands
Other vegetative classification: Acer Viola Osmorhiza (AVO_1), Tsuga Acer Mitchella (TAM_1)
Hydric soil rating: No

Description of Gull Point

Setting

Landform: Flood plains on till plains
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope, dip, talf
Down-slope shape: Linear
Across-slope shape: Concave, linear
Parent material: Fine-loamy alluvium over fine-loamy till

Typical profile

Oi - 0 to 1 inches: peat
A1 - 1 to 7 inches: loam
A2 - 7 to 15 inches: loam
AB1 - 15 to 28 inches: loam
AB2 - 28 to 33 inches: clay loam
2Bt - 33 to 40 inches: loam
2BCd1 - 40 to 61 inches: silt loam
2BCd2 - 61 to 80 inches: silt loam

Properties and qualities

Slope: 1 to 2 percent

Depth to restrictive feature: 40 to 60 inches to densic material
Drainage class: Poorly drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: About 0 inches
Frequency of flooding: FrequentOccasionalNone
Frequency of ponding: None
Calcium carbonate, maximum content: 10 percent
Available water supply, 0 to 60 inches: Moderate (about 8.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7w
Hydrologic Soil Group: C/D
Ecological site: R092XY005WI - Wet Floodplains
Other vegetative classification: Fraxinus Impatiens (FI_1), Fraxinus Mentha Carex (FMC_1)
Hydric soil rating: Yes

Minor Components

Watton

Percent of map unit: 10 percent
Landform: Till plains
Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope
Landform position (three-dimensional): Interfluve, head slope, nose slope, side slope, base slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Concave, convex
Ecological site: R092XY014WI - Loamy Uplands
Other vegetative classification: Acer Viola Osmorhiza (AVO_1), Tsuga Acer Mitchella (TAM_1)
Hydric soil rating: No

Trap falls

Percent of map unit: 3 percent
Landform: Depressions on till plains
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R092XY007WI - Wet Loamy or Clayey Lowlands
Other vegetative classification: Fraxinus Impatiens (FI_1), Fraxinus Mentha Carex (FMC_1)
Hydric soil rating: Yes

Belding

Percent of map unit: 2 percent
Landform: Ground moraines
Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R092XY011WI - Moist Loamy Lowlands
Other vegetative classification: Tsuga Maianthemum Coptis - Dryopteris (TMC-D_1), Acer Viola Osmorhiza - Circaea Impatiens (AVO-CI_3)

Hydric soil rating: No

108A—Greenstone silt loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 1kwmp
Elevation: 590 to 1,800 feet
Mean annual precipitation: 25 to 34 inches
Mean annual air temperature: 37 to 43 degrees F
Frost-free period: 100 to 140 days
Farmland classification: Not prime farmland

Map Unit Composition

Greenstone and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Greenstone

Setting

Landform: Till plains
Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loamy till

Typical profile

Oa - 0 to 2 inches: highly decomposed plant material
Bw - 2 to 6 inches: silt loam
Bt - 6 to 12 inches: silt loam
Btx - 12 to 18 inches: cobbly silt loam
2Crt - 18 to 21 inches: extremely channery silt loam
2R - 21 to 80 inches: bedrock

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: 10 to 20 inches to paralithic bedrock; 20 to 60 inches to lithic bedrock
Drainage class: Somewhat poorly drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: About 6 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 3.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: C/D
Ecological site: R092XY009WI - Loamy Sandstone Uplands
Other vegetative classification: Tsuga Maianthemum Coptis - Dryopteris (TMC-D_1), Acer Viola Osmorhiza - Circaea Impatiens (AVO-CI_3)
Hydric soil rating: No

Minor Components

Nonesuch

Percent of map unit: 6 percent
Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R092XY009WI - Loamy Sandstone Uplands
Other vegetative classification: Acer Viola Osmorhiza (AVO_1), Acer Tsuga Dryopteris (ATD_1)
Hydric soil rating: No

Trap falls

Percent of map unit: 6 percent
Landform: Depressions on till plains
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R092XY007WI - Wet Loamy or Clayey Lowlands
Other vegetative classification: Fraxinus Impatiens (FI_1), Fraxinus Mentha Carex (FMC_1)
Hydric soil rating: Yes

Big iron

Percent of map unit: 3 percent
Landform: Till plains
Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R092XY011WI - Moist Loamy Lowlands
Other vegetative classification: Tsuga Thuja Petasites (TTP_1), Tsuga Acer Mitchella - Equisetum (TAM-Eq)
Hydric soil rating: No

109—Dumps, sanitary landfill

Map Unit Setting

National map unit symbol: 1kwmq
Elevation: 590 to 1,800 feet
Mean annual precipitation: 25 to 34 inches
Mean annual air temperature: 37 to 43 degrees F

Frost-free period: 100 to 140 days
Farmland classification: Not prime farmland

Map Unit Composition
Dumps, sanitary landfill: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

119A—Moquah loam, 0 to 3 percent slopes, occasionally flooded

Map Unit Setting
National map unit symbol: 1kwn7
Elevation: 600 to 1,800 feet
Mean annual precipitation: 25 to 34 inches
Mean annual air temperature: 37 to 43 degrees F
Frost-free period: 100 to 140 days
Farmland classification: Prime farmland if protected from flooding or not frequently flooded during the growing season

Map Unit Composition
Moquah, occasionally flooded, and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Moquah, Occasionally Flooded

Setting
Landform: Flood plains
Landform position (two-dimensional): Footslope, toeslope
Landform position (three-dimensional): Base slope, rise, talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Coarse-loamy alluvium

Typical profile
A - 0 to 5 inches: loam
C1 - 5 to 19 inches: stratified loamy fine sand to loamy very fine sand to silt loam
C2 - 19 to 48 inches: stratified fine sand to very fine sandy loam to silt loam
C3 - 48 to 55 inches: stratified silt loam
C4 - 55 to 80 inches: stratified sand to fine sand to loamy fine sand to silt loam

