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872000

Clean Water State Revolving Fund

Project Plan CWSRF 5958-01

Allegan Township

Miner Lake Sanitary Sewer Extension

Allegan County, Michigan

Allegan Township
Allegan County, Michigan

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Introduction and Executive Summary

Allegan Township's Miner Lake Project Plan (PROJECT PLAN) was completed to qualify for financing through the Clean Water State Revolving Fund (CWSRF). This report will provide the basis for evaluation of the Township's proposed wastewater system construction for funding from the clean water Loan and Grant program.

The scope of the project plan includes a summary of the existing water quality issues within the Township's service area, projection of population served within the next twenty years, screening, and identifying principal alternatives to meet the future wastewater needs of the service area and to evaluate the environmental impacts in both the long and short term on a selected alternative.

The project plan also presents projected user costs for financing the selected alternative and a review of the public participation and public comments solicited by the Township on the selected alternative.

Project Background

In 2007, Allegan Township hired Fleis & VandenBrink Engineering, Inc. (F&V) to prepare a sewer feasibility study for the Miner Lake area. This study culminated in a Clean Water Revolving Fund (SRF) Project Plan report. The study was presented to the Township Board and Lake Association, including explanation of the four options for providing sewer service around the lake and their associated costs. A "straw poll" was taken by landowners in the service area and the project was shelved due to a perceived lack of majority in favor of moving forward with the project.

Since 2007, there has been a shift in demographics of the area, and several properties have changed ownership. While historically most property owners were full-time West Michigan residents, recently properties have been purchased as vacation homes and the area has become more seasonal. As described in this PROJECT PLAN, many of the existing onsite septic systems are aging, do not conform to current onsite septic codes, and require frequent maintenance and pumping. Because of the challenges associated with the existing aging and non-conforming onsite septic systems around the lake, residents approached the Miner Lake Property Association (MLPA) and Allegan Township in 2021 with a renewed interest in pursuing a public wastewater system.

As discussed in the public outreach section of this PROJECT PLAN, The MLPA has actively sought public input regarding the potential of constructing a public wastewater system including conducting public meetings and maintaining a sewer information page on the MLPA website. Homeowner surveys have also been conducted by MLPA which indicate strong support from residents for a public wastewater system.

In response to the renewed interest in a public wastewater system, Allegan Township hired F&V to revisit and update the original Project Plan including the following:

- Review existing historical data and project documentation
- Update service area and properties within
- Confirm prior alternatives are still viable and identify any new alternatives
- Provide updated preliminary cost estimates
- Identify current funding alternatives

The 2025 update to the 2007 project plan was completed in April 2025 and presented to Allegan Township and the MLPA. The response to the update was positive and at the April 7, 2025 board meeting, Allegan Township approved F&V to move forward with a funding application to the CWSRF Program.

A. Project Planning Area

1. Location

Miner Lake is located approximately three miles northeast of the City of Allegan and is a 325-acre surface water body approximately 1.5 miles in length and less than one mile in width. There are

approximately 229 single family homes in the study area. An MDNR public access is located on the southern shore at the western end of the lake just north of 120th Avenue. A general location map is shown in Figure 1 below.

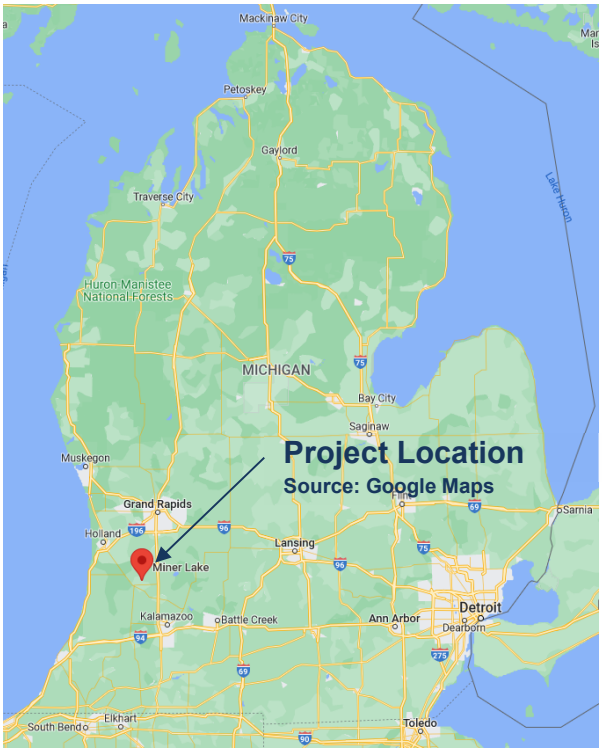


Figure 1. General Project Location

The study area for the Project Plan is the entire area around Miner Lake in Sections 11, 12, 13, and 14 of Allegan Township. The study area was defined in the SRF project plan completed in 2007 and was updated as a part of this PROJECT PLAN. The service area consists of the developed land immediately adjacent to the lake as well as properties in close proximity to the lake.

The existing land use surrounding Miner Lake consists of both full-time and seasonal single-family residential homes; there is no commercial/industrial land use within the study area. It is estimated that approximately 60% of the homes are full-time residents. There are no Township or County parks in the service area.

In general, the sewer collection system is expected to be installed within existing road rights-of-way, easements, or purchased property. Based on conversations with the MLPA, amendments to existing private road easements to allow for utility construction and/or securing several utility easements may be required. Construction of sewer will have limited impact on areas that have not been previously disturbed by construction activities and directional drilling installation methods will minimize disturbance to nearby land uses, waterbodies, or wetlands.

2. Historic Environmental Concerns

Since 1998, a number of projects have been implemented on Miner Lake under the direction of the Miner Lake Improvement Board. Key components of the current improvement project include aquatic plant control, water quality monitoring, a recreational carrying capacity analysis, information dissemination, and watershed management. A brief summary of project activities is provided below, and a complete copy of the 2006 Water Quality Monitoring Report is included in Appendix E.

Aquatic Plant Control

Plant control efforts in Miner Lake have focused on the control of the nuisance exotic plant Eurasian milfoil (Myriophyllum spicatum) with a tiny insect known as the milfoil weevil (Euhrychiopsis lecontei). Weevils were stocked in the lake in the years 1998 through 2001 and again in 2003. In total, 36,500 weevils have been stocked in Miner Lake. The populations of Eurasian milfoil and the milfoil weevils naturally cycle up and down. When the weevils deplete their food (i.e., the milfoil plants), the weevil population itself will decline. As the milfoil population increases and more food becomes available, then the weevil's population will also increase. The most recent survey of aquatic plants in Miner Lake conducted by biologists from Progressive AE in September 2005 found that a majority of the Eurasian milfoil present in the lake were damaged by weevils. However, five relatively small areas had apparent healthy (undamaged) Eurasian milfoil populations and should be evaluated for possible weevil stockings in the future. It is proposed that during 2006, these areas be closely monitored to gauge weevil damage and if necessary, a weevil stocking evaluation should be coordinated with EnviroScience (the weevil supplier) to determine the need for future stocking. In addition to Eurasian milfoil, Miner Lake contains a healthy diversity of native plants including several pondweeds, wild celery, coontail, and water stargrass.

Water Quality Monitoring

Progressive AE collecting water quality data on Miner Lake periodically since 1996. Overall, Miner Lake exhibits good water quality. However, over the years, phosphorus levels in Miner Lake have hovered around 20 parts per billion, a level known as the "eutrophic threshold." Once phosphorus exceeds the eutrophic threshold, lakes begin to show signs of nutrient enrichment with increased plant and algae growth.

Recreational Carrying Capacity Study

The carrying capacity study of Miner Lake provided an estimate of how many boats could be operated on the lake without compromising safe recreational use and/or environmental quality. Based in part on the results of the study, Allegan Township adopted an ordinance that regulates access to the lake by back lots. The ordinance will help to stem boating pressure on the lake from back lot development that may occur around the lake in the future.

Information Dissemination

Information on the lake improvement project and practices to improve water quality have been disseminated to all lake residents through newsletters and meetings. Topics covered have included wetland protection, lakeside lawn care, greenbelt landscaping, septic system maintenance, boating safety, fertilizer controls, and lake water quality.

Watershed Management

A primary focus on the watershed management element of the project has been agricultural drains that flow into the lake. In general, these drains have very low flow, therefore do not carry a large volume of water into the lake. However, at times, phosphorus content can be high. The lake board has met with representatives of the U.S. Department of Agriculture, county soil conservation district staff, area farmers, and completed a field inventory of both the Steffens and Setter drains. The MLPA investigated the feasibility of establishing an in-line sedimentation basin on the Steffens Drain just upstream of the lake as a means of trapping sediments that could otherwise be carried to the lake.

3. Environmental Resources Present

An Environmental Review (ER) was prepared as part of the funding applications. An ER for the project site was completed in August of 2024. The detailed report is provided in Appendix G.

There are four drains that are tributary to the lake. The Steffens-Setter Drain enters the lake at the northwestern corner just south of 121st Ave; the Thompson Drain enters at the western end; the Wall Drain enters at the northeastern corner just south of 122nd Ave; and the Bentley Drain enters at the eastern end of the lake. Miner Creek, the controlled outlet of Miner Lake, begins at the southeast corner of the lake and flows south through Otsego Township and eventually discharges

into the Kalamazoo River. Lake levels are maintained and controlled by the Allegan County Drain Commission.

4. Growth Areas and Population Trends

The majority of the land use surrounding Miner Lake is zoned R-2, Low-Density Residential District. Out of the 307 parcels within the service area, approximately 229 are currently developed with single-family homes/cottages. An additional 26 parcels are currently developed with secondary buildings (garages, etc.) that do not require sanitary service. A copy of the Township's official zoning map is shown in Figure 8. The minimum lot size for lots not served by public water and sewer in Zone R-2 is 15,000 square feet with a minimum width of 100 feet. Lakefront lots are required to have a rear yard of not less than 50 feet in width.

The Township had adopted an "anti-funneling" ordinance that prohibits easements/private access to "back lots" around the lake which will have an impact on future development around Miner Lake.

The east side of the lake has remained undeveloped most likely due to unsuitable soils and high groundwater conditions that would prohibit the cost of constructing on-site systems to meet current Allegan County Sanitary Regulations. The Miner Lake Association, in conjunction with a local foundation, is in the process of pledging funds so that this land area around the entire east side of the lake can be purchased and would be preserved for future conservation and recreational use. This land is zoned agricultural based on current Township zoning.

Future development trends in the study area will most likely be adjacent to lakefront properties and would be limited to areas that can support on-site wastewater systems. Vacant platted lots are currently available in the northern sections in Bay View and Crystal Cove Drive areas, along with larger parcels south of Kateras Drive and 120th Avenue in the southern sections of the study area.

Table 1 summarizes the Township's past and projected population trends based on data from the U.S. Census Bureau. From year 2000 to 2020, the population increased by 0.74% annually. This value was used to estimate a 20-year projected population in 2043.

Table 1. Allegan Twp. Population

Year	Population
2000	4,050
2010	4,406
2020	4,689
2023	4,794*
2033	5,161*
2043	5,556*

**Estimate based on 0.74% annual growth*

Table 2 summarizes the current and projected population of the Miner Lake service area. The current population was estimated based on the number of existing single-family homes in the service area and, per Census data, Allegan Township's 2.52 persons per household. The projected population was estimated by applying the aforementioned 0.74% annual growth rate. The current population is estimated at 577 and the 20-year projected population is estimated at 669. An estimated ultimate population of 708 would be reached if each of the remaining 52 vacant parcels within the service area were to be developed with a single-family home.

Table 2. Miner Lake Service Area Population

Year	Population
2023	577*

2033	621**
2043	669**
Ultimate	708*

**Estimate based on 2.52 persons per household*
***Estimate based on 0.74% annual growth*

B. Existing Facilities

1. Location Map

The City of Allegan's Wastewater Treatment Facility (WWTF) is the closest municipal facility to Miner Lake and is approximately 1.7 miles west and 2.3 miles south of the service area. A map of the feasibility study area and Allegan's WWTF is included as Figure 1 of Appendix A.

2. History

There are no public sewers or public wastewater treatment systems currently serving the study area and residents rely on private septic systems. Due to the density of the lots on Miner Lake in the service area, high groundwater, heavy soils, and proximity to Miner Lake, the potential for septic system failure with accompanying lake and groundwater contamination has increasingly become a concern of Miner Lake residents.

Water supply is not a problem in the study area; however, shallow wells and wells adjacent to non-conforming septic systems are vulnerable to contamination.

3. Description

Existing Onsite Septic Systems

Wastewater treatment in the study area is currently provided by on-site wastewater systems such as septic tank/drainfield or dry well systems, elevated mound systems, or holding tanks for pump and haul operations. Health Department records indicate that since 1970, approximately 34% of homes in the service area have been permitted for new on-site treatment systems or replacement of existing systems. High groundwater levels, unsuitable soils for adequate on-site treatment, and small lot sizes characterize site conditions as not favorable for long-term on-site wastewater treatment in the study area.

Much of the soil surrounding Miner Lake consists of various types of mucks and silt loams, which are poorly drained, as defined by a USDA Natural Resources Conservation Service (NRCS) Web Soil Survey of the service area. Additionally, the depth to groundwater around the lake is shallow. Low porosity and shallow depth to groundwater do not allow for proper filtration and treatment of septic tank effluent. The NRCS rating of "Very Limited" describes the soils as unfavorable for absorption and treatment of septic tank effluent.

While septic tank systems can be effective in removing solids and providing partial treatment to residential sewage before discharge, drain fields can only provide a limited amount of phosphorous and nitrate treatment, and essentially no advanced treatment.

As previously discussed, approximately 75% of parcels are already developed around the lake, and future wastewater flows will be impacted as full-time residences are converted to seasonal cottages requiring upgraded or expanded on-site wastewater facilities due to higher peaks in water use associated with seasonal household occupancy.

A review of the Allegan County Health Department permit records was conducted for the area surrounding Miner Lake. The data goes back to the early 1970's. No records are available prior to 1970. The Health Department data is summarized in Table 1 below and records are included in Appendix E for reference.

Table 1 – summary of Health Department Records

Category	Top Half of Lake		Bottom Half of Lake		Total	
	Total	Percentage	Total	Percentage	Total	Percentage
Total Permits	51	100%	47	100%	98	100%
New Home	28	55%	30	64%	58	59%
Existing Home	23	45%	17	36%	40	41%
Mound System	14	27%	6	13%	20	20%
Drywell System	5	10%	4	9%	9	9%
Trench System	1	2%	4	9%	5	5%
Holding Tank	4	8%	3	6%	7	7%
Denied Permit	1	2%	0	0%	1	1%
Pumps Required	16	31%	13	28%	29	30%
Specialized Systems	35	69%	35	74%	70	71%
Replacement Issues	3	6%	3	6%	6	6%
Well Variance	4	8%	6	13%	10	10%
Lake Variance	2	4%	6	13%	8	8%
Other Variances	1	2%	4	9%	5	5%

* Note: The data above reflects information gathered for the study area. Permits for homes not reflected in this table are either not available or the septic systems have not been permitted.

Public Wastewater Treatment and Collection System

The City of Allegan has the closest, publicly owned, and centralized treatment facility in the area. The City of Allegan has indicated the existing collection system and wastewater treatment facility have adequate capacity to accommodate wastewater flows from the proposed Miner Lake system.

The Township and City have entered into a “Utility Services Agreement” on February 12, 2024. The Utility Services Agreement details the services and rate structure for existing Township sewer customers serviced by the City of Allegan. The Utility Services Agreement will also serve as the agreement for Miner Lake sewer customers if connected to the City of Allegan system. A letter of intent to allow the Miner Lake collection system to connect to the City of Allegan wastewater collection and treatment system is included in Appendix F for reference.

There are no industrial facilities in the service area that would require industrial pretreatment considerations.

4. Condition of Existing Facilities

A letter from the Allegan County Health Department is provided in Appendix D, and outlines the Department’s support for a municipal sewage disposal system to serve Miner Lake in Allegan Township. Over the last thirty years, the Department has “struggled” to find solutions for on-site systems due to poor soil conditions and small lot sizes, which have limited remodeling and also required the use of pump and haul facilities as a last resort treatment option. The Health Department has denied on-site sewage disposal systems for approximately 35 vacant parcels for residential homes, largely due to the limitations stated above. The Department also notes that the transition from full-time homes to seasonal cottages puts an additional burden on the existing on-site systems that may not have been built to current sanitary regulation standards, which would have a direct impact on the nutrient loading to Miner Lake, the recreational use of the lake, and would potentially impact private wells in the service area.

Reviewing the summary in Table 1 above, there were 98 total permit records available for review. Of the total, 59% were for new construction and 41% were for replacement of existing on-site systems. Out of the total permit records, 20% were for required mound systems to provide the necessary 4-foot separation between the drain tile and the seasonal high groundwater level. Nine

percent of the permits were for dry wells, 1% where the permit was denied, and 18% of the permits required a distance variance from the owners' or neighbors' private well or a variance from the required distance of the septic tank/drainfield from the lake. Of the total permit records reviewed, almost half required either a mound system, dry wells, or a variance in order for the new construction or replacement on-site system to be permitted by the Allegan County Health Department.

With approximately 257 existing residences around the lake, this means that 57% have no Health Department record of the size and construction of the existing on-site system. Based on the soils and high groundwater conditions in the service area, it is reasonable to assume that almost all of the existing on-site systems may need replacement within the next 20 years based on the average expected life of an absorption/dry well system component.

Figure 2 shows the location of the existing mound systems currently operating in the service area based on a windshield survey. Mound systems have been used in many of the areas around Miner Lake in situations where high ground water and poor soils do not permit the use of a standard drain field. The Allegan County Health Department acknowledges that many of the existing mound systems have been undersized since the lots are typically not large enough to support the size of the system that should be used in these areas.

In many of these locations, a six-foot high mound with a footprint of approximately 13,900 square feet would be necessary to provide a 2- to 3-bedroom home with a 1,000 square foot drain bed with 1 on 4 slopes and a 42-foot minimum berm. This system would take up almost all of the minimum lot size currently allowed by zoning restrictions; even before isolation distances are considered. The minimum lot size is 15,000 square feet, and many lots in this area are smaller than this.

An area must be set aside to provide for a replacement system, meeting the size requirements of the original system and meeting isolation distances. The replacement system must have an isolation of 15 feet from the original drainfield or dry well.

The disposal area and reserve area must not be under a driveway, pavement, material stockpile, or building. These areas must be located on the property being served unless otherwise permitted. Dry wells are allowed in areas where there is a protected water supply, and the soil has a stabilized percolation rate of 10 minutes/inch or less. As a last resort, pump and haul facilities are allowed for existing structures and prohibited for new construction. The only exception to the new construction restriction is on a temporary basis of less than six months while a community or public system is being constructed.

Figure 7 graphically shows the required isolation distances based on the minimum lot size and setbacks according to the Township's R-2 zoning district and shows the minimum areas required to meet current Allegan County Sanitary Regulations for on-site wastewater systems.

A majority of the smaller lots around Miner Lake could not meet these new sanitary regulations due to lot size and required reserve area for a mound system and/or future drainfield area. The private wells are approximately 140 feet deep in the area protected by a 30-foot clay layer and would most likely be isolated from any impacts from properly operated or overloaded on-site wastewater systems. This would only be true as long as the existing private well was adequately grouted and installed according to current Michigan Department of Public Health well instruction guidelines for private wells.

Appendix E contains records of nitrate concentrations from the limited well sampling conducted by the Health Department. All of the nitrate concentrations are well below current EGLE action levels.

Figure 9 is a USDA NRCS Web Soil Survey map, which detail the soil types, septic tank absorption field ratings, and depth to groundwater of the service area. As shown in Figure 9, the eastern

shoreline of Miner Lake is characterized by soils of type “5” (Houghton muck), “7” (Palms muck), “65” (Cohoctah silt loam), and “67” (Martisco muck). The southern shoreline is characterized by soils of type “12B” (Ockley loam), “41B” (Blount silt loam), and “45” (Pewamo silt loam). The northern shoreline is characterized by soils of type “6” (Adrian muck), “12C” (Ockley loam), “22A” (Matherton loam), and “30” (Colwood silt loam). The mucks, silt loams, and Matherton and Colwood loams are characterized as somewhat poorly drained to very poorly drained and are not acceptable for septic tank absorption operations. The Ockley loams are characterized as well drained but are still not acceptable for septic tanks due to seepage of the bottom layer and slow water movement.

Figure 10 displays the depth to water table below seasonal high-water conditions throughout the service area. The red areas represent a depth to water table of approximately 0-0.8 feet, the orange areas represent 0.8-1.6 feet, the yellow areas represent 1.6-3.3 feet, and the blue areas represent greater than 6.6 feet. Based on this depth to water table map, in addition to the existing systems already constructed as mound systems as shown in Figure 2, it is reasonable to assume that a majority of on-site systems that will need to be replaced over the next 20-30 years will most likely require an elevated drainfield or mound system. Almost all replacement systems could not be permitted under the current Allegan County Sanitary Regulations.

Figure 11 illustrates the extent to which the soils throughout the service area are limited by the soil features that affect the use of the soils as septic tank absorption fields. Only that part of the soil between depths of 24 and 60 inches is evaluated, and the ratings are based on the soil properties that affect absorption of the effluent, construction and maintenance of the system, and public health. The soils throughout the entire service area are rated as “very limited”, which indicates that the soils have one or more features that are unfavorable for use as septic tank absorption fields. The limitations generally cannot be overcome without major soil reclamation, special design, or expensive installation procedures. Poor performance and high maintenance can be expected.

Financial Status

There are no public wastewater collection or treatment systems in the study area, therefore, no existing debts or reserve funds are in place related to wastewater systems.

C. Need for Project

1. Health, Sanitation, and Security

Nitrate, phosphorous, pathogens, and other contaminants are present in significant concentrations in on-site septic systems. Conventional septic tank and absorption field systems are capable, when operated and designed properly, to remove many household pollutants, including bacteria. These systems, however, do not provide significant nutrient removal of nitrogen and phosphorous compounds. This issue is further exacerbated by seasonal use and density of the systems around Miner Lake. The nutrients from septic systems are carried via the effluent into the groundwater. Groundwater, being the lake’s primary source of water, transports these nutrients to the lake which leads to degrading water quality. The high density of residential development impedes the soil’s treatment ability with the high nutrient loading. Further, these nutrients pose a health and safety issue for shallow private water supply wells located between the lake and any septic systems.

Excessive nitrate levels in drinking water can cause methemoglobinemia in infants and pregnancy complications for women. This condition is usually found in areas with sandy, fast percolating soils. Nitrates have not been a problem in the Miner Lake area, as there have been no recorded incidences with the Allegan County Health Department of nitrates above the State limit of 10 mg/L in drinking water.

Nitrogen and phosphorus, as nutrients, are vital for aquatic plant growth. An increase of these nutrients in surface waters, especially lakes, can lead to eutrophication of the water body, stimulating the growth of algae and other aquatic plants which results in the depletion of dissolved oxygen in the water.

Since agriculture plays a major role in the economy of Allegan County, and since Miner Lake is largely surrounded by agricultural land use, the drains that flow into the lake have been and will continue to be a significant source of nutrient loading from agricultural runoff. It is difficult to predict the impact of future algae and weed growth on the lake if the on-site systems were eliminated, since nutrients have been building up in the lake for so many years. Reducing the nutrient input by removing on-site septic systems will have a positive impact but quantifying the magnitude of the impact is very difficult.

Lake water quality tests by Progressive AE were conducted between 1996 and 2004. These tests generally indicated that phosphorous levels are seasonally elevated. The report recommended that Miner Lake residents reduce their use of fertilizers containing phosphorous and properly maintain their septic systems to decrease phosphorous inputs into the lake. Water clarity was moderate, and chlorophyll concentrations were generally low. The report also indicated that high concentrations of phosphorous and fecal coliform bacteria were present in the inlet streams to Miner Lake, although the overall effect of these contributions is limited by low stream water flows.

The extent of the effect of septic systems on the water quality of Miner Lake is not quantifiable. Some of the tests may indicate the presence of sewage in the lakes, although much more comprehensive testing would be required to determine its extent. Based upon the limited testing completed, there have not been any alarming levels of sewage indicators. The soils and high groundwater in this area place a limitation on the lifespan and effectiveness of septic systems.

Homeowners in this area should be aware that poor septic maintenance can cause significant and irreversible damage to the lake's overall quality. Since reversing the eutrophication process of lakes this size is not possible, slowing it by limiting the phosphorous and nitrogen input is critical since the lake has already reached a eutrophic state.

2. Future Environment without Proposed Project

Without sanitary sewage collection and treatment, the area will continue to experience issues with isolation distances to wells, surface waters, and neighboring properties as development continues or existing systems fail and require replacement. As drain fields require replacement and isolation distance cannot be maintained, variances from septic codes will be required, expensive on-site treatment may be required, or development will not be possible. Miner Lake will continue to suffer from nutrient loading and result in a steady and prolonged decline in water quality. Eventually, this will result in loss of recreation opportunities, tourism, property values, and economic decline to the area.

3. Public Engagement

Completed Public Outreach:

1) **Local Association Meetings –** The Miner Lake Property Owners Association (MLPOA) holds meetings every spring and fall for Miner Lake residents to stay informed and voice their opinions on matters relating to the lake. The proposed sewer project has been regularly discussed at these meetings.

2) **Allegan Township Board Meetings –** The Allegan Township Board of Appeals holds public meetings every other month. The Board hears and decides on appeals which deviate from the Township's Zoning ordinance. Its authority includes site plan review, appeal of planned unit development, special land use decisions, and granting of variances.

3) **Website Updates –** The MLPOA maintains a website where Miner Lake residents can access resources and information on Miner Lake issues and events. A portion of the website (www.sewer.minerlake.com) is dedicated to providing updated facts and information on the proposed sewer project. The website lists the cons of the continued use of failing septic systems and the pros of the proposed sewer system. It also addresses

common questions about the sewer such as property concerns and the project's cost and timeline. A link to F&V's May 2022 Sewer Feasibility Study is provided, as well as how residents can get involved in the decision-making process.

D. Collection System Alternatives

The proposed alternatives were developed and evaluated on their ability to meet Allegan Township's goals regarding the health, safety, and environmental concerns of the region.

Project objectives include:

- Protect surface water and environmental resources critical to the area
- Develop a solution that is modest in scope and cost, and supported by those involved
- Provide reliable wastewater service (collection and treatment) to the customers

The Study Area includes areas with high groundwater and poorly-drained soils, which poses challenges for each alternative.

Five collection system alternatives have been developed and evaluated for this study:

A. No Action (required to be evaluated)
B. Optimizing Performance of Existing Systems
C. Gravity System
D. Low-Pressure Grinder Pump System
E. Low-Pressure STEP System

A. No Action

The No Action alternative consists of the continued use of on-site wastewater treatment systems around Miner Lake. As detailed in the review of the Health Department Permit records and the Department staff's experience in trying to work with the residents around the lake to meet current sanitary code regulations, the continued use of absorption beds in very limited soils and in areas of high seasonal groundwater is not conducive to long-term use of on-site systems.

It is anticipated that based on the number of existing mound systems already built, the replacement of absorption systems will most likely also require an elevated mound system in the future. Several lots will not have adequate space to construct an elevated mound absorption system to meet current County standards based on the existing soil types and limited lot size.

Clustering homes into small systems that pump wastewater to combined off-site absorption or disposal areas away from the lake and on higher ground may be required to provide adequate absorption bed capacity for continued wastewater treatment. This method would still be difficult due to the soil and groundwater conditions in the immediate areas beyond the lake front properties.

Any future replacements or upgrades of on-site systems would most likely involve construction of elevated mound systems. Several replacement systems would need to be constructed on lots that do not have adequate space for a properly sized and constructed mound system. Any new construction will be prohibited in areas that cannot meet current sanitary regulations since a pump and haul system will not be permitted on those parcels that cannot meet current regulations. Those systems on the current pump and haul operations will continue to incur high maintenance and disposal costs and are operating on a wastewater treatment system that is not recommended as a long-term solution.

The owners of the individual on-site systems will have continued treatment costs and septic system maintenance upgrade and/or replacement costs. The number of pump and haul sites will increase as existing absorption beds/dry wells fail after they reach their useful life and limited and undersized mound systems cannot be constructed on small lots.

The cost associated with the No Action alternative is difficult to quantify, as it largely consists of naturally variable indirect costs in the form of environmental degradation and potential impacts to residents' health.

The No Action alternative will result in continued degradation of Miner Lake's water quality. Further, as the water quality decreases, the lake's economic value to the region would also decrease, resulting in decreased property values and commerce. Concerns regarding septic discharges into aquifers shared with shallow drinking water wells would also not be addressed.

Without an improved wastewater collection and treatment system, water quality issues within the service area will be exacerbated by increased loadings of sewage constituents as existing on-site systems age and fail. Many of the replacement absorption systems required in the future with the failing systems will not be able to be constructed according to current Allegan County Sanitary Regulations.

The No Action alternative does not meet the project objectives and will not be further evaluated as a principal alternative.

B. Optimizing Performance of Existing Systems

Optimizing the performance of the existing septic/drainfield systems would not be feasible on many of the existing parcels surrounding the lake. Much of the service area has a seasonal high groundwater table within 2 feet of the ground surface. An effective septic/drainfield treatment system would most likely involve installing onsite advanced treatment systems which are costly to construct and maintain. Advanced treatment systems also typically require a certified operator to maintain and operate the system. There is very limited or no available land on many parcels to construct advanced treatment systems or allocate space for replacement drainfield areas. Many properties within the project area do not have land available to accommodate a new or upgraded septic system and/or drain field. Required isolation distances from water wells further constrains optimization efforts of these systems, especially on small lots.

In the event that advanced treatment systems could not be constructed, holding tanks and pump and haul operations are typically the only remaining option. Pump and haul operations are costly, subject to leaking or overflowing tanks, and are not economically feasible during periods of high use.

Optimizing the performance of the existing facilities is neither an effective nor implementable alternate. This alternative does not meet the project objectives and will not be further evaluated as a principal alternative.

C. Gravity System

Description

This alternative would consist of a conventional gravity sewer collection system utilizing 8-inch or larger diameter pipe to convey wastewater. The sewers would be installed at the minimum slope required to maintain sufficient sewage flow velocities and to prevent the deposition of solids. Manholes would be constructed at periodic intervals for access, cleaning, and inspection. Lift stations would be utilized throughout the collection system where the sewer becomes too deep, and sewage would be pumped uphill to another part of the collection system to continue flowing by gravity. Two ultimate downstream lift stations would collect all sewage and pump it to the City of Allegan's wastewater collection system to be treated at the WWTF.

Conventional gravity sewers could serve most of the homes in the service area. Some homes, however, are at lower elevations relative to the roadway and would have service leads that are lower than the gravity sewer, especially if a basement or walk-out level requires sewer service. In these instances, the homeowner would be responsible for providing a pump to lift the sewage up to the gravity sewer elevation.

The conventional gravity sewer system would require lift stations in several locations throughout the collection system. Each station would consist of two underground chambers and an above-ground electrical panel. The total area required for each station would be approximately 20×30 feet. Landscaping would be provided to screen the station.

The preliminary layout of the conventional gravity sewer system contains eleven lift stations – six on the north side of the lake and five on the south side. Two of the eleven lift stations would serve as ultimate downstream lift stations for the north and south sides of the lake. They would be located towards the western end of the lake; one on Lake Dr and one on Haas Dr. The forcemain from the main lift stations would be constructed west along 120th Ave, south along 28th St, west along 118th Ave, then south along 30th St where it would discharge into the City of Allegan's existing wastewater collection system at the northern City limits. The forcemain route is shown in Figure 5. Several cleanouts would be installed at regular intervals along the length of the forcemain, and air release valves would be installed at high points.

Due to the long length and detention time that sewage will spend inside the forcemain to the City's collection and treatment facilities, chemical addition equipment would be installed at the two main lift stations, which would inject chemicals into the sewage to control odors and sulfide formation.

This type of system relies on the slope of the pipe to carry wastewater, so the depth of the sewer can be an issue, especially in areas around Miner Lake with high groundwater. Costs for dewatering, trench undercutting, and sand backfill are included in the capital construction costs due to the poor soil conditions and narrow roadway construction, which result in greater installation and restoration costs.

The gravity collection system would consist of approximately:

- 4.04 miles of gravity sewer;
- 62 manholes;
- 40 grinder pump systems for homes below road elevation;
- 11 pump stations; and
- 7.30 miles of forcemain.

Design Criteria

Guidelines established in the Recommended Standards for Wastewater Facilities were used to design the preliminary wastewater collection system. The collection system was designed so that the maximum flow conditions based on the service area's ultimate projected population would be accommodated.

Map

See Figure 3 in Appendix A for the preliminary gravity collection system layout.

Environmental Impacts/Land Requirements

The gravity collection system would be constructed in existing public road rights-of-way wherever possible. Additional purchased property or easements would be necessary for locating lift stations and forcemains required to serve the gravity sections of the collection system.

Open cut installation of gravity sewers can be disruptive and may involve staging of excavated soils, dewatering, pavement removal and restoration, and may temporarily impact property access during construction.

It can be difficult to install gravity sewer within areas of wetlands or floodplains, as it is not typically possible to meet construction tolerances and regulatory requirements while directional drilling gravity sewer.

Potential Construction Issues

- Dewatering costs can be unpredictable
- Trenching operations with gravity pipe are disruptive and require expensive surface restoration and pavement replacement
- Locating existing discharge lines to homes for gravity connection can be difficult, especially homes with multiple discharge locations
- Construction of multiple duplex submersible pumping stations requires shoring and dewatering for deep excavations
- Duplex submersible pumping stations require easements or property acquisition

Sustainability

Conventional gravity systems are the least complicated form of collection system to operate in the long term. Low-pressure systems require more maintenance, pumping costs, and equipment, however they can be less expensive than constructing a series of larger pump stations.

Cost Estimates

The capital cost of this alternative is estimated at $27,480,000 and the annual operations, maintenance, and replacement (OM&R) cost is estimated at $133,000. A detailed breakdown of estimated costs is provided in Table 2 of Appendix C.

Advantages

- Minimal maintenance required to keep system functioning.
- Future expansion of system is relatively easy.
- Ease of operation with a limited utility staff.
- Contractors are plentiful and well versed in construction of gravity sewers.

Disadvantages

- Higher construction costs due to deeper trenching required for proper pipe sloping, and additional dewatering as a result of deeper trenches.
- Higher material costs due to larger diameter and longer length of pipe required to construct the system.
- Several intermediate lift stations required throughout the system to overcome terrain constraints.
- Chemical addition required at each lift station for odor and corrosion control.
- Some homes would require pumping systems due to elevation relative to road.
- Lower seasonal flows during the winter would allow some solids to settle in the gravity mains, which is expected to increase the cleaning and maintenance required to prevent clogging and backups in the system.
- Possibility for infiltration/inflow as gravity sewer ages, leading to higher O/M costs.

D. Low-Pressure Grinder Pump System

Description

This alternative would utilize a single grinder pump at each home in the service area, or dual pumps for two or more homes combined. The home's wastewater would be ground up and pumped into a common network of low-pressure forcemain, typically no more than 4 inches in diameter. Collectively, the pumps would convey the wastewater through the collection system to a single downstream lift station located at the western end of Miner Lake. Several cleanouts would be installed at regular intervals throughout the system, and air release valves would be installed at high points. Corrosion and odor control chemicals would be added to the wastewater at the lift station before being pumped through a primary forcemain, following the same path proposed in the gravity system alternative. The forcemain would discharge into the City of Allegan's wastewater collection system at the northern City limits and the wastewater would then be treated at Allegan's WWTF.

Pressure sewer systems are easier to install than gravity systems because smaller pipes are installed at shallower depths. The pressure sewer lines would be installed by directional drilling both on the private property and the public road right-of-way, which reduces restoration costs and construction impacts to adjacent properties. Eliminating duplex submersible lift stations removes costly and highly critical pumps, and land requirements. Construction of conventional gravity sewer would require significant dewatering, whereas the only dewatering required to install the grinder system would be for the small pits dug for each grinder station. With this type of system, the existing septic tanks are abandoned and/or removed.

Due to the high seasonality of the system, low flows are expected during off season times. Lower flows result in reduced cycling of grinder pump stations, and also reduce flushing velocity in pressure mains. Additional cleaning and maintenance of the grinder stations and low-pressure mains would be expected to prevent clogging and backups in the system. Maintaining the pump cutter blades and grinder pumps along with electrical and mechanical maintenance also causes the grinder pump system to have a higher operation and maintenance cost than the STEP system.

The low-pressure grinder collection system would consist of approximately:

- 281 grinder systems; (225 Active and 52 Vacant Lots)
- 6.25 miles of low-pressure forcemain;
- 1 pump station; and
- 3.28 miles of forcemain.

Design Criteria

Guidelines established in the Recommended Standards for Wastewater Facilities were used to design the preliminary wastewater collection system. The collection system was designed so that the maximum flow conditions based on the service area's ultimate projected population would be accommodated.

Map

See Figure 4 in Appendix A for the preliminary low-pressure collection system layout.

Environmental Impacts/Land Requirements

The low-pressure collection system would be constructed in existing public road rights-of-way wherever possible. Additional purchased property or easements would be necessary for locating some forcemains in addition to potentially amending existing private road easements to allow construction of utilities. Because directional drilling creates less of an impact than open cut methods, smaller easements and less use of existing property would be required. Surface disruption would be much less than what would be required for installation of gravity sewers. Directionally drilling under wetlands and waterways would limit environmental impacts.

Potential Construction Issues

Due to the high groundwater table, dewatering for installation of grinder stations would be required. However, it is expected that this would require much less effort than installing STEP tanks or gravity sewer in high groundwater locations.

Grinder pumps require a connection to the home's electrical service. In some cases, older homes may require an upgrade to 240V electrical service to power the grinder pump. More homes are expected to require these upgrades compared to the STEP system alternative, which only requires 120V electrical service.

Sustainability

In the event of a power outage, those homes without generators would not be able to run their private wells for water use, or their grinder pumps for wastewater disposal. Since grinder systems have minimal storage capacity, residents would not be able to use any emergency water inside

their homes without causing a sewage backup. Those residents who wish to power their well and grinder pump during a power outage may need to purchase a generator capable of supplying 240V.

Because the collection system is not gravity-driven, the low-pressure forcemains only need to be installed just below the frost line, or about 5-6 feet below the ground surface. Construction of the collection system would be completed by horizontal directional drilling, which minimizes surface disturbance and environmental impacts. These construction methods also reduce the need for dewatering. The collective pumping power of each residence's grinder system eliminates the need for several large lift stations throughout the collection system, which also reduces construction disturbances.

The large number of grinder pumps increases the overall complexity of the collection system and the number of potential points of failure. The grinder pumps have a shorter lifespan than STEP pumps, and they are more costly to repair or replace.

Cost Estimates

The capital cost of this alternative is estimated at $14,4790,00 and the annual operations, maintenance, and replacement (OM&R) cost is estimated at $219,000. A detailed breakdown of estimated costs is provided in Table 2 of Appendix C.

Advantages

- Grinder stations are generally smaller and require less area for installation, which is less disruptive to private property
- The location of grinder stations on private property is flexible, allowing them to be placed in areas that minimize disruption and accommodate future plans of residents
- Grinder systems pump solids so pumping of storage tanks is not required
- Low-pressure systems allow for easier and shallower installation via directional drill methods and shallower trenching
- A low-pressure system is easily expandable for future needs

Disadvantages

- Each service will have an on-site grinder station, which will require maintenance of pumps and cutter blades
- Higher operations and maintenance costs than STEP systems
- Grinder pumps have a 10-year anticipated life span and are more costly to replace
- Grinder pumps require 240-volt electrical systems, which may require more upgrades to homeowner's electrical systems.
- Due to the high seasonality of the system, low flows are expected during off season times. Lower flows result in less cycling times of grinder pump stations, and also reduce flushing velocity in pressure mains. Additional cleaning and maintenance of the grinder stations and low-pressure mains would be expected to prevent plugging and backups in the system.

E. Low-Pressure STEP System

Description

This alternative would consist of each residence in the service area utilizing a septic tank effluent pumping (STEP) system that discharges into a common network of small diameter low-pressure forcemain. Collectively, the pumps would convey the effluent through the collection system to a single downstream lift station located at the western end of Miner Lake. Several cleanouts would be installed at regular intervals throughout the system, and air release valves would be installed at high points. The primary forcemain from the lift station would follow the same path proposed in the previous alternatives. The forcemain would discharge into the City of Allegan's wastewater collection system at the northern City limits and the wastewater would then be treated at Allegan's WWTF. The solids in residents' septic tanks would need to be regularly removed every 7-10 years and hauled to the WWTF for disposal and further treatment.

Pressure sewer systems are easier to install than gravity systems because smaller pipes are installed at shallower depths. The pressure sewer lines would be installed by directional drilling both on the private property and the public road right-of-way, which reduces restoration costs and construction impacts to adjacent properties. Eliminating duplex submersible lift stations removes costly and highly critical pumps, and land requirements. Since solids are retained in the individual tanks on each property, STEP systems require maintenance and cleaning less frequently than gravity and grinder pump systems that convey solids. Pumping the effluent without solids also reduces the pumping effort required, which saves energy. Based on a system wide average of a 7-year solids removal frequency of the STEP tanks, the operation and maintenance costs for the STEP system are less than a gravity system or grinder pump system.

The low-pressure STEP collection system would consist of approximately:

- 281 STEP systems; (229 Active Systems and 52 Vacant Lots)
- 6.25 miles of low-pressure forcemain;
- 1 pump station; and
- 3.28 miles of forcemain.

Design Criteria

Guidelines established in the Recommended Standards for Wastewater Facilities were used to design the preliminary wastewater collection system. The collection system was designed so that the maximum flow conditions based on the service area's ultimate projected population would be accommodated.

Map

See Figure 4 in Appendix A for the preliminary low-pressure collection system layout.

Environmental Impacts/Land Requirements

The low-pressure collection system would be constructed in existing public road rights-of-way wherever possible. Additional purchased property or easements would be necessary for locating some forcemains. Because directional drilling creates less of an impact than open cut methods, smaller easements and less use of existing property would be required. Surface disruption would be much less than what would be required for installation of gravity sewers. Directionally drilling under wetlands and waterways would limit environmental impacts.

Potential Construction Issues

Locating STEP systems on small lots may be difficult and may require removal of the existing septic system for placement. On-lot construction activities would require coordination with property owners. In locations where lots are very small, existing tanks may need to be removed and new STEP tanks replaced in the same location, which may result in disruption of sewer service for a short time.

Due to the high groundwater table, dewatering for installation of STEP tanks would be required. However, it is expected that this would require much less effort than installing gravity sewer in high groundwater locations.

STEP systems require a connection to the home's electrical service. In some cases, older homes may require an upgrade to 120V electrical service to power the STEP pump. Fewer of these upgrades, however, are expected to be needed compared to a system composed of grinder pumps, which require 240V electrical service.

Sustainability

A STEP system consists of an underground water-tight storage tank with a low-flow, high-head pump that only pumps out the effluent. Pumping the effluent without solids reduces the pumping effort required, which reduces energy consumption. Because solids are retained in the individual

tanks on each property, the pumps and low-pressure forcemains require cleaning less frequently than systems that convey solids, which reduces the system's operation and maintenance costs. Additionally, smaller diameter pipes can be used since solids are not conveyed.

In the event of a power outage, those homes without generators would not be able to run their private wells for water use, which in turn would not require the STEP pump to be operational. Even so, the STEP tank can provide storage for any emergency water that may be used. Those homes with generators that are able to power their water well would most likely be able to power their STEP pump as well. This significantly reduces the risk of a potential storage tank overflow or backup due to a power outage.

Because the collection system is not gravity-driven, the low-pressure forcemains only need to be installed just below the frost line, or about 5-6 feet below the ground surface. Construction of the collection system would be completed by horizontal directional drilling, which minimizes surface disturbance and environmental impacts. These construction methods also reduce the need for dewatering. The collective pumping power of each residence's STEP system eliminates the need for several large lift stations throughout the collection system, which also reduces construction disturbances.

The large number of STEP systems, each requiring a pump and electrical control panel, increases the overall complexity of the collection system and the number of potential points of failure. Fortunately, the control panels are basic, and the pumps have a higher lifespan than grinder pumps or larger submersible pumps, and all electrical and pumping components can be replaced relatively easily and inexpensively.

Cost Estimates

The capital cost of this alternative is estimated at $14,138,000 and the annual operations, maintenance, and replacement (OM&R) cost is estimated at $65.000. A detailed breakdown of estimated costs is provided in Table 3 of Appendix C.

Advantages

- Low-pressure systems allow for easier installation via directional drilling methods and shallower trenching
- Directional drilling reduces dewatering costs and environmental impacts over open trenching methods
- A low-pressure system is easily expandable for future needs
- Because solids are kept onsite, a STEP system is better suited for seasonal applications than gravity or grinder systems where flows fluctuate, and solids can accumulate during low-flow periods
- There is less potential for odor and corrosion issues with a STEP system
- Maintenance required for STEP system pumps and mains is much less than that of a grinder pump system or gravity collection system, as solids are not pumped or conveyed through the pumps and sewers
- The location of STEP systems on private property is flexible, allowing tanks to be placed in areas that would minimize disturbance and accommodate future plans of property owners
- STEP pumps have up to a 20-year lifespan
- STEP pumps are cost effective to replace and repair

Disadvantages

- Each service will have an onsite STEP system, which will require maintenance of pumps, controls, and electrical components
- Locating STEP system tanks on some lots may be difficult, especially where isolation distances are not currently met
- STEP tanks require periodic removal of solids

- STEP systems require an electrical connection, which may require an electrical service upgrade in some locations

A summary of the collection system alternatives is provided below in Table 3.

Table 3. Collection System Alternatives

Alternative	Advantages	Disadvantages
No Action	• No initial monetary cost • No construction related environmental impacts	• Does not protect Miner Lake water quality • Does not protect public health and safety • No replacement of existing septic systems that are failing or underperforming • As systems fail, costly advanced treatment or holding tanks would be required
Optimize Performance of Existing Systems	• Limited construction related environmental impacts	• Limited availability of land on small parcels • Advanced treatment is costly to install, operate, and maintain • No economy of scale for construction costs • Isolation distance issues can limit options and require variances
Gravity System	• Protects Miner Lake water quality • Protects public health and safety	• Many duplex pumping stations to maintain • Chemical feed system required to mitigate odor and corrosion • Most environmentally disruptive • Most initial private party impact • Highest capital cost
Low-Pressure Grinder System	• Protects Miner Lake water quality • Protects public health and safety • Directional drilling limits environmental impacts • Low-pressure system is easily expandable for future needs • Smallest footprint on private land allows flexibility of installation location • Storage tank pumping is not required	• Chemical feed system required to mitigate odor and corrosion • Minimal storage capacity during power outages • Requires 240V electrical service • Highest OM&R costs
Low-Pressure STEP System	• Protects Miner Lake water quality • Protects public health and safety • Directional drilling limits environmental impacts • Low-pressure system is easily expandable for future needs • Storage capacity during power outage • Better suited to serve seasonal areas • Lowest capital cost • Lowest OM&R costs	• Largest footprint on private land • Storage tank pumping is required • Requires most effort to coordinate with homeowners • Requires 120V electrical service

E. Treatment System Alternatives

The proposed alternatives were developed and evaluated on their ability to meet Allegan Township's goals regarding the health, safety, and environmental concerns of the region.

Project objectives include:

- Protect surface water and environmental resources critical to the area
- Develop a solution that is modest in scope and cost, and supported by those involved
- Provide reliable wastewater service (collection and treatment) to the customers

Four treatment system alternatives have been developed and evaluated for this study:

A. No Action (required to be evaluated)
B. Community Drainfield Treatment System
C. Lagoon Treatment System
D. Regionalization with the City of Allegan

A. No Action

Under the No Action alternative, no wastewater treatment would be provided to the service area. Miner Lake residents would continue to depend upon maintaining their existing septic systems for wastewater disposal.

This alternative does not address any of the issues stemming from the area's poorly drained soils, limited lot sizes, or discharge of untreated or partially treated wastewater due to septic systems reaching the end of their service life. The No Action alternative does not address the Township's needs or meet the project objectives and will not be further evaluated as a principal alternative.

B. Community Drainfield Treatment System

A Community Drainfield Treatment System is considered a decentralized treatment system. Decentralized wastewater treatment systems, frequently referred to as "Alternative Systems" or "Innovative Systems" are characterized as collection and treatment of wastewater close to the source of the wastewater or at designated locations based around the population center. Decentralized wastewater systems can significantly reduce the wastewater collection system's cost when the treatment system and disposal areas can be located in close proximity to the populations. A significant disadvantage of decentralized systems is that the locations and quantity of complex systems are multiplied and spread across the area.

When considering decentralized systems, the analysis must consider all three components of any comprehensive wastewater evaluation, including collection/conveyance, treatment, and discharge/polishing. Further, the evaluation of decentralized systems must consider the loss of economy-of-scale that has been demonstrated to exist as wastewater systems are constructed at smaller sizes. To date, the vast majority of decentralized systems have been constructed at the lowest (poorest) economies-of-scale and therefore, typically result in higher final costs to the users.

For the Miner Lake service area, two community drainfield treatment systems would be constructed, one to serve the north side of the lake and one to serve the south side. The systems would need to be located at least one-half to one mile away from the lake to avoid disrupting wetland areas and to obtain a large enough area away from populated areas that provides the necessary site conditions for the drainfield treatment systems. A major consideration of decentralized treatment facilities is evaluation of soil types and identification of prime agricultural land use surrounding the service area.

After reviewing aerial photography and USGS soil maps and data of Miner Lake and the surrounding area, it was determined that areas with adequate soils to support the community drainfield systems are very limited. In addition, a preliminary evaluation indicates that the reduction of the population served by decentralized systems due to splitting Miner Lake into two service areas would not financially overcome the loss of economy-of-scale.

Due to cost issues and the lack of suitable soils surrounding the Miner Lake area, this alternative will not be further evaluated as a principal alternative.

C. Lagoon Treatment System

This alternative would involve constructing an independent Township treatment facility that would utilize PVC lined lagoons on top of a "native" compacted clay liner. Storage lagoons and an aeration pond with aeration equipment would be constructed as part of the treatment facility. The facility would either utilize surface/groundwater discharge or surface water discharge. Surface/groundwater discharge would utilize spray irrigation on Township crops and on leased farmland already in production. Surface water discharge would utilize an outfall structure that discharges into Miner Creek or into the Kalamazoo River. The treatment facility is assumed to be within a 2.5-mile radius of the Miner Lake service area and would require 90 acres of land.

A preliminary evaluation ruled out the groundwater discharge option. The USGS soil data for the Miner Lake area shows there is a lack of adequate soils in the area to make groundwater discharge viable. In addition, discharge to crops is not viable due to the City of Allegan's Wellhead Protection Plan. The City has a 10-year municipal wellhead protection area, shown in Figure 6, that projects out towards the Miner Lake service area. Any treatment facility and surface discharge would need to be located outside of this 10-year wellhead protection area and east of the groundwater flow divide identified as the "Dorr Channel Outwash Deposit," to protect the head. Due to these circumstances, groundwater discharge is not a viable option.

A preliminary evaluation has also ruled out the surface water discharge option. Miner Creek is a low flow waterway and it is projected that stringent effluent limits would be required to discharge into the creek. A lagoon system would most likely be incapable of producing effluent that complies with the permit required to discharge into the creek, so a mechanical plant with tertiary treatment would be needed. A mechanical plant would be expensive to build and operate and does not meet the goals of the Township.

Surface discharge to the Kalamazoo River is projected to require less stringent effluent limits, as the river is a high flow waterway. A lagoon treatment system would be capable of meeting the projected effluent requirements to discharge into the river. However, this would involve constructing a forcemain from the treatment plant to the river. The distance required for the forcemain to reach the river is similar to the distance required to construct a forcemain to the City of Allegan's WWTF. The cost to build a lagoon treatment system and the forcemain to the Kalamazoo River, when compared to only building a forcemain to Allegan's facility, rules out the option to discharge in the Kalamazoo River.

The lagoon treatment alternative does not meet the Township's goals of developing a solution that is modest in scope and cost. Therefore, this alternative will not be further evaluated as a principal alternative.

D. Regionalization with the City of Allegan

Description

This alternative involves constructing pump stations and a forcemain to transport wastewater from the Miner Lake area to the City of Allegan Wastewater Treatment Facility for treatment. The forcemain would be installed using directional drilling wherever possible. The City currently has the capacity for the existing and future wastewater flows from the Allegan Township/Miner Lake service area. There already exists a Utility Services Agreement between the City and the Township. Treatment at the City's WWTF would provide economies of scale and would be a principal alternative as compared to the Township constructing their own wastewater treatment facilities. As such, a forcemain to the City of Allegan's WWTF will be part of a principal alternative considered for the service area.

Environmental Impacts/Land Requirements

Improvements would be made in existing public road rights-of-way wherever possible. Additional purchased property or easements may be necessary for locating pump stations and sewer mains.

Because shallower trenching and directional drilling creates less of an impact than open cut methods, smaller easements and less use of existing property would be required. Directionally drilling under waterways and wetlands would limit surface disruption and environmental impacts.

Potential Construction Issues

Due to the high groundwater table, dewatering for construction of pump stations may be required. In addition, the pump stations will require 240- or 480-volt power supplies to operate. Access to 240- or 480-volt power supplies may be an issue as the majority of the Miner Lake area is agricultural.

Sustainability Considerations

Corrosion of the forcemain is possible over time. In addition, odors can become an issue at the WWTF and intermediate pump stations due to the length of the main. To mitigate corrosion and odors, chemicals would be added at the main lift station.

Cost Estimates

The capital cost of this alternative is estimated at $14,138,000 million, not including non-construction project costs such as land purchase, design and construction engineering, permitting, and legal and bond counsel. The annual operations, maintenance, and replacement (OM&R) cost of this alternative is estimated at $65,000. A detailed breakdown of estimated costs is provided in Appendix C.

Advantages

- The joint effort with the City of Allegan allows for both communities to share the risks associated with wastewater treatment
- Sending wastewater to the City of Allegan relieves the Township of the burden of wastewater treatment plant operations

Disadvantages

- Lack of control over wastewater treatment system and cost associated with treatment

F. Selection of Alternative

The selection of an alternative includes the monetary evaluation of the Principal Alternatives.

Three of the five collection system alternatives meet the project objectives:

- Gravity System
- Low-Pressure Grinder System
- Low-Pressure STEP System

Only one of the four treatment system alternatives meets the project objectives:

- Regionalization with the City of Allegan

A. Life Cycle Cost Analysis

The present worth analysis compares life cycle costs for the principal alternatives over a 20-year period. The present worth is the sum which, if invested now at a given interest rate, would provide exactly the same funds required to pay all present and future costs. The total present worth is the sum of the initial capital cost, plus the present worth of operation, maintenance, and replacement (OM&R) costs, minus the present worth of the salvage value at the end of the 20-year period. The discount rate used in computing the present worth cost is established by the Office of Management and Budget and is currently set at 2.5%.

The salvage value is calculated at the end of 20 years, and where portions of the project structures or equipment may have salvage value, it is determined using a straight-line depreciation. The present value of the salvage value is computed using the discount rate of 2.5%.

The cost of labor, equipment and materials is not escalated over the 20-year life, assuming that any increases in these costs would apply equally to all alternatives. For the purpose of the present worth analysis, the energy costs between the principal alternatives were assumed to escalate at the same rate over the 20-year period.

To ensure uniformity of the cost comparisons, the following cost comparison details have been specifically addressed and applied in the present worth analysis:

- Capital costs were included for all identified improvements.
- Financing costs and capitalized interest were included.
- NPW period of 20 years was used.
- Operation, maintenance, and replacement (OM&R) costs were included in the present worth accumulated over the 20-year period.
- Discount rate of 2.5%, as identified by the Office of Management and Budget and required by Rural Development.
- Salvage values were included in the present worth cost as a value subtracted from the project cost.

Collection System

A summary of the present worth analysis for the collection system is presented in Table 5 of Appendix C. This table represents the costs associated with construction, operation, and maintenance of the collection system over a 20-year planning period. This analysis will be further used in conjunction with the treatment plant costs to develop the overall recommendation.

Treatment System

A summary of the present worth analysis for the treatment system alternative is presented in Table 5 of Appendix C.

B. Non-Monetary Factors

Other considerations, which are addressed and could provide a basis of comparison of the alternatives, include residuals management, industrial waste treatment needs, facility growth capacity/expandability, and reliability. The following summarizes these other items considered during the alternative comparison.

Industrial Waste Treatment Needs

No discharge of non-domestic flows is anticipated from commercial and industrial users. Lagoon treatment systems are not typically designed to handle higher strength or non-domestic discharges from industrial facilities.

Facility Growth Capacity/Expandability

Each of the alternatives would provide for the anticipated growth over the 20-year planning period.

C. Annual Operating Budget and Income

Income

There are no existing public sewers in the service area and therefore no existing user rate structure exists. Income is anticipated to be obtained through a combination of special assessment bonds and user charges. Preliminary discussions with the Municipal Financial Advisor (MFA) and Bond Counsel indicate that the revenue structure would be set so that income from Special Assessments would provide capital to cover expenses incurred prior to sewer connections being made,

Annual O&M Costs

Operations, Maintenance and Replacement (OM&R) costs are expected to be $65,000 for the first full year of operation (2027) including Because operating revenue will not be available until a significant number of sewer connections are made, the first full year of O&M costs have been included in the project budget.

Debt Repayments

The anticipated debt repayment for loans to pay for capital project costs are approximately $631,000 per year.

Reserves

As required , the Township will be required to build a reserve fund of 10% of the total loan debt within the first 10 years of the loan.

Total Project Cost Estimate

The total capital cost for the recommended alternative is estimated to be $14,138,000. This includes the estimated construction, and construction contingencies.

The total project cost includes the following additional items:

- Construction and construction contingencies: $11,220,000
- Operations and Maintenance expenses for the first full year after construction: $65,000
- Survey, Design, & Construction Engineering, and Bond Counsel, Financial Advisor, and Legal fees: $1,796,000

D. Project Delivery Method

EGLE published a State Revolving Funds Design Phase Guidance document in March 2015 which lists the following project delivery methods as acceptable for use in the DWSRF program: Design-Bid-Build (DBB), Construction Management At-Risk (CMAR), Fixed-Price Design-Build (FPDB), and Progressive Design-Build (PDB).

The City is reviewing each of the available methods. A comparison/summary of each are outlined below.

Design-Bid-Build (DBB)

Many public infrastructure projects are delivered using the DBB method. In the DBB method, an engineer works closely with the City and prepares the project bidding documents including the construction drawings and specifications.

General contractors submit bids based on the plans and specifications, and the lowest, bidder responsible is awarded the project. The general contractor pricing includes their subcontractors, or trade contractors, to perform specialized work such as electrical/controls, mechanical work, pavement/concrete work, etc. Typically, the engineering firm that developed the design provides construction observation and construction administration services during the construction phase. In this alternative, there are three parties: the owner, the engineer, and the general contractor.

The DBB method offers the following advantages:

- Well-understood and accepted.
- Independent oversight of Builder.
- Open to Owner involvement during design.

The DBB method includes the following disadvantages:

- Pricing is not known until the design process is complete.
- Contractor is selected based on low bid, not on value, knowledge, and experience brought to the team.

Construction Management At-Risk (CMAR)

CMAR is similar to DBB in that the engineering/design contract is separate from the construction contract. However, in the CMAR method, a construction management firm (CM) is hired independently by the Owner before or early in the design process. An engineer works closely with the Owner and the CM during the entire design process. The CM provides input to the engineer and owner through the entire design process. The engineer prepares the construction drawings and specifications while the CM prepares the bidding documents and obtains pricing from their subcontractors and suppliers.

The CM develops a Guaranteed Maximum Price (GMP). In this alternative there are three parties: the owner, the engineer, and the independently contracted CM firm.

The CMAR method offers the following advantages:

- Open to owner involvement during design.
- Early integration of builder.
- Provides early and continuous constructability review.
- Provides early certainty of costs.
- Pricing and design may be conducted in parallel.
- Reduced likelihood of claims compared to the DBB alternative.

The CMAR method includes the following disadvantages:

- Not a single source of responsibility.
- No legal obligation linking designer to builder.
- Potential for disputes, claims, and change orders.

Fixed-Price Design-Build (FPDB)

Fixed Price Design Build (FPDB) is a delivery method where the owner designates one firm, a design-builder (DB), under one contract for the design and construction of the project. The DB provides a fixed price based on a defined scope, requirements, and schedule; but before complete and detailed design documents have been prepared.

Owner involvement during the design process is typically very limited after the fixed price is accepted. The “book is closed” on pricing around the 30% mark of the design process.

Progressive Design-Build (PDB)

The PDB delivery method is similar to the CMAR method with one major distinction – the design-builder (DB) is under one contract for design and construction of the project. Therefore, the Owner has one single firm responsible for the design, schedule, construction, and warranty of the project. If there are issues that arise during construction or after construction, the Owner has one firm to address the issues.

During the latter part of the design phase, the DB prepares the bidding documents and obtains pricing from their subcontractors and suppliers on an open book basis.

If an agreement is reached on the pricing, the Owner will move forward collaboratively to construction. With such flexibility, the PDB method allows the owner to improve the project outcome by participating directly in design decisions. In this alternative there are two parties – the owner and the DB firm.

The PDB method offers the following advantages:

- The owner can transfer more risk to the DB since there is a single point of responsibility for the design, permitting, construction, and performance warranty of the project.
- Owner is involved during the entire design and construction.
- Early integration of builder.
- Provides early and continuous constructability review.
- Provides early certainty of costs.
- Pricing and design may be conducted in parallel.

Project Delivery Selection

The Township and the engineering firm that developed the Project Plan will have discussions regarding the available project delivery methods and the advantages and disadvantages offered by each method to develop the preferred method for the Owner. Based on preliminary discussions, it is anticipated that the Owner will proceed with the Design-Bid-Build or Progressive Design-Build delivery method for the project.

G. Proposed Project (Recommended Alternative)

A. Collection System

The recommended collection system alternative is the Low-Pressure STEP system. A preliminary collection system layout is included as Figure 4 of Appendix A. The Low-Pressure STEP collection system provides the most protection for the health and safety of the community and Miner Lake water quality by collecting the most septic system discharge from the Miner Lake watershed and is the best value for the study area. Further, the directional drilling construction methods offer the least amount of environmental and economic disruption to the area.

B. Wastewater Treatment

The recommended wastewater treatment alternative is Regionalization with the City of Allegan. This was the only feasible and cost-effective treatment system alternative, and it met the project objectives.

C. Project Funding and Staging Approach

Due to the large size and significant cost of the project, a staged approach to the design and construction of the project could be feasible. When considering staging of the project, it will be important to consider factors including feasibility of constructing certain components as stand-alone infrastructure, and balancing collection and treatment capacity with the number of users in each stage of construction. In addition, factors such as the creation of a special assessment district and available funding through USDA and other programs will impact project timing and approach.

Timing of the project will also be important. While the project needs can technically be approached in segments, subsequent stages of the project will need to follow relatively promptly in part due to time limitations on use of special assessment funds as well as public concern and perception of fairness. Fortunately, because a STEP collection system has been selected as the recommended alternative, constructing the collection system in segments will be relatively straight forward, and easy to partition based on funds available. The collection system can be designed and constructed from the downstream portion of the project at the connection to Allegan's wastewater collection system and expanded outward in segments.

The first stage of the project would include construction of the primary lift station and forcemain to the City of Allegan as well as the first portion of the collection system, with additional stages of the collection system constructed as funding becomes available. It would be prudent to initially construct enough collection system to connect a significant number of users to be able to offset the initial costs. The initial stages of the project are the most critical to fund at a high level in order to create a sizable user base that can sustain the debt retirement and operating costs. Most of the costs including permitting, purchase of property, clearing, grading sitework, and utilities will be required under the first stage of the project.

