City of Grand Rapids
Drinking Water State Revolving Fund FY2024
Project Planning Document

Project No. 221812
March 30, 2023

REVIEW DRAFT

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Prepared For:
City of Grand Rapids
Grand Rapids, MI

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List of Abbreviations/Acronyms

ADD	average day demands
Airport	Gerald R. Ford International Airport
AWWA	American Water Works Association
CCT	Corrosion Control Treatment
City	City of Grand Rapids, Michigan
CMP	Comprehensive Master Plan
DWSRF	Drinking Water State Revolving Fund
EGLE	Michigan Department of Environment, Great Lakes, and Energy
EHPD	East High-Pressure Districts
EQ	equalization
FEMA	Federal Emergency Management Agency
floc/sed	flocculation/sedimentation
FY	fiscal year
gal/day/ft^2	gallons per day per square foot
GIS	geographic information system
gpd	gallons per day
gpm	gallons per minute
HP	high pressure
lb/day	pounds per day
lb/hr	pounds per hour
LCR	Lead and Copper Rule
LLPS	low lift pump stations
LMFP	Lake Michigan Filtration Plant
LP	low pressure
LUST	leaking underground storage tanks
MAH	median annual household income
MDD	maximum day demands
MP	medium pressure
mg/L	milligrams per liter
MG	million gallons
mgd	million gallons per day
MNFI	Michigan Natural Features Inventory
NPDES	National Pollutant Discharge Elimination System
PAC	powdered activated carbon
PFAS	polyfluoroalkyl substance
pH	potential of hydrogen measure of acidity and alkalinity
ppb	parts per billion
ppm	parts per million

ppt	parts per trillion
PRV	pressure reducing valves
psi	pounds per square inch
REGIS	Grand Valley Metro Council Regional GIS
SETM	Southeast Transmission Main
SHPO	Michigan State Historical Preservation Office
State	State of Michigan
TDH	total dynamic head
THPO	Tribal Historic Preservation Officers
USD	Utility Service District or Water Contract Area
USFWS	U. S. Fish and Wildlife Services

1.0 Introduction

The City of Grand Rapids (City) has chosen to complete a fiscal year (FY) 2024 Drinking Water State Revolving Fund (DWSRF) Project Planning Document for the proposed improvements to their water system. The City submitted an amended DWSRF project plan in 2021, and there are some projects that are being carried over into this Project Planning Document. The purpose of this document is to meet the project planning requirements of the Michigan Department of Environment, Great Lakes, and Energy (EGLE).

The City supplies water service within the Grand Rapids metropolitan area to the City itself, and to all or parts of several other municipalities (Customer Communities). The City has contractual agreements to supply water within the Utility Service District (USD), also known as the Water Contract Area, shown in Figure 1. Customer Communities are the cities of Coopersville, East Grand Rapids, Kentwood, Walker, townships of Ada, Gaines, Caledonia, Tallmadge, Wright, charter townships of Allendale, Cascade, and sites in Ottawa County. The Customer Communities include both retail and wholesale customers.

The Lake Michigan Filtration Plant (LMFP) is a 135 million gallon per day (mgd) water filtration treatment facility owned and operated by the City of Grand Rapids, using Lake Michigan as its water source. The LMFP is in Grand Haven Township in Ottawa County. The treated water is pumped approximately 25 miles to the City of Grand Rapids distribution system. Along the 25-mile transmission main are wholesale customers including Allendale Township, Coopersville, and Ottawa County. When the water reaches the City, it is distributed to various ground level reservoirs from which the water is pumped throughout the distribution system. Figure 1 shows the location of the LMFP relative to the water distribution system.

The water distribution system, shown in Figure 2, includes reservoirs, elevated storage tanks, water mains, booster pumps, and pressure districts. The reservoirs within the City of Grand Rapids are ground level and below ground units with pumping stations. The elevated storage tanks and booster pump stations help maintain and regulate pressure within the system.

The distribution system is divided into multiple pressure districts. The pressure districts are illustrated in Figure 2 and Figure 3. Labeling pressure districts as high or low refers to the hydraulic grade line. In general, the City tries to provide pressures between 40 and 80 pounds per square inch (psi) across the system. The various pressure districts are connected by pressure reducing valves (PRVs) and emergency interconnects.

The proposed projects in this Project Planning Document include some that are entirely within the City limits, and some that include the entire service area. The projects within the City include upgrades to the distribution system to loop water mains, replace aged water mains, and replace lead service lines to improve water quality, reliability and to comply with the Safe Drinking Water Act. The projects that are applicable to the City and the surrounding communities (Overall Service Area) include improvements at the Lake Michigan Filtration Plant (LMFP) and the distribution system that focuses on public health, reliability, and compliance.

The recommended projects included in the DWRSF Project Planning Document are as follows:

Water Main Improvements

1. Fremont Avenue Water Main (3rd to 4th Streets)
2. Hall Street Water Main (Madison to Eastern Avenues); Paris Avenue Water Main (Gilbert to Hall Streets)
3. Eleanor Street Water Main (Plainfield to Diamond Avenues)
4. Valley Avenue Water Main (4th to Bridge Streets); Sibley Street Water Main (Valley to Garfield Avenues)
5. Boston Street Water Main (Calvin to Plymouth Avenues)
6. Burton Street Water Main (Eastern to Kalamazoo Avenues)
7. Burton Street Water Main (Horton to Eastern Avenues)
8. Oakwood Avenue Water Main (Knapp to 3 Mile Streets)

9. Valley Avenue Water Main (Fulton to Bridge Streets); 1st Street and 3rd Street Water Main (Valley to Garfield Avenues)
10. Buchanan Avenue Water Main (Hall to Corinne Streets)
11. 2nd Street Water Main (Valley to Fremont Avenues)
12. Sherman Street Water Main (Giddings to Norwood Avenues)
13. Butterworth Street Water Main (Marion to Lane Avenues)
14. Buchanan Avenue Water Main (Stewart to Corinne Streets)
15. Alger Street Water Main (Division to Madison Avenues)
16. Butterworth Street Water Main (Lane Avenue to Hogadone Place)
17. Mulford Drive Water Main (Alger/Madison to Union Avenues)
18. Admore Street Water Main (Eastern to Silver Avenues)
19. College Avenue Water Main (Hoyt to Dickinson Streets)
20. Houseman Street Water Main (Knapp to Eleanor Streets)
21. Union Avenue Water Main (Fountain to Lyon Streets)
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30. LMFP Chemical Unloading Improvements
31. LMFP Carbon Feed System Improvements and Phosphate Feed System Improvements

Regionalization

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Two projects have been carried over from the 2020 DWSRF Project Plan; the LMFP Residuals Handling Improvements, and Eleanor Street Water Main (Plainfield to Diamond Avenues) projects. These projects have updated schedules to take advantage of the available grant funding; the scope for each project, detailed in the previous project plan, remains unchanged.

2.0 Project Background

2.1 Delineation of Study Area

The City of Grand Rapids, located in the central western portion of the state, is a regional waterworks system supplying a large portion of the surrounding community. The Study Area includes the City of Grand Rapids and its retail customers as shown in Figure 1. The retail customers include the Kentwood, Walker, Tallmadge Township, Cascade Township, and Grand Rapids Township. The current water distribution system is depicted in Figure 2. The water system improvements related to the water mains and lead service line replacements in Grand Rapids will occur within the City's service area. The water main improvements in Cascade Township and the Caledonia Township Connection Project will occur within the USD.

The LMFP in Grand Haven Township is located on the shore of Lake Michigan, in the central portion of the state. The proposed projects at LMFP are within the existing water treatment facilities and includes site work within the LMFP property boundaries.

2.2 Land Use

Maps 1.1 and 1.2 visually represent the population density within the Study Area. The existing land use in the Study Area includes residential, commercial, industrial, recreational, and undeveloped, as indicated on Maps 2.1 and 2.2. Existing land use is represented using the current zoning map layers published by the City on Esri ArcOnline map services. As indicated by these maps, East Grand Rapids and the City of Grand Rapids are fully developed. East Grand Rapids is predominantly residential with some commercial development. The City of Grand Rapids is mostly medium density residential with commercial development and public land interspersed. Most of the industrial development in the City is along the Grand River, near I-196 at the eastern City limits, and on the south side of the City.

Ada Township and Grand Rapids Township are mostly residential with interspersed commercial development. Significant portions of the Townships are forested. There is very little industrial land use in these townships, except for Amway/Alticor located in Ada Township along the Grand River.

Cascade Charter Township is industrial in the southwest corner near the airport (utility/transportation). There is a corridor of commercial development along 28th Street that extends from Cascade Township through Kentwood and Grand Rapids, into Wyoming and Grandville. East of the airport is mostly residential development with some agricultural land on the eastern limit.

The City of Kentwood within the USD is mixed-use. There is a significant portion of industrial land use south near the airport. Again, there is commercial development along 28th Street. There is a fair amount of water/wetland and parks/open space. Residential development in this part of the City of Kentwood is more dispersed. There is some agricultural land to the south of the airport.

The City of Walker is mixed-use with most of the residential development along the central portion of the City. Industrial development is concentrated near the I-96 corridor to the north with some development south along the Grand River and I-196. South Walker is mixed residential and forested with a large area of parks/open space in the southeast corner (Johnson Park).

Tallmadge Township is mostly agricultural and forested with intermixed residential development. There is sparse commercial development and one industrial area in the central portion of the Township along the eastern limit.

Maps 3.1 and 3.2 present the planned land use for each municipality as provided by Grand Valley Metro Council Regional GIS (REGIS). Planned land use was obtained from individual community comprehensive master plans and compiled by REGIS for communities in Kent County.

In the development of the 2020 Comprehensive Master Plan (CMP), each customer community was contacted and provided an opportunity to review and comment on the amount and distribution of projected growth within the Study Area. The regional economic model was customized to forecast long-term growth because of changes such as product and service technologies, transportation, energy, environmental and workforce policies, and investment initiatives. The areas projected to see reasonably significant growth in total population include Cascade Charter Township and Grand Rapids Charter Township. These outlying areas have experienced an increase in total population over the past decade and anticipate continued growth with additional development in the future.

2.3 Population Projections

The CMP Update 2020 (Segment I-General Plan Update) includes population projections and land use development forecasts compiled as a basis for predicting future water demands through the year 2040.

Population projections are fundamental in measuring the demand for public services. Projections were made for a 20-year planning period with five-year increments for two periods followed by a single ten-year period.

The final population projections encompass many levels of data review: national trends and county economics used in the original REMI model, regional distribution of population by GVMC extrapolated from planning sub-regions, U. S. Census Bureau mid-census projections, and local response to the data based on in-house knowledge of recent development and plans for growth.

Table 1 summarizes the total population projections for jurisdictions in the Study Area.

Table 1 – Summary of Total Population Projections for Jurisdictions in the Study Area

	Year			
Jurisdiction	2020	2025	2030	2040
Ada Township	14,717	15,067	15,242	15,592
Caledonia Township	14,659	15,082	15,999	17,832
Cascade Township	19,245	19,795	20,895	23,095
East Grand Rapids	11,884	11,900	11,915	11,945
Gaines Township	27,539	29,304	31,182	35,306
City of Grand Rapids	202,100	208,220	214,952	230,502
Grand Rapids Township	18,600	19,200	19,600	20,800
Kentwood	52,370	53,370	54,370	56,000
Walker	24,952	25,435	25,700	26,635
Tallmadge Township	8,400	8,700	9,000	9,600
Wright Township	3,283	3,304	3,325	3,355

Each community submitted projected water service populations within the Study Area as summarized in Table 2.

Table 2 – Summary of Water Service Population Projections for Jurisdictions in the Study Area

Jurisdiction	Year			
	2020	2025	2030	2040
City of Grand Rapids	202,100	208,220	214,952	230,502
City of Kentwood	23,620	25,480	27,340	28,000
City of Walker	21,425	22,975	24,525	26,075
Tallmadge Township	1,380	1,580	1,780	2,180
Cascade Township	10,180	11,245	12,310	14,440
Grand Rapids Township	14,300	15,000	15,500	15,900
City of Coopersville	4,300	4,305	4,310	4,320
East Grand Rapids	11,884	11,900	11,915	11,945
Ada Township	7,250	8,300	9,600	12,000
Allendale Township	10,032	12,371	14,869	18,797
Misc. Ottawa County	1,344	1,572	1,829	2,343
Total	307,815	322,948	338,930	366,502

Notes: The connected population was estimated by the City of Grand Rapids and Ottawa County.
The connected population for Allendale Township reflects the permanent population and includes the transient GVSU student population.

2.4 Water Demand

The entire water demand for the City of Grand Rapids and its customer communities is supplied by water from Lake Michigan that is treated at the LMFP. Population projections, in conjunction with historical water use data and land use planning information, were used to project future water demands. The wholesale customers connected to the distribution system are metered and billed at a single supply point and retail customers in the distribution system are metered individually.

Accurate water demand projections are necessary to properly evaluate the capacity and reliability of the Grand Rapids Metropolitan Area Water System, and to determine improvements necessary to accommodate anticipated growth and development within the service area.

As indicated in Segment II of the CMP the projected average day demands (ADDs) for the entire system is expected to increase approximately 20.1% from 38.8 mgd in 2020 to 46.6 mgd in 2040. With the projected increases, the 2040 ADDs are expected to be less than the highest historical annual averages that occurred in the 1980s, but approach and exceed more recent historical annual averages from the late 1990s and 2000s. The ADDs for each community in the Grand Rapids system are summarized in Table 3.

Table 3 – Grand Rapids Metropolitan Area Average Day Demand Projections

	Average Day Demand (mgd)					Percent Increase
Governmental Unit	2020	2025	2030	2035	2040	2020 – 2040
City of Grand Rapids	20.552	20.926	21.336	21.810	22.284	8.4%
Kentwood	4.488	4.842	5.195	5.258	5.321	18.5%
Walker	3.061	3.283	3.504	3.615	3.726	21.7%
East Grand Rapids	1.265	1.267	1.269	1.270	1.272	0.5%
Cascade Township	2.389	2.639	2.889	3.139	3.389	41.8%
Grand Rapids Township	1.718	1.802	1.862	1.886	1.910	11.2%
Ada Township	1.393	1.595	1.845	2.075	2.306	65.5%
Tallmadge Township	0.123	0.141	0.159	0.177	0.194	58.0%
Allendale Township	2.010	2.420	2.910	3.290	3.680	83.1%
Coopersville	1.560	1.700	1.840	1.970	2.110	35.3%
Other Ottawa County	0.230	0.269	0.313	0.358	0.401	74.3%
Total	38.790	40.883	43.121	44.848	46.592	20.1%

Maximum day demands (MDDs) were also projected. The maximum day to average day peaking factor for the entire water system was evaluated, and peaking factors were then assigned to individual communities based on historical water use characteristics. The MDD projections are presented in Table 4.

Table 4 – Grand Rapids Metropolitan Area Maximum Day Demand Projections

	Maximum Day Demand (mgd)					Percent Increase
Governmental Unit	2020	2025	2030	2035	2040	2020 – 2040
City of Grand Rapids	45.215	46.036	46.939	47.982	49.026	8.4%
Kentwood	7.855	8.473	9.092	9.202	9.311	18.5%
Walker	6.429	6.894	7.359	7.592	7.824	21.7%
East Grand Rapids	2.948	2.952	2.956	2.960	2.963	0.5%
Cascade Township	4.540	5.015	5.489	5.964	6.439	41.8%
Grand Rapids Township	4.122	4.324	4.468	4.526	4.583	11.2%
Ada Township	3.552	4.067	4.704	5.291	5.879	65.5%

Table 4 – Grand Rapids Metropolitan Area Maximum Day Demand Projections

Governmental Unit	Maximum Day Demand (mgd) 2020	2025	2030	2035	2040	Percent Increase 2020 – 2040
Tallmadge Township	0.289	0.331	0.373	0.415	0.457	58.0%
Allendale Township	4.020	4.840	5.820	6.590	7.360	83.1%
Coopersville	3.330	3.620	3.910	4.000	4.000	20.1%
Other Ottawa County	0.689	0.811	0.938	1.070	1.202	74.5%
Total	82.989	87.363	92.048	95.592	99.045	19.3%

These projections indicate that the MDD will increase from approximately 83.0 mgd in 2020 to 99.0 mgd by the year 2040.

The ADD and MDD projections represent the total demand on the system. These demand projections were inputted into the hydraulic model to evaluate the capacity and reliability of the existing Grand Rapids Metropolitan Area Water System and to determine expansion and improvements necessary to accommodate the projected increase in demand.

2.5 Existing Facilities

2.5.1 LMFP

The Grand Rapids LMFP is located on Lake Michigan Drive near Lakeshore Avenue in Grand Haven Township, near the Lake Michigan shore as depicted in Figure 1 and Figure 5. The LMFP provides drinking water to the City of Grand Rapids and its customer communities. The LMFP has two intakes in Lake Michigan connecting to two low lift pump stations (LLPS) which supply raw water from Lake Michigan to the LMFP. The LMFP is a conventional surface water treatment plant rated at 135 mgd.

The major facilities within this plant are listed in a summary of existing process facilities presented in Appendix 1. The summary includes design criteria, sizes, and capacities for each major component of the plant. Appendix 1 also includes a list of the installation/latest renovation date, the expected remaining service life, and the observed condition of each component.

At the LMFP, the raw water travels through rapid mix tanks for chemical addition, then to either flocculation/sedimentation (floc/sed) basins or inclined plate settlers for clarification. After clarification, the water travels through dual media (sand/anthracite) filters for further purification. After filtration, the water is stored in two treated water reservoirs prior to high lift pumping, which transfers the water to the distribution system transmission mains. Residuals from the sedimentation and filtration processes are sent to earthen lagoons onsite that are periodically drained, and the alum residue is disposed offsite.

The approximate capacities of the main plant components are shown in Table 5.

Table 5 – LMFP Treatment Units Capacity Information

Treatment Units	Capacity
North Intake and Old Low Lift Pumps	60 mgd North Intake Capacity
South Intake and New Low Lift Pumps	95 mgd One Large Pump + One Small Pump
Total Raw Water Delivery to Plant	155 mgd
Rapid Mix/Floc/Sed	135 mgd
Dual Media Filtration	135 mgd All Filters Online at 3. 9 gal/min/sq ft
High Service Pumping (without booster)	86. 5 mgd Limited by Downstream Conditions
Chlorine, Alum, Fluoride, Phosphate Systems	135 mgd

The LMFP treatment capacity of 135 mgd is significantly higher than the 2040 projected MDD of 99.0 mgd. As shown above, all the critical water supply and treatment components of the LMFP have adequate capacity for the current year (2020) MDD. Except for high service pumping, the critical water supply and treatment components of the LMFP also have adequate capacity for the projected year (2040) MDD. Reduced high service pumping capacity has been evaluated in the Segment III of the 2020 CMP. Fifteen alternatives were evaluated, and recommendations were included in the report.

Although the LMFP is located along the Lake Michigan shoreline, the site is outside of the 100-year flood plain and it has not historically experienced flooding due to extreme weather events. EGLE issued a Sanitary Survey for the City of Grand Rapids Water System in 2017 that identified components at the LMFP that may experience flooding in the event of pipe or tank failure, which included the Old Low Lift Pumps, North High Lift Pumps, and the Filter Backwash Pumps. In the event of a power outage, adequate standby power is available as a backup to maintain operations at the LMFP. The equipment is regularly exercised and maintained.

Treatment capacities at the LMFP are adequate. Improvements that are recommended for the treatment facility are not driven by a need to increase capacity, but by the need to replace or upgrade some of the existing facilities and equipment.

2.5.2 Distribution System

Segment II of the 2020 CMP provides a comprehensive summary of the Grand Rapids Water Distribution System. An evaluation of the electrical reliability and redundancy of the water distribution system pump stations was also included in the document. The evaluation focused on the age of the equipment and on the availability of redundant supply including dual power supplies, onsite generators, and generator connections that are operated using a portable generator. Modifications to improve the system's response to events related to extreme weather or other climatic factors are being addressed by the City through efforts to obtain Federal Emergency Management Agency (FEMA) grants for several pump stations. An updated evaluation of the availability of backup power supply for continued facility operations was included in the 2020 CMP update.

Appendix 1 presents a summary of the distribution system detailing the properties and conditions of system components and includes a detailed list of all pumps in the system. The appendix also includes a summary of pipe properties and age, the age and size of valves in the system, the age of hydrants and service lines, and details on storage facilities. The oldest sections of the water system are in downtown Grand Rapids, and the City occasionally experiences water main breaks due to old pipes and valves. The City maintains an ongoing program to replace aging water main and valves in conjunction with street repaving and utility work. DWRSF funding is being sought for water main replacement to address water quality, reliability, compliance, and aging infrastructure. The current water distribution system is shown in Figure 2, with a hydraulic profile provided in Figure 3. Below is a summary of the major system components and the general flow of water through the system.

Starting at the LMFP in Grand Haven Township, there are two 5-million-gallon (MG) reservoirs. As a note, within the Grand Rapids system, reservoirs are ground-level or below grade tanks paired with pumping stations. Nine high service pumps deliver the finished water 25 miles through the North and South Transmission Mains, from the LMFP to the City. Along the North Transmission Main is the M-45 Booster Pump Station in Allendale. Previously, when the North Transmission Main delivered water to the Monroe Reservoir, the Booster Pump Station was operated to increase capacity. When the North Transmission Main was connected directly to the Low-Pressure District, 100 feet (ft) of static head were added, so the M-45 Booster Pump Station has not been utilized since this time. The operation of the M-45 Booster Pump Station is being reviewed along with other improvements to increase the high service pump capacity.

At the City, the water is first supplied to the Wilson Reservoir (5 MG), the Covell Reservoir (16 MG), the Burton Reservoir (5 MG), the Livingston Reservoir (16 MG), and the Franklin Reservoir (16 MG). In addition, the North Transmission Main connects directly to the Low-Pressure District.

Within the City's distribution system, each pressure district is operated at a different hydraulic grade. Interconnects and PRVs between pressure districts provide a fully connected system. To isolate the districts, existing valves are closed in various portions of the system, which in some cases creates dead-end water mains. Dead-end lines are flushed approximately once every 30 days to maintain water quality.

A brief explanation is provided for each pressure district.

2.5.2.1 West High and North Walker Pressure Districts

The West High Pressure District can be supplied by the Wilson or Covell Reservoirs. Ideally, supply is provided by Wilson, which is located on the west side of the distribution system, 6.5 miles before the transmission main first ties into the Low Pressure District at Richmond Street and Seward Avenue. Due to the Wilson Reservoir location on the west side of the system, hydraulic losses are minimized as compared to the Covell Reservoir, which fills from the Low Pressure District. The Covell Reservoir pumps to the West High Pressure District; however, it is hydraulically connected to and filled from, the Low Pressure District. The hydraulic grade in the West High Pressure District is controlled by the 1.0 MG Leonard Street Storage Tank.

Supply to the North Walker Pressure District is through the Bristol Booster Pump Station, which is used to supply the district and to fill the North Walker Elevated Storage Tank.

2.5.2.2 Low Pressure District

The Low Pressure District runs along the Grand River valley. Both the North and South Transmission Mains connect to the Low Pressure District. In addition, the Covell, Livingston, and Franklin Reservoirs are connected to the Low Pressure District. Water is pumped out of the Low Pressure District into the Regulated, Intermediate, Tulip, Alger, West High, and East High Pressure Districts (EHPD).

2.5.2.3 Intermediate Pressure District

The Intermediate Pressure District is supplied from three Intermediate pumps at the Livingston Pump Station and three pressure regulating valves connected to the EHPD. One valve is located at Fuller Avenue and Three Mile, one is near the intersection of Diamond Avenue and Baldwin Street, and the third is at the Livingston Pump Station. The Franklin Reservoir is located on the edge of the Intermediate Pressure District but is hydraulically connected to the Low Pressure District. Booster A pumps from the Intermediate Pressure District into the EHPD.

2.5.2.4 East High Pressure District

The EHPD is supplied by the Livingston and Franklin Reservoirs. The hydraulic grade is controlled by the Knapp, Cambridge, and Patterson Elevated Storage Tanks. The Dean Lake Service Center Reservoir and East Paris Service Center Reservoir provide additional storage within the EHPD, and their respective pump stations pump water to the east side of the EHPD. Dean Lake Service Center can operate as an inline booster pump station and/or fill the reservoir directly from the EHPD and then pump the water back into the EHPD. The East Paris Service Center Reservoir is supplied from the Franklin Pump Station through the low-pressure Southeast Transmission Main (SETM). Water is pumped from the East Paris Service Center to the east side of the EHPD and fills the Patterson Elevated Tank.

East Grand Rapids and Ada Township are wholesale communities connected to the EHPD. East Grand Rapids has an elevated storage tank filled directly by the Franklin Pump Station. Ada Township uses booster pumps for its supply and to fill its elevated storage tank.

2.5.2.5 Tulip Pressure District

Supply to the Tulip Pressure District is through the Booster D Pump Station, which pumps from the Low Pressure District into the Tulip Tank. The Tulip Pressure District is normally hydraulically controlled by the tank. There is

also a PRV located at Grant and Division that is used to supply demand in the Tulip Pressure District from the Intermediate Pressure District.

2.5.2.6 Alger Pressure District

The Alger Reservoir is filled from the Low Pressure District and the Alger Pump Station supplies the Alger Pressure District. The Alger Pump Station has both reservoir pumps and booster pumps, so the district can be supplied from the reservoir or directly from the Low Pressure District. There are also two PRVs that supply the Alger Pressure District from the EHPD. The PRVs are located at Blaine Avenue and Burton Street, and Blaine Avenue and 28th Street.

2.5.2.7 Regulated Pressure Districts

There are five regulated pressure districts in the distribution system that are supplied through and controlled by PRVs. The West Regulated and South Walker Regulated Pressure Districts are supplied by the West High Pressure District. The Cascade Regulated Pressure District is at a low elevation near the Thornapple River and is supplied by the EHPD. The 36th Street and 28th Street Regulated Pressure Districts, located at the southwest end of the EHPD, are also supplied by the EHPD.

2.5.2.8 Security Systems

The water system has several security measures. The LMFP is fenced and locked with security lighting and cameras. The LMFP is staffed 24 hours per day and operators monitor the LMFP security system. All pumping stations have door alarms that transmit by telemetry to the LMFP. Most facilities are fenced and locked with security lighting. Booster A, Booster D, and Bristol Booster Pump Station are solid brick buildings. Ground tanks have bolted hatches. Elevated tanks are locked with alarms. Security cameras that transmit to the LMFP have been installed at Coldbrook, Livingston, Franklin, and Booster A pump station locations. As street and utility work provide the opportunity for fiber optic installation, additional cameras will be installed. As upgrades are made to reservoirs in the system, improvements include adding automated gate controllers that can be opened using a passcode or remotely opened from the LMFP, a locked vandal guard on the reservoir ladder, and a locked hinged roof hatch access.

2.6 Summary of Project Need – LMFP Residuals Handling Improvements

Residual solids generated from the LMFP clarification and filtration processes are currently dechlorinated and discharged to two unlined earthen lagoons that were constructed with the original water treatment facility in the early 1960s. The suspended solids settle to the bottom of the lagoons and are periodically removed by LMFP staff using earth moving equipment. The material is staged in a modified drying bed area, where it partially dries prior to being transported and disposed of in a landfill. Initially, the processed wastewater infiltrated into the ground. Over time, however, the soil pore space became partially plugged and required surface discharge of the process wastewater. Improvements were made during the 1990s plant expansion to accommodate increased drainage in the lagoons. This included an underdrain system, inlet/outlet structures, and dewatering pumps to expedite lagoon cleaning. Currently, settled water from the lagoons is discharged into Pigeon Creek to the south of the LMFP under a National Pollutant Discharge Elimination System (NPDES) permit. The performance of the 55+ year old lagoon system is negatively impacted by high groundwater at the site.

The LMFP has multiple sources of process wastewater which are ultimately discharged to the existing lagoon system. Most of the solids that enter the lagoons originate from the sludge blowdown from the floc/sed basins. Solids were also discharged from the Accelators when they were in use. New pretreatment equipment has recently been installed to replace the Accelators that include flocculators, inclined plate settlers, and vacuum sludge removal. The new vacuum sludge collection equipment in the new pretreatment system discharges solids to the existing lagoon system. Filter backwash water discharges into the lagoon system in large volumes but has much lower solids concentrations. Tank drainage water with minimal solids is also discharged into the lagoons

when process tanks are drained during periodic maintenance. Multiple roof and floor drains with minimal solids also discharge into the lagoons from multiple locations within the plant.

Table 6 provides a summary of the residuals quantities that were developed in a current design project for the residual handling improvements. An extensive analysis of the quantity of residuals produced was performed to determine the residuals production. This was done by monitoring flow rates to the lagoons during the filter backwashing and sludge blowdown processes and solids concentration sampling performed on both residuals streams. During average demand days when the plant treats 38.79 million gallons per day (MGD), the LMFP produces approximately 4,672 lbs of residuals per day. This increases to 9,973 lbs per day during maximum demand periods when the flow rate is 82.99 mgd. This equates to approximately 120 lbs of residuals produced for every million gallons of water treated.

Table 6 – Basis of Design for Residual Quantities

	Existing (2020)			Future (2040)		
	Minimum	Average	Maximum	Minimum	Average	Maximum
Plant Flow (MGD)	19.18	38.79	82.99	23.04	46.592	99.05
Plate Settler Basins Underflow (gal/day)	22,500	45,000	45,000	22,500	45,000	45,000
Wet Solids (lb/day)	187,650	375,300	375,300	187,650	375,300	375,300
Dry Solids (lb/day)	272	841	1,764	327	1,010	2,105
Floc/Sed Basins Underflow (gal/day)	157,500	189,000	189,000	157,500	189,000	189,000
Wet Solids (lb/day)	1,313,550	1,576,260	1,576,260	1,313,550	1,576,260	1,576,260
Dry Solids (lb/day)	1,905	3,531	7,408	2,288	4,241	8,842
Filter Backwash Washwater (gal/day)	100,000	300,000	800,000	200,000	400,000	900,000
Wet Solids (lb/day)	834,000	2,502,000	6,672,000	1,668,000	3,336,000	7,506,000
Dry Solids (lb/day)	100	300	801	200	400	901
Combined Residuals Flow (gal/day)	180,000	234,000	234,000	180,000	234,000	234,000
Filter Backwash Washwater (gal/day)	100,000	300,000	800,000	200,000	400,000	900,000
Total Residuals Flow (gal/day)	302,500	579,000	1,079,000	402,500	679,000	1,179,000
Total Dry Solids Production (lb/day)	2,277	4,672	9,973	2,815	5,651	11,848
Total Dry Solids Production (lb/MG)	119	120	120	122	121	120

2.7 Summary of Project Need – LMFP Chemical Unloading

The LMFP utilizes multiple chemicals for its daily water treatment operations. The bulk chemicals are delivered to the Chemical Building by tanker trucks and are unloaded at the Chemical Unloading Station. The unloading station consists of two unloading bays and a small building that houses chemical fill pipes and equipment. There is a small, curbed area below the chemical fill pipes in the unloading bay to capture incidental spills from the hose connections. This curbed area does not provide adequate containment in the event of a major spill that could result from a hose rupture or disconnection at the truck.

Improvements have been evaluated to increase the spill protection provided at the chemical unloading area. Part 5 rules under Michigan Administrative Rules R.324. 2001 to R.324. 2009 address requirements for spillage of oil and polluting materials. The rules require that any areas used for chemicals be designed and constructed to prevent the release of any polluting materials. A major spill in the chemical unloading area could migrate to stormwater drains located adjacent to the building. To contain a spill and account for potential stormwater, a containment system that is capable of containing at least 125% of the full volume of a tanker truck, approximately 5,600 gallons, should be provided at this location. This would allow for sufficient containment of a major spill and provide a factor of safety in the event that some of the containment volume is taken up by precipitation or dirt and grit that has migrated into the containment drains.

2.8 Summary of Project Need – LMFP Carbon Feed System Phosphate Feed System

Both the carbon feed system and the phosphate feed system at the LMFP need improvements.

Objectionable taste and odor sometimes occur seasonally in Lake Michigan, the raw water supply to the LMFP. These taste and odor episodes typically occur between June and October when Lake Michigan warms, and natural compounds are produced by algae or other microorganisms that result in an objectionable taste or odor. Powdered activated carbon (PAC) is added to the raw water supply to treat these taste and odor compounds through adsorption. The existing PAC feed system is original to the 1960s construction of the LMFP. The existing carbon feed system is located on the third floor of the Administration Building. It is a manual process that requires staff to load 45-pound bags of dry PAC into a mixing tank with water and create a slurry. The slurry is then dosed into Rapid Mix Basins 1 and 2. The carbon feed equipment is old and undersized by current standards. The system is capable of feeding a maximum of 5 ppm. Ten States Standards currently recommends the ability to provide a higher dose, up to 40 ppm.

The City adds low doses of a blended phosphate product (50/50 orthophosphate and polyphosphate) to its treated water for corrosion control purposes. The existing phosphate feed system is located north of the truck drive in the lower level of the LMFP. This area of the plant was originally the location of the aluminum sulfate chemical feed system but was converted to its present use for the phosphate chemical feed system in the 1990s when the Lead and Copper Rule (LCR) required that a corrosion inhibitor be fed. The system lacks adequate secondary containment volume, and significant corrosion has occurred causing pinhole leaks in the bulk storage tanks.

2.9 Summary of Project Need – Distribution System

The proposed distribution system projects recommend action due to aged water main, dead-end lines, or lead service lines. To avoid redundancy, the concerns of each of these items are described.

Aged Water Main

Failure of cast iron water mains and valves built before 1940 in the older parts of Grand Rapids are common, particularly during the winter months. This lessens the distribution system reliability and increases operation and maintenance efforts. The City's policy is to replace aged water mains with ductile iron pipe as streets are reconstructed. Aged water mains generally include lead service lines; it is best practice and most cost effective to replace both the water main and lead service lines concurrently.

Dead End Lines

Dead end lines result in a breakdown of chlorine residuals, thereby limiting their disinfection abilities. Chlorine residual also helps to keep lead out of solution, which is important where lead service lines and old water mains exist within the distribution system. The poor water quality is noticeable to residents and results in a lack of confidence in the safety of the water. For these reasons, dead-end lines are flushed approximately once every 30 days. Where feasible, dead-end lines are gradually being removed from the system to eliminate the associated maintenance and operation efforts and water safety concerns.

Lead Service Lines

Lead water services are a known potential public health hazard. Many lead service lines still exist within older portions of the distribution system. These lead service lines need to be eliminated within the next 20 years to meet the requirements of the Safe Drinking Water Act.

2.9.1 Fremont Avenue Water main (3rd Street to 4th Street)

Approximately 310 feet of 8-inch low pressure (LP) water main exist in Fremont Avenue from Third to Fourth Streets. The main was installed in the 1890s and is made of cast iron. Of the 16 water services connected to the main, 14 are either fully or partially made of lead.

2.9.2 Hall Street Water Main (Madison Avenue to 250' East of Union Avenue); Paris Avenue Water Main (Gilbert Street to Hall Street)

Hall Street (Madison Avenue to 250 feet East of Union Avenue)

Approximately 1,300 feet of 16-inch, 1,000 feet of 24-inch, and 250 feet of 4-inch medium pressure (MP) water main exist in Hall Street from Madison Avenue to 250 feet east of Union Avenue. The 4-inch and 16-inch mains were installed in the 1903, the 24-inch main in 1935. All are made of cast iron. The 24-inch water main is no longer required for transmission purposes and can be abandoned. Of the 23 water services connected to the mains, 12 are either fully or partially made of lead.

Paris Avenue (Gilbert to Hall Street)

Approximately 750 feet of 24-inch MP water main exist in Paris Avenue from Gilbert to Hall Streets. The main was installed in 1935 and is made of cast iron. The main is no longer required for transmission purposes and can be downsized. There are no services connected to this main.

2.9.3 Eleanor Street Water Main (Plainfield Avenue to Diamond Avenue)

Approximately 2,400 feet of 6-inch-high pressure (HP) water main installed prior to 1937 exist in Eleanor Street from Plainfield to Diamond Avenues. Approximately 1,000 feet of this main is a dead-end line serving 27 properties. Of the 69 water services connected to the main, 21 are either fully or partially made of lead.

The 6-inch water main represents the southeasterly limits or the EHPD, but it remains connected by piping to the Intermediate Pressure District to the south. Existing valves are always closed on the southerly legs of four intersections to isolate the districts. The result is an additional 2,600 feet of dead-end water main serving approximately 75 residential properties.

2.9.4 Valley Avenue Water Main (Fulton Street to Bridge Street); Sibley Street Water Main (Valley Avenue to Garfield Avenues)

Valley Avenue (Fulton to Bridge Streets)

Approximately 1,800 feet of 8-inch and 1,100 feet of aged 6-inch LP water main exists in Valley Avenue from Fulton to Bridge Streets. The main was installed in 1898 and 1905 is made of cast iron. Of the 81 water services connected to the main, 61 are either fully or partially made of lead.

The main exists in two separate non-continuous sections:

- Fulton to Veto Streets: 320 feet of 8-inch water main
- Lake Michigan Drive to Bridge Street: 1,480 feet of 8-inch water main

Sibley Street (Valley to Garfield Avenues)

Approximately 350 feet of 6-inch LP water main in Sibley Street from Valley to Garfield Avenues. The main was installed between 1923 is made of cast iron. Of the two water services connected to the main, one is fully or partially made of lead.

2.9.5 Boston Street Water Main (Calvin to Plymouth Avenues)

Approximately 3,100 feet of 10-inch HP water main exist in Boston Street from Calvin to Plymouth Avenues. The main was installed in 1924 and 1930 and is made of cast iron. Of the 83 water services connected to the main, 41 are either fully or partially made of lead.

2.9.6 Burton Street Water Main (Eastern to Kalamazoo Avenues)

Approximately 3,900 feet of 12-inch MP and HP water main exist in Burton Street from Eastern to Kalamazoo Avenues. The main was installed in 1923 and is made of cast iron. Of the 107 water services connected to the main, 76 are either fully or partially made of lead.

2.9.7 Burton Street Water Main (Horton to Eastern Avenues)

Approximately 3,900 feet of 12-inch MP water main exist in Burton Street from Horton to Eastern Avenues. The main was installed between 1913 and 1921 and is made of cast iron. Of the 104 water services connected to the main, 77 are either fully or partially made of lead.

The main exists in two separate non-continuous sections:

- Horton to Jefferson Avenues: 900 feet of 12-inch water main.
- Prospect to Eastern Avenues: 3,000 feet of 12-inch water main.

2.9.8 Oakwood Avenue Water Main (Knapp to 3 Mile Streets)

Approximately 5,300 feet of 6-inch LP and MP water main exist in Oakwood Avenue from Knapp Street to 3 Mile Street. The main was installed between 1925 and 1927 and is made of cast iron. Approximately 400 feet of the LP main is a dead-end line serving eight properties. Of the 119 water services connected to the main, 98 are either fully or partially made of lead.

Three side streets have LP water mains with closed valves at Oakwood Avenue. The result is an additional 1,200 feet of dead-end water main serving approximately 19 residential properties.

2.9.9 Valley Avenue Water Main (Bridge to 4th Streets); 1st and 3rd Streets Water Main (Valley to Garfield Avenues)

<u>Valley Avenue (Bridge to 4th Streets)</u>

Approximately 2,150 feet of 6-inch and 8-inch MP water main and 1,250 feet of 6-inch LP water main exist in Valley Avenue from Bridge to 4th Streets. The mains were installed in 1897 and 1956, respectively. Both mains are made of cast iron. There is no longer a need for medium pressure water main in Valley Avenue therefore it can be abandoned. Of the 36 water services connected to the main, 21 are either fully or partially made of lead.

<u>1st Street (Valley to Garfield Avenues)</u>

Approximately 230 feet of 8-inch MP water main in 1st Street from Valley (North) to Valley (South) Avenue. The main was installed in 1900 and is made of cast iron. There is no longer a need for medium pressure water main in 1st Street therefore it can be abandoned. There are no water services in this block.

<u>3rd Street (Valley to Garfield Avenues)</u>

Approximately 350 feet of 6-inch LP water main exist in 3rd Street from Valley to Garfield Avenues. The main was installed in 1897 and is made of cast iron. Of the 13 water services connected to the main, nine are either fully or partially made of lead.

2.9.10 Buchanan Avenue Water Main (Corinne to Hall Streets)

Approximately 2,800 feet of 6-inch and 10-inch MP water main exist in Buchanan Avenue from Corinne to Hall Streets. The main was installed in 1904 and 1912 and is made of cast iron. Of the 11 water services connected to the main, six are either fully or partially made of lead.

2.9.11 2nd Street Water Main (Valley to Fremont Avenues)

Approximately 1,360 feet of 4-inch and 6-inch LP water main exist in 2nd Street from Valley and Fremont Avenues. The main was installed in 1922 and is made of cast iron. Of the 28 water services connected to the main, 20 are either fully or partially made of lead.

The main exists in three separate non-continuous sections:

- Valley to Garfield Avenues: 380 feet of 6-inch water main.
- Lincoln to Pine Avenues: 600 feet of 4-inch water main.
- Lane to Fremont Avenues: 380 feet of 4-inch water main.

2.9.12 Sherman Street Water Main (Giddings to Norwood Avenues)

Approximately 800 feet of 10-inch HP water main exist in Sherman Street from Giddings to Norwood Avenues. The main was installed in 1909 and is made of cast iron. Of the 25 water services connected to the main, 24 are either fully or partially made of lead.

2.9.13 Butterworth Street Water Main (Marion to Lane Avenues)

Approximately 670 feet of 8-inch LP water main exist in Butterworth Street from Marion to Lane Avenues. The main was built in 1892 and is made of cast iron. Of the 20 water services connected to the main, 16 are either fully or partially made of lead.

2.9.14 Buchanan Avenue Water Main (Stewart to Corinne Streets)

Approximately 1,850 feet of 10-inch MP water main exist in Buchanan Avenue from Stewart to Corinne Streets. The main was installed in 1913 and is made of cast iron. Of the 40 water services connected to the main, 37 are either fully or partially made of lead.

2.9.15 Alger Street Water Main (Division to Madison Avenues)

Approximately 2,300 feet of 12-inch MP water main exist in Alger Street from Division to Madison Avenues. The main was built in the 1920's is made of cast iron. Of the 36 water services connected to the main, 20 are either fully or partially made of lead.

2.9.16 Butterworth Street Water Main (Lane Avenue to Hogadone Place)

Approximately 670 feet of 8-inch LP water main exist in Butterworth Street from Marion to Lane Avenues. The main was built in 1892 and is made of cast iron. Of the 15 water services connected to the main, 14 are either fully or partially made of lead.

2.9.17 Mulford Drive Water Main (Alger/Madison to Union Avenues)

Approximately 1,570 feet of 6-inch MP water main exist in Mulford Drive from Alger/Madison intersection to Union Avenue. The main was built in 1928 and is made of cast iron. Of the 42 water services connected to the main, 40 are either fully or partially made of lead.

2.9.18 Ardmore Street Water Main (Eastern to Silver Avenues)

Approximately 2,100 feet of 6-inch MP and HP water main exist in Ardmore Street from Eastern to Silver Avenues. The main was built in 1926 and is made of cast iron. Of the 76 water services connected to the main, 52 are either fully or partially made of lead.

2.9.19 College Avenue Water Main (Hoyt to Dickinson Avenues)

Approximately 2,350 feet of 6-inch MP water main exist in College Avenue from Hoyt to Dickinson Avenues. The main was installed in 1922 and is made of cast iron. Of the 81 water services connected to the main, 56 are either fully or partially made of lead.

The main exists in two separate non-continuous sections:

- Hoyt to Burton Avenues: 1,370 feet of 6-inch water main
- Elliott to Dickson Avenues: 980 feet of 6-inch water main

2.9.20 Houseman Street Water Main (Knapp to Eleanor Streets)

Approximately 1,300 feet of 6-inch HP water main exist in Houseman Avenue from Knapp to Eleanor Streets. The main was built in 1929 and is made of cast iron. Of the 43 water services connected to the main, one is either fully or partially made of lead.

2.9.21 Union Avenue Water Main (Fountain to Lyon Streets)

Approximately 780 feet of 6-inch MP water main exist in Union Avenue from Fountain to Lyon Streets. The main was built in 1899 and is made of cast iron. Of the 22 water services connected to the main, 17 are either fully or partially made of lead.

2.9.22 Hall Street Water Main (Underhill Avenue to US-131)

Approximately 1,450 feet of 8-inch and 12-inch MP water main exist in Hall Street from Underhill Avenue to US-131. The main was built in 1909 and is made of cast iron. Of the 26 water services connected to the main, 21 are either fully or partially made of lead.

2.10 Summary of Project Need – Lead Service Lines Replacement

The lead service lines associated with any proposed water main improvement project will be addressed. However, there are potential lead service lines in the distribution system that are not associated with any water main improvements. Lead water service lines are a known potential public health hazard.

The data from Segment II of the 2020 CMP shows the number of services with lead on both sides of the service or just on the public or private side.

Table 7 – Lead Services by Private and Public Side (Data from July 2020)

Category	Quantity
Lead Service – Public and Private Side	13,891
Lead Service – Public Side Only	2,789
Lead Service – Private Side Only	7,788
Total	24,468

As indicated in the Table 7, more than 24,000 lead service line replacement projects need to be completed to meet the requirements of the revised LCR. The City had begun replacing lead service lines proactively prior to the revisions to the LCR; however, the additional cost of replacing the private along with the public side of the services and the timeline for replacement imposed was not anticipated. Therefore, this Project Planning

Document includes the replacement of potential lead service lines within the City's distribution system each year (2024-2028).

2.11 Summary of Project Need – Caledonia Township Connection

Caledonia Township currently operates two groundwater treatment plants to serve their water distribution system. The demand in the Township has been increasing and threatens to exceed the treatment capacity of the existing facilities. In addition, there are concerns regarding water quality and aging infrastructure of the existing facilities. The Township has recently been evaluating different alternatives for supplying their water system which include water treatment upgrades and different source supplies. One alternative is to connect to the Grand Rapids water system, which was evaluated in Segment II of the 2020 CMP.

2.12 Summary of Project Need – Cascade Township Water Mains

There are groundwater quality concerns in areas that may be affected by activities at the Gerald R. Ford International Airport (Airport). Polyfluoroalkyl substance (PFAS) contamination of groundwater in Cascade Township has been reported for the area north of I-96, west of the Thornapple River and east of Thornapple River Drive. Much of this area is currently not connected to the water distribution system and properties are served by private wells. There is a need to provide quality drinking water to residents in this area.

2.13 Compliance with Drinking Water Standards

EGLE issued a Sanitary Survey for the City of Grand Rapids Water System in 2017. The document listed numerous recommendations for the water system. The City has addressed several of the recommendations, but many others require substantial capital improvements, and some have been incorporated herein.

The 2017 Sanitary Survey evaluated compliance with the LCR for the City of Grand Rapids. Since sampling for lead and copper began in 1997, the City has sampled more frequently than the requirement of Rule 710b (5) of Act 399 to ensure compliance is maintained. The City currently feeds blended phosphate to prevent leaching of lead and copper from the existing pipes, which has kept the lead levels below the action level of 15 parts per billion (ppb). Target levels for water quality parameters including pH, alkalinity, and phosphate levels were set by EGLE and the City for both the point of entry (where the water leaves the LMFP) and for locations in the distribution system. All point of entry samples (samples taken where water leaves the plant and enters the distribution system) since 2014 follow Act 399; however, samples taken from the distribution system have had multiple excursions since 2014. This was due to inaccurate sampling practices, which were corrected beginning in 2016. Since that time, the sampling issues have been resolved. In 2017, the City enacted a policy to replace public and private lead service lines when exposed due to construction or when leak repairs are needed. The City also provides a payment plan to customers seeking the replacement of lead service lines.

The lagoons at the LMFP overflow to Little Pigeon Creek. The City has an NPDES permit for discharge with a residual chlorine limit of 0. 038 mg/L. Multiple exceedances of this limit have occurred since 2005, and a violation notice was issued on March 1, 2007. There have been no further violations since that time. The LMFP Residuals Handling Improvements is expected to reduce the chance for any future exceedances by installing a flow paced dechlorination system just upstream of discharge to the lagoons.

The 2015 CMP describes water supply needs and deficiencies for the Grand Rapids distribution system and for the LMFP in Segments II and III. Many of the issues that were identified have since been addressed and corrected. The needs and deficiencies of the system and the LMFP were evaluated and updated in the 2020 CMP and was used to select the projects identified in this report.

2.14 Orders or Enforcement Actions

No court or enforcement orders, or written enforcement actions have been issued to the City regarding the water system.

2.15 Drinking Water Quality Problems

The aesthetic quality of the water produced by the LMFP is generally good; there are no known drinking water problems in the overall distribution system. There have been occasional occurrences of taste and odor events, but they have been rare in the last decade and are not considered to be a major priority. The LMFP feeds carbon as needed to address taste and odor.

There have been water quality issues in select areas of the system. The water quality issues have led to customer complaints and frequent flushing of the water mains in these affected areas.

2.16 Projected Needs for the Next 20 Years

The CMP completed in 2020 outlined projected needs for the 20-year period from 2020 to 2040.

Section 14.0 in Segment II of the 2020 CMP identified water system capital improvements. Table II-14-3 in that report shows the individual projects for both the LMFP and the distribution system for which funding has been planned.

The 2020 CMP also evaluated anticipated growth and expansion of customer communities within the 20-year planning period and identified future water mains needed to service potential growth.

The 2017 Sanitary Survey identified deficiencies in the standby power in the water supply system and urged the City to focus on installing reliable power for use during normal operation and emergency conditions. As improvements to pump stations are implemented and as future improvements are considered, the City is actively addressing issues concerning standby power at each facility.

Modifications to improve the system's response to events related to extreme weather or other climatic factors are being addressed by the City. Improvements include the installation of a combination of generator plugs, manual transfer switches, automatic transfer switches, and dedicated natural gas or portable diesel generators at pump stations throughout the system. Upgrading the alternative power sources at the selected pump stations is a cost-effective, long-term solution to protect the City's critical facilities. Generators with manual or automatic transfer switches will promote individual and community safety and resilience, reducing response and recovery resource requirements in the wake of a disaster or incident, and ultimately reducing the risk of loss of life and property from future disasters.

3.0 Analysis of Alternatives

3.1 LMFP Residuals Handling Improvements

3.1.1 No-Action

If no action is taken, the performance of the 55+ year old lagoon system will continue to be negatively impacted by high groundwater at the site, which could cause future regulatory issues. The existing surface water discharge has occasionally been problematic due to chlorine exceedances of the NPDES permit, which may occur again if no action is taken. The LMFP staff will continue to remove the solids that settle in the lagoons using earth moving equipment before final transport and disposal to a landfill. Over time, the underdrain system in the lagoons may become plugged with solids, which would have a negative impact on the performance of the system. Because of the declining condition of the existing lagoons and the challenges associated with maintaining the NPDES permit, the No-Action alternative is not being considered further.

3.1.2 Optimum Performance of Existing Facilities

Operation of the existing lagoons and the existing residuals handling process has been optimized, but certain additions would further optimize residuals handling. The recommended residuals handling improvement project was developed as a result of three Fishbeck engineering studies for the LMFP: *Technical Memo No. P-2: Residuals Handling Evaluation (June 2003)*, *Technical Mem No. P-19: Residuals Treatment Alternatives Evaluation (August 2010),* and *Lake Michigan Filtration Plant Pretreatment System Improvements Preliminary Design Report (December 2015).* The alternatives carried forward from previous studies and discussed herein include:

- Separate Residuals Treatment.
- Combined Residuals Treatment.

3.1.2.1 Separate Residuals Treatment

To optimize the residuals handling process at the LMFP, new gravity thickeners and mechanical dewatering equipment are needed. The recommended LMFP Residuals Handling Improvements would repurpose the east half of the existing Accelator Building for the installation of the new equipment. The Accelator clarifiers are installed in square, flat bottomed concrete basins that are in good condition, so implementation of this project would improve existing tank and building space utilization. An addition to the existing Accelator Building would be constructed to the north of Basin 2 for the storage of additional equipment. Openings would be cut into the north wall of Basin 2 to allow passage between the new building addition and the existing basin.

This alternative would implement a process to collect the concentrated and dilute residuals from the LMFP for equalization (EQ), clarification, thickening, and mechanical dewatering treatment. Filter washwater would initially be pumped to a two chamber EQ tank retrofitted into Basin 4 of the existing Accelator Building. The EQ tank would be capable of holding a volume of eight filter backwashes (800,000 gallons). A decant overflow of clarified water would be dechlorinated and sent to the lagoons. The remaining backwash water would be pumped from the EQ tank to redundant clarifiers, retrofitted into Basin 2 of the existing Accelator Building. An anionic polymer would be added to the backwash water prior to entering the clarifiers to enhance settling.

Concentrated sludge blowdown from the floc/sed basins would be pumped to the existing Accelator Building and combined with the sludge blowdown from plate settlers in Pretreatment Basins 1 and 2. Collected solids from the backwash water clarifiers would also be added to the concentrated residual waste stream. After adding polymer, the combined concentrated stream would enter redundant gravity thickeners retrofitted into Basin 2 of the existing Accelator Building. Additional polymer would be added to the thickened sludge from the gravity thickeners prior to entering mechanical solids dewatering equipment. The dewatering equipment would be located in the building addition. The dry residual solids would be collected in dumpsters and landfilled.

Dilute streams of clarified effluent from the backwash water clarifiers, supernatant from the gravity thickeners, and pressate from the mechanical dewatering equipment would be combined, dechlorinated, and discharge to the existing lagoons. The flow would be metered as it is sent to the lagoons. After further settling in the lagoons, the clarified effluent would then be discharged to the surface water.

This alternative would include the following items:

- Site piping rerouting the existing floc/sed basin sludge blowdown.
- Booster pumps for the floc/sed sludge blowdown.
- Pump station for pumping filter backwash water to the new EQ tank.
- EQ tank for filter washwater with decant system, retrofitted into existing Accelator Basins.
- EQ tank for concentrated residuals, retrofitted into existing Accelator Basins.
- A pump station for pumping filter backwash water from the EQ tank to the clarifiers.
- Site piping rerouting the filter backwash water.
- Two clarifiers and piping for filter backwash water.

- Additional piping within the Accelator Pipe Gallery for the combined residuals stream from the floc/sed basins concentrated blowdown, the clarifiers sludge, and the plate settlers concentrated blowdown.
- Pumps to feed gravity thickeners.
- Two gravity thickeners for concentrating the combined residuals stream.
- Reconfiguration of the east half of the Accelator Basins for clarification and dewatering.
- Sludge pumping equipment to feed the mechanical dewatering equipment.
- Redundant mechanical dewatering equipment.
- Building addition to house mechanical dewatering equipment.
- Site piping for routing filtrate effluent.
- Polymer feed systems.
- Flow meter and sodium bisulfite feed points for dechlorination prior to entering to the lagoons.

3.1.2.2 Combined Residuals Treatment

Another alternative is to combine all concentrated sludge with the filter backwash water prior to dewatering. Similar to the previous alternative, filter backwash water would be pumped to an EQ tank. Unlike the previous alternative, the concentrated sludge blowdown from the floc/sed basins would also be sent to the EQ tank. The EQ tank would have a capacity of 1 million gallons to hold eight filter backwash cycles, plus the additional blowdown volume from the floc/sed basins. The combined flow would be pumped to the existing Accelator Building and combined with the concentrated sludge from the pretreatment plate settlers. The combined flow would then be sent to redundant clarifiers, retrofitted into Basin 4 of the existing Accelator Building. The flow would then be sent to gravity thickeners, retrofitted into Basin 2, then sent through the mechanical dewatering equipment located in the building addition constructed to the north of Basin 2. The dry residual solids would be collected in dumpsters and landfilled. The clarifiers, gravity thickeners, and the dewatering equipment would be larger in this alternative because of the large volume of water in the combined flow.

Like the previous alternative, dilute streams of clarified effluent from the clarifiers, gravity thickeners, and dewatering equipment would be combined, dechlorinated, flow-metered, and discharge to the existing lagoons.

This alternative would include the following items:

- Site piping rerouting the existing floc/sed basin sludge blowdown.
- Pump replacement for pumping filter backwash water to the new EQ tank.
- EQ tank for filter backwash water and floc/sed sludge blowdown.
- A pump station for pumping the combined flow from the EQ tank to the clarifiers.
- Site piping rerouting the combined flow.
- Two clarifiers and piping for the combined flow.
- Additional piping within the Accelator Pipe Gallery for the combined filter backwash water, floc/sed basins concentrated blowdown, and the plate settlers concentrated blowdown.
- Pumps to feed gravity thickeners.
- Two gravity thickeners for concentrating the combined stream.
- Reconfiguration of the east half of the Accelator Basins for clarification and dewatering.
- Sludge pumping equipment to feed the mechanical dewatering equipment.
- Redundant mechanical dewatering equipment.
- Building addition to house mechanical dewatering equipment.
- Site piping for routing filtrate effluent.
- Polymer feed systems.
- Flow meter and bisulfite feed points for dechlorination prior to entering to the lagoons.

3.1.3 Regional Alternatives

A regional alternative is not available.

3.2 LMFP Chemical Unloading

3.2.1 No-Action

The no-action alternative, the existing operations of chemical unloading will continue without secondary containment in case of a potential spill. The existing curbed area does not provide adequate containment in the event of a major spill that could result from a hose rupture or disconnection at the truck. This could result in chemicals entering the stormwater system and ultimately migrating to Lake Michigan.

Therefore, the no-action alternative will not be evaluated further.

3.2.2 Optimum Performance of Existing Facilities

Because the City currently utilizes only the south unloading bay for chemical deliveries, this bay would be modified for the new containment system. The existing concrete pad and subgrade would be removed from the south unloading bay and a new sloped pad would be installed to direct any spills to a center drain in the bay. A central drain in the middle of the bay would minimize the amount of precipitation or dirt that could enter the drain. Because the unloading bay has a roof, any precipitation would fall outside the sloped containment area. The drain would be piped to a new 6,000-gallon double-wall containment tank and would be buried to the west of the Chemical Unloading Station. In the event of a major spill, the chemical would be contained and directed to the new underground tank. If a spill occurs, the City would be able to sample the contained material in the tank and contract with a chemical waste hauling company to pump out the tank and dispose of the material. To facilitate the installation of the 6,000-gallon containment tank and drain, some smaller chemical feed piping buried to the west of the unloading station would need to be relocated.

Small amounts of leakage occur from drippings during attachment and removal of the truck hoses to the fill pipes located on the outside of the Chemical Unloading Station. It would be effective to provide a small sump to capture any drippings that occur during this process. The small sump would be installed below the fill pipes with an air diaphragm transfer pump that would pump any drippings to a new 500-gallon double wall containment tank located inside the Chemical Building. This small containment tank would be installed in the current sodium bisulfite area as this chemical feed system is being relocated as part of the Residuals Handling Improvements Project. A second air diaphragm transfer pump would then be used to pump out of the new containment tank to a discharge port on the outside of the building that a waste truck hauler can connect to. Pumping of the spills would be a manual process so there would be minimal electrical and control system improvements necessary for the project. Level switches would be installed at the containment tanks to alarm when a spill occurs and fills the tank. A compressed air line would be installed to drive the air diaphragm transfer pumps.

Additional site work would be included in the project. The asphalt drive surrounding the Chemical Unloading Station would need be removed and reinstalled to slope away from the unloading bay. This would prevent stormwater runoff from entering the containment area.

3.2.3 Regional Alternatives

A regional alternative is not available.

3.3 LMFP Carbon Feed System and Phosphate Feed System

3.3.1 No-Action

The no-action alternative implies the existing carbon and phosphate feed systems will continue to be operated as the condition of the equipment and its reliability declines.

The existing carbon feed system is original to the 1960s construction of the LMFP. The feed equipment is old and undersized by current standards. In addition, due to its current location on the third floor of the Administration Building and manual process, there is no containment of the carbon dust generated. This could result in a potential fire hazard.

The existing phosphate feed system lacks adequate secondary containment volume and significant corrosion has occurred causing pinhole leaks in the bulk storage tanks.

Therefore, the no-action alternative will not be evaluated further.

3.3.2 Optimum Performance of Existing Facilities

A new PAC slurry mixing, storage, and feed system should be constructed to replace the existing PAC system. The new system would be installed near the low lift pump stations. Dosing PAC at the low lift pump discharge would maximize the contact time with the constituents that create the taste and odor issues. It is assumed that the average dose that the system would be designed for is 5 ppm with a maximum of 10 ppm. This is a typical dose that has been shown to be effective at other conventional treatment plants on Lake Michigan that use PAC for taste and odor control.

The new carbon feed system would consist of concrete mixing and storage tanks that would be buried below grade with concrete covers. A masonry building would be constructed above the tanks to house the carbon feed equipment. The bulk dry PAC would be delivered by truck and would be unloaded into the concrete tanks. Water would be added, and the PAC would be mixed into a slurry during the unloading process. PAC slurry must be kept in suspension at all times, so mixers would be installed at each tank. Two mixers would be included at each tank to allow the slurry to be kept in suspension if one of the mixers is taken out of service for repair. Dust collection equipment would be provided inside the building to contain any dust that is generated during the unloading process. With the covered tanks and sealed pipes used for unloading, the dust generation should be minimal.

The PAC slurry would be dosed into the low lift pump discharge with chemical feed pumps that have adjustable speed to meet different dosage rates when needed. Buried slurry pipes would be installed from the Carbon Feed Building to each low lift pump discharge header. A small carbon feed mix tank would be also provided in the station to give the plant flexibility to provide PAC in small doses in the event taste and odor issues arise outside the typical PAC dosing season. This smaller system would include a mixing tank where bags of dry PAC can be emptied, similar to the existing system.

To optimize the existing facilities for the phosphate feed system, the system should be replaced and relocated to a new location in the existing Chemical Building. The new phosphate chemical feed system would be installed in the Chemical Building at the location of the abandoned potassium permanganate feed system. The required secondary containment facilities have already been provided for the potassium permanganate system, so no new building modifications for chemical containment would be necessary.

The new phosphate chemical feed system would consist of two new 5,000-gallon bulk storage tanks. This would allow the plant to accept delivery from a full tanker truck and would still provide more than a 30-day supply under average day demand conditions. A new 250-gallon day tank and three new chemical feed pumps would be installed. Chemical feed piping would need to be installed from the west end of the Chemical Building to the injection points in the filtered water effluent piping. It is assumed that the existing HVAC and controls systems that have been abandoned would be replaced as part of the relocation of the chemical feed system. New

electrical equipment to power the new equipment, a new control panel, and new instrumentation would be included.

3.3.3 Regional Alternatives

A regional alternative is not available.

3.4 Fremont Avenue Water Main (3rd to 4th Streets)

3.4.1 No-Action

Approximately 310 feet of 8-inch LP water main has exceeded its design life; in the No-Action alternative, this water main would remain in service. The 14 lead service lines would need to be replaced within the next 17 years to comply with the Safe Drinking Water Act.

3.4.2 Optimum Performance of Existing Facilities

The existing 8-inch LP water main and lead water services have exceeded their design lives and no longer function optimally, nor do they meet current City design and operational expectations and standards.

3.4.3 Construction Alternatives

3.4.3.1 New 8-inch LP Water Main and Services

Replace approximately 310 feet of the existing 8-inch LP water main with new 8-inch LP water main from 3rd to 4th Streets.

Replace 14 lead service lines (including the portions on private property) with copper services.

3.4.3.2 New Service Line

Replace 14 lead service lines (including the portions on private property) with copper services. No water main replacements.

3.4.4 Regional Alternatives

A regional alternative is not available.

3.5 Hall Street Water main (Madison Avenue to 250 feet East of Union Avenue); Paris Avenue Water Main (Gilbert to Hall Streets)

3.5.1 No-Action

Approximately 3,300 feet of 4-inch, 16-inch and 24-inch MP water main has exceeded its design life; in the No-Action alternative, this water main would remain in service. The 12 lead service lines would need to be replaced within the next 17 years to comply with the Safe Drinking Water Act.

3.5.2 Optimum Performance of Existing Facilities

The existing 4-inch, 16-inch and 24-inch MP water mains and lead water services have exceeded their design lives and no longer function optimally, nor do they meet current City design and operational expectations and standards. The 24-inch water main is no longer needed for transmission purposes and can be abandoned.

3.5.3 Construction Alternatives

3.5.3.1 New 6-inch and 12-inch MP Water Main and Services

Replace approximately 1,300 feet of existing 16-inch MP water main with new 12-inch MP water main in Hall Street from Madison to Union Avenues. Abandon existing 24-inch water main.

Replace approximately 250 feet of existing 4-inch MP water main with new 6-inch MP water main in Hall Street from Union Avenue to 250 feet east.

Replace approximately 350 feet of existing 24-inch MP water main with new 6-inch MP water main in Paris Avenue from Gilbert to Hall Streets.

Replace 12 lead service lines (including the portions on private property) with copper services.

3.5.3.2 New Service Lines

Replace 12 lead service lines (including the portions on private property) with copper services. No water main replacement.

3.5.4 Regional Alternatives

A regional alternative is not available.

3.6 Eleanor Street Water Main (Plainfield to Diamond Avenues)

3.6.1 No-Action

The No-Action alternative would result in the continued need for monthly flushing of approximately 3,600 feet of dead-end water main to maintain water quality and limit customer complaints and concerns. Additionally, approximately 21 lead service lines and 2,400 feet of 6-inch HP water main that have exceeded their design life would remain. The 21 lead service lines would need to be replaced within 17 years to comply with the Safe Drinking Water Act.

3.6.2 Optimum Performance of Existing Facilities

The existing 6-inch HP water main and lead water services have exceeded their design lives and no longer function optimally, nor do they meet current City design and operational expectations and standards.

3.6.3 Construction Alternatives

3.6.3.1 New 6-inch HP and 6-inch MP Water Main and Services

Replace approximately 1,000 feet of existing 6-inch water main with new 6-inch MP water main between Plainfield and Eastern Avenues. Install and open new valves on side streets, thereby eliminating all dead-end lines.

Replace approximately 1,400 feet of existing 6-inch HP water main with new 6-inch HP water main from Eastern to Diamond Avenues.

Replace 21 lead service lines (including the portions on private property) with copper services.

3.6.3.2 Disconnect Pressure Districts and New Service Lines

Keep the existing 6-inch water main in service but physically disconnect the EHPD from the Intermediate Pressure District at the Eleanor/Eastern intersection. Open existing valves on side streets, thereby eliminating all dead-ends.

Replace 21 lead service lines (including the portions on private property) with copper services.

3.6.4 Regional Alternatives

A regional alternative is not available.

3.7 Valley Avenue Water Main (Bridge to Fulton Streets); Sibley Street Water Main (Valley to Garfield Avenues)

3.7.1 No-Action

Approximately 3,250 feet of 6-inch and 8-inch LP water main has exceeded its design life; in the No-Action alternative, this water main would remain in service. The 62 lead service lines would need to be replaced within the next 17 years to comply with the Safe Drinking Water Act.

3.7.2 Optimum Performance of Existing Facilities

The existing 6-inch and 8-inch LP water mains and lead water services have exceeded their design lives and no longer function optimally, nor do they meet current City design and operational expectations and standards.

3.7.3 Construction Alternatives

3.7.3.1 New 6-inch and 8-inch MP Water Main and Services

Replace approximately 320 feet of existing 6-inch LP water main with new 8-inch LP water main in Valley Avenue from Fulton to Veto Streets.

Replace approximately 2,580 feet of parallel existing 6-inch and 8-inch LP water main with a single new, 1,800 foot long, 8-inch LP water main in Valley Avenue from Lake Michigan Drive to Bridge Street.

Replace approximately 350 feet of existing 6-inch LP water main with new 6-inch LP water main In Sibley Street from Valley to Garfield Avenues.

Replace 62 lead service lines (including the portions on private property) with copper services.

3.7.3.2 New Service Lines

Replace 62 lead service lines (including the portions on private property) with copper services. No water main replacement.

3.7.4 Regional Alternatives

A regional alternative is not available.

3.8 Boston Street Water Main (Calvin to Plymouth Avenues)

3.8.1 No-Action

Approximately 3,100 feet of 10-inch HP water main has exceeded its design life; in the No-Action alternative, this water main would remain in service. The 41 lead service lines would need to be replaced within the next 17 years to comply with the Safe Drinking Water Act.

3.8.2 Optimum Performance of Existing Facilities

The existing 10-inch HP water main and lead water services have exceeded their design lives and no longer function optimally, nor do they meet current City design and operational expectations and standards.

3.8.3 Construction Alternatives

3.8.3.1 New 8-inch and 12-inch HP Water Main and Services

Replace approximately 550 feet of the existing 10-inch HP water main with new 8-inch HP water main from Calvin to Giddings Avenues.

Replace approximately 2,550 feet of the existing 10-inch HP water main with new 12-inch HP water main from Giddings to Plymouth Avenues.

Replace 41 lead service lines (including the portions on private property) with copper services.

3.8.3.2 New Service Lines

Replace 41 lead service lines (including the portions on private property) with copper services. No water main replacements.

3.8.4 Regional Alternatives

A regional alternative is not available.

3.9 Burton Street Water Main (Eastern to Kalamazoo Avenues)

3.9.1 No-Action

Approximately 1,350 feet of 12-inch MP water main and 2,550 feet of 12-inch HP water main has exceeded its design life; in the No-Action alternative, this water main would remain in service. The 76 lead service lines would need to be replaced within the next 17 years to comply with the Safe Drinking Water Act.

3.9.2 Optimum Performance of Existing Facilities

The existing 12-inch MP and HP water main and lead water services have exceeded their design lives and no longer function optimally, nor do they meet current City design and operational expectations and standards.

3.9.3 Construction Alternatives

3.9.3.1 New 12-inch MP and HP Water Main and Services

Replace approximately 1,350 feet of existing 12-inch MP water main with new 12-inch MP water main from Eastern to Blaine Avenues.

Replace approximately 2,550 feet of existing 12-inch HP water main with new 12-inch HP water main from Blaine to Kalamazoo Avenues.

Replace 76 lead service lines (including the portions on private property) with copper services.

3.9.3.2 New Service Lines

Replace 76 lead service lines (including the portions on private property) with copper services. No water main replacements.

3.9.4 Regional Alternatives

A regional alternative is not available.

3.10 Burton Street Water Main (Horton to Eastern Avenues)

3.10.1 No-Action

Approximately 3,900 feet of 12-inch MP water main has exceeded its design life; in the No-Action alternative, this water main would remain in service. The 77 lead service lines would need to be replaced within the next 17 years to comply with the Safe Drinking Water Act.

3.10.2 Optimum Performance of Existing Facilities

The existing 12-inch MP water main and lead water services have exceeded their design lives and no longer function optimally, nor do they meet current City design and operational expectations and standards.

3.10.3 Construction Alternatives

3.10.3.1 New 12-inch MP Water Main and Services

Replace approximately 900 feet of existing 12-inch MP water main with new 12-inch MP water main from Horton to Jefferson Streets.

Replace approximately 3,000 feet of existing 12-inch MP water main with new 12-inch MP water main from Prospect to Eastern Avenues.

Replace 77 lead service lines (including the portions on private property) with copper services.

3.10.3.2 New Service Lines

Replace 77 lead service lines (including the portions on private property) with copper services. No water main replacement.

3.10.4 Regional Alternatives

A regional alternative is not available.

3.11 Oakwood Avenue Water Main (Knapp to 3 Mile Streets)

3.11.1 No-Action

The No-Action alternative would result in the continued need for routinely flushing of approximately 1,600 feet of dead-end water main to maintain water quality and limit customer complaints and concerns. Additionally, approximately 98 lead service lines and 5,300 feet of 6-inch LP and MP water main that have exceeded their design life would remain. The 98 lead service lines would need to be replaced within 17 years to comply with the Safe Drinking Water Act.

3.11.2 Optimum Performance of Existing Facilities

The existing 6-inch LP and MP water main and lead water services have exceeded their design lives and no longer function optimally, nor do they meet current City design and operational expectations and standards.

3.11.3 Construction Alternatives

3.11.3.1 New 6-inch MP, 8-inch LP, 8-inch MP Water Main and Services

Replace approximately 3,550 feet of existing 6-inch MP water main with new 8-inch MP water main from Knapp Street to Plainfield Avenue.

Replace approximately 950 feet of existing 6-inch LP water main with new 6-inch LP water main from Plainfield Avenue to Sligh Boulevard.

Place approximately 800 feet of existing 6-inch MP water main with new 6-inch MP water main from Sligh Boulevard to 3 Mile.

Install and open new valves on side streets, thereby eliminating all dead-end lines.

