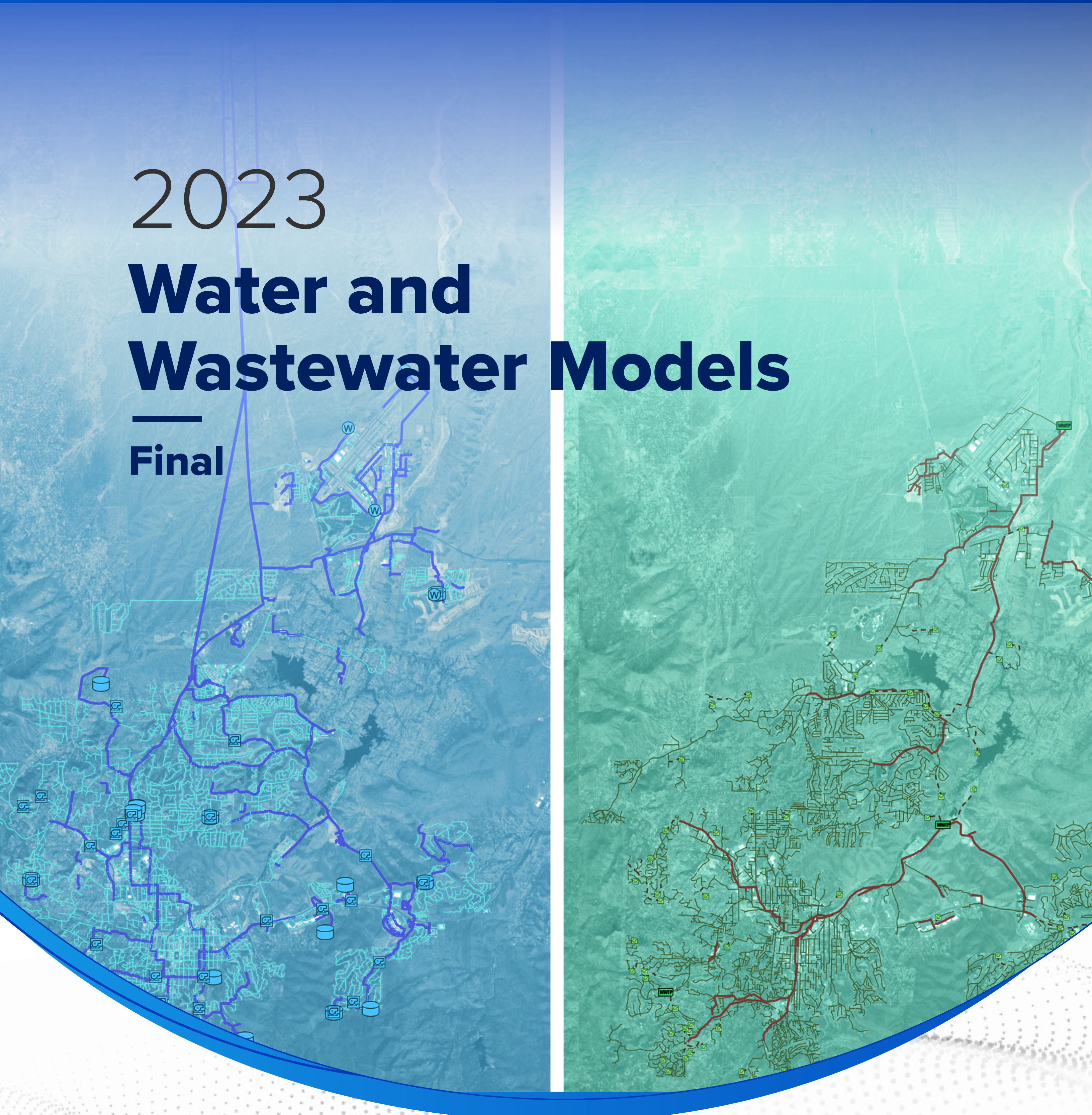
Prepared for the
CITY OF PRESCOTT

2023
Water and Wastewater Models

Final



November 2023

City of Prescott

2023 WATER AND WASTEWATER MODELS

FINAL | November 2023

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Abbreviations

$M	millions of dollars
2013 Study	2013 Water and Wastewater Models Study
2018 IBC	2018 International Building Code
2018 IFC	2018 International Fire Code
2018 Study	2018 Water and Wastewater Models Study
2023 Study	2023 Water and Wastewater Model Update Study
A.A.C.	Arizona Administrative Code
AACE	Association for the Advancement of Cost Engineers
AADF	average annual daily flow
ADD	annual daily demand
ADWF	average dry weather flow
AED	Arizona Eco Development
AFY	acre-feet per year
AWRF	Airport Water Reclamation Facility
BCWR	Big Chino Water Ranch
Carollo	Carollo Engineers
CCFRPM	Centrifugally Cast, Fiberglass-Reinforced, Polymer Mortar
CIP	capital improvements program
CIPP	cured-in-place pipe
City	City of Prescott
CVID	Chino Valley Irrigation District
d/D	depth over diameter
DIP	ductile iron pipe
DU	dwelling unit
ENR CCI	Engineering News Record Construction Cost Index
EPA	Environmental Protection Agency
EPS	extended period simulation
ft	feet
ft/ft	feet per foot
ft/sec	feet per second
FRP	fiberglass reinforced plastic
GIS	geographic information system
gpad	gallons per acre per day
gpd/DU	gallons per day per dwelling unit
gpm	gallons per minute
GSP	galvanized steel pipe
HDPE	high-density polyethylene
HGL	hydraulic grade line
I/I	inflow and infiltration

IIP	Infrastructure Improvement Plan
in	inch(es)
lf	linear feet
MCL	maximum contaminant level
MD	maximum day
MD/ADD	maximum day to annual daily demand
MDD	maximum day demand
MF	multi-family
MG	million gallons
mgd	million gallons per day
min	minute(s)
MM	maximum month
NA	non-applicable
ND	not detectable by laboratory method EPA 527.1
NR	non-residential
PCC	Prescott City Code
PDF	peak daily flows
PFAS	per- and polyfluoroalkyl substances
PFOA	perfluorooctanoic acid
PFOS	perfluorooctane sulfonate
PH	peak hour
PHD	peak hour demand
Planning Model	Water Demand and Supply Model
ppb	parts per billion
Project	2023 Water and Wastewater Models Project
PRV	pressure reducing valve
psi	pounds per square inch
PVC	polyvinyl chloride
SCADA	supervisory control and data acquisition
SF	single family
VA	Veterans Affairs
VCP	vitrified clay pipe
WLE	Willow Lake Estates
WLR	Willow Lake Regional
WPF	water production facility
WRF	water reclamation facility
WRP	water reclamation plant
WWTP	wastewater treatment plant
YPIT	Yavapai Prescott Indian Tribe
YRMC	Yavapai Regional Medical Center

Chapter 1

OVERVIEW

The City of Prescott (City) currently provides water and sewer service to a population of approximately 57,000. The City has experienced relatively steady growth since 1970 with a short period of decline after the year 2010 following the Great Recession. In 2022, Prescott's economy continued to thrive and attract new development. In future years, the population is expected to increase within the City's incorporated limits, some future development areas, and Chino Valley.

The City initiated the 2023 Water and Wastewater Models Study (2023 Study) to proactively plan water and sewer system improvements to support both existing customers and new development.

1.1 2015 General Plan and Planning Model

The study area, land use, and zoning data for infrastructure planning in the 2023 Study includes the City's incorporated limits, active growth areas outside of the City limits in Deep Well Ranch and Granite Dells Ranch, and portions of unincorporated Yavapai County that are defined in the City's 2015 General Plan Land Use Plan. The City's Water Demand and Supply Model (the Planning Model) prepared by Herb Dishlip Consulting and the City was used for estimating population growth, development timing, water demand projections, and wastewater flow projections. However, the development timing of some areas was adjusted based on the City's feedback. Therefore, the 2023 Study development timing is not exactly the same as the Planning Model.

The water and wastewater infrastructure recommendations in the 2023 Study were developed based on the assumptions in the City's Planning Model.

1.2 Previous Model Studies

The City's first water distribution system model was developed in 2005 and the City's first wastewater collection system model was developed in 2008. The 2013 Water and Wastewater Models Study (2013 Study) and the 2018 Water and Wastewater Models Study (2018 Study) provided updates to the water distribution and wastewater collection systems models and capital plans. The City uses both models regularly to evaluate system capacity requirements for new developments and evaluate the impacts of potential operational changes before physical system changes are made (i.e., modifying pressure zone boundaries).

Major outcomes of the 2005 Water Distribution System Model Report include:

1. A plan for providing additional water supplies for the City through the purchase of the Big Chino Water Ranch (BCWR) project and Airport Area wells.
2. Establishing the need for an Intermediate Storage and Pumping facility west of the Airport to receive water from the City's Chino Valley wells and the future BCWR project.
3. Identifying new water infrastructure needed to support new development and strengthen fire protection.

4. Establishing water storage requirements, identifying storage deficits and storage surpluses that could benefit the City.
5. Identifying pump station improvements needed to support new development and to strengthen fire protection.
6. Identifying opportunities to simplify pressure zones to reduce operating costs.

Major outcomes of the 2008 Wastewater Collection System Model Report include:

1. Identifying gravity interceptors that need increased capacity.
2. Identifying lift station upgrades to increase capacity.
3. Identifying lift stations that could be decommissioned to reduce operating costs.
4. Recommendations to expand the City's treatment capacity.
5. Recommendations to upgrade the capacity of the Lake surface water recharge pipeline.

Upon completing the 2005 and 2008 Model Studies, the City engaged in an aggressive capital improvement program that involved installing water mains, gravity sewers, storage tanks, pump stations and wells, including:

- Zone 0 Storage Reservoirs.
- Zone 12 Tank.
- Zone 19 Pump Station, Tank and Transmission Main.
- Zone 24 Pump Station and Tank.
- Zone 27 Pump Station, Tanks and Transmission Main.
- Zone 39 Pump Station and Tank.
- Zone 48 Pump Station.
- Airport Well No. 2.
- Nearly 30 miles of gravity sewers.

One of the purposes of the 2013 Study was to re-assess the capacity of the water and wastewater systems following the many changes the City made to each system including the new infrastructure that had been constructed based on recommendations in the 2005 and 2008 studies. The primary outcomes of the 2013 Study include:

1. Additional recommendations for simplifying pressure zones and potentially reducing operating costs.
2. An evaluation of the infrastructure needed to deliver water from Zone 12 to the Intermediate Storage and Pumping Facility.
3. An evaluation of emergency operations and redundancy to improve water system reliability.
4. A desktop condition assessment of the collection system to assess the criticality, vulnerability, and risk to the City in the event of a collection system failure.
5. An evaluation of the water and wastewater infrastructure needed to serve growth in undeveloped areas.
6. Preparation of a capital improvement program with a definition of impact fee service areas and specific infrastructure to include in the City's Infrastructure Improvement Plan (IIP).

One of the purposes of the 2018 Study was to re-assess the capacity of the water and wastewater systems following the many changes the City made to each system including the new infrastructure that had been constructed based on recommendations in the 2005 and 2008 reports and the 2013 Study. The primary outcomes of the 2018 Study include:

1. Updated documentation of the City's water resources portfolio.
2. Additional recommendations for simplifying pressure zones and potentially reducing operating costs, including an updated water system schematic.
3. An updated evaluation of emergency operations and redundancy to improve water system reliability.
4. A new wastewater system schematic that illustrates the City's collection system service areas, lift stations and connectivity to assist operations in emergency planning.
5. An evaluation of the water and wastewater infrastructure needed to serve growth in undeveloped areas, including an updated and calibrated wastewater model with a representation of a centralized wastewater treatment at the Airport Water Reclamation Facility (WRF).
6. Updated capital improvements for the water and wastewater systems, including modifications to the City's IIP service areas.

1.3 Project Purpose and Scope

The 2023 Study builds upon the water distribution and wastewater collection planning work previously completed by the City since 2005. Like the previous model studies, the 2023 Study is based on a definition of the City's planning area, a set of flow projections, currently developed lands, and potential growth areas. Field work was completed to record water system pressures and monitor wastewater flows so that the City's water and wastewater models could be updated and applied to evaluate infrastructure capacity and identify infrastructure requirements for growth.

The purpose of the 2023 Water and Wastewater Models Project (Project) is to provide the City with updated hydraulic models for water and wastewater systems that incorporate the infrastructure additions and new projected development since the models were last updated in 2018. This update will include current water demand and wastewater flow projections that will form the basis for infrastructure improvements to the water distribution and wastewater collection systems. This recommended infrastructure will be incorporated into the City's Capital Improvement Program (CIP) and IIP. The results of this study will be used in the City's upcoming water and sewer rate study.

The scope of work for the 2023 Study includes:

1. Updated water demand and wastewater flow projections, as well as projections and timing for planned development areas in the City.
2. An updated and calibrated water model that includes the infrastructure improvements that have been installed since 2018, infrastructure that is currently being designed but is not yet constructed, and updated water demands.
3. An updated and calibrated wastewater model that includes the infrastructure improvements that have been installed since 2018, current lift station operating parameters and pump curves, infrastructure improvements that are currently being designed but are not yet constructed, private low pressure sewer lines, proposed infrastructure from the 2020 Sewer Connections Study, and updated wastewater flows including wastewater flow estimates from the Prop 400 areas.

4. An evaluation of the capacity of the water system including supply, storage, pumping, distribution system capacity (flows and pressures) for both peak hour and fire flow conditions.
5. A desktop condition assessment evaluation of the existing water system.
6. An updated emergency operations and redundancy analysis for the water system.
7. An evaluation of the capacity of the wastewater system including gravity mains, lift stations and force mains.
8. A desktop condition assessment evaluation of the existing wastewater system.
9. An emergency operations and redundancy analysis for wastewater system.
10. Updated capital improvements for the water and wastewater systems, including modifications to the City's IIP service areas.
11. A correlation of projects completed in the 2018 Study to aid the City in managing recommendations from previous studies and developing capital improvement projects moving forward.
12. Updates to the City's water system pressure zone schematic that illustrate opportunities to simplify operation by combining pressure zones.
13. Updates to the City's wastewater system schematic that illustrates the City's collection system service areas, lift stations and connectivity to assist operations in emergency planning.

The 2023 Study covers six planning horizons, namely 2022, 2027, 2032, 2037, 2042, and Buildout (2130).

The report is organized as follows:

- Chapter 1 – Introduction
- Chapter 2 – Planning Framework, including definition of the study area for water and wastewater services; definition of growth areas; population and growth projections; water demand projections; and wastewater flow projections.
- Chapter 3 – Water System Analysis, including water model update and calibration; definition of water system performance criteria; water supply, storage, pumping, and distribution system capacity analysis for existing and future conditions; water system efficiency specifically related to water storage utilization and optimization and pressure zone evaluation; fire flow evaluation; desktop condition assessment; emergency operations and redundancy analysis; and identification of capital improvements to address existing and future system deficiencies.
- Chapter 4 – Water System Capital Improvement Program, including cost development methodology; unit costs; IIP service area definition; water infrastructure project definitions with timing and costs for capital improvement projects, IIP projects, future development projects, and operational recommendations; and project correlation with previous studies.
- Chapter 5 – Wastewater System Analysis, including wastewater model update and calibration; definition of wastewater system performance criteria; collection system and lift station capacity evaluations; desktop condition assessment; emergency operations evaluation; and identification of capital improvements to address existing and future system deficiencies.
- Chapter 6 – Wastewater System Capital Improvement Program, including cost development methodology; unit costs; IIP service area definition; wastewater infrastructure project definitions with timing and costs for capital improvement projects, IIP projects, and future development projects; and project correlation with previous studies.

Chapter 2

PLANNING FRAMEWORK

This chapter presents the planning framework for the 2023 Water and Wastewater Model Update Study (2023 Study). The planning framework includes the assumptions and criteria that have been established through collaboration with the City of Prescott (City). The planning framework forms the basis for the capital improvement and other recommendations from this study and includes the following:

- Study area for water and wastewater services.
- Population and growth projections.
- Water demand projections.
- Wastewater flow projections.

The planning years used for this project are 2027, 2032, 2037, 2042, and Buildout (2130).

2.1 Study Area

The study area for infrastructure planning in the 2023 Study includes the City's incorporated limits and portions of unincorporated Yavapai County that are defined in the City's General Plan Land Use Plan. The Yavapai Prescott Indian Tribe (YPIT) Reservation and Chino Valley Irrigation District (CVID) service area are included in the study area for the water resources evaluation. The study area is shown in Figure 2.1 and includes locations that are served by private water and sewer systems, undevelopable lands, and areas that may not have water resources to develop; so this study does not assume buildout of the entire planning area.

The CVID service area and YPIT Reservation were identified for special planning considerations primarily for water resources planning, although there could be new infrastructure needed in these service areas. The CVID service area contains a relatively small number of water connections adjacent to the City's Chino Valley wells, and the YPIT Reservation is currently served by the City's water distribution system. Figure 2.2 shows the CVID service area and Figure 2.3 shows the YPIT reservation.

Growth is projected in the City's planning areas over the next fifteen years within the incorporated City limits and the unincorporated areas adjacent to the City. The City identified seven growth areas that are likely to develop in the next 5 to 15 years, including:

- Deep Well Ranch.
- The Yavapai Regional Medical Center (YRMC), part of Deep Well Ranch.
- Arizona Eco Development (AED).
- Granite Dells Estates.
- Granite Dells Ranch.
- Granite Dells Ranch – South.
- Storm Ranch.
- The New Development South of Storm Ranch shown as New Development in Figure 2.1.

These new developments were identified in the Water Demand and Supply Model (the Planning Model).

The timing of development in the entire service area was estimated by referring to the Water Demand and Supply Model (the Planning Model) prepared by Herb Dishlip Consulting and the City. The Planning Model incorporated geographically based data and actual historical water use data to predicate an annual average water demand for both existing and future water customers. Each customer account also has development timing information so that the timing of development could be estimated. The version of the planning model used in this study is: General Plan Area 2021 Version 7 26.

The Planning Model predicts that there will be 52,549 accounts in total by Buildout. In 2022, there are 25,675 active accounts. From 2022 to 2040, the growth rate is estimated to be 450 accounts per year. From 2040 through 2130 (buildout year), the growth rate is estimated to be 200 accounts per year. Table 2.1 summarizes the number of new accounts expected between each planning year for the City's service area. However, the development timing in some areas was adjusted with the City's feedback. Therefore, the 2023 Study account development timing isn't exactly the same as the Planning Model. Figure 2.4 shows the additional accounts in each planning year from 2022 through Buildout. Figure 2.5 shows the accounts by land use category (single family [SF], multi-family [MF], non-residential [NR], or non-applicable [NA]) in 2022. In the Planning Model, NA is the account with no water use. Figure 2.6, Figure 2.7, Figure 2.8, Figure 2.9 and Figure 2.10 show the number of new accounts by land use category within each planning year.

Land areas east of the AED North development in Section 32 and Section 33 (AED South) are slated for development, but the Planning Model was last updated before these developments were identified. Figure 2.6 through Figure 2.10 align with the Planning Model so accounts in this land area are not shown on the maps. However, the AED South populations, demands and flows are included in the projections when planning and modeling. The Section 33 planning year is 2027, and the Section 32 planning year is 2032.

Table 2.1 Anticipated Development Account Numbers Within Each Planning Year

	Planning Year				
	2023 – 2027	2028 – 2032	2033 – 2037	2038 – 2042	2043 – Buildout
Newly Developed Accounts	2,590	2,250	2,250	2,250	9,210

