West Warren - Warren Water Improvement District

Capital Facilities Plan and Impact Fee Analysis

(Final - November 2025)

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SECTION 1

INTRODUCTION

BACKGROUND

West Warren and Warren are supplied with culinary water by the West Warren - Warren Improvement District. The District was organized in 1980 by the Weber County Commission for the purpose of constructing a culinary water distribution system to supply unincorporated areas in western Weber County. Initial facilities construction was financed by a combination of grants from the Farmers Home Administration, general obligation bonds, revenue bonds, and District funds. Construction of the initial water system facilities was completed in 1984, and additional construction in subsequent years has further extended the water distribution system. The District purchases water on a wholesale contract basis from the Weber Basin Water Conservancy District. (Davis, 1997)

The District faces the challenge of providing culinary water over a very large service area with a current population that is relatively small. This challenge is further magnified by the potential for residential, commercial, and industrial growth within the District's service area. Continued growth and changing land use will directly impact requirements for the culinary water system. District leaders have recognized that the challenges faced by the District in meeting the area's current and future culinary water demands and have authorized this study to address these issues.

The District has completed previous capital facilities plans in order to comply with the Utah Impact Fee Act (1995) and subsequent amendments. The initial impact fee analysis was completed in 1997 by Stephen Davis. The impact fee capital facilities plan was updated and expanded in 2007 by Wasatch Civil Consulting Engineering. A subsequent update was completed in 2018-2019. Updates have addressed storage options, improvements required for growth and to correct existing deficiencies, and fees.

PURPOSE AND SCOPE

This study is intended to update the Capital Facilities Plan and meet the current requirements, as given in Sections 11-36a-501 and 503 of the Utah Code, for a water system impact fee. The overall goal of the Capital Facilities Plan is to provide the District with planning information necessary for construct and operation of facilities that are efficient and effective under the wide range of demands placed on the system by the users. This study was also prepared to meet the requirements for an impact fee capital facilities plan. The specific determinations and analysis required for an impact fee capacity facilities plan are given in Section 6 of this study. The overall study and report should be considered as a supporting document to the impact fee capital facilities plan.

This study included the following steps: 1) Investigations into water demand patterns; 2) Evaluations of water source and storage requirements; 3) Modeling and analysis of the water distribution system, 4) Identification of water system improvements, 5) Impact fee analysis and determination, and 6) Evaluation of connection fees. Both existing and future conditions were considered when evaluating water system requirements and recommending improvements.

The Warren - West Warren area is also served by secondary (irrigation) water systems that are independently operated. This Capital Facilities Plan does not include analysis or planning for the secondary water systems, but assumes that secondary water systems will continue to be developed and expanded as required by current Weber County standards and code.

ACRONYMS AND ABBREVIATIONS

The following acronyms and abbreviations are used in this report:

ADD - average day demand
ERC - equivalent residential connection
GAL - gallon
GPD - gallons per day
GPM - gallons per minute
IFC - International Fire Code
MG - million gallons
PDD - peak demand demand
PID - peak instantaneous demand
WBWCD - Weber Basin Water Conservancy District

SECTION 2

WATER QUANTITY REQUIREMENTS

INTRODUCTION

Rules Governing Public Drinking Water Systems published by the Utah Division of Drinking Water indicate that public drinking water systems must generally be capable of meeting peak daily flow requirements and average yearly flow requirements. Indoor use, outdoor use, and fire flows should all be considered when estimating water demands on the sources, storage, and distribution system.

SERVICE AREA

The District serves the unincorporated communities of Warren and West Warren. These communities in western Weber County lack formal boundaries but are loosely bounded by the incorporated areas in Marriott-Slaterville, Plain City, and West Haven and the margins of the Great Salt Lake to west and to the north. The District is currently in the process of expanding their service area. The expansion includes areas that are currently being served and areas where development is expected extend future water system facilities. The current service area and the expected service area for the West Warren - Warren Improvement District is shown on Figure 2 -1.

The Warren - West Warren area is also supplied by secondary water (irrigation) sources, which currently provide water for outside irrigation to about 70% of the residences within the District. For the purposes of this study, we have assumed that the secondary water sources will be expanded as the area grows.

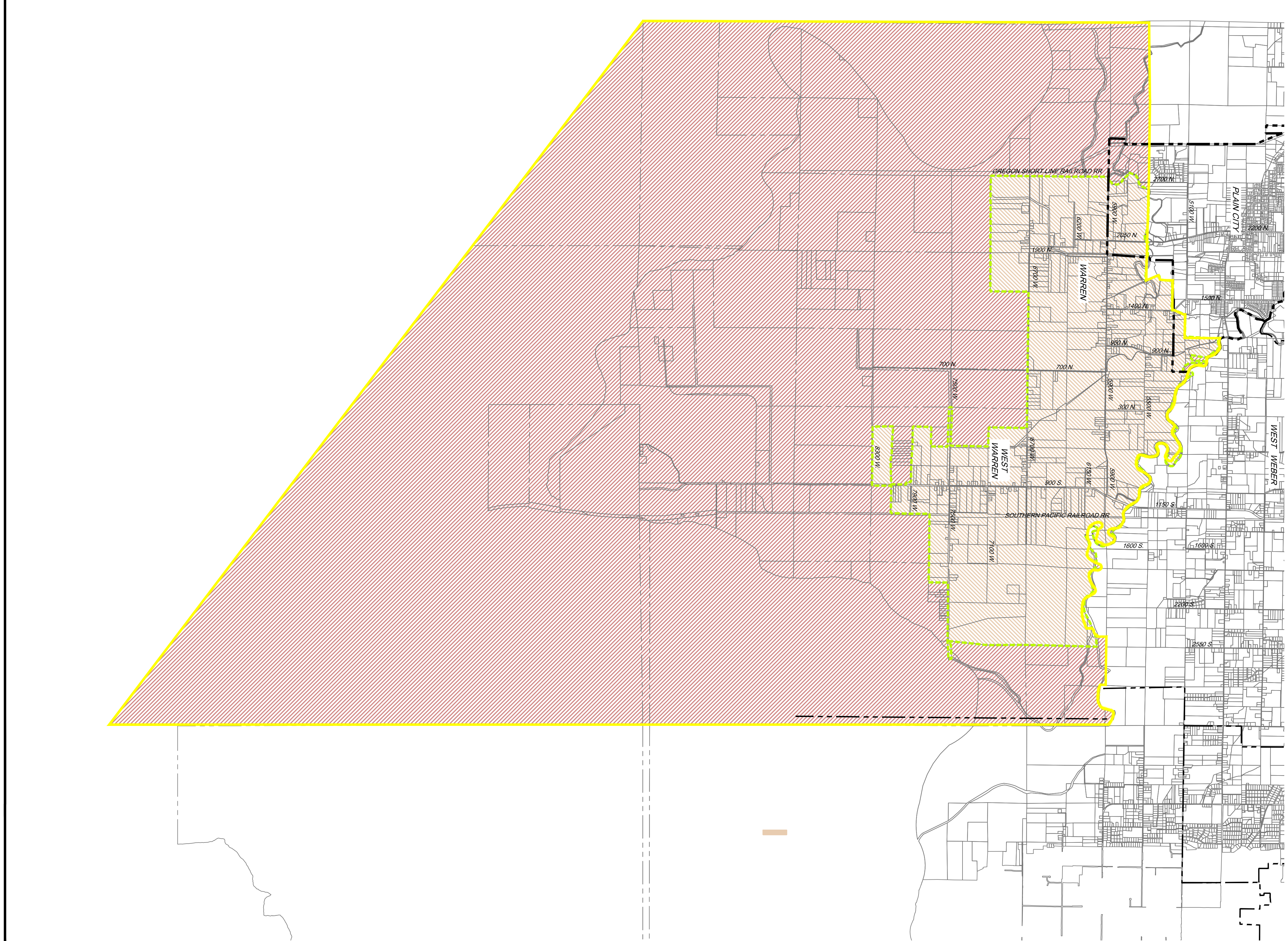
POPULATION AND GROWTH PROJECTIONS

The Warren - West Warren area has experienced moderate population growth over the past 20 years. Table 2-1 lists the service connections and population history of the District. The average growth rate over the past 20 years has been approximately 2.5 percent.

Over the past 10 years, the average annual growth rate within the District has been approximately 3.5%. This approximate rate of growth is expected to continue for the near future. Although much lower growth rates are forecasted for Weber County as a whole, it is anticipated that the District's service area, which borders more suburban areas, will likely grow at a rate faster than Weber County growth rate. For the purposes of this study, an annual growth rate of 3% will be used to estimate future service connections for the next 10 years. An annual growth rate of 2% annual growth will be used to estimate future connections for 10 to 50 years in the future. Projections are presented in Table 2-2.

WEST WARREN
CAPITAL FACILITIES PLAN & IMPACT FEE UPDATE

DISTRICT SERVICE AREA



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SCALE: 1"=7500'

LEGEND

- DISTRICT BOUNDARY
- PROPOSED ANNEXATION BOUNDARY
- MUNICIPALITY BOUNDARY
- EXISTING SERVICE AREA
- POTENTIAL SERVICE AREA AREA EXPANSION

FIGURE 2-1

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TABLE 2-1
SERVICE CONNECTION
AND POPULATION HISTORY

Year	Service Connections	Population Served[1]
1990	145	490
1995	170	580
2000	225	780
2005	263	890
2010	302	1,030
2015	320	1,090
2020	380	1,290
2025	450	1,530

1. Estimated based upon an average of 3.4 persons per connection.

TABLE 2-2
PROJECTED SERVICE CONNECTIONS
AND POPULATION

Year	Service Connections	Population Served[1]
2025	450	1,530
2030	520	1,770
2035	600	2,040
2040	670	2,280
2045	740	2,520
2055	900	3,060
2065	1,100	3,740
2075	1,340	4,560

1. Estimated based upon an average of 3.4 persons per connection.

The current District boundaries encompass about 8,730 acres. A proposed annexation will increase the District to over 50,000 acres. However, most of the annexation area is unsuitable for residential development due to mudflats, wetlands, and the shifting shoreline of the Great Salt

Lake. It is estimated that the potential developed area served by the District could approach 11,000 acres. A development area of 11,000 acres corresponds approximately to a buildout population of 14,000. Because the buildout condition is unlikely in the foreseeable future, the 20-year and 50-year projections will be used to develop the capital facilities plan and calculate impact fees. Capital facilities to meet water source and storage requirements will be planned using the 20-year population projections. Capital facilities for distribution system improvements, which typically have a much greater service life, will be planned using the 50-year projections. The 50-year population project is less than one third of the potential buildout population.

HISTORICAL WATER USE

Existing water use records were reviewed to determine historical water usage. Available water use records consisted of monthly water production metered at the WBWCD connections. Monthly production records for 2020 through 2024 are given in Table 2-3. These records show the expected seasonal water use pattern. The maximum seasonal demands occur June through August and are associated with outside irrigation. Although a high percentage of the residents in Warren - West Warren area use secondary irrigation systems for the irrigation of lawns and gardens, higher water use in the summer is still the expected pattern.

TABLE 2-3
MONTHLY WATER USE

Month	Water Use (acre-feet)				
	2020	2021	2022	2023	2024
January	16.93	18.61	16.66	18.02	14.06
February	14.80	15.40	18.49	16.35	11.16
March	16.61	19.59	15.40	16.71	13.01
April	23.22	22.74	12.48	18.76	12.97
May	37.29	35.74	29.40	33.09	24.78
June	46.74	56.29	36.13	38.89	43.98
July	54.55	45.23	45.09	58.45	59.88
August	54.81	21.76	47.19	46.00	40.89
September	37.64	36.36	32.37	31.92	40.82
October	28.13	26.35	23.61	17.10	24.00
November	20.20	19.18	11.51	12.54	10.85
December	18.13	17.95	20.28	13.31	11.36
Total	369.05	335.20	308.61	321.14	307.76

Water use shows a significant decline between 2020 and 2022. The District reports that the primary reason for the decline is decreased water use by a large dairy farm. More effective secondary water systems may also be a factor. Culinary water use is higher in drought years when secondary water supplies have been restricted or shallow irrigation wells have been inadequate. Water use in the past couple of years is reasonably close to design standards advised by the Utah Division of Drinking Water. See Appendix A for a more detailed analysis.

Water System Demand and Peaking Factors

The Utah Division of Drinking Water requires that water sources, storage, and distribution system must be adequate to meet the varying demand. Variations in demand are often described by **average day demand**, **peak day demand**, and **peak instantaneous demand**. A definition of these terms and their importance to the water system design is described below:

Average Day Demand (ADD) - The average rate of water use over an entire year. Average day demand is typically used to determine the required storage capacity for a water system. The Utah Division of Drinking Water requires that water systems have storage capacity equal to or exceeding the total demand for one day at the average day demand rate.

Peak Day Demand (PDD) - The average rate of water use for the day with the highest total water use. Peak day demand is an important criteria for determining the required capacity of the sources and the water distribution system. The Utah Division of Drinking Water requires water sources to have the physical and legal capacity to meet peak day demands. In addition, fire flow criteria established by the International Fire Code indicates that water distribution systems must be capable of delivering peak day demands plus fire flows with a minimum residual pressure of 20 psi throughout the distribution system.

Peak Instantaneous Demand (PID) - The highest rate of water use for typical (not fire flow) condition. Peak instantaneous demand is usually equivalent to peak hour demand or the average rate of water use for the hour with the highest total water use. Peak instantaneous demand is an important criteria for determining the capacity of the water distribution system. The water distribution system should have sufficient capacity to meet peak instantaneous demands while maintaining an acceptable delivery pressure at all service connections.

Variations in water demand can also be expressed as peaking factors. Peaking factors are the ratios of peak demands to the average demand. Average day and peak day demands were obtained from water use records submitted by the District to the Utah Division of Water Resources. Peak instantaneous demand was calculated from Utah Division of Drinking Water design standards. Table 2-4 summarizes the current water demands and peaking factors. Detailed calculations of the water demand are included in the Appendix.