Replace 98 lead service lines (including the portions on private property) with copper services.

3.11.3.2 Disconnect Pressure Districts and New Service Lines

Keep the existing 6-inch water main in service but physically disconnect the low and medium pressure districts at the Oakwood/Plainfield and Oakwood/Sligh intersections. Open existing and new valves on side streets, thereby eliminating all dead-ends.

Replace 98 lead service lines (including the portions on private property) with copper services.

3.11.4 Regional Alternatives

A regional alternative is not available.

3.12 Valley Avenue Water Main (4th to Bridge Streets); 1st and 3rd Street Water Main (Valley to Garfield Avenues)

3.12.1 No-Action

Approximately 3,980 feet of 6-inch and 8-inch LP and MP water main has exceeded its design life; in the No-Action alternative, this water main would remain in service. The 30 lead service lines would need to be replaced within the next 17 years to comply with the Safe Drinking Water Act.

3.12.2 Optimum Performance of Existing Facilities

The existing 6-inch and 8-inch LP and MP water mains and lead water services have exceeded their design lives and no longer function optimally, nor do they meet current City design and operational expectations and standards. The MP main is no longer required to provide adequate service to the area.

3.12.3 Construction Alternatives

3.12.3.1 New 6-inch and 8-inch LP Water Main and Services

Replace the parallel existing 6-inch and 8-inch LP and MP water mains with a single new, 1,300 foot long, 8-inch LP water main in Valley Avenue from 1st to 4th Streets.

Replace approximately 100 feet of existing 8-inch MP water main with new 6-inch LP water main in Valley Avenue from 1st Street to 100 feet south.

Abandon existing 8-inch MP water main in Valley Avenue from Bridge to 1st Streets.

Install approximately 350 feet of new 8-inch LP water main in First Street from Valley to Garfield Avenues. Abandon existing 8-inch MP water main.

Replace approximately 350 feet of existing 6-inch LP water main with new 6-inch LP water main in 3rd Street from Valley to Garfield Avenues.

Replace 30 lead service lines (including the portions on private property) with copper services.

3.12.3.2 New Service Lines

Replace 30 lead service lines (including the portions on private property) with copper services. No water main replacement.

3.12.4 Regional Alternatives

A regional alternative is not available.

3.13 Buchanan Avenue Water Main (Corinne to Hall Streets)

3.13.1 No-Action

Approximately 2,800 feet of 6-inch and 10-inch MP water main has exceeded its design life; in the No-Action alternative, this water main would remain in service. The six lead service lines would need to be replaced within the next 17 years to comply with the Safe Drinking Water Act.

3.13.2 Optimum Performance of Existing Facilities

The existing 6-inch and 10-inch MP water main and lead water services have exceeded their design lives and no longer function optimally, nor do they meet current City design and operational expectations and standards.

3.13.3 Construction Alternatives

3.13.3.1 New 8-inch MP Water Main and Services

Replace approximately 2,800 feet of existing 6-inch and 10-inch MP water main with new 8-inch MP water main from Corrinne to Hall Streets.

Replace six lead service lines (including the portions on private property) with copper services.

3.13.3.2 New Service Lines

Replace six lead service lines (including the portions on private property) with copper services. No water main replacements.

3.13.4 Regional Alternatives

A regional alternative is not available.

3.14 2nd Street Water Main (Valley to Fremont Avenues)

3.14.1 No-Action

Approximately 1,360 feet of 6-inch LP water main has exceeded its design life; in the No-Action alternative, this water main would remain in service. The 20 lead service lines would need to be replaced within the next 17 years to comply with the Safe Drinking Water Act.

3.14.2 Optimum Performance of Existing Facilities

The existing 6-inch LP water main and lead water services have exceeded their design lives and no longer function optimally, nor do they meet current City design and operational expectations and standards.

3.14.3 Construction Alternatives

3.14.3.1 New 6-inch LP Water Main and Services

Replace approximately 380 feet of existing 6-inch LP water main with new 6-inch LP water main from Valley to Garfield Avenues.

Replace approximately 600 feet of existing 6-inch LP water main with new 6-inch LP water main from Lincoln to Pine Avenues.

Replace approximately 380 feet of existing 6-inch LP water main with new 6-inch LP water main from Lane to Fremont Avenues.

Replace 20 lead service lines (including the portions on private property) with copper services.

3.14.3.2 New Service Lines

Replace 20 lead service lines (including the portions on private property) with copper services. No water main replacement.

3.14.4 Regional Alternatives

A regional alternative is not available.

3.15 Sherman Street Water Main (Giddings to Norwood Avenues)

3.15.1 No-Action

Approximately 800 feet of 10-inch HP water main has exceeded its design life; in the No-Action alternative, this water main would remain in service. The 24 lead service lines would need to be replaced within the next 17 years to comply with the Safe Drinking Water Act.

3.15.2 Optimum Performance of Existing Facilities

The existing 10-inch HP water main and lead water services have exceeded their design lives and no longer function optimally, nor do they meet current City design and operational expectations and standards.

3.15.3 Construction Alternatives

3.15.3.1 New 8-inch and 12-inch HP Water Main and Services

Replace approximately 430 feet of existing 10-inch HP water main with new 12-inch HP water main from Giddings to Ethel Avenues.

Replace approximately 370 feet of existing 10-inch HP water main with new 8-inch HP water main from Ethel to Norwood Avenues.

Replace 24 lead service lines (including the portions on private property) with copper services.

3.15.3.2 New Service Lines

Replace 24 lead service lines (including the portions on private property) with copper services. No water main replacements.

3.15.4 Regional Alternatives

A regional alternative is not available.

3.16 Butterworth Street Water Main (Marion to Lane Avenues)

3.16.1 No-Action

Approximately 670 feet of 8-inch LP water main has exceeded its design life; in the No-Action alternative, this water main would remain in service. The 16 lead service lines would need to be replaced within the next 17 years to comply with the Safe Drinking Water Act.

3.16.2 Optimum Performance of Existing Facilities

The existing 8-inch LP water main and lead water services have exceeded their design lives and no longer function optimally, nor do they meet current City design and operational expectations and standards.

3.16.3 Construction Alternatives

3.16.3.1 New 12-inch LP Water Main and Services

Replace approximately 670 feet of existing 8-inch LP water main with new 12-inch LP water main from Marion to Lane Avenues.

Replace 16 lead service lines (including the portions on private property) with copper services.

3.16.3.2 New Service Lines

Replace 16 lead service lines (including the portions on private property) with copper services. No water main replacements.

3.16.4 Regional Alternatives

A regional alternative is not available.

3.17 Buchanan Avenue Water Main (Stewart to Corinne Streets)

3.17.1 No-Action

Approximately 1,850 feet of 10-inch MP water main has exceeded its design life; in the No-Action alternative, this water main would remain in service. The 37 lead service lines would need to be replaced within the next 17 years to comply with the Safe Drinking Water Act.

3.17.2 Optimum Performance of Existing Facilities

The existing 10-inch MP water main and lead water services has exceeded their design lives and no longer function optimally, nor do they meet current City design and operational expectations and standards.

3.17.3 Construction Alternatives

3.17.3.1 New 8-inch MP Water Main and Services

Replace approximately 1,850 feet of existing 10-inch MP water main with new 8-inch MP water main from Stewart to Corrinne Streets.

Replace 37 lead service lines (including the portions on private property) with copper services.

3.17.3.2 New Service Lines

Replace 37 lead service lines (including the portions on private property) with copper services. No water main replacements.

3.17.4 Regional Alternatives

A regional alternative is not available.

3.18 Alger Street Water Main (Division to Madison Avenues)

3.18.1 No-Action

Approximately 2,300 feet of 12-inch MP water main has exceeded its design life; in the No-Action alternative, this water main would remain in service. The 20 lead service lines would need to be replaced within the next 17 years to comply with the Safe Drinking Water Act.

3.18.2 Optimum Performance of Existing Facilities

The existing 12-inch MP water main and lead water services has exceeded their design lives and no longer function optimally, nor do they meet current City design and operational expectations and standards.

3.18.3 Construction Alternatives

3.18.3.1 New 12-inch MP Water Main and Services

Replace approximately 2,300 feet of existing 12-inch MP water main with new 12-inch MP water main from Division to Madison Avenues.

Replace 20 lead service lines (including the portions on private property) with copper services.

3.18.3.2 New Service Lines

Replace 20 lead service lines (including the portions on private property) with copper services. No water main replacements.

3.18.4 Regional Alternatives

A regional alternative is not available.

3.19 Butterworth Street Water Main (Lane Avenue to Hogadone Place)

3.19.1 No-Action

Approximately 670 feet of 8-inch LP water main has exceeded its design life; in the No-Action alternative, this water main would remain in service. The 14 lead service lines would need to be replaced within the next 17 years to comply with the Safe Drinking Water Act.

3.19.2 Optimum Performance of Existing Facilities

The existing 8-inch LP water main and lead water services have exceeded their design lives and no longer function optimally, nor do they meet current City design and operational expectations and standards.

3.19.3 Construction Alternatives

3.19.3.1 New 12-inch LP Water Main and Services

Replace approximately 670 feet of existing 8-inch LP water main with new 12-inch LP water main from Lane Avenue to Hogadone Place.

Replace 14 lead service lines (including the portions on private property) with copper services.

3.19.3.2 New Service Lines

Replace 14 lead service lines (including the portions on private property) with copper services. No water main replacements.

3.19.4 Regional Alternatives

A regional alternative is not available.

3.20 Mulford Drive Water Main (Alger/Madison to Union Avenues)

3.20.1 No-Action

Approximately 1,570 feet of 6-inch MP water main has exceeded its design life; in the No-Action alternative, this water main would remain in service. The 40 lead service lines would need to be replaced within the next 17 years to comply with the Safe Drinking Water Act.

3.20.2 Optimum Performance of Existing Facilities

The existing 6-inch MP water main and lead water services have exceeded their design lives and no longer function optimally, nor do they meet current City design and operational expectations and standards.

3.20.3 Construction Alternatives

3.20.3.1 New 6-inch MP Water Main and Services

Replace approximately 1,570 feet of existing 6-inch MP water main with new 6-inch MP water main from the Alger/Madison intersection to Union Avenue.

Replace 40 lead service lines (including the portions on private property) with copper services.

3.20.3.2 New Service Lines

Replace 40 lead service lines (including the portions on private property) with copper services. No water main replacements.

3.20.4 Regional Alternatives

A regional alternative is not available.

3.21 Ardmore Street Water Main (Eastern to Silver Avenues)

3.21.1 No-Action

Approximately 2,100 feet of 6-inch MP and HP water main has exceeded its design life; in the No-Action alternative, this water main would remain in service. The 52 lead service lines would need to be replaced within the next 17 years to comply with the Safe Drinking Water Act.

3.21.2 Optimum Performance of Existing Facilities

The existing 6-inch MP and HP water main and lead water services have exceeded their design lives and no longer function optimally, nor do they meet current City design and operational expectations and standards.

3.21.3 Construction Alternatives

3.21.3.1 New 6-inch MP and 6-inch HP Water Main and Services

Replace approximately 1,300 feet of existing 6-inch MP water main with new 6-inch MP water main from Eastern to Blaine Avenues.

Replace approximately 800 feet of existing 6-inch HP water main with new 6-inch HP water main from Blaine to Kalamazoo Avenues.

Replace 52 lead service lines (including the portions on private property) with copper services.

3.21.3.2 New Service Lines

Replace 52 lead service lines (including the portions on private property) with copper services. No water main replacements.

3.21.4 Regional Alternatives

A regional alternative is not available.

3.22 College Avenue Water Main (Hoyt to Dickinson Streets)

3.22.1 No-Action

Approximately 2,350 feet of 6-inch MP water main has exceeded its design life; in the No-Action alternative, this water main would remain in service. The 56 lead service lines would need to be replaced within the next 17 years to comply with the Safe Drinking Water Act.

3.22.2 Optimum Performance of Existing Facilities

The existing 6-inch MP water main and lead water services have exceeded their design lives and no longer function optimally, nor do they meet current City design and operational expectations and standards.

3.22.3 Construction Alternatives

3.22.3.1 New 6-inch MP Water Main and Services

Replace approximately 1,370 feet of existing 6-inch MP water main with new 6-inch MP water main from Hoyt to Burton Streets.

Replace approximately 980 feet of existing 6-inch MP water main with new 6-inch MP water main from Storrs to Dickinson Streets.

Replace 56 lead service lines (including the portions on private property) with copper services.

3.22.3.2 New Service Lines

Replace 56 lead service lines (including the portions on private property) with copper services. No water main replacements.

3.22.4 Regional Alternatives

A regional alternative is not available.

3.23 Houseman Street Water Main (Knapp to Eleanor Streets)

3.23.1 No-Action

Approximately 1,300 feet of 6-inch HP water main has exceeded its design life; in the No-Action alternative, this water main would remain in service. The one lead service line would need to be replaced within the next 17 years to comply with the Safe Drinking Water Act.

3.23.2 Optimum Performance of Existing Facilities

The existing 6-inch HP water main and lead water service have exceeded their design lives and no longer function optimally, nor do they meet current City design and operational expectations and standards.

3.23.3 Construction Alternatives

3.23.3.1 New 6-inch HP Water Main and Services

Replace approximately 1,300 feet of existing 6-inch HP water main with new 6-inch HP water main from Knapp to Eleanor Streets.

Replace one lead service line (including the portions on private property) with copper services.

3.23.3.2 New Service Lines

Replace one lead service line (including the portions on private property) with copper services. No water main replacements.

3.23.4 Regional Alternatives

A regional alternative is not available.

3.24 Union Avenue Water Main (Fountain to Lyon Streets)

3.24.1 No-Action

Approximately 780 feet of 6-inch MP water main has exceeded its design life; in the No-Action alternative, this water main would remain in service. The 17 lead service lines would need to be replaced within the next 17 years to comply with the Safe Drinking Water Act.

3.24.2 Optimum Performance of Existing Facilities

The existing 6-inch MP water main and lead water service have exceeded their design lives and no longer function optimally, nor do they meet current City design and operational expectations and standards.

3.24.3 Construction Alternatives

3.24.3.1 New 6-inch MP Water Main and Services

Replace approximately 780 feet of existing 6-inch MP water main with new 6-inch MP water main from Fountain to Lyon Streets.

Replace 17 lead service lines (including the portions on private property) with copper services.

3.24.3.2 New Service Lines

Replace 17 lead service lines (including the portions on private property) with copper services. No water main replacements.

3.24.4 Regional Alternatives

A regional alternative is not available.

3.25 Hall Street Water Main (Underhill Avenue to US-131)

3.25.1 No-Action

Approximately 1,450 feet of 8-inch and 12-inch MP water main has exceeded its design life; in the No-Action alternative, this water main would remain in service. The 21 lead service lines would need to be replaced within the next 17 years to comply with the Safe Drinking Water Act.

3.25.2 Optimum Performance of Existing Facilities

The existing 8-inch and 12-inch MP water main and lead water service have exceeded their design lives and no longer function optimally, nor do they meet current City design and operational expectations and standards.

3.25.3 Construction Alternatives

3.25.3.1 New 8-inch and 12-inch MP Water Main and Services

Replace approximately 500 feet of existing 12-inch MP water main with new 12-inch MP water main from Underhill Avenue to Hall Street.

Replace approximately 950 feet of existing 12-inch MP water main with new 8-inch MP water main from Hall Street to US-131.

Replace 21 lead service lines (including the portions on private property) with copper services.

3.25.3.2 New Service Lines

Replace 21 lead service lines (including the portions on private property) with copper services. No water main replacements.

3.25.4 Regional Alternatives

A regional alternative is not available.

3.26 Lead Services Line Replacement

3.26.1 No-Action

This alternative is not a considered because lead service lines are no longer acceptable and must be replaced to comply with the Safe Drinking Water Act.

3.26.2 Optimum Performance of Existing Facilities

Lead is no longer an acceptable material for water service lines and no improvements can be made to the existing services to reduce health risks associated with lead and improve performance; therefore, this alternative is not viable.

3.26.3 Construction Alternative – New Service Lines

Potential lead service lines needing to be replaced are indicated in Figure 29. There are more than 24,000 lead service line replacement. The City maintains an online database of the services that need replacements.

(https://www.grandrapidsmi.gov/Government/Departments/Water-System/Lead-in-Drinking-Water/Lead-Water-Service-Line-Map). This alternative will focus on replacements of the lead service lines within the indicated areas of the system. The replacements will vary and fall into the following categories:

- Full replacements: Water service to be replaced from the water main up to the Owner meter location.
- Partial Replacement: Water service to be replaced from water main up to the curb stop OR from the curb stop to the Owner meter location.

This alternative is evaluated further as a principal alternative.

3.26.4 Regional Alternative

A regional alternative is not applicable for lead service line replacement because the service line replacements are required to comply with the Safe Drinking Water Act.

3.27 Caledonia Township Connection

3.27.1 No-Action

The no-action alternative would not influence the current Grand Rapids system, but Caledonia Township would need to find an alternative solution to meet the needs of their system regarding capacity and water quality.

3.27.2 Optimum Performance of Existing Facilities

Optimizing the performance of existing facilities is not applicable to this project as Caledonia Township is not currently a customer community of the Grand Rapids water system.

3.27.3 Construction / Regional Alternative

The construction alternative includes infrastructure necessary for connecting the Caledonia Township water system to the Grand Rapids water system. This alternative also provides regionalization of neighboring water systems. The Township would likely be a wholesale customer of the City, similar to Ada Township, an existing wholesale customer. A booster pump station connected to the Grand Rapids EHPD would be constructed to supply the Township. The pump station would house two pumps with room to add a third, each with an approximate capacity of 1. 5 mgd and a total dynamic head (TDH) of 95 feet. The proposed location for the pump station is near the northeast corner of the Broadmoor Avenue and 60th Street intersection. This area is currently being developed with a multi-family housing complex and the development includes several new 8-inch, 12-inch, and 16-inch water mains. Preliminary hydraulic modeling was performed to determine additional improvements that are needed in the Grand Rapids system to supply the pump station. The evaluation showed a new 24-inch water main should be installed in East Paris Avenue between 40th Street and Broadmoor to improve capacity to the south. In addition, a new water main is needed to provide the station with two (redundant) supply lines. The new water main would be a 12-inch main that crosses Broadmoor Avenue and connects an existing 12-inch water main in Patterson Avenue to an existing 12-inch in 60th Street.

Additional water system improvements are needed in Caledonia's water system to complete the connection. These improvements will be completed by Caledonia and are not included in this Project Planning Document.

3.28 Cascade Township Water Mains

3.28.1 No-Action

The no-action alternative would imply residents in the affected area would continue to use private wells that are contaminated with PFAS. Over time, the PFAS concentration may rise above the regulatory threshold.

3.28.2 Optimum Performance of Existing Facilities

Optimizing existing facilities is not applicable to this project.

3.28.3 Construction Alternative

The construction alternative involves adding several new water mains that will connect residents with wells affected by PFAS to the Grand Rapids water system. The proposed water mains are listed:

- 635 ft of 12-inch water main along Thornapple River Drive from Thornhills Drive to Burger Drive.
- 1,740 ft of 8-inch water main along Thornapple River Drive from Burger Drive north to Mahesh Drive.
- 1,180 ft of 12-inch water main along Burger Drive from Thornapple River Drive east to Westridge Drive.
- 1,515 ft of 8-inch water main along Brookhills Court from Thornapple River Drive to Tricklewood Drive.
- 445 ft of 6-inch water main along Winterberry Court from Tanglewood Drive to dead end.
- 850 ft of 8-inch water main along Brookhill Point Drive from Brookhills Court to Tanglewood.
- 330 ft of 6-inch water main along Misty Lane Court from Tanglewood Drive to dead end.
- 500 ft of 6-inch water main along Woodbrook Drive from dead end to Tricklewood Drive.
- 335 ft of 8-inch water main along Woodbrook Drive from Tricklewood Drive to Ridgemont Drive.
- 790 ft of 8-inch water main along Tanglewood Drive from Woodbrook Drive to Tricklewood Court.
- 220 ft of 6-inch water main along Ridgemont Court from Woodbrook Drive to dead end.
- 185 ft of 8-inch water main and 535 feet of 6-inch water main along Sandy Lane Drive from Woodbrook Drive to dead end.
- 175 ft of 6-inch water main along Sandy Lane Court from Sandy Lane Drive to dead end.
- 485 ft of 6-inch water main and 310 feet of 16-inch water main along Thornapple River Drive from Ridgemont Drive to Nik Kik Drive.
- 565 ft of 8-inch water main along Oakmont Street from Ridgemont Drive to Forest Valley Drive.
- 3,065 ft of 8-inch water main along Forest Valley Drive from Oakmont Street to Oak Tree Drive.
- 255 ft of 6-inch water main along White Oak Court from Forest Valley Drive to dead end.
- 280 ft of 6-inch water main along Oak Creek Court from Forest Valley Drive to dead end.
- 360 ft of 6-inch water main along Forest Valley Court from Forest Valley Drive to dead end.
- 1,595 ft of 8-inch water main along Oak Tree Drive from Maplecrest Drive to Woodbrook Drive.
- 390 ft of 6-inch water main along Maplecrest Drive from Oak Tree Drive to dead end.
- 715 ft of 8-inch water main along Maplecrest Drive from Oak Tree Drive to Maplecrest Court.
- 430 ft of 6-inch water main along Maplecrest Court from Maplecrest Drive to dead end.
- 560 ft of 6-inch water main along Aqua Fria Court from Goodwood Drive to dead end.

3.28.4 Regional Alternative

A regional alternative is not applicable to this project.

4.0 Principal Alternatives

4.1 LMFP

4.1.1 Monetary Evaluation

4.1.1.1 Residuals Handling Improvements

A cost-effective analysis was completed for each of the two optimization alternatives. The project budgetary cost summary for Separate Residuals Treatment is presented in Table 8. The project budgetary cost summary for Combined Residuals Treatment is presented in Table 9.

Table 8 – Estimated Project Cost Summary for Separate Residuals Treatment Alternative

Item	Initial Capital Cost	Design Life (years)	Salvage Value
Residuals Pump Station	$1,800,000	20	$0
Civil Site Piping and Utilities	$1,600,000	50	$960,000
Demolition/Modifications to Existing Accelator Basins	$6,300,000	permanent	$0
Washwater Clarifier & Gravity Thickening Equipment	$1,600,000	20	$0
Solids Dewatering/Conveyance Equipment	$2,700,000	20	$0
Dewatering Building Addition	$4,000,000	50	$2,400,000
Process Piping and Valves	$1,200,000	50	$720,000
Chemical Feed Systems	$400,000	20	$0
Electrical & Instrumentation	$2,600,000	20	$0
Subtotal: Estimated Construction Cost	$22,200,000		
Administration, Engineering, Contingency	$7,800,000		
Total: Estimated Project Budget	$30,000,000		

Table 9 – Estimated Project Cost Summary for Combined Residuals Treatment Alternative

Item	Initial Capital Cost	Design Life (years)	Salvage Value
Residuals Pump Station	$2,160,000	20	$0
Civil Site Piping and Utilities	$1,600,000	50	$960,000
Demolition/Modifications to Existing Accelator Basins	$6,300,000	permanent	$0
Washwater Clarifier & Gravity Thickening Equipment	$1,920,000	20	$0
Solids Dewatering/Conveyance Equipment	$3,240,000	20	$0
Dewatering Building Addition	$4,000,000	50	$1,944,000
Process Piping and Valves	$1,440,000	50	$2,400,000
Chemical Feed Systems	$480,000	20	$0
Electrical & Instrumentation	$2,600,000	20	$0
Subtotal: Estimated Construction Cost	$23,740,000		
Administration, Engineering, Contingency	$8,310,000		
Total: Estimated Project Budget	$32,050,000		

Table 10 shows a side-by-side comparison of the present worth analysis for the two optimization alternatives.

Table 10 – 20-Year Present Worth Analysis: LMFP Residuals Handling System Improvements

	Separate Residuals Treatment		Combined Residuals Treatment	
Alternatives	Cost/Value	20-Year Present Worth	Cost/Value	20-Year Present Worth
Capital Cost	$30,000,000	$30,000,000	$32,050,000	$32,050,000
O&M Cost/Year	$400,000	$7,673,600	$400,000	$7,673,600
Salvage Value	$4,080,000	($3,766,900)	$5,304,000	($4,897,000)
Total Worth		$33,906,700		$34,826,600

4.1.1.2 Chemical Unloading Improvements

The cost-effective analysis was completed for the optimization alternative and for the No-Action alternative. The project budgetary cost summary is presented in Table 11.

Table 11 – Estimated Project Cost Summary for Chemical Unloading Improvements

Item	Initial Capital Cost	Design Life (years)	Salvage Value
Underground Double Wall Storage Tank	$120,000	50	$72,000
Sitework and Paving	$290,000	50	$174,000
Transfer Piping & Appurtenances	$170,000	50	$102,000
Small Storage Tank and Secondary Containment	$97,000	20	$0
Electrical & Instrumentation	$140,000	20	$0
Subtotal: Estimated Construction Cost	$817,000		
Administration, Engineering, Contingency	$283,000		
Total: Estimated Project Budget	$1,100,000		

A present worth analysis was completed for the optimization alternative and the No-Action alternative. The No-Action alternative has no associated capital costs. Table 12 shows the comparison of the present worth analysis for the alternatives.

Table 12 – 20-Year Present Worth Analysis: Chemical Unloading Improvements

	Chemical Unloading Improvements		No-Action	
Alternatives	Cost/Value	20-Year Present Worth	Cost/Value	20-Year Present Worth
Capital Cost	$1,100,000	$1,100,000	$0	$0
O&M Cost/Year	$1,000	$19,200	--	--
Salvage Value	$348,000	($321,300)	$0	$0
Total Worth		$797,900		$0

4.1.1.3 Carbon Feed System Improvements and Phosphate Feed System Relocation

The cost-effective analysis was completed for the optimization alternative and for the No-Action alternative. The project budgetary cost summary is presented in Table 13.

Table 13 – Estimated Project Cost Summary for Carbon Feed and Phosphate Feed Systems Improvements

Item	Initial Capital Cost	Design Life (years)	Salvage Value
Carbon Feed: Demolition of Existing	$200,000	permanent	$0
Carbon Feed: Concrete Tanks and Building	$3,000,000	50	$1,800,000
Carbon Feed: Chemical Feed and Mixing Equipment	$1,000,000	20	$0
Carbon Feed: Site Piping	$200,000	50	$120,000
Carbon Feed: Electrical & Instrumentation	$500,000	20	$0
Phosphate Feed: Demolition of Existing	$110,000	permanent	$0
Phosphate Feed: Chemical Storage Bulk Tanks	$180,000	20	$0
Phosphate Feed: Chemical Storage Day Tanks	$25,000	20	$0
Phosphate Feed: Chemical Feed Pumps	$30,000	20	$0
Phosphate Feed: Chemical Feed Piping & Appurtenances	$120,000	50	$72,000
Phosphate Feed: Building and HVAC Modifications	$105,000	20	$0
Phosphate Feed: Electrical & Instrumentation	$150,000	20	$0
Subtotal: Estimated Construction Cost	$5,620,000		
Administration, Engineering, Contingency	$1,900,000		
Total: Estimated Project Budget	$7,520,000		

A present worth analysis was completed for the optimization alternative and the No-Action alternative. The No-Action alternative has no associated capital costs. Table 14 shows the comparison of the present worth analysis for the alternatives.

Table 14 – 20-Year Present Worth Analysis: Carbon Feed and Phosphate Feed Systems Improvements

	Carbon Feed System Improvements		No-Action	
Alternatives	Cost/Value	20-Year Present Worth	Cost/Value	20-Year Present Worth
Capital Cost	$7,520,000	$ 7,520,000	$0	$0
O&M Cost/Year	$584,800	$11,218,900	--	--
Salvage Value	$1,992,000	($1,839,100)	$0	$0
Total Worth		$16,899,800		$0

4.1.2 Environmental Evaluation

4.1.2.1 Cultural Resources

The proposed LMFP Improvement Projects are on an existing site and in a previous construction area and no direct historical or archeological impact is expected. There are no historical sites in the vicinity of the projects.

4.1.2.2 Natural Environment

Most of the work for the LMFP projects would occur inside existing buildings at the LMFP property, with limited work occurring outside of the building in the proximity of the building footprints. The only anticipated impact to the natural environment is a temporary decrease in air quality due to construction.

4.1.3 Mitigation

Mitigation of environmental impacts will include best construction practices such as soil erosion prevention techniques, maintenance of construction equipment, and limiting construction to regular working hours during the week.

4.1.4 Implementability and Public Participation

The Project Planning Document will be available for public review. If at that time it becomes apparent that an alternative is not acceptable to the public, the alternatives will be reevaluated. Implementability of the project was evaluated. The proposed improvements will create new operation and maintenance requirements, but some existing maintenance issues will be eliminated. There are no competing uses for the proposed project locations and the project does not require intermunicipal agreements.

4.1.5 Technical Considerations

For the Residuals Handling improvements, either of the two action alternatives would meet regulatory standards as well as improve the reliability of the residuals handling process. The design for either of these alternatives includes redundant units for the mechanical dewatering equipment, gravity thickeners, and clarifiers. For the *Separate Residuals Treatment* alternative, the EQ tank for the filter backwash water would be sized to hold eight filter backwash cycles and would have two chambers so that operation can be maintained while the tank undergoes maintenance. For the *Combined Residuals Treatment* alternative, the EQ tank for the combined flow from the filter backwash and the floc/sed sludge blowdown would be sized to hold eight filter backwash cycles, plus additional storage to accommodate the blowdown. Again, the tank would have two chambers so that operation can be maintained. All pumping equipment would have redundant units to improve reliability. For either of the two action alternatives in the event of emergencies, the existing lagoons provide additional redundancy to the system and would function using the existing operation.

The Chemical Unloading Improvements will provide spill protection for the chemical unloading area and will comply with Part 5 rules under Michigan Administrative Rules R.324.2001 to R.324.2009. The proposed containment system volume also includes a safety factor to account for precipitation, dirt, or grit that may be in the drains.

The Carbon Feed System Improvements will replace aged equipment and bring the system up to current Ten State Standards.

The Phosphate Feed System relocation provides the added benefit of increased space for ease of operation and maintenance activities. The bulk storage tanks could be filled in the same location as the existing chemicals, and not through the truck drive inside the plant. The chemical building is better suited for chemical feed activities than the current phosphate feed system location. A Corrosion Control Treatment (CCT) Study is currently being conducted for the City by Fishbeck and Cornwell Engineering. The work completed thus far for the study showed that both phosphoric acid and zinc orthophosphate performed better than the blended phosphate product currently being used. It will take approximately two more years to complete the study, but at this time, it appears likely that the City will be feeding a different corrosion inhibitor in the near future. If the design of the new phosphate feed system occurs prior to the change in corrosion inhibitors, it needs to be compatible with both the current blended product and the corrosion inhibitor likely to be fed in the future. The chemical storage tanks and pumps may need to be sized larger to accommodate feeding phosphoric acid or zinc orthophosphate depending on the concentration of the chemical used and the anticipated dose.

4.1.6 Residuals

The method for treating and disposing of residuals currently generated at the LMFP will improve with the proposed Residuals Handling Project. The Chemical Unloading Improvements will help contain and dispose of chemicals more effectively and will not generate additional residuals at the LMFP. Carbon Feed System improvements include increasing the capacity of the system, so the project has potential to increase residuals generated from the carbon feed process. However, dosing speed would be adjustable so the PAC slurry would be supplied more efficiently as taste and odor issues arise. The project also includes dust collection equipment to contain any dust that is generated during the unloading process. No additional residuals are expected to be generated as a result of the Phosphate Feed System replacement and relocation.

4.1.7 Growth Capacity

Each of the proposed improvements to the LMFP consider the projected 2040 demand for water production. The proposed systems include redundant equipment that can be used if needed due to a growing demand on the LMFP.

4.1.8 Industrial/Commercial/Institutional

The projected 2040 demand assumes there will be increases in industrial/commercial/institutional water usage. The proposed improvements to the LMFP are designed to accommodate the projected 2040 demand.

4.1.9 Contamination

There is no known contamination at the project site. Regarding the Residuals Handling Improvements, a survey was performed in 2017 for lead and asbestos inside the existing Accelator Building at the LMFP, which confirmed contaminants were not present.

4.2 Fremont Avenue Water Main (3rd to 4th Streets)

4.2.1 Monetary Evaluation

The cost-effective analysis was completed for the two construction alternatives and for the No-Action alternative. The project budgetary cost summary for the two construction alternatives is presented in Table 15 and Table 16. The cost estimates include the restoration of curb, pavement, sidewalk, grass, and other items required to complete the improvements.

Table 15 – Estimated Project Cost Summary for Fremont Avenue Water Main (3rd to 4th Streets)

Item	Initial Capital Cost	Design Life (years)	Salvage Value
New 8-inch Water Main	$118,885	50	$71,331
City Street Reconstruction	$64,015	10	$0
Lead Service Line Replacement	$114,100	50	$68,460
Contamination Allowance	$5,000	NA	NA
Subtotal: Estimated Construction Cost	$302,000		
Administration, Engineering, Contingency	$103,000		
Total: Estimated Project Budget	$405,000		

Table 16 – Estimated Project Cost Summary for New Service Lines

Item	Initial Capital Cost	Design Life (years)	Salvage Value
Lead Service Line Replacement	$114,100	50	$68,460
Contamination Allowance	$5,000	NA	NA
Subtotal: Estimated Construction Cost	$119,100		
Administration, Engineering, Contingency	$41,000		
Total: Estimated Project Budget	$160,100		

A present worth analysis was completed for the two construction alternatives and for the No-Action alternative, as summarized in Table 17. The No-Action alternative has no associated capital costs. Sunk costs are not included in the analysis.

Table 17 – 20-Year Present Worth Analysis: Fremont Avenue Water Main (3rd to 4th Streets)

	New Water Main and Services		New Service Lines		No-Action	
Alternatives	Cost/Value	20-Year Present Worth	Cost/Value	20-Year Present Worth	Cost/Value	20-Year Present Worth
Capital Cost	$405,000	$405,000	$160,100	$160,100	$0	$0
O&M Cost/Year	$0	$0	$0	$0	$0	$0
Salvage Value	$139,791	($130,000)	$68,460	($64,000)	$0	$0
Total Worth		$275,000		$96,100		$0

4.2.2 Environmental Evaluation

4.2.2.1 Cultural Resources

The project is in a previous construction area and no direct historical or archeological impact is expected. There are no historical sites in the vicinity of the project.

4.2.2.2 Natural Environment

The effects on the natural environment do not differ between construction alternatives. The only anticipated impact to the natural environment is a temporary decrease in air quality due to construction.

4.2.3 Mitigation

The impact on air quality will be controlled to the greatest extent possible by limiting construction to regular working hours during the week.

4.2.4 Implementability and Public Participation

Both construction alternatives would involve work within and outside of the existing City of Grand Rapids public right-of-way. The City will cover the cost of the work on private property. No expense to the home-owner is anticipated for lead service line replacement.

Appendix 2 provides detailed information on lead service line replacement public outreach and construction techniques.

4.2.1 Technical Considerations

4.2.1.1 No-Action

Water main age and capacity concerns based on 20-year planning projections are not addressed. Within 17 years, the lead service lines would need to be replaced to meet compliance requirements.

4.2.1.2 New 8-inch LP Water Main and Services

Water main age is addressed. Water main capacity concerns based on 20-year planning projects are addressed. Lead service compliance requirements are met.

4.2.1.3 New Service Lines

Lead service compliance requirements are met. Roadway would be patched for lead service line replacements.

4.2.2 Residuals

This project will have no impact on residuals.

4.2.3 Growth Capacity

The purpose of the proposed project is to serve existing customers. The water main is not being installed for growth.

4.2.4 Industrial/Commercial/Institutional

The project area is fully developed; the majority of the properties served by the water main are residential or small businesses. Industrial/commercial/institutional usage does not require consideration in this case.

4.2.5 Contamination

There are several Part 201 Sites and leaking underground storage tanks (LUSTs) located near the project area. Map 4.1 shows the location of the project in relation to the contaminated sites. Past projects within the City have encountered contaminated soils within the road right-of-way. Any soil borings taken during preliminary design will be tested. During construction, onsite inspectors will take soil samples if contaminated soils are encountered. Contaminated soils will be removed and disposed of in accordance with all state and federal regulations.

4.3 Hall Street Water Main (Madison Avenue to 250 feet East of Union Avenue); Paris Avenue Water Main (Gilbert to Hall Streets)

4.3.1 Monetary Evaluation

The cost-effective analysis was completed for the two construction alternatives and for the No-Action alternative. The project budgetary cost summary for the two construction alternatives is presented in Table 18 and Table 19. The cost estimates include the restoration of curb, pavement, sidewalk, grass, and other items required to complete the improvements.

Table 18 – Estimated Project Cost Summary for Hall Street Water Main (Madison to Eastern Avenues) and Paris Avenue Water Main (Gilbert to Hall Streets)

Item	Initial Capital Cost	Design Life (years)	Salvage Value
New 6-inch and 12-inch Water Main, Abandon 24-inch	$902,200	50	$541,320
City Street Reconstruction	$485,800	10	$0
Lead Service Line Replacement	$99,600	50	$59,760
Contamination Allowance	$10,000	NA	NA
Subtotal: Estimated Construction Cost	$1,497,600		
Administration, Engineering, Contingency	$510,000		
Total: Estimated Project Budget	$2,007,600		

Table 19 – Estimated Project Cost Summary for New Service Lines

Item	Initial Capital Cost	Design Life (years)	Salvage Value
Lead Service Line Replacement	$99,600	50	$59,760
Contamination Allowance	$10,000	NA	NA
Subtotal: Estimated Construction Cost	$109,600		
Administration, Engineering, Contingency	$38,000		
Total: Estimated Project Budget	$147,600		

A present worth analysis was completed for the two construction alternatives and for the No-Action alternative, as summarized in Table 20. The No-Action alternative has no associated capital costs. Sunk costs are not included in the analysis.

Table 20 – 20-Year Present Worth Analysis: Hall Street Water Main (Madison to Eastern Avenues) and Paris Avenue Water Main (Gilbert to Hall Streets)

	New Water Main and Services		New Service Lines		No-Action	
Alternatives	Cost/Value	20-Year Present Worth	Cost/Value	20-Year Present Worth	Cost/Value	20-Year Present Worth
Capital Cost	$2,007,600	$2,007,600	$147,600	$147,600	$0	$0
O&M Cost/Year	$0	$0	$0	$0	$0	$0
Salvage Value	$601,080	($555,000)	$59,760	($56,000)	$0	$0
Total Worth		$1,452,600		$91,600		$0

4.3.2 Environmental Evaluation

4.3.2.1 Cultural Resources

The project is in a previous construction area and no direct historical or archeological impact is expected. There are no historical sites in the vicinity of the project.

4.3.2.2 Natural Environment

The effects on the natural environment do not differ between construction alternatives. The only anticipated impact to the natural environment is a temporary decrease in air quality due to construction.

4.3.3 Mitigation

The impact on air quality will be controlled to the greatest extent possible by limiting construction to regular working hours during the week.

4.3.4 Implementability and Public Participation

Both construction alternatives would involve work within and outside of the existing City of Grand Rapids public right-of-way. The City will cover the cost of the work on private property. No expense to the homeowner is anticipated for lead service line replacement.

Appendix 2 provides detailed information on lead service line replacement public outreach and construction techniques.

4.3.5 Technical Considerations

4.3.5.1 No-Action

Water main age and capacity concerns based on 20-year planning projections are not addressed. Within 17 years, the lead service lines would need to be replaced to meet compliance requirements.

4.3.5.2 New 6-inch and 12-inch HP Water Main and Services

Water main age is addressed. Water main capacity concerns based on 20-year planning projects are addressed. Lead service compliance requirements are met.

4.3.5.3 New Service Lines

Lead service compliance requirements are met. Roadway would be patched for lead service line replacements.

4.3.6 Residuals

This project will have no impact on residuals.

4.3.7 Growth Capacity

The purpose of the proposed project is to serve existing customers. The water main is not being installed for growth.

4.3.8 Industrial/Commercial/Institutional

The project area is fully developed; the majority of the properties served by the water main are residential or small businesses. Industrial/commercial/institutional usage does not require consideration in this case.

4.3.9 Contamination

There are several Part 201 Sites and LUSTs located near the project area. Map 4.1 shows the location of the project in relation to the contaminated sites. Past projects within the City have encountered contaminated soils within the road right-of-way. Any soil borings taken during preliminary design will be tested. During construction, onsite inspectors will take soil samples if contaminated soils are encountered. Contaminated soils will be removed and disposed of in accordance with all state and federal regulations.

4.4 Eleanor Street Water Main (Plainfield to Diamond Avenues)

4.4.1 Monetary Evaluation

The cost-effective analysis was completed for the two construction alternatives and for the No-Action alternative. The project budgetary cost summary for the two construction alternatives is presented in Table 21 and Table 22. The cost estimates include the restoration of curb, pavement, sidewalk, grass, and other items required to complete the improvements.

Table 21 – Estimated Project Cost Summary for Eleanor Street Water Main (Plainfield to Diamond Avenues)

Item	Initial Capital Cost	Design Life (years)	Salvage Value
New 6-inch Water Main	$889,200	50	$533,520
City Street Reconstruction	$478,800	10	$0
Lead Service Line Replacement	$173,100	50	$103,860
Contamination Allowance	$10,000	NA	NA
Subtotal: Estimated Construction Cost	$1,551,100		
Administration, Engineering, Contingency	$528,000		
Total: Estimated Project Budget	$2,079,100		

Table 22 – Estimated Project Cost Summary for New Service Lines

Item	Initial Capital Cost	Design Life (years)	Salvage Value
Lead Service Line Replacement	$173,100	50	$103,860
Contamination Allowance	$10,000	NA	NA
Subtotal: Estimated Construction Cost	$183,100		
Administration, Engineering, Contingency	$63,000		
Total: Estimated Project Budget	$246,100		

A present worth analysis was completed for the two construction alternatives and for the No-Action alternative, as summarized in Table 23. The No-Action alternative has no associated capital costs. Sunk costs are not included in the analysis.

Table 23 – 20-Year Present Worth Analysis: Eleanor Street Water Main (Plainfield to Diamond Avenues)

	New Water Main and Services		New Service Lines		No-Action	
Alternatives	Cost/Value	20-Year Present Worth	Cost/Value	20-Year Present Worth	Cost/Value	20-Year Present Worth
Capital Cost	$2,079,100	$2,079,100	$246,100	$246,100	$0	$0
O&M Cost/Year	$0	$0	$0	$0	$0	$0
Salvage Value	$637,380	($589,000)	$103,860	($96,000)	$0	$0
Total Worth		$1,490,100		$150,100		$0

4.4.2 Environmental Evaluation

4.4.2.1 Cultural Resources

The project is in a previous construction area and no direct historical or archeological impact is expected. There are no historical sites in the vicinity of the project.

4.4.2.2 Natural Environment

The effects on the natural environment do not differ between construction alternatives. The only anticipated impact to the natural environment is a temporary decrease in air quality due to construction.

4.4.3 Mitigation

The impact on air quality will be controlled to the greatest extent possible by limiting construction to regular working hours during the week.

4.4.4 Implementability and Public Participation

Both construction alternatives would involve work within and outside of the existing City of Grand Rapids public right-of-way. The City will cover the cost of the work on private property. No expense to the home-owner is anticipated for lead service line replacement.

Appendix 2 provides detailed information on lead service line replacement public outreach and construction techniques.

4.4.5 Technical Considerations

4.4.5.1 No-Action

Water main age and capacity concerns based on 20-year planning projections are not addressed. Within 17 years, the lead service lines would need to be replaced to meet compliance requirements.

4.4.5.2 New 6-inch MP and 8-inch HP Water Main and Services

Water main age is addressed. Dead-end water mains would be eliminated. Water main capacity concerns based on 20-year planning projects are addressed. Lead service compliance requirements are met.

4.4.5.3 New Service Lines

Lead service compliance requirements are met. Roadway would be patched for lead service line replacements.

4.4.6 Residuals

This project will have no impact on residuals.

4.4.7 Growth Capacity

The purpose of the proposed project is to serve existing customers. The water main is not being installed for growth.

4.4.8 Industrial/Commercial/Institutional

The project area is fully developed; the majority of the properties served by the water main are residential or small businesses. Industrial/commercial/institutional usage does not require consideration in this case.

4.4.9 Contamination

There are several Part 201 Sites and LUSTs located near the project area. Map 4.1 shows the location of the project in relation to the contaminated sites. Past projects within the City have encountered contaminated soils within the road right-of-way. Any soil borings taken during preliminary design will be tested. During construction, onsite inspectors will take soil samples if contaminated soils are encountered. Contaminated soils will be removed and disposed of in accordance with all state and federal regulations.

4.5 Valley Avenue Water Main (Fulton to Bridge Streets); Sibley Street Water Main (Valley to Garfield Avenues)

4.5.1 Monetary Evaluation

The cost-effective analysis was completed for the two construction alternatives and for the No-Action alternative. The project budgetary cost summary for the two construction alternatives is presented in Table 24 and Table 25. The cost estimates include the restoration of curb, pavement, sidewalk, grass, and other items required to complete the improvements.

Table 24 – Estimated Project Cost Summary for Valley Avenue Water Main (Fulton to Bridge Streets) and Sibley Street Water Main (Valley to Garfield Avenues)

Item	Initial Capital Cost	Design Life (years)	Salvage Value
New 6-inch and 8-inch Water Main	$819,975	50	$491,985
City Street Reconstruction	$441,525	10	$0
Lead Service Line Replacement	$431,200	50	$258,720
Contamination Allowance	$10,000	NA	NA
Subtotal: Estimated Construction Cost	$1,702,700		
Administration, Engineering, Contingency	$579,000		
Total: Estimated Project Budget	$2,281,700		

Table 25 – Estimated Project Cost Summary for New Service Lines

Item	Initial Capital Cost	Design Life (years)	Salvage Value
Lead Service Line Replacement	$431,200	50	$258,720
Contamination Allowance	$10,000	NA	NA
Subtotal: Estimated Construction Cost	$441,200		
Administration, Engineering, Contingency	$151,000		
Total: Estimated Project Budget	$592,200		

A present worth analysis was completed for the two construction alternatives and for the No-Action alternative, as summarized in Table 26. The No-Action alternative has no associated capital costs. Sunk costs are not included in the analysis.

Table 26 – 20-Year Present Worth Analysis: Valley Avenue Water Main (Fulton to Bridge Streets) and Sibley Street Water Main (Valley to Garfield Avenues)

	New Water Main and Services		New Service Lines		No-Action	
Alternatives	Cost/Value	20-Year Present Worth	Cost/Value	20-Year Present Worth	Cost/Value	20-Year Present Worth
Capital Cost	$2,281,700	$2,281,700	$592,200	$592,200	$0	$0
O&M Cost/Year	$0	$0	$0	$0	$0	$0
Salvage Value	$750,705	($694,000)	$258,720	($239,000)	$0	$0
Total Worth		$1,587,700		$353,200		$0

4.5.2 Environmental Evaluation

4.5.2.1 Cultural Resources

The project is in a previous construction area and no direct historical or archeological impact is expected. There are no historical sites in the vicinity of the project.

4.5.2.2 Natural Environment

The effects on the natural environment do not differ between construction alternatives. The only anticipated impact to the natural environment is a temporary decrease in air quality due to construction.

4.5.3 Mitigation

The impact on air quality will be controlled to the greatest extent possible by limiting construction to regular working hours during the week.

4.5.4 Implementability and Public Participation

Both construction alternatives would involve work within and outside of the existing City of Grand Rapids public right-of-way. The City will cover the cost of the work on private property. No expense to the home-owner is anticipated for lead service line replacement.

Appendix 2 provides detailed information on lead service line replacement public outreach and construction techniques.

4.5.5 Technical Considerations

4.5.5.1 No-Action

Water main age and capacity concerns based on 20-year planning projections are not addressed. Within 17 years, the lead service lines would need to be replaced to meet compliance requirements.

4.5.5.2 New 6-inch and 8-inch MP Water Main and Services

Water main age is addressed. Unneeded parallel mains would be eliminated. Water main capacity concerns based on 20-year planning projects are addressed. Lead service compliance requirements are met.

4.5.5.3 New Service Lines

Lead service compliance requirements are met. Roadway would be patched for lead service line replacements.

4.5.6 Residuals

This project will have no impact on residuals.

4.5.7 Growth Capacity

The purpose of the proposed project is to serve existing customers. The water main is not being installed for growth.

4.5.8 Industrial/Commercial/Institutional

The project area is fully developed; the majority of the properties served by the water main are residential or small businesses. Industrial/commercial/institutional usage does not require consideration in this case.

4.5.9 Contamination

There are several Part 201 Sites and LUSTs located near the project area. Map 4.1 shows the location of the project in relation to the contaminated sites. Past projects within the City have encountered contaminated soils within the road right-of-way. Any soil borings taken during preliminary design will be tested. During construction, onsite inspectors will take soil samples if contaminated soils are encountered. Contaminated soils will be removed and disposed of in accordance with all state and federal regulations.

4.6 Boston Street Water Main (Calvin to Plymouth Avenues)

4.6.1 Monetary Evaluation

The cost-effective analysis was completed for the two construction alternatives and for the No-Action alternative. The project budgetary cost summary for the two construction alternatives is presented in Table 27 and Table 28.

The cost estimates include the restoration of curb, pavement, sidewalk, grass, and other items required to complete the improvements.

Table 27 – Estimated Project Cost Summary for Boston Street Water Main (Calvin to Plymouth Avenues)

Item	Initial Capital Cost	Design Life (years)	Salvage Value
New 8-inch and 12-inch Water Main	$1,321,450	50	$792,870
City Street Reconstruction	$711,550	10	$0
Lead Service Line Replacement	$263,400	50	$158,040
Contamination Allowance	$10,000	NA	NA
Subtotal: Estimated Construction Cost	$2,306,400		
Administration, Engineering, Contingency	$785,000		
Total: Estimated Project Budget	$3,091,400		

Table 28 – Estimated Project Cost Summary for New Service Lines

Item	Initial Capital Cost	Design Life (years)	Salvage Value
Lead Service Line Replacement	$272,100	50	$163,260
Contamination Allowance	$10,000	NA	NA
Subtotal: Estimated Construction Cost	$282,100		
Administration, Engineering, Contingency	$96,000		
Total: Estimated Project Budget	$378,100		

A present worth analysis was completed for the two construction alternatives and for the No-Action alternative, as summarized in Table 29. The No-Action alternative has no associated capital costs. Sunk costs are not included in the analysis.

Table 29 – 20-Year Present Worth Analysis: Boston Street Water Main (Calvin to Plymouth Avenues)

	New Water Main and Services		New Service Lines		No-Action	
Alternatives	Cost/Value	20-Year Present Worth	Cost/Value	20-Year Present Worth	Cost/Value	20-Year Present Worth
Capital Cost	$3,091,400	$3,091,400	$378,100	$378,100	$0	$0
O&M Cost/Year	$0	$0	$0	$0	$0	$0
Salvage Value	$950,910	($878,000)	$163,260	($151,000)	$0	$0
Total Worth		$2,213,400		$227,100		$0

4.6.2 Environmental Evaluation

4.6.2.1 Cultural Resources

The project is in a previous construction area and no direct historical or archeological impact is expected. There are no historical sites in the vicinity of the project.

4.6.2.2 Natural Environment

The effects on the natural environment do not differ between construction alternatives. The only anticipated impact to the natural environment is a temporary decrease in air quality due to construction.

4.6.3 Mitigation

The impact on air quality will be controlled to the greatest extent possible by limiting construction to regular working hours during the week.

4.6.4 Implementability and Public Participation

Both construction alternatives would involve work within and outside of the existing City of Grand Rapids public right-of-way. The City will cover the cost of the work on private property. No expense to the home-owner is anticipated for lead service line replacement.

Appendix 2 provides detailed information on lead service line replacement public outreach and construction techniques.

4.6.5 Technical Considerations

4.6.5.1 No-Action

Water main age and capacity concerns based on 20-year planning projections are not addressed. Within 17 years, the lead service lines would need to be replaced to meet compliance requirements.

4.6.5.2 New 8-inch and 12-inch MP Water Main and Services

Water main age is addressed. Water main capacity concerns based on 20-year planning projects are addressed. Lead service compliance requirements are met.

4.6.5.3 New Service Lines

Lead service compliance requirements are met. Roadway would be patched for lead service line replacements.

4.6.6 Residuals

This project will have no impact on residuals.

4.6.7 Growth Capacity

The purpose of the proposed project is to serve existing customers. The water main is not being installed for growth.

4.6.8 Industrial/Commercial/Institutional

The project area is fully developed; the majority of the properties served by the water main are residential or small businesses. Industrial/commercial/institutional usage does not require consideration in this case.

4.6.9 Contamination

There are several Part 201 Sites and LUSTs located near the project area. Map 4.1 shows the location of the project in relation to the contaminated sites. Past projects within the City have encountered contaminated soils within the road right-of-way. Any soil borings taken during preliminary design will be tested. During construction, onsite inspectors will take soil samples if contaminated soils are encountered. Contaminated soils will be removed and disposed of in accordance with all state and federal regulations.

4.7 Burton Street Water Main (Eastern to Kalamazoo Avenues)

4.7.1 Monetary Evaluation

The cost-effective analysis was completed for the two construction alternatives and for the No-Action alternative. The project budgetary cost summary for the two construction alternatives is presented in Table 30 and Table 31.

The cost estimates include the restoration of curb, pavement, sidewalk, grass, and other items required to complete the improvements.

Table 30 – Estimated Project Cost Summary for Burton Street Water Main (Eastern to Kalamazoo Avenues)

Item	Initial Capital Cost	Design Life (years)	Salvage Value
New 12-inch Water Main	$1,698,450	50	$1,019,070
City Street Reconstruction	$914,550	10	$0
Lead Service Line Replacement	$516,200	50	$309,720
Contamination Allowance	$10,000	NA	NA
Subtotal: Estimated Construction Cost	$3,139,200		
Administration, Engineering, Contingency	$1,068,000		
Total: Estimated Project Budget	$4,207,200		

Table 31 – Estimated Project Cost Summary for New Service Lines

Item	Initial Capital Cost	Design Life (years)	Salvage Value
Lead Service Line Replacement	$516,200	50	$309,720
Contamination Allowance	$10,000	NA	NA
Subtotal: Estimated Construction Cost	$526,200		
Administration, Engineering, Contingency	$179,000		
Total: Estimated Project Budget	$705,200		

A present worth analysis was completed for the two construction alternatives and for the No-Action alternative, as summarized in Table 32. The No-Action alternative has no associated capital costs. Sunk costs are not included in the analysis.

Table 32 – 20-Year Present Worth Analysis: Burton Street Water Main (Eastern to Kalamazoo Avenues)

	New Water Main and Services		New Service Lines		No-Action	
Alternatives	Cost/Value	20-Year Present Worth	Cost/Value	20-Year Present Worth	Cost/Value	20-Year Present Worth
Capital Cost	$4,207,200	$4,207,200	$705,200	$705,200	$0	$0
O&M Cost/Year	$0	$0	$0	$0	$0	$0
Salvage Value	$1,328,790	($1,227,000)	$309,720	($286,000)	$0	$0
Total Worth		$2,980,200		$419,200		$0

4.7.2 Environmental Evaluation

4.7.2.1 Cultural Resources

The project is in a previous construction area and no direct historical or archeological impact is expected. There are no historical sites in the vicinity of the project.

4.7.2.2 Natural Environment

The effects on the natural environment do not differ between construction alternatives. The only anticipated impact to the natural environment is a temporary decrease in air quality due to construction.

4.7.3 Mitigation

The impact on air quality will be controlled to the greatest extent possible by limiting construction to regular working hours during the week.

4.7.4 Implementability and Public Participation

Both construction alternatives would involve work within and outside of the existing City of Grand Rapids public right-of-way. The City will cover the cost of the work on private property. No expense to the home-owner is anticipated for lead service line replacement.

Appendix 2 provides detailed information on lead service line replacement public outreach and construction techniques.

4.7.5 Technical Considerations

4.7.5.1 No-Action

Water main age and capacity concerns based on 20-year planning projections are not addressed. Within 17 years, the lead service lines would need to be replaced to meet compliance requirements.

4.7.5.2 New 12-inch MP and HP Water Main and Services

Water main age is addressed. Water main capacity concerns based on 20-year planning projects are addressed. Lead service compliance requirements are met.

4.7.5.3 New Service Lines

Lead service compliance requirements are met. Roadway would be patched for lead service line replacements.

4.7.6 Residuals

This project will have no impact on residuals.

4.7.7 Growth Capacity

The purpose of the proposed project is to serve existing customers. The water main is not being installed for growth.

4.7.8 Industrial/Commercial/Institutional

The project area is fully developed; the majority of the properties served by the water main are residential or small businesses. Industrial/commercial/institutional usage does not require consideration in this case.

4.7.9 Contamination

There are several Part 201 Sites and LUSTs located near the project area. Map 4.1 shows the location of the project in relation to the contaminated sites. Past projects within the City have encountered contaminated soils within the road right-of-way. Any soil borings taken during preliminary design will be tested. During construction, onsite inspectors will take soil samples if contaminated soils are encountered. Contaminated soils will be removed and disposed of in accordance with all state and federal regulations.

4.8 Burton Street Water Main (Horton to Eastern Avenues)

4.8.1 Monetary Evaluation

The cost-effective analysis was completed for the two construction alternatives and for the No-Action alternative. The project budgetary cost summary for the two construction alternatives is presented in Table 33 and Table 34.

The cost estimates include the restoration of curb, pavement, sidewalk, grass, and other items required to complete the improvements.

Table 33 – Estimated Project Cost Summary for Burton Street Water Main (Horton to Eastern Avenues)

Item	Initial Capital Cost	Design Life (years)	Salvage Value
New 12-inch Water Main	$1,567,800	50	$940,680
City Street Reconstruction	$844,200	10	$0
Lead Service Line Replacement	$592,800	50	$355,680
Contamination Allowance	$10,000	NA	NA
Subtotal: Estimated Construction Cost	$3,014,800		
Administration, Engineering, Contingency	$1,026,000		
Total: Estimated Project Budget	$4,040,800		

Table 34 – Estimated Project Cost Summary for New Service Lines

Item	Initial Capital Cost	Design Life (years)	Salvage Value
Lead Service Line Replacement	$592,800	50	$355,680
Contamination Allowance	$10,000	NA	NA
Subtotal: Estimated Construction Cost	$602,800		
Administration, Engineering, Contingency	$205,000		
Total: Estimated Project Budget	$807,800		

A present worth analysis was completed for the two construction alternatives and for the No-Action alternative, as summarized in Table 35. The No-Action alternative has no associated capital costs. Sunk costs are not included in the analysis.

Table 35 – 20-Year Present Worth Analysis: Burton Street Water Main (Horton to Eastern Avenues)

	New Water Main and Services		New Service Lines		No-Action	
Alternatives	Cost/Value	20-Year Present Worth	Cost/Value	20-Year Present Worth	Cost/Value	20-Year Present Worth
Capital Cost	$4,040,800	$4,040,800	$807,800	$807,800	$0	$0
O&M Cost/Year	$0	$0	$0	$0	$0	$0
Salvage Value	$1,296,360	($1,197,000)	$355,680	($329,000)	$0	$0
Total Worth		$2,843,800		$478,800		$0

4.8.2 Environmental Evaluation

4.8.2.1 Cultural Resources

The project is in a previous construction area and no direct historical or archeological impact is expected. There are no historical sites in the vicinity of the project.

4.8.2.2 Natural Environment

The effects on the natural environment do not differ between construction alternatives. The only anticipated impact to the natural environment is a temporary decrease in air quality due to construction.

4.8.3 Mitigation

The impact on air quality will be controlled to the greatest extent possible by limiting construction to regular working hours during the week.

4.8.4 Implementability and Public Participation

Both construction alternatives would involve work within and outside of the existing City of Grand Rapids public right-of-way. The City will cover the cost of the work on private property. No expense to the home-owner is anticipated for lead service line replacement.

Appendix 2 provides detailed information on lead service line replacement public outreach and construction techniques.

4.8.5 Technical Considerations

4.8.5.1 No-Action

Water main age and capacity concerns based on 20-year planning projections are not addressed. Within 17 years, the lead service lines would need to be replaced to meet compliance requirements.

4.8.5.2 New 12-inch MP Water Main and Services

Water main age is addressed. Water main capacity concerns based on 20-year planning projects are addressed. Lead service compliance requirements are met.

4.8.5.3 New Service Lines

Lead service compliance requirements are met. Roadway would be patched for lead service line replacements.

4.8.6 Residuals

This project will have no impact on residuals.

4.8.7 Growth Capacity

The purpose of the proposed project is to serve existing customers. The water main is not being installed for growth.

4.8.8 Industrial/Commercial/Institutional

The project area is fully developed; the majority of the properties served by the water main are residential or small businesses. Industrial/commercial/institutional usage does not require consideration in this case.

4.8.9 Contamination

There are several Part 201 Sites and LUSTs located near the project area. Map 4.1 shows the location of the project in relation to the contaminated sites. Past projects within the City have encountered contaminated soils within the road right-of-way. Any soil borings taken during preliminary design will be tested. During construction, onsite inspectors will take soil samples if contaminated soils are encountered. Contaminated soils will be removed and disposed of in accordance with all state and federal regulations.

4.9 Oakwood Avenue Water Main (Knapp to 3 Mile Streets)

4.9.1 Monetary Evaluation

The cost-effective analysis was completed for the two construction alternatives and for the No-Action alternative. The project budgetary cost summary for the two construction alternatives is presented in Table 36 and Table 37.

The cost estimates include the restoration of curb, pavement, sidewalk, grass, and other items required to complete the improvements.

Table 36 – Estimated Project Cost Summary for Oakwood Avenue Water Main (Knapp to 3 Mile Streets)

Item	Initial Capital Cost	Design Life (years)	Salvage Value
New 6-inch and 8-inch Water Main	$2,022,150	50	$1,213,290
City Street Reconstruction	$1,088,850	10	$0
Lead Service Line Replacement	$635,500	50	$381,300
Contamination Allowance	$10,000	NA	NA
Subtotal: Estimated Construction Cost	$3,756,500		
Administration, Engineering, Contingency	$1,278,000		
Total: Estimated Project Budget	$5,034,500		

Table 37 – Estimated Project Cost Summary for New Service Lines

Item	Initial Capital Cost	Design Life (years)	Salvage Value
Lead Service Line Replacement	$635,500	50	$381,300
Contamination Allowance	$10,000	NA	NA
Subtotal: Estimated Construction Cost	$645,500		
Administration, Engineering, Contingency	$220,000		
Total: Estimated Project Budget	$865,500		

A present worth analysis was completed for the two construction alternatives and for the No-Action alternative, as summarized in Table 38. The No-Action alternative has no associated capital costs. Sunk costs are not included in the analysis.

Table 38 – 20-Year Present Worth Analysis: Oakwood Avenue Water Main (Knapp to 3 Mile Streets)

	New Water Main and Services		New Service Lines		No-Action	
Alternatives	Cost/Value	20-Year Present Worth	Cost/Value	20-Year Present Worth	Cost/Value	20-Year Present Worth
Capital Cost	$5,034,500	$5,034,500	$865,500	$865,500	$0	$0
O&M Cost/Year	$0	$0	$0	$0	$0	$0
Salvage Value	$1,594,590	($1,473,000)	$381,300	($353,000)	$0	$0
Total Worth		$3,561,500		$512,500		$0

4.9.2 Environmental Evaluation

4.9.2.1 Cultural Resources

The project is in a previous construction area and no direct historical or archeological impact is expected. There are no historical sites in the vicinity of the project.

4.9.2.2 Natural Environment

The effects on the natural environment do not differ between construction alternatives. The only anticipated impact to the natural environment is a temporary decrease in air quality due to construction.

4.9.3 Mitigation

The impact on air quality will be controlled to the greatest extent possible by limiting construction to regular working hours during the week.

4.9.4 Implementability and Public Participation

Both construction alternatives would involve work within and outside of the existing City of Grand Rapids public right-of-way. The City will cover the cost of the work on private property. No expense to the home-owner is anticipated for lead service line replacement.

Appendix 2 provides detailed information on lead service line replacement public outreach and construction techniques.

4.9.5 Technical Considerations

4.9.5.1 No-Action

Water main age and capacity concerns based on 20-year planning projections are not addressed. Within 17 years, the lead service lines would need to be replaced to meet compliance requirements.

4.9.5.2 New 8-inch LP, 8-inch LP and 8-inch MP Water Main and Services

Water main age is addressed. Dead-end water mains would be eliminated. Water main capacity concerns based on 20-year planning projects are addressed. Lead service compliance requirements are met.

4.9.5.3 New Service Lines

Lead service compliance requirements are met. Roadway would be patched for lead service line replacements.

4.9.6 Residuals

This project will have no impact on residuals.

4.9.7 Growth Capacity

The purpose of the proposed project is to serve existing customers. The water main is not being installed for growth.

4.9.8 Industrial/Commercial/Institutional

The project area is fully developed; the majority of the properties served by the water main are residential or small businesses. Industrial/commercial/institutional usage does not require consideration in this case.

4.9.9 Contamination

There are several Part 201 Sites and LUSTs located near the project area. Map 4.1 shows the location of the project in relation to the contaminated sites. Past projects within the City have encountered contaminated soils within the road right-of-way. Any soil borings taken during preliminary design will be tested. During construction, onsite inspectors will take soil samples if contaminated soils are encountered. Contaminated soils will be removed and disposed of in accordance with all state and federal regulations.

4.10 Valley Avenue Water Main (Bridge to 4th Streets); 1st and 3rd Street Water Main (Valley to Garfield Avenues)

4.10.1 Monetary Evaluation

The cost-effective analysis was completed for the two construction alternatives and for the No-Action alternative. The project budgetary cost summary for the two construction alternatives is presented in Table 39 and Table 40.

The cost estimates include the restoration of curb, pavement, sidewalk, grass, and other items required to complete the improvements.

Table 39 – Estimated Project Cost Summary for Valley Avenue Water Main (Bridge to 4th Streets); 1st and 3rd Streets Water Main (Valley to Garfield Avenues)

Item	Initial Capital Cost	Design Life (years)	Salvage Value
New 6-inch and 8-inch Water Main	$804,050	50	$482,430
City Street Reconstruction	$432,950	10	$0
Lead Service Line Replacement	$216,600	50	$129,960
Contamination Allowance	$10,000	NA	NA
Subtotal: Estimated Construction Cost	$1,463,600		
Administration, Engineering, Contingency	$498,000		
Total: Estimated Project Budget	$1,961,600		

Table 40 – Estimated Project Cost Summary for New Service Lines

Item	Initial Capital Cost	Design Life (years)	Salvage Value
Lead Service Line Replacement	$216,600	50	$129,960
Contamination Allowance	$10,000	NA	NA
Subtotal: Estimated Construction Cost	$226,600		
Administration, Engineering, Contingency	$78,000		
Total: Estimated Project Budget	$304,600		

A present worth analysis was completed for the two construction alternatives and for the No-Action alternative, as summarized in Table 41. The No-Action alternative has no associated capital costs. Sunk costs are not included in the analysis.

Table 41 – 20-Year Present Worth Analysis: Valley Avenue Water Main (4th to Bridge Streets); 1st and 3rd Streets Water Main (Valley to Garfield Avenues)

	New Water Main and Services		New Service Lines		No-Action	
Alternatives	Cost/Value	20-Year Present Worth	Cost/Value	20-Year Present Worth	Cost/Value	20-Year Present Worth
Capital Cost	$1,961,600	$1,961,600	$304,600	$304,600	$0	$0
O&M Cost/Year	$0	$0	$0	$0	$0	$0
Salvage Value	$612,390	($566,000)	$129,960	($120,000)	$0	$0
Total Worth		$1,395,600		$184,600		$0

4.10.2 Environmental Evaluation

4.10.2.1 Cultural Resources

The project is in a previous construction area and no direct historical or archeological impact is expected. There are no historical sites in the vicinity of the project.

4.10.2.2 Natural Environment

The effects on the natural environment do not differ between construction alternatives. The only anticipated impact to the natural environment is a temporary decrease in air quality due to construction.

4.10.3 Mitigation

The impact on air quality will be controlled to the greatest extent possible by limiting construction to regular working hours during the week.

4.10.4 Implementability and Public Participation

Both construction alternatives would involve work within and outside of the existing City of Grand Rapids public right-of-way. The City will cover the cost of the work on private property. No expense to the home-owner is anticipated for lead service line replacement.

Appendix 2 provides detailed information on lead service line replacement public outreach and construction techniques.

4.10.5 Technical Considerations

4.10.5.1 No-Action

Water main age and capacity concerns based on 20-year planning projections are not addressed. Within 17 years, the lead service lines would need to be replaced to meet compliance requirements.

4.10.5.2 New 6-inch and 8-inch LP Water Main and Services

Water main age is addressed. Unneeded parallel water mains would be eliminated. Water main capacity concerns based on 20-year planning projects are addressed. Lead service compliance requirements are met.

4.10.5.3 New Service Lines

Lead service compliance requirements are met. Roadway would be patched for lead service line replacements.

4.10.6 Residuals

This project will have no impact on residuals.

4.10.7 Growth Capacity

The purpose of the proposed project is to serve existing customers. The water main is not being installed for growth.

4.10.8 Industrial/Commercial/Institutional

The project area is fully developed; the majority of the properties served by the water main are residential or small businesses. Industrial/commercial/institutional usage does not require consideration in this case.

4.10.9 Contamination

There are several Part 201 Sites and LUSTs located near the project area. Map 4.1 shows the location of the project in relation to the contaminated sites. Past projects within the City have encountered contaminated soils within the road right-of-way. Any soil borings taken during preliminary design will be tested. During construction, onsite inspectors will take soil samples if contaminated soils are encountered. Contaminated soils will be removed and disposed of in accordance with all state and federal regulations.

4.11 Buchanan Avenue Water Main (Corinne to Hall Streets)

4.11.1 Monetary Evaluation

The cost-effective analysis was completed for the two construction alternatives and for the No-Action alternative. The project budgetary cost summary for the two construction alternatives is presented in Table 42 and Table 43.

The cost estimates include the restoration of curb, pavement, sidewalk, grass, and other items required to complete the improvements.

Table 42 – Estimated Project Cost Summary for Buchanan Avenue Water Main (Corinne to Hall Streets)

Item	Initial Capital Cost	Design Life (years)	Salvage Value
New 8-inch Water Main	$1,073,800	50	$644,280
City Street Reconstruction	$578,200	10	$0
Lead Service Line Replacement	$52,200	50	$31,320
Contamination Allowance	$10,000	NA	NA
Subtotal: Estimated Construction Cost	$1,714,200		
Administration, Engineering, Contingency	$583,000		
Total: Estimated Project Budget	$2,297,200		

Table 43 – Estimated Project Cost Summary for New Service Lines

Item	Initial Capital Cost	Design Life (years)	Salvage Value
Lead Service Line Replacement	$52,200	50	$31,320
Contamination Allowance	$10,000	NA	NA
Subtotal: Estimated Construction Cost	$62,200		
Administration, Engineering, Contingency	$22,000		
Total: Estimated Project Budget	$84,200		

A present worth analysis was completed for the two construction alternatives and for the No-Action alternative, as summarized in Table 44. The No-Action alternative has no associated capital costs. Sunk costs are not included in the analysis.

Table 44 – 20-Year Present Worth Analysis: Buchanan Avenue Water Main (Corinne to Hall Streets)

	New Water Main and Services		New Service Lines		No-Action	
Alternatives	Cost/Value	20-Year Present Worth	Cost/Value	20-Year Present Worth	Cost/Value	20-Year Present Worth
Capital Cost	$2,297,200	$2,297,200	$84,200	$84,200	$0	$0
O&M Cost/Year	$0	$0	$0	$0	$0	$0
Salvage Value	$675,600	($624,000)	$31,320	($29,000)	$0	$0
Total Worth		$1,673,200		$55,200		$0

4.11.2 Environmental Evaluation

4.11.2.1 Cultural Resources

The project is in a previous construction area and no direct historical or archeological impact is expected. There are no historical sites in the vicinity of the project.

4.11.2.2 Natural Environment

The effects on the natural environment do not differ between construction alternatives. The only anticipated impact to the natural environment is a temporary decrease in air quality due to construction.

4.11.3 Mitigation

The impact on air quality will be controlled to the greatest extent possible by limiting construction to regular working hours during the week.

4.11.4 Implementability and Public Participation

Both construction alternatives would involve work within and outside of the existing City of Grand Rapids public right-of-way. The City will cover the cost of the work on private property. No expense to the home-owner is anticipated for lead service line replacement.

