

CITY OF DETROIT

Water and Sewerage Department



**Water Main Replacement and Rehabilitation inclusive of
Lead (Pb) Service Line Replacements in Neighborhoods at Various
Locations West and East of Livernois:**

**Project A, WS -732: Warrendale, McDowell, Claytown, Brightmoor,
Springwells, Crary/St. Marys, and Grandmont**

**Project B, WS -733: Martin Park, Pilgrim Village, University District,
Grixdale Farms, Greenfield Park, Mapleridge, East English Village,
Yorkshire Woods, Denby, and Outer Drive-Hayes**

**Project Plan
April 20, 2022**

**Mike Duggan
Mayor**

**Gary Brown
Director**

**Michael Einheuser
Chairperson
Board of Water Commissioners**



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Table of Contents

1.	EXECUTIVE SUMMARY	1
2.	PROJECT OVERVIEW	4
2.1.	INTRODUCTION.....	4
2.1.1	WS-732-WATER MAIN REPLACEMENT/REHABILITATION inclusive of Lead (Pb) water services replacement (West of Livernois): WARRENDALE, MCDOWELL, BRIGHTMOOR, CLAYTOWN, SPRINGWELLS, CRARY/ST. MARYS, and GRANDMONT.....	4
2.1.2	WS-732-WATER MAIN REPLACEMENT/REHABILITATION inclusive of Lead (Pb) water services replacement (East of Livernois): MARTIN PARK, PILGRIM VILLAGE, UNIVERSITY DISTRICT, GRIXDALE FARMS, GREENFIELD PARK, MAPLERIDGE, EAST ENGLISH VILLAGE, YORKSHIRE WOODS, DENBY, and OUTER DRIVE-HAYES.....	4
2.2.	PURPOSE.....	5
3.	PROJECT BACKGROUND.....	6
3.1.	SUMMARY OF PROJECT NEED	6
3.2.	STUDY AREA CHARACTERISTICS	6
3.2.1.	DELINEATION OF STUDY AREA	20
3.2.2.	LAND USE IN STUDY AREA	20
3.2.3.	ECONOMIC CHARACTERISTICS.....	20
3.3.	POPULATION DATA	21
3.4.	EXISTING FACILITIES	21
4.	ANALYSIS OF ALTERNATIVES	23
4.1.	IDENTIFICATION OF POTENTIAL ALTERNATIVES.....	23
4.1.1.	NO ACTION – Alternative 1	23
4.1.2.	OPTIMUM PERFORMANCE OF EXISTING FACILITIES – Alternative 2.....	23
4.1.3.	REGIONAL ALTERNATIVE – Alternative 3	24
4.2.	ANALYSIS OF PRINCIPAL ALTERNATIVES for Project A, WS-732 and Project B, WS-733 WATER MAIN REPLACEMENT and REHABILITATION at Select Locations East and West of Livernois.....	24
4.2.1.	DESCRIPTION OF PRINCIPAL ALTERNATIVES.....	24
4.2.2.	COST EFFECTIVENESS ANALYSIS.....	25
4.2.3.	ENVIRONMENTAL EVALUATION.....	30
4.2.4.	IMPLEMENTABILITY AND PUBLIC PARTICIPATION	30
4.2.5.	TECHNICAL AND OTHER CONSIDERATIONS	31
5.	SELECTED ALTERNATIVE.....	32
5.1.	DESCRIPTION.....	32
5.1.1.	COSTS.....	32
5.1.2.	IMPLEMENTATION SCHEDULE.....	34
5.1.3.	USER COST.....	34
5.1.4.	ABILITY TO IMPLEMENT THE SELECTED ALTERNATIVE.....	37
5.1.5.	DISADVANTAGED COMMUNITY STATUS.....	37
5.1.6.	SURFACE WATER INTAKE PROTECTION PROGRAM.....	38

6.	EVALUATION OF ENVIRONMENTAL IMPACTS	39
6.1.	GENERAL	39
6.1.1.	BENEFICIAL AND ADVERSE	39
6.1.2.	SHORT AND LONG-TERM	39
6.1.3.	IRREVERSIBLE OR IRRETRIEVABLE	40
6.2.	ANALYSIS OF IMPACTS	40
6.2.1.	DIRECT IMPACTS	40
6.2.2.	INDIRECT IMPACTS	40
6.2.3.	CUMULATIVE IMPACTS.....	40
7.	MITIGATION.....	41
7.1.	GENERAL	41
7.2.	MITIGATION OF SHORT-TERM IMPACTS.....	41
7.3.	MITIGATION OF LONG-TERM IMPACTS.....	41
7.4.	MITIGATION OF INDIRECT IMPACTS.....	41
8.	PUBLIC PARTICIPATION	42
8.1.	PUBLIC HEARING	42
8.1.1.	PUBLIC HEARING ADVERTISEMENT AND NOTICE.....	42
8.1.2.	PUBLIC HEARING COMMENTS RECEIVED AND ANSWERED	42
8.1.3.	ADOPTION OF THE PROJECT PLAN	42

TABLES

Table 3-2. LAND USE IN DETROIT	20
Table 3-3. CITY-WIDE DISTRIBUTION SYSTEM PIPING SUMMARY	21
Table 3-4. SUMMARY OF DETROIT WATER MAIN DISTRIBUTION PIPES.....	21
Table 4-1-1 COST COMPARISON OF WS-732: WATER MAIN REPLACEMENT and REHABILITATION in Select Locations West and East of Livernois.....	28
Table 4-1-2 COST COMPARISON OF WS-733: WATER MAIN REPLACEMENT and REHABILITATION at Select Locations West and East of Livernois.....	29
Table 5-1-A WS-732 Cost Summary:	33
Table 5-1-B WS-733 Cost Summary	33
Table 5-2 PROJECT MILESTONE SCHEDULES	34
Table 5-3-1 USER COST IMPACT FOR Water Main Replacements/Rehabilitation WS-732	35
Table 5-3-2 USER COST IMPACT FOR Water Main Replacements/Rehabilitation WS-733	36

FIGURES

Figure 3-1-A/B PROJECT LOCATION MAPS WS-732 and WS-733.....	8 and 15
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APPENDICES

- A. ESTIMATED CONSTRUCTION COSTS
- B. DISADVANTAGED COMMUNITY STATUS DETERMINATION WORKSHEET;
SUBMITTAL FORM, SELF-CERTIFICATION FORM, BOARD RESOLUTIONS
- C. PUBLIC HEARING NOTICE, MAILING LIST FOR PUBLIC HEARING, PUBLIC HEARING
TRANSCRIPT, VISUAL AIDS
- D. PROJECT PLAN CORRESPONDENCE; USACE PERMIT; SHPO SUBMITTAL;
MNFI REVIEW; USFWS REVIEW

1. EXECUTIVE SUMMARY

The City of Detroit is a retail customer of the Great Lakes Water Authority (GLWA), for which GLWA provides potable water to the City of Detroit and neighboring southeastern Michigan communities throughout Wayne, Oakland, Macomb, St. Clair, Lapeer, Genesee, Washtenaw and Monroe Counties. The 1,079 square mile water service area, which includes Detroit and 127 suburban communities, makes up approximately 40% of the state's population.

The water distribution system servicing the City of Detroit is comprised of approximately 2,700 miles of various size pipes ranging mainly from 6 to 16 inches. Most of these pipes were installed in the late 19th century and first half of the 20th century. Due to the age of these pipes and the multiseasonal stresses upon the network, water main breaks are a constant occurrence and they constitute a drain on the Detroit Water and Sewerage Department's (DWSD) resources necessary to address these breaks, often times during inclement weather conditions. Water main breaks can also increase the potential public health risk from cross-connection contamination (bacteriological and/or chemical) resulting from reduced pressure or depressurized water mains during the repair. DWSD has developed a process for the identification of water system improvements needed in neighborhoods across the City of Detroit.

Project A, WS-732: Water Main Replacement and Rehabilitation at Select Locations West of Livernois; Warrendale, McDowell, Brightmoor, Claytown, Springwells, Crary/St. Marys, and Grandmont

DWSD has identified several project areas for pipe replacement and rehabilitation, in Warrendale, McDowell, Brightmoor, Claytown, Springwells, and Crary/St. Marys, and Grandmont Neighborhoods that are in urgent need of addressing the repeated water main breaks and also based on Risk Analysis and results of hydraulic modeling. DWSD proposed to develop contract number WS-732 with a Project scope that includes replacing and rehabilitating approximately 29,716 linear feet of vintage cast iron water main of pipe size 6 through 12 inches in diameter for an estimated total project cost of \$11.485 M.

This Project Plan identifies the current condition of the existing pipes and presents alternatives for addressing the deteriorated conditions of these pipes. Evaluation of these alternatives was performed based on the Michigan Department of Environment, Great Lakes and Energy (MI-EGLE) guidelines for preparing a Drinking Water State Revolving Fund (DWSRF) Project Plan. The recommendation presented in this Project Plan consists primarily of replacing the aged water mains with new ones based on the findings of hydraulic modelling results and water main break history. Several of the replaced water mains based upon poor condition will be upsized where hydraulic capacity does not support a minimum of 20 psi under all flow conditions. In a limited number of streets, rehabilitating the existing main with a structural liner will be performed as opposed to replacement. Full Lead service line replacements (approximately 430 Lead services) are also included in the water main replacement project. It is a benefit to the public health and safety

to replace the Lead service lines. DWSD policy is that all Lead water services, as encountered, shall be replaced with copper from the proposed water main to the individual customer meters as part of its capital project work. Additionally, DWSD contractors are required to perform an excavation at every service connection to visually verify if the service is Lead or copper.