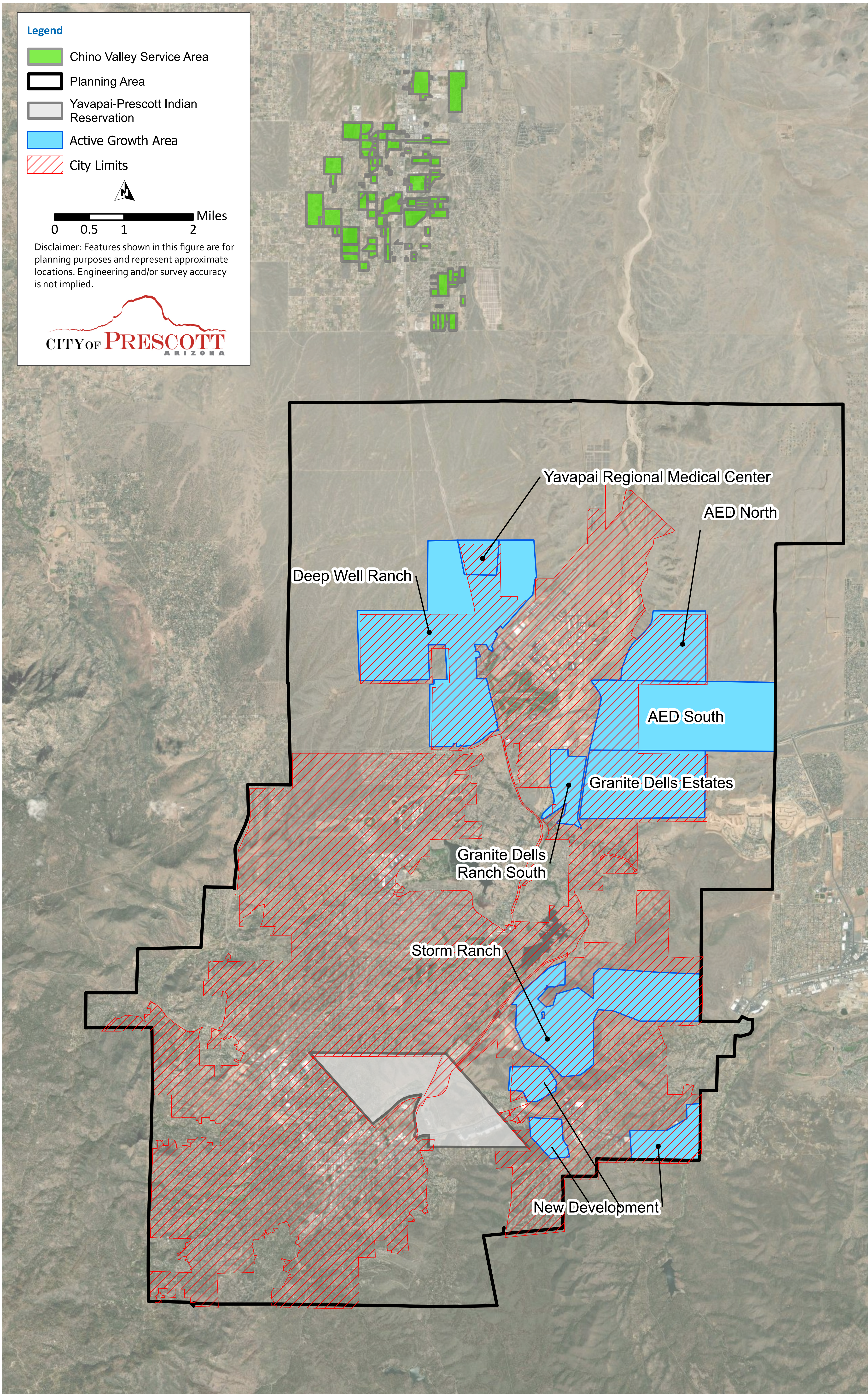


Figure 2.1 City of Prescott Water and Wastewater Study Area

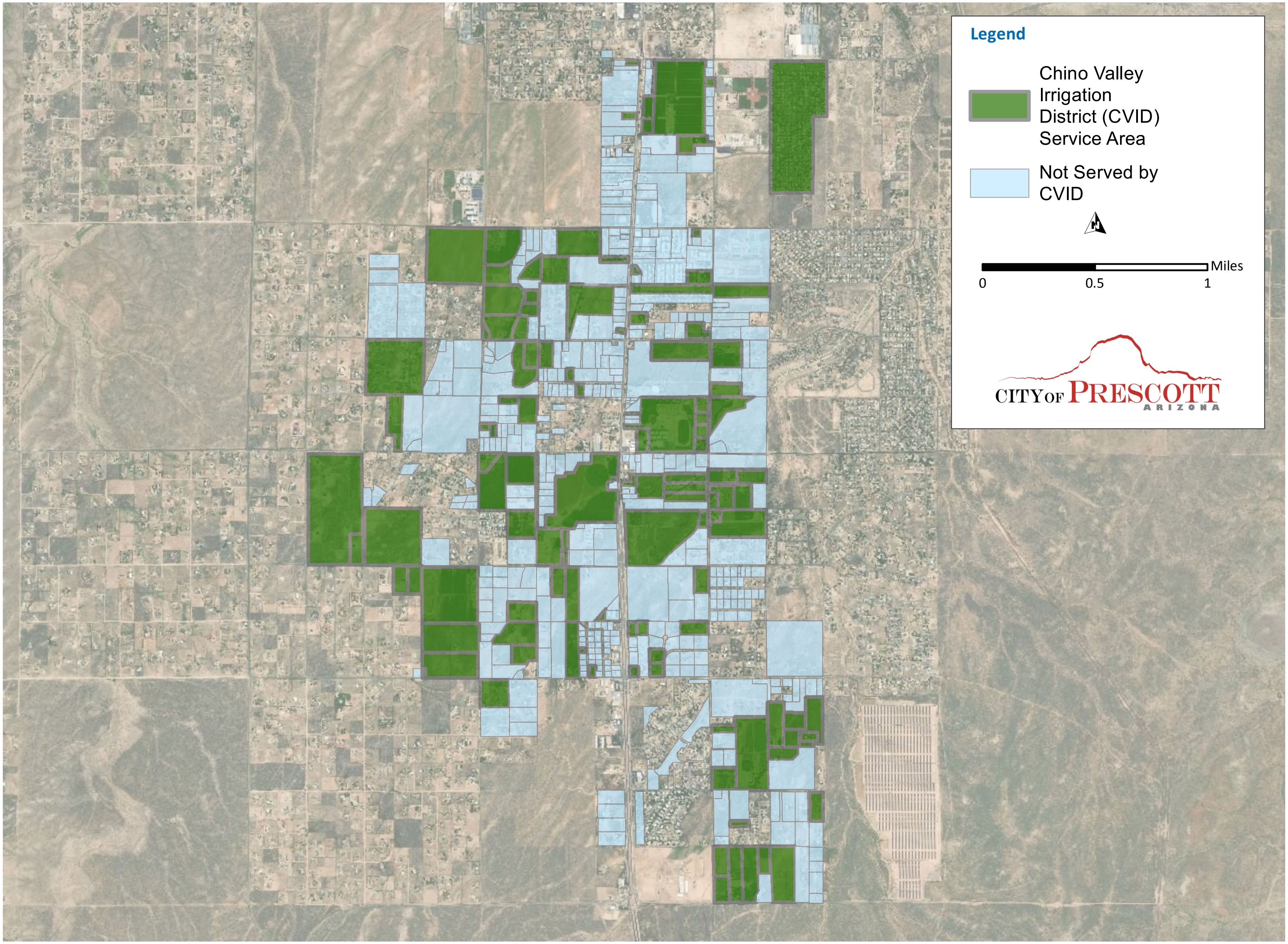


Figure 2.2 Chino Valley Irrigation District Service Area

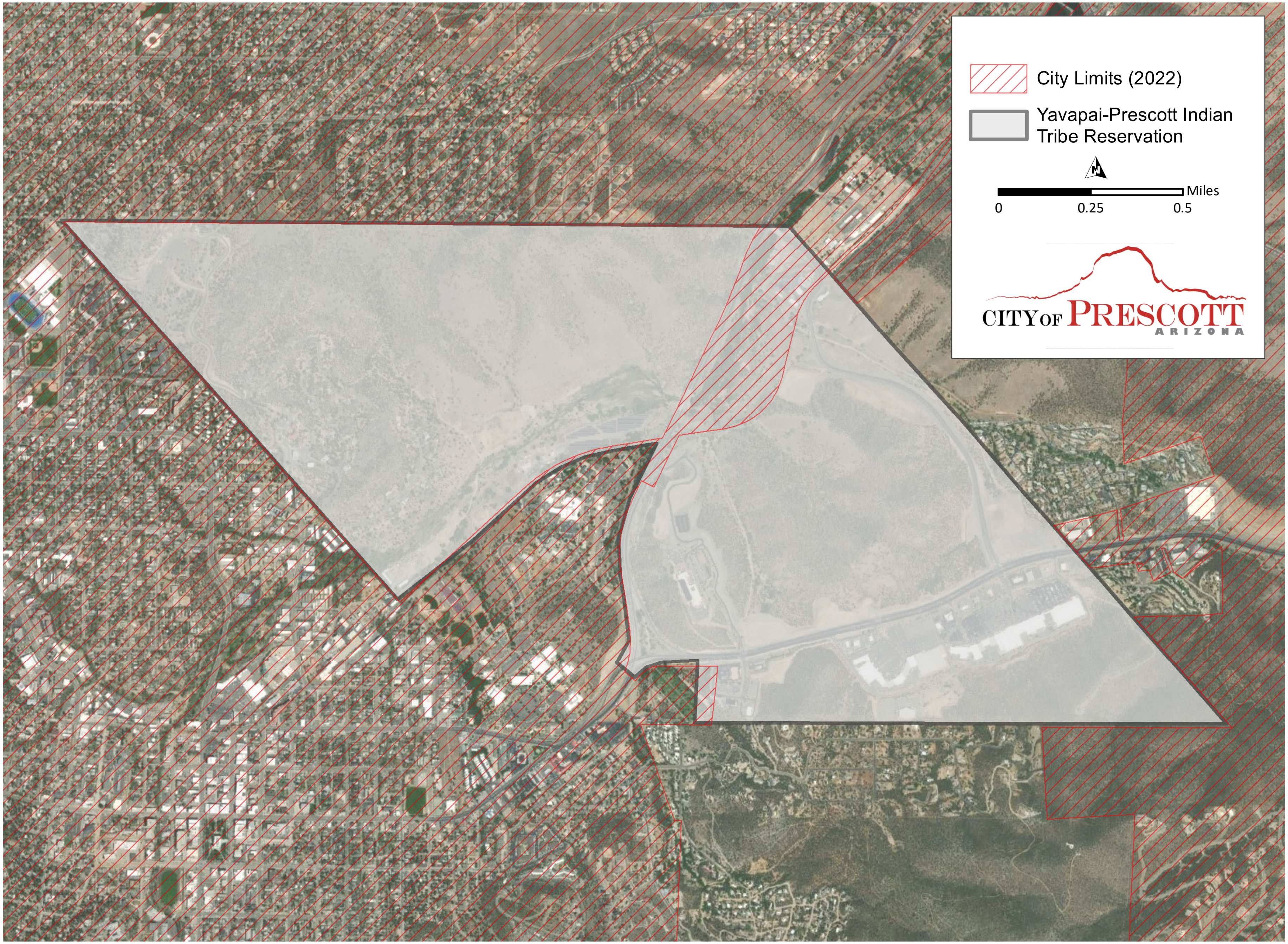


Figure 2.3 Yavapai Prescott Indian Tribe (YPIT) Reservation Lands

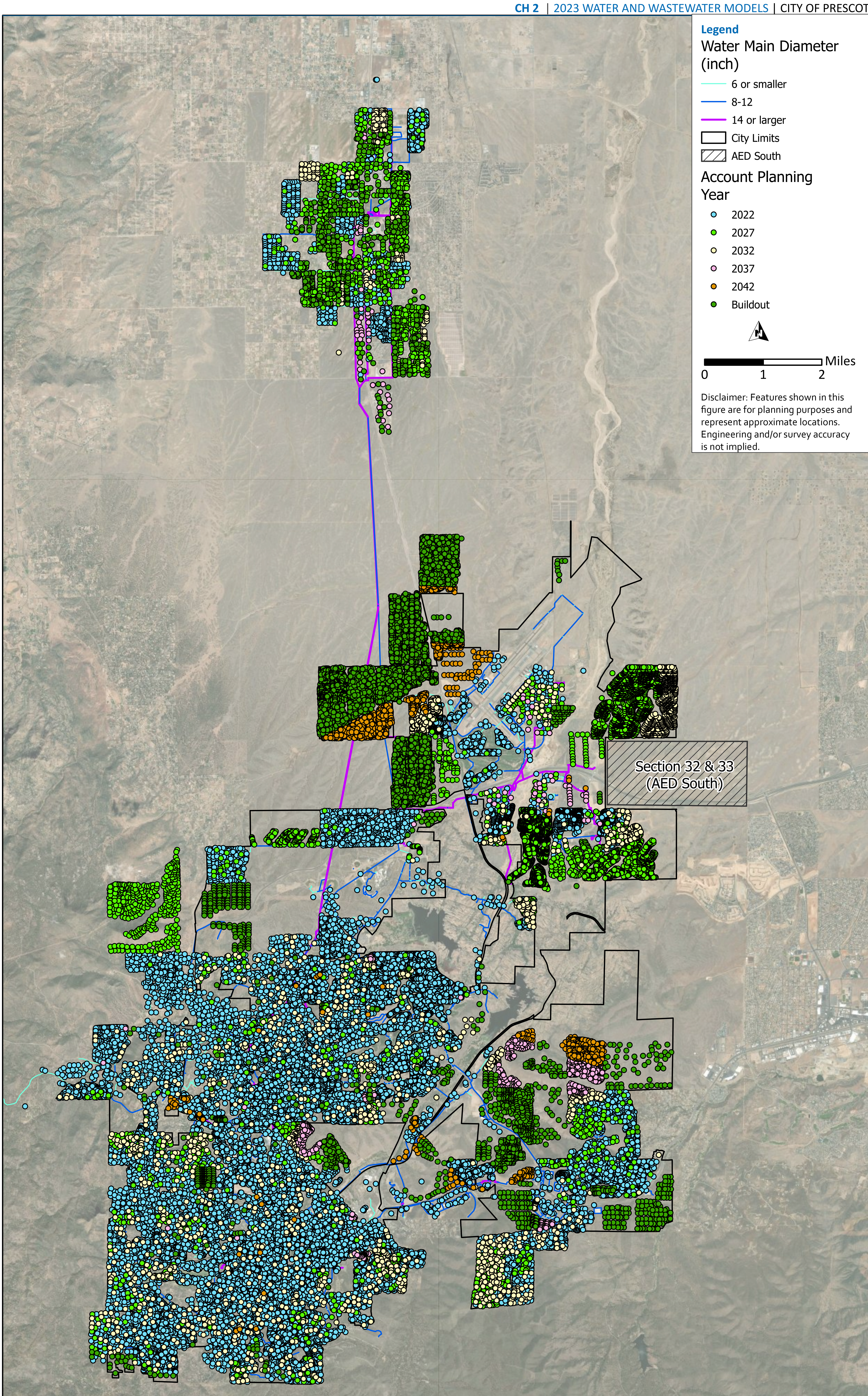


Figure 2.4 Accounts per Planning Year

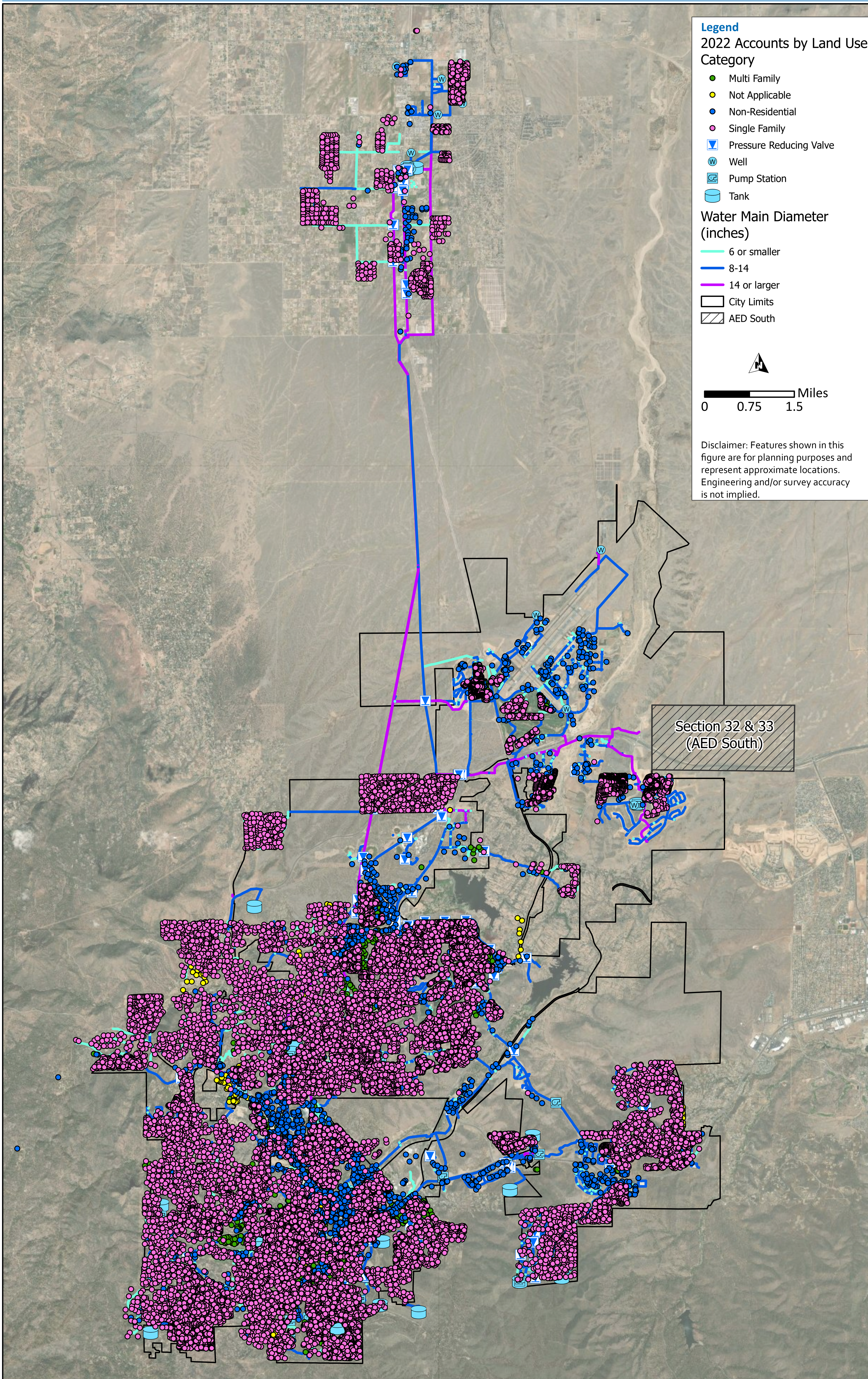


Figure 2.5 2022 Accounts by Land Use Category

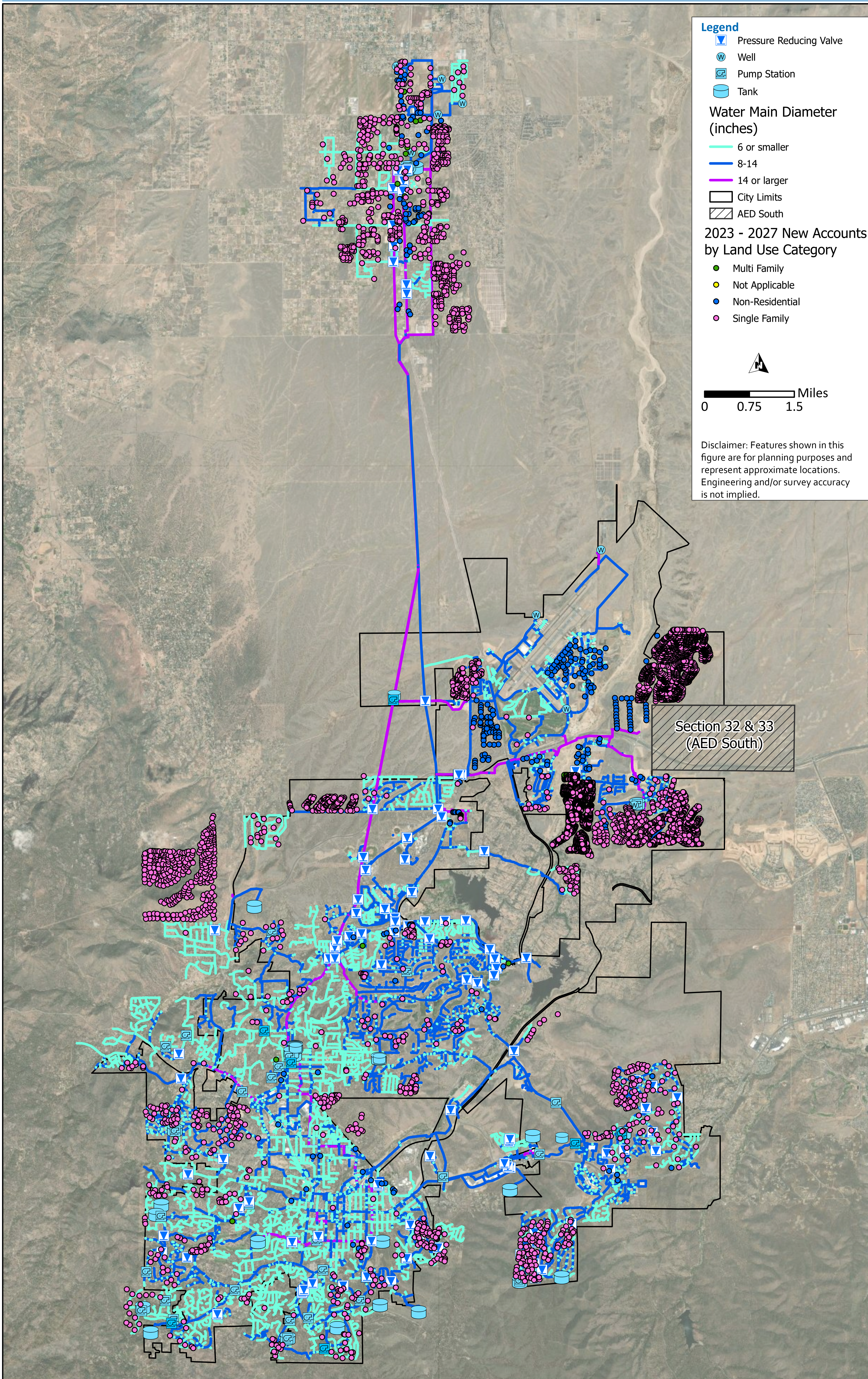


Figure 2.6 2023 - 2027 New Accounts by Land Use Category

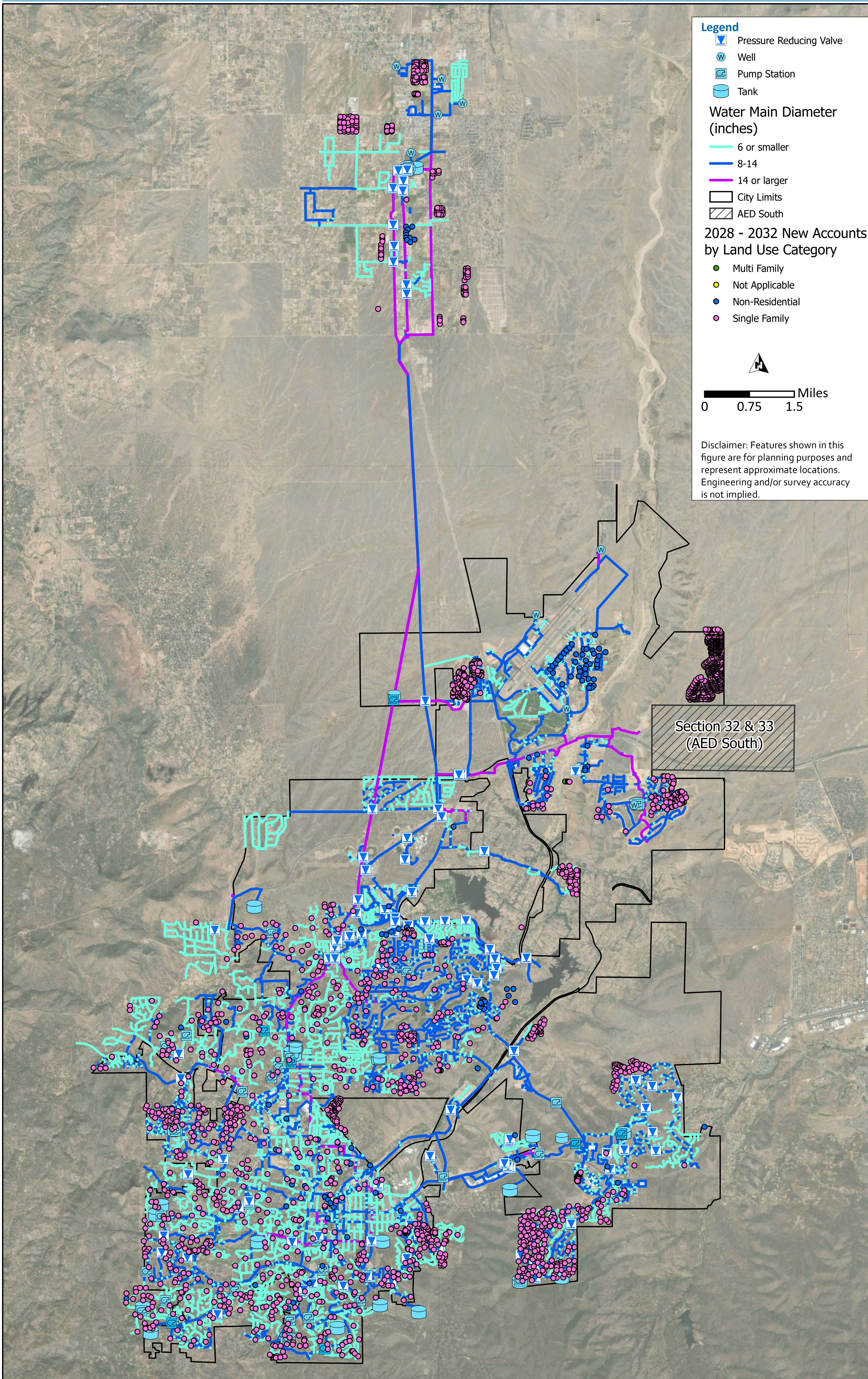


Figure 2.7 2028 - 2032 New Accounts by Land Use Category

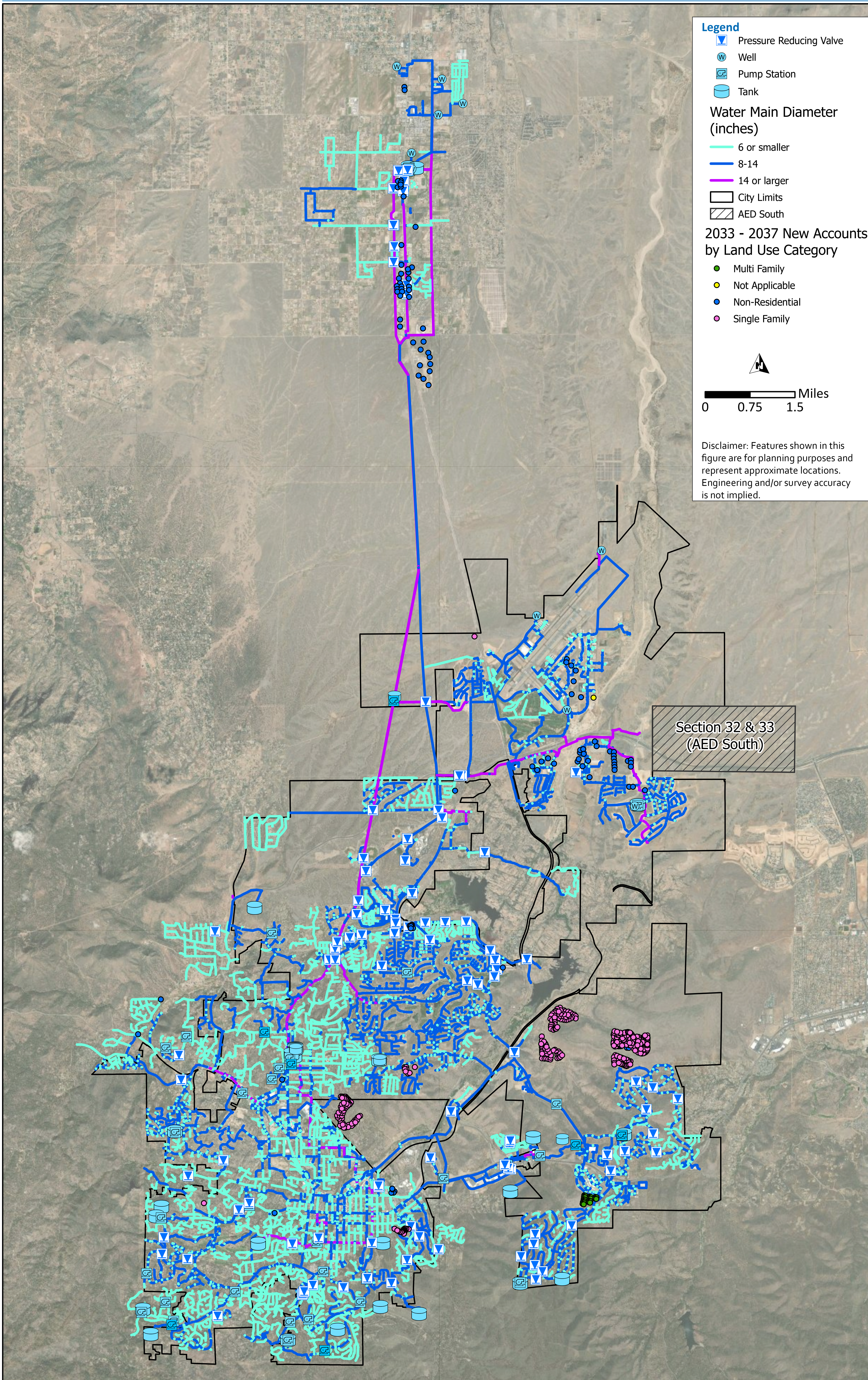


Figure 2.8 2033 - 2037 New Accounts by Land Use Category

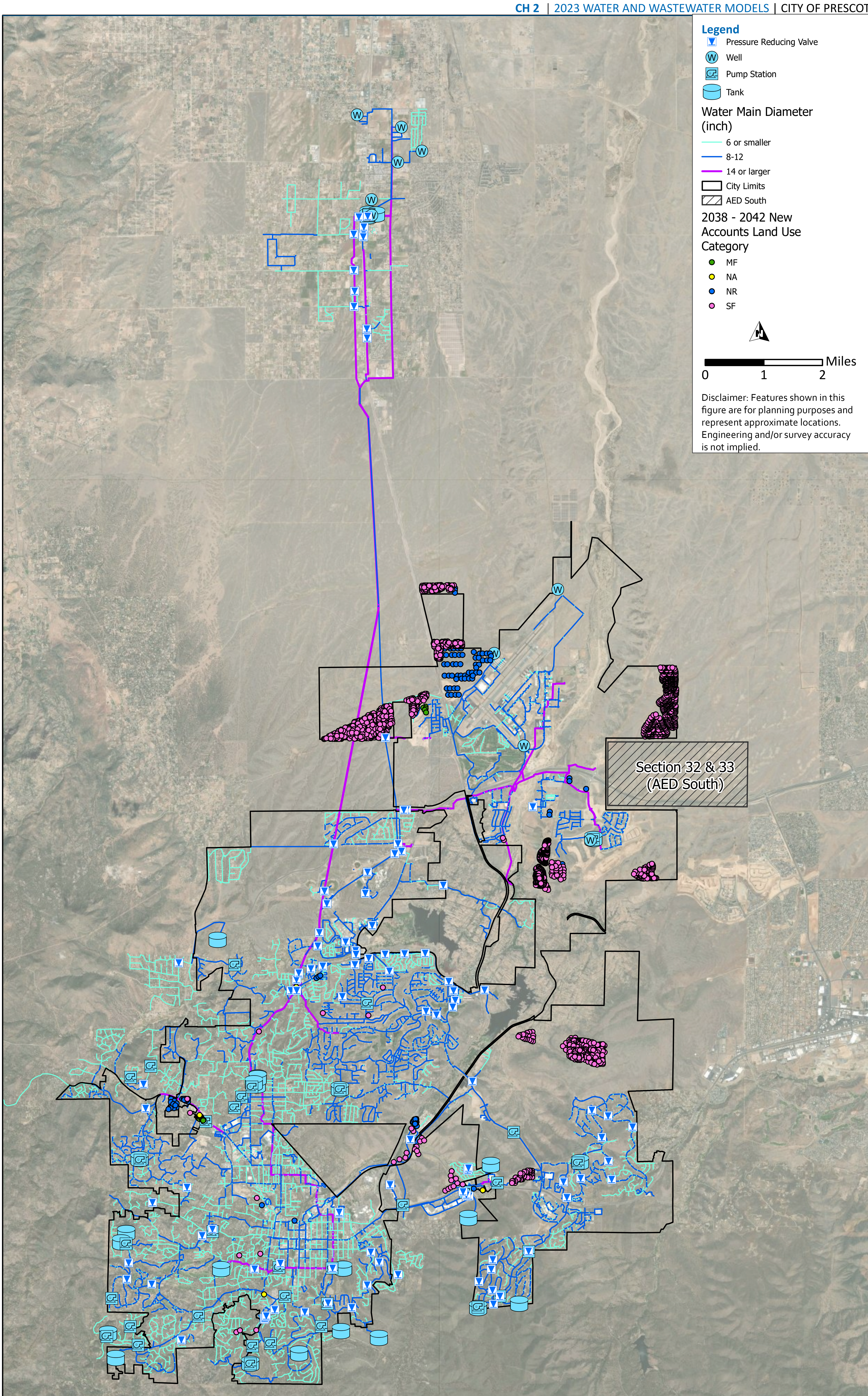


Figure 2.9 2038 - 2042 New Accounts by Land Use Category

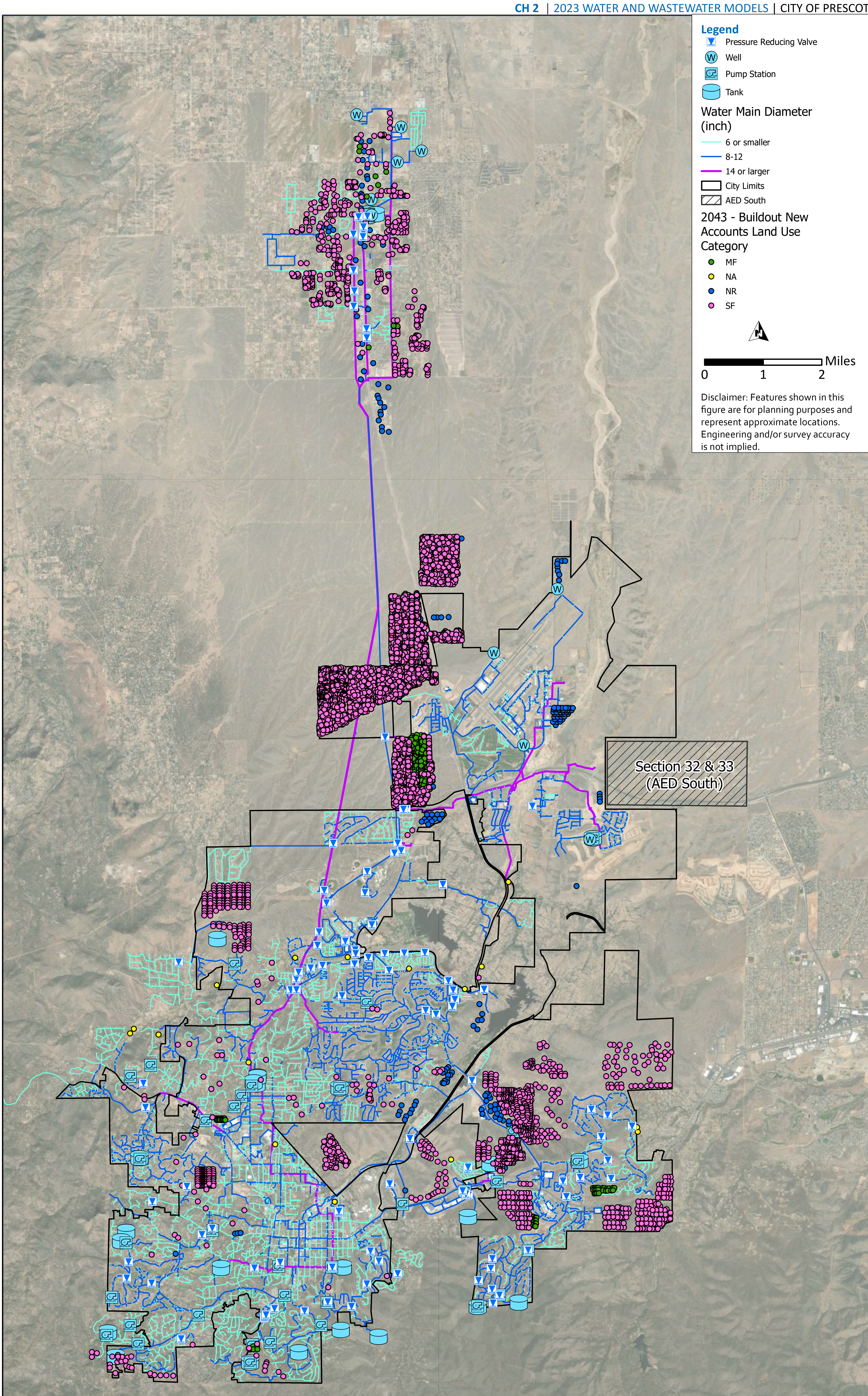


Figure 2.10 2043 - Buildout New Accounts by Land Use Category

2.2 Population and Growth Projections

Population projections are useful as a check on the reasonableness of the water demand projections. The future population was projected from the Planning Model. In the Planning Model, the population was estimated for each account land use category, e.g., SF, MF, and NR. Each account was assumed to have a population density as listed in Table 2.2.

Table 2.2 Population Density

Housing Type	Population Per House (people/DU)
Single Family	2.0
Multi Family	1.8

Abbreviation:
DU = dwelling unit

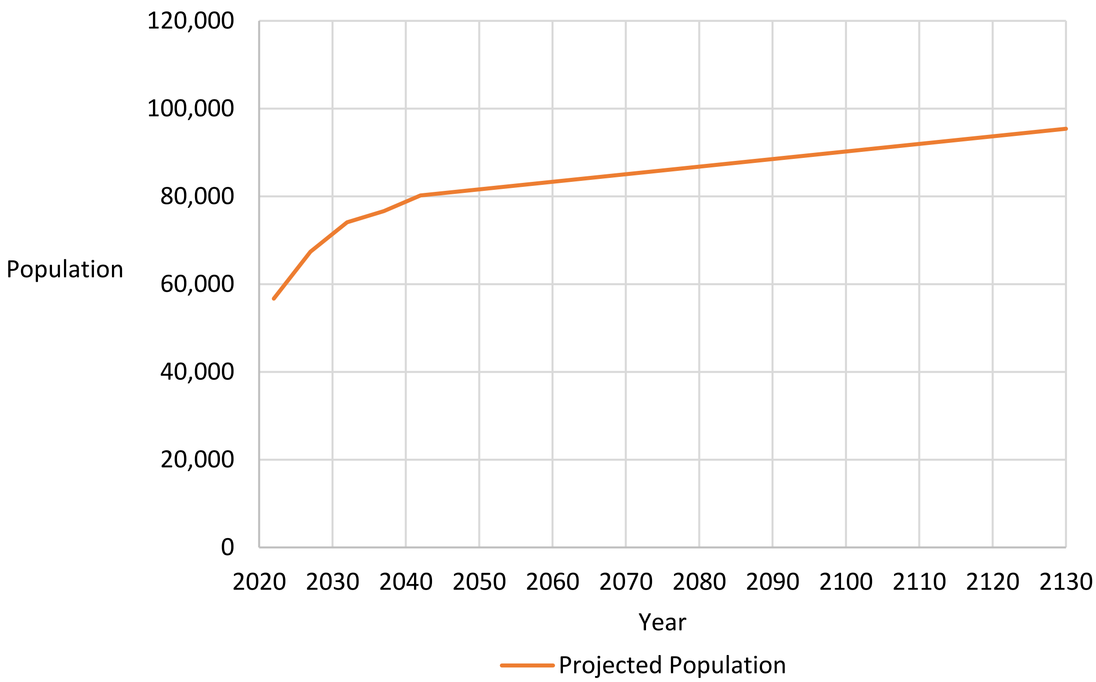
Table 2.3 presents the historical population of the City plus Chino Valley from the year 2011 to 2020, the projected population for future planning years, and population growth rate. The projected population below counts the population within the City's incorporated limits and some future development area and Chino Valley. The population projections show the total population by Buildout (year 2130) is 95,410. The population growth rate for future planning periods ranges from 0.7 percent to 3.8 percent from 2022 to 2042 and 0.2 percent from 2023 through Buildout.

Table 2.3 Population Estimate and Growth Rates for the City of Prescott

	Historical Population(1)	Projected Population(2)	Population Growth Rate (%/year)
2011	40,055		
2012	39,916		-0.3
2013	40,003		0.2
2014	40,130		0.3
2015	40,700		1.4
2016	41,090		1.0
2017	41,468		0.9
2018	42,068		1.4
2019	42,785		1.7
2020	43,463		1.6
2022		56,693	
2027		67,392	3.8
2032		74,094	2.0
2037		76,632	0.7
2042		80,226	0.9
Buildout		95,410	0.2

Notes:
(1) From United States Census Bureau. This population is the population in the City of Prescott City Limits.
(2) This projected population is the population in the City of Prescott service area, including City of Prescott area plus the water service portion of the Town of Chino Valley. Projected population is based on the account number and account type information in the Planning Model.

Figure 2.11 presents the projected population for the City plus the Town of Chino Valley. The growth rate from 2022 to 2042 is relatively aggressive compared with the growth rate after 2042.



Note: This graph plots the projected population of the City of Prescott plus the water service portion of the Town of Chino Valley.

Figure 2.11 Historical and Projected Population for the City of Prescott and the Town of Chino Valley

2.3 Water Demand Projections

Demand projections were developed by the Planning Model. Table 2.4 shows the unit demands that were used for the water demand projection for future development accounts. The unit demands were calculated as the average water usage for existing accounts based on the water billing data. The non-revenue water ratio of 8 percent was used to project water production.

Table 2.4 Unit Water Demands Used in Water Demand Projections

Land Use Category	Average Demand Per Unit (AFY)
Single Family	0.17
Multi-Family	0.10
Non-Residential Use	1.08

Abbreviation:
AFY = acre-feet per year

2.3.1 Future Water Demands and Growth Areas

The planning model listed 52,549 accounts by Buildout, broken out by land use category. Therefore, an estimated water demand for each account was calculated, based on the unit demands of each land use category.

Table 2.5 summarizes the projected annual demands for the City's service area from 2022 to Buildout categorized by land use categories.

Table 2.5 Water Demand Projection Summary

Land Use	Annual Average Water Demand (mgd)					
	2022	2027	2032	2037	2042	Buildout
Single Family	3.5	4.4	5.0	5.2	5.5	7.7
Multi-Family	0.6	0.6	0.6	0.6	0.6	0.9
Non-Residential	1.9	2.1	2.3	2.3	2.4	3.5
Non-Revenue Water(1)	0.5	0.6	0.6	0.7	0.7	1.0
Total	**6.5**	**7.7**	**8.5**	**8.8**	**9.2**	**13.1**

Notes:
(1) Non-revenue water is assumed to be 8 percent of water demand.
Abbreviation:
mgd = million gallons per day

Table 2.6 summarizes the projected demands for each of the identified active growth areas and the expected timing of demands corresponding to each planning year.

Table 2.6 Projected Demands in Prescott Growth Areas

Growth Area	Average Annual Demand (AFY)					
	2022	2027	2032	2037	2042	Buildout
AED	0	179	356	507	578	578
Deep Well Ranch	4	88	102	102	345	1,434
Granite Dells Estates	89	213	226	229	230	230
Granite Dells Ranch	0	0	32	34	38	42
Granite Dells Ranch South	0	110	111	111	111	111
New Development South of Storm Ranch	0	0	0	0	0	74
Storm Ranch	0	2	7	53	104	195
Subtotal	**93**	**591**	**834**	**1,036**	**1,405**	**2,664**
Non-Revenue Water(1)	7	47	67	83	112	213
Total	**100**	**639**	**901**	**1,119**	**1,518**	**2,877**

Notes:
(1) Non-revenue water is assumed to be 8 percent of water demand.

Table 2.7 summarizes the projected demands categorized by the land areas within the City limits, County area outside of City limits, CVID, and YPIT. Figure 2.12 presents these demands graphically.

Table 2.7 Future Water Demand Summary by Area

Area	Average Daily Demand (mgd)					
	2022	2027	2032	2037	2042	Buildout
City of Prescott	5.3	5.9	6.3	6.5	6.9	7.8
County Areas within City Planning Area	0.4	0.5	0.5	0.5	0.6	3.0
Chino Valley Irrigation District	0.2	0.4	0.5	0.5	0.5	0.7
Yavapai-Prescott Indian Tribe	0.1	0.1	0.1	0.1	0.1	0.2
Subtotal	**6.0**	**6.9**	**7.4**	**7.6**	**8.1**	**11.7**
Non-Revenue Water[(1)]	0.5	0.6	0.6	0.6	0.6	0.9
Total Water Production	**6.5**	**7.5**	**8.0**	**8.2**	**8.7**	**12.6**

Notes:
(1) Non-revenue water is assumed to be 8 percent of water demand.

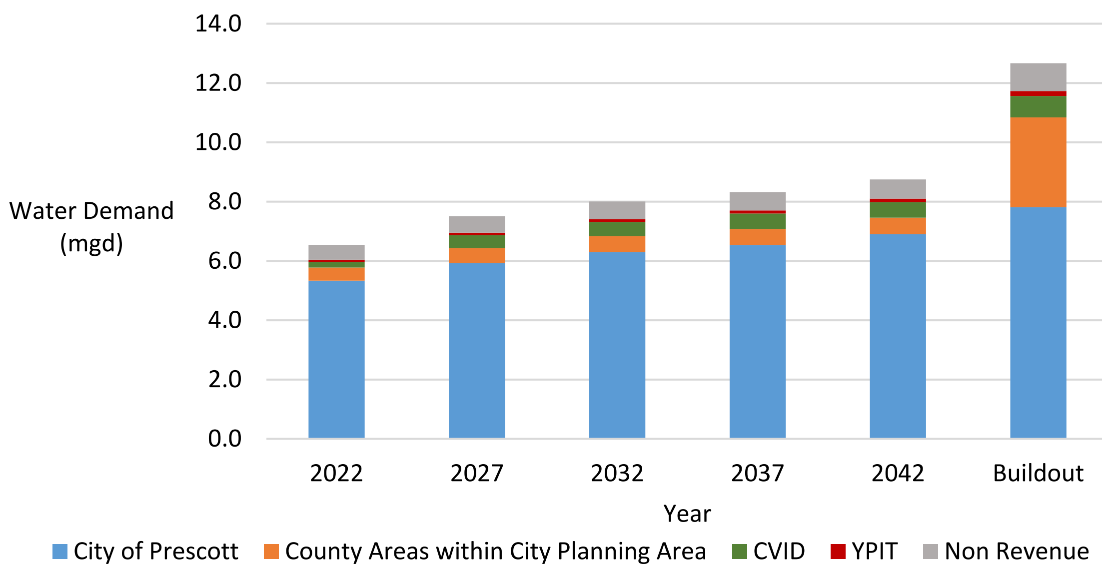


Figure 2.12 Timing of Future Water Demand by Area

2.3.1.1 Future Chino Valley Irrigation District Water Demands

The City is obligated by contract to provide water service to customers in the CVID service area. The current water demand for CVID is approximately 0.2 mgd (224 AFY). The future CVID water demand is estimated to be 0.7 mgd (784 AFY) based on the contractual required deliveries and is conservative for water resources planning purposes.

2.3.1.2 Future Yavapai-Prescott Indian Tribe Water Demands

The City is also obligated by contract to provide water service to the YPIT Reservation. The current water demand for the YPIT is approximately 0.1 mgd (112 AFY). The buildout YPIT water demand is estimated to be 0.2 mgd (224 AFY).

2.3.1.3 Future Water Demand Summary

In the 2018 Water and Wastewater Models Study (2018 Study), the Buildout average daily water demand projection was 13.6 mgd, which is approximately 1 mgd higher than the 2023 Study future water demand projection (12.7 mgd). The changes in flow are due to slight differences in the Buildout service area, which increased since the 2018 Study, and the difference in demand projection methodologies. The 2018 Study applied the unit water demands (in gallons per acre per day [gpad]) to the acreages that could potentially develop from the land use and zoning analysis. However, the 2023 Study applies the unit demand (in gallons per day per dwelling unit [gpd/DU]) to the number of accounts that could potentially develop in the future.

2.3.2 Water Demand Patterns and Peaking Factors

The City's historical water production records were reviewed to determine the maximum day to annual daily demand (MD/ADD) peaking factor. Typically, the maximum water production day is during the summer months (June through September) when irrigation demands are the highest. Figure 2.13 shows the water production by month for years 2017 through 2022.

The maximum day demands represent the highest water demand day during the maximum demand month. To calculate the MD/ADD peaking factor, the water production records from years 2017 through 2022 were reviewed. The maximum day peaking factor was calculated by dividing the total volume of water produced on the MD by the water produced on the ADD. The MD/ADD peaking factor of 1.8 was used in the 2023 Study.

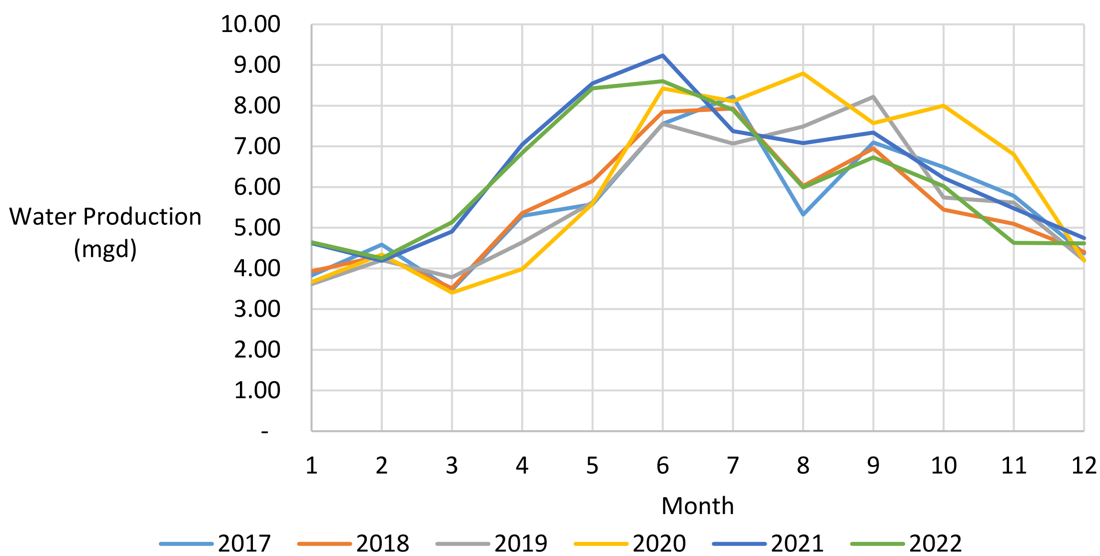


Figure 2.13 City of Prescott Seasonal Water Production by Month

Peak hour factors can vary by pressure zone. The City does not have sufficient supervisory control and data acquisition (SCADA) data available to calculate a peak hour (PH) demand estimate for years 2017 through 2022. Therefore, the PH/MD peaking factor of 1.8 used in the 2018 Study was also used in the 2023 Study. This is equivalent to PH/ADD peaking factor of 3.24 with the MD/ADD peaking factor of 1.8.

Peaking factors are used during the hydraulic modeling scenarios to assess the existing water system performance compared to the City's established criteria (flow, pressure, head loss, etc.), and to plan future system improvements.

Maximum day demands and peak hour demands were developed for each planning period using the peaking factors described above. Table 2.8 summarizes the average daily, maximum daily and peak hour demands for the 2023 Study.

Table 2.8 Water Demand Projection Summary

Planning Year	Water Demand (mgd)(1)		
	Average Daily	Maximum Daily(2)	Peak Hour(3)
2022	6.5	11.7	21.0
2027	7.7	13.9	25.0
2032	8.5	15.2	27.4
2037	8.8	15.8	28.4
2042	9.2	16.6	29.8
Buildout	13.1	23.7	42.6

Notes:
(1) Values include non-revenue water (8 percent of water production).
(2) Maximum daily to average daily demand peaking factor: 1.8.
(3) Peak hour to average daily demand peaking factor: 3.24.

2.4 Wastewater Flow Projections

The City has two major wastewater collection basins that convey flow to either the Sundog Wastewater Treatment Plant (WWTP) or the Airport Water Reclamation Facility (WRF). In addition, the Hassayampa Water Reclamation Plant (WRP) receives wastewater for treatment during the spring and summer to produce reclaimed water for irrigation.

The City is currently moving to centralize wastewater treatment at the Airport WRF, which will eventually result in a single wastewater collection basin for the entire City. For the 2023 Study, wastewater flow projections were developed for the Sundog and Airport wastewater collection basins to assist the City in managing flows throughout the centralization process.

2.4.1 Historical Wastewater Flows

From 2017 to 2021, the average annual daily flows (AADF) in the Sundog collection basin have oscillated between about 2.6 mgd and 2.3 mgd. During the same period, the Airport collection basin observed an increase in AADFs from 1.44 mgd to 2.74 mgd, peaking in 2019. Peak daily flows of 9.13 mgd occurred in 2017 for the Sundog WWTP and a peak flow of 6.16 mgd occurred in 2020 for the Airport WRF. For both the Sundog WWTP and Airport WRF, average daily flows were lower in 2020 and 2021 than in 2019.

The Sundog collection basin receives a significant amount of inflow and infiltration (I/I). The high peak daily flows observed in 2017 in the Sundog collection basin are the result of I/I following storm events. The Airport collection basin system is also affected by I/I; however, on a smaller scale as compared to the Sundog collection basin. In 2019 and 2020, the peak daily flows were 5.16 mgd and 6.16 mgd, respectively, for the Airport collection basin, which are significantly higher than other recent years. Previously, the City has taken steps to identify sources of I/I including pipes running through washes and illegal storm sewer connections (e.g., rain gutters routed to the sanitary sewer). Storm derived I/I should be minimized whenever possible to prevent the need for upsizing sanitary sewers and treatment capacity.

Table 2.9 summarizes the AADF, maximum month (MM) and peak daily flows (PDF) for the Sundog WWTP and Airport WRF. Figure 2.14 provides a graphical representation of the daily flows for each treatment plant from 2017 through 2021.

Table 2.9 Historical Wastewater Flows

Flow Condition	Wastewater Flow (mgd)				
	2017	2018	2019	2020	2021
Sundog WWTP					
Average Annual Daily Flow	2.64	2.12	2.62	2.30	2.29
Maximum Month	4.33	2.48	4.36	4.61	2.84
Peak Daily Flow	9.13	3.45	8.06	8.55	7.09
Airport WRF					
Average Annual Daily Flow	1.44	1.89	2.74	2.68	2.19
Maximum Month	1.70	2.41	3.17	4.50	2.62
Peak Daily Flow	3.19	3.76	5.16	6.16	3.14

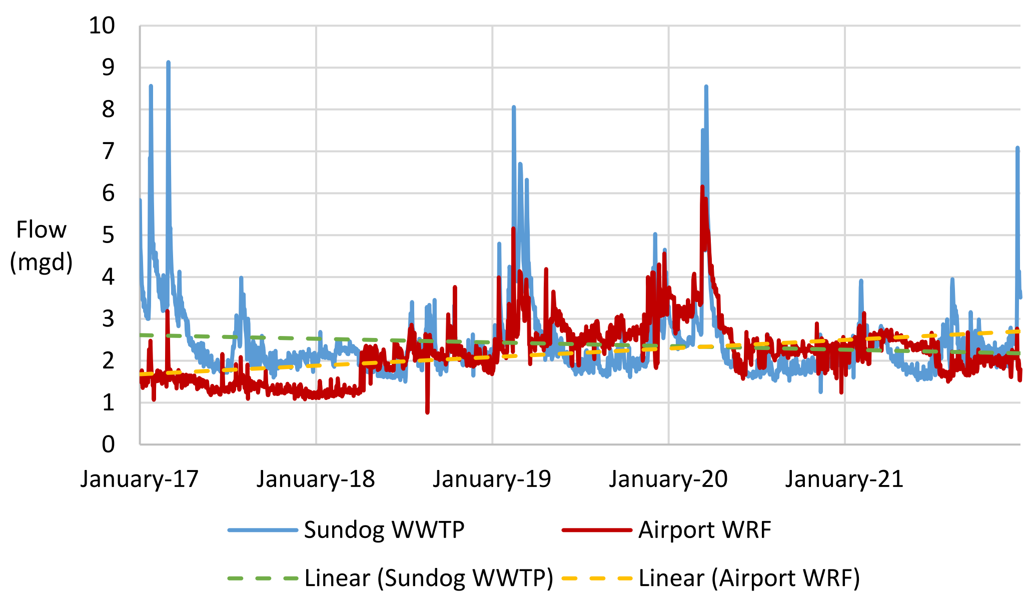


Figure 2.14 Historical Daily Wastewater Flows for the Sundog WWTP and Airport WRF

2.4.2 Flow Monitoring Field Tests

Wastewater flows were measured from a series of field tests conducted in the late spring of 2022. Figure 2.15 shows the flow monitoring basins that were used, which are similar to the basins metered in the 2018 Study. Table 2.10 summarizes the wastewater flows for each flow monitoring basin for the flow monitoring tests performed in 2013, 2017, and 2022.

Table 2.10 shows that, in most basins, average flows have generally increased since 2013. In the 2022 flow monitoring test, it was decided to split the Hassayampa basin into two halves (Hassayampa 1 and Hassayampa 2). Hassayampa was monitored as a single basin in previous tests and therefore there is no data for Hassayampa 2 for previous tests.

Table 2.10 2022 and Historical Wastewater Flow Monitoring Data

Flow Monitoring Basin	2013 Avg Flow (gpm)	2017 Avg Flow (gpm)	2022 Avg Flow (gpm)
Banning Creek	128	86	264
City Lights	43	62	54
Copper Basin	150	278	441
Forest Trails	68	182	75
Hassayampa 1	415	265	718
Hassayampa 2	N/A	N/A	102
Main VA	928	1,259	1,169
North Force Main	546	571	844
Pinion Oaks	67	95	112
Prescott Heights	145	92	109
Prescott Lakes Parkway	148	422	427
Robinson	67	79	85

Abbreviation:
gpm = gallons per minute

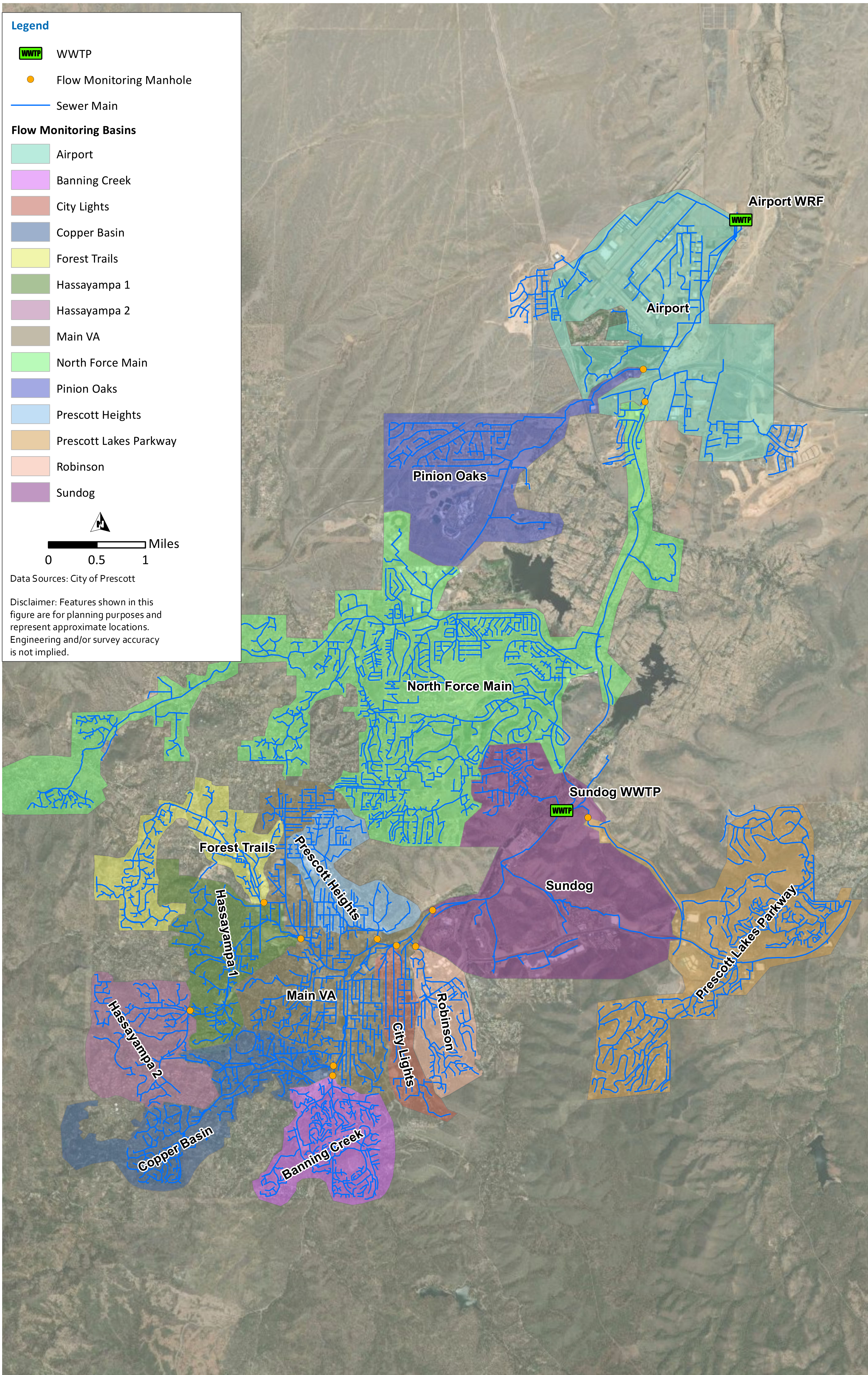


Figure 2.15 Wastewater Flow Monitoring Basins

2.4.3 Dry Weather Diurnal Patterns

Diurnal patterns are used to model how wastewater flows increase and decrease throughout the course of a 24-hour day. For this study, two diurnal patterns were developed for each flow monitoring basin; one to represent weekday flows and one to represent weekend flows. Diurnal patterns were created by calculating an average flow for each hour for weekdays and weekends from the measured flow monitoring data. These average flows are then normalized so that the diurnal pattern values all average to one. The diurnal pattern values can then be used as multipliers to the average flow in a flow monitoring basin to increase and decrease flow values throughout a model day while not changing the overall average flow value. The developed diurnal pattern for the City Lights flow monitoring basin is shown as an example in Figure 2.16.

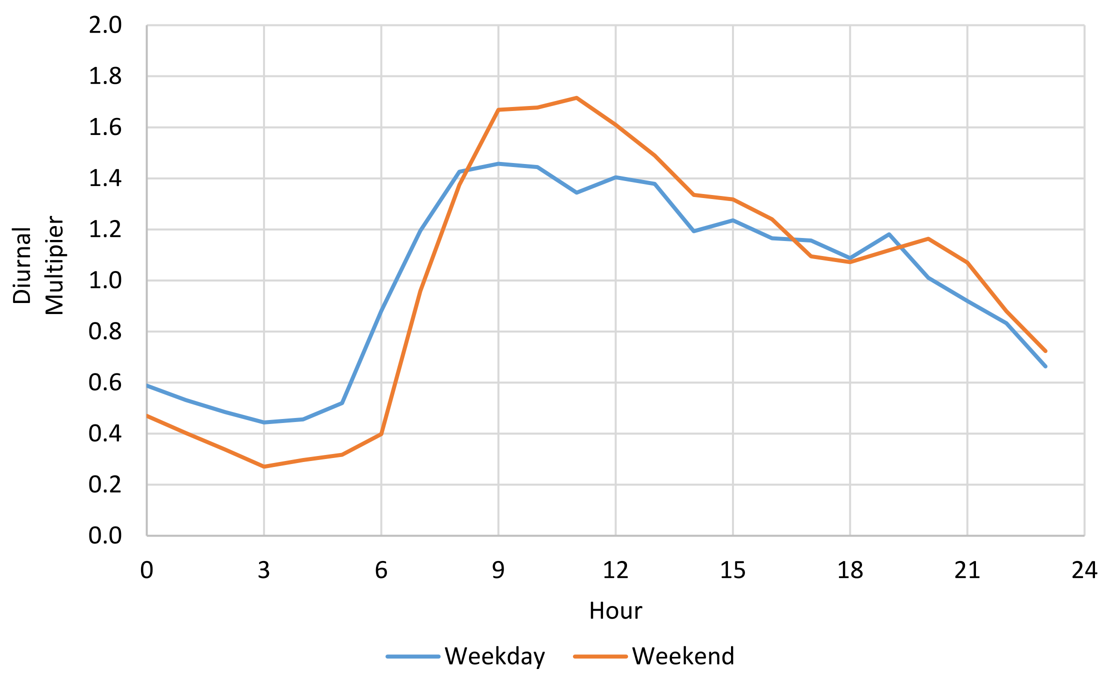


Figure 2.16 City Lights Basin Diurnal Pattern

Initial diurnal patterns were created from flow monitoring data. These patterns were used to obtain initial model results. Results from the model were used to manually adjust the diurnal patterns to calibrate the model to match the observed flows from the flow monitoring study. A full list of calibrated diurnal patterns are included in Appendix 2A.

Diurnal patterns show how peak flows compare to the average flow in each flow monitoring basin. Table 2.11 summarizes the peak flow multiplier applied to each basin.

Table 2.11 Peak Hour Wastewater Flow Multipliers

Flow Monitoring Basin	Peak Flow Multiplier
Banning Creek	1.19
City Lights	1.72
Copper Basin	1.25
Forest Trails	1.88
Hassayampa 1	1.76
Hassayampa 2	1.22
Main VA	1.46
North Force Main	1.66
Pinion Oaks	1.61
Prescott Heights	1.62
Prescott Lakes Parkway	1.42
Robinson	1.50

2.4.4 Wet Weather Inflows

The city's collection system receives a significant amount of I/I from storm events. I/I is highest in older areas of the city's collection system, such as downtown. In these areas, there is a higher concentration of sewer lines that run below creek beds that flow during wet weather events. The majority of I/I is currently conveyed to the Sundog WWTP. Based on this information, manholes were systematically chosen in the model, primarily in older parts of the collection system near potential creek beds, to apply wet weather inflows.

According to the city's data of historical WWTP inflows, a combined WWTP peak day inflow of 14.1 mgd occurred in 2020. This peak inflow was chosen as a target inflow to calibrate the model with wet weather inflows. Wet weather inflows were added to the chosen I/I manholes in addition to calibrated dry weather flows to bring the total WWTP inflow in the model to match the observed peak daily flow of 14.1 mgd. The applied wet weather flows totaled to 10.8 mgd.

2.4.5 Future Wastewater Flows

Section 2.3 describes the 52,549 projected service accounts used to estimate future water demands in the city's system. These projected service accounts were also used to estimate the city's future wastewater flows. Figure 2.17 shows the projected wastewater account development per planning year from 2027 through Buildout.

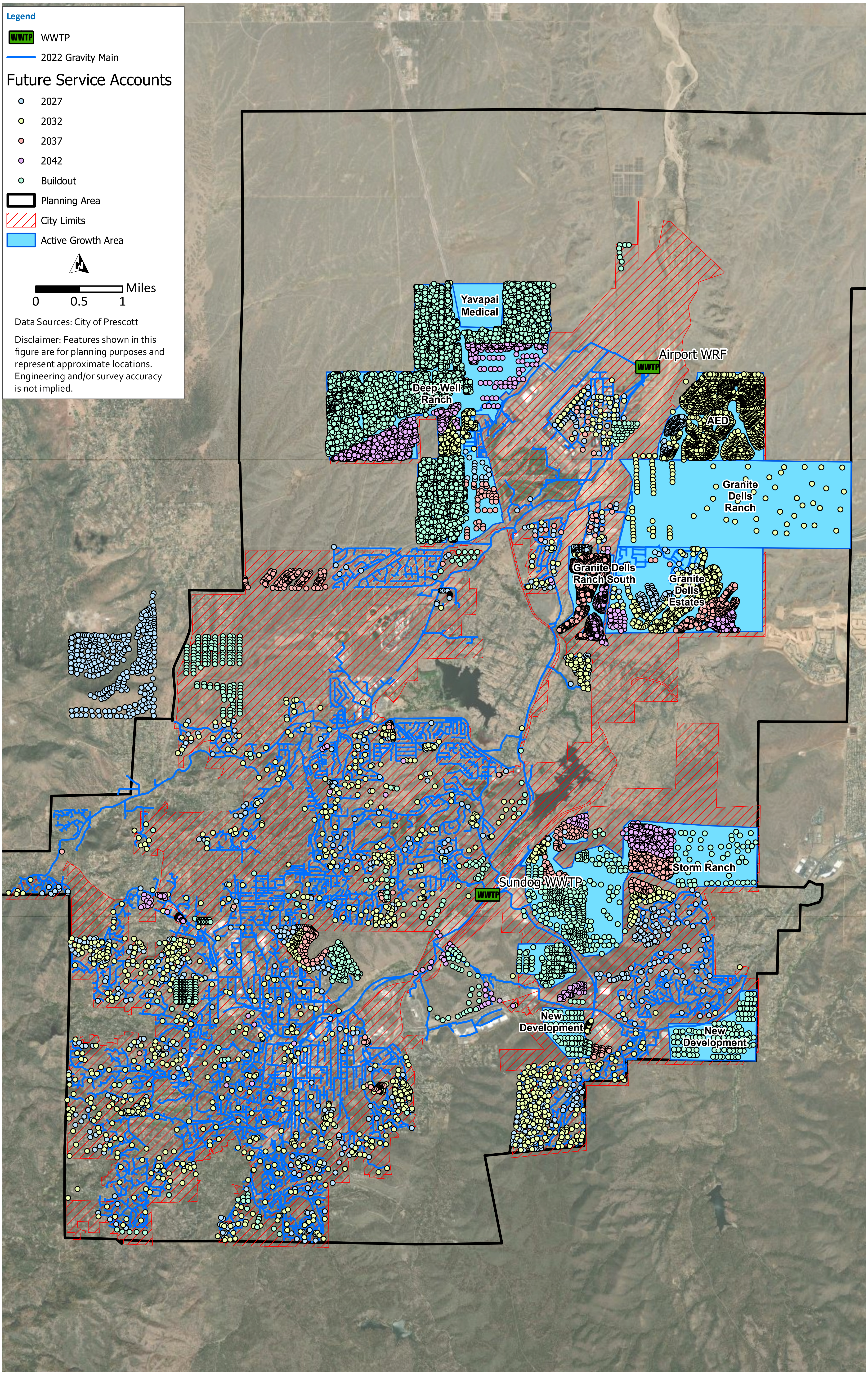


Figure 2.17 Wastewater Accounts per Planning Year

A water to wastewater ratio of 0.65 was applied to the projected water demands to represent water usage and losses when comparing water demands and wastewater flows. This ratio was based on the average of the City's 2020 and 2021 21-day average dry weather flows (ADWF) to Average Day Water Demands. Projected service accounts in areas where the city will not provide wastewater services, such as Chino Valley, were set to have no wastewater flows. Table 2.12 summarizes the projected total wastewater flows for each planning period, showing the new flows and the net total flow for each planning period.

Table 2.12 Wastewater Flow Projection Summary

Flow Type	Flow (mgd)					
	2022	2027	2032	2037	2042	Buildout
Incremental New Dry Weather	0	0.3	0.7	0.2	0.3	1.0
Average Total Dry Weather	4	4.3	5.0	5.3	5.6	6.6
Peak Day Wet Weather	10.8	10.8	10.8	10.8	10.8	10.8
Total Flow (mgd)	**14.8**	**15.1**	**15.8**	**16.1**	**16.4**	**17.4**

The flows in Table 2.12 summarize the values that were used to analyze the city's collection system under dry and wet weather conditions for each planning period. Although the city's service area will expand over time, the applied wet weather flows remained constant as newly constructed sewer facilities should have a significantly lower amount of wet weather inflow as compared to the existing facilities.

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Chapter 3

WATER SYSTEM ANALYSIS

This chapter presents the water system evaluation for the City of Prescott (City) as part of the 2023 Water and Wastewater Model Update Study (2023 Study). The purpose of the model update in the 2023 Study was to incorporate the updated geographic information system (GIS) data, current infrastructure, and operational information since the last update in the 2018 Water and Wastewater Model Update Study (2018 Study). Then the model was used to plan capital improvements for growth and new development. Specific model update tasks included the following:

- Calibrate the model for 2022 average day demand (ADD) conditions.
- Evaluate existing system capacity under varying demand and operation conditions.
- Conduct a fire flow analysis to estimate available flows and pressures throughout the system during a fire event.
- Evaluate the impact of future demands on the existing system and identify future infrastructure requirements.
- Perform a desktop condition assessment.
- Identify capital improvements to address system deficiencies.

3.1 Water System Overview

The City's water distribution system contains over 500 miles of distribution mains and approximately 37 miles of transmission mains that deliver water from five production wells in Chino Valley and three production wells in the Prescott Airport Area. In addition to the wells and pipelines in the water system, there are 27 storage tanks, 39 booster pump stations, and 72 pressure reducing valve (PRV) stations. Currently, the water system is divided into 80 pressure zones. Figure 3.1 shows the existing water system and associated infrastructure.

3.2 Water Model Update

InfoWater Pro software Version 2023 was used for the City's water distribution system model. The City's water distribution system model was updated using the City's 2022 GIS data and record drawings for infrastructure constructed since the 2018 model update. Recent operational information and water production data were incorporated into the updated model.

3.2.1 Facility Updates

Multiple changes to the City's water system have been added since the 2018 Study. These changes include new infrastructure, as described below:

- The pipeline along Highway 69 from Zone 56 Reservoir west towards the future Zone 7 booster station has been constructed.
- The new Zone 41 Booster Pump Station, Tank, and pipeline are at 100 percent design and have not been constructed yet but were added to the model.
- The water mains connecting Zone 12 to the Intermediate Storage Tanks have been constructed. This project will enable Zone 12 well water to fill in the Intermediate Storage Tanks.
- The Embry Riddle Interconnect PRV has been constructed to potentially supply fire flow from Zone 0 to Zone 46.
- A new 18-inch water main along the existing 12-inch transmission main from the Intermediate site to Pinion Oaks has been constructed to provide increased supply to Zone 110 and associated zones.
- The new Chino Valley Booster Pump Station has been constructed.

Each of these new facilities was updated in the model for 2022 conditions. Existing storage tanks, booster pump stations, and PRV stations were verified and updated in the model as required to make certain that capacities, operational setpoints, configurations, and connectivity were correct.

The City is currently planning or is in the design or construction phase of several new water facilities, which will be online in the near future. These facilities include the following:

- In Zone 12, the City is responsible for boring under Pioneer Parkway to construct a pipe connecting from Willow Creek Road to Pioneer Road to supply Zone 58 Southeast.
- The Zone 56 Tank and Zone 7 Booster Pump Station are under construction.
- A new 24-inch water main from Zone 12 to the Intermediate Storage Tanks is under construction. The Intermediate Storage Tanks and Booster Pump Station are currently under construction.
- A new 12-inch main on Senator Highway was constructed from Nathan Lane to the Juniper Vista subdivision. The Juniper Vista Tank is being removed along with the booster pump station. This project will connect Zone 32 to the Southeast Regional Tank to provide fire flow and the availability to meet peak hour demands (PHD).
- The design for the Yavapai-Prescott Indian Tribe (YPIT) water main upgrade along Sundog Ranch Road has been completed. This project will improve fire flows in the YPIT Reservation in Zone zero and supply the Storm Ranch Development.
- The Zone 24/27 water main piping replacement is under design. This project will modify Zone 27 and 39 boundaries and reduce pressures to manageable levels for the current southeast area of Zone 27 and improve the water supply looping in Zone 39.
- A new water main connecting Zone 51 to Northwest Regional Tank is under design. This project will allow the Longview Tank to be decommissioned and Zone 51 will be incorporated into Zone 52.

The City-wide Water Main Replacement Phase 1 and Phase 2 were not included in this summary. These facilities were included in the scenarios associated with the year in which the infrastructure is expected to be constructed and operating.

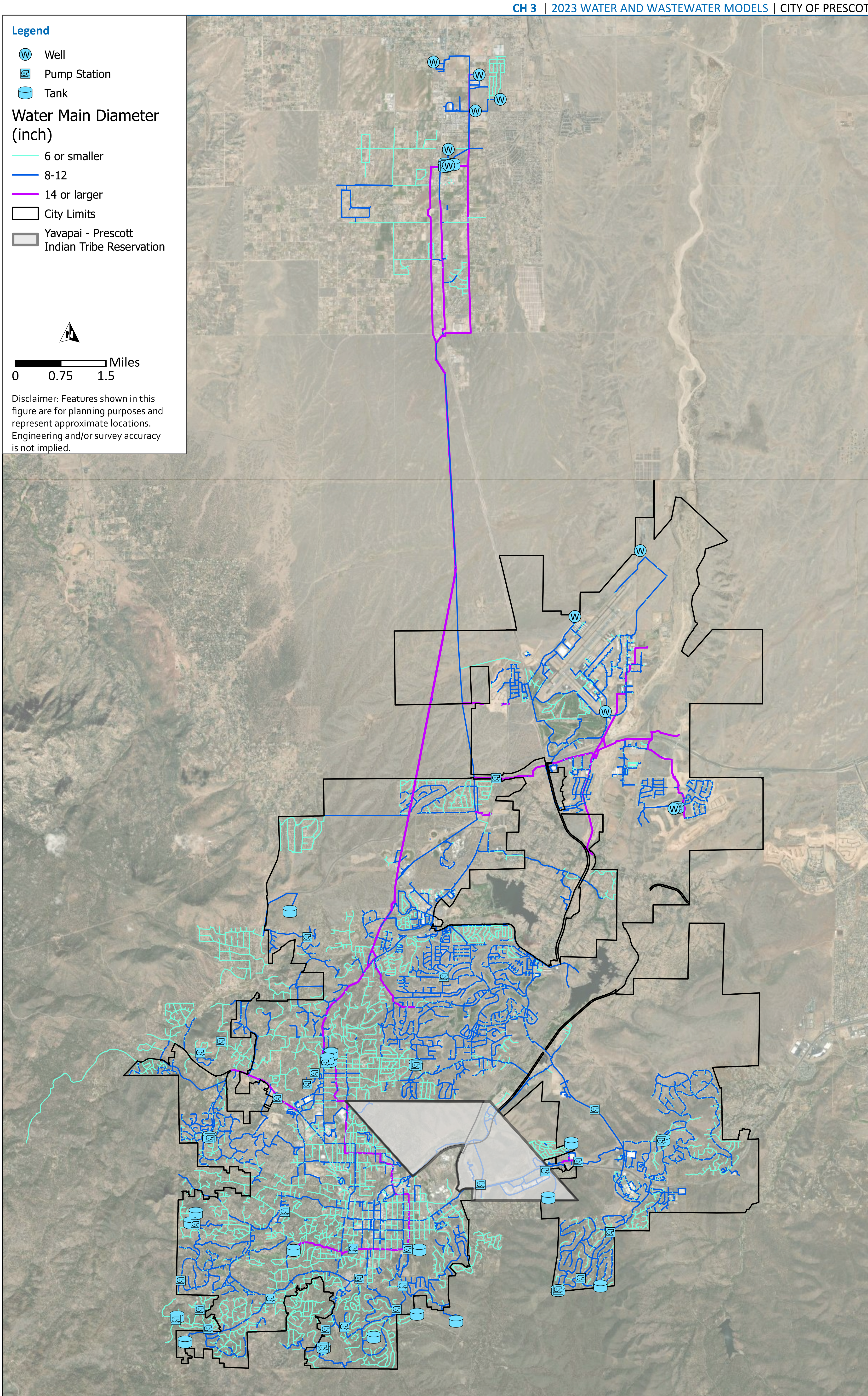

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Figure 3.1 2022 Water System

3.2.2 Operational Updates

The operational setpoints of each booster pump and PRV station in the model were verified by City staff using several data sources and operational records. Where available, pump curves were used for pump definitions in the model. Where pump curves were not available, a design flow and head were used. The City maintains an Excel database of operational settings for each of the PRV stations. These records were used to verify and update the PRV data in the model. The supervisory control and data acquisition (SCADA) tank operating water levels during the field test period were used to calibrate the model.