Properties and qualities
Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: About 42 inches
Frequency of flooding: OccasionalRareNone
Frequency of ponding: None
Available water supply, 0 to 60 inches: High (about 10.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: A
Ecological site: R092XY004WI - Seasonally Dry Floodplains
Other vegetative classification: Acer Osmorhiza Caulophyllum (AOC), Acer-Viola-Osmorhiza (AVO_2)
Hydric soil rating: No

Minor Components

Arnheim

Percent of map unit: 10 percent
Landform: Flood plains
Landform position (two-dimensional): Footslope, toeslope
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R092XY005WI - Wet Floodplains
Other vegetative classification: Frequently flooded, organics (G090AY010WI), Fraxinus Mentha Carex - Caltha (FMC-C), Fraxinus Mentha Carex (FMC_1)
Hydric soil rating: Yes

Gull point, occasionally flooded

Percent of map unit: 3 percent
Landform: Flood plains on till plains
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope, dip, talf
Down-slope shape: Linear
Across-slope shape: Concave, linear
Ecological site: R092XY005WI - Wet Floodplains
Other vegetative classification: Fraxinus Impatiens (FI_1), Fraxinus Mentha Carex (FMC_1)
Hydric soil rating: Yes

Schaat creek, occasionally flooded

Percent of map unit: 2 percent
Landform: Flood plains on flood plains
Landform position (two-dimensional): Footslope, toeslope
Landform position (three-dimensional): Talf, dip
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R092XY005WI - Wet Floodplains
Other vegetative classification: Fraxinus Mentha Carex - Caltha (FMC-C)
Hydric soil rating: Yes

120D—Croswell-Au Gres-Tawas complex, 0 to 18 percent slopes

Map Unit Setting

National map unit symbol: 1kwn8

Elevation: 590 to 1,800 feet
Mean annual precipitation: 25 to 34 inches
Mean annual air temperature: 37 to 43 degrees F
Frost-free period: 100 to 140 days
Farmland classification: Not prime farmland

Map Unit Composition

Croswell and similar soils: 40 percent
Au gres and similar soils: 25 percent
Tawas and similar soils: 20 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Croswell

Setting

Landform: Beach ridges
Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope
Landform position (three-dimensional): Interfluve, head slope, nose slope, side slope, base slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Concave, convex
Parent material: Sandy drift

Typical profile

A - 0 to 3 inches: sand
E - 3 to 7 inches: sand
Bs - 7 to 34 inches: sand
C - 34 to 80 inches: sand

Properties and qualities

Slope: 4 to 18 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): High to very high (6.00 to 20.00 in/hr)
Depth to water table: About 24 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 4.0 inches)

Interpretive groups

Land capability classification (irrigated): 6s
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: A
Ecological site: R092XY001WI - Sandy Shore Complex
Other vegetative classification: Tsuga Maianthemum Vaccinium (TMV_1)
Hydric soil rating: No

Description of Au Gres

Setting

Landform: Backshores on shore complexes, interdunes on shore complexes
Landform position (two-dimensional): Footslope, toeslope
Landform position (three-dimensional): Side slope, base slope

Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Sandy drift

Typical profile

Oa - 0 to 3 inches: highly decomposed plant material
E - 3 to 6 inches: sand
Bhs - 6 to 7 inches: sand
Bs - 7 to 19 inches: sand
BC - 19 to 35 inches: sand
C - 35 to 80 inches: sand

Properties and qualities

Slope: 0 to 1 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat poorly drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): High to very high (6.00 to 20.00 in/hr)
Depth to water table: About 6 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 4.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: A/D
Ecological site: R092XY010WI - Moist Sandy Lowlands
Other vegetative classification: Tsuga Maianthemum Coptis - Vaccinium (TMC-Vac_1), Tsuga Maianthemum Coptis (TMC_1)
Hydric soil rating: No

Description of Tawas

Setting

Landform: Swamps on shore complexes
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope, dip
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Highly decomposed organic material over sandy drift

Typical profile

Oa - 0 to 22 inches: muck
C1 - 22 to 42 inches: sand
C2 - 42 to 80 inches: gravelly sand

Properties and qualities

Slope: 0 to 1 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Very poorly drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 in/hr)
Depth to water table: About 0 inches
Frequency of flooding: None

Frequency of ponding: Frequent
Available water supply, 0 to 60 inches: High (about 11.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6w
Hydrologic Soil Group: A/D
Ecological site: R092XY002WI - Mucky Swamps
Other vegetative classification: Tsuga Thuja Mitchella (TTM_1), Tsuga Thuja Sphagnum (TTS_1)
Hydric soil rating: Yes

Minor Components

Paquin

Percent of map unit: 10 percent
Landform: Dunes
Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R092XY013WI - Sandy Uplands
Other vegetative classification: Tsuga Maianthemum Vaccinium (TMV_1), Acer Tsuga Dryopteris - Dryopteris (ATD-D_1)
Hydric soil rating: No

Deford

Percent of map unit: 5 percent
Landform: Interdunes
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R092XY006WI - Wet Sandy Lowlands
Other vegetative classification: Tsuga Thuja Sphagnum (TTS_1), Tsuga-Thuja-Mitella (TTM_2)
Hydric soil rating: Yes

121B—Deer Park sand, 0 to 6 percent slopes

Map Unit Setting

National map unit symbol: 1kwn9
Elevation: 590 to 1,800 feet
Mean annual precipitation: 25 to 34 inches
Mean annual air temperature: 37 to 43 degrees F
Frost-free period: 100 to 140 days
Farmland classification: Not prime farmland

Map Unit Composition

Deer park and similar soils: 90 percent

Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Deer Park

Setting

Landform: Dunes, beach ridges
Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope
Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Beach sand and/or eolian sands

Typical profile

Oe - 0 to 1 inches: moderately decomposed plant material
E - 1 to 11 inches: sand
Bs - 11 to 33 inches: fine sand
BC - 33 to 38 inches: sand
C - 38 to 80 inches: sand