TABLE 2-4
CURRENT WATER DEMANDS

Condition	Total System Demand		Peaking Factor
	(gpd)	(gpm)	
Average Day	284,100	197	ADD/ADD = 1.0
Peak Day	770,670	535	PDD/ADD = 2.7
Peak Instantaneous	NA	950	PID/ADD = 4.8

Water Demand in Equivalent Residential Connections

Water demand is often defined in terms of demand per equivalent residential connection (ERC). In this study, an ERC is defined as the typical water demand for an average residential connection. The District currently serves approximately 440 residential connections. Each residential connection is defined as 1 ERC, giving a total of 440 residential ERCs.

The District currently serves 10 non-residential connections. The non-residential connections include agricultural and industrial connections with significant water use. The water use for the non-residential connections is equivalent to approximately 60 residential connections. The sum of the residential and non-residential demand is estimated at 500 ERCs for 2025.

Average and Peak Demands per ERC

Peak Day and Peak Hour Demands can be calculated by applying the peaking factors to the Average Day Demand. Average and peak demands per ERC are given in Table 2-5.

TABLE 2-5
AVERAGE AND PEAK DEMANDS PER ERC

Condition	Water Demand per ERC		Peaking Factor
	(gpd)	(gpm)	
Average Day	570	0.4	1.0
Peak Day	1,540	1.1	2.7
Peak Instantaneous	NA	1.9	4.8

The water demands per ERC as given in Table 2-5 represent average system-wide demands for the given condition. They do not represent the average, peak day, or peak instantaneous demand for a single home. Individual homes could have peak instantaneous demands that exceed 10 gpm, but fortunately, the timing of these demands vary from home to home. Therefore, the peak instantaneous demand condition for the water system is much lower than the peak demand occurring at one residence. Similar variations occur at individual homes for both the peak day and average day conditions.

FIRE PROTECTION

Weber County and the Weber Fire District have adopted the International Fire Code (IFC) which defines fire protection requirements. Several minimum fire flow requirements from the IFC are summarized below:

Structure Type	Structure Area	Minimum Fire Flow
Single Family Dwelling	Up to 3600 sq. ft.	1,000 gpm
Single Family Dwelling	Greater Than 3600 sq. ft.	1,500+ gpm
Commercial	See IFC	1,500+ gpm

Most homes in the District are likely to have a fire flow requirement of 1,000 gpm. However, some of the larger homes will require 1,500 gpm or more according to the IFC standards. Commercial buildings or multi-family structures could have much higher fire flow requirements. This study did not evaluate the fire flow requirements for individual structures. Based on typical fire flow requirements in similar areas, the highest anticipated fire flow requirement is approximately 2,750 gpm for 2 hours. With this assumption, the required fire flow storage is estimated at **330,000 gallons**.

FUTURE WATER REQUIREMENTS

Future water requirements were estimated based upon the projected number of future water system connections as given in Table 2-2. There are areas on the west side of the District boundaries that are currently zoned for industrial land use. Therefore, it was assumed that the relative percentage of non-residential ERCs will remain constant. Projected future water requirements are given in Table 2-6.

TABLE 2-6
FUTURE WATER DEMANDS

Year	Number of ERCs	Yearly Demand[1] (ac-ft)	Peak Day Demand[2] (gallons)	Peak Instantaneous Demand[3] (gpm)
2025	500	320	770,000	950
2030	580	370	890,000	1,100
2035	670	430	1,030,000	1,270
2040	740	470	1,140,000	1,410
2045	820	520	1,260,000	1,560
2050	900	580	1,390,000	1,710
2055	1,000	640	1,540,000	1,900
2060	1,100	700	1,690,000	2,090
2065	1,220	780	1,880,000	2,320
2070	1,340	860	2,060,000	2,550
2075	1,480	950	2,280,000	2,810

1. Yearly demand = 0.64 ac-ft/ERC
2. Peak Day Demand = 1,540 gpd/ERC
3. Peak Instantaneous Demand = 1.9 gpm/ERC

SECTION 3

WATER SOURCES

EXISTING WATER SOURCES

Weber Basin Water Conservancy District (WBWCD) provides culinary water to the District on a wholesale basis through three metering stations spaced along the WBWCD mainline in 900 South. The District currently has contracts to purchase approximately 545 acre-feet of water per year from WBWCD.

Flow into the District's water system from the WBWCD connections is regulated by pressure reducing valves and measured through 6-inch and 4-inch meters. Because the WBWCD transmission pipeline is relatively large diameter (16-inch) and at a much higher pressure than the District water system, the functional capacities of the existing WBWCD connections are limited only by the capacities of the flow meters. The combined capacity of the two meter stations is over 4,000 gpm which exceeds projected peak instantaneous demand and peak day demand plus fire flow for the 20-year planning period. Metering stations capacities are summarized below:

<u>Meter Station - 5900 West 900 South</u>

- Rockwell 6-inch meter - Continuous Flow Capacity = 1,500 gpm
- Rockwell 4-inch meter - Continuous Flow Capacity = 750 gpm
- Total Capacity = 2,250 gpm

<u>Meter Station - 7000 West 900 South</u>

- Rockwell 6-inch meter - Continuous Flow Capacity = 1,500 gpm
- Rockwell 4-inch meter - Continuous Flow Capacity = 750 gpm
- Total Capacity = 2,250 gpm

<u>Meter Station - 7740 West 900 South</u>

- Rosemount 6-inch meter - Continuous Flow Capacity = 1,800 gpm
- Total Capacity = 1,800 gpm

ANNUAL SOURCE REQUIREMENTS

Annual source requirements were calculated for current and future conditions using the growth projections and the water use characteristics developed in Section 2. Annual water source requirements are given in Table 2-6. Water demand projections indicate that the existing WBWCD contract for 545 ac-ft per year should provide sufficient source capacity until the total demand approaches 850 ERCs. Rather than waiting until the source capacity is reached, the District's policy should be to expand source capacity as new developments or connections are added to the system. The most accessible prospect for additional source capacity is increasing the contract quantity purchases from WBWCD. Continued expansion of the supply contract is recommended to maintain a supply surplus and avoid future deficiencies.

WBWCD currently offers two options for additional water purchases, yearly contract water and a water purchase fee with operation and maintenance costs. With the first option, the District could add additional contract water to their annual purchases. This would be similar to the existing purchase contract wherein the District must pay for the full annual contract volume even if the actual use is less. The second option for purchasing additional water from WBWCD is a water purchase impact fee paid to WBWCD for each new water connection added to the District's water system. Payment of the $10,082 (current cost) impact fee provides 0.45 acre-feet of supply per connection, which is the annual indoor demand requirement for a typical residential connection per Utah Division of Drinking Water standards. WBWCD would only charge for only annual operation and maintenance costs after the one-time water supply impact fee is paid. The second purchase option is recommend to decrease future costs to customers.

Construction of a well for a District water source is possible, but unlikely due to water right restrictions and questionable capacity in the underlying aquifers. The Warren-West Warren area is presently closed to new groundwater appropriations with very limited exceptions. Therefore, water rights for a new well would need to be purchased from an existing water user and converted to culinary use. The production capacity of a well in the District area is uncertain because the water bearing layers in the underlying aquifer become thinner and finer grained near the margins of the Great Salt Lake. Water rights records indicate that there are many small diameter and low capacity wells in the area, but no larger capacity wells were noted.

SECTION 4

WATER STORAGE

EXISTING STORAGE FACILITIES

A residential/commercial development that currently under construction is constructing a 1 MG storage reservoir and pump station that will be transferred to the District. The new reservoir will meet the current storage requirement of for the District. It is expected to be in use by 2026.

STORAGE REQUIREMENTS

Storage reservoirs supplement the supply from water system sources during peak demand periods, fires, and emergencies. The storage volume needed to make up the difference between the supply rate and the daily peak demand is referred to as equalization storage. Equalization storage requirements are highest during the summer peak demand periods. Storage requirements for fires are determined by the largest required fire flows and expected duration of the fire event. The Utah Division of Drinking Water recommends that water systems consider additional emergency storage. However, there are no clear standards for calculating an emergency storage volume. In general, a water systems total storage volume should equal or exceed an average day's demand.

The State of Utah outlines storage requirements in *Rules Governing Public Drinking Water Systems, R309-510 Minimum Sizing Requirements* . These standards outline a methodology for calculating required storage based on indoor water use, outdoor water use, and required fire flows. Storage requirements of 685 gallons per ERC and 330,000 gallons for fire flow. Storage requirements are summarized in Table 4-1.

FUTURE STORAGE

The new storage reservoir should meet the District's storage needs for about 30 years. Future storage requirements could be met by an additional storage reservoirs or leasing storage capacity from WBWCD. The District should continue to monitor storage needs. As the water system is expanded, there may be benefits to providing storage tanks in other locations to improve redundancy and system performance in emergencies.

TABLE 4-1
WATER STORAGE REQUIREMENTS

Year	Number of ERCs	Equalization Storage (gal)	Fire Flow Storage (gal)	Total Storage (gal)
2025	500	340,000	330,000	670,000
2035	670	460,000	330,000	790,000
2045	820	560,000	330,000	890,000
2055	1,000	690,000	330,000	1,020,000
2065	1,220	840,000	330,000	1,170,000
2075	1,480	1,010,000	330,000	1,340,000

SECTION 5

DISTRIBUTION SYSTEM

EXISTING WATER DISTRIBUTION SYSTEM

The existing water distribution system is comprised primarily of 6-inch, 8-inch, 10-inch, and 12-inch diameter PVC water lines. Figure 5-1 shows the existing water system distribution system. The District reports that the water distribution system is in good physical condition with no significant maintenance problems.

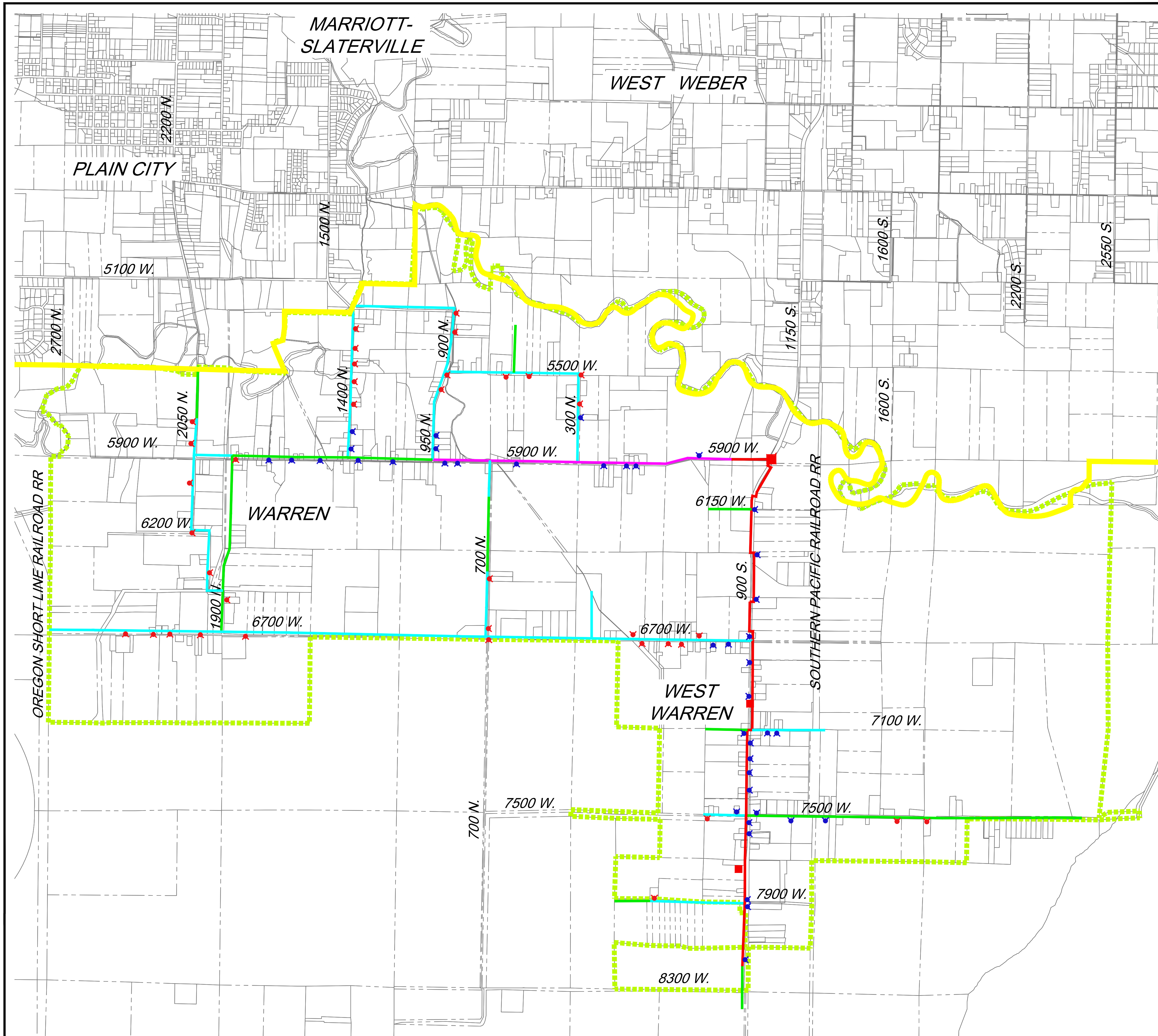
WATER SYSTEM MODEL DEVELOPMENT AND CALIBRATION

WaterCad by Bentley Systems, a graphically based pipe network analysis program, was used to model the existing and future water distribution system and evaluate proposed improvements. Pipe sizes and locations were obtained from maps and other information supplied by the District. Elevation data were obtained from USGS mapping. A more detailed discussion of the water system analysis, using the WaterCad model, is given in the Appendix.

To accurately simulate the performance of the distribution system, the mathematical computer model was calibrated to match the actual performance of the distribution system. Calibration was accomplished during previous capital facilities plans and subsequent updates. Water system modifications and improvements during the past 10 years were related mostly to waterline extensions to new development. These improvements were expected to have little impact on calibration related characteristics of the water system, so the model calibration was not evaluated or updated as part of this study.

DISTRIBUTION SYSTEM ANALYSIS

The model of the water system was used to analyze the performance of the water system at peak instantaneous demand and at peak day demand plus fire flow. A printout of the computer model database and results for several model runs are provided in the Appendix. Results were used to discover which existing water lines have insufficient capacity and where additional water lines should be constructed A description of the modeling analysis and results for each of the design criteria is given in the following sections.