3.2.3 Model Validation

3.2.3.1 Field Test

A water system field test was developed to record system pressures at 22 locations in the distribution system over a period of no less than one week in March 2022 (either the time span of 3/3 – 3/15 or 3/15 – 3/22) using a combination of hydrant pressure transducers and SCADA data. The locations selected to record pressures were determined through discussions with City staff and are shown on Figure 3.2.

The pressure data collected in the field was reviewed to check for reasonableness prior to using the data for model calibration. The hydraulic grade line (HGL) of each pressure monitoring location was developed and plotted in groups by pressure zone. Figure 3.3 shows an example HGL plot for Zone 39 from the field test. This plot illustrates the HGL downstream of the White Spar Booster Pump Station (Site A14), which changes throughout the day as the booster pump station operates. Appendix 3A contains the HGL plots developed from the field test.

3.2.3.2 Model Calibration

The model was calibrated for March 2022 conditions and represents an ADD condition. The projected 2022 water demands were spatially allocated to the model junctions, then the tank water level initial settings, pump pressure set points, and well flowrates were adjusted in the model to correlate the SCADA data and field test data. The model was calibrated for extended period simulation (EPS) conditions.

The purpose of the model calibration was to establish confidence in the hydraulic model results by making adjustments that replicate conditions as they were observed during the field test. Table 3.1 summarizes the average observed pressures at each monitoring location, the model predicted pressure, and the differences between the observed pressure and model predicted pressure. Pressure loggers malfunctioned at sites A1, A7, A11, A12, and B1, so pressure data was missing at these locations.

The pressure transducers used to record pressures have an accuracy of ±1 percent of the pressure rating of the transducer. When evaluating comparisons of field data and model results, a correlation of ±5 percent is considered good, ±10 percent is considered acceptable and a difference greater than 10 percent suggests an unresolved anomaly. These anomalies may be a result of instrument error, incorrect elevations, or pipe connectivity differences between the system and the model (i.e., closed valves).

Table 3.1 Water Model Calibration Summary

Location[(1)]	Description	Field Test (psi)	Model (psi)	Difference (psi)	Difference (%)
A2	Zone 0 - Hydrant	89	90.5	0.5	0.6%
A3	Zone 62 - Hydrant	108	106	-2.5	-2.3%
A4	Zone 48 - Hydrant	163	164	0.9	0.6%
A5	Zone 48 - Hydrant	70	70	0.3	0.5%
A6	Zone 48 - Hydrant	98	99	0.5	0.5%
A8	Zone 0 - Hydrant	71	73.5	2.5	3.5%
A9	Zone 0 - Hydrant	94	92.5	-1.5	-1.5%
A10	Zone 40 - Hydrant	115	115	0.0	0.0%
A13	Zone 0 - Hydrant	70	73	3.0	4.3%
A14	Zone 39 - Hydrant	135	145	9.9	7.3%
A15	Zone 7 - Hydrant	79	86	6.7	8.4%
A16	Zone 11 - Hydrant	95	104	8.9	9.4%
A17	Zone 61 - Hydrant	54	57	3.1	5.7%
B2	Zone 12 - Hydrant	87	87	-0.1	0%
B3	Zone 12 - Hydrant	70	64	-5.3	-8%
B4	Zone 58 - Hydrant	79	75	-4.5	-6%
B5	Zone 51 - Hydrant	95	116	21.1	22%

Notes:
(1) Locations identified on Figure 3.2.
Abbreviation:
psi = pounds per square inch.

Ten of the pressure monitoring locations in the field test were considered to have a good correlation with model results, six of the locations were considered to have acceptable correlation with model results, and one location B5 was considered to have unresolved anomalies. Overall, the model provides a good representation of existing conditions and was considered well calibrated with the available data.

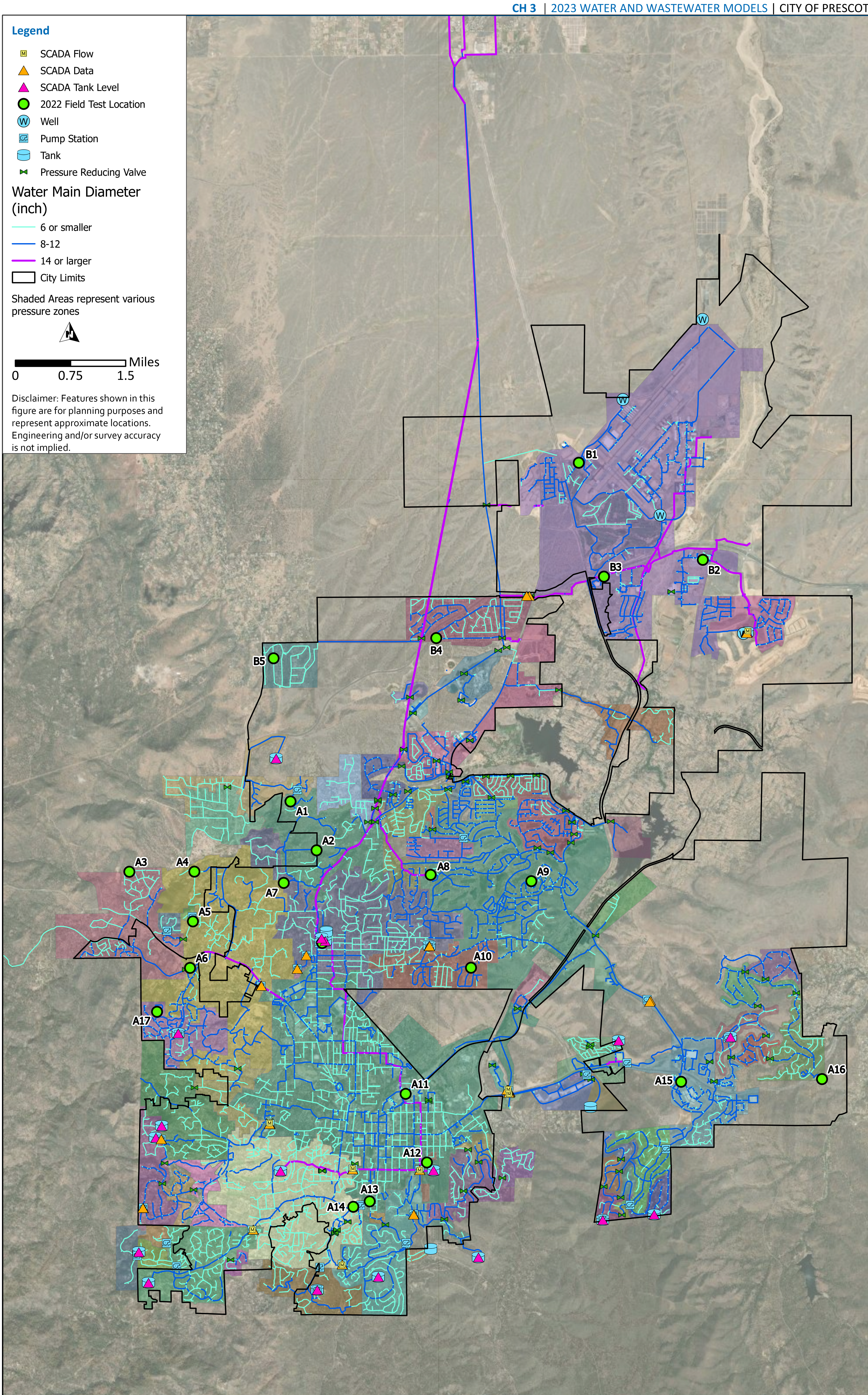

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Figure 3.2 Water System Field Test Pressure Transducer Locations

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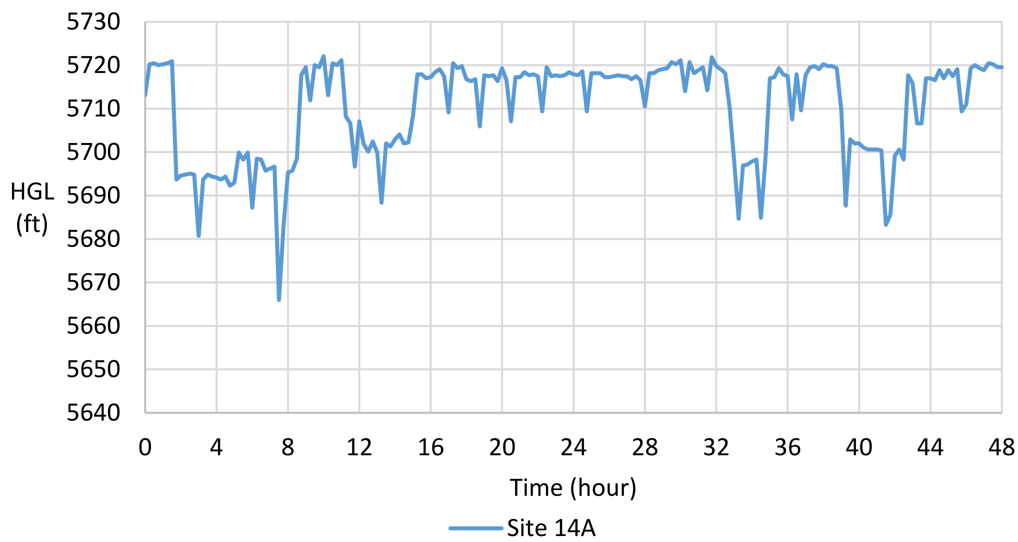

Figure 3.3 Example HGL Plot for the White Spar Pump Station Discharge to Zone 39

3.2.4 Model Structure

The water hydraulic model was set up with nine scenarios. The first scenario is the 2022 calibration scenario which runs in EPS mode. This scenario was intended to calibrate the model and adjust settings for pumps, tanks, wells, and PRVs to simulate the actual existing system. It also prepared a model base for future planning year scenarios. In addition to the 2022 calibration scenario, there are future planning years 2027, 2032, 2037, 2042 and buildout year PHD scenarios and maximum day demand (MDD) scenarios which are in the steady state mode. The new demands and associated new infrastructure were added accordingly to each year's scenario to reflect the demand growth and new infrastructure construction. The PHD scenarios were set up to analyze the minimum pressures under PHD, and the MDD scenarios were set up to conduct a fire flow analysis.

It is recommended that future studies utilize these same scenarios, or similar scenarios, in order to compare the results with this 2023 Study.

3.3 Performance Criteria

3.3.1 Background

Performance criteria are the standards of measurement used to evaluate the adequacy of water system infrastructure including supply, storage, booster pumping, and distribution system capacity. Performance criteria are based on legal requirements and engineering best practices. The criteria in this document have been reviewed with City staff and represent the level of service the City strives to provide to its customers. The water system performance criteria have not changed since the 2018 Study.

According to the Arizona Administrative Code (A.A.C.), public water systems shall be designed using good engineering practice (A.A.C. R-18-5-502). The City's water system performance criteria includes standards from the A.A.C., Engineering Bulletin No. 10 (issued by the Arizona Department of Health Services, May 1978), water industry best practices, and criteria established in the 2004 Water Distribution Model Study and 2018 Study using data collected by the City. The City's water system performance criteria are considered good engineering practices and provide acceptable levels of water system performance and reliability.

3.3.2 Water System Components

The City's water system consists of the following components:

- Groundwater wells in the Chino Valley well field and Airport Area.
- Power sources.
- PRV stations.
- Booster pump stations.
- Storage tanks.
- Transmission and distribution mains.

The function of these water system components and their associated performance criteria is discussed in the following sections.

3.3.3 Basis of Criteria

The acceptable level of service expected from the water system is defined by the adequacy and reliability of the water supply delivered to the customer. A reasonable level of service usually includes the provision for adequate system pressure, fire protection, and supply reliability. Therefore, water system performance criteria address the following areas:

- **Water Supply Redundancy:** a level of service such that water supplies can be delivered into the distribution system from more than one source.
- **Water System Reliability:** a level of service such that the distribution system infrastructure can deliver water to as many areas as possible even when a key facility is not in service.
- **System Operational Requirements:** a level of service such that water can be delivered reliably under fire flow, MDD, and PHD conditions.

3.3.3.1 Water Supply Redundancy

Water supply redundancy refers to the degree to which water can be supplied to the City's customers if one or more of the water supply sources is unavailable. Decisions about the extent of redundancy are often policy decisions influenced by the price a utility is willing to pay for redundancy compared to the risk of having to implement water use restrictions or provide a lower level of service to the customer if a water supply source is unavailable. Under some conditions, it may be more economical for the City to implement water demand management or conservation measures rather than build infrastructure that will be used infrequently in response to water source availability.

Although no firm guidelines exist, many communities seek to provide redundant or backup water supplies for ADD conditions because ADD provides sufficient water for public health and safety.

3.3.3.2 Water System Reliability

The City's water system reliability is dependent on the reliability of all the components within the system and the reliability of the energy sources that supply the booster pump stations and wells. The level of reliability provided is usually based on historical operational experience and judgment, which results in confidence that the system can deliver water under a variety of normal and emergency conditions. Consequently, professional judgment must be used when specifying system components and the number and location of components needed to meet reliability criteria.

Reliability of the City's water system is provided by a combination of the following factors:

- Sufficient water sources to meet MDD.
- Reserve system storage to meet emergency conditions, in addition to fire and normal operational needs.
- Transmission capacity to deliver water to the distribution system.
- Looped transmission and distribution system networks.
- Sufficient booster pumping capabilities with a pump station or the largest pump in a pump station out of service.
- Backup power supply for critical facilities.

3.3.3.3 Water System Operational Requirements

Water system operational requirements provide for a defined level of service from the City to the customer. Levels of service include maximum and minimum pressures, maximum flow velocities, storage, redundancy, and provisions for emergency conditions. Adequate pressure is usually defined in terms of a minimum pressure under certain demand conditions, such as peak hour or fire flow. Adequate fire protection refers to providing adequate flow to meet firefighting demands. The water system is adequate when demand conditions are satisfied while meeting performance criteria, such as pressure, velocity, and head loss.

3.3.4 Water Production Facilities

Production facilities for the water system should have sufficient capacity to meet the demands of the maximum day of the year.

State regulations regarding emergency operation plans require that municipalities be equipped to address emergency conditions, such as loss of a source of water supply. The City has provisions for emergency conditions codified in Prescott City Code (PCC) 3-10-11.

3.3.5 Fire Flow

Fire flow requirements are usually determined by the local fire department. The City has adopted the 2018 International Building Code (2018 IBC) and International Fire Code (2018 IFC), which specifies fire flow requirements for different types of building construction. The City may also consider establishing unique fire flow requirements of the wooded residential areas in parts of the City that are adjacent to the national forest (known as the wild land/urban interface).

For one- and two-family dwellings, the 2018 IFC specifies the minimum required fire flows as follows:

- < 3,600 square foot fire area: 1,000 gallons per minute (gpm) for 1 hour.
- ≥ 3,600 square foot fire area: refer to 2018 IFC Appendix B, Table B105.1.

Depending on the type of use, construction and fire area, the required fire flow and duration for fire areas greater than or equal to 3,600 square feet ranges from 1,500 gpm for 2 hours to 8,000 gpm for 4 hours.

Standard engineering practice is to assume that a major fire will not occur during the peak hour of the day, since the chance of this happening is minimal. It is more likely that a fire could occur under MDD conditions. Consequently, this condition was used to evaluate water system infrastructure.

To assess the adequacy of the Prescott water system with respect to MDD plus fire demand conditions, a land-use based approach was taken to assign fire flow requirements and durations as summarized in Table 3.2.

Table 3.2 Land Use Fire Flow Criteria

Type of Development (Land Use)	Fire Flow (gpm)	Duration (hours)
Single Family Residential 1[1]	1,000	2
Single Family Residential 2[2]	1,500	2
Multi-Family Residential	2,500	2
Commercial – Low Risk	2,500	3
Commercial – High Risk	4,000	4
Industrial – Low Risk	6,000	4
Industrial – High Risk	10,000	4

Notes:
(1) Residential area originally designed with fire flow standard less than 1,500 gpm.
(2) Residential area originally designed with fire flow standard of 1,500 gpm.

Some older areas of the City were originally designed with a lower fire flow standard than the current 1,500 gpm. Therefore, these areas do not meet the current 1,500 gpm residential fire flow standard. In these areas of the City, the modeled fire flow is set at 1,000 gpm as the standard against which fire flow delivery capability is measured. When economically viable, capital improvements to meet fire flow in these areas may be considered.

3.3.6 Booster Pump Stations

Booster pump stations are often the most critical components in a distribution system with respect to meeting reliability/redundancy criteria because pump stations are subject to disruption by power outages, mechanical failures, or line breaks.

Table 3.3 summarizes pump failure conditions and the associated reliability criteria.

Table 3.3 Booster Pump Station Reliability Criteria

Condition	Result	Reliability Criteria
Power Outage	Creates loss of pumping capacity at one or more pumping facilities.	Provide emergency backup power supply or dual power feed to critical facilities.
Mechanical Failure	Creates loss of pumping capacity due to pumps, electrical controls, or other components being out of service.	Produce sufficient pumping capacity at each booster pump station to meet MDD with the largest pump out of service ("firm" capacity).
Line Break	Occurrences at or near the booster pump station creates a loss of all or a portion of the pumping capacity of the facility.	Mitigate short-term (less than 24 hours) disruption in supply caused by a line break by providing multiple pumping facilities, storage, looped transmission/distribution lines, and/or PRV stations throughout the system.

For line breaks affecting critical pumping facilities, reliability/redundancy criteria are established so that ADD rather than MDD conditions can be met in each pressure zone in the distribution system.

When pumping to a closed system with no other sources or elevated storage, a booster pump station should be sized for the larger of PHD or MDD plus fire flow demand conditions. Diurnal demands and fire demands will be supplied through the pumps. Booster pump stations should be designed based on the firm capacity that can be consistently provided with the largest pump out of service. In addition, booster pump stations that deliver water into higher pressure zones must be sized to meet the demands of both zones.

The booster pump station performance criteria are:

- When pumping to a closed system, the capacity equals the larger of PHD or MDD plus fire flow.
- The allowance for reliability and uncertainties in demand projections equals 10 percent.
- Booster pump stations should be sized to meet demands with the largest pump out of service (firm capacity) except when a single high-capacity pump is required only for fire flow.
- When multiple booster pump stations supply a pressure zone, if the largest station is out of service, the remaining stations should be able to supply average day demands.

The firm capacity of booster pump stations that pump from tanks is often set so that half of the tank can be emptied in a six-hour period. These booster pump stations should also have a pumping capacity that exceeds the well capacity feeding the storage tank.

3.3.7 Transmission and Distribution Mains

Water system piping serves three basic purposes:

- To transfer water from the source of production to storage.
- To provide a conduit for domestic water supply.
- To provide a conduit for firefighting water.

Water distribution mains should be looped and interconnected wherever possible so that in the event of a fire, a failure of a portion of the distribution system, or another emergency there is more than one path for water to flow to supply customer demands and fire flows.

Transmission and distribution mains are sized to not exceed the maximum water velocity criteria as defined in Table 3.4.

The following pressure criteria are required for the distribution system:

- MDD plus Fire Flow: a minimum of 20 psi at the point of maximum fire draft.
- PHD: a minimum service pressure of 40 psi.

The City's plumbing code (2018 International Plumbing Code) requires service line PRVs when distribution system pressures exceed 80 psi. Due to Prescott's topography and pressure zone elevation ranges, there are many areas which require service line PRVs.

The recommended pipeline maximum water velocity and head loss criteria are listed in Table 3.4 for maximum day, peak hour, and fire flow conditions.

Table 3.4 Water Main Velocity and Head Loss Criteria

Condition	Pipe Diameter (in)	Maximum Velocity (ft/sec)	Maximum Head Loss (ft head loss per 1,000 ft of pipe)
Maximum Day	< 36	≤ 5	2 – 7
	≥ 36	≤ 6	1 – 2.5
Peak Hour	All	≤ 8	< 10
Fire Flow	All	≤ 10	NA

Abbreviations:
in = inch(es); ft/sec = feet per second; ft = feet; NA = non-applicable

3.3.8 Storage Facilities

Because production facilities are designed to operate at a steady rate over an extended period of time, storage tanks are used to accommodate fluctuating demands. Storage tanks should be designed and operated to meet daily demand fluctuations, fire demand, and emergency reserve storage, while achieving storage turnover to minimize water quality degradation.

3.3.8.1 Storage for Diurnal Demands

The storage capacity required to meet diurnal demand fluctuation is the volume of water required to meet the PHD exceeding the MDD production rate (the difference between maximum day and peak hour). For storage volume planning, a conservative value of 20 percent of MDD was used to evaluate storage capacity.

3.3.8.2 Storage for Fire Demand

The fire flow duration for determining storage requirements is determined by the local fire department, but generally ranges from two to four hours for single fire flow occurrences within a pressure zone. For planning purposes, a land use and zoning approach was taken to develop fire flow and storage requirements. The required fire flow storage by development type is summarized in Table 3.5.

Table 3.5 Storage Required for Fire Flow

Type of Development	Maximum Fire Flow		Duration	Fire Storage
	(gpm)	(mgd)	(hours)	(MG)
Fire Flow and Storage[1]				
Single Family Residential 1[2]	1,000	1.4	2	0.12
Single Family Residential 2[3]	1,500	2.2	2	0.18
Multi-Family Residential	2,500	3.6	2	0.30
Commercial – Low Risk	2,500	3.6	3	0.45
Commercial – High Risk	4,000	5.8	4	0.96
Industrial – Low Risk	6,000	8.6	4	1.44
Industrial – High Risk	10,000	14.4	4	2.40

Notes:
(1) The City's Fire Marshall determines fire flow requirements for new construction. Reductions in maximum fire flow may be allowed under the 2018 IFC and upon approval from the Fire Marshall.
(2) Residential area originally designed with fire flow standard less than 1,500 gpm.
(3) Residential area originally designed with fire flow standard of 1,500 gpm.
Abbreviations:
mgd = million gallons per day; MG = million gallons

There are some older developments in the City where the water infrastructure was designed using standards with lower required fire flows and storage requirements than are contained in the City's current performance criteria. In some of these areas, it may not be economically feasible to increase storage volumes to meet fire storage requirements because land may not be available for new or expanded tanks. In these cases, fire storage deficiencies may be met by utilizing available pumping capacity from lower pressure zones.

3.3.8.3 Storage for Emergency Reserve

Emergency or reserve storage capacity is an additional volume of water that is held in the tank to meet various emergency conditions, such as a facility outage. Emergency reserve storage is also available to provide reliability/redundancy to an adjacent pressure zone(s) through booster pump stations. The volume of emergency storage that a utility should plan for is largely based on professional judgment and is influenced by several factors such as power outage history, line break frequency, and overall supply redundancy. For storage volume planning, a value of 10 percent of MDD was used to evaluate emergency reserve storage.

3.3.9 Performance Criteria Summary

Table 3.6 summarizes the City's water system performance criteria. These criteria were used in the distribution system capacity evaluation to determine the adequacy of the water system, as well as for planning infrastructure improvements.

Table 3.6 Water System Performance Criteria Summary

Description	Criteria			
Water Production	MDD for existing system evaluation; MDD + 10% reserve for future planning			
Water Storage				
Equalizing (Diurnal)	20% of MDD			
Fire	Volume based on development type			
Emergency	10% of MDD			
Booster Pumping				
Without Elevated Storage	Firm capacity equal to larger of PHD or MDD + fire flow + 10%			
Firm Capacity	Capacity with the largest pump out of service			
Transmission/Distribution Pipes(1)				
Maximum day				
Pipes < 36-in	≤ 5 ft/sec			
Pipes ≥ 36-in	≤ 6 ft/sec			
Peak hour	≤ 8 ft/sec			
Fire flow	≤ 10 ft/sec			
System Pressure Criteria(2)				
Minimum	≥ 40 psi			
Maximum	≤ 120 psi			
Fire flow	≥ 20 psi			
Type of Development	Maximum Fire Flow		Duration (hours)	Fire Storage (MG)
	(gpm)	(mgd)		
Fire Flow and Storage(3)				
Single Family Residential 1(4)	1,000	1.4	2	0.12
Single Family Residential 2(5)	1,500	2.2	2	0.18
Multi-Family Residential	2,500	3.6	2	0.30
Commercial – Low Risk	2,500	3.6	3	0.45
Commercial – High Risk	4,000	5.8	4	0.96
Industrial – Low Risk	6,000	8.6	4	1.44
Industrial – High Risk	10,000	14.4	4	2.40

Notes:
(1) Pipe head loss should be less than 10 ft per 1,000 linear feet (lf) of pipe.
(2) The City's plumbing code requires service line PRVs in areas where static pressures are greater than 80 psi.
(3) The Adopted International Fire Code determines fire flow requirements for new construction. Reductions in maximum fire flow may be allowable under the 2018 IFC upon approval from the Fire Marshall.
(4) Residential area originally designed with fire flow standard less than 1,500 gpm.
(5) Residential area originally designed with fire flow standard of 1,500 gpm.

3.4 Water System Evaluations

The calibrated water model was used to perform evaluations of the distribution system, including water supplies, storage tanks and booster pump stations. Additional evaluations to optimize system storage, reconfigure pressure zones, estimate available fire flow, and operational redundancy were also performed.

3.4.1 Existing Water System Evaluation

3.4.1.1 Water Supply Requirements

Most of the City's water supply is provided from six groundwater wells in Chino Valley that deliver water through parallel 36-inch, 18-inch, and 12-inch transmission mains. The City also has three groundwater wells in the Airport Area (Zone 12) and has plans to add future Airport wells to improve water supply reliability. The total current production capacity of the City's wells is summarized in Table 3.7.

Table 3.7 2022 Well Production Capacity

Well	Capacity (gpm)	Capacity (mgd)
Chino 1	850	1.2
Chino 2	1,000	1.4
Chino 3	1,800	2.6
Chino 4	3,000	4.3
Chino 5	2,400	3.5
Chino 6(1)	300	0.4
Chino Total Capacity(1)	**9,350**	**13.4**
Airport 2	1,100	1.6
Airport 3	730	1.1
Airport 5	1,250	1.8
Airport Total Capacity	**3,080**	**4.5**
System Total Capacity(1)	**12,130**	**17.9**
System Firm Capacity(1)(2)	**9,130**	**13.2**

Notes:
(1) Chino Well 6 is physically disconnected from the system and is not included in the supply total.
(2) Production capacity with the largest well (Chino 4) out of service.

As shown in Table 3.7, the City's firm well capacity is 9,130 gpm (13.2 mgd). According to the City's performance criteria, the firm production capacity should be sufficient to meet the City's 2022 MDD of 8,115 gpm (11.7 mgd) as shown in Table 3.8.

The City's MDD projections were used to evaluate the adequacy of the City's water supply. For year 2022, the MDD was compared to the firm production capacity (largest well out of service). For years 2023 through buildout, the MDD plus 10 percent was compared to the firm production capacity. New well sources were added as required in each planning year to increase supplies to meet demands. Table 3.8 summarizes the results of the water supply analysis through buildout.

Table 3.8 Water Supply and Demand Analysis

Well	Total Capacity (gpm)	Firm Capacity (gpm)	Planning Year MDD (gpm)					
			2022	2027	2032	2037	2042	Buildout
Chino 1	850	850	850	850	850	850	850	850
Chino 2	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
Chino 3	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800
Chino 4(1)	3,000	–	–	–	–	–	–	–
Chino 5	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400
Chino 6(2)	300	–	–	–	–	–	–	–
Airport 2	1,100	1,100	1,100	1,100	1,100	1,100	1,100	1,100
Airport 3	730	730	730	730	730	730	730	730
Airport 5(3)	2,500	2,500	1250	2,500	2,500	2,500	2,500	2,500
Airport 6(4)	950	950	–	950	950	950	950	950
Airport 7(4)	950	950	–	–	950	950	950	950
Airport 8(4)	950	950	–	–	–	–	950	950
Other Well Supply(5)	3,600	2,700(1)	–	–	–	–	–	2,700
Additional Capacity Needed	–	–	–	–	–	–	–	2,160
Total Supply(5)	**20,130**	**15,930**	**9,130**	**11,330**	**12,280**	**12,280**	**13,230**	**18,090**
Total Demand(6)(7)	**–**	**–**	**8,115**	**10,611**	**11,632**	**12,064**	**12,651**	**18,085**
Surplus/(Deficit)(8)	**–**	**–**	**1,015**	**719**	**648**	**216**	**579**	**5**

Notes:
(1) Largest production well out of service for "Firm Capacity".
(2) Chino Well 6 is physically disconnected from the system and is not shown as a supply source.
(3) Airport Well No. 5 has been pump tested at 2,500 gpm, but Airport Well No. 5 will pump 1,250 gpm until other pipes are upsized.
(4) Future wells assume 950 gpm production rate. Note: Airport Well No. 4 is a monitoring well.
(5) Other Well Supply refers to Big Chino Water Ranch Well Supply.
(6) Assumes no reduction in well production yield over time.
(7) For year 2022: Total Demand = MDD, for years 2023 – Buildout: Total Demand = MDD + 10%.
(8) This is calculated as firm supply less demand.

The City currently has sufficient production capacity to meet the projected MDD. Over the next 20 years, three additional Airport Wells are required as follows:

- One 950 gpm well (Airport No. 6) by planning year 2027.
- One 950 gpm well (Airport No. 7) by planning year 2032.
- One 950 gpm well (Airport No. 8) by planning year 2042.

Airport Well No. 5 was pump tested at 2,500 gpm and is expected to produce water at this rate once it is fully equipped and operating. Currently, Airport Well No. 5 is pumping at the rate of 1,250 gpm due to other pipes needing to be upsized. To be conservative, Airport Wells No. 6 through 8 were assumed to produce 950 gpm. However, it is possible that the actual yield of new wells will be more or less than 950 gpm. It is recommended that the City pursue construction of two to three additional wells over the next 10 to 15 years and re-evaluate the need and timing of bringing new well supplies on-line after the actual new well yields are known.

The buildout condition assumes all areas within the City's 2022 Study Area are developed. According to the Planning Model, the buildout year is 2130. The estimated MDD at buildout is over two times the City's current MDD. This indicates that the buildout condition will likely be reached well beyond the current 20-year planning horizon, assuming sufficient water supplies are available.

Table 3.8 shows that by buildout, the six Airport Wells (three current plus three future), and the Big Chino Water Ranch (BCWR) project would not provide enough supply to meet the City's projected MDD, which would require an additional 2,160 gpm of supply. This supply shortfall could be met through:

- Additional groundwater production in the Airport Area.
- Additional groundwater production in Chino Valley.
- Programming well capacity in the BCWR project to supply the seasonal peak demands.

In association with well development in the Airport Area, the City is constructing the Intermediate Storage Tanks and Booster Pump Station site and related interconnection with Pressure Zone 12. These projects will allow excess water production capacity from the Airport Area to be supplied to other parts of Prescott. The current MDD of Pressure Zones 12 and 101 (Prescott Airport Area) is approximately 0.84 mgd (581 gpm), which is less than the 1,830 gpm capacity provided by Airport Wells 2 and 3; therefore, the City could benefit immediately from the Intermediate Storage Tanks and Booster Pump Station site and Zone 12 interconnection that are needed to deliver Airport Well water to the rest of the Prescott system.

In addition to evaluating the quantity of water supply for the City, there have been some water quality concerns that need to be addressed. Recent analyses have found per- and polyfluoroalkyl substances (PFAS), specifically perfluoro octane sulfonate (PFOS) and perfluorooctanoic acid (PFOA) in some wells.

Table 3.9 presents the PFAS sampling results at the City of Prescott's water production wells in December 2022.

Table 3.9 PFAS Sampling Results (December 2022)

Source	PFOS (ppb)	PFOA (ppb)
Chino 1	ND	3.3
Chino 2	ND	3.2
Chino 3	ND	3.6
Chino 4	ND	ND
Chino 5	ND	3.1
Airport 2	ND	ND
Airport 3	ND	ND
Airport 5	9.5	12.9
EPDS 11 (Chino wells)	ND	ND

Abbreviations:
ppb = parts per billion; ND = not detectable by laboratory method EPA 527.1

The sampling results show that Airport Well 5 has both high PFOS and PFOA concentration levels, and that most of the Chino wells also have detectable amounts of PFOA. However, a proposed maximum contaminant level (MCL) for the PFAS group has not yet been released by the Environmental Protection Agency (EPA). To reduce PFAS concentrations below a future MCL, there are three preliminary strategies and one future strategy that the City should consider.

- **Strategy No.1 (preliminary):** For the Chino Valley wells, operate the high PFAS concentration wells along with the low PFAS concentration wells to blend water in the Chino Valley tank, such that the overall PFAS contaminate level is reduced to below the MCL.
- **Strategy No.2 (preliminary):** For the Airport wells, construct a new blending storage tank near Airport Well 5 and a new transmission line from the nearest Airport well to the blending storage tank. Blend the high PFAS concentration Airport Well 5 water with the low PFAS concentration well water in the new blending tank, then pump the blended water to the water distribution system with a new booster pump station. Airport Well 5 and the other well production rates and durations need to be determined to mitigate the blended water PFAS contamination level below the MCL. This strategy is not being considered further because the PFAS concentrations in the blending well is too high.
- **Strategy No.3 (preliminary):** Drill another new well far away from the PFAS contaminated area. A cost analysis should be conducted before taking this strategy to compare the cost of constructing blending facilities to the cost of drilling a new well.
- **Strategy No.4 (future):** Install water treatment facilities to treat the well water to remove or reduce PFAS at the affected wells. This option is currently considered to be the most viable strategy.

3.4.1.2 Water Storage Requirements

The capacity of the City's storage tanks was evaluated to determine if the storage requirements in the City's water system performance criteria were met. This evaluation included diurnal, fire flow and emergency storage requirements. Table 3.10 summarizes the available capacity and total storage requirement for the City's existing and currently planned storage tanks. Discussions that follow clarify the solutions to address the storage deficit.

Table 3.10 Storage Tank Capacity Requirements

Tank	Volume (MG)				
	Year 2022 Capacity	Year 2022 Required Capacity	Year 2022 Surplus/ (Deficit)	Buildout Required Capacity	Buildout Surplus/ (Deficit)
Zone 40 (Cedarwood)[(1)]	0.10	0.24	(0.14)	0.25	(0.15)
Zone 19 (Copper Basin)	1.00	0.26	0.74	0.27	0.73
Zone 21 (Upper Rancho Vista)[(1)]	0.05	0.12	(0.07)	0.13	(0.08)
Zone 7 (East Regional)	3.00	1.64	1.36	1.70	1.30
Zone 48 (Forest Trails)	0.40	1.17	(0.77)	1.23	(0.83)
Zone 54/55 (Frontier Village)[(1)]	0.50	-	-	-	-
Zone 39 (Indian Hills)	1.33	1.17	0.16	1.18	0.15
Zone 16 (Haisley)[(2)]	0.23	0.23	0	0.26	
Zone 32 (Juniper)[(1)]	0.01	0.12	(0.11)	0.12	(0.11)
Zone 51 (Longview)[(1)]	0.10	0.14	(0.04)	0.14	(0.04)
Zone 41 (Mingus)[(3)(4)]	0.40	1.14	(0.74)	1.14	(0.74)
Zone 0 (North)[(3)]	7.54	3.94	3.60	4.63	2.91
Zone 52 (Northwest Regional)	2.00	0.16	1.84	0.17	1.83
Zone 56 (Prescott Canyon)[(1)]	0.12	0.98	(0.86)		
New Zone 56 Tank	1.5			1.04	0.46
Zone 30 (Prescott Pines)[(1)]	0.10	0.21	(0.11)	0.21	(0.11)
Zone 5 (Ranch I)	0.25	0.21	0.04	0.22	0.03
Zone 3 (Ranch II)	0.15	0.19	(0.04)	0.21	(0.06)
Zone 0 (South)	5.00	3.43	1.57	2.42	2.58
Zone 33 (Southeast Regional)	1.50	0.22	1.28	0.21	1.29
Zone 27 (Lower Thumb Butte)	1.25	0.18	1.07	0.19	1.06
Zone 24 (Upper Thumb Butte)	0.50	0.17	0.33	0.18	0.32
Zone 12 (Granite Dells)[(5)]	3.88	2.06	1.08	2.57	1.31
Zone 80 (Chino)[(3)]	10.00	–	–	–	–
Intermediate	12.00	–	–	–	–

Notes:
(1) Tank planned to be retired when replacement tank is online or when an operational change is made.
(2) The pump stations to Zone 16 provide sufficient flows to meet the storage needs.
(3) Capacity shown includes the volume from two storage tanks at this site.
(4) Planned capital improvements program (CIP) Project.
(5) Serves Pressure Zones 12 (elevated storage) and 101 (ground storage).

As shown in Table 3.10, there are ten storage tanks that are not adequately sized for year 2022 conditions and buildout conditions. Each of these tanks were identified in the 2013 Water and Wastewater Model Update Study (2013 Study) and 2018 Study as undersized. In the 2013 Study, four tank projects were recommended:

- Zone 40 (Cedarwood).
- Zone 41 (Mingus).
- Zone 3 (Ranch II).

Zone 40 (Cedarwood)

The Zone 40 (Cedarwood) Tank serves Zone 40. The tank storage deficit in 2022 is 0.14 MG, and the storage deficit at buildout is 0.15 MG. In the 2018 Study, the Mingus Tank was proposed to be upsized to 1.5 MG in order to provide enough storage capacity for both Zone 41 and 40 so that the Cedarwood Tank can be abandoned. However, the City proceeded with a new 0.75 MG Mingus Tank which cannot provide enough storage for both Zone 41 and 40. Therefore, upsizing Cedarwood tank to a 0.5 MG storage tank is needed to provide enough storage for peak flow and fire flow in Zone 40.

Zone 41 (Mingus)

The Zone 41 (Mingus) Tank serves Zones 41 and 94. The tank storage deficits in 2022 and at buildout are 0.74 MG. Upsizing to a 1.5 MG tank was proposed in the 2018 Study to provide enough storage for peak flow and fire flow conditions. However, The City proceeded with a new 0.75 MG tank under the analysis conducted by Brown and Caldwell. This will result in a storage deficit in Zone 41 four buildout condition. Additionally, the 0.75 MG tank at Mingus is not sufficient to provide enough storage for both Zone 41 and 40 so that the Zone 40 Cedarwood Tank cannot be removed. This project is under construction now.

Zone 3 (Ranch II)

The Zone 3 (Ranch II) Tank serves Zones 1, 2, 3, 4, 82, 83, and 85. The tank storage deficit in 2022 is 0.04 MG, and the storage deficit at buildout increases to 0.06 MG. Therefore, upsizing to a 0.5 MG tank was proposed in the 2018 Study to provide enough storage for peak flow and fire flow. Although this recommendation can help meet the storage requirements, it is not economically viable to satisfy such a small deficit.

However, as a more cost-effective alternative to upsizing the Zone 3 (Ranch II) Tank, the Zone 4 (Ranch III) booster station which serves Zones 1, 2, 3, 4, 82, 83, and 85 is recommended to be upsized with a 1,000-gpm high-capacity pump. Therefore, upsizing the Zone 3 (Ranch II) Tank is not presented in the CIP.

3.4.1.3 Water Storage Utilization and Optimization

The remaining deficit storage tank solutions were recommended in the 2018 Study, including supplemental booster pumping or connections with larger, regional tanks. Some solutions proposed in the 2018 Study were accepted by the City and the projects are under construction now. The estimated buildout capacity required for each tank, shown in Table 3.10, was used to develop the recommendations for the undersized tanks.

- Zone 48 (Forest Trails).
- Zone 32 (Juniper).
- Zone 51 (Longview).
- Zone 56 (Prescott Canyon).
- Zone 30 (Prescott Pines).
- Zone 21 (Upper Rancho Vista).

According to Table 3.10, eleven tanks were projected to have surplus storage capacity at buildout. Other than the Zone 5 tank, the remaining ten tanks could be used to supplement storage needs in other pressure zones. These tanks include:

- Zone 19 (Copper Basin).
- Zone 7 (East Regional).
- Zone 39 (Indian Hills).
- Zone 0 (North).
- Zone 52 (Northwest Regional).
- Zone 0 (South).
- Zone 33 (Southeast Regional).
- Zone 27 (Lower Thumb Butte).
- Zone 24 (Upper Thumb Butte).
- Zone 12 (Granite Dells).

Section 3.4.1.2 discusses the new tank projects that are needed to address the storage shortfalls for Zone 40, 16, 41, and 3. The following sections describe how available storage or alternative booster pumping strategies can be used to address projected shortfalls for Zones 48, 32, 51, 30, and 21.

Zone 48 (Forest Trails)

The Zone 48 (Forest Trails) Tank provides fire flow and PHD, however, the storage analysis shows a 0.77 MG deficit in year 2022 and a projected 0.83 MG deficit at buildout. The Forest Trails Tank is located on Forest View Drive and Hidden Canyon Road adjacent to a residential development. The site is too small to expand the storage tank and there aren't additional sites available in Zone 48 to construct an additional storage tank.

Therefore, a booster pumping solution to address this storage deficit that draws on the surplus capacity in Zone 0 was defined in the 2013 and 2018 Water and Wastewater Model Update Study (2013 Study and 2018 Study). However, the land selected for a pump station is located too high to take water from Zone 0. This pump station might be able to take water from Zone 41 although Zone 41 pumps and pipelines have not been sized to convey the required flows to Zone 48.

This project is currently defined as follows:

- Construct a new booster pump station located near Green Lane and Willow Creek Road.
- Construct a new water main connected to the 30-inch water main in Willow Creek Road or to an 8-inch main in Zone 41 that starts at Green Lane and extends west to the proposed booster pump station (Green Lane and Meadow Ridge Drive).
- Upsize the existing water main along Yakashba Drive to Peaceful Mesa Drive.

There are not many homes in this portion of Zone 48 so the infrastructure cost is high relative to the number of customers that would be served. This project will be postponed till buildout until a more economically viable solution can be obtained.

Zone 32 (Juniper)

At 10,000 gallons, the Zone 32 (Juniper) Tank is the smallest tank in the City's system and serves approximately 50 homes. Zone 32 is fully developed and has a current and projected future storage requirement of 0.12 MG. Although this tank can supply MDD, it is not large enough to provide required fire flow.

It is not technically feasible to upsize the Juniper Tank due to site constraints. The City plans to construct a connection between Zone 32 and the Zone 33 Southeast Regional Tank equipped with a PRV that would be set to open when pressures drop below a defined threshold during a fire event or other emergency condition. Specifically, a 12-inch main along Senator Highway from Nathan Lane to the Juniper Tank will be installed to allow available capacity from the Southeast Regional Tank (Zone 33) to serve Zone 32. This project is currently under construction.

Zone 51 (Longview)

The Zone 51 (Longview) Tank has a storage volume of 0.1 MG and serves approximately 150 homes located east of Williamson Valley Road, north of Pioneer Parkway. The current and projected storage requirements for Zone 51 are 0.14 MG.

To address this deficit, the City plans to serve this area from the Northwest Regional Tank (Zone 52) through a PRV station. The City plans to retire the Zone 51 Tank once a connection is made that will allow Zone 51 to be served by the Northwest Regional Tank (Zone 52). This connection will require a 12-in main to be installed in Williamson Valley Road between Pioneer Parkway and Bowie Drive, to connect to the distribution mains at the Longview Storage Tank. This project is currently at 100 percent design.

Zone 56 (Prescott Canyon)

The City is constructing a new 1.5 MG storage tank for Zone 56. Once this new tank is operating, the existing Zone 56 (Prescott Canyon) Tank will be retired.

Zone 30 (Prescott Pines)

Zone 30 relies on the Prescott Pines Tank to provide fire flow and PHD. The storage analysis presented previously shows a 0.11 MG deficit in year 2022 and at buildout. However, replacing or upsizing the Zone 30 (Prescott Pines) Tank may not be technically feasible due to site constraints.

Therefore, a booster pumping solution to address this storage deficit is proposed. This project would include a new booster pump station located near Hidden Valley Road and Coyote Road, on the boundary of Zone 16 and Zone 30, and would pump water from Zone 16 to Zone 30. Because the pipes on the suction and discharge end of this proposed booster pump station are 6 inches in diameter, it is recommended that the booster pump station be designed with a firm capacity of 850 gpm (1.2 mgd) to keep pipe velocities below 10 ft/sec.

A pumping period of 3 hours would provide adequate capacity to meet the projected buildout storage deficit (850 gpm x 3 hours = 0.15 MG). This pumping period is reasonable to assume due to the excess available capacity in Zone 33 from the Southeast Regional Tank that could be provided in an emergency. This is the solution recommended in the CIP.

This solution would require upsizing approximately 1,300 lf of 6-inch main to 8-inch main on Hidden Valley Drive from Valley Ranch Road, extending to the west to tie into an existing Zone 30 8-inch main.

Zone 21 (Upper Rancho Vista)

Zone 21 is served by the 0.05 MG Upper Rancho Vista Storage Tank. The current and projected storage requirements for Zone 21 are 0.12 MG and 0.13 MG, respectively. However, it is not technically feasible to upsize the Zone 21 Tank due to site constraints.

Therefore, a booster pumping solution was identified to address the 0.08 MG buildout storage deficit and to pump water from Zone 19 to Zone 21 to increase the water supply. The Upper Rancho Vista Booster Pump Station supplies the Zone 21 Tank and has a firm capacity of 60 gpm. A high-capacity pump (1,000 gpm) is recommended for the Upper Rancho Vista Booster Pump Station to meet fire flow demands for Zone 21 and to address the storage deficit for the zone.

Table 3.11 summarizes the recommendations for the undersized storage tanks.

Table 3.11 Storage Tank Recommendations

Tank	Undersized in Year 2022	Undersized at Buildout	Recommendation	Project Status
Zone 40 (Cedarwood)	Yes	Yes	CIP Tank Project – upsize to 0.5 MG.	
Zone 41 (Mingus)	Yes	Yes	CIP Project – upsize to 0.75 MG.	Under construction.
Zone 3 (Ranch II)	Yes	Yes	Upsize the Zone 4 (Ranch III) booster station to a 1,000-gpm high-capacity pump.(1)	This project is recommended to meet storage capacity. Not included in 2023 Study CIP considering cost efficiency.
Zone 48 (Forest Trails)	Yes	Yes	Supplement with booster pumping.(1) Construct a new Zone 48 Booster Pump Station.	
Zone 32 (Juniper)	Yes	Yes	Construct a direct connection to Zone 33 (Southeast Regional) Tank equipped with a PRV which would open during fire or emergency conditions.	Under construction.
Zone 51 (Longview)	Yes	--	Retire after Zone 51 is served by the Northwest Regional Tank and a PRV station.	60% Design.
Zone 56 (Prescott Canyon)	Yes	--	Construct new 1.5 MG Zone 56 tank and retire existing tank when new tank is online.	Under construction.
Zone 30 (Prescott Pines)	Yes	Yes	Supplement with booster pumping and upsizing existing 6-inch pipe to 8-inch pipe from the new booster pump station to the existing system downstream.(1)	
Zone 21 (Upper Rancho Vista)	Yes	Yes	Supplement with booster pumping.(1) Construct a new 1,000 gpm booster pump station from Zone 19 to Zone 21.	

Notes:
(1) Replacing or upsizing tank may not be technically feasible. A booster pumping solution was developed to overcome the storage deficiency.

3.4.1.4 Booster Pumping Requirements

The City's booster pump stations were evaluated using the 2022 MDD (plus 10 percent) plus the largest fire flow requirement for each pressure zone, which was greater than the estimated PHD for each pressure zone. The firm booster pumping capacity of each booster pump station and available contributions from elevated storage tanks were compared to the demand requirements for the 2022 conditions. Flows from storage tanks were calculated as 67 percent of the total available storage and an equivalent flow rate from the tank was determined using the required fire duration (2 to 4 hours) for each pressure zone based on the current zoning. However, flow contributions from elevated storage tanks were limited to the maximum flow rates that could be achieved through the water mains from the tanks to the pressure zones they served while maintaining pipe velocity criteria. This analysis accounts for fire potential in each pressure zone but does not account for multiple fires occurring simultaneously.

Table 3.12 summarizes the results of the booster pumping analysis. Appendix 3B includes the detailed booster pumping analysis that shows the estimated buildout demands, which are required to provide recommendations for the ultimate size of each booster pump station. New booster pump station projects or operational changes have been identified to provide the required capacity.

Some project recommendations include infrastructure changes to achieve the required fire flow demands. These projects include:

- **Zone 94 (Granite Springs):** Zone 94 is a small zone, and the original pump design has limited fire flow supply capability.
- **Zone 48 (Iron Springs):** An alternative pumping solution was proposed in the 2018 Study that includes 2,600 gpm of additional firm pumping capacity from Zone 0 to serve this area. This solution is still recommended.
- **Zone 32 (Juniper):** A connection to Zone 33 and the Southeast Regional Tank will provide fire flow supply to this zone. This solution was recommended in the 2018 Study and this project is under construction now.
- **Zone 51 (Longview):** A connection to the Northwest Regional Tank was recommended in the 2018 Study. The project is in 60 percent design.

Table 3.13 summarizes the capital improvement recommendations for the booster pump station projects to address the deficiencies in Table 3.12. Each of these recommendations from the 2018 Study were confirmed in the 2023 analysis.