Properties and qualities

Slope: 0 to 6 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Excessively drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 4.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: A
Ecological site: R092XY001WI - Sandy Shore Complex
Other vegetative classification: Quercus-Acer-Epigaea (QAE_2), Acer-Quercus-Vaccinium (AQV_2)
Hydric soil rating: No

Minor Components

Croswell

Percent of map unit: 5 percent
Landform: Beach ridges
Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope
Landform position (three-dimensional): Interfluve, head slope, nose slope, side slope, base slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Concave, convex
Ecological site: R092XY013WI - Sandy Uplands
Other vegetative classification: Tsuga Maianthemum Vaccinium (TMV_1)
Hydric soil rating: No

Rubicon

Percent of map unit: 5 percent
Landform: Beach ridges
Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope
Landform position (three-dimensional): Interfluve, head slope, nose slope, side slope, base slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Concave, convex
Ecological site: R092XY013WI - Sandy Uplands
Other vegetative classification: Tsuga Maianthemum Vaccinium (TMV_1), Acer Quercus Vaccinium (AQV_1)
Hydric soil rating: No

121D—Deer Park sand, 6 to 15 percent slopes

Map Unit Setting

National map unit symbol: 1kwnb
Elevation: 590 to 1,800 feet
Mean annual precipitation: 25 to 34 inches
Mean annual air temperature: 37 to 43 degrees F
Frost-free period: 100 to 140 days
Farmland classification: Not prime farmland

Map Unit Composition

Deer park and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Deer Park

Setting

Landform: Dunes, beach ridges
Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope
Landform position (three-dimensional): Interfluve, head slope, nose slope, side slope, base slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Concave, convex
Parent material: Beach sand and/or eolian sands

Typical profile

Oe - 0 to 1 inches: moderately decomposed plant material
E - 1 to 11 inches: sand
Bs - 11 to 33 inches: fine sand
BC - 33 to 38 inches: sand
C - 38 to 80 inches: sand

Properties and qualities

Slope: 6 to 15 percent

Depth to restrictive feature: More than 80 inches
Drainage class: Excessively drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 4.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: A
Ecological site: R092XY001WI - Sandy Shore Complex
Other vegetative classification: Quercus-Acer-Epigaea (QAE_2), Acer-Quercus-Vaccinium (AQV_2)
Hydric soil rating: No

Minor Components

Rubicon

Percent of map unit: 5 percent
Landform: Beach ridges
Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope
Landform position (three-dimensional): Interfluve, head slope, nose slope, side slope, base slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Concave, convex
Ecological site: R092XY013WI - Sandy Uplands
Other vegetative classification: Tsuga Maianthemum Vaccinium (TMV_1), Acer Quercus Vaccinium (AQV_1)
Hydric soil rating: No

Croswell

Percent of map unit: 5 percent
Landform: Beach ridges
Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope
Landform position (three-dimensional): Interfluve, head slope, nose slope, side slope, base slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Concave, convex
Ecological site: R092XY013WI - Sandy Uplands
Other vegetative classification: Tsuga Maianthemum Vaccinium (TMV_1)
Hydric soil rating: No

123A—Mishwabic silt loam, 0 to 2 percent slopes

Map Unit Setting

National map unit symbol: 1kwnd
Elevation: 590 to 1,800 feet
Mean annual precipitation: 25 to 34 inches
Mean annual air temperature: 37 to 43 degrees F
Frost-free period: 100 to 140 days
Farmland classification: Not prime farmland

Map Unit Composition

Mishwabic and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Mishwabic

Setting

Landform: Depressions on till plains
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Coarse-loamy till

Typical profile

Oa - 0 to 3 inches: highly decomposed plant material
Bg - 3 to 6 inches: silt loam
C1 - 6 to 13 inches: silt loam
C2 - 13 to 22 inches: paragravelly silt loam
Cr - 22 to 25 inches: weathered bedrock, loam, silt loam
2R - 25 to 80 inches: bedrock

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: 20 to 50 inches to lithic bedrock; 20 to 30 inches to paralithic bedrock
Drainage class: Poorly drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: About 0 inches
Frequency of flooding: None
Frequency of ponding: Frequent
Available water supply, 0 to 60 inches: Low (about 5.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: C/D
Ecological site: R092XY009WI - Loamy Sandstone Uplands

Other vegetative classification: Fraxinus Impatiens (FI_1), Fraxinus Mentha Carex (FMC_1)
Hydric soil rating: Yes

Minor Components

Trap falls
Percent of map unit: 10 percent
Landform: Depressions on till plains
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R092XY007WI - Wet Loamy or Clayey Lowlands
Other vegetative classification: Fraxinus Impatiens (FI_1), Fraxinus Mentha Carex (FMC_1)
Hydric soil rating: Yes

Greenstone
Percent of map unit: 5 percent
Landform: Till plains
Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R092XY009WI - Loamy Sandstone Uplands
Other vegetative classification: Tsuga Maianthemum Coptis - Dryopteris (TMC-D_1), Acer Viola Osmorhiza - Circaea Impatiens (AVO-CI_3)
Hydric soil rating: No

124F—Zandi loamy very fine sand, 35 to 70 percent slopes

Map Unit Setting
National map unit symbol: 1kwnj
Elevation: 590 to 1,800 feet
Mean annual precipitation: 25 to 34 inches
Mean annual air temperature: 37 to 43 degrees F
Frost-free period: 100 to 140 days
Farmland classification: Not prime farmland

Map Unit Composition
Zandi and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Zandi

Setting
Landform: Till-floored lake plains
Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope

Landform position (three-dimensional): Interfluve, head slope, nose slope, side slope, base slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Concave, convex
Parent material: Coarse-loamy glaciolacustrine deposits