Detailed scenarios of staged costs versus user generated revenue will be developed after the available funding levels have been established, but in general, a segmented approach will have a higher total capital cost when compared to a single project due to the economy of scale.

D. Schedule for Design and Construction

The following table shows an approximate construction schedule based on historical milestone schedules

Milestone	Anticipated Date
Submit Final CWSRF Project Plan to EGLE	May 2025
Submit Preliminary Plans & Specifications	January 2026
Submit Final Plans & Specifications	March 2026
Bidding	May 2026
EGLE Order of Approval	August 2026
Begin Construction	September/October 2026
Complete Construction	September 2027
Project Closeout/Record Drawings	November/December 2027

H. Public Participation

A. Public Meeting

A Public Meeting was held on April 29, 2025 at 6:00 PM at the Township Hall located at 3037 118th Avenue, Allegan, Michigan, 49010

I. Public Meeting Advertisement

Prior to the public hearing, a copy of the Draft Project Plan was made available to the public for a 15-day period at the Township and as stated in the public hearing notice.

J. Public Meeting Summary

- Matt Johnson from Fleis and VandenBrink presented on the proposed project plan.
- The following questions, comments, and responses were discussed at the meeting.

1. Michelle Waite asked who will be maintaining the system and how was the maintenance fee determined.
    - Mr. Johnson and Mr. Jim Connell explained the party responsible to maintain the system has not been determined. It will most likely be the City of Allegan. The fee is an estimate based on the required funds to replace the STEP pumps
2. Ed Ellinger asked how many vacant lots are present and how many will be assessed.
    - Mr. Johnson explained there 54 vacant lots around the lake and how many will be assessed is still to be determined.
3. Steve Shultz asked if the City of Allega allows sanitary sewer to metered rather than a flat rate
    - Mr. Johnosn explained the City is open to metering flow rather than just providing a flat rate.
4. Ron Gordon asked if the future costs of not installing the system were calculated.
    - Mr. Johnson explained there are future costs to install new septic tanks and future costs for further damage to the Lake. These costs are difficult to calculate.
5. Rick Lussenhop asked if he read in an F&V report about the effects of too much fertilizer in the lakes and the inability to recover
    - Mr. Johnson explained a separate copy has drafted environmental reports for the Lake and he may be thinking of that report.

K. Public Hearing Written Comments and Answers

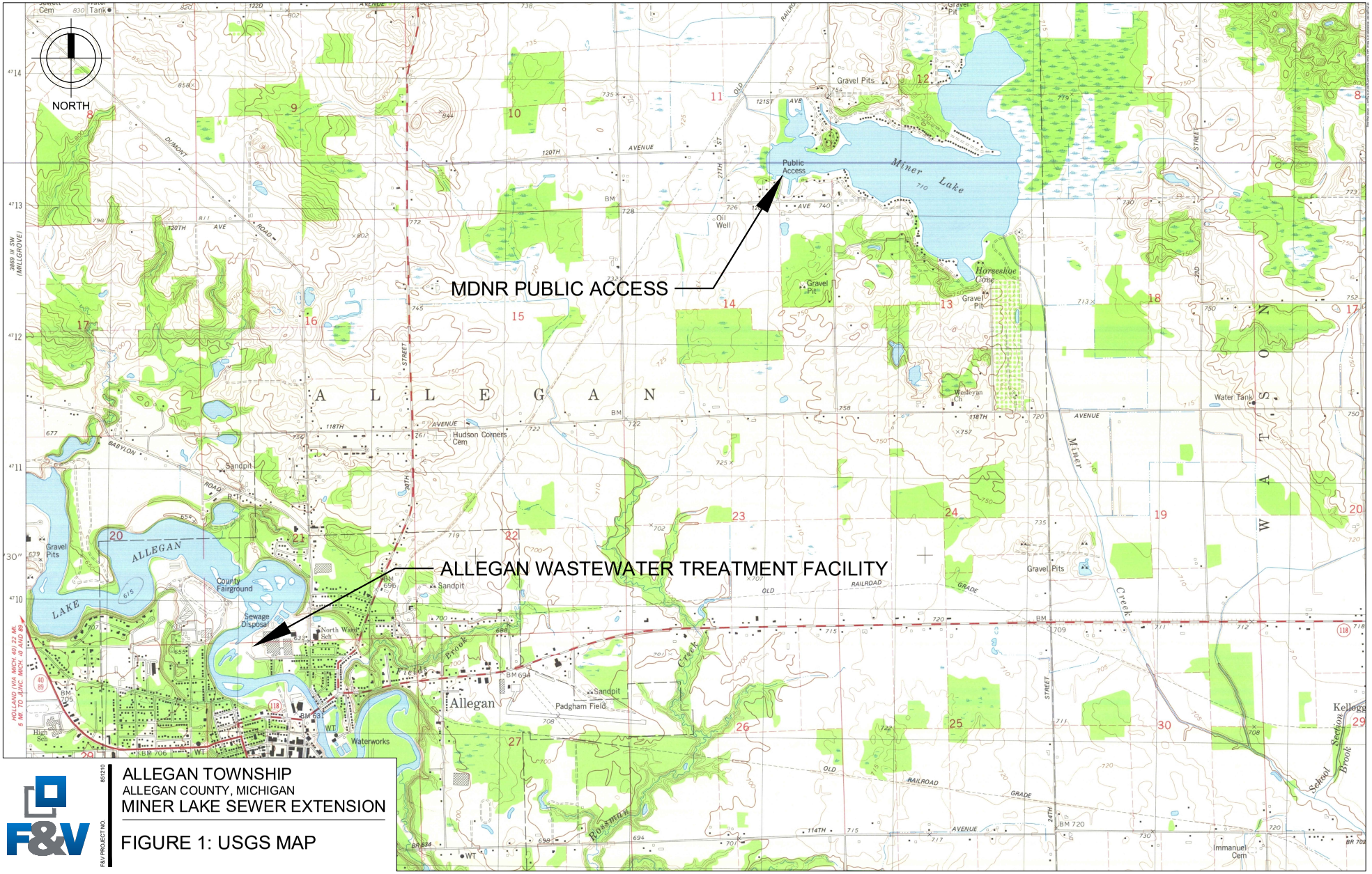
No written comments were received prior to the meeting.

L. Adoption of the Project Plan

The Township passed resolution No. 25-02 adopting the project plan and the recommended alternative to install a STEP system and discharge waste to the City of Allegan.

Appendix A

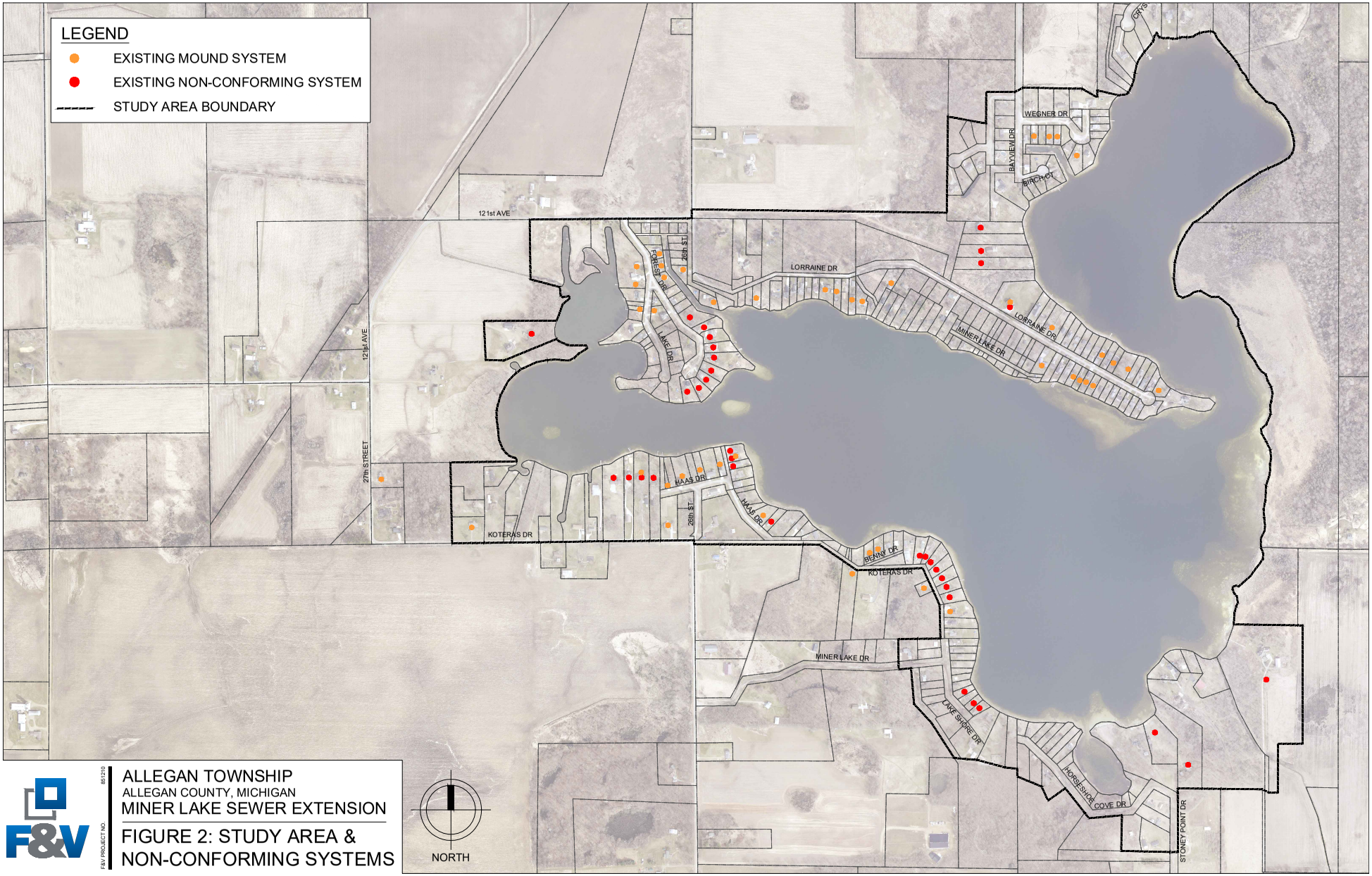
Figures



ALLEGAN TOWNSHIP
ALLEGAN COUNTY, MICHIGAN
MINER LAKE SEWER EXTENSION

FIGURE 1: USGS MAP

F&V PROJECT NO. 851210

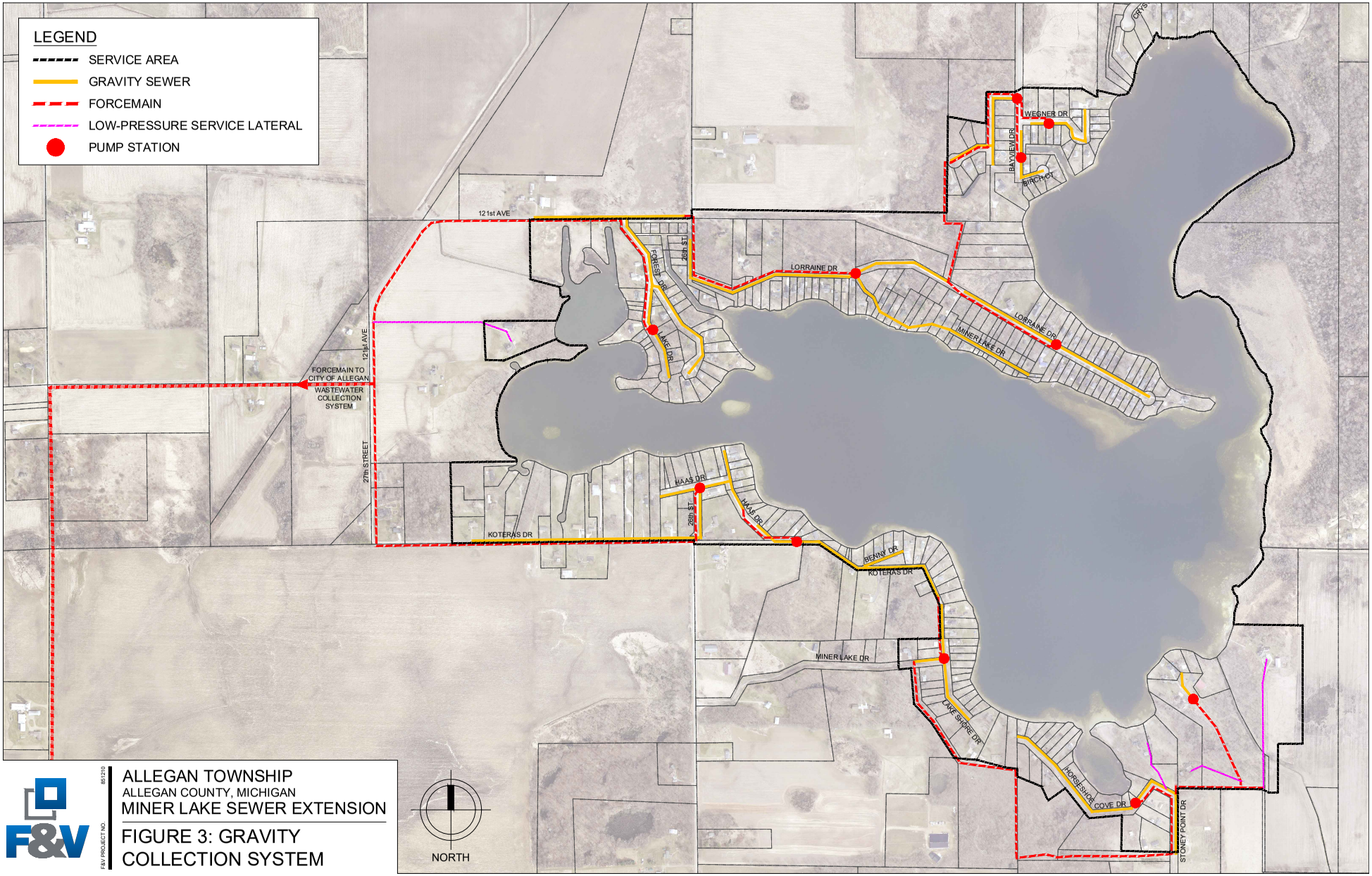


F&V

F&V PROJECT NO. 851210

ALLEGAN TOWNSHIP
ALLEGAN COUNTY, MICHIGAN
MINER LAKE SEWER EXTENSION

FIGURE 2: STUDY AREA & NON-CONFORMING SYSTEMS

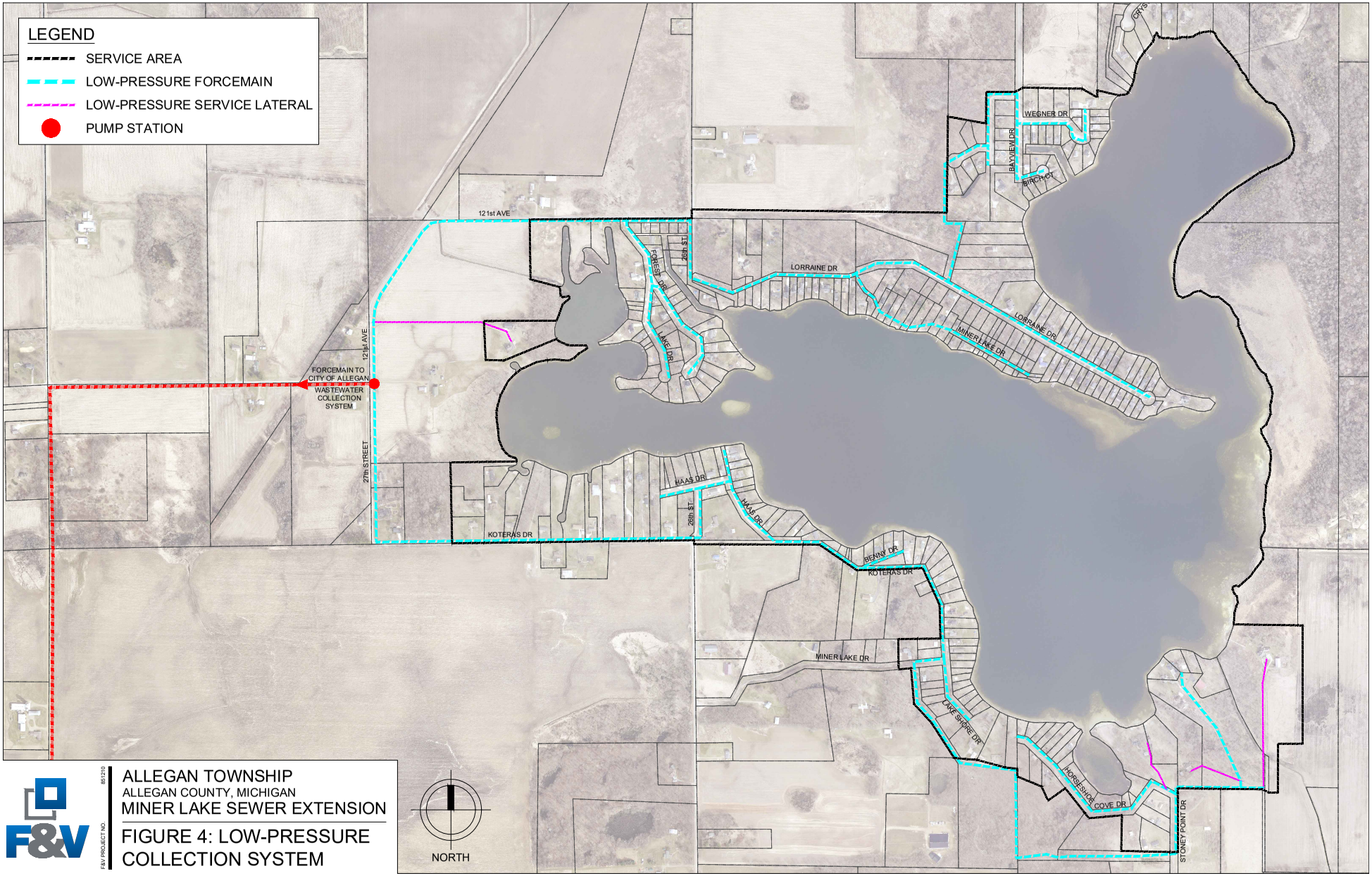


F&V

F&V PROJECT NO. 851210

ALLEGAN TOWNSHIP
ALLEGAN COUNTY, MICHIGAN
MINER LAKE SEWER EXTENSION

FIGURE 3: GRAVITY COLLECTION SYSTEM

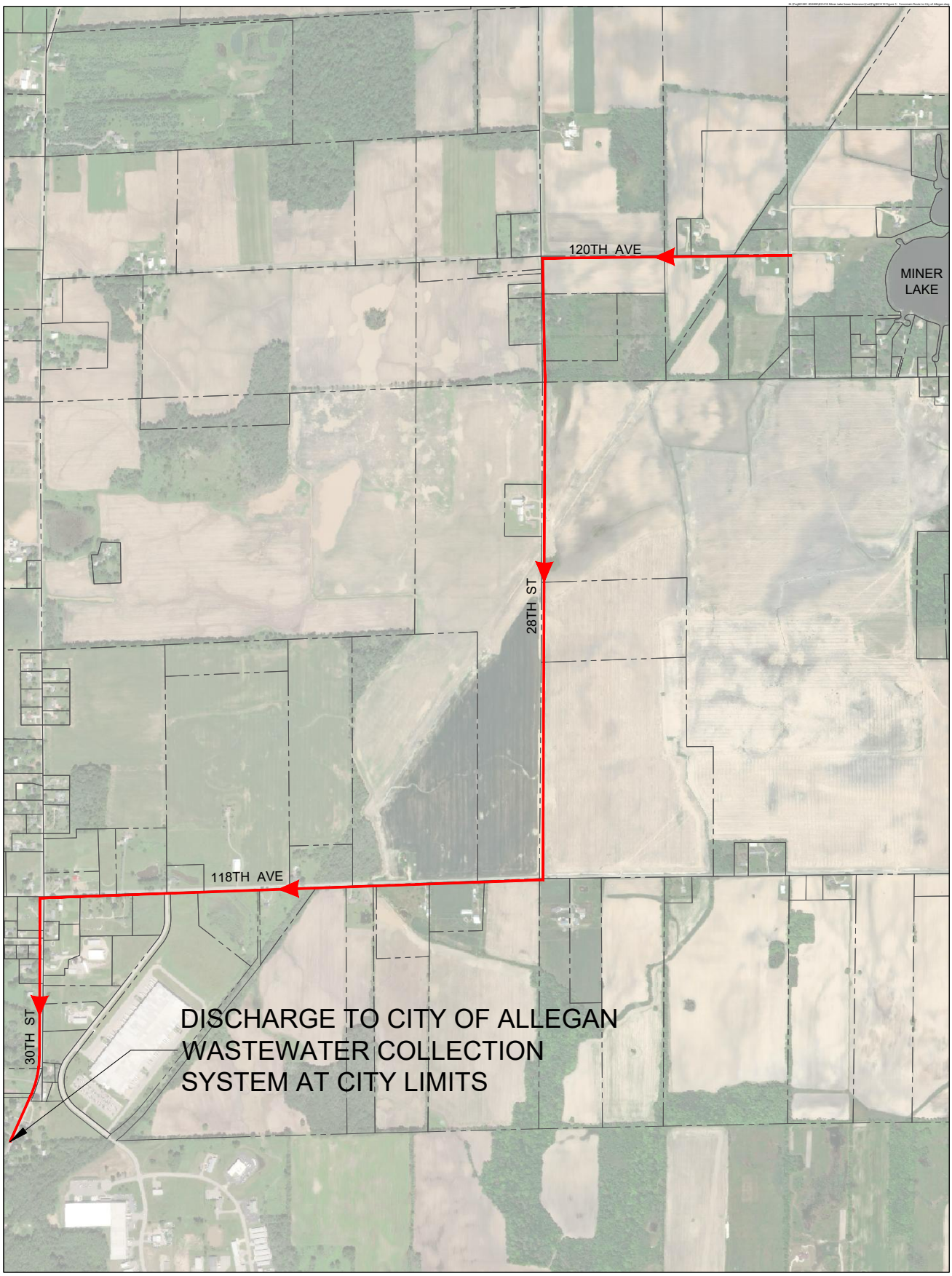


F&V

F&V PROJECT NO. 851210

ALLEGAN TOWNSHIP
ALLEGAN COUNTY, MICHIGAN
MINER LAKE SEWER EXTENSION

FIGURE 4: LOW-PRESSURE COLLECTION SYSTEM

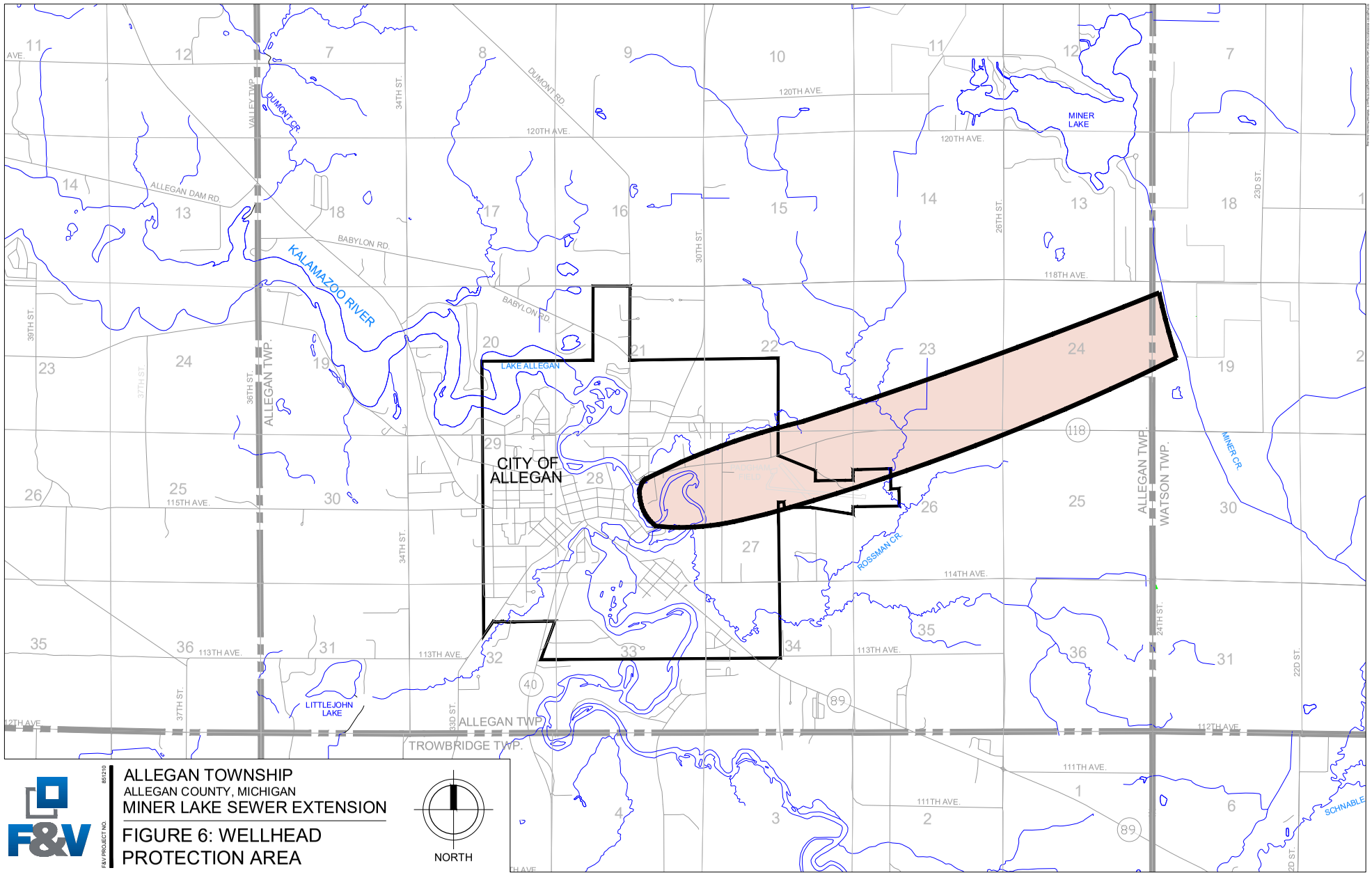


F&V PROJECT NO. 8612.10

ALLEGAN TOWNSHIP
ALLEGAN COUNTY, MICHIGAN
MINER LAKE SEWER EXTENSION

FIGURE 5: FORCEMAIN ROUTE TO CITY OF ALLEGAN

NORTH

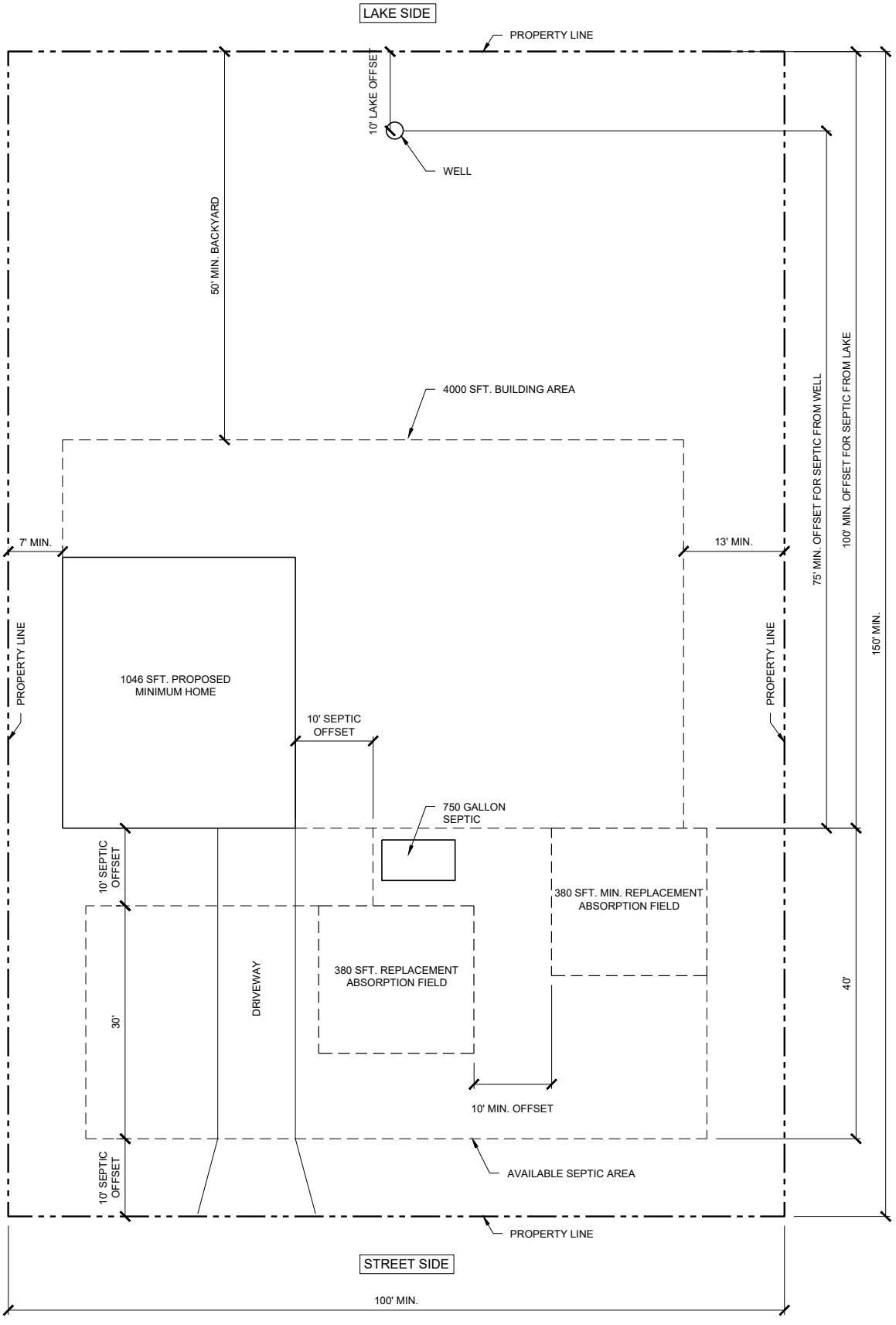


F&V

F&V PROJECT NO. 851210

ALLEGAN TOWNSHIP
ALLEGAN COUNTY, MICHIGAN
MINER LAKE SEWER EXTENSION

FIGURE 6: WELLHEAD PROTECTION AREA



NOTES:
- No garbage disposal, hot tub, or water softener discharge with this septic size
- Assume 1-2 bedroom home
- Soil Perculation Rate of 11-15 min/inch, moderate to poor soils

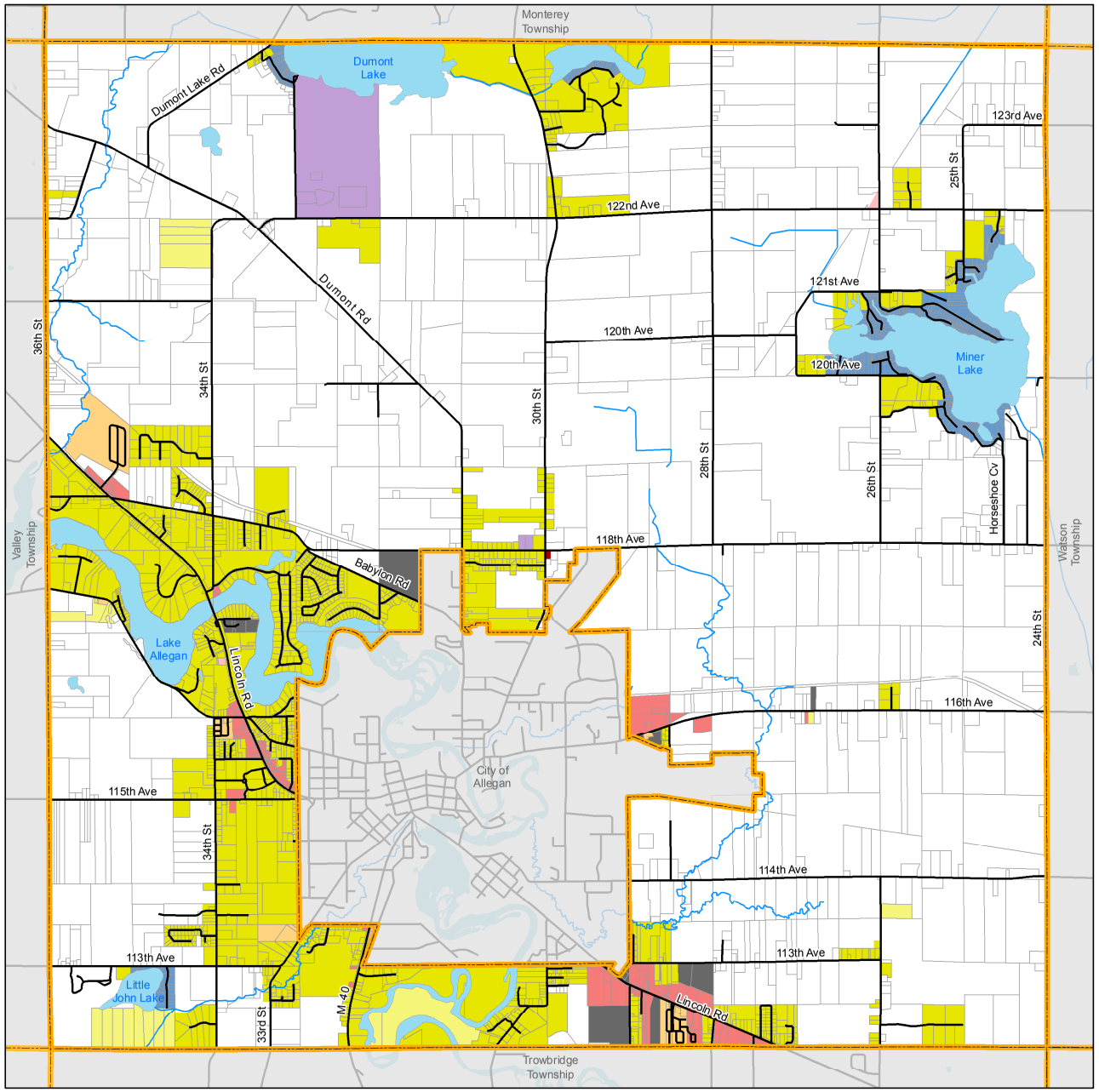
ALLEGAN TOWNSHIP
ALLEGAN COUNTY, MICHIGAN

MINER LAKE SEWER EXTENSION

FIGURE 7: MINIMUM ISOLATION REQUIREMENTS

F&V PROJECT NO. 851210

F&V



Allegan Township

Allegan County, Michigan

DRAFT
Zoning Map
December 29, 2015

Legend

- A - Agriculture
- R1 - Residential
- R2 - Residential
- R3 - Residential
- LR - Lake Residential
- C1 - Commercial
- C2 - Commercial
- C2 - Commercial*
- GS - Government Service
- I1 - Industrial

* Property was rezoned to C2 conditionally. See condtions for specific C-2 zoning boundary and permitted uses on this parcel.

1 inch = 3,250 feet

0 3,250 6,500 13,000 Feet

williams&works
engineers | surveyors | planners

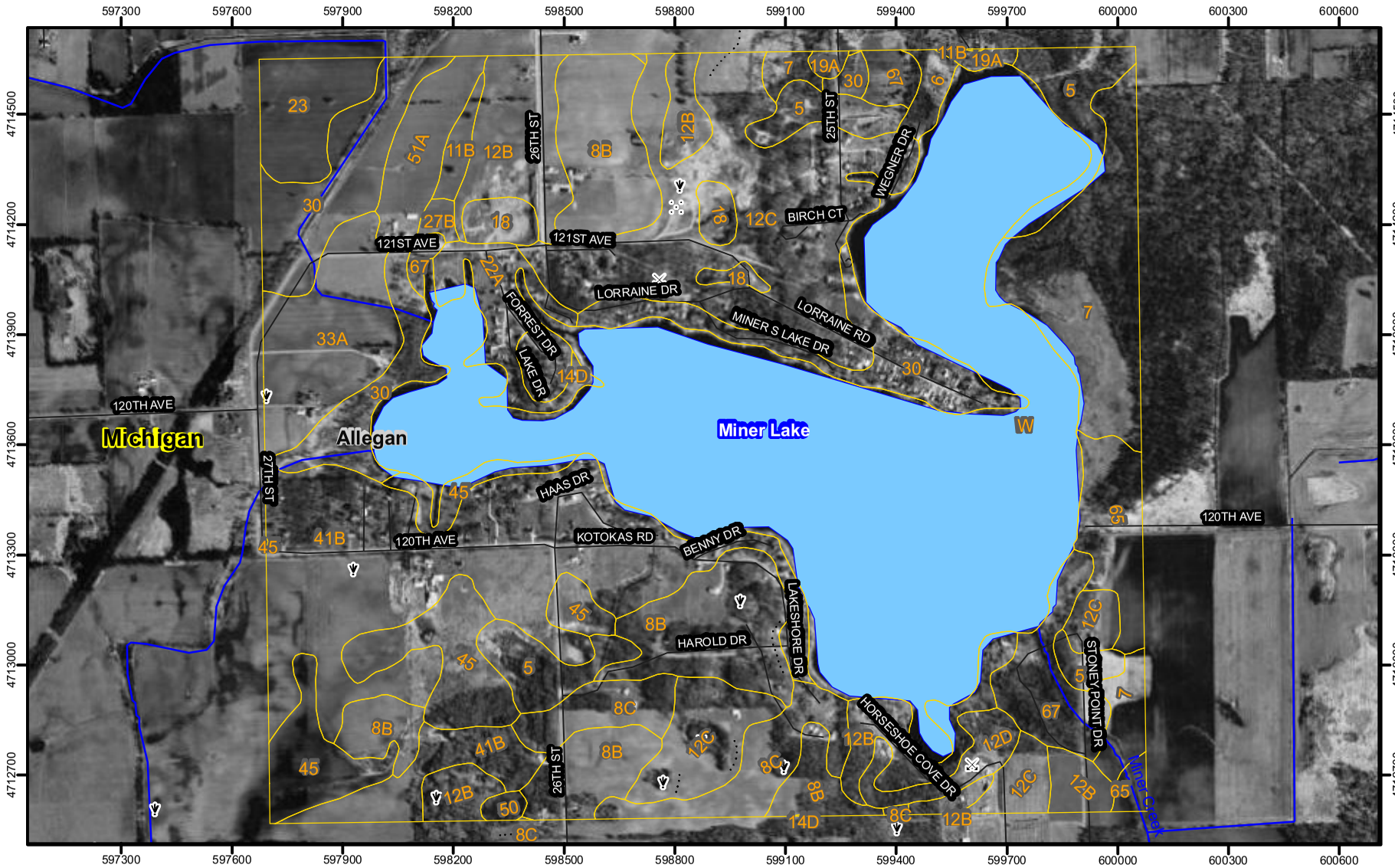

597300
597600
597900
598200
598500
598800
599100
599400
599700
600000
600300
600600
4714500
4714200
4713900
4713600
4713300
4713000
4712700
Miner Lake
Allegan
Michigan
120TH AVE
121ST AVE
26TH ST
25TH ST
27TH ST
WEGNER DR
BIRCH CT
LORRAINE DR
LORRAINE RD
MINER S LAKE DR
FORREST DR
LAKE DR
HAAS DR
KOTOKAS RD
BENNY DR
HAROLD DR
LAKESHORE DR
HORSESHOE COVE DR
STONEY POINT DR
Miner Creek
Meters
0 150 300 600
Feet
0 500 1,000 2,000 3,000 4,000

Figure 9

MAP LEGEND

- Soil Map Units
- Cities
- Detailed Counties
- Detailed States
- Interstate Highways
- Roads
- Rails
- Water
- Hydrography
- Oceans
- Escarpment, bedrock
- Escarpment, non-bedrock
- Gulley
- Levee
- Slope
- Blowout
- Borrow Pit
- Clay Spot
- Depression, closed
- Eroded Spot
- Gravel Pit
- Gravelly Spot
- Gulley
- Lava Flow
- Landfill
- Marsh or Swamp
- Miscellaneous Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Slide or Slip
- Sinkhole
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Perennial Water
- Wet Spot

MAP INFORMATION

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov

Coordinate System: UTM Zone 16

Soil Survey Area: Allegan County, Michigan
Spatial Version of Data: 5
Soil Map Compilation Scale: 1:15840

Map comprised of aerial images photographed on these dates:
3/27/1999; 4/13/1999

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.

Figure 9

Tables - Septic Tank Absorption Fields

Summary by Map Unit - Allegan County, Michigan

Soil Survey Area Map Unit Symbol	Map Unit Name	Rating	Component Name (Percent)	Rating Reasons	Total Acres in AOI	Percent of AOI
5	Houghton muck	Very limited	Houghton (100%)	Depth to saturated zone Subsidence Seepage, bottom layer Ponding	54.3	4.1
6	Adrian muck	Very limited	Adrian (100%)	Depth to saturated zone Subsidence Seepage, bottom layer Ponding	9.0	0.7
7	Palms muck	Very limited	Palms (100%)	Depth to saturated zone Subsidence Ponding Slow water movement	66.6	5.0
8B	Glynwood clay loam, 1 to 6 percent slopes	Very limited	Glynwood (93%)	Slow water movement Depth to saturated zone	85.7	6.4
			Blount (7%)	Depth to saturated zone Slow water movement		

Summary by Map Unit - Allegan County, Michigan

Soil Survey Area Map Unit Symbol	Map Unit Name	Rating	Component Name (Percent)	Rating Reasons	Total Acres in AOI	Percent of AOI
8C	Glynwood clay loam, 6 to 12 percent slopes	Very limited	Glynwood (90%)	Slow water movement	25.6	1.9
				Depth to saturated zone		
				Slope		
			Blount (5%)	Depth to saturated zone		
				Slow water movement		
			Marlette (5%)	Slow water movement		
				Slope		
11B	Oshtemo-Chelsea complex, 0 to 6 percent slopes	Very limited	Oshtemo (65%)	Seepage, bottom layer	13.6	1.0
			Chelsea (27%)	Seepage, bottom layer		
				Filtering capacity		
			Ockley (4%)	Seepage, bottom layer		
				Slow water movement		
			Brady (4%)	Depth to saturated zone		
				Seepage, bottom layer		

Summary by Map Unit - Allegan County, Michigan

Soil Survey Area Map Unit Symbol	Map Unit Name	Rating	Component Name (Percent)	Rating Reasons	Total Acres in AOI	Percent of AOI
11C	Oshtemo-Chelsea complex, 6 to 12 percent slopes	Very limited	Oshtemo (60%)	Seepage, bottom layer	2.1	0.2
				Slope		
			Chelsea (35%)	Seepage, bottom layer		
				Filtering capacity		
				Slope		
			Brady (3%)	Depth to saturated zone		
				Seepage, bottom layer		
			Ockley (2%)	Seepage, bottom layer		
				Slow water movement		
				Slope		
12B	Ockley loam, 1 to 6 percent slopes	Very limited	Ockley (87%)	Seepage, bottom layer	66.4	5.0
				Slow water movement		
			Brady (7%)	Depth to saturated zone		
				Seepage, bottom layer		
			Chelsea (6%)	Seepage, bottom layer		
				Filtering capacity		

Summary by Map Unit - Allegan County, Michigan

Soil Survey Area Map Unit Symbol	Map Unit Name	Rating	Component Name (Percent)	Rating Reasons	Total Acres in AOI	Percent of AOI
12C	Ockley loam, 6 to 12 percent slopes	Very limited	Ockley (93%)	Seepage, bottom layer	137.2	10.3
				Slow water movement		
				Slope		
			Brady (7%)	Depth to saturated zone		
				Seepage, bottom layer		
12D	Ockley loam, 12 to 18 percent slopes	Very limited	Ockley (87%)	Seepage, bottom layer	7.6	0.6
				Slope		
				Slow water movement		
			Brady (13%)	Depth to saturated zone		
				Seepage, bottom layer		

Summary by Map Unit - Allegan County, Michigan

Soil Survey Area Map Unit Symbol	Map Unit Name	Rating	Component Name (Percent)	Rating Reasons	Total Acres in AOI	Percent of AOI
14D	Marlette loam, 12 to 18 percent slopes	Very limited	Marlette (90%)	Slow water movement	5.8	0.4
				Slope		
			Oshtemo (4%)	Slope		
				Seepage, bottom layer		
			Chelsea (4%)	Seepage, bottom layer		
				Slope		
				Filtering capacity		
			Capac (2%)	Depth to saturated zone		
				Slow water movement		
18	Pits	Not rated	Pits (100%)		11.8	0.9
19A	Brady sandy loam, 0 to 3 percent slopes	Very limited	Brady (87%)	Depth to saturated zone	11.3	0.9
				Seepage, bottom layer		
			Sebewa (7%)	Depth to saturated zone		
				Seepage, bottom layer		
				Ponding		
				Slow water movement		
			Oshtemo (6%)	Seepage, bottom layer		

Summary by Map Unit - Allegan County, Michigan

Soil Survey Area Map Unit Symbol	Map Unit Name	Rating	Component Name (Percent)	Rating Reasons	Total Acres in AOI	Percent of AOI
22A	Matherton loam, 0 to 3 percent slopes	Very limited	Matherton (93%)	Depth to saturated zone	20.2	1.5
				Seepage, bottom layer		
				Slow water movement		
			Sebewa (4%)	Depth to saturated zone		
				Seepage, bottom layer		
				Ponding		
				Slow water movement		
			Oshtemo (3%)	Seepage, bottom layer		
23	Sebewa loam	Very limited	Sebewa (93%)	Depth to saturated zone	41.6	3.1
				Seepage, bottom layer		
				Ponding		
				Slow water movement		
			Matherton (4%)	Depth to saturated zone		
				Seepage, bottom layer		
				Slow water movement		
			Brady (3%)	Depth to saturated zone		
				Seepage, bottom layer		
27B	Metea loamy fine sand, 1 to 6 percent slopes	Somewhat limited	Metea (90%)	Slow water movement	2.3	0.2

Summary by Map Unit - Allegan County, Michigan

Soil Survey Area Map Unit Symbol	Map Unit Name	Rating	Component Name (Percent)	Rating Reasons	Total Acres in AOI	Percent of AOI
30	Colwood silt loam	Very limited	Colwood (87%)	Depth to saturated zone	98.1	7.4
				Slow water movement		
				Ponding		
			Granby (13%)	Depth to saturated zone		
				Seepage, bottom layer		
				Filtering capacity		
				Ponding		
33A	Kibbie fine sandy loam, 0 to 3 percent slopes	Very limited	Kibbie (93%)	Depth to saturated zone	55.9	4.2
				Slow water movement		
			Colwood (3%)	Depth to saturated zone		
				Slow water movement		
				Ponding		
			Rimer (2%)	Slow water movement		
				Depth to saturated zone		
			Thetford (2%)	Depth to saturated zone		
				Seepage, bottom layer		

Summary by Map Unit - Allegan County, Michigan

Soil Survey Area Map Unit Symbol	Map Unit Name	Rating	Component Name (Percent)	Rating Reasons	Total Acres in AOI	Percent of AOI
41B	Blount silt loam, 1 to 4 percent slopes	Very limited	Blount (90%)	Depth to saturated zone	154.1	11.6
				Slow water movement		
			Rimer (3%)	Slow water movement		
				Depth to saturated zone		
			Pewamo (3%)	Depth to saturated zone		
				Slow water movement		
				Ponding		
			Seward (2%)	Slow water movement		
				Depth to saturated zone		
			Glynwood (2%)	Slow water movement		
				Depth to saturated zone		
42B	Metamora sandy loam, 1 to 4 percent slopes	Very limited	Metamora (90%)	Depth to saturated zone	0.2	0.0
				Slow water movement		
			Rimer (5%)	Slow water movement		
				Depth to saturated zone		

Summary by Map Unit - Allegan County, Michigan

Soil Survey Area Map Unit Symbol	Map Unit Name	Rating	Component Name (Percent)	Rating Reasons	Total Acres in AOI	Percent of AOI
			Corunna (5%)	Depth to saturated zone		
				Slow water movement		
				Ponding		
45	Pewamo silt loam	Very limited	Pewamo (91%)	Depth to saturated zone	53.5	4.0
				Slow water movement		
				Ponding		
			Blount (5%)	Depth to saturated zone		
				Slow water movement		
			Belleville (4%)	Depth to saturated zone		
				Slow water movement		
				Ponding		
51A	Thetford loamy fine sand, 0 to 4 percent slopes	Very limited	Thetford (88%)	Depth to saturated zone	20.3	1.5
				Seepage, bottom layer		
			Granby (6%)	Depth to saturated zone		
				Seepage, bottom layer		
				Filtering capacity		
				Ponding		
			Kibbie (6%)	Depth to saturated zone		
				Slow water movement		

Summary by Map Unit - Allegan County, Michigan

Soil Survey Area Map Unit Symbol	Map Unit Name	Rating	Component Name (Percent)	Rating Reasons	Total Acres in AOI	Percent of AOI
65	Cohoctah silt loam, protected	Very limited	Cohoctah (90%)	Depth to saturated zone	20.8	1.6
				Seepage, bottom layer		
				Ponding		
				Flooding		
			Sloan (4%)	Flooding		
				Depth to saturated zone		
				Slow water movement		
			Palms (3%)	Depth to saturated zone		
				Subsidence		
				Ponding		
				Slow water movement		
			Glendora (3%)	Flooding		
				Depth to saturated zone		
				Seepage, bottom layer		
				Filtering capacity		
67	Martisco muck	Very limited	Martisco (100%)	Flooding	27.8	2.1
				Slow water movement		
				Depth to saturated zone		
				Ponding		
W	Water	Not rated	Water (100%)		337.0	25.4

Summary by Rating Value

Rating	Total Acres in AOI	Percent of AOI
Very limited	977.8	73.6
Not rated	348.8	26.2
Somewhat limited	2.3	0.2

Description - Septic Tank Absorption Fields

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 60 inches is evaluated. The ratings are based on the soil properties that affect absorption of the effluent, construction and maintenance of the system, and public health. Saturated hydraulic conductivity (Ksat), depth to a water table, ponding, depth to bedrock or a cemented pan, and flooding affect absorption of the effluent. Stones and boulders, ice, and bedrock or a cemented pan interfere with installation. Subsidence interferes with installation and maintenance. Excessive slope may cause lateral seepage and surfacing of the effluent in downslope areas.

Some soils are underlain by loose sand and gravel or fractured bedrock at a depth of less than 4 feet below the distribution lines. In these soils the absorption field may not adequately filter the effluent, particularly when the system is new. As a result, the ground water may become contaminated.

The ratings are both verbal and numerical. Rating class terms indicate the extent to which the soils are limited by all of the soil features that affect the specified use. "Not limited" indicates that the soil has features that are very favorable for the specified use. Good performance and very low maintenance can be expected. "Somewhat limited" indicates that the soil has features that are moderately favorable for the specified use. The limitations can be overcome or minimized by special planning, design, or installation. Fair performance and moderate maintenance can be expected. "Very limited" indicates that the soil has one or more features that are unfavorable for the specified use. The limitations generally cannot be overcome without major soil reclamation, special design, or expensive installation procedures. Poor performance and high maintenance can be expected.

Numerical ratings indicate the severity of individual limitations. The ratings are shown as decimal fractions ranging from 0.01 to 1.00. They indicate gradations between the point at which a soil feature has the greatest negative impact on the use (1.00) and the point at which the soil feature is not a limitation (0.00).

Parameter Summary - Septic Tank Absorption Fields

Aggregation Method: Dominant Condition

Component Percent Cutoff:

Tie-break Rule: Higher

DEPTH TO WATER TABLE RATING FOR ALLEGAN COUNTY, MICHIGAN

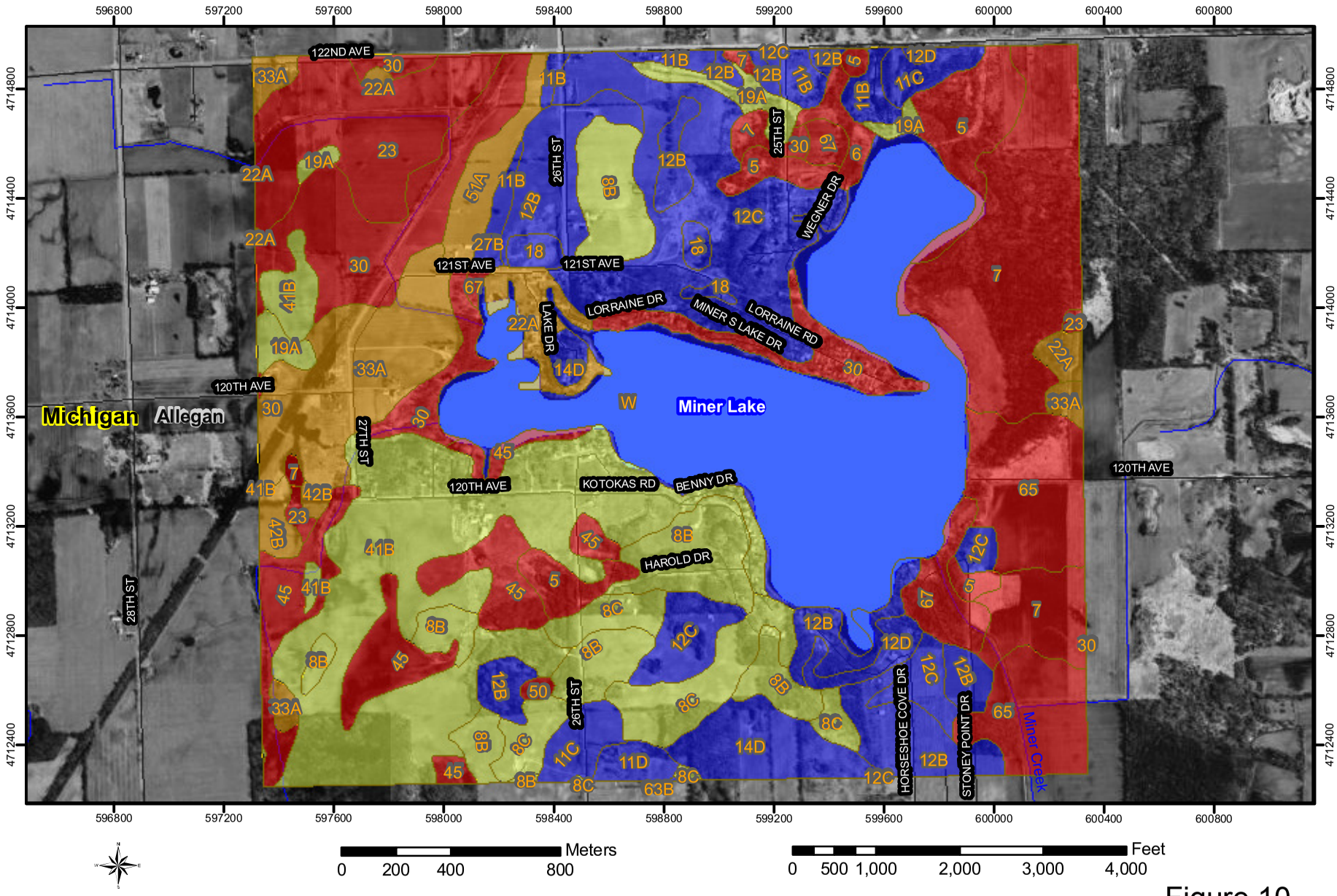


Figure 10

DEPTH TO WATER TABLE RATING FOR ALLEGAN COUNTY, MICHIGAN

MAP LEGEND

Depth to Water Table

(January to December), {Dominant Component, <}, [cm]

- 0 - 25
- 25 - 50
- 50 - 100
- 100 - 150
- 150 - 200
- > 200
- Soil Map Units
- Cities
- Detailed Counties
- Detailed States
- Interstate Highways
- Roads
- Rails
- Water
- Hydrography
- Oceans

MAP INFORMATION

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov

Coordinate System: UTM Zone 16

Soil Survey Area: Allegan County, Michigan
Spatial Version of Data: 5
Soil Map Compilation Scale: 1:15840

Map comprised of aerial images photographed on these dates:
3/27/1999; 4/13/1999

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.

Figure 10

SEPTIC TANK ABSORPTION FIELDS RATING FOR ALLEGAN COUNTY, MICHIGAN

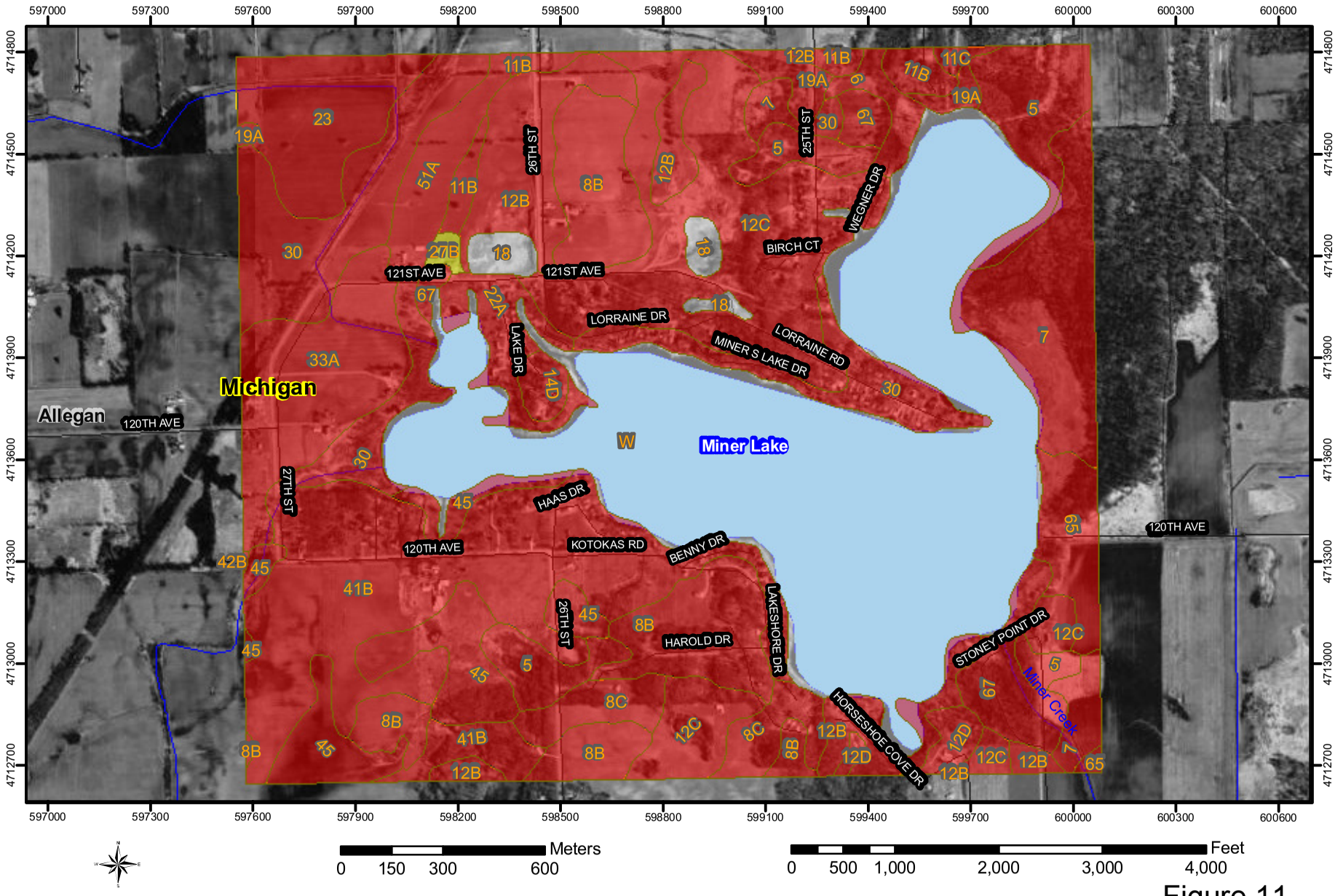


Figure 11

MAP LEGEND

Septic Tank Absorption Fields

{Dominant Condition, >}

- Very limited
- Somewhat limited
- Not limited
- Not rated or not available
- Soil Map Units
- Cities
- Detailed Counties
- Detailed States
- Interstate Highways
- Roads
- Rails
- Water
- Hydrography
- Oceans

MAP INFORMATION

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov

Coordinate System: UTM Zone 16

Soil Survey Area: Allegan County, Michigan
Spatial Version of Data: 5
Soil Map Compilation Scale: 1:15840

Map comprised of aerial images photographed on these dates:
3/27/1999; 4/13/1999

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.

Figure 11

Appendix B

Bond Schedule

Bond Schedule

Date: ***04/30/25***

Borrower Name: **Allegan Township** ***Type of Bond:*** **Revenue**
Interest Rate: 2.000%
Yrs Deferred Principle 0
Principal: **$14,138,000** (round to nearest $1000)
Ammort. Factor 0.0446
Ammortized Payment: $631,261

Year	1st Interest	2nd Interest	Principal Paid	Total Year Payment	Loan Balance
					14,138,000
1	141,380	141,380	349,000	631,760	13,789,000
2	137,890	137,890	355,000	630,780	13,434,000
3	134,340	134,340	363,000	631,680	13,071,000
4	130,710	130,710	370,000	631,420	12,701,000
5	127,010	127,010	377,000	631,020	12,324,000
6	123,240	123,240	385,000	631,480	11,939,000
7	119,390	119,390	392,000	630,780	11,547,000
8	115,470	115,470	400,000	630,940	11,147,000
9	111,470	111,470	408,000	630,940	10,739,000
10	107,390	107,390	416,000	630,780	10,323,000
11	103,230	103,230	425,000	631,460	9,898,000
12	98,980	98,980	433,000	630,960	9,465,000
13	94,650	94,650	442,000	631,300	9,023,000
14	90,230	90,230	451,000	631,460	8,572,000
15	85,720	85,720	460,000	631,440	8,112,000
16	81,120	81,120	469,000	631,240	7,643,000
17	76,430	76,430	478,000	630,860	7,165,000
18	71,650	71,650	488,000	631,300	6,677,000
19	66,770	66,770	498,000	631,540	6,179,000
20	61,790	61,790	508,000	631,580	5,671,000
21	56,710	56,710	518,000	631,420	5,153,000
22	51,530	51,530	528,000	631,060	4,625,000
23	46,250	46,250	539,000	631,500	4,086,000
24	40,860	40,860	550,000	631,720	3,536,000
25	35,360	35,360	561,000	631,720	2,975,000
26	29,750	29,750	572,000	631,500	2,403,000
27	24,030	24,030	583,000	631,060	1,820,000
28	18,200	18,200	595,000	631,400	1,225,000
29	12,250	12,250	607,000	631,500	618,000
30	6,180	6,180	619,000	631,360	0

Appendix C

Tables

FLEIS&VANDENBRINK
DESIGN. BUILD. OPERATE.

Project No.: 851210
By: PDD
Date: 10/14/2022

Project: Gravity Collection System - Alternative 1

Basis for Estimate: [x] Conceptual [ ] Basis of Design [ ] Other [ ] Final

Work: Gravity collection system to serve properies around Miner Lake, low pressure service for approximately 36 properties where gravi sewer is not feasible, 9 submersible pump stations, and 2 main pump stations with forcemain discharge to City of Allegan wastewater collection and treatment system.