Table 3.12 Booster Pump Station Requirements

Booster Pump Station	Year 2022 Required Capacity (gpm)(1)	Year 2022 Firm Capacity (gpm)(2)	Year 2022 Fire Pump Capacity (gpm)	Year 2022 Elevated Storage Support (gpm)(3)	Year 2022 Surplus/ (Deficit)
Zone 65 (Arrowhead)	1,002	65	0	0	(937)
Zone 40 (Cedarwood)	1,653	350	1,000	0	(303)
Zone 31 (Cristy Vista)	1,002	75	1,000	0	73
Zone 33 (Foothills)	1,568	400	0	3,500	2,332
Zone 23 (Forest Mountain)	1,005	22	1,000	0	17
Zone 61 (Forest Trails)	1,581	220	1,000	0	(361)
Zone 54/55 (Frontier Village)	4,064	275	0	4,190(4)	401
Zone 94 (Granite Springs)	1,002	42	0	0	(960)
Zone 16 (Haisley)	1,680	375	0	1,350	45
Zone 22 (High Valley)	1,008	103	500	0	(405)
Zone 48 (Iron Springs)	4,526	1,720	0	1,120	(1,686)
Zone 32 (Juniper)	1,011	45	0	0	(966)
Zone 51 (Longview)	1,543	440	1,000	0	(103)
Zone 60 (Lower Rancho Vista)	1,003	40	0	0	(963)
Zone 27 (Lower Thumb Butte)	1,267	894	0	2,790	2,417
Zone 41 (Mingus)	4,034	1,000	0	2,090(5)	(944)
Zone 39 (Pioneer and White Spar)	4,543	2,401	0	3,710	735
Zone 56 (Prescott Canyon)	4,118	1,200	0	4,190(4)	1,272
Zone 7 (Prescott Lakes plus Yavapai Hills Lower)	4,602	1,180	0	3,600	178
Zone 30 (Prescott Pines)	1,071	320	590	0	(161)
Zone 76 (Prescott Resort)	2,525	2,100	0	0	(425)
Zone 6 (Ranch I)	1,058	170	1,000	0	112
Zone 5 (Ranch II)	1,024	150	1,000	0	126
Zone 4 (Ranch III)	1,016	170	0	0	(846)
Zone 82 (Ranch IV)	1,001	33	0	0	(968)
Zone 19 (Sierra Vista)	1,224	1,425	0	0	201
Zone 52 (Southview)	1,652	700	0	3,500	2,548
Zone 91 (Trailwalk)	1,539	160	1,000	0	(379)
Zone 21 (Upper Rancho Vista)	1,020	70	0	280	(670)
Zone 24 (Upper Thumb Butte)	1,057	238	0	2,790	1,971
Zone 16 (Virginia)	1,701	2100	0	625	1,024
Zone 50 (Vista del Cerro)	1,007	440	0	0	(567)
Zone 8 (Yavapai Hills Upper)	1,512	195	1,000	0	(317)
Zone 101	1,527	940	1,000	0	413

Notes:
(1) MDD + 10% + fire demand.
(2) Firm booster pumping capacity, including high-capacity pump.
(3) Where available, support from elevated storage serving the zone. Sixty-seven percent of the storage tank was assumed to be available for a duration equivalent to the fire flow requirements for the zone based on zoning.
(4) Assumed the design capacity of the Zone 56/76 booster station and Zone 56 Tank.
(5) Assumed 0.75 MG capacity of new Mingus Tank for elevated storage support calculation.

Table 3.13 Booster Pump Station Recommendations

Booster Pump Station	Recommendation	Justification	Project Status
Zone 65 (Arrowhead)	1,000 gpm high-capacity pump	Provide required fire flow.	
Zone 40 (Cedarwood)	1,500 gpm high-capacity pump and upsize the connection pipe to 10 inches	Provide required fire flow.	
Zone 61 (Forest Trails)	1,500 gpm high-capacity pump	Provide required fire flow.	
Zone 94 (Granite Springs)	Zone 94 is a small zone. The Zone 94 pump was original, not designed for fire flow supply. Possible piping reconfiguration	Provide required fire flow.	
Zone 22 (High Valley)	1,000 gpm high-capacity pump	Provide required fire flow.	
Zone 48 (Iron Springs)	2,600 gpm total capacity pumping solution from Zone 0.	Provide required fire flow and address storage deficiency.	
Zone 32 (Juniper)	Connection to Zone 33 and Southeast Regional Tank	Provide MDD and required fire flow.	Under construction.
Zone 51 (Longview)	Connection to Northwest Regional Tank	Provide required fire flow.	60% Design.
Zone 60 (Lower Rancho Vista)	1,000 gpm high-capacity pump and upsize the connection pipe to 8 inches	Provide required fire flow.	
Zone 7 (Prescott Lakes plus Yavapai Hills Lower)	No change.	Evaluated with Zone 7 (Yavapai Hills Lower) Booster Station and East Regional Tank to supply fire flow.	
Zone 30 (Prescott Pines)	No change.	Original fire flow criteria less than current standard.	
Zone 76	Add 500 gpm capacity fire pump	Provide required fire flow	
Zone 4 (Ranch III)	1,000 gpm high-capacity pump	Provide required fire flow.	
Zone 82 (Ranch IV)	1,000 gpm high-capacity pump and upsize the connection pipe to 8 inches	Provide required fire flow.	
Zone 91 (Trailwalk)	1,500 gpm high-capacity fire pump and upsize the connection pipe to 10 inches	Provide required fire flow.	
Zone 21 (Upper Rancho Vista)	1,000 gpm firm capacity upsize the connection pipe to 8 inches	Provide MDD and required fire flow.	
Zone 50 (Vista del Cerro)	1,000 gpm high-capacity pump	Provide required fire flow.	
Zone 8 (Yavapai Hills Upper)	No change	Original fire flow criteria less than current standard.	

3.4.1.5 Chino Water Supply Infrastructure

Water supplied from the Chino Well fields is currently delivered through a booster pump station with a total pumping capacity of 12,000 gpm and a firm capacity of 9,000 gpm. Water from Chino Booster Pump Station is delivered to the Zone 0 North Storage Tanks. The maximum safe pumping capacity of the Chino Booster Pump Station is 9,000 gpm to assure that the maximum pressure in the Chino transmission mains remains below the pipe pressure rating.

The City has constructed the new Chino Booster Pump Station and is in the process of constructing the Intermediate Storage Tanks and Booster Pump Station west of the Airport Area (Zone 12). When the construction of the Intermediate Storage Tanks and Booster Pump Station project is complete, the new Chino Booster Pump Station with firm capacity of 13.6 mgd will replace the old booster pump station and will deliver water to the Intermediate Storage Tanks, which is closer to the City and provides a more reliable supply for the City's water system. The intermediate storage tank also enables the Chino pipeline to be operated at a lower hydraulic grade line. The Intermediate Storage Tanks will be particularly important to deliver surplus water from Zone 12 to the other parts of the City's water system as additional well capacity is developed in the Airport Area. The Intermediate Storage Tanks are planned for 12 MG of storage and the Intermediate Booster Pump Station is planned for 22.7 mgd firm capacity in total, 17.0 mgd firm capacity for the pump station supplying Zone 0, and 5.7 mgd firm capacity for the pump station supplying Zone 110.

The Chino Booster Pump Station and transmission mains are perhaps the most important components of the City's water supply infrastructure. Once construction is completed, the Intermediate Storage Tanks and Booster Pump Station, supplied by excess well production capacity in the Airport Area, will provide partial redundancy to the Chino supply and additional reliability for the Prescott water system.

3.4.1.6 Distribution System

The capacity of the distribution system piping was evaluated using the City's hydraulic model, the demands prepared for the model update, and the City's water system performance criteria. There are several areas that require distribution system improvements so that the required fire flows can be delivered, or the required peak hour pressures can be met. These recommended pipe improvements include areas identified in the City's 2013 and 2018 Study as well as one additional area, and they are listed below and shown in Appendix 4A.

- Highway 69 from the New Zone 56/76 Booster Station to the new Zone 56 Tank.
- Stony Creek Drive and Northridge Drive.
- River Oaks Road & Shinnery Road and Valley Road & Tabosa Road.
- From the Virginia Booster Pump Station to Haisley Road & Valley Ranch Road.
- Thumb Butte Road to the Thumb Butte Tank and to Upper Thumb Butte Tank.
- Gail Gardner Drive from Fair Road to Linwood Road.
- Pine Lakes Road.
- Iron Springs Road.
- Zone 61, 41, 40,39, 0 in various locations.
- Zone 31.
- Zone 51.
- Buttermilk Drive.

- Arrowhead Road from Iron Springs Road to Sidewinder Road.
- White Cloud Road, Meadow Ridge Road, and Estrella Road.
- Highland Avenue from Evergreen Road to Copper Basin Road

The City should replace water mains that are 4 inches in diameter and smaller that are required to provide fire flows. The City may elect to program small diameter main replacement projects when streets or other utility improvements are planned.

3.4.1.7 Condition Assessment

An evaluation of the water system infrastructure that may need to be replaced or rehabilitated based on its condition was conducted, using the City's GIS data. According to the pipeline GIS data, there are currently 154 feet of galvanized pipes, mostly 2-inch pipes. These pipes need to be replaced with 6-inch ductile iron pipes. The galvanized pipe replacement project cost is estimated to be $78,000. In addition, there are currently 2,087 feet of asbestos concrete pipes, mostly 6-inch pipes. There are 941,536 feet of polyvinyl chloride (PVC) pipes; 502,430 feet of PVC pipes were installed earlier than Year 2000. The aging PVC pipes will need to be replaced when leaks or breakages occur.

The infrastructure condition assessment was also based on the Lucity (City's Asset Management Software) data provided by the City. According to the Lucity data, Figure 3.4 presents the water main break locations in the City since 2017. These water mains have since been repaired or replaced. Cast iron and asbestos cement pipes have a higher possibility to fail compared to other material pipes.

3.4.2 Pressure Zone Evaluation

The elevation range in Prescott's service area is between 4,600 and 6,400 feet. In general, pressure zones have been established to provide a range of operating pressures greater than 40 psi and less than 120 psi. Prescott's pressure zone boundaries were established based on both elevation and geography. Due to the large elevation range and location of developments, the City's distribution system has 80 pressure zones.

3.4.2.1 Pressure Zone Recommendations from the 2013 Study and the 2018 Study

In the 2013 Study and 2018 Study, eleven areas in total were identified where pressure zone boundaries could be adjusted to simplify operations and improve system redundancy. These areas include:

- Zones 14, 15, and Sarafina.
- Zones 48 and 61.
- Zones 0 and 42.
- Zones 34 and 57.
- Zones 54, 55 and 56.
- Zones 24, 27, 28, 39, and 48.
- Zones 16 and 90.
- Zones 44 and 70.
- Zones 7 and 7A.
- Zones 68 and 77.
- Zones 46, 79, 86, and 88.

The City has moved forward with six of the pressure zone boundary modifications identified in the 2013 Study and 2018 Study, including:

- **Zones 14, 15 and Sarafina:** Completed as recommended in the 2013 Study with one additional PRV (Basis) added to serve the combined Zone 14.
- **Zones 48 and 61:** Completed as recommended in the 2018 Study with a high elevation portion of Zone 48 located near Ridgewood Drive and Starview being absorbed in Zone 61 by opening the zone valve on Ridgewood Drive north of Starview and closing the zone valve on Ridgewood north of Sierry Peaks Drive.
- **Zones 0 and 42:** Completed as recommended in the 2013 Study as a portion of Zone 42 being absorbed in Zone 0 following the Smoketree Lane water main project.
- **Zones 34 and 57:** Completed as recommended in the 2013 Study with Zone 57 being absorbed in Zone 34, which continues to serve sub-zone 84.
- **Zones 54, 55, and 56:** The City agreed on the consolidation of these three zones. Detailed pressure zone changes and operating changes are presented below.
- **Zones 24, 27, 28, 39, and 48:** The City proposed pipe and PRV improvements in Zone 0, 27, 28, and 39, as a part of zone boundary changes between Zone 27 and Zone 39. Detailed new project improvements, pressure zone changes and operating changes are presented below.

Zones 54, 55, and 56

Zones 54, 55, and 56 are adjacent pressure zones in the Frontier Village Area. Zone 56 is served by the Prescott Canyon Booster Pump Station and Storage Tank. Zones 54 and 55 are served by the Frontier Village Booster Pump Station and Storage Tank. The City constructed a new booster pump station to serve Zones 56 and 76. A 16-inch water main will be installed along Highway 69 and a new 1.5 MG storage tank will replace the existing Zone 56 Tank.

Once these projects are complete, Zones 54, 55, and 56 can be combined as a single pressure zone, as shown on Figure 3.5, by doing the following:

- Remove the Frontier Village PRV Station at Cocky's Chicken n' Brew.
- Remove the Frontier Village PRV Station at Home Depot.
- Remove the Frontier Village PRV Station on Tank Road.
- Retire the Frontier Village Pump Station, Yavapai Hills Lower Pump Station, Frontier Village Storage Tank, and the existing Zone 56 Prescott Canyon Storage Tank.
- Open three zone valves along Highway 69.
- Install a PRV Station at Highway 69 and Prescott Canyon Estates to reduce the total pressure increase expected in this subdivision with the new Zone 56/76 Booster Pump Station.

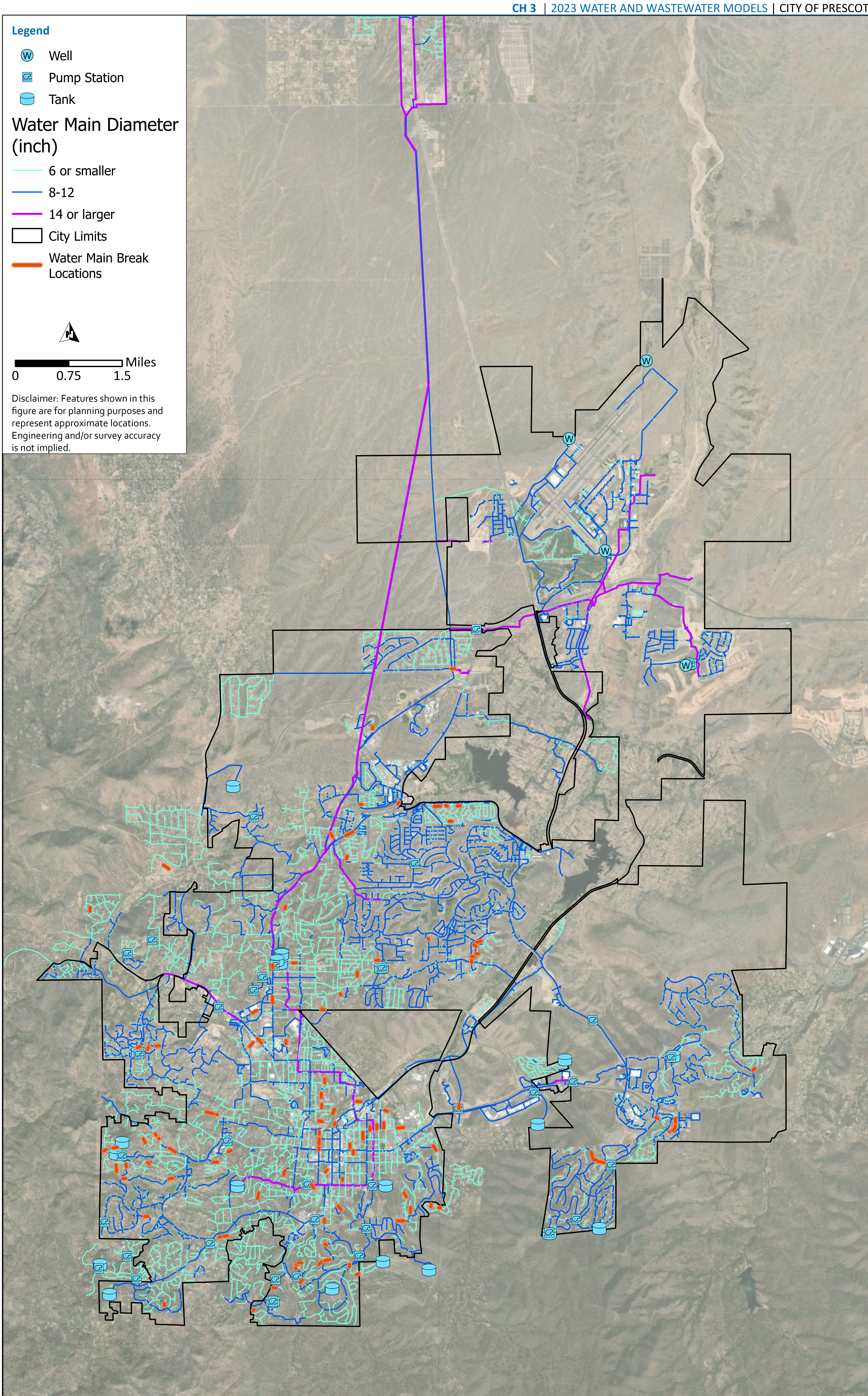

Figure 3.4 Water Main Break Locations

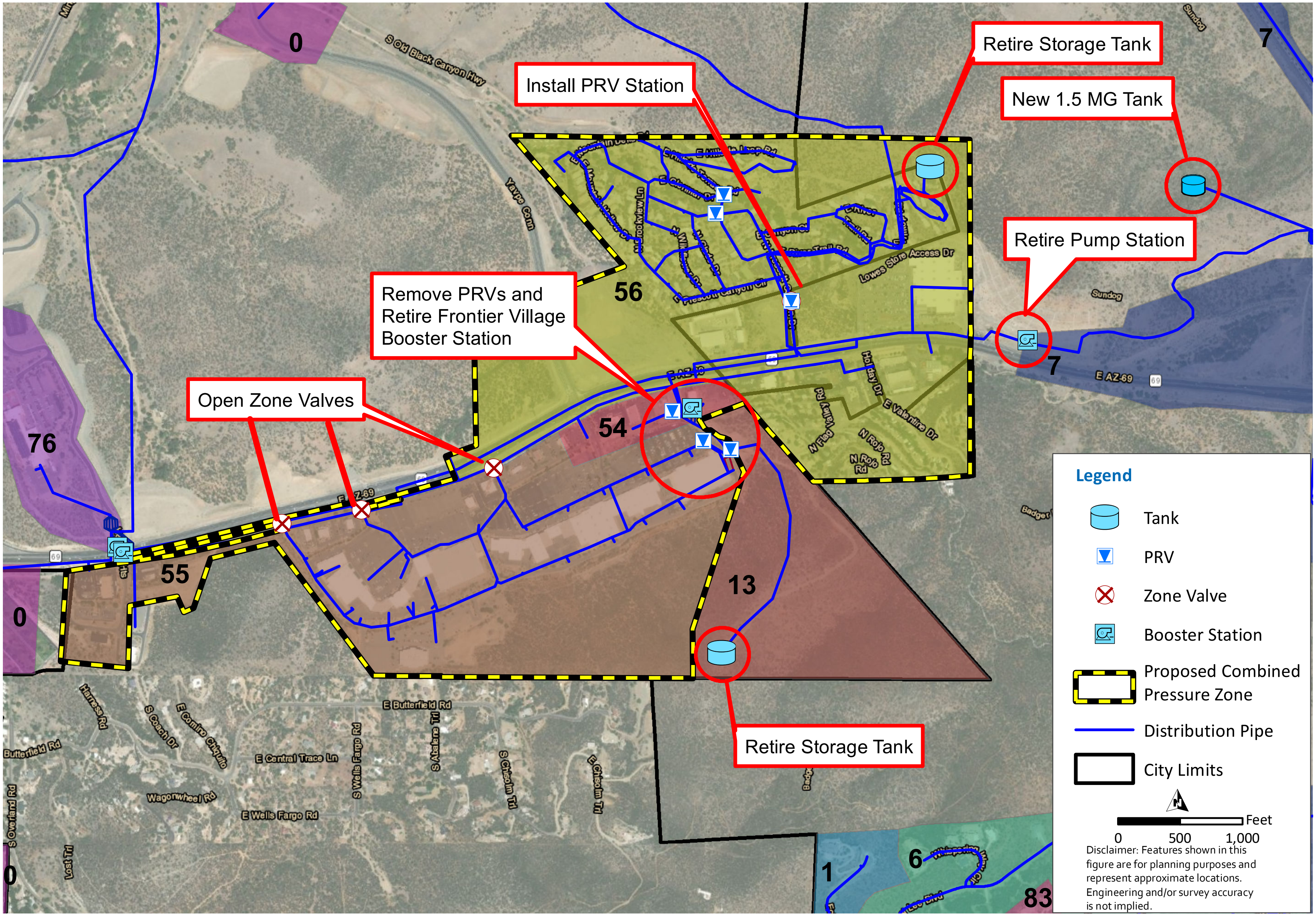

Figure 3.5 Pressure Zones 54, 55, and 56

Zones 24, 27, 28, 39, and 48

Several pipe and PRV projects were proposed by the City and the 2023 Study to improve the Zone 24, 27, and 39 pressures and meet fire flow requirements, including small pipe replacements, new pipe and PRV construction, and Zone 27 and 39 boundary changes. Figure 3.6 presents the City of Prescott 2023 water system and the proposed new pipe and PRV projects. Figure 3.7 presents the Zone 27 and 39 boundary change.

The following small pipe replacements were proposed to meet the pressure and fire flow requirements:

- New 6-inch water main along Brush Street connecting with the pipes on Western Avenue and Gurley Street.
- New 6-inch water main along Ash Street and North Willow Street connecting to the pipe on Western Avenue.
- New 6-inch water main along Cherry Drive connecting with the pipes on Middlebrook Road and Linden Road.
- Project 68W, new 12-inch Zone 27 pipe starting from Butte Canyon Drive along Forest Hills Road and new 12-inch Zone 39 pipe connecting Sherwood Drive and Rustic Timbers Lane to modify the Zone 27 and 39 boundaries. Upsize the water main from Zone 24 Pump Station to Zone 24 Tank and this project was recommended and evaluated in the 2023 Study as well as previous studies although the alignment has changed.

The following new pipes and PRV stations were proposed to supply existing and future developments:

- New 6-inch water main along the Country Club Circle.
- New 8-inch water main along Parker Drive with new PRV station and vault to connect Zone 24 with Zone 27. The PRV setpoint of the new PRV from Zone 24 to Zone 27 should be 15 psi.
- New PRV station and vault from Zone 27 to Zone 28. The PRV setpoint of the new PRV from Zone 48 to Zone 28 should be 70 psi.
- New PRV station and vault from Zone 48 to Zone 28. The PRV setpoint of the new PRV from Zone 48 to Zone 28 should be 63 psi.

Zone 27 and 39 Boundary Change

The boundary between Zone 27 and Zone 39 is planned to be modified by constructing one 8-inch water main along Forest Meadows Drive and one 12-inch pipe connecting pipes on Rustic Timbers Lane and Sherwood Drive. This project was documented in the Zone 24-27 Design Report. The 8-inch Zone 27 water main connects from the intersection of Thumb Butte Road and Sherwood Drive to the intersection of Butte Canyon Drive and Meadowbrook Road. With the construction of these water mains, the land area south of Meadowbrook Road and east of Butte Canyon Drive will transition from Zone 27 to Zone 39 as shown in Figure 3.7. This change will enable the transitioned area to operate at lower pressures.

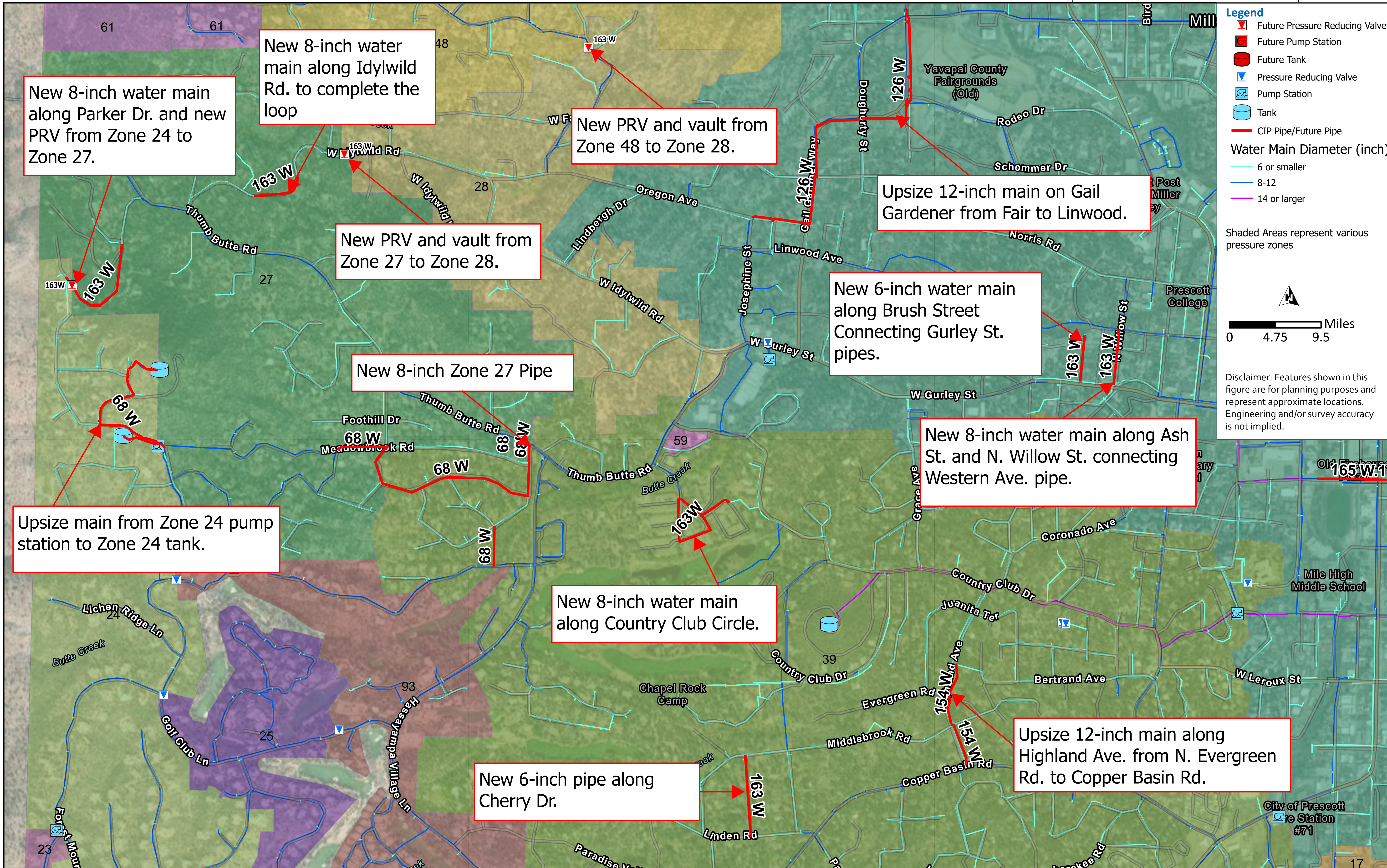

Figure 3.6 Pressure Zones 24, 27, 28, 39, and 48

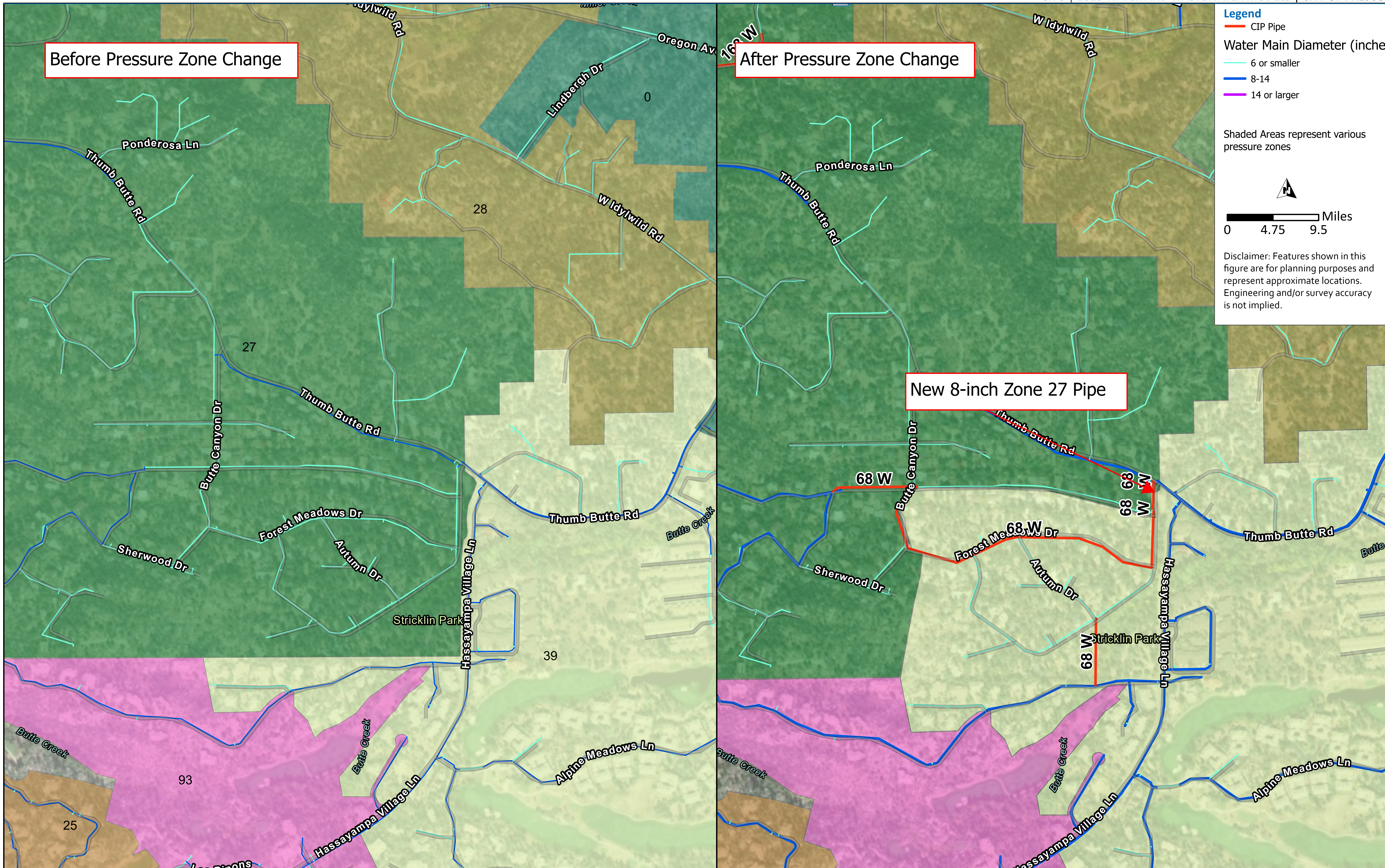

Figure 3.7 Pressure Zones 27 and 39

Zones 16 and 90

The City has decided not to move forward with the pressure Zones 16 and 90 boundary modification.

The following sections describe the steps required for the City to complete the remaining zone boundary changes that were identified since the 2013 Study and 2018 Study.

Zones 44 and 70

Zones 44 and 70 are adjacent zones located in central Prescott that are currently served by two PRVs, one to each pressure zone, off the 14-inch Willow Lake Road transmission line, as shown in Figure 3.8. A zone valve at Portside Drive and Louis Street separates the water mains in these two pressure zones. Opening the zone valve will result in a single, combined pressure zone with two feeds, which increases supply redundancy for the combined zone.

The model indicates that the Zone 70 PRV (Lakeside) should be set to 115 psi and the current Zone 44 PRV (North Lake) should be set to 90 psi for the combined zone feed.

Zones 7 and 7A

Pressures in the eastern portion of Zone 7 have been observed to be greater than 160 psi. The 2013 Study recommended realigning a portion of Zone 7 through the installation of new PRV stations to provide pressures that meet the City's performance criteria. Three PRV stations would be required at the following locations:

- Ranch Drive east of Lee Blvd.
- San Francisco Drive east of Lee Blvd.
- Liese Drive west of Equestrian Way.

These areas are shown on Figure 3.9 along with the proposed new PRV locations and the re-aligned Zone 7 boundary.

Zones 68 and 77

This area is not recommended for consolidation at this time. Pressure Zone 68 serves a County complex. Pressure Zone 77 serves Pioneer Park. These pressure zones are located west of Zone 86 and are each served by a single PRV station from Zone 0. While these zones are adjacent and at approximately the same elevation, there may be limited benefits to consolidating and operating these zones as a single pressure zone.

However, if development expands in this area and new pipes will be constructed, the City should consider consolidating Zones 68 and 77 as a single pressure zone to provide a dual feed to the combined zone. Zones 68 and 77 could also potentially be combined as part of Zones 46, 79, 86, and 88.

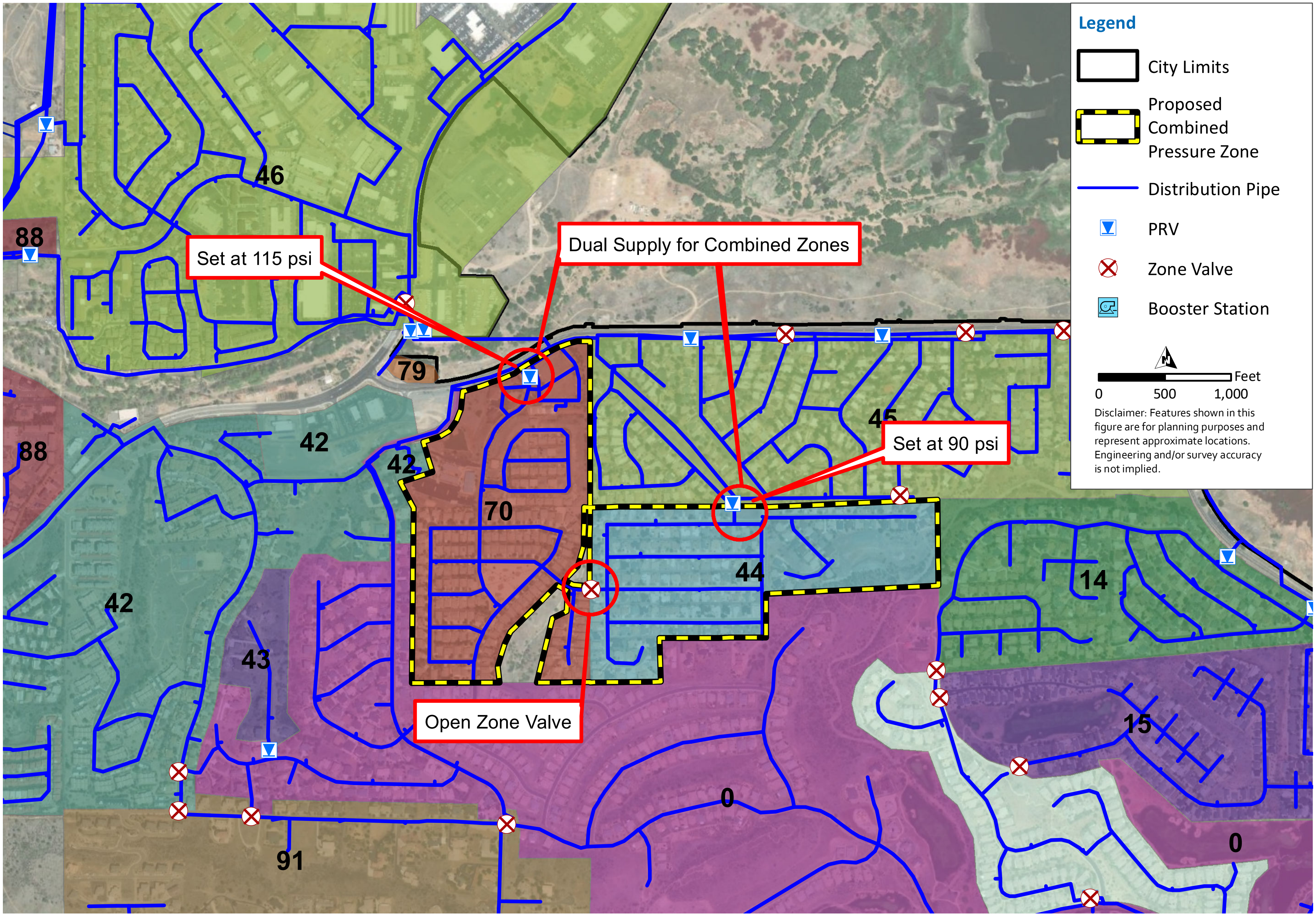

Figure 3.8 Pressure Zones 44 and 70

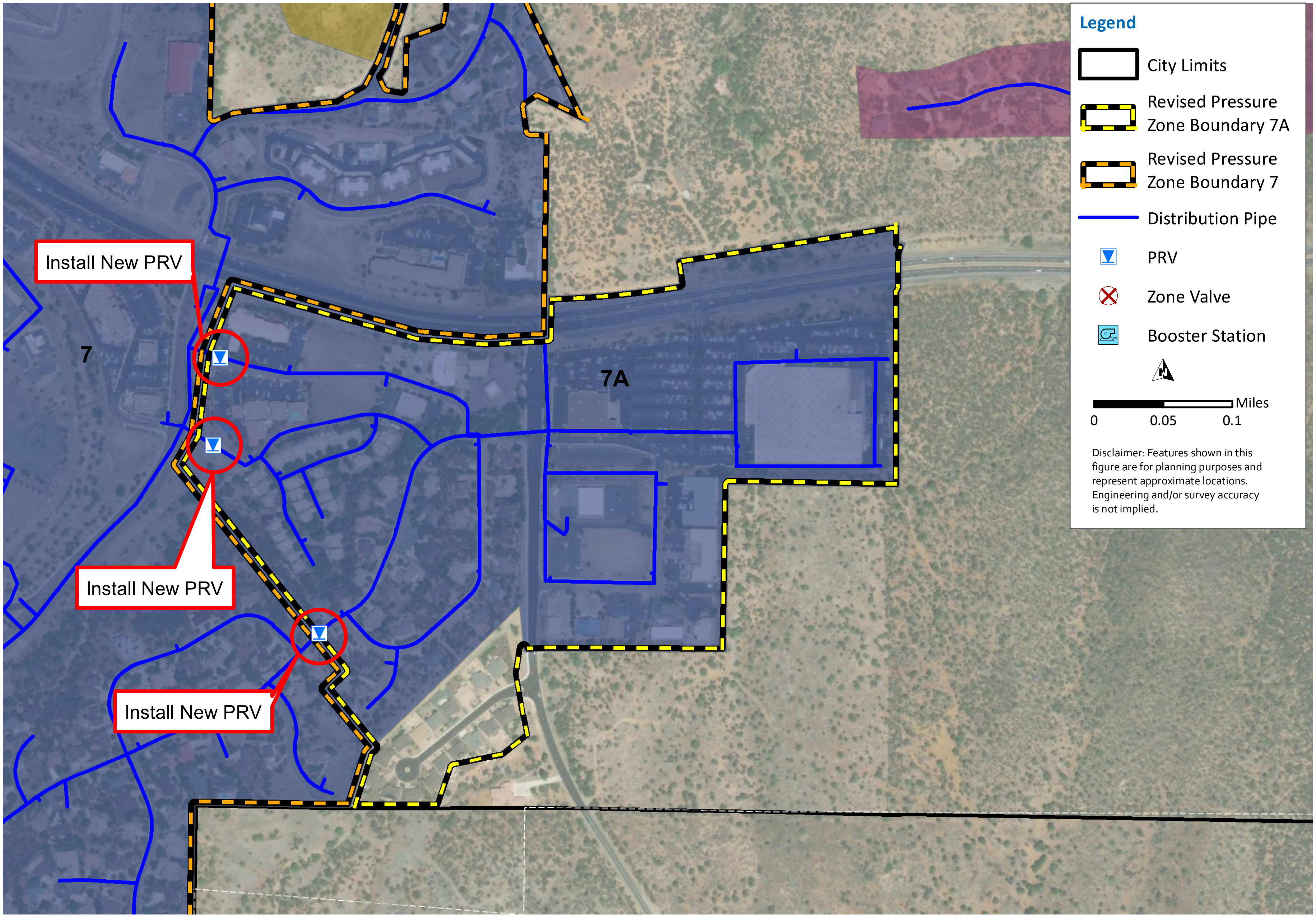

Figure 3.9 Pressure Zones 7 and 7A

3.4.2.2 Additional Pressure Zone Recommendations

In addition to the above recommendations that the City moved forward from the 2013 Study and the 2018 Study, there are four additional pressure zone changes or operational changes that the City is planning to conduct, which are listed and described below:

- Zones 51, 202, and 58 NW connection.
- Zones 110, 58 Southeast, 46, 72, and 86 reconfiguration and connection.
- Zones 12 (including Arizona Eco Development [AED] North), 101, and 113 (AED South) connection.

Zones 51, 202, and 58 NW

Zones 51 and 58 are located west of Zone 12 and south of the future Zone 110. When the Intermediate Booster Pump Station is in operation, Zone 58 will be split into two zones by closing a valve that crosses Pioneer Parkway to create Zone 58 NW and Zone 58 SE. Zone 58 NW will be served by the transmission main from the Intermediate Booster Pump Station to Zone 0 with an existing PRV. Zone 58NW will also be supplied from the combined Zone 51/Zone 202 through the existing Hidden Hills PRV. Zone 58 SE will be combined with Zone 110 and supplied by the Zone 110 Pump Station at the Intermediate Booster Station site as explained in the next section.

The Longview Tank will be decommissioned, and Zone 51 will be served by the Northwest Regional Tank. One 12-inch transmission main and one PRV will be constructed to connect Zone 51 and the Northwest Regional Tank.

Figure 3.10 and Figure 3.11 show Zone 51 and Zone 58 NW pressure zones in both map and schematic formats.

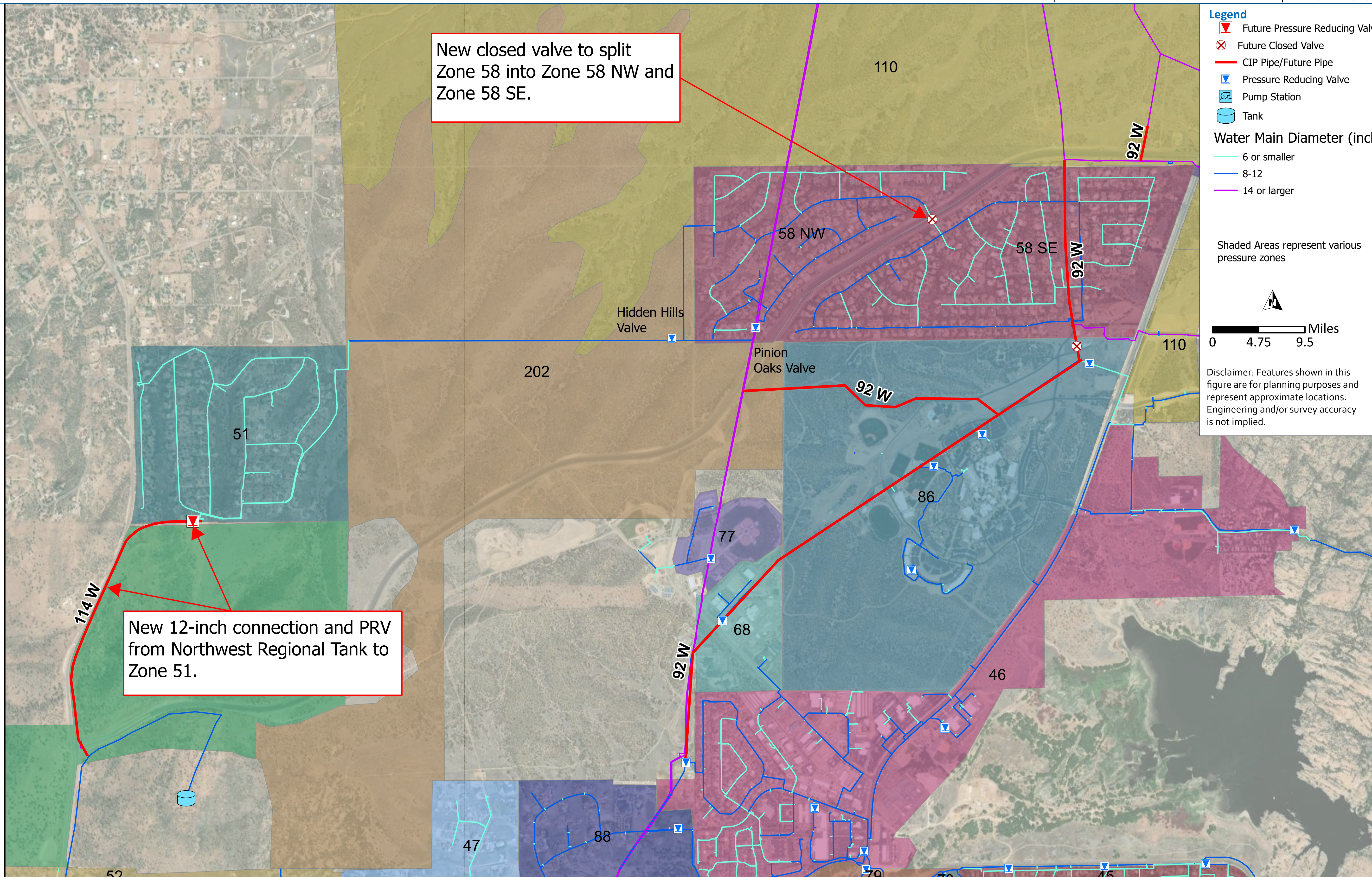

Figure 3.10 Pressure Zones 51, 202 and 58 NW

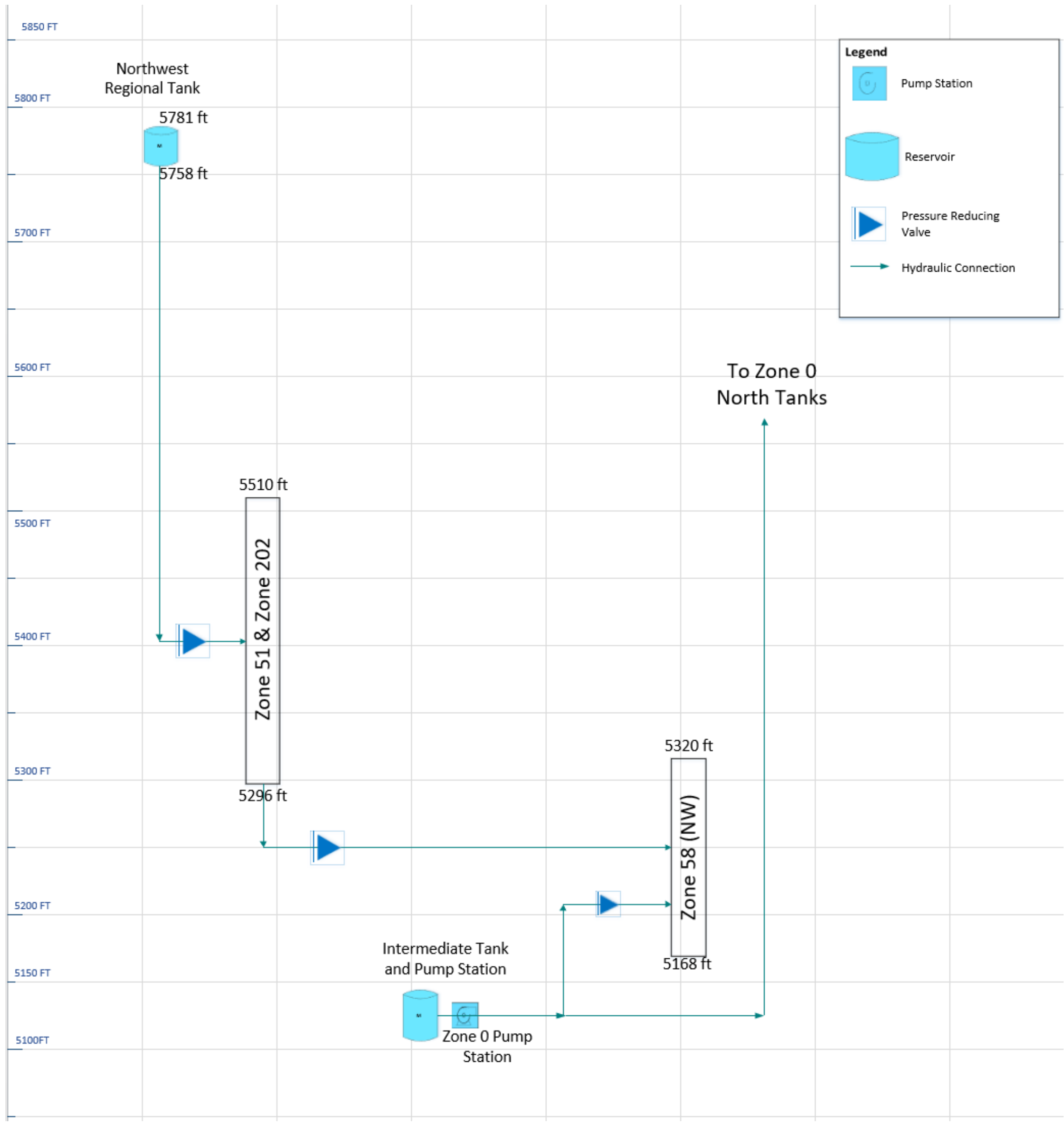

Figure 3.11 Pressure Zones 51, 202, and 58 NW Schematic

Zones 110, 58 SE, 58 SW, 46, 72 and 86

Improvements to Zones 110, 58 SE and SW, 46, 72, and 86 will be complete in three phases as follows:

Phase 1:

1. A new 18-inch transmission main will be connected to the curved 16-inch pipeline from the Zone 110 booster station and then be constructed underneath Pioneer Parkway so that Zone 58 SE can be served by the Zone 110 pump station located at the Intermediate Booster Pump Station.
2. A new valve will be added to the 12-inch transmission main that currently connects the Intermediate Pump Station to the North Reservoirs. This valve will be closed so that Zone 58 SE can be supplied by Zone 110 and Embry Riddle in Zone 86 can still be supplied by Zone 0. These changes will combine Zones 110 and Zone 58 SE.
3. The existing valve along Pioneer Parkway will be closed to separate Zone 58 NW and 58 SE.
4. The PRVs on the east-west pipeline parallel Pioneer Parkway that previously moved water into and out of Zone 12 will be permanently closed so that all water leaving Zone 12 for the rest of the distribution system will go to Intermediate Storage Tanks.
5. The Hidden Hills PRV and the PRV from the Zone 0 transmission main are adjusted to the desired pressure to serve Zone 58NW.