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EXISTING WATER SYSTEM

N

SCALE: 1"=3000'

LEGEND

- DISTRICT BOUNDARY
- 6" CULINARY WATERLINE
- 8" CULINARY WATERLINE
- 10" CULINARY WATERLINE
- 12" CULINARY WATERLINE
- HYDRANT WITH <1000 GPM FIRE FLOW CAPACITY
- HYDRANT WITH >1000 GPM FIRE FLOW CAPACITY
- WEBER BASIN WATER CONSERVANCY DISTRICT CONNECTION & METER STATION

FIGURE 5-1

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Peak Instantaneous Demand

Criteria given by the Division of Drinking Water in *Rules Governing Public Drinking Water Systems* indicate that the distribution system must be capable of delivering peak instantaneous demand to the entire service area and maintain a minimum pressure of 20 psi at any service connection within the distribution system. Usually, minimum pressures of 20 psi at peak hour demand are too low for customer satisfaction, and pressures less than 45 psi often generate customer complaints.

The analysis demonstrated that peak instantaneous demand is not the critical condition for the District's distribution system. The existing distribution system can deliver peak instantaneous demand, while maintaining pressures near 70 psi at all service connections.

Peak Day Demand Plus Fire Flow

Peak day demand plus fire flow is the most severe demand condition for the District's water distribution system. Providing fire flow at peak day demand produces the highest flow rates and is the design criteria for most of the distribution system piping.

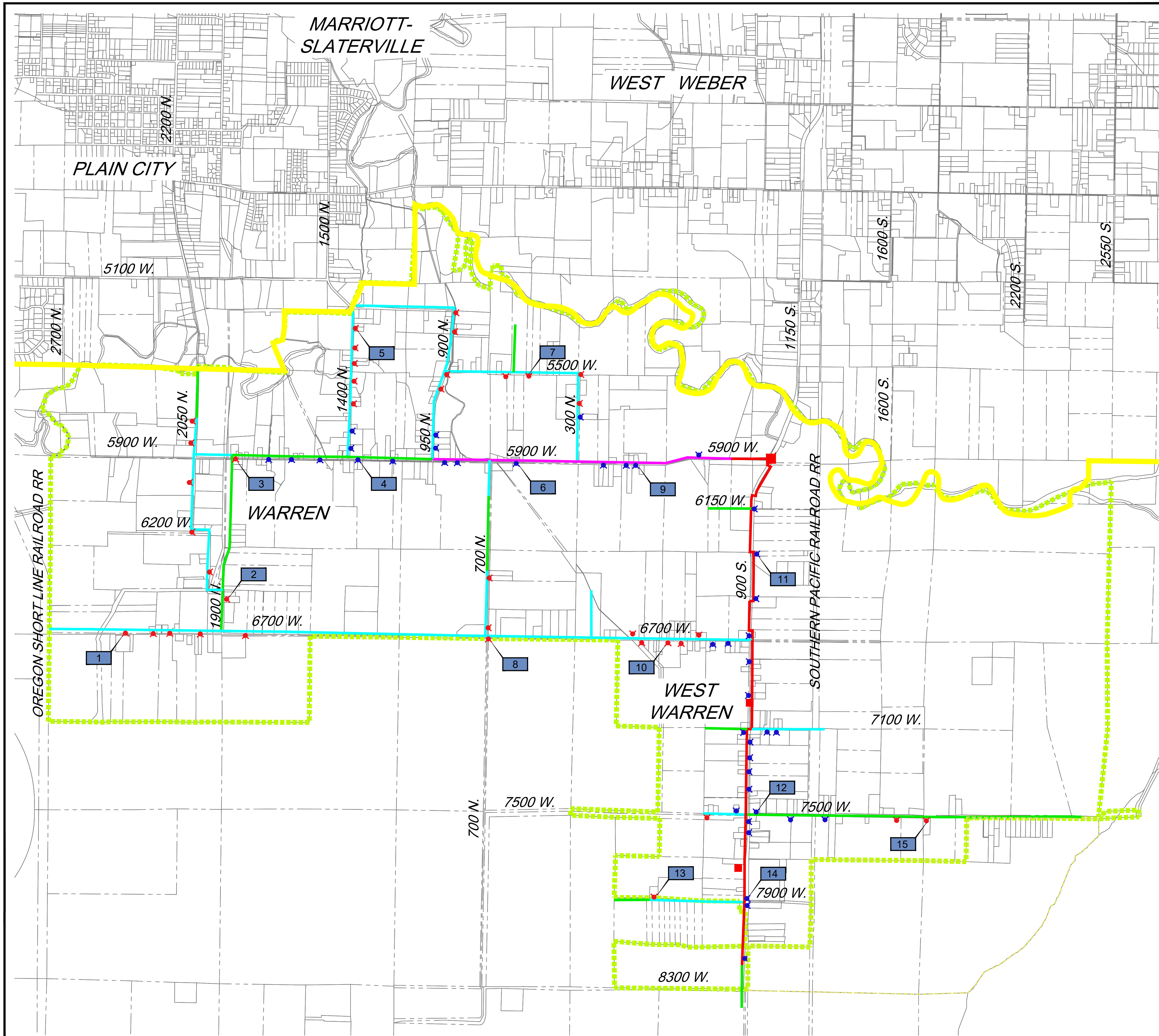
This condition was analyzed by using the computer model to calculate available fire flow for various locations throughout the distribution system. Available fire flow is defined as the amount of water that can be obtained from the distribution system at a given point while maintaining a minimum residual pressure of at least 20 psi at the delivery point and at all service connections within the water system. The available fire flows were calculated at peak day demand for all junction nodes within the water system model. It should be noted that junction node locations do not necessarily correspond to all fire hydrant locations. The available fire flows were calculated with the WBWCD meter station pressure reducing valves set to 73 psi. For current conditions (500 ERCs) the peak day demand plus fire flow represents a total system demand of approximately 1,500 gpm to 3,300 gpm, depending upon the fire flow requirement. This amount can be delivered through the existing WBWCD connections. However, in many locations the distribution system piping was found to be incapable of delivering minimum required fire flows to the hydrants. Results from the computer analysis indicate that some of the District's pipelines are undersized and significant portions of the distribution system have delivery capacities less than the required fire flow. Areas where model indicated that the distribution system cannot supply a fire flow of at least 1,000 gpm are shown on Figure 5-2.

As a general guideline, water lines which fit any of the following criteria are probably not capable of supplying minimum required fire flows: 1) Any waterlines less than 6-inches in diameter, 2) 6-inch diameter waterlines that are not looped or have long loops extending several

WEST WARREN

CAPITAL FACILITIES PLAN & IMPACT FEE UPDATE

FIRE FLOW CAPACITIES



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SCALE: 1"=3000'

FIRE FLOW CAPACITY AT SELECTED HYDRANTS

Hydrant	Capacity	Hydrant	Capacity
1	410 GPM	9	2210 GPM
2	830 GPM	10	830 GPM
3	900 GPM	11	3000 GPM
4	1130 GPM	12	3000 GPM
5	640 GPM	13	510 GPM
6	1710 GPM	14	3000 GPM
7	760 GPM	15	960 GPM
8	930 GPM		

LEGEND

- DISTRICT BOUNDARY
- 6" CULINARY WATERLINE
- 8" CULINARY WATERLINE
- 10" CULINARY WATERLINE
- 12" CULINARY WATERLINE
- HYDRANT WITH <1000 GPM FIRE FLOW CAPACITY
- HYDRANT WITH >1000 GPM FIRE FLOW CAPACITY
- WEBER BASIN WATER CONSERVANCY DISTRICT CONNECTION & METER STATION

FIGURE 5-2

DESIGNED J.D.B. DATE SEPT. 05, 2025
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P:\05—MISC\WEST WARREN\CAD\2025 CFP AND IMPACT FEE ANALYSIS\DWG\BASE2.DWG 9/8/2025 11:58:28 AM thousand feet; and 3) Dead-end water lines that are 8-inches in diameter and longer than 600 feet. Looped waterlines are waterlines that are interconnected so they can be supplied from two directions. Dead-end waterlines can be supplied from only one direction. It is recommended that all waterlines installed by future development and/or expansion of the distribution system be 8-inches in diameter or larger and looped into other waterlines wherever feasible. It is also recommended that the District begin a long term program to upgrade the distribution system in order to meet minimum fire flow requirements.

RECOMMENDED IMPROVEMENTS FOR EXISTING DEFICIENCIES

Peak day demand plus fire flow is the critical condition for analyzing and sizing the District's waterlines. The existing distribution system is not capable of delivering required fire flows to many areas of the District. To meet fire flow requirements some undersized waterlines will need to be replaced or paralleled with a new larger diameter waterline. New waterlines should be looped into existing waterlines whenever possible. Specific improvements and costs are summarized in Table 5-1 and shown on Figure 5-3. More detailed cost estimates are provided in the Appendix.

Distribution system improvements necessary to provide required fire flow are considered to be existing deficiencies. Existing deficiencies should not be funded through impact fees unless the improvement also directly benefits new development. Constructing the waterlines to improve fire flow capacity will benefit both existing residents and new development. Existing residents and future development should share the cost of these improvements proportionately to achieve an equitable distribution of costs.

RECOMMENDED IMPROVEMENTS FOR GROWTH

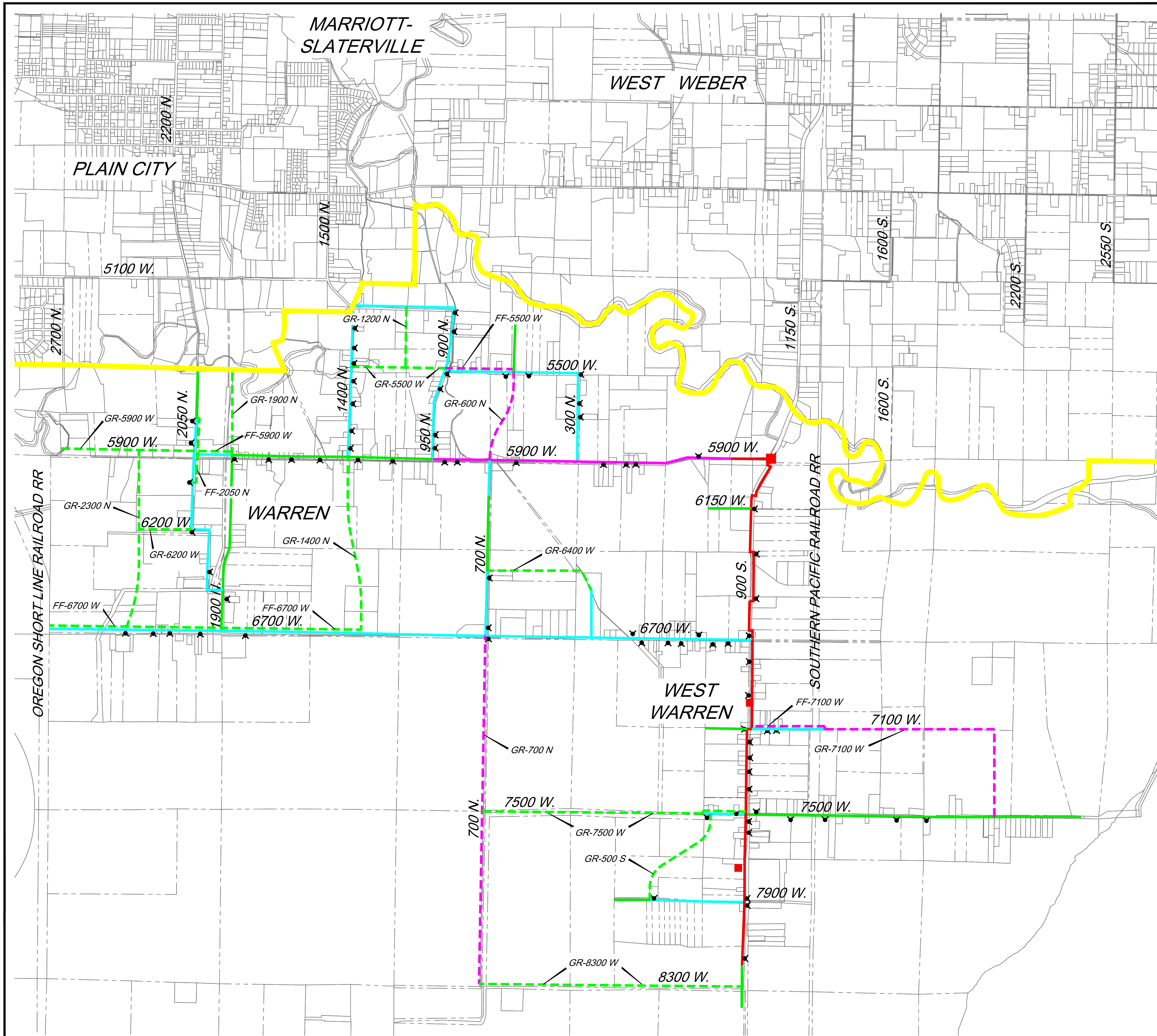
It is anticipated that both the District and developers will construct distribution system improvements to accommodate growth and expansion of the water system. The District will be responsible for the design and construction of new waterlines to areas where there are existing homes and where significant regional development is anticipated. Waterlines constructed by the District will form the essential backbone of the distribution network. Developers will be responsible to construct onsite waterlines necessary to connect homes and their individual developments to the distribution system. It is anticipated that offsite waterline improvements for growth will be constructed by a combination of the District and developers. In some cases the District may pay upsizing costs for larger diameter pipes or for extension of the development waterlines to complete loops. Anticipated distribution system improvements with the primary purpose of accommodating growth and development are listed in Table 5-2 as a guide for pipeline sizing and potential looping locations. It is not possible to predict the exact locations for future waterlines in areas without existing major roadways, so waterline locations are intended as a general guide for planning, rather than actual construction alignments.