Typical profile

Oe - 0 to 0 inches: moderately decomposed plant material
E - 0 to 4 inches: loamy very fine sand
Bhs - 4 to 6 inches: sandy loam
Bs - 6 to 34 inches: silt loam
E/B - 34 to 42 inches: stratified very fine sand to loamy very fine sand to very fine sandy loam to silt loam
B/E - 42 to 57 inches: stratified loamy very fine sand to very fine sandy loam to silt loam to silt
E and Bt - 57 to 80 inches: stratified very fine sand to loamy very fine sand to very fine sandy loam to silt loam

Properties and qualities

Slope: 35 to 70 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 8.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: B
Ecological site: R092XY014WI - Loamy Uplands
Other vegetative classification: Acer Tsuga Dryopteris (ATD_1), Tsuga Maianthemum (TM_1)
Hydric soil rating: No

Minor Components

Toivola

Percent of map unit: 5 percent
Landform: Outwash plains
Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope
Landform position (three-dimensional): Interfluve, head slope, nose slope, side slope, base slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Concave, convex
Ecological site: R092XY013WI - Sandy Uplands
Other vegetative classification: Acer Tsuga Dryopteris - Dryopteris (ATD-D_1), Tsuga Maianthemum (TM_1)
Hydric soil rating: No

Keweenaw

Percent of map unit: 5 percent

Landform: Moraines
Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R092XY013WI - Sandy Uplands
Other vegetative classification: Acer Tsuga Dryopteris - Dryopteris (ATD-D_1), Tsuga Maianthemum (TM_1)
Hydric soil rating: No

Karlin

Percent of map unit: 5 percent
Landform: Moraines, stream terraces, outwash plains
Landform position (two-dimensional): Shoulder, backslope
Ecological site: R092XY013WI - Sandy Uplands
Hydric soil rating: No

125F—Rockland-Moquah, frequently flooded-Watton complex, 0 to 70 percent slopes

Map Unit Setting

National map unit symbol: 1kwnk
Elevation: 590 to 1,800 feet
Mean annual precipitation: 25 to 34 inches
Mean annual air temperature: 37 to 43 degrees F
Frost-free period: 100 to 140 days
Farmland classification: Not prime farmland

Map Unit Composition

Rockland and similar soils: 50 percent
Moquah and similar soils: 20 percent
Watton and similar soils: 15 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Rockland

Setting

Landform: Slumps
Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope
Landform position (three-dimensional): Interfluve, head slope, nose slope, side slope, base slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Concave, convex
Parent material: Loamy rotational earth slide deposits

Typical profile

A - 1 to 5 inches: silt loam
Bw - 5 to 23 inches: silt loam
C - 23 to 80 inches: silt loam

Properties and qualities

Slope: 35 to 70 percent
Surface area covered with cobbles, stones or boulders: 0.0 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 5 percent
Available water supply, 0 to 60 inches: High (about 11.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: C
Ecological site: R092XY014WI - Loamy Uplands
Other vegetative classification: Acer Osmorhiza Caulophyllum (AOC), Acer Viola Osmorhiza (AVO_1)
Hydric soil rating: No

Description of Moquah

Setting

Landform: Flood plains
Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope
Landform position (three-dimensional): Interfluve, head slope, nose slope, side slope, base slope, crest
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Coarse-loamy alluvium

Typical profile

A - 0 to 5 inches: fine sandy loam
C1 - 5 to 19 inches: stratified loamy fine sand to loamy very fine sand to silt loam
C2 - 19 to 48 inches: stratified fine sand to very fine sandy loam to silt loam
C3 - 48 to 55 inches: stratified silt loam
C4 - 55 to 80 inches: stratified sand to fine sand to loamy fine sand to silt loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: About 42 inches
Frequency of flooding: RareNone
Frequency of ponding: None
Available water supply, 0 to 60 inches: High (about 10.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 2s
Hydrologic Soil Group: A
Ecological site: R092XY004WI - Seasonally Dry Floodplains
Other vegetative classification: Acer Osmorhiza Caulophyllum (AOC), Acer-Viola-Osmorhiza (AVO_2)
Hydric soil rating: No

Description of Watton

Setting

Landform: Till plains
Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope
Landform position (three-dimensional): Interfluve, head slope, nose slope, side slope, base slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Concave, convex
Parent material: Fine-loamy till

Typical profile

A - 0 to 3 inches: silt loam
E/B - 3 to 6 inches: silt loam
B/E - 6 to 23 inches: silt loam
Bt - 23 to 44 inches: silt loam
BC - 44 to 56 inches: silt loam
Cd - 56 to 81 inches: silt loam

Properties and qualities

Slope: 35 to 70 percent
Depth to restrictive feature: 40 to 60 inches to densic material
Drainage class: Well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: About 12 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 11 percent
Available water supply, 0 to 60 inches: Moderate (about 7.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: C/D
Ecological site: R092XY014WI - Loamy Uplands
Other vegetative classification: Acer Viola Osmorhiza (AVO_1), Tsuga Acer Mitchella (TAM_1)
Hydric soil rating: No

Minor Components

Arnheim

Percent of map unit: 10 percent
Landform: Flood plains
Ecological site: R092XY005WI - Wet Floodplains
Other vegetative classification: Fraxinus Impatiens (FI_1), Fraxinus Mentha Carex (FMC_1)

Hydric soil rating: Yes

Karlin

Percent of map unit: 5 percent
Landform: Moraines, stream terraces, outwash plains
Landform position (two-dimensional): Shoulder, backslope
Ecological site: R092XY013WI - Sandy Uplands
Hydric soil rating: No

127A—Big Iron-Trap Falls complex, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 1kwnn
Elevation: 590 to 1,800 feet
Mean annual precipitation: 25 to 34 inches
Mean annual air temperature: 37 to 43 degrees F
Frost-free period: 100 to 140 days
Farmland classification: Not prime farmland

Map Unit Composition

Big iron and similar soils: 50 percent
Trap falls and similar soils: 45 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Big Iron

Setting

Landform: Till plains
Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Fine-loamy till