Item Number	Item Description	Unit	Qty.	Unit Price	Amount
1	General Conditions, Bonds, Insurances and Mobilization, Max. 5%	Lsum	1	$ 1,039,000	$ 1,039,000
2	8" Gravity Sewer	Lft	21,400	$ 75	$ 1,605,000
3	Sanitary Manhole	EA	62	$ 5,000	$ 310,000
4	6" Wastewater Lateral	Lft	9,500	$ 35	$ 332,500
5	8"×8"×6" Wastewater Wye	EA	237	$ 500	$ 118,500
6	4" Wastewater Forcemain (parallel to gravity sewer)	Lft	9,500	$ 50	$ 475,000
7	4" Wastewater Forcemain (standalone)	Lft	29,100	$ 160	$ 4,656,000
8	Trench Undercutting and Backfill	Cyd	13,000	$ 60	$ 780,000
9	Forcemain Cleanout	EA	49	$ 4,000	$ 196,000
10	Forcemain Air Release Valve	EA	26	$ 8,500	$ 221,000
11	Grinder Service, Tank, Controls, Connection, Restoration	EA	36	$ 12,000	$ 432,000
12	Duplex Grinder Service, Tank, Controls, Connection, Restoration	EA	4	$ 50,000	$ 200,000
13	Duplex Submersible Pump Station	EA	9	$ 200,000	$ 1,800,000
14	Main Pump Station with Chemical Feed System	EA	2	$ 850,000	$ 1,700,000
15	Bituminous Removal/Replacement	Syd	117,000	$ 48	$ 5,616,000
16	Gravel Road Restoration	Syd	14,800	$ 15	$ 222,000
17	Surface Restoration	Syd	169,100	$ 6	$ 1,014,600
18	Dewatering	Lft	21,400	$ 22	$ 470,800
19	Easement Acquisition	EA	16	$ 5,000	$ 80,000
20	Creek Crossing	EA	4	$ 20,000	$ 80,000
21	Trailer-Mounted Generator	EA	2	$ 80,000	$ 160,000
22	Permanent Generator Installation	EA	2	$ 150,000	$ 300,000

The Design Professional has no control over costs or the price of labor, equipment or materials, or over the Contractor's method of pricing. Bid prices may vary significantly based on these factors and market conditions at time of bid.

Subtotal:	**$ 21,809,000**
Contingency (10%)	**$ 2,181,000**
Engineering, Legal & Administrative	**$ 3,490,000**
Total:	**$ 27,480,000**

FLEIS&VANDENBRINK
DESIGN. BUILD. OPERATE.

Project No.: 851210
By: PDD
Date: 10/14/2022

Project: Grinder Sewer System - Alternative 2

Basis for Estimate: [x] Conceptual [ ] Basis of Design [ ] Other [ ] Final

Work: Low pressure grinder collection collection system to serve properies around Miner Lake. Main pump station with chemical odor and corrosion control with discharge to City of Allegan wastewater collection and treatment system.

Item Number	Item Description	Unit	Qty.	Unit Price	Amount
1	General Conditions, Bonds, Insurances and Mobilization, Max. 5%	Lsum	1	$ 548,000	$ 548,000
2	4" Wastewater Forcemain (to City of Allegan)	Lft	17,400	$ 160	$ 2,784,000
3	4" Forcemain Cleanout	EA	22	$ 4,000	$ 88,000
4	4" Forcemain Air Rlease Valve	EA	12	$ 8,500	$ 102,000
5	Low-Pressure Sewer - Directionally Drilled	Lft	33,000	$ 52	$ 1,716,000
6	Low-Pressure Sewer Cleanout	EA	42	$ 2,500	$ 105,000
7	Low-Pressure Sewer Air Release Valve	EA	22	$ 5,000	$ 110,000
8	Grinder Service, Tank, Controls, Connection, Restoration	EA	221	$ 12,000	$ 2,652,000
9	Duplex Grinder Service, Tank, Controls, Connection, Restoration	EA	4	$ 40,000	$ 160,000
10	Low Pressure Service - Vacant Lot	EA	52	$ 2,500	$ 130,000
11	Main Pump Station with Chemical Feed System	EA	1	$ 850,000	$ 850,000
12	Bituminous Removal/Replacement	Syd	28,500	$ 50	$ 1,425,000
13	Gravel Road Restoration	Syd	14,800	$ 15	$ 222,000
14	Surface Restoration	Syd	40,300	$ 6	$ 241,800
15	Dewatering	Lsum	1	$ 25,000	$ 25,000
16	Easement Acquisition	EA	16	$ 5,000	$ 80,000
17	Spare Grinder Pump	EA	12	$ 3,000	$ 36,000
18	Creek Crossing	EA	4	$ 20,000	$ 80,000
19	Permanent Generator Installation	EA	1	$ 150,000	$ 150,000
The Design Professional has no control over costs or the price of labor, equipment or materials, or over the Contractor's method of pricing. Bid prices may vary significantly based on these factors and market conditions at time of bid.		**Subtotal:**			**$ 11,505,000**
		Contingency (10%)			**$ 1,151,000**
		Engineering, Legal & Administrative			**$ 1,841,000**
		Total:			**$ 14,497,000**

FLEIS&VANDENBRINK
DESIGN. BUILD. OPERATE.

Project No.: 851210
By: PDD
Date: 10/14/2022

Project: STEP Sewer System - Alternative 3

Basis for Estimate: [x] Conceptual [ ] Basis of Design [ ] Other [ ] Final

Work: Low pressure STEP collection collection system to serve properies around Miner Lake. Main pump station with forcemain discharge to City of Allegan wastewater collection and treatment system.

Item Number	Item Description	Unit	Qty.	Unit Price	Amount
1	General Conditions, Bonds, Insurances and Mobilization, Max. 5%	Lsum	1	$ 535,000	$ 535,000
2	4" Wastewater Forcemain (to City of Allegan)	Lft	17,400	$ 160	$ 2,784,000
3	4" Forcemain Cleanout	EA	22	$ 4,000	$ 88,000
4	4" Forcemain Air Rlease Valve	EA	12	$ 8,500	$ 102,000
5	Low-Pressure Sewer - Directionally Drilled	Lft	33,000	$ 52	$ 1,716,000
6	Low-Pressure Sewer Cleanout	EA	42	$ 2,500	$ 105,000
7	Low-Pressure Sewer Air Release Valve	EA	22	$ 5,000	$ 110,000
8	STEP Service, Tank, Controls, Connection, Restoration	EA	221	$ 11,000	$ 2,431,000
9	Duplex STEP Service, Tank, Controls, Connection, Restoration	EA	4	$ 30,000	$ 120,000
10	Low Pressure Service - Vacant Lot	Ea	52	$ 2,500	$ 130,000
11	Main Pump Station	EA	1	$ 750,000	$ 750,000
12	Bituminous Removal/Replacement	Syd	29,000	$ 50	$ 1,450,000
13	Gravel Road Restoration	Syd	14,800	$ 15	$ 222,000
14	Surface Restoration	Syd	54,000	$ 6	$ 324,000
15	Dewatering	Lsum	1	$ 25,000	$ 25,000
16	Easement Acquisition	EA	16	$ 5,000	$ 80,000
17	Spare STEP Pump	EA	12	$ 1,500	$ 18,000
18	Creek Crossing	EA	4	$ 20,000	$ 80,000
19	Permanent Generator Installation	EA	1	$ 150,000	$ 150,000

The Design Professional has no control over costs or the price of labor, equipment or materials, or over the Contractor's method of pricing. Bid prices may vary significantly based on these factors and market conditions at time of bid.

Subtotal:	**$ 11,220,000**
Contingency (10%)	**$ 1,122,000**
Engineering, Legal & Administrative	**$ 1,796,000**
Total:	**$ 14,138,000**

10/17/2022
Allegan Township Miner Lake Wastewater System
F&V Project No. 851210
Projected Wastewater Flows

FLEIS&VANDENBRINK
DESIGN. BUILD. OPERATE.

Projected Flows - Service Area					
User Type	No. of Connections	No. of REUs	Average Day Usage (gpd)	Average Day Flow (gpm)	Peak Hour Flow (gpm)
Initial flow					
Residential	229	229	40,400	28	111
Commercial	0	0	0	0	0
Total, Initial:	**229**	**229**	**40,400**	**28**	**111**
Additional Future Flow (Undeveloped Parcels)					
Residential	52	52	9,200	6	25
Commercial	0	0	0	0	0
Additional Future:	**52**	**52**	**9,200**	**6**	**25**
Total, Initial & Future:	**281**	**281**	**49,600**	**34**	**136**

Population (2.52 persons per REU): 577
Calculated Peak Factor: 3.94

FLEIS&VANDENBRINK
DESIGN. BUILD. OPERATE.

Net Present Worth Summary Table						
Alternative	Anticipated Project Year	Project Cost	Annual OM&R Cost	Net Present Worth of OM&R Cost (1)	Total Present Worth	Net Present Worth
Alternative 1 - Gravity	2024	$27,480,000	$133,000	$2,070,000	**$ 29,550,000**	**$29,550,000**
Alternative 2 - Low Pressure Grinder	2024	$14,497,000	$219,000	$3,410,000	**$ 17,907,000**	**$17,907,000**
Alternative 3 - Low Pressure STEP	2024	$14,138,000	$65,000	$1,010,000	**$ 15,148,000**	**$15,148,000**

Note: This table represents budgetary estimates for planning purposes. Further definition of the scope of the projects through preliminary and final design will provide details necessary to improve the accuracy of the costs.

(1) Net Present Worth calculated using the real discount rate for a 20-year period (i = 2.5%) based on USDA RD guidance.

Appendix D

Correspondence

ALLEGAN COUNTY HEALTH DEPARTMENT

3255 – 122nd Ave., Suite 200, Allegan, MI 49010

Office Administration
(269) 673-5411 Fax (269) 673-4172
Bioterrorism Preparedness
(269) 673-5411
Personal Health
(269) 673-5411

Communicable Disease
(269) 673-5411
Environmental Health
(269) 673-5415
Resource Recovery
(269) 673-5415

April 25, 2022

Mr. Steve Schulz
Allegan Township Supervisor
3037 118th Ave
Allegan, MI 49010-9555

RE: Proposed Sanitary Sewer around Miner Lake; Allegan Township; Allegan County, Michigan

Dear Mr. Schulz;

I would like to thank you and the Allegan Township for including the Allegan County Health Department (ACHD) in your discussion for the proposed sewer for the residents of Miner Lake, Allegan Township.

As you are probably aware, the ACHD is vested in protecting public health, which includes protecting our vital groundwater and surface water resources. The area that has been outlined by the site plan from Fleis and Vandenbrink is an area of high density, small lots and groundwater and surface water quality concerns. Because of these obstacles, we would very much like to work with the Township to further explore methods to protect these vital resources.

If there is anything else we can assist the township with, please do not hesitate to reach out to us.

Sincerely,

Randy Rapp, RS
Environmental Health Services Manager
Allegan County Health Department

ALLEGAN COUNTY HEALTH DEPARTMENT

3255 – 122nd Ave., Suite 200, Allegan, MI 49010

Office Administration
269-673-5411 (Main Phone)
269-673-4172 (Main Fax)

Personal Health Services
269-673-5413

Resource Recovery
269-686-4524

Environmental Health
269-673-5415

October 16, 2006

Paul R. Galdes, P.E.
Fleis & Vandenbrink Engineering, Inc.
2960 Lucerne Drive SE
Grand Rapids MI 49546

Re: Proposed public sewer around Miner Lake, Allegan Township

Dear Mr. Galdes:

Please consider this correspondence as the Allegan County Health Department's enthusiastic support for the proposed municipal sewage disposal system to serve Miner Lake in Allegan Township.

Over the last 30 years our department has struggled to find solutions to the problems of heavy and/or wet soil conditions and frequently small lot sizes, limit proposed remodeling and the use of pump and haul facilities as a treatment of last resort. Pump and haul facilities in and of themselves can limit the use of dwellings due to the cost and constant need to pump the tank under "normal" use. Over the years, this department has denied approximately 35 parcels for residential homes for on-site sewage disposal systems. This is largely due to heavy and /or wet soils and limited parcel size.

As these homes are transitioning from cottages to full time homes, a municipal sewage disposal system will provide the only long term, practical solution which will protect the lake, the health of the public using the lake and the health of the lake residents.

Enclosed is a list of homes that have had their sewage disposal system replaced or had pump and haul facilities installed. A list of homes that have had mortgage evaluations is also included and the nitrate levels for the respective water wells. Nitrates do not seem to be a problem around Miner Lake.

If our department can be of any further assistance or provide any additional support, please feel free to contact me at 269-686-4558.

Sincerely,

Gary L. LaPorte, R.S.
Environmental Health Division

Enc

GLL/gl

Appendix E

Water Quality and Septic Permit Data

Water Quality Monitoring

Miner Lake
2006 Water Quality Monitoring Report

Prepared for:
Miner Lake Improvement Board
c/o Allegan County Drain Commissioner
113 Chestnut Street
Allegan, MI 49010-1332

Prepared by:
Progressive AE
1811 4 Mile Road, NE
Grand Rapids, MI 49525-2442
616/361-2664

February 2007

Project No: 50610103

ProgressiveAE

Miner Lake
2006 Water Quality Monitoring Report

Prepared for:

Miner Lake Improvement Board
c/o Allegan County Drain Commissioner
113 Chestnut Street
Allegan, MI 49010-1332

Prepared by:

Progressive AE
1811 4 Mile Road, NE
Grand Rapids, MI 49525-2442
616/361-2664

February 2007

Project No: 50610103

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Introduction

Water quality monitoring of Miner Lake has been conducted under the direction of the Miner Lake Improvement Board on a periodic basis since 1996 to evaluate baseline water conditions in the lake. This report contains background information on the various water quality parameters sampled and a discussion of the data collected to date.

Lake water quality is determined by a unique combination of processes that occur both within and outside of the lake. In order to make sound management decisions, it is necessary to have an understanding of the current physical, chemical, and biological conditions of the lake, and the potential impact of drainage from the surrounding watershed.

Lakes are commonly classified as **oligotrophic, mesotrophic, or eutrophic** (Figure 1). Oligotrophic lakes are generally deep and clear with little aquatic plant growth. These lakes maintain sufficient dissolved oxygen in the cool, deep bottom waters during late summer to support cold water fish such as trout and whitefish. By contrast, eutrophic lakes are generally shallow, turbid, and support abundant aquatic plant growth. In deep eutrophic lakes, the cool bottom waters usually contain little or no dissolved oxygen. Therefore, these lakes can only support warm water fish such as bass and pike. Lakes that fall between these two extremes are called mesotrophic lakes.

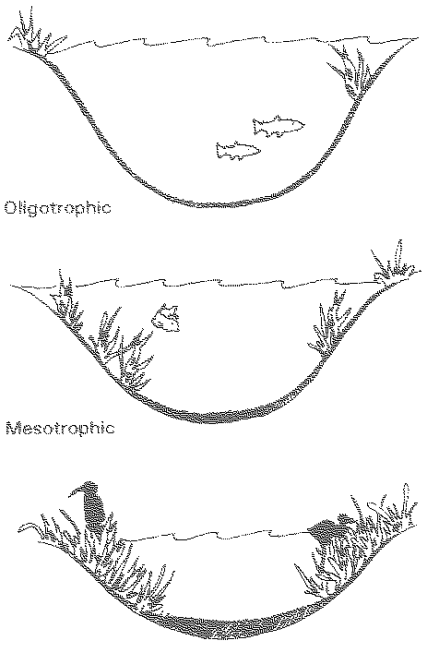

Figure 1. Lake classification.

Under natural conditions, most lakes will ultimately evolve to a eutrophic state as they gradually fill with sediment and organic matter transported to the lake from the surrounding watershed. As the lake becomes shallower, the process accelerates. When aquatic plants become abundant, the lake slowly begins to fill in as sediment and decaying plant matter accumulate on the lake bottom. Eventually, terrestrial plants become established and the lake is transformed to a marshland. The aging process in lakes is called "**eutrophication**" and may take anywhere from a few hundred to several thousand years, generally depending on the size of the lake and its watershed. The natural lake aging process can be greatly accelerated if excessive amounts of sediment and nutrients (which stimulate aquatic plant growth) enter the lake from the surrounding watershed. Because these added inputs are usually associated with human activity, this accelerated lake aging process is often referred to as "**cultural eutrophication**." The problem of cultural eutrophication can be managed by identifying sources of sediment and nutrient loading (i.e., inputs) to the lake and developing strategies to halt or slow the inputs. Thus, in developing a management plan, it is necessary to determine the limnological (i.e., the physical, chemical, and biological) condition of the lake and the physical characteristics of the watershed as well.

Key parameters used to evaluate the limnological condition of a lake include temperature, dissolved oxygen, total phosphorus, chlorophyll-*a*, and Secchi transparency. A brief description of these water quality measurements is as follows.

TEMPERATURE

Temperature is important in determining the type of organisms which may live in a lake. For example, trout prefer temperatures below 68°F. Temperature also determines how water mixes in a lake. As the ice cover breaks up on a lake in the spring, the water temperature becomes uniform from the surface to the bottom. This period is referred to as "spring turnover" because water mixes throughout the entire water column. As the surface waters warm, they are underlain by a colder, more dense strata of water. This process is called thermal stratification (Figure 2). Once thermal stratification occurs, there is little mixing of the warm surface waters with the cooler bottom waters. The transition layer that separates these layers is referred to as the "thermocline." The thermocline is characterized as the zone where temperature drops rapidly with depth. As fall approaches, the warm surface waters begin to cool and become more dense. Eventually, the surface temperature drops to a point that allows the lake to undergo complete mixing. This period is referred to as "fall turnover." As the season progresses and ice begins to form on the lake, the lake may stratify again. However, during winter stratification, the surface waters (at or near 32°F) are underlain by slightly warmer water (about 39°F). This is sometimes referred to as "inverse stratification" and occurs because water is most dense at a temperature of about 39°F. As the lake ice melts in the spring, these stratification cycles are repeated.

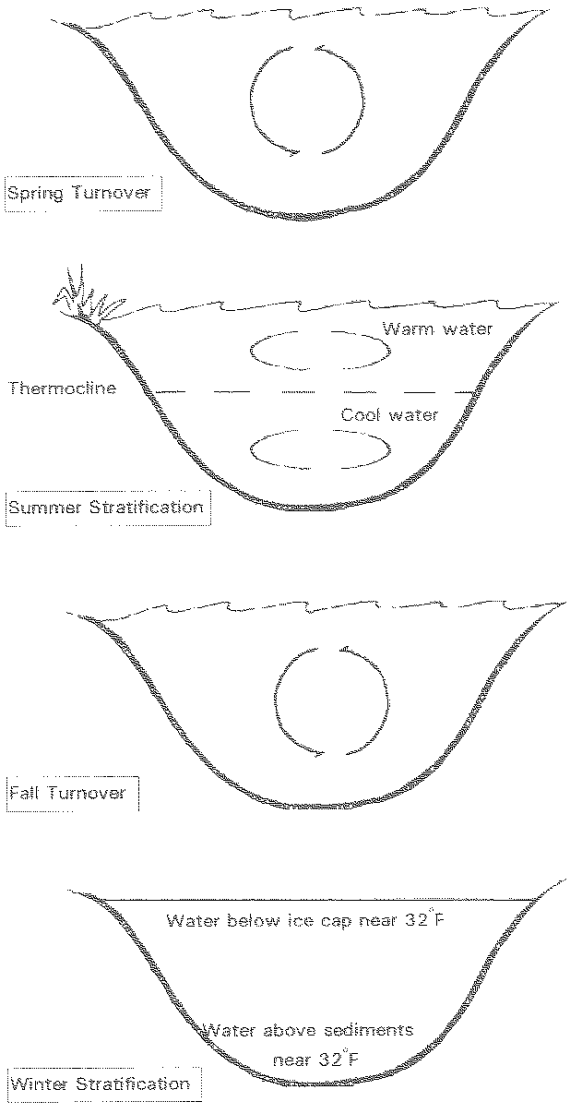

Figure 2. Seasonal thermal stratification cycles.

DISSOLVED OXYGEN

An important factor influencing lake water quality is the quantity of **dissolved oxygen** in the water column. The major inputs of dissolved oxygen to lakes are the atmosphere and photosynthetic activity by aquatic plants. An oxygen level of about 5 mg/L (milligrams per liter, or parts per million) is required to support warm water fish. In lakes deep enough to exhibit thermal stratification, oxygen levels are often reduced or depleted below the thermocline once the lake has stratified. This is because the oxygen has been consumed, in large part, by bacteria that use oxygen as they decompose organic matter (plant and animal remains) at the bottom of the lake. Bottom-water oxygen depletion is a common occurrence in eutrophic and some mesotrophic lakes. Thus, eutrophic and most mesotrophic lakes cannot support cold water fish because the cool, deep water (that the fish require to live) does not contain sufficient oxygen.

PHOSPHORUS

The quantity of **phosphorus** present in the water column is especially important since phosphorus is the nutrient that most often controls aquatic plant growth and the rate at which a lake ages and becomes more eutrophic. In the presence of oxygen, lake sediments act as a phosphorus trap, retaining phosphorus and, thus, making it available for aquatic plant growth. However, if bottom water oxygen is depleted, phosphorus will be released from the sediments and may be available to promote aquatic plant growth. In some lakes, the internal release of phosphorus from the bottom sediments is the primary source of phosphorus loading (or input).

By reducing the availability of phosphorus in a lake, it is often possible to control the amount of aquatic plant growth. In general, lakes with a phosphorus concentration of 20 µg/L (micrograms per liter, or parts per billion) or greater are able to support abundant plant growth and are classified as nutrient-enriched or eutrophic.

CHLOROPHYLL-*a*

Chlorophyll-*a* is a pigment that imparts the green color to plants and algae. A rough estimate of the quantity of algae present in lake water can be made by measuring the amount of chlorophyll-*a* in the water column. A chlorophyll-*a* concentration greater than 6 µg/L is considered characteristic of a eutrophic condition.

SECCHI TRANSPARENCY

A Secchi disk is often used to estimate water clarity. The measurement is made by fastening a round, black and white, 8-inch disk to a calibrated line (Figure 3). The disk is lowered over the deepest point of the lake until it is no longer visible, and the depth is noted. The disk is then raised until it reappears. The average between these two depths is the Secchi transparency. Generally, it has been found that aquatic plants can grow at a depth of at least twice the Secchi transparency measurement. In eutrophic lakes, water clarity is often reduced by algae growth in the water column, and Secchi disk readings of 7.5 feet or less are common.

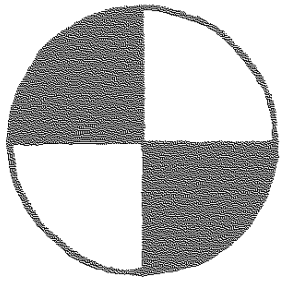

Figure 3. Secchi disk.

Ordinarily, as phosphorus inputs (both internal and external) to a lake increase, the amount of algae the lake can support will also increase. Thus, the lake will exhibit increased chlorophyll-*a* levels and decreased transparency. A summary of lake classification criteria developed by the Michigan Department of Environmental Quality is shown in Table 1.

TABLE 1
LAKE CLASSIFICATION CRITERIA

Lake Classification	Total Phosphorus (µg/L)[1]	Chlorophyll-*a* (µg/L)	Secchi Transparency (feet)
Oligotrophic	Less than 10	Less than 2.2	Greater than 15.0
Mesotrophic	10 to 20	2.2 to 6.0	7.5 to 15.0
Eutrophic	Greater than 20	Greater than 6.0	Less than 7.5

[1] µg/L = micrograms per liter = parts per billion.

FECAL COLIFORM BACTERIA

A primary consideration in evaluating the suitability of a lake to support swimming and other water-based recreational activities is the level of bacteria in the water. *Escherichia coli* (*E. coli*) is a bacteria commonly associated with fecal contamination. The current State of Michigan public health standard for total body contact recreation (e.g., swimming) requires that the number of *E. coli* bacteria not exceed 300 per 100 milliliters of water for a single sampling event.

SAMPLING METHODS

Water quality sampling was conducted in the spring and summer of 2006 over the central deep basin of Miner Lake (Figure 4). Temperature was measured using a YSI Model 550A probe. Samples were collected at 10-foot intervals over the central deep basin with a Kemmerer bottle to be analyzed for dissolved oxygen, pH, total alkalinity, and total phosphorus. Dissolved oxygen samples were fixed in the field and then transported to Progressive AE for analysis using the modified Winkler method (Standard Methods procedure 4500-O C). pH was measured in the field using a YSI EcoSense pH meter. Total alkalinity and total phosphorus samples were placed on ice and transported to Progressive AE and to Prein and Newhof[1], respectively, for analysis. Total alkalinity was titrated at Progressive AE using Standard Methods procedure 2320.B, and total phosphorus was analyzed at Prein and Newhof using Standard Methods procedure 4500-P E. In addition to the depth-interval samples at each deep basin, Secchi transparency was measured and composite chlorophyll-a samples were collected from the surface to a depth equal to twice the Secchi transparency. Chlorophyll-a samples were analyzed by Prein and Newhof using Standard Methods procedure 10200H. Ten samples were collected at various locations along the shoreline in mid-summer and were analyzed for fecal coliform bacteria at the Kent County Health Department Laboratory[2].

Tributary monitoring was conducted in spring and summer for the three major tributaries to Miner Lake (Figure 4). Tributary stream discharge was estimated using the U.S. Geological Survey midsection method (Buchanan and Somers 1969). Stream velocity was measured with a Pygmy Gurley flow meter. Samples were analyzed for total phosphorus at Prein and Newhof, and for fecal coliform bacteria at the Kent County Health Department Laboratory.

[1] Prein and Newhof, 3260 Evergreen Drive NE, Grand Rapids, MI 49525

[2] Kent County Health Department, 700 Fuller NE, Grand Rapids, MI 49503

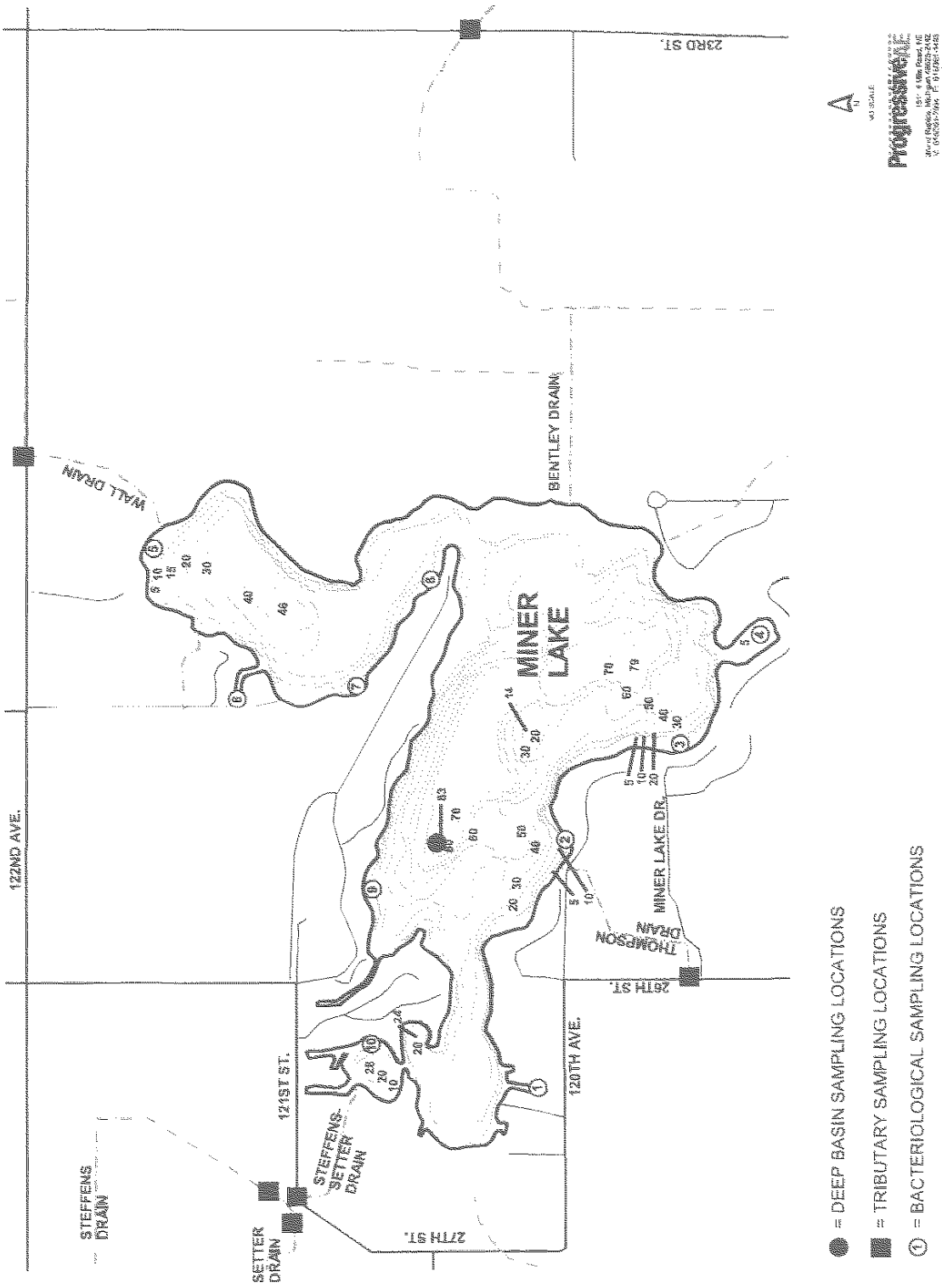

Figure 4. Miner Lake sampling location map.

Results and Discussion

Deep-basin water quality data are provided in Table 2 and Figure 5. Secchi transparency and chlorophyll-*a* data are included in Table 3 and Figures 6 and 7. Miner Lake summary statistics are included in Table 4. Shoreline bacteria sampling results are included in Table 5. Tributary water quality data are included in Table 6. Historical data for Miner Lake is contained in Appendix A.

TABLE 2
MINER LAKE
2006 DEEP BASIN WATER QUALITY DATA

Date	Sample Depth (feet)	Temperature (°F)	Dissolved Oxygen (mg/L)[1]	Total Phosphorus (µg/L)[2]
31-Mar-06	1	44	12.7	54
31-Mar-06	10	44	12.4	105
31-Mar-06	20	44	12.5	16
31-Mar-06	30	44	12.8	11
31-Mar-06	40	44	9.5	<5
31-Mar-06	50	43	11.8	9
31-Mar-06	60	42	8.8	<5
31-Mar-06	70	41	11.4	<5
31-Mar-06	80	41	9.7	<5
22-Sep-06	1	66	8.4	51
22-Sep-06	10	66	8.4	34
22-Sep-06	20	66	8.5	42
22-Sep-06	30	52	3.4	35
22-Sep-06	40	46	0.3	32
22-Sep-06	50	45	0.0	68
22-Sep-06	60	44	0.0	99
22-Sep-06	70	44	0.0	137
22-Sep-06	80	44	0.0	152

[1] mg/L = milligrams per liter = parts per million.
[2] µg/L = micrograms per liter = parts per billion.

TABLE 3
MINER LAKE
2006 SURFACE WATER QUALITY DATA

Date	Secchi Transparency (feet)	Chlorophyll-a (µg/L)[1]
31-Mar-06	8.0	4
22-Sep-06	10.0	2

TABLE 4
MINER LAKE
WATER QUALITY SUMMARY STATISTICS (1996-2006)

	Total Phosphorus (µg/L)[1]	Chlorophyll-a (µg/L)[1]	Secchi Transparency (feet)
Average	55	2.7	8.7
Standard Deviation	92	2.6	1.0
Median	27	1.7	8.5
Minimum	5	0.0	7.5
Maximum	869	8.2	10.0
Number of Samples	143	16	14

TABLE 5
MINER LAKE
2006 BACTERIOLOGICAL DATA

Date	Sample Location	*E. coli* Bacteria/100 mL[2]
17-Jul-06	1	26
17-Jul-06	2	2
17-Jul-06	3	2
17-Jul-06	4	12
17-Jul-06	5	2
17-Jul-06	6	17
17-Jul-06	7	20
17-Jul-06	8	29
17-Jul-06	9	2
17-Jul-06	10	16

[1] µg/L = micrograms per liter = parts per billion.

[2] mL = milliliters.

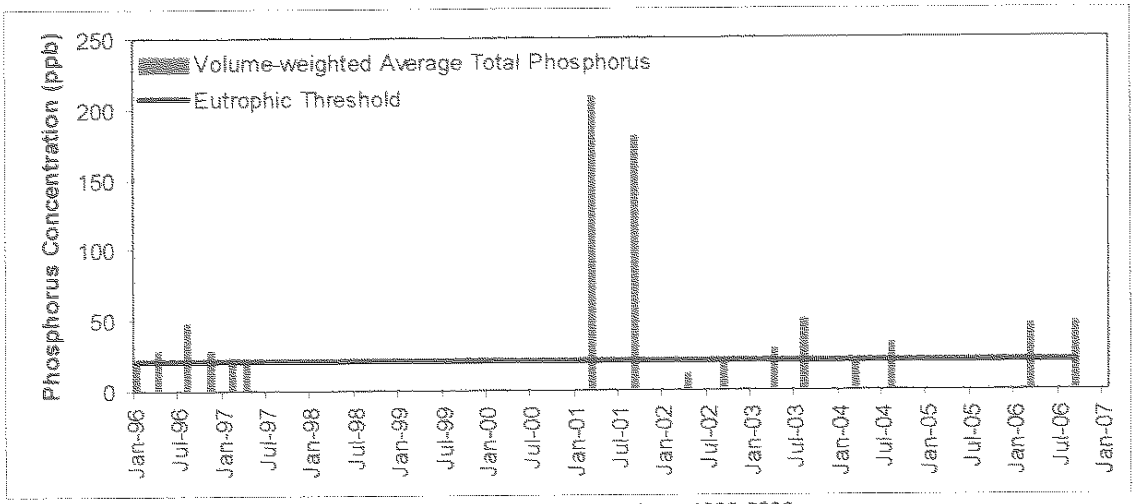

Figure 5. Volume-weighted average total phosphorus concentrations, 1996-2006.

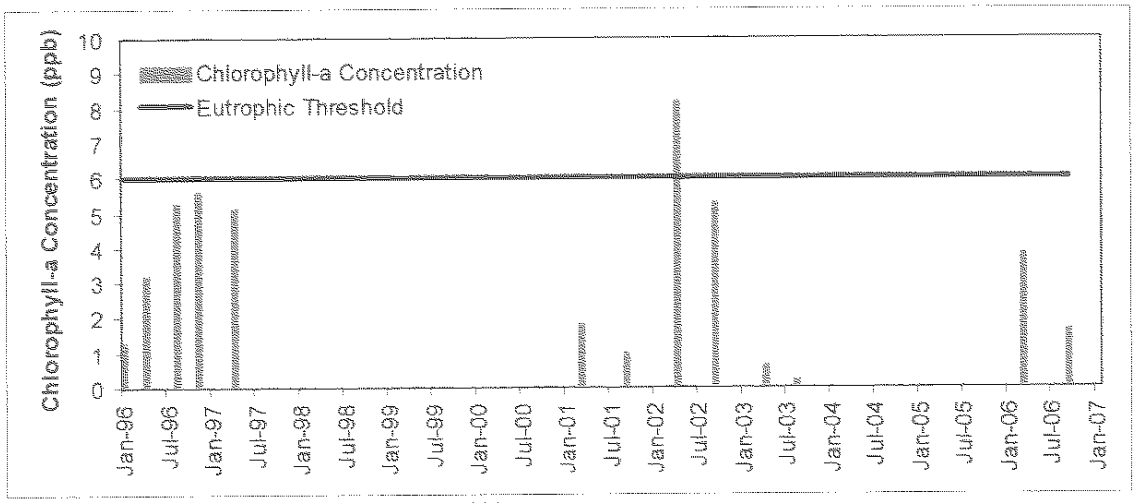

Figure 6. Chlorophyll-*a* concentrations, 1996-2006.

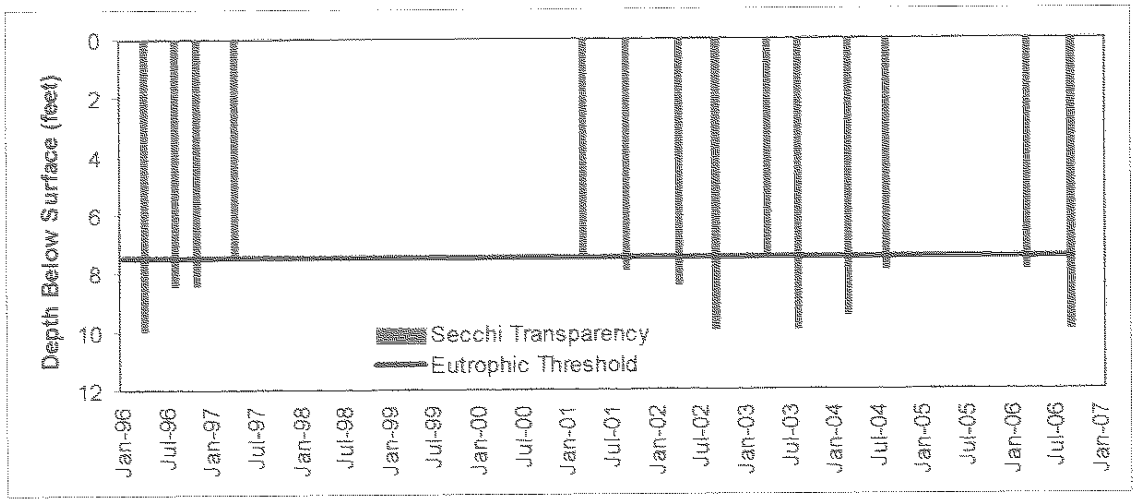

Figure 7. Secchi transparency measurements, 1996-2006.

TABLE 6
MINER LAKE
2006 TRIBUTARY WATER QUALITY DATA

Date	Sample Location	Discharge (cfs)[1]	Total Phosphorus (µg/L)[2]	*E. coli* (per 100 mL)[3]
31-Mar-06	Steffens-Setter Drain	0.9	11	135
31-Mar-06	Wall Drain	0.1	8	9
31-Mar-06	Bentley Drain	2.9	19	63
22-Sep-06	Steffens-Setter Drain	0.1	54	
22-Sep-06	Wall Drain	0	35	
22-Sep-06	Bentley Drain	0	100	

Miner Lake is eutrophic with some mesotrophic characteristics. That is, Miner Lake exhibits some aspects of a eutrophic lake (i.e., bottom water oxygen depletion) and some aspects of a mesotrophic lake (i.e., moderate water clarity and chlorophyll-*a* concentrations). Total phosphorus concentrations were generally low in spring, with the exception of the samples collected from the 1-foot and 10-foot depths. By September, phosphorus concentrations were elevated, particularly in the low-oxygen bottom waters, indicating phosphorus was being released from the deep lake sediments. Chlorophyll-*a* measurements indicate algae growth was moderate in spring and low in late summer. Therefore, it is likely most of the available phosphorus is being used by rooted plants rather than algae. Secchi transparency measurements indicate water clarity was moderate. No fecal contamination was detected at the time of shoreline bacteria sampling.

The concentration of phosphorus and fecal coliform bacteria in the Miner Lake tributary streams is often high. However, discharge measurements indicate that the volume of water that flows to the lake from the streams is generally quite low. Thus, the overall quantity of phosphorus and bacteria reaching the lake is relatively small. Bacteria levels measured in the tributary streams in 2006 were well below the public health standard for safe swimming.

In order to protect the quality of Miner Lake over the long term, steps must be taken to reduce pollution inputs to the lake to the extent practical. The Miner Lake Improvement Board is currently in the process of finalizing plans to construct a series of check dams on the Steffens-Setter Drain to help reduce sediment transport to Miner Lake. In addition, area residents can reduce phosphorus inputs to the lake by using phosphorus-free fertilizer (or no fertilizer at all) and by maintaining a natural or landscaped vegetated buffer strip along the shoreline. A review of the Soil Survey for Allegan County prepared by the U.S. Department of Agriculture Soil Conservation Service indicates the soils generally found around Miner Lake have severe limitations to the proper functioning of septic systems due to ponding, slow percolation, or excessive wetness. Lake residents should be vigilant in properly maintaining their septic systems and should eventually consider a sanitary sewer system for the Miner Lake area.

[1] cfs = cubic feet per second.

[2] µg/L = micrograms per liter = parts per billion.

[3] mL = milliliters.

Appendix A
Miner Lake
Historical Water Quality Data

TABLE A1
MINER LAKE
1996-2004 DEEP BASIN WATER QUALITY DATA

Date	Sample Depth (feet)	Temperature (°F)	Dissolved Oxygen (mg/L)[1]	Total Phosphorus (µg/L)[2]
24-Jan-96	1	33	14.0	10
24-Jan-96	10	33	12.8	26
24-Jan-96	20	34	11.9	17
24-Jan-96	30	34	11.3	26
24-Jan-96	40	34	10.4	10
24-Jan-96	50	34	9.8	7
24-Jan-96	60	34	9.6	6
24-Jan-96	70	36	9.0	15
24-Jan-96	80	38	8.6	21
10-Apr-96	1	41	11.7	21
10-Apr-96	10	41	10.9	25
10-Apr-96	20	41	11.5	46
10-Apr-96	30	42	11.7	25
10-Apr-96	40	41	11.9	23
10-Apr-96	50	41	11.9	22
10-Apr-96	60	41	11.3	27
10-Apr-96	70	42	11.2	22
10-Apr-96	80	42	11.0	21
1-Aug-96	1	75	8.7	30
1-Aug-96	10	74	8.3	32
1-Aug-96	20	63	4.5	70
1-Aug-96	30	51	0.6	15
1-Aug-96	40	48	1.7	22
1-Aug-96	50	47	0.6	116
1-Aug-96	60	46	0.6	48
1-Aug-96	70	46	0.6	137
1-Aug-96	80	46	0.3	141

[1] mg/L = milligrams per liter = parts per million.

[2] µg/L = micrograms per liter = parts per billion.

TABLE A1 (continued)
MINER LAKE
1996-2004 DEEP BASIN WATER QUALITY DATA

Date	Sample Depth (feet)	Temperature (°F)	Dissolved Oxygen (mg/L)[1]	Total Phosphorus (µg/L)[2]
4-Nov-96	1	45	6.6	22
4-Nov-96	10	46	7.6	22
4-Nov-96	20	46	7.2	29
4-Nov-96	30	46	4.0	27
4-Nov-96	40	46	5.8	27
4-Nov-96	50	46	6.8	31
4-Nov-96	60	45	6.3	28
4-Nov-96	70	45	0.0	88
4-Nov-96	80	45	0.0	118
20-Feb-97	1	34	12.1	28
20-Feb-97	10	34	11.2	18
20-Feb-97	20	34	10.7	27
20-Feb-97	30	34	10.4	24
20-Feb-97	40	34	9.8	26
20-Feb-97	50	35	9.4	18
20-Feb-97	60	37	8.6	16
20-Feb-97	70	37	9.4	27
20-Feb-97	80	37	8.4	27
3-Apr-97	1	42	11.3	16
3-Apr-97	10	42	11.1	20
3-Apr-97	20	42	10.7	17
3-Apr-97	30	42	10.7	17
3-Apr-97	40	42	9.8	43
3-Apr-97	50	42	10.5	20
3-Apr-97	60	42	10.5	14
3-Apr-97	70	42	10.3	100
3-Apr-97	80	42	10.5	15

[1] mg/L = milligrams per liter = parts per million.
[2] µg/L = micrograms per liter = parts per billion.

TABLE A1 (continued)
MINER LAKE
1996-2004 DEEP BASIN WATER QUALITY DATA

Date	Sample Depth (feet)	Temperature (°F)	Dissolved Oxygen (mg/L)[1]	Total Phosphorus (µg/L)[2]
26-Mar-01	1	41	10.0	112
26-Mar-01	10	41	10.0	183
26-Mar-01	20	41	10.0	389
26-Mar-01	30	41	10.0	287
26-Mar-01	40	41	10.0	197
26-Mar-01	50	41	10.0	31
26-Mar-01	60	40	8.5	146
26-Mar-01	70	40	7.5	203
26-Mar-01	80	39	7.3	112
10-Sep-01	1	75	9.7	336
10-Sep-01	10	74	9.5	87
10-Sep-01	20	72	6.1	156
10-Sep-01	30	58	0.3	178
10-Sep-01	40	49	0.3	37
10-Sep-01	50	47	0.3	7
10-Sep-01	60	47	0.4	869
10-Sep-01	70	46	0.0	47
10-Sep-01	80	46	0.0	50
2-Apr-02	1	39	12.0	11
2-Apr-02	10	39	12.0	11
2-Apr-02	20	39	12.1	14
2-Apr-02	30	39	12.1	11
2-Apr-02	40	39	12.1	11
2-Apr-02	50	39	12.1	10
2-Apr-02	60	39	12.1	12
2-Apr-02	70	39	12.2	11
2-Apr-02	80	39	12.2	11

[1] mg/L = milligrams per liter = parts per million.

[2] µg/L = micrograms per liter = parts per billion.

TABLE A1 (continued)
MINER LAKE
1996-2004 DEEP BASIN WATER QUALITY DATA

Date	Sample Depth (feet)	Temperature (°F)	Dissolved Oxygen (mg/L)[1]	Total Phosphorus (µg/L)[2]
12-Sep-02	1	75	8.1	11
12-Sep-02	10	76	8.2	13
12-Sep-02	20	65	2.4	39
12-Sep-02	30	52	1.1	12
12-Sep-02	40	46	0.7	11
12-Sep-02	50	45	0.6	13
12-Sep-02	60	44	0.6	9
12-Sep-02	70	44	0.0	23
12-Sep-02	80	44	0.0	27
9-Apr-03	1	41	10.0	33
9-Apr-03	10	40	10.2	29
9-Apr-03	20	40	10.1	29
9-Apr-03	30	40	10.1	27
9-Apr-03	40	40	10.1	25
9-Apr-03	50	40	10.2	31
9-Apr-03	60	40	10.1	
9-Apr-03	70	40	10.0	31
9-Apr-03	80	40	10.0	40
18-Aug-03	1	82	9.0	31
18-Aug-03	10	80	9.1	34
18-Aug-03	20	68	8.0	65
18-Aug-03	30	50	0.1	96
18-Aug-03	40	45	0.4	29
18-Aug-03	50	44	0.1	45
18-Aug-03	60	43	0.0	57
18-Aug-03	70	43	0.0	117
18-Aug-03	77	43	0.0	131

[1] mg/L = milligrams per liter = parts per million.
[2] µg/L = micrograms per liter = parts per billion.

TABLE A1 (continued)
MINER LAKE
1996-2004 DEEP BASIN WATER QUALITY DATA

Date	Sample Depth (feet)	Temperature (°F)	Dissolved Oxygen (mg/L)[1]	Total Phosphorus (µg/L)[2]
31-Mar-04	1	44	11.2	15
31-Mar-04	10	44	10.5	29
31-Mar-04	20	42	10.4	24
31-Mar-04	30	41	10.3	15
31-Mar-04	40	41	10.3	10
31-Mar-04	50	41	10.2	20
31-Mar-04	60	41	10.2	13
31-Mar-04	70	41	10.2	13
31-Mar-04	80	41	10.1	17
20-Aug-04	1	72	8.1	43
20-Aug-04	10	72	8.3	38
20-Aug-04	20	66	0.9	27
20-Aug-04	30	51	1.4	<5
20-Aug-04	40	47	2.0	<5
20-Aug-04	50	46	1.5	34
20-Aug-04	60	45	1.4	43
20-Aug-04	70	45	1.3	76
20-Aug-04	80	45	1.3	130

[1] mg/L = milligrams per liter = parts per million.

[2] µg/L = micrograms per liter = parts per billion.

TABLE A2
MINER LAKE
1996-2004 SURFACE WATER QUALITY DATA

Date	Secchi Transparency (feet)	Chlorophyll-a (µg/L)[1]
24-Jan-96		1
10-Apr-96	10.0	3
1-Aug-96	8.5	5
4-Nov-96	8.5	6
20-Feb-97		0
3-Apr-97	7.5	5
26-Mar-01	7.5	2
10-Sep-01	8.0	1
02-Apr-02	8.5	8
12-Sep-02	10.0	5
09-Apr-03	7.5	1
18-Aug-03	10.0	0
31-Mar-04	9.5	0
20-Aug-04	8.0	0

[1] µg/L = micrograms per liter = parts per billion.

TABLE A3
MINER LAKE
2000-2004 TRIBUTARY WATER QUALITY DATA

Date	Sample Location	Discharge (cfs)[1]	Total Phosphorus (µg/L)[2]	*E. coli* (per 100 mL)[3]
15-May-00	Steffens-Setter Drain	4.3	156	
15-May-00	Wall Drain	0.3	78	
15-May-00	Bentley Drain	4.0	46	
4-Apr-01	Steffens-Setter Drain	1.4	80	24
4-Apr-01	Wall Drain	0.4	44	2
4-Apr-01	Bentley Drain	1.4	67	9
10-Sep-01	Steffens-Setter Drain	0.4	6	488
10-Sep-01	Wall Drain	0	37	179
10-Sep-01	Bentley Drain	0.4	268	344
2-Apr-02	Steffens-Setter Drain	2.3	16	687
2-Apr-02	Wall Drain	0.8	11	96
2-Apr-02	Bentley Drain	2.0	15	10
12-Sep-02	Steffens-Setter Drain	0.2	38	921
12-Sep-02	Wall Drain	0	19	27
12-Sep-02	Bentley Drain	0.4	11	3
9-Apr-03	Steffens-Setter Drain	4.5	104	
9-Apr-03	Wall Drain	1.5	209	
9-Apr-03	Bentley Drain	5.5	88	
29-May-03	Steffens-Setter Drain	0.5	32	866
29-May-03	Steffens Drain	0	40	548
29-May-03	Setter Drain	0	34	579

[1] cfs = cubic feet per second.

[2] µg/L = micrograms per liter = parts per billion.

[3] mL = milliliters.

TABLE A3 (continued)
MINER LAKE
2000-2004 TRIBUTARY WATER QUALITY DATA

Date	Sample Location	Discharge (cfs)[1]	Total Phosphorus (µg/L)[2]	*E. coli* (per 100 mL)[3]
18-Aug-03	Steffens-Setter Drain	0.3	100	649
18-Aug-03	Wall Drain	0	142	649
18-Aug-03	Bentley Drain	0	174	816
31-Mar-04	Steffens-Setter Drain	1.8	27	18
31-Mar-04	Wall Drain	0.2	18	9
31-Mar-04	Bentley Drain	1.0	427	10
31-Mar-04	Thompson Drain	0	42	
20-Aug-04	Steffens-Setter Drain	0.3	5	
20-Aug-04	Wall Drain	0	5	
20-Aug-04	Bentley Drain	0	54	

[1] cfs = cubic feet per second.

[2] µg/L = micrograms per liter = parts per billion.

[3] mL = milliliters.

References

Buchanan T.J., and W.P. Somers. 1969. Discharge measurements at gaging stations. U.S. Geological Survey Techniques of Water-Resources Investigations, book 3, chap. A8.

Allegan Township Miner Lake Wastewater System
F&V Project No. 851210
2007 Summary of Health Department Records

FLEIS&VANDENBRINK
DESIGN. BUILD. OPERATE.

Health Record Summary*

Category	Top Half of Lake		Bottom Half of Lake		Total	
	Total	Percentage	Total	Percentage	Total	Percentage
Total Permits	51	100%	47	100%	98	100%
New Home	28	55%	30	64%	58	59%
Existing Home	23	45%	17	36%	40	41%
Mound System	14	27%	6	13%	20	20%
Drywell System	5	10%	4	9%	9	9%
Trench System	1	2%	4	9%	5	5%
Holding Tank	4	8%	3	6%	7	7%
Denied Permit	1	2%	0	0%	1	1%
Pumps Required	16	31%	13	28%	29	30%
Specialized Systems	35	69%	35	74%	70	71%
Replacement Issues	3	6%	3	6%	6	6%
Well Variance	4	8%	6	13%	10	10%
Lake Variance	2	4%	6	13%	8	8%
Other Variances	1	2%	4	9%	5	5%

* Note: The data above reflects information gathered for the study area. Permits for homes not reflected in this table are either not available or the septic systems have not been permitted.

FLEIS&VANDENBRINK
DESIGN. BUILD. OPERATE.

ALLEGAN TOWNSHIP
2007 Master List Sewer Study

Sewer Permits

Project No. 15073
By: LEB
Date: 4/24/2007

DATE	ADDRESS		Description	Type	SPECIAL CIRCUMSTANCES SEPTIC	Septic Details
8/12/1967		Unknown	New	B		2-800 Gal Septic w/ 300 Sft Drainfield
11/12/1970		Unknown	New	D	1000 Gal Drywell	1-800 Gal Septic w/ 1000 Gal Drywell
10/15/1970		Lakeland Drive	New	D	1000 Gal Drywell	1-1000 Gal Septic w/ 1000 Gal Drywell
7/14/1971		Unknown	New	D	Drywell System	1-1000 Gal Septic w/ Drywell
9/14/1971		Forest Drive	New	B		1-800 Gal Septic w/ 300 Sft Drainfield
7/26/1971		Unknown	New	D	1200 Gal Drywell	1-1000 Gal Septic w/ 1200 Gal Drywell
8/4/1971	25th	Miner Lake	New	B		1-1000 Gal Septic w/ 300 Sft Drainfield, Lake Isolation Variance
7/29/1971		Unknown	New	T	Trench System	1-1000 Gal Septic w/ 120 Sft Trench System
11/13/1971		Unknown	New	M	Lake Isolation Variance, Mound System	1-1000 Gal Septic w/ 500 Sft Drainfield, Lake Isolation Variance, Mound System
8/8/1972		Liechti Knoll Subdivision	New	B		1-1000 Gal Septic w/ 450 Sft Drainfield
12/27/1972		North side of Miner Lake	New	B	Lake Isolation Variance, Fill Required	1-1000 Gal Septic w/ 400 Sft Drainfield, Lake Isolation Variance, Fill Required
8/17/1973		Unknown	New	B		Unknown Septic w/ 500 Sft Drainfield
8/17/1973		Miner Lake	New	M	Lift Pump, Mound System	2-1000 Gal Septic w/ 700 Sft Drainfield, Mound System, Lift Pump
6/30/1973	Lot 21	Haas Street	New	M	Lake Isolation Variance, Mound System	1-800 Gal Septic w/ 450 Sft Drainfield, Lake Isolation Variance, Mound System
8/7/1973		S side of Miner Lake	New	M	Mound System	2-1000 Gal Septic w/ 700 Sft Drainfield, Mound System
7/25/1973		Unknown	New	D	Drywell System	1-1000 Gal Septic w/ 2 Drywells
7/25/1973		Off 118th Ave	New	B	Undersized for Cottage Use	1-600 Gal Septic w/ 360 Sft Drainfield, Undersized for Cottage Use
12/9/1974	200	Forest Drive	New	M	Mound System	1-1000 Gal Septic w/ 450 Sft Drainfield, Mound System
7/19/1974		Unknown	New	M	Lake Isolation Variance, Mound System	1-1000 Gal Septic w/ 990 Sft Drainfield, Lake Isolation Variance, Mound System
5/22/1974	Lot 17	Bayview	New	B		2-1000 Gal Septic w/ 1320 Sft Drainfield
9/4/1974		Unknown	New	T	Trench System	1-1000 Gal Septic w/ 500 Sft Trench System
5/14/1976		25th Street	New	B		1-1000 Gal Septic w/ 750 Sft Drainfield
3/28/1976	2003	Lake Drive	New	D	1500 Gal Drywell	1-1000 Gal Septic w/ 1500 Gal Drywell
7/22/1976		Unknown	New	B		1-1000 Gal Septic w/ 510 Sft Drainfield
8/24/1977	2003	26th Street	New	D	1500 Gal Drywell	2-750 Gal Septic w/ 1500 Gal Drywell
10/13/1978		Unknown	Repair	M	Mound System	2-800 Gal Septic w/ 600 Sft Drainfield, Mound System
11/1/1979	2591	Haas Drive	Repair	M	Mound System	1-1000 Gal Septic w/ 600 Sft Drainfield, Mound System
8/30/1979		Forest Lake Drive	Repair	B	3 Ft Depth of Excavation and Fill Required	1-1000 Gal Septic w/ 800 Sft Drainfield, Excavate and Fill
1980	2605	Haas Drive	Repair	T	Trench System	Unknown Septic w/ Trench System
5/29/1980	2490	Wagner	Repair	M	Mound System	Existing Septic w/ 500 Sft Drainfield, Mound System
10/7/1985		Lorraine Drive	Repair	M	500 Gal Pump Chamber, Mound System	1-1000 Gal and 1-750 Gal Septic w/ 500 Gal Pump Chamber and 990 Sft Drainfield, Mound System
12/11/1986		Lorraine Drive	New	M	Mound System	1-800 Gal Septic w/ 340 Sft Drainbed, Mound System 4.5' High
11/7/1986		Horseshoe Cove	New	T	Trench System	1-1000 Gal Septic w/ 345 Sft Trench System
5/31/1988	2476	Lorraine Drive	Repair	M	Mound System with Lift Pump	Existing Septic w/ Unknown Gal Pump Chamber and Unknown Sft Drainfield, Mound System
11/10/1988		Lorraine Drive	New	M	500 Gal Pump Chamber, Mound System	1-1500 Gal and 1-1000 Gal Septic w/ 500 Gal Pump Chamber and 1000 Sft Drainfield, Mound System
7/19/1988		Horseshoe Cove	New	B	Extensive Excavation and Backfill~5.5 Ft Deep	1-1000 Gal Septic w/ 660 Sft Drainfield and Extensive Excavation and Backfill~5.5 Ft Deep
11/7/1989	2472	Lorraine Drive	Repair	B	800 Gal Pump Chamber	1-1000 Gal Septic w/ 800 Gal Pump Chamber and 450 Sft Drainfield
12/13/1990	2447	118th	New	B		1-1000 Gal Septic w/ 510 Sft Drainfield
7/16/1991	2467	Lorraine Drive	Repair	M	500 Gal Pump Chamber, Mound System, Well Variance, Retaining Wall	1-1000 Gal Septic w/ 500 Gal Pump Chamber and 340 Sft Drainfield, Mound System, Well Variance, Retaining Wall
9/4/1992	2473	Lorraine Drive	Repair	M	500 Gal Pump Chamber, Mound System	1-1500 Gal Septic Tank w/ 500 Gal Pump Chamber and 540 Sft Drainfield, Mound System
10/20/1992	1975	Koteris Drive	Repair	M	500 Gal Pump Chamber, Well Variance, Drainfield Undersized, No Replacement Options, Mound System	1-1500 Gal Septic Tank w/ 500 Gal Pump Chamber and 600 Sft Drainfield, Well Variance, Drainfield Undersized, No Replacement Options, Mound System
10/21/1993	1999	Benny Drive	New	B	500 Gal Pump Chamber, Berm Wall and 8" Tile Required, Well Relocated	2-800 Gal Septic w/ 500 Gal Pump Chamber and 600 Sft Drainfield, Berm Wall and 8" Tile Required, Well Relocated
12/16/1993	1955	Lakeshore Drive	New	U	Size and Type Not Known	Size and Type Not Known
12/16/1993	1935	Lakeshore Drive	New	D	500 Gal Pump Chamber, 2-Drywells w/ Alternating Valve	1-1500 Gal Septic Tank w/ 500 Gal Pump Chamber, 2-Drywells w/ Alternating Valve
12/14/1993	1943	Lakeshore Drive	New	B	500 Gal Pump Chamber	1500 Gal Dual Compartment Tank w/ 500 Gal Pump Chamber, 345 Sft Drainfield
6/11/1993	1981	Koteris Drive	Repair	B	500 Gal Pump Chamber, Variance for Lake Isolation and Slope, Pumped under Road	1-1500 Gal Septic Tank w/ 500 Gal Pump Chamber and 750 Sft Drainfield, Variance for Lake Isolation and Slope, Pumped under Road
9/2/1993	2553	Lorraine Drive	Repair	B	500 Gal Pump Chamber	Existing 1000 Gal Septic w/ 500 Gal Pump Chamber and 400 Sft Drainfield
6/2/1993	2595	Haas Drive	Repair	B		1-1000 Gal Additional Septic w/ 1000 Sft Drainfield
5/11/1994	1971	Koteris Drive	Repair	M	Mound System with 500 Gal Pump Chamber	1-1000 Gal Septic w/ 500 Gal Pump Chamber and 500 Sft Drainfield, Mound System
4/11/1994	2551	Lorraine Drive	Repair	B		1-800 Gal Septic w/ 600 Sft Drainfield
7/25/1994	2084	Lake Drive	Repair	D	Existing Drywell System with Lines Routed Under Driveway	1-1000 Gal Septic w/ Existing Drywell and Drainfield, Routed Under Driveway
4/26/1994		Lorraine Drive	Repair	P	1500 Gal Holding Tank, Designed for Seasonal Use Only	1500 Gal Holding Tank, Designed for Seasonal Use Only
10/18/1995	2579	Lorraine Drive	New	M	Mound System with 500 Gal Pump Chamber	1-1000 Gal Septic w/ 500 Gal Pump Chamber and 627 Sft Drainfield, Mound System
7/25/1995	1959	Lakeshore Drive	New	B	500 Gal Pump Chamber	2-1000 Gal Septic w/ 500 Gal Pump Chamber and 1188 Sft Drainfield
7/11/1995	2495	Wagner Drive	New	B	500 Gal Pump Chamber	2-1000 Gal Septic w/ 500 Gal Pump Chamber and 800 Sft Drainfield
10/17/1995	2469	Lorraine Drive	Repair	M	Mound System with 500 Gal Pump Chamber	1-1000 Gal Septic w/ 500 Gal Pump Chamber and 429 Sft Drainfield, Mound System
6/19/1996	1996	Koteris Drive	New	B	500 Gal Pump Chamber	2-1000-Gal Septic w/ 500 Gal Pump Chamber and 1100 Sft Drainfield
4/10/1997	2090	Lake Drive	Repair	B	Lift Pump Required	2-1000 Gal Septic w/ 1080 Sft Drainfield, Lift Pump
8/15/1997	1973	Koteris Drive	Repair	B		2-1000 Gal Septic w/ 660 Sft Drainfield
7/8/1997	2501	Lorraine Drive	Repair	P	Holding Tank	3-1000 Gal Septic w/ No Drainfield (Pump & Haul)
9/15/1998	1968	Stoney Point	Repair	D	Property Line and Well Isolation Variance, 500 Gal Pump Chamber and 2 Drywells	Property Line and Well Isolation Variance, 500 Gal Pump Chamber and 2 Drywells, 1000 Gal Septic
6/24/1998	1906	Horseshoe Cove	New	B	Close Proximity to Steep Slopes	1-1000 Gal Septic w/ 700 Sft Drainbed near steep slope
10/21/1998	1997	Benny Drive	Repair	B	Lake and Well Isolation Variance	1-500 Gal and 1-800 Gal Septic w/ 500 Sft Drainfield, Lake and Well Isolation Variance
6/19/1998	2483	Lorraine Drive	New	B	500 Gal Pump Chamber	2-1000 Gal Septic w/ 500 Gal Pump Chamber and 1000 Sft Drainfield
12/29/1998	2555	Lorraine Drive	Repair	M	Mound System with 500 Gal Pump Chamber	1-1000 Gal Septic w/ 500 Gal Pump Chamber and 600 Sft Drainfield, Mound System
3/17/1999	1916	Horseshoe Cove	New	B		1-1000 Gal Septic w/ 400 Sft Drainfield or 600 Sft Drainbed
5/5/1999	2499	Lorraine Drive	New	B	Limited Replacement Options	2-1000 Gal Septic w/ 1320 Sft Drainfield, Limited Replacement Options
5/5/1999	2485	Lorraine Drive	Repair	B	Clay Sidewalls Required around Sand Backfill, Constructed on Clay-Sanitarian Concerned about how Long the Bed will Last	2-1000 Gal Septic w/ 1000 Sft Drainfield, Clay Sidewalls Required around Sand Backfill, Constructed on Clay
11/5/1999	2474	Lorraine Drive	Repair	B		2-800 Gal Septic w/ 500 Sft Drainfield
8/6/1999	2494	Wegner Drive	New	B		1-1000 Gal Septic w/ 520 Sft Drainfield
4/13/1999	1964	Stoney Point	New	B		2-1000 Gal Septic w/ 1000 Sft Drainfield
6/11/1999	1958	Stoney Point	Repair	B		2-1000 Gal Septic w/ 1200 Sft Drainfield
12/2/1999	2603	Haas Drive	New	B	Close Proximity to Steep Slopes	2-1000 Gal Septic w/ 700 Sft Drainfield
7/18/2000	2487	Wegner Drive	New	B		1-1000 Gal Septic w/ 750 Sft Drainfield
4/19/2000	2915	Miner Lake Road	Repair	B	Well Isolation Variance, Close Proximity to Steep Slopes	2-1000 Gal Septic w/ 675 Sft Drainfield
10/16/2000	2581	Haas Drive	Repair	B	Lift Pump	1500 Gal Dual Compartment Septic and Pump to Existing Bed
6/19/2001	2571	Harold	Repair	B		2-1000 Gal Septic w/ 680 Sft Drainfield
7/26/2002	1965	Miner Lake Road	Repair	P	Well Isolation Not Met, 2-1000 Gal Holding Tanks	Well Isolation Not Met, 2-1000 Gal Holding Tanks
8/5/2002	2497	Horseshoe Cove	Repair	B	Lake Isolation Variance and Pump Chamber	2-1000 Gal Septic w/ 700 Sft Drainfield and Pump Chamber with Lake Variance
12/9/2003	2470	Lorraine Drive	Repair	B		2-1000 Gal Septic w/ 600 Sft Drainfield
9/18/2003	1911	Horseshoe Cove	New	B		2-1000 Gal Septic w/ 800 Sft Drainfield
5/20/2003	2555	Haas Drive	Repair	B	Lake and Well Isolation Variance	1-1000 Gal Septic w/ 400 Sft Drainfield, Lake and Well Isolation Variance
7/29/2003	2561	Haas Drive	New	B	500 Gal Pump Chamber and Well Isolation Not Met	2-1000-Gal Septic w/ 500 Gal Pump Chamber and 920 Sft Drainfield, Well Isolation 63 Ft
9/15/2004	1961	Lakeshore Drive	Repair	P	1500 Gal Holding Tank	1500 Gal Holding Tank
9/29/2004	1969	Stoney Point	New	B	500 Gal Pump Chamber	1-1000 Gal Septic w/ 500 Gal Pump Chamber
6/4/2004	2479	Lorraine Drive	Repair	B		2-1000 Gal Septic w/ 600 Sft Drainfield
11/14/2005	2466	Lorraine Drive	Loan Evaluation	B	Septic/Well Seperation less than 75Ft, Lift Pump	500 Gal Septic w/ 450 Sft Drainfield and Lift Pump
5/5/2005	2571	Haas Drive	Repair	P	Well Distance Variance and 1500 Gal Holding Tank	Well Distance Variance and 1500 Gal Holding Tank
10/11/2005	2585	Haas Drive	Loan Evaluation	T	Trench System	Trench System
3/24/2006	3524	Vanhorn Court	New	B	Lift Pump Required	2-1000 Gal Septic w/ 900 Sft Drainfield and Lift Pump
2/13/2006	2154	Crystal Cove Drive	New	P	1500 Gal Holding Tank	1500 Gal Temp Holding Tank
	1979	Koteris Drive	New	P	1500 Gal Holding Tank	1500 Gal Holding Tank
	2004	Benny Drive	New	M	Mound System	2-1000 Gal Septic w/ 990 Sft Drainfield
	2001	Benny Drive	New	U	Size and Type Not Known	Size and Type Not Known