Water main replacement (WS-732) through the DWSRF loan program is expected to increase by no more than 0.82% the cost of water to a typical City of Detroit customer due to the impact of construction cost. However, the impact may be less since it would be influenced by other factors such as the reduction in operating costs (chemicals, energy, etc.), less water loss through breaks, and reduced maintenance/repairs. Therefore, the actual rate determination would be based on factors that encompass the delivery of comprehensive services by DWSD to its customers. It should be recognized that the debt for distribution water main replacement work within the City of Detroit will be paid by Detroit customers only, not the entire service area.

The increase in rate as calculated above is based on repayment of the DWSRF loan over a 20-year period. As a disadvantaged community, the City of Detroit can request a 30-year or 40-year financing period. DWSD has indicated they will select a 30-year financing period.

Project B, WS-733: Water Main Replacement and Rehabilitation at Select Locations East of Livernois; Martin Park, Pilgrim Village, University District, Grixdale Farms, Greenfield Park, Mapleridge, East English Village, Yorkshire Woods, Denby, and Outer Drive-Hayes

DWSD has identified several project areas for pipe replacement and rehabilitation, in Martin Park, Pilgrim Village, University District, Grixdale Farms, Greenfield Park, Mapleridge, East English Village, Yorkshire Woods, Denby, and Outer Drive-Hayes Neighborhoods that are in urgent need of addressing the repeated water main breaks and also based on Risk Analysis and results of hydraulic modeling. DWSD proposed to develop a contract number WS-733 with a Project scope that includes replacing and rehabilitating approximately 27,176 linear feet of vintage cast iron water main of pipe size 6 through 12 inches in diameter for an estimated total project cost of \$10.86 M.

This Project Plan identifies the current condition of the existing pipes and presents alternatives for addressing the deteriorated conditions of these pipes. Evaluation of these alternatives was performed based on the Michigan Department of Environment, Great Lakes and Energy (MI-EGLE) guidelines for preparing a Drinking Water State Revolving Fund (DWSRF) Project Plan. The recommendation presented in this Project Plan consists primarily of replacing the aged water mains with new ones based on the findings of hydraulic modelling results and water main break history. Several of the replaced water mains based upon poor condition will be upsized where hydraulic capacity does not support a minimum of 20 psi under all flow conditions. In a limited number of streets, rehabilitating the existing main with a structural liner will be performed as opposed to replacement. Full Lead service line replacements (approximately 430 Lead services) are also included in the water main replacement project. It is a benefit to the public health and safety to replace the Lead service lines. DWSD's policy is that all Lead water services, as encountered,

shall be replaced with copper from the proposed water main to the individual customer meters as part of its capital project work. Additionally, DWSD contractors are required to perform an excavation at every service connection to visually verify if the service is Lead or copper.

Water main replacement (WS-733) through the DWSRF loan program is expected to increase by no more than 0.78% the cost of water to a typical City of Detroit customer due to the impact of construction cost. However, the impact may be less since it would be influenced by other factors such as the reduction in operating costs (chemicals, energy, etc.), less water loss through breaks, and reduced maintenance/repairs. Therefore, the actual rate determination would be based on factors that encompass the delivery of comprehensive services by DWSD to its customers. It should be recognized that the debt for distribution water main replacement work within the City of Detroit will be paid by Detroit customers only, not the entire service area.

The increase in rate as calculated above is based on repayment of the DWSRF loan over a 20-year period. As a disadvantaged community, the City of Detroit can request a 30-year or 40-year financing period. DWSD has indicated they will select a 30-year financing period.

2. PROJECT OVERVIEW

2.1. INTRODUCTION

2.1.1. Project A, WS-732: Water Main Replacement and Rehabilitation at Select Locations West of Livernois: Warrendale, McDowell, Brightmoor, Claytown, Springwells, Crary/St.Marys, and Grandmont

2.1.2 Project B, WS-733: Water Main Replacement and Rehabilitation at Select Locations East of Livernois: Martin Park, Pilgrim Village, University District, Grixdale Farms, Greenfield Park, Mapleridge, East English Village, Yorkshire Woods, Denby, and Outer Drive-Hayes

DWSD has identified several project areas for pipe replacement and rehabilitation, WS-732, West of Livernois, in Warrendale, McDowell, Brightmoor, Claytown, Springwells, Crary/St.Marys, and Grandmont and WS-733, East of Livernois, in Martin Park, Pilgrim Village, University District, Grixdale Farms, Greenfield Park, Mapleridge, East English Village, Yorkshire Woods, Denby, and Outer Drive-Hayes Neighborhoods in Detroit, that are in urgent need of addressing the repeated water main breaks and based on Risk Analysis and results of hydraulic models.

Under the CIP, planning work to renew and rehabilitate the water infrastructure for WS-732 and WS-733 were conducted and the following approach was typically used: 1) assessing the condition of the infrastructure by direct field assessment/inspection; 2) assessing the performance of the infrastructure, using hydraulic modeling and other analytical tools; 3) comparing condition and performance to level of service benchmarks/goals; 4) identifying capital improvement requirements and prioritizing them based on agreed-upon parameters and 5) developing a value-based CIP to identify prioritized needs. Work includes either rehabilitation or replacement of buried water infrastructure.

The City of Detroit has an estimated 80,000 + Lead water services active within the municipal water system. Given the potential negative health impacts to water system customers, DWSD has been undertaking efforts in the replacement of these services. Per EPA and MI-EGLE requirements, Lead services are replaced from the water main all the way to the customer meter within their property (residence, commercial space, other). While the Lead services are expected to be within the older portions of Detroit, realistically, they can be located in any neighborhood. Replacing about 860 Lead services will be replaced across WS-732 and WS-733 which is included in the estimated total project cost of nearly twenty two and a half million dollars (\$11.485 M and \$10.86 M respectively).

2.2 PURPOSE

This document has been prepared in accordance with the planning guidelines adopted by MI-EGLE for the Drinking Water State Revolving Fund (DWSRF) low interest loan program. It is the intent of the DWSD to seek low interest loan assistance under the DWSRF program for the recommended work.

The purpose of this document is to describe the capital improvement project for water main replacement/rehabilitation, which DWSD is proposing to undertake with DWSRF assistance to provide reliable water supply to its customers. This Project Plan provides information on the status of the current water main system, a description of why the project is needed, an evaluation of alternatives, and a description of the recommended alternative and an assessment of environmental impacts. The Project Plan also serves as the basis for public review and comment on the proposed work in accordance with the public participation requirements of the DWSRF program.

3. PROJECT BACKGROUND

3.1. SUMMARY OF PROJECT NEED

Project A, WS-732: Water Main Replacement and Rehabilitation at Select Locations West of Livernois: Warrendale, McDowell, Brightmoor, Claytown, Springwells, Crary/St.Marys, and Grandmont

Most of the water distribution system serving the City of Detroit was installed in the late 19th century or early 20th century. These water mains are unlined pit cast iron or spun cast iron pipe and have outlived their useful life of 50 years based on recorded number of water main breaks and field experience with the system. As the pipes start to exceed this life expectancy, problems arise such as: frequent breakage, loss of pipe wall thickness, exfiltration of treated water through leaks, cracks and corroded joints, hydraulic obstructions due to tuberculation on the interior pipe surfaces, increased pumping costs due to reduced hydraulic capacity, and in severe leaking cases, ponding of water on roadways.

Reduced or complete loss of pressure during these main breaks and subsequent repair can pose an increased risk to public health from potential chemical or bacteriological contamination by cross-connection. Loss of pressure in a public water supply is to be avoided whenever possible and maintaining minimum system pressure is imposed upon public water systems through the requirements of the Michigan Safe Drinking Water Act (PA 399, as amended).

The project will replace Lead service lines of two inches in diameter and smaller from the public water main to the meter, as part of these projects, Full Lead Service Line Replacement (FLSLR). Lead service lines 1.5-inches and 2-inches are replaced with in-kind diameters in copper; 1-inch and less are replaced with 1-inch copper. Service lines that are larger than two inches in diameter are rigid metal pipe of copper or iron per building code.

DWSD has established an asset management program with a goal to replace the aged water distribution system, which is approximately 2,700 miles of water main of various sizes (six to sixteen inches) over a 70 year period. This asset management replacement program started more than ten years ago. This goal would enable the distribution system to be replaced on a cycle consistent with the life expectancy of the pipe. Currently, DWSD prioritizes its water main replacement program based on a consideration of the following factors:

1. Frequency of breaks/leaks in the system.
2. Occupancy of the area under consideration with a dense resident occupancy considered as a high priority. Also, a pipe is considered a priority if it supplies a school, hospitals, government buildings, public safety offices, or another prioritized structure.
3. Reduced hydraulic capacity due to low coefficients of friction (C factors) as a

- result of tuberculation on the interior pipe surface.
4. Inadequate fire protection availability due to reduced hydraulic capacity.
 5. Increased pumping cost as a result of frictional increases.
 6. Age and structural condition of the water main.

Historically, DWSD has tracked water maintenance activity and carefully logged the frequency of breakage in various sectors of the system. Breakage/leaks of 5 or more per 1,000 feet of water main as measured from valve to valve are considered to be threshold for evaluating possible pipe replacement, in conjunction with the above criteria. The project identified in this project plan has been recently identified as an area in critical need based upon break history and hydraulic modelling analysis which identified one or more criteria listed above. The entire length of water mains identified for replacement and rehabilitation as part of WS-732 project plan had, on average 14.85 breaks per 1,000 linear feet of main over the mains' lifetime. For WS-733, that value is 11.15 breaks per 1000 linear feet. For water main replacements, pipes of eight and twelve inch diameters will remain those sizes. Ten-inch pipe (not being a commercially produced pipe size) will be replaced with twelve-inch. Also, six-inch pipe is no longer a recommended minimum size for water main supply, thus 6-inch pipe will be replaced with eight-inch (except in those cases of a fire hydrant supply connection).

Several overview maps are included to identify project locations for WS-732 and WS-733 **Figures 3-1-A and 3-1-B**.