Typical profile

Oi - 0 to 1 inches: slightly decomposed plant material
A - 1 to 3 inches: silt loam
E - 3 to 4 inches: silt loam
Bw - 4 to 11 inches: loam
E/B - 11 to 17 inches: loam
Bt - 17 to 47 inches: silt loam
BCd1 - 47 to 66 inches: loam
BCd2 - 66 to 80 inches: gravelly silt loam

Properties and qualities

Slope: 1 to 3 percent
Depth to restrictive feature: 40 to 60 inches to densic material
Drainage class: Somewhat poorly drained

Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: About 6 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 20 percent
Available water supply, 0 to 60 inches: Moderate (about 8.1 inches)

Interpretive groups
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: C/D
Ecological site: R092XY011WI - Moist Loamy Lowlands
Other vegetative classification: Tsuga Thuja Petasites (TTP_1), Tsuga Acer Mitchella - Equisetum (TAM-Eq)
Hydric soil rating: No

Description of Trap Falls

Setting
Landform: Depressions on till plains
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Fine-loamy till

Typical profile
Oi - 0 to 1 inches: peat
A - 1 to 10 inches: clay loam
Bt1 - 10 to 18 inches: clay loam
Bt2 - 18 to 31 inches: clay loam
2C - 31 to 55 inches: loam
2Cd - 55 to 80 inches: gravelly fine sandy loam

Properties and qualities
Slope: 0 to 1 percent
Depth to restrictive feature: 40 to 60 inches to densic material
Drainage class: Poorly drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately high (0.00 to 0.20 in/hr)
Depth to water table: About 0 inches
Frequency of flooding: None
Frequency of ponding: Frequent
Calcium carbonate, maximum content: 10 percent
Available water supply, 0 to 60 inches: High (about 9.7 inches)

Interpretive groups
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: C/D
Ecological site: R092XY007WI - Wet Loamy or Clayey Lowlands
Other vegetative classification: Fraxinus Impatiens (FI_1), Fraxinus Mentha Carex (FMC_1)
Hydric soil rating: Yes

Minor Components

Belding

Percent of map unit: 5 percent
Landform: Ground moraines
Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R092XY011WI - Moist Loamy Lowlands
Other vegetative classification: Tsuga Maianthemum Coptis - Dryopteris (TMC-D_1), Acer Viola Osmorhiza - Circaea Impatiens (AVO-CI_3)
Hydric soil rating: No

129F—Karlin-Sporley complex, 1 to 70 percent slopes

Map Unit Setting

National map unit symbol: 1kwnq
Elevation: 590 to 1,800 feet
Mean annual precipitation: 25 to 34 inches
Mean annual air temperature: 37 to 43 degrees F
Frost-free period: 100 to 140 days
Farmland classification: Not prime farmland

Map Unit Composition

Karlin and similar soils: 60 percent
Sporley and similar soils: 30 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Karlin

Setting

Landform: Outwash plains
Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope
Landform position (three-dimensional): Interfluve, head slope, nose slope, side slope, crest, base slope
Down-slope shape: Convex, linear
Across-slope shape: Concave, convex
Parent material: Sandy glaciofluvial deposits

Typical profile

Oa - 0 to 1 inches: highly decomposed plant material
E - 1 to 4 inches: sandy loam
Bs - 4 to 15 inches: sandy loam
2BC - 15 to 29 inches: sand
2C - 29 to 80 inches: sand

Properties and qualities

Slope: 1 to 70 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 5.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: A
Ecological site: F093BY007MI - Sandy Uplands
Other vegetative classification: Acer Tsuga Dryopteris (ATD_1), Tsuga Maianthemum (TM_1)
Hydric soil rating: No

Description of Sporley

Setting

Landform: Escarpments
Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope
Landform position (three-dimensional): Interfluve, head slope, nose slope, side slope, crest, base slope
Down-slope shape: Convex, linear
Across-slope shape: Concave, convex
Parent material: Stratified loamy and silty glaciolacustrine deposits

Typical profile

Ap - 0 to 6 inches: silt loam
E - 6 to 7 inches: silt loam
Bs - 7 to 12 inches: silt loam
E' - 12 to 15 inches: silt loam
E/B - 15 to 24 inches: silt loam
B/E - 24 to 30 inches: silt loam, silty clay loam
BC - 30 to 80 inches: stratified very fine sandy loam to silt loam to silt

Properties and qualities

Slope: 6 to 70 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Very high (about 12.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: C
Ecological site: F093BY009MI - Alfic Loamy Uplands
Other vegetative classification: Acer Viola Osmorhiza (AVO_1), Acer Tsuga Dryopteris (ATD_1)
Hydric soil rating: No

Minor Components

Zandi

Percent of map unit: 5 percent
Landform: Till-floored lake plains
Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope
Landform position (three-dimensional): Interfluve, head slope, nose slope, side slope, crest, base slope
Down-slope shape: Convex, linear
Across-slope shape: Concave, convex
Ecological site: F093BY010MI - Loamy Uplands
Other vegetative classification: Acer Tsuga Dryopteris (ATD_1), Tsuga Maianthemum (TM_1)
Hydric soil rating: No

Liminga

Percent of map unit: 5 percent
Landform: Outwash plains
Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope
Landform position (three-dimensional): Interfluve, head slope, nose slope, side slope, crest, base slope
Down-slope shape: Linear
Across-slope shape: Convex, linear
Ecological site: F093BY007MI - Sandy Uplands
Other vegetative classification: Tsuga/Maianthemum (TM), Tsuga Maianthemum Vaccinium (TMV_1)
Hydric soil rating: No

140E—Loggerhead-Big Iron-Belding complex, dissected, 1 to 35 percent slopes

Map Unit Setting

National map unit symbol: 1kwp4
Elevation: 590 to 1,800 feet
Mean annual precipitation: 25 to 34 inches
Mean annual air temperature: 37 to 43 degrees F
Frost-free period: 100 to 140 days
Farmland classification: Not prime farmland

Map Unit Composition

Loggerhead and similar soils: 55 percent
Big iron and similar soils: 20 percent
Belding and similar soils: 15 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Loggerhead