DATE	ADDRESS		Description	Type	SPECIAL CIRCUMSTANCES SEPTIC	Septic Details
	2488	Wegner Drive	New	U	Size and Type Not Known	Size and Type Not Known
		121st Street	New	B		1-800 Gal Septic w/ 300 Sft Drainfield
4/20/1977		Horseshoe Cove	New	B		1-800 Gal Septic w/ Drainfield
3/18/1983	Lot #30	Lorraine Drive	New		System Denied-Unsuitable Soils	
5/14/1976		25th Street	New	B		1-1000 Gal Septic w/ 750 Sft Drainfield
4/26/1994		Lorraine Drive	Repair	P	1500 Gal Holding Tank, Designed for Seasonal Use Only	1500 Gal Holding Tank, Designed for Seasonal Use Only
10/13/1978		Unknown	Repair	M	Mound System	2-800 Gal Septic w/ 600 Sft Drainfield, Mound System
7/22/1976		Unknown	New	B		1-1000 Gal Septic w/ 510 Sft Drainfield
3/28/1976	2003	Lake Drive	New	D	1500 Gal Drywell	1-1000 Gal Septic w/ 1500 Gal Drywell
8/17/1973		Unknown	New	B		Unknown Septic w/ 500 Sft Drainfield
11/13/1971		Unknown	New	M	Lake Isolation Variance, Mound System	1-1000 Gal Septic w/ 500 Sft Drainfield, Lake Isolation Variance, Mound System
7/26/1971		Unknown	New	T	Trench System	1-1000 Gal Septic w/ 120 Sft Trench System
7/14/1971		Unknown	New	D	Drywell System	1-1000 Gal Septic w/ Drywell
8/12/1967		Unknown	New	B		2-800 Gal Septic w/ 300 Sft Drainfield
5/22/1974	Lot 17	Bayview	New	B		2-1000 Gal Septic w/ 1320 Sft Drainfield
3/18/1983	Lot #30	Lorraine Drive	New		System Denied-Unsuitable Soils	
10/7/1985		Lorraine Drive	Repair	M	500 Gal Pump Chamber, Mound System	1-1000 Gal and 1-750 Gal Septic w/ 500 Gal Pump Chamber and 990 Sft Drainfield, Mound System
5/31/1988	2476	Lorraine Drive	Repair	M	Mound System with Lift Pump	Existing Septic w/ Unknown Gal Pump Chamber and Unknown Sft Drainfield, Mound System
11/10/1988		Lorraine Drive	New	M	500 Gal Pump Chamber, Mound System	1-1500 Gal and 1-1000 Gal Septic w/ 500 Gal Pump Chamber and 1000 Sft Drainfield, Mound System
11/7/1989	2472	Lorraine Drive	Repair	B	800 Gal Pump Chamber	1-1000 Gal Septic w/ 800 Gal Pump Chamber and 450 Sft Drainfield
7/16/1991	2467	Lorraine Drive	Repair	M	500 Gal Pump Chamber, Mound System, Well Variance, Retaining Wall	1-1000 Gal Septic w/ 500 Gal Pump Chamber and 340 Sft Drainfield, Mound System, Well Variance, Retaining Wall
9/4/1992	2473	Lorraine Drive	Repair	M	500 Gal Pump Chamber, Mound System	1-1500 Gal Septic Tank w/ 500 Gal Pump Chamber and 540 Sft Drainfield, Mound System
9/2/1993	2553	Lorraine Drive	Repair	B	500 Gal Pump Chamber	Existing 1000 Gal Septic w/ 500 Gal Pump Chamber and 400 Sft Drainfield
4/11/1994	2551	Lorraine Drive	Repair	B		1-800 Gal Septic w/ 600 Sft Drainfield
10/17/1995	2469	Lorraine Drive	Repair	M	Mound System with 500 Gal Pump Chamber	1-1000 Gal Septic w/ 500 Gal Pump Chamber and 429 Sft Drainfield, Mound System
10/18/1995	2579	Lorraine Drive	New	M	Mound System with 500 Gal Pump Chamber	1-1000 Gal Septic w/ 500 Gal Pump Chamber and 627 Sft Drainfield, Mound System
7/8/1997	2501	Lorraine Drive	Repair	P	Holding Tank	3-1000 Gal Septic w/ No Drainfield (Pump & Haul)
6/10/1998	2483	Lorraine Drive	New	B	500 Gal Pump Chamber	2-1000 Gal Septic w/ 500 Gal Pump Chamber and 1000 Sft Drainfield
12/29/1998	2555	Lorraine Drive	Repair	M	Mound System with 500 Gal Pump Chamber	1-1000 Gal Septic w/ 500 Gal Pump Chamber and 600 Sft Drainfield, Mound System
5/5/1999	2499	Lorraine Drive	New	B	Limited Replacement Options	2-1000 Gal Septic w/ 1320 Sft Drainfield, Limited Replacement Options
5/5/1999	2485	Lorraine Drive	Repair	B	Clay Sidewalls Required around Sand Backfill, Constructed on Clay-Sanitarian Concerned about how Long the Bed will Last	2-1000 Gal Septic w/ 1000 Sft Drainfield, Clay Sidewalls Required around Sand Backfill, Constructed on Clay
11/5/1999	2474	Lorraine Drive	Repair	B		2-800 Gal Septic w/ 500 Sft Drainfield
12/9/2003	2470	Lorraine Drive	Repair	B		2-1000 Gal Septic w/ 600 Sft Drainfield
6/4/2004	2479	Lorraine Drive	Repair	B		2-1000 Gal Septic w/ 600 Sft Drainfield
11/14/2005	2466	Lorraine Drive	Loan Evaluation	B	Septic/Well Seperation less than 75Ft, Lift Pump	500 Gal Septic w/ 450 Sft Drainfield and Lift Pump
3/24/2006	3524	Vanhorn Court	New	B	Lift Pump Required	2-1000 Gal Septic w/ 900 Sft Drainfield and Lift Pump
5/29/1980	2490	Wagner	Repair	M	Mound System	Existing Septic w/ 500 Sft Drainfield, Mound System
7/11/1995	2495	Wegner Drive	New	B	500 Gal Pump Chamber	2-1000 Gal Septic w/ 500 Gal Pump Chamber and 800 Sft Drainfield
8/6/1999	2494	Wegner Drive	New	B		1-1000 Gal Septic w/ 520 Sft Drainfield
7/18/2000	2487	Wegner Drive	New	B		1-1000 Gal Septic w/ 750 Sft Drainfield
	2488	Wegner Drive	New	U	Size and Type Not Known	Size and Type Not Known
		121st Street	New	B		1-800 Gal Septic w/ 300 Sft Drainfield
8/24/1977	2003	26th Street	New	D	1500 Gal Drywell	2-750 Gal Septic w/ 1500 Gal Drywell
7/25/1994	2084	Lake Drive	Repair	D	Existing Drywell System with Lines Routed Under Driveway	1-1000 Gal Septic w/ Existing Drywell and Drainfield, Routed Under Driveway
4/10/1997	2090	Lake Drive	Repair	B	Lift Pump Required	2-1000 Gal Septic w/ 1080 Sft Drainfield, Lift Pump
2/13/2006	2154	Crystal Cove Drive	New	P	1500 Gal Holding Tank	1500 Gal Temp Holding Tank
12/9/1974	200	Forest Drive	New	M	Mound System	1-1000 Gal Septic w/ 450 Sft Drainfield, Mound System
8/30/1979		Forest Lake Drive	Repair	B	3 Ft Depth of Excavation and Fill Required	1-1000 Gal Septic w/ 800 Sft Drainfield, Excavate and Fill
12/27/1972		North side of Miner Lake	New	B	Lake Isolation Variance, Fill Required	1-1000 Gal Septic w/ 400 Sft Drainfield, Lake Isolation Variance, Fill Required
8/4/1971	25th	Miner Lake	New	B		1-1000 Gal Septic w/ 300 Sft Drainfield, Lake Isolation Variance
8/17/1973		Miner Lake	New	M	Lift Pump, Mound System	2-1000 Gal Septic w/ 700 Sft Drainfield, Mound System, Lift Pump
4/19/2000	2915	Miner Lake Road	Repair	B	Well Isolation Variance, Close Proximity to Steep Slopes	2-1000 Gal Septic w/ 675 Sft Drainfield
7/26/2002	1965	Miner Lake Road	Repair	P	Well Isolation Not Met, 2-1000 Gal Holding Tanks	Well Isolation Not Met, 2-1000 Gal Holding Tanks
7/26/1971		Unknown	New	D	1200 Gal Drywell	1-1000 Gal Septic w/ 1200 Gal Drywell
12/11/1986		Lorraine Drive	New	M	Mound System	1-800 Gal Septic w/ 340 Sft Drainbed, Mound System 4.5' High
9/4/1974		Unknown	New	T	Trench System	1-1000 Gal Septic w/ 500 Sft Trench System
7/25/1973		Unknown	New	D	Drywell System	1-1000 Gal Septic w/ 2 Drywells
9/15/1998	1968	Stoney Point	Repair	D	Property Line and Well Isolation Variance, 500 Gal Pump Chamber and 2 Drywells	Property Line and Well Isolation Variance, 500 Gal Pump Chamber and 2 Drywells, 1000 Gal Septic
4/13/1999	1964	Stoney Point	New	B		2-1000 Gal Septic w/ 1000 Sft Drainfield
6/11/1999	1958	Stoney Point	Repair	B		2-1000 Gal Septic w/ 1200 Sft Drainfield
9/29/2004	1969	Stoney Point	New	B	500 Gal Pump Chamber	1-1000 Gal Septic w/ 500 Gal Pump Chamber
8/7/1973		S side of Miner Lake	New	M	Mound System	2-1000 Gal Septic w/ 700 Sft Drainfield, Mound System
12/13/1990	2447	118th	New	B		1-1000 Gal Septic w/ 510 Sft Drainfield
7/25/1973		Off 118th Ave	New	B	Undersized for Cottage Use	1-600 Gal Septic w/ 360 Sft Drainfield, Undersized for Cottage Use
6/19/2001	2571	Harold	Repair	B		2-1000 Gal Septic w/ 680 Sft Drainfield
10/20/1992	1975	Koteris Drive	Repair	M	500 Gal Pump Chamber, Well Variance, Drainfield Undersized, No Replacement Options, Mound System	1-1500 Gal Septic Tank w/ 500 Gal Pump Chamber and 600 Sft Drainfield, Well Variance, Drainfield Undersized, No Replacement Options, Mound System
6/11/1993	1981	Koteris Drive	Repair	B	500 Gal Pump Chamber, Variance for Lake Isolation and Slope, Pumped under Road	1-1500 Gal Septic Tank w/ 500 Gal Pump Chamber and 750 Sft Drainfield, Variance for Lake Isolation and Slope, Pumped under Road
5/11/1994	1971	Koteris Drive	Repair	M	Mound System with 500 Gal Pump Chamber	1-1000 Gal Septic w/ 500 Gal Pump Chamber and 500 Sft Drainfield, Mound System
6/19/1996	1996	Koteris Drive	New	B	500 Gal Pump Chamber	2-1000-Gal Septic w/ 500 Gal Pump Chamber and 1100 Sft Drainfield
8/15/1997	1973	Koteris Drive	Repair	B		2-1000 Gal Septic w/ 660 Sft Drainfield
	1979	Koteris Drive	New	P	1500 Gal Holding Tank	1500 Gal Holding Tank
1980	2605	Haas Drive	Repair	T	Trench System	Unknown Septic w/ Trench System
11/1/1979	2591	Haas Drive	Repair	M	Mound System	1-1000 Gal Septic w/ 600 Sft Drainfield, Mound System
6/2/1993	2595	Haas Drive	Repair	B		1-1000 Gal Additional Septic w/ 1000 Sft Drainfield
12/2/1999	2603	Haas Drive	New	B	Close Proximity to Steep Slopes	2-1000 Gal Septic w/ 700 Sft Drainfield
10/16/2000	2581	Haas Drive	Repair	B	Lift Pump	1500 Gal Dual Compartment Septic and Pump to Existing Bed
5/20/2003	2555	Haas Drive	Repair	B	Lake and Well Isolation Variance	1-1000 Gal Septic w/ 400 Sft Drainfield, Lake and Well Isolation Variance
7/29/2003	2561	Haas Drive	New	B	500 Gal Pump Chamber and Well Isolation Not Met	2-1000-Gal Septic w/ 500 Gal Pump Chamber and 920 Sft Drainfield, Well Isolation 63 Ft
5/5/2005	2571	Haas Drive	Repair	P	Well Distance Variance and 1500 Gal Holding Tank	Well Distance Variance and 1500 Gal Holding Tank
10/11/2005	2585	Haas Drive	Loan Evaluation	T	Trench System	Trench System
6/30/1973	Lot 21	Haas Street	New	M	Lake Isolation Variance, Mound System	1-800 Gal Septic w/ 450 Sft Drainfield, Lake Isolation Variance, Mound System
10/21/1993	1999	Benny Drive	New	B	500 Gal Pump Chamber, Berm Wall and 8" Tile Required, Well Relocated	2-800 Gal Septic w/ 500 Gal Pump Chamber and 600 Sft Drainfield, Berm Wall and 8" Tile Required, Well Relocated
10/21/1998	1997	Benny Drive	Repair	B	Lake and Well Isolation Variance	1-500 Gal and 1-800 Gal Septic w/ 500 Sft Drainfield, Lake and Well Isolation Variance
	2004	Benny Drive	New	M	Mound System	2-1000 Gal Septic w/ 990 Sft Drainfield
	2001	Benny Drive	New	U	Size and Type Not Known	Size and Type Not Known
10/15/1970		Lakeland Drive	New	D	1000 Gal Drywell	1-1000 Gal Septic w/ 1000 Gal Drywell
12/14/1993	1943	Lakeshore Drive	New	B	500 Gal Pump Chamber	1500 Gal Dual Compartment Tank w/ 500 Gal Pump Chamber, 345 Sft Drainfield
12/16/1993	1955	Lakeshore Drive	New	U	Size and Type Not Known	Size and Type Not Known
12/16/1993	1935	Lakeshore Drive	New	D	500 Gal Pump Chamber, 2-Drywells w/ Alternating Valve	1-1500 Gal Septic Tank w/ 500 Gal Pump Chamber, 2-Drywells w/ Alternating Valve
7/25/1995	1959	Lakeshore Drive	New	B	500 Gal Pump Chamber	2-1000 Gal Septic w/ 500 Gal Pump Chamber and 1188 Sft Drainfield
9/15/2004	1961	Lakeshore Drive	Repair	P	1500 Gal Holding Tank	1500 Gal Holding Tank
4/20/1977		Horseshoe Cove	New	B		1-800 Gal Septic w/ Drainfield
11/7/1986		Horseshoe Cove	New	T	Trench System	1-1000 Gal Septic w/ 345 Sft Trench System
7/19/1988		Horseshoe Cove	New	B	Extensive Excavation and Backfill~5.5 Ft Deep	1-1000 Gal Septic w/ 660 Sft Drainfield and Extensive Excavation and Backfill~5.5 Ft Deep
6/24/1998	1906	Horseshoe Cove	New	B	Close Proximity to Steep Slopes	1-1000 Gal Septic w/ 700 Sft Drainbed near steep slope
3/17/1999	1916	Horseshoe Cove	New	B		1-1000 Gal Septic w/ 400 Sft Drainfield or 600 Sft Drainbed
8/5/2002	2497	Horseshoe Cove	Repair	B	Lake Isolation Variance and Pump Chamber	2-1000 Gal Septic w/ 700 Sft Drainfield and Pump Chamber with Lake Variance
9/18/2003	1911	Horseshoe Cove	New	B		2-1000 Gal Septic w/ 800 Sft Drainfield
8/8/1972		Liechti Knoll Subdivision	New	B		1-1000 Gal Septic w/ 450 Sft Drainfield
9/14/1971		Forest Drive	New	B		1-800 Gal Septic w/ 300 Sft Drainfield
7/19/1974		Unknown	New	M	Lake Isolation Variance, Mound System	1-1000 Gal Septic w/ 990 Sft Drainfield, Lake Isolation Variance, Mound System
11/12/1970		Forest Drive	New	D	1000 Gal Drywell	1-800 Gal Septic w/ 1000 Gal Drywell

Allegan County Health Department
Loan Evaluations Around Miner Lake
Printed 10/17/06

Facility Number	Address	Date
2100026	2100 26TH ST	2/24/1997
2128025	2128 25TH ST	7/12/1995
2156026	2156 26TH ST ND	2/27/1996
2432122	2432 122ND AVE	12/23/1996
2437118	2437 118TH AVE	5/24/2004
2454122	2454 122ND AVE	9/25/1997
2492122	2492 122ND AVE	1/4/1995
2500121	2500 121ST AVE 0.9	1/8/1993
2582121	2582 121ST AVE	3/29/2006
2590121	2590 121ST AVE ND	7/21/1995
2602122	2602 122ND AVE	8/13/1999
2602122	2602 122ND AVE	10/1/1999
2663120	2663 120TH AVE ND	7/13/1981
2667120	2667 120TH AVE	7/26/1995
2667120	2667 120TH AVE ND	7/8/1998
2673120	2673 120TH AVE 0.5	7/28/1994
9011838HORSE	1838 HORSESHOE COVE	5/25/1999
9011838HORSE	1838 HORSESHOE COVE ND	6/11/2001
9011968STONE	1968 STONEY POINT DRIVE ND	9/3/1998
9011981KOTER	1981 KOTERAS DR	5/4/1900
9011981KOTER	1981 KOTERAS DR ND	3/9/1993
9011987KOTER	1987 KORTERAS ND	6/16/1993
9011997BENNY	1997 BENNY DR ND	4/28/1900
9012001BENNY	2001 BENNY DR ND	4/20/1993
9012041FORRE	2041 FORREST DR ND	8/23/1995
9012047FORES	2047 FOREST DR	10/11/1994
9012047FORES	2047 FOREST DR ND	4/9/1998
9012061FORRE	2061 FORREST DR ND	4/2/1998
9012080LAKED	2080 LK DR	5/22/1995
9012080LAKED	2080 LK DR ND	6/21/1999
9012084LAKED	2084 LK DR ND	6/22/1994
9012091FORRE	2091 FORREST DR ND	11/21/1994
9012095FORRE	2095 FORREST DR ND	9/29/1994
9012095FORRE	2095 FORREST DR	10/12/2000
9012116BAYVI	2116 BAYVIEW DR	10/6/1994
9012394MINER	2394 MINER LAKE RD ND	5/1/1987
9012466LORRA	2466 LORRAINE DR ND	11/7/2005
9012466WEGNA	2466 WEGNAR DR ND	9/8/1993
9012467LORRA	2467 LORRAINE DR	9/8/1986
9012467LORRA	2467 LORRAINE DR ND	5/8/2002
9012470LORRA	2470 LORRAINE ND	6/20/1997
9012482WEGNA	2482 WEGNAR DR ND	11/17/2003
9012488BIRCH	2488 BIRCH CT	2/3/1987
9012488BIRCH	2488 BIRCH CT ND	11/16/2005

Facility Number	Address		Date
9012488WEGNA	2488 WEGNAR DR		7/21/1995
9012489BIRCH	2489 BIRCH CT		8/19/1996
9012492HORSE	2492 HORSESHOE COVE DR	ND	6/27/2001
9012497MINER	2497 MINER LAKE DR	ND	7/26/2001
9012500BIRCH	2500 BIRCH CT	ND	9/10/1998
9012502SHAFE	2502 SHAFER DR	ND	11/29/2004
9012520HAROL	2520 HAROLD DR	ND	7/15/2002
9012535MINER	2535 MINER LK DR	ND	6/3/1997
9012552HAROL	2552 HAROLD DR	ND	5/11/2004
9012553LORRA	2553 LORRAINE DR	ND	9/22/1999
9012569LORRA	2569 LORRAINE DR	ND	8/1/2005
9012573LORRA	2573 LORRAINE DR	ND	6/25/1993
9012581HAASD	2581 HAAS DR	ND	4/25/1994
9012585HAASD	2585 HAAS DR	ND	10/7/2005
9012605HAASD	2605 HAAS DR	ND	12/8/1995
9012605HAASD	2605 HAAS DR		3/19/2001
9012605HAASD	2605 HAAS DR	ND	6/25/2004

Appendix F

Utility Services Agreement

UTILITY SERVICES AGREEMENT

This Utility Services Agreement is made as of February 12, 2024, between the City of Allegan, Michigan home rule city, the principal off address of which is 231 Trowbridge Street, Allegan, MI 49040 (the "City") and Allegan Township, a Michigan general law township, the principal office address of which is 3037 118th Avenue, Allegan, MI 49010 (the "Township").

RECITALS

A. The Township wishes to make public water and/or sanitary sewer services available to properties in the Township.

B. The City currently owns and operates a public water system (the "Water System") and a sanitary sewer system (the "Sewer System") which currently have unused capacity to serve additional customers. The Water System and the Sewer System are collectively called the Utility Systems.

C. The Township does not wish to operate a public water or sanitary sewer system.

D. The parties find it in their mutual best interests to enter into this Agreement such that the Utility Systems can serve users in the Township while assuring such use does not adversely affect the parties' interests in preserving the City's commercial and industrial areas.

TERMS AND CONDITIONS

Now, therefore, in exchange for the consideration in and referred to by this Agreement, the parties agree as follows:

ARTICLE I

1. Extension of Utility Systems

   a) Right to Extend.
   The Township may, without cost to the City, construct, or cause to be constructed anywhere within the Township water and/or sanitary sewer system improvements and any needed extensions from existing Utility Systems lines to connect to those improvements constructed within the Township, provided capacity is available without expansion of the existing Utility Systems. This right shall be limited in location only as follows:

      i) Industrial and Commercial Users.
      The City and the Township agree it is in their mutual best interest that the commercial and industrial areas of the City remain vibrant. To protect that vibrancy, the parties

agree no utility service shall be provided to any new industrial or commercial customer in the Township without the City's prior written consent after an approving resolution of the City Council. All existing Township industrial or commercial users in place at the time of adoption of this Agreement shall be eligible to for City utility service.

The restrictive service provision for new industrial and commercial customers does not preclude any new industrial or commercial development in the Township, but such development may be precluded from connecting to the Utility Systems.

ii) Residential Users.

The Township may, without cost to the City, construct or cause to be constructed anywhere in the Township, water and/or sanitary sewer system improvements and any needed extensions from existing utility system lines to connect to the improvements constructed in the Township.

b) Submission and Review.

All such improvements in the Township and extension of the Utility Systems shall be in accordance with City specifications, standards, and practices. Unless otherwise agreed in writing by the City with respect to any given project, the plans, and specifications for such work shall be submitted to the City and approved by the City's engineers before letting any bids or seeking any permits or other approvals. The cost incurred by the City for such a review shall be paid by the developer, or other party seeking the utility services. The review and approval by the City's engineers shall not be unreasonably denied, delayed, or conditioned. The bid documents and contract documents shall provide that the City, including its officers, employees, and engineers, shall be insured by the contractors' and subcontractors' insurance and those copies of such policies and certificates of insurance shall, upon request, be provided to the City.

c) Other Consents.

i) The Township shall, prior to any construction, obtain or cause to be obtained any required consents of the Michigan Department of Transportation, Allegan County Road Commission, the Allegan County Drain Commissioner, the Allegan County Health Department, The Michigan Department of EGLE (or the State of Michigan Department assigned to oversee environmental regulations), other utilities, etc. The City shall not be obligated to seek or obtain any such additional approvals for any work but shall cooperate to the extent reasonably necessary with the Township's efforts to obtain them.

ii) To the extent works is do be done with the City, the Township shall provide details of the staging, traffic control and other related plans normally needed to obtain permission from the City for such work.

iii) The Township shall also obtain or cause to be obtained, without cost to the City and prior the letting of any bids for the work, any needed easements or other property interests needed in the property in which the lines, valves, pumps, or other components will be located, and which are needed to have reasonable access to those components. The easements and property interests shall be in the name of the City, shall be in the form reasonably acceptable to the City, and shall be recorded.

d) Contractor.
The work shall be performed by a contractor and subcontractors reasonably acceptable to the City. Accordingly, before awarding any bid, the Township shall submit the bid tabulation, the selected bid, and the contractor's qualifications to the City for its review and written approval. The City Manager may give that approval on behalf of the City and may, if the City Manager wishes, first consult with the City Council. Such approval of the contractor shall not be unreasonably denied, delayed, or conditioned.

e) Inspection.
The City (or its engineers) shall inspect any such work before it is covered to satisfy the City that the work complies with the approved plans and specifications. Such an inspection, if conducted, shall be at the expense of the parties performing the work.

f) Record Plans.
Upon the completion of construction of any work undertaken pursuant to this Section 1.1, the Township shall, at its sole expense, provide or cause to be provide to the City "record plans" showing the exact location of the lines, valves, pumps, and other components constructed or installed as part of such work.

g) Costs.

i) The parties intend that costs for construction and installing the lines, valves, pumps, and other components pursuant to the Section 1.1 shall be borne by those needing or desiring the service(s), generally by special assessments levied by the Township or by a developer paying the costs. Special connection fees and payback agreements might be used in situations where the parties agree they are appropriate.

ii) If part of an improvement is wholly or partially beneficial to other existing portions of one of the Utility Systems, the parties shall allocate the costs of such improvement according to the benefit to that system and the benefit for the property to be newly served. In case of any dispute, it shall be resolved as provided in Section 1.5 a) below.

2. Operations and Management
Once completed and following the inspection by and approval of City officials, all of the lines, valves, pumps, and other components constructed and installed as provided in Section 1.1, shall become part of the Water System and/or Sewer System and the City shall be

responsible for all operation, maintenance, repair, replacement and improvement of them as it is for all of the existing Utility Systems. The costs of such work shall be paid from rates, fees, and charges as it is for all of the existing Utility Systems. If the City would normally specially assess properties specially benefited by any required work, the Township agrees to so specially assess the properties determined by the City to specially benefit from any such work. The costs of extending lines, building pump stations, or providing service to property not previously served shall be paid by the property owner, developer or occupant and shall not be a Utility System costs.

3. Connection and Use Conditional.
No structure or other use located in the Township shall be connected to, draw any water from, or make any discharge to the Utility Systems except after paying all rates, fees, and charges which may be due and after obtaining all consents which may be required pursuant to this Agreement. Such connection and use of the Utility Systems shall be conditions upon initial compliance and continues compliance of the Township, and any users of the Utility System, with the terms and conditions of this Agreement. If the Township fails to fully comply with the terms of this Agreement, the City may, upon 120 days written notice to the Township or, in case of a threat to the public health, safety and welfare resulting form such noncompliance, immediately terminate Utility.

4. Compliance.
The Township and all persons using one or both of the Utility Systems by virtue of this Agreement shall comply with all laws, rules, regulations, permit requirement, orders, and directives of any agency or entity of competent jurisdiction which are applicable to the connection to or use of the Utility Systems.

5. Rates, Fees, and Charges.
   a) Fees for the operation, maintenance, repair, replacement, and debt of the Utility Systems shall be determined on a cost-of-service basis using a rate methodology approved annually by the City. The Township has the right to review and comment on the methodology.

   b) Except for any special connection fee to be imposed by the Township as provided in Section 1.1, the fees charged to connect to either of the Utility Systems shall be uniform, throughout the City and Township. Connection fees are set annually by the City Council.

   c) Fees for the operation, maintenance, repair, and replacement of the Utility Systems shall be the same for users in the City and users in the Township with respect to the intake and treatment of water and for the treatment of wastewater. The charges for water distribution and wastewater collection shall be based on a cost-of-service basis as provided in subsection 1.5 a) above, provided however, the charges to users in the Township shall not be less than the charges to the users in the City.

d) No free service shall be provided to any user.

e) As used in this Agreement, the term "operation, maintenance, repair, and replacement" means all work, materials, equipment, utilities, and other efforts required to operate, maintain repair and replace the wastewater collection, water distribution, wastewater treatment and water treatment water treatment lines, facilities and appurtenances consistent with ensuring adequate collection and treatment of wastewater and adequate intake, treatment and distribution of water in compliance with all applicable state and federal laws, rules and regulations, permit and license requirement, and the orders and directives of any governmental officials and agencies of competent jurisdiction, including without any limitations by the city's National Pollutant Discharge Elimination System (NPDES) permit.

f) Charges for Township debt service for required water and/or sanitary sewer system improvements and extensions connection to the Utility Systems shall be determined using a rate methodology agreed upon by both parties. The current debt service fee is $4.50 per Residential Equivalency Unit (REU) but may be changed by the Township at any time.

g) Charges for Township debt service as specified in subsection 1.5 f) above shall be billed to Township users in accordance with the billing procedures provided by this Agreement and paid to the Township by the City on a quarterly basis from March 1, 2012, until December 31, 2032. Such charges shall be based on a cost-of-service basis as provided in subsection 1.5 a) above.

6. Billing and Payment

This is a retail utility service agreement. The City shall directly bill all users.

a) The due date for users of the Utility Systems in the Township shall be the same as users of the Utility Systems within the City.

b) There shall be a lien upon the premises served pursuant to this Agreement for all rates, fees, and charges imposed for such services which lien shall commend on the date service is provided. The Township shall adopt an ordinance and/or take any other actions required to impose and/or collect such lien in the same manner as ad valorem real and personal property tax rolls and bills, even if such tax rolls or bills must be specially created for the parcel. The City may also use any other means for collecting such amounts including, without limitation, discontinuance of service, lawsuits for collection, required escrow deposits and any other methods also used for users in the City.

7. Interruption of Service.

The City shall not be responsible for any inconvenience, damage, interruption of operations or other direct or indirect results of the interruption of the water service to any parcel.

8. Capacity Limitation.
The City shall annually review with the Township Supervisor and Township Engineer the capacities of the Utility Systems and the Township's forecast of needed and desired new service. To the extent practicable, the City shall take steps to expand the Utility Systems' capacity as reasonably needed to reasonably accommodate those needs. If the City believes technical, financial, or other issues limit its ability to expand such capacity, it shall meet with the Township Supervisor and Township Engineer to explain and discuss such issues.

9. Utility Capital Improvement Plan.
Annually the City and the Township shall review a 10-year capital improvement plan showing what water and sanitary sewer improvements are planned for each year in the City and Township.

ARTICLE II

TOWNSHIP OBLIGATIONS

2.1 Ordinances.
The Township shall adopt and maintain ordinances substantially identical to the City's ordinances applicable to the Utility Systems and, as the City amends ordinance(s) from time to time to adopt amendments to the Township ordinance(s).

2.2 Enforcement.
The Township shall enforce the ordinances adopted pursuant to Section 2.1 above and appoint the City as its enforcement agent for those ordinances with respect to any property in the Township receiving any service from either of the Utility Systems, such that City officials for purposes of enforcing such ordinances with respect to any property or the Township connected to either of the Utility Systems.

2.3 Collection.
The Township shall take actions reasonably needed to assist the City in its collections of rates, fees, and charges for services to parcels in the Township from either of the Utility Systems.

2.4 Consent.
The Township's execution of this Agreement constitutes its consent pursuant to Article VII, Section 29 of the Michigan Constitutions of 1963 to the use of streets, roads, alleys, and other public places in the Township for lines, valves, pumps, and other components of the Utility Systems. The parties agree this is an inter-local agreement pursuant to the Urban Cooperation Act of 1967, MCL 124.501 et seq., and, accordingly, no franchise is needed pursuant to Article VII, Section 29 of the Michigan Constitution of 1963.

2.5 No Disconnect.
Once any premises in the Township is served by either of the Utility Systems, it may not

thereafter disconnect from the that system and be served by any other public water or sanitary sewer system. The parties acknowledge that the Utility Systems will be planning operations, repairs, maintenance, improvements, replacements, and extensions in anticipation of the need to continue service to all users and that such disconnection would disrupt such planning, burden the affected system, and impose significant added costs on its remaining users.

ARTICLE III

CITY OBLIGATIONS

3.1 Service.

The City shall, except as otherwise provided in this Agreement, provide services to property within the Township as if that property were within the jurisdictional limits of the City.

3.2 Expenses.

Once improvements in the Township are completed and approved and accepted by the City as provided in this Agreement, the Township shall not, except otherwise as provided in this Agreement, incur, or be required to pay any costs or expenses because of the service provided or to be provided by the City pursuant to this Agreement. The City shall hold the Township harmless from and against any claims, demands or causes of action arising from or related to the services to be provided pursuant to this Agreement.

ARTICLE IV

TERM AND TERMINATION

4.1 Term.

This Agreement shall remain in effect until both municipalities mutually agree to a change, changes required by other governing bodies or as described in Section 1.3 of this Agreement.

ARTICLE V

REMEDIES

5.1 Cumulative

All the remedies provided in this Agreement shall be cumulative of one another and any other remedies available at law or in equity. No failure to pursue any breach of this Agreement shall affect the right to pursue any subsequent breach of this Agreement. The remedies under this Agreement may be exercised simultaneously or sequentially and no election of any particular remedy shall prevent the election simultaneously or subsequently to exercise another remedy.

5.2 Specific Performance.

The parties agree that the parties generally cannot be made whole by remedies at law and stipulate and agree that equitable remedies including, without limitation, specific performance, mandamus, and injunctions are appropriate remedies under this Agreement. They further stipulate and agree that irreparable harm results from any breach of this Agreement.

5.3 Jurisdiction and Venue.

To the extent not otherwise prohibit by law, the parties agree that the jurisdiction and venue for any action brough pursuant to or to enforce any provision of this Agreement shall be solely in the state court in Allegan County, Michigan.

5.4 Costs.

To the extent not otherwise prohibited by law, the parties agree that in any action brought pursuant to or to enforce any provision of this Agreement, the prevailing parties shall, in addition to any other remedy to which it (they) may have, be entitled to recover actual costs, including without limitation actual reasonable attorney fees, expert witness fees, and other legal expenses, incurred to bring, maintain or defend any such action from is accrual or first notice thereof through any and all appellate and collection proceedings.

ARTICLE VI

MISCELLANEOUS

1. Interpretation.

This is the entire Agreement between the parties with respect to its subject matter. Except for those documents specifically referred to and incorporated herein, no other documents shall have any effect upon its interpretation. This Agreement supersedes and replaces any prior or contemporaneous agreement or representations between the parties, whether written or oral, expressed, or implied. This Agreement was made pursuant to and shall be interpreted under the laws of the State of Michigan. This Agreement was made and is to be performed solely within Allegan County, Michigan. Both parties had the opportunity to have this Agreement reviewed by legal counsel and to have input into its drafting. Therefore, it shall be interpreted as if it were mutually drafted. The captions in this Agreement are for reference purposes only and shall form no part in its interpretation. The Recitals, however, are deemed an integral part of this Agreement.

2. Notices.

Any notices required to be provided under this Agreement shall be deemed made when placed in a United States mail receptacle with first-class postage fully prepaid to address first given above unless that address has changed by written notice to another party. Alternatively, notice shall be deemed made if personally delivered to such address. If made to the City, the notice shall be directed or delivered to the City Clerk. If notice is made to the Township, it shall be directed or delivered to the Township Clerk.

3. Authority.
The parties each covenant and agree that they have the required authority to execute this Agreement and that, upon its execution, this Agreement shall be a binding obligation upon such party. In order to ensure such authority exists, the parties have caused re-solutions of their governing bodies to be attached and incorporated by reference.

In witness whereof, the parties have signed this Agreement as of the date first written above.

City of Allegan

By: _____
Roger Bird, Mayor

By: Michaela Kleehammer
Michaela Kleehammer, Clerk

Date: February 12, 2024

Allegan Township

By: Stephen A. Schulz
Steve Schulz, Supervisor

By: Michelle Waite
Michelle Waite, Clerk

Date: 2-8-2024

Environmental Assessment

Allegan Township, Wastewater System Improvements:
Allegan County, Michigan

8/1/24

Prepared by: Jason Laney and Valerie Van Fleet, Great Lakes Community Action Partnership. This report has been made possible as a result of funding as part of the RCAP/Technitrain Program, an RCAP network project. GLCAP is an equal opportunity employer and provider.

Table of Contents

1.0 Purpose and Need of Project

1.1 Project Description

Miner Lake is an all-sports lake located in Allegan Township in Allegan County, Michigan. Miner Lake is a lake 1-1/2 miles in length and less than a mile in width and is located approximately three miles northeast of the City of Allegan. There are approximately 248 primary properties in the study area. Miner Lake is a lake 1-1/2 miles in length and less than a mile in width and is located approximately three miles northeast of the City of Allegan. There are approximately 248 primary properties in the study area. A DNR public access is located at the southwest portion of the Lake just north of 120th Avenue. There is no commercial/industrial land use within the study area.

Most of the eastern shoreline consists of freshwater emergent or freshwater forested/shrub wetland with additional areas along Miner Creek at the far southeast outlet of the Lake. Additional wetlands are located along the western inland areas.

The existing land use surrounding Miner Lake is both full-time and seasonal residential homes. It is estimated that 60% of the homes are full-time residents. There are no Township or County parks in the service area.

1.2 Purpose and Need of Project

Allegan Township is seeking an expansion in the Miner Lake area to provide sewer service around the lake to approximately 248 primary properties in the study area. The service area for the sewer system is the entire area around Miner Lake in Sections 11, 12, 13 and 14 of Allegan Township. The outline of the service area is shown in Appendix A. The service area consists of the developed land immediately adjacent to the Lake as well as lots near the Lake.

The City of Allegan's Wastewater Treatment Facilities (WWTF) are the closest municipal facilities and are approximately 1.7 miles west and 2.3 miles south of the Miner Lake service area. Wastewater treatment is currently provided by on-site septic systems in the study area.

2.0 Alternatives to the Proposed Action

Table 1. List of Alternatives for the Supply and Treatment Systems.

Alternative	Beneficial Environmental Impacts	Potential Adverse Environmental Impacts
Do nothing	No construction related environmental impacts	• Does not protect Miner Lake water quality • Does not protect public health and safety • No replacement of existing septic systems that are failing or underperforming • As systems fail, costly advanced treatment or holding tanks
Optimizing the Performance of Existing Systems	Limited construction related environmental impacts	• Limited availability of land on small parcels • Advanced treatment is costly to install, operate, and maintain • No economy of scale for construction costs • Isolation distance issues can limit options and require variances
Gravity System	• Protects Miner Lake water quality • Protects public health and safety	• Many duplex pumping stations to maintain • Chemical feed system required to mitigate odor and corrosion • Most environmentally disruptive • Most initial private party impact • Highest capital cost
Low-Pressure Grinder System	• Protects Miner Lake water quality • Protects public health and safety • Directional drilling limits environmental impacts • Low-pressure system is easily expandable for future needs • Smallest footprint on private land allows flexibility of installation location • Storage tank pumping is not required	• Chemical feed system required to mitigate odor and corrosion • Minimal storage capacity during power outages • Requires 240V electrical service • Highest OM&R costs

Low-Pressure STEP System	• Protects Miner Lake water quality • Protects public health and safety • Directional drilling limits environmental impacts • Low-pressure system is easily expandable for future needs • Storage capacity during power outage • Better suited to serve seasonal areas • Lowest capital cost • Lowest OM&R costs	• Largest footprint on private land • Storage tank pumping is required • Requires most effort to coordinate with homeowners • Requires 120V electrical service

2.1 Alternative 1 – Do Nothing

2.2 Alternative 2 – Optimizing the Performance of Existing Systems

Optimizing the performance of the existing septic/drainfield systems would not be feasible on many of the existing parcels surrounding the lake. Much of the service area has a seasonal high groundwater table within 2 feet of the ground surface. An effective septic/drainfield treatment system would most likely involve installing onsite advanced treatment systems which are costly to construct and maintain. Advanced treatment systems also typically require a certified operator to maintain and operate the system. There is very limited or no available land on many parcels to construct advanced treatment systems or allocate space for replacement drainfield areas. Many properties within the project area do not have land available to accommodate a new or upgraded septic system and/or drain field. Required isolation distances from water wells further constrains optimization efforts of these systems, especially on small lots.

In the event that advanced treatment systems could not be constructed, holding tanks and pump and haul operations are typically the only remaining option. Pump and haul operations are costly, subject to leaking or overflowing tanks, and are not economically feasible during periods of high use.

Optimizing the performance of the existing facilities is neither an effective nor implementable alternate. This alternative does not meet the project objectives and will not be further evaluated as a principal alternative.

2.3 Alternative 3 – Gravity System

This alternative would consist of a conventional gravity sewer collection system utilizing 8-inch or larger diameter pipe to convey wastewater. The sewers would be installed at the minimum slope required to maintain sufficient sewage flow velocities and to prevent the deposition of solids. Manholes would be constructed at periodic intervals for access, cleaning, and inspection. Lift stations would be utilized throughout the collection system where the sewer becomes too deep, and sewage would be pumped uphill to another part of the collection system to continue flowing by gravity. Two ultimate downstream lift stations would collect all sewage and pump it to the City of Allegan's wastewater collection system to be treated at the WWTF.

Conventional gravity sewers could serve most of the homes in the service area. Some homes, however, are at lower elevations relative to the roadway and would have service leads that are lower than the gravity sewer, especially if a basement or walk-out level requires sewer service. In these instances, the

homeowner would be responsible for providing a pump to lift the sewage up to the gravity sewer elevation.

The conventional gravity sewer system would require lift stations in several locations throughout the collection system. Each station would consist of two underground chambers and an above-ground electrical panel. The total area required for each station would be approximately 20×30 feet. Landscaping would be provided to screen the station.

The preliminary layout of the conventional gravity sewer system contains eleven lift stations –six on the north side of the lake and five on the south side. Two of the eleven lift stations would serve as ultimate downstream lift stations for the north and south sides of the lake. They would be located towards the western end of the lake; one on Lake Dr and one on Haas Dr. The forcemain from the main lift stations would be constructed west along 120th Ave, south along 28th St, west along 118th Ave, then south along 30th St where it would discharge into the City of Allegan's existing wastewater collection system at the northern City limits. The forcemain route is shown in Figure 5. Several cleanouts would be installed at regular intervals along the length of the forcemain, and air release valves would be installed at high points.

Due to the long length and detention time that sewage will spend inside the forcemain to the City's collection and treatment facilities, chemical addition equipment would be installed at the two main lift stations, which would inject chemicals into the sewage to control odors and sulfide formation.

This type of system relies on the slope of the pipe to carry wastewater, so the depth of the sewer can be an issue, especially in areas around Miner Lake with high groundwater. Costs for dewatering, trench undercutting, and sand backfill are included in the capital construction costs due to the poor soil conditions and narrow roadway construction, which result in greater installation and restoration costs.

The gravity collection system would consist of approximately:

- 4.04 miles of gravity sewer;
- 62 manholes;
- 40 grinder pump systems for homes below road elevation;
- 11 pump stations; and
- 7.30 miles of forcemain.

2.4 Alternative 4 – Low-Pressure Grinder Pump System

This alternative would utilize a single grinder pump at each home in the service area, or dual pumps for two or more homes combined. The home's wastewater would be ground up and pumped into a common network of low-pressure forcemain, typically no more than 4 inches in diameter. Collectively, the pumps would convey the wastewater through the collection system to a single downstream lift station located at the western end of Miner Lake. Several cleanouts would be installed at regular intervals throughout the system, and air release valves would be installed at high points. Corrosion and odor control chemicals would be added to the wastewater at the lift station before being pumped through a primary forcemain, following the same path proposed in the gravity system alternative. The forcemain would discharge into the City of Allegan's wastewater collection system at the northern City limits and the wastewater would then be treated at Allegan's WWTF.

Pressure sewer systems are easier to install than gravity systems because smaller pipes are installed at shallower depths. The pressure sewer lines would be installed by directional drilling both on the private property and the public road right-of-way, which reduces restoration costs and construction impacts to adjacent properties. Eliminating duplex submersible lift stations removes costly and highly critical pumps,

and land requirements. Construction of conventional gravity sewer would require significant dewatering, whereas the only dewatering required to install the grinder system would be for the small pits dug for each grinder station. With this type of system, the existing septic tanks are abandoned and/or removed.

Due to the high seasonality of the system, low flows are expected during off season times. Lower flows result in reduced cycling of grinder pump stations, and also reduce flushing velocity in pressure mains. Additional cleaning and maintenance of the grinder stations and low-pressure mains would be expected to prevent clogging and backups in the system. Maintaining the pump cutter blades and grinder pumps along with electrical and mechanical maintenance also causes the grinder pump system to have a higher operation and maintenance cost than the STEP system.

The low-pressure grinder collection system would consist of approximately:

•229 grinder systems;

•6.25 miles of low-pressure forcemain;

•1 pump station; and

•3.28 miles of forcemain.

2.5 Alternative 5 – Low-Pressure STEP System

This alternative would consist of each residence in the service area utilizing a septic tank effluent pumping (STEP) system that discharges into a common network of small diameter low-pressure forcemain. Collectively, the pumps would convey the effluent through the collection system to a single downstream lift station located at the western end of Miner Lake. Several cleanouts would be installed at regular intervals throughout the system, and air release valves would be installed at high points. The primary forcemain from the lift station would follow the same path proposed in the previous alternatives. The forcemain would discharge into the City of Allegan's wastewater collection system at the northern City limits and the wastewater would then be treated at Allegan's WWTF. The solids in residents'septic tanks would need to be regularly removed every 7-10 years and hauled to the WWTF for disposal and further treatment.

Pressure sewer systems are easier to install than gravity systems because smaller pipes are installed at shallower depths. The pressure sewer lines would be installed by directional drilling both on the private property and the public road right-of-way, which reduces restoration costs and construction impacts to adjacent properties. Eliminating duplex submersible lift stations removes costly and highly critical pumps, and land requirements. Since solids are retained in the individual tanks on each property, STEP systems require maintenance and cleaning less frequently than gravity and grinder pump systems that convey solids. Pumping the effluent without solids also reduces the pumping effort required, which saves energy. Based on a system wide average of a 7- year solids removal frequency of the STEP tanks, the operation and maintenance costs for the STEP system are less than a gravity system or grinder pump system.

The low-pressure STEP collection system would consist of approximately:

•229 STEP systems;

•6.25 miles of low-pressure forcemain;

•1 pump station; and

•3.28 miles of forcemain.

3.0 Affected Environment/Environmental Consequences

No adverse environmental consequences expected.

3.1 Land Use/Important Farmland/Formally Classified Lands

3.1.1 Affected Environment

The proposed project is the entire area around Miner Lake in Sections 11, 12, 13 and 14 of Allegan Township. The service area consists of the developed land immediately adjacent to the Lake as well as lots near the Lake. This area contains:

Farmland of local importance: 5-Houghton muck, 6-Adrian muck, 7-Palms muck, 12C-Ockley loam, 51A-Thetford loamy fine sand

Prime farmland: 8B-Glynwood clay loam, 11B-Oshtemo-Chelsea complex, 12B-Ockley loam, 19A-Brady sandy loam, 33A-Kibbie fine sandy loam

Prime farmland if drained: 22A-Matherton loam, 30-Colwood silt, 41B-Blount silt loam, 45-Pewamo silt

A detailed Soil Resource Report was collected from the USDA NRCS website and can be found in Sections 7.8.1 & 7.8.2 of this document.

3.1.2 Environmental Consequences

The proposed project is the entire area around Miner Lake in Sections 11, 12, 13 and 14 of Allegan Township. The service area consists of the developed land immediately adjacent to the Lake as well as lots near the Lake. The project will not take place in any areas designated as “Farmland of local importance”, “Prime Farmland” or “Prime farmland if drained”; no environmental consequences are anticipated as a direct result of this project.

3.1.3 Mitigation

No mitigation is necessary as no direct impact is anticipated regarding prime and important soils nor prime farmland with the proposed project.

3.2 Floodplains

3.2.1 Affected Environment

The project area has not been mapped. FEMA has not completed a study to determine flood hazard for this location. Therefore, a flood map has not been published at this time. This project will have no effect on floodplains, furthermore, excavations will be below ground, and the ground returned to its original condition including restored topsoil, grass, and paving, etc.

3.2.2 Environmental Consequences

No long-term environmental consequences associated with the floodplains are anticipated in association with the proposed project.

3.2.3 Mitigation

No mitigation is necessary as no direct impact is anticipated regarding floodplains with the proposed project.

3.3 Wetlands

3.3.1 Affected Environment

Most of the eastern shoreline consists of freshwater emergent or freshwater forested/shrub wetland with additional areas along Miner Creek at the far southeast outlet of the Lake. Additional wetlands are located

along the western inland areas. The project area has been mapped using the USFWS National Wetlands Inventory (NWI) data to determine if there were wetlands within the project area. According to the NWI data, this project will have no effect to any wetlands. Furthermore, excavations will be below ground, and the ground returned to its original condition including restored topsoil, grass, and paving, etc. The National Final Wetlands Inventory map is shown in Section 7.7.

3.3.2 Environmental Consequences

No long-term environmental consequences associated with wetlands are anticipated with the proposed project.

3.3.3 Mitigation

No mitigation will be required, as no significant adverse impacts exist. Any excavations will be below ground, and the ground returned to its original condition.

3.4 Water Resources

3.4.1 Affected Environment

The environment affected by the proposed project is the entire area around Miner Lake in Sections 11, 12, 13 and 14 of Allegan Township. The service area consists of the developed land immediately adjacent to the Lake as well as lots near the Lake. This project should not have any negative impact on surface or ground water quality in the area because of the proposed actions.

3.4.2 Mitigation

No mitigation measures are necessary regarding water quality as no negative impacts are anticipated to result from the proposed project.

3.5 Coastal Resources

3.5.1 Affected Environment

The project is not located within the Coastal Zone Management (CZM) Area. It is located within the township's local streets and road right-of-way. Therefore, no affect to coastal resources is anticipated with this project.

3.5.2 Environmental Consequences

No environmental consequences or impacts are anticipated with this project regarding coastal resources.

3.5.3 Mitigation

No mitigation will be required, as there are no environmental impacts anticipated regarding coastal resources.

3.6 Biological Resources

3.6.1 Affected Environment

No environmental consequences are anticipated to occur with the proposed wastewater system upgrades. The proposed project is the entire area around Miner Lake in Sections 11, 12, 13 and 14 of Allegan Township. The service area consists of the developed land immediately adjacent to the Lake as well as lots near the Lake. Within the Allegan Township there are known endangered and threatened species including: Indiana Bat, Northern Long-eared Bat, Tricolored Bat, Rufa Red Knot, Whooping Crane, Eastern Massasauga Rattlesnake, Kramer Blue Butterfly, Monarch Butterfly and Pitcher's Thistle.

Indiana Bat: There is a final critical habitat for this species however, the location is not available. The Piping Plover is endangered and is found in Allegan county Michigan. There is a final critical habitat for

this species but the location is not available. This project will be built on road rights-of-way and mowed ditches therefore there is no suitable habitat.

Northern Long-eared Bat: No critical habitat has been designated for this species.

Tricolored Bat: Proposed Endangered; Species proposed for official listing as endangered. No critical habitat has been designated for this species. This project will be built on road rights-of-way and mowed ditches therefore there is no suitable habitat.

Rufa Red Knot: is an endangered species but only needs to be considered when the action occurs along coastal areas during the migratory window of May 1 – September 30. This project will be built on road rights-of-way and mowed ditches therefore there is no suitable habitat.

Whooping Crane: is an endangered species and are currently listed as "experimental population, non-essential" in Michigan. No critical habitat has been designated for this species.

Eastern Massasauga rattlesnake: is a threatened species that live in wet areas including wet prairies, marshes, fens, sedge meadows, peatlands, and low areas along rivers and lakes. Massasaugas also use adjacent uplands (shrubland, open woodlands, prairie) during part of the year. They often hibernate in crayfish burrows but may also be found under logs and tree roots or in small mammal burrows. Unlike other rattlesnakes, massasaugas hibernate alone. No critical habitat has been designated for this species.

Kramer Blue Butterfly: is an endangered species and there is a proposed critical habitat for this species however, the location of the critical habitat is not available. This project will be built on road rights-of-way and mowed ditches therefore there is no suitable habitat.

Monarch Butterfly: breed year-round, undergo long-distance migration and live for an extended period of time. No critical habitat has been designated for this species. This project will be built on road rights-of-way and mowed ditches therefore there is no suitable habitat.

Pitcher's Thistle: is threatened and is found in Michigan. No critical habitat has been designated for this species. This project will be built on road rights-of-way and mowed ditches therefore there is no suitable habitat.

The U.S. Fish and Wildlife Service (USFWS) Information for Planning and Consultation (IPaC) website was consulted to provide further information about the habitat in this area. According to USFWS IPaC site, there is no known candidate, threatened or endangered species and no known critical habitat or hibernacula within the project area. Please see the attached Species List and General Project Design Guidelines in Section 6 regarding habitat and threatened and endangered species surveys that have been conducted in this area. Below briefly describes each species' habitats and lists the likelihood of affect:

3.6.2 Environmental Consequences

The components of the proposed project involve the entire area around Miner Lake in Sections 11, 12, 13 and 14 of Allegan Township. The service area consists of the developed land immediately adjacent to the Lake as well as lots near the Lake. Tree removals are not anticipated with this project. No environmental consequences are anticipated with regards to threatened or endangered species with this project.

3.6.3 Mitigation

No mitigation is required as there are no anticipated effects to endangered species with this project.

3.7 Historic and Cultural Resources

3.7.1 Affected Environment

The land area impacted by the proposed project is the entire area around Miner Lake in Sections 11, 12, 13 and 14 of Allegan Township. The service area consists of the developed land immediately adjacent to the Lake as well as lots near the Lake. There are no historic sites listed in the National Register or

sites identified within the Area of Potential Effect (APE).

3.7.2 Environmental Consequences

The National Historic Preservation Act of 1966 requires a Section 106 review to determine any impacts upon historic properties and cultural resources. The State Historic Preservation Officer (SHPO) requires an archaeological consultant to review the project and conduct any necessary field work to ensure that no cultural or historic sites are affected by the project. The details of this project were reviewed by the archaeological consultant: Great Lakes Research, LLC. The archaeologist determined the project would have no effect on historic or cultural resources. The archaeological report was included within the Section 106 Application and sent in to SHPO, who then conducted their own review of the project. Upon SHPO's review, the State Historic Preservation Officer concurs with the determination of the USDA/RD that no Historic properties are affected within the area of potential effects of this undertaking. See State Historic Preservation Officer Response in Section 6.5. The National Historic Preservation Act also requires that the federal agencies consult with any Indian tribe and /or Tribal Historic Preservation Officer (THPO). The SHPO letter and determination was sent to the appropriate tribes and/or Tribal Historic Preservation Officers for their review and comments. The 106 Application, archaeological report, State Historic Preservation officer response, and Tribal Historic Preservation Officer responses can be seen in Section 6.

3.7.3 Mitigation

No mitigation required as there are no anticipated effects to cultural and historic resources.

3.8 Aesthetics

3.8.1 Affected Environment

The proposed project is the entire area around Miner Lake in Sections 11, 12, 13 and 14 of Allegan Township. The service area consists of the developed land immediately adjacent to the Lake as well as lots near the Lake. There are no visually sensitive areas or landscape features within the area of the proposed project. All areas have been previously developed for either municipal or commercial use.

3.8.2 Environmental Consequences

The construction may have a temporary impact on the aesthetics of the area; however, any excavations will be below ground, and the ground returned to its original condition including restored topsoil, grass, paving, etc.

3.8.3 Mitigation

No mitigation is required with respect to aesthetics.

3.9 Air Quality

3.9.1 Affected Environment

Air quality in Allegan Township is generally good. The proposed project is not anticipated to increase in any emissions after construction. Allegan County is inside of the Nonattainment areas for ozone (See Section 7.8).

3.9.2 Environmental Consequences

During construction, there will be short term air quality impacts from fugitive dust as is common with any construction project; however, these impacts will be mitigated using best management practices during construction, such as dampening of the soil to limit dust and use of diesel-powered equipment that will be fueled with low sulfur diesel fuel. Additionally, contractors will be encouraged to limit idling time during

operation of heavy equipment to reduce air quality impacts from exhaust.

The National Ambient Air Quality Standards (NAAQS) are health-based pollution standards set by EPA. Areas of the state that are above the NAAQS concentration level are called nonattainment areas. For large increases in emissions requiring permitting, companies in nonattainment areas must meet additional requirements, including the requirement to get offsets. Keweenaw County is NOT located within a nonattainment area for ozone or sulfur dioxide and will not be producing long term air quality impacts, therefore, this project will not require offsets or any other mitigation measures.

3.9.3 Mitigation

No mitigation measures are necessary regarding impacts to air quality as there will be no long-lasting impacts to the air quality in the area resulting from this project.

3.10 Socio-Economic Impact Assessment/Environmental Justice Issues

3.10.1 Affected Environment

According to the 2020 Decennial Census, there were 4,689 people living in Allegan Township, the Census Designated Place within the Township that the project lies within. There were 1,776 households, and 1042 married-couple households residing in Allegan Township. The racial makeup was 166 Hispanic or Latino, 4206 White, 70 African American, 22 American Indian or Alaska Native, 24 Asian and 0 Native Hawaiian and Other Pacific Islander.

There were 1776 households out of which 488 had children under the age of 18 living with them, 1357 were married couples living together, 291 had a female householder with no spouse/partner present, 286 had a male householder with no spouse/partner present and 419 were non-families. Of all households, 100 were made up of individuals and 81 were 65 years of age or older. The average household size was 2.52. Allegan Township has a population range that consists of 80.1% over the age of 18, and 25.1% who were 65 years of age or older. The median age was 46 years.

According to the American Community Survey 2020, the median income for a household in Allegan Township was $64,733, and the median family (married couple) income was $83,217. Individuals and families below the poverty line were 4,404. Out of the total people living in poverty, 838 are under the age of 18, 2513 are between the ages of 18 and 64 and 1477 are over the age of 60.

Allegan Township expansion in the Miner Lake area will serve all the residents. The customers are to be charged fairly and equitably according to their usage of the system. The planned improvements in association with this project will benefit all residents within the wastewater service district equally. The cost of the project will be distributed across all users, through user rates. No segment of the population will be treated differently than any other, and discrimination within Allegan Township is prohibited.

3.10.2 Environmental Consequences

No environmental consequences are anticipated regarding socio- economic/ environmental justice issues relating to this project. All residents and users of the system will be treated equally, and all will share equally in the benefits and cost of the improvements proposed.

3.10.3 Mitigation

No mitigation measures are necessary as no socio-economic/environmental justice impacts are anticipated in relation to this project.

3.11 Miscellaneous Issues

3.11.1 Noise

3.11.1.1 Affected Environment

The proposed project is the entire area around Miner Lake in Sections 11, 12, 13 and 14 of Allegan Township. The service area consists of the developed land immediately adjacent to the Lake as well as lots near the Lake. There is no commercial/industrial land use within the study area. Major sources of noise in the area are traffic related to local activities.

3.11.1.2 Environmental Consequences

No new sound generating equipment is anticipated in the proposed project. However, during construction, noise levels will increase due to the construction activities and heavy equipment use. The use of best management practices should limit the unnecessary noise from construction by limiting idling time of heavy equipment, and unnecessary noise from construction workers during construction. Construction will be limited to normal daylight hours as well, which will limit the disruption of the normal quiet nature of the community.

3.11.1.3 Mitigation

No mitigation measures are necessary in association with noise control related to this project as no long-term impacts are anticipated.

3.11.2 Transportation

3.11.2.1 Affected Environment

The areas of construction for this project have the potential to disrupt the normal flow of traffic along local streets. Local transportation may be temporarily affected on these streets by construction, employee, and equipment traffic.

3.11.2.2 Environmental Consequences

The project will have a temporary effect on local transportation due to construction in the road rights- of-ways and construction equipment using these roads to gain access to the construction sites, which is expected to disrupt normal traffic flow. This project is not anticipated to have any lasting impacts on transportation patterns. If street closures or detours are necessary, these will be coordinated with the Michigan Department of Transportation, the local street department and/or the County Road Commission. These should be highly publicized and well-marked during construction.

3.11.2.3 Mitigation

No mitigation measures are necessary in relation to the proposed project regarding transportation, as no long-term impacts are anticipated.

3.11.3 Solid Waste Disposal

3.11.3.1 Affected Environment

Solid waste disposal will not be impacted by this project. During construction, construction crews should be responsible for cleanup of debris daily, as well as at the end of the construction during the cleanup and restoration phases. There are no new permanent sources of solid waste materials associated with this project.