Lead service lines are a public health threat. The replacement of the Lead service lines on private and public property are DWSRF eligible. DWSD policy is that all Lead water services, as encountered, shall be replaced with copper from the water main to the individual customer meters as part of its capital project work. Additionally, DWSD contractors are required to perform an excavation at the curb box of every service connection to visually verify if the service is Lead or copper. The project will replace Lead service lines of two inches in diameter and smaller from the public water main to the meter, defined here as Full Lead Service Line Replacement (FLSLR). Lead service lines of 1.5-inches and 2-inches are replaced with in-kind diameters in copper; 1-inch and less are replaced with 1-inch copper. Service lines that are larger than two inches in diameter are rigid metal pipe of copper or iron per building.

Figure 3-1-A PROJECT LOCATION MAPS for Project A, WS-732

Project Location Map - Watermain Replacement WS-732



Detroit West Side - Council District 1 - Watermains on Burt, Southfield Freeway Northbound Service Drive, Puritan, Harlow, and Oakfield

Watermain Replacement Locations, City of Detroit Water and Sewerage Department **FY: 2023 DWSRF Project Plan for WS-732**

Replacing approximately 29,716 LFT of water main, fire hydrants, gate valves, and all other appurtenance with full lead service replacement in neighborhood of Crary/St. Marys, Brightmoor, Grandmont, Pembroke, Warrendale, Claytown, and Springwells of City of Detroit

Project Location Map - Watermain Replacement WS-732



Detroit Northwest Side - Council District 2 - Watermains on Meyers Rd

Watermain Replacement Locations, City of Detroit Water and Sewerage Department **FY: 2023 DWSRF Project Plan for WS-732**

Replacing approximately 29,716 LFT of water main, fire hydrants, gate valves, and all other appurtenance with full lead service replacement in neighborhood of Crary/St. Marys, Brightmoor, Grandmont, Pembroke, Warrendale, Claytown, and Springwells of City of Detroit

Project Location Map - Watermain Replacement WS-732



Detroit West Side - Council District 7 - Watermains on Paul, Piedmont, Artesian, Greenview, and Faust

Watermain Replacement Locations, City of Detroit Water and Sewerage Department FY: 2023 DWSRF Project Plan for WS-732

Replacing approximately 29,716 LFT of water main, fire hydrants, gate valves, and all other appurtenance with full lead service replacement in neighborhood of Crary/St. Marys, Brightmoor, Grandmont, Pembroke, Warrendale, Claytown, and Springwells of City of Detroit

Project Location Map - Watermain Replacement WS-732



Detroit Southwest Side - Council District 6 - Watermains on John Kronk

Watermain Replacement Locations, City of Detroit Water and Sewerage Department **FY: 2023 DWSRF Project Plan for WS-732**

Replacing approximately 29,716 LFT of water main, fire hydrants, gate valves, and all other appurtenance with full lead service replacement in neighborhood of Crary/St. Marys, Brightmoor, Grandmont, Pembroke, Warrendale, Claytown, and Springwells of City of Detroit

Table 3-1-A DETAILED LIST OF WATER MAIN REPLACEMENT IN NEIGHBORHOOD WEST of LIVERNOIS UNDER WS-732

Neighborhood	Street Name	From	To	Length of Existing Pipe (Ft.) per Pipe Diameter (inch)					Pipe Material	Intervention Suggested
				6"	8"	10"	12"	16"		
McDowell	Meyers	Seven mile	Chippewa	815	440		1,918		CI	
Brightmoor	Burt	Lyndon	I-96		2,592				CI	
Claytown	Lonyo	John Kronk	Baabee				2,821		CI	
Springwells	Lonyo	John Kronk	Dix				1,084		CI	
Warrendale	Paul	Southfield Fwy	Minock		4,135				CI	
Warrendale	Piedmont	W Warren Ave	Paul	2,582					CI	
Warrendale	Artesian	Paul	Kirkwood		1,316				CI	
Warrendale	Greenview	Paul	Ford St	2,514					CI	
Warrendale	Faust	Dayton	Kirkwood		777				CI	
Grandmont	Southfield Fwy	Grand River	Schoolcraft	2,440	170		2,400		CI	
Crary/ St.Marys	Harlow	Verne	Puritan		1,310				CI	
Crary/ St.Marys	Oakfield	Verne	Puritan	1,292					CI	
Crary/ St.Marys	Puritan	Southfield Fwy	Oakfield		1,110				CI	
		Total Linear Feet: 29,716							CI= CAST IRON	

Project B, WS-733: Water Main Replacement and Rehabilitation at Select Locations East of Livernois; Martin Park, Pilgrim Village, University District, Grixdale Farms, Greenfield Park, Mapleridge, East English Village, Yorkshire Woods, Denby, and Outer Drive-Hayes

Most of the water distribution system serving the City of Detroit was installed in the late 19th century or early 20th century. These water mains are unlined pit cast iron or spun cast iron pipe and have outlived their useful life of 50 years based on recorded number of water main breaks and field experience with the system. As the pipes start to exceed this life expectancy, problems arise such as: frequent breakage, loss of pipe wall thickness, exfiltration of treated water through leaks, cracks and corroded joints, hydraulic obstructions due to tuberculation on the interior pipe surfaces, increased pumping costs due to reduced hydraulic capacity, and in severe leaking cases, ponding of water on roadways.

Reduced or complete loss of pressure during these main breaks and subsequent repair can pose an increased risk to public health from potential chemical or bacteriological contamination by cross-connection. Loss of pressure in a public water supply is to be avoided whenever possible and maintaining minimum system pressure is imposed upon public water systems through the requirements of the Michigan Safe Drinking Water Act (PA 399, as amended).

The project will replace Lead service lines of two inches in diameter and smaller from the public water main to the meter, as part of these projects, Full Lead Service Line Replacement (FLSLR). Lead service lines 1.5-inches and 2-inches are replaced with in-kind diameters in copper; 1-inch and less are replaced with 1-inch copper. Service lines that are larger than two inches in diameter are rigid metal pipe of copper or iron per building code.

DWSD has established an asset management program with a goal to replace the aged water distribution system, which is approximately 2,700 miles of water main of various sizes (six to sixteen inches) over a 70 year period. This asset management replacement program started more than ten years ago. This goal would enable the distribution system to be replaced on a cycle consistent with the life expectancy of the pipe. Currently, DWSD prioritizes its water main replacement program based on a consideration of the following factors:

1. Frequency of breaks/leaks in the system.
2. Occupancy of the area under consideration with a dense resident occupancy considered as a high priority. Also, a pipe is considered a priority if it supplies a school, hospitals, government buildings, public safety offices, or another prioritized structure.
3. Reduced hydraulic capacity due to low coefficients of friction (C factors) as a result of tuberculation on the interior pipe surface.
4. Inadequate fire protection availability due to reduced hydraulic capacity.
5. Increased pumping cost as a result of frictional increases.

6. Age and structural condition of the water main.

Historically, DWSD has tracked water maintenance activity and carefully logged the frequency of breakage in various sectors of the system. Breakage/leaks of 5 or more per 1,000 feet of water main as measured from valve to valve are considered to be threshold for evaluating possible pipe replacement, in conjunction with the above criteria. The project identified in this project plan has been recently identified as an area in critical need based upon break history and hydraulic modelling analysis which identified one or more criteria listed above. The entire length of water mains identified for replacement and rehabilitation as part of WS-732 project plan had, on average 14.85 breaks per 1,000 linear feet of main over the mains' lifetime. For WS-733, that value is 11.15 breaks per 1000 linear feet. For water main replacements, pipes of eight and twelve inch diameters will remain those sizes. Ten-inch pipe (not being a commercially produced pipe size) will be replaced with twelve-inch. Also, six-inch pipe is no longer a recommended minimum size for water main supply, thus 6-inch pipe will be replaced with eight-inch (except in those cases of a fire hydrant supply connection).

Several overview maps are included to identify project locations for WS-732 and WS-733 **Figure 3-1-B .**

Lead service lines are a public health threat. The replacement of the Lead service lines on private and public property are DWSRF eligible. DWSD policy is that all Lead water services, as encountered, shall be replaced with copper from the water main to the individual customer meters as part of its capital project work. Additionally, DWSD contractors are required to perform an excavation at the curb box of every service connection to visually verify if the service is Lead or copper. The project will replace Lead service lines of two inches in diameter and smaller from the public water main to the meter, defined here as Full Lead Service Line Replacement (FLSLR). Lead service lines of 1.5-inches and 2-inches are replaced with in-kind diameters in copper; 1-inch and less are replaced with 1-inch copper. Service lines that are larger than two inches in diameter are rigid metal pipe of copper or iron per building.