Appendix 2 provides detailed information on lead service line replacement public outreach and construction techniques.

4.11.5 Technical Considerations

4.11.5.1 No-Action

Water main age and capacity concerns based on 20-year planning projections are not addressed. Within 17 years, the lead service lines would need to be replaced to meet compliance requirements.

4.11.5.2 New 8-inch MP Water Main and Services

Water main age is addressed. Water main capacity concerns based on 20-year planning projects are addressed. Lead service compliance requirements are met.

4.11.5.3 New Service Lines

Lead service compliance requirements are met. Roadway would be patched for lead service line replacements.

4.11.6 Residuals

This project will have no impact on residuals.

4.11.7 Growth Capacity

The purpose of the proposed project is to serve existing customers. The water main is not being installed for growth.

4.11.8 Industrial/Commercial/Institutional

The project area is fully developed; the majority of the properties served by the water main are residential or small businesses. Industrial/commercial/institutional usage does not require consideration in this case.

4.11.9 Contamination

There are several Part 201 Sites and LUSTs located near the project area. Map 4.1 shows the location of the project in relation to the contaminated sites. Past projects within the City have encountered contaminated soils within the road right-of-way. Any soil borings taken during preliminary design will be tested. During construction, onsite inspectors will take soil samples if contaminated soils are encountered. Contaminated soils will be removed and disposed of in accordance with all state and federal regulations.

4.12 2nd Street Water Main (Valley to Fremont Avenues)

4.12.1 Monetary Evaluation

The cost-effective analysis was completed for the two construction alternatives and for the No-Action alternative. The project budgetary cost summary for the two construction alternatives is presented in Table 45 and Table 46.

The cost estimates include the restoration of curb, pavement, sidewalk, grass, and other items required to complete the improvements.

Table 45 – Estimated Project Cost Summary for 2nd Street Water Main (Valley to Fremont Avenues)

Item	Initial Capital Cost	Design Life (years)	Salvage Value
New 6-inch Water Main	$503,880	50	$302,328
City Street Reconstruction	$271,320	10	$0
Lead Service Line Replacement	$153,700	50	$92,220
Contamination Allowance	$10,000	NA	NA
Subtotal: Estimated Construction Cost	$938,900		
Administration, Engineering, Contingency	$320,000		
Total: Estimated Project Budget	$1,258,900		

Table 46 – Estimated Project Cost Summary for New Service Lines

Item	Initial Capital Cost	Design Life (years)	Salvage Value
Lead Service Line Replacement	$153,700	50	$92,220
Contamination Allowance	$10,000	NA	NA
Subtotal: Estimated Construction Cost	$163,700		
Administration, Engineering, Contingency	$56,000		
Total: Estimated Project Budget	$219,700		

A present worth analysis was completed for the two construction alternatives and for the No-Action alternative, as summarized in Table 47. The No-Action alternative has no associated capital costs. Sunk costs are not included in the analysis.

Table 47 – 20-Year Present Worth Analysis: Second Street Water Main (Valley to Fremont Avenues)

	New Water Main and Services		New Service Lines		No-Action	
Alternatives	Cost/Value	20-Year Present Worth	Cost/Value	20-Year Present Worth	Cost/Value	20-Year Present Worth
Capital Cost	$1,258,900	$1,258,900	$219,700	$219,700	$0	$0
O&M Cost/Year	$0	$0	$0	$0	$0	$0
Salvage Value	$394,548	($365,000)	$92,220	($86,000)	$0	$0
Total Worth		$893,900		$133,700		$0

4.12.2 Environmental Evaluation

4.12.2.1 Cultural Resources

The project is in a previous construction area and no direct historical or archeological impact is expected. There are no historical sites in the vicinity of the project.

4.12.2.2 Natural Environment

The effects on the natural environment do not differ between construction alternatives. The only anticipated impact to the natural environment is a temporary decrease in air quality due to construction.

4.12.3 Mitigation

The impact on air quality will be controlled to the greatest extent possible by limiting construction to regular working hours during the week.

4.12.4 Implementability and Public Participation

Both construction alternatives would involve work within and outside of the existing City of Grand Rapids public right-of-way. The City will cover the cost of the work on private property. No expense to the home-owner is anticipated for lead service line replacement.

Appendix 2 provides detailed information on lead service line replacement public outreach and construction techniques.

4.12.5 Technical Considerations

4.12.5.1 No-Action

Water main age and capacity concerns based on 20-year planning projections are not addressed. Within 17 years, the lead service lines would need to be replaced to meet compliance requirements.

4.12.5.2 New 6-inch LP Water Main and Services

Water main age is addressed. Water main capacity concerns based on 20-year planning projects are addressed. Lead service compliance requirements are met.

4.12.5.3 New Service Lines

Lead service compliance requirements are met. Roadway would be patched for lead service line replacements.

4.12.6 Residuals

This project will have no impact on residuals.

4.12.7 Growth Capacity

The purpose of the proposed project is to serve existing customers. The water main is not being installed for growth.

4.12.8 Industrial/Commercial/Institutional

The project area is fully developed; the majority of the properties served by the water main are residential or small businesses. Industrial/commercial/institutional usage does not require consideration in this case.

4.12.9 Contamination

There are several Part 201 Sites and LUSTs located near the project area. Map 4.1 shows the location of the project in relation to the contaminated sites. Past projects within the City have encountered contaminated soils within the road right-of-way. Any soil borings taken during preliminary design will be tested. During construction, onsite inspectors will take soil samples if contaminated soils are encountered. Contaminated soils will be removed and disposed of in accordance with all state and federal regulations.

4.13 Sherman Street Water Main (Giddings to Norwood Avenues)

4.13.1 Monetary Evaluation

The cost-effective analysis was completed for the two construction alternatives and for the No-Action alternative. The project budgetary cost summary for the two construction alternatives is presented in Table 48 and Table 49.

The cost estimates include the restoration of curb, pavement, sidewalk, grass, and other items required to complete the improvements.

Table 48 – Estimated Project Cost Summary for Sherman Street Water Main (Giddings to Norwood Avenues)

Item	Initial Capital Cost	Design Life (years)	Salvage Value
New 8-inch and 12-inch Water Main	$329,160	50	$197,496
City Street Reconstruction	$177,240	10	$0
Lead Service Line Replacement	$203,000	50	$121,800
Contamination Allowance	$10,000	NA	NA
Subtotal: Estimated Construction Cost	$719,400		
Administration, Engineering, Contingency	$245,000		
Total: Estimated Project Budget	$964,400		

Table 49 – Estimated Project Cost Summary for New Service Lines

Item	Initial Capital Cost	Design Life (years)	Salvage Value
Lead Service Line Replacement	$203,000	50	$121,800
Contamination Allowance	$10,000	NA	NA
Subtotal: Estimated Construction Cost	$213,000		
Administration, Engineering, Contingency	$73,000		
Total: Estimated Project Budget	$286,000		

A present worth analysis was completed for the two construction alternatives and for the No-Action alternative, as summarized in Table 50. The No-Action alternative has no associated capital costs. Sunk costs are not included in the analysis.

Table 50 – 20-Year Present Worth Analysis: Sherman Street Water Main (Giddings to Norwood Avenues)

	New Water Main and Services		New Service Lines		No-Action	
Alternatives	Cost/Value	20-Year Present Worth	Cost/Value	20-Year Present Worth	Cost/Value	20-Year Present Worth
Capital Cost	$964,400	$964,400	$286,000	$286,000	$0	$0
O&M Cost/Year	$0	$0	$0	$0	$0	$0
Salvage Value	$319,296	($295,000)	$121,800	($113,000)	$0	$0
Total Worth		$669,400		$173,000		$0

4.13.2 Environmental Evaluation

4.13.2.1 Cultural Resources

The project is in a previous construction area and no direct historical or archeological impact is expected. There are no historical sites in the vicinity of the project.

4.13.2.2 Natural Environment

The effects on the natural environment do not differ between construction alternatives. The only anticipated impact to the natural environment is a temporary decrease in air quality due to construction.

4.13.3 Mitigation

The impact on air quality will be controlled to the greatest extent possible by limiting construction to regular working hours during the week.

4.13.4 Implementability and Public Participation

Both construction alternatives would involve work within and outside of the existing City of Grand Rapids public right-of-way. The City will cover the cost of the work on private property. No expense to the home-owner is anticipated for lead service line replacement.

Appendix 2 provides detailed information on lead service line replacement public outreach and construction techniques.

4.13.5 Technical Considerations

4.13.5.1 No-Action

Water main age and capacity concerns based on 20-year planning projections are not addressed. Within 17 years, the lead service lines would need to be replaced to meet compliance requirements.

4.13.5.2 New 8-inch and 12-inch HP Water Main and Services

Water main age is addressed. Water main capacity concerns based on 20-year planning projects are addressed. Lead service compliance requirements are met.

4.13.5.3 New Service Lines

Lead service compliance requirements are met. Roadway would be patched for lead service line replacements.

4.13.6 Residuals

This project will have no impact on residuals.

4.13.7 Growth Capacity

The purpose of the proposed project is to serve existing customers. The water main is not being installed for growth.

4.13.8 Industrial/Commercial/Institutional

The project area is fully developed; the majority of the properties served by the water main are residential or small businesses. Industrial/commercial/institutional usage does not require consideration in this case.

4.13.9 Contamination

There are several Part 201 Sites and LUSTs located near the project area. Map 4.1 shows the location of the project in relation to the contaminated sites. Past projects within the City have encountered contaminated soils within the road right-of-way. Any soil borings taken during preliminary design will be tested. During construction, onsite inspectors will take soil samples if contaminated soils are encountered. Contaminated soils will be removed and disposed of in accordance with all state and federal regulations.

4.14 Butterworth Street Water Main (Marion to Lane Avenues)

4.14.1 Monetary Evaluation

The cost-effective analysis was completed for the two construction alternatives and for the No-Action alternative. The project budgetary cost summary for the two construction alternatives is presented in Table 51 and Table 52.

The cost estimates include the restoration of curb, pavement, sidewalk, grass, and other items required to complete the improvements.

Table 51 – Estimated Project Cost Summary for Butterworth Street Water Main (Marion to Lane Avenues)

Item	Initial Capital Cost	Design Life (years)	Salvage Value
New 12-inch Water Main	$291,785	50	$175,071
City Street Reconstruction	$157,115	10	$0
Lead Service Line Replacement	$133,400	50	$80,040
Contamination Allowance	$10,000	NA	NA
Subtotal: Estimated Construction Cost	$592,300		
Administration, Engineering, Contingency	$202,000		
Total: Estimated Project Budget	$794,300		

Table 52 – Estimated Project Cost Summary for New Service Lines

Item	Initial Capital Cost	Design Life (years)	Salvage Value
Lead Service Line Replacement	$133,400	50	$80,040
Contamination Allowance	$10,000	NA	NA
Subtotal: Estimated Construction Cost	$143,400		
Administration, Engineering, Contingency	$49,000		
Total: Estimated Project Budget	$192,400		

A present worth analysis was completed for the two construction alternatives and for the No-Action alternative, as summarized in Table 53. The No-Action alternative has no associated capital costs. Sunk costs are not included in the analysis.

Table 53 – 20-Year Present Worth Analysis: Butterworth Street Water Main (Marion to Lane Avenues)

	New Water Main and Services		New Service Lines		No-Action	
Alternatives	Cost/Value	20-Year Present Worth	Cost/Value	20-Year Present Worth	Cost/Value	20-Year Present Worth
Capital Cost	$794,300	$794,300	$192,400	$192,400	$0	$0
O&M Cost/Year	$0	$0	$0	$0	$0	$0
Salvage Value	$255,111	($236,000)	$80,040	($74,000)	$0	$0
Total Worth		$558,300		$118,400		$0

4.14.2 Environmental Evaluation

4.14.2.1 Cultural Resources

The project is in a previous construction area and no direct historical or archeological impact is expected. There are no historical sites in the vicinity of the project.

4.14.2.2 Natural Environment

The effects on the natural environment do not differ between construction alternatives. The only anticipated impact to the natural environment is a temporary decrease in air quality due to construction.

4.14.3 Mitigation

The impact on air quality will be controlled to the greatest extent possible by limiting construction to regular working hours during the week.

4.14.4 Implementability and Public Participation

Both construction alternatives would involve work within and outside of the existing City of Grand Rapids public right-of-way. The City will cover the cost of the work on private property. No expense to the home-owner is anticipated for lead service line replacement.

Appendix 2 provides detailed information on lead service line replacement public outreach and construction techniques.

4.14.5 Technical Considerations

4.14.5.1 No-Action

Water main age and capacity concerns based on 20-year planning projections are not addressed. Within 17 years, the lead service lines would need to be replaced to meet compliance requirements.

4.14.5.2 New 12-inch LP Water Main and Services

Water main age is addressed. Water main capacity concerns based on 20-year planning projects are addressed. Lead service compliance requirements are met.

4.14.5.3 New Service Lines

Lead service compliance requirements are met. Roadway would be patched for lead service line replacements.

4.14.6 Residuals

This project will have no impact on residuals.

4.14.7 Growth Capacity

The purpose of the proposed project is to serve existing customers. The water main is not being installed for growth.

4.14.8 Industrial/Commercial/Institutional

The project area is fully developed; the majority of the properties served by the water main are residential or small businesses. Industrial/commercial/institutional usage does not require consideration in this case.

4.14.9 Contamination

There are several Part 201 Sites and LUSTs located near the project area. Map 4.1 shows the location of the project in relation to the contaminated sites. Past projects within the City have encountered contaminated soils within the road right-of-way. Any soil borings taken during preliminary design will be tested. During construction, onsite inspectors will take soil samples if contaminated soils are encountered. Contaminated soils will be removed and disposed of in accordance with all state and federal regulations.

4.15 Buchanan Avenue Water Main (Stewart to Corinne Streets)

4.15.1 Monetary Evaluation

The cost-effective analysis was completed for the two construction alternatives and for the No-Action alternative. The project budgetary cost summary for the two construction alternatives is presented in Table 54 and Table 55.

The cost estimates include the restoration of curb, pavement, sidewalk, grass, and other items required to complete the improvements.

Table 54 – Estimated Project Cost Summary for Buchanan Avenue Water Main (Stewart to Corinne Streets)

Item	Initial Capital Cost	Design Life (years)	Salvage Value
New 6-inch and 12-inch Water Main	$709,475	50	$425,685
City Street Reconstruction	$382,025	10	$0
Lead Service Line Replacement	$305,500	50	$183,300
Contamination Allowance	$10,000	NA	NA
Subtotal: Estimated Construction Cost	$1,407,000		
Administration, Engineering, Contingency	$479,000		
Total: Estimated Project Budget	$1,886,000		

Table 55 – Estimated Project Cost Summary for New Service Lines

Item	Initial Capital Cost	Design Life (years)	Salvage Value
Lead Service Line Replacement	$305,500	50	$183,300
Contamination Allowance	$10,000	NA	NA
Subtotal: Estimated Construction Cost	$315,500		
Administration, Engineering, Contingency	$108,000		
Total: Estimated Project Budget	$423,500		

A present worth analysis was completed for the two construction alternatives and for the No-Action alternative, as summarized in Table 56. The No-Action alternative has no associated capital costs. Sunk costs are not included in the analysis.

Table 56 – 20-Year Present Worth Analysis: Buchanan Avenue Water Main (Stewart to Corinne Street)

	New Water Main and Services		New Service Lines		No-Action	
Alternatives	Cost/Value	20-Year Present Worth	Cost/Value	20-Year Present Worth	Cost/Value	20-Year Present Worth
Capital Cost	$1,886,000	$1,886,000	$423,500	$423,500	$0	$0
O&M Cost/Year	$0	$0	$0	$0	$0	$0
Salvage Value	$608,985	($563,000)	$183,300	($170,000)	$0	$0
Total Worth		$1,323,000		$253,500		$0

4.15.2 Environmental Evaluation

4.15.2.1 Cultural Resources

The project is in a previous construction area and no direct historical or archeological impact is expected. There are no historical sites in the vicinity of the project.

4.15.2.2 Natural Environment

The effects on the natural environment do not differ between construction alternatives. The only anticipated impact to the natural environment is a temporary decrease in air quality due to construction.

4.15.3 Mitigation

The impact on air quality will be controlled to the greatest extent possible by limiting construction to regular working hours during the week.

4.15.4 Implementability and Public Participation

Both construction alternatives would involve work within and outside of the existing City of Grand Rapids public right-of-way. The City will cover the cost of the work on private property. No expense to the home-owner is anticipated for lead service line replacement.

Appendix 2 provides detailed information on lead service line replacement public outreach and construction techniques.

4.15.5 Technical Considerations

4.15.5.1 No-Action

Water main age and capacity concerns based on 20-year planning projections are not addressed. Within 17 years, the lead service lines would need to be replaced to meet compliance requirements.

4.15.5.2 New 8-inch MP Water Main and Services

Water main age is addressed. Water main capacity concerns based on 20-year planning projects are addressed. Lead service compliance requirements are met.

4.15.5.3 New Service Lines

Lead service compliance requirements are met. Roadway would be patched for lead service line replacements.

4.15.6 Residuals

This project will have no impact on residuals.

4.15.7 Growth Capacity

The purpose of the proposed project is to serve existing customers. The water main is not being installed for growth.

4.15.8 Industrial/Commercial/Institutional

The project area is fully developed; the majority of the properties served by the water main are residential or small businesses. Industrial/commercial/institutional usage does not require consideration in this case.

4.15.9 Contamination

There are several Part 201 Sites and LUSTs located near the project area. Map 4.1 shows the location of the project in relation to the contaminated sites. Past projects within the City have encountered contaminated soils within the road right-of-way. Any soil borings taken during preliminary design will be tested. During construction, onsite inspectors will take soil samples if contaminated soils are encountered. Contaminated soils will be removed and disposed of in accordance with all state and federal regulations.

4.16 Alger Street Water Main (Division to Madison Avenues)

4.16.1 Monetary Evaluation

The cost-effective analysis was completed for the two construction alternatives and for the No-Action alternative. The project budgetary cost summary for the two construction alternatives is presented in Table 57 and Table 58.

The cost estimates include the restoration of curb, pavement, sidewalk, grass, and other items required to complete the improvements.

Table 57 – Estimated Project Cost Summary for Alger Street Water Main (Division to Madison Avenues)

Item	Initial Capital Cost	Design Life (years)	Salvage Value
New 12-inch Water Main	$1,001,650	50	$600,990
City Street Reconstruction	$539,350	10	$0
Lead Service Line Replacement	$159,600	50	$95,760
Contamination Allowance	$10,000	NA	NA
Subtotal: Estimated Construction Cost	$1,710,600		
Administration, Engineering, Contingency	$582,000		
Total: Estimated Project Budget	$2,292,600		

Table 58 – Estimated Project Cost Summary for New Service Lines

Item	Initial Capital Cost	Design Life (years)	Salvage Value
Lead Service Line Replacement	$159,600	50	$95,760
Contamination Allowance	$10,000	NA	NA
Subtotal: Estimated Construction Cost	$169,600		
Administration, Engineering, Contingency	$58,000		
Total: Estimated Project Budget	$227,600		

A present worth analysis was completed for the two construction alternatives and for the No-Action alternative, as summarized in Table 59. The No-Action alternative has no associated capital costs. Sunk costs are not included in the analysis.

Table 59 – 20-Year Present Worth Analysis: Alger Street Water Main (Division to Madison Avenues)

	New Water Main and Services		New Service Lines		No-Action	
Alternatives	Cost/Value	20-Year Present Worth	Cost/Value	20-Year Present Worth	Cost/Value	20-Year Present Worth
Capital Cost	$2,292,600	$2,292,600	$227,600	$227,600	$0	$0
O&M Cost/Year	$0	$0	$0	$0	$0	$0
Salvage Value	$696,750	($644,000)	$95,760	($89,000)	$0	$0
Total Worth		$1,648,600		$138,600		$0

4.16.2 Environmental Evaluation

4.16.2.1 Cultural Resources

The project is in a previous construction area and no direct historical or archeological impact is expected. There are no historical sites in the vicinity of the project.

4.16.2.2 Natural Environment

The effects on the natural environment do not differ between construction alternatives. The only anticipated impact to the natural environment is a temporary decrease in air quality due to construction.

4.16.3 Mitigation

The impact on air quality will be controlled to the greatest extent possible by limiting construction to regular working hours during the week.

4.16.4 Implementability and Public Participation

Both construction alternatives would involve work within and outside of the existing City of Grand Rapids public right-of-way. The City will cover the cost of the work on private property. No expense to the home-owner is anticipated for lead service line replacement.

Appendix 2 provides detailed information on lead service line replacement public outreach and construction techniques.

4.16.5 Technical Considerations

4.16.5.1 No-Action

Water main age and capacity concerns based on 20-year planning projections are not addressed. Within 17 years, the lead service lines would need to be replaced to meet compliance requirements.

4.16.5.2 New 12-inch MP Water Main and Services

Water main age is addressed. Water main capacity concerns based on 20-year planning projects are addressed. Lead service compliance requirements are met.

4.16.5.3 New Service Lines

Lead service compliance requirements are met. Roadway would be patched for lead service line replacements.

4.16.6 Residuals

This project will have no impact on residuals.

4.16.7 Growth Capacity

The purpose of the proposed project is to serve existing customers. The water main is not being installed for growth.

4.16.8 Industrial/Commercial/Institutional

The project area is fully developed; the majority of the properties served by the water main are residential or small businesses. Industrial/commercial/institutional usage does not require consideration in this case.

4.16.9 Contamination

There are several Part 201 Sites and LUSTs located near the project area. Map 4.1 shows the location of the project in relation to the contaminated sites. Past projects within the City have encountered contaminated soils within the road right-of-way. Any soil borings taken during preliminary design will be tested. During construction, onsite inspectors will take soil samples if contaminated soils are encountered. Contaminated soils will be removed and disposed of in accordance with all state and federal regulations.

4.17 Butterworth Street Water Main (Lane Avenue to Hogadone Lane)

4.17.1 Monetary Evaluation

The cost-effective analysis was completed for the two construction alternatives and for the No-Action alternative. The project budgetary cost summary for the two construction alternatives is presented in Table 60 and Table 61.

The cost estimates include the restoration of curb, pavement, sidewalk, grass, and other items required to complete the improvements.

Table 60 – Estimated Project Cost Summary for Butterworth Street Water Main (Lane Avenue to Hogadone Place)

Item	Initial Capital Cost	Design Life (years)	Salvage Value
New 12-inch Water Main	$291,785	50	$175,071
City Street Reconstruction	$157,115	10	$0
Lead Service Line Replacement	$114,100	50	$68,460
Contamination Allowance	$10,000	NA	NA
Subtotal: Estimated Construction Cost	$573,000		
Administration, Engineering, Contingency	$195,000		
Total: Estimated Project Budget	$768,000		

Table 61 – Estimated Project Cost Summary for New Service Lines

Item	Initial Capital Cost	Design Life (years)	Salvage Value
Lead Service Line Replacement	$114,100	50	$68,460
Contamination Allowance	$10,000	NA	NA
Subtotal: Estimated Construction Cost	$124,100		
Administration, Engineering, Contingency	$43,000		
Total: Estimated Project Budget	$167,100		

A present worth analysis was completed for the two construction alternatives and for the No-Action alternative, as summarized in Table 62. The No-Action alternative has no associated capital costs. Sunk costs are not included in the analysis.

Table 62 – 20-Year Present Worth Analysis: Butterworth Street Water Main (Lane Avenue to Hogadone Place)

	New Water Main and Services		New Service Lines		No-Action	
Alternatives	Cost/Value	20-Year Present Worth	Cost/Value	20-Year Present Worth	Cost/Value	20-Year Present Worth
Capital Cost	$768,000	$768,000	$167,100	$167,100	$0	$0
O&M Cost/Year	$0	$0	$0	$0	$0	$0
Salvage Value	$243,531	($225,000)	$68,460	($64,000)	$0	$0
Total Worth		$543,000		$103,100		$0

4.17.2 Environmental Evaluation

4.17.2.1 Cultural Resources

The project is in a previous construction area and no direct historical or archeological impact is expected. There are no historical sites in the vicinity of the project.

4.17.2.2 Natural Environment

The effects on the natural environment do not differ between construction alternatives. The only anticipated impact to the natural environment is a temporary decrease in air quality due to construction.

4.17.3 Mitigation

The impact on air quality will be controlled to the greatest extent possible by limiting construction to regular working hours during the week.

4.17.4 Implementability and Public Participation

Both construction alternatives would involve work within and outside of the existing City of Grand Rapids public right-of-way. The City will cover the cost of the work on private property. No expense to the home-owner is anticipated for lead service line replacement.

Appendix 2 provides detailed information on lead service line replacement public outreach and construction techniques.

4.17.5 Technical Considerations

4.17.5.1 No-Action

Water main age and capacity concerns based on 20-year planning projections are not addressed. Within 17 years, the lead service lines would need to be replaced to meet compliance requirements.

4.17.5.2 New 12-inch LP Water Main and Services

Water main age is addressed. Water main capacity concerns based on 20-year planning projects are addressed. Lead service compliance requirements are met.

4.17.5.3 New Service Lines

Lead service compliance requirements are met. Roadway would be patched for lead service line replacements.

4.17.6 Residuals

This project will have no impact on residuals.

4.17.7 Growth Capacity

The purpose of the proposed project is to serve existing customers. The water main is not being installed for growth.

4.17.8 Industrial/Commercial/Institutional

The project area is fully developed; the majority of the properties served by the water main are residential or small businesses. Industrial/commercial/institutional usage does not require consideration in this case.

4.17.9 Contamination

There are several Part 201 Sites and LUSTs located near the project area. Map 4.1 shows the location of the project in relation to the contaminated sites. Past projects within the City have encountered contaminated soils within the road right-of-way. Any soil borings taken during preliminary design will be tested. During construction, onsite inspectors will take soil samples if contaminated soils are encountered. Contaminated soils will be removed and disposed of in accordance with all state and federal regulations.

4.18 Mulford Drive Water Main (Alger/Madison to Union Avenues)

4.18.1 Monetary Evaluation

The cost-effective analysis was completed for the two construction alternatives and for the No-Action alternative. The project budgetary cost summary for the two construction alternatives is presented in Table 63 and Table 64.

The cost estimates include the restoration of curb, pavement, sidewalk, grass, and other items required to complete the improvements.

Table 63 – Estimated Project Cost Summary for Mulford Drive Water Main (Alger/Madison to Union Avenues)

Item	Initial Capital Cost	Design Life (years)	Salvage Value
New 6-inch Water Main	$581,685	50	$349,011
City Street Reconstruction	$313,215	10	$0
Lead Service Line Replacement	$191,500	50	$114,900
Contamination Allowance	$10,000	NA	NA
Subtotal: Estimated Construction Cost	$1,096,400		
Administration, Engineering, Contingency	$373,000		
Total: Estimated Project Budget	$1,469,400		

Table 64 – Estimated Project Cost Summary for New Service Lines

Item	Initial Capital Cost	Design Life (years)	Salvage Value
Lead Service Line Replacement	$191,500	50	$114,900
Contamination Allowance	$10,000	NA	NA
Subtotal: Estimated Construction Cost	$201,500		
Administration, Engineering, Contingency	$69,000		
Total: Estimated Project Budget	$270,500		

A present worth analysis was completed for the two construction alternatives and for the No-Action alternative, as summarized in Table 65. The No-Action alternative has no associated capital costs. Sunk costs are not included in the analysis.

Table 65 – 20-Year Present Worth Analysis: Mulford Drive Water Main (Alger/Madison to Union Avenues)

	New Water Main and Services		New Service Lines		No-Action	
Alternatives	Cost/Value	20-Year Present Worth	Cost/Value	20-Year Present Worth	Cost/Value	20-Year Present Worth
Capital Cost	$1,469,400	$1,469,400	$270,500	$270,500	$0	$0
O&M Cost/Year	$0	$0	$0	$0	$0	$0
Salvage Value	$463,911	($429,000)	$114,900	($107,000)	$0	$0
Total Worth		$1,040,400		$163,500		$0

4.18.2 Environmental Evaluation

4.18.2.1 Cultural Resources

The project is in a previous construction area and no direct historical or archeological impact is expected. There are no historical sites in the vicinity of the project.

4.18.2.2 Natural Environment

The effects on the natural environment do not differ between construction alternatives. The only anticipated impact to the natural environment is a temporary decrease in air quality due to construction.

4.18.3 Mitigation

The impact on air quality will be controlled to the greatest extent possible by limiting construction to regular working hours during the week.

4.18.4 Implementability and Public Participation

Both construction alternatives would involve work within and outside of the existing City of Grand Rapids public right-of-way. The City will cover the cost of the work on private property. No expense to the home-owner is anticipated for lead service line replacement.

Appendix 2 provides detailed information on lead service line replacement public outreach and construction techniques.

4.18.5 Technical Considerations

4.18.5.1 No-Action

Water main age and capacity concerns based on 20-year planning projections are not addressed. Within 17 years, the lead service lines would need to be replaced to meet compliance requirements.

4.18.5.2 New 8-inch MP Water Main and Services

Water main age is addressed. Water main capacity concerns based on 20-year planning projects are addressed. Lead service compliance requirements are met.

4.18.5.3 New Service Lines

Lead service compliance requirements are met. Roadway would be patched for lead service line replacements.

4.18.6 Residuals

This project will have no impact on residuals.

4.18.7 Growth Capacity

The purpose of the proposed project is to serve existing customers. The water main is not being installed for growth.

4.18.8 Industrial/Commercial/Institutional

The project area is fully developed; the majority of the properties served by the water main are residential or small businesses. Industrial/commercial/institutional usage does not require consideration in this case.

4.18.9 Contamination

There are several Part 201 Sites and LUSTs located near the project area. Map 4.1 shows the location of the project in relation to the contaminated sites. Past projects within the City have encountered contaminated soils within the road right-of-way. Any soil borings taken during preliminary design will be tested. During construction, onsite inspectors will take soil samples if contaminated soils are encountered. Contaminated soils will be removed and disposed of in accordance with all state and federal regulations.

4.19 Ardmore Street Water Main (Eastern to Silver Avenues)

4.19.1 Monetary Evaluation

The cost-effective analysis was completed for the two construction alternatives and for the No-Action alternative. The project budgetary cost summary for the two construction alternatives is presented in Table 66 and Table 67.

The cost estimates include the restoration of curb, pavement, sidewalk, grass, and other items required to complete the improvements.

Table 66 – Estimated Project Cost Summary for Ardmore Street Water Main (Eastern to Silver Avenues)

Item	Initial Capital Cost	Design Life (years)	Salvage Value
New 6-inch Water Main	$778,050	50	$466,830
City Street Reconstruction	$418,950	10	$0
Lead Service Line Replacement	$439,900	50	$263,940
Contamination Allowance	$10,000	NA	NA
Subtotal: Estimated Construction Cost	$1,646,900		
Administration, Engineering, Contingency	$560,000		
Total: Estimated Project Budget	$2,206,900		

Table 67 – Estimated Project Cost Summary for New Service Lines

Item	Initial Capital Cost	Design Life (years)	Salvage Value
Lead Service Line Replacement	$439,900	50	$263,940
Contamination Allowance	$10,000	NA	NA
Subtotal: Estimated Construction Cost	$449,900		
Administration, Engineering, Contingency	$153,000		
Total: Estimated Project Budget	$602,900		

A present worth analysis was completed for the two construction alternatives and for the No-Action alternative, as summarized in Table 68. The No-Action alternative has no associated capital costs. Sunk costs are not included in the analysis.

Table 68 – 20-Year Present Worth Analysis: Ardmore Street Water Main (Eastern to Silver Avenues)

	New Water Main and Services		New Service Lines		No-Action	
Alternatives	Cost/Value	20-Year Present Worth	Cost/Value	20-Year Present Worth	Cost/Value	20-Year Present Worth
Capital Cost	$2,206,900	$2,206,900	$602,900	$602,900	$0	$0
O&M Cost/Year	$0	$0	$0	$0	$0	$0
Salvage Value	$730,770	($675,000)	$263,940	($244,000)	$0	$0
Total Worth		$1,531,900		$358,900		$0

4.19.2 Environmental Evaluation

4.19.2.1 Cultural Resources

The project is in a previous construction area and no direct historical or archeological impact is expected. There are no historical sites in the vicinity of the project.

4.19.2.2 Natural Environment

The effects on the natural environment do not differ between construction alternatives. The only anticipated impact to the natural environment is a temporary decrease in air quality due to construction.

4.19.3 Mitigation

The impact on air quality will be controlled to the greatest extent possible by limiting construction to regular working hours during the week.

4.19.4 Implementability and Public Participation

Both construction alternatives would involve work within and outside of the existing City of Grand Rapids public right-of-way. The City will cover the cost of the work on private property. No expense to the home-owner is anticipated for lead service line replacement.

Appendix 2 provides detailed information on lead service line replacement public outreach and construction techniques.

4.19.5 Technical Considerations

4.19.5.1 No-Action

Water main age and capacity concerns based on 20-year planning projections are not addressed. Within 17 years, the lead service lines would need to be replaced to meet compliance requirements.

4.19.5.2 New 6-inch MP and 6-inch HP Water Main and Services

Water main age is addressed. Water main capacity concerns based on 20-year planning projects are addressed. Lead service compliance requirements are met.

4.19.5.3 New Service Lines

Lead service compliance requirements are met. Roadway would be patched for lead service line replacements.

4.19.6 Residuals

This project will have no impact on residuals.

4.19.7 Growth Capacity

The purpose of the proposed project is to serve existing customers. The water main is not being installed for growth.

4.19.8 Industrial/Commercial/Institutional

The project area is fully developed; the majority of the properties served by the water main are residential or small businesses. Industrial/commercial/institutional usage does not require consideration in this case.

4.19.9 Contamination

There are several Part 201 Sites and LUSTs located near the project area. Map 4.1 shows the location of the project in relation to the contaminated sites. Past projects within the City have encountered contaminated soils within the road right-of-way. Any soil borings taken during preliminary design will be tested. During construction, onsite inspectors will take soil samples if contaminated soils are encountered. Contaminated soils will be removed and disposed of in accordance with all state and federal regulations.

4.20 College Avenue Water Main (Hoyt to Dickinson Streets)

4.20.1 Monetary Evaluation

The cost-effective analysis was completed for the two construction alternatives and for the No-Action alternative. The project budgetary cost summary for the two construction alternatives is presented in Table 69 and Table 70.

The cost estimates include the restoration of curb, pavement, sidewalk, grass, and other items required to complete the improvements.

Table 69 – Estimated Project Cost Summary for College Avenue Water Main (Hoyt to Dickinson Streets)

Item	Initial Capital Cost	Design Life (years)	Salvage Value
New 6-inch Water Main	$870,675	50	$522,405
City Street Reconstruction	$468,825	10	$0
Lead Service Line Replacement	$458,400	50	$275,040
Contamination Allowance	$10,000	NA	NA
Subtotal: Estimated Construction Cost	$1,807,900		
Administration, Engineering, Contingency	$615,000		
Total: Estimated Project Budget	$2,422,900		

Table 70 – Estimated Project Cost Summary for New Service Lines

Item	Initial Capital Cost	Design Life (years)	Salvage Value
Lead Service Line Replacement	$458,400	50	$275,040
Contamination Allowance	$10,000	NA	NA
Subtotal: Estimated Construction Cost	$468,400		
Administration, Engineering, Contingency	$160,000		
Total: Estimated Project Budget	$628,400		

A present worth analysis was completed for the two construction alternatives and for the No-Action alternative, as summarized in Table 71. The No-Action alternative has no associated capital costs. Sunk costs are not included in the analysis.

Table 71 – 20-Year Present Worth Analysis: College Avenue Water Main (Hoyt to Dickinson Streets)

	New Water Main and Services		New Service Lines		No-Action	
Alternatives	Cost/Value	20-Year Present Worth	Cost/Value	20-Year Present Worth	Cost/Value	20-Year Present Worth
Capital Cost	$2,422,900	$2,422,900	$628,400	$628,400	$0	$0
O&M Cost/Year	$0	$0	$0	$0	$0	$0
Salvage Value	$797,445	($737,000)	$275,040	($254,000)	$0	$0
Total Worth		$1,685,900		$374,400		$0

4.20.2 Environmental Evaluation

4.20.2.1 Cultural Resources

The project is in a previous construction area and no direct historical or archeological impact is expected. There are no historical sites in the vicinity of the project.

4.20.2.2 Natural Environment

The effects on the natural environment do not differ between construction alternatives. The only anticipated impact to the natural environment is a temporary decrease in air quality due to construction.

4.20.3 Mitigation

The impact on air quality will be controlled to the greatest extent possible by limiting construction to regular working hours during the week.

4.20.4 Implementability and Public Participation

Both construction alternatives would involve work within and outside of the existing City of Grand Rapids public right-of-way. The City will cover the cost of the work on private property. No expense to the home-owner is anticipated for lead service line replacement.

Appendix 2 provides detailed information on lead service line replacement public outreach and construction techniques.

4.20.5 Technical Considerations

4.20.5.1 No-Action

Water main age and capacity concerns based on 20-year planning projections are not addressed. Within 17 years, the lead service lines would need to be replaced to meet compliance requirements.

4.20.5.2 New 6-inch MP Water Main and Services

Water main age is addressed. Water main capacity concerns based on 20-year planning projects are addressed. Lead service compliance requirements are met.

4.20.5.3 New Service Lines

Lead service compliance requirements are met. Roadway would be patched for lead service line replacements.

4.20.6 Residuals

This project will have no impact on residuals.

4.20.7 Growth Capacity

The purpose of the proposed project is to serve existing customers. The water main is not being installed for growth.

4.20.8 Industrial/Commercial/Institutional

The project area is fully developed; the majority of the properties served by the water main are residential or small businesses. Industrial/commercial/institutional usage does not require consideration in this case.

4.20.9 Contamination

There are several Part 201 Sites and LUSTs located near the project area. Map 4.1 shows the location of the project in relation to the contaminated sites. Past projects within the City have encountered contaminated soils within the road right-of-way. Any soil borings taken during preliminary design will be tested. During construction, onsite inspectors will take soil samples if contaminated soils are encountered. Contaminated soils will be removed and disposed of in accordance with all state and federal regulations.

4.21 Houseman Street Water Main (Knapp to Eleanor Streets)

4.21.1 Monetary Evaluation

The cost-effective analysis was completed for the two construction alternatives and for the No-Action alternative. The project budgetary cost summary for the two construction alternatives is presented in Table 72 and Table 73.

The cost estimates include the restoration of curb, pavement, sidewalk, grass, and other items required to complete the improvements.

Table 72 – Estimated Project Cost Summary for Houseman Street Water Main (Knapp to Eleanor Streets)

Item	Initial Capital Cost	Design Life (years)	Salvage Value
New 6-inch Water Main	$481,650	50	$288,990
City Street Reconstruction	$259,350	10	$0
Lead Service Line Replacement	$8,700	50	$5,220
Contamination Allowance	$10,000	NA	NA
Subtotal: Estimated Construction Cost	$759,700		
Administration, Engineering, Contingency	$259,000		
Total: Estimated Project Budget	$1,018,700		

Table 73 – Estimated Project Cost Summary for New Service Lines

Item	Initial Capital Cost	Design Life (years)	Salvage Value
Lead Service Line Replacement	$8,700	50	$5,220
Contamination Allowance	$10,000	NA	NA
Subtotal: Estimated Construction Cost	$18,700		
Administration, Engineering, Contingency	$7,000		
Total: Estimated Project Budget	$25,700		

A present worth analysis was completed for the two construction alternatives and for the No-Action alternative, as summarized in Table 74. The No-Action alternative has no associated capital costs. Sunk costs are not included in the analysis.

Table 74 – 20-Year Present Worth Analysis: Houseman Street Water Main (Knapp to Eleanor Streets)

	New Water Main and Services		New Service Lines		No-Action	
Alternatives	Cost/Value	20-Year Present Worth	Cost/Value	20-Year Present Worth	Cost/Value	20-Year Present Worth
Capital Cost	$1,018,700	$1,018,700	$25,700	$25,700	$0	$0
O&M Cost/Year	$0	$0	$0	$0	$0	$0
Salvage Value	$294,210	($272,000)	$5,220	($5,000)	$0	$0
Total Worth		$746,700		$20,700		$0

4.21.2 Environmental Evaluation

4.21.2.1 Cultural Resources

The project is in a previous construction area and no direct historical or archeological impact is expected. There are no historical sites in the vicinity of the project.

4.21.2.2 Natural Environment

The effects on the natural environment do not differ between construction alternatives. The only anticipated impact to the natural environment is a temporary decrease in air quality due to construction.

4.21.3 Mitigation

The impact on air quality will be controlled to the greatest extent possible by limiting construction to regular working hours during the week.

4.21.4 Implementability and Public Participation

Both construction alternatives would involve work within and outside of the existing City of Grand Rapids public right-of-way. The City will cover the cost of the work on private property. No expense to the home-owner is anticipated for lead service line replacement.

Appendix 2 provides detailed information on lead service line replacement public outreach and construction techniques.

4.21.5 Technical Considerations

4.21.5.1 No-Action

Water main age and capacity concerns based on 20-year planning projections are not addressed. Within 17 years, the lead service lines would need to be replaced to meet compliance requirements.

4.21.5.2 New 6-inch HP Water Main and Services

Water main age is addressed. Water main capacity concerns based on 20-year planning projects are addressed. Lead service compliance requirements are met.

4.21.5.3 New Service Lines

Lead service compliance requirements are met. Roadway would be patched for lead service line replacements.

4.21.6 Residuals

This project will have no impact on residuals.

4.21.7 Growth Capacity

The purpose of the proposed project is to serve existing customers. The water main is not being installed for growth.

4.21.8 Industrial/Commercial/Institutional

The project area is fully developed; the majority of the properties served by the water main are residential or small businesses. Industrial/commercial/institutional usage does not require consideration in this case.

4.21.9 Contamination

There are several Part 201 Sites and LUSTs located near the project area. Map 4.1 shows the location of the project in relation to the contaminated sites. Past projects within the City have encountered contaminated soils within the road right-of-way. Any soil borings taken during preliminary design will be tested. During construction, onsite inspectors will take soil samples if contaminated soils are encountered. Contaminated soils will be removed and disposed of in accordance with all state and federal regulations.

4.22 Union Avenue Water Main (Fountain to Lyon Streets)

4.22.1 Monetary Evaluation

The cost-effective analysis was completed for the two construction alternatives and for the No-Action alternative. The project budgetary cost summary for the two construction alternatives is presented in Table 75 and Table 76.

The cost estimates include the restoration of curb, pavement, sidewalk, grass, and other items required to complete the improvements.

Table 75 – Estimated Project Cost Summary for Union Avenue Water Main (Fountain to Lyon Streets)

Item	Initial Capital Cost	Design Life (years)	Salvage Value
New 6-inch Water Main	$288,990	50	$173,394
City Street Reconstruction	$155,610	10	$0
Lead Service Line Replacement	$136,300	50	$81,780
Contamination Allowance	$10,000	NA	NA
Subtotal: Estimated Construction Cost	$590,900		
Administration, Engineering, Contingency	$201,000		
Total: Estimated Project Budget	$791,900		

Table 76 – Estimated Project Cost Summary for New Service Lines

Item	Initial Capital Cost	Design Life (years)	Salvage Value
Lead Service Line Replacement	$136,300	50	$81,780
Contamination Allowance	$10,000	NA	NA
Subtotal: Estimated Construction Cost	$146,300		
Administration, Engineering, Contingency	$50,000		
Total: Estimated Project Budget	$196,300		

A present worth analysis was completed for the two construction alternatives and for the No-Action alternative, as summarized in Table 77. The No-Action alternative has no associated capital costs. Sunk costs are not included in the analysis.

Table 77 – 20-Year Present Worth Analysis: Union Avenue Water Main (Fountain to Lyon Streets)

	New Water Main and Services		New Service Lines		No-Action	
Alternatives	Cost/Value	20-Year Present Worth	Cost/Value	20-Year Present Worth	Cost/Value	20-Year Present Worth
Capital Cost	$791,900	$791,900	$196,300	$196,300	$0	$0
O&M Cost/Year	$0	$0	$0	$0	$0	$0
Salvage Value	$255,174	($236,000)	$81,780	($76,000)	$0	$0
Total Worth		$555,900		$120,300		$0

4.22.2 Environmental Evaluation

4.22.2.1 Cultural Resources

The project is in a previous construction area and no direct historical or archeological impact is expected. There are no historical sites in the vicinity of the project.

4.22.2.2 Natural Environment

The effects on the natural environment do not differ between construction alternatives. The only anticipated impact to the natural environment is a temporary decrease in air quality due to construction.

4.22.3 Mitigation

The impact on air quality will be controlled to the greatest extent possible by limiting construction to regular working hours during the week.

4.22.4 Implementability and Public Participation

Both construction alternatives would involve work within and outside of the existing City of Grand Rapids public right-of-way. The City will cover the cost of the work on private property. No expense to the home-owner is anticipated for lead service line replacement.

Appendix 2 provides detailed information on lead service line replacement public outreach and construction techniques.

4.22.5 Technical Considerations

4.22.5.1 No-Action

Water main age and capacity concerns based on 20-year planning projections are not addressed. Within 17 years, the lead service lines would need to be replaced to meet compliance requirements.

4.22.5.2 New 6-inch MP Water Main and Services

Water main age is addressed. Water main capacity concerns based on 20-year planning projects are addressed. Lead service compliance requirements are met.

4.22.5.3 New Service Lines

Lead service compliance requirements are met. Roadway would be patched for lead service line replacements.

4.22.6 Residuals

This project will have no impact on residuals.

4.22.7 Growth Capacity

The purpose of the proposed project is to serve existing customers. The water main is not being installed for growth.

4.22.8 Industrial/Commercial/Institutional

The project area is fully developed; the majority of the properties served by the water main are residential or small businesses. Industrial/commercial/institutional usage does not require consideration in this case.

4.22.9 Contamination

There are several Part 201 Sites and LUSTs located near the project area. Map 4.1 shows the location of the project in relation to the contaminated sites. Past projects within the City have encountered contaminated soils within the road right-of-way. Any soil borings taken during preliminary design will be tested. During construction, onsite inspectors will take soil samples if contaminated soils are encountered. Contaminated soils will be removed and disposed of in accordance with all state and federal regulations.

4.23 Hall Street Water Main (Underhill Avenue to US-131)

4.23.1 Monetary Evaluation

The cost-effective analysis was completed for the two construction alternatives and for the No-Action alternative. The project budgetary cost summary for the two construction alternatives is presented in Table 78 and Table 79.

The cost estimates include the restoration of curb, pavement, sidewalk, grass, and other items required to complete the improvements.

Table 78 – Estimated Project Cost Summary for Hall Street Water Main (Underhill Avenue to West of US-131)

Item	Initial Capital Cost	Design Life (years)	Salvage Value
New 8-inch and 12-inch Water Main	$582,075	50	$349,245
City Street Reconstruction	$313,425	10	$0
Lead Service Line Replacement	$173,100	50	$103,860
Contamination Allowance	$10,000	NA	NA
Subtotal: Estimated Construction Cost	$1,078,600		
Administration, Engineering, Contingency	$367,000		
Total: Estimated Project Budget	$1,445,600		

Table 79 – Estimated Project Cost Summary for New Service Lines

Item	Initial Capital Cost	Design Life (years)	Salvage Value
Lead Service Line Replacement	$173,100	50	$103,860
Contamination Allowance	$10,000	NA	NA
Subtotal: Estimated Construction Cost	$183,100		
Administration, Engineering, Contingency	$63,000		
Total: Estimated Project Budget	$246,100		

A present worth analysis was completed for the two construction alternatives and for the No-Action alternative, as summarized in Table 80. The No-Action alternative has no associated capital costs. Sunk costs are not included in the analysis.

Table 80 – 20-Year Present Worth Analysis: Hall Street Water Main (Underhill Avenue to West of US-131)

	New Water Main and Services		New Service Lines		No-Action	
Alternatives	Cost/Value	20-Year Present Worth	Cost/Value	20-Year Present Worth	Cost/Value	20-Year Present Worth
Capital Cost	$1,445,600	$1,445,600	$246,100	$246,100	$0	$0
O&M Cost/Year	$0	$0	$0	$0	$0	$0
Salvage Value	$453,105	($419,000)	$103,860	($96,000)	$0	$0
Total Worth		$1,026,600		$150,100		$0

4.23.2 Environmental Evaluation

4.23.2.1 Cultural Resources

The project is in a previous construction area and no direct historical or archeological impact is expected. There are no historical sites in the vicinity of the project.

4.23.2.2 Natural Environment

The effects on the natural environment do not differ between construction alternatives. The only anticipated impact to the natural environment is a temporary decrease in air quality due to construction.

4.23.3 Mitigation

The impact on air quality will be controlled to the greatest extent possible by limiting construction to regular working hours during the week.

4.23.4 Implementability and Public Participation

Both construction alternatives would involve work within and outside of the existing City of Grand Rapids public right-of-way. The City will cover the cost of the work on private property. No expense to the home-owner is anticipated for lead service line replacement.

Appendix 2 provides detailed information on lead service line replacement public outreach and construction techniques.

4.23.5 Technical Considerations

4.23.5.1 No-Action

Water main age and capacity concerns based on 20-year planning projections are not addressed. Within 17 years, the lead service lines would need to be replaced to meet compliance requirements.

4.23.5.2 New 8-inch and 12-inch MP Water Main and Services

Water main age is addressed. Water main capacity concerns based on 20-year planning projects are addressed. Lead service compliance requirements are met.

4.23.5.3 New Service Lines

Lead service compliance requirements are met. Roadway would be patched for lead service line replacements.

4.23.6 Residuals

This project will have no impact on residuals.

4.23.7 Growth Capacity

The purpose of the proposed project is to serve existing customers. The water main is not being installed for growth.

4.23.8 Industrial/Commercial/Institutional

The project area is fully developed; the majority of the properties served by the water main are residential or small businesses. Industrial/commercial/institutional usage does not require consideration in this case.

4.23.9 Contamination

There are several Part 201 Sites and LUSTs located near the project area. Map 4.1 shows the location of the project in relation to the contaminated sites. Past projects within the City have encountered contaminated soils within the road right-of-way. Any soil borings taken during preliminary design will be tested. During construction, onsite inspectors will take soil samples if contaminated soils are encountered. Contaminated soils will be removed and disposed of in accordance with all state and federal regulations.

4.24 Lead Services Line Replacement

4.24.1 Monetary Evaluation

The cost-effective analysis was completed for the construction alternative and for the No-Action alternative. The City has budgeted $8 million for lead service line replacements for each fiscal year of this Project Planning Document. The project budgetary cost summary for the alternative is presented in Table 81.

Table 81 – Estimated Project Cost Summary for New Service Lines

Item	Initial Capital Cost	Design Life (years)	Salvage Value
Lead Service Line Replacements FY24	$8,000,000	50	$4,800,000
Lead Service Line Replacements FY25	$8,000,000	50	$4,800,000
Lead Service Line Replacements FY26	$8,000,000	50	$4,800,000
Lead Service Line Replacements FY27	$8,000,000	50	$4,800,000
Lead Service Line Replacements FY28	$8,000,000	50	$4,800,000
Total: Estimated Project Budget	$40,000,000		

A present worth analysis was completed for the construction alternative and for the No-Action alternative, as summarized in Table 82. The No-Action alternative has no associated capital costs. Sunk costs are not included in the analysis.

Table 82 – 20-Year Present Worth Analysis: Lead Services Line Replacement

	New Service Lines		No-Action	
Alternatives	Cost/Value	20-Year Present Worth	Cost/Value	20-Year Present Worth
Capital Cost	$40,000,000	$40,000,000	$0	$0
O&M Cost/Year	$0	$0	$0	$0
Salvage Value	$24,000,000	($22,159,000)	$0	$0
Total Worth		$17,841,000		$0

4.24.2 Environmental Evaluation

4.24.2.1 Cultural Resources

The Lead Services Line Replacement project is in a previous construction area and no direct historical or archeological impact is expected.

4.24.2.2 Natural Environment

The only anticipated impact to the natural environment is a temporary decrease in air quality due to construction.

4.24.3 Mitigation

The impact on air quality will be controlled to the greatest extent possible by limiting construction to regular working hours during the week.

4.24.4 Implementability and Public Participation

The project would involve work within and outside of the existing City of Grand Rapids public right-of-way. The City will cover the cost of the work on private property. No expense to the home-owner is anticipated for lead service line replacement.

Appendix 2 provides detailed information on lead service line replacement public outreach and construction techniques.

4.24.5 Technical Considerations

With the No-Action alternative, the lead service lines would need to be replaced within 17 years to meet compliance requirements. The construction alternative ensures compliance requirements are met.

4.24.6 Residuals

This project will have no impact on residuals.

4.24.7 Growth Capacity

Not applicable.

4.24.8 Industrial/Commercial/Institutional

Not applicable.

4.24.9 Contamination

There are several Part 201 Sites and LUSTs located in the City, as shown in Map 4.1. Depending on the size of the plume, the sites could impact the locations of the proposed lead service line replacements.

4.25 Caledonia Township Connection

4.25.1 Monetary Evaluation

The cost-effective analysis was completed for the construction/regional alternative and for the No-Action alternative. The project budgetary cost summary is presented in Table 83.

Table 83 – Estimated Project Cost Summary for Caledonia Township Connection

Item	Initial Capital Cost	Design Life (years)	Salvage Value
Land Acquisition	$150,000	permanent	$0
Building	$800,000	50	$480,000
Process Pumps	$160,000	20	$0
Process Piping and Valves	$300,000	20	$0
Site Piping	$200,000	50	$120,000
Electrical and Controls	$300,000	50	$180,000
12-inch and 24-inch Water Mains	$3,331,500	50	$1,998,900
Subtotal: Estimated Construction Cost	$5,241,500		
Administration, Engineering, Contingency	$1,840,000		
Total: Estimated Project Budget	$7,081,500		

A present worth analysis was completed for the construction/regional alternative and the No-Action alternative. The No-Action alternative has no associated capital costs. Table 84 shows the comparison of the present worth analysis for the alternatives.

Table 84 – 20-Year Present Worth Analysis: Caledonia Township Connection

	Caledonia Township Connection		No-Action	
Alternatives	Cost/Value	20-Year Present Worth	Cost/Value	20-Year Present Worth
Capital Cost	$7,081,500	$7,081,500	$0	$0
O&M Cost/Year	$1,858,000	$35,644,000	--	--
Salvage Value	$2,779,000	($2,565,700)	$0	$0
Total Worth		$40,159,800		$0

4.25.2 Environmental Evaluation

4.25.2.1 Cultural Resources

There are no direct historical or archeological impacts expected as a result of the project.

4.25.2.2 Natural Environment

The proposed site for the pump station is in an area that is currently being developed. Construction of this pump station will coincide with other construction in the area and will change the current natural environment. Air quality will also temporarily decrease due to construction.

4.25.3 Mitigation

Mitigation of environmental impacts will include best construction practices such as soil erosion prevention techniques, maintenance of construction equipment, and limiting construction to regular working hours during the week.

4.25.4 Implementability and Public Participation

The project plan will be available for public review. If at that time it becomes apparent that an alternative is not acceptable to the public, the alternatives will be reevaluated. Implementability of the project was evaluated. The proposed pump station will create new operation and maintenance requirements but will operate similar to existing facilities. The project will require an intermunicipal agreement between Grand Rapids and Caledonia Township. The proposed location for the new pump station is within Cascade Township. The City will obtain all necessary land acquisition and construction permits for the project to proceed.

4.25.5 Technical Considerations

Two pumps are included in the project to provide redundancy and reliability. The pumps will be sized to efficiently meet current and projected future demands for Caledonia Township. The Township has an estimated 2020 MDD of 1.85 mgd and 2040 MDD of 3.0 mgd. Based on this preliminary evaluation, the pumps would each have an approximate capacity of 1.5 mgd and a TDH of 95 feet. The pump station would be designed to allow for space to add a third pump in the future. If water main improvements are made to the Caledonia system to improve transmission capacity, the TDH of the proposed pumps could be reduced. Caledonia's demand should be confirmed with recent data and further hydraulic modeling should be performed to confirm the size of the pumps.

4.25.6 Residuals

The project will have no impact on residuals.

4.25.7 Growth Capacity

The proposed pump station and the water main improvements associated with the project would be designed to provide future (2040) demand as projected by Caledonia Township. The pump station will house two pumps, with room to add a third in the future.

4.25.8 Industrial/Commercial/Institutional

Industrial/commercial/institutional usage has been considered in the development of the demand projections for the City and for the Township. The current (2020) and future (2040) demands, as outlined in the 2020 CMP, were used to complete a preliminary evaluation for the design of the pump station.

4.25.9 Contamination

Map 4.2 shows the location of the project in relation to the contaminated sites. As indicated, the project location has few nearby contaminated sites.

4.26 Cascade Township Water Mains

4.26.1 Monetary Evaluation

The cost-effective analysis was completed for the construction alternative and for the No-Action alternative. The project budgetary cost summary is presented in Table 85.

Table 85 – Estimated Project Cost Summary for Cascade Township Water Mains

Item	Initial Capital Cost	Design Life (years)	Salvage Value
New 6, 8, 12, and 16-inch Water Mains	$5,456,783	50	$3,274,070
City Street Reconstruction	$2,938,268	10	$0
Contamination Allowance	$10,000	NA	NA
Subtotal: Estimated Construction Cost	$8,405,050		
Administration, Engineering, Contingency	$2,858,000		
Total: Estimated Project Budget	$11,263,050		

A present worth analysis was completed for the construction alternative and the No-Action alternative. The No-Action alternative has no associated capital costs. Table 86 shows the comparison of the present worth analysis for the alternatives.

Table 86 – 20-Year Present Worth Analysis: Cascade Township Water Mains

	Caledonia Township Connection		No-Action	
Alternatives	Cost/Value	20-Year Present Worth	Cost/Value	20-Year Present Worth
Capital Cost	$ 11,263,050	$ 11,263,050	$0	$0
O&M Cost/Year	$0	$0	--	--
Salvage Value	$ 3,274,070	($3,023,000)	$0	$0
Total Worth		$ 8,240,100		$0

4.26.2 Environmental Evaluation

4.26.2.1 Cultural Resources

There will be no direct impact on any historical sites during the construction project.

4.26.2.2 Natural Environment

The proposed project addresses environmental concerns, namely ending contaminated groundwater consumption from residential homes. The only anticipated impact to the natural environment is a temporary decrease in air quality due to construction.

4.26.3 Mitigation

The impact on air quality will be controlled to the greatest extent possible by limiting construction to regular working hours during the week. Erosion control measures will be taken during construction to prevent impact on nearby wetlands.

4.26.4 Implementability and Public Participation

The Project Planning Document will be available for public review. If at that time it becomes apparent that an alternative is not acceptable to the public, the alternatives will be reevaluated.

4.26.5 Technical Considerations

The project proposes new connections to the Grand Rapids system, which will slightly increase demand on the system. The estimated additional average day demand from the new users from Phase 1 of this project is about 0.054 mgd.

4.26.6 Residuals

This project will have no impact on residuals.

4.26.7 Growth Capacity

The purpose of the proposed project is to bring on new customers that are currently served by private wells. The proposed water mains will be sized appropriately for the estimated future demand.

4.26.8 Industrial/Commercial/Institutional

The project area is fully developed; the majority of the properties served by the water main are residential. Industrial/commercial/institutional usage does not require consideration in this case.

4.26.9 Contamination

Map 4.2 shows the location of the project in relation to the contaminated sites. As indicated, the project location has few nearby contaminated sites. Although there is known PFAS contamination in the vicinity of the project, there are no known sites with PFAS above 70 parts per trillion (ppt).

5.0 Selected Alternatives

5.1 Selected Alternatives

5.1.1 LMFP Improvement Projects

5.1.1.1 Residuals Handling Improvements

The selected alternative for the LMFP Residuals Handling Improvements is the Separate Residuals Treatment. This alternative will provide the necessary treatment of the solids generated at the LMFP while optimizing reliability, energy use, and space utilization. Separating the waste streams into dilute and concentrated streams will aid in the effectiveness of treatment. The treatment equipment will be sized for separate dilute and concentrated streams, which will help to optimize the size and energy use of the equipment. If all waste streams were combined, much larger equipment would be required to treat the large volume of wastewater. The dilute stream from the filter backwash cycles will initially be stored in an EQ tank, then pumped to redundant clarifiers. The clarified stream will be sent to the lagoons, while the concentrated solids will be combined with the concentrated sludge blowdown from the floc/sed basins and the pretreatment plate settlers. The combined, concentrated stream will be thickened using redundant gravity thickeners, then dewatered using mechanical dewatering equipment. The solids will be discharged to dumpsters, then sent to a landfill. The dilute, effluent filtrate from the clarifiers, gravity thickeners, and the dewatering equipment will be dechlorinated, then sent to the lagoons for final discharge. An overview of the selected alternative is shown in Figure 5. Figure 6 shows a process flow schematic for the proposed improvements to the residuals handling process at the LMFP.

5.1.1.2 Chemical Unloading Improvements

The selected alternative is to optimize the existing facilities by modifying the existing south unloading bay for the new containment system. This alternative minimizes the amount of precipitation or dirt that could enter the drain, and chemicals from any major spill would be contained and directed to a new underground tank. The improvements would allow the City to sample the contained material and contract with a chemical waste hauling company to pump out the tank and dispose of the material. An overview of the LMFP with the selected alternative is shown in Figure 5.

5.1.1.3 Carbon Feed System Improvements and Phosphate Feed System Relocation

Due to the age, poor condition, and inadequate size of the existing carbon feed and phosphate feed systems, the selected alternative is to optimize the existing facilities. The improvements would bring the carbon feed system into compliance with current standards, right-size it for the current needs of the water treatment plant, and provide containment for the carbon dust generated (a potential fire hazard). Replacing and relocating the phosphate feed system will improve ease of maintenance and allow for future modifications to the system if changes are made to the chemicals used in this process. An overview of the LMFP with the selected alternative is shown in Figure 5.

5.1.2 Fremont Avenue Water Main (3rd to 4th Streets)

The selected alternative for the Fremont Street Water Main project is the installation of the *New 8-inch LP Water Main and Services*. This alternative addresses the concern of water main age and lead service line compliance. The selected alternative is detailed in Figure 7.

5.1.3 Hall Street Water Main (Madison Avenue to 250 feet East of Union Avenue); Paris Avenue Water Main (Gilbert to Hall Streets)

The selected alternative for the Hall Street and Paris Avenue Water Main project is the installation of the *New 6-inch and 12-inch MP Water Main and Services*. This alternative addresses the concern of water main age and lead service line compliance. The selected alternative is detailed in Figure 8.

5.1.4 Eleanor Street Water Main (Plainfield to Diamond Avenues)

The selected alternative for the Eleanor Street Water Main project is the installation of the new *6-inch MP and 6-inch HP Water Mains and Services*. This alternative addresses the three major problems described in the summary of need, including water main age, dead-end line O&M, and lead service line compliance. The selected alternative is detailed in Figure 9.

5.1.5 Valley Avenue Water Main (Fulton to Bridge); Sibley Street Water main (Valley to Garfield Avenues)

The selected alternative for the Valley Avenue and Sibley Street Water Main project is the installation of the *New 6-inch and 8-inch LP Water Main and Services*. This alternative addresses the concern of water main age and lead service line compliance. The selected alternative is detailed in Figure 10.

5.1.6 Boston Street Water Main (Calvin to Plymouth Avenues)

The selected alternative for the Boston Street Water Main project is the installation of the *New 8-inch and 12-inch HP Water Main and Services*. This alternative addresses the concern of water main age and lead service line compliance. The selected alternative is detailed in Figure 11.

5.1.7 Burton Street Water Main (Eastern to Kalamazoo Avenues)

The selected alternative for the Burton Street Water Main project is the installation of the *New 12-inch MP and 12-inch HP Water Main and Services*. This alternative addresses the concern of water main age and lead service line compliance. The selected alternative is detailed in Figure 12.

5.1.8 Burton Street Water Main (Horton to Eastern Avenues)

The selected alternative for the Burton Street Water Main project is the installation of the *New 12-inch MP Water Main and Services*. This alternative addresses the concern of water main age and lead service line compliance. The selected alternative is detailed in Figure 13.

5.1.9 Oakwood Avenue Water Main (Knapp to 3 Mile Streets)

The selected alternative for the Oakwood Avenue Water Main project is the installation of the *New 6-inch MP, 8-inch LP, 8-inch MP Water Main and Services*. This alternative addresses the concern of water main age, dead-end line O&M, and lead service line compliance. The selected alternative is detailed in Figure 14.

5.1.10 Valley Avenue Water Main (Bridge to 4th Streets); 1st and 3rd Street Water Main (Valley to Garfield Avenues)

The selected alternative for the Valley Avenue, First Street, and Third Street Water Main project is the installation of the *New 6-inch and 8-inch LP Water Main and Services*. This alternative addresses the concern of water main age and lead service line compliance. The selected alternative is detailed in Figure 15.

5.1.11 Buchanan Avenue Water Main (Corinne to Hall Streets)

The selected alternative for the Buchanan Avenue Water Main project is the installation of the *New 8-inch MP Water Main and Services*. This alternative addresses the concern of water main age and lead service line compliance. The selected alternative is detailed in Figure 16.

5.1.12 2nd Street Water Main (Valley to Fremont Avenues)

The selected alternative for the Second Street Water Main project is the installation of the *New 6-inch LP Water Main and Services*. This alternative addresses the concern of water main age and lead service line compliance. The selected alternative is detailed in Figure 17.

5.1.13 Sherman Street Water Main (Giddings to Norwood Avenues)

The selected alternative for the Sherman Street Water Main project is the installation of the *New 8-inch and 12-inch HP Water Main and Services*. This alternative addresses the concern of water main age and lead service line compliance. The selected alternative is detailed in Figure 18.

5.1.14 Butterworth Street Water Main (Marion to Lane Avenues)

The selected alternative for the Butterworth Street Water Main project is the installation of the *New 12-inch LP Water Main and Services*. This alternative addresses the concern of water main age and lead service line compliance. The selected alternative is detailed in Figure 19.

5.1.15 Buchanan Avenue Water Main (Stewart to Corinne Avenues)

The selected alternative for the Buchanan Avenue Water Main project is the installation of the *New 8-inch MP Water Main and Services*. This alternative addresses the concern of water main age and lead service line compliance. The selected alternative is detailed in Figure 20.

5.1.16 Alger Street Water Main (Division to Madison Avenues)

The selected alternative for the Alger Street Water Main project is the installation of the *New 12-inch MP Water Main and Services*. This alternative addresses the concern of water main age and lead service line compliance. The selected alternative is detailed in Figure 21.

5.1.17 Butterworth Street Water Main (Lane Avenue to Hogadone Place)

The selected alternative for the Butterworth Street Water Main project is the installation of the *New 12-inch LP Water Main and Services*. This alternative addresses the concern of water main age and lead service line compliance. The selected alternative is detailed in Figure 22.

5.1.18 Mulford Drive Water Main (Alger/Madison to Union Avenues)

The selected alternative for the Mulford Drive Water Main project is the installation of the *New 6-inch MP Water Main and Services*. This alternative addresses the concern of water main age and lead service line compliance. The selected alternative is detailed in Figure 23.

5.1.19 Ardmore Street Water Main (Eastern to Silver Avenues)

The selected alternative for the Ardmore Street Water Main project is the installation of the *New 6-inch MP and 6-inch HP Water Main and Services*. This alternative addresses the concern of water main age and lead service line compliance. The selected alternative is detailed in Figure 24.

5.1.20 College Avenue Water Main (Hoyt to Dickinson Streets)

The selected alternative for the College Avenue Water Main project is the installation of the *New 6-inch MP Water Main and Services*. This alternative addresses the concern of water main age and lead service line compliance. The selected alternative is detailed in Figure 25.

5.1.21 Houseman Street Water Main (Knapp to Eleanor Streets)

The selected alternative for the Houseman Avenue Water Main project is the installation of the *New 6-inch HP Water Main and Services*. This alternative addresses the concern of water main age and lead service line compliance. The selected alternative is detailed in Figure 26.

5.1.22 Union Avenue Water Main (Fountain to Lyon Streets)

The selected alternative for the Union Avenue Water Main project is the installation of the *New 6-inch MP Water Main and Services*. This alternative addresses the concern of water main age and lead service line compliance. The selected alternative is detailed in Figure 27.

5.1.23 Hall Street Water Main (Underhill Avenue to US-131)

The selected alternative for the Hall Street Water Main project is the installation of the *New 8-inch MP and 12-inch MP Water Main and Services*. This alternative addresses the concern of water main age and lead service line compliance. The selected alternative is detailed in Figure 28.

5.1.24 Lead Services Line Replacement

The selected alternative for the Lead Services Line Replacement project is the installation of new service lines. This alternative addresses lead service line compliance. Figure 29 depicts all the known lead service lines in the City.

5.1.25 Caledonia Township Connection

The selected alternative is to connect Caledonia Township to the Grand Rapids water system and acquire the Township as a customer community. The Township would be incorporated into cost distribution for water system

projects. A new booster station and new water mains would be constructed to supply the Township from the Grand Rapids East High Pressure District. The selected alternative is detailed in Figure 30.

5.1.26 Cascade Township Water Mains

The selected alternative is to construct new water main in the area affected by PFAS in Cascade Township. Residents with groundwater wells currently affected by PFAS contamination will be brought on as new customers to the water system. The selected alternative is detailed in Figure 31.

5.2 Design Parameters

5.2.1 LMFP Improvement Projects

Figure 6 shows a process flow schematic for the proposed improvements at the LMFP.

Parameters for the basis of design for the Residuals Handling project are as follows:

- Filter washwater EQ tank capacity: 823,000 gallons (2 tanks; approximately 400,000 gallons each).
- Concentrated Residuals EQ tank capacity: 440,000 gallons (2 tanks; 220,000 gallons each).
- Filter washwater pumps (from filters to washwater EQ basin) low rate: 5,000 gpm; high rate: 7,800 gpm. Three pumps.
- Concentrated Residuals pumps (floc/sed basins to concentrated residuals EQ basin) design flow: 800 gpm. Two pumps.
- Clarifier volume: 2 clarifiers, each 45-foot-diameter, 11.5-feet-deep. Detention time: 3.8 hr. Surface Overflow Rate: 550 gal/day/ft^2.
- Gravity thickeners capacity: 3 thickeners, each 45-foot-diameter, 12.3-feet-deep. Solids loading design rate 7.0 lbs/day/ft^2.
- Mechanical dewatering equipment capacity: 3 units (two duty, one standby). Solids loading design rate: 1,310 dry lbs/hr per press, 144 gpm hydraulic loading.
- New flow metering, sodium bisulfite feed for dechlorination, and polymer chemical feed.

The Chemical Unloading improvements will have the following preliminary design parameters:

- Containment system capable of containing at least 125% of the full volume of a tanker truck (about 5,600 gallons).
- Double-wall containment tank with 6,000-gallon capacity.
- Double-wall containment tank to capture drippings during attachment and removal of truck hoses with 500-gallon capacity.

The Carbon Feed System Improvements would be designed for an average dosing of 5 ppm with a maximum of 10 ppm.

The new Phosphate Feed System will have the following preliminary design parameters:

- Two new 5,000-gallon bulk storage tanks to accept delivery from a full tanker truck, and still provide more than a 30-day supply under average day demand conditions.
- New 250-gallon day tank.
- Three new chemical feed pumps.