3.11.3.2 Environmental Consequences

No environmental consequences are anticipated because of this project. Solid waste generated by the project will be managed in an appropriate manner as required in the construction agreements. The general contractor will be responsible for adequate and appropriate disposal of all wastes generated during

construction. No long-term impact on solid waste is anticipated, other than those that will be subject to permitting processes currently in place locally or statewide.

3.11.3.3 Mitigation

No mitigation measures are necessary as no impacts are anticipated to result from the proposed project.

3.12 Health and Human Safety

3.12.1 Electromagnetic fields and interference

3.12.1.1 Affected Environment

This project will not include any equipment that produces any significant electromagnetic fields.

3.12.1.2 Environmental Consequences

No environmental consequences are anticipated regarding electronic fields.

3.12.1.3 Mitigation

No mitigation measures are necessary as no impacts are anticipated to result from the proposed project.

3.12.2 Environmental Management

3.12.2.1 Affected Environment

EGLE STD (Storage Tank Division) enforces state and federal laws regarding pollution from storage tank leaks or releases and maintains a listing of all known releases of hazardous materials from any registered underground or above ground storage tanks. There are no known releases in the proposed construction area.

3.12.2.2 Environmental Consequences

A search of the EGLE/STD website showed does show a closed underground storage tank location, but it is not within 2000' of the proposed area. Further, there are no open underground storage tanks within the proposed area. See section 7.9 for a map of known active and closed storage tanks in the vicinity of the project.

Part 213 of the Natural Resources Environmental Protection Act (NREPA) prohibits any exacerbation of any polluted areas (e.g., through excavation and/or dewatering activities). The consultants and contractors will take all necessary precautions when working in potentially contaminated areas.

If, during construction, the contractor encounters any contaminated soil which appears to be the result of an unreported release of hazardous material, the contractor will immediately cease construction and notify the municipal entity, who in turn will notify the EGLE STD of a suspected release. According to law, a discovery of a suspected release of hazardous materials must be reported to EGLE STD within 24 hours. This begins a series of mitigation efforts and/or enforcement actions. These measures are designed to protect the public from any environmental consequences from hazardous spills.

3.12.2.3 Mitigation

No mitigation measures are necessary as no impacts are anticipated to result from the proposed project.

3.13 Corridor Analysis

3.13.1 Affected Environment

The proposed project is the entire area around Miner Lake in Sections 11, 12, 13 and 14 of Allegan Township. The service area consists of the developed land immediately adjacent to the Lake as well as lots near the Lake. There are no visually sensitive areas or landscape features within the area of the proposed project.

3.13.2 Mitigation

No mitigation required for the proposed project.

4.0 Cumulative Effects

No negative long term environmental impacts are anticipated regarding the Allegan Township expansion in the Miner Lake area. The project will continue to improve the conveyance of the Township's wastewater.

5.0 Summary of Mitigation

No mitigation measures are necessary in relation to this project as no long-term negative impacts are anticipated to result from the proposed actions.

6.0 Coordination, Consultation, and Correspondence

6.1 Fish and Wildlife Service Review and Section 7 Endangered Species Act Consultation

6.2 U.S. Fish and Wildlife Service General Project Guidelines

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Michigan Ecological Services Field Office
2651 Coolidge Road Suite 101
East Lansing, MI 48823-6360
Phone: (517) 351-2555 Fax: (517) 351-1443

In Reply Refer To: February 14, 2024
Project Code: 2023-0014057
Project Name: Allegan Township, Wastewater System Improvments

Subject: List of threatened and endangered species that may occur in your proposed project location or may be affected by your proposed project

To Whom It May Concern:

Official Species List
The attached species list identifies any Federally threatened, endangered, proposed and candidate species that may occur within the boundary of your proposed project or may be affected by your proposed project. The list also includes designated critical habitat if present within your proposed project area or affected by your project. This list is provided to you as the initial step of the consultation process required under section 7(c) of the Endangered Species Act, also referred to as Section 7 Consultation.

Under 50 CFR 402.12(e) (the regulations that implement section 7 of the Endangered Species Act), the accuracy of this species list should be verified after 90 days. You may verify the list by visiting the IPaC website (https://ipac.ecosphere.fws.gov/) at regular intervals during project planning and implementation. To update an Official Species List in IPaC: from the My Projects page, find the project, expand the row, and click Project Home. In the What's Next box on the Project Home page, there is a Request Updated List button to update your species list. Be sure to select an "official" species list for all projects.

Consultation requirements and next steps
Section 7 of the Endangered Species Act of 1973 requires that actions authorized, funded, or carried out by Federal agencies not jeopardize Federally threatened or endangered species or adversely modify designated critical habitat. To fulfill this mandate, Federal agencies (or their designated non-Federal representative) must consult with the Fish and Wildlife Service if they determine their project may affect listed species or critical habitat.

There are two approaches to evaluating the effects of a project on listed species.

Approach 1. Use the All-species Michigan determination key in IPaC. This tool can assist you in making determinations for listed species for some projects. In many cases, the determination key

will provide an automated concurrence that completes all or significant parts of the consultation process. Therefore, we strongly recommend screening your project with the **All-Species Michigan Determination Key (Dkey)**. For additional information on using IPaC and available Determination Keys, visit https://www.fws.gov/media/mifo-ipac-instructions (and click on the attachment). Please carefully review your Dkey output letter to determine whether additional steps are needed to complete the consultation process.

Approach 2. Evaluate the effects to listed species on your own without utilizing a determination key. Once you obtain your official species list, you are not required to continue in IPaC, although in most cases using a determination key should expedite your review. If the project is a Federal action, you should review our section 7 step-by-step instructions before making your determinations: https://www.fws.gov/office/midwest-region-headquarters/midwest-section-7-technical-assistance. If you evaluate the details of your project and conclude "no effect," document your findings, and your listed species review is complete; you do not need our concurrence on "no effect" determinations. If you cannot conclude "no effect," you should coordinate/consult with the Michigan Ecological Services Field Office. The preferred method for submitting your project description and effects determination (if concurrence is needed) is electronically to EastLansing@fws.gov. Please include a copy of this official species list with your request.

For all **wind energy projects** and **projects that include installing communications towers >450 feet that use guy wires**, please contact this field office directly for assistance, even if no Federally listed plants, animals or critical habitat are present within your proposed project area or may be affected by your proposed project.

Migratory Birds
Please see the "Migratory Birds" section below for important information regarding incorporating migratory birds into your project planning. Our Migratory Bird Program has developed recommendations, best practices, and other tools to help project proponents voluntarily reduce impacts to birds and their habitats. The Bald and Golden Eagle Protection Act prohibits the take and disturbance of eagles without a permit. If your project is near an eagle nest or winter roost area, see our Eagle Permits website at https://www.fws.gov/program/eagle-management/eagle-permits to help you avoid impacting eagles or determine if a permit may be necessary.

Executive Order 13186: *Responsibilities of Federal Agencies to Protect Migratory Birds*, obligates all Federal agencies that engage in or authorize activities that might affect migratory birds, to minimize those effects and encourage conservation measures that will improve bird populations. Executive Order 13186 provides for the protection of both migratory birds and migratory bird habitat. For information regarding the implementation of Executive Order 13186, please visit https://www.fws.gov/partner/council-conservation-migratory-birds.

We appreciate your consideration of threatened and endangered species during your project

planning. Please include a copy of this letter with any request for consultation or correspondence about your project that you submit to our office.

Attachment(s):

- Official Species List
- USFWS National Wildlife Refuges and Fish Hatcheries
- Bald & Golden Eagles
- Migratory Birds
- Wetlands

OFFICIAL SPECIES LIST

This list is provided pursuant to Section 7 of the Endangered Species Act, and fulfills the requirement for Federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action".

This species list is provided by:

Michigan Ecological Services Field Office
2651 Coolidge Road Suite 101
East Lansing, MI 48823-6360
(517) 351-2555

PROJECT SUMMARY

Project Code: 2023-0014057
Project Name: Allegan Township, Wastewater System Improvments
Project Type: Wastewater Pipeline - New Constr - Below Ground
Project Description: Allegan Township is seeking an expansion in the Miner Lake area to provide sewer service around the lake to approximately 248 primary properties in the study area. The service area for the sewer system is the entire area around Miner Lake in Sections 11, 12, 13 and 14 of Allegan Township. The service area consists of the developed land immediately adjacent to the Lake as well as lots near the Lake.
The City of Allegan's Wastewater Treatment Facilities (WWTF) are the closest municipal facilities and are approximately 1.7 miles west and 2.3 miles south of the Miner Lake service area. Wastewater treatment is currently provided by on-site septic systems in the study area.

Project Location:

The approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/@42.5688876,-85.79656210022176,14z

Counties: Allegan County, Michigan

ENDANGERED SPECIES ACT SPECIES

There is a total of 9 threatened, endangered, or candidate species on this species list.

Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species. Note that 2 of these species should be considered only under certain conditions.

IPaC does not display listed species or critical habitats under the sole jurisdiction of NOAA Fisheries[1], as USFWS does not have the authority to speak on behalf of NOAA and the Department of Commerce.

See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area under this office's jurisdiction. Please contact the designated FWS office if you have questions.

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1. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

MAMMALS

NAME	STATUS
Indiana Bat *Myotis sodalis* There is **final** critical habitat for this species. Your location does not overlap the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/5949 General project design guidelines: https://ipac.ecosphere.fws.gov/project/UTHDXUUWBFBRTODXI2MDBKBHYA/documents/generated/6982.pdf	Endangered
Northern Long-eared Bat *Myotis septentrionalis* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/9045	Endangered
Tricolored Bat *Perimyotis subflavus* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/10515	Proposed Endangered

BIRDS

NAME	STATUS
Rufa Red Knot *Calidris canutus rufa*	Threatened

There is **proposed** critical habitat for this species.
This species only needs to be considered under the following conditions:
- Only actions that occur along coastal areas during the Red Knot migratory window of MAY 1 - SEPTEMBER 30.

Species profile: https://ecos.fws.gov/ecp/species/1864

Whooping Crane *Grus americana*	Experimental Population, Non-Essential

Population: U.S.A. (AL, AR, CO, FL, GA, ID, IL, IN, IA, KY, LA, MI, MN, MS, MO, NC, NM, OH, SC, TN, UT, VA, WI, WV, western half of WY)
No critical habitat has been designated for this species.
Species profile: https://ecos.fws.gov/ecp/species/758

REPTILES

NAME	STATUS
Eastern Massasauga (=rattlesnake) *Sistrurus catenatus*	Threatened

No critical habitat has been designated for this species.
This species only needs to be considered under the following conditions:
- For all Projects: Project is within EMR Range

Species profile: https://ecos.fws.gov/ecp/species/2202
General project design guidelines:
https://ipac.ecosphere.fws.gov/project/UTHDXUUWBFBRTODXI2MDBKBHYA/documents/generated/5280.pdf

INSECTS

NAME	STATUS
Karner Blue Butterfly *Lycaeides melissa samuelis*	Endangered

There is **proposed** critical habitat for this species.
Species profile: https://ecos.fws.gov/ecp/species/6656

Monarch Butterfly *Danaus plexippus*	Candidate

No critical habitat has been designated for this species.
Species profile: https://ecos.fws.gov/ecp/species/9743

FLOWERING PLANTS

NAME	STATUS
Pitcher's Thistle *Cirsium pitcheri*	Threatened

No critical habitat has been designated for this species.
Species profile: https://ecos.fws.gov/ecp/species/8153

CRITICAL HABITATS

THERE ARE NO CRITICAL HABITATS WITHIN YOUR PROJECT AREA UNDER THIS OFFICE'S JURISDICTION.

YOU ARE STILL REQUIRED TO DETERMINE IF YOUR PROJECT(S) MAY HAVE EFFECTS ON ALL ABOVE LISTED SPECIES.

USFWS NATIONAL WILDLIFE REFUGE LANDS AND FISH HATCHERIES

Any activity proposed on lands managed by the National Wildlife Refuge system must undergo a 'Compatibility Determination' conducted by the Refuge. Please contact the individual Refuges to discuss any questions or concerns.

THERE ARE NO REFUGE LANDS OR FISH HATCHERIES WITHIN YOUR PROJECT AREA.

BALD & GOLDEN EAGLES

Bald and golden eagles are protected under the Bald and Golden Eagle Protection Act[1] and the Migratory Bird Treaty Act[2].

Any person or organization who plans or conducts activities that may result in impacts to bald or golden eagles, or their habitats[3], should follow appropriate regulations and consider implementing appropriate conservation measures, as described in the links below. Specifically, please review the "Supplemental Information on Migratory Birds and Eagles".

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1. The Bald and Golden Eagle Protection Act of 1940.
2. The Migratory Birds Treaty Act of 1918.
3. 50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)

There are bald and/or golden eagles in your project area.

For guidance on when to schedule activities or implement avoidance and minimization measures to reduce impacts to migratory birds on your list, see the PROBABILITY OF PRESENCE SUMMARY below to see when these birds are most likely to be present and breeding in your project area.

NAME	BREEDING SEASON
Bald Eagle *Haliaeetus leucocephalus* This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/1626	Breeds Dec 1 to Aug 31

PROBABILITY OF PRESENCE SUMMARY

The graphs below provide our best understanding of when birds of concern are most likely to be present in your project area. This information can be used to tailor and schedule your project activities to avoid or minimize impacts to birds. Please make sure you read "Supplemental Information on Migratory Birds and Eagles", specifically the FAQ section titled "Proper

Interpretation and Use of Your Migratory Bird Report" before using or attempting to interpret this report.

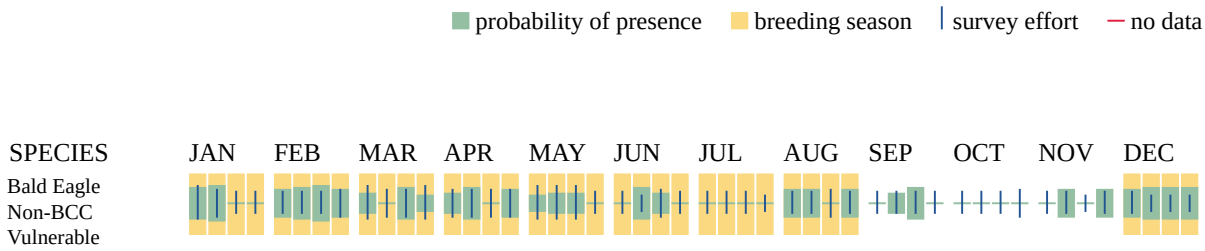
Probability of Presence (▪)

Green bars; the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during that week of the year.

Breeding Season (▪)
Yellow bars; liberal estimate of the timeframe inside which the bird breeds across its entire range.

Survey Effort (|)
Vertical black lines; the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps.

No Data (–)
A week is marked as having no data if there were no survey events for that week.



Additional information can be found using the following links:

- Eagle Management https://www.fws.gov/program/eagle-management
- Measures for avoiding and minimizing impacts to birds https://www.fws.gov/library/collections/avoiding-and-minimizing-incidental-take-migratory-birds
- Nationwide conservation measures for birds https://www.fws.gov/sites/default/files/documents/nationwide-standard-conservation-measures.pdf
- Supplemental Information for Migratory Birds and Eagles in IPaC https://www.fws.gov/media/supplemental-information-migratory-birds-and-bald-and-golden-eagles-may-occur-project-action

MIGRATORY BIRDS

Certain birds are protected under the Migratory Bird Treaty Act[1] and the Bald and Golden Eagle Protection Act[2].

Any person or organization who plans or conducts activities that may result in impacts to migratory birds, eagles, and their habitats[3] should follow appropriate regulations and consider

implementing appropriate conservation measures, as described in the links below. Specifically, please review the "Supplemental Information on Migratory Birds and Eagles".

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1. The Migratory Birds Treaty Act of 1918.
2. The Bald and Golden Eagle Protection Act of 1940.
3. 50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)

For guidance on when to schedule activities or implement avoidance and minimization measures to reduce impacts to migratory birds on your list, see the PROBABILITY OF PRESENCE SUMMARY below to see when these birds are most likely to be present and breeding in your project area.

NAME	BREEDING SEASON
American Golden-plover *Pluvialis dominica* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/10561	Breeds elsewhere
Bald Eagle *Haliaeetus leucocephalus* This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/1626	Breeds Dec 1 to Aug 31
Black-billed Cuckoo *Coccyzus erythropthalmus* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9399	Breeds May 15 to Oct 10
Bobolink *Dolichonyx oryzivorus* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9454	Breeds May 20 to Jul 31
Cerulean Warbler *Dendroica cerulea* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/2974	Breeds Apr 22 to Jul 20
Chimney Swift *Chaetura pelagica* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9406	Breeds Mar 15 to Aug 25
Eastern Whip-poor-will *Antrostomus vociferus* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/10678	Breeds May 1 to Aug 20

NAME	BREEDING SEASON
Golden-winged Warbler *Vermivora chrysoptera* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/8745	Breeds May 1 to Jul 20
Lesser Yellowlegs *Tringa flavipes* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9679	Breeds elsewhere
Pectoral Sandpiper *Calidris melanotos* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9561	Breeds elsewhere
Red-headed Woodpecker *Melanerpes erythrocephalus* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9398	Breeds May 10 to Sep 10
Rusty Blackbird *Euphagus carolinus* This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA https://ecos.fws.gov/ecp/species/9478	Breeds elsewhere
Short-billed Dowitcher *Limnodromus griseus* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9480	Breeds elsewhere
Upland Sandpiper *Bartramia longicauda* This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA https://ecos.fws.gov/ecp/species/9294	Breeds May 1 to Aug 31
Wood Thrush *Hylocichla mustelina* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9431	Breeds May 10 to Aug 31

PROBABILITY OF PRESENCE SUMMARY

The graphs below provide our best understanding of when birds of concern are most likely to be present in your project area. This information can be used to tailor and schedule your project activities to avoid or minimize impacts to birds. Please make sure you read "Supplemental Information on Migratory Birds and Eagles", specifically the FAQ section titled "Proper Interpretation and Use of Your Migratory Bird Report" before using or attempting to interpret this report.

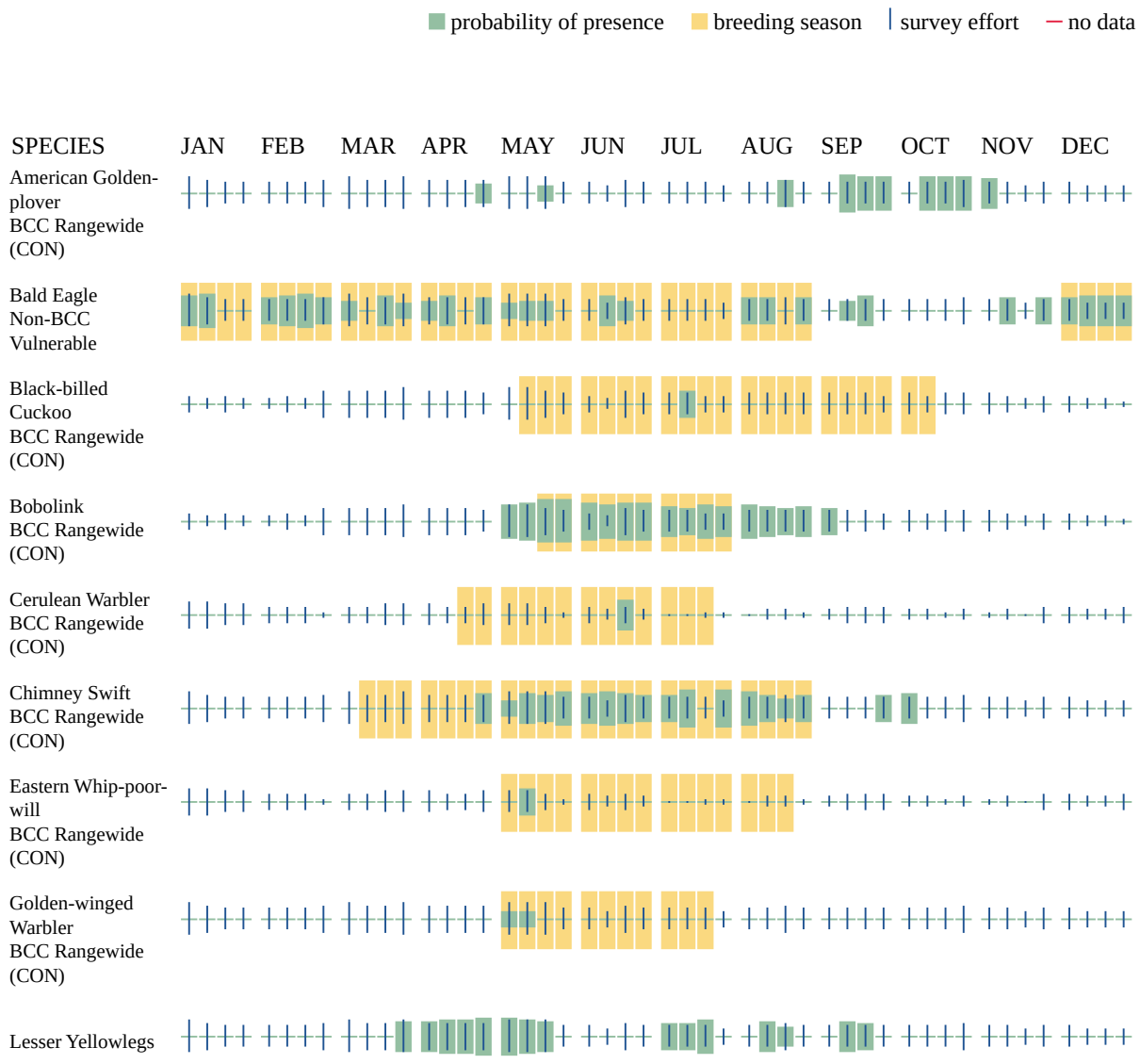
Probability of Presence (■)

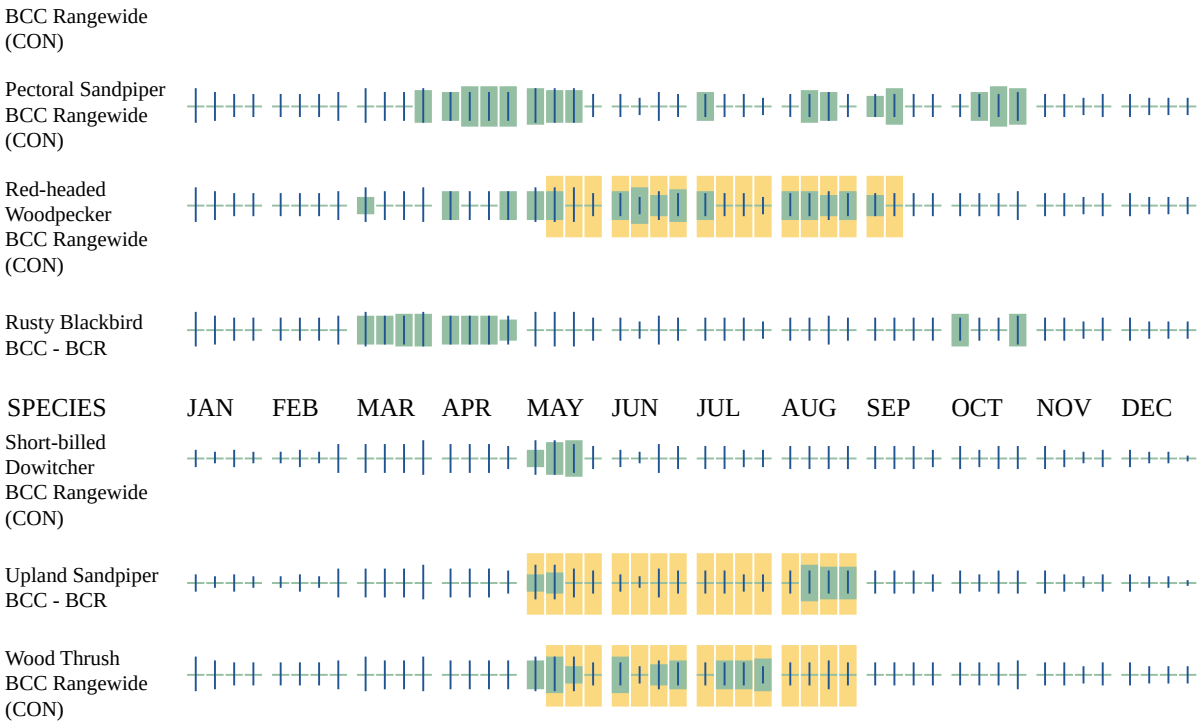
Green bars; the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during that week of the year.

Breeding Season (■)
Yellow bars; liberal estimate of the timeframe inside which the bird breeds across its entire range.

Survey Effort (|)
Vertical black lines; the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps.

No Data (–)
A week is marked as having no data if there were no survey events for that week.





Additional information can be found using the following links:

- Eagle Management https://www.fws.gov/program/eagle-management
- Measures for avoiding and minimizing impacts to birds https://www.fws.gov/library/collections/avoiding-and-minimizing-incidental-take-migratory-birds
- Nationwide conservation measures for birds https://www.fws.gov/sites/default/files/documents/nationwide-standard-conservation-measures.pdf
- Supplemental Information for Migratory Birds and Eagles in IPaC https://www.fws.gov/media/supplemental-information-migratory-birds-and-bald-and-golden-eagles-may-occur-project-action

WETLANDS

Impacts to NWI wetlands and other aquatic habitats may be subject to regulation under Section 404 of the Clean Water Act, or other State/Federal statutes.

For more information please contact the Regulatory Program of the local U.S. Army Corps of Engineers District.

Please note that the NWI data being shown may be out of date. We are currently working to update our NWI data set. We recommend you verify these results with a site visit to determine the actual extent of wetlands on site.

FRESHWATER EMERGENT WETLAND

- PEM1Cd
- PEM1Af
- PEM1C

FRESHWATER FORESTED/SHRUB WETLAND

- PSS1Cd
- PSS1C
- PFO1Ad
- PFO1A
- PFO1C

RIVERINE

- R5UBFx
- R5UBH

FRESHWATER POND

- PUBGx

LAKE

- L2ABH
- L1UBH

IPAC USER CONTACT INFORMATION

Agency: Allegan township
Name: Valerie Van Fleet
Address: 127 S Front Street
City: Fremont
State: OH
Zip: 43420
Email vjvanfleet@glcap.org
Phone: 4193336074

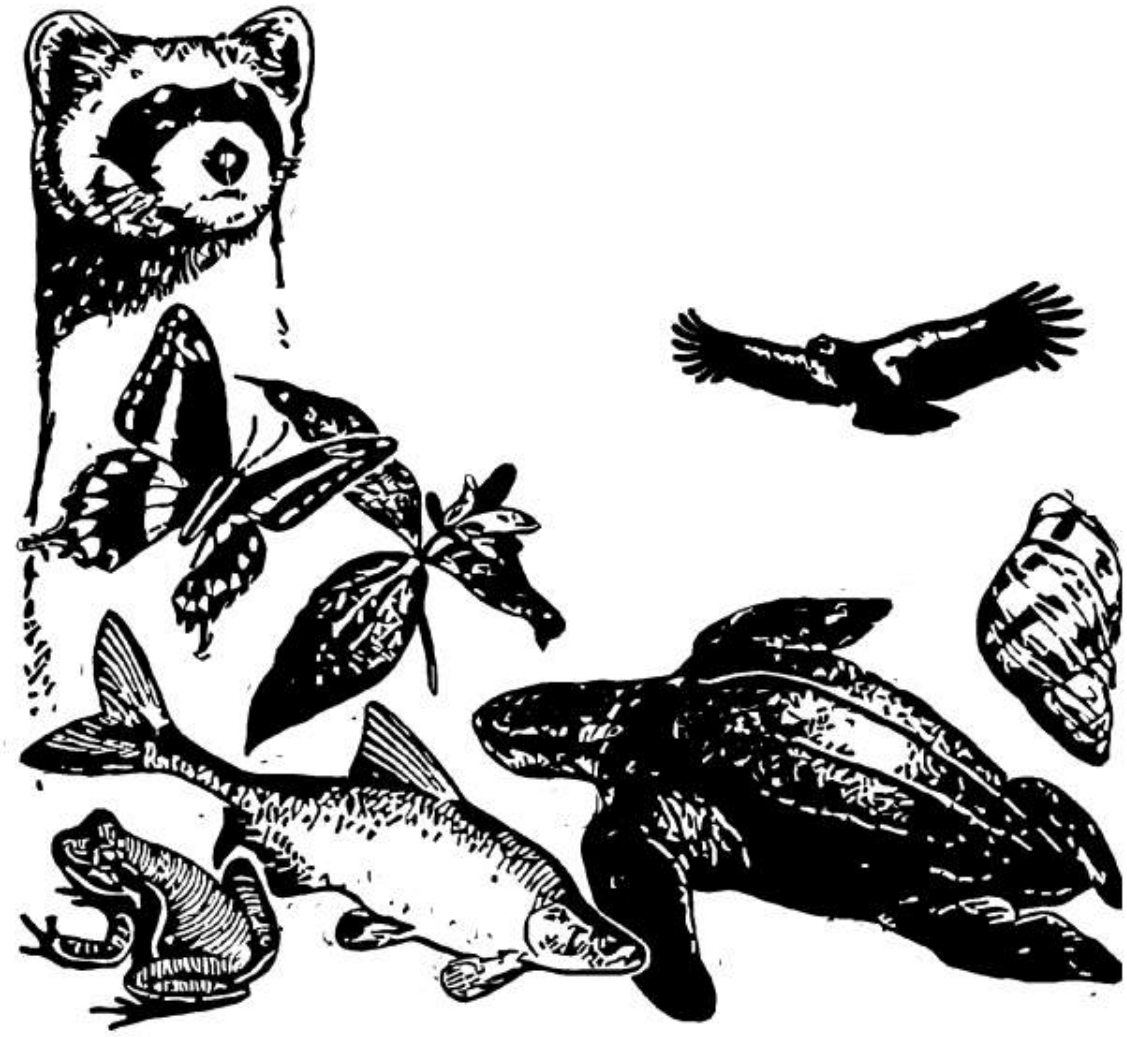
LEAD AGENCY CONTACT INFORMATION

Lead Agency: Rural Development

U.S. Fish & Wildlife Service

General Project Design Guidelines (2 Species)

Generated February 14, 2024 09:35 PM UTC, IPaC v6.104.2-rc1



IPaC - Information for Planning and Consultation (https://ipac.ecosphere.fws.gov/): A project planning tool to help streamline the U.S. Fish and Wildlife Service environmental review process.

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Species Document Availability

Species with general design guidelines

Eastern Massasauga (=rattlesnake) *Sistrurus catenatus*

Indiana Bat *Myotis sodalis*

Species without general design guidelines available

Karner Blue Butterfly *Lycaeides melissa samuelis*

Monarch Butterfly *Danaus plexippus*

Northern Long-eared Bat *Myotis septentrionalis*

Pitcher's Thistle *Cirsium pitcheri*

Rufa Red Knot *Calidris canutus rufa*

Tricolored Bat *Perimyotis subflavus*

Whooping Crane *Grus americana*

General Project Design Guidelines - Indiana Bat and 8 more species

Published by Michigan Ecological Services Field Office - Publication Date: June 10, 2022 for the following species included in your project

- Indiana Bat *Myotis sodalis*
- Karner Blue Butterfly *Lycaeides melissa samuelis*
- Tricolored Bat *Perimyotis subflavus*
- Pitcher's Thistle *Cirsium pitcheri*
- Rufa Red Knot *Calidris canutus rufa*
- Whooping Crane *Grus americana*
- Monarch Butterfly *Danaus plexippus*
- Eastern Massasauga (=rattlesnake) *Sistrurus catenatus*
- Northern Long-eared Bat *Myotis septentrionalis*

Indiana Bat Project Review in Michigan

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I. BACKGROUND INFORMATION

The Indiana bat was listed as endangered under the Endangered Species Act (ESA) in 1967 due to episodes of people disturbing hibernating bats in caves during winter, which resulted in the death of substantial numbers of bats. Indiana bats are vulnerable to disturbance because they hibernate in large numbers in only a few sites, with major hibernacula supporting 20,000 to 50,000 bats. Several threats are believed to have contributed to the Indiana bat's decline, including the commercialization of caves, loss and degradation of forested habitat, pesticides and other contaminants, and most recently, the disease white-nose syndrome (WNS). For more information on the Indiana bat, including life history information, designated critical habitat, draft recovery plan, and 5-year reviews, please visit the USFWS Indiana Bat page.

Indiana Bat in Michigan

Indiana bats have been documented at many sites in Lower Michigan and are believed to range throughout the southern five county tiers, as well as parts of the thumb and the western coastal counties up to (and including) the Leelanau Peninsula (see range map below). Michigan is home to a single known Indiana bat hibernaculum: a hydroelectric dam in Manistee County (Tippy Dam). Although the dam supports about 20,000 hibernating bats, Indiana bats comprise less than 1% of the winter population. Research suggests that the majority of the Indiana bats that summer in Michigan migrate to hibernacula in adjacent states, such as Indiana and Kentucky.

Like their overwintering sites, Indiana bats exhibit strong fidelity to their summer home ranges; however, we do not have knowledge of all of these summering areas in Michigan. Therefore, unless presence/absence surveys conducted in accordance with U.S. Fish and Wildlife Service (Service or USFWS) Range-wide Indiana Bat Survey Guidelines indicate the probable absence of the species, Indiana bats are considered potentially present wherever suitable habitat exists within their range.

Range of the Indiana Bat in Michigan

Suitable Habitat for Indiana Bats

During the winter, Indiana bats hibernate in caves, mines, or similar structures. Most major hibernacula for the species are found in Illinois, Indiana, Kentucky, Missouri, Tennessee, and West Virginia, and critical (winter) habitat has been designated in these states. Michigan is home to a single known Indiana bat hibernaculum, and there is no designated critical habitat for the species in Michigan.

Suitable summer habitat for Indiana bats consists of a wide variety of forested/wooded habitats where they roost, forage, and travel and may also include some adjacent and interspersed non-forested habitats, such as emergent wetlands and adjacent edges of agricultural fields, old fields and pastures. This includes forests and woodlots containing potential roosts (including live trees and/or snags ≥5 inches in diameter at breast height (DBH) that have exfoliating bark and/or cracks/crevices), as well as linear features such as fencerows, riparian forests, and other wooded corridors. These wooded areas may be dense or loose aggregates of trees with variable amounts of canopy closure.

In summer, female Indiana bats form colonies of 60-80 adults and their young and roost together in networks of trees, including 1-3 primary roosts and multiple secondary/alternate roosts. Southern Michigan maternity roost trees are typically dead or dying trees in open areas exposed to solar radiation. Infrequently, Indiana bats are observed roosting in human-made structures, such as buildings, barns, bridges, and bat boxes. Suitable bridges and culverts include those located below the third county tier of Michigan and within 1,000 feet of suitable forested habitat that contain suitable roosting spaces (e.g., expansion joints, cracks/crevices). Suitable culverts are at least 4 feet (1.2 meters) high and 50 feet (15 meters) long.

Modeled Indiana Bat Habitat in Michigan

To better characterize potential habitat and focus Indiana bat conservation efforts, the Michigan Ecological Services Field Office developed a habitat suitability model within the species' Michigan range based on available summer occurrence data for the state. The model is available for download as a shapefile or KMZ here, and more information on the development of the model can be found in Appendix I. Additionally, the model has been integrated into our Information for Planning and Conservation (IPaC) website and tools, including our All-Species Michigan Determination Key.

We strongly encourage project managers, including Federal agencies and their designated representatives as well as proponents of non-Federal projects, to use the All-Species Michigan Determination Key (Dkey) to evaluate potential effects of proposed activities on the Indiana bat and other Federally listed species in Michigan. For more information on using IPaC and its consultation tools to conduct project reviews for Indiana bat and/or other listed species, please see our IPaC instructions for MI projects and our All Species Michigan Dkey Standing Analysis.

II. VOLUNTARY CONSERVATION MEASURES

Voluntary conservation measures that benefit the Indiana bat include protecting, creating, and enhancing mature forest, particularly hardwood/mixedwood stands containing standing snags, dying trees, midstory/understory flight space, and waterbodies such as streams, ponds, and forested wetlands. As Indiana bats are known to avoid traversing large open areas outside of migration, preserving wooded corridors (such as tree lines) can be extremely beneficial in connecting fragmented patches of suitable roosting/foraging habitat.

Conserving Indiana bat habitat likely benefits the Federally threatened northern long-eared bat (*Myotis septentrionalis*) and other native bat species, several of which are experiencing recent population declines as a result of WNS and/or other factors. As significant predators of nocturnal insects, including many crop and forest pests, bats are important to Michigan's agriculture and forests. For example, Whitaker (1995)[1] estimated that a single colony of 150 big brown bats (*Eptesicus fuscus*) would eat nearly 1.3 million pest insects each year. Boyles et al. (2011)[2] noted that the "loss of bats in North America could lead to agricultural losses estimated at more than $3.7 billion/year," and using their data for Michigan alone, we totaled the estimated value at over $500 million per year (assuming standard crop pest survival). Taking proactive steps to help protect bats may be valuable to agricultural and timber producer yields and pest management costs.

Continue to the following sections for ESA guidance on Federal and non-Federal projects in Michigan. For more information on the Indiana bat, including life history information, designated critical habitat, draft recovery plan, and 5-year reviews, please visit the USFWS Indiana Bat page.

III. ESA GUIDANCE: PRIVATE LANDOWNERS/NON-FEDERAL PROJECTS

The Service does not require private landowners to conduct surveys for ESA-listed bats on their lands in Michigan. However, the bats and the habitats where they are known to occur are protected by the ESA. Under Section 9 of the ESA, it is unlawful for any person to "take" an endangered species. The term "take" is defined as, "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct." "Harm" is further defined to include "significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering."

In general, activities that impact suitable Indiana bat habitat have the potential to result in take. One of the most common activities impacting Indiana bat habitat is tree clearing during the summer season. The potential for incidental take of Indiana bats during tree removal or forest management activities (i.e., trimming, cutting, prescribed burning) can usually be avoided by scheduling these activities during the inactive, or dormant, season, when bats have departed from summer habitat to overwinter in caves, mines, or similar environments (October 1 through April 14 in most of the species' Michigan range). The inactive season for Indiana bats is slightly reduced within close proximity of hibernacula, as Indiana bats may remain active and utilize trees for roosting through the early fall near hibernation sites. Therefore, within 5 miles of Michigan's

[1]Whitaker, J.O. 1995. Food of the Big Brown Bat *Eptesicus fuscus* from Maternity Colonies in Indiana and Illinois. American Midland Naturalist 134(2):346-360.
[2]Boyles, J.G., P.M. Cryan, G.F. McCracken, and T.H. Kunz. 2011. Economic Importance of Bats in Agriculture. Science 332:41-42.

single known Indiana bat hibernaculum (Tippy Dam), we recommend scheduling tree removal activities during the period of November 1 through March 31.

As described in Section I, the Michigan Ecological Services Field Office recently developed a habitat model for the Indiana bat's Michigan range based on available occurrence data (available for download as a shapefile or KMZ here; more information on the model's development can be found in Appendix I). Outside modeled habitat, take is less likely, but could still occur if suitable trees are impacted when Indiana bats are present, particularly during the non-volant period or "pup season," when young of the year are unable to fly. To help avoid the potential for take of Indiana bats outside of modeled habitat and more than 5 miles from Tippy Dam, we recommend avoiding potential impacts to suitable trees (including cutting/trimming and prescribed burning) during the months of June and July. In addition to seasonally restricting tree cutting and burning of suitable habitat, we recommend applying the same location-specific seasonal restrictions to pesticide (including insecticide and rodenticide) application within suitable habitat to further minimize potential impacts to roosting and foraging bats. We recommend limiting herbicide applications in the active season to targeted application methods like spot-spraying, hack-and-squirt, basal bark, injections, cut-stump, or foliar spraying on individual plants.

As long as the scope of habitat removal is not significant enough to constitute "harm," effects to Indiana bats can be kept minimal or beneficial by avoiding the relevant sensitive seasons described above (and summarized below). The Michigan Ecological Services Field Office does not expect tree removal outside of the active season to cause harm via habitat loss if clearing does not exceed 10 contiguous[3] acres of modeled habitat and/or 20 contiguous acres of suitable forest. Projects that will exceed these acreage thresholds are encouraged to coordinate with the Michigan Ecological Services Field Office before proceeding with planned activities.

In summary, we recommend the following measures to help avoid the potential for take of Indiana bats in Michigan:

(1) Do not disturb known or potential hibernacula (e.g., natural caves, abandoned mines) within the species' range.

(2) Do not modify or remove a human structure (e.g., barn, house, or other building) known to contain roosting Indiana bats without coordinating with USFWS.

(3) Schedule activities[4] that may impact bats, potential roost trees[5] or bridges/culverts[6] during the inactive season for the project's location (see Table 1 below).

[3]Connected by 1,000 feet or less.

[4]Activities that could impact suitable roost trees include tree cutting, trimming, or clearing, prescribed burning, and pesticide application.
[5]Suitable roost trees include live trees and/or snags ≥5 inches dbh that have exfoliating bark or cracks/crevices.
[6]Suitable bridges and culverts include those located below the third county tier of Michigan and within 1,000 feet of suitable forested habitat that contain suitable roosting spaces (e.g., expansion joints, cracks/crevices). Suitable culverts are at least 4 feet (1.2 meters) high and 50 feet (15 meters) long

(4) Within suitable habitat, limit active season herbicide application to targeted methods like spot-spraying, hack-and-squirt, basal bark, injections, cut-stump, or foliar spraying on individual plants.

(5) Limit tree clearing to the extent possible. If more than 20 contiguous[7] acres of forested habitat and/or more than 10 contiguous acres of modeled Indiana bat habitat must be removed at any time of year, we recommend coordinating with the Michigan Ecological Services Field Office. Additionally, avoid fragmenting or eliminating forested corridors, such as tree lines, the loss of which could functionally impair much larger blocks of suitable habitat.

Table 1. Recommended dates for avoiding reasonable certainty of taking Indiana bats

Proposed Activity	Location	Recommended Activity Dates	Recommended Avoidance Dates
(1) Cutting/trimming/ of potential roost trees[8]; (2) Prescribed burning within potentially suitable habitat or if flames/smoke will reach potential habitat; and/or (3) Pesticide application and/or aerial/nontargeted herbicide application	Within 5 miles of Tippy Dam	November 1 through March 31	April 1 through October 31
	Within modeled summer habitat and more than 5 miles from Tippy Dam	October 1 through April 14	April 15 through September 30
	Outside of modeled summer habitat and more than 5 miles from Tippy Dam	August 1 through May 31	June 1 through July 31
Removal/modification of an existing bridge or culvert suitable for day-roosting Indiana bats[9]	October 1 through April 14		

Permits and authorizations are required whenever incidental take of Indiana bats is will occur. If your project is likely to result in take of Indiana bats, please contact the Michigan Ecological Services Field Office to determine if a permit pursuant to the ESA is warranted. For general information about take permits, visit our USFWS permits page.

As a means to determine the likelihood of take, project proponents may be interested in documenting whether potential modeled or unmodeled habitat is, in fact, occupied by Indiana bats. In such cases, presence/absence surveys conducted in accordance with current USFWS

[7]Connected by 1,000 feet or less.
[8]Suitable roost trees include live trees and/or snags ≥5 inches dbh that have exfoliating bark or cracks/crevices.
[9]Suitable bridges and culverts include those located below the third county tier of Michigan and within 1,000 feet of suitable forested habitat that contain suitable roosting spaces (e.g., expansion joints, cracks/crevices). Suitable culverts are at least 4 feet (1.2 meters) high and 50 feet (15 meters) long.

Range-wide Indiana Bat Survey Guidelines (and also available via IPaC) can inform project-specific conservation measures and the need for a permit.

Please note that projects that require State permits or authorizations that implement Federal laws or are supported by Federal funds (e.g., Clean Water Act, transportation projects) may have additional requirements under or similar to Section 7 of the ESA, as described in the following section: IV. ESA GUIDANCE: FEDERAL PROJECTS.

As described in Section I, we strongly encourage project managers, including private landowners and proponents of non-Federal projects, to use the All-Species Michigan Determination Key in IPaC to evaluate potential effects of proposed activities on Indiana bats and other Federally listed species in Michigan. The All-Species Michigan Dkey allows users to quickly check whether their project qualifies for automated effects determinations for listed species and habitats. For more information on using IPaC and its consultation tools to conduct project reviews for NLEB and/or other listed species, please see our IPaC instructions for MI projects (PDF).

IV. ESA GUIDANCE: FEDERAL PROJECTS

Section 7 Consultation

Under the ESA, requirements for Federal projects (i.e., projects funded, authorized, permitted, or implemented by a Federal agency) are different than requirements for wholly private or otherwise non-Federal projects. The ESA mandates all Federal departments and agencies to conserve listed species and to utilize their authorities in furtherance of the purposes of the ESA. Section 7 of the ESA, called "Interagency Cooperation," is the mechanism by which Federal agencies ensure the actions they conduct, including those they fund or authorize, do not jeopardize the existence of any listed species.

Federal agencies must request a list of species and designated critical habitat that may be present in the project area from the Service via our Information for Planning and Consultation (IPaC) website. Then they must determine whether their actions may affect those species or critical habitat. If a listed species or critical habitat may be affected, consultation with the Service is required.

The Service developed IPaC to help streamline the ESA review process. IPaC can assist users through the section 7 consultation process when a Federal agency authorizes, funds, permits, or carries out an action. For further information on obtaining an official Species List through IPaC and using available assisted Determination Keys, see our IPaC instructions for MI projects (PDF).

Please note that Section 7 or similar obligations may also apply to State permits or authorizations that implement Federal laws or projects that are supported by Federal funds (e.g., Clean Water Act, transportation projects).

For general guidance on Section 7(a)(2) obligations for Federal projects, see our ESA Section 7 Consultation page.

IPaC Determination Keys

Determination Keys (Dkeys), available through the Service's Information for Planning and Consultation (IPaC) web site, are logically structured sets of questions designed to assist users in determining if a project qualifies for a pre-determined consultation outcome based on existing programmatic consultations or internal USFWS standing analyses. Qualifying projects may generate USFWS concurrence letters instantly through IPaC. Dkeys provide consistent and transparent outcomes, and significantly reduce the time to complete consultation for qualifying projects.

Two Dkeys are currently available for evaluating the effects of Federal projects on Indiana bat in Michigan: The All-Species Michigan Dkey, and the FHWA, FRA, FTA Programmatic Consultation Dkey for Transportation Projects. As described in Section II, we strongly encourage project managers, including Federal agencies and/or their designated non-Federal representatives, to use IPaC, and in particular the All-Species Michigan Determination Key, to evaluate potential effects of proposed activities on Indiana bats in Michigan. For additional details on using Dkeys and other IPaC tools, see our IPaC instructions for MI projects.

Evaluating Effects to Indiana Bats

The Michigan Ecological Services Field Office has established a consistent and transparent process for evaluating potential effects of Federal actions on the Indiana bat, based on existing Service guidance and relevant literature, available Michigan survey data, and expert elicitation. This process is outlined below as well as in an internal standing analysis developed to support our All-Species Michigan Determination Key.

As described in Section I, the Michigan Ecological Services Field Office recently developed a habitat suitability model for the Indiana bat's Michigan range based on available species presence data. (The model is available for download as a shapefile or KMZ here, and more information on the model's development can be found in Appendix I). We have slightly modified our recommendations for avoiding adverse effects to Indiana bats based on whether projects overlap with modeled habitat (see below).

Within the species' Michigan range, we do not expect Federal actions to rise to the level of adverse effects to Indiana bat when the following conditions are met[10]:

- The action area does not contain any known or potential hibernacula (including natural caves, abandoned mines, or underground quarries).
- The action will not remove/modify a human structure (barn, house or other building) known to contain roosting Indiana bats.

[10]Projects that do not meet these conditions may still be able to avoid adverse effects to Indiana bat but warrant project-specific review and considerations.

- Tree clearing/cutting/trimming does not impact any potential roost trees[11]; OR, if suitable roost trees must be cut/trimmed, it is done so during the applicable recommended season (see Table 2 below).
- Tree clearing does not exceed 20 acres of contiguous[12], forested habitat and/or more than 10 acres of contiguous modeled Indiana bat summer habitat and does not fragment a connective corridor between two or more forest patches of at least 5 acres.
- Prescribed burning does not clear >20 acres of contiguous forest or 10 acres of modeled Indiana bat habitat and is conducted during the recommended applicable season (see Table 2).
- If burning in non-suitable habitat adjacent to suitable forest when Indiana bats may be present (e.g., grassland or scrub/shrublands near mature forest), flame height and smoke are kept to a minimum.
- Application of pesticides (including insecticides and rodenticides) and/or aerial/nontargeted herbicide application is restricted to the applicable recommended season (see Table 2).
- Application of herbicides follows the label and is limited to targeted methods like spot-spraying, hack-and-squirt, basal bark, injections, cut-stump, or foliar spraying on individual plants or conducted during the applicable recommended season (see Table 2).
- Removal/modification of an existing bridge or culvert suitable for day-roosting Indiana bats[13] does not result in the permanent loss of known or potential roosting spaces and is conducted during the inactive season (October 1 through April 14).
- Projects that include temporary or permanent lighting of roadway(s), facility(ies), and/or parking lot(s) apply the following conservation measures:

    (a) When installing new or replacing existing permanent lights, use downward-facing, full cut-off lens lights (with same intensity or less for replacement lighting); or for those transportation agencies using the BUG system developed by the Illuminating Engineering Society, the goal is to be as close to 0 for all three ratings with a priority of "uplight" of 0 and "backlight" as low as practicable.

    (b) Direct temporary lighting away from suitable habitat when bats may be present.

[11]Suitable roost trees include live trees and/or snags ≥5 inches dbh that have exfoliating bark or cracks/crevices.
[12]Connected by 1,000 feet or less.
[13]Suitable bridges and culverts include those located below the third county tier of Michigan and within 1,000 feet of suitable forested habitat that contain suitable roosting spaces (e.g., expansion joints, cracks/crevices). Suitable culverts are at least 4 feet (1.2 meters) high and 50 feet (15 meters) long.

Table 2. Recommended dates for avoiding adverse effects to Indiana bats

Proposed Activity	Location	Recommended Activity Dates	Recommended Avoidance Dates
(1) Cutting/trimming of potential roost trees[14]; (2) Prescribed burning within potentially suitable habitat or if flames/smoke will reach potential habitat; and/or (3) Pesticide application and/or aerial/nontargeted herbicide application	Within 5 miles of Tippy Dam	November 1 through March 31	April 1 through October 31
	Within modeled summer habitat and more than 5 miles from Tippy Dam	October 1 through April 14	April 15 through September 30
	Outside of modeled summer habitat and more than 5 miles from Tippy Dam	August 1 through May 31	June 1 through July 31
Removal/modification of an existing bridge or culvert suitable for day-roosting Indiana bats[15]	October 1 through April 14		

If the above conditions are met, projects may be able to complete Section 7 consultation through our IPaC All-Species Michigan Determination Key and/or through informal consultation with the Service outside the Dkey. If these conditions cannot be met, please contact our office for additional site-specific review regarding your project.

Note that these conditions are only necessary if Indiana bats are present. Prior to conducting a project, including tree clearing or burning, surveys can be done to determine if Indiana bats are present or likely absent from the action area. See our Range-wide Indiana Bat Survey Guidelines for more information. In the absence of site-specific survey data, adherence to the above conditions should appreciably reduce the potential for adverse effects.

In addition to habitat assessments and presence/probable absence surveys, bridge/culvert assessment can be conducted to determine whether a suitable bridge or culvert is occupied by bats. See these Guidelines for more information. If a bridge/culvert has been inspected for signs of roosting bats (guano, urine staining, bat vocalizations, and/or bats) during the summer roosting season (May 15 through August 15), and no bats or signs of bats were observed, work on the bridge/structure can proceed at any time of year.

[14]Suitable roost trees include live trees and/or snags ≥5 inches dbh that have exfoliating bark or cracks/crevices.
[15]Suitable bridges and culverts include those located below the third county tier of Michigan and within 1,000 feet of suitable forested habitat that contain suitable roosting spaces (e.g., expansion joints, cracks/crevices). Suitable culverts are at least 4 feet (1.2 meters) high and 50 feet (15 meters) long.

V. MICHIGAN ECOLOGICAL SERVICES FIELD OFFICE CONTACT INFORMATION

Please contact the Michigan Ecological Services Field Office for more information on potential impacts to Indiana bats or other Federally listed species as a result of any projects occurring in Michigan.

U.S. Fish and Wildlife Service
Michigan Ecological Services Field Office
2651 Coolidge Road, Suite 101
East Lansing, MI 48823
Phone: 517-351-2555
Fax: 517-351-1443
TTY: 1-800-877-8339 (Federal Relay)
e-mail: EastLansing@fws.gov

Appendix I: Development of a Habitat Suitability Model for the Indiana Bat (*Myotis sodalis*) in Michigan

In 2018, the Michigan Ecological Services Field Office contracted with Dr. Eric McCluskey of Grand Valley State University to develop a habitat model for the Indiana bat in Michigan. A shapefile and KMZ of the model are available for download here: Indiana Bat Habitat Model

To develop the model, we compiled all available Indiana bat summer capture (foraging) and roost occurrence data and applied a 500-m spatial filter as a minimum distance between occurrence records to minimize overemphasis of habitat importance based on clusters of individuals. After filtering the occurrence data, 44 locations remained (20 capture and 24 roost locations). We developed models using capture and roost occurrences separately as well as with all occurrences combined to determine which model was best suited for identifying foraging and roost habitat.

Due to the small number of occurrences, we used an ensemble of small models (ESM) approach that permits more predictor variables to be used by running each pairwise combination of variables and then weighting these final models in an ensemble. The ESMs were run in the R package ecospat. Presence only modeling requires the selection of background area from which background points will be randomly sampled to compare to the occurrence data. The background area should represent parts of the landscape that are accessible to the focal organism. We created a convex hull around our occurrence data using ArcMap, a polygon formed by connecting straight lines between points. We then buffered this convex hull by 25 km to include areas beyond the known core distribution of Indiana Bat in southern Michigan that should be physically accessible and may have undetected presences. We set background point selection for this entire buffered area except for within 5 km of Indiana Bat occurrences where background points are most likely to unintentionally represent true presences.

We selected predictor variables by removing the worse performing variable from highly correlated pairs (>0.75) using the 'corSelect' function from the fuzzySim R package. Then we then used Maxent's internal variable importance (permutation importance) and jackknife measures to determine which of the remaining variables were important to retain for separate capture and roost models. We selected two model types, Artificial neural network (ANN) and Maxent, for the ESMs. We compared five runs for each model type with the capture, roost, and combined datasets using area under the ROC curve (AUC) and true skill statistic (TSS). We then calculated the Boyce Index value using ecospat to compare the ANN and Maxent models from each dataset in their ability to identify capture and roost locations. We used Boyce Index as the primary assessment metric as it allowed for comparisons across all three model types for capture and roost data.

Based on the Boyce Index assessment, we selected the Maxent presence-only roost model as the strongest fit model. Using the 10th percentile threshold, we converted the model output to a binary raster. The binary raster was then converted to a shapefile using non-simplified shapes. Because considerable portions of the modeled habitat contained clearly non-suitable cover types, particularly near highly developed urban areas, we further refined the model by clipping the binary shapefile by the most recent available National Land Cover Database (NLCD 2019) data. Land cover categories excluded (clipped) from modeled habitat included open water, perennial ice/snow, developed (low, medium, and high intensity), and barren land (sand, rock, clay).

General Project Design Guidelines - Indiana Bat and 8 more species

Published by Michigan Ecological Services Field Office for the following species included in your project

- Indiana Bat *Myotis sodalis*
- Karner Blue Butterfly *Lycaeides melissa samuelis*
- Tricolored Bat *Perimyotis subflavus*
- Pitcher's Thistle *Cirsium pitcheri*
- Rufa Red Knot *Calidris canutus rufa*
- Whooping Crane *Grus americana*
- Monarch Butterfly *Danaus plexippus*
- Eastern Massasauga (=rattlesnake) *Sistrurus catenatus*
- Northern Long-eared Bat *Myotis septentrionalis*

Environmental Screening for Eastern Massasauga Rattlesnake in Michigan

March 14, 2017

Background

The Eastern Massasauga Rattlesnake (EMR) is listed as a threatened species under the U.S. Endangered Species Act (Act). The Act protects the EMR and their habitat by prohibiting "take" and may require agencies to coordinate with the U.S. Fish and Wildlife Service (Service) before authorizing or funding an activity affecting the species. To streamline coordination, the Service's Michigan Ecological Services Field Office has developed a set of Best Management Practices (BMPs) for specific activities potentially impacting EMR in Michigan. These BMPs are voluntary and just one of the ways that compliance with the Act may be achieved.

Projects may…

- have no effect to EMR and no need for additional ESA compliance considerations.
- have potential for adverse effects, but use BMPs to avoid adverse effects (i.e., "not likely to adversely affect" EMR) or minimize the adverse effects.
- use surveys to confirm probable absence of EMR (contact the Service for survey guidance).
- use "Informal Consultation" with Service (for actions requiring a Federal permit or funding).
- use "Formal Consultation" with Service (for actions requiring a Federal permit or funding).
- develop a Habitat Conservation Plan and seek an ESA permit, if adverse effects cannot be avoided.

For activities not listed in the BMPs, please contact the Service for project-specific recommendations. In some cases implementation of BMPs may not be sufficient to avoid all adverse impacts to EMR and additional consultation with the Service may be required. The Service can assist planners in determining whether adverse effects are likely as a result of proposed projects, and whether implementation of BMPs is sufficient to remove the risk of adverse effects.

Additional information on compliance with the Act can be found:

For Federal actions/section 7 consultation:
https://www.fws.gov/midwest/Endangered/section7/s7process/index.html

For non-Federal actions:
https://www.fws.gov/midwest/endangered/permits/index.html

For questions or comments you may contact the Service below:
U.S. Fish and Wildlife Service
Michigan Ecological Services Field Office
2651 Coolidge Road, Suite 101
East Lansing, MI 48823
Phone: (517)351-2555
Email: eastlansing@fws.gov

Definitions

Active Season: The active season begins in the spring when snakes emerge from hibernation, generally when maximum air temperatures are above 50°F, and ends in the fall when EMR have returned to their hibernacula and temperatures are consistently below 45°F. In Michigan, the active season is generally April through October. The active season dates will vary by location and weather. **Contact the Service for project-specific dates based on location when work in EMR habitat is planned near the start or end of the active season**.

Affecting hydrology: We consider "affecting hydrology" to include projects that are likely to appreciably change the elevations of surface water upstream or downstream, or in the local ground water (as estimated pre-project vs. post-project). The concern is for changes to local hydrology (e.g., creating new ditches, creating a new impoundment) that might harm EMR hibernating at or near ground water, or actions that significantly alter available suitable habitat either through flooding or drying of EMR wetlands.

Hibernacula: Areas suitable for EMR to overwinter. For most EMR populations, the locations of hibernacula are not known, but these areas are critical to protect. Unfortunately, we lack information on how to reliably identify these areas. EMR usually hibernate below the frost line in crayfish or small mammal burrows, tree root networks or rock cervices in or along the edge of wetlands or in adjacent upland areas with presumably high water tables (areas where the soil is saturated but not inundated). Following egress from hibernacula in the spring, EMR typically remain aboveground in the vicinity for a week or two, and return to these areas in the fall for several weeks prior to entering hibernation. Surveys in the spring (shorting following egress) or fall (prior to ingress) when snakes are congregating in the vicinity may help identify these important areas. Maintaining stable hydrology of these areas is important during the inactive season.

IPaC: "Information for Planning and Conservation" is a project planning tool available on-line to the public that streamlines the Service's environmental review process.

EMR Habitat: "Eastern Massasaugas have been found in a variety of wetland habitats. Populations in southern Michigan are typically associated with open wetlands, particularly prairie fens, while those in northern Michigan are known from open wetlands and lowland coniferous forests, such as cedar swamps. Some populations of Eastern Massasaugas also utilize open uplands and/or forest openings for foraging, basking, gestation and parturition (i.e., giving birth to young). Massasauga habitats generally appear to be characterized by the following: (1) open, sunny areas intermixed with shaded areas, presumably for thermoregulation; (2) presence of the water table near the surface for hibernation; and (3) variable elevations between adjoining lowland and upland habitats." From Michigan Natural Features Inventory (Website: mnfi.anr.msu.edu)

Tier 1 Habitat: Areas known to be occupied by EMR or highly likely to be occupied by EMR.

Tier 2 Habitat: Areas with high potential habitat and may be occupied by EMR.

Within the known range: EMR can occur throughout the Lower Peninsula and on Bois Blanc Island in Mackinac County. Areas within the known range but outside of Tier 1 and Tier 2 are considered less likely to be occupied. EMR is highly secretive and cryptic in nature, and can persist in low densities, which makes them difficult to detect. Further, there are extensive areas of the state that have never been surveyed. It is likely that there are additional and yet-unknown occurrences throughout the Lower Peninsula of Michigan. Mapped habitats are subject to change based on new information identifying current Tier 1 and 2 areas as unsuitable, or based on discovery of new EMR occurrences.

EMR Environmental Screening Step-wise Process

Step 1. Determine if EMR may be present in the action area

- ✓ Determine whether the project is in potential EMR habitat using https://ecos.fws.gov/ipac
  - You can search for your project location and define the action area by drawing a polygon or uploading a shapefile.
  - IPaC will give you a list of species that may be present in the area you identified. If you click on the thumbnail for EMR, it will tell you if your project is within Tier 1 or Tier 2 habitat, or within the known range of EMR. If EMR is not listed, you do not need to consider this species. Effects to other listed species should also be considered; contact the Service if you need assistance.
  - If EMR is listed, it does not necessarily mean that the entire action area is potential habitat, only that some potential habitat is within the action area entered. For large-scale (e.g., county-wide or multi-county projects) consider coordinating the Michigan Ecological Services Field Office for direct assistance.

If your project is within the known range of EMR, including Tier 1 or Tier 2 habitat, continue to step 2:

Step 2. Determine if the project has the potential to affect EMR

Projects have no effect on EMR when…

- ✓ There is no suitable EMR habitat in the project area and no potential impact off-site (e.g., water discharge into adjacent EMR habitat). If project site conditions are determined to be wholly unsuitable for EMR (e.g., project is in regularly mowed turf grass, row crop, graveled lot, existing building, or industrial site), it is not suitable EMR habitat.
- ✓ The project occurs within suitable habitat, but the action will have absolutely no effect on the habitat or EMR.
- ✓ In suitable EMR habitat, but the site is entirely unoccupied by the species. This is typically confirmed through surveys (contact the Service for more information). In some cases it may be easier to assume EMR are present and use BMPs than to conduct surveys for the species.

For projects where there is a potential for effects to EMR, continue to the section of the document as follows:

For projects with a combination of Tier 1 and Tier 2 habitat, follow the instructions for Tier 1.

Tier 1 Habitat

Tier 1: Project will not affect EMR if all of the following apply:

1. Project will not result in any changes to suitable EMR habitat quality, quantity, availability or distribution, including changes to local hydrology
2. If EMR are present in the project area, they are not likely to have any response as a result of exposure to the action or any environmental changes as a result of the action
3. Project includes all General Best Management Practices:
   a. Use wildlife-safe materials for erosion control and site restoration (see Erosion Control Resources side panel). In Tier 1 habitat, immediately eliminate use of erosion control products containing plastic mesh netting or other similar material that could entangle EMR.
   b. To increase human safety and awareness of EMR, those implementing the project should first watch MDNR's "60-Second Snakes: The Eastern Massasauga Rattlesnake" video (available at https://youtu.be/-PFnXe_e02w), or review the EMR factsheet (available at https://www.fws.gov/midwest/endangered/reptiles/eama/pdf/EMRfactsheetSept2016.pdf or by calling 517-351-2555.
   c. Require reporting of any EMR observations, or observation of any other listed threatened or endangered species, during project implementation to the Service within 24 hours.

