

Preliminary Engineering Report

Wastewater Collection and Treatment System

Allegan Township
Miner Lake
Allegan County, Michigan

PRELIMINARY DRAFT
11/23/2022



Allegan Township
Allegan County, Michigan

11/23/2022

Table of Contents

Table of Contents	i
Introduction and Executive Summary	1
Project Background	1
A. Project Planning Area	2
1. Location	2
2. Historic Environmental Concerns	2
3. Environmental Resources Present	3
4. Growth Areas and Population Trends	4
B. Existing Facilities	5
1. Location Map	5
2. History	5
3. Description	5
4. Condition of Existing Facilities	6
C. Need for Project	8
1. Health, Sanitation, and Security	8
2. Future Environment without Proposed Project	9
3. Public Engagement	9
D. Collection System Alternatives	10
A. No Action	10
B. Optimizing Performance of Existing Systems	11
C. Gravity System	11
D. Low-Pressure Grinder Pump System	13
E. Low-Pressure STEP System	15
E. Treatment System Alternatives	18
A. No Action	19
B. Community Drainfield Treatment System	19
C. Lagoon Treatment System	20
D. Regionalization with the City of Allegan	20
F. Selection of Alternative	21
A. Life Cycle Cost Analysis	21
B. Non-Monetary Factors	22
C. Annual Operating Budget and Income	22
G. Proposed Project (Recommended Alternative)	23
A. Collection System	23
B. Wastewater Treatment	23
C. Project Funding and Staging Approach	23

List of Appendices

Appendix A – Figures

- Figure 1 USGS Map
- Figure 2 Study Area and Non-Conforming Systems
- Figure 3 Gravity Collection System
- Figure 4 Low-Pressure Collection System
- Figure 5 Forcemain Route to City of Allegan
- Figure 6 Wellhead Protection Area
- Figure 7 Typical Isolation Distances
- Figure 8 Allegan Township Zoning Map
- Figure 9 USGS Soil Survey
- Figure 10 Depth to Water Table
- Figure 11 Septic Absorption Field Rating

Appendix B – PER Summary Tables

- 1. Operating Budget
- 2. Present Worth Analysis & Short-Lived Depreciation – Collection System
- 3. Present Worth Analysis & Short-Lived Depreciation – WWTP
- 4. Bond Schedule

Appendix C – Tables

- | No. | Description |
|-----|---|
| 1. | Engineer's Estimate of Probable Cost – Gravity Collection System Alternative |
| 2. | Engineer's Estimate of Probable Cost – Low Pressure Grinder Collection System Alternative |
| 3. | Engineer's Estimate of Probable Cost – Low Pressure STEP Collection System Alternative |
| 4. | Net Present Worth Summary Table |
| 5. | Projected Wastewater Flows |

Appendix D – Correspondence

- 1. 2022 Allegan County Health Department Letter of Support
- 2. 2006 Allegan County Health Department Letter of Support

Appendix E – Water Quality and Septic Permit Data

- 1. 2006 Water Quality Testing Report
- 2. 2007 Summary of Miner Lake Sewer Permits
- 3. 2007 Miner Lake Sewer Permit Data
- 4. Nitrate Sampling Results

Appendix F – Utility Services Agreement

- 1. City of Allegan Utility Services Agreement

Appendix G – Environmental Review

PRELIMINARY DRAFT
11/23/2022

Introduction and Executive Summary

Allegan Township's Miner Lake Preliminary Engineering Report (PER) was prepared to fulfill the project planning requirements of the United States Department of Agriculture (USDA), Rural Development, Rural Utilities Service – Water and Wastewater Programs. This report will provide the basis for evaluation of the Township's proposed wastewater system construction for funding from the Water and Wastewater Loan and Grant program.

The format for this PER was selected to match Rural Development RUS Bulletin 1780-2. This report includes a summary of wastewater issues within the service area, a 20-year projection of the population to be served, and identification and screening of the principal alternatives necessary to meet the current and future wastewater needs of the service area. It also presents projected user costs for financing the selected alternative.

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 PER, 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 PER, 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 2022 update to the 2007 project plan was completed in April 2022 and presented to Allegan Township and the MLPA. The response to the update was positive and at the June 6, 2022 board meeting, Allegan Township approved F&V to move forward with a funding application to the USDA Rural Development Program.

11/23/2022

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.

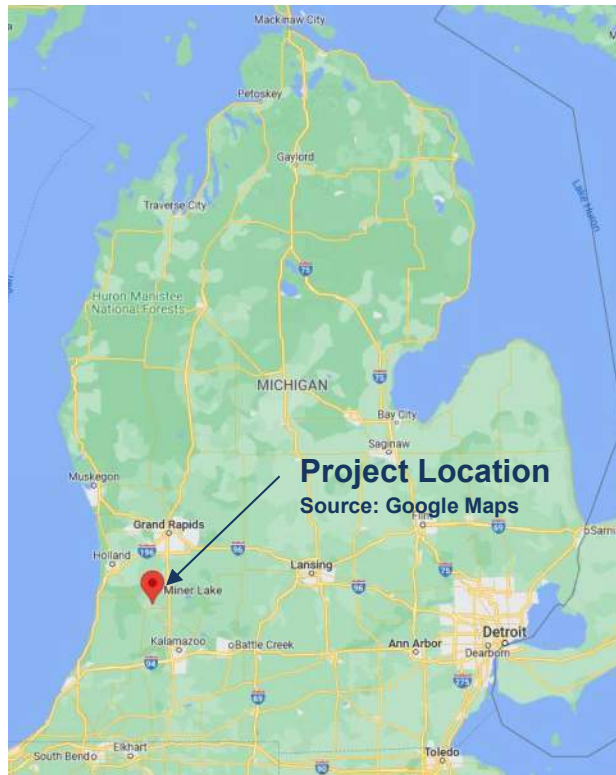


Figure 1. General Project Location

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 PER. 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

Per the RUS Project Planning Guide, an Environmental Review (ER) is required for PERs associated with funding applications. An ER for the project site **was completed in the fall of 2022.** **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.

11/23/2022

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

11/23/2022

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 May 23, 2005 which has been updated and executed on , 20 . 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 copy of the current agreement is included in Appendix E.**

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

Pending negotiations between Allegan Township and the City of Allegan

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

11/23/2022

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

11/23/2022

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

11/23/2022

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.

11/23/2022

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

11/23/2022

- 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:

- 229 grinder systems;
- 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

11/23/2022

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 \$14,479,00 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

11/23/2022

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.

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

11/23/2022

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.

11/23/2022

Table 3. Collection System Alternatives

Alternative	Advantages	Disadvantages
No Action	<ul style="list-style-type: none"> No initial monetary cost No construction related environmental impacts 	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> Limited construction related environmental impacts 	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> Protects Miner Lake water quality Protects public health and safety 	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> 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 	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> 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 	<ul style="list-style-type: none"> 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:

11/23/2022

- 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.

11/23/2022

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.

11/23/2022

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 — Budgets dependent on City of Allegan connection and OM&R costs

The capital cost of this alternative is estimated at \$ _____ million 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 \$ _____ million. A detailed breakdown of estimated costs is provided in Table _____ of Appendix _____.

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

11/23/2022

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.

Income & rates dependent on City of Allegan connection and OM&R costs

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. However, because expenses may be realized prior to having capital available, the MFA has recommended a budget amount of \$ [redacted] to cover capitalized interest if required.

The projected income for the first full year of operation (2025) is expected to be \$ [redacted].

11/23/2022

Note: Highlighted blanks dependent on City of Allegan connection and OM&R costs

Annual O&M Costs

Operations, Maintenance and Replacement (OM&R) costs are expected to be \$65,000 for the first full year of operation (2025) including \$ for the collection system and \$ for the treatment system. 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 \$ per year.

Reserves

As required by USDA-RD, 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. The annual operating budget includes collection of \$ per year to meet that obligation.

Total Project Cost Estimate

A summary of the total project cost is shown in Table ___ of Appendix ___.

The total capital cost for the recommended alternative () is estimated to be \$. This includes the estimated construction, land acquisition, and construction contingencies.

The total project cost includes the following additional items:

- Operations and Maintenance expenses for the first full year after construction
- Survey, Design, & Construction Engineering
- Bond Counsel, Financial Advisor, and Legal fees, including:
 - An allowance of \$ for capitalized interest/interim financing
 - Filing and publication fees
 - Fees for Township attorneys and legal reviews
 - Fees for bond counsel and Municipal Financial Advisor
- Cost for preparing a USDA funding application

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.

11/23/2022

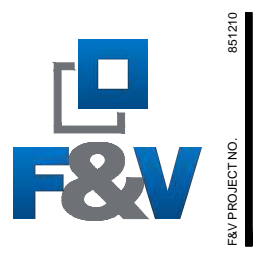
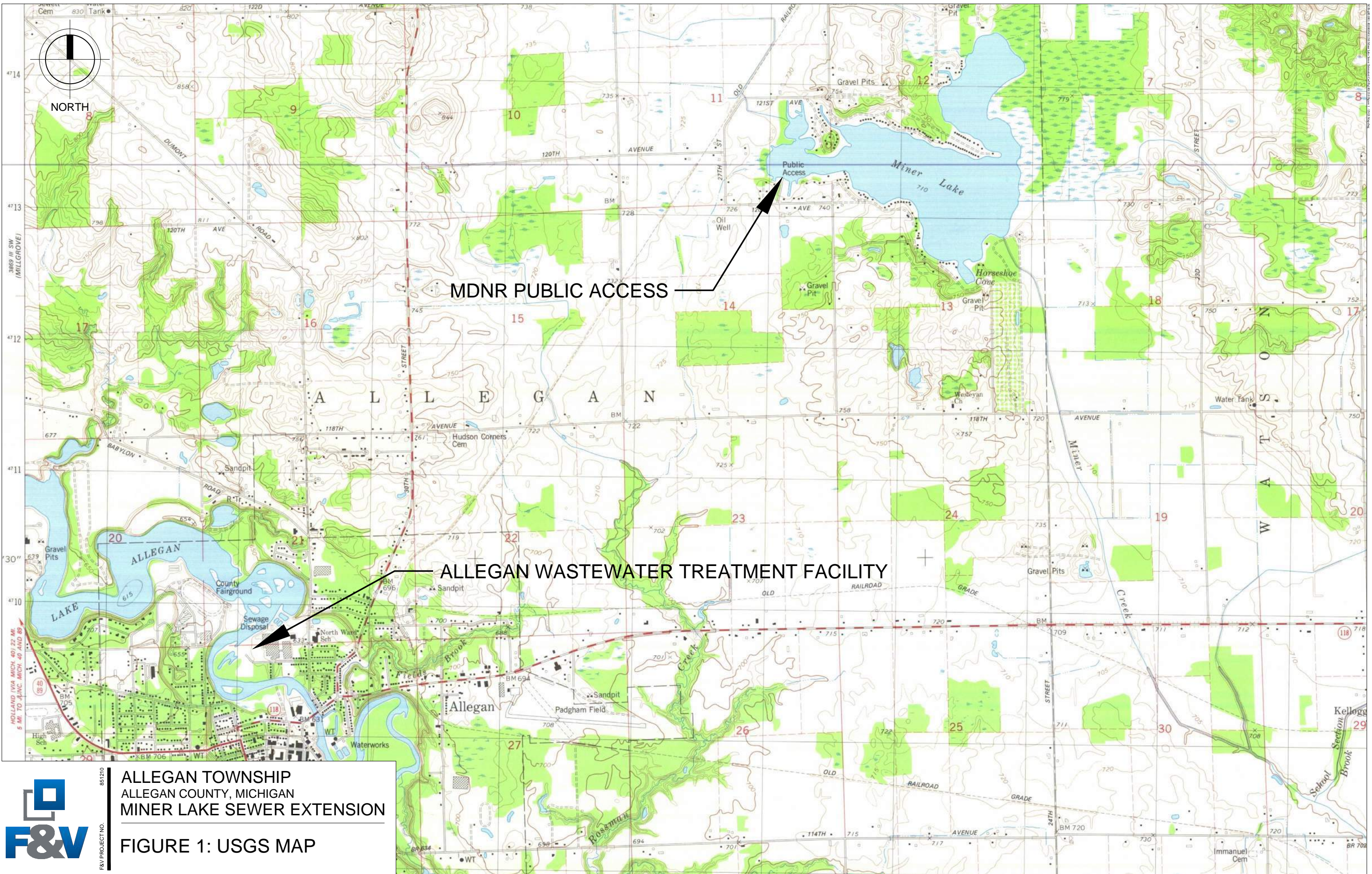
Timing of the project will also be important. While the project needs can technically be approached in segments, subsequent stages of the project will need to follow relatively promptly in part due to time limitations on use of special assessment funds as well as public concern and perception of fairness. 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.