5.2.2 Fremont Avenue Water Main (3rd to 4th Streets)

- Replace Aged Water Main — 310 feet of 8-inch LP water main
- Lead Service Line Replacement — 14 homes

5.2.3 Hall Street Water Main (Madison to Eastern Avenue); Paris Avenue Water Main (Gilbert to Hall Streets)

- Replace Aged Water Main — 250 feet of 6-inch MP water main (Hall Street); 1,300 feet of 12-inch MP water main (Hall Street); 350 feet of 6-inch MP water main (Paris Avenue)
- Lead Service Line Replacement — 12 homes

5.2.4 Eleanor Street Water Main (Plainfield to Diamond Avenues)

- Replace Aged Water Main — 1,350 feet of 6-inch MP water main
- Replace Aged Water Main and Eliminate Dead-End Mains — 1,050 feet of 6-inch HP water main
- Lead Service Line Replacement — 21 homes
- Dead-End Water Main Lines Eliminated — 3,600 feet, 102 homes

5.2.5 Valley Avenue Water Main (Fulton to Bridge Streets); Sibley Street Water Main (Valley to Garfield Avenues)

- Replace Aged Water Main — 350 feet of 6-inch LP water main (Sibley Street); 1,800 feet of 8-inch LP water main (Valley Avenue)
- Lead Service Line Replacement — 62 homes

5.2.6 Boston Street Water Main (Calvin to Plymouth Avenues)

- Replace Aged Water Main — 550 feet of 8-inch HP water main; 2,550 feet of 12-inch HP water main
- Lead Service Line Replacement — 41 homes

5.2.7 Burton Street Water Main (Eastern to Kalamazoo Avenues)

- Replace Aged Water Main — 1,350 feet of 12-inch MP water main; 2,550 feet of 12-inch HP water main
- Lead Service Line Replacement — 76 homes

5.2.8 Burton Street Water Main (Horton to Eastern Avenues)

- Replace Aged Water Main — 3,900 feet of 12-inch MP water main
- Lead Service Line Replacement — 77 homes

5.2.9 Oakwood Avenue Water Main (Knapp to 3 Mile Streets)

- Replace Aged Water Main — 800 feet of 6-inch MP water main; 3,550 feet of 8-inch MP water main
- Replace Aged Water Main and Eliminate Dead-End Mains — 950 feet of 8-inch LP water main
- Lead Service Line Replacement — 98 homes
- Dead-End Water Main Lines Eliminated — 1,600 feet, 27 homes

5.2.10 Valley Avenue Water Main (Bridge to 4th); 1st and 3rd Street Water Main (Valley to Garfield Avenues)

- Replace Aged Water Main — 100 feet of 6-inch LP water main (Valley Avenue)
1,300 feet of 8-inch LP water main (Valley Avenue)
350 feet of 8-inch LP water main (1st Street)
350 feet of 6-inch LP water main (3rd Street)
- Lead Service Line Replacements — 30 homes

5.2.11 Buchanan Avenue Water Main (Corinne to Hall Streets)

- Replace Aged Water Main — 2,800 feet of 8-inch MP water main
- Lead Service Line Replacement — 6 properties

5.2.12 Second Street Water Main (Valley to Fremont Avenues)

- Replace Aged Water Main — 1,360 feet of 6-inch LP water main
- Lead Service Line Replacement — 20 homes

5.2.13 Sherman Street Water Main (Giddings to Norwood Avenues)

- Replace Aged Water Main — 370 feet of 8-inch HP water main
430 feet of 12-inch HP water main
- Lead Service Line Replacement — 24 homes

5.2.14 Butterworth Street Water Main (Marion to Lane Avenues)

- Replace Aged Water Main — 670 feet of 12-inch LP water main
- Lead Service Line Replacement — 16 properties

5.2.15 Buchanan Avenue Water Main (Stewart to Corinne Streets)

- Replace Aged Water Main — 1,850 feet of 8-inch MP water main
- Lead Service Line Replacement — 37 homes

5.2.16 Alger Street Water Main (Division to Madison Avenues)

- Replace Aged Water Main — 2,300 feet of 12-inch MP water main
- Lead Service Line Replacements — 20 homes

5.2.17 Butterworth Street Water Main (Lane Avenue to Hogadone Place)

- Replace Aged Water Main — 670 feet of 12-inch LP water main
- Lead Service Line Replacement — 14 properties

5.2.18 Mulford Drive Water Main (Alger/Madison to Union Avenues)

- Replace Aged Water Main — 1,570 feet of 6-inch MP water main
- Lead Service Line Replacement — 40 homes

5.2.19 Ardmore Street Water Main (Eastern to Silver Avenues)

- Replace Aged Water Main — 1,300 feet of 6-inch MP water main
800 feet of 6-inch HP water main
- Lead Service Line Replacements — 52 homes

5.2.20 College Avenue Water Main (Hoyt to Dickinson Streets)

- Replace Aged Water Main — 2,350 feet of 6-inch MP water main
- Lead Service Line Replacements — 56 homes

5.2.21 Houseman Street Water Main (Knapp to Eleanor Streets)

- Replace Aged Water Main — 1,300 feet of 6-inch HP water main
- Lead Service Line Replacement — 1 home

5.2.22 Union Avenue Water Main (Fountain to Lyon Streets)

- Replace Aged Water Main — 780 feet of 6-inch MP water main
- Lead Service Line Replacement — 17 homes

5.2.23 Hall Street Water Main (Underhill Avenue to US-131)

- Replace Aged Water Main — 950 feet of 8-inch MP water main; 500 feet of 12-inch MP water main
- Lead Service Line Replacements — 21 homes

5.2.24 Lead Services Line Replacement

Lead service lines throughout the City will be replaced as a part of this Project Planning Document until funds are exhausted. EGLE-approved material and methods of installation alongside AWWA guidelines will be utilized to perform the replacements.

5.2.25 Caledonia Township Connection

Caledonia Township has an estimated 2020 MDD of 1.85 mgd and a 2040 MDD of 3.0 mgd. The proposed booster station would be designed to meet these demands and would house two pumps for redundancy. Based on preliminary sizing of the pumps, each pump should have a capacity of 1.5 mgd each and a TDH of 95 feet. The project would also include a new 24-inch water main in East Paris Ave between 40th Street and Broadmoor Avenue to improve capacity to the south, and a new 12-inch water main crossing Broadmoor Avenue near the station to provide a second supply line.

5.2.26 Cascade Township Water Mains

Phase 1 of this project, which is included in this Project Planning Document, includes 221 new service lines. The total estimated average day demand from these new users is 37.7 gallons per minute (gpm).

5.3 Project Maps

A list of figures associated with the selected alternatives is summarized:

Water System Recommended Improvements	Figure 4
LMFP Improvement Projects	Figure 5
Fremont Avenue Water Main	Figure 7
Hall Street Water Main; Paris Avenue Water Main	Figure 8
Eleanor Street Water Main	Figure 9
Valley Avenue Water Main; Sibley Street Water Main	Figure 10
Boston Street Water Main	Figure 11
Burton Street Water Main (Eastern to Kalamazoo Avenues)	Figure 12
Burton Street Water Main (Horton to Eastern Avenues)	Figure 13
Oakwood Avenue Water Main	Figure 14

Valley Avenue Water Main; 1st and 3rd Street Water Main	Figure 15
Buchanan Avenue Water Main (Corinne to Hall Streets)	Figure 16
2nd Street Water Main	Figure 17
Sherman Street Water Main	Figure 18
Butterworth Street Water Main (Marion to Lane Avenues)	Figure 19
Buchanan Avenue Water Main (Stewart to Corinne Streets)	Figure 20
Alger Street Water Main	Figure 21
Butterworth Street Water Main (Lane Avenue to Hogadone Place)	Figure 22
Mulford Drive Water Main	Figure 23
Ardmore Street Water Main	Figure 24
College Avenue Water Main	Figure 25
Houseman Street Water Main	Figure 26
Union Avenue Water Main	Figure 27
Hall Street Water Main (Underhill Avenue to US-131)	Figure 28
Potential Lead Service Lines	Figure 29
Caledonia Township Connection	Figure 30
Cascade Township Water Mains	Figure 31

5.4 Schedule for Design and Construction

EGLE has approved two separate project numbers for this DWSRF for Grand Rapids based on two categories of loans. One category includes projects that impact the City of Grand Rapids only and the other category includes projects that impact the overall service area. There are a total of eight loans, with five being “City-only” loans and three being “overall service area” loans. Fiscal Years 24, 25, and 27 include projects in both categories, so there are two loans for each of those three years. Fiscal Years 26 and 28 includes City projects only, so there is one loan for each of those two years. Appendix 6 summarizes the loans within each fiscal year, the projects within each loan, and the anticipated construction start date for each project. The schedule for each project is consistent with the quarterly DWSRF funding deadlines.

5.5 Cost Estimate

This section summarizes the selected alternatives and their estimated project costs including engineering design, administrative and legal costs, and construction. Engineering costs include preparation of the Project Planning Document, route alternative analyses, design, construction, and inspection services. The cost estimates presented in this report reflect February 2023 costs and were prepared to determine approximate project costs to aid the City in its planning and budgeting process. There are a number of factors that could cause the actual project costs to deviate from these estimates, including the competitive bidding climate at the time that the construction bids are received, inflation, and additions to or changes in the scope of the project that may occur during the design process. Appendix 6 includes the estimated total cost for each loan, indicates whether the loan is categorized as “City-only” or “overall service area”, and identifies the projects and the project costs within each loan. Table 87 summarizes this information and presents the total amount of each loan.

Table 87 – Summary of Estimated Loan Amounts

DWSRF Fiscal Year	Overall Service Area Loan	City-Only Loan
FY24	$ 18,344,550	$ 14,773,400
FY25	$ 30,000,000	$ 19,339,400
FY26	NA	$ 17,293,300
FY27	$ 8,620,000	$ 15,964,200
FY28	NA	$ 17,355,400

Table 88 shows the cost break-down between estimated capital cost, contingencies, and engineering/administration/and legal fees.

Table 88 – Breakdown of Estimated Loan Amounts

	Overall Service Area Loan			City-Only Loan		
DWSRF Fiscal Year	Estimated Capital Cost	Project Contingency + Engineering, Administration, Legal	Total Loan Amount	Estimated Capital Cost	Project Contingency + Engineering, Administration, Legal	Total Loan Amount
FY24	$ 13,646,550	$ 4,698,000	$ 18,344,550	$ 13,053,400	$ 1,720,000	$ 14,773,400
FY25	$ 22,200,000	$ 7,800,000	$ 30,000,000	$ 16,460,400	$ 2,879,000	$ 19,339,400
FY26	NA	NA	NA	$ 14,934,300	$ 2,359,000	$ 17,293,300
FY27	$ 6,437,000	$ 2,183,000	$ 8,620,000	$ 13,941,200	$ 2,023,000	$ 15,964,200
FY28	NA	NA	NA	$ 14,980,400	$ 2,375,000	$ 17,355,400

5.6 User Costs

The cost of each project in this DWSRF plan is allocated to each community that benefits from the project. The 22 water main projects and the lead service line replacement project are fully within and for the City of Grand Rapids, so the cost is fully allocated to Grand Rapids users. The cost of the Cascade Township Water Mains Project and the Caledonia Township Connection Project are allocated to their respective communities. The projects at the LMFP are considered integrated costs because they benefit all users, and the cost is distributed proportionately among users through a commodity charge based on the current (2020) average day water demand.

There will be new users added to the Grand Rapids water system as a result of the Cascade Township Water Mains Project and the Caledonia Township Connection Project. Both projects are included in the first year of this Project Planning Document, Fiscal Year 2024. For the purpose of this evaluation, the estimated additional demand resulting from the Cascade and Caledonia projects were used in the integrated cost calculations.

The integrated cost distribution for the LMFP projects is as follows.

- City of Grand Rapids: 52.08%
- Walker: 7.76%
- Kentwood: 11.37%
- Cascade Township: 6.19%
- Grand Rapids Township: 4.35%
- Tallmadge Township: 0.31%
- East Grand Rapids: 3.21%
- Ada Township: 3.53%
- Allendale Township: 5.09%
- Coopersville: 3.95%
- Ottawa County: 0.58%
- Caledonia Township: 1.57%

The Caledonia Township Connection Project includes a 24-inch water main in East Paris Avenue that will benefit other communities in addition to Caledonia. The cost of this water main was distributed to those communities. The rest of the Caledonia project, namely the 12-inch water main crossing Broadmoor Avenue and the pump station along with its associated site piping, is fully allocated (100%) to Caledonia Township. The integrated cost for the 24-inch water main is as follows:

- Kentwood: 75.89%
- Cascade Township: 7.23%
- Caledonia Township: 16.88%

The estimated total cost to each community was calculated using the allocation described above. Table 89 summarizes the total cost to each community.

Table 89 – Estimated Total User Cost per Community

Customer Community	Cost Allocation	
	Cost	Percent of Total
City of Grand Rapids	$104,838,520	73.99%
Kentwood	$6,612,344	4.67%
Walker	$2,995,589	2.11%
East Grand Rapids	$1,237,968	0.87%
Cascade Township	$13,865,663	9.79%
Grand Rapids Township	$1,681,288	1.19%
Ada Township	$1,363,233	0.96%
Tallmadge Township	$120,372	0.08%
Allendale Township	$1,967,048	1.39%
Coopersville	$1,526,664	1.08%
Ottawa County	$225,085	0.16%
Caledonia Township	$5,256,477	3.71%
Total	$141,690,250	100%

The cost per 100 cubic feet of water to finance the projects over a 20-year period at an interest rate of 1.875% (obtained from EGLE as the DWSRF interest rate) was calculated for each community and is summarized in Table 90. For a family of four consuming 100 gallons per day per person (400 gpd total), the monthly cost to finance the projects is presented in column three of Table 90.

Table 90 – Estimated User Cost to Finance the Projects

Customer Community	Cost per 100 cubic feet	Estimated Monthly Cost @ 400 gpd
City of Grand Rapids	$0.63	$10.20
Kentwood	$0.18	$2.95
Walker	$0.12	$1.96
East Grand Rapids	$0.12	$1.96
Cascade Township	$0.70	$11.35
Grand Rapids Township	$0.12	$1.96
Ada Township	$0.12	$1.96
Tallmadge Township	$0.12	$1.96
Allendale Township	$0.12	$1.96
Coopersville	$0.12	$1.96
Ottawa County (max)	$0.12	$1.96
Caledonia Township	$1.04	$16.96

The current average monthly cost for a family of four is presented in Table 91 along with the adjusted monthly cost after all of the proposed projects have been financed. As the system is improved or demands change the City periodically reallocates the zonegated (shared) capital improvements.

Table 91 – Current and Adjusted Typical Monthly Cost for Family of Four

Customer Community	Typical Monthly Cost for Family of Four	
	Current Monthly Cost	Adjusted Monthly Cost
City of Grand Rapids	$49.85	$60.06
Kentwood	$46.53	$49.47
Walker	$45.51	$47.47
East Grand Rapids	$23.20	$25.16
Cascade Township	$63.88	$75.23
Grand Rapids Township	$52.94	$54.89
Ada Township	$41.89	$43.84
Tallmadge Township	$48.66	$50.62
Allendale Township	$51.97	$53.93
Coopersville	$54.91	$56.87
Ottawa County (max)	$54.99	$56.95
Caledonia Township	$36.64	$53.60

5.7 Overburdened Community

EGLE has revised the previous “Disadvantaged Community” criteria and created a new metric for evaluating communities applying for DWSRF funding. Communities can be classified as “overburdened” or “significantly overburdened” based on the cost of the projects and the median annual household income (MAHI) of the community. The qualification is determined for each loan the community applies for.

For some loans, the overburdened qualification may apply, while for other loans it may not, depending on the projects included in the specific loan and the users that those projects impact. The water main projects and the lead service line replacement projects included in this DWSRF Project Planning Document are fully allocated to the City of Grand Rapids, and the project costs will only impact Grand Rapids users. The LMFP Improvement Projects impact users of multiple customer communities, to which the project costs are allocated. The costs for the Caledonia Township Connection Project and the proposed water mains in Cascade Township are allocated to their respective communities. Based on the qualification criteria provided by EGLE, the projects that impact only the City of Grand Rapids may classify the City as overburdened. Loans that include projects that share costs with other customer communities likely will not meet the overburdened qualification. EGLE makes the final determination of whether a community meets the Overburdened Community qualifications and determines the benefits that will be awarded.

For the purpose of this evaluation, it was assumed that projects planned within the same fiscal year will fall into two categories for loans; projects that affect only the City of Grand Rapids and projects that affect multiple customer communities. This results in eight loans total, with five being “City-only” loans and three being “overall service area” loans. Appendix 6 summarizes the projects under each loan.

5.8 Ability to Implement the Selected Alternatives

The LMFP and water distribution system are owned and operated by the City of Grand Rapids, and the City has water service agreements with all of the retail and wholesale customers. All financial and loan related work will be handled by the City of Grand Rapids Financial Department.

If Caledonia Township is brought on as a customer community, a water supply agreement will need to be made between the City and the Township. The Township initiated conversations regarding connecting to the Grand Rapids system and desires the implementation of the project.

6.0 Environmental Evaluation

6.1 Historical/Archeological/Tribal Resources

Appendix 3 includes a list of all historic sites within Kent and Ottawa Counties according to the National Register of Historic Places database. No direct historical or archeological impacts are expected. However, if the project is deemed equivalent, contact with appropriate historical and archeological agencies will be initiated. The Michigan State Historical Preservation Office (SHPO) and Tribal Historic Preservation Officers (THPOs) will also be contacted to review the project locations in detail if the plan is deemed equivalent.

6.2 Water Quality

The proposed construction projects will provide continued high-quality water. Updates at the LMFP will optimize reliability, energy use, and space utilization, and will bring systems into compliance with current water quality standards. Distribution system projects will replace aging infrastructure and address water quality concerns. Current groundwater quality concerns in Cascade Township will be addressed by the proposed project.

The proposed projects will not affect surface water or groundwater quality or quantity.

6.3 Land/Water Interface

Maps 5.1 and 5.2 depict the major water surfaces within the project area and Maps 6.1 and 6.2 show the location of wetlands with respect to the proposed project. The Caledonia Township Connection Project is near freshwater emergent wetlands, but disruption to this area can be avoided during construction. No negative impacts to the wetlands are expected as a result of the proposed projects.

The extent of the 500-year flood boundary as defined by the National Flood Insurance Program consists primarily of the areas immediately adjacent to the Grand River and its tributaries. Maps 7.1 and 7.2 present both the 100-year and 500-year floodplains. GIS data was not available for Cascade Township and is therefore not shown on Map 6.2, however information from the Township's website indicates the project area is not within floodplains. All water main projects on the west side of the Grand River and the Godfrey Avenue Water Main Project are within the limits of the 500-year flood boundary. Many of the lead service lines to be replaced are also within the 500-year flood boundary. No negative impacts on the flood boundaries are expected as a result of the proposed projects.

Maps 8.1 and 8.2 indicate the type of soils in the vicinity of the projects.

6.4 Endangered Species

Endangered or threatened species are defined as those species that are or could become endangered or threatened and, therefore, are protected under the Endangered Species Act. The objective of the act is to preserve and restore species threatened with extinction. The U. S. Fish and Wildlife Services (USFWS) Environmental Conservation Online System was used to identify endangered and threatened species by state. A list of endangered and threatened species within the State of Michigan is provided in Appendix 4.

The Michigan Natural Features Inventory (MNFI) by county has additional listings of fauna and flora with a state status of endangered, threatened, or special concern. Appendix 5 lists the species for Kent and Ottawa Counties.

The LMFP is located near the Lake Michigan lakeshore. Although the facility is in close proximity to the Lake, the project work will be limited to the plant site and no negative impacts to endangered species are expected.

The probability of threatened, endangered, or special concern species can be seen on Maps 9.1 and 9.2. All the Grand Rapids distribution system projects occur in areas of low probability, except for the northern portion of the Oakwood Avenue Water Main that is within an area of moderate probability. The Caledonia Township Connection Project and the Cascade Township Water Mains Project are also in areas of low probability. If the Project Planning Document is deemed equivalent, contact with the MNFI and USFWS will be initiated.

Construction or operation activities for the proposed projects are not anticipated to have long-term negative impacts.

6.5 Agricultural Land

The location of prime farmland with respect to the proposed projects is depicted in Maps 10.1 and 10.2. The Caledonia Township Connection Project is located on or near prime farmland and farmland of local importance, however the area is not currently being used as farmland. The water mains included in the project will be constructed within the road right-of-way and will not negatively impact existing land use. The pump station footprint is estimated to be about 32 feet by 32 feet and is not expected to significantly impact agricultural land.

The Cascade Township Water Mains Project is located on or near farmland of unique importance, however the project will occur within the road right-of-way and will not negatively impact existing land use.

6.6 Social/Economic Impact

Upgrading the LMFP and the distribution system will result in direct cultural and social benefits. Public health and safety will benefit from the increased quality and reliability the proposed projects will create.

The construction phase of the projects will create jobs and contribute favorably to the local economy.

6.7 Construction/Operational Impact

6.7.1 LMFP Improvement Projects

The LMFP Improvement Projects will not greatly disrupt the area of construction. The area surrounding the LMFP is not heavily trafficked or populated, so construction activity will have minimal disruption. The LMFP property has adequate space available for new structures without significant modifications to the environment.

6.7.2 Fremont Avenue Water Main (3rd to 4th Streets)

The proposed project is completely within a residential neighborhood. The new water main would be installed under the pavement just east of the west curb line. Removal and replacement of the westerly curb line and approximately 10 feet of pavement will be required. Though trees exist in some locations, no tree removal is anticipated. All grass parkways will be restored in kind.

Roads to be closed, including Fremont Avenue, are used predominately for local traffic. No adverse impacts to major street traffic patterns are anticipated. Vehicular and pedestrian access to all properties will be maintained throughout construction. Construction for projects of this type is generally limited to the hours of 7:00 a.m. to 7:00 p.m. Monday through Friday, and 7:00 a.m. to 1:00 p.m. on Saturday.

6.7.3 Hall Street Water Main (Madison to Eastern Avenues); Paris Avenue Water Main (Gilbert to Hall Streets)

The Hall Street portion of the project is within a residential/commercial neighborhood. The Paris Avenue portion is 100 percent residential. The new water main in Hall Street would be installed under the pavement just south of the northerly curb line. The existing northerly curb line would remain but removal and replacement of approximately 15 feet of pavement will be required. Paris Avenue is a narrow street in a narrow right-of-way. The majority of pavement will require removal and replacement to install the proposed water main. Hall Street is

partially tree-lined but no tree removal is anticipated. All grass parkways will be restored in kind. There are no trees or parkways along Paris Avenue.

Hall Street is a major street and will be closed during construction. During construction through traffic will be detoured while local access will be maintained for residents and businesses. No adverse impacts to major street traffic patterns are anticipated because of the detour. Construction for projects of this type is generally limited to the hours of 7:00 a.m. to 7:00 p.m. Monday through Friday, and 7:00 a.m. to 1:00 p.m. on Saturday.

6.7.4 Eleanor Street Water Main (Plainfield to Diamond Avenues)

The proposed project is completely within a residential neighborhood. The new water main would be installed under the pavement just south of the northerly curb line. Removal and replacement of the northerly curb line and approximately 10 feet of pavement will be required. Though Eleanor Street is tree-lined, no tree removal is anticipated. All grass parkways will be restored in kind.

Eleanor Street will be closed to through traffic during construction. No adverse impacts to major street traffic patterns are anticipated. Vehicular and pedestrian access to all properties will be maintained throughout construction. Construction for projects of this type is generally limited to the hours of 7:00 a.m. to 7:00 p.m. Monday through Friday, and 7:00 a.m. to 1:00 p.m. on Saturday.

6.7.5 Valley Avenue Water Main (Fulton to Bridge Streets); Sibley Street Water Main (Valley to Garfield Avenues)

The proposed project is completely within a residential area. In Valley Avenue, the new water main would be installed under the pavement just east of the westerly curb line. Removal and replacement of the westerly curb line and approximately 10 feet of pavement will be required. In Sibley Street, the new water main would be installed under the pavement just south of the northerly curb line. Removal and replacement of the northerly curb line and approximately 10 feet of pavement will be required. Though the streets are tree-lined, no tree removal is anticipated. All grass parkways will be restored in kind.

Roads to be closed, including Valley Avenue, are used predominately for local traffic. No adverse impacts on major street traffic patterns are anticipated. Vehicular and pedestrian access to all properties will be maintained throughout construction. Construction hours for projects of this type are generally limited to the hours of 7:00 a.m. to 7:00 p.m. Monday through Friday and 7:00 a.m. to 1:00 p.m. on Saturday.

6.7.6 Boston Street Water Main (Calvin to Plymouth Avenues)

The proposed project is completely within a residential neighborhood. The new water main would be installed under the pavement just south of the northerly curb line. Removal and replacement of the north curb line and approximately 10 feet of pavement will be required. Though the street is tree-lined, no tree removal is anticipated. All grass parkways will be restored in kind.

Boston Street will be closed to through traffic and detoured during construction. No adverse impacts on major street traffic patterns are anticipated. Vehicular and pedestrian access to all properties will be maintained throughout construction. Construction for projects of this type is generally limited to the hours of 7:00 a.m. to 7:00 p.m. Monday through Friday and 7:00 a.m. to 1:00 p.m. on Saturday.

6.7.7 Burton Street Water Main (Eastern to Kalamazoo Avenues)

The proposed project is within a commercial/residential neighborhood. The new water main would be installed under the pavement just south of the northerly curb line. Removal and replacement of the north curb line and approximately 10 feet of pavement will be required. Though the street is tree-lined, no tree removal is anticipated. All grass parkways will be restored in kind.

Burton Street will be closed to through traffic and detoured during construction. No adverse impacts on major street traffic patterns are anticipated. Vehicular and pedestrian access to all properties will be maintained throughout construction. Construction for projects of this type is generally limited to the hours of 7:00 a.m. to 7:00 p.m. Monday through Friday and 7:00 a.m. to 1:00 p.m. on Saturday.

6.7.8 Burton Street Water Main (Horton to Eastern Avenues)

The proposed project is in a residential neighborhood. The new water main would be installed under the pavement just south of the northerly curb line. Removal and replacement of the north curb line and approximately 10 feet of pavement will be required. Though the streets are tree-lined, no tree removal is anticipated. All grass parkways will be restored in kind.

Burton Street will be closed to through traffic and detoured during construction. No adverse impacts on major street traffic patterns are anticipated. Vehicular and pedestrian access to all properties will be maintained throughout construction. Construction for projects of this type is generally limited to the hours of 7:00 a.m. to 7:00 p.m. Monday through Friday and 7:00 a.m. to 1:00 p.m. on Saturday.

6.7.9 Oakwood Avenue Water Main (Knapp to 3 Mile Streets)

The proposed project is in a residential neighborhood. The new water main would be installed under the pavement just east of the westerly curb line. Removal and replacement of the westerly curb line and approximately 10 feet of pavement will be required. Though the streets are tree-lined, no tree removal is anticipated. All grass parkways will be restored in kind.

Oakwood Avenue will be closed to through traffic during construction. No adverse impacts on major street traffic patterns are anticipated. Vehicular and pedestrian access to all properties will be maintained throughout construction. Construction for projects of this type is generally limited to the hours of 7:00 a.m. to 7:00 p.m. Monday through Friday and 7:00 a.m. to 1:00 p.m. on Saturday.

6.7.10 Valley Avenue Water Main (Bridge to 4th Street); 1st and 3rd Street Water Main (Valley to Garfield Avenues)

The proposed project is completely within a residential area. On Valley Avenue, the new water main would be installed under the pavement just east of the westerly curb line. Removal and replacement of the westerly curb line and approximately 10 feet of pavement will be required. For both 1st and 3rd Streets, the new water mains would likely be installed under the pavement just south of the northerly curb line. Removal and replacement of the northerly curb line and approximately 10 feet of pavement will be required. Though the streets are tree-lined, no tree removal is anticipated. All grass parkways will be restored in kind.

Roads to be closed, including Valley Avenue, are used predominately for local traffic. No adverse impacts on major street traffic patterns are anticipated. Vehicular and pedestrian access to all properties will be maintained throughout construction. Construction for projects of this type is generally limited to the hours of 7:00 a.m. to 7:00 p.m. Monday through Friday and 7:00 a.m. to 1:00 p.m. on Saturday.

6.7.11 Buchanan Avenue Water Main (Corinne to Hall Streets)

The proposed project is within a commercial/residential neighborhood. The new water main would be installed under the pavement just east of the westerly curb line. Removal and replacement of the westerly curb line and approximately 10 feet of pavement will be required. Though the streets are treelined, no tree removal is anticipated. All grass parkways will be restored in kind.

Buchanan Avenue will be closed to through traffic and detoured during construction. No adverse impacts on major street traffic patterns are anticipated. Vehicular and pedestrian access to all properties will be maintained throughout construction. Construction for projects of this type is generally limited to the hours of 7:00 a.m. to 7:00 p.m. Monday through Friday and 7:00 a.m. to 1:00 p.m. on Saturday.

6.7.12 2nd Street Water Main (Valley to Fremont Avenues)

The proposed project is within a residential neighborhood. The new water main would be installed under the pavement just south of the northerly curb line. Removal and replacement of the northerly curb line and approximately 10 feet of pavement will be required. Though the streets are tree-lined, no tree removal is anticipated. All grass parkways will be restored in kind.

2nd Street will be closed to through traffic and detoured during construction. No adverse impacts on major street traffic patterns are anticipated. Vehicular and pedestrian access to all properties will be maintained throughout construction. Construction for projects of this type is generally limited to the hours of 7:00 a.m. to 7:00 p.m. Monday through Friday and 7:00 a.m. to 1:00 p.m. on Saturday.

6.7.13 Sherman Street Water Main (Giddings to Norwood Avenues)

The proposed project is within a residential neighborhood. The new water main would be installed under the pavement just south of the northerly curb line. Removal and replacement of the northerly curb line and approximately 10 feet of pavement will be required. Though the streets are tree-lined, no tree removal is anticipated. All grass parkways will be restored in kind.

Sherman Street will be closed to through traffic during construction. No adverse impacts on major street traffic patterns are anticipated. Vehicular and pedestrian access to all properties will be maintained throughout construction. Construction for projects of this type is generally limited to the hours of 7:00 a.m. to 7:00 p.m. Monday through Friday and 7:00 a.m. to 1:00 p.m. on Saturday.

6.7.14 Butterworth Street Water Main (Marion to Lane Avenues)

The proposed project is within a commercial/residential neighborhood. The new water main would be installed under the pavement just south of the northerly curb line. Removal and replacement of the northerly curb line and approximately 10 feet of pavement will be required. Though the streets are tree-lined, no tree removal is anticipated. All grass parkways will be restored in kind.

Butterworth Street will be closed to through traffic and detoured during construction. No adverse impacts on major street traffic patterns are anticipated. Vehicular and pedestrian access to all properties will be maintained throughout construction. Construction for projects of this type is generally limited to the hours of 7:00 a.m. to 7:00 p.m. Monday through Friday and 7:00 a.m. to 1:00 p.m. on Saturday.

6.7.15 Buchanan Avenue Water Main (Stewart to Corinne Streets)

The proposed project is within a residential neighborhood. The new water main would be installed under the pavement just east of the westerly curb line. Removal and replacement of the westerly curb line and approximately 10 feet of pavement will be required. Though the streets are tree-lined, no tree removal is anticipated. All grass parkways will be restored in kind.

Buchanan Avenue will be closed to through traffic and detoured during construction. No adverse impacts on major street traffic patterns are anticipated. Vehicular and pedestrian access to all properties will be maintained throughout construction. Construction for projects of this type is generally limited to the hours of 7:00 a.m. to 7:00 p.m. Monday through Friday and 7:00 a.m. to 1:00 p.m. on Saturday.

6.7.16 Alger Street Water Main (Division to Madison Avenue)

The proposed project is within a residential neighborhood. The new water main would be installed under the pavement just south of the northerly curb line. Removal and replacement of the northerly curb line and approximately 10 feet of pavement will be required. Though the streets are tree-lined, no tree removal is anticipated. All grass parkways will be restored in kind.

Alger Street will be closed to through traffic and detoured during construction. No adverse impacts on major street traffic patterns are anticipated. Vehicular and pedestrian access to all properties will be maintained throughout construction. Construction for projects of this type is generally limited to the hours of 7:00 a.m. to 7:00 p.m. Monday through Friday and 7:00 a.m. to 1:00 p.m. on Saturday.

6.7.17 Butterworth Street Water Main (Lane Avenue to Hogadone Place)

The proposed project is within a commercial/residential neighborhood. The new water main would be installed under the pavement just south of the northerly curb line. Removal and replacement of the northerly curb line and approximately 10 feet of pavement will be required. Though the streets are tree-lined, no tree removal is anticipated. All grass parkways will be restored in kind.

Butterworth Street will be closed to through traffic and detoured during construction. No adverse impacts on major street traffic patterns are anticipated. Vehicular and pedestrian access to all properties will be maintained throughout construction. Construction for projects of this type is generally limited to the hours of 7:00 a.m. to 7:00 p.m. Monday through Friday and 7:00 a.m. to 1:00 p.m. on Saturday.

6.7.18 Mulford Drive Water Main (Alger/Madison to Union Avenues)

The proposed project is within a residential neighborhood. The new water main would be installed under the pavement just south of the northerly curb line. Removal and replacement of the northerly curb line and approximately 10 feet of pavement will be required. Though the streets are tree-lined, no tree removal is anticipated. All grass parkways will be restored in kind.

Mulford Drive will be closed to through traffic during construction. No adverse impacts on major street traffic patterns are anticipated. Vehicular and pedestrian access to all properties will be maintained throughout construction. Construction for projects of this type is generally limited to the hours of 7:00 a.m. to 7:00 p.m. Monday through Friday and 7:00 a.m. to 1:00 p.m. on Saturday.

6.7.19 Ardmore Street Water Main (Eastern to Silver Avenues)

The proposed project is within a residential neighborhood. The new water main would be installed under the pavement just south of the northerly curb line. Removal and replacement of the northerly curb line and approximately 10 feet of pavement will be required. Though the trees exist in some locations, no tree removal is anticipated. All grass parkways will be restored in kind.

Ardmore Street will be closed to through traffic during construction. No adverse impacts on major street traffic patterns are anticipated. Vehicular and pedestrian access to all properties will be maintained throughout construction. Construction for projects of this type is generally limited to the hours of 7:00 a.m. to 7:00 p.m. Monday through Friday and 7:00 a.m. to 1:00 p.m. on Saturday.

6.7.20 College Avenue Water Main (Hoyt to Dickinson Streets)

The proposed project is within a residential neighborhood. The new water main would be installed under the pavement just east of the westerly curb line. Removal and replacement of the westerly curb line and approximately 10 feet of pavement will be required. Though trees exist in some locations, no tree removal is anticipated. All grass parkways will be restored in kind.

College Avenue will be closed to through traffic during construction. No adverse impacts on major street traffic patterns are anticipated. Vehicular and pedestrian access to all properties will be maintained throughout construction. Construction for projects of this type is generally limited to the hours of 7:00 a.m. to 7:00 p.m. Monday through Friday and 7:00 a.m. to 1:00 p.m. on Saturday.

6.7.21 Houseman Street Water Main (Knapp to Eleanor Streets)

The proposed project is within a residential neighborhood. The new water main would be installed under the pavement just east of the westerly curb line. Removal and replacement of the westerly curb line and approximately 10 feet of pavement will be required. Though trees exist in some locations, no tree removal is anticipated. All grass parkways will be restored in kind.

Houseman Avenue will be closed to through traffic during construction. No adverse impacts on major street traffic patterns are anticipated. Vehicular and pedestrian access to all properties will be maintained throughout construction. Construction for projects of this type is generally limited to the hours of 7:00 a.m. to 7:00 p.m. Monday through Friday and 7:00 a.m. to 1:00 p.m. on Saturday.

6.7.22 Union Avenue Water Main (Fountain to Lyon Streets)

The proposed project is within a residential neighborhood. The new water main would be installed under the pavement just east of the westerly curb line. Removal and replacement of the westerly curb line and approximately 10 feet of pavement will be required. Though trees exist in some locations, no tree removal is anticipated. All grass parkways will be restored in kind.

Union Avenue will be closed to through traffic and detoured during construction. No adverse impacts on major street traffic patterns are anticipated. Vehicular and pedestrian access to all properties will be maintained throughout construction. Construction for projects of this type is generally limited to the hours of 7:00 a.m. to 7:00 p.m. Monday through Friday and 7:00 a.m. to 1:00 p.m. on Saturday.

6.7.23 Hall Street Water Main (Underhill Avenue to US-131)

The proposed project is within a commercial/residential neighborhood. The new water main would be installed under the pavement just south of the northerly curb line. Removal and replacement of the north curb line and approximately 10 feet of pavement will be required. Though trees exist in some locations, no tree removal is anticipated. All grass parkways will be restored in kind.

Hall Street will be closed to through traffic and detoured during construction. No adverse impacts on major street traffic patterns are anticipated. Vehicular and pedestrian access to all properties will be maintained throughout construction. Construction for projects of this type is generally limited to the hours of 7:00 a.m. to 7:00 p.m. Monday through Friday and 7:00 a.m. to 1:00 p.m. on Saturday.

6.7.24 Lead Services Line Replacement

Nearly all the work would take place behind the curb lines. Though most of the streets are tree-lined, no tree removal is anticipated. All grass parkways will be restored in kind.

No adverse impacts on major street traffic patterns are anticipated. Construction for projects of this type is generally limited to the hours of 7:00 a.m. to 7:00 p.m. Monday through Friday, and 7:00 a.m. to 1:00 p.m. on Saturday. Vehicular and pedestrian access to all properties will be maintained throughout construction.

6.7.25 Caledonia Township Connection

Construction of the project will require coordination between the City of Grand Rapids and Caledonia Township, as well as Cascade Township where the proposed location resides. Based on preliminary discussions, the booster pump station used to supply Caledonia would be operated and monitored by Grand Rapids through their SCADA system, but Caledonia would own and maintain the pump station and their distribution system.

6.7.26 Cascade Township Water mains

The proposed project is within a residential neighborhood. The new water mains would be installed under the pavement. All grass parkways will be restored in kind. Streets will be closed to through traffic and detoured during construction. No adverse impacts on major street traffic patterns are anticipated. Vehicular and pedestrian access to all properties will be maintained throughout construction. Construction for projects of this type is generally limited to the hours of 7:00 a.m. to 7:00 p.m. Monday through Friday and 7:00 a.m. to 1:00 p.m. on Saturday.

6.8 Indirect Impacts

6.8.1 Changes in Development

The City of Grand Rapids and the City of Kentwood have limited undeveloped land. Other communities within the service area have the potential for further development. The proposed alternatives enhance the existing water distribution and treatment system. The proposed projects have been designed to support 20-year demand projections.

6.8.2 Changes in Land Use

With limited undeveloped land in Grand Rapids, significant changes in land use in the City are not expected as an indirect result of the proposed improvements. Future changes in land use in the region are most likely to occur in the surrounding townships where growth is expected. To mitigate potential indirect environmental impacts, the West Michigan Planning Commission recommends agricultural zoning, tax relief mechanisms, purchase of development rights, and other methods to preserve agricultural land in Kent County.

6.8.3 Changes in Air or Water Quality

With water system improvements, the potential exists for new development in the area and indirect air pollutant loadings from additional automobile traffic and recreational activities. Any new development will be selective because of the limited undeveloped property in the City, the long-term ownership of existing property, and the limited capacity of the LMFP.

6.8.4 Changes to Natural Setting or Sensitive Ecosystems

With limited undeveloped land in Grand Rapids, significant ecosystem or natural setting changes are not expected as an indirect result of the proposed projects. Changes to the natural settings in the townships could result from planned growth; the effect on sensitive ecosystems will be controlled by the assessment of environmental impacts and the permitting process.

6.8.5 Changes to Aesthetic Aspects of the Community

The proposed pump station included in the Caledonia Township Connection Project will change aesthetics to the area. The architecture of the proposed station will be designed to be consistent with existing water facilities.

The improvements at the LMFP and the water main projects will not change aesthetics aspects of the community.

6.8.6 Resource Consumption

Resource consumption in the form of building materials and energy will occur as a result of the projects.

7.0 Mitigation Measures

7.1 Short-Term Impacts

Measures that will be taken to avoid, eliminate, or mitigate potential short-term environmental impacts include the following:

- Traffic: use of designated traffic routes for construction traffic, as well as flagmen, warning signs, barricades, and cones.
- Air emissions: use of calcium chloride or water for dust control and proper maintenance on heavy equipment to reduce exhaust emissions.
- Noise control: use designated daytime work hours, use mufflers on all equipment, and minimize work on weekends and/or holidays.
- Soil erosion and sedimentation control: use riprap, hay bales, erosion control fence, silt fence, etc.
- Restoration: use topsoil, seed, sod, mulch, gravel, and pavement.

7.2 Long-Term Impacts

Measures that will be taken to avoid, eliminate, or mitigate potential long-term environmental impacts including the following:

- Soils disposal and contaminated soils: if construction occurs in floodplains or near a lake or stream, a U. S. Army Corps of Engineers-EGLE Joint Permit will be filed that indicates quantities of soils taken off-site or used onsite as fill, new fill materials utilized onsite, buffer zones from ecologically sensitive areas, and measures that will be taken to stabilize embankments.
- A Soil Erosion Plan for the construction of the selected alternatives will be filed with the local Soil Erosion and Sedimentation Control Agency (Kent County Drain Commissioner). The plan will also be reviewed by the EGLE Land and Water Management Division. The plan will summarize the quantity of soils that will be removed, locations where soil will be stored, the destination of soils (onsite or off-site) and measures that will be taken (silt fence, sod, etc.) to minimize erosion.

8.0 Public Participation

8.1 Public Meeting Advertisement

On April 6, 2023, a notice of the public meeting for the DWSRF Project Planning Document Proposed Improvements will be posted on the City's website (https://www. grandrapidsmi. gov) and on the City's social media pages. The EGLE Project Manager will be provided a link to this public meeting advertisement on April 6, 2023. The advertisement briefly describes the proposed projects and estimated costs, mentions the availability of the report for viewing, and invites written comments from the public. The Project Planning Document will be made available on the City's website for public review and comment starting April 6, 2023. Written comments are requested to be received no later than April 18, 2023, the date of the public meeting.

A screen shot of the public meeting advertisement will be included in the final Project Planning Document.

8.2 Public Meeting

A public meeting will be held at the regularly scheduled City Council Meeting on April 18, 2023. The meeting minutes from the public meeting will be included in the final Project Planning Document.

8.2.1 Public Meeting Contents

Fishbeck will provide a presentation of the proposed improvements at the public meeting. The contents of the presentation will include the following:

- A description of the project needs and problems to be addressed by the proposed projects and the principal alternatives that were considered.
- A description of the selected alternatives, including capital costs.
- A description of project financing and anticipated costs to users, including the proposed method of project financing and the proposed annual charge to the typical residential customer.
- A description of the anticipated social and environmental impacts associated with the recommended alternatives and the measures that will be taken to mitigate adverse impacts.

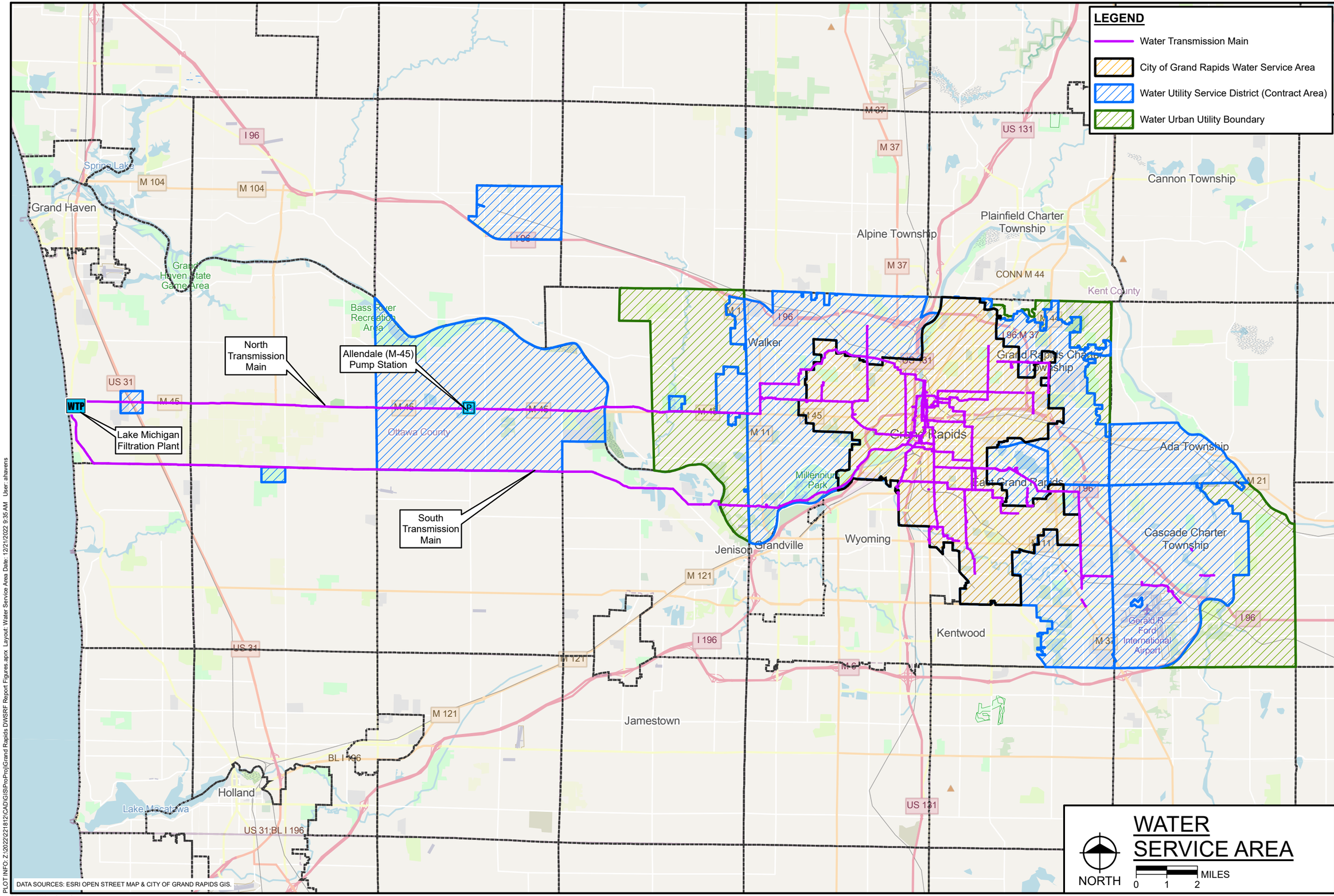
8.2.2 Comments Received and Answered

The comments received at the public meeting and responses provided will be included in the final Project Planning Document.

8.3 Resolution to Adopt the Project Planning Document

A resolution to formally adopt the Project Planning Document and implement the selected alternatives will be included with the submittal form in the final DWSRF Project Planning Document to EGLE.

Figures



DATA SOURCES: ESRI OPEN STREET MAP & CITY OF GRAND RAPIDS GIS.

NORTH

WATER SERVICE AREA

0 1 2 MILES

PROJECT NO. 221812

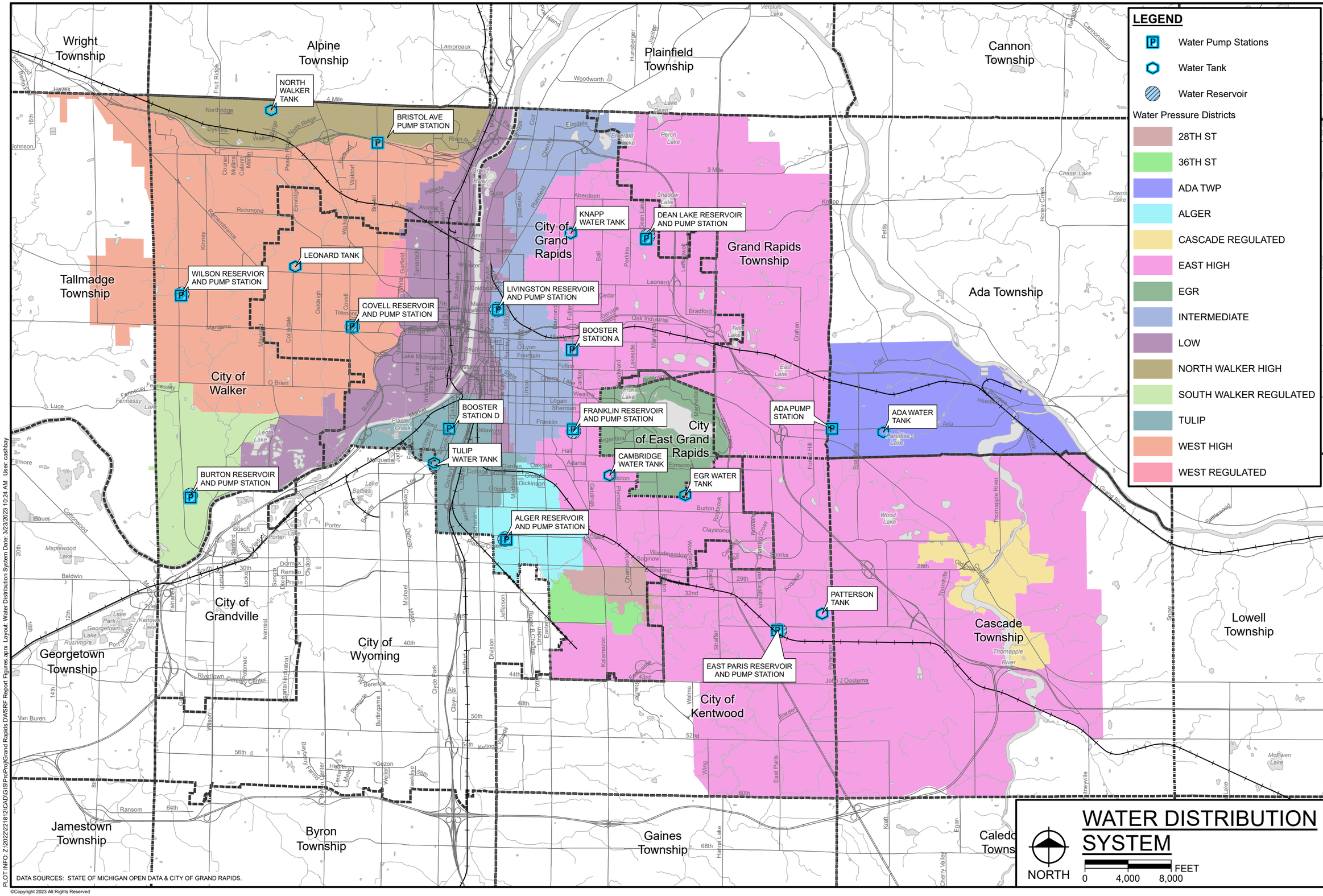
FIGURE NO. 1

City of Grand Rapids
Kent County, Michigan
Drinking Water State Revolving Fund (DWSRF) Planning Document

fishbeck
Engineers | Architects | Scientists | Constructors

Hard copy is intended to be 11"x17" when plotted. Scale(s) indicated and graphic quality may not be accurate for any other size.

PLOT INFO: Z:\2022\221812\CAD\GIS\ProProj\Grand Rapids DWSRF Report Figures.aprx Layout: Water Service Area Date: 12/21/2022 9:35 AM User: ahavens



PLOT INFO: Z:\2022\221812\CAD\GIS\ProPro\Grand Rapids DWSRF Report Figures.aprx Layout: Water Distribution System Date: 3/23/2023 10:24 AM User: cashbay

DATA SOURCES: STATE OF MICHIGAN OPEN DATA & CITY OF GRAND RAPIDS.

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City of Grand Rapids
Kent County, Michigan
Drinking Water State Revolving Fund (DWSRF) Planning Document

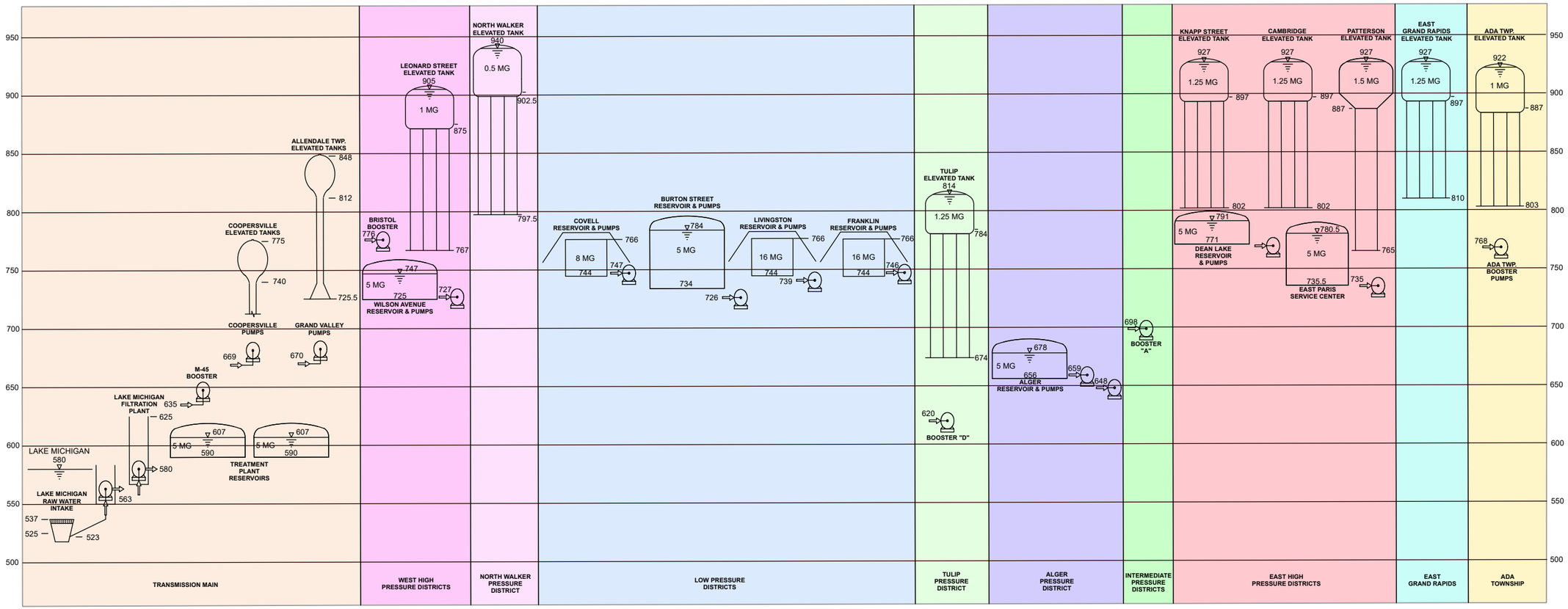
WATER DISTRIBUTION SYSTEM

PROJECT NO.
221812

FIGURE NO.
2

LEGEND

- ADA TOWNSHIP
- ALGER
- EAST GRAND RAPIDS
- EAST HIGH
- INTERMEDIATE
- LOW
- NORTH WALKER
- TRANSMISSION MAIN
- TULIP
- WEST HIGH



DATA SOURCES: CITY OF GRAND RAPIDS.

NORTH

HYDRAULIC PROFILE

NO SCALE

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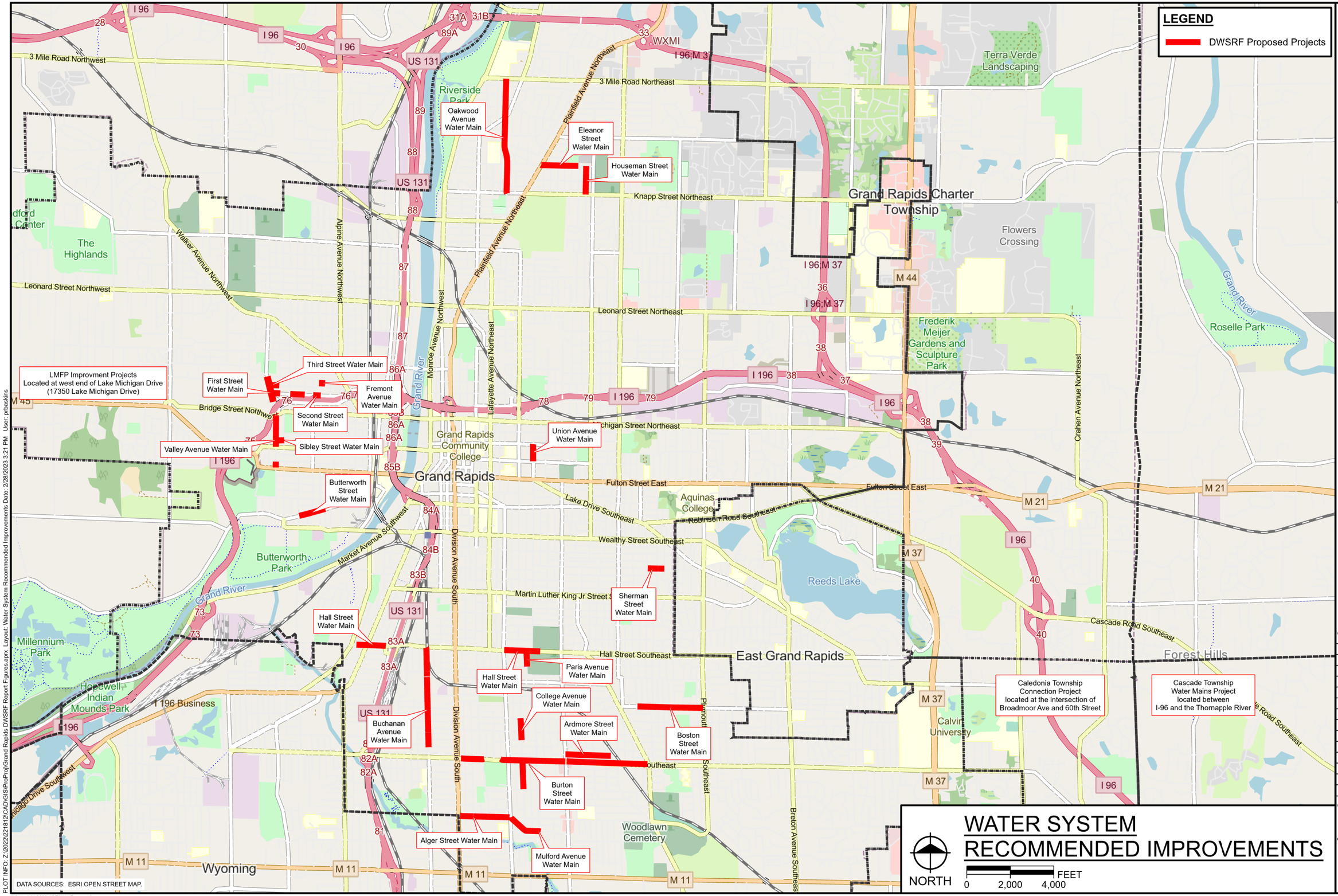
City of Grand Rapids
Kent County, Michigan
Drinking Water State Revolving Fund (DWSRF)
Planning Document

PROJECT NO.
221812

MAP NO.
3



PLOT INFO: Z:\2022\221812\CAD\GIS\ProProj\Grand Rapids DWSRF Report Figures.aprx Layout: Water System Recommended Improvements Date: 2/28/2023 3:21 PM User: prbaskins

DATA SOURCES: ESRI OPEN STREET MAP.

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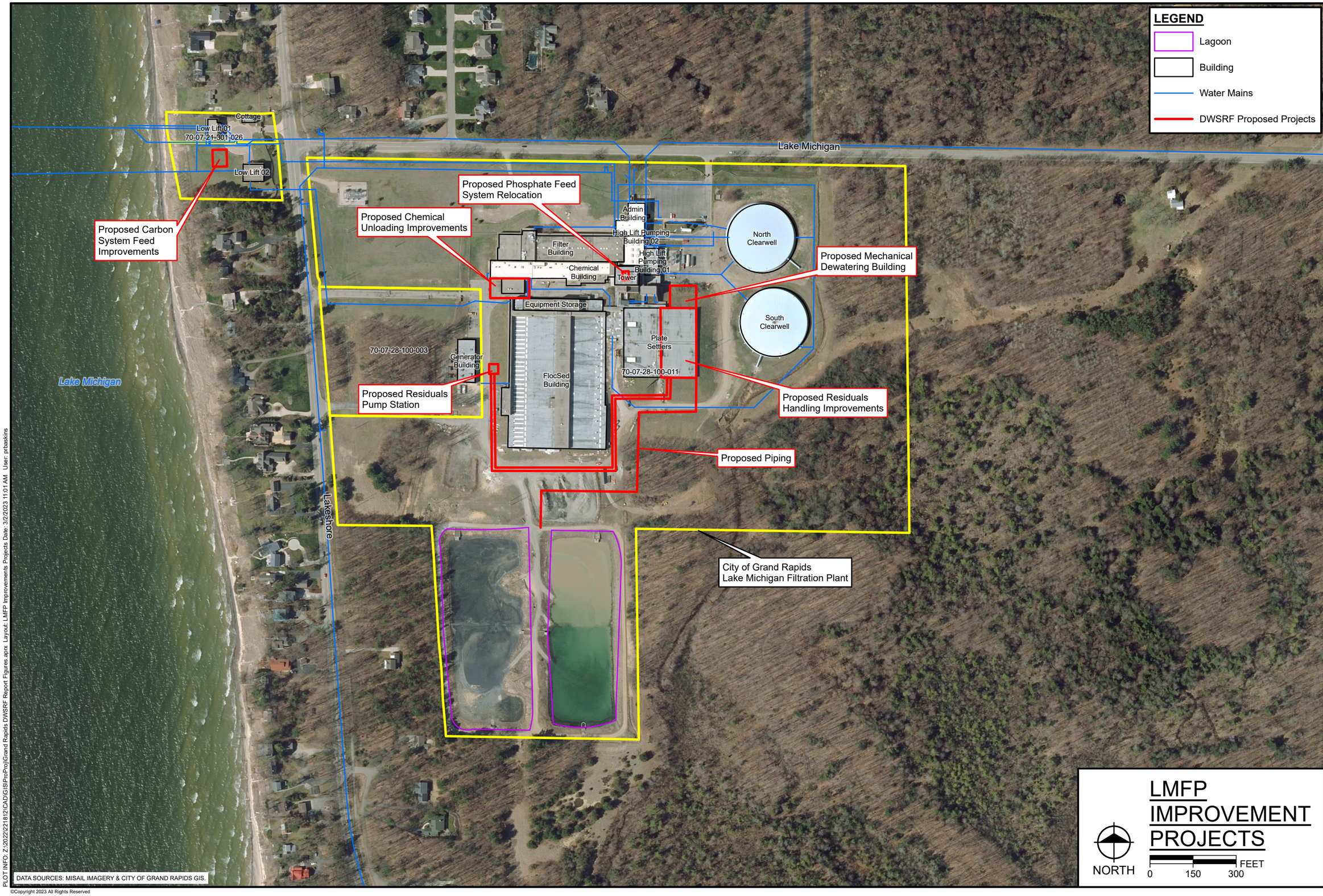
City of Grand Rapids
Kent County, Michigan
Drinking Water State Revolving Fund (DWSRF)
Planning Document

WATER SYSTEM RECOMMENDED IMPROVEMENTS

PROJECT NO.
221812

FIGURE NO.
4



PLOT INFO: Z:\2022\221812\CAD\GIS\ProjGrand Rapids DWSRF Report Figures.aprx Layout: LMFP Improvements Projects Date: 3/2/2023 11:01 AM User: pbaskins

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City of Grand Rapids
Kent County, Michigan
Drinking Water State Revolving Fund (DWSRF)
Planning Document

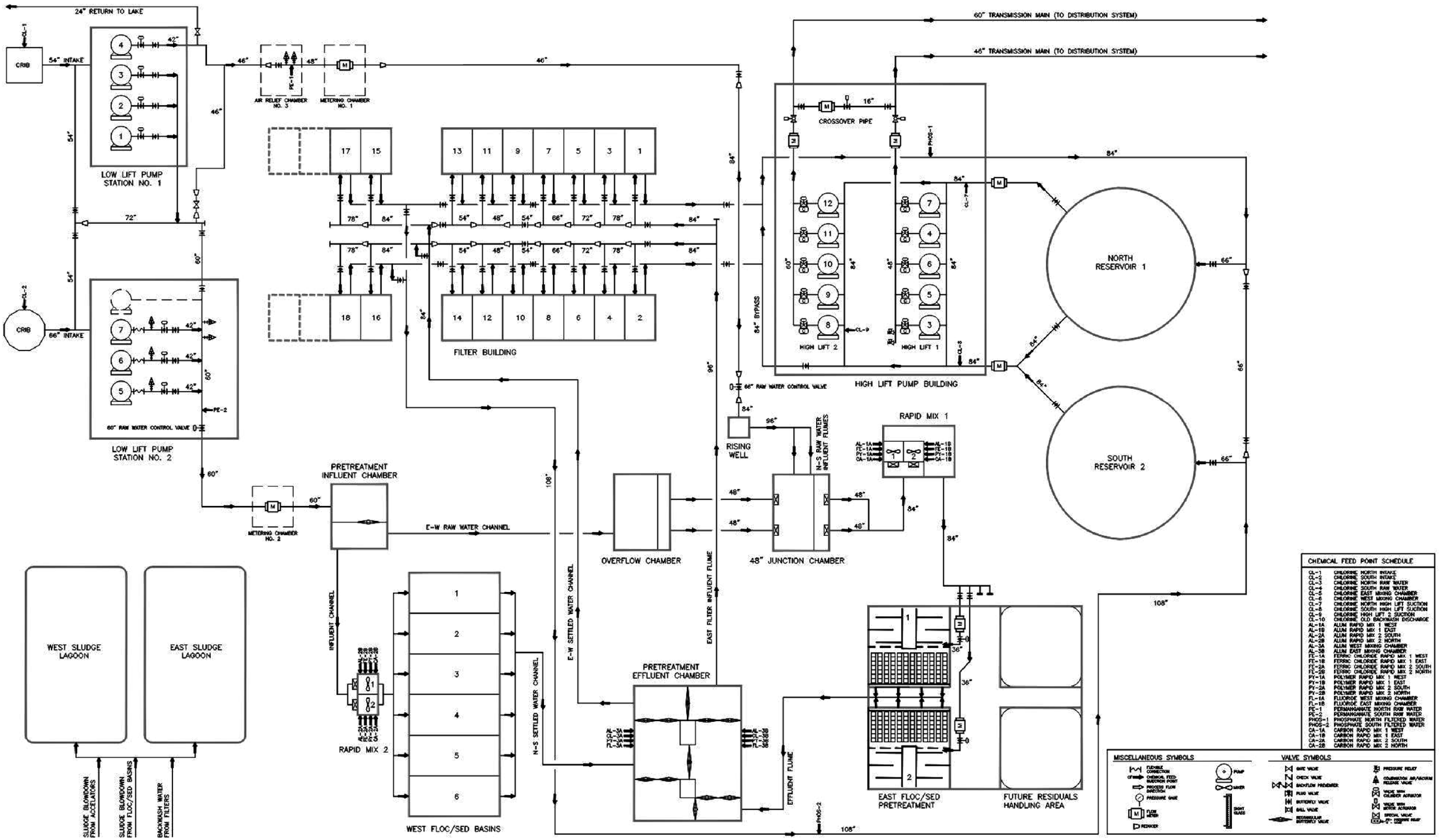
LMFP IMPROVEMENT PROJECTS

NORTH

0 150 300 FEET

PROJECT NO.
221812

FIGURE NO.
5



NORTH

LMFP FLOW SCHEMATIC

NOT TO SCALE

PROJECT NO. 221812

FIGURE NO. 6

City of Grand Rapids
Kent County, Michigan
Drinking Water State Revolving Fund (DWSRF)
Planning Document

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PLOT INFO: Z:\2022\221812\CAD\GIS\ProjGrand Rapids DWSRF Report Figures.aprx Layout: LMFP Flow Schematic Date: 12/21/2022 9:35 AM User: ahavens

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City of Grand Rapids
Kent County, Michigan
Drinking Water State Revolving Fund (DWSRF)
Planning Document

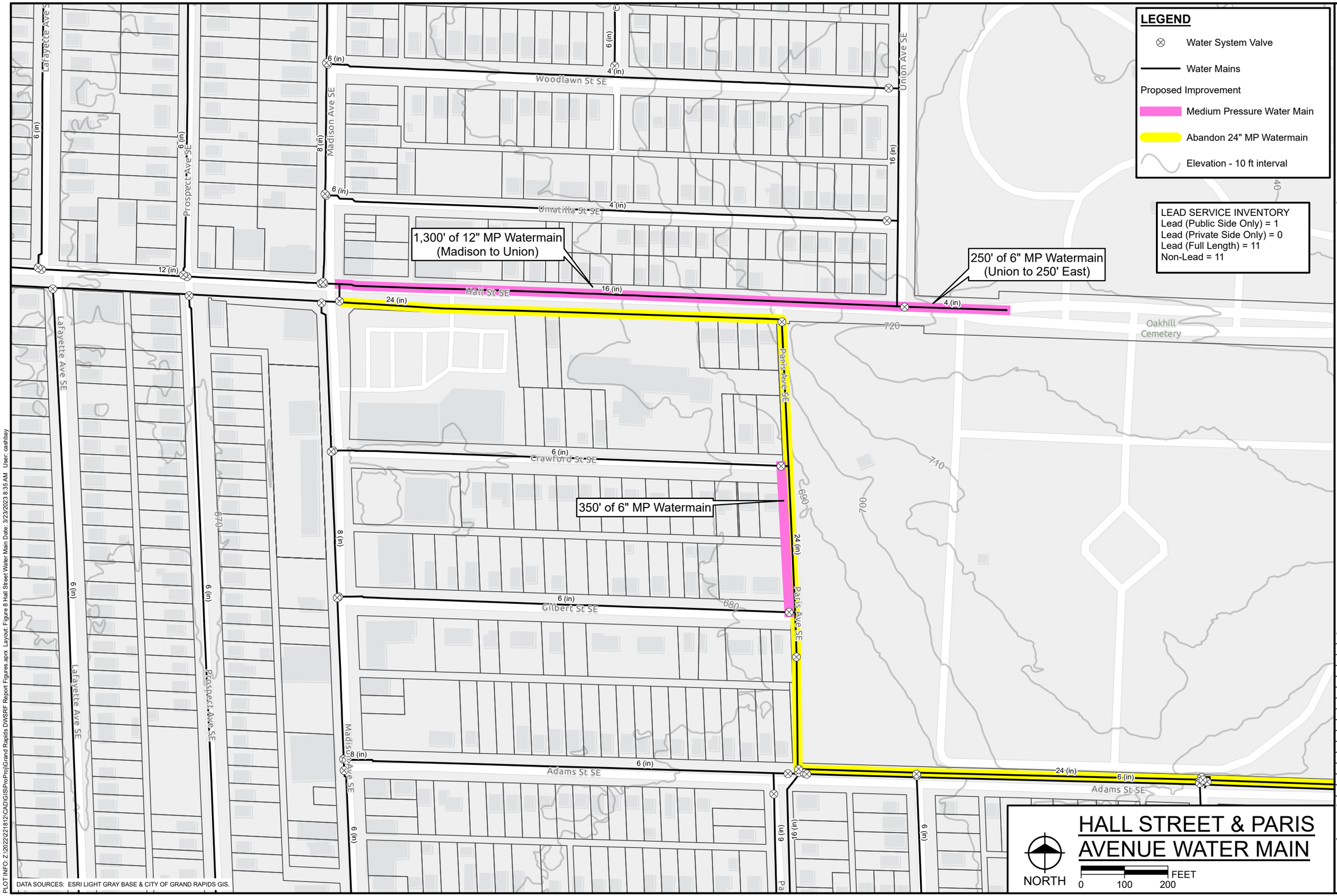
FREMONT AVENUE WATER MAIN

PROJECT NO.
221812

FIGURE NO.
7

PLOT INFO: Z:\2022\221812\CAD\GIS\Proj\Grand Rapids DWSRF Report Figures.aprx Layout: Figure 7 Fremont Avenue Water Main Date: 2/28/2023 1:12 PM User: prbaskins

DATA SOURCES: ESRI LIGHT GRAY BASE & CITY OF GRAND RAPIDS GIS.



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City of Grand Rapids
Kent County, Michigan

Drinking Water State Revolving Fund (DWSRF)
Planning Document

HALL STREET & PARIS AVENUE WATER MAIN

NORTH

0 100 200 FEET

PROJECT NO.
221812

FIGURE NO.
8

DATA SOURCES: ESRI LIGHT GRAY BASE & CITY OF GRAND RAPIDS GIS.

PLOT INFO: Z:\2022\221812\CAD\GIS\ProjGrand Rapids DWSRF Report Figures.aprx Layout: Figure 8 Hall Street Water Main Date: 3/23/2023 8:35 AM User: cashbay

LEAD SERVICE INVENTORY
Lead (Public Side Only) = 2
Lead (Private Side Only) = 0
Lead (Full Length) =19
Non-Lead = 48

LEGEND

- Water System Valve
- Currently closed valve; to be opened after the project
- Water Mains
- Currently dead end water main; to be looped after project

Proposed Improvement

- High Pressure Water Main
- Medium Pressure Water Main
- Elevation - 10 ft interval

Existing 6" HP Watermain

1,050' of 6" MP Watermain

1,350' of 6" HP Watermain

Existing 6" MP Watermain

Evelyn St NE
Marywood Dr NE
Halena St NE
Plainfield Ave NE
Eleanor St NE
Graceland St NE
Woodridge St NE
Edgewood Ave NE
Melita Ave NE
Rowe Ave NE
Eastern Ave NE
Dunker Ave NE
Emerald Ave NE
Houseman Ave NE
Diamond Ave NE
Aberdeen Park
690
700
710
720
6 (in)
8 (in)
12 (in)

DATA SOURCES: ESRI LIGHT GRAY BASE & CITY OF GRAND RAPIDS GIS.