Tier 1: Project Not Affecting EMR Coordination Recommendation: No pre-project coordination with Service needed. Document the steps above for your records.

Tier 1: All Other Projects: For any other projects in Tier 1 habitat that may affect EMR or its habitat, contact the Service for assistance in evaluating potential impacts. Best Management Practices (starting on page 8) are included for many actions to help with project planning, but may not be sufficient to avoid all adverse impacts. The Service can determine whether additional measures are necessary after a project-specific review.

Erosion Control Resources

USFWS Michigan Ecological Services Field Office

Tier 2 Habitat

Tier 2: Project is not likely to adversely affect EMR if all of the following apply:

1. Project does not impact more than 1 acre of wetland habitat and includes all applicable activity-specific BMPs (starting on page 8), and
2. Project will not appreciably affect hydrology
3. Project includes all General Best Management Practices:
    a. Use wildlife-safe materials for erosion control and site restoration (See Erosion Control Resources side panel, page 4). In Tier 2 habitat, eliminate the use of erosion control products containing plastic mesh netting or other similar material that could ensnare EMR as soon as is feasible but no later than January 1, 2018.
    b. To increase human safety and awareness of EMR, those implementing the project should first watch MDNR's "60-Second Snakes: The Eastern Massasauga Rattlesnake" video (available at https://youtu.be/-PFnXe_e02w), or review the EMR factsheet (available at https://www.fws.gov/midwest/endangered/reptiles/eama/pdf/EMRfactsheetSept2016.pdf or by calling 517-351-2555.
    c. Require reporting of any EMR observations, or observation of any other listed threatened or endangered species, during project implementation to the Service within 24 hours.

Tier 2: Project Not Likely to Adversely Affect EMR Coordination Recommendation: Informal consultation with Service for actions requiring a Federal permit or funding. For non-Federal projects, document the steps above for your records, but no pre-project coordination with the Service needed.

Tier 2: All Other Projects: Coordinate with the Service for a project-level review to determine potential impacts and whether additional conservation measures are needed to avoid adverse effects.

Within the known range of EMR

For projects within the known range of EMR, but outside of Tier 1 and Tier 2 habitat:

To help ensure your project is unlikely to affect EMR:

1. Project applies the General Best Management Practices:
    a. Use wildlife-safe materials for erosion control and site restoration (See Erosion Control Resources side panel, page 4). By January 1, 2019, eliminate the use of erosion control products containing plastic mesh netting or other similar material that could ensnare EMR (within the known range but outside of Tier1 or Tier 2 habitat).
    b. To increase human safety and awareness of EMR, those implementing the project should first watch MDNR's "60-Second Snakes: The Eastern Massasauga Rattlesnake" video (available at https://youtu.be/-PFnXe_e02w), or review the EMR factsheet (available at https://www.fws.gov/midwest/endangered/reptiles/eama/pdf/EMRfactsheetSept2016.pdf or by calling 517-351-2555.
    c. Require reporting of any EMR observations, or observation of any other listed threatened or endangered species, during project implementation to the Service within 24 hours.
2. Project will not have significant impacts to dispersal, connectivity, or hydrology of existing EMR potential habitat, i.e., filling less than 1 acre of wetland habitat or converting less than 20 acres of uplands of potential EMR habitat (uplands associated with high quality wetland habitat) to other land uses.

Within the Known Range, but Outside Tier 1 or 2 Coordination Recommendation:
Document the steps above for your records and no pre-project coordination with the Service needed. If you cannot implement the General Best Management Practices contact the Service for assistance in evaluating potential impacts.

Activity-Specific Best Management Practices

For Tier 1, BMPs are included; however, even with implementation of the BMPs, project-specific review may be needed to determine whether they are sufficient to avoid all adverse impacts

- In Tier 1 habitat, contact the Service regarding the potential applicability of surveys to determine EMR absence in suitable habitat. In Tier 2, surveys can be conducted to confirm the presence of suitable habitat and/or the presence/probable absence of EMR. If onsite habitat is determined to be wholly unsuitable via desktop analysis (e.g., entirely mowed lawn, row crop, graveled lot, and industrial site), then it can be classified as unoccupied and the BMPs will not be necessary.
- Minimize work in Tier 1 and Tier 2 EMR habitat. When feasible, do not route new construction projects, such as pipelines, facilities, or access roads, through potential EMR habitat. Implement the use of wildlife-friendly corridors (e.g., oversized culverts) into new road design to maintain or enhance habitat connectivity.
- Projects should be designed to minimize the potential for disturbance to EMR during project activities.

Maintenance Activities (includes nominal modifications to existing roads and infrastructure)

1. Ground Disturbing Activities
    a. All
        i. No known EMR hibernacula are destroyed or disturbed at any time of year. Because these areas are often not known:
            1. For Tier 1: contact the Service to determine whether adverse impacts are likely as a result of ground disturbing work in Tier 1 habitat.
            2. For Tier 2: when operating in potential hibernation areas (e.g., EMR wetlands and adjacent areas with crayfish burrows, rodent holes, small mammal burrows, etc.), work is conducted well within the active season (June – August) to avoid when snakes are likely to be present. During this time, they are most likely to be able to move out of the way of disturbance and have greater chances to find alternative hibernation sites. Destroying potential hibernacula may still impact snakes indirectly. Potential hibernation areas should be avoided to the extent possible.
    b. Grading
        i. When working during EMR active season, use exclusionary fencing to separate EMR habitat from the work site to prevent EMR from accessing the disturbance area. For example, in linear projects exclusionary fencing should run parallel to the disturbance, creating a barrier to snake movement. Each end of the exclusionary fencing should be angled away from the area of disturbance to direct snakes traveling along fencing away from the site. The

exclusionary fencing will typically be traditional silt fence that is set up outside of all areas of disturbance and other types of fencing (i.e., snow fence used to delineate the work zone). Do not use fencing materials that can entangle or injure snakes.

ii. Any areas using exclusionary fencing should first be "cleared" by a qualified individual[1] before beginning construction activities. Fencing should be installed a minimum of 1 day before construction activities occur and walked weekly to ensure the integrity of the fence. If snakes are seen within the work zone, activity should stop until the snake can be safely moved, and the fence examined for breeches.

iii. Revegetate all disturbed Tier 1 and Tier 2 habitat with appropriate plant species (i.e., native species or other suitable non-invasive species present on site prior to disturbance). Monitor all restoration plantings for proper establishment and implement supplemental plantings as necessary to ensure restorations are of equal to or better habitat quality than previous conditions.

iv. In Tier 1 and Tier 2, avoid spread of invasive species into EMR habitat by following best practices. This includes inspecting and cleaning equipment and vehicles between work sites as needed to avoid the spread of invasive plant materials.

c. Trenching

i. In Tier 1 and Tier 2, avoid trenching in EMR wetlands when possible. In Tier 1, if open trenching is required install exclusionary fencing (follow measures 1(b)(i)-(iv)) and ensure the area is clear prior to trenching.

d. Fill

i. In Tier 1 and Tier 2, ensure all imported fill material is free from contaminants or invasive species could affect the species or habitat through acquisition of materials at an appropriate quarry or other such measures.

ii. In Tier 1 and Tier 2, use exclusionary fencing around the area to be filled and have the site "cleared" prior to placing fill by a qualified individual (as in 1(b)(i)-(ii).

e. Ditching

i. For Tier 1 and Tier 2, conduct work well within the active season (June-August) when snakes are not likely to be near hibernation sites and can escape disturbance, or contact Service for project specific recommendations.

ii. For Tier 1, use exclusionary fencing around the area to be cleared/graded and have the site cleared by a qualified individual prior to construction activities.

iii. For Tier 1, contact the Service for work greater than 200' for project specific recommendations.

[1] A qualified individual is someone who has received training on the identification and life history of EMR.

2. Site Access with vehicles (both Tiers)
    a. Limit operating vehicles/equipment, clearing trees, etc., in EMR habitat to the inactive season when the ground is frozen. During this time, under these conditions, EMR are most likely underground and will not be impacted by these activities. When possible, use low-impact equipment such as light weight track mounted vehicles with low ground pressure. In Tier 1, if the ground isn't completely frozen (due to weather conditions during the inactive season or if working near seeps and springs that are less likely to freeze), or if working near potential hibernacula, manual access (on foot) may be required.
    b. Strictly control and minimize vehicle activity in known/presumed occupied EMR habitat to the extent possible. During EMR active season, speed limits at facilities and access roads (i.e., 2-track and gravel) in occupied habitat should be <15 MPH.
    c. In Tier 1 and Tier 2 habitat areas, drivers should be aware of the potential danger to the driver of swerving to intentionally drive over snakes as well as legal and conservation implications.

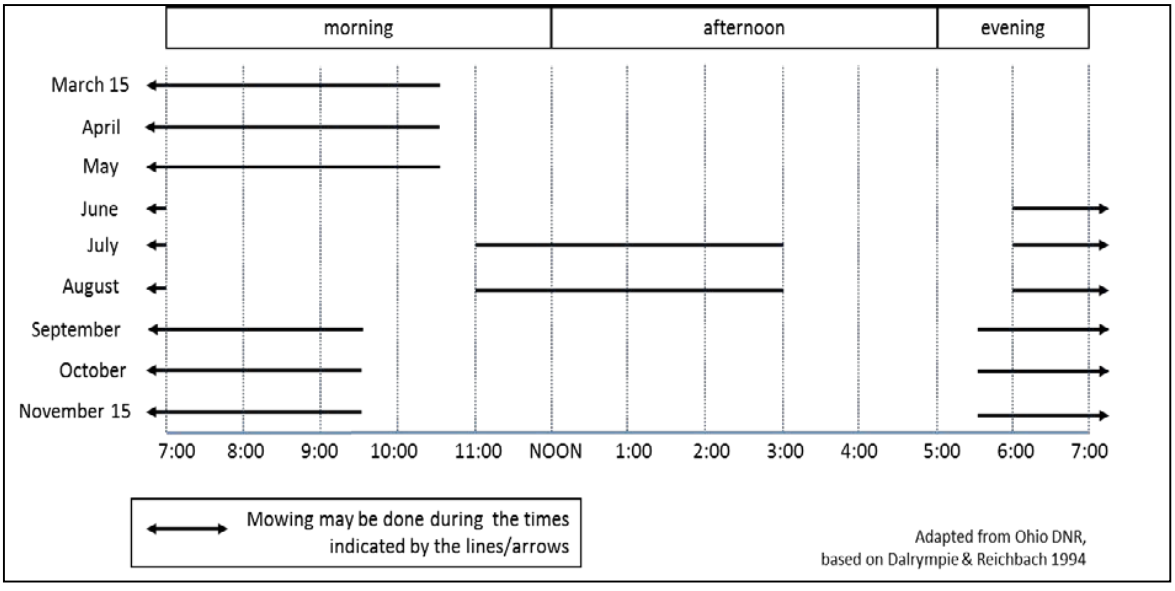
3. Heavy Equipment (both Tiers)
    a. Spill Prevention for oils/fluids
        i. Site staging areas for equipment, fuel, materials, and personnel at least 100 feet from the waterway, if available, to reduce the potential for sediment and hazardous spills entering the waterway. If sufficient space is not available, a shorter distance can be used with additional control measures (e.g., redundant spill containment structures, on-site staging of spill containment/clean-up equipment and materials). If a reportable spill has impacted occupied habitat:
            1. Follow spill response plan;
            2. Call MDEQ and the National Response Center (800-424-8802), and the Service's Michigan Ecological Services Field Office (517-351-2555) to report the release.
    b. Do not use large equipment or perform earth-moving activities, water withdrawal and discharge for hydrostatic testing, or other activities that substantially affect the ground or water levels in potential EMR hibernacula areas. Avoidance measures may include, but are not limited to, re-routing of pipeline and appurtenance facilities, boring or drilling, and timing/weather-related restrictions. Measures will be determined on a site-specific basis, based on local habitat conditions, contact Service for more information.

4. Hydrology impacts (both Tiers)
        i. Water levels in known/presumed occupied habitats should not be artificially manipulated during the inactive season.

ii. Where applicable, water levels should be allowed to flow naturally and not be artificially stabilized. This allows for the restoration of early successional habitats.

Habitat Management and Restoration

5. Vegetation Management
    a. Mowing
        i. In Tier 1, mow during the inactive season.
        ii. For Tier 2, mowing is unrestricted during the inactive season. During the active season, follow daytime mowing restrictions and mow during times of day when snakes are less likely to be active (Figure 1). Increase mower deck height to >8 inches to reduce likelihood of injury to snakes. Higher deck height will reduce the risk of death or injury to snakes in the area.
        iii. In areas with turf grass or areas where trying to discourage EMR (e.g., in areas around buildings), mow regularly and keep grass relatively short (less than 4-6 inches) to reduce its suitability for EMR. If starting with longer grass (greater than 6 inches), mow during the inactive season initially, and then maintenance mowing can occur during the active season (as long as it is regularly maintained and kept shorter than 4-6 inches, so that EMR is unlikely to use those areas). Unmaintained/longer grass may be used by snakes and make them vulnerable to mortality during the next mowing event.



b. Cultivation (e.g., disking)
    i. In Tier 1 habitat, disking should be limited to the inactive season, and areas within 50 m of known or potential hibernacula should be avoided. In Tier 2, disking can occur in the active season if area is mowed during the inactive season and maintained shorter than 4-5 inches.
c. Brush/Tree Removal
    i. In Tier 1, conduct brush or tree removal in known/presumed EMR habitat during the inactive season, when the ground is frozen (such that soils can be left undisturbed).
    ii. Use low impact harvest methods in Tier 1 and Tier 2 wetlands to cut and remove individual trees. This includes using low-impact equipment such as light weight track mounted vehicles with low ground pressure. In Tier 1, if the ground isn't completely frozen (due to weather conditions during the inactive season or if working near seeps and springs that are less likely to freeze), or if working near potential hibernacula, use hand tools and access site on foot.
    iii. In Tier 1 and Tier 2, do not burn brush piles during the active season. Dispose of brush offsite or leave in place.
d. Herbicides
    i. Follow all appropriate label instructions regarding which herbicide formulation to use in potential EMR habitat. Avoid spray drift beyond the target species/area (observing label instructions regarding optimal wind speed and direction, boom height, droplet size calibration, precipitation forecast, etc.).
    ii. Avoid broadcast applications of herbicides in Tier 1. Spot spraying or wicking can be used to control invasive plants in occupied habitat. If using broadcast spray in Tier 2, limit the area of exposure to less than half of the available EMR habitat to allow for untreated areas to provide potential areas of refugia from exposure. Contact the Service if you need help in determining this.
e. Prescribed burning (Tier 1 and Tier 2)
    i. Conduct prescribed burns during the inactive season before snakes emerge from hibernation. Walk the burn unit following the burn and report any dead or injured EMR to the Service within 24 hours. Burn only a portion (e.g., one-third) of available EMR habitat in any year to leave suitable cover for EMR and its prey.
    ii. Establish fire breaks using existing fuel breaks (roads, rivers, trails, etc.) to the greatest extent possible. Cultivation (disking or roto-tilling) of burn breaks will be minimized to the extent that human health and safety are not jeopardized. Cultivation and mowing to establish fire breaks will occur during the inactive season.

6. Erosion control
    a. Use wildlife-safe erosion control blankets (without plastic mesh netting in the layers of material) as required in the general BMPs. Remove all silt fence used for erosion control once soils are stable to reduce barriers to EMR movement.
7. Revegetation
    a. Revegetate all disturbed Tier 1 and Tier 2 habitat with appropriate plant species (i.e., native species or other suitable non-invasive species present on site prior to disturbance). Monitor all restoration plantings for proper establishment and implement supplemental plantings as necessary to ensure restorations are of equal to or better habitat quality than previous conditions.
8. Invasive species
    a. In Tier 1 and Tier 2, avoid spread of invasive species into EMR habitat by following best practices. This includes inspecting and cleaning equipment and vehicles between work sites as needed to avoid the spread of invasive plant materials.
9. Wetland restoration
    a. Restoring natural hydrology in areas that have been drained by tiling and ditching may greatly benefit EMR habitat. Conduct tile breaking or excavation well within the active season to avoid potential hibernacula. Have a qualified individual walk in front of the equipment to clear the area. Work with the Service for Tier 1 habitat to ensure no indirect adverse effects are expected as a result of restoration efforts.
10. Water-level manipulation
    a. Water levels should not be artificially manipulated during the inactive season to avoid impacts to hibernating snakes. Contact the Service in Tier 1 habitat when water levels will be manipulated during the inactive season or will result in significant alterations to EMR habitat during the active season.

State Historic Preservation Office

6.3.1 Application for Section 106 Review

APPLICATION FOR SHPO SECTION 106 CONSULTATION

Submit one application for each project for which comment is requested. Consult the *Instructions for the Application for SHPO Section 106 Consultation Form* when completing this application.

Mail form, all attachments, and check list to: Michigan State Historic Preservation Office, 300 North Washington Square, Lansing, MI 48913

I. GENERAL INFORMATION

☒ New submittal
☐ More information relating to SHPO ER# SHPO Project #
☐ Submitted under a Programmatic Agreement (PA)
PA Name/Date: PA name/date, if applicable

a. **Project Name: Miner Lake Wastewater Collection System**
b. **Project Municipality**: Allegan Township
c. **Project Address** (*if applicable*): Township 2N, Range 13W, Sections 11, 12, 13, 14, 21, 22, 23.
d. **County:** Allegan

II. FEDERAL AGENCY INVOLVEMENT AND RESPONSE CONTACT INFORMATION

a. **Federal Agency:** USDA Rural Development
Contact Name: Andrew H. Granskog
Contact Address: 3001 Coolidge Rd. Suite 200 **City:** E. Lansing **State: Michigan** **Zip:**48823
Email: andy.granskog@usda.gov
Specify the federal agency involvement in the project: Project funder.

b. **If HUD is the Federal Agency: 24 CFR Part 50 ☐ or Part 58 ☐**
Responsible Entity (RE): Name of the entity that is acting as the Responsible Entity
Contact Name: RE Contact name
Contact Address: RE mailing address **City:** RE city **State:** RE State **Zip:** RE zip code
RE Email: RE contact's email **Phone:** RE contact's phone #

c. **State Agency Contact (*if applicable*):** Name of state agency
Contact Name: Name of state agency contact
Contact Address: State agency contact's mailing address **City:** State contact's city **Zip:** State contact's zip code
Email: State contact's email **Phone:** State contact's phone #

d. **Applicant (if different than federal agency):** Allegan Township
Contact Name: Steve Schulz
Contact Address: 3037 118th Ave **City:** Allegan **State:** Michigan **Zip:** 49010
Email: DOparka@rowepsc.com| **Phone:** 810-341-7500

e. **Consulting Firm (if applicable):** RESCOM Environmental Corp.
Contact Name: Andrew Smith
Contact Address: PO BOX 361 **City:** Petoskey **State:** MI **Zip**: 49770
Email: andrew.smith@rescom.org Phone: 260-385-6999

APPLICATION FOR SHPO SECTION 106 CONSULTATION

III. PROJECT INFORMATION

a. **Project Location and Area of Potential Effect (APE)**

i. **Maps.** Please indicate all maps that will be submitted as attachments to this form.
☒Street map, clearly displaying the direct and indirect APE boundaries
☒Site map
☒USGS topographic map Name(s) of topo map(s): Allegan, MI
☒Aerial map
☐Map of photographs
☐Other: Identify type(s) of map(s)

ii. **Site Photographs**

iii. **Describe the APE:**
The APE consists of road rights-of-way, utility easements and City of Allegan property for a proposed common network low-pressure forcemain collection system and sewer extension extending from a lift station west of Miner Lake to the northern City of Allegan's wastewater collection system. All work overlaps previously disturbed locations, and no major landscape alteration or tree removal is anticipated.

iv. **Describe the steps taken to define the boundaries of the APE:**
The direct APE consists of disturbed areas overlapping existing road rights-of-way, utility easements and City of Allegan property. Because the proposed work consists of buried and ground level features within previously disturbed locations the impact will be minimal. The scope of work will not impact archaeological or historic resources and no indirect visual APE was selected.

b. **Project Work Description**
Describe all work to be undertaken as part of the project:
The proposed collection system consists of each residence in the service area utilizing a septic tank effluent pumping (STEP) system that discharges into a common network of low-pressure forcemain installed within existing road rights-of-way, easements, or city property. Collectively, the pumps will convey the effluent through the low-pressure forcemain to a single downstream lift station located at the western end of Miner Lake. Corrosion and odor control chemicals will be added to the wastewater at the lift station before being pumped through a primary forcemain that discharges into the City of Allegan's wastewater collection system at the northern City limits. The wastewater will then be treated at Allegan's wastewater treatment facilities (WWTF), and the solids in residents' septic tanks will need to be regularly removed every 7-10 years and hauled to the WWTF for treatment. No substantial tree removal or significant landscaping changes are anticipated.

IV. IDENTIFICATION OF HISTORIC PROPERTIES

a. **Scope of Effort Applied**

i. **List sources consulted for information on historic properties in the project area** (including but not limited to SHPO office and/or other locations of inventory data).
- MI SHPO records check dated 10/5/22
- HistoricAerials.com
- Google Maps aerial imagery
- Allegan County GIS

ii. Provide documentation of previously identified sites as attachments.
iii. **Provide a map** showing the relationship between the previously identified properties and sites, your project footprint and project APE.
iv. Have you reviewed existing site information at the SHPO: ☒Yes ☐ No
v. Have you reviewed information from non-SHPO sources: ☒Yes ☐ No

b. **Identification Results**

i. **Above-ground Properties**

A. Attach the appropriate Michigan SHPO Architectural Identification Form for each resource or site 50 years of age or older in the APE. Refer to the *Instructions for the Application for SHPO Section 106 Consultation Form* for guidance on this.

B. **Provide the name and qualifications of the person who made recommendations of eligibility for the above-ground identification forms.**
Name Jill McDevitt **Agency/Consulting Firm:** RESCOM Environmental Corp
Is the individual a 36CFR Part 61 Qualified Historian or Architectural Historian ☒ Yes ☐ No
Are their credentials currently on file with the SHPO? ☒ Yes ☐ No
If NO attach this individual's qualifications form and resume.

ii. **Archaeology** (complete this section if the project involves temporary or permanent ground disturbance) Submit the following information using attachments, as necessary.

A. **Attach Archaeological Sensitivity Map.**

B. **Summary of previously reported archaeological sites and surveys:**

An archaeological records check conducted via the Michigan State Historic Preservation Office on 10/5/22 determined that no known archaeological sites overlap the project areas. Nine previously recorded archaeological sites are present within a mile of the project location. Eight of the sites consist of prehistoric lithic scatter (potential camps) of undetermined Native American cultural affiliation and were recorded by a 1978 conducted by Western Michigan University, Department of Anthropology in the Middle Kalamazoo River Valley. This survey largely overlaps the project area surrounding Miner Lake where the proposed low-pressure forceman is proposed. Site 20AE010 consists of a historical reference to a camp with Prehistoric and Historic Native American cultural affiliation. No sites have been evaluated for inclusion in the National Register of Historic Places (NRHP).

In addition to the 1978 Western Michigan University survey four compliance projects have been conducted within a mile of the project area. These projects failed to re-locate known sites or record new cultural resources.

Archaeological sites within a mile of the project.

Site No	Site Type	Cultural Affiliation	NRHP Status
20AE010	(Camp) Historic Reference	Prehistoric & Historic: Undetermined Native American	Unevaluated
20AE199	Lithic Scatter (Camp)	Prehistoric: Undetermined Native American	Unevaluated
20AE200	Lithic Scatter (Camp)	Prehistoric: Undetermined Native American	Unevaluated
20AE201	Lithic Scatter (Camp)	Prehistoric: Undetermined Native American	Unevaluated
20AE202	Lithic Scatter (Camp)	Prehistoric: Undetermined Native American	Unevaluated
20AE204	Lithic Scatter (Camp)	Prehistoric: Undetermined Native American	Unevaluated
20AE205	Lithic Scatter (Camp)	Prehistoric: Undetermined Native American	Unevaluated
20AE206	Lithic Scatter (Camp)	Prehistoric: Undetermined Native American	Unevaluated
20AE209	Lithic Scatter (Camp)	Prehistoric: Undetermined Native American	Unevaluated
20AE210	Lithic Scatter (Camp)	Prehistoric: Undetermined Native American	Unevaluated
20AE211	Lithic Scatter (Camp)	Prehistoric: Undetermined Native American	Unevaluated
20AE302	Lithic Scatter (Camp)	Prehistoric: Undetermined Native American	Unevaluated
20AE303	Lithic Scatter (Camp)	Prehistoric: Undetermined Native American	Unevaluated
20AE304	Lithic Scatter (Camp)	Prehistoric: Undetermined Native American	Unevaluated
20AE305	Lithic Scatter (Camp)	Prehistoric: Undetermined Native American	Unevaluated
20AE332	Lithic Scatter (Camp)	Prehistoric: Undetermined Native American	Unevaluated
20AE333	Lithic Scatter (Camp)	Prehistoric: Undetermined Native American	Unevaluated
20AE335	Lithic Scatter (Camp)	Prehistoric: Undetermined Native American	Unevaluated
20AE352	Lithic Scatter (Camp)	Prehistoric: Undetermined Native American	Unevaluated

Compliance projects within a mile of the project.

Project Id	Bibkey	Citation
N/A	N/A	Cremin, William M. and J.F. Marek. 1978 An Archaeological Survey of Allegan County, Michigan: 1978 Multiple Transect Survey in the Middle Kalamazoo River Valley. Western Michigan University, Department of Anthropology
ER8519	00702	Nassaney, Michael S. 1994. Report of a Limited Archaeological Assessment of the Highland Industrial Park (ER-008519), Allegan, Allegan County, Michigan. Western Michigan University, Department of Anthropology
ER-4458	07865	Cremin, William M. 1980. An Archaeological Survey of the Grand Ravine Senior Housing, Inc. Property, City of Allegan, Allegan County, Michigan. 47. Western Michigan University, Department of Anthropology
ER16-231	14549	Jackson, Misty. 2016. Archaeological Phase I and Geomorphological Investigation for the City of Allegan River Erosion Hazard Mitigation for the Stabilization of the Kalamazoo River Bank. Arbre Croche Cultural Resources
ER00-7. 19.190235	16676	Stillwell, Larry. 2019. Archaeological Field Reconnaissance of a Proposed Telecommunications Facility (Project #190235) in Allegan, Allegan County, Michigan. Archaeological Consultants of Ossian

C. **Town/Range/Section or Private Claim numbers:** Township 2N, Range 13W, Sections 11, 12, 13, 14, 21, 22, 23

D. **Width(s), length(s), and depth(s) of proposed ground disturbance(s):** The proposed work overlaps previously disturbed rights-of-way, utility easements and city property. Any trenching will overlap disturbed fill.

E. **Will work potentially impact previously undisturbed soils?** ☐ Yes ☒ No
***If YES,* summarize new ground disturbance:**
Summary of new ground disturbance

F. **Summarize past and present land use:**
Rights-of-ways and utility easement.

G. **Potential to adversely affect significant archaeological resources**:
☒ Low ☐ Moderate ☐ High
For moderate and high potential, is fieldwork recommended? ☐ Yes ☒ No
Briefly justify the recommendation:
No new ground disturbance will occur as part of the proposed work as it overlaps existing features within city owned property.

H. **Has fieldwork already been conducted?** ☐ Yes ☒ No
If YES:
☐ Previously surveyed; refer to A. and B. above.
☐ Newly surveyed; attach report copies and provide full report reference here:

I. **Provide the name and qualifications of the person who provided the information for the Archaeology section:**
Name: Andrew Smith **Agency/Firm:** RESCOM Environmental Corp
Is the person a 36CFR Part 61 Qualified Archaeologist? ☒ Yes ☐ No
Are their credentials currently on file with the SHPO? ☒ Yes ☐ No
If NO, attach this individual's qualifications form and resume.

Archaeological site locations are legally protected.
This application may not be made public without first redacting sensitive archaeological information.

V. IDENTIFICATION OF CONSULTING PARTIES

a. **Provide a list of *all* consulting parties,** including Native American tribes, local governments, applicants for federal assistance/permits/licenses, parties with a demonstrated interest in the undertaking, and public comment:
Identify consulting parties, mailing addresses, and email addresses.

b. **Provide a summary of consultation with consultation parties:**
Summary of consultation with parties other than the SHPO

c. **Provide summaries of public comment and the method by which that comment was sought:**
Public comment summary

VI. DETERMINATION OF EFFECT

Guidance for applying the Criteria of Adverse Effect can be found in *the Instructions for the Application for SHPO Section 106 Consultation Form*.

a. **Basis for determination of effect**:
There are no historic properties within the project's APE.

b. **Determination of effect**
☒ **No historic properties will be affected** or
☐ **Historic properties will be affected** and the project will (check one):
☐ have **No Adverse Effect** on historic properties within the APE.
☐ have an **Adverse Effect** on one or more historic properties in the APE and the federal agency, or federally authorized representative, will consult with the SHPO and other parties to resolve the adverse effect under 800.6.
☐ **More Information Needed:** We are initiating early consultation. A determination of effect will be submitted to the SHPO at a later date, pending results of survey.

Federally Authorized Signature:_____ Date:_____

Type or Print Name: _____

Title: _____

ATTACHMENT CHECKLIST

Identify any materials submitted as attachments to the form:

☐ Additional federal, state, local government, applicant, consultant contacts

☒ Maps of project location

Number of maps attached: number of maps

☒ Site Photographs

☒Map of photographs

☒ Plans and specifications

☒ Other information pertinent to the work description: Identify the type of materials attached

☐ Documentation of previously identified historic properties

☐ Architectural Properties Identification Forms

☐ Map showing the relationship between the previously identified properties, your project footprint, and project APE

☒ Above-ground qualified person's qualification form and resume

☒ Archaeological sensitivity map

☐ Survey report

☒ Archaeologist qualifications and resume

☐ Other: Identify other attached materials

Allegan, MI

10/24/2022, 3:17:41 PM

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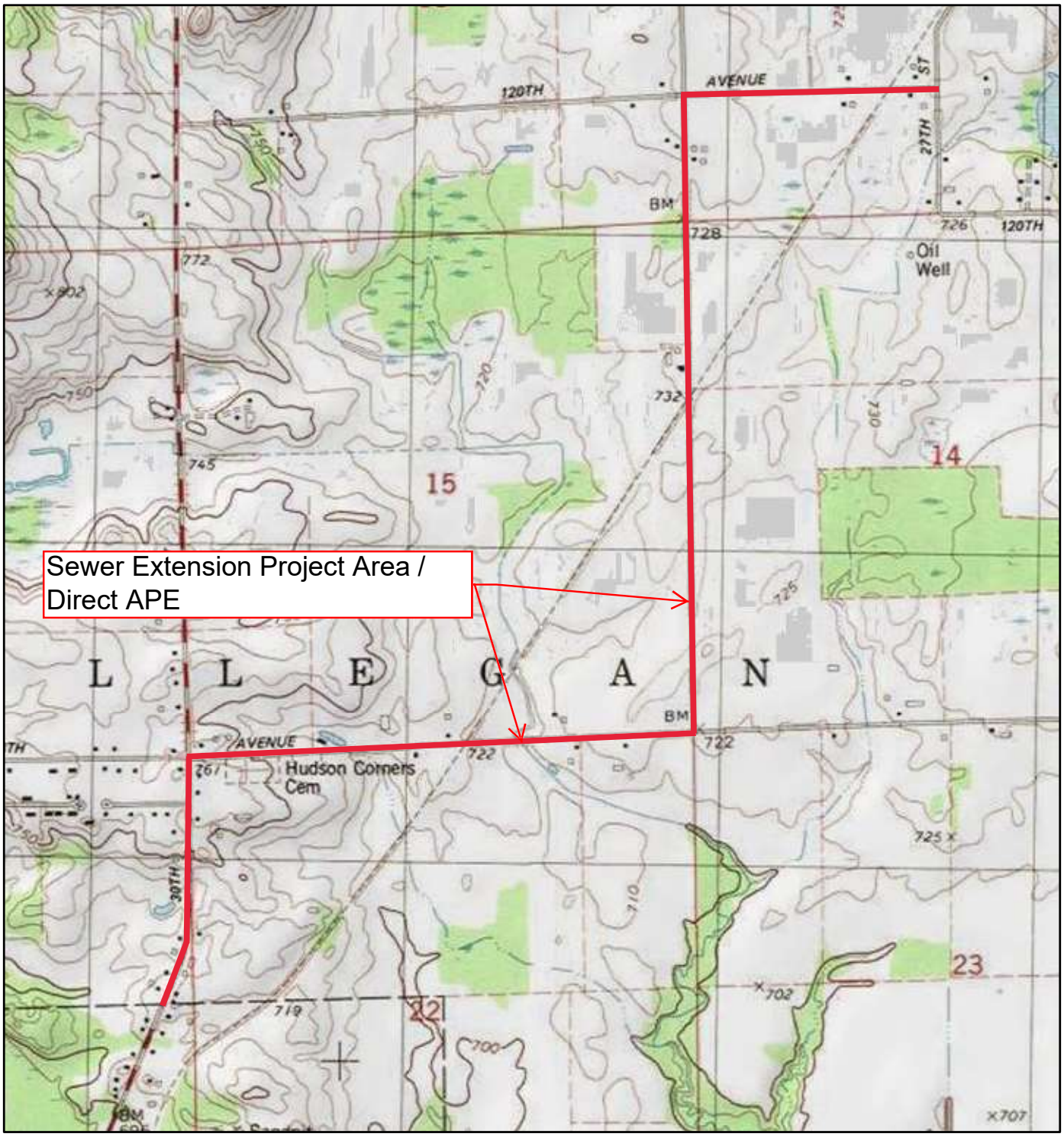
USGS
2021 USGS

Allegan, MI



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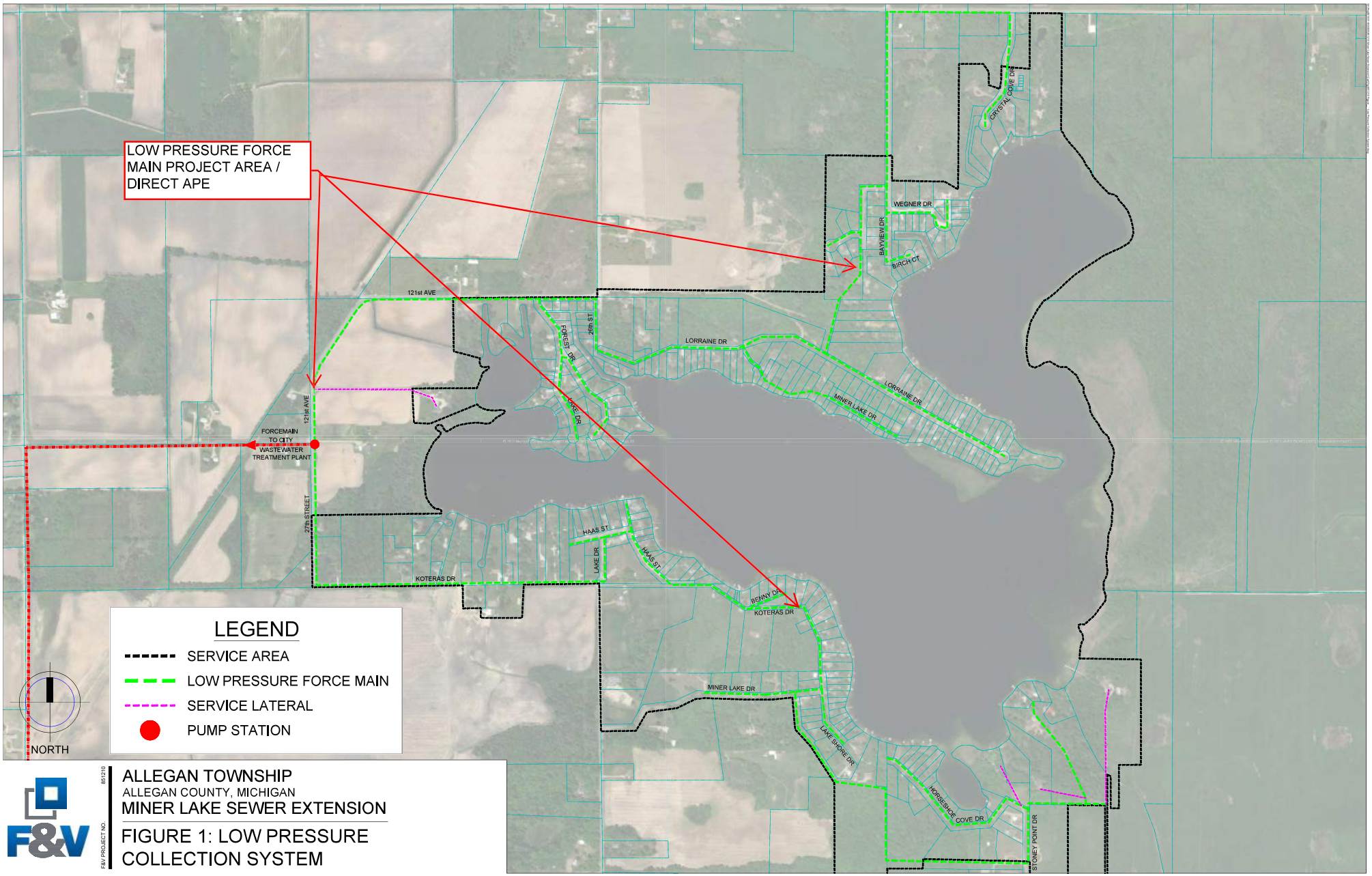
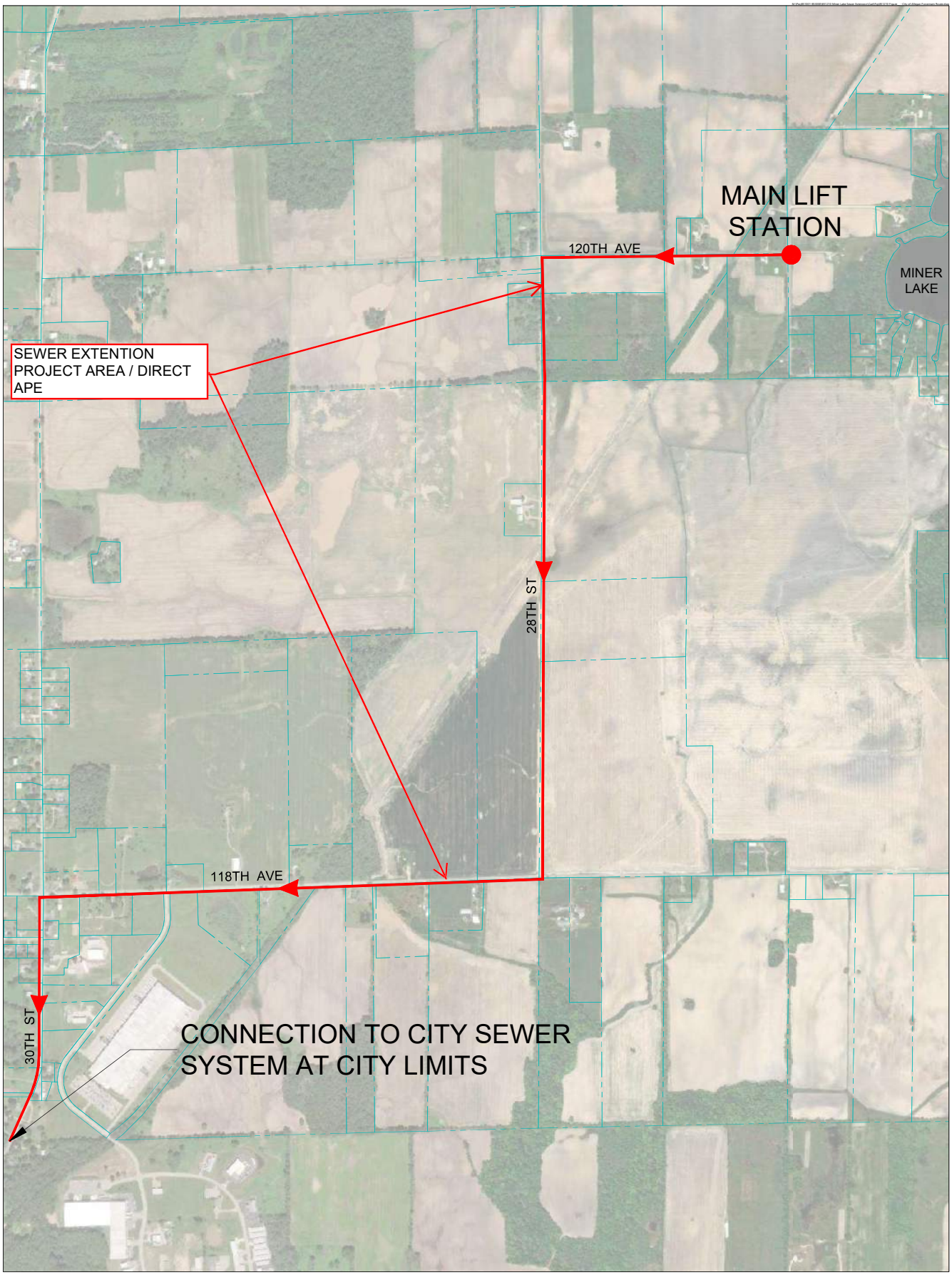
USGS
2021 USGS



F&V PROJECT NO. 851210

ALLEGAN TOWNSHIP
ALLEGAN COUNTY, MICHIGAN
MINER LAKE SEWER EXTENSION

FIGURE 1: LOW PRESSURE COLLECTION SYSTEM



F&V

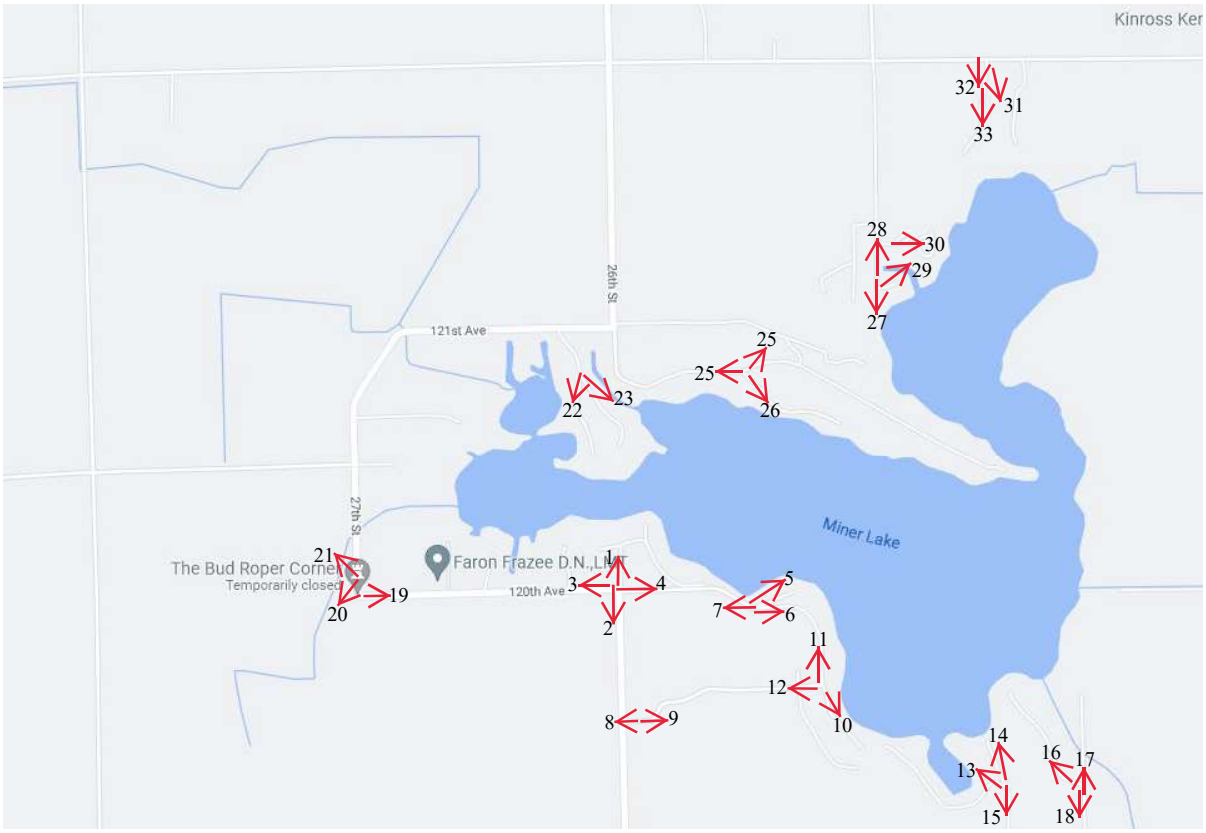
F&V PROJECT NO. 85121C

ALLEGAN TOWNSHIP
ALLEGAN COUNTY, MICHIGAN
MINER LAKE SEWER EXTENSION

FIGURE 2: FORCEMAIN ROUTE TO CITY OF ALLEGAN

NORTH

Low Pressure System Project Area Photo Key



LOW-PRESSURE SYSTEM PROJECT AREA PHOTOS

1. Hass Drive facing north.

2. 26th Street facing south.

LOW-PRESSURE SYSTEM PROJECT AREA PHOTOS

3. 120th Street facing west.

4. Koteras Drive facing east.

LOW-PRESSURE SYSTEM PROJECT AREA PHOTOS

5. Berry Drive facing northeast.

6. Koteras Drive facing east.

LOW-PRESSURE SYSTEM PROJECT AREA PHOTOS

7. Koteras Drive facing west.

8. Harold Drive facing west.

LOW-PRESSURE SYSTEM PROJECT AREA PHOTOS

9. Harold Drive facing east.

10. Lakeshore Drive facing southeast

LOW-PRESSURE SYSTEM PROJECT AREA PHOTOS

11. Miner Lake Drive facing north.

12. Harold Drive facing west.

LOW-PRESSURE SYSTEM PROJECT AREA PHOTOS

13. Horseshoe Cove facing northwest.

14. Homestead Drive facing north-northwest.

LOW-PRESSURE SYSTEM PROJECT AREA PHOTOS

15. Horseshoe Cove facing south.

16. Story Point Drive facing northwest.

LOW-PRESSURE SYSTEM PROJECT AREA PHOTOS

17. Story Point Drive facing north.

18. Story Point Drive facing south.

LOW-PRESSURE SYSTEM PROJECT AREA PHOTOS

19. 120th Avenue facing east.

20. Intersection at 120th Avenue and 27th Street facing southwest.

LOW-PRESSURE SYSTEM PROJECT AREA PHOTOS

21. 27th Street facing northwest.

22. Lake Drive facing south-southwest.

LOW-PRESSURE SYSTEM PROJECT AREA PHOTOS

23. Forest Drive facing southeast.

24. Lorraine Drive facing northeast.

LOW-PRESSURE SYSTEM PROJECT AREA PHOTOS

25. Lorraine Drive facing west.

26. Miner Lake Drive facing southeast.

LOW-PRESSURE SYSTEM PROJECT AREA PHOTOS

27. Bayview Drive facing south.

28. Bayview Drive facing north.

LOW-PRESSURE SYSTEM PROJECT AREA PHOTOS

29. Birch Court facing northeast.

30. Wegner Drive facing east.

LOW-PRESSURE SYSTEM PROJECT AREA PHOTOS

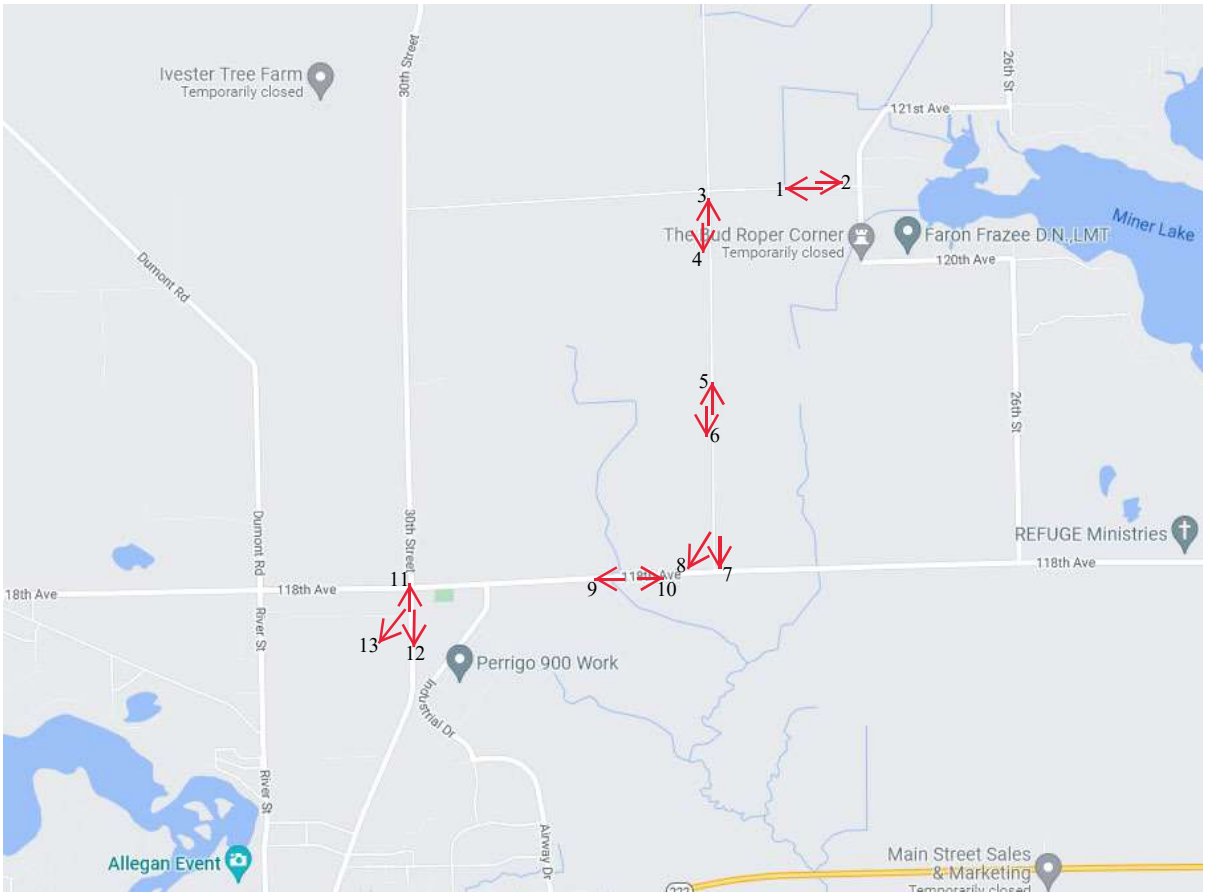
31. Crystal Cove Drive facing south-southeast.

32. Crystal Cove Drive facing south.

LOW-PRESSURE SYSTEM PROJECT AREA PHOTOS

33. Crystal Cove Drive facing south.

Sewer Extension Project Area Photo Key



SEWER EXTENSION PROJECT AREA PHOTOS

1. 120th Avenue facing west.

2. 120th Avenue facing east.

SEWER EXTENSION PROJECT AREA PHOTOS

3. 28th Street facing north.

4. 28th Street facing south.

SEWER EXTENSION PROJECT AREA PHOTOS

5. 28th Street facing north.

6. 28th Street facing south.

SEWER EXTENSION PROJECT AREA PHOTOS

7. Intersection of 118th and 28th Street facing south.

8. Intersection of 118th and 28th Street facing southwest.

SEWER EXTENSION PROJECT AREA PHOTOS

9. 118th Avenue facing west.

10. 118th Avenue facing east.

SEWER EXTENSION PROJECT AREA PHOTOS

11. 30th Street facing north.

12. 30th Street facing south.

SEWER EXTENSION PROJECT AREA PHOTOS

13. 30th Street facing southwest.

CURRICULUM VITAE
ANDREW M. SMITH M.A.

EDUCATION:

Bachelor of Arts: Anthropology, Indiana University Fort Wayne, Indiana December 2005
Master of Arts: Anthropology, Ball State University Muncie, Indiana July 2010

PROFESSIONAL QUALIFICATIONS:

- Multiple years of experience in budgeting, planning and carrying out Section 106 compliance work.
- Extensive experience managing staff for grant and contracted archaeological investigations
- Coordination with lead agencies, SHPO's, THPO's and interested parties
- Proficient in Microsoft suite of programs, Adobe CS, as well as Golden Surfer, ESRI ArcGIS 10.1.
- Established history of completing complex projects.
- Fully aware of cultural resources management laws and their applications.

ARCHAEOLOGY AND RELATED EXPERIENCE:

Vice President of Operations at RESCOM. July 2014 to Present
Supervisor: Joe Lee 231-947-4454

Running the day to day operations for completion and management of Section 106, Phase I Environmental Site Assessments (ESAs) and National Environmental Policy Act Assessments (NEPAs).

Professor of Practice at Purdue University Fort Wayne. November 2019 to Present
Supervisor: Harold Odden 260-481-4183

Working with the Department of Anthropology and Sociology to develop a certificate in Cultural Resources Management along with developing and teaching classes in archaeology directly related to the practice of Section 106 Cultural Resources Management in the United States.

Site Files Manager at Louisiana Division of Archaeology. February 2014 to July 2014
Supervisor: Rachel Watson 225-342-8165

Review of site submissions and maintenance of archaeological site data for the State of Louisiana in both print and digital format. Use of ArcGIS platform to spatially represent archaeological data and datasets within the State of Louisiana.

Interim Director at IPFW Archaeological Survey. June 2009 to 2014
Supervisor: Richard Sutter 260-481-6676

Experience from Phase Ia surveys to Phase III mitigations. Use and supervision of those using surveying equipment, GPS, aerial and topographic maps, digital cameras, as well as resistivity and magnetometer/gradiometer equipment. Management of up to 15 personnel and overseeing all paperwork and documentation. Extensive laboratory experience and report writing. Direct consultation with the state historic preservation officers, as well as INDOT and NAGPRA representatives.

Staff Archaeologist at Ball State Applied Archaeology Laboratories (formerly Archaeological Resources Management Services). July 2006 to June 2009
Supervisor: Beth McCord 765-285-1834

Conducted field work and supervised personnel in the field and in the lab. Wrote technical reports. Participated in grant applications. Conducted research, fieldwork, labwork, and writing for grant compliance.

Archaeological Technician at CDimensions. January 2012
Supervisor: Eben Cooper 972-881-5577

Worked two weeks during vacation from my permanent job to gain Forest Service archaeological experience. Phase I survey, including shovel testing and walkover and site recording in accordance with USDA NFS standards.

LIST OF PUBLICATIONS AVAILABLE UPON REQUEST

Jill McDevitt, MSHP
Curriculum Vitae
jill.mcdevitt@rescom.org

Education
M.S. in Historic Preservation, Ball State University, 2013
B.A. in History (minor in Mathematics), Saint Joseph's College, 2010

Selected Employment
RESCOM Environmental Corp
July 2018-present
Project Manager-Cultural Resources
Supervisor: Jamie Cochran-Smith, 260-385-6998
Conduct historic reviews and prepare evaluations for SHPO submissions.

ARCH, Inc.
October 2016-March 2018
Executive Director
Managed historic preservation nonprofit advocacy organization. Supervised staff, prepared annual and project budgets, conducted public outreach and oversaw fundraising and event planning. Managed a historic rehabilitation construction project, conducted historic research.

ARCH, Inc.
May 2013-October 2016
Historic Preservation Specialist
Supervisor: Michael Galbraith, 260-469-3476
Conducted field survey for Allen County Historic Sites and Structures Inventory, researched and wrote National Register Nominations, Historic Structure Reports, and Historic Tax Credit Applications, Part I and II.

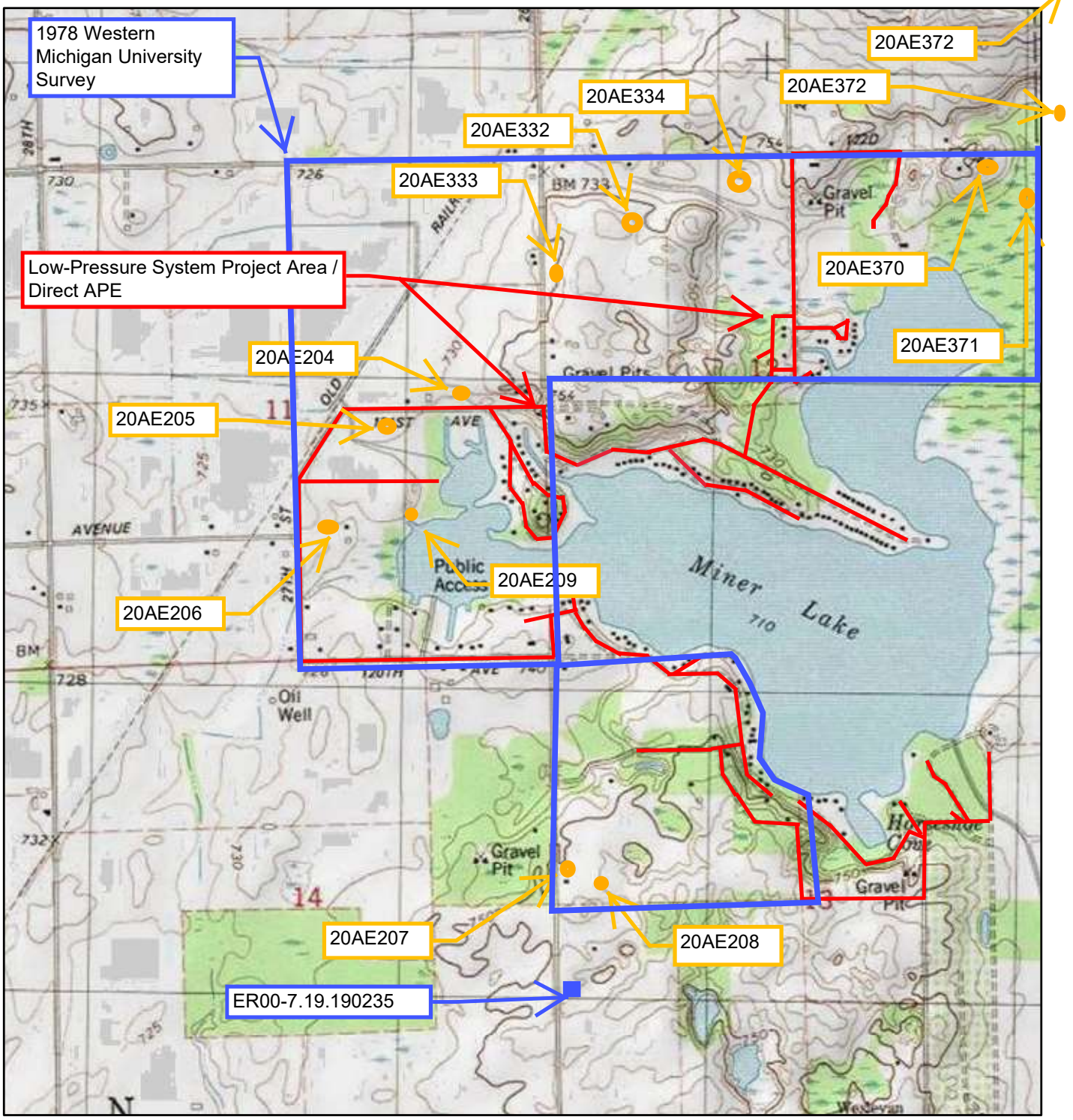
Professional Publications
National Register of Historic Places Nomination: Cyrus and Jennie Cline House, Steuben County, Indiana. Co-Author, 2017.

Historic Structure Report for Blue Cast Springs, Allen County, Indiana. Co-Author, 2016.

National Register of Historic Places Nomination: Bluffton Commercial Historic District, Wells County, Indiana (under review). Co-Author, 2015.

National Register of Historic Places Nomination: Brimfield School No. 2, Noble County, Indiana (under review). Author, 2014.

Archaeological Sensitivity Map (NOT FOR PUBLIC DISTRIBUTION) Allegan, MI 7.5' Quadrangle



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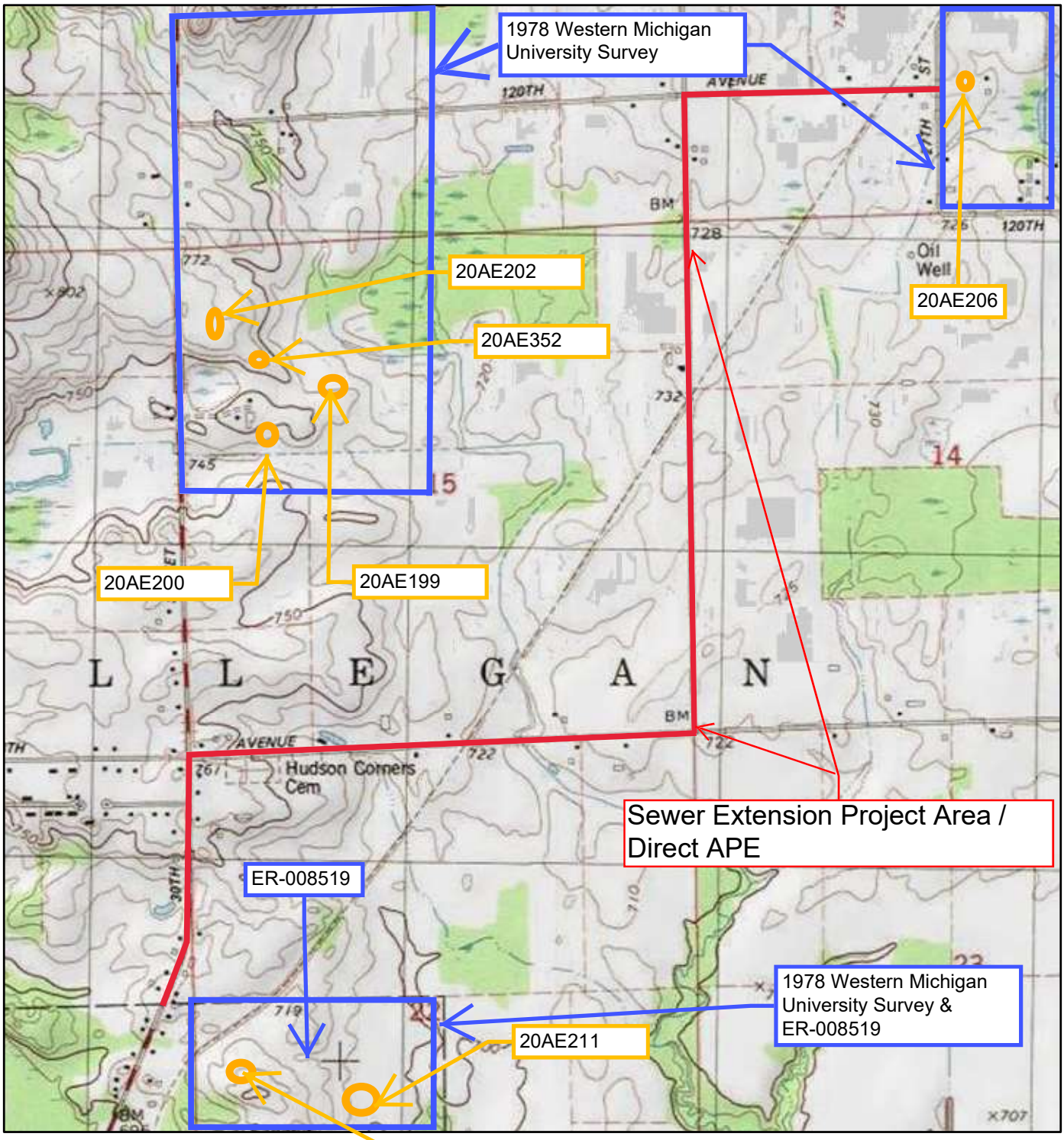
The direct APE consists of disturbed areas overlapping existing road rights-of-way, utility easements and City of Allegan property. Because the proposed work consists of buried and ground level features within previously disturbed locations the impact will be minimal. The scope of work will not impact archaeological or historic resources and no indirect visual APE was selected.