Appendix A

Figures

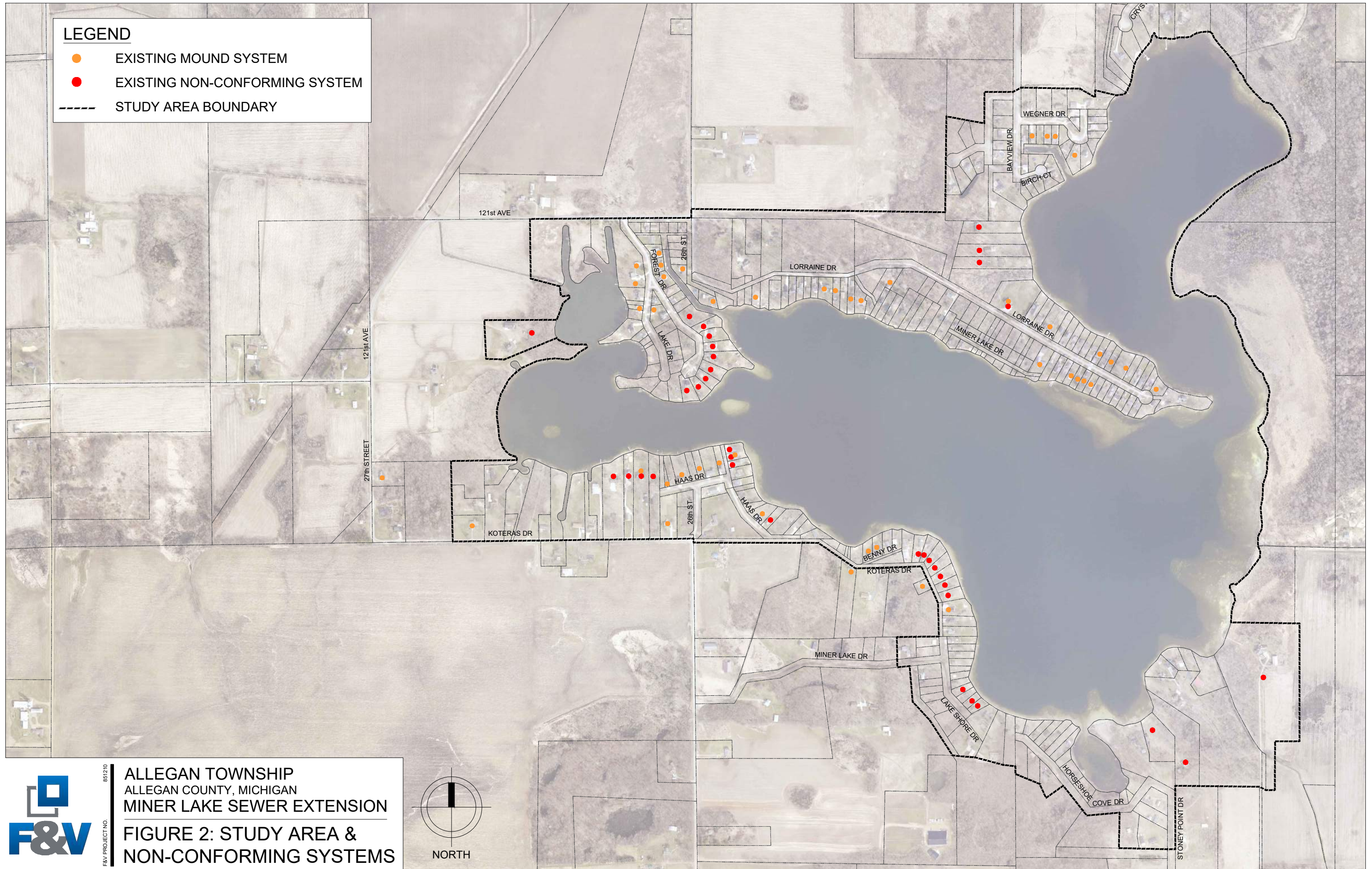


851210
ALLEGAN TOWNSHIP
ALLEGAN COUNTY, MICHIGAN
MINER LAKE SEWER EXTENSION

FIGURE 1: USGS MAP

LEGEND

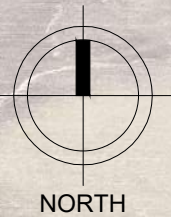
- EXISTING MOUND SYSTEM
- EXISTING NON-CONFORMING SYSTEM
- STUDY AREA BOUNDARY








F&V PROJECT NO. 851210

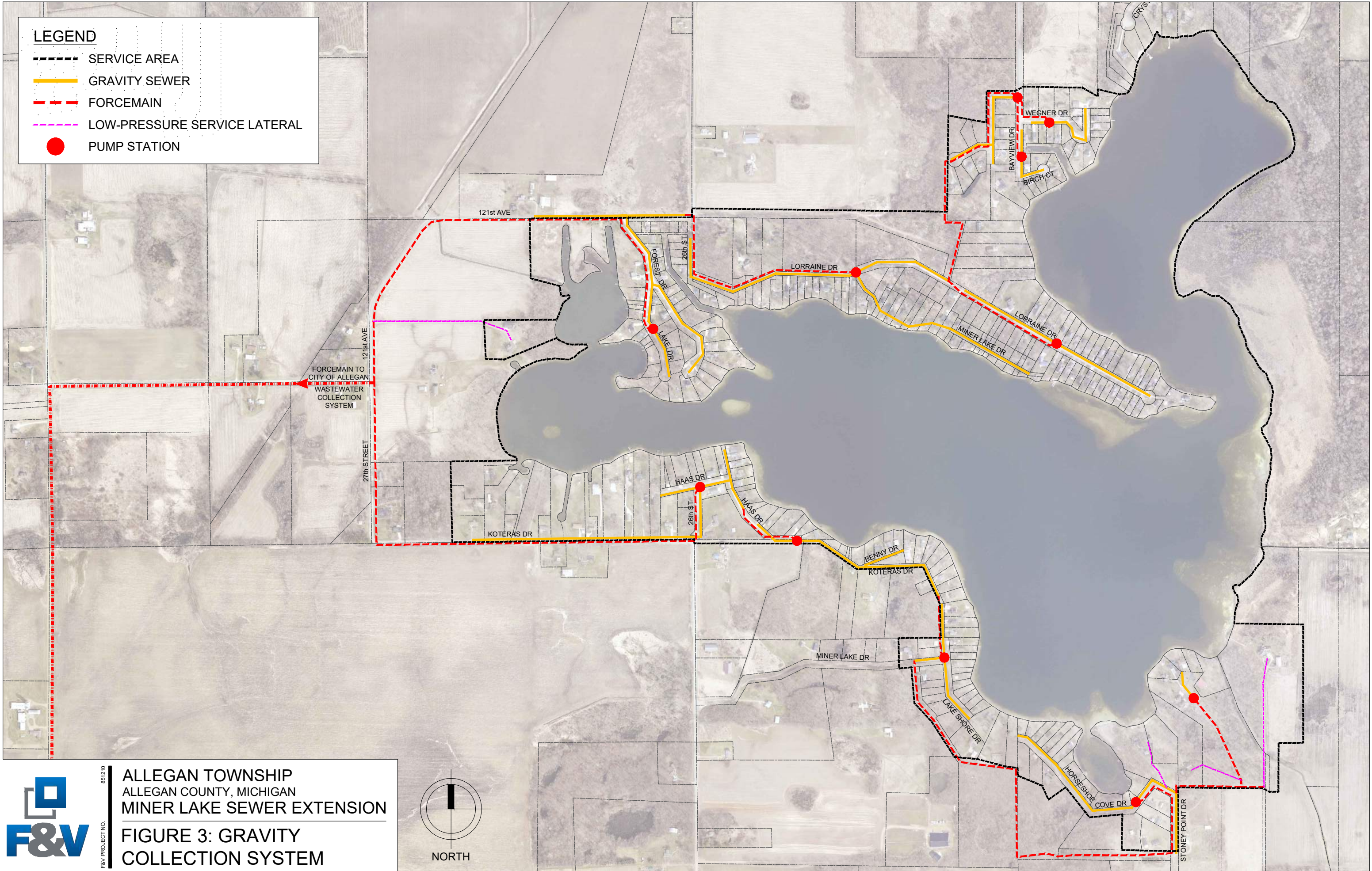
ALLEGAN TOWNSHIP
ALLEGAN COUNTY, MICHIGAN
MINER LAKE SEWER EXTENSION

FIGURE 2: STUDY AREA &
NON-CONFORMING SYSTEMS



LEGEND

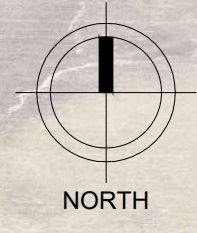
-  SERVICE AREA
-  GRAVITY SEWER
-  FORCEMAIN
-  LOW-PRESSURE SERVICE LATERAL
-  PUMP STATION



