DRAFT 2025 Drinking Water State Revolving Fund Project Plan

Pump Station 5 and 14 Upgrades

DWSRF Project Number: XXXX-XX

March 2024

TETRA TECH

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PRESENTED TO

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ACRONYMS/ABBREVIATIONS

Acronyms/Abbreviations	Definition
DNR	Michigan Department of Natural Resources
DWSRF	Drinking Water State Revolving Fund
EGLE	Michigan Department of Environment, Great Lakes, and Energy
FEMA	United States Federal Emergency Management Agency
FWS	United States Fish and Wildlife Service
gpm	Gallons per Minute
LSL	Lead Service Line
MDOT	Michigan Department of Transportation
MG	Million Gallons
MGD	Million Gallons per Day
MNFI	Michigan Natural Features Inventory
NREPA	Natural Resources and Environmental Protection Act
O&M	Operations and Maintenance
SHPO	State Historical Preservation Office
SRF	State Revolving Fund
USEPA	United States Environmental Protection Agency
WIFFS	Water Infrastructure Funding and Financing Section
WPS	Well Pump Station
WTP	Water Treatment Plant

1.0 SUMMARY AND RECOMMENDATIONS

1.1 SUMMARY

The City submitted an intent to apply for Fiscal Year 2025 Drinking Water State Revolving Fund (DWSRF) financing to fund pump stations 5 and 14 upgrades. The DWSRF provides financial assistance in the form of low interest loans to assist water suppliers meet the requirements of the Safe Drinking Water Act. The current interest rate for Fiscal Year 2024 loans is 2.5% for a 20-year loan. Interest rates may change for Fiscal Year 2025.

The DWSRF program requires a Project Plan to be submitted to EGLE by June 1, 2024, in order to be on the project priority list for Fiscal Year 2025 (October 1, 2024, to September 30, 2025). The City's Project Plan was prepared using the *DWSRF Project Plan Preparation Guidance Manual* with assistance from the Michigan Department of Environment, Great Lakes, and Energy (EGLE) Water Infrastructure Funding and Financing Section (WIFFS).

1.2 RECOMMENDATIONS

The City's drinking water system was reviewed to evaluate existing and projected future conveyance and treatment capacities, the condition of major equipment and facilities, and operations and maintenance tasks. The Project Plan details the project recommended for implementation within the next five years. This project is recommended because it improves the existing infrastructure and protects human health. The total opinion of cost to implement the recommended alternative is $51.3 million. The proposed project is summarized as follows:

Project 1, Pump Stations 5 and 14 Upgrades

Project 1 proposes to upgrade Pump Stations 5 and 14 with additional water treatment to remove iron and PFAS to meet regulatory standards. The existing pump stations do not currently have a way to remove these pollutants. Water treatment is recommended to remove levels of iron and PFAS that may negatively impact human health if not treated.

2.0 PROJECT BACKGROUND

The City's drinking water needs are based on comprehensive reviews of its water system and other planning information. This Project Plan was developed using the information presented in the following reports:

- *DWSRF Project Plan for City of Kalamazoo*, May 2023
- *Kalamazoo Water System Capacity Study*, April 2022
- *Water System Reliability Study, December 2017*
- *Water Asset Management Plan, December 2017*
- *Kalamazoo Master Plan*, October 2017

2.1 DELINEATION OF STUDY AREA

The existing service area includes all of the City and portions of the cities of Parchment and Portage as well as Kalamazoo, Comstock, Cooper, Oshtemo, Texas, Pavillion, and Richland Townships. The City has almost 200,000 customers in the 170 square mile service area. The study area includes a portion of the existing service area from Spring Valley Drive to Schippers Lane along Henson, Junction, Trimble, and Wallace Avenues. ***Figure 2-1*** shows the study area.

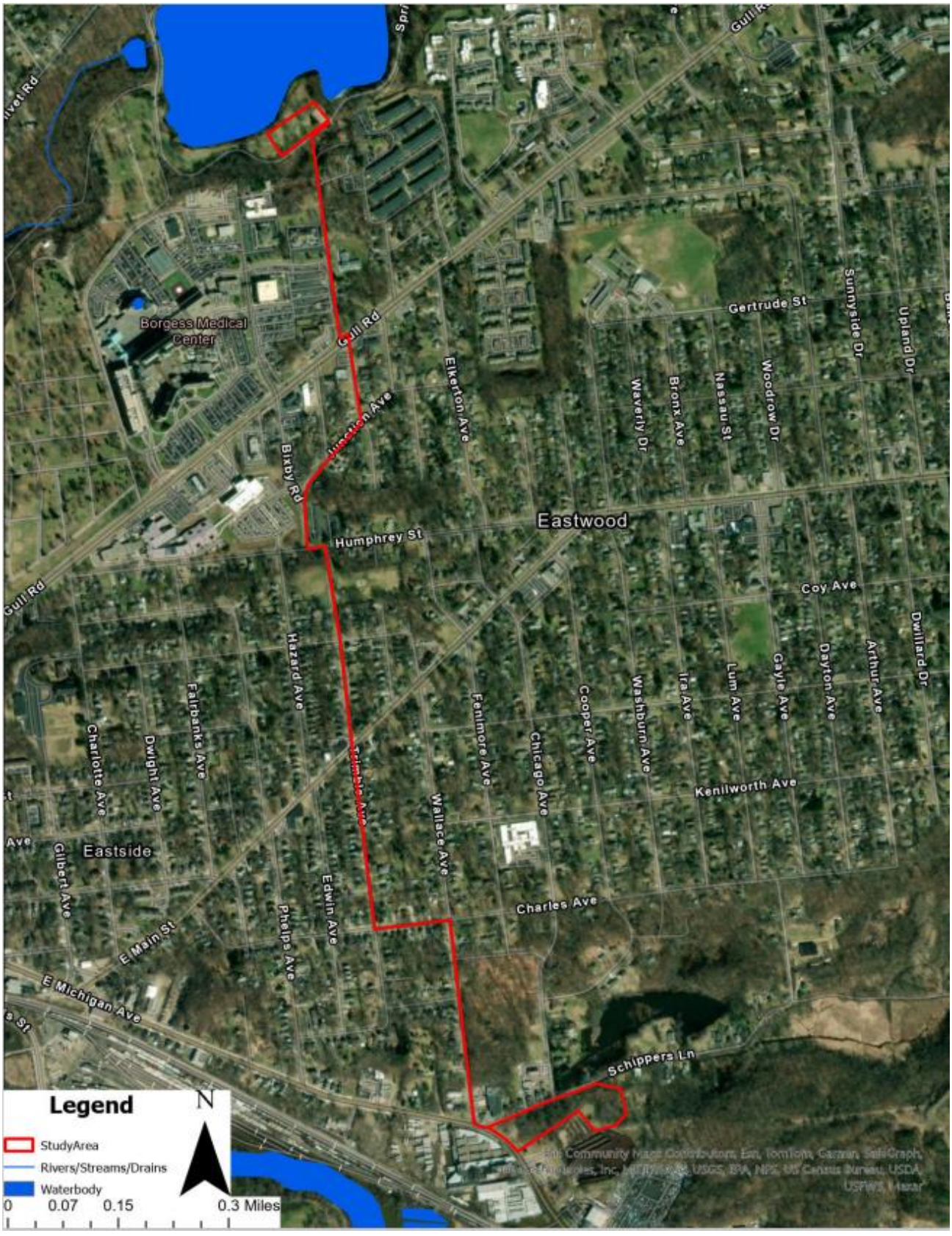
2.2 POPULATION PROJECTIONS

The City's population declined between 2010 and 2020, but the City projects the population will increase by 0.5 percent per year during the planning period. ***Table 2-1*** summarizes population projections for the entire City and the water service area, which includes additional cities and townships.

Table 2-1. Population Projections

Year	Kalamazoo Service Area	City of Kalamazoo
2010 Census	-	74,262
2020 Census	123,000	73,598
2022 U.S. Census Bureau Estimate	-	72,873
2024 projection	125,479	73,604
2029 projection	128,647	75,462
2044 projection	142,142	83,378

Figure 2-1. Study Area Map



2.3 EXISTING ENVIRONMENT EVALUATION

2.3.1 Cultural and Historic Resources

Orbis Environmental Consulting conducted a historical evaluation which is included in Appendix A. An addendum to this evaluation to include the project area is expected before final submission to EGLE. There are no anticipated impacts to any historical, archeological, or cultural resources. Additional evaluation for potential resources will be completed during the design phase.

2.3.2 Air Quality

National Ambient Air Quality Standards are health-based standards set by the United States Environmental Protection Agency (USEPA). The City is in attainment for carbon dioxide, lead, nitrogen dioxide, particulate matter, sulfur dioxide, and ozone. The project is not anticipated to negatively impact the air quality.

2.3.3 Wetlands

Wetlands are located north of Spring Valley Drive along Spring Valley Lake and along Schippers Lane in the study area. Wetlands may be within the project limits and delineation of potential wetlands will occur during the design phase of the project. During the design phase of the project, all necessary permits will be obtained and impacts to wetlands will be minimized and/or mitigated. ***Figure 2-2*** shows wetlands from the National Wetland Inventory within the study area.

2.3.4 Great Lakes Shorelands, Coastal Zones, and Coastal Management Areas

There are no coastal zones within the study area.

2.3.5 Floodplains

There are no floodplains within the study area. ***Figure 2-3*** shows the 100-year floodplains from FEMA within the study area.

2.3.6 Natural or Wild and Scenic Rivers

There are no designated Michigan Natural Rivers listed by the Michigan Department of Natural Resources (DNR) or National Wild and Scenic Rivers listed by the United States Fish and Wildlife Service (FWS) within the study area.

2.3.7 Major Surface Waters

The Kalamazoo River and Portage Creek are within the service area, but not the study area. No project work will impact any major surface waters.

Figure 2-2. Wetlands Map

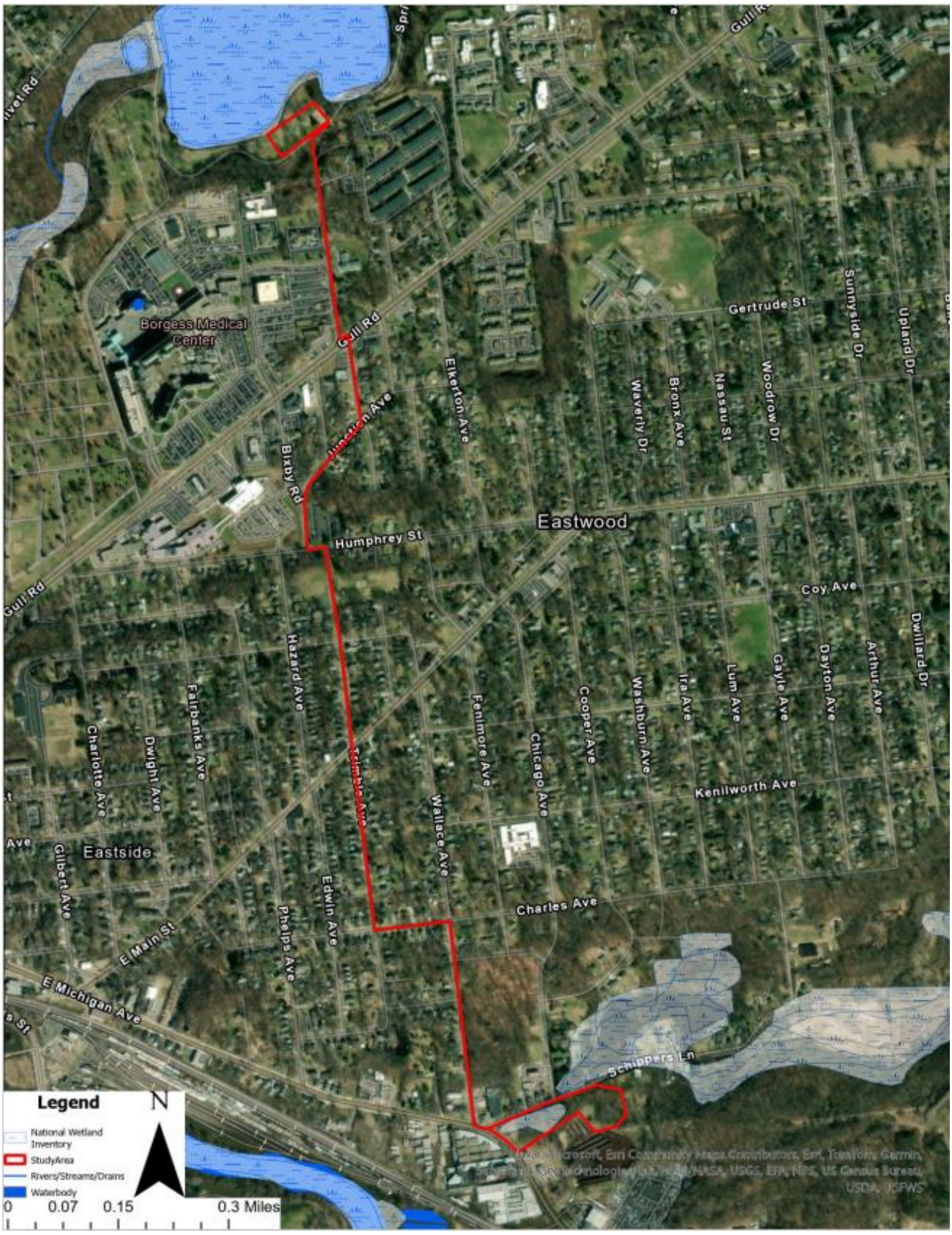
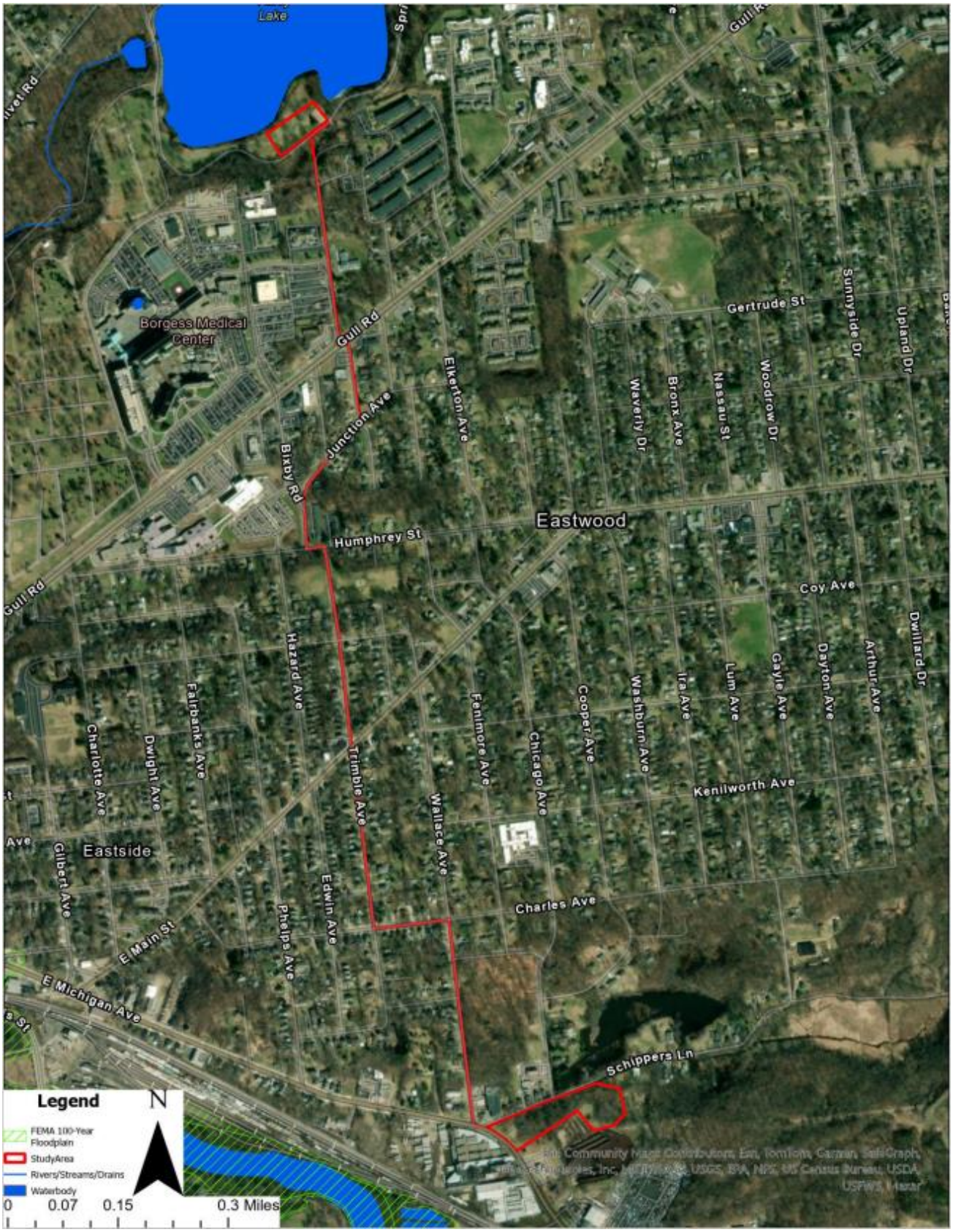


Figure 2-3. Floodplain Map



2.3.8 Topography

No proposed topography changes are included within the project scope. ***Figure 2-4*** includes the existing topography of the study area.