WEST WARREN
CAPITAL FACILITIES PLAN & IMPACT FEE UPDATE

FUTURE WATER SYSTEM

N

SCALE: 1"=3000'



LEGEND

- 6" CULINARY WATERLINE
- 8" CULINARY WATERLINE
- 10" CULINARY WATERLINE
- 12" CULINARY WATERLINE
- FUTURE 8" CULINARY WATERLINE
- FUTURE 10" CULINARY WATERLINE
- FUTURE 12" CULINARY WATERLINE
- FIRE HYDRANT
- WEBER BASIN WATER CONSERVANCY DISTRICT CONNECTION & METER STATION

IMPROVEMENT NO. FF-7500W — LOCATION — IMPROVEMENT TYPE*

* FF - DENOTES CAPITAL IMPROVEMENTS RELATED TO FIRE FLOW REQUIREMENTS (SEE TABLE 5-1)

GR - DENOTES CAPITAL IMPROVEMENTS RELATED TO GROWTH AND EXPANSION OF THE WATER DISTRIBUTION SYSTEM (SEE TABLE 5-2)

FIGURE 5-3

DESIGNED	J.D.B.	DATE	SEPT. 05, 2025
DRAWN	D.L.C	SCALE:	1"=3000'
CHECKED	J.D.B.		

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TABLE 5-1
DISTRIBUTION SYSTEM IMPROVEMENTS
TO INCREASE FIRE FLOW CAPACITY

Project No.	Approximate Location	Description	Length	Cost Estimate	Comment
FF-5500W	5500 W. from 700 N. to 950 N.	Replace 6" dia. with 10" dia.	2,040 ft	$ 381,000	Requires a new 10" dia. waterline between 5900 W. and 5500 W. to be effective
FF-5900W	5900 W. from 1900 N. to 2050 N.	Replace 6" dia. with 8" dia.	1,110 ft	$ 190,000	Improves fire flow capacity along 2050 N. and along 5900 W. north of 1900 North
FF-2050N	2050 N. from 5750 W. to 6150 W.	Replace 6" dia. with 8" dia.	2,370 ft	$ 392,000	Improves fire flow capacity along 2050 N.
FF-6700W	6700 W. from 1350 N. to 2700 N.	Replace 6" dia. with 8" dia.	9,440 ft	$ 1,296,000	Requires an 8" dia. waterline looping to the 8" dia. waterline in 5900 W. to be effective
FF-7100W	7100 W. from 900 S. to 500 S.	Replace 6" dia. with 10" dia.	2,600 ft	$ 402,000	Improves fire flow capacity on 7100 W. and provides and opportunity for future extension of a larger dia. waterline to the south
			Sum =	**$ 2,661,000**	

TABLE 5-2
DISTRIBUTION SYSTEM IMPROVEMENTS
FOR GROWTH

Project No.	Approximate Location	Description	Length	Cost Estimate
GR-1200N	1200 N. from 5200 W. to 5500 W.	New 8" dia. waterline	1,900	$268,000
GR-1400N	1400 N. from 5900 W. to 6700 W.	New 8" dia. waterline	5,300	$727,000
GR-1900N	1900 N. from 5900 W. to 5500 W., then north to 2050 N.	New 8" dia. waterline	3,600	$514,000
GR-2300N	2300 N. from 5900 W. to 6700 W.	New 8" dia. waterline	5,300	$760,000
GR-500S	500 S. from 7500 W. to 7900 W.	New 8" dia. waterline	3,800	$534,000
GR-5500W	5500 W. from 950 N. to 1400 N.	New 8" dia. waterline	2,900	$405,000
GR-600N	600 N. from 5500 W. to 5900 W.	New 10" dia. waterline	2,700	$413,000
GR-6200W	6200 W. from 2050 N. to 2300 N.	New 8" dia. waterline	1,800	$250,000
GR-6400W	6400 W. from 100 N. to 700 N.	New 8" dia. waterline	3,300	$490,000
GR-7100W	7100 W. from 500 S. to 2100 S., then west to 7500 W.	New 10"dia. waterline	7,900	$1,256,000
GR-5900W	5900 W. from 2050 N. to 2700 N.	New 8" dia. waterline	4,300	$803,000
GR-700N	700 North from 6700 W. to 8300 W.	New 10" dia. waterline	10,600	$1,796,000
GR-7500W	7500 W. from 700 S. to 700 N.	New 8" dia. waterline	6,600	$906,000
GR-8300W	8300 W. from 900 S. to 700 N.	New 8" dia. waterline	7,900	$1,062,000
			Sum =	**$10,184,000**

SECTION 6

WATER SYSTEM CAPITAL FACILITIES PLAN
AND IMPACT FEE ANALYSIS

CAPITAL FACILITIES PLAN

This study recommends a water system capital facilities based on 20-year projections for water source and storage facilities, and on 50-year projections for distribution system improvements. At approximately 3% annual growth for the next 10 years and 2% annual growth for subsequent years, the District will reach a service base of 820 ERCs in 20 years (Year 2045) and 1,480 ERCs in 50 Years (Year 2075). Water demands have been determined for the present system, and the water demands for the future have been projected using current water use patterns (See Section 2). The capability for the water system to meet these demands was evaluated with respect to water sources, storage, and distribution (See Sections 3, 4 and 5). Water system improvements have been identified to provide storage, improve the fire flow capacity, and meet the needs of growth.

Key Issues

The most important issues that need to be considered for the future water system are related to future WBWCD contracts, peak flows, storage, and distribution system improvements required to improve fire flow. While analyzing the capacity of the existing water system and projecting demands for the future water system, the following key issues were identified:

- The existing distribution system is not capable of delivering required fire flows to some areas of the District. Fire flow capacity can be increased by replacing undersized waterlines and expanding the distribution system with looped waterlines.

- The existing WBWCD contract for 545 acre-feet per year is adequate for existing demands, but additional source capacity will be necessary. Annual water demands will increase as connections are added to the system. Source capacity should be increased with on-going growth.

- Storage for the system will be provided by a 1 MG storage reservoir which is currently under construction. This reservoir is being constructed by development. An impact fee for storage is not under consideration.

Water Sources

It is anticipated that all existing and future water demands will be met through water purchase contracts or source capacity purchases through WBWCD. At the current time, no new capital improvements are planned to provide additional water source capacity except as the water supply requirements are related to the distribution system.

WBWCD currently offers an option for purchasing additional source water with an impact fee that is paid for each connection. The impact fee that is collected by the District and passed through to WBWCD is expected to continue. The impact fee for WBWCD is collected for each new water connection added to the District's water system. At the current time, WBWCD charges an impact fee of $10,082 for 0.45 acre-feet of annual water source capacity, which is the annual indoor demand requirement for a residential connection per Utah Division of Drinking Water standards. Once the source capacity is purchased by impact fee, WBWCD charges for only annual operation and maintenance costs for delivering the water to the District.

Storage Facilities

A development is currently constructing a 1 MG storage reservoir which will be transferred to the District ownership. This reservoir should meet anticipated storage requirements for 20 to 30 years. No new capital facilities for storage are currently planned.

Distribution System Improvements

The District recently replaced the existing 6" and 8" waterline on 900 South Street with a 12-inch waterline, which is sized for future demands and system expansion. The total cost for this project was $2.1 million. The District has obtained funding through a 30-year no interest loan from the Drinking Water Board for approximately $1.8 million. The balance remaining on the loan is $1.4 million. Approximately $700,000 has been paid by the current service base of 500 ERCs. The District's payment of $700,000 is eligible for proportional recoupment through impact fees. The impact fees collected from the recoupment can be used for partial repayment of the loan. This provides a fair distribution of costs for these improvements. To determine an recoupment impact fee that will bring a new connection on par with the existing service base, the amount paid for the $700,000 paid to date will be divided by the existing 500 ERC service base.

Distribution system improvements required to increase fire flow capacity are listed in Table 5-1. The total cost of these improvements is estimated at **$2,661,000**. Distribution system improvements necessary to provide required fire flow will benefit both existing residents and future development and both should share proportionately in costs. The total service base for these improvements is the total **1,480 ERCs** projected for the 50-year planning period (Year 2075). Some additional funding for these improvements will also need to be provided through monthly user fees or other funding sources. Clearly, it is not financially feasible for the District to undertake all of these projects in the near future. It is recommended that the District undertake a long term capital improvements program to make improvements, and that water rates be adjusted to provide a revenue source for funding these improvements.

Improvements to expand the distribution system for growth are listed in Table 5-2. The projects listed represent future line sizes for anticipated growth of the system with future road extensions. It is anticipated that development will construct most of these improvements when they are necessary for the associated development. The District may participate in the costs for extending pipelines beyond development boundaries when these extensions are needed to loop to existing waterlines. The District may also participate in costs to upsize development waterlines for future demands. The specific waterlines where District participation is needed will depend upon development patterns that cannot yet be predicted. However, we anticipate that District could provide about 10% to 15% of the growth related improvements. This will require total capital costs of about $1,100,000 over the next 20 years. The service base for these projects is conservatively allocated to **820 ERCs,** which is the total projected service base after 20 years.. Existing ERCs are included in the allocated service base because these improvements will loop waterlines and provide the benefit of redundancy and higher fire flow to the existing water system services.

Future Capital Facilities Plan Updates

It is anticipated that growth will require updates of the water system master plan approximately every 5 to 7 years. Impact fees can be charged for planning studies. It is anticipated that updating the Capital Facilities Plan will cost approximately $20,000 for each update. Assuming at least two updates over the next 20 years, this represents a cost of **$40,000** that should be shared by the projected growth of **320 ERCs** over the 20-year planning period.

IMPACT FEE ANALYSIS

The purposes of the Impact Fee Analysis are to identify capital facilities that are to be financed in part by impact fees and to calculate an appropriate impact fee amount. Impact fees are a one-time charge on new development for the purpose of funding new or expanded public facilities necessitated by that development. In 1995, the Utah State Legislature passed the Impact Fee Act, which regulates how impact fees can be calculated, implemented, and challenged. The Impact Fee Act has been amended several times since 1995, and impact fees are currently regulated under Utah Code, Title 11, Chapter 36a. Discussions in this document relating to impact fees are intended to provide the basis for planning and justification as required by the most current version of the Impact Fees Act.

The information used for the impact fees analysis represents the District's best effort at this point in time to project the need for new facilities. However, facilities planning is not a one time event, but rather an ongoing process. Projected capital facilities may change in the future due to changing growth patterns, new regulatory requirements, or unanticipated needs. As the District prepares further planning, the impact fee analysis should be reviewed and updated accordingly.

New development will use capacity that has been constructed in existing water system facilities and will require the District to construct new capital facilities. Impacts of growth on specific water system facilities are described in previous sections of this report. A water system impact fee will be charged to all new water system connections to equitably distribute the costs of facilities between existing residents and future growth. Water system impacts will be measured in equivalent residential connections (ERCs). An ERC for the water system is defined as the demand from a typical residential connection which is 570 gallons per day or 208,000 gals (0.64 ac-ft) per year. The impact fee is calculated by proportionate share analysis for future capital improvements. The proportionate share analysis accomplished by dividing the total cost of the projected capital improvements by the appropriate service base. Results are presented in Table 6-2.

TABLE 6-2
IMPACT FEE CALCULATION

Description	Capital Cost ($)	Service Base (ERCs)	Cost per ERC ($/ERC)
Recoupment for 900 South Waterline	$700,000	500	$1,400
Improvements for Growth	$1,100,000	820	$1,341
Improvements for Fire Flow	$2,661,000	1,480	$1,798
Future Planning Studies	$40,000	320	$125
		Total =	**$4,664**

IMPACT FEE FOR WBWCD SOURCE CAPACITY

WBWCD has established a program where their wholesale customers can purchase source capacity through an impact fee. If the District chooses to continue to participate in this program, an impact fee of $10,082 per ERC can be collected by the District and then paid to WBWCD. This impact fee is in addition to the impact fee amount calculated in Table 6-2. Impact fee calculations and implementation details should be obtained from WBWCD as justification for the fee and compliance with the Impact Fee Act. The ERC calculation for this impact fee should be based on an annual demand of 0.45 ac-ft, rather than the annual demand factors calculated in this study.

ASSESSING IMPACT FEES TO NEW DEVELOPMENT

A $4,664 per ERC impact fee was calculated with the proportionate share analysis. This represents the maximum impact fee that can be charged to new development. Each single-family residence is defined as 1 ERC. The number of ERCs representing the impact for multi-family development and non-residential development will be calculated by dividing the development's projected average water demand in gallons per year by 208,000 gallons per year, which is the calculated average yearly demand for a typical residential connection. Projected water demands for non-residential developments will be evaluated by the District based upon historical demands from similar developments or on design standards published by the State of Utah. The formula for calculating the impact of non-residential development and multi-unit residential development is given as follows:

No. of ERCs = (Projected Annual Demand)/(208,000 gal/year)

Where:
- Projected Annual Demand = The total projected culinary water demand in (gal/year) for the development.
- 208,000 gal/year represents the average annual demand for an equivalent residential connection.

Assuming a $4,664 impact fee is adopted by the District, the formula for calculating the impact fee for non-residential and multi-unit residential connections is given below.

Impact Fee = ($4,664/ERC) * (No. of ERCs)

CAPITAL FACILITIES REPLACEMENT FUND

Many capital facilities improvements cannot be financed by impact fees because they are not reasonably related growth. Capital facilities improvements that are not eligible, or only partially eligible, for impact fee funding include correction of existing of deficiencies and replacement of aging facilities. A capital facilities replacement fund is recommended to provide the District with a comprehensive funding plan.

A capital facilities replacement fund is essential for a water utility because it ensures long-term financial stability and reliable service delivery. Water infrastructure—such as , pipelines, pumps, and storage tanks—has a limited useful life and requires significant investment to replace when it deteriorates. By establishing a dedicated replacement fund, the District can:

- Fund projects that are not eligible, or only partially eligible, for funding through impact fees.

- Plan for future capital needs instead of reacting to emergencies or system failures.
- Avoid rate shocks by spreading the cost of replacements over time, ensuring more predictable and equitable rate structures for customers.
- Protect system reliability and public health by maintaining infrastructure in good condition and preventing service interruptions.

The recommended level of funding for a capital improvements replacement fund is 1% to 1.5% of the value of the water system. This is based on an average projected useful lifespan of 50 to 100 years for capital facilities. An approximate estimate of the current value of the District's facilities is given in Table 6-3. With a total replacement value of approximately $20 million, the recommended level of funding for a capital facilities replacement fund is $200,000 to $300,000 per year. This amount is in addition to the typical water system maintenance budget.