F&V PROJECT NO. 851210

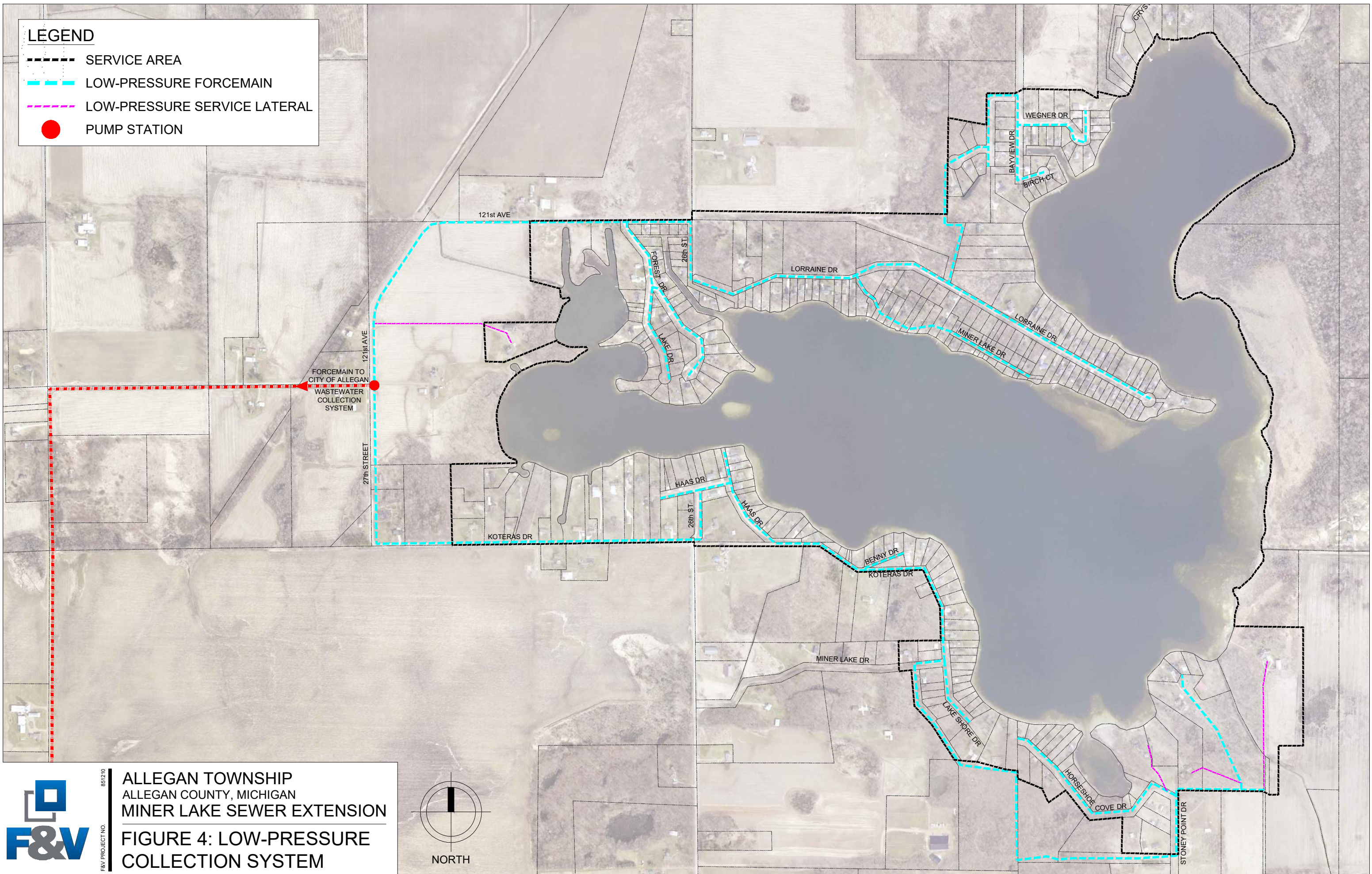
**ALLEGAN TOWNSHIP
ALLEGAN COUNTY, MICHIGAN
MINER LAKE SEWER EXTENSION**

**FIGURE 3: GRAVITY
COLLECTION SYSTEM**



LEGEND

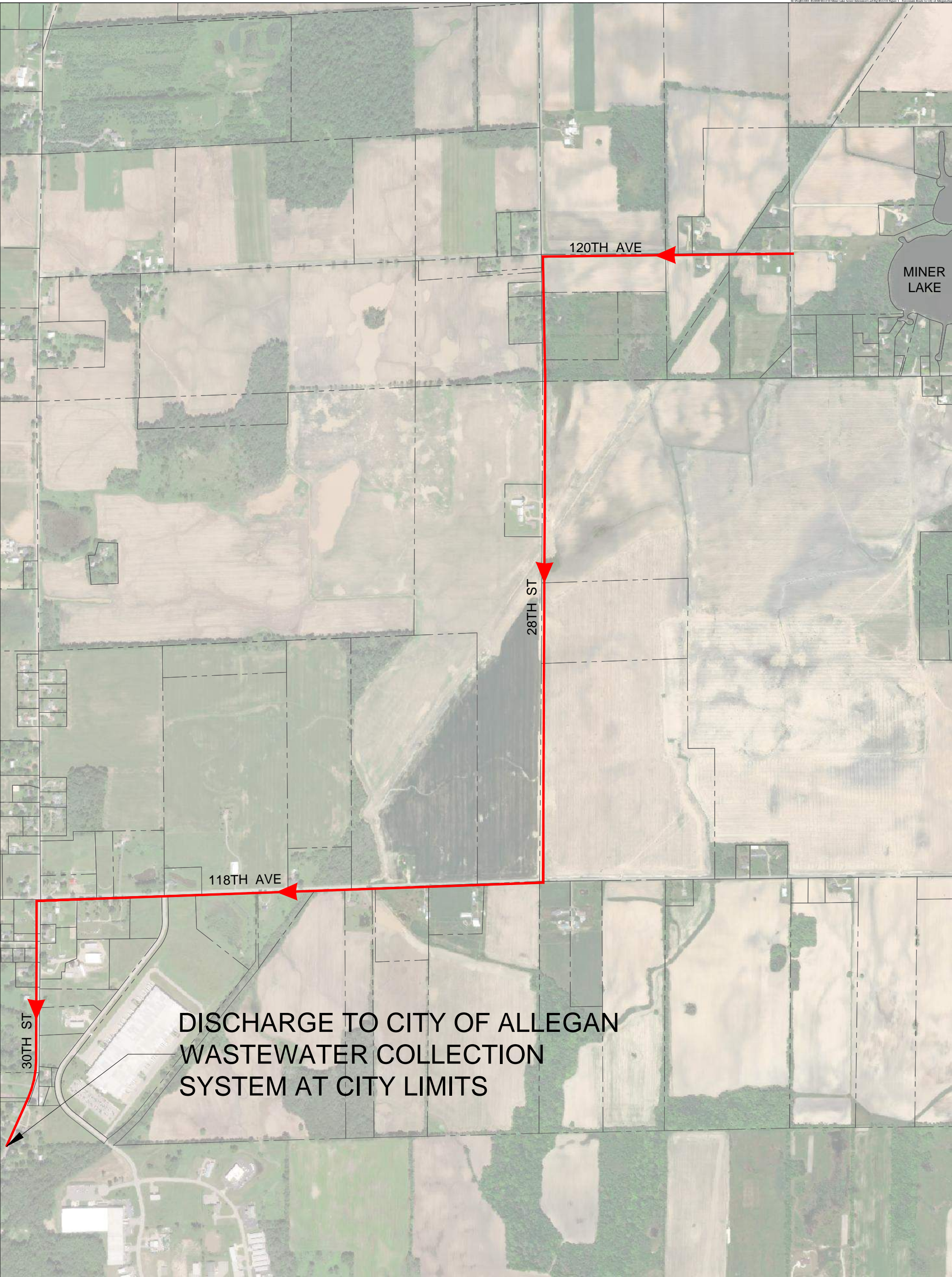
- SERVICE AREA
- LOW-PRESSURE FORCEMAIN
- LOW-PRESSURE SERVICE LATERAL
- PUMP STATION