Archaeological Sensitivity Map (NOT FOR PUBLIC DISTRIBUTION) Allegan, MI 7.5' Quadrangle



The direct APE consists of disturbed areas overlapping existing road rights-of-way, utility easements and City of Allegan property. Because the proposed work consists of buried and ground level features within previously disturbed locations the impact will be minimal. The scope of work will not impact archaeological or historic resources and no indirect visual APE was selected.

6.3 State Historic Preservation Officer Response

6.4 Tribal Coordination

GRETCHEN WHITMER
GOVERNOR

STATE OF MICHIGAN
MICHIGAN STRATEGIC FUND
STATE HISTORIC PRESERVATION OFFICE

QUENTIN L. MESSER, JR.
PRESIDENT

January 11, 2023

ANDREW GRANSKOG
ENVIRONMENTAL COORDINATOR
USDA RURAL DEVELOPMENT OFFICE
3001 COOLIDGE ROAD SUITE 200
EAST LANSING MI 48823

RE: ER23-206 Miner Lake Wastewater Collection System, T2N, R13W, 11, 12, 13, 14, 21, 22, 23, 24, Allegan County (USDA)

Dear Andrew Granskog:

Under the authority of Section 106 of the National Historic Preservation Act of 1966, as amended, we have reviewed the above-cited undertaking at the location noted above. Based on the information provided for our review, the State Historic Preservation Officer (SHPO) concurs with the determination of USDA that **no historic properties are affected** within the area of potential effects of this undertaking.

This letter evidences EPA's compliance with 36 CFR § 800.4 "Identification of historic properties," and the fulfillment of EPA's responsibility to notify the SHPO, as a consulting party in the Section 106 process, under 36 CFR § 800.4(d)(1) "No historic properties affected." **If the scope of work changes in any way, or in the unlikely event that human remains or archaeological material are encountered during construction activities related to the above-cited undertaking, work must be halted, and the Michigan SHPO and other appropriate authorities must be contacted immediately.**

We remind you that federal agency officials or their delegated authorities are required to involve the public in a manner that reflects the nature and complexity of the undertaking and its effects on historic properties per 36 CFR § 800.2(d). The National Historic Preservation Act also requires that federal agencies consult with Native American Tribes and/or Tribal Historic Preservation Officers (THPO) who may attribute religious and cultural significance to historic properties that may be affected by the agency's undertakings per 36 CFR § 800.2(c)(2)(ii).

The State Historic Preservation Office is not the office of record for this undertaking. You are therefore asked to maintain a copy of this letter with your environmental review record for this undertaking.

MICHIGAN SHPO STATE HISTORIC PRESERVATION OFFICE

300 NORTH WASHINGTON SQUARE • LANSING, MICHIGAN 48913
michigan.gov/**shpo** • (517) 335-9840

If you have any questions, please contact Amy Krull, Federal Projects Archaeologist at 517-285-4211 or by email at krulla@michigan.gov. **Please reference our project number in all communication with this office regarding this undertaking.** Thank you for this opportunity to review and comment, and for your cooperation.

Sincerely,

Amy Krull
Federal Projects Archaeologist

SES:AK

Copy: Steve Schulz, Allegan County
Andrew Smith, RESCOM Environmental Corp.

United States Department of Agriculture

January 12, 2023

SUBJECT: SHPO ER23-206 Allegan Twp Miner Lake Sewer Extension, Allegan Township, Allegan County, MI Section 106 Historic Review & Tribal Coordination

TO: Edith Leoso, Bad River Band of Lake Superior Chippewa
Paula Carrick, Bay Mills Indian Community
Jaylen Strong & Bill Latady, Bois Forte Band of Chippewa
Tracy Wind, Citizen Potawatomi Nation
Larry Heady, Delaware Tribe of Indians
Evan Schroeder & Jill Hoppe, Fond du Lac Band
Benjamin Rhodd, Forest County Potawatomi
Rob Hull, Beth Drost, & Maryann Gagnon, Grand Portage Band of the Minnesota Chippewa Tribe
Sharon Detz, Grand River Band of Ottawa Indians
Victoria Alfonseca, Grand Traverse Band of Ottawa & Chippewa Indians
Kenneth Meshigaud, Hannahville Indian Community
William Quackenbush, Ho-Chunk Nation of Wisconsin
Alden Connor, Keweenaw Bay Indian Community
Brian Bisonette, Lac Courte Oreilles Band of Lak Superior Chippewa Indians of Wisconsin
Sarah Thompson, Lac Du Flambeau Band of Lake Superior Chippewa
Alina Shively, Lac Vieux Desert Band of Lake Superior Chippewa Indians
Amy Burnette & Colleen Wells, Leech Lake Band of Chippewa
Jonnie "Jay" Sam, Little River Band of Ottawa Indians
Melissa Wiatrolic, Little Traverse Bay Bands of Ottawa Indians
Lakota Hobia, Match-e-be-nash-she-wish (Gun Lake) Band of Potawatomi Indians
David Grignon, Menominee Indian Tribe of Wisconsin
Diane Hunter & Logan York, Miami Tribe of Oklahoma
Terry Kemper, Mille Lacs Band of Ojibwe
Douglas Taylor, John Rodwan, & Dan Green, Nottawaseppi Huron Band of the Potawatomi
Rhonda Hayworth, Ottawa Tribe of Oklahoma
Matthew Bussler, Pokagon Band of Potawatomi Indians
Raphael Wahwassuck, Prairie Band of Potawatomi Nation
Noah White, Prairie Island Indian Community
Marvin DeFoe & Chris Boyd, Red Cliff Band
Kade Ferris & Darrel Seki, Red Lake Band of Chippewa Indians
Marcella Hadden, Saginaw Chippewa Indian Tribe
Marie R Richards & Aaron Payment, Sault Ste. Marie Tribe of Chippewa Indians
William Tarrant, Seneca-Cayuga Nation
Michael LaRonge & Robert VanZile, Sokaogon Chippewa (Mole Lake) Community of Wisconsin
Wanda McFaggen, St. Croix Chippewa Indians of Wisconsin
Jamie Arsenault & Cayla Olson, White Earth Band of the Minnesota Chippewa Tribe

Under the authority of Section 106 of the National Historic Preservation Act of 1966, as amended, the State Historic Preservation Office (SHPO) has reviewed the above-mentioned project and concluded that:

X No historic properties are affected by the project (36 CFR § 800.4 (d) (1)), or

□ The project will have no adverse effect on historic properties (36 CFR § 800.5)

The project was initially reviewed by a third party archaeologist the meets the minimum federal professional qualifications set forth in 36 CFR Part 61. Further, the SHPO review of this project included a review by the Office of the State Archaeologist (OSA). The OSA review process includes looking at the presence and/or proximity of

known archaeological sites near to and within the project area. To do this, they consider a variety of information, including the distribution of archaeological sites in the surrounding region, the amount of previous archaeological surveys in the vicinity and the results of that survey work, topography, surface water, soil types, the presence of old transportation features such as railroad grades and roadbeds, as well as other factors which may inform on the potential presence or absence of archaeological sites.

As a standard requirement of all USDA Rural Development contracts, in the event that historic or archaeological resources are uncovered during excavation, the project engineer and USDA Rural Development will be immediately notified. Construction shall be temporarily halted pending the notification process and further directions issued by USDA Rural Development after coordination with the SHPO and interested tribes.

Based on the SHPO review and opinion, USDA Rural Development is issuing a finding as noted above for the above-mentioned project. If you have site specific information that causes your tribe to disagree with this opinion, please contact me by email at andy.granskog@usda.gov or our office at (517) 324-5209 within thirty days.

Sincerely,

Andrew H. Granskog, PE
State Environmental Coordinator

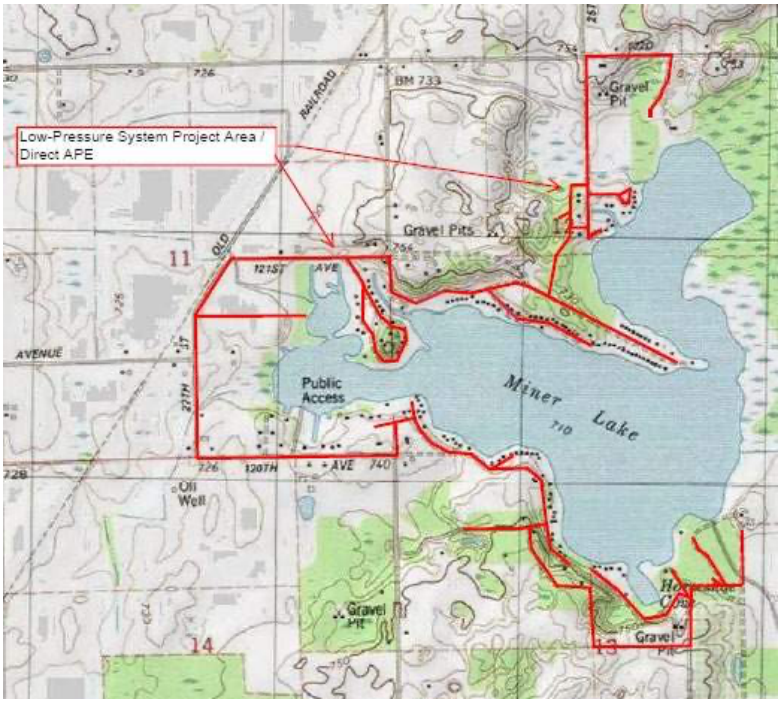
Project Description:

The proposed collection system consists of each residence in the service area utilizing a septic tank effluent pumping (STEP) system that discharges into a common network of low-pressure forcemain installed within existing road rights-of-way, easements, or city property. Collectively, the pumps will convey the effluent through the low-pressure forcemain to a single downstream lift station located at the western end of Miner Lake. Corrosion and odor control chemicals will be added to the wastewater at the lift station before being pumped through a forcemain that discharges into the City of Allegan's sewer system at the northern city limits for treatment.

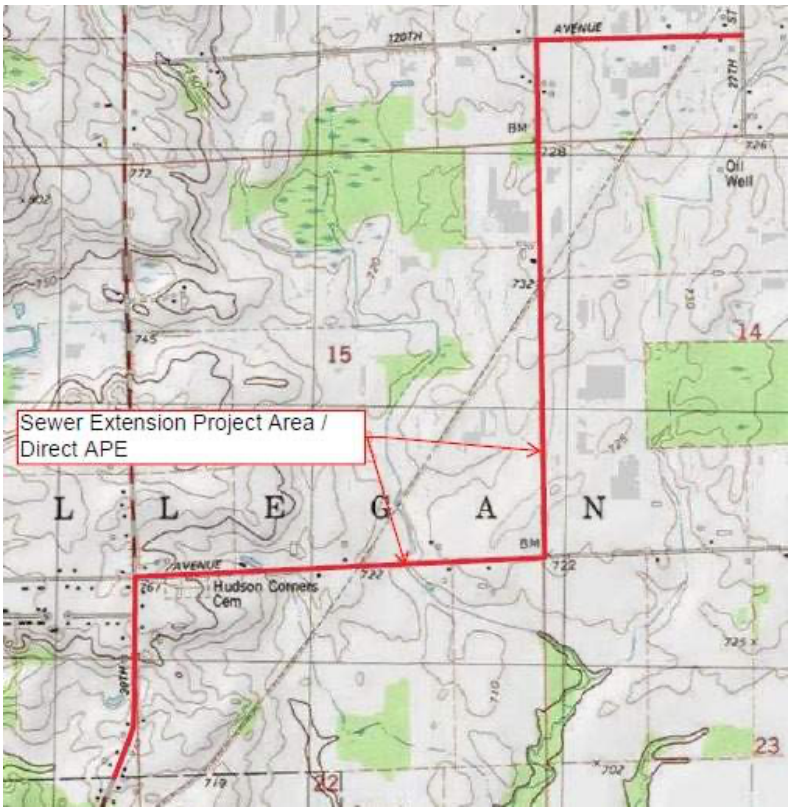
Project Maps (see next page):

USDA

United States Department of Agriculture



Forcemain:



3001 Coolidge Road • Suite 200 • East Lansing, MI 48823
Phone: (517) 324-5156 • Fax: (855) 813-7741 • TDD: (800) 649-3777• Web: http://www.rurdev.usda.gov/mi

From: David Grignon
To: Granskog, Andy - RD, MI
Subject: RE: EXTERNAL - Allegan Township Miner Lake Sewer Extension
Date: Thursday, January 12, 2023 4:10:41 PM
Attachments: image001.png

Andy,

Thank you for sending the proposed federal undertaking to the Menominee Tribe for compliance under Section 106 of the National Historic Preservation Act. The Menominee Tribe concurs with the finds of "no adverse effect" to historic properties.

David Grignon
Tribal Historic Preservation Officer
Menominee Indian Tribe of Wisconsin

From: Granskog, Andy - RD, MI <andy.granskog@usda.gov>
Sent: Thursday, January 12, 2023 6:35 AM
To: THPO@badriver-nsn.gov; deputythpo@badriver-nsn.gov; paulacarrick@baymills.org; blatady@boisforte-nsn.gov; jaylen.strong@boisforte-nsn.gov; tracy.wind@potawatomi.org; cpnthpo@potawatomi.org; lheady@delawaretribe.org; evanschroeder@fdlrez.com; jillhoppe@fdlrez.com; Benjamin.Rhodd@fcp-nsn.gov; bethdrost@grandportage.com; maryanng@grandportage.com; thpo@grandportage.com; Jareds@grandportage.com; grbottawa@yahoo.com; victoria.alfonseca@gtb-nsn.gov; tribal.manager@gtb-nsn.gov; Meshigaud, Kenneth <tyderyien@hannahville.org>; bill.quackenbush@ho-chunk.com; BQuackenbush@ho-chunk.com; aconnor@kbic-nsn.gov; brian.bisonette@lco-nsn.gov; sarah.thompson@ldftribe.com; ldfthpo@ldftribe.com; alina.shively@lvd-nsn.gov; Farron Jackson <amy.burnette@llojibwe.org>; Colleen.Wells@llojibwe.org; jsam@lrboi-nsn.gov; Mwiatrolik@Ltbbodawa-nsn.gov; Lakota.Hobia@glt-nsn.gov; Mbpi_thpo@glt-nsn.gov; David Grignon <dgrignon@mitw.org>; THPO@miamination.com; terry.kemper@millelacsband.com; todd.moilanen@millelacsband.com; Green, Dan <dgreen@nhbpi.com>; Douglas.Taylor@nhbpi.com; John.rodwan@nhbp-nsn.gov; rhonda.oto@gmail.com; Matthew.Bussler@pokagonband-nsn.gov; raphaelwahwassuck@pbpnation.org; Onnen, Liana <liana@pbpnation.org>; noah.white@piic.org; Chris.Boyd@redcliff-nsn.gov; marvin.defoe@redcliff-nsn.gov; dseki@redlakenation.org; Darrell SekiSr. <kade.ferris@redlakenation.org>; MlHadden@sagchip.org; Payment, Aaron <aaronpayment@saulttribe.net>; mrichards@saulttribe.net; William Tarrant <wtarrant@sctribe.com>; michael.laronge@scc-nsn.gov; robert.vanzile@scc-nsn.gov; garland.mcgeshick@scc-nsn.gov; wandam@stcroixojibwe-nsn.gov; wandam@stcroixtribalcenter.com; cayla.olson@whiteearth-nsn.gov; Jaime.Arsenault@whiteearth-nsn.gov
Cc: Webb, Danielle - RD, MI <Danielle.Webb@usda.gov>; Bristol, Paul - RD, MI <paul.bristol@usda.gov>
Subject: EXTERNAL - Allegan Township Miner Lake Sewer Extension

Good Morning,

Please see the attached SHPO letter and tribal coordination document for the above-mentioned project. If you have any questions about this project whatsoever, please do not hesitate to contact me.

Andrew H. Granskog, PE | State Engineer
Rural Development
U.S. Department of Agriculture
3001 Coolidge Rd, Suite 200 | East Lansing, MI 48823
Phone: 517.324.5209 www.rd.usda.gov

"Together, America Prospers"

From: Douglas Taylor
To: Granskog, Andy - RD, MI
Subject: RE: Allegan Township Miner Lake Sewer Extension
Date: Monday, January 16, 2023 12:44:11 PM
Attachments: image001.png
image002.png

Greetings,

Ref: Allegan Township Miner Lake Sewer Extension

Thank you for including the Nottawaseppi Huron Band of the Potawatomi (NHBP) in your consultation process. From the description of your proposed project, it does not appear as if any cultural or religious concerns of the Tribe's will be affected. We therefore have no objection to the project. Of course, if the project scope is significantly changed or inadvertent findings are discovered during the course of the project, please contact us for further consultation.

Very Respectfully
Douglas R. Taylor

Douglas R. Taylor | Tribal Historic Preservation Officer (THPO) & NAGPRA Representative
Pine Creek Indian Reservation
1301 T Drive S, Fulton, MI 49052
o: 269-704-8347 | c: 269-419-9434 | f: 269-729-5920
Douglas.Taylor@nhbp-nsn.gov | www.nhbp-nsn.gov

NOTTAWASEPPI HURON BAND OF THE POTAWATOMI
A FEDERALLY RECOGNIZED TRIBAL GOVERNMENT

From: Granskog, Andy - RD, MI <andy.granskog@usda.gov>
Sent: Thursday, January 12, 2023 7:35 AM
To: THPO@badriver-nsn.gov; deputythpo@badriver-nsn.gov; paulacarrick@baymills.org; blatady@boisforte-nsn.gov; jaylen.strong@boisforte-nsn.gov; tracy.wind@potawatomi.org; cpnthpo@potawatomi.org; lheady@delawaretribe.org; evanschroeder@fdlrez.com;

jillhoppe@fdlrez.com; Benjamin.Rhodd@fcp-nsn.gov; bethdrost@grandportage.com; maryanng@grandportage.com; thpo@grandportage.com; Jareds@grandportage.com; grbottawa@yahoo.com; victoria.alfonseca@gtb-nsn.gov; tribal.manager@gtb-nsn.gov; Meshigaud, Kenneth <tyderyien@hannahville.org>; bill.quackenbush@ho-chunk.com; BQuackenbush@ho-chunk.com; aconnor@kbic-nsn.gov; brian.bisonette@lco-nsn.gov; sarah.thompson@ldftribe.com; ldfthpo@ldftribe.com; alina.shively@lvd-nsn.gov; Farron Jackson <amy.burnette@llojibwe.org>; Colleen.Wells@llojibwe.org; jsam@lrboi-nsn.gov; Mwiatrolik@Ltbbodawa-nsn.gov; Lakota.Hobia@glt-nsn.gov; Mbpi_thpo@glt-nsn.gov; dgrignon@mitw.org; THPO@miamination.com; terry.kemper@millelacsband.com; todd.moilanen@millelacsband.com; Dan Green <dan.green@nhbp-nsn.gov>; Douglas Taylor <Douglas.Taylor@nhbp-nsn.gov>; John Rodwan <John.Rodwan@nhbp-nsn.gov>; rhonda.oto@gmail.com; Matthew.Bussler@pokagonband-nsn.gov; raphaelwahwassuck@pbpnation.org; Onnen, Liana <liana@pbpnation.org>; noah.white@piic.org; Chris.Boyd@redcliff-nsn.gov; marvin.defoe@redcliff-nsn.gov; dseki@redlakenation.org; Darrell SekiSr. <kade.ferris@redlakenation.org>; MlHadden@sagchip.org; Payment, Aaron <aaronpayment@saulttribe.net>; mrichards@saulttribe.net; William Tarrant <wtarrant@sctribe.com>; michael.laronge@scc-nsn.gov; robert.vanzile@scc-nsn.gov; garland.mcgeshick@scc-nsn.gov; wandam@stcroixojibwe-nsn.gov; wandam@stcroixtribalcenter.com; cayla.olson@whiteearth-nsn.gov; Jaime.Arsenault@whiteearth-nsn.gov
Cc: Webb, Danielle - RD, MI <Danielle.Webb@usda.gov>; Bristol, Paul - RD, MI <paul.bristol@usda.gov>
Subject: Allegan Township Miner Lake Sewer Extension

Good Morning,

Please see the attached SHPO letter and tribal coordination document for the above-mentioned project. If you have any questions about this project whatsoever, please do not hesitate to contact me.

Andrew H. Granskog, PE | State Engineer
Rural Development
U.S. Department of Agriculture
3001 Coolidge Rd, Suite 200 | East Lansing, MI 48823
Phone: 517.324.5209 www.rd.usda.gov

"Together, America Prospers"

penalties. If you believe you have received this message in error, please notify the sender and delete the email immediately.

From: Benjamin Rhodd
To: Granskog, Andy - RD, MI
Subject: RE: Allegan Township Miner Lake Sewer Extension
Date: Thursday, January 12, 2023 8:11:52 AM
Attachments: image001.png

Mr. Granskog,

Pursuant to consultation under Section 106 of the National Historic Preservation Act (1966 as amended) the Forest County Potawatomi Community (FCPC), a Federally Recognized Native American Tribe, reserves the right to comment on Federal undertakings, as defined under the act.

The Tribal Historic Preservation Office (THPO) staff has reviewed the information you provided for this project. Upon review of site data and supplemental cultural history within our Office, the FCPC THPO is pleased to offer a finding of No Historic Properties affected of significance to the FCPC, however, we request to remain as a consulting party for this project.

As a standard caveat sent with each proposed project reviewed by the FCPC THPO, the following applies. In the event an Inadvertent Discovery (ID) occurs at any phase of a project or undertaking as defined, and human remains or archaeologically significant materials are exposed as a result of project activities, work should cease immediately. The Tribe(s) must be included with the SHPO in any consultation regarding treatment and disposition of an ID find.

Thank you for protecting cultural and historic properties and if you have any questions or concerns, please contact me at the email or number listed below.

Respectfully,

Ben Rhodd, MS, RPA, Tribal Historic Preservation Officer
Forest County Potawatomi
Historic Preservation Office
8130 Mish ko Swen Drive, P.O. Box 340, Crandon, Wisconsin 54520
P: 715-478-7354 C: 715-889-0202 Main: 715-478-7474
Email: Benjamin.Rhodd@fcp-nsn.gov
www.fcpotawatomi.com

From: Granskog, Andy - RD, MI <andy.granskog@usda.gov>
Sent: Thursday, January 12, 2023 6:35 AM
To: THPO@badriver-nsn.gov; deputythpo@badriver-nsn.gov; paulacarrick@baymills.org; blatady@boisforte-nsn.gov; jaylen.strong@boisforte-nsn.gov; tracy.wind@potawatomi.org; cpnthpo@potawatomi.org; lheady@delawaretribe.org; evanschroeder@fdlrez.com; jillhoppe@fdlrez.com; Benjamin Rhodd <Benjamin.Rhodd@fcp-nsn.gov>; bethdrost@grandportage.com; maryanng@grandportage.com; thpo@grandportage.com; Jareds@grandportage.com; grbottawa@yahoo.com; victoria.alfonseca@gtb-nsn.gov; tribal.manager@gtb-nsn.gov; Meshigaud, Kenneth <tyderyien@hannahville.org>; bill.quackenbush@ho-chunk.com; BQuackenbush@ho-chunk.com; aconnor@kbic-nsn.gov; brian.bisonette@lco-nsn.gov; sarah.thompson@ldftribe.com; ldfthpo@ldftribe.com;

alina.shively@lvd-nsn.gov; Farron Jackson <amy.burnette@llojibwe.org>; Colleen.Wells@llojibwe.org; jsam@lrboi-nsn.gov; Mwiatrolik@Ltbbodawa-nsn.gov; Lakota.Hobia@glt-nsn.gov; Mbpi_thpo@glt-nsn.gov; dgrignon@mitw.org; THPO@miamination.com; terry.kemper@millelacsband.com; todd.moilanen@millelacsband.com; Green, Dan <dgreen@nhbpi.com>; Douglas.Taylor@nhbpi.com; John.rodwan@nhbp-nsn.gov; rhonda.oto@gmail.com; Matthew.Bussler@pokagonband-nsn.gov; raphaelwahwassuck@pbpnation.org; Onnen, Liana <liana@pbpnation.org>; noah.white@piic.org; Chris.Boyd@redcliff-nsn.gov; marvin.defoe@redcliff-nsn.gov; dseki@redlakenation.org; Darrell SekiSr. <kade.ferris@redlakenation.org>; MlHadden@sagchip.org; Payment, Aaron <aaronpayment@saulttribe.net>; mrichards@saulttribe.net; William Tarrant <wtarrant@sctribe.com>; michael.laronge@scc-nsn.gov; robert.vanzile@scc-nsn.gov; garland.mcgeshick@scc-nsn.gov; wandam@stcroixojibwe-nsn.gov; wandam@stcroixtribalcenter.com; cayla.olson@whiteearth-nsn.gov; Jaime.Arsenault@whiteearth-nsn.gov
Cc: Webb, Danielle - RD, MI <Danielle.Webb@usda.gov>; Bristol, Paul - RD, MI <paul.bristol@usda.gov>
Subject: Allegan Township Miner Lake Sewer Extension

Good Morning,

Please see the attached SHPO letter and tribal coordination document for the above-mentioned project. If you have any questions about this project whatsoever, please do not hesitate to contact me.

Andrew H. Granskog, PE | State Engineer
Rural Development
U.S. Department of Agriculture
3001 Coolidge Rd, Suite 200 | East Lansing, MI 48823
Phone: 517.324.5209 www.rd.usda.gov

"Together, America Prospers"

Miami Tribe of Oklahoma
3410 P St. NW, Miami, OK 74354 ● P.O. Box 1326, Miami, OK 74355
Ph: (918) 541-1300 ● Fax: (918) 542-7260
www.miamination.com

Via email: andy.granskog@usda.gov

January 23, 2023

Andrew H. Granskog, PE
State Environmental Coordinator
USDA Rural Development
3001 Coolidge Rd, Suite 200
East Lansing, MI 48823

Re: ER23-206 Miner Lake Wastewater Collection System, Allegan County, Michigan – Comments of the Miami Tribe of Oklahoma

Dear Mr. Granskog:

Aya, kweehsitoolaani– I show you respect. The Miami Tribe of Oklahoma, a federally recognized Indian tribe with a Constitution ratified in 1939 under the Oklahoma Indian Welfare Act of 1936, respectfully submits the following comments regarding ER23-206 Miner Lake Wastewater Collection System in Allegan County, Michigan.

The Miami Tribe offers no objection to the above-referenced project at this time, as we are not currently aware of existing documentation directly linking a specific Miami cultural or historic site to the project site. However, given the Miami Tribe's deep and enduring relationship to its historic lands and cultural property within present-day Michigan, if any human remains or Native American cultural items falling under the Native American Graves Protection and Repatriation Act (NAGPRA) or archaeological evidence is discovered during any phase of this project, the Miami Tribe requests immediate consultation with the entity of jurisdiction for the location of discovery. In such a case, please contact me at 918-541-8966 or by email at THPO@miamination.com to initiate consultation.

The Miami Tribe accepts the invitation to serve as a consulting party to the proposed project. In my capacity as Tribal Historic Preservation Officer I am the point of contact for consultation.

Respectfully,

Diane Hunter

Diane Hunter
Tribal Historic Preservation Officer

2872 Mission Drive, Shelbyville, MI 49344 | {p} 269.397.1780 | gunlaketribe-nsn.gov

January 20, 2023

Andy Granskog
State Environmental Coordinator
USDA Rural Development
3001 Coolidge Road
East Lansing, MI 48823
Andy.granskog@usda.gov

Re: MBPI THPO response to SHPO ER23-206

Dear Mr. Granskog:

The Match-E-Be-Nash-She-Wish Band of Pottawatomi Indians' Tribal Historic Preservation Office has received the Section 106 consultation request for comments regarding the proposed collection system utilizing a septic tank effluent pumping system for residences on Miner Lake in Allegan Township, Allegan County, Michigan. At present, we are not providing any additional comments. We have not identified any information concerning the presence of any cultural resources significant to the Match-E-Be-Nash-She-Wish Band of Pottawatomi Indians within the Area of Potential Effect (APE). This is not to say that such a site may not exist, just that this office does not have any available information for the area(s) at this point in time.

This office will be available to assist you in the future or during the course of the project if there is a discovery of human remains, funerary objects, and artifacts. The discovery will require reinitiating Section 106 consultation related to all ongoing and proposed project work and the handling of the inadvertent discovery per the National Historic Preservation Act (NHPA) implementing regulations, 36 CFR Part 800, and, as applicable, the Native American Graves and Repatriation Act (NAGPRA) and its implementing regulations, 43 CFR Part 10. In the event of a discovery of artifacts, human remains, or funerary objects, we request to be notified within 72 hours. At that time, the Tribe will determine if further consultation is necessary.

We thank you for including the Match-E-Be-Nash-She-Wish Band of Pottawatomi Indians in your plans.

Sincerely,

Lakota Hobia

Lakota Hobia
THPO
Lakota.Hobia@glt-nsn.gov
Mbpi_thpo@glt-nsn.gov
Phone: (269) 397-1780

7.0 References

7.1 Project Narrative

Project Narrative

Miner Lake is an all-sports lake located in Allegan Township in Allegan County, Michigan. Miner Lake is a lake 1-1/2 miles in length and less than a mile in width and is located approximately three miles northeast of the City of Allegan. There are approximately 248 primary properties in the study area. Miner Lake is a lake 1-1/2 miles in length and less than a mile in width and is located approximately three miles northeast of the City of Allegan. There are approximately 248 primary properties in the study area. A DNR public access is located at the southwest portion of the Lake just north of 120th Avenue. There is no commercial/industrial land use within the study area.

Most of the eastern shoreline consists of freshwater emergent or freshwater forested/shrub wetland with additional areas along Miner Creek at the far southeast outlet of the Lake. Additional wetlands are located along the western inland areas.

The existing land use surrounding Miner Lake is both full-time and seasonal residential homes. It is estimated that 60% of the homes are full-time residents. There are no Township or County parks in the service area.

Allegan Township is seeking an expansion in the Miner Lake area to provide sewer service around the lake to approximately 248 primary properties in the study area. The service area for the sewer system is the entire area around Miner Lake in Sections 11, 12, 13 and 14 of Allegan Township. The outline of the service area is shown in Appendix A. The service area consists of the developed land immediately adjacent to the Lake as well as lots near the Lake.

The City of Allegan's Wastewater Treatment Facilities (WWTF) are the closest municipal facilities and are approximately 1.7 miles west and 2.3 miles south of the Miner Lake service area. Wastewater treatment is currently provided by on-site septic systems in the study area.

7.2 Street Map with Project Location

7.3 Topographical Map

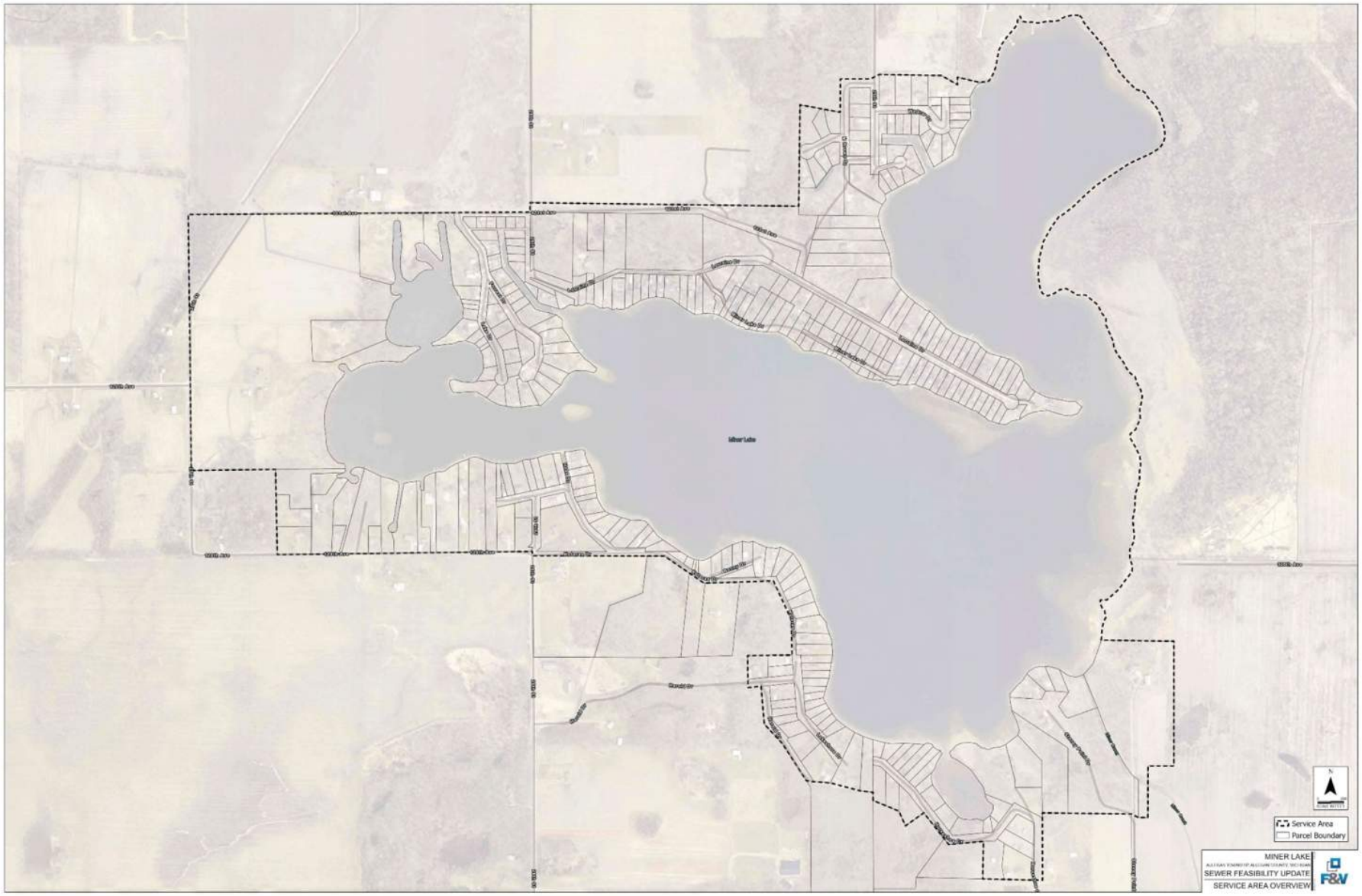
7.4 Aerial Map

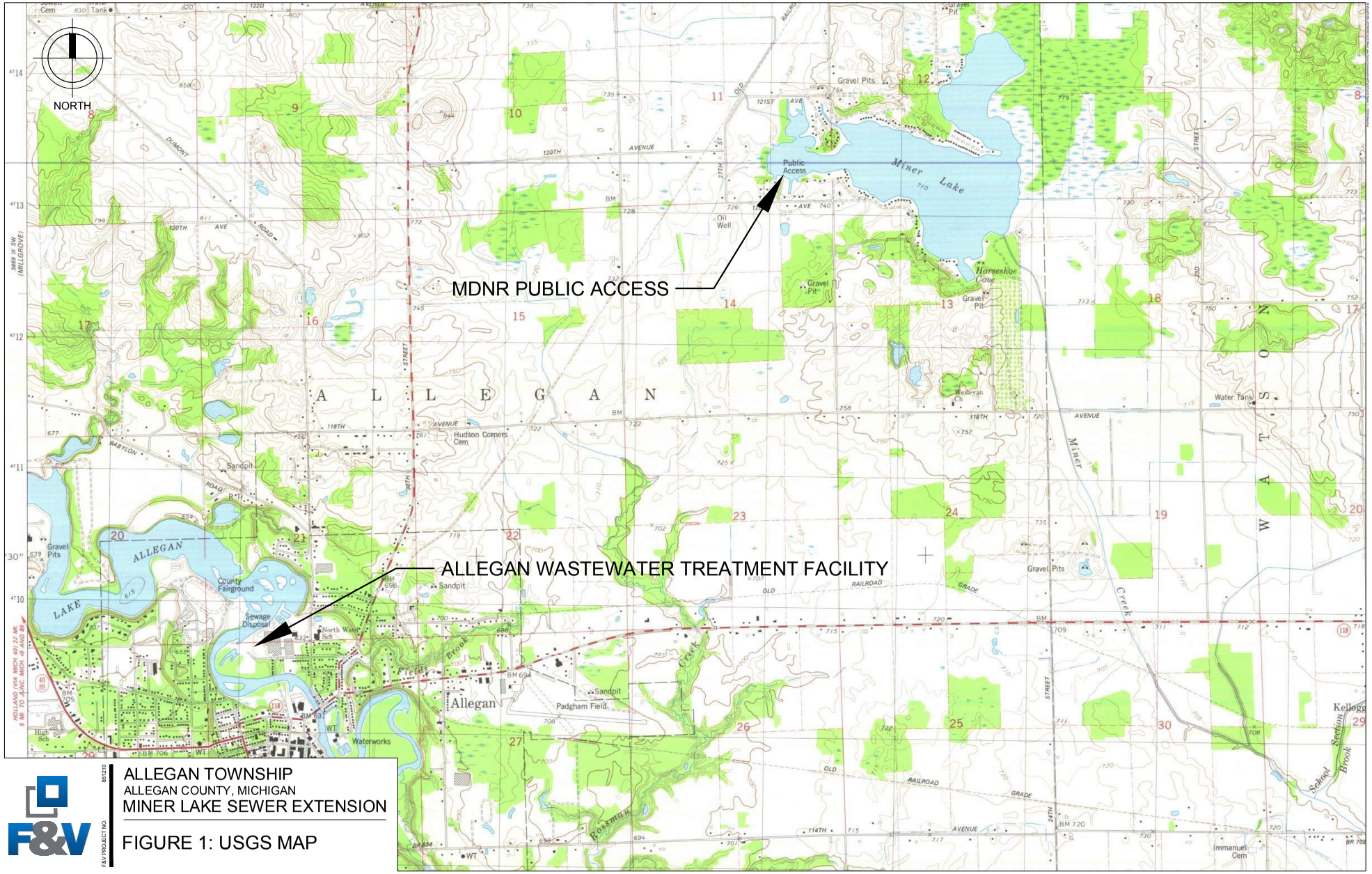
7.5 Flood Insurance Rate Map

7.6 Flood Certificate

7.7 Wetlands Map

7.8 Air Quality: Nonattainment Area Map

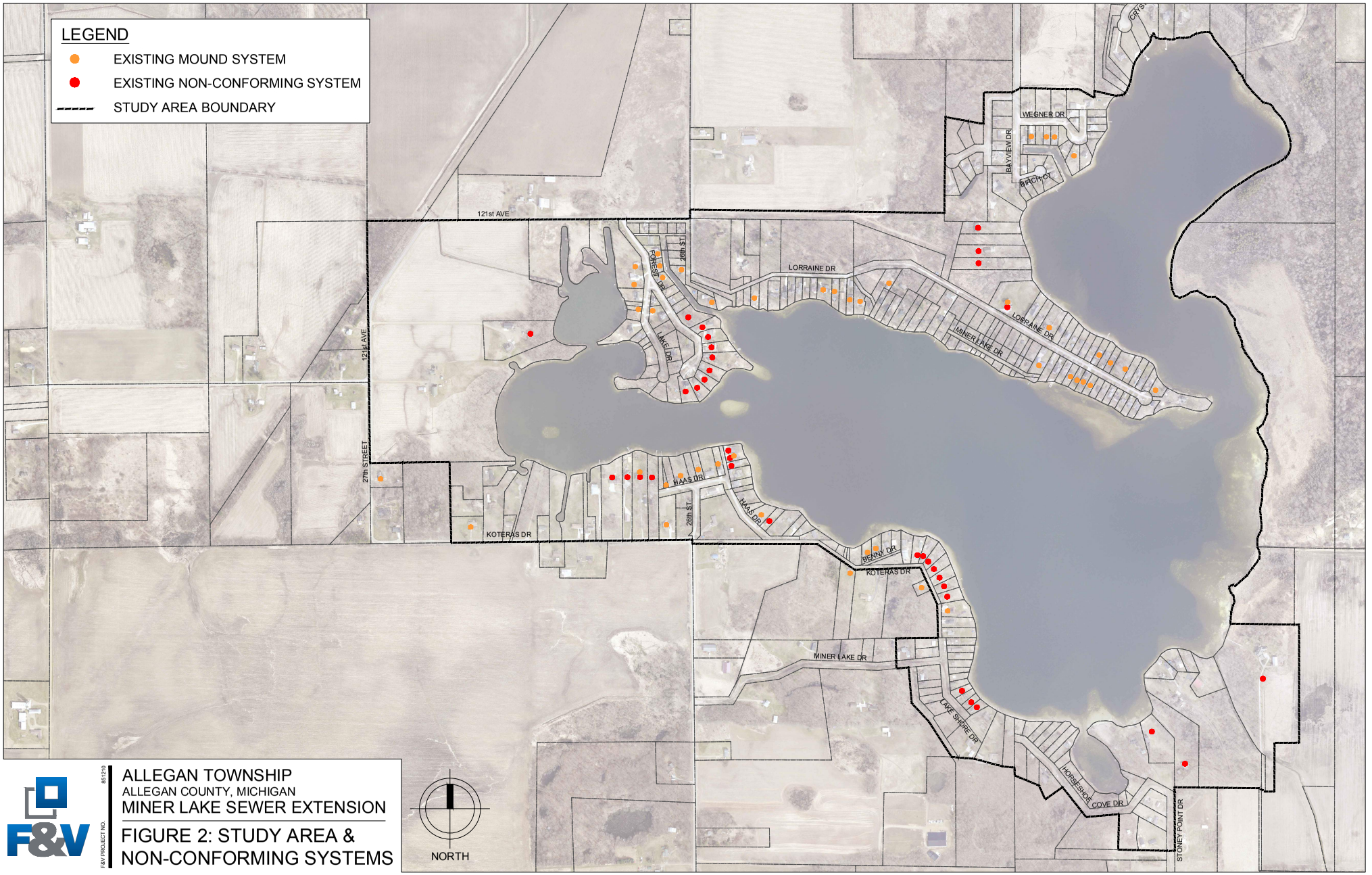

Miner Lake
Service Area
Parcel Boundary
MINER LAKE
SEWER FEASIBILITY UPDATE
SERVICE AREA OVERVIEW
F&V



ALLEGAN TOWNSHIP
ALLEGAN COUNTY, MICHIGAN
MINER LAKE SEWER EXTENSION

FIGURE 1: USGS MAP

F&V PROJECT NO. 851210

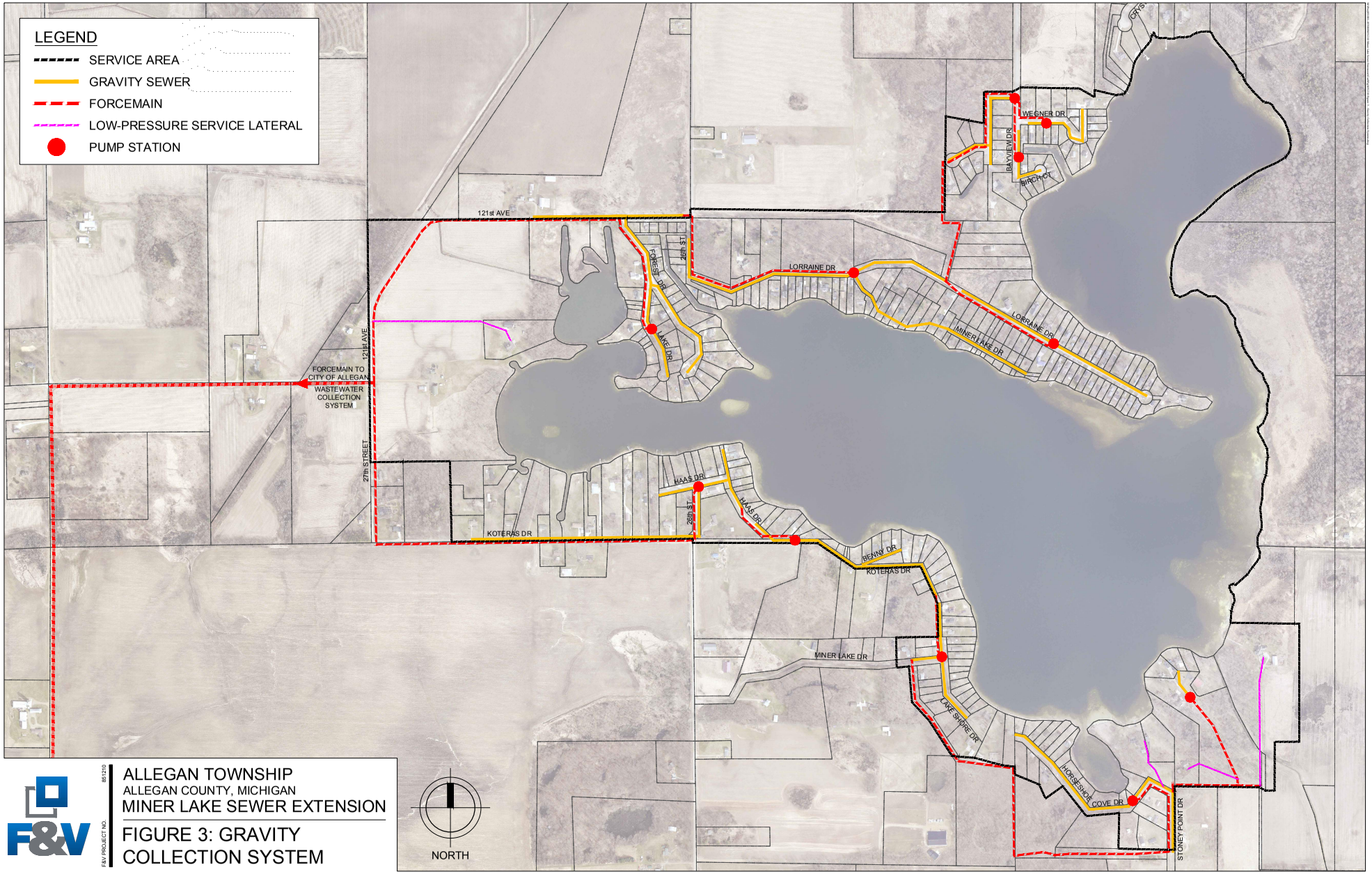


F&V

F&V PROJECT NO. 85121.0

ALLEGAN TOWNSHIP
ALLEGAN COUNTY, MICHIGAN
MINER LAKE SEWER EXTENSION

FIGURE 2: STUDY AREA & NON-CONFORMING SYSTEMS

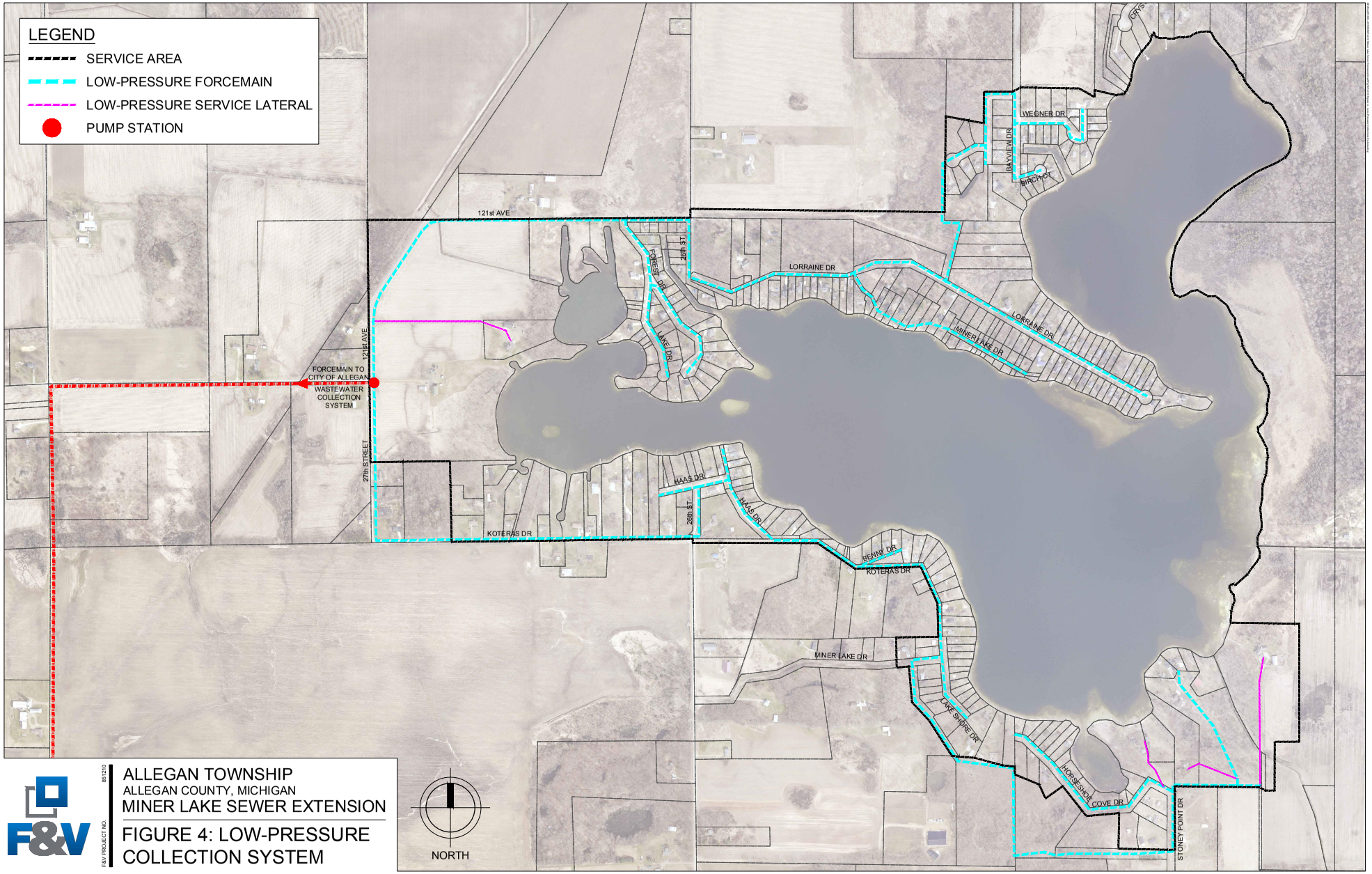


F&V

F&V PROJECT NO. 851210

ALLEGAN TOWNSHIP
ALLEGAN COUNTY, MICHIGAN
MINER LAKE SEWER EXTENSION

FIGURE 3: GRAVITY COLLECTION SYSTEM

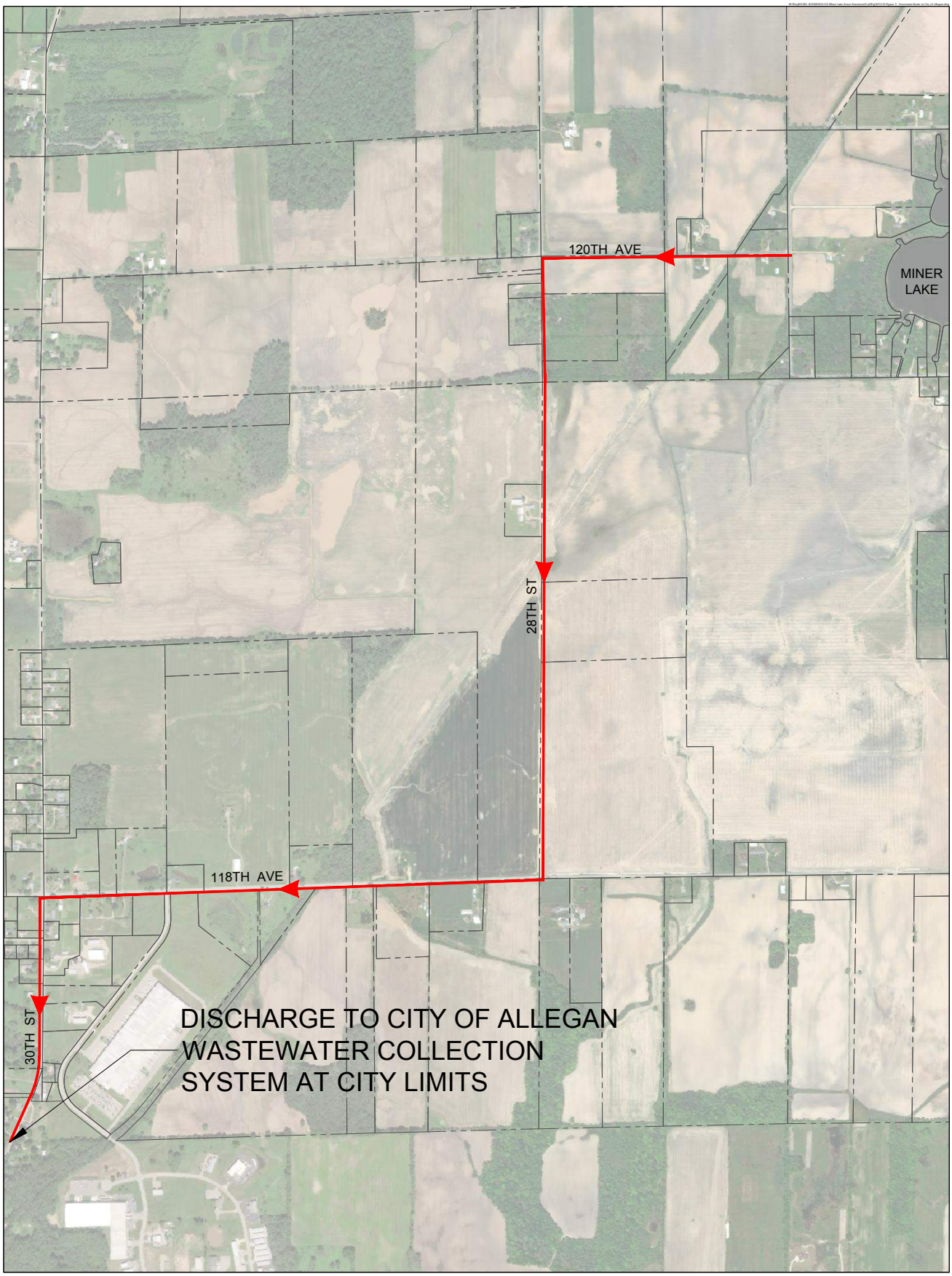


F&V

F&V PROJECT NO. 851210

ALLEGAN TOWNSHIP
ALLEGAN COUNTY, MICHIGAN
MINER LAKE SEWER EXTENSION

FIGURE 4: LOW-PRESSURE COLLECTION SYSTEM

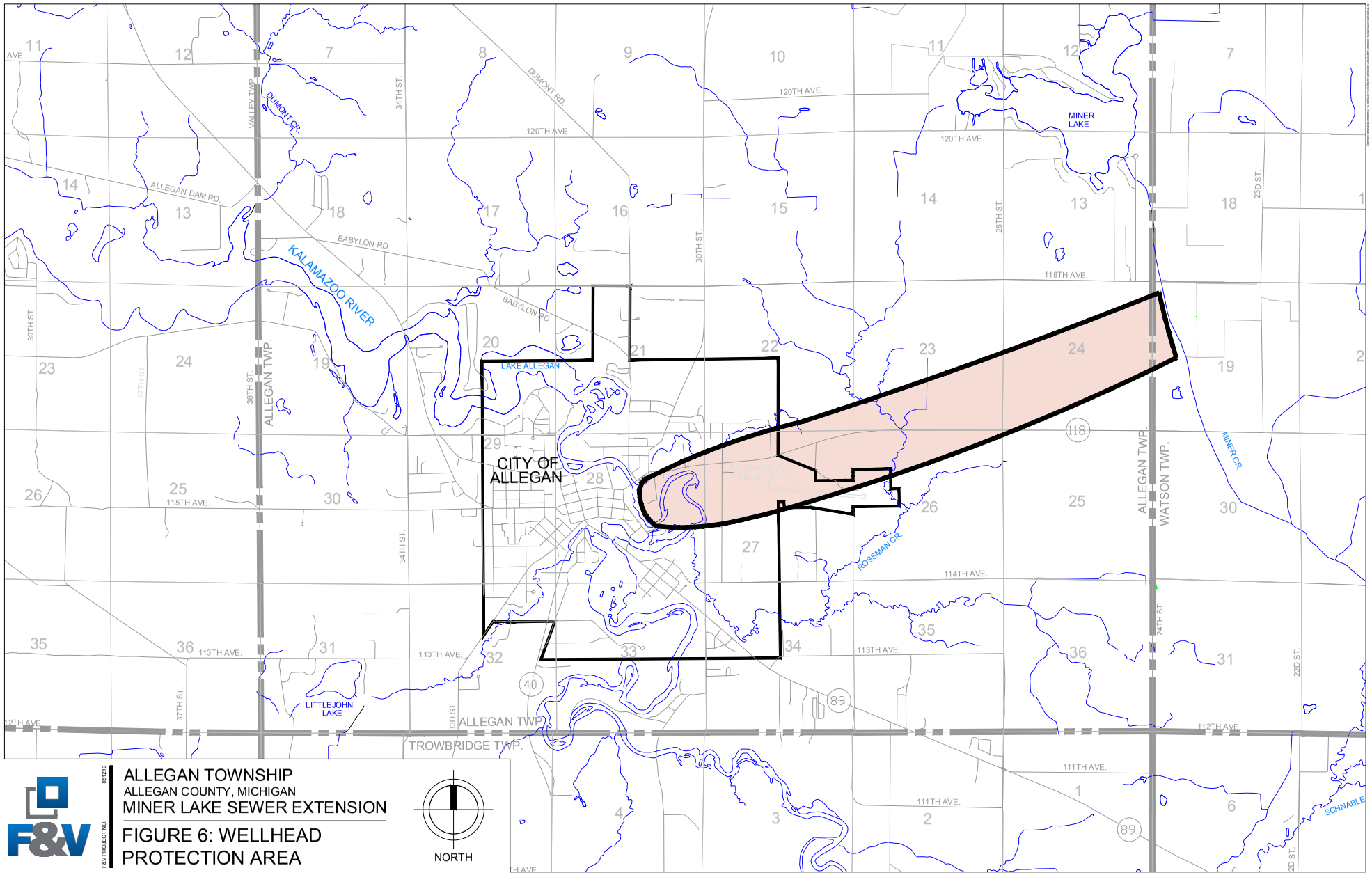


F&V PROJECT NO. 8612.10

ALLEGAN TOWNSHIP
ALLEGAN COUNTY, MICHIGAN
MINER LAKE SEWER EXTENSION

FIGURE 5: FORCEMAIN ROUTE TO CITY OF ALLEGAN

NORTH

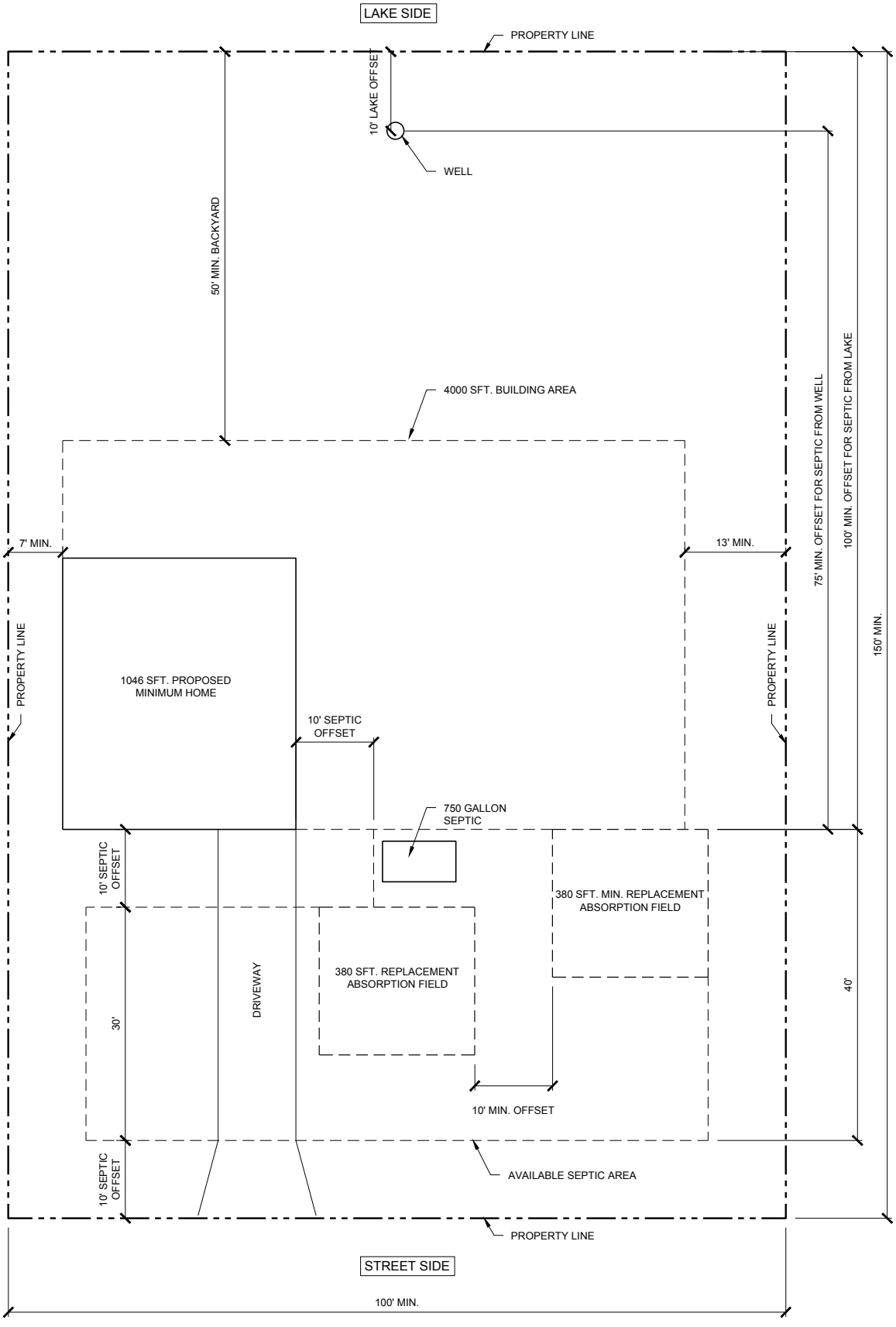


F&V

F&V PROJECT NO. 851210

ALLEGAN TOWNSHIP
ALLEGAN COUNTY, MICHIGAN
MINER LAKE SEWER EXTENSION

FIGURE 6: WELLHEAD PROTECTION AREA



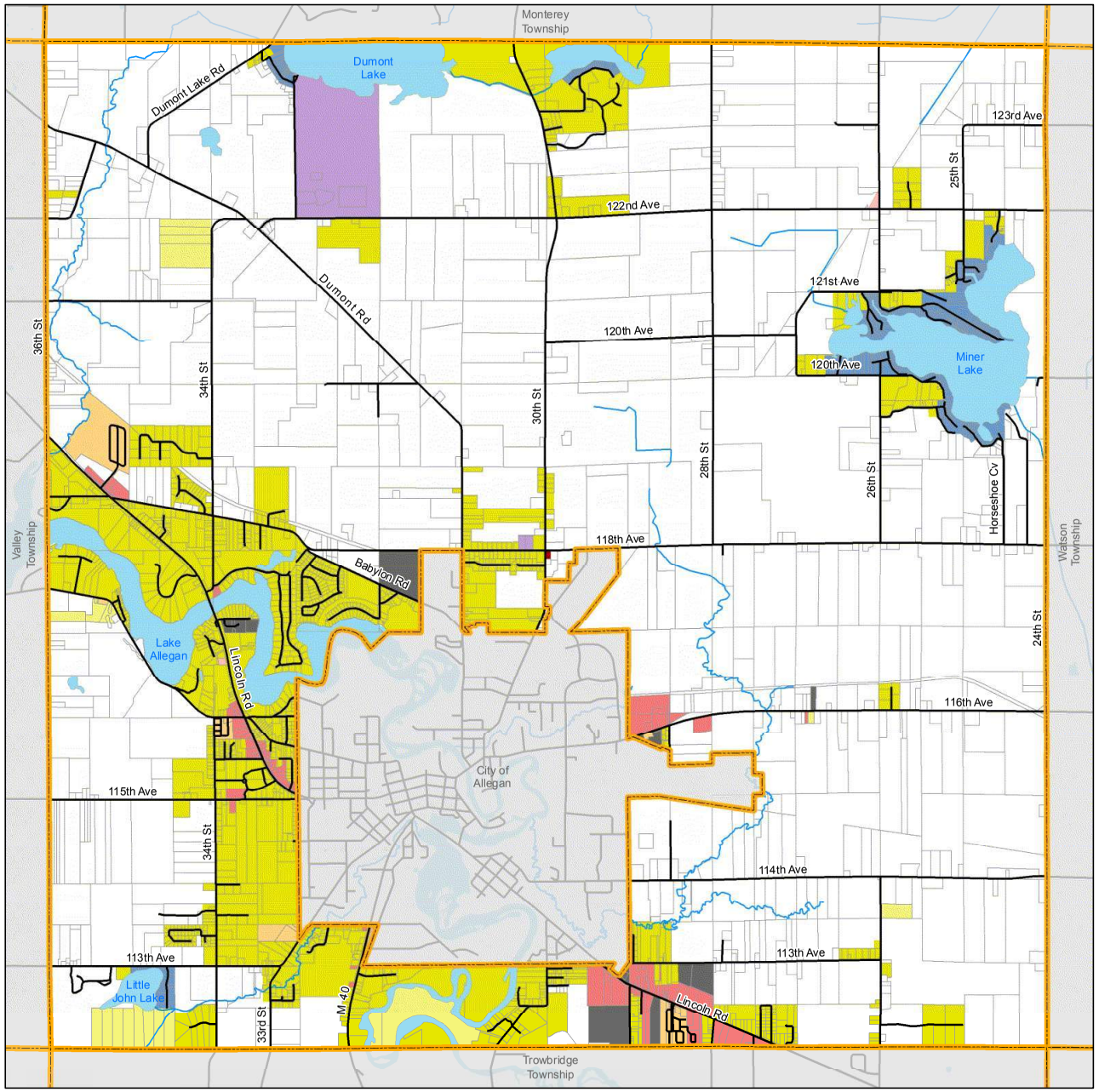
NOTES:
- No garbage disposal, hot tub, or water softener discharge with this septic size
- Assume 1-2 bedroom home
- Soil Perculation Rate of 11-15 min/inch, moderate to poor soils