TABLE 6-3
VALUE OF EXISTING WATER SYSTEM FACILITIES

Description	Quantity	Price	Amount
WATER SOURCES			
Meter Stations	3 Each	$230,000	$690,000.00
STORAGE			
1 MG Reservoir and Pump Sta.	1 Each	$2,100,000	$2,100,000
DISTRIBUTION SYSTEM			
8" Dia. (and smaller) Pipe	89,000 Ft	$140	$12,460,000
10" Dia. Pipe	10,000 Ft	$150	$1,500,000
12" Dia. Pipe	17,000 Ft.	$180	$3,060,000
MAINTENANCE FACILITIES			
Building	1 Each	$400,000	$400,000
		Total	**$20,210,000**

CONNECTION FEES

The District should charge connection fees for the purpose of recovering the cost (for materials and labor) of connecting a customer to the nearest waterline and setting up a billing account with the District. Connection fees are independent of impact fees. The following categories of connection fees are recommended for the District:

- Connection without an existing water service lateral
- Connection with an existing water service lateral

New Connections Without an Existing Service Lateral

Connection of a new service without a service lateral requires the District to excavate to the water main, tap the main, construct a water service line, restore the asphalt roadway, and construct a meter box with fittings and a meter. A billing account also needs to be established by the District's secretary. A summary of the estimated costs are given in Table 6-4.

TABLE 6-4
CONNECTION COSTS FOR NEW SERVICE
WITHOUT EXISTING SERVICE LATERAL

Description	Quantity	Price	Amount
Backhoe w/ Operator	4 Hrs.	$150	$600
Truck w/ Operator	2 Hrs.	$100	$200
Import Backfill	10 Tons	$30	$300
Asphalt Patch	15 S.Y.	$60	$900
Labor	8 Hrs.	$80	$640
Pipe, Fittings, Meter, etc.	1 L.S.	$1,560	$1,560
		Construction - Subtotal	$4,200
		Administration - Account Setup	$100
		Total	**$4,300**

New Connections With an Existing Service Lateral

It is anticipated that developers will be required to construct the water services lateral with meter box for lots in a new subdivision. The District will inspect the construction and install the meter. A billing account also needs to be established by the District's secretary. A summary of the estimated costs are given in Table 6-5.

TABLE 6-5
CONNECTION COSTS FOR NEW SERVICE
WITH EXISTING SERVICES LATERAL

Description	Quantity	Price	Amount
Inspection and Labor	3 Hrs.	$75	$225
Meter	1 L.S.	$275	$275
		Construction - Subtotal	$500
		Administration - Account Setup	$100
		Total	**$600**

SUMMARY OF CONCLUSIONS

1. The District currently serves approximately 500 ERCs. With a 3% annual growth rate for the next 10 years and a 2% annual growth rate in subsequent years, demand is expected to grow to 820 ERCs in about 20 years.

2. Water demand for the current conditions (500 ERCs) is 320 acre-feet per year, 770,000 gallons per day on a peak day, and 950 gpm for peak instantaneous conditions.

3. In the next 20 years, water demand is expected to increase to a total 820 ERCs, which represents 520 acre-feet per year, 1,260,000 gallons per day on a peak day, and 1,560 gpm on the peak hour of the peak day. Water demand will exceed the current 500 acre-feet per year contract with WBWCD in 15 to 20 years. Additional water source capacity should be purchased as needed from WBWCD. The recommended purchase option is the source capacity impact fee with 0.45 ac-ft provided for each ERC.

4. The District should continue to monitor storage needs. The 1 MG reservoir that is under construction should provide sufficient storage volume for 20 to 30 years. As

the water system is expanded, there may be benefits to providing storage in other locations to improve redundancy and system performance in emergencies.

5. The existing distribution system is unable to provide required fire flows in many areas of the District due to inadequate pipe sizes. Pipeline improvements necessary to increase fire flow capacity to minimum required flow rates are identified in Table 5-1.

6. When waterlines are extended by development, the waterlines should be looped whenever possible. Looped waterlines provide redundancy and improve fire flow capacity.

SUMMARY OF RECOMMENDATIONS

1. Formally adopt the capital facilities plan and impact fee study.

2. Maintain existing source capacity from WBWCD. Consider long-term needs when entering into annual purchase contracts and source capacity purchases.

3. Implement a long-term capital facilities financing plan that will provide funding for construction of the water system improvements necessary to increase fire flow capacity and replace aging infrastucture. The goal for funding a capital improvements replacement should be $220,000 to $330,000 per year.

4. Adopt construction connection fees that will cover the District's direct costs for new connections.

5. Adjust water rates and fees on an annual basis to meet the revenue requirements of the water utility. Revenue should be adequate to meet operation and maintenance expenses, capital improvements, and debt service.

6. Continue to update the water distribution system model to reflect new construction and additional demand within the District.

<u>**REFERENCES**</u>

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Wasatch Civil Consulting Engineering, 2007. Capital Facilities Plan and Impact Fee Analysis.

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APPENDIX A

WATER DEMAND AND STORAGE REQUIREMENTS

WATER DEMAND AND STORAGE REQUIREMENTS

Water demand and storage requirements as imposed by State of Utah in Rules Governing Public Drinking Water Systems (R309) are calculated based upon the number of equivalent residential connections (ERCs) and the irrigated acreage. The District currently serves 380 ERCs. Irrigated acreage must be estimated based upon the water use pattern.

IRRIGATED ACREAGE

Total Water Use - Use metered amounts for 2024.

Annual Water Use = 307.76 acre-feet

Total ERCs = 504 (2024 estimate)

Annual Water Use = (307.76 ac-ft) / (504 ERCs) = 0.61 ac-ft per ERC

Indoor Water Use - Assume 80 gallons per capita day and 3.5 person per home

Indoor Use = (3.5 persons per ERC) * (80 gal/person/day) = 280 gal/day/ERC

Indoor Use = (280 gal/day/ERC)*(365 days/yr) = 102,200 gal/yr/ERC

Indoor Use = 0.314 ac-ft/yr

Outdoor Water Use - Difference between total use and indoor use

Outdoor Use = (0.61 ac-ft/ERC) - (0.31 ac-ft/yr) = 0.30 ac-ft/yr

Irrigated Acreage - Assume demand of 3.0 acre-feet per acre

Irrigated Acreage = (0.30 ac-ft/ERC) / (3.0 ac-ft/acre) = 0.10 acres/ERC
= 4,356 q. ft. per ERC

Randy Giordano estimates 70% of all residences have a secondary water source. With 30% of the lots using culinary water for irrigation, the average irrigated acreage per lot would be 0.33 acres, which appears reasonable for the large lots that are typical within the District’s service area.

EQUALIZATION STORAGE REQUIREMENT PER ERC

1) Indoor Demand - The storage volume requirement is 400 gallons/ ERC

2) Outdoor Demand:

Average Irrigated Area (with culinary water) = 0.10 acres/ERC

For moderately high irrigation demand the storage volume requirement is 2,848 gal of storage per irrigated acre.

Required Volume = (0.10 ac/ERC) (2,848 gal/ac) = 285 gallons/ERC

3) Total Storage Requirement = 400 + 285 = 685 gallons per ERC

FIRE FLOW STORAGE REQUIREMENT

The general fire flow requirements as established by the International Fire Code, are 1,000 gpm for one- or two-family dwellings less than 3,600 ft2, and at 1,500 gpm or greater for all other structures. The highest known fire flow requirement is estimated at 2,000 gpm for 2 hours at the LDS Church on 5900 West. Proposed developments will almost certainly increase the required demand. However, fire flow requirements have not been evaluated for all structures within the City. We are conservatively assuming a potential fire flow demand of 2,750 gpm for 2 hours.

Required Fire Flow Storage Volume = (2,750 gpm) (2 x 60 minutes) = 330,000 gal

EMERGENCY STORAGE REQUIREMENTS

We recommend 10% to 20% of the total storage volume be reserved for emergency conditions. With a conservatively high fire flow demand and a limited number of buildings that have demands higher than a 1,000 gpm, the fire flow storage amount appears to cover emergency storage requirements.

WATER DEMAND

The Utah Division of Drinking water recommends that water demands to be determined using metered data when it is available and by the parameters given in *Rules Governing Public Drinking Water Systems* when metered data is not available.

WATER USE - METERED AMOUNTS

Month	Water Use (acre-feet)				
	2020	2021	2022	2023	2024
January	16.93	18.61	16.66	18.02	14.06
February	14.80	15.40	18.49	16.35	11.16
March	16.61	19.59	15.40	16.71	13.01
April	23.22	22.74	12.48	18.76	12.97
May	37.29	35.74	29.40	33.09	24.78
June	46.74	56.29	36.13	38.89	43.98
July	54.55	45.23	45.09	58.45	59.88
August	54.81	21.76	47.19	46.00	40.89
September	37.64	36.36	32.37	31.92	40.82
October	28.13	26.35	23.61	17.10	24.00
November	20.20	19.18	11.51	12.54	10.85
December	18.13	17.95	20.28	13.31	11.36
Total	369.05	335.20	308.61	321.14	307.76

Reference: Utah Division of Water Rights on-line water use records.

Average Day Demand

Average day demand per connection was estimated from metered water use records (master meters) for the year 2024. Metered yearly water use of 308 acre-feet by approximately 500 ERCs equates to an average demand of **0.4 gpm per ERC**.

Peak Day Demand

Peak day demand was estimated from the metered monthly water use data (master meters). Metered water records from WBWCD indicate that highest daily water use in 2024 was 770,000 gallons. This equates to a peak demand of **1.1 gpm per ERC**.

Peak Instantaneous Demand

No hourly metering records are available. Therefore, use State Standards to estimate peak instantaneous demand.

Indoor Demand

State Standard - Use Equation: $Q = 10.8 * (\text{No. ERCs})^{0.64}$

$Q = 10.8 * (500)^{0.64} = 576$ gpm

Indoor Demand = (576 gpm) / (500 ERCs) = 1.15 gpm/ERC

Outdoor Demand

State Standard: Demand is 7.92 gpm/irrigated acre for this location.

Outdoor Demand = (0.1 acres/ERC) * (7.92 gpm/ERC) = 0.79 gpm/ERC

Total Peak Instantaneous Demand = 1.15 + 0.79 = **1.9 gpm/ERC**

APPENDIX B

WATER DISTRIBUTION SYSTEM MODELING AND RESULTS

COMPUTER MODEL ANALYSIS WITH WATERCAD

A computer model of the District's water system was created and analyzed using the current version of WaterCad by Bentley Systems. WaterCad is software for analyzing flow distribution in pipe networks. WaterCad allows the user to create a graphical and numerical representation of a pipe network and then analyze the pipe network for a variety of different conditions.

The computer model of the District's water system used in this study was created using available base mapping and water system information supplied by the District.

MODEL CALIBRATION

To accurately simulate the performance of the distribution system, the mathematical computer model must be calibrated to match the actual performance of the distribution system. The model was calibrated using fire flow test data from tests performed by District in April of 2007. A total of six fire flow test locations were selected throughout the District to provide a general calibration for the entire distribution system. The computer model was calibrated by adjusting pipe roughness values or making other corrections until the pressure changes predicted by the computer model matched pressure changes measured during the fire flow tests. In general, the model calibrated to within a reasonable percentage of measured values.

MODEL ELEMENTS AND INPUT DATA

The two basic elements of the computer model are pipes and nodes. A pipe is described by its inside diameter, overall length, minor friction loss factors, and a roughness value associated with friction head losses. A pipe can contain elbows, bends, valves, and other operational elements. Nodes are the end points of a pipe and they can be categorized as junction nodes or boundary nodes. A junction node is a point where two or more pipes meet, where a change in pipe diameter occurs, or where flow is put in or taken out of the system. A boundary node is a point where the hydraulic grade is known, usually a reservoir or pressure reducing valve.

The computer model of the water distribution system is not an exact replica of the actual water system. Pipeline locations used in the model are approximate and every pipeline may not included in the model. It is not necessary to include all of the distribution system pipes in the model to accurately simulate its performance. In general, water lines less than 6-inches in diameter and dead end water lines have little or no effect on the overall performance of the distribution system.

Pipe Network

As indicated previously the pipe network layout was based upon information and maps provided by Mr. Randy Giordano. Pipe roughness coefficients were initially assigned a roughness value based upon the pipe material type. These values were then adjusted during the calibration process. The Hazen-Williams roughness coefficients of the existing pipelines varied from 100 to 120 depending upon pipe type, size, and age. Future pipes were assigned a roughness coefficient of 130.

Water Demands

Water demands were input into the model as equivalent residential connections (ERCs) and the ERCs associated with each junction node were multiplied in the model by the appropriate factors to produce the desired data sets for average day demand, peak day demand, and peak instantaneous demand. Water demands were assigned to junction nodes based upon the locations of the service connections. Property line maps were used to allocate demands in residential areas. Each residential lot was assumed to equal 1 ERC. Each commercial and industrial connection was assigned a demand in ERCs based upon their water use as reported by the District.

Water Sources and Reservoirs

WBWCD connections were modeled as storage reservoirs set to an elevation equal to the hydraulic grade of the downstream pressure settings at the metering station pressure reducing valves. The model calculated the inflows from these connections based upon hydraulic pressures within the water distribution system.

RESULTS

The model output primarily consists of the computed flowrates at nodes and through pipes and the hydraulic pressure at junction nodes. The model also provides additional data related to pipeline flow velocity and head loss to help the modeler evaluate the performance of the various components of the distribution system. Results from several computer model runs are attached.

The output data are not a complete indication of system performance. Even though the computer is fast and accurate, it lacks the judgment of correct mistakes and it does not suggest improvements. The computer calculates an instantaneous flow rate from the supply facilities. There is not direct consideration whether this flow can be maintained or whether the storage has adequate capacity. Further analysis and judgement is needed to evaluate the computer results determine the system performance over time.