2.3.9 Geology

No proposed geology changes or dewatering are included within the project scope.

2.3.10 Soil Types

Soil within the study area is mostly sand and gravel. No removal or additional soil is anticipated outside of the study area. Appendix B includes a map of the existing soil types in the project area.

2.3.11 Agricultural Resources

The proposed project is in a residential area and not anticipated to be constructed near farmland.

2.3.12 Recreational Areas

The study area includes a park along Spring Valley Lake. Impacts to local recreational areas will be minimized as much as possible.

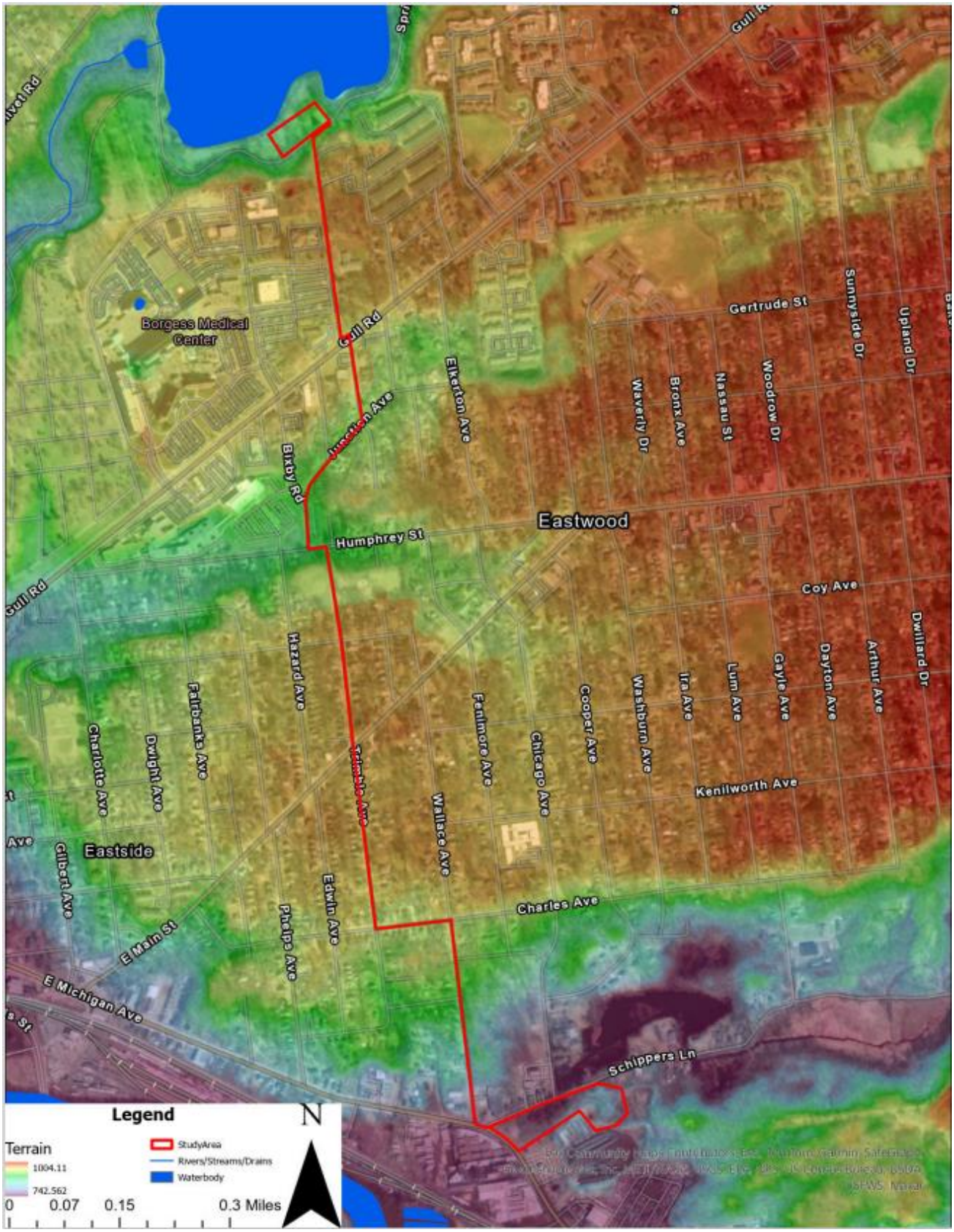
2.3.13 Fauna and Flora

The existing plant and animal species are typical to urbanized areas. No habitat for animals of economic or sport value is within the study area. Appendix C contains the *Orbis Threatened and Endangered Species Desktop Review* with correspondence from applicable environmental agencies. An addendum to this evaluation to include the project area is expected before final submission to EGLE.

Project work located in already-developed areas where there is minimal habitat present for threatened and endangered species is expected to have “no effect” on the listed species, their habitats, or proposed or designated critical habitat.

Project work in undeveloped areas around PS 5 and 14 may impact local wildlife and plants. During the design phase, additional reviews will be made to determine if the habitat or species will be impacted. If there are any concerns, appropriate actions will be taken to avoid these areas and/or mitigate any disturbance so that the species are protected.

Figure 2-4. Topography Map



2.4 EXISTING SYSTEM

The City operates and maintains its own water distribution system for its residents and surrounding municipalities. The *Water System Capacity Study* provides details on the City's drinking water system.

2.4.1 Water Supply, Pump Stations, and Treatment

The system is supplied by 96 groundwater wells which are operated by 16 well pump stations (WPS). WPS 2, 17, and 18 are not in use due to water quality concerns. ***Table 2-2*** from the *Water System Capacity Study* provides a summary of the well pump stations.

Water treatment is provided at each WPS. The water may be treated depending on the well by chlorination, fluoridation, addition of phosphate for corrosion control, air stripping and aeration for volatile organic compound removal, and iron and manganese removal. All the well pump stations are equipped to treat water with chlorination, fluoridation, and phosphate addition except for WPS 17. WPS 1 and 11 are also set up for air stripping as well as iron and manganese removal.

Table 2-2. Summary of Well Pump Stations

WPS	Station Name	Number of Active Wells	Total Well Capacity (gpm)	Number of Pumps	Firm Pumping Capacity (gpm)	Total Pumping Capacity (gpm)
1	Central Water Treatment Plant	6	9,000	4	7,500	9,000
2[+]	Born Court	1	1,300	1	0	2,000
3/7	Balch Street	7	2,450	2	1,900	5,700
4	Maple Street	10	4,500	3	2,200	6,600
5	Schippers Lane	4	1,400	1	0	1,200
8	East Kilgore Road	5	1,750	1	0	2,400
9	West Kilgore Road	12	4,200	3	5,600	8,800
11	Kendal Avenue	7	2,350	2	1,800	3,600
12	DeHaan	4	1,400	1	0	1,200
14	Spring Valley	5	1,950	1	0	1,600
17[+]	Konkle Avenue	1	500	1	0	500
18[+]	Emerald Drive	2	1,250	2	500	1,250
22	Colony Farm	6	3,300	2	2,200	4,400
24	Atwater	16	9,700	4	11,200	16,000
25	Campbell	9	4,950	3	3,350	5,600
39	Morrow Lake	1	2,600	2	1,300	2,600

[+]Station is not in use.

2.4.2 Storage Tanks

The City has 10 storage tanks with a total storage volume of 17.8 MG, which are listed in ***Table 2-3*** with their locations, years constructed, types, and volumes. The *Water System Capacity Study* provides further details about the storage tanks.

Table 2-3. Summary of Storage Tanks

Location	Year Constructed	Type	Volume (MG)
Dartmouth	1939	Elevated	0.35
Edgemoor	1939	Elevated	0.75
Siesta	2019	Elevated	2.50
Gull Road	1982	Elevated	1.50
Mount Olivet	1955	Elevated	0.50
Parchment	1973	Elevated	0.20
Stadium Drive	2005	Elevated	1.50
6th Street	2005	Elevated	1.00
Beech	2007	Elevated	2.50
Blakeslee	1932	Below Ground	7.00

2.4.3 Booster and Bleeder Stations

The City operates 16 booster and bleeder stations to adequately distribute water to all 11 pressure districts. ***Table 2-4*** from the *Water System Capacity Study* provides a summary of the booster and bleeder stations.

Table 2-4. Summary of Booster and Bleeder Stations

	Station Name	Type	Boost (gpm)	Firm Boost (gpm)	Number of Pumps	Bleed (gpm)
6	Parker	Booster/Bleeder	2,400	0	1	700
10	East Main	Booster/Bleeder	2,000	0	1	1,000
11A	Kendall	Booster	1,600	500	4	-
21	Miller Road	Bleeder	-	-	-	1,400
23	Gull Road	Booster/Bleeder	1,000	0	1	650
28	Beech	Booster	1,600	800	2	-
29	9th Street	Booster	1,600	800	2	-
30	Parkview	Bleeder	-	-	-	2,400
31	Prairie	Booster	3,200	1,600	2	-
32	Almena	Bleeder	-	-	-	
33	33rd Street	Bleeder	-	-	-	1,300

	Station Name	Type	Boost (gpm)	Firm Boost (gpm)	Number of Pumps	Bleed (gpm)
34	KL Avenue	Bleeder	-	-	-	
35	KL Avenue – US131	Booster/Bleeder	1,000	0	3	750
36	West Main	Bleeder	-	-	-	
40	Q Avenue	Booster				-
41	unnamed	Bleeder	-	-	-	

2.4.4 Water Distribution System

The City owns over 800 miles of water main, almost entirely cast or ductile iron, and with diameters ranging in size from 2- to 30-inch. The oldest water mains that are still in use were constructed in the 1930s.

2.4.5 Residuals Handling

Treatment processes and residual handling at the Water Treatment Plant are not being changed. Therefore, there are no negative impacts associated with residuals.

2.4.6 Water Meter and Reading Infrastructure

The City maintains an active water efficiency program to minimize water loss, maintain accurate records, and maximize revenue. Water meter testing and replacement is included in the program. A replacement schedule with refurbished or new meters is set up for meters every 10 years in residential areas or 3 years in commercial and industrial areas.

2.4.7 Design Capacity

Table 2-5 summarizes the recent and projected future demands. The *Water Reliability Study* provides details on the demand development.

Table 2-5. Recent and Projected Future Demand

	Demand (MGD)		
	2019	2025	2040
Average Day Demand	2.6	3.0	3.2
Maximum Day Demand	3.2	5.8	6.2
Peak Hour Demand	7.8	8.0	8.7

2.5 SUMMARY OF PROJECT NEED

2.5.1 Compliance with Drinking Water Standards

The City's water system is in compliance with Michigan drinking water standards. The proposed project will ensure continued compliance with drinking water standards and reduce the risk of any potential non-compliance by addressing water quality concerns of PFAS and iron concentrations.

2.5.2 Orders of Enforcement Actions

There are no current enforcement orders against the City. An Administrative Consent Order was issued December 3, 2020, and resolved April 30, 2022, with the *Water System Capacity Study.*

2.5.3 Water Quality

The City has documented water quality problems of detectable PFAS and iron concentrations at pump stations 5 and 14. The proposed project is expected to provide water quality benefits by adding water treatment for iron and PFAs removal at those pump stations.

2.5.4 Projected Needs for the Next 20 Years

Project needs for the next 20 years beyond those listed in the Project Plan are documented in the *Water System Reliability Study*. Future needs are primarily related to maintaining existing infrastructure, replacing old, undersized water main and constructing new water main to connect existing mains for improved water quality and distribution.

2.6 EXPLORATORY WELL INVESTIGATIONS/WELL SITE SELECTION/TEST WELL DRILLING PROCEDURES

No new water supply wells are included in the proposed project.

3.0 ANALYSIS OF ALTERNATIVES

The alternatives analysis examines the project objectives, constraints, and cost-effectiveness over a 20-year planning period.

3.1 NO ACTION

No action would retain the existing, aging infrastructure. Not treating the raw water from PS 5 and 14 will negatively impact future water quality leading to non-compliance with state and federal regulations.

3.2 OPTIMUM PERFORMANCE OF EXISTING FACILITIES

The existing water system is performing as well as it can and additional staffing, staff training, and operational changes are not likely to improve the performance of the system because the primary concerns are related to the condition of the infrastructure. Therefore, this alternative was not considered further.

3.3 REGIONALIZATION

There are no regional alternatives.

3.4 CONSTRUCTION ALTERNATIVES

3.4.1 Pump Station 5 and 14 Upgrades

3.4.1.1 Alternative 1, Pump Station 5 and 14 Consolidated WTP

Alternative 1 proposes the implementation of a single consolidated 3,000-gpm capacity water treatment plant near PS 5. This facility would treat the combined flows from PS 5 (1,400 gpm) and from PS 14 (1,600 gpm), which is located approximately 1.3-miles north of proposed plant site. Improvements and upgrades to the pumps and treatment processes at each station are included in alternative 1 as well as a new 9,000-ft raw water transmission main to convey flows from PS 14. Details of these improvements, including a summary of the treatment processes the plant will be equipped, with are outlined below:

- **Upgrades to Well Pumps (PS 5 and 14):** The existing well pumps at both pump stations need replacement due to their age. The existing wells will be cleaned and inspected for leaks. Consequently, all wells at these stations will undergo replacement with new units having similar flow rates to the existing pumps, ensuring enhanced performance. The recommendation involves installing a total of four replacement well pumps at PS 5 and five well pumps at PS 14. These replacements are designed to efficiently handle the rated capacities of 1,400 gpm at PS 5 and 1,600 gpm at PS 14. Dedicated well pump houses will be constructed to house these newly installed replacement pumps.
- **Booster Pumps Upgrades (PS 5 and PS 14)**: At PS 14, the current configuration includes a single horizontal split case booster pump, rated at 1600 gpm flow and 180 feet head. The recommendation is to replace this existing horizontal split case booster pump with two new vertical split case pumps rated at 1600 gpm each rated at 120-ft of head. The purpose of these pumps is to convey flow from PS 14 to PS 5 for further treatment before pumping into distribution system. The total head (120-ft) calculated for pumping is explained in detail in the next section. The new pumps will be on variable frequency drives to account for pumping with flow and head variations. This arrangement ensures a firm capacity of 1600 gpm with the one

pump out of service. The existing pump will be demolished, and new pumps will be housed in the existing PS 14 building.

Pump Station 5 improvements within this alternative include four new high-service pumps; three pumps are rated at 1,500 gpm each, and one rated at 700 gpm. These high-service pumps will be housed in a pump room located in a new treatment building at PS 5. This new facility will house all the recommended treatment processes for PS 5. This arrangement ensures a firm capacity of 3,000 gpm with the largest and smallest pump out of service.

- **New transmission main from PS 14 to PS 5**

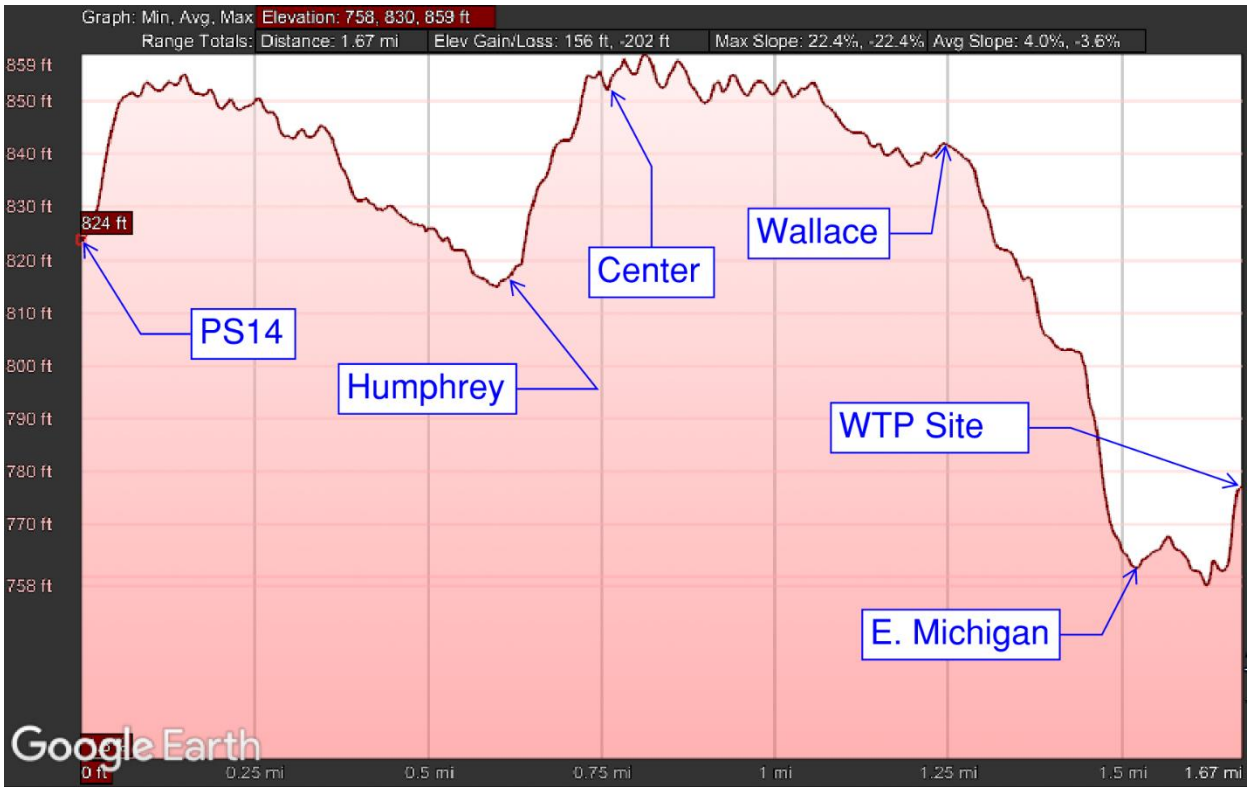
  As mentioned above, a new raw transmission main will be required to convey a flow rate of 1,600 gpm from PS 14 to the proposed consolidated treatment plant. PS 14 is located south of Spring Lake within the Spring Valley Park property. PS 5 and the plant site are located near the corner of E. Michigan Ave and Schippers Lane. A fairly direct alignment is possible routing the water main within public road rights-of-ways totaling approximately 9,000-ft. ***Figure 2-1*** shows the proposed transmission line.