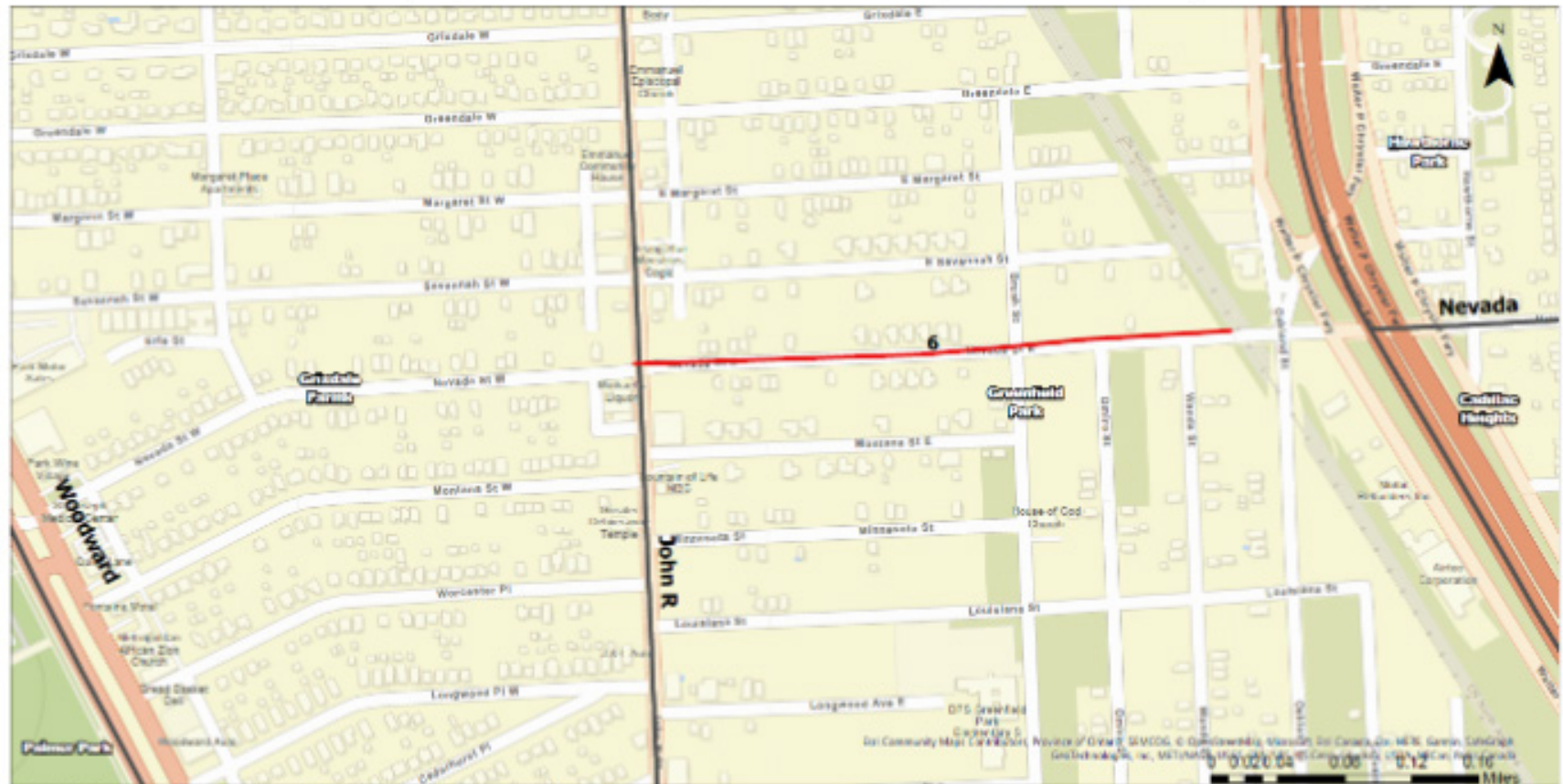
Figure 3-1-B PROJECT LOCATION MAPS for Project A, WS-733



Watermain Replacement Locations, City of Detroit Water and Sewerage Department
FY: 2023 DWSRF Project Plan for WS-733

Replacing approximately 27,176 LFT of water main, fire hydrants, gate valves, and all other appurtenance with full lead service replacement in neighborhood of Bagley, University District, Fitzgerald, Martin Park, Pilgrim Village, Grixdale Farms, Greenfield Park, Mapleridge, Denby, Yorkshire Woods, and East English Village of City of Detroit

Project Location Map - Watermain Replacement WS-733



Detroit North Side - Council District 3 - Watermain on Nevada

Watermain Replacement Locations, City of Detroit Water and Sewerage Department

FY: 2023 DWSRF Project Plan for WS-733

Replacing approximately 27,176 LFT of water main, fire hydrants, gate valves, and all other appurtenance with full lead service replacement in neighborhood of Bagley, University District, Fitzgerald, Martin Park, Pilgrim Village, Griswold Farms, Greenfield Park, Mapleridge, Denby, Yorkshire Woods, and East English Village of City of Detroit

Project Location Map - Watermain Replacement WS-733



Detroit Northeast Side - Council District 4 - Watermains on Linnhurst, Troester, Cedar Grove, and Hazelridge

Watermain Replacement Locations, City of Detroit Water and Sewerage Department **FY: 2023 DWSRF Project Plan for WS-733**

Replacing approximately 27,176 LFT of water main, fire hydrants, gate valves, and all other appurtenance with full lead service replacement in neighborhood of Bagley, University District, Fitzgerald, Martin Park, Pilgrim Village, Grixdale Farms, Greenfield Park, Mapleridge, Denby, Yorkshire Woods, and East English Village of City of Detroit

Project Location Map - Watermain Replacement WS-733



Detroit Northeast Side - Council District 4 - Watermains on Whittier

Watermain Replacement Locations, City of Detroit Water and Sewerage Department **FY: 2023 DWSRF Project Plan for WS-733**

Replacing approximately 27,176 LFT of water main, fire hydrants, gate valves, and all other appurtenance with full lead service replacement in neighborhood of Bagley, University District, Fitzgerald, Martin Park, Pilgrim Village, Grixdale Farms, Greenfield Park, Maplenidge, Denby, Yorkshire Woods, and East English Village of City of Detroit

Table 3-1-B DETAILED LIST OF WATER MAIN REPLACEMENT IN NEIGHBORHOOD EAST of LIVERNOIS UNDER WS-733

Neighborhood	Street Name	From	To	Length of Existing Pipe (Ft.) per Pipe Diameter (inch)					Pipe Material	Intervention Suggested
				6"	8"	10"	12"	16"		
University District/ Martin Park/ Pilgrim Village	Livernois	Margareta	M-10	385	870		7,080		CI	
Grixdale Farms/ Greenfield Park	Nevada	I-75	John R.	1,900					CI	
East English Village/ Yorkshire Woods/ Denby/Outer Drive-Hayes	Whittier	Whitehill	Chandler Park Dr	589	4,500		1,470		CI	
Mapleridge	Linnhurst	Hayes	Morang	1,528					CI	
Mapleridge	Troester	Maccrary	Kelly	2,855					CI	
Mapleridge	Cedargrove	Maccrary	Kelly	1,516	1,355				CI	
Mapleridge	Hazelridge	Celestine	Kelly	3,128					CI	
		Total Linear Feet: 27,176							CI= CAST IRON	

3.2 STUDY AREA CHARACTERISTICS

3.2.1 DELINEATION OF STUDY AREA

The general study area for this Project Plan is the portion of DWSD service area within the corporate limits of the City of Detroit. The study area encompasses approximately 88,876 acres with a population of approximately 642,508 people according to the 2020 Census, plus considerable commercial and industrial activity.

3.2.2 LAND USE IN STUDY AREA

As shown in **Table 3.2**, the existing land use within the City of Detroit is comprised predominantly of residential, commercial and industrial uses. Most of the land in the area is developed already and there is, therefore, little opportunity for land use changes to occur except through redevelopment.

Table 3-2. LAND USE IN DETROIT

Land Use	Acreage	Percentage (%)
Residential	54,392	61%
Commercial	13,492	15%
Industrial	7,020	8%
Recreation/Open	9,497	11%
Other	4,475	5%

3.2.3 ECONOMIC CHARACTERISTICS

Detroit has had an unemployment rate considerably above regional and national averages. High unemployment rates have been a chronic problem in a ring surrounding the central business district. Compared to regional averages, Detroit has a relatively low percentage of its population employed in professional occupations and has a higher than average incidence of unskilled workers. Prime employment categories include civil service, banking, real estate and insurance. The median household income was listed as \$[30,894 update] on the U.S. Census website along with an estimated persons in poverty at 35.0%¹. Income levels in Detroit tend to be significantly below those levels reported in neighboring areas in Wayne, Oakland, and Macomb Counties.

¹ <https://www.census.gov/quickfacts/fact/table/detroitcitymichigan/IPE120216#viewtop> Census Data 2019

3.3 POPULATION DATA

The population projections presented in the 2015 Water Master Plan Update report prepared by CDM/Smith for DWSD indicate a forecasted decline in population for the City of Detroit. The City of Detroit population is expected to decrease from 713,777 (2010 Census) to 613,709 by the year 2035. The 2019 estimated population on the U.S. Census website is 670,031¹. The SEMCOG July 2020 Projected Population is 642,508.

3.4. EXISTING FACILITIES

The Detroit Water Distribution System is defined as pipes that are 16 inches and smaller in diameter with the majority of piping in diameters of six-inch and eight-inch. Most of the system is quite old. Many pipes are over 100 years old, and the average age of pipes in the entire city is approximately 85 years.

Most of the pipe in the Detroit Water Distribution System is comprised of older unlined pit cast and centrifugally spun cast iron pipe. Newer ductile iron pipe has been installed in the City ever since it became commonly available (generally after 1970), but ductile iron piping represents a very small percentage of the total length of pipe in the system. Additionally, there is some asbestos cement pipe in the system. DWSD use of asbestos cement pipe ended in the mid-1980s.

Table 3.3 summarizes the distribution of various pipe sizes in the system. It is noted that much of the six-inch and eight-inch pipes have low coefficients of friction (C factors) citywide, thereby increasing the energy required to maintain adequate pressure and transport capacity.

Table 3-3. CITY-WIDE DISTRIBUTION SYSTEM PIPING SUMMARY

Pipe Diameter	Linear Footage	% of System
6"	5,481,018	39%
8"	6,047,000	42%
10"	257,222	2%
12"	1,665,873	12%
16"	748,742	5%

Table 3-4 shows the existing water main data by type and installation year, and shows the distribution of various pipe types within the system.