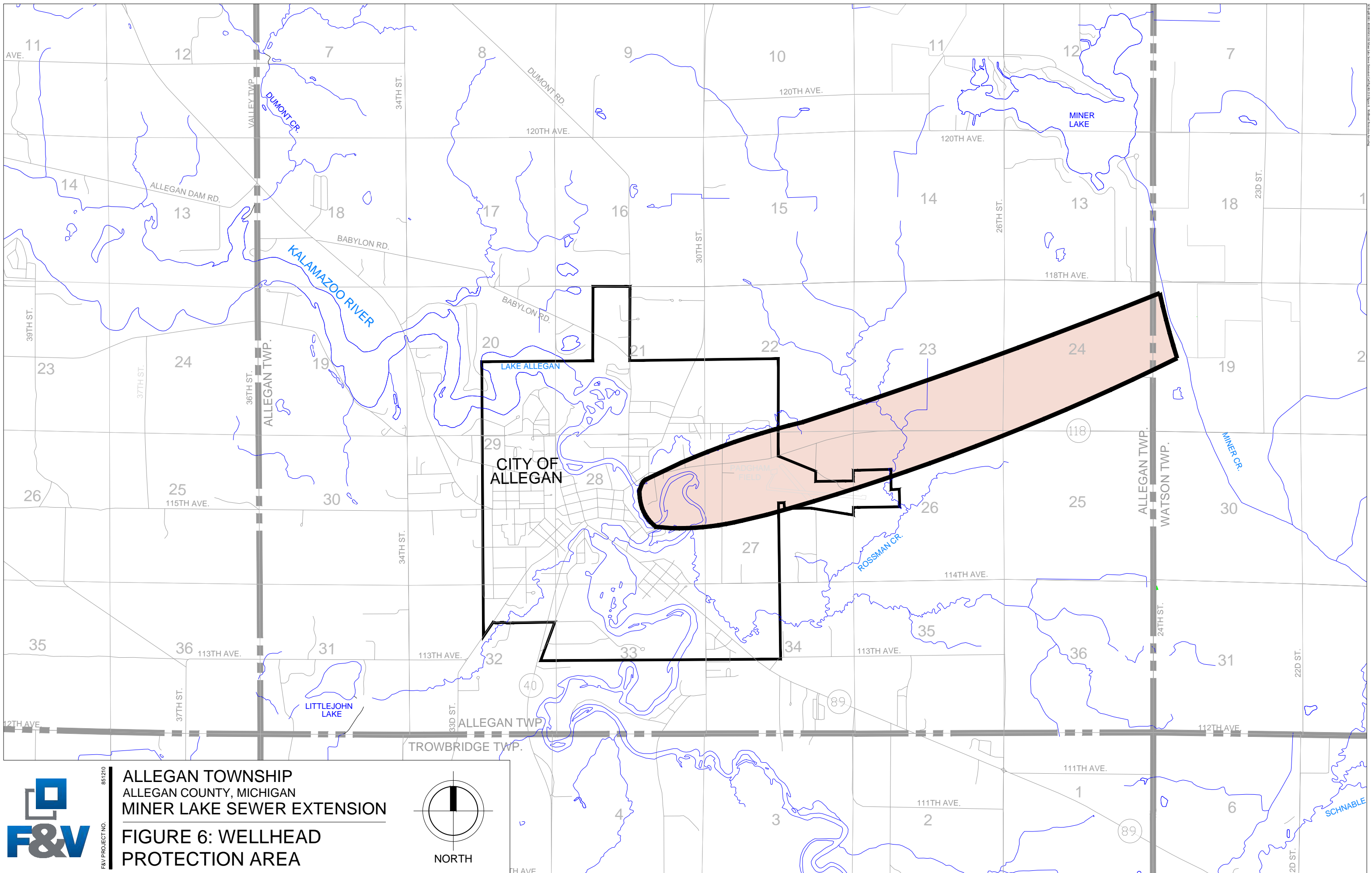


F&V PROJECT NO. 851210

ALLEGAN TOWNSHIP
ALLEGAN COUNTY, MICHIGAN
MINER LAKE SEWER EXTENSION
FIGURE 4: LOW-PRESSURE
COLLECTION SYSTEM

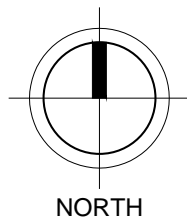


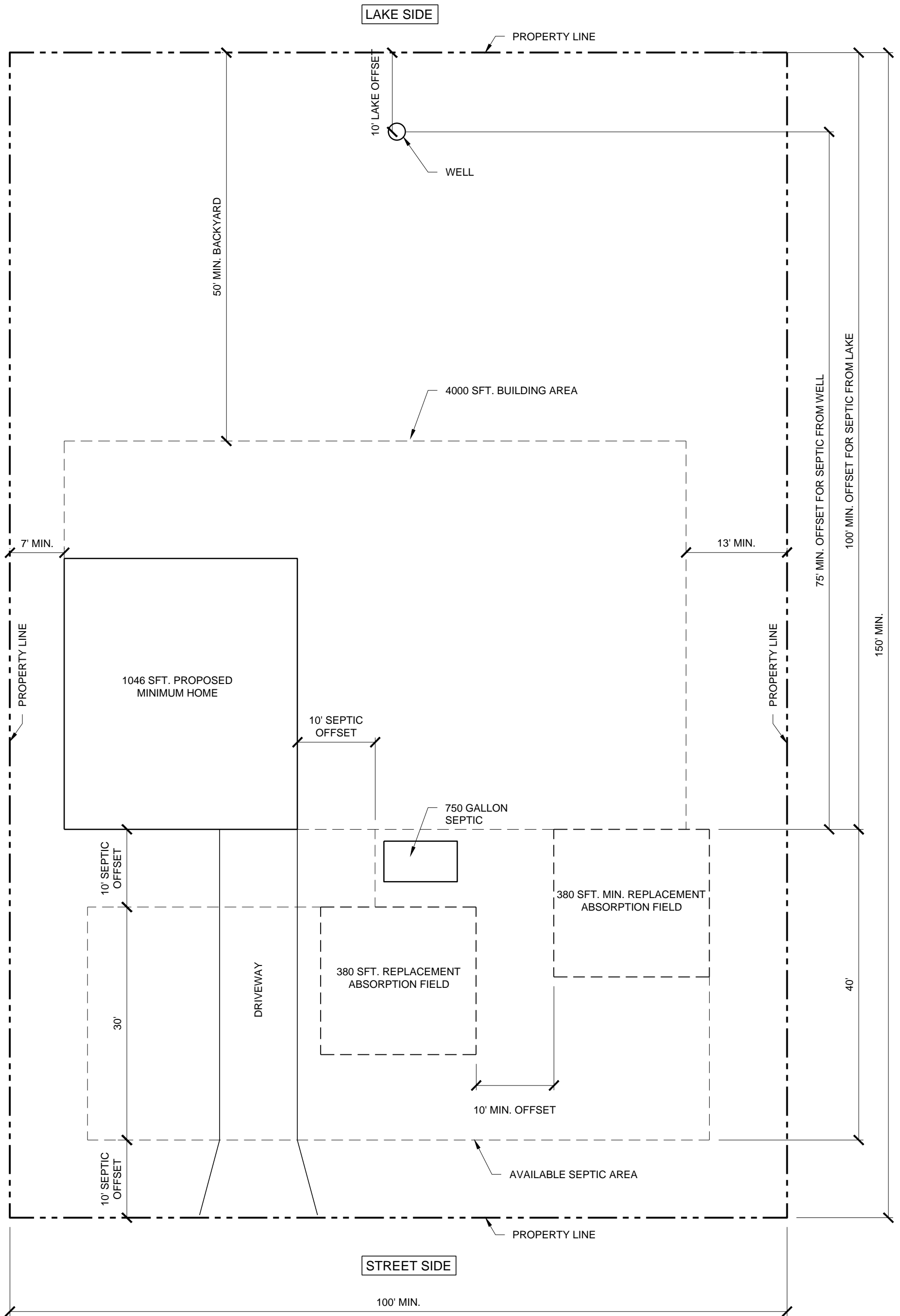




F&V PROJECT NO. 851210

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 Percolation Rate of 11-15 min/inch, moderate to poor soils

ALLEGAN TOWNSHIP
ALLEGAN COUNTY, MICHIGAN
MINER LAKE SEWER EXTENSION
FIGURE 7: MINIMUM ISOLATION
REQUIREMENTS

851210
 F&V PROJECT NO.



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

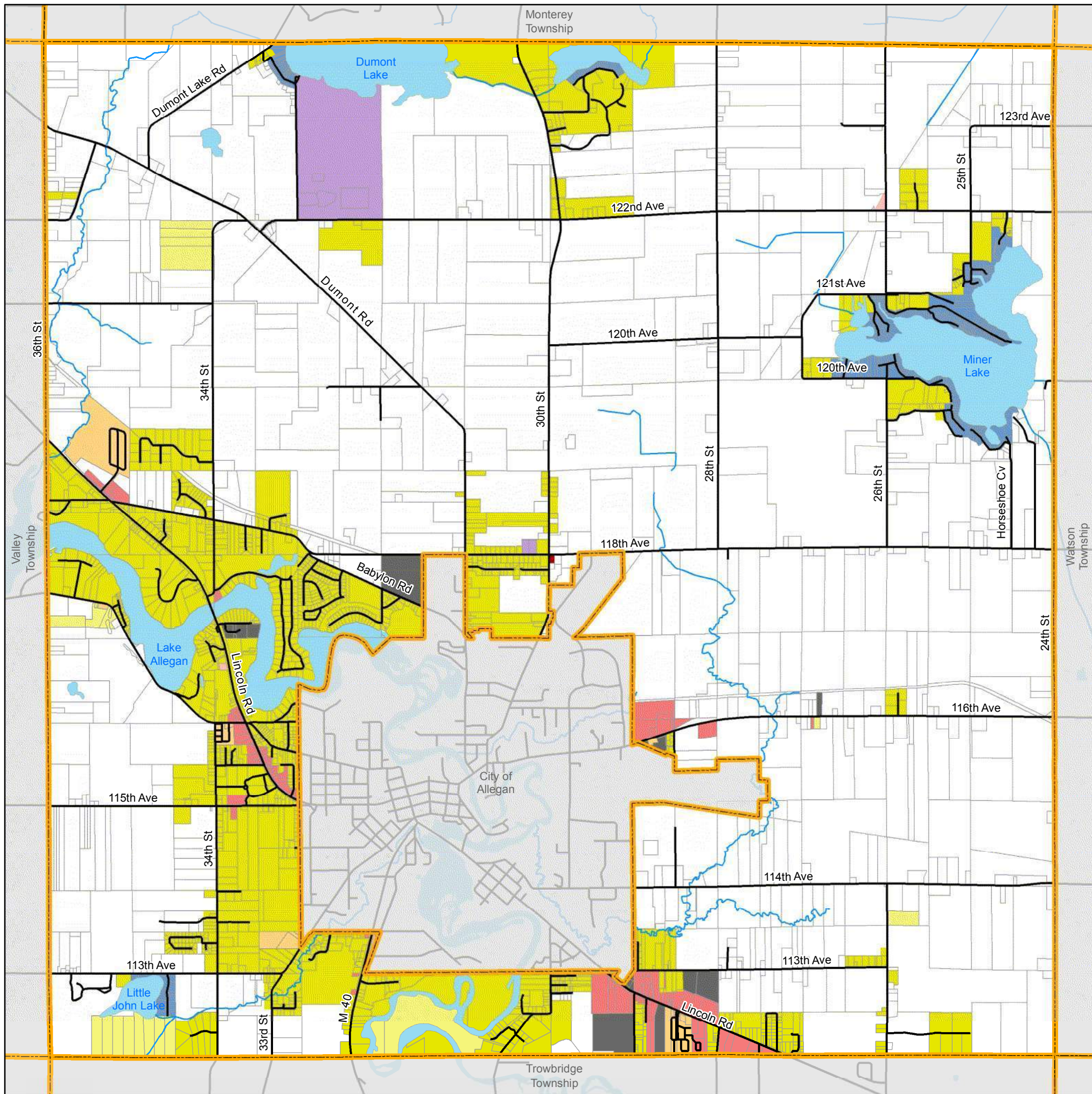
* Property was rezoned to C2 conditionally.
See conditions for specific C-2 zoning boundary
and permitted uses on this parcel.

1 inch = 3,250 feet




































williams&works
engineers | surveyors | planners

Figure 8



SOIL SURVEY OF ALLEGAN COUNTY, MICHIGAN

MAP LEGEND

-  Soil Map Units
-  Cities
-  Detailed Counties
-  Detailed States
-  Interstate Highways
-  Roads
-  Rails
-  Water
-  Hydrography
-  Oceans
-  Escarpment, bedrock
-  Escarpment, non-bedrock
-  Gully
-  Levee
-  Slope
-  Blowout
-  Borrow Pit
-  Clay Spot
-  Depression, closed
-  Eroded Spot
-  Gravel Pit
-  Gravelly Spot
-  Gully
-  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.

