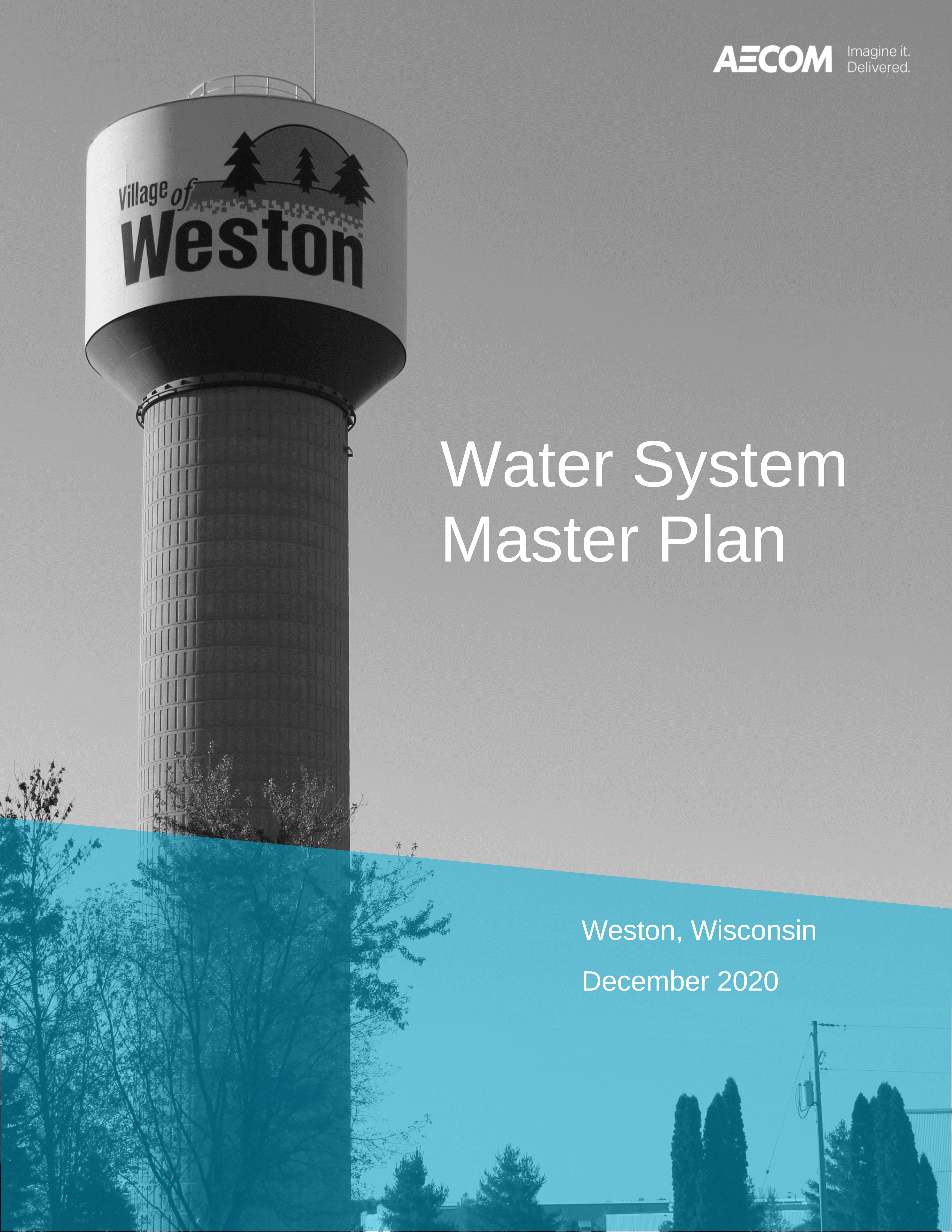


AECOM Imagine it. Delivered.

Water System Master Plan

Weston, Wisconsin

December 2020

Contents

Executive Summary 1
  Population and Future Service Area 1
  Water Requirements 1
  Water System Evaluation 1
  Capital Improvements Plan 3
  Additional Recommendations 3

1.0 Introduction 1-1
  1.1 Purpose 1-1
  1.2 Scope 1-1

2.0 Existing Water System 2-1
  2.1 Water Systems 2-1
  2.2 Water Distribution System 2-1
  2.3 Water System Facilities 2-7
    2.3.1 Water Treatment Plant 2-7
    2.3.2 Water Supply Wells 2-8
    2.3.3 Water Storage 2-16
    2.3.4 Emergency Interconnections 2-18
  2.4 Water System Operation and Control 2-18
  2.5 Water Quality Data 2-19
    2.5.1 Well 1 (Alta Verde) 2-21
    2.5.2 Well 2 (Kerry) 2-21
    2.5.3 Well 3 (Mesker) and Well 4 (Sternberg) 2-22
    2.5.4 Well 5 (Bloedel) and Well 6 (Rippling Creek) 2-22
    2.5.5 Drinking Water Quality Investigation 2-22
    2.5.6 Summary 2-23
  2.6 Historical Well Pumpage and Performance 2-23

3.0 Population and Community Growth 3-1
  3.1 Population 3-1
    3.1.1 Historical and Projected Populations by Municipality 3-1
    3.1.2 Estimated Historical and Future Population Served by the Utility 3-2
  3.2 Future Community Growth and Service Area 3-5
  3.3 Summary 3-5

4.0 Water Requirements 4-1

4.1 Water Consumption 4-1
 4.1.1 Metered Water Sales 4-1
 4.1.2 Water Pumpage 4-1
 4.1.3 Per Capita Water Usage 4-5
 4.1.4 Non-Revenue Water 4-6
 4.1.5 Industrial Water Usage 4-9
4.2 Variations in Customer Demands and Pumpage 4-12
 4.2.1 Seasonal Pumpage Variations 4-12
 4.2.2 Entire System Maximum Day Pumpage 4-12
 4.2.3 Kerry System Maximum Day Pumpage 4-12
 4.2.4 Main System Maximum Day Pumpage 4-16
 4.2.5 Hourly Demand Fluctuations 4-18
4.3 Water Consumption and Pumpage Projections 4-19
 4.3.1 Main System 4-19
 4.3.2 Kerry System 4-19
4.4 Summary of Total Demands and Pumpage Requirements 4-19

5.0 Water Supply and Storage 5-1
5.1 Water Supply Analysis 5-1
 5.1.1 Reliable Supply Capacity 5-1
5.2 Water Storage Needs 5-4
 5.2.1 Main System Storage Requirements 5-5
 5.2.2 Kerry System Storage Requirements 5-7
5.3 Supply Reliability 5-7
5.4 Summary 5-8

6.0 Water Distribution System Evaluation 6-1
6.1 Water System Hydraulic Model 6-1
6.2 Water System Pressures 6-2
6.3 Fire Flow Capacities 6-5
6.4 Water System Headloss and Velocity 6-5
6.5 Water System Water Age 6-9
6.6 Summary 6-15

7.0 Water Main Replacement Rate 7-1
7.1 Water Distribution Main Inventory for Replacement 7-1
7.2 Water Distribution Main Category Definitions 7-2
7.3 Water Main Life Expectancies 7-2
7.4 Results of KANEW Analysis 7-7

7.5 Findings from KANEW Analysis 7-7
7.6 Comparison of Analysis Results 7-12
7.7 Water Main Rehabilitation/Replacement 7-13
7.8 Asbestos Cement Pipe 7-14

8.0 Condition Assessment of Water System Facilities 8-1
8.1 Condition Assessment Evaluation 8-1
8.2 Summary 8-3

9.0 Recommended Water System Improvements 9-1
9.1 Summary of Water System Evaluation 9-1
9.2 Water Supply to Future Service Area 9-1
9.3 Water Supply Improvements – Main System 9-4
9.4 Water Storage Improvements – Main System 9-7
9.5 Water Treatment Improvements – Main System 9-9
9.6 Facility Improvements- Main System 9-10
9.7 SCADA Improvements – Main System and Kerry System 9-11
9.8 System Improvements – Kerry System 9-11
9.9 Water Main Improvements 9-12
  9.9.1 Distribution System Improvements to Address Deficiencies 9-12
  9.9.2 Water Main Renewal 9-14
  9.9.3 Water Main Improvement - Street Projects and Planned Development 9-15
  9.9.4 Distribution System Expansion 9-18
9.10 Proposed Timing for Supply and Storage Improvements 9-21
9.11 Recommended Water System Evaluation – Main System 9-23
9.12 O&M Recommendations 9-23
  9.12.1 Entire System 9-23
  9.12.2 Main System 9-28
  9.12.3 Kerry System 9-28

10.0 Capital Improvements Plan 10-1
10.1 Recommended Improvements 10-1
  10.1.1 Main System 10-1
  10.1.2 Kerry System 10-5
10.2 SCADA – Entire System 10-5
10.3 Recommended Improvement Plan 10-5
10.4 Additional Recommendations 10-7

List of Appendices

Appendix A Glossary of Terms

Appendix B Historical Well Water Levels

Appendix C Well 2 (Kerry) 2019 Pumpage

Appendix D EMOR Well Pumpage Graphs

Appendix E Kerry Meeting Minutes

Appendix F Summary of Rothschild Water Distribution System

Appendix G ISO Fire Flow Requirements

Appendix H Field Testing Results

Appendix I Model Calibration

Appendix J Executive Summary – AwwaRF Project Quantifying Future Rehabilitation Needs

Appendix K CIP Projects

List of Tables

Table ES-1: Summary of Water System Evaluation 2
Table ES-2: Capital Improvements Plan 4
Table 2-1: Water Main Size Inventory 2-1
Table 2-2: Water Main Material Inventory 2-4
Table 2-3: Water Main Installation Date Inventory 2-4
Table 2-4: Water Main Installation Date/Material Inventory 2-4
Table 2-5: WTP, Booster Pumps, and Clearwell 2-9
Table 2-6: Well 1 – Alta Verde 2-10
Table 2-7: Well 2 – Kerry 2-11
Table 2-8: Well 3 – Mesker 2-12
Table 2-9: Well 4 – Sternberg 2-13
Table 2-10: Well 5 – Bloedel 2-14
Table 2-11: Well 6 – Rippling Creek 2-15
Table 2-12: Summit Water Tower 2-16
Table 2-13: Everest Tower 2-17
Table 2-14: Business Park Tower 2-17
Table 2-15: Kerry Tower 2-18
Table 2-16: Summary of System Operation – Main System 2-19
Table 2-17: Summary of System Operation – Kerry System 2-19
Table 2-18: Summary of Well Water Quality Data 2-20
Table 2-19: Summary of Historical Well Pumpage 2-24
Table 3-1: Population Data Historical and Projections 3-2
Table 3-2: Estimated Population Served by Weston Water Utility 3-4
Table 3-3: Estimated Future Population Served By Weston Water Utility 3-6
Table 3-4: Development Areas Acreage by 2040 3-10
Table 4-1: Entire System Water Sales and Pumpage History 4-2
Table 4-2: Entire System Historical Number of Customers Served 4-4
Table 4-3: Entire System Historical Per Capita Consumption 4-6
Table 4-4: Utility Per Capita Consumption Comparisons 4-8
Table 4-5: Summary of Non-Revenue Water 4-10
Table 4-6: Kerry System Demand 4-11
Table 4-7: Seasonal Pumpage Variations 4-13
Table 4-8: Entire System Daily Pumpage Variations 4-14

Table 4-9: Entire System Statistical Analysis: Ratio of Maximum to Average Day Demand 4-15
Table 4-10: Kerry System Daily Pumpage Variations...4-16
Table 4-11: Kerry System Statistical Analysis Ratio of Maximum Day to Average Day Demand 4-17
Table 4-12: Main System Maximum Day Factor...4-18
Table 4-13: Water Sales and Pumpage Projections..4-20
Table 4-14: Future Pumpage Projection 4-21
Table 5-1: Existing Reliable Supply Capacity – Main System 5-2
Table 5-2: Existing Recommended Supply Capacity – Main System 5-3
Table 5-3: Supply Capacity - Kerry System 5-3
Table 5-4: Fire Flow Requirements 5-5
Table 5-5: Existing Storage Requirements – Main System...5-6
Table 5-6: Existing Storage Requirements – Kerry System 5-7
Table 6-1: Volume Weighted Average Water Age Summary...6-12
Table 7-1: Water Main Category Life Expectancies 7-2
Table 7-2: Water Main Category Residual Life Expectancies..7-4
Table 7-3: Recommended Water Main Renewal Rates 7-8
Table 7-4: Comparison of KANEW Analysis Results...7-12
Table 7-5: Piping Lining Cost Estimates 7-14
Table 8-1: Facility Condition Rating...8-1
Table 8-2: Facility Condition Assessment – WTP and Wells 8-2
Table 8-3: Facility Condition Assessment – Towers...8-3
Table 8-4: Facility Condition Assessment – Other Facilities 8-3
Table 9-1: Summary of Water System Evaluation...9-2
Table 9-2: Reliable Supply Capacity with Recommended Improvements – Main System 9-6
Table 9-3: Supply Capacity with Recommended Improvements – Main System...................................9-7
Table 9-4: Storage Evaluation with Recommended Improvements – Main System 9-8
Table 9-5: Summary of Water Distribution System Improvements to Address Deficiencies 9-14
Table 9-6: Additional Water Distribution System Improvements Including Water main Renewal.........9-16
Table 9-7: Comparison of Water Main Capacities 9-18
Table 9-8: Supply Capacity with Well 7 and Well 8 by 2025 – Main System...9-21
Table 9-9: Storage Evaluation with Well 7 and Well 8 by 2025 – Main System 9-22
Table 10-1: Capital Improvements Plan 10-6

List of Figures

Figure ES-1: Recommended Capital Improvements Plan Schematic 5
Figure ES-2: Recommended Water System Master Plan 6
Figure 2-1: Existing Water Distribution System 2-2
Figure 2-2: Existing Water System Schematic 2-3
Figure 2-3: Existing Water Distribution System Material 2-5
Figure 2-4: Existing Water Distribution System Installation decade 2-6
Figure 3-1: Population Data Historical and Projections 3-3
Figure 3-2: Estimated Projected Population Served By Weston Water Utility 3-7
Figure 3-3: Land Use Plan and Future Service Area 3-8
Figure 3-4: Future Service Area by Development Area 3-9
Figure 4-1: Entire System Sales History 4-3
Figure 4-2: Entire System Total Sales and Pumpage History 4-5
Figure 4-3: Entire System Historical Per Capita Consumption 4-7
Figure 4-4: Historical Daily Kerry Water System Usage 4-11
Figure 4-5: Time of Day Demand Curve 4-18
Figure 4-6: Annual Water Sales Projections by Customer Sector 4-21
Figure 5-1: Distribution System Storage Requirements 5-4
Figure 6-1: Existing Water System Pressure Under Average Day Demand 6-3
Figure 6-2: Existing Water System Pressure Under Peak Hour Demand 6-4
Figure 6-3: Existing Required Fire Flow Based on Land Use 6-6
Figure 6-4: Existing Available Fire Flow Under Maximum Day Demand 6-7
Figure 6-5: Existing Fire Flow Adequacy Under Maximum Day Demand 6-8
Figure 6-6: Maximum Velocity Under Maximum Day Demand 6-10
Figure 6-7: Maximum Headloss Under Maximum Day Demand 6-11
Figure 6-8: 24 Hour Average Water Age Under Average Day Demand 6-13
Figure 6-9: Estimated Tank Water Age and HGL Under Average Day Demand 6-14
Figure 7-1: Water Main Survival Function – Long Life Expectancy 7-3
Figure 7-2: Water Main Survival Function – Short Life Expectancy 7-3
Figure 7-3: Distribution of Water Mains by Installation Year 7-5
Figure 7-4: Inventory of Water Mains by Type and Installation Year 7-6
Figure 7-5: Age Distribution of Water Mains in 2018 7-6
Figure 7-6: Cumulative Age Distribution of Water Mains in 2018 7-7
Figure 7-7: Average Age and Residual Life Expectancy for Types of Water Main 7-7

Figure 7-8: Length of Water Mains to be Renewed Based on Long Life Expectancies 7-9
Figure 7-9: Length of Water Mains to be Renewed Based on Short Life Expectancies 7-9
Figure 7-10: Annual Renewal Rates for Types of Water Mains Based on Long Life Expectancies 7-10
Figure 7-11: Annual Renewal Rates for Types of Water Mains Based on Short Life Expectancies 7-10
Figure 7-12: Recommended Water Main Renewal Rates 7-11
Figure 9-1: Ground elevations and Future Service Area 9-3
Figure 9-2: Recommended Water Facility System Improvements 9-5
Figure 9-3: Projected Maximum Day Pumpage Versus Reliable Supply Capacity 9-7
Figure 9-4: Recommended Water Distribution System Improvements 9-13
Figure 9-5: Proposed Future Water Distribution System Expansion 9-19
Figure 9-6: Future Fire Flow Requirements Based on Future Land Use 9-20
Figure 9-7: Pressures with Recommended System Improvements – Peak Hour Demands 9-24
Figure 9-8: Pressures with Recommended System Improvements – Average Day Demands 9-25
Figure 9-9: Available Fire Flow with Recommended System Improvements 9-26
Figure 9-10: Fire Flow Adequacy with Recommended System Improvements 9-27
Figure 10-1: Recommended Future Water System Schematic 10-2
Figure 10-2: Recommended Water System Master Plan 10-3

List of Abbreviations and Acronyms

AC	asbestos cement
AWWA	American Water Works Association
CI	cast iron
CIPP	cured-in place pipe
CTH	County Trunk Highway
DI	ductile iron
DNR	Department of Natural Resources
DOA	Department of Administration
EMOR	Electronic Monthly Operating Reports
EPA	Environmental Protection Agency
EPS	extended period simulation
fps	feet per second
GAC	granular activated carbon
GIS	Geographic Information System
gpcd	gallons per capita per day
gpm	gallons per minute
HDPE	High-Density Polyethylene
HGL	hydraulic grade line
hp	Horsepower
ISO	Insurance Services Offices
LUST	leaking underground tank
MG	million gallons
MGD	million gallons per day
MGY	million gallons per year
MIC	microbiologically-influenced corrosion
MSL	mean sea level
NESHAP	National Emission Standards for Hazardous Air Pollutants
NRW	non-revenue water
NSF	National Sanitation Foundation
O&M	operation and maintenance
PECFA	Petroleum Environmental Cleanup Fund Award
PPC	Public Protection Classification
PRV	pressure reducing valve
PSC	Public Service Commission
psi	pounds per square inch
PVC	polyvinyl chloride
RACM	regulated asbestos cement material
SCADA	Supervisory Control and Data Acquisition
SIPP	spray-in-place pipe
SPS	Safety and Professional Services
SS	steady state
TDS	total dissolved solids
TOD	time of day
µg/L	micrograms per liter
VFD	variable frequency drive
VOCs	volatile organic compounds
WAC	Wisconsin Administrative Code
WRF	Water Research Foundation
WTP	water treatment plant

Executive Summary

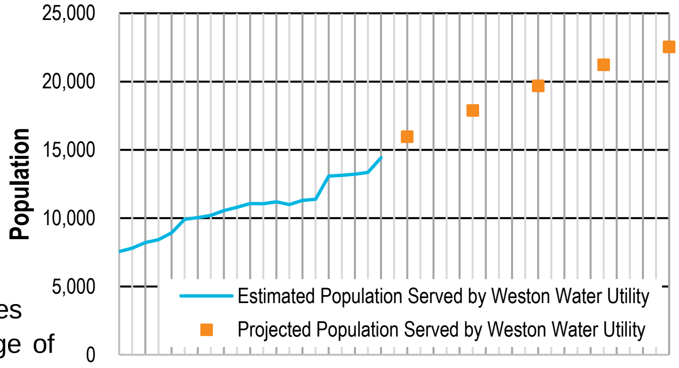
The Village of Weston is a community of approximately 15,000 persons located in Central Wisconsin. The Weston Water Utility provides water service to most residences and businesses within the Village of Weston and partially serves customers in the Village of Rothschild, Town of Rib Mountain, and City of Schofield.

The Utility has 2 separate water systems consisting of 6 groundwater wells, a water treatment plant (WTP) (air stripper) with a booster station, 4 elevated water storage tanks, emergency connections with the Rothschild Water Utility and the Schofield Water Utility, a Supervisory Control and Data Acquisition (SCADA) system, and approximately 108 miles of transmission and distribution water mains. The Main System provides service to the majority of the Utility's customers and the Kerry System provides water to the largest industrial customer near I-39, Kerry, and the Rib Mountain Metropolitan Sewerage District Wastewater Treatment Plant on the west side of the Wisconsin River.

Population and Future Service Area

As of 2019, AECOM estimated that the Utility provides water to approximately 12,688 people within the Village of Weston versus a total Village population of approximately 15,630. The remaining Village of Weston population currently is unsewered and has private wells.

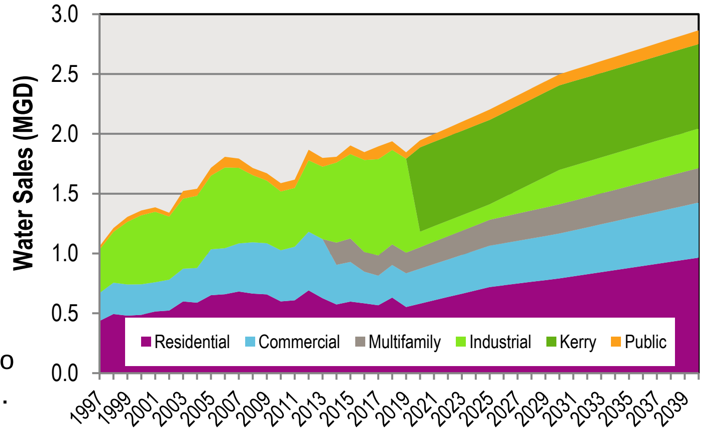
Similarly, AECOM estimated that the Utility provides water to approximately 1,786 people within the Village of Rothschild. Therefore, the total estimated population served by the Weston Water Utility as of 2019 is approximately 14,474 people.



For this study, it was assumed the total population served by the Utility by the year 2040 will be approximately 22,503 people which is an approximately 55 percent increase from 2019.

Water Requirements

Based on an analysis of land development and population growth, the projected 2040 average day water requirement in the Main System is estimated to be approximately 2.5 million gallons per day (MGD), and approximately 0.7 MGD for the Kerry System. This represents an increase in water requirements of nearly 95 percent from the current average day water requirement of approximately 1.3 MGD in the Main System. Kerry representatives are forecasting no increase in water consumption over the planning period.



Water System Evaluation

The major findings from the existing water system evaluation are summarized in Table ES-1. The most significant areas to be addressed in the water system include:

- Adequate reliable supply capacity to meet projected future maximum day demands.
- Adequate storage capacity to meet existing and future requirements.
- Ensure adequate water quality.
- Adequate available fire flows to meet estimated fire flow requirements
- System expansion to serve future development

TABLE ES-1: SUMMARY OF WATER SYSTEM EVALUATION

<table>
<tr><th colspan="2">Main System</th></tr>
<tr><th colspan="2">Well Water Quality</th></tr>
<tr><td>• Well 1 (Alta Verde) exceeds the secondary standards for total dissolved solids (TDS), manganese, and iron.
• Well 5 (Bloedel) exceeds the secondary standards for manganese.
• Well 3 (Mesker) exceeds the secondary standards for manganese and iron.
• Corrosion control is managed through pH adjustment and blended phosphate addition.</td><td>• Well 4 (Sternberg) and Well 6 (Rippling Creek) appear to meet secondary standards.
• The water treatment facility for Wells 3 and 4 provides pH adjustment through the air stripping tower (no longer needed for VOC treatment).
• Wells 1, 5, and 6 pH adjustment is completed with chemical feed systems.</td></tr>
<tr><th colspan="2">Supply</th></tr>
<tr><td>• Existing Reliable Well Capacity: 3.6 MGD
• Design 2020 Maximum Day Demand: 3.0 MGD
• Design 2040 Maximum Day Demand: 5.8 MGD</td><td>• Adequate reliable supply capacity to meet existing design maximum day demands (approximately 0.58 MGD excess)
• Deficiency in reliable supply capacity projected to increase to ~2.24 MGD by 2040.</td></tr>
<tr><th colspan="2">Storage</th></tr>
<tr><td colspan="2">• Existing storage deficiency of approximately 0.34 MG; however, the deficiency can nearly be completely offset by the excess reliable supply capacity (storage requirement 1.19 MG).
• Future storage deficiency projected to be approximately 0.79 MG (storage requirement 1.62 MG).
• Not currently filling existing storage tanks completely full (approximately 0.2 MG is not being utilized).</td></tr>
<tr><th colspan="2">System Reliability</th></tr>
<tr><td colspan="2">• Single river crossing at Ross Avenue limits flow reliability to the distribution system north of the Eau Claire River (single well north of river, Rippling Creek Well)
• The Utility can maintain water supply during a power outage (existing and projected future average day demands) with auxiliary sources of power. The Utility has standby power/engine at Well 1 (Alta Verde), Well 3 (Mesker/WTP), Well 4 (Sternberg), Well 5 (Bloedel), Well 6 (Rippling Creek).</td></tr>
<tr><th colspan="2">Water System Pressures</th></tr>
<tr><td>Minimum System Pressures: ~40 to 45 psi</td><td>Minimum pressure near Summit Tower and near the hospital along Weston Avenue.</td></tr>
<tr><td>Maximum System Pressures: ~90 to 95 psi</td><td>Maximum pressure near the Village of Rothschild.</td></tr>
<tr><td>Average System Pressure: ~75 psi</td><td></td></tr>
<tr><td colspan="2">Per NR 811, the minimum and maximum normal static pressure in the distribution system shall be 35 psi and 100 psi, respectively. The system pressure shall be maintained at a minimum of 20 psi under emergency conditions.</td></tr>
<tr><th colspan="2">Available Fire Flows</th></tr>
<tr><td>Approximately 89 percent of the hydrants meet the fire flow requirements.</td><td>Fire Flow Requirements: 500 gpm to 3,500 gpm</td></tr>
<tr><td colspan="2">Areas deficient include:</td></tr>
<tr><td>• Near Saint Clare's Hospital along Weston Avenue/Birch Street (3,500 gpm requirement)
• Industrial areas (3,500 gpm requirements) south of Highway 29 on east side of Village (dead ends)
• Commercial area/dead end south of Highway 29 east side of Village
• Near DC Everest Senior High School along Alderson Street
• One hydrant on the west side of Weston Elementary school (other hydrants surrounding the school meet the requirement</td><td>• Near YMCA on Howland Avenue (south dead end, 3,500 gpm requirement)
• Northern industrial area along Bernard Avenue (3,500 gpm requirement)
• Multi-family area served by dead end in Village of Rothschild
• Near the industrial area east of the WTP on Fuller Street and Saxon Avenue.
• Multiple dead ends</td></tr>
<tr><th colspan="2">Hydraulic Capacity (Headloss/Velocity)</th></tr>
<tr><td>• No water mains have higher than recommended velocities or headlosses.</td><td>Guidelines
• AWWA Manual M32 recommends that all pipe velocities should be less than 4 to 6 feet per second (fps) during normal operation.
• AWWA Manual M32 recommends headlosses in pipes less than 16-inches in diameter should be less than 5 to 7 feet per 1,000 feet of pipe during normal operating conditions. The recommended headloss limit for larger pipes in AWWA Manual M32 is 2 to 3 feet per 1,000 feet of pipe during normal operating conditions.</td></tr>
<tr><th colspan="2">Water Main Reinvestment (KANEW Analysis)</th></tr>
<tr><td colspan="2">• The Utility's water distribution system is a "newer" water system; approximately 40 percent of the water mains are less than 20 years old and nearly 20 percent of the water mains are over 45 years old.
• Based on the long and short life expectancies in the KANEW analysis, the total recommended replacement lengths in the first 10 years of replacement are approximately 0.8 miles (0.73 percent) and 8.1 miles (7.5 percent), respectively.
• Based on the long and short life expectancies in the KANEW analysis, the total replacement lengths over the 20 year period of replacement are approximately 6.4 miles (5.4 percent) and 15.0 miles (13.9 percent), respectively.
Note: AWWA Research Foundation developed KANEW software to be used to perform replacement rate analysis for water system based on water main inventory.</td></tr>
<tr><th colspan="2">Condition Assessment</th></tr>
<tr><td colspan="2">• Well 1 (Alta Verde) – structure and pump are in poor condition; pump motor is 20 years old.
• The control system should have a significant upgrade due to inaccessibility of replacement equipment (includes Kerry System).
• The electrical at Well 3 (Mesker) is in very poor condition.
• The booster pumps at the treatment plant (air stripper) are in poor condition.
• Pump at Well 4 (Sternberg) is in poor condition.
• 2012 Summit Tower Inspection Report noted concrete spalling, cracking and deteriorating along with sediment in tank, limited access to tower noted (exterior last painted 1983).
• All other well facility structures, pumps, electrical, HVAC, and chemical feed were noted to be in good to fair condition.</td></tr>
<tr><th colspan="2">Kerry Water System</th></tr>
<tr><td colspan="2">• Adequate supply capacity from Well 2 to meet Kerry maximum day demand.
• Supply reliability to the system is from the emergency connection with Village of Rothschild and portable diesel generator hookup.
• Kerry Tower is leaking in multiple locations; updates are needed for the overflow termination to meet DNR Codes and coating is nearing obsolete.
• Well 2 exceeds the secondary standards for manganese. Kerry personnel have indicated issues with pinhole leaks in stainless steel pipe in the facility.
• The Well 2 pump was inspected during a recent well rehabilitation. The Well 2 pump motor is aged and should be scheduled for replacement.
• Kerry personnel indicated phosphate, which is added by the Utility for corrosion control and sequestering manganese, is a challenge in the water supply to Kerry due to proposed phosphate limits in wastewater discharge.
• Manual operation of valves, coordination with Village of Rothschild, and flushing is needed to use the emergency connection.
• Dependent on Rothschild for fire protection.</td></tr>
</table>

Capital Improvements Plan

The capital improvements plan includes projects estimated to cost approximately $48.8 million dollars over the 20 year planning period, including approximately $19.1 million in the short-term (5 years), approximately $12.3 million in the mid-term (6 to 10 years), and $17.4 million in the long-term (11 to 20 years).

The schematic of the recommended future water distribution system is illustrated in Figure ES-1. Table ES-2 summarizes the proposed capital improvements plan for the Weston Water Utility water system, which is illustrated in Figure ES-2.

Additional Recommendations

Additional recommendations include:

- Complete a pilot study for the recommended new BloedeI WTP for Well 5 (Bloedel) and Well 1 (Alta Verde) (approximately $10,000).
- Complete a pilot study for the recommended new Mesker WTP (approximately $10,000).
- Conduct a Storage Alternative Study for the Kerry System (approximately $10,000).
- Update the water system hydraulic model on an annual basis.
- Plan to update the master plan every 5 years or after significant changes that are not outlined in this document are made to the water distribution system.
- Consider a risk-based water main prioritization analysis to help develop a long-term water main replacement program in the future.
- Perform unidirectional flushing on a routine basis to improve water quality.
- Establish procedures for recording daily well pumpage volumes and runtimes.
- Develop and implement an operational strategy to fill the towers and utilize the wells with higher water quality more than the others when possible.
- Develop an agreement with the Village of Rothschild to document the responsibilities of each of the parties associated with water supply and to ensure future supply reliability and fire protection.
- When the air stripper reaches the end of its useful life, the Utility should evaluate other options for pH control instead of replacing the air stripper.

TABLE ES-2: CAPITAL IMPROVEMENTS PLAN

Short-Term Improvements (5 Years)	**Estimated Cost[1]**	**Mid-Term Improvements (6-10 Years)**	**Estimated Cost[1],**
New Well 7 Including Well, Pump, VFD Controls, Building, Chemical Feed Equipment, SCADA, Generator and Site Work	$2,646,000	New Weston Ave 0.75 MG Composite Tower with Altitude Valve, Site Work, Telemetry, and Piping	$3,066,000
New Well 8 (Pitless Well, Pump, VFD Controls and Piping)	$448,000	Demolish Summit Tower	$56,000
New Bloedel WTP (includes pressure filters with backwash tank and chemical feed in new building at Well 5, new building and pump at Well 1, piping from Well 1 to WTP, Well 5 pump modifications with VFD controls, and standby generator)	$5,089,000	New Mesker WTP (includes new treatment building, pressure filters with backwash tank and chemical feed systems, Well 3 pump modifications with VFD controls, electrical improvements at Well 3, and standby generator)	$4,200,000
SCADA Upgrades Including New Control Panels at the WTP (Air Stripper), Existing Towers and Wells	$728,000	Well 4 (Sternberg) Pump Replacement and VFD Addition	$70,000
Altitude Valve at Summit Tower	$60,200	WTP (Air Stripper) Booster Pumps Replacement and New VFD	$126,000
Distribution System Project 1 - Ryan Street River Crossing[3,4,5,8]	$726,000		
Distribution System Project 5 - Fuller St[2,5,8]	$276,000	Distribution System Project 2 - Lexington Ct[3,5,8]	$218,000
Distribution System Project 8 -Kraemer Ln[3,5,8]	$707,000	Distribution System Project 3 - Birch St[2,5,8]	$304,000
Distribution System Project 12 - Development, Weston Ave[3,5,8]	$1,013,000	Distribution System Project 4 - Alderson St[2,5,8]	$473,000
Distribution System Project 13 - Development, Weston Ave[3,5,8]	$604,000	Distribution System Project 6 - Business 51[2,3,5,8]	$511,000
Distribution System Project 14 - Development, Weston Ave[3,5,8]	$428,000	Distribution System Project 9 - Kiowa Ln[3,5,8]	$171,000
Distribution System Project 16 - Everest Ave[2,5,8]	$858,000	Distribution System Project 10 - Alderson St[3,5,8]	$278,000
Distribution System Project 17 - Birch St[3,5,8]	$170,000	Water Main Renewal - Year 6-10: (~550 feet and $84,700 per year)[2,5,7]	$424,000
Distribution System Project 18 - Jelinek Ave[2,3,5,8]	$383,000		
Distribution System Project 19 - Everest Ave[2,5,8]	$482,000	Transmission Mains for Expansion (approximately 3.0 miles of 12-inch main)[3]	$2,418,000
Distribution System Project 20 – Summit Tower Reliability[2,3,5,8]	$522,000		
Well 2 Standby Generator	$200,000	**Total**	**$12,315,000**
Automatic System for Opening Rothschild Connection and Hydrant Flushing System (Kerry System)	$136,000	**Long-Term Improvements (11-20 Years)**	
		Water Main Renewal - Years 11-20 (~ 500 feet and $84,700 per year)[2,5,7]	$847,000
Kerry System Storage Improvements[6]	$175,000	Transmission Mains for Expansion (~ 3.6 miles of 16-inch main, ~ 15.3 miles of 12-inch main, and 4 additional river crossings)[3,4]	$16,545,000
Expansion Transmission Mains for Expansion (~ 4.2 miles of 12-inch main)[3]	$3,419,000		
Total	**$19,070,200**	**Total**	**$17,392,000**

Footnotes:

[1] Assumed 15 percent for engineering design and construction administration/inspection and 25 percent for contingencies.

[2] Water main replacement costs before engineering and contingency were estimated using $100/foot for 6-inch pipe, $110/foot for 8-inch pipe, and $130/foot for 12-inch pipe.

[3] Water main expansion costs before engineering and contingency were estimated using $90/foot for 8-inch pipe, $110/foot for 12-inch pipe, $140/ft for 16-inch pipe main.

[4] Water mains crossing rivers were estimated at $180/foot for 12-inch pipe.

[5] Water main estimates are general planning numbers and do not include roadway replacement.

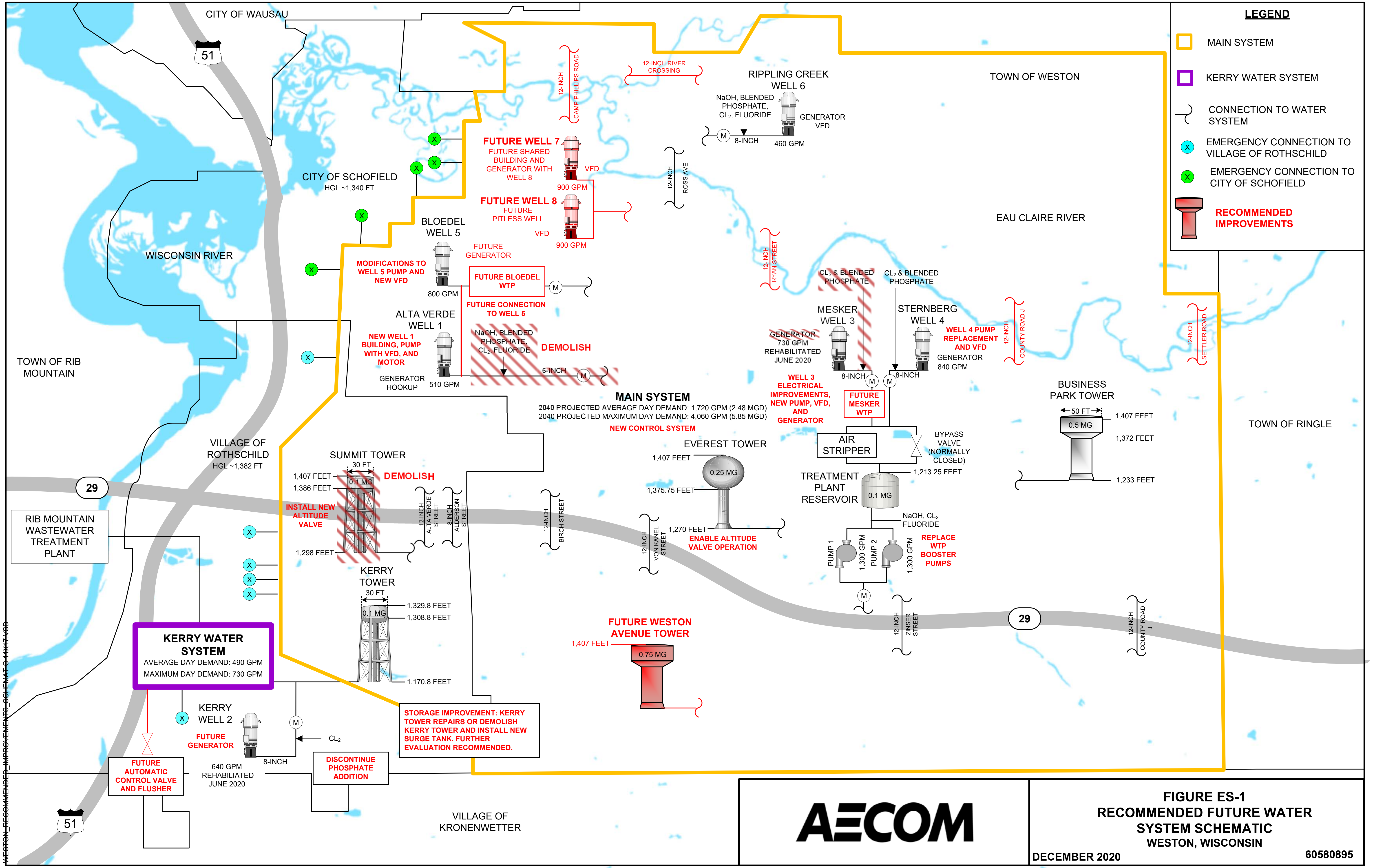
[6] It is recommended that the Utility evaluate alternatives such as hydropneumatic tank for surge protection and removing the Kerry Tower from service or plan to complete the repairs needed for the Kerry Tower.

[7] Water main replacement cost for water main renewal is based on 8-inch water main.

[8] As illustrated in Figure 9-4.

Notes:

- Distribution System Project 7, Project 11, and Project 15 were completed in 2020; therefore, are not included in the CIP.
- Estimates do not include land purchase, if necessary.
- The engineer's cost estimates are only an estimate of possible construction costs for budgeting purposes. The estimates are limited to the conditions existing at issuance of the report and is not a guarantee of actual price or cost. Uncertain market conditions such as, but not limited to local labor or contractor availability, wages, other work, material market fluctuations, price escalations, force majeure events, and developing bidding conditions, etc. may affect the accuracy of this estimate. AECOM is not responsible for any variance from this estimate or actual prices and conditions obtained.
- This estimate is an AACE Class 4 Order of Magnitude cost estimate and is based on 2020 dollars.



AECOM

FIGURE ES-1
RECOMMENDED FUTURE WATER SYSTEM SCHEMATIC

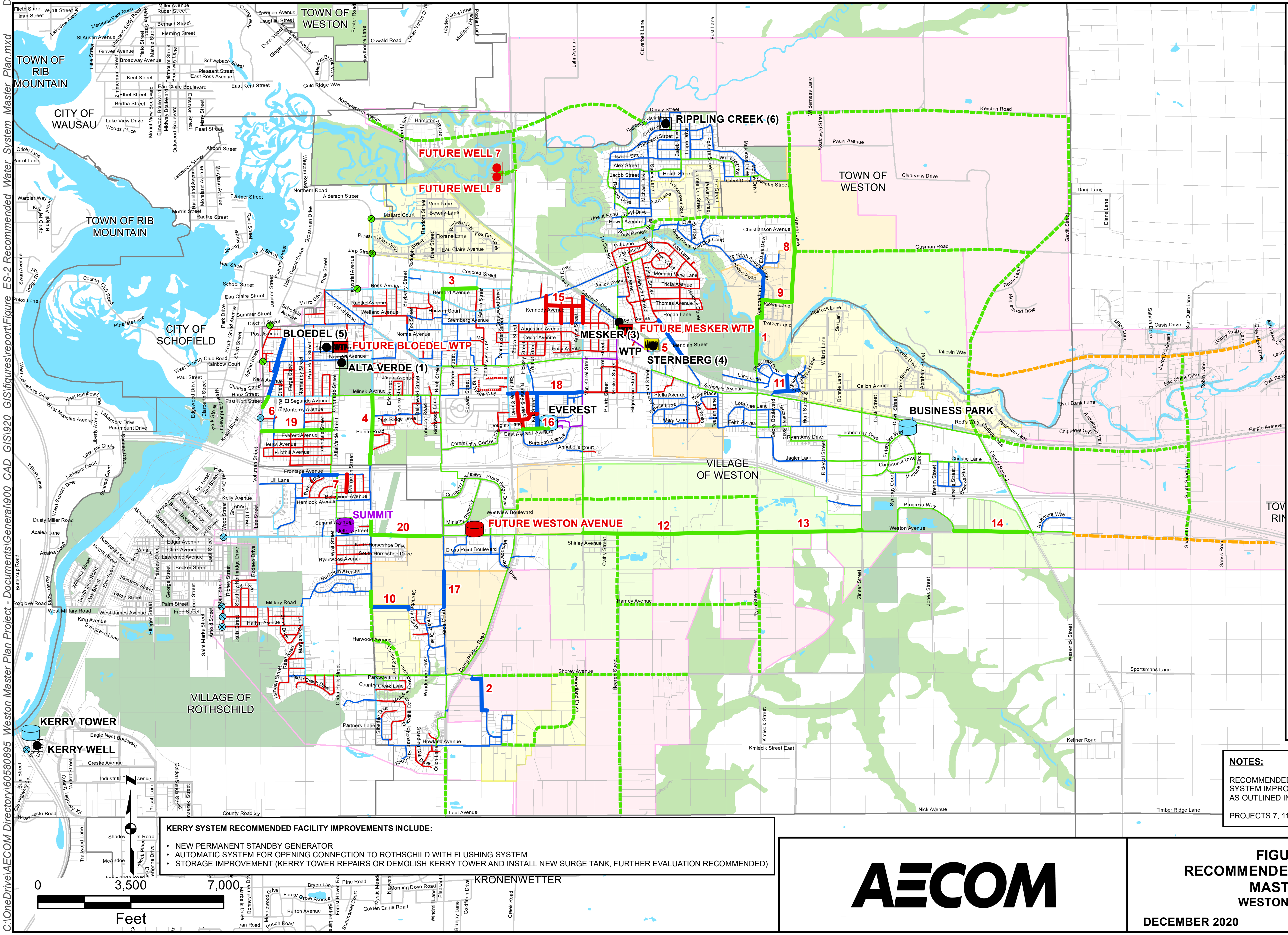
WESTON, WISCONSIN

DECEMBER 2020

60580895

C:\ONEDRIVE\AECOM DIRECTORY\60580895_WESTON MASTER PLAN PROJECT - DOCUMENTS\GENERAL\900_CAD_GIS\920_GIS\FIGURES\REPORT\FIGURE_ES-1
WESTON_RECOMMENDED_IMPROVEMENTS_SCHEMATIC 11X17.VSD

C:\OneDrive\AECOM Directory\60580895 Weston Master Plan Project - Documents\General\900 CAD GIS\920 GIS\figures\report\Figure ES-2 Recommended Water System Master Plan.mxd Dec 18 202



LEGEND

RECOMMENDED FACILITIES
- 🟥 FUTURE TOWER
- WTP FUTURE WTP
- ● FUTURE WELL

RECOMMENDED WATER DISTRIBUTION SYSTEM IMPROVEMENTS
- 6-INCH
- 8-INCH
- 12-INCH

RECOMMENDED WATER MAIN EXPANSION
- 12-INCH
- 16-INCH

EXISTING WATER MAIN DIAMETER
- 6-INCH
- 8-INCH
- 10-INCH
- 12-INCH
- 14-INCH

PRIVATE WATER MAINS
- 6-INCH

WATER SYSTEM FACILITIES
- ● WELL
- WTP TREATMENT PLANT/CLEARWELL
- ELEVATED TOWER
- DEMOLISHED TOWER

EMERGENCY CONNECTIONS
- ⊗ VILLAGE OF ROTHSCHILD
- ⊗ CITY OF SCHOFIELD

PROJECTED AREAS FOR WATER SERVICE BY UTILITY
- 🟨 CURRENTLY NOT SEWERED
- 🟧 2025 DEVELOPMENT
- 🟩 2030 DEVELOPMENT
- 🟪 2040 DEVELOPMENT
- ☐ 2040 SERVICE BOUNDARY

BASE MAPPING
- ☐ MUNICIPAL BOUNDARY
- PARCELS
- ROADS
- 🟩 ENVIRONMENTAL CORRIDOR
- 🟩 PARK
- 🟦 WATER

NOTES:

RECOMMENDED WATER DISTRIBUTION SYSTEM IMPROVEMENTS ARE PROJECTS AS OUTLINED IN CHAPTER 9 SECTION 9.9.

PROJECTS 7, 11, AND 15 WERE COMPLETED IN 2020.

KERRY SYSTEM RECOMMENDED FACILITY IMPROVEMENTS INCLUDE:

- NEW PERMANENT STANDBY GENERATOR
- AUTOMATIC SYSTEM FOR OPENING CONNECTION TO ROTHSCHILD WITH FLUSHING SYSTEM
- STORAGE IMPROVEMENT (KERRY TOWER REPAIRS OR DEMOLISH KERRY TOWER AND INSTALL NEW SURGE TANK, FURTHER EVALUATION RECOMMENDED)

AECOM

FIGURE ES-2
RECOMMENDED WATER SYSTEM MASTER PLAN
WESTON, WISCONSIN

DECEMBER 2020

60580895

1.0 Introduction

The Village of Weston is a community of approximately 15,000 persons located in Central Wisconsin. The Weston Water Utility provides water service to most residences and businesses within the Village of Weston and partially serves customers in the Village of Rothschild, Town of Rib Mountain, and City of Schofield.

The Weston Water Utility has 2 separate water systems consisting of 6 groundwater wells, a water treatment plant (air stripper) with a booster station, 4 elevated water storage tanks, emergency connections with the Rothschild Water Utility and the Schofield Water Utility, a SCADA system, and approximately 108 miles of transmission and distribution water mains. The Main System provides service to the majority of the Utility's customers and the Kerry System provides water to the largest industrial customer near I-39, Kerry, and the Rib Mountain Metropolitan Sewerage District Wastewater Treatment Plant on the west side of the Wisconsin River.

The Village of Weston's location with respect to the Wausau urban corridor, and other local municipalities offers potential for future growth and development; therefore, proper planning is essential to coordinate the expansion of municipal water system facilities with the short-term as well as the long-term needs of the community.

1.1 Purpose

This report summarizes the findings of a water system planning study for the Weston Water Utility. The primary purpose of the study was to evaluate the water needs and system improvements required to serve current and future Utility customers. Present and future water needs of the Weston Water Utility have been evaluated and recommendations have been made concerning improvements necessary to maintain an adequate level of water service. This report will serve as a comprehensive planning tool to guide short-term and long-term needs of the water system to meet future requirements.

1.2 Scope

The primary tasks of the Water System Master Plan project included the following:

- Population and Community Growth Projections
- Water Requirement and Demand Projections
- Evaluation of Existing Water System Facilities and Operations
- Hydraulic Model Updates and Model Verification
- Existing and Future Supply and Storage Evaluation
- Water System Evaluation
- Water Main Replacement Rate of Water System and Strategic Asset Management Plan
- Water System Improvements including Kerry Cost-Benefit Analysis
- Capital Improvement Plan

The planning approach used for the study began with an evaluation of the service area needs and characteristics. Current and future water needs were evaluated over a planning period extending to the year 2040.

A review of existing water system facilities is summarized in Chapter 2. Population, community growth, and water consumption projections serve as the foundation for evaluating and identifying recommended improvements to the system. Chapter 3 discusses existing and expected future land uses and community growth. The assumptions and conclusions presented in Chapter 3 were used to develop projections of water requirements that are presented in Chapter 4.

The supply and storage capacity evaluation is summarized in Chapter 5. Chapter 6 summarizes the evaluation of the existing water system. Chapter 7 summarizes the results of a water main replacement analysis and presents annual water main reinvestment rates and Chapter 8 presents the condition assessment of the water system facilities. Recommended water system improvements are presented in Chapter 9, and a proposed capital improvement plan is presented in Chapter 10.

Because needs change with time, comprehensive planning is a continuous function; therefore, the long-term projections and improvements discussed in this report should be reviewed, reevaluated, and modified in future years, as necessary, to assure the adequacy of future planning efforts. Proper future planning will help assure that system expansion is coordinated and constructed in the most effective manner.

2.0 Existing Water System

The Weston Water Utility is comprised of two separate systems and operates and maintains the following facilities:

- 6 groundwater wells
- 1 water treatment plant (WTP) for Well 3 and Well 4 (air stripper)
- 4 elevated water storage tanks
- One booster pumping station (at WTP)
- 6 emergency connections to Village of Rothschild
- 5 emergency connections to City of Schofield
- A Supervisory Control and Data Acquisition (SCADA) system
- A network of transmission and distribution water mains

This chapter presents a summary of the existing water systems (Main System and Kerry System) components and historical well water quality data. The general location and layout of the water system facilities are illustrated in Figure 2-1. A schematic of the water systems is illustrated in Figure 2-2.

2.1 Water Systems

The Weston Water Utility is comprised of two separate water systems that are not connected to each other. The Main System of the Weston Water Utility provides service to the majority of the Village of Weston and a portion of the Village of Rothschild as illustrated in Figure 2-1. The Utility also serves 4 customers in the City of Schofield and 1 Town of Rib Mountain customer via the Main System.

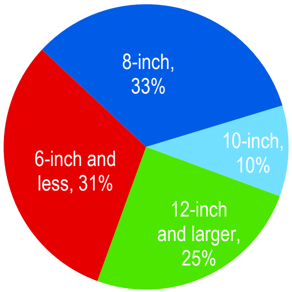
The Kerry System is a separate water system near I-39 in the Village of Rothschild serving one industrial customer, Kerry and one commercial customer, the Rib Mountain Metropolitan Sewerage District Wastewater Treatment Plant on the west side of the Wisconsin River via a 2-inch pipe. The Kerry System has an emergency interconnection with the Village of Rothschild. According to Utility personnel, the Village of Weston does not provide fire protection to Kerry.

2.2 Water Distribution System

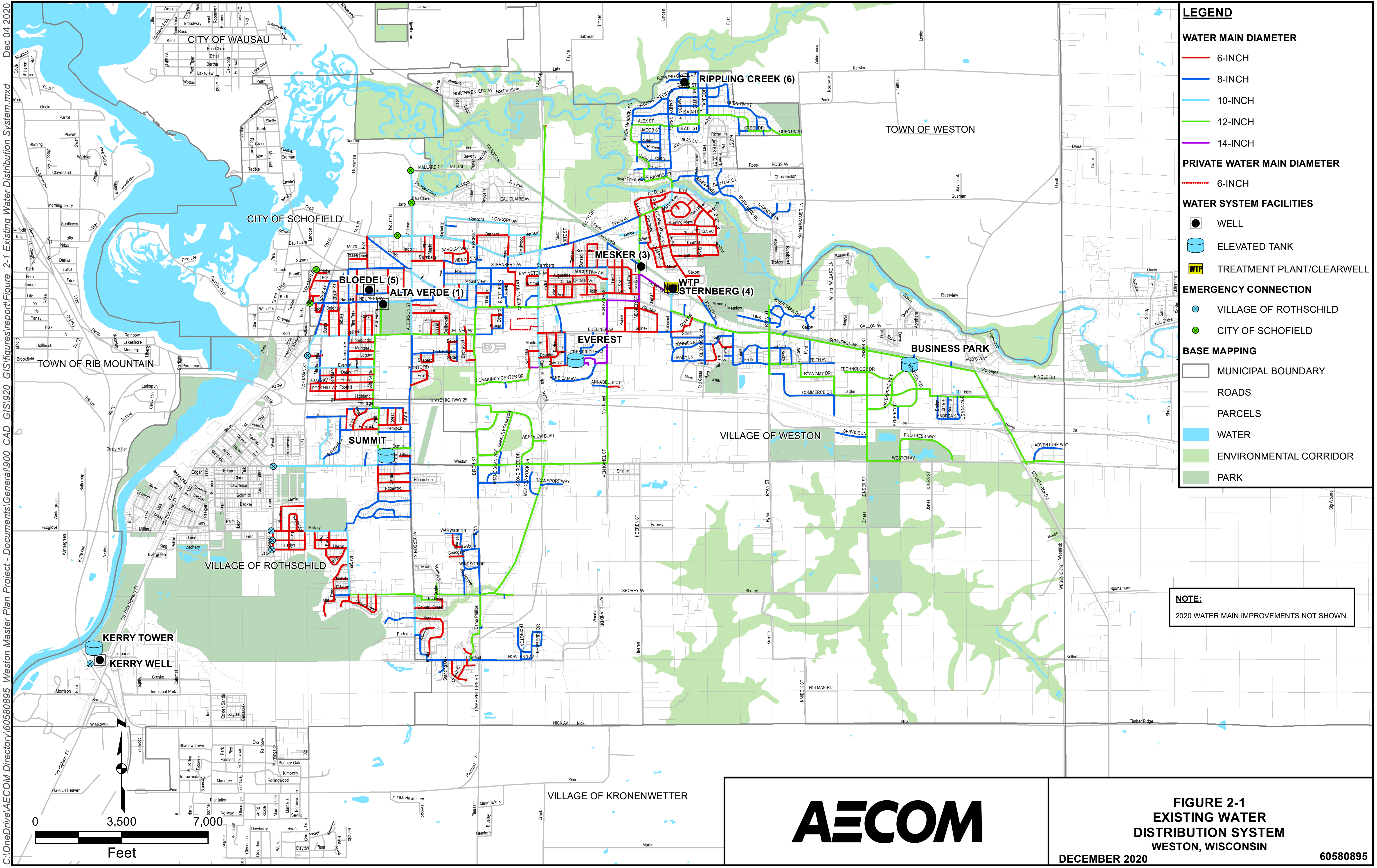
The Utility's water distribution system provides a means of transporting and distributing water from the supply sources to the Utility's customers and other points of usage. The distribution system must be capable of supplying adequate quantities of water at reasonable water system pressures throughout the service area under a range of operating conditions. The distribution system must be able to adequately deliver water during normal and peak water demand conditions and also must deliver adequate water supply for fire protection purposes.

The Utility's water systems are comprised of approximately 108 miles of water mains ranging in size up to 14 inches in diameter as summarized in Table 2-1 (note the inventory does not include 2020 water main improvements).

TABLE 2-1: WATER MAIN SIZE INVENTORY

Diameter	Approximate Total Length	Percentage of Total	
6-inch	179,450 feet	31.4%	
8-inch	190,760 feet	33.4%	
10-inch	58,930 feet	10.3%	
12-inch	132,810 feet	23.2%	
14-inch	9,750 feet	1.7%	
Total	**571,700 feet**	**100%**	

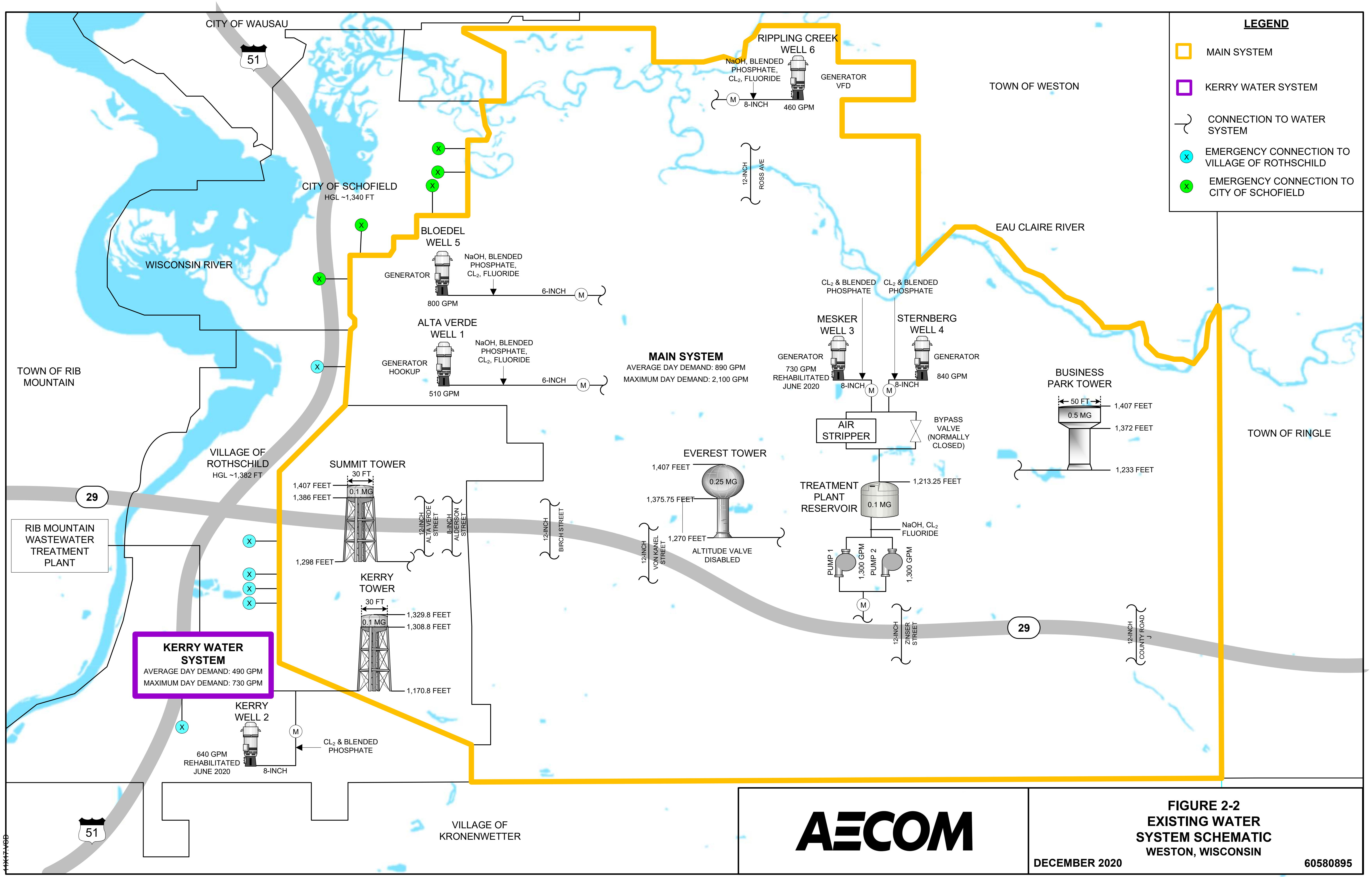
C:\OneDrive\AECOM Directory\60580895 Weston Master Plan Project - Documents\General\900 CAD GIS\920 GIS\figures\report\Figure 2-1 Existing Water Distribution System.mxd Dec 04 2020 - 11:10:55



NOTE:
2020 WATER MAIN IMPROVEMENTS NOT SHOWN.

AECOM

FIGURE 2-1
EXISTING WATER
DISTRIBUTION SYSTEM
WESTON, WISCONSIN
DECEMBER 2020
60580895



AECOM

FIGURE 2-2
EXISTING WATER SYSTEM SCHEMATIC
WESTON, WISCONSIN

DECEMBER 2020

60580895

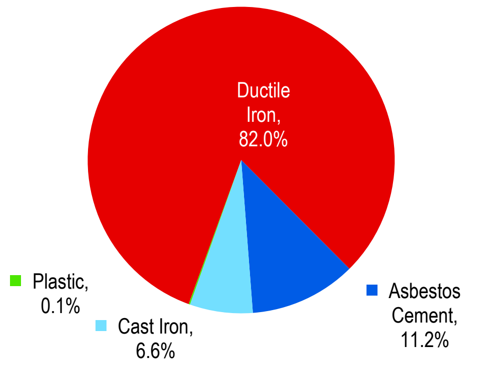
C:\ONEDRIVEAECOM DIRECTORY\60580895_WESTON MASTER PLAN PROJECT - GENERAL (1)\900_C/
11X17.VSD

Of the approximately 108 miles of water main, nearly 25 percent are 12 inches in diameter or larger which represent the primary transmission mains that carry the water throughout the system.

The water main inventory by material is summarized in Table 2-2 and illustrated in Figure 2-3. As shown, the majority of the water mains in the system are ductile iron (approximately 82 percent) with the remaining main materials being asbestos cement (approximately 11 percent) and cast iron (approximately 7 percent).

TABLE 2-2: WATER MAIN MATERIAL INVENTORY

Material	Approximate Total Length	Percentage of Total
Ductile Iron	468,750 feet	82%
Asbestos Cement	64,260 feet	11%
Cast Iron	37,910 feet	7%
PVC	470 feet	<1%
HDPE	310 feet	<1%
Total	**571,700 feet**	**100%**



The water main inventory by installation decade is summarized in Table 2-3 and illustrated in Figure 2-4. As shown, approximately 16 percent of the existing water main was installed prior to 1970, while 62 percent of the water main has been installed since 1990. Table 2-4 summarizes the water main installation dates and corresponding materials.

TABLE 2-3: WATER MAIN INSTALLATION DATE INVENTORY

Material	Approximate Total Length	Percentage of Total
1960	94,020 feet	16%
1970	26,870 feet	5%
1980	93,690 feet	16%
1990	116,300 feet	20%
2000	223,840 feet	39%
2010	15,650 feet	3%
Unknown	1,330 feet	<1%
Total	**571,700 feet**	**100%**

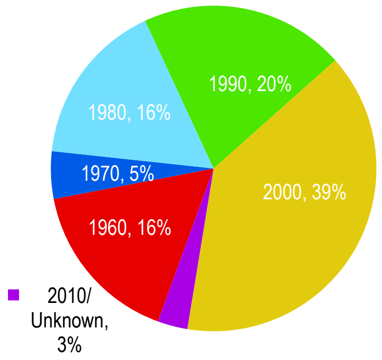
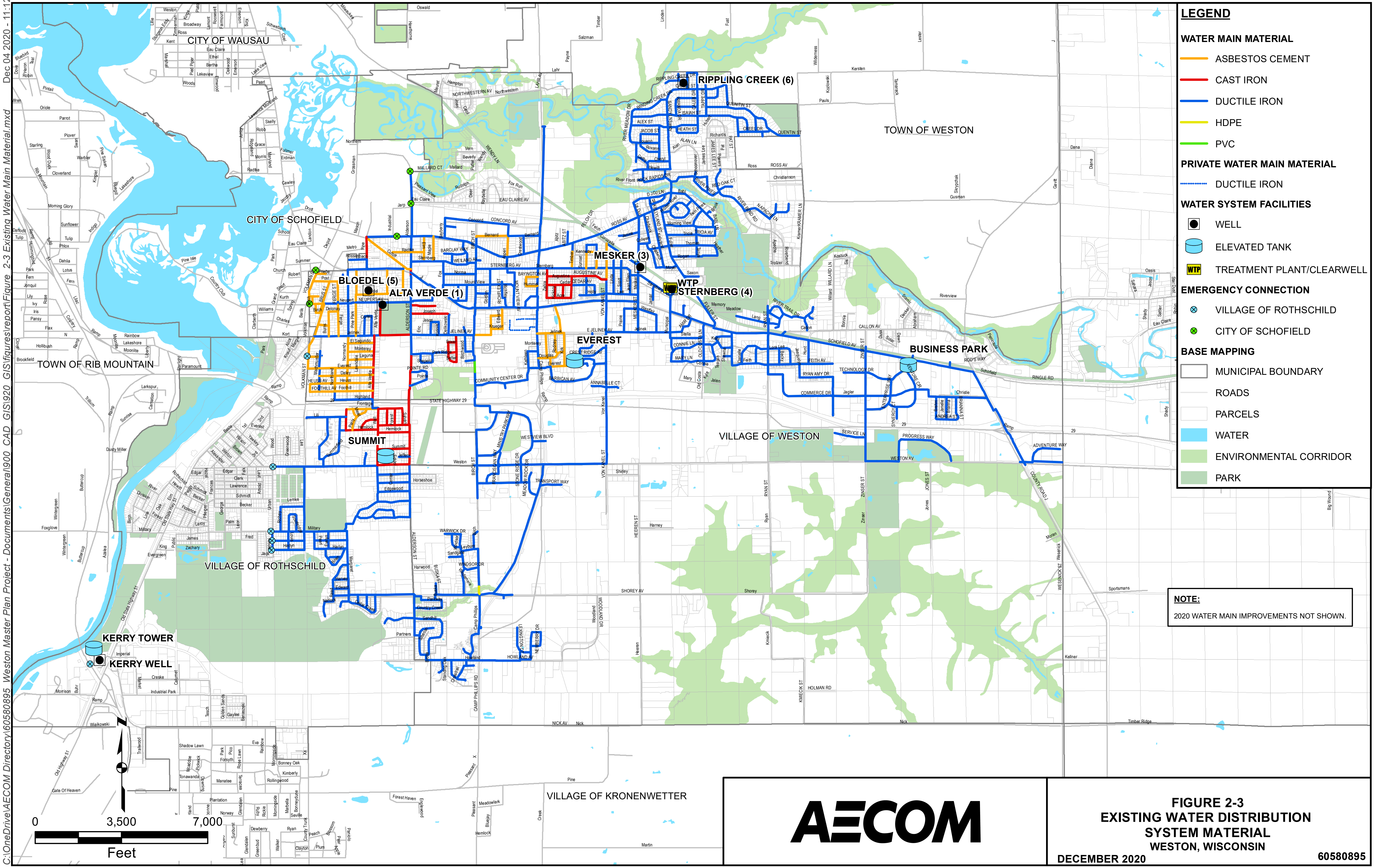


TABLE 2-4: WATER MAIN INSTALLATION DATE/MATERIAL INVENTORY

Material	Installation Decade							Total
	1960	1970	1980	1990	2000	2010	Unknown	
Asbestos Cement	62,410 ft	1,820 ft	-	30 ft	-	-	-	64,260 ft
Cast Iron	31,590 ft	6,060 ft	-	-	-	-	250 feet	37,900 ft
Ductile Iron	20 ft	18,990 ft	93,690 ft	116,270 ft	223,060 ft	15,650 ft	1,080 ft	468,760 ft
HDPE	-	-	-	-	310 ft	-	-	310 ft
PVC	-	-	-	-	470 ft	-	-	470 ft
Unknown	-	-	-	-	-	-	-	-
Total	94,020 ft	26,870 ft	93,690 ft	116,300 ft	223,840 ft	15,650 ft	1,330 ft	571,700 ft

C:\OneDrive\AECOM Directory\60580895 Weston Master Plan Project - Documents\General\900_CAD_GIS\920_GIS\figures\report\Figure_2-3 Existing Water Main Material.mxd Dec 04 2020 - 11:12:10 AM



NOTE:

2020 WATER MAIN IMPROVEMENTS NOT SHOWN.

AECOM

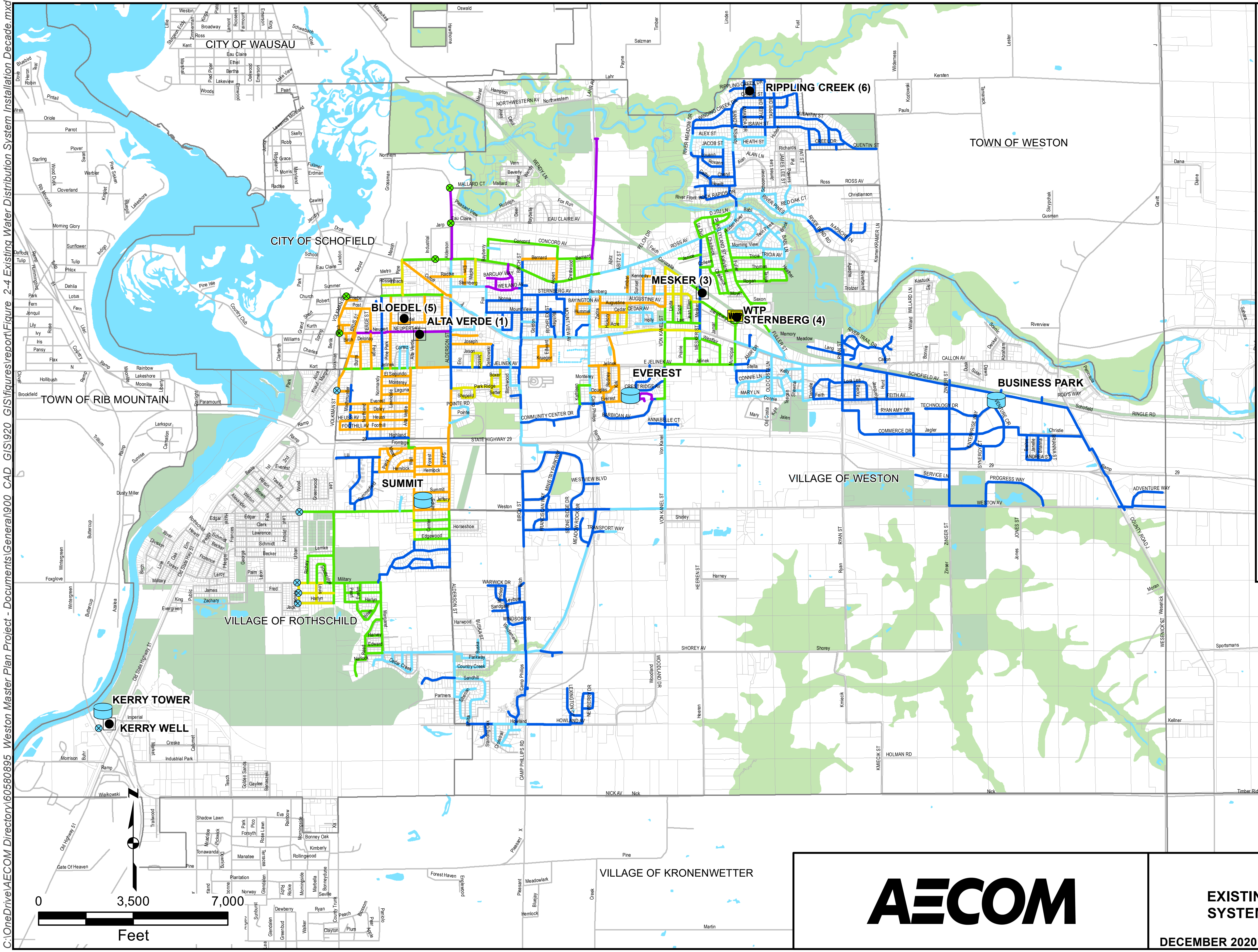
FIGURE 2-3
EXISTING WATER DISTRIBUTION SYSTEM MATERIAL

WESTON, WISCONSIN

DECEMBER 2020

60580895

C:\OneDrive\AECOM Directory\60580895_Weston Master Plan Project - Documents\General\900_CAD_GIS\920_GIS\figures\report\Figure 2-4 Existing Water Distribution System Installation Decade.mxd



LEGEND

WATER MAIN INSTALLATION DECADE

- 🟧 1960 - 1969
- 🟨 1970 - 1979
- 🟩 1980 - 1989
- 🟦 1990 - 1999
- 🟦 2000 - 2009
- 🟪 2010 - PRESENT

PRIVATE WATER MAIN INSTALLATION DECADE

- ┈ 1990 - 2000
- ┈ 2000 - 2009

WATER SYSTEM FACILITIES

- ● WELL
- ⬭ ELEVATED TANK
- WTP TREATMENT PLANT/CLEARWELL

EMERGENCY CONNECTION

- ⊗ VILLAGE OF ROTHSCHILD
- ⊗ CITY OF SCHOFIELD

BASE MAPPING

- ☐ MUNICIPAL BOUNDARY
- ─ ROADS
- ☐ PARCELS
- 🟦 WATER
- 🟩 ENVIRONMENTAL CORRIDOR
- 🟩 PARK

NOTE:

2020 WATER MAIN IMPROVEMENTS NOT SHOWN.

AECOM

FIGURE 2-4
EXISTING WATER DISTRIBUTION
SYSTEM INSTALLATION DECADE
WESTON, WISCONSIN
DECEMBER 2020
60580895

The geography of the Weston water system includes two divides that must be crossed with water mains: Highway 29 and the Eau Claire River. Currently, water mains transport water across Highway 29 at six locations:

- Alta Verde Street (12-inch)
- Alderson Street (8-inch)
- Birch Street (12-inch)
- Von Kanel Street (12-inch)
- Zinser Street (12-inch)
- CTH J (12-inch)

Currently, the 12-inch water main on Ross Avenue is the only main that transports water north of the Eau Claire River; however, the Utility has a well on the north side of the river

2.3 Water System Facilities

The Weston Water Utility has the following facilities in the two water systems which are further detailed in the following sections:

Main System Facilities	Kerry System Facilities
• WTP including booster pumps, clearwell, and air stripper • Well 1 (Alta Verde) • Well 3 (Mesker) • Well 4 (Sternberg) • Well 5 (Bloedel) • Well 6 (Rippling Creek) • Business Park Tower • Summit Tower • Everest Tower	• Well 2 (Kerry) • Kerry Tower

2.3.1 Water Treatment Plant

The Utility operates one WTP that treats water from Well 3 (Mesker) and Well 4 (Sternberg). The original purpose of the WTP was to remove volatile organic compounds (VOCs). The Environmental Protection Agency (EPA) established the first regulations for VOCs in July 1987. Prior to the regulation commencement, water was tested at the Well 3 and Well 4 in 1984 and 1985 for VOCs. In August 26, 1985, the water sample at Well 3 had elevated levels of tetrachloroethylene at 10 micrograms per liter (µg/L). The regulatory limit of 5 µg/L for tetrachloroethylene was established in January 1991. In August 26, 1985, the water sample at Well 4 had elevated levels of benzene at 38 µg/L. The 5 µg/L regulatory limit for benzene was established in July 1987. It was determined that a leaking underground tank (LUST) site was the source of the contamination (5505 Schofield Ave, Weston). It was a self-service gas station with Facility ID 737088660 (DNR BRRTS Website).

The WTP was designed by Donohue (now AECOM) in 1987. In February 1989, the blueprints for the water treatment building were submitted to DNR as part of the LUST site remediation work. Petroleum Environmental Cleanup Fund Award (PECFA) funds were claimed for the LUST site and localized remediation treatment at the LUST site was completed and the site was closed in July 2003. Closure of the site indicates that cleanup is complete and no further contamination or treatment at the LUST site is anticipated. Well 3 and Well 4 have not had raw water VOCs above regulatory standards since 1990; however, the air stripper for Well 3 and Well 4 has continued to be operated.

The original WTP was designed for the peak well capacity of 2,400 gpm (3.5 MGD) (1,200 gpm from Well 3 and 1,200 gpm from Well 4). Design notes indicate that Well 3 and Well 4 could not pump at 1,200 gpm continuously for extended periods of time as it would dewater the aquifer. The original design included a granular activated carbon (GAC) treatment system for Well 4 that was either not required in final construction or has since been removed from service.

The treatment system treats water from both wells through a single air stripper. The well pumps provide enough pressure to pump the water from the well and through the air stripper. The air stripper is a packed tower with countercurrent air feed into the tower at the bottom of the unit. The packing within the air stripper tower is a large number of 1 to 3.5 inch hollow plastic balls that are randomly placed in the air stripper to fill the air stripper between the top where the water enters and the bottom where the air enters. The packing media is designed to increase the water to air contact and improves the performance of the air stripper. The air stripper is free draining, so no water is left in the air stripper to freeze during intermittent well operations. The water from the air stripper drains into a 100,000 gallon below ground level storage clearwell.

The raw well water is considered corrosive due to the low calcium, low alkalinity, and low pH. The principal acidity source in the raw water is dissolved carbon dioxide (CO_2). The air stripping process installed to remove VOCs also removes CO_2 gas and raises the pH. Water samples taken by the Utility in January 2020 indicated that the raw well water pH was 6.35 (Well 3) and 6.27 (Well 4) and was raised to 7.18 using only the air stripping process. The Utility should review the water pH and corrosion control water chemistry before considering removal of the air stripping treatment system.

The WTP clearwell was designed for a 30-minute detention time for disinfection purposes. The two high service pumps each have rated capacity of 1,200 gpm with 200 feet total dynamic head. The high service pumps pump the water from the clearwell into the distribution system. The design included space for a future third pump. Chemical addition at the WTP includes chlorine (sodium hypochlorite), fluoride (hydrofluorosilicic acid), and caustic soda (sodium hydroxide).

Table 2-5 summarizes the WTP, clearwell, and booster pumps at the WTP.

2.3.2 Water Supply Wells

The 6 groundwater wells in the water system are summarized in the following tables:

- Well 1 (Alta Verde): Table 2-6
- Well 2 (Kerry): Table 2-7
- Well 3 (Mesker): Table 2-8
- Well 4 (Sternberg): Table 2-9
- Well 5 (Bloedel): Table 2-10
- Well 6 (Rippling Creek): Table 2-11

The Weston Water Utility uses a number of chemicals to treat water drawn from wells. Chlorine (sodium hypochlorite) is added as a disinfectant to safeguard against any potential bacterial contamination. Fluoride is added to strengthen tooth enamel and prevent cavity formation. Sodium hydroxide is added for pH adjustment to provide corrosion control. Blended phosphate is added for further corrosion control and to prevent the precipitation of naturally occurring iron and manganese in the water.

TABLE 2-5: WTP, BOOSTER PUMPS, AND CLEARWELL

Key Components

- Air stripper and blower (single)
- Clearwell
- Booster pumps (constant speed)
- Chlorine and fluoride addition
- pH adjustment for corrosion control – sodium hydroxide
- Meter (14-inch)

WTP Facility

Booster Pumps

Number of Pumps	2	
	Pump 1	**Pump 2**
Type	Vertical Turbine	Vertical Turbine
Pump manufacturer	Layne	Unknown
Motor manufacturer	U.S Motor	Unknown
Rated Flow	1,300 gpm	1,300 gpm
Rated TDH	200 feet	200 feet
Year installed		
Pump	1980	1988
Motor	2017	1973
Horsepower	100 hp	Unknown
Standby power	Diesel generator at wells not for WTP	

Booster Pumps

Chemical Feed Equipment

Clearwell

Capacity	0.1 MG
Year constructed	Unknown
Constructed by	Unknown
Type	Ground Reservoir
Construction material	Cast in place reinforced concrete
Overflow elevation	1,219.67 feet
Dimensions	35 ft by 35 ft
Head range	11.92 feet
Base elevation	1,207.75 feet

Comments

- No record of last cleaning/inspection of air stripper.
- Clearwell is needed for chlorine contact time to meet virus disinfection and associated code requirements and is not available for storage.
- Chemical feed of fluoride and sodium hydroxide (caustic soda) are after air stripping treatment.
- Air Stripper has a bypass.

TABLE 2-6: WELL 1 – ALTA VERDE

Key Components

- Well
- Well Pump
- Chlorine addition
- Fluoride addition
- pH adjustment – sodium hydroxide
- Corrosion control – blended phosphate (Aquadene SK-7534)
- Magnetic Meter (6-inch)
- ABB drive on pump (at 59.9 Hz during site visit)

Well	
DNR Well Number	BG313
Year Constructed	1963
Casing Size	24 inches
Well Depth	78 feet
Static Water Level	~45 feet
Pumping Water Level	~57 feet

Operation:

Pumps directly to Main System

Well Pump	
Type	Vertical Turbine
Manufacturer	Unknown
Year Installed	
Pump	1999
Motor	1999
Horsepower	60 hp
Standby Power	Natural gas with right angle drive that will run the well pump only. Drive speed 1750 rpm. Manual startup required.
Design Conditions	
Flow	600 gpm
TDH	~260 feet
Current Operating Conditions	
Flow	510 gpm

Well 1 Facility

Chemical Feed Equipment

Well 1 Pump

Comments

- Date of Last Meter Test: July 31, 2018

TABLE 2-7: WELL 2 – KERRY

Key Components

- Well
- Well Pump
- Chlorine addition
- Corrosion control – blended phosphate (Aquadene SK-7534)
- Magnetic Meter (8-inch)

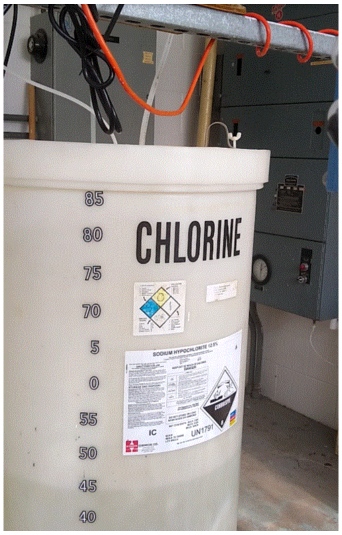
Operation:

Pumps directly to Kerry Water System

Well Pump	
Type	Vertical Turbine
Manufacturer	Unknown
Year Installed	
Pump	1993 (inspected in 2020)
Motor	1993, US Motors
Horsepower	50 hp
Standby Power	Portable Diesel Generator Hookup
Design Conditions	
Flow	630 gpm
TDH	Unknown (70 psi noted during August 2019 site visit)
Current Operating Conditions	
Flow	640 gpm

Well	
DNR Well Number	VX756 (formerly BG314)
Year Constructed	1965, reconstructed in 2007
Casing Size	26 inches
Well Depth	70 feet
Static Water Level	~30 feet
Pumping Water Level	~38 feet

Well 2 Facility



Chemical Feed Equipment

Well 2 Pump

Comments

- Date of Last Meter Test: July 31, 2018
- Last well rehabilitation: June 2020, well capacity increased from approximately 590 gpm to approximately 640 gpm.

TABLE 2-8: WELL 3 – MESKER

Key Components

- Well
- Well Pump
- Chlorine addition
- Corrosion control – blended phosphate (Aquadene SK-7534)
- Meter (8-inch)

Well	
DNR Well Number	VX7771 (formerly BG315)
Year Constructed	1973, reconstructed in 2005/2012
Casing Size	20 inches
Well Depth	92 feet
Static Water Level	~36 feet
Pumping Water Level	~48 feet

Operation:

Pumps to Air Stripper

Well Pump	
Type	Vertical Turbine
Manufacturer	Unknown
Year Installed	
Pump	1998
Motor	1988
Horsepower	75 hp
Standby Power	Natural Gas Power (manual transfer)
Design Conditions	
Flow	930 gpm
TDH	Unknown (discharges to WTP air stripper)
Current Operating Conditions	
Flow	730 gpm

Well Facility

Chemical Feed Equipment

Well 3 Pump

Comments

- Date of Last Meter Test: July 31, 2018
- Date of last well rehabilitation: June 2020, well capacity increased from approximately 530 gpm to 730 gpm.

TABLE 2-9: WELL 4 – STERNBERG

Key Components

- Well
- Well Pump
- Chlorine addition
- Corrosion control – blended phosphate (Aquadene SK-7534)
- Meter (8-inch)

Well

DNR Well Number	BG316
Year Constructed	1980
Casing Size	20 inches
Well Depth	83 feet
Static Water Level	~ 36 feet
Pumping Water Level	~ 50 feet

Operation:

Pumps to Air Stripper

Well Pump

Type	Vertical Turbine
Manufacturer	Unknown
Year Installed	
Pump	1980
Motor	1988
Horsepower	75 hp
Standby Power	250 KW Diesel. Manual start, in well house.
Design Conditions	
Flow	850 gpm
TDH	Unknown (discharges to WTP air stripper)
Current Operating Conditions	
Flow	840 gpm

Well 4 Facility

Diesel Generator

Well 4 Pump

Comments

- Date of Last Meter Test: July 31, 2018
- Single diesel generator runs well pump and chemical treatment; however, generator needs to be started manually.
- Diesel storage tank in the wellhouse has secondary containment but size was not noted.

TABLE 2-10: WELL 5 – BLOEDEL

Key Components

- Well
- Well pump
- Chlorine addition
- Fluoride addition
- pH adjustment – sodium hydroxide
- Corrosion control – blended phosphate (Aquadene SK-7534)
- Magnetic Meter (8-inch)

Well

DNR Well Number	OH869
Year Constructed	2000
Casing Size	30 inches
Well Depth	85 feet
Static Water Level	~43 feet
Pumping Water Level	~64 feet

Operation:

Pumps directly into Main System

Well Pump

Type	Vertical Turbine
Manufacturer	Unknown
Year Installed	
Pump	2001
Motor	2001
Horsepower	75 hp
Standby Power	Natural Gas, 2001
Design Conditions	
Flow	890 gpm
TDH	~ 285 feet
Current Operating Conditions	
Flow	800 gpm

Well Facility

Chlorine and Fluoride Equipment

Well Pump

Comments

- Date of Last Meter Test: July 31, 2018
- Well pump and chemical addition equipment run off natural gas generator with automatic transfer switch.

TABLE 2-11: WELL 6 – RIPPLING CREEK

Key Components

- Well
- Well pump
- Chlorine addition
- Fluoride addition
- pH adjustment – sodium hydroxide
- Corrosion control – blended phosphate (Aquadene SK-7534)
- Magnetic Meter (8-inch)
- Variable frequency drive (VFD)

Well	
DNR Well Number	WH967
Year Constructed	2006
Casing Size	16 inches
Well Depth	111 feet
Static Water Level	~43 feet
Pumping Water Level	~ 83 feet

Operation:

Pumps directly into Main System

Well Pump	
Type	Vertical Turbine
Manufacturer	Unknown
Year Installed	
Pump	2007
Motor	2007
Horsepower	60 hp
Standby Power	Natural Gas, 162 hp, 2007
Design Conditions	
Flow	550 gpm
TDH	~ 306 feet
Current Operating Conditions	
Flow	460 gpm

Well 6 Facility

Natural Gas Generator

Well 6 Pump

Comments

- Date of Last Meter Test: July 31, 2018
- Well pump and chemical addition equipment run on natural gas generator with automatic transfer switch.
- According to Utility staff, well rehabilitated on April 10, 2018 and flow capacity increased from 374 gpm pre-rehabilitation to 469 gpm post-rehabilitation.

2.3.3 Water Storage

The Weston Water Utility has the following storage facilities:

- Summit Tower: Table 2-12
- Everest Tower:
- Business Park Tower: Table 2-14
- Kerry Tower: Table 2-15

TABLE 2-12: SUMMIT WATER TOWER

Summit Tower	
Capacity	0.1 MG
Year constructed	1969
Constructed by	Pittsburgh Des Moines
Type	Multileg
Construction material	Steel
Overflow elevation	1,407.4 feet
Height to bottom	79 feet
Diameter	30 ft
Head range	21 feet
Ground elevation	1,298.4 feet
Date last inspected	2012
Date last painted -exterior	1983
Date last painted -interior	2006

Summit Tower

Comments

- 2012 Inspection report noted concrete spalling at the foundation, cracking and deteriorating along with sediment in tank.
- No altitude valve is present at the Summit Tower.

TABLE 2-13: EVEREST TOWER

<table>
<tr><th colspan="2">Everest Tower</th><td rowspan="12">
Everest Tower</td></tr>
<tr><td>Capacity</td><td>0.25 MG</td></tr>
<tr><td>Year constructed</td><td>1980</td></tr>
<tr><td>Constructed by</td><td>CB&I</td></tr>
<tr><td>Type</td><td>Spheroid</td></tr>
<tr><td>Construction material</td><td>Steel</td></tr>
<tr><td>Overflow elevation</td><td>1,407.4 feet</td></tr>
<tr><td>Height to bottom</td><td>105.75 feet</td></tr>
<tr><td>Head range</td><td>31 ft</td></tr>
<tr><td>Ground elevation</td><td>1,270 feet</td></tr>
<tr><td>Date last inspected</td><td>2016</td></tr>
<tr><td>Date last painted</td><td>2015 (Interior and exterior)</td></tr>
<tr><th colspan="3">Comments</th></tr>
<tr><td colspan="3">Warranty inspection 2016.
The tower has an altitude valve that has been taken out of service.</td></tr>
</table>

TABLE 2-14: BUSINESS PARK TOWER

<table>
<tr><th colspan="2">Business Park Tower</th><td rowspan="13">
Business Park Water Tower</td></tr>
<tr><td>Capacity</td><td>0.5 MG</td></tr>
<tr><td>Year constructed</td><td>2004</td></tr>
<tr><td>Constructed by</td><td>Unknown</td></tr>
<tr><td>Type</td><td>Composite</td></tr>
<tr><td>Construction material</td><td>Steel and concrete</td></tr>
<tr><td>Overflow elevation</td><td>1,407.4 feet</td></tr>
<tr><td>Height to bottom</td><td>139.13 feet</td></tr>
<tr><td>Diameter</td><td>50 feet</td></tr>
<tr><td>Head range</td><td>35 feet</td></tr>
<tr><td>Ground elevation</td><td>1,233.27 feet</td></tr>
<tr><th colspan="2">Comments</th></tr>
<tr><td colspan="2">• Washed out assessment and inspected in 2017.
• Village has annual maintenance contract for this tank.
• A Red Valve water quality unit was installed at the time of construction and was removed due to excessive headloss.
• A PAX mixer has been installed to mix the water and reduce water age and water freezing concerns.</td></tr>
</table>

TABLE 2-15: KERRY TOWER

<table>
<tr><th colspan="2">Kerry Tower</th><td rowspan="13">
Kerry Tower</td></tr>
<tr><td>Capacity</td><td>0.1 MG</td></tr>
<tr><td>Year constructed</td><td>Unknown</td></tr>
<tr><td>Constructed by</td><td>Unknown</td></tr>
<tr><td>Type</td><td>Multi-Leg</td></tr>
<tr><td>Construction material</td><td>Steel</td></tr>
<tr><td>Overflow elevation</td><td>1,329.8 feet</td></tr>
<tr><td>Height to bottom</td><td>138 feet</td></tr>
<tr><td>Diameter</td><td>30 feet</td></tr>
<tr><td>Head range</td><td>21 feet</td></tr>
<tr><td>Ground elevation</td><td>1,170.8 feet</td></tr>
<tr><td>Date inspected</td><td>2009</td></tr>
<tr><td>Date last painted</td><td>2009 (interior and exterior)</td></tr>
<tr><th colspan="3">Comments</th></tr>
<tr><td colspan="3">• Provides storage in Kerry System
• During August 2019 site visit the tower was leaking along weld seams.</td></tr>
</table>

2.3.4 Emergency Interconnections

The Weston Water Utility Main System currently has 5 interconnections (manually closed valves) with the City of Schofield distribution system which has an approximately hydraulic grade line (HGL) of 1,340 feet and 5 interconnections (manually closed valves) with the Village of Rothschild distribution system which has an HGL of approximately 1,382 feet. The location of the interconnections are illustrated in Figure 2-1. The Kerry system has an emergency interconnection with the Village of Rothschild which has been used historically when Well 2 is out of service. According to information provided by Becher-Hoppe Associates, Inc. the Village of Rothschild water system can provide approximately 2,000 gpm at approximately 40 pounds per square inch (psi) at the connection to Kerry.

2.4 Water System Operation and Control

Table 2-17 summarizes the current setpoints programmed in SCADA for the Main System provided by Utility personnel. As shown in the table, the SCADA system is set up with setpoints to operate the wells and booster pumps that pump directly into the system based on each of the towers. The current controlling tower is the Everest Tower, that is, the Alta Verde Well, Bloedel Well, Rippling Creek Well and the WTP booster pumps are turned on/off by the SCADA controls based on the Everest Tower level.

Note that although the head range of the Everest Tower is 31 feet, the SCADA system is programmed to stop the pumps at 24 feet (i.e. not filling the tower).

As summarized in Table 2-17, the SCADA system is programmed to turn on/off the Mesker and Sternberg Wells based on the WTP clearwell level. As noted, the two wells are rotated as lead/lag on a weekly basis.

According to the Utility, the tower set points are set based on peak times and seasonal variations. Seasonal tower level in winter months is set lower to help minimize freezing when colder water is being sent out to the system. This also helps to ease icing problems within the towers themselves.

TABLE 2-16: SUMMARY OF SYSTEM OPERATION – MAIN SYSTEM

Facility	Description
Alta Verde Well, Bloedel Well, Rippling Creek, and WTP Booster Pumps	Everest Tower – 31 feet head range (current controlling tower) • Pumps turn on at 16 feet • Pumps turn off at 24 feet • On-peak and off-peak (based on electrical rates) setpoints the same Summit Tower – 21 feet head range (programmed into SCADA, but currently not used) • Pumps turn on at 15 feet • Pumps turn off at 19 feet Business Park Tower – 35 feet head range (programmed into SCADA, but currently not used) • Pumps turn on at 21 feet • Pumps turn off at 28 feet
Mesker and Sternberg Wells	Start/stop of lead/lag wells is controlled in SCADA by WTP clearwell. (head range 11.92 feet) • Lead well start level 3 feet low, (7 feet water in reservoir) • Lead well stop level 1 foot low, (9 feet) • Lag well start 3.5 feet low (6.5 feet in reservoir) • Lag well stop at 1.5 feet low, (8.5 feet). • Lead/lag well rotate on a weekly basis

As summarized in Table 2-17, the SCADA system is set to turn the Kerry well on and off based on the level of the water in the Kerry Tower.

TABLE 2-17: SUMMARY OF SYSTEM OPERATION – KERRY SYSTEM

Facility	Description
Kerry Well	Kerry Tower – 21 feet head range • Pump turns on at 20 feet • Pump turns off at 14 feet Utility staff indicates the well operates nearly 20 hours per day.

2.5 Water Quality Data

This section discusses available water quality data for the Weston Water Utility (Main System and Kerry System). In general, the raw water quality at the wells is corrosive in nature and all wells have pH adjustment and phosphate addition to address corrosion prior to distribution. Some wells have elevated inorganic concentrations that result in water that is discolored. As noted in the 2018 DNR Sanitary Survey, the Utility occasionally gets water quality complaints related to brown or black water, which is generally attributed to elevated manganese concentrations in some of the wells.

Table 2-18 summarizes some of the historical inorganic water quality sampling that Weston Water Utility completed at the wells. Items noted in red in the table exceed the secondary standards (total dissolved solids (TDS), manganese, and iron). TDS can create colored water, staining, and unpleasant taste. Manganese can cause black to brown color in the water and bitter metallic taste, and iron can cause rusting, reddish to orange color in the water and metallic taste.

TABLE 2-18: SUMMARY OF WELL WATER QUALITY DATA

Sample Description	Units[2]	Regulatory Standard[1]	Well 1 (Alta Verde)			Well 2 (Kerry)		WTP – Effluent	Well 4 (Sternberg)	Well 5 (Bloedel)			Well 6 (Rippling Creek)		
			1999	2008	2017	2008	2017	2017	1999	2000	2008	2017	2006	2008	2017
Selenium	mg/L	0.05	ND	ND	ND	ND	ND	ND	ND	0.0013	ND	ND	ND	0	ND
Alkalinity	mg/L	-	38.6	36	72	71	75	42	24.4	64.6	48	56	30	40	49
TDS[3]	mg/L	500	321	428	520	416	440	310	145	290	387	460	110	140	210
Chromium	mg/L	0.1	ND	ND	ND	ND	0.00043	0.0005	ND	0.0011	ND	0.00056	0.0027	ND	0.0007
Thallium	mg/L	0.002	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Sulfate	mg/L	250	14.8	15.4	15	18.2	15	12	8.75	14.2	16.3	17	14	12.3	11
Fluoride	mg/L	4	ND	0.29	0.82	ND	0.054	0.21	ND	ND	0.19	0.069	0.071	0.2	0.22
Manganese[3]	µg/L	0.05	27	78.5	99	344	230	59	ND	280	113	120	ND	1	6.3
Sodium	mg/L	-	43.7	83.7	140	64.9	98	65	19	26	70.6	110	5.2	4.9	23
Calcium	mg/L	-	29.6	37.7	39	49.4	38	25	13.4	31	38.7	38	18	18	26
Cadmium	mg/L	0.005	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chloride	mg/L	250	125	203	240	158	180	120	41.9	82.9	178	220	13	16	61
Antimony	mg/L	0.006	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Nitrogen, NO_3+NO_2	mg/L	10	3	3.48	0.23	3.19	2.7	2.2	1.23	2.17	3.52	3.5	3.6	3.81	5.5
pH	SU	-	6.25	6.31	7.43	7.05	7.07	7.49	5.99	6.64	6.46	6.68	7.08	6.63	6.62
Barium	mg/L	2	0.081	0.116	0.11	0.0341	0.033	0.066	0.022	0.044	0.0595	0.067	0.024	0.0286	0.055
Zinc	µg/L	5	ND	5.1	22	5.9	100	11	ND	Not tested	13.8	36	Not tested	30.3	32
Hardness	mg/L	-	128	164	160	195	150	98	53.7	140	169	160	75	77.6	110
Nitrogen, NO_2 - N	mg/L	1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Aluminum	mg/L	0.05	ND	ND	ND	0.0058	ND	ND	ND	0.17	ND	ND	ND	0.0024	ND
Iron[3]	mg/L	0.3	0.026	ND	0.5	0.035	ND	0.29	0.031	0.046	0.046	ND	0.013	ND	ND
Nickel	mg/L	0.1	ND	0.00053	0.0016	0.00059	0.00072	0.0012	ND	0.0063	0.00134	0.0012	0.0014	0.0011	0.0017
Magnesium	mg/L	-	13.3	15.5	15	17.7	14	8.9	4.91	14	17.3	16	7.4	7.66	9.7
Mercury	mg/L	0.002	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Silver	µg/L	0.1	ND	0.00087	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.00117	ND
Arsenic	mg/L	0.01	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Beryllium	mg/L	0.004	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

Footnotes:

[1] Wisconsin Administrative Code NR 809.11 and NR 809.70 Table AA.

[2] mg/L – milligrams per liter; µg/L – micrograms per liter; SU – standard unit

[3] Items in red exceed the secondary standards.

Definitions:

ND = Non detect – sample results were below the detection limit.

" – " = No Regulatory Standard Exists

"1999" "2008" and other dates = These dates are the year the samples were collected

2.5.1 Well 1 (Alta Verde)

Manganese, iron, and TDS concentrations have increased from 1999 to 2017 in Well 1 (Alta Verde). The change in water quality from original water quality indicates well rehabilitation may be an option to recover water quality. Currently, Well 1 (Alta Verde) exceeds TDS, manganese, and iron secondary standards. Reduced Well 1 pumping may improve distribution system water quality by reducing the TDS, manganese, and iron added into the distribution system from Well 1 (Alta Verde).

2.5.2 Well 2 (Kerry)

Well 2 (Kerry) has the following water quality concerns:

- Manganese concentrations that exceed the secondary standard of 50 µg/L.
- Positive bacteria detections.
- Pinhole leaks in the stainless-steel pipe in the Kerry facility may be from water quality issues.
- Phosphates added to the water for sequestering and corrosion control negatively impacts the wastewater discharge from Kerry.

Manganese can cause black to brown color in the water and bitter metallic taste. High manganese has also been an issue in the Kerry system because the manganese precipitates and is trapped by the filters which then must be cleaned. The galvanized pipes were replaced in the Kerry facility with stainless steel pipes due to manganese deposits. The Utility adds a blended phosphate to reduce corrosion and sequester manganese. The purpose of sequestering manganese is to prevent the formation of manganese precipitates in the water distribution system. The Kerry customer has reported that the blended phosphate feed has not been sufficient to address all the concerns with manganese in the Kerry system.

The Utility has indicated the Kerry well has a historic problem with positive bacteria detections in the well water. Bacteria in the well can negatively affect water quality in the well and in the water distribution system served by the well. Typically, well rehabilitation is completed to disinfect the well and inactivate any bacteria within the well when bacteria is detected in the water (well rehabilitation was completed in June 2020).

Kerry personnel indicated there are issues with pinhole leaks in the stainless steel pipe in the Kerry facility. Currently, the water treatment process includes pH adjustment for corrosion control. The Utility also adds a blended phosphate to reduce corrosion and sequester manganese. The blended phosphate reduces corrosion by creating a film on the interior pipe walls. That phosphate film prevents corrosive water from contacting the pipe surface which prevents corrosion of the pipe material. The Weston Water Utility hired Process Research Solutions, LLC. to review the corrosion issues in the water system. Process Research Solutions, LLC. reported that the development of pinhole leaks in stainless steel piping in the facility is likely due to microbiologically-influenced corrosion (MIC). Process Research Solutions, LLC. is assisting the Utility in evaluating removal of the phosphate feed system. The phosphate is believed to be acting as a food source for the MIC and is promoting more biological growth. The current pilot system by Process Research Solutions, is a full-scale review of the removal of phosphate at Well 2. The pilot study will track associated changes in manganese and MIC in the Kerry System with the reduced phosphate feed.

Kerry personnel indicated phosphates are a challenge in the water supply due to proposed phosphorus limits on the wastewater discharge. It is the opinion of Kerry personnel that the blended polyphosphate is not preventing corrosion or sequestering manganese; therefore, could be eliminated. If the pilot test is successful and phosphate feed is discontinued, the stopping of the phosphate feed would also benefit Kerry by reducing the phosphorus loading at their wastewater facility.

2.5.3 Well 3 (Mesker) and Well 4 (Sternberg)

Well 3 (Mesker) raw water samples starting in 1991 had no VOC detections. Well 4 (Sternberg) raw water had no VOCs in samples collected starting in 1994. These wells previously had VOCs that required the air stripper for water treatment. As noted in Section 2.3.1, the air stripper is no longer needed for VOC removal. As previously noted, air stripping treatment for the Well 3 and Well 4 raw water results in increasing the pH and reducing the water corrosivity.

Table 2-18 includes sampling results from the Weston Water Utility sampling events. No sampling was collected for Well 3 raw water and only one sample from Well 4 raw water.

The Weston Water Utility provided the MI-Tech report (February 2019) which has sample results for Well 3 and Well 4 raw water. The samples are collected to confirm water safety as part of a Weston Landfill water quality monitoring plan. MI-Tech has been collecting samples at a number of landfill monitoring wells and Weston Utility Well 3 and Well 4. No contamination from the Weston landfill has been noted and the sampling is only precautionary. MI-Tech generates a report that summarizes the sampling results from the monitoring wells and Weston Wells 3 and 4.

Well 3 (Mesker) and Well 4 (Sternberg) raw water quality for manganese and iron was provided in the MI-Tech report (February 2019). The manganese at Well 3 (Mesker) exceeded the 50 µg/L secondary standard and has ranged from approximately 134 to 129 µg/L from 2013 through 2018. Iron concentrations in Well 3 exceeded the 0.3 mg/L secondary standard ranging from approximately 0.641 to 0.983 mg/L from 2013 through 2018. Well 3 has consistently had iron and manganese concentrations above the secondary standards.

From the MI-Tech report (February 2019) sample results, Well 4 manganese has ranged from 4 to 3 µg/L from 2013 through 2018. Well 4 test results have been below all secondary standards for manganese and iron.

Table 2-18 provides the results of the WTP effluent sampling. The WTP effluent manganese concentration is the blend of the Well 3 and Well 4 water.

2.5.4 Well 5 (Bloedel) and Well 6 (Rippling Creek)

Well 5 (Bloedel) has consistently had manganese concentrations above the secondary standards in samples from 2000 until 2017 (Table 2-18).

Well 6 (Rippling Creek) has met all secondary standards from 2006 until 2017(Table 2-18).

2.5.5 Drinking Water Quality Investigation

The Weston Water Utility hired Process Research Solutions, LLC. to complete two phases of a Drinking Water Quality Investigation for the Main System. That investigation concluded that significant issues with biological growth in the system exist that have exacerbated issues with metals in the water system. The recommendations from the report include:

- Cleaning the wells and piping from chemical scale and biofilm.
- Treating the water to remove iron and manganese where needed.
- Discontinuing the use of phosphates in the system.
- Installing various chemical feed controls to control pH and alkalinity adjustment using sodium hydroxide and soda ash addition, respectively. (Alkalinity and pH adjustment reduce water corrosivity and the ultimate feed rates have not yet been established by Process Research Solutions, LLC.)

2.5.6 Summary

The following summarizes the water quality of the wells:

- Well 1 (Alta Verde), Well 2 (Kerry), Well 3 (Mesker), and Well 5 (Bloedel) exceed secondary standards for manganese.
- Well 1 (Alta Verde) and Well 3 (Mesker) exceed secondary standards for iron.
- Well 1 (Alta Verde) exceeds secondary standards for TDS.
- Well 2 (Kerry) has had positive bacteria samples.
- Well 4 (Sternberg) and Well 6 (Rippling Creek) do not exceed secondary standards for manganese, iron, or TDS.
- The Weston Water Utility has corrosion control concerns with all the wells and actively treats the well water to reduce corrosivity at all the wells
- Well 3 (Mesker) and Well 4 (Sternberg) no longer have VOCs in the raw water and air stripping is used only for pH adjustment.

2.6 Historical Well Pumpage and Performance

Table 2-19 summarizes the historical well pumpage from 2013 through 2018 for the entire system (Main System and Kerry System). As illustrated, Well 2 (Kerry) provides approximately 30 percent of the entire system demand to the Kerry System. The remaining 5 wells each provide approximately 10 to 18 percent of the entire system demand to the Main System (70 percent of the entire system demand).

Utility staff indicated that Well 5 (Bloedel) is not pumped as much as other wells, especially during the winter months (lower system water demands), due to the higher manganese levels. Well 6 (Rippling Creek) provides a smaller percentage of the total annual pumpage likely due to the lower production capacity of the well.

Appendix B includes the historical static and pumping water levels for each of the wells from 2013 through 2018 as well as daily 2019 calculated flow rates for each well. As illustrated in the figures in Appendix B, the static and pumping water levels of Well 1 (Alta Verde), Well 2 (Kerry), Well 3 (Mesker), and Well 4 (Sternberg) have remained relatively steady. The water levels in Well 5 (Bloedel) and Well 6 (Rippling Creek) have declined in the last year.

Appendix D includes the well capacity for each of the wells from January 2019 to February 2020 Electronic Monthly Operating Report (EMOR) data. Pumping rates have remained relatively constant over the period for Well 1, Well 4, and Well 5. Well 2 (Kerry) as illustrated in Appendix D. In June of 2020, Well 2 (Kerry) and Well 3 (Mesker) were rehabilitated increasing the capacities to approximately 640 gpm and 730 gpm, respectively.

The following well operating capacities were used for planning purposes in this study:

- Well 1 (Alta Verde): 510 gpm (most recent 3-month average flow rate)
- Well 2 (Kerry): 640 gpm (after June 2020 rehabilitation)
- Well 3 (Mesker): 730 gpm (after June 2020 rehabilitation)
- Well 4 (Sternberg): 840 gpm (most recent 3-month average flow rate)
- Well 5 (Bloedel): 800 gpm (most recent 3-month average flow rate)
- Well 6 (Rippling Creek): 460 gpm (most recent 3-month average flow rate)

Well 6 (Rippling Creek) increased in flow in October 2019 (from historical flow of approximately 290 gpm to approximately 460 gpm).

The increased capacities for Well 2 (Kerry) and Well 3 (Mesker) were used as the current operating capacities for planning purposes.

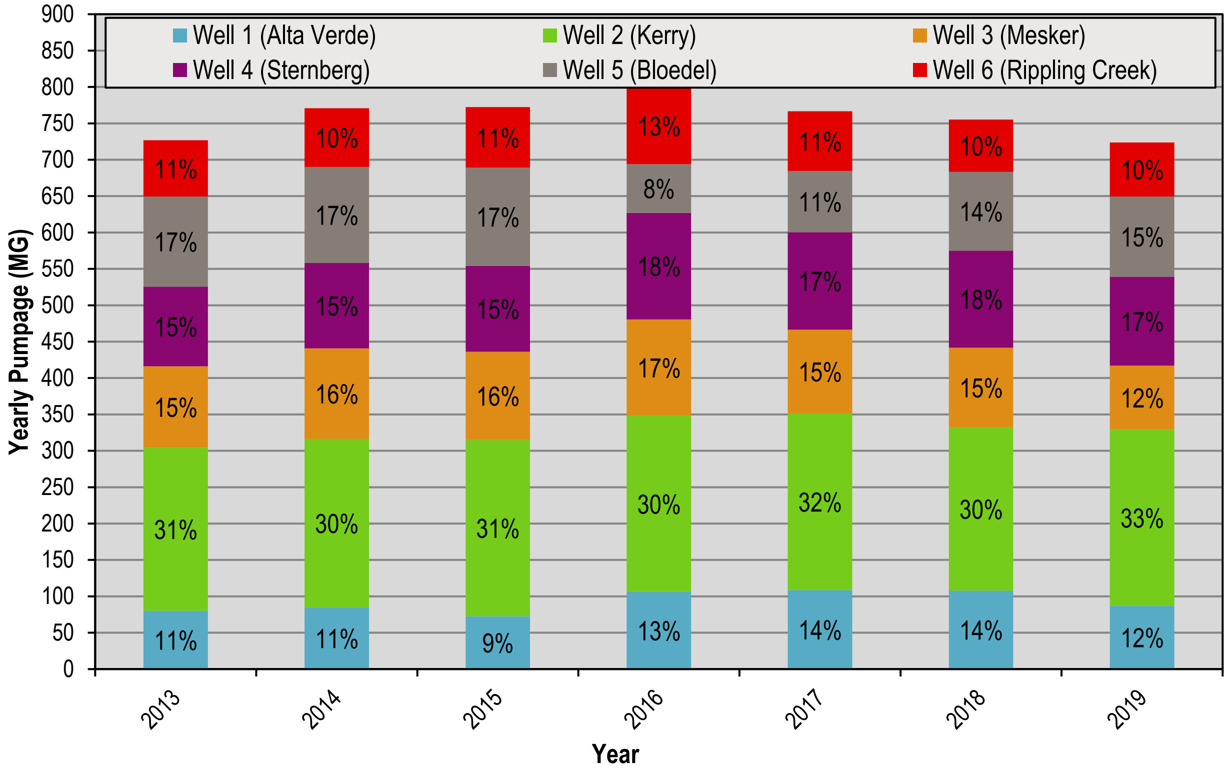
TABLE 2-19: SUMMARY OF HISTORICAL WELL PUMPAGE

Year	Historical Pumpage					
	Well 1 (Alta Verde)	Well 2 (Kerry)	Well 3 (Mesker)	Well 4 (Sternberg)	Well 5 (Bloedel)	Well 6 (Rippling Creek)
2013	80.2 MG	224.0 MG	111.9 MG	109.5 MG	123.9 MG	77.3 MG
2014	84.6 MG	231.7 MG	124.3 MG	117.5 MG	131.8 MG	80.7 MG
2015	72.7 MG	242.2 MG	121.2 MG	117.9 MG	135.0 MG	83.4 MG
2016	106.1 MG	242.0 MG	132.5 MG	146.5 MG	66.9 MG	105.0 MG
2017	108.5 MG	242.8 MG	115.1 MG	133.9 MG	84.3 MG	82.1 MG
2018	107.9 MG	224.2 MG	109.6 MG	133.5 MG	108.0 MG	71.9 MG
2019[1]	87.0 MG	241.9 MG	88.0 MG	122.3 MG	110.2 MG	74.3 MG

Source: Utility Electronic Monthly Operating Report (EMOR) data.

Footnote:

[1] 2019 data from Utility was adjusted from the EMOR data submitted to DNR/PSC. Corrected data provided to AECOM in July 2020.



3.0 Population and Community Growth

This chapter summarizes the planning assumptions made regarding future service area characteristics for the Weston Water Utility. The population and community growth discussed in this chapter are the basis for the water requirement projections for the Utility in Chapter 4. As noted in Chapter 2, the Weston Water Utility serves customers in the Village of Weston, a portion of customers in the Village of Rothschild and a small number (5) customers in the City of Schofield and Town of Rib Mountain. In addition, there are currently unsewered areas in the Village of Weston currently with private wells; therefore, this must be considered during planning.

3.1 Population

Generally, a close relationship exists between a community's population and total water consumption. Future water sales are generally expected to reflect future changes in service area population. For the Weston Water Utility, consideration needs to be given to the population served by the Weston Water Utility.

The current population served by the Utility is a significant percent, but not the entire population, of the Village of Weston and a portion of the Village of Rothschild; therefore, historical populations and population projections of both Villages are discussed in the following sections.

3.1.1 Historical and Projected Populations by Municipality

3.1.1.1 U.S. Census and Wisconsin DOA Population

In the 2010 U.S. Census, the Village of Weston population totaled 14,868 people. According to the Wisconsin Department of Administration (DOA), the Village of Weston has an estimated population of 15,630 in 2019.