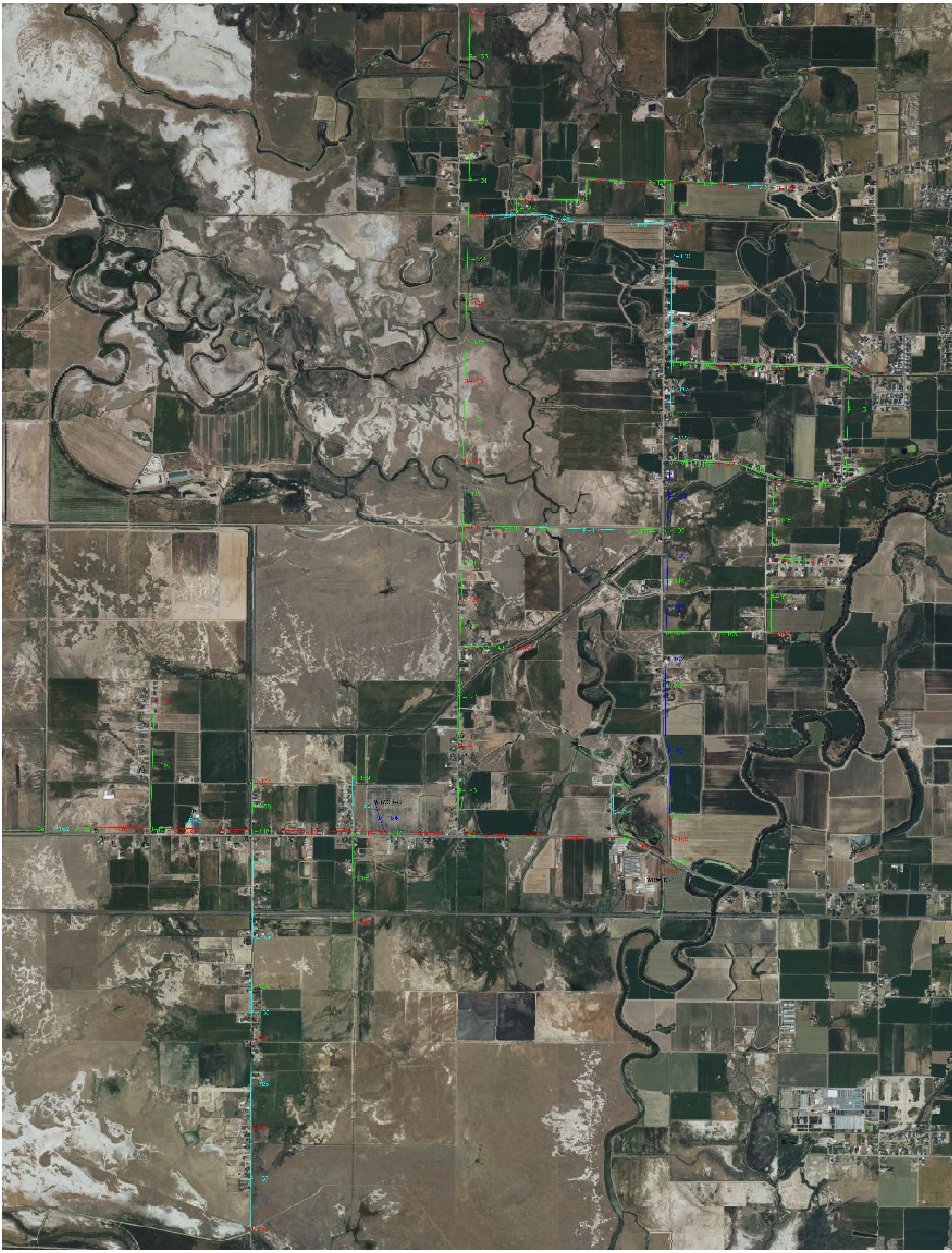
CONTINUED USE OF THE COMPUTER PROGRAM

The computer model can assist the District during future operations by determining:

- Effect on the system if individual facilities are added or taken out of service.
- Verification of pipe diameters and location of proposed water mains.
- Capacity of the system to provide fire flows.
- Compliance with State Requirements for Hydraulic Modeling Certification.

The computer model should be retained for future use. Necessary data required for continued use of the program are:

- The location , length, diameter, pipe material, and ground elevation at each end of each new pipeline constructed.
- Changes in supply location and characteristics.
- Location and normal rate of demand for large customers.
- Recognition of new or developing service areas



P-133
P-131
P-128
P-120
P-134
P-135
P-117
P-118
P-113
P-105
P-109
P-110
P-103
P-102
P-101
P-100
P-144
P-145
P-160
P-164
P-166
P-149
P-151
P-155
P-156
P-157
WBWCD-2
WBWCD-1

Scenario: Base Adjusted Fire Flow
Current Time Step: 0.000 h
FlexTable: Junction Table

ID	Label	Elevation (ft)	Demand (gpm)	Hydraulic Grade (ft)	Pressure (psi)	X (ft)	Y (ft)	Fire Flow Status
92	J-129	4,214.00	4	4,388.02	75	1,326,788.26	15,001,768.40	Residual Pressure and Zone Pressure Failed
93	J-128	4,214.00	9	4,388.08	75	1,326,754.01	14,999,970.50	Residual Pressure and Zone Pressure Failed
116	J-105	4,220.00	6	4,388.54	73	1,334,562.12	14,991,117.90	Residual Pressure and Zone Pressure Failed
82	J-139	4,218.00	9	4,390.00	74	1,326,531.41	14,988,840.50	Zone Pressure Failed
100	J-121	4,215.00	3	4,388.05	75	1,333,209.40	15,000,741.00	Zone Pressure Failed
101	J-120	4,214.00	5	4,388.05	75	1,331,942.29	15,000,826.60	Zone Pressure Failed
60	J-161	4,220.00	25	4,388.44	73	1,335,567.32	14,991,093.30	Residual Pressure Failed
65	J-156	4,218.00	23	4,392.56	76	1,318,662.55	14,987,496.70	Residual Pressure Failed
67	J-154	4,220.00	4	4,392.93	75	1,321,223.26	14,985,415.90	Residual Pressure Failed
68	J-153	4,212.00	8	4,392.65	78	1,321,137.65	14,973,909.20	Residual Pressure Failed
69	J-152	4,216.00	13	4,392.65	76	1,321,137.65	14,976,494.80	Residual Pressure Failed
70	J-151	4,219.00	8	4,392.70	75	1,321,154.77	14,978,789.30	Residual Pressure Failed
74	J-147	4,220.00	5	4,392.94	75	1,323,791.72	14,981,785.80	Residual Pressure Failed
80	J-141	4,225.00	18	4,391.09	72	1,326,514.29	14,986,323.40	Residual Pressure Failed
81	J-140	4,220.00	6	4,389.98	74	1,327,884.13	14,988,857.60	Residual Pressure Failed
83	J-138	4,215.00	5	4,389.76	76	1,326,565.66	14,990,090.50	Residual Pressure Failed
86	J-135	4,217.00	1	4,389.51	75	1,326,599.90	14,991,956.90	Residual Pressure Failed
87	J-134	4,214.00	0	4,389.20	76	1,326,617.03	14,993,669.20	Residual Pressure Failed
88	J-133	4,210.00	0	4,388.84	77	1,326,668.40	14,995,706.80	Residual Pressure Failed
89	J-132	4,210.00	0	4,388.48	77	1,326,702.64	14,997,727.40	Residual Pressure Failed
90	J-131	4,212.00	1	4,388.00	76	1,326,771.13	15,005,141.60	Residual Pressure Failed
91	J-130	4,214.00	6	4,388.00	75	1,326,788.26	15,002,984.10	Residual Pressure Failed
94	J-127	4,216.00	5	4,388.09	74	1,329,767.67	14,999,747.90	Residual Pressure Failed
95	J-126	4,215.00	4	4,388.08	75	1,327,986.87	14,999,953.40	Residual Pressure Failed
96	J-125	4,215.00	6	4,388.07	75	1,327,986.87	15,000,364.30	Residual Pressure Failed
97	J-124	4,215.00	8	4,388.04	75	1,329,784.79	15,000,860.90	Residual Pressure Failed
98	J-123	4,214.00	4	4,388.05	75	1,330,846.42	15,000,809.50	Residual Pressure Failed
99	J-122	4,216.00	1	4,388.05	74	1,334,699.11	15,000,672.50	Residual Pressure Failed
102	J-119	4,218.00	8	4,388.11	74	1,331,993.66	14,999,713.60	Residual Pressure Failed
103	J-118	4,220.00	20	4,388.18	73	1,331,976.54	14,998,138.30	Residual Pressure Failed
106	J-115	4,218.00	6	4,388.31	74	1,333,123.79	14,996,117.80	Residual Pressure Failed
107	J-114	4,218.00	9	4,388.26	74	1,334,579.24	14,996,049.30	Residual Pressure Failed
108	J-113	4,221.00	1	4,388.25	72	1,336,565.52	14,996,015.10	Residual Pressure Failed
109	J-112	4,221.00	18	4,388.25	72	1,336,490.65	14,993,942.20	Residual Pressure Failed
110	J-111	4,221.00	8	4,388.31	72	1,336,462.78	14,992,932.90	Residual Pressure Failed
114	J-107	4,224.00	4	4,388.82	71	1,333,158.03	14,993,566.50	Residual Pressure Failed
115	J-106	4,218.00	11	4,388.53	74	1,334,613.49	14,993,155.50	Residual Pressure Failed
117	J-104	4,218.00	14	4,389.05	74	1,334,545.00	14,989,183.00	Residual Pressure Failed
61	J-160	4,220.00	8	4,392.96	75	1,330,494.24	14,985,321.60	Passed
62	J-159	4,222.00	23	4,392.93	74	1,323,765.97	14,985,504.30	Passed
63	J-158	4,216.00	3	4,392.93	77	1,315,384.30	14,984,200.20	Passed
64	J-157	4,216.00	8	4,392.93	77	1,316,634.29	14,984,200.20	Passed
66	J-155	4,219.00	14	4,392.93	75	1,318,569.19	14,984,183.00	Passed
71	J-150	4,221.00	4	4,392.76	74	1,321,171.90	14,980,161.50	Passed
72	J-149	4,221.00	9	4,392.85	74	1,321,206.14	14,982,607.70	Passed
73	J-148	4,222.00	19	4,392.93	74	1,321,171.90	14,984,131.70	Passed
75	J-146	4,221.00	22	4,392.96	74	1,323,757.48	14,984,080.30	Passed
76	J-145	4,220.00	9	4,392.99	75	1,324,596.51	14,984,080.30	Passed
77	J-144	4,220.00	20	4,392.97	75	1,330,463.92	14,983,934.60	Passed
78	J-143	4,216.00	4	4,392.96	77	1,327,952.62	14,983,994.70	Passed
79	J-142	4,216.00	11	4,392.96	77	1,326,480.04	14,984,046.10	Passed
84	J-137	4,215.00	1	4,389.53	76	1,330,863.54	14,991,837.00	Passed
85	J-136	4,214.00	3	4,389.52	76	1,328,569.05	14,991,905.50	Passed
104	J-117	4,222.00	9	4,388.72	72	1,331,942.29	14,994,867.80	Passed
105	J-116	4,219.00	17	4,388.39	73	1,331,976.54	14,996,152.00	Passed
111	J-110	4,218.00	3	4,389.93	74	1,331,873.80	14,990,569.90	Passed
112	J-109	4,218.00	5	4,389.55	74	1,331,856.68	14,991,871.30	Passed
113	J-108	4,224.00	29	4,389.10	71	1,331,942.29	14,993,617.80	Passed
118	J-103	4,217.00	0	4,390.34	75	1,331,839.56	14,989,234.30	Passed
119	J-102	4,216.00	10	4,390.98	76	1,331,822.43	14,987,898.70	Passed
120	J-101	4,221.00	1	4,392.73	74	1,331,925.17	14,984,525.50	Passed
121	J-100	4,222.00	38	4,392.98	74	1,331,942.29	14,983,344.00	Passed
213	J-2	4,220.04	0	4,392.94	75	1,319,473.04	14,984,165.47	Passed

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Scenario: Base Adjusted Fire Flow
Current Time Step: 0.000 h
FlexTable: Pipe Table