NORTH

0 100 200 FEET

ELEANOR STREET WATER MAIN

PROJECT NO. 221812

FIGURE NO. 9

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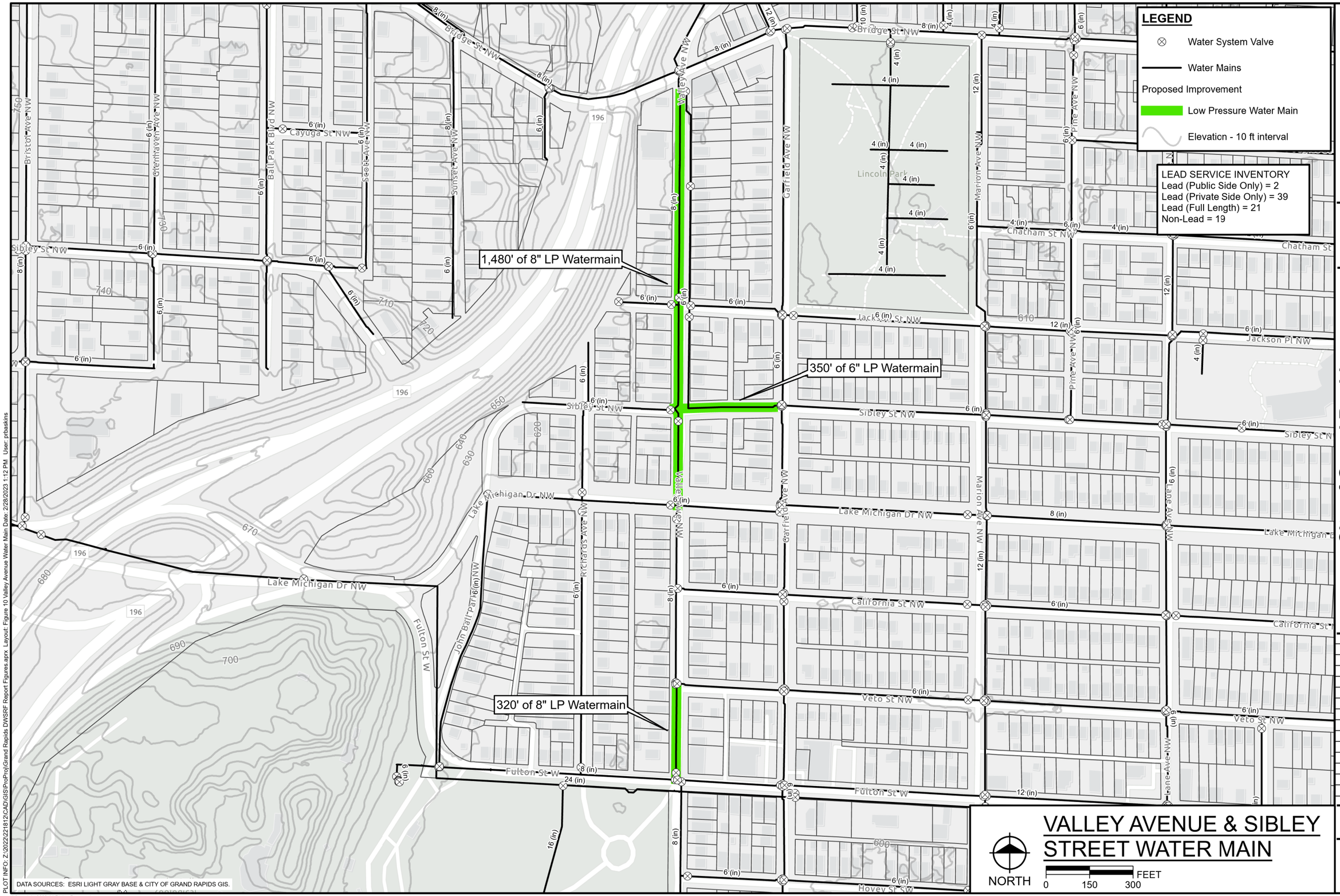
PLOT INFO: Z:\2022\221812\CAD\GIS\ProProj\Grand Rapids DWSRF Report Figures.aprx Layout: Figure 9 Eleanor Street Water Main Date: 3/23/2023 8:37 AM User: cashbay



PLOT INFO: Z:\2022\221812\CAD\GIS\ProjGrand Rapids DWSRF Report Figures.aprx Layout: Figure 10 Valley Avenue Water Main Date: 2/28/2023 1:12 PM User: prbaskins

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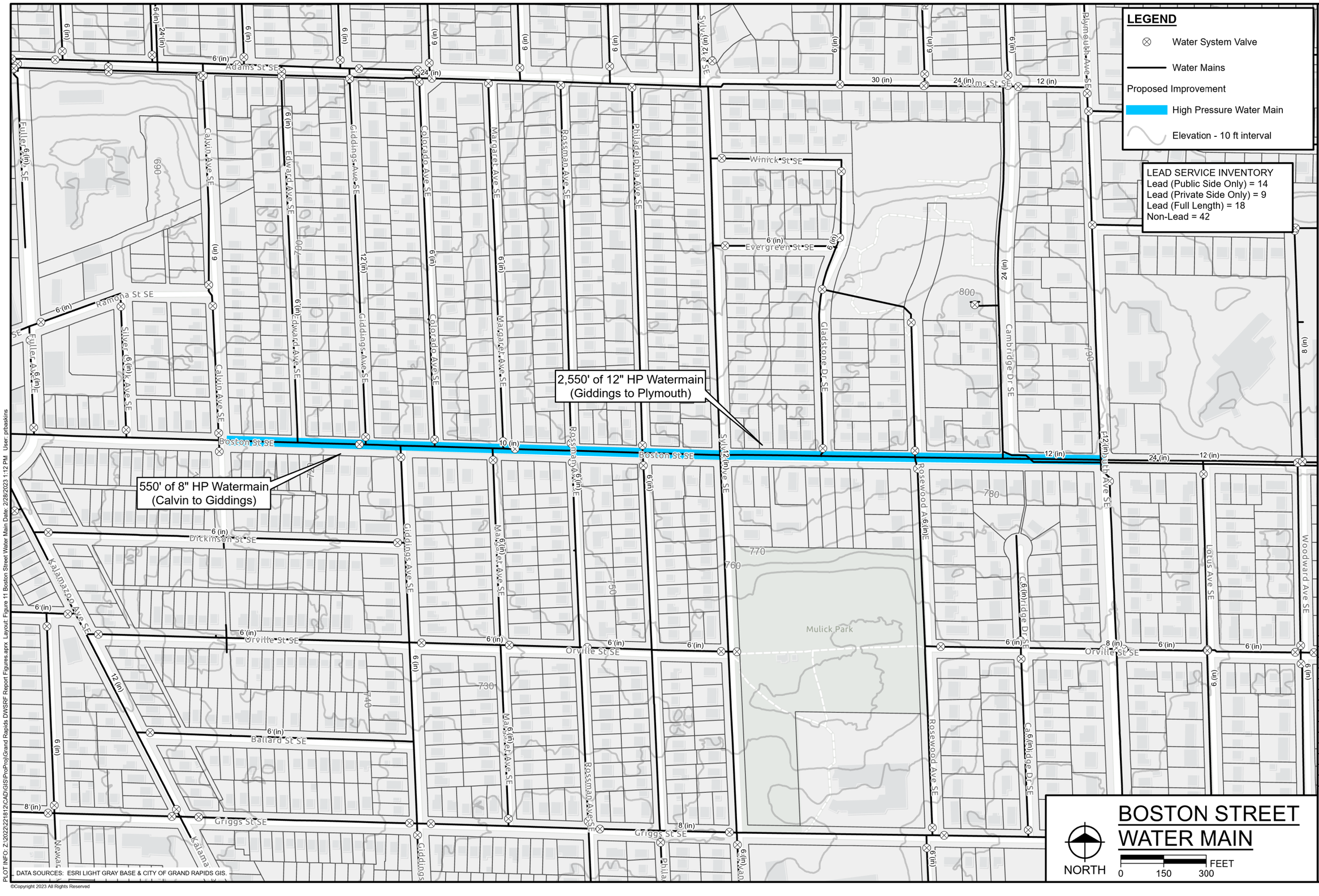
Planning Document

VALLEY AVENUE & SIBLEY STREET WATER MAIN

PROJECT NO.
221812

FIGURE NO.
10



BOSTON STREET WATER MAIN

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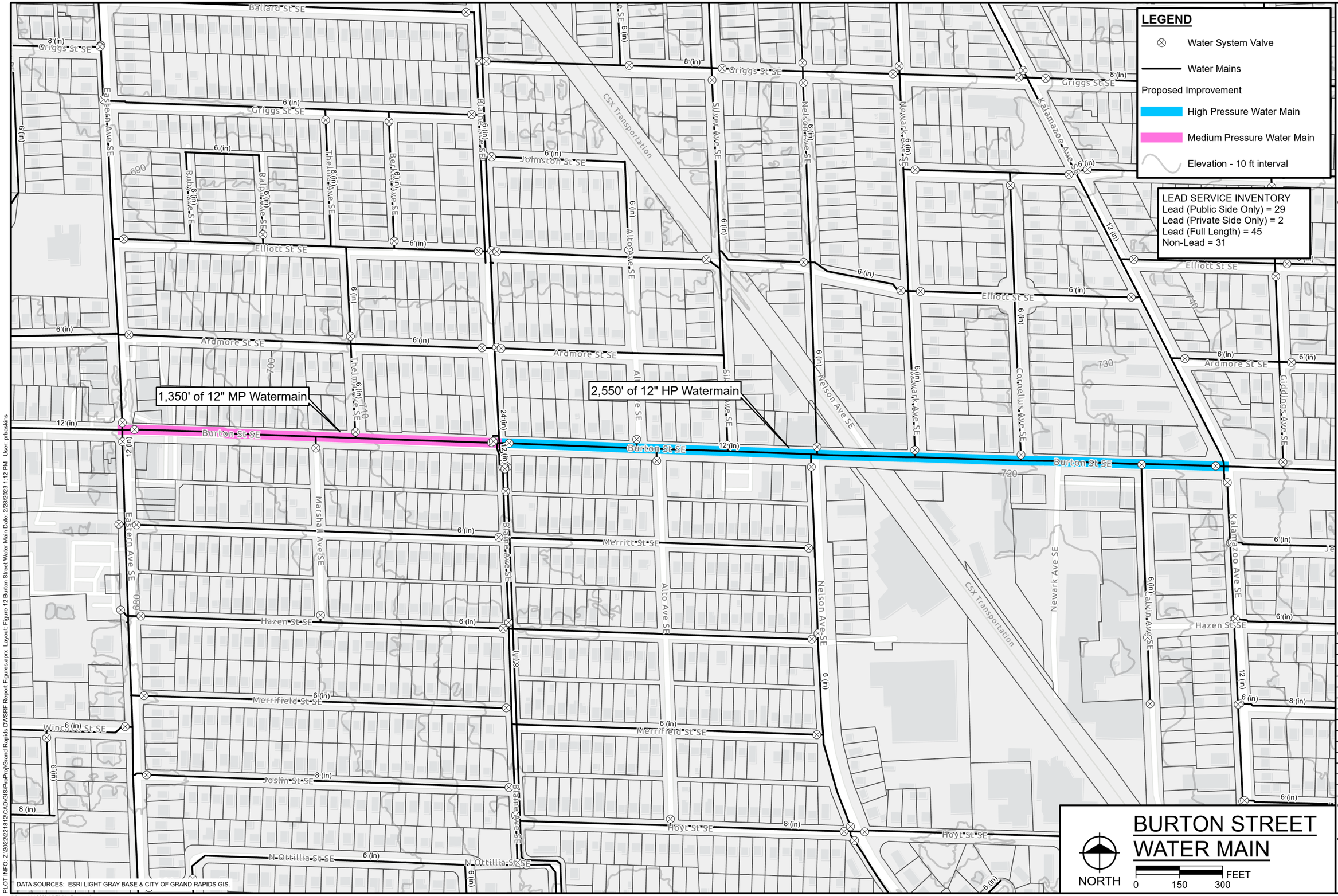
PROJECT NO.
221812

FIGURE NO.
11

PLOT INFO: Z:\2022\221812\CAD\GIS\ProProj\Grand Rapids DWSRF Report Figures.aprx Layout: Figure 11 Boston Street Water Main Date: 2/28/2023 1:12 PM User: pfbaskins

DATA SOURCES: ESRI LIGHT GRAY BASE & CITY OF GRAND RAPIDS GIS.



PLOT INFO: Z:\2022\221812\CAD\GIS\ProPro\Grand Rapids DWSRF Report Figures.aprx Layout: Figure 12 Burton Street Water Main Date: 2/28/2023 1:12 PM User: pbaskins

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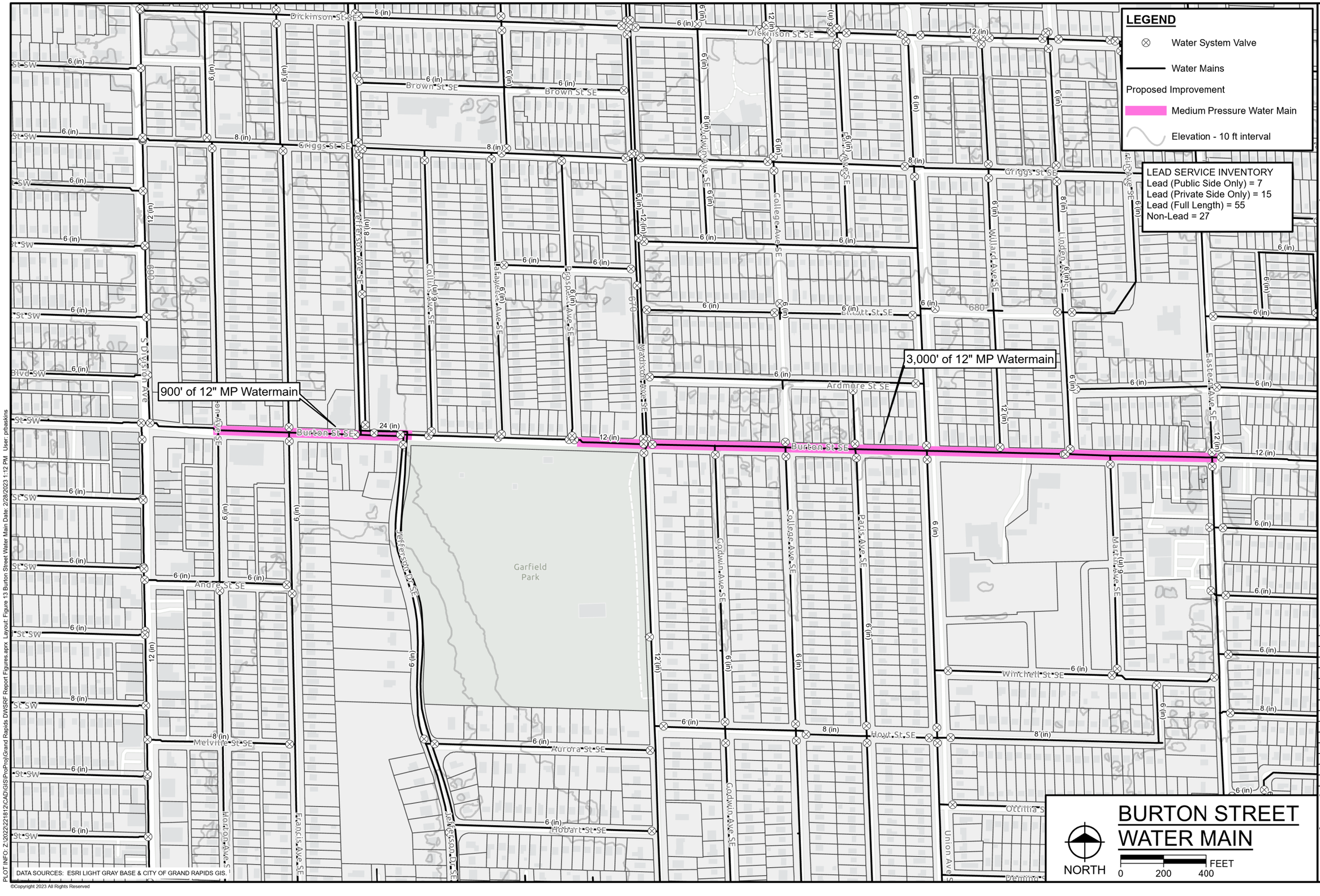
Planning Document

BURTON STREET WATER MAIN

PROJECT NO.
221812

FIGURE NO.
12



PLOT INFO: Z:\2022\221812\CAD\GIS\ProProj\Grand Rapids DWSRF Report Figures.aprx Layout: Figure 13 Burton Street Water Main Date: 2/28/2023 1:12 PM User: pbaskins

NORTH

0 200 400 FEET

BURTON STREET WATER MAIN

PROJECT NO. 221812

FIGURE NO. 13

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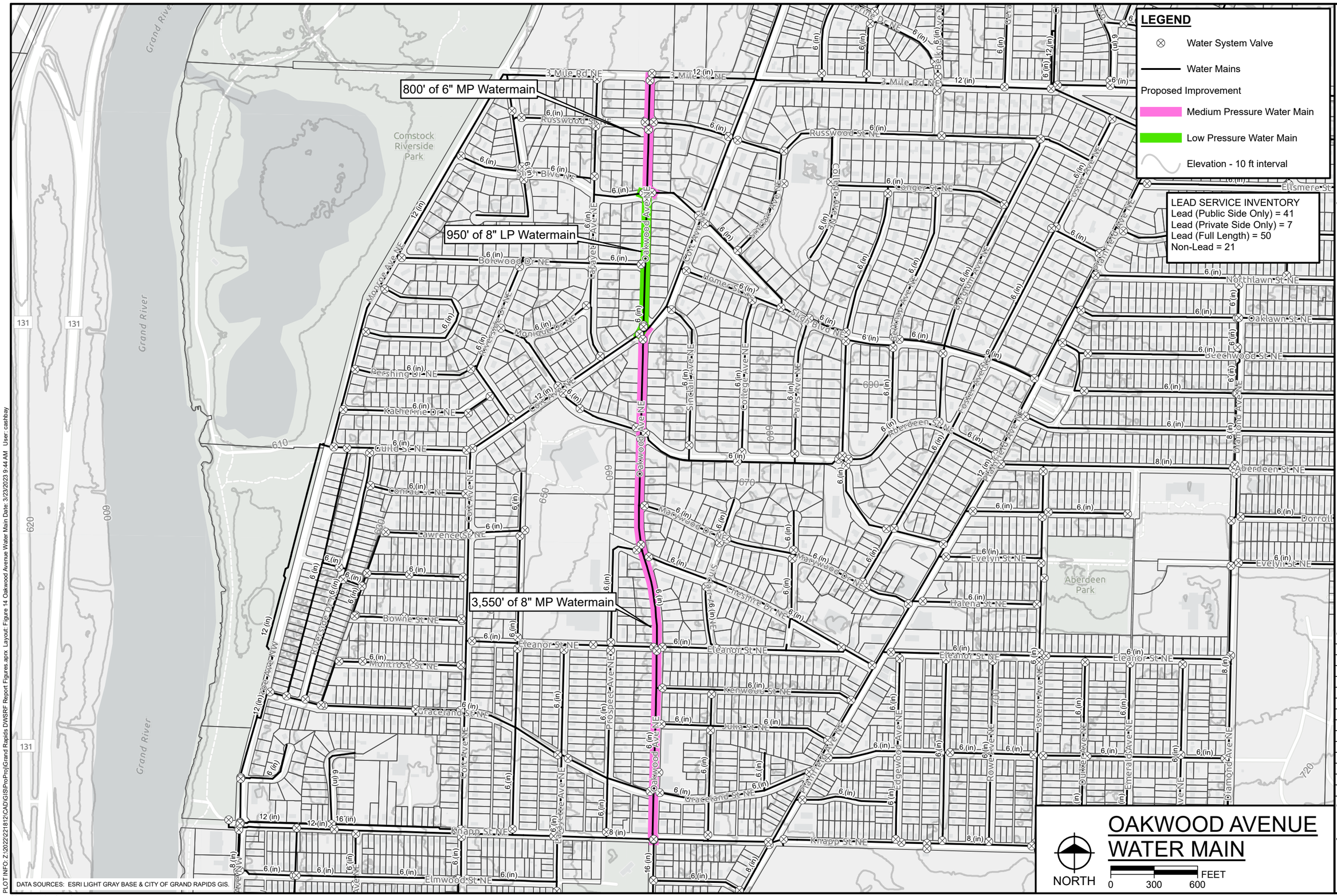

LEGEND

- Water System Valve
- Water Mains

Proposed Improvement

- Medium Pressure Water Main
- Low Pressure Water Main
- Elevation - 10 ft interval

LEAD SERVICE INVENTORY
Lead (Public Side Only) = 41
Lead (Private Side Only) = 7
Lead (Full Length) = 50
Non-Lead = 21

NORTH

0 300 600 FEET

DATA SOURCES: ESRI LIGHT GRAY BASE & CITY OF GRAND RAPIDS GIS.

PLOT INFO: Z:\2022\221812\CAD\GIS\ProjGrand Rapids DWSRF Report Figures.aprx Layout: Figure 14 Oakwood Avenue Water Main Date: 3/22/2023 9:44 AM User: cashbay

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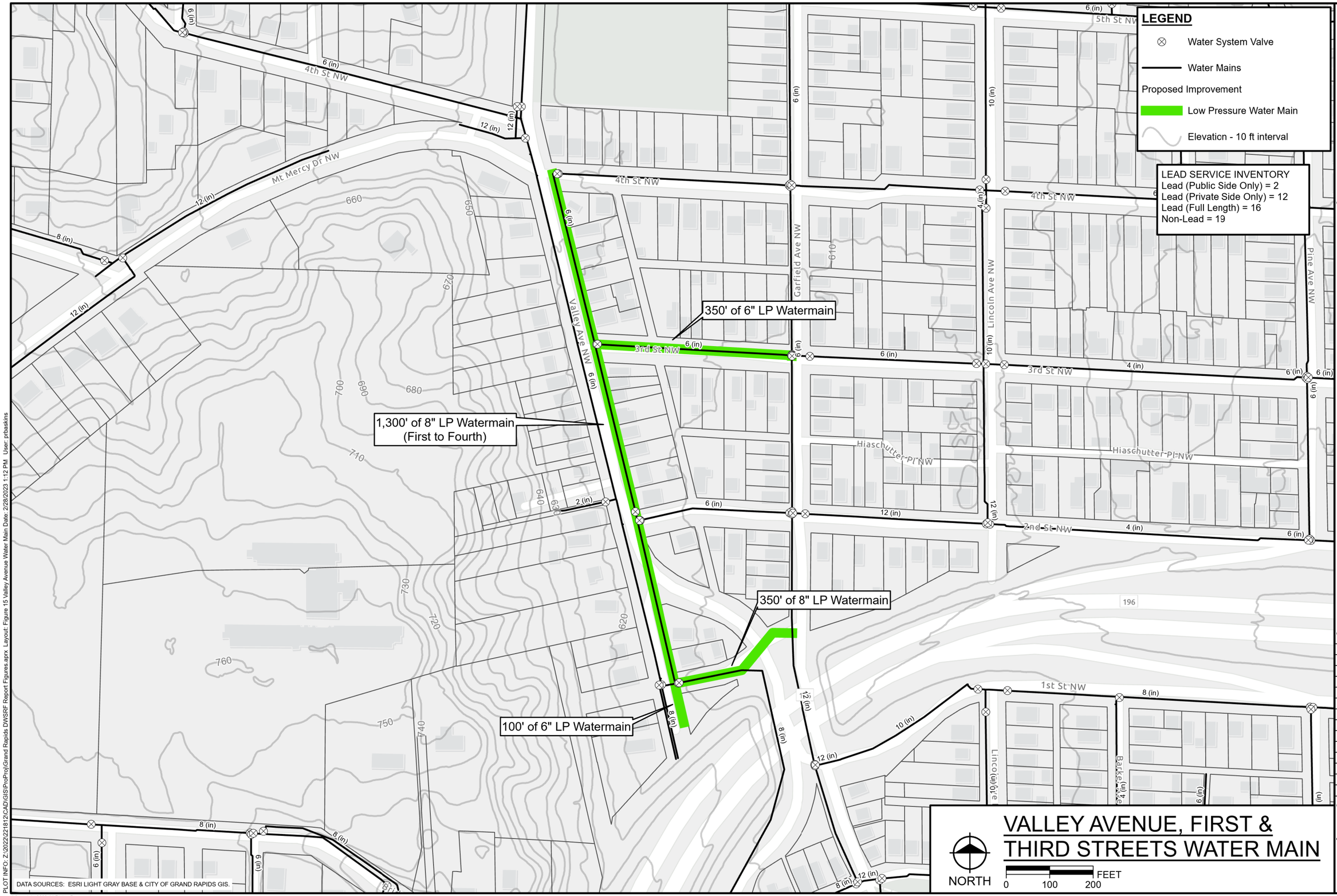
Kent County, Michigan
Drinking Water State Revolving Fund (DWSRF)
Planning Document

OAKWOOD AVENUE WATER MAIN

PROJECT NO.
221812

FIGURE NO.
14



DATA SOURCES: ESRI LIGHT GRAY BASE & CITY OF GRAND RAPIDS GIS.

PLOT INFO: Z:\2022\221812\CAD\GIS\ProProj\Grand Rapids DWSRF Report Figures.aprx Layout: Figure 15 Valley Avenue Water Main Date: 2/28/2023 1:12 PM User: prbaskins

VALLEY AVENUE, FIRST & THIRD STREETS WATER MAIN

PROJECT NO. 221812

FIGURE NO. 15

City of Grand Rapids
Kent County, Michigan

Drinking Water State Revolving Fund (DWSRF)
Planning Document

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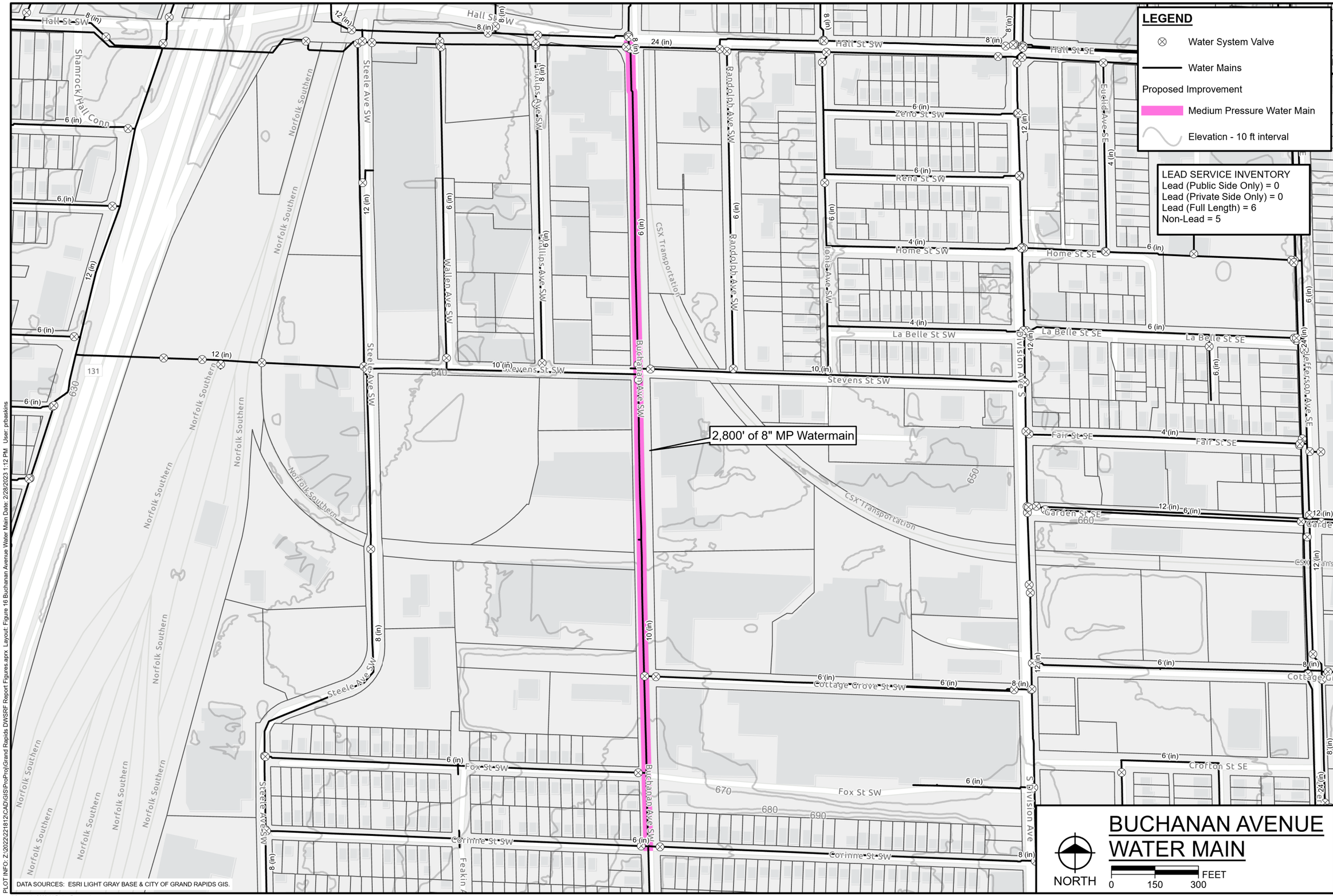

PLOT INFO: Z:\2022\221812\CAD\GIS\Proj\Grand Rapids DWSRF Report Figures.aprx Layout: Figure 16 Buchanan Avenue Water Main Date: 2/28/2023 1:12 PM User: prbaskins

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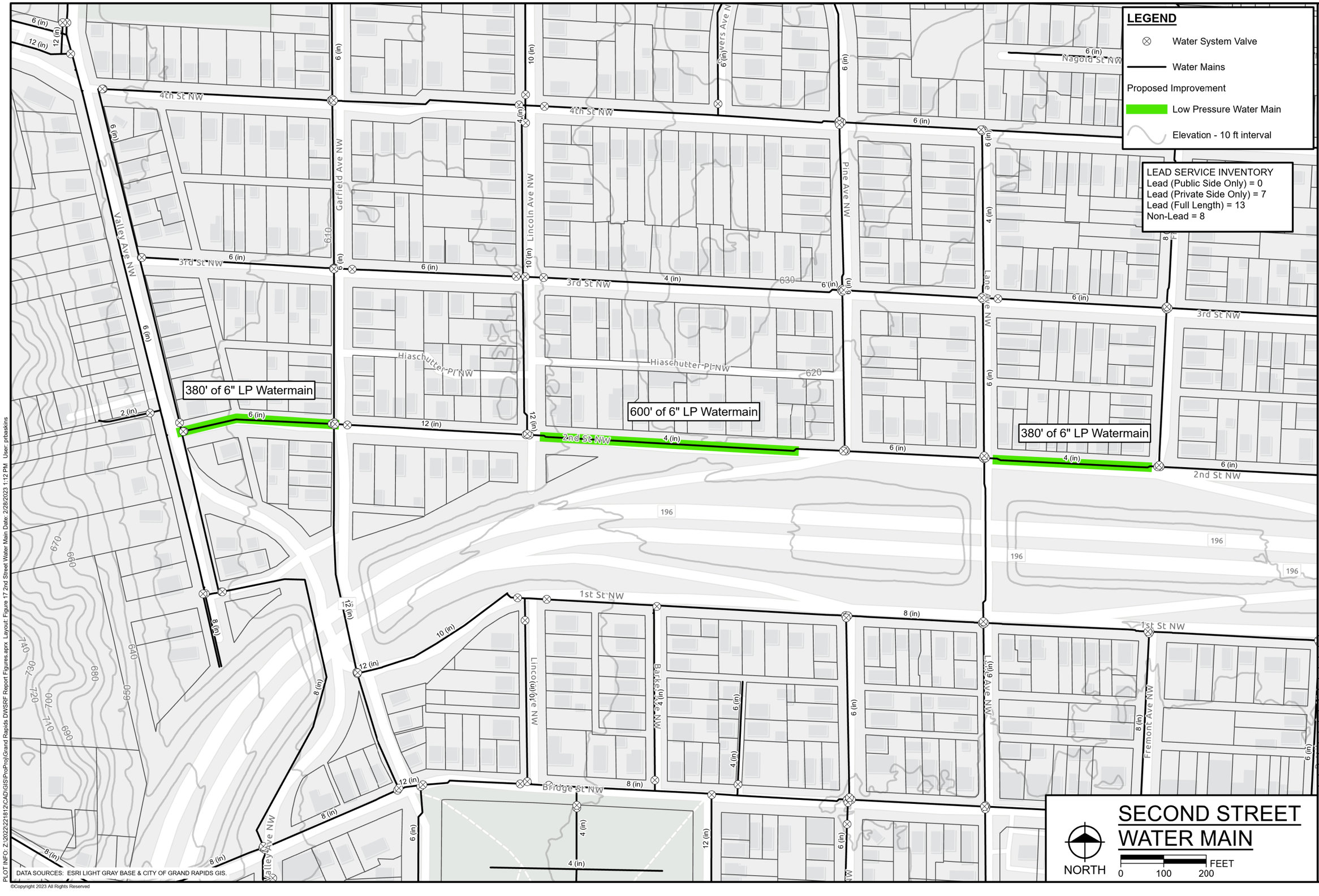
City of Grand Rapids
Kent County, Michigan

Drinking Water State Revolving Fund (DWSRF)
Planning Document

BUCHANAN AVENUE WATER MAIN

PROJECT NO.
221812

FIGURE NO.
16



PLOT INFO: Z:\2022\221812\CAD\GIS\ProProj\Grand Rapids DWSRF Report Figures.aprx Layout: Figure 17 2nd Street Water Main Date: 2/28/2023 1:12 PM User: pbaskins

DATA SOURCES: ESRI LIGHT GRAY BASE & CITY OF GRAND RAPIDS GIS.

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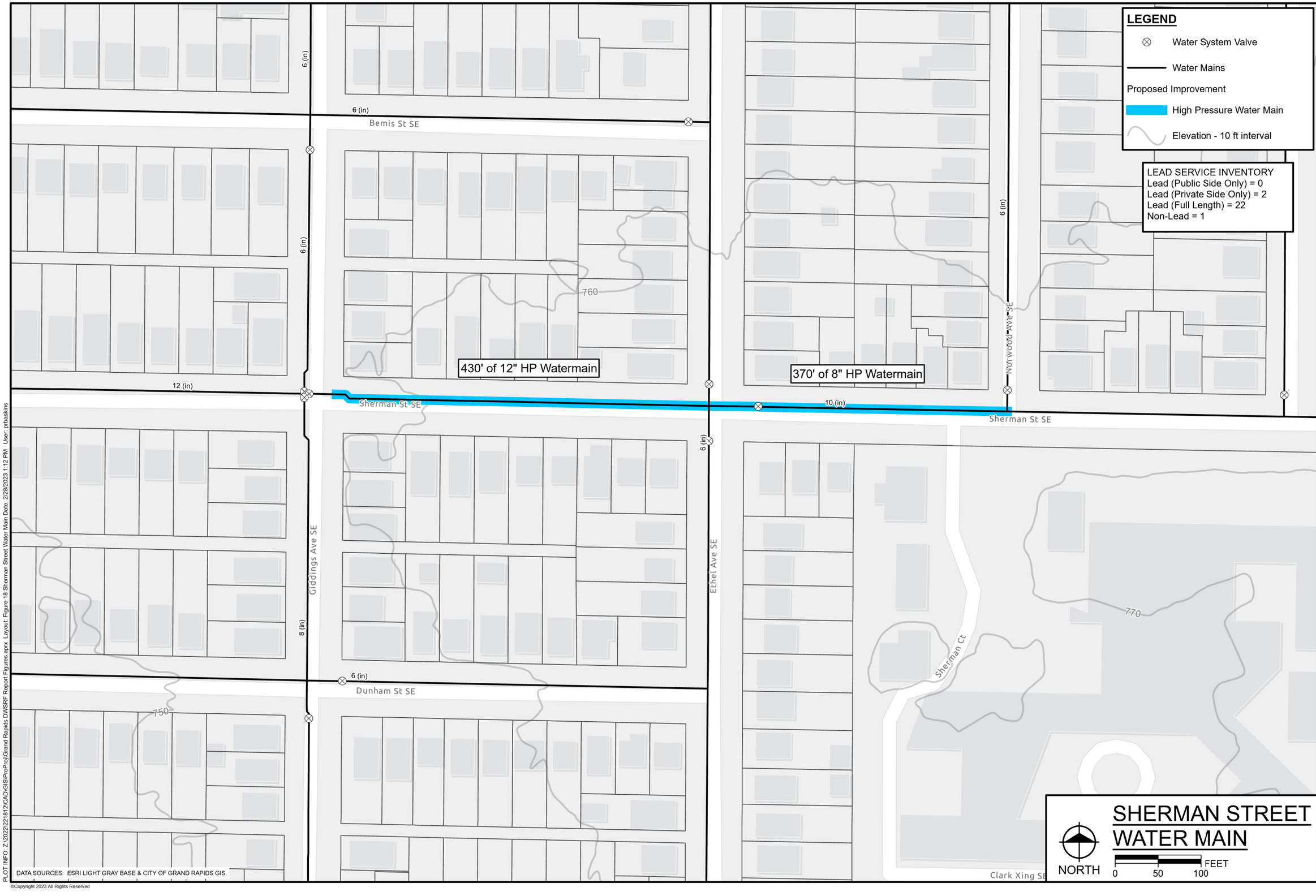
City of Grand Rapids
Kent County, Michigan
Drinking Water State Revolving Fund (DWSRF)
Planning Document

SECOND STREET WATER MAIN

PROJECT NO.
221812

FIGURE NO.
17



DATA SOURCES: ESRI LIGHT GRAY BASE & CITY OF GRAND RAPIDS GIS.

PLOT INFO: Z:\2022\221812\CAD\GIS\ProProj\Grand Rapids DWSRF Report Figures.aprx Layout: Figure 18 Sherman Street Water Main Date: 2/28/2023 1:12 PM User: ptbaskins

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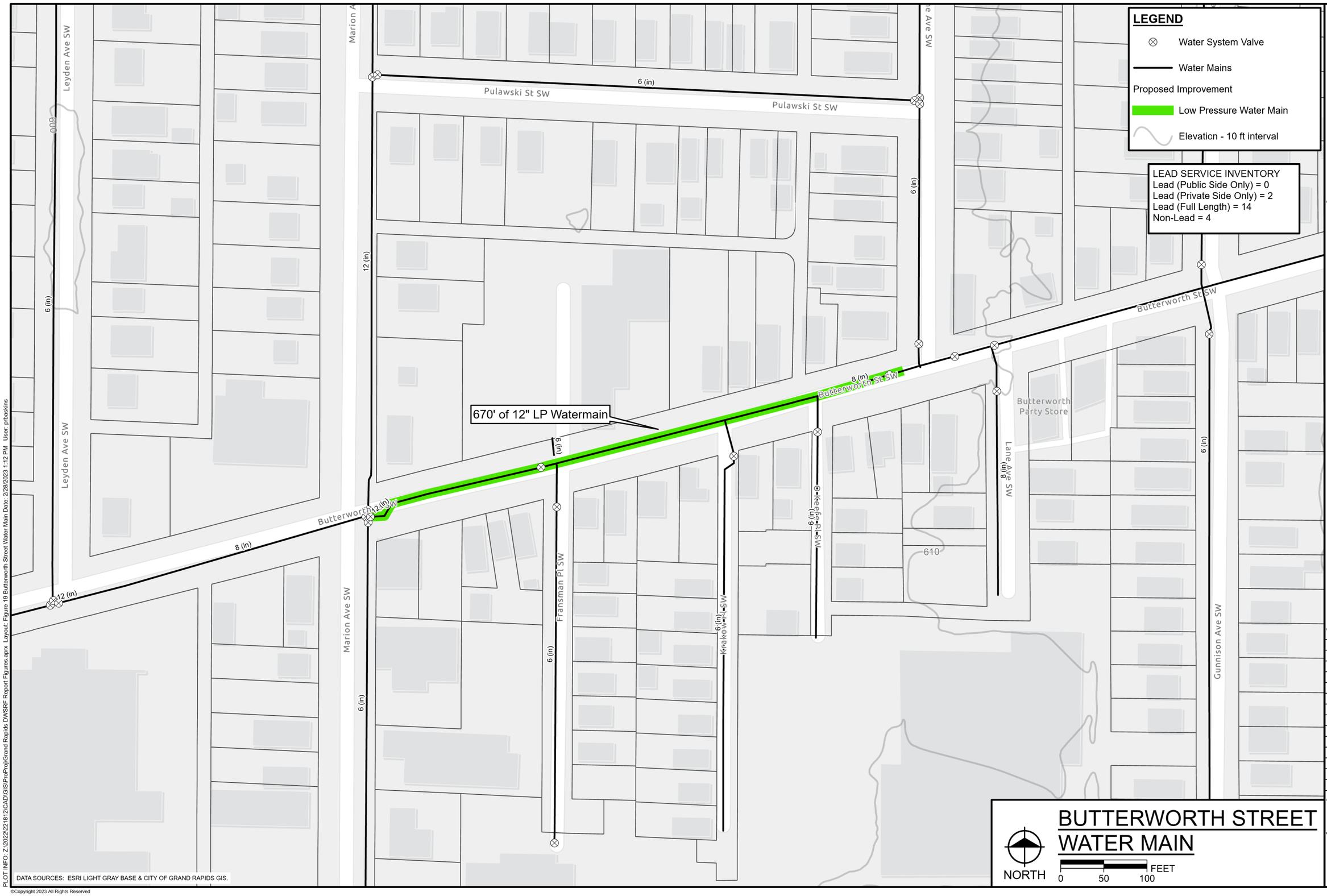
City of Grand Rapids
Kent County, Michigan

Drinking Water State Revolving Fund (DWSRF)
Planning Document

PROJECT NO.
221812

FIGURE NO.
18



PLOT INFO: Z:\2022\221812\CAD\GIS\Proj\Grand Rapids DWSRF Report Figures.aprx Layout: Figure 19 Butterworth Street Water Main Date: 2/28/2023 1:12 PM User: prbaskins

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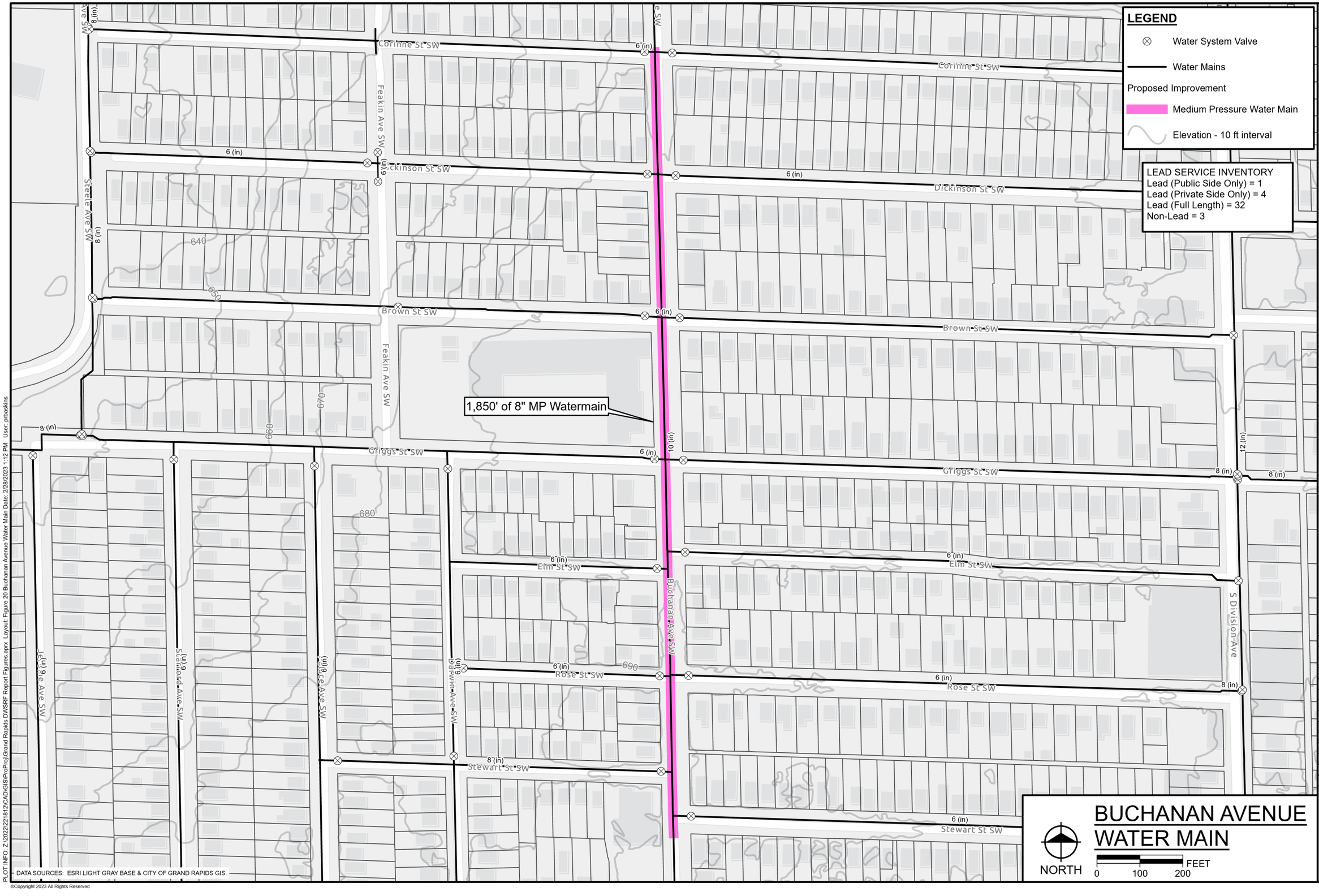
Kent County, Michigan

Drinking Water State Revolving Fund (DWSRF)
Planning Document

BUTTERWORTH STREET WATER MAIN

PROJECT NO.
221812

FIGURE NO.
19



BUCHANAN AVENUE WATER MAIN

DATA SOURCES: ESRI LIGHT GRAY BASE & CITY OF GRAND RAPIDS GIS.

PLOT INFO: Z:\2022\221812\CAD\GIS\ProProj\Grand Rapids DWSRF Report Figures.aprx Layout: Figure 20 Buchanan Avenue Water Main Date: 2/28/2023 1:12 PM User: prbaskins

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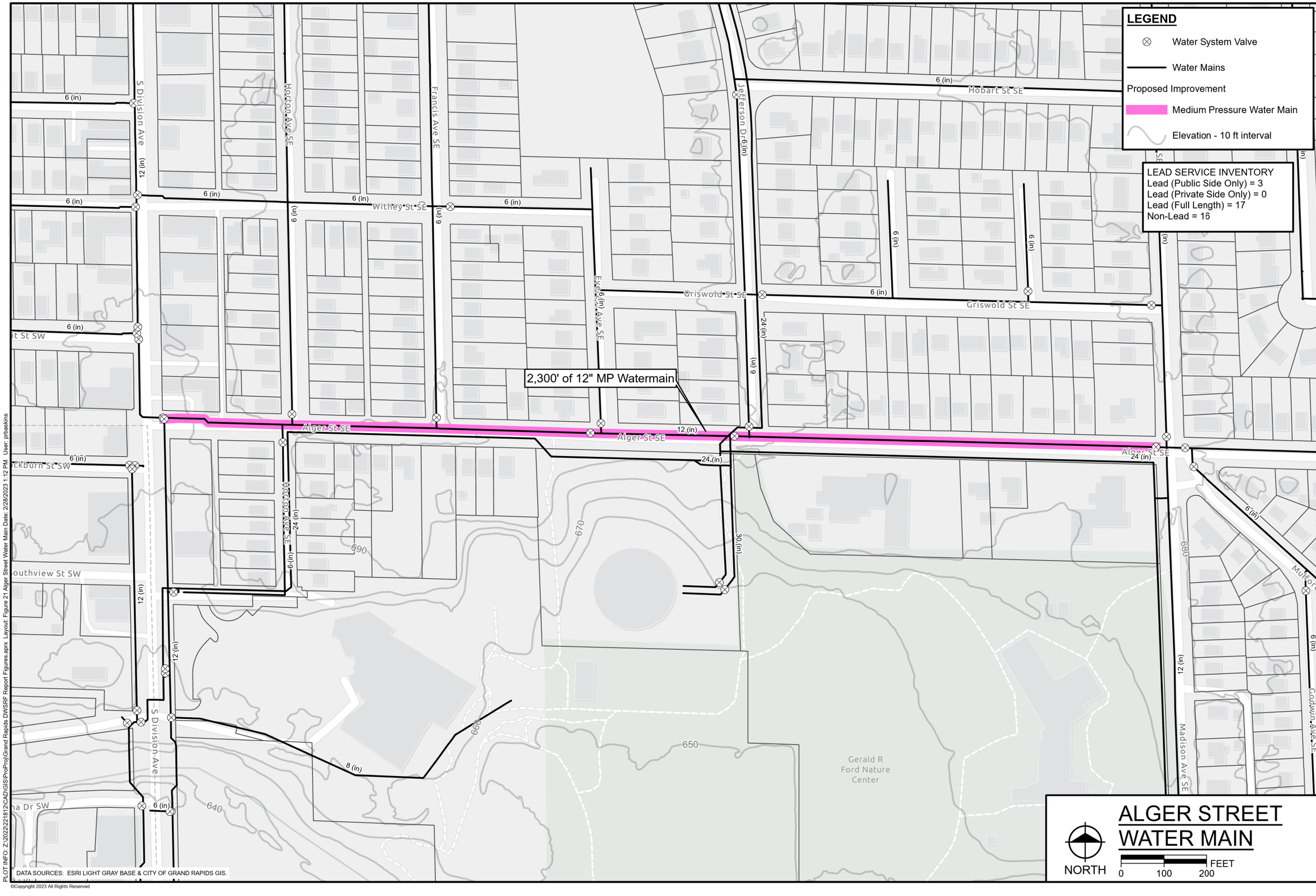
City of Grand Rapids
Kent County, Michigan

Drinking Water State Revolving Fund (DWSRF)
Planning Document

PROJECT NO.
221812

FIGURE NO.
20



ALGER STREET WATER MAIN

fishbeck
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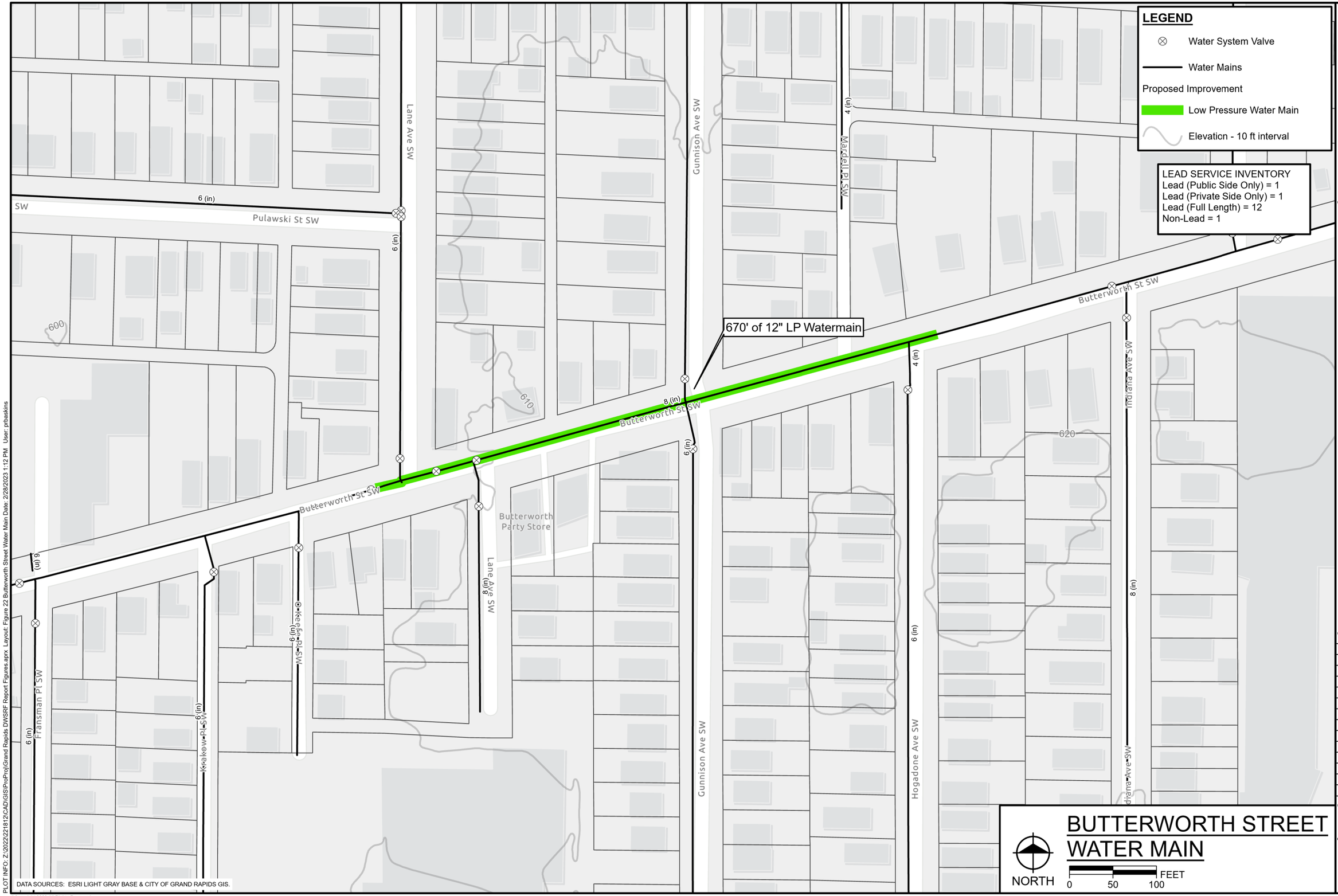
City of Grand Rapids
Kent County, Michigan
Drinking Water State Revolving Fund (DWSRF)
Planning Document

PROJECT NO.
221812

FIGURE NO.
21

DATA SOURCES: ESRI LIGHT GRAY BASE & CITY OF GRAND RAPIDS GIS.

PLOT INFO: Z:\2022\221812\CAD\GIS\ProProj\Grand Rapids DWSRF Report Figures.aprx Layout: Figure 21 Alger Street Water Main Date: 2/28/2023 1:12 PM User: prbaskins



Hard copy is intended to be 11"x17" when plotted. Scale(s) indicated and graphic quality may not be accurate for any other size.

fishbeck
Engineers | Architects | Scientists | Constructors

City of Grand Rapids
Kent County, Michigan

Drinking Water State Revolving Fund (DWSRF)
Planning Document

BUTTERWORTH STREET WATER MAIN

NORTH

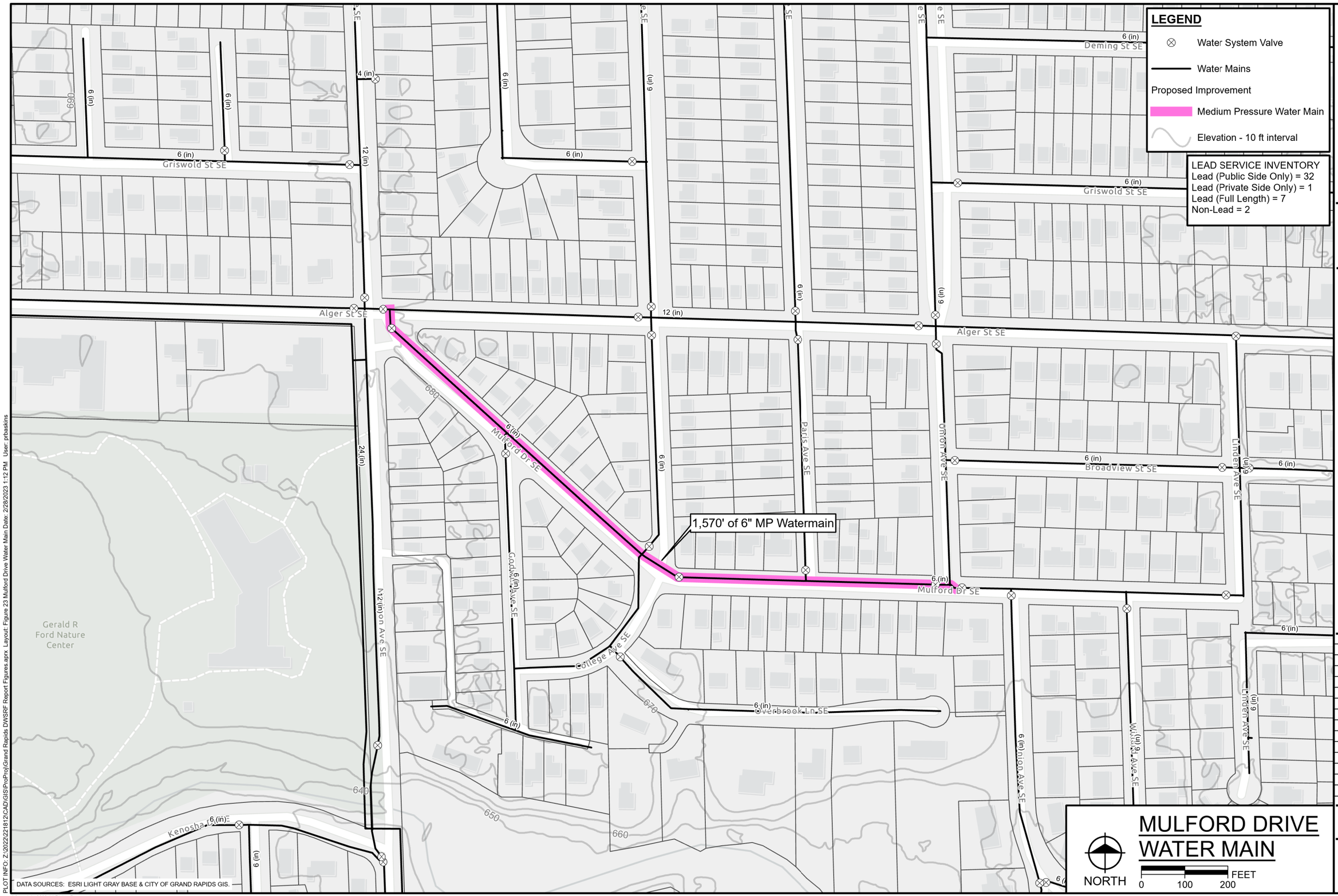
0 50 100 FEET

PROJECT NO.
221812

FIGURE NO.
22

DATA SOURCES: ESRI LIGHT GRAY BASE & CITY OF GRAND RAPIDS GIS.

PLOT INFO: Z:\2022\221812\CAD\GIS\ProPro\Grand Rapids DWSRF Report Figures.aprx Layout: Figure 22 Butterworth Street Water Main Date: 2/28/2023 1:12 PM User: prbaskins



fishbeck
Engineers | Architects | Scientists | Constructors

Hard copy is intended to be 11"x17" when plotted. Scale(s) indicated and graphic quality may not be accurate for any other size.

City of Grand Rapids
Kent County, Michigan
Drinking Water State Revolving Fund (DWSRF)
Planning Document

PROJECT NO.
221812

FIGURE NO.
23

PLOT INFO: Z:\2022\221812\CAD\GIS\ProjProj\Grand Rapids DWSRF Report Figures.aprx Layout: Figure 23 Mulford Drive Water Main Date: 2/28/2023 1:12 PM User: pbaskins

LEGEND

- Water System Valve
- Water Mains

Proposed Improvement

- High Pressure Water Main
- Medium Pressure Water Main
- Elevation - 10 ft interval

LEAD SERVICE INVENTORY
Lead (Public Side Only) = 2
Lead (Private Side Only) = 1
Lead (Full Length) = 49
Non-Lead = 24

NORTH

ARDMORE STREET WATER MAIN

0 100 200 FEET

DATA SOURCES: ESRI LIGHT GRAY BASE & CITY OF GRAND RAPIDS GIS.

PLOT INFO: Z:\2022\221812\CAD\GIS\Proj\Grand Rapids DWSRF Report Figures.aprx Layout: Figure 24 Ardmore Street Water Main Date: 2/28/2023 1:12 PM User: prbaskins

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Kent County, Michigan
Drinking Water State Revolving Fund (DWSRF)
Planning Document

PROJECT NO.
221812

FIGURE NO.
24

980' of 6" MP Watermain

1,370' of 6" MP Watermain

LEGEND

- Water System Valve
- Water Mains

Proposed Improvement

- Medium Pressure Water Main
- Elevation - 10 ft interval

LEAD SERVICE INVENTORY
Lead (Public Side Only) = 6
Lead (Private Side Only) = 0
Lead (Full Length) = 50
Non-Lead = 25

DATA SOURCES: ESRI LIGHT GRAY BASE & CITY OF GRAND RAPIDS GIS.

NORTH

0 200 400 FEET

COLLEGE AVENUE WATER MAIN

PROJECT NO. 221812

FIGURE NO. 25

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Kent County, Michigan

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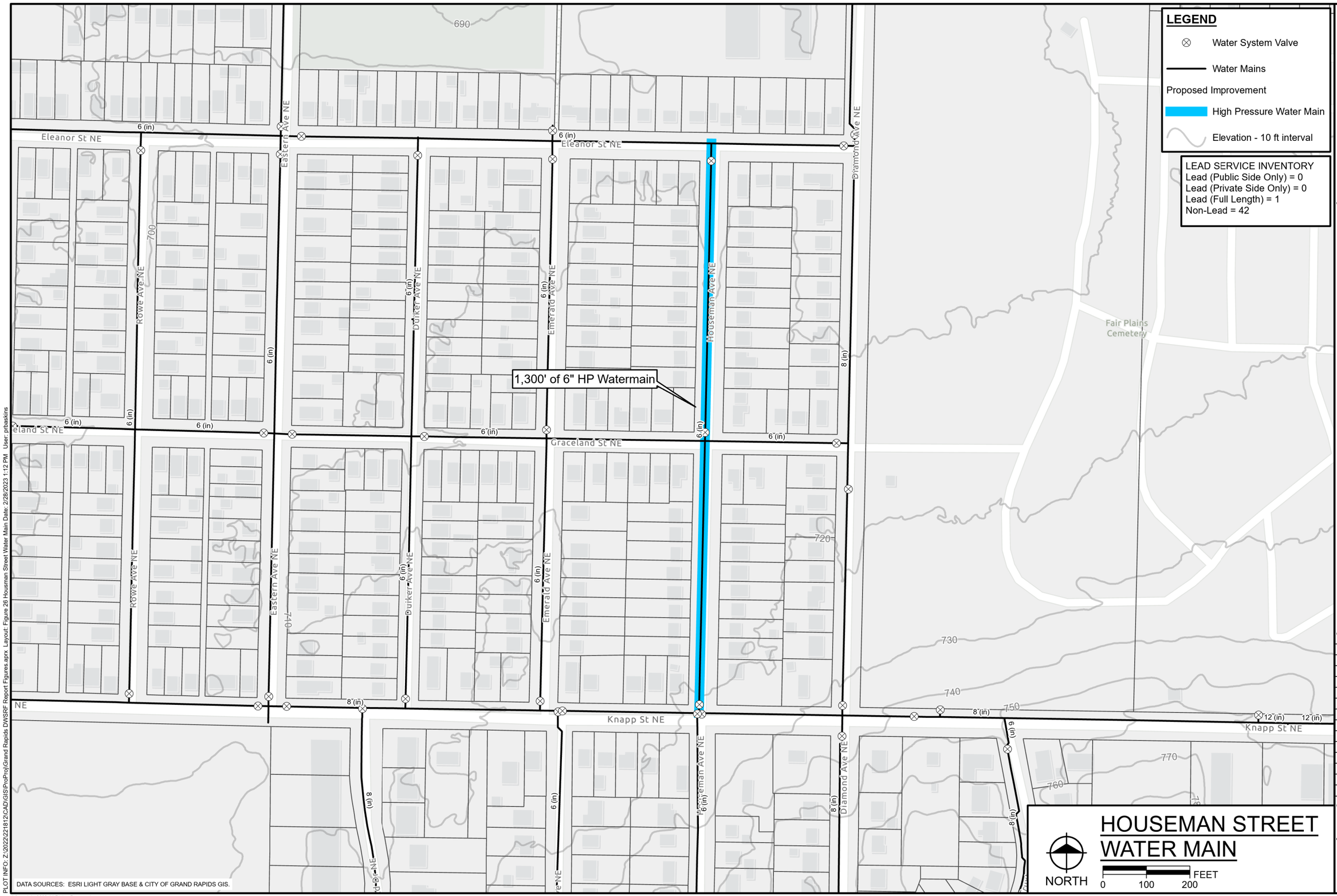
PLOT INFO: Z:\2022\221812\CAD\GIS\ProjGrand Rapids DWSRF Report Figures.aprx Layout: Figure 25 College Avenue Water Main Date: 2/28/2023 1:12 PM User: ptbaskins



LEGEND

- Water System Valve
- Water Mains

Proposed Improvement

- High Pressure Water Main
- Elevation - 10 ft interval

LEAD SERVICE INVENTORY
Lead (Public Side Only) = 0
Lead (Private Side Only) = 0
Lead (Full Length) = 1
Non-Lead = 42

NORTH

0 100 200 FEET

HOUSEMAN STREET WATER MAIN

DATA SOURCES: ESRI LIGHT GRAY BASE & CITY OF GRAND RAPIDS GIS.

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PROJECT NO.
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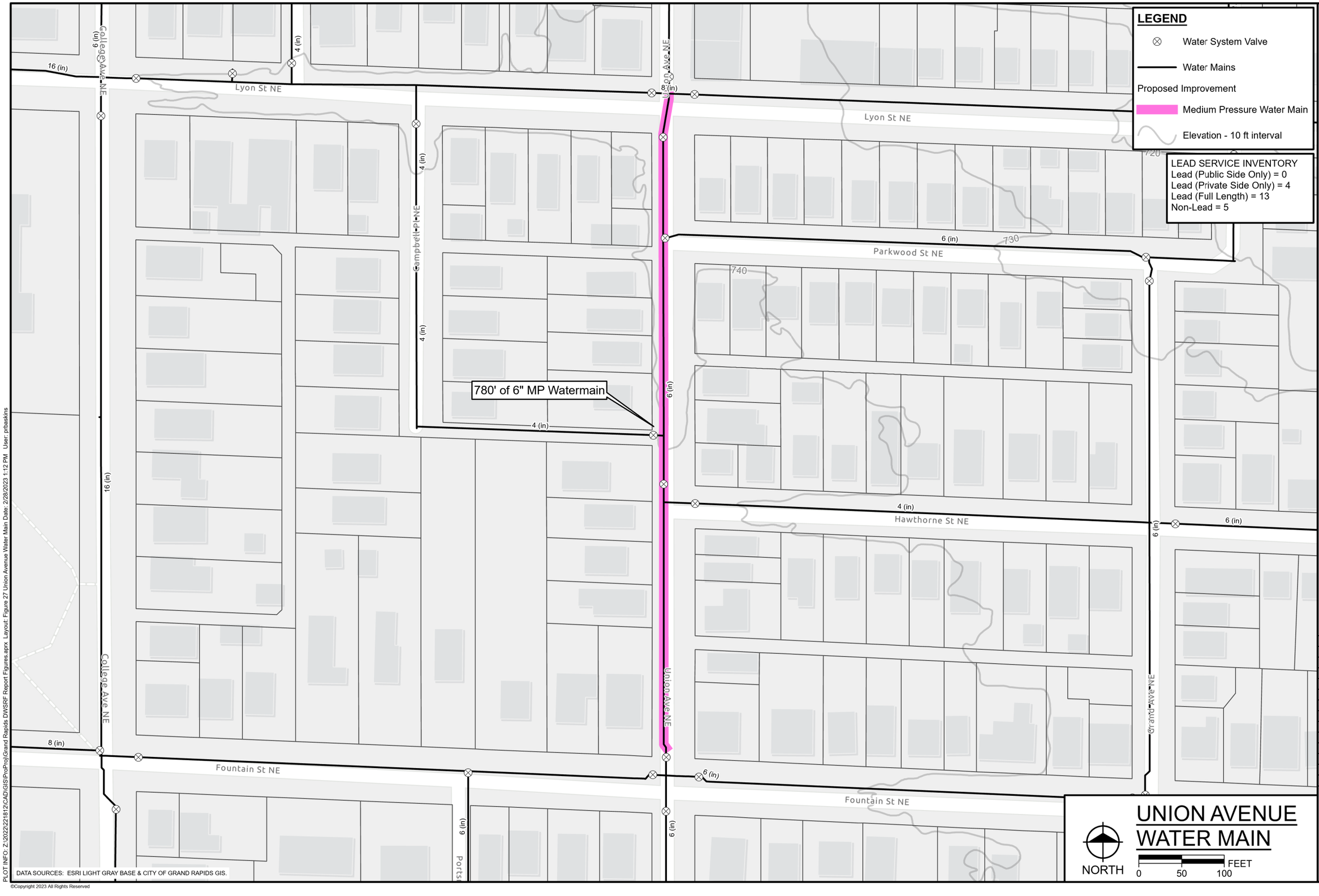
FIGURE NO.
26

PLOT INFO: Z:\2022\221812\CAD\GIS\ProjProj\Grand Rapids DWSRF Report Figures.aprx Layout: Figure 26 Housman Street Water Main Date: 2/28/2023 1:12 PM User: prbaskins



DATA SOURCES: ESRI LIGHT GRAY BASE & CITY OF GRAND RAPIDS GIS.

PLOT INFO: Z:\2022\221812\CAD\GIS\ProPro\Grand Rapids DWSRF Report Figures.aprx Layout: Figure 27 Union Avenue Water Main Date: 2/28/2023 1:12 PM User: prbaskins

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UNION AVENUE WATER MAIN

PROJECT NO.
221812

FIGURE NO.
27

LEGEND

- Water System Valve
- Water Mains

Proposed Improvement

- Medium Pressure Water Main
- Elevation - 10 ft interval

LEAD SERVICE INVENTORY
Lead (Public Side Only) = 2
Lead (Private Side Only) = 0
Lead (Full Length) = 19
Non-Lead = 5

500' of 12" MP Watermain

950' of 8" MP Watermain

Hall St SW

Hughart St SW

Underhill Ave SW

E Ave SW

Caulfield Ave SW

Sheridan Ave SW

Shamrock St SW

Shamrock/Hall Conn

196

620 630 640 650 660 670 680

6 (in) 8 (in) 12 (in) 24 (in)

DATA SOURCES: ESRI LIGHT GRAY BASE & CITY OF GRAND RAPIDS GIS.