  The proposed alignment is routed from PS 14 along Henson Ave to Junction Ave, where it shifts west to Humphrey St. There it jogs east 150-ft to Trimble Ave and continues south, crossing Main St to Charles Ave. At Charles Ave, the alignment again jogs east to Wallace Ave. Wallace Ave intersects E. Michigan Ave near Schippers Lane. The plant site is approximately 660-ft east on Schippers from the corner of E. Michigan Ave and Schippers Lane. Most of the alignment can be installed via open cut construction, however, jack and bore crossings may be required at Gull Rd and Main St. The main will likely be under the pavement and would require a minimum of one lane of pavement replacement. The final alignment may vary from this and will be based on the best route available while maintaining the required separation from existing water distribution mains and storm and sanitary sewer lines.

  The profile of this route is presented in ***Figure 3-1*** below with PS 14 being on the left and the WTP site on the right. Spring Valley Park is a regionally depressed area compared to the immediately surrounding grade, as indicated by the initial immediate 25-ft change in elevation from 824-ft to 850-ft. From there it is a gradual downhill slope to the low point of 815-ft at Humphrey St. There is a sharp incline along Trimble Ave to Center St, where the profile generally levels off to Charles Ave and across to Wallace Ave. At Wallace, the profile drops steeply, dropping 80-ft in elevation in a quarter mile.

  The 10-States Standards stipulate a minimum pressure of 20 psi at ground level at all points is required. Therefore, a static head of 60-ft is required. A 12-inch diameter pipe would result in velocities of 4.5-feet per second (fps) at 1,600 gpm and friction losses of 55-ft to reach Wallace, where a pressure control valve would be located to regulate pressures the remaining distance. The pumps would see a TDH of 115 to 120-ft of head at 1,600 gpm. Combination air / vacuum valves will also be required at points along the transmission main.

Figure 3-1. Transmission Main Route Elevation Profile



- **Treatment Plant Processes at PS 5**

  Figure 3-2 shows the proposed water treatment plant layout at PS 5.

  - **Groundwater Oxidation:** Water from the well pumps will be pumped into water holding tanks. Prior to reaching these holding tanks, chlorine will be injected into the well water. Chlorine feed rates shall be determined as required to oxidize iron and manganese removal levels in the raw water at a combined flow capacity of 3000-gpm.
  - **Oxidation/Detention Tanks:** The raw water to which chlorine has been added will be pumped into one of two water holding tanks. This step provides extended detention time and allows for complete oxidation of dissolved iron and manganese present in the groundwater supply. This pre-filtration process occurs before the water undergoes pressure filtration. Additionally, the presence of Oxidation/Detention Basins contributes to improved process efficiency and pump control. Two 24-ft diameter and 13-ft tall oxidation/detention tanks are proposed to handle the combined flow from PS 5 and 14. These tanks will be located on the site outside of the new pump and treatment building.
  - **Pre-Filter Oxidation:** Greensand filters require "oxidizing conditions" within the filters to effectively reduce and capture remaining soluble iron and manganese on filter media. It is considered beneficial to minimize chlorine residuals from the detention basin and Greensand Pressure Filters to reduce adsorption capacity impacts on GAC. Therefore, "tweaking" of chlorine residual prior to the Greensand Pressure Filters will enhance process control and operation flexibility.
  - **Booster/High Service Pumps:** The pressure of the water in the oxidation/detention tanks will be raised by a set of booster/high service pumps. These pumps will provide the pressure to

overcome the losses through the greensand filters and GAC contactors and provide the necessary pressure to enter the distribution system. A set of 4 pumps will be provided, three with a capacity of 1,500 gpm each and one with a capacity of 700 gpm, to provide a firm capacity of 3,700 gpm.

- **Pressure Filters (Greensand Filters):** Analysis of groundwater sampling data spanning from 2017 to 2019, as detailed in the Wightman Basis of Design report, has identified elevated levels of iron and manganese surpassing the secondary Maximum Contaminant Levels (MCLs). To address this, Greensand filters will be employed with the specific goal of reducing iron and manganese concentrations to levels below the secondary MCLs. This approach meets regulatory standards and also prevents potential fouling of Granular Activated Carbon (GAC) filters by iron and manganese particulates. A total of eight 12-ft diameter cylindrical type pressure filters are proposed to handle the combined flow of 3000 gpm from PS 5 and 14. These filters will be located in the treatment building.
- **PFAS Treatment (GAC Adsorption):** Analysis of individual well sampling data for Station 5 in 2020, as outlined in the Wightman Basis of Design report, shows elevated levels of PFAS compounds like Perfluorooctanoic Acid (PFOA), Perfluorooctane Sulfonic Acid (PFOS), Perfluorohexane Sulfonic Acid (PFHxS), Perfluorobutane Sulfonic Acid (PFBS), and Perfluorohexanoic Acid (PFHxA). These concentrations were observed to be approaching or exceeding the proposed EPA regulatory maximum contaminant levels.

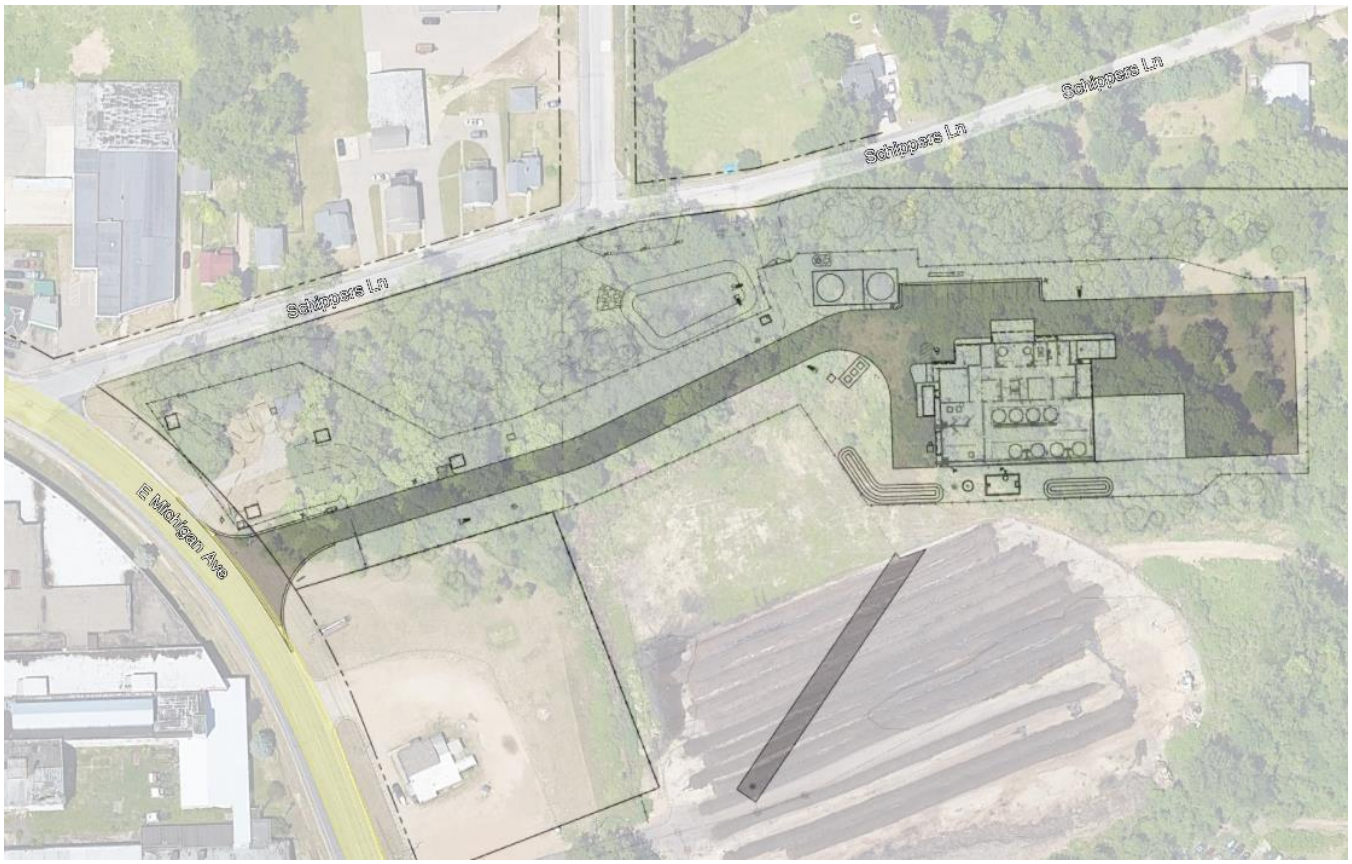
  Similarly, well sampling data at station 14 showed detected concentration levels for PFOS that were slightly above the proposed EPA regulatory maximum contaminant levels.

  To address, the recent PFAs compounds detected, Granular Activated Carbon (GAC) filters will be installed after the removal of iron and manganese through Greensand filters, to effectively eliminate PFAS substances from the water. This process aims to reduce PFAS levels to below the Michigan drinking water Maximum Contaminant Levels (MCLs) established for PFAS and the proposed USEPA regulations. Thus, for the combined flow of 3000 gpm, four trains of 12-ft diameter lead-lag configuration of GAC adsorption contactors are recommended. This results in a total of eight vessels with two vessels per train.
- **Backwash Holding Tank:** The greensand filter and GAC adsorption filters will require periodic backwashing, where water is reversed through the filter media to eliminate accumulated particles and rejuvenate the filters' efficiency. The backwash holding tank will serve as a reservoir to store water utilized during the backwashing operation for both greensand and GAC adsorption filters. Assuming a backflow rate of 1000 gpm and a detention time of 40 mins, the required backwash tank volume needed is 40,000. Thus, a belowground 40,000 gallon tank is provided in the site with approximate dimensions of 20-ft by 30-ft area with an approximate depth of 10-ft.
- **Final Disinfection: The** majority of iron and manganese will be removed through the oxidation and greensand pressure filtration system. In addition to PFAS, the GAC adsorption system will also reduce total organic carbon (TOC) concentrations. To complete the treatment process, chlorine will be introduced into the finished water as a final disinfection step. This addition of chlorine will serve as a disinfectant and also ensure the maintenance of a minimum residual chlorine concentration throughout the distribution system. Based on a chlorine demand of 2 mg/L and a total of 3000 gpm, a total feed of 72 pounds per day of chlorine injection is required.
- **Corrosion Control:** The city has been feeding sodium hexametaphosphate at their existing pump station which has acts as a sequestering agent for iron, manganese, and calcium as well as a corrosion control measure. Currently, the City is changing to a liquid corrosion control

chemical for ease of application and to provide a higher level of corrosion control against lead and other metallic components in the distribution system. This alternative presents a similar strategy of using orthophosphate storage and feed systems for corrosion control. Based on the target orthophosphate dose of 4 mg/L as PO4, the design dosage value is determined to be 5.5 mg/l as PO4 at the injection point. For the combined flow of 3000 gpm, a total feed of 200 pounds per day of blended orthophosphate injection is required.

- **Fluoridation:** Fluoridation is a public health measure aimed at preventing tooth decay and improving dental health in communities. This alternative includes fluoridation using Hydrofluorosilicic Acid (H2SiF6) storage and feed to provide a design dose of 0.99 mg/l to maintain minimum fluoride levels in the distribution system. For the combined flow of 3000 gpm, a total feed of 36 pounds per day of Hydrofluorosilicic Acid injection is required.
- **New Pump and Treatment Building:** A new approximately 21,000 square foot building, is proposed at the site to serve as a dedicated Pump and Treatment Building. The new treatment facilities shall be located east of the existing well field site with access from East Michigan Ave on land currently owned by the City. This facility is designed to accommodate various components crucial to the water treatment process. There is dedicated space within this building allocated for high-service pumps, pressure filters, GAC adsorption filters, chemical feed systems, chemical feed storage, an electrical room, and other areas essential for the operation and maintenance of the water treatment system.

Figure 3-2. Treatment Plant Footprint at PS 5



3.4.1.2 Alternative 2, Individual WTPs at Pump Station 5 and 14

Alternative 2 proposes the construction of two water treatment plants, with the first one being a 1,600 gallons per minute (gpm) WTP located at PS 14, and the second one being a 1,400 gpm WTP at PS5. ***Figure 3-2*** shows the proposed site layout at PS 5. ***Figure 3-3*** shows the proposed site layout at PS 14.

A. Station 14 Upgrades

- **Well Pumps Upgrades:** Station 14 consists of 5 vertical turbine well pumps in service. These pumps need replacement due to their age. The existing wells will be cleaned and inspected for leaks. Consequently, all wells will undergo replacement with new units having similar flow rates to the existing pumps, ensuring enhanced performance. The recommendation under this alternative involves installing a total of five well pumps with a firm capacity of 1600 gpm. Dedicated well pump houses will be constructed to house these newly installed replacement pumps.
- **Booster Pumps Upgrades:** At PS 14, the current configuration includes a single horizontal split case booster pump, rated at 1600 gpm flow and 180 feet head. The recommendation is to replace this existing horizontal split case booster pump with two new horizontal split case pumps rated at 1600 gpm each rated at 240-ft of head. This arrangement ensures a firm capacity of 1600 gpm with the one pump out of service. The purpose of these pumps is to effectively continue the existing production capacity of PS 14. The existing pump at the current PS 14 building will be decommissioned. Due to spatial constraints in the existing pump building at PS 14, the new pump will be housed in a new treatment building. This new building is designed to house the booster pumps and various other process components for water treatment at this station. Additional costs associated with land acquisition will be considered, given the limited space near the current building.
- **New Pump and Treatment Building:** A new building measuring approximately 110 feet by 140 feet, is proposed at the site to serve as a dedicated Pump and Treatment Building. This facility is designed to accommodate various components crucial to the water treatment process. There is dedicated space within this building allocated for high-service pumps, pressure filters, GAC adsorption filters, chemical feed systems, chemical feed storage, an electrical room, and other areas essential for the operation and maintenance of the water treatment system. There is space for the facility in the existing park near PS14, however, due to the community impacts this would have, land acquisition costs for a separate parcel nearby were included.
- **Groundwater Oxidation:** This process will be similar to the description outlined in alternative 1. Chlorine feed rates shall be determined to feed chlorine required for iron and manganese removal levels at the individual flow of 1,600 gpm for PS 14.
- **Oxidation/Detention Basins:** This process will be similar to the description outlined in alternative 1. One 24-ft diameter and 16-ft tall oxidation/detention tank is proposed to handle the individual flow of 1,600 gpm for PS 14. This tank will be located on the site outside the new pump and treatment building.
- **Pre-Filter Oxidation :** This process will be similar to the description outlined in alternative 1.
- **Pressure Filters :** This process will be similar to the description outlined in alternative 1. A total of four 14-ft diameter cylindrical type pressure filters are proposed to handle the flow of 1600 gpm for PS 14. These filters will be located in the new treatment building.
- **PFAS Treatment (GAC Adsorption):** As mentioned in alternative 1, station 14 well sampling data showed significant PFOS levels exceeding the proposed EPA MLCs. Thus, for this alternative, GAC adsorption filters are recommended. The individual PS 14 station flow of 1600 gpm required two

trains of 12-ft diameter lead-lag configuration of GAC Adsorption filters. This results in a total of four vessels with two lead-lag vessels per train.