ID	Label	Length (Scaled) (ft)	Start Node	Stop Node	Diameter (in)	Hazen-Williams C	Flow (gpm)	Velocity (ft/s)	Pressure (Start) (psi)	Velocity (Maximum) (ft/s)
193	P-1	2,296	J-136	J-137	8.0	130.0	-8	0.05	76	0.05
216	P-2	534	R-1	J-2	8.0	130.0	66	0.42	0	0.42
164	P-100	1,182	J-100	J-101	12.0	120.0	244	0.69	74	0.69
163	P-101	3,386	J-101	J-102	10.0	120.0	242	0.99	74	0.99
162	P-102	1,336	J-102	J-103	10.0	120.0	232	0.95	76	0.95
161	P-103	2,706	J-103	J-104	6.0	100.0	50	0.57	75	0.57
160	P-104	1,935	J-104	J-105	6.0	100.0	36	0.41	74	0.41
159	P-105	2,038	J-105	J-106	6.0	100.0	5	0.05	73	0.05
158	P-106	1,533	J-106	J-107	6.0	100.0	-31	0.35	74	0.35
157	P-107	1,217	J-107	J-108	6.0	100.0	-34	0.39	71	0.39
156	P-108	1,749	J-108	J-109	10.0	120.0	-165	0.67	71	0.67
155	P-109	1,302	J-109	J-110	10.0	120.0	-179	0.73	74	0.73
154	P-110	1,336	J-110	J-103	10.0	120.0	-182	0.74	74	0.74
153	P-111	1,863	J-106	J-111	6.0	100.0	24	0.27	74	0.27
152	P-112	1,010	J-111	J-112	6.0	100.0	16	0.18	72	0.18
151	P-113	2,074	J-112	J-113	6.0	100.0	-2	0.02	72	0.02
150	P-114	1,987	J-113	J-114	6.0	100.0	-3	0.03	72	0.03
149	P-115	1,457	J-114	J-115	6.0	100.0	-12	0.14	74	0.14
148	P-116	1,148	J-115	J-116	6.0	100.0	-18	0.21	74	0.21
147	P-117	1,285	J-116	J-117	8.0	120.0	-92	0.59	73	0.59
146	P-118	1,250	J-117	J-108	8.0	120.0	-101	0.65	72	0.65
145	P-119	1,986	J-116	J-118	8.0	120.0	57	0.37	73	0.37
144	P-120	1,575	J-118	J-119	8.0	120.0	37	0.24	73	0.24
143	P-121	1,114	J-119	J-120	6.0	100.0	14	0.16	74	0.16
142	P-122	1,270	J-120	J-121	6.0	100.0	4	0.04	75	0.04
141	P-123	1,491	J-121	J-122	8.0	120.0	1	0.01	75	0.01
140	P-124	1,096	J-120	J-123	6.0	100.0	6	0.06	75	0.06
139	P-125	1,063	J-123	J-124	6.0	100.0	2	0.02	75	0.02
138	P-126	2,329	J-124	J-125	6.0	100.0	-6	0.07	75	0.07
137	P-127	411	J-125	J-126	6.0	100.0	-12	0.14	75	0.14
136	P-128	1,811	J-126	J-127	8.0	120.0	-10	0.06	75	0.06
135	P-129	2,226	J-127	J-119	8.0	120.0	-15	0.10	74	0.10
134	P-130	1,233	J-126	J-128	8.0	120.0	-6	0.04	75	0.04
133	P-131	1,798	J-128	J-129	6.0	90.0	11	0.13	75	0.13
132	P-132	1,216	J-129	J-130	6.0	100.0	8	0.09	75	0.09
131	P-133	2,158	J-130	J-131	6.0	90.0	1	0.01	75	0.01
130	P-134	2,244	J-128	J-132	6.0	90.0	-27	0.30	75	0.30
129	P-135	2,021	J-132	J-133	6.0	90.0	-27	0.30	77	0.30
128	P-136	2,038	J-133	J-134	6.0	90.0	-27	0.30	77	0.30
127	P-137	1,712	J-134	J-135	6.0	90.0	-27	0.30	76	0.30
126	P-138	1,970	J-135	J-136	6.0	100.0	-5	0.06	75	0.06
125	P-140	994	J-137	J-109	6.0	100.0	-9	0.10	76	0.10
124	P-141	1,867	J-135	J-138	6.0	90.0	-23	0.26	75	0.26
190	P-142	1,250	J-138	J-139	6.0	90.0	-28	0.32	76	0.32
189	P-143	1,353	J-139	J-140	6.0	100.0	6	0.07	74	0.07
188	P-144	2,517	J-139	J-141	6.0	90.0	-43	0.49	74	0.49
187	P-145	2,278	J-141	J-142	6.0	90.0	-61	0.69	72	0.69
186	P-146	1,473	J-142	J-143	12.0	120.0	-14	0.04	77	0.04
185	P-147	2,512	J-143	J-144	12.0	120.0	-18	0.05	77	0.05
184	P-148	1,636	J-144	J-100	12.0	120.0	-46	0.13	75	0.13
183	P-149	1,884	J-142	J-145	12.0	120.0	-58	0.16	77	0.16
182	P-150	839	J-145	J-146	12.0	120.0	94	0.27	75	0.27
181	P-151	2,295	J-146	J-147	6.0	100.0	5	0.06	74	0.06
180	P-152	2,586	J-146	J-148	12.0	120.0	45	0.13	74	0.13
179	P-153	1,524	J-148	J-149	8.0	120.0	41	0.26	74	0.26
178	P-154	2,446	J-149	J-150	8.0	120.0	32	0.20	74	0.20
177	P-155	1,372	J-150	J-151	8.0	100.0	28	0.18	74	0.18
176	P-156	2,295	J-151	J-152	8.0	100.0	20	0.13	75	0.13
175	P-157	2,586	J-152	J-153	8.0	120.0	8	0.05	76	0.05
174	P-158	1,285	J-148	J-154	6.0	100.0	4	0.04	74	0.04
214	P-159(1)	1,699	J-148	J-2	12.0	120.0	-19	0.05	74	0.05
215	P-159(2)	904	J-2	J-155	12.0	120.0	47	0.13	75	0.13
172	P-160	3,315	J-155	J-156	6.0	100.0	23	0.26	75	0.26
171	P-161	1,935	J-155	J-157	12.0	120.0	10	0.03	75	0.03
170	P-162	1,250	J-157	J-158	8.0	120.0	3	0.02	77	0.02
169	P-163	743	WBWCD-1	J-100	12.0	120.0	328	0.93	0	0.93
168	P-164	850	WBWCD-2	J-145	10.0	120.0	161	0.66	0	0.66
167	P-165	1,424	J-146	J-159	8.0	120.0	23	0.15	74	0.15
166	P-166	1,387	J-144	J-160	8.0	120.0	8	0.05	75	0.05
165	P-167	1,006	J-105	J-161	6.0	120.0	25	0.29	73	0.29

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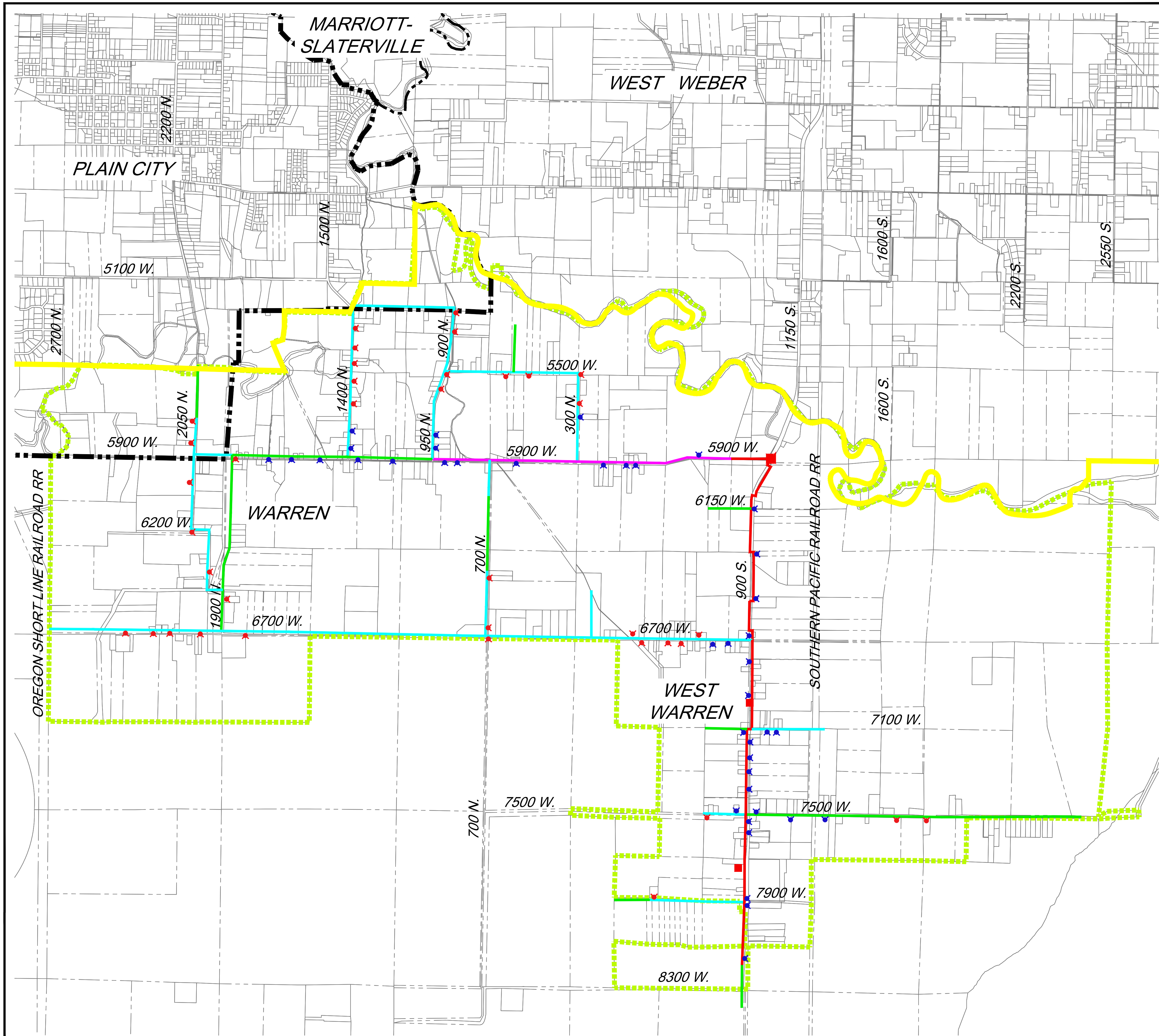

WEST WARREN
CAPITAL FACILITIES PLAN & IMPACT FEE UPDATE

FIRE FLOW CAPACITY

- HYDRANT WITH LESS THAN 1000 GPM
- HYDRANT WITH 1000 GPM OR HIGHER

N

SCALE: 1"=3000'

LEGEND

- STUDY AREA BOUNDARY
- CURRENT DISTRICT BOUNDARY
- MUNICIPALITY BOUNDARY
- 6" CULINARY WATERLINE
- 8" CULINARY WATERLINE
- 10" CULINARY WATERLINE
- 12" CULINARY WATERLINE
- FIRE HYDRANT
- METER STATION

EXISTING SYSTEM MODEL

FIGURE A-1

DESIGNED J.D.B.
DRAWN D.L.C
CHECKED J.D.B.
DATE SEPT. 05, 2025
SCALE: 1"=3000'

WASATCH CIVIL
CONSULTING ENGINEERING
1150 DEPOT DRIVE, SUITE 225, OGDEN, UT 84404
(801) 775-9191 WASATCHCIVIL.COM

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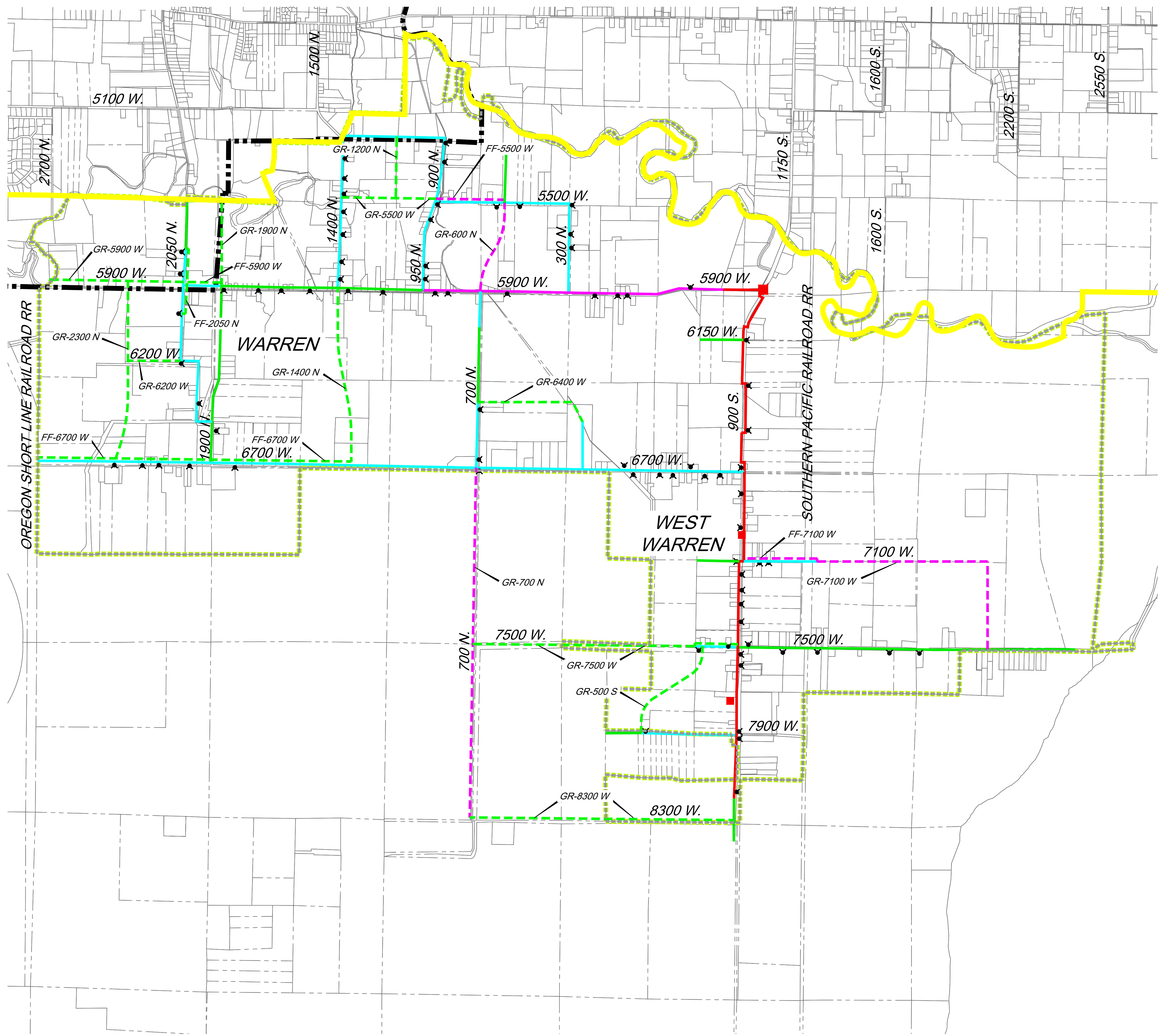

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WEST WARREN
CAPITAL FACILITIES PLAN & IMPACT FEE UPDATE

LEGEND

- CURRENT DISTRICT BOUNDARY
- MUNICIPALITY BOUNDARY
- 6" CULINARY WATERLINE
- 8" CULINARY WATERLINE
- 10" CULINARY WATERLINE
- 12" CULINARY WATERLINE
- FUTURE 8" CULINARY WATERLINE
- FUTURE 10" CULINARY WATERLINE
- FUTURE 12" CULINARY WATERLINE
- FIRE HYDRANT
- WEBER BASIN WATER CONSERVANCY DISTRICT CONNECTION & METER STATION

IMPROVEMENT NO. FF-7500W

LOCATION

IMPROVEMENT TYPE*

* FF - DENOTES CAPITAL IMPROVEMENTS RELATED TO FIRE FLOW REQUIREMENTS

GR - DENOTES CAPITAL IMPROVEMENTS RELATED TO GROWTH AND EXPANSION OF THE WATER DISTRIBUTION SYSTEM

FUTURE SYSTEM MODEL

FIGURE A-2

DESIGNED J.D.B.
DRAWN D.L.C
CHECKED J.D.B.
DATE SEPT. 05, 2025
SCALE: 1"=3000'

WASATCH CIVIL CONSULTING ENGINEERING
1150 DEPOT DRIVE, SUITE 225, OGDEN, UT 84404
(801) 775-9191 WASATCHCIVIL.COM

APPENDIX C

COST ESTIMATES

West Warren - Warren Improvement District
Fire Flow Improvement
Project No. FF-5500W
5500 W. from 700 N. to 950 N.
Conceptual Cost Estimate