Setting

Landform: Till plains
Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope
Landform position (three-dimensional): Interfluve, head slope, nose slope, side slope, base slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Concave, convex
Parent material: Coarse-loamy till over loamy till

Typical profile

A - 0 to 4 inches: loam
E - 4 to 5 inches: gravelly fine sandy loam
Bs - 5 to 15 inches: gravelly loam
E/B - 15 to 36 inches: gravelly fine sandy loam
2B/E - 36 to 56 inches: gravelly fine sandy loam
2Bt - 56 to 80 inches: loam

Properties and qualities

Slope: 3 to 35 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: About 12 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: High (about 9.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: C/D
Ecological site: F093BY009MI - Alfic Loamy Uplands
Other vegetative classification: Acer Viola Osmorhiza (AVO_1), Acer Tsuga Dryopteris (ATD_1)
Hydric soil rating: No

Description of Big Iron

Setting

Landform: Till plains
Landform position (two-dimensional): Footslope, toeslope
Landform position (three-dimensional): Side slope, base slope
Down-slope shape: Linear
Across-slope shape: Linear

Parent material: Fine-loamy till

Typical profile

Oi - 0 to 1 inches: slightly decomposed plant material
A - 1 to 3 inches: silt loam
E - 3 to 4 inches: silt loam
Bw - 4 to 11 inches: loam
E/B - 11 to 17 inches: loam
Bt - 17 to 47 inches: silt loam
BCd1 - 47 to 66 inches: loam
BCd2 - 66 to 80 inches: gravelly silt loam

Properties and qualities

Slope: 1 to 3 percent
Depth to restrictive feature: 40 to 60 inches to densic material
Drainage class: Somewhat poorly drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: About 6 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 20 percent
Available water supply, 0 to 60 inches: Moderate (about 8.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: C/D
Ecological site: F093BY005MI - Moist Lowlands
Other vegetative classification: Tsuga Maianthemum Coptis - Dryopteris (TMC-D_1), Acer Viola Osmorhiza - Circaea Impatiens (AVO-CI_3)
Hydric soil rating: No

Description of Belding

Setting

Landform: Ground moraines
Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Coarse-loamy till over fine-loamy till

Typical profile

Oa - 0 to 1 inches: highly decomposed plant material
A1 - 1 to 4 inches: fine sandy loam
A2 - 4 to 9 inches: fine sandy loam
E - 9 to 14 inches: fine sandy loam
Bs1 - 14 to 19 inches: fine sandy loam
Bs2 - 19 to 22 inches: fine sand
2Bt - 22 to 34 inches: silty clay loam
2BCd - 34 to 36 inches: silty clay loam
2Cd - 36 to 80 inches: silty clay loam

Properties and qualities

Slope: 1 to 4 percent
Depth to restrictive feature: 30 to 60 inches to densic material

Drainage class: Somewhat poorly drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: About 6 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 20 percent
Available water supply, 0 to 60 inches: Low (about 5.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C/D
Ecological site: F093BY005MI - Moist Lowlands
Other vegetative classification: Tsuga Maianthemum Coptis - Dryopteris (TMC-D_1), Acer Viola Osmorhiza - Circaea Impatiens (AVO-CI_3)
Hydric soil rating: No

Minor Components

Ubly

Percent of map unit: 7 percent
Landform: Till plains
Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope
Landform position (three-dimensional): Interfluve, head slope, nose slope, side slope, base slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Concave, convex
Ecological site: F093BY009MI - Alfic Loamy Uplands
Other vegetative classification: Acer Viola Osmorhiza (AVO_1), Acer Tsuga Dryopteris (ATD_1)
Hydric soil rating: No

Gull point

Percent of map unit: 3 percent
Landform: Flood plains on till plains
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope, talf
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R092XY005WI - Wet Floodplains
Other vegetative classification: Fraxinus Mentha Carex (FMC_1), Fraxinus Impatiens (FI_1)
Hydric soil rating: Yes

149—Pits, sand and gravel

Map Unit Setting

National map unit symbol: 1kwpm
Elevation: 600 to 1,800 feet
Mean annual precipitation: 25 to 34 inches
Mean annual air temperature: 37 to 43 degrees F
Frost-free period: 100 to 140 days
Farmland classification: Not prime farmland

Map Unit Composition

Pits, sand and gravel: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Pits, Sand And Gravel

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8s
Hydric soil rating: Unranked

150B—Siskiwit loamy sand, 1 to 6 percent slopes

Map Unit Setting

National map unit symbol: 1kwpn
Elevation: 600 to 1,800 feet
Mean annual precipitation: 25 to 34 inches
Mean annual air temperature: 37 to 43 degrees F
Frost-free period: 100 to 140 days
Farmland classification: Not prime farmland

Map Unit Composition

Siskiwit and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Siskiwit

Setting

Landform: Till plains
Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope

Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Sandy glaciofluvial deposits

Typical profile

Oa - 0 to 2 inches: highly decomposed plant material
E - 2 to 8 inches: loamy sand
Bhs - 8 to 11 inches: fine sandy loam
Bs1 - 11 to 16 inches: loamy sand
Bs2 - 16 to 28 inches: sand
E/B - 28 to 34 inches: stratified sand to fine sand
B/E - 34 to 55 inches: stratified fine sand to loamy sand
C - 55 to 80 inches: stratified gravelly sand to sand to loamy sand

Properties and qualities

Slope: 1 to 6 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 2.00 in/hr)
Depth to water table: About 24 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: High (about 10.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: C
Ecological site: R092XY013WI - Sandy Uplands
Other vegetative classification: Acer Tsuga Dryopteris - Dryopteris (ATD-D_1), Tsuga Maianthemum (TM_1)
Hydric soil rating: No