ALLEGAN TOWNSHIP
ALLEGAN COUNTY, MICHIGAN

MINER LAKE SEWER EXTENSION

FIGURE 7: MINIMUM ISOLATION REQUIREMENTS

F&V PROJECT NO. 851210



Allegan Township

Allegan County, Michigan

DRAFT
Zoning Map
December 29, 2015

Legend

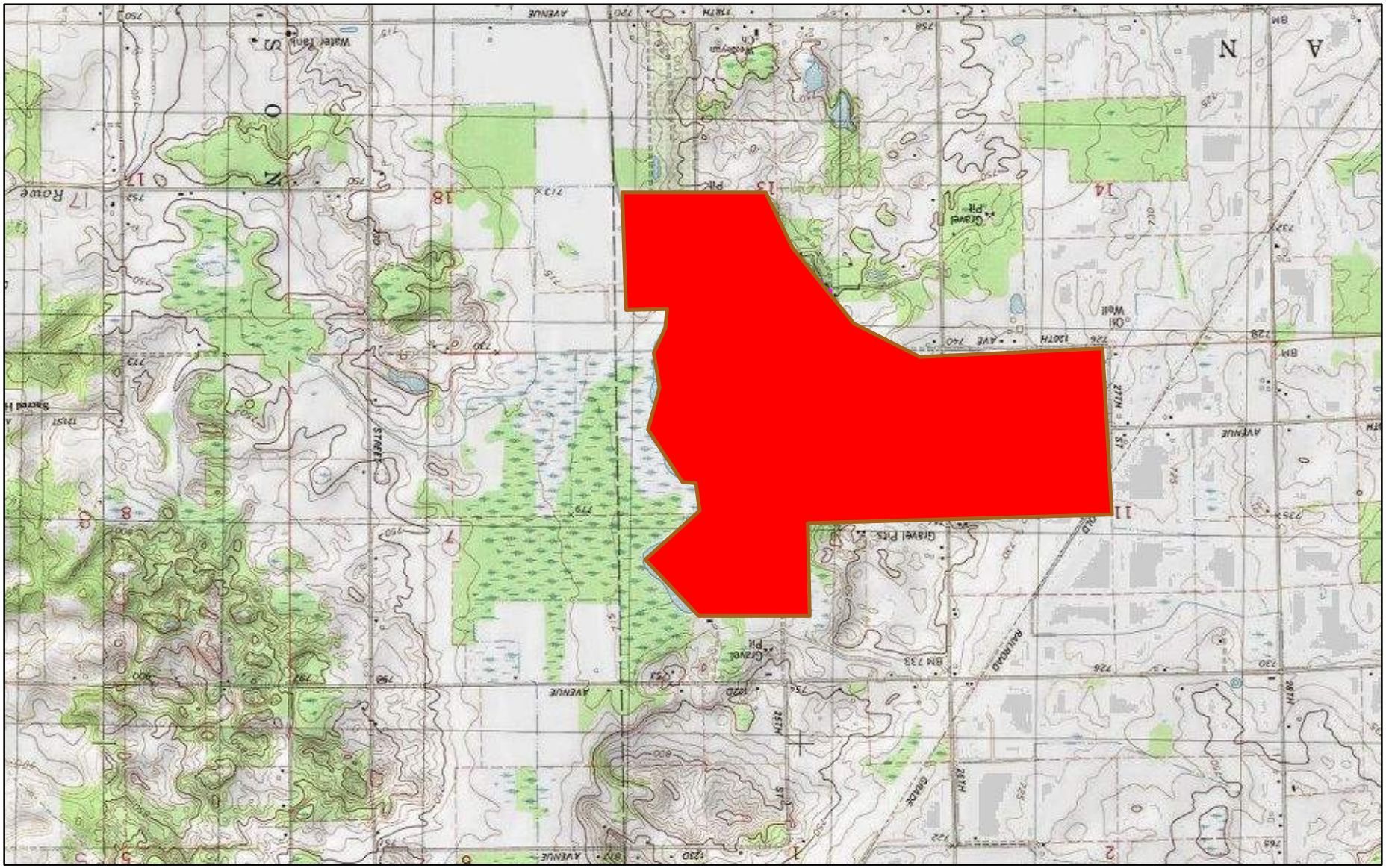
- A - Agriculture
- R1 - Residential
- R2 - Residential
- R3 - Residential
- LR - Lake Residential
- C1 - Commercial
- C2 - Commercial
- C2 - Commercial*
- GS - Government Service
- I1 - Industrial

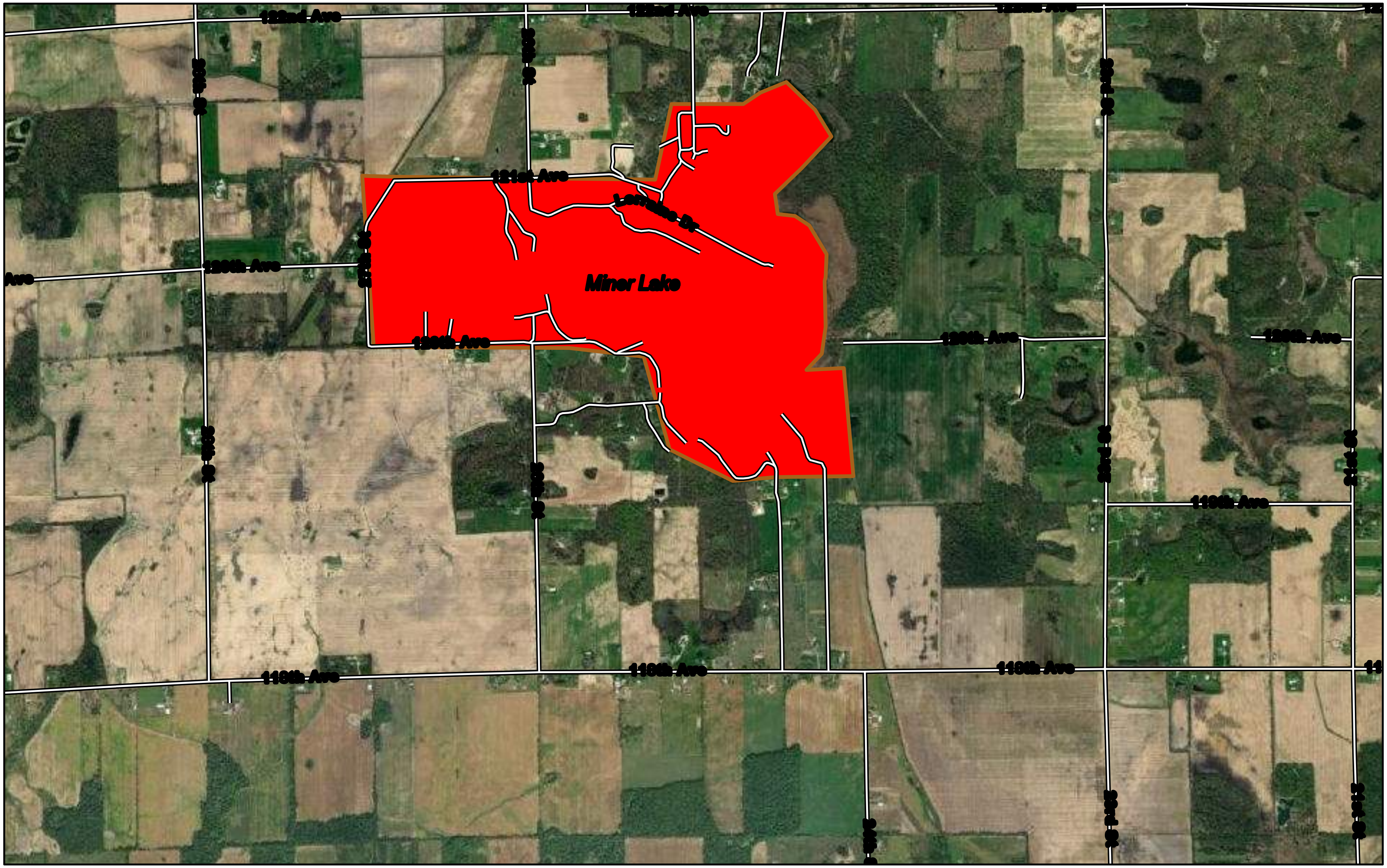
* Property was rezoned to C2 conditionally. See condtions for specific C-2 zoning boundary and permitted uses on this parcel.

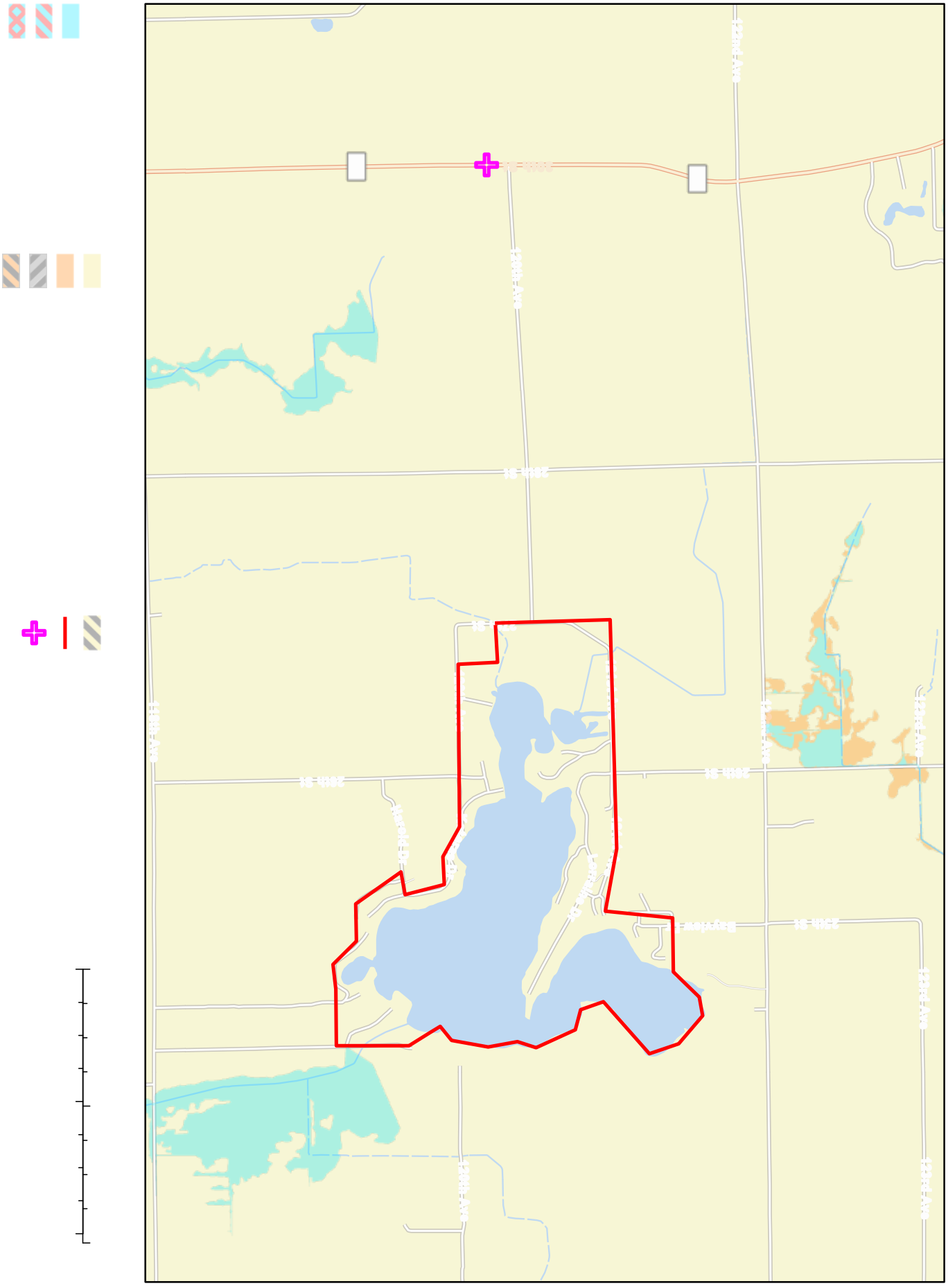
1 inch = 3,250 feet

0 3,250 6,500 13,000 Feet

williams&works
engineers | surveyors | planners




122nd Ave
121st Ave
120th Ave
119th Ave
118th Ave
Miner Lake



PIN
- Approximate location based on user input and does not represent an authoritative property location

MAP PANELS
- Selected FloodMap Boundary
- Digital Data Available
- No Digital Data Available
- Unmapped

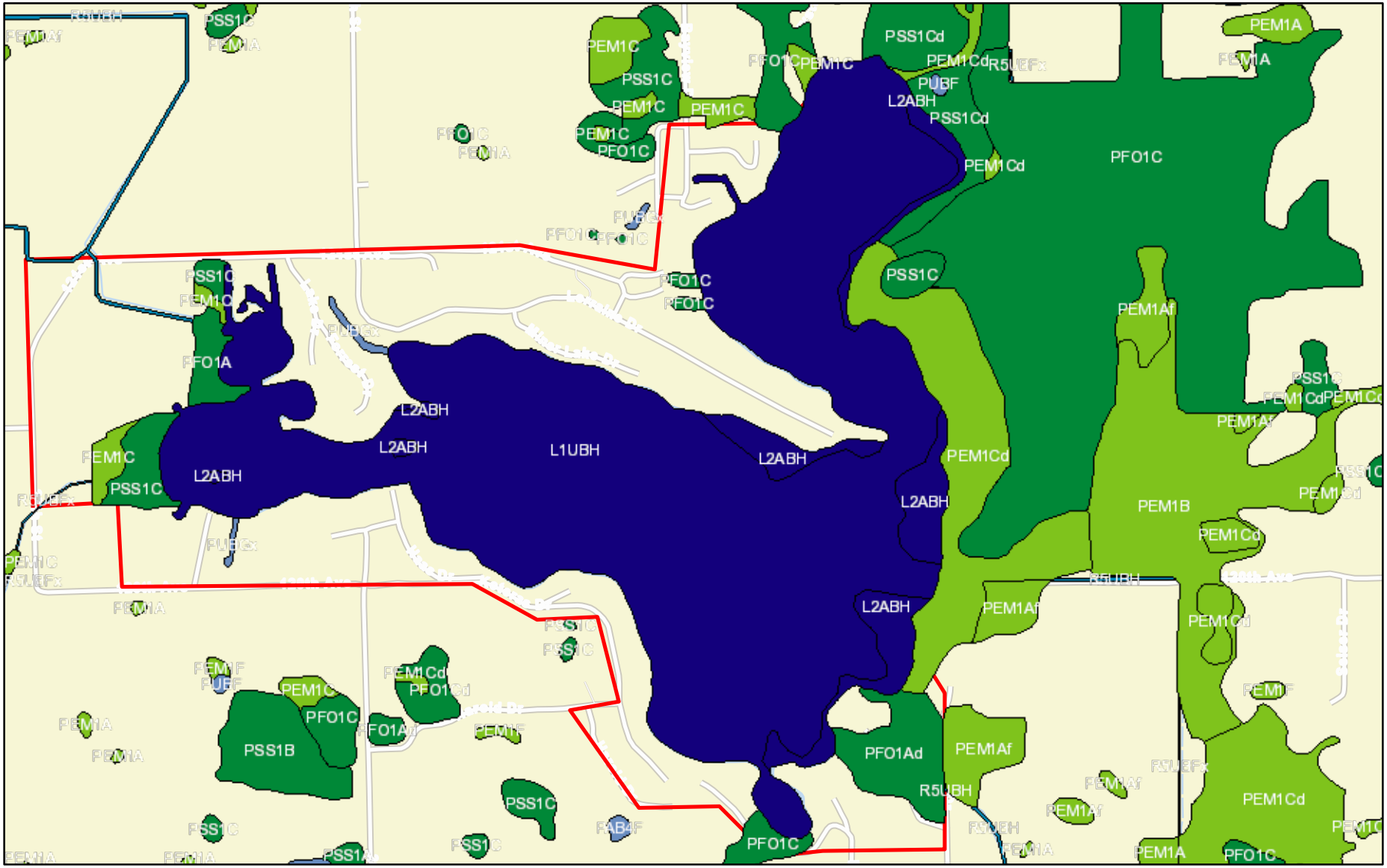
OTHER AREAS
- Area of Minimal Flood Hazard Zone X
- Effective LOMRs
- Area of Undetermined Flood Hazard Zone D
- Otherwise Protected Area
- Coastal Barrier Resource System Area

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) Zone A, V, A99
- With BFE or Depth
- Regulatory Floodway Zone AE, AO, AH, VE, AR

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile Zone X
- Future Conditions 1% Annual Chance Flood Hazard Zone X
- Area with Reduced Flood Risk due to Levee. See Notes. Zone X
- Area with Flood Risk due to Levee Zone D

OTHER FEATURES
- 20.2 Cross Sections with 1% Annual Chance
- 17.5 Water Surface Elevation
- Coastal Transect
- Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall


PSS1C
PEM1C
PFO1C
PEM1Cd
PSS1Cd
PEM1A
PUBF
L2ABH
L1UBH
PFO1A
PEM1Af
PEM1B
PFO1Ad
PSS1B
R5UBH
PFO1C

Attainment Status for the National Ambient Air Quality Standards

The National Ambient Air Quality Standards (NAAQS) are health-based pollution standards set by EPA.

Areas of the state that are below the NAAQS concentration level are called attainment areas. The entire state of Michigan is in attainment for the following pollutants:

- Carbon Monoxide
- Lead
- Nitrogen Dioxide
- Particulate Matter

Non-attainment areas are those that have concentrations over the NAAQS level. Portions of the state are in non-attainment for sulfur dioxide and ozone (see map). The ozone non-attainment area is classified as marginal.

LEGEND

Sulfur Dioxide Nonattainment Area

Ozone Nonattainment Area

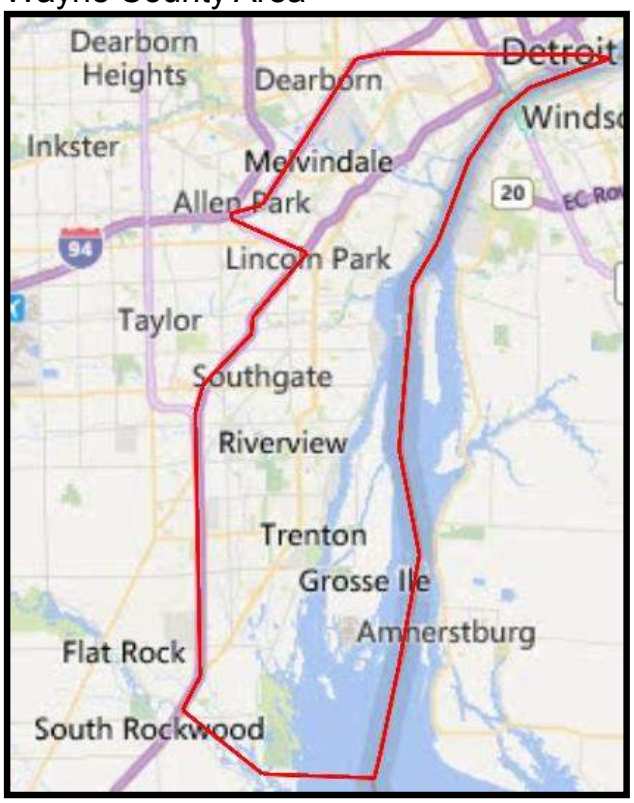
See Page 2 for close-up maps of partial county nonattainment areas

Updated July 23, 2019
Prepared by MDEQ, Air Quality Division, State Implementation Plan Unit

Close-Up Maps of Partial County Nonattainment Areas

Sulfur Dioxide Nonattainment Areas

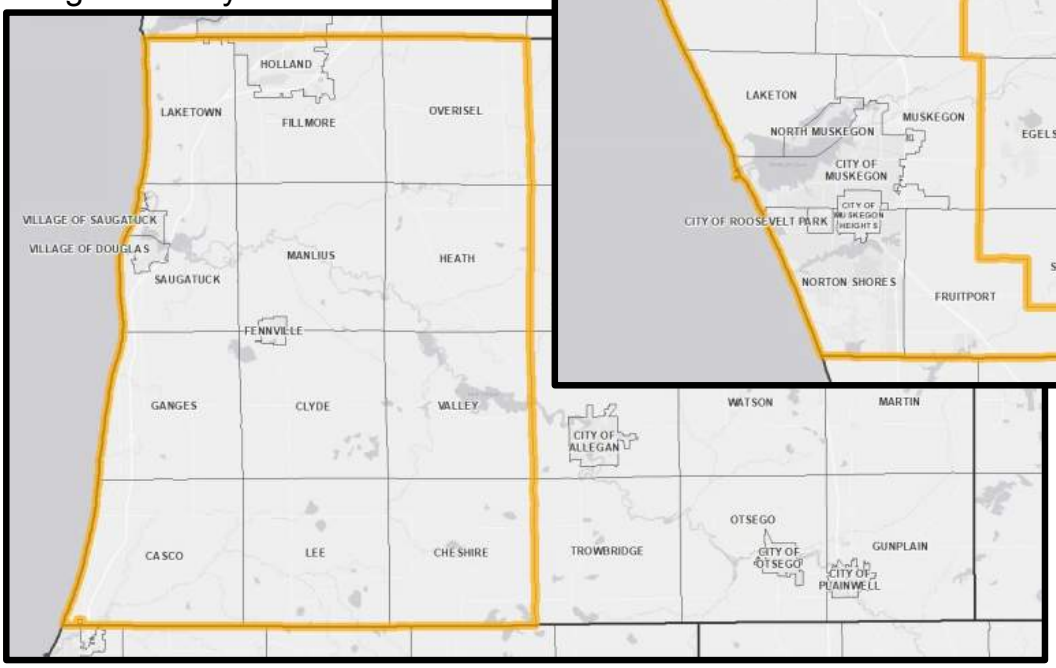
Wayne County Area

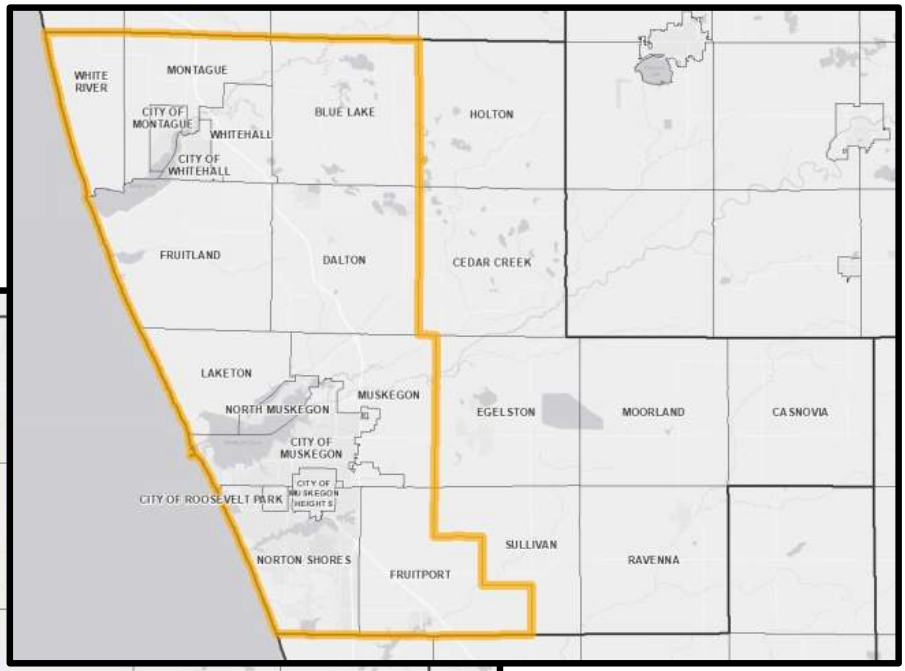


St. Clair County Area

Ozone Nonattainment Areas

Allegan County Area





Muskegon County Area

Updated July 23, 2019

Prepared by MDEQ, Air Quality Division, State Implementation Plan Unit

7.8.1 Soils Map

7.8.2 Prime and Other Important Farmlands

United States Department of Agriculture

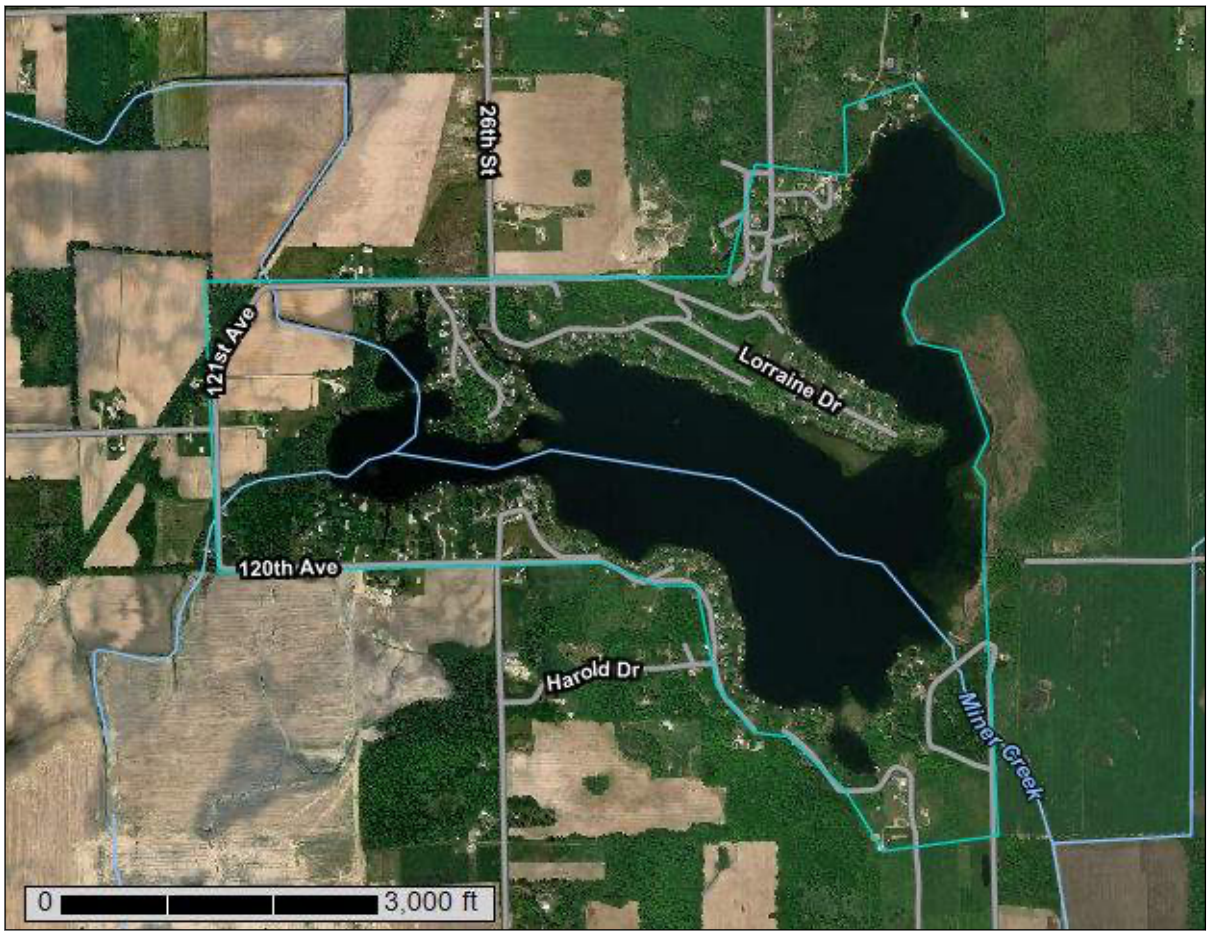
NRCS

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 Allegan County, Michigan

Miner Lake, Allegan Township, Allegan County MI



September 8, 2022

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.

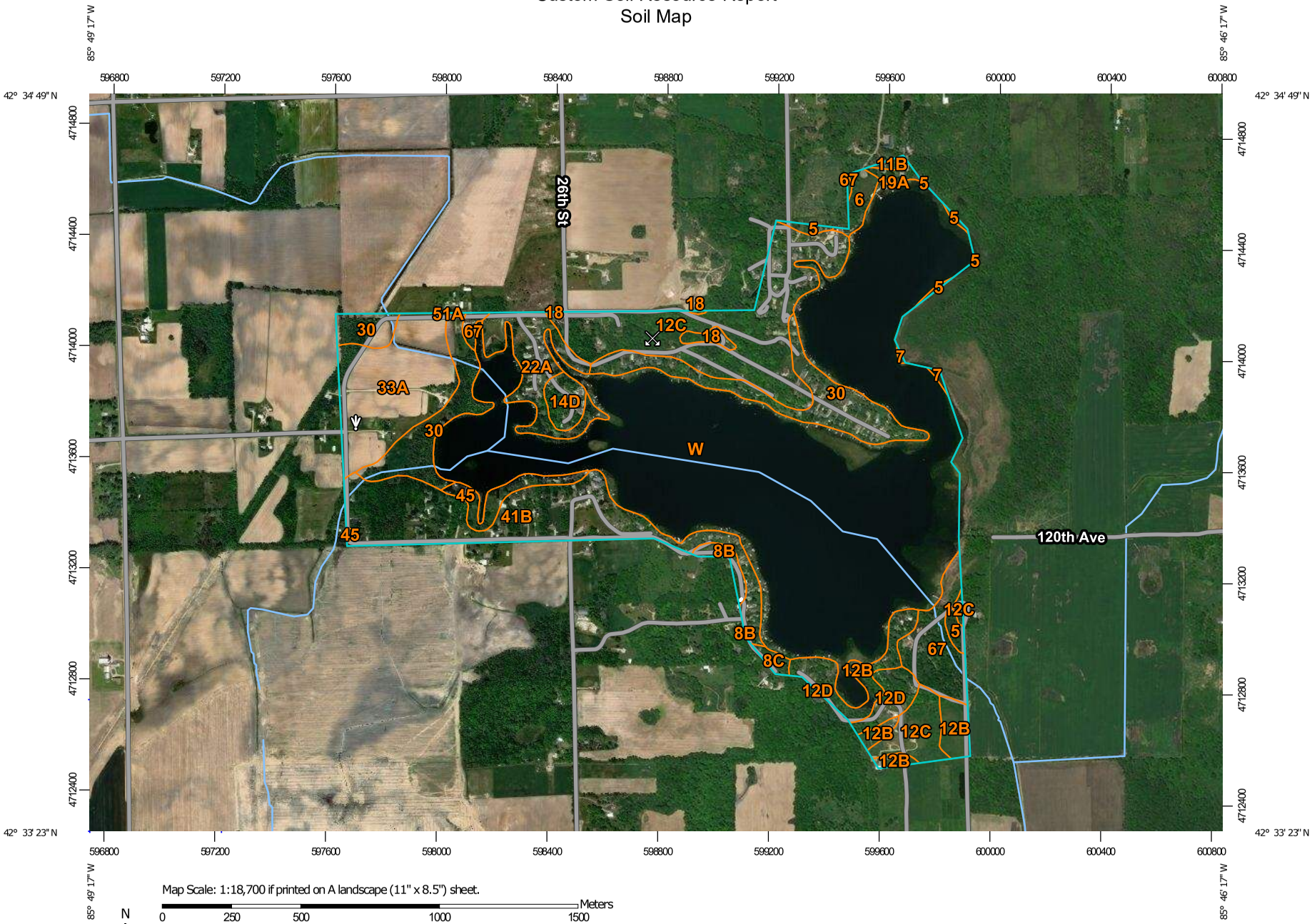
After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

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 1:15,800.

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: Allegan County, Michigan
Survey Area Data: Version 19, Sep 2, 2021

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

Date(s) aerial images were photographed: Dec 31, 2009—Aug 31, 2017

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
5	Houghton muck, 0 to 1 percent slopes	3.6	0.5%
6	Adrian muck, 0 to 1 percent slopes	4.3	0.7%
7	Palms muck, 0 to 1 percent slopes	0.6	0.1%
8B	Glynwood clay loam, 1 to 6 percent slopes	2.9	0.4%
8C	Glynwood clay loam, 6 to 12 percent slopes	1.8	0.3%
11B	Oshtemo-Chelsea complex, 0 to 6 percent slopes	0.8	0.1%
12B	Ockley loam, 1 to 6 percent slopes	21.0	3.2%
12C	Ockley loam, 6 to 12 percent slopes	70.2	10.8%
12D	Ockley loam, 12 to 18 percent slopes	6.9	1.1%
14D	Filer loam, 12 to 18 percent slopes	5.9	0.9%
18	Pits	2.2	0.3%
19A	Brady sandy loam, 0 to 3 percent slopes	2.1	0.3%
22A	Matherton loam, 0 to 3 percent slopes	19.8	3.0%
30	Colwood silt loam	50.5	7.8%
33A	Kibbie fine sandy loam, 0 to 3 percent slopes	40.6	6.3%
41B	Blount silt loam, 1 to 4 percent slopes	57.7	8.9%
45	Pewamo silt loam	7.5	1.2%
51A	Thetford loamy fine sand, 0 to 4 percent slopes	0.0	0.0%
67	Martisco muck	17.8	2.8%
W	Water	332.3	51.2%
Totals for Area of Interest		**648.4**	**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.

Allegan County, Michigan

5—Houghton muck, 0 to 1 percent slopes

Map Unit Setting

National map unit symbol: 2rfgy
Elevation: 580 to 1,360 feet
Mean annual precipitation: 31 to 41 inches
Mean annual air temperature: 43 to 52 degrees F
Frost-free period: 125 to 205 days
Farmland classification: Farmland of local importance

Map Unit Composition

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

Description of Houghton

Setting

Landform: Depressions on moraines on outwash plains, depressions on outwash plains
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope, dip
Down-slope shape: Concave
Across-slope shape: Linear
Parent material: Herbaceous organic material

Typical profile

Oa1 - 0 to 12 inches: muck
Oa2 - 12 to 35 inches: muck
Oa3 - 35 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 low to high (0.14 to 14.17 in/hr)
Depth to water table: About 0 inches
Frequency of flooding: None
Frequency of ponding: Frequent
Calcium carbonate, maximum content: 3 percent
Maximum salinity: Nonsaline to very slightly saline (0.4 to 2.7 mmhos/cm)
Sodium adsorption ratio, maximum: 0.8
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): 5w
Hydrologic Soil Group: A/D
Ecological site: F098XA006MI - Mucky Depressions
Hydric soil rating: Yes

Minor Components

Adrian

Percent of map unit: 4 percent
Landform: Depressions on moraines on outwash plains, depressions on outwash plains
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope, dip
Down-slope shape: Concave
Across-slope shape: Linear
Ecological site: F098XA006MI - Mucky Depressions, F097XA030MI - Mucky Depression, F096XA014MI - Snowy Mucky Depression, F096XB027MI - Mucky Depression
Hydric soil rating: Yes

Edwards

Percent of map unit: 3 percent
Landform: Depressions on moraines on outwash plains, depressions on outwash plains
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope, dip
Down-slope shape: Concave, linear
Across-slope shape: Linear
Hydric soil rating: Yes

Palms

Percent of map unit: 2 percent
Landform: Swamps on till plains, swamps on outwash plains, depressions on till plains, depressions on outwash plains, drainageways on outwash plains, drainageways on moraines, drainageways on till plains, swamps on moraines, depressions on moraines
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave, linear
Across-slope shape: Concave, linear
Ecological site: F098XA006MI - Mucky Depressions, F097XA030MI - Mucky Depression
Hydric soil rating: Yes

Gilford, gravelly subsoil

Percent of map unit: 1 percent
Landform: Glacial drainage channels, glacial drainage channels
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: Yes

6—Adrian muck, 0 to 1 percent slopes

Map Unit Setting

National map unit symbol: 2rfgz
Elevation: 630 to 1,110 feet
Mean annual precipitation: 31 to 41 inches
Mean annual air temperature: 43 to 52 degrees F
Frost-free period: 125 to 205 days
Farmland classification: Farmland of local importance

Map Unit Composition

Adrian and similar soils: 92 percent
Minor components: 8 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Adrian

Setting

Landform: Depressions on moraines on outwash plains, depressions on outwash plains
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope, dip
Down-slope shape: Concave
Across-slope shape: Linear
Parent material: Herbaceous organic material over sandy glaciofluvial deposits

Typical profile

Oa1 - 0 to 12 inches: muck
Oa2 - 12 to 34 inches: muck
Cg - 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 low to high (0.14 to 14.17 in/hr)
Depth to water table: About 0 inches
Frequency of flooding: None
Frequency of ponding: Frequent
Calcium carbonate, maximum content: 15 percent
Maximum salinity: Nonsaline (0.3 to 1.9 mmhos/cm)
Sodium adsorption ratio, maximum: 0.2
Available water supply, 0 to 60 inches: Very high (about 15.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: A/D

Ecological site: F098XA006MI - Mucky Depressions, F096XB027MI - Mucky Depression
Hydric soil rating: Yes

Minor Components

Kingsville
Percent of map unit: 3 percent
Landform: Nearshore zones (relict), outwash plains
Landform position (three-dimensional): Dip
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: Yes

Houghton
Percent of map unit: 2 percent
Landform: Depressions on moraines on outwash plains, depressions on outwash plains
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope, dip
Down-slope shape: Concave
Across-slope shape: Linear
Ecological site: F098XA006MI - Mucky Depressions, F097XA030MI - Mucky Depression, F096XA014MI - Snowy Mucky Depression, F096XB027MI - Mucky Depression
Hydric soil rating: Yes

Edwards
Percent of map unit: 2 percent
Landform: Depressions on moraines on outwash plains, depressions on outwash plains
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope, dip
Down-slope shape: Concave, linear
Across-slope shape: Linear
Hydric soil rating: Yes

Gilford, gravelly subsoil
Percent of map unit: 1 percent
Landform: Glacial drainage channels, glacial drainage channels
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: Yes

7—Palms muck, 0 to 1 percent slopes

Map Unit Setting
National map unit symbol: 2x2st
Elevation: 700 to 1,080 feet

Mean annual precipitation: 30 to 41 inches
Mean annual air temperature: 43 to 52 degrees F
Frost-free period: 140 to 230 days
Farmland classification: Farmland of local importance

Map Unit Composition

Palms and similar soils: 92 percent
Minor components: 8 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Palms

Setting

Landform: Drainageways on till plains, drainageways on outwash plains, drainageways on moraines, swamps on till plains, swamps on outwash plains, swamps on moraines, depressions on till plains, depressions on outwash plains, depressions on moraines
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave, linear
Across-slope shape: Concave, linear
Parent material: Herbaceous organic material over loamy drift

Typical profile

Oa1 - 0 to 11 inches: muck
Oa2 - 11 to 28 inches: muck
Cg - 28 to 80 inches: silt 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): Very low to moderately high (0.00 to 1.42 in/hr)
Depth to water table: About 0 inches
Frequency of flooding: None
Frequency of ponding: Frequent
Calcium carbonate, maximum content: 35 percent
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Sodium adsorption ratio, maximum: 3.0
Available water supply, 0 to 60 inches: Very high (about 17.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: B/D
Ecological site: F098XA006MI - Mucky Depressions
Hydric soil rating: Yes

Minor Components

Barry

Percent of map unit: 3 percent
Landform: Drainageways on moraines, depressions on moraines, flats on till plains
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope, talf

Down-slope shape: Concave
Across-slope shape: Concave, linear
Ecological site: F098XA012MI - Wet Loamy Depressions
Hydric soil rating: Yes

Gilford, gravelly subsoil

Percent of map unit: 2 percent
Landform: Glacial drainage channels, glacial drainage channels
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: Yes

Houghton

Percent of map unit: 2 percent
Landform: Drainageways on outwash plains, drainageways on moraines, drainageways on glacial drainage channels, drainageways on moraines, depressions on outwash plains, depressions on moraines, depressions on outwash plains
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: Yes

Edwards

Percent of map unit: 1 percent
Landform: Lakebeds (relict) on glacial drainage channels, lakebeds (relict) on moraines, lakebeds (relict) on outwash plains
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope, dip
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: Yes

8B—Glynwood clay loam, 1 to 6 percent slopes

Map Unit Setting

National map unit symbol: 743m
Elevation: 620 to 840 feet
Mean annual precipitation: 32 to 36 inches
Mean annual air temperature: 46 to 50 degrees F
Frost-free period: 160 to 180 days
Farmland classification: All areas are prime farmland

Map Unit Composition

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

Description of Glynwood

Setting

Landform: Till plains
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loamy till

Typical profile

Ap - 0 to 10 inches: clay loam
Bt - 10 to 29 inches: clay
C - 29 to 60 inches: clay loam

Properties and qualities

Slope: 1 to 6 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 low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 24 to 42 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 7.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: D
Ecological site: F097XA022MI - Moist Loamy Drift Plains
Hydric soil rating: No

Minor Components

Blount

Percent of map unit: 7 percent
Landform: Moraines
Landform position (three-dimensional): Rise
Hydric soil rating: No

8C—Glynwood clay loam, 6 to 12 percent slopes

Map Unit Setting

National map unit symbol: 743n
Elevation: 620 to 840 feet
Mean annual precipitation: 32 to 36 inches
Mean annual air temperature: 46 to 50 degrees F
Frost-free period: 160 to 180 days
Farmland classification: Farmland of local importance

Map Unit Composition

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

Description of Glynwood

Setting

Landform: Till plains, moraines, hills on till plains
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Concave
Across-slope shape: Linear
Parent material: Loamy till

Typical profile

Ap - 0 to 10 inches: clay loam
Bt - 10 to 29 inches: clay
C - 29 to 60 inches: clay loam

Properties and qualities

Slope: 6 to 12 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 24 to 42 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 7.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: D
Ecological site: F097XA022MI - Moist Loamy Drift Plains
Hydric soil rating: No

Minor Components

Blount

Percent of map unit: 5 percent
Hydric soil rating: No

Marlette

Percent of map unit: 5 percent
Hydric soil rating: No

11B—Oshtemo-Chelsea complex, 0 to 6 percent slopes

Map Unit Setting

National map unit symbol: 741h
Elevation: 360 to 1,500 feet
Mean annual precipitation: 32 to 36 inches
Mean annual air temperature: 46 to 50 degrees F
Frost-free period: 160 to 180 days
Farmland classification: Farmland of local importance

Map Unit Composition

Oshtemo and similar soils: 65 percent
Chelsea and similar soils: 27 percent
Minor components: 8 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Oshtemo

Setting

Landform: Outwash plains
Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loamy over sandy outwash

Typical profile

Ap - 0 to 10 inches: loamy sand
Bt - 10 to 35 inches: sandy loam
E and Bt - 35 to 60 inches: sand

Properties and qualities

Slope: 0 to 6 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): High (1.98 to 5.95 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 7.1 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 3s
Hydrologic Soil Group: A
Ecological site: F097XA018MI - Dry Loamy Drift Plains
Hydric soil rating: No

Description of Chelsea

Setting

Landform: Outwash plains, flats
Landform position (two-dimensional): Backslope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Sandy eolian sands

Typical profile

A - 0 to 4 inches: loamy fine sand
E ans Bt - 4 to 60 inches: fine sand

Properties and qualities

Slope: 0 to 6 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 (5.95 to 19.98 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): 4s
Hydrologic Soil Group: A
Ecological site: F097XA004MI - Dry Sandy Lake Plain
Hydric soil rating: No

Minor Components

Ockley

Percent of map unit: 4 percent
Landform: Outwash plains
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope, rise
Down-slope shape: Concave
Across-slope shape: Convex
Hydric soil rating: No

Brady

Percent of map unit: 4 percent
Hydric soil rating: No

12B—Ockley loam, 1 to 6 percent slopes

Map Unit Setting

National map unit symbol: 741m
Elevation: 360 to 1,500 feet
Mean annual precipitation: 32 to 36 inches
Mean annual air temperature: 46 to 50 degrees F
Frost-free period: 160 to 180 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Ockley and similar soils: 87 percent
Minor components: 13 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Ockley

Setting

Landform: Outwash plains, moraines
Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loamy over sandy and gravelly outwash

Typical profile

Ap - 0 to 11 inches: loam
Bt - 11 to 42 inches: sandy clay loam
E and Bt - 42 to 60 inches: gravelly sand

Properties and qualities

Slope: 1 to 6 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 (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 40 percent
Available water supply, 0 to 60 inches: Moderate (about 8.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: B
Ecological site: F097XA018MI - Dry Loamy Drift Plains
Hydric soil rating: No

Minor Components

Brady
Percent of map unit: 7 percent
Hydric soil rating: No

Chelsea
Percent of map unit: 6 percent
Hydric soil rating: No

12C—Ockley loam, 6 to 12 percent slopes

Map Unit Setting
National map unit symbol: 741n
Elevation: 360 to 1,200 feet
Mean annual precipitation: 32 to 36 inches
Mean annual air temperature: 46 to 50 degrees F
Frost-free period: 160 to 180 days
Farmland classification: Farmland of local importance

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

Description of Ockley

Setting
Landform: Outwash plains, moraines
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Concave
Across-slope shape: Linear
Parent material: Loamy over sandy and gravelly outwash

Typical profile
Ap - 0 to 11 inches: loam
Bt - 11 to 42 inches: sandy clay loam
E and Bt - 42 to 60 inches: gravelly sand

Properties and qualities
Slope: 6 to 12 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None

Calcium carbonate, maximum content: 40 percent
Available water supply, 0 to 60 inches: Moderate (about 8.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: B
Ecological site: F097XA018MI - Dry Loamy Drift Plains
Hydric soil rating: No

Minor Components

Brady

Percent of map unit: 7 percent
Hydric soil rating: No

12D—Ockley loam, 12 to 18 percent slopes

Map Unit Setting

National map unit symbol: 741p
Elevation: 360 to 1,200 feet
Mean annual precipitation: 32 to 36 inches
Mean annual air temperature: 46 to 50 degrees F
Frost-free period: 160 to 180 days
Farmland classification: Not prime farmland

Map Unit Composition

Ockley and similar soils: 87 percent
Minor components: 13 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Ockley

Setting

Landform: Outwash plains, moraines
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Concave
Across-slope shape: Convex
Parent material: Loamy over sandy and gravelly outwash

Typical profile

Ap - 0 to 11 inches: loam
Bt - 11 to 42 inches: sandy clay loam
E and Bt - 42 to 60 inches: gravelly sand

Properties and qualities

Slope: 12 to 20 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Medium

Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 40 percent
Available water supply, 0 to 60 inches: Moderate (about 8.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: B
Ecological site: F097XA017MI - Loamy Slopes
Hydric soil rating: No

Minor Components

Brady

Percent of map unit: 13 percent
Hydric soil rating: No

14D—Filer loam, 12 to 18 percent slopes

Map Unit Setting

National map unit symbol: 2w5mh
Elevation: 700 to 990 feet
Mean annual precipitation: 30 to 41 inches
Mean annual air temperature: 43 to 52 degrees F
Frost-free period: 140 to 230 days
Farmland classification: Not prime farmland

Map Unit Composition

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

Description of Filer

Setting

Landform: Moraines
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Head slope, nose slope, side slope
Down-slope shape: Convex, linear
Across-slope shape: Linear, convex
Parent material: Loamy till

Typical profile

Ap - 0 to 7 inches: loam
B/E - 7 to 15 inches: clay loam
Bt - 15 to 35 inches: clay loam
C - 35 to 80 inches: loam

Properties and qualities

Slope: 12 to 18 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 low (0.02 to 0.14 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 30 percent
Maximum salinity: Nonsaline (0.1 to 0.4 mmhos/cm)
Sodium adsorption ratio, maximum: 2.0
Available water supply, 0 to 60 inches: High (about 9.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: C
Ecological site: F098XA022MI - Loamy Slopes
Hydric soil rating: No

Minor Components

Capac

Percent of map unit: 3 percent
Landform: Moraines
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Spinks

Percent of map unit: 3 percent
Landform: Moraines
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Head slope, nose slope, side slope
Down-slope shape: Convex, linear
Across-slope shape: Convex, linear
Hydric soil rating: No

Parkhill, non dense till subsoil

Percent of map unit: 2 percent
Landform: Moraines
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave, linear
Across-slope shape: Concave, linear
Hydric soil rating: Yes

Oshtemo

Percent of map unit: 2 percent
Landform: Moraines
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Head slope, nose slope, side slope

Down-slope shape: Convex, linear
Across-slope shape: Linear, convex
Hydric soil rating: No

18—Pits

Map Unit Setting
National map unit symbol: 741y
Mean annual precipitation: 30 to 36 inches
Mean annual air temperature: 45 to 48 degrees F
Frost-free period: 140 to 150 days
Farmland classification: Not prime farmland

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

19A—Brady sandy loam, 0 to 3 percent slopes

Map Unit Setting
National map unit symbol: 741z
Elevation: 600 to 1,200 feet
Mean annual precipitation: 30 to 36 inches
Mean annual air temperature: 45 to 48 degrees F
Frost-free period: 140 to 150 days
Farmland classification: All areas are prime farmland

Map Unit Composition
Brady and similar soils: 87 percent
Minor components: 13 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Brady

Setting
Landform: Outwash plains
Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loamy and/or sandy outwash; loamy outwash over sandy and gravelly outwash

Typical profile
Ap - 0 to 9 inches: sandy loam
Bt - 9 to 36 inches: loam
BC - 36 to 55 inches: loamy sand
C - 55 to 60 inches: coarse sand

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): High (1.98 to 5.95 in/hr)
Depth to water table: About 12 to 36 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 25 percent
Available water supply, 0 to 60 inches: Moderate (about 7.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: B
Ecological site: F097XA022MI - Moist Loamy Drift Plains
Hydric soil rating: No

Minor Components

Sebewa

Percent of map unit: 7 percent
Landform: Depressions
Hydric soil rating: Yes

Oshtemo

Percent of map unit: 6 percent
Hydric soil rating: No

22A—Matherton loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 7422
Elevation: 600 to 1,000 feet
Mean annual precipitation: 30 to 36 inches
Mean annual air temperature: 45 to 48 degrees F
Frost-free period: 140 to 150 days
Farmland classification: Prime farmland if drained

Map Unit Composition

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

Description of Matherton

Setting

Landform: Outwash plains

Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loamy over sandy and gravelly outwash

Typical profile

Ap - 0 to 8 inches: loam
Btg - 8 to 26 inches: sandy clay loam
2C - 26 to 60 inches: gravelly sand

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat poorly drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: About 12 to 24 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 25 percent
Available water supply, 0 to 60 inches: Low (about 5.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: B/D
Ecological site: F097XA022MI - Moist Loamy Drift Plains
Hydric soil rating: No

Minor Components

Sebewa

Percent of map unit: 4 percent
Landform: Depressions
Hydric soil rating: Yes

Oshtemo

Percent of map unit: 3 percent
Hydric soil rating: No

30—Colwood silt loam

Map Unit Setting

National map unit symbol: 7429
Elevation: 600 to 1,500 feet
Mean annual precipitation: 30 to 36 inches
Mean annual air temperature: 45 to 48 degrees F
Frost-free period: 140 to 150 days
Farmland classification: Prime farmland if drained

Map Unit Composition

Colwood and similar soils: 87 percent
Minor components: 13 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Colwood

Setting

Landform: Outwash plains
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Stratified sandy and/or silty and/or loamy glaciolacustrine deposits

Typical profile

Ap - 0 to 12 inches: silt loam
Bg - 12 to 32 inches: silt loam
Cg - 32 to 60 inches: stratified fine sand to silt loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: About 0 inches
Frequency of flooding: None
Frequency of ponding: Frequent
Calcium carbonate, maximum content: 20 percent
Available water supply, 0 to 60 inches: High (about 10.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: C/D
Ecological site: F097XA023MI - Wet Loamy Depression
Hydric soil rating: Yes

Minor Components

Granby

Percent of map unit: 13 percent
Landform: Depressions
Hydric soil rating: Yes

33A—Kibbie fine sandy loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 742g

Elevation: 600 to 1,500 feet
Mean annual precipitation: 30 to 36 inches
Mean annual air temperature: 45 to 48 degrees F
Frost-free period: 140 to 150 days
Farmland classification: All areas are prime farmland

Map Unit Composition

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

Description of Kibbie

Setting

Landform: Lake plains
Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loamy glaciofluvial deposits and/or silty glaciolacustrine deposits

Typical profile

Ap - 0 to 9 inches: fine sandy loam
Bt - 9 to 25 inches: loam
C - 25 to 60 inches: stratified very fine sandy loam to silty clay loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat poorly drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: About 12 to 24 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 35 percent
Available water supply, 0 to 60 inches: High (about 10.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: B/D
Ecological site: F097XA022MI - Moist Loamy Drift Plains
Hydric soil rating: No

Minor Components

Colwood

Percent of map unit: 3 percent
Landform: Depressions
Hydric soil rating: Yes

Rimer

Percent of map unit: 2 percent
Hydric soil rating: No

Thetford

Percent of map unit: 2 percent

Hydric soil rating: No

41B—Blount silt loam, 1 to 4 percent slopes

Map Unit Setting

National map unit symbol: 742m
Elevation: 580 to 1,530 feet
Mean annual precipitation: 32 to 36 inches
Mean annual air temperature: 46 to 50 degrees F
Frost-free period: 160 to 180 days
Farmland classification: Prime farmland if drained

Map Unit Composition

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

Description of Blount

Setting

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

Typical profile

Ap - 0 to 6 inches: silt loam
Bt - 6 to 27 inches: silty clay loam
BC - 27 to 30 inches: silty clay loam
C - 30 to 60 inches: silty clay loam

Properties and qualities

Slope: 0 to 6 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat poorly drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.57 in/hr)
Depth to water table: About 12 to 36 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 30 percent
Available water supply, 0 to 60 inches: Moderate (about 7.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: C
Ecological site: F097XA022MI - Moist Loamy Drift Plains
Hydric soil rating: No

Minor Components

Pewamo
Percent of map unit: 3 percent
Landform: Depressions
Hydric soil rating: Yes

Rimer
Percent of map unit: 3 percent
Hydric soil rating: No

Glynwood
Percent of map unit: 2 percent
Hydric soil rating: No

Seward
Percent of map unit: 2 percent
Hydric soil rating: No

45—Pewamo silt loam

Map Unit Setting
National map unit symbol: 742t
Elevation: 580 to 1,530 feet
Mean annual precipitation: 32 to 36 inches
Mean annual air temperature: 46 to 50 degrees F
Frost-free period: 160 to 180 days
Farmland classification: Prime farmland if drained

Map Unit Composition
Pewamo and similar soils: 91 percent
Minor components: 9 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Pewamo

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

Typical profile
Ap - 0 to 10 inches: silt loam
Btg - 10 to 30 inches: silty clay
Cg - 30 to 60 inches: silty clay loam

Properties and qualities
Slope: 0 to 1 percent
Depth to restrictive feature: More than 80 inches

Drainage class: Poorly drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 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: High (about 10.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: C/D
Ecological site: F097XA023MI - Wet Loamy Depression
Hydric soil rating: Yes

Minor Components

Blount

Percent of map unit: 5 percent
Hydric soil rating: No

Belleville

Percent of map unit: 4 percent
Landform: Depressions
Hydric soil rating: Yes

51A—Thetford loamy fine sand, 0 to 4 percent slopes

Map Unit Setting

National map unit symbol: 7430
Elevation: 600 to 1,200 feet
Mean annual precipitation: 30 to 36 inches
Mean annual air temperature: 45 to 48 degrees F
Frost-free period: 140 to 150 days
Farmland classification: Farmland of local importance

Map Unit Composition

Thetford and similar soils: 88 percent
Minor components: 12 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Thetford

Setting

Landform: Outwash plains
Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Sandy outwash

Typical profile

Ap - 0 to 9 inches: loamy fine sand
E - 9 to 17 inches: fine sand
E and Bt - 17 to 49 inches: fine sand
C - 49 to 60 inches: fine sand

Properties and qualities

Slope: 0 to 6 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): High (1.98 to 5.95 in/hr)
Depth to water table: About 12 to 24 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 4.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: A/D
Ecological site: F097XA012MI - Moist Sandy Depression
Hydric soil rating: No

Minor Components

Kibbie

Percent of map unit: 6 percent
Hydric soil rating: No

Granby

Percent of map unit: 6 percent
Landform: Depressions
Hydric soil rating: Yes

67—Martisco muck

Map Unit Setting

National map unit symbol: 743c
Elevation: 50 to 1,200 feet
Mean annual precipitation: 30 to 36 inches
Mean annual air temperature: 45 to 48 degrees F
Frost-free period: 140 to 150 days
Farmland classification: Not prime farmland

Map Unit Composition

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

Description of Martisco

Setting

Landform: Outwash plains, outwash plains
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Herbaceous organic material over marl

Typical profile

Oa - 0 to 11 inches: muck
Lma - 11 to 60 inches: marly material

Properties and qualities

Slope: 0 to 1 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Very poorly drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 0 inches
Frequency of flooding: NoneFrequent
Frequency of ponding: Frequent
Calcium carbonate, maximum content: 90 percent
Available water supply, 0 to 60 inches: High (about 10.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: C/D
Ecological site: F097XA027MI - Wet Floodplain
Hydric soil rating: Yes

W—Water

Map Unit Composition

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

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7.9 Storage Tanks and Sites of Environmental Contamination

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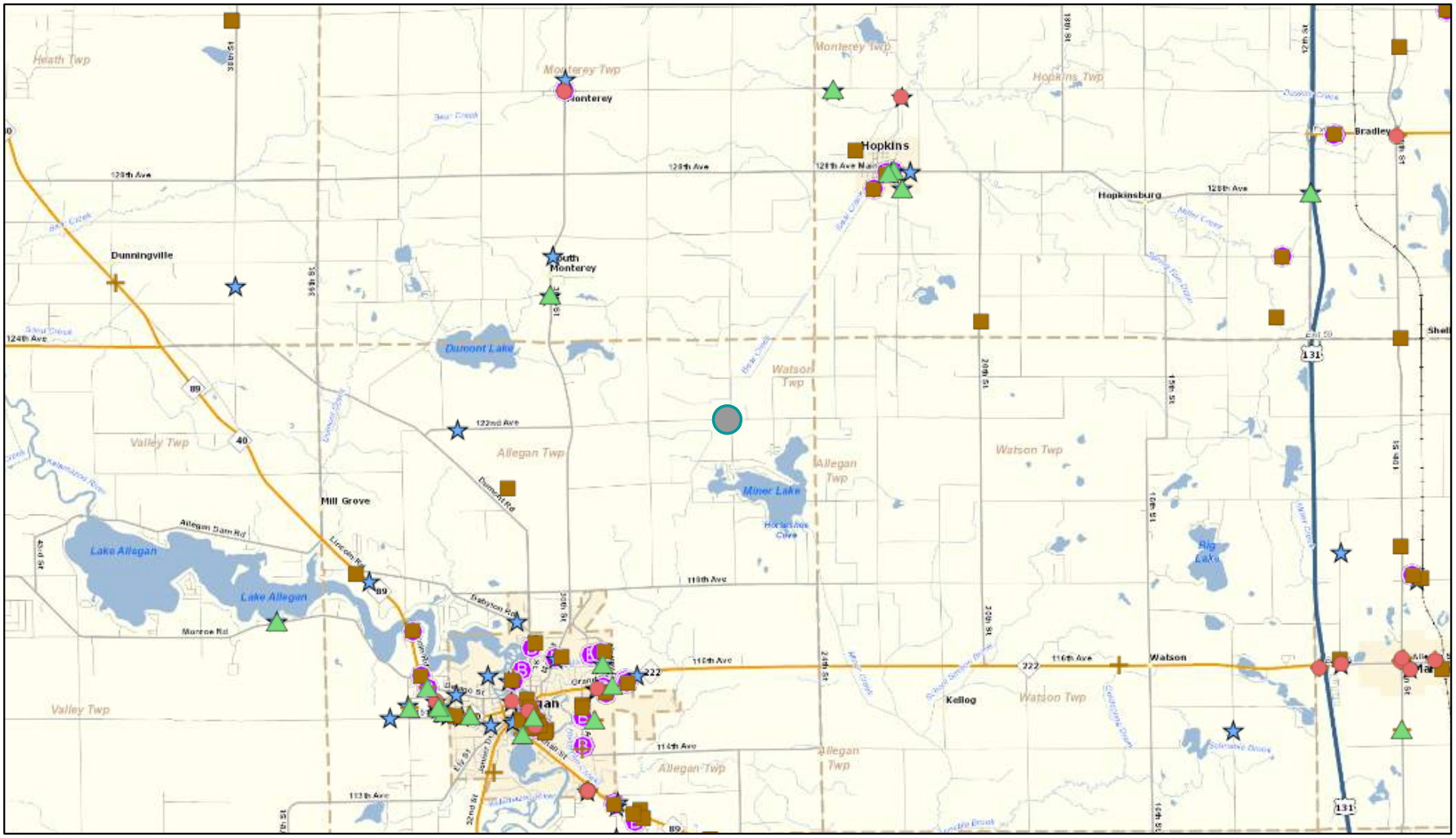

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