Item	Description	Quantity	Units	Unit Price	Total
1	10" Dia. PVC Waterline	2040	LF	$ 115.00	$ 234,600.00
2	Pavement Repair	1360	SY	$ 50.00	$ 68,000.00
3	Fittings	4	EA	$ 1,500.00	$ 6,000.00
4	Connect Existing Hydrants	3	EA	$ 3,000.00	$ 9,000.00
				Subtotal	$ 317,600.00
				Design, Surveying & Contingency	$ 63,520.00
				Total Project Cost	**$ 381,120.00**

West Warren - Warren Improvement District
Fire Flow Improvement
Project No. FF-5900W
5900 W. from 1900 N. to 2050 N.
Conceptual Cost Estimate

Item	Description	Quantity	Units	Unit Price	Total
1	8" Dia. PVC Waterline	1110	LF	$ 100.00	$ 111,000.00
2	Pavement Repair	740	SY	$ 50.00	$ 37,000.00
3	Fittings	3	EA	$ 1,500.00	$ 4,500.00
4	Connect Existing Hydrants	2	EA	$ 3,000.00	$ 6,000.00
				Subtotal	$ 158,500.00
				Design, Surveying & Contingency	$ 31,700.00
				Total Project Cost	**$ 190,200.00**

Note: Construction cost estimates are based on conceptual level engineering. Sources used to estimate

West Warren - Warren Improvement District
Fire Flow Improvement
Project No. FF-2050N
2050 N. from 5750 W. to 6150 W.
Conceptual Cost Estimate

Item	Description	Quantity	Units	Unit Price	Total
1	8" Dia. PVC Waterline	2370	LF	$ 100.00	$ 237,000.00
2	Pavement Repair	1580	SY	$ 50.00	$ 79,000.00
3	Fittings	3	EA	$ 1,500.00	$ 4,500.00
4	Connect Existing Hydrants	2	EA	$ 3,000.00	$ 6,000.00
				Subtotal	$ 326,500.00
				Design, Surveying & Contingency	$ 65,300.00
				Total Project Cost	**$ 391,800.00**

West Warren - Warren Improvement District
Fire Flow Improvement
Project No. FF-6700W
6700 W. from 1350 N. to 2700 N.
Conceptual Cost Estimate

Item	Description	Quantity	Units	Unit Price	Total
1	8" Dia. PVC Waterline	9440	LF	$ 100.00	$ 944,000.00
2	Pavement Repair	2000	SY	$ 50.00	$ 100,000.00
3	Fittings	12	EA	$ 1,500.00	$ 18,000.00
4	Connect Existing Hydrants	6	EA	$ 3,000.00	$ 18,000.00
				Subtotal	$ 1,080,000.00
				Design, Surveying & Contingency	$ 216,000.00
				Total Project Cost	**$ 1,296,000.00**

Note: Construction cost estimates are based on conceptual level engineering. Sources used to estimate

West Warren - Warren Improvement District
Fire Flow Improvement
Project No. FF-900S
900 S. from 7000 W. to 7900 W.
Conceptual Cost Estimate

Item	Description	Quantity	Units	Unit Price	Total
1	12" Dia. PVC Waterline	3430	LF	$ 130.00	$ 445,900.00
2	10" Dia. PVC Waterline	2600	LF	$ 110.00	$ 286,000.00
3	Pavement Repair	4020	SY	$ 50.00	$ 201,000.00
4	Fittings	12	EA	$ 1,500.00	$ 18,000.00
5	Connect Existing Hydrants	8	EA	$ 3,000.00	$ 24,000.00
				Subtotal	$ 974,900.00
				Design, Surveying & Contingency	$ 194,980.00
				Total Project Cost	**$ 1,169,880.00**

Note: Construction cost estimates are based on conceptual level engineering. Sources used to estimate

West Warren - Warren Improvement District
Fire Flow Improvement
Project No. FF-7100W
7100 W. from 900 S. to 500 S.
Conceptual Cost Estimate

Item	Description	Quantity	Units	Unit Price	Total
1	10" Dia. PVC Waterline	2600	LF	$ 110.00	$ 286,000.00
2	Pavement Repair	800	SY	$ 50.00	$ 40,000.00
3	Fittings	2	EA	$ 1,500.00	$ 3,000.00
4	Connect Existing Hydrants	2	EA	$ 3,000.00	$ 6,000.00
				Subtotal	$ 335,000.00
				Design, Surveying & Contingency	$ 67,000.00
				Total Project Cost	**$ 402,000.00**

West Warren - Warren Improvement District
Improvement for Growth
Project No. GR-1200N
1200 N. from 5500 W. to 5900 W.
Conceptual Cost Estimate

Item	Description	Quantity	Units	Unit Price	Total
1	8" Dia. PVC Waterline	1900	LF	$ 100.00	$ 190,000.00
2	Pavement Repair	0	SY	$ 50.00	$ 0.00
3	Valves and Fittings	6	EA	$ 1,500.00	$ 9,000.00
4	Fire Hydrants	3	EA	$ 8,000.00	$ 24,000.00
				Subtotal	$ 223,000.00
				Design, Surveying & Contingency	$ 44,600.00
				Total Project Cost	**$ 267,600.00**

West Warren - Warren Improvement District
Improvement for Growth
Project No. GR-1400N
1400 N. from 5900 W. to 6700 W.
Conceptual Cost Estimate

Item	Description	Quantity	Units	Unit Price	Total
1	8" Dia. PVC Waterline	5300	LF	$ 100.00	$ 530,000.00
2	Pavement Repair	0	SY	$ 50.00	$ 0.00
3	Valves and Fittings	8	EA	$ 1,500.00	$ 12,000.00
4	Fire Hydrants	8	EA	$ 8,000.00	$ 64,000.00
				Subtotal	$ 606,000.00
				Design, Surveying & Contingency	$ 121,200.00
				Total Project Cost	**$ 727,200.00**

West Warren - Warren Improvement District
Improvement for Growth
Project No. GR-1900N
1900 N. from 5900 W. to 5500 W., 2050 N.
Conceptual Cost Estimate

Item	Description	Quantity	Units	Unit Price	Total
1	8" Dia. PVC Waterline	3600	LF	$ 100.00	$ 360,000.00
2	Pavement Repair	0	SY	$ 50.00	$ 0.00
3	Valves and Fittings	8	EA	$ 1,500.00	$ 12,000.00
4	Fire Hydrants	7	EA	$ 8,000.00	$ 56,000.00
				Subtotal	$ 428,000.00
				Design, Surveying & Contingency	$ 85,600.00
				Total Project Cost	**$ 513,600.00**

West Warren - Warren Improvement District
Improvement for Growth
Project No. GR-2300N
2300 N. from 5900 W. to 6700 W.
Conceptual Cost Estimate

Item	Description	Quantity	Units	Unit Price	Total
1	8" Dia. PVC Waterline	5400	LF	$ 100.00	$ 540,000.00
2	Pavement Repair	0	SY	$ 50.00	$ 0.00
3	Valves and Fittings	9	EA	$ 1,500.00	$ 13,500.00
4	Fire Hydrants	10	EA	$ 8,000.00	$ 80,000.00
				Subtotal	$ 633,500.00
				Design, Surveying & Contingency	$ 126,700.00
				Total Project Cost	**$ 760,200.00**

West Warren - Warren Improvement District

Improvement for Growth

Project No. GR-500S

500 S. from 7500 W. to 7900 W.

Conceptual Cost Estimate

Item	Description	Quantity	Units	Unit Price	Total
1	8" Dia. PVC Waterline	3800	LF	$ 100.00	$ 380,000.00
2	Pavement Repair	0	SY	$ 50.00	$ 0.00
3	Valves and Fittings	6	EA	$ 1,500.00	$ 9,000.00
4	Fire Hydrants	7	EA	$ 8,000.00	$ 56,000.00
				Subtotal	$ 445,000.00
				Design, Surveying & Contingency	$ 89,000.00
				Total Project Cost	**$ 534,000.00**

West Warren - Warren Improvement District

Improvement for Growth

Project No. GR-5500W

5500 W. from 950 N. to 1400 N.

Conceptual Cost Estimate

Item	Description	Quantity	Units	Unit Price	Total
1	8" Dia. PVC Waterline	2900	LF	$ 100.00	$ 290,000.00
2	Pavement Repair	0	SY	$ 50.00	$ 0.00
3	Valves and Fittings	5	EA	$ 1,500.00	$ 7,500.00
4	Fire Hydrants	5	EA	$ 8,000.00	$ 40,000.00
				Subtotal	$ 337,500.00
				Design, Surveying & Contingency	$ 67,500.00
				Total Project Cost	**$ 405,000.00**

West Warren - Warren Improvement District
Improvement for Growth
Project No. GR-600N
600 N. from 5500 W. to 5900 W.
Conceptual Cost Estimate

Item	Description	Quantity	Units	Unit Price	Total
1	10" Dia. PVC Waterline	2700	LF	$ 110.00	$ 297,000.00
2	Pavement Repair	0	SY	$ 50.00	$ 0.00
3	Valves and Fittings	5	EA	$ 1,500.00	$ 7,500.00
4	Fire Hydrants	5	EA	$ 8,000.00	$ 40,000.00
				Subtotal	$ 344,500.00
				Design, Surveying & Contingency	$ 68,900.00
				Total Project Cost	**$ 413,400.00**

West Warren - Warren Improvement District
Improvement for Growth
Project No. GR-6200W
6200 W. from 2050 N. to 2300 N.
Conceptual Cost Estimate

Item	Description	Quantity	Units	Unit Price	Total
1	8" Dia. PVC Waterline	1800	LF	$ 100.00	$ 180,000.00
2	Pavement Repair	0	SY	$ 50.00	$ 0.00
3	Valves and Fittings	3	EA	$ 1,500.00	$ 4,500.00
4	Fire Hydrants	3	EA	$ 8,000.00	$ 24,000.00
				Subtotal	$ 208,500.00
				Design, Surveying & Contingency	$ 41,700.00
				Total Project Cost	**$ 250,200.00**

West Warren - Warren Improvement District
Improvement for Growth
Project No. GR-6400W
6400 W. from 100 N. to 700 N.
Conceptual Cost Estimate

Item	Description	Quantity	Units	Unit Price	Total
1	8" Dia. PVC Waterline	3600	LF	$ 100.00	$ 360,000.00
2	Pavement Repair	20	SY	$ 50.00	$ 1,000.00
3	Valves and Fittings	5	EA	$ 1,500.00	$ 7,500.00
4	Fire Hydrants	5	EA	$ 8,000.00	$ 40,000.00
				Subtotal	$ 408,500.00
				Design, Surveying & Contingency	$ 81,700.00
				Total Project Cost	**$ 490,200.00**

West Warren - Warren Improvement District
Improvement for Growth
Project No. GR-7100W
7100 W. from 500 S. to 2100 S., 7500 W.
Conceptual Cost Estimate

Item	Description	Quantity	Units	Unit Price	Total
1	10" Dia. PVC Waterline	7900	LF	$ 115.00	$ 908,500.00
2	Pavement Repair	0	SY	$ 50.00	$ 0.00
3	Valves and Fittings	12	EA	$ 1,500.00	$ 18,000.00
4	Fire Hydrants	15	EA	$ 8,000.00	$ 120,000.00
				Subtotal	$ 1,046,500.00
				Design, Surveying & Contingency	$ 209,300.00
				Total Project Cost	**$ 1,255,800.00**

West Warren - Warren Improvement District

Improvement for Growth

Project No. GR-5900W

5900 W. from 2050 N. to 2700 N.

Conceptual Cost Estimate

Item	Description	Quantity	Units	Unit Price	Total
1	8" Dia. PVC Waterline	4300	LF	$ 100.00	$ 430,000.00
2	Pavement Repair	3800	SY	$ 50.00	$ 190,000.00
3	Fittings	6	EA	$ 1,500.00	$ 9,000.00
4	Fire Hydrants	5	EA	$ 8,000.00	$ 40,000.00
				Subtotal	$ 669,000.00
				Design, Surveying & Contingency	$ 133,800.00
				Total Project Cost	**$ 802,800.00**

West Warren - Warren Improvement District

Improvement for Growth

Project No. GR-700N

700 N. from 6700 W. to 8300 W.

Conceptual Cost Estimate

Item	Description	Quantity	Units	Unit Price	Total
1	10" Dia. PVC Waterline	10600	LF	$ 115.00	$ 1,219,000.00
2	Pavement Repair	3500	SY	$ 50.00	$ 175,000.00
3	Fittings	15	EA	$ 1,500.00	$ 22,500.00
4	Fire Hydrants	10	EA	$ 8,000.00	$ 80,000.00
				Subtotal	$ 1,496,500.00
				Design, Surveying & Contingency	$ 299,300.00
				Total Project Cost	**$ 1,795,800.00**

West Warren - Warren Improvement District
Improvement for Growth
Project No. GR-7500W
7500 W. from 700 S. to 700 N.
Conceptual Cost Estimate

Item	Description	Quantity	Units	Unit Price	Total
1	8" Dia. PVC Waterline	6600	LF	$ 100.00	$ 660,000.00
2	Pavement Repair	800	SY	$ 50.00	$ 40,000.00
3	Fittings	10	EA	$ 1,500.00	$ 15,000.00
4	Fire Hydrants	5	EA	$ 8,000.00	$ 40,000.00
				Subtotal	$ 755,000.00
				Design, Surveying & Contingency	$ 151,000.00
				Total Project Cost	**$ 906,000.00**

West Warren - Warren Improvement District
Improvement for Growth
Project No. GR-8300W
8300 W. from 900 S. to 700 N.
Conceptual Cost Estimate

Item	Description	Quantity	Units	Unit Price	Total
1	8" Dia. PVC Waterline	7900	LF	$ 100.00	$ 790,000.00
2	Pavement Repair	800	SY	$ 50.00	$ 40,000.00
3	Fittings	10	EA	$ 1,500.00	$ 15,000.00
4	Fire Hydrants	5	EA	$ 8,000.00	$ 40,000.00
				Subtotal	$ 885,000.00
				Design, Surveying & Contingency	$ 177,000.00
				Total Project Cost	**$ 1,062,000.00**