Minor Components

Annalake

Percent of map unit: 5 percent
Landform: Till plains, outwash terraces, outwash plains
Landform position (two-dimensional): Summit, backslope, footslope
Landform position (three-dimensional): Base slope, riser, tread, rise
Down-slope shape: Convex, linear
Across-slope shape: Linear
Ecological site: R092XY014WI - Loamy Uplands
Other vegetative classification: Acer Viola Osmorhiza (AVO_1), Acer Tsuga Dryopteris (ATD_1)
Hydric soil rating: No

Noseum

Percent of map unit: 5 percent
Landform: Outwash plains
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope, rise
Down-slope shape: Linear
Across-slope shape: Linear

Ecological site: F090AY003WI - Sandy Floodplain
Other vegetative classification: Acer Tsuga Dryopteris (ATD_1), Tsuga Maianthemum (TM_1)
Hydric soil rating: No

Manido

Percent of map unit: 5 percent
Landform: Till-floored lake plains
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R092XY013WI - Sandy Uplands
Other vegetative classification: Tsuga Maianthemum Coptis (TMC_1)
Hydric soil rating: No

Wainola

Percent of map unit: 5 percent
Landform: Outwash plains
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R092XY010WI - Moist Sandy Lowlands
Other vegetative classification: Tsuga Maianthemum Coptis - Vaccinium (TMC-Vac_1)
Hydric soil rating: No

8104F—Zandi-Morganlake complex, dissected, 25 to 60 percent slopes

Map Unit Setting

National map unit symbol: 1t6sh
Elevation: 600 to 1,800 feet
Mean annual precipitation: 27 to 38 inches
Mean annual air temperature: 36 to 45 degrees F
Frost-free period: 70 to 170 days
Farmland classification: Not prime farmland

Map Unit Composition

Zandi, dissected, and similar soils: 50 percent
Morganlake, dissected, and similar soils: 40 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Zandi, Dissected

Setting

Landform: Till-floored lake plains
Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope

Landform position (three-dimensional): Interfluve, head slope, nose slope, side slope, base slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Concave, convex
Parent material: Coarse-loamy glaciolacustrine deposits

Typical profile

Oe - 0 to 0 inches: moderately decomposed plant material
E - 0 to 4 inches: fine sandy loam
Bhs - 4 to 6 inches: sandy loam
Bs - 6 to 34 inches: silt loam
E/B - 34 to 42 inches: stratified very fine sand to loamy very fine sand to very fine sandy loam to silt loam
B/E - 42 to 57 inches: stratified loamy very fine sand to very fine sandy loam to silt loam
E and Bt - 57 to 80 inches: stratified very fine sand to loamy very fine sand to very fine sandy loam to silt loam

Properties and qualities

Slope: 25 to 60 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 8.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: B
Ecological site: R092XY014WI - Loamy Uplands
Other vegetative classification: Acer Viola Osmorhiza (AVO_1), Acer Tsuga Dryopteris (ATD_1)
Hydric soil rating: No

Description of Morganlake, Dissected

Setting

Landform: Outwash plains on till plains
Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope
Landform position (three-dimensional): Side slope, crest, interfluve, head slope, nose slope, base slope
Down-slope shape: Concave, convex, linear
Across-slope shape: Linear, convex, concave
Parent material: Sandy outwash over loamy till

Typical profile

Oe - 0 to 2 inches: moderately decomposed plant material
E - 2 to 9 inches: loamy fine sand
Bhs - 9 to 16 inches: fine sand
Bs - 16 to 35 inches: sand
2B/E - 35 to 40 inches: silty clay loam

2Bt - 40 to 50 inches: silty clay loam
2C - 50 to 80 inches: loam

Properties and qualities

Slope: 25 to 35 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 2.00 in/hr)
Depth to water table: About 24 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 20 percent
Available water supply, 0 to 60 inches: Moderate (about 8.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: B
Ecological site: R092XY014WI - Loamy Uplands
Other vegetative classification: Acer Viola Osmorhiza (AVO_1), Acer Tsuga Dryopteris (ATD_1)
Hydric soil rating: No

Minor Components

Annalake, dissected

Percent of map unit: 5 percent
Landform: Till plains, outwash terraces, outwash plains
Landform position (two-dimensional): Summit, backslope, footslope
Landform position (three-dimensional): Base slope, riser, tread, rise
Down-slope shape: Convex, linear
Across-slope shape: Linear
Ecological site: F093BY009MI - Alfic Loamy Uplands
Other vegetative classification: Acer Viola Osmorhiza (AVO_1), Acer Tsuga Dryopteris (ATD_1)
Hydric soil rating: No

Toivola, dissected

Percent of map unit: 4 percent
Landform: Outwash plains
Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope
Landform position (three-dimensional): Interfluve, head slope, nose slope, side slope, base slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Concave, convex
Ecological site: F093BY006MI - Alfic Sandy Uplands
Other vegetative classification: Acer Tsuga Dryopteris - Dryopteris (ATD-D_1), Tsuga Maianthemum (TM_1)
Hydric soil rating: No

Richter, dissected

Percent of map unit: 1 percent
Landform: Outwash plains
Landform position (two-dimensional): Footslope

Landform position (three-dimensional): Rise, talf
Down-slope shape: Concave, linear
Across-slope shape: Linear, concave
Ecological site: F093BY005MI - Moist Lowlands
Other vegetative classification: Tsuga Maianthemum Coptis - Dryopteris (TMC-D_1)
Hydric soil rating: No

8307—Lupton and Cathro soils, 0 to 1 percent slopes

Map Unit Setting

National map unit symbol: 2tnxw
Elevation: 1,100 to 1,900 feet
Mean annual precipitation: 27 to 36 inches
Mean annual air temperature: 37 to 46 degrees F
Frost-free period: 80 to 150 days
Farmland classification: Not prime farmland

Map Unit Composition

Lupton and similar soils: 45 percent
Cathro and similar soils: 35 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Lupton

Setting

Landform: Depressions on lake plains, depressions on outwash plains, depressions on moraines
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Dip
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Woody organic material and/or herbaceous organic material