Since 1997, the Village of Weston has grown at a steady pace until 2011 when the population stabilized at approximately 15,000 people. The DOA projections, based on 2010 Census data, estimate that the Village of Weston population will grow to approximately 16,770 by 2020 and 20,330 by 2040 which is an approximate 12.8 percent increase from 2010 to 2020 and an approximate 21.2 percent increase from 2020 to 2040.

AECOM reviewed overall population trends for the Village of Rothschild since the Utility serves a portion of the Village of Rothschild population. Since 1997, the Village of Rothschild maintained a population of approximately 5,200 people. The DOA projections, based on 2010 Census data, estimate that the Village of Rothschild population will grow to approximately 5,525 by 2020 and 5,790 by 2040 which is an approximate 4.9 percent increase from 2010 to 2020 and an approximate 4.8 percent increase from 2020 to 2040.

3.1.1.2 Revised Population Projections for Study

As the current year is 2020, and the population for the Village of Weston and the Village of Rothschild has not increased as much as projected by the DOA, revised projections for the purposes of this study were developed.

Utility staff indicated that future water demands should be based on the Wisconsin DOA projections for 2040; however, the 2020 through 2040 population projections would be interpolated between the actual 2019 population and the projected 2040 population. This method increases the population growth rate from 2020 to 2040 compared to the DOA projections to approximately 28.2 percent for the Village of Weston and approximately 7.8 percent for the Village of Rothschild.

Table 3-1 and Figure 3-1 summarize historical and projected population trends for the Village of Weston and the Village of Rothschild based on Wisconsin DOA data and the revised population projections for this study.

TABLE 3-1: POPULATION DATA HISTORICAL AND PROJECTIONS

Year	Village of Weston		Village of Rothschild	
	Wisconsin DOA Population Data[1]	Revised Population Projections for Study[2]	Wisconsin DOA Population Data[1]	Population Revised Projections for Study[2]
1997	11,250	-	5,224	-
1998	11,518	-	5,234	-
1999	11,660	-	5,252	-
2000	12,079	-	4,970	-
2001	12,249	-	4,979	-
2002	12,502	-	4,981	-
2003	12,802	-	4,993	-
2004	13,003	-	5,071	-
2005	13,195	-	5,171	-
2006	13,350	-	5,201	-
2007	13,805	-	5,321	-
2008	14,040	-	5,336	-
2009	14,310	-	5,390	-
2010	14,868	-	5,269	-
2011	15,045	-	5,269	-
2012	15,051	-	5,276	-
2013	15,052	-	5,280	-
2014	15,090	-	5,287	-
2015	15,276	-	5,302	-
2016	15,338	-	5,325	-
2017	15,276	-	5,288	-
2018	15,445	-	5,314	-
2019	15,630	-	5,349	-
2020	16,770	15,854	5,525	5,370
2025	17,870	16,973	5,655	5,475
2030	18,890	18,092	5,755	5,580
2035	19,700	19,211	5,795	5,685
2040	**20,330**	**20,330**	**5,790**	**5,790**

Footnotes:

[1] Source: Wisconsin Department of Administration including historical populations and 2020 through 2040 population projections.

[2] 2020, 2025, 2030, and 2035 population projections based on the actual 2019 population interpolated to the 2040 projected population from Wisconsin DOA.

3.1.2 Estimated Historical and Future Population Served by the Utility

To determine the estimated population served by the Utility the number of residential and multi-family customers was used. Table 3-2 summarizes the historical number of customers served by the Weston Water Utility by municipality from the PSC Annual Reports. The Utility serves customers in the Village of Weston, Village of Rothschild, City of Schofield, and Town of Rib Mountain; however, the City of Schofield and Town of Rib Mountain is 5 customers; therefore, these customers are not included in this analysis.

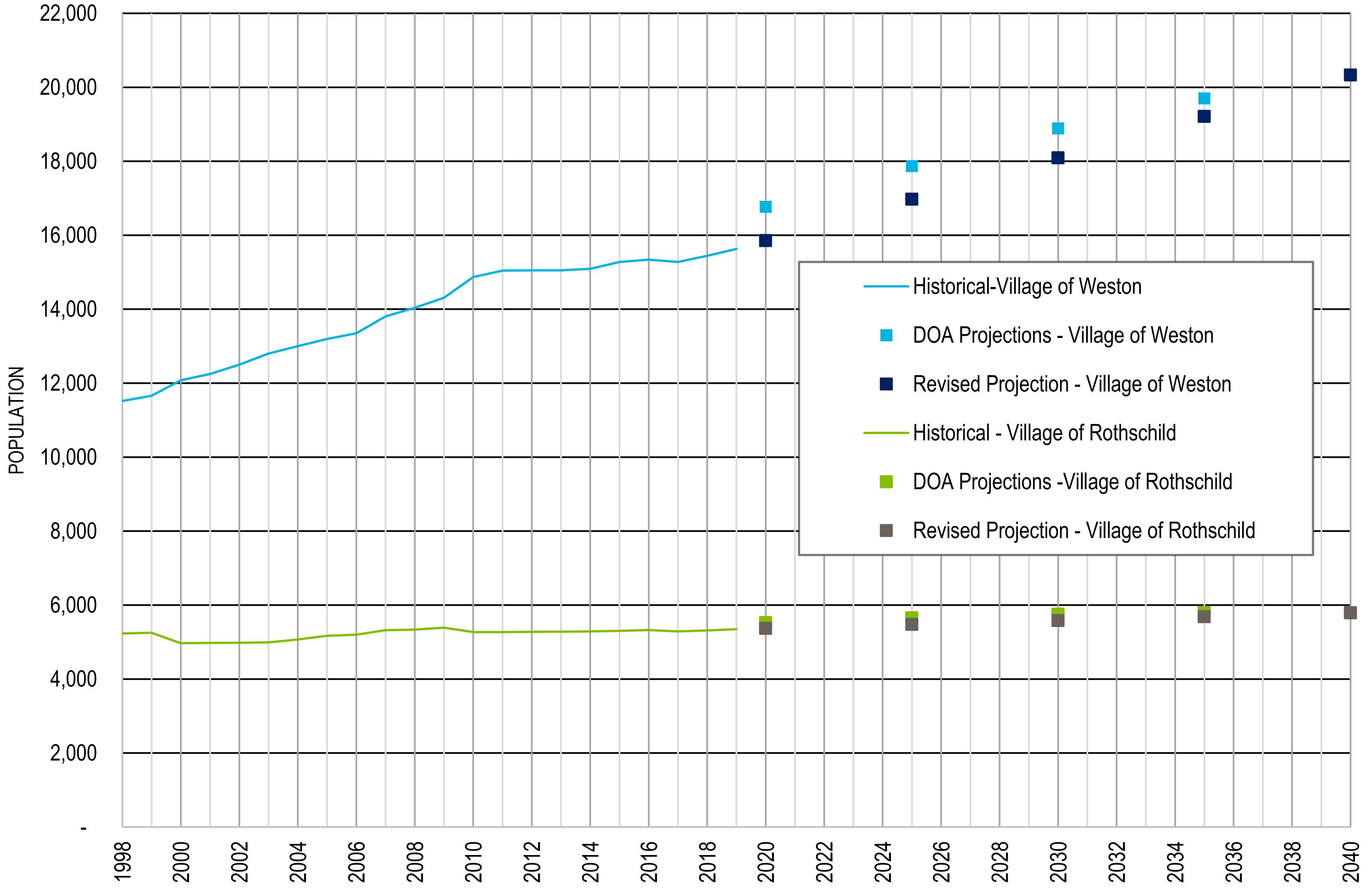


FIGURE 3-1: POPULATION DATA HISTORICAL AND PROJECTIONS

TABLE 3-2: ESTIMATED POPULATION SERVED BY WESTON WATER UTILITY

Year	Weston Water Utility Customers			Estimated Residential Customers by Municipality[4]			Estimated Population Served by Municipality		
	Total Customers[1]	Residential Customers[1]	Multi-Family Customers[1]	Village of Weston[3]	Village of Rothschild[2]	Total Weston Water Utility	Village of Weston[5]	Village of Rothschild[6]	Total Weston Water Utility
1997	3,157	2,813	-	2,234	579	2,813	5,629	1,361	6,990
1998	3,401	3,037	-	2,456	585	3,041	6,189	1,375	7,564
1999	3,492	3,131	-	2,545	591	3,136	6,414	1,389	7,802
2000	3,685	3,301	-	2,704	597	3,301	6,814	1,403	8,217
2001	3,779	3,386	-	2,783	603	3,386	7,013	1,417	8,430
2002	3,992	3,585	-	2,976	609	3,585	7,499	1,431	8,931
2003	4,409	3,980	-	3,365	615	3,980	8,479	1,446	9,925
2004	4,480	4,028	-	3,407	621	4,028	8,585	1,460	10,045
2005	4,556	4,092	-	3,464	628	4,092	8,730	1,475	10,205
2006	4,702	4,229	-	3,595	634	4,229	9,059	1,490	10,549
2007	4,882	4,330	-	3,690	640	4,330	9,298	1,505	10,803
2008	5,057	4,434	-	3,787	647	4,434	9,544	1,520	11,064
2009	5,020	4,434	-	3,781	653	4,434	9,527	1,535	11,063
2010	5,158	4,488	-	3,828	660	4,488	9,647	1,551	11,198
2011	5,066	4,409	-	3,743	666	4,409	9,432	1,565	10,997
2012	5,205	4,532	-	3,855	677	4,532	9,715	1,591	11,306
2013	5,250	4,563	-	3,877	686	4,563	9,770	1,612	11,382
2014	5,196	4,577	165	3,867	710	4,577	11,408	1,669	13,077
2015	5,231	4,600	166	3,870	730	4,600	11,426	1,716	13,141
2016	5,266	4,624	168	3,914	710	4,624	11,557	1,669	13,225
2017	5,311	4,669	169	3,935	734	4,669	11,620	1,725	13,345
2018	5,735	5,059	179	4,322	737	5,059	12,696	1,732	14,428
2019	5,817	5,055	185	4,295	760	5,055	12,688	1,786	14,474

Footnotes:

[1] Source: Weston Water Utility Annual PSC Reports. Multi-family customers were reported as commercial customers prior to 2014.

[2] 2010 to 2019 assumed all Rothschild customers were residential customers, assumed 1 percent growth in Rothschild customers per year from 1997 to 2010.

[3] Village of Weston estimated residential customers based on total Utility residential customers less Rothschild estimated residential customers.

[4] City of Schofield customers (4) and Town of Rib Mountain customer (1) not included in analysis

[5] Estimated Village of Weston population served by Weston Water Utility calculated as estimated residential customers multiplied by DOA residential density for Village of Weston of 2.52, and multifamily customers multiplied by 4 units per customer multiplied by residential population density of 2.52 (all multi-family customer assumed to be in the Village of Weston).

[6] Estimated Village of Rothschild residential population served by Weston Water Utility calculated as residential customers multiplied by DOA residential density for Village of Rothschild of 2.35.

As of 2019, AECOM estimated that the Weston Water Utility provides water to approximately 12,688 people within the Village of Weston versus a total Village population of approximately 15,630 based on the number of residential and multi-family customers served and the average number of people per household. The remaining Village of Weston population currently is unsewered and have private wells.

Similarly, AECOM estimated that the Utility provides water to approximately 1,786 people within the Village of Rothschild. Therefore, the total estimated population served by the Weston Water Utility as of 2019 is approximately 14,474 people.

For this project, it is assumed that the Utility will service any additional population within in the Village of Weston (population growth) and any existing Village of Weston residents currently not served by the water distribution system (unsewered areas) by 2040. As discussed with Utility personnel, it is also assumed that all additional growth within the Village of Rothschild will be provided water via the Weston water distribution system (conservative approach for planning; however, not a significant amount with an additional 441 people by 2040).

Table 3-3 estimates the projected population served by the Weston Water Utility which is illustrated in Figure 3-2. The population served by the Weston Water Utility in 2040 is estimated to be approximately 22,503 people which is an approximately 55 percent increase from 2019.

3.2 Future Community Growth and Service Area

Figure 3-3 illustrates the 2040 planning boundary and future land use plan as provided by the Village which represents the nature and extent of development within the Village.

The Village future land use map consists largely of residential subdivisions with the main thoroughfares filled with commercial parcels, such as along Schofield Avenue. Residential parcels to the north of the Eau Claire River are within the 2040 planning boundary.

Figure 3-4 illustrates specific development areas as identified by the Village designated by the timeframe for development. Table 3-4 outlines the development areas, the estimated percent likely to be developed by 2040 and the corresponding estimated acreage to be developed by 2040 by land use category. Additionally, 5 currently developed unsewered areas were identified. These 5 areas are currently 100 percent developed with residential lots that are provided water via private wells. The Utility anticipates incorporation of these areas into the water distribution system by 2040. The outer boundary of the future urban service area illustrated in Figure 3-3 was used for this study to identify the area which is expected to develop by 2040 and require Village of Weston municipal water utility services.

The expected increase in residential development is directly related to previous projections of population growth. Commercial land use is also expected to increase with increases in population. As a result, water demand projections discussed in Chapter 4 will be estimated from the population projections for the Utility.

3.3 Summary

This chapter summarizes the primary assumptions regarding future growth of the Weston Water Utility service area and population served. The present and future needs and characteristics of the identified service area will have a direct impact on the need for expansion of water system facilities; therefore, the conclusions discussed in this chapter were used as a primary basis for projecting future water needs, evaluating the adequacy of existing water system facilities, and identifying needs for future water system expansion.

TABLE 3-3: ESTIMATED FUTURE POPULATION SERVED BY WESTON WATER UTILITY

Year	Population Data and Projections[1]		Population Growth		Village of Weston Unsewered Area Population[4,5]	Estimated Population Served by Weston Water Utility[6]		
	Village of Weston	Village of Rothschild	Village of Weston[2]	Village of Rothschild[3]		Village of Weston	Village of Rothschild	Total
2015	15,276	5,302	-	-		11,426	1,716	13,141
2018	15,445	5,314	-	-		12,696	1,732	14,428
2019	15,630	5,349	-	-	2,942	12,688	1,786	14,474
2020	15,854	5,370	224	21	2,942	12,912	1,753	14,665
2025	16,973	5,475	1,119	105	2,206	14,767	1,858	16,624
2030	18,092	5,580	1,119	105	1,471	16,621	1,963	18,584
2035	19,211	5,685	1,119	105	735	18,476	2,068	20,543
2040	20,330	5,790	1,119	105	0	20,330	2,173	22,503

Footnotes:

[1] Source: Wisconsin Department of Administration 2040 projection linearly interpolated from 2019 actual population to the 2040 DOA projection.

[2] All future Village of Weston population growth assumed to be served by the Weston Water Utility.

[3] All future Village of Rothschild population growth assumed to be served by the Weston Water Utility.

[4] All unsewered areas in the Village of Weston are assumed to be served by the Weston Water Utility by 2040.

[5] The Village of Weston unsewered population was estimated as the difference between the 2019 Village and the estimated Village of Weston population served by the Utility. The unsewered population is planned to be served by 2040. Linear interpolation was used between 2020 and 2040 for additional population served by the Utility.

[6] Determination of 2015, 2018, and 2019 population served summarized in Table 2-2. Future population served based on 2019 estimated and assumptions in growth elsewhere in this table.

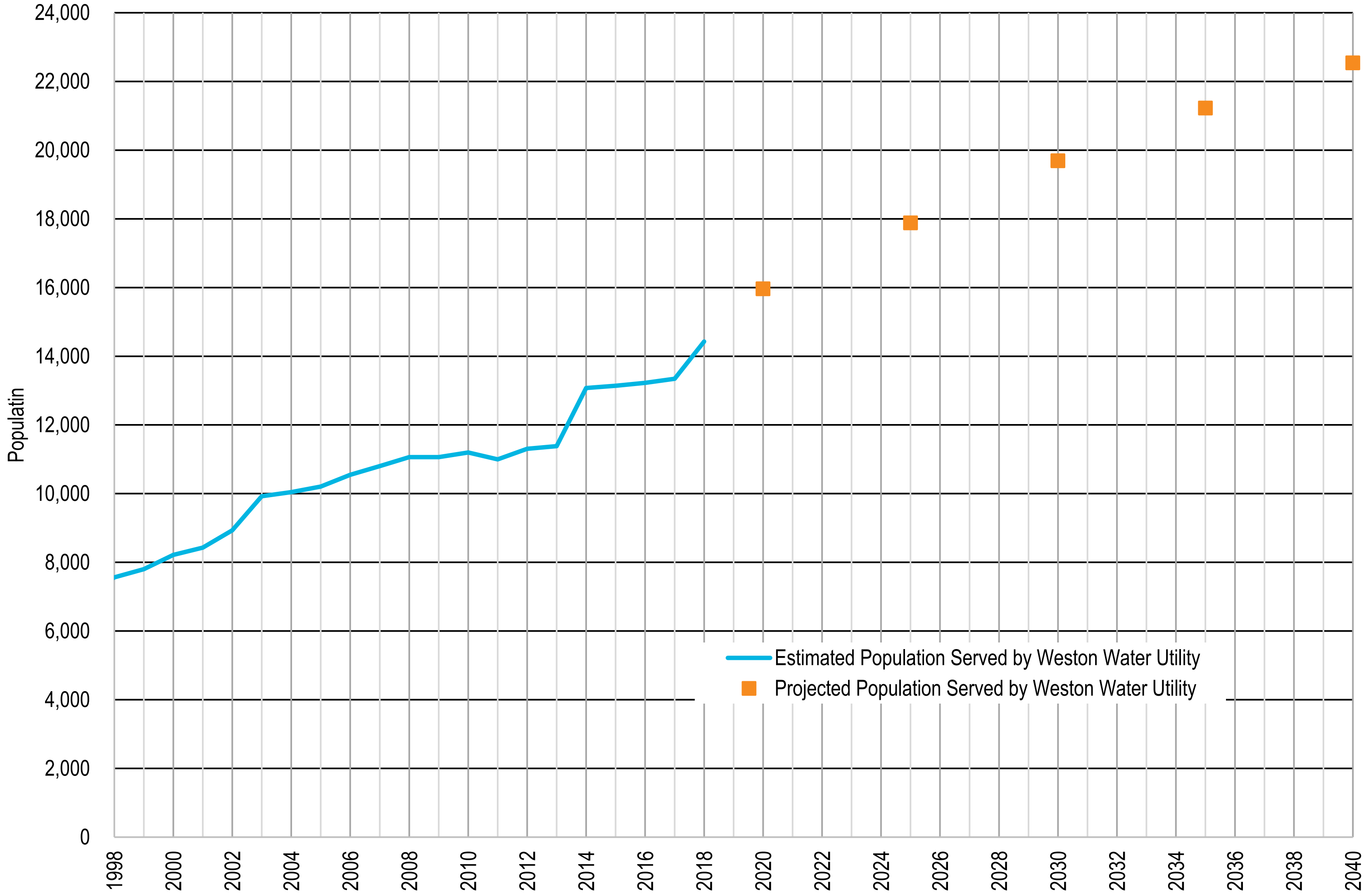
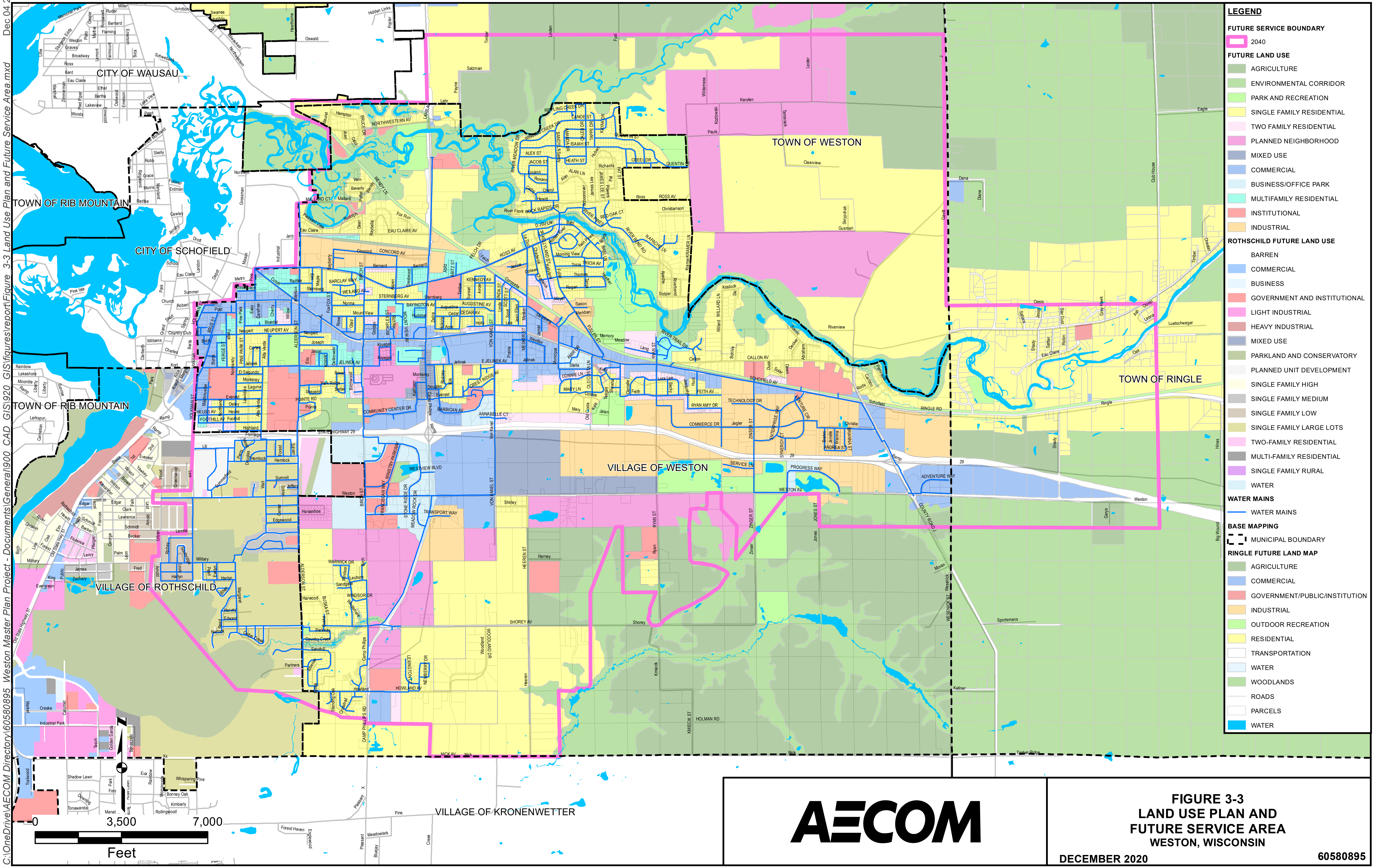


FIGURE 3-2: ESTIMATED PROJECTED POPULATION SERVED BY WESTON WATER UTILITY

C:\OneDrive\AECOM Directory\60580895 Weston Master Plan Project - Documents\General\900_CAD_GIS\920_GIS\figures\report\Figure 3-3 Land Use Plan and Future Service Area.mxd Dec 04 2020 - 10:



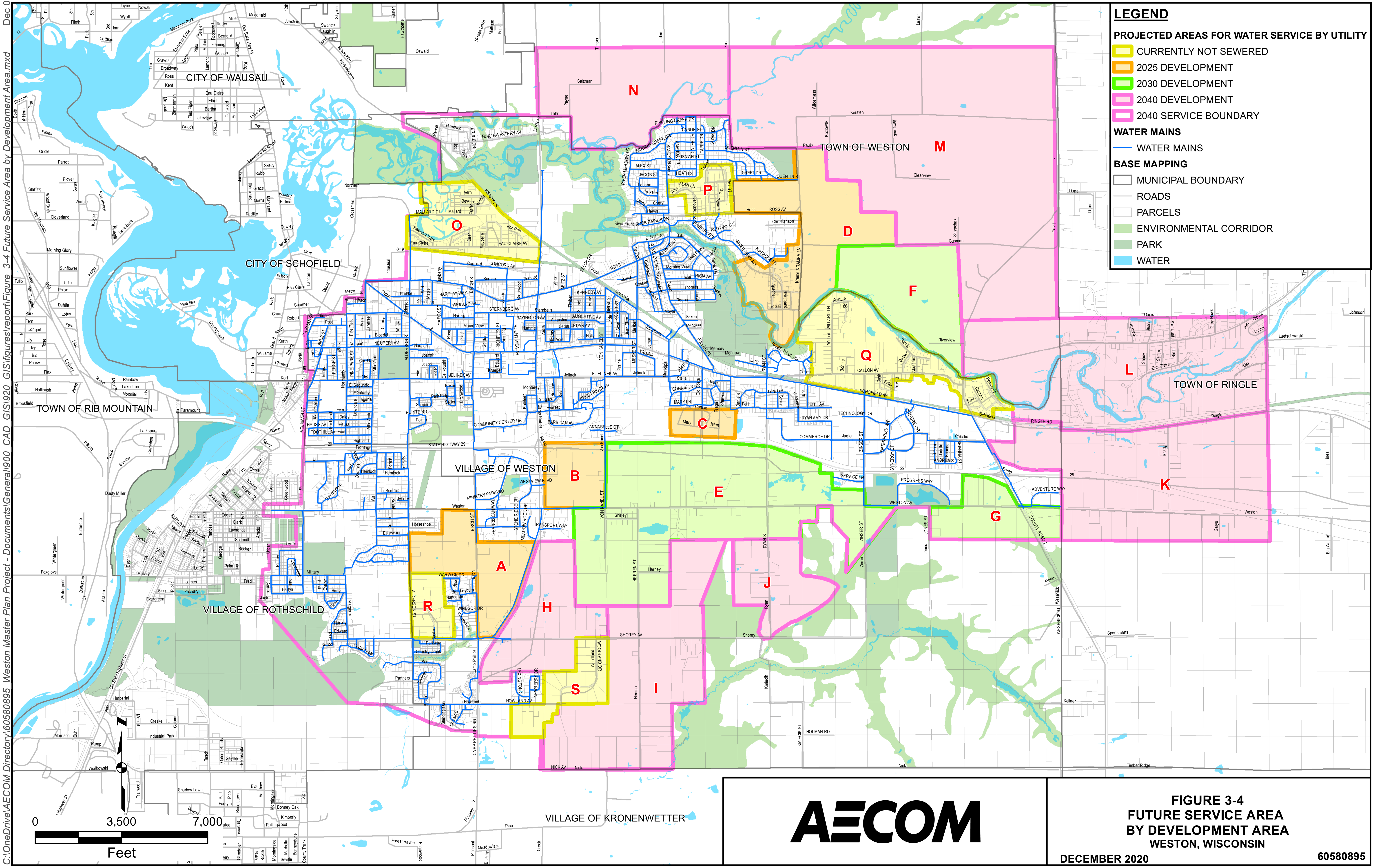
AECOM

FIGURE 3-3
LAND USE PLAN AND
FUTURE SERVICE AREA
WESTON, WISCONSIN

DECEMBER 2020

60580895

C:\OneDrive\AECOM Directory\60580895 Weston Master Plan Project - Documents\General\900_CAD_GIS\920_GIS\figures\report\Figure 3-4 Future Service Area by Development Area.mxd Dec 04 2020 -



LEGEND

PROJECTED AREAS FOR WATER SERVICE BY UTILITY

- 🟨 CURRENTLY NOT SEWERED
- 🟧 2025 DEVELOPMENT
- 🟩 2030 DEVELOPMENT
- 🟥 2040 DEVELOPMENT
- □ 2040 SERVICE BOUNDARY

WATER MAINS

- — WATER MAINS

BASE MAPPING

- □ MUNICIPAL BOUNDARY
- — ROADS
- □ PARCELS
- 🟩 ENVIRONMENTAL CORRIDOR
- 🟩 PARK
- 🟦 WATER

AECOM

FIGURE 3-4
FUTURE SERVICE AREA
BY DEVELOPMENT AREA
WESTON, WISCONSIN

DECEMBER 2020

60580895

TABLE 3-4: DEVELOPMENT AREAS ACREAGE BY 2040

Development Area	Percent Developed by 2040[1]	Total Acreage					Acreage Developed by 2040				
		Residential	Commercial	Multi-Family	Public	Industrial	Residential	Commercial	Multi-Family	Public	Industrial
A	85%	231	47				196	40	0	0	0
B	80%		142				0	114	0	0	0.0
C	50%	36					18	0	0	0	0.0
D	80%	490					392	0	0	0	0.0
E	25%	443	260		40	206	111	65	0	10	51.5
F	20%	328					66	0	0	0	0.0
G	30%		31			44	0	9	0	0	13.2
H	15%	302			1	50	45	0	0	0	7.5
I	5%	536					27	0	0	0	0.0
J	15%	17.5			25		3	0	0	4	0.0
K	10%	163.5	142			77	16	14	0	0	7.7
L	5%	911	1		10		46	0	0	1	0.0
M	10%	1643					164	0	0	0	0.0
N	10%	130					13	0	0	0	0.0
O	100% Current Developed Unsewered Areas	89.5		10.5			90	0	11	0	0.0
P		92					92	0	0	0	0.0
Q		293	5		17		293	5	0	17	0.0
R		87					87	0	0	0	0.0
S		167					167	0	0	0	0.0
Total	-	5959.5	628	10.5	93	377	1825	247	11	31	79.9

Footnote:

[1] Source: Village staff.

4.0 Water Requirements

This chapter summarizes historic customer water demands and pumpage over the past 23 years for the entire Weston Water Utility. As described in Chapter 2, the water system is divided into two separate systems 1) Main System and 2) Kerry System. The PSC Annual Report documents water sales and pumpage data as a single Utility; however, the two systems are hydraulically independent of each other. Therefore, the two systems are separated out for demand projections and analysis in the master plan.

Using the historical data and projections for development and growth (Chapter 3), future water requirements have been estimated for the Main System and the Kerry System. Projections of customer demands serve as the basis for capital improvement planning.

4.1 Water Consumption

Generally, a close relationship exists between the total gallons of water pumped, and the gallons of water metered and sold to water utility customers. Total metered water sales are less than the amount of pumpage (and purchased water) due to several factors and the difference is termed non-revenue water (NRW). NRW is summarized in a later section of this chapter.

An analysis was made of past water consumption characteristics by reviewing annual pumpage and water sales records for the period from 1997 to 2019. Average and maximum day water consumption during this period, together with the amount of water sold in each customer category, has been analyzed. Projections of future water requirements are based on the results of this analysis coupled with estimates of population and community growth discussed in Chapter 3.

4.1.1 Metered Water Sales

A summary of historical water sales and pumpage for the entire system is provided in Table 4-1. Over the 22-year period of data summarized in the table; water sales varied from a low of 387 million gallons per year (MGY) in 1997 to a high of 707 MGY in 2018. Total water sales have increased nearly 74 percent since 1997. Total sales have been steadily climbing since 1997, reaching a peak in 2018. Water sales trends are graphically illustrated in Figure 4-1.

The Weston Water Utility water system serves the majority of the Village of Weston's population as well as part of the Village of Rothschild along with 5 customers in the City of Schofield and Town of Rib Mountain. The number of customers served by the Weston Water Utility has increased steadily since 1997. A historical summary of Weston Water Utility customers served is provided in Table 4-2.

As illustrated in Table 4-1 and Table 4-2, residential customers presently account for approximately 87 percent of the Weston Water Utility customers and 30 percent of the total sales. Commercial and multifamily water use in 2019 accounted for approximately 11 percent of the Weston Water Utility customers and 24 percent of total sales. Metered industrial sales and public uses currently account for 2 percent of the Weston Water Utility customers and 46 percent of total pumpage.

4.1.2 Water Pumpage

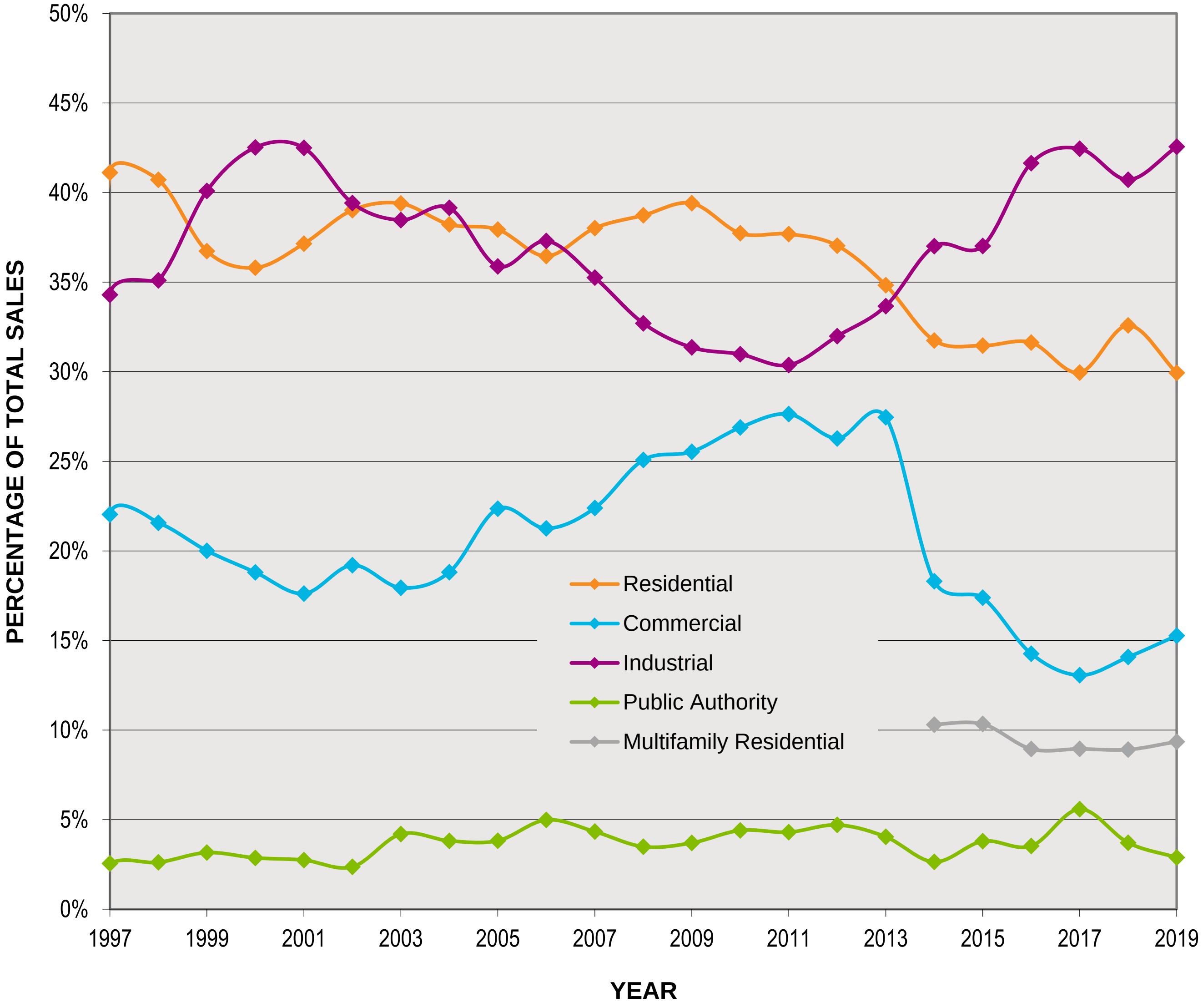
A summary of historical water pumpage (raw) and water purchased from another Utility for the entire system is provided in Table 4-1. Over the last 23 years, the total of water pumpage (raw) and purchased water from Rothschild has varied from a high of 794 MGY in 2016 to a low of 433 MGY in 1997. Since 1997 raw water pumpage (pumped from ground water) has generally been increasing; however, has been steady more recently. For the past 5 years, water sales and raw water pumpage/purchased water averaged approximately 1.9 MGD and 2.1 MGD, respectively. Water sales and raw water pumpage/purchased water trends are graphically illustrated in Figure 4-2.

TABLE 4-1: ENTIRE SYSTEM WATER SALES AND PUMPAGE HISTORY

Year	Annual Water Sales (MGY)								Total Sales (MGY)	Total Pumpage (MGY)	Total Volume Purchased (MGY)	Total Volume Pumped or Purchased (MGY)	Sales to Pumpage Ratio
	Residential		Commercial		Multifamily Residential	Industrial		Public Authority					
	Metered	Unmetered	Metered	Unmetered	Metered	Metered	Unmetered	Metered					
1997	159.10	-	85.27	-	-	132.71	-	9.88	386.96	433.42	0.00	433.42	89.3%
1998	180.19	0.01	95.44	-	-	155.32	-	11.58	442.53	460.53	0.00	460.53	96.1%
1999	174.31	**0.84**	95.39	-	-	191.15	-	15.06	476.74	518.57	0.00	518.57	91.9%
2000	177.61	-	93.27	-	-	208.34	**2.56**	14.20	495.98	526.22	0.00	526.22	94.3%
2001	187.96	-	89.11	0.02	-	214.01	1.02	13.88	506.00	534.94	**16.74**	551.68	91.7%
2002	190.96	-	93.98	-	-	192.88	-	11.56	489.37	536.28	0.00	536.28	91.3%
2003	218.93	-	99.72	-	-	212.58	1.22	23.31	555.76	577.20	6.26	583.46	95.3%
2004	214.97	-	104.85	0.95	-	220.15	-	21.45	562.37	590.78	0.76	591.54	95.1%
2005	237.57	-	138.82	1.17	-	224.70	-	23.94	626.19	648.75	0.00	648.75	**96.5%**
2006	240.64	-	139.47	0.83	-	246.21	-	32.90	660.05	721.51	1.56	723.08	91.3%
2007	248.96	-	145.75	0.88	-	230.87	-	28.35	654.80	746.26	11.11	757.37	86.5%
2008	242.44	-	156.62	0.33	-	204.73	-	21.84	625.95	696.06	11.84	707.90	88.4%
2009	240.32	-	155.40	0.33	-	191.23	-	22.57	609.86	696.34	13.61	709.95	85.9%
2010	218.74	-	152.59	3.29	-	179.60	-	25.50	579.73	655.63	7.58	663.21	87.4%
2011	222.42	-	162.84	0.28	-	179.27	-	25.38	590.18	657.49	12.42	669.91	88.1%
2012	**252.35**	-	174.47	**4.56**	-	217.94	-	32.05	681.36	752.66	0.00	752.66	90.5%
2013	228.68	-	**175.77**	4.49	-	221.00	-	26.52	656.46	726.75	6.03	732.78	89.6%
2014	209.54	-	120.34	0.51	68.00	244.27	-	17.42	660.07	770.72	0.50	771.22	85.6%
2015	218.50	-	117.78	2.98	**71.80**	257.12	-	26.36	694.53	772.68	8.15	780.84	88.9%
2016	213.15	-	94.20	1.91	60.27	280.65	-	23.76	673.94	**792.67**	1.59	**794.26**	84.9%
2017	207.13	-	90.30	0.01	61.86	**293.52**	-	**38.63**	691.45	766.68	3.82	770.50	89.7%
2018	230.48	-	98.38	1.18	63.02	288.03	-	26.23	**707.32**	755.11	0.97	756.07	93.6%
2019	201.64	-	102.06	0.76	62.98	286.64	-	19.43	673.50	723.71	0.00	723.71	93.1%

Maximum value in each category is highlighted blue = 🟦

Footnote: Source PSC Reports, 2019 total volume pumped from EMOR data updated July 2020.



Note: Prior to 2014, multifamily residential water services were reported as commercial.
Source: Weston Water Utility Annual PSC Report.

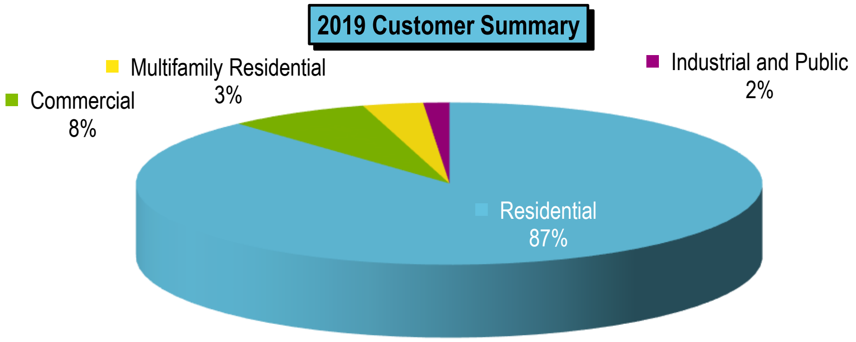
FIGURE 4-1: ENTIRE SYSTEM SALES HISTORY

TABLE 4-2: ENTIRE SYSTEM HISTORICAL NUMBER OF CUSTOMERS SERVED

Year	Number of Customers					Total Customers Served
	Residential	Commercial	Multifamily Residential[1]	Industrial	Public Authority	
1997	2,813	341	-	3	18	3,175
1998	3,041	361	-	3	20	3,425
1999	3,136	358	-	3	20	3,517
2000	3,301	381	-	4	21	3,707
2001	3,386	391	-	5	23	3,805
2002	3,585	403	-	4	23	4,015
2003	3,980	425	-	5	26	4,436
2004	4,028	459	-	4	28	4,519
2005	4,092	466	-	4	28	4,590
2006	4,229	476	-	4	29	4,738
2007	4,330	558	-	4	46	4,938
2008	4,434	578	-	4	46	5,062
2009	4,434	548	-	4	39	5,025
2010	4,488	628	-	4	46	5,166
2011	4,409	615	-	4	44	5,072
2012	4,532	628	-	4	49	5,213
2013	4,563	645	-	4	46	5,258
2014	4,577	416	165	4	39	5,201
2015	4,600	436	166	4	40	5,246
2016	4,624	416	168	21	42	5,271
2017	4,669	406	169	38	30	5,312
2018	5,059	420	179	35	42	5,735
2019	5,055	479	185	49	49	5,817

Footnote:

[1] Prior to 2014, multifamily residential was reported as a part of commercial.



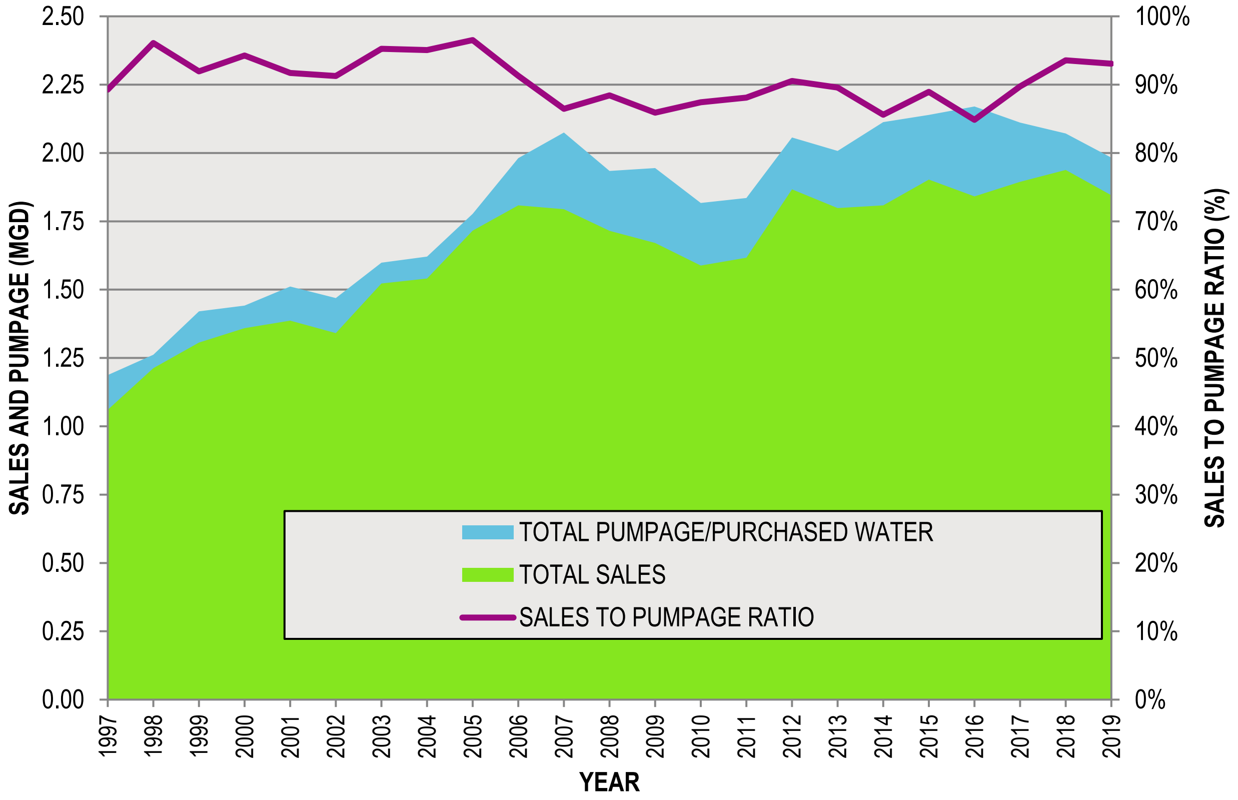


FIGURE 4-2: ENTIRE SYSTEM TOTAL SALES AND PUMPAGE HISTORY

4.1.3 Per Capita Water Usage

Residential, commercial, and public water usage can often be correlated to a community's population. An analysis of per capita water consumption for the entire system for each of those customer classifications was made from the available sales records summarized in Table 4-3. Weston Water Utility per capita trends are illustrated in Figure 4-3.

The Utility's residential per capita consumption has generally declined in the past 10 years, likely due to conservation, ranging from approximately 61 gallons per capita per day (gpcd) to 38 gpcd with an average of 43 gpcd over the last 5 years. This value of residential water use is comparable with other water utilities across Wisconsin as summarized in Table 4-4. To project future water needs a fixed value of 43 gpcd for residential customer was used based on the 5 year average per capita water consumption rate

Commercial per capita consumption by Utility customers has declined slightly over the past 10 years ranging from approximately 31 gpcd to 43 gpcd. Note that multifamily was separated from commercial usage in 2014. For projecting commercial water usage, a fixed value of 33 gpcd was used based on the 5 year average per capita water consumption rate (13 gpcd for multifamily and 20 gpcd for commercial usage). This value of commercial/multi-family water use is comparable with other water utilities across Wisconsin as summarized in Table 4-4.

Public per capita consumption by Utility customers has remained relatively constant from 1997 ranging from approximately 4 gpcd to 9 gpcd. A fixed value of 5 gpcd was used for public demand projections based on the 5 year average public per capita consumption rate. This value of public water use is comparable with other water utilities across Wisconsin as summarized in Table 4-4.

TABLE 4-3: ENTIRE SYSTEM HISTORICAL PER CAPITA CONSUMPTION

Year	Estimated Total Population Served[1]	Gallons per Capita per Day					
		Residential	Commercial	Multifamily Residential	Public	Industrial	Total System
1997	6,990	62.4	33.4	-	3.9	52.0	151.7
1998	7,564	**65.3**	34.6	-	4.2	56.3	160.3
1999	7,802	61.5	33.5	-	5.3	67.1	167.4
2000	8,217	59.1	31.1	-	4.7	**70.3**	165.4
2001	8,430	61.1	29.0	-	4.5	69.9	164.4
2002	8,931	58.6	28.8	-	3.5	59.2	150.1
2003	9,925	60.4	27.5	-	6.4	59.0	153.4
2004	10,045	58.5	28.9	-	5.9	60.0	153.4
2005	10,205	63.8	37.6	-	6.4	60.3	168.1
2006	10,549	62.5	36.4	-	**8.5**	63.9	**171.4**
2007	10,803	63.1	37.2	-	7.2	58.6	166.1
2008	11,064	59.9	38.9	-	5.4	50.7	155.0
2009	11,063	59.5	38.6	-	5.6	47.4	151.0
2010	11,198	53.5	38.1	-	6.2	43.9	141.8
2011	10,997	55.4	40.6	-	6.3	44.7	147.0
2012	11,306	61.0	43.4	-	7.8	52.8	165.1
2013	11,382	55.0	**43.4**	-	6.4	53.2	158.0
2014	13,077	43.9	25.3	14.2	3.6	51.2	138.3
2015	13,141	45.6	25.2	**15.0**	5.5	53.6	144.8
2016	13,225	44.0	19.9	12.5	4.9	58.1	139.6
2017	13,345	42.5	18.5	12.7	7.9	60.3	142.0
2018	14,428	43.8	18.9	12.0	5.0	54.7	134.3
2019	14,474	38.2	19.5	11.9	3.7	54.3	127.5

Footnote:

[1] Estimated population served based on Village of Weston and Village of Rothschild customers served outlined in Table 3-2.

Maximum Value = 🟦

4.1.4 Non-Revenue Water

Non-revenue water (NRW) is the difference between total pumpage and total sales. The total metered water sales are generally less than the volume of pumped water due to several factors including but not limited to:

- Unmetered water usage for maintenance purposes such as hydrant flushing, fire protection and water main repairs
- Inaccuracies in water metering devices
- Leakage within the distribution system

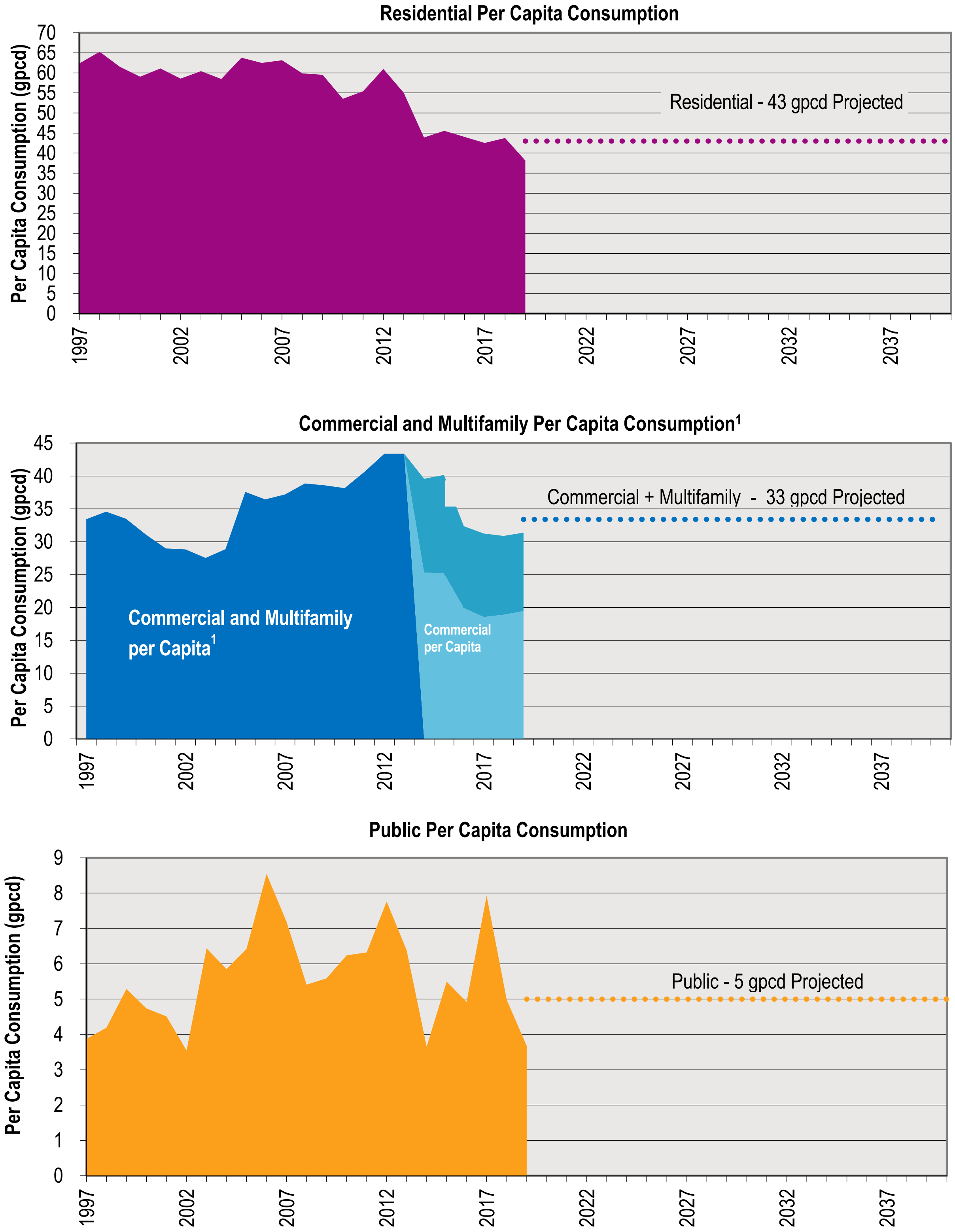


FIGURE 4-3: ENTIRE SYSTEM HISTORICAL PER CAPITA CONSUMPTION

Footnote:

Multi-family sales were included in commercial sales prior to 2014.

TABLE 4-4: UTILITY PER CAPITA CONSUMPTION COMPARISONS

Utility Name	Estimated 2019 Population	Total Pumpage	Residential Per Capita Consumption	Commercial Per Capita Consumption	Multifamily Per Capita Consumption	Public Per Capita Consumption
Ashwaubenon Water and Sewer Utility	16,880	1259.20 MGY	27 gpcd	54 gpcd	6 gpcd	3 gpcd
Beaver Dam Water Utility	16,928	719.45 MGY	35 gpcd	16 gpcd	10 gpcd	2 gpcd
Bellevue Water Utility	15,556	407.14 MGY	28 gpcd	13 gpcd	15 gpcd	0 gpcd
Brown Deer Water Public Utility	12,246	442.37 MGY	39 gpcd	17 gpcd	25 gpcd	2 gpcd
Chippewa Falls Department of Public Utilities	14,168	891.39 MGY	36 gpcd	18 gpcd	5 gpcd	14 gpcd
Darboy Joint Sanitary District No 1	14,114	290.14 MGY	38 gpcd	9 gpcd	2 gpcd	0 gpcd
Hudson Public Utilities	14,094	724.32 MGY	45 gpcd	27 gpcd	9 gpcd	4 gpcd
Kaukauna Utilities	16,278	416.57 MGY	38 gpcd	9 gpcd	3 gpcd	2 gpcd
Platteville Water and Sewer Utility	12,569	285.72 MGY	23 gpcd	10 gpcd	6 gpcd	12 gpcd
River Falls Municipal Utility	15,835	387.17 MGY	29 gpcd	9 gpcd	5 gpcd	7 gpcd
Stoughton Water Utility	12,911	490.53 MGY	42 gpcd	9 gpcd	7 gpcd	1 gpcd
Verona Water Utility	12,442	431.48 MGY	45 gpcd	22 gpcd	9 gpcd	5 gpcd
Village of Allouez Water Department	13,793	398.95 MGY	40 gpcd	9 gpcd	1 gpcd	13 gpcd
Village of Plover Municipal Water Utility	13,298	574.00 MGY	34 gpcd	13 gpcd	13 gpcd	1 gpcd
Village of Whitefish Bay Water Utility	14,050	396.33 MGY	47 gpcd	11 gpcd	0 gpcd	1 gpcd
Waunakee Water and Light Commission	13,855	443.52 MGY	48 gpcd	6 gpcd	5 gpcd	2 gpcd
City of Baraboo Water Utility	12,023	625.79 MGY	37 gpcd	15 gpcd	9 gpcd	5 gpcd
City of Fort Atkinson Water Utility	12,437	660.74 MGY	40 gpcd	14 gpcd	6 gpcd	1 gpcd
Village of Greendale Water Utility	14,366	384.97 MGY	41 gpcd	6 gpcd	13 gpcd	1 gpcd
City of Hartford Utilities	15,578	546.85 MGY	40 gpcd	7 gpcd	5 gpcd	4 gpcd
Menasha Electric and Water Utilities	17,510	691.96 MGY	26 gpcd	7 gpcd	2 gpcd	2 gpcd
City of Menomonie Water Department	16,330	694.42 MGY	28 gpcd	15 gpcd	8 gpcd	11 gpcd
City of Oconomowoc Utilities	17,212	552.02 MGY	45 gpcd	23 gpcd	8 gpcd	0 gpcd
Weston Water Utility	**15,630**	**715.85 MGY**	**35 gpcd**	**18 gpcd**	**11 gpcd**	**3 gpcd**

NRW is comprised of unbilled authorized consumption and water losses (apparent and real losses). The documentation of NRW in the PSC reports has become more detailed over the past 23 years as summarized in Table 4-5.

As summarized in the table, the most recent 5 years of water sales to pumpage ratio for the entire system is approximately 85 percent to 94 percent. Authorized system uses have ranged from approximately 7.7 MGY to 16.1 MGY over the last 5 years. Unknown/not accounted for water has ranged from approximately 0.2 MGY to 99.1 MGY in the past 5 years. Non-revenue water was projected at 10 percent of entire system pumpage as discussed with Utility staff for the planning period and all NRW was assumed to be in the Main System.

4.1.5 Industrial Water Usage

Industrial water consumption can vary widely on an annual basis depending on the types of industries served and the annual level of production activity. Fluctuations in water consumption for a particular industrial firm can be attributed to several factors including:

- Changes in production schedules or operational capacity.
- Changes in manufacturing processes.
- Changes in the number of persons employed.
- Addition or deletion of product lines.
- Seasonal variation in cooling requirements.
- Seasonal changes in business activity.
- Implementation of conservation measures

The Weston Water Utility supplies water to a large industrial user, Kerry. The Kerry system is separate from the Main System as discussed in Chapter 2. As shown in Table 4-6, the Kerry water usage has remained relatively constant over the past 7 years. The total demand from EMOR and PSC data (pumpage and purchased water) and the billing records (sales) are relatively consistent for 2014, 2015, and 2017. Pumpage is lower than actual sales in 2018 and 2019 which may be related to the meter accuracy.

The past five years of billing data for Kerry has ranged from approximately 473 gpm to 492 gpm excluding 2016 which is suspect to be an error. Therefore, for planning purposes, the Kerry average day demand was selected as 490 gpm.

Figure 4-4 illustrates the daily water usage data for the Kerry water system for reference for peaking factors and seasonal variation; however, note that Utility personnel indicated the EMOR data is recorded manually by the operators and may not be consistently recorded at the same time each day.

As shown in Appendix C, review of the 2019 historical daily pumpage records for Well 2 (Kerry) indicates that days surrounding the recorded top 4 high pumpage days are below the monthly average which is indicative that the daily pumpage may not have been recorded over a 24 hour period. The highest recorded pumpage day in 2019 was approximately 660 gpm however, the fifth next highest daily pumpage was approximately 590 gpm which is approximately 1.3 times the average pumpage for the year.

TABLE 4-5: SUMMARY OF NON-REVENUE WATER

Year	Total Sales (MGY)	Total Pumpage (MGY)	Sales to Pumpage Ratio	Non-Revenue Water (MGY)								Percent of Non-Revenue Water
				Treatment Process	Authorized System Uses	Water Losses (Real and Apparent)					Total Non-Revenue Water	
						Main Leaks or Breaks	Services Leaks or Breaks	Hydrant Leaks, Overflows, PRVS	Unknown/ Not Accounted For	Subtotal Water Losses		
1997	387.0	433.4	89.3%	-	25.95	-	-	-	20.51	20.51	46.46	10.7%
1998	442.5	460.5	96.1%	-	6.67	-	-	-	11.33	11.33	18.00	3.9%
1999	476.7	518.6	91.9%	-	12.51	-	-	-	29.32	29.32	41.82	8.1%
2000	496.0	526.2	94.3%	-	12.09	-	-	-	18.16	18.16	30.25	5.7%
2001	506.0	551.7	91.7%	-	14.35	-	-	-	31.33	31.33	45.68	8.3%
2002	489.4	536.3	91.3%	-	11.18	-	-	-	35.73	35.73	46.91	8.7%
2003	555.8	583.5	95.3%	-	11.74	-	-	-	15.97	15.97	27.71	4.7%
2004	562.4	591.5	95.1%	-	15.95	-	-	-	13.23	13.23	29.17	4.9%
2005	626.2	648.7	**96.5%**	-	12.82	-	-	-	9.74	9.74	22.55	3.5%
2006	660.1	723.1	91.3%	-	16.16	-	-	-	46.87	46.87	63.03	8.7%
2007	654.8	757.4	86.5%	-	21.17	-	-	-	81.40	81.40	102.57	13.5%
2008	626.0	707.9	88.4%	11.57	8.58	1.30	0.02	**0.05**	60.43	61.80	81.95	11.6%
2009	609.9	709.9	85.9%	**12.96**	9.83	0.23	-	-	77.07	77.30	100.09	14.1%
2010	579.7	663.2	87.4%	9.67	11.03	0.75	-	-	62.03	62.78	83.48	12.6%
2011	590.2	669.9	88.1%	11.42	6.80	0.25	-	-	61.26	61.51	79.73	11.9%
2012	681.4	752.7	90.5%	11.45	5.10	0.40	-	-	54.35	54.75	71.30	9.5%
2013	656.5	732.8	89.6%	4.37	6.77	0.50	0.10	-	64.58	65.18	76.32	10.4%
2014	660.1	771.2	85.6%	4.12	**83.73**	1.00	**1.70**	-	20.60	23.30	111.15	14.4%
2015	694.5	780.8	88.9%	-	7.70	0.60			73.35	73.95	81.65	10.5%
2016	673.9	**794.3**	84.9%	-	14.00	1.00			**99.09**	**100.09**	**114.09**	**14.5%**
2017	691.5	770.5	89.7%	-	16.12	1.00			56.11	57.11	73.24	9.6%
2018	**707.3**	756.1	93.6%	-	12.65	**30.53**			0.17	30.70	43.35	5.8%
2019	673.5	723.7	93.1%	-	12.50	25.00			4.85	29.85	42.35	6.9%

TABLE 4-6: KERRY SYSTEM DEMAND

Year	Well 2 (Kerry) Pumpage[1,2] (MGD)	Purchased from Rothschild[3] (MGD)	Total Kerry System Demand		Billing Records[4,5]
			MGD	gpm	
2013	0.63	0.02	0.65	450 gpm	408 gpm
2014	0.65	0.00	0.65	449 gpm	450 gpm
2015	0.68	0.02	0.70	489 gpm	492 gpm
2016	0.66	0.01	0.67	465 gpm	351 gpm
2017	0.68	0.01	0.69	481 gpm	480 gpm
2018	0.62	0.01	0.63	434 gpm	473 gpm
2019	0.66	0.00	0.66	460 gpm	485 gpm

Footnotes:

[1] Includes the Rib Mountain WWTP usage.

[2] Source: Wisconsin DNR EMOR Data.

[3] Source: Weston Water Utility Annual PSC Report.

[4] Source Weston customer billing data for Meters 401600, 401700, 411500.

[5] 2016 value of 351 gpm is suspected error in data.

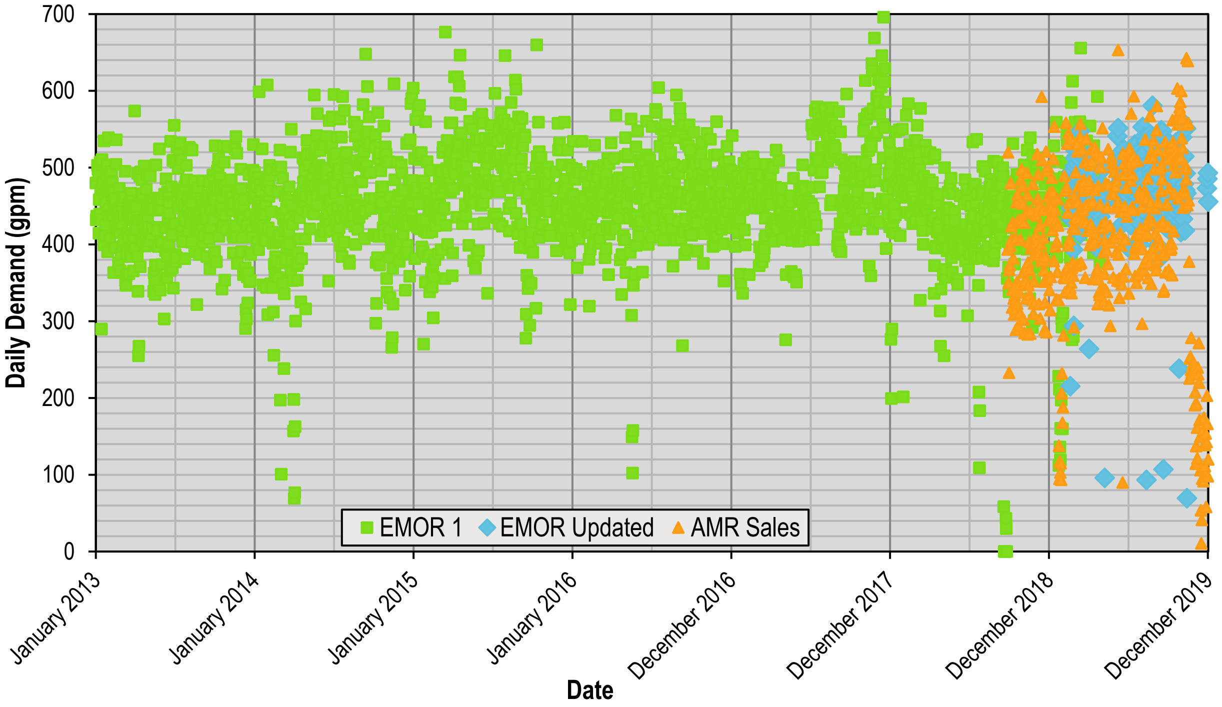


FIGURE 4-4: HISTORICAL DAILY KERRY WATER SYSTEM USAGE

Footnotes:

[1] Source: Historical EMOR pumpage records and daily AMR readings.

[2] AMR data sums readings from Meters 401600, 401700, 411500.

[3] EMOR pumpage totals includes total Kerry System pumpage. EMOR data updated July 2020. AMR sales data totals only Kerry (customer) demand.

4.2 Variations in Customer Demands and Pumpage

Seasonal pumpage, system maximum day pumpage, and hourly demand fluctuations are important factors in the design and sizing of water supply and storage facilities.

4.2.1 Seasonal Pumpage Variations

Seasonal fluctuations in water usage are important factors in the design and sizing of water supply and storage facilities. The seasonal nature of water consumption in the Weston Water Utility water system can be demonstrated by an analysis of monthly pumpage variations. The Village of Weston's monthly pumpage variations in 2019 for the entire system are presented in Table 4-7.

In 2019, the maximum monthly pumpage of approximately 72.4 MG occurred in June, while the minimum monthly pumpage approximately 50.7 MG occurred in January. The Utility's average monthly pumpage in 2019 was approximately 60 MG.

4.2.2 Entire System Maximum Day Pumpage

Table 4-8 summarizes the average and maximum day pumpage for the entire system for each year from 1997 to 2019. A statistical analysis was performed of historical maximum day pumpage ratios. Three time periods were analyzed; the entire period of 1997 to 2019, the latest 10-year period from 2010 to 2019 and the latest 9-year time period from 2011 to 2019.

The last 9 years were analyzed due to the 2010 maximum day ratio (2.00) included in the 10-year time period being 2.00 which is the second highest maximum day factor in the 23 year period and significantly higher than the other maximum day factors. As noted previously, the daily pumpage records are recorded manually by operator and not necessarily at the same time each day; therefore, this data may be erroneous.

Table 4-9 summarizes the results of this analysis, and also includes an analysis of calculated maximum day pumpage ratios for various statistical confidence levels. For example, based on the analysis of the data from 2010 to 2019, there is statistically an 80 percent chance in any given year that the actual maximum day pumpage ratio will be less than or equal to 177 percent. Conversely, there is statistically a 20 percent chance the actual ratio will exceed 177 percent.

To evaluate future water supply and storage needs, a maximum day pumpage ratio of 188 percent is recommended for the entire system which provides a statistical confidence level of approximately 99 percent based on the last 9 years of data, is greater than 90 percent based on the last 10 years of data and greater than 85 percent based on the last 23 years of data.

4.2.3 Kerry System Maximum Day Pumpage

Table 4-10 summarizes the average and maximum day pumpage for each year from 2013 to 2019 for the Kerry System. Similar to the entire system, a statistical analysis was performed of historical maximum day pumpage ratios for the period from 2013 through 2019 for the Kerry System.

Table 4-11 summarizes the results of this analysis, and also includes an analysis of calculated maximum day pumpage ratios for various statistical confidence levels. For example, based on the analysis of the data from 2013 to 2019, there is statistically an 80 percent chance in any given year that the actual maximum day pumpage ratio will be less than or equal to 143 percent. Conversely, there is statistically a 20 percent chance the actual ratio will exceed 143 percent.

TABLE 4-7: SEASONAL PUMPAGE VARIATIONS

Month	Monthly Pumpage	Percentage of Total Pumpage	Percentage of Average Pumpage
January	50.67 MG	7.0%	84.0%
February	50.84 MG	7.0%	84.3%
March	55.82 MG	7.7%	92.6%
April	53.79 MG	7.4%	89.2%
May	68.29 MG	9.4%	113.2%
June	72.35 MG	10.0%	120.0%
July	70.27 MG	9.7%	116.5%
August	72.10 MG	10.0%	119.6%
September	60.82 MG	8.4%	100.9%
October	57.33 MG	7.9%	95.1%
November	56.56 MG	7.8%	93.8%
December	54.88 MG	7.6%	91.0%
Total	723.71 MG	100.0%	
Footnote: Monthly pumpage based on EMOR data updated July 2020.			

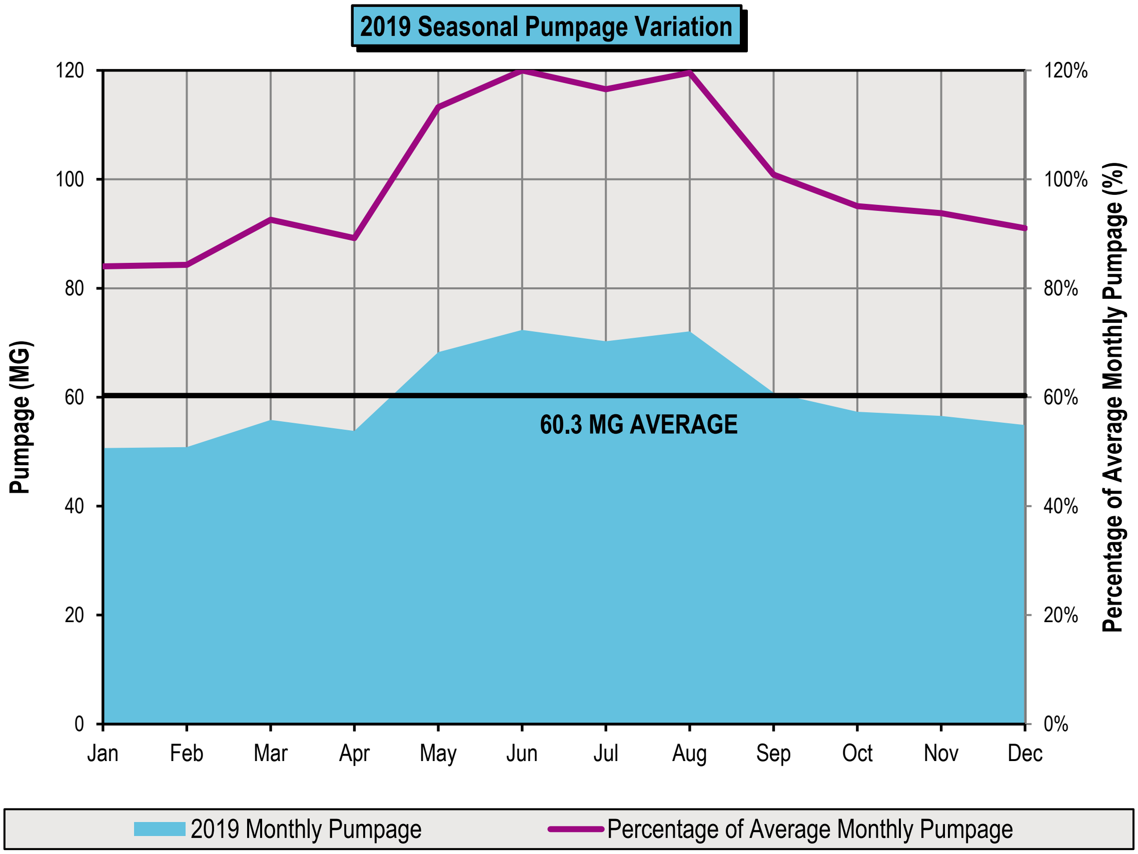


TABLE 4-8: ENTIRE SYSTEM DAILY PUMPAGE VARIATIONS

Year	Average Day Pumpage (MGD)	Maximum Day Pumpage (MGD)	Date of Maximum Day	Ratio of Maximum to Average Day
1997	1.19	1.82	8-Aug	1.53
1998	1.26	2.34	27-Jul	1.86
1999	1.42	2.40	21-Jun	1.69
2000	1.44	2.06	6-May	1.43
2001	1.51	2.62	15-Jul	1.73
2002	1.47	2.71	14-Jul	1.85
2003	1.60	2.72	26-Aug	1.70
2004	1.62	2.63	25-Jul	1.62
2005	1.78	3.62	14-Jul	2.04
2006	1.98	3.89	18-Jul	1.97
2007	2.07	3.50	23-Jul	1.69
2008	1.93	3.41	20-Aug	1.76
2009	1.95	3.51	8-Jul	1.81
2010	1.82	3.63	24-May	2.00
2011	1.84	3.00	7-Jun	1.64
2012	2.06	3.61	8-Jul	1.75
2013	2.01	3.13	20-Aug	1.56
2014	2.11	3.28	28-Feb	1.55
2015	2.13	3.51	30-Jul	1.65
2016	2.15	2.98	17-Jul	1.38
2017	2.10	3.00	23-Jul	1.43
2018	2.06	3.65	8-Jul	1.77
2019	1.96	3.00	26-Jun	1.51

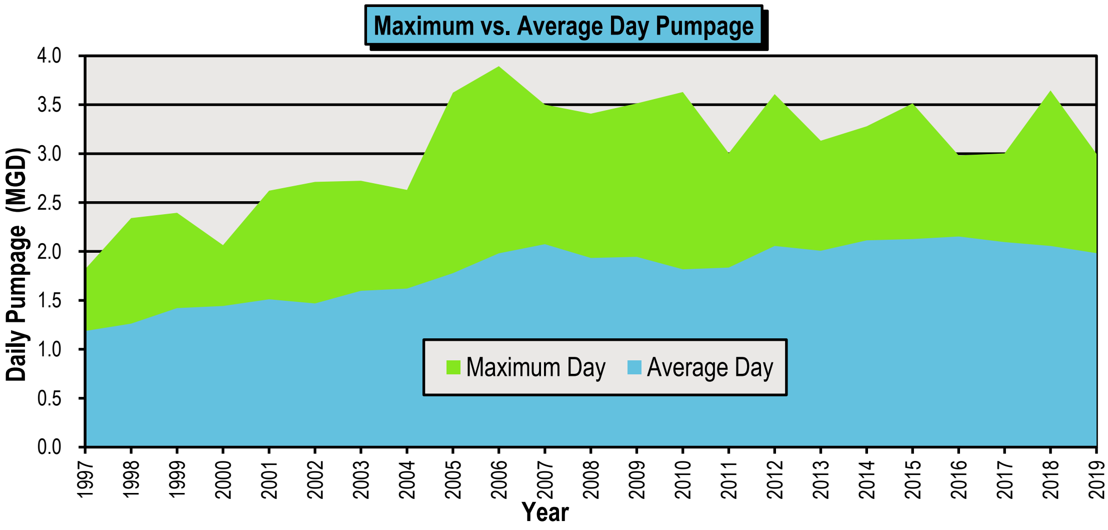
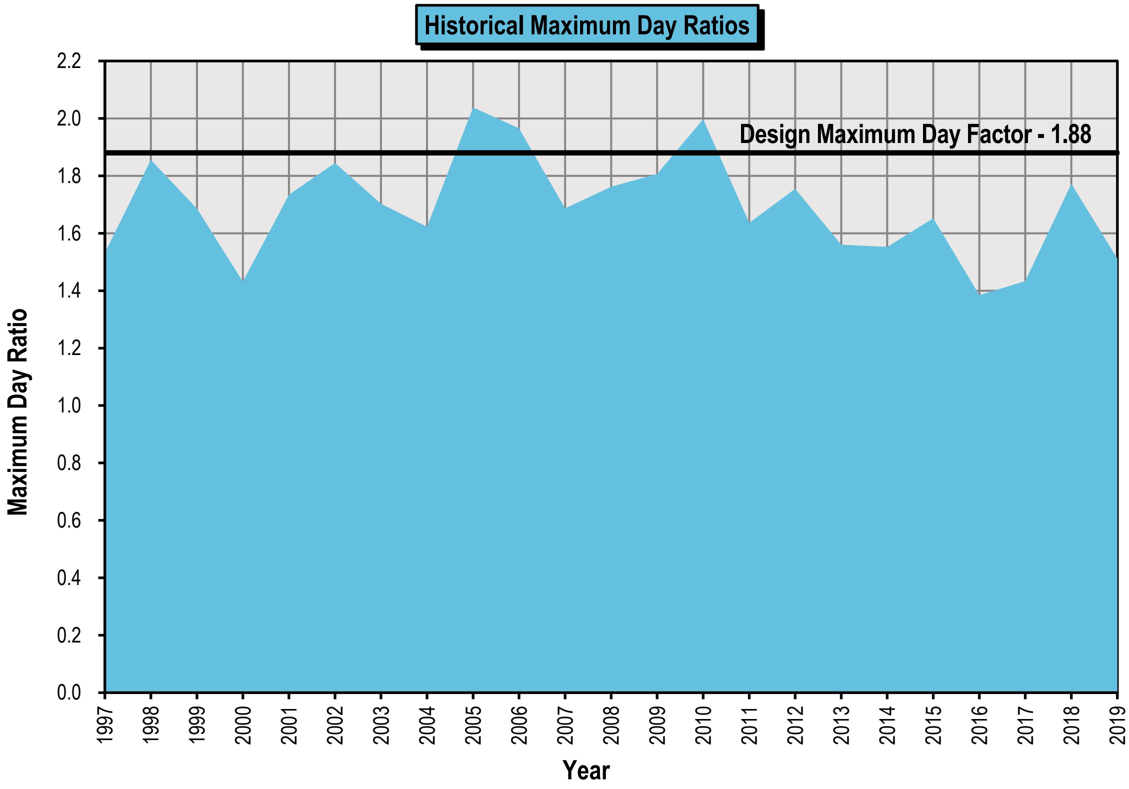


TABLE 4-9: ENTIRE SYSTEM STATISTICAL ANALYSIS: RATIO OF MAXIMUM TO AVERAGE DAY DEMAND

	1997 to 2019	**2010 to 2019**	**2011 to 2019**
Number of years of Data	23	10	9
Maximum Ratio - Maximum to Average Day Pumpage	203.8%	199.7%	177.3%
Minimum Ratio - Maximum to Average. Day Pumpage	138.5%	138.5%	138.5%
Average Ratio Maximum to Average Day Pumpage	169.2%	162.6%	158.4%
Standard Deviation	17.5%	17.2%	12.5%
Confidence Level (%)	**Ratio of Maximum to Average Day Pumpage**	**Ratio of Maximum to Average Day Pumpage**	**Ratio of Maximum to Average Day Pumpage**
80 percent	184%	177%	169%
85 percent	187%	180%	171%
90 percent	192%	185%	174%
95 percent	198%	191%	179%
98 percent	205%	198%	184%
99 percent	210%	203%	188%

Notes:

The "Confidence Level" represents the probability (%) that in any given year, the actual ratio of maximum to average day pumpage will be less than or equal to the ratio indicated in the table. The ratios in the table were determined based on a statistical analysis of historical ratios over each period of analysis, assuming a normal distribution.



Maximum day pumpage volumes for the Kerry System have been relatively consistent over the last 10 years; however, as noted in Section 4.1.5, daily pumpage records may be erroneous as operators manually record the data each day but not necessarily at the same time To evaluate future water supply and storage needs, a maximum day pumpage ratio of 149 percent is recommended which provides a statistical confidence level of approximately 95 percent based on the last 7 years of data.

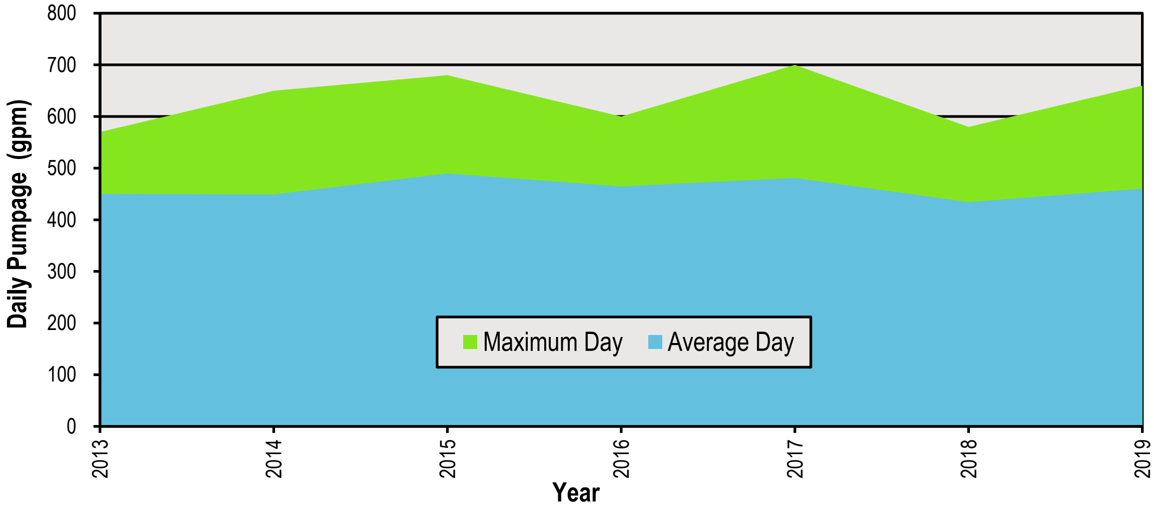
TABLE 4-10: KERRY SYSTEM DAILY PUMPAGE VARIATIONS

Year	Average Day Pumpage (gpm)[1]	Maximum Day Pumpage (gpm)[2]	Date of Maximum Day	Ratio of Maximum to Average Day
2013	450	570	31-Mar	1.27
2014	449	650	13-Sep	1.45
2015	490	680	15-Mar	1.39
2016	465	600	17-Jul	1.29
2017	481	700	16-Dec	1.46
2018	434	580	11-Feb	1.34
2019	460	660	14-Mar	1.43

Footnotes:

[1] Well 2 Historical EMOR Pumpage Records and purchased water from Rothschild (Source: PSC).

[2] Source: EMOR data (used pumpage data for average usage to be consistent with data source for maximum day usage). Note daily pumpage records are recorded manually by operators not necessarily at the same time each day.



4.2.4 Main System Maximum Day Pumpage

For demand project purposes, the maximum day demand for the Main System was estimated based on the maximum day demand of the entire system as summarized in Table 4-12. As shown the maximum day factor for the Main System was based on the design maximum day factor of the entire system and assumes an average daily demand from Kerry on that day. This assumption is conservative; however, based on a review of available data the maximum recorded day for Kerry does not typically coincide with the entire system maximum day demand. Therefore, subtracting the Kerry average day demand from the entire system maximum day demand yields an estimate of approximately 2,100 gpm for an estimated Main System maximum day demand which equates to a maximum day factor of 2.36 times the average day demand of the Main System for planning purposes.

TABLE 4-11: KERRY SYSTEM STATISTICAL ANALYSIS RATIO OF MAXIMUM DAY TO AVERAGE DAY DEMAND

	2013 to 2019
Number of years of Data	7
Maximum Ratio - Maximum to Average Day Pumpage	145.5%
Minimum Ratio - Maximum to Average. Day Pumpage	126.6%
Average Ratio Maximum to Average Day Pumpage	137.4%
Standard Deviation	7.1%
Confidence Level (%)	**Ratio of Maximum to Average Day Pumpage**
80 percent	143%
85 percent	145%
90 percent	147%
95 percent	149%
98 percent	152%
99 percent	154%
Notes:	
The "Confidence Level" represents the probability (%) that in any given year, the actual ratio of maximum to average day pumpage will be less than or equal to the ratio indicated in the table. The ratios in the table were determined based on a statistical analysis of historical ratios over each period of analysis, assuming a normal distribution.	

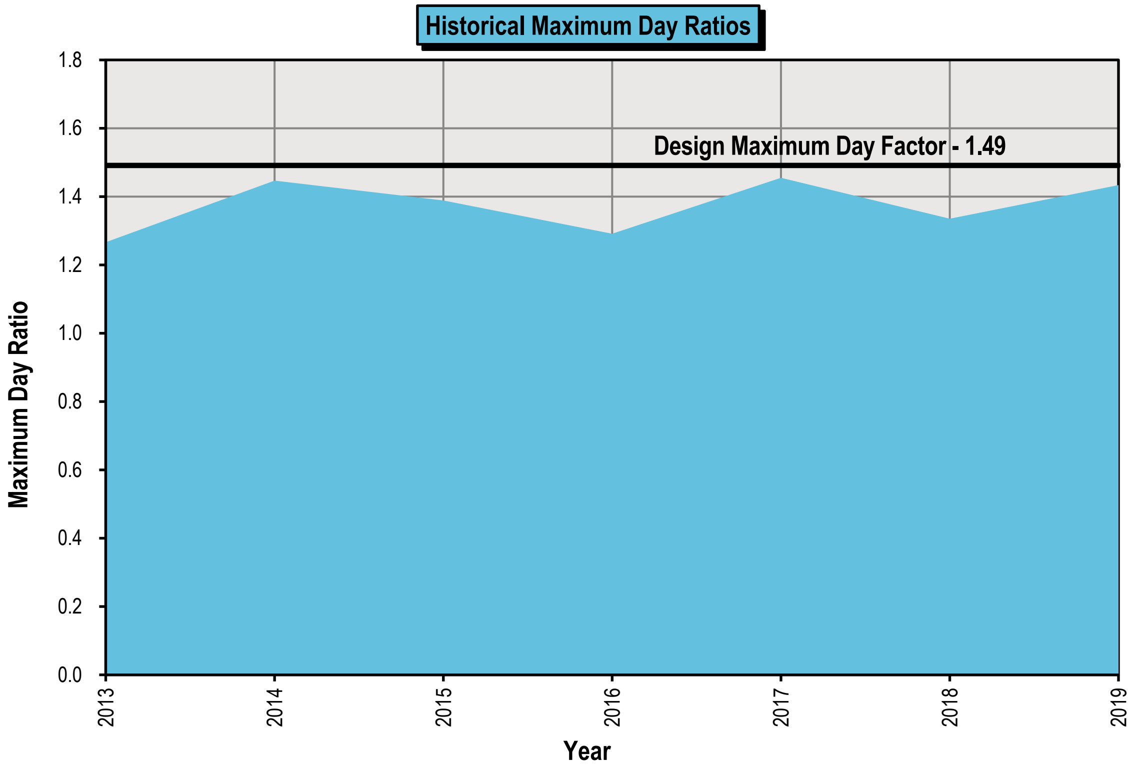


TABLE 4-12: MAIN SYSTEM MAXIMUM DAY FACTOR

[A]	Existing, Entire System Maximum Day Demand[1]	2,590 gpm
[B]	Existing, Estimated Usage on Maximum Day by Kerry[2]	490 gpm
[C]	Existing, Main System Maximum Day Demand ([A]-[B]=[C])	2,100 gpm
[D]	Existing, Entire System Average Day Demand[3]	1,380 gpm
[E]	Existing, Kerry Average Day Demand	490 gpm
[F]	Existing, Main System Average Day Demand ([D]-[E]=[F])	890 gpm
[G]	Existing, Main System Maximum Day Factor [C]/[F]=[G]	2.36

Footnotes:

[1] Entire System maximum day based on maximum day factor of 1.88.

[2] Conservative for design purposes. Equivalent to Kerry average day. In discussion with Kerry staff, Kerry demand does not fluctuate significantly with season, therefore is expected to be consistent throughout the year.

[3] Source: EMOR data updated 2020.

4.2.5 Hourly Demand Fluctuations

The hour-to-hour variation of customer demands is also an important characteristic used to evaluate water supply and storage requirements. As with maximum day demands, peak hour demand is often expressed as a ratio of peak hour to average day demand for the year. Peak hour demand is simply the hour of maximum demand that occurs on the maximum day.

AECOM used an American Water Works Association (AWWA) standard time of day (TOD) demand curve to determine daily demand variations for the Weston Water Utility as illustrated in Figure 4-5. Based upon this analysis the design peak hour demand ratio for the Main System was estimated to be 1.60 times the maximum day demand or 3.78 times average day demand.

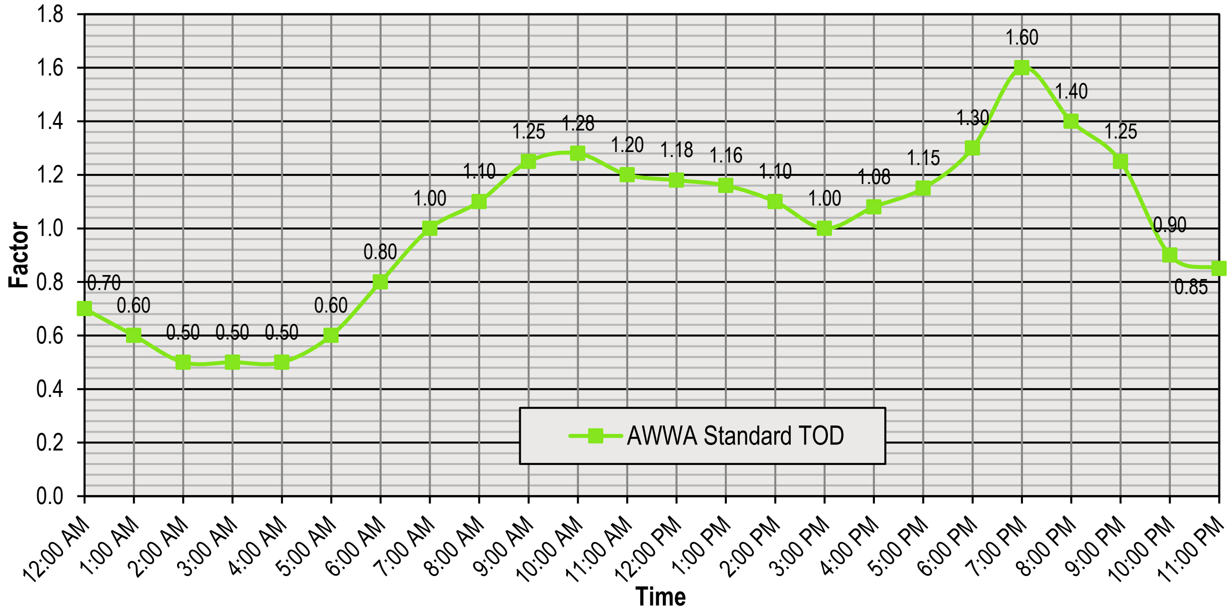


FIGURE 4-5: TIME OF DAY DEMAND CURVE

4.3 Water Consumption and Pumpage Projections

Future sales and pumpage projections are based on assumptions of water demand, coupled with estimates of future population and community growth presented in Chapter 3. A detailed summary of the individual components of projected water sales and pumpage requirements is provided in Table 4-13.

4.3.1 Main System

As summarized in Table 4-13, non-industrial sales include residential, commercial, multi-family, and public water consumption. Projections for the individual categories are based on historical 5-year average per capita demands for each category and future population projections for the Utility presented in Chapter 3.

4.3.1.1 Residential Sales

Total residential sales are projected to be approximately 263 MGY in 2025 and approximately 352 MGY by 2040. Based on projections, residential water sales will account for approximately 34 percent of total water sales in the entire system by 2040.

4.3.1.2 Public Sales

By the year 2040, it is estimated that public sales will be approximately 42 MGY, or approximately 4 percent of total annual sales of the entire system.

4.3.1.3 Commercial and Multifamily Sales

Total annual sales to commercial and multifamily customers in the Main System are expected to reach approximately 273 MGY by 2040, or approximately 26 percent of total annual sales of the entire system.

4.3.1.4 Industrial Sales

Existing industrial sales were assumed to remain constant over the planning period, remaining at approximately 47 MGY and accounting for approximately 6 percent of total sales by 2040 of the entire system.

4.3.1.5 Future Industrial Growth

Village planning representatives anticipate a certain amount of industrial development to support projected future community and regional growth in population. Future growth areas are identified in Figure 3-4 and Table 3-4, illustrating 80 undeveloped acres planned for industrial growth.

Industrial acres per parcel were calculated based on the existing land use map provided in Chapter 3. Total existing acres zoned industrial were calculated to be approximately 866 acres containing approximately 176 parcels. Future industrial usage was projected to be 8.5 gpm per customer based on average Class AB municipality industrial usage data provided by the PSC. Assuming one customer per parcel, future industrial sales were calculated to be approximately 74 MGY by 2040, accounting for approximately 9 percent of future sales of the entire system. It will be necessary to review, and revise water needs projections during future planning efforts based on the actual types of industrial developments that may occur.

4.3.2 Kerry System

Kerry is not anticipated to have additional water usage over the planning period. In discussions with Kerry staff, additional water usage associated with future growth is expected to be offset by water conservation measures. Therefore, the Kerry system water usage is projected to remain constant over the planning period at approximately 258 MGY.

4.4 Summary of Total Demands and Pumpage Requirements

The total annual metered sales projections previously summarized in Table 4-13 were based on a summation of water sales projections for each major customer classification. An allowance was also made for unmetered miscellaneous water usage and losses (unaccounted-for water) to arrive at total pumpage projections.

TABLE 4-13: WATER SALES AND PUMPAGE PROJECTIONS

Customer Classification	Actual 2019	Projected 2025	Projected 2030	Projected 2040
Served by Weston Water Utility (Total)	14,474	16,624	18,584	22,503
Estimated Village of Weston[1]	12,688	14,767	16,621	20,330
Estimated Village of Rothschild[2]	1,786	1,858	1,963	2,173
Non-Industrial Sales				
Residential Sales				
Per Capita Sales (gpcd)	38.2	43.0	43.0	43.0
Annual Sales (gpm)	380	500	550	670
Commercial Sales				
Per Capita Sales (gpcd)	19.5	20.4	20.4	20.4
Annual Sales (gpm)	190	240	260	320
Multifamily Residential				
Per Capita Sales (gpcd)	11.9	13.0	13.0	13.0
Annual Sales (gpm)	120	150	170	200
Public Sales				
Per Capita Sales (gpcd)	3.7	5.0	5.0	5.0
Annual Sales (gpm)	40	60	65	80
Total Non-Industrial Sales (gpm)	**730**	**950**	**1,045**	**1,270**
Industrial Sales (without Kerry)				
Existing Industrial User Sales (gpm)	90	90	90	90
Future Sales[3] (gpm)	--	0	110	140
Total Main System Sales (gpm)	**820**	**1,040**	**1,245**	**1,500**
Non-Revenue Water[4] (gpm)	100	170	190	220
Total Main System Pumpage (gpm)	**920**	**1,210**	**1,435**	**1,720**
Kerry System Pumpage[5] (gpm)	**460**	**490**	**490**	**490**

Footnotes:

[1] Assumed that 100 percent of population growth through 2040 for the Village of Weston will be served by the Village of Weston, and that the existing population currently not served by the Village of Weston will be 100 percent served by 2040.

[2] Assumed that 100 percent of population growth through 2040 for the Village of Rothschild will be supplied water by the Village of Weston.

[3] Industrial sales based on percent of industrial acreage to be developed, assuming 5 acres parcels (based on current Village of Weston data), and 8.5 gpm/customer for usage (based on PSC Class AB industrial data).

[4] Non-revenue water was projected at 10 percent of entire system pumpage for projections.

[5] Estimated based on EMOR Pumpage Records and AMR billing data for 2013-2019.

Table 4-14 summarizes Main System and Kerry System projections of future water needs for average day, maximum day, and peak hour demands. Figure 4-6 illustrates the annual water sales projections by customer sector for the planning period.

Main System average day demand is anticipated to grow from the existing design demand of approximately 890 gpm to approximately 1,720 gpm by 2040. Main System maximum day demand is anticipated to grow from the existing design demand of approximately 2,100 gpm to approximately 4,060 gpm by 2040.

TABLE 4-14: FUTURE PUMPAGE PROJECTION

	Design 2019	Projected 2025	Projected 2030	Projected 2040
Main System				
Average Day Demand (gpm)	890	1,210	1,435	1,720
Maximum Day Demand (gpm)[1]	2,100	2,860	3,380	4,060
Peak Hour Demand (gpm)[2]	3,360	4,580	5,410	6,500
Kerry System[3]				
Average Day Demand (gpm)	490	490	490	490
Maximum Day Demand (gpm)[4]	730	730	730	730

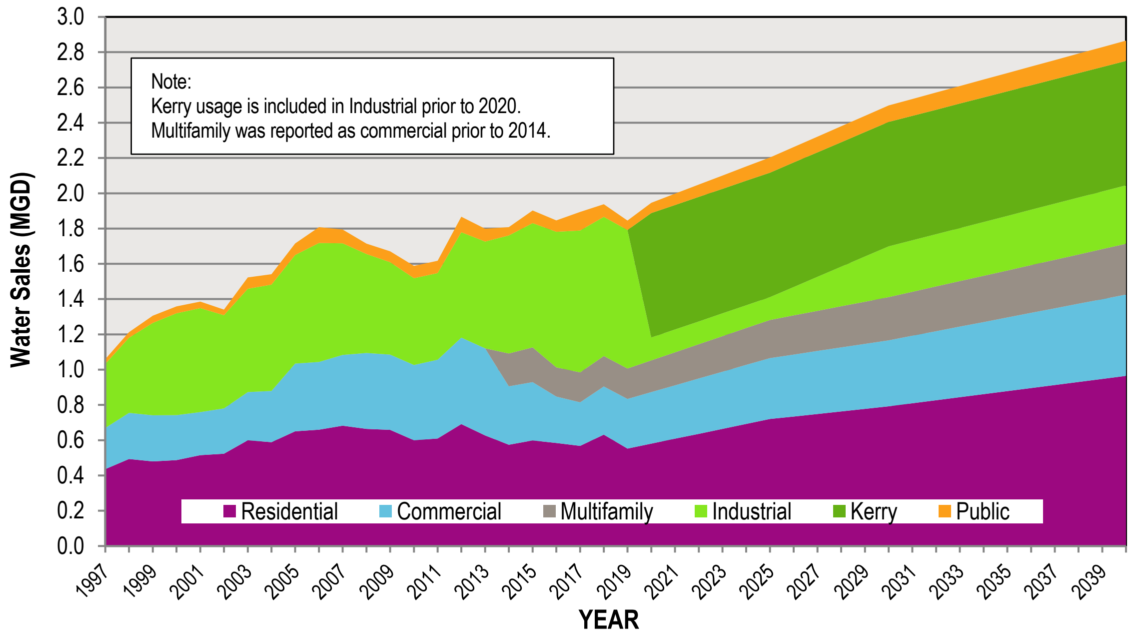
Footnotes:

[1] Design maximum day demand projections for the Main System were estimated using a ratio of maximum day to average day demand of 236 percent.

[2] Design peak hour demand was estimated using a ratio of peak hour to maximum day of 160 percent for the total system (AWWA M31 standard time of day pattern).

[3] Kerry System demands estimated based on historical EMOR pumpage records and billing data and a meeting with Kerry personnel indicating additional expansion will be offset by water conservation measures.

[4] Design maximum day demand projections for the Kerry System were estimated using a ratio of maximum day to average day demand of 149 percent for Kerry.



Note:
Kerry usage is included in Industrial prior to 2020.
Multifamily was reported as commercial prior to 2014.

FIGURE 4-6: ANNUAL WATER SALES PROJECTIONS BY CUSTOMER SECTOR

5.0 Water Supply and Storage

A critical step in the water system evaluation for the Weston Water Utility is an assessment of water supply and storage requirements which are closely related. The primary criteria used in determining required supply rates and storage volumes include maximum and peak water demands, operational characteristics, and fire protection needs. Water supply facilities are designed to meet maximum day demands, and storage facilities are needed to meet fire protection, peak hour demand, and other reserve storage needs. Water supply facilities need to supply maximum day demand, or on consecutive maximum days, water storage will be depleted, and supply facilities may not be able to meet water demands.

For the Weston Water Utility, the supply and storage evaluations were completed for the Main System and the Kerry System as summarized in the following sections.

5.1 Water Supply Analysis

5.1.1 Reliable Supply Capacity

It is frequently necessary to take pumps and/or treatment equipment out of service for periods of several days to several weeks for maintenance; therefore, the reliable supply capacity is the total available delivery rate with the largest pumping unit or unit of treatment process equipment out of service as stated in Wisconsin Administrative Code.

For evaluating a municipal water system, reliable supply capacity should equal or exceed maximum day pumpage requirements, assuming adequate storage is available. When this criterion is met, supply facilities will have adequate capacity to replenish storage during off-peak hours, while depletion of available storage occurs during peak demand hours.

5.1.1.1 Main System

For the Main System, reliable supply capacity was evaluated for the following requirements:

- Well Capacity
- Treatment Capacity
- Booster Pumping Capacity

Reliable well pumping capacity is the capacity of the supply wells to reliably supply maximum day demands. Reliable booster pumping capacity is the capacity of the high lift booster pumps in conjunction with the supply wells to reliably supply maximum day demands. Reliable treatment capacity is the capacity of the treatment plant in conjunction with the supply wells to reliably supply maximum day demands.

Table 5-1 summarizes the total and reliable water well capacity and the booster pumping capacities used for the Main System reliable supply evaluation.

As discussed in Chapter 2 and illustrated in Figure 2-2., although there is a single air stripper with a capacity of approximately 2,400 gpm the air stripper has a bypass such that the air stripper is not a single point of failure as Well 3 and Well 4 have not had raw water VOCs above regulatory standards since 1990 (i.e. air stripper is not needed for compliance). Therefore, the treatment capacity is not the limiting factor for reliable supply capacity.

The Main System wells can reliably supply approximately 2,500 gpm (3.60 MGD) and the wells and booster pumps can reliably supply approximately 3,070 gpm (4.42 MGD). Therefore, the reliable well pumping capacities are the limiting factor in determining Main System supply needs.

TABLE 5-1: EXISTING RELIABLE SUPPLY CAPACITY – MAIN SYSTEM

Water Supply Source	Supply Capacities[1]	
	(gpm)	(MGD)
Groundwater Wells		
Alta Verde (Well 1)	510	0.73
Mesker (Well 3)	730	1.05
Sternberg (Well 4)	840	1.21
Bloedel (Well 5)	800	1.15
Rippling Creek (Well 6)	460	0.66
Total Pumping Supply Capacity	**3,340**	**4.81**
Less: Largest Supply Unit	840	1.21
Reliable Supply of Groundwater Wells	**2,500**	**3.60**
Groundwater Wells with Booster Pumps		
Alta Verde (Well 1)	510	0.73
Booster Pump 1	1,300	1.87
Booster Pump 2	1,300	1.87
Bloedel (Well 5)	800	1.15
Rippling Creek (Well 6)	460	0.66
Total Pumping Supply Capacity	**4,370**	**6.29**
Less: Largest Supply Unit	1,300	1.87
Reliable Supply of Groundwater Wells with Booster Pumps	**3,070**	**4.42**

Footnote:

[1] Supply capacities from three month average of EMOR daily readings as illustrated in Appendix D. Mesker capacity updated post rehabilitation in June 2020.

The reliable water supply capacity evaluation for the current design maximum day and 2025, 2030, and 2040 projected maximum day demands for the Main System is summarized in Table 5-2.

The tables summarize the maximum day demand requirement and the available reliable water supply (well) capacity. The Main System currently has adequate capacity as the reliable well pumping capacity exceeds existing design maximum day demand by approximately 400 gpm. However, the reliable well pumping capacity is projected to be deficient by approximately 360 gpm in 2025 with the deficiency increasing to approximately 1,560 gpm by 2040.

5.1.1.2 Kerry System

The Kerry System has a single well (Well 2) and an emergency connection to the Village of Rothschild water system as summarized in Table 5-3.

Currently, Well 2 (Kerry) has adequate capacity to meet existing and projected average day demand for the Kerry System; however, Well 2 (Kerry) does not have adequate capacity to meet design maximum day demand projected using a 1.49 maximum day factor based on the statistical analysis in Chapter 4.

The Kerry water system can be reliably supplied from the connection to Rothschild. As shown in Appendix F, data provided in the 2019 PSC Report for the Rothschild Municipal Water Utility indicates there is adequate supply available to provide water to the Kerry system as the reliable well capacity is approximately 3 MGD and maximum day demand was approximately 1 MGD (without Kerry in 2019) .

TABLE 5-2: EXISTING RECOMMENDED SUPPLY CAPACITY – MAIN SYSTEM

	2019 Existing	2025 Projected	2030 Projected	2040 Projected
Total Average Annual Pumpage (MGY)	470	640	750	900
Average Day Pumpage (gpm)	890	1,210	1,435	1,720
Design Maximum Day Pumpage (gpm)[1]	2,100	2,860	3,380	4,060
Existing Reliable Supply Capacity (gpm)	2,500	2,500	2,500	2,500
Additional Capacity Required (gpm)	**None**	**360**	**880**	**1,560**
Reliable Capacity in Excess of Maximum Day Demand	**400**	**None**	**None**	**None**

Footnote:

[1] Design maximum day pumpage requirements were based on a Main System maximum day factor of 2.36.

TABLE 5-3: SUPPLY CAPACITY - KERRY SYSTEM

Water Supply Sources	**Supply Capacities**	
	(gpm)	**(MGD)**
Supply Sources		
Well 2 (Kerry)[1]	640	0.92
Emergency Connection to Village of Rothschild[2]	730	1.05
Total Supply Capacity	**1,370**	**1.97**
Less: Largest Supply Unit	730	1.05
Reliable Supply	**640**	**0.92**

Recommended Supply Capacity	**Existing**	**2040 Projection[3]**
Average Day Pumpage	490 gpm	490 gpm
Design Maximum Day Pumpage	730 gpm	730 gpm

Footnotes:

[1] As provided by Weston Water Utility staff, after June 2020 rehabilitation.

[2] The connection to the Village of Rothschild has supplied the Kerry water system in the past; therefore, it is assumed the available capacity is equal to the historical usage. Total well capacity for the Rothschild Water Utility is 3,350 gpm (PSC), 2018 average day demand was 500 gpm (PSC) and maximum day demand was 1,150 gpm (PSC).

[3] As discussed in Chapter 4, Kerry does not anticipate an increase in water demand in the future.

Based on hydraulic modeling results from the Rothschild system, as shown in Appendix F, approximately 2,000 gpm is hydraulically available at approximately 41 psi; therefore, it is assumed that the capacity available from Rothschild in an emergency is adequate to meet the estimated existing and future projected maximum day demand. Note no formal agreement between the Weston Water Utility and the Rothschild Water Utility that indicates the amount of water to be supplied to Kerry in the event water is needed.

Using the current and projected average day demand of 490 gpm, Well 2 can supply to a maximum day factor of approximately 1.30. As discussed in Chapter 4, there is uncertainty in the maximum day pumpage records for Weston as daily pumpage records are based on manual reads at the wells which is not necessarily completed at the same time each day (refer to Appendix C for 2019 daily pumpage records).

In addition, as noted in Appendix E and based on discussion with Kerry personnel, seasonal water use has been relatively consistent, as Kerry's operations are 24/7.

5.2 Water Storage Needs

In addition to providing water for fire protection, system storage is used as a "cushion" to equalize fluctuations in customer demands, establish and maintain water system pressures, provide operational flexibility for water supply facilities, and improve water supply reliability. The primary criteria used in this study for evaluating storage volume needs includes average and peak demands, water supply capacities, and fire protection needs.

In general, storage facilities should be adequately sized to provide sufficient quantities of water for fire protection on days of maximum customer demands. Peak hour demands and reliable supply capacities will change as the Utility grows and improvements are implemented.

Figure 5-1 illustrates general categories of system storage. As customer demands exceed supply capacities during peak hour conditions, these excess demands must be met by depleting available storage. The amount of storage depleted is referred to as equalizing storage for peak hour requirements. Storage should also be available for fire protection purposes. To assure a reliable supply for fire protection, this fire protection storage should not be utilized to meet peak hour requirements.

In some instances, it may be desirable to provide additional reserve storage for other purposes. Reserve storage may be needed as a safety factor in emergencies or where customer demands are unpredictable and fluctuate widely. Additional storage may also be desired where the Utility wishes to take advantage of off-peak electrical rates for pumping. Additional reserve storage of approximately 10 to 15 percent is usually provided to allow for a variety of operational parameters.

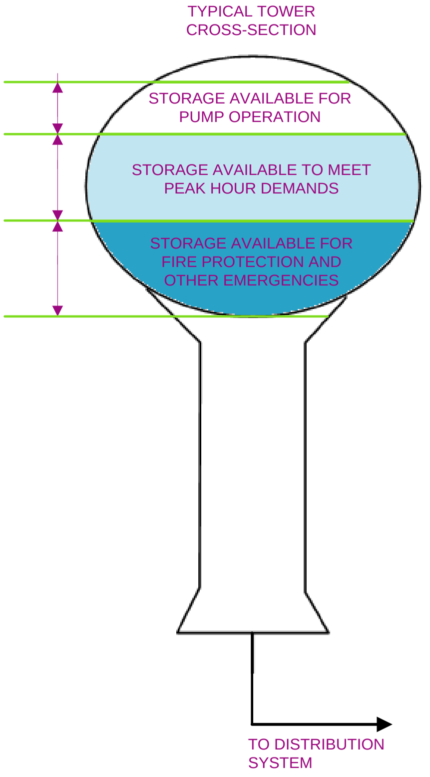


FIGURE 5-1: DISTRIBUTION SYSTEM STORAGE REQUIREMENTS

Three primary criteria were used to develop a relationship between supply capacities and optimum storage volumes for the Weston Water Utility:

- Reliable supply capacity should at least equal projected maximum day pumpage requirements.
- Total available storage should be capable of meeting fire protection needs, assuming reliable supply capacity is just adequate to meet maximum day requirements. A fire flow of 3,500 gpm for three hours was used.
- Where reliable system capacity exceeds maximum day demands, the excess reliable system capacity may offset total storage requirements in the following ways:
    - Peak Hour Equalization Storage: If reliable system capacity is greater than maximum day demand requirements.
    - Fire Protection Storage: Equal to the excess reliable system capacity which exceeds the peak hour demand requirements for the duration of the maximum fire flow requirement for the pressure zone.

For the Weston Water Utility, fire flow requirements were assigned by land use classification served as shown in Table 5-4.

TABLE 5-4: FIRE FLOW REQUIREMENTS

Land Use	Fire Flow Requirement
Agriculture and Environmental Corridor (Undeveloped land)	500 gpm
Park and Recreation	1,000 gpm
Single Family Residential	1,000 gpm
Planned Neighborhood	1.000 gpm
Two Family Residential	1,750 gpm
Multi-Family Residential	2,500 gpm
Commercial and Mixed Use	2,500 gpm
Institutional	3,500 gpm
Business Park/Office Park	3,500 gpm
Industrial	3,500 gpm
Source: Provided by Utility personnel and referencing the available ISO requirement data provided in Appendix G.	

For areas with multiple property types, the property with the highest fire flow need was assigned to that area. To evaluate the capacity of the water system to provide fire protection, the available flow at each fire hydrant throughout the water system was estimated using the hydraulic model as discussed in Chapter 6.

5.2.1 Main System Storage Requirements

Table 5-5 summarizes the existing and projected storage needs for the Main System for the Utility. The total available storage for the Main System is approximately 0.85 MG. The estimated existing and projected 2040 optimum water storage requirements for the Main System, assuming a fire flow requirement of 3,500 gpm for three hours, are approximately 1.19 MG and 1.62 MG respectively. Therefore, currently there is a deficiency in storage of approximately 0.34 MG which is projected to grow to approximately 0.77 MG by 2040.

Currently, as shown in Table 5-5, there is approximately 400 gpm of reliable water supply in excess of the design maximum day demand which can be used to offset a portion of the storage deficiency. With current excess reliable supply, an additional 0.28 MG can be credited as peak hour equalization storage in the Main System. Therefore, there is a shortfall in storage of approximately 0.06 MG currently; however, as demands increase the ability to offset storage capacity with excess reliable supply will be reduced.

Currently, the towers in the Main System are not being filled resulting is additional storage shortfalls. Based on the current Main System well set points outlined in Chapter 2, approximately 0.2 MG of storage is currently not used.