NORTH

HALL STREET WATER MAIN

0 50 100 FEET

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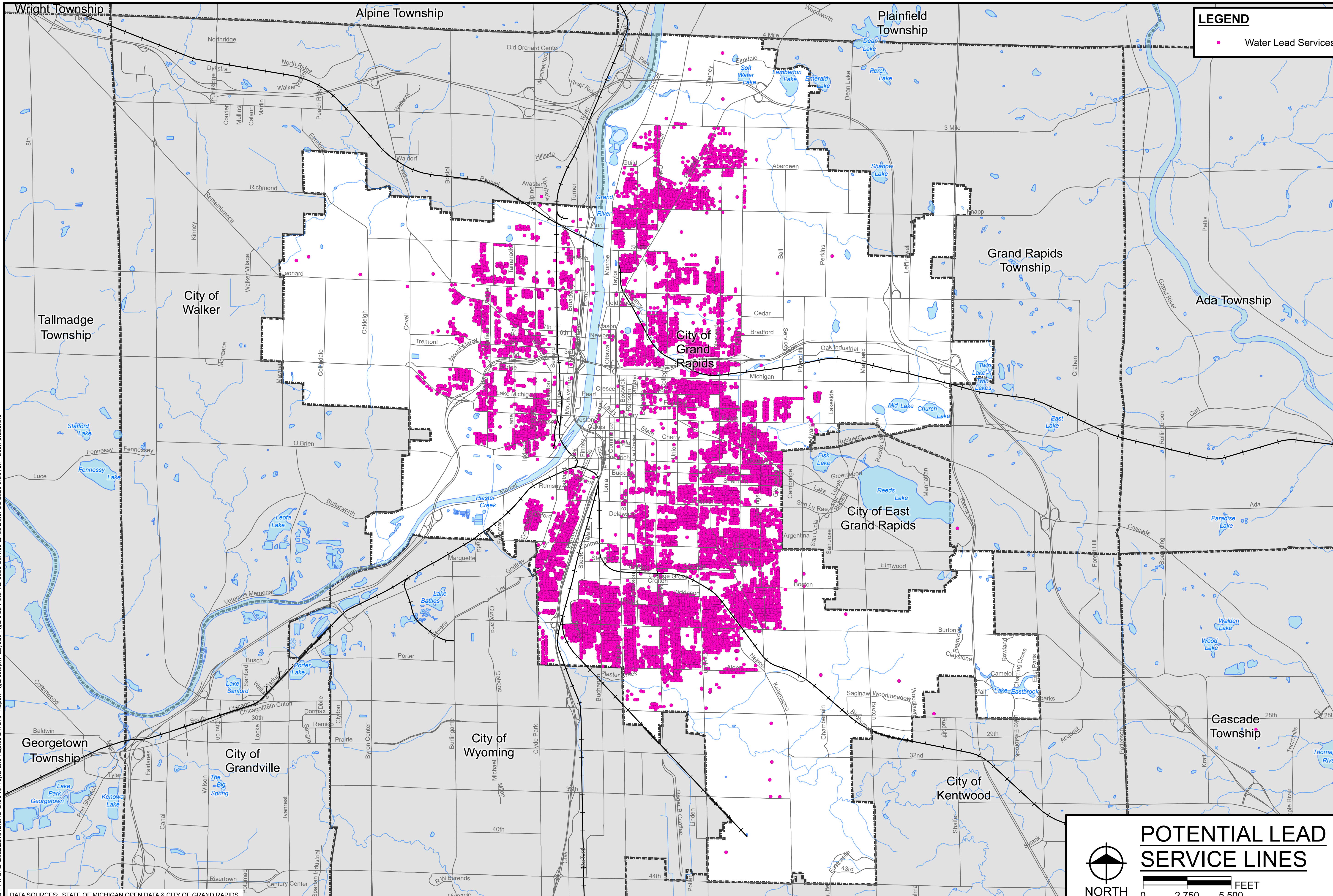
PROJECT NO.
221812

FIGURE NO.
28

PLOT INFO: Z:\2022\221812\CAD\GIS\ProPro\Grand Rapids DWSRF Report Figures aprx Layout: Figure 28 Hall Street Water Main Date: 2/28/2023 1:12 PM User: prbaskins



POTENTIAL LEAD SERVICE LINES

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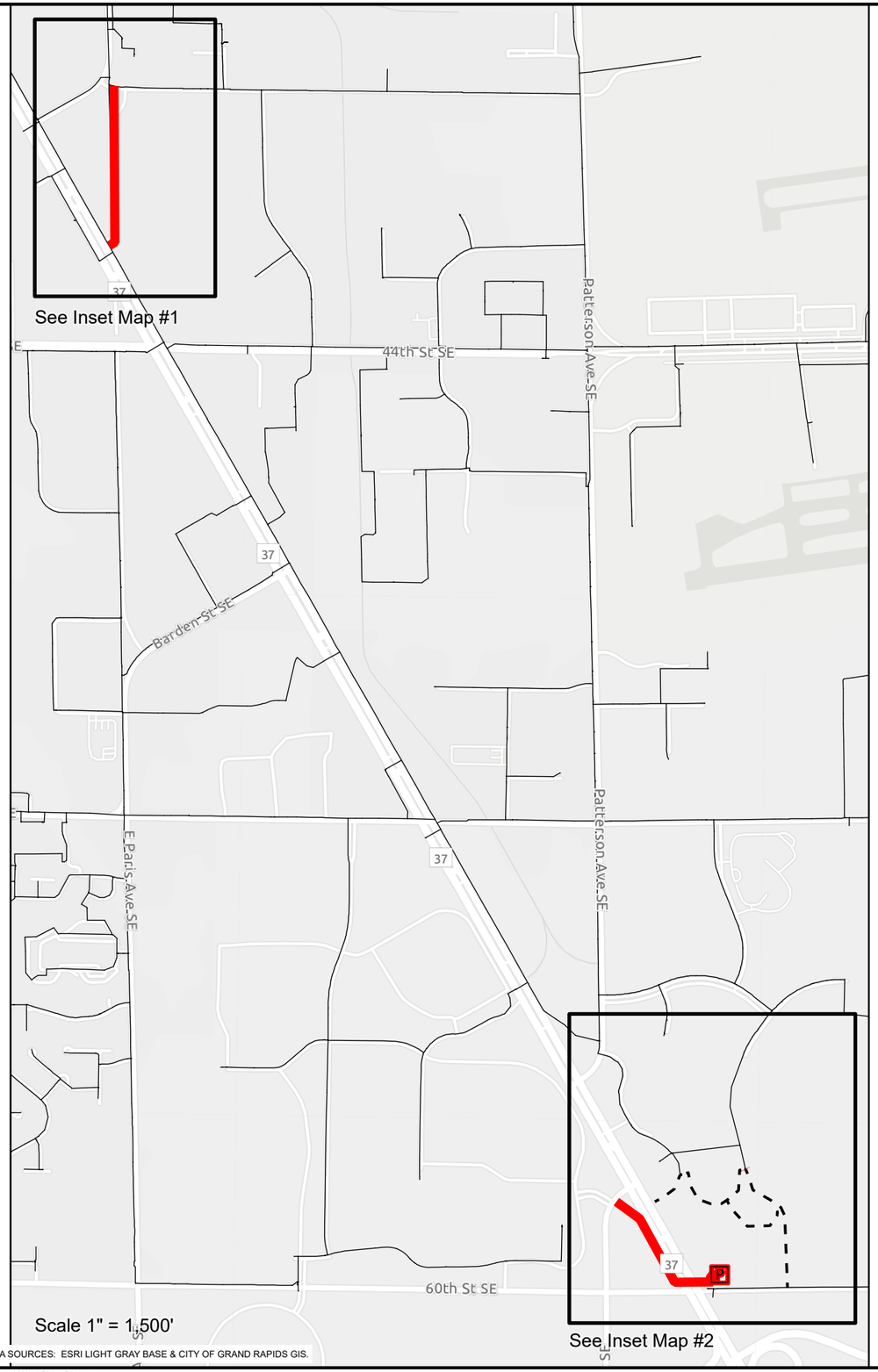
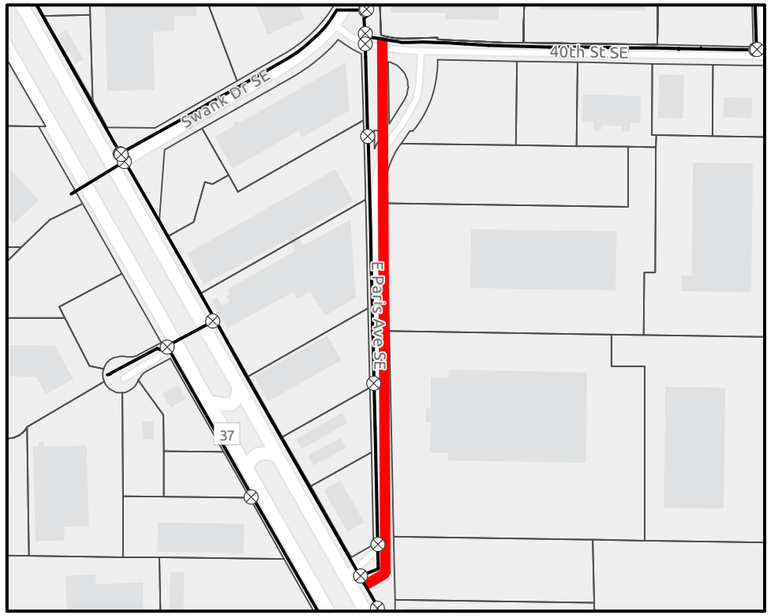
PROJECT NO.
221812

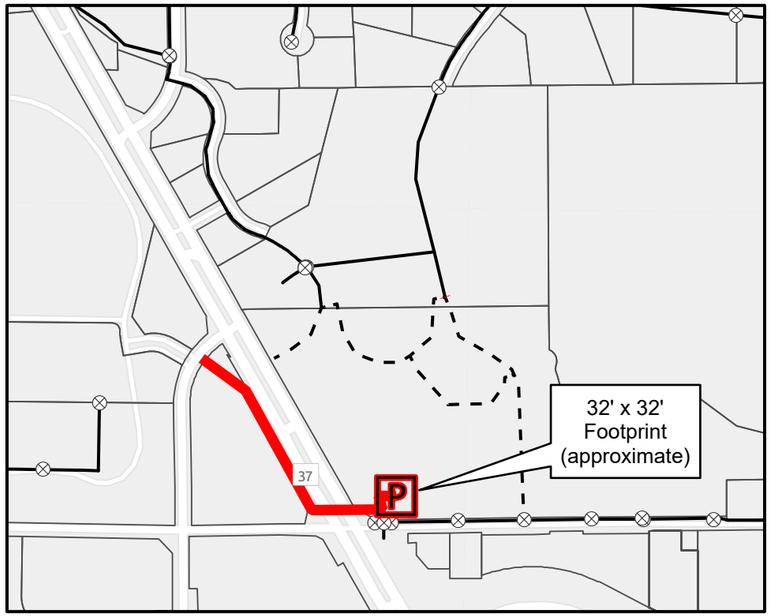
FIGURE NO.
29

PLOT INFO: Z:\2022\221812\CAD\GIS\Pro\Grand Rapids DWSRF Report Figures.aprx Layout: Figure 29 Potential Lead Service Lines Date: 3/2/2023 9:36 AM User: prbaskins





Inset Map #1
Scale 1" = 500'



Inset Map #2
Scale 1" = 1,000'

LEGEND

- Proposed Pump Station
- Water System Valve
- DWSRF Proposed Projects
- Water Mains
- Future Water Main Planned by City for Development

NORTH

CALEDONIA TWP CONNECTION

DATA SOURCES: ESRI LIGHT GRAY BASE & CITY OF GRAND RAPIDS GIS.

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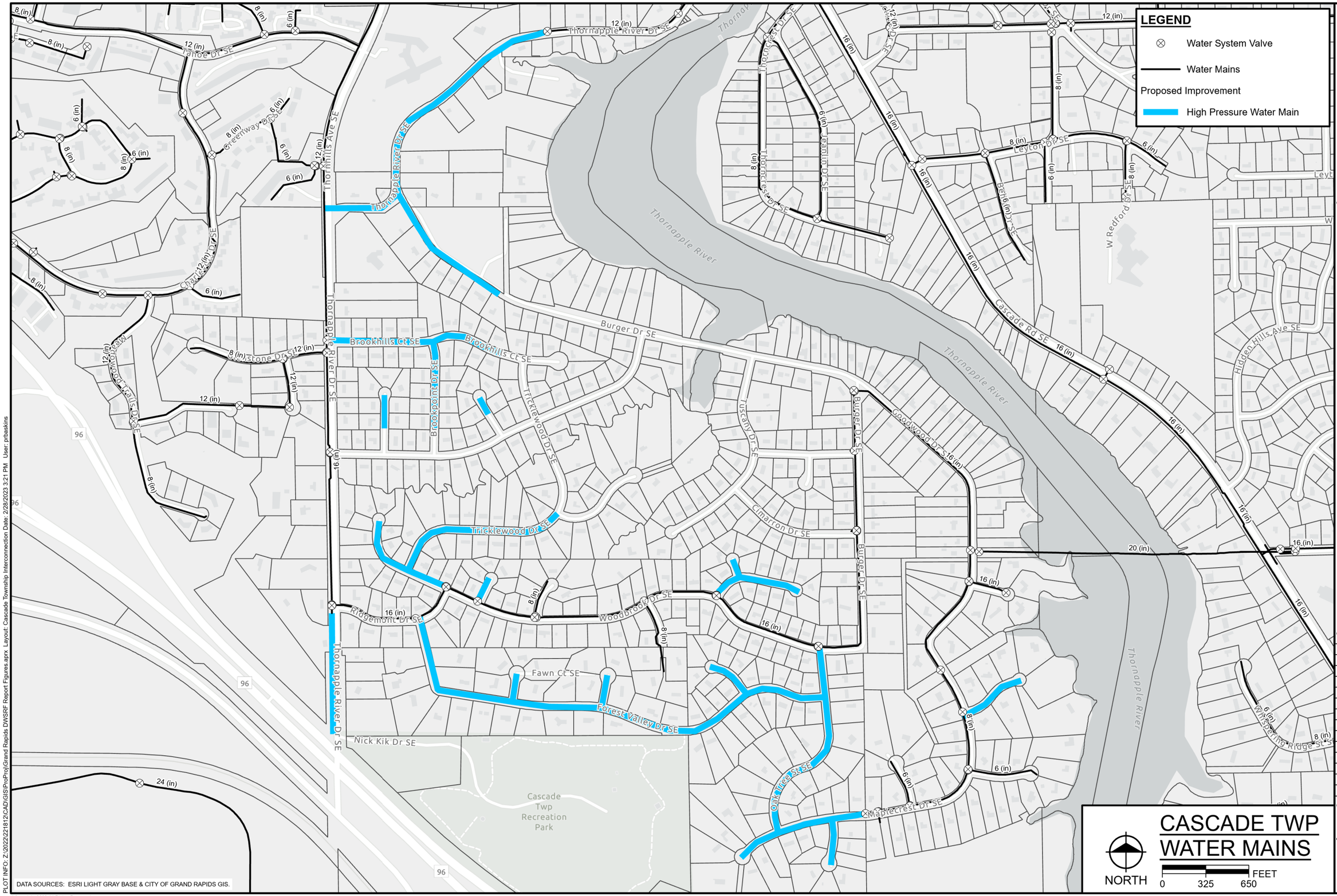
PROJECT NO.
221812

FIGURE NO.
30



DATA SOURCES: ESRI LIGHT GRAY BASE & CITY OF GRAND RAPIDS GIS.

NORTH

CASCADE TWP WATER MAINS

0 325 650 FEET

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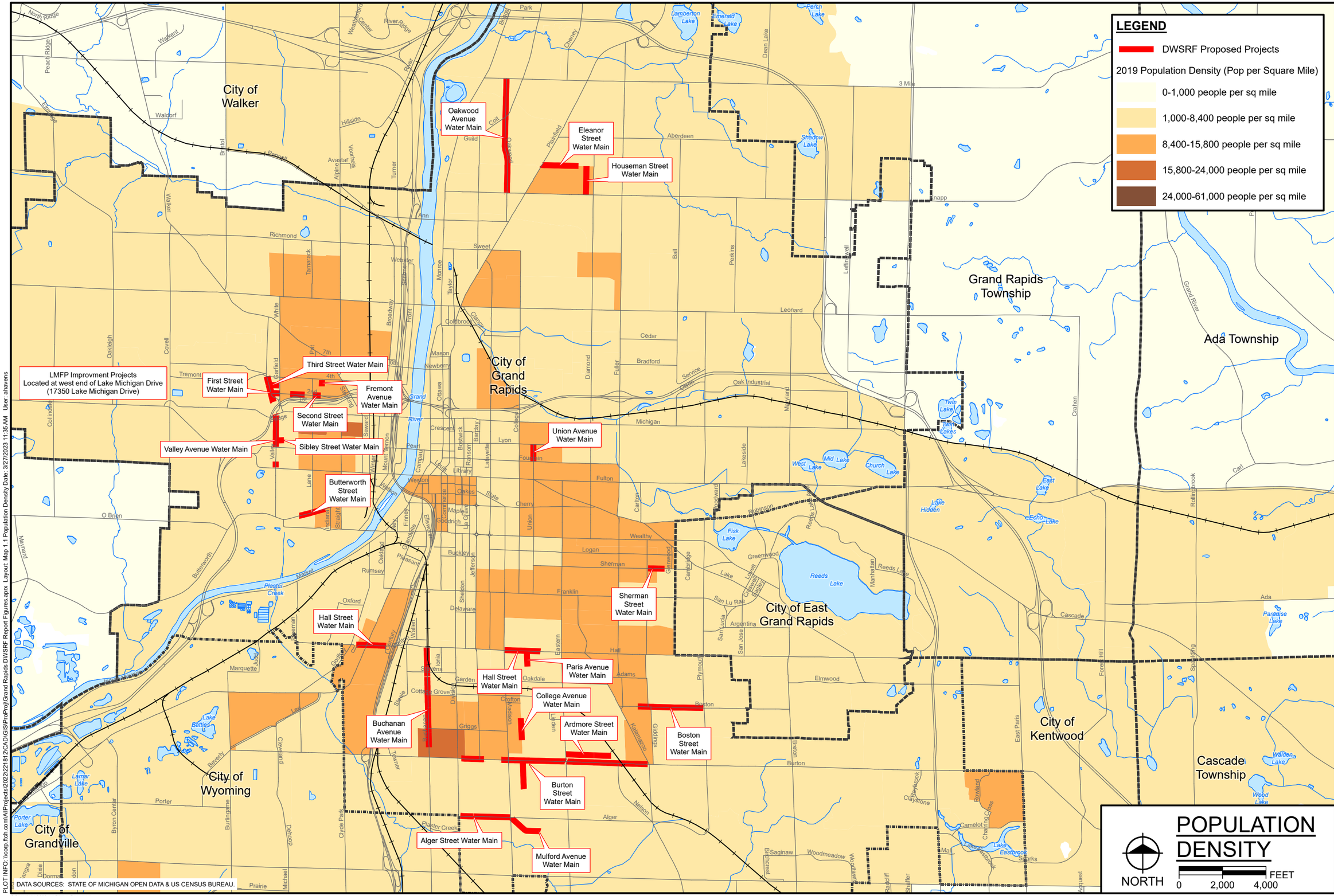
PROJECT NO.
221812

FIGURE NO.
31

PLOT INFO: Z:\2022\221812\CAD\GIS\ProjProj\Grand Rapids DWSRF Report Figures.aprx Layout: Cascade Township Interconnection Date: 2/28/2023 3:21 PM User: ptbaskins

Maps



PLOT INFO: \\corp.fish.com\AllProjects\2022\221812\CAD\GIS\ProPro\[Grand Rapids DWSRF Report Figures.aprx - Layout: Map 1.1 Population Density Date: 3/27/2023 11:35 AM User: ahavens

DATA SOURCES: STATE OF MICHIGAN OPEN DATA & US CENSUS BUREAU.

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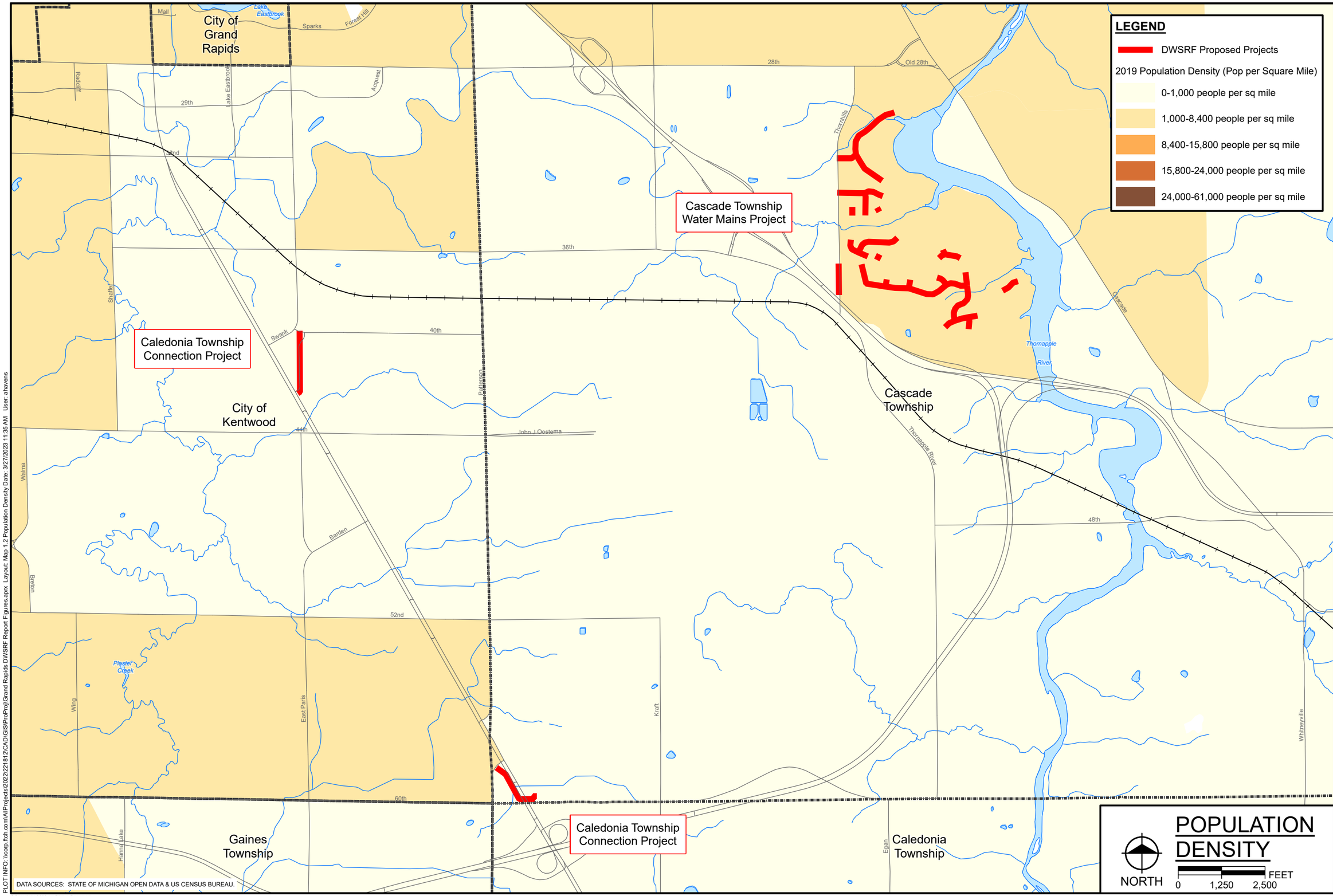
PROJECT NO.
221812

MAP NO.
1.1



DATA SOURCES: STATE OF MICHIGAN OPEN DATA & US CENSUS BUREAU.

PLOT INFO: \\corp.ftch.com\AllProjects\2022\221812\CAD\GIS\ProProj\Grand Rapids DWSRF Report Figures.aprx Layout: Map 1.2 Population Density Date: 3/27/2023 11:35 AM User: ahavens

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POPULATION DENSITY

PROJECT NO.
221812

MAP NO.
1.2

LMFP Improvment Projects
Located at west end of Lake Michigan Drive
(17350 Lake Michigan Drive)

Third Street Water Main
First Street Water Main
Fremont Avenue Water Main
Second Street Water Main
Valley Avenue Water Main
Sibley Street Water Main
Butterworth Street Water Main
Hall Street Water Main
Buchanan Avenue Water Main
Oakwood Avenue Water Main
Eleanor Street Water Main
Houseman Street Water Main
Union Avenue Water Main
Sherman Street Water Main
Hall Street Water Main
Paris Avenue Water Main
College Avenue Water Main
Ardmore Street Water Main
Boston Street Water Main
Burton Street Water Main
Alger Street Water Main
Mulford Avenue Water Main

City of Walker
City of Grand Rapids
Grand Rapids Township
City of East Grand Rapids
City of Kentwood
Cascade Township
City of Wyoming
City of Grandville

LEGEND

- DWSRF Proposed Projects
- Open Water
- Developed Open Space
- Developed Low Intensity
- Developed Medium Intensity
- Developed High Intensity
- Barren Land
- Deciduous Forest
- Evergreen Forest
- Mixed Forest
- Shrub/Scrub
- Grassland/Herbaceous
- Pasture/Hay
- Cultivated Crops
- Woody Wetlands
- Emergent Herbaceous Wetlands

DATA SOURCES: STATE OF MICHIGAN OPEN DATA & NATIONAL LAND COVER DATABASE.

NORTH

0 2,000 4,000 FEET

EXISTING LAND USE

PROJECT NO. 221812

MAP NO. 2.1

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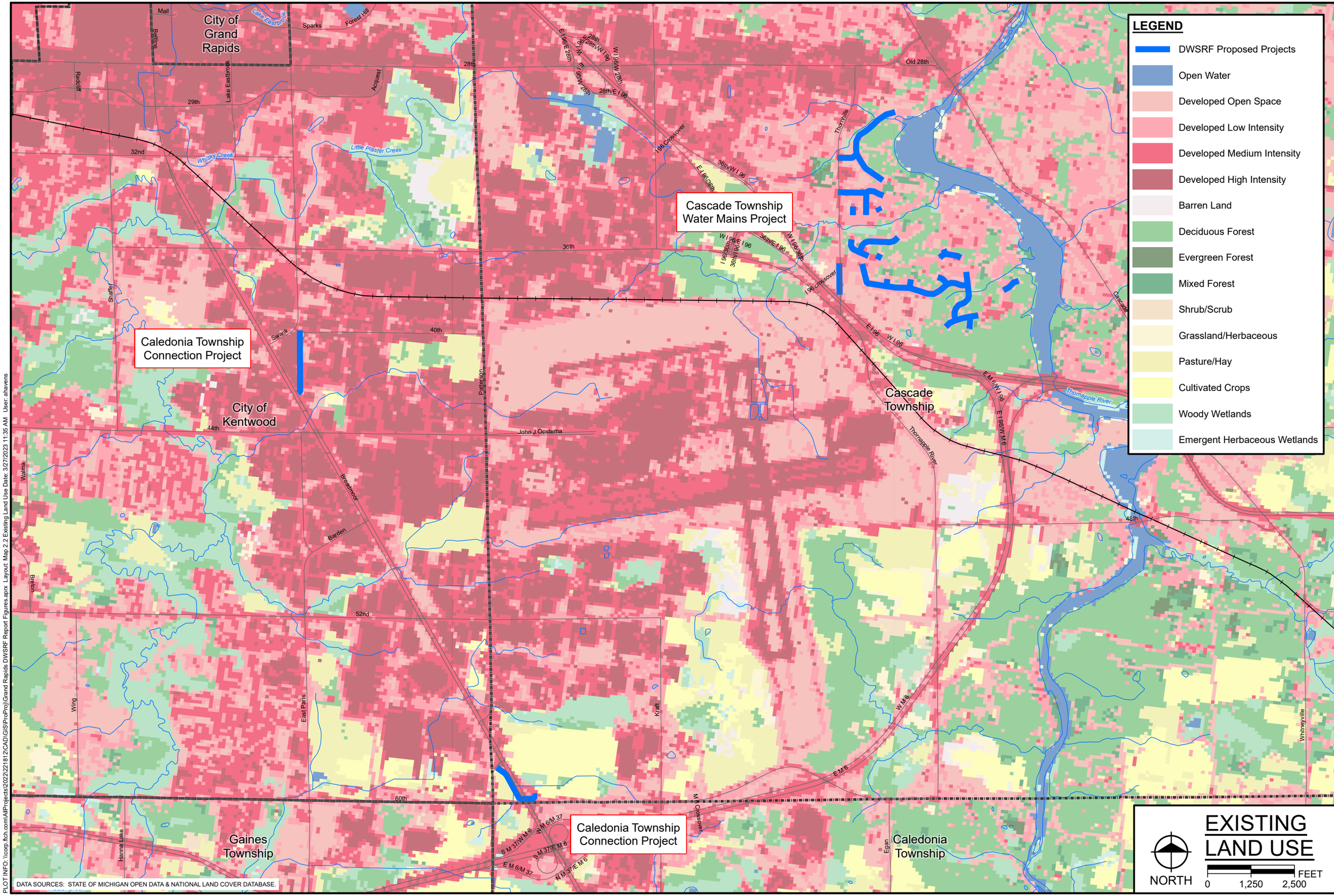
PLOT INFO: \\corp.fish.com\AllProjects\2022\221812\CAD\GIS\ProPro\Grand Rapids DWSRF Report Figures.aprx Layout: Map 2.1 Existing Land Use Date: 3/27/2023 11:35 AM User: ahavens



LEGEND

- DWSRF Proposed Projects
- Open Water
- Developed Open Space
- Developed Low Intensity
- Developed Medium Intensity
- Developed High Intensity
- Barren Land
- Deciduous Forest
- Evergreen Forest
- Mixed Forest
- Shrub/Scrub
- Grassland/Herbaceous
- Pasture/Hay
- Cultivated Crops
- Woody Wetlands
- Emergent Herbaceous Wetlands

NORTH

EXISTING LAND USE

0 1,250 2,500 FEET

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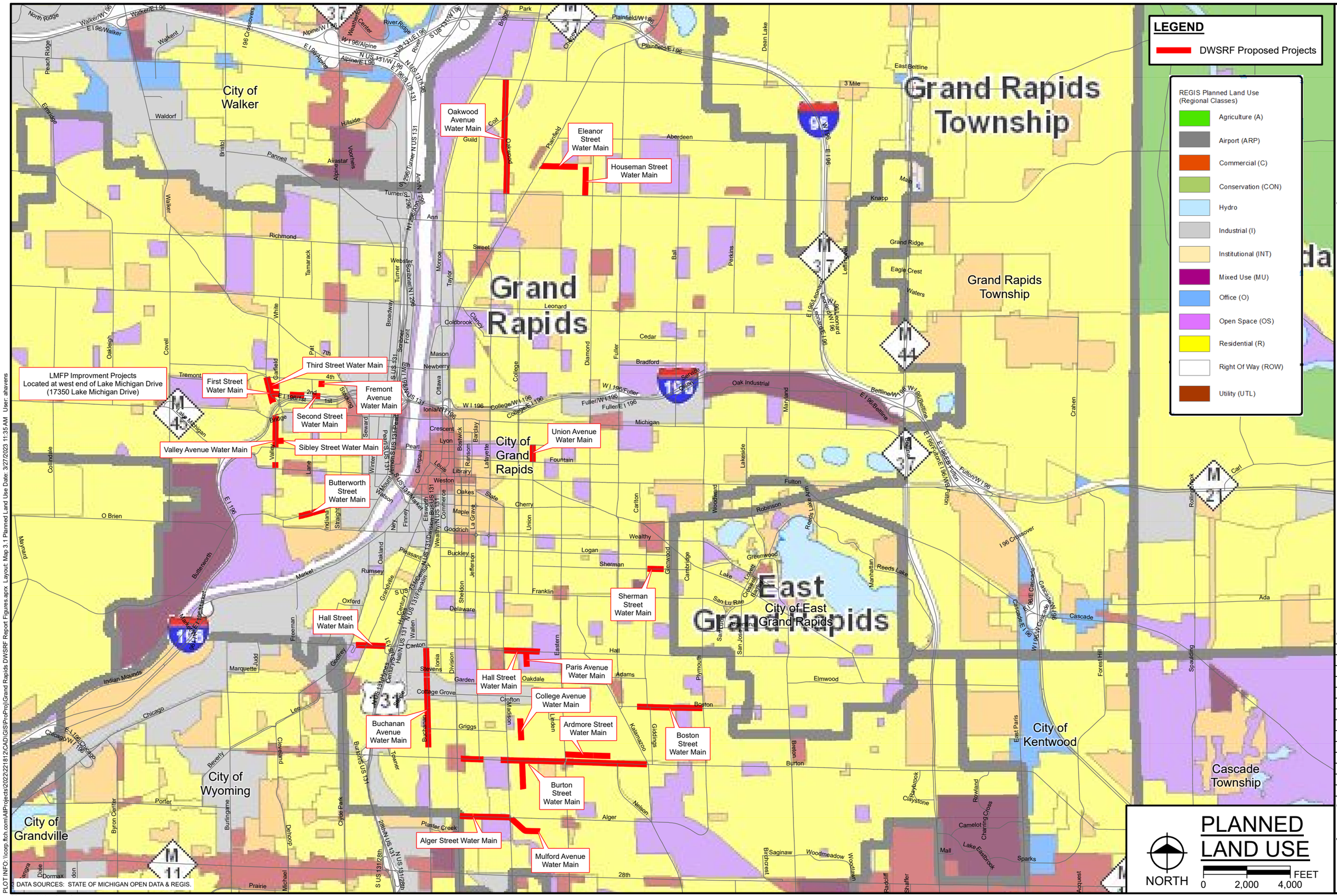
PROJECT NO.
221812

MAP NO.
2.2

PLOT INFO: \\corp.fbch.com\All\Projects\2022\221812\CAD\GIS\ProPro\Grand Rapids DWSRF Report Figures.aprx Layout: Map 2.2 Existing Land Use Date: 3/27/2023 11:35 AM User: ahavens



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PROJECT NO.
221812

MAP NO.
3.1

PLOT INFO: \\corp.fich.com\AllProjects\2022\221812\CADGIS\ProPro\Grand Rapids DWSRF Report Figures.aprx Layout: Map 3.1 Planned Land Use Date: 3/27/2023 11:35 AM User: ahavens

DATA SOURCES: STATE OF MICHIGAN OPEN DATA & REGIS.

Cascade Township

City of Grand Rapids

City of Kentwood

Kentwood

Cascade Township

Gaines Township

Caledonia Township

Gerald R. Ford International Airport

Cascade Township Water Mains Project

Caledonia Township Connection Project

Caledonia Township Connection Project

Mall
Sparks
Forest Hill
Bellline
Radcliff
Lake Eastbrook
Aquest
29th
32nd
Shaffer
Swank
40th
44th
Patterson
John J Oostema
Walma
Broadmoor
Barden
Burton
52nd
Wing
East Paris
Kraft
60th
Hanna Lake
Old 28th
Thornhills
196 Crossover
36th/W I 196
E I 196/36th
36th/E I 196
W I 196/36th
E I 196
W I 196
Cascade
E M 6/W I 96
E I 96/W M 6
Thornapple River
48th
W M 6
E M 6
M 6 Crossover
Whitneyville
S M 37/W M 6
W M 6/M 37
S M 37/E M 6
E M 6/M 37
N M 37/E M 6
Egan

M 11
M 37
M 6

LEGEND

DWSRF Proposed Projects

REGIS Planned Land Use (Regional Classes)

- Agriculture (A)
- Airport (ARP)
- Commercial (C)
- Conservation (CON)
- Hydro
- Industrial (I)
- Institutional (INT)
- Mixed Use (MU)
- Office (O)
- Open Space (OS)
- Residential (R)
- Right Of Way (ROW)
- Utility (UTL)

DATA SOURCES: STATE OF MICHIGAN OPEN DATA & REGIS.

PLOT INFO: \\corp.fich.com\AllProjects\2022\221812\CAD\GIS\ProProj\Grand Rapids DWSRF Report Figures.aprx Layout: Map 3.2 Planned Land Use Date: 3/27/2023 11:35 AM User: ahavens

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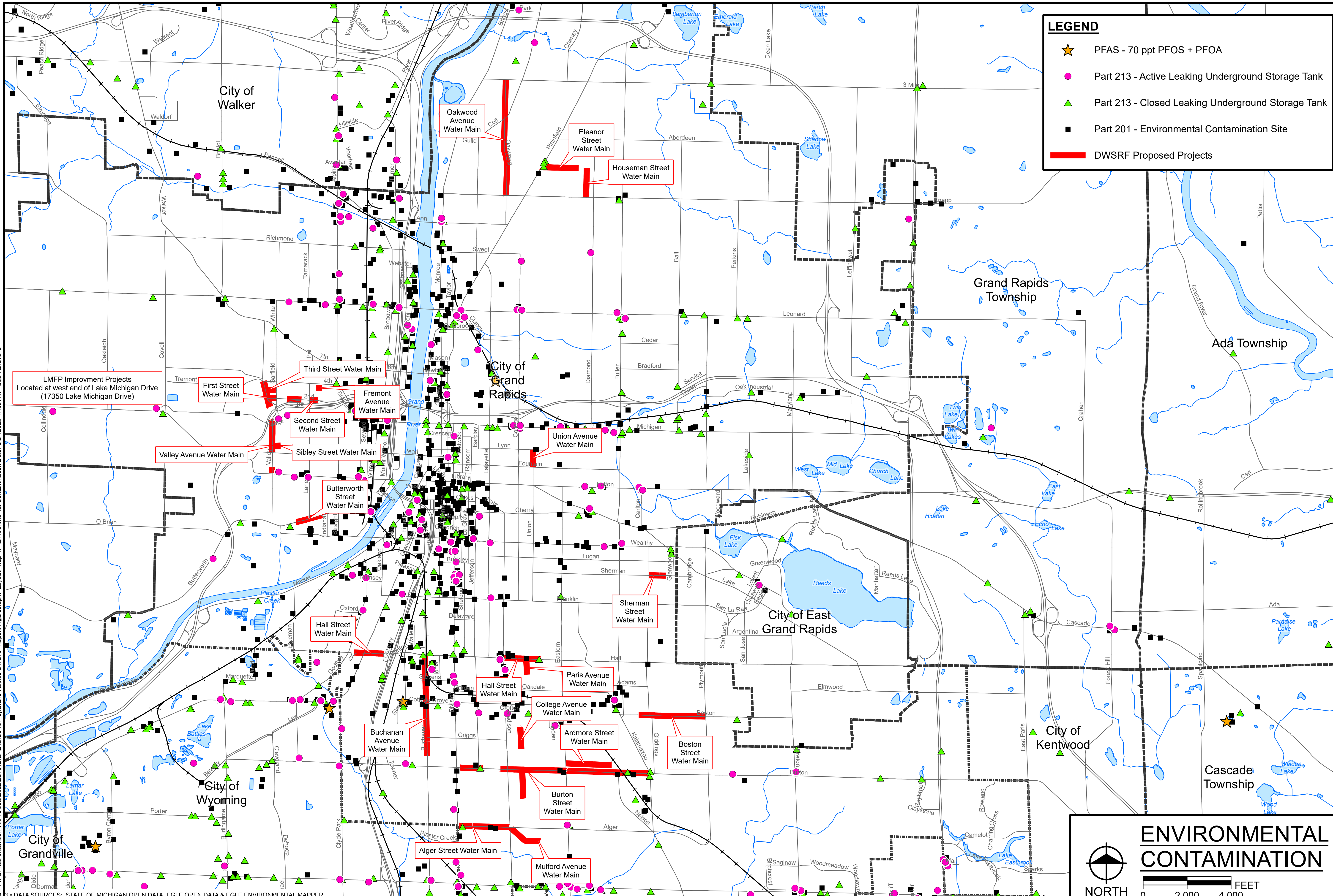
PLANNED LAND USE

NORTH

0 1,250 2,500 FEET

PROJECT NO. 221812

MAP NO. 3.2



ENVIRONMENTAL CONTAMINATION

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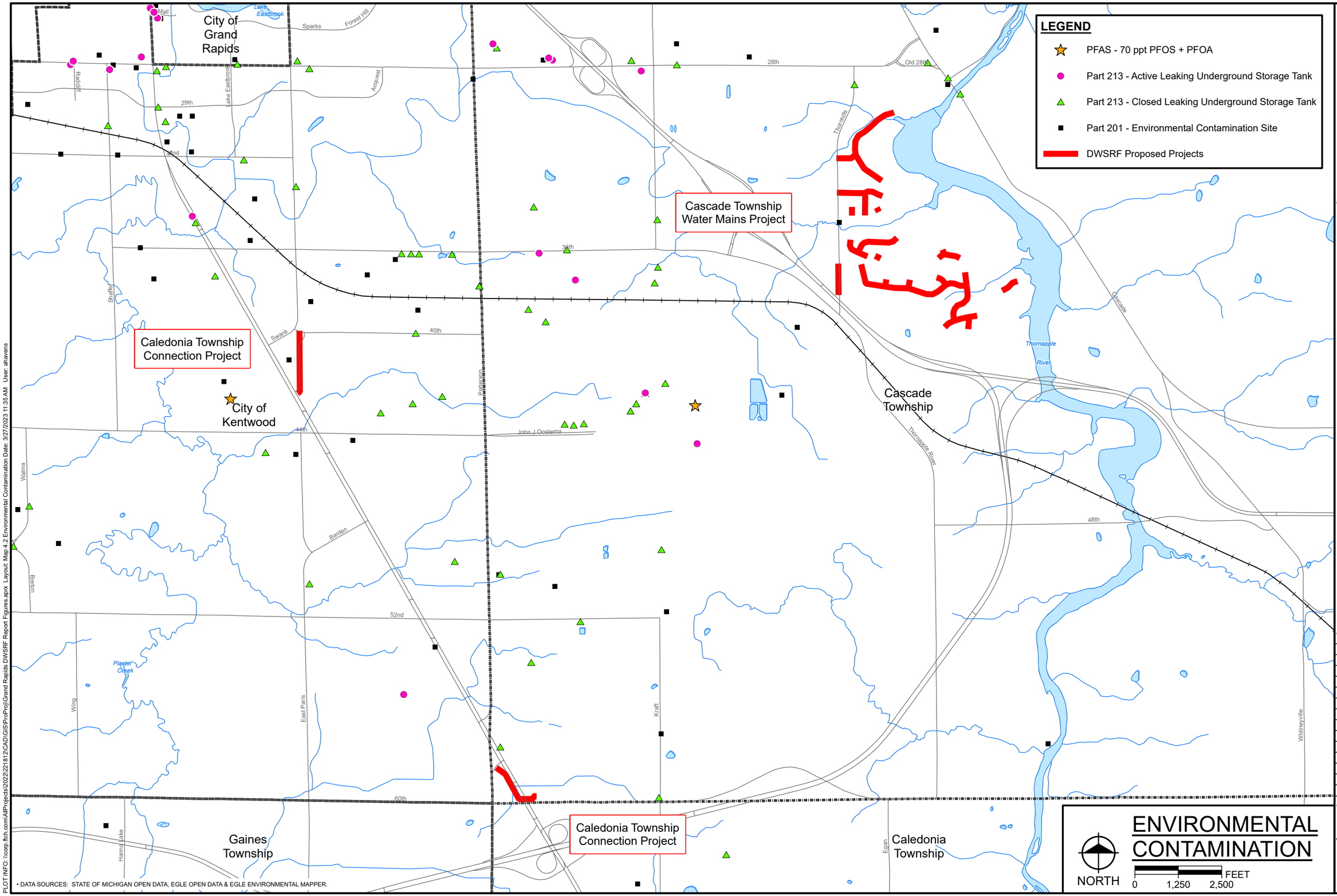
PROJECT NO.
221812

MAP NO.
4.1

• DATA SOURCES: STATE OF MICHIGAN OPEN DATA, EGLE OPEN DATA & EGLE ENVIRONMENTAL MAPPER.

PLOT INFO: \\corp.fth.com\AllProjects\2022\221812\CAD\GIS\ProProj\Grand Rapids DWSRF Report Figures.aprx Layout: Map 4.1 Environmental Contamination Date: 3/27/2023 11:35 AM User: ahavens



PLOT INFO: \\cop.fich.com\AllProjects\2022\221812\CAD\GIS\ProProj\Grand Rapids DWSRF Report Figures.aprx Layout: Map 4.2 Environmental Contamination Date: 3/27/2023 11:35 AM User: ahavens

• DATA SOURCES: STATE OF MICHIGAN OPEN DATA, EGLE OPEN DATA & EGLE ENVIRONMENTAL MAPPER.

ENVIRONMENTAL CONTAMINATION

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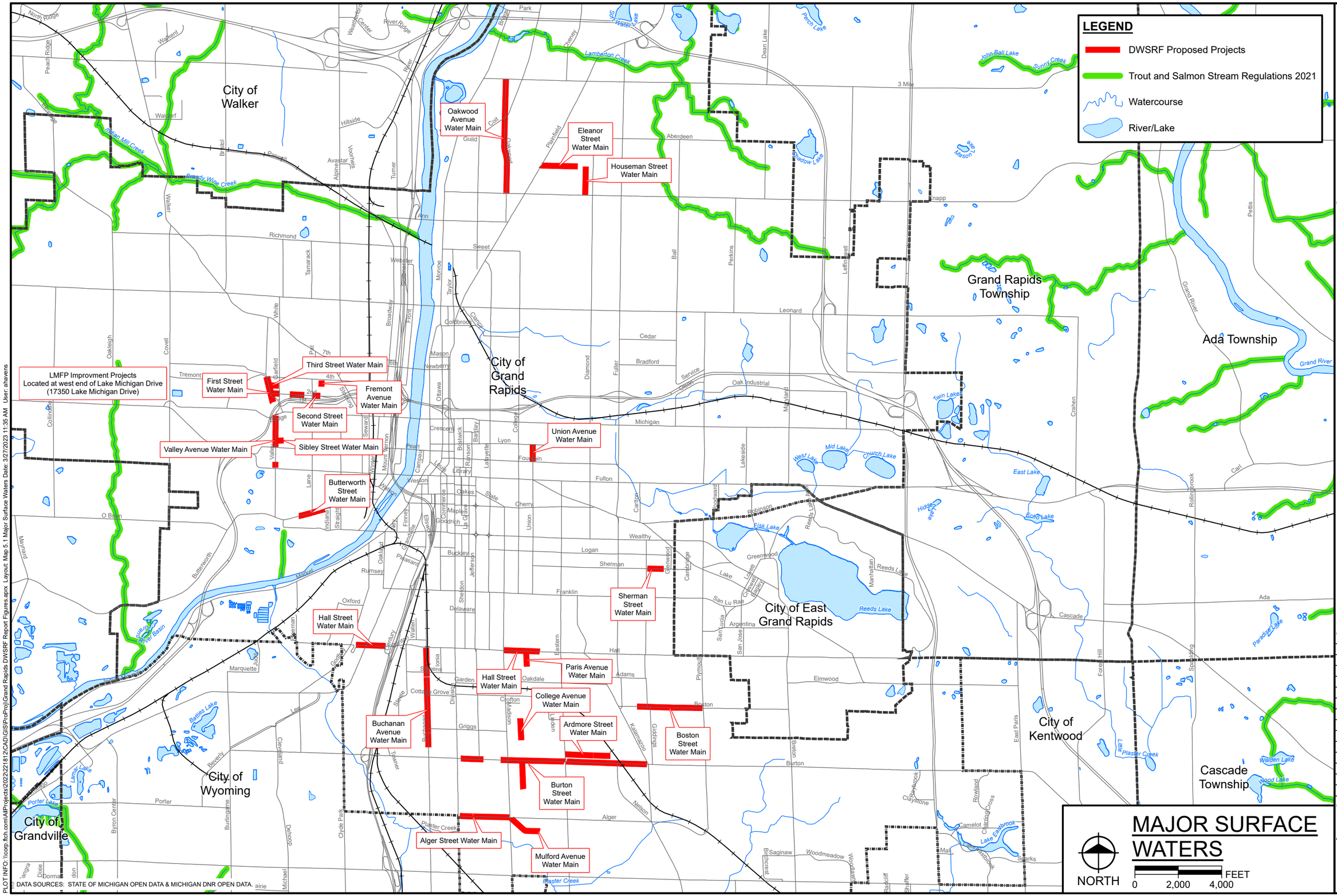
PROJECT NO.
221812

MAP NO.
4.2



MAJOR SURFACE WATERS

PLOT INFO: \\corp.ftch.com\AllProjects\2022\221812\CAD\GIS\ProPro\Grand Rapids DWSRF Report Figures.aprx Layout: Map 5.1 Major Surface Waters Date: 3/27/2023 11:35 AM User: ahavens

DATA SOURCES: STATE OF MICHIGAN OPEN DATA & MICHIGAN DNR OPEN DATA.

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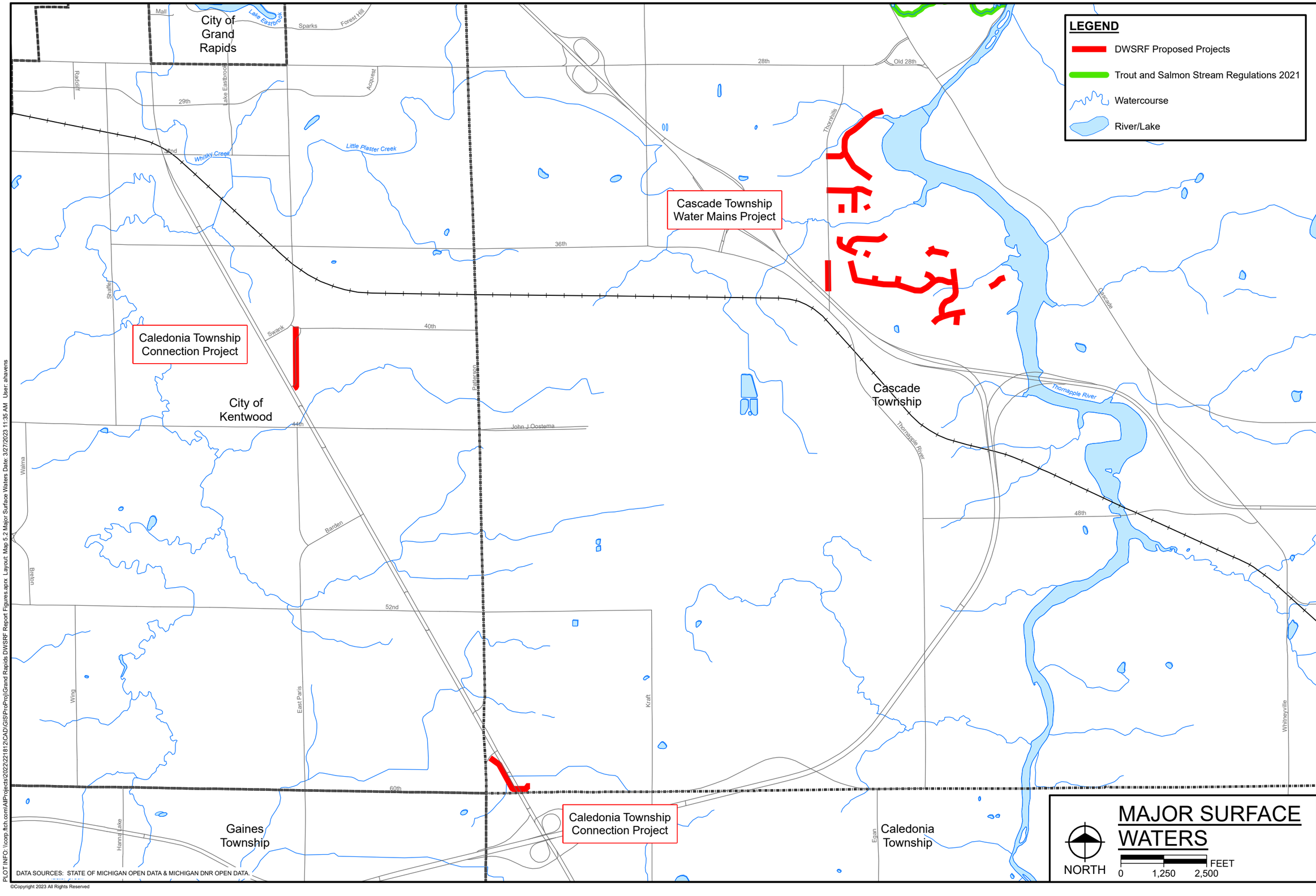
PROJECT NO.
221812

MAP NO.
5.1



PLOT INFO: \\corp.fish.com\All\Projects\2022\221812\CAD\GIS\ProPro\Grand Rapids DWSRF Report Figures.aprx Layout: Map 5.2 Major Surface Waters Date: 3/27/2023 11:35 AM User: ahavens

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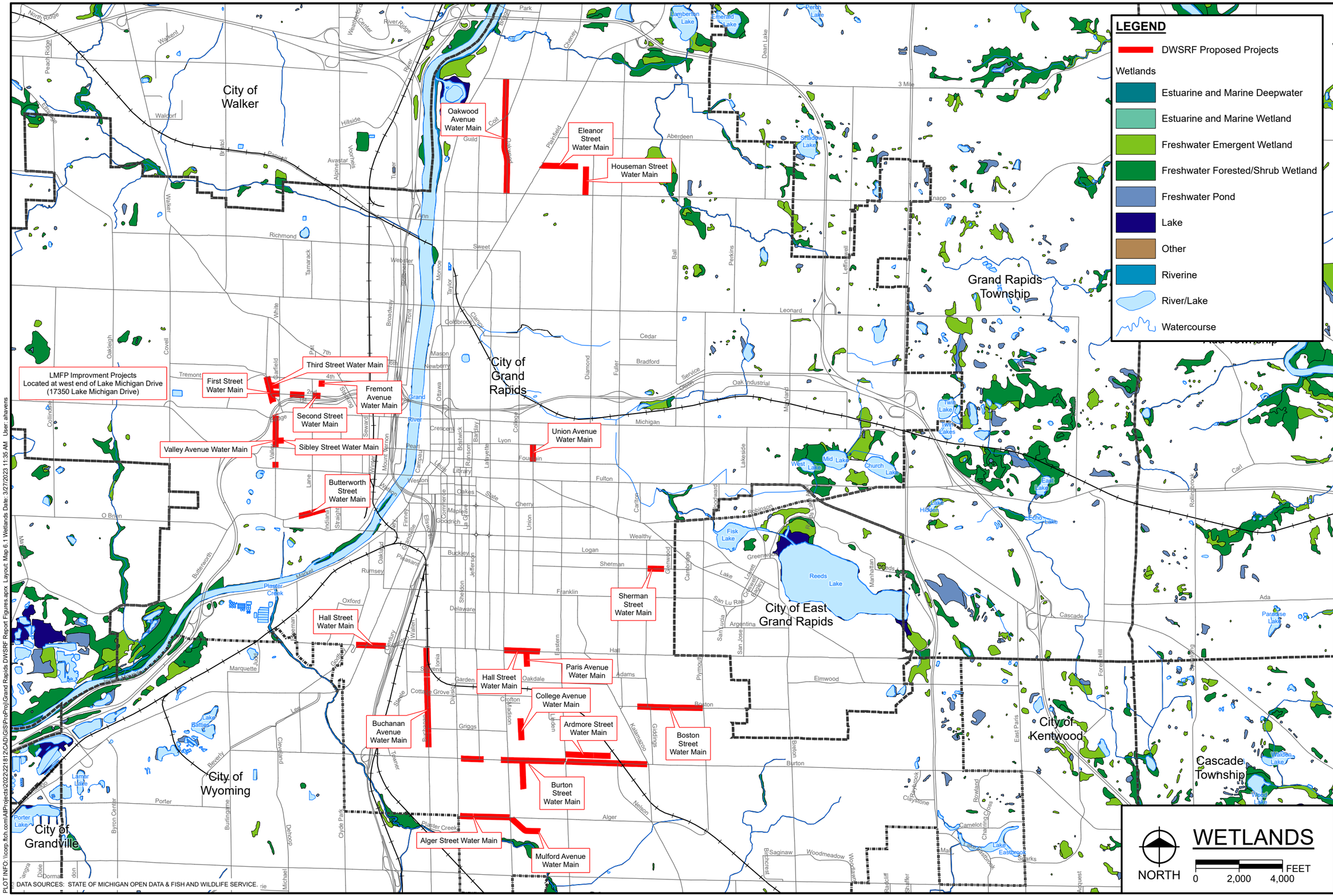
MAJOR SURFACE WATERS

PROJECT NO.
221812

MAP NO.
5.2



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Kent County, Michigan
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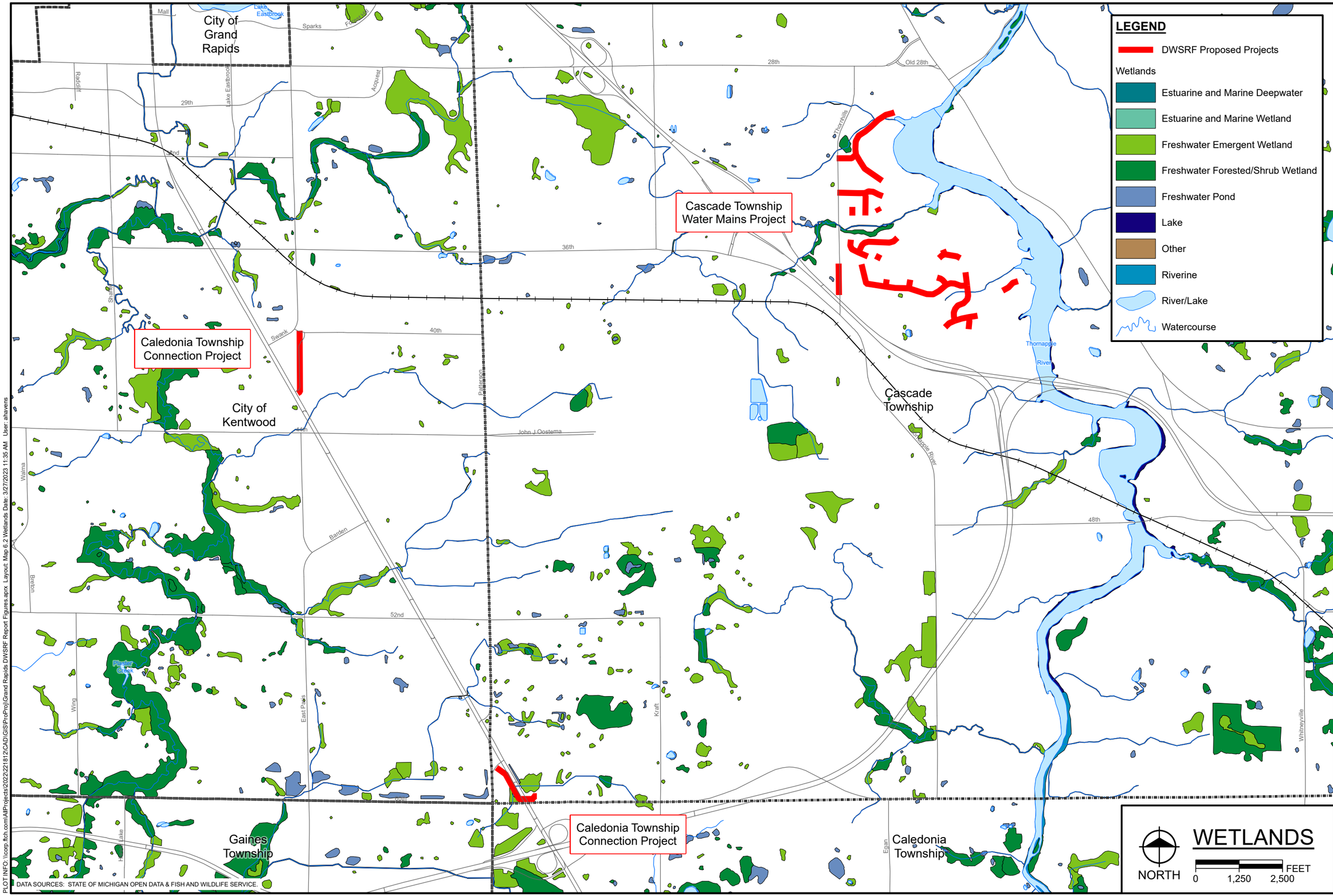
PROJECT NO.
221812

MAP NO.
6.1

PLOT INFO: \\corp.fish.com\All\Projects\2022\221812\CAD\GIS\ProPro\Grand Rapids DWSRF Report Figures.aprx Layout: Map 6.1 Wetlands Date: 3/27/2023 11:35 AM User: ahavens

DATA SOURCES: STATE OF MICHIGAN OPEN DATA & FISH AND WILDLIFE SERVICE.



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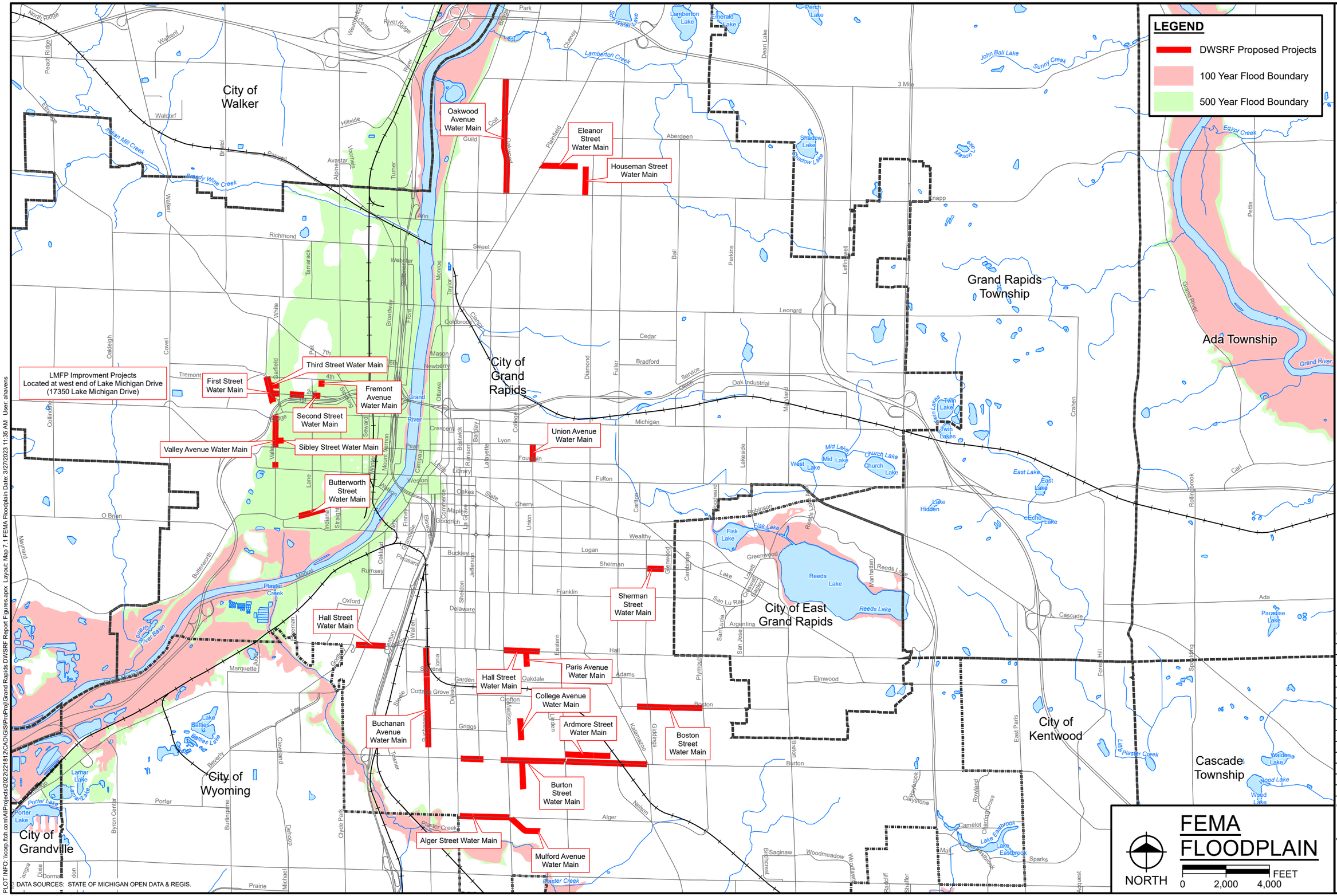
PROJECT NO.
221812

MAP NO.
6.2

PLOT INFO: \\corp.fich.com\AllProjects\2022\221812\CAD\GIS\ProProj\Grand Rapids DWSRF Report Figures.aprx Layout: Map 6.2 Wetlands Date: 3/27/2023 11:35 AM User: ahavens

DATA SOURCES: STATE OF MICHIGAN OPEN DATA & FISH AND WILDLIFE SERVICE.



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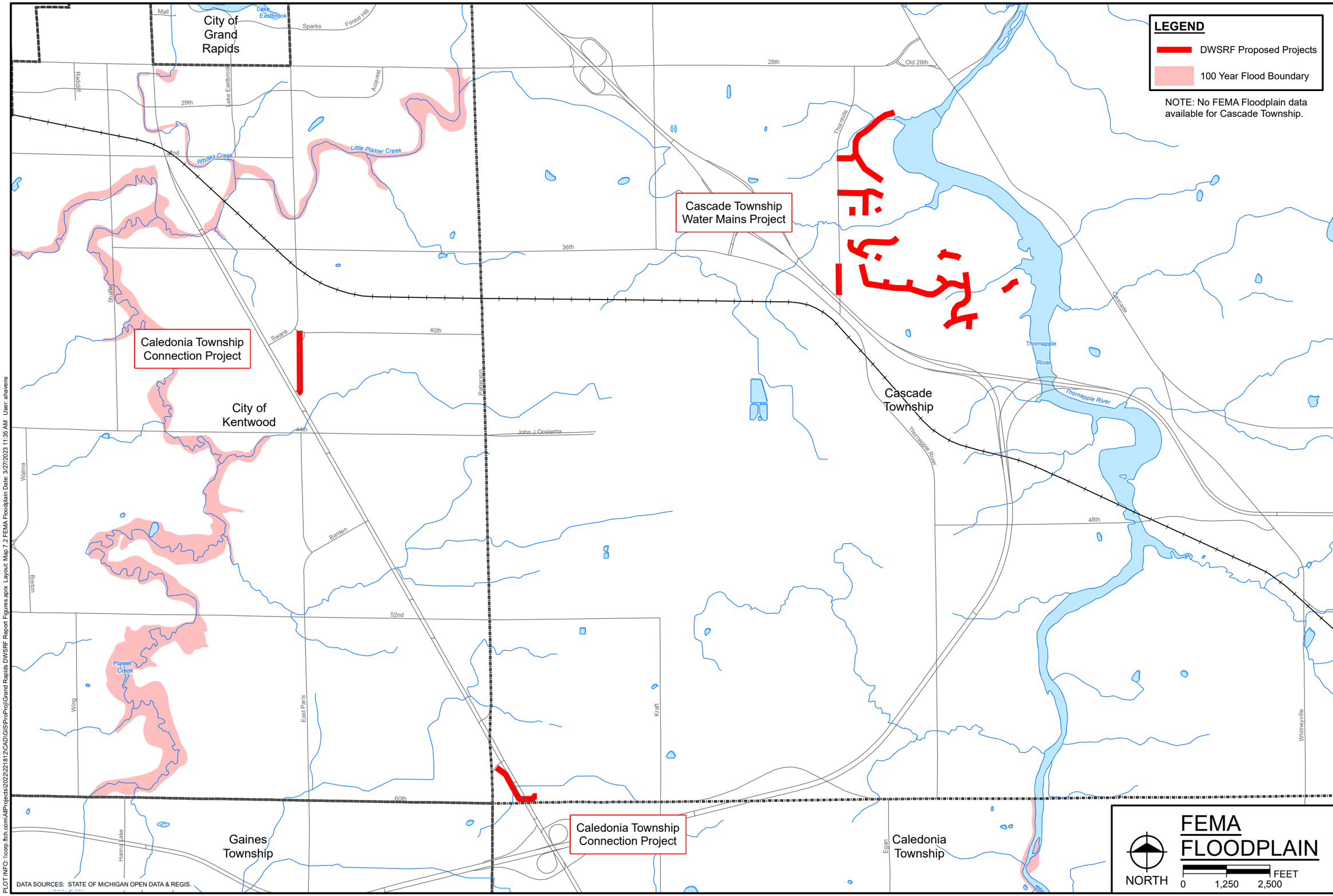
PROJECT NO.
221812

MAP NO.
7.1

PLOT INFO: \\corp.fbch.com\A\Projects\2022\221812\CAD\GIS\Pro\Grand Rapids DWSRF Report Figures.aprx Layout: Map 7.1 FEMA Floodplain Date: 3/27/2023 11:35 AM User: ahavens

DATA SOURCES: STATE OF MICHIGAN OPEN DATA & REGIS.



PLOT INFO: \\corp.fish.com\AllProjects\2022\221812\CAD\GIS\ProProj\Grand Rapids DWSRF Report Figures.aprx Layout: Map 7.2 FEMA Floodplain Date: 3/27/2023 11:35 AM User: ahavens

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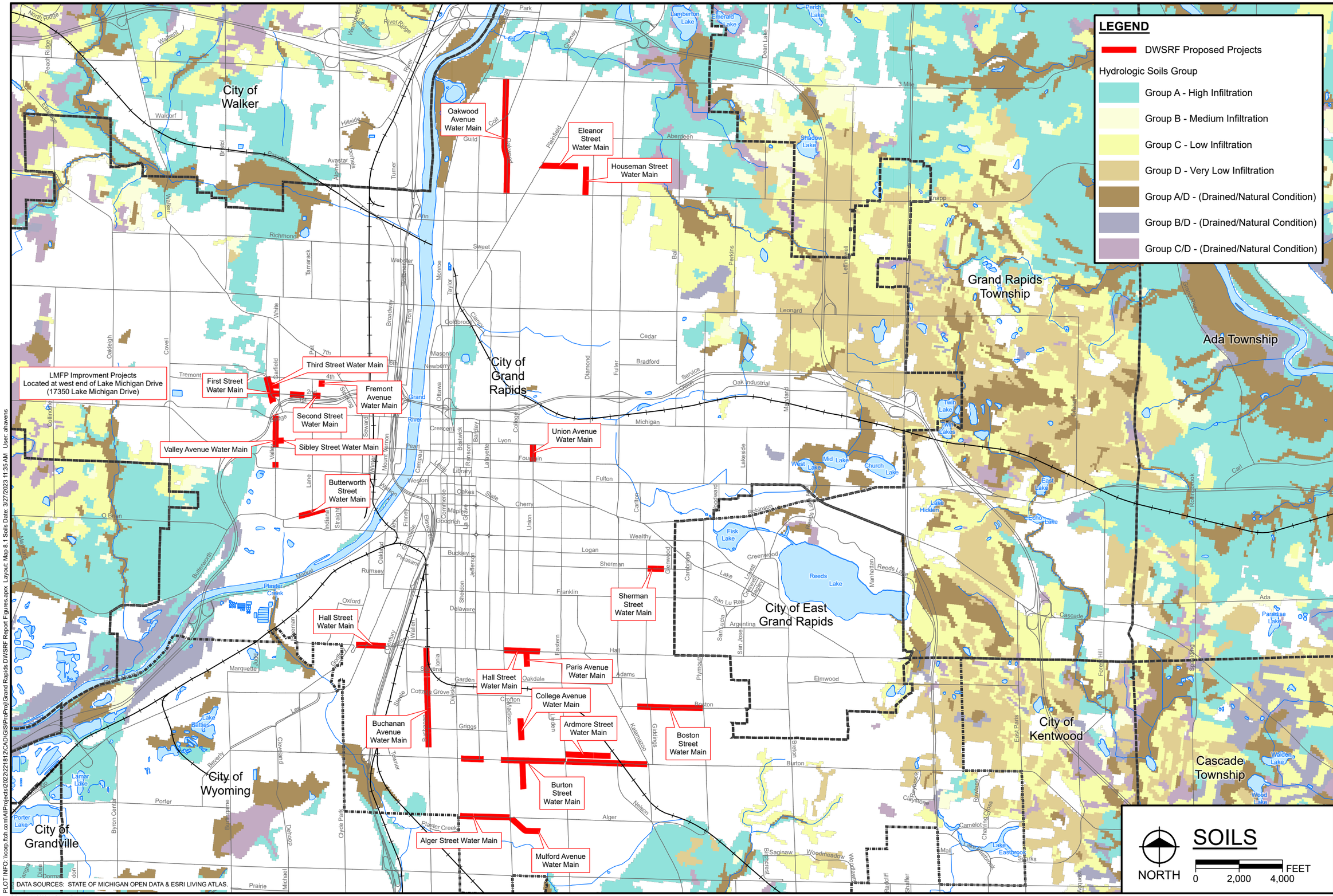
PROJECT NO.
221812

MAP NO.
7.2



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DATA SOURCES: STATE OF MICHIGAN OPEN DATA & ESRI LIVING ATLAS.