- **Backwash Holding Tank:** This alternative includes a backwash holding tank for the backwash flow storage from the greensand filters and the GAC filters. Assuming a backflow rate of 400 gpm and a detention time of 40 mins, the required backwash tank volume needed is 16,000. Thus, a belowground 20,000 gallon tank is provided at the site with approximate dimensions of 20-ft by 30-ft area with an approximate depth of 10-ft.
- **Final Disinfection** This process will be similar to the description outlined in alternative 1. Based on the chlorine demand of 2 mg/l and for the PS 14 flow of 1600 gpm, a total feed of 38 pounds per day of chlorine injection is required.
- **Corrosion Control** This process will be similar to the description outlined in alternative 1 Based on the target orthophosphate dose of 4 mg/L as PO4, the design dosage value is determined to be 5.5 mg/l as PO4 at the injection point. Thus, a total feed of 110 pounds per day of blended orthophosphate injection is required for 1600 gpm flow for PS 14.
- **Fluoridation** This process will be similar to the description outlined in alternative 1. Based on the target Hydrofluorosilicic Acid demand of 0.99 mg/l, a total feed of 20 pounds per day of Hydrofluorosilicic Acid injection is required for 1600 gpm flow for PS 14.

Figure 3-3. Treatment Plant Footprint at PS 14

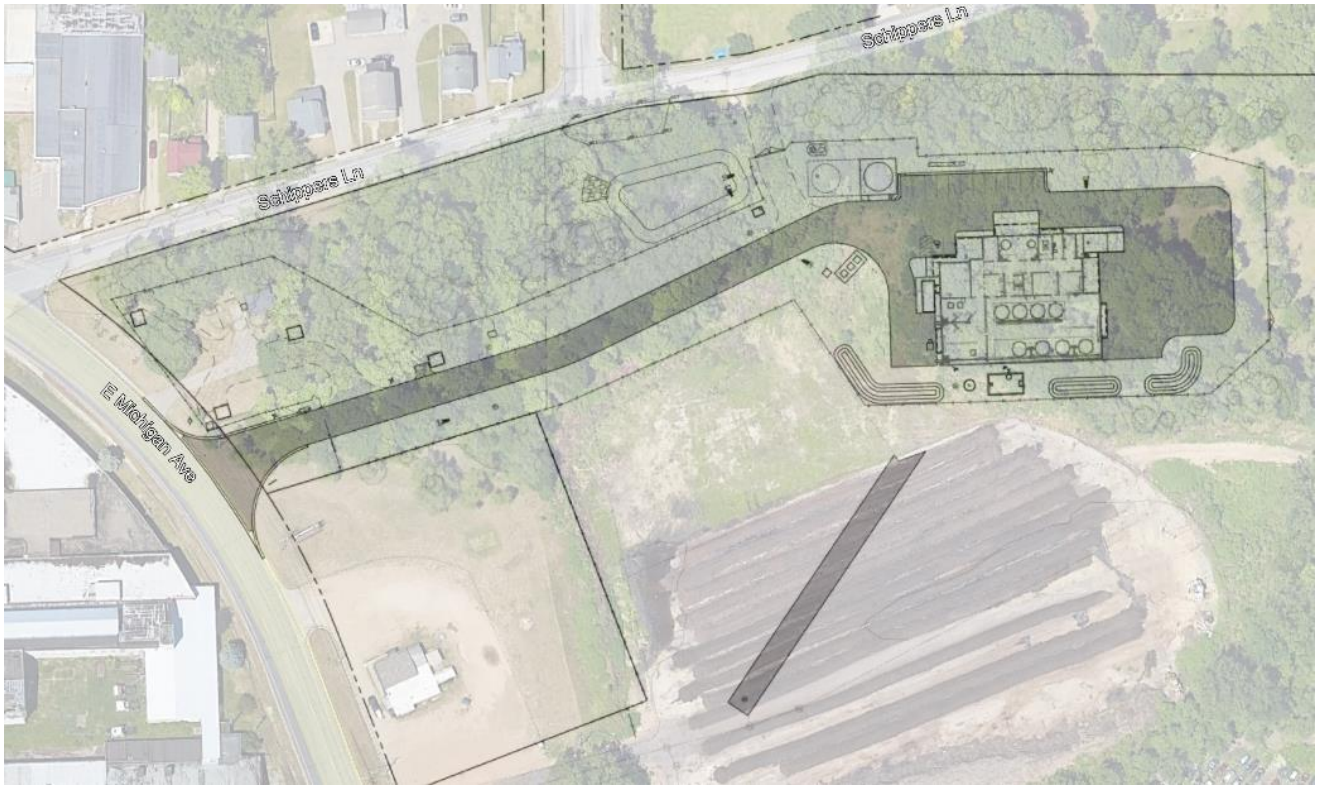
B. Station 5 Upgrades

- **Well Pumps Upgrades** Station 5 consist of four 350 gpm vertical turbine well pumps. These pumps need replacement due to their age. The existing wells will be cleaned and inspected for leaks. Consequently, all wells will undergo replacement with new units having similar flow rates to the existing pumps, ensuring enhanced performance. The recommendation under this alternative involves installing a total of four well pumps for a total capacity of 1,400 gpm. Dedicated well pump houses will be constructed to house these newly installed replacement pumps.

- **Booster Pumps** For this alternative, it is recommended to install three new horizontal split case booster/high service pumps: two pumps rated at 1400 gpm each and one at 800 gpm. This arrangement ensures a firm capacity of 2400 gpm even with the largest pump out of service. The new pumps will be housed in a new treatment building. This new building is designed to house the booster pumps and various other process components for water treatment at this station. The booster pumps will be sized to boost pressure to go through the filters and GAC contactors and then provide the necessary pressure for the distribution system.

- **Groundwater Oxidation** This process will be similar to the description outlined in alternative 1. Chlorine feed rates shall be determined to feed chlorine required iron and manganese removal levels at the individual flow of 1,400 gpm for PS 5.
- **Oxidation/Detention Basins** This process will be similar to the description outlined in alternative 1. One 24-ft diameter and 16-ft tall oxidation/detention tank is proposed to handle the total flow of 1,400 gpm for PS 5. This tank will be located on the site outside the pump and treatment building.
- **Pre-Filter Oxidation** This process will be similar to the description outlined in alternative 1.
- **Pressure Filters** This process will be similar to the description outlined in alternative 1. A total of four 12-ft diameter cylindrical type pressure filters are proposed to handle the flow of 1400 gpm for PS 5. These filters will be located in the new pump and treatment building.
- **PFAS Treatment (GAC Adsorption)** As mentioned in alternative 1, the analysis of individual well sampling data for Station 5 in 2020, as outlined in the Wightman Basis of Design report, shows elevated levels of PFAS compounds. Thus, for this alternative, GAC adsorption filters are recommended. The PS 5 station flow of 1400 gpm requires two trains of 12-ft diameter lead-lag configuration of GAC Adsorption filters. This results in a total of four vessels with two vessels per train.
- **Backwash Holding Tank :** This alternatives includes a backwash holding tank for the backwash flow storage from the greensand filters and the GAC filters. Assuming a backwash flow rate of 400 gpm and a detention time of 40 mins, the required backwash tank volume needed is 16,000. Thus, a below ground 20,000 gallon tank is provided in the site with approximate dimensions of 20-ft by 15-ft area with an approximate depth of 10-ft.
- **Final Disinfection** This process will be similar to the description outlined in alternative 1. Based on the chlorine demand of 2 mg/l and for the PS 5 flow of 1400 gpm, a total feed of 34 pounds per day of chlorine injection is required.
- **Corrosion Control** This process will be similar to the description outlined in alternative 1 Based on the target orthophosphate dose of 4 mg/L as PO4, the design dosage valve is determined to be 5.5 mg/L as PO4 at the injection point. Thus, a total feed of 100 pounds per day of blended orthophosphate injection is required for 1400 gpm flow for PS 5.
- **Fluoridation** This process will be similar to the description outlined in alternative 1. Based on the target Hydrofluorosilicic Acid dose of 0.99 mg/l, a total feed of 17 pounds per day of Hydrofluorosilicic Acid injection is required for 1400 gpm flow for PS 5.
- **New Pump and Treatment Building:** A new building measuring approximately 110 feet by 140 feet, is proposed at the site to serve as a dedicated Pump and Treatment Building. The new treatment facilities shall be located east of the existing well field site with access from East Michigan Avenue on land currently owned by the City. This facility is designed to accommodate various components crucial to the water treatment process. There is dedicated space within this building allocated for booster/high-service pumps, pressure filters, GAC adsorption filters, chemical feed systems, chemical feed storage, an electrical room, and other areas essential for the operation and maintenance of the water treatment system.

Figure 3-4. Treatment Plant Footprint at PS 5



3.5 MONETARY EVALUATION

The monetary evaluation compares the present worth of the alternatives over a 20-year planning period. It does not include costs accrued before or during the Project Plan phase. The real discount rate used for the present worth analysis is 2.5 percent (from the United States Office of Management and Budget when the project planning began in December 2023). Appendix D includes the detailed cost opinions and present worth calculations with weighted useful life for each alternative.

3.5.1 Pump Station 5 and 14 Upgrades

Alternative 2 has a higher capital cost than Alternative 1 due to construction of two WTPs. Operations and maintenance costs include the cost to maintain the equipment, chemicals, energy consumption, and labor. ***Table 3-1*** provides the present worth of Project 1 Alternatives 1 and 2.

Table 3-1. Alternatives 1 and 2 Present Worth

Cost Category	Alternative 1	Alternative 2
Capital Cost	$51,304,000	$66,424,000
Present Worth of Salvage Value	($14,863,000)	($18,345,000)
Present Worth of Annual OM&R	$11,614,000	$14,561,000
Total Present Worth	**$45,055,000**	**$62,640,000**

3.6 ENVIRONMENTAL EVALUATION

The principal alternatives have potential environmental impacts which can be beneficial or adverse, short- or long-term, and reversible or irreversible. Both alternatives require work in undeveloped areas. The proposed water main for Alternative 1 will be placed within the existing right-of-way and will not have an impact on previously undisturbed land.

No cultural or historical resources, agricultural resources, coastal zones, floodplains, wild and scenic or natural rivers, or major surface waters will be impacted by either alternative as discussed in Section 2.3.

3.6.1 Recreational Areas

Recreational areas will be impacted by Alternative 2. Alternative 2 includes construction of treatment plants near Spring Valley Lake Park. Alternative 1 is the preferred alternative to minimize impacts to recreational areas.

3.6.2 Wetlands

Wetlands exist primarily along Spring Valley Lake and Schippers Lane. Both alternatives are expected to have wetlands present in the construction area. During the design phase of the project, all necessary permits will be obtained and impacts to wetlands will be minimized and/or mitigated. Alternative 1 is the preferred alternative to minimize impacts to wetlands since it is limited to one area.

3.6.3 Existing Plant and Animal Communities

Threatened or endangered species or their habitat may be affected by either alternative. During the design phase, additional reviews will be made to determine if the habitat or species will be impacted. If there are any concerns, appropriate actions will be taken to avoid these areas and/or mitigate any disturbance so that the species are protected. Alternative 1 is the preferred alternative to minimize impacts to wildlife since it is limited to one area.

3.7 TECHNICAL CONSIDERATIONS

The principal alternatives comply with Safe Drinking Water Act and are designed to meet the standard recommended guidelines established in the “Recommended Standards for Waterworks.” Sufficient pumping capacity to meet design flows, a minimum of two units for each treatment process, adequate storage volume, and stand-by power requirements were all met for each alternative considered. Technical considerations are detailed in Sections 3.4.1.

3.8 NEW/INCREASED WATER WITHDRAWALS

There is no proposed increase in water withdrawals associated with this project.

4.0 SELECTED ALTERNATIVE

The selected alternative includes the following project:

- **Project 1, Alternative 1**: A consolidated water treatment plant will be constructed near PS 5 with a transmission main pumping raw water from PS 14 for iron and PFAS treatment. This alternative has the lowest capital, operation and maintenance, and present worth costs. The project also minimizes potential negative impacts such as the loss of park land and wetlands at PS 14.

4.1 DESIGN PARAMETERS

The project will meet local and state water distribution standards while improving water quality. More information on the calculations and assumptions made for the design parameters are found in Section 1.1.

The selected alternative includes:

- A single consolidated 3,000-gpm capacity water treatment plant near PS 5 to treat the combined flows from PS 5 (1,400 gpm) and from PS 14 (1,600 gpm).
- Four replacement well pumps at PS 5 and five well pumps at PS 14 to handle the rated capacities of 1,400 gpm at PS 5 and 1,600 gpm at PS 14.
- Two new vertical turbine pumps rated at 1,600 gpm each rated at 120 feet of head with variable frequency drives to account for pumping with flow and head variations to convey water from PS 14 to PS 5 for treatment.
- Four new high-service pumps at PS 5 to handle incoming flow from PS 14; three with a capacity of 1,500 gpm each and one with a capacity of 700 gpm.
- 9,000 feet of 12-inch transmission main from PS 14 to PS 5.
- Treatment Plant Processes at PS 5
    - Groundwater oxidation.
    - Two 24-ft diameter and 13-ft tall oxidation/detention tanks.
    - Pre-filter oxidation.
    - Eight 14-ft diameter cylindrical type pressure filters.
    - Eight vessels with two vessels per train of 12-ft diameter lead-lag configuration of GAC adsorption filters.
    - A 40,000-gallon backwash holding tank with approximate dimensions of 40-ft by 30-ft area with an approximate depth of 10 feet.
    - Final Disinfection with a total feed of 72 pounds per day of chlorine injection.
    - Corrosion control with a design dosage valve of 5.5 mg/l (total feed of 200 pounds per day) of blended orthophosphate injection.
    - Fluoridation using hydrofluorosilicic acid (H2SiF6) storage and feed to maintain minimum fluoride levels of 0.99 mg/l (total feed of 200 pounds per day) in the distribution system.
    - A new pump and treatment building measuring approximately 170 feet by 140 feet.

4.2 USEFUL LIFE

The selected alternative is expected to have a useful life of 43 years.

4.3 WATER AND ENERGY EFFICIENCY

The selected alternative is the most energy efficient of the project alternatives because it consolidates water treatment operations to one area. This alternative does require pumping water from PS 14 to PS 5, which is an additional energy cost, but is less than maintaining two WTPs.

Water loss may become an issue for the transmission main but can be avoided with regular maintenance.

4.4 SCHEDULE FOR DESIGN AND CONSTRUCTION

Table 4-1 provides a proposed schedule for the Project Plan submittal. ***Table 4-2*** presents the anticipated funding schedule for the project proposed for implementation within five years.

Table 4-1. Proposed SRF Project Schedule

Task	Complete By
Public Meeting Notice	April 12, 2024
Place Draft Project Plan on Public Record	April 23, 2024
Formal Public Meeting	May 6, 2024
Commission Approval of Project Plan	May 20, 2024
Submit Final Project Plan to EGLE	June 1, 2024

Table 4-2. Anticipated Funding Schedule for Proposed Project

Project	SRF Fiscal Year
Project 1: Pump Stations 5 and 14 Upgrades	2026

4.5 COST SUMMARY

Table 4-3 lists the selected alternative for the project and the associated costs. Project 1 is fully eligible for SRF funding.

Table 4-3. Selected Alternative Cost Summary

Project	Project Cost	Present Worth	SRF Eligible	SRF Eligible Cost	Annual Equivalent Cost
Project 1: Pump Stations 5 and 14 Upgrades	$51,304,000	$48,055,000	100%	$51,304,000	$3,292,000

The costs for the project described herein will be paid for by user charges. ***Table 4-4*** shows the user charges calculated over the useful life of the project. The City intends to implement this project over a five-year period, so the rate increases also will be staged as the project proceeds. ***Table 4-2*** lists the planned construction years for each project,

Table 4-4 estimates the typical quarterly user charge per typical residential user in the City for each project.

The quarterly user charge in the last column is calculated per the following steps:

Column 2: SRF Eligible Project Cost

Column 3: Annual Debt Service = Project Cost times Capital Recovery Factor based on 20-year SRF loan at 2.5%

Column 4: Additional Annual O&M Cost

Column 5: Total Annual Cost

Column 6: Quarterly User Charge = Total Annual Cost/42,376 residential equivalent units/4 billing periods per year

Table 4-4. Estimated User Charge Summary

Column 1: Project	Column 2: SRF Project Cost	Column 3: Annual Debt Service = Col 2 x 0.06415	Column 4: Additional Annual O&M	Column 5: Total Annual Cost = Col 3 + Col 4	Column 6: Quarterly User Charge = Col 5/169,504
Project 1: Pump Stations 5 and 14 Upgrades	$51,304,000	$3,291,152	$745,000	$4,036,152	$23.81

4.6 IMPLEMETABILITY

The City Commission has the sole legal authority to implement the Project Plan. A copy of the resolution is provided in Appendix F.

The City's Department of Public Services maintains a full-time engineering staff and will implement the selected alternative with in-house engineering staff and assistance from engineering consultants. The City has the managerial capability and financial means to implement the selective alternatives.