Table 3-4. SUMMARY OF DETROIT WATER MAIN DISTRIBUTION PIPES

Type	Installation Period	% of System
Unlined cast iron pipes – Pit cast	Until 1923	40%
Unlined cast iron pipes – Class 150	1923-1940	38%
Unlined cast iron pipes – Class 250	After 1940	10%
Lined ductile iron	After 1970	7%
Asbestos cement	After 1980	5%

According to a 1977 report prepared by DWSD, cast iron pipes purchased and installed prior to 1923 were manufactured by the pit-cast process, which gave long trouble-free service. From 1923 to 1940, cast iron pipes (Class 150) made by a centrifugal process (spun cast) were purchased and installed in the Detroit system. The Department experienced serious trouble with spun cast pipes, and a lifespan of 35 to 40 years was suggested to this class of pipes based on the same report. Starting from 1940, DWSD began using Class 250 spun cast pipe for additional wall thickness for combating corrosion. DWSD officially adopted the standard use of Class 250 pipe in 1945. The CIPMO team has evaluated the current pipe class standard for the application and pressure duty required of the pipe replacements. Trench construction is generally proposing the use of Class 52 and 54 ductile iron pipe encased with a polyethylene wrap. For trenchless installation, such as pipe-bursting of existing cast iron pipe and horizontal directional drilling, pipe replacement will be with High Density Polyethylene (HDPE), -DR11 C900 pipe. These trenchless construction techniques are used around the country in urban areas and is a means to save time and construction cost, and minimize disruption to the right-of-way, other existing utilities, and the rate payers in Detroit.

The City of Detroit has an estimated 80,000 + Lead (Pb) water services active within the municipal water system. Given the potential negative health impacts to water system customers, DWSD has been undertaking efforts in the replacement of these services. Per EPA and MI-EGLE requirements, Lead services are replaced from the water main all the way to the customer meter within their property (residence, commercial space, other). Lead replacements are integrated into water main replacement capital work.

4 ANALYSIS OF ALTERNATIVES

In accordance with the MI-EGLE guidelines for preparing a DWSRF Project Plan, the potential alternatives to be analyzed include a No Action Alternative, Optimum Performance of Existing Facilities Alternative, and a Regional Alternative.

4.1 IDENTIFICATION OF POTENTIAL ALTERNATIVES

Project A, WS-732: Water Main Replacement and Rehabilitation at Select Locations West of Livernois: Warrendale, McDowell, Brightmoor, Claytown, Springwells, Crary/St.Marys, and Grandmont

Project B, WS-733: Water Main Replacement and Rehabilitation at Select Locations East of Livernois: Martin Park, Pilgrim Village, University District, Grixdale Farms, Greenfield Park, Mapleridge, East English Village, Yorkshire Woods, Denby, and Outer Drive-Hayes

4.1.1. “NO ACTION” – Alternative 1

As indicated in Section 3.1, the project is needed due to the aging water mains. The water mains included in this project have exceeded their useful life as evidenced by the frequent breaks that occur leading to disruption of water supply, potential increased risk to public health, and potential flooding issues for the residents, commercial, and industrial customers. A “No Action” alternative would simply worsen the conditions by leading to an increase in water main breaks, more frequent disruption to customer service and potential increased public health risk, and potential for loss of other utilities including sewers, gas, and roads; all the while, putting additional stress on an already resource-challenged DWSD. Furthermore, the “No Action” alternative leaves unaddressed the higher energy loss associated with the pipe interior roughness. Therefore, a “No Action” alternative is not considered viable and is not pursued further.

4.1.2 OPTIMUM PERFORMANCE OF EXISTING FACILITIES – Alternative 2

DWSD is currently operating the water distribution system within the constraints of an aging system. The aging system contains Lead service lines. It is a benefit to the public health and safety to remove and replace the Lead service lines. Water main breaks are handled through the assigned DWSD staff, and supplemented with contracted services as conditions may require. In 2014, DWSD embarked on a 20-Year Infrastructure Plan to address upgrading, maintaining or replacing the water mains depending on the severity of the problem. A water main leakage detection program is ongoing. The program used to be outsourced, but currently DWSD is self-performing leak detection efforts. The leak survey completed in 2014 was based on several studies conducted to qualitatively and quantitatively evaluate the water leaks in the City water distribution system. As mentioned in Section 1 of this plan, DWSD has engaged a Capital Improvement Plan Management Organization (CIPMO) for the purpose of targeting assets for condition assessment and accelerating the replacement of DWSD’s buried infrastructure. Through

collaboration with DWSD and other City departments, the CIPMO team has developed a specific five year CIP, targeting specific areas of Detroit for condition assessment of buried water and sewer infrastructure and development of rehabilitation or replacement strategies.

4.1.3 REGIONAL ALTERNATIVE – Alternative 3

Under the Bifurcation Agreement, GLWA operates the water treatment plants, pump stations, transmission mains, and distribution mains that provide potable water to the City of Detroit and 127 additional municipal water supplies as a regional water system. The service area identified for water main replacement resides entirely within the City of Detroit.

The City of Detroit and all of the surrounding communities, adjacent to the subject area, are serviced by GLWA. Therefore, a Regional Alternative in the context of this Project Plan is not applicable.

4.2 ANALYSIS OF PRINCIPAL ALTERNATIVES

Project A, WS-732: Water Main Replacement and Rehabilitation at Select Locations West of Livernois: Warrendale, McDowell, Brightmoor, Claytown, Springwells, Crary/St.Marys, and Grandmont

Project B, WS-733: Water Main Replacement and Rehabilitation at Select Locations East of Livernois: Martin Park, Pilgrim Village, University District, Grixdale Farms, Greenfield Park, Mapleridge, East English Village, Yorkshire Woods, Denby, and Outer Drive-Hayes

4.2.1 DESCRIPTION OF PRINCIPAL ALTERNATIVES

There are only two options for addressing the problems associated with aged water mains. DWSD can either do nothing and continue to repair the old pipes (Alternative 1), or replace or rehabilitate the old pipes with new ones (Alternative 2). As a part of Alternative 2, rehabilitation of a limited number of feet of water main will be incorporated.

A. Alternative 1 – Repair of Existing Water Mains

Water main repair is conducted throughout the system, particularly in those areas where problems have not escalated to the point which would warrant replacement as described in Section 3.1. Nevertheless, water main repairs are time consuming, costly, constitute a drain on DWSD resources needed to carry out the repairs, and pose a potential increase in public health risk. In addition, repairs often trigger additional breakage and/or leaks in the vicinity as a result of disturbances to the section of pipe being repaired. Water main repairs require shutting off potable water service to multiple customers while the source of the leak is confirmed, repaired

and returned to service. Repair activities cannot be pre-scheduled, and field crews must respond on an “as needed” basis, often during the winter months when cold weather and freeze-thaw conditions trigger pipe breaks.

B. Alternative 2 – Water Main Replacement

Replacement of aged water main pipes is based on the replacement criteria discussed in Section 3.1. The replacement pipe is sized to meet the service area needs, including commercial, business and residential demographics. In all cases, 6-inch diameter water mains are being replaced with an 8-inch minimum diameter water main to facilitate maintaining pressures under all flow conditions. Full Lead Service Line Replacement (FLSLR) will be included in the scheduled replacement of aged water mains. It is a benefit to the public health and safety to replace the Lead service lines. DWSD policy is that all Lead water services, as encountered, shall be replaced with copper from the water main to the individual customer meter as part of its capital project work. Additionally, DWSD contractors are required to perform an excavation at every service connection to visually verify if the service is Lead or copper. The project will replace Lead service lines of two (2) inches in diameter and smaller from the public water main to the meter, herein defined as FLSLR. Lead service lines of 1.5-inches and 2-inches are replaced with in-kind diameters in copper; Lead services of 1-inch and less are replaced with 1-inch copper. Replacement of aged water mains also provides for the use of ductile iron or HDPE piping. Finally, some pipes are rehabilitated in place using a specialty lining process.

The cast iron pipes included in this project have surpassed their anticipated service life. The piping replacements call for a minimum eight-inch diameter water main, the minimum recommended size in a distribution system for communities who intend to provide fire flow protection, which is also supported by Recommended Standards for Water Works

COST EFFECTIVENESS ANALYSIS

A monetary evaluation of the feasible alternatives was prepared using MI-EGLE guidelines for DWSRF Project Plans, including the present worth formulas and discount interest rate of (-0.500%). Under this analysis, the useful life is assumed to be 50 years for pipelines. The salvage value of pipes at the end of the 20-year planning period was computed on the basis of a straight-line depreciation over the useful life of the item. Therefore, the salvage value of the pipes at the end of the 20-year planning period is estimated to be 60% of the initial cost. $(20/50)=0.6$

The present worth of salvage value was then computed by multiplying the salvage at the end of the 20 years by the conversion factor 0.9418 based on the following formula:

$$1/(1+(0.3)/100)^{20}=0.9418$$

$PW = F * 1/(1 + i)^n$ Where:

PW = Present Worth (Salvage)

F = Future Value (Salvage)
 i = Discount Interest Rate (0.3%)
 n = Number of Years (20)
 $1/(1 + i)^n$ = Conversion Factor

Interest during the construction period was computed using the formula:

$(0.3)/100 * 0.5 * 2 * 15,159,150 = (45,477)$ Project A, WS-732

and,

$(0.3)/100 * 0.5 * 2 * 14,882,512 = (44,648)$ Project B, WS-733

$I = i * 0.5 * P * C$

Where:

I = Interest Value

i = Discount Interest Rate (0.3%)

P = Period of Construction in Years (assumed to be two years)

C = Capital Cost of the Project

The annual Operation and Maintenance (O&M) expenses associated with each alternative were estimated, and then converted into a Present Worth value by multiplying the annual cost by a conversion factor of 19.3836 using the following formula:

$[(1 + (0.3)/100)^{20} - 1] / 0.3 / 100 (1 + (0.3)/100)^{20} = 19.3836$

$PW = A * [((1 + i)^n - 1) / i(1 + i)^n]$

Where:

PW = Present Worth (O&M)

A = Annual O&M Cost

i = Discount Interest Rate (0.3%)

n = Number of Years (20)

$[(1 + i)^n - 1] / i(1 + i)^n$ = Conversion Factor

For each alternative, the total Present Worth was computed from the estimated cost (including construction, engineering, and administrative costs), salvage value, interest during construction, and/or O&M costs. This equates to the amount which would be needed at the start of the project to cover construction costs and operating expenses over the 20-year planning period if interest were to accrue at the discount rate (0.3%) annually.