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%) Blount (7%)	Slow water movement Depth to saturated zone Depth to saturated zone Slow water movement	85.7	6.4

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		
			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		
			Capac (2%)	Filtering capacity		
	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		
				Depth to saturated zone		
			Sebewa (4%)	Seepage, bottom layer		
				Ponding		
				Slow water movement		
			Oshtemo (3%)	Seepage, bottom layer		
			23	Sebewa loam		
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

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		
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		
			Rimer (2%)	Ponding		
				Slow water movement		
			Thetford (2%)	Depth to saturated zone		
				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 Slow water movement Ponding	53.5	4.0
			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 Seepage, bottom layer	20.3	1.5
			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

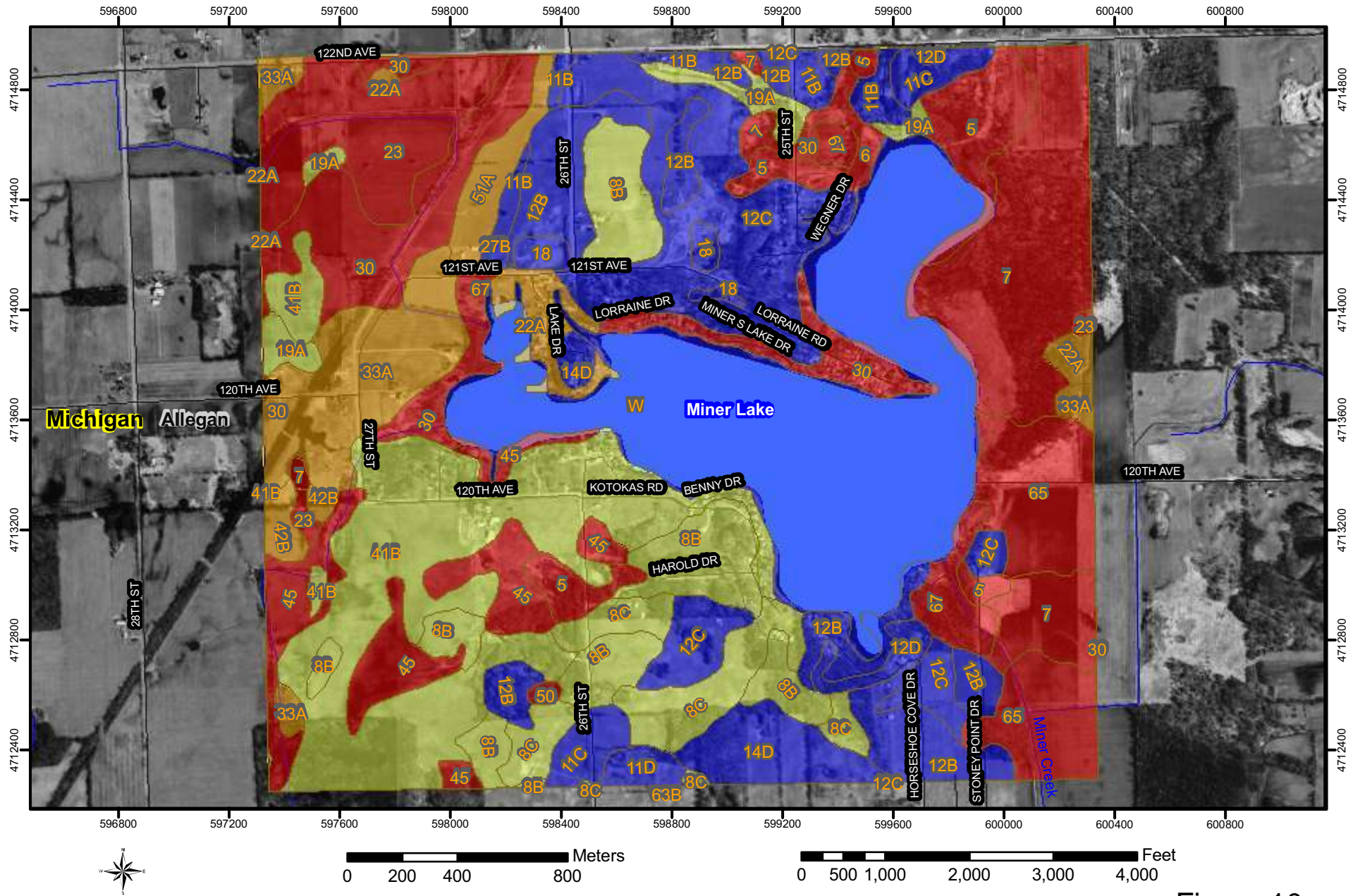


Figure 10

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.

SEPTIC TANK ABSORPTION FIELDS RATING FOR ALLEGAN COUNTY, MICHIGAN

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.

Appendix B

PER Summary Tables

Not included with current draft.
Budgets are dependent on City
of Allegan connection and
OM&R Costs, pending
negotiations between City of
Allegan and Allegan Township

Appendix C

Tables



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

Project: Gravity Collection System - Alternative 1

Basis for Estimate: Conceptual Basis of Design Other Final

Work: Gravity collection system to serve properties around Miner Lake, low pressure service for approximately 36 properties where gravity 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"x8"x6" 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
<i>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.</i>		Subtotal:			\$ 21,809,000
		Contingency (10%)			\$ 2,181,000
		Engineering, Legal & Administrative			\$ 3,490,000
		Total:			\$ 27,480,000



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

Project: Grinder Sewer System - Alternative 2

Basis for Estimate: Conceptual Basis of Design Other Final

Work: Low pressure grinder collection collection system to serve properties 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 Release 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	
<i>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.</i>					Subtotal:	\$ 11,505,000
					Contingency (10%)	\$ 1,151,000
					Engineering, Legal & Administrative	\$ 1,841,000
					Total:	\$ 14,497,000



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

Project: STEP Sewer System - Alternative 3

Basis for Estimate: Conceptual Basis of Design Other Final

Work: Low pressure STEP collection system to serve properties 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 Release 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	
<i>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.</i>					Subtotal:	\$ 11,220,000
					Contingency (10%)	\$ 1,122,000
					Engineering, Legal & Administrative	\$ 1,796,000
					Total:	\$ 14,138,000

10/17/2022

Allegheny Township Miner Lake Wastewater System

F&V Project No. 851210

Projected Wastewater Flows



Projected Flows - Service Area					
User Type	No. of Connections	No. of REUs	Average Day Usage (gpd)	Average Day Flow (gpm)	Peak Hour Flow (gpm)
<i>Initial flow</i>					
Residential	229	229	40,400	28	111
Commercial	0	0	0	0	0
Total, Initial:	229	229	40,400	28	111
<i>Additional Future Flow (Undeveloped Parcels)</i>					
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



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.

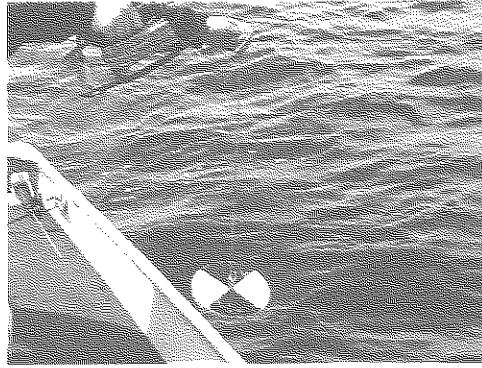
If there is anything else we can assist the township with, please do not hesitate to reach out to us.

Sincerely,

A handwritten signature in blue ink that reads "Randy Rapp, RS". The signature is stylized and includes a large flourish at the end.

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

Appendix E
Water Quality and Septic Permit Data



**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

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

Table of Contents

INTRODUCTION	1
Temperature	2
Dissolved Oxygen	2
Phosphorus	3
Chlorophyll-a	3
Secchi Transparency	3
Fecal Coliform Bacteria	4
Sampling Methods	4
SAMPLING RESULTS AND DISCUSSION	6
APPENDIX	
A Miner Lake Historical Water Quality Data	
REFERENCES	

LIST OF TABLES

Table 1. Lake Classification Criteria	3
Table 2. Miner Lake 2006 Deep Basin Water Quality Data	6
Table 3. Miner Lake 2006 Surface Water Quality Data	7
Table 4. Miner Lake 1996-2006 Water Quality Summary Statistics	7
Table 5. Miner Lake 2006 Bacteriological Data	7
Table 6. Miner Lake 2006 Tributary Water Quality Data	9
Table A1. Miner Lake 1996 - 2004 Deep Basin Water Quality Data	A-1 to A-5
Table A2. Miner Lake 1996 - 2004 Surface Water Quality Data	A-6
Table A3. Miner Lake 2000 - 2004 Tributary Water Quality Data	A-7 to A-8

LIST OF FIGURES

Figure 1. Lake Classification	1
Figure 2. Seasonal Thermal Stratification Cycles	2
Figure 3. Secchi Disk	3
Figure 4. Miner Lake Sampling Location Map	5
Figure 5. Volume-Weighted Average Total Phosphorus Concentrations, 1996-2006	8
Figure 6. Chlorophyll-a Concentrations, 1996-2006	8
Figure 7. Secchi Transparency Measurements, 1996-2006	8

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.

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.

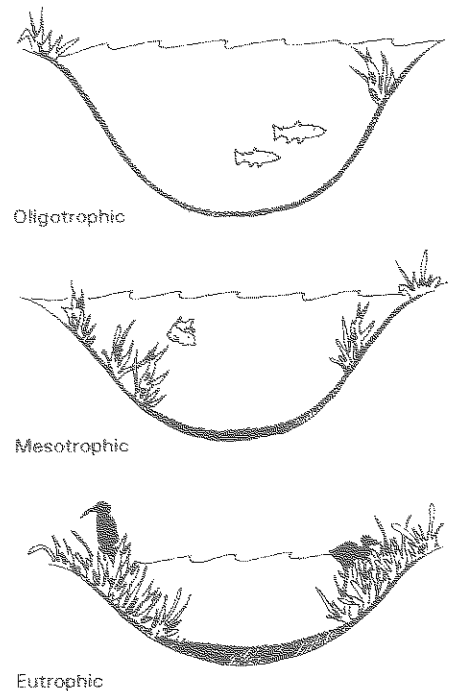


Figure 1. Lake classification.

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.

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.