5.0 ENVIRONMENTAL AND PUBLIC HEALTH IMPACTS

The anticipated environmental impacts resulting from the construction of the selected alternative include beneficial and adverse, short-term and long-term, and irreversible and irretrievable impacts.

5.1 DIRECT IMPACTS

5.1.1 Construction/Operational Impacts

Construction of the proposed facilities will be coordinated and sequenced to minimize disruptions to residential and natural areas.

The following impacts are anticipated:

- Tree removal: Tree removal will be needed for the new treatment facilities at WPS 5.
- Traffic patterns: Traffic may need to be stopped or redirected in project areas.
- Construction chemicals, dust, air emissions, and noise: Use of construction chemicals will follow safety procedures. Water will be used for dust control. Well maintained equipment will be used to minimize air emissions. Construction will occur during daylight on work weekdays to reduce noise unless significant traffic changes are required. If night work is necessary, proper permitting will be acquired.
- Groundwater/dewatering impacts and proximity to wetlands: Proper permitting will be acquired for dewatering and work near wetlands.
- Soil erosion: Soil erosion prevention will be implemented during excavation activities and the project area will be revegetated shortly after construction completion.

5.1.2 Social/Economic Impact

Short-term social and economic impacts may occur during the construction phase. Increased construction traffic may occur near the proposed project and reduced traffic capacity may create longer travel times. Most of the project is in residential or undeveloped areas, so reduced commercial activity to businesses within the project area is expected to be limited. The local economy may be stimulated for contractors and suppliers of the materials, labor, and equipment necessary to construct the project.

Increased user costs are a long-term negative impact.

5.2 INDIRECT IMPACTS

5.2.1 Changes in Development and the Associated Transportation Changes

There are no changes anticipated to development or transportation upon completion of the project. There may be temporary traffic disruptions during construction that will be managed with traffic control.

5.2.2 Changes in Land Use

Changes to land use are anticipated around PS 5. There will be tree removal to place the water treatment plant. The ground surface will be restored to existing conditions as much as possible with the new infrastructure.

5.2.3 Changes in Air or Water Quality due to Facilitated Development

There are no anticipated negative impacts to air or water quality. Upon completion of the project, water quality will be improved due to the additional treatment of iron and PFAS removal at WPS 5 and 14.

5.2.4 Changes to the Natural Setting or Sensitive Features Resulting from Secondary Growth

There are no anticipated changes to the natural setting or sensitive features resulting from secondary growth. Tree removal and ground disturbance activities will be scheduled during hibernation periods to avoid negative impacts to sensitive animals and plants.

5.2.5 Impacts of Community Aesthetics

The proposed treatment facility at WPS 5 may affect community aesthetics since it is undeveloped land with trees near a residential area. Any concerns regarding the impact on community aesthetics will be addressed during the public comment period.

5.2.6 Impacts on Cultural, Human, Social, and Economic Resources

The project will improve water quality for residents. Beneficial impacts include the creation of construction and equipment manufacturing related jobs, and local contractors will have an equal opportunity to bid on the construction contracts.

5.3 CUMULATIVE IMPACTS

5.3.1 Siltation

Siltation may occur during the construction phase of the project. Proper soil erosion and sedimentation control practices will be followed to reduce the impacts of siltation on surrounding areas.

5.3.2 Development

The project will not cause an increase in development. It is necessary to improve the performance of the existing system.

5.3.3 Multiple Projects

Construction will be completed with specified staging plans and seasonally between April 1 and October 15 to avoid significant traffic delays/detours for multiple years. If multiple projects are planned in the same vicinity of the selected alternative, an implementation plan will be used to coordinate projects and minimize disruptions to people and the natural environment.

5.3.4 Fiscal Impacts

The proposed project is necessary to improve water quality and maintain compliance with Michigan drinking water standards. The lowest cost alternative was selected to minimize negative fiscal impacts.

6.0 MITIGATION

6.1 SHORT-TERM, CONSTRUCTION-RELATED MITIGATION

The short-term adverse impacts caused by construction will be minimal and mitigatable, relative to the resulting long-term beneficial impacts. Short-term impacts include traffic disruption, dust, and noise.

Environmental disruption will occur during construction. Guidelines will be established for cover vegetation removal, dust reduction, traffic control, and accident prevention. Once construction is completed those short-term effects will end and the area will be returned to the original conditions, as practical.

The soil erosion impact will be mitigated through the contractor's compliance with a soil erosion and sedimentation control program, as required in Part 91 of Michigan Act 451, P.A. of 1994. The use of soil erosion and sedimentation controls, such as straw bales, sedimentation basins, and silt fence, will protect nearby waterways and local stormwater facilities.

Floodplain and wetland fill will require a compensating cut if the fill exceeds thresholds in Part 31 or Part 303 regulations, respectively. No impacts are expected to floodplains, but wetlands may be affected. Disturbance to wetlands will be minimized by limiting construction activities near wetlands as much as possible.

Impacts to threatened and endangered species will be minimized by removing trees and vegetation during inactive periods (October 1 to March 31). Design and construction will follow requirements for the protection of rare species.

Construction equipment will be maintained in good condition to decrease noise. The City's noise ordinance will limit construction times to avoid disturbing surrounding residential areas during evenings and weekends. Access roads will be swept to avoid tracking dirt onto public roads.

6.2 MITIGATION OF LONG TERM AND INDIRECT IMPACTS

No long-term negative impacts are anticipated. The long-term positive impacts include improved water quality.

7.0 PUBLIC PARTICIPATION

The City welcomes public participation in the planning process for transparency, to garner support for the project from the citizens, and accept comments on the Project Plan.

7.1 PUBLIC MEETING

The public meeting was held April 23, 2024, to review the work associated with the proposed Project Plan, including estimated user costs, and to receive comments and views of interested persons. A summary of the public meeting and attendance list is included in Appendix E.

7.1.1 Advertisement

A legal notice of the availability of this Project Plan for review to the public was placed online at the City's website for review by the public by April 12, 2024. In addition, copies were sent to the EGLE Water Infrastructure Financing Section and District Engineer for review.

7.1.2 Public Meeting Summary

A summary of the meeting presentation, public comments, attendees, and a final Project Plan was provided to the EGLE project manager for review.

The public meeting agenda covered the drinking water system problems targeted in the Project Plan, possible alternatives to each improvement, anticipated user costs and financing, and potential community impacts and mitigation.

7.1.3 Comments Received and Answered

No comments were received from the public.

7.2 ADOPTION OF PROJECT PLAN

The City Commission adopted the Project Plan on May 20, 2024. The signed Resolution of Adoption is included in Appendix F.

APPENDIX A: CITY OF KALAMAZOO HISTORICAL SITES

APPENDIX B: SOILS MAP

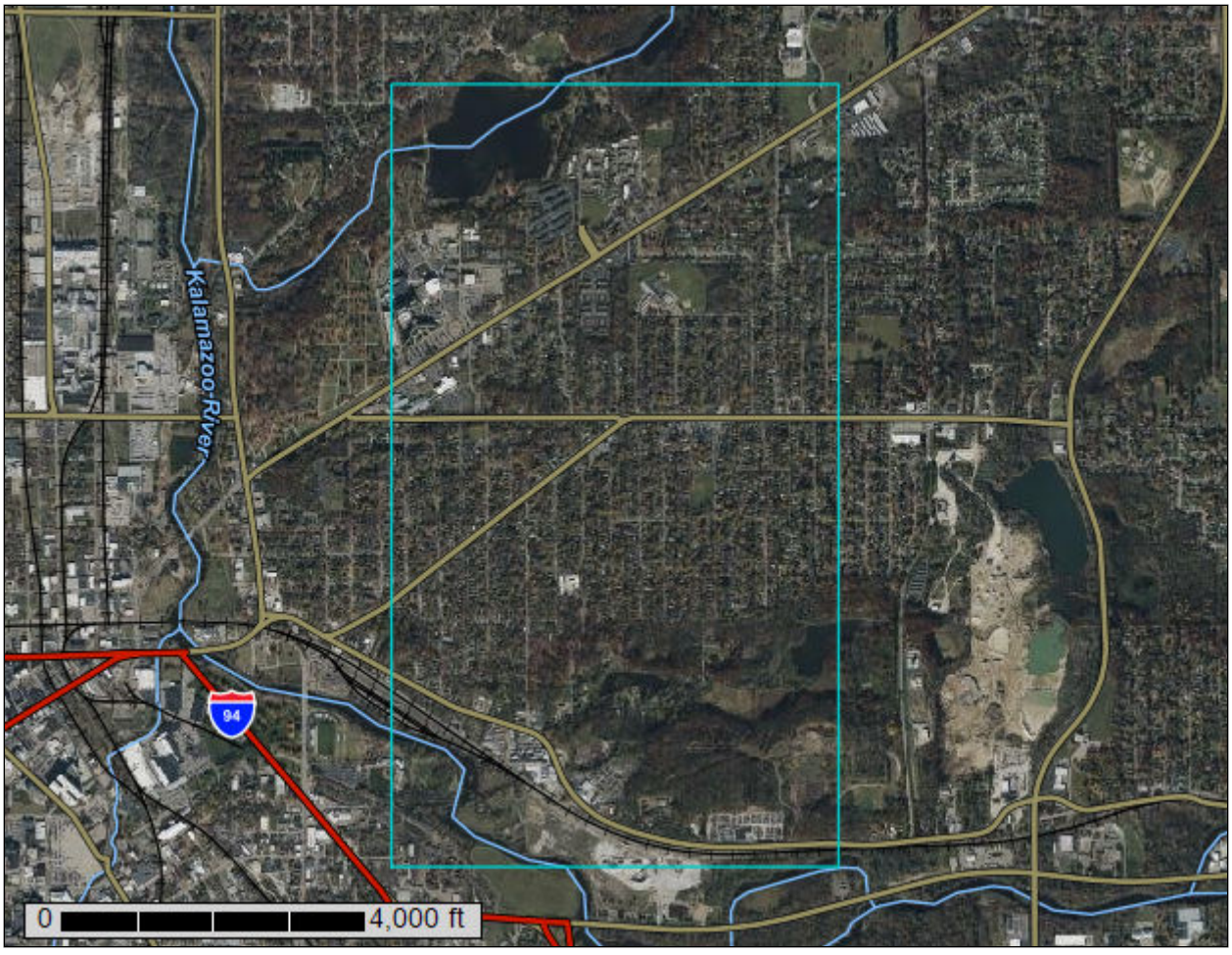
United States Department of Agriculture

NRCS

Natural Resources Conservation Service

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

Custom Soil Resource Report for Kalamazoo County, Michigan



March 6, 2024

Preface

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

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

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

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

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

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

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require

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Contents

How Soil Surveys Are Made

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

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

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

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

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

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

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

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

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

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

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

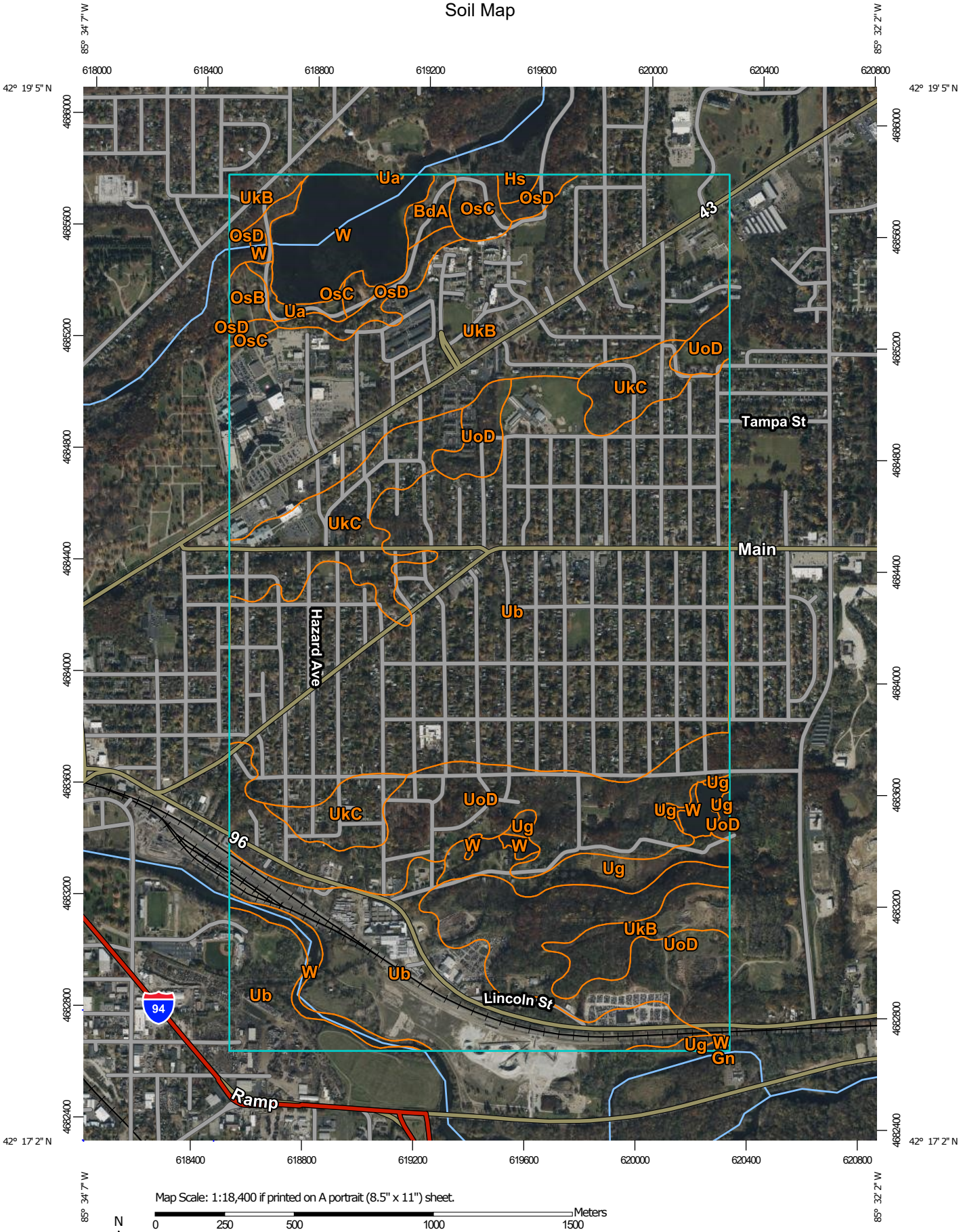
After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

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

Soil Map

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

Custom Soil Resource Report
Soil Map



Map Scale: 1:18,400 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 250 500 1000 1500

Feet: 0 500 1000 2000 3000

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 16N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:15,800.