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PROJECT NO.
221812

MAP NO.
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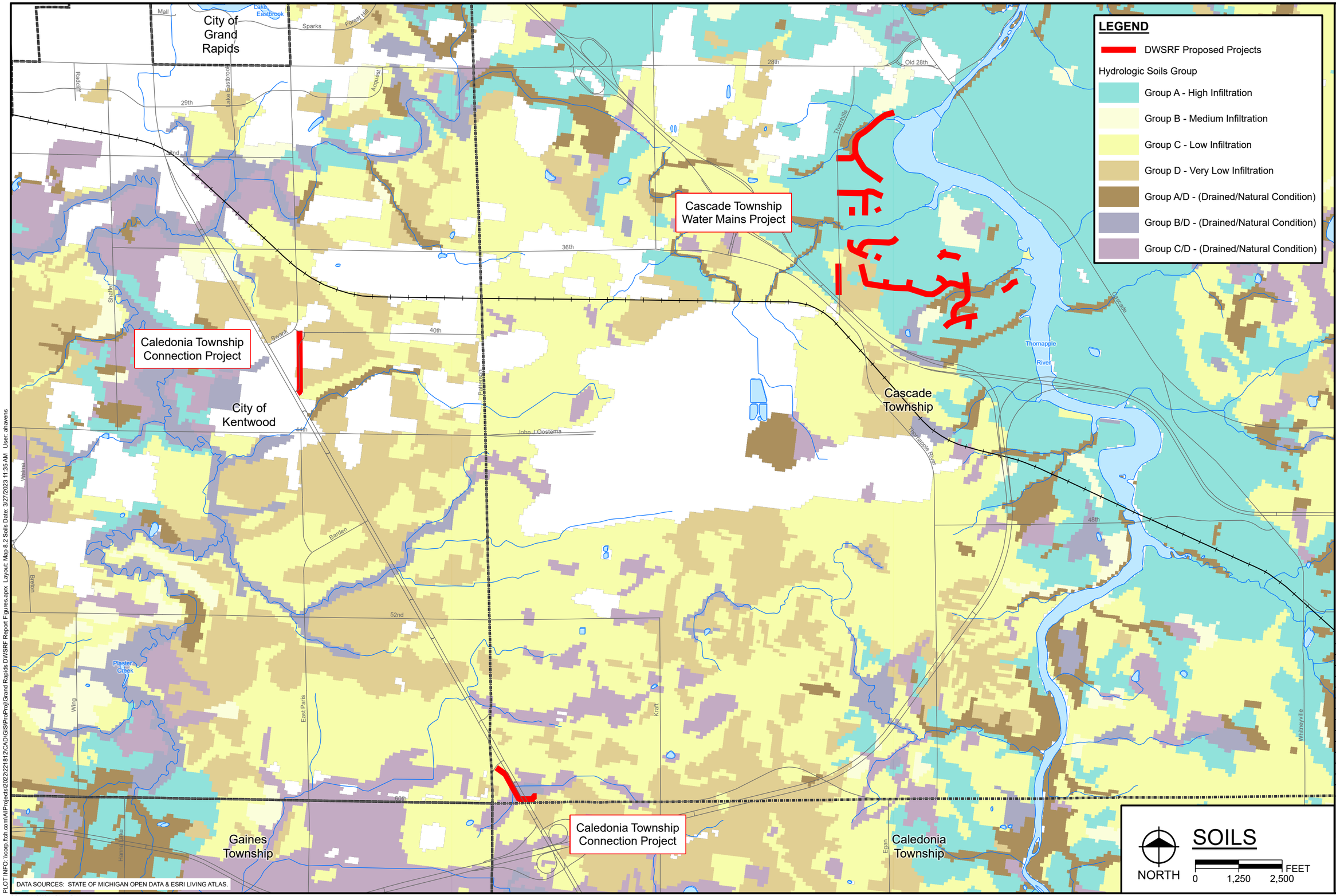

LEGEND

DWSRF Proposed Projects

Hydrologic Soils Group

- Group A - High Infiltration
- Group B - Medium Infiltration
- Group C - Low Infiltration
- Group D - Very Low Infiltration
- Group A/D - (Drained/Natural Condition)
- Group B/D - (Drained/Natural Condition)
- Group C/D - (Drained/Natural Condition)

NORTH

SOILS

0 1,250 2,500 FEET

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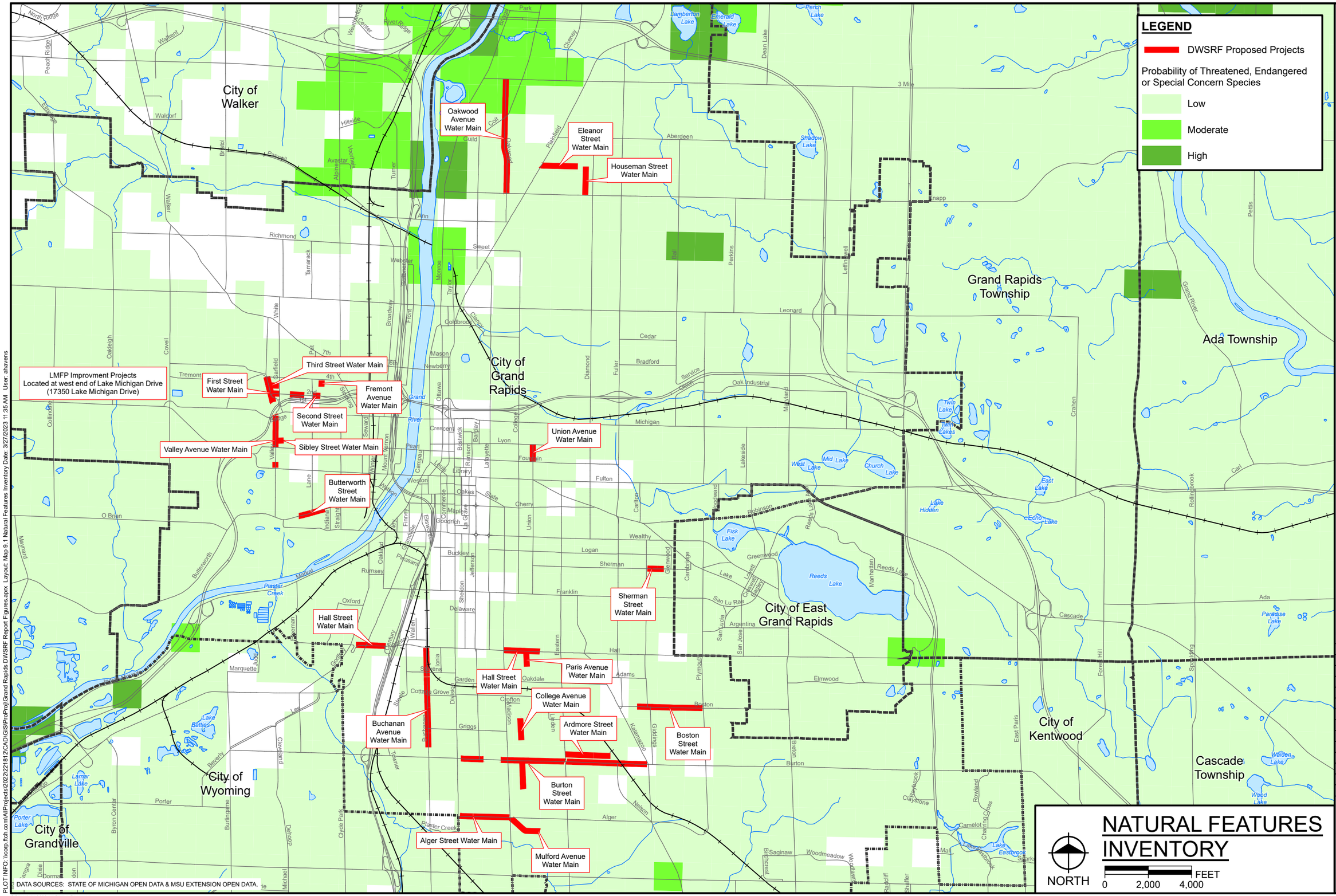

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DATA SOURCES: STATE OF MICHIGAN OPEN DATA & MSU EXTENSION OPEN DATA.

NORTH

0 2,000 4,000 FEET

NATURAL FEATURES INVENTORY

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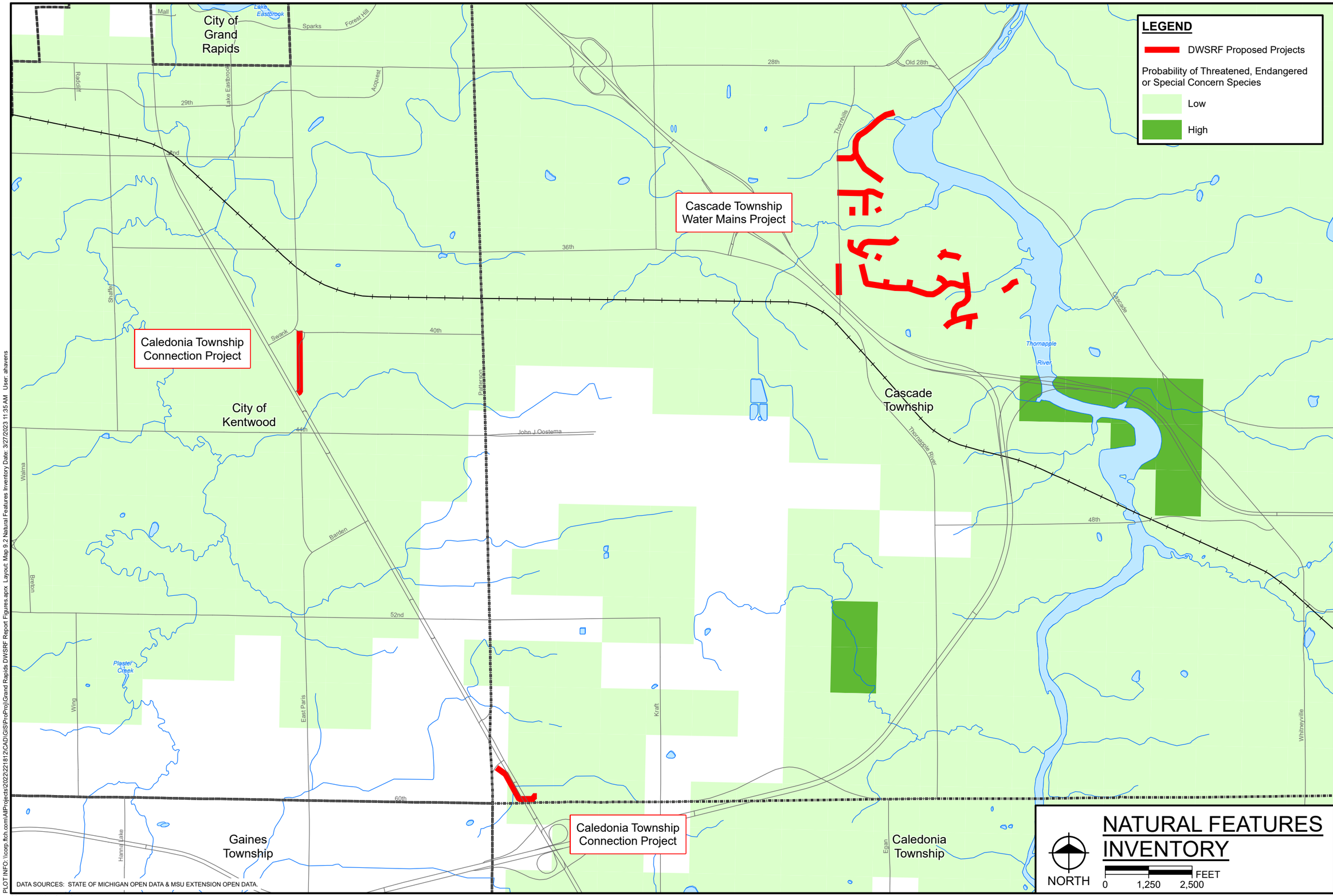

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NORTH

NATURAL FEATURES INVENTORY

0 1,250 2,500 FEET

PROJECT NO.
221812

MAP NO.
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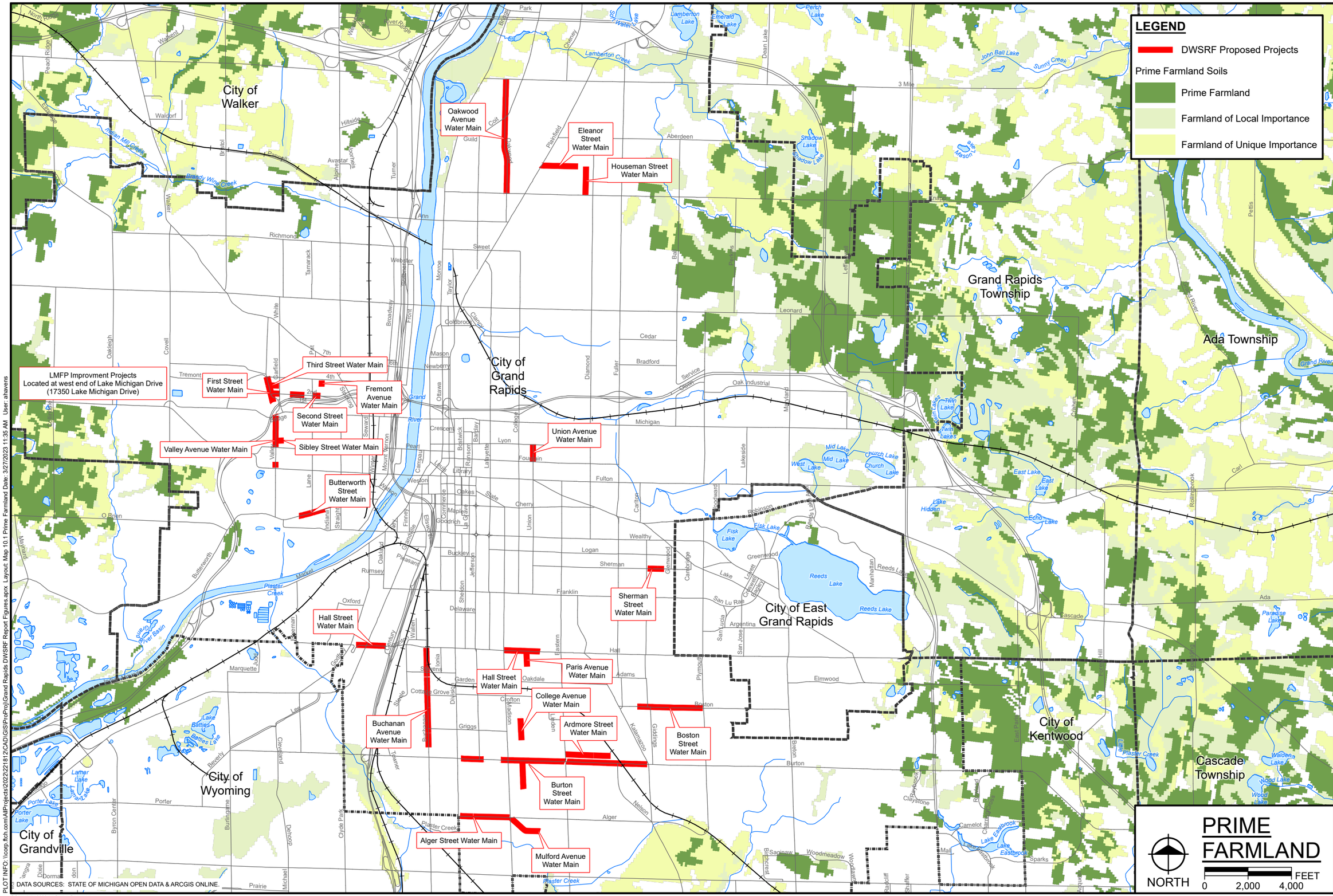

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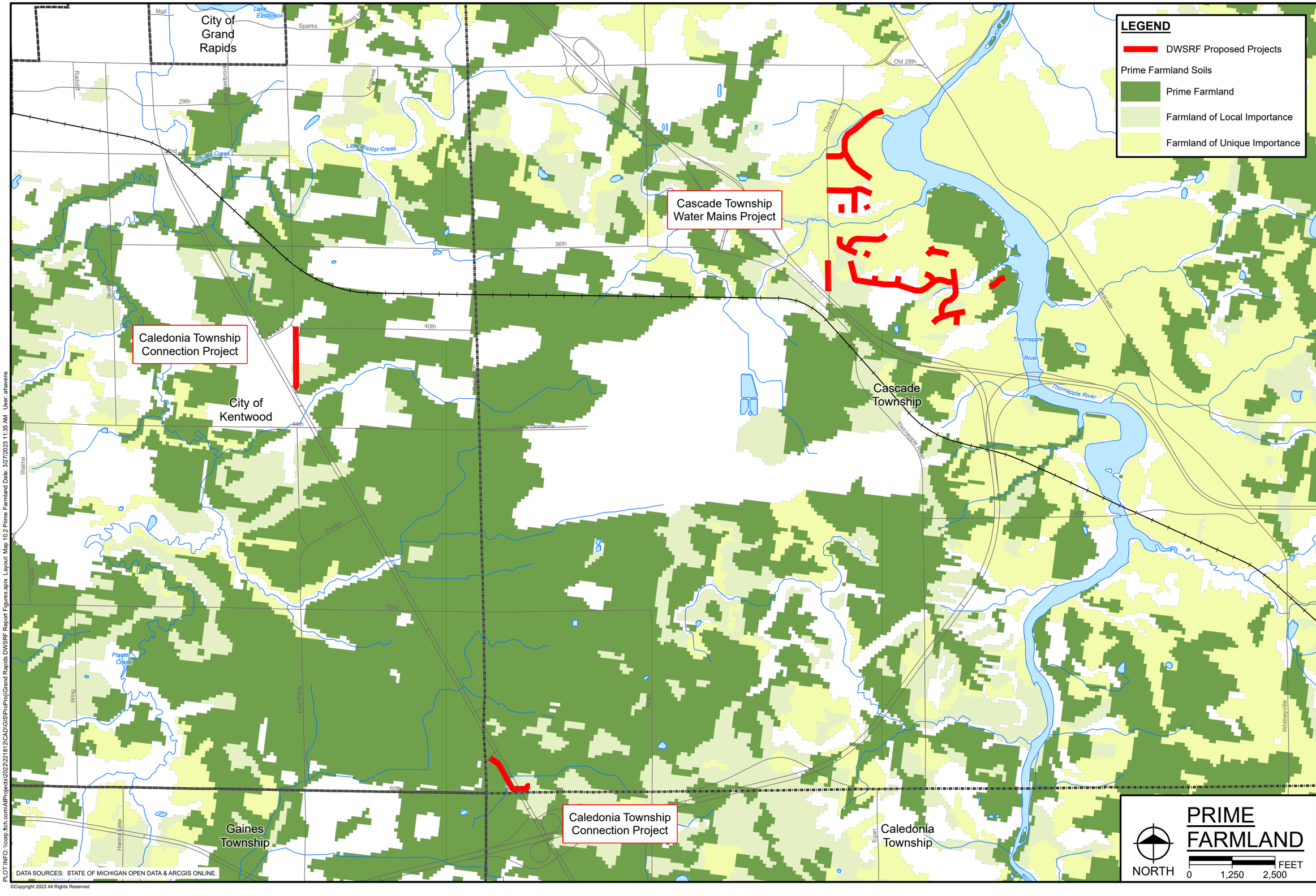
DATA SOURCES: STATE OF MICHIGAN OPEN DATA & ARCGIS ONLINE.



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MAP NO.
10.2

DATA SOURCES: STATE OF MICHIGAN OPEN DATA & ARCGIS ONLINE.

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Appendix 1

City of Grand Rapids

2024 DWRF Planning Document

Lake Michigan Filtration Plant

Project 221812

Facilities Summary at Lake Michigan Filtration Plant

Lake Michigan Intakes

1. North, Intake 1 (Constructed 1939)
   - a. Pipe size, inches: 54
   - b. Pipe material: Steel
   - c. Pipe length, feet (ft): 6,100
   - d. Crib: 36 ft x 36 ft x10 ft timber
   - e. Reported capacity (mgd): 56
   - f. Mussel control: Crib chlorination, bronze bar racks
   - g. Typical Use: Winter with North Low Lift Station
2. South, Intake 2 (Constructed 1992)
   - a. Pipe size, in: 66
   - b. Pipe material: Concrete
   - c. Pipe length, ft: 4,850
   - d. Crib: 62 ft diameter x 11 ft (12-sided timber)
   - e. Reported capacity, mgd: 111
   - f. Mussel control: Crib chlorination; Copper sheathed inlet timbers
   - g. Typical Use: Summer with South Low Lift Station

Low Lift Pumping Stations

1. North Low Lift Pumping Station (Constructed 1939)
   - a. Screen
     - 1) Number: 1
     - 2) Type: Manual winch lift
     - 3) Overall size: 60 inch x 60 inch
     - 4) Opening size: 7/8 inch
     - 5) Cleaning frequency: Approx. monthly
   - b. Number of pumps: 4
   - c. Pump Type: Constant speed vertical centrifugal
   - d. Capacities/ motor power
     - 1) Low Lift Pump 1: 25.0 mgd, 300 horsepower (HP)
     - 2) Low Lift Pump 2: 38.5 mgd, 600 HP
     - 3) Low Lift Pump 3: 38.5 mgd, 600 HP
     - 4) Low Lift Pump 4: 45.0 mgd, 700 HP
   - e. Discharge Pipe
     - 1) Size, in.: 46
     - 2) Approx. length, ft: 2,000
     - 3) Flow metering: 48-inch Venturi meter in vault
2. South Low Lift Pumping Station (Constructed 1992)

a. Screens
   1) Number — 2
   2) Type — Electric winch lift
   3) Overall size — 7 ft – 6 inches x 13 ft - 6 inches
   4) Cleaning frequency — Weekly
b. Number of pumps — 3
c. Pump Type — Vertical mixed flow
d. Capacities/ motor power
   1) Low Lift Pump 5 (Variable Speed) — 61.9 mgd — 900 horsepower (HP)
   2) Low Lift Pump 6 (Constant speed) — 46.7 mgd — 600 HP
   3) Low Lift Pump 7 (Constant Speed) — 46.7 mgd — 600 HP
e. Discharge Pipe
   1) Size, in. — 60
   2) Approx. length, ft. — 1,300
   3) Flow metering — 60 inch Venturi meter in vault

B. Rapid Mixing
1. Rapid Mixing Facility 1 (Upstream of East Pretreatment System, Constructed 1992)
   a. Number of tanks — 2
   b. Size, each
      1) Dimensions — 11 ft x 11 ft x 15.5 ft surface water depth (SWD)
      2) Volume, gal — 14,030
   c. Detention time at 64.0 mgd, sec — 37.9
   d. Mixers, each tank
      1) Type — Variable speed axial flow turbine
      2) Manufacturer and model — Philadelphia 38C5Q-PTC
      3) Motor horsepower — 10
      4) Mixer full speed, revolutions per minute (rpm) — 68
      5) Number of blades — 3
      6) Blade length, in. — 59
      7) Typical operating speed (%) — 70 – 100%
      8) Typical G value range, 1/sec — 137 - 235
2. Rapid Mixing Facility 2 (Upstream of Floc/Sed Basins, Constructed 1992)
   a. Number of Tanks — 2
   b. Size, each
      1) Dimensions — 13.25 ft x 13.25 ft x 15.75 ft SWD
      2) Volume, gal — 20,600
   c. Detention time at 85.2 mgd, second — 42
      Mixers, ea. Tank
      1) Type — Variable speed axial flow turbine
      2) Manufacturer and model — Philadelphia 38C5Q-PTC
      3) Motor HP — 15
      4) Mixer full speed, rpm — 86
      5) Number of blades — 3
      6) Blade length, in. — 65
      7) Typical operating speed (%) — 70 – 100%
      8) Typical G value range, 1/second — 204 - 349

C. West Flocculation Basins (Constructed 1992, Upgraded 2019/2020)

1. Number of basins	6 (Integral with Sedimentation Basins)
2. Rated capacity each, mgd	14.2
3. Total capacity, mgd	85.2
4. Size, each basin	
a. Dimensions	75 ft x 35 ft x 15.5 ft SWD
b. Volume, gal	304,342
5. Detention time at 14.2 mgd, min	30.9
6. Stage dimensions	
a. Stage 1	75 ft x 8 ft x 15.5 ft SWD
b. Stage 2	75 ft x 11 ft x 15.5 ft SWD
c. Stage 3	75 ft x 16 ft x 15.5 ft SWD
7. Horizontal velocity at 14.2 mgd, ft/min	1.13
8. Mixers	
a. Type	Horizontal shaft paddles-variable speed
b. Shafts per basin	5
c. Stages per basin/shaft	3
d. Approx. paddle sizes	
1) Stage 1	6 inch x 4.8 ft
2) Stage 2	6 inch x 9 ft
3) Stage 3	6 inch x 12 ft
e. Number of paddles per stage	
1) Stage 1	60 (12 per shaft)
2) Stage 2	30 (6 per shaft)
3) Stage 3	20 (4 per shaft)
f. Motor horsepower, each shaft	3 hp (single gearmotor per shaft)
g. Shaft speed range, rpm	0-4.49
h. Typical operating speed	60% (2.69 rpm)
i. Approx. 70 degree Fahrenheit G values at 3.00 rpm	
1) Stage 1, 1/sec	50
2) Stage 2, 1/sec	41
3) Stage 3, 1/sec	29
j. Approx. 33 degree Fahrenheit G values at 3.61 rpm	
1) Stage 1, 1/sec	50
2) Stage 2, 1/sec	41
3) Stage 3, 1/sec	29
k. Equipment Manufacturer	JMS

D. Sedimentation Basins (Constructed 1992)

1. Number of basins	6 (Integral with Flocculation Basins)
2. Rated capacity each, mgd	14.2
3. Total capacity, mgd	85.2
4. Size, each basin	
a. Dimensions	75 ft x 268 ft x 16.5 ft SWD
b. Volume, gal	2,480,742
5. Detention time at 14.2 mgd, min	251 (4.18 hours)
6. Surface loading at 14.2 mgd, gallons per minute (gpm)/sq ft	0.49
7. Horizontal velocity at 14.2 mgd, ft/min	1.06
8. Effluent troughs	
a. Type	FRP with submerged orifices
b. Number per basin	32
c. Length each trough, ft	17.5

d. Total weir length per basin, ft	1,120
e. Weir loading at 14.2 mgd, gal/day/ft	12,680
f. Orifices per trough	34
g. Orifice diameter, in	1.5
9. Bottom sludge collectors	
a. Type	Chain and flight
b. Number per basin	4 + 1 cross collector
c. Blowdown rate, gpm	700
d. Blowdown Wet Volume (average), gal/day	189,000 (0.22% solids concentration)
e. Control	Timed interval operation
f. Cleaning interval	Daily

E. Sedimentation Basins (Constructed 1992)

1. Number of basins	6 (Integral with Flocculation Basins)
2. Rated capacity each, mgd	14.2
3. Total capacity, mgd	85.2
4. Size, each basin	
a. Dimensions	75 ft x 268 ft x 16.5 ft SWD
b. Volume, gal	2,480,742
5. Detention time at 14.2 mgd, min	251 (4.18 hours)
6. Surface loading at 14.2 mgd, gallons per minute (gpm)/sq ft	0.49
7. Horizontal velocity at 14.2 mgd, ft/min	1.06
8. Effluent troughs	
a. Type	FRP with submerged orifices
b. Number per basin	32
c. Length each trough, ft	17.5
d. Total weir length per basin, ft	1,120
e. Weir loading at 14.2 mgd, gal/day/ft	12,680
f. Orifices per trough	34
g. Orifice diameter, in	1.5
9. Bottom sludge collectors	
a. Type	Chain and flight
b. Number per basin	4 + 1 cross collector
c. Blowdown rate, gpm	700
d. Blowdown Wet Volume (average), gal/day	189,000 (0.22% solids concentration)
e. Control	Timed interval operation
f. Cleaning interval	Daily

F. East Flocculators (Retrofitted Accelator Basins, Constructed 2019/2020)

1. Number of basins	2
2. Number of trains per basin	2
3. Rated capacity each basin, mgd	32.0
4. Total capacity, mgd	64.0
5. Size, each train	
a. Dimensions	51.92 ft x 56.17 ft x 15.67 ft SWD
b. Volume, gal	325,232
6. Detention time at 32.0 mgd, min	30
7. Stage dimensions	
a. Stage 1	51.92 ft x 17 ft x 15.67 ft SWD
b. Stage 2	51.92 ft x 17 ft x 15.67 ft SWD

c. Stage 3	51.92 ft x 17 ft x 15.67 ft SWD
d. Stage 4 (hydraulic stage)	51.92 ft x 5.17 ft x 11.92 ft SWD
8. Horizontal velocity at 32.0 mgd, ft/min	5.58
9. Mixers	
a. Type	Horizontal shaft paddles-variable speed
b. Shafts per train	3
c. Stages per basin	3 (plus a fourth hydraulic stage)
d. Approx. paddle sizes	
1) Stage 1	6 inches x 14.67 ft
2) Stage 2	6 inches x 14.67 ft
3) Stage 3	6 inches x 14.67 ft
4) Stage 4	--
e. Number of paddles per stage	
1) Stage 1	36
2) Stage 2	18
3) Stage 3	12
4) Stage 4	--
f. Motor minimum horsepower, hp	
1) Stage 1	5
2) Stage 2	3
3) Stage 3	2
4) Stage 4	--
g. Shaft speed range, rpm	
1) Stage 1	0-4.41
2) Stage 2	0-4.41
3) Stage 3	0-4.41
4) Stage 4	--
h. Approx. 70 degree Fahrenheit G values at shaft rpm	
1) Stage 1, 1/sec	48 (shaft 3.28 rpm)
2) Stage 2, 1/sec	40 (shaft 3.00 rpm)
3) Stage 3, 1/sec	30 (shaft 3.00 rpm)
4) Stage 4	--
i. Approx. 33 degree Fahrenheit G values at shaft rpm	
1) Stage 1, 1/sec	50 (shaft 4.00 rpm)
2) Stage 2, 1/sec	40 (shaft 3.65 rpm)
3) Stage 3, 1/sec	30 (shaft 3.65 rpm)
4) Stage 4	--
j. Equipment manufacturer	JMS

G. Pretreatment Plate Settlers (Retrofitted Accelator Basins, Constructed 2020)

1. Number of basins	2
2. Rated capacity each, mgd	32.0
3. Total rated capacity, mgd	64.0
4. Size, each basin	
a. Dimensions	114 ft x 53.83 ft x 15.67 ft SWD
b. Volume, gal	711,480
5. Plate settlers	
a. Dimensions	10 ft x 4.53 ft
b. Angle, deg	55
6. Design plate loading rate, gpm/sq ft	0.340
7. Design plate efficiency, percent	80%

8. Min. effective projected horizontal surface area, sq ft — 65,851 (per basin)
9. Bottom sludge collectors
   a. Type — Traveling vacuum telescoping pipe
   b. Number per basin — 5 plus 2 static collectors
   c. Sludge collection drive unit horsepower, hp — 1/4
   d. Blowdown rate, gpm — 250 – 400
   e. Blowdown wet volume, gallons/day — 45,000 (0.22% solids concentration)
   f. Control — Timed interval operation
   g. Cleaning interval — Daily
10. Equipment manufacturer — JMS

H. Filters (1-14 constructed 1962 and 15-18 constructed 1992)
1. Number of two-cell filters — 18
2. Type — Dual media with two cells per filter
3. Dimensions each cell — 17 ft x 39 ft
4. Area each two-cell filter, sf — 1,326
5. Filter underdrains
   a. Filters 1 - 14 — Leopold low profile plastic blk, IMS cap
   b. Filters 15 - 18 — Clay block with 12 inch graded gravel, 3 inch torpedo sand
6. Approximate filter media depths (Current standard is 18 inch sand – 12 inch anthracite)
   a. Filter 1 — 18 inch sand - 15 inch anthracite
   b. Filters 2 - 18 — 18 inch sand - 12 inch anthracite
7. Sand effective size, mm — 0.45-0.55 (Current standard)
8. Anthracite effective sizes, mm
   a. Filters 1 - 14 — 0.95 - 1.05 (Current standard)
   b. Filters 15 - 18 — 0.45 - 0.80
9. Allowable filtration rate (EGLE)
   a. With all filters in service, gpm/sf — 3.9
   b. During filter backwash, gpm/sf — 4.2
10. Total filter rated capacity, mgd — 135
11. Individual filter rate control — Based on level in common influent flume
12. Filter backwashing (one filter cell at a time)
   a. Number of backwash pumps — 3 (constant speed)
   b. Pump capacities/ motor power
      1) Backwash Pump 1 — 18 mgd @ 60 ft — 250 HP
      2) Backwash Pump 2 — 18 mgd @ 60 ft — 250 HP
      3) Backwash Pump 3 — 21.6 mgd @ 85 ft — 400 HP
   c. Water source — Plant reservoirs
   d. Startup backwash rate, gpm — 2,700 (4.1 gpm/sf)
   e. Low backwash rate, gpm — 5,400 (8.2 gpm/sf)
   f. High backwash rate, gpm — 11,450 gpm, (17.3 gpm/sf)
   g. Backwash flow control — Venturi meters and control valves
   h. Water used/ filter backwash, gal — 100,000 (average)
13. Filter surface washing
   a. Type — Rotary surface sweeps
   b. Water source — Settled water headers
   c. Number of pumps and type — 2 (constant speed), vertical inline
   d. Pump capacity/ motor power, each — 450 gpm @ 140 ft / 25 HP

e. Surface wash rate of flow	0.68 gpm/sf of filter area		

I. Plant Treated Water Reservoirs

1. Number of Reservoirs	2		
2. Type	Ground-level circular welded steel		
3. Size, each			
a. Dimensions	240 ft dia x 17 ft approx height		
b. Volume, MG	5.0		
4. Typical operating level range, ft	8 ft to 15 ft		
5. Overflow level, ft	15.5 ft		
6. Total volume with both in service, MG	10.0		
7. Working volume with both in service, MG	5.0		

J. High Lift Pumping

1. North High Lift Pumps (Pumps 3-6 were 1939 units moved to plant in 1963. They were replaced in 2019)			
a. Number of pumps	5		
b. Pump Type	Vertical centrifugal		
c. Capacities/ motor power			
1) High Lift Pump 3, constant speed (2019)	23.0 mgd @ 255 ft	1,250 HP	
2) High Lift Pump 4, constant speed (2019)	25.5 mgd @ 269 ft	1,500 HP	
3) High Lift Pump 5, variable speed (2019)	35.5 mgd @ 335 ft	2,500 HP	
4) High Lift Pump 6, variable speed (2019)	35.5 mgd @ 335 ft	2,500 HP	
d. Discharge			
1) To	North 46 inch transmission main		
2) Flow metering	Venturi meter		
2. South High Lift Pumps (1992 plant expansion)			
a. Number of pumps	5		
1) Pump Type	Two-speed canned vertical turbine		
b. Capacities/ motor power			
1) High Lift Pump 8	12.5/17 mgd @185/250 ft	800/1,250 HP	
2) High Lift Pump 9	25/33 mgd @225/275 ft	1,800/2,500 HP	
3) High Lift Pump 10	25/33 mgd @225/275 ft	1,800/2,500 HP	
4) High Lift Pump 11	12.5/17 mgd @185/250 ft	800/1,250 HP	
5) High Lift Pump 12	25/33 mgd @225/275 ft	1,800/2,500 HP	
c. Discharge			
1) To	South 60 inch transmission main		
2) Flow metering	Venturi meter		

K. Sludge Handling

1. Earthen Lagoons	
a. Number	2
b. Approx Size, each	700 ft x 295 ft x 4 ft
c. Volume of 1 ft sludge layer, cu yd	15,300
2. Dry Solids Quantities	
a. Current (2020) lb/day	4,672
b. Future (2040) lb/day	5,651
3. Wet Solids Quantities (at 15% by wt)	
a. Current (2020), cu yd/year	6,145
b. Future (2040), cu yd/year	7,435
c. Future storage volume at 1 ft depth, yrs	2.05

L. Sodium Hypochlorite Disinfection System

1. Material fed	Liquid sodium hypochlorite (12.5% solution)
2. Bulk Storage Tanks	
a. Number	5
b. Type	Fiberglass-reinforced plastic
c. Volume, gal	12,028
d. Diameter, ft	11
e. Shell height, ft	17
f. Pre-chlorination tanks	#1, #2, #3
g. Post-chlorination tanks	#4, #5 (Not typically used, standby)
3. Day Tanks	
a. Day Tank 1 – Post-chlorination	
1) Type	Fiberglass-reinforced plastic
2) Volume, gal	1,743
3) Diameter, ft	7
4) Height, ft	7
b. Day Tank 2 – Post-chlorination (Not typically used, available as standby).	
1) Type	Fiberglass-reinforced plastic
2) Volume, gal	157
3) Diameter, ft	3
4) Height, ft	4
4. Transfer Pumps	
a. Pre-chlorination area	
1) Quantity	2 (Pumps 1 and 2)
2) Type	Magnetic Drive Centrifugal
3) Manufacturer/Model	Innomag U415210101-UD0
4) Design Point	200 gpm at 30 ft TDH
5) Electrical Motor Information	3ph, 460V, 10HP, 3,500 rpm
b. Pre-chlorination area	
1) Quantity (small)	2 (Pumps 3 and 4)
2) Type	Magnetic Drive Centrifugal
3) Manufacturer/Model	Innomag U012710101-UB0
4) Design Point	20 gpm at 25 ft TDH
5) Electrical Motor Information	1ph, 115V, 0.5HP, 3,500 rpm
c. Post-chlorination area	
1) Quantity	1 (Pump 5)
2) Type	Magnetic Drive Centrifugal
3) Manufacturer/Model	Innomag U415210101-UD0
4) Design Point	200 gpm at 30 ft TDH
5) Electrical Motor Information	3ph, 460V, 0.5HP, 1,735 rpm
5. Chemical Feed Metering Pumps	
a. Metering Pumps 1 and 2 (Pre-chlorination area)	
1) Type	Peristaltic
2) Manufacturer/Model	Watson-Marlow Bredel 25
3) Maximum capacity and pressure	723 gph, 232 pounds per square inch (psi)
4) Pump Speed	100 rpm
5) Electrical Information	1ph, 230V, 0.75HP, 1,735 rpm
b. Metering Pump 3 (Pre-chlorination area)	

1) Type — Peristaltic
2) Manufacturer/Model — Watson-Marlow Bredel 15
3) Maximum capacity and pressure — 139 gph, 174 psi
4) Pump Speed — 75 rpm
5) Electrical Information — 1ph, 230V, 0.5HP, 1,735 rpm

c. Metering Pump 4 and 7 (Pre-chlorination area)
1) Type — Peristaltic
2) Manufacturer/Model — Watson-Marlow Bredel 10
3) Maximum capacity and pressure — 42 gph, 174 psi
4) Pump Speed — 80 rpm
5) Electrical Information — 1ph, 230V, 0.5HP, 1,735 rpm

d. Metering Pumps 5 and 6 (Pre-chlorination area)
1) Type — Peristaltic
2) Manufacturer/Model — Watson-Marlow Bredel 20
3) Maximum capacity and pressure — 216 gph, 145 psi
4) Pump Speed — 65 rpm
5) Electrical Information — 1ph, 230V, 0.5HP, 1,735 rpm

e. Metering Pumps 8 and 9 (Post-chlorination area)
1) Type — Peristaltic
2) Manufacturer/Model — Watson-Marlow Bredel 10
3) Maximum capacity and pressure — 42 gph, 174 psi
4) Pump Speed — 80 rpm
5) Electrical Information — 1ph, 230V, 0.5HP, 1,735 rpm

6. Chlorine feed points
a. North and South intake cribs
b. (Pre-chlorination) Upstream of 48-inch junction chamber/rising well on north raw water line
c. (Pre-chlorination) Upstream of pretreatment influent chamber on south raw water line
d. East filter influent
e. West filter influent
f. (Post-chlorination) North high lift suction
g. (Post-chlorination) South high lift suction
h. Auxiliary old high lift suction
i. Old backwash pipe
7. Normal chlorine feed point — Pre-chlorination
8. Typical dose range, milligrams per liter (mg/L) — 2.0-4.0
9. Automated control — Flow paced dosage control from SCADA
10. Appurtenances
a. Calibration columns — 1,000 mL through 10,000 mL
b. Pressure Gauges — Feed pump discharge
c. Pressure Relief Valves — Feed pump discharge
d. Ultrasonic Level Indication — Bulk storage and day tanks
11. Safety
a. Secondary Containment
b. Chlorine gas detection
c. Chemical containment sumps
d. Emergency eye-wash stations

M. Alum System
1. Material fed — Liquid aluminum sulfate (50% solution)
2. Bulk Storage Tanks

a. Quantity 3
b. Type Rubber-lined steel elevated on legs
c. Volume, gal 11,000

3. Day Tanks (no current day tank used)
4. Transfer Pumps (no current transfer pumps used)
5. Chemical Feed Metering Pumps (Pumps 1, 2,3, 4 and 5)
   a. Type Peristaltic
   b. Manufacturer/Model FlowRox LPPDO.75GM7.5-3/4 inch-N
   c. Maximum capacity and pressure 317 gph, 108 psi
   d. Pump Speed 111 rpm
   e. Electrical Information 1ph, 230V, 0.75HP, 2,285 rpm
6. Alum feed points
   a. Rapid Mix No. 1 (East Pretreatment System)
   b. Rapid Mix No. 2 (Flocculation/Sedimentation Basins)
7. Typical dose, mg/L as Al+3 0.7-1.0 (per EGLE)
8. Alum flow metering Magnetic flow meter at feed points
9. Automated control Flow paced dosage control from SCADA
10. Appurtenances
    a. Calibration columns 10,000 mL
    b. Pressure Gauges Feed pump discharge
    c. Pressure Relief Valves Feed pump discharge
    d. Ultrasonic Level Indication Bulk storage and day tanks
11. Safety
    a. Secondary Containment
    b. Chemical containment sumps
    c. Emergency eye-wash station

N. Fluoride System
1. Material fed Liquid hydrofluorosilicic acid (23% solution)
2. Bulk Storage Tanks
   a. Quantity 2
   b. Type Rubber-lined steel elevated on legs
   c. Volume, gal 6,000
3. Day Tanks
   a. Quantity 1
   b. Type Rubber-lined steel elevated on legs
   c. Volume, gal 400 (350 usable)
4. Transfer Pumps
   a. Quantity 2 (1 standby
   b. Type Magnetic Drive Centrifugal
   c. Manufacturer/Model FTI UC326AECSSVF550
   d. Design Point 250 gpm at 90 ft TDH (5.5” impeller)
   e. Electrical Motor Information 3ph, 460V, 10HP, 3,500 rpm
5. Chemical Feed Metering Pumps
   a. Quantity 2 (1 standby)
   b. Type Peristaltic
   c. Manufacturer/Model FlowRox LPP-M3S-24P-DN250
   d. Maximum capacity and pressure ` 54 gph, 80 psi
   e. Pump Speed 125 rpm
   f. Electrical Information 1ph, 230V, 0.5HP

6. Fluoride feed point
   a. Pretreatment Effluent Chamber
7. Typical dose, mg/L as F — 1.0-1.1
8. Alum flow metering — Magnetic flow meter at feed point
9. Automated control — Flow paced dosage control from SCADA
10. Appurtenances
    a. Calibration columns — 10,000 mL
    b. Pressure Gauges — Feed pump discharge
    c. Pressure Relief Valves — Feed pump discharge
    d. Ultrasonic Level Indication — Bulk storage and day tanks
11. Safety
    a. Secondary Containment
    b. Chemical containment sumps
    c. Emergency eye-wash station

O. Phosphate (Blended 50/50 poly-ortho phosphate) System
1. Material fed — Liquid orthophosphate/polyphosphate blend (50/50 blend – 38% solution)
2. Bulk Storage Tanks
   a. Quantity — 2
   b. Type — Rubber-lined steel (old alum tanks)
   c. Volume, gal — 8,000 and 5,500
3. Day Tank
   a. Number — 1
   b. Type — Polyethylene
   c. Capacity, gallons — 500 (400 usable)
4. Transfer Pumps
   a. Quantity — 2 (1 standby)
   b. Type — Magnetic Drive Centrifugal
   c. Manufacturer/Model — FTI DB-10V-T-2-M218
   d. Design Point — 60 gpm at 35 ft TDH (3.5 inch impeller)
   e. Electrical Motor Information — 1ph, 120V, 1HP, 3,500 rpm
5. Chemical Feed Metering Pumps
   a. Chemical Feed Pumps (large)
      1) Quantity — 1 (Pump 1)
      2) Type — Peristaltic
      3) Manufacturer/Model — FlowRox FXM3-34B-N269
      4) Maximum capacity and pressure — 221 gph, 80 psi
      5) Electrical Information — 1ph, 230V, 0.5HP
   b. Chemical Feed Pumps (small)
      1) Quantity — 2 (1 standby)
      2) Type — Peristaltic
      3) Manufacturer/Model — FlowRox LPP-M3S-24P-DN250
      4) Maximum capacity and pressure — 54 gph, 80 psi
      5) Pump Speed — 125 rpm
      6) Electrical Information — 1ph, 230V, 0.5HP
6. Phosphate feed point
   a. North Filtered Water – 60-inch pipe below phosphate feed area
   b. South Filtered Water – 108” pipe below filter pipe gallery
7. Typical dose, mg/L as P (orthophosphate) — 1.0 – 1.2 mg/L
8. Phosphate flow metering — Magnetic flow meter feed pumps

9. Automated control	Flow paced dosage control from SCADA
10. Appurtenances	
a. Calibration columns	1,000 mL
b. Pressure Gauges	Feed pump discharge
c. Ultrasonic Level Indication	Bulk storage and day tanks
11. Safety	
a. Emergency eye-wash station	
12. System deficiencies	Inadequate secondary containment Corroding bulk tanks with pin holes
P. Powdered Activated Carbon (PAC) System	
1. Material Fed	11% carbon solution (1 lb PAC per 1 gallon water)
2. Manual Make-up Slurry Tank	
a. Number	2
b. Type	Hopper-bottom steel
c. Capacity each, gallons	1,250
d. Carbon addition	Manual bag dumping
3. Slurry Mixer	
a. Number	2 (1 for each tank)
b. Type	Propeller
c. Manufacturer/Model	Lightnin NLDG-150 (CEIXG Type)
d. Electrical Information	3 phase, 208V, 1.5HP, 1,735 rpm
4. Chemical Feed Metering Pumps	
a. Chemical Feed Pumps	
1) Quantity	2
2) Type	Peristaltic
3) Manufacturer/Model	Eccentric Pumps SLP128
4) Maximum capacity and pressure	63 gph, 100 psi
5) Electrical Information	3 phase, 208V, 1.5hp, 1,800 – 600 rpm
5. Carbon feed points	
a. Rapid Mix No. 1 (East Pretreatment System)	
b. Rapid Mix No. 2 (Flocculation/Sedimentation Basins)	
6. Typical dose	1.0 – 5.0 mg/L
7. Manual control	Set at chemical feed pumps
8. Appurtenances	
a. Calibration columns	5,000 mL
b. Pressure Gauges	Feed pump discharge
c. Ultrasonic Level Indication	Slurry tanks
9. Safety	
a. Emergency eye-wash station	
b. Carbon dust vacuum system	Omega 71-02
Q. Sodium Bisulfite System (Wastewater Dechlorination)	
1. Material fed	Liquid sodium bisulfite (40% solution)
2. Storage Tanks	
a. Quantity	Space for 5 tanks
b. Type	330-gallon chemical totes
3. Day Tank	
a. Number	2
b. Type	Polyethylene
c. Capacity, gallons	30

4. Transfer Pumps
   a. Quantity — 2 (1 standby)
   b. Type — Magnetic Drive Centrifugal
   c. Manufacturer/Model — FTI DB5.5V-T-M622
   d. Design Point — 15 gpm at 24 ft TDH (3.0 inch impeller dia.)
   e. Electrical Motor Information — 1 phase, 120V, 0.33HP, 3,450 rpm

5. Chemical Feed Metering Pumps
   a. Chemical Feed Pumps (small)
      1) Quantity — 2
      2) Type — Peristaltic
      3) Manufacturer/Model — Stenner Pump S3007
      4) Maximum capacity and pressure — 40 gpd, 100 psi
      5) Electrical Information — 1 phase, 115V, 1/10HP
   b. Chemical Feed Pumps (large)
      1) Quantity — 2
      2) Type — Peristaltic
      3) Manufacturer/Model — Black Line MD18PPPN2A-XXX
      4) Maximum capacity and pressure — 14 gph, 150 psi
      5) Electrical Information — 1 phase, 115V, 0.5HP, 1,735 rpm
6. Sodium Bisulfite feed point
   a. Filter Backwash Washwater
   b. Flocculation/Sedimentation Blowdown
   c. Filter 16 Drain - Emergency
7. Automated control — Flow paced with filter and blowdown operation

8. Appurtenances
   a. Calibration columns — 1,000 mL
   b. Pressure Gauges — Feed pump discharge
9. Safety
   a. Emergency eye-wash station
   b. Secondary Containment
   c. Chemical containment sumps

R. Potassium Permanganate System (Abandoned)

Lake Michigan Filtration Plant Condition Summary

Equipment or Treatment Facility	Installation Date/ Last Renovation	Description (capacity, # of units, dimensions)	Make & Model, hp, rpm (480V unless noted otherwise)	Location	Design Service Life / Remaining (yrs)	Observations from 2020 CMP Update
Lake Michigan North Intake 1	1939	Crib 36' x 36' x 10' Timber Reported Capacity 56 MGD	NA	Lake Michigan	50-70/0	Preventative maintenance includes annual inspection of intake, recent inspections have shown no issues. Facility is in good condition. Typically used in winter months only.
Lake Michigan South Intake 2	1992	Crib Diameter 62' x 11' 12 Sided Timber Reported Capacity 111 MGD	NA	Lake Michigan	50-70/22-41	Preventative maintenance includes annual inspection of intake, recent inspections have shown no issues. Facility is in excellent condition. Typically used in summer months only.
North Low Lift Pump Station - Screen	1939	60" square, 7/8" opening size	NA	North Low Lift Pumping Station	50-70/0	Maintained through preventative maintenance program with monthly cleaning. Screens are in good condition. Typically used in winter months only.
North Low Lift Pump Station - Pumps	1939	4 Constant Speed; Vertical Centrifugal Pumps: Pump 1 - 25 mgd, 300 hp Pump 2 - 38.5 mgd, 600 hp Pump 3 - 38.5 mgd, 600 hp Pump 4 - 45 mgd, 700 hp	Pumps 1-3 - Fairbanks Morse; Pump 4 - Worthington-Ideal	North Low Lift Pumping Station	20+/0	Good condition has been maintained through preventative maintenance program. Typically used in winter months only.
South Low Lift Pump Station - Screens	1992	7-'6" x 13'-6"	NA	South Low Lift Pumping Station	50-70/22-461	Maintained through preventative maintenance program with weekly cleaning. Screens are in excellent condition. Typically used in summer months only.
South Low Lift Pump Station - Pumps	1992	Vertical Mixed Flow Pumps, Variable Speed Pump: Pump 5 - 62 mgd, 900 hp; Constant Speed Pumps: Pump 6 - 46.7 mgd, 600 hp Pump 7 - 46.7 mgd, 600 hp	Pumps 5-7 - Byron Jackson-Ideal	South Low Lift Pumping Station	20+/0	Excellent condition. All pumps typically used in summer months only.
Rapid Mixing Facility No. 1	1992	2 Tanks; each tank 11'x11'x15.5' surface water depth (SWD); 14,000 gal per tank; 42.5 sec detention time at 56.8 mgd	NA	Rapid Mixing Facility 1	50-70/27-47	Excellent condition. Area underwent concrete restoration in Winter 2013/2014.
Rapid Mixing Facility No. 1 Mixers	1992	Variable Speed Axial Flow Turbine 1 per tank	Philadelphia 3805Q, 10 hp, 68 rpm	Rapid Mixing Facility 1	20+/0	Maintained through preventative maintenance program. Excellent condition.
Rapid Mixing Facility 2	1992	2 Tanks; each 13.25'x13.25'x15.75' SWD; 20,600 gal per tank; 42 sec detention time at 85.2 mgd	NA	Rapid Mixing Facility 2	50-70/22-41	Excellent condition. Area underwent concrete restoration in Winter 2011/2012.
Rapid Mixing Facility 2 Mixers	1992	Variable Speed Axial Flow Turbine 1 per tank	Philadelphia 3805Q, 15 hp, 84 rpm	Rapid Mixing Facility 2	20+/0	Maintained through preventative maintenance program. Excellent condition.
Flocculation Basins	1992	6 Basins Integral with Sedimentation Basins; Capacity 14.2 mgd each; 85.2 total capacity; each basin 75'x35'x15.5' SWD; each volume 304,342 gal	N/A	Floc/Sed Basins	50-70/22-41	Good condition. Area has underwent numerous phases of concrete restoration from 2006 through 2013.

Equipment or Treatment Facility	Installation Date/ Last Renovation	Description (capacity, # of units, dimensions)	Make & Model, hp, rpm (480V unless noted otherwise)	Location	Design Service Life / Remaining (yrs)	Observations from 2020 CMP Update
Flocculator Mixers	2020	Horizontal Shaft Paddles - Variable Speed; 5 shafts per basin; 3 stages per basin/shaft; Approximate paddle sizes: Stage 1 is 6"x4.5', Stage 2 is 6"x8', Stage 3 is 6"x10'	3 hp for each shaft, speed range - 0-3.61 rpm	Floc/Sed Basins	20+/20	Maintained through preventative maintenance program. Excellent condition.
Sedimentation Basin	1992	6 Basins Integral with Flocculation Basins; Capacity 14.2 mgd each; 85.2 total capacity; each basin 75'x268'x16.5' SWD; each volume 2,480,742 gal	N/A	Floc/Sed Basins	50-70/27-47	Good condition. Area has underwent numerous phases of concrete restoration from 2006 through 2013.
Sedimentation Basin Sludge Collectors	1992	Chain and Flight; 4+1 cross collector; timed interval operation	Envirex. Chains are FRP.	Sludge Collector Drive Gallery	20+/0	Maintained through preventative maintenance program. Excellent condition.
East Pretreatment Flocculators	2020	2 Basins; 2 Trains per Basin; Capacity 32.0 mgd each; Total capacity 64.0 mgd; each train 51.92'x56.17'x16' SWD; each train volume 335,134 gal; Horizontal Shaft Paddles - Variable Speed; 3 shafts per train; 1 stage per shaft; Approximate paddle sizes (all stages): 6"x14.67'	JMS Flocculators variable speed, Stage 1 - 5 hp, Stage 2 - 3 hp, Stage 3 - 2 hp	Old Accelator Building	50-70/50-70	Pretreatment flocculators are currently under construction and are being retrofitted into the old West Accelator basins.
East Pretreatment Plate Settlers	2020	2 Basins; Capacity 32.0 mgd each; Total capacity 64.0 mgd; each basin 114'x53.83'x15.67' SWD; each volume 711,480 gal; Plate settlers 10'x4.53', 55 deg angle	JMS Plate Settlers variable speed sludge scraper 1/4 hp	Old Accelator Building	50-70/50-70	Pretreatment plate settlers are currently under construction and are being retrofitted into the old West Accelator basins.
Filters 1-14	1962	Dual Media with 2 cells per filter 17'x39' each cell; Area of 1,326 sf per filter	All filters have Leopold HDPE underdrains with media retention caps.	Filter Building	50-70/0-2	All filters have undergone rehabilitation and concrete restoration as of 2015.
Filters 15-18	1992	Dual Media with 2 cells per filter 17'x39' each cell; Area of 1,326 sf per filter	Filter Underdrains Clay block with 12" graded gravel.	Filter Building	50-70/22-41	Excellent condition.
Filter Backwash Pumps	1962; 1992	3 Constant Speed Pumps	Pumps 1 and 2 (1962) - 18 mgd @ 60', 250 hp Pump 3 (1992) - 21.6 mgd @ 85', 400 hp	Filter Building	20+/0	Pump #2 motor was rebuilt in 2015. Maintained through preventative maintenance program. Pumps are in excellent to good condition.
Filter Surface Wash	1962	Rotary Surface Sweeps	2 Constant Speed Pumps each 255 gpm @ 240', 25 hp	Filter Building	20+/0	Good condition.
North Clearwell	1962/2019	Ground-level circular welded steel	240' dia x 17' approx height, 5 mgal	Reservoir	25/25	Tank are maintained through test inspections by tank supplier/repair companies. Tank underwent internal/external rehabilitation in 2019. No replacement planned for near term.

Equipment or Treatment Facility	Installation Date/ Last Renovation	Description (capacity, # of units, dimensions)	Make & Model, hp, rpm (480V unless noted otherwise)	Location	Design Service Life / Remaining (yrs)	Observations from 2020 CMP Update
South Clearwell	1982	Ground-level circular welded steel	240' dia x 17' approx height, 5 mgal	Reservoir	25/0	Tank are maintained through test inspections by tank supplier/repair companies. Tank underwent internal rehabilitation to repair beams and purlins in 2013-2014. The interior walls and floors are scheduled to be repainted in 2020. No replacement planned for near term.
High Lift Pumping - Old High Lift Pumps 3-6	2019	4 Constant Speed Vertical Centrifugals; Pump 3 - 21 mgd, 1250 hp Pump 4 - 25 mgd, 1500 hp Pump 5 - 34.5 mgd, 2500 hp Pump 6 - 35.5 mgd, 2500 hp	Flowserve-Hyundai/Ideal	High Lift Pump Station No. 1	20+/20	Pumps, motors, and intermediate shafting were replaced in 2019. Pumps are maintained through preventative maintenance program. Pumps are in excellent condition.
High Lift Pumping - Old High Lift Pump 7	1981	Constant Speed Vertical Centrifugal Pump 7 - 50 mgd, 3500 hp	Worthington-Ideal	High Lift Pump Station No. 1	20+/0	The starter for this pump was removed in 2019. The pump is no longer operable.
High Lift Pumping - New High Lift Pumps 8-12	1992	5 Two Speed Vertical Turbines; Pump 8 and 11-12.5/17 mgd, 800/1250 hp; Pump 9, 10, 12 - 25/33 mgd, 1800/2500 hp	Peerless-Ideal	High Lift Pump Station No. 2	20+/0	Excellent condition.
Sludge Handling	1962	2 Earthen Lagoons; each 700'x295'x4'; Sludge Drain Dewatering Pumps	NA	South of Floc/Sed Basins	50-70/0-8	Study underway considering possible residuals handling upgrades. Study is considering potential reuse of Accelator Building for residuals purposes.
Sodium Hypochlorite System	2014	Liquid Sodium Hypochlorite (Pre and Post Systems)	Watson Marlow - Bradel Peristaltic Pumps	Old Polymer and Ferric Rooms	20+/14	System was repaired after accidental chlorine release in Summer 2015.
Alum System	1992; 2001	3 Bulk Storage Tanks, 1 day tank, 8 Metering Pumps	Pulsafeeder model 7440	Alum System	20+/0	Tanks are in good condition. Pulsafeeder Pumps are a 2001 upgrade, excellent condition.
Fluoride System	1992; 2001	2 Bulk Storage Tanks, 1 day tank, 2 Metering Pumps	Pulsafeeder model 7120	Fluoride Room	20+/0	Tanks are in good condition. Pulsafeeder Pumps are a 2001 upgrade, excellent condition.
Phosphate System	1962	2 Bulk Storage Tanks, 1 day tank	storage tanks are the old steel alum tanks	Phosphate Area	20+/0	System has inadequate spill containment and corroding bulk tanks with pin holes. Recoating/relining of tanks is likely within next 5 years.
Powdered Activated Carbon (PAC) System	1962	Manual Make-Up Slurry Tank, Slurry Feeder, Slurry pump	Watson Marlow peristaltic pump & Rotodip equipment	Powdered Activated Carbon (PAC) System	20+/0	Parts are becoming obsolete on 1962 vintage rotodip equipment. Maintaining reliable operation is difficult.
Potassium Permanganate System	1992	2 Manual Make-Up Solution Tanks, 4 metering pumps	Chemcon metering pumps	Potassium Permanganate System	20+/0	Currently this equipment is not used.
HVAC System	2015	Separate systems includes Admin Building Laboratory, Floc/Sed basins, Accelators (old), Control Room	Various	Throughout LMFP	15-30/10-25	Much of air conditioning and heating equipment throughout the plant was replaced in 2015 and 2016.

City of Grand Rapids

2024 DWRF Planning Document

City of Grand Rapids Distribution System

Project 221812

Summary of Distribution System Facilities

A. Distribution System

1. Table A-1 summarizes pipe sizes in the system.

Table No. A-1 – Distribution System Pipe Diameter Summary

Pipe Diameter (inches)	Total Pipe Length (feet)	Percent of Water System Piping
4	108,049	1.6%
6	2,453,876	36.1%
8	1,388,328	20.4%
10	61,950	0.9%
12	1,397,140	20.6%
14	13	0.0%
16	655,138	9.6%
18	2,626	0.0%
20	21,382	0.3%
24	195,679	2.9%
30	80,458	1.2%
36	61,832	0.9%
42	12,600	0.2%
46	160,800	2.4%
48	18,819	0.3%
54	6,780	0.1%
60	165,972	2.4%
Total	6,791,442	100.0%

Taken from GIS (updated in 2018) and Hydraulic Model Databases

2. Pipe condition varies throughout the system. Pipes are replaced in conjunction with other road and utility work. Table A-2 summarizes the estimated percentage of each type of pipe material to total piping in the system. Table A-3 summarizes the estimated age of the pipes in the system.

Table No. A-2 – Distribution System Pipe Material Summary

Pipe Material	Percent of Water System Piping
Cast Iron	3.69%
Concrete	1.02%
Ductile Iron	54.3%
Plastic	0.01%
Steel	0.11%
Unknown	40.8%
Total	100.0%

Taken from GIS (updated in 2018)

Table No. A-3 – Distribution System Pipe Age Summary

Pipe Age (years)	Percent of Water System Piping
100+	6.6%
90 - 99	5.9%
80 - 89	2.2%
70 - 79	1.7%
60 - 69	4.0%
50 - 59	11.2%
40 - 49	9.3%
30 - 39	10.1%
20 - 29	17.6%
10 - 19	19.4%
0 - 9	6.8%
Unknown	5.1%
Total	100.0%

Taken from GIS (updated in 2018)

3. The condition of valves in the distribution system varies throughout the system. Valves are replaced in conjunction with other road and utility work. Table A-4 summarizes the valve sizes in the system. Table A-5 summarizes the estimated age of the valves in the system.

Table No. A-4 – Distribution System Valve Size Summary

Valve Age (years)	Percent of All Valves
4	5.04%
6	62.15%
8	16.52%
10	0.52%
12	10.68%
16	2.90%
18	0.01%
20	0.15%
24	0.57%
30	0.29%
36	0.13%
42	0.08%
46	0.01%
48	0.04%
50	0.01%
54	0.01%
60	0.08%
66	0.01%
84	0.01%
Unknown	0.77%
Total	100.0%

Taken from GIS (updated in 2018)

Table No. A-5 – Distribution System Valve Age Summary

Valve Age (years)	Percent of All Valves
100+	4.2%
90 - 99	5.5%
80 - 89	1.4%
70 - 79	1.4%
60 - 69	3.7%
50 - 59	10.9%
40 - 49	9.2%
30 - 39	10.4%
20 - 29	17.8%
10 - 19	19.0%
0 - 9	6.2%
Unknown	10.5%
Total	100.0%

Taken from GIS (updated in 2018)

4. Table A-6 summarizes the estimated age of the hydrants in the system.

Table No. A-6 – Distribution System Hydrant Age Summary

Hydrant Age (years)	Percent of All Hydrants
100+	4.0%
90 - 99	5.6%
80 - 89	1.3%
70 - 79	1.4%
60 - 69	4.1%
50 - 59	13.0%
40 - 49	11.2%
30 - 39	12.6%
20 - 29	17.7%
10 - 19	16.5%
0 - 9	5.3%
Unknown	7.5%
Total	100.0%

Taken from GIS (updated in 2018)

5. Table A-7 summarizes the estimated age of the service lines in the system. Note, the data is taken from the assumed install date in the GIS database. Some data may be inaccurate.

Table No. A-7 – Distribution System Service Line Age Summary

Service Line Age (years)	Percent of All Services
100+	2.8%
90 - 99	3.1%
80 - 89	0.6%
70 - 79	1.0%
60 - 69	1.5%
50 - 59	3.9%
40 - 49	4.8%
30 - 39	5.3%
20 - 29	7.8%
10 - 19	35.3%
0 - 9	29.7%
Unknown	4.2%
Total	100.0%

Taken from GIS (updated in 2018)

B. Water Storage Facilities
   1. Wilson Reservoir
      a. Volume 5.0 MG
      b. Built 1971
   2. Leonard Elevated Storage Tank
      a. Volume 1.0 MG
      b. Built 1965
   3. Burton Reservoir
      a. Volume 5.0 MG
      b. Built 1989
   4. Covell Reservoir
      a. Volume: 8.0 MG
      b. Built: 1939
   5. Livingston Reservoir
      a. Volume: 16.0 MG
      b. Built: 1939
   6. Franklin Reservoir
      a. Volume: 16.0 MG
      b. Built 1938
   7. Tulip Elevated Storage Tank
      a. Volume 1.25 MG
      b. Built 1960
   8. Alger Reservoir
      a. Volume 5.0 MG
      b. Built 1972
   9. Knapp Elevated Storage Tank
      a. Volume 1.25 MG
      b. Built 1956
   10. Cambridge Elevated Storage Tank
      a. Volume 1.25 MG
      b. Built 1956

11. Dean Lake Service Center
    a. Volume 5.0 MG
    b. Built 1987
12. East Paris Service Center
    a. Volume 5.0 MG
    b. Built 1978
13. East Grand Rapids Elevated Tank
    a. Volume 1.25 MG
    b. Built 1959
14. Ada Township Elevated Storage Tank
    a. Volume 1.0 MG
    b. Built 1980
15. Patterson Elevated Storage Tank
    a. Volume 1.5 MG
    b. Built 2013
16. North Walker Elevated Storage Tank
    a. Volume 0.5 MG
    b. Built 2017

C. Water Pumping Facilities – See Attached Data Sheets
    1. Wilson Reservoir
    2. Bristol Booster Pump Station
    3. Burton Reservoir
    4. Covell Reservoir
    5. Livingston Reservoir
    6. Franklin Reservoir
    7. Booster A
    8. Booster D
    9. Alger Reservoir
    10. Dean Lake Service Center
    11. East Paris Service Center
    12. Ada Booster Pump Station
    13. Allendale / South Walker Booster Pump Station

Appendix 1. Grand Rapids Distribution System Summary of Pumps

Pump Station Description	Pump No.	Pump Center Line Elevation	Head (feet)	Pressure (psi)	Capacity		Pumps				Motors						
					(gpm)	(mgd)	Make	Model	Year Installed	Serial No.	Make	Type	HP	Speed	Serial No.	Voltage	Ampere
Lake Low Lift	1	562.90	53.4	23	17,360	25.0	F-M	24" 5710	1963	798761	F-M	SYNC	300	600	B6247	2400/4160	58/33.4
	2	562.90	60	26	26,750	38.6	F-M	30" 5713	1963	798685	F-M	SYNC	600	400	B6265	2400/4160	114.2/66
	3	562.90	60	26	26,750	38.6	F-M	30" 6713	1963	798686	F-M	SYNC	600	400	B6264	2400/4160	114.2/66
	4	563.00	71	31	31,250	45.0	Worth	30 MNZ 43	1985	86ZUS8384-1	Ideal	SYNC	700	450	334338	2300	137
	5	596.17	55	24	43,000	62.0	BYR-JCK	48 VX-1	1991	891-C-0483	Ideal	SMVB	900	600	350762	2300	1771
	6	596.17	53	23	32,400	47.0	BYR-JCK	42 VX-1	1991	891-C-0484	Ideal	SMVB	600	720	350751&753	2300	116
	7	596.17	53	23	32,400	47.0	BYR-JCK	42 VX-1	1991	891-C-0485	Ideal	SMVB	600	720	350752&754	2300	116
Lake High Lift	3	579.96	255	110	14,600	21.0	Flowserve	20 NA-37 FR9L	2019	1806MT008011	Hyundai	INDC	1250	890	20171748RMH597001	4160	172.4
	4	579.96	280	121	17,400	25.1	Flowserve	24 NA-37 FR9L	2019	1903MT000812-1	Hyundai	INDC	1500	892	20171748RMH598001	4160	206.3
	5	579.96	340	147	22,050	31.8	Flowserve	30 NA-40 9H	2019	1806MT000813-1	Hyundai	INDC	2500	888	20171748RMH599001	4160	339.9
	6	579.96	340	147	25,000	36.0	Flowserve	30 NA-40	2019	1901MT000823-1	Hyundai	INDC	2500	888	20171748RMHB27001	4160	339.9
	8	608.42	185/250	80/108	8,680/11,800	12.5/17	Peer	30LA-4STG	1992	258341	Ideal	INDC	800/1250	711/891	901056-01	4000	115/179
	9	608.42	225/275	97/119	17,360/22,900	25/33	Peer	36HXB-5STG	1992	258338	Ideal	INDC	1800/2500	596/716	901057-01	4000	276/395
	10	608.42	225/275	97/119	17,360/22,900	25/33	Peer	36HXB-5STG	1992	258339	Ideal	INDC	1800/2500	596/716	901057-02	4000	276/395
	11	608.42	185/250	80/108	8,680/11,800	12.5/17	Peer	30LA-4STG	1992	258342	Ideal	INDC	800/1250	711/891	901056-02	4000	115/179
	12	608.42	225/275	97/119	17,360/22,900	25/33	Peer	36HXB5	1992	258340	Ideal	INDC	1800/2500	596/716	901057-03	4000	276/395
Ada	1	768.00	50	22	1,500	2.2	ITT-AC	8x8x12 8100	2004	04-552181-01-01	G.E.	INDC	30	1170		230/460	71.6/35.8
	2	768.00	50	22	1,500	2.2	ITT-AC	8x8x12 8100	2004	04-552181-01-02	G.E.	INDC	30	1170		230/460	71.6/35.8
	3	768.00	63	27	1,200	1.7	ITT-AC	8x6x12XL 8100	1998	98-246289-01-01	U.S. M	INDC	25	1170		460	
Allendale	2	638.00	210	91	14,600	21.0	Worth	20 LCS-3	1940	997647	West	SYNC	900	900	1S1OP15	2300	176.5
	3	638.25	225	97	17,400	25.0	Worth	20 LCS-4	1940	997648	West	SYNC	1200	720	1S1OP17	2300	235
	4	638.25	240	102	21,550	31.0	Worth	20 LCS-4	1940	997649	West	SYNC	1500	720	1S1OP19	2300	293
	5	638.00	250	108	21,700	31.3	Worth	20 LCS-4	1949	1346734	West	SYNC	1750	720	1S37P74	2300	342
Burton Booster	1	726.17	66	28	53,500	77.0	Patter	42x36 MAD	1992	9OPT14164A36	Ideal	INDC	1250	507	901020-01	2300	314/362
	2	726.17	66	28	53,500	77.0	Patter	42x36 MAD	1992	9OPT14165A36	Ideal	INDC	1250	507	901019-01	2300	314/362
Booster "A"	1	698.62	85	37	3,500	5.0	Patter	14x12 MAB	1999	SC-0013761-01	G.E.	INDC	100	890	VNG322035	460	120
	2	698.62	80	35	1,400	2.2	Peer	6AE11	1992	470534	Reli	INDC	40	1775	1MAF62758CIVS	230/460	98.6/49.3
	3	698.62	75	32	709	1.0	A-C	6x4x11	1992	1-74019-02-1	EMS	INDC	20	1770	NZ6141434003	230/460	46.6/23.3
Booster "D"	1	619.55	75	32	4,170	6.0	Aurora	411 10x12x15B	2020	2585705-1	U.S. M	INDC	100	1185		460	123
	2	619.54	75	32	4,170	5.7	Aurora	411 10x12x15B	2020	2585705-2	U.S. M	INDC	100	1185		460	123
	3	619.57	75	32	2,400	3.5	Aurora	411 8x10x15B	2020	2585703	U.S. M	INDC	75	1190		460	86

Pump Station Description	Pump No.	Pump Center Line Elevation	Head (feet)	Pressure (psi)	Capacity		Pumps				Motors						
					(gpm)	(mgd)	Make	Model	Year Installed	Serial No.	Make	Type	HP	Speed	Serial No.	Voltage	Ampere
Alger	1	647.58	100	43	1,050	1.5	Aurora	411 5x6x11A	2019	18-2550925	U.S. M	INDC	40	1775	1315412-100	230/460	91/46
	2	647.58	110	48	2,100	3.0	Aurora	411 8x10x17B	2019	19-2551056	U.S. M	INDC	100	1180	1322012-100	230/460	117/59
	3	659.58	185	80	700	1.0	Aurora	412 3x4x10C	2019		U.S. M	INDC	50	3565	1315434-100	230/460	113/57
	4	659.58	185	80	2,100	3.0	Aurora	412 6x8x15	2019	19-2550922	U.S. M	INDC	150	1775	1315433-100	230/460	335/168
Bristol	1	775.88	70	30	1,736	2.5	Aurora	411 8x10x15A	2018		U.S. M	INDC	40	1180		230/460	92/46
	2	775.88	70	30	1,736	2.5	Aurora	411 8x10x15A	2018		U.S. M	INDC	40	1180		230/460	92/46
	3	775.88	49.5	21	694	1.0	Aurora	411 5x6x11A	2018		U.S. M	INDC	15	1180		230/460	37/18.5
Covell	1 (N)	747.63	155	67	4,164	6.0	Worth	10 LN-22	1982	81Z002355-1	West	INDC	200	1180	8201	460	236
	2 (S)	747.29	142	62	3,472	5.0	E-P	10x8 M	1954	A8-82118	Tosh	INDC	150	1785	92203383	230/460	334/167
	3 (V-3)	744.62	150	65	2,430	3.5	A-C	10x8x17	1970	1-94540-1-1	F-M	INDC	125	1775	502787R1	460	131
Dean Lake	1	768.00	170	74	700	1.0	Aurora	413 4x5x15	2012		U.S. M	INDC	50	1775	21246	460	59
	2	768.33	162	70	2,800	4.0	Worth	8 LN-21	1987	Z002970	Reli	INDC	200	1185	1MQF26372-GI-WM	460	229
	3	768.50	65	28	5,125	7.4	Aurora	411 12x14x15B	2012		U.S. M	INDC	100	1185		460	121
	4	768.50	65	28	5,125	7.4	Aurora	411 12x14x15B	2012		U.S. M	INDC	100	1185		460	121
East Paris	1	735.22	180	78	5,000	7.2	Patter	14x12 MAB	2015	SC-C0114558-01	G.E.	INDC	350	1185	BGFT051U001	460	395
	2	735.22	180	78	5,000	7.2	Patter	14x12 MAB	2015	SC-C0114558-02	G.E.	INDC	350	1185	BGFT052U005	460	395
	3	735.22	180	78	5,000	7.2	Patter	14x12 MAB	2015	SC-C0114559-01	G.E.	INDC	350	1185	BGFT050U022	460	395
	4	735.22	180	78	5,000	7.2	Patter	14x12 MAB	2015	SC-C0114559-02	G.E.	INDC	350	1185	BGFT0530U22	460	395
Franklin	1	747.28	200	87	6,930	10.0	Worth	12 FAS-2	1956	1519650	F-M	INDC	450	1175	502787R1	440	520
	2	748.63	220	95	9,720	14.0	Worth	18 NA-25	1940	997461	West	SYNC	700	1200	1S10P3	440	720
	3	747.17	175	76	4,160	6.0	Worth	12 FAS-2	1956	1520329	Elli	INDC	250	1180	CS3034-1	440/480	295
	4 Alt	744.76	200	87	11,104	16.0	A-C	250	1982	811-37187-3-1	Det. D	DIESEL	600	1415	663941		
	5	746.25	220	95	5,500	8.0	Patter	MABS-C 18x14	1995		G.E.	INDC	450	1190	RNG142002	460	511
	6	745.98	220	95	8,300	12.0	ITT-AC	WSHD 18x16	1995	40010201	G.E.	INDC	600	1185	PNG134002	460	676
	7	745.98	75	32	8,000	11.5	ITT-AC	WSHD 18x16	1995	40010301	G.E.	INDC	200	890	PNG131002	460	241
	8	745.98	75	32	8,000	11.5	ITT-AC	WSHD 18x16	1995	40010302	G.E.	INDC	200	890	PNG131001	460	241
	9	745.98	75	32	8,000	11.5	ITT-AC	WSHD 18x16	1995	40010303	G.E.	INDC	200	890	PNG131003	460	241
Livingston	1	739.17	184	80	2,080	3.0	Whelr		1956	A6-22121	E-D	INDC	125	1760	AJ4462A2	220/440	300/150
	2	738.88	220	95	3,480	5.0	Whelr	M 10X8	1956	A822120-1	E-D	INDC	250	1760	AJ4006A1	440	290
	3	739.17	220	95	3,480	5.0	Whelr	M 10X8	1956	A822120-2	E-D	INDC	250	1760	AJ4006A2	440	290
	4	740.18	230	100	6,250	9.0	Aurora	410 10x12x18	2020	2571514	Baldor	INDC	450	1780	A2001102024	460	507
	5	738.88	210	91	5,035	7.25	Aurora	410 10x12x18	2020	2571501	Baldor	INDC	350	1785	A1912132025	460	389
	6	737.76	120	52	4,167	6.0	Aurora	412C 10x12x18	2020	2571523	Baldor	INDC	200	1190	A1910152026	460	231
	7	737.76	125	54	6,944	10.0	Aurora	412C 12x14x15B	2020	2571517-2	Baldor	INDC	300	1785	A2002282009	460	329
	8	737.76	125	54	6,944	10.0	Aurora	412C 12x14x15B	2020	2571517-1	Baldor	INDC	300	1785	A2002282010	460	329
South Walker	3	723.70	90	39	700	1.0	Patter	S4B11A-1	2010	HV-C103766-1-01	Baldor	INDC	25	1770	C1105060503	230/460	60/30
	4	723.70	90	39	700	1.0	Patter	S4B11A-1	2010	HV-C103766-1-02	Baldor	INDC	25	1770	C1105060508	230/460	60/30
Wilson	1	726.27	170	74	4,166	6.0	Aurora	411 10x12x15C	2015	2429594	Baldor	INDC	250	1785		460	275
	2	727.21	170	74	7,600	11.0	A-C	150	1940	781-27407-1-1	G.E.	INDC	400	1175	EP8409538	2300	93
	3	726.92	170	74	4,200	6.0	Aurora	411 10x12x15C	2019	202591129	Nidec	INDC	250	1780	B0920200721-0001R0001	460	284

Appendix 2

CITY OF GRAND RAPIDS
ADMINISTRATIVE POLICY

NUMBER: 17-01	DATE: March 28, 2017
REVISIONS: 7/31/2019	
ISSUED BY: City Manager	SIGNED: 

SUBJECT: Replacement of Privately-owned Lead Water Service Line

PURPOSE: To provide for the replacement of privately-owned portion of a lead water service line (i) whenever a leak or failure has been discovered on either the privately owned or Water Supply System ("WSS") owned portion of the service or (ii) when any portion of the WSS owned lead water service line is replaced on either a planned or emergency basis.