TABLE 5-5: EXISTING STORAGE REQUIREMENTS – MAIN SYSTEM

SUPPLY REQUIREMENTS	**Design Existing**	**Projected 2025**	**Projected 2030**	**Projected 2040**
Design Average Day Demand (gpm)	890	1,210	1,435	1,720
Design Maximum Day Demand (gpm)	2,100	2,860	3,380	4,060
Design Peak Hour Demand (gpm)	3,360	4,580	5,410	6,500
Present Reliable Supply Capacity (gpm)	**2,500**	**2,500**	**2,500**	**2,500**
Reliable Supply Capacity in Excess of Maximum Day Demand (gpm)	**400**	**None**	**None**	**None**

STORAGE REQUIREMENTS	**Design Existing**	**Projected 2025**	**Projected 2030**	**Projected 2040**
Peak Hour Equalizing Requirements (gallons) [1]	384,000	523,000	619,000	743,000
Optimum Fire Protection Needs (gallons) [2]	630,000	630,000	630,000	630,000
Operational/Reserve Storage (gallons; 15% of Total) [3]	179,000	204,000	221,000	243,000
Total Optimum Storage Requirements (gallons)	**1,193,000**	**1,357,000**	**1,470,000**	**1,616,000**
Available Effective Storage Capacity (gallons):				
Business Park Tower	500,000	500,000	500,000	500,000
Everest Tower	250,000	250,000	250,000	250,000
Summit Tower	100,000	100,000	100,000	100,000
Total Effective Storage Capacity	**850,000**	**850,000**	**850,000**	**850,000**
Subtotal Capacity Required (gallons)	**343,000**	**507,000**	**620,000**	**766,000**
Excess Available Reliable Main System Supply Capacity				
Peak Hour Supply Capacity for Peak Hour Equalization[4]	**285,000**	**None**	**None**	**None**
Supply Capacity in Excess of Peak Hour for Fire Protection	**None**	**None**	**None**	**None**
Total Additional Capacity Required (gallons)	**58,000**	**507,000**	**620,000**	**766,000**

Footnotes:

[1] Peak hour storage is storage required to meet demands which exceed the maximum day demand rate assuming the reliable supply capacity is equal to the maximum day demand rate.

[2] Optimum fire protection based on requirement for 3,500 gpm for 180 minutes.

[3] Operational/Reserve storage is storage required to provide a start/stop range for pump operation and an emergency reserve storage supply.

[4] Peak hour supply capacity cannot exceed peak hour equalization and is calculated utilizing time of day demand curve and supply capacity.

5.2.2 Kerry System Storage Requirements

The storage evaluation for the Kerry System indicates that the current system is slightly deficient, however there are many factors that affect the analysis. Fire protection for Kerry is supplied by Rothschild, therefore is not included. Peak hour equalizing volume was estimated as 10 percent of maximum day demand due to hourly data of the Kerry water system usage not being available. Based on discussions with Kerry staff, Well 2 runs nearly 20 hours a day, therefore there is little need for operational storage. It is unclear if the Kerry Tower supplies peak hour equalization volumes due to hourly usage data not being available. The Kerry Tower does provide surge protection for the Kerry system.

TABLE 5-6: EXISTING STORAGE REQUIREMENTS – KERRY SYSTEM

Storage Capacity	Existing and Future
STORAGE REQUIREMENTS	
Peak Hour Equalizing Requirements (gallons)[1]	105,130
Optimum Fire Protection Needs (gallons)[2]	-
Operational/Reserve Storage (gallons; 15% of Total)[3]	18,870
Total Optimum Storage Requirements (gallons)	124,000
Total Effective Storage	
Kerry Tower (gallons)	100,000
Subtotal Capacity Required (gallons)	24,000

Footnotes:

[1] Peak hour storage is storage required to meet demands which exceed the maximum day demand rate assuming the reliable supply capacity is equal to the maximum day demand rate. Estimated at approximately 10 percent of maximum day demand.

[2] Weston Water Utility does not provide fire protection.

[3] Operational/Reserve storage is storage required to provide a start/stop range for pump operation and an emergency reserve storage supply.

5.3 Supply Reliability

For any water utility to serve its customers and protect the public welfare, water system facilities, equipment, and distribution systems must be reliable under all operating conditions. Reliability of utility service comprises a large part of the investment in plant and equipment. Wisconsin Administrative Code, Section NR 811.30, requires all pumping stations to be served by a power supply from at least two independent electrical substations or from a standby, auxiliary power source dedicated to water supply use. As a general rule, the Weston Water Utility should be able to reliably supply average day customer demands and maintain adequate fire protection using auxiliary power sources.

The Weston Water Utility has a standby diesel motor with a power takeoff available at Well 1 (Alta Verde) and standby power generators at Well 3 (Mesker/WTP), Well 4 (Sternberg), Well 5 (Bloedel) and Well 6 (Rippling Creek); therefore, all Main System wells can continue to operate using standby power generators in the event of an emergency or other power interruption. The Weston Water Utility can maintain average day demands with auxiliary sources of power in the event of a power emergency or interruption in the Main System.

Well 2 (Kerry) is equipped with a portable generator receptacle for use in the event of a power interruption; therefore, the well can be operated during a power outage with a portable generator (not automated).

Additional supply reliability was considered, since there is only one river crossing to the north part of the water system. Well 6 (Rippling Creek) is located on the north side of the river and could supply water in the event of a failure at the Ross Avenue river crossing.

5.4 Summary

This chapter summarizes the findings for the water supply and storage evaluation of the Weston Water Utility entire water system. The major findings from this evaluation include the following:

- The existing Main System reliable supply capacity (approximately 3.6 MGD) is currently adequate to meet existing design maximum day demand (3.0 MGD). The existing Main System reliable supply is projected to be deficient by approximately 360 gpm by 2025 and 1,560 gpm by 2040.
- Existing Main System storage is currently deficient by approximately 0.34 MG; however, the deficiency can nearly be completely offset by the excess reliable supply capacity. The current operational strategy of not filling the Main System towers increases this deficiency by approximately 0.2 MG.
- The Main System is projected to have a storage deficiency of approximately 0.77 MG by 2040.
- Well 2 (Kerry) has historically met average and maximum day demand for the Kerry System and the connection with the Village of Rothschild has been able to provide water to the Kerry System when needed.
- With Kerry average day demand being approximately 490 gpm and the statistical maximum day factor of 1.49, Well 2 (Kerry) cannot meet projected Kerry maximum day demand of approximately 730 gpm; however, there is uncertainty in the Well 2 (Kerry) maximum day pumpage data. Well 2 can supply up to a maximum day factor of approximately 1.30.
- No formal agreement exists between the Weston Water Utility and the Rothschild Water Utility based on the amount of water to be supplied to Kerry in the event water is needed.
- The Main System has standby power generators at Well 3 (Mesker/WTP), Well 4 (Sternberg), Well 5 (Bloedel) and Well 6 (Rippling Creek); therefore, has adequate auxiliary power to maintain average day demands and provide fire protection (storage). Note Well 1 (Alta Verde) has a standby generator receptacle.
- Well 2 (Kerry) is equipped with a portable generator receptacle for use in the event of a power interruption. Therefore, the well can be operated during a power outage with a portable generator; however, it is not automated.
- There is currently only one river crossing (pipe) to the north part of the system, however, Well 6 (Rippling Creek) is located in that area and can supply water in the event of an emergency.

6.0 Water Distribution System Evaluation

This chapter summarizes the findings from the existing water distribution deficiency analysis of the Main System for the Weston Water Utility. Recommendations to address the water distribution system evaluation are in Chapter 9.

Water systems are analyzed, planned, and designed primarily through the application of basic hydraulic and water quality principles. Important factors which should be considered when performing this analysis include:

- Location, capacity, and water quality of supply facilities
- Location, sizing, and elevation of storage facilities
- Location, magnitude, and variability of customer demands
- Water system geometry and geographic topography
- Minimum and maximum pressure requirements
- Land use characteristics with respect to fire protection needs
- Operation criteria which promote efficient performance

For this study, an evaluation of the Weston Water Utility Main System was performed to determine the adequacy of the system to supply existing water needs and to supply water for fire protection purposes. The system was evaluated based on the following criteria:

- Pressure
- Flow Capacity
- Headloss and Velocities
- Water Age

The water system evaluation was based on compliance with state code requirements (Wisconsin Administrative Code NR811) and standard water industry engineering practice.

6.1 Water System Hydraulic Model

As part of this project, the water distribution system hydraulic model of the existing Main Water System was updated and calibrated from the geographic information system (GIS) for use in evaluating existing deficiencies and planning future water system growth. The characteristics of the physical water system included in the model are length, installation date, material, and diameter of water mains, pipe roughness coefficients, ground surface elevations, characteristics of pumping and storage facilities, and water demands.

Prior to utilizing a hydraulic model to evaluate a water system, the model must be calibrated. Model calibration is the term given to the adjustment of the model input data, so the hydraulic model accurately simulates measured field conditions and data with an appropriate level of accuracy.

The calibration of the water distribution system hydraulic model was performed under both steady-state simulations (micro calibration) and extended period simulations (EPS) (macro calibration). The steady-state model simulations were performed to replicate the field results from the flow and pressure testing. The extended period model simulations were performed to replicate the results from the extended period flow and pressure monitoring.

Appendix H contains a description of all field work completed and the flow and pressure testing results used for steady-state (micro) calibration. A full description of the model calibration process including the desired accuracy of hydraulic model calibration for the Main System is included in Appendix I. A summary of the model calibration results is also included in Appendix I.

Precise duplication of the field test results at all locations within the water distribution system during calibration of the computer model is not realistic due to the many factors that influence the field test results. The goal of model calibration is to minimize error between the field test data and the model simulations and create a “best fit” at all locations; therefore, some error between the field tests and model simulations is expected. However, limits to the amount of allowable error must also be made to ensure the calibrated model is a reasonably accurate representation of the actual water distribution system.

As summarized in Appendix I for the steady-state (micro) calibration, the Main System hydraulic model calibrates within the desired accuracy for static pressures (99 percent of the data points meet established criteria), pressure differential less than 10 psi (97 percent of the data points meet established criteria), and hydrant flow (100 percent meet criteria).

As documented in Appendix I, the extended period macro calibration meets the criteria established. As a result, the hydraulic model currently provides a reasonably accurate representation of actual system characteristics based on current knowledge of the water system and is adequate to be used for planning purposes.

6.2 Water System Pressures

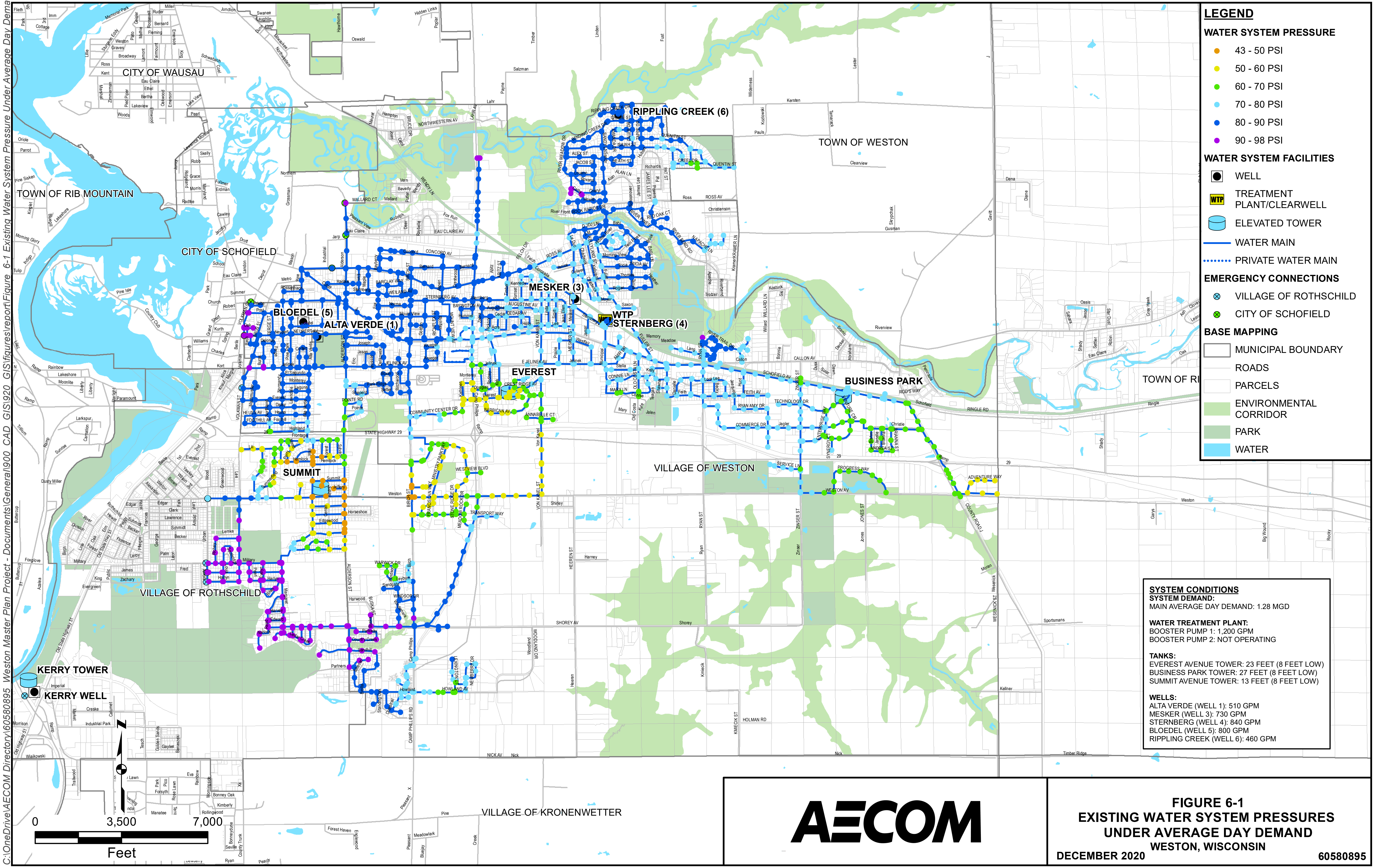
Water system pressures vary around the Weston Water Utility based on differences in topographic elevations, as well as supply rates and customer demands. In general, as customer demands increase, pressures decrease. Areas higher in topographic elevation exhibit lower water system pressures.

The Wisconsin Administrative Code, Chapter NR 811, requires that municipal water systems be designed with a minimum pressure of 35 psi and a maximum pressure of 100 psi at all locations in the service area under normal operating conditions. In addition, water systems are required to be operated so that under emergency conditions (fire flow); the residual pressure in the system will not fall below 20 psi at any location.

Safety and Professional Services (SPS) 382.40 requires that a pressure reducing valve (PRV) be installed on individual services if the supply pressure exceeds 80 psi. While not the responsibility of the Utility, knowledge of the requirement can assist the Utility with decision making during the water system planning process.

Figure 6-1 illustrates water system pressures throughout the water system, under average day demand, and Figure 6-2 illustrates water system pressures under peak hour demand. Pressures throughout the Main System do not vary greatly even over varying demand conditions. According to model simulations, no areas exist within the distribution system where pressures are below the 35 psi minimum required pressure under average day demands and peak hour demand conditions.

The average pressure in the Main System is approximately 78 psi with a relatively wide range of pressures due to topography. Higher system pressures (approximately 85 psi to 98 psi) in the Main System are to the west near the City of Schofield and in the Village of Rothschild as well as in the north near Well 6 (Rippling Creek). Low pressures (approximately 42 psi to 60 psi) are near Summit Tower and Everest Tower, near the Hospital, as well as to the east near the extremities of the system.



SYSTEM CONDITIONS

SYSTEM DEMAND:
MAIN AVERAGE DAY DEMAND: 1.28 MGD

WATER TREATMENT PLANT:
BOOSTER PUMP 1: 1,200 GPM
BOOSTER PUMP 2: NOT OPERATING

TANKS:
EVEREST AVENUE TOWER: 23 FEET (8 FEET LOW)
BUSINESS PARK TOWER: 27 FEET (8 FEET LOW)
SUMMIT AVENUE TOWER: 13 FEET (8 FEET LOW)

WELLS:
ALTA VERDE (WELL 1): 510 GPM
MESKER (WELL 3): 730 GPM
STERNBERG (WELL 4): 840 GPM
BLOEDEL (WELL 5): 800 GPM
RIPPLING CREEK (WELL 6): 460 GPM

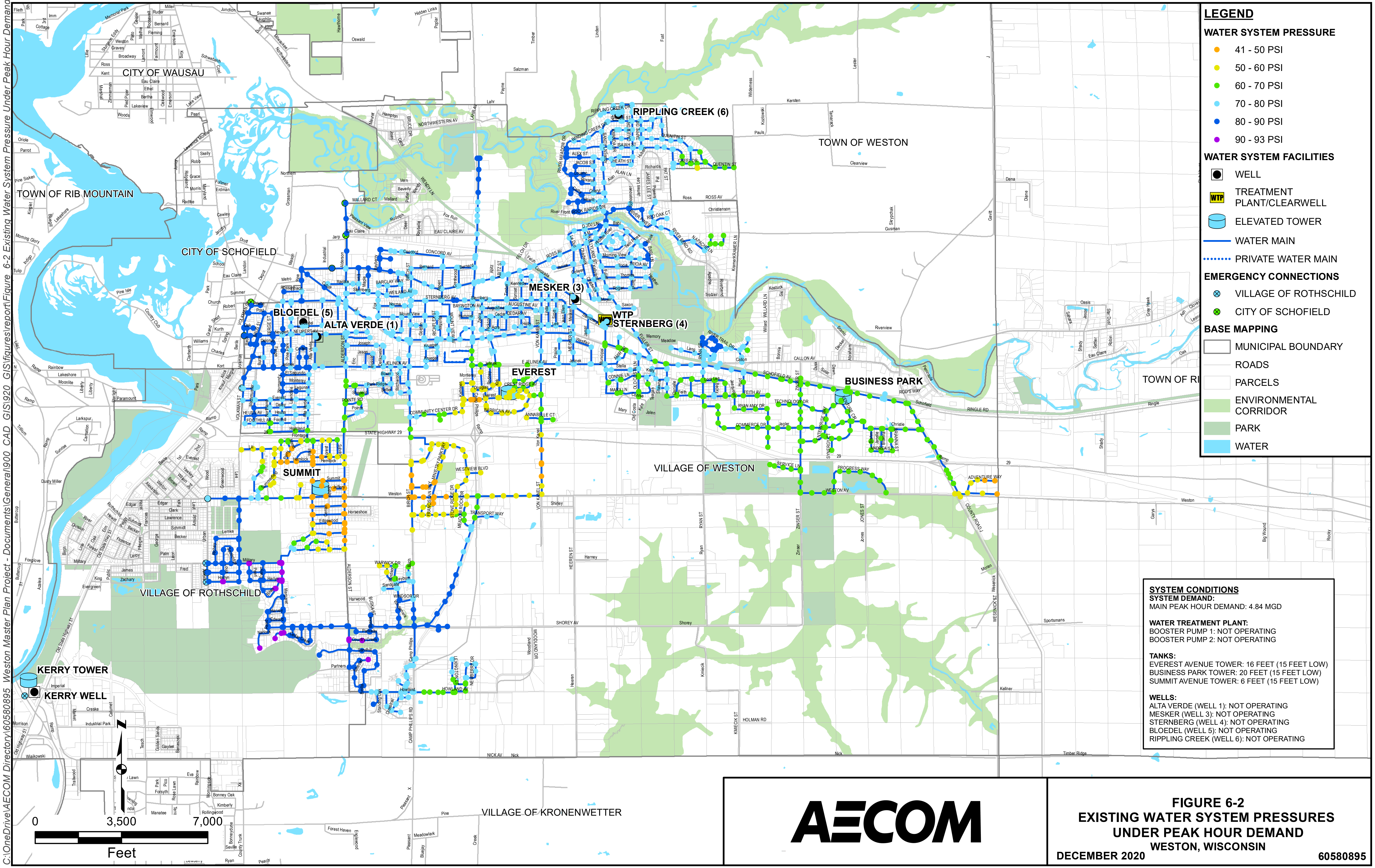
AECOM

FIGURE 6-1
EXISTING WATER SYSTEM PRESSURES UNDER AVERAGE DAY DEMAND

WESTON, WISCONSIN
DECEMBER 2020
60580895

C:\OneDrive\AECOM Directory\60580895 Weston Master Plan Project - Documents\General\900 CAD GIS\920 GIS\figures\report\Figure 6-1 Existing Water System Pressure Under Average Day Demand.mxd

C:\OneDrive\AECOM Directory\60580895 Weston Master Plan Project - Documents\General\900 CAD GIS\920 GIS\figures\report\Figure 6-2 Existing Water System Pressure Under Peak Hour Demand.mxd



SYSTEM CONDITIONS
SYSTEM DEMAND:
MAIN PEAK HOUR DEMAND: 4.84 MGD

WATER TREATMENT PLANT:
BOOSTER PUMP 1: NOT OPERATING
BOOSTER PUMP 2: NOT OPERATING

TANKS:
EVEREST AVENUE TOWER: 16 FEET (15 FEET LOW)
BUSINESS PARK TOWER: 20 FEET (15 FEET LOW)
SUMMIT AVENUE TOWER: 6 FEET (15 FEET LOW)

WELLS:
ALTA VERDE (WELL 1): NOT OPERATING
MESKER (WELL 3): NOT OPERATING
STERNBERG (WELL 4): NOT OPERATING
BLOEDEL (WELL 5): NOT OPERATING
RIPPLING CREEK (WELL 6): NOT OPERATING

AECOM

FIGURE 6-2
EXISTING WATER SYSTEM PRESSURES UNDER PEAK HOUR DEMAND
WESTON, WISCONSIN
DECEMBER 2020
60580895

6.3 Fire Flow Capacities

Water system planning for fire protection is an important consideration. In most instances, water main sizes are designed specifically to supply desired fire flows. Guidelines for determining the fire flow requirements are provided by the Insurance Services Offices (ISO). ISO is the insurance service organization responsible for evaluating and classifying municipalities for fire insurance rating purpose. From a letter with an effective date of July 1, 2016 for the South Area Fire District FPSA, Marathon County Wisconsin (including Village of Weston), Public Protection Classification (PPC) is a Class 3 of Class 10. A Class 1 represents superior property fire protection and Class 10 indicating the area's fire suppression program does not meet ISO's minimum criteria.

Fire protection needs vary with the physical characteristics of each building to be protected as described in Chapter 5. The fire flow requirement for each fire hydrant was determined by assigning a land use and then the corresponding fire flow requirement. For areas with multiple property types, the highest fire flow need was assigned to that area.

Figure 6-3 illustrates the fire flow requirement at each fire hydrant throughout the water system. Using the hydraulic model, the maximum available fire flow at each fire hydrant was calculated, while maintaining a residual system pressure of 20 psi throughout the system. Available fire flows ranged from approximately 500 gpm to more than 3,500 gpm. Figure 6-4 illustrates the available fire flow, under maximum day water demand, throughout the water system. Based on the fire flow requirements determined, Figure 6-5 illustrates the locations which meet the needed fire flow requirement and the ones that fail to meet the needed fire flow requirement.

Many of the deficiencies identified in Figure 6-5 are in commercial and industrial land use areas. Often, businesses utilize sprinkler systems, firewalls, fire retardant materials, or other means, which can substantially reduce presumed fire flow requirements; therefore, a location identified as deficient of needed fire flow may have sufficient fire flow available to meet a reduced requirement at that particular location. Other deficiencies, as in many water systems, are the result of dead ends and small diameter mains.

Areas with deficient available fire flow include:

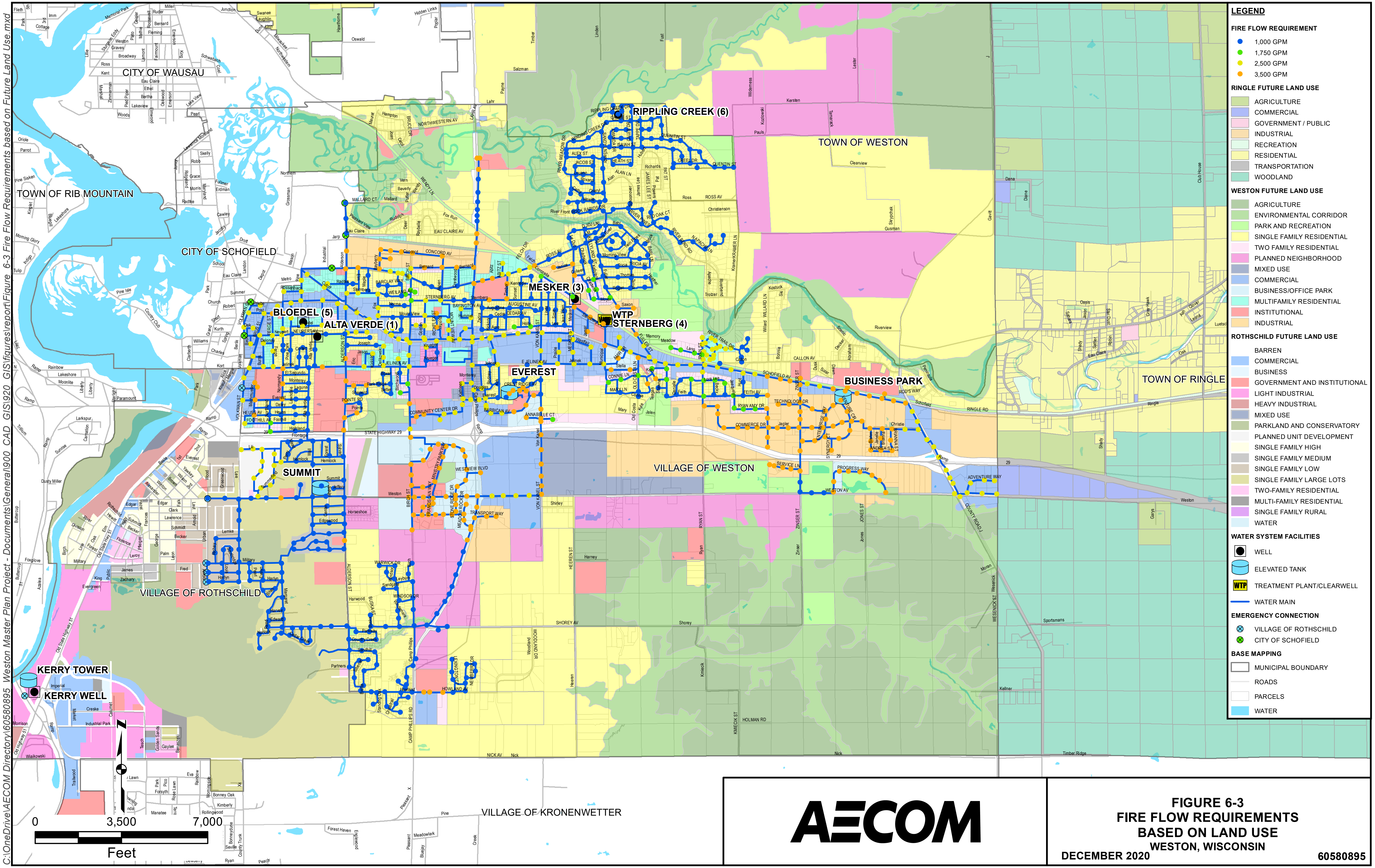
- Near Saint Clare's Hospital along Weston Avenue and Birch Street, 3,500 gpm requirement, approximately 2,500 to 3,500 gpm available.
- Near the YMCA on Howland Avenue, 3,500 gpm requirement, approximately 1,500 to 2,000 gpm currently available.
- Near the industrial area south of Highway 29 on east side of Village of Weston, 3,500 gpm requirement.
- Near DC Everest Senior High School on Alderson Street.
- Northern industrial area along Bernard Avenue.
- Near the eastern commercial and multi-family area south of Highway 29
- Near the industrial area east of the WTP on Fuller Street and Saxon Avenue.
- One hydrant on the west side of Weston Elementary school (other hydrants surrounding the school meet the requirement)
- Multi-family area in the Village of Rothschild.

6.4 Water System Headloss and Velocity

One important element of any hydraulic system analysis is to evaluate the distribution system network for water mains that are at or near capacity. High velocities or high headlosses are indicators of potential capacity problems. Mathematically, headloss is a function of velocity and often high headlosses occur within distribution mains that exhibit high velocities. However, older water mains may also exhibit high headlosses because of loss in hydraulic capacity due to the deterioration of the interior of the pipe even when velocities are within acceptable values.

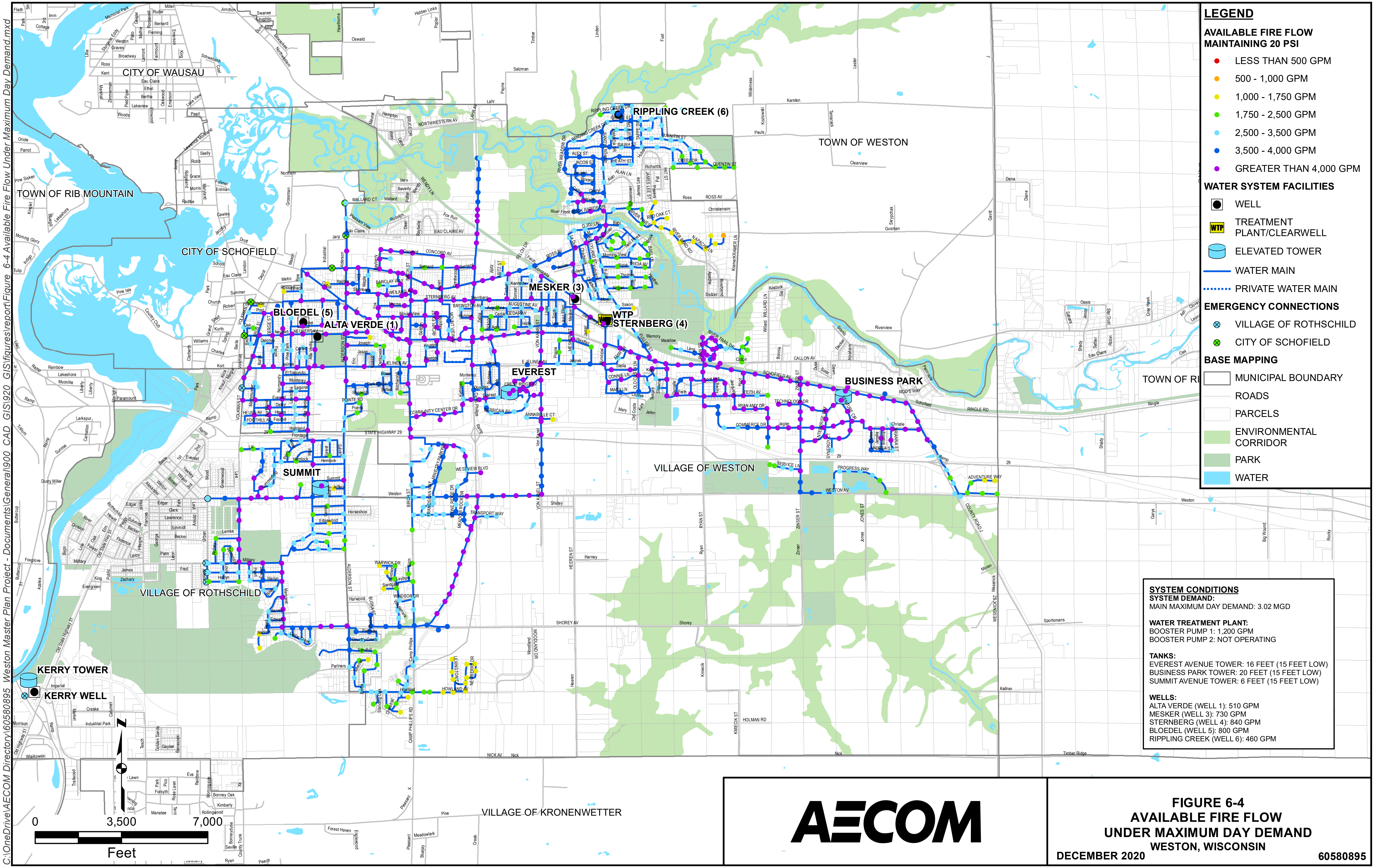
Dec 0

C:\OneDrive\AECOM Directory\60580895 Weston Master Plan Project - Documents\General\900_CAD_GIS\920_GIS\figures\report\Figure_6-3 Fire Flow Requirements based on Future Land Use.mxd



AECOM

FIGURE 6-3
FIRE FLOW REQUIREMENTS
BASED ON LAND USE
WESTON, WISCONSIN
DECEMBER 2020
60580895



LEGEND

AVAILABLE FIRE FLOW MAINTAINING 20 PSI

- ● LESS THAN 500 GPM
- ● 500 - 1,000 GPM
- ● 1,000 - 1,750 GPM
- ● 1,750 - 2,500 GPM
- ● 2,500 - 3,500 GPM
- ● 3,500 - 4,000 GPM
- ● GREATER THAN 4,000 GPM

WATER SYSTEM FACILITIES

- ● WELL
- WTP TREATMENT PLANT/CLEARWELL
- ELEVATED TOWER
- WATER MAIN
- PRIVATE WATER MAIN

EMERGENCY CONNECTIONS

- ⊗ VILLAGE OF ROTHSCHILD
- ⊗ CITY OF SCHOFIELD

BASE MAPPING

- ☐ MUNICIPAL BOUNDARY
- ROADS
- ☐ PARCELS
- ▨ ENVIRONMENTAL CORRIDOR
- ▨ PARK
- ▨ WATER

SYSTEM CONDITIONS

SYSTEM DEMAND:
MAIN MAXIMUM DAY DEMAND: 3.02 MGD

WATER TREATMENT PLANT:
BOOSTER PUMP 1: 1,200 GPM
BOOSTER PUMP 2: NOT OPERATING

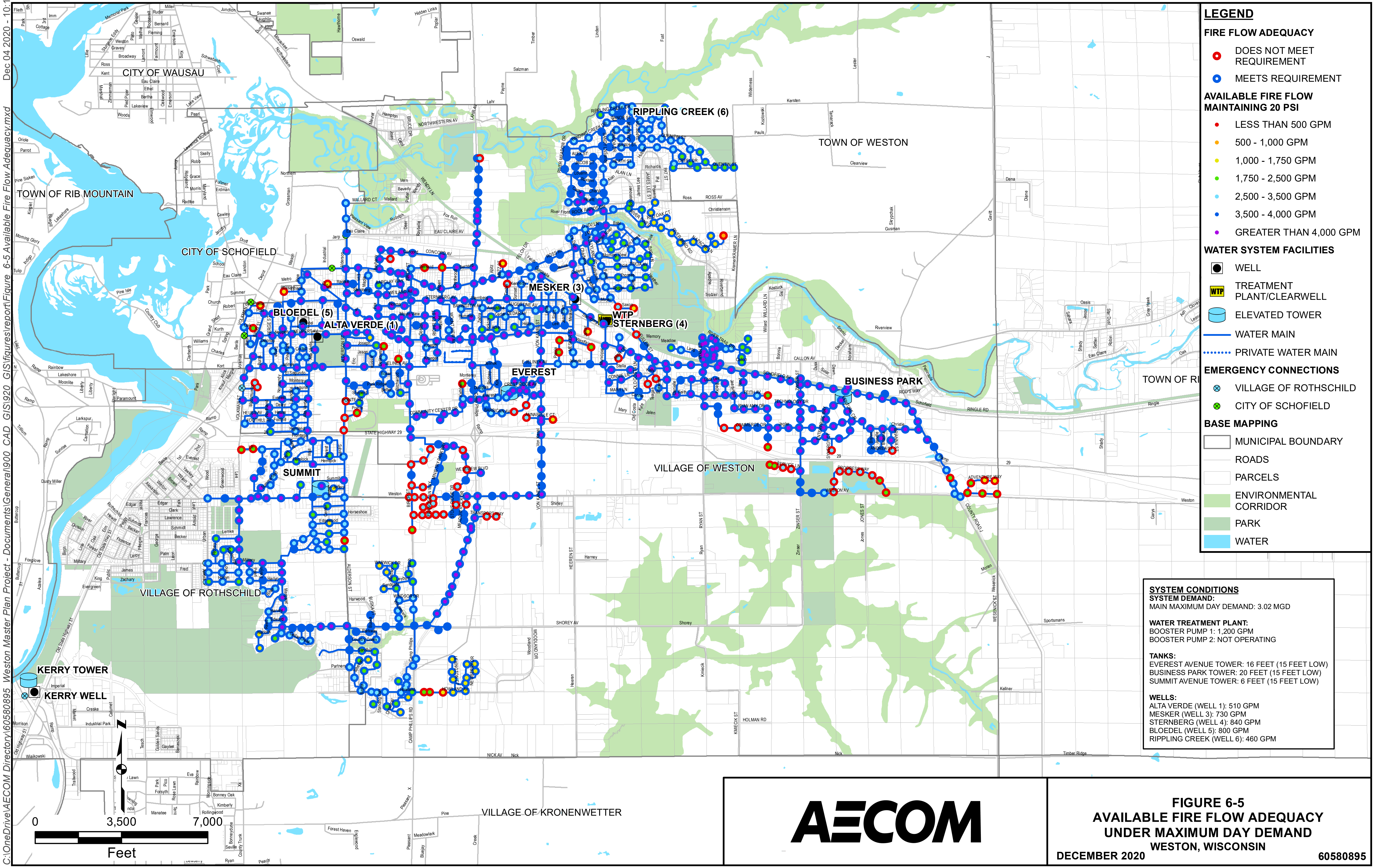
TANKS:
EVEREST AVENUE TOWER: 16 FEET (15 FEET LOW)
BUSINESS PARK TOWER: 20 FEET (15 FEET LOW)
SUMMIT AVENUE TOWER: 6 FEET (15 FEET LOW)

WELLS:
ALTA VERDE (WELL 1): 510 GPM
MESKER (WELL 3): 730 GPM
STERNBERG (WELL 4): 840 GPM
BLOEDEL (WELL 5): 800 GPM
RIPPLING CREEK (WELL 6): 460 GPM

AECOM

FIGURE 6-4
AVAILABLE FIRE FLOW UNDER MAXIMUM DAY DEMAND
WESTON, WISCONSIN
DECEMBER 2020
60580895

C:\OneDrive\AECOM Directory\60580895 Weston Master Plan Project - Documents\General\900_CAD_GIS\920_GIS\figures\report\Figure 6-5 Available Fire Flow Adequacy.mxd   Dec 04 2020 - 10:16:07 AM



SYSTEM CONDITIONS

SYSTEM DEMAND:
MAIN MAXIMUM DAY DEMAND: 3.02 MGD

WATER TREATMENT PLANT:
BOOSTER PUMP 1: 1,200 GPM
BOOSTER PUMP 2: NOT OPERATING

TANKS:
EVEREST AVENUE TOWER: 16 FEET (15 FEET LOW)
BUSINESS PARK TOWER: 20 FEET (15 FEET LOW)
SUMMIT AVENUE TOWER: 6 FEET (15 FEET LOW)

WELLS:
ALTA VERDE (WELL 1): 510 GPM
MESKER (WELL 3): 730 GPM
STERNBERG (WELL 4): 840 GPM
BLOEDEL (WELL 5): 800 GPM
RIPPLING CREEK (WELL 6): 460 GPM

AECOM

FIGURE 6-5
AVAILABLE FIRE FLOW ADEQUACY UNDER MAXIMUM DAY DEMAND
WESTON, WISCONSIN
DECEMBER 2020
60580895

AWWA Manual M32, *Computer Modeling of Water Distribution Systems,* Fourth Edition includes typical piping design criteria for velocities and headloss. As noted, the piping design criteria are rules of thumb and are provided as a guide for identifying areas where improvements are most needed. AWWA Manual M32 states the following for typical piping design criteria:

- Velocities greater than 4 – 6 feet per second (fps)
- Small pipe diameters (less than 16-inch) having headlosses greater than 5 – 7 feet/ 1,000 feet
- Large pipe diameters (16-inch and greater) having headlosses greater than 2 – 3 feet/1,000 feet

Because higher demands will increase both pipe flow velocity and headloss, pipes were evaluated for headloss and velocity under maximum day demand conditions for a 24-hour period. This condition represents a period of “normal operation” (i.e. non-emergency operation) that would likely yield the largest pipe headlosses and velocities in the water distribution system. Excessively high headloss and velocity could contribute to low system pressure or fire flows, or increased energy costs for operation.

Figure 6-6 and Figure 6-7 illustrate the maximum velocity and headloss in the water mains over the 24-hour maximum day during a model simulation. As illustrated, no water mains have higher than recommended velocities and very few have headloss gradients higher than recommended. As illustrated, transmission mains river crossings, and pipes facilities tend to have higher velocities and headlosses than the other distribution mains which is typical of a water system.

6.5 Water System Water Age

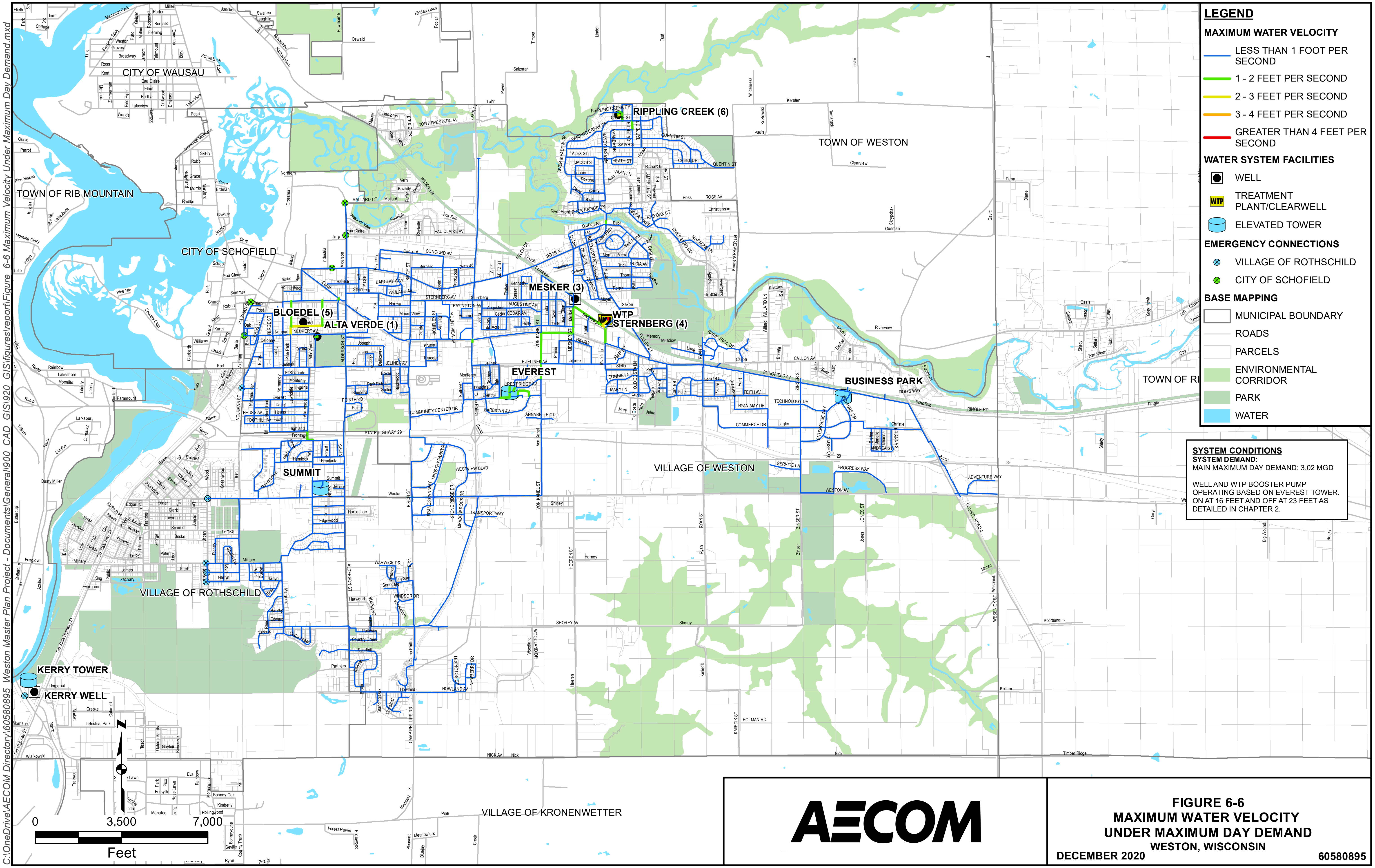
Age of water in the distribution system is used as the basis for evaluating water quality for this study. Chemical levels within the water, such as chlorine or disinfection byproducts, will vary over time as either growth or decay occurs in the water distribution system. As a result of these and other time-dependent reactions in the distribution system, water age can be used as the basis for evaluating water quality. In general, water quality deteriorates with time, thus older water can be an indicator of potential water quality concerns.

General industry guidelines indicate water age should be minimized in the distribution system to maintain good water quality. According to the AwwaRF Guidance Manual for Maintaining Distribution System Water Quality report, distribution system water age should not exceed five to seven days.

Water age in the Weston water system varies depending upon water demands and distance from the supply source. As water demands increase, water age decreases, and water age will be lower nearer the source of supply than locations farther away. To determine water age, the water system model was run for a period of 15 days under average day demands assuming the tanks are completely mixed.

C:\OneDrive\AECOM Directory\60580895 Weston Master Plan Project - Documents\General\900 CAD GIS\920 GIS\figures\report\Figure 6-6 Maximum Velocity Under Maximum Day Demand.mxd

Dec 04 2



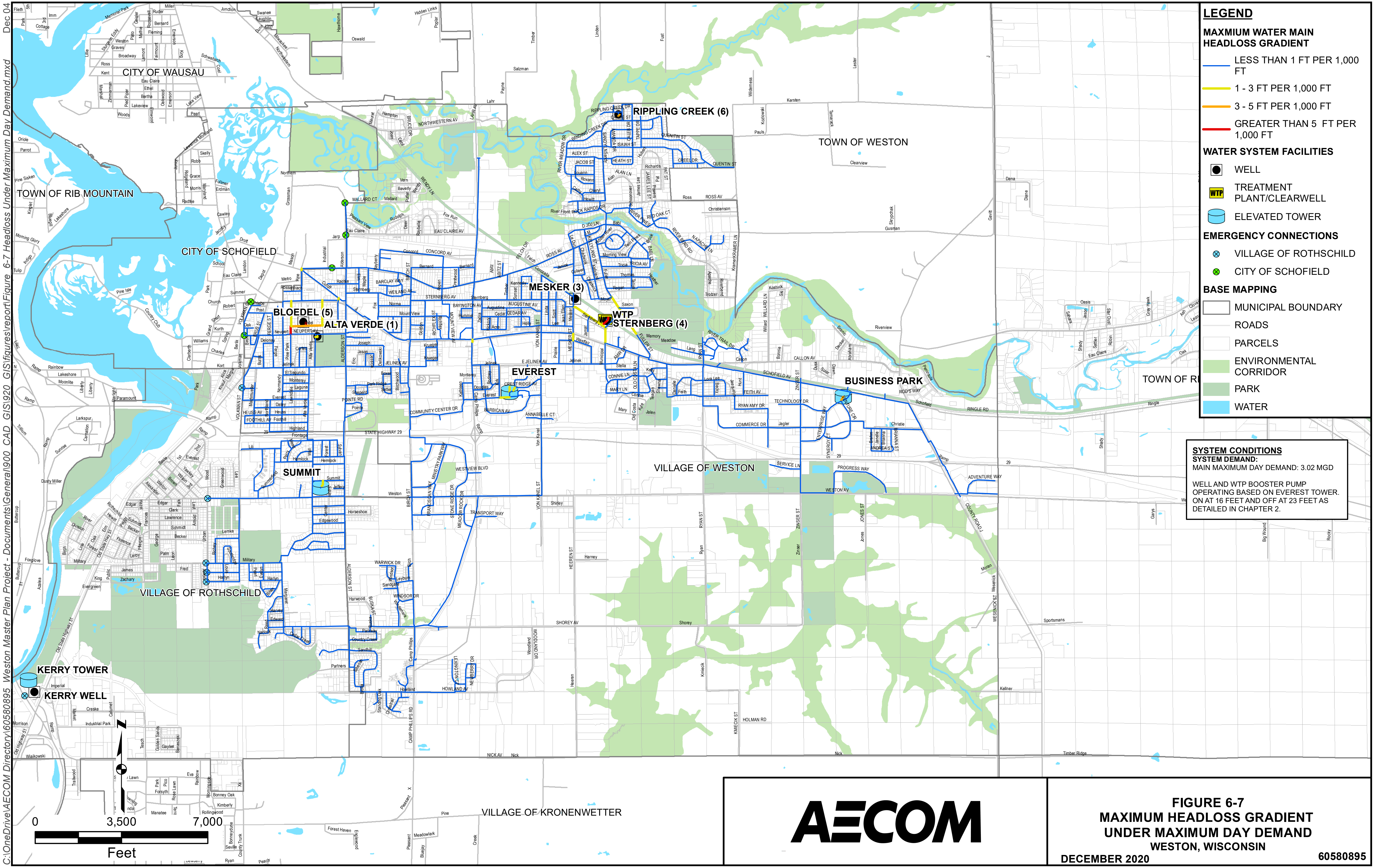
SYSTEM CONDITIONS
SYSTEM DEMAND:
MAIN MAXIMUM DAY DEMAND: 3.02 MGD

WELL AND WTP BOOSTER PUMP OPERATING BASED ON EVEREST TOWER. ON AT 16 FEET AND OFF AT 23 FEET AS DETAILED IN CHAPTER 2.

AECOM

FIGURE 6-6
MAXIMUM WATER VELOCITY
UNDER MAXIMUM DAY DEMAND
WESTON, WISCONSIN
DECEMBER 2020
60580895

C:\OneDrive\AECOM Directory\60580895 Weston Master Plan Project - Documents\General\900 CAD GIS\920 GIS\figures\report\Figure 6-7 Headloss Under Maximum Day Demand.mxd Dec 04 2020 - 10



SYSTEM CONDITIONS
SYSTEM DEMAND:
MAIN MAXIMUM DAY DEMAND: 3.02 MGD

WELL AND WTP BOOSTER PUMP OPERATING BASED ON EVEREST TOWER. ON AT 16 FEET AND OFF AT 23 FEET AS DETAILED IN CHAPTER 2.

AECOM

FIGURE 6-7
MAXIMUM HEADLOSS GRADIENT
UNDER MAXIMUM DAY DEMAND
WESTON, WISCONSIN
DECEMBER 2020
60580895

Figure 6-8 illustrates the estimated 24-hour average water age for Day 15 of the model simulation in the system under average day demand. As illustrated, a significant amount of the system is estimated to have an average water age of less than 4 days with higher water age on dead ends and the extremities of the system in particular on the eastern portion near the Business Park Tower and the area south of Summit Tower. Table 6-1 summarizes the water age analysis. Water age in the towers under average day demands is illustrated in Figure 6-9.

As shown in Figure 6-9, simulated water age in Summit Tower and Everest Tower is approximately 2 to 3 days old, however, Business Park Tower continues to increase over time and does not come to an equilibrium. As illustrated in the hydraulic grade line graphic, Business Park Tower turns over with the other towers in the Main System; however, the water demands in the eastern end of the system is generally low leading to higher aged water being forced back into the Business Park Tower when the wells are running. The Business Park Tower does have a PAX mixer system to help reduce water age and freezing concerns at the tower. Actual water age in the system will vary depending upon demand conditions.

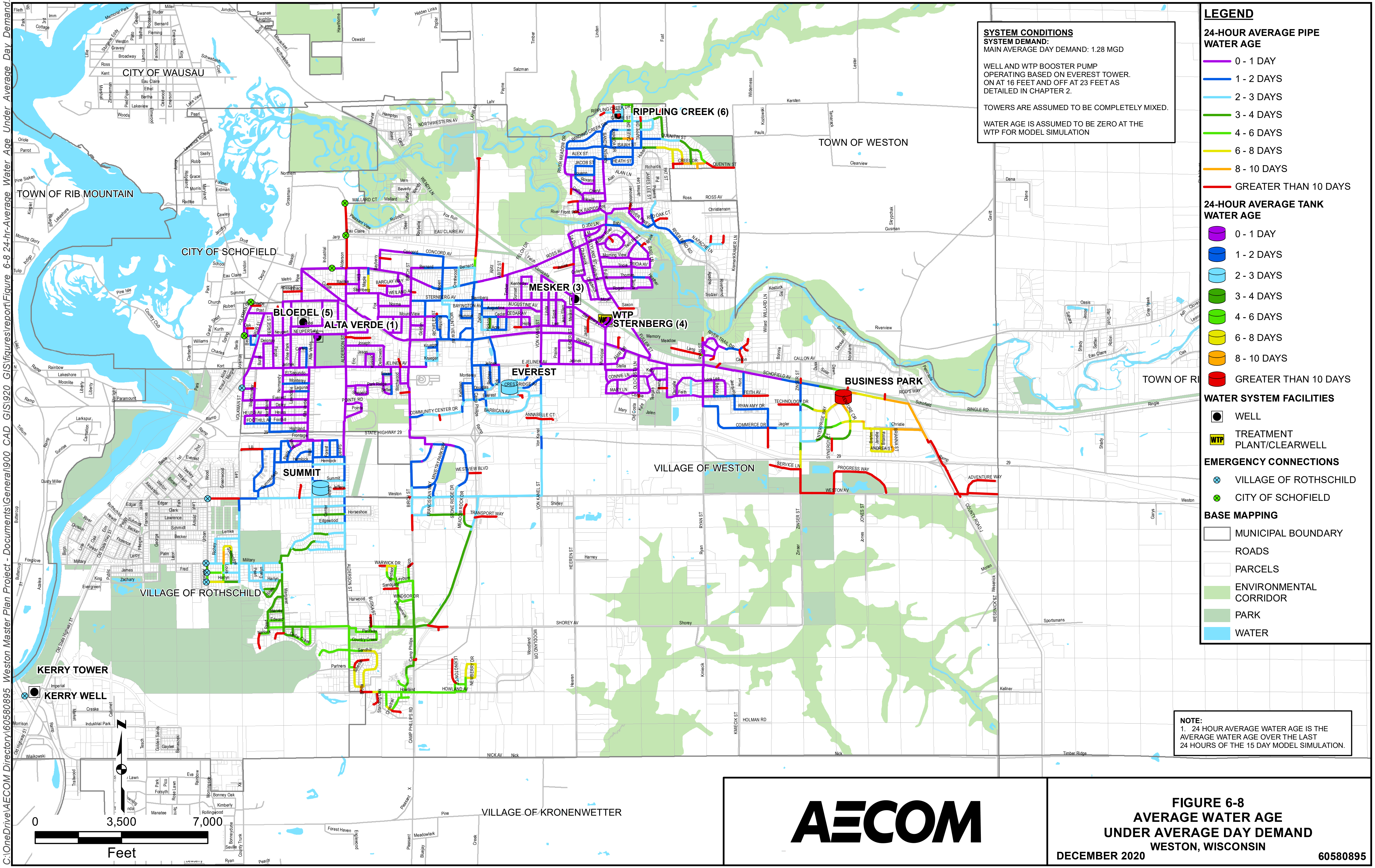
TABLE 6-1: VOLUME WEIGHTED AVERAGE WATER AGE SUMMARY

Water Age[1,2]	Pipe Volume	Pipe Volume Percentage	Tank Storage Volume	Tank Storage Volume Percentage	Total Volume	Total Volume Percentage
0-1 Day	796,600 gal	45.2%	0 gal	0.0%	796,600 gal	30.4%
1-2 Days	297,100 gal	16.8%	0 gal	0.0%	297,100 gal	11.4%
2-3 Days	211,900 gal	12.0%	350,000 gal	41.2%	561,900 gal	21.5%
3-4 Days	130,900 gal	7.4%	0 gal	0.0%	130,900 gal	5.0%
4-6 Days	69,700 gal	3.9%	0 gal	0.0%	69,700 gal	2.7%
6-8 Days	50,600 gal	2.9%	0 gal	0.0%	50,600 gal	1.9%
8-10 Days	49,400 gal	2.8%	0 gal	0.0%	49,400 gal	1.9%
Greater Than 10 days	159,200 gal	9.0%	500,000 gal	58.8%	659,200 gal	25.2%
Total	**1,765,400 gal**	**100.0%**	**850,000 gal**	**100.0%**	**2,615,400 gal**	**100.0%**

Footnotes:

[1] Model simulated 15 day water age analysis under average day demand conditions with the current operating strategy.

[2] Based on the calculated 24-hour average water age multiplied by the component volume all divided by the total system volume.



SYSTEM CONDITIONS
SYSTEM DEMAND:
MAIN AVERAGE DAY DEMAND: 1.28 MGD

WELL AND WTP BOOSTER PUMP OPERATING BASED ON EVEREST TOWER. ON AT 16 FEET AND OFF AT 23 FEET AS DETAILED IN CHAPTER 2.

TOWERS ARE ASSUMED TO BE COMPLETELY MIXED.

WATER AGE IS ASSUMED TO BE ZERO AT THE WTP FOR MODEL SIMULATION.

LEGEND

24-HOUR AVERAGE PIPE WATER AGE
- 🟪 0 - 1 DAY
- 🟦 1 - 2 DAYS
- 🟦 2 - 3 DAYS
- 🟩 3 - 4 DAYS
- 🟩 4 - 6 DAYS
- 🟨 6 - 8 DAYS
- 🟧 8 - 10 DAYS
- 🟥 GREATER THAN 10 DAYS

24-HOUR AVERAGE TANK WATER AGE
- 🟪 0 - 1 DAY
- 🟦 1 - 2 DAYS
- 🟦 2 - 3 DAYS
- 🟩 3 - 4 DAYS
- 🟩 4 - 6 DAYS
- 🟨 6 - 8 DAYS
- 🟧 8 - 10 DAYS
- 🟥 GREATER THAN 10 DAYS

WATER SYSTEM FACILITIES
- ● WELL
- WTP TREATMENT PLANT/CLEARWELL

EMERGENCY CONNECTIONS
- ⊗ VILLAGE OF ROTHSCHILD
- ⊗ CITY OF SCHOFIELD

BASE MAPPING
- ☐ MUNICIPAL BOUNDARY
- ROADS
- PARCELS
- 🟩 ENVIRONMENTAL CORRIDOR
- 🟩 PARK
- 🟦 WATER

NOTE:
1. 24 HOUR AVERAGE WATER AGE IS THE AVERAGE WATER AGE OVER THE LAST 24 HOURS OF THE 15 DAY MODEL SIMULATION.

AECOM

FIGURE 6-8
AVERAGE WATER AGE
UNDER AVERAGE DAY DEMAND
WESTON, WISCONSIN
DECEMBER 2020
60580895

C:\OneDrive\AECOM Directory\60580895 Weston Master Plan Project - Documents\General\900 CAD GIS\920 GIS\figures\report\Figure 6-8 24-hr-Average Water Age Under Average Day Demand.mxd

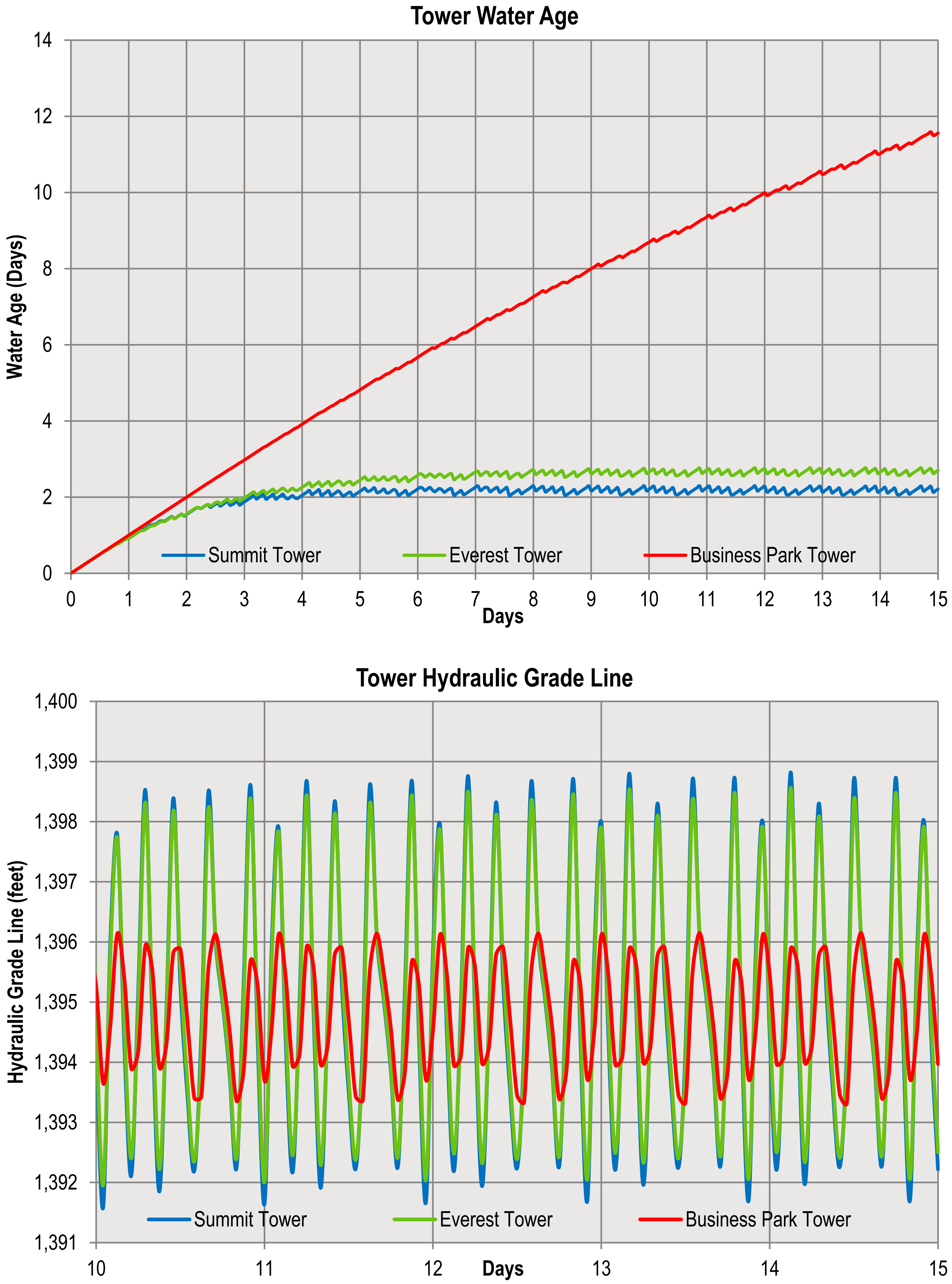


FIGURE 6-9: ESTIMATED TANK WATER AGE AND HGL UNDER AVERAGE DAY DEMAND

6.6 Summary

This chapter summarizes the findings from the evaluation of the Weston Water Utility Main System distribution system. Major findings from this evaluation include the following:

- The average pressure in the Main System is approximately 78 psi with a relatively wide range of pressures due to topography; however, system pressures are above the minimum requirement of 35 psi.
- Higher system pressures (approximately 85 psi to 98 psi) in the in the Main System are to the west near the City of Schofield and in the Village of Rothschild as well as in the north near Well 6 (Rippling Creek)
- Lower system pressures (approximately 42 psi to 60 psi) are near Summit Tower and Everest Tower as well as to the east near the extremities of the system.
- The required fire flows are available at approximately 89 percent of the fire hydrants in the system with deficient areas on small diameter mains, dead end mains and extremities of the water system including:
    - Near Saint Clare’s Hospital along Weston Avenue and Birch Street, 3,500 gpm requirement, approximately 2,500 to 3,500 gpm available.
    - Near the YMCA on Howland Avenue, 3,500 gpm requirement, approximately 1,500 to 2,000 gpm currently available.
    - Near the industrial area south of Highway 29 on east side of Village, 3,500 gpm requirement,
    - Near DC Everest Senior High School on Alderson Street
    - Northern industrial area along Bernard Avenue.
    - Near the eastern commercial and multi-family area south of Highway 29
    - Near the industrial area east of the WTP on Fuller Street and Saxon Avenue.
    - One hydrant on the west side of Weston Elementary school (other hydrants surrounding the school meet the requirement)
    - Multifamily area in the Village of Rothschild.
    - Dead end water mains
    - Small diameter mains
    - Extremities of the water system
- No water mains are estimated to have velocities in excess of 5 fps and/or headlosses greater than the AWWA guidelines.
- Under simulated average day water demands, water age was estimated to exceed 10 days in the Business Park Tower and at the extremities of the system including the eastern area near Highway 29 and the southern area along Camp Phillips Road near Shorey Avenue and Howland Avenue and on dead ends. The majority of the system was estimated to have water age less than 6 days including the Summit Tower and Everest Tower. General industry guidelines indicate water age should not exceed 5 to 7 days in the system to maintain good water quality, according to an AwwaRF report.

7.0 Water Main Replacement Rate

The water industry has under-invested in the buried assets as documented in the *Dawn of the Replacement Era – Reinvesting in the Drinking Water Industry and Buried No Longer – Confronting America's Water Infrastructure Challenge*, published by AWWA. Therefore, significant investment in buried assets is needed to provide the level of service required by utility customers. The typical industry guideline for annual water main replacement is 1 percent of the total length of water main. This results in a full water system replacement every 100 years. In many communities, replacement rates have been lower than 1 percent; therefore, the current needed replacement rate is often higher than 1 percent.

This chapter summarizes a macro analysis of water main replacement requirements for the Weston Water Utility system water mains using the AwwaRF (AWWA Research Foundation, now known as Water Research Foundation) software (KANEW). The KANEW software used to perform the replacement rate analysis for the Weston Water Utility water system was developed as part of the AwwaRF project: Quantifying Future Rehabilitation and Replacement Needs of Water Mains (1998). A copy of the executive summary of the AwwaRF project is included in Appendix J.

The primary objective of this analysis is to provide the Weston Water Utility with guidelines for long-range water main replacement strategies. The KANEW model predicts the pipe length that should be replaced on an annual basis based on the water main inventory and estimated lifespan. As KANEW is a statistical survival model and is a macro model, it does not provide location-specific replacement information, and it does not consider the individual pipe physical condition or historical performance (breaks and leaks). The AwwaRF project recommends that further work should be done to expand on the KANEW analysis to develop procedures of establishing the priority for water main replacement. The information required to perform the KANEW analysis is the age, diameter, material, and length of the water mains.

Survival functions were prepared based on the life expectancy for each water main category. The survival function is a mathematical expression, which represents the aging process of the water main. The specific parameters of a survival function indicate the percentage of water mains that will survive beyond a given age. The survival functions are applied to the current inventory of water mains year by year, and the KANEW model estimates the length of water mains that have reached the end of their useful life and must, therefore, be replaced.

7.1 Water Distribution Main Inventory for Replacement

For this analysis, the water main inventory presented in Chapter 2 was used. The water distribution system main inventory used for the analysis was comprised of approximately 108 miles of water main.

7.2 Water Distribution Main Category Definitions

Based on a review of water mains within the Weston Water Utility water distribution system, the following water main categories based on water main material were defined:

- Asbestos Cement
- Cast Iron Pipe
- Ductile Iron Pipe
- Polyvinyl Chloride Pipe (PVC)
- High Density Polyethylene (HDPE)

7.3 Water Main Life Expectancies

The water main life expectancies are a key input in determining the survival function, which helps describe the nature of the lifespan for each water main category. The life expectancy range is the lifespan that 100 percent, 50 percent, and 10 percent of the pipes are expected to reach without failure. The lower and upper bounds of the life expectancy range are referred to as the “short (pessimistic)” and “long (optimistic)” estimates, respectively.

The short (pessimistic) and long (optimistic) life expectancies for each water main category, as provided in Table 7-1, were established for the analysis.

TABLE 7-1: WATER MAIN CATEGORY LIFE EXPECTANCIES

Water Main Category	Life Expectancy Range (years)		
	100% Survival	50% Survival	10% Survival
Cast Iron (CIP)	40 - 60	60 - 75	75 - 90
Ductile Iron (DI)	60 - 80	80 - 100	110 - 130
Asbestos Cement (AC)	40 – 60	60 – 80	80 – 100
PVC (combined with HDPE as Plastic)	60 – 80	80 – 100	90 – 120
HDPE (combined with PVC as Plastic)	60 – 80	80 – 100	90 – 120

The survival curves developed for each water main category by the KANEW software for long and short life expectancies are presented in Figure 7-1 and Figure 7-2 , respectively.

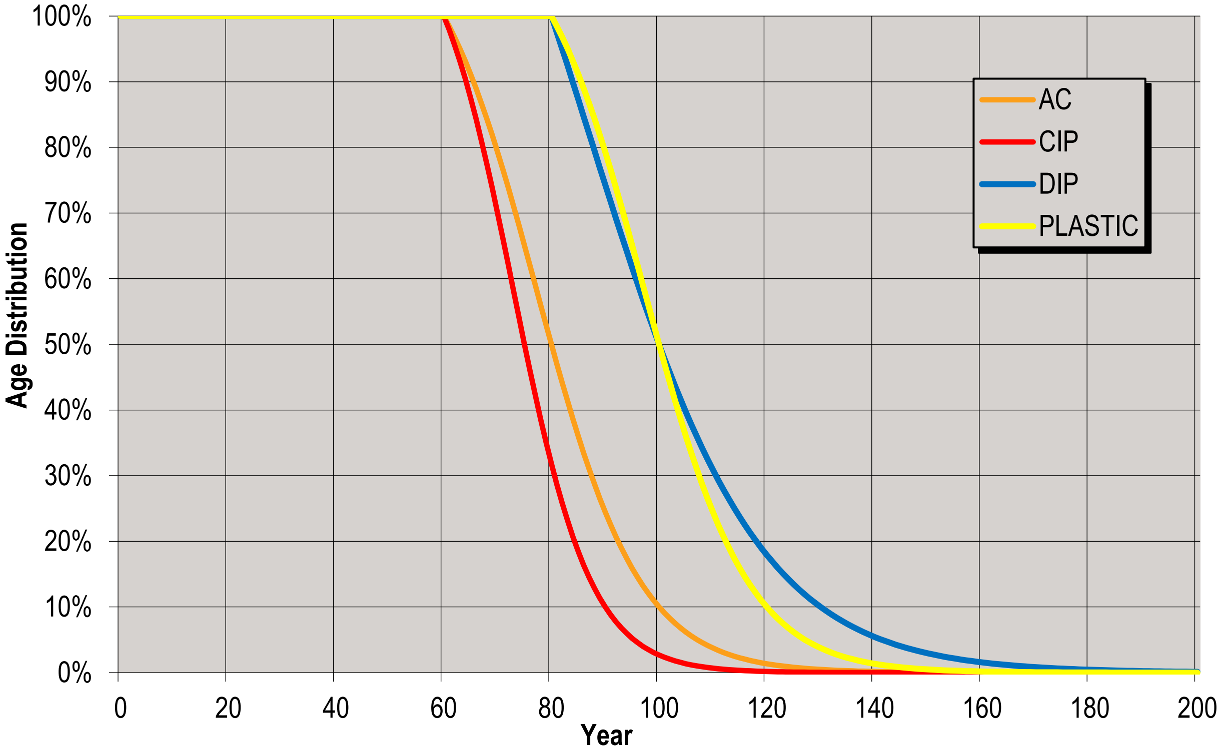


FIGURE 7-1: WATER MAIN SURVIVAL FUNCTION – LONG LIFE EXPECTANCY

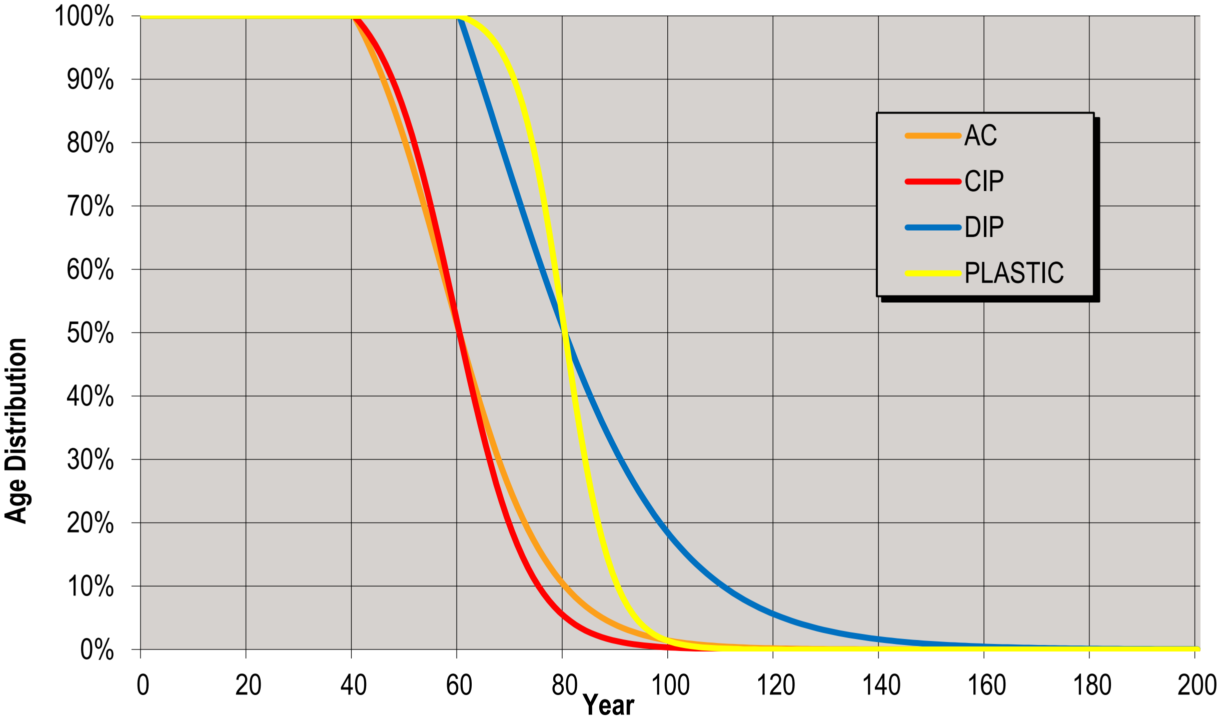


FIGURE 7-2: WATER MAIN SURVIVAL FUNCTION – SHORT LIFE EXPECTANCY

The following figures that illustrate the KANEW results have been included in this section for documentation purposes.

Figure No.	Description
7-3	Distribution of water mains by installation year
7-4	Inventory of water mains by type and installation year
7-5	Age distribution of water mains in 2018
7-6	Cumulative age distribution of water mains in 2018
7-7	Average age and residual life expectancy for types of water mains

Figure 7-7 provides a useful illustration of the average age of water mains in the Weston Water Utility water distribution system and the average useful life based on long and short life expectancies. Table 7-2 provides a summary of the information presented in Figure 7-7.

TABLE 7-2: WATER MAIN CATEGORY RESIDUAL LIFE EXPECTANCIES

Water Main Material	Average Age (years)	Average Residual Life[1] (years)	
		Pessimistic	Optimistic
Asbestos Cement	51	15	29
Cast Iron Pipe	50	13	25
Ductile Iron Pipe	22	62	82
HDPE	15	64	86
PVC	12	67	89

Footnote:

[1] Average residual life is the remaining life expectancy of the pipe.

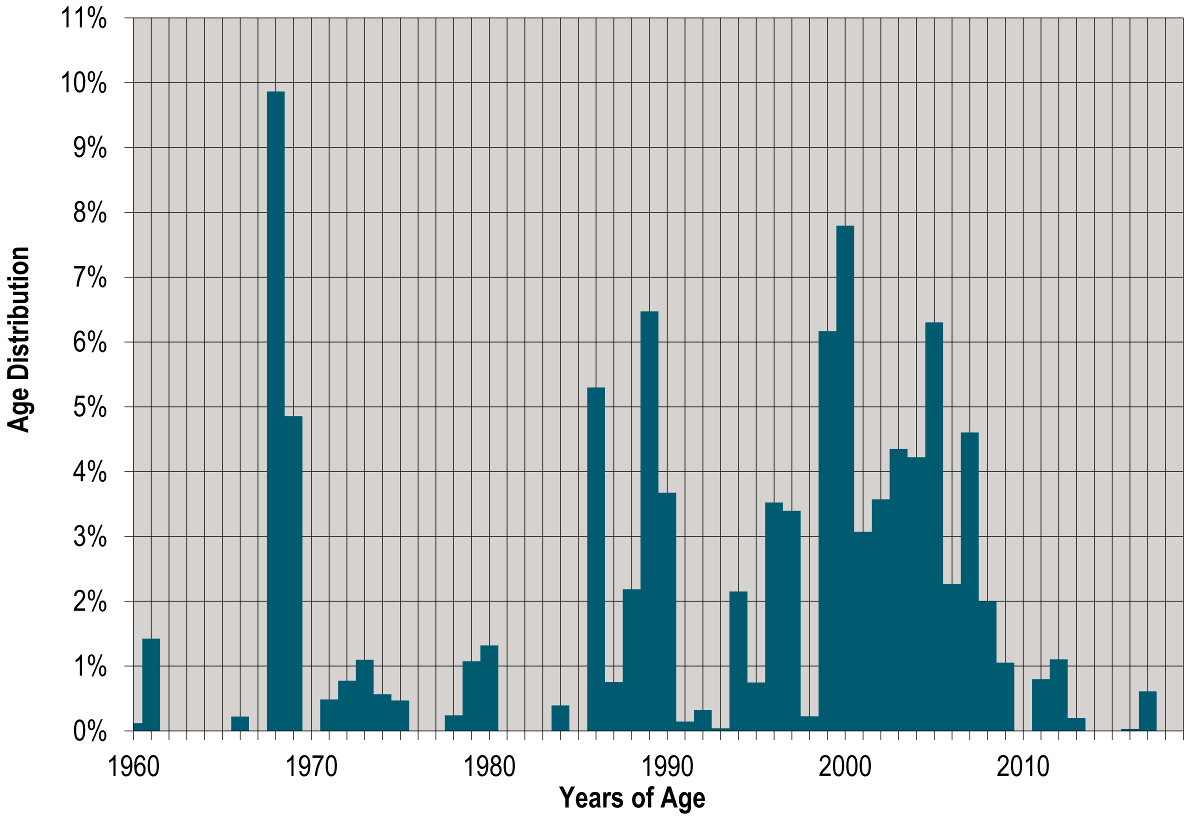


FIGURE 7-3: DISTRIBUTION OF WATER MAINS BY INSTALLATION YEAR

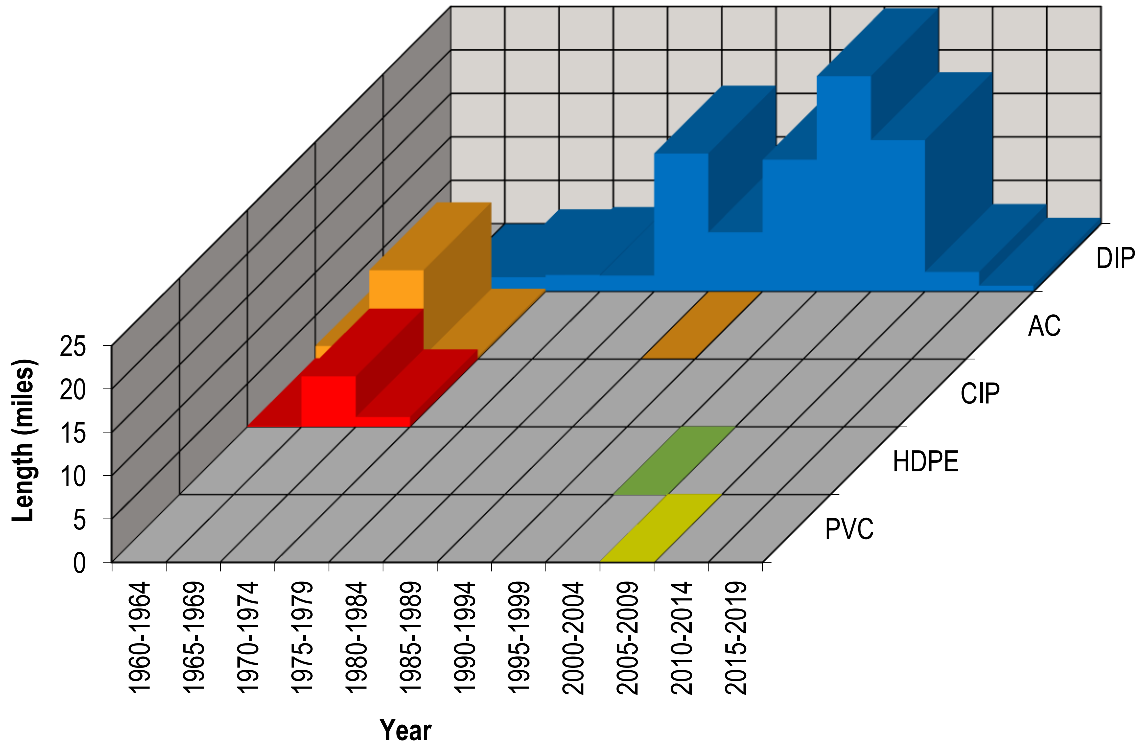


FIGURE 7-4: INVENTORY OF WATER MAINS BY TYPE AND INSTALLATION YEAR

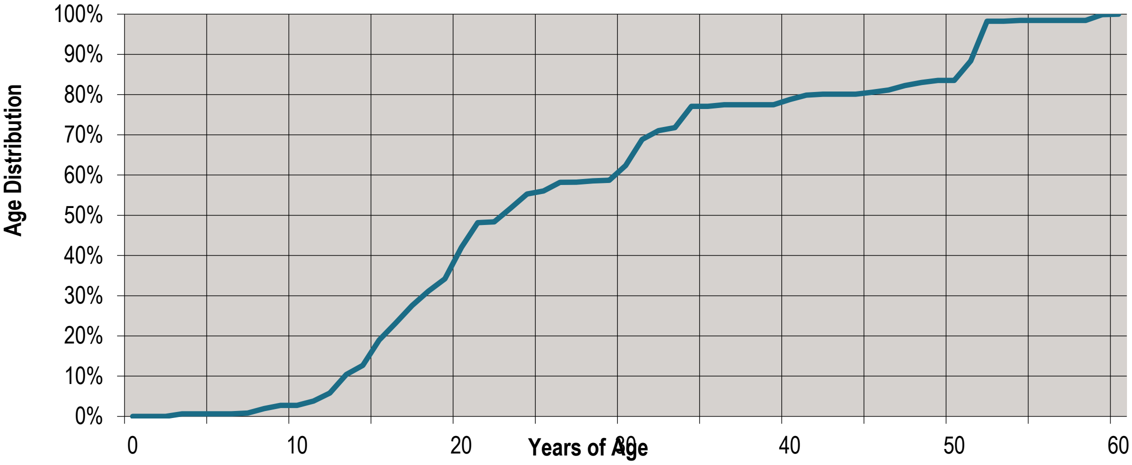


FIGURE 7-5: AGE DISTRIBUTION OF WATER MAINS IN 2018

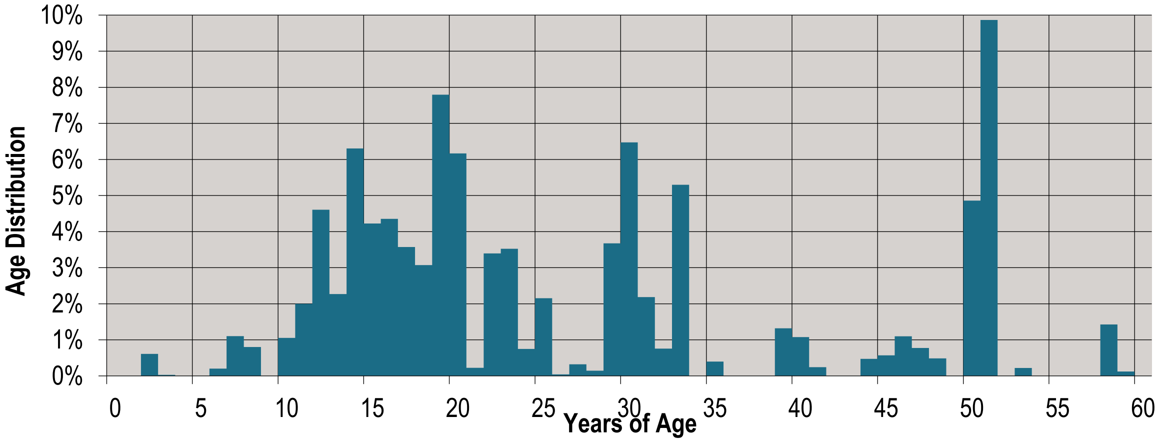


FIGURE 7-6: CUMULATIVE AGE DISTRIBUTION OF WATER MAINS IN 2018

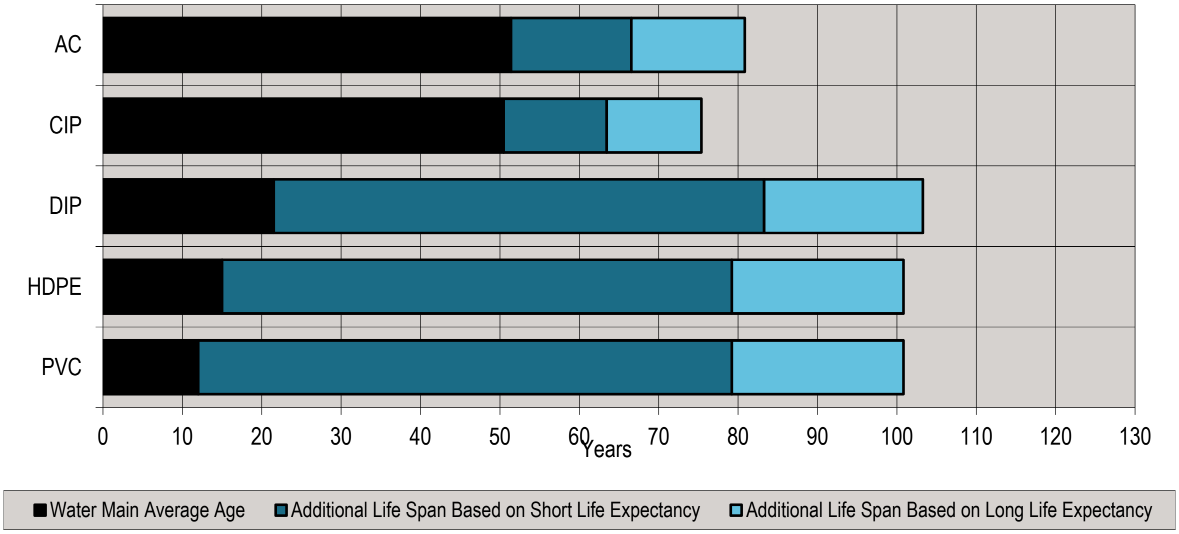


FIGURE 7-7: AVERAGE AGE AND RESIDUAL LIFE EXPECTANCY FOR TYPES OF WATER MAIN

7.4 Results of KANEW Analysis

The results of the water main replacement KANEW analysis are summarized in the following figures.

Figure	Description
7-8	Length of water mains to be renewed based on long life expectancies for types of water mains
7-9	Length of water mains to be renewed based on short life expectancies for types of water mains
7-10	Annual renewal rates for types of water mains based on long life expectancies
7-11	Annual renewal rates for types of water mains based on short life expectancies
7-12	Average annual renewal rates based on long and short life expectancies

The annual renewal rates shown in Figure 7-10 and Figure 7-11 illustrate the percentage of water main that should be replaced for each water main category.

7.5 Findings from KANEW Analysis

The results of the KANEW analysis, based on the survival functions developed, indicate that the total length of water main to be replaced within the Weston Water Utility water distribution system in the next 20 years is approximately 5.8 miles to 15.0 miles based on long to short water main life expectancies, respectively. Table 7-3 and Figure 7-12 summarize the replacement needs of the Weston Water Utility water distribution system based on the analysis. Figure 7-12 also includes a “medium” life expectancy (between the short and long life expectancies).

TABLE 7-3: RECOMMENDED WATER MAIN RENEWAL RATES

Year	Long Life Expectancy		Short Life Expectancy	
	Annual Renewal Rate	Total Length (miles)	Annual Renewal Rate	Total Length (miles)
1	0.00%	0.00	0.68%	0.74
2	0.02%	0.03	0.71%	0.76
3	0.03%	0.03	0.73%	0.79
4	0.03%	0.03	0.75%	0.81
5	0.03%	0.03	0.76%	0.82
6	0.03%	0.03	0.77%	0.83
7	0.04%	0.04	0.78%	0.84
8	0.04%	0.04	0.77%	0.84
9	0.21%	0.23	0.77%	0.83
10	0.30%	0.33	0.76%	0.82
11	0.33%	0.35	0.74%	0.80
12	0.36%	0.39	0.72%	0.77
13	0.40%	0.43	0.70%	0.75
14	0.43%	0.47	0.69%	0.74
15	0.46%	0.49	0.67%	0.72
16	0.48%	0.52	0.65%	0.70
17	0.51%	0.55	0.61%	0.66
18	0.53%	0.57	0.58%	0.62
19	0.55%	0.59	0.55%	0.59
20	0.57%	0.61	0.54%	0.58
Total	**-**	**5.78**	**-**	**15.01**

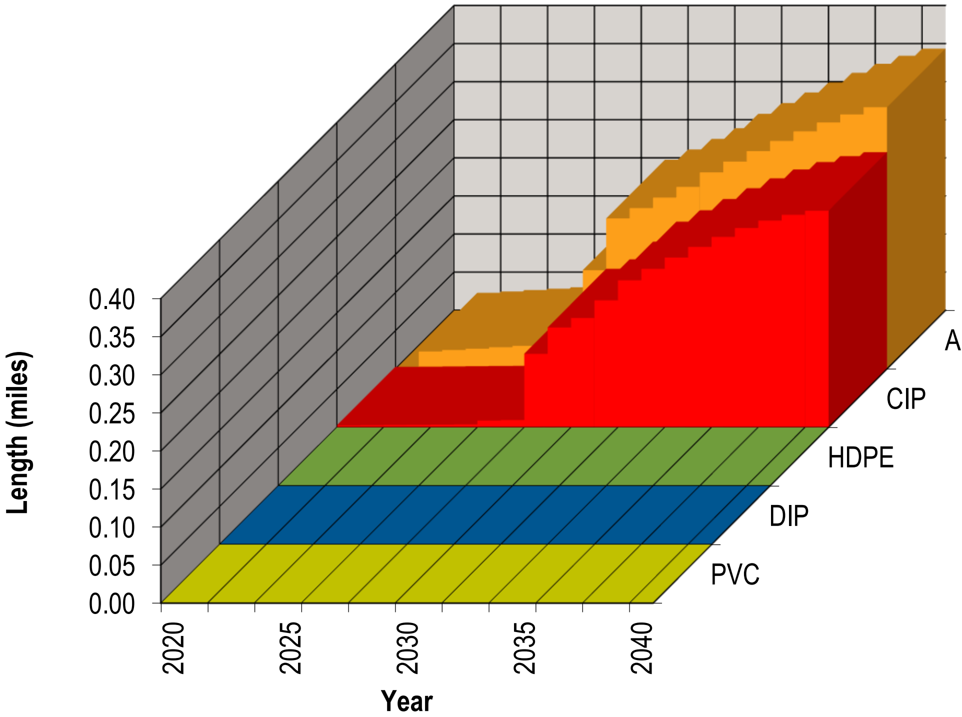


FIGURE 7-8: LENGTH OF WATER MAINS TO BE RENEWED BASED ON LONG LIFE EXPECTANCIES

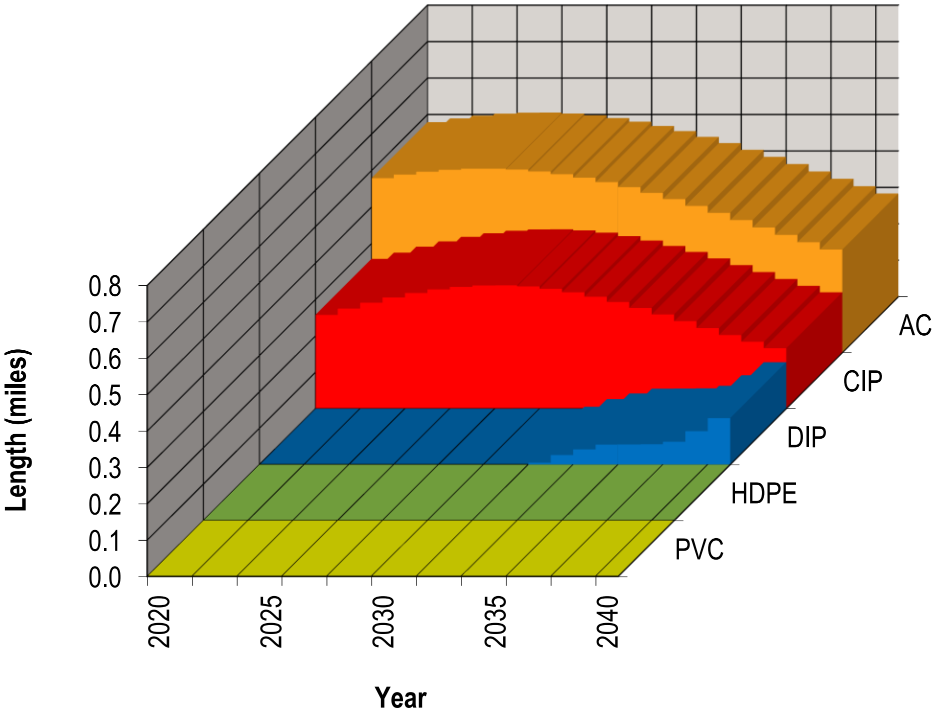


FIGURE 7-9: LENGTH OF WATER MAINS TO BE RENEWED BASED ON SHORT LIFE EXPECTANCIES

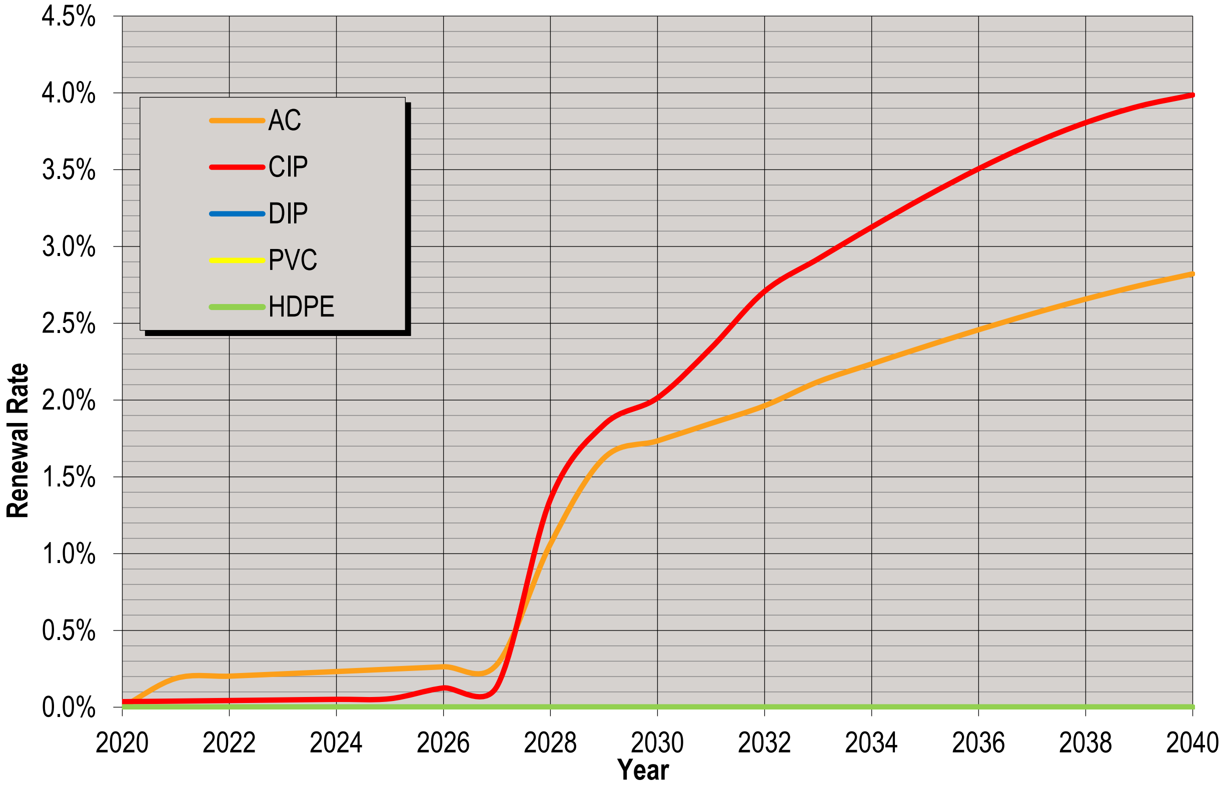


FIGURE 7-10: ANNUAL RENEWAL RATES FOR TYPES OF WATER MAINS BASED ON LONG LIFE EXPECTANCIES

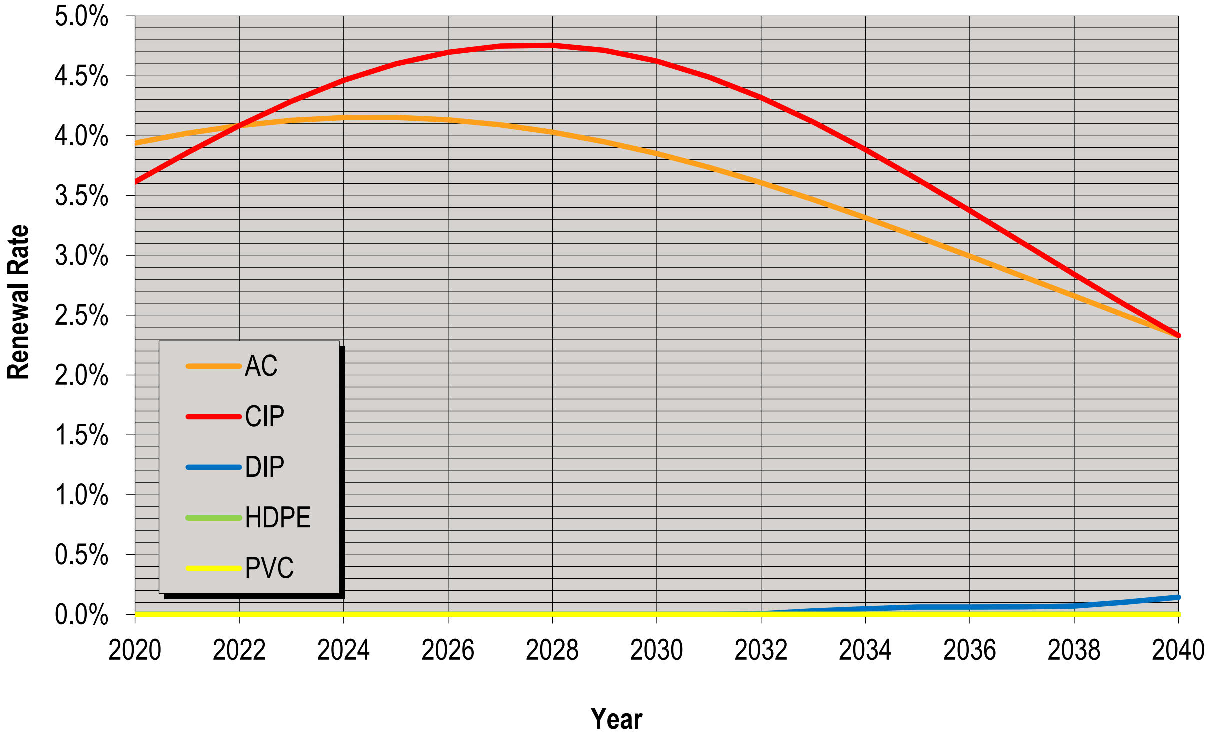


FIGURE 7-11: ANNUAL RENEWAL RATES FOR TYPES OF WATER MAINS BASED ON SHORT LIFE EXPECTANCIES

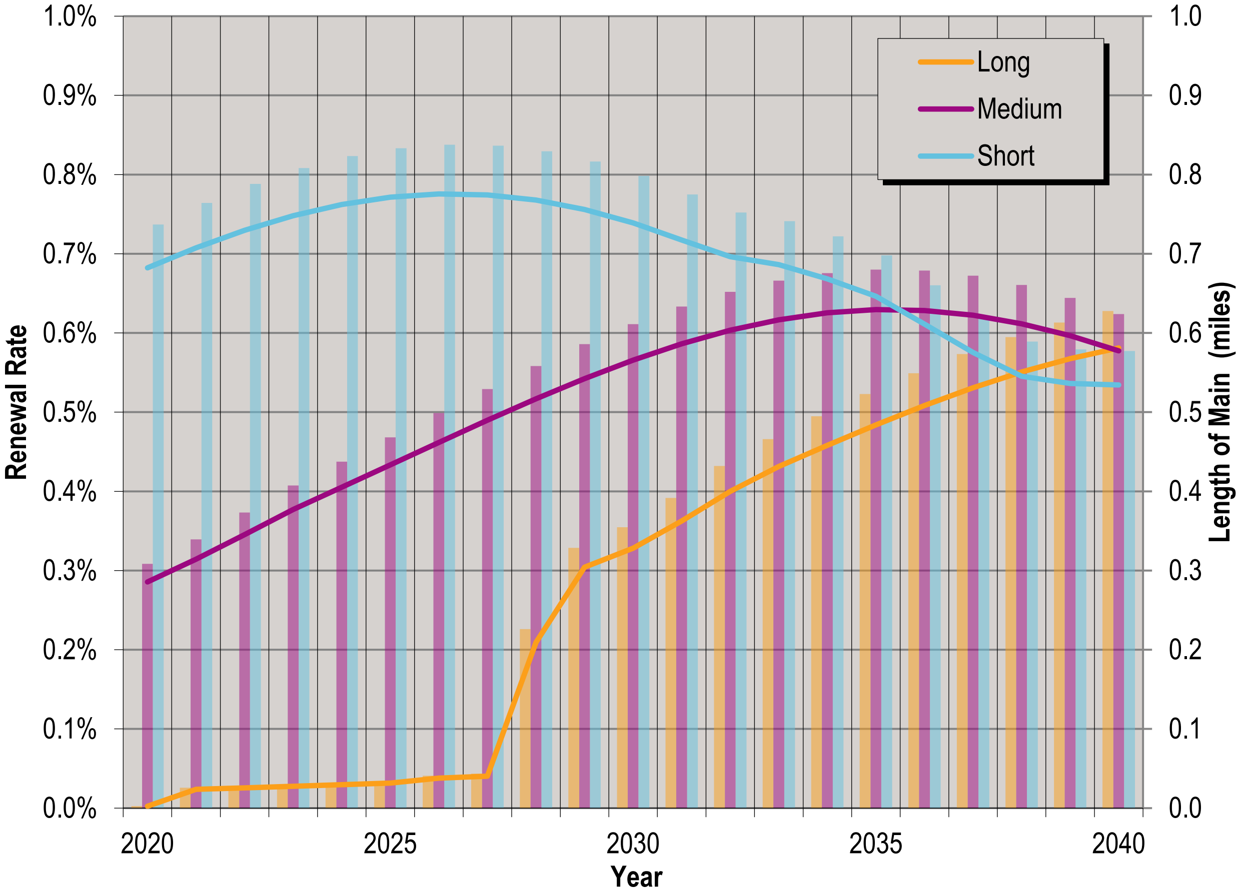


FIGURE 7-12: RECOMMENDED WATER MAIN RENEWAL RATES

The KANEW analysis provides a further breakdown of water main replacement rates based on water main categories.

The following summarizes the key findings from the macro (KANEW) analysis:

- The Utility's water distribution system is an "newer" water system; approximately 40 percent of the water mains are less than 20 years old and nearly 20 percent of the water mains are over 45 years old.
- Based on the long and short life expectancies in the KANEW analysis, the total recommended replacement lengths in the first 10 years of replacement are approximately 0.8 miles (0.73 percent) and 8.1 miles (7.5 percent), respectively.
- Based on the long and short life expectancies in the KANEW analysis, the total replacement lengths over the 20 year period of replacement are approximately 6.4 miles (5.4 percent) and 15.0 miles (13.9 percent), respectively.
- This analysis is based on age and material of the water mains; it does not consider the historical performance (leaks and breaks), water quality, reliability, cost of failure, hydraulic analysis, or the physical condition of the pipe.

7.6 Comparison of Analysis Results

For benchmarking purposes, KANEW analysis results were compared with other water utilities. KANEW was used to evaluate the rehabilitation/replacement needs of the following four U.S. water utilities and one UK water utility as part of the AwwaRF project, "Quantifying Future Rehabilitation and Replacement Needs of Water Mains" (1998):

- Philadelphia Water Department, Pennsylvania
- Los Angeles Department of Water and Power, California
- Boston Water and Sewer Commission, Massachusetts
- Fort Worth Water Department, Texas
- Nottinghamshire Water System, Severn Trent Water, Ltd., UK

Table 7-4 summarizes the results of the five case studies from the AwwaRF project and other AECOM projects along with the results for Weston Water Utility water system.

TABLE 7-4: COMPARISON OF KANEW ANALYSIS RESULTS

Water System	Distribution System	Annual Rehabilitation/Replacement Rate	
		Long Life Expectancy	Short Life Expectancy
Philadelphia Water Department	3,300 miles	Fairly constant at 0.6% to 0.8% per year	1.25% initially, declining to 1%
Los Angeles Department of Water and Power	7,100 miles	2.2% initially, gradually declining to 1.2%	4.4% initially, declining to 2.1%
Boston Water and Sewer Commission	1,180 miles	2% initially, gradually declining to 1.5%	6.5% initially, drops significantly to nearly 1% later
Forth Worth Water Department	2,257 miles	Increases with time, initially 0.3%, increases to nearly 0.9%	
Nottinghamshire Water System of Severn Trent Water, Ltd.	412 miles	1.5% throughout planning period	Initially 3.3%, gradually declining to about 1.5%
Large Midwest System (large diameter pipes)	644 miles	1% throughout planning period	Initially 5%, gradually declining to about 1%
Large Utility – Southern U.S.	1,542 miles	4.5% initially, gradually declining to about 1.3%	5.5% initially, gradually declining to about 1.8%
Large Utility - North Carolina	333 miles	<0.1% initially, gradually increasing to about 1.2%	0.3% initially, increasing to 1.2% and declining to about 0.8%
Mid-Sized Utility – Midwest	356 miles	9.4% initially, declining to about 0.6%	14.7% initially, declining to 0.8%
Mid-Sized Utility – Midwest	425 miles	1.5% initially, gradually increasing to about 0.7%	4.4% initially, declining to 1.0% and increasing to about 1.5%
Military Installation – East Coast	62 miles	0.9% initially, increasing to about 2.1% and then declining to 1.4%	7.5% initially, gradually declining to about 0.8%
Mid-Sized Utility – Midwest	135 miles	0% initially, gradually increasing to about 0.8%	1.8% initially, gradually declining to about 0.6%
Mid-Sized Utility – Midwest	176 miles	0.2% initially, gradually increasing to about 1%	3.5% initially, gradually declining to 1.1 – 0.8%
Mid-Sized Utility – Midwest	370 miles	2.7% initially, decreasing to 1.5%, then gradually decreasing to 0.5%	5.3% initially, gradually declining to 0.7% - 1.0%
Large Utility – West Virginia	2,563 miles	1.0% initially, gradually increasing to about 1.2%	2.3% initially, gradually declining to 1.0%
Midwest University	36 miles	1.9% initially, 1.8% average first 10 years, 1.3% average over 25 years	4.9% initially, 2.9% average first 10 years, 1.6% average over 25 year
Mid-Sized Utility – Midwest	378 miles	5.5 % initially, 2.1% average first 10 years, 1.4% average over 20 years	8.3% initially, 2.8% average first 10 years, 1.7% average over 20 years
Weston Water Utility	108 miles	>0.1% initially, 0.07% average first 10 years, 0.30% average over 20 years	0.68% initially, 0.75% average first 10 years and 20 years

7.7 Water Main Rehabilitation/Replacement

Water main rehabilitation may offer the Weston Water Utility advantages over replacing pipes that have deteriorated. This section discusses water main rehabilitation concepts for consideration.

As discussed in AWWA M28, Rehabilitation of Water Mains, the following two approaches are generally taken for water main renewal:

- Rehabilitation
- Open-trench construction (replacement)

Although other trenchless methods are also used for replacement.

Pipe rehabilitation methods are sometimes less expensive and less disruptive to a community; however, rehabilitation is not appropriate for all situations. As discussed in AWWA M28, various water main rehabilitation/replacement techniques exist which offer various benefits. Some key elements for selection of rehabilitation solutions include:

- Nature of the problem(s) being solved
- Hydraulic and operating pressure requirements for the main
- Material, dimensions, and geometry of the pipe
- Types and locations of valves, fittings, and service connections
- Length of time in which the pipe can be taken out of service
- Site-specific factors

The water main rehabilitation/replacement techniques discussed in AWWA M28 include:

- Pipe bursting (replacement)
- Sliplining (replacement)
- Lining (Semi-structural – Class II/III, and Structural – Class VI)

Lining options include cement-mortar lining, spray-on polymer lining, and cured-in place lining.

Generally, open-trench construction is the cost-effective solution; however, water main rehabilitation options are sometimes preferred when the road or other surface repairs associated with pipe open-trench replacement may be challenging.

The Weston Water Utility owns pipes that are located in the Village of Rothschild. The lack of control on the roadway that is owned by the Village of Rothschild makes open-trench construction challenging and rehabilitation may be preferred for those areas. In addition, Utility personnel have indicated that some of the pipes located in the Village of Rothschild are also in areas that have high bedrock which limits some of the rehabilitation options for the water mains. In areas with high bedrock, water main rehabilitation/replacement options, such as pipe bursting and pipe pulling, that would displace the ground surface are not feasible options. Pipe lining is preferred to other water main rehabilitation options when the ground has high bedrock.

Pipe lining may be feasible option where the existing pipe size has sufficient capacity. Water main lining is a newer technology for drinking water pipe rehabilitation / renewal. The water main liner is comprised of National Sanitation Foundation (NSF) approved material and may be HDPE, epoxy or another material. Depending on the pipe lining technique, the pipe lining may be Class I (nonstructural), Class II/III (semi structural), or Class IV (structural).

A minimum of two excavations are normally required for pipe lining; one at each end of the pipe segment to be lined. Temporary service lines may be required when lining pipes for customer service connections or for fire protection. All services must be cut after lining; therefore, pipe lining is less expensive when there are fewer services.

Table 7-5 provides the anticipated cost range by diameter of main for pipe lining based on discussions with a lining contractor.

TABLE 7-5: PIPING LINING COST ESTIMATES

Diameter	Pipe Lining Cost Estimate[1,2]
6-inch	$85 - $125 per foot
8-inch	$110 - $170 per foot
12-inch	$170 - $250 per foot

Footnotes:
[1] Cost does not include engineering and contingency. Based on low $14 per inch per foot and high $21 per inch per foot.
[2] Cost is a budgetary estimate based on information given by RePipe 4710, August 2020.

7.8 Asbestos Cement Pipe

As summarized in Chapter 2, approximately 11 percent of the distribution system is comprised of asbestos cement (AC) pipe. AC pipe was installed in North America beginning in the 1930s and continuing to the early 1980s mainly as an affordable alternative to metallic pipe in areas prone to corrosion. As noted in AWWA M77, AC pipe degrades differently than metallic pipe. As AC pipe ages, gradual leaching of calcium out of the pipe wall occurs leaving behind a soft material that has less strength. Some conditions which may affect the longevity of AC pipe may include system pressures, soil type, topography, climate, and water quality.

Asbestos is regulated at the Federal level by the Environmental Protection Agency (EPA) under the National Emission Standards for Hazardous Air Pollutants (NESHAP). Under NESHAP, AC pipe is a Category II non friable material, meaning it cannot be crumbled, pulverized, or reduced to powder by hand pressure when dry. According to Water Research Foundation, Environmental Impact of Asbestos Cement Pipe Renewal Technologies, Project #4465, 2015, in July 1991, the EPA provided clarification on NESHAP regulations pertaining to the crushing of excavated AC pipe in the form of a letter containing the following key points:

- "…the crushing of asbestos cement pipe with mechanical equipment would cause this material to become RACM." [RACM is regulated asbestos cement material]
- "The backfilling and burial of the crushed asbestos cement pipe in place would cause the locations to become active waste disposal sites…"
- "If the pipe is left in place or removed in such a way that it is not crumbled, pulverized, or reduced to powder, it would not be subject to the NESHAP."

As noted in the WRF project, the enforcement and interpretation of the NESHAP has largely been left to the state regulatory agencies. Based on correspondence with the Wisconsin DNR personnel, asbestos cement pipe does not necessarily require notification to the DNR if the contractor removing the pipe can keep it non-friable during the removal. If the plan is to saw or break the AC pipe into sections, then the sawing or breaking would be regulated under Chapter NR447 Wisconsin Administrative Code requiring notification to the DNR using Form 4500-113 (Notice) and the use of Wisconsin Department of Health Services (DHS) certified persons to do the sawing or breaking of the ACCP sections. Wisconsin DNR personnel noted the AC pipe needs to be disposed of at a landfill that accepts asbestos containing material.

Several options exist for addressing failing AC pipe segments including the traditional open-cut and abandon-in place and trenchless technologies such as cured-in-place pipe (CIPP), spray-in-place pipe (SIPP), and pipe bursting.

Concerns about the longevity of AC pipe has risen across the United States as pipe breaks have increased. Assessments have revealed deteriorated AC pipe material. According the Water Research Foundation, Long Term Performance of Asbestos Cement Pipe, Project #4093, 2013, water quality, pipe diameter, and pipe age were identified as the factors that contribute to AC pipe failures. Water with low aggressiveness index, soft water, or water with low alkalinity contributes to internal degradation. Soil movement contributes to failures of small diameter pipes in communities with expansive clay soil.

According to the WRF study, expected remaining service life for AC pips varies from utility to utility depending on water quality and soil environments. Expected remaining life predictions for AC pipes in areas with aggressive water quality and soil environments ranged from imminent failure to 50 years. In areas with less aggressive water quality and dry soil conditions, AC pipe might be expected to serve for another 100 to 150 years.

To date, the Weston Water Utility has not reported experiencing a significant number of leaks/breaks on AC pipe; therefore, it is recommended that the Utility track leak/breaks going forward and monitor for an increasing trend of AC pipe leaks/breaks.