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

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

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

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

Soil Survey Area: Kalamazoo County, Michigan
Survey Area Data: Version 18, Aug 25, 2023

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

Date(s) aerial images were photographed: Oct 4, 2022—Nov 7, 2022

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

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
BdA	Brady sandy loam, 0 to 3 percent slopes	6.8	0.5%
Gn	Glendora sandy loam	0.2	0.0%
Hs	Houghton and Sebewa soils, ponded	2.9	0.2%
OsB	Oshtemo sandy loam, 0 to 6 percent slopes	6.3	0.4%
OsC	Oshtemo sandy loam, 6 to 12 percent slopes	15.7	1.1%
OsD	Oshtemo sandy loam, 12 to 18 percent slopes	23.1	1.6%
Ua	Udipsamments, level to steep	5.8	0.4%
Ub	Urban land	622.6	44.4%
Ug	Urban land-Glendora complex	31.9	2.3%
UkB	Urban land-Kalamazoo complex, 0 to 6 percent slopes	295.7	21.1%
UkC	Urban land-Kalamazoo complex, 6 to 12 percent slopes	97.4	6.9%
UoD	Urban land-Oshtemo complex, 12 to 25 percent slopes	226.1	16.1%
W	Water	67.6	4.8%
Totals for Area of Interest		**1,402.3**	**100.0%**

Map Unit Descriptions

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

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

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

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

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

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

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

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

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

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

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion

of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

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

Kalamazoo County, Michigan

BdA—Brady sandy loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 68n2
Elevation: 600 to 1,200 feet
Mean annual precipitation: 30 to 36 inches
Mean annual air temperature: 45 to 48 degrees F
Frost-free period: 140 to 150 days
Farmland classification: All areas are prime farmland

Map Unit Composition

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

Description of Brady

Setting

Landform: Outwash plains
Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Sandy outwash

Typical profile

Ap - 0 to 12 inches: sandy loam
Bt - 12 to 24 inches: sandy loam
2BC - 24 to 56 inches: loamy sand
2C - 56 to 68 inches: sand

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat poorly drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)
Depth to water table: About 12 to 36 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 25 percent
Available water supply, 0 to 60 inches: Moderate (about 7.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: B
Ecological site: F098XA011MI - Moist Loamy Drift Plains
Hydric soil rating: No

Minor Components

Bronson

Percent of map unit: 10 percent

Landform: Flats on outwash plains
Ecological site: F098XA011MI - Moist Loamy Drift Plains
Hydric soil rating: No

Gn—Glendora sandy loam

Map Unit Setting

National map unit symbol: 68nb
Elevation: 600 to 1,000 feet
Mean annual precipitation: 30 to 36 inches
Mean annual air temperature: 45 to 48 degrees F
Frost-free period: 140 to 150 days
Farmland classification: Not prime farmland

Map Unit Composition

Glendora and similar soils: 87 percent
Minor components: 13 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Glendora

Setting

Landform: Flood plains
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Sandy alluvium

Typical profile

A - 0 to 10 inches: sandy loam
C - 10 to 60 inches: stratified sand to loamy sand

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Very poorly drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)
Depth to water table: About 0 to 12 inches
Frequency of flooding: Frequent
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 5.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6w
Hydrologic Soil Group: A/D
Ecological site: F098XA004MI - Wet Floodplains
Hydric soil rating: Yes

Minor Components

Sebewa
Percent of map unit: 5 percent
Landform: Depressions on outwash plains
Ecological site: F098XA012MI - Wet Loamy Depressions
Hydric soil rating: Yes

Adrian
Percent of map unit: 4 percent
Landform: Depressions on lake plains
Ecological site: F098XA006MI - Mucky Depressions
Hydric soil rating: Yes

Houghton
Percent of map unit: 4 percent
Landform: Depressions
Ecological site: F098XA006MI - Mucky Depressions
Hydric soil rating: Yes

Hs—Houghton and Sebewa soils, ponded

Map Unit Setting
National map unit symbol: 68nf
Elevation: 360 to 1,000 feet
Mean annual precipitation: 30 to 36 inches
Mean annual air temperature: 45 to 48 degrees F
Frost-free period: 140 to 150 days
Farmland classification: Not prime farmland

Map Unit Composition
Houghton and similar soils: 45 percent
Sebewa and similar soils: 40 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Houghton

Setting
Landform: Depressions, outwash plains
Landform position (three-dimensional): Dip
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Herbaceous organic material

Typical profile
Oa1 - 0 to 10 inches: muck
Oa2 - 10 to 60 inches: muck

Properties and qualities
Slope: 0 to 1 percent

Depth to restrictive feature: More than 80 inches
Drainage class: Very poorly drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 5.95 in/hr)
Depth to water table: About 0 inches
Frequency of flooding: None
Frequency of ponding: Frequent
Available water supply, 0 to 60 inches: Very high (about 23.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8w
Hydrologic Soil Group: A/D
Ecological site: F098XA006MI - Mucky Depressions
Hydric soil rating: Yes

Description of Sebewa

Setting

Landform: Outwash plains
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loamy over sandy and gravelly outwash

Typical profile

Ap - 0 to 11 inches: loam
Btg - 11 to 23 inches: clay loam
2Cg - 23 to 60 inches: loamy sand

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Very poorly drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: About 0 inches
Frequency of flooding: None
Frequency of ponding: Frequent
Calcium carbonate, maximum content: 25 percent
Available water supply, 0 to 60 inches: Low (about 5.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: B/D
Ecological site: F098XA012MI - Wet Loamy Depressions
Hydric soil rating: Yes

Minor Components

Glendora

Percent of map unit: 3 percent
Landform: Flood plains
Ecological site: F098XA004MI - Wet Floodplains

Hydric soil rating: Yes

Adrian

Percent of map unit: 3 percent
Landform: Depressions on lake plains
Ecological site: F098XA006MI - Mucky Depressions
Hydric soil rating: Yes

Edwards

Percent of map unit: 3 percent
Landform: Depressions on lakebeds
Ecological site: F098XA006MI - Mucky Depressions
Hydric soil rating: Yes

Granby

Percent of map unit: 3 percent
Landform: Depressions on lake plains
Ecological site: F098XA020MI - Wet Sandy Drift Depressions
Hydric soil rating: Yes

Gilford

Percent of map unit: 3 percent
Landform: Depressions on outwash plains
Ecological site: F098XA012MI - Wet Loamy Depressions
Hydric soil rating: Yes

OsB—Oshtemo sandy loam, 0 to 6 percent slopes

Map Unit Setting

National map unit symbol: 2v2cd
Elevation: 710 to 1,010 feet
Mean annual precipitation: 30 to 41 inches
Mean annual air temperature: 43 to 52 degrees F
Frost-free period: 140 to 200 days
Farmland classification: All areas are prime farmland

Map Unit Composition

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

Description of Oshtemo

Setting

Landform: Outwash plains, outwash terraces, moraines
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Interfluve, head slope, nose slope, side slope
Down-slope shape: Linear
Across-slope shape: Linear

Parent material: Loamy drift over calcareous sandy and gravelly drift

Typical profile

Ap - 0 to 8 inches: sandy loam
E - 8 to 13 inches: sandy loam
Bt - 13 to 36 inches: sandy loam
E and Bt - 36 to 55 inches: loamy sand
2C - 55 to 80 inches: gravelly sand

Properties and qualities

Slope: 0 to 6 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high (0.14 to 14.17 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 34 percent
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Sodium adsorption ratio, maximum: 1.0
Available water supply, 0 to 60 inches: Moderate (about 6.3 inches)

Interpretive groups

Land capability classification (irrigated): 3s
Land capability classification (nonirrigated): 3s
Hydrologic Soil Group: A
Ecological site: F098XA015MI - Dry Loamy Drift Plains
Hydric soil rating: No

Minor Components

Brady

Percent of map unit: 3 percent
Landform: Outwash terraces, outwash plains, moraines
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: F098XA011MI - Moist Loamy Drift Plains
Hydric soil rating: No

Bronson

Percent of map unit: 3 percent
Landform: Outwash terraces, outwash plains, moraines
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Head slope, nose slope, side slope
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: F098XA011MI - Moist Loamy Drift Plains
Hydric soil rating: No

Spinks

Percent of map unit: 3 percent
Landform: Outwash terraces, outwash plains, moraines
Landform position (two-dimensional): Summit, shoulder, backslope

Landform position (three-dimensional): Interfluve, head slope, nose slope, side slope
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: F098XA014MI - Dry Sandy Drift Plains
Hydric soil rating: No

Gilford

Percent of map unit: 1 percent
Landform: Outwash terraces, outwash plains, moraines
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave, linear
Across-slope shape: Concave, linear
Ecological site: F098XA012MI - Wet Loamy Depressions
Hydric soil rating: Yes

OsC—Oshtemo sandy loam, 6 to 12 percent slopes

Map Unit Setting

National map unit symbol: 2v2cf
Elevation: 740 to 1,030 feet
Mean annual precipitation: 30 to 41 inches
Mean annual air temperature: 43 to 52 degrees F
Frost-free period: 140 to 200 days
Farmland classification: Farmland of local importance

Map Unit Composition

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

Description of Oshtemo

Setting

Landform: Moraines, outwash plains, outwash terraces
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Head slope, nose slope, side slope
Down-slope shape: Convex, linear
Across-slope shape: Linear
Parent material: Loamy drift over calcareous sandy and gravelly drift

Typical profile

Ap - 0 to 8 inches: sandy loam
E - 8 to 13 inches: sandy loam
Bt - 13 to 36 inches: sandy loam
E and Bt - 36 to 55 inches: loamy sand
2C - 55 to 80 inches: gravelly sand

Properties and qualities

Slope: 6 to 12 percent

Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high (0.14 to 14.17 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 34 percent
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Sodium adsorption ratio, maximum: 1.0
Available water supply, 0 to 60 inches: Moderate (about 6.3 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: A
Ecological site: F098XA015MI - Dry Loamy Drift Plains
Hydric soil rating: No

Minor Components

Bronson

Percent of map unit: 3 percent
Landform: Moraines, outwash terraces, outwash plains
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Head slope, nose slope, side slope
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: F098XA011MI - Moist Loamy Drift Plains
Hydric soil rating: No

Brady

Percent of map unit: 3 percent
Landform: Moraines, outwash terraces, outwash plains
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: F098XA011MI - Moist Loamy Drift Plains
Hydric soil rating: No

Spinks

Percent of map unit: 3 percent
Landform: Moraines, outwash plains, outwash terraces
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Head slope, nose slope, side slope
Down-slope shape: Convex, linear
Across-slope shape: Linear
Ecological site: F098XA014MI - Dry Sandy Drift Plains
Hydric soil rating: No

Gilford

Percent of map unit: 1 percent
Landform: Moraines, outwash terraces, outwash plains
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope

Down-slope shape: Concave, linear
Across-slope shape: Concave, linear
Ecological site: F098XA012MI - Wet Loamy Depressions
Hydric soil rating: Yes

OsD—Oshtemo sandy loam, 12 to 18 percent slopes

Map Unit Setting

National map unit symbol: 2w64x
Elevation: 760 to 1,030 feet
Mean annual precipitation: 30 to 41 inches
Mean annual air temperature: 43 to 52 degrees F
Frost-free period: 140 to 230 days
Farmland classification: Farmland of local importance

Map Unit Composition

Oshtemo and similar soils: 89 percent
Minor components: 11 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Oshtemo

Setting

Landform: Outwash plains, moraines, outwash deltas
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Head slope, nose slope, side slope
Down-slope shape: Convex, linear
Across-slope shape: Convex, linear
Parent material: Loamy drift over calcareous sandy and gravelly drift

Typical profile

A - 0 to 7 inches: sandy loam
E - 7 to 12 inches: sandy loam
Bt - 12 to 35 inches: sandy loam
E and Bt - 35 to 54 inches: loamy sand
2C - 54 to 80 inches: gravelly sand

Properties and qualities

Slope: 12 to 18 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high (0.14 to 14.17 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 34 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Sodium adsorption ratio, maximum: 1.0

Available water supply, 0 to 60 inches: Moderate (about 6.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: A
Ecological site: F098XA022MI - Loamy Slopes
Other vegetative classification: Trees/Timber (Woody Vegetation)
Hydric soil rating: No

Minor Components

Plainfield

Percent of map unit: 5 percent
Landform: Outwash plains, moraines
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Head slope, nose slope, side slope
Down-slope shape: Convex, linear
Across-slope shape: Convex, linear
Ecological site: F098XA021MI - Sandy Slopes
Other vegetative classification: Trees/Timber (Woody Vegetation)
Hydric soil rating: No

Hillsdale

Percent of map unit: 2 percent
Landform: Moraines
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Head slope, nose slope, side slope
Down-slope shape: Convex, linear
Across-slope shape: Convex, linear
Ecological site: F098XA022MI - Loamy Slopes
Other vegetative classification: Trees/Timber (Woody Vegetation)
Hydric soil rating: No

Spinks

Percent of map unit: 2 percent
Landform: Moraines, outwash plains
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Head slope, nose slope, side slope
Down-slope shape: Convex, linear
Across-slope shape: Convex, linear
Ecological site: F098XA021MI - Sandy Slopes
Other vegetative classification: Trees/Timber (Woody Vegetation)
Hydric soil rating: No

Brady

Percent of map unit: 2 percent
Landform: Moraines, outwash plains, outwash deltas
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave, linear
Across-slope shape: Concave, linear
Ecological site: F098XA011MI - Moist Loamy Drift Plains
Other vegetative classification: Trees/Timber (Woody Vegetation)
Hydric soil rating: No

Ua—Udipsamments, level to steep

Map Unit Setting

National map unit symbol: 68p3
Elevation: 740 to 1,000 feet
Mean annual precipitation: 30 to 36 inches
Mean annual air temperature: 45 to 48 degrees F
Frost-free period: 140 to 150 days
Farmland classification: Not prime farmland

Map Unit Composition

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

Description of Udipsamments

Setting

Landform: Outwash plains
Landform position (three-dimensional): Side slope
Down-slope shape: Concave, linear
Across-slope shape: Convex, linear
Parent material: Sandy drift

Typical profile

H1 - 0 to 60 inches: sand

Properties and qualities

Slope: 0 to 25 percent
Depth to restrictive feature: More than 80 inches
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 4.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Ecological site: F098XA014MI - Dry Sandy Drift Plains
Hydric soil rating: No

Ub—Urban land

Map Unit Setting

National map unit symbol: 68p4
Mean annual precipitation: 30 to 36 inches

Mean annual air temperature: 45 to 48 degrees F
Frost-free period: 140 to 150 days
Farmland classification: Not prime farmland

Map Unit Composition
Urban land: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Ug—Urban land-Glendora complex

Map Unit Setting
National map unit symbol: 68p5
Elevation: 600 to 1,000 feet
Mean annual precipitation: 30 to 36 inches
Mean annual air temperature: 45 to 48 degrees F
Frost-free period: 140 to 150 days
Farmland classification: Not prime farmland

Map Unit Composition
Urban land: 50 percent
Glendora and similar soils: 35 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Glendora

Setting
Landform: Flood plains
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Sandy alluvium

Typical profile
A - 0 to 10 inches: sandy loam
C - 10 to 60 inches: stratified sand to loamy sand

Properties and qualities
Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Very poorly drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)
Depth to water table: About 0 to 12 inches
Frequency of flooding: Frequent
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 5.4 inches)

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

Ecological site: F098XA004MI - Wet Floodplains
Hydric soil rating: Yes

Minor Components

Adrian
Percent of map unit: 5 percent
Landform: Depressions on lake plains
Ecological site: F098XA006MI - Mucky Depressions
Hydric soil rating: Yes

Sebewa
Percent of map unit: 5 percent
Landform: Depressions on lake plains, depressions on outwash plains
Ecological site: F098XA012MI - Wet Loamy Depressions
Hydric soil rating: Yes

Houghton
Percent of map unit: 5 percent
Landform: Depressions
Ecological site: F098XA006MI - Mucky Depressions
Hydric soil rating: Yes

UkB—Urban land-Kalamazoo complex, 0 to 6 percent slopes

Map Unit Setting
National map unit symbol: 2w5m5
Elevation: 770 to 970 feet
Mean annual precipitation: 30 to 41 inches
Mean annual air temperature: 43 to 52 degrees F
Frost-free period: 140 to 200 days
Farmland classification: Not prime farmland

Map Unit Composition
Urban land: 65 percent
Kalamazoo and similar soils: 30 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Urban Land

Properties and qualities
Slope: 0 to 6 percent
Depth to restrictive feature: 0 inches to manufactured layer

Interpretive groups
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Hydrologic Soil Group: D
Hydric soil rating: No

Description of Kalamazoo

Setting

Landform: Outwash plains, outwash terraces
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Interfluve, head slope, nose slope, side slope, tread
Down-slope shape: Convex, linear
Across-slope shape: Linear
Parent material: Loess-influenced loamy outwash over sandy and gravelly outwash

Typical profile

Ap - 0 to 10 inches: loam
Bt1 - 10 to 27 inches: sandy clay loam
Bt2 - 27 to 35 inches: sandy loam
2BC - 35 to 52 inches: loamy sand
2C - 52 to 80 inches: gravelly sand

Properties and qualities

Slope: 0 to 6 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately low (0.01 to 0.14 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 22 percent
Maximum salinity: Nonsaline (0.1 to 0.3 mmhos/cm)
Sodium adsorption ratio, maximum: 1.0
Available water supply, 0 to 60 inches: Moderate (about 7.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: C
Ecological site: F098XA015MI - Dry Loamy Drift Plains
Hydric soil rating: No

Minor Components

Spinks

Percent of map unit: 2 percent
Landform: Outwash plains, outwash terraces
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Interfluve, head slope, nose slope, side slope, tread
Down-slope shape: Convex, linear
Across-slope shape: Linear
Ecological site: F098XA014MI - Dry Sandy Drift Plains
Hydric soil rating: No

Bronson

Percent of map unit: 2 percent

Landform: Outwash plains, outwash terraces
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Interfluve, head slope, nose slope, side slope, tread
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: F098XA011MI - Moist Loamy Drift Plains
Hydric soil rating: No

Sleeth

Percent of map unit: 1 percent
Landform: Outwash plains, outwash terraces
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope, tread
Down-slope shape: Concave, linear
Across-slope shape: Linear
Ecological site: F098XA011MI - Moist Loamy Drift Plains
Hydric soil rating: No

UkC—Urban land-Kalamazoo complex, 6 to 12 percent slopes

Map Unit Setting

National map unit symbol: 68p7
Elevation: 400 to 1,360 feet
Mean annual precipitation: 30 to 36 inches
Mean annual air temperature: 45 to 48 degrees F
Frost-free period: 140 to 150 days
Farmland classification: Not prime farmland

Map Unit Composition

Urban land: 50 percent
Kalamazoo and similar soils: 45 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Urban Land

Setting

Landform: Outwash plains
Landform position (two-dimensional): Backslope

Description of Kalamazoo

Setting

Landform: Outwash plains
Down-slope shape: Concave
Across-slope shape: Linear
Parent material: Loamy over sandy outwash

Typical profile

Ap - 0 to 11 inches: loam
Bt - 11 to 38 inches: clay loam
2B - 38 to 55 inches: loamy coarse sand
2C - 55 to 60 inches: gravelly sand

Properties and qualities

Slope: 6 to 12 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 25 percent
Available water supply, 0 to 60 inches: Moderate (about 6.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: B
Ecological site: F098XA015MI - Dry Loamy Drift Plains
Hydric soil rating: No

Minor Components

Coloma

Percent of map unit: 3 percent
Landform: Knolls on outwash plains
Ecological site: F098XA014MI - Dry Sandy Drift Plains
Hydric soil rating: No

Sleeth

Percent of map unit: 2 percent
Landform: Drainageways on outwash plains
Ecological site: F098XA011MI - Moist Loamy Drift Plains
Hydric soil rating: No

UoD—Urban land-Oshtemo complex, 12 to 25 percent slopes

Map Unit Setting

National map unit symbol: 68p8
Elevation: 580 to 1,360 feet
Mean annual precipitation: 30 to 36 inches
Mean annual air temperature: 45 to 48 degrees F
Frost-free period: 140 to 150 days
Farmland classification: Not prime farmland

Map Unit Composition

Urban land: 58 percent
Oshtemo and similar soils: 25 percent
Minor components: 17 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Urban Land

Setting

Landform: Outwash plains
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Concave
Across-slope shape: Convex

Description of Oshtemo

Setting

Landform: Moraines
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Concave
Across-slope shape: Convex
Parent material: Coarse-loamy over sandy outwash

Typical profile

Ap - 0 to 9 inches: sandy loam
Bt - 9 to 29 inches: sandy loam
B - 29 to 69 inches: sand

Properties and qualities

Slope: 12 to 25 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 6.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: A
Ecological site: F098XA022MI - Loamy Slopes
Hydric soil rating: No

Minor Components

Coloma

Percent of map unit: 9 percent
Landform: Ridges on outwash plains
Landform position (two-dimensional): Backslope
Ecological site: F098XA021MI - Sandy Slopes

Hydric soil rating: No

Plainfield

Percent of map unit: 8 percent
Landform: Flats on outwash plains
Ecological site: F098XA014MI - Dry Sandy Drift Plains
Hydric soil rating: No

W—Water

Map Unit Composition

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

References

American Association of State Highway and Transportation Officials (AASHTO). 2004. Standard specifications for transportation materials and methods of sampling and testing. 24th edition.