Phase 2:

1. A new 18-inch transmission main replaces the aging 12-inch transmission main running north to south between Pioneer Parkway in Zone 58 SE and the closed valve between Pinion Oaks and Embry Riddle.
2. Construct project 92W that loops in the existing 12-inch transmission main that serves Embry Riddle in Zone 86 with the transmission mains going to Zone 0 and the North reservoirs. This new 18-inch pipe along Dobberteen Dr. connecting the two transmission mains provides a second feed to Embry Riddle.

Phase 3:

1. Construct a new 18-inch transmission main in place of the aging 12-inch transmission main that serves Zone 86. The new 18-inch pipe across Embry Riddle is intended to replace the existing 12-inch pipe to increase the supply capacity from Zone 0 to Embry Riddle, Zone 46 and Zone 72.
2. Construct a new PRV station that provides a second feed from the new 18-inch transmission main serving Zone 86 to provide a second connection for looping into the Embry Riddle Campus.

According to the Intermediate Booster Pump Station Project 100% Design Report conducted by Waterworks Engineers, the Intermediate Booster Pump Station pump head was designed based on the higher elevations (5,176 ~ 5,308 ft) in the Zone 110 service area. However, elevations in the hydraulic model shows the elevation of the Zone 110 service area plus the Zone 58 NW service area with lower elevations (4,994 ~ 5,254 ft).

Figure 3.12 and Figure 3.13 show these pressure zones in both map and schematic formats.

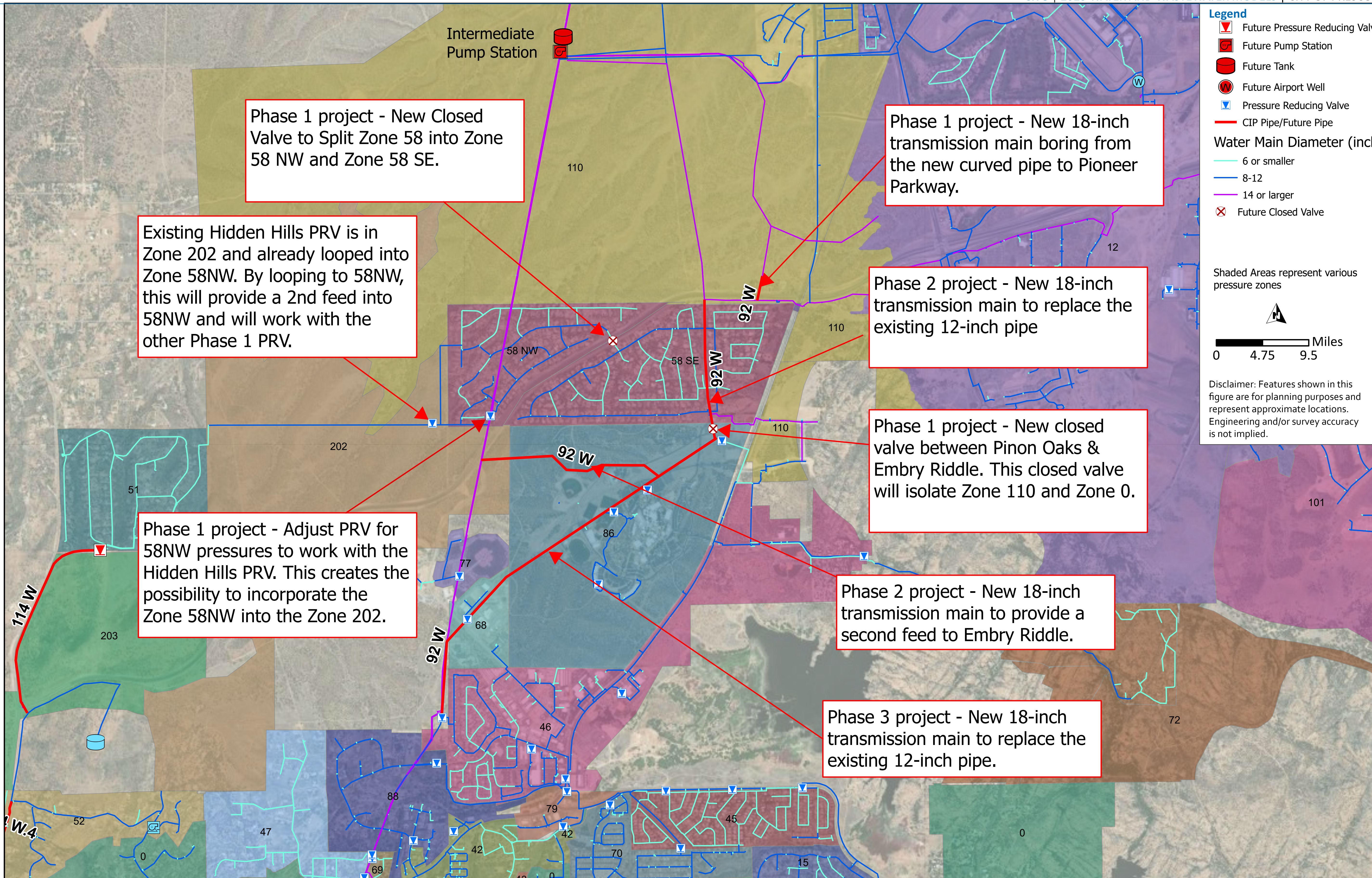

Figure 3.12 Pressure Zones 110, 58 SE, 58 NW, 46, 72, and 86

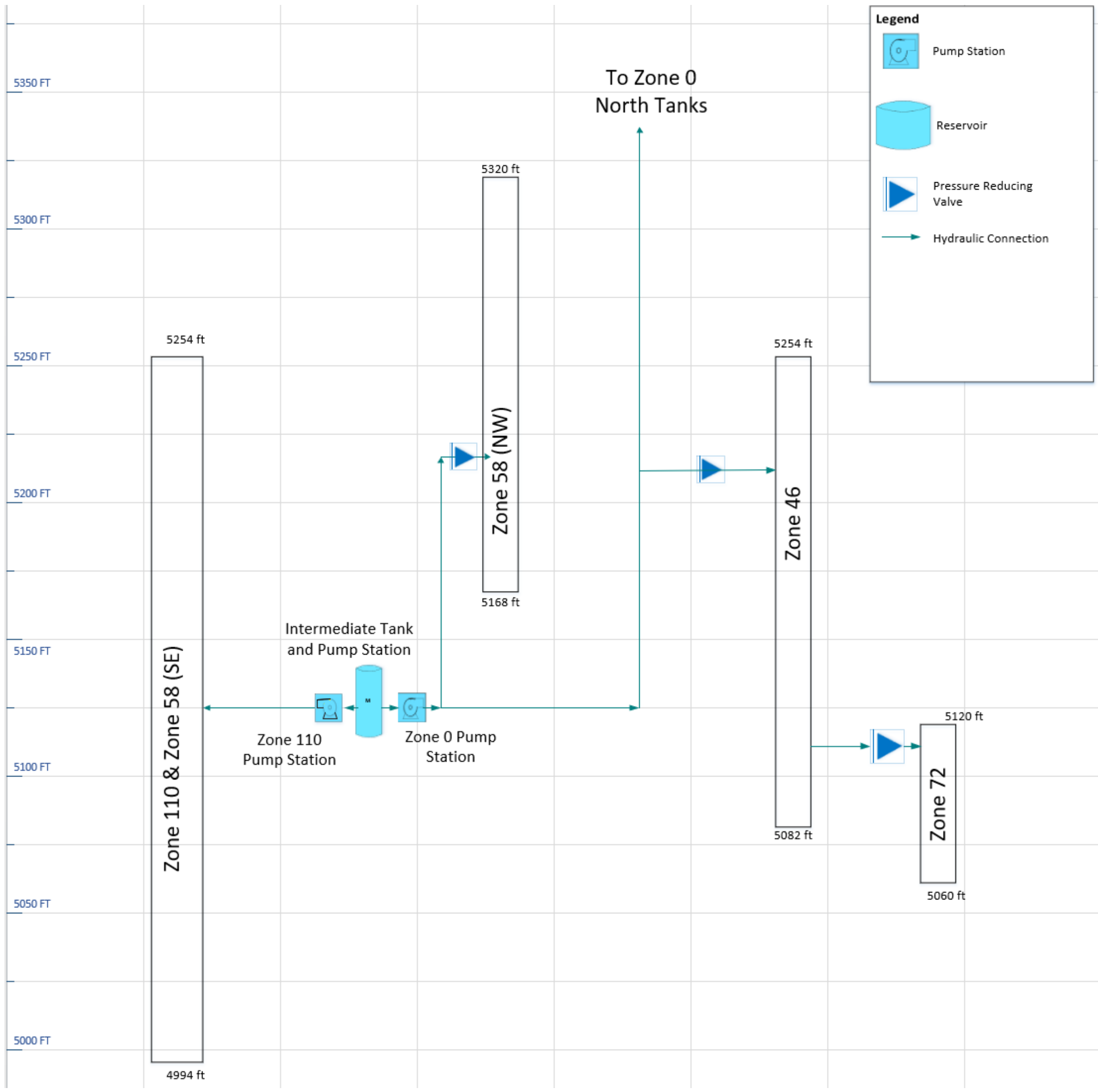

Figure 3.13 Pressure Zones 110, 58 Southeast, 58 Northwest, 46, and 72 Schematic

Zones 12 (including AED North), 101, and 113 (AED South)

The AED North Area is located north of Highway 89 and east of the Airport while the new development area AED South (Section 32 and 33) are located east of the AED North Area and north of Highway 89. The AED North Area and AED South Area are expected to be developed in next 10 years. AED North Area elevations are within the elevation range of Zone 12. Therefore, the AED North Area is designed to be included in Zone 12 by connecting the 16-inch main west of Granite Dells Parkway along Highway 89. AED South Area, designed as Zone 113, will be connected with Zone 101 to the transmission main downstream of the Zone 12 Tank south of Highway 89. The HGL will flow from Zone 101 to Zone 113, then to the AED North Area.

Figure 3.14 and Figure 3.15 show these pressure zones in both map and schematic formats.

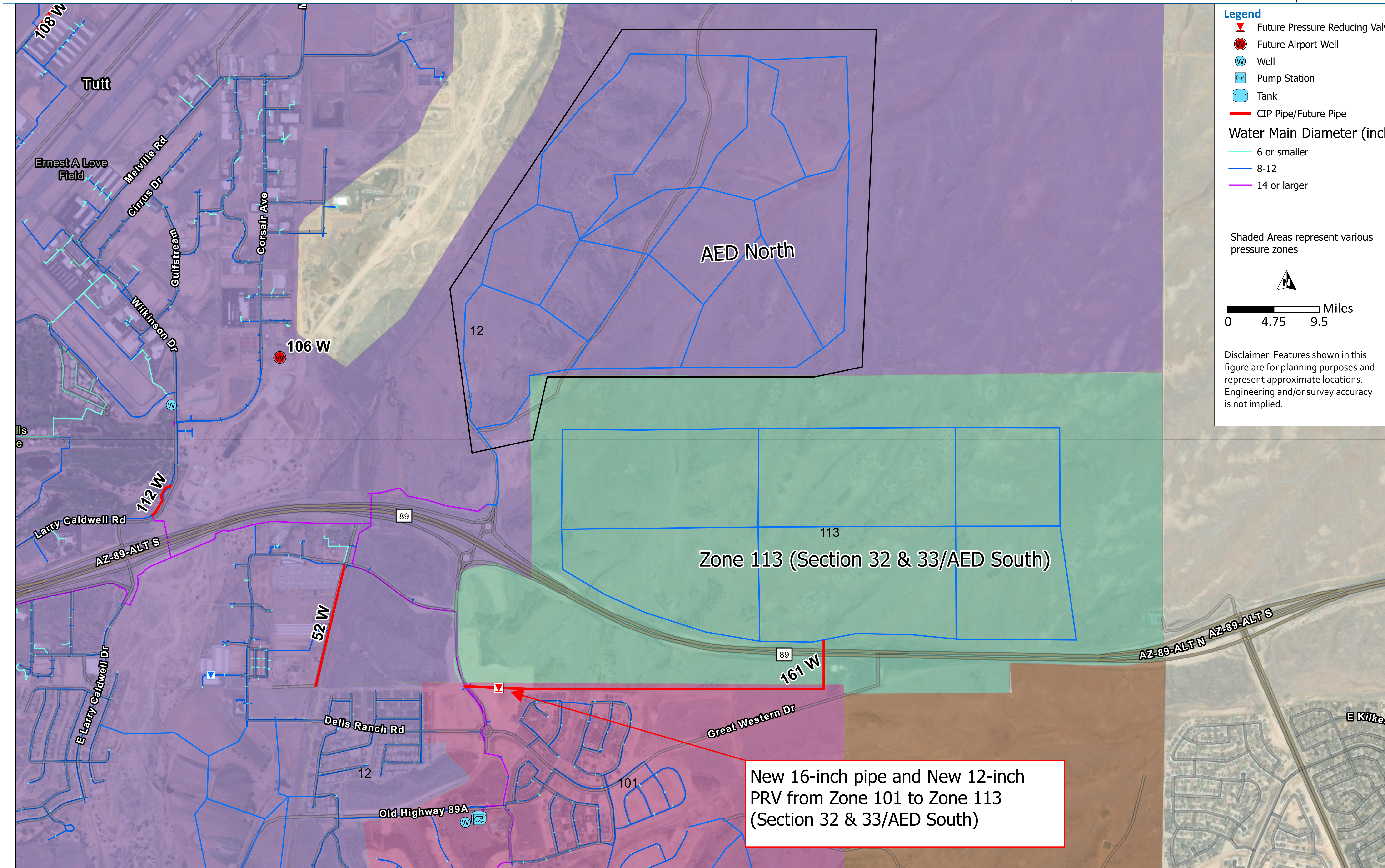

Figure 3.14 Pressure Zones 12 (including AED North), 101, and 113 (AED South)

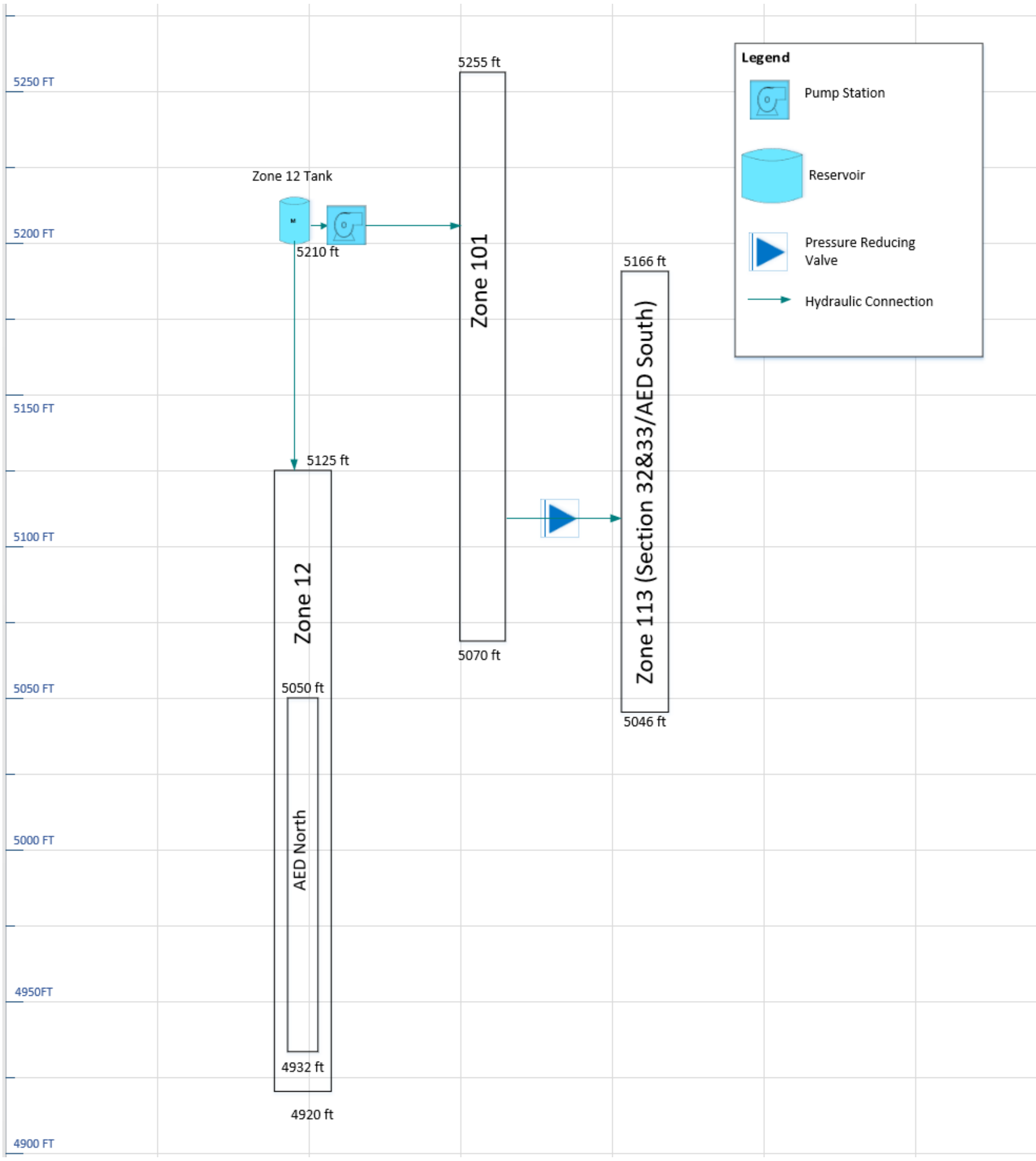

Figure 3.15 Pressure Zones 12 (including AED North), 101, and 113 (AED South) Schematic

3.4.2.3 Pressure Zone Schematic

Appendix 3C contains an elevation schematic of the City's water system that illustrates the elevation ranges of each pressure zone (with recommended pressure zone boundary changes and service area boundary changes), as well as the storage tanks, booster pump stations, and PRV stations.

3.4.3 Fire Flow Evaluation

The hydraulic model was used to perform a fire flow analysis for 2022 and buildout conditions. The required fire flows were taken from the City's performance criteria and allocated to hydrants in the model based on land use classification. Fire demands were allocated in addition to MDD in the hydraulic evaluation. Booster pump stations were assumed to be operating with the largest pump out of service (firm capacity) for the existing system evaluation. For the buildout evaluation, the booster pump stations were operated at firm capacity except for those booster pump stations that will have only one high-capacity fire pump in operation.

Figure 3.16 shows the results of the 2022 fire flow evaluation and Figure 3.17 shows the results of the buildout fire flow evaluation.

The model indicated the City has ten storage tanks that do not have sufficient storage capacity to provide the minimum required fire flow volume of 0.12 MG (1,000 gpm for 2 hours). The water system has areas with high elevations and dead-end lines with inadequate looping. It is difficult to meet the fire flow requirements for those areas. In addition, the water system has areas with 6-inch, 4-inch, and 2-inch water mains. It is difficult to obtain required fire flows through pipes less than 8 inches in diameter because of high head losses, and the resulting pressures are often not adequate to provide a minimum level of fire flow service.

The storage deficiencies are addressed through recommendations in Section 3.4.1.2 to either increase storage capacity or provide a booster pumping solution for these areas. For areas where pipe networks are primarily less than 8 inches in diameter, larger water mains would achieve the required fire flows. These storage and water main recommendations were outlined previously in the existing system evaluation.

3.4.4 Emergency Operations and Redundancy

In the 2018 Study, an extensive evaluation was completed to evaluate emergency operations and redundancy requirements for the water system. The purpose of this evaluation was to identify the factors that are within the City's control so that appropriate steps could be taken to mitigate the risk of losing water service in all or a portion of the system.

Potential threats to the Prescott water distribution system were identified as:

- Loss of supply.
- Equipment failure (power, mechanical, main breaks, etc.).
- Extreme demands (building fire, forest fire).
- Human caused disruptions (vandalism, terrorism, accidents).
- Natural disasters (storm, flood, earthquake, drought).

The methodology used estimated risk as a product of the probability of a specific event occurring times the consequence of a loss of service from the event times the effectiveness of the mitigation efforts that the City could put in place.

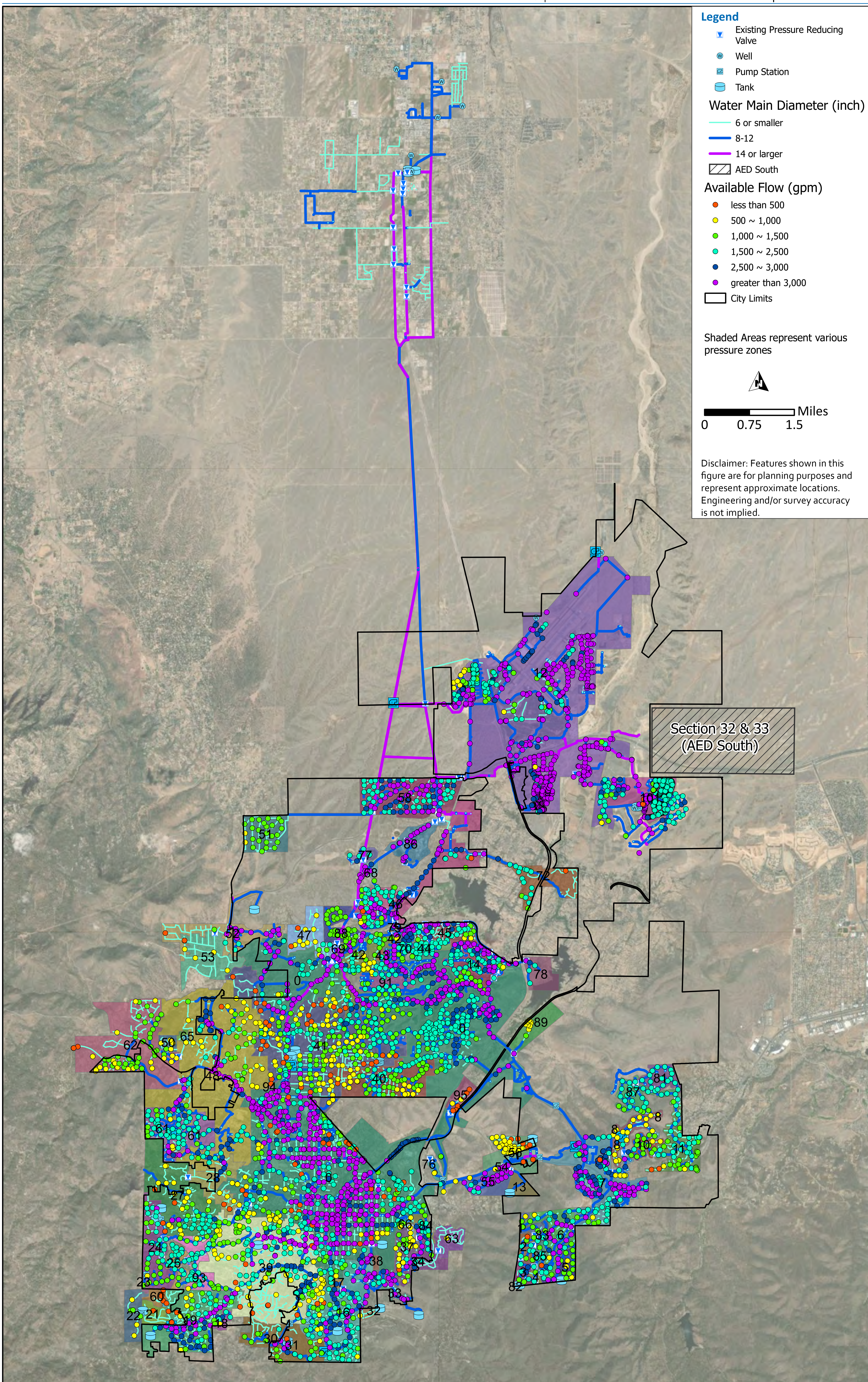

Figure 3.16 2022 Fire Flow Results

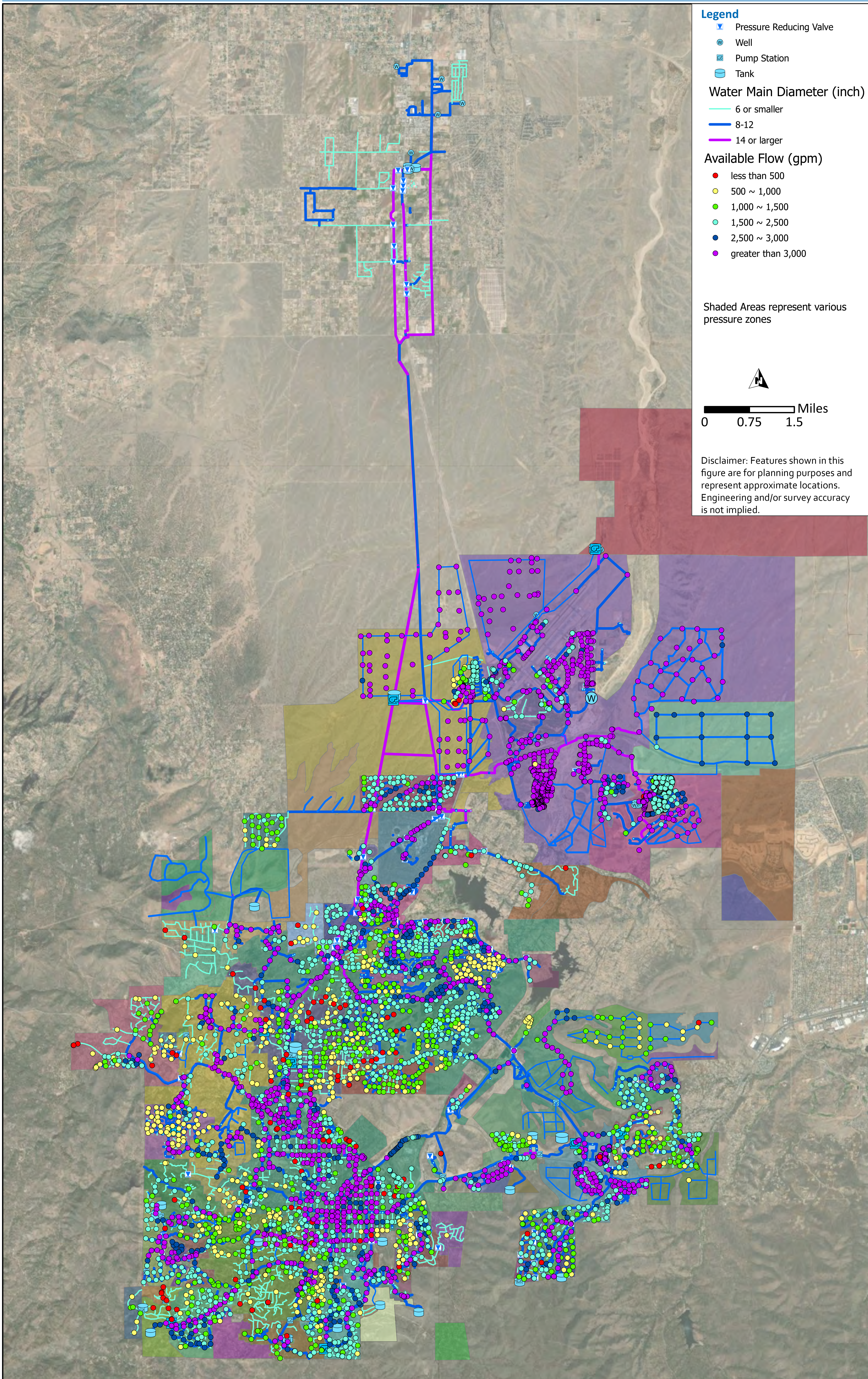

Figure 3.17 Buildout Fire Flow Results

The water system was organized into 18 services areas for the purposes of this evaluation. Then scores were developed for each area and rankings were developed for the overall system.

The Emergency Operations and Redundancy analysis results from the 2018 Study are generally representative of current conditions and are included in Appendix 3D. The results are carried forward here for continuity.

The service areas that continue to be the highest risk for the City include:

1. The Chino pumping and transmission system is the highest risk infrastructure in the City's water system due to potential loss of service because of well failure, power outages, main ruptures, and natural disasters. The failure of this system is likely to affect the entire service area. This system needs to have routine maintenance and redundancy measures to protect the City of Prescott's water supply. The City's current project to construct the Intermediate Storage Tanks and Booster Pump Station will provide redundancy to the system and lower the risk of a main rupture due to extreme pressures once the Chino and Intermediate facilities are operating together.
2. The Prescott Pines area is the next highest risk area for the City because of the risk of fires originating to the south of the City. Water infrastructure recommendations have been provided to improve water supply and storage for this area for increased fire protection.
3. The Zone 56/Frontier Village area includes a large commercial and transportation corridor for the City. The greatest risks in this area are due to equipment failures, fires, and chemical spills.

The types of events that could cause service disruptions that are of most concern in the Prescott water system include:

1. Main breaks, forest fires, and intentional chemical contamination. While these events cannot be controlled by staff, the City should be prepared to respond to them.
2. Pneumatic tank, pump, and PRV failures are a concern for the City. These failures can be mitigated by continuing to engage in proactive maintenance and rehabilitation before assets get to the end of their useful life.
3. Risks related to storms, power outages, building fires, and peak demands are also largely out of the City's control. However, these are "routine" emergencies that the City is accustomed to responding to and the City should continue to prepare to address these types of emergencies in the future.

3.5 Water System Capital Improvement Program Projects

After performing the evaluations described in Section 3.4, the following CIP projects have been identified and are described below.

3.5.1 Water Supply CIP Projects

Based on the water supply evaluations performed in Section 3.4.1.1, the following projects have been identified related to water supply and are described in more detail below in Table 3.14.

Table 3.14 Water Supply CIP Projects

Project #	Description	Diameter (in)	Length (ft)/Number	Capacity (gpm)	Project Justification/Driver
106 W.1	Future Airport Well No. 6	--	--	950	Serves existing and future development in Pressure Zone 12 by providing additional water supplies. In conjunction with Project 92 W, this project can serve existing and future development in the City of Prescott by sending supplies in excess of Zone 12 demands to the rest of Prescott. Note: wellhead treatment costs are not included.

3.5.2 Water Storage CIP Projects

Based on the water storage evaluations performed in Sections 3.4.1.2 and 3.4.2, the following projects have been identified related to water storage and are described in more detail below in Table 3.15.

Table 3.15 Water Storage CIP Projects

Project #	Description	Diameter (in)	Number	Capacity (MG)	Project Justification/Driver
44 W.2	New Zone 56 Storage Tank	--	--	1.5	Provides additional storage for Pressure Zone 56 and other Pressure Zones along the SR 69 corridor through buildout.
74 W.1	Replace Mingus Tanks	--	--	0.75	Provides storage for Pressure Zones 41
98 W.1	Upsize the Cedarwood Tank	--	--	0.5	Provides additional capacity in the Cedarwood tank to provide fire flows to Pressure Zone 40.

3.5.3 Booster Pump Station CIP Projects

Based on the booster pump station evaluations performed in Sections 3.4.1.4 and 3.4.3, the following projects have been identified for the booster pump stations and are described in more detail below in Table 3.16.

Table 3.16 Booster Pump Station CIP Projects

Project #	Description	Number	Capacity (gpm)	Project Justification/Driver
44 W.1	Replace Lower Yavapai Hills Pump Station	1	1,600	Provides increased water supply to Zone 7 and downstream pressure zones as part of the Zone 56 improvements. Provides second supply to Yavapai Hills area and supports additional growth.
70 W.1	Upper Rancho Vista Booster Pump Upsize	1	150	Increases the capacity of the Upper Rancho Vista Booster Pump Station to provide buildout demands
74 W.2	Mingus Pump Station Replacement	1	4*750 + 1* 300 jockey pump	Replaces aging facility.
80 W.2	Pump Station - Forest Trails	1	1,500	Helps meet the Zone 61 pumping capacity requirement.
104 W.2	New booster pump station near Green Ln and Willow Creek Rd.	1	1,000	Addresses storage and fire flow requirement deficiencies for Iron Springs (Pressure Zone 48), along with Project 104 W.1 and 104 W.3. With Project 104 W.1, a pumping capacity of 1,000 gpm is an appropriate pumping capacity given the limitations of the existing 6-in water mains downstream of this proposed booster pump station project. Fire flows are improved in Zone 48 but the performance criteria are not satisfied at all locations in the Zone. This project is postponed till buildout
132 W.1	Zone 30 Booster Pump Station at Hidden Valley and Valley Ranch between Zone 16 and Zone 30.	1	850	Provides emergency fire flow for Zones 30 and 31 at buildout.
158 W.1	Upsize Upper Yavapai Hills Booster Pump Station	1	1,000	Provides capacity to meet maximum day and peak hour demands.

3.5.4 Water Distribution and Transmission System CIP Projects

Based on the distribution and transmission system evaluations performed in Sections 3.4.1, 3.4.3, 3.4.4, and 3.4.5, the following projects have been identified for the water distribution and transmission system and are described in more detail below in Table 3.17.

Table 3.17 Water Distribution and Transmission Main CIP Projects

Project #	Description	Diameter (in)	Length (ft)	Project Justification/Driver
52 W.1	New Water Main from Centerpointe/Side Rd. to Heckthorn Rd.	12	2,105	Included in Granite Dells Ranch Holdings Development Agreement (p 46 of 57; CIP Project Number W4:30).
64 W.1	Upsize water main along Hwy 69 from new Zone 56/76 booster pump station to connect with the 16-inch main.	16	7,826	This project provides additional capacity along SR 69 corridor to supply the new Zone 56 Tank through buildout (Project 2A) and is necessary to consolidate Pressure Zones 54 and 55 and make them part of Pressure Zone 56.
68 W.1	New Zone 27 water main from the cross of Thumb Butte Rd and Sherwood Dr along Sherwood Dr, Forest Meadows Dr, Butte Canyon Dr. to Meadowbrook Rd.	8	3,364	Modifies the Zone 27 boundary and serves existing and future development by supplying maximum day, peak hour and fire flows to Zone 27.
68 W.2	Upsize water main from Zone 24 Pump Station to Zone 24 Tank	12	2,453	Serves existing and future development by supplying maximum day, peak hour and fire flows to Zone 24.
68 W.3	New water main in Zone 39 connecting Sherwood Dr. and Rustic Timbers Ln.	12	523	Provides looping for Zone 39 to improve fire flow pressures and flows.
74 W.3	Mingus Pipeline Upsize	12	935	Connects the new Mingus Tank to the Mingus Booster Pump Station.
76 W.1	Sundog Ranch Road Connector Water line between Yavapai Connector and Old Black Canyon Hwy.	12	2,795	Improves fire flows in Zone 0 for the YPIT Reservation and provides for the Storm Ranch Development.
80 W.1	New Zone 61 Water Mains - Distribution loop along Forest View Dr. from Woods to Enchanted Canyon Rd.	8	1,800	Provides looping for Zone 61 to improve fire flow pressures and flows.
82 W.1	New Zone 41 Water Main - Garland St. from Willow Creek Rd. to Moall Dr.	8	300	Helps meet the Zone 61 pumping capacity requirement.
82 W.2	New Zone 41 Water Main – Victoria St. from Stevens Rd. to Green Ln.	8	725	Provides looping for Zone 41 to improve fire flow pressures and flows.
82 W.3	New Zone 41 Water Main – Arena Dr. from Lester to 600 ft east	8	585	Provides looping for Zone 41 to improve fire flow pressures and flows.
82 W.4	New Zone 41 Water Main - Northside Dr. from Flora to Rosser Rd.	8	335	Provides looping for Zone 41 to improve fire flow pressures and flows.
82 W.5	New Zone 40 Water Main - Eagleview Rd. from Rosser to Soaring Rd.	8	565	Provides looping for Zone 40 to improve fire flow pressures and flows.
88 W.1	Water main loop connections - River Oaks & Shinnery and Valley/Tabosa	8	474	Provides looping to the southern part of Pressure Zone 42 that becomes part of Pressure Zone 0 in Project 50 W to increase reliability and provide additional fire flows.

Project #	Description	Diameter (in)	Length (ft)	Project Justification/Driver
92 W.1	Water Line Bore Under Pioneer Parkway	16	262	This project will connect Zone 110 with Zone 58 SE
92 W.2	New 18-inch transmission main to replace the existing 12-inch pipe cross the Zone 58 SE	18	3,025	This project will increase the pipe supply capacity to Zone 58 SE.
92 W.3	New 18-inch transmission main along Dobberteen Dr. to provide a second feed to Embry Riddle.	18	4,086	This project will provide a second feed to Embry Riddle.
92 W.4	New 18-inch transmission main along across Embry Riddle to replace the existing 12-inch pipe.	18	9,099	This project will increase the pipe supply capacity from Zone 0 to Embry Riddle and Zone 46.
104 W.1	New water main connected to 30-in water main in Willow Creek Rd. at Green Ln. extending west to near Green Ln. and Meadow Ridge Dr.	12	2,020	Addresses storage and fire flow requirement deficiencies for Iron Springs (Pressure Zone 48), along with Project 104 W.2. This project is postponed until Buildout.
104 W.3	Upsize water main along Yakashba (west extension of Green Ln.) to Peaceful Mesa Dr.	12	3,970	Addresses storage and fire flow requirement deficiencies for Iron Springs (Pressure Zone 48), along with Projects 104 W.1 and 104 W.2. This project is postponed till Buildout.
108 W.1	North Airport Distribution System Loop	12	4,975	Serves existing and future development in Pressure Zone 12 by completing a distribution system loop around the Prescott Airport.
112 W.1	Upsize water main along Larry Caldwell Dr from connection at Larry Caldwell Dr and Wilkinson Dr.	16	703	This project serves existing and future development in Pressure Zone 12 by providing a second feed from the Future Pressure Zone 12 tank to the area directly south/southeast of the Prescott Airport
114 W.1	Water main to connect Zone 51 to Northwest Regional Tank with a PRV	12	4,587	Allows the Longview Tank to be decommissioned.
118 W.1	8-inch main distribution system loop in Arrowhead Rd. from Iron Springs to Sidewinder	8	3,000	Provides looping to improve fire flow pressures and flows.
120 W.1	8-inch main distribution system loop in Whitecloud, Meadowridge and Estrella in Zone 48	8	1,715	Provides looping to improve fire flow pressures and flows.
122 W.1	Upsize water main along Stony Creek and Northridge 8-in to 12-in	12	2,200	Improves fire flow and peak hour pressures in Pressure Zone 0 area.
126 W.1	Upsize 12-in main on Gail Gardner from Fair to Linwood	12	4,155	Provides additional capacity to deliver estimated peak hour demands and fire flows at buildout.
128 W.1	Upsize 8-in main on Pine Lakes Rd.	12	4,025	Provides additional capacity to deliver estimated peak hour demands and fire flows at buildout.

Project #	Description	Diameter (in)	Length (ft)	Project Justification/Driver
130 W.1	Upsize 8-in main on Iron Springs Rd.	12	1,720	Provides additional capacity to deliver estimated peak hour demands and fire flows at buildout.
154 W.1	154 W.1 Upsize main from N. Evergreen Rd. to Copper Basin Rd. along Highland Ave.	12	1,140	Improves fire flow and peak hour pressures.
161 W.1	New water main west of Section 32 along Hwy. 89 connecting to Granite Dells Pkwy.	16	1,957	Serves future development in Pressure Zone 113.
162 W.1	New 16-inch water main connecting from Zone 12 existing pipe to supply the annexation area northwest of the airport.	16	6,913	This project will supply the annexation area northwest of the airport.
163 W.1	New 6-inch water main along Brush St. connecting with the pipes on Gurley St.	6	615	Improves fire flow and peak hour pressures in Zone 0.
163 W.2	New water main along North Willow St. connecting to the pipes on Western Ave and Gurley St.	8	459	Improves fire flow and peak hour pressures in Zone 0.
163 W.3	New water main along Cherry Dr. connecting with the pipes on Middlebrook Rd. and Linden Rd.	6	859	Improves fire flow and peak hour pressures in Zone 39.
163 W.4	New water main along the Country Club Circle	8	1,627	Improves fire flow and peak hour pressures in Zone 39.
163 W.5	New water main along Parker Dr. to connect Zone 24 and 27	8	1,231	Increases water supply to Zone 27 and improves fire flow and peak hour pressures in Zone 27.
163 W.9	New water main along Idylwild Rd	12	720	This project will complete the pipe loop and improve fire flow and peak hour pressures in Zone 27.
164 W.1	New 4-inch pipes in Ho Kay Gan development	4	2,799	This project will supply Ho Kay Gan development
164 W.2	New 6-inch pipes in Ho Kay Gan development	6	5,354	This project will supply Ho Kay Gan development
164 W.1	New 8-inch pipes in Ho Kay Gan development	8	14,120	This project will supply Ho Kay Gan development
164 W.1	New 12-inch pipes in Ho Kay Gan development	12	14,415	This project will supply Ho Kay Gan development
165 W.1	New 8-inch pipe replacement in downtown	8	2,480	This project will replace the pipes in the downtown area and improve the fire flow.
165 W.2	New 10-inch pipe replacement in downtown	10	1,339	This project will replace the pipes in the downtown area and improve the fire flow.
166 W.1	New 12-inch pipe on Sundog Ranch Rd connecting with Prescott Lakes Pkwy	12	3,300	This project will supply water in Storm Ranch development
167 W.1	Annual pipe repair & replacement	Varies	Varies	Repairs/replaces old pipes or the pipes with breakages or leaks.

3.5.5 Water Pressure Reducing Valve CIP Projects

Based on the distribution and transmission system evaluations performed in Sections 3.4.1, 3.4.3, 3.4.4, and 3.4.5, the following projects have been identified for the water pressure reducing valve and are described in more detail below in Table 3.18 and shown in Figure 3.18.

Table 3.18 Water Pressure Reducing Valve and Isolation Valve CIP Projects

Project #	Description	Diameter (in)	Number	Project Justification/Driver
92 W.5	New closed valve between Zone 58 NW and Zone 58 SE	12	1	This project will split the Zone 58 into Zone 58 NW and Zone 58 SE.
92 W.6	New closed valve between Pinon Oaks & Embry Riddle	12	1	This project will isolate Zone 110 and Zone 0.
114 W.2	PRV on the new water main connecting from Northwest Regional Tank to Zone 51	12	1	Allows the Longview tank to be decommissioned.
161 W.2	New PRV on the new water main west of Section 32 along Highway 89 connecting to Granite Dells Parkway	12	1	Serves future development in Pressure Zone 113.
163 W.6	New PRV station and vault from Zone 24 with Zone 27.	6	1	Increases water supply to Zone 27 and improves fire flow and peak hour pressures in Zone 27.
163 W.7	New PRV station and vault from Zone 27 to Zone 28	6	1	Increases water supply to Zone 28 and improves fire flow and peak hour pressures in Zone 28.
163 W.8	New PRV station and vault from Zone 48 to Zone 28	6	1	Increases water supply to Zone 28 and improves fire flow and peak hour pressures in Zone 28.

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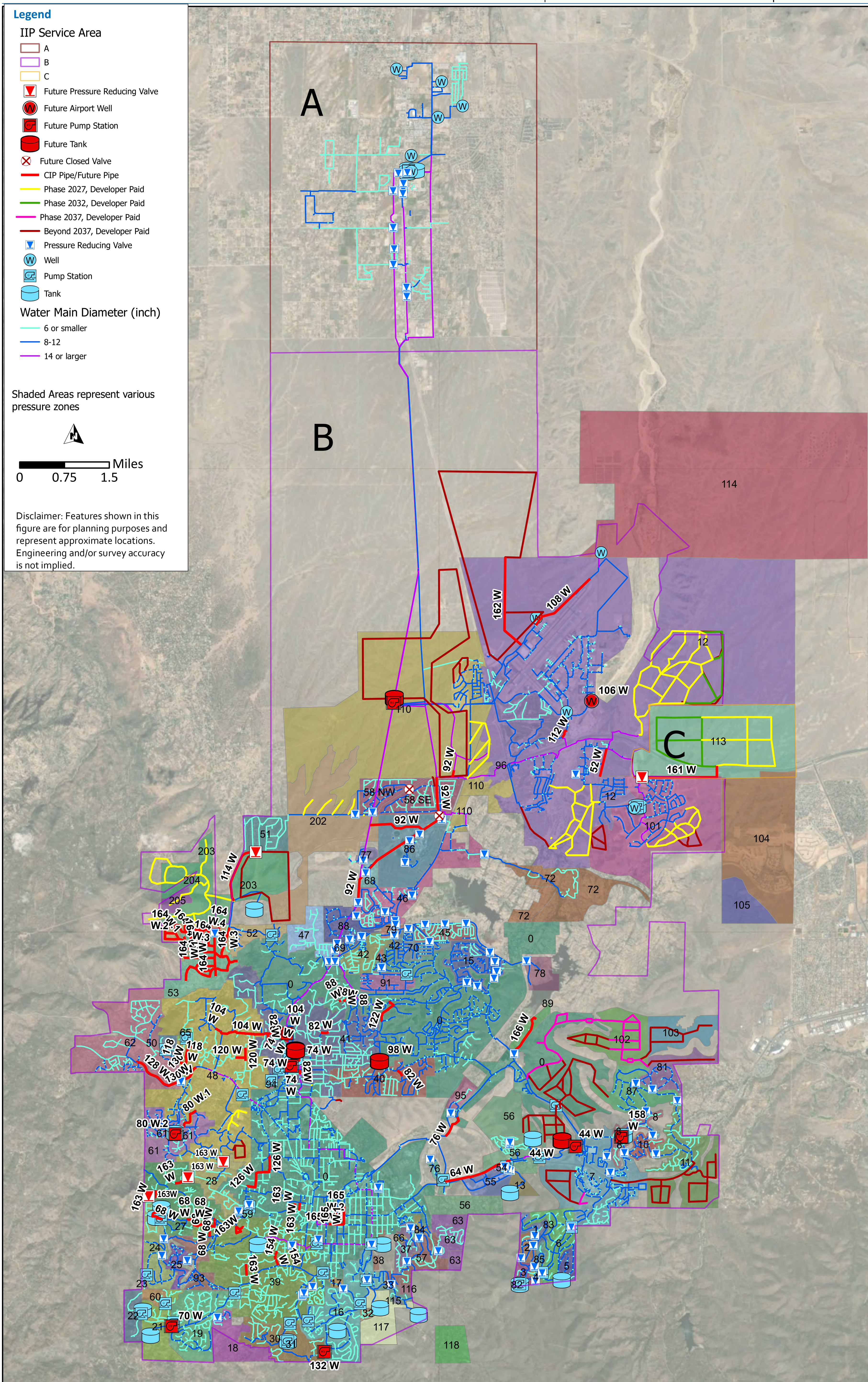

Figure 3.18 Water System CIP Projects

Chapter 4

WATER SYSTEM CAPITAL IMPROVEMENT PROGRAM

This chapter presents the water system capital improvement program (CIP) for the 2023 Water and Wastewater Model Update Study (2023 Study) for the City of Prescott (City). This chapter includes the following:

- Cost development methodology
- Unit costs
- Impact fee service areas
- Capital improvement projects
- Future development projects
- Operational recommendations
- Project correlation with previous studies

4.1 Overview

The locations and cost estimates of the recommended water system capital improvement projects and the projects required for growth areas are summarized in this chapter. These projects are associated with City's CIP and Infrastructure Improvement Plan (IIP). The justification for these recommended projects is included in Chapter 3, and fall into the following categories:

- **CIP Projects:** These projects provide additional capacity to address existing deficiencies or to provide capacity for future growth that would be paid for by the City and fall within the 20-year planning horizon (through year 2042).
- **IIP Projects:** These projects include CIP projects that are planned for construction in the next 20 years, and for which there is a sufficient growth component such that a portion or all of the project cost can be recovered through impact fees. Some IIP projects are defined by the City to address specific needs that are not capacity related and are therefore not included in the CIP projects.
- **Future Development Projects:** These projects define the major transmission, pumping, and storage facilities on undeveloped lands within the City's planning area. The plans for this infrastructure are at a conceptual level and may change significantly as specific development plans are prepared. These projects would occur beyond year 2042 and are therefore not included in the CIP.
- **Operational Recommendations:** These recommendations are actions that the City can take to adjust zone boundaries to improve system pressures and/or reduce operating and maintenance costs, to plan effectively for emergencies, and to operate the water system more efficiently. There are no significant capital costs associated with these recommendations.

Appendix 4A is a map of the Prescott service area showing the capital improvement and future development projects that have been identified in this study.

4.2 Cost Development Methodology

Cost estimates have been developed for the water capital improvement projects identified in Chapter 3. These estimates were prepared in accordance with the guidelines of the Association for the Advancement of Cost Engineers (AACE) International for a Class 4 estimate unless otherwise noted. Table 4.1 summarizes the AACE International cost estimating classifications, the level of project definition (percent of design), use, appropriate cost estimating methodologies, and the expected accuracy of each class. Design work would need to be undertaken to obtain more precise cost estimates.

Table 4.1 AACE International Cost Estimating Classification Summary

Estimate Class	Maturity Level of Project Definition Deliverables - (Level of Engineering Design)	End Use	Typical Cost Estimating Methodology Used	Expected Accuracy Range (Low/High)
Class 5	0% to 2%	Conceptual screening	Capacity factored, parametric models, judgment, or analogy	L: -20% to -50% H: +30% to +100%
Class 4	1% to 15%	Study or feasibility	Equipment factored or parametric models	L: -15% to -30% H: +20% to +50%
Class 3	10% to 40%	Budget authorization or control	Semi-detailed unit costs with assembly level line items	L: -10% to -20% H: +10% to +30%
Class 2	30% to 75%	Control or bid/tender	Detailed unit cost with forced detailed take-off	L: -5% to -10% H: +5% to +20%
Class 1	65% to 100%	Check estimate or bid/tender	Detailed unit cost with detailed take-off	L: -3% to -10% H: +3% to +15%

4.3 Unit Costs

Unit costs were developed for the recommended water projects based on, R.S. Means and other unit cost sources, unless otherwise noted. The July 2022 Engineering News Record Construction Cost Index (ENR CCI) 20-city value of 13,168 was used to scale up previously developed unit costs.

Multipliers for construction overhead and profit (16 percent), sales tax (65 percent of applicable costs at 8.35 percent), bidding contingencies (30 percent), and general conditions (10 percent) were then added to prepare unit construction costs. When multiplied by the capacity, quantity, or size of infrastructure, the construction cost represents what the City should expect to pay a contractor to construct the project. The City will have other expenses to complete the project including design, inspection, project management, and contingencies. A multiplier of 1.4 was used to represent these additional costs and applied to the unit construction cost to obtain a project cost for each project.