The Present Worth of each alternative was then converted to an Equivalent Annual Cost, which is the amount which would be paid uniformly over a 20-year period based on the Present Worth value. This amount was obtained by the using the following formula and capital recovery factor

of 0.0516:

$$=[(0.3)/100(1+(0.3)/100)^{20}/((1+(0.3)/100)^{20}-1)]=0.0516$$

$$A = PW * [(i(1+i)^n)/((1+i)^n - 1)]$$

Where:

A = Equivalent Annual Cost

PW = Present Worth

i = Discount Interest Rate (0.3%) n =

Number of Years (20)

$$[(i(1+i)^n)/((1+i)^n - 1)] = \text{Capital Recovery Factor}$$

The cost analysis for Alternatives 1 and 2 is presented in **Table 4-1-1 and 4-1-2**. Capital costs are based on a unit cost basis for the purpose of this analysis to show the estimated expenses for a typical 1,000 foot pipe length. The annual O&M cost is based on DWSD historical data in past reports.

Table 4-1-1 COST COMPARISON OF WS-732, WATER MAIN REPLACEMENT - Warrendale, McDowell, Brightmoor, Claytown, Springwells, Crary/St.Marys, and Grandmont

AVERAGE EQUIVALENT ANNUAL COST DETERMINATION
PROJECT-A, WS-732

Cost Effective Analysis and Present Worth Determination									
Project:	DWSD Project A								
System:	Water Main Replacement, Various Locations in Detroit West of Livernois Avenue								
Planning Period:	2023-2043	20	Years	Alternative 1	Alternative 2				
Construction Duration:		2	Year	NO ACTION	29,716 LINEAR FEET OF				
Inflation Rate (CPI):		2.000%			WATER MAIN REPLACEMENT				
Discount Rate:		0.300%							
Capital Costs (One Time Expenditures):			Salvage Value Factor		Present Worth Factor		Present Worth Factor		
50 Yr. Structures			0.6000	\$ -		\$ 11,484,204			
20 Yr. Process Equipment			0.0000	\$ -		\$ -			
10 Yr. Process Equipment			0.0000	\$ -	0.9997	\$ -		0.9997	
15 Yr. Auxiliary Equipment			0.6667	\$ -	0.9996	\$ -		0.9996	
10 Yr. Auxiliary Equipment			0.0000	\$ -	0.9997	\$ -		0.9997	
Subtotal				\$ -		\$ 11,484,204			
Contingency		10%		\$ -		\$ 1,148,420			
Engineering, Legal, Admin., "Green" Provisions		20%		\$ -		\$ 2,526,525			
Total				\$ -		\$ 15,159,150			
			CPI Factor						
10 Replacement Cost at Yr.		1.2190		\$ -		\$ -			
15 Replacement Cost at Yr.		1.3459		\$ -		\$ -			
20 Salvage Value at Yr.				\$ -	0.9418	\$ 6,890,523		0.9418	
OM&R Costs (Recurring Equal Expenditures)				2023	2043	2023	2043		
Repair & Maintenance				\$ 1,188,640	\$ 1,262,028	\$ -	\$ -		
Total O&M Costs				\$ 1,188,640	\$ 1,262,028	\$ -	\$ -		
Fixed O&M Costs				\$ 1,188,640	\$ 1,188,640	\$ -	\$ -		
Total Variable O&M Costs				\$ -	\$ 73,388	\$ -	\$ -		
Yearly Increase				\$ 3,669		\$ -			
Present worth (PW) of constant annual O&M cost:						19.3836		19.3836	
PW of variable annual O&M cost (annual increase):						182.2139		182.2139	
Capital Recovery Factor						0.0516		0.0516	
Assumptions				CALCULATIONS - PRESENT WORTH			CALCULATIONS - PRESENT WORTH		
1) Based on an average of five breaks per year				1. Initial Cost	\$ -		1. Initial Cost	\$ 15,159,150	
2) Annual O&M cost does not include cost of restoration and cost of contracted services if needed				2a. Constant O&M	\$ 23,040,151		2a. Constant O&M	\$ -	
				2b. Variable O&M	\$ 668,616		2b. Variable O&M	\$ -	
				3. Replacement Cost	\$ -		3. Replacement Cost	\$ -	
				4. Salvage Value (minus)	\$ -		4. Salvage Value (minus)	\$ 6,489,833	
				5. Interest During Construction	\$ -		5. Interest During Construction	\$ 45,477	
				6. Total Present Worth	\$ 23,708,767		6. Total Present Worth	\$ 8,714,794	
EQUIVALENT ANNUAL COST					\$ 1,223,134			\$ 449,596	

Table 4-1-2 COST COMPARISON OF WS-733, WATER MAIN REPLACEMENT - Martin Park, Pilgrim Village, University District, Grixdale Farms, Greenfield Park, Mapleridge, East English Village, Yorkshire Woods, Denby, and Outer Drive-Hayes

AVERAGE EQUIVALENT ANNUAL COST DETERMINATION
PROJECT-B, WS-733

Cost Effective Analysis and Present Worth Determination									
Project:	DWSO Project B								
System:	Water Main Replacement, Various Locations in Detroit East of Livernois Avenue								
Planning Period:	2023-2043	20	Years	Alternative 1		Alternative 2			
Construction Duration:		2	Year	NO ACTION		27,176	LINEAR FEET OF		
Inflation Rate (CPI):		2.000%					WATER MAIN REPLACEMENT		
Discount Rate:		0.300%							
Capital Costs (One Time Expenditures):			Salvage Value Factor		Present Worth Factor		Present Worth Factor		
50 Yr. Structures			0.6000	\$ -		\$ 10,866,792			
20 Yr. Process Equipment			0.0000	\$ -		\$ -			
10 Yr. Process Equipment			0.0000	\$ -	0.9997	\$ -		0.9997	
15 Yr. Auxiliary Equipment			0.6667	\$ -	0.9996	\$ -		0.9996	
10 Yr. Auxiliary Equipment			0.0000	\$ -	0.9997	\$ -		0.9997	
Subtotal				\$ -		\$ 10,866,792			
Contingency		10%		\$ -		\$ 1,086,679			
Engineering, Legal, Admin., "Green" Provisions		20%		\$ -		\$ 2,390,694			
Total				\$ -		\$ 14,344,165			
			CPI Factor						
10 Replacement Cost at Yr.		1.2190		\$ -		\$ -			
15 Replacement Cost at Yr.		1.3459		\$ -		\$ -			
20 Salvage Value at Yr.				\$ -	0.9418	\$ 6,520,075		0.9418	
OM&R Costs (Recurring Equal Expenditures)				2023	2043	2023	2043		
Repair & Maintenance				\$ 1,087,040	\$ 1,154,155	\$ -	\$ -		
Total O&M Costs				\$ 1,087,040	\$ 1,154,155	\$ -	\$ -		
Fixed O&M Costs				\$ 1,087,040	\$ 1,087,040	\$ -	\$ -		
Total Variable O&M Costs				\$ -	\$ 67,115	\$ -	\$ -		
Yearly Increase				\$ 3,356		\$ -			
Present worth (PW) of constant annual O&M cost:						19.3836		19.3836	
PW of variable annual O&M cost (annual increase):						182.2139		182.2139	
Capital Recovery Factor						0.0516		0.0516	
Assumptions				CALCULATIONS - PRESENT WORTH			CALCULATIONS - PRESENT WORTH		
1) Based on an average of five breaks per year				1. Initial Cost	\$ -		1. Initial Cost	\$ 14,344,165	
2) Annual O&M cost does not include cost of restoration and cost of contracted services if needed				2a. Constant O&M	\$ 21,070,775		2a. Constant O&M	\$ -	
				2b. Variable O&M	\$ 611,466		2b. Variable O&M	\$ -	
				3. Replacement Cost	\$ -		3. Replacement Cost	\$ -	
				4. Salvage Value (minus)	\$ -		4. Salvage Value (minus)	\$ 6,140,927	
				5. Interest During Construction	\$ -		5. Interest During Construction	\$ 43,032	
				6. Total Present Worth	\$ 21,682,241		6. Total Present Worth	\$ 8,246,271	
EQUIVALENT ANNUAL COST					\$ 1,118,585			\$ 425,425	

As shown in Tables 4-1-1 and 4-1-2 for WS-732 and WS-733, the equivalent annual cost of option 2 (water main replacement) is significantly less than the Equivalent Annual Cost of ongoing repairs. Therefore, Alternative 2, Replacement of the water mains is the most cost efficient.

4.1.1 ENVIRONMENTAL EVALUATION

The environmental impact of the pipe repair alternative is more severe when compared to the water main replacement alternative. Under the repair alternative, the environmental impact and disruption of service is experienced multiple times annually, and will increase over the 20-year analysis period. The environmental impact of the water main replacement is related mostly to the one-time construction phase and is discussed in more detail in Section 6.0. Leakage from aged pipes results in wasted treated water and increased energy use by equipment required to treat the raw water and pump the finished water into the distribution system. Water leaking from aged pipes is referred to as non-revenue water since it is wasted and lost to the environment after having gone through the expense of treatment and pumping processes. The wasted water has an impact on the GLWA cost of treating and pumping potable water. That cost is borne by all of GLWA customers including DWSD customers. Leakage (including water lost through leaking joints, as well as breaks and main flushing) based on past DWSD studies has been found to be significant, and above average when compared to other major cities nationwide. This lost water from leaks and broken water mains also has an impact on the regional wastewater treatment facilities because the waste water collection system serving the City of Detroit is a combined sewer. Therefore, additional energy used at interceptor lift stations and the raw and intermediate sewerage lift pumps at the Water Resource Recovery Facility to pump this additional flow from water main leakage has a negative environmental impact. This leakage would also contribute to combined sewer overflows during severe weather events in the City.