American Society for Testing and Materials (ASTM). 2005. Standard classification of soils for engineering purposes. ASTM Standard D2487-00.

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of wetlands and deep-water habitats of the United States. U.S. Fish and Wildlife Service FWS/OBS-79/31.

Federal Register. July 13, 1994. Changes in hydric soils of the United States.

Federal Register. September 18, 2002. Hydric soils of the United States.

Hurt, G.W., and L.M. Vasilas, editors. Version 6.0, 2006. Field indicators of hydric soils in the United States.

National Research Council. 1995. Wetlands: Characteristics and boundaries.

Soil Survey Division Staff. 1993. Soil survey manual. Soil Conservation Service. U.S. Department of Agriculture Handbook 18. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_054262

Soil Survey Staff. 1999. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. 2nd edition. Natural Resources Conservation Service, U.S. Department of Agriculture Handbook 436. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053577

Soil Survey Staff. 2010. Keys to soil taxonomy. 11th edition. U.S. Department of Agriculture, Natural Resources Conservation Service. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053580

Tiner, R.W., Jr. 1985. Wetlands of Delaware. U.S. Fish and Wildlife Service and Delaware Department of Natural Resources and Environmental Control, Wetlands Section.

United States Army Corps of Engineers, Environmental Laboratory. 1987. Corps of Engineers wetlands delineation manual. Waterways Experiment Station Technical Report Y-87-1.

United States Department of Agriculture, Natural Resources Conservation Service. National forestry manual. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/home/?cid=nrcs142p2_053374

United States Department of Agriculture, Natural Resources Conservation Service. National range and pasture handbook. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/landuse/rangepasture/?cid=stelprdb1043084

United States Department of Agriculture, Natural Resources Conservation Service. National soil survey handbook, title 430-VI. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/scientists/?cid=nrcs142p2_054242

United States Department of Agriculture, Natural Resources Conservation Service. 2006. Land resource regions and major land resource areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053624

United States Department of Agriculture, Soil Conservation Service. 1961. Land capability classification. U.S. Department of Agriculture Handbook 210. http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_052290.pdf

APPENDIX C: MICHIGAN NATURAL FEATURES INVENTORY

APPENDIX D: OPINIONS OF PROBABLE COST AND PRESENT WORTH ANALYSIS

OPINION OF PROBABLE CONSTRUCTION COST

3497 Coolidge Rd, East Lansing, MI 48823

Telephone: (517) 316-3930 FAX: (517) 484-8140

PROJECT:	City of Kalamazoo, MI DWSRF Project Plan	**DATE:**	3/27/2024
LOCATION:	Kalamazoo, MI	**PROJECT NO.**	200-19743-24005
BASIS FOR ESTIMATE:	[X] CONCEPTUAL [ ] PRELIMINARY [ ] FINAL	**ESTIMATOR:**	D. Warren
WORK:	Pump Station 5 and 14 Consolidated WTP	**CHECKED BY:**	N. Raut
	Alternative 1	**CURRENT ENR:**	13532

ITEM NO.	DESCRIPTION	QUANT.	UNIT	UNIT AMOUNT	TOTAL AMOUNT		Civil/Site/Piping		Structures		Mechanical/ Electrical		Other
	Consolidated WTP												
1	Yard Piping and Site Work	1	Lump Sum	$ 3,604,000	$ 3,604,000.00	TRUE	$3,604,000		$0		$0		$0
2	Building Costs	1	Lump Sum	$ 5,180,000	$ 5,180,000.00		$0	TRUE	$5,180,000		$0		$0
3	Electrical and I&C	1	Lump Sum	$ 6,630,000	$ 6,630,000.00		$0		$0	TRUE	$6,630,000		$0
4	Utilities	1	Lump Sum	$ 100,000	$ 100,000.00		$0		$0	TRUE	$100,000		$0
5	Process Interconnections	1	Lump Sum	$ 3,178,000	$ 3,178,000.00	TRUE	$3,178,000		$0		$0		$0
6	Process Gas and Liquid Handling, Purification, and Storage Equipment	1	Lump Sum	$ 1,483,000	$ 1,483,000.00	TRUE	$1,483,000		$0		$0		$0
7	Water and Wastewater Equipment	1	Lump Sum	$ 6,800,000	$ 6,800,000.00	TRUE	$6,800,000		$0		$0		$0
8	Land Acquisition	4	Acres	$ 750,000	$ 3,000,000.00	TRUE	$3,000,000						
	Raw Water Main												
9	PS 14 3,000 GPM Pumps	2	Each	$ 100,000	$ 200,000.00	TRUE	$200,000						
10	Mobilization (5% of Pipe Construction Cost, Max $75,000)	1	LS	$ 46,000	$ 46,000		$0		$0		$0	TRUE	$46,000
11	Traffic Control	1	LS	$ 50,000	$ 50,000		$0		$0		$0	TRUE	$50,000
12	12-inch Raw Water Main	9,000	LF	$ 250	$ 2,250,000	TRUE	$2,250,000		$0		$0		$0
13	Jack / Bore at Gull Rd	100	LF	$ 600	$ 60,000	TRUE	$60,000		$0		$0		$0
14	Jack / Bore at Main St	100	LS	$ 600	$ 60,000	TRUE	$60,000		$0		$0		$0
15	Pressure Control Valve	1	EA	$ 15,000	$ 15,000	TRUE	$15,000		$0		$0		$0
16	Air Vacuum Valves	1	LS	$ 25,000	$ 25,000	TRUE	$25,000		$0		$0		$0
	Subtotal				$ 32,681,000								
						Sewers	$20,675,000	Structures	$5,180,000	Mech	$6,730,000	Other	$96,000
	General Conditions and Requirements	5	%		$ 1,635,000	General	$1,034,000	General	$259,000	General	$337,000	General	$5,000
	Administrative, Legal, and Engineering	15	%		$ 5,148,000	Admin	$3,257,000	Admin	$816,000	Admin	$1,060,000	Admin	$15,000
	Contingencies	30	%		$ 11,840,000	Contingency	$7,490,000	Contingency	$1,877,000	Contingency	$2,438,000	Contingency	$35,000
	TOTAL CONSTRUCTION COST				**$ 51,304,000.00**	**Total**	**$32,456,000.00**		**$8,132,000.00**		**$10,565,000.00**		**$151,000.00**

Assumptions

1. Building costs increased 40% from original estimate to include additional flow from PS 14.
2. Process interconnection costs increased 40% from original estimate to include additional flow from PS 14.
3. Water and wastewater equipment costs increased 200% from original estimate to include additional flow from PS 14.
4. Electrical costs increased 30% from original estimate to include additional flow from PS 14.

OPINION OF PROBABLE CONSTRUCTION COST

TETRA TECH

3497 Coolidge Rd, East Lansing, MI 48823 Telephone: (517) 316-3930 FAX: (517) 484-8140

PROJECT:	City of Kalamazoo, MI CWSRF Project Plan	DATE:	3/27/2024
LOCATION:	Kalamazoo, MI	PROJECT NO.	200-19743-24005
BASIS FOR ESTIMATE:	[X] CONCEPTUAL [ ] PRELIMINARY [ ] FINAL	ESTIMATOR:	J. Christopher
WORK:	Pump Station 5 and 14 Consolidated WTP	CHECKED BY:	N. Raut
	Alternative 1	CURRENT ENR:	13532

Construction and Equipment Costs Summary

	Total Project Costs	Service Life	Present Worth of Capital Investments	Salvage Value at End of Planning Period (NPW)	Net Present Worth (Cost)
Civil/Site Work/Piping	$32,456,000	50	$32,456,000	$11,885,000	$20,571,000
Structures	$8,132,000	50	$8,132,000	$2,978,000	$5,154,000
Mechanical/Electrical	$10,565,000	20	$10,565,000	$0	$10,565,000
Other	$151,000	20	$151,000	$0	$151,000
Total	$51,304,000			Total	$36,441,000

Annual Costs (O&M) Summary

Type	Annual Cost	Net Present Worth of O&M
O&M	$745,000.00	$11,614,000
	Total	$11,614,000

Net Present Worth	$48,055,000
Weighted Useful Life (years)	43.73

Assumptions:

Present Worth Factor Salvage Value	0.610270943
Present Worth Factor O&M	15.58916229
Discount Rate (%)	2.5

Weighted Useful Life = ((Item Cost A * Service Life A)+(Item Cost B * Service Life B) + (etc.)) / (Total Capital Cost)

OPINION OF PROBABLE CONSTRUCTION COST

3497 Coolidge Rd, East Lansing, MI 48823

Telephone: (517) 316-3930 FAX: (517) 484-8140

PROJECT:	City of Kalamazoo, MI DWSRF Project Plan	**DATE:**	3/27/2024
LOCATION:	Kalamazoo, MI	**PROJECT NO.**	200-19743-24005
BASIS FOR ESTIMATE:	[X] CONCEPTUAL [ ] PRELIMINARY [ ] FINAL	**ESTIMATOR:**	L. Roberts
WORK:	Individual WTPs at Pump Station 5 and 14	**CHECKED BY:**	N. Raut
	Alternative 2	**CURRENT ENR:**	13532

ITEM NO.	DESCRIPTION	QUANT.	UNIT	UNIT AMOUNT	TOTAL AMOUNT		Civil/Site/Piping		Structures		Mechanical/ Electrical		Other
	Pump Station 14 WTP												
1	Yard Piping and Site Work	1	Lump Sum	$ 3,604,000	$ 3,604,000.00	TRUE	$3,604,000		$0		$0		$0
2	Building Costs	1	Lump Sum	$ 3,700,000	$ 3,700,000.00		$0	TRUE	$3,700,000		$0		$0
3	Electrical and I&C	1	Lump Sum	$ 5,100,000	$ 5,100,000.00		$0		$0	TRUE	$5,100,000		$0
4	Utilities	1	Lump Sum	$ 100,000	$ 100,000.00		$0		$0	TRUE	$100,000		$0
5	Process Interconnections	1	Lump Sum	$ 2,270,000	$ 2,270,000.00	TRUE	$2,270,000		$0		$0		$0
6	Process Gas and Liquid Handling, Purification, and Storage Equipment	1	Lump Sum	$ 1,483,000	$ 1,483,000.00	TRUE	$1,483,000		$0		$0		$0
7	Water and Wastewater Equipment	1	Lump Sum	$ 3,400,000	$ 3,400,000.00	TRUE	$3,400,000		$0		$0		$0
8	Land Acquisition	4	Acres	$ 750,000	$ 3,000,000.00	TRUE	$3,000,000						
	Pump Station 5 WTP												
9	Yard Piping and Site Work	1	Lump Sum	$ 3,604,000	$ 3,604,000.00	TRUE	$3,604,000		$0		$0		$0
10	Building Costs	1	Lump Sum	$ 3,700,000	$ 3,700,000.00		$0	TRUE	$3,700,000		$0		$0
11	Electrical and I&C	1	Lump Sum	$ 5,100,000	$ 5,100,000.00		$0		$0	TRUE	$5,100,000		$0
12	Utilities	1	Lump Sum	$ 100,000	$ 100,000.00		$0		$0	TRUE	$100,000		$0
13	Process Interconnections	1	Lump Sum	$ 2,270,000	$ 2,270,000.00	TRUE	$2,270,000		$0		$0		$0
14	Process Gas and Liquid Handling, Purification, and Storage Equipment	1	Lump Sum	$ 1,483,000	$ 1,483,000.00	TRUE	$1,483,000		$0		$0		$0
15	Water and Wastewater Equipment	1	Lump Sum	$ 3,400,000	$ 3,400,000.00	TRUE	$3,400,000		$0		$0		$0
	Subtotal				$ 42,314,000								
						Sewers	$24,514,000	Structures	$7,400,000	Mech	$10,400,000	Other	$0
	General Conditions and Requirements	5	%		$ 2,116,000	General	$1,226,000	General	$370,000	General	$520,000	General	$0
	Administrative, Legal, and Engineering	15	%		$ 6,665,000	Admin	$3,861,000	Admin	$1,166,000	Admin	$1,638,000	Admin	$0
	Contingencies	30	%		$ 15,329,000	Contingency	$8,880,000	Contingency	$2,681,000	Contingency	$3,768,000	Contingency	$0
	TOTAL CONSTRUCTION COST				**$ 66,424,000.00**	**Total**	**$38,481,000.00**		**$11,617,000.00**		**$16,326,000.00**		**$0.00**

Assumptions

1. Original costs increased 200% from original estimate to include 2 WTPs.
2. Land will be purchased for WTP at PS 14.

$66,424,000.00

OPINION OF PROBABLE CONSTRUCTION COST

TETRA TECH

3497 Coolidge Rd, East Lansing, MI 48823 Telephone: (517) 316-3930 FAX: (517) 484-8140

PROJECT:	City of Kalamazoo, MI CWSRF Project Plan	DATE:	3/27/2024
LOCATION:	Kalamazoo, MI	PROJECT NO.	200-19743-24005
BASIS FOR ESTIMATE:	[X] CONCEPTUAL [ ] PRELIMINARY [ ] FINAL	ESTIMATOR:	J. Christopher
WORK:	Individual WTPs at Pump Station 5 and 14	CHECKED BY:	N. Raut
	Alternative 2	CURRENT ENR:	13532

Construction and Equipment Costs Summary

	Total Project Costs	Service Life	Present Worth of Capital Investments	Salvage Value at End of Planning Period (NPW)	Net Present Worth (Cost)
Civil/Site Work/Piping	$38,481,000	50	$38,481,000	$14,091,000	$24,390,000
Structures	$11,617,000	50	$11,617,000	$4,254,000	$7,363,000
Mechanical/Electrical	$16,326,000	20	$16,326,000	$0	$16,326,000
Other	$0	20	$0	$0	$0
Total	$66,424,000			Total	$48,079,000

Annual Costs (O&M) Summary

Type	Annual Cost	Net Present Worth of O&M
O&M	$934,000.00	$14,561,000
	Total	$14,561,000

Net Present Worth	$62,640,000
Weighted Useful Life (years)	42.63

Assumptions:

Present Worth Factor Salvage Value	0.610270943
Present Worth Factor O&M	15.58916229
Discount Rate (%)	2.5

Weighted Useful Life = ((Item Cost A * Service Life A)+(Item Cost B * Service Life B) + (etc.)) / (Total Capital Cost)

Station 5 Operation and Maintenance Cost

Labor	hrs/yr	Rate[13]	
Iron Filters	1900	$ 36.20	$ 68,780.00
GAC Contactors	460	$ 36.20	$ 16,652.00
Chlorine Gas	500	$ 36.20	$ 18,100.00
Phosphate	65	$ 36.20	$ 2,353.00
Fluoride	62	$ 36.20	$ 2,244.40
Wells	530	$ 36.20	$ 19,186.00
Booster Pumps	0	$ 36.20	$ -
High Service	530	$ 36.20	$ 19,186.00
Admin, Lab and Maintenance	2200	$ 36.20	$ 79,640.00
Total			$ 226,141.40