8.0 Condition Assessment of Water System Facilities

This chapter summarizes the visual condition assessment of the following Weston Water Utility facilities (Main and Kerry System):

- 6 groundwater wells
- 1 WTP (air stripper) and booster pumping station (at WTP)
- 4 elevated water storage tanks
- SCADA
- Office and operational space

8.1 Condition Assessment Evaluation

For the water system facilities, the condition assessment was based on the visual inspection of each facility. The facility inspections were conducted on July 26, 2019 and August 6, 2019. Each facility is assigned a condition rating from 1 to 5 as summarized in Table 8-1.

The condition assessment evaluation for the WTP and well facilities are summarized in Table 8-2 and for the towers is summarized in Table 8-3. The condition assessment of other Utility facilities is summarized in Table 8-4.

TABLE 8-1: FACILITY CONDITION RATING

Rating		Scoring Definitions
1	Very Good	Very Good Condition Only Normal Maintenance Required, No Corrective Maintenance
2	Good	Minor Defects Only Minor Maintenance Required, Minimal Corrective Maintenance
3	Fair	Maintenance Required to Return to Accepted Level of Service Several Minor Deficiencies Noted and Corrective Maintenance Required
4	Poor	Requires Renewal/Rehabilitation Major Deficiencies and Significant Corrective Maintenance or Rehab Required
5	Very Poor	Asset Unserviceable Asset Requires Replacement/Rehabilitation

TABLE 8-2: FACILITY CONDITION ASSESSMENT – WTP AND WELLS

Facility	Summary of Findings			Condition Score
Air Stripper, Clearwell, and Booster Pumps	Structure • Fair Booster Pumps • Poor	Clearwell • Unknown Electrical • Fair	HVAC • Fair Chemical Feed • Fair	3
Well 1 (Alta Verde)	Structure • Poor, as building size cannot accommodate the chemical feed systems in separate rooms, significant cracking on the floor, significant space along exterior wall for sealing, exterior damage at the building door, historic water entrance at the roof. Pump • Poor, pump motor is 20 years old, pump bowls were not visible for inspection Electrical • Fair, electrical panels recently replaced; however, the outlets were overloaded.		HVAC • Good Chemical Feed • Fair General • Activities surrounding the well did not appear consistent with wellhead protection (empty storage adjacent to wellhouse was noted. Note no pesticide, herbicide, or fertilizer use, storage, or transfer should be conducted adjacent to the well)	4 to 5
Well 2 (Kerry)	Structure • Fair Pump • Poor	Electrical • Poor	HVAC • Fair Chemical Feed • Fair	3
Well 3 (Mesker)	Structure • Good Pump • Poor	Electrical • Very poor – Electrical equipment including transformer, motor starters, transfer switch and breakers are old and do not meet current codes.	HVAC • Good Chemical Feed • Fair	3
Well 4 (Sternberg)	Structure • Good Pump • Poor	Electrical • Fair	HVAC • Fair Chemical Feed • Fair	3
Well 5 (Bloedel)	Structure • Fair (floor issues) Pump • Fair	Electrical • Good	HVAC • Good Chemical Feed • Fair	3
Well 6 (Rippling Creek)	Structure • Good Pump • Fair	Electrical • Good	HVAC • Good Chemical Feed • Good	2

TABLE 8-3: FACILITY CONDITION ASSESSMENT – TOWERS

Tower	Summary of Findings	Condition Score
Kerry Tower	• Leaking from the tank, in multiple locations • Updates needed for the overflow termination to meet DNR Codes • Coating is zinc based coating which has some challenges in sourcing materials and coating specialists for zinc coatings.	4
Business Park Tower	• Routine inspection and maintenance	1
Summit Tower	• Poor access conditions. Lack of maintenance space due to proximity to neighbors.	3
Everest Tower	• Routine inspection and maintenance	1

TABLE 8-4: FACILITY CONDITION ASSESSMENT – OTHER FACILITIES

Facility	Summary of Findings	Condition Score
Office Space	• No noted issue / a new facility is pending.	2
Operations Area	• More space desired, but currently meets most system needs.	2
Computer Systems	• Noted ongoing replacement needs due to equipment age and lack of replacement parts. • Dialers, local control panels, radios, and other equipment appear to exceed the anticipated life of equipment. • Challenges in obtaining the data was noted during field testing and overall SCADA program should be evaluated to ensure data is recorded and easily retrievable to evaluate the system performance.	4

8.2 Summary

In general, the water wells are in fair condition. In most wells the chemical feed systems were added after the well building design and do not have the proper space for chemical rooms. Any updates at the well building would require new chemical feed rooms for the chemicals as well as secondary containment and HVAC system designed in those rooms for the chemical feed systems at the sites. The chemical feed systems would benefit from a review of the onsite storage in bulk delivery compared to barrel delivery. Many of the existing tanks may be suitable for 30 days storage; however, the tank sizes have not been adequately reviewed compared to current well pumping rates, durations, and chemical feed capacities.

The well pumps and motors are typically older and do not meet current standards for efficiency and performance and may be more prone to failure due to the age of the units. Variable frequency drives (VFDs) would improve energy efficiency a provide flexibility and are recommended with any pump or motor replacement or other electrical upgrades.

The Business Park Tower and Everest Tower are in good condition. The Summit Tower has a fair condition as it is in a congested area and there are significant hurdles to addressing the issues with access and maintenance.

The office space and operations areas are shared with the Village and, while there is some shortage of operational space, there were no significant condition issues noted.

The controls system should have a significant upgrade due to the inaccessibility of replacement equipment.

9.0 Recommended Water System Improvements

This chapter summarizes the water system evaluations and presents the recommended improvements plan along with the evaluation of the improvements. Based on the water system evaluation, the improvements plan was developed to address water system deficiencies (current and future) and improve overall water system operation. The recommended improvements plan prioritizes system improvements to meet the needs and requirements of the Weston Water Utility over the planning period (20 years) and provides a schedule for the construction timing. Budget cost estimates for each improvement are presented in the following chapter.

9.1 Summary of Water System Evaluation

Table 9-1 summarizes the water system evaluations that are used to develop the recommended water system capital improvement plan.

The most significant areas to be addressed in the water system include:

- Adequate reliable supply capacity to meet projected future maximum day demands.
- Adequate storage capacity to meet existing and future requirements.
- Ensure adequate water quality.
- Adequate available fire flows to meet estimated fire flow requirements
- System expansion to serve future development

The recommended improvements are discussed in the following sections.

9.2 Water Supply to Future Service Area

A critical step in long-range planning was identifying the future needs of the service area coupled with an assessment of water supply and storage requirements. Figure 3-3 in Chapter 3 illustrates the anticipated Weston Water Utility planning boundary along with the areas to be developed within which municipal water service is expected.

Figure 9-1 illustrates the ground elevation within the Utility planned service area and the areas that can be served by the existing HGL of the Main System as summarized in the following table:

Main System Pressure[1]	Condition[2]	Approximate HGL	Serviceable Elevation
40 psi	Towers approximately 10 feet low	1,397 feet	1,304 feet
80 psi[3]	Towers Full	1,407 feet	1,223 feet
100 psi	Towers Full	1.407 feet	1,176 feet

Footnotes:

[1] The Wisconsin Administrative Code, Chapter NR 811, requires that municipal water systems be designed with a minimum pressure of 35 psi and a maximum pressure of 100 psi at all locations in the service area under normal operating condition. Although requirement is 35 psi, 40 psi is used for planning purposes to be conservative and account for system losses.

[2] Tower overflow elevations are approximately 1,407 feet MSL.

[3] WAC, Chapter SPS 382 requires that a PRV be installed on individual services if the supply pressure exceeds 80 psi.

As illustrated in the figure, there are two areas of high elevation in Development Areas K and N that would experience pressures below 40 psi (requirement is 35 psi; however, 40 psi is used for planning purposes to be conservative and to account for any system losses). For the purposes of this study, it was assumed the Utility would not provide service to these areas of high elevation. There is also an area of low elevation in currently unsewered Area O that would experience pressures above 100 psi if served. Also illustrated in the figure, much of the northern and southwestern area of the Main System, including Development Areas A, F, H, I, J, L, M, N, and currently unsewered areas O, P, Q, R, S, will likely experience pressures greater than or equal to 80 psi. It should be noted that in areas with pressures greater than 80 psi, individual PRVs should be installed on water service lines in accordance with WAC, Chapter SPS 382.

TABLE 9-1: SUMMARY OF WATER SYSTEM EVALUATION

Main System

Well Water Quality

- Well 1 (Alta Verde) exceeds the secondary standards for TDS, manganese, and iron.
- Well 5 (Bloedel) exceeds the secondary standards for manganese.
- Well 3 (Mesker) exceeds the secondary standards for manganese and iron.
- Corrosion control is managed through pH adjustment and blended phosphate addition.
- Well 4 (Sternberg) and Well 6 (Rippling Creek) appear to meet secondary standards.
- The water treatment facility for Wells 3 and 4 provides pH adjustment through the air stripping tower (no longer needed for VOC treatment).
- Wells 1, 5, and 6 pH adjustment is completed with chemical feed systems.

Supply

- Existing Reliable Well Capacity: 3.6 MGD
- Design 2020 Maximum Day Demand: 3.0 MGD
- Design 2040 Maximum Day Demand: 5.8 MGD
- Adequate reliable supply capacity to meet existing design maximum day demands (approximately 0.58 MGD excess)
- Deficiency in reliable supply capacity projected to increase to ~2.24 MGD by 2040.

Storage

- Existing storage deficiency of approximately 0.34 MG; however, the deficiency can nearly be completely offset by the excess reliable supply capacity (storage requirement 1.19 MG).
- Future storage deficiency projected to be approximately 0.79 MG (storage requirement 1.62 MG).
- Not currently filling existing storage tanks completely full (approximately 0.2 MG is not be utilized).

System Reliability

- Single river crossing at Ross Avenue limits flow reliability to the distribution system north of the Eau Claire River (single well north of river, Rippling Creek Well)
- The Utility can maintain water supply during a power outage (existing and projected future average day demands) with auxiliary sources of power. The Utility has standby power/engine at Well 1 (Alta Verde), Well 3 (Mesker/WTP), Well 4 (Sternberg), Well 5 (Bloedel), Well 6 (Rippling Creek).

Water System Pressures

Minimum System Pressures: ~40 to 45 psi	Minimum pressure near Summit Tower and near the hospital along Weston Avenue.
Maximum System Pressures: ~90 to 95 psi	Maximum pressure near the Village of Rothschild.
Average System Pressure: ~75 psi	

Per NR 811, the minimum and maximum normal static pressure in the distribution system shall be 35 psi and 100 psi, respectively. The system pressure shall be maintained at a minimum of 20 psi under emergency conditions.

Available Fire Flows

Approximately 89 percent of the hydrants meet the fire flow requirements.	Fire Flow Requirements: 500 gpm to 3,500 gpm

Areas deficient include:

- Near Saint Clare's Hospital along Weston Avenue/Birch Street (3,500 gpm requirement)
- Industrial areas (3,500 gpm requirements) south of Highway 29 on east side of Village (dead ends)
- Commercial area/dead end south of Highway 29 east side of Village
- Near DC Everest Senior High School along Alderson Street
- One hydrant on the west side of Weston Elementary school (other hydrants surrounding the school meet the requirement
- Near YMCA on Howland Avenue (south dead end, 3,500 gpm requirement)
- Northern industrial area along Bernard Avenue (3,500 gpm requirement)
- Multi-family area served by dead end in Village of Rothschild
- Near the industrial area east of the WTP on Fuller Street and Saxon Avenue.
- Multiple dead ends

Hydraulic Capacity (Headloss/Velocity)

- No water mains have higher than recommended velocities or headlosses.

Guidelines

- AWWA Manual M32 recommends that all pipe velocities should be less than 4 to 6 feet per second (fps) during normal operation.
- AWWA Manual M32 recommends headlosses in pipes less than 16-inches in diameter should be less than 5 to 7 feet per 1,000 feet of pipe during normal operating conditions. The recommended headloss limit for larger pipes in AWWA Manual M32 is 2 to 3 feet per 1,000 feet of pipe during normal operating conditions.

Water Main Reinvestment (KANEW Analysis)

- The Utility's water distribution system is a "newer" water system; approximately 40 percent of the water mains are less than 20 years old and nearly 20 percent of the water mains are over 45 years old.
- Based on the long and short life expectancies in the KANEW analysis, the total recommended replacement lengths in the first 10 years of replacement are approximately 0.8 miles (0.73 percent) and 8.1 miles (7.5 percent), respectively.
- Based on the long and short life expectancies in the KANEW analysis, the total replacement lengths over the 20 year period of replacement are approximately 6.4 miles (5.4 percent) and 15.0 miles (13.9 percent), respectively.

Note: AWWA Research Foundation developed KANEW software to be used to perform replacement rate analysis for water system based on water main inventory.

Condition Assessment

- Well 1 (Alta Verde) – structure and pump are in poor condition; pump motor is 20 years old.
- The control system should have a significant upgrade due to inaccessibility of replacement equipment (includes Kerry System).
- The electrical system at Well 3 (Mesker) is in very poor condition.
- The booster pumps at the treatment plant (air stripper) are in poor condition.
- Pump at Well 4 (Sternberg) is in poor condition.
- 2012 Summit Tower Inspection Report noted concrete spalling, cracking and deteriorating along with sediment in tank, limited access to tower due to narrow driveway and easement from the road to the water site (exterior last painted 1983).
- All other well facility structures, pumps, electrical, HVAC, and chemical feed were noted to be in good to fair condition.

Kerry Water System

- Adequate supply capacity from Well 2 to meet Kerry maximum day demand.
- Supply reliability to the system is from the emergency connection with Village of Rothschild and portable diesel generator hookup.
- Kerry Tower is leaking in multiple locations along the seams in the metal that appear to have corroded. Updates are needed for the overflow termination to meet DNR Codes and coating is nearing obsolete.
- Well 2 exceeds the secondary standards for manganese. Kerry personnel have indicated issues with pinhole leaks in stainless steel pipe in the facility that may be caused by microbially induced corrosion from the manganese.
- The Well 2 pump was inspected during a recent well rehabilitation. The Well 2 pump motor is aged and should be scheduled for replacement.
- Kerry personnel indicated phosphate, which is added by the Utility for corrosion control and sequestering manganese, is a challenge in the water supply to Kerry due to proposed phosphate limits in wastewater discharge.
- Manual operation of valves, coordination with Village of Rothschild, and flushing is needed to use the emergency connection.
- Dependent on Rothschild for fire protection.

LEGEND

- 🟪 ELEVATION <1,176 FT (GREATER THAN 100 PSI WITH TOWERS FULL)
- 🟦 ELEVATION <1,223 FT (GREATER THAN 80 PSI WITH TOWERS FULL)
- 🟧 ELEVATION >1,304 FT (LESS THAN 40 PSI WITH TOWERS 10 FEET LOW)

GROUND ELEVATION

- 1,136 - 1,146 FEET
- 1,147 - 1,156 FEET
- 1,157 - 1,166 FEET
- 1,167 - 1,176 FEET
- 1,177 - 1,186 FEET
- 1,187 - 1,196 FEET
- 1,197 - 1,206 FEET
- 1,207 - 1,216 FEET
- 1,217 - 1,226 FEET
- 1,227 - 1,236 FEET
- 1,237 - 1,246 FEET
- 1,247 - 1,256 FEET
- 1,257 - 1,266 FEET
- 1,267 - 1,276 FEET
- 1,277 - 1,286 FEET
- 1,287 - 1,296 FEET
- 1,297 - 1,306 FEET
- 1,307 - 1,400 FEET

CURRENTLY DEVELOPED

- ▭ UNSEWERED AREAS

AREAS FOR DEVELOPMENT

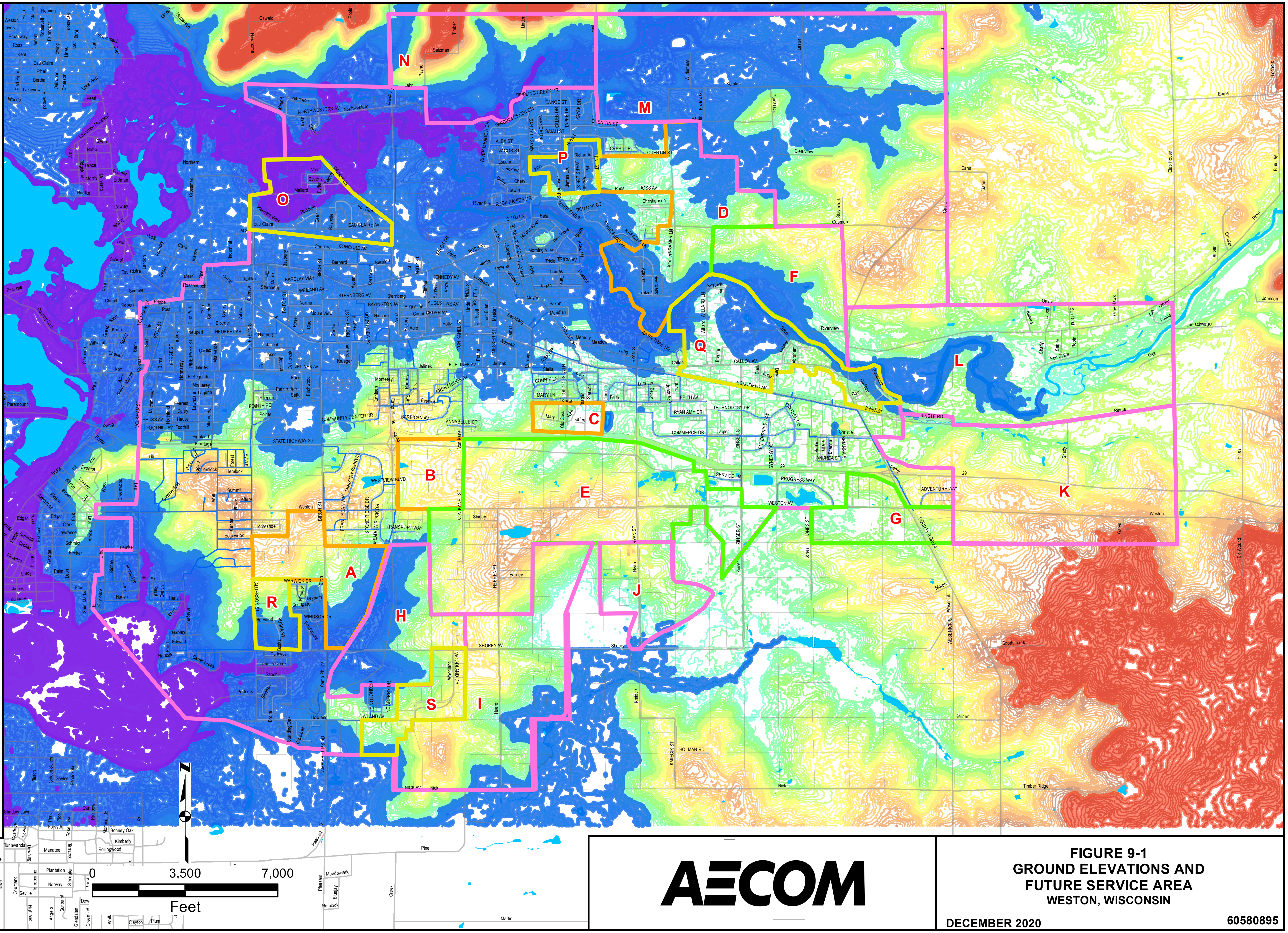
- ▭ 2025
- ▭ 2030
- ▭ 2040

FUTURE SERVICE BOUNDARY

- ▭ 2040

BASE MAPPING

- ROADS
- PARCELS



AECOM

FIGURE 9-1
GROUND ELEVATIONS AND FUTURE SERVICE AREA
WESTON, WISCONSIN

DECEMBER 2020

60580895

9.3 Water Supply Improvements – Main System

As stated in Chapter 5, the Main System reliable supply capacity is approximately 3.6 MGD, meeting the existing approximately 3.0 MGD design maximum day demand. However, the reliable supply in the Main System will be deficient by approximately 0.5 MGD by 2025 and approximately 2.2 MGD by 2040.

New wells need to be designed in accordance with Wisconsin Administrative Code Chapter NR 811. The proposed well site locations should be evaluated based on the following considerations:

- Estimated yield potential
- Estimated water quality characteristics
- Proximity to existing and planned municipal wells, existing private wells, wetlands, and surface waters
- Location of known potential and existing contamination sources and minimum recommended separation distances to potential contamination sources
- Apparent land availability
- Transmission main requirements
- Probable wellhead protection requirements and impacts on surrounding land uses

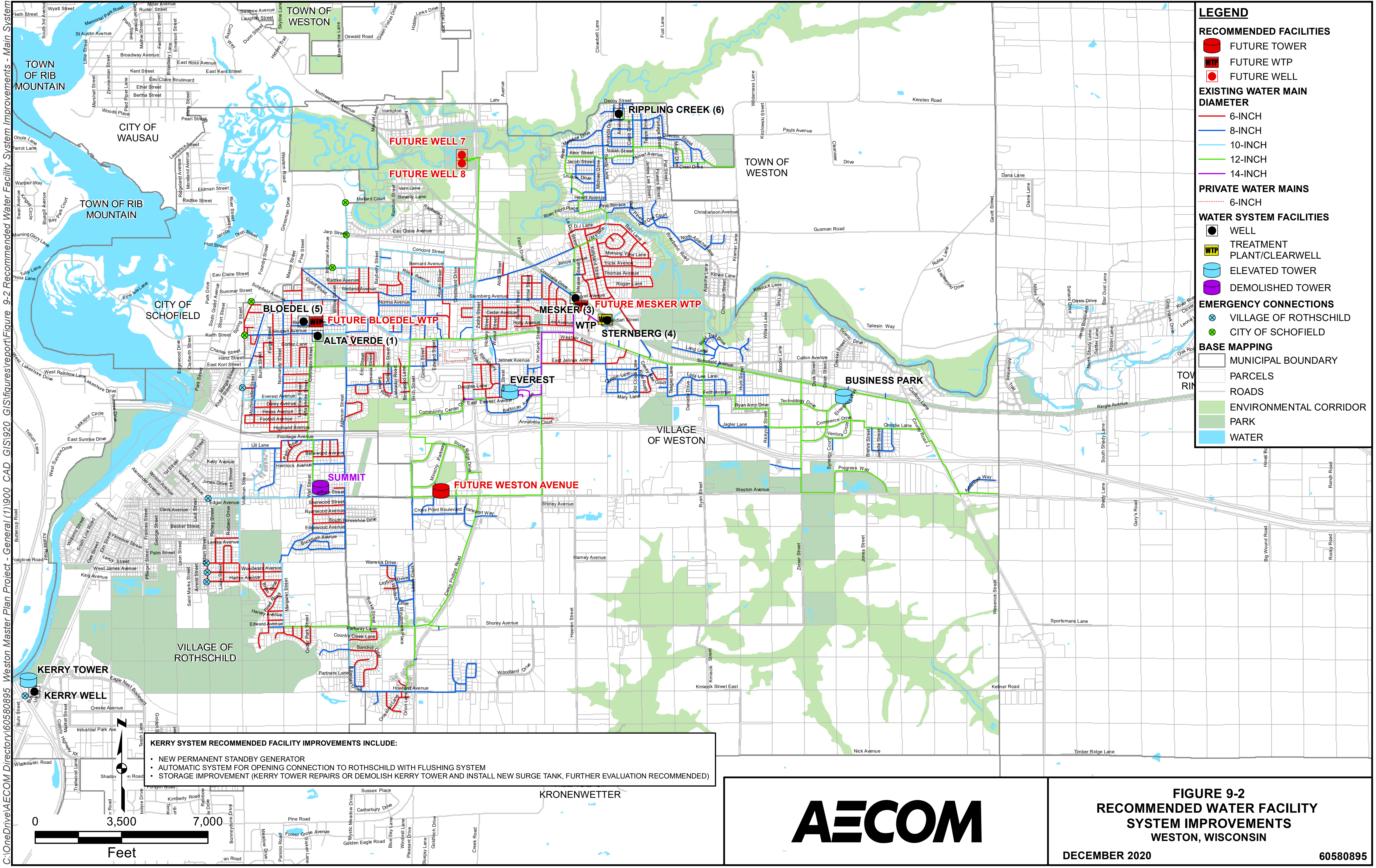
As documented in the Wellfield Concept Technical Memorandum (AECOM, 2020), AECOM recommends that 2 new wells (Well 7 and Well 8) with a likely capacity of approximately 900 gpm (1.3 MGD) each be developed in the Yellow Banks Park wellfield on Camp Phillips Road as illustrated in Figure 9-2.

The Utility's current plan is Well 7 will be constructed at a location separate from the water treatment and electrical equipment to support the well. The Well 7 building will be constructed within a park structure that includes a pavilion and bathroom. A new, separate water treatment building would be constructed to treat water from Well 7 and Well 8 with disinfection and pH adjustment. The water treatment building will include chemical feed rooms, electrical equipment, and a backup power generator sized for Well 7, Well 8, and the treatment facility. The Well 7 and Well 8 water manganese and iron concentrations are anticipated to be below the secondary standards. The wells will not require additional treatment for manganese or iron removal. If future treatment is needed due to water quality changes, sufficient space is available at the site for additional treatment equipment.

The planned location of Well 8 is approximately 500 feet southwest of Well 7. The Utility plans to use a pitless adaptor at Well 8 with a security enclosure to meet DNR requirements.

Table 9-2 and Table 9-3 summarize the maximum day demand requirement and the available reliable water supply (well) capacity for the Main System. With the addition of Well 7 before 2025 and Well 8 before 2030, maximum day demands will be met reliably in the Main System throughout the planning period. Note that the dates are not precise and the timing of Well 7 and Well 8 is primarily a function of the growth in water demand.

Figure 9-3 illustrates projected water supply capacities with the recommended improvements with the projected maximum day pumpage requirements for the Main System. The graph illustrates the "trigger" maximum day demand for the recommended wells as currently timing of the recommended wells is based on estimated demand projections which may vary from actual demands.



KERRY SYSTEM RECOMMENDED FACILITY IMPROVEMENTS INCLUDE:

- NEW PERMANENT STANDBY GENERATOR
- AUTOMATIC SYSTEM FOR OPENING CONNECTION TO ROTHSCHILD WITH FLUSHING SYSTEM
- STORAGE IMPROVEMENT (KERRY TOWER REPAIRS OR DEMOLISH KERRY TOWER AND INSTALL NEW SURGE TANK, FURTHER EVALUATION RECOMMENDED)

AECOM

FIGURE 9-2
RECOMMENDED WATER FACILITY
SYSTEM IMPROVEMENTS
WESTON, WISCONSIN

DECEMBER 2020

60580895

TABLE 9-2: RELIABLE SUPPLY CAPACITY WITH RECOMMENDED IMPROVEMENTS – MAIN SYSTEM

	2025		2030		2040	
Water Supply Source	**Supply Capacities[1]**					
	(gpm)	**(MGD)**	**(gpm)**	**(MGD)**	**(gpm)**	**(MGD)**
Groundwater Wells						
Alta Verde (Well 1)	510	0.73	510	0.73	510	0.73
Mesker (Well 3)	730	1.05	730	1.05	730	1.05
Sternberg (Well 4)	840	1.21	840	1.21	840	1.21
Bloedel (Well 5)	800	1.15	800	1.15	800	1.15
Rippling Creek (Well 6)	460	0.66	460	0.66	460	0.66
Future Well 7[2]	900	1.30	900	1.30	900	1.30
Future Well 8[2]	--	--	900	1.30	900	1.30
Total Pumping Supply Capacity	**4,240**	**6.11**	**5,140**	**7.40**	**5,140**	**7.40**
Less: Largest Supply Unit	900	1.30	900	1.30	900	1.30
Reliable Supply of Groundwater Wells	**3,340**	**4.81**	**4,240**	**6.11**	**4,240**	**6.11**
Groundwater Wells with Booster Pumps						
Alta Verde (Well 1)	510	0.73	510	0.73	510	0.73
Booster Pump 1	1,300	1.87	1,300	1.87	1,300	1.87
Booster Pump 2	1,300	1.87	1,300	1.87	1,300	1.87
Bloedel (Well 5)	800	1.15	800	1.15	800	1.15
Rippling Creek (Well 6)	460	0.66	460	0.66	460	0.66
Future Well 7[2]	900	1.30	900	1.30	900	1.30
Future Well 8[2]	--	--	900	1.30	900	1.30
Total Pumping Supply Capacity	5,270	7.59	6,170	8.88	6,170	8.88
Less: Largest Supply Unit	1,300	1.87	1,300	1.87	1,300	1.87
Reliable Supply of Groundwater Wells with Booster Pumps	**3,970**	**5.72**	**4,870**	**7.01**	**4,870**	**7.01**

Footnotes:

[1] Supply capacities from three month average of EMOR daily readings as illustrated in Appendix D. Mesker capacity updated post rehabilitation in June 2020.

[2] Estimated capacities available from wellfield based on modeling of aquifer. Well 7 assumed to be constructed by 2025 and Well 8 assumed to be constructed by 2030.

AECOM recommends that the Utility continue to monitor, record, and trend actual reliable supply capacity from the wells and the actual maximum day demands to plan for the recommended supply improvements as needed. At times, growth occurs faster than expected resulting in the need for a well sooner than originally planned and other times growth does not occur as quickly as expected which may delay the construction of a new well. Note it is important to verify the capacity of the wells on regular basis, as historically the wells have had specific capacity/production losses prior to rehabilitation where the specific capacity/production was regained.

TABLE 9-3: SUPPLY CAPACITY WITH RECOMMENDED IMPROVEMENTS – MAIN SYSTEM

	2025 Projected	2030 Projected	2040 Projected
Average Day Pumpage (gpm)	1,210	1,435	1,720
Design Maximum Day Pumpage (gpm)[1]	2,860	3,380	4,060
Reliable Supply Capacity with Recommended Improvements (gpm)	3,340	4,240	4,240
Additional Capacity Required (gpm)	**None**	**None**	**None**
Reliable Capacity in Excess of Maximum Day Demand (gpm)	**480**	**860**	**180**

Footnote:

[1] Design maximum day pumpage requirements were based on a Main System maximum day factor of 2.36.

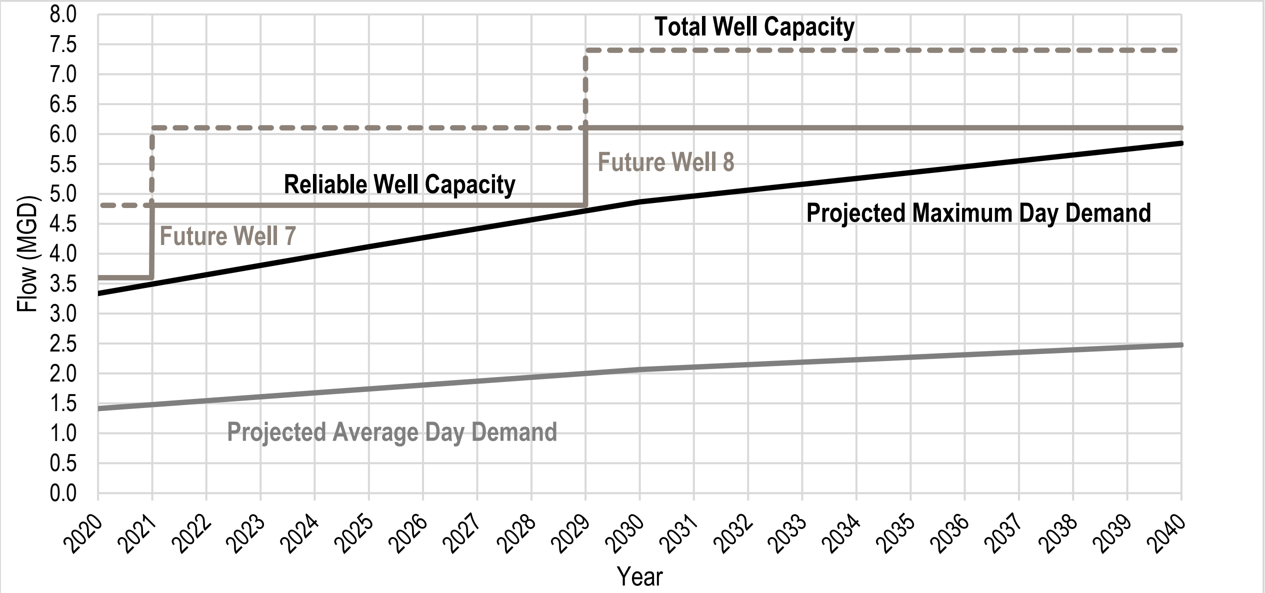


FIGURE 9-3: PROJECTED MAXIMUM DAY PUMPAGE VERSUS RELIABLE SUPPLY CAPACITY

9.4 Water Storage Improvements – Main System

As stated in Chapter 5, additional storage is needed currently in the Main System (approximately 0.34 MG); however, the deficiency can nearly be completely offset by the excess reliable supply capacity. Based on the storage evaluation in Table 5-5, a total of approximately 0.77 MG additional storage will be needed by 2040.

It is recommended that a new 0.75 MG composite tower be constructed in the short-term near the hospital on Weston Avenue on a parcel the Utility has identified with a relatively high elevation as illustrated Figure 9-2 with an overflow elevation of approximately 1,407 feet MSL (approximate tank height would be approximately 126 feet). This area was selected as the area has a high elevation, the area has high fire flow requirements, and the Utility owns a parcel of land in the area.

In addition, Summit Tower (0.1 MG capacity) installed in 1969 was last painted on the exterior in 1983 and interior in 2006. Due to the small volume of the tank, concrete concerns noted in the 2012 inspection, and coating rehabilitation required, it is recommended that the Utility remove the tower from service and demolish it once the recommended new tower is in service (refer to Section 9.7 for relocation of communication systems on the tower with the SCADA system upgrades).

Table 9-4 summarizes the projected storage needs with recommended improvements for the Main System for the Utility.

TABLE 9-4: STORAGE EVALUATION WITH RECOMMENDED IMPROVEMENTS – MAIN SYSTEM

SUPPLY REQUIREMENTS	**Projected 2025**	**Projected 2030**	**Projected 2040**
Design Average Day Demand (gpm)	1,210	1,435	1,720
Design Maximum Day Demand (gpm)	2,860	3,380	4,060
Design Peak Hour Demand (gpm)	4,580	5,410	6,500
Projected Reliable Supply Capacity (gpm)	**3,340**	**4,240**	**4,240**
Reliable Supply Capacity in Excess of Maximum Day Demand (gpm)	**480**	**860**	**180**

STORAGE REQUIREMENTS	**Projected 2025**	**Projected 2030**	**Projected 2040**
Peak Hour Equalizing Requirements (gallons) [1]	523,000	619,000	743,000
Optimum Fire Protection Needs (gallons) [2]	630,000	630,000	630,000
Operational/Reserve Storage (gallons; 15% of Total) [3]	204,000	221,000	243,000
Total Optimum Storage Requirements (gallons)	**1,357,000**	**1,470,000**	**1,616,000**
Available Effective Storage Capacity (gallons):			
Business Park Tower	500,000	500,000	500,000
Everest Tower	250,000	250,000	250,000
Summit Tower (Demolished)	-	-	-
Future Weston Avenue Tower	750,000	750,000	750,000
Total Effective Storage Capacity	**1,500,000**	**1,500,000**	**1,500,000**
Subtotal Capacity Required (gallons)	**None**	**None**	**116,000**
Excess Available Reliable Main System Supply Capacity			
Peak Hour Supply Capacity for Peak Hour Equalization[4]	372,000	510,000	151,000
Supply Capacity in Excess of Peak Hour for Fire Protection	None	None	None
Total Additional Capacity Required (gallons)	**None**	**None**	**None**

Footnotes:

[1] Peak hour storage is storage required to meet demands which exceed the maximum day demand rate assuming the reliable supply capacity is equal to the maximum day demand rate.

[2] Optimum fire protection based on requirement for 3,500 gpm for 180 minutes.

[3] Operational/Reserve storage is storage required to provide a start/stop range for pump operation and an emergency reserve storage supply.

[4] Peak hour supply capacity cannot exceed peak hour equalization and is calculated utilizing time of day demand curve and supply capacity

As shown in Table 9-4 , with the construction of the new Weston Avenue Tower and the demolition of the Summit Avenue Tower by 2025, the total available storage for the Main System is approximately 1.5 MG. Estimated projected 2025, 2030 and 2040 optimum water storage requirements for the Main System, assuming a fire flow requirement of 3,500 gpm for three hours, are approximately 1.36 MG, 1.47 MG, and 1.62 MG, respectively. With the addition of Well 7 and Well 8, there is approximately 180 gpm of excess water supply in 2040, which offsets the projected storage deficiency of approximately 0.12 MG in 2040.

9.5 Water Treatment Improvements – Main System

As discussed in Chapter 2, Well 1 (Alta Verde) exceeds the secondary standards for TDS, manganese, and iron and Well 5 (Bloedel) exceeds the secondary standards for manganese.

Based on land availability, AECOM recommends that an iron and manganese removal treatment plant be added to the existing Well 5 (Bloedel) site which will treat the water from Well 5 and Well 1. The recommended water treatment facility is referred to as the Bloedel WTP for this report. It is recommended that a pilot study be completed prior to design. The recommended improvements include:

- Pressure filters with reliable capacity to treat Well 5 and Well 1
- New Well 5 pump and motor with VFD to meet WTP head conditions
- New Well 1 pump and motor with VFD to meet WTP head conditions
- New building for Well 1 (demolish existing building as it is in poor condition)
- New 8-inch raw water piping from Well 1 to Well 5
- Discharge pipe size improvement from Well 5 (12-inch to existing 12-inch on Alta Verde)
- New chemical feed systems at Well 5 to support Well 1 and Well 5 treatment.
- Backwash supply and backwash waste systems to support new pressure filters.
- New standby generator in the building expansion at Well 5

Treatment building options include an expansion to Well 5 existing building or a secondary building.

Well 3 (Mesker) exceeds the secondary standards for manganese and iron. Currently, a sequestering agent is added to prevent iron and manganese from precipitating in the system. The water from Well 3 (Mesker) and Well 4 (Sternberg) are blended prior to distribution. At present, the blended water has not had iron and manganese above the secondary standard.

It is recommended that Well 3 (Mesker) water is treated to remove iron and manganese in the future. The recommended water treatment facility is referred to as the Mesker WTP for this report. Based on land availability, the treatment system may be constructed at the Well 3 (Mesker) site or at the current Air Stripper WTP site. The treatment process at Bloedel WTP (recommended in this study) will provide a general plan for iron and manganese treatment at the Mesker WTP; however, it is recommended that a pilot study be completed prior to design as small variations in water quality may require adjustments to the Mesker WTP design. Air stripping currently provides pH control for Well 3. Pilot testing should review alternative pH adjustment processes in lieu of air stripping. Mesker WTP will add headloss and the Well 3 (Mesker) pump and motor will need to be replaced to meet the new pressure requirements. The recommended improvements include:

- Pressure filters with reliable capacity to treat Well 3.
- New Well 3 pump and motor with a VFD to meet revised pumping requirements with Mesker WTP.
- New chemical feed systems at Well 3.
- Backwash supply and backwash waste systems to support new pressure filters.
- New standby generator to accommodate the expanded power needs (operate the well and WTP).
- Electrical system updates to replace aged equipment (noted in Chapter 8)

It is not certain if the air stripper will continue to be utilized with the new Mesker WTP; therefore, upgrades to the existing Air Stripper water treatment facilities should be evaluated based on the plans for the recommended Mesker WTP.

It is recommended that until Well 3 (Mesker) water is treated to remove iron and manganese, Well 3 (Mesker) should be operated in conjunction with Well 4 (Sternberg). Well 3 should only operate when Well 4 operates to allow the blending of the two sources to continue. AECOM recommends a new well operation plan that focuses on pumping the wells with better water quality more than the wells with lower water quality. The Utility should consider operating Well 4 (Sternberg) more frequently with or without Well 3 (Mesker) operating. In all cases, Well 3 (Mesker) should not operate without Well 4 (Sternberg) under normal operations; however, Well 3 could be operated without Well 4 if necessary during an emergency.

Although the air stripper is no longer needed for VOC removal from Well 3 (Mesker) and Well 4 (Sternberg), it is recommended the air stripper continue to be used for pH adjustment. At a future time, when the air stripper replacement is required, or when treatment is designed and constructed for Well 3 (Mesker) the Utility should evaluate the economics of removing the air stripper and adjusting the pH with chemical addition at the well site(s) or at the WTP (air stripper, clearwell, booster station).

9.6 Facility Improvements- Main System

Based on the facility condition assessment in Chapter 8, the following facility improvements are recommended as illustrated in Figure 9-2:

- Well 1 (Alta Verde) structure is in very poor condition and should be replaced (refer to Section 9.5 for revised treatment so the new building does not need chemical feed systems).
- Replace two existing WTP booster pumps and motors and add VFDs.
- Electrical improvements at Well 3 (Mesker) and add a VFD (Table 8-2, refer to Section 9.5).
- Replace Well 4 pump (Sternberg) and add a VFD.
- Activate the altitude valve at Everest Tower and add an altitude valve to Summit Tower for immediate operational improvement to fill towers (Everest Tower and Summit Tower fill before the Business Park Tower fills) and improve overall storage within the system.
- Summit Tower should be abandoned as significant improvements are required (refer to Section 9.4, only abandon after the construction of the recommended new Weston Avenue Tower).

Wells should be equipped with VFDs when pump replacements occur (if applicable) to allow better management of the well operations.

As noted above, it is recommended the Utility replace the two existing WTP booster pumps and motors (at the Air Stripper WTP) and add VFDs. Currently, both Well 3 (Mesker) and Well 4 (Sternberg) are treated at the Air Stripper WTP. It is recommended that the booster pumps be designed to have similar capacities to the wells and the booster station have adequate reliable pumping capacity to the supply wells.

However, the replacement of the Air Stripper WTP booster pumps should be further evaluated once additional design details are determined for the recommended Mesker WTP. It is likely that the Well 3 water treated at the Mesker WTP will not go to the Air Stripper WTP. Without Well 3, the needed reliable capacity of the booster pumps would be less to only accommodate Well 4 at the Air Stripper WTP. The Utility should evaluate the number of required pumps and the overall design capacity of the booster pumps for the Air Stripper WTP based on the well capacities when replacing the booster pumps. From an O&M perspective, the repumping of the Well 3 (Mesker) and Well 4 (Sternberg) is not ideal; however, until other treatment provisions are implemented (a new treatment plant with pH control) the Air Stripper WTP is still needed for pH control.

9.7 SCADA Improvements – Main System and Kerry System

SCADA improvements are required as the availability of replacement components is challenging. The SCADA systems have moved to continually evolving platforms which results in less support for older SCADA equipment and the need to upgrade equipment to maintain serviceability.

With the addition of new wells and treatment processes, AECOM recommends an update of the SCADA platform to accommodate these new assets and recommends replacement of equipment that is no longer easily serviceable. It is recommended that the SCADA upgrades be included with the first major upgrade to a water system facility, which is likely to be the future Well 7. The new Well 7 project will require work by a SCADA systems contractor to upgrade programming and screens to show the new facility. The new Well 7 project will require new SCADA equipment as well for controls, monitoring, and communication.

Summit Tower is scheduled for removal and that will result in removal of communication systems (SCADA and meter reading systems) located at the Summit Tower site. The SCADA improvements design should accommodate changes in communication terminations for both the SCADA and meter reading systems that will be associated with the removal of the Summit Tower.

Other planned short-term improvements including water treatment systems and a new storage tower should be accommodated in the programming and screen layouts so the SCADA updates with each of the planned improvements are already incorporated in a reasonable manner in the major SCADA upgrade.

It is recommended that the new SCADA platform is suitable for generating monthly reports and tracking historic operations and trends. Also, the SCADA program should have tiered password access and tracking systems to further protect the Utility from unauthorized system changes that may lead to system failures.

9.8 System Improvements – Kerry System

As summarized in Chapter 4, Kerry does not plan additional water usage in the future and the existing well (Well 2) has met the needs in the past. It is believed that the high maximum day pumpage values recorded in the past may be a result of inconsistent recording times; therefore, it is recommended that the Utility develop a more rigid procedure for documenting daily pumpage in the Kerry System for future decision-making.

The quality of water from Well 2 (Kerry) has been a concern as it exceeds the secondary standards for manganese and Kerry personnel have indicated issues with pinhole leaks in stainless steel pipe in the facility. The leaks have been attributed to microbially induced corrosion with microbes using manganese and added phosphorus as food sources. In addition, Kerry personnel have indicated that phosphorus from the added corrosion control and iron and manganese sequestering chemical is a challenge in the water supply due to proposed phosphorus limits in the wastewater discharge. It is recommended by Process Research Solutions (Drinking Water Quality Investigation Phase 2 Report, April 2017) that the phosphorus addition for corrosion control is discontinued to prevent microbial growth within the Kerry piping system. The removal of the phosphorus feed system will also reduce the phosphorus loading to the wastewater treatment system. The Utility is currently reviewing phosphorus feed reduction and eventual removal and has a long-term pilot plan in progress. Part of the pilot study is to determine if treating the water for manganese removal is desired as the removal of the phosphorus may result in adverse manganese oxidation within the water and reduce the water quality. At this time, it is assumed that only removal of the blended phosphate chemical feed will be required.

The connection to the Village of Rothschild system provides supply reliability. Based on a review of PSC records, the Village of Rothschild has adequate capacity to supply Kerry; however, no formal agreement is in place. It is recommended that the Utility enter into an agreement with the Village of Rothschild to document Rothschild's, Weston's and Kerry's responsibilities associated with water supply and to ensure future supply reliability and fire protection.

It is AECOM's understanding that opening the current connection with the Village of Rothschild is a manual process including notification, valve operation and flushing. It is recommended that the Weston Water Utility, Village of Rothschild, and Kerry meet to determine improvements to automate the supply reliability which would include an automatic system for opening the connection via SCADA and an automatic hydrant flushing system.

In addition, it is recommended that the Utility add a standby generator at Well 2 (Kerry) for reliability during power outage. The standby generator would have an automatic transfer switch that would automatically start the generator to provide power to Well 2 (Kerry) when the main power supply goes down. This would reduce response time versus having to bring a portable generator to the site.

Based on AECOM's understanding from discussions with Kerry, the primary purpose of the existing 0.1 MG elevated tank is surge protection and that the tank does not provide peak hour equalizing storage or fire protection (provided by Rothschild). During the site visit in August 2019, the elevated tank was leaking. The Kerry Tower was painted in 2009 and will be due for repainting in the 20-year planning period. The tower paint is a zinc-based paint/coating that is no longer used for new tank coatings. No other, newer coating type can be used to coat over a zinc-based coating. The zinc-based paint does not meet current VOC requirements and is challenging to source. There are limited painting companies that will bid on projects using the zinc-based paint. It is recommended that the Utility evaluate Kerry water storage alternatives such as (1) add a hydropneumatic tank for surge protection and remove the Kerry Tower from service or (2) complete the repairs needed for the Kerry Tower.

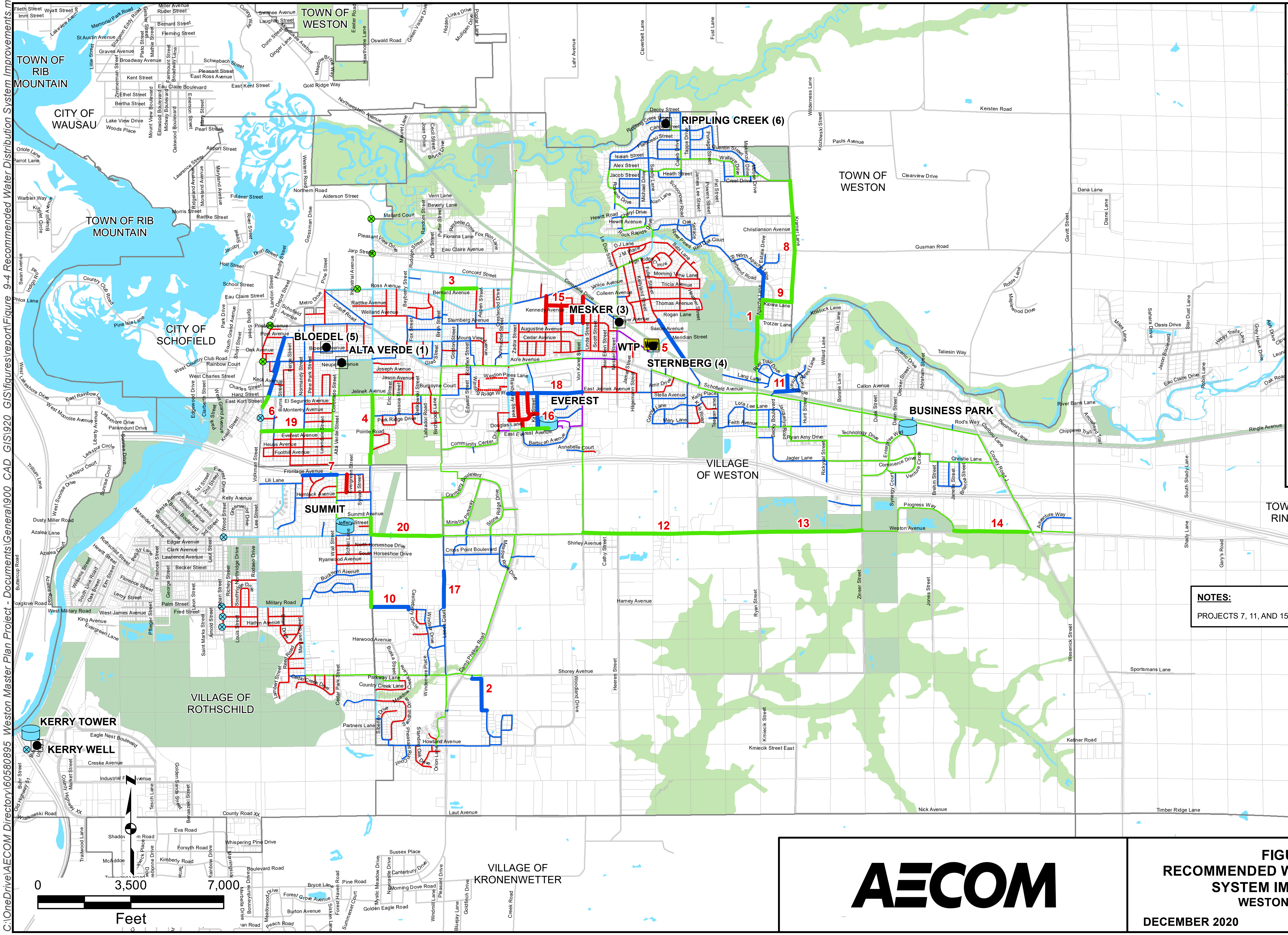
9.9 Water Main Improvements

The recommended water main improvements projects have been developed based on deficiencies identified in the existing water distribution system and the needs projected for the 20-year planning period. The following summarizes the categories of water main improvements discussed in the following sections:

- Distribution System Improvements to Address Deficiencies
- Water Main Renewal
- Street Projects and Planned Development
- Distribution System Improvements for Expansion

9.9.1 Distribution System Improvements to Address Deficiencies

As part of this study, distribution system improvements have been recommended to strengthen the existing system and improve flow capacity, system reliability and fire protection to various parts of the system based on the deficiency analysis. The recommended distribution system improvements are illustrated in Figure 9-4 and summarized in Table 9-5.



LEGEND

RECOMMENDED WATER DISTRIBUTION SYSTEM IMPROVEMENTS
- 🟥 6-INCH
- 🟦 8-INCH
- 🟩 12-INCH

EXISTING WATER MAIN DIAMETER
- 6-INCH
- 8-INCH
- 10-INCH
- 12-INCH
- 14-INCH

PRIVATE WATER MAINS
- 6-INCH

WATER SYSTEM FACILITIES
- ● WELL
- WTP TREATMENT PLANT/CLEARWELL
- ELEVATED TOWER

EMERGENCY CONNECTIONS
- ⊗ VILLAGE OF ROTHSCHILD
- ⊗ CITY OF SCHOFIELD

BASE MAPPING
- ☐ MUNICIPAL BOUNDARY
- PARCELS
- ROADS
- 🟩 ENVIRONMENTAL CORRIDOR
- 🟩 PARK
- 🟦 WATER

NOTES:

PROJECTS 7, 11, AND 15 WERE COMPLETED IN 2020.

AECOM

FIGURE 9-4
RECOMMENDED WATER DISTRIBUTION SYSTEM IMPROVEMENTS
WESTON, WISCONSIN

DECEMBER 2020

60580895

C:\OneDrive\AECOM Directory\60580895_Weston Master Plan Project - Documents\General\900_CAD_GIS\920_GIS\figures\report\Figure 9-4 Recommended Water Distribution System Improvements.mxd

TABLE 9-5: SUMMARY OF WATER DISTRIBUTION SYSTEM IMPROVEMENTS TO ADDRESS DEFICIENCIES

Location[1]	Diameter	Length	Description	Deficiency Addressed
1	8-inch	1,210 feet	Install new 12-inch pipe from River Trail Dr to Kiowa Ln and new 8-inch pipe from Kiowa Ln to N Apache Ln for the new Ryan St river crossing.	Additional River Crossing (reliability)
	12-inch	2,610 feet		
2	8-inch	1,730 feet	Install new 8-inch pipe northwest from Lexington Ct to existing 8-inch stub on Shorey Ave to improve local fire flows near the YMCA.	Improves fire flow deficiencies near the YMCA.
3	12-inch	1,670 feet	Replace existing 1968 AC and 2007 DI 6-inch pipe on Birch St from Ross Ave to Bernard Ave and Bernard Ave from Birch St to Aspen St with 12-inch pipe to address local fire flow deficiencies near the northern industrial area.	Improves fire flow deficiencies near the northern industrial area.
4	12-inch	2,600 feet	Replace existing 1968 CI and 2002 DI 8-inch pipe on Alderson St from Jelinek Ave to Hwy 29 with 12-inch pipe to address local fire flow deficiencies near DC Everest Senior High School.	Improves fire flow deficiencies near DC Everest Senior High School.
5	8-inch	1,790 feet	Replace existing 1989 DI 6-inch pipe on Fuller St from existing 8-inch main to the south to Moyer Avenue with 8-inch pipe to address fire flow deficiencies near the industrial area east of the Air Stripper WTP on Fuller Street	Improves fire flow deficiencies near the industrial area east of the WTP.

Footnote:
[1] As shown in Figure 9-4.

Some fire flow deficiencies are resolved as future water main expansion occurs as additional transmission main is added and looped (refer to recommendations in Section 9.9.4). The locations for water main improvements have been identified to address clusters of fire flow deficiencies; however, the recommended improvements do not resolve all fire flow deficiencies. Many of the remaining deficiencies are on dead ends, or isolated areas (1 or 2 hydrants). Available fire flow must be balanced with cost, complexity, practicality, and feasibility of correction. It is recommended that the Utility evaluate the required fire flows in the remaining deficient areas on an individual basis.

The Ryan Street river crossing is recommended to provide system reliability by adding a second river crossing to the north part of the Main System.

9.9.2 Water Main Renewal

As noted in Chapter 7, the Utility is a relatively “new” system with approximately 40 percent of the water mains being less than 20 years old and nearly 20 percent of the water mains over 45 years old. The oldest water main is the cast iron and asbestos cement main installed in the 1960s.

Based on the long and short life expectancies in the KANEW analysis, the total replacement lengths over the 20 year period of replacement are approximately 6 miles and 15 miles, respectively. However, the KANEW analysis does not consider the historical performance, water quality, reliability, cost of failure, hydraulic analysis, or the physical condition of the pipe nor does it specify which mains to replace. Therefore, it is recommended that the utility plan to replace approximately 6 miles of main in the next 20 years for budgeting purposes (includes the specific recommended replacements associated with deficiencies and street projects). It is recommended that the Utility begin to track water main failures, leaks, repairs, etc. to help with water main renewal planning and in the future the Utility should consider developing a risk based water main prioritization plan. The program will allow the Utility to proactively budget and plan for water main replacement of aging infrastructure on an incremental basis.

For the Master Plan, the local/neighborhood street projects (Appendix K) were reviewed to evaluate the need for water main replacement in conjunction with the street project. As summarized, many of the mains are approximately 50 to 60 years old and, based on typical life expectancies and no known historical performance issues, it is not recommended that the water mains be replaced at the time of the street repairs.

Based on discussions with the Utility, Table 9-6 includes a summary of the projects the Utility should consider or are planning as water main renewal related to street projects which are illustrated in Figure 9-4 (note some were completed in 2020 as noted in the table). The projects associated with water main renewal include Project 6, Project 7, Project 15, Project 16, and Project 19. Project 6 is on Business 51 and is a DOT project and Project 7 (completed in 2020) involves Rothschild streets. As noted, in the table the water mains are older asbestos cement pipe.

It should be noted that the Utility should evaluate the water main size when replacing water mains. For example, some water main may be replaced with the same diameter pipe; however, others may be recommended to be upsized to improve overall system reliability and hydraulic capacity. One example of this may be the 14-inch water main from the Air Stripper WTP, when the time comes to replace this main it may be recommended to increase the size to a 16-inch, a more common pipe diameter and a relatively significant improvement in capacity compared to the cost of the larger main. A similar example may be a 10-inch main, especially in the central part of the distribution system, where a 12-inch pipe should be considered as the increased capacity of a 12-inch main is considerable compared to the cost increase.

For reference, Table 9-7 compares water main capacities smaller diameter distribution mains (6-inch and 8-inch) and transmission mains (10-inch, 12-inch, 14-inch, and 16-inch) based on a c-factor of 120 and recommended headloss per 1,000 feet from AWWA M32. As shown, the capacity of a 6-inch diameter is approximately 47 percent of an 8-inch water main, the capacity of a 10-inch diameter is approximately 74 percent of a 12-inch water main, and the capacity of a 14-inch diameter is approximately 71 percent of a 16-inch water main.

9.9.3 Water Main Improvement - Street Projects and Planned Development

Additional water main improvements are also summarized in Table 9-6 in conjunction with the water main renewal projects and illustrated in Figure 9-4 which include:

- New water mains in conjunction with street projects. Generally, these water mains improve system reliability and overall system capacity; however, are not required.
- Near-term development, subdivisions, growth (included as specific project instead of general expansion main)

Note the pipe diameter recommended for Project 10 improvement is based on the institutional land use (typically 3,500 gpm fire flow requirement) in Rothschild along Alderson Street as illustrated in Figure 3-3. This recommendation along with the recommended distribution system expansion main along Alderson Street is needed to obtain the higher fire flow requirement. The Utility should evaluate the actual fire flow requirements prior to implementing this project.

TABLE 9-6: ADDITIONAL WATER DISTRIBUTION SYSTEM IMPROVEMENTS INCLUDING WATER MAIN RENEWAL

Location[1]	Diameter	Length	Description[2]	Improvement	Planned Year of Construction
6	8-inch	2,800 feet	Replace existing 1961-1968 8-inch asbestos cement pipe on Business 51 with 8-inch pipe. Replace existing 1961 10-inch asbestos cement pipe on Business 51 with 12-inch pipe. Abandon parallel 6-inch pipe on Business 51 and connect 6-inch pipe on S Birch Lane with new 8-inch pipe to the 8-inch replacement pipe on Business 51 to maintain required fire flow on Birch Street.	Water Main Renewal	WisDOT planned for 2024/2025
	12-inch	450 feet			
7[3]	6-inch	680 feet	Replace existing 1969 8-inch asbestos cement pipe on Frontage Ave with 8-inch pipe and existing 1968 CI 6-inch pipe on Evergreen St with 6-inch pipe in conjunction with Rothschild street improvements.	Water Main Renewal	Completed in 2020.
	8-inch	1,300 feet			
8	12-inch	4,590 feet	Install new 12-inch pipe on Kraemer Ln from Kiowa Ln to Quentin St to connect to new Ryan Street river crossing. Coincides with PW21-Kraemer and part of PW22-Ross (street projects).	Development	TBD
9	12-inch	1,110 feet	Install new 12-inch pipe on Kiowa Ln from Kraemer Ln to Apache Ln to connect to new Ryan Street river crossing.	Development/ Water Service	TBD
10	8-inch	1,500 feet	Install new 12-inch pipe on Alderson Rd and 8-inch pipe east to connect to existing 8-inch pipe on Warwick Dr. 12-inch sizing is due to 3,500 gpm fire flow requirement on Alderson Rd (institutional land use in Rothschild).	Development	TBD (long-term)
	12-inch	580 feet			
11[3]	8-inch	1,490 feet	Install new 8-inch pipe on Callon Ave from Hunt St to Schofield Ave and on Hunt St from Schofield Ave to Callon Ave.	Development	Completed in 2020.
12	12-inch	6,580 feet	Install new 12-inch pipe on Weston Ave from Von Kanel St. to Ryan St.	Development	Before 2026, likely 2022/2023
13	12-inch	3,920 feet	Install new 12-inch pipe on Weston Ave from Ryan St to Zinser St.	Development	Before 2026, likely 2022/2023
14	12-inch	2,780 feet	Install new 12-inch pipe on Weston Ave from Progress Way to CTH J.	Development	Before 2026, likely 2022/2023

Location[1]	Diameter	Length	Description[2]	Improvement	Planned Year of Construction
15[3]	6-inch	4,730 feet	Install new 6-inch pipe on Kennedy Ave between S Timber St and Sunset St. Replace existing 6-inch pipe with new 6-inch pipe on Sunset St between Kennedy Ave and Sternberg Ave, on S Timber St between Ross Ave and Sternberg Ave, on Arrow St between Kennedy Ave and Sternberg Ave, on Von Kanel St from Kennedy Ave to Sternberg Ave and on Kennedy Ave between Sunset St and Von Kanel St. Replace existing 8-inch pipe with new 6-inch pipe on Von Kanel St between Kennedy Ave and Corozalla Dr. Coincides with PW19-School (street project).	System Reliability/Street Project/Water Main Renewal	Completed in 2020.
16	6-inch	3,370 feet	Replace existing 1969 6-inch AC pipe with new 6-inch pipe on Randy Jay St, Rodney St, Douglas Ln, and Robin St.	System Reliability/Street Project/Water Main Renewal	2021
	8-inch	1,340 feet	Replace existing 1969 8-inch AC pipe with new 8-inch pipe on Kirk St.		
	12-inch	990 feet	Replace 1969 6-inch AC on Everest Ave from Barbican Ave to the 14-inch pipe at Everest Tower with 12-inch pipe for system reliability. Coincides with PW20-Crest (street project).		
17	8-inch	1,350 feet	Install new 8-inch pipe on Birch St from 8-inch pipe on Leeds Ct to approximately 600 feet south of Cross Point Blvd. Coincides with PW21-BirchS (street project).	System Reliability/Street Project	2022
18	8-inch	2,800 feet	Install new 8-inch pipe on Jelinek Ave from Kirk St to Von Kanel St. Replace existing 1969 6-inch AC pipe with new 8-inch pipe on Jelinek Ave from Kirk Street to Camp Phillips Rd.	System Reliability/Street Project	2024
19	12-inch	2,650 feet	Replace existing 1969 10-inch AC pipe with new 12-inch pipe on Everest Ave from Volkman St to Alta Verde St. Coincides with PW24-Everest (street project).	Street Project/ Water Main Renewal	2024
20	12-inch	3,270 feet	Replace existing 1968 10-inch CI pipe with new 12-inch pipe on Alderson St from Summit Ave to Jefferey Ln. Replace existing 1968 8-inch CI pipe with new 12-inch pipe on Alderson St from Jefferey Ln to Weston Ave. Install new 12-inch pipe on Weston Ave from Alderson St to Birch St.	System Reliability	TBD

Footnotes:

[1] As shown in Figure 9-4.

[2] Refer to Appendix K for additional details on street projects.

[3] Project completed in 2020.

TABLE 9-7: COMPARISON OF WATER MAIN CAPACITIES

Main Diameter	Hazen- Williams C-Factor	Allowable Headloss per 1,000 feet[1]	Estimated Capacity	Percent of 8-inch Capacity
6-inch	120	7 feet	260 gpm	47%
8-inch	120	7 feet	550 gpm	100%
Main Diameter	**Hazen- Williams C-Factor**	**Allowable Headloss per 1,000 feet[1]**	**Estimated Capacity**	**Percent of 12-inch Capacity**
10-inch	120	7 feet	990 gpm	74%
12-inch	120	7 feet	1,590 gpm	100%
Main Diameter	**Hazen- Williams C-Factor**	**Allowable Headloss per 1,000 feet[1]**	**Estimated Capacity**	**Percent of 16-inch Capacity**
14-inch	120	7 feet	2,390 gpm	71%
16-inch	120	7 feet	3,390 gpm	100%

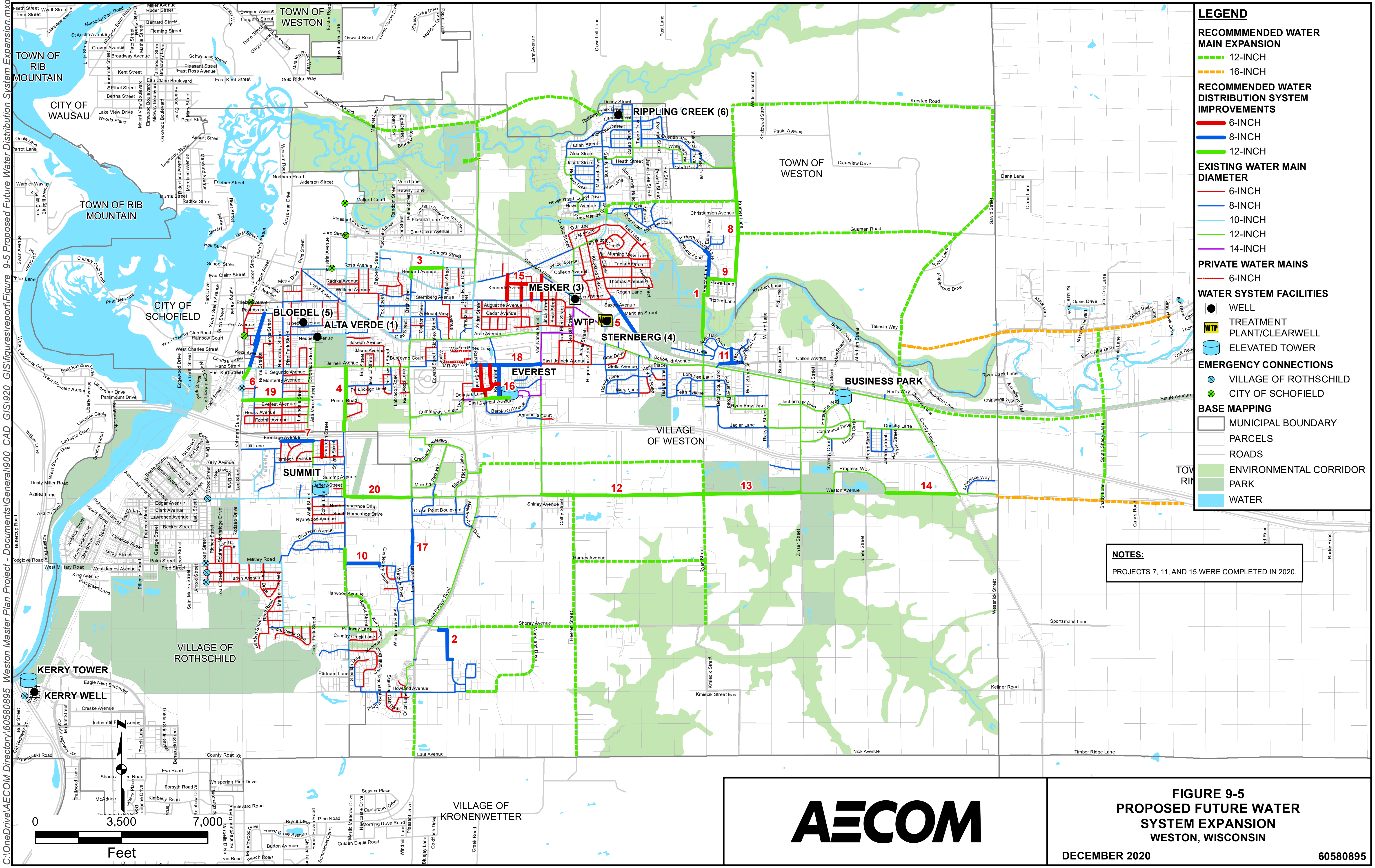
9.9.4 Distribution System Expansion

Recommendations for water mains to serve the anticipated future development areas (herein referred to as “expansion mains”) are illustrated on Figure 9-5. All major transmission mains have been sized to meet projected future water demands and to provide the anticipated fire flow requirement based on future land use (Figure 9-6). For example, the recommended 16-inch transmission main to the east toward the Town of Ringle is recommended based on the potential higher fire flow requirement of 3,500 gpm to the school.

Note that some mains in residential areas may have a lower fire flow requirement (1,000 gpm); however, a transmission main network is recommended with higher available flows as plans may change and schools, churches, etc. may be included in future developments which may need a higher fire flow requirement.

The mains shown in Figure 9-5, are only the recommended transmission mains. Smaller, local service mains have not been shown. It is recommended that water mains to serve developing residential land should be sized at a minimum of 8 inches in diameter. The proposed transmission mains shown follow known or presumed locations for major streets or roads in the future service area.

Two recommended expansion mains to be noted in the plan are the main on Northwestern Avenue which was sized for the potential connection to the City of Wausau connection and the main on Heeren Street south of Shorey Avenue which is sized for the potential connection to the Village of Kronenwetter. If connections are not completed to these adjacent community water systems in the future, water main sizing should be reevaluated.



NOTES:

PROJECTS 7, 11, AND 15 WERE COMPLETED IN 2020.

AECOM

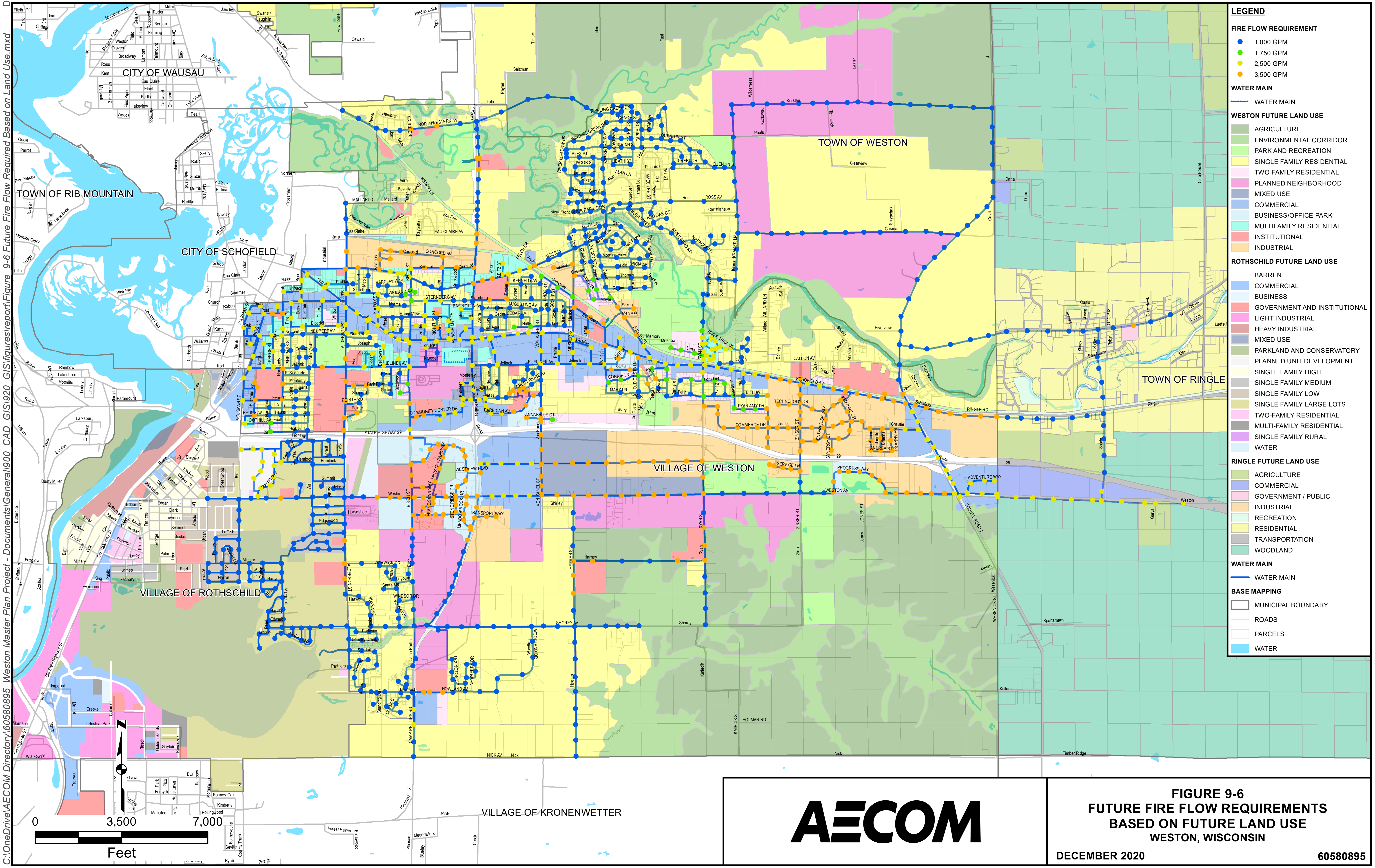
FIGURE 9-5
PROPOSED FUTURE WATER SYSTEM EXPANSION
WESTON, WISCONSIN

DECEMBER 2020

60580895

C:\OneDrive\AECOM Directory\60580895_Weston Master Plan Project - Documents\General\900_CAD_GIS\920_GIS\figures\report\Figure 9-5 Proposed Future Water Distribution System Expansion.mxd

C:\OneDrive\AECOM Directory\60580895 Weston Master Plan Project - Documents\General\900_CAD_GIS\920_GIS\figures\report\Figure_9-6 Future Fire Flow Required Based on Land Use.mxd Dec 15 202



LEGEND

FIRE FLOW REQUIREMENT

- ● 1,000 GPM
- ● 1,750 GPM
- ● 2,500 GPM
- ● 3,500 GPM

WATER MAIN

- ┄ WATER MAIN

WESTON FUTURE LAND USE

- ■ AGRICULTURE
- ■ ENVIRONMENTAL CORRIDOR
- ■ PARK AND RECREATION
- ■ SINGLE FAMILY RESIDENTIAL
- ■ TWO FAMILY RESIDENTIAL
- ■ PLANNED NEIGHBORHOOD
- ■ MIXED USE
- ■ COMMERCIAL
- ■ BUSINESS/OFFICE PARK
- ■ MULTIFAMILY RESIDENTIAL
- ■ INSTITUTIONAL
- ■ INDUSTRIAL

ROTHSCHILD FUTURE LAND USE

- ■ BARREN
- ■ COMMERCIAL
- ■ BUSINESS
- ■ GOVERNMENT AND INSTITUTIONAL
- ■ LIGHT INDUSTRIAL
- ■ HEAVY INDUSTRIAL
- ■ MIXED USE
- ■ PARKLAND AND CONSERVATORY
- ■ PLANNED UNIT DEVELOPMENT
- ■ SINGLE FAMILY HIGH
- ■ SINGLE FAMILY MEDIUM
- ■ SINGLE FAMILY LOW
- ■ SINGLE FAMILY LARGE LOTS
- ■ TWO-FAMILY RESIDENTIAL
- ■ MULTI-FAMILY RESIDENTIAL
- ■ SINGLE FAMILY RURAL
- ■ WATER

RINGLE FUTURE LAND USE

- ■ AGRICULTURE
- ■ COMMERCIAL
- ■ GOVERNMENT / PUBLIC
- ■ INDUSTRIAL
- ■ RECREATION
- ■ RESIDENTIAL
- ■ TRANSPORTATION
- ■ WOODLAND

WATER MAIN

- ― WATER MAIN

BASE MAPPING

- ☐ MUNICIPAL BOUNDARY
- ― ROADS
- ☐ PARCELS
- ■ WATER

AECOM

FIGURE 9-6
FUTURE FIRE FLOW REQUIREMENTS
BASED ON FUTURE LAND USE
WESTON, WISCONSIN

DECEMBER 2020 **60580895**

9.10 Proposed Timing for Supply and Storage Improvements

As noted in Section 9.3, two new wells (Well 7 and Well 8) are recommended in the planning period both at the same site. Well 7 is recommended in the short-term (2021) and Well 8 is projected to be needed in the mid-term (2030) based on current demand projections.

Well 8 may be constructed at the same time as Well 7 to realize the economy of scale associated with constructing both facilities at the same time. Constructing Well 8 early has two additional benefits:

1. Early construction of Well 8 will offset some existing water storage deficiencies and allow the Utility to delay tower construction for a period of time.
2. Assuming that the water quality in Well 8 is good, early construction of Well 8 would allow for primary use of Well 8 and reduce the operational frequency of other wells with higher iron and manganese concentrations. This would improve water quality in the near term until treatment is constructed for Well 1 (Alta Verde) and Well 5 (Bloedel).

Table 9-8 summarizes the available reliable water supply (well) capacity for the Main System with both Well 7 and Well 8 constructed prior to 2025. With the addition of Well 7 and Well 8 before 2025, it is projected the excess reliable capacity is 2025 will be approximately 1,380 gpm.

TABLE 9-8: SUPPLY CAPACITY WITH WELL 7 AND WELL 8 BY 2025 – MAIN SYSTEM

	2025 Projected	2030 Projected	2040 Projected
Average Day Pumpage (gpm)	1,210	1,435	1,720
Design Maximum Day Pumpage (gpm)[1]	2,860	3,380	4,060
Reliable Supply Capacity with Recommended Improvements (gpm)	4,240	4,240	4,240
Additional Capacity Required (gpm)	**None**	**None**	**None**
Reliable Capacity in Excess of Maximum Day Demand (gpm)	**1,380**	**860**	**180**

Footnote:

[1] Design maximum day pumpage requirements were based on a Main System maximum day factor of 2.36.

Table 9-9 summarizes the projected storage needs with the addition of Well 7 and Well 8 in the short-term. As summarized, the excess reliable well capacity can be used to offset the storage deficiency in the short-term (shown as a slight deficiency (4,000 gallons) within the accuracy of the calculation in 2025 which increases to a deficiency of approximately 100,000 gallons in 2030) based on the current demand projections and storage estimates.

Based on discussions with the Utility, it is recommended that the Utility construct Well 7 and Well 8 at the same time and delay the Weston Avenue Water Tower until the mid-term. It is recommended the Utility monitor water system demands to determine the actual time the Weston Avenue Water Tower is needed. It is recommended that unless maintenance is needed, Summit Tower should remain in service until after the construction of the new Weston Avenue Water Tower.

As noted in Section 9.7, it is recommended that the SCADA upgrades be included with the first major upgrade to a water system facility. Upgrading the SCADA system with Well 7 and Well 8 will provide an opportunity to start the new supply well with the long-term SCADA monitoring equipment and reduce rework by the systems house as new screens are created that include all the monitored Utility assets.

As noted in Section 9.5, it is recommended that the Mesker WTP design details be determined prior to replacing the existing booster pumps at the air stripper to adequately determine the number of pumps and reliable pumping capacity needed.

TABLE 9-9: STORAGE EVALUATION WITH WELL 7 AND WELL 8 BY 2025 – MAIN SYSTEM

SUPPLY REQUIREMENTS	Projected 2025	Projected 2030	Projected 2040
Design Average Day Demand (gpm)	1,210	1,435	1,720
Design Maximum Day Demand (gpm)	2,860	3,380	4,060
Design Peak Hour Demand (gpm)	4,580	5,410	6,500
Projected Reliable Supply Capacity (gpm)	**4,240**	**4,240**	**4,240**
Reliable Supply Capacity in Excess of Maximum Day Demand (gpm)	**1,380**	**860**	**180**

STORAGE REQUIREMENTS	Projected 2025	Projected 2030	Projected 2040
Peak Hour Equalizing Requirements (gallons) [1]	523,000	619,000	743,000
Optimum Fire Protection Needs (gallons) [2]	630,000	630,000	630,000
Operational/Reserve Storage (gallons; 15% of Total) [3]	204,000	221,000	243,000
Total Optimum Storage Requirements (gallons)	**1,357,000**	**1,470,000**	**1,616,000**
Available Effective Storage Capacity (gallons):			
Business Park Tower	500,000	500,000	500,000
Everest Tower	250,000	250,000	250,000
Summit Tower (Demolished)	100,000	-	-
Future Weston Avenue Tower		750,000	750,000
Total Effective Storage Capacity	**850,000**	**1,500,000**	**1,500,000**
Subtotal Capacity Required (gallons)	**507,000**	**None**	**116,000**
Excess Available Reliable Main System Supply Capacity			
Peak Hour Supply Capacity for Peak Hour Equalization[4]	503,000	510,000	151,000
Supply Capacity in Excess of Peak Hour for Fire Protection	None	None	None
Total Additional Capacity Required (gallons)	**4,000**	**None**	**None**

Footnotes:

[1] Peak hour storage is storage required to meet demands which exceed the maximum day demand rate assuming the reliable supply capacity is equal to the maximum day demand rate.

[2] Optimum fire protection based on requirement for 3,500 gpm for 180 minutes.

[3] Operational/Reserve storage is storage required to provide a start/stop range for pump operation and an emergency reserve storage supply.

[4] Peak hour supply capacity cannot exceed peak hour equalization and is calculated utilizing time of day demand curve and supply capacity

9.11 Recommended Water System Evaluation – Main System

Evaluation of the water distribution system was repeated with the recommended improvements to confirm the effectiveness of the recommendations for future conditions in the Main System.

Figure 9-7 illustrates future water system pressures throughout the water system under projected 2040 peak hour day demands (minimum system pressures) and Figure 9-8 illustrates future water system pressures throughout the water system under projected 2040 average day demands (typical system pressures).

The future average pressure in the Main System is approximately 79 psi with a relatively wide range of pressures due to topography. Higher system pressures (approximately 90 psi to 103 psi) in the Main System are to the west near the City of Schofield and in the Village of Rothschild as well as in the north of new Well 7 and Well 8. Low pressures (approximately 44 psi to 60 psi) are near the to be demolished Summit Tower and the new development areas in the south central part of the system, as well as to the east near the extremities of the system.

Figure 9-9 illustrates the available fire flow, under projected 2040 maximum day water demand throughout the Main System with the recommended improvements while maintaining a residual system pressure of 20 psi throughout the system. Available fire flows ranged from approximately 1,000 gpm to more than 3,500 gpm.

Figure 9-10 illustrates future fire flow adequacy in the Main System with the recommended improvements under projected 2040 maximum day demand. Generally, fire flow requirements are met except in areas with dead end mains or small diameters (6-inch). Available fire flow is improved to approximately 3,000 to 3,400 gpm near the YMCA with the completion of Distribution System Project 2 and the 12-inch expansion main on Woodland Drive. The 3,500 gpm fire flow requirement for the YMCA can be met by replacing the existing 8-inch main on Howland Avenue with 12-inch main; however, this is anticipated to be beyond the 20-year planning period due to the recent installation year of the 8-inch main and the improvement in available flow with the other water main improvements.

9.12 O&M Recommendations

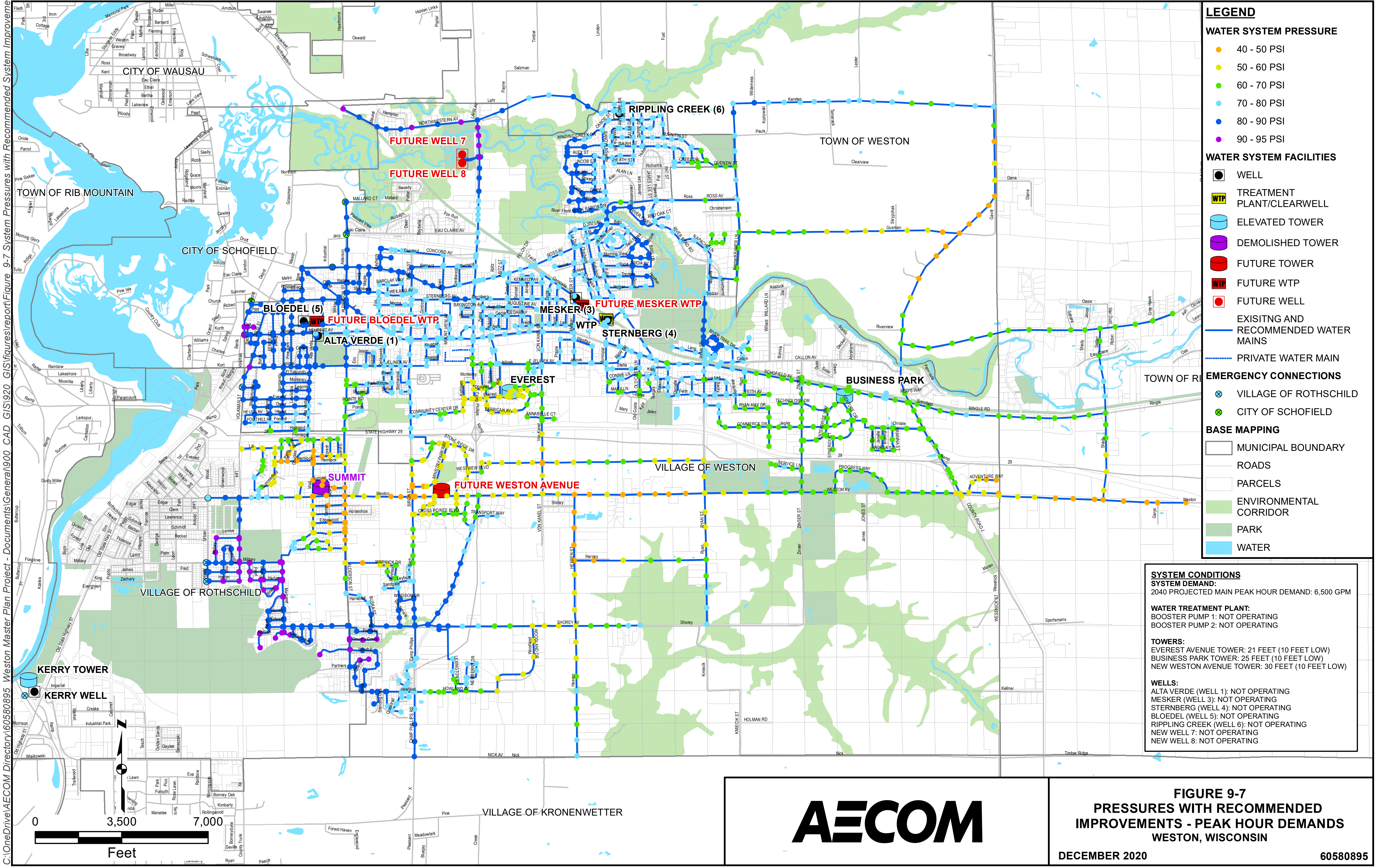
The proposed operations and maintenance (O&M) changes in this section can improve asset service life and/or improve the overall utility performance. In general, the Utility noted sufficient staff for the O&M needs and a new building for the Village will also provide additional space for the Utility. Therefore, no asset improvements are noted for O&M.

9.12.1 Entire System

The Utility should record daily well pumpage volumes and runtimes at the same time each day such that daily pumpage records are improved, particularly for a better understanding of the maximum day requirements for planning purposes.

Well operations should be recorded monthly and reviewed on a quarterly basis to track production loss and to allow for timely scheduling of the well rehabilitation services to prevent significant declines in the well capacity that may not be recoverable.

C:\OneDrive\AECOM Directory\60580895 Weston Master Plan Project - Documents\General\900_CAD_GIS\920_GIS\figures\report\Figure_9-7 System Pressures with Recommended System Improvements - Peak



LEGEND

WATER SYSTEM PRESSURE

- ● 40 - 50 PSI
- ● 50 - 60 PSI
- ● 60 - 70 PSI
- ● 70 - 80 PSI
- ● 80 - 90 PSI
- ● 90 - 95 PSI

WATER SYSTEM FACILITIES

- ● WELL
- WTP TREATMENT PLANT/CLEARWELL
- ELEVATED TOWER
- DEMOLISHED TOWER
- FUTURE TOWER
- WTP FUTURE WTP
- ● FUTURE WELL
- EXISITNG AND RECOMMENDED WATER MAINS
- PRIVATE WATER MAIN

EMERGENCY CONNECTIONS

- ⊗ VILLAGE OF ROTHSCHILD
- ⊗ CITY OF SCHOFIELD

BASE MAPPING

- ☐ MUNICIPAL BOUNDARY
- ROADS
- PARCELS
- 🟩 ENVIRONMENTAL CORRIDOR
- 🟩 PARK
- 🟦 WATER

SYSTEM CONDITIONS

SYSTEM DEMAND:
2040 PROJECTED MAIN PEAK HOUR DEMAND: 6,500 GPM

WATER TREATMENT PLANT:
BOOSTER PUMP 1: NOT OPERATING
BOOSTER PUMP 2: NOT OPERATING

TOWERS:
EVEREST AVENUE TOWER: 21 FEET (10 FEET LOW)
BUSINESS PARK TOWER: 25 FEET (10 FEET LOW)
NEW WESTON AVENUE TOWER: 30 FEET (10 FEET LOW)

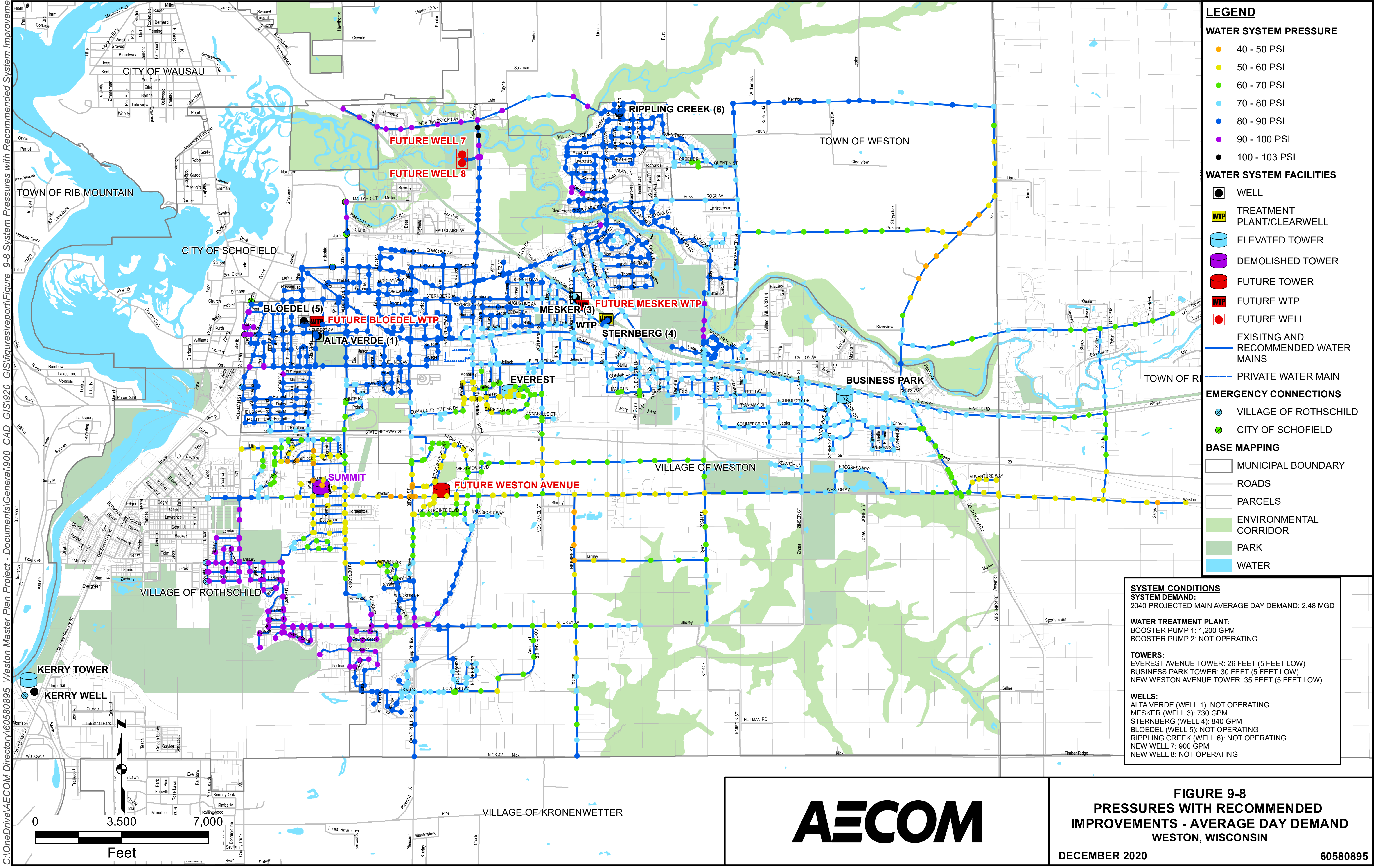
WELLS:
ALTA VERDE (WELL 1): NOT OPERATING
MESKER (WELL 3): NOT OPERATING
STERNBERG (WELL 4): NOT OPERATING
BLOEDEL (WELL 5): NOT OPERATING
RIPPLING CREEK (WELL 6): NOT OPERATING
NEW WELL 7: NOT OPERATING
NEW WELL 8: NOT OPERATING

AECOM

FIGURE 9-7
PRESSURES WITH RECOMMENDED IMPROVEMENTS - PEAK HOUR DEMANDS
WESTON, WISCONSIN

DECEMBER 2020
60580895

C:\OneDrive\AECOM Directory\60580895 Weston Master Plan Project - Documents\General\900_CAD_GIS\920_GIS\figures\report\Figure 9-8 System Pressures with Recommended System Improvements - Aver



SYSTEM CONDITIONS
SYSTEM DEMAND:
2040 PROJECTED MAIN AVERAGE DAY DEMAND: 2.48 MGD

WATER TREATMENT PLANT:
BOOSTER PUMP 1: 1,200 GPM
BOOSTER PUMP 2: NOT OPERATING

TOWERS:
EVEREST AVENUE TOWER: 26 FEET (5 FEET LOW)
BUSINESS PARK TOWER: 30 FEET (5 FEET LOW)
NEW WESTON AVENUE TOWER: 35 FEET (5 FEET LOW)

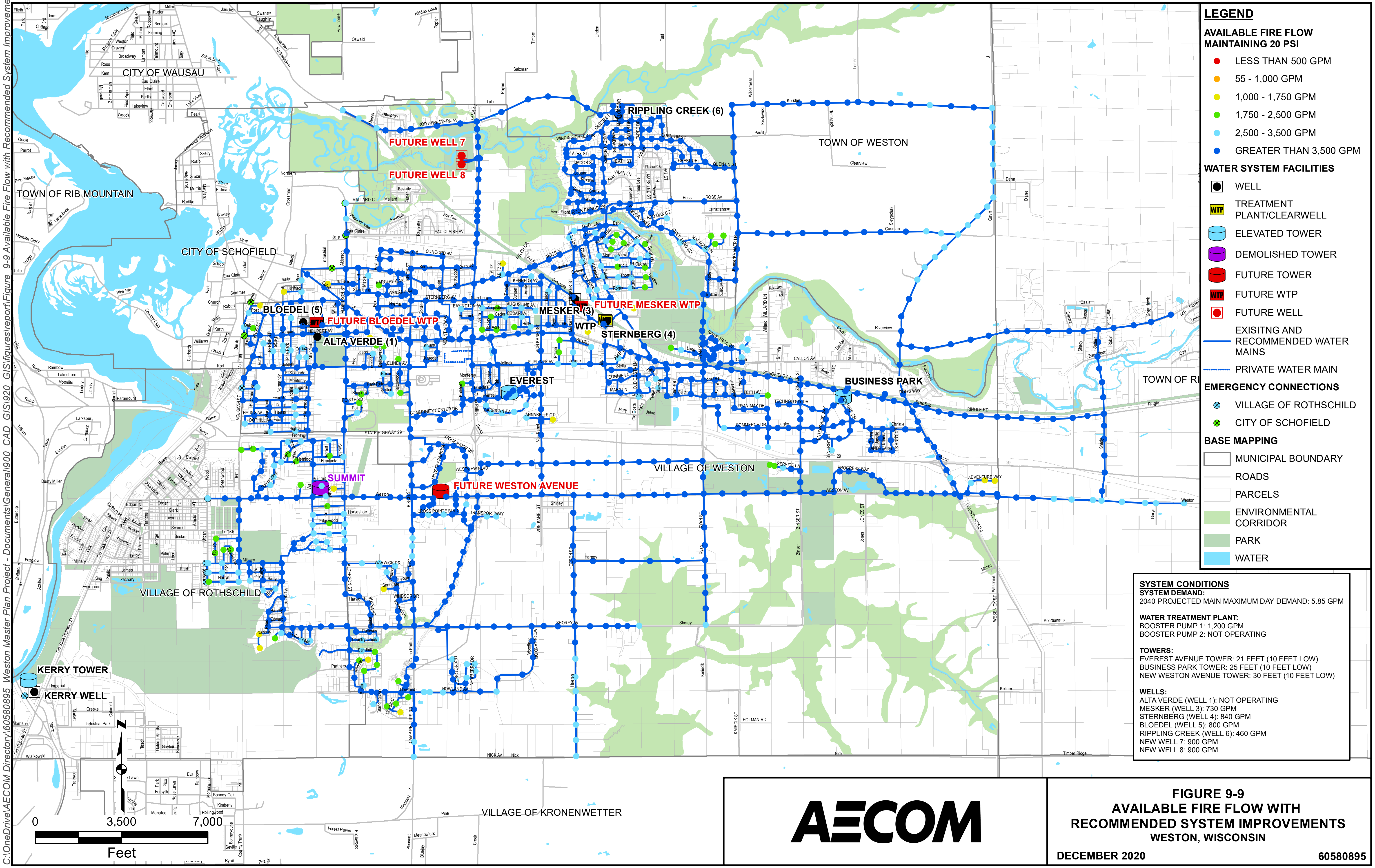
WELLS:
ALTA VERDE (WELL 1): NOT OPERATING
MESKER (WELL 3): 730 GPM
STERNBERG (WELL 4): 840 GPM
BLOEDEL (WELL 5): NOT OPERATING
RIPPLING CREEK (WELL 6): NOT OPERATING
NEW WELL 7: 900 GPM
NEW WELL 8: NOT OPERATING

AECOM

FIGURE 9-8
PRESSURES WITH RECOMMENDED IMPROVEMENTS - AVERAGE DAY DEMAND
WESTON, WISCONSIN

DECEMBER 2020
60580895

C:\OneDrive\AECOM Directory\60580895 Weston Master Plan Project - Documents\General\900 CAD GIS\920 GIS\figures\report\Figure 9-9 Available Fire Flow with Recommended System Improvements.mxd



SYSTEM CONDITIONS

SYSTEM DEMAND:
2040 PROJECTED MAIN MAXIMUM DAY DEMAND: 5.85 GPM

WATER TREATMENT PLANT:
BOOSTER PUMP 1: 1,200 GPM
BOOSTER PUMP 2: NOT OPERATING

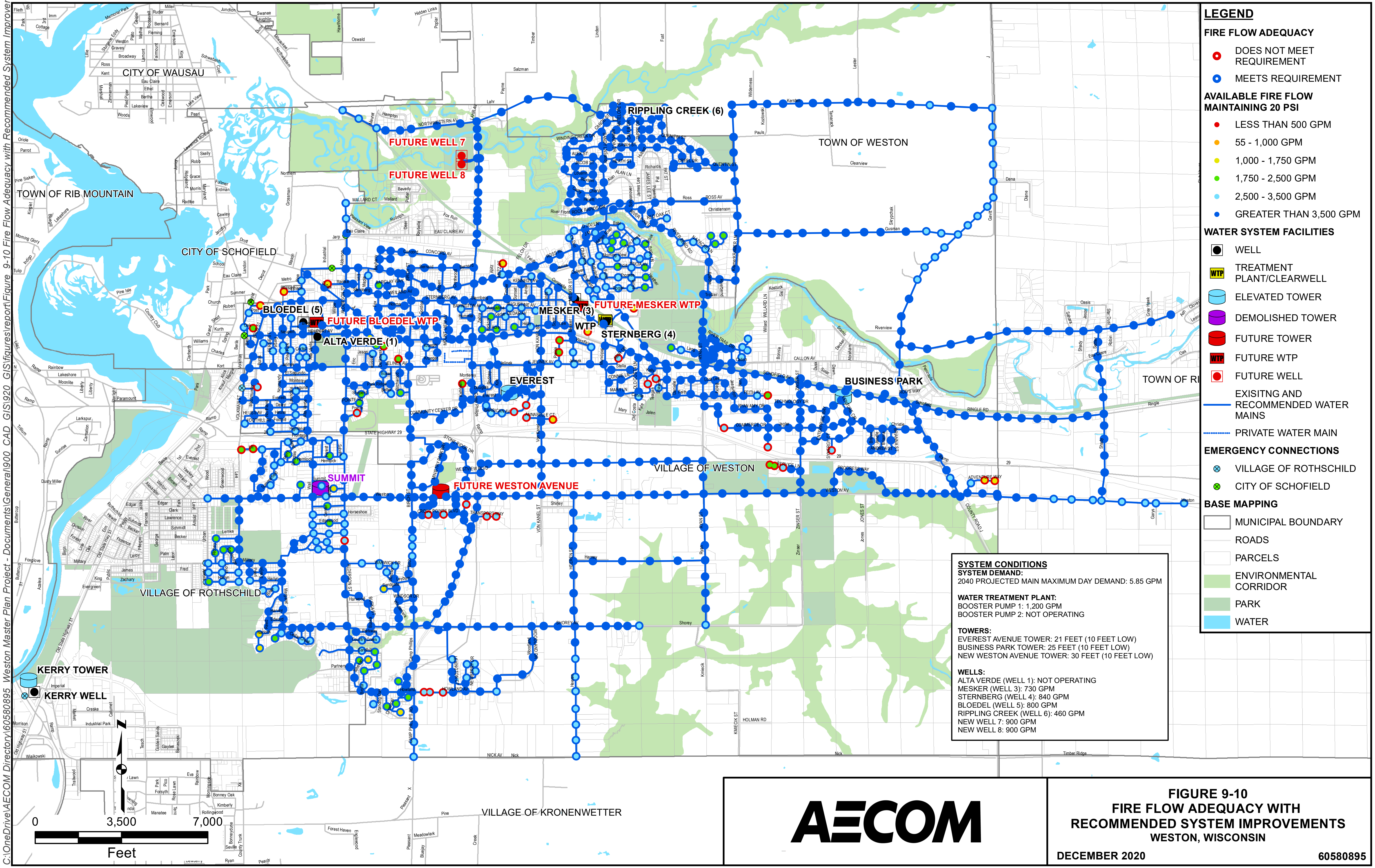
TOWERS:
EVEREST AVENUE TOWER: 21 FEET (10 FEET LOW)
BUSINESS PARK TOWER: 25 FEET (10 FEET LOW)
NEW WESTON AVENUE TOWER: 30 FEET (10 FEET LOW)

WELLS:
ALTA VERDE (WELL 1): NOT OPERATING
MESKER (WELL 3): 730 GPM
STERNBERG (WELL 4): 840 GPM
BLOEDEL (WELL 5): 800 GPM
RIPPLING CREEK (WELL 6): 460 GPM
NEW WELL 7: 900 GPM
NEW WELL 8: 900 GPM

FIGURE 9-9
AVAILABLE FIRE FLOW WITH RECOMMENDED SYSTEM IMPROVEMENTS
WESTON, WISCONSIN

DECEMBER 2020 **60580895**

C:\OneDrive\AECOM Directory\60580895 Weston Master Plan Project - Documents\General\900 CAD GIS\920 GIS\figures\report\Figure 9-10 Fire Flow Adequacy with Recommended System Improvements.mx



LEGEND

FIRE FLOW ADEQUACY
- ○ DOES NOT MEET REQUIREMENT
- ○ MEETS REQUIREMENT

AVAILABLE FIRE FLOW MAINTAINING 20 PSI
- ● LESS THAN 500 GPM
- ● 55 - 1,000 GPM
- ● 1,000 - 1,750 GPM
- ● 1,750 - 2,500 GPM
- ● 2,500 - 3,500 GPM
- ● GREATER THAN 3,500 GPM

WATER SYSTEM FACILITIES
- WELL
- WTP TREATMENT PLANT/CLEARWELL
- ELEVATED TOWER
- DEMOLISHED TOWER
- FUTURE TOWER
- WTP FUTURE WTP
- FUTURE WELL
- EXISITNG AND RECOMMENDED WATER MAINS
- PRIVATE WATER MAIN

EMERGENCY CONNECTIONS
- ⊗ VILLAGE OF ROTHSCHILD
- ⊗ CITY OF SCHOFIELD

BASE MAPPING
- ☐ MUNICIPAL BOUNDARY
- ROADS
- ☐ PARCELS
- 🟩 ENVIRONMENTAL CORRIDOR
- 🟩 PARK
- 🟦 WATER

SYSTEM CONDITIONS

SYSTEM DEMAND:
2040 PROJECTED MAIN MAXIMUM DAY DEMAND: 5.85 GPM

WATER TREATMENT PLANT:
BOOSTER PUMP 1: 1,200 GPM
BOOSTER PUMP 2: NOT OPERATING

TOWERS:
EVEREST AVENUE TOWER: 21 FEET (10 FEET LOW)
BUSINESS PARK TOWER: 25 FEET (10 FEET LOW)
NEW WESTON AVENUE TOWER: 30 FEET (10 FEET LOW)

WELLS:
ALTA VERDE (WELL 1): NOT OPERATING
MESKER (WELL 3): 730 GPM
STERNBERG (WELL 4): 840 GPM
BLOEDEL (WELL 5): 800 GPM
RIPPLING CREEK (WELL 6): 460 GPM
NEW WELL 7: 900 GPM
NEW WELL 8: 900 GPM

AECOM

FIGURE 9-10
FIRE FLOW ADEQUACY WITH RECOMMENDED SYSTEM IMPROVEMENTS
WESTON, WISCONSIN

DECEMBER 2020
60580895

Well rehabilitation is generally recommended at a minimum once every 10 years, regardless of any changes in well operations, as a standard preventative maintenance process. Well rehabilitation may be required more frequently than every 10 years if there is a 10 to 15 percent loss in well specific capacity. Specific capacity is the production of the well per foot of drawdown measured in gpm/ft. Drawdown is defined as the difference between the pumping water level and the static water level of the well. If the specific capacity declines over time (compared to last month or last year, etc.), this would indicate the need for well rehabilitation.

Well rehabilitation may also be required more frequently than every 10 years if there are significant water quality changes including over 10 percent increase in raw water concentrations of iron, manganese, or turbidity. The Utility is currently collecting quarterly raw water samples including iron, manganese, and turbidity to track and trend water quality. Well rehabilitation is also required if biogrowth is noted in the well.

A unidirectional flushing program should be performed on a routine basis to improve water quality as recommended in the Process Water Research Solutions, LLC Water Quality Investigation report.

9.12.2 Main System

As noted in Chapter 2 and Chapter 5, the Utility is not currently filling the elevated storage tanks The wells currently turn on/off based on the Everest Tower, which has head range of 31 feet; however, the SCADA system is programmed to stop the pumps at 23 feet (HGL of approximately 1398 feet MSL). The SCADA program should be changed to use the full head range at the Everest Tower. As noted in Chapter 5, assuming the tanks are filled, there is an existing shortage in storage of approximately 0.34 MG which can be offset by approximately 0.28 MG due to the current excess reliable pumping capacity.

Therefore, it is recommended that the Weston Water Utility develop an operational strategy that fills the towers (using the altitude valve at Everest Tower and installing an altitude valve at Summit Tower will help with this) and utilizes the wells with the higher water quality more than the others when possible. This strategy may include a staggered start/stop of the wells based on tower level. In no event should wells not be operated at the minimum frequencies required by DNR.

Chapter 2 also notes that the current operation is to turn on all 3 wells that pump directly into the distribution system (Alta Verde (Well 1), Bloedel (Well 5), and Rippling Creek (Well 6)) along with one booster pump at the WTP at the same time and turn the same well pumps and WTP pump off at the same time based on the tower level in Everest Tower.

As described in Chapter 2, the water quality of wells is not all the same. Wells with better water quality should be used preferentially which will reduce iron and manganese build-up in the distribution system. Prior to treatment at Well 3 (Mesker), it is recommended that Well 3 (Mesker) be operated only when Well 4 (Sternberg) is operating to allow blending of the two sources under normal (not emergency) conditions. Based on water quality, it is recommended that the well operations are prioritized in the following order Rippling Creek (Well 6), Well 4/Well 3 (WTP booster pump), Bloedel (Well 5), and Well 1 (Alta Verde) until the new wells are constructed.

The Business Park Tower does have a PAX mixer system to help reduce water age and freezing concerns at the tower. This is the only tower with a separate mixing system. It is recommended that the PAX mixing system remain in operation for the Business Park Tower.

9.12.3 Kerry System

It is recommended that the Utility discontinue the addition of blended phosphate at Well 2 (Kerry) due to the challenge Kerry has with phosphorus in the wastewater discharge and to prevent microbial growth in the Kerry's internal piping. This effort is under review in a separate study.

10.0 Capital Improvements Plan

This chapter summarizes the recommended water system improvements and presents a proposed capital improvements program. The recommended capital improvements plan prioritizes system improvements and provides a schedule for the timing of construction. Planning level budget cost estimates (2020 dollars) for each improvement are also summarized.

10.1 Recommended Improvements

The schematic of the recommended future water distribution system is illustrated in Figure 10-1. Figure 10-2 illustrates the recommended water system master plan. The following sections summarize the improvements.

10.1.1 Main System

10.1.1.1 Water Supply

The Weston Water Utility should plan to construction two additional water supply wells during the planning period. It is recommended that both new wells (Well 7 and Well 8 at the same site) be constructed in the short term to meet the projected demands of the system and to help offset the storage deficiency in the short-term.

As documented in the Wellfield Concept Technical Memorandum (AECOM, 2020), it is recommended that 2 new wells (Well 7 and Well 8) with a likely capacity of approximately 900 gpm (1.3 MGD) each be developed in the Yellow Banks Park wellfield on Camp Phillips Road.

10.1.1.2 Water Storage

Additional storage is needed in the short-term in the Main System; therefore, it is recommended that a new 0.75 MG composite tower be constructed near the hospital on Weston Avenue on a parcel the Utility has identified as illustrated Figure 10-2 with an overflow elevation of approximately 1,407 feet MSL (approximate tank height 126 feet). However, as noted above, it is recommended that both Well 7 and Well 8 be constructed in the short-term; therefore, the excess reliable supply capacity will offset the storage deficiency in the short-term. As water demands increase, the excess reliable supply capacity will decrease and it is recommended the new tower be constructed. It is recommended that the Utility monitor demands to determine the actual time the new storage is needed. Currently, based on the demand projections, it is estimated the new tower would be need in 2030.

In the short-term it is recommended that an altitude valve be added at Summit Tower to allow for the Business Park Tower to be filled completely.

Due to the small volume of the Summit Tower and concrete concerns noted in the 2012 inspection, it is recommended that the Utility remove the tower from service and plan to demolish it preferably after the new Weston Avenue Tower is constructed (note the communications systems on the tower are anticipated to be accommodated during the SCADA upgrade).

10.1.1.3 Water Treatment

Well 1 (Alta Verde) exceeds the secondary standards for TDS, manganese, and iron and Well 5 (Bloedel) exceeds the secondary standards for manganese. The Well 1 site does not have adequate space to add a treatment process. Based on land availability, it is recommended that a treatment plant for iron and manganese removal be added to the existing Well 5 (Bloedel) site which will treat the water from Well 5 and Well 1. AECOM recommends a pilot study be completed prior to design.

Well 3 (Mesker) water exceeds the secondary standard for iron and manganese. In the short-term, Well 3 can be blended with Well 4 (Sternberg) to reduce water quality complaints; however, in the long-term, a Mesker WTP is recommended to remove iron and manganese. The new Mesker WTP should be evaluated with the Air Stripper WTP to determine the best treatment process and pumping system for both Well 3 (Mesker) and Well 4 (Sternberg).