Table 4.2 summarizes the water infrastructure unit costs for the 2023 Study. The water infrastructure unit cost detail is included in Appendix 4B.

Table 4.2 Water Infrastructure Unit Costs

Infrastructure	Unit Construction Cost(1)
Water Pipelines	**($/lf)**
6-in (with hydrant)	$214
8-in (with hydrant)	$223
12-in (with hydrant)	$297
16-in	$306
18-in	$350
24-in	$471
Wells	**($M)**
750 gpm (1.1 mgd)	$2.4
1,400 gpm (2.0 mgd)	$3.5
Booster Pump Stations	**($M)**
1.5 mgd	$1.7
2.0 mgd	$2.0
3.0 mgd	$2.5
4.0 mgd	$2.7
6.0 mgd	$3.3
8.0 mgd	$4.2
Storage Tanks(2)	**($M)**
0.5 MG	$2.0
1.0 MG	$2.4
1.5 MG	$2.7
2.0 MG	$3.0

Notes:
(1) ENR CCI = 13,168 (20 Cities Index, July 2022). 30% of the unit cost was added considering the bidding uncertainties.
(2) Site-specific conditions impact the bid-based unit costs for tanks. The projects these costs area applied to in the 2017 CIP/IIP are expected to have similar site-specific conditions.
Abbreviations:
in = inch(es); gpm = gallons per minute; mgd = million gallons per day; MG = million gallons; lf = linear feet; $M = millions of dollars.

4.4 Impact Fee Service Areas

The IIP Service Areas developed in the 2018 Water and Wastewater Model Update Study (2018 Study) were modified to include the growth areas identified for the 2023 Study (Figure 2.1). They were also simplified to distinguish between the City's primary water supply sources in Chino Valley and the infrastructure that serves customers in Prescott.

The City has defined three IIP service areas for the water system:

- **Area A:** Includes the entire system from the Chino Valley wells, tanks and booster station.
- **Area B:** Includes all portions of the system except the Chino Valley wells, tanks and booster station.
- **Area C:** Includes the system in Section 32 and Section 33.

The water IIP service areas are shown on Figure 4.A in Appendix 4A.

4.5 Capital Improvement Projects

Table 4.3 summarizes the water system capital projects needed to address system deficiencies and serve future growth. Table 4.3 includes the capacity, justification, cost, and an allocation between existing customers and future development. The City provided some project specific costs and fee rate allocations for several projects. The project numbers correspond to the numbering convention adopted in the 2018 Study. Appendix 4C contains detailed project maps for each CIP project.

Table 4.4 summarizes the water system construction and project costs for each five-year planning period. The total project costs for water infrastructure required over the next twenty years is $124 M. The majority of the costs, $62 M, are required over the next five years.

Table 4.3 Water System Capital Project Summary

Project #	COP Project Name	Description	Diameter (in)	Length (ft) / Number	Capacity (gpm or MG)	Unit Cost ($)	Construction Cost ($)	Project Cost ($)	Project Justification/Driver	IIP (Y/N)	Service Area	% Fees	% Rates	Planning Year
44 W.1	Zone 56 Tank and Pipeline and Zone 7 Pump Station	Replace Lower Yavapai Hills Pump Station	--	--	1,600 gpm	2,460,000	2,460,000	3,444,000	Provides increased water supply to Zone 7 and downstream pressure zones as part of the Zone 56 improvements. Provides second supply to Yavapai Hills area and also supports additional growth.	Y	B	25	75	2027
44 W.2	Zone 56 Tank and Pipeline and Zone 7 Pump Station	New Zone 56 Storage Tank	--	--	1.5 MG	2,728,000	2,728,000	3,819,000	Provides additional storage for Pressure Zone 56 and other Pressure Zones along the SR 69 corridor through buildout.	Y	B	25	75	2027
52 W.1	Heckthorn Road Water Main (DA)	New Water Main from Centerpointe/Side Rd. to Heckthorn Rd.	12	2,105	--	297	625,000	875,000	Included in Granite Dells Ranch Holdings Development Agreement (p 46 of 57; CIP Project Number W4:30).	Y	B	100	0	Buildout
64 W .1	SR69 Corridor Water Main	Upsize water main along Hwy 69 from new Zone 56/76 booster pump station to connect with the 16-inch main	16	7,826	--	306	2,395,000	3,353,000	Provides additional capacity along SR 69 corridor to supply the new Zone 56 Tank through buildout (Project 2A) and is necessary to consolidate Pressure Zones 54 and 55 and make them part of Pressure Zone 56.	Y	B	25	75	2032
68 W.1	Zone 24/27 Water Pipeline Upsizing – Thumb Butte Rd to Upper Thumb Butte Tank	New Zone 27 water main from the cross of Thumb Butte Rd. and Sherwood Dr. along Sherwood Dr., Forest Meadows Dr., Butte Canyon Dr. to Meadowbrook Rd.	8	3,364	--	223	750,000	1,050,000	Modifies the Zone 27 boundary and serves existing and future development by supplying maximum day, peak hour and fire flows to Zone 27.	Y	B	30	70	2027
68 W.2	Zone 24/27 Water Pipeline Upsizing – Thumb Butte Rd to Upper Thumb Butte Tank	Upsize water main from Zone 24 Pump Station to Zone 24 Tank	12	2,453	--	297	729,000	1,021,000	Serves existing and future development by supplying maximum day, peak hour and fire flows to Zone 24.	Y	B	30	70	2027
68 W.3	Zone 24/27 Water Pipeline Upsizing – Thumb Butte Rd to Upper Thumb Butte Tank	New water main in Zone 39 connecting Sherwood Dr. and Rustic Timbers Ln.	12	523	--	297	155,000	217,000	Provides looping for Zone 39 to improve fire flow pressures and flows.	Y	B	30	70	2027
70 W.1	Upper Rancho Vista Pump Station Upgrade	Upper Rancho Vista Booster Pump Upsize	--	--	150 gpm	732,000	732,000	1,025,000	Increases the capacity of the Upper Rancho Vista Booster Pump Station to provide buildout demands.	Y	B	0	100	Buildout
74 W.1	Zone 41 Mingus Pump Station, Tank and Pipeline	Replace Mingus Tanks	--	--	0.75 MG	2,350,000	2,350,000	3,290,000	Provides sufficient storage for Pressure Zones 41 and 40.	N	B	0	100	2027
74 W.2	Zone 41 Mingus Pump Station, Tank and Pipeline	Mingus Pump Station Replacement	--	--	4*750 gpm + 1* 300 gpm jockey pump	--	5,376,000	7,526,000	Replaces aging facility.	N	B	0	100	2027
74 W.3	Zone 41 Mingus Pump Station, Tank and Pipeline	Mingus Pipeline Upsize	12	935	--	297	278,000	389,000	Connects the new Mingus Tank to the Mingus Booster Pump Station.	N	B	0	100	2027
76 W.1	Quaka Crossing – YPIT Water Main Upgrade	Sundog Ranch Rd. Connector Water line between Yavapai Connector and Old Black Canyon Hwy.	12	1,840	--	297	546,000	764,000	Improves fire flows in Zone 0 for the Yavapai-Prescott Indian Tribe (YPIT) Reservation and provides for the Storm Ranch Development.	Y	B	0	100	2027
80 W.1	Zone 61 Water Main Upgrade	New Zone 61 Water Mains - Distribution loop along Forest View Dr. from Woods to Enchanted Canyon Rd.	8	1,800	--	223	401,000	561,000	Provides looping for Zone 61 to improve fire flow pressures and flows.	N	B	0	100	2032
80 W.2	Zone 61 Water Main Upgrade	Pump Station - Forest Trails	--	--	1,500 gpm	2,460,000	2,460,000	3,444,000	Helps meet the Zone 61 pumping capacity requirement.	N	B	0	100	2032
82 W.1	Zone 40 and 41 Water Main Upgrades	New Zone 41 Water Main - Garland St. from Willow Creek Rd. to Moall Dr.	8	300	--	223	67,000	94,000	Provides looping for Zone 41 to improve fire flow pressures and flows.	N	B	25	75	Buildout
82 W.2	Zone 40 and 41 Water Main Upgrades	New Zone 41 Water Main - Victoria St. from Stevens Rd. to Green Ln.	8	725	--	223	162,000	227,000	Provides looping for Zone 41 to improve fire flow pressures and flows.	N	B	25	75	Buildout

Table4.3 Water System Capital Project Summary (continued)

Project #	COP Project Name	Description	Diameter (in)	Length (ft) / Number	Capacity (gpm or MG)	Unit Cost ($)	Construction Cost ($)	Project Cost ($)	Project Justification/Driver	IIP (Y/N)	Service Area	% Fees	% Rates	Planning Year
82 W.3	Zone 40 and 41 Water Main Upgrades	New Zone 41 Water Main - Arena Dr. from Lester to 600 ft east	8	585	--	223	130,000	182,000	Provides looping for Zone 41 to improve fire flow pressures and flows.	N	B	25	75	Buildout
82 W.4	Zone 40 and 41 Water Main Upgrades	New Zone 41 Water Main - Northside Dr. from Flora to Rosser Rd.	8	335	--	223	75,000	105,000	Provides looping for Zone 41 to improve fire flow pressures and flows.	N	B	25	75	Buildout
82 W.5	Zone 40 and 41 Water Main Upgrades	New Zone 40 Water Main - Eagleview Rd. from Rosser to Soaring Rd.	8	565	--	223	126,000	176,000	Provides looping for Zone 40 to improve fire flow pressures and flows.	N	B	25	75	Buildout
88 W.1	Zone 42 Pipeline Upgrade	Water main loop connections - River Oaks & Shinnery and Valley/Tabosa	8	474	--	223	106,000	148,000	Provides looping to the southern part of Pressure Zone 42 that becomes part of Pressure Zone 0 in Project 50 W to increase reliability and provide additional fire flows.	N	B	0	100	2032
92 W.1	Zone 110 New Transmission Main	Water Line Bore Under Pioneer Parkway	16	282		306	86,000	120,000	This project will connect Zone 110 with Zone 58 SE.	Y	B	50	50	2027
92 W.2	Zone 110 New Transmission Main	New 18-inch transmission main to replace the existing 12-inch pipe cross the Zone 58 SE	18	3,025		350	1,059,000	1,483,000	This project will increase the pipe supply capacity to Zone 58 SE.	Y	B	50	50	2032
92 W.3	Zone 110 New Transmission Main	New 18-inch transmission main along Dobberteen Dr. to provide a second feed to Embry Riddle.	18	4,086		350	1,430,000	2,002,000	This project will provide a second feed to Embry Riddle.	Y	B	50	50	2032
92 W.4	Zone 110 New Transmission Main	New 18-inch transmission main along across Embry Riddle to replace the existing 12-inch pipe.	18	9,099		350	3,185,000	4,459,000	This project will increase the pipe supply capacity from Zone 0 to Embry Riddle and Zone 46.	Y	B	50	50	2037
92 W.5	Zone 110 New Transmission Main	New closed valve between Zone 58 NW and Zone 58 SE	12	1		15,000	15,000	21,000	This project will split the Zone 58 into Zone 58 NW and Zone 58 SE.	Y	B	50	50	2027
92 W.6	Zone 110 New Transmission Main	New closed valve between Pinon Oaks & Embry Riddle	12	1		15,000	15,000	21,000	This project will isolate Zone 110 and Zone 0.	Y	B	50	50	2027
98 W.1	Zone 40 Cedarwood Tank Upsizing	Upsize the Cedarwood Tank	--	--	0.5 MG	2,350,000	2,350,000	3,290,000	Provides additional capacity in the Cedarwood tank to provide fire flows to Pressure Zone 40.	N	B	0	100	2032
104 W.1	Green Lane Water Main Improvements	New water main connected to 30-in water main in Willow Creek Rd. at Green Ln. extending west to near Green Ln. and Meadow Ridge Dr.	12	2,020	--	297	599,900	840,000	Addresses storage and fire flow requirement deficiencies for Iron Springs (Pressure Zone 48), along with Project 104 W.2.	N	B	0	100	Buildout
104 W.2	Green Lane Water Main Improvements	New booster pump station near Green Ln. and Meadow Ridge Dr.	--	--	1,000 gpm	1,691,000	1,691,000	2,367,000	Addresses storage and fire flow requirement deficiencies for Iron Springs (Pressure Zone 48), along with Project 104 W.1 and 104 W.3. With Project 104 W.1, a pumping capacity of 1,000 gpm is an appropriate pumping capacity given the limitations of the existing 6-in water mains downstream of this proposed booster pump station project. Fire flows are improved in Zone 48 but the performance criteria are not satisfied at all locations in the Zone.	N	B	0	100	Buildout
104 W.3	Green Lane Water Main Improvements	Upsize water main along Yakashba Dr. (west extension of Green Ln.) to Peaceful Mesa Dr.	12	3,970	--	297	1,179,000	1,651,000	Addresses storage and fire flow requirement deficiencies for Iron Springs (Pressure Zone 48), along with Projects 104 W.1 and 104 W.2.	N	B	0	100	Buildout
106 W.1	Production Well No. 6 AP - New	Future Airport Well No. 6	--	--	950 gpm	3,511,000	3,511,000	4,915,000	Serves existing and future development in Pressure Zone 12 by providing additional water supplies. In conjunction with Project 92 W, this project can serve existing and future development in the City of Prescott by sending supplies in excess of Zone 12 demands to the rest of Prescott. Note: wellhead treatment costs are not included.	Y	B	100	0	2032

Table4.3 Water System Capital Project Summary (continued)

Project #	COP Project Name	Description	Diameter (in)	Length (ft) / Number	Capacity (gpm or MG)	Unit Cost ($)	Construction Cost ($)	Project Cost ($)	Project Justification/Driver	IIP (Y/N)	Service Area	% Fees	% Rates	Planning Year
108 W.1	North Airport Distribution System Loop	North Airport Distribution System Loop	12	4,975	--	297	1,478,000	2,069,000	Serves existing and future development in Pressure Zone 12 by completing a distribution system loop around the Prescott Airport.	Y	B	75	25	2027
112 W.1	Wilkinson/Larry Caldwell Drive Water Main Upsizing	Upsize water main along Larry Caldwell Dr. from connection at Larry Caldwell Dr. and Wilkinson Dr.	16	703		306	215,000	301,000	This project serves existing and future development in Pressure Zone 12 by providing a second feed from the Future Pressure Zone 12 tank to the area directly south/southeast of the Prescott Airport	Y	B	75	25	2027
114 W.1	Zone 52 Water Main Connect to Northwest Regional Tank	Water main to connect Zone 51 to Northwest Regional Tank	12	4,587	--	297	1,362,000	1,907,000	This project will allow the Longview tank to be decommissioned.	Y	B	35	65	2027
114 W.2	Zone 52 Water Main Connect to Northwest Regional Tank	PRV on the new water main connecting from Northwest Regional Tank to Zone 51	12	1		252,200	252,000	353,000	This project will allow the Longview tank to be decommissioned.	Y	B	35	65	2027
118 W.1	Arrowhead Distribution System Loop	8-inch main distribution system loop in Arrowhead Rd from Iron Springs to Sidewinder	8	3,000	--	223	669,000	937,000	This project will provide looping to improve fire flow pressures and flows.	N	B	0	100	2032
120 W.1	Zone 48 Distribution Loop	8-inch main distribution system loop in Whitecloud, Meadowridge and Estrella in Zone 48	8	1,715	--	223	382,000	535,000	This project will provide looping to improve fire flow pressures and flows.	N	B	0	100	2032
122 W.1	Stoney Creek and Northridge Water Main Upsizing	Upsize water main along Stony Creek and Northridge 8-in to 12-in	12	2,200	--	297	653,000	914,000	This project will improve fire flow and peak hour pressures in Pressure Zone 0 area	N	B	0	100	2032
126 W.1	Gail Gardner Upsizing from Fair to Linwood	Upsize 12-in main on Gail Gardner from Fair to Linwood	12	4,155	--	297	1,234,000	1,728,000	This project will provide additional capacity to deliver estimated peak hour demands and fire flows at buildout	N	B	0	100	2037
128 W.1	Pine Lakes Rd. and Iron Springs Rd. Upsizing	Upsize 8-in main on Pine Lakes Rd	12	4,025	--	297	1,195,000	1,673,000	This project will provide additional capacity to deliver estimated peak hour demands and fire flows at buildout	N	B	0	100	2042
130 W.1	Pine Lakes Rd. and Iron Springs Rd. Upsizing	Upsize 8-in main on Iron Springs Rd	12	1,720	--	297	511,000	715,000	This project will provide additional capacity to deliver estimated pea hour demands and fire flows at buildout	N	B	0	100	2042
132 W.1	Zone 30 Pump Station	Zone 30 Booster Pump Station at Hidden Valley and Valley Ranch between Zone 16 and Zone 30.	--	--	850 gpm	1,691,000	1,691,000	2,367,000	This project would construct a booster pump station at Hidden Valley Drive to provide emergency fire flow for Zones 30 and 31 at buildout.	N	B	0	100	2042
154 W.1	Evergreen Main Upsizing	154 W.1 Upsize main from N Evergreen Rd to Copper Basin Rd along Highland Ave	12	1,140		297	339,000	475,000	This project will improve fire flow and peak hour pressures	N	B	0	100	2032
158 W.1	Upper Yavapai Hills Booster Pump Station	Upsize Upper Yavapai Hills Booster Pump Station	-	-	1,000 gpm	1,691,000	1,691,000	2,367,000	This project will provide capacity to meet maximum day and peak hour demands.	N	B	0	100	2032
161 W.1	Section 32 and 33	New water main west of Section 32 along Highway 89 connecting to Granite Dells Parkway	16	1,957		306	599,000	839,000	This project serves future development in Pressure Zone 113.	Y	C	100	0	2027
161 W.2	Section 32 and 33	New PRV on the new water main west of Section 32 along Highway 89 connecting to Granite Dells Parkway	12	1		252,200	252,000	353,000	This project serves future development in Pressure Zone 113.	Y	C	100	0	2,027
162 W.1	Deep Well Ranch	New 16-inch water main connecting from Zone 12 existing pipe to supply the annexation area northwest of the airport.	16	6,913		306	2,115,000	2,961,000	This project will supply the annexation area northwest of the airport.	N	B	100	0	2027

Table4.3 Water System Capital Project Summary (continued)

Project #	COP Project Name	Description	Diameter (in)	Length (ft) / Number	Capacity (gpm or MG)	Unit Cost ($)	Construction Cost ($)	Project Cost ($)	Project Justification/Driver	IIP (Y/N)	Service Area	% Fees	% Rates	Planning Year
163 W.1	Citywide Water Main Replacement	New 6-inch water main along Brush St. connecting with the pipes on Gurley St.	6	601	--	214	129,000	181,000	Improves fire flow and peak hour pressures in Zone 0.	N	B	25	75	2027
163 W.2	Citywide Water Main Replacement	New water main along North Willow St. connecting to the pipes on Western Ave and Gurley St.	8	712	--	223	159,000	223,000	Improves fire flow and peak hour pressures in Zone 0.	N	B	25	75	2027
163 W.3	Citywide Water Main Replacement	New water main along Cherry Dr. connecting with the pipes on Middlebrook Rd. and Linden Rd.	6	859	--	214	184,000	258,000	Improves fire flow and peak hour pressures in Zone 39.	N	B	25	75	2027
163 W.4	Citywide Water Main Replacement	New water main along the Country Club Circle	8	1,627	--	223	363,000	508,000	Improves fire flow and peak hour pressures in Zone 39.	N	B	25	75	2027
163 W.5	Citywide Water Main Replacement	New water main along Parker Dr. to connect Zones 24 and 27	8	1,231	--	223	275,000	385,000	Increases water supply to Zone 27 and improves fire flow and peak hour pressures in Zone 27.	N	B	25	75	2027
163 W.6	Citywide Water Main Replacement	New PRV station and vault from Zone 24 to Zone 27	6	1	--	152,200	152,000	213,000	Increases water supply to Zone 27 and improves fire flow and peak hour pressures in Zone 27.	N	B	25	75	2027
163 W.7	Citywide Water Main Replacement	New PRV station and vault from Zone 27 to Zone 28	6	1	--	152,200	152,000	213,000	Increases water supply to Zone 28 and improves fire flow and peak hour pressures in Zone 28.	N	B	25	75	2027
163 W.8	Citywide Water Main Replacement	New PRV station and vault from Zone 48 to Zone 28	6	1	--	152,200	152,000	213,000	Increases water supply to Zone 28 and improves fire flow and peak hour pressures in Zone 28.	N	B	25	75	2027
163 W.9	Citywide Water Main Replacement	New water main on W Idylwild Rd to complete the loop	12	720		297	214,000	300,000	This project will complete the pipe loop and improve fire flow and peak hour pressures in Zone 27.	N	B	25	75	2027
164 W.1	City Water Main Replacement Program	New 4-inch pipes in Ho Kay Gan development	4	2,799		200	560,000	784,000	This project will supply Ho Kay Gan development	N	B	0	100	2027
164 W.2	City Water Main Replacement Program	New 6-inch pipes in Ho Kay Gan development	6	5,354		214	1,146,000	1,604,000	This project will supply Ho Kay Gan development	N	B	0	100	2027
164 W.3	City Water Main Replacement Program	New 8-inch pipes in Ho Kay Gan development	8	14,120		223	3,149,000	4,409,000	This project will supply Ho Kay Gan development	N	B	0	100	2027
164 W.4	City Water Main Replacement Program	New 12-inch pipes in Ho Kay Gan development	12	14,415		297	4,281,000	5,993,000	This project will supply Ho Kay Gan development	N	B	0	100	2027
165 W.1	City Water Main Replacement Program	New 8-inch pipe replacement in downtown	8	2,480		223	553,000	774,000	This project will replace the pipes in the downtown area and improve the fire flow.	N	B	0	100	2027
165 W.2	City Water Main Replacement Program	New 10-inch pipe replacement in downtown	10	1,339		256	343,000	480,000	This project will replace the pipes in the downtown area and improve the fire flow.	N	B	0	100	2027
166 W.1	Storm Ranch Water Main	New 12-inch pipe on Sundog Ranch Rd connecting with Prescott Lakes Pkwy	12	3,300		256	422,500	592,000	This project will supply water in Storm Ranch development	N	B	50	50	2027
167 W.1	Citywide Water Main Replacement	Annual pipe repair & replacement(1)	Varies	Varies	--	--	1,429,000	2,000,000	Repairs/replaces old pipes or the pipes with breakages or leaks.	N	B	25	75	Annual
168 W.1	Frontier Village Demo of Water Tank, PRV	Combine pressure zones 54, 55 and 56, including retiring two pump stations, retiring a storage tank, removing three PRVs and installing one PRV					71,000	100,000	This project will combine zones 54, 55, and 56 to simplify operations.	N	B	0	100	2032

Notes:
(1) Pipe repair & replacement is an annual cost.
(2) Projects 92 W, 163 W, 164 W, and 165 W are projects in the City's CIP created from other analyses that are included in this table for completeness.
Abbreviations:
WPF = water production facility; PFAS = per- and polyfluoroalkyl substances; PRV = pressure reducing valve

Table 4.4 Water Infrastructure Cost Summary

Project Cost ($)	2023-2027	2028-2032	2033-2037	2038-2042	Buildout	Total Project Cost ($)
Pipe	29,183,000	10,408,000	6,187,000	2,388,000	4,150,000	52,316,000
Pump Station	14,414,000	2,367,000	0	2,367,000	3,392,000	22,540,000
Tank	7,109,000	3,290,000	0	0	0	10,399,000
Well	0	4,915,000	0	0	0	4,915,000
Valve	1,387,000	0	0	0	0	1,387,000
Pipe Repair & Replacement	10,000,000	10,000,000	10,000,000	10,000,000	-	-
Others	0	100,000	0	0	0	100,000
Total Project Cost ($)	**62,093,000**	**31,080,000**	**16,187,000**	**14,755,000**	**7,542,000**	**131,657,000**

Notes:
(1) Include total pipe repair & replacement cost for the period of planning years.

4.6 Future Development Projects

The Intermediate Storage Tanks and Booster Pump Station are needed to serve the City's growth. Future connections in Deep Well Ranch and adjacent areas were assumed to be supported by the Intermediate Storage Tanks and a separate pump station to serve future Pressure Zone 110.

The Intermediate Storage Tanks and Booster Pump Station project includes a fill valve to allow Airport (Pressure Zone 12) supplies to enter the Intermediate Storage Tanks where they would then be available to serve existing customers as well as future growth in Pressure Zone 110.

A number of future developments are planned in the City limits, and new water infrastructure will be required to serve these developments and growth areas. The developers will be required to pay for the cost of the infrastructure, so it is not included in the City's CIP. Since the exact development plans may change in the future, a conceptual layout of water mains to serve these growth areas has been developed and is summarized below in Table 4.5.

Table 4.5 summarizes the pipes required for each growth area.

Table 4.5 Growth Area Water Pipes

Growth Area	Pipe Size (inch)	Length[1] (ft)	Total Length[1] (ft)
Deep Well Ranch			
	12	86,000	**86,000**
Granite Dells Estates			
	12	18,000	**18,000**
Granite Dells Ranch South			
	12	34,000	**34,000**
Arizona Eco Development (AED) North			
	12	53,000	**53,000**
AED South			
	12	50,000	**50,000**
Storm Ranch			
	8	22,000	
	12	58,000	**80,000**
Yavapai Regional Medical Center			
	12	6,000	**6,000**
New Developments along AZ-69			
(Zone 56, 7 and 11)	12	42,000	**42,000**

Notes:
(1) Pipe lengths are estimated and should be updated when development plans are received.

4.7 Operational Recommendations

The City has an opportunity to make operational adjustments that will simplify the water system and could potentially save money. Chapter 3 outlines the opportunities the City has for adjusting pressure zone boundaries, reducing energy usage, and planning for emergencies.

Table 4.6 summarizes the recommended pressure zone changes that are discussed in detail in Chapter 3.

Other ways the City may reduce operating costs were discussed in Chapter 3. There are actions the City can take by monitoring energy usage and taking operational actions to maintain efficiencies, which can be achieved through:

- Proactive pump maintenance to address wear.
- Periodic pump testing to identify pumps that are not operating efficiently or were placed into service in an area where demands have significantly changed since they were first installed.
- Continue to implement supervisory control and data acquisition (SCADA) monitoring at the City's remote water sites to track flow rates and pressures.
- Track electric power usage of pump stations regularly to identify trends that indicate deviations from normal operations or efficiency expectations.
- When selecting new pumps, evaluate total life cycle cost (capital plus operating costs) rather than the capital cost of equipment only.
- Utilize variable frequency drives at pump stations where the pump station serves a closed zone.

Table 4.6 Recommended Pressure Zone Changes

No.	Description	Required for Change	Justification for Change
1	Consolidate Zones 54, 55, and 56	1. Remove the Frontier Village PRV Station at Cocky's Chicken. 2. Remove the Frontier Village PRV Station at Home Depot. 3. Remove the Frontier Village PRV Station at Tank Road. 4. Retire the Frontier Village Pump Station and Storage Tank. 5. Open three zone valves along Hwy. 69. 6. Install new PRV station at Highway 69 and Prescott Canyon Estates.	Reduces system operation and maintenance costs.
2	Adjust Zones 24, 27, 28, 39, and 48	1. Install new PRV station with piping to connect Zone 24 with Zone 27 on Parker Dr. 2. Install new PRV station from Zone 27 to Zone 28 on W. Idylwild Rd. 3. Install new PRV station from Zone 48 to Zone 28 on Downer Tr. 4. Install new 8-inch pipes to change the Zone 27 and 39 boundaries.	Increases water supply to Zone 27and 28 to meet peak hour supply and fire flow requirements. Adjusts zone boundary to improve pressures in Zone 27.
3	Realign Zones 7 and 7A	1. Install new PRV station at Ranch Dr. east of Lee Blvd. 2. Install new PRV station at San Francisco Dr. east of Lee Blvd. 3. Install new PRV station at Liese Dr. west of Equestrian Wy.	Realigns Zone 7 to reduce system operating pressures in areas where they have been observed to be greater than 160 psi.
4	Connect Zones 51 and 58 NW	1. Split Zone 58 into Zone 58 NW and Zone 58 SE by closing the pipe across Pioneer Pkwy. 2. Decommission Longview Tank. 3. Connect Zone 51 and Northwest Regional Tank with 12-inch pipe and PRV. 4. Connect Zone 51 and Zone 202 with Zone 58 NW with 12-inch pipe and PRV.	Improves the pressures in Zone 58 NW, simplifies operations of Zone 51, and completes the system loop.
5	Consolidate Zones 110 and 58 SE	1. Zone 110 and Zone 58 SE will be consolidated and supplied by the Zone 110 Pump Station. 2. Embry Riddle, Zone 46, and Zone 79 are supplied by the Zone 0 transmission main. 3. A new closed zone boundary valve is needed on the transmission main across Zone 58 SE to isolate Zone 110 and Zone 0.	Changes zone supplies when the Intermediate Booster Pump Station is operating.
6	Connect Zones 12 (including AED North), 101, and 113 (AED South)	1. The AED North Area is designed to be included in Zone 12 by connecting the 18-inch main west of Granite Dells Pkwy along Hwy 89. 2. Connect Zone 113 (AED South) to Zone 101 with the pipe along Highway 89 to Granite Dells Parkway	Simplifies operations and completes the system loop.

Abbreviations:
PRV = pressure reducing valve; psi = pounds per square inch

4.8 Project Correlation with Previous Studies

Recommendations from the City's 2018 Study regarding water supplies, storage and pumping were mostly carried forward in the 2023 Study. However, some water main recommendations in the 2018 Study were not carried forward in the 2023 Studies for the following possible reasons:

- Project no longer needed due to a change in demand projections.
- Project replaced by alternate project which met system performance criteria.
- Development plans, land use, or other planning assumptions changed that made the project unnecessary.

As part of the 2023 Study, the 2018 Study recommendations were reviewed and assessed to document projects that were not carried forward to the 2023 Study, with the reason for the change identified. The new water main recommendations in the 2023 Study were also tracked.

Table 4.7 summarizes the water main projects identified in the 2018 Study that were no longer required or addressed with an alternative project, as well as the new water main projects that were proposed in the 2023 Study.

Table 4.7 2023 Study Water CIP Tracking – Water Mains

Project #	Description	Recommended in 2018 Study (Y/N)	Recommended in 2023 Study (Y/N)	Project Modification Explanation
68 W.1	New Zone 27 water main from the cross of Thumb Butte Rd and Sherwood Dr along Sherwood Dr, Forest Meadows Dr, Butte Canyon Dr. to Meadowbrook Rd.	N	Y	This project will modify the Zone 27 boundary and serve existing and future development by supplying maximum day, peak hour and fire flows to Zone 27.
68 W.2	New Zone 39 water main from Hassayampa Village Lane along Sherwood Dr, Forest Meadows Dr, Butte Canyon Dr. to Meadowbrook Rd.	N	Y	This project will modify the zone boundary to serve existing and future development by supplying maximum day, peak hour and fire flows to Zone 39.
80 W.2	Pump Station - Forest Trails	N	Y	This project will help meet the Zone 61 pumping capacity requirement.
92 W.1	Southeast Offsite Water Bore Pioneer Parkway	N	Y	This project will connect Zone 110 with Zone 58 SE.
92 W.2	New 18-inch transmission main to replace the existing 12-inch pipe cross the Zone 58 SE	N	Y	This project will increase the pipe supply capacity to Zone 58 SE.
92 W.3	New 18-inch transmission main along Dobberteen Dr. to provide a second feed to Embry Riddle.	N	Y	This project will provide a second feed to Embry Riddle.

Project #	Description	Recommended in 2018 Study (Y/N)	Recommended in 2023 Study (Y/N)	Project Modification Explanation
92 W.4	New 18-inch transmission main along across Embry Riddle to replace the existing 12-inch pipe.	N	Y	This project will increase the pipe supply capacity from Zone 0 to Embry Riddle and Zone 46.
161 W.1-W.2	16-in Water Main with 12-in PRV connecting AED South with Zone 12.	N	Y	AED South was not in the 2018 Study plan area. This project serves future development in AED South (Pressure Zone 113).
163 W.1	New 6-inch water main along Brush Street connecting with the pipes on Western Avenue and Gurley Street.	N	Y	This project will improve fire flow and peak hour pressures in Zone 0.
163 W.2	New water main along Ash Street and North Willow Street connecting to the pipe on Western Avenue.	N	Y	This project will improve fire flow and peak hour pressures in Zone 0.
163 W.3	New water main along Cherry Drive connecting with the pipes on Middlebrook Road and Linden Road	N	Y	This project will improve fire flow and peak hour pressures in Zone 39.
163 W.4	New water main along the Country Club Circle.	N	Y	This project will improve fire flow and peak hour pressures in Zone 39
163 W.5	New water main along Parker Drive to connect Zone 24 and 27	N	Y	This project will increase water supply to Zone 27 and improve fire flow and peak hour pressures in Zone 27.
163 W.6	New PRV station and vault from Zone 24 with Zone 27.	N	Y	This project will increase water supply to Zone 27 and improve fire flow and peak hour pressures in Zone 27.
163 W.7	New PRV station and vault from Zone 27 to Zone 28	N	Y	This project will increase water supply to Zone 28 and improve fire flow and peak hour pressures in Zone 28.
163 W.8	New PRV station and vault from Zone 48 to Zone 28	N	Y	This project will increase water supply to Zone 28 and improve fire flow and peak hour pressures in Zone 28.

Project #	Description	Recommended in 2018 Study (Y/N)	Recommended in 2023 Study (Y/N)	Project Modification Explanation
164 W.1	New 4-inch pipes in Ho Kay Gan development	N	Y	This project will supply Ho Kay Gan development
164 W.2	New 6-inch pipes in Ho Kay Gan development	N	Y	This project will supply Ho Kay Gan development
164 W.3	New 8-inch pipes in Ho Kay Gan development	N	Y	This project will supply Ho Kay Gan development
164 W.4	New 12-inch pipes in Ho Kay Gan development	N	Y	This project will supply Ho Kay Gan development
165 W.1	New 8-inch pipe replacement in downtown	N	Y	This project will replace the pipes in the downtown area and improve the fire flow.
165 W.2	New 10-inch pipe replacement in downtown	N	Y	This project will replace the pipes in the downtown area and improve the fire flow.

Chapter 5

WASTEWATER SYSTEM ANALYSIS

This chapter presents the wastewater system evaluation for the City of Prescott (City) as part of the 2023 Water and Wastewater Model Update Study (2023 Study). The purpose of the model update in the 2023 Study was to incorporate the updated geographic information system (GIS) data, current infrastructure, and operational information into the wastewater collection system hydraulic model since the last update in the 2018 Water and Wastewater Model Update Study (2018 Study). Then the model was used to evaluate collection system improvements. Specific model update tasks included the following:

- Wastewater model update.
- Calibrate model based on 2021/2022 flow monitoring data.
- Wastewater system evaluations based on performance criteria and condition assessment.
- Evaluate the impact of future flows on the existing system and identify future infrastructure requirements.
- Recommended capital improvements to address system deficiencies.

5.1 Introduction

The City's wastewater system contains nearly 383 miles of gravity mains, 25 miles of force mains, 65 sewage lift stations, and three wastewater treatment facilities. Some parts of the City are not sewered, so residents in those locations have individual septic systems.

The City is in the process of building the infrastructure that will allow all wastewater to be treated at the Airport Water Reclamation Facility (AWRF). Although the timing for completing this work is dependent on a number of capital improvement program (CIP) projects, which are included in Chapter 6, the transition to the Airport WRF could be complete in five to seven years. Once this infrastructure is in place, the City will decommission the Sundog Wastewater Treatment Plant (WWTP) and utilize the site as a flow equalization basin with a lift station that will pump wastewater to the Airport WRF. The Hassayampa Water Reclamation Plant (WRP) will continue to operate as a seasonal flow scalping facility to provide reclaimed water for golf course turf irrigation. Figure 5.1 presents the City's existing wastewater collection system.

5.2 Wastewater Model Update

In 2013, the City completed a full update of the wastewater collection system model. At that time the model was updated using H2OMap Sewer software by Innovyze and was based on the City's 2012 GIS data. The model has since been converted to the InfoSewer software by Innovyze as part of the 2018 models study. The purpose of the model update in the 2023 Study was to incorporate the updated GIS data, current infrastructure, and operational information. The City's wastewater collection system hydraulic model was updated using the City's 2022 GIS data and record drawings for infrastructure constructed since the 2018 model update. Recent operational information and wastewater flow data were incorporated into the updated model. Specific model update tasks include the following:

- Infrastructure updates.
  - New wastewater infrastructure that has been added to the City's system since the 2018 Study.
  - Lift stations have been updated with current operating parameters and pump curves.
  - Private sewer lines were added to the model to ensure the flows from these areas are accounted for and routed to the appropriate manhole in the City's collection system.
  - Proposed infrastructure from the City's 2020 Sewer Connections Study was incorporated into the model.
  - In instances where previous model updates showed "future" pipes or facilities that are now in service, the phasing has been updated to reflect current conditions.
  - Proposed infrastructure that is currently being designed but not yet constructed was phased for each planning year.
- Calibrate the model for 2022 conditions.
- Evaluate existing system capacity under varying flow and operational conditions.
- Evaluate the impact of future flows on the existing system and identify future infrastructure requirements.
  - Wastewater flows were allocated in the model based on the flow projections for each planning year.

5.2.1 Infrastructure Updates

There have been some changes to the City's wastewater system since the 2018 model update. The primary change has been the City's ongoing construction of infrastructure required to decommission the Sundog WWTP and treat all wastewater at the Airport WRF. The infrastructure that has already been constructed was incorporated in the model. Specific updates to the model included:

- 527 pipes (16.7 miles) of gravity mains ranging in size from 6 to 36 inches in diameter were added to the model. The majority of these new mains have been constructed to serve new development, as well as the 24-, 36-, and 48-inch pipe from the Sundog WWTP to the Airport WRF.
- 2,600 feet of sewer force main 6 inches in diameter were added to the model.
- The Granite Dells and Hidden Hills lift stations were added to the model.

Figure 5.2 shows the pipes that were updated as part of the model update.

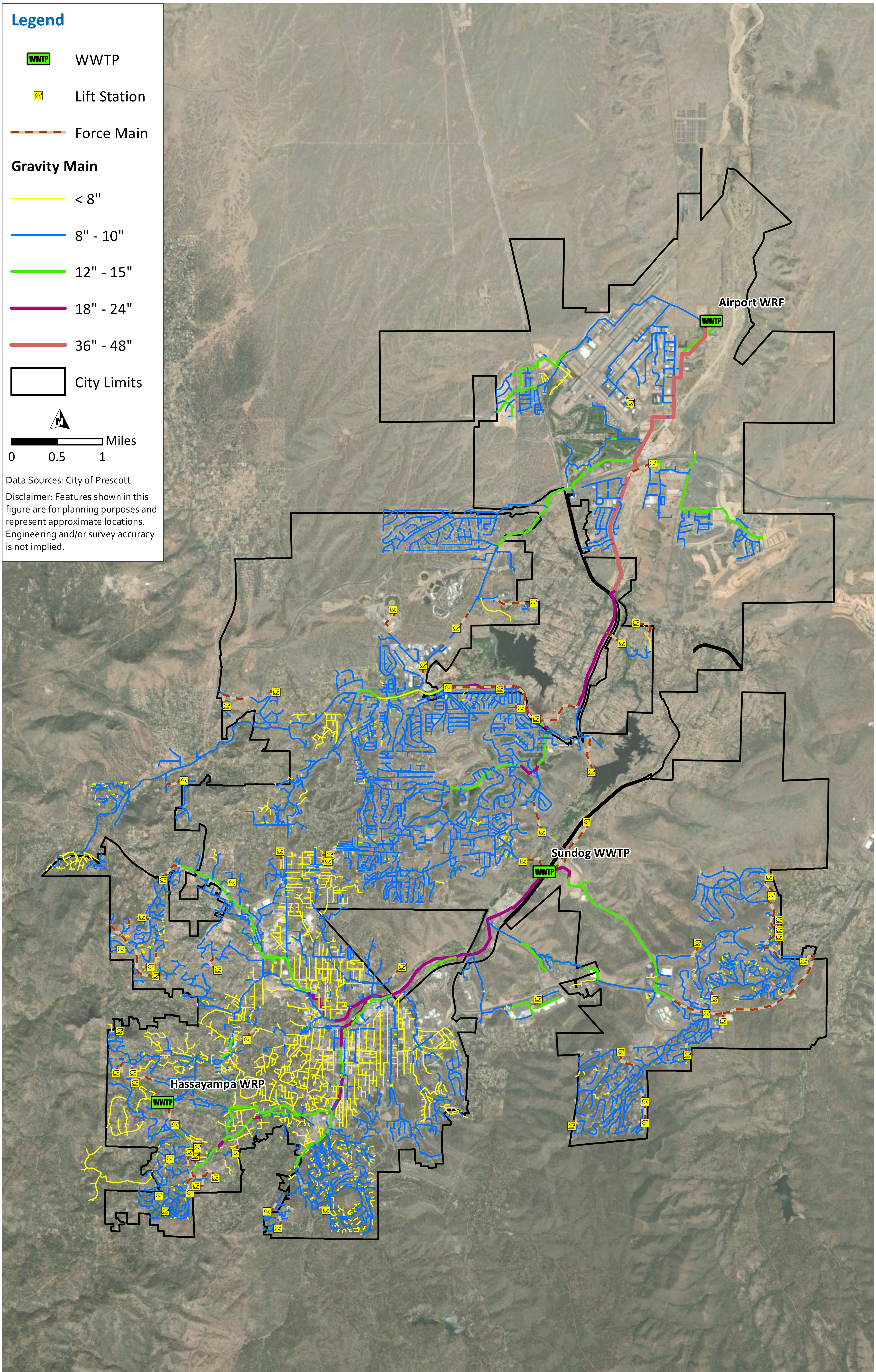

Figure 5.1 2023 Wastewater System

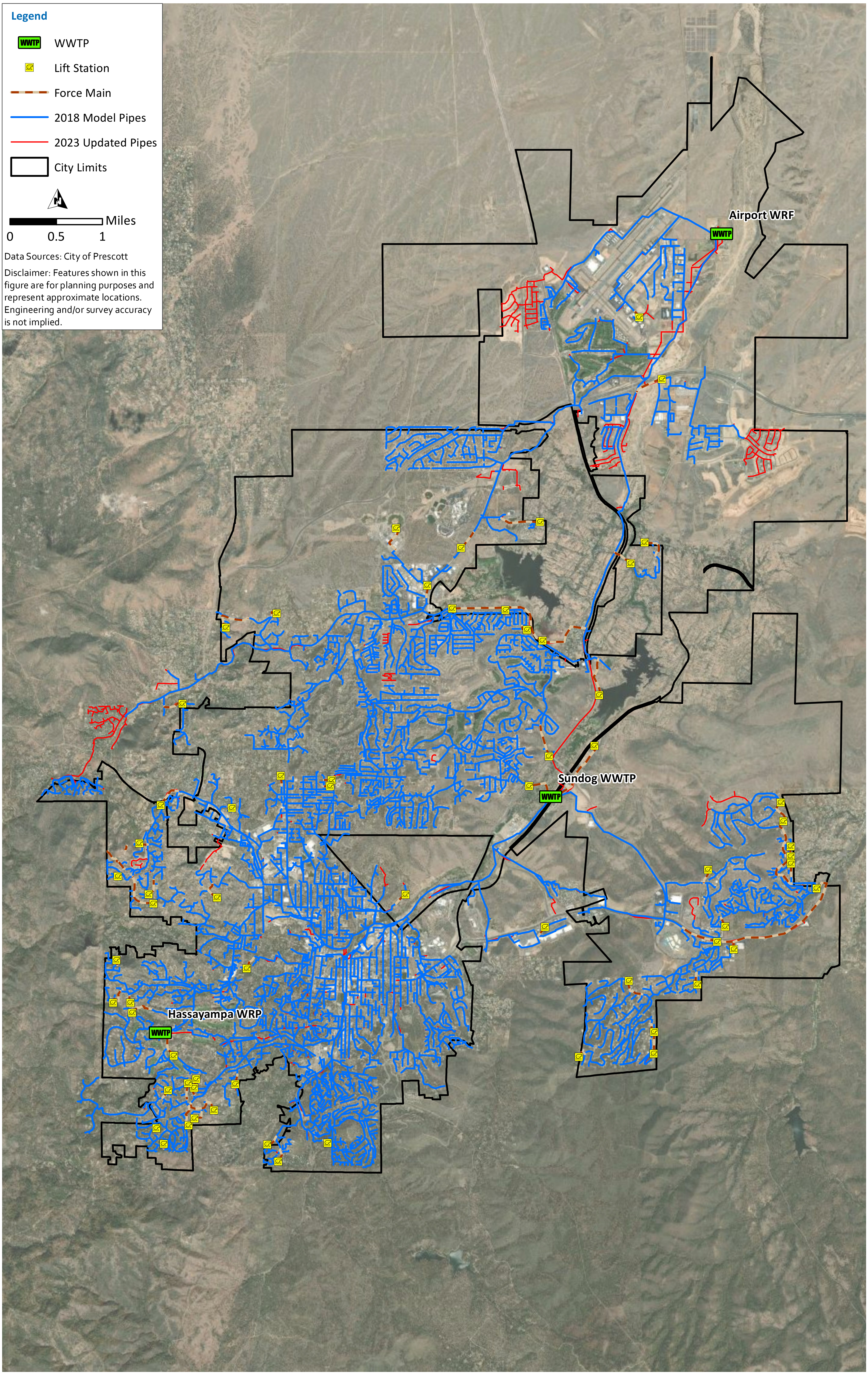

Figure 5.2 Wastewater Model Pipe Updates

5.2.2 Operational Updates

The operational setpoints of each sewage lift station in the model have been verified by Carollo using operational records. Where available, pump curves were used for pump definitions in the model. Where pump curves were not available, the design flow and head were used in conjunction with pump set points.

- The pumping capacities and operational set points for all 65 sewage lift stations were verified and updated as required. This includes 1 new lift station and 1 lift station that has been decommissioned since the 2018 Study.

5.2.3 Model Validation

5.2.3.1 Field Test

A wastewater system field test was developed to record flow, velocity and depth at 12 locations throughout the collection system starting December 13, 2021 and ending on February 4, 2022 using three flowmeters owned by the City. The locations selected for flow monitoring were mostly the same sites metered in the 2013 and 2018 studies. In this study, it was decided to split the Hassayampa basin into two basins and remove the Gurley basin, the smallest basin from previous studies. Table 5.1 lists the manholes where the flowmeters were installed. The field test locations and collection basins are shown on Figure 5.3.

Table 5.1 Wastewater Field Test Locations

Wastewater Basin	Manhole ID(1)
Banning Creek	13204SE114
City Lights	14234NW408
Copper Basin	13204SE120
Forest Trails	14229SE307
Hassayampa 1	14233NW403
Hassayampa 2	13205NW112
Main Veterans Affairs (VA)	14234NE100
North Force Main	15236SE528
Pinion Oaks	15236NE402
Prescott Heights	14233NE303
Prescott Lakes Parkway	14225NW103
Robinson	14234NW303

Notes:
(1) Manhole where temporary flowmeter was installed.

Flowmeters were deployed for one week at each location and recorded data every fifteen minutes. At the end of each week, the flowmeters were retrieved from that location and the data was downloaded and validated prior to deploying the flowmeters to the next location. A break in the recording schedule was taken for the holiday season. The field tests were conducted as summarized in Table 5.2.

Table 5.2 Wastewater Field Test Durations

Field Test	Dates	Basins Monitored
1	12/13 – 12/20/2021	Hassayampa 1, Hassayampa 2, Forest Trails
2	1/4 – 1/11/2022	North Force Main, Pinion Oaks, Prescott Lakes Parkway
3	1/11 – 1/21/2022	Banning Creek, Copper Basin, Prescott Heights
4	1/27 – 2/4/2022	City Lights, Main VA, Robinson

The flow data was reviewed to make certain it appeared reasonable prior to using it for model calibration. Scatter plots showing the flow depth versus the flow velocity were created for each flow monitoring location that provide a comparison to the Manning's Equation predicted flow depth and velocities as a quality check on the flow monitoring data. While some deviations from the Manning's curve are not unusual, scatter plot points graphed near the Manning's predicted curve indicate the data is following expected open channel flow patterns. Large or unexpected deviations of scatter plot points from the Manning's predicted curve can indicate a downstream obstruction, hydraulic interference, or a flowmeter equipment error.

In general, for most of the sites, the scatter plots showed velocity and depth patterns that are expected for unobstructed, open channel flow. However, low flow depth conditions at some of the sites may have resulted in times where the flowmeter sensor was not completely submerged. In these cases, depth and velocity readings cannot be recorded and these points will show outside the expected scatter plot patterns. Additionally, data collected during very low flow conditions or when the meter velocity signal indicates potentially poor readings was used cautiously when applying the data to model calibration.

Flow data from the Hassayampa 1 site was much larger than expected and was higher than recorded flows further downstream in the system. There appears to be an error with the flow monitor at this location. Therefore, flows were adjusted in this area using data from previous flow monitoring tests at this location and flow data from nearby locations from this test.

Figure 5.4 shows an example of a scatter plot for the Robinson Basin and Figure 5.5 is an example of the flow, velocity, and depth data for the Robinson Basin. Appendix 5A contains the results from the flow monitoring field tests including the scatter plots.