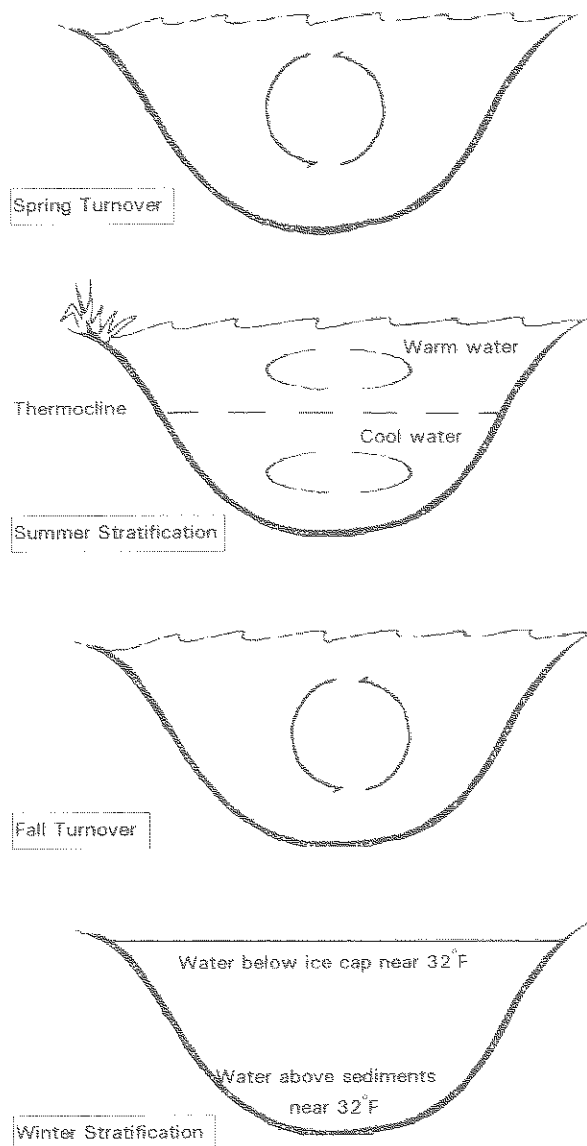


Figure 2. Seasonal thermal stratification cycles.

INTRODUCTION

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.

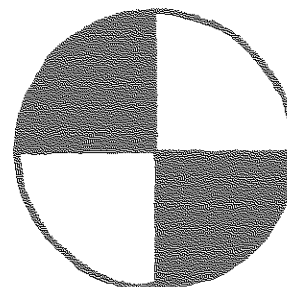


Figure 3. Secchi disk.

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.

INTRODUCTION

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 Newhof¹, 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 Laboratory².

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

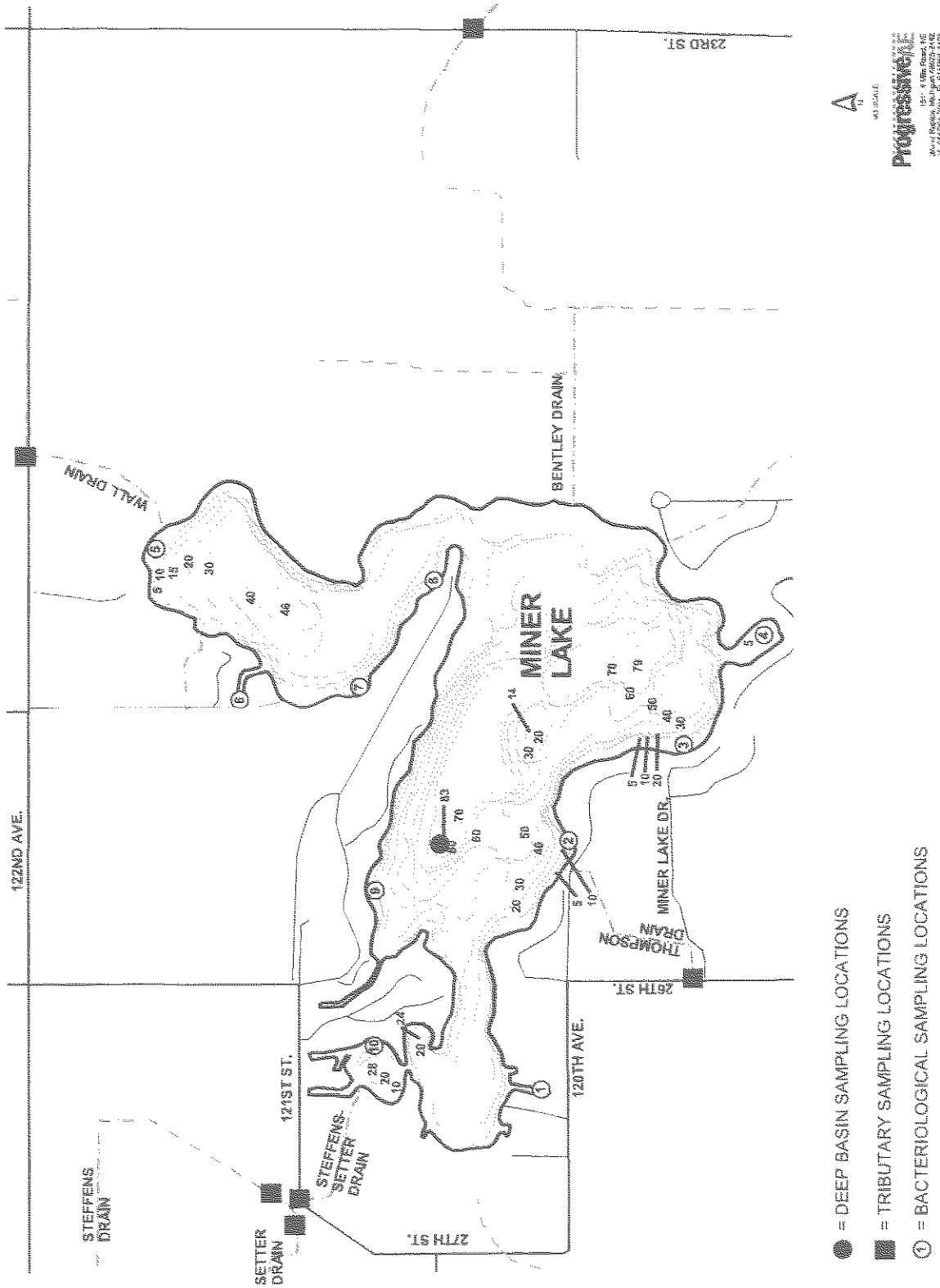


Figure 4. Miner Lake sampling location map.

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.

RESULTS AND DISCUSSION

TABLE 3
MINER LAKE
2006 SURFACE WATER QUALITY DATA

Date	Secchi Transparency (feet)	Chlorophyll-a ($\mu\text{g/L}$) 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 ($\mu\text{g/L}$) ¹	Chlorophyll-a ($\mu\text{g/L}$) 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	<i>E. coli</i> 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 $\mu\text{g/L}$ = micrograms per liter = parts per billion.

² mL = milliliters.

RESULTS AND DISCUSSION

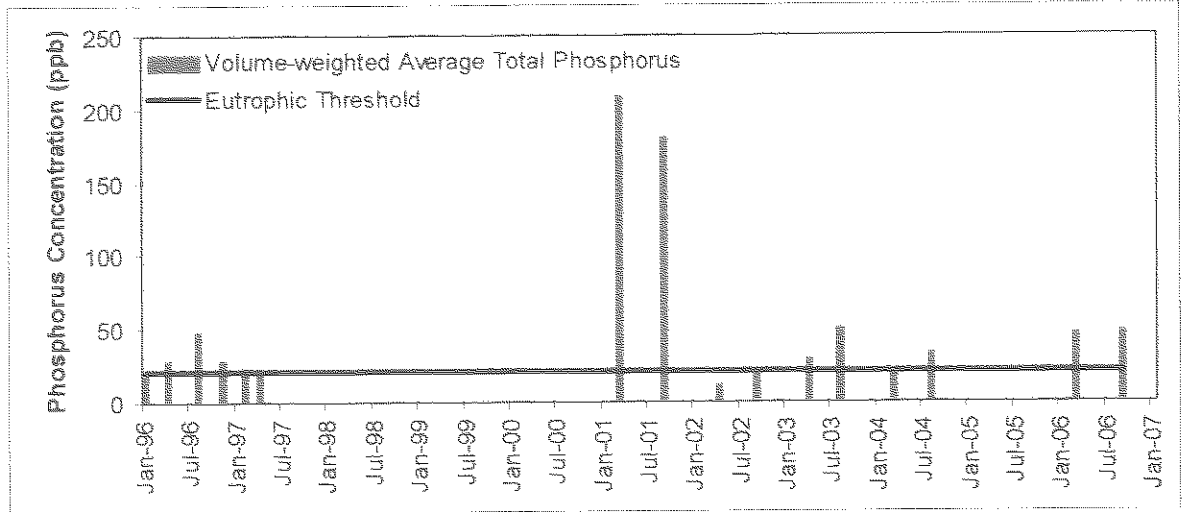


Figure 5. Volume-weighted average total phosphorus concentrations, 1996-2006.

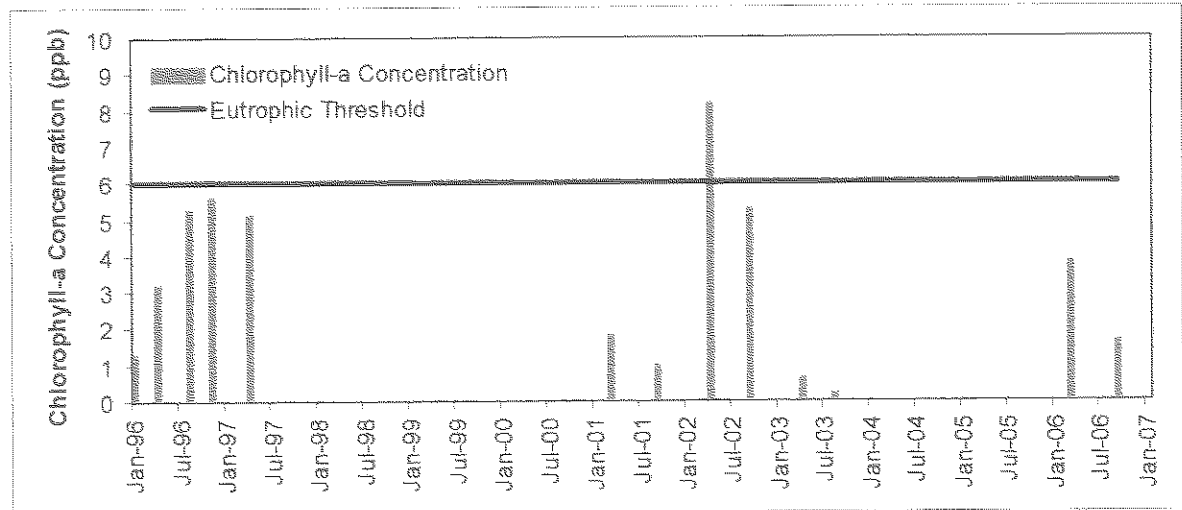


Figure 6. Chlorophyll-a concentrations, 1996-2006.