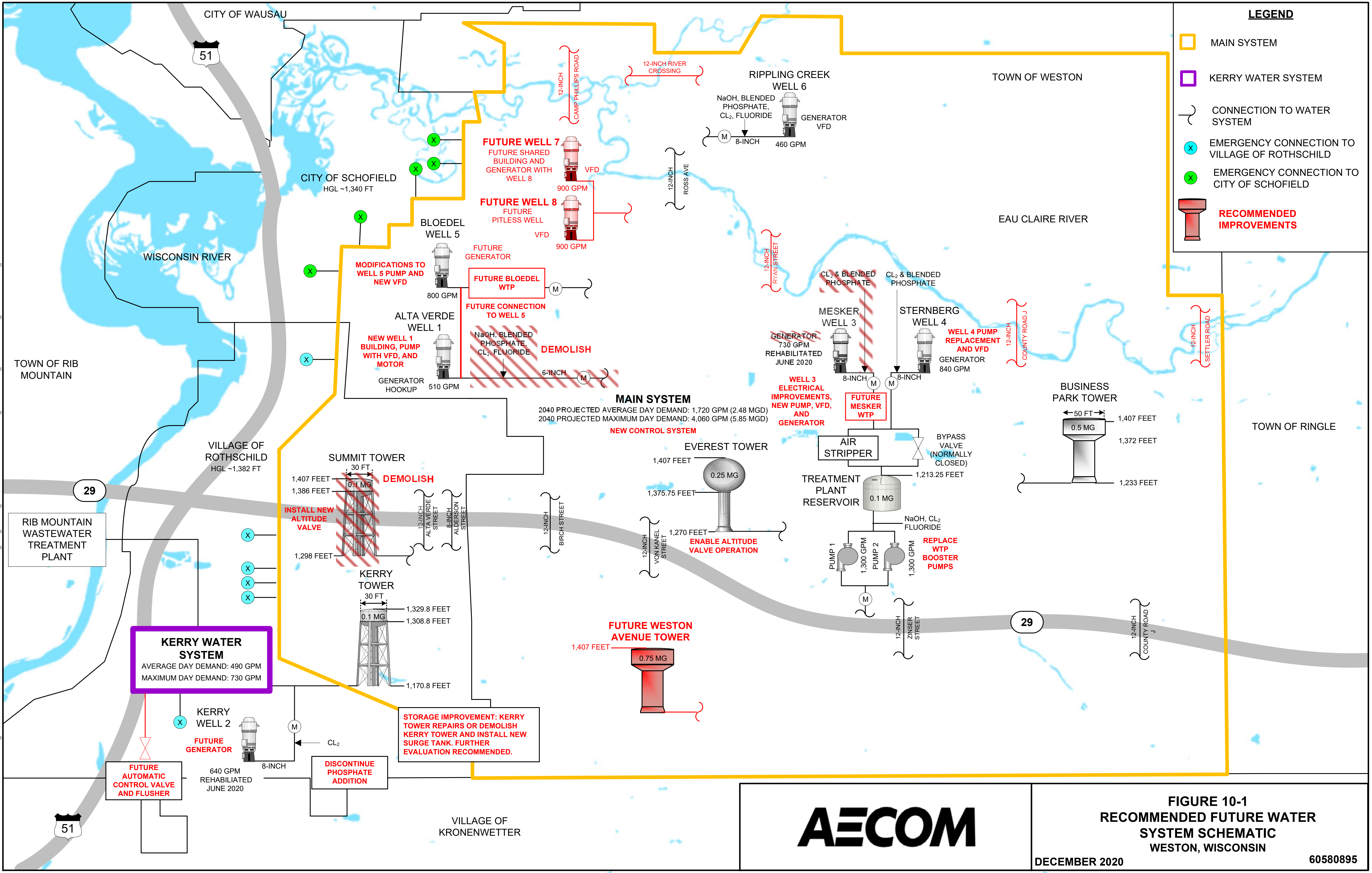
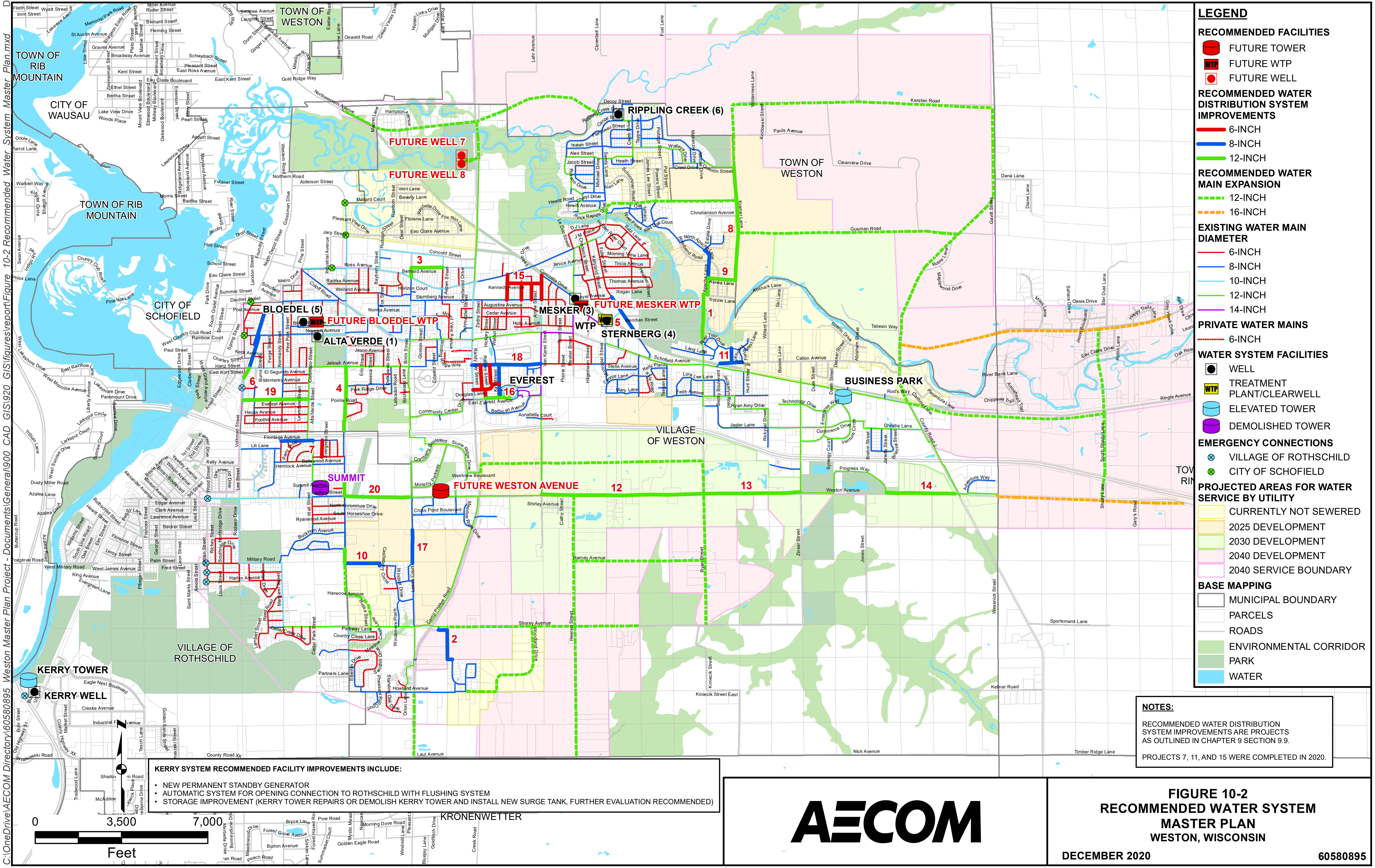


FIGURE 10-1
RECOMMENDED FUTURE WATER SYSTEM SCHEMATIC
WESTON, WISCONSIN

DECEMBER 2020

60580895

C:\ONEDRIVE\AECOM DIRECTORY\60580895_WESTON MASTER PLAN PROJECT - DOCUMENTS\GENERAL\900_CAD_GIS\920_GIS\FIGURES\REPORT\FIGURE_10-1 WESTON_RECOMMENDED_IMPROVEMENTS_SCHEMATIC 11X17.VSD



KERRY SYSTEM RECOMMENDED FACILITY IMPROVEMENTS INCLUDE:

- NEW PERMANENT STANDBY GENERATOR
- AUTOMATIC SYSTEM FOR OPENING CONNECTION TO ROTHSCHILD WITH FLUSHING SYSTEM
- STORAGE IMPROVEMENT (KERRY TOWER REPAIRS OR DEMOLISH KERRY TOWER AND INSTALL NEW SURGE TANK, FURTHER EVALUATION RECOMMENDED)

NOTES:

RECOMMENDED WATER DISTRIBUTION SYSTEM IMPROVEMENTS ARE PROJECTS AS OUTLINED IN CHAPTER 9 SECTION 9.9.

PROJECTS 7, 11, AND 15 WERE COMPLETED IN 2020.

AECOM

FIGURE 10-2
RECOMMENDED WATER SYSTEM MASTER PLAN
WESTON, WISCONSIN

DECEMBER 2020

60580895

Although the air stripper is no longer needed for VOC removal from Well 3 (Mesker) and Well 4 (Sternberg), it is recommended that the air stripper continue to be used for pH adjustment. At a future time when the air stripper replacement is required, the Utility should evaluate the economics for removing the air stripper and adjusting the pH with chemical addition at the well site(s) or at the WTP (air stripper, clearwell, booster station).

10.1.1.4 Water System Facilities

Based on the facility condition assessment, the following facility improvements are recommended:

- Replace Well 1 (Alta Verde) structure (included in WTP recommendation at Well 5 (Bloedel)).
- Replace the two existing WTP booster pumps and motors and add VFDs for those pumps (after Mesker WTP to determine the number of pumps and pump capacities).
- Perform electrical improvements at Well 3 (Mesker) and add VFD (included in Mesker WTP recommendation).
- Replace Well 4 pump (Sternberg) and add VFD.
- Reactivate the altitude valve at Everest Tower and install an altitude valve at Summit Tower for immediate improvements in water storage capacity (ability to fill Business Park Tower).
- Remove Summit Tower from service (after construction of the new Weston Avenue Tower) and demolish.

10.1.1.5 Distribution System

Distribution system improvements have been recommended to strengthen the existing water system, enhance system reliability, loop major transmission mains, and improve flow and fire protection. Figure 10-2 illustrates the recommended distribution system improvements. Approximately 8,700 feet of water main are recommended to improve the existing water system (water main replacements and new water mains).

Approximately 27 miles of future transmission mains are recommended to supply development during the planning period (referred to as expansion mains).

Additionally, water main renewal (replacement of aging water mains) was included in the plan on an incremental basis. For planning purposes, a total of 6 miles is recommended for water main renewal based on the KANEW analysis summarized in Chapter 7. Approximately 4.5 miles of replacement main is included in the recommended water distribution system replacements; therefore, it is recommended for planning and budgeting purposes that approximately 550 feet of water main is replaced annually in the mid-term and long term (approximate total of 1.5 miles over the 15 years). Specific projects were not identified for the additional approximate 550 feet of water main replacement annually in the mid-term and long-term. AECOM recommends that the Utility begin to track water main leaks, repairs, and failures to help in identifying candidates for water main replacement and the Utility should consider a risk-based water main prioritization analysis in the future.

10.1.1.6 Operation and Maintenance

It is recommended that the Weston Water Utility develop an operational strategy that fills the towers completely and utilizes the wells with the better water quality more than the other wells when possible.

The Utility should record daily well pumpage volumes and runtimes at the same time each day such that daily pumpage records are improved particularly to allow for a better understanding of the maximum day requirements for future planning purposes. Well operations should be recorded monthly and reviewed on a quarterly basis to track production loss and to allow for timely scheduling of well rehabilitation services to prevent significant declines in the well capacity that may not be recoverable.

It is recommended that the Utility conduct unidirectional flushing on a routine basis.

10.1.2 Kerry System

10.1.2.1 Water Supply

It is recommended that the Weston Water Utility, Village of Rothschild, and Kerry meet to determine needed improvements to automate the supply reliability including an automatic system for opening the emergency connection between Rothschild and the Kerry System via SCADA and an automatic flushing system.

AECOM recommends that the Utility enter into an agreement with the Village of Rothschild to ensure future supply reliability and fire protection for the Kerry System.

In addition, it is recommended that the Utility add a standby generator at Well 2 (Kerry) for reliability during power outage (automatic transfer to backup power versus having to bring a portable generator to the site).

10.1.2.2 Water Storage

AECOM recommends that the Utility preform a detailed evaluation to determine the best alternative for storage for the Kerry System. Alternatives should include: (1) hydropneumatic tank for surge protection and removing the Kerry Tower from service or (2) completing the repairs needed for the Kerry Tower.

10.1.2.3 Water Treatment

Process Research Solutions recommended in the Drinking Water Quality Investigation Phase 2 Report (April 2017) that the phosphorus addition at Well 2 (Kerry) be discontinued to prevent suspected microbial growth within the Kerry System piping. The Utility is conducting a long-term pilot plan to slowly discontinue the phosphorus feed and demonstrate the final water quality to DNR. The phosphorus was originally added to control manganese oxidation in the water. Within the pilot study, the manganese issue is tracked. The Utility should schedule discussions with Kerry after the pilot study is complete to determine if treating the water for manganese removal is desired.

10.2 SCADA – Entire System

SCADA improvements are required as the availability of replacement components for older SCADA equipment is challenging. It is recommended that the new SCADA platform be suitable for generating monthly reports, tracking historic operations and trends. SCADA improvements should be completed with the water supply improvements (Well 7 and Well 8) to reduce rework in SCADA program updates and should accommodate changes in communication terminations for both the SCADA and metering reading systems that will be associated with the demolition of the Summit Tower.

10.3 Recommended Improvement Plan

The proposed capital improvement plan, as summarized in Table 10-1 has been formulated based on all the information presented in this study. All the improvements listed have been developed and prioritized based on deficiencies identified in the existing water system and the needs for future development within the Weston Water Utility. Improvements have been broken down into three categories:

- Short-term improvements (5 years)
- Mid-term improvements (6 to 10 years)
- Long-term improvements (11 to 20 years)

The engineer's cost estimates are only estimates of possible construction costs for budgeting purposes. The estimate is limited to the conditions existing at the time of issuance and not a guarantee of actual price or cost. Uncertain market conditions and bidding environment such as, but not limited to local labor or contractor availability, wages, other work, material market fluctuations, price escalations, force majeure events, and developing biding conditions, etc. may affect the accuracy of these cost estimates.

The recommended improvements plan has been developed as a tool to guide the Weston Water Utility in future system improvements. While the plan may represent the current planned expansion of the Weston water system, future changes in land use, water demands, or customer characteristics could substantially alter implementation. For this reason, it is recommended that the plan be periodically reviewed and updated every 5 years, using the Utility's planning information, to reflect the most current service area plan.

TABLE 10-1: CAPITAL IMPROVEMENTS PLAN

Short-Term Improvements (5 Years)	**Estimated Cost[1]**	**Mid-Term Improvements (6-10 Years)**	**Estimated Cost[1],**
New Well 7 Including Well, Pump, VFD Controls, Building, Chemical Feed Equipment, SCADA, Generator and Site Work	$2,646,000	New Weston Ave 0.75 MG Composite Tower with Altitude Valve, Site Work, Telemetry, and Piping	$3,066,000
New Well 8 (Pitless Well, Pump, VFD Controls and Piping)	$448,000	Demolish Summit Tower	$56,000
New Bloedel WTP (includes pressure filters with backwash tank and chemical feed in new building at Well 5, new building and pump at Well 1, piping from Well 1 to WTP, Well 5 pump modifications with VFD controls, and standby generator)	$5,089,000	New Mesker WTP (includes new treatment building, pressure filters with backwash tank and chemical feed systems, Well 3 pump modifications with VFD controls, electrical improvements at Well 3, and standby generator)	$4,200,000
SCADA Upgrades Including New Control Panels at the WTP (Air Stripper), Existing Towers and Wells	$728,000	Well 4 (Sternberg) Pump Replacement and VFD Addition	$70,000
Altitude Valve at Summit Tower	$60,200	WTP (Air Stripper) Booster Pumps Replacement and New VFD	$126,000
Distribution System Project 1 - Ryan Street River Crossing[3,4,5,8]	$726,000		
Distribution System Project 5 - Fuller St[2,5,8]	$276,000	Distribution System Project 2 - Lexington Ct[3,5,8]	$218,000
Distribution System Project 8 -Kraemer Ln[3,5,8]	$707,000	Distribution System Project 3 - Birch St[2,5,8]	$304,000
Distribution System Project 12 - Development, Weston Ave[3,5,8]	$1,013,000	Distribution System Project 4 - Alderson St[2,5,8]	$473,000
Distribution System Project 13 - Development, Weston Ave[3,5,8]	$604,000	Distribution System Project 6 - Business 51[2,3,5,8]	$511,000
Distribution System Project 14 - Development, Weston Ave[3,5,8]	$428,000	Distribution System Project 9 - Kiowa Ln[3,5,8]	$171,000
Distribution System Project 16 - Everest Ave[2,5,8]	$858,000	Distribution System Project 10 - Alderson St[3,5,8]	$278,000
Distribution System Project 17 - Birch St[3,5,8]	$170,000	Water Main Renewal - Year 6-10: (~550 feet and $84,700 per year)[2,5,7]	$424,000
Distribution System Project 18 - Jelinek Ave[2,3,5,8]	$383,000		
Distribution System Project 19 - Everest Ave[2,5,8]	$482,000	Transmission Mains for Expansion (approximately 3.0 miles of 12-inch main)[3]	$2,418,000
Distribution System Project 20 – Summit Tower Reliability[2,3,5,8]	$522,000		
Well 2 Standby Generator	$200,000	**Total**	**$12,315,000**
Automatic System for Opening Rothschild Connection and Hydrant Flushing System (Kerry System)	$136,000	**Long-Term Improvements (11-20 Years)**	
		Water Main Renewal - Years 11-20 (~ 500 feet and $84,700 per year)[2,5,7]	$847,000
Kerry System Storage Improvements[6]	$175,000	Transmission Mains for Expansion (~ 3.6 miles of 16-inch main, ~ 15.3 miles of 12-inch main, and 4 additional river crossings)[3,4]	$16,545,000
Expansion Transmission Mains for Expansion (~ 4.2 miles of 12-inch main)[3]	$3,419,000		
Total	**$19,070,200**	**Total**	**$17,392,000**

Footnotes:

[1] Assumed 15 percent for engineering design and construction administration/inspection and 25 percent for contingencies.

[2] Water main replacement costs before engineering and contingency were estimated using $100/foot for 6-inch pipe, $110/foot for 8-inch pipe, and $130/foot for 12-inch pipe.

[3] Water main expansion costs before engineering and contingency were estimated using $90/foot for 8-inch pipe, $110/foot for 12-inch pipe, $140/ft for 16-inch pipe main.

[4] Water mains crossing rivers were estimated at $180/foot for 12-inch pipe.

[5] Water main estimates are general planning numbers and do not include roadway replacement.

[6] It is recommended that the Utility evaluate alternatives such as hydropneumatic tank for surge protection and removing the Kerry Tower from service or plan to complete the repairs needed for the Kerry Tower.

[7] Water main replacement cost for water main renewal is based on 8-inch water main.

[8] As illustrated in Figure 9-4.

Notes:

- Distribution System Project 7, Project 11, and Project 15 were completed in 2020; therefore, are not included in the CIP.
- Estimates do not include land purchase, if necessary.
- The engineer's cost estimates are only an estimate of possible construction costs for budgeting purposes. The estimates are limited to the conditions existing at issuance of the report and is not a guarantee of actual price or cost. Uncertain market conditions such as, but not limited to local labor or contractor availability, wages, other work, material market fluctuations, price escalations, force majeure events, and developing bidding conditions, etc. may affect the accuracy of this estimate. AECOM is not responsible for any variance from this estimate or actual prices and conditions obtained.
- This estimate is an AACE Class 4 Order of Magnitude cost estimate and is based on 2020 dollars.

10.4 Additional Recommendations

Additional recommendations associated include:

- Complete a pilot study for the recommended new Bloedel WTP for Well 5 (Bloedel) and Well 1 (Alta Verde) (approximately $10,000).
- Conduct a Storage Alternative Study for the Kerry System (approximately $10,000).
- Complete a pilot study for the recommended new Mesker WTP (approximately $10,000).
- Update the water system hydraulic model on an annual basis.
- Plan to update the master plan every 5 years or after significant changes that are not outlined in this document are made to the water distribution system.
- Consider a risk-based water main prioritization analysis to help develop a long-term water main replacement program in the future.
- When the air stripper reaches the end of its useful life, the Utility should evaluate other options for pH control instead of replacing the air stripper.

Appendix A

Glossary of Terms

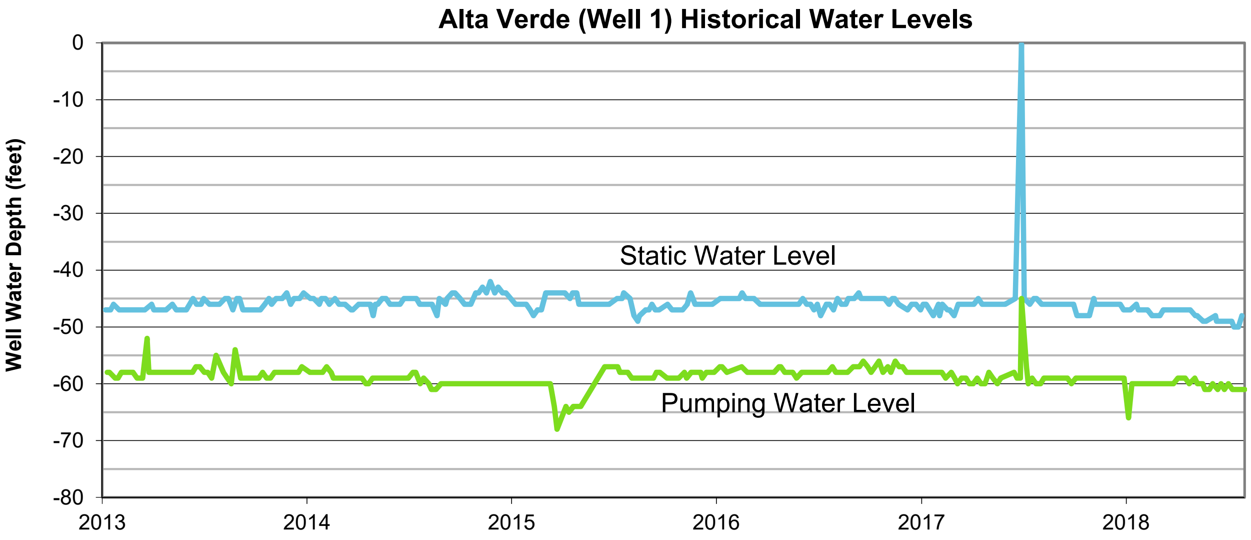
Appendix A Glossary of Terms

Average Day Demand:	The average quantity of daily water usage in a water system.
Elevated Storage:	A facility for storing water supplies above ground level at a specific elevation.
Extended Period Calibration	Extended period (macro) calibration is performed to ensure the model accurately reflects how the overall system operates over time with respect to transmission mains, pumps, tanks, and reservoir operations under normal operating conditions. The goal of the calibration is to minimize the error between field test data and model simulations.
Extended Period Simulation	For this project, an hourly model simulation for a 24 hour period to evaluate system performance over time.
Flow Capacity:	The maximum flow rate that can be supplied by a water distribution system at a specified location and residual pressure (usually expressed as gpm).
Hydraulic Gradeline:	The head at a specific location as a product of water pressure and elevation (usually expressed in feet).
Maximum Day Demand:	The highest quantity of daily water usage in a municipal water system.
Maximum Day Ratio:	The ratio of maximum day to average day demand (usually expressed as a percentage).
Peak Hour Demand:	The daily rate of water usage during the hour of greatest water demand on a maximum usage day.
Peak Hour Demand Ratio:	The ratio of peak hour pumpage (expressed as a daily rate) to average day pumpage (usually expressed as a percentage).
Pipe Roughness Coefficient:	A coefficient (generally assumed to be constant) which describes the energy loss due to friction that will occur as water flows through a section of piping.
Pressure Differential	During model calibration, the difference between the pressure drop (difference between the static and residual pressure) measured in the field and the pressure drop simulated in the model.

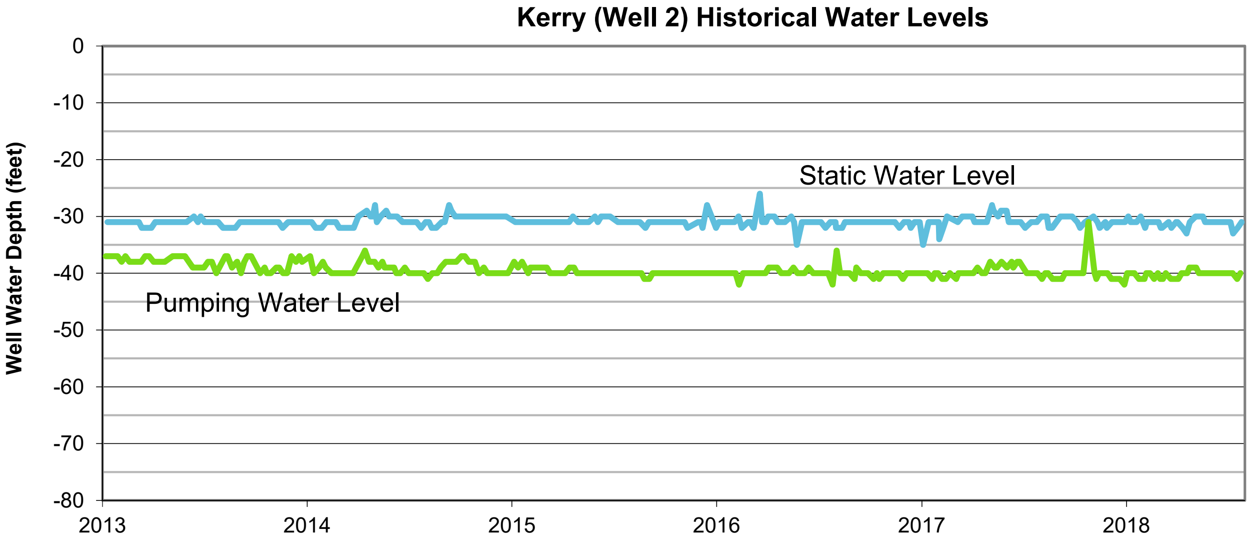
Reliable Supply Capacity:	The pumping capacity of a water supply facility with the largest pumping unit out of service.
Residual Pressure:	Pressure at a specified location in the water distribution system when water is being removed or flowed.
Static Pressure:	Normal pressure at a specified location in the water distribution system when no water is being removed or flowed.
Steady State Calibration	Steady state (micro) calibration is the process of comparing flow and pressure test data with the hydraulic model simulations. The goal of the calibration is to minimize the error between field test data and model simulations.
Steady State Simulation	Model simulation which represents a snapshot in time and used to determine the operating behavior of a system under static conditions.
Time-of-Day Demand Curve:	A curve which describes changes in the quantities of water used by customers at different times of the day.
Water Demand:	The amount of water required by a water user or users at a specific point or area within a water distribution system.
Water Distribution Main:	A water main which primarily extends water services and fire protection to an area.
Water Distribution System:	A facility usually consisting of a network of piping which is designed to distribute water from a given water supply to specific water users.
Water Transmission Main:	A large water main (generally 10-inch or larger) which is used to convey water between a water system's supply/storage facilities and service area.

Appendix B

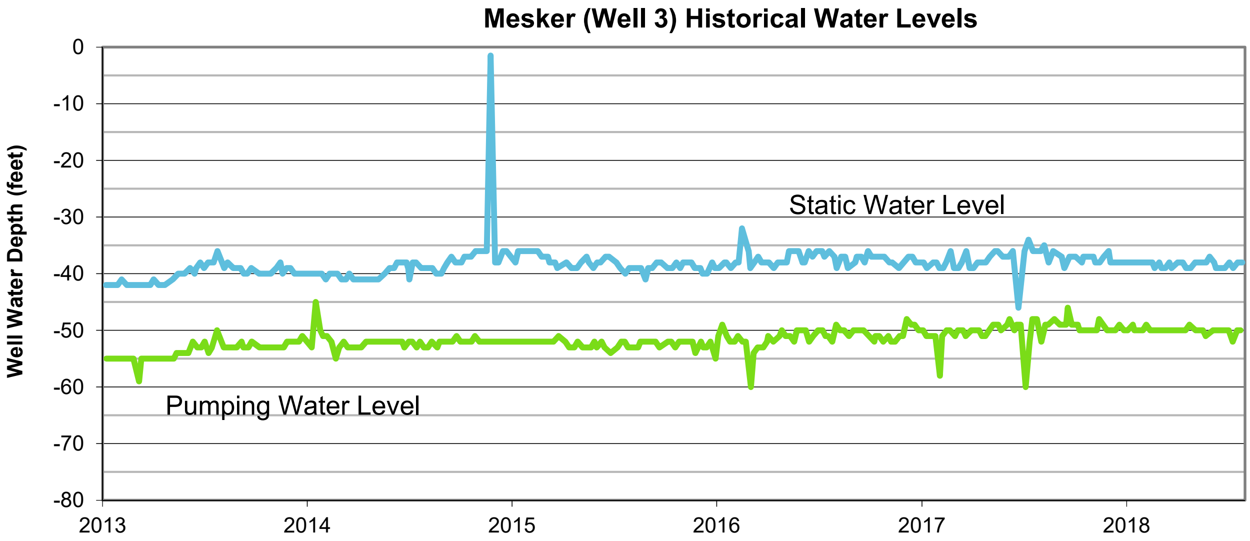
Historical Well Water Levels



Alta Verde (Well 1) Historical Water Levels

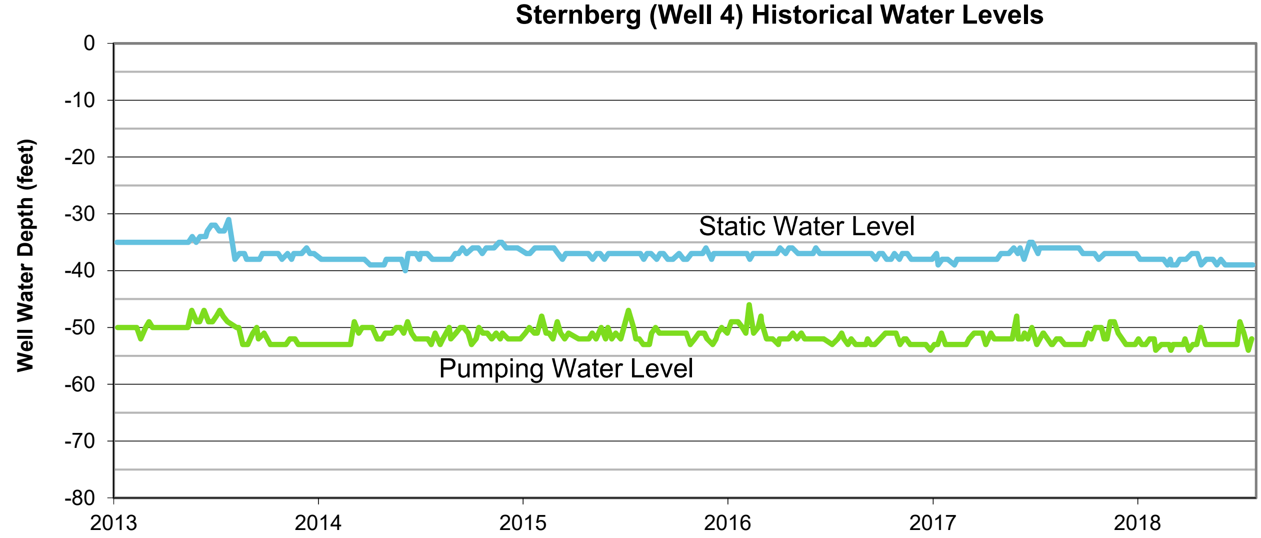


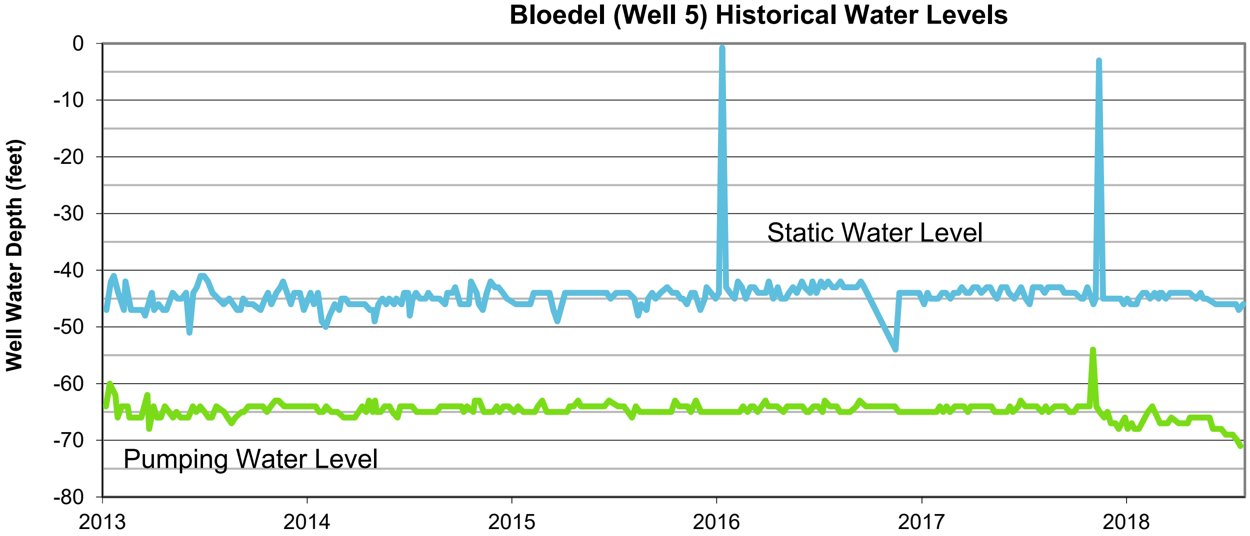
Kerry (Well 2) Historical Water Levels

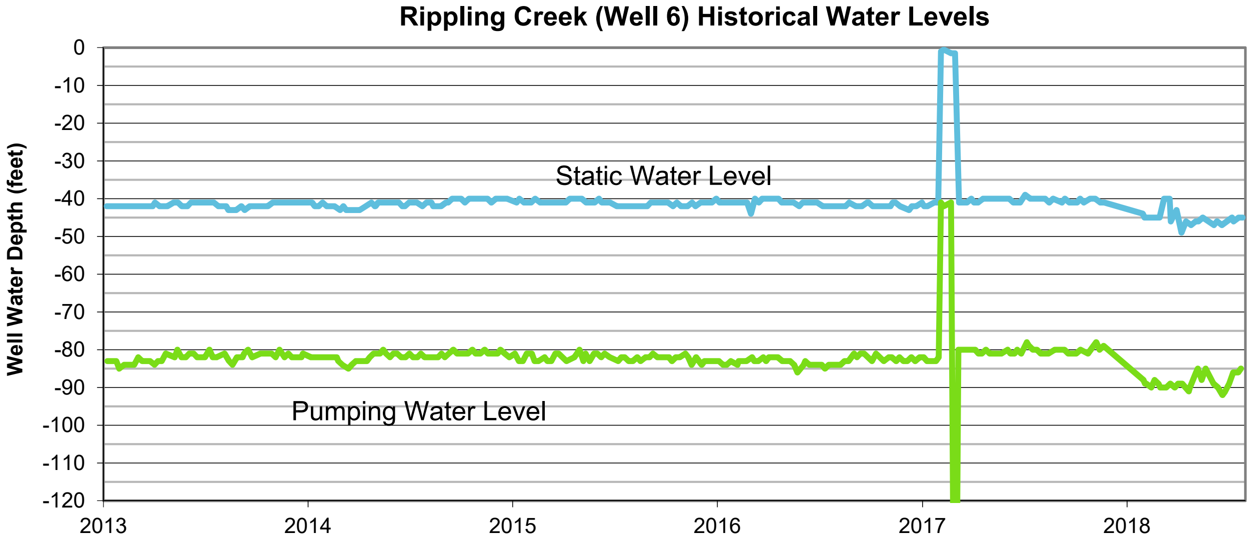


Mesker (Well 3) Historical Water Levels

P:\60580895\400_Technical\453_Water\Existing Well Data\[Weston_EMOR_pumping_and_static_levels.xlsx]Well 1,2,3







P:\60580895\400_Technical\453_Water\Existing Well Data\[Weston_EMOR_pumping_and_static_levels.xlsx]Well 4,5,6

Appendix C

Well 2 (Kerry) 2019 Pumpage

Well 2 (Kerry) Daily Pumpage

Date	Pumpage (000 gals)	Date	Pumpage (000 gals)	Date	Pumpage (000 gals)	Date	Pumpage (000 gals)	Date	Pumpage (000 gals)	Date	Pumpage (000 gals)	Date	Pumpage (000 gals)	Date	Pumpage (000 gals)	Date	Pumpage (000 gals)	Date	Pumpage (000 gals)	Date	Pumpage (000 gals)	Date	Pumpage (000 gals)
1/1/2019	604	2/1/2019	447	3/1/2019	805	4/1/2019	669	5/1/2019	632	6/1/2019	689	7/1/2019	721	8/1/2019	702	9/1/2019	711	10/1/2019	656	11/1/2019	803	12/1/2019	358
1/2/2019	570	2/2/2019	691	3/2/2019	748	4/2/2019	686	5/2/2019	671	6/2/2019	655	7/2/2019	638	8/2/2019	641	9/2/2019	688	10/2/2019	694	11/2/2019	726	12/2/2019	328
1/3/2019	663	2/3/2019	620	3/3/2019	656	4/3/2019	679	5/3/2019	581	6/3/2019	750	7/3/2019	690	8/3/2019	804	9/3/2019	718	10/3/2019	571	11/3/2019	754	12/3/2019	264
1/4/2019	629	2/4/2019	702	3/4/2019	600	4/4/2019	798	5/4/2019	648	6/4/2019	749	7/4/2019	680	8/4/2019	767	9/4/2019	662	10/4/2019	704	11/4/2019	619	12/4/2019	200
1/5/2019	601	2/5/2019	644	3/5/2019	772	4/5/2019	656	5/5/2019	724	6/5/2019	698	7/5/2019	610	8/5/2019	708	9/5/2019	624	10/5/2019	635	11/5/2019	697	12/5/2019	235
1/6/2019	698	2/6/2019	681	3/6/2019	751	4/6/2019	735	5/6/2019	648	6/6/2019	797	7/6/2019	559	8/6/2019	777	9/6/2019	557	10/6/2019	736	11/6/2019	694	12/6/2019	444
1/7/2019	684	2/7/2019	625	3/7/2019	618	4/7/2019	692	5/7/2019	598	6/7/2019	799	7/7/2019	818	8/7/2019	738	9/7/2019	619	10/7/2019	673	11/7/2019	726	12/7/2019	645
1/8/2019	666	2/8/2019	729	3/8/2019	725	4/8/2019	746	5/8/2019	784	6/8/2019	681	7/8/2019	678	8/8/2019	727	9/8/2019	656	10/8/2019	780	11/8/2019	582	12/8/2019	566
1/9/2019	640	2/9/2019	690	3/9/2019	708	4/9/2019	679	5/9/2019	597	6/9/2019	691	7/9/2019	679	8/9/2019	760	9/9/2019	683	10/9/2019	717	11/9/2019	721	12/9/2019	592
1/10/2019	665	2/10/2019	782	3/10/2019	698	4/10/2019	620	5/10/2019	737	6/10/2019	722	7/10/2019	761	8/10/2019	744	9/10/2019	766	10/10/2019	715	11/10/2019	746	12/10/2019	726
1/11/2019	761	2/11/2019	770	3/11/2019	741	4/11/2019	628	5/11/2019	578	6/11/2019	677	7/11/2019	621	8/11/2019	672	9/11/2019	586	10/11/2019	652	11/11/2019	760	12/11/2019	565
1/12/2019	691	2/12/2019	580	3/12/2019	806	4/12/2019	560	5/12/2019	672	6/12/2019	704	7/12/2019	651	8/12/2019	720	9/12/2019	633	10/12/2019	742	11/12/2019	714	12/12/2019	692
1/13/2019	670	2/13/2019	650	3/13/2019	727	4/13/2019	761	5/13/2019	647	6/13/2019	660	7/13/2019	712	8/13/2019	757	9/13/2019	617	10/13/2019	755	11/13/2019	627	12/13/2019	611
1/14/2019	676	2/14/2019	677	3/14/2019	944	4/14/2019	638	5/14/2019	731	6/14/2019	700	7/14/2019	185	8/14/2019	715	9/14/2019	718	10/14/2019	636	11/14/2019	710	12/14/2019	675
1/15/2019	699	2/15/2019	718	3/15/2019	594	4/15/2019	560	5/15/2019	751	6/15/2019	630	7/15/2019	817	8/15/2019	640	9/15/2019	750	10/15/2019	715	11/15/2019	705	12/15/2019	604
1/16/2019	617	2/16/2019	647	3/16/2019	614	4/16/2019	706	5/16/2019	651	6/16/2019	780	7/16/2019	630	8/16/2019	630	9/16/2019	759	10/16/2019	632	11/16/2019	701	12/16/2019	428
1/17/2019	805	2/17/2019	721	3/17/2019	739	4/17/2019	685	5/17/2019	618	6/17/2019	729	7/17/2019	839	8/17/2019	683	9/17/2019	810	10/17/2019	617	11/17/2019	717	12/17/2019	438
1/18/2019	552	2/18/2019	551	3/18/2019	700	4/18/2019	662	5/18/2019	658	6/18/2019	631	7/18/2019	664	8/18/2019	732	9/18/2019	732	10/18/2019	688	11/18/2019	425	12/18/2019	686
1/19/2019	732	2/19/2019	652	3/19/2019	713	4/19/2019	737	5/19/2019	704	6/19/2019	651	7/19/2019	706	8/19/2019	807	9/19/2019	685	10/19/2019	773	11/19/2019	677	12/19/2019	692
1/20/2019	657	2/20/2019	842	3/20/2019	703	4/20/2019	587	5/20/2019	650	6/20/2019	726	7/20/2019	735	8/20/2019	765	9/20/2019	605	10/20/2019	738	11/20/2019	694	12/20/2019	633
1/21/2019	634	2/21/2019	546	3/21/2019	658	4/21/2019	853	5/21/2019	562	6/21/2019	771	7/21/2019	807	8/21/2019	646	9/21/2019	699	10/21/2019	637	11/21/2019	623	12/21/2019	676
1/22/2019	329	2/22/2019	397	3/22/2019	674	4/22/2019	593	5/22/2019	682	6/22/2019	667	7/22/2019	743	8/22/2019	689	9/22/2019	640	10/22/2019	615	11/22/2019	733	12/22/2019	755
1/23/2019	161	2/23/2019	882	3/23/2019	620	4/23/2019	662	5/23/2019	675	6/23/2019	698	7/23/2019	730	8/23/2019	659	9/23/2019	749	10/23/2019	672	11/23/2019	602	12/23/2019	597
1/24/2019	304	2/24/2019	733	3/24/2019	747	4/24/2019	646	5/24/2019	701	6/24/2019	662	7/24/2019	723	8/24/2019	763	9/24/2019	684	10/24/2019	784	11/24/2019	549	12/24/2019	725
1/25/2019	196	2/25/2019	403	3/25/2019	728	4/25/2019	705	5/25/2019	692	6/25/2019	682	7/25/2019	513	8/25/2019	794	9/25/2019	726	10/25/2019	613	11/25/2019	710	12/25/2019	736
1/26/2019	172	2/26/2019	577	3/26/2019	602	4/26/2019	698	5/26/2019	678	6/26/2019	614	7/26/2019	571	8/26/2019	847	9/26/2019	623	10/26/2019	625	11/26/2019	694	12/26/2019	641
1/27/2019	231	2/27/2019	776	3/27/2019	762	4/27/2019	542	5/27/2019	652	6/27/2019	666	7/27/2019	706	8/27/2019	741	9/27/2019	684	10/27/2019	767	11/27/2019	538	12/27/2019	817
1/28/2019	284	2/28/2019	651	3/28/2019	770	4/28/2019	684	5/28/2019	752	6/28/2019	700	7/28/2019	718	8/28/2019	560	9/28/2019	698	10/28/2019	664	11/28/2019	676	12/28/2019	704
1/29/2019	436			3/29/2019	659	4/29/2019	590	5/29/2019	687	6/29/2019	740	7/29/2019	725	8/29/2019	735	9/29/2019	757	10/29/2019	648	11/29/2019	659	12/29/2019	714
1/30/2019	421			3/30/2019	645	4/30/2019	614	5/30/2019	602	6/30/2019	585	7/30/2019	736	8/30/2019	692	9/30/2019	693	10/30/2019	576	11/30/2019	660	12/30/2019	705
1/31/2019	230			3/31/2019	722			5/31/2019	648			7/31/2019	742	8/31/2019	652			10/31/2019	598			12/31/2019	707
Total	16678		18384		21949		20071		20611		20904		21108		22267		20532		21028		20242		18159
Maximum	805		882		944		853		784		799		839		847		810		784		803		817
Minimmum	161		397		594		542		562		585		185		560		557		571		425		200
Average	538		657		708		669		665		697		681		718		684		678		675		586

🟥 Top 5 2019 readings

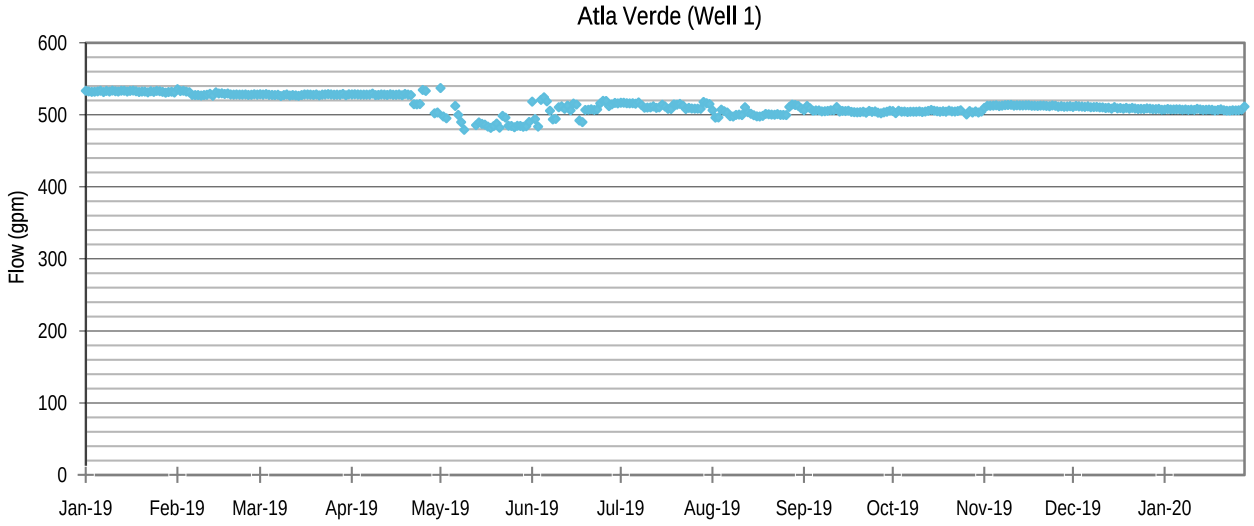
🟧 Below monthly average readings near top 5 2019 readings

Source: EMOR data updated July 2020.

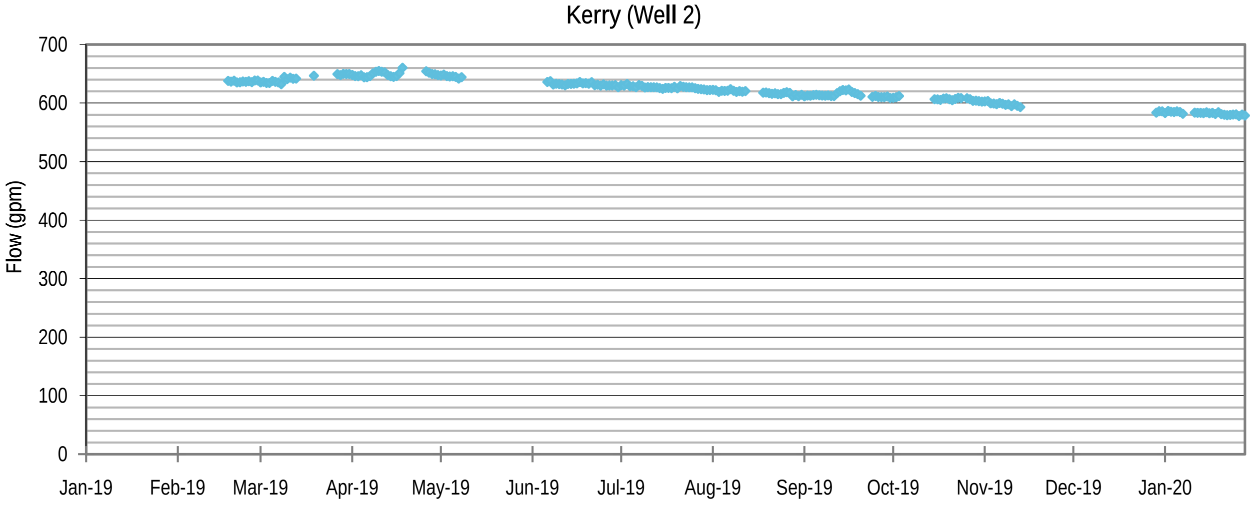
C:\OneDrive\AECOM Directory\60580895_Weston Master Plan Project - Documents\General\400_Technical\453_Water\report\appendices\C_kerry_maximum_pumpages\pieces\[EMOR Data_from_Josh_07152020_Kerry_max_pumpages.xlsx]Sheet1

Appendix D

EMOR Well Pumpage Graphs

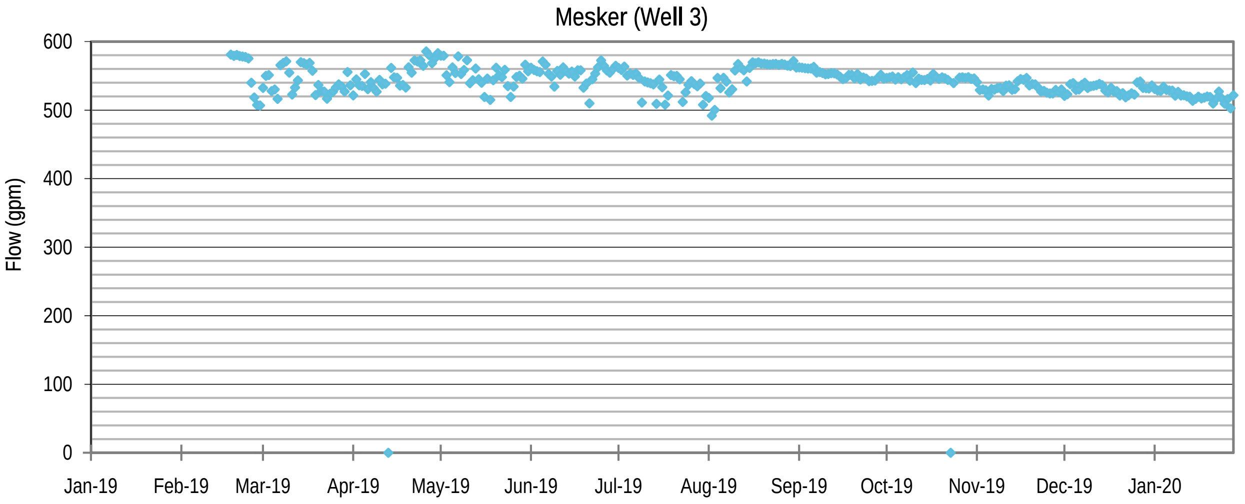

Atla Verde (Well 1)

Most Recent 3 Month Average: 510 gpm


Kerry (Well 2)

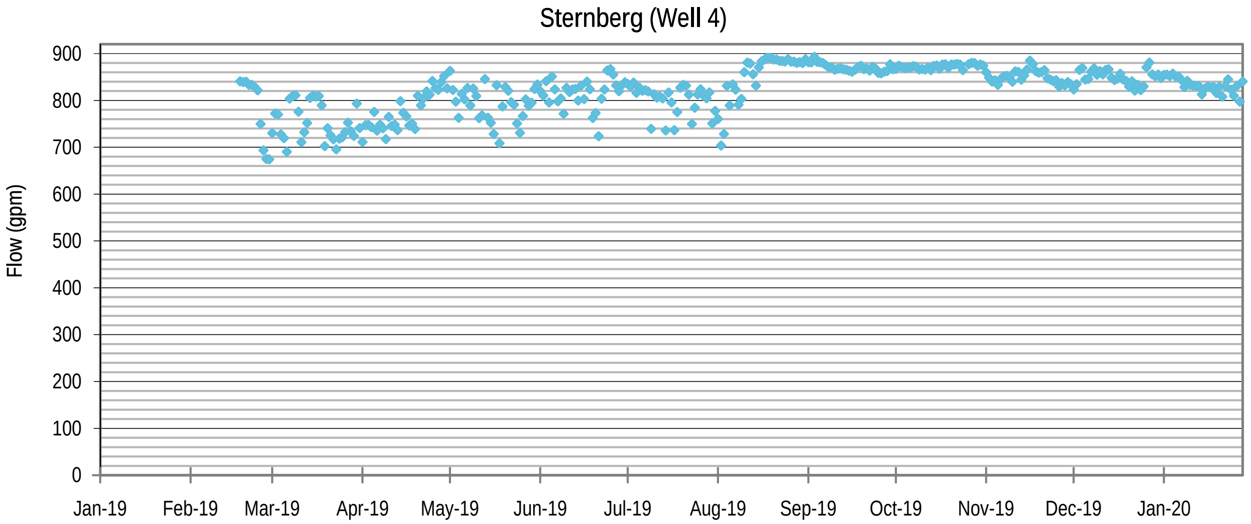
Most Recent 3 Month Average: 590 gpm

After June 2020 Rehabilitation: 640 gpm

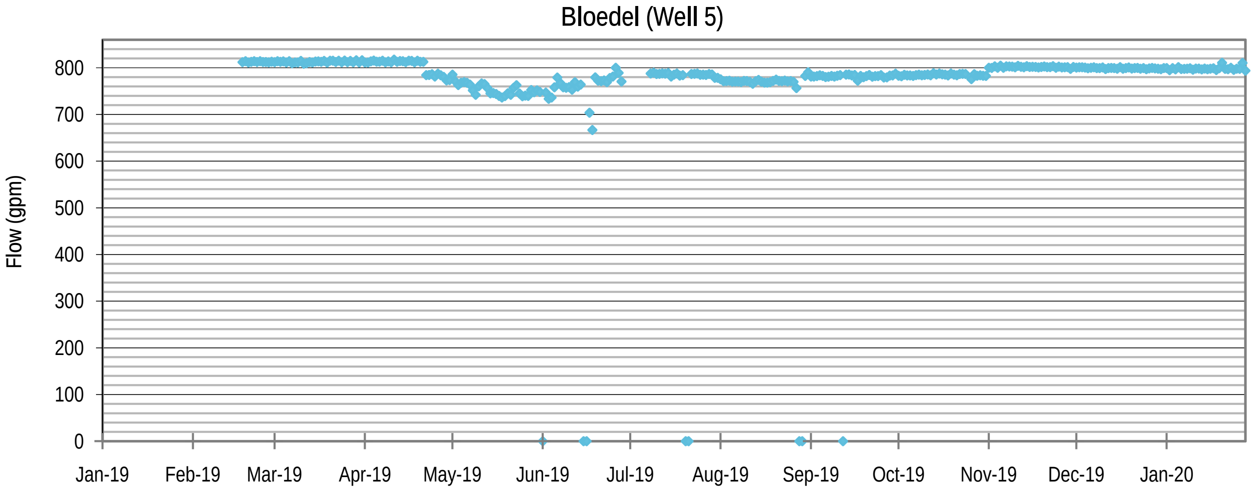

Mesker (Well 3)

Most Recent 3 Month Average: 530 gpm

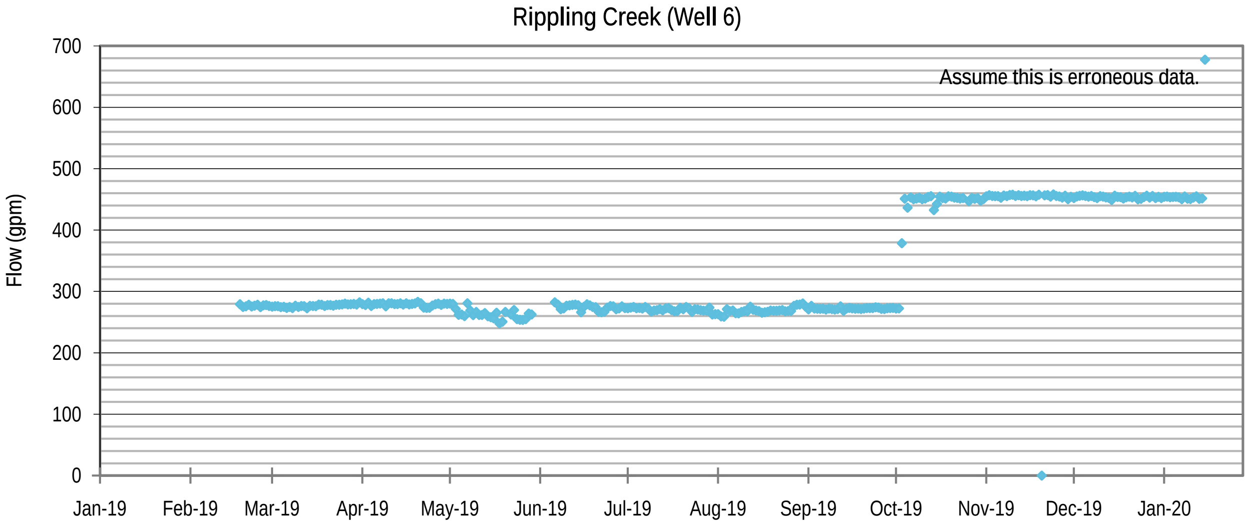
After June 2020 Rehabilitation: 730 gpm



Most Recent 3 Month Average: 840 gpm



Most Recent 3 Month Average: 800 gpm



Most Recent 3 Month Average: 460 gpm

C:\OneDrive\AECOM Directory\60580895_Weston Master Plan Project - General\400_Technical\453_Water\Existing Well Data\[2019_2020_Daily_Well_Data_kab_new_ta

Appendix E

Kerry Meeting Minutes

Minutes

Meeting name Kerry Water Needs Meetings	**Subject** Kerry Needs & Misc Discussions	**Attendees** Keith Donner Michael Wodalski Kathy Beduhn Josh Swenson Dean Zaretzke, Kerry Ryan, Kerry Jason, Kerry Rob, Kerry
Meeting date May 16, 2019	**Time** 9:30 am	
Prepared by Tom Degen, AECOM		

Two meetings were conducted regarding water system master plan: 1) a meeting with Village of Weston staff to discuss the topics for the pending Kerry meeting, and 2) a meeting with Kerry representatives to discuss Kerry's existing and future water needs. In addition, other topics other than Kerry's water supply were discussed with village staff. The following is a summary of the meetings.

Meeting with Village staff – Kerry

- The historic problem with the Kerry well is the frequency of positive bacteria detections. Once the positive bacteria detection occurs the well must be taken off-line to be super chlorinated.
- A 1971 annexation agreement with Rothschild gave part of the Town of Weston to the Village of Rothschild.
- A 1993 annexation agreement gives the Village of Weston the right to serve Foremost/Kerry. This right was granted because Weston owned the land Kerry has a 100 year lease on.
- About five years ago, the Kerry well was rebuilt due to corrosion issues and a smaller screen was inserted.
- Kerry has been experiencing corrosion in the stainless steel piping. Abigail Cantor tested the stainless steel piping and identified pinholes that she believed bacteria was attacking.
- Weston charges Kerry for fire protection but Weston is also billed for fire protection by Rothschild for Kerry.
- Rib Mountain Sanitary is served with a 2 inch pipe and a 1.5 inch meter via the Kerry well.
- The option of selling the well back to Kerry was discussed.
- Rib Mountain Sanitary also gets a fire protection fee.
- Hydraulic grade lines:
  - Rothschild's hydraulic grade line: 1,382 feet MSL
  - Weston's hydraulic grade line: 1,408 feet MSL
  - Kerry's hydraulic grade line: 1,330 feet MSL
  - Schofield's hydraulic grade line: 1,340 feet MSL
- Weston has discussed the option of running a pipe from Alderson Road to Kerry. Wetlands must be traversed.
- The Public Service Commission's recent rate case increased the rate for high-volume users.
- Keith noted that Public Service Commission has standby tariffs for other communities including Cudahay which has an emergency connection with Milwaukee.

- Rothschild has complained in the past about serving Kerry because the need for water was not planned.
- The Kerry well does not have standby generator but has a receptacle for portable generator.
- The Village does not have historical well data for monitoring wells by the proposed well field (for use in AECOM's well evaluation).
- The WDNR required Weston to sample water from the Sternberg and Mesker wells because of contamination in the aquifer due to the landfill. Previously the regional groundwater was contaminated with petroleum products from a nearby gas station. The gas station owners (the site of the current carwash) installed a groundwater treating system with the air stripper and remediated the site. Weston is no longer sampling.

Meeting with Kerry Representatives

- The purpose of the meeting was to understand Kerry's water needs as AECOM is developing a long term water master plan for Weston.
- The well is nearing capacity. Kerry's operations are 24/7. The well operates approximately 20 hours a day and cycles approximately seven times per day.
- Several years ago, Kerry used 850 - 900 gallons per minute (gpm). Kerry is now using approximately 750 gpm. Kerry is working on several projects to be completed by the end of the year that will reduce the amount of water used by about 100,000 gallons per day (gpd) however, Kerry also plans production increases that will result in an additional use about 100,000 gpd. The net result is no change from what they have been using (approximately 750 gpm).
- The Weston Kerry plant is the number one plant in terms of total water usage and the amount of water used per pound of product. This fact has drawn attention to the Weston plant. There is pressure from corporate to reduce water used. Kerry representatives are very aware of the need to reduce water consumption and are reviewing options.
- The well was refurbished in 2012. Before the rehab it was producing 813 gpm. After words, it was producing 766 gpm. The reduction is due to the installation of a smaller well screen
- Kerry has experienced corrosion in the form of pinholes in the stainless steel pipes. They have begun using different type of piping (AL6N - called six Molly). The new type material is very expensive, $100 per lineal foot of 2 inch pipe. They have not replaced all of their stainless pipe. Their tanks are also not protected. They have found that after installing segment of 316 L stainless steel pipe, pinholes occur within 2 to 3 months. They suspected pinholes may be related to the high temperature of the water (140°). They believe that the pinhole corrosion may be resulting from the high chlorides to the water. Once the pinholes have occurred Kerry personnel found iron hydroxide along the perimeter of the hole indicating a chemical reaction. They contacted other industries in the neighborhood who had the same problem with the stainless steel pipe including Domtar, Siemens and WPS. Even though some of these systems are probably provided water by Schofield, water quality is likely similar to that of Weston's water. Keith indicated that other water utilities are also having problems with high chlorides believed to be related to road salt use. He believes that Weston's chloride concentrations similar to Rothschild's.
- Kerry replaced all galvanized piping because galvanized pipe became plugged with manganese deposits.
- Kerry has discussed internally changing the cooling system to another type of system that doesn't use water but if that is implemented the change will occur well into the future.
- They are planning for later this year second pass cooling for some of their processes that use higher heat, which will reduce their water consumption as discussed above. The WBA (dairy industry) won't allow second passive cooling for some dairy products.

- They see high concentrations of manganese as a problem because the manganese precipitates and is trapped by the filters which must be clean.
- Conductivity of the water is 800.
- Phosphorus is a big challenge related to the water supply. Weston is adding about 37 pounds per day of the sequestering agent. Their proposed limit for phosphorus in the wastewater discharge is 0.1 mg/L. Kerry's opinion is that the phosphorus is not preventing corrosion or sequestering manganese. We discussed eliminating the sequestering agent to prevent the phosphates from getting to the wastewater discharge.
- AECOM talked about sequestering agent science and said that the mix is proprietary, and vendors claim that various products work differently with various types of water and selection of the proper product is based on a trial and error process.
- The Plant has two waste streams. Kerry's process water goes to their own wastewater treatment plant and the cooling water is not treated. The wastewater takes three days to be processed and discharged. The wastewater plant and cooling water pipes combine after the wastewater treatment process prior to entering the river. DNR samples are collected after the waste is combined.
- Approximately 40 percent of Kerry's water use is for cooling water. We talked about domestic use of water and they believe that use is maybe 1 percent of their overall use. Their opinion is that they prefer using point of use treatment for domestic uses and believe that be cost-effective for the Rib Mountain wastewater buildings also.
- Most of their water is used for processes including evaporators flushing processes. They treat some of their process water using an RO process.
- We talked about challenges when switching over to use Rothschild water. Before each switch over they clean the filters and clean them again after the switchover. They believe that stagnant water in the pipes at the dead ends in Rothschild's system results in particulates that must be filtered out.
- We talked about the option of Kerry purchasing the well and facilities. Kerry representatives said that they are not interested in purchasing the well but would check with corporate.
- They are not aware of requirements for fire protection. The insurance company has been silent on this issue. They do not have a sprinkler system. Rothschild has hydrants on their site.
- They are comfortable with tower being removed. Weston talked about providing a variable frequency drive to match their demands. If the tower were to be removed, Kerry would use the space for parking or other pressing needs.

Follow up meeting at the Weston office

- Mesker well and Sternberg well are pumped through the air stripper. The effluent is no longer sampled for VOCs. Weston is unaware of documentation from DNR allowing the discontinuation of sampling.
- Sternberg well has a generator. Mesker well has a couple motor that is no longer functional.
- They believe that the Mesker well was not contaminated, but DNR required treating and testing because of proximity to the landfill.
- We called Mark Thompson, the former DPW, who said that the reason that Weston owns the Kerry water system is because Weston owned land and the sale of water is financially lucrative**.**
- We discussed possible regionalization including Weston, Rothschild and Schofield. Rothschild is essentially landlocked except for areas where they can in-fill. Schofield is also land locked. Rothschild's wells are co- located in the same vicinity except for the new well which is ½ mile away.
- With regards to water quality, AECOM needs data for each well indicating the levels of iron and manganese so AECOM can evaluate if treatment is needed.

- Keith said that the Bloedel well has the highest levels of manganese. They limit the use of the well but the water is needed during the summer months.

Ref	**Action**	**Responsibility**
01	Provide iron and manganese testing data for each well for this year and for 10 years ago (or a table of annual results, if available)	Michael
02	Review regulations for drilling new well at the Kerry site.	AECOM
03	Provide 10 years of static and flowing water levels for each well including Kerry.	Michael
04	Provide a list of parameters requested to use for resampling wellheads on a periodic basis.	AECOM
05	Sample each of the wells at the wellhead for parameters to be defined by AECOM.	Michael
06	Provide the results of the full suite of sampling at the wellheads that was performed in the last five years.	Michael
07	Talk to a NALCO about other sequestering agent science for phosphates to determine if another product is available may not cause corrosion.	Kerry
08	Contact Glenn Falkowski from DNR to determine if the air stripper can be abandoned.	AECOM
09	Provide monthly DNR well reports from 2009 until 2013 and for 2018.	Michael
10	Advise Weston if the test wells can be abandoned.	AECOM
11	Add a discussion in the report about possibly lining pipes, especially problematic pipes in Rothschild.	AECOM
12	Scan and send documents that AECOM marked in Weston’s files.	Michael

Appendix F

Summary of Rothschild Water Distribution System

Summary of Rothschild Municipal Water Utility

Historical Water Pumpage

Year	Total Pumpage	Wholesale (Kerry)	Average Day	Maximum Day	Date	Reason	Ratio of Maximum to Average
2014	244.38 MGY	18.45 MGY	0.67 MGD	1.51 MGD	Sep-14	Kerry	2.26
2015	238.85 MGY	8.15 MGY	0.65 MGD	1.50 MGD	Sep-15	Kerry	2.29
2016	209.44 MGY	1.59 MGY	0.57 MGD	1.38 MGD	Sep-16	Kerry	2.40
2017	204.32 MGY	0.14 MGY	0.56 MGD	1.29 MGD	Feb-17	Kerry	2.30
2018	263.48 MGY	0.14 MGY	0.72 MGD	1.29 MGD	Sep-18	Kerry	1.79
2019	211.27 MGY	-	0.58 MGD	1.01 MGD	Aug-19	Hot Day	1.74

Well Data

Name	Number	Pump Capacity (PSC)	Pumping Capacity (DNR)	Year Constructed (DNR)	Notes (PSC)
Well E Kort	6	1.44 MGD	1.44 MGD	2016	Distribution
Well Kort St. and W Grand Avenue	3	1.01 MGD	1.08 MGD	2013	Treatment
Well Park St	4	1.73 MGD	1.44 MGD	1963	Treatment
Well W Grand Ave	5	0.65 MGD	0.54 MGD	2012	Treatment

High Lift Pumps

Name	Location	Capacity
High lift pump 1	1126 W Grand #5 Dist	1.73 MGD
High lift pump 2	1126 W Grand #5 Dist	1.73 MGD
High lift pump 3	Air Stripper	1.73 MGD

Rothschild Comprehensive Plan notes new 2.2 MGD water treatment facility in 2002.

Tank Data

Name	Year Constructed	Capacity
Cedar Creek Tower	1996	0.30 MG
Rothschild Tower	2005	0.30 MG

Fire Flow Information

Hydraulic model data provided by Becher-Hoppe Associates indicates 2,000 gpm is available at approximately 41 psi under Rothschild maximum day demand near Kerry.

Source: PSC Report and DNR Well Data.

Appendix G

ISO Fire Flow Requirements

111 NORTH CANAL STREET SUITE 950 CHICAGO, IL 60606-7270
TEL: (312) 930-0070 (800) 444-4554 FAX: (312) 930-0017

RECEIVED
JUN 16 2011
VILLAGE OF WESTON

June 14, 2011

Fred Schuster, Village Administrator
Village of Weston
5500 Schofield Ave.
Weston, WI 54476

RE: Weston, Marathon County, WI
Public Protection Classification: 4/9
Effective Date: August 1, 2011

Dear Mr. Schuster:

We wish to thank you, Fire Chief Meilahn and Water Official Donner for your cooperation during our recent Public Protection Classification (PPC) survey. ISO has completed its analysis of the structural fire suppression delivery system provided in your community. The resulting classification is indicated above.

Enclosed is a summary of the ISO analysis of your fire suppression services. If you would like to know more about your community's PPC classification, or if you would like to learn about the potential effect of proposed changes to your fire suppression delivery system, please call us at the phone number listed below.

ISO's Public Protection Classification Program (PPC) plays an important role in the underwriting process at insurance companies. In fact, most U.S. insurers – including the largest ones – use PPC information as part of their decision- making when deciding what business to write, coverage's to offer or prices to charge for personal or commercial property insurance.

Each insurance company independently determines the premiums it charges its policyholders. The way an insurer uses ISO's information on public fire protection may depend on several things – the company's fire-loss experience, ratemaking methodology, underwriting guidelines, and its marketing strategy.

PPC is important to communities and fire departments as well. Communities whose PPC improves may get lower insurance prices. PPC also provides fire departments with a valuable benchmark, and is used by many departments as a valuable tool when planning, budgeting and justifying fire protection improvements.

ISO appreciates the high level of cooperation extended by local officials during the entire PPC survey process. The community protection baseline information gathered by ISO is an essential foundation upon which determination of the relative level of fire protection is made using the Fire Suppression Rating Schedule.

The classification is a direct result of the information gathered, and is dependent on the resource levels devoted to fire protection in existence at the time of survey. Material changes in those resources that occur after the survey is completed may affect the classification. Although ISO maintains a pro-active process to keep baseline information as current as possible, in the event of changes please call us at (800) 930-1677 to expedite the update activity.

ISO is the leading supplier of data and analytics for the property/casualty insurance industry. Most insurers use PPC classifications for underwriting and calculating premiums for residential, commercial and industrial properties. The PPC program is not intended to analyze all aspects of a comprehensive structural fire suppression delivery system program. It is not for purposes of determining compliance with any state or local law, nor is it for making loss prevention or life safety recommendations.

If you have any questions about your classification, please let us know.

Sincerely,

Very truly yours,
Public Protection Classification Dept.
Public Protection Classification Dept.
(800) 930-1677 Ext. 6209

Encl.

cc: Steve Meilahn, Fire Chief
✓Keith Donner, Director of Public Works

INSURANCE SERVICES OFFICE, INC.

HYDRANT FLOW DATA SUMMARY

City Weston

County Marathon State Wisconsin Witnessed by: Insurance Services Office, Inc. Date: February 17, 2011

TEST NO.	TYPE DIST.*	TEST LOCATION	SERVICE	FLOW - GPM $Q=(29.83(C(d^{2})p^{0.5}))$		PRESSURE PSI		FLOW -AT 20 PSI		REMARKS***
				INDIVIDUAL HYDRANTS	TOTAL	STATIC	RESID.	NEEDED **	AVAIL.	
1	Comm	Fuller Street & Saxon Ave	Village of Weston, Main	Network Model Prediction				750	4000	
1.1	Comm	Fuller Street & Saxon Ave	Village of Weston, Main	Network Model Prediction				5500	4000	(D)-(3767 gpm)
2	Comm	Alderson Street & Jelinek Ave	Village of Weston, Main	Network Model Prediction				3000	3100	
2.1	Comm	Alderson Street & Pointe Rd	Village of Weston, Main	Network Model Prediction				5000	3100	(D)-(3767 gpm)
3	Comm	Rickval Street & Commererce Dr	Village of Weston, Main	Network Model Prediction				1500	5000	
3.1	Comm	Commerce Drive & Rickyval St	Village of Weston, Main	Network Model Prediction				4000	5000	(D)-(3767 gpm)
4	Comm	Bayberry Street & Ross Ave	Village of Weston, Main	Network Model Prediction				3500	4500	
5	Comm	Camp Phillips Road & Concord St	Village of Weston, Main	Network Model Prediction				3500	4500	
6	Comm	Everest Avenue & Machmuller St	Village of Weston, Main	Network Model Prediction				3500	4000	
7	Comm	Mesker Street & Corozalla Dr	Village of Weston, Main	Network Model Prediction				3500	5000	
8	Comm	Schofield Avenue & Fuller St	Village of Weston, Main	Network Model Prediction				3500	5000	
9	Comm	Jelinek Avenue & Machmueller St	Village of Weston, Main	Network Model Prediction				1500	3000	
9.1	Comm	Machmueller Street & Jelinke Ave	Village of Weston, Main	Network Model Prediction				4500	3000	(D)-(3767 gpm)
10	Comm	Howland Avenue & Camp Phillps Rd	Village of Weston, Main	Network Model Prediction				3500	1800	
11	Comm	Community Center Drive & Camp Phillips Rd	Village of Weston, Main	Network Model Prediction				2500	4000	
12	Res	Quentin Street & Makenzie Dr	Village of Weston, Main	Network Model Prediction				1000	2300	

THE ABOVE LISTED NEEDED FIRE FLOWS ARE FOR PROPERTY INSURANCE PREMIUM CALCULATIONS ONLY AND ARE *NOT* INTENDED TO PREDICT THE MAXIMUM AMOUNT OF WATER REQUIRED FOR A LARGE SCALE FIRE CONDITION.

THE AVAILABLE FLOWS ONLY INDICATE THE CONDITIONS THAT EXISTED AT THE TIME AND AT THE LOCATION WHERE TESTS WERE WITNESSED.

*Comm = Commercial; Res = Residential.

**Needed is the rate of flow for a specific duration for a full credit condition. Needed Fire Flows greater than 3,500 gpm are not considered in determining the classification of the city when using the Fire Suppression Rating Schedule.

*** (A)-Limited by available hydrants to gpm shown. Available facilities limit flow to gpm shown plus consumption for the needed duration of (B)-2 hours, (C)-3 hours or (D)-4 hours.

INSURANCE SERVICES OFFICE, INC.

HYDRANT FLOW DATA SUMMARY

City Weston

County Marathon State Wisconsin Witnessed by: Insurance Services Office, Inc. Date

TEST NO.	TYPE DIST.*	TEST LOCATION	SERVICE	FLOW - GPM $Q=(29.83(C(d^2)p^{0.5}))$				PRESSURE PSI		FLOW -AT 20 PSI		REMARKS***
				INDIVIDUAL HYDRANTS			TOTAL	STATIC	RESID.	NEEDED **	AVAIL.	
13	Comm	Ryan Street & Lang LN	Village of Weston, Main	Network Model Prediction						1750	3000	
14	Comm	Schofield Avenue & Zinser St	Village of Weston, Main	Network Model Prediction						2500	4900	
15	Comm	Schofield Avenue & Pine St	Village of Weston, Main	Network Model Prediction						1750	4300	

THE ABOVE LISTED NEEDED FIRE FLOWS ARE FOR PROPERTY INSURANCE PREMIUM CALCULATIONS ONLY AND ARE *NOT* INTENDED TO PREDICT THE MAXIMUM AMOUNT OF WATER REQUIRED FOR A LARGE SCALE FIRE CONDITION.

THE AVAILABLE FLOWS ONLY INDICATE THE CONDITIONS THAT EXISTED AT THE TIME AND AT THE LOCATION WHERE TESTS WERE WITNESSED.

***Comm = Commercial; Res = Residential.**

****Needed is the rate of flow for a specific duration for a full credit condition. Needed Fire Flows greater than 3,500 gpm are not considered in determining the classification of the city when using the Fire Suppression Rating Schedule.**

***** (A)-Limited by available hydrants to gpm shown. Available facilities limit flow to gpm shown plus consumption for the needed duration of (B)-2 hours, (C)-3 hours or (D)-4 hours.**

Public Protection Classification
Summary Report

Weston

Wisconsin

Prepared by

Insurance Services Office, Inc.
111 North Canal Street, Suite 950
Chicago, Illinois 60606-7270
(312) 930-0070

June 7, 2011

©ISO Properties, Inc., 2007

Background Information

Introduction

ISO collects and evaluates information from communities in the United States on their structure fire suppression capabilities. The data is analyzed using our Fire Suppression Rating Schedule (FSRS™) and then a Public Protection Classification (PPC™) number is assigned to the community. The surveys are conducted whenever it appears that there is a possibility of a classification change. As such, the PPC program provides important, up-to-date information about fire protection services throughout the country.

The Fire Suppression Rating Schedule (FSRS) recognizes fire protection features only as they relate to suppression of first alarm structure fires. In many communities, fire suppression may be only a small part of the fire department's overall responsibility. ISO recognizes the dynamic and comprehensive duties of a community's fire service, and understands the complex decisions a community must make in planning and delivering emergency services. However, in developing a community's Public Protection Classification, only features related to reducing property losses from structural fires are evaluated. Multiple alarms, simultaneous incidents and life safety are not considered in this evaluation. The PPC program evaluates the fire protection for small to average size buildings. Specific properties with a Needed Fire Flow in excess of 3,500 gpm are evaluated separately and assigned an individual classification.

A community's investment in fire mitigation is a proven and reliable predictor of future fire losses. Statistical data on insurance losses bears out the relationship between excellent fire protection – as measured by the PPC program – and low fire losses. So, insurance companies use PPC information for marketing, underwriting, and to help establish fair premiums for homeowners and commercial fire insurance. In general, the price of fire insurance in a community with a good PPC is substantially lower than in a community with a poor PPC, assuming all other factors are equal.

ISO is an independent company that serves insurance companies, communities, fire departments, insurance regulators, and others by providing information about risk. ISO's expert staff collects information about municipal fire suppression efforts in communities throughout the United States. In each of those communities, ISO analyzes the relevant data and assigns a Public Protection Classification – a number from 1 to 10. Class 1 represents an exemplary fire suppression program, and Class 10 indicates that the area's fire suppression program does not meet ISO's minimum criteria.

ISO's PPC program evaluates communities according to a uniform set of criteria, incorporating nationally recognized standards developed by the National Fire Protection Association and the American Water Works Association. A community's PPC depends on:

- **Needed Fire Flows**, which are representative building locations used to determine the theoretical amount of water necessary for fire suppression purposes.
- **Receiving and Handling Fire Alarms**, including telephone systems, telephone lines, staffing, and dispatching systems.
- **Fire Department**, including equipment, staffing, training, and geographic distribution of fire companies.
- **Water Supply**, including condition and maintenance of hydrants, alternative water supply operations, and a careful evaluation of the amount of available water compared with the amount needed to suppress fires up to 3,500 gpm.

©ISO Properties, Inc., 2007

Data Collection and Analysis

ISO has evaluated and classified over 48,000 fire protection areas across the United States using its Fire Suppression Rating Schedule (FSRS). A combination of meetings between trained ISO field representatives and the dispatch center coordinator, community fire official, and water superintendent is used in conjunction with a comprehensive questionnaire to collect the data necessary to determine the PPC number. In order for a community to obtain a classification better then a Class 9, three elements of fire suppression features are reviewed. These three elements are Receiving and Handling Fire Alarms, Fire Department and Water Supply.

A review of the **Receiving and Handling Fire Alarms** fire alarm and communication system accounts for 10% of the total classification. The review focuses on the community's facilities and support for handling and dispatching fire alarms. This section is weighted at **10 points,** as follows:

• Telephone Service	2 points
• Number of Needed Operators	3 points
• Dispatch Circuits	5 points

A review of the **Fire Department** accounts for 50% of the total classification. ISO focuses on a fire department's first alarm response and initial attack to minimize potential loss. In this section, ISO reviews such items as engine companies, ladder or service companies, distribution of fire stations and fire companies, equipment carried on apparatus, pumping capacity, reserve apparatus, department personnel, and training. The fire department section is weighted at **50 points,** as follows:

• Engine Companies	10 points
• Reserve Pumpers	1 point
• Pumper Capacity	5 points
• Ladder/Service Companies	5 points
• Reserve Ladder/Service Trucks	1 point
• Distribution of Companies	4 points
• Company Personnel	15 points
• Training	9 points

A review of the **Water Supply** system accounts for 40% of the total classification. ISO reviews the water supply a community uses to determine the adequacy for fire suppression purposes. Hydrant size, type, and installation is also considered, as well as the inspection frequency and condition of fire hydrants. The water supply system is weighted at **40 points,** as follows:

• Credit for Supply System	35 points
• Hydrant Size, Type & Installation	2 points
• Inspection/Condition of Hydrants	3 points

There is one additional factor considered in calculating the final score – **Divergence**.

Even the best fire department will be less than fully effective if it has an inadequate water supply. Similarly, even a superior water supply will be less than fully effective if the fire department lacks the equipment or personnel to use the water. The FSRS score is subject to modification by a divergence factor, which recognizes disparity between the effectiveness of the fire department and the water supply.

The Divergence factor mathematically reduces the score based upon the relative difference between the fire department and water supply scores. The factor is introduced in the final equation.

Public Protection Classification Number

The PPC number assigned to the community will depend on the community's score on a 100-point scale:

PPC	Points
1	90.00 or more
2	80.00 to 89.99
3	70.00 to 79.99
4	60.00 to 69.99
5	50.00 to 59.99
6	40.00 to 49.99
7	30.00 to 39.99
8	20.00 to 29.99
9	10.00 to 19.99
10	0.00 to 9.99

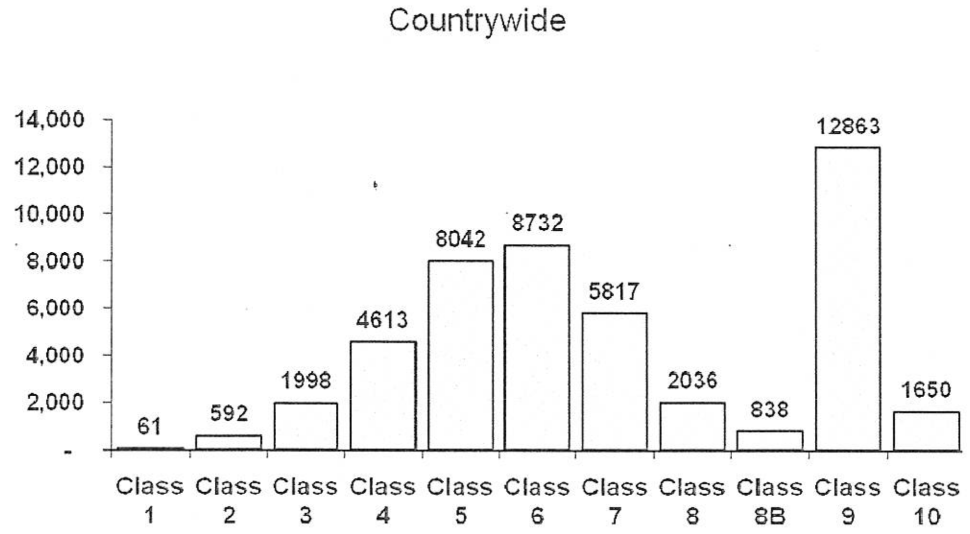
The classification numbers are interpreted as follows:

- Class 1 through (and including) Class 8 represents a fire suppression system that includes an FSRS creditable dispatch center, fire department, and water supply.
- Class 8B is a special classification that recognizes a superior level of fire protection in otherwise Class 9 areas. It is designed to represent a fire protection delivery system that is superior except for a lack of a water supply system capable of the minimum FSRS fire flow criteria of 250 gpm for 2 hours.
- Class 9 is a fire suppression system that includes a creditable dispatch center, fire department but no FSRS creditable water supply.
- Class 10 does not meet minimum FSRS criteria for recognition.

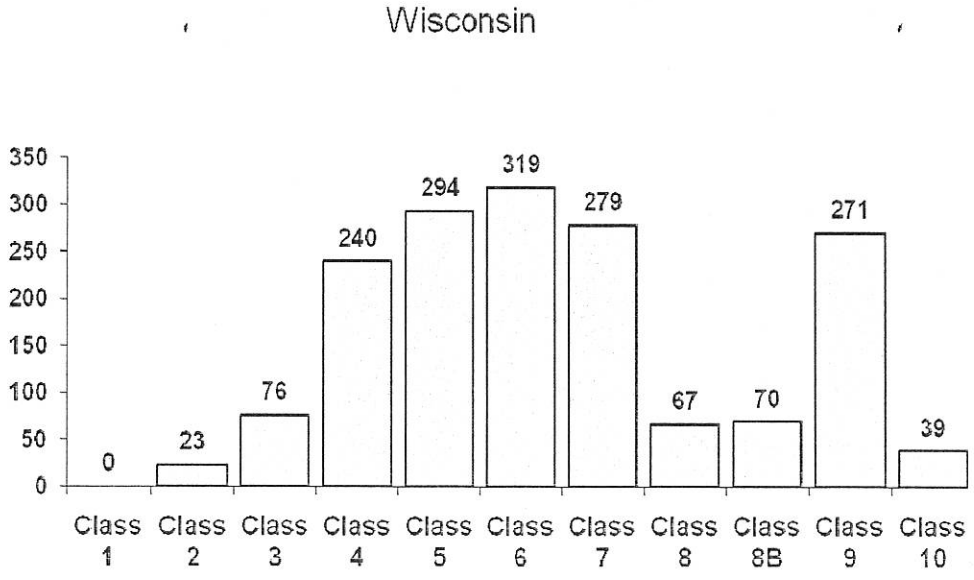
©ISO Properties, Inc., 2007

Distribution of Public Protection Classification Numbers

The 2011 published countrywide distribution of communities by the Public Protection Classification number is as follows:



The 2011 published statewide distribution of communities by the Public Protection Classification number is as follows:



©ISO Properties, Inc., 2007

Assistance

The PPC program offers help to communities, fire departments and other public officials as they plan for, budget, and justify improvements. ISO is also available to assist in the understanding of the details of this evaluation.

ISO Public Protection representatives can be reached by telephone at (800) 444-4554. The technical specialists at this telephone number have access to the details of this evaluation and can effectively speak with you about your PPC questions. What's more, we can be reached via the internet at www.isomitigation.com/talk/.

We also have a website dedicated to our Community Hazard Mitigation Classification programs at www.isomitigation.com. Here, fire chiefs, building code officials, community leaders and other interested citizens can access a wealth of data describing the criteria used in evaluating how cities and towns are protecting residents from fire and other natural hazards. This website will allow you to learn more about ISO's Public Protection Classification program. The website provides important background information, insights about the PPC grading processes and technical documents. ISO is also pleased to offer Fire Chiefs Online — a special secured website with information and features that can help improve your ISO Public Protection Classification, including a list of the Needed Fire Flows for all the commercial occupancies ISO has on file for your community. Visitors to the site can download information, see statistical results and also contact ISO for assistance.

In addition, on-line access to the Fire Suppression Rating Schedule and its commentaries is available to registered customers for a fee. However, fire chiefs and community chief administrative officials are given access privileges to this information without charge.

To become a registered fire chief or community chief administrative official, register at www.isomitigation.com.

Classification Details

Public Protection Classification

On Feb 28, 2011 ISO concluded its review of the fire suppression features being provided for/by Weston. The resulting community classification is **Class 4/9**.

If the classification is a single class, the classification applies to properties with a Needed Fire Flow of 3,500 gpm or less in the community. If the classification is a split class (e.g., 6/9), the following applies:

- The first class (e.g., "6" in a 6/9) applies to properties within 5 road miles of a recognized fire station and within 1,000 feet of a fire hydrant or alternate water supply.
- Class 8B or class 9 applies to properties beyond 1,000 feet of a fire hydrant but within 5 road miles of a recognized fire station.
- Alternative Water Supply: The first class (e.g., "6" in a 6/10) applies to properties within 5 road miles of a recognized fire station with no hydrant distance requirement.
- Class 10 applies to properties over 5 road miles of a recognized fire station.
- Specific properties with a Needed Fire Flow in excess of 3,500 gpm are evaluated separately and assigned an individual classification.

Summary Evaluation Analysis

The following points represent the analysis of the application of the criteria outlined in the FSRS of four topics– Receiving and Handling Fire Alarms, Fire Department, Water Supply, and the Divergence factor for Weston:

FSRS Feature	Earned Credit	Credit Available
Receiving and Handling Fire Alarms		
414. Credit for Telephone Service	**2.00**	2
422. Credit for Operators	**3.00**	3
432. Credit for Dispatch Circuits	**3.15**	5
440. Credit for Receiving and Handling Fire Alarms	**8.15**	**10**
Fire Department		
513. Credit for Engine Companies	**8.71**	10
523. Credit for Reserve Pumpers	**0.54**	1
532. Credit for Pumper Capacity	**5.00**	5
549. Credit for Ladder Service	**4.72**	5
553. Credit for Reserve Ladder and Service Trucks	**0.28**	1
561. Credit for Distribution	**1.72**	4
571. Credit for Company Personnel	**6.19**	15
580. Credit for Training	**2.79**	9
590. Credit for Fire Department	**29.95**	**50**
Water Supply		
616. Credit for Supply System	**33.40**	35
621. Credit for Hydrants	**1.94**	2
631. Credit for Inspection and Condition	**2.10**	3
640. Credit for Water Supply	**37.44**	**40**
Divergence	**-6.74**	--
Total Credit	**68.80**	**100**

©ISO Properties, Inc., 2007

Water Supply

Forty percent of a community's overall score is based on the adequacy of the water supply system. The ISO field representative evaluated:

- the capability of the water distribution system to meet the Needed Fire Flows at selected locations up to 3,500 gpm.
- size, type and installation of fire hydrants.
- inspection and condition of fire hydrants.

Item 616 – Credit for Supply System (35 points)

The first item reviewed was Item 616 "Credit for Supply System (CSS)". This item reviews the rate of flow that can be credited at each of the Needed Fire Flow test locations considering the supply works capacity, the main capacity and the hydrant distribution. The lowest flow rate of these items is credited for each representative location. A water system capable of delivering 250 gpm or more for a period of two hours plus consumption at the maximum daily rate at the fire location is considered minimum in the ISO review.

To determine the score for Item 616 "Credit for Supply System (CSS)", three sub-items are evaluated (Item 612 "Supply Works Capacity", Item 613 "Main Capacity" and Item 614 "Hydrant Distribution").

Where there are 2 or more systems or services distributing water at the same location, credit is given on the basis of the joint protection provided by all systems and services available.

The final step in determining the Credit for Fire Department is to add the following eight components:

Item	Earned Credit	Credit Available
513. Credit for Engine Companies (CEC)	**8.71**	10
523. Credit for Reserve Pumpers (CRP)	**0.54**	1
532. Credit for Pumper Capacity (CPC)	**5.00**	5
549. Credit for Ladder Service (CLS)	**4.72**	5
553. Credit for Reserve Ladder and Service Trucks (CRLS)	**0.28**	1
561. Credit for Distribution (CD)	**1.72**	4
571. Credit for Company Personnel (CCP)	**6.19**	15
581. Credit for Training (CT)	**2.79**	9
Item 590. Credit for Fire Department:	**29.95**	**50**

Water Supply

Forty percent of a community's overall score is based on the adequacy of the water supply system. The ISO field representative evaluated:

- the capability of the water distribution system to meet the Needed Fire Flows at selected locations up to 3,500 gpm.
- size, type and installation of fire hydrants.
- inspection and condition of fire hydrants.

Item 616 – Credit for Supply System (35 points)

The first item reviewed was Item 616 "Credit for Supply System (CSS)". This item reviews the rate of flow that can be credited at each of the Needed Fire Flow test locations considering the supply works capacity, the main capacity and the hydrant distribution. The lowest flow rate of these items is credited for each representative location. A water system capable of delivering 250 gpm or more for a period of two hours plus consumption at the maximum daily rate at the fire location is considered minimum in the ISO review.

To determine the score for Item 616 "Credit for Supply System (CSS)", three sub-items are evaluated (Item 612 "Supply Works Capacity", Item 613 "Main Capacity" and Item 614 "Hydrant Distribution").

Where there are 2 or more systems or services distributing water at the same location, credit is given on the basis of the joint protection provided by all systems and services available.

The supply works capacity is calculated for each representative Needed Fire Flow test location, considering a variety of water supply sources. These include public water supplies, emergency supplies (usually accessed from neighboring water systems), suction supplies (usually evidenced by dry hydrant installations near a river, lake or other body of water), and supplies developed by a fire department using large diameter hose or vehicles to shuttle water from a source of supply to a fire site. The result is expressed in gallons per minute (gpm).

The normal ability of the distribution system to deliver Needed Fire Flows at the selected building locations is reviewed. The results of a flow test at a representative test location will indicate the ability of the water mains (or fire department in the case of fire department supplies) to carry water to that location.

The hydrant distribution is reviewed within 1,000 feet of representative test locations measured as hose can be laid by apparatus. Credit is allowed up to 1,000 gpm for each hydrant within 300 feet of the location, 670 gpm for hydrants within 301 to 600 feet of the location and 250 gpm for hydrants within 601 to 1,000 feet of the location. Credit may be reduced when hydrants do not have a pumper outlet and/or two or more hose outlets. If a hose diameter greater than 2½ inch is carried by all in-service pumpers, the hydrant distribution credit may be greater due to the reduced friction loss in the larger diameter hose.

For maximum credit, the Needed Fire Flows should be available at each location in the district. Needed Fire Flows of 2,500 gpm or less should be available for 2 hours; and Needed Fire Flows of 3,000 and 3,500 gpm should be obtainable for 3 hours.

Item 616 "Credit for Supply System (CSS)" = 33.40

Item 621 – Credit for Hydrants (2 points)

The second item reviewed is Item 621 "Credit for Hydrants (CH)". This item reviews the number of fire hydrants of each type compared with the total number of hydrants.

For maximum credit, all hydrants should have a pumper outlet, 6 inch or larger branch connection, uniform size operating nut and should operate in a uniform direction in accordance with AWWA C-502 *Standard for Dry-Barrel Fire Hydrants* or AWWA C-503 *Standard for Wet-Barrel Fire Hydrants.*

For maximum credit, all suction supply points should be equipped with a dry hydrant with a 6 inch or larger pipe and fittings, a minimum number of 90 degree elbows (preferably no more than two), and suction screen placement so that the dry hydrant will deliver the design capacity (usually 1,000 gpm) as specified in NFPA 1142, *Standard on Water Supplies for Suburban and Rural Fire Fighting.*

There are a total of 784 hydrants in the city.

620. Hydrants, - Size, Type and Installation	Earned Credit	Credit Available
A. With a 6 -inch or larger branch and a pumper outlet with or without 2½ -inch outlets There are 696 hydrants that have a 6 -inch or larger branch and a pumper outlet.	88.78	100
B. With a 6 -inch or larger branch and no pumper outlet but two or more 2½ -inch outlets, or with a small foot valve, or with a small barrel There are 88 hydrants that have a 6 -inch or larger branch but no pumper outlet, or have a small foot valve or with a small barrel.	8.42	75
C. With only a 2½ -inch outlet There are 0 hydrants with only a 2½ -inch outlet.	0.00	25
D. With less than a 6 -inch branch There are 0 hydrants with less than a 6 -inch branch connection.	0.00	25
E. Flush Type There are 0 hydrants that are of the flush type.	0.00	25
F. Cistern or suction point There are 0 locations that are considered a cistern and/or a suction point.	0.00	25
Total	97.19	100

Note 1: 2 points are deducted for each 10 percent of the hydrants that are not operating in a uniform direction of the majority, or with an operating nut different from the majority.

Of the 784 hydrants that were reviewed, 0% did not operate in the direction of the majority and 0% had a different size operating nut.

Note 2: 10 points are deducted if more than one type hose thread is used for pumper or hose outlets. Of the 784 hydrants that were reviewed, none had a different hose thread than the majority. There were no points deducted for this item.

To determine the "Credit for Hydrants (CH)", the points credited in Item 620.A though 620.F are summed, including any deductions. The sum is divided by 100 and then multiplied by the 2 points available for Item 621 "Credit for Hydrants (CH)".

Item 621 "Credit for Hydrants (CH)" = 1.94

Item 630 – Credit for Inspection and Condition (3 points)

The third item reviewed is Item 630 “Credit for Inspection and Condition (CIC)”. This item reviews the fire hydrant inspection frequency, the completeness of the inspections and the condition of hydrants. Inspection and condition of hydrants should be in accordance with AWWA M-17, *Installation, Field Testing and Maintenance of Fire Hydrants.*

A. Inspection (HI):

The frequency of inspection is the average time interval between the 3 most recent inspections.

Frequency of Inspections	Points
½ year	100
1 year	80
2 years	65
3 years	55
4 years	45
5 years or more	40

Note: The points for inspection frequency are reduced by 10 points if the inspections are incomplete or do not include a flushing program. An additional reduction of 10 points are made if hydrants are not subjected to full system pressure during inspections. If the inspection of cisterns or suction points does not include actual drafting with a pumper, or back-flushing for dry hydrants, 40 points are deducted.

B. Condition (HF):

A factor (HF) is determined from the following list of conditions according to the actual condition of hydrants examined compared with the total number examined during the survey:

Condition	Factor
Standard (no leaks, opens easily, conspicuous, well located for use by pumper)	1.0
Usable (with some defects and/or impediments to use)	0.5
Not Usable	0.0

For maximum credit, all hydrants should be inspected twice a year. The inspection should include operation of the fire hydrant, a test for leaks (using domestic pressure), and a flushing of the hydrant. Records should be kept of inspections.

Water System: Village of Weston

Item 630.A "Inspection (HI):"		**Time Interval**
Most recent inspection was Jul 01, 2010		
1st prior inspection was Jul 01, 2009		**1 year**
2nd prior inspection was Jul 01, 2008		**1 year**
Review of Inspection (HI):	**Earned Credit**	**Credit Available**
	70	**100**

For maximum credit, all hydrants should be conspicuous, well located for use by a pumper and in good condition. There were 30 hydrants examined in this FSRS item.

Item 630.B "Condition (HF):"		**Maximum Factor**
Standard: There were 30 hydrants considered in standard condition.		**1.0**
Usable: There were 0 hydrants considered in usable condition.		**0.5**
Not Usable: There were 0 hydrants considered not usable.		**0.0**
Review of Condition (HF):	**Condition Factor (HF)**	**Maximum Factor**
	1.00	**1.0**

To determine the "Credit for Inspection and Condition (CIC)", the points credited in Item 630.A are multiplied by the Condition Factor from Item 630.B. The product is divided by 100 and then multiplied by the 3 points available for Item 631 "Credit for Inspection and Condition (CIC)".

Item 631 "Credit for Inspection and Condition (CIC)" = 2.10

The final step in determining the credit for Water Supply is to add Item 616, Item 621, and Item 631:

Item	Earned Credit	Credit Available
616. Credit for Supply System (CSS)	**33.40**	35
621. Credit for Hydrants (CH)	**1.94**	2
631. Credit for Inspection and Condition (CIC)	**2.10**	3
Item 640. Credit for Water Supply:	**37.44**	**40**

<u>Divergence =</u> -6.74

The Divergence factor mathematically reduces the score based upon the relative difference between the fire department and water supply scores. The factor is introduced in the final equation.

©ISO Properties, Inc., 2007

Summary of Public Protection Classification Review
Completed by ISO on Feb 28, 2011
for
Weston

FSRS Item	Earned Credit	Credit Available
Receiving and Handling Fire Alarms		
414. Credit for Telephone Service	2.00	2
422. Credit for Operators	3.00	3
432. Credit for Dispatch Circuits	3.15	5
440. Credit for Receiving and Handling Fire Alarms	8.15	10
Fire Department		
513. Credit for Engine Companies	8.71	10
523. Credit for Reserve Pumpers	0.54	1
532. Credit for Pumper Capacity	5.00	5
549. Credit for Ladder Service	4.72	5
553. Credit for Reserve Ladder and Service Trucks	0.28	1
561. Credit for Distribution	1.72	4
571. Credit for Company Personnel	6.19	15
580. Credit for Training	2.79	9
590. Credit for Fire Department	29.95	50
Water Supply		
616. Credit for Supply System	33.40	35
621. Credit for Hydrants	1.94	2
631. Credit for Inspection and Condition	2.10	3
640. Credit for Water Supply	37.44	40
Divergence	-6.74	–
Total Credit	68.80	100

Community Classification = 4/9

If the individual scores Weston achieved for Receiving and Handling Fire Alarms; Fire Department; and Water Supply were translated into a 100 point scale instead of the (10, 50 and 40) points actually used, the relative Fire Suppression Rating Schedule classification for each of these sections would be:

Receiving and Handling Fire Alarms: a (relative) **Class 2**

Fire Department: a (relative) **Class 5**

Water Supply: a (relative) **Class 1**

©ISO Properties, Inc., 2007

Appendix H

Field Testing Results

Field Testing

Water system field tests were performed for use in calibrating the water system model of the Main System. Flow and pressure test results were used to verify the model accurately simulates actual field conditions under high flow conditions. Pressure recorders (Telogs) were used to verify that the model accurately simulates actual system pressure over an extended period of time. Table 1 summarizes the field testing performed for the model calibration. Table 2 summarizes the flow and levels from the SCADA system used for calibration.

TABLE 1: SUMMARY OF FIELD TESTING PERFORMED

Type	Description	Date(s)
Extended Period Pressure Monitoring	20 locations	October 2, 2018 to October 9, 2018
Flow/Pressure Tests	19 locations	October 2, 2018

TABLE 2: SUMMARY OF SCADA FACILITY DATA USED FOR CALIBRATION

Facility	Monitoring
Water Treatment Plant Booster Pumps	Flow
Alta Verde Well (Well 1)	Flow
Bloedel Well (Well 5)	Flow
Rippling Creek Well (Well 6)	Flow
Summit Tower	Level
Everest Tower	Level
Business Park Tower	Level

Flow and Pressure Testing

Flow and pressure tests were performed to collect data for the steady state (micro) calibration of the hydraulic model. A pressure and flow test can be described as flowing one (or more) hydrant(s) while measuring pressure at another nearby fire hydrant(s) (Figure 1). The tests are not specifically performed for determining available fire flows, but rather for comparing flows and pressures measured in the field with those simulated by the hydraulic model.

Flow and pressure testing were conducted at 19 locations in the Main System (no tests were performed in Kerry System). The test locations are illustrated in Figure 2 and a field test forms are included in Attachment 1.

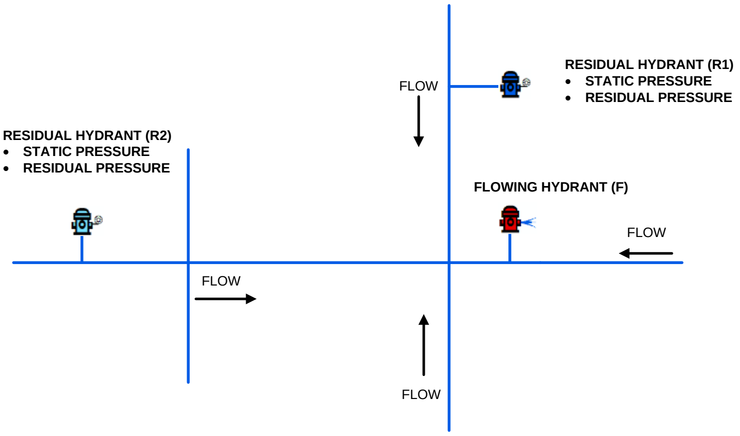
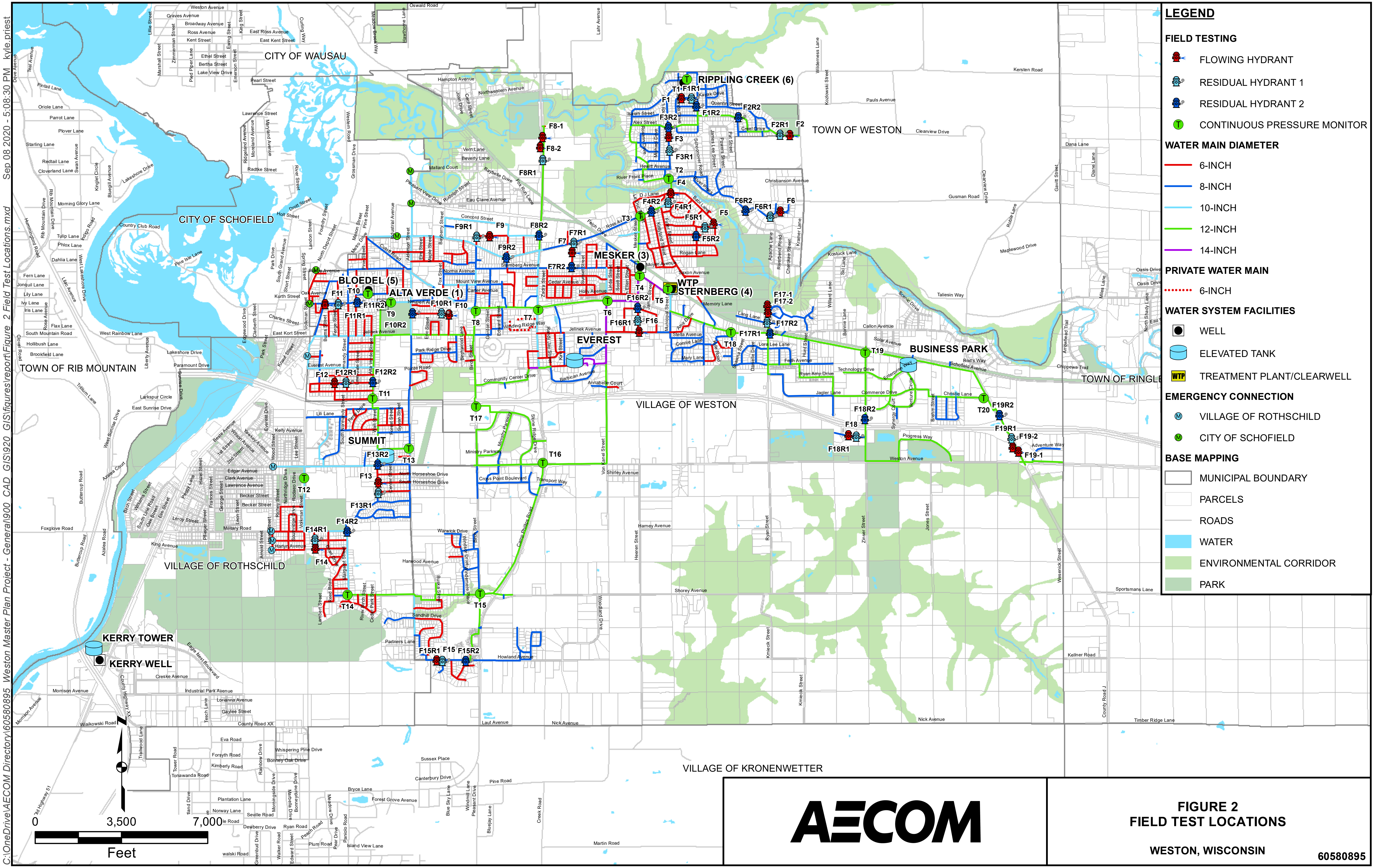


FIGURE 1: PRESSURE AND FLOW TEST ILLUSTRATION

C:\OneDrive\AECOM Directory\60580895 Weston Master Plan Project - General\900 CAD GIS\920 GIS\figures\report\Figure 2 Field Test Locations.mxd Sep 08 2020 - 5:08:30 PM kyle.priest



AECOM

FIGURE 2
FIELD TEST LOCATIONS

WESTON, WISCONSIN

60580895

Continuous Pressure Monitoring

Extended period pressure monitoring was performed to collect data to assist in the calibration of the hydraulic model. The data collected was compared to the model simulation results. Continuous pressure monitoring (as illustrated in Figure 3) was performed throughout the water system in Weston at 20 representative locations illustrated in Figure 2. Continuous pressure monitoring records static pressure over an extended period at 15 second intervals.

Continuous pressure monitoring data helps establish system conditions during the flow and pressure monitoring for steady state calibration of the model and for the extended period model calibration.