Typical profile

Oa1 - 0 to 10 inches: muck
Oa2 - 10 to 25 inches: muck
Oa3 - 25 to 46 inches: muck
Oa4 - 46 to 79 inches: muck

Properties and qualities

Slope: 0 to 1 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Very poorly drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high (0.14 to 5.95 in/hr)
Depth to water table: About 0 inches

Frequency of flooding: None
Frequency of ponding: Frequent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Very high (about 23.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6w
Hydrologic Soil Group: A/D
Ecological site: F090AY002WI - Mucky Swamp
Forage suitability group: Frequently flooded, organics (G090AY010WI)
Other vegetative classification: Frequently flooded, organics (G090AY010WI), Tsuga-Thuja-Mitella/Tsuga-Thuja-Sphagnum (TTM/TTS)
Hydric soil rating: Yes

Description of Cathro

Setting

Landform: Depressions on lake plains, depressions on outwash plains, depressions on moraines
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Dip
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Herbaceous organic material over deposits loamy drift

Typical profile

Oa1 - 0 to 15 inches: muck
Oa2 - 15 to 28 inches: muck
Cg1 - 28 to 49 inches: loam
Cg2 - 49 to 79 inches: sandy loam

Properties and qualities

Slope: 0 to 1 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Very poorly drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high (0.14 to 1.98 in/hr)
Depth to water table: About 0 inches
Frequency of flooding: None
Frequency of ponding: Frequent
Calcium carbonate, maximum content: 25 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Very high (about 16.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6w
Hydrologic Soil Group: B/D
Ecological site: F090AY002WI - Mucky Swamp
Forage suitability group: Frequently flooded, organics (G090AY010WI)
Other vegetative classification: Frequently flooded, organics (G090AY010WI), Tsuga-Thuja-Mitella/Fraxinus-Impatiens (TTM/FI)
Hydric soil rating: Yes

Minor Components

Markey

Percent of map unit: 5 percent
Landform: Depressions on lake plains, depressions on outwash plains, depressions on moraines
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Dip
Down-slope shape: Concave
Across-slope shape: Concave
Ecological site: F090AY002WI - Mucky Swamp
Other vegetative classification: Frequently flooded, organics (G090AY010WI), Not Assigned (non-acid organic soils) (Nnor)
Hydric soil rating: Yes

Capitola

Percent of map unit: 5 percent
Landform: Drainageways on moraines, depressions on moraines
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Dip
Down-slope shape: Linear, concave
Across-slope shape: Concave
Ecological site: F090AY006WI - Wet Loamy Lowland
Other vegetative classification: Mod AWC, high water table (G090AY004WI), Not Assigned (wet mineral soils) (Nmin)
Hydric soil rating: Yes

Beseman

Percent of map unit: 5 percent
Landform: Depressions on outwash plains, depressions on moraines, depressions on lake plains
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Dip
Down-slope shape: Concave
Across-slope shape: Concave
Ecological site: F090AY001WI - Poor Fen
Other vegetative classification: Frequently flooded, organics (G090AY010WI), Not Assigned (acid organic soils) (Naor)
Hydric soil rating: Yes

Loxley

Percent of map unit: 5 percent
Landform: Depressions on outwash plains, depressions on moraines, depressions on lake plains
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Dip
Down-slope shape: Concave
Across-slope shape: Concave
Ecological site: F090AY001WI - Poor Fen
Other vegetative classification: Frequently flooded, organics (G090AY010WI), Not Assigned (acid organic soils) (Naor)
Hydric soil rating: Yes

8309—Cathro muck, drainageway, 0 to 1 percent slopes

Map Unit Setting

National map unit symbol: 1t6w6
Elevation: 590 to 1,970 feet
Mean annual precipitation: 27 to 38 inches
Mean annual air temperature: 36 to 45 degrees F
Frost-free period: 70 to 170 days
Farmland classification: Not prime farmland

Map Unit Composition

Cathro and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Cathro

Setting

Landform: Drainageways
Down-slope shape: Linear
Across-slope shape: Concave
Parent material: Herbaceous organic material over loamy drift

Typical profile

Oa1 - 0 to 6 inches: muck
Oa2 - 6 to 31 inches: muck
Cg - 31 to 80 inches: fine sandy loam

Properties and qualities

Slope: 0 to 1 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Very poorly drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 2.00 in/hr)
Depth to water table: About 0 inches
Frequency of flooding: None
Frequency of ponding: Frequent
Calcium carbonate, maximum content: 30 percent
Available water supply, 0 to 60 inches: Very high (about 16.5 inches)

Interpretive groups

Land capability classification (irrigated): 6w
Land capability classification (nonirrigated): 6w
Hydrologic Soil Group: B/D
Ecological site: F093BY002MI - Mucky Swamps
Forage suitability group: Frequently flooded, organics (G090AY010WI)
Other vegetative classification: Frequently flooded, organics (G090AY010WI), Fraxinus Impatiens (FI_1), Tsuga Thuja Sphagnum (TTS_1)

Hydric soil rating: Yes

Minor Components

Foxpaw

Percent of map unit: 10 percent
Landform: Depressions on till plains, drainageways on till plains
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: F093BY004MI - Wet Lowlands
Other vegetative classification: Fraxinus Impatiens (FI_1), Tsuga Maianthemum Coptis (TMC_1)
Hydric soil rating: Yes

Lupton

Percent of map unit: 5 percent
Landform: Swamps on till plains
Landform position (three-dimensional): Dip
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: F093BY002MI - Mucky Swamps
Other vegetative classification: Tsuga Thuja Mitchella (TTM_1), Tsuga Thuja Sphagnum (TTS_1)
Hydric soil rating: Yes

W—Water

Map Unit Setting

National map unit symbol: 1t1r9
Elevation: 590 to 1,800 feet
Mean annual precipitation: 25 to 34 inches
Mean annual air temperature: 37 to 43 degrees F
Frost-free period: 100 to 140 days
Farmland classification: Not prime farmland

Map Unit Composition

Water: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

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