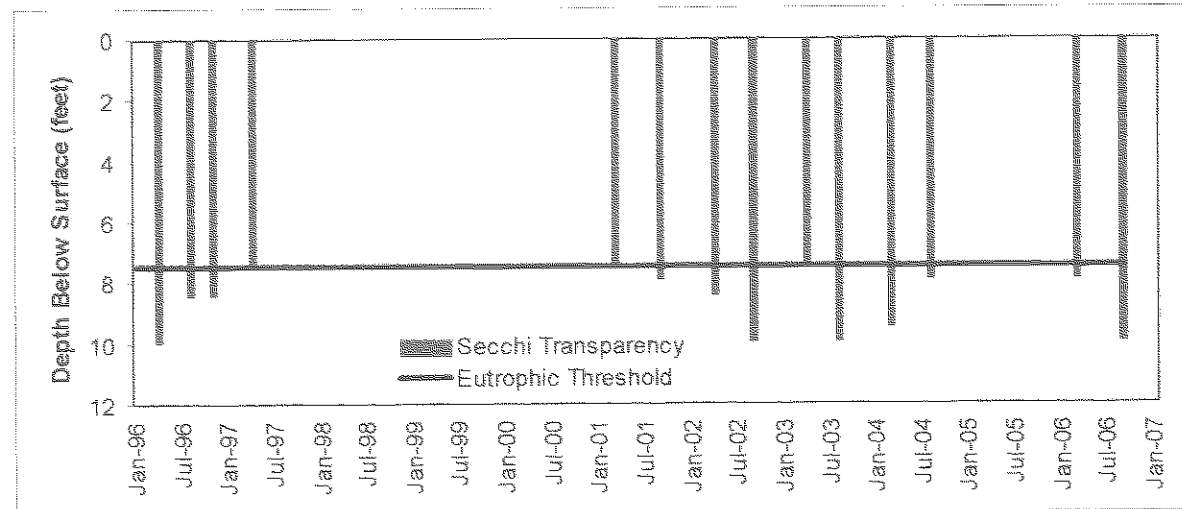


Figure 7. Secchi transparency measurements, 1996-2006.

TABLE 6
MINER LAKE
2006 TRIBUTARY WATER QUALITY DATA

Date	Sample Location	Discharge (cfs) ¹	Total Phosphorus (µg/L) ²	<i>E. coli</i> (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

APPENDIX A

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.

APPENDIX A

TABLE A2
MINER LAKE
1996-2004 SURFACE WATER QUALITY DATA

Date	Secchi Transparency (feet)	Chlorophyll-a ($\mu\text{g/L}$) 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 $\mu\text{g/L}$ = micrograms per liter = parts per billion.

APPENDIX A

TABLE A3
MINER LAKE
2000-2004 TRIBUTARY WATER QUALITY DATA

Date	Sample Location	Discharge (cfs) ¹	Total Phosphorus (µg/L) ²	<i>E. coli</i> (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	<i>E. coli</i> (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.



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.



**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	1-800 Gal Septic w/ 1000 Gal Drywell
10/15/1970		Lakeland Drive	New	D	1-1000 Gal Septic w/ 1000 Gal Drywell
7/14/1971		Unknown	New	D	Drywell System
9/14/1971		Forest Drive	New	B	1-800 Gal Septic w/ 300 Sft Drainfield
7/26/1971		Unknown	New	D	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
7/26/1971		Unknown	New	T	Trench System
11/13/1971		Unknown	New	M	Lake Isolation Variance, Mound System
8/8/1972		Liechti Knoll Subdivision	New	B	1-1000 Gal Septic w/ 500 Sft Drainfield, Lake Isolation Variance, Mound System
12/27/1972		North side of Miner Lake	New	B	1-1000 Gal Septic w/ 450 Sft Drainfield
8/17/1973		Unknown	New	B	1-1000 Gal Septic w/ 400 Sft Drainfield, Lake Isolation Variance, Fill Required
8/17/1973		Miner Lake	New	M	Unknown Septic w/ 500 Sft Drainfield
6/30/1973	Lot 21	Haas Street	New	M	2-1000 Gal Septic w/ 700 Sft Drainfield, Mound System, Lift Pump
8/7/1973		S side of Miner Lake	New	M	1-800 Gal Septic w/ 450 Sft Drainfield, Lake Isolation Variance, Mound System
7/25/1973		Unknown	New	D	2-1000 Gal Septic w/ 700 Sft Drainfield, Mound System
7/25/1973		Off 118th Ave	New	B	1-1000 Gal Septic w/ 2 Drywells
12/9/1974	200	Forest Drive	New	M	1-600 Gal Septic w/ 360 Sft Drainfield, Undersized for Cottage Use
7/19/1974		Unknown	New	M	1-1000 Gal Septic w/ 450 Sft Drainfield, Mound System
5/22/1974	Lot 17	Bayview	New	B	1-1000 Gal Septic w/ 990 Sft Drainfield, Lake Isolation Variance, Mound System
9/4/1974		Unknown	New	T	2-1000 Gal Septic w/ 1320 Sft Drainfield
5/14/1976		25th Street	New	B	1-1000 Gal Septic w/ 500 Sft Trench System
3/28/1976	2003	Lake Drive	New	D	1-1000 Gal Septic w/ 750 Sft Drainfield
7/22/1976		Unknown	New	B	1-1000 Gal Septic w/ 1500 Gal Drywell
8/24/1977	2003	28th Street	New	D	1-1000 Gal Septic w/ 510 Sft Drainfield
10/13/1978		Unknown	Repair	M	2-750 Gal Septic w/ 1500 Gal Drywell
11/1/1979	2591	Haas Drive	Repair	M	2-800 Gal Septic w/ 600 Sft Drainfield, Mound System
8/30/1979		Forest Lake Drive	Repair	B	1-1000 Gal Septic w/ 800 Sft Drainfield, Mound System
1980	2605	Haas Drive	Repair	T	1-1000 Gal Septic w/ 800 Sft Drainfield, Excavate and Fill
5/29/1980	2490	Wagner	Repair	M	Unknown Septic w/ Trench System
10/7/1985		Lorraine Drive	Repair	M	Existing Septic w/ 500 Sft Drainfield, Mound System
12/11/1986		Lorraine Drive	New	M	1-1000 Gal and 1-750 Gal Septic w/ 500 Gal Pump Chamber and 990 Sft Drainfield, Mound System
11/7/1986		Horseshoe Cove	New	T	1-800 Gal Septic w/ 340 Sft Drainbed, Mound System 4.5' High
5/31/1988	2476	Lorraine Drive	Repair	M	1-1000 Gal Septic w/ 345 Sft Trench System
11/10/1988		Lorraine Drive	New	M	Existing Septic w/ Unknown Gal Pump Chamber and Unknown Sft Drainfield, Mound System
7/18/1988		Horseshoe Cove	New	B	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	1-1000 Gal Septic w/ 660 Sft Drainfield and Extensive Excavation and Backfill--5.5 Ft Deep
12/13/1990	2447	118th	New	B	1-1000 Gal Septic w/ 800 Gal Pump Chamber and 450 Sft Drainfield
7/16/1991	2467	Lorraine Drive	Repair	M	1-1000 Gal Septic w/ 510 Sft Drainfield
9/4/1992	2473	Lorraine Drive	Repair	M	1-1000 Gal Septic w/ 500 Gal Pump Chamber and 340 Sft Drainfield, Mound System, Well Variance, Retaining Wall
10/20/1992	1975	Koteris Drive	Repair	M	1-1500 Gal Septic Tank w/ 500 Gal Pump Chamber and 540 Sft Drainfield, Mound System
10/21/1993	1999	Benny Drive	New	B	1-1500 Gal Septic Tank w/ 500 Gal Pump Chamber, Well Variance, Drainfield Undersized, No Replacement Options, Mound System
12/16/1993	1955	Lakeshore Drive	New	U	2-800 Gal Septic w/ 500 Gal Pump Chamber and 600 Sft Drainfield, Berm Wall and 8" Tile Required, Well Relocated
12/16/1993	1935	Lakeshore Drive	New	D	Size and Type Not Known
12/14/1993	1943	Lakeshore Drive	New	B	1-1500 Gal Septic Tank w/ 500 Gal Pump Chamber, 2-Drywells w/ Alternating Valve
6/11/1993	1981	Koteris Drive	Repair	B	1500 Gal Dual Compartment Tank w/ 500 Gal Pump Chamber, 345 Sft Drainfield
9/2/1993	2553	Lorraine Drive	Repair	B	1-1500 Gal Septic Tank w/ 500 Gal Pump Chamber and 750 Sft Drainfield, Variance for Lake Isolation and Slope, Pumped under Road
6/2/1993	2595	Haas Drive	Repair	B	Existing 1000 Gal Septic w/ 500 Gal Pump Chamber and 400 Sft Drainfield
5/11/1994	1971	Koteris Drive	Repair	M	1-1000 Gal Additional Septic w/ 1000 Sft Drainfield
4/11/1994	2551	Lorraine Drive	Repair	B	1-1000 Gal Septic w/ 500 Gal Pump Chamber and 500 Sft Drainfield, Mound System
7/25/1994	2084	Lake Drive	Repair	D	1-800 Gal Septic w/ 600 Sft Drainfield
4/26/1994		Lorraine Drive	Repair	P	1-1000 Gal Septic w/ Existing Drywell and Drainfield, Routed Under Driveway
10/18/1995	2579	Lorraine Drive	New	M	1500 Gal Holding Tank, Designed for Seasonal Use Only
7/25/1995	1959	Lakeshore Drive	New	B	1-1000 Gal Septic w/ 500 Gal Pump Chamber and 627 Sft Drainfield, Mound System
7/11/1995	2495	Wegner Drive	New	B	2-1000 Gal Septic w/ 500 Gal Pump Chamber and 1188 Sft Drainfield
10/17/1995	2469	Lorraine Drive	Repair	M	2-1000 Gal Septic w/ 500 Gal Pump Chamber and 800 Sft Drainfield
6/19/1996	1996	Koteris Drive	New	B	1-1000 Gal Septic w/ 500 Gal Pump Chamber and 429 Sft Drainfield, Mound System
4/10/1997	2090	Lake Drive	Repair	B	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/ 1080 Sft Drainfield, Lift Pump
7/8/1997	2501	Lorraine Drive	Repair	P	2-1000 Gal Septic w/ 660 Sft Drainfield
9/15/1998	1968	Stoney Point	Repair	D	3-1000 Gal Septic w/ No Drainfield (Pump & Haul)
6/24/1998	1906	Horseshoe Cove	New	B	Property Line and Well Isolation Variance, 500 Gal Pump Chamber and 2 Drywells, 1000 Gal Septic
10/21/1998	1997	Benny Drive	Repair	B	1-1000 Gal Septic w/ 700 Sft Drainbed near steep slope
6/10/1998	2483	Lorraine Drive	New	B	1-500 Gal and 1-800 Gal Septic w/ 500 Sft Drainfield, Lake and Well Isolation Variance
12/29/1998	2555	Lorraine Drive	Repair	M	2-1000 Gal Septic w/ 500 Gal Pump Chamber and 1000 Sft Drainfield
3/17/1999	1916	Horseshoe Cove	New	B	1-1000 Gal Septic w/ 500 Gal Pump Chamber and 600 Sft Drainfield, Mound System
5/5/1999	2499	Lorraine Drive	New	B	1-1000 Gal Septic w/ 400 Sft Drainfield or 600 Sft Drainbed
5/5/1999	2485	Lorraine Drive	Repair	B	2-1000 Gal Septic w/ 1320 Sft Drainfield, Limited Replacement Options
11/5/1999	2474	Lorraine Drive	Repair	B	2-1000 Gal Septic w/ 1000 Sft Drainfield, Clay Sidewalls Required around Sand Backfill, Constructed on Clay
8/6/1999	2494	Wegner Drive	New	B	2-800 Gal Septic w/ 500 Sft Drainfield
4/13/1999	1964	Stoney Point	New	B	1-1000 Gal Septic w/ 520 Sft Drainfield
6/11/1999	1958	Stoney Point	Repair	B	2-1000 Gal Septic w/ 1000 Sft Drainfield
12/2/1999	2603	Haas Drive	New	B	2-1000 Gal Septic w/ 1200 Sft Drainfield
7/18/2000	2487	Wegner Drive	New	B	2-1000 Gal Septic w/ 700 Sft Drainfield
4/19/2000	2915	Miner Lake Road	Repair	B	1-1000 Gal Septic w/ 750 Sft Drainfield
10/16/2000	2581	Haas Drive	Repair	B	2-1000 Gal Septic w/ 675 Sft Drainfield
6/19/2001	2571	Harold	Repair	B	1500 Gal Dual Compartment Septic and Pump to Existing Bed
7/26/2002	1965	Miner Lake Road	Repair	P	2-1000 Gal Septic w/ 680 Sft Drainfield
8/5/2002	2497	Horseshoe Cove	Repair	B	Well Isolation Not Met, 2-1000 Gal Holding Tanks
12/9/2003	2470	Lorraine Drive	Repair	B	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/ 600 Sft Drainfield
5/20/2003	2555	Haas Drive	Repair	B	2-1000 Gal Septic w/ 800 Sft Drainfield
7/29/2003	2561	Haas Drive	New	B	2-1000 Gal Septic w/ 400 Sft Drainfield, Lake and Well Isolation Variance
9/15/2004	1961	Lakeshore Drive	Repair	P	2-1000-Gal Septic w/ 500 Gal Pump Chamber and 920 Sft Drainfield, Well Isolation 63 Ft
9/29/2004	1969	Stoney Point	New	B	1500 Gal Holding Tank
6/4/2004	2479	Lorraine Drive	Repair	B	1-1000 Gal Septic w/ 500 Gal Pump Chamber
11/14/2005	2466	Lorraine Drive	Loan Evaluation	B	2-1000 Gal Septic w/ 600 Sft Drainfield
5/5/2005	2571	Haas Drive	Repair	P	500 Gal Septic w/ 450 Sft Drainfield and Lift Pump
10/11/2005	2585	Haas Drive	Loan Evaluation	T	Well Distance Variance and 1500 Gal Holding Tank
3/24/2006	3524	Vanhorn Court	New	B	Trench System
2/13/2006	2154	Crystal Cove Drive	New	P	2-1000 Gal Septic w/ 900 Sft Drainfield and Lift Pump
	1979	Koteris Drive	New	P	1500 Gal Temp Holding Tank
	2004	Benny Drive	New	M	1500 Gal Holding Tank
	2001	Benny Drive	New	U	2-1000 Gal Septic w/ 990 Sft Drainfield
					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 Separation 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
7/18/1988		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		Liechi 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	<i>Nitrate level</i>	Date
2100026	2100 26TH ST		2/24/1997
2128025	2128 25TH ST		7/12/1995
2156026	2156 26TH ST	<i>ND</i>	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	<i>0.9</i>	1/8/1993
2582121	2582 121ST AVE		3/29/2006
2590121	2590 121ST AVE	<i>ND</i>	7/21/1995
2602122	2602 122ND AVE		8/13/1999
2602122	2602 122ND AVE		10/1/1999
2663120	2663 120TH AVE	<i>ND</i>	7/13/1981
2667120	2667 120TH AVE		7/26/1995
2667120	2667 120TH AVE	<i>ND</i>	7/8/1998
2673120	2673 120TH AVE	<i>0.5</i>	7/28/1994
9011838	<u>1838 HORSESHOE COVE</u>		5/25/1999
9011838	1838 HORSESHOE COVE	<i>ND</i>	6/11/2001
9011968	1968 STONEY POINT DRIVE	<i>ND</i>	9/3/1998
9011981	1981 KOTERAS DR		5/4/1900
9011981	1981 KOTERAS DR	<i>ND</i>	3/9/1993
9011987	1987 KORTERAS	<i>ND</i>	6/16/1993
9011997	1997 BENNY DR	<i>ND</i>	4/28/1900
9012001	2001 BENNY DR	<i>ND</i>	4/20/1993
9012041	2041 FORREST DR	<i>ND</i>	8/23/1995
9012047	2047 FOREST DR		10/11/1994
9012047	2047 FOREST DR	<i>ND</i>	4/9/1998
9012061	2061 FORREST DR	<i>ND</i>	4/2/1998
9012080	2080 LK DR		5/22/1995
9012080	2080 LK DR	<i>ND</i>	6/21/1999
9012084	2084 LK DR	<i>ND</i>	6/22/1994
9012091	2091 FORREST DR	<i>ND</i>	11/21/1994
9012095	2095 FORREST DR	<i>ND</i>	9/29/1994
9012095	2095 FORREST DR		10/12/2000
9012116	2116 BAYVIEW DR		10/6/1994
9012394	2394 MINER LAKE RD	<i>ND</i>	5/1/1987
9012466	2466 LORRAINE DR	<i>ND</i>	11/7/2005
9012466	2466 WEGNAR DR	<i>ND</i>	9/8/1993
9012467	2467 LORRAINE DR		9/8/1986
9012467	2467 LORRAINE DR	<i>ND</i>	5/8/2002
9012470	2470 LORRAINE	<i>ND</i>	6/20/1997
9012482	2482 WEGNAR DR	<i>ND</i>	11/17/2003
9012488	2488 BIRCH CT		2/3/1987
9012488	2488 BIRCH CT	<i>ND</i>	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 6.2	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 May 23, 2005, 2004, between the City of Allegan, a Michigan home rule city, the principal office address of which is 112 Locust Street, Allegan, MI 49010 (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 such property in the Township that the Township Board may from time to time wish to serve with such utilities.
- B. The City currently owns and operates a public water system (the "Water System") and a sanitary sewer system (the "Sewer System") which have currently unused capacity to serve additional customers (together the "Utility Systems").
- C. The Township does not currently 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 downtown 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 SERVICE