INTRODUCTION:

A review of scientific and professional resource materials supports the conclusion that partial lead water service line replacement of the publicly owned portion could cause harm that may not occur if there were a full lead water service line replacement.

A September 2011 cover letter to the United States Environmental Protection Agency ("EPA") Administrator accompanying a report of the Drinking Water Committee of EPA's Science Advisory Board states in part: "The weight of evidence indicates that partial lead water service line replacement often causes tap water lead levels to increase significantly for a period of days to weeks, or even several months." The letter further states that full lead water service line replacement "appears generally effective in reliably achieving long-term reductions in drinking water lead levels, unlike partial lead water service line replacement" and, in summary, states that "the Science Advisory Board found that available information is broadly suggestive that partial lead water service line replacement may pose a risk to the population, due to the short-term elevations in drinking water lead concentrations."

In 2018, the State of Michigan adopted Michigan Administrative Code Rule 604f, i.e. R325.10604f, entitled "Treatment techniques for lead and copper" pursuant to the Safe Drinking Water Act, Act 399 of Public Acts of Michigan of 1976, as amended ("Act 399"). Rule 604f requires a reduction in the threshold of allowable lead in water to 12 parts per billion by 2025. Water supplies with lead service lines, regardless of lead action level values, must replace all lead service lines at an average rate of five percent per year, not

to exceed 20 years, or in accordance with an alternate schedule incorporated into an asset management plan, and approved by the MDEQ. Partial lead service line replacement is no longer permitted, except in case of an emergency repair and the full lead service line must be replaced at the expense of the water supply. The new rules apply to residential and commercial owned lead water service line.

Since all potable water provided through the WSS is potentially capable of human consumption, all privately-owned water service lines, whether they are for residential, commercial, industrial or government use, shall be replaced in accordance with this policy. Such replacement shall be accomplished for general public health and safety purposes.

This Administrative Policy is used pursuant to Section 2.23, Management of Water System, of Article 2, Water System Use, of Chapter 26, City Water System of Title II, Utilities and Services, of the Code of Ordinances of the City.

DEFINITIONS:

"Eligible lead water service line" means all privately-owned water service lines, whether they are for residential, commercial, industrial or government use, since all potable water provided through the WSS is potentially capable of human consumption.

"Lead water service line" means either a service line which is made of lead, or any lead pigtail, lead gooseneck or other lead fitting that is connected to the service line, or both.

"Privately-owned portion of a lead water service line" means the section of lead water service piping from the outlet joint of the curb stop to customer site piping or building plumbing at the first shut-off valve inside the building or 18 inches inside the building.

Water Supply System ("WSS") means the water utility operated by the City of Grand Rapids, including its retail partner communities.

"WSS owned portion of a lead water service line" means the section of lead water service piping from the discharge of the corporation fitting on the water main to, but not including, the outlet joint of the curb stop.

REPLACEMENT REQUIREMENT:

The City's WSS shall, at its cost and at no cost to the property owner, replace the privately owned portion of a lead water service line whenever:

a. a leak or failure has been discovered on either the privately owned or WSS portion of the service line; or

b. when any portion of the WSS owned portion of the service line is replaced on either a planned or an emergency basis.

In the event that a non-WSS project creates a disturbance of an existing lead service line, the party creating the disturbance shall be responsible for the replacement of the full lead service line and it costs.

REPAIR OR RECONNECTION PROHIBITED.

Repair of an existing lead water service line, or reconnection of a privately-owned lead water service line to the WSS is prohibited by Michigan Administrative Code Rule 604f, i.e.R325.10604f, entitled “Treatment techniques for lead and copper” promulgated pursuant to Public Act 399 (Safe Drinking Water Act), as amended.

EXCEPTION.

The City Manager or his/her designee may grant a temporary exception to the replacement requirement or the repair or reconnection prohibition if he/she determines that doing so will not create an imminent threat to the health, safety or welfare of the public.

NOTICE.

Leak or Emergency Replacement. In the event of a lead water service line leak or failure or an emergency replacement of the WSS owned portion of the lead water service line, the City Manager or his/her designee shall promptly provide written notice to the property owner of the replacement requirement and the property owner shall sign and provide the City with a water service line replacement agreement as hereinafter provided for the privately owned portion of the lead water service line before replacement can begin.

Planned Replacement. In the event of a planned replacement of a WSS owned portion of a lead water service line, the City Manager and/or his/her designee shall provide at least 30 days written notice prior to the commencement of the planned replacement and the property owner shall sign and provide the City with a water service line replacement agreement as hereinafter provided for the privately owned portion of the lead water service line before replacement can begin.

WATER SERVICE LINE REPLACEMENT AGREEMENT.

Before a privately owned lead water service line can be replaced the property owner shall sign and provide the City with a water service line replacement agreement on a form provided by the City (a) acknowledging to ownership of the property being served by the lead water service line, (b) permitting access to the City or its contractor to replace the privately owned lead water service line and any related testing and adjustments during any contractor guarantee period, (c) retaining full ownership, maintenance, repair and replacement for that portion of the privately owned service line and related appurtenances not replaced, and (d) agreeing to assume ownership of the water service line that replaces the privately owned lead water service line and be fully responsible for its ownership and, after the expiration of any guarantee period, its maintenance, repair and replacement.

FAILURE TO SIGN WATER SERVICE LINE REPLACEMENT AGREEMENT.

If the City Manager or his/her designee has determined, in accordance with this Administrative Policy, to replace a privately owned lead water service line and the property owner of such dwelling has declined or failed to respond to requests to sign a

water service replacement agreement, (a) the City may, upon notice to the property owner, discontinue water service if the City determines there is an imminent threat to the health, safety or welfare of the public or (b) the City Manager may request that the City Attorney or special counsel apply for and obtain an appropriate court-issued order authorizing replacement in accordance with the terms in the water service replacement agreement.

Lead Service Replacement Checklist Form

Address: _____ Date: _____

Service Worker: _____

Leak on a Lead Service? What can be done?

If there is a leak on the lead water service, the City of Grand Rapids may be able to pay for the replacement of the water service. There are a number of conditions that must be met for the City of Grand Rapids to pay for the replacement of the private portion of the lead service:

CHECKLIST:

- Emergency water service leak confirmed on private or public side of water service; verified by city representative

  One of the following conditions qualify for lead service replacement of commercial/residential accounts:
  ____ City-side lead service leak
  ____ Broken curb stop
  ____ Private-side lead service leak
  ____ Lead wipe joint leak
  ____ Leak on galvanized pipe downstream of lead service line

- Reported water service leaks must occur AFTER 3/28/17.
- Must have lead water service verified by a City of Grand Rapids representative.
- Water Service Agreement must be signed BEFORE work begins on homeowners' side of water service.
- Repairs must be coordinated by City and performed by approved City Contractor (under existing service contract) in order to be paid by the City of Grand Rapids. The City will solicit quotes from these contractors and authorize City's contractor to replace private portion of the lead service line.
- Water service material type to be reinstalled is to be Type K copper.
- Is property "front-back" situation? If so, replace lead service line with new service to each home.

There can be expectations to the replacement requirement or repair prohibition if it is determined that doing so will not create an imminent threat to the health, safety or welfare of the public.

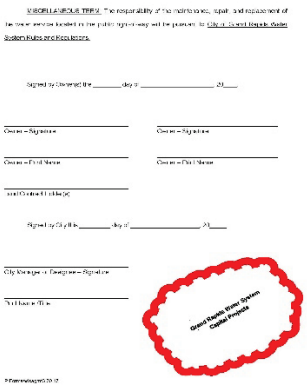
Call one of our Field Operations Supervisors at 456-3141.

Negligent actions by the homeowner or a contractor will disqualify the service from a City sponsored replacement.

CAPITAL PROJECT LSLR MAILING CHECKLIST

Agreements

- Fill in address on 1st page of agreement
- Make sure Signature sheet of agreement has the "Grand Rapids Water System Capital Projects" stamp on it in the lower right portion of the page:



Letters

Owners

- All owners need to be mailed the letter and agreement
- Address Format for window in Envelope

  Property owner

  1234 Street Name

  Grand Rapids, MI 49505

Customers

- Only customers with a different name AND address than owner
- Address Format for window in Envelope

  JOHN DOE OR CURRENT RESIDENT
  2711 ORDWAY ST NW APT 204
  WASHINGTON DC 20008-5036

If excluding the name, use this format:

HOUSEHOLDER
2711 ORDWAY ST NW APT 204
WASHINGTON DC 20008-5036

- Envelope can't have "RETURN SERVICE REQUESTED" printed on it, and be addressed to "OR CURRENT RESIDENT"
- When you put this mail in your outgoing mail area, please separate it from the regular mail and label it as No Endorsement
- Another suggestion is to include a line of text on the envelope (to the right of the mailing address or above & to the center of the mailing address) that says "IMPORTANT PROPERTY INFORMATION" or something of that sort.

WATER SYSTEM

CITY OF GRAND RAPIDS

Notice of Water Service Line Replacement

Por favor ver atrás para traducción en español

Date

Hello, Neighbor:

We're committed to delivering high-quality water and we work hard to protect your health. We're reaching out because our records show the water service line to your home may include a lead pipe. If so, **we can replace your lead service line at no cost to you** while we're doing road work on your street that includes replacement of the water main.

Did you know that swallowing or breathing in lead may result in lead poisoning and young children are at most risk? By replacing your lead water service line, we can help remove a health risk in your home and protect you and your loved ones.

Please contact our office as soon as possible to give us permission to enter your home to see whether there's a lead service line. If we find one, we ask that the homeowner signs the enclosed agreement and return it to us at the following address:

Lead Service Line Replacement Program
1900 Oak Industrial Drive Dr. NE
Grand Rapids, MI 49505

Scheduling your lead service line replacement is very important. Your response is needed as soon as possible. Please contact us at 616. 456. 4678 or leadfreewater@grcity.us to schedule an appointment.

In partnership,

Your Grand Rapids Water System Team

WATER SYSTEM

CITY OF GRAND RAPIDS

Aviso de reemplazo de servicio de agua

Fecha

Hola, vecino:

Nosotros estamos comprometidos de producir agua de alta calidad y estamos trabajando duro para proteger su salud. Estamos tratando de contactarlo porque nuestros datos indican que su servicio de agua puede contener plomo. Si ese es el caso, nosotros **vamos a reemplazar su servicio de agua sin costo a usted** durante el proyecto de construcción que ocurrirá en su calle que incluirá el reemplazo de la cañería principal.

Usted sabe que ingerir o respirar plomo puede resultar en intoxicación de plomo y niños pequeños están en más riesgo? Reemplazando su línea de servicio de plomo, podemos ayudar a eliminar un riesgo de salud de su casa que protegerá a usted y sus seres queridos.

Por favor de contactarnos a nuestra oficina para darnos permiso para entrar a su casa y verificar si su línea de servicio de agua es de plomo. Si encontramos plomo, el dueño de casa tendrá que firmar el contrato y regresarlo a esta dirección:

Lead Service Line Replacement Program
1900 Oak Industrial Drive Dr. NE
Grand Rapids, MI 49505

Si no podemos reemplazar su línea de servicio de plomo, no podemos reconectar su servicio de agua al sistema público. **Esto significa que no tendrá servicio de agua en su casa. Llamando para ser una cita es muy importante y necesitamos que nos responda rápidamente. Por favor de contactarnos at 616.456.4550 o leadfreewater@grcity.us para ser una cita.**

Gracias,

El Sistema de agua de Grand Rapids

WATER SYSTEM

CITY OF GRAND RAPIDS

SECOND NOTICE OF WATER SERVICE LINE REPLACEMENT

Por favor ver atrás para traducción en español

Date:

Hello, Neighbor:

We're again trying to contact you about road work on your street that includes a water main replacement. Our records show the water service line to your home may include a lead pipe. If so, we can replace your lead service line **at no cost to you**. Swallowing or breathing in lead may result in lead poisoning, and young children are at most risk.

Please contact our office as soon as possible to give us permission to enter your home to see whether there's a lead service line. If we find one, we ask that the homeowner signs the enclosed agreement and return it to us at the following address:

Lead Service Line Replacement Program
1900 Oak Industrial Drive Dr. NE
Grand Rapids, MI 49505

If we can't replace your lead service line, we can't reconnect your water service to the public water supply once the water main is replaced. **That means you won't have water service in your home. Scheduling your lead service line replacement is very important. Your response is needed as soon as possible. Please contact us at 616.456.4678 or leadfreewater@grcity.us to schedule an appointment.**

In partnership,

Your Grand Rapids Water System Team

WATER SYSTEM

CITY OF GRAND RAPIDS

Segundo aviso de reemplazo de servicio de agua

Fecha

Hola, vecino:

Estamos tratando de contactarlo sobre el proyecto de construcción que ocurrirá en su calle que incluirá el reemplazo de la cañería principal. Nuestros datos indican que su servicio de agua puede contener plomo. Si ese es el caso, nosotros vamos a reemplazar su servicio de agua **sin costo a usted** durante el proyecto de construcción. Ingiriendo o respirando plomo puede resultar en intoxicación de plomo y niños pequeños están en más riesgo.

Por favor llame a nuestra oficina para darnos permiso para entrar a su casa y verificar si su línea de servicio de agua es de plomo. Si encontramos plomo, el dueño de casa tendrá que firmar el contrato y regresarlo a esta dirección:

Lead Service Line Replacement Program
1900 Oak Industrial Drive Dr. NE
Grand Rapids, MI 49505

Si no podemos reemplazar su línea de servicio de plomo, no podemos reconectar su servicio de agua al sistema público. **Esto significa que no tendrá servicio de agua en su casa. Llamando para ser una cita es muy importante y necesitamos que nos responda rápidamente. Por favor de contactarnos al 616.456.4550 o leadfreewater@grcity.us para ser una cita.**

Gracias,

El Sistema de agua de Grand Rapids

CITY OF GRAND RAPIDS ENGINEERING DEPARTMENT

SPECIAL SPECIFICATION
FOR
WATER MAINS - CONSTRUCTION OF WATER SERVICES OUTSIDE THE RIGHT-OF-WAY

a. Description. This project will construct new copper water service pipe from proposed or existing curb stop boxes to proposed or existing water meters for properties within the project limits. The work will include conducting an exploratory investigation to the expose the existing water service from the curb box to the meter (building), the placement of the new service with trenchless technology, and may include open cut construction when required or as directed by the Engineer. The work shall be done in accordance with the City of Grand Rapids Standard Construction Specifications and as specified herein.

The location of the existing water services and proposed water services from the curb box to the structure (meter location) as shown on the Drawings are only approximate. The Contractor shall field verify all service locations prior to the placement of the new copper water service.

b. Materials. All materials used to construct water services outside the public ROW, including all internal plumbing required to re-connect water services, shall be in accordance with the Standard Construction Specifications, ANSI A13.1 Standard for the Identification of Piping Systems, NSF/ANSI 61-2012 Drinking Water System Components, NSF/ANSI 372 -2011 Drinking Water System Components, ASME B31.9 Building Service Piping, ASTM A325 Structural Bolts, Stee, Heat Treated, 120/105 ksi Minimum Tensile Strength, EPA U.S. Safe Drinking Water Act (US SDWA) 2014 and the Michigan Plumbing Code.

All materials used to restore any lawn, sidewalks, driveways, and landscaping disturbed by the construction of water services outside the public ROW shall also be in accordance with the Standard Construction Specifications and shall match the existing material being disturbed, or as Directed by the Engineer.

Trenchless Technology Submittals The Contractor shall furnish document(s) supporting the directional drilling Contractor's qualifications and experience.

Equipment and Expertise - The Contractor shall have equipment and expertise, appropriate for horizontal directional drilling, horizontal boring or other Engineered approved trenchless installations. This includes the preparation and maintenance of the bore path using drilling fluids as appropriate for the geology of the soils. The Contractor shall also have experience in safety and dependability installing, in similar geology, similar size and length of piping involved.

Work Plan - Prior to beginning work, the Contractor shall submit to the Engineer a work plan detailing the procedure and schedule to be used to execute the project. The Contractor shall also submit all proof of all required permits. The work plan shall include a description of all equipment to be used, down-hole tools, a list of personnel and their qualifications and experience (including back-up personnel in the event that an individual is unavailable), list of subcontractors, a schedule of work activity, a safety plan (including MSDS of any potentially hazardous substances to be used), traffic control plan (if applicable), an environmental protection plan and contingency plans for possible problems. Work plan shall be comprehensive, realistic and based on actual working conditions for this particular project. Plan shall document the thoughtful planning required to successfully complete the project.

c. Construction. Construction shall be according to Divisions 19 of the City of Grand Rapids Standard Construction Specifications and as specified herein.

General - The City will obtain grading permits and agreements from individual property owners for the water service construction outside the ROW. Prior to starting any work outside the ROW, the Contractor shall verify with the Engineer that the appropriate grading permits and agreements have been obtained from the property owner.

Plumbing permits will be required for work performed inside and outside existing buildings. The Contractor shall secure all required permits and pay all associated fees. All plumbing work inside and within five feet of a building shall be performed by a licensed plumber in possession of a valid permit. The Contractor will coordinate with the City plumbing inspector and water department. A list of names, addresses, and telephone numbers will be made available to Contractor.

Exploratory Investigation – Establish necessary lane, shoulder and/or sidewalk closures required to perform work. Advance the exploratory excavation using vacuum boring excavation, hand digging, conventional machine excavation, or a combination thereof subject to approval of the Engineer. Allow the Engineer access to document the necessary information. If the technique used to advance the excavation is causing damage to the existing facilities, ease all work until an alternate method approved by the Engineer.

Prior to construction of the proposed water service, the Contractor and licensed plumber shall coordinate with the Engineer and the property owner to determine the location of the proposed service, new meter (if required) and construction schedule.

Water Service Outside of the Right of Way - Where shown on the Drawings, the Contractor shall construct water services outside the public ROW and re-connect them to the new or existing copper water service at the curb stop. The Contractor will schedule the work for the services such that at no time will connections from any new copper service piping to lead services.

Place water services perpendicular the water main unless otherwise approved by the Engineers, and a minimum of 5 feet deep from finish grade.

Basement Penetration - Core drill 3-inch maximum hole for 1-inch or 1-1/2-inch copper service. Coordinate hole sized for copper services over 1-1/2-inch with Engineer. Hole to be minimum of 5 feet below exterior finished grade. If basement wall is nonexistent or cannot be drilled, the copper may be fed into the house through the basement floor with tunneling equipment. Seal void between hole and copper with Fosrock, Preco Plug, or equal. Existing service lines may not be used for new connections, unless approved by Engineer.

Connection of New Service Line:

1. Connect new shut off valve, copper horn, and meter within 3 feet of basement wall, or as approved by the Engineer.
2. Continue copper to existing house plumbing, match existing size, 1 inch minimum. Connect to maximum pipe size of system. Provide all copper and fittings necessary to make connection.
3. Flush water system until water clears, check all new plumbing for leaks.
4. Restore temporary removals or damages to the lawn, driveway, or building.
5. Have homeowner sign a letter of acceptance of the Work, in a form approved by Engineer.
6. The contractor shall not connect proposed copper back to an existing lead service for any reason. Temporary or otherwise.

Remote Meters - If building does not have a basement, or an area where meter can be installed inside of the first floor, utilize a meter pit. Install City of Grand Rapids standard meter pit per detail WS-5 on private property in a location approved by the homeowner. Run new copper into the home and install a new shut off valve. Install new copper to the existing house plumbing. Install remote meter reader per City standard detail, or as approve by the Engineer. Flush water system until water clears, check all new plumbing for leaks. Restore temporary removals or damages to the lawn, driveway, or building.

Saw cut existing supply line just inside basement wall and plug pipe with threaded or soldered cap.

For trench excavation approved by the Engineer, the Contractor shall saw cut existing bituminous and concrete surfaces and shall carefully remove all paved areas inside and around all buildings affected by the project. The Contractor shall directional drill the proposed water services in all instances where removal and replacement of walls, trees, concrete stairs, porch structures and other appurtenances not on the bid form would be required.

Following the placement of the water service, the Contractor shall restore the area disturbed outside the ROW to match the conditions prior to construction of the service.

d. Measurement and Payment. The completed work as measured for the construction of water services outside the right of way will be paid for at the contract unit price for the following contract items (pay items).

Pay Item	**Pay Unit**
__" Water Service (Curb Box to Meter)	each
__" Water Service (Curb Box to Meter), over 60 feet	each
Internal Plumbing, Water Service	dollars
Exploratory Investigation, Water Service	each
Meter Pit, per Detail ___	each

"__" Water Service (Curb Box to Meter)" shall be payment in full for placement of new copper water service from the curb box line to the building penetration at the meter or proposed meter location utilizing directional drilling or other approved trenchless technology, and includes furnishing and placing all copper piping, fittings, sand backfill, permit fees and any incidental work required for the proper placement of the water services.

"__" Water Service (Curb Box to Meter), over 60 feet" shall be payment in full for placement of new copper water service in locations where the distance from the curb stop box to the building penetration location exceeds 60 feet. "__" Water Service (Curb Box to Meter), over 60 feet" will be measured and paid when the service exceeds a 60 foot distance from the curb box to the building penetration and will be paid in addition to __" Water Service (Curb Box to Meter) and includes furnishing and placing all copper piping, fittings, sand backfill and any incidental work required for the proper placement of the water services.

"Internal Plumbing, Water Service" is an allowance established to pay for all materials, labor, and equipment, including the services of a licensed plumber, required to replace the water service inside and within five feet of a building and connect the service to the existing or proposed service meter. Where the work is performed by a subcontractor or supplier, the Contractor will be paid for the amount invoiced plus an additional 6% of the invoiced cost as reimbursement for the Contractor's administrative costs. Where the Contractor will be performing the work with his own forces, the work will be paid for using predetermined, negotiated prices. If the Contractor and Engineer cannot agree upon prices, the work will be paid for by force account in accordance with section 109.07 of the MDOT Standard Specifications for Construction.

"Exploratory Investigation, Water Service" will be paid for at the Contract unit price for the exploratory investigation of existing water services. "Exploratory Investigation, Water Service" will be paid only once each for each individual water service. At locations where abatement is not required and the excavation of the existing water service is part of the connection of a new copper service from the main to the curb box, the excavation will not be paid separately but will be considered included in the price of the new water service. "Exploratory Investigation, Water Service" includes all labor, equipment and materials

required to complete the work, including all costs associated with repair or replacement resulting from the contractor's activities.

"Meter Pit, per Detail ___" shall be payment in full for placement of new meter pit. The price shall be payment in full for furnishing all labor, equipment and material and shall include all work as listed in the measure and payment section of Division 20 of the City of Grand Rapids Standards Specification.

When approved by the Engineer, water services from curb box to meter may be placed in open trenches and will be measured and paid for per lineal foot for "__" Water Service", according to Division 19 of the Standard Construction Specifications from the water main to the building penetration, and includes furnishing and placing all piping, fittings, sand backfill and any incidental work required for the proper reconnection of the water services.

When water services outside the right of way are placed by open cut, the restoration of surface over the new water service will be paid for separately under the related items.

Appendix 3

Appendix 3 - National Register of Historical Places for Kent & Ottawa Counties
Source: https://www.nps.gov/subjects/nationalregister/database-research.htm#table

Reference number	Property Name	State	County	City	Street & Number	Level of Significance - International	Level of Significance - Local	Level of Significance - National	Level of Significance - Not Indicated	Level of Significance - State	Listed Date
_70000275	Ada Covered Bridge	MICHIGAN	Kent	Ada	Across the Thornapple River	False	False	False	False	True	2/16/1970
_01001018	Porter Hollow Embankment and Culvert	MICHIGAN	Kent	Algoma Township	White Pine Strail at Stegman Creek, W of Summit Ave.	False	True	False	False	False	9/24/2001
_90000570	Thornapple River Drive Bridge	MICHIGAN	Kent	Cascade Township	Thornapple River Dr. over Thornapple River	False	True	False	False	False	4/18/1990
_06001326	Whitney Tavern Stand	MICHIGAN	Kent	Cascade Township	5283 Whitneyville Ave.	False	True	False	False	False	2/1/2007
_83000877	Blodgett, John W., Estate	MICHIGAN	Kent	East Grand Rapids	250 Plymouth Rd., SE	False	True	False	False	False	7/28/1983
_82000536	Aldrich Building	MICHIGAN	Kent	Grand Rapids	98 Monroe Center, NW	False	True	False	False	False	11/12/1982
_99000052	Aldrich, Godfrey, and White Block	MICHIGAN	Kent	Grand Rapids	89-99 Monroe Center	False	True	False	False	False	1/27/1999
_08001102	Alten, Mathias., House and Studio	MICHIGAN	Kent	Grand Rapids	1593 E. Fulton St.	False	False	True	False	False	6/23/2009
_100005823	American Box Board Company Headquarters and Factory	MICHIGAN	Kent	Grand Rapids	470 Market Ave. SW	False	True	False	False	False	11/24/2020
_03000687	American Seating Company Factory Complex	MICHIGAN	Kent	Grand Rapids	801 Broadway Ave. NW	False	False	True	False	False	7/25/2003
_00001486	Berkey and Gay Furniture Company Factory	MICHIGAN	Kent	Grand Rapids	940 Monroe Ave., NW	False	False	False	False	True	12/20/2000
_13000969	Central Furniture Company-H.E. Shaw Furniture Company Factory	MICHIGAN	Kent	Grand Rapids	400 Ionia Ave., SW.	False	True	False	False	False	12/24/2013
_99001523	Division Avenue-Plaster Creek Bridge	MICHIGAN	Kent	Grand Rapids	Division Ave. over Plaster Creek	False	False	False	False	True	12/17/1999
_13000666	Eastern Avenue School	MICHIGAN	Kent	Grand Rapids	758 Eastern Ave., NE.	False	True	False	False	False	9/4/2013
_82000537	Fine Arts Building	MICHIGAN	Kent	Grand Rapids	220 Lyon St., NW	False	True	False	False	False	11/12/1982
_82000538	First (Park) Congregational Church	MICHIGAN	Kent	Grand Rapids	10 E. Park Pl., NE	False	True	False	False	False	11/12/1982
_95000073	Ford, President Gerald R., Jr., Boyhood Home	MICHIGAN	Kent	Grand Rapids	649 Union Ave., SE.	False	False	True	False	False	2/27/1995
_100007211	Fulton Manor	MICHIGAN	Kent	Grand Rapids	1450 Fulton St. East	False	True	False	False	False	12/2/2021
_80001877	Goodspeed Brothers Building	MICHIGAN	Kent	Grand Rapids	188 Monroe St., NW	False	True	False	False	False	4/17/1980
_100002712	Grand Rapids Christian High School	MICHIGAN	Kent	Grand Rapids	415 Franklin St., SE	False	True	False	False	False	7/25/2018
_90001956	Grand Rapids Savings Bank Building	MICHIGAN	Kent	Grand Rapids	60 Monroe Center, NW	False	True	False	False	False	12/28/1990
_12001032	Grand Rapids Storage and Van Company Building	MICHIGAN	Kent	Grand Rapids	1415 Lake Dr. SE.	False	True	False	False	False	12/12/2012
_82002844	Heartside Historic District	MICHIGAN	Kent	Grand Rapids	Division, Commerce, and Ionia Aves., Fulton, Weston, Oakes, and Cherry Sts.	False	True	False	False	False	3/2/1982
_100007933	Heartside Historic District (Boundary Increase)	MICHIGAN	Kent	Grand Rapids	Roughly Sheldon Blvd. SE, South Division Ave., Commerce Ave. SW, Ionia Ave. SW, Weston St. SE, Cherry St. SW, Williams St. SW, Bartlett St. SW, and Goodrich Street SW, all south of Fulton St. and north of Wealthy St.	False	True	False	False	False	7/11/2022
_71000399	Heritage Hill Historic District	MICHIGAN	Kent	Grand Rapids	Bounded by Michigan Ave. on the N, Pleasant St. on the S, Union Ave. on the E, and Clarendon Pl. and Jefferson Ave. W	False	True	False	False	False	3/11/1971
_80004806	Keeler Building	MICHIGAN	Kent	Grand Rapids	56 N Division Ave.	False	False	False	False	False	11/27/2017
_04000690	Kent County Civil War Monument	MICHIGAN	Kent	Grand Rapids	Division Ave. at Monroe Ave.	False	False	False	False	True	7/14/2004
_71000400	Ladies' Literary Club	MICHIGAN	Kent	Grand Rapids	61 Sheldon St., SE.	False	True	True	False	False	10/26/1971
_83000878	Ledyard Block Historic District	MICHIGAN	Kent	Grand Rapids	123-145 Ottawa Ave., and 104-124 Monroe Center, NW	False	True	False	False	False	9/8/1983
_13000667	Lexington School	MICHIGAN	Kent	Grand Rapids	45 Lexington, NW.	False	True	False	False	False	9/4/2013
_82000539	Loraine Building	MICHIGAN	Kent	Grand Rapids	124 E. Fulton St.	False	True	False	False	False	11/24/1982
_00000506	Medical Arts Building	MICHIGAN	Kent	Grand Rapids	26 Sheldon Blvd. SE	False	True	False	False	False	5/18/2000
_04000691	Metal Office Furniture Company (Steelcase) Plants No. 2 and 3	MICHIGAN	Kent	Grand Rapids	401 Hall St. SW	False	True	False	False	False	7/17/2004
_83000879	Michigan Trust Company Building	MICHIGAN	Kent	Grand Rapids	40 Pearl St., NW	False	False	False	False	True	2/24/1983
_02000815	Monroe Avenue Water Filtration Plant	MICHIGAN	Kent	Grand Rapids	1430 Monroe Ave. NW	False	False	True	False	False	7/31/2002
_93000769	Mt. Mercy Academy and Convent	MICHIGAN	Kent	Grand Rapids	1425 Bridge St., NW	False	True	False	False	False	8/5/1993
_66000396	Norton Mound Group	MICHIGAN	Kent	Grand Rapids	Address Restricted	False	False	True	False	False	10/15/1966
_85002154	Paddock, Augustus, House	MICHIGAN	Kent	Grand Rapids	1033 Lake Dr., SE	False	True	False	False	False	9/12/1985
_00001483	Peck Block	MICHIGAN	Kent	Grand Rapids	34-50 Monroe Center NW	False	True	False	False	False	12/7/2000
_70000276	Pike, Abram W., House	MICHIGAN	Kent	Grand Rapids	230 Fulton St., E.	False	False	False	False	True	7/8/1970
_88000142	Rood Building	MICHIGAN	Kent	Grand Rapids	Address Restricted	False	True	False	False	False	3/4/1988
_100004384	Saint Joseph Seminary	MICHIGAN	Kent	Grand Rapids	600 Burton St. SE	False	True	False	False	False	9/16/2019
_100007588	Sisters of the Order of Saint Dominic Motherhouse Complex	MICHIGAN	Kent	Grand Rapids	2025 Fulton St. East	False	True	False	False	False	4/7/2022
_76001030	Sixth Street Bridge	MICHIGAN	Kent	Grand Rapids	Spans Grand River between Newberry and 6th St.	False	False	False	False	True	8/13/1976
_71000401	St. Cecilia Society Building	MICHIGAN	Kent	Grand Rapids	24--30 Ransom Ave., NE	False	True	False	False	False	12/9/1971
_82002845	Third Reformed Church	MICHIGAN	Kent	Grand Rapids	1009 Hermitage St., SE	False	True	False	False	False	4/22/1982
_70000277	Turner House	MICHIGAN	Kent	Grand Rapids	731 Front St., NW	False	True	False	False	False	7/8/1970
_74000990	U.S. Post Office	MICHIGAN	Kent	Grand Rapids	Ionia and Pearl Sts.	False	True	False	False	False	7/10/1974
_86003373	Villa Maria	MICHIGAN	Kent	Grand Rapids	1315 Walker NW	False	True	False	False	False	3/27/1987
_12001172	Willard Building	MICHIGAN	Kent	Grand Rapids	150 E. Fulton St.	False	True	False	False	False	1/14/2013
_99001539	Downtown Lowell Historic District	MICHIGAN	Kent	Lowell	Roughly along Main St. bet. Hudson and Washington	False	True	False	False	False	12/9/1999
_72000627	Fallasburg Covered Bridge	MICHIGAN	Kent	Lowell	Covered Bridge Rd.	False	False	False	False	True	3/16/1972
_72000626	Graham House	MICHIGAN	Kent	Lowell	323--325 Main St.	False	True	False	False	False	1/13/1972
_98001217	Fallasburg Historic District	MICHIGAN	Kent	Vergennes Township	Covered Bridge Rd.	False	True	False	False	False	3/31/1999
_99001522	Business Route M-21-Plaster Creek Bridge	MICHIGAN	Kent	Wyoming	Bus. Rte. M-21 over Plaster Creek	False	True	False	False	False	12/17/1999
_73002294	Grand Rapids, Grand Haven and Muskegon Railway Depot	MICHIGAN	Ottawa	Coopersville	363 W. Main St.	False	True	False	False	False	2/6/1973
_73002158	Spoonville Site	MICHIGAN	Ottawa	Crockery	Address Restricted	False	False	False	False	True	3/30/1973
_82002860	Ferry, Edward P., House	MICHIGAN	Ottawa	Grand Haven	514 Lafayette St.	False	True	False	False	False	3/19/1982
_16000584	Grand Haven Historic District	MICHIGAN	Ottawa	Grand Haven	Washington Ave, adjacent Sts Harbor Dr. through 600 blks.	False	False	False	True	False	9/6/2016
_16000583	Grand Trunk Western Railroad Grand Haven Coal Tipple	MICHIGAN	Ottawa	Grand Haven	300 Block of N. Harbor Dr. in Chinook Pier Park	False	True	False	False	False	9/6/2016
_00001490	Pere Marquette Railway Locomotive #1223	MICHIGAN	Ottawa	Grand Haven	Chinook Pier Park, Jackson Ave.	False	False	False	False	True	12/7/2000
_95001161	Piers and Revetments at Grand Haven, Michigan	MICHIGAN	Ottawa	Grand Haven	Mouth of Grand R.	False	True	False	False	False	10/23/1995
_09000203	Robbins, Nathaniel and Esther (Savidge), House	MICHIGAN	Ottawa	Grand Haven	20 S. 5th Ave.	False	True	False	False	False	4/16/2009
_84001478	Cappon, Isaac, House	MICHIGAN	Ottawa	Holland	228 W. 9th St.	False	True	False	False	False	1/26/1984
_100002333	De Zwaan Windmill	MICHIGAN	Ottawa	Holland	Windmill Island Gardens, 1 Lincoln Ave.	False	False	False	False	True	4/17/2018
_84000548	Gold, Egbert H., Estate	MICHIGAN	Ottawa	Holland	1116 Hazel Ave.	False	False	False	False	True	12/27/1984
_90001534	Holland Downtown Historic District	MICHIGAN	Ottawa	Holland	Roughly, Eighth St. from just E of College Ave. to River Ave. and River Ave. from Ninth St. to just N of Eighth St.	False	True	False	False	False	10/4/1990
_78001509	Holland Harbor Lighthouse	MICHIGAN	Ottawa	Holland	South Pier, Holland Harbor	False	False	False	False	True	7/20/1978
_83000889	Holland Historic District	MICHIGAN	Ottawa	Holland	11th, 12th, 13th Sts., and Washington, Maple, and Pine Aves.	False	True	False	False	False	5/12/1983
_90001234	Holland Historic District (Boundary Increase)	MICHIGAN	Ottawa	Holland	Roughly bounded by River Ave., Pine Ave., 16th St., 14th St., Columbia Ave., 13th St., Central Ave., and 10th St.	False	True	False	False	False	8/10/1990
_85000063	Holland Old City Hall and Fire Station	MICHIGAN	Ottawa	Holland	108 E. 8th St.	False	True	False	False	False	1/11/1985
_90001243	Holland Reformed Protestant Dutch Church	MICHIGAN	Ottawa	Holland	57 E. 10th St.	False	False	False	False	True	8/23/1990
_99000337	Morrissey, Thomas and Anna, House	MICHIGAN	Ottawa	Holland	190 W. 9th St.	False	True	False	False	False	3/29/1999
_71000418	Third Reformed Church of Holland	MICHIGAN	Ottawa	Holland	110 W. 12th St.	False	True	False	False	False	4/16/1971
_89000790	Van Raalte, Benjamin, House	MICHIGAN	Ottawa	Holland	1076 Sixteenth St.	False	True	False	False	False	12/4/1989
_08000224	Hudsonville Christian School	MICHIGAN	Ottawa	Hudsonville	5692 School Ave.	False	True	False	False	False	3/27/2008
_73000956	Battle Point Site	MICHIGAN	Ottawa	NW Ottawa County	Address Restricted	False	False	False	False	True	8/14/1973
_98001061	Olive Township District No. 1 School	MICHIGAN	Ottawa	Olive Township	11611 Stanton St.	False	True	False	False	False	8/14/1998
_95000451	Ottawa Beach Historic District	MICHIGAN	Ottawa	Ottawa Beach	Ottawa Beach Rd., Park Township	False	True	False	False	False	4/14/1995
_100005825	Lakewood Farm	MICHIGAN	Ottawa	Park Township	264 North Lake Shore Dr.	False	True	False	False	False	11/25/2020
_87002139	Bilz, Aloys, House	MICHIGAN	Ottawa	Spring Lake	107 S. Division St.	False	True	False	False	False	12/14/1987
_99001535	Fruitport Road-Pettys Bayou Bridge	MICHIGAN	Ottawa	Spring Lake Township	Fruitport Rd. over Pettys Bayou	False	True	False	False	False	12/17/1999
_100000886	De Pree, Max and Esther, House	MICHIGAN	Ottawa	Zeeland	279 S. Division St.	False	False	True	False	False	4/17/2017

Appendix 4

Data from U.S. Fish & Wildlife Service, Environmental Conservation Online System

Scientific Name	Common Name	Where Listed	Region	ESA Listing Status	Group
Myotis sodalis	Indiana bat	Wherever found	3	Endangered	Mammals
Canis lupus	Gray wolf	U.S.A.: All of AL, AR, CA, CO, CT, DE, FL, GA, IA, IN, IL, KS, KY, LA, MA, MD, ME, MI, MO, MS, NC, ND, NE, NH, NJ, NV, NY, OH, OK, PA, RI, SC, SD, TN, TX, VA, VT, WI, and WV; and portions of AZ, NM, OR, UT, and WA. Mexico.	6	Endangered	Mammals
Lynx canadensis	Canada Lynx	Wherever Found in Contiguous U.S.	6	Threatened	Mammals
Charadrius melodus	Piping Plover	[Great Lakes watershed DPS] - Great Lakes, watershed in States of IL, IN, MI, MN, NY, OH, PA, and WI and Canada (Ont.)	3	Endangered	Birds
Nerodia erythrogaster neglecta	Copperbelly water snake	Indiana north of 40 degrees north latitude, Michigan, Ohio	3	Threatened	Reptiles
Pleurobema clava	Clubshell	Wherever found; Except where listed as Experimental Populations	5	Endangered	Clams
Epioblasma rangiana	Northern rifffleshell	Wherever found	5	Endangered	Clams
Lycaeides melissa samuelis	Karner blue butterfly	Wherever found	3	Endangered	Insects
Neonympha mitchellii mitchellii	Mitchell's satyr Butterfly	Wherever found	3	Endangered	Insects
Brychius hungerfordi	Hungerford's crawling water Beetle	Wherever found	3	Endangered	Insects
Somatochlora hineana	Hine's emerald dragonfly	Wherever found	3	Endangered	Insects
Cirsium pitcheri	Pitcher's thistle	Wherever found	3	Threatened	Flowering Plants
Iris lacustris	Dwarf lake iris	Wherever found	3	Threatened	Flowering Plants
Mimulus michiganensis	Michigan monkey-flower	Wherever found	3	Endangered	Flowering Plants
Platanthera leucophaea	Eastern prairie fringed orchid	Wherever found	3	Threatened	Flowering Plants
Solidago houghtonii	Houghton's goldenrod	Wherever found	3	Threatened	Flowering Plants
Hymenoxys herbacea	Lakeside daisy	Wherever found	3	Threatened	Flowering Plants
Asplenium scolopendrium var. americanum	American hart's-tongue fern	Wherever found	5	Threatened	Ferns and Allies
Epioblasma triquetra	Snuffbox mussel	Wherever found	3	Endangered	Clams
Villosa fabalis	Rayed Bean	Wherever found	3	Endangered	Clams
Grus americana	Whooping crane	U.S.A. (AL, AR, CO, FL, GA, ID, IL, IN, IA, KY, LA, MI, MN, MS, MO, NC, NM, OH, SC, TN, UT, VA, WI, WV, western half of WY)	2	Experimental Population, Non-Essential	Birds
Sistrurus catenatus	Eastern Massasauga (=rattlesnake)	Wherever found	3	Threatened	Reptiles
Calidris canutus rufa	Red knot	Wherever found	5	Threatened	Birds
Myotis septentrionalis	Northern Long-Eared Bat	Wherever found	3	Endangered	Mammals
Oarisma poweshiek	Poweshiek skipperling	Wherever found	3	Endangered	Insects

Appendix 5

County Element Data

The lists include all elements (species and natural communities) for which locations have been recorded in MNFI's database for each county. Information from the database cannot provide a definitive statement on the presence, absence, or condition of the natural features in any given locality, since much of the state has not been specifically or thoroughly surveyed for their occurrence and the conditions at previously surveyed sites are constantly changing. The County Elements Lists should be used as a reference of which natural features currently or historically were recorded in the county and should be considered when developing land use plans.

Choose a county Kent

Kent County

Code Definitions

Species

Scientific Name	Common Name	Federal Status	State Status	Global Rank	State Rank	Occurrences in County	Last Observed in County
Acella haldemani	Spindle lymnaea		SC	G3	SH	1	Historical
Acipenser fulvescens	Lake sturgeon		T	G3G4	S2	1	1970
Acris blanchardi	Blanchard's cricket frog		T	G5	S2S3	7	2021
Adlumia fungosa	Climbing fumitory		SC	G4	S3	1	1889
Alasmidonta marginata	Elktoe		SC	G4	S3?	16	2021
Alasmidonta viridis	Slippershell		T	G4G5	S2S3	16	2017
Ammodramus savannarum	Grasshopper sparrow		SC	G5	S4	2	2006
Amorpha canescens	Leadplant		SC	G5	S3	2	1984
Anaxyrus fowleri	Fowler's toad		SC	G5	S3S4	1	
Astragalus canadensis	Canadian milk vetch		T	G5	S1S2	1	1901
Astragalus neglectus	Cooper's milk vetch		SC	G4	S3	2	1897
Baptisia lactea	White or prairie false indigo		SC	G4Q	S3	1	1880
Berula erecta	Cut-leaved water parsnip		T	G4G5	S2	1	2020
Besseya bullii	Kitten-tails		E	G3	S1	5	2008
Boechera dentata	Rock cress		T	G5	S1	5	2016
Boechera missouriensis	Missouri rock-cress		SC	G5	S2	2	1898
Bombus affinis	Rusty-patched bumble bee	LE	SC	G2	SH	1	1937

Scientific Name	Common Name	Federal Status	State Status	Global Rank	State Rank	Occurrences in County	Last Observed in County
Bombus auricomus	Black and gold bumble bee		SC	G5	S2	3	2021
Bombus pensylvanicus	American bumble bee		SC	G3G4	S1	2	1946
Bombus sandersoni	Sanderson's bumble bee		SC	G5	S2S3	1	2021
Bouteloua curtipendula	Side-oats grama grass		E	G5	S1	2	1986
Brickellia eupatorioides	False boneset		SC	G5	S2	3	2011
Buteo lineatus	Red-shouldered hawk		T	G5	S4	1	2016
Calephelis muticum	Swamp metalmark		SC	G3	S1	3	1964
Callophrys irus	Frosted elfin		T	G2G3	S2S3	1	2003
Cambarus robustus	Big water crayfish		SC	G5	S2?	1	2014
Carex assiniboinensis	Assiniboia sedge		T	G4G5	S2	1	2012
Carex davisii	Davis's sedge		SC	G4	S3	4	2016
Carex oligocarpa	Eastern few-fruited sedge		T	G4G5	S2	1	2016
Carex trichocarpa	Hairy-fruited sedge		SC	G4	S2	4	1939
Carex typhina	Cattail sedge		T	G5	S1	1	2014
Cincinnatia cincinnatiensis	Campeloma spire snail		SC	G5	S3	2	Historical
Cistothorus palustris	Marsh wren		SC	G5	S3	1	2003
Clemmys guttata	Spotted turtle		T	G5	S2	4	2021
Collinsia verna	Blue-eyed Mary		SC	G5	SNR	2	1897
Conioselinum chinense	Hemlock-parsley		SC	G5	SNR	3	1899
Coregonus artedi	Lake herring or Cisco		T	GNR	S3	2	2013
Cyclonaias tuberculata	Purple wartyback		T	G5	S2	14	2019
Cypripedium candidum	White lady slipper		T	G4	S2	2	2004
Diarrhena obovata	Beak grass		T	G4G5	S2	3	2016
Dorydiella kansana	Leafhopper		SC	GNR	S3	1	
Draba reptans	Creeping whitlow grass		T	G5	S1	3	1901
Echinacea purpurea	Purple coneflower		X	G4	SX	1	1891
Eleocharis compressa	Flattened spike rush		T	G4	S2	1	1898
Eleocharis engelmannii	Engelmann's spike rush		SC	G4G5	S2S3	1	1901
Eleocharis melanocarpa	Black-fruited spike-rush		SC	G4	S3	6	1944
Eleocharis tricostata	Three-ribbed spike		T	G4	S2	1	2015

Scientific Name	Common Name	Federal Status	State Status	Global Rank	State Rank	Occurrences in County	Last Observed in County
	rush						
Emydoidea blandingii	Blanding's turtle		SC	G4	S2S3	21	2022
Endodeca serpentaria	Virginia snakeroot		T	G4	S2	2	1985
Epioblasma triquetra	Snuffbox	LE	E	G3	S1S2	7	2020
Erynnis martialis	Mottled duskywing		SC	G3	SU	1	1955
Erynnis persius persius	Persius dusky wing		T	G5T1T3	S3	1	1954
Euonymus atropurpureus	Wahoo		SC	G5	S3	3	2016
Euphorbia commutata	Tinted spurge		T	G5	S1	3	1901
Falco peregrinus	Peregrine falcon		E	G4	S3	1	2020
Faxonius immunis	Calico crayfish		SC	G5	S4	4	2014
Fontigens nickliniana	Watercress snail		SC	G5	S2S3	4	1935
Fuirena pumila	Umbrella-grass		T	G4	S2	1	1974
Galearis spectabilis	Showy orchis		T	G5	S2	2	1894
Gentiana alba	White gentian		E	G4	S1	1	1901
Gentiana puberulenta	Downy gentian		E	G4G5	S1	1	1943
Gentianella quinquefolia	Stiff gentian		T	G5	S2	1	1901
Geum triflorum	Prairie smoke		T	G5	S2S3	2	1992
Glyptemys insculpta	Wood turtle		SC	G3	S2	1	1996
Graphephorum melicoides	Purple false oats		SC	G4G5	SNR	1	1894
Haliaeetus leucocephalus	Bald eagle		SC	G5	S4	5	2021
Helianthus hirsutus	Whiskered sunflower		SC	G5	S3	1	1967
Hybanthus concolor	Green violet		SC	G5	S3	4	1999
Hydrastis canadensis	Goldenseal		T	G3G4	S2	2	1989
Incisalia henrici	Henry's elfin		T	G5	S2S3	1	1955
Isotria verticillata	Whorled pogonia		T	G5	S2	2	1979
Jeffersonia diphylla	Twinleaf		SC	G5	S3	2	1980
Lasmigona compressa	Creek heelsplitter		SC	G5	S3	12	2017
Lasmigona costata	Flutedshell		SC	G5	SNR	15	2022
Lepisosteus oculatus	Spotted gar		SC	G5	S2S3	1	1988
Leptodea leptodon	Scaleshell	LE	E	G1G2	SX	1	1930
Ligumia recta	Black sandshell		E	G4G5	S1?	11	2020
Linum sulcatum	Furrowed flax		SC	G5	S2S3	1	1896

Scientific Name	Common Name	Federal Status	State Status	Global Rank	State Rank	Occurrences in County	Last Observed in County
Linum virginianum	Virginia flax		T	G4G5	S2	2	1899
Lipocarpha micrantha	Dwarf-bulrush		SC	G5	S3	4	1979
Lithobates palustris	Pickerel frog		SC	G5	S3S4	5	2017
Lithospermum latifolium	Broad-leaved puccoon		SC	G4	S2	6	2021
Lycaeides melissa samuelis	Karner blue	LE	T	G1G2	S2	2	2021
Lycopus virginicus	Virginia water-horehound		T	G5	S2	1	2016
Mertensia virginica	Virginia bluebells		E	G5	S1S2	7	2018
Mesomphix cupreus	Copper button		SC	G5	S1	1	Historical
Morus rubra	Red mulberry		T	G5	S2	5	2002
Moxostoma carinatum	River redhorse		T	G4	S2	3	2018
Moxostoma duquesnei	Black Redhorse		SC	G5	S2	3	2018
Myotis septentrionalis	Northern long-eared bat	LT	SC	G2G3	S1	1	1975
Notropis anogenus	Pugnose shiner		E	G3	S1S2	2	1955
Notropis dorsalis	Bigmouth shiner		SC	G5	S2	5	1997
Oarisma poweshiek	Poweshiek skipperling	LE	T	G1	S1	2	1968
Oecanthus laricis	Tamarack tree cricket		SC	G3?	S3	1	
Oxyloma peoriense	Depressed ambersnail		SC	G4G5	SNR	1	1885
Panax quinquefolius	Ginseng		T	G3G4	S2S3	1	1896
Pandion haliaetus	Osprey		SC	G5	S4	2	2020
Parkesia motacilla	Louisiana waterthrush		T	G5	S2	1	2016
Penstemon calycosus	Beard tongue		T	G5	S2	1	1891
Persicaria careyi	Carey's smartweed		T	G4	S1S2	1	1938
Platanthera ciliaris	Orange- or yellow-fringed orchid		E	G5	S1S2	5	1942
Pleurobema sintoxia	Round pigtoe		SC	G4G5	S3	15	2017
Pomatiopsis cincinnatiensis	Brown walker		SC	G4	SH	2	Historical
Potamilus alatus	Pink heelsplitter		SC	G5	SNR	1	2018
Potamogeton vaseyi	Vasey's pondweed		T	G4	S1S2	2	2003
Protonotaria citrea	Prothonotary warbler		SC	G5	S3	1	2007
Rallus elegans	King rail		E	G4	S2	1	1986
Ranunculus rhomboideus	Prairie buttercup		T	G5	S2	6	2012

Scientific Name	Common Name	Federal Status	State Status	Global Rank	State Rank	Occurrences in County	Last Observed in County
Regina septemvittata	Queen snake		SC	G5	S2S3	1	2017
Rhynchospora macrostachya	Tall beakrush		SC	G4	S3S4	2	1955
Rhynchospora scirpoides	Bald-rush		T	G4	S2	1	1899
Schoenoplectus americanus	Three-square bulrush		E	G5	S1	1	1899
Schoenoplectus torreyi	Torrey's bulrush		SC	G5?	S2S3	1	1900
Setophaga cerulea	Cerulean warbler		T	G4	S3	2	2005
Setophaga citrina	Hooded warbler		SC	G5	S3	2	2005
Silphium laciniatum	Compass plant		T	G5	S1S2	1	2012
Sistrurus catenatus	Eastern massasauga	LT	SC	G3	S3	2	2006
Sisyrinchium atlanticum	Atlantic blue-eyed-grass		T	G5	S2	1	2018
Sisyrinchium strictum	Blue-eyed-grass		SC	G3	S2	1	1942
Smallanthus uvedalia	Yellow-flowered leafcup		T	G4G5	S1	1	1897
Solidago missouriensis	Missouri goldenrod		T	G5	SX	1	1938
Sphaerium fabale	River fingernail clam		SC	G5	SNR	1	Historical
Strophostyles helvula	Trailing wild bean		SC	G5	S3	1	1979
Symphyotrichum drummondii	Drummond's aster		T	G5	S2	2	1941
Symphyotrichum sericeum	Western silvery aster		T	G5	S2	1	1896
Terrapene carolina carolina	Eastern box turtle		SC	G5T5	S2S3	30	2021
Toxolasma parvum	Lilliput		E	G5	S1	5	2020
Triphora trianthophora	Nodding pogonia or three birds orchid		T	G4?	S1	1	1901
Triplasis purpurea	Sand grass		SC	G4G5	S2	1	1999
Truncilla donaciformis	Fawnsfoot		T	G5	S1	1	2017
Truncilla truncata	Deertoe		SC	G5	S2S3	5	2018
Utterbackia imbecillis	Paper pondshell		SC	G5	S2S3	3	2016
Valerianella chenopodiifolia	Goosefoot corn salad		T	G4	S1	1	1897
Valvata perdepressa	Purplecap valvata		SC	G2G3	SNR	1	1914
Ventridens intertextus	Pyramid dome		SC	G5	SNR	1	1948
Venustaconcha ellipsiformis	Ellipse		SC	G4	S3	14	2022

Scientific Name	Common Name	Federal Status	State Status	Global Rank	State Rank	Occurrences in County	Last Observed in County
Villosa iris	Rainbow		SC	G5	S3	10	2020
Zizia aptera	Prairie golden alexanders		T	G5	S1S2	4	1985

Natural Communities

Community Name	Global Rank	State Rank	Occurrences in County	Last Observed in County
Bog	G3G5	S4	4	2015
Dry-mesic Northern Forest	G4	S3	1	2015
Dry-mesic Southern Forest	G4	S3	6	2019
Emergent Marsh	GU	S4	2	1990
Floodplain Forest	G3?	S3	2	2015
Hardwood-Conifer Swamp	G4	S3	4	2015
Hillside Prairie	G3	S1	5	2002
Mesic Southern Forest	G2G3	S3	1	1990
Oak Barrens	G2?	S1	1	2014
Poor Conifer Swamp	G4	S4	1	1991
Prairie Fen	G3	S3	8	2010
Southern Hardwood Swamp	G3	S3	1	1981
Southern Shrub-carr	GU	S4	1	1990
Southern Wet Meadow	G4?	S3	2	2020

County Element Data

The lists include all elements (species and natural communities) for which locations have been recorded in MNFI's database for each county. Information from the database cannot provide a definitive statement on the presence, absence, or condition of the natural features in any given locality, since much of the state has not been specifically or thoroughly surveyed for their occurrence and the conditions at previously surveyed sites are constantly changing. The County Elements Lists should be used as a reference of which natural features currently or historically were recorded in the county and should be considered when developing land use plans.

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Ottawa County

Code Definitions

Species

Scientific Name	Common Name	Federal Status	State Status	Global Rank	State Rank	Occurrences in County	Last Observed in County
Acris blanchardi	Blanchard's cricket frog		T	G5	S2S3	4	2021
Adlumia fungosa	Climbing fumitory		SC	G4	S3	1	1871
Alasmidonta marginata	Elktoe		SC	G4	S3?	1	Historical
Alasmidonta viridis	Slippershell		T	G4G5	S2S3	1	Historical
Boechera dentata	Rock cress		T	G5	S1	1	2016
Bombus affinis	Rusty-patched bumble bee	LE	SC	G2	SH	2	1954
Bombus auricomus	Black and gold bumble bee		SC	G5	S2	1	2015
Bombus borealis	Northern amber bumble bee		SC	G4G5	S3	1	1912
Botaurus lentiginosus	American bittern		SC	G5	S3	1	2021
Buteo lineatus	Red-shouldered hawk		T	G5	S4	1	2000
Carex davisii	Davis's sedge		SC	G4	S3	1	1986
Carex seorsa	Sedge		T	G5	S2	1	2015
Cincinnatia cincinnatiensis	Campeloma spire snail		SC	G5	S3	2	1932
Cirsium pitcheri	Pitcher's thistle	LT	T	G3	S3	3	2015
Cistothorus palustris	Marsh wren		SC	G5	S3	2	2005
Clemmys guttata	Spotted turtle		T	G5	S2	5	2005
Clonophis kirtlandii	Kirtland's snake		E	G2	S1	1	1976

Scientific Name	Common Name	Federal Status	State Status	Global Rank	State Rank	Occurrences in County	Last Observed in County
Collinsia verna	Blue-eyed Mary		SC	G5	SNR	1	1966
Coregonus artedi	Lake herring or Cisco		T	GNR	S3	1	1997
Coregonus kiyi	Kiyi		SC	G3G4	S2S3	1	1983
Coregonus zenithicus	Shortjaw cisco		T	G3	S2	1	2001
Corispermum americanum	American bugseed		SC	G5?	SNR	1	1900
Corispermum pallasii	Pallas' bugseed		SC	G4?	SNR	2	2015
Cyclonaias tuberculata	Purple wartyback		T	G5	S2	2	2016
Dasistoma macrophylla	Mullein-foxglove		E	G4	S1	1	2021
Diarrhena obovata	Beak grass		T	G4G5	S2	1	2014
Eleocharis tricostata	Three-ribbed spike rush		T	G4	S2	1	1942
Emydoidea blandingii	Blanding's turtle		SC	G4	S2S3	8	2021
Euonymus atropurpureus	Wahoo		SC	G5	S3	1	2012
Euphorbia commutata	Tinted spurge		T	G5	S1	1	1901
Euxoa aurulenta	Dune cutworm		SC	G5	S2S3	1	1959
Falco columbarius	Merlin		T	G5	S3	1	2011
Falco peregrinus	Peregrine falcon		E	G4	S3	2	2020
Fontigens nickliniana	Watercress snail		SC	G5	S2S3	1	Historical
Galearis spectabilis	Showy orchis		T	G5	S2	1	1894
Haliaeetus leucocephalus	Bald eagle		SC	G5	S4	14	2021
Hybanthus concolor	Green violet		SC	G5	S3	1	1979
Hypericum gentianoides	Gentian-leaved St. John's-wort		SC	G5	S3	1	1986
Jeffersonia diphylla	Twinleaf		SC	G5	S3	1	2010
Juncus brachycarpus	Short-fruited rush		T	G4G5	S1S2	1	2011
Lasmigona compressa	Creek heelsplitter		SC	G5	S3	4	1934
Lasmigona costata	Flutedshell		SC	G5	SNR	2	1960
Lepisosteus oculatus	Spotted gar		SC	G5	S2S3	1	2019
Ligumia recta	Black sandshell		E	G4G5	S1?	2	Historical
Lithobates palustris	Pickerel frog		SC	G5	S3S4	1	2018
Lithospermum latifolium	Broad-leaved puccoon		SC	G4	S2	2	1899
Lycopodiella subappressa	Northern appressed clubmoss		SC	G2	S2	2	1986

Scientific Name	Common Name	Federal Status	State Status	Global Rank	State Rank	Occurrences in County	Last Observed in County
Mertensia virginica	Virginia bluebells		E	G5	S1S2	5	2018
Morus rubra	Red mulberry		T	G5	S2	1	1896
Moxostoma carinatum	River redhorse		T	G4	S2	2	2018
Moxostoma duquesnei	Black Redhorse		SC	G5	S2	1	2018
Nelumbo lutea	American lotus		T	G4	S2	2	1999
Notropis dorsalis	Bigmouth shiner		SC	G5	S2	3	1997
Notropis texanus	Weed shiner		X	G5	S1	1	1934
Nycticorax nycticorax	Black-crowned night-heron		SC	G5	S3	1	2016
Obliquaria reflexa	Threehorn wartyback		E	G5	S1	5	2019
Obovaria olivaria	Hickorynut		E	G4	S1	7	1959
Panax quinquefolius	Ginseng		T	G3G4	S2S3	7	2010
Perimyotis subflavus	Eastern pipistrelle		SC	G3G4	S1	1	2004
Pisidium cruciatum	Ornamanted peaclam		SC	G4?	SNR	3	1959
Pisidium simplex	A fingernail clam		SC	G5	SNR	2	1959
Pleurobema sintoxia	Round pigtoe		SC	G4G5	S3	2	1960
Poa paludigena	Bog bluegrass		T	G3G4	S2	1	1899
Potamilus alatus	Pink heelsplitter		SC	G5	SNR	6	2019
Potamilus ohiensis	Pink papershell		T	G5	SNR	3	1960
Proserpinaca pectinata	Mermaid-weed		E	G5	S1	1	2011
Pterospora andromedea	Pine-drops		T	G5	S2	1	1871
Pycnanthemum verticillatum	Whorled mountain mint		SC	G5	S2	1	1910
Pyganodon subgibbosa	Round lake floater		T	G1Q	S1	1	1930
Rallus elegans	King rail		E	G4	S2	1	1894
Ranunculus ambigens	Spearwort		T	G4	SX	1	1940
Rhexia mariana	Maryland meadow beauty		T	G5T5	S1S2	1	1995
Rhexia virginica	Meadow beauty		SC	G5	S3	2	2011
Sander canadensis	Sauger		T	G5	S1	1	1919
Setophaga citrina	Hooded warbler		SC	G5	S3	1	2003
Setophaga dominica	Yellow-throated warbler		T	G5	S3	1	1999
Silphium integrifolium	Rosinweed		T	G5	S2	1	2018
Sisyrinchium atlanticum	Atlantic blue-eyed-grass		T	G5	S2	1	1982

Scientific Name	Common Name	Federal Status	State Status	Global Rank	State Rank	Occurrences in County	Last Observed in County
Smilax herbacea	Smooth carrion-flower		SC	G5	S3	1	1979
Spiza americana	Dickcissel		SC	G5	S3	1	2007
Strophostyles helvula	Trailing wild bean		SC	G5	S3	1	1918
Sympistis saundersiana	Saunders' sallow moth		SC	GNR	SNR	1	1999
Terrapene carolina carolina	Eastern box turtle		SC	G5T5	S2S3	10	2021
Toxolasma parvum	Lilliput		E	G5	S1	1	2020
Trillium nivale	Snow trillium		T	G4	S2	1	1900
Truncilla donaciformis	Fawnsfoot		T	G5	S1	4	1959
Truncilla truncata	Deertoe		SC	G5	S2S3	5	2019
Utterbackia imbecillis	Paper pondshell		SC	G5	S2S3	1	
Venustaconcha ellipsiformis	Ellipse		SC	G4	S3	1	2019
Villosa iris	Rainbow		SC	G5	S3	1	1929
Zizania aquatica	Wild rice		T	G5	S2S3	7	1988

Natural Communities

Community Name	Global Rank	State Rank	Occurrences in County	Last Observed in County
Bog	G3G5	S4	2	1987
Dry-mesic Southern Forest	G4	S3	1	2008
Emergent Marsh	GU	S4	1	2009
Great Lakes Barrens	G3	S2	1	2012
Great Lakes Marsh	G2	S3	6	2009
Interdunal Wetland	G2?	S2	1	2012
Mesic Northern Forest	G4	S3	3	2012
Mesic Southern Forest	G2G3	S3	3	1984
Open Dunes	G3	S3	4	2015

Appendix 6

Appendix 6 - Schedule for Design and Construction

City Only Loan

Overall Service Area Loan

DWSRF Fiscal Year	Loans		Project Name	Total Project Cost	Quarter				Anticipated Construction Start
	City Only	Overall Service Area			1	2	3	4	
FY-24		Loan 1	Caledonia Township Connection	$ 7,081,500				x	1-Apr-24
			Cascade Township Watermains	$ 11,263,050				x	1-Apr-24
			Total Loan Cost	***$ 18,344,550***					
	Loan 1		Lead Service Line Replacements	$ 8,000,000				x	1-Apr-24
			Fremont Avenue Watermain	$ 405,000				x	1-Apr-24
			Hall Street Watermain; Paris Avenue Watermain	$ 2,007,600				x	1-Apr-24
			Eleanor Street Watermain	$ 2,079,100				x	1-Apr-24
			Valley Avenue Watermain; Sibley Street Watermain	$ 2,281,700				x	1-Apr-24
			Total Loan Cost	***$ 14,773,400***					
FY-25		Loan 2	LMFP Residuals Handling Improvements	$ 30,000,000				x	1-May-25
			Total Loan Cost	***$ 30,000,000***					
	Loan 2		Lead Service Line Replacements	$ 8,000,000				x	1-Apr-25
			Boston Street Watermain	$ 3,091,400				x	1-Apr-25
			Burton Street Watermain (Eastern to Kalamazoo)	$ 4,207,200				x	1-Apr-25
			Burton Street Watermain (Horton to Eastern)	$ 4,040,800				x	1-Apr-25
			Total Loan Cost	***$ 19,339,400***					
FY-26	Loan 3		Lead Service Line Replacements	$ 8,000,000				x	1-Apr-26
			Oakwood Avenue Watermain	$ 5,034,500				x	1-Apr-26
			Valley Avenue Watermain; First Street and Third Street Watermain	$ 1,961,600				x	1-Apr-26
			Buchanan Avenue Watermain (Corinne to Hall)	$ 2,297,200				x	1-Apr-26
			Total Loan Cost	***$ 17,293,300***					
FY-27		Loan 3	LMFP Chemical Unloading Improvements	$ 1,100,000				x	1-May-27
			LMFP Carbon Feed System and Phospahte Feed System Improvements	$ 7,520,000				x	1-May-27
			Total Loan Cost	***$ 8,620,000***					
	Loan 4		Lead Service Line Replacement	$ 8,000,000				x	1-Apr-27
			Second Street Watermain	$ 1,258,900				x	1-Apr-27
			Sherman Street Watermain	$ 964,400				x	1-Apr-27
			Butterworth Street Watermain (Marion to Lane)	$ 794,300				x	1-Apr-27
			Buchanan Avenue Watermain (Stewart to Corinne)	$ 1,886,000				x	1-Apr-27
			Alger Street Watermain	$ 2,292,600				x	1-Apr-27
			Butterworth Street Watermain (Lane to Hogadone)	$ 768,000				x	1-Apr-27
			Total Loan Cost	***$ 15,964,200***					
FY-28	Loan 5		Lead Service Line Replacement	$ 8,000,000				x	1-Apr-28
			Mulford Drive Watermain	$ 1,469,400				x	1-Apr-28
			Admore Street Watermain	$ 2,206,900				x	1-Apr-28
			College Avenue Watermain	$ 2,422,900				x	1-Apr-28
			Housman Street Watermain	$ 1,018,700				x	1-Apr-28
			Union Avenue Watermain	$ 791,900				x	1-Apr-28
			Hall Street Watermain (Underhill to US-131)	$ 1,445,600				x	1-Apr-28
			Total Loan Cost	***$ 17,355,400***					