4.1.2 IMPLEMENTABILITY AND PUBLIC PARTICIPATION

Both alternatives described in Section 4.2.1 can be implemented. The pipe repair alternative would be implemented primarily by the DWSD maintenance staff with occasional support from contracted services under emergency conditions when break occurrence is extensive, whereas the pipe replacement alternative would require DWSD to procure a contractor to implement the work through a contract agreement. As previously discussed, there is a benefit to the public health to replace the Lead service lines during a water main replacement project. The public participation would be ensured through a public notice to allow local residents ample time to review the Project Plan and become familiar with the proposed project. A 30-day minimum advanced public notice of a hearing, and a public hearing would be held to provide time for the local residents to provide input and express their concerns regarding the Project Plan and the selected alternative.

4.1.3 TECHNICAL AND OTHER CONSIDERATIONS

Pipe replacement (Alternative 2) is substantially less burdensome from a staffing and resource management perspective, since new pipes constructed of modern materials require minimal maintenance over long periods of time. By contrast, repairing old pipe (Alternative 1) is very resource intensive and very difficult to plan. Furthermore, the work must be conducted on an emergency basis, often during extremely inclement weather. Pipe breaks adversely impact residents as they experience an interruption in their service, and they are exposed to a potential increase in public health risk due to the potential for contamination through backflow or back-pressure from a cross-connection. Many breaks occur during winter due to shifting soils from freeze/thaw cycles and result in roadways, sidewalks, and other areas encumbered with ice that can be very destructive to roads and vehicles and constitute a safety hazard. In addition, new pipes provide greater fire protection due to improved hydraulic capacity, since the old pipes often exhibit tuberculation on their interior surfaces. This tuberculation increases friction between the flowing water and the interior pipe wall, causing increased pressure loss and decreased flow.

5 SELECTED ALTERNATIVE

Alternative 2 is the alternative recommended for implementation based on both monetary and non-monetary evaluation. This alternative encompasses the installation of new water mains to replace aged pipes subject to excessive breaks. The work will include excavation of the existing mains and installation of new pipes. All pipes whether replaced by open excavation, Horizontal Directional Drilling and Pipe Bursting or lined will be subjected to pressure testing and disinfection, and then right-of-way restoration will be performed. The replacement or rehabilitation of the existing mains will include the replacement of Lead service lines as encountered during the water main replacement work. It is a benefit to the public health and safety to remove the Lead service lines. As previously mentioned, DWSD policy is that all Lead water services shall be replaced with copper from the water main to the individual customer meter as part of capital project work. Additionally, DWSD contractors are required to perform an excavation at every service connection to visually verify if the service is Lead or copper. The project will replace Lead service lines of two inches in diameter and smaller from the public water main to the meter (FLSLR). Lead service lines 1.5-inches and 2-inches are replaced with in-kind diameters in copper and 1-inch and less are replaced with 1-inch copper. Any disturbed areas adjacent to the pipes will be re-vegetated and restored to pre-project conditions.

5.1 DESCRIPTION

Project A, WS-732 and Project B, WS-733

The specific streets where the new water mains for WS-732 will be installed are listed in **Table 3-1-A**, along with the pipe diameters, lengths and general location within the project. For WS-733, the streets and pipe breakdowns is shown in **Table 3-1-B**. Figures 3-1-A and 3-1-B are the mapsets showing the piping work.

5.2 COSTS

Project A, WS-732 and Project B, WS-733

The estimated cost for the proposed water main project consists of: construction costs plus costs to cover engineering (design and construction) and administrative tasks. The estimated total cost for the Water Main Replacement all the listed Neighborhoods in Detroit is provided in **Appendix A-2**.

Cost are summarized below in **Tables 5-1-A and 5-1-B.**

Table 5-1-A Project A, WS-732: Water Main Replacement and Rehabilitation at Select Locations West of Livernois: Warrendale, McDowell, Brightmoor, Claytown, Springwells, and Crary/St.Marys and Grandmont

Planning Period:	2023-2043	20	Years	PROJECT A: WS-732
Construction Duration:		2	Years	29,716 LINEAR FEET OF
Inflation Rate (CPI):		2	%	WATER MAIN REPLACEMENT
Discount Rate:		(0.3)	%	AND REHABILITATION
Capital Costs (One Time Expenditures):				
50 Yr. Structures				\$11,484,204
Contingency		10%		\$1,148,420
Engineering, Administrative, Legal, "Green" Provisions		20%		\$2,526,525
Total				\$15,159,150

Table 5-1-B Project B, WS-733: Water Main Replacement and Rehabilitation at Select Locations East of Livernois: Martin Park, Pilgrim Village, University District, Grixdale Farms, Greenfield Park, Mapleridge, East English Village, Yorkshire Woods, Denby, and Outer Drive-Hayes

Planning Period:	2023-2043	20	Years	PROJECT B: WS-733
Construction Duration:		2	Years	27,176 LINEAR FEET OF
Inflation Rate (CPI):		2	%	WATER MAIN REPLACEMENT
Discount Rate:		(0.3)	%	AND REHABILITATION
Capital Costs (One Time Expenditures):				
50 Yr. Structures				\$10,866,792
Contingency		10%		\$1,086,679
Engineering, Legal, Admin."Green " Provisions		20%		\$2,390,694
Total				\$14,344,165

The Estimated cost for Full service line replacement is included in **Appendix A-1**

5.2.1 IMPLEMENTATION SCHEDULE

The recommended Water Main Replacement project is scheduled to be completed in accordance with the following schedule.

Table 5-2 PROJECT MILESTONE SCHEDULES

Project Activity	Project WS-732	Project WS-733
Advertise for Public Hearing	March 18, 2022	May 18, 2022
Public Hearing on Draft Project Plan	April 20, 2022	June 20, 2022
Complete and Submit Final Project Plan	June 28, 2022	August 28, 2022
Complete Plans and Specifications	February, 2023	April, 2023
Advertise for Bids	March, 2023	May, 2023
Receive Bids	April, 2023	June, 2023
Award Construction Contract	July, 2023	September, 2023
Start of Construction	August, 2023	October, 2023
Complete Construction	August, 2025	October, 2025

5.2.2 USER COST

The water main replacement recommended in this Project Plan is targeted for low interest loan assistance through the DWSRF program. The availability of loan funds is dependent on annual appropriations and the placement of the project on the Priority List prepared annually by MI-EGLE.

Repayment of the DWSRF loan through annual debt retirement payments will impact the residential customer rates resulting in increased user costs. This impact to customer rates is generally determined by dividing the additional expenses among the users in the service area as summarized in **Table 5-3-1 and 5-3-2**. The annualized cost of the project was calculated using the capital recovery factor 0.0516 and the following formula:

$$A = PW * [(i(1 + i)^n)/((1 + i)^n - 1)]$$

Where:

A = Equivalent Annual Cost

PW = Present Worth

i = Interest Rate through DWSRF Loan (0.3%)

n = Number of Years (20)

$$[(i(1 + i)^n)/((1 + i)^n - 1)] = \text{Capital Recovery Factor}$$

Table 5-3-1 USER COST IMPACT FOR PROJECT A, WS-732

Item	Project A WS-732
Total Cost of Project	\$15,159,150
Annualized Cost of Project (assuming DWRP interest rate of 2.0% over 20 years)	\$449,596
Number of User Accounts (households) in City of Detroit	175,000
Average Water Consumption per Household (industry average)	7,333 gallons/month (approximately 980 ft ³ /month)
Current DWSD Water Supply Rate	\$26.60 per 1,000 ft ³
Current Monthly DWSD Water Supply Rate per Household	\$26.07
Current Annual DWSD Water Supply Rate per Household	\$312.82
Increase in Cost per Household (Year 1)	\$2.57
Proposed Annual DWSD Water Supply Rate per Household (Year 1)	\$315.39
Proposed Percent Increase in Cost per Household per Year	0.82%

Table 5-3-2 USER COST IMPACT FOR PROJECT B, WS-733

Item	Project B WS-733
Total Cost of Project	\$14,344,165
Annualized Cost of Project (assuming DWRP interest rate of 2.0% over 20 years)	\$425,425
Number of User Accounts (households) in City of Detroit	175,000
Average Water Consumption per Household (industry average)	7,333 gallons/month (approximately 980 ft ³ /month)
Current DWSD Water Supply Rate	\$26.60 per 1,000 ft ³
Current Monthly DWSD Water Supply Rate per Household	\$26.07
Current Annual DWSD Water Supply Rate per Household	\$312.82
Increase in Cost per Household (Year 1)	\$2.43
Proposed Annual DWSD Water Supply Rate per Household (Year 1)	\$315.25
Proposed Percent Increase in Cost per Household per Year	0.78%

The theoretical impact of financing the WS-732 and WS-733 water main replacement through the DWSRF loan program is expected to increase by no more than 0.82% due to WS-732 and 0.78% due to WS-733 the cost of water to a typical user. This anticipated increase is due to the impact of construction cost. However, the impact would be less since it would be influenced by other factors such as the reduction in operating costs (chemicals, energy, etc.), less water loss through breaks, and reduced maintenance/repairs. Therefore, the actual rate determination would be based on factors that encompass the delivery of comprehensive services by DWSD to its customers. It should be recognized that the debt for distribution water main replacement work within the City of Detroit will be paid by Detroit customers only, not the entire service area.

If DWSRF loans are not available, DWSD will need to finance the cost of the water main replacement as part of its Capital Improvement Program (CIP) through revenue bonds.