FIGURE 3: CONTINUOUS PRESSURE MONITORING DEVICE

Attachment 1: Flow and Pressure Test Forms

FLOW AND PRESSURE TESTS
WESTON WATER UTILITY

Test Number: F-1 **Date & Time:** 10/2/2018 8:54 **Area:** North

Flowing Hydrant(s)

Location(s):	F1	10-066
	F2	

Residual Hydrant(s)

Location(s):	R1	10-059
	R2	10-025
	R3	

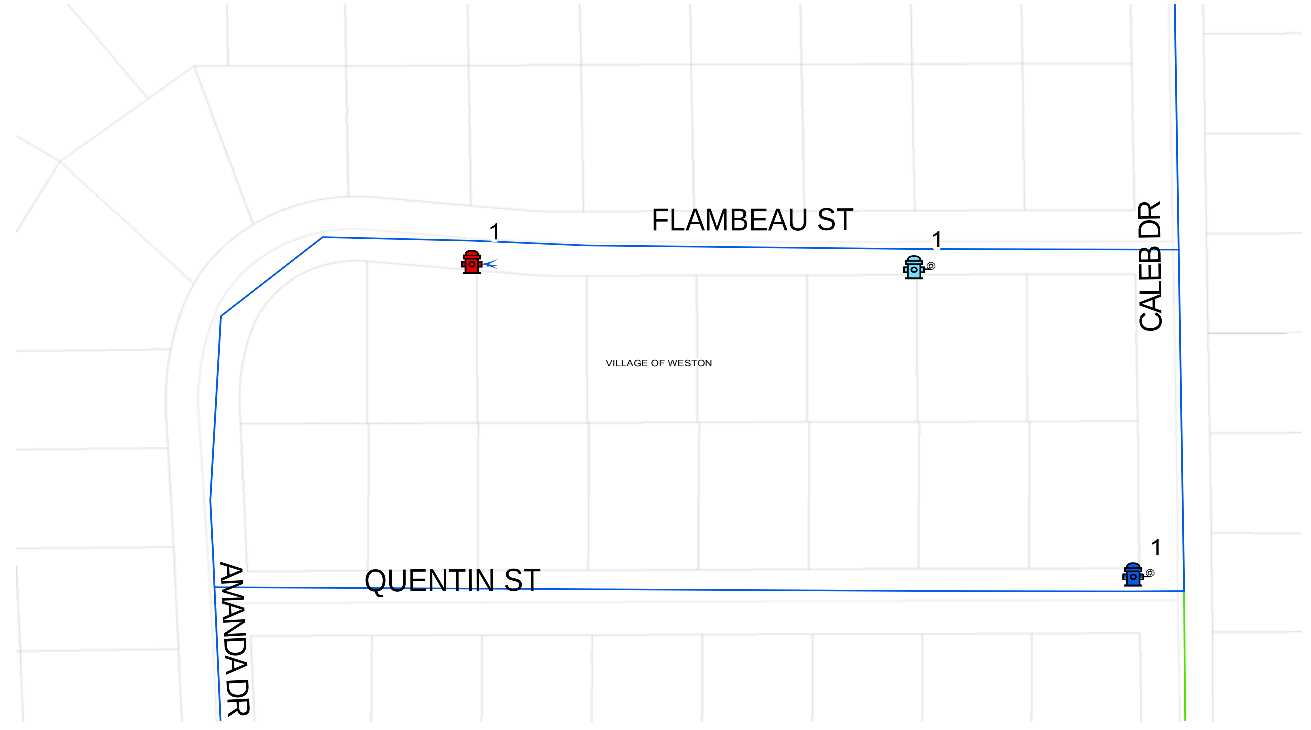
Field Flow Data					Field Test Time				
Hydrant	**Flow Device**	**Nozzle Size**	**Velocity Pressure**	**Flow**	**Start to Open**	**Fully Open**	**Residual**	**Start to Close**	**Fully Closed**
F1 - Nozzle 1	Diff	4 inches	26 psi	1,870 gpm	8:50	8:52	8:54	8:58	8:59
F1 - Nozzle 2									
F2 - Nozzle 1									
F2 - Nozzle 2									

Hydrant	**Static Pressure**		**Residual Pressure**	**Hydrant**	**Static Pressure**		**Residual Pressure**
	Initial	**Final**			**Initial**	**Final**	
Residual 1	78 psi	79 psi	61 psi	Residual 3			
Residual 2	77 psi	78 psi	62 psi	Residual 4			

System Conditions

Business Park Tower Level	21.3 feet	Summit Tower Level	8.6 feet
Everest Tower Level	18.2 feet		
Well 1 (Alta Verde)	On	Well 5 (Bloedel)	On
Well 3 (Mesker)	On	Well 6 (Rippling Creek)	On
Well 4 (Sternberg)	On		

Location Map (not to scale)



FLOW AND PRESSURE TESTS
WESTON WATER UTILITY

Test Number: F-1 **Date & Time:** 10/2/2018 8:54 **Area:** North

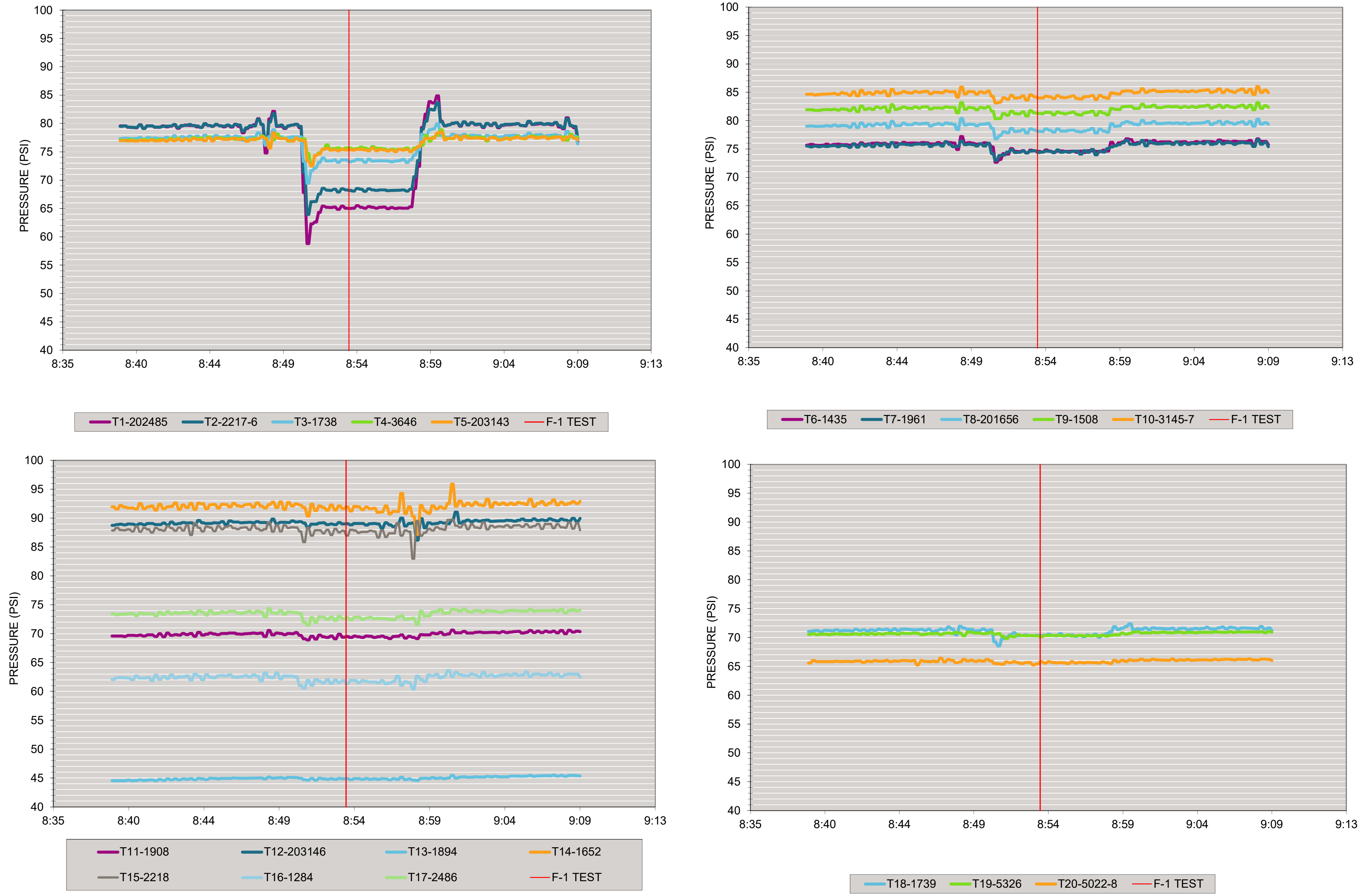
Pressure Recorder Locations

ID		Location	ID	Location
T1	2485	Rippling Creek Well	T21	
T2	2217	Corner of Sandy Lane and Ross Lane	T22	
T3	1738	Corner of Mesker Street and Ross Lane	T23	
T4	3646	Corner of Mesker Street and Sternberg	T24	
T5	3143	Water Treatment Plant	T25	
T6	1435	Corner of Von Kanel Street and Schofield Avenue	T26	
T7	1961	Corner of Camp Phillips Road and Schofield Avenue	T27	
T8	1656	Corner of Birch Street and Schofield Avenue	T28	
T9	1508	Alta Verde Well	T29	
T10	3145	Bloedel Well	T30	
T11	1908	Corner of Highland Avenue and Alta Verde Street	T31	
T12	3146	On Volkman, south of Weston	T32	
T13	1894	Close to Summit Avenue Tower	T33	
T14	1652	On Shorey Avenue north of Cedar Creek	T34	
T15	2218	Corner of Camp Phillips Road and Shorey Avenue	T35	
T16	1284	Corner of Weston Avenue and Camp Phillips Road	T36	
T17	2486	Corner of Birch Street and Highway 29	T37	
T18	1739	Corner of Tiegen Lanr and Schofield Avenue	T38	
T19	5326	Close to Business Park Tower	T39	
T20	5022	Far East of Business Park, near Business Park Tower	T40	

Pressure Data

ID		Static Pressure		Residual Pressure	ID	Static Pressure		Residual Pressure
		Initial	Final			Initial	Final	
T1	2485	79 psi	79 psi	65 psi	T21			
T2	2217	79 psi	79 psi	68 psi	T22			
T3	1738	77 psi	77 psi	73 psi	T23			
T4	3646	77 psi	77 psi	75 psi	T24			
T5	3143	77 psi	77 psi	75 psi	T25			
T6	1435	76 psi	76 psi	74 psi	T26			
T7	1961	76 psi	76 psi	74 psi	T27			
T8	1656	79 psi	79 psi	78 psi	T28			
T9	1508	82 psi	82 psi	81 psi	T29			
T10	3145	85 psi	85 psi	84 psi	T30			
T11	1908	70 psi	70 psi	69 psi	T31			
T12	3146	89 psi	89 psi	89 psi	T32			
T13	1894	45 psi	45 psi	45 psi	T33			
T14	1652	92 psi	92 psi	92 psi	T34			
T15	2218	88 psi	88 psi	88 psi	T35			
T16	1284	63 psi	63 psi	62 psi	T36			
T17	2486	74 psi	74 psi	73 psi	T37			
T18	1739	71 psi	71 psi	70 psi	T38			
T19	5326	70 psi	70 psi	70 psi	T39			
T20	5022	66 psi	66 psi	66 psi	T40			

C:\OneDrive\AECOM Directory\60580895_Weston Master Plan Project - General\400_Technical\453_Water\Field_Work\Telogs\[Weston_Telog_Graphs_2.xlsx]F-(1)



AECOM

FIGURE F-1
PRESSURE MONITORING LOCATIONS
VILLAGE OF WESTON, WISCONSIN

DATA FROM 10/2/2018

60580895

FLOW AND PRESSURE TESTS
WESTON WATER UTILITY

Test Number: F-2 **Date & Time:** 10/2/2018 8:32 **Area:** North

Flowing Hydrant(s)

Location(s): F1 10-064
F2

Residual Hydrant(s)

Location(s): R1 10-041
R2 10-032
R3

Field Flow Data					Field Test Time				
Hydrant	Flow Device	Nozzle Size	Velocity Pressure	Flow	Start to Open	Fully Open	Residual	Start to Close	Fully Closed
F1 - Nozzle 1	Diff	4 inches	20 psi	1,700 gpm	8:27	8:27	8:32	8:35	8:36
F1 - Nozzle 2									
F2 - Nozzle 1									
F2 - Nozzle 2									

Hydrant	Static Pressure		Residual Pressure	Hydrant	Static Pressure		Residual Pressure
	Initial	Final			Initial	Final	
Residual 1	70 psi	71 psi	50 psi	Residual 3			
Residual 2	75 psi	75 psi	59 psi	Residual 4			

System Conditions

Business Park Tower Level	20.9 feet	Summit Tower Level	6.5 feet
Everest Tower Level	17.2 feet		
Well 1 (Alta Verde)	On	Well 5 (Bloedel)	On
Well 3 (Mesker)	On	Well 6 (Rippling Creek)	On
Well 4 (Sternberg)	On		

Location Map (not to scale)

FLOW AND PRESSURE TESTS
WESTON WATER UTILITY

Test Number: F-2 **Date & Time:** 10/2/2018 8:32 **Area:** North

Pressure Recorder Locations

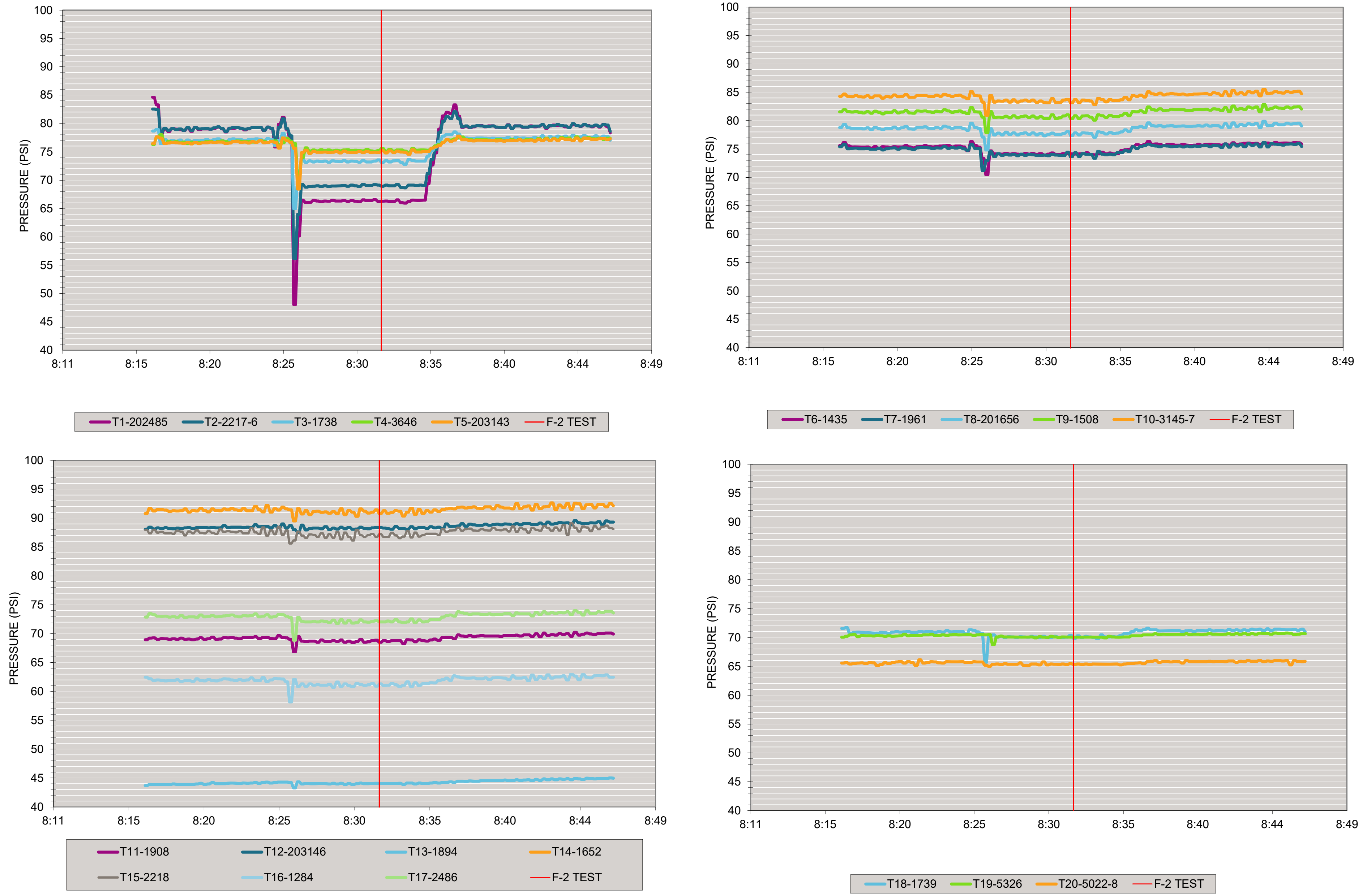
	ID	Location	ID	Location
T1	2485	Rippling Creek Well	T21	
T2	2217	Corner of Sandy Lane and Ross Lane	T22	
T3	1738	Corner of Mesker Street and Ross Lane	T23	
T4	3646	Corner of Mesker Street and Sternberg	T24	
T5	3143	Water Treatment Plant	T25	
T6	1435	Corner of Von Kanel Street and Schofield Avenue	T26	
T7	1961	Corner of Camp Phillips Road and Schofield Avenue	T27	
T8	1656	Corner of Birch Street and Schofield Avenue	T28	
T9	1508	Alta Verde Well	T29	
T10	3145	Bloedel Well	T30	
T11	1908	Corner of Highland Avenue and Alta Verde Street	T31	
T12	3146	On Volkman, south of Weston	T32	
T13	1894	Close to Summit Avenue Tower	T33	
T14	1652	On Shorey Avenue north of Cedar Creek	T34	
T15	2218	Corner of Camp Phillips Road and Shorey Avenue	T35	
T16	1284	Corner of Weston Avenue and Camp Phillips Road	T36	
T17	2486	Corner of Birch Street and Highway 29	T37	
T18	1739	Corner of Tiegen Lanr and Schofield Avenue	T38	
T19	5326	Close to Business Park Tower	T39	
T20	5022	Far East of Business Park, near Business Park Tower	T40	

Pressure Data

ID	Static Pressure		Residual Pressure	ID	Static Pressure		Residual Pressure
	Initial	Final			Initial	Final	
T1 2485	79 psi	79 psi	66 psi	T21			
T2 2217	79 psi	79 psi	69 psi	T22			
T4 3646	77 psi	77 psi	75 psi	T24			
T5 3143	77 psi	77 psi	75 psi	T25			
T6 1435	75 psi	75 psi	74 psi	T26			
T7 1961	75 psi	75 psi	74 psi	T27			
T8 1656	79 psi	79 psi	78 psi	T28			
T9 1508	82 psi	82 psi	81 psi	T29			
T10 3145	84 psi	84 psi	83 psi	T30			
T11 1908	69 psi	69 psi	69 psi	T31			
T12 3146	88 psi	88 psi	88 psi	T32			
T13 1894	44 psi	44 psi	44 psi	T33			
T14 1652	91 psi	91 psi	91 psi	T34			
T15 2218	87 psi	87 psi	87 psi	T35			
T16 1284	62 psi	62 psi	61 psi	T36			
T17 2486	73 psi	73 psi	72 psi	T37			
T18 1739	71 psi	71 psi	70 psi	T38			
T19 5326	70 psi	70 psi	70 psi	T39			
T20 5022	65 psi	65 psi	65 psi	T40			

C:\OneDrive\AECOM Directory\60580895_Weston Master Plan Project - General\400_Technical\453_Water\Field_Work\[Weston_Field_Test_Forms.xlsx]F (2)

C:\OneDrive\AECOM Directory\60580895_Weston Master Plan Project - General\400_Technical\453_Water\Field_Work\Telogs\[Weston_Telog_Graphs_2.xlsx]F-(2)



AECOM

FIGURE F-2
PRESSURE MONITORING LOCATIONS
VILLAGE OF WESTON, WISCONSIN

DATA FROM 10/2/2018

60580895

FLOW AND PRESSURE TESTS
WESTON WATER UTILITY

Test Number: F-3 **Date & Time:** 10/2/2018 9:15 **Area:** North

Flowing Hydrant(s)

Location(s):
F1 10-020
F2

Residual Hydrant(s)

Location(s):
R1 10-021
R2 10-002
R3

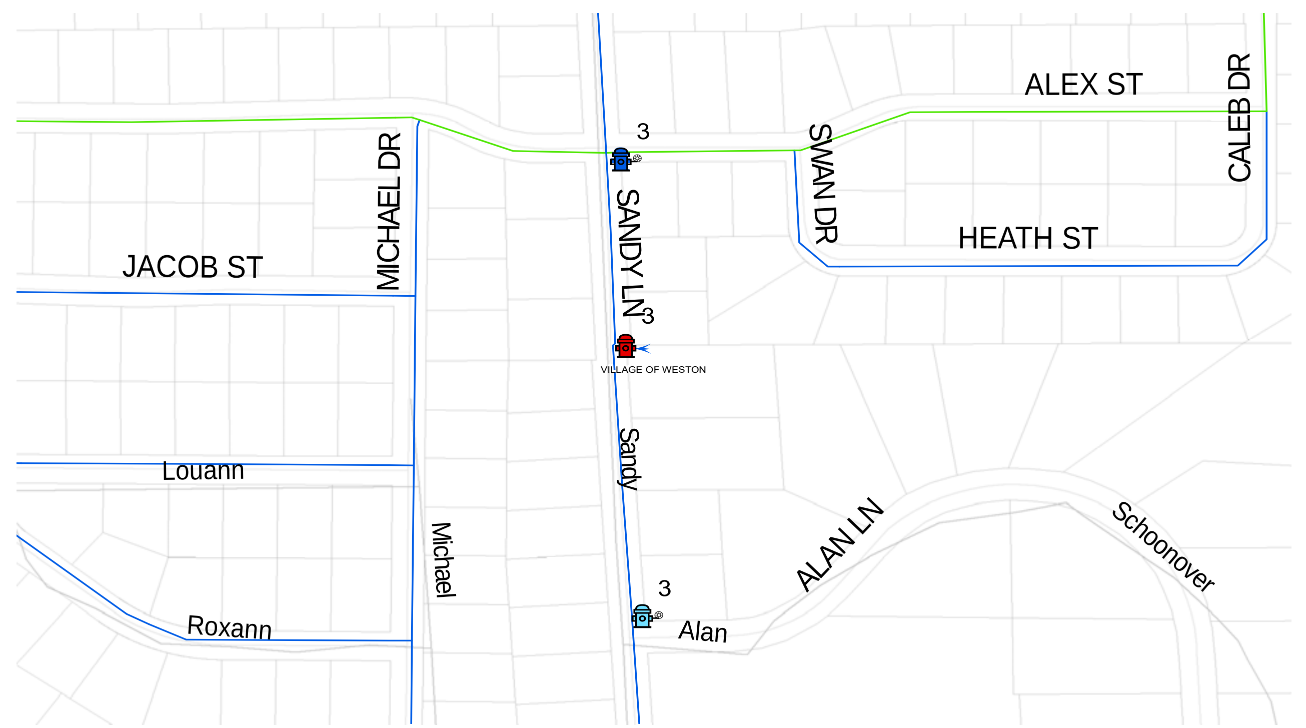
Field Flow Data					Field Test Time				
Hydrant	**Flow Device**	**Nozzle Size**	**Velocity Pressure**	**Flow**	**Start to Open**	**Fully Open**	**Residual**	**Start to Close**	**Fully Closed**
F1 - Nozzle 1	Diff	4 inches	26 psi	1,870 gpm	9:10	9:12	9:15	9:17	9:18
F1 - Nozzle 2									
F2 - Nozzle 1									
F2 - Nozzle 2									

Hydrant	**Static Pressure**		**Residual Pressure**	**Hydrant**	**Static Pressure**		**Residual Pressure**
	Initial	**Final**			**Initial**	**Final**	
Residual 1	81 psi	81 psi	66 psi	Residual 3			
Residual 2	77 psi	78 psi	65 psi	Residual 4			

System Conditions

Business Park Tower Level	22.0 feet	Summit Tower Level	9.6 feet
Everest Tower Level	19.1 feet		
Well 1 (Alta Verde)	On	Well 5 (Bloedel)	On
Well 3 (Mesker)	On	Well 6 (Rippling Creek)	On
Well 4 (Sternberg)	On		

Location Map (not to scale)



FLOW AND PRESSURE TESTS
WESTON WATER UTILITY

Test Number: F-3 **Date & Time:** 10/2/2018 9:15 **Area:** North

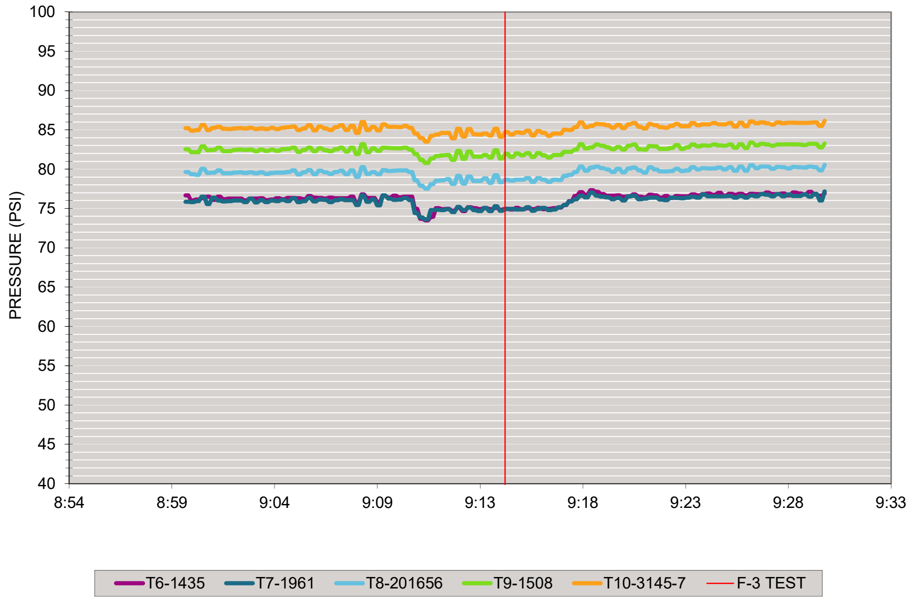
Pressure Recorder Locations

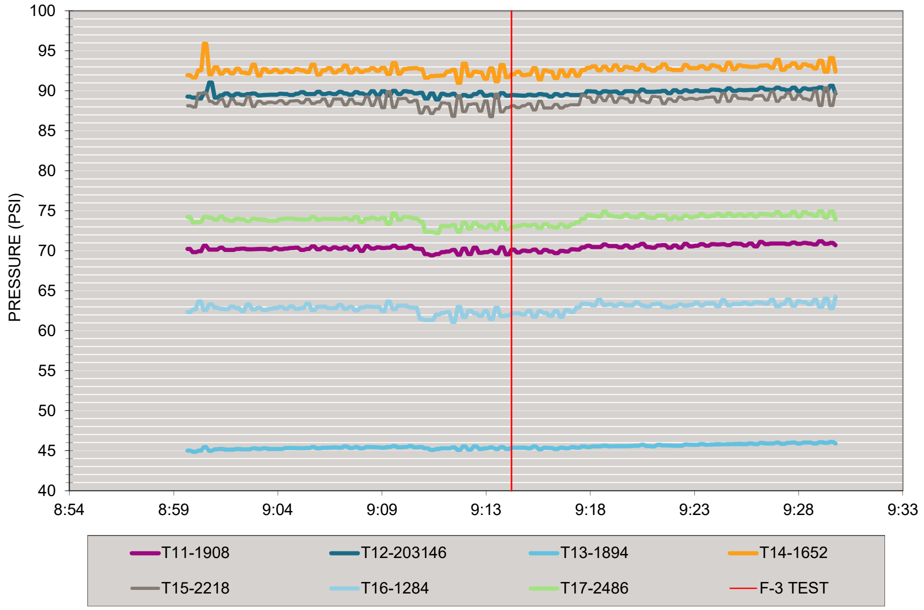
ID		Location	ID	Location
T1	2485	Rippling Creek Well	T21	
T2	2217	Corner of Sandy Lane and Ross Lane	T22	
T3	1738	Corner of Mesker Street and Ross Lane	T23	
T4	3646	Corner of Mesker Street and Sternberg	T24	
T5	3143	Water Treatment Plant	T25	
T6	1435	Corner of Von Kanel Street and Schofield Avenue	T26	
T7	1961	Corner of Camp Phillips Road and Schofield Avenue	T27	
T8	1656	Corner of Birch Street and Schofield Avenue	T28	
T9	1508	Alta Verde Well	T29	
T10	3145	Bloedel Well	T30	
T11	1908	Corner of Highland Avenue and Alta Verde Street	T31	
T12	3146	On Volkman, south of Weston	T32	
T13	1894	Close to Summit Avenue Tower	T33	
T14	1652	On Shorey Avenue north of Cedar Creek	T34	
T15	2218	Corner of Camp Phillips Road and Shorey Avenue	T35	
T16	1284	Corner of Weston Avenue and Camp Phillips Road	T36	
T17	2486	Corner of Birch Street and Highway 29	T37	
T18	1739	Corner of Tiegen Lanr and Schofield Avenue	T38	
T19	5326	Close to Business Park Tower	T39	
T20	5022	Far East of Business Park, near Business Park Tower	T40	

Pressure Data

ID		Static Pressure		Residual Pressure	ID	Static Pressure		Residual Pressure
		Initial	Final			Initial	Final	
T1	2485	80 psi	80 psi	67 psi	T21			
T2	2217	80 psi	80 psi	68 psi	T22			
T3	1738	78 psi	78 psi	74 psi	T23			
T4	3646	78 psi	78 psi	76 psi	T24			
T5	3143	78 psi	78 psi	76 psi	T25			
T6	1435	76 psi	76 psi	75 psi	T26			
T7	1961	76 psi	76 psi	75 psi	T27			
T8	1656	79 psi	79 psi	78 psi	T28			
T9	1508	83 psi	83 psi	82 psi	T29			
T10	3145	85 psi	85 psi	84 psi	T30			
T11	1908	70 psi	70 psi	70 psi	T31			
T12	3146	90 psi	90 psi	90 psi	T32			
T13	1894	45 psi	45 psi	45 psi	T33			
T14	1652	92 psi	92 psi	92 psi	T34			
T15	2218	89 psi	89 psi	88 psi	T35			
T16	1284	63 psi	63 psi	62 psi	T36			
T17	2486	74 psi	74 psi	73 psi	T37			
T18	1739	72 psi	72 psi	71 psi	T38			
T19	5326	71 psi	71 psi	71 psi	T39			
T20	5022	66 psi	66 psi	66 psi	T40			

C:\OneDrive\AECOM Directory\60580895_Weston Master Plan Project - General\400_Technical\453_Water\Field_Work\Telogs\[Weston_Telog_Graphs_2.xlsx]F-(3)





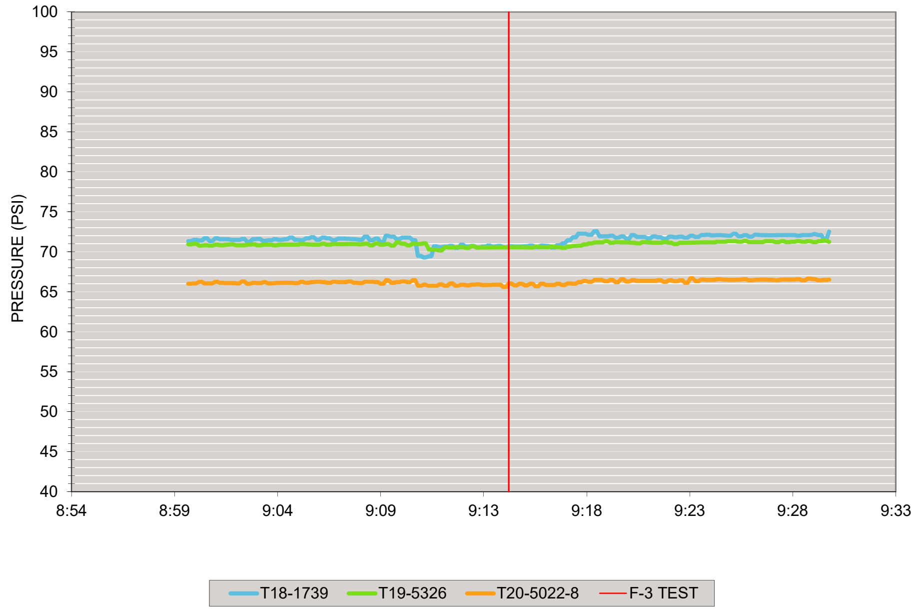


FIGURE F-3
PRESSURE MONITORING LOCATIONS
VILLAGE OF WESTON, WISCONSIN

DATA FROM 10/2/2018
60580895

FLOW AND PRESSURE TESTS

WESTON WATER UTILITY

Test Number: F-4 **Date & Time:** 10/2/2018 9:59 **Area:** North

Flowing Hydrant(s)

Location(s):	F1	09-005
	F2	

Residual Hydrant(s)

Location(s):	R1	16-018
	R2	16-011
	R3	

Field Flow Data					Field Test Time				
Hydrant	**Flow Device**	**Nozzle Size**	**Velocity Pressure**	**Flow**	**Start to Open**	**Fully Open**	**Residual**	**Start to Close**	**Fully Closed**
F1 - Nozzle 1	Diff	4 inches	35 psi	2,070 gpm	9:56	9:57	9:59	10:02	10:04
F1 - Nozzle 2									
F2 - Nozzle 1									
F2 - Nozzle 2									

Hydrant	**Static Pressure**		**Residual Pressure**	**Hydrant**	**Static Pressure**		**Residual Pressure**
	Initial	**Final**			**Initial**	**Final**	
Residual 1	81 psi	82 psi	72 psi	Residual 3			
Residual 2	77 psi	78 psi	71 psi	Residual 4			

System Conditions

Business Park Tower Level	23.6 feet	Summit Tower Level	12.7 feet
Everest Tower Level	21.7 feet		
Well 1 (Alta Verde)	On	Well 5 (Bloedel)	On
Well 3 (Mesker)	On	Well 6 (Rippling Creek)	On
Well 4 (Sternberg)	On		

Location Map (not to scale)

FLOW AND PRESSURE TESTS
WESTON WATER UTILITY

Test Number: F-4 **Date & Time:** 10/2/2018 9:59 **Area:** North

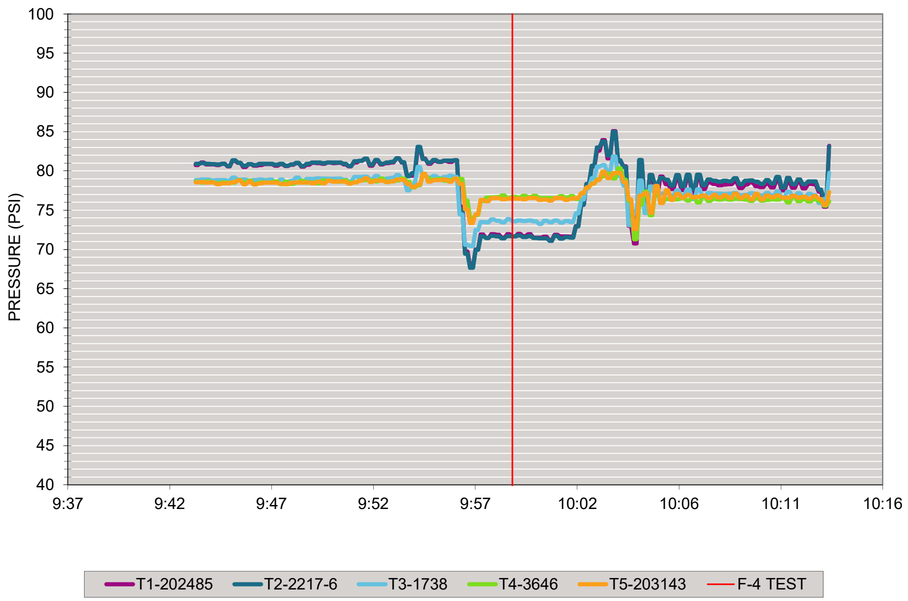
Pressure Recorder Locations

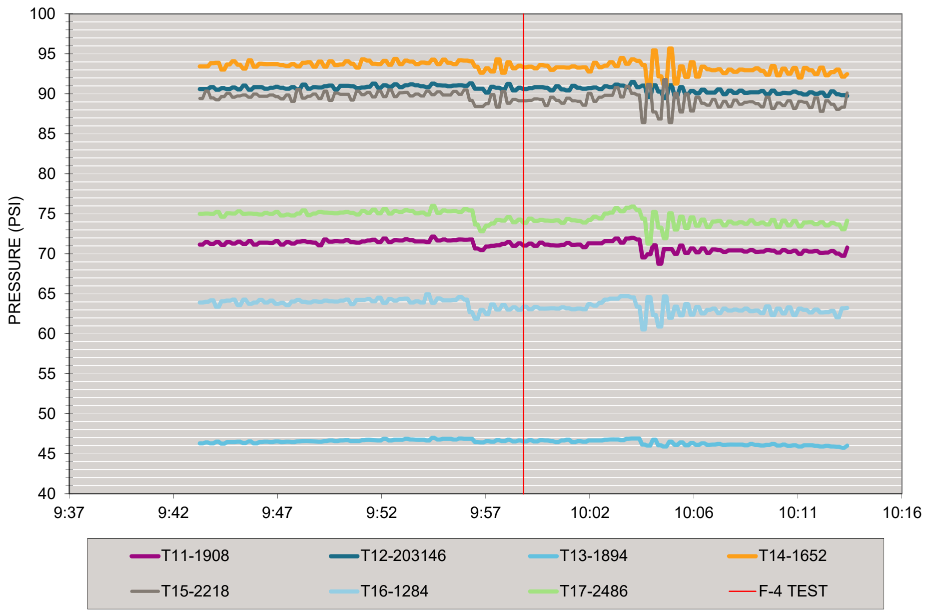
	ID	Location	ID	Location
T1	2485	Rippling Creek Well	T21	
T2	2217	Corner of Sandy Lane and Ross Lane	T22	
T3	1738	Corner of Mesker Street and Ross Lane	T23	
T4	3646	Corner of Mesker Street and Sternberg	T24	
T5	3143	Water Treatment Plant	T25	
T6	1435	Corner of Von Kanel Street and Schofield Avenue	T26	
T7	1961	Corner of Camp Phillips Road and Schofield Avenue	T27	
T8	1656	Corner of Birch Street and Schofield Avenue	T28	
T9	1508	Alta Verde Well	T29	
T10	3145	Bloedel Well	T30	
T11	1908	Corner of Highland Avenue and Alta Verde Street	T31	
T12	3146	On Volkman, south of Weston	T32	
T13	1894	Close to Summit Avenue Tower	T33	
T14	1652	On Shorey Avenue north of Cedar Creek	T34	
T15	2218	Corner of Camp Phillips Road and Shorey Avenue	T35	
T16	1284	Corner of Weston Avenue and Camp Phillips Road	T36	
T17	2486	Corner of Birch Street and Highway 29	T37	
T18	1739	Corner of Tiegen Lanr and Schofield Avenue	T38	
T19	5326	Close to Business Park Tower	T39	
T20	5022	Far East of Business Park, near Business Park Tower	T40	

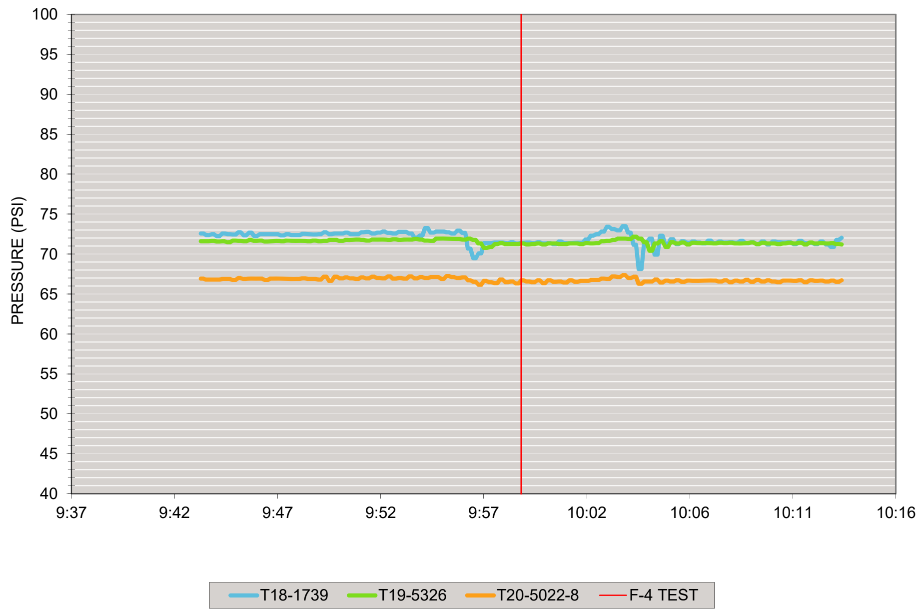
Pressure Data

ID		Static Pressure		Residual Pressure	ID	Static Pressure		Residual Pressure
		Initial	Final			Initial	Final	
T1	2485	81 psi	81 psi	72 psi	T21			
T2	2217	81 psi	81 psi	72 psi	T22			
T3	1738	79 psi	79 psi	73 psi	T23			
T4	3646	79 psi	79 psi	76 psi	T24			
T5	3143	79 psi	79 psi	76 psi	T25			
T6	1435	77 psi	77 psi	76 psi	T26			
T7	1961	77 psi	77 psi	76 psi	T27			
T8	1656	81 psi	81 psi	80 psi	T28			
T9	1508	84 psi	84 psi	83 psi	T29			
T10	3145	87 psi	87 psi	86 psi	T30			
T11	1908	72 psi	72 psi	72 psi	T31			
T12	3146	91 psi	91 psi	91 psi	T32			
T13	1894	47 psi	47 psi	47 psi	T33			
T14	1652	94 psi	94 psi	93 psi	T34			
T15	2218	90 psi	90 psi	89 psi	T35			
T16	1284	64 psi	64 psi	63 psi	T36			
T17	2486	75 psi	75 psi	74 psi	T37			
T18	1739	73 psi	73 psi	71 psi	T38			
T19	5326	72 psi	72 psi	72 psi	T39			
T20	5022	67 psi	67 psi	67 psi	T40			

C:\OneDrive\AECOM Directory\60580895_Weston Master Plan Project - General\400_Technical\453_Water\Field_Work\Telogs\[Weston_Telog_Graphs_2.xlsx]F-(4)







AECOM

FIGURE F-4
PRESSURE MONITORING LOCATIONS
VILLAGE OF WESTON, WISCONSIN

DATA FROM 10/2/2018

60580895

FLOW AND PRESSURE TESTS

WESTON WATER UTILITY

Test Number: F-5 **Date & Time:** 10/2/2018 10:22 **Area:** North

Flowing Hydrant(s)

Location(s): F1 15-010
F2

Residual Hydrant(s)

Location(s): R1 15-009
R2 15-013
R3

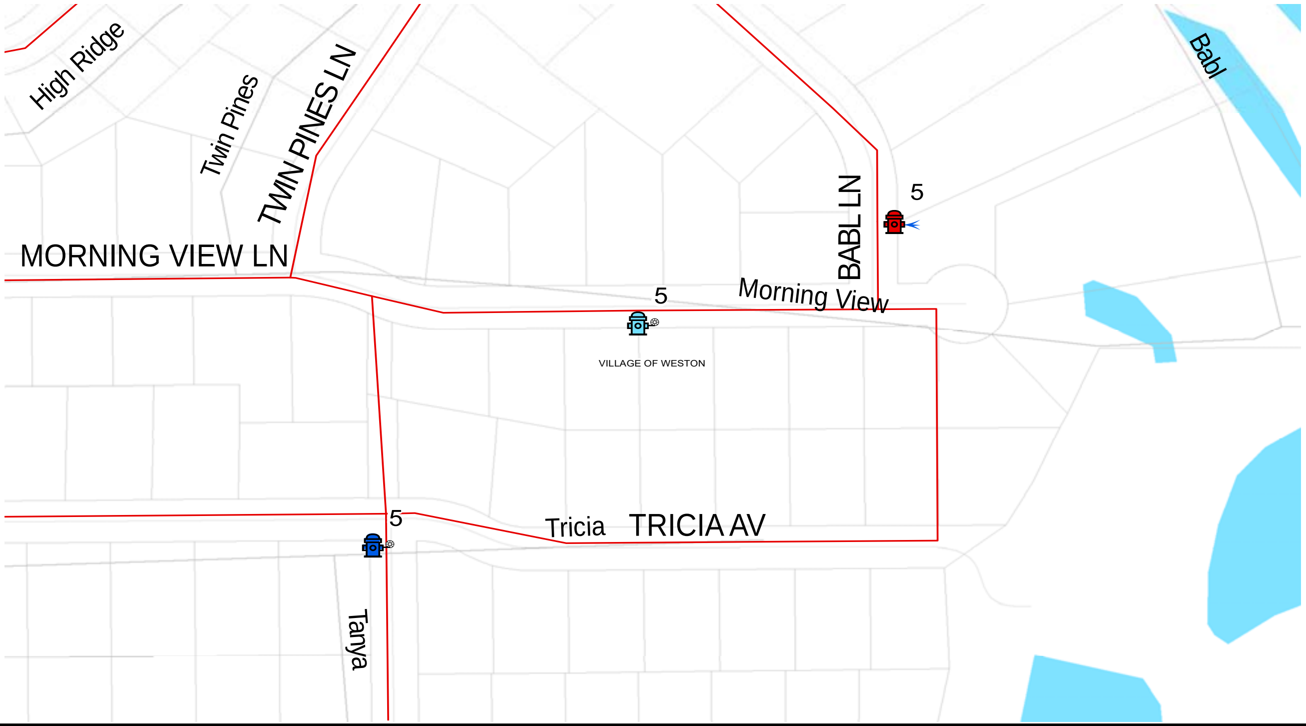
Field Flow Data					Field Test Time				
Hydrant	Flow Device	Nozzle Size	Velocity Pressure	Flow	Start to Open	Fully Open	Residual	Start to Close	Fully Closed
F1 - Nozzle 1	Diff	4 inches	22 psi	1,760 gpm	10:18	10:20	10:22	10:23	10:25
F1 - Nozzle 2									
F2 - Nozzle 1									
F2 - Nozzle 2									

Hydrant	Static Pressure		Residual Pressure	Hydrant	Static Pressure		Residual Pressure
	Initial	Final			Initial	Final	
Residual 1	82 psi	82 psi	57 psi	Residual 3			
Residual 2	79 psi	79 psi	62 psi	Residual 4			

System Conditions

Business Park Tower Level	22.4 feet	Summit Tower Level	10.6 feet
Everest Tower Level	19.5 feet		
Well 1 (Alta Verde)	Off	Well 5 (Bloedel)	Off
Well 3 (Mesker)	Off	Well 6 (Rippling Creek)	Off
Well 4 (Sternberg)	Off		

Location Map (not to scale)



FLOW AND PRESSURE TESTS

WESTON WATER UTILITY

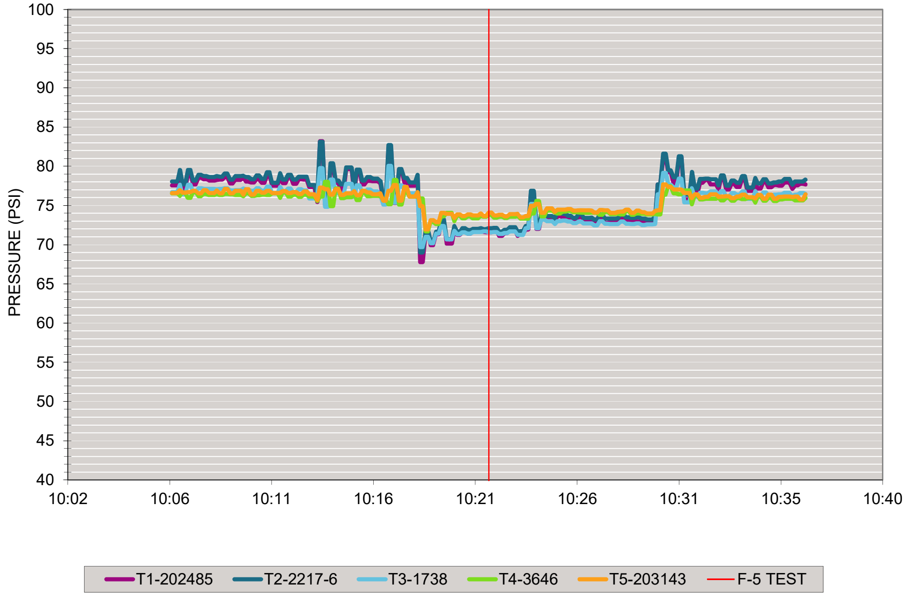
Test Number: F-5 **Date & Time:** 10/2/2018 10:22 **Area:** North

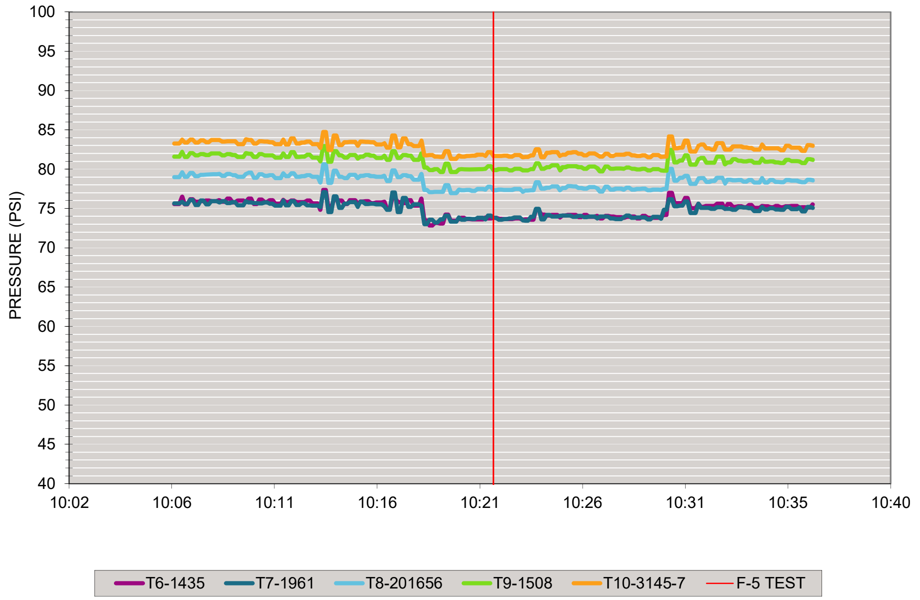
Pressure Recorder Locations

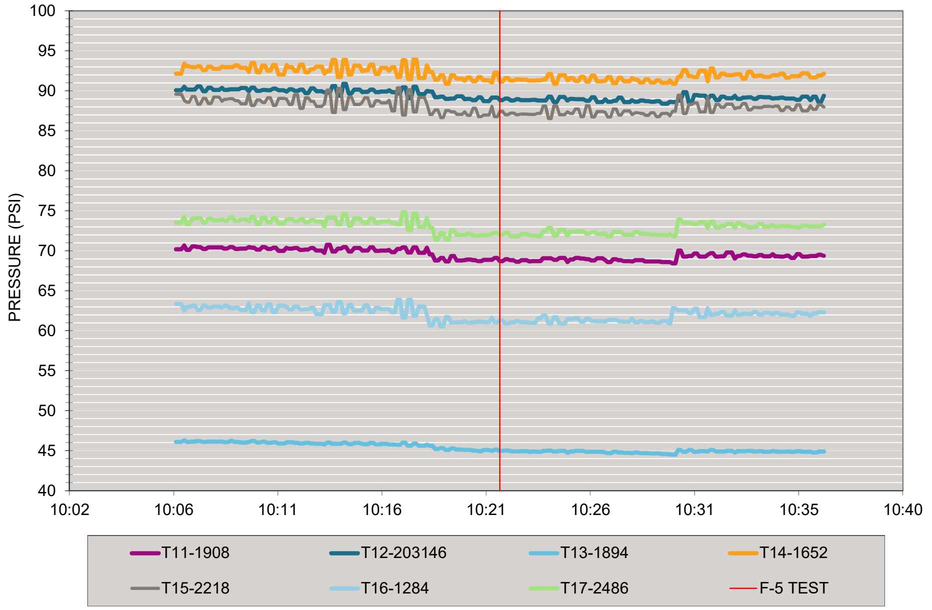
ID		Location	ID	Location
T1	2485	Rippling Creek Well	T21	
T2	2217	Corner of Sandy Lane and Ross Lane	T22	
T3	1738	Corner of Mesker Street and Ross Lane	T23	
T4	3646	Corner of Mesker Street and Sternberg	T24	
T5	3143	Water Treatment Plant	T25	
T6	1435	Corner of Von Kanel Street and Schofield Avenue	T26	
T7	1961	Corner of Camp Phillips Road and Schofield Avenue	T27	
T8	1656	Corner of Birch Street and Schofield Avenue	T28	
T9	1508	Alta Verde Well	T29	
T10	3145	Bloedel Well	T30	
T11	1908	Corner of Highland Avenue and Alta Verde Street	T31	
T12	3146	On Volkman, south of Weston	T32	
T13	1894	Close to Summit Avenue Tower	T33	
T14	1652	On Shorey Avenue north of Cedar Creek	T34	
T15	2218	Corner of Camp Phillips Road and Shorey Avenue	T35	
T16	1284	Corner of Weston Avenue and Camp Phillips Road	T36	
T17	2486	Corner of Birch Street and Highway 29	T37	
T18	1739	Corner of Tiegen Lanr and Schofield Avenue	T38	
T19	5326	Close to Business Park Tower	T39	
T20	5022	Far East of Business Park, near Business Park Tower	T40	

Pressure Data

ID		Static Pressure		Residual Pressure	ID	Static Pressure		Residual Pressure
		Initial	Final			Initial	Final	
T1	2485	78 psi	78 psi	72 psi	T21			
T2	2217	78 psi	78 psi	72 psi	T22			
T3	1738	76 psi	76 psi	72 psi	T23			
T4	3646	76 psi	76 psi	74 psi	T24			
T5	3143	76 psi	76 psi	74 psi	T25			
T6	1435	76 psi	76 psi	74 psi	T26			
T7	1961	76 psi	76 psi	74 psi	T27			
T8	1656	79 psi	79 psi	77 psi	T28			
T9	1508	81 psi	81 psi	80 psi	T29			
T10	3145	83 psi	83 psi	82 psi	T30			
T11	1908	70 psi	70 psi	69 psi	T31			
T12	3146	90 psi	90 psi	89 psi	T32			
T13	1894	46 psi	46 psi	45 psi	T33			
T14	1652	93 psi	93 psi	91 psi	T34			
T15	2218	89 psi	89 psi	87 psi	T35			
T16	1284	63 psi	63 psi	61 psi	T36			
T17	2486	74 psi	74 psi	72 psi	T37			
T18	1739	71 psi	71 psi	70 psi	T38			
T19	5326	71 psi	71 psi	71 psi	T39			
T20	5022	67 psi	67 psi	66 psi	T40			







AECOM

FIGURE F-5
PRESSURE MONITORING LOCATIONS
VILLAGE OF WESTON, WISCONSIN

DATA FROM 10/2/2018
60580895

FLOW AND PRESSURE TESTS

WESTON WATER UTILITY

Test Number: F-6 **Date & Time:** 10/2/2018 9:37 **Area:** North

Flowing Hydrant(s)

Location(s): F1 15-047
F2

Residual Hydrant(s)

Location(s): R1 15-046
R2 15-044
R3

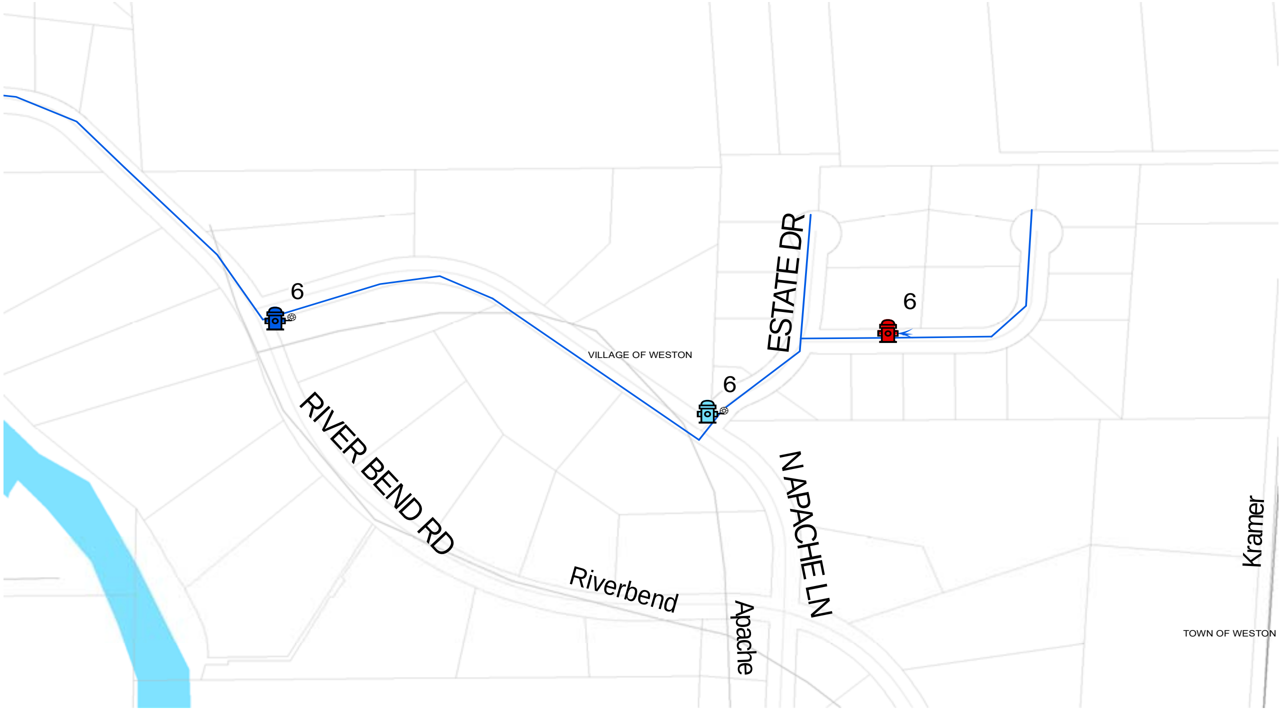
Field Flow Data					Field Test Time				
Hydrant	**Flow Device**	**Nozzle Size**	**Velocity Pressure**	**Flow**	**Start to Open**	**Fully Open**	**Residual**	**Start to Close**	**Fully Closed**
F1 - Nozzle 1	Diff	4 inches	6 psi	1,010 gpm	9:34	9:35	9:37	9:40	9:41
F1 - Nozzle 2									
F2 - Nozzle 1									
F2 - Nozzle 2									

Hydrant	**Static Pressure**		**Residual Pressure**	**Hydrant**	**Static Pressure**		**Residual Pressure**
	Initial	**Final**			**Initial**	**Final**	
Residual 1	76 psi	76 psi	27 psi	Residual 3			
Residual 2	80 psi	80 psi	43 psi	Residual 4			

System Conditions

Business Park Tower Level	22.9 feet	Summit Tower Level	11.3 feet
Everest Tower Level	20.6 feet		
Well 1 (Alta Verde)	On	Well 5 (Bloedel)	On
Well 3 (Mesker)	On	Well 6 (Rippling Creek)	On
Well 4 (Sternberg)	On		

Location Map (not to scale)



FLOW AND PRESSURE TESTS
WESTON WATER UTILITY

Test Number: F-6 **Date & Time:** 10/2/2018 9:37 **Area:** North

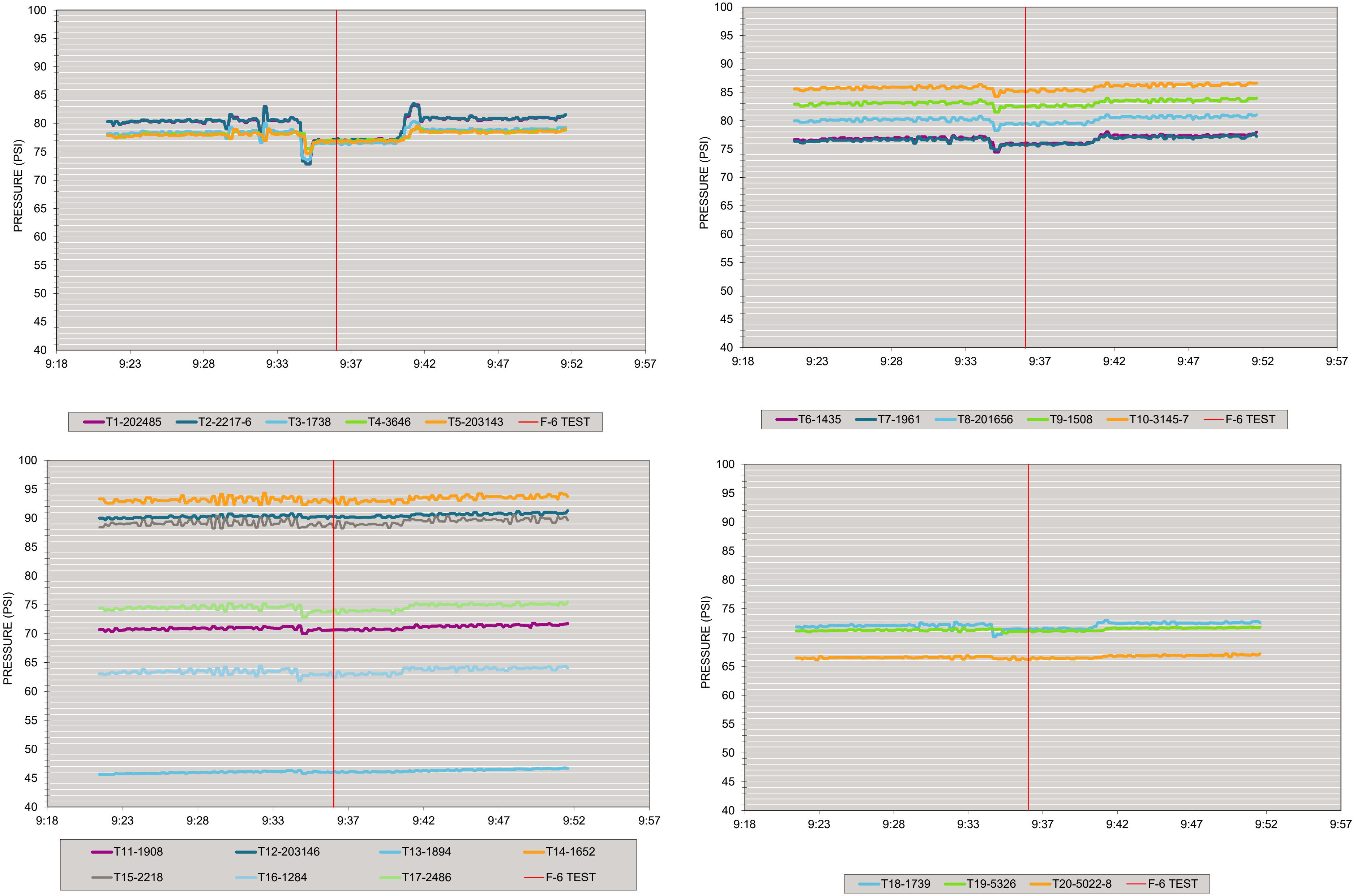
Pressure Recorder Locations

ID		Location	ID	Location
T1	2485	Rippling Creek Well	T21	
T2	2217	Corner of Sandy Lane and Ross Lane	T22	
T3	1738	Corner of Mesker Street and Ross Lane	T23	
T4	3646	Corner of Mesker Street and Sternberg	T24	
T5	3143	Water Treatment Plant	T25	
T6	1435	Corner of Von Kanel Street and Schofield Avenue	T26	
T7	1961	Corner of Camp Phillips Road and Schofield Avenue	T27	
T8	1656	Corner of Birch Street and Schofield Avenue	T28	
T9	1508	Alta Verde Well	T29	
T10	3145	Bloedel Well	T30	
T11	1908	Corner of Highland Avenue and Alta Verde Street	T31	
T12	3146	On Volkman, south of Weston	T32	
T13	1894	Close to Summit Avenue Tower	T33	
T14	1652	On Shorey Avenue north of Cedar Creek	T34	
T15	2218	Corner of Camp Phillips Road and Shorey Avenue	T35	
T16	1284	Corner of Weston Avenue and Camp Phillips Road	T36	
T17	2486	Corner of Birch Street and Highway 29	T37	
T18	1739	Corner of Tiegen Lanr and Schofield Avenue	T38	
T19	5326	Close to Business Park Tower	T39	
T20	5022	Far East of Business Park, near Business Park Tower	T40	

Pressure Data

ID		Static Pressure		Residual Pressure	ID	Static Pressure		Residual Pressure
		Initial	Final			Initial	Final	
T1	2485	80 psi	80 psi	77 psi	T21			
T2	2217	80 psi	80 psi	77 psi	T22			
T3	1738	78 psi	78 psi	77 psi	T23			
T4	3646	78 psi	78 psi	77 psi	T24			
T5	3143	78 psi	78 psi	77 psi	T25			
T6	1435	77 psi	77 psi	76 psi	T26			
T7	1961	77 psi	77 psi	76 psi	T27			
T8	1656	80 psi	80 psi	79 psi	T28			
T9	1508	83 psi	83 psi	82 psi	T29			
T10	3145	86 psi	86 psi	85 psi	T30			
T11	1908	71 psi	71 psi	71 psi	T31			
T12	3146	90 psi	90 psi	90 psi	T32			
T13	1894	46 psi	46 psi	46 psi	T33			
T14	1652	93 psi	93 psi	93 psi	T34			
T15	2218	89 psi	89 psi	89 psi	T35			
T16	1284	63 psi	63 psi	63 psi	T36			
T17	2486	75 psi	75 psi	74 psi	T37			
T18	1739	72 psi	72 psi	71 psi	T38			
T19	5326	71 psi	71 psi	71 psi	T39			
T20	5022	66 psi	66 psi	66 psi	T40			

C:\OneDrive\AECOM Directory\60580895_Weston Master Plan Project - General\400_Technical\453_Water\Field_Work\Telogs\[Weston_Telog_Graphs_2.xlsx]F-(6)



AECOM

FIGURE F-6
PRESSURE MONITORING LOCATIONS
VILLAGE OF WESTON, WISCONSIN

DATA FROM 10/2/2018

60580895

FLOW AND PRESSURE TESTS
WESTON WATER UTILITY

Test Number: F-7 **Date & Time:** 10/2/2018 16:02 **Area:** Central

Flowing Hydrant(s)

Location(s):
F1 16-052
F2

Residual Hydrant(s)

Location(s):
R1 16-004
R2 16-051
R3

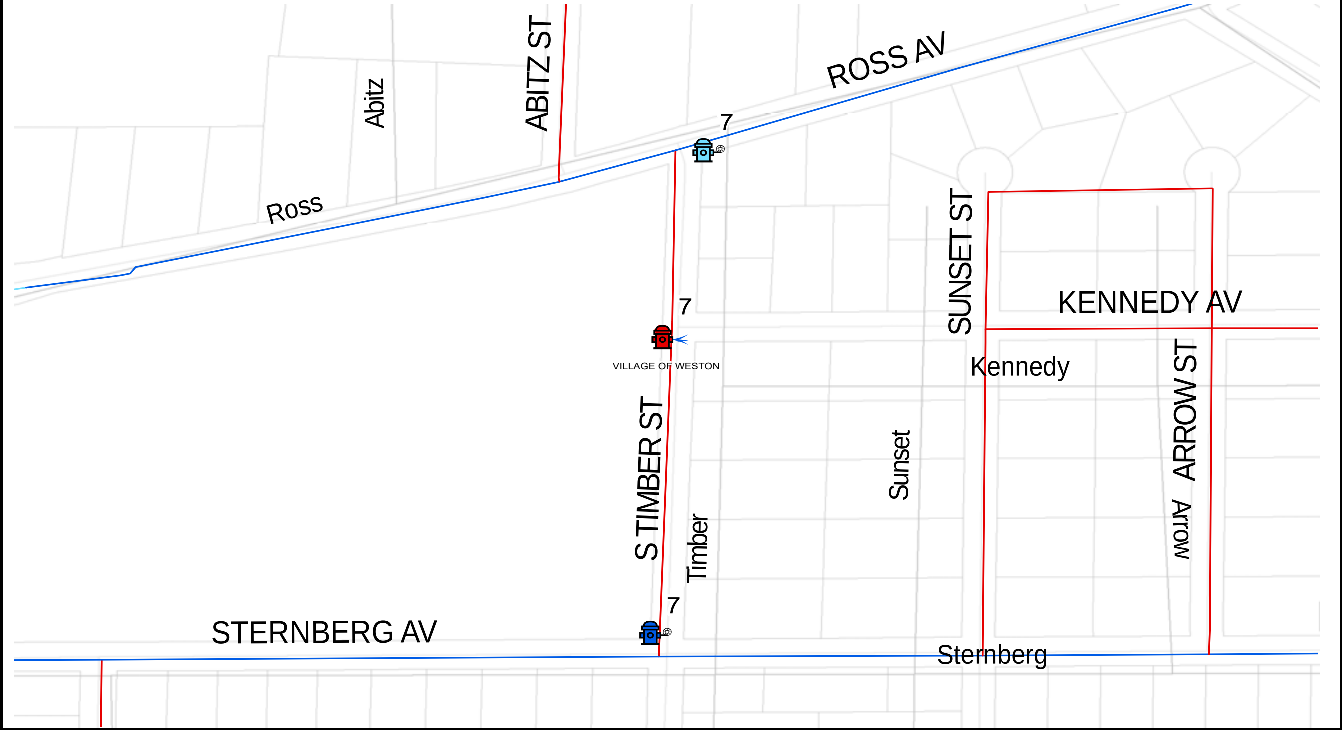
Field Flow Data					Field Test Time				
Hydrant	**Flow Device**	**Nozzle Size**	**Velocity Pressure**	**Flow**	**Start to Open**	**Fully Open**	**Residual**	**Start to Close**	**Fully Closed**
F1 - Nozzle 1	Diff	2.5 inches	44 psi	780 gpm	3:59	4:00	4:02	4:11	4:12
F1 - Nozzle 2	FTK	2.25 inches	41 psi	970 gpm					
F2 - Nozzle 1									
F2 - Nozzle 2									

Hydrant	**Static Pressure**		**Residual Pressure**	**Hydrant**	**Static Pressure**		**Residual Pressure**
	Initial	**Final**			**Initial**	**Final**	
Residual 1	78 psi	78 psi	71 psi	Residual 3			
Residual 2	74 psi	74 psi	71 psi	Residual 4			

System Conditions

Business Park Tower Level	23.6 feet	Summit Tower Level	11.4 feet
Everest Tower Level	21.9 feet		
Well 1 (Alta Verde)	Off	Well 5 (Bloedel)	Off
Well 3 (Mesker)	Off	Well 6 (Rippling Creek)	Off
Well 4 (Sternberg)	Off		

Location Map (not to scale)



FLOW AND PRESSURE TESTS

WESTON WATER UTILITY

Test Number: F-7 **Date & Time:** 10/2/2018 16:02 **Area:** Central

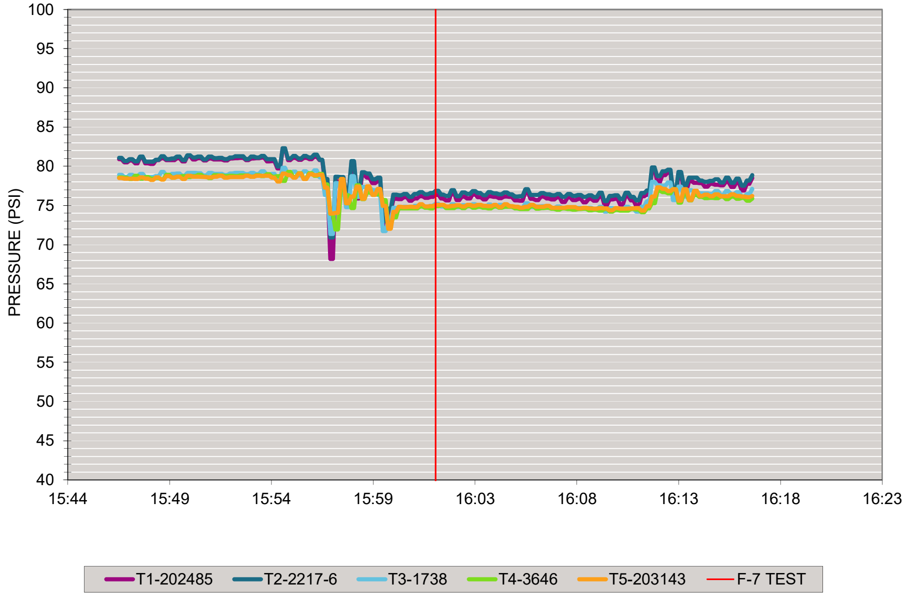
Pressure Recorder Locations

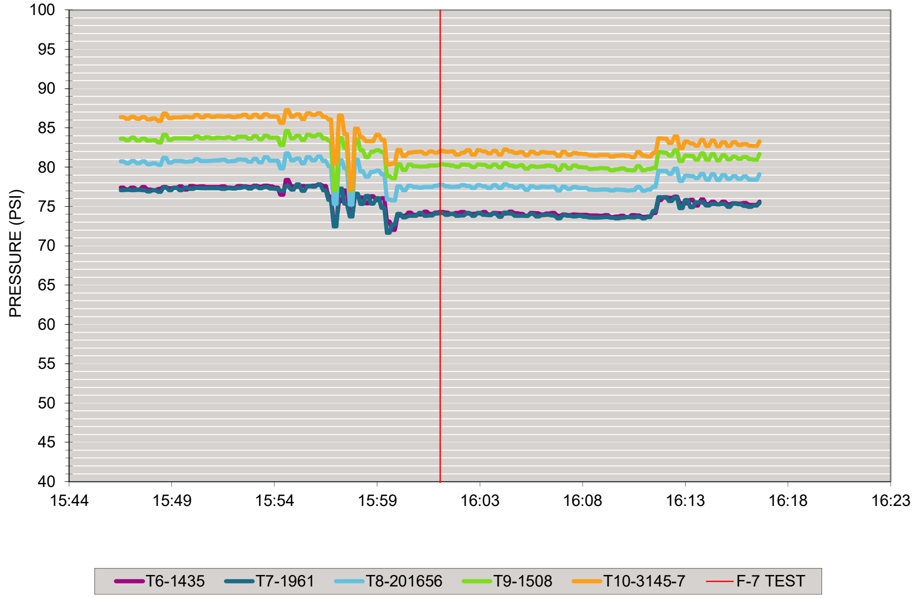
	ID	Location	ID	Location
T1	2485	Rippling Creek Well	T21	
T2	2217	Corner of Sandy Lane and Ross Lane	T22	
T3	1738	Corner of Mesker Street and Ross Lane	T23	
T4	3646	Corner of Mesker Street and Sternberg	T24	
T5	3143	Water Treatment Plant	T25	
T6	1435	Corner of Von Kanel Street and Schofield Avenue	T26	
T7	1961	Corner of Camp Phillips Road and Schofield Avenue	T27	
T8	1656	Corner of Birch Street and Schofield Avenue	T28	
T9	1508	Alta Verde Well	T29	
T10	3145	Bloedel Well	T30	
T11	1908	Corner of Highland Avenue and Alta Verde Street	T31	
T12	3146	On Volkman, south of Weston	T32	
T13	1894	Close to Summit Avenue Tower	T33	
T14	1652	On Shorey Avenue north of Cedar Creek	T34	
T15	2218	Corner of Camp Phillips Road and Shorey Avenue	T35	
T16	1284	Corner of Weston Avenue and Camp Phillips Road	T36	
T17	2486	Corner of Birch Street and Highway 29	T37	
T18	1739	Corner of Tiegen Lanr and Schofield Avenue	T38	
T19	5326	Close to Business Park Tower	T39	
T20	5022	Far East of Business Park, near Business Park Tower	T40	

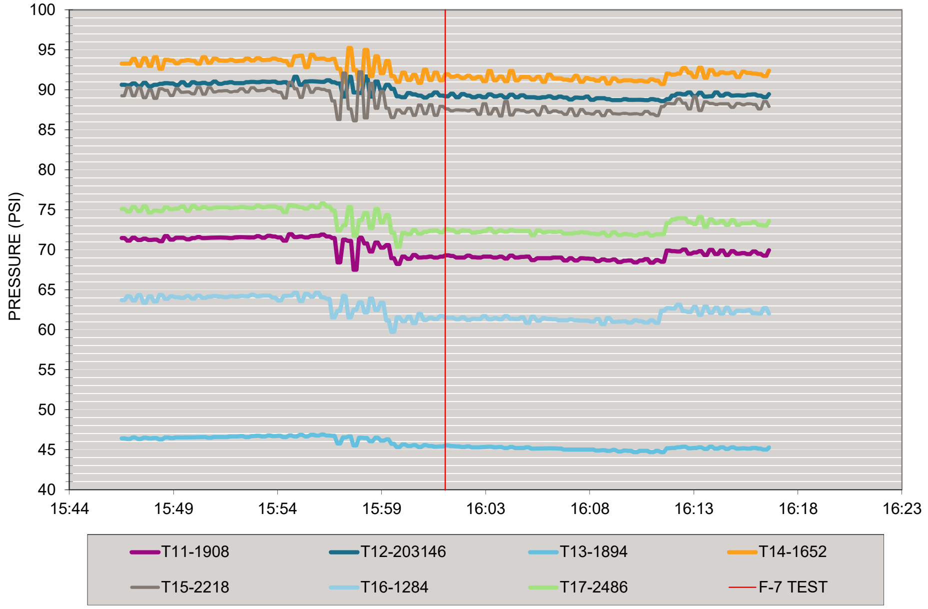
Pressure Data

ID		Static Pressure		Residual Pressure	ID	Static Pressure		Residual Pressure
		Initial	Final			Initial	Final	
T1	2485	81 psi	81 psi	76 psi	T21			
T2	2217	81 psi	81 psi	76 psi	T22			
T3	1738	79 psi	79 psi	75 psi	T23			
T4	3646	79 psi	79 psi	75 psi	T24			
T5	3143	79 psi	79 psi	75 psi	T25			
T6	1435	77 psi	77 psi	74 psi	T26			
T7	1961	77 psi	77 psi	74 psi	T27			
T8	1656	81 psi	81 psi	79 psi	T28			
T9	1508	84 psi	84 psi	80 psi	T29			
T10	3145	86 psi	86 psi	82 psi	T30			
T11	1908	72 psi	72 psi	69 psi	T31			
T12	3146	91 psi	91 psi	89 psi	T32			
T13	1894	47 psi	47 psi	45 psi	T33			
T14	1652	94 psi	94 psi	91 psi	T34			
T15	2218	90 psi	90 psi	87 psi	T35			
T16	1284	64 psi	64 psi	61 psi	T36			
T17	2486	75 psi	75 psi	72 psi	T37			
T18	1739	73 psi	73 psi	70 psi	T38			
T19	5326	72 psi	72 psi	71 psi	T39			
T20	5022	67 psi	67 psi	66 psi	T40			

C:\OneDrive\AECOM Directory\60580895_Weston Master Plan Project - General\400_Technical\453_Water\Field_Work\Telogs\[Weston_Telog_Graphs_2.xlsx]F-(7)







AECOM

FIGURE F-7
PRESSURE MONITORING LOCATIONS
VILLAGE OF WESTON, WISCONSIN

DATA FROM 10/2/2018 60580895

FLOW AND PRESSURE TESTS
WESTON WATER UTILITY

Test Number: F-8 **Date & Time:** 10/2/2018 15:34 **Area:** North

Flowing Hydrant(s)

Location(s):	F1	09-040
	F2	08-008

Residual Hydrant(s)

Location(s):	R1	09-017
	R2	17-032
	R3	

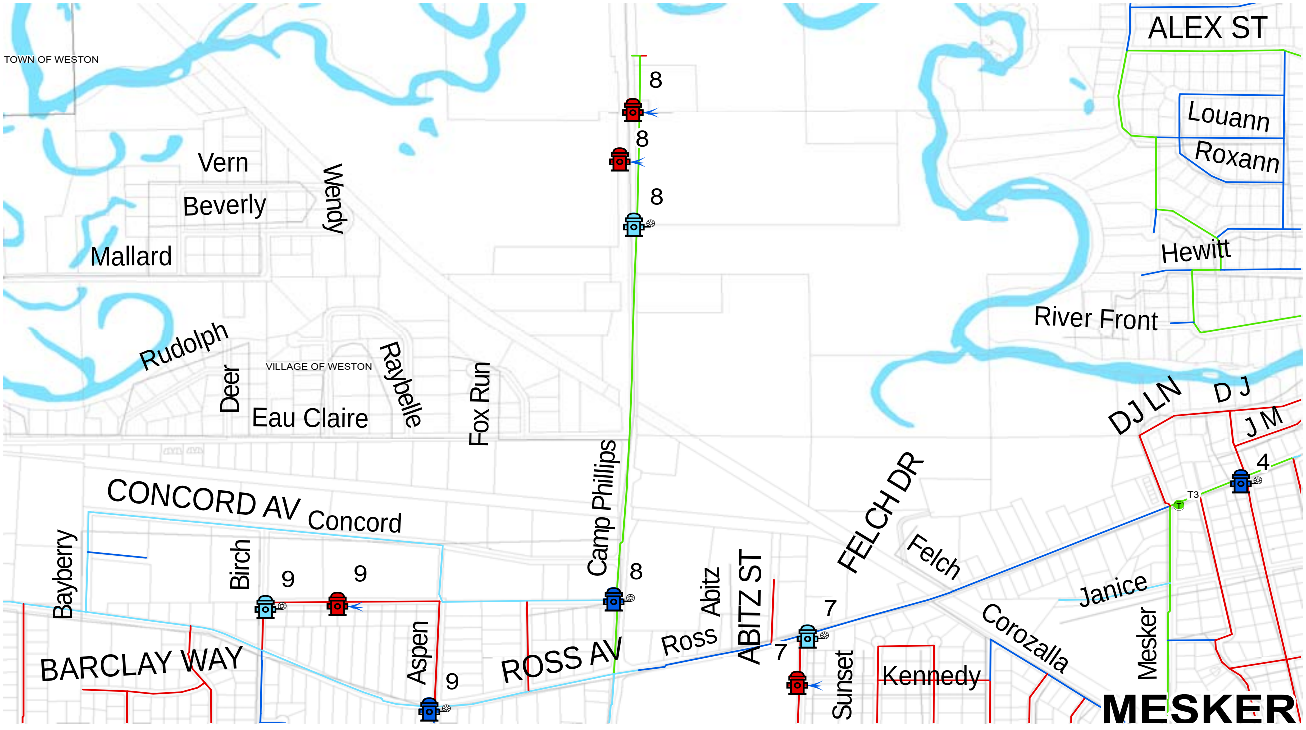
Field Flow Data					Field Test Time				
Hydrant	**Flow Device**	**Nozzle Size**	**Velocity Pressure**	**Flow**	**Start to Open**	**Fully Open**	**Residual**	**Start to Close**	**Fully Closed**
F1 - Nozzle 1	FTK	2.25 inches	25 psi	760 gpm	3:30	3:31	3:34	3:39	3:41
F1 - Nozzle 2	FTK	2.25 inches	25 psi	760 gpm					
F2 - Nozzle 1	Diff	4 inches	21 psi	1,730 gpm	3:32	3:33		3:35	3:36
F2 - Nozzle 2									

Hydrant	Static Pressure		Residual Pressure	Hydrant	Static Pressure		Residual Pressure
	Initial	Final			Initial	Final	
Residual 1	85 psi	85 psi	45 psi	Residual 3			
Residual 2	80 psi	80 psi	68 psi	Residual 4			

System Conditions

Business Park Tower Level	23.6 feet	Summit Tower Level	11.4 feet
Everest Tower Level	21.9 feet		
Well 1 (Alta Verde)	On	Well 5 (Bloedel)	On
Well 3 (Mesker)	On	Well 6 (Rippling Creek)	On
Well 4 (Sternberg)	On		

Location Map (not to scale)



FLOW AND PRESSURE TESTS
WESTON WATER UTILITY

Test Number: F-8 **Date & Time:** 10/2/2018 15:34 **Area:** North

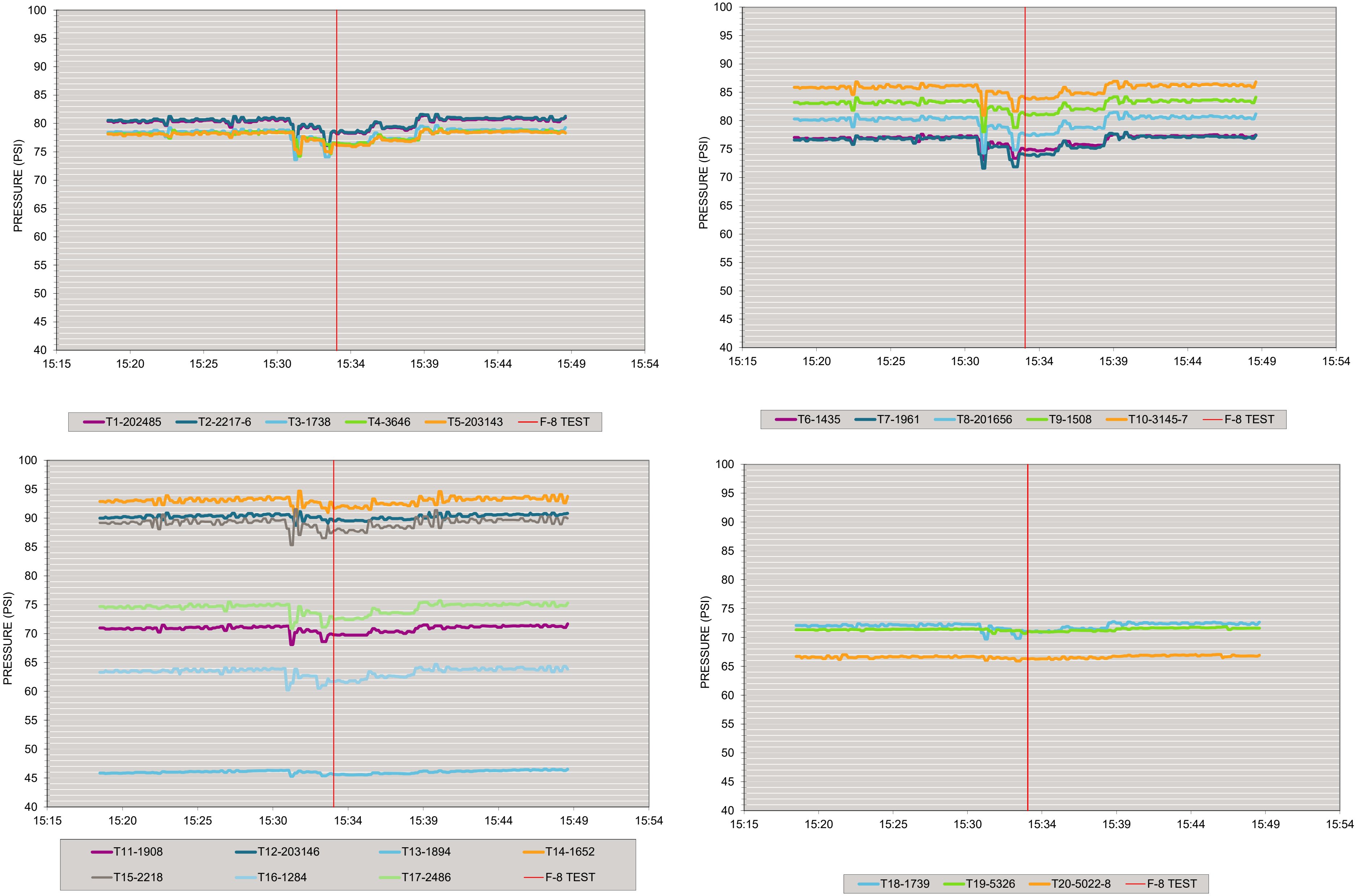
Pressure Recorder Locations

	ID	Location	ID	Location
T1	2485	Rippling Creek Well	T21	
T2	2217	Corner of Sandy Lane and Ross Lane	T22	
T3	1738	Corner of Mesker Street and Ross Lane	T23	
T4	3646	Corner of Mesker Street and Sternberg	T24	
T5	3143	Water Treatment Plant	T25	
T6	1435	Corner of Von Kanel Street and Schofield Avenue	T26	
T7	1961	Corner of Camp Phillips Road and Schofield Avenue	T27	
T8	1656	Corner of Birch Street and Schofield Avenue	T28	
T9	1508	Alta Verde Well	T29	
T10	3145	Bloedel Well	T30	
T11	1908	Corner of Highland Avenue and Alta Verde Street	T31	
T12	3146	On Volkman, south of Weston	T32	
T13	1894	Close to Summit Avenue Tower	T33	
T14	1652	On Shorey Avenue north of Cedar Creek	T34	
T15	2218	Corner of Camp Phillips Road and Shorey Avenue	T35	
T16	1284	Corner of Weston Avenue and Camp Phillips Road	T36	
T17	2486	Corner of Birch Street and Highway 29	T37	
T18	1739	Corner of Tiegen Lanr and Schofield Avenue	T38	
T19	5326	Close to Business Park Tower	T39	
T20	5022	Far East of Business Park, near Business Park Tower	T40	

Pressure Data

ID		Static Pressure		Residual Pressure	ID	Static Pressure		Residual Pressure
		Initial	Final			Initial	Final	
T1	2485	80 psi	80 psi	78 psi	T21			
T2	2217	80 psi	80 psi	78 psi	T22			
T3	1738	78 psi	78 psi	76 psi	T23			
T4	3646	78 psi	78 psi	76 psi	T24			
T5	3143	78 psi	78 psi	76 psi	T25			
T6	1435	77 psi	77 psi	75 psi	T26			
T7	1961	77 psi	77 psi	74 psi	T27			
T8	1656	80 psi	80 psi	78 psi	T28			
T9	1508	83 psi	83 psi	81 psi	T29			
T10	3145	86 psi	86 psi	84 psi	T30			
T11	1908	71 psi	71 psi	70 psi	T31			
T12	3146	90 psi	90 psi	90 psi	T32			
T13	1894	46 psi	46 psi	46 psi	T33			
T14	1652	93 psi	93 psi	92 psi	T34			
T15	2218	89 psi	89 psi	88 psi	T35			
T16	1284	64 psi	64 psi	62 psi	T36			
T17	2486	75 psi	75 psi	74 psi	T37			
T18	1739	72 psi	72 psi	71 psi	T38			
T19	5326	71 psi	71 psi	71 psi	T39			
T20	5022	66 psi	66 psi	66 psi	T40			

C:\OneDrive\AECOM Directory\60580895_Weston Master Plan Project - General\400_Technical\453_Water\Field_Work\Telogs\[Weston_Telog_Graphs_2.xlsx]F-(8)



AECOM

FIGURE F-8
PRESSURE MONITORING LOCATIONS
VILLAGE OF WESTON, WISCONSIN

DATA FROM 10/2/2018

60580895

FLOW AND PRESSURE TESTS
WESTON WATER UTILITY

Test Number: F-9 **Date & Time:** 10/2/2018 15:12 **Area:** Central

Flowing Hydrant(s)

Location(s):	F1	17-092
	F2	

Residual Hydrant(s)

Location(s):	R1	17-061
	R2	17-028
	R3	

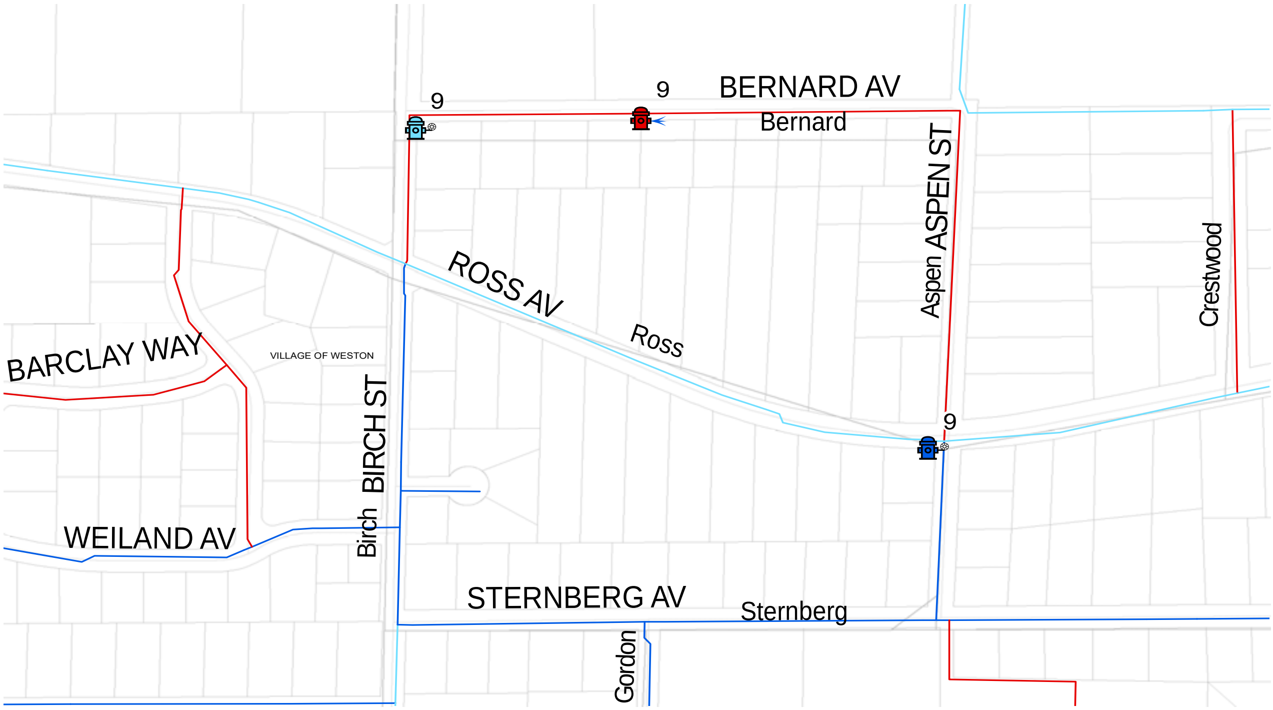
Field Flow Data					Field Test Time				
Hydrant	**Flow Device**	**Nozzle Size**	**Velocity Pressure**	**Flow**	**Start to Open**	**Fully Open**	**Residual**	**Start to Close**	**Fully Closed**
F1 - Nozzle 1	Diff	4 inches	14 psi	1,470 gpm	3:09	3:10	3:12	3:14	3:15
F1 - Nozzle 2									
F2 - Nozzle 1									
F2 - Nozzle 2									

Hydrant	**Static Pressure**		**Residual Pressure**	**Hydrant**	**Static Pressure**		**Residual Pressure**
	Initial	**Final**			**Initial**	**Final**	
Residual 1	80 psi	80 psi	62 psi	Residual 3			
Residual 2	82 psi	82 psi	77 psi	Residual 4			

System Conditions

Business Park Tower Level	22.4 feet	Summit Tower Level	9.8 feet
Everest Tower Level	19.9 feet		
Well 1 (Alta Verde)	On	Well 5 (Bloedel)	On
Well 3 (Mesker)	On	Well 6 (Rippling Creek)	On
Well 4 (Sternberg)	On		

Location Map (not to scale)



FLOW AND PRESSURE TESTS
WESTON WATER UTILITY

Test Number: F-9 **Date & Time:** 10/2/2018 15:12 **Area:** Central

Pressure Recorder Locations

	ID	Location	ID	Location
T1	2485	Rippling Creek Well	T21	
T2	2217	Corner of Sandy Lane and Ross Lane	T22	
T3	1738	Corner of Mesker Street and Ross Lane	T23	
T4	3646	Corner of Mesker Street and Sternberg	T24	
T5	3143	Water Treatment Plant	T25	
T6	1435	Corner of Von Kanel Street and Schofield Avenue	T26	
T7	1961	Corner of Camp Phillips Road and Schofield Avenue	T27	
T8	1656	Corner of Birch Street and Schofield Avenue	T28	
T9	1508	Alta Verde Well	T29	
T10	3145	Bloedel Well	T30	
T11	1908	Corner of Highland Avenue and Alta Verde Street	T31	
T12	3146	On Volkman, south of Weston	T32	
T13	1894	Close to Summit Avenue Tower	T33	
T14	1652	On Shorey Avenue north of Cedar Creek	T34	
T15	2218	Corner of Camp Phillips Road and Shorey Avenue	T35	
T16	1284	Corner of Weston Avenue and Camp Phillips Road	T36	
T17	2486	Corner of Birch Street and Highway 29	T37	
T18	1739	Corner of Tiegen Lanr and Schofield Avenue	T38	
T19	5326	Close to Business Park Tower	T39	
T20	5022	Far East of Business Park, near Business Park Tower	T40	

Pressure Data

ID		Static Pressure		Residual Pressure	ID	Static Pressure		Residual Pressure
		Initial	Final			Initial	Final	
T1	2485	80 psi	80 psi	79 psi	T21			
T2	2217	80 psi	80 psi	79 psi	T22			
T3	1738	78 psi	78 psi	77 psi	T23			
T4	3646	78 psi	78 psi	77 psi	T24			
T5	3143	78 psi	78 psi	77 psi	T25			
T6	1435	76 psi	76 psi	75 psi	T26			
T7	1961	76 psi	76 psi	75 psi	T27			
T8	1656	80 psi	80 psi	78 psi	T28			
T9	1508	83 psi	83 psi	82 psi	T29			
T10	3145	85 psi	85 psi	84 psi	T30			
T11	1908	71 psi	71 psi	70 psi	T31			
T12	3146	90 psi	90 psi	90 psi	T32			
T13	1894	45 psi	45 psi	45 psi	T33			
T14	1652	93 psi	93 psi	92 psi	T34			
T15	2218	89 psi	89 psi	88 psi	T35			
T16	1284	63 psi	63 psi	62 psi	T36			
T17	2486	74 psi	74 psi	73 psi	T37			
T18	1739	72 psi	72 psi	71 psi	T38			
T19	5326	71 psi	71 psi	71 psi	T39			
T20	5022	66 psi	66 psi	66 psi	T40			

C:\OneDrive\AECOM Directory\60580895_Weston Master Plan Project - General\400_Technical\453_Water\Field_Work\Telogs\[Weston_Telog_Graphs_2.xlsx]F-(9)

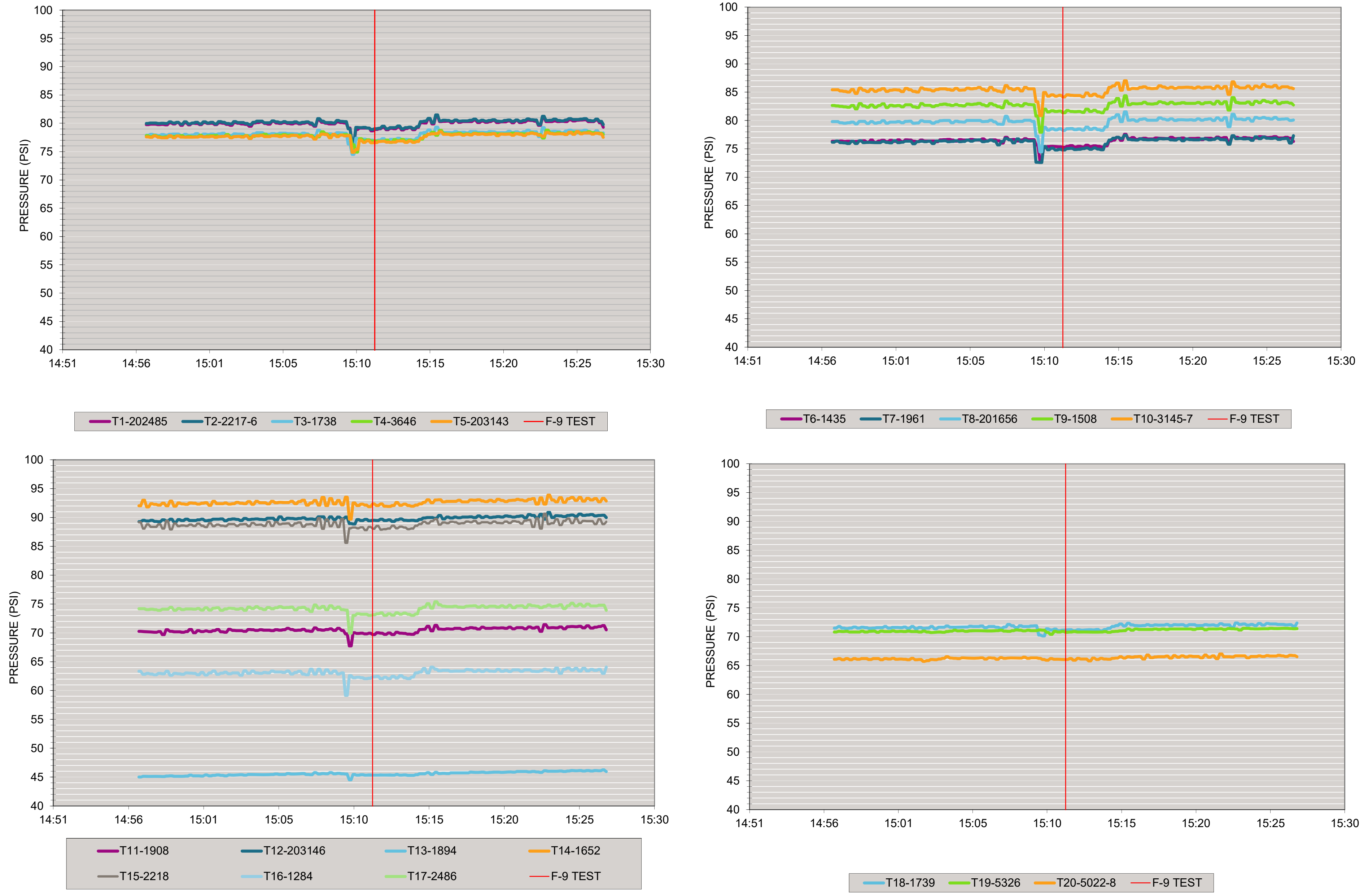


FIGURE F-9
PRESSURE MONITORING LOCATIONS
VILLAGE OF WESTON, WISCONSIN

DATA FROM 10/2/2018 60580895

FLOW AND PRESSURE TESTS
WESTON WATER UTILITY

Test Number: F-10 **Date & Time:** 10/2/2018 14:52 **Area:** Central

Flowing Hydrant(s)

Location(s): F1 17-083
F2

Residual Hydrant(s)

Location(s): R1 17-060
R2 17-058
R3

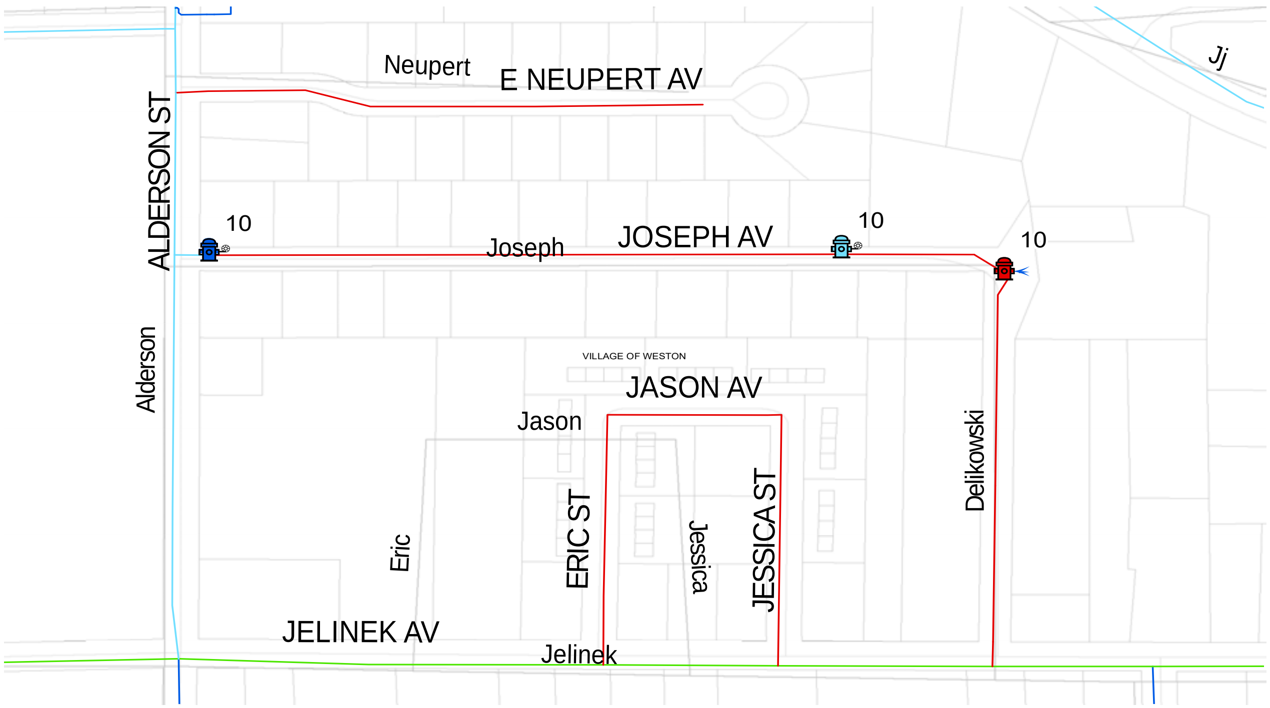
Field Flow Data					Field Test Time				
Hydrant	**Flow Device**	**Nozzle Size**	**Velocity Pressure**	**Flow**	**Start to Open**	**Fully Open**	**Residual**	**Start to Close**	**Fully Closed**
F1 - Nozzle 1	FTK	2.25 inches	28 psi	800 gpm	2:50	2:51	2:52	2:53	2:54
F1 - Nozzle 2	FTK	2.25 inches	28 psi	800 gpm					
F2 - Nozzle 1									
F2 - Nozzle 2									

Hydrant	**Static Pressure**		**Residual Pressure**	**Hydrant**	**Static Pressure**		**Residual Pressure**
	Initial	**Final**			**Initial**	**Final**	
Residual 1	81 psi	81 psi	54 psi	Residual 3			
Residual 2	82 psi	82 psi	78 psi	Residual 4			

System Conditions

Business Park Tower Level	21.7 feet	Summit Tower Level	7.8 feet
Everest Tower Level	18.9 feet		
Well 1 (Alta Verde)	Off	Well 5 (Bloedel)	Off
Well 3 (Mesker)	Off	Well 6 (Rippling Creek)	Off
Well 4 (Sternberg)	Off		

Location Map (not to scale)



FLOW AND PRESSURE TESTS
WESTON WATER UTILITY

Test Number: F-10 **Date & Time:** 10/2/2018 14:52 **Area:** Central

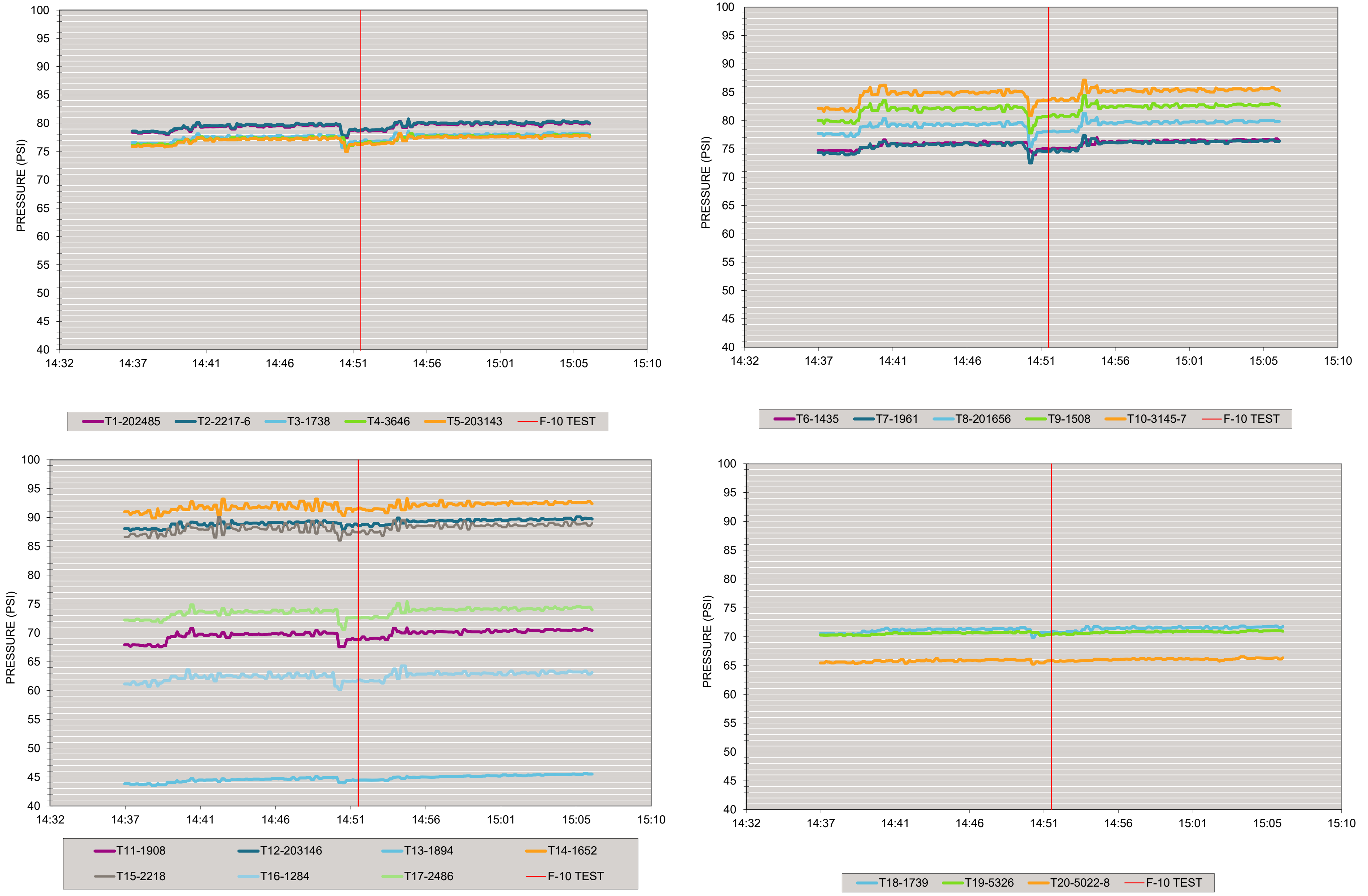
Pressure Recorder Locations

ID		Location	ID	Location
T1	2485	Rippling Creek Well	T21	
T2	2217	Corner of Sandy Lane and Ross Lane	T22	
T3	1738	Corner of Mesker Street and Ross Lane	T23	
T4	3646	Corner of Mesker Street and Sternberg	T24	
T5	3143	Water Treatment Plant	T25	
T6	1435	Corner of Von Kanel Street and Schofield Avenue	T26	
T7	1961	Corner of Camp Phillips Road and Schofield Avenue	T27	
T8	1656	Corner of Birch Street and Schofield Avenue	T28	
T9	1508	Alta Verde Well	T29	
T10	3145	Bloedel Well	T30	
T11	1908	Corner of Highland Avenue and Alta Verde Street	T31	
T12	3146	On Volkman, south of Weston	T32	
T13	1894	Close to Summit Avenue Tower	T33	
T14	1652	On Shorey Avenue north of Cedar Creek	T34	
T15	2218	Corner of Camp Phillips Road and Shorey Avenue	T35	
T16	1284	Corner of Weston Avenue and Camp Phillips Road	T36	
T17	2486	Corner of Birch Street and Highway 29	T37	
T18	1739	Corner of Tiegen Lanr and Schofield Avenue	T38	
T19	5326	Close to Business Park Tower	T39	
T20	5022	Far East of Business Park, near Business Park Tower	T40	

Pressure Data

ID		Static Pressure		Residual Pressure	ID	Static Pressure		Residual Pressure
		Initial	Final			Initial	Final	
T1	2485	80 psi	80 psi	79 psi	T21			
T2	2217	80 psi	80 psi	79 psi	T22			
T3	1738	77 psi	77 psi	76 psi	T23			
T4	3646	77 psi	77 psi	76 psi	T24			
T5	3143	77 psi	77 psi	76 psi	T25			
T6	1435	76 psi	76 psi	75 psi	T26			
T7	1961	76 psi	76 psi	75 psi	T27			
T8	1656	79 psi	79 psi	78 psi	T28			
T9	1508	82 psi	82 psi	81 psi	T29			
T10	3145	85 psi	85 psi	84 psi	T30			
T11	1908	70 psi	70 psi	69 psi	T31			
T12	3146	89 psi	89 psi	89 psi	T32			
T13	1894	45 psi	45 psi	45 psi	T33			
T14	1652	92 psi	92 psi	92 psi	T34			
T15	2218	88 psi	88 psi	87 psi	T35			
T16	1284	63 psi	63 psi	62 psi	T36			
T17	2486	74 psi	74 psi	73 psi	T37			
T18	1739	71 psi	71 psi	71 psi	T38			
T19	5326	71 psi	71 psi	71 psi	T39			
T20	5022	66 psi	66 psi	66 psi	T40			

C:\OneDrive\AECOM Directory\60580895_Weston Master Plan Project - General\400_Technical\453_Water\Field_Work\Telogs\[Weston_Telog_Graphs_2.xlsx]F-(10)



AECOM

FIGURE F-10
PRESSURE MONITORING LOCATIONS
VILLAGE OF WESTON, WISCONSIN

DATA FROM 10/2/2018 60580895

FLOW AND PRESSURE TESTS
WESTON WATER UTILITY

Test Number: F-11 **Date & Time:** 10/2/2018 14:37 **Area:** West

Flowing Hydrant(s)

Location(s):	F1	18-038
	F2	

Residual Hydrant(s)

Location(s):	R1	18-013
	R2	18-025
	R3	

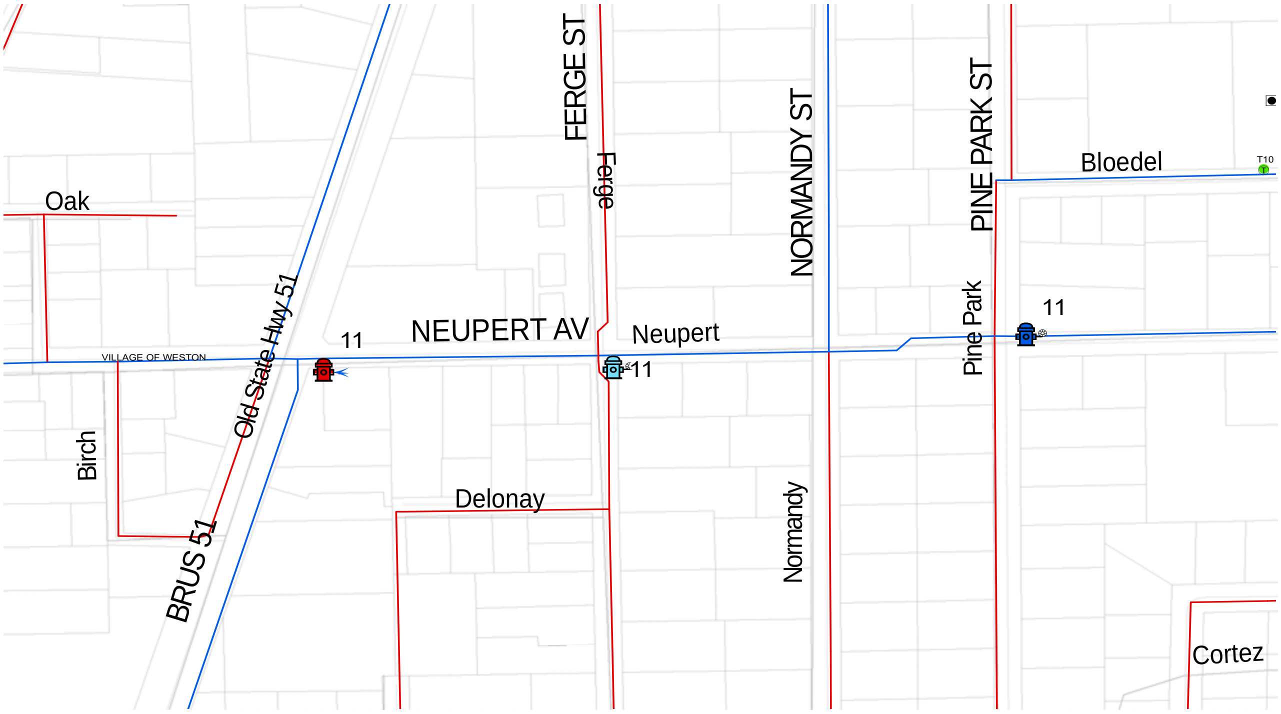
Field Flow Data					**Field Test Time**				
Hydrant	**Flow Device**	**Nozzle Size**	**Velocity Pressure**	**Flow**	**Start to Open**	**Fully Open**	**Residual**	**Start to Close**	**Fully Closed**
F1 - Nozzle 1	Diff	4 inches	40 psi	2,160 gpm	2:34	2:35	2:37	2:39	2:40
F1 - Nozzle 2									
F2 - Nozzle 1									
F2 - Nozzle 2									

Hydrant	**Static Pressure**		**Residual Pressure**	**Hydrant**	**Static Pressure**		**Residual Pressure**
	Initial	**Final**			**Initial**	**Final**	
Residual 1	83 psi	83 psi	78 psi	Residual 3			
Residual 2	82 psi	82 psi	79 psi	Residual 4			

System Conditions

Business Park Tower Level	21.2 feet	Summit Tower Level	6.6 feet
Everest Tower Level	18.0 feet		
Well 1 (Alta Verde)	On	Well 5 (Bloedel)	On
Well 3 (Mesker)	On	Well 6 (Rippling Creek)	On
Well 4 (Sternberg)	On		

Location Map (not to scale)