Chemicals	Flow, MGD	Dose, mg/L	PPD	PPY	Cost/lb	Total Annual
Chlorine-Pre-Ox	0.27	0.74	1.66993488	609.526231	$ 1.32	804.5746252
Fluoride	0.27	0.89	2.004102	731.49723	$ 0.32	234.0791136
Phosphate	0.27	5.3	11.93454	4356.1071	$ 1.76	7666.748496
Chlorine-Disinfection	0.27	2.69	6.057342	2210.92983	$ 1.32	2918.427376
Total						$ 11,623.83

Energy	Flow, MGD	Head, feet	Efficiency	KWH/Year	$/KWH	Total Annual
Pumping						
Wells	0.27	50	0.71	21,543	$0.14	$3,015.96
Booster	0	120	0.71	0	$0.14	$0.00
High Service	0.27	209	0.73	88,124	$0.14	$12,337.30
Process						
Iron Pressure Filters				115000	$0.14	$16,100.00
Pressure Carbon Contactors				2200		
Chlorine Gas				505	$0.14	$70.70
Fluoride				3000	$0.14	$420.00
Phosphate				3000	$0.14	$420.00
Building						
Iron Filters				230000	$0.14	$32,200.00
Pressure Carbon Contactors				230000	$0.14	$32,200.00
Chlorine Gas				2250	$0.14	$315.00
Fluoride				1200	$0.14	$168.00
Phosphate				3100	$0.14	$434.00
Admin, Lab and Maintenance				85000	$0.14	$11,900.00
Total				784,921		$109,580.96

			Cost/Year	Escalation[12]	Total $/year
Maintenance Materials					
Iron Filter Maintenance			3200	3.59	11,488
Pressure Carbon Contactors			2350	3.59	8,437
GAC Media Regen/Replace	40,000 lbs/year	@$1.50/lb	60000	1.00	60,000
Chlorine Gas			2000	3.59	7,180

Fluoride Feed System	74	3.59	266
Phosphate	74	3.59	266
Admin, Lab and Maintenance	2200	3.59	7,898
Raw Water/Well Pumps	460	3.59	1,651
Booster Pumps	0	3.59	0
High Service Pumps	480	3.59	1,723
Total			$ 98,908.42
Total Annual O&M			$446,254.61

1 Design Flow: Sta 14 1600 gpm, 2.304 MGD; Sta 5 1,400 gpm, 2.016 MGD; Combined 3,000 gpm, 4.32 MGD
2 Estimating WTP Costs, EPA, 1979, Figure 107 with filter area of 450 sq ft
3 Estimating WTP Costs, EPA, 1979, Figure 18 for <1 pph
4 Estimating WTP Costs, EPA, 1979, Figure 203 for 2 MGD capacity
5 Estimating WTP Costs, EPA, 1979, Figure 215 for 2 MGD capacity
6 Estimating WTP Costs, EPA, 1979, Figure 216 for 2 MGD capacity
7 Estimating WTP Costs, EPA, 1979, Figure 202 for 2 MGD capacity
8 Estimating WTP Costs, EPA, 1979, Figure 205 for 2 MGD capacity
9 Estimating WTP Costs, EPA, 1979, Figure 206 for 2 MGD capacity
10 Estimating WTP Costs, EPA, 1979, Figure 136 for 450 sq ft* .2 adjust for no backwashing and reduced replacement freq
11 Estimating WTP Costs, EPA, 1979, Figure 135 for 450 sq ft
Estimating WTP Costs, EPA, 1979, Figure 216 for 2 MGD capacity
12 Escalation October 1978 Producer Price Index Finished Goods = 71.6 to February 2024 = 256.872
13 Mean wage $25.83 Michigan W & WW treatment operator BLS May 2022 x 1.4 fringe.
14 2 vessels @ 40,000 lbs.every 730 days = 40000
15 Estimating WTP Costs, EPA, 1979, Figure 17 for <1 pph
17 Estimating WTP Costs, EPA, 1979, Figure 2 for 60 ppd
18 Estimating WTP Costs, EPA, 1979, Figure 3 for 60 ppd
19 Estimating WTP Costs, EPA, 1979, Figure 17 for <4 pph
20 Estimating WTP Costs, EPA, 1979, Figure 18 for <4 pph

Station 14 Operation and Maintenance Cost

Labor					hrs/yr	Rate[13]	
Iron Filters					1900	$ 36.20	$ 68,780.00
GAC Contactors					460	$ 36.20	$ 16,652.00
Chlorine Gas					500	$ 36.20	$ 18,100.00
Phosphate					65	$ 36.20	$ 2,353.00
Fluoride					62	$ 36.20	$ 2,244.40
Wells					530	$ 36.20	$ 19,186.00
Booster Pumps					0	$ 36.20	$ -
High Service					530	$ 36.20	$ 19,186.00
Admin, Lab and Maintenance					2200	$ 36.20	$ 79,640.00
Total							$ 226,141.40

Chemicals	Flow, MGD	Dose, mg/L	PPD	PPY	Cost/lb	Total Annual
Chlorine-Pre-Ox	0.808	0.47	3.18672691	1163.15532	$ 1.32	1535.365023
Fluoride	0.808	0.89	5.99870336	2189.52672	$ 0.32	700.6485519
Phosphate	0.808	5.3	35.7226155	13038.7547	$ 1.76	22948.20819
Chlorine-Disinfection	0.808	2.26	15.2326625	5559.9218	$ 1.32	7339.09677
Total						$ 32,523.32

Energy	Flow	Head	Efficiency	KWH/Year	$/KWH	Total Annual
Pumping						
Wells	0.808	50	0.71	64,481	$0.14	$9,027.40
Booster	0	120	0.71	0	$0.14	$0.00
High Service	0.808	151	0.73	190,573	$0.14	$26,680.15
Process						
Iron Pressure Filters				115000	$0.14	$16,100.00
Pressure Carbon Contactors				2200		
Chlorine Gas				505	$0.14	$70.70
Fluoride				3000	$0.14	$420.00
Phosphate				3000	$0.14	$420.00
Building						
Iron Filters				230000	$0.14	$32,200.00
Pressure Carbon Contactors				230000	$0.14	$32,200.00
Chlorine Gas				2250	$0.14	$315.00
Fluoride				1200	$0.14	$168.00
Phosphate				3100	$0.14	$434.00
Admin, Lab and Maintenance				85000	$0.14	$11,900.00
Total				930,309		$129,935.25

				Cost/Year	Escalation[12]	Total $/year
Maintenance Materials						
Iron Filter Maintenance				3200	3.59	11,488
Pressure Carbon Contactors				2350	3.59	8,437
GAC Media Regen/Replace	40,000	lbs/year	@$1.50/lb	60000	1.00	60,000
Chlorine Gas				2000	3.59	7,180

Fluoride Feed System	74	3.59	266
Phosphate	74	3.59	266
Admin, Lab and Maintenance	2200	3.59	7,898
Raw Water/Well Pumps	460	3.59	1,651
Booster Pumps	0	3.59	0
High Service Pumps	480	3.59	1,723
Total			$ 98,908.42
Total Annual O&M			$487,508.39

1 Design Flow: Sta 14 1600 gpm, 2.304 MGD; Sta 5 1,400 gpm, 2.016 MGD; Combined 3,000 gpm, 4.32 MGD
2 Estimating WTP Costs, EPA, 1979, Figure 107 with filter area of 450 sq ft
3 Estimating WTP Costs, EPA, 1979, Figure 18 for <1 pph
4 Estimating WTP Costs, EPA, 1979, Figure 203 for 2 MGD capacity
5 Estimating WTP Costs, EPA, 1979, Figure 215 for 2 MGD capacity
6 Estimating WTP Costs, EPA, 1979, Figure 216 for 2 MGD capacity
7 Estimating WTP Costs, EPA, 1979, Figure 202for 2 MGD capacity
8 Estimating WTP Costs, EPA, 1979, Figure 205 for 2 MGD capacity
9 Estimating WTP Costs, EPA, 1979, Figure 206 for 2 MGD capacity
10 Estimating WTP Costs, EPA, 1979, Figure 136 for 450 sq ft* .2 adjust for no backwashing and reduced replacement freq
11 Estimating WTP Costs, EPA, 1979, Figure 135 for 450 sq ft
Estimating WTP Costs, EPA, 1979, Figure 216 for 2 MGD capacity
12 Escalation October 1978 Producer Price Index Finished Goods = 71.6 to February 2024 = 256.872
13 Mean wage $25.83 Michigan W & WW treatment operator BLS May 2022 x 1.4 fringe.
14 2 vessels @ 40,000 lbs.every 730 days = 40,000lbs/year; 310 * 1400/561
15 Estimating WTP Costs, EPA, 1979, Figure 17 for <1 pph
17 Estimating WTP Costs, EPA, 1979, Figure 2 for 60 ppd
18 Estimating WTP Costs, EPA, 1979, Figure 3 for 60 ppd
19 Estimating WTP Costs, EPA, 1979, Figure 17 for <4 pph
20 Estimating WTP Costs, EPA, 1979, Figure 18 for <4 pph

Station 5 @ 3,000 gpm Operation and Maintenance Cost

Labor	hrs/yr	Rate[13]	
Iron Filters	2400	$ 36.20	$ 86,880.00
GAC Contactors	560	$ 36.20	$ 20,272.00
Chlorine Gas	550	$ 36.20	$ 19,910.00
Phosphate	65	$ 36.20	$ 2,353.00
Fluoride	62	$ 36.20	$ 2,244.40
Wells	1200	$ 36.20	$ 43,440.00
Booster Pumps	530	$ 36.20	$ 19,186.00
High Service	610	$ 36.20	$ 22,082.00
Admin, Lab and Maintenance	3400	$ 36.20	$ 123,080.00
Total	9,377		$ 339,447.40

Chemicals	Flow, MGD	Dose, mg/L	PPD	PPY	Cost/lb	Total Annual
Chlorine-Pre-Ox	1.063	0.54	4.81091282	1755.98318	$ 1.32	2317.897797
Fluoride	1.063	0.89	7.8913266	2880.33421	$ 0.32	921.7069474
Phosphate	1.063	5.3	46.9932933	17152.552	$ 1.76	30188.49159
Chlorine-Disinfection	1.063	2.46	21.8178925	7963.53077	$ 1.32	10511.86061
Total						$ 43,939.96

Energy	Flow	Head	Efficiency	KWH/Year	$/KWH	Total Annual
Pumping						
Wells	1.063	50	0.71	84,826	$0.14	$11,875.60
Booster	0.532	120	0.71	102,422	$0.14	$14,339.03
High Service	1.063	209	0.73	346,994	$0.14	$48,579.19
Process						
Iron Pressure Filters				210000	$0.14	$29,400.00
Pressure Carbon Contactors				4300		
Chlorine Gas				6000	$0.14	$840.00
Fluoride				3000	$0.14	$420.00
Phosphate				3000	$0.14	$420.00
Building						
Iron Filters				360000	$0.14	$50,400.00
Pressure Carbon Contactors				360000	$0.14	$50,400.00
Chlorine Gas				3200	$0.14	$448.00
Fluoride				1500	$0.14	$210.00
Phosphate				4800	$0.14	$672.00
Admin, Lab and Maintenance				130000	$0.14	$18,200.00
Total				1,620,042		$226,203.82

				Cost/Year	Escalation	Total $/year
Maintenance Materials						
Iron Filter Maintenance				5400	3.59	19,386
Pressure Carbon Contactors				4000	3.59	14,360
GAC Media Regen/Replace	49,650	lbs/year	@$1.50/lb	74475	1.00	74,475
Chlorine Gas				2150	3.59	7,719

Fluoride Feed System	74	3.59	266
Phosphate	74	3.59	266
Admin, Lab and Maintenance	3000	3.59	10,770
Raw Water/Well Pumps	800	3.59	2,872
Booster Pumps	460	3.59	1,651
High Service Pumps	800	3.59	2,872
Total			$ 134,636.22
Total Annual O&M			$744,227.39

1 Design Flow: Sta 14 1600 gpm, 2.304 MGD; Sta 5 1,400 gpm, 2.016 MGD; Combined 3,000 gpm, 4.32 MGD
2 Estimating WTP Costs, EPA, 1979, Figure 107 with filter area of 450 sq ft
3 Estimating WTP Costs, EPA, 1979, Figure 18 with feed rate xx lb/hr
4 Estimating WTP Costs, EPA, 1979, Figure 19 with feed rate xx lb/hr
5 Estimating WTP Costs, EPA, 1979, Figure 215 for 2 MGD capacity
6 Estimating WTP Costs, EPA, 1979, Figure 216 for 2 MGD capacity
7 Estimating WTP Costs, EPA, 1979, Figure 202 for 2/4.32 MGD capacity
8 Estimating WTP Costs, EPA, 1979, Figure 205 for 4.322 MGD capacity
9 Estimating WTP Costs, EPA, 1979, Figure 206 for 2 MGD capacity
10 Estimating WTP Costs, EPA, 1979, Figure 136 for 904 sq ft* .2 adjust for no backwashing and reduced replacement freq
11 Estimating WTP Costs, EPA, 1979, Figure 135 for 450 sq ft
Estimating WTP Costs, EPA, 1979, Figure 216 for 2 MGD capacity
12 Escalation October 1978 Producer Price Index Finished Goods = 71.6 to February 2024 = 256.872
13 Mean wage $25.83 Michigan W & WW treatment operator BLS May 2022 x 1.4 fringe.
14 2 vessels @ 40,000 lbs.every 588 days = 49,650lbs/year; 310*1400/738 gpm
15 Estimating WTP Costs, EPA, 1979, Figure 17 for <1 pph
17 Estimating WTP Costs, EPA, 1979, Figure 2 for 133 ppd
18 Estimating WTP Costs, EPA, 1979, Figure 3 for 133 ppd
19 Estimating WTP Costs, EPA, 1979, Figure 17 for <8pph
20 Estimating WTP Costs, EPA, 1979, Figure 18 for <8 pph

APPENDIX E: PUBLIC MEETING DOCUMENTATION

NOTICE OF PROJECT PLANNING PUBLIC MEETING

The City of Kalamazoo will hold a public meeting on the proposed Pump Station 5 and 14 project for the purpose of receiving comments from interested persons. The meeting will be held at **6 p.m. on April 23, 2024** at the following location:

Kalamazoo Water Reclamation Plant

1415 Harrison Street, Kalamazoo, MI 49007

The purpose of the proposed projects is to improve drinking water quality. The projects will address this by adding iron and PFAS treatment capabilities for Pump Station 5 and 14.

Project construction will occur from approximately 2025 to 2029 and will involve construction of a new transmission main in the Eastside neighborhood area from Spring Valley Drive to Schippers Lane along Henson, Trimble, and Wallace Avenues.

Impacts of the proposed project will include temporary traffic disruptions and noise from construction activities during daylight, weekday hours.

The approximate cost of each project is shown below.

Project	Project Cost
Project 1: Pump Station 5 and 14 Upgrades	$51,304,000

The estimated cost to users if all of the projects are constructed based on these approximate costs will be approximately $23.81 per user per quarter.

Copies of the draft project planning document detailing the proposed projects are available for inspection at the following location(s):

www.kalamazoocity.org

https://twitter.com/KalamazooCity

Written comments received before the meeting record is closed on April 23, 2024 at 6 pm will receive responses in the final project planning document.

Written comments should be sent to:

Anna Crandall, Assistant City Engineer, 415 E. Stockbridge Avenue, Kalamazoo, MI 49001

APPENDIX F: RESOLUTION OF ADOPTION

CITY OF KALAMAZOO

KALAMAZOO CITY COMMISSION

A RESOLUTION ADOPTING A FINAL PROJECT PLAN FOR WATER SYSTEM IMPROVEMENTS AND DESIGNATING AN AUTHORIZED PROJECT REPRESENTATIVE

WHEREAS, the City of Kalamazoo recognizes the need to make improvements to its existing water treatment and distribution system; and

WHEREAS, the City of Kalamazoo authorized Tetra Tech to prepare a Drinking Water State Revolving Fund Project Plan, which recommends the following projects;

- Pump Station 5 and 14 Upgrades

WHEREAS, said Project Plan was presented at a Public Meeting held on Monday, May 6, 2024, and all public comments have been considered and addressed;

NOW THEREFORE BE IT RESOLVED, that the City of Kalamazoo formally adopts said Project Plan and agrees to implement the selected alternatives.

BE IT FURTHER RESOLVED, that the assistant city engineer of the Water Resources Division, a position currently held by Anna Crandall, is designated as the authorized representative for all activities with the project referenced above, including the submittal of said Project Plan as the first step in applying to the State of Michigan for a Drinking Water State Revolving Fund Loan to assist in implementation of the selected alternative.

Yeas:

Nays:

Abstain:

Absent:

I certify that the above Resolution was adopted by Kalamazoo City Commission on Monday May 20, 2024.

BY: _____.

Name and Title *(please print or type)*

_____.

Signature Date