1.1 Extension of Utilities 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 then existing Water System and Sewer System. This right shall be limited in location only as follows:

(1) Industrial and Commercial Users. The City and Township agree it is in their mutual best interest that the downtown area and industrial land in 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 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 utility service.

(2) 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 extensions 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 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 review shall be paid by the developer or other party seeking the utility service. 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.

(1) 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 Environmental Quality, 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.

(2) To the extent work is to be done within 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.

(3) 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 a 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) may, but is not required to, inspect any such work before it is covered in an effort to satisfy the City that the work complies with the approved plans and specifications. Such 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 provided 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.

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

(2) 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 subsection 1.5(E)(3) below.

1.2 Operation and Maintenance. 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 the 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 Utility System costs.

1.3 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 conditioned upon initial compliance and continuing compliance of the Township, and any users of the Utility System, with the terms and conditions of this Agreement. If the Township or any user fails to fully comply with the terms of this Agreement, the City may, upon 120 days written notice to the Township and the user or, in case of a threat to the public health, safety and welfare resulting from such noncompliance, immediately terminates Utility Systems service to that user.

1.4 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 requirements, orders, and directives of any agency or entity of competent jurisdiction which are applicable to the connection to or use of the Utility Systems.

1.5 Rates, Fees and Charges.

(A) Fees for the operation, maintenance, repair, and replacement of the Utility Systems shall be determined on a cost of service basis using a rate methodology to be mutually agreed upon by the parties.

(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 the Township. The current connection fees are \$900 for sanitary sewer and \$800 for water. These connection fees are subject to change at the discretion of the City.

(C) Fees for the operation, maintenance, repair, and replacement of the Utility System shall be as follows for Township users:

(1) Readiness to Serve Charge – same as City rate.

(2) Commodity Charge – 1.5 times City rate.

1.6 Billing and Payment. This is a retail utility services agreement. The City shall directly bill all users.

(A) Due Date. The due date for such payments for Utility Services shall be within the same number of days after billing therefor as payments are due by users of the system lying within the City.

(B) Lien. 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 commence 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 taxes, including, without limitation, providing for putting any delinquent amount on the Township's *ad valorem* real and property tax rolls and bills, even if such tax rolls or bills have to 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.

1.7 Interruption of Service. The City shall not be responsible for any inconvenience, damages, interruption of operations or other direct or indirect results of the interruption of water service to any parcel served by the Project.

1.8 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.

1.9 Township CIP. Not later than 1 year after the effective date of this Agreement, the Township shall approve a 5 to 10 year capital improvement plan ("CIP") showing what water and sanitary sewer improvements are planned for each year of that CIP and file a copy of the CIP with the City. The Township shall annually review and approve a CIP and file the newly approved CIP with the City.

1.10 Payback. Any new user connecting to the 12-inch water main serving the Allegan Public Schools building(s) in the Township shall pay an extra connection fee that is a portion of the costs incurred by the City to extend that line equal to the portion of the line capacity needed by that user based on historical flows to current users and the new user's anticipated draws.

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), which ordinance(s) shall be applicable to any parcel, parcel owner, and parcel occupants as long as that parcel is served by either of the Utility Systems.

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 may act instead of and with the full powers and authority of Township 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 Constitution 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 be disconnected from that system and be served by any other public water or sanitary sewer system without the City's prior written consent. The parties acknowledge that the Utility Systems will be planning operations, repairs, maintenance, improvements, replacements and expansions 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 provided in this Agreement, incur or be required to pay any costs or expenses as a result of the services 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 as long as any Utility Systems services are provided within the Township.

ARTICLE V
REMEDIES

5.1 Cumulative. All of 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 prohibited by law, the parties agree that the jurisdiction and venue for any action brought pursuant to or to enforce any provision of this Agreement shall be solely in the state courts 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 party(ies) 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 its accrual or first notice thereof through any and all appellate and collection proceedings.

ARTICLE VI
MISCELLANEOUS

6.1 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 affect 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.

6.2 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.

6.3 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 assure such authority exists, the parties have caused resolutions 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: Jon Cook
Jon Cook, Mayor

By: Lori VanderClay
Lori VanderClay, Deputy Clerk

ALLEGAN TOWNSHIP

By: Steve Schulz
Steve Schulz, Supervisor

By: Hollis Hough
Hollis Hough, Township Clerk

Appendix G
Public Participation and Informational Meetings