FLOW AND PRESSURE TESTS
WESTON WATER UTILITY

Test Number: F-11 **Date & Time:** 10/2/2018 14:37 **Area:** West

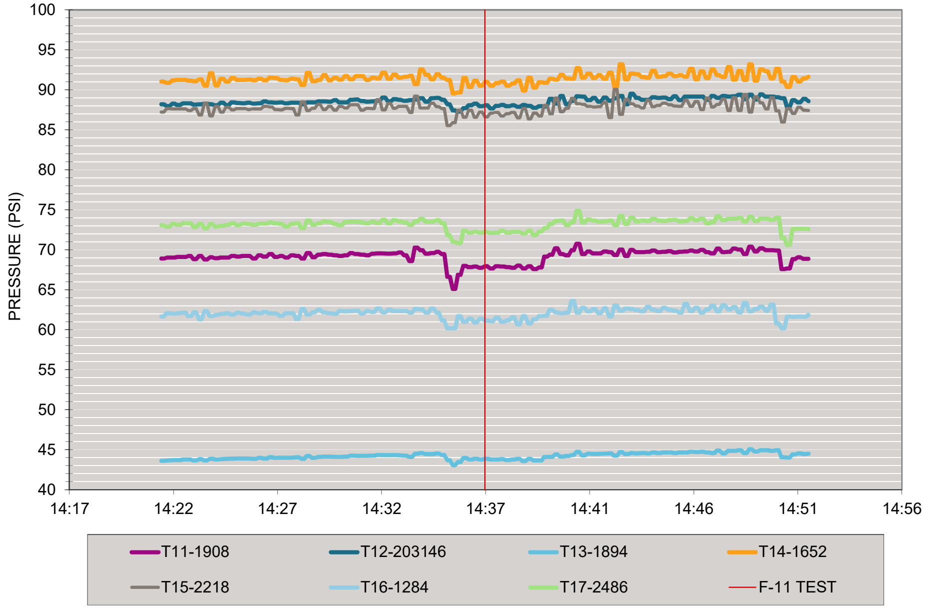
Pressure Recorder Locations

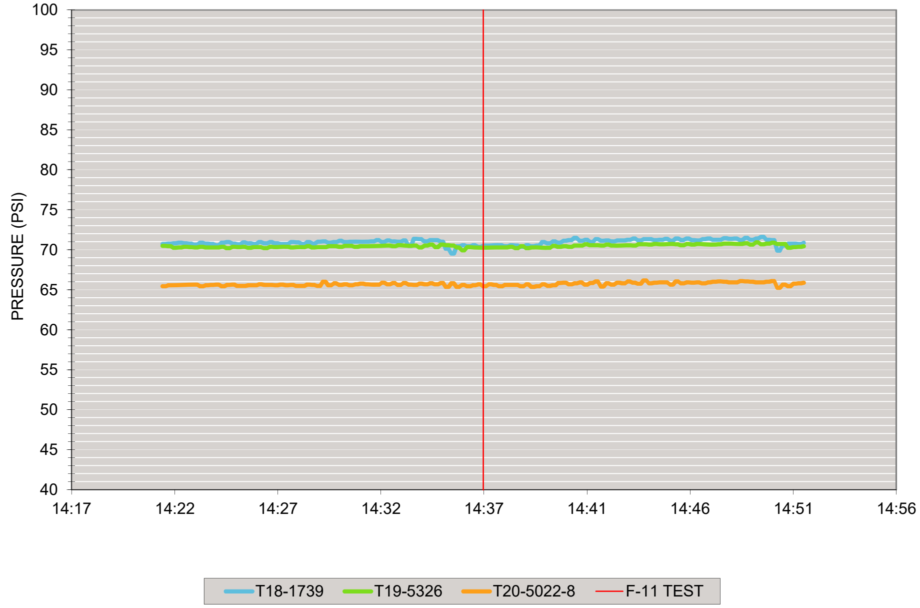
ID		Location	ID	Location
T1	2485	Rippling Creek Well	T21	
T2	2217	Corner of Sandy Lane and Ross Lane	T22	
T3	1738	Corner of Mesker Street and Ross Lane	T23	
T4	3646	Corner of Mesker Street and Sternberg	T24	
T5	3143	Water Treatment Plant	T25	
T6	1435	Corner of Von Kanel Street and Schofield Avenue	T26	
T7	1961	Corner of Camp Phillips Road and Schofield Avenue	T27	
T8	1656	Corner of Birch Street and Schofield Avenue	T28	
T9	1508	Alta Verde Well	T29	
T10	3145	Bloedel Well	T30	
T11	1908	Corner of Highland Avenue and Alta Verde Street	T31	
T12	3146	On Volkman, south of Weston	T32	
T13	1894	Close to Summit Avenue Tower	T33	
T14	1652	On Shorey Avenue north of Cedar Creek	T34	
T15	2218	Corner of Camp Phillips Road and Shorey Avenue	T35	
T16	1284	Corner of Weston Avenue and Camp Phillips Road	T36	
T17	2486	Corner of Birch Street and Highway 29	T37	
T18	1739	Corner of Tiegen Lanr and Schofield Avenue	T38	
T19	5326	Close to Business Park Tower	T39	
T20	5022	Far East of Business Park, near Business Park Tower	T40	

Pressure Data

ID		Static Pressure		Residual Pressure	ID	Static Pressure		Residual Pressure
		Initial	Final			Initial	Final	
T1	2485	79 psi	79 psi	78 psi	T21			
T2	2217	79 psi	79 psi	78 psi	T22			
T3	1738	77 psi	77 psi	76 psi	T23			
T4	3646	77 psi	77 psi	76 psi	T24			
T5	3143	77 psi	77 psi	76 psi	T25			
T6	1435	76 psi	76 psi	75 psi	T26			
T7	1961	76 psi	76 psi	74 psi	T27			
T8	1656	79 psi	79 psi	77 psi	T28			
T9	1508	82 psi	82 psi	80 psi	T29			
T10	3145	85 psi	85 psi	82 psi	T30			
T11	1908	70 psi	70 psi	68 psi	T31			
T12	3146	89 psi	89 psi	88 psi	T32			
T13	1894	44 psi	44 psi	44 psi	T33			
T14	1652	91 psi	91 psi	91 psi	T34			
T15	2218	88 psi	88 psi	87 psi	T35			
T16	1284	62 psi	62 psi	61 psi	T36			
T17	2486	73 psi	73 psi	72 psi	T37			
T18	1739	71 psi	71 psi	71 psi	T38			
T19	5326	71 psi	71 psi	70 psi	T39			
T20	5022	66 psi	66 psi	66 psi	T40			

C:\OneDrive\AECOM Directory\60580895_Weston Master Plan Project - General\400_Technical\453_Water\Field_Work\Telogs\[Weston_Telog_Graphs_2.xlsx]F-(11)





AECOM

FIGURE F-11
PRESSURE MONITORING LOCATIONS
VILLAGE OF WESTON, WISCONSIN

DATA FROM 10/2/2018

60580895

FLOW AND PRESSURE TESTS
WESTON WATER UTILITY

Test Number: F-12 **Date & Time:** 10/2/2018 14:18 **Area:** West

Flowing Hydrant(s)

Location(s):
F1 19-037
F2

Residual Hydrant(s)

Location(s):
R1 19-034
R2 19-022
R3

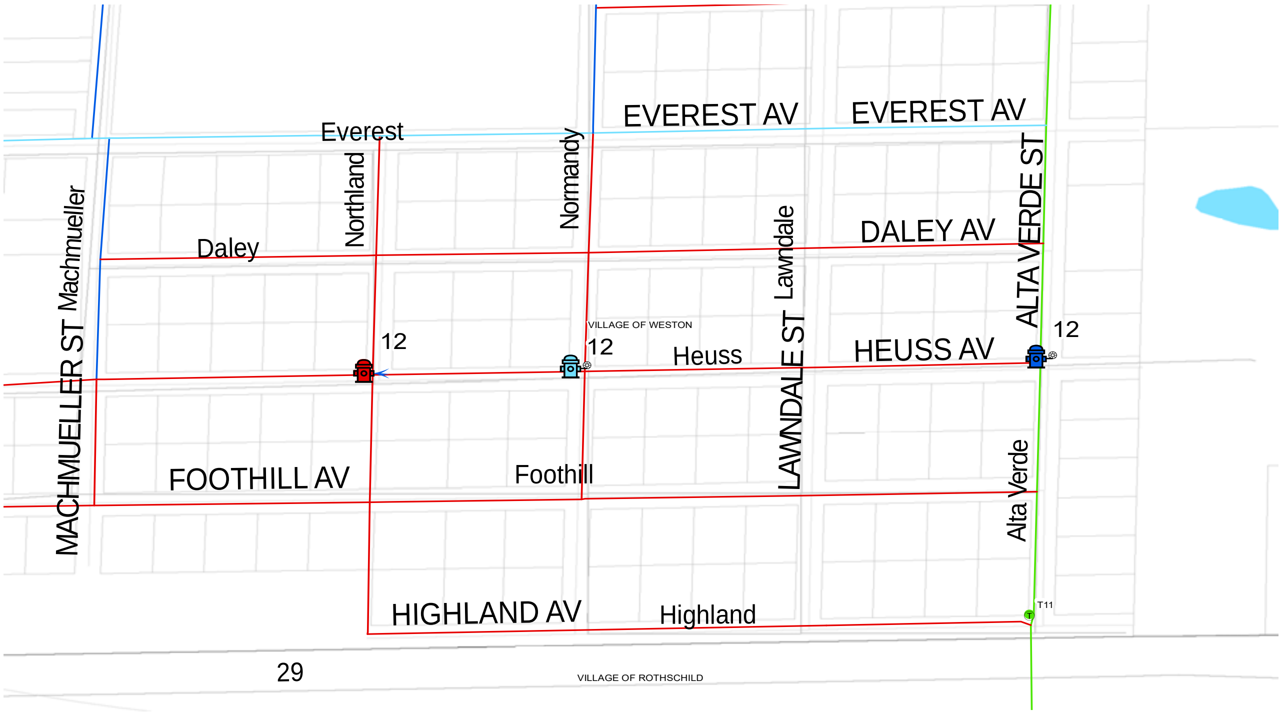
Field Flow Data					Field Test Time				
Hydrant	**Flow Device**	**Nozzle Size**	**Velocity Pressure**	**Flow**	**Start to Open**	**Fully Open**	**Residual**	**Start to Close**	**Fully Closed**
F1 - Nozzle 1	FTK	2.25 inches	38 psi	930 gpm	2:16	2:17	2:18	2:20	2:23
F1 - Nozzle 2	FTK	2.25 inches	38 psi	930 gpm					
F2 - Nozzle 1									
F2 - Nozzle 2									

Hydrant	Static Pressure		Residual Pressure	Hydrant	Static Pressure		Residual Pressure
	Initial	**Final**			**Initial**	**Final**	
Residual 1	79 psi	79 psi	75 psi	Residual 3			
Residual 2	76 psi	76 psi	76 psi	Residual 4			

System Conditions

Business Park Tower Level	21.1 feet	Summit Tower Level	5.0 feet
Everest Tower Level	17.9 feet		
Well 1 (Alta Verde)	Off	Well 5 (Bloedel)	Off
Well 3 (Mesker)	Off	Well 6 (Rippling Creek)	Off
Well 4 (Sternberg)	Off		

Location Map (not to scale)



FLOW AND PRESSURE TESTS
WESTON WATER UTILITY

Test Number: F-12 **Date & Time:** 10/2/2018 14:18 **Area:** West

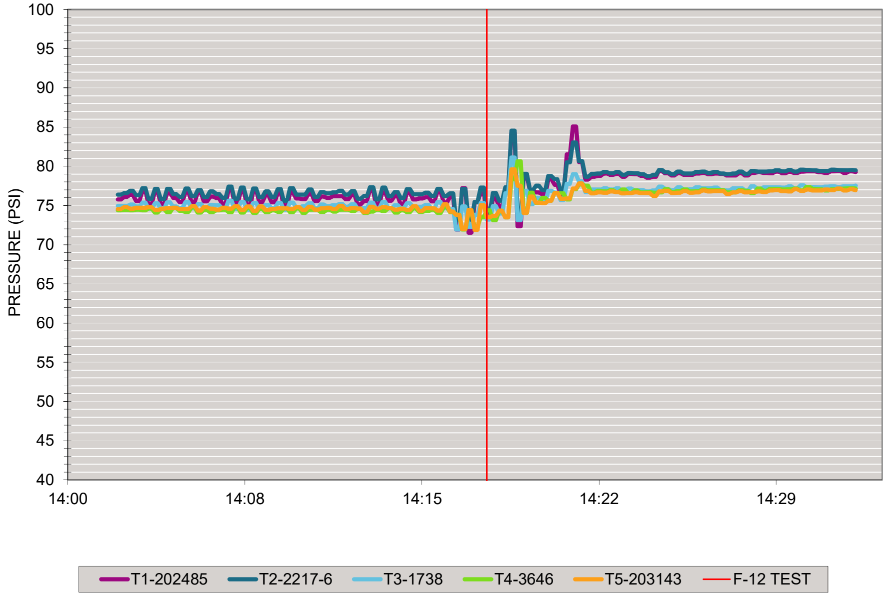
Pressure Recorder Locations

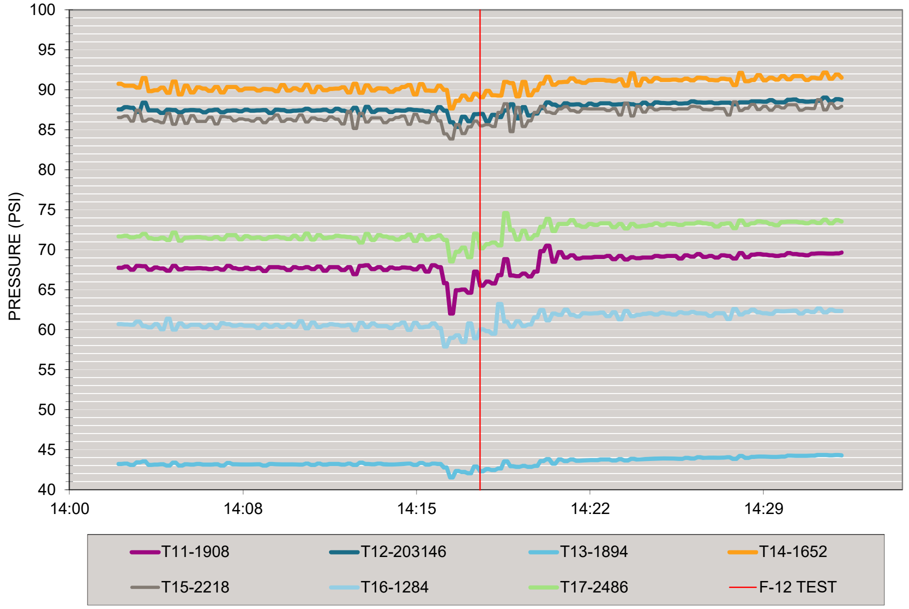
	ID	Location	ID	Location
T1	2485	Rippling Creek Well	T21	
T2	2217	Corner of Sandy Lane and Ross Lane	T22	
T3	1738	Corner of Mesker Street and Ross Lane	T23	
T4	3646	Corner of Mesker Street and Sternberg	T24	
T5	3143	Water Treatment Plant	T25	
T6	1435	Corner of Von Kanel Street and Schofield Avenue	T26	
T7	1961	Corner of Camp Phillips Road and Schofield Avenue	T27	
T8	1656	Corner of Birch Street and Schofield Avenue	T28	
T9	1508	Alta Verde Well	T29	
T10	3145	Bloedel Well	T30	
T11	1908	Corner of Highland Avenue and Alta Verde Street	T31	
T12	3146	On Volkman, south of Weston	T32	
T13	1894	Close to Summit Avenue Tower	T33	
T14	1652	On Shorey Avenue north of Cedar Creek	T34	
T15	2218	Corner of Camp Phillips Road and Shorey Avenue	T35	
T16	1284	Corner of Weston Avenue and Camp Phillips Road	T36	
T17	2486	Corner of Birch Street and Highway 29	T37	
T18	1739	Corner of Tiegen Lanr and Schofield Avenue	T38	
T19	5326	Close to Business Park Tower	T39	
T20	5022	Far East of Business Park, near Business Park Tower	T40	

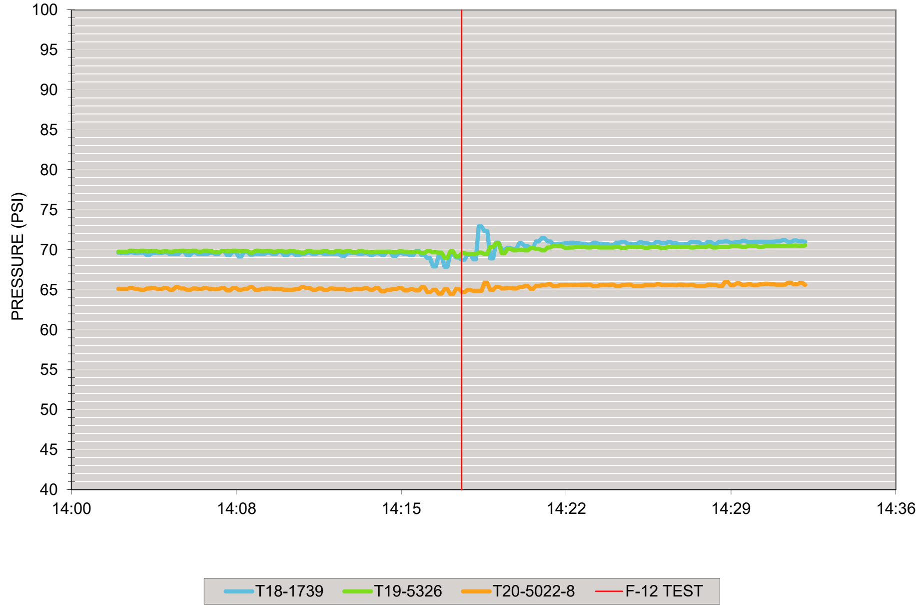
Pressure Data

ID		Static Pressure		Residual Pressure	ID	Static Pressure		Residual Pressure
		Initial	Final			Initial	Final	
T1	2485	79 psi	79 psi	76 psi	T21			
T2	2217	79 psi	79 psi	77 psi	T22			
T3	1738	77 psi	77 psi	74 psi	T23			
T4	3646	77 psi	77 psi	75 psi	T24			
T5	3143	77 psi	77 psi	75 psi	T25			
T6	1435	75 psi	75 psi	74 psi	T26			
T7	1961	75 psi	75 psi	73 psi	T27			
T8	1656	79 psi	79 psi	77 psi	T28			
T9	1508	81 psi	81 psi	79 psi	T29			
T10	3145	84 psi	84 psi	81 psi	T30			
T11	1908	68 psi	68 psi	65 psi	T31			
T12	3146	87 psi	87 psi	86 psi	T32			
T13	1894	43 psi	43 psi	43 psi	T33			
T14	1652	90 psi	90 psi	89 psi	T34			
T15	2218	86 psi	86 psi	85 psi	T35			
T16	1284	61 psi	61 psi	60 psi	T36			
T17	2486	72 psi	72 psi	70 psi	T37			
T18	1739	69 psi	69 psi	68 psi	T38			
T19	5326	70 psi	70 psi	70 psi	T39			
T20	5022	63 psi	63 psi	63 psi	T40			

C:\OneDrive\AECOM Directory\60580895_Weston Master Plan Project - General\400_Technical\453_Water\Field_Work\Telogs\[Weston_Telog_Graphs_2.xlsx]F-(12)







AECOM

FIGURE F-12
PRESSURE MONITORING LOCATIONS
VILLAGE OF WESTON, WISCONSIN

DATA FROM 10/2/2018
60580895

FLOW AND PRESSURE TESTS
WESTON WATER UTILITY

Test Number: F-13 **Date & Time:** 10/2/2018 13:59 **Area:** Southwest

Flowing Hydrant(s)

Location(s):	F1	30-007
	F2	

Residual Hydrant(s)

Location(s):	R1	30-006
	R2	19-005
	R3	

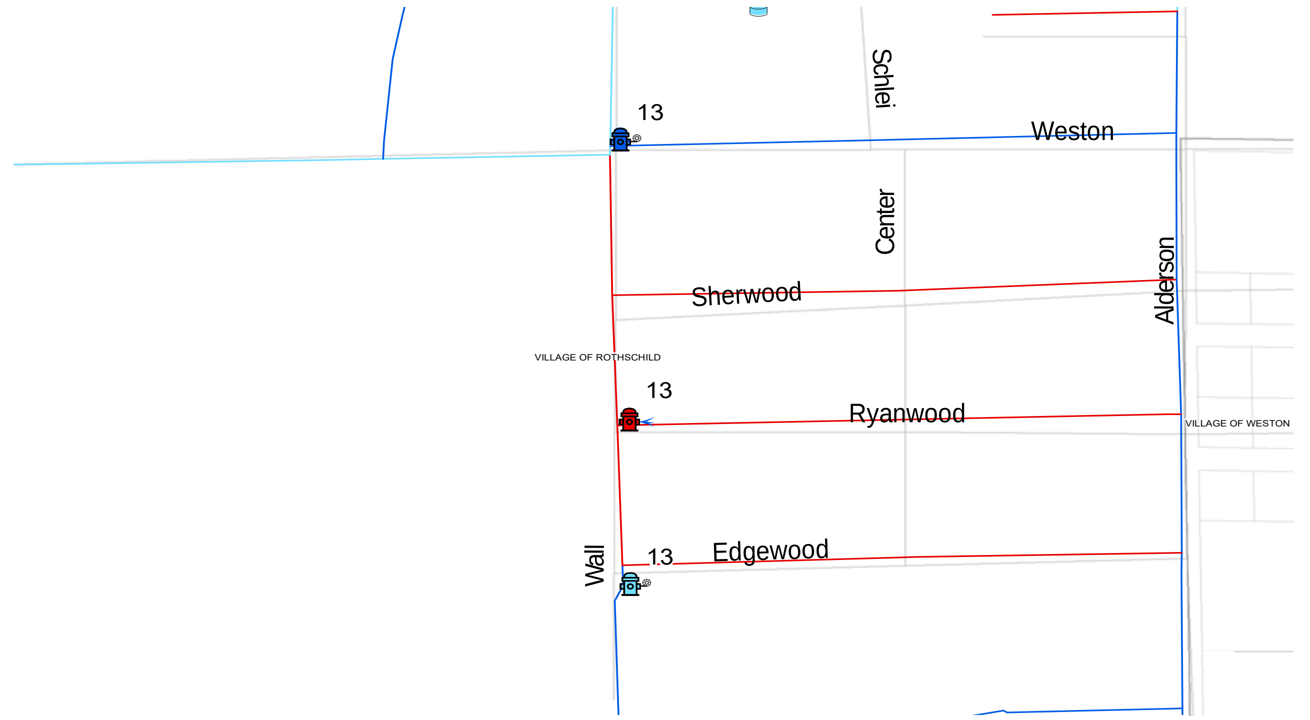
Field Flow Data					Field Test Time				
Hydrant	**Flow Device**	**Nozzle Size**	**Velocity Pressure**	**Flow**	**Start to Open**	**Fully Open**	**Residual**	**Start to Close**	**Fully Closed**
F1 - Nozzle 1	Diff	4 inches	12 psi	1,380 gpm	1:57	1:58	1:59	2:02	2:03
F1 - Nozzle 2									
F2 - Nozzle 1									
F2 - Nozzle 2									

Hydrant	**Static Pressure**		**Residual Pressure**	**Hydrant**	**Static Pressure**		**Residual Pressure**
	Initial	**Final**			**Initial**	**Final**	
Residual 1	51 psi	51 psi	46 psi	Residual 3			
Residual 2	43 psi	43 psi	43 psi	Residual 4			

System Conditions

Business Park Tower Level	20.7 feet	Summit Tower Level	5.6 feet
Everest Tower Level	17.2 feet		
Well 1 (Alta Verde)	Off	Well 5 (Bloedel)	Off
Well 3 (Mesker)	Off	Well 6 (Rippling Creek)	Off
Well 4 (Sternberg)	Off		

Location Map (not to scale)



FLOW AND PRESSURE TESTS
WESTON WATER UTILITY

Test Number: F-13 **Date & Time:** 10/2/2018 13:59 **Area:** Southwest

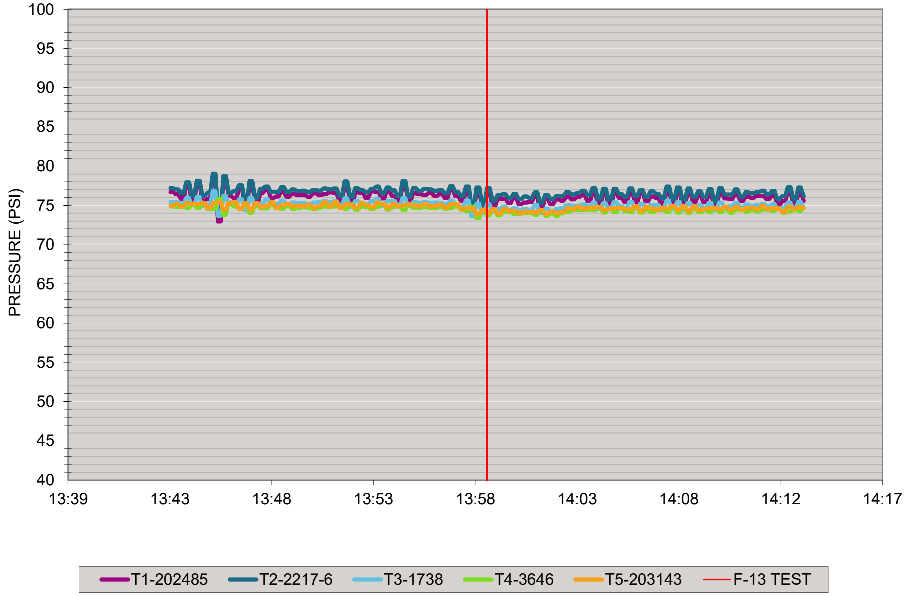
Pressure Recorder Locations

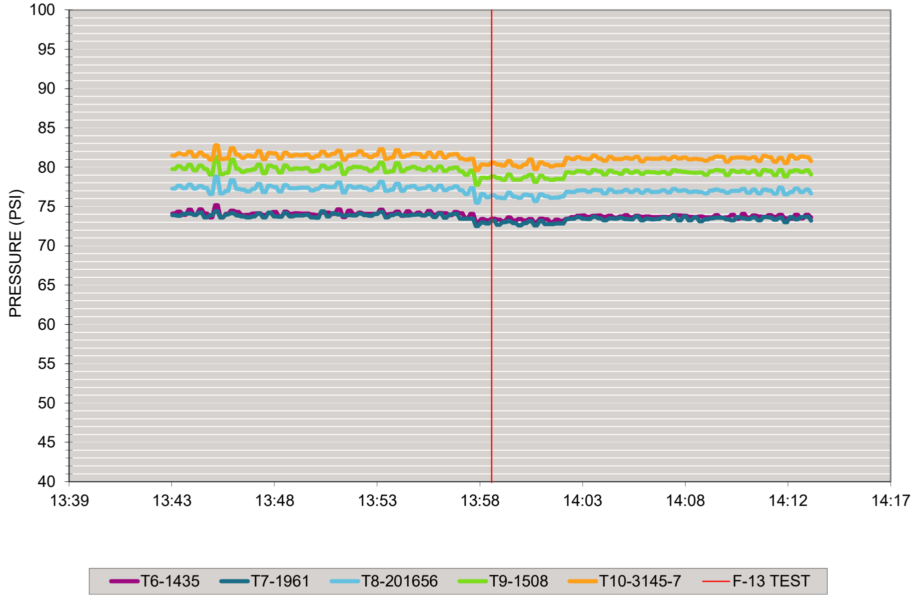
ID		Location	ID	Location
T1	2485	Rippling Creek Well	T21	
T2	2217	Corner of Sandy Lane and Ross Lane	T22	
T3	1738	Corner of Mesker Street and Ross Lane	T23	
T4	3646	Corner of Mesker Street and Sternberg	T24	
T5	3143	Water Treatment Plant	T25	
T6	1435	Corner of Von Kanel Street and Schofield Avenue	T26	
T7	1961	Corner of Camp Phillips Road and Schofield Avenue	T27	
T8	1656	Corner of Birch Street and Schofield Avenue	T28	
T9	1508	Alta Verde Well	T29	
T10	3145	Bloedel Well	T30	
T11	1908	Corner of Highland Avenue and Alta Verde Street	T31	
T12	3146	On Volkman, south of Weston	T32	
T13	1894	Close to Summit Avenue Tower	T33	
T14	1652	On Shorey Avenue north of Cedar Creek	T34	
T15	2218	Corner of Camp Phillips Road and Shorey Avenue	T35	
T16	1284	Corner of Weston Avenue and Camp Phillips Road	T36	
T17	2486	Corner of Birch Street and Highway 29	T37	
T18	1739	Corner of Tiegen Lanr and Schofield Avenue	T38	
T19	5326	Close to Business Park Tower	T39	
T20	5022	Far East of Business Park, near Business Park Tower	T40	

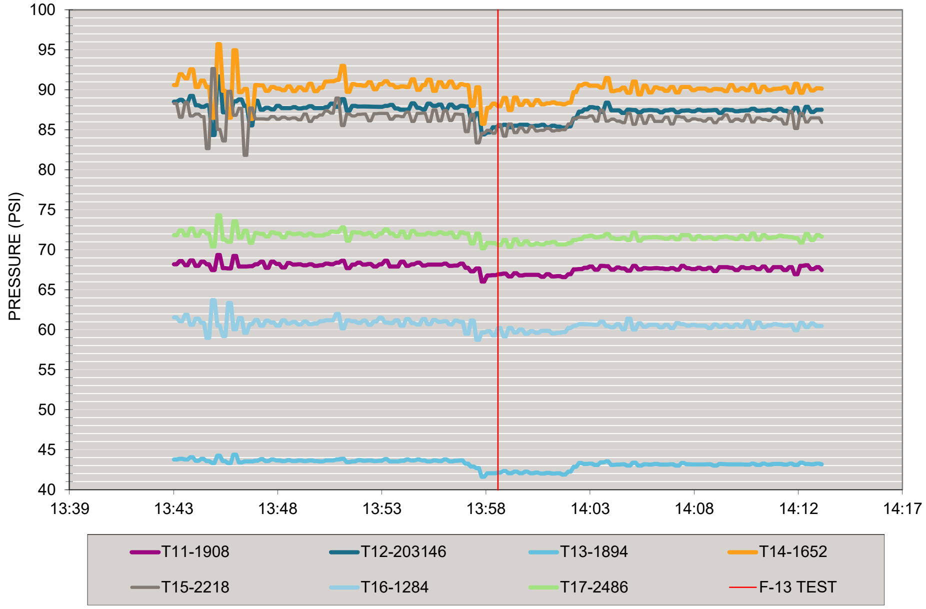
Pressure Data

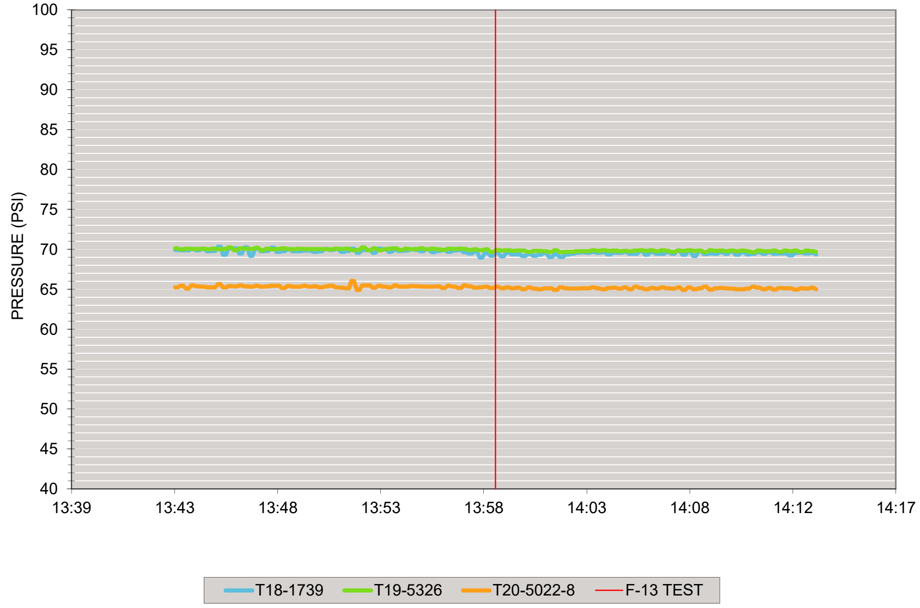
ID		Static Pressure		Residual Pressure	ID	Static Pressure		Residual Pressure
		Initial	Final			Initial	Final	
T1	2485	76 psi	77 psi	76 psi	T21			
T2	2217	77 psi	76 psi	76 psi	T22			
T3	1738	75 psi	75 psi	74 psi	T23			
T4	3646	75 psi	75 psi	74 psi	T24			
T5	3143	75 psi	75 psi	74 psi	T25			
T6	1435	74 psi	74 psi	73 psi	T26			
T7	1961	74 psi	74 psi	73 psi	T27			
T8	1656	77 psi	77 psi	76 psi	T28			
T9	1508	80 psi	80 psi	79 psi	T29			
T10	3145	81 psi	81 psi	80 psi	T30			
T11	1908	68 psi	68 psi	67 psi	T31			
T12	3146	88 psi	88 psi	85 psi	T32			
T13	1894	44 psi	44 psi	42 psi	T33			
T14	1652	91 psi	91 psi	88 psi	T34			
T15	2218	87 psi	87 psi	85 psi	T35			
T16	1284	61 psi	61 psi	60 psi	T36			
T17	2486	72 psi	72 psi	71 psi	T37			
T18	1739	70 psi	70 psi	70 psi	T38			
T19	5326	70 psi	70 psi	70 psi	T39			
T20	5022	65 psi	65 psi	65 psi	T40			

C:\OneDrive\AECOM Directory\60580895_Weston Master Plan Project - General\400_Technical\453_Water\Field_Work\Telogs\[Weston_Telog_Graphs_2.xlsx]F-(13)









AECOM

FIGURE F-13
PRESSURE MONITORING LOCATIONS
VILLAGE OF WESTON, WISCONSIN

DATA FROM 10/2/2018

60580895

FLOW AND PRESSURE TESTS

WESTON WATER UTILITY

Test Number: F-14 **Date & Time:** 10/2/2018 13:41 **Area:** Southwest

Flowing Hydrant(s)

Location(s):
F1 30-015
F2

Residual Hydrant(s)

Location(s):
R1 30-014
R2 30-018
R3

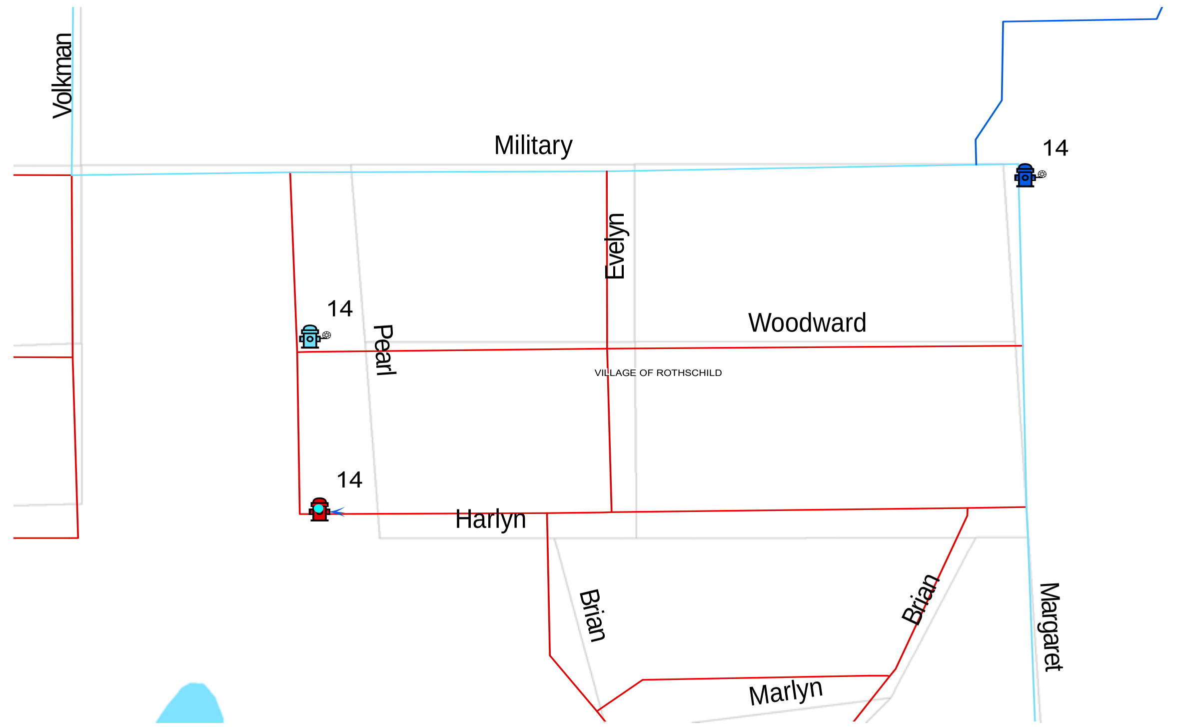
Field Flow Data					Field Test Time				
Hydrant	**Flow Device**	**Nozzle Size**	**Velocity Pressure**	**Flow**	**Start to Open**	**Fully Open**	**Residual**	**Start to Close**	**Fully Closed**
F1 - Nozzle 1	Diff	4 inches	24 psi	1,820 gpm	1:38	1:39	1:41	1:43	1:44
F1 - Nozzle 2									
F2 - Nozzle 1									
F2 - Nozzle 2									

Hydrant	**Static Pressure**		**Residual Pressure**	**Hydrant**	**Static Pressure**		**Residual Pressure**
	Initial	**Final**			**Initial**	**Final**	
Residual 1	87 psi	87 psi	72 psi	Residual 3			
Residual 2	88 psi	88 psi	80 psi	Residual 4			

System Conditions

Business Park Tower Level	20.7 feet	Summit Tower Level	5.6 feet
Everest Tower Level	17.2 feet		
Well 1 (Alta Verde)	Off	Well 5 (Bloedel)	Off
Well 3 (Mesker)	Off	Well 6 (Rippling Creek)	Off
Well 4 (Sternberg)	Off		

Location Map (not to scale)



FLOW AND PRESSURE TESTS
WESTON WATER UTILITY

Test Number: F-14 **Date & Time:** 10/2/2018 13:41 **Area:** Southwest

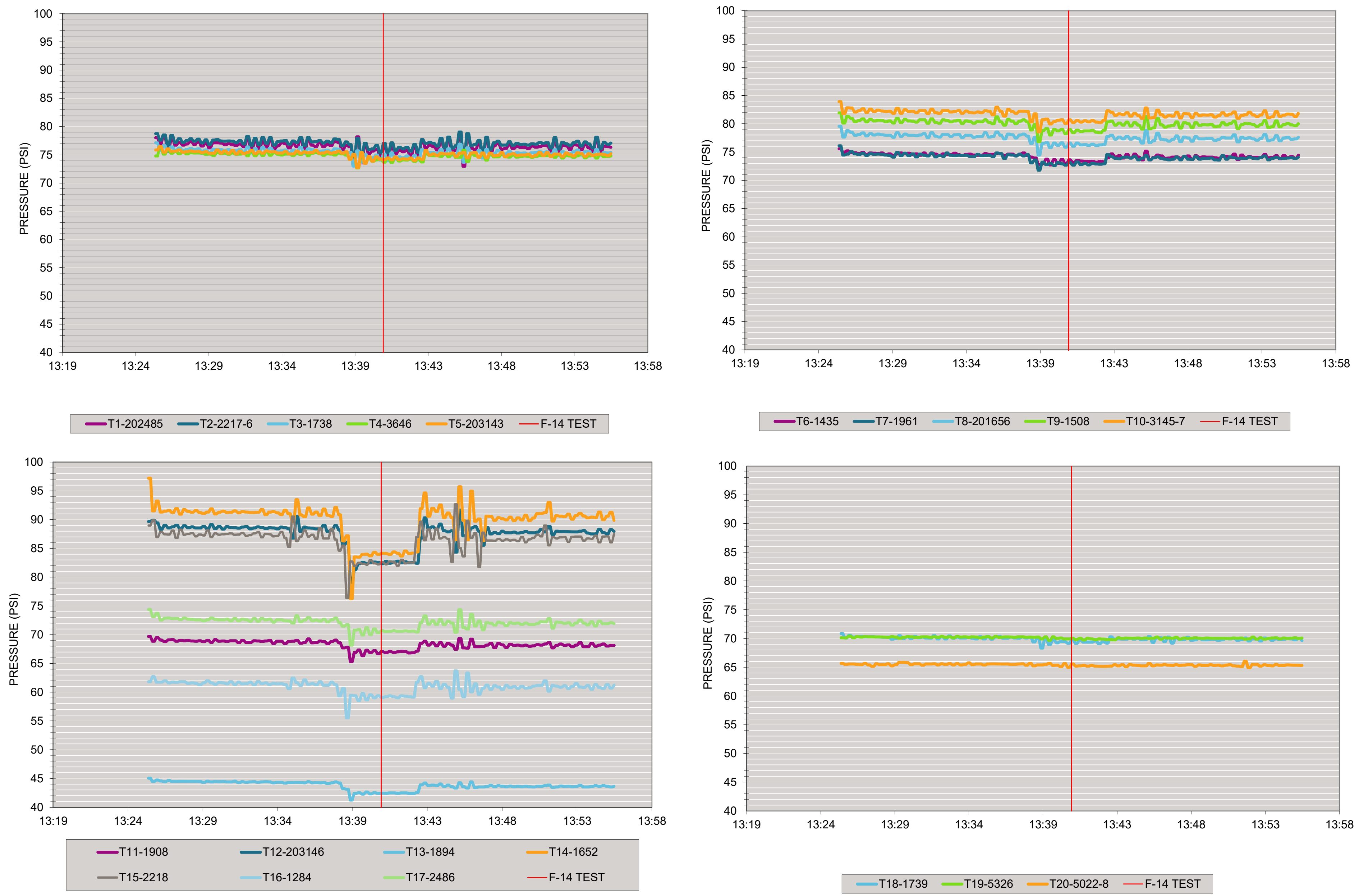
Pressure Recorder Locations

ID		Location	ID	Location
T1	2485	Rippling Creek Well	T21	
T2	2217	Corner of Sandy Lane and Ross Lane	T22	
T3	1738	Corner of Mesker Street and Ross Lane	T23	
T4	3646	Corner of Mesker Street and Sternberg	T24	
T5	3143	Water Treatment Plant	T25	
T6	1435	Corner of Von Kanel Street and Schofield Avenue	T26	
T7	1961	Corner of Camp Phillips Road and Schofield Avenue	T27	
T8	1656	Corner of Birch Street and Schofield Avenue	T28	
T9	1508	Alta Verde Well	T29	
T10	3145	Bloedel Well	T30	
T11	1908	Corner of Highland Avenue and Alta Verde Street	T31	
T12	3146	On Volkman, south of Weston	T32	
T13	1894	Close to Summit Avenue Tower	T33	
T14	1652	On Shorey Avenue north of Cedar Creek	T34	
T15	2218	Corner of Camp Phillips Road and Shorey Avenue	T35	
T16	1284	Corner of Weston Avenue and Camp Phillips Road	T36	
T17	2486	Corner of Birch Street and Highway 29	T37	
T18	1739	Corner of Tiegen Lanr and Schofield Avenue	T38	
T19	5326	Close to Business Park Tower	T39	
T20	5022	Far East of Business Park, near Business Park Tower	T40	

Pressure Data

ID		Static Pressure		Residual Pressure	ID	Static Pressure		Residual Pressure
		Initial	Final			Initial	Final	
T1	2485	77 psi	77 psi	76 psi	T21			
T2	2217	77 psi	77 psi	76 psi	T22			
T3	1738	76 psi	76 psi	75 psi	T23			
T4	3646	75 psi	75 psi	74 psi	T24			
T5	3143	75 psi	75 psi	74 psi	T25			
T6	1435	74 psi	74 psi	73 psi	T26			
T7	1961	74 psi	74 psi	73 psi	T27			
T8	1656	78 psi	78 psi	76 psi	T28			
T9	1508	80 psi	80 psi	79 psi	T29			
T10	3145	82 psi	82 psi	80 psi	T30			
T11	1908	69 psi	69 psi	67 psi	T31			
T12	3146	89 psi	89 psi	82 psi	T32			
T13	1894	44 psi	44 psi	42 psi	T33			
T14	1652	91 psi	91 psi	84 psi	T34			
T15	2218	87 psi	87 psi	82 psi	T35			
T16	1284	61 psi	61 psi	59 psi	T36			
T17	2486	73 psi	73 psi	71 psi	T37			
T18	1739	70 psi	70 psi	69 psi	T38			
T19	5326	70 psi	70 psi	70 psi	T39			
T20	5022	65 psi	65 psi	65 psi	T40			

C:\OneDrive\AECOM Directory\60580895_Weston Master Plan Project - General\400_Technical\453_Water\Field_Work\Telogs\[Weston_Telog_Graphs_2.xlsx]F-(14)



AECOM

FIGURE F-14
PRESSURE MONITORING LOCATIONS
VILLAGE OF WESTON, WISCONSIN

DATA FROM 10/2/2018

60580895

FLOW AND PRESSURE TESTS
WESTON WATER UTILITY

Test Number: F-15 **Date & Time:** 10/2/2018 13:19 **Area:** South

Flowing Hydrant(s)

Location(s):
F1 32-016
F2

Residual Hydrant(s)

Location(s):
R1 32-026
R2 32-024
R3

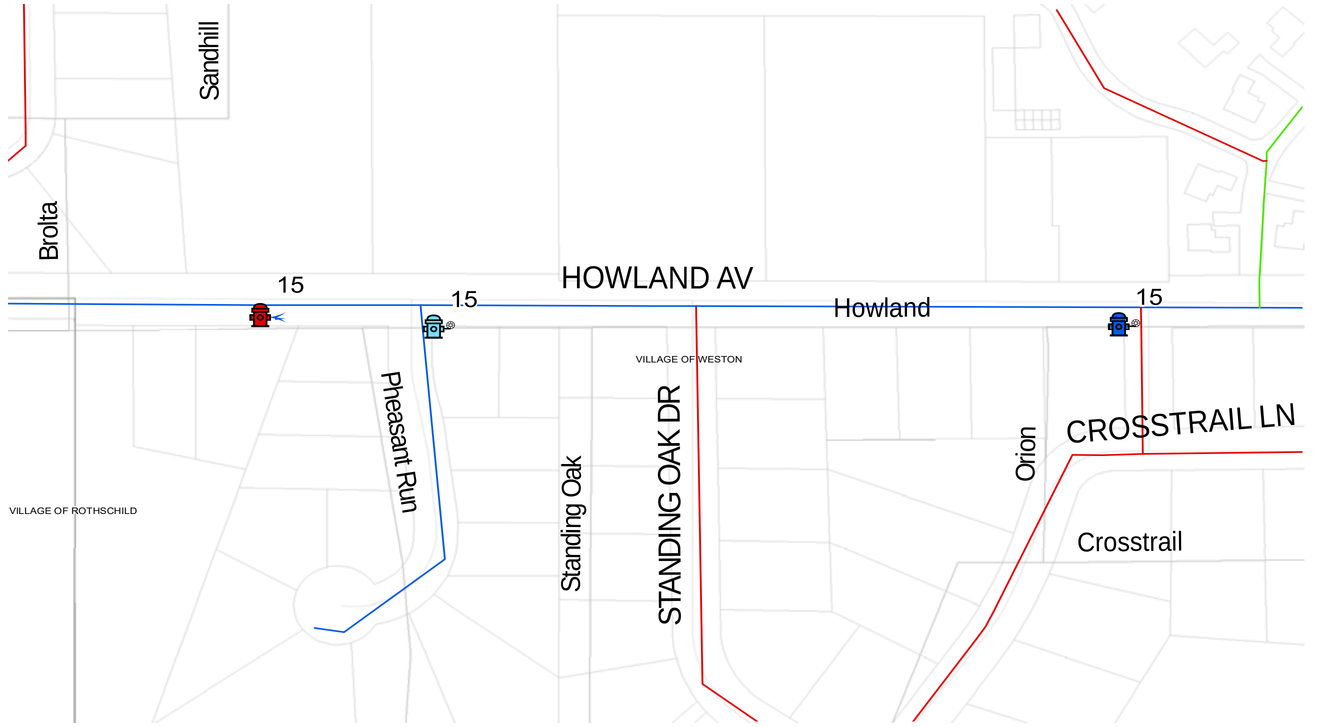
Field Flow Data					Field Test Time				
Hydrant	**Flow Device**	**Nozzle Size**	**Velocity Pressure**	**Flow**	**Start to Open**	**Fully Open**	**Residual**	**Start to Close**	**Fully Closed**
F1 - Nozzle 1	Diff	4 inches	23 psi	1,790 gpm	1:18	1:19	1:22	1:24	1:25
F1 - Nozzle 2									
F2 - Nozzle 1									
F2 - Nozzle 2									

Hydrant	**Static Pressure**		**Residual Pressure**	**Hydrant**	**Static Pressure**		**Residual Pressure**
	Initial	**Final**			**Initial**	**Final**	
Residual 1	81 psi	81 psi	58 psi	Residual 3			
Residual 2	75 psi	75 psi	58 psi	Residual 4			

System Conditions

Business Park Tower Level	21.0 feet	Summit Tower Level	9.0 feet
Everest Tower Level	18.5 feet		
Well 1 (Alta Verde)	Off	Well 5 (Bloedel)	Off
Well 3 (Mesker)	Off	Well 6 (Rippling Creek)	Off
Well 4 (Sternberg)	Off		

Location Map (not to scale)



FLOW AND PRESSURE TESTS
WESTON WATER UTILITY

Test Number: F-15 **Date & Time:** 10/2/2018 13:19 **Area:** South

Pressure Recorder Locations

	ID	Location	ID	Location
T1	2485	Rippling Creek Well	T21	
T2	2217	Corner of Sandy Lane and Ross Lane	T22	
T3	1738	Corner of Mesker Street and Ross Lane	T23	
T4	3646	Corner of Mesker Street and Sternberg	T24	
T5	3143	Water Treatment Plant	T25	
T6	1435	Corner of Von Kanel Street and Schofield Avenue	T26	
T7	1961	Corner of Camp Phillips Road and Schofield Avenue	T27	
T8	1656	Corner of Birch Street and Schofield Avenue	T28	
T9	1508	Alta Verde Well	T29	
T10	3145	Bloedel Well	T30	
T11	1908	Corner of Highland Avenue and Alta Verde Street	T31	
T12	3146	On Volkman, south of Weston	T32	
T13	1894	Close to Summit Avenue Tower	T33	
T14	1652	On Shorey Avenue north of Cedar Creek	T34	
T15	2218	Corner of Camp Phillips Road and Shorey Avenue	T35	
T16	1284	Corner of Weston Avenue and Camp Phillips Road	T36	
T17	2486	Corner of Birch Street and Highway 29	T37	
T18	1739	Corner of Tiegen Lanr and Schofield Avenue	T38	
T19	5326	Close to Business Park Tower	T39	
T20	5022	Far East of Business Park, near Business Park Tower	T40	

Pressure Data

ID		Static Pressure		Residual Pressure	ID	Static Pressure		Residual Pressure
		Initial	Final			Initial	Final	
T1	2485	77 psi	77 psi	75 psi	T21			
T2	2217	78 psi	78 psi	76 psi	T22			
T3	1738	76 psi	76 psi	74 psi	T23			
T4	3646	76 psi	76 psi	74 psi	T24			
T5	3143	76 psi	76 psi	74 psi	T25			
T6	1435	75 psi	75 psi	73 psi	T26			
T7	1961	75 psi	75 psi	73 psi	T27			
T8	1656	79 psi	79 psi	77 psi	T28			
T9	1508	81 psi	81 psi	79 psi	T29			
T10	3145	83 psi	83 psi	81 psi	T30			
T11	1908	69 psi	69 psi	67 psi	T31			
T12	3146	90 psi	90 psi	86 psi	T32			
T13	1894	45 psi	45 psi	43 psi	T33			
T14	1652	92 psi	92 psi	82 psi	T34			
T15	2218	88 psi	88 psi	77 psi	T35			
T16	1284	62 psi	62 psi	58 psi	T36			
T17	2486	73 psi	73 psi	70 psi	T37			
T18	1739	70 psi	70 psi	69 psi	T38			
T19	5326	70 psi	70 psi	70 psi	T39			
T20	5022	65 psi	65 psi	65 psi	T40			

C:\OneDrive\AECOM Directory\60580895_Weston Master Plan Project - General\400_Technical\453_Water\Field_Work\Telogs\[Weston_Telog_Graphs_2.xlsx]F-(15)

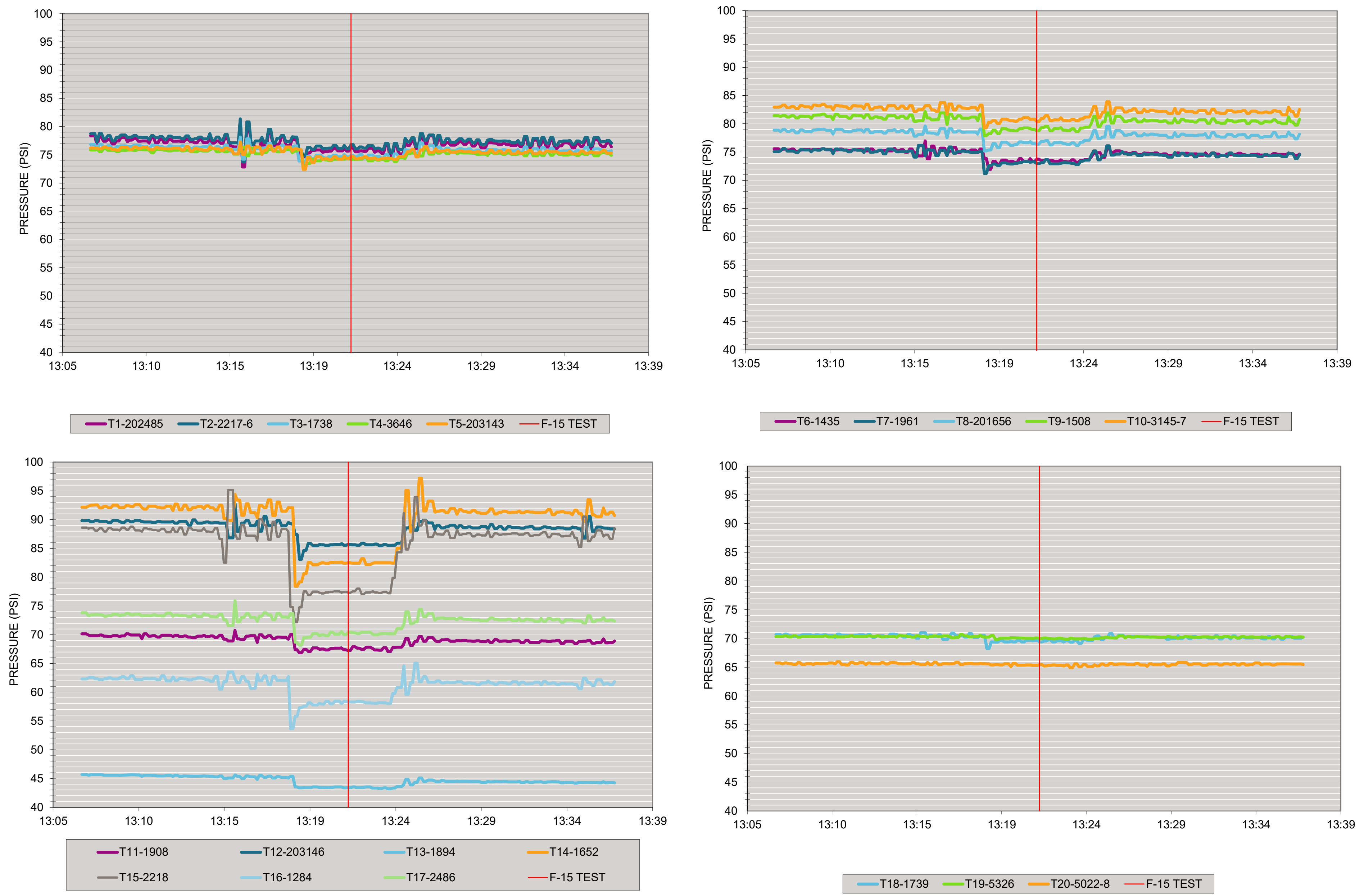


FIGURE F-15
PRESSURE MONITORING LOCATIONS
VILLAGE OF WESTON, WISCONSIN

DATA FROM 10/2/2018 60580895

FLOW AND PRESSURE TESTS
WESTON WATER UTILITY

Test Number: F-16 **Date & Time:** 10/2/2018 16:39 **Area:** Central

Flowing Hydrant(s)

Location(s): F1 16-025
F2

Residual Hydrant(s)

Location(s): R1 16-024
R2 16-023
R3

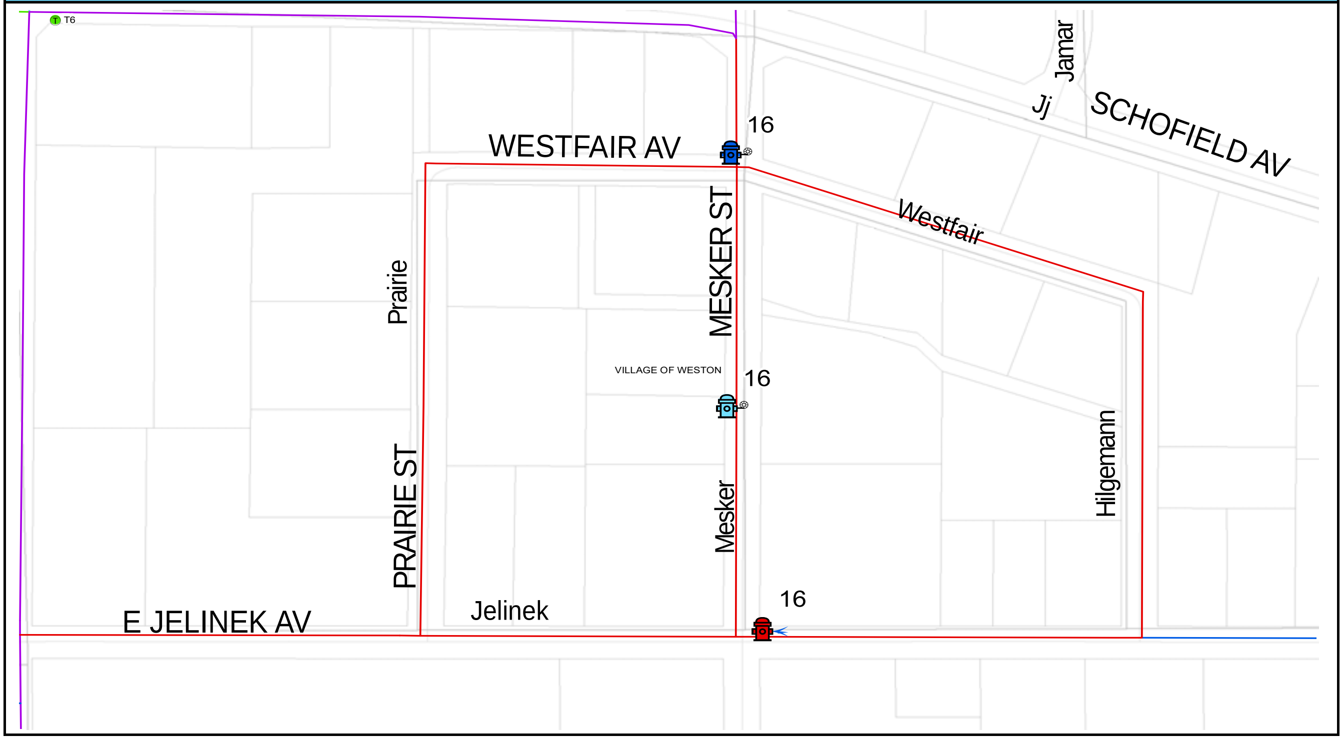
Field Flow Data					Field Test Time				
Hydrant	**Flow Device**	**Nozzle Size**	**Velocity Pressure**	**Flow**	**Start to Open**	**Fully Open**	**Residual**	**Start to Close**	**Fully Closed**
F1 - Nozzle 1	Diff	4 inches	23 psi	1,790 gpm	4:36	4:37	4:39	4:41	4:42
F1 - Nozzle 2									
F2 - Nozzle 1									
F2 - Nozzle 2									

Hydrant	**Static Pressure**		**Residual Pressure**	**Hydrant**	**Static Pressure**		**Residual Pressure**
	Initial	**Final**			**Initial**	**Final**	
Residual 1	75 psi	75 psi	61 psi	Residual 3			
Residual 2	74 psi	74 psi	67 psi	Residual 4			

System Conditions

Business Park Tower Level	21.3 feet	Summit Tower Level	8.2 feet
Everest Tower Level	16.8 feet		
Well 1 (Alta Verde)	Off	Well 5 (Bloedel)	Off
Well 3 (Mesker)	Off	Well 6 (Rippling Creek)	Off
Well 4 (Sternberg)	Off		

Location Map (not to scale)



FLOW AND PRESSURE TESTS
WESTON WATER UTILITY

Test Number: F-16 **Date & Time:** 10/2/2018 16:39 **Area:** Central

Pressure Recorder Locations

ID		Location	ID	Location
T1	2485	Rippling Creek Well	T21	
T2	2217	Corner of Sandy Lane and Ross Lane	T22	
T3	1738	Corner of Mesker Street and Ross Lane	T23	
T4	3646	Corner of Mesker Street and Sternberg	T24	
T5	3143	Water Treatment Plant	T25	
T6	1435	Corner of Von Kanel Street and Schofield Avenue	T26	
T7	1961	Corner of Camp Phillips Road and Schofield Avenue	T27	
T8	1656	Corner of Birch Street and Schofield Avenue	T28	
T9	1508	Alta Verde Well	T29	
T10	3145	Bloedel Well	T30	
T11	1908	Corner of Highland Avenue and Alta Verde Street	T31	
T12	3146	On Volkman, south of Weston	T32	
T13	1894	Close to Summit Avenue Tower	T33	
T14	1652	On Shorey Avenue north of Cedar Creek	T34	
T15	2218	Corner of Camp Phillips Road and Shorey Avenue	T35	
T16	1284	Corner of Weston Avenue and Camp Phillips Road	T36	
T17	2486	Corner of Birch Street and Highway 29	T37	
T18	1739	Corner of Tiegen Lanr and Schofield Avenue	T38	
T19	5326	Close to Business Park Tower	T39	
T20	5022	Far East of Business Park, near Business Park Tower	T40	

Pressure Data

ID		Static Pressure		Residual Pressure	ID	Static Pressure		Residual Pressure
		Initial	Final			Initial	Final	
T1	2485	77 psi	77 psi	75 psi	T21			
T2	2217	78 psi	78 psi	75 psi	T22			
T3	1738	76 psi	76 psi	74 psi	T23			
T4	3646	76 psi	76 psi	73 psi	T24			
T5	3143	76 psi	76 psi	73 psi	T25			
T6	1435	75 psi	75 psi	73 psi	T26			
T7	1961	75 psi	75 psi	73 psi	T27			
T8	1656	78 psi	78 psi	76 psi	T28			
T9	1508	81 psi	81 psi	79 psi	T29			
T10	3145	83 psi	83 psi	81 psi	T30			
T11	1908	69 psi	69 psi	68 psi	T31			
T12	3146	89 psi	89 psi	88 psi	T32			
T13	1894	45 psi	45 psi	44 psi	T33			
T14	1652	92 psi	92 psi	91 psi	T34			
T15	2218	88 psi	88 psi	86 psi	T35			
T16	1284	62 psi	62 psi	60 psi	T36			
T17	2486	73 psi	73 psi	71 psi	T37			
T18	1739	71 psi	71 psi	69 psi	T38			
T19	5326	71 psi	71 psi	70 psi	T39			
T20	5022	66 psi	66 psi	65 psi	T40			

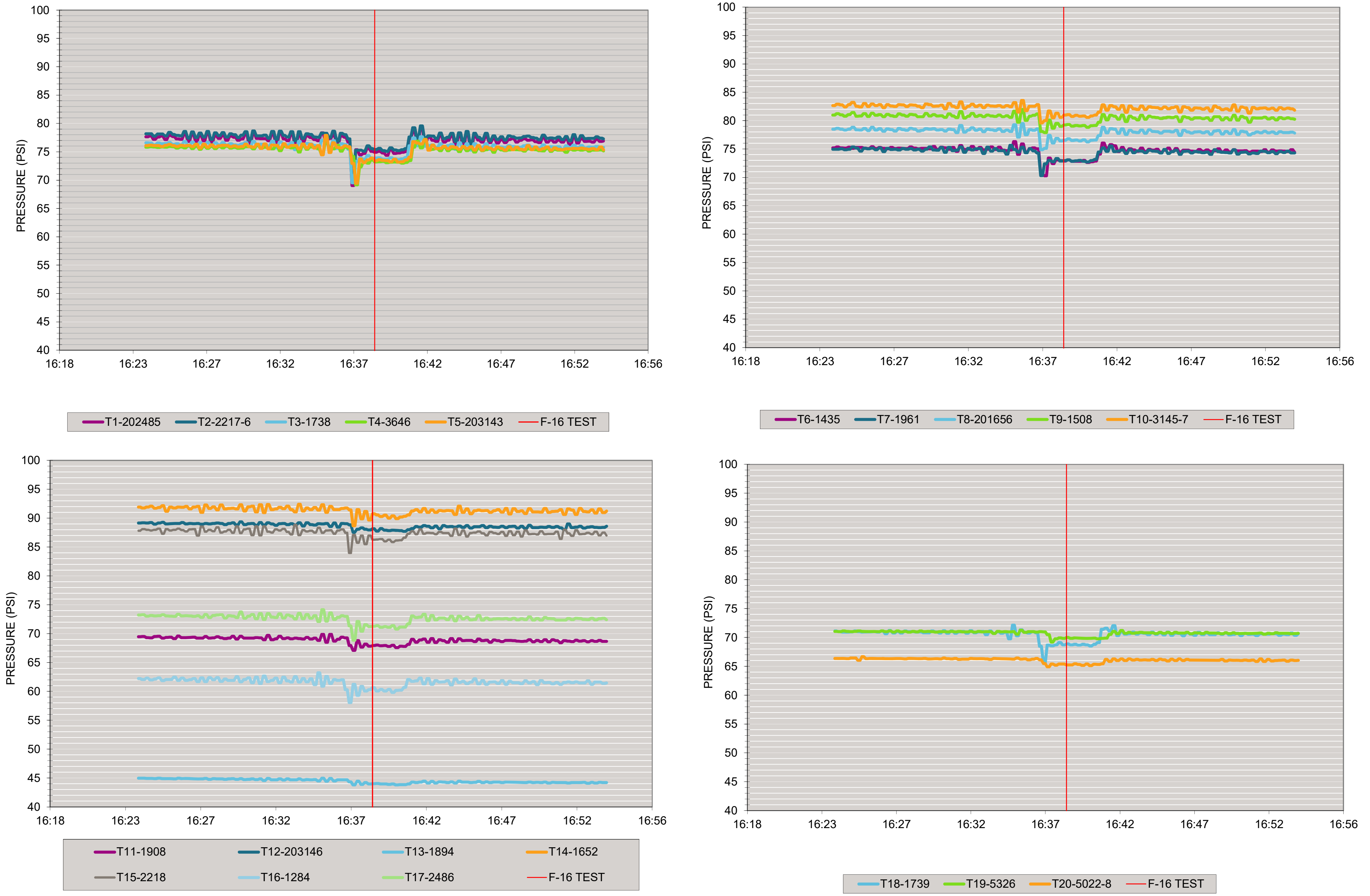


FIGURE F-16
PRESSURE MONITORING LOCATIONS
VILLAGE OF WESTON, WISCONSIN

DATA FROM 10/2/2018

60580895

FLOW AND PRESSURE TESTS
WESTON WATER UTILITY

Test Number: F-17 **Date & Time:** 10/2/2018 11:38 **Area:** East

Flowing Hydrant(s)

Location(s):
F1 15-032
F2 15-033

Residual Hydrant(s)

Location(s):
R1 15-034
R2 22-027
R3

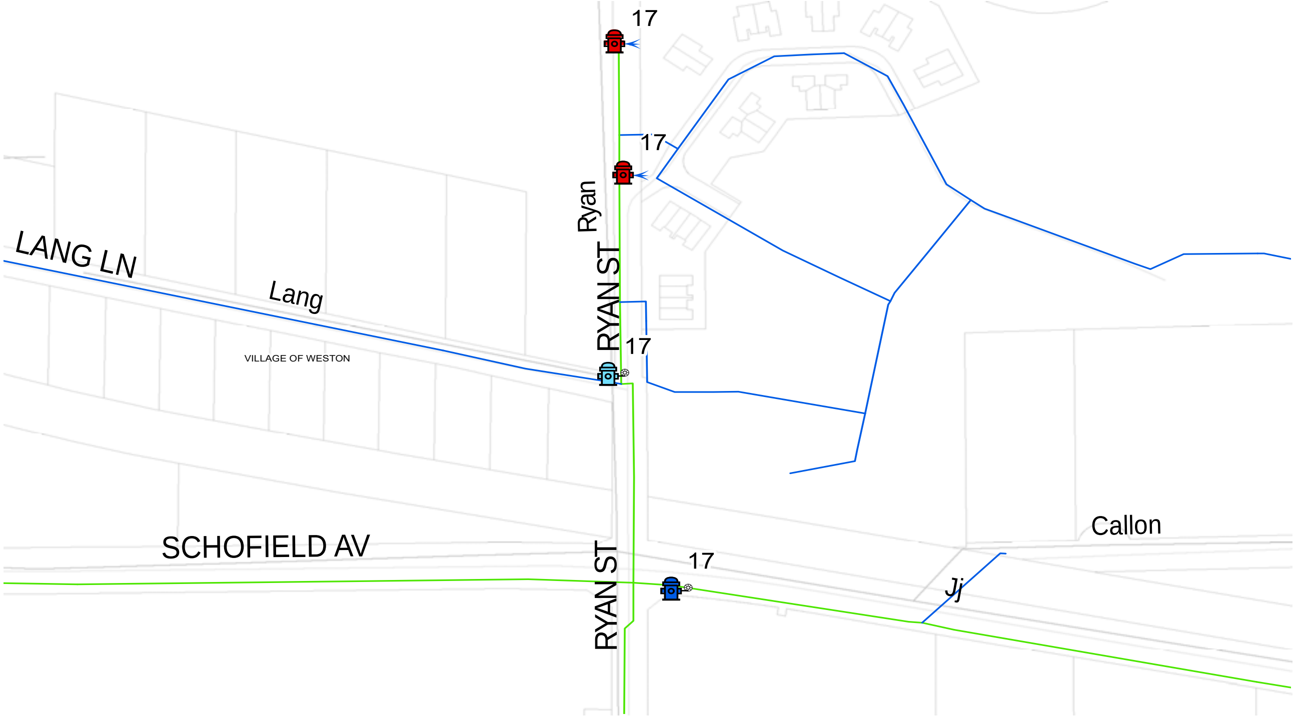
Field Flow Data					Field Test Time				
Hydrant	**Flow Device**	**Nozzle Size**	**Velocity Pressure**	**Flow**	**Start to Open**	**Fully Open**	**Residual**	**Start to Close**	**Fully Closed**
F1 - Nozzle 1	Diff	4 inches	26 psi	1,870 gpm	11:32	11:33	11:38	11:42	11:43
F1 - Nozzle 2									
F2 - Nozzle 1	FTK	2.3 inches	37 psi	920 gpm	11:33	11:34		11:44	11:47
F2 - Nozzle 2	FTK	2.3 inches	37 psi	920 gpm					

Hydrant	**Static Pressure**		**Residual Pressure**	**Hydrant**	**Static Pressure**		**Residual Pressure**
	Initial	**Final**			**Initial**	**Final**	
Residual 1	75 psi	75 psi	58 psi	Residual 3			
Residual 2	75 psi	75 psi	64 psi	Residual 4			

System Conditions

Business Park Tower Level	23.0 feet	Summit Tower Level	5.9 feet
Everest Tower Level	17.5 feet		
Well 1 (Alta Verde)	On	Well 5 (Bloedel)	On
Well 3 (Mesker)	On	Well 6 (Rippling Creek)	On
Well 4 (Sternberg)	On		

Location Map (not to scale)



FLOW AND PRESSURE TESTS

WESTON WATER UTILITY

Test Number: F-17 **Date & Time:** 10/2/2018 11:38 **Area:** East

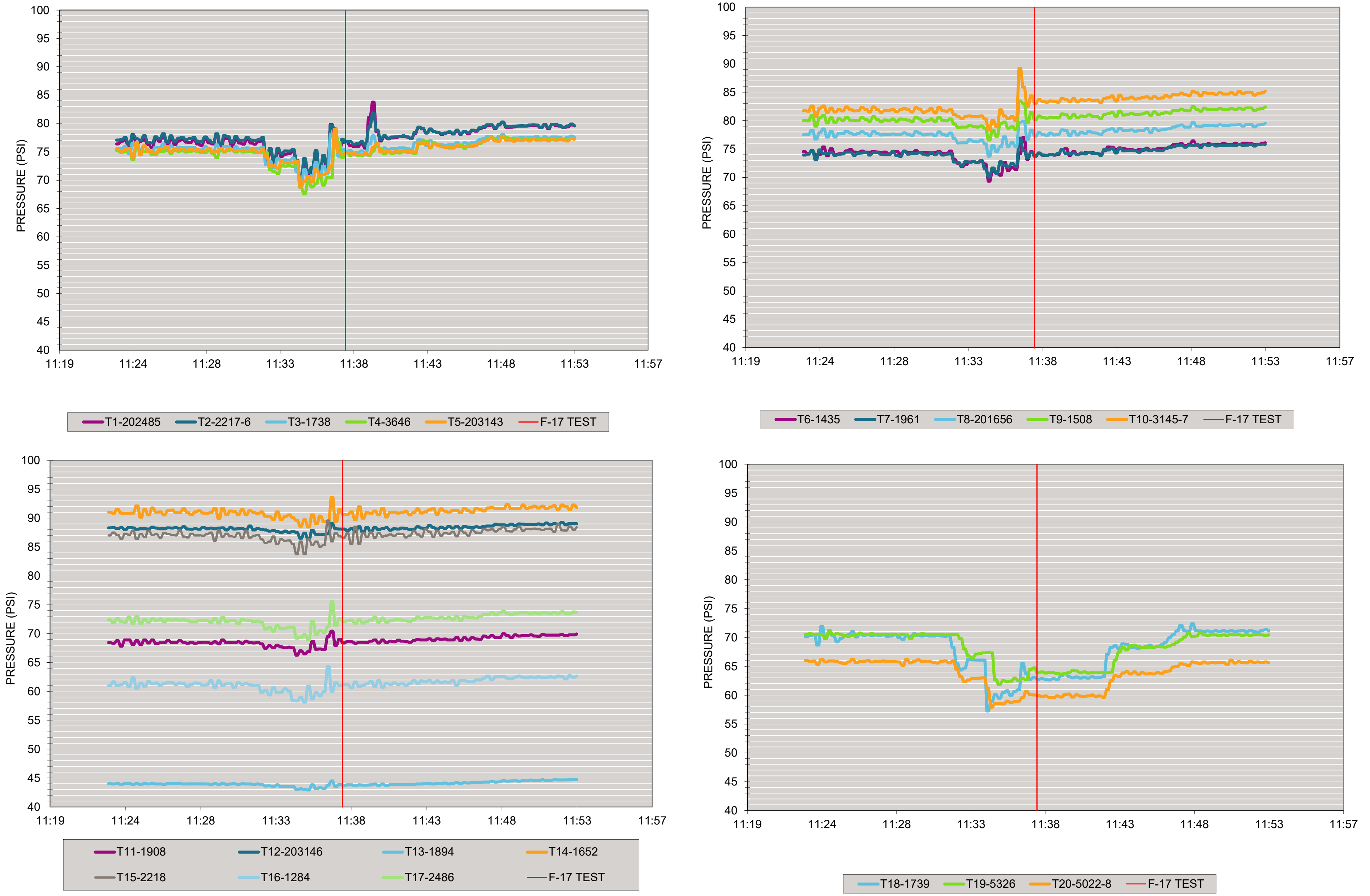
Pressure Recorder Locations

ID		Location	ID	Location
T1	2485	Rippling Creek Well	T21	
T2	2217	Corner of Sandy Lane and Ross Lane	T22	
T3	1738	Corner of Mesker Street and Ross Lane	T23	
T4	3646	Corner of Mesker Street and Sternberg	T24	
T5	3143	Water Treatment Plant	T25	
T6	1435	Corner of Von Kanel Street and Schofield Avenue	T26	
T7	1961	Corner of Camp Phillips Road and Schofield Avenue	T27	
T8	1656	Corner of Birch Street and Schofield Avenue	T28	
T9	1508	Alta Verde Well	T29	
T10	3145	Bloedel Well	T30	
T11	1908	Corner of Highland Avenue and Alta Verde Street	T31	
T12	3146	On Volkman, south of Weston	T32	
T13	1894	Close to Summit Avenue Tower	T33	
T14	1652	On Shorey Avenue north of Cedar Creek	T34	
T15	2218	Corner of Camp Phillips Road and Shorey Avenue	T35	
T16	1284	Corner of Weston Avenue and Camp Phillips Road	T36	
T17	2486	Corner of Birch Street and Highway 29	T37	
T18	1739	Corner of Tiegen Lanr and Schofield Avenue	T38	
T19	5326	Close to Business Park Tower	T39	
T20	5022	Far East of Business Park, near Business Park Tower	T40	

Pressure Data

ID		Static Pressure		Residual Pressure	ID	Static Pressure		Residual Pressure
		Initial	Final			Initial	Final	
T1	2485	79 psi	79 psi	76 psi	T21			
T2	2217	79 psi	79 psi	76 psi	T22			
T3	1738	77 psi	77 psi	75 psi	T23			
T4	3646	77 psi	77 psi	75 psi	T24			
T5	3143	77 psi	77 psi	75 psi	T25			
T6	1435	76 psi	76 psi	74 psi	T26			
T7	1961	76 psi	76 psi	74 psi	T27			
T8	1656	79 psi	79 psi	78 psi	T28			
T9	1508	82 psi	82 psi	81 psi	T29			
T10	3145	85 psi	85 psi	83 psi	T30			
T11	1908	68 psi	68 psi	68 psi	T31			
T12	3146	88 psi	88 psi	88 psi	T32			
T13	1894	44 psi	44 psi	44 psi	T33			
T14	1652	91 psi	91 psi	91 psi	T34			
T15	2218	87 psi	87 psi	86 psi	T35			
T16	1284	61 psi	61 psi	61 psi	T36			
T17	2486	72 psi	72 psi	72 psi	T37			
T18	1739	70 psi	70 psi	63 psi	T38			
T19	5326	70 psi	70 psi	64 psi	T39			
T20	5022	66 psi	66 psi	60 psi	T40			

C:\OneDrive\AECOM Directory\60580895_Weston Master Plan Project - General\400_Technical\453_Water\Field_Work\Telogs\[Weston_Telog_Graphs_2.xlsx]F-(17)



AECOM

FIGURE F-17
PRESSURE MONITORING LOCATIONS
VILLAGE OF WESTON, WISCONSIN

DATA FROM 10/2/2018

60580895

FLOW AND PRESSURE TESTS
WESTON WATER UTILITY

Test Number: F-18 **Date & Time:** 10/2/2018 12:11 **Area:** East

Flowing Hydrant(s)

Location(s):
F1 23-057
F2

Residual Hydrant(s)

Location(s):
R1 23-058
R2 23-017
R3

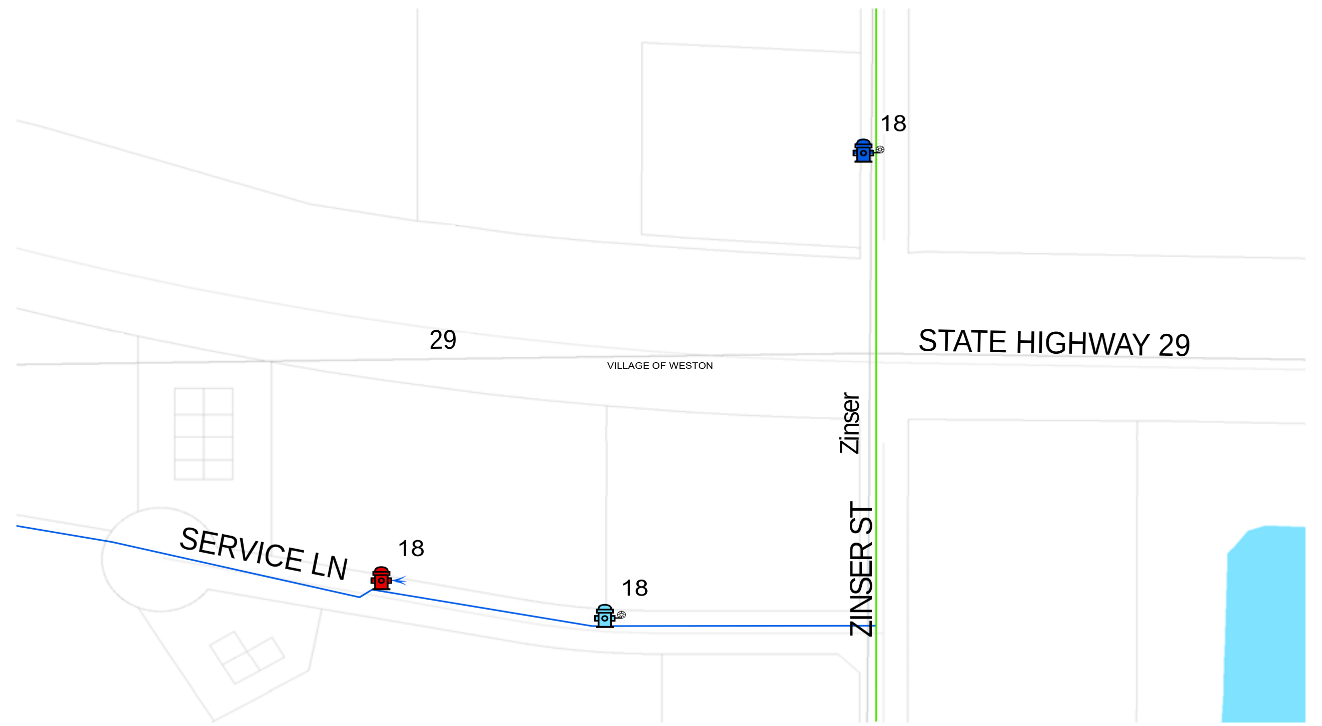
Field Flow Data					Field Test Time				
Hydrant	**Flow Device**	**Nozzle Size**	**Velocity Pressure**	**Flow**	**Start to Open**	**Fully Open**	**Residual**	**Start to Close**	**Fully Closed**
F1 - Nozzle 1	Diff	4 inches	18 psi	1,630 gpm	12:07	12:08	12:11	12:13	12:15
F1 - Nozzle 2									
F2 - Nozzle 1									
F2 - Nozzle 2									

Hydrant	**Static Pressure**		**Residual Pressure**	**Hydrant**	**Static Pressure**		**Residual Pressure**
	Initial	**Final**			**Initial**	**Final**	
Residual 1	67 psi	67 psi	52 psi	Residual 3			
Residual 2	67 psi	67 psi	64 psi	Residual 4			

System Conditions

Business Park Tower Level	22.5 feet	Summit Tower Level	9.4 feet
Everest Tower Level	20.0 feet		
Well 1 (Alta Verde)	On	Well 5 (Bloedel)	On
Well 3 (Mesker)	On	Well 6 (Rippling Creek)	On
Well 4 (Sternberg)	On		

Location Map (not to scale)



FLOW AND PRESSURE TESTS
WESTON WATER UTILITY

Test Number: F-18 **Date & Time:** 10/2/2018 12:11 **Area:** East

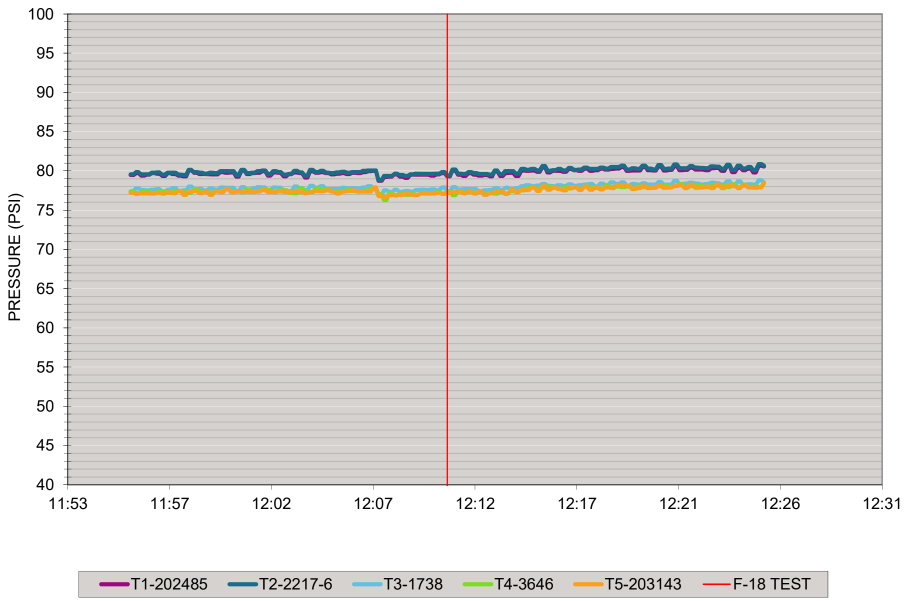
Pressure Recorder Locations

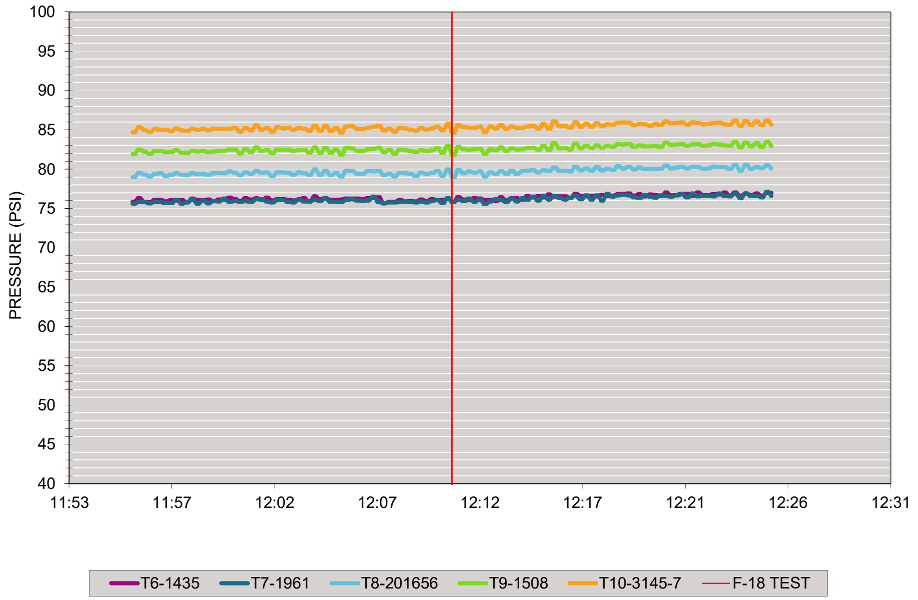
ID		Location	ID	Location
T1	2485	Rippling Creek Well	T21	
T2	2217	Corner of Sandy Lane and Ross Lane	T22	
T3	1738	Corner of Mesker Street and Ross Lane	T23	
T4	3646	Corner of Mesker Street and Sternberg	T24	
T5	3143	Water Treatment Plant	T25	
T6	1435	Corner of Von Kanel Street and Schofield Avenue	T26	
T7	1961	Corner of Camp Phillips Road and Schofield Avenue	T27	
T8	1656	Corner of Birch Street and Schofield Avenue	T28	
T9	1508	Alta Verde Well	T29	
T10	3145	Bloedel Well	T30	
T11	1908	Corner of Highland Avenue and Alta Verde Street	T31	
T12	3146	On Volkman, south of Weston	T32	
T13	1894	Close to Summit Avenue Tower	T33	
T14	1652	On Shorey Avenue north of Cedar Creek	T34	
T15	2218	Corner of Camp Phillips Road and Shorey Avenue	T35	
T16	1284	Corner of Weston Avenue and Camp Phillips Road	T36	
T17	2486	Corner of Birch Street and Highway 29	T37	
T18	1739	Corner of Tiegen Lanr and Schofield Avenue	T38	
T19	5326	Close to Business Park Tower	T39	
T20	5022	Far East of Business Park, near Business Park Tower	T40	

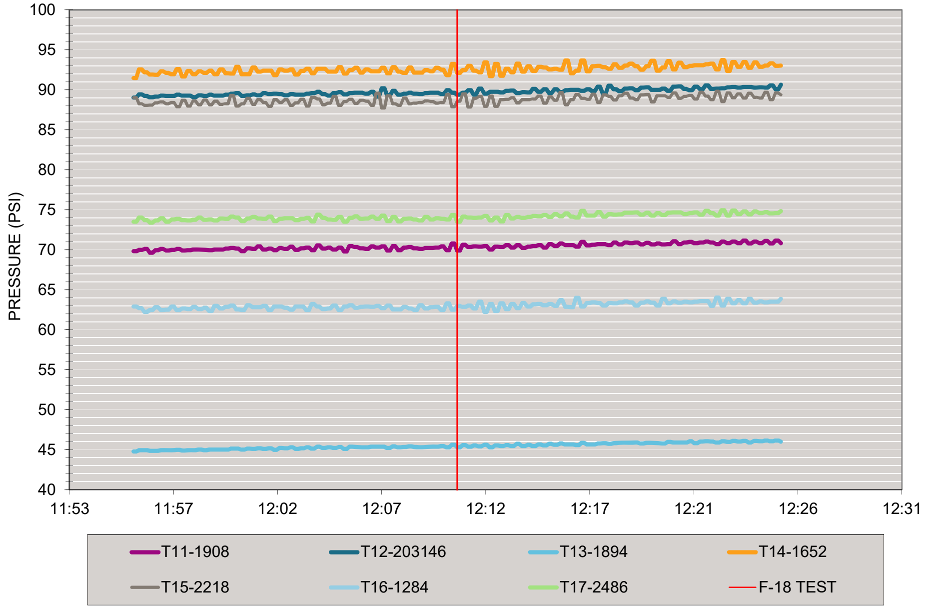
Pressure Data

ID		Static Pressure		Residual Pressure	ID	Static Pressure		Residual Pressure
		Initial	Final			Initial	Final	
T1	2485	80 psi	80 psi	80 psi	T21			
T2	2217	80 psi	80 psi	80 psi	T22			
T3	1738	78 psi	78 psi	77 psi	T23			
T4	3646	78 psi	78 psi	77 psi	T24			
T5	3143	78 psi	78 psi	77 psi	T25			
T6	1435	76 psi	76 psi	76 psi	T26			
T7	1961	76 psi	76 psi	76 psi	T27			
T8	1656	80 psi	80 psi	80 psi	T28			
T9	1508	83 psi	83 psi	83 psi	T29			
T10	3145	85 psi	85 psi	85 psi	T30			
T11	1908	70 psi	70 psi	70 psi	T31			
T12	3146	89 psi	89 psi	89 psi	T32			
T13	1894	45 psi	45 psi	45 psi	T33			
T14	1652	92 psi	92 psi	92 psi	T34			
T15	2218	88 psi	88 psi	88 psi	T35			
T16	1284	63 psi	63 psi	63 psi	T36			
T17	2486	79 psi	79 psi	74 psi	T37			
T18	1739	71 psi	71 psi	70 psi	T38			
T19	5326	71 psi	71 psi	69 psi	T39			
T20	5022	66 psi	66 psi	64 psi	T40			

C:\OneDrive\AECOM Directory\60580895_Weston Master Plan Project - General\400_Technical\453_Water\Field_Work\Telogs\[Weston_Telog_Graphs_2.xlsx]F-(18)







AECOM

FIGURE F-18
PRESSURE MONITORING LOCATIONS
VILLAGE OF WESTON, WISCONSIN

DATA FROM 10/2/2018

60580895

FLOW AND PRESSURE TESTS
WESTON WATER UTILITY

Test Number: F-19 **Date & Time:** 10/2/2018 12:42 **Area:** East

Flowing Hydrant(s)

Location(s):
F1 24-020
F2 24-021

Residual Hydrant(s)

Location(s):
R1 24-022
R2 24-024
R3

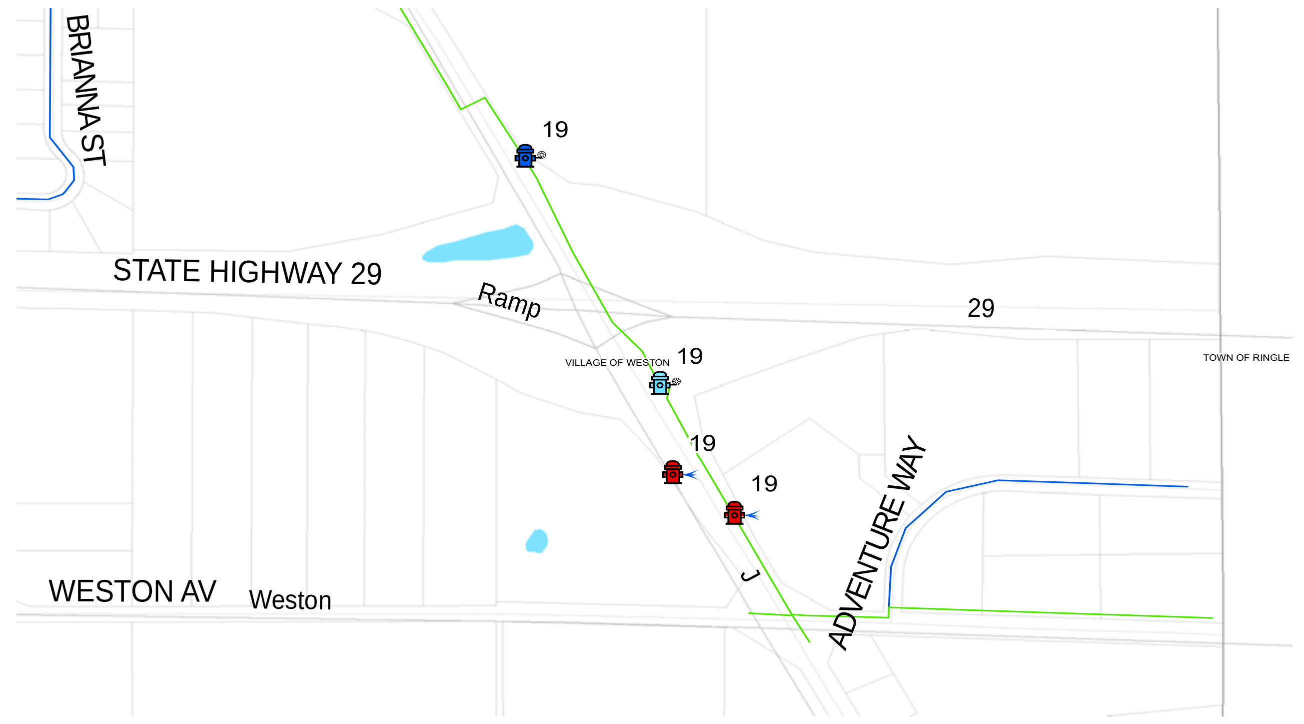
Field Flow Data					Field Test Time				
Hydrant	**Flow Device**	**Nozzle Size**	**Velocity Pressure**	**Flow**	**Start to Open**	**Fully Open**	**Residual**	**Start to Close**	**Fully Closed**
F1 - Nozzle 1	Diff	4 inches	10 psi	1,270 gpm	12:35	12:36	12:42	12:45	12:46
F1 - Nozzle 2									
F2 - Nozzle 1	FTK	2.3 inches	19 psi	660 gpm	12:38	12:39		12:48	12:50
F2 - Nozzle 2	FTK	2.3 inches	19 psi	660 gpm					

Hydrant	Static Pressure		Residual Pressure	Hydrant	Static Pressure		Residual Pressure
	Initial	**Final**			**Initial**	**Final**	
Residual 1	64 psi	64 psi	36 psi	Residual 3			
Residual 2	66 psi	66 psi	47 psi	Residual 4			

System Conditions

Business Park Tower Level	22.0 feet	Summit Tower Level	12.3 feet
Everest Tower Level	21.9 feet		
Well 1 (Alta Verde)	On	Well 5 (Bloedel)	On
Well 3 (Mesker)	On	Well 6 (Rippling Creek)	On
Well 4 (Sternberg)	On		

Location Map (not to scale)



FLOW AND PRESSURE TESTS

WESTON WATER UTILITY

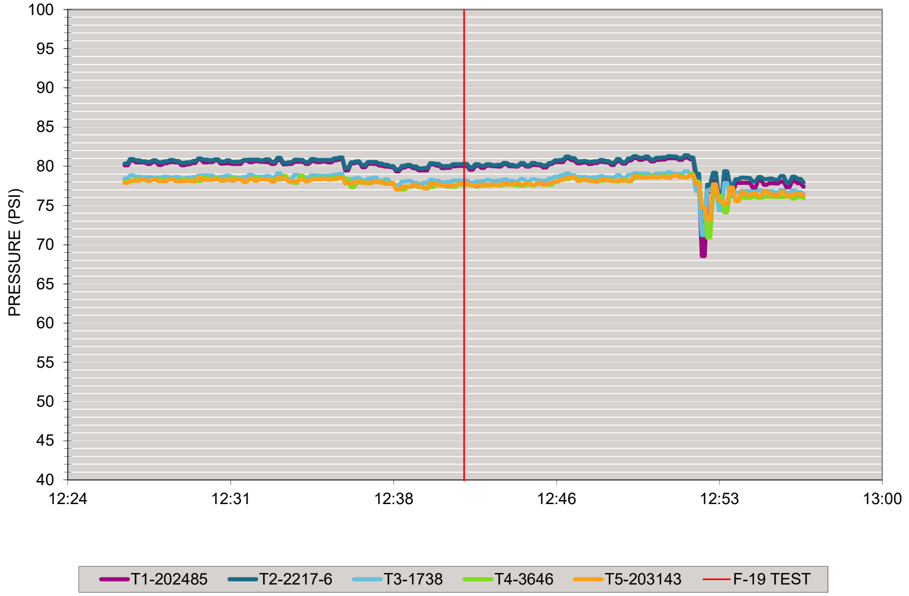
Test Number: F-19 **Date & Time:** 10/2/2018 12:42 **Area:** East

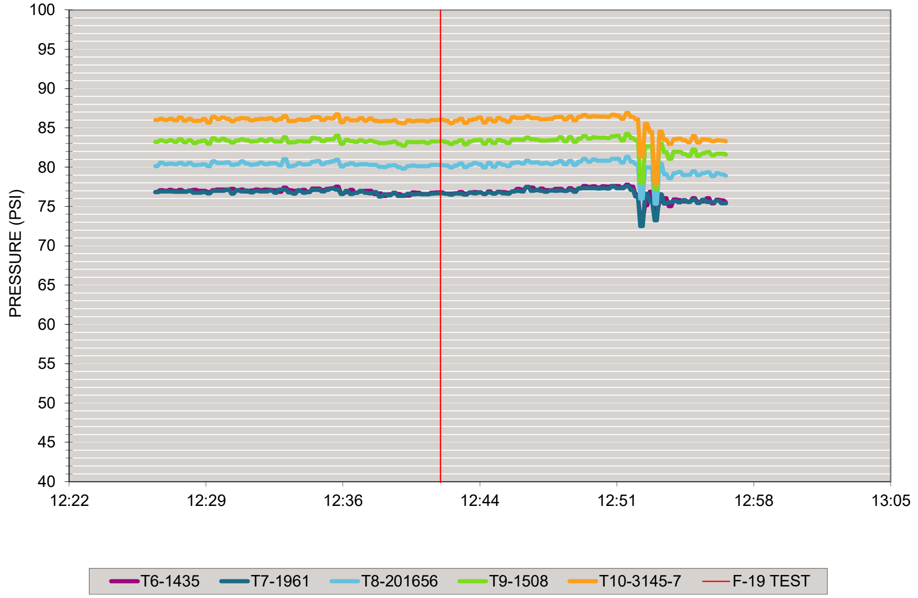
Pressure Recorder Locations

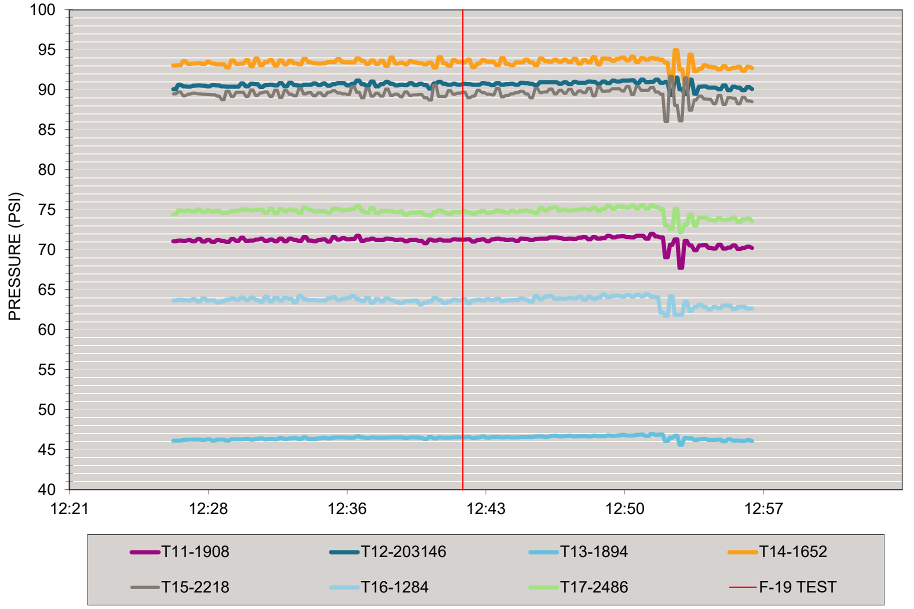
	ID	Location	ID	Location
T1	2485	Rippling Creek Well	T21	
T2	2217	Corner of Sandy Lane and Ross Lane	T22	
T3	1738	Corner of Mesker Street and Ross Lane	T23	
T4	3646	Corner of Mesker Street and Sternberg	T24	
T5	3143	Water Treatment Plant	T25	
T6	1435	Corner of Von Kanel Street and Schofield Avenue	T26	
T7	1961	Corner of Camp Phillips Road and Schofield Avenue	T27	
T8	1656	Corner of Birch Street and Schofield Avenue	T28	
T9	1508	Alta Verde Well	T29	
T10	3145	Bloedel Well	T30	
T11	1908	Corner of Highland Avenue and Alta Verde Street	T31	
T12	3146	On Volkman, south of Weston	T32	
T13	1894	Close to Summit Avenue Tower	T33	
T14	1652	On Shorey Avenue north of Cedar Creek	T34	
T15	2218	Corner of Camp Phillips Road and Shorey Avenue	T35	
T16	1284	Corner of Weston Avenue and Camp Phillips Road	T36	
T17	2486	Corner of Birch Street and Highway 29	T37	
T18	1739	Corner of Tiegen Lanr and Schofield Avenue	T38	
T19	5326	Close to Business Park Tower	T39	
T20	5022	Far East of Business Park, near Business Park Tower	T40	

Pressure Data

ID		Static Pressure		Residual Pressure	ID	Static Pressure		Residual Pressure
		Initial	Final			Initial	Final	
T1	2485	81 psi	81 psi	80 psi	T21			
T2	2217	81 psi	81 psi	80 psi	T22			
T3	1738	79 psi	79 psi	78 psi	T23			
T4	3646	79 psi	79 psi	78 psi	T24			
T5	3143	79 psi	79 psi	78 psi	T25			
T6	1435	77 psi	77 psi	77 psi	T26			
T7	1961	77 psi	77 psi	77 psi	T27			
T8	1656	80 psi	80 psi	80 psi	T28			
T9	1508	83 psi	83 psi	83 psi	T29			
T10	3145	86 psi	86 psi	86 psi	T30			
T11	1908	71 psi	71 psi	71 psi	T31			
T12	3146	91 psi	91 psi	91 psi	T32			
T13	1894	46 psi	46 psi	46 psi	T33			
T14	1652	93 psi	93 psi	93 psi	T34			
T15	2218	90 psi	90 psi	90 psi	T35			
T16	1284	64 psi	64 psi	64 psi	T36			
T17	2486	75 psi	75 psi	75 psi	T37			
T18	1739	72 psi	72 psi	69 psi	T38			
T19	5326	71 psi	71 psi	67 psi	T39			
T20	5022	66 psi	66 psi	56 psi	T40			







AECOM

FIGURE F-19
PRESSURE MONITORING LOCATIONS
VILLAGE OF WESTON, WISCONSIN

DATA FROM 10/2/2018 60580895

Appendix I

Model Calibration

Model Calibration

Calibration of a water system model is required to ensure that the results obtained from the hydraulic model simulations reliably reflect actual system operating characteristics. The calibration of the Weston hydraulic model was performed under both steady-state simulations (micro calibration) and extended period simulations (EPS) (macro calibration). The steady-state model simulations were performed to replicate the results from the flow and pressure testing. The extended period model simulations were performed to replicate the results from the extended period flow and pressure monitoring. The following sections discuss the results of the steady-state micro calibration and the results of the extended period macro calibration.

Target Calibration Criteria

The goal of model calibration is to minimize the error between field test data and model simulations and create a “best fit” throughout the system. Some difference between field tests and model simulations are therefore expected. However, limits to the amount of allowable error must also be made to ensure the calibrated model is a reasonably accurate representation of the actual water distribution system and can be used with confidence to evaluate system deficiencies and improvement to the water distribution system.

The operation and performance of a water distribution system depends on the interaction of many variables that determine flow and pressure available to customers throughout the water system.

The following items are examples of factors which may complicate precise hydraulic model duplication of field results during calibration:

- Pump curves – Manufacturer pump curve may not precisely represent the current operation of the pump.
- Unknown closed or partially closed valves.
- Variation of C-factors– The model assumes a consistent relationship between material, age, and diameter of pipe; however, some individual pipes may not follow this assumption.
- Inaccurate system mapping – This is minimized by using the current GIS, but inaccuracies still may exist that can affect model calibration.

Therefore, precise duplication of the field testing results during model calibration is unrealistic; however, AECOM developed target model calibration criteria to use a guideline. The target model calibration criteria were established with the goal of using the hydraulic model for capital improvement planning.

Generally, the water industry in the United States has not developed nor published guidelines for the calibration of water distribution system models. This is understandable as each water system has unique characteristics and models are used for a range of purposes that have different levels of required calibration. For many years, hydraulic models were determined to be calibrated based on the judgment of the individuals calibrating the model. Historically, general statements have been made such as the “model is calibrated.” Such statements, although reassuring, do not quantify the accuracy of the overall model calibration. The AWWA Manual M32, *Computer Modeling of Water Distribution Systems*, Fourth Edition includes some general model calibration guidelines; however, stated there are no established standards for hydraulic calibration. It states the real guideline for determining if a model is calibrated appropriately is whether the end result is capable of supporting the decisions to be made. AWWA Manual M32 references general guidelines that include hydraulic grade lines (HGL) predicted by the model within 5 to 10 feet (2.2 to 4.3 psi) of those recorded in the field and water level fluctuations predicted by the model should be within 3 to 6 feet of those recorded in the field.

AECOM has developed target calibration criteria based on over 20 years of experience in calibrating hydraulic models. The target calibration criteria are established prior to beginning the model calibration efforts. Where model calibration to the target levels is not achieved, AECOM provides an opinion on the impact on using the hydraulic model for the desired purpose and the cost of achieving the target model calibration. AECOM's target accuracy for steady state calibration for the water system model is summarized in Table 1.

TABLE 1: SUMMARY OF TARGET STEADY STATE CALIBRATION ACCURACY CRITERIA

Parameter	Deviation[1]	Target Acceptance
Static Pressure	3 psi	90 percent
Pressure Differential (pressure drop greater than 10 psi)[2]	5 psi	80 percent
Pressure Differential (pressure drop less than or equal to 10 psi)[2]	2 psi	
Simulated Hydrant Flow	10 percent of field recorded	100 percent

Footnotes:

[1] Deviation between field data and model simulations.

[2] Measured at hydrants during flow testing.

Note: Refer to Glossary of Terms for definition of terms.

The target accuracy of extended period calibration for the model is summarized in Table 2.

TABLE 2: SUMMARY OF TARGET EXTENDED PERIOD CALIBRATION ACCURACY CRITERIA

Parameter	Deviation[1]	Target Acceptance
Pressure Difference	3 psi	70 percent
Pressure Difference	5 psi	85 percent
Pressure Difference	8 psi	100 percent
Tank Levels	3 feet	70 percent
Tank Levels	5 feet	85 percent
Tank Levels	8 feet	100 percent
Flow Rate	15 percent	80 percent

Footnote:

[1] Deviation between field data and model simulations.

Note: EPS duration equal to 24 hours.

Achieving the desired level of accuracy for the extended period calibration is often difficult due to the dynamic nature of extended period analysis. Precise duplication of actual water demands is complicated; therefore, some amount of error in the simulation results is inevitable. The purpose of establishing extended period calibration criteria is to provide a basis for the confidence of the overall extended period calibration. The stepwise criteria (for example, three criteria for pressure difference with increasing target percentages as the pressure difference increases) allows for some amount of inconsistency, while maintaining defined accuracy criteria. AECOM has used this or similar target accuracy levels for several projects and has presented these target accuracy guidelines nationally at the American Water Works Association (AWWA) annual conference.

Steady State Calibration

Steady state (micro) calibration is performed by comparing flow and pressure test data with the hydraulic model simulations. Based on this comparison, key hydraulic parameters are adjusted until the model simulated results and field data agree within accepted tolerances. The main adjustment to the hydraulic model during steady state calibration is to the water main friction coefficient (Hazen Williams C-factor). In this process C-factors are adjusted throughout the hydraulic model based on water main age, material, and diameter. It is important to have a consistent approach to adjusting C-factors to all pipes so that the global calibration or "best fit" calibration is achieved rather than only achieving calibration in the vicinity of field tests.

Two model simulations were performed for each field test, one during no hydrant flow (static) conditions and one during hydrant flowing (dynamic) conditions. The static condition simulates the water system during normal operating conditions, while the dynamic condition simulates the water system during the stressed (high flow condition) of flowing a hydrant. While the individual pressures under both static and dynamic conditions are important, the general criterion for model calibration is to match the pressure drop for each test location (the difference between static and dynamic pressure). The steady state calibration process provides confidence that the hydraulic model can accurately simulate static and dynamic conditions throughout the water system.

Calibration Data

Field testing for the steady state calibration of the hydraulic model was conducted on October 2, 2018. For each test, pressure drops (the difference in pressure between static and flowing conditions) were measured at both the residual hydrants (R1 and R2), as well as at each continuous pressure recorder location. Flow and pressure test results were compared to model simulation results under the same operating conditions.

Calibration Results

During calibration several simulations were performed while adjusting C-factors globally (the same throughout the model) and flow rates within target criteria and good model calibration was achieved in the entire Main System as summarized in Table 3. Figure 1 summarizes the model calibration accuracy.

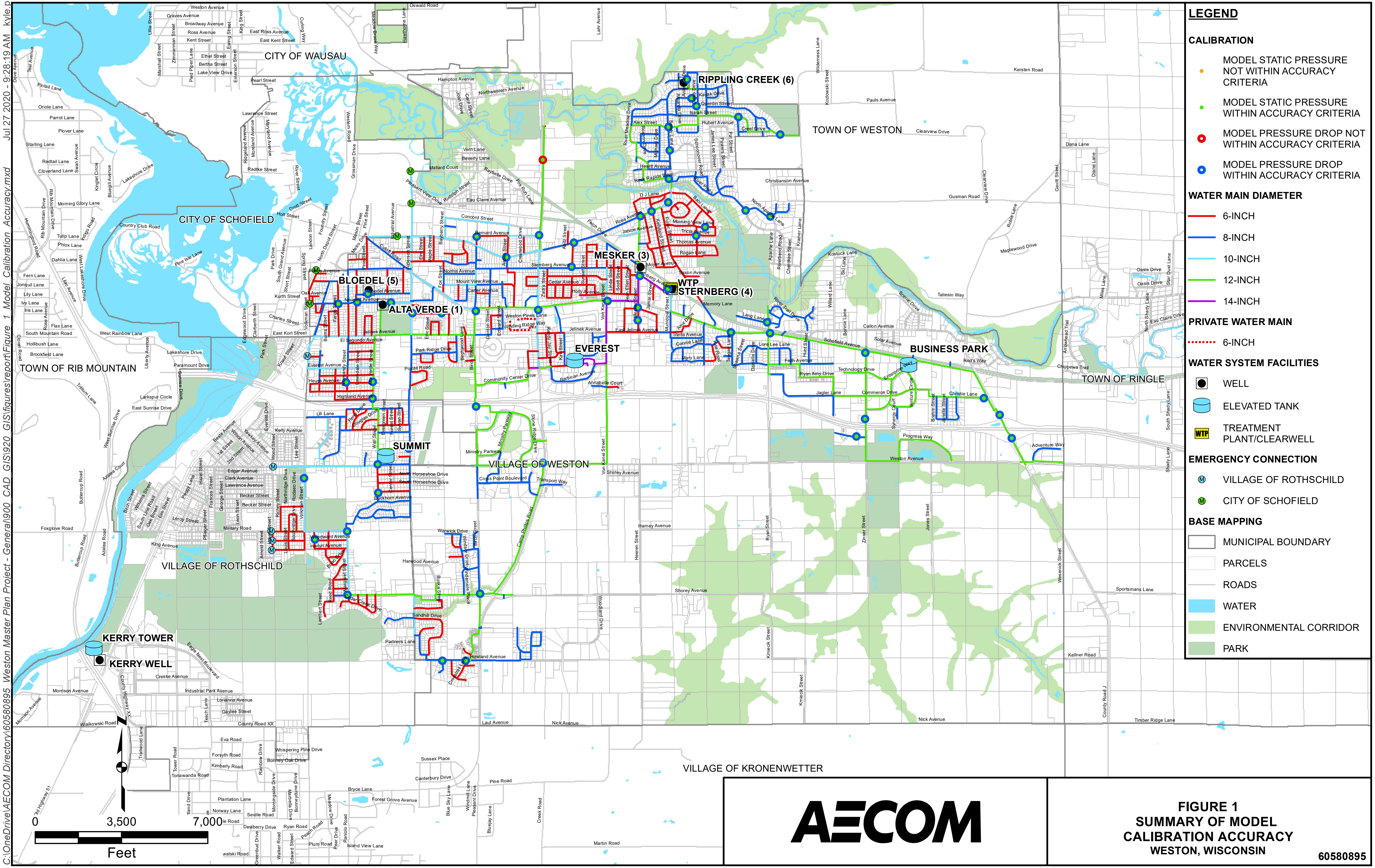
TABLE 3: STEADY STATE CALIBRATION ACCURACY

Level of Accuracy	Percent of Field Tests within Target Level of Accuracy	Target Acceptance
Static Pressure	99 percent	90 percent
Pressure Differential	97 percent	80 percent
Simulated Hydrant Flow	100 percent	100 percent
Note: Percent of field tests based upon all residual hydrant locations.		