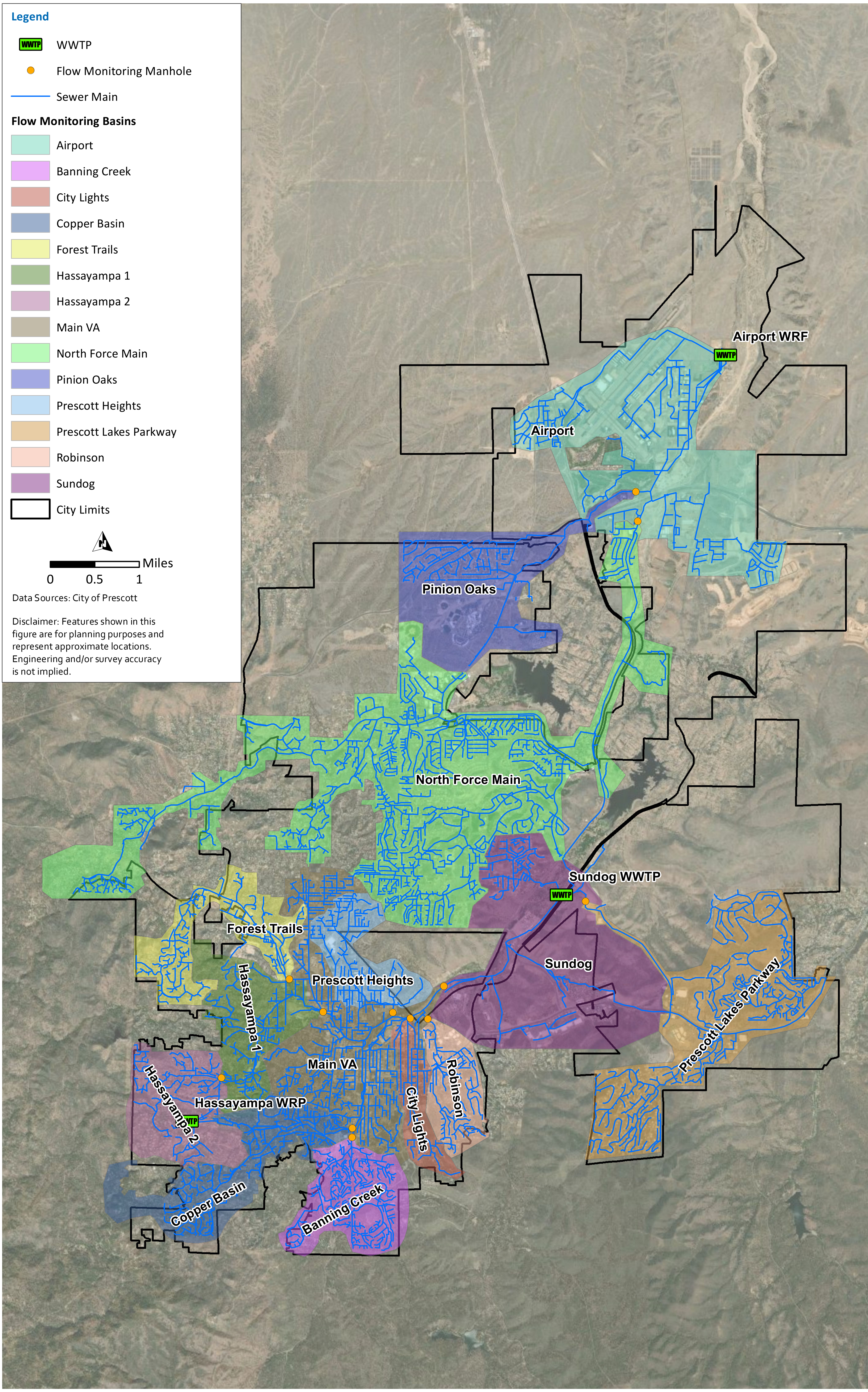

Figure 5.3 Wastewater Field Test

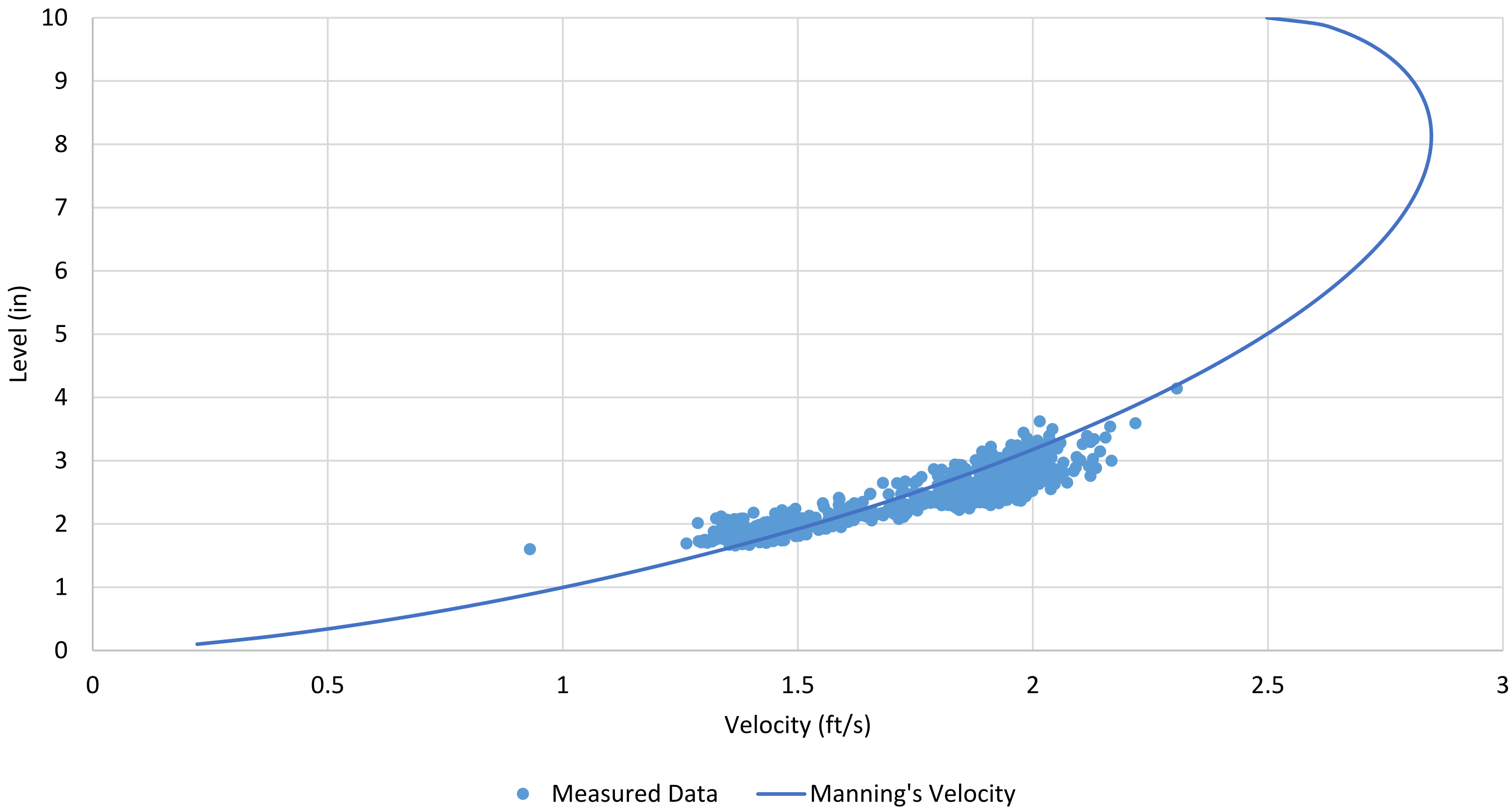

Figure 5.4 Flow Monitoring Data Scatter Plot for the Robinson Basin

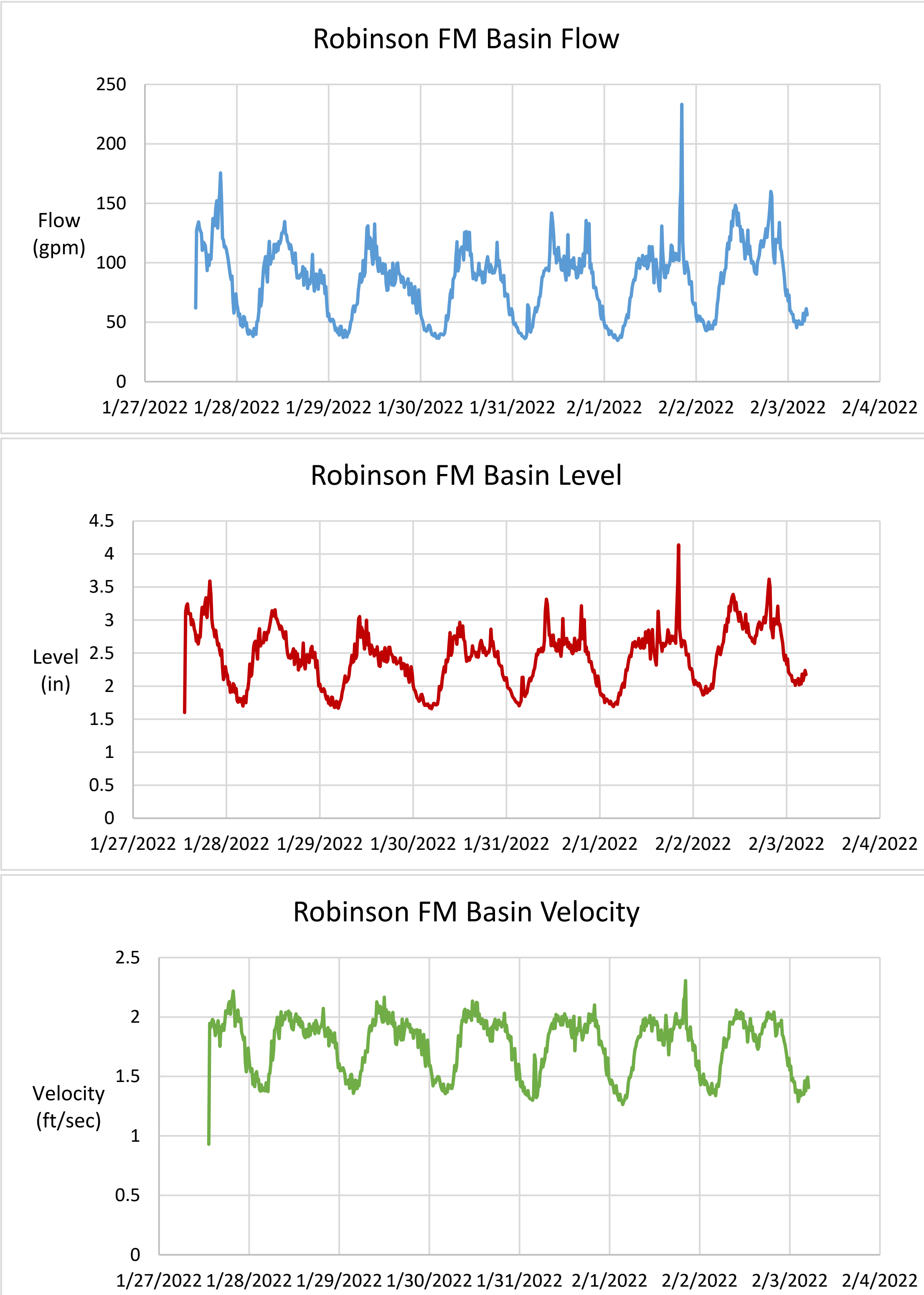

Figure 5.5 Flow Monitoring Data for the Robinson Basin

5.2.3.2 Flow Modeling Comparison

The 2021/2022 flow monitoring results were compared with flow monitoring data from previous model studies to determine how flows have changed over the past several years, as shown in Table 5.3. At most tested locations, flows have gradually increased since 2013.

Table 5.3 Wastewater Field Test Flow Comparisons

Wastewater Basin	Average Flow (gpm)(1)		
	2013	2017	2021/22
Banning Creek	128	86	264
City Lights	43	62	54
Copper Basin	150	278	441
Forest Trails	68	182	75
Hassayampa 1	415	265	718
Hassayampa 2	N/A	N/A	102
Main Veterans Affairs (VA)	928	1259	1169
North Force Main	546	571	844
Pinion Oaks	67	95	112
Prescott Heights	145	92	109
Prescott Lakes Parkway	148	422	427
Robinson	67	79	85

Notes:
(1) Average flows were calculated by averaging each flow recording from the entire flow monitoring period from each test.
Abbreviation:
gpm = gallons per minute

5.2.3.3 Model Calibration

The model was calibrated using data from the field test. The flow data was evaluated to determine average daily and peak flows. A calibration period was selected for each flow basin. Data from these days was used to develop the diurnal patterns applied in the model and to select the calibration day. Table 5.4 summarizes the selected calibration period, average flow, peak flow, and average velocity and depths for each collection basin.

To calibrate the model, the diurnal flow patterns were adjusted until the modeled flow provided a reasonable representation of the observed flow. In some basins, the Manning's 'n' value was adjusted so the model predicted flow velocity and depth would match more closely with the field test data. Increasing the 'n' value increases flow depth and decreases flow velocity. Decreasing the 'n' value has the opposite effect. The 'n' values assigned for calibration are used so that the model matches measured field conditions for existing infrastructure and are not intended to be used as design values for new infrastructure.

Table 5.4 Wastewater Model Calibration Summary

Location	Calib. Period	Pipe Diam (in)	Avg. Flow (gpm)	Peak Flow (gpm)	Peak Factor	Avg. Velocity (ft/sec)	Avg. Depth (in)	Peak d/D
Banning Creek	1/21/22	12	108	129	1.19	3.50	1.69	0.33
City Lights	2/4/22	8	54	82	1.51	1.91	1.83	0.35
Copper Basin	1/21/22	14	206	263	1.28	4.55	2.06	0.32
Forest Trails	12/20/21	12	74	125	1.68	2.31	1.64	0.29
Hassayampa 1	12/20/21	10	273	406	1.49	4.05	3.14	0.68
Hassayampa 2	12/20/21	10	102	133	1.31	3.57	1.66	0.36
Main VA	2/4/22	21	1,133	1,551	1.37	3.68	6.80	0.58
North Force Main	1/11/22	48	857	1,278	1.49	2.06	5.74	0.24
Pinion Oaks	1/11/22	12	113	174	1.55	2.66	2.08	0.27
Prescott Heights	1/21/22	10	110	161	1.47	1.70	3.05	0.47
Prescott Lakes Parkway	1/11/22	12	407	590	1.45	4.15	3.29	0.51
Robinson	2/4/22	10	85	117	1.38	1.74	2.49	0.37

Abbreviations:
in = inch(es); ft/sec = feet per second; d/D = depth over diameter

Figure 5.6 shows an example calibration plot for the Robinson drainage basin. Appendix 5B includes the calibration summary graphs for each of the drainage basins.

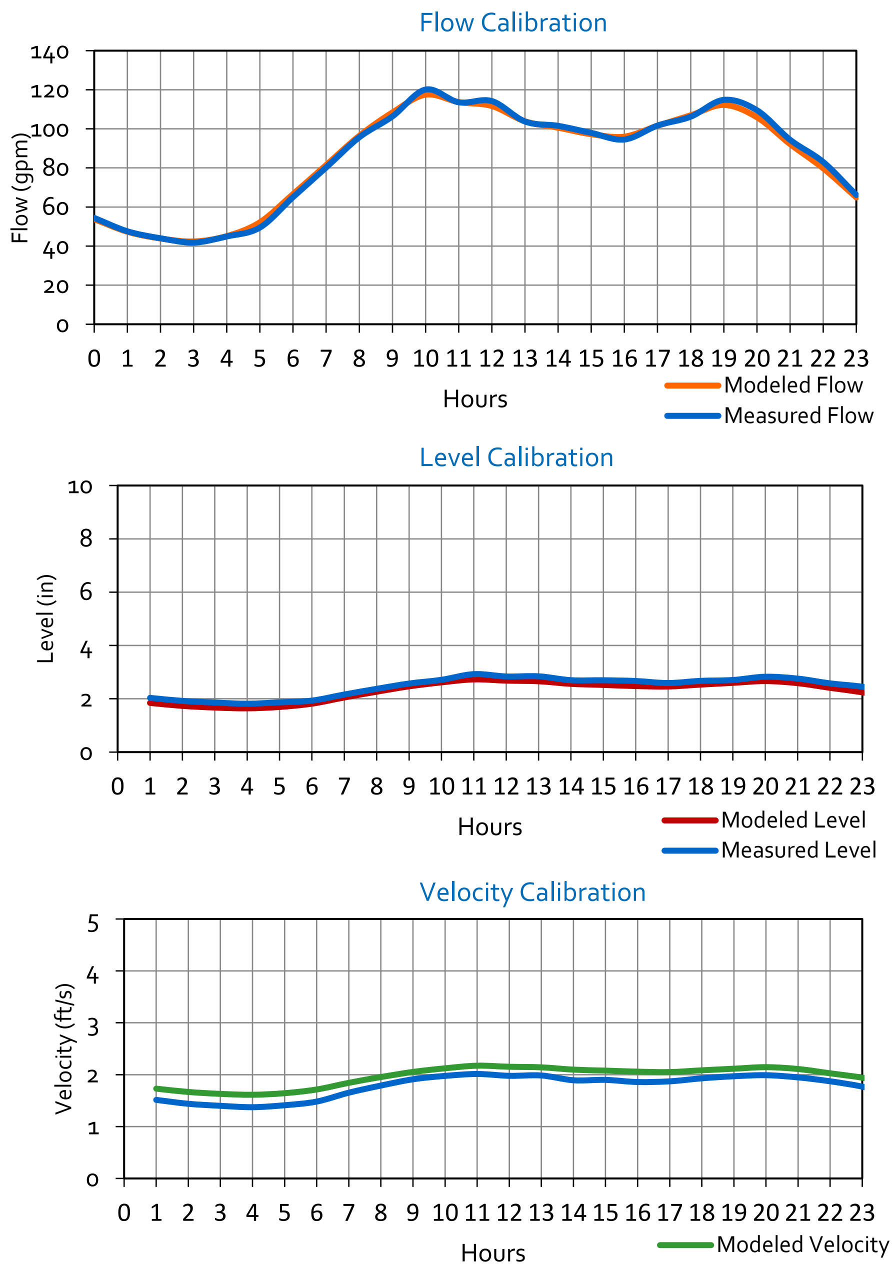

Figure 5.6 Example Calibration Graphs for the Robinson Basin

5.2.4 Model Structure

The wastewater collection system model has been built to perform extended period simulation (EPS) analyses. The EPS scenarios in the model simulate the flow of wastewater through the collection system for 48 hours, recording data at 10-minute intervals throughout. The model utilizes diurnal patterns (detailed in Section 2.4.3) to simulate how inflows into the collection system vary based on time of day and location in the City. For each planning period analyzed in this study, a dry weather and peak wet weather flow scenario has been created. These scenarios are used to analyze the collection system's current and projected performance in average flow and peak flow conditions. The model can be used to analyze how failures would affect the system. For example, a lift station's pumps could be set to never run to see how the upstream system will be affected or the diameter of a gravity main could be lowered to see how silt buildup would affect the collection system.

The 2022 collection system facilities (manholes, pipes, lift stations, treatment plants) in the model are named to match the City's Lucity ID system. When creating projected future infrastructure, efforts were made to follow the Enterprise Asset Management naming scheme. However, when future iterations of the model are created, any areas that change from "projected" to "existing" should be revised and renamed using the City's Lucity IDs.

5.3 Performance Criteria

5.3.1 Background

Performance criteria are the standards of measurement used to evaluate the adequacy of wastewater collection system infrastructure including pipe (gravity and force main) and lift station capacity. Performance criteria are based on legal requirements and engineering best practices. The criteria in this document have been reviewed with City staff and represent the level of service the City strives to provide to its customers. The wastewater system performance criteria have not changed since the 2018 Study and are described below.

5.3.2 Wastewater System Components

The City's wastewater system consists of the following components:

- Gravity mains.
- Force mains.
- Lift stations.
- Airport, Sundog, and Hassayampa treatment facilities.
- Septic systems.

The function of these wastewater system components and their associated performance criteria is discussed in the following sections.

5.3.3 Pipe Capacities

Sewer capacities are dependent on many factors. These include roughness of pipe, maximum allowable depth of flow, limiting velocity, and pipe slope. The Continuity Equation and Manning's Equation are used to calculate sewer capacity under steady-flow hydraulic conditions. The Manning's coefficient 'n' is a friction coefficient that varies with respect to pipe material, size of pipe, depth of flow, smoothness of joints, root intrusion, and other factors.
For gravity sewers, the Manning's coefficient ranges between 0.011 and 0.017. For planning purposes, an 'n' value of 0.013 is used for this project, except where modified during model calibration, or where the pipe material is known. It should be noted that the Arizona Administrative Code (A.A.C.) requires the use of a Manning's coefficient of 0.013 for the design of new sewers (A.A.C. R18-9-E301(D)(2)(e)).

5.3.4 Flow Depth (d/D)

When designing sewers, it is common practice to adopt variable flow depth capacity criteria for various pipe sizes. This criterion is expressed as a ratio of maximum depth of flow (d) to pipe diameter (D). Design d/D ratios typically range from 0.5 to 0.75, with the lower values typically used for smaller pipes that may experience flow peaks greater than planned or may experience blockages from debris.

The A.A.C. requires that the d/D ratio for new sewers shall not exceed 0.75 for peak dry weather flow conditions (A.A.C. R-18-9-E301(D)(2)(e)). The flow depth criterion used in this study for new sewers is 0.5 for diameters less than 12 inches, and 0.75 for diameters 12 inches and greater. However, existing sewers were evaluated based on a flow depth criteria of 0.9 at peak flows because there are fewer unknowns, especially in established, built-out areas, and because there is no need to replace or provide relief for an existing sewer until flows are at the design capacity of the pipe (A.A.C. R-18-E301(D)(b)(i)). The hydraulic criteria used for sizing proposed future gravity sewers will have a greater factor of safety than the criteria used to evaluate the capacity of the existing system due to the uncertainties in making projections of future flows.

5.3.5 Velocity

In order to minimize the settlement of solids in the flow and promote scouring, it is standard design practice to specify that a minimum velocity of 2 ft/sec be maintained when the pipe is flowing half full. At this velocity, the sewer flow will typically provide adequate scouring to clean the pipe. Due to the hydraulics of a circular pipe, the velocity for half-full pipe flow approaches the velocity of nearly full pipe flow. The Arizona Administrative Code requires new sewers to be designed with minimum slopes calculated from Manning's Equation using a roughness coefficient of 0.013 and a velocity of 2 ft/sec when flowing full (A.A.C. R-18-9-E301(D)(2)(e)).

Table 5.5 lists the minimum slopes for maintaining self-cleaning velocities at full flow with d/D = 1.0, which provides the most conservative minimum slope. The minimum slope listed in the table is 0.0008 foot per foot (ft/ft), which is the minimum practical slope for gravity sewer construction.

Table 5.5 Recommended Minimum Slopes for Circular Gravity Sewers

Pipe Diameter (in)	Minimum Slope (ft/ft)(1)(2)	Pipe Capacity(3)	
		(gpm)	(mgd)
8	0.0034(4)	310	0.45
10	0.0025	485	0.70
12	0.0020	700	1.02
14	0.0016	960	1.38
15	0.0015	1,100	1.59
16	0.0014	1,250	1.80
18	0.0012	1,580	2.28
20	0.001	1,960	2.82
21	0.001	2,160	3.11
24	0.0008	2,820	4.06
>24	0.0008	--	--

Notes:
(1) Slopes are calculated using Manning's Equation for pipes flowing full with a minimum velocity of 2 ft/sec.
(2) Sewers larger than 24 inches should have a slope ≥ 0.0008.
(3) Based on pipe flowing full (d/D = 1.0)
(4) Prescott prefers a slope of 0.005 (5 percent), for 8-inch diameter pipes where possible.
Abbreviation:
mgd = million gallons per day

Greater slopes are desirable if they are compatible with existing topography and infrastructure, provided that the wastewater velocity does not exceed the maximum velocity criteria of 10 ft/sec established in A.A.C. R-18-9-E301(D)(2)(f) unless scour resistant material is used. Velocities greater than 10 ft/sec may also result in turbulent flow conditions that contribute to odor problems.

The slopes listed in Table 5.5 are target criteria for existing and proposed sewer pipes. However, it should be noted that some of the existing sewer pipes in the City's collection system have flat slopes, and the minimum slope criteria may not be met in all locations within the wastewater system. Unless these pipes are undersized based on capacity criteria (d/D), they have not been recommended for replacement or upsizing at this time.

5.3.6 Manhole Spacing

Manholes are typically installed at grade changes, changes in sewer pipe sizes, alignment changes, and intersections with other sewer pipes. In addition, manholes should be located to facilitate sewer cleaning. The recommended maximum manhole spacing for different diameters of sewer pipe are listed in Table 5.6. The recommended maximum spacing is in accordance with A.A.C. R18-9-E301(D)(3)(a).

Table 5.6 Recommended Maximum Manhole Spacing

Sewer Pipe Diameter (in)	Maximum Manhole Spacing (ft)(1)
Less than 8 in	400
8 in to less than 18 in	500
18 in to less than 36 in	600
36 in to less than 60 in	800

Notes:
(1) A.A.C. R18-9-E301(D)(3)(a).
Abbreviation:
ft = feet

5.3.7 Changes in Pipe Size

When a smaller sewer joins a larger sewer, the invert of the larger sewer will be lowered sufficiently to maintain the same energy gradient across the manhole. The GIS data for the City's wastewater system was used for the sewer inverts. For master planning purposes, proposed sewer crowns were matched at manholes when a smaller sewer joins a larger one.

5.3.8 Lift Stations

Lift stations should be sized for a "firm" capacity greater than the peak daily flow. The lift station should be able to provide a firm pumping capacity with the largest pump out of service. This same concept applies to package lift stations with equally sized, duplex pumps where one pump acts as the duty pump and the other as the standby pump. In these cases, the required pumping capacity should be provided by the duty pump.

5.3.8.1 Normal Operation

Lift station wet well sizing takes into consideration the fill time at average flow conditions and the minimum pump cycle time. The minimum wet well volume shall be per the City's General Engineering Standards. When selecting the minimum cycle time, the pump manufacturer's duty cycle recommendations will be utilized. Starting and stopping more than seven times an hour for any one pump is not recommended.

5.3.8.2 Emergency Operation

The objective of emergency operation is to protect public health by preventing sewer back-ups and subsequent discharge into streets and other public or private property. The most common emergency would be a power outage. The City has permanent back-up generators with automatic transfer switches at their regional lift stations and portable generators that can be used at all other stations. The City requires emergency generators to be installed at all new lift stations.

5.3.9 Gravity Sewer Planning Guidelines

Gravity sewers should be designed and constructed to have:

- A minimum of 4 feet of cover or sufficient depth to serve the ultimate drainage area.
- A target depth of 7 feet of cover for new sewer main installation.

Gravity sewers and force mains must have a minimum separation of 6 feet from potable water mains and reclaimed water mains unless they are provided with increased protection in accordance with A.A.C. R-18-5, Article 4 and A.A.C. R-18-9, Article 6.

Manholes with sewers intersecting at greater than or equal to 90-degree angles should provide 0.1 foot of invert drop across the manhole. Other manholes should provide a minimum 0.1 foot of invert drop.

5.3.10 Force Mains

The A.A.C. requires that new force mains be designed to maintain a minimum flow velocity of 3 ft/sec and a maximum flow velocity of 7 ft/sec (A.A.C. R-18-9-E301(D)(4)(a)). These velocity criteria promote scouring so that the solids deposited in the force main while the pumps are off will be transported downstream when the pumps are operating. Wastewater retention time in the pipeline should also be considered in sizing force mains to avoid excessive hydrogen sulfide generation. A typical Hazen-Williams friction coefficient value of 120 was used for all force mains unless a specific force main was known to behave differently.

5.3.11 Peaking Factors

Peaking factors for the City's wastewater system were calculated based on field data from the flow monitoring conducted in the winter of 2021/2022. The peak hour to average daily flow ratio during the flow monitoring period was determined for each of the flow monitoring locations.

Table 5.7 summarizes the peak flow multipliers for each flow monitoring basin. The values range from 1.34 to 2.85 and are dependent on the size of the drainage area and type of development contributing to the flow monitoring point.

Table 5.7 Peak Hour Wastewater Flow Factors

Flow Monitoring Basin	Peak Flow Multiplier
Banning Creek	1.51
City Lights	2.35
Copper Basin	1.48
Forest Trails	2.85
Hassayampa 1	1.34
Hassayampa 2	2.85
Main VA	1.57
North Force Main	1.94
Pinion Oaks	2.18
Prescott Heights	2.02
Prescott Lakes Parkway	2.02
Robinson	2.75

5.3.12 Storm Inflows

The City's collection system receives a significant amount of inflow and infiltration (I/I) from storm events. I/I is highest in older areas of the City's collection system, such as downtown. Thus, the majority of I/I is currently conveyed to the Sundog WWTP. Therefore, manholes were systematically chosen in the model, primarily in older parts of the collection system and in washes, to have wet weather inflows applied.

According to the City's data of historical WWTP inflows, a combined WWTP peak day inflow of 14.1 mgd occurred in 2020. This peak inflow was chosen as a target inflow to calibrate the model to wet weather inflows. Wet weather inflows were added to the chosen I/I manholes in addition to calibrated dry weather flows to bring the total WWTP inflow in the model to match the observed peak daily flow of 14.1 mgd. The applied wet weather flows totaled to 10.8 mgd.

During the winter of 2022/2023, the City experienced even higher flows due to a combination of rain and snow melt. This peak flow event caused several sewer overflows in the collection system. Due to the timing of the event, this project did not analyze the system response to these new record peak flows. However, this event displays the importance of testing peak wet weather flows in the system and planning system improvements to handle peak flow events.

5.3.13 Performance Criteria Summary

Table 5.8 summarizes the City's wastewater collection system performance criteria.

Table 5.8 Wastewater System Performance Criteria Summary

Pipe Diameter (in)	Minimum Slope (ft/ft)(1)(2)	Pipe Capacity(3)	
		(gpm)	(mgd)
Gravity Sewer Minimum Slope and Capacity			
8	0.0034(4)	310	0.45
10	0.0025	485	0.70
12	0.0020	700	1.02
14	0.0016	960	1.38
15	0.0015	1,100	1.59
16	0.0014	1,250	1.80
18	0.0012	1,580	2.28
20	0.001	1,960	2.82
21	0.001	2,160	3.11
24	0.0008	2,820	4.06
>24	0.0008	–	–

Description	Criteria
Maximum Velocity	≤ 10 ft/sec (polyvinyl chloride [PVC] pipe) > 10 ft/sec (scour resistant pipe)
Flow Depth, d/D (dry weather peak)	
d/D for evaluating existing mains	0.9
d/D for planning new pipes < 12-in diameter	0.5
d/D for planning new pipes ≥ 12-in diameter	0.75
Head Loss in New Pipes	
Gravity main	Manning's "n" = 0.013
Pressure pipes	Hazen Williams "C" = 120
Changes in Pipe Size When a smaller sewer joins a larger sewer	Sewer crowns will be matched at a minimum or an internal drop at the transition manhole will be provided
Head Loss at Manholes	
Manholes with pipes intersecting at angles greater than 90 degrees	Provide 0.1-ft invert drop
Manholes with pipes intersecting at angles 90 degrees or less	Provide 0.1-ft invert drop
Collection System Peaking Factors	
Peak flow to average daily flow(5)	1.34 – 2.85
Inflow and Infiltration	
Peak wet weather inflow	10.8 mgd

Notes:
(1) Slopes are calculated using Manning's Equation for pipes flowing full with a minimum velocity of 2 ft/sec.
(2) Sewers larger than 24 inches should have a slope ≥ 0.0008.
(3) Based on pipe flowing full (d/D = 1.0) at the minimum pipe slope.
(4) Prescott prefers a slope of 0.005 (5 percent), for 8-inch diameter pipes where possible.
(5) Values measured during flow monitoring study conducted in December 2021 to February 2022.

5.4 Wastewater System Evaluations

The calibrated wastewater model was used to evaluate the capacity of the City's existing infrastructure and to determine system expansion requirements for growth. All analyses assumed a centralized approach for wastewater treatment at the Airport WRF.

5.4.1 Collection System Evaluation

Most of the pipes in the City's collection system have sufficient capacity to convey the existing and projected future flows. There are several areas where the estimated d/D exceeded 0.9 for 2022 flow conditions. These areas were previously identified in the 2018 Study and include:

- Sewers on Willow Creek Road, Rosser Street, and Demerse Avenue.
- Sewers on Fifth Street, Sixth Street, and Hillside Avenue from the Sundog Trunk Main to Fifth Street.
- Sewers on Granite Street from north of Aubrey Street to Sheldon Street.
- Sewer on Sun Drive east of Scott Drive.
- Sundog Trunk Main Phase I – Sundog WWTP to Highway 89.
- Sundog Trunk Main Phase II – Sundog WWTP to Miller Valley Road.
- Sewer on Josephine/Osburn Road from Plaza Drive to Miller Valley Road.
- Sewer on Thumb Butte Road from Meadowbrook Road to Country Club Drive.
- Sewer on Meadowbrook Road from Butte Canyon Drive to 200 feet east of Butte Canyon Drive.

Figure 5.7 shows the locations in the collection system noted above where pipe capacities are predicted to have a d/D of 0.9 for 2022. Existing infrastructure recommendations and pipes to serve new growth were sized to convey buildout flows.

5.4.1.1 Arizona Eco Development Service Area

The Arizona Eco Development (AED) North service area is a 980-acre active growth area located in northeast Prescott. Analysis was performed to create a planning-level wastewater collection system layout for the AED North area. This analysis used the projected future AED North wastewater service points, shown in Figure 2.17, and ground elevation data to plan a layout of gravity mains and lift stations. The AED North service area is projected to contain 1,500 future wastewater collection service accounts with a projected total average daily wastewater flow of about 200 gpm.

Two lift stations were determined to be required to serve the AED North area. These lift stations are summarized in CIP projects WW 81 (0.8 mgd) and WW 82 (0.2 mgd). Planned gravity mains in the AED North area were not included in CIP projects as they are likely to significantly change to meet development designs. The planned gravity mains and lift stations for the AED North area are shown in Figure 6.2.

The AED South area consists of Sections 32 and 33. An additional 3,000 housing units are planned in AED South. AED South will be served by a lift station and force main that will be connected to the City's collection system.

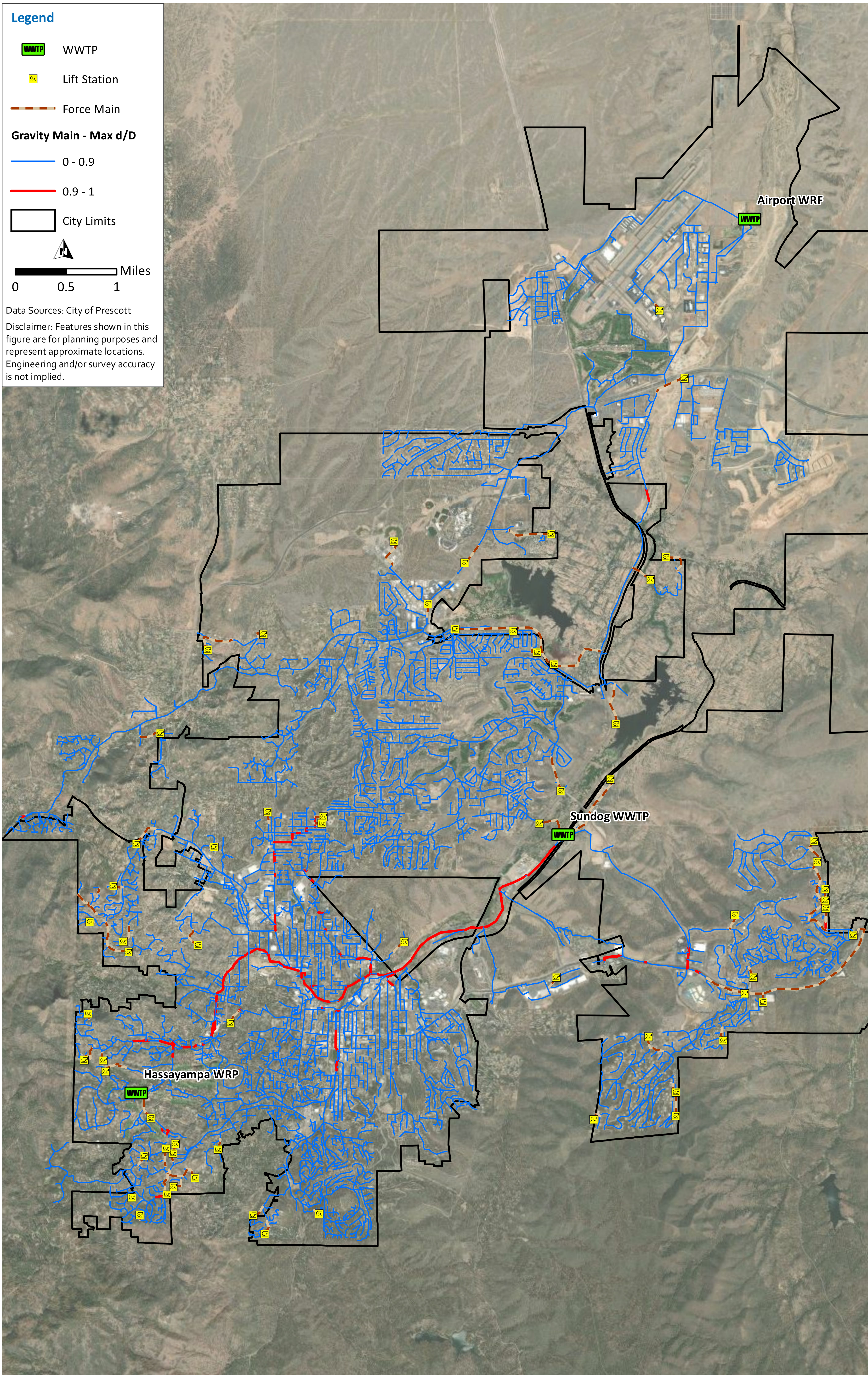

Figure 5.7 2023 Pipe Capacity

5.4.2 Lift Station Evaluation

The capacity of the City's lift stations was evaluated using the model predicted peak wet weather flows to each lift station compared to the firm pumping capacity of each lift station. Table 5.9 summarizes the results of the lift station capacity evaluation.

Table 5.9 Lift Station Capacity

Lift Station	Year 2022 Total Capacity (gpm)	Year 2022 Firm Capacity(1) (gpm)	Year 2022 Peak Wet Weather Flow (gpm)	Surplus/Deficit (gpm)
Airpark	400	200	4	196
Banning Creek	360	180	5	175
Cathedral Pines #1	900	450	5	445
Cathedral Pines #2	900	450	10	440
Circle P	100	50	50	0
Cliff Rose(2)	750	375	200	175
Copper Canyon #1	640	320	135	185
Copper Canyon #2	172	86	5	81
Copper Vista	120	60	6	54
Costco	120	60	25	35
Country Dells	670	320	25	295
Downer Trail	76	38	2	36
Forest Trails #1	600	300	160	140
Forest Trails #2	2,700	1,350	5	1,345
Forest Trails #3	400	200	16	184
Forest Trails #4	400	200	4	196
Forest Trails #5	2,300	1,150	4	1,146
Granite Dells #1	140	70	4	66
Granite Dells #2	360	180	48	132
Gurley St	600	300	4	296
Hassayampa #1	1,000	500	120	380
Hassayampa #2	400	200	105	95
Hemlock	500	250	12	238
Loma Rica	220	110	42	68
Milia Way	120	60	6	54
Oaklawn	400	200	2	198
Prescott Boulders	80	40	4	36
Prescott Lake Regional	5,840	2,920	1200	1,720
Private Drive	800	400	24	376
Ranch #1(2)(4)	2,300	1,150	1350(3)	-200
Ranch #3	100	50	10	40
Ranch #4	154	77	92(3)	-15

Lift Station	Year 2022 Total Capacity (gpm)	Year 2022 Firm Capacity(1) (gpm)	Year 2022 Peak Wet Weather Flow (gpm)	Surplus/Deficit (gpm)
Ranch #5	154	77	5	72
Ranch #6	372	136	40	96
Ranch #7	130	65	2	63
Reservation	100	50	12	38
Sandretto	400	200	95	105
Shadow Valley	800	400	8	392
Skyline	100	50	5	45
South View #1	400	200	8	192
South View #2	100	50	3	47
Thunderbird	200	100	10	90
Timber Ridge #1	1,560	780	900(3)	-120
Timber Ridge #2	600	300	19	281
Timber Ridge #3	600	300	19	281
Transfer Station	140	60	2	58
Wendy's	650	325	26	299
Willow Creek	600	300	6	294
Yavapai Hills #1(2)	1,650	825	600	225
Yavapai Hills #2	800	400	775(3)	-375
Yavapai Hills #3	800	400	518(3)	-118
Yavapai Hills #4	800	400	5	395
Yavapai Hills #5	120	60	20	40
Yavapai Hills #6	120	60	7	53
Yavapai Hills #8	246	123	30	93
Yavapai Hills #9	530	265	23	242

Notes:
(1) Represents capacity of the single largest pump.
(2) Lift station has redundant wet wells and pumps.
(3) Year 2022 peak wet weather flow exceeds year 2022 firm capacity.
(4) Lift station has redundant force main.

There are five lift stations that have current predicted peak wet weather flows that are greater than the firm capacity of the station: Ranch #1, Ranch #4, Timber Ridge #1, Yavapai Hills #2, and Yavapai Hills #3. However, the total capacity of these lift stations is sufficient to convey the peak wet weather flow, therefore no improvements are recommended for these stations at this time.

5.4.3 Condition Assessment Evaluation

The City's wastewater collection system condition was analyzed based on both pipe age and pipe material. The data for both of these analyses were obtained from the City's Lucity and GIS pipe data. In discussions with the City, it was agreed that this data is mostly accurate. However, it is important to note that it is difficult to conclude the exact material or condition of any individual pipe without surveying the pipe. However, on a grand scale, this data is useful to analyze the system as a whole.

As mentioned in Section 5.3.12, much of the wet weather infiltration in the City's system is observed at wash crossings and older areas of the collection system. Older pipes are also more likely to have significant pipe failures. Figure 5.8 and Table 5.10 show the age of pipes in the collection system, grouping pipes by installation decade dating back to the 1940s. Generally, the southwestern area of Prescott, near downtown, is the oldest and, thus, the largest area of concern.

Table 5.10 Pipeline Age Summary

Installation Decade	Length (miles)	Percent of System (by length)
Pre-1941	25.4	6.6%
1941 to 1950	9.5	2.5%
1951 to 1960	9.6	2.5%
1961 to 1970	45.8	11.9%
1971 to 1980	71.1	18.5%
1981 to 1990	108.2	28.2%
1991 to 2000	67.8	17.7%
2001 to 2010	32.1	8.4%
2011 to 2022	3.6	0.9%
No Data	10.8	2.8%
Total	**383.9**	**100.0**

Notes:
(1) Source: City's Lucity and GIS databases.

According to the City's engineering design standards, acceptable sewer pipe materials are:

- Vitrified Clay Pipe (VCP) (15" and larger).
- PVC SDR35 (Up to 15").
- PVC ASTM F679-t1 (18" – 27").
- CL350 ductile iron pipe (DIP).
- High-density polyethylene (HDPE).
- Centrifugally Cast Fiberglass Reinforced Polymer Mortar.

Figure 5.9 and Table 5.11 shows the variety of pipe materials that are present in the City's collection system. This figure and table show that there are a variety of pipe materials existing in the system that do not meet the City's current standard. However, according to the City, they do not currently have any pipe failure or inflow issues in areas with non-conforming pipe materials.

Through discussions between the City and Carollo, it was agreed that while it is important to analyze the collection system based on pipe age and pipe materials, project recommendations will not be made solely on these factors.

Table 5.11 Pipeline Material Summary

Pipe Material	Length (miles)	Percent of System (by length)
Asbestos Concrete	3.23	0.8
Centrifugally Cast, Fiberglass-Reinforced, Polymer Mortar (CCFRPM)	1.38	0.4
Cured-in-Place Pipe (CIPP)	8.71	2.3
Concrete Cylinder	0.11	0.03
Ductile Iron Pipe (DIP)	40.43	10.53
Fiberglass Reinforced Plastic (FRP)	3.23	0.84
Galvanized Steel Pipe (GSP)	0.01	0.004
High Density Polyethylene (HDPE)	5.87	1.53
Polyvinyl Chloride (PVC)	185.86	48.4
Steel	0.062	0.02
Vitrified Clay Pipe (VCP)	134.98	35.2
Total	**383.9**	**100.0**

Notes:
(1) Source: City's GIS database.

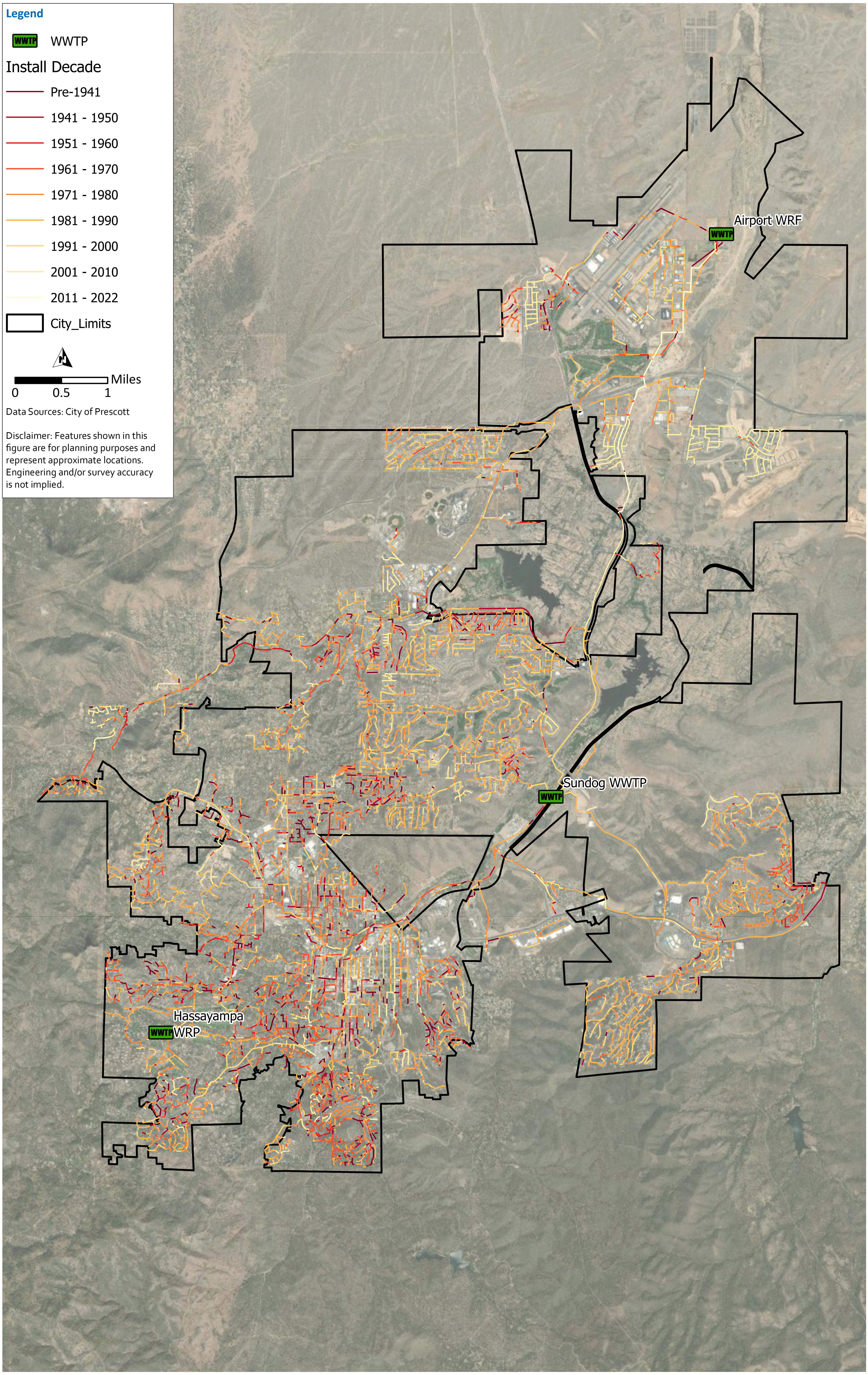

Figure 5.8 Pipe Age

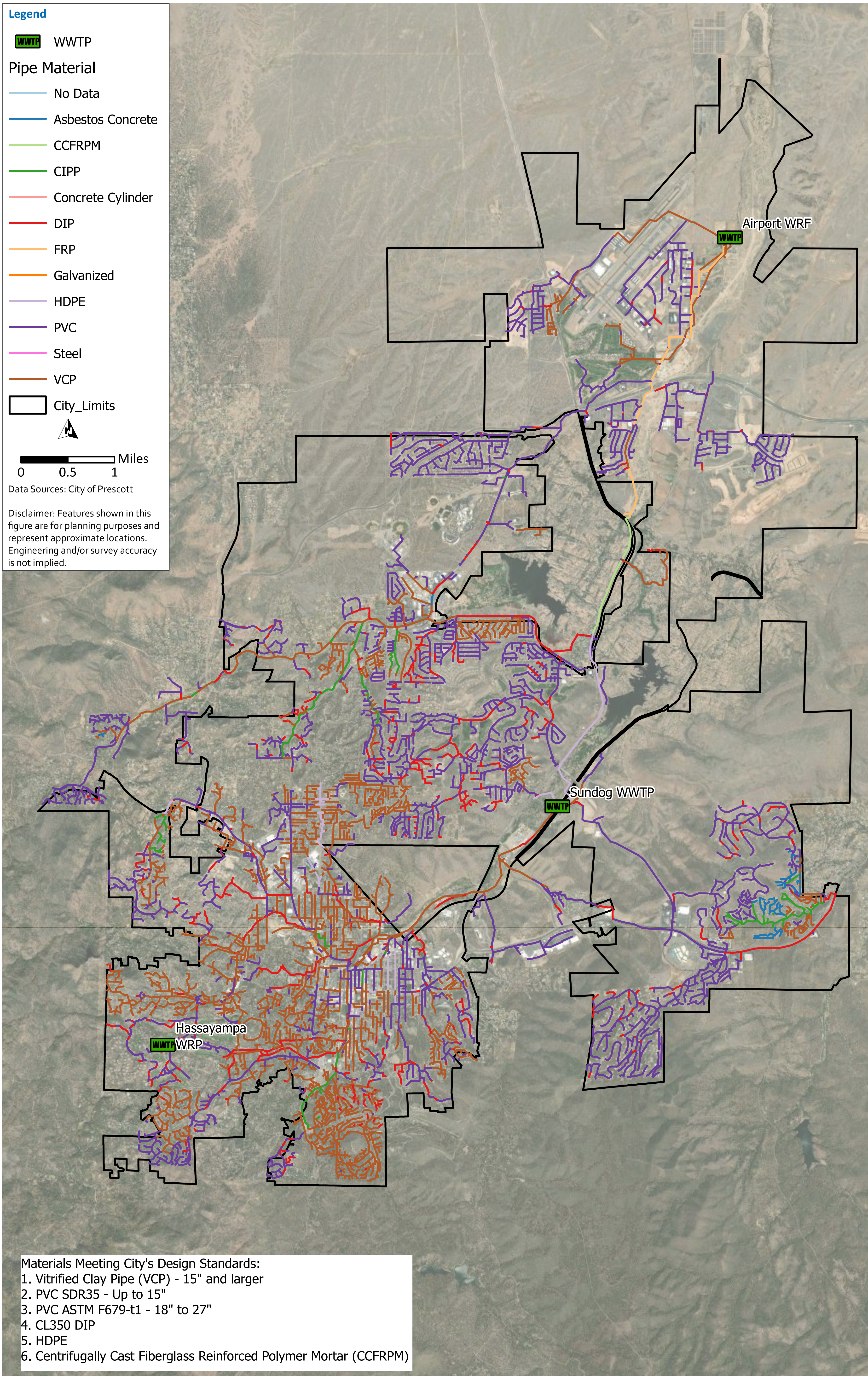

Figure 5.9 Pipe Materials

5.4.4 Emergency Operations Evaluation

5.4.4.1 Regional Lift Stations

An emergency operations evaluation was conducted for the City's six regional lift stations including:

- Willow Lake.
- Prescott Lakes.
- Yavapai Hills #1.
- Timber Ridge #1.
- Ranch #1.
- Forest Trails #1.