5.2.3 ABILITY TO IMPLEMENT THE SELECTED ALTERNATIVE

DWSD is a City-owned utility with broad statutory authority. Prior to GLWA assuming responsibility for operating and maintaining the regional water supply through the Bifurcation Agreement, DWSD had entered into contracts with its suburban customers, which establish the terms and conditions for providing water, and overseeing the operation and maintenance of the regional system. The Department has substantial experience in the financing of capital improvements under a variety of programs. It has a proven track record for using system revenues to retire its debt on new facilities.

The Great Lakes Water Authority (GLWA) will be the loan applicant on behalf of the City of Detroit Water and Sewerage Department (DWSD), the loan recipient.

5.2.4 DISADVANTAGED COMMUNITY STATUS

The DWSRF program includes provisions for qualifying the applicant community as a disadvantaged community. The benefits for communities with a population of 10,000 or more that qualify for the disadvantaged community status consist of:

- Award of 30 additional priority points.
- Possible extension of the loan term to 30 years or the useful life of the components funded, whichever is earlier. The estimated useful life of the new water mains is 50 years. DWSD is aware that the DWSRF program offers 20, 30 and 40 year loan terms and will evaluate which term is the most appropriate for DWSD and its customers. DWSD has initially indicated they will select a 30 year loan term.

MI-EGLE requires submittal of a Disadvantaged Community Status Determination Worksheet to determine if the community qualifies for this status. A completed worksheet is included in **Appendix C.**

Reference;¹ <https://www.census.gov/quickfacts/fact/table/detroitcitymichigan/IPE120216#viewtop>
Under Criterion 1, Detroit qualifies for Disadvantaged Community Status based on approximately 37.9% of families in Detroit below the poverty level.

5.2.5 SURFACE WATER INTAKE PROTECTION PROGRAM

Protection of surface water intakes for the system is the responsibility of GLWA as a part of the bifurcation agreement. Prior to that agreement, three (3) grants were received to develop plans for a Surface Water Intake Protection program. These grants are for the three raw water intakes now maintained by GLWA. Two intakes are located in the Detroit River at Fighting Island and Belle Isle; the third intake is located in Lake Huron adjacent to Burtchville Township, located north of the City of Port Huron. The plans were prepared as part of the 2015 Water Master Plan Update. The applicable box in the Project Plan Submittal Form will be checked for State approval of the Surface Water Intake Protection Program.

6 EVALUATION OF ENVIRONMENTAL IMPACTS

6.1 GENERAL

The anticipated environmental impacts resulting from implementing the recommendations of this Project Plan include beneficial and adverse; short and long-term; and irreversible and irretrievable. The following is a brief discussion of the anticipated environmental impacts of the selected alternative.

6.1.1 BENEFICIAL AND ADVERSE

The proposed project will significantly improve DWSD capability to provide reliable, high quality potable water (at the required service volume and pressure) to its residents in the City of Detroit. The project will also generate construction-related jobs, and local contractors would have an opportunity to bid the contracts.

Noise and dust will be generated during construction of the proposed Projects. The contractors will be required to implement efforts to minimize noise, dust and related temporary construction byproducts. Some street congestion and disruption of vehicular movement may occur for short periods of time, and areas targeted for water main replacement will require a short (2-4 hour) service interruption for the switchover from the old pipes to the new ones. Residents will need to flush their lines after the switchover is made. Spoils from open trenches will be subject to erosion; the contractors will thereby be required to implement a Soil Erosion and Sedimentation Control (SESC) Program as described and regulated under Michigan's Part 91, Soil Erosion and Sedimentation Control, of the Natural Resources and Environmental Protection Act (NREPA). Wayne County considers DWSD an Authorized Public Agency with regard to SESC. Underground utility services (water, electric, gas, etc.) may be interrupted occasionally for short periods of time. The aesthetics of the area will be temporarily affected until restoration is complete. Resources will be lost in the production of materials used in construction, and fossil fuels will also be utilized during construction activities. All construction will be in the road right-of-way (ROW). The work will be done in the City of Detroit ROW. Replacement of Lead water service lines will occur on private property as permitted by a written agreement with the resident.

SHORT AND LONG-TERM

The short-term adverse impacts associated with construction activities will be minimal, and will be mitigated in comparison to the resulting long-term beneficial impacts. Short-term adverse impacts include traffic disruption, dust, noise, and site aesthetics. No adverse long-term impacts are anticipated. Additionally, there will be no change to the visible landscape at the completion of this project.

6.1.2 IRREVERSIBLE OR IRRETRIEVABLE

The impact of the proposed project on irreversible and irretrievable commitment of resources includes materials utilized during construction and fossil fuels utilized to implement project construction.

6.2 ANALYSIS OF IMPACTS

6.2.1 DIRECT IMPACTS

Construction of the proposed project is not expected to have an adverse effect on historical, archaeological, geographic or cultural areas, as the construction activities will occur within extensively urbanized areas which have previously been disturbed by prior development and existing road rights-of-way. Additionally, there will be no change to the visible landscape at the completion of this project.

The proposed project will not detrimentally affect the water quality of the area, air quality, wetlands, endangered species, wild and scenic rivers, or unique agricultural lands.

6.2.2 INDIRECT IMPACTS

It is not anticipated that DWSD's proposed projects will alter the ongoing pattern of growth and development in the study area. Growth patterns in the service area are subject to local use and zoning plans, thus providing further opportunity to minimize indirect impacts.

6.2.3 CUMULATIVE IMPACTS

Improved customer satisfaction and reliable service delivery of potable water to customers are the primary cumulative beneficial impacts anticipated from the construction of the proposed water mains.

7 MITIGATION

7.1 GENERAL

Where adverse impacts cannot be avoided, mitigation methods will be implemented. Mitigation measures for the project such as soil erosion control will be utilized as necessary and in accordance with applicable laws. Details will be further specified in the construction contract documents used for the projects.

7.2 MITIGATION OF SHORT-TERM IMPACTS

Short-term impacts due to construction activities such as noise, dust and street congestion cannot be avoided. However, efforts will be made to minimize the adverse impacts by use of thorough design and well planned construction sequencing. To the extent possible, water mains will be located in rights-of-way to minimize adverse impacts on private property and routings will be selected to avoid major street and ornamental vegetation whenever possible. Established tree removals in the public right-of-way will also be avoided where possible. Where tree removals cannot be avoided, replacement saplings will be planted as a part of the restoration after construction. Access to properties will be maintained throughout the construction period for the water main replacement work. Site restoration will minimize the adverse impacts of construction, and adherence to the Soil Erosion and Sedimentation Act will minimize the impacts due to disturbance of the soil structure. Specific techniques will be specified in the construction contract documents.

Open trenches will be protected to minimize the hazards to citizens and construction will not normally take place in residential areas at night or on weekends in order to minimize disruption of normal living patterns.

7.3 MITIGATION OF LONG-TERM IMPACTS

Careful restoration of street pavement, sidewalks and driveways will be required to ensure that they perform satisfactorily in the future. The aesthetic impacts of construction will be mitigated by site restoration.

7.4 MITIGATION OF INDIRECT IMPACTS

In general, it is not anticipated that mitigation measures to address indirect impacts will be necessary for the recommended improvements addressed in this Project Plan. The proposed project is not located in undeveloped areas, nor is it to promote growth in areas not currently served by DWSD. In addition, the local land use plan and zoning ordinance further regulate and control development. For these reasons, indirect impacts are not likely to be a concern for this project.

8 PUBLIC PARTICIPATION

8.1 PUBLIC HEARING

8.1.1 PUBLIC HEARING ADVERTISEMENT AND NOTICE

A Public Hearing Notice will be published 30 days in advance of the hearing date to alert parties interested in this Project Plan and request input prior to its adoption (see **Appendix D**). This direct mail notice will be included an invitation to comment. While the public hearing is scheduled to be held at a regular DWSD Board of Water Commissioners meeting at a location out in the community, due to COVID-19 protocols, the meeting will be held virtually on April 20, 2022.

PUBLIC HEARING TRANSCRIPT

A formal public hearing on the draft Project Plan will be held before the DWSD Board of Water Commissioners on April 20, 2022. The hearing included a presentation on the project, as well as an opportunity for public comment and questions. The official hearing transcript and a copy of the visual aids (handout) used during the presentation is included in **Appendix D** along with the attendance list.

8.1.2 PUBLIC HEARING COMMENTS RECEIVED AND ANSWERED

There were no comments or responses from the public resulting from the public hearing.

8.1.3 ADOPTION OF THE PROJECT PLAN

The Project Plan is expected to get approved by the DWSD Board of Water Commissioners at the public hearing on April 20, 2022, and the GLWA Board of Directors at their regular meeting conducted on April 27, 2022 and resolutions will be adopted, ultimately authorizing GLWA to proceed with official filing of the Project Plan for purposes of securing low interest loan assistance under the DWSRF Program. Executed copies of the DWSD Board of Water Commissioners and the GLWA Board of Directors Resolutions approving the Project Plan are included in **Appendix C** of this document. Miscellaneous correspondence applicable to the Project Plan will also be included in **Appendix C** of the final document.

APPENDIX A-1 and A-2

*Table A- 1and A-2 Cost Estimate for
Full Lead service Line Replacement
Water Main Replacement in Midtown, Cultural Center, and Medical Center
Neighborhoods in Detroit*

APPENDIX B

*SUBMITTAL FORM, SELF-CERTIFICATION FORM, DISADVANTAGED
COMMUNITY STATUS DETERMINATION WORKSHEET, BOARD RESOLUTIONS*

APPENDIX C

*PUBLIC HEARING NOTICE, MAILING LIST FOR PUBLIC HEARING, PUBLIC HEARING
TRANSCRIPT, VISUAL AIDS*

APPENDIX D

*PROJECT PLAN CORRESPONDENCE; USACE PERMIT; SHPO SUBMITTAL; MNFI REVIEW;
USFWS REVIEW*