Attachment 1 summarizes the results of steady-state calibration based on field test data gathered.

As shown in Attachment 1, Residual Hydrant 1 at Field Test 8 does not meet the calibration criteria for pressure differential; however, when the flow at the flowing hydrants for Field Test 8 was adjusted by 10 percent (allowable level for calibration accuracy), the pressure differential met the requirement..

C:\OneDrive\AECOM Directory\60580895 Weston Master Plan Project - General\900 CAD GIS\920 GIS\figures\report\Figure 1 Model Calibration Accuracy.mxd Jul 27 2020 - 9:28:19 AM kyle.priest



LEGEND

CALIBRATION

- MODEL STATIC PRESSURE NOT WITHIN ACCURACY CRITERIA
- MODEL STATIC PRESSURE WITHIN ACCURACY CRITERIA
- MODEL PRESSURE DROP NOT WITHIN ACCURACY CRITERIA
- MODEL PRESSURE DROP WITHIN ACCURACY CRITERIA

WATER MAIN DIAMETER

- 6-INCH
- 8-INCH
- 10-INCH
- 12-INCH
- 14-INCH

PRIVATE WATER MAIN

- 6-INCH

WATER SYSTEM FACILITIES

- WELL
- ELEVATED TANK
- WTP TREATMENT PLANT/CLEARWELL

EMERGENCY CONNECTION

- Ⓜ VILLAGE OF ROTHSCHILD
- Ⓜ CITY OF SCHOFIELD

BASE MAPPING

- MUNICIPAL BOUNDARY
- PARCELS
- ROADS
- WATER
- ENVIRONMENTAL CORRIDOR
- PARK

AECOM

FIGURE 1
SUMMARY OF MODEL CALIBRATION ACCURACY
WESTON, WISCONSIN

60580895

Extended Period Calibration

In addition to steady state calibration, AECOM also calibrated the model for an extended period simulation (EPS). Extended period (macro) calibration was performed to ensure the model accurately reflects how the overall system operates over time with respect to transmission mains, pumps, tanks, and reservoir operations under normal operating conditions.

Calibration Data

Continuous pressure monitoring was performed to collect data for extended period calibration of the hydraulic model. The pressure data was compared with the results from model simulations for calibration purposes. Extended period pressure monitoring was conducted throughout the water distribution system at 20 locations.

Calibration Results

An extended period simulation was performed for the hydraulic model calibration to simulate pressure measurements recorded in the Main System and flow and level data in the Main System from SCADA. The EPS calibration scenario simulated well operation based on continuous pressure monitoring data for October 3, 2018.

Attachment 2 contains graphical results comparing the extended period calibration simulation data. An example graph of extended period calibration results is illustrated in Figure 2 showing the pressure measured near the Alta Verde Well (Well 1). As illustrated in the figure, the extended period simulation was performed for 1 day (24 hours).

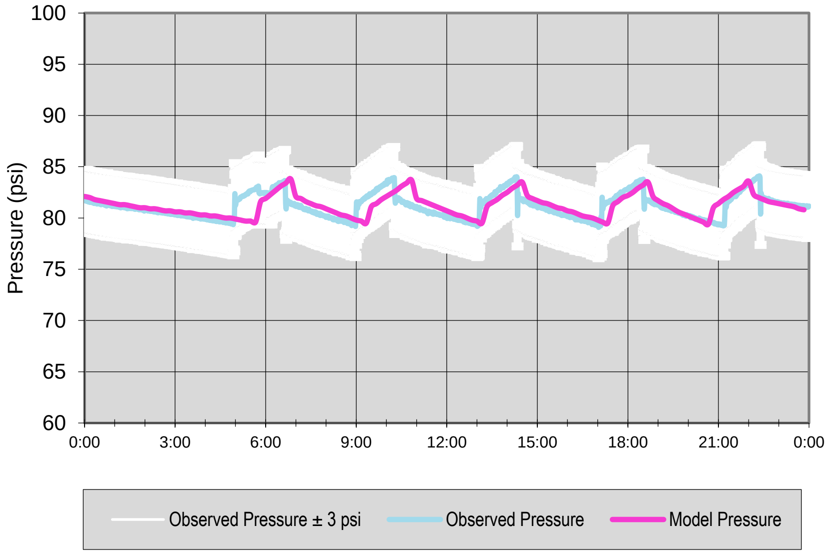


FIGURE 2: EXAMPLE EPS MODEL CALIBRATION – PRESSURE NEAR ALTA VERDE WELL

For each graph, an error band (±3 psi for pressure) is shown in white to help identify the accuracy of the simulation results. Table 4 summarizes the accuracy of the extended period extended period calibration. As shown, the EPS calibration meets the pressure, flow and tank level requirements for all criteria. The accuracy of the flow data is lower than pressure and level data likely due to slight differences in hourly demands between the actual data and the model simulation shifting the tank filling/draining times which results in a “shift” in the on/off times of the wells.

TABLE 4: EXTENDED PERIOD CALIBRATION ACCURACY

Level of Accuracy	Percent of Results within Level of Accuracy	Target Acceptance
Pressure difference between field data and model simulations within 3 psi	98 percent	70 percent
Pressure difference between field data and model simulations within 5 psi	99 percent	85 percent
Pressure difference between field data and model simulations within 8 psi	100 percent	100 percent
Tank levels within 3 feet between field data and model simulations	99 percent	70 percent
Tank levels within 5 feet between field data and model simulations	100 percent	85 percent
Flow rate within 15 percent of observed	83 percent	80 percent

Footnote:

[1] Tank levels were evaluated as pressure at the base of each tank using continuous pressure monitoring data from data loggers, Tower SCADA was unavailable for comparison.

Overall, AECOM believes the model provides an accurate representation of actual field conditions for a 24-hour period modeled.

Summary

It is believed that the developed hydraulic model provides a reasonably accurate representation of the actual system characteristics under extended period operating and demand conditions.

Attachment 1: Steady-State Micro Calibration Table

CALIBRATION TABLE
WESTON WATER UTILITY

			FIELD TESTING/ MODEL SIMULATIONS																																																																																						
Flow Test Number	Test Hydrant Flow (gpm) Test Location	F= Field Test Data M= Model Data	Residual 1				Residual 2				T1-2485				T2-2217				T3-1738				T4-3646				T5-3143				T6-1435				T7-1961				T8-1656				T9-1508				T10-3145				T11-1908				T12-3146				T13-1894				T14-1652				T15-2218				T16-1284				T17-2486				T18-1739				T19-5326				T20-5022			
											Rippling Creek Well				Corner of Sandy Lane and Ross Lane				Corner of Mesker Street and Ross Lane				Corner of Mesker Street and Sternberg				Water Treatment Plant				Corner of Von Kanel Street and Schofield Avenue				Corner of Camp Phillips Road and Schofield Avenue				Corner of Birch Street and Schofield Avenue				Alta Verde Well				Bloedel Well				Corner of Highland Avenue and Alta Verde Street				On Volkman, south of Weston				Close to Summit Avenue Tower				On Shorey Avenue north of Cedar Creek				Corner of Camp Phillips Road and Shorey Avenue				Corner of Weston Avenue and Camp Phillips Road				Corner of Birch Street and Highway 29				Corner of Tiegen Lanr and Schofield Avenue				Close to Business Park Tower				Far East of Business Park, near Business Park Tower			
			Static Pressure (psi)	Residual Pressure (psi)	Pressure Differential (psi)	Δ Pressure Differential (psi)	Static Pressure (psi)	Residual Pressure (psi)	Pressure Differential (psi)	Δ Pressure Differential (psi)	Static Pressure (psi)	Residual Pressure (psi)	Pressure Differential (psi)	Δ Pressure Differential (psi)	Static Pressure (psi)	Residual Pressure (psi)	Pressure Differential (psi)	Δ Pressure Differential (psi)	Static Pressure (psi)	Residual Pressure (psi)	Pressure Differential (psi)	Δ Pressure Differential (psi)	Static Pressure (psi)	Residual Pressure (psi)	Pressure Differential (psi)	Δ Pressure Differential (psi)	Static Pressure (psi)	Residual Pressure (psi)	Pressure Differential (psi)	Δ Pressure Differential (psi)	Static Pressure (psi)	Residual Pressure (psi)	Pressure Differential (psi)	Δ Pressure Differential (psi)	Static Pressure (psi)	Residual Pressure (psi)	Pressure Differential (psi)	Δ Pressure Differential (psi)	Static Pressure (psi)	Residual Pressure (psi)	Pressure Differential (psi)	Δ Pressure Differential (psi)	Static Pressure (psi)	Residual Pressure (psi)	Pressure Differential (psi)	Δ Pressure Differential (psi)	Static Pressure (psi)	Residual Pressure (psi)	Pressure Differential (psi)	Δ Pressure Differential (psi)	Static Pressure (psi)	Residual Pressure (psi)	Pressure Differential (psi)	Δ Pressure Differential (psi)	Static Pressure (psi)	Residual Pressure (psi)	Pressure Differential (psi)	Δ Pressure Differential (psi)	Static Pressure (psi)	Residual Pressure (psi)	Pressure Differential (psi)	Δ Pressure Differential (psi)	Static Pressure (psi)	Residual Pressure (psi)	Pressure Differential (psi)	Δ Pressure Differential (psi)	Static Pressure (psi)	Residual Pressure (psi)	Pressure Differential (psi)	Δ Pressure Differential (psi)	Static Pressure (psi)	Residual Pressure (psi)	Pressure Differential (psi)	Δ Pressure Differential (psi)	Static Pressure (psi)	Residual Pressure (psi)	Pressure Differential (psi)	Δ Pressure Differential (psi)	Static Pressure (psi)	Residual Pressure (psi)	Pressure Differential (psi)	Δ Pressure Differential (psi)	Static Pressure (psi)	Residual Pressure (psi)	Pressure Differential (psi)	Δ Pressure Differential (psi)	Static Pressure (psi)	Residual Pressure (psi)	Pressure Differential (psi)	Δ Pressure Differential (psi)	Static Pressure (psi)	Residual Pressure (psi)	Pressure Differential (psi)	Δ Pressure Differential (psi)
F-1	1,870 gpm	F	78	61	17	/	77	62	15	/	79	65	14	/	79	68	11	/	77	73	4	/	77	75	2	/	77	75	2	/	76	74	2	/	76	74	2	/	79	78	1	/	82	81	1	/	85	84	1	/	70	69	1	/	89	89	0	/	45	45	0	/	92	92	0	/	88	88	0	/	63	62	1	/	74	73	1	/	71	70	1	/	70	70	0	/	66	66	0	/
	10/2/2018 8:54 AM	M	78	60	18	1	78	62	16	1	80	64	16	2	81	70	11	0	76	69	7	3	76	73	3	1	77	75	2	0	75	72	3	1	74	72	2	0	80	78	2	1	81	80	1	0	85	84	1	0	70	69	1	0	88	88	0	0	46	45	1	1	90	89	1	1	86	85	1	1	63	61	2	1	72	70	2	1	71	70	1	0	71	71	0	0	66	65	1	1
F-2	1,700 gpm	F	70	50	20	/	75	59	16	/	79	66	13	/	79	69	10	/	-	-	-	/	77	75	2	/	77	75	2	/	75	74	1	/	75	74	1	/	79	78	1	/	82	81	1	/	84	83	1	/	69	69	0	/	88	88	0	/	44	44	0	/	91	91	0	/	87	87	0	/	62	61	1	/	73	72	1	/	71	70	1	/	70	70	0	/	65	65	0	/
	10/2/2018 8:32 AM	M	70	47	23	3	76	56	20	4	79	66	13	0	81	71	10	0	76	69	7	-	75	72	3	1	77	74	3	1	74	72	2	1	74	72	2	1	79	77	2	1	81	80	1	0	84	83	1	0	69	68	1	1	87	87	0	0	45	44	1	1	90	89	1	1	86	85	1	1	62	61	1	0	71	70	1	0	71	70	1	0	71	70	1	1	66	65	1	1
F-3	1,870 gpm	F	81	66	15	/	77	65	12	/	80	67	13	/	80	68	12	/	78	74	4	/	78	76	2	/	78	76	2	/	76	75	1	/	76	75	1	/	79	78	1	/	83	82	1	/	85	84	1	/	70	70	0	/	90	90	0	/	45	45	0	/	92	92	0	/	89	88	1	/	63	62	1	/	74	73	1	/	72	71	1	/	71	71	0	/	66	66	0	/
	10/2/2018 9:15 AM	M	79	63	16	1	79	65	14	2	80	66	14	1	81	70	11	-1	77	70	7	3	76	73	3	1	77	75	2	0	75	73	2	1	75	73	2	1	80	78	2	1	82	81	1	0	85	84	1	0	70	70	0	0	89	88	1	1	46	46	0	0	91	90	1	1	87	86	1	0	63	62	1	0	72	71	1	0	72	70	2	1	71	71	0	0	66	66	0	0
F-4	2,070 gpm	F	81	72	9	/	77	71	6	/	81	72	9	/	81	72	9	/	79	73	6	/	79	76	3	/	79	76	3	/	77	76	1	/	77	76	1	/	81	80	1	/	84	83	1	/	87	86	1	/	72	72	0	/	91	91	0	/	47	47	0	/	94	93	1	/	90	89	1	/	64	63	1	/	75	74	1	/	73	71	2	/	72	72	0	/	67	67	0	/
	10/2/2018 9:59 AM	M	81	71	10	1	79	70	9	3	81	70	11	2	82	71	11	2	78	69	9	3	77	74	3	0	78	76	2	-1	76	74	2	1	76	74	2	1	81	79	2	1	83	82	1	0	86	85	1	0	72	71	1	1	90	89	1	1	47	47	0	0	92	91	1	0	88	87	1	0	64	63	1	0	74	72	2	1	73	71	2	0	72	72	0	0	67	66	1	1
F-5	1,760 gpm	F	82	57	25	/	79	62	17	/	78	72	6	/	78	72	6	/	76	72	4	/	76	74	2	/	76	74	2	/	76	74	2	/	76	74	2	/	79	77	2	/	81	80	1	/	83	82	1	/	70	69	1	/	90	89	1	/	46	45	1	/	93	91	2	/	89	87	2	/	63	61	2	/	74	72	2	/	71	70	1	/	71	71	0	/	67	66	1	/
	10/2/2018 10:22 AM	M	81	54	27	2	81	61	20	3	77	66	11	5	79	68	11	5	74	65	9	5	74	69	5	3	75	71	4	2	74	70	4	2	73	71	2	0	78	76	2	0	80	77	3	2	81	79	2	1	69	68	1	0	88	87	1	0	46	46	0	-1	90	89	1	-1	86	84	2	0	62	60	2	0	71	69	2	0	70	68	2	1	71	70	1	1	66	65	1	0
F-6	1,010 gpm	F	76	27	49	/	80	43	37	/	80	77	3	/	80	77	3	/	78	77	1	/	78	77	1	/	78	77	1	/	77	76	1	/	77	76	1	/	80	79	1	/	83	82	1	/	86	85	1	/	71	71	0	/	90	90	0	/	46	46	0	/	93	93	0	/	89	89	0	/	63	63	0	/	75	74	1	/	72	71	1	/	71	71	0	/	66	66	0	/
	10/2/2018 9:37 AM	M	77	33	44	-5	80	46	34	-3	80	75	5	2	82	77	5	2	77	73	4	3	76	74	2	1	78	76	2	1	76	74	2	1	75	73	2	1	81	79	2	1	83	81	2	1	86	85	1	0	71	70	1	1	89	89	0	0	47	46	1	1	91	91	0	0	87	86	1	1	64	62	2	2	73	72	1	0	72	71	1	0	72	71	1	1	66	66	0	0
F-7	1,750 gpm	F	78	71	7	/	74	71	3	/	81	76	5	/	81	76	5	/	79	75	4	/	79	75	4	/	79	75	4	/	77	74	3	/	77	74	3	/	81	79	2	/	84	80	4	/	86	82	4	/	72	69	3	/	91	89	2	/	47	45	2	/	94	91	3	/	90	87	3	/	64	61	3	/	75	72	3	/	73	70	3	/	72	71	1	/	67	66	1	/
	10/2/2018 4:02 PM	M	77	72	5	-2	76	72	4	1	77	76	1	-4	80	78	2	-3	75	74	1	-3	74	74	0	-4	76	75	1	-3	74	74	0	-3	74	73	1	-2	79	78	1	-1	80	80	0	-4	82	81	1	-3	70	69	1	-2	88	88	0	-2	46	46	0	-2	91	90	1	-2	87	86	1	-2	63	62	1	-2	72	71	1	-2	71	71	0	-3	72	71	1	0	66	66	0	-1
F-8	3,250 gpm	F	85	45	40	/	80	68	12	/	80	78	2	/	80	78	2	/	78	76	2	/	78	76	2	/	78	76	2	/	77	75	2	/	77	74	3	/	80	78	2	/	83	81	2	/	86	84	2	/	71	70	1	/	90	90	0	/	46	46	0	/	93	92	1	/	89	88	1	/	64	62	2	/	75	74	1	/	72	71	1	/	71	71	0	/	66	66	0	/
	10/2/2018 3:34 PM	M	85	39	46	6	79	63	16	4	81	78	3	1	82	79	3	1	77	74	3	1	77	74	3	1	78	76	2	0	76	73	3	1	76	72	4	1	81	76	5	3	83	79	4	2	86	83	3	1	71	69	2	1	89	88	1	1	47	46	1	1	92	90	2	1	88	86	2	1	64	62	2	0	73	70	3	2	72	71	1	0	72	72	0	0	67	67	0	0
F-9	1,470 gpm	F	80	62	18	/	82	77	5	/	80	79	1	/	80	79	1	/	78	77	1	/	78	77	1	/	78	77	1	/	76	75	1	/	76	75	1	/	80	78	2	/	83	82	1	/	85	84	1	/	71	70	1	/	90	90	0	/	45	45	0	/	93	92	1	/	89	88	1	/	63	62	1	/	74	73	1	/	72	71	1	/	71	71	0	/	66	66	0	/
	10/2/2018 3:12 PM	M	82	69	13	-5	82	77	5	0	80	78	2	1	82	80	2	1	77	75	2	1	76	74	2	1	78	76	2	1	75	73	2	1	75	73	2	1	80	78	2	0	82	80	2	1	85	84	1	0	70	69	1	0	89	88	1	1	46	46	0	0	91	90	1	0	87	86	1	0	63	62	1	0	73	71	2	1	72	71	1	0	71	71	0	0	66	66	0	0
F-10	1,600 gpm	F	81	54	27	/	82	78	4	/	80	79	1	/	80	79	1	/	77	76	1	/	77	76	1	/	77	76	1	/	76	75	1	/	76	75	1	/	79	78	1	/	82	81	1	/	85	84	1	/	70	69	1	/	89	89	0	/	45	45	0	/	92	92	0	/	88	87	1	/	63	62	1	/	74	73	1	/	71	71	0	/	71	71	0	/	66	66	0	/
	10/2/2018 2:52 PM	M	79	54	25	-2	80	76	4	0	76	73	3	2	78	76	2	1	74	71	3	2	73	71	2	1	74	72	2	1	73	71	2	1	73	70	3	2	78	74	4	3	79	75	4	3	81	77	4	3	68	66	2	1	87	86	1	1	45	44	1	1	89	88	1	1	85	83	2	1	61	59	2	1	71	68	3	2	70	69	1	1	71	70	1	1	66	65	1	1
F-11	2,160 gpm	F	83	78	5	/	82	79	3	/	79	78	1	/	79	78	1	/	77	76	1	/	77	76	1	/	77	76	1	/	76	75	1	/	76	74	2	/	79	77	2	/	82	80	2	/	85	82	3	/	70	68	2	/	89	88	1	/	44	44	0	/	91	91	0	/	88	87	1	/	62	61	1	/	73	72	1	/	71	71	0	/	71	70	1	/	66	66	0	/
	10/2/2018 2:37 PM	M	84	76	8	3	83	78	5	2	79	78	1	0	81	79	2	1	76	74	2	1	75	73	2	1	77	76	1	0	75	73	2	1	74	72	2	0	79	76	3	1	81	77	4	2	84	80	4	1	69	67	2	0	87	86	1	0	45	44	1	1	90	88	2	2	86	84	2	1	62	61	1	0	72	69	3	2	71	71	0	0	71	71	0	-1	66	66	0	0
F-12	1,860 gpm	F	79	75	4	/	76	76	0	/	79	76	3	/	79	77	2	/	77	74	3	/	77	75	2	/	77	75	2	/	75	74	1	/	75	73	2	/	79	77	2	/	81	79	2	/	84	81	3	/	68	65	3	/	87	86	1	/	43	43	0	/	90	89	1	/	86	85	1	/	61	60	1	/	72	70	2	/	69	68	1	/	70	70	0	/	63	63	0	/
	10/2/2018 2:18 PM	M	79	72	7	3	77	72	5	5	76	73	3	0	78	75	3	1	73	70	3	0	73	70	3	1	74	72	2	0	73	70	3	2	72	69	3	1	77	73	4	2	78	74	4	2	80	76	4	1	67	64	3	0	86	84	2	1	44	43	1	1	88	86	2	1	85	82	3	2	61	59	2	1	70	67	3	1	70	68	2	1	70	70	0	0	65	65	0	0
F-13	1,380 gpm	F	51	46	5	/	43	43	0	/	76	76	0	/	77	76	1	/	75	74	1	/	75	74	1	/	75	74	1	/	74	73	1	/	74	73	1	/	77	76	1	/	80	79	1	/	81	80	1	/	68	67	1	/	88	85	3	/	44	42	2	/	91	88	3	/	87	85	2	/	61	60	1	/	72	71	1	/	70	70	0	/	70	70	0	/	65	65	0	/
	10/2/2018 1:59 PM	M	51	45	6	1	46	44	2	2	75	74	1	1	78	76	2	1	73	71	2	1	73	71	2	1	74	72	2	1	72	71	1	0	72	70	2	1	77	75	2	1	78	77	1	0	80	78	2	1	67	66	1	0	86	84	2	-1	44	43	1	-1	88	86	2	-1	84	82	2	0	61	59	2	1	70	68	2	1	69	69	0	0	70	70	0	0	65	65	0	0
F-14	1,820 gpm	F	87	72	15	/	88	80	8	/	77	76	1	/	77	76	1	/	76	75	1	/	75	74	1	/	75	74	1	/	74	73	1	/	74	73	1	/	78	76	2	/	80	79	1	/	82	80	2	/	69	67	2	/	89	82	7	/	44	42	2	/	91	84	7	/	87	82	5	/	61	59	2	/	73	71	2	/	70	69	1	/	70	70	0	/	65	65	0	/
	10/2/2018 1:41 PM	M	90	76	14	-1	92	83	9	1	75	73	2	1	78	75	3	2	73	71	2	1	73	71	2	1	74	72	2	1	72	71	1	0	72	70	2	1	77	75	2	0	78	76	2	1	80	77	3	1	67	65	2	0	86	81	5	-2	44	43	1	-1	88	81	7	0	84	79	5	0	61	58	3	1	70	67	3	1	69	68	1	0	70	70	0	0	65	65	0	0
F-15	1,790 gpm	F	81	58	23	/	75	58	17	/	77	75	2	/	78	76	2	/	76	74	2	/	76	74	2	/	76	74	2	/	75	73	2	/	75	73	2	/	79	77	2	/	81	79	2	/	83	81	2	/	69	67	2	/	90	86	4	/	45	43	2	/	92	82	10	/	88	77	11	/	62	58	4	/	73	70	3	/	70	69	1	/	70	70	0	/	65	65	0	/
	10/2/2018 1:19 PM	M	81	60	21	-2	72	57	15	-2	76	74	2	0	78	76	2	0	74	71	3	1	73	71	2	0	74	72	2	0	73	71	2	0	73	70	3	1	78	75	3	1	79	77	2	0	81	78	3	1	68	66	2	0	87	84	3	-1	45	44	1	-1	89	81	8	-2	85	75	10	-1	61	58	3	-1	70	67	3	0	70	69	1	0	70	70	0	0	65	65	0	0
F-16	1,790 gpm	F	75	61	14	/	74	67	7	/	77	75	2	/	78	75	3	/	76	74	2	/	76	73	3	/	76	73	3	/	75	73	2	/	75	73	2	/	78	76	2	/	81	79	2	/	83	81	2	/	69	68	1	/	89	88	1	/	45	44	1	/	92	91	1	/	88	86	2	/	62	60	2	/	73	71	2	/	71	69	2	/	71	70	1	/	66	65	1	/
	10/2/2018 4:39 PM	M	73	61	12	-2	73	66	7	0	76	72	4	2	78	74	4	1	73	69	4	2	73	69	4	1	74	70	4	1	72	70	2	0	72	70	2	0	77	75	2	0	79	77	2	0	80	78	2	0	68	67	1	0	87	86	1	0	45	45	0	-1	89	88	1	0	85	83	2	0	61	59	2	0	70	68	2	0	70	67	3	1	70	69	1	0	65	65	0	-1
F-17	3,710 gpm	F	75	58	17	/	75	64	11	/	79	76	3	/	79	76	3	/	77	75	2	/	77	75	2	/	77	75	2	/	76	74	2	/	76	74	2	/	79	78	1	/	82	81	1	/	85	83	2	/	68	68	0	/	88	88	0	/	44	44	0	/	91	91	0	/	87	86	1	/	61	61	0	/	72	72	0	/	70	63	7	/	70	64	6	/	66	60	6	/
	10/2/2018 11:38 AM	M	77	60	17	0	76	65	11	0	79	76	3	0	81	77	4	1	76	72	4	2	75	72	3	1	77	73	4	2	75	72	3	1	74	72	2	0	79	77	2	1	81	80	1	0	84	83	1	-1	69	68	1	1	87	87	0	0	44	44	0	0	90	89	1	1	86	85	1	0	62	61	1	1	71	70	1	1	72	63	9	2	72	66	6	0	66	62	4	-2
F-18	1,630 gpm	F	67	52	15	/	67	64	3	/	80	80	0	/	80	80	0	/	78	77	1	/	78	77	1	/	78	77	1	/	76	76	0	/	76	76	0	/	80	80	0	/	83	83	0	/	85	85	0	/	70	70	0	/	89	89	0	/	45	45	0	/	92	92	0	/	88	88	0	/	63	63	0	/	79	74	5	/	71	70	1	/	71	69	2	/	66	64	2	/
	10/2/2018 12:11 PM	M	70	57	13	-2	70	67	3	0	80	78	2	2	82	80	2	2	77	75	2	1	76	74	2	1	78	76	2	1	75	74	1	1	75	73	2	2	80	79	1	1	82	81	1	1	85	84	1	1	70	70	0	0	88	88	0	0	46	46	0	0	91	90	1	1	87	86	1	1	63	62	1	1	73	71	2	-3	72	70	2	1	72	70	2	0	66	65	1	-1
F-19	2,590 gpm	F	64	36	28	/	66	47	19	/	81	80	1	/	81	80	1	/	79	78	1	/	79	78	1	/	79	78	1	/	77	77	0	/	77	77	0	/	80	80	0	/	83	83	0	/	86	86	0	/	71	71	0	/	91	91	0	/	46	46	0	/	93	93	0	/	90	90	0	/	64	64	0	/	75	75	0	/	72	69	3	/	71	67	4	/	66	56	10	/
	10/2/2018 12:42 PM	M	63	40	23	-5	65	49	16	-3	81	78	3	2	82	80	2	1	77	75	2	1	77	74	3	2	78	76	2	1	76	74	2	2	76	74	2	2	81	79	2	2	83	82	1	1	86	85	1	1	71	71	0	0	90	89	1	1	47	47	0	0	92	91	1	1	88	87	1	1	64	63	1	1	73	72	1	1	72	69	3	0	71	68	3	-1	66	57	9	-1

Notes:

F = Field Result

M = Model Result

For Example Flow Test 5 (F-5)

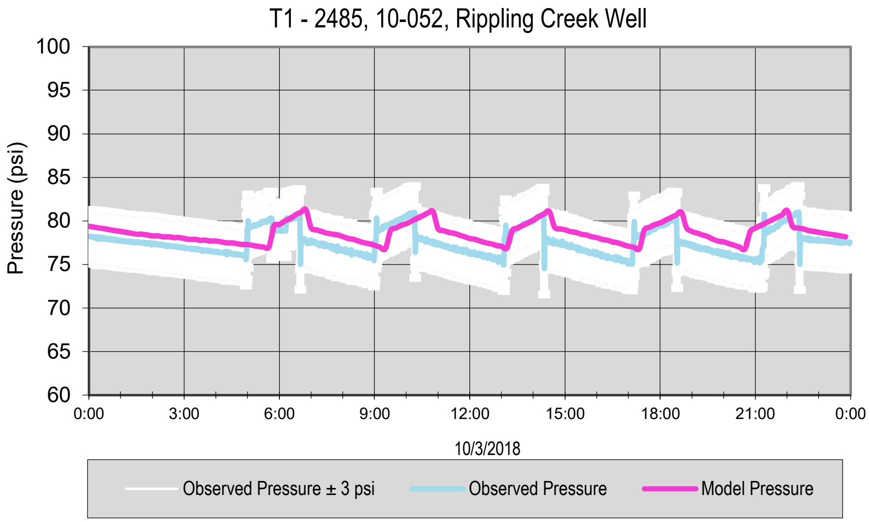
Field flow was 1,760 gallons per minute (gpm).

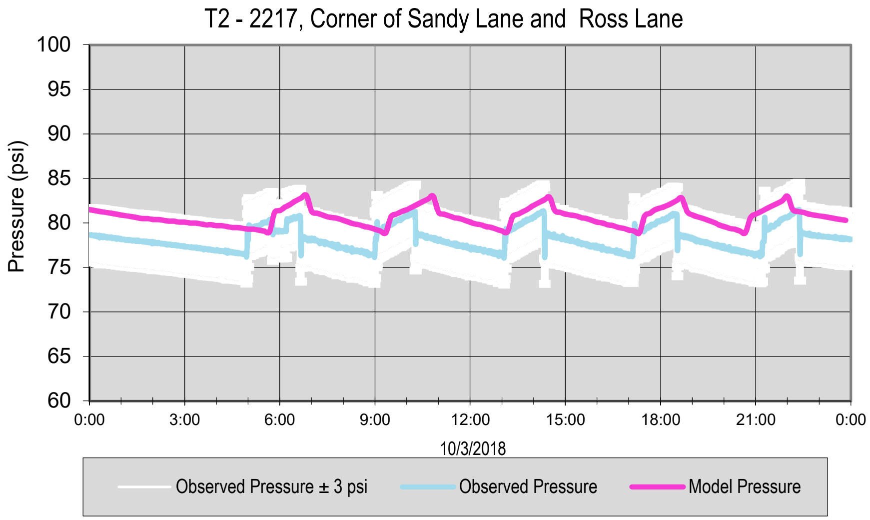
Static pressure at F-5 Residual Hydrant 1 (R1) was 82 pounds per square inch (psi) in the field and 81 psi in the model (within the ±3 psi target tolerance)

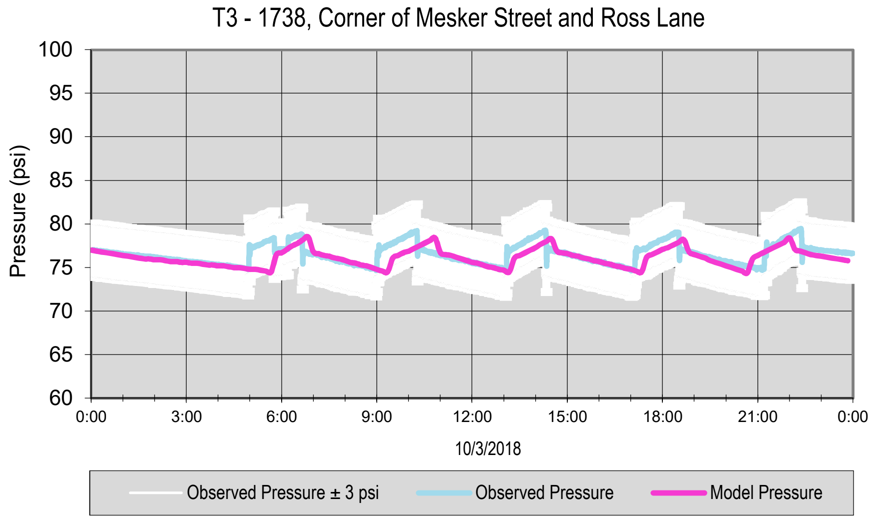
Residual (dynamic) pressure at F-5 R1 was 57 psi in the field and 54 psi in the model, resulting in a pressure drop (Δ) of 25 psi in the field and 27 psi in the model (within the ±5 psi target tolerance).

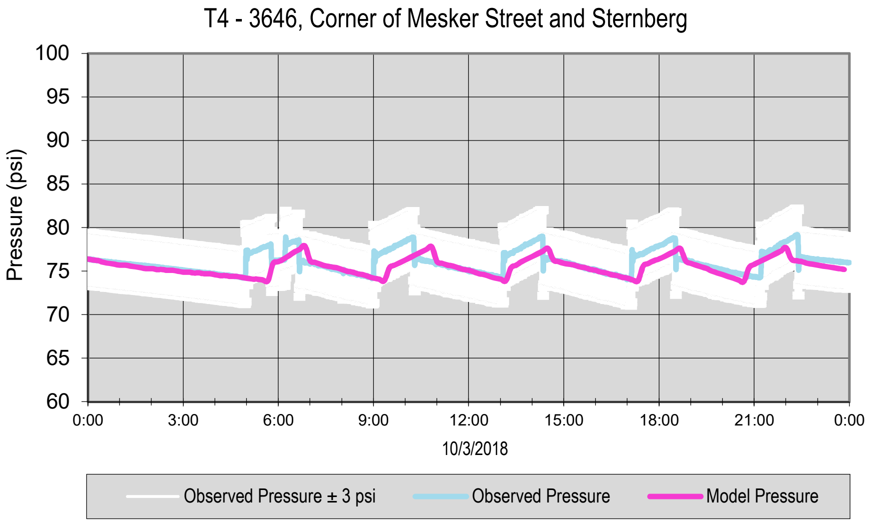
2	Meets AECOM's calibration criteria.
4	Does not meet AECOM's calibration criteria (± 2 psi) for flow tests with 10 psi or less measured pressure drop.
-6	Does not meet AECOM's calibration criteria (± 5 psi) for flow tests greater than 10 psi measured pressure drop.

Attachment 2: Extended Period Macro Calibration Figures


T1 - 2485, 10-052, Rippling Creek Well


T2 - 2217, Corner of Sandy Lane and Ross Lane


T3 - 1738, Corner of Mesker Street and Ross Lane


T4 - 3646, Corner of Mesker Street and Sternberg

Location	**Accuracy**
T1 - 2485	99%
T2 - 2217	99%
T3 - 1738	100%
T4 - 3646	100%

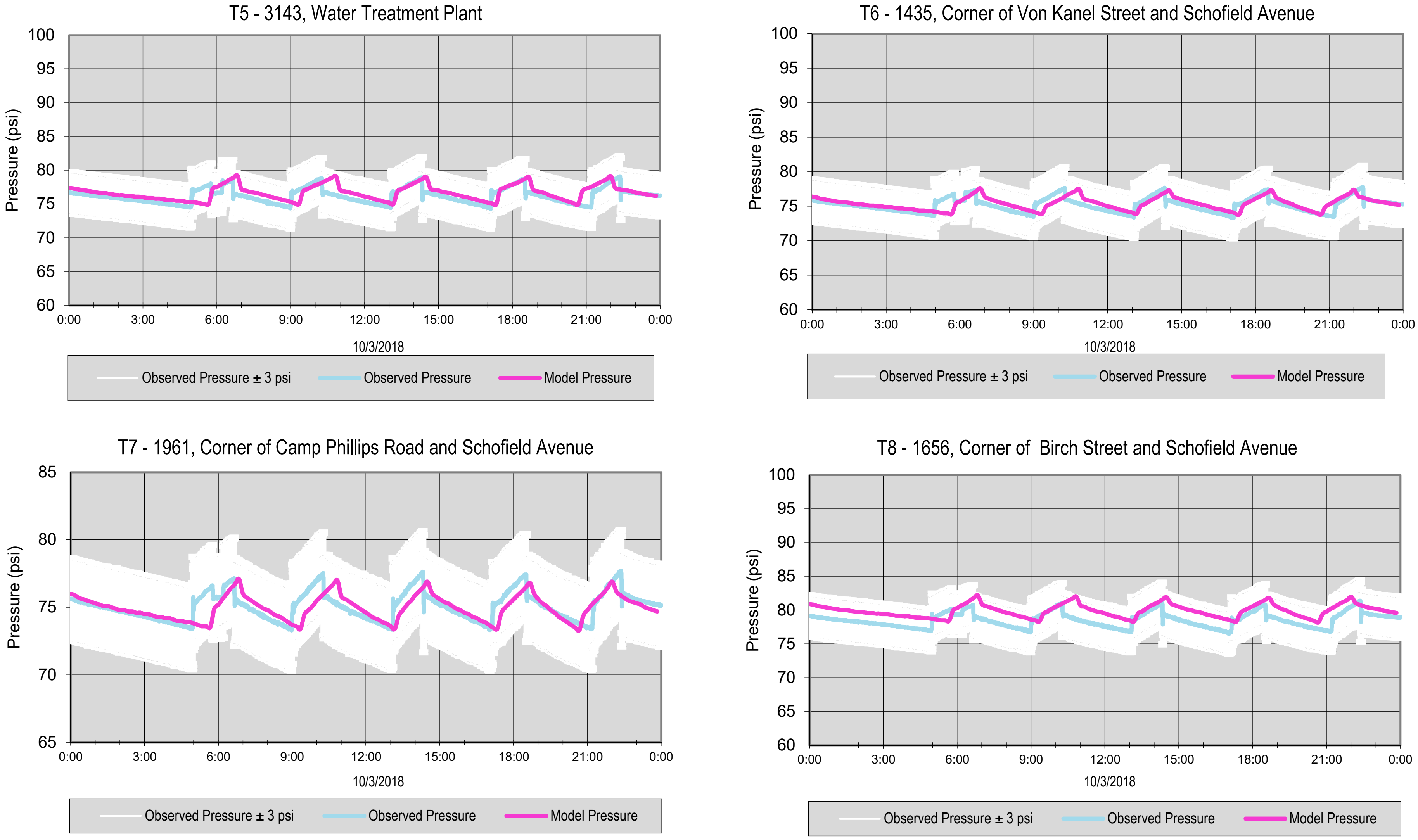
Note(s):

FIGURE 1
EXTENDED PERIOD MODEL CALIBRATION
CONTINUOUS PRESSURE MONITORING

AECOM WESTON, WISCONSIN

60580895

C:\Users\kyle.priest\AECOM Directory\60580895_Weston Master Plan Project - General\400_Technical\453_Water\calibration\[Macro_Calibration_kjp_04-2020.xlsx]Tel 5-8


T5 - 3143, Water Treatment Plant

T6 - 1435, Corner of Von Kanel Street and Schofield Avenue

T7 - 1961, Corner of Camp Phillips Road and Schofield Avenue

T8 - 1656, Corner of Birch Street and Schofield Avenue

Location	**Accuracy**
T5 - 3143	100%
T6 - 1435	100%
T7 - 1961	100%
T8 - 1656	100%

Note(s):

FIGURE 2

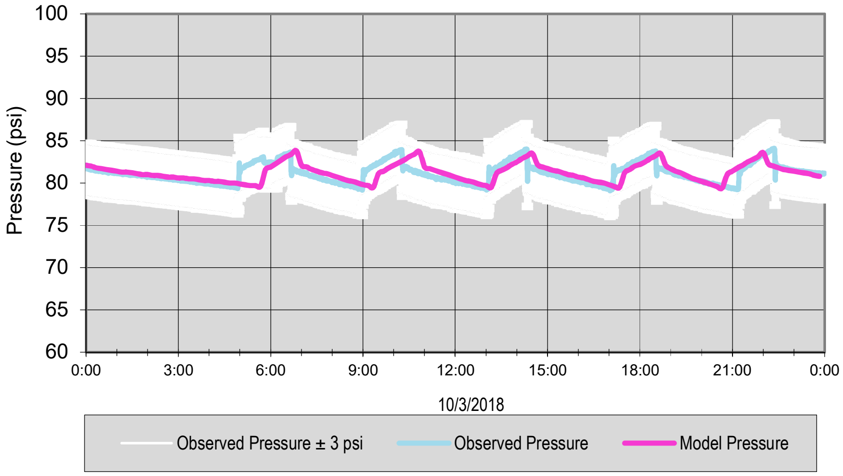
EXTENDED PERIOD MODEL CALIBRATION
CONTINUOUS PRESSURE MONITORING

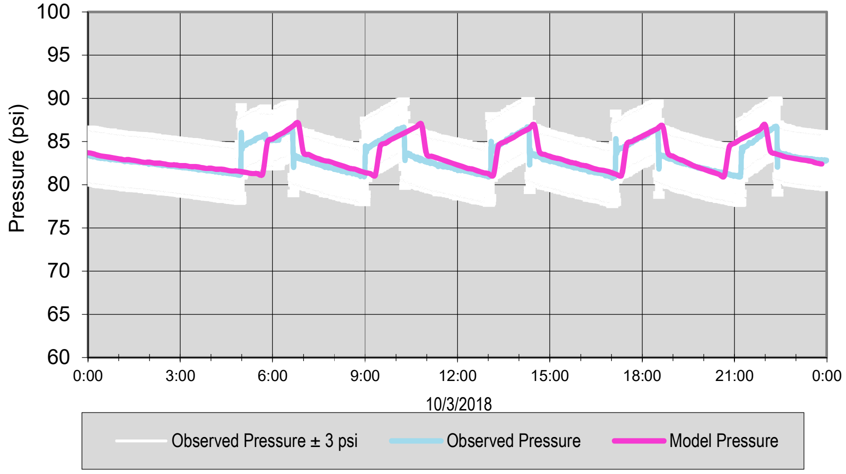
AECOM

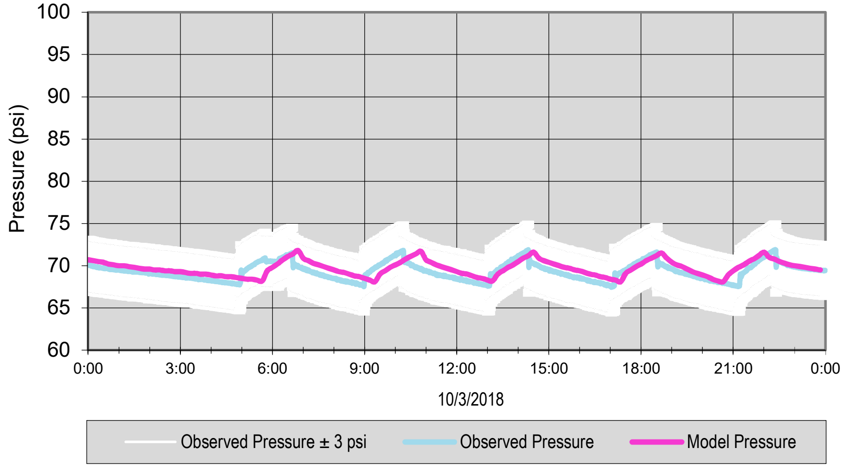
WESTON, WISCONSIN

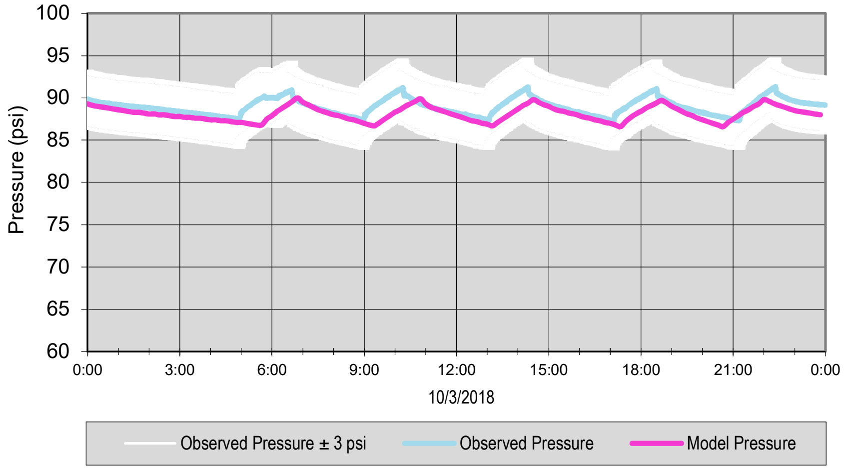
60580895

C:\Users\kyle.priest\AECOM Directory\60580895_Weston Master Plan Project - General\400_Technical\453_Water\calibration\[Macro_Calibration_kjp_04-2020.xlsx]Tel 9-12


T9 - 1508, Alta Verde Well


T10 - 3145, Bloedel Well


T11 - 1908, Corner of Highland Avenue and Alta Verde Street


T12 - 3146, On Volkman, south of Weston

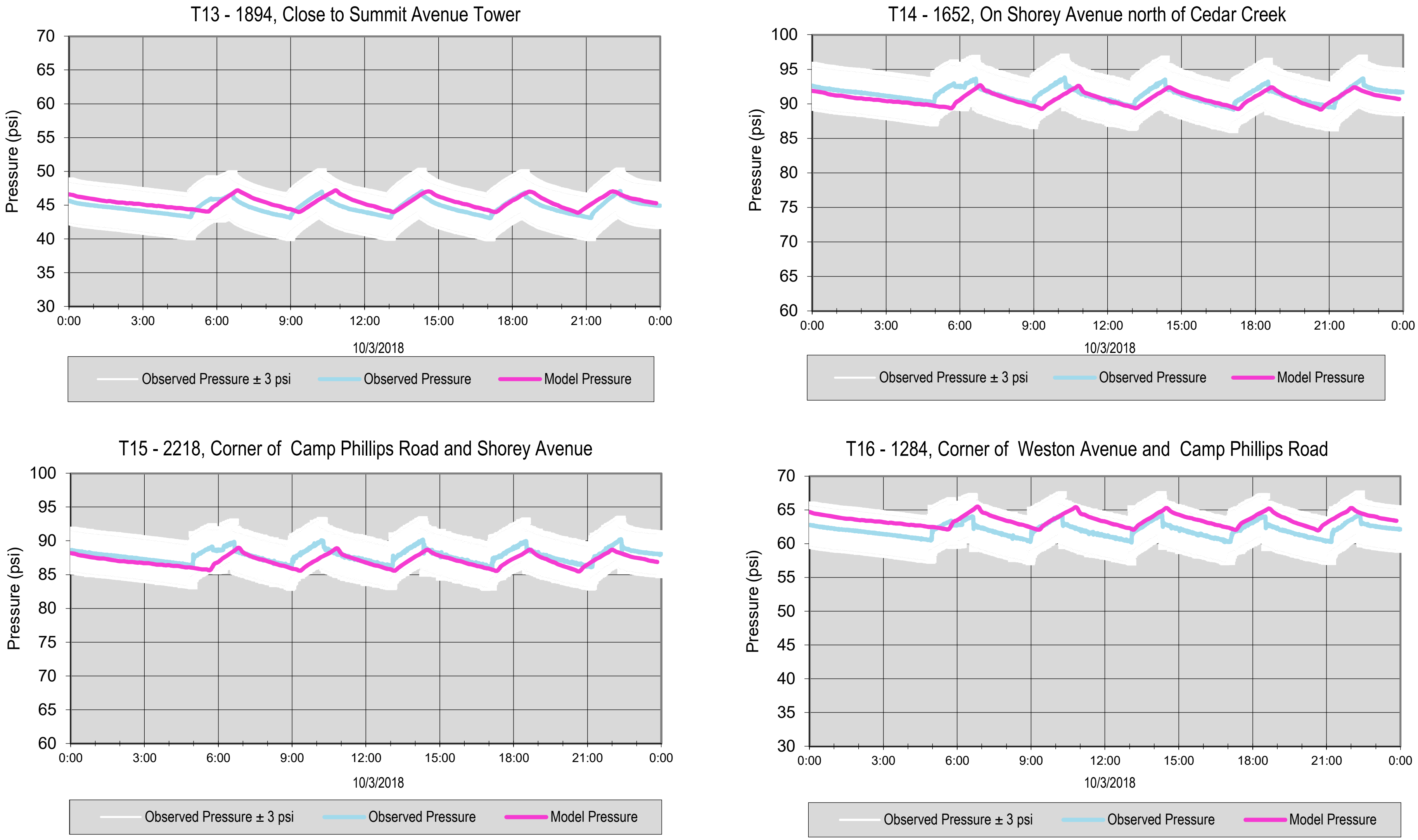
Location	**Accuracy**
T9 - 1508	100%
T10 - 3145	100%
T11 - 1908	100%
T12 - 3146	100%

Note(s):

FIGURE 3
EXTENDED PERIOD MODEL CALIBRATION
CONTINUOUS PRESSURE MONITORING

AECOM
WESTON, WISCONSIN
60580895

C:\Users\kyle.priest\AECOM Directory\60580895_Weston Master Plan Project - General\400_Technical\453_Water\calibration\[Macro_Calibration_kjp_04-2020.xlsx]Tel 13-16



Location	**Accuracy**
T13 - 1894	100%
T14 - 1652	100%
T15 - 2218	100%
T16 - 1284	100%

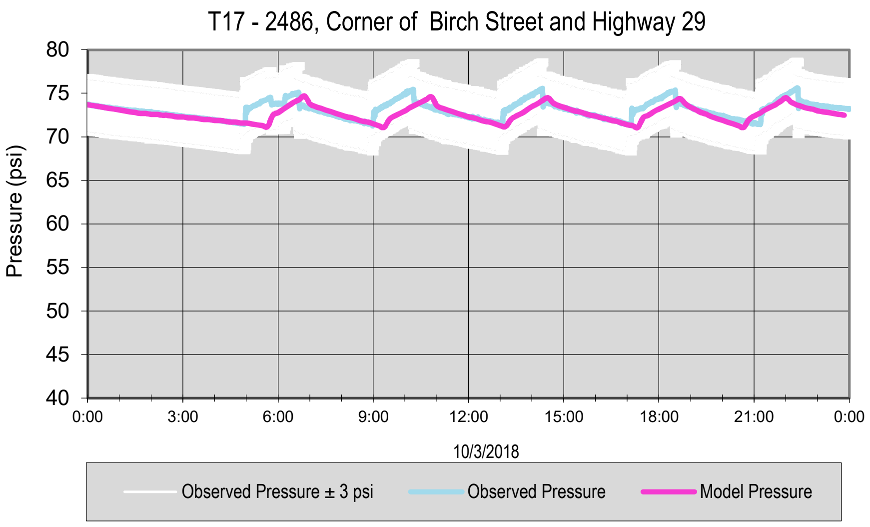
Note(s):

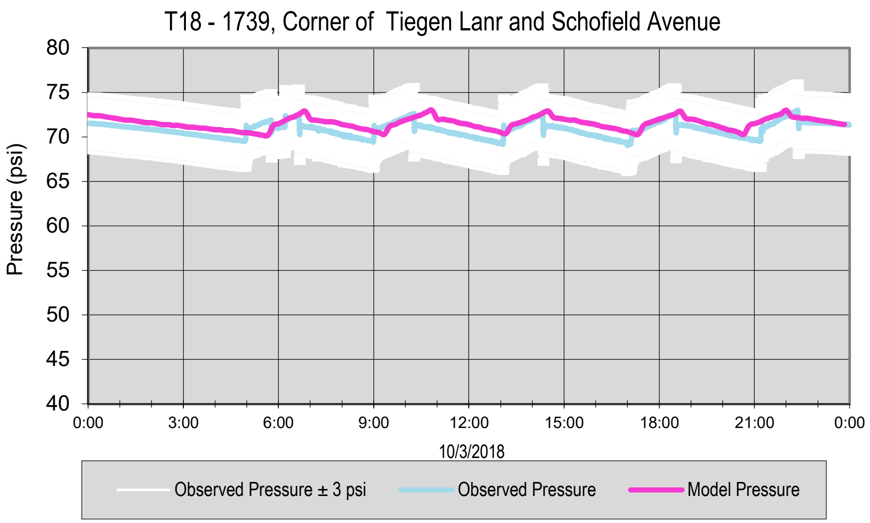
FIGURE 4
EXTENDED PERIOD MODEL CALIBRATION
CONTINUOUS PRESSURE MONITORING

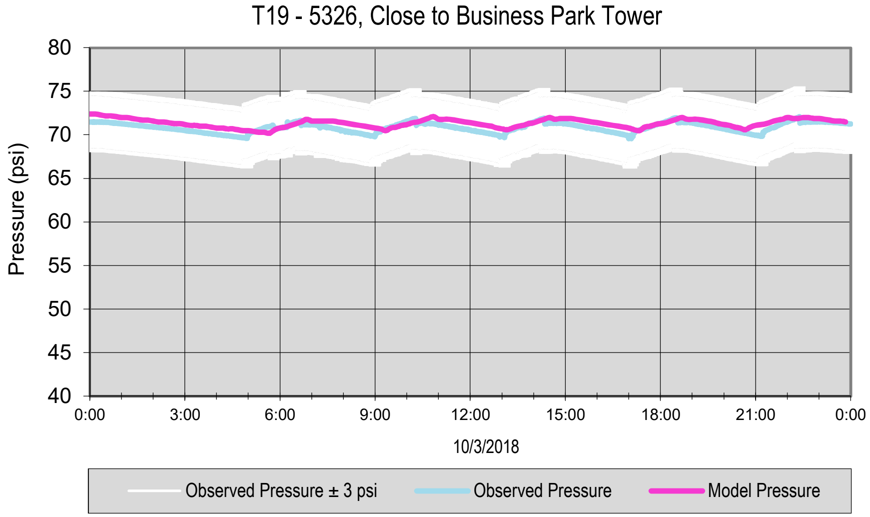
AECOM WESTON, WISCONSIN

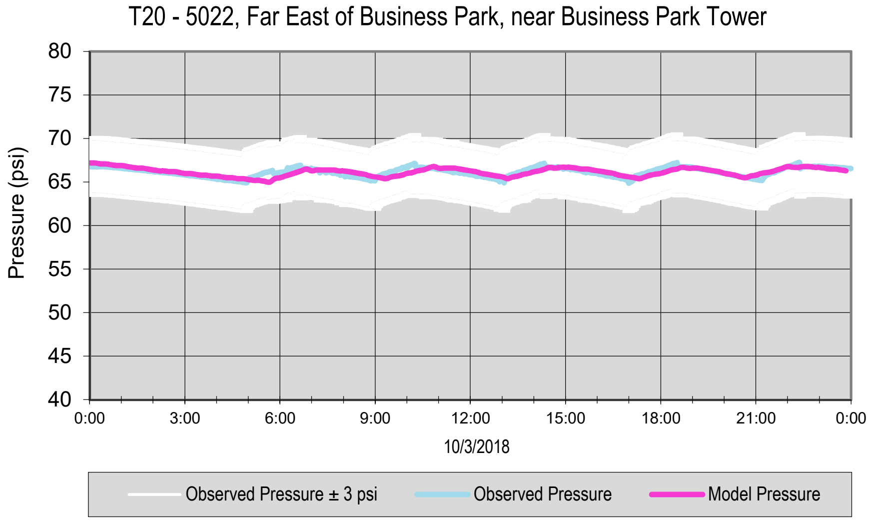
60580895

C:\Users\kyle.priest\AECOM Directory\60580895_Weston Master Plan Project - General\400_Technical\453_Water\calibration\[Macro_Calibration_kjp_04-2020.xlsx]Tel 17-20


T17 - 2486, Corner of Birch Street and Highway 29


T18 - 1739, Corner of Tiegen Lanr and Schofield Avenue


T19 - 5326, Close to Business Park Tower


T20 - 5022, Far East of Business Park, near Business Park Tower

Location	**Accuracy**
T17 - 2486	100%
T18 - 1739	100%
T19 - 5326	100%
T20 - 5022	100%

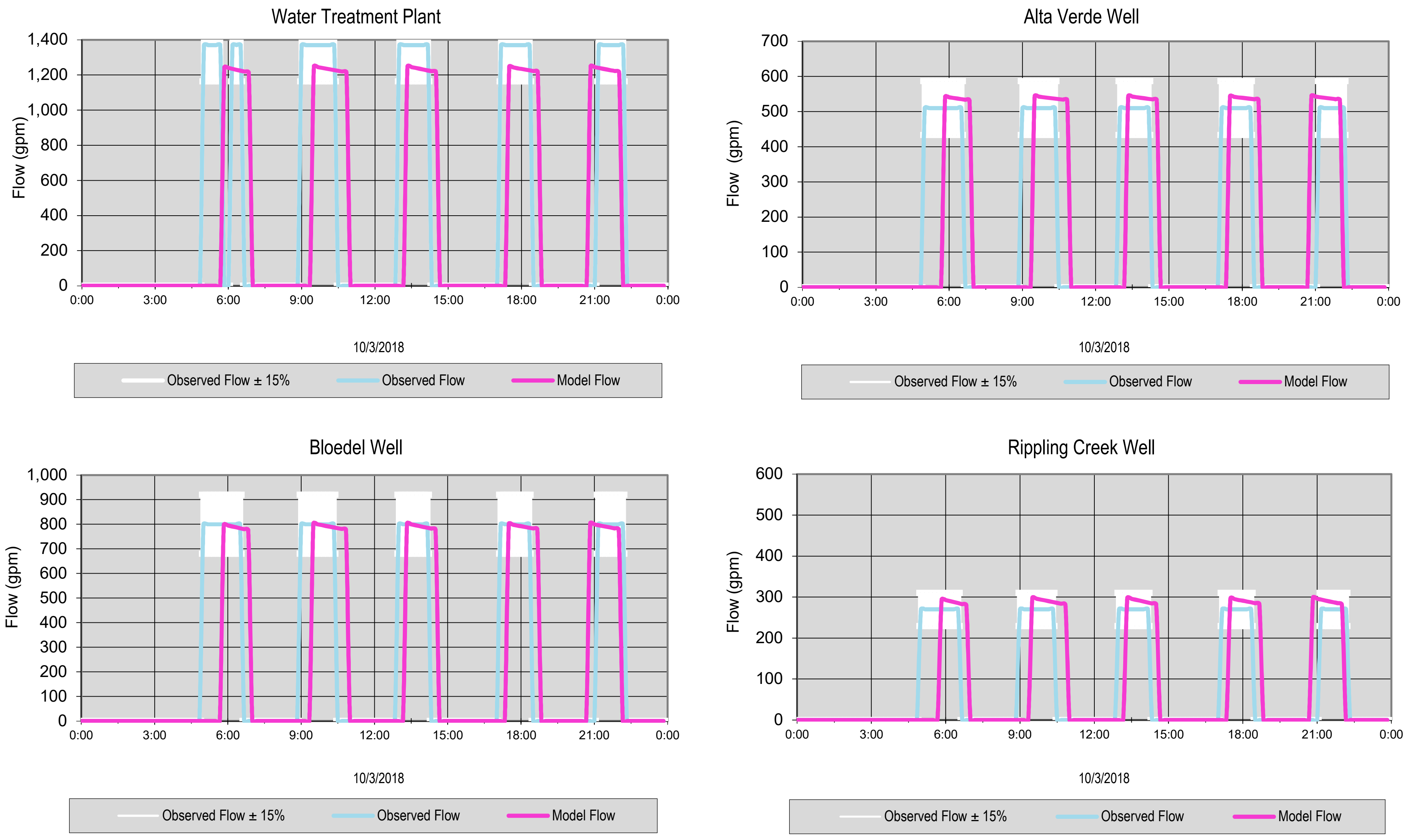
Note(s):

FIGURE 5
EXTENDED PERIOD MODEL CALIBRATION
CONTINUOUS PRESSURE MONITORING

WESTON, WISCONSIN

60580895

C:\Users\kyle.priest\AECOM Directory\60580895_Weston Master Plan Project - General\400_Technical\453_Water\calibration\[Macro_Calibration_kjp_04-2020.xlsx]Fac 1-4



Location	**Accuracy**
Water Treatment Plant	82%
Alta Verde Well	83%
Bloedel Well	83%
Rippling Creek Well	83%

Note(s):

FIGURE 6

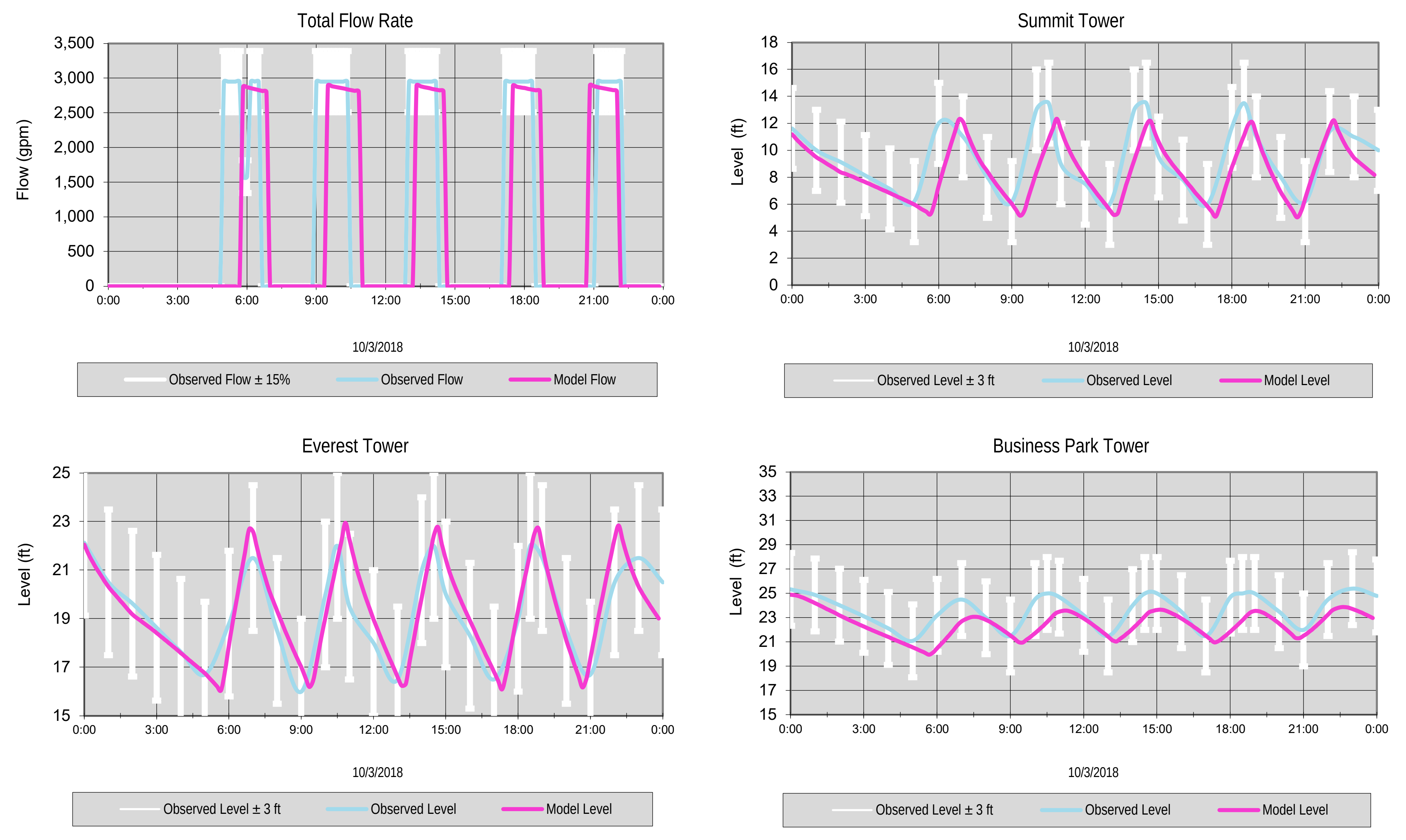
EXTENDED PERIOD MODEL CALIBRATION
CONTINUOUS PRESSURE MONITORING

AECOM

WESTON, WISCONSIN

60580895

C:\OneDrive\AECOM Directory\60580895_Weston Master Plan Project - General (1)\400_Technical\453_Water\calibration\[Macro_Calibration_kjp_06-2020_summit_graph_printing.xlsx]Fac 5-8



Location	**Accuracy**
Total Flow	82%
Summit Tower	100%
Everest Tower	100%
Business Park	100%

Note(s):

Tower levels were estimated hourly from SCADA graphs on October 3, 2018.

FIGURE 7
EXTENDED PERIOD MODEL CALIBRATION
CONTINUOUS PRESSURE MONITORING

AECOM

WESTON, WISCONSIN

60580895

Appendix J

Executive Summary – AwwaRF Project Quantifying Future Rehabilitation Needs

EXECUTIVE SUMMARY

INTRODUCTION AND OBJECTIVES

Due to the aging of the water distribution systems and the lack of timely maintenance on the part of most water utilities, there is an urgent need for the development of a predictive distribution system condition assessment model. This model should consider factors such as age, material, joints, and environmental conditions in identifying and estimating rehabilitation and replacement needs of a water distribution system. The American Water Works Association Research Foundation (AWWARF) contracted Roy F. Weston, Inc., (WESTON) to provide North American water utilities with such a model. The specific objectives of this study were the following:

- Develop a user friendly software suitable for use by North American water utilities to forecast water main rehabilitation and replacement needs, and develop long-term cost-effective strategies for water main rehabilitation and replacement.
- Demonstrate the effectiveness and applicability of this software by testing it at four North American and one British water utility.
- Develop a user manual for the easy use of the software.
- Identify and define the characteristics of the North American water distribution systems in terms of rehabilitation and replacement needs.

BACKGROUND AND SCOPE

To date, few if any, standardized techniques are available for North American water utilities to evaluate distribution systems and to develop proactive procedures. Water utility operators, in general, manage and operate distribution systems in a reactive mode by responding to emergency breaks and water main leaks. In Europe, however, Raimund K. Herz, a faculty member at Dresden University of Technology, and formerly at Karlsruhe University, Germany, developed the Karlsruhe model (KAMODEL) and applied it successfully at more than ten European utilities (Herz 1996).

WESTON teamed with Raimund K. Herz to develop a user friendly software (KANEW) for North American utilities and to enhance KAMODEL's capabilities.

As detailed input from water utilities was crucial to the development of KANEW, WESTON also teamed with the Philadelphia Water Department (PWD), and worked with Boston Water and Sewer Commission (BWSC), Los Angeles Department of Water and Power (LADWP), Fort Worth Water Department (FWWD), and Severn Trent Water, Ltd., (STW) United Kingdom, (UK) to test the software. Additional utilities participated by responding to a survey.

CHARACTERIZATION OF NORTH AMERICAN WATER DISTRIBUTION SYSTEMS

In order to provide a frame of reference for water utilities using the model, a study of available distribution system data was conducted to characterize North American water distribution systems. The goal was to determine "typical" distribution system characteristics for systems of various sizes and in different geographic regions. Three primary data sources were utilized for this purpose:

- American Water Works Association (AWWA) Water Industry Database (WIDB)
- Questionnaire developed for this project
- Previous AWWARF projects

In examining the data, North America was divided into seven geographic regions, six for the U.S., and one for Canada. It was found that in both countries, the use of both types of cast iron pipe, lined and unlined, is similar - in the range of 43% to 48%. However, in the U.S., the percentage of lined and unlined cast iron pipe are almost equal, in the range of 22% to 26%. In contrast, Canadian systems have substantially more unlined cast iron pipe than lined cast iron pipe (35% unlined versus 9% lined). Regional differences showed that the generally older sections of the country represented by the Northeast and Midwest have the highest percentages of cast iron pipe at 62% and 57%, respectively. The Northwest and West both have significant quantities of steel pipe (10% and 14%, respectively) compared to the rest of the country. The West region also has a substantial percentage (45%) of asbestos cement (AC) pipe, which is much higher than any other region of the country. Also the average percentage of the distribution system pipe that is replaced annually in the U.S. and Canada is 0.5% and 0.6%, respectively. Within the U.S. the annual replacement rates vary from 0.4% in the Midwest region to 0.7% in the Southeast region. Utilities are expanding their distribution systems at annual rates of 1.5% and 0.9% in the U.S. and Canada, respectively. Expansion rates vary from 1.0% in the South Central and Northwest regions to 2.3% in the Southeast region.

MODEL DESCRIPTION

The primary objective of KANEW is to provide water utilities with a tool to develop their long range pipe rehabilitation and replacement strategies. Based on the historical inventory of water main and the estimated life-span data, KANEW predicts the length of different categories of pipe to be rehabilitated or replaced on an annual basis. KANEW is a macro model and does not provide location specific rehabilitation and replacement information.

The process involves importing data on the water distribution network to the model, differentiated according to year of installation or rehabilitation and pipe categories which are defined with respect of aging behavior and data availability. Most important criteria for the definition of types of water mains are age, material, diameter and bedding quality.

For each type of water main survival functions must be determined. Survival functions are mathematical expressions of the life expectancies of each water main category, and are defined based on three ages, "low", "medium" and "high". These functions are estimated on the basis of failure, rehabilitation and replacement rates in the past and, particularly for modern pipe materials, through expert estimates of the useful life-span of the different water main categories. These estimates are used by the software to determine the parameters of the survival function for each pipe category. The model then simulates the aging process. The survival functions are applied to the current inventory of water mains year by year, and calculations are made to determine the lengths of water mains which reach the end of their useful lives and must therefore be rehabilitated or replaced.

There is considerable uncertainty in estimating future events, so, for each pipe category pessimistic and optimistic estimates of the useful life-spans are made. This results in a pessimistic survival function based on short life expectancies and an optimistic survival function based on long life expectancies of each pipe category.

The KANEW model developed in this study is user friendly and capable of providing 13 different sets of graphical and tabular outputs primarily showing percent or length of water mains of each category to be rehabilitated or replaced each year during a specified planning period.

CASE STUDIES

KANEW was applied to four U.S. and one UK water utility. The project team worked with each utility to select water main categories for modeling and to estimate life expectancies for each category. In some cases, the project team also worked closely with the utility to collect the data necessary to complete the water main inventory for modeling.

Each water utility was unique in terms of data availability. Some had detailed computerized databases with which the water main inventory could be readily generated. Others had more limited data available and relied on known information about the distribution system and assumptions by personnel familiar with the system. In one case, the utility had enough historic data available to calculate aging functions for several of its water main categories. Regardless of the level of detail available, the model was shown to provide valuable guidance for utilities in planning long-term rehabilitation and replacement programs. The results of the case studies and the characterization of North American water utilities indicate that due to lack of availability of a detailed inventory of pipes for water utilities, inventory of each separate group of pipes cannot be developed. Rather, several groups of pipes can be consolidated to compromise with the lack of data. Additionally, it was found that the unlined cast iron water mains were the predominant type of mains in North American water utilities, and required most of the replacement or rehabilitation. For the test case utilities the following observations were made:

1. Under optimistic assumptions for PWD, the rehabilitation and replacement rate is fairly constant at approximately 0.6% to 0.8% of water mains per year. Under pessimistic assumptions, about 1.2% rehabilitation and replacement is required at the beginning of the planning period with this rate dropping during the latter part of the

planning period. Small diameter cast iron mains are the predominant pipes for rehabilitation and replacement.

2. Under optimistic assumptions LADWP would require rehabilitation and replacement rates of approximately 2.3% of its water main annually, gradually declining to 1.1% by year 2015. Under pessimistic assumptions, the predicted rehabilitation and replacement rates start at the rate of 4.4% annually and then decline to 1.1% by year 2015. LADWP's actual rehabilitation and replacement rate of 2.7% for fiscal year 1995 fell between the optimistic and pessimistic assumptions. Again, most of the water mains that are rehabilitated or replaced are cast iron mains.
3. BWSC water systems require about 2% per year (optimistic assumptions) to about 6.5% per year (pessimistic assumptions) at the beginning of the planning period. Most of these candidates mains are 8 inch to 12 inch unlined cast iron mains. In recent years the actual replacement and rehabilitation rates at BWSC have been very close to the optimistic estimation.
4. Due to its relatively young age, FWWD's rehabilitation and replacement needs increased with time as the average age of the system increased coming closer to the life-span estimates.
5. Under optimistic assumptions the water main replacement and rehabilitation rate for Nottinghamshire Water System of STW is 1.5% per year. Under pessimistic assumptions, the rate of rehabilitation and replacement starts initially at 3.3% annually and then reduces to about 1.5% by year 2015. Most of the candidate water mains for replacement and rehabilitation are cast iron and gray iron pipes.

RECOMMENDATIONS

To develop good estimates of water main replacement and rehabilitation needs the following recommendations are made for North American water utilities:

1. KANEW should be used by other water utilities for assessing and developing water main replacement and rehabilitation programs.

2. Water utilities should develop better database management systems for their existing distribution system inventories and for capturing historical water main replacement and rehabilitation data.
3. Water utilities should develop geographic information systems (GIS) which would also assist utilities in the use of the model.
4. A workshop should be conducted to discuss and develop consensus on estimation of survival functions for various categories of water mains.

FUTURE WORK

The following are recommended for future work:

1. The present model should be enhanced by incorporating
    - main break functions to predict water main break frequency changes as a result of the implementation of different rehabilitation and replacement strategies
    - the impact of future rehabilitation and replacement work in the development of rehabilitation and replacement strategies
    - the impact of the frequency and cost of failures on rehabilitation and replacement strategies
2. A companion model should be developed. This model would derive survival functions for various water main categories from historical data on main failures, and replacement and rehabilitation data.
3. Additional investigations should be conducted on the prioritization of rehabilitation and replacement work using results from KANEW and other information found in engineering literature.

Appendix K

CIP Projects

Village of Weston, Wisconsin

CAPITAL IMPROVEMENTS PROGRAM

2020 thru 2024

PROJECTS BY DEPARTMENT

Department	Project #	Priority	2020	2021	2022	2023	2024	Total
Culture & Recreation								
Aquatic Center - Pool Controller	*AC20-Cont*	n/a	4,000					*4,000*
Aquatic Center - Drop Slide Repairs	*AC20-DSRep*	n/a	10,000					*10,000*
Aquatic Center - Electrical Connection Upgrades	*AC20-Elec*	n/a	10,000					*10,000*
Aquatic Center - Heat Filter Room	*AC20-FiltRM*	n/a	25,000					*25,000*
Aquatic Center - Lifting Crane for Pool Motors	*AC20-Lift*	n/a	10,000					*10,000*
Aquatic Center - Log Slice Repairs	*AC20-Logs*	n/a	27,000					*27,000*
Aquatic Center - Parking Lot Repairs	*AC20-Parking*	n/a	20,000					*20,000*
Aquatic Center - Pool Surface Repairs	*AC20-PoolSu*	n/a	100,000	80,000				*180,000*
Aquatic Center - Shower Upgrades	*AC20-Shower*	n/a	19,000					*19,000*
Aquatic Center - Regenerative Filter Media	*AC21-Media*	n/a		275,000				*275,000*
Aquatic Center - Log Slide Safety Pads	*AC21-Pads*	n/a		25,000				*25,000*
Aquatic Center - Roof Replacement	*AC21-Roof*	n/a		75,000				*75,000*
Aquatic Center - Gear Operators	*AC22-Gears*	n/a			10,000			*10,000*
Aquatic Center - Slide and Activity Pump Upgrades	*AC22-PumpUp*	n/a			35,000			*35,000*
Aquatic Center - Water Ride Anchors	*AC22-RideAnc*	n/a			4,000			*4,000*
Aquatic Center - Water Play Structure	*AC22-WatStr*	n/a			350,000			*350,000*
One Ton Truck 6	*EQ22-Truck6*	n/a			45,000			*45,000*
Backstop fencing replacement at Kennedy	*PR20-KenBack*	n/a	24,000					*24,000*
Replace Kennedy Restroom Facility	*PR20-KenRR*	n/a	80,000					*80,000*
Park Shelter and Bathroom Painting	*PR20-Paint*	n/a	10,000					*10,000*
Yellow Banks Restroom Replacement	*PR20-YB-BR*	n/a	175,000					*175,000*
Yellowbanks Shelter Roof	*PR20-YBShRf*	n/a	8,000					*8,000*
Sandhill Play Structure Upgrades	*PR21-SH Play*	n/a		40,000				*40,000*
Park Shop Expansion	*PR21-Shop*	n/a		100,000				*100,000*
Kennedy Park Play Structure Upgrades	*PR22-KenPlay*	n/a			40,000			*40,000*
Prohaska Park Development	*PR22-PP UTIL*	n/a			1,000,000			*1,000,000*
Machmueller Park Play Structure Upgrades	*PR23-MachPl*	n/a				40,000		*40,000*
Culture & Recreation Total			522,000	595,000	1,484,000	40,000		*2,641,000*
Enterprise Funds								
Utility Crossings of River at Ryan St	*EF20-ECRXING*	n/a		1,580,000				*1,580,000*
SCADA Upgrades	*EF20-SCADA*	n/a	225,000					*225,000*
TMDL Modeling	*EF20-TMDL*	n/a	131,120					*131,120*
Trisha/Tonya Lift Station	*EF20-TrishaT*	n/a	500,000					*500,000*
Well #7 - Camp Phillips Road	*EF20-Well*	1		1,100,000				*1,100,000*
Bloedel Well Iron/Mang Removal	*EF21-BLOED*	n/a	75,000	600,000				*675,000*
Utility Van 88	*EQ20-Van88*	n/a	31,000					*31,000*
Enterprise Funds Total			962,120	3,280,000				*4,242,120*
General Government								
Safety Building Upgrades	*GG20-SAFBLD*	n/a	300,000	289,000				*589,000*
Yardwaste Site Access Control	*GG20-Yard*	n/a	50,000					*50,000*
New Municipal Center	*GG22-MunCen*	n/a	497,000		14,503,000			*15,000,000*

Department	Project #	Priority	2020	2021	2022	2023	2024	Total
General Government Total			847,000	289,000	14,503,000			*15,639,000*
Public Safety								
SAFER 2020 Equipment	*PS20-SAFER*	n/a	204,701					*204,701*
SAFER 2021 Equipment	*PS21-SAFER*	n/a		351,846				*351,846*
SAFER 2022 Equipment	*PS22-SAFER*	n/a			282,925			*282,925*
SAFER 2023 Equipment	*PS23-SAFER*	n/a				540,740		*540,740*
SAFER 2024 Equipment	*PS24-SAFER*	n/a					300,000	*300,000*
Public Safety Total			204,701	351,846	282,925	540,740	300,000	*1,680,212*
Public Works								
Excavator 23 (2016-20)	*EQ15-Exca23*	n/a	62,070					*62,070*
Mini Excavator	*EQ16-MiniEx*	n/a	13,310	6,655				*19,965*
Plow Truck 70 (2016-20)	*EQ16-Truck70*	n/a	40,245					*40,245*
Plow/Leaf Truck 60 (2017-21)	*EQ17-Truck60*	n/a	75,205	75,205				*150,410*
End Loader 32	*EQ20-Load32*	n/a	64,000					*64,000*
Mobile Column Hoists	*EQ20-MobCol*	n/a	35,000					*35,000*
Skid Steer	*EQ20-Skid*	2	60,000					*60,000*
One Ton Truck 21	*EQ20-Truck21*	n/a	65,000					*65,000*
Pickup Truck 55 (Sign Truck)	*EQ20-Truck55*	n/a	75,000					*75,000*
Plow Truck 69 Replacement	*EQ20-Truck69*	n/a	215,000					*215,000*
Wing For Loader 38	*EQ20-Wing*	n/a	40,000					*40,000*
Grader	*EQ21-Grader*	n/a		325,000				*325,000*
Pickup Truck 2	*EQ21-Truck2*	n/a		36,000				*36,000*
Tri-Axle Truck 28 Replacement	*EQ21-Truck28*	n/a		175,000				*175,000*
Replacement 1-Ton Dump Truck #31	*EQ21-Truck31*	n/a		45,000				*45,000*
End Loader 14	*EQ22-Load14*	n/a			225,000			*225,000*
Mini Excavator	*EQ22-MiniEx*	n/a			100,000			*100,000*
Bucket Truck 111 Replacement	*EQ23-Buck*	n/a				170,000		*170,000*
Plow Truck 10 Replacement	*EQ23-Truck10*	n/a				215,000		*215,000*
Quad Axle Truck 15 (2023)	*EQ23-Truck15*	n/a				180,000		*180,000*
Weston School-Arrow/Sunset/S.Timber/Kennedy/VonK	*PW19-School*	1	2,092,452					*2,092,452*
2020 Intersection Studies	*PW-20 Inters*	n/a	60,000					*60,000*
Crestwood Acres - (Rodney/Kirk/Douglas Area)	*PW20-Crest*	2	109,236	2,621,674				*2,730,910*
2020 Curb Repairs	*PW20-Curb*	n/a	75,000					*75,000*
2020 Asphalt Overlays	*PW20-Overlay*	n/a	100,000					*100,000*
2020 Schofield Ave Repairs (Birch to X)	*PW20-SCHOAve*	n/a	175,000					*175,000*
Birch St (Cross Pointe to Shorey)	*PW21-BirchS*	n/a		1,787,583				*1,787,583*
Kramer Ln - Gusman to Trotzer	*PW21-Kraemer*	n/a		69,756				*69,756*
2021 Asphalt Overlays	*PW21-Overlay*	n/a		100,000				*100,000*
Shorey Ave - X to Heeren	*PW21-Shorey*	n/a		200,000				*200,000*
E Jelinek and Von Kanel	*PW22-EJEL-VK*	n/a			2,340,000			*2,340,000*
Howland Ave (Brolta to CTH X)	*PW22-Howland*	n/a			420,849			*420,849*
2022 Asphalt Overlays	*PW22-Overlay*	n/a			100,000			*100,000*
Ross Ave and Kramer Ln (River Bend to Quentin)	*PW22-Ross*	n/a			2,091,000			*2,091,000*
Birch St (Jelinek to Com Cen Dr)	*PW23-BirchN*	n/a				1,400,070		*1,400,070*
Ferge and Delonay Reconstruction	*PW23-Ferge*	n/a				1,614,866		*1,614,866*
Northwestern Ave (CTH X to Town/Wausau Boundary)	*PW23-Nrwstrn*	n/a				2,290,000		*2,290,000*
2023 Asphalt Overlays	*PW23-Overlay*	n/a				100,000		*100,000*
Intersection Improvement CTH X/Ross	*PW24-CPR/ROS*	n/a					937,500	*937,500*
Everest Ave Reconstruction	*PW24-Everest*	n/a					1,425,676	*1,425,676*
Fuller St (Ross to Schofield Ave)	*PW24-Fuller*	n/a					1,658,000	*1,658,000*
Public Works Total			3,356,518	5,441,873	5,276,849	5,969,936	4,021,176	*24,066,352*

Volkman Multi-Use Path

Figure 1: Project Location Map along with Planned Rothschild projects

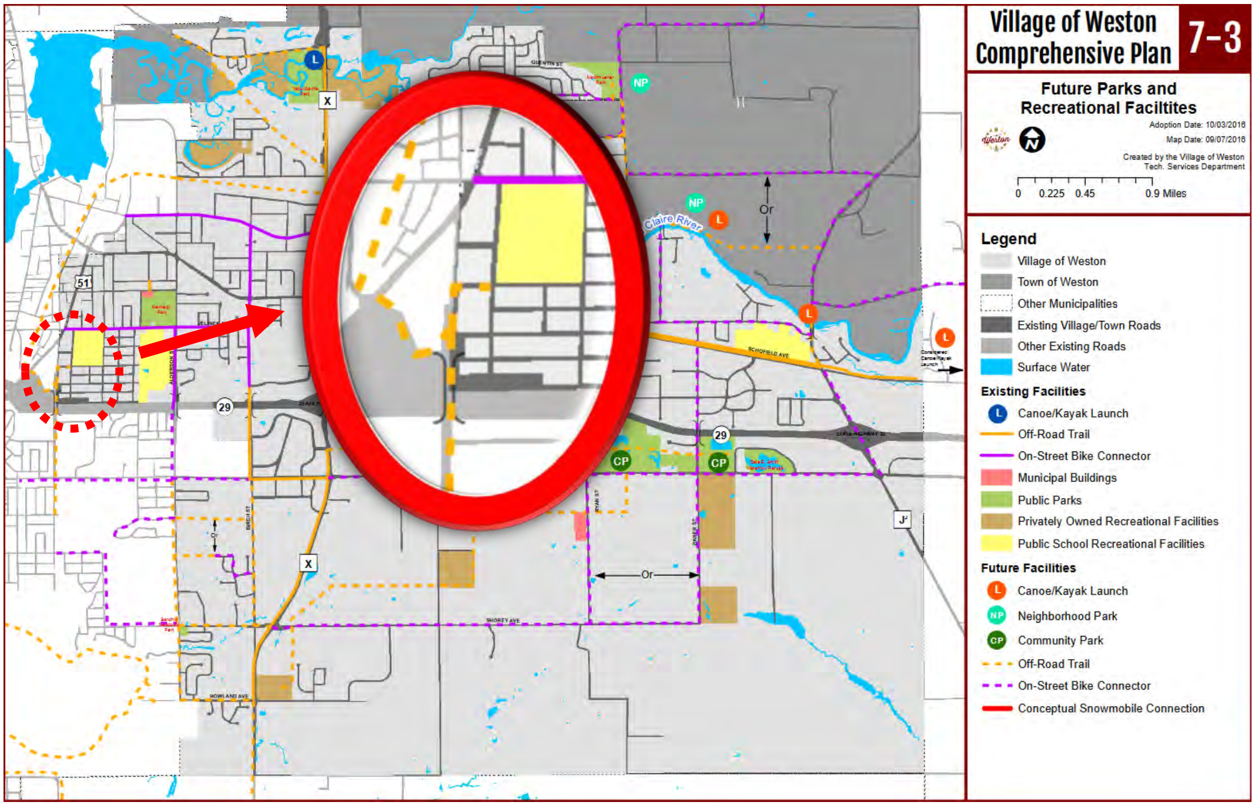


Figure 2: Future Parks and Recreation Facilities Map from Comprehensive Plan: note project shown as a future off-road facility.

Weston Neighborhood Reconstruction

Figure 1: Project Location Map

Figure 2: Pavement on Kennedy At S Timber

Figure 3: Pavement on Von Kanel just South of Kennedy

Crestwood Acres Reconstruction

Figure 1: Map of streets included in this planned neighborhood reconstruction.

Figure 2: Kirk St Pavement Deuteriation, typical for the roads in this neighborhood.

Figure 3: Kirk St water service leak from 2017.

Birch St Reconstruction (Shorey to Cross Pointe)

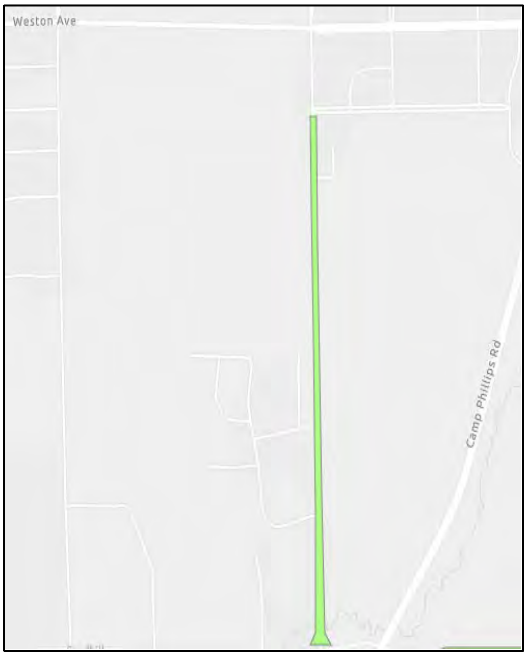


Figure 1: Picture of cracked pavement and rutting in the wheel tracks (~3" deep. This is typical along the length of the roadway)

Figure1: Map of Project Location

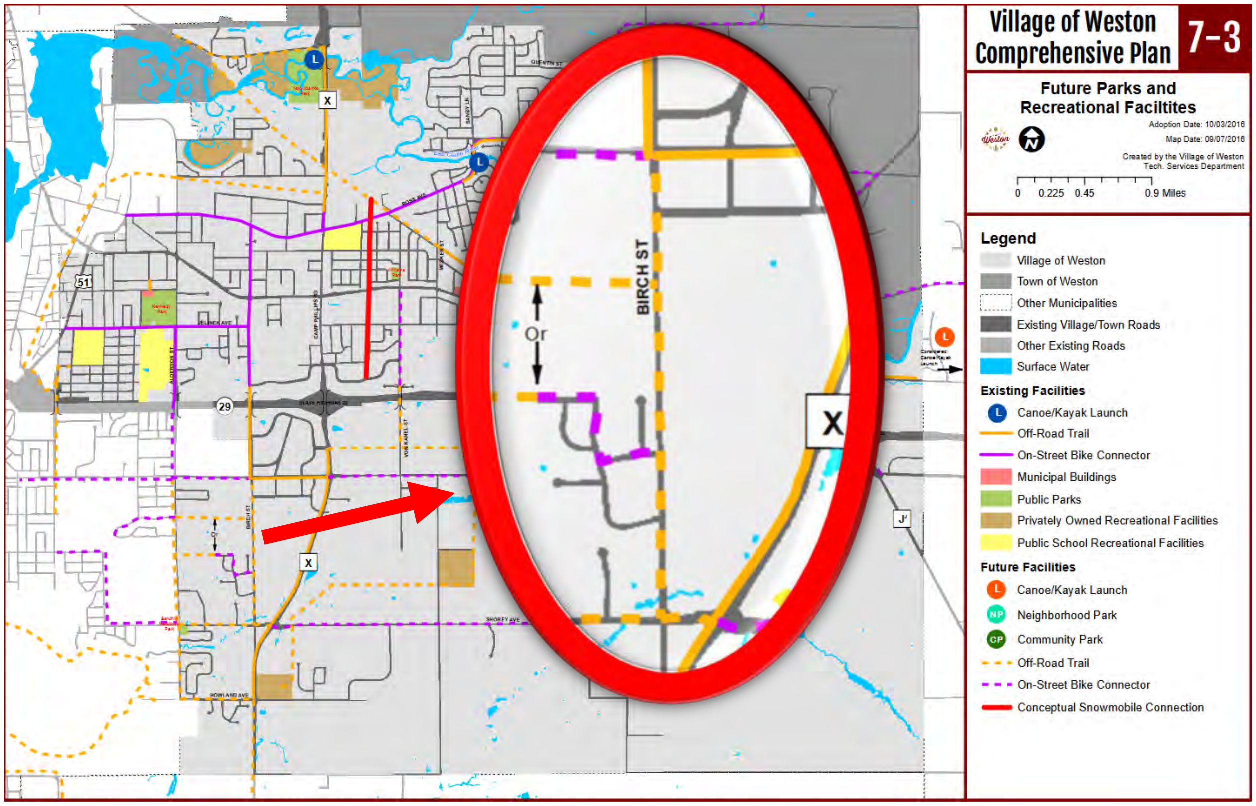


Figure 3: Village's Comprehensive Plan Future Recreational Facilities Map, note Birch St is listed as a Future Off-Road Trail

Kramer Ln (Trotzer to Gusman)

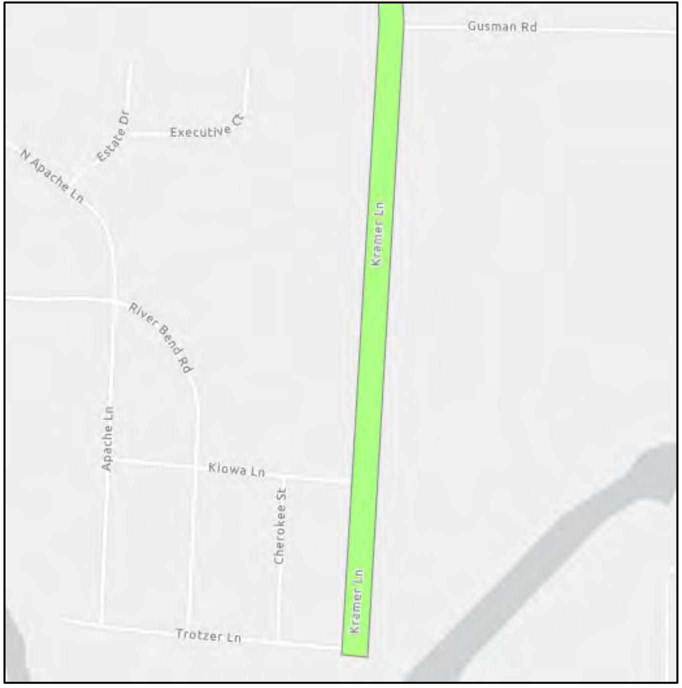


Figure 1: Project Location Map

Figure 2: Kramer Ln, north of Kiowa looking south.

Figure 3: Kramer Ln, north of Kiowa looking north

East Jelinek (X to Von Kanel) and
Von Kanel (Barbican to Schofield Ave)

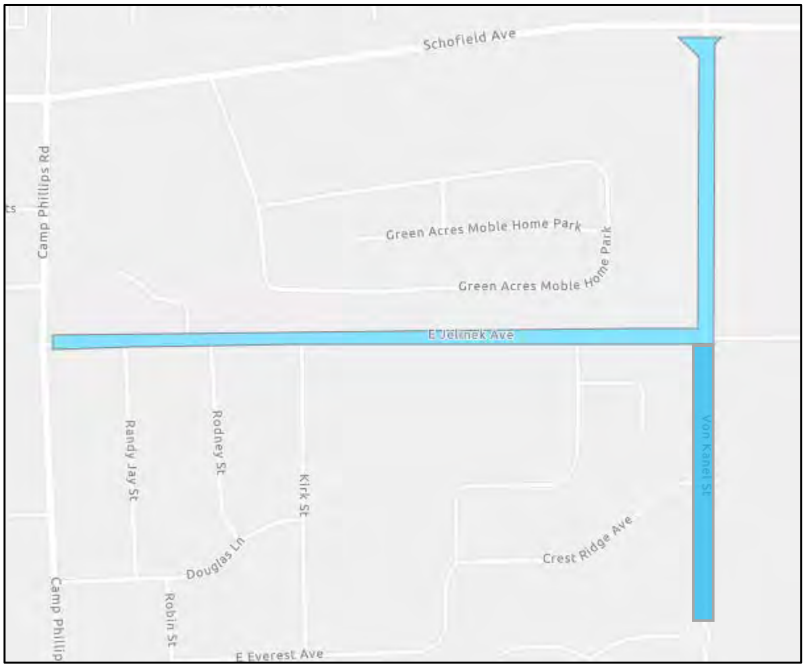


Figure 1: Project Location Map

Figure 2: Von Kanel between E Jelinek and Schofield Ave looking south towards E Jelinek

Ross Ave (River Bend to Quentin)

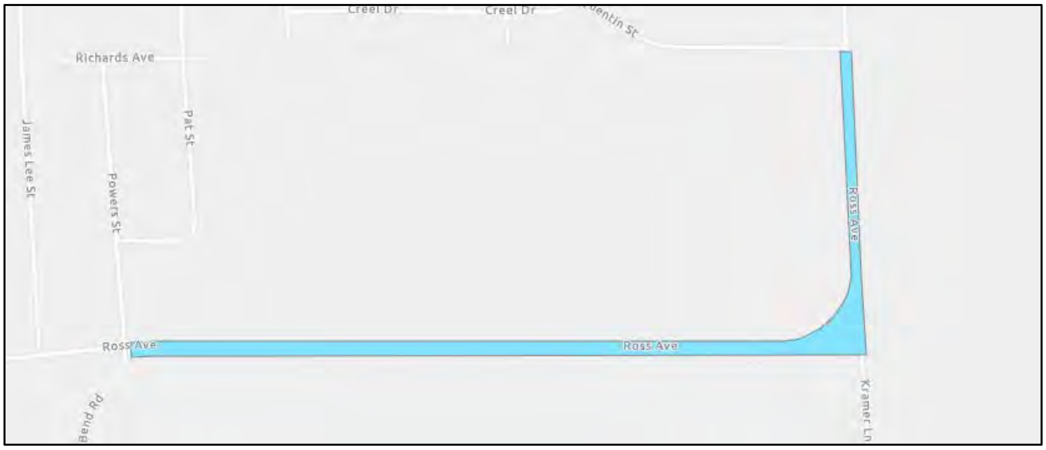


Figure 1: Project Location Map

Figure 2: Ross Ave just south of Quentin St looking south towards Kramer Ln: Note pavement cracking and bike route sign. Also the heavily wooded west side of the road makes for the poor visibility issues at the intersection.

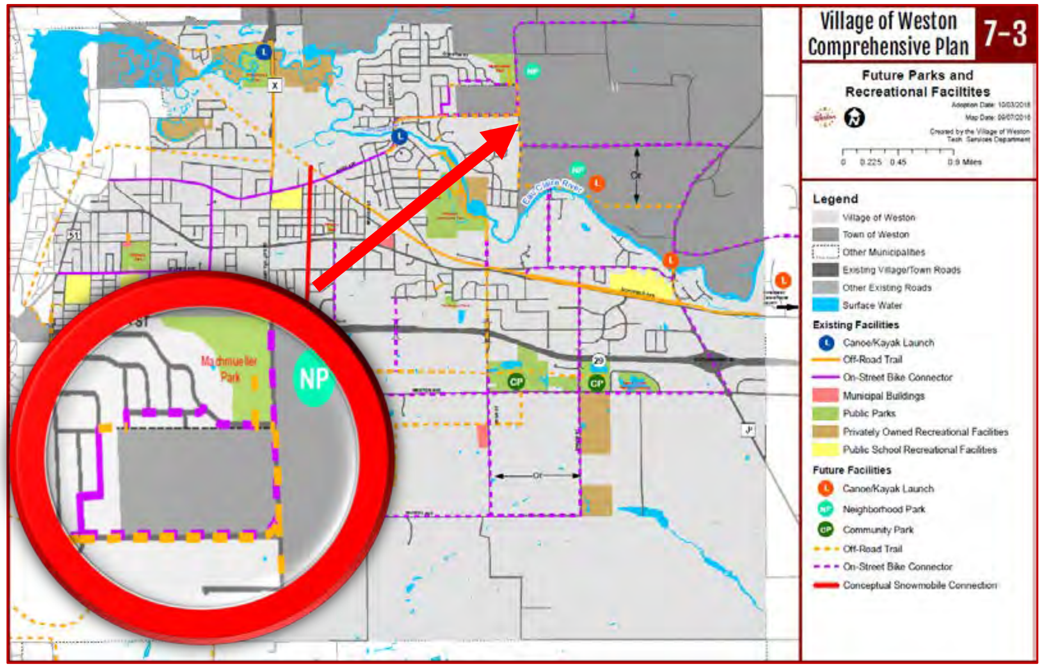


Figure 3: Village of Weston Future Parks and Recreational Facilities Map showing Ross Ave with a Future Off-Road Trail and On-Street Bike Connector

Birch St (Community Center Dr to Jelinek Ave)

Figure 1: Project Location Map

Figure 2: Birch St at Foxtail Ct looking north towards Jelinek Ave: Note pavement cracking and failed sections that have been patched along the wheel ruts on the left side of the picture.

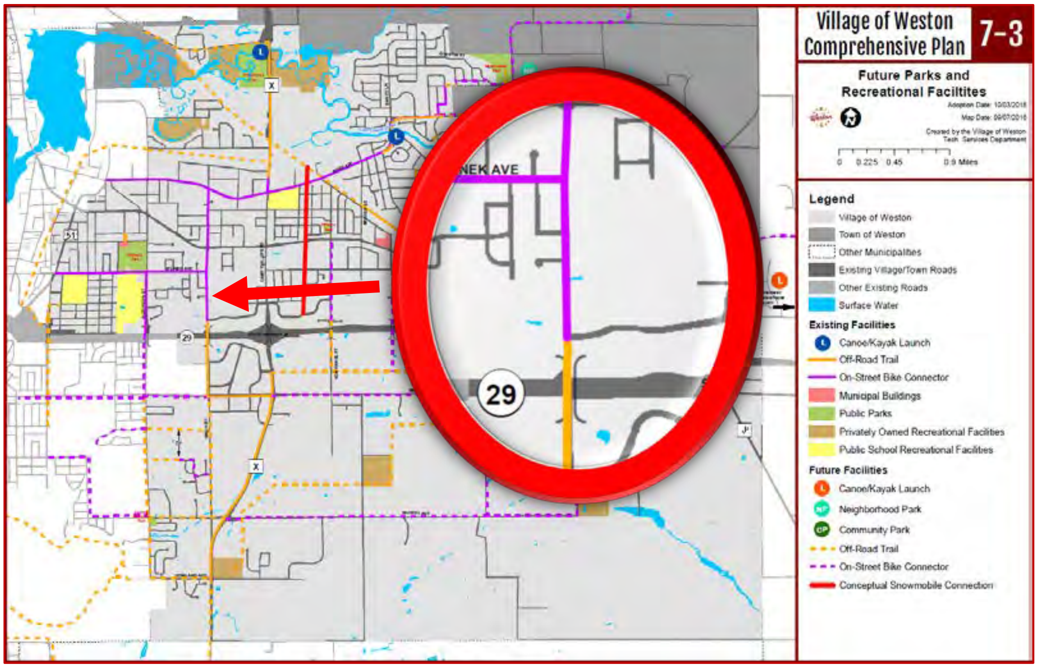


Figure 3: Village of Weston Future Parks and Recreational Facilities Map showing Birch St as an On-Street Bike Connector

Ferge St (Post to Jelinek) and Delonay Ave

Figure 1: Project Location Map

Figure 2: Ferge St at Delonay looking north towards Post Ave: Note pavement cracking and failed sections that have been patched. Also, there's standing water along the side of the road where water can't drain away

Figure 3: Ferge St between Jelinek and Delonay looking north towards Delonay. Note existence of sidewalk here and then in Figure 2 it does not exist.

Northwestern Ave (X to City of Wausau Limits)

Figure 1: Project Location Map

Figure 2: Northwestern Ave at Yellowbanks Park looking west: Note the patching and wear in the wheel tracks

Figure 3: Northwestern Ave at Bruce Dr looking east Note cracking of pavement and patching in wheel tracks.

Everest Ave (Volkman to Alta Verde)

Figure 1: Project Location Map

Figure 2: Everest Ave east of Normandy looking east. Sealcoat is flaking off in spots and reflective cracks are showing through.

Figure 3: Close up look at the pavement on Everest Ave showing the sealcoat flaking off and small potholes in the right wheel tracks

Fuller St (Ross to Schofield Ave)

Figure 1: Project Location Map

Figure 2: Fuller St near Thomas Ave looking North. Along the route the edge of the road is broken up which is shown on the right side as well as the reflective cracking through the sealcoat.

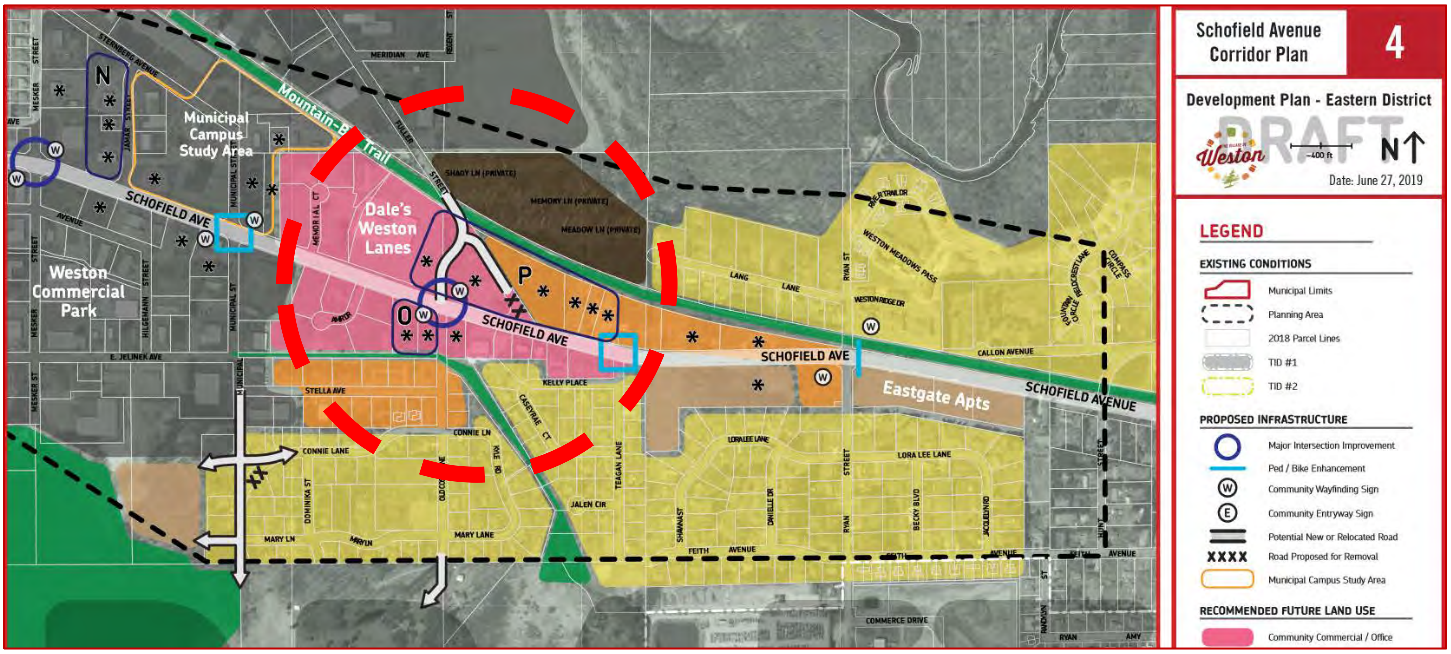
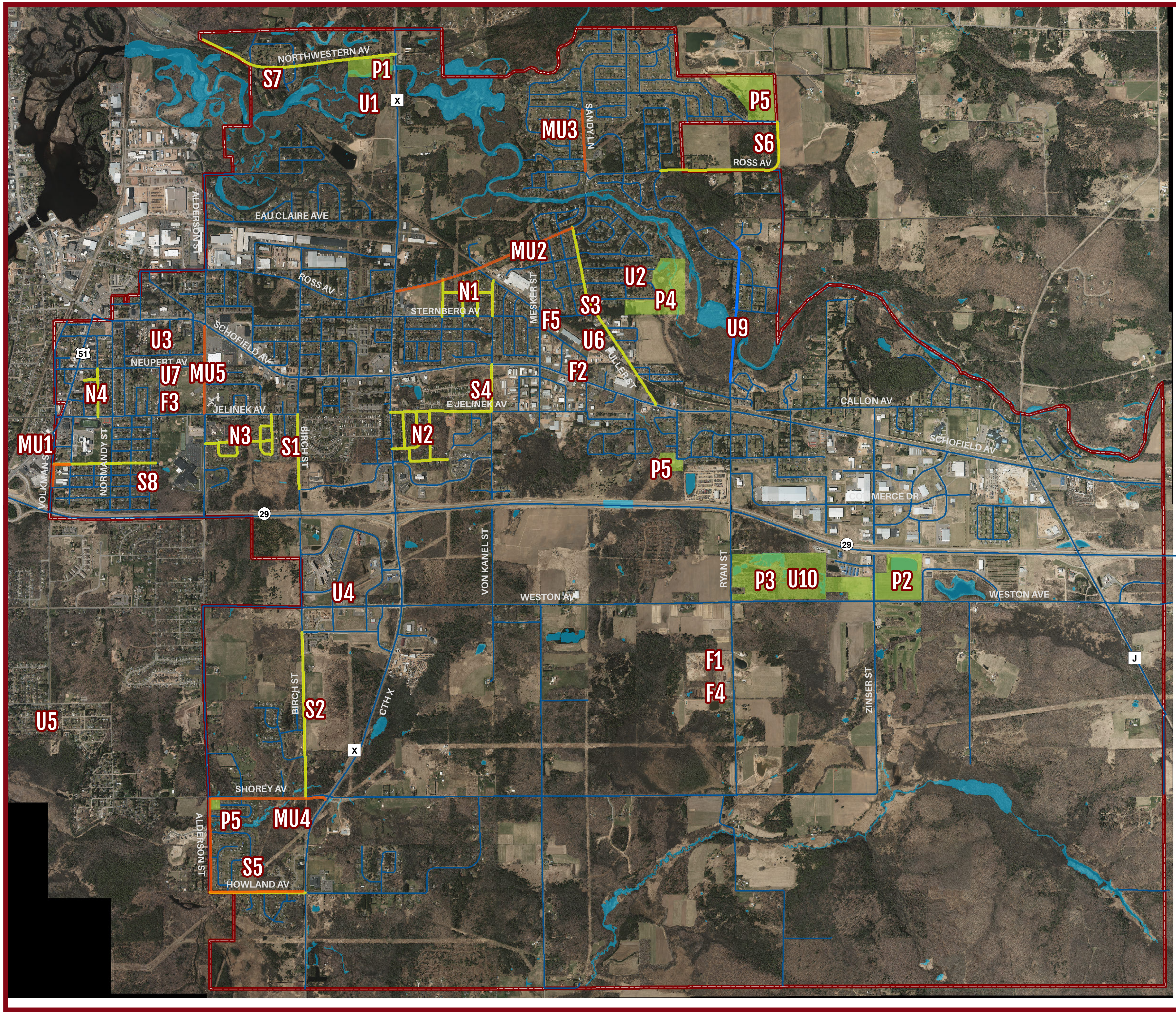


Figure 3: Schofield Avenue Corridor Plan Map for the Eastern District showing the reconfigured Fuller St and Schofield Ave intersection



Village of Weston
Marathon County, Wisconsin

Weston PW - Proposed Infrastructure and Related Projects

DRAFT

Map Date: 6/30/2017

Adoption Date (Village): N/A

Map by the Technology Services Department
Village of Weston

0 0.25 0.5 1 Miles

Legend

🟦	WatermainExtensions
🟧	Multi-Use Paths / Ped Facilities Projects
🟨	Street Projects
🟩	Parks Projects

FACILITY PROJECTS

F1	Ryan St Access Control
F2	Municipal Center
F3	Aquatic Center Upgrades
F4	Ryan St Building
F5	Public Safety Building

NON-TIF STREET PROJECTS

S1	Birch St (Jelinek to Community Center Dr)
S2	Birch St (Shorey to Cross Pointe)
S3	Fuller (Ross to Schofield)
S4	E Jelinek (X to Von Kanel) and Von Kanel (E Jelinek to Schofield)
S5	Howland (X to Brolta/Alderson)
S6	Ross/Kramer
S7	Northwestern (X to Wausau)
S8	Everest Ave (Volkman to Alta Verde)

NEIGHBORHOOD STREET PROJECTS

N1	Weston School Addition (Kennedy, S Timber, Sunset, Arrow, Von Kanel)
N2	Crestwood Acres (Douglas, Kirk, Rodney, Randy Jay, Robin, E Everest)
N3	Park Ridge (Shepherd, Boxer, Labrador, Setter, Park Ridge)
N4	Ferge & Delonay

MULTI-USE PATHS / PED FACILITY PROJECTS

MU1	Volkman St (Heuss to Everest)
MU2	Ross Ave (X to Fuller)
MU3	Sandy Ln (Hewitt to Alex)
MU4	Alderson/Howland/Shorey (SW Neighborhood)
MU5	Alderson (Jelinek to Schofield)

PARK PROJECTS

P1	Yellow Banks
P2	Sports Complex
P3	Prohaska Park
P4	Kellyland Park
P5	Play Structure Replacement/Shelter Upgrades (Robinwood/Sandhill/Machmueller)

UTILITY SPECIFIC PROJECTS

U1	Well 7
U2	Tonya/Tricia Lift Station
U3	Bloedel Well Manganese Removal
U4	Weston Ave Water Tower
U5	Harlyn Lift Station
U6	Sternberg Well Upgrades
U7	Alta Verde Well Upgrades
U8	SCADA Upgrade (implement Wonderware)
U9	River Crossing at Ryan St
U10	Prohaska Park Service