All of the City's regional lift stations have sufficient capacity for current and projected buildout wastewater flows under normal operating conditions. However, most lift stations have small wet wells that would overflow quickly if the pumps were inoperable. The purpose of the emergency operations analysis was to determine the time it would take for the lift station wet well to fill and overflow in the event of a power or mechanical failure that would prevent the lift station from operating. Although the regional lift stations are equipped with on-site emergency power generators, it is possible that a catastrophic failure could occur that would require longer than anticipated time to remedy. This analysis provides operations staff with additional information to make decisions when lift station power failure events occur.

Table 5.12 summarizes the estimated time it would take for the lift station wet well to fill prior to overflowing. System storage includes any pipe capacity for sewers upstream of the wet well that have crowns below the ground level of the wet well. Estimates were developed for minimum and maximum flows on a day with peak wet weather flows both for 2022 conditions and projected buildout conditions to provide a range of required response times for peak flow (worst case) and minimum flow (best case) scenarios.

Table 5.12 Regional Lift Station Time to Spill Analysis

Lift Station	Estimated Time to Wet Well Overflow (min)(1)			
	At 2022 Peak Flow	At 2022 Minimum Flow	At Buildout Peak Flow	At Buildout Minimum Flow
Willow Lake	10	10	Decommissioned	Decommissioned
Prescott Lakes	30	80	10	20
Yavapai Hills #1	20	120	20	120
Timber Ridge #1	10	10	10	10
Ranch #1	10	70	10	60
Forest Trails #1	100	310	30	180

Notes:
(1) Values are minutes from the start of the simulated power outage/mechanical failure.
Abbreviation:
min = minutes

At peak flow, the regional lift stations are estimated to overflow between 10 and 100 minutes if an unexpected shut down were to occur.

For minimum flow conditions, the Prescott Lakes, Yavapai Hills #1, Ranch #1, and Forest Trails #1 lift stations are estimated to overflow between 70 and 310 minutes. The remaining two lift stations are estimated to overflow within 10 minutes if an unexpected shut down were to occur.

While unexpected shutdowns can't be predicted, there are some measures that the City can take to minimize the chance of an occurrence, including:

- Performing scheduled maintenance of pumps, valves, floats, stand by power generators and other mechanical components.
- Performing maintenance of on-site generators.
- Performing regular condition assessments of equipment and proactively replacing equipment components when they become worn.
- Stockpile spare parts from vendors for critical system components and replacing equipment for which spare parts cannot be obtained.
- Construct additional wet well capacity.

Figure 5.10 shows an example of how the wet well capacity compared to the inflow volume to the wet well after the outage occurs. The point at which the inflow volume line crosses the wet well capacity line is the point at which flows are estimated to reach the wet well rim elevation. Appendix 5C contains graphs that display the system capacity versus the wet well inflows for each lift station.

Appendix 5D contains a schematic of the wastewater collection system basins and lift stations that illustrates the ground elevation of the wet wells, invert elevation of the force main outfalls, range of elevations served by each lift station, and the connectivity between lift stations (upstream/downstream). The schematic has been updated to reflect the planned decommissioning of the Sundog WWTP and centralization of the collection system to the Airport WRF.

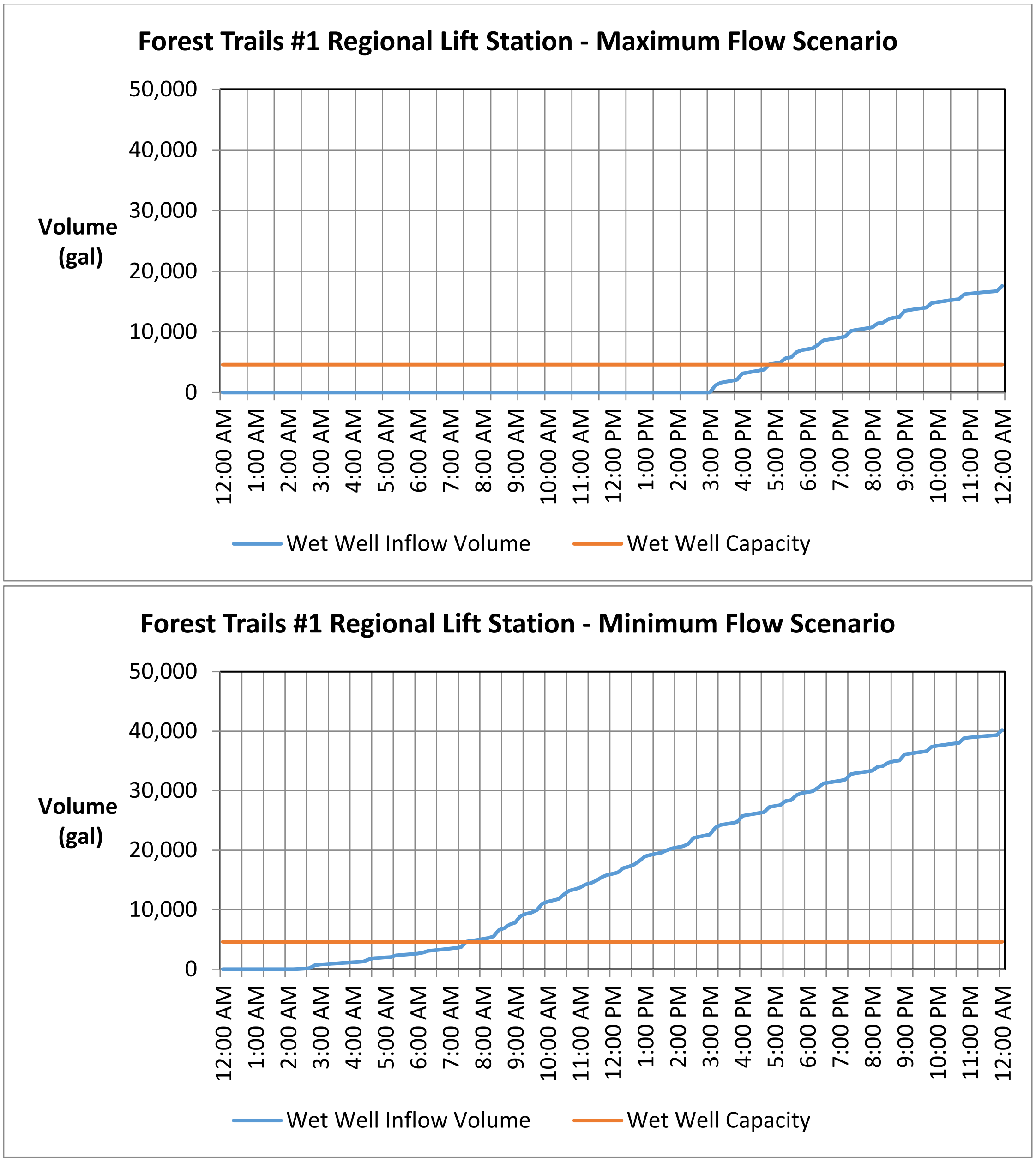

Figure 5.10 Outage Simulation for Forest Trails #1 Regional Lift Station

5.5 Wastewater System Capital Improvement Program Projects

After performing the evaluations described in Section 5.4, the following CIP projects have been identified and are described below.

5.5.1 Collection System CIP Projects

Based on the collection system evaluation performed in Sections 5.4.1 and 5.4.3, the following projects shown in Table 5.13 have been identified for the collection system and are described in more detail below.

Table 5.13 Wastewater Collection System CIP Projects

Project #	Description	Diameter/ Size (in/mgd)	Length/Qty (ft/#)
36 WW.1	Montezuma and Gurley Street Improvements	8	513
36 WW.2	Montezuma and Gurley Street Improvements	10	172
36 WW.3	Montezuma and Gurley Street Improvements	12	92
36 WW.4	Montezuma and Gurley Street Improvements	18	2,347
38 WW.1	Hassayampa Trunk Main - Sonora Dr to Sundog Phase C Lift Station	18	3,196
38 WW.2	Hassayampa Trunk Main - Oregon Ave to Miller Valley Rd	15	5,618
38 WW.3	Hassayampa Trunk Main - Gurly St to Oregon Ave	15	1,445
44 WW.1	5th Street, 6th Street and Hillside Sewer Main Upsize	15	1,867
44 WW.2	5th Street, 6th Street and Hillside Sewer Main Upsize	18	765
46 WW.1	New Sewer Connection on Ruth Dr from Whetstine Ave to Sun St	10	2,380
46 WW.2	Upsize sewer from Cambell St to 2nd St (diagonal crossing Merritt St)	12	2,281
52 WW.1	Hassayampa - Upsize Meadowbrook Rd at Butte Canyon Dr	8	2,930
52 WW.2	Hassayampa - Upsize Meadowbrook Rd from Sherwood Dr to Plaza Dr	15	3,013
56 WW.1	Upsize Willow Creek Gravity Sewer Main from Willow Lake Regional Lift Station west to Cottonwood Ln	12	4,967
56 WW.2	Upsize Willow Creek Gravity Sewer Main from Willow Lake Regional Lift Station west to Cottonwood Ln	15	3,926
56 WW.3	Upsize Willow Creek Gravity Sewer Main from Willow Lake Regional Lift Station west to Cottonwood Ln	18	1,795
62 WW.3	Willow Lake Gravity Sewer	24	6,500
66 WW.1	Gurley, Sheldon, EZ Street and Roughrider Improvements	8	612
66 WW.2	Gurley, Sheldon, EZ Street and Roughrider Improvements	10	478
66 WW.3	Gurley, Sheldon, EZ Street and Roughrider Improvements	12	644
68 WW	Fair St and Miller Valley Collector Main	15	3,760
70 WW	Peace Land and Gail Gardner Way	10	176
72 WW	Upsize sewer on Prescott Lakes Pkwy north of Hwy 69	15	1,077
78 WW	Shadow Valley Drive and Archers Path	12	145
86 WW.1	Airport Ruger Road Trunk Main Extension	24	2,963
86 WW.2	Airport Ruger Road Trunk Main Extension	30	2,625
88 WW.2	Section 32 & 33 Gravity Main	12	4,977
97 WW.3	Yavapai Medical Center - Gravity Main	16	2,650
98 WW	Skyline Sewer Realignment	8	250
99 WW	Loma Rica Lift Station Abandonment	8	1,269
102 WW.1	Deep Well Ranch Trunkline	12	11,991
103 WW.1	Storm Ranch Trunkline	12	1,700

5.5.2 Lift Station CIP Projects

Based on the lift station evaluation performed in Section 5.4.2, no lift station improvements are recommended at this time as the total capacity of the lift stations is sufficient to convey the peak wet weather flow. However, per the emergency operations evaluation performed in Section 5.4.4, the following projects have been identified for the lift stations and are described in more detail below.

Table 5.14 Lift Station CIP Projects

Project #	Description	Diameter/Size (in/mgd)	Length/Qty (ft/#)
26 WW	Sundog Trunk Main Phase C - Lift Station	9	1
26 WW	Sundog Trunk Main Phase C - Force Main	18	27,892
32 WW	Granite Dells Development - New Lift Station from Hwy 89/Sideroad to Granite Dells Development	1	1
32 WW	Granite Dells Development - New Sewer Force Main from Hwy 89/Sideroad to Granite Dells Development	10	2,430
55 WW.1	Centralization - Airport WRF Effluent Pump Station	3	1
55 WW.2	Centralization - Airport WRF Effluent Line to Watson Lake Park	18	8,666
62 WW.1	Willow Lake Gravity Sewer	4	1
62 WW.2	Willow Lake Gravity Sewer	18	3,050
87 WW	Yavapai Hills Lift Station	3	1
87 WW	Yavapai Hills Lift Station - Force Main	16	7,781
88 WW.1	Section 32 & 33 Force Main	8	5,000
97 WW.1	Yavapai Medical Center Lift Station	1	1
97 WW.2	Yavapai Medical Center Force Main	8	1,010
100 WW	Prescott Lakes Parkway Lift Station	0.2	1
101 WW	Timber Ridge #1 Lift Station Rehabilitation	1	1
101 WW	Timber Ridge #1 Lift Station Rehabilitation	8	1,469
102 WW.2	Deep Well Ranch Lift Station	1	1
102 WW.3	Deep Well Ranch Force Main	8	2,660
103 WW.2	Storm Ranch Force Main	6	2,900

5.5.3 Wastewater System CIP Projects Summary

The CIP projects for the wastewater system are summarized in Table 5.15.

Table 5.15 Wastewater System CIP Project Summary

Project #	Description	Diameter/Size (in/mgd)	Length/Qty (ft/#)	Project Justification/Driver	Planning Year
26 WW	Sundog Trunk Main Phase C - Lift Station	9	1	Addresses capacity limitation estimated by buildout.	2023
26 WW	Sundog Trunk Main Phase C - Force Main	18	27,892	Addresses capacity limitation estimated by buildout.	2023
32 WW	Granite Dells Development - New Lift Station from Hwy 89/Sideroad to Granite Dells Development	1	1	Serve growth area	2027
32 WW	Granite Dells Development - New Sewer Force Main from Hwy 89/Sideroad to Granite Dells Development	10	2,430	Serve growth area	2027
36 WW.1	Montezuma and Gurley Street Improvements	8	513	Addresses capacity limitation estimated by buildout.	2032
36 WW.2	Montezuma and Gurley Street Improvements	10	172	Addresses capacity limitation estimated by buildout.	2032
36 WW.3	Montezuma and Gurley Street Improvements	12	92	Addresses capacity limitation estimated by buildout.	2032
36 WW.4	Montezuma and Gurley Street Improvements	18	2,347	Addresses capacity limitation estimated by buildout.	2032
38 WW.1	Hassayampa Trunk Main - Sonora Dr to Sundog Phase C Lift Station	18	3,196	Addresses capacity limitation estimated by buildout.	2027
38 WW.2	Hassayampa Trunk Main - Oregon Ave to Miller Valley Rd	15	5,618	Addresses capacity limitation estimated by buildout.	2027
38 WW.3	Hassayampa Trunk Main - Gurly St to Oregon Ave	15	1,445	Addresses capacity limitation estimated by buildout.	2027
44 WW.1	5th Street, 6th Street and Hillside Sewer Main Upsize	15	1,867	Addresses capacity limitation in existing system.	2037
44 WW.2	5th Street, 6th Street and Hillside Sewer Main Upsize	18	765	Addresses capacity limitation in existing system.	2037
46 WW.1	New Sewer Connection on Ruth Dr from Whetstine Ave to Sun St	10	2,380	Addresses capacity limitation estimated by buildout.	2032
46 WW.2	Upsize sewer from Cambell St to 2nd St (diagonal crossing Merritt St)	12	2,281	Addresses capacity limitation estimated by buildout.	2032
52 WW.1	Hassayampa - Upsize Meadowbrook Rd at Butte Canyon Dr	8	2,930	Addresses capacity limitation estimated by buildout.	2032
52 WW.2	Hassayampa - Upsize Meadowbrook Rd from Sherwood Dr to Plaza Dr	15	3,013	Addresses capacity limitation estimated by buildout.	2032
54 WW	Centralization - Sundog Equalization and Plant Decommissioning	--	--	Sundog decommissioning and centralization.	2027
55 WW.1	Centralization - Airport WRF Effluent Pump Station	3	1	Centralization of the sewer system. Effluent pumping to new tank at Watson Lake Park.	2027
55 WW.2	Centralization - Airport WRF Effluent Line to Watson Lake Park	18	8,666	Centralization of the sewer system. Effluent pumping to new tank at Watson Lake Park.	2027

Project #	Description	Diameter/Size (in/mgd)	Length/Qty (ft/#)	Project Justification/Driver	Planning Year
55 WW.3	Centralization - Watson Lake Park Effluent Tank	1.5	1	Centralization of the sewer system. Effluent pumping to new tank at Watson Lake Park.	2027
56 WW.1	Upsize Willow Creek Gravity Sewer Main from Willow Lake Regional Lift Station west to Cottonwood Ln	12	4,967	Addresses capacity limitation estimated by buildout.	2027
56 WW.2	Upsize Willow Creek Gravity Sewer Main from Willow Lake Regional Lift Station west to Cottonwood Ln	15	3,926	Addresses capacity limitation estimated by buildout.	2027
56 WW.3	Upsize Willow Creek Gravity Sewer Main from Willow Lake Regional Lift Station west to Cottonwood Ln	18	1,795	Addresses capacity limitation estimated by buildout.	2027
62 WW.1	Willow Lake Gravity Sewer – Lift Station	4	1	Replace WLR and WLE lift stations.	2027
62 WW.2	Willow Lake Gravity Sewer – Force Main	18	3,050	Replace WLR and WLE lift stations.	2027
62 WW.3	Willow Lake Gravity Sewer	24	6,500	Replace WLR and WLE lift stations.	2027
66 WW.1	Gurley, Sheldon, EZ Street and Roughrider Improvements	8	612	Addresses capacity limitation in existing system	2027
66 WW.2	Gurley, Sheldon, EZ Street and Roughrider Improvements	10	478	Addresses capacity limitation in existing system	2027
66 WW.3	Gurley, Sheldon, EZ Street and Roughrider Improvements	12	644	Addresses capacity limitation in existing system	2027
68 WW	Fair St and Miller Valley Collector Main	15	3,760	Addresses capacity limitation in existing system	2042
70 WW	Peace Land and Gail Gardner Way	10	176	Addresses capacity limitation estimated by buildout.	2032
72 WW	Upsize sewer on Prescott Lakes Pkwy north of Hwy 69	15	1,077	Addresses capacity limitation in existing system during peak flows.	2032
78 WW	Shadow Valley Drive and Archers Path	12	145	Larger diameter needed due to low-slope pipe.	2032
84 WW.1	Centralization - Airport WRF Solids Handling Facility and New Centrifuge			Treat expanded buildout flows and flows previously treated by Sundog	2027
84 WW.2	Centralization - Airport WRF Expansion Phase 2			Treat expanded buildout flows and flows previously treated by Sundog	2027
86 WW.1	Airport Ruger Road Trunk Main Extension	24	2,963	Convey flows from future developments to collection system.	2027
86 WW.2	Airport Ruger Road Trunk Main Extension	30	2,625	Convey flows from future developments to collection system.	2027
87 WW	Yavapai Hills Lift Station	3	1	Lift station rehabilitation.	2027
87 WW	Yavapai Hills Lift Station - Force Main	16	7,781	Lift station rehabilitation.	2032

Project #	Description	Diameter/Size (in/mgd)	Length/Qty (ft/#)	Project Justification/Driver	Planning Year
88 WW.1	Section 32 & 33 Force Main	6	5,000	Convey flows from future developments to collection system.	2032
88 WW.2	Section 32 & 33 Gravity Main	12	4,977	Convey flows from future developments to collection system.	2032
97 WW.1	Yavapai Medical Center - Lift Station	1	1	Convey flows from future developments to collection system.	2042
97 WW.2	Yavapai Medical Center - Force Main	8	1,010	Convey flows from future developments to collection system.	2042
97 WW.3	Yavapai Medical Center - Gravity Main	16	2,650	Convey flows from future developments to collection system.	2042
98 WW	Skyline Sewer Realignment	8	250	Abandon Skyline Lift Station	2027
99 WW	Loma Rica Lift Station Abandonment	8	1,269	Abandon Loma Rica Lift Station	2027
100 WW	Prescott Lakes Parkway Lift Station	0.2	1	Convey flows from future developments to collection system.	2027
101 WW	Timber Ridge #1 Lift Station Rehabilitation	1	1	Upsize existing lift station.	2027
101 WW	Timber Ridge #1 Lift Station Rehabilitation	8	1,469	Upsize existing lift station.	2027
102 WW.1	Deep Well Ranch Trunkline	12	11,991	Convey flows from future developments to collection system.	2037
102 WW.2	Deep Well Ranch Lift Station	1	1	Convey flows from future developments to collection system.	2037
102 WW.3	Deep Well Ranch Force Main	8	2,660	Convey flows from future developments to collection system.	2037
103 WW.1	Storm Ranch Trunkline	12	1,700	Convey flows from future developments to collection system.	2027
103 WW.2	Storm Ranch Force Main	6	2,900	Convey flows from future developments to collection system.	2027

Chapter 6

WASTEWATER SYSTEM CAPITAL IMPROVEMENT PROGRAM

This chapter presents the wastewater system capital improvement program (CIP) for the 2023 Water and Wastewater Model Update Study (2023 Study) for the City of Prescott (City). This chapter includes the following:

- Cost development methodology.
- Unit costs.
- Impact fee service areas.
- Capital improvement projects.
- Future development projects.
- Project correlation with previous studies.

6.1 Overview

The locations and cost estimates of the recommended wastewater system capital improvement projects and the projects required for growth areas are summarized in this chapter. These projects are associated with the City's CIP and Infrastructure Improvement Plan (IIP). The justification for these recommended projects is included in Chapter 5, and fall into the following categories:

- **CIP Projects:** These projects provide additional capacity to address existing deficiencies or to provide capacity for future growth and fall within the 15-year planning horizon (through year 2037).
- **IIP Projects:** These projects include CIP projects that are planned for construction in the next 10 years, and for which there is a sufficient growth component that a portion or all of the project cost can be recovered through impact fees. Some IIP projects are defined by the City to address specific needs that are not capacity related and are therefore not included in the CIP projects.
- **Future Development Projects:** These projects define the major interceptors, collectors and lift stations on undeveloped lands within the City's planning area. The plans for this infrastructure are at a conceptual level and may change significantly as specific development plans are prepared. These projects would occur beyond year 2037 and are therefore not included in the CIP recommendations, though they are discussed in this chapter.

Appendix 6A, Figure 6.A shows the capital improvement and future development projects in the City's service area that have been identified in this study.

6.2 Cost Development Methodology

Cost estimates have been developed for the wastewater capital improvement projects identified in Chapter 5. These estimates were prepared in accordance with the guidelines of the Association for the Advancement of Cost Engineers (AACE) International for a Class 5 estimate unless otherwise noted. Table 6.1 summarizes the AACE International cost estimating classifications, the level of project definition (percent of design), uses, appropriate cost estimating methodologies, and the expected accuracy of each class. Design work would need to be undertaken to obtain more precise cost estimates.

Table 6.1 AACE International Cost Estimating Classification Summary

Estimate Class	Maturity Level of Project Definition Deliverables - (Level of Engineering Design)	End Use	Typical Cost Estimating Methodology Used	Expected Accuracy Range (Low/High)
Class 5	0% to 2%	Conceptual screening	Capacity factored, parametric models, judgment or analogy	L: -20% to -50% H: +30% to +100%
Class 4	1% to 15%	Study or feasibility	Equipment factored or parametric models	L: -15% to -30% H: +20% to +50%
Class 3	10% to 40%	Budget authorization or control	Semi-detailed unit costs with assembly level line items	L: -10% to -20% H: +10% to +30%
Class 2	30% to 75%	Control or bid/tender	Detailed unit cost with forced detailed take-off	L: -5% to -10% H: +5% to +20%
Class 1	65% to 100%	Check estimate or bid/tender	Detailed unit cost with detailed take-off	L: -3% to -10% H: +3% to +15%

6.3 Unit Costs

Unit costs were developed for the recommended water projects based on R.S. Means and other unit cost sources, unless otherwise noted. The July 2022 Engineering News Record Construction Cost Index (ENR CCI) 20-city value of 13,168 was used to scale up previously developed unit costs.

Multipliers for construction overhead and profit (16 percent), sales tax (65 percent of applicable costs at 8.35 percent), bidding contingencies (30 percent), and general conditions (10 percent) were then added to prepare unit construction costs. After discussion with the City, an additional 30 percent multiplier was applied to unit costs to better match the volatile market rates at the time this study was performed. When multiplied by the capacity, quantity, or size of infrastructure, the unit construction cost represents what the City should expect to pay a contractor to construct the project. The City will have other expenses to complete the project including design, inspection, project management, and contingencies. A multiplier of 1.4 was used to represent these additional costs and applied to the unit construction cost to obtain a total project cost for each project.

Table 6.2 summarizes the wastewater infrastructure unit costs for the 2023 Study. The wastewater infrastructure unit cost detail is included in Appendix 6B.

Table 6.2 Wastewater Infrastructure Unit Costs

Infrastructure	Unit Construction Cost(1)
Force Mains	**($/lf)**
4-in	$215
6-in	$243
8-in	$280
10-in	$355
12-in	$420
14-in	$503
16-in	$608
18-in	$730
20-in	$824
Gravity Sewers	**($/lf)**
8-in PVC	$300
10-in PVC	$362
12-in PVC	$426
15-in PVC	$524
18-in PVC	$656
24-in PVC	$933
27-in PVC	$1,091
30-in VCP	$826
36-in VCP	$983
42-in VCP	$1,268
48-in Concrete	$1,410
Lift Stations	**($M)**
0.2 mgd	$1.0
0.5 mgd	$1.1
0.8 mgd	$1.2
3.0 mgd	$3.1
6.0 mgd	$4.6
9.0 mgd	$6.2
12.0 mgd	$7.0
15.0 mgd	$7.9

Notes:
(1) Engineering News Record Construction Cost Index (ENR CCI) = 13,168 (20 Cities Index, July 2022).
Abbreviations:
in = inches; lf = linear feet; PVC = polyvinyl chloride; VCP = vitrified clay pipe; mgd = million gallons per day; $M = millions of dollars

6.4 Impact Fee Service Areas

The IIP Service Areas developed in the 2013 Study, then revised in 2018, were modified to include the growth areas identified for the 2023 Study (Figure 2.1). They were also simplified to show a single IIP service area for the wastewater system because the City has adopted a centralized wastewater collection and treatment approach. The wastewater IIP service areas are shown on Figure 6.1.

Future flow projections were used to allocate the portion of new infrastructure cost for new developments (fees) with existing customers (rates). For each infrastructure project, the ratio of upstream flows from existing customers and projected new developments was analyzed. The resulting split between fees and rates are shown in Table 6.3.

6.5 Capital Improvement Projects

Table 6.3 summarizes the wastewater system capital projects needed to address system deficiencies and serve future growth. Table 6.3 includes the capacity, justification, cost, and an allocation between existing customers and future development. The project numbers correspond to the numbering convention adopted in the 2013 and 2018 Studies. Appendix 6A contains an overview of the locations of each project in the city and detailed project maps for each CIP project.

Table 6.4 summarizes the wastewater system construction and project costs for each five-year planning period. The total project costs for wastewater infrastructure required over the next fifteen years is $189.2 million. Cost estimates for the Airport Water Reclamation Facility (WRF) upgrades and Sundog Wastewater Treatment Plant (WWTP) decommissioning were provided by the City.

The 2020 Sewer Connections Study resulted in capital improvement recommendations to provide sewer service to unsewered areas within the City that are provided water service. After discussion with the city, it was agreed to continue analysis of these areas but to not include them as CIP projects because these areas are not likely to sewered for some time due to the high cost of serving these areas with wastewater collection service.

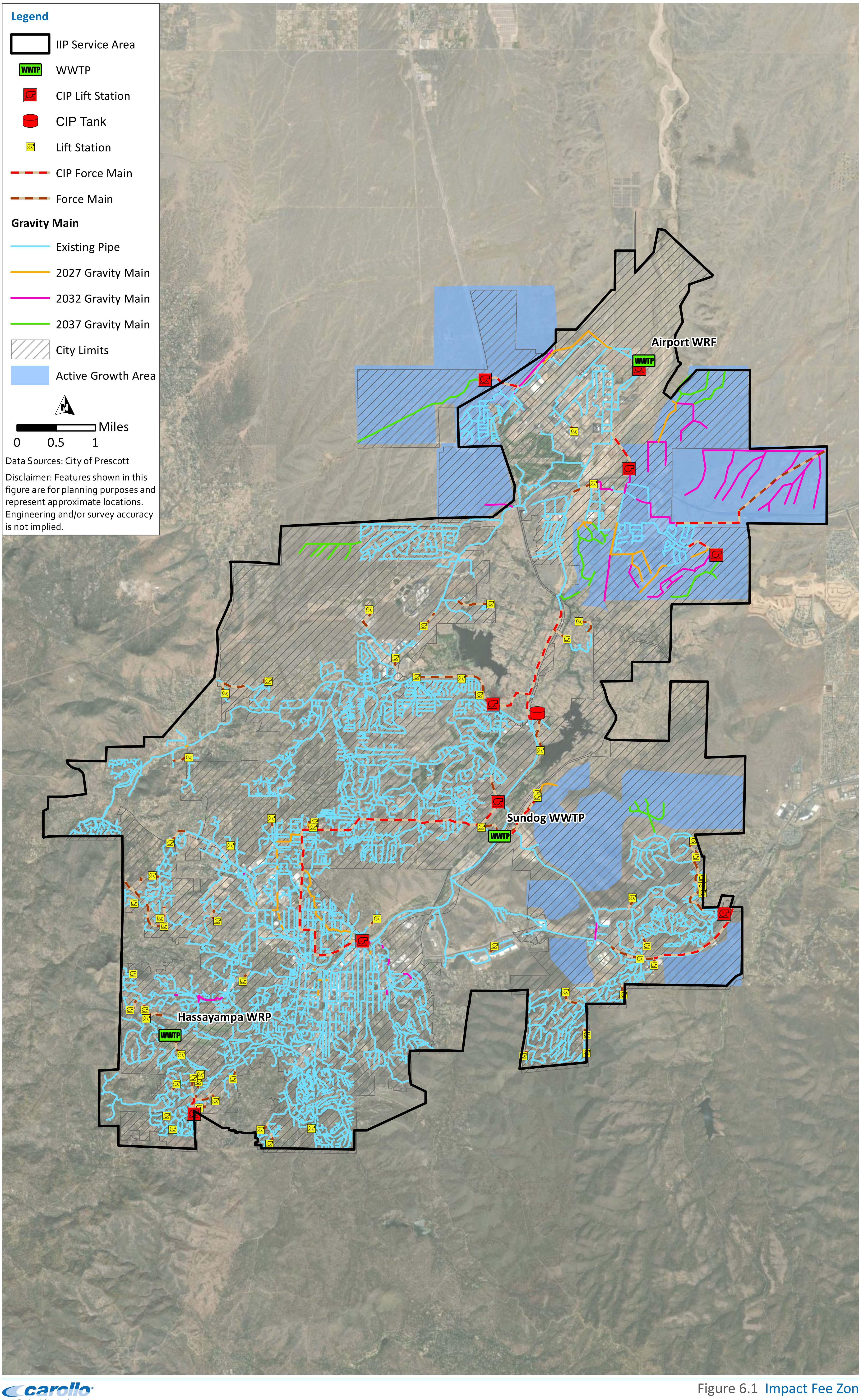

Figure 6.1 Impact Fee Zone

Table 6.3 Wastewater System Capital Project Summary

Facility Type	Project #	COP Project Name	Description	Diameter/ Size (in/mgd)	Length/ Qty (ft/#)	Unit Construction Cost	Construction Cost	Project Cost	Project Justification/Driver	IIP (Y/N)	Service Area	% Fees	% Rates	Planning Year
Lift Station	26 WW	Sundog Trunk Main Phase C	Sundog Trunk Main Phase C - Lift Station	9	1	$6,174,000	$6,174,000	$8,644,000	Addresses capacity limitation estimated by buildout.	Y	A	35	65	2023
Force Main	26 WW	Sundog Trunk Main Phase C	Sundog Trunk Main Phase C - Force Main	18	27,892	$730	$20,362,000	$28,507,000	Addresses capacity limitation estimated by buildout.	Y	A	35	65	2023
Lift Station	32 WW	Granite Dells Ranch Development (DA) Wastewater Requirements - Airport East Regional Lift Station and Pipelines	Granite Dells Development - New Lift Station from Hwy 89/Sideroad to Granite Dells Development	1	1	$1,800,000	$1,800,000	$2,340,000	Serve growth area	Y	A	100	0	2027
Force Main	32 WW	Granite Dells Ranch Development (DA) Wastewater Requirements - Airport East Regional Lift Station and Pipelines	Granite Dells Development - New Sewer Force Main from Hwy 89/Sideroad to Granite Dells Development	10	2,430	$355	$862,000	$1,207,000	Serve growth area	Y	A	100	0	2027
Gravity Main	36 WW.1	Montezuma and Gurley Street Improvements or Montezuma Trunk Main Upsizing	Montezuma and Gurley Street Improvements	8	513	$300	$154,000	$216,000	Addresses capacity limitation estimated by buildout.	Y	A	25	75	2032
Gravity Main	36 WW.2	Montezuma and Gurley Street Improvements or Montezuma Trunk Main Upsizing	Montezuma and Gurley Street Improvements	10	172	$362	$62,000	$87,000	Addresses capacity limitation estimated by buildout.	Y	A	25	75	2032
Gravity Main	36 WW.3	Montezuma and Gurley Street Improvements or Montezuma Trunk Main Upsizing	Montezuma and Gurley Street Improvements	12	92	$426	$39,000	$55,000	Addresses capacity limitation estimated by buildout.	Y	A	25	75	2032
Gravity Main	36 WW.4	Montezuma and Gurley Street Improvements or Montezuma Trunk Main Upsizing	Montezuma and Gurley Street Improvements	18	2,347	$656	$1,540,000	$2,156,000	Addresses capacity limitation estimated by buildout.	Y	A	25	75	2032
Gravity Main	38 WW.1	Hassayampa Sewer Trunk Main Upsizing	Hassayampa Trunk Main - Sonora Dr to Sundog Phase C Lift Station	18	3,196	$656	$2,098,000	$2,937,000	Addresses capacity limitation estimated by buildout.	Y	A	25	75	2027
Gravity Main	38 WW.2	Hassayampa Sewer Trunk Main Upsizing	Hassayampa Trunk Main - Oregon Ave to Miller Valley Rd	15	5,618	$524	$2,945,000	$4,123,000	Addresses capacity limitation estimated by buildout.	Y	A	25	75	2027
Gravity Main	38 WW.3	Hassayampa Sewer Trunk Main Upsizing	Hassayampa Trunk Main - Gurly St to Oregon Ave	15	1,445	$524	$758,000	$1,061,000	Addresses capacity limitation estimated by buildout.	Y	A	25	75	2027
Gravity Main	44 WW.1	5th Street, 6th Street and Hillside Sewer Main Upsize	5th Street, 6th Street and Hillside Sewer Main Upsize	15	1,867	$524	$979,000	$1,371,000	Addresses capacity limitation in existing system.	N	A	10	90	2037
Gravity Main	44 WW.2	5th Street, 6th Street and Hillside Sewer Main Upsize	5th Street, 6th Street and Hillside Sewer Main Upsize	18	765	$656	$502,000	$703,000	Addresses capacity limitation in existing system.	N	A	10	90	2037
Gravity Main	46 WW.1	Sun Street Sewer Main Upgrade	New Sewer Connection on Ruth Dr from Whetstine Ave to Sun St	10	2,380	$362	$863,000	$1,208,000	Addresses capacity limitation estimated by buildout.	N	A	0	100	2032
Gravity Main	46 WW.2	Sun Street Sewer Main Upgrade	Upsize sewer from Cambell St to 2nd St (diagonal crossing Merritt St)	12	2,281	$426	$972,000	$1,361,000	Addresses capacity limitation estimated by buildout.	N	A	0	100	2032
Gravity Main	52 WW.1	Thumb Butte Rd Upsizing	Hassayampa - Upsize Meadowbrook Rd at Butte Canyon Dr	8	2,930	$300	$879,000	$1,231,000	Addresses capacity limitation estimated by buildout.	N	A	0	100	2032
Gravity Main	52 WW.2	Thumb Butte Rd Upsizing	Hassayampa - Upsize Meadowbrook Rd from Sherwood Dr to Plaza Dr	15	3,013	$524	$1,580,000	$2,212,000	Addresses capacity limitation estimated by buildout.	N	A	0	100	2032
WWTP	54 WW	Centralization - Sundog Equalization and Plant Decommissioning	Centralization - Sundog Equalization and Plant Decommissioning	--	--	--	--	$2,300,000	Sundog decommissioning and centralization.	Y	A	20	80	2027
Lift Station	55 WW.1	Centralization - Effluent Tank and Pipeline	Centralization - Airport WRF Effluent Pump Station	3	1	$3,144,000	$3,144,000	$4,402,000	Effluent pumping to new tank at Watson Lake Park.	Y	A	20	80	2027
Force Main	55 WW.2	Centralization - Effluent Tank and Pipeline	Centralization - Airport WRF Effluent Line to Watson Lake Park	18	8,666	$730	$6,326,000	$8,856,000	Effluent pumping to new tank at Watson Lake Park.	Y	A	20	80	2027
Tank	55 WW.3	Centralization - Effluent Tank and Pipeline	Centralization - Watson Lake Park Effluent Tank	1.5	1	$2,728,000	$2,728,000	$3,819,000	Effluent pumping to new tank at Watson Lake Park.	Y	A	20	80	2027

Table 6.3 Wastewater System Capital Project Summary (continued)

Facility Type	Project #	COP Project Name	Description	Diameter/ Size (in/mgd)	Length/ Qty (ft/#)	Unit Construction Cost	Construction Cost	Project Cost	Project Justification/Driver	IIP (Y/N)	Service Area	% Fees	% Rates	Planning Year
Gravity Main	56 WW.1	Willow Creek Trunk Main Upsize	Upsize Willow Creek Gravity Sewer Main from Willow Lake Regional Lift Station west to Cottonwood Ln	12	4,967	$426	$2,117,000	$2,964,000	Addresses capacity limitation estimated by buildout.	N	A	25	75	2027
Gravity Main	56 WW.2	Willow Creek Trunk Main Upsize	Upsize Willow Creek Gravity Sewer Main from Willow Lake Regional Lift Station west to Cottonwood Ln	15	3,926	$524	$2,058,000	$2,881,000	Addresses capacity limitation estimated by buildout.	N	A	25	75	2027
Gravity Main	56 WW.3	Willow Creek Trunk Main Upsize	Upsize Willow Creek Gravity Sewer Main from Willow Lake Regional Lift Station west to Cottonwood Ln	18	1,795	$656	$1,178,000	$1,649,000	Addresses capacity limitation estimated by buildout.	N	A	25	75	2027
Lift Station	62 WW.1	Willow Lake Gravity Sewer	Willow Lake Gravity Sewer - Lift Station	4	1	$3,463,200	$3,463,000	$4,848,000	Replace WLR and WLE lift stations.	Y	A	25	75	2027
Force Main	62 WW.2	Willow Lake Gravity Sewer	Willow Lake Gravity Sewer - Force Main	18	3,050	$730	$2,227,000	$3,118,000	Replace WLR and WLE lift stations.	Y	A	25	75	2027
Gravity Main	62 WW.3	Willow Lake Gravity Sewer	Willow Lake Gravity Sewer	24	6,500	$933	$6,066,000	$8,492,000	Replace WLR and WLE lift stations.	Y	A	25	75	2027
Gravity Main	66 WW.1	Gurley, Sheldon, EZ Street and Roughrider Improvements	Gurley, Sheldon, EZ Street and Roughrider Improvements	8	612	$300	$184,000	$258,000	Addresses capacity limitation in existing system	N	A	0	100	2027
Gravity Main	66 WW.2	Gurley, Sheldon, EZ Street and Roughrider Improvements	Gurley, Sheldon, EZ Street and Roughrider Improvements	10	478	$362	$173,000	$242,000	Addresses capacity limitation in existing system	N	A	0	100	2027
Gravity Main	66 WW.3	Gurley, Sheldon, EZ Street and Roughrider Improvements	Gurley, Sheldon, EZ Street and Roughrider Improvements	12	644	$426	$274,000	$384,000	Addresses capacity limitation in existing system	N	A	0	100	2027
Gravity Main	68 WW	Fair St and Miller Valley Collector Main	Fair St and Miller Valley Collector Main	15	3,760	$524	$1,971,000	$2,759,000	Addresses capacity limitation in existing system	N	A	0	100	2042
Gravity Main	70 WW	Peace Lane and Gail Gardner Way	Peace Land and Gail Gardner Way	10	176	$362	$64,000	$90,000	Addresses capacity limitation estimated by buildout.	N	A	0	100	2032
Gravity Main	72 WW	Prescott Lakes Parkway Sewer Upsizing	Upsize sewer on Prescott Lakes Pkwy north of Hwy 69	15	1,077	$524	$565,000	$791,000	Addresses capacity limitation in existing system during peak flows.	Y	A	25	75	2032
Gravity Main	78 WW	Shadow Valley Dr and Archers Path	Shadow Valley Drive and Archers Path	12	145	$426	$62,000	$87,000	Larger diameter needed due to low slope pipe.	N	A	0	100	2032
WWTP	84 WW.1	Centralization	Centralization - Airport WRF Solids Handling Facility and New Centrifuge	--	--	--	--	$13,000,000	Treat expanded buildout flows and flows previously treated by Sundog	Y	A	20	80	2027
WWTP	84 WW.2	Centralization	Centralization - Airport WRF Expansion Phase 2	--	--	--	--	$25,000,000	Treat expanded buildout flows and flows previously treated by Sundog	Y	A	20	80	2027
Gravity Main	86 WW.1	Ruger Road Phase 2 and Phase 3	Airport Ruger Road Trunk Main Extension	24	2,963	$933	$2,765,000	$3,871,000	Convey flows from future developments to collection system.	Y	A	90	10	2027
Gravity Main	86 WW.2	Ruger Road Phase 2 and Phase 3	Airport Ruger Road Trunk Main Extension	30	2,625	$826	$2,169,000	$3,037,000	Convey flows from future developments to collection system.	Y	A	90	10	2027
Lift Station	87 WW	Yavapai Hills #1 Lift Station Rehab	Yavapai Hills Lift Station	3	1	$3,144,000	$3,144,000	$4,402,000	Lift station rehabilitation.	Y	A	60	40	2027
Force Main	87 WW	Yavapai Hills Lift Station Force Main	Yavapai Hills Lift Station - Force Main	16	7,781	$608	$4,730,000	$6,622,000	Lift station rehabilitation.	Y	A	60	40	2032
Force Main	88 WW.1	Section 32 & 33 Force Main and Gravity Main	Section 32 & 33 Force Main	8	5,000	$280	$1,401,000	$1,961,000	Convey flows from future developments to collection system.	Y	B	100	0	2032
Gravity Main	88 WW.2	Section 32 & 33 Force Main and Gravity Main	Section 32 & 33 Gravity Main	12	4,977	$426	$2,121,000	$2,969,000	Convey flows from future developments to collection system	Y	B	100	0	2032

Table 6.3 Wastewater System Capital Project Summary (continued)

Facility Type	Project #	COP Project Name	Description	Diameter/ Size (in/mgd)	Length/ Qty (ft/#)	Unit Construction Cost	Construction Cost	Project Cost	Project Justification/Driver	IIP (Y/N)	Service Area	% Fees	% Rates	Planning Year
Lift Station	97 WW.1	Yavapai Medical Center Lift Station and Sewer Main	Yavapai Medical Center - Lift Station	1	1	$1,800,000	$1,800,000	$2,340,000	Convey flows from future developments to collection system.	Y	A	100	0	2042
Force Main	97 WW.2	Yavapai Medical Center Lift Station and Sewer Main	Yavapai Medical Center - Force Main	8	1,010	$280	$283,000	$396,000	Convey flows from future developments to collection system.	Y	A	100	0	2042
Gravity Main	97 WW.3	Yavapai Medical Center Lift Station and Sewer Main	Yavapai Medical Center - Gravity Main	16	2,650	$576	$1,526,000	$2,136,000	Convey flows from future developments to collection system.	Y	A	100	0	2042
Gravity Main	98 WW	Skyline Sewer Realignment	Skyline Sewer Realignment	8	250	$600	$150,000	$210,000	Abandon Skyline Lift Station	Y	A	0	100	2027
Gravity Main	99 WW	Loma Rica Lift Station Abandonments	Loma Rica Lift Station Abandonment	8	1,269	$360	$457,000	$640,000	Abandon Loma Rica Lift Station	Y	A	0	100	2027
Lift Station	100 WW	Prescott Lakes Parkway Lift Station	Prescott Lakes Parkway Lift Station	0.2	1	$974,000	$974,000	$1,364,000	Convey flows from future developments to collection system.	Y	A	100	0	2027
Lift Station	101 WW	Timber Ridge #1 Lift Station Rehab	Timber Ridge #1 Lift Station Rehabilitation	1	1	$1,800,000	$1,800,000	$2,340,000	Upsize existing lift station.	Y	A	0	100	2027
Force Main	101 WW	Timber Ridge #1 Lift Station Rehab	Timber Ridge #1 Lift Station Rehabilitation	8	1,469	$280	$412,000	$577,000	Upsize existing lift station.	Y	A	0	100	2027
Gravity Main	102 WW.1	Deep Well Ranch Trunkline and Lift Station	Deep Well Ranch Trunkline	12	11,991	$426	$5,110,000	$7,154,000	Convey flows from future developments to collection system.	Y	A	100	0	2037
Lift Station	102 WW.2	Deep Well Ranch Trunkline and Lift Station	Deep Well Ranch Lift Station	1	1	$1,800,000	$1,800,000	$2,340,000	Convey flows from future developments to collection system.	Y	A	100	0	2037
Force Main	102 WW.3	Deep Well Ranch Trunkline and Lift Station	Deep Well Ranch Force Main	8	2,660	$280	$745,000	$1,043,000	Convey flows from future developments to collection system.	Y	A	100	0	2037
Gravity Main	103 WW.1	Storm Ranch Trunkline and Force Main	Storm Ranch Trunkline	12	1,700	$126	$214,000	$300,000	Convey flows from future developments to collection system.	Y	A	100	0	2027
Force Main	103 WW.2	Storm Ranch Trunkline and Force Main	Storm Ranch Force Main	6	2,900	$29	$83,000	$116,000	Convey flows from future developments to collection system.	Y	A	100	0	2027

Note:
(1) Engineering News Record Construction Cost Index (ENR CCI) = 13,168 (20 Cities Index, July 2022).
Abbreviations:
WLE = Willow Lake Estates; WLR = Willow Lake Regional

Table 6.4 Wastewater Infrastructure Cost Summary

Project Cost ($)	2023-2027	2028-2032	2033-2037	2038 - 2042	Total Project Cost
Gravity Sewer	33,049,000	12,463,000	9,228,000	4,895,000	59,635,000
Force Main	42,381,000	8,583,000	1,043,000	396,000	52,403,000
Lift Station	28,340,000	0	2,340,000	2,340,000	33,020,000
Tank	3,819,000	-	-	-	3,819,000
Treatment Plant	40,300,000	-	-	-	40,300,000
Total Project Cost ($)	**147,889,000**	**21,046,000**	**12,611,000**	**7,631,000**	**189,177,000**

6.6 Future Development Projects

New pipes and lift stations are required to serve growth areas. The growth area lift stations include:

- Arizona Eco Development (AED), Granite Dells Ranch (commercial), and Granite Dells Estates – New developments in the Northeastern region of the Prescott.
- Deep Well Ranch – New development in Northwestern region of Prescott.
- Yavapai Regional Medical Center – Area in Northwestern Prescott, surrounded by Deep Well Ranch.
- Storm Ranch – New development in Southeastern Prescott, north of Yavapai Hills.

Figure 6.2 shows a conceptual layout for infrastructure to serve future developments in these growth areas. Costs for these projects are expected to be paid for by developers and are, therefore, not included in the City's CIP list.

6.7 Project Correlation with Previous Studies

The City's 2008 Wastewater Collection System Model contained recommendations for pipes and lift stations that were not carried forward in the 2013 and 2018 Studies.

As part of the 2023 Study, the 2018 Study recommendations were reviewed and assessed to document the projects that were not carried forward and identify the reason for the change. Table 6.5 summarizes the four projects that were identified in the 2018 Study that were either no longer required or addressed with an alternative project.

Table 6.5 2023 Study Wastewater CIP Tracking – Gravity Mains

Project Name	Description	Included in 2018 Study (Y/N)	Included in 2023 Study (Y/N)	Project Modification Explanation
32 WW	Granite Dells Development – New Lift Station, Force Main, and Gravity Mains	Y	N	Project completed. Existing infrastructure integrated into model.
40 WW	City Lights – replace 8-in sewer north of Virginia St	Y	N	Model has been updated to reflect completed improvements.
44 WW	Upsize sewers on Fifth St, Sixth St, Hillside Dr from Sundog Trunk Sewer to Fifth St	Y	Y	Project carried forward as 44 WW as part of 2023 update.
56 WW	Upsize Willow Creek trunk main from Willow Lake Regional Lift Station west to Cottonwood Ln	Y	Y	Project carried forward as 56 WW as part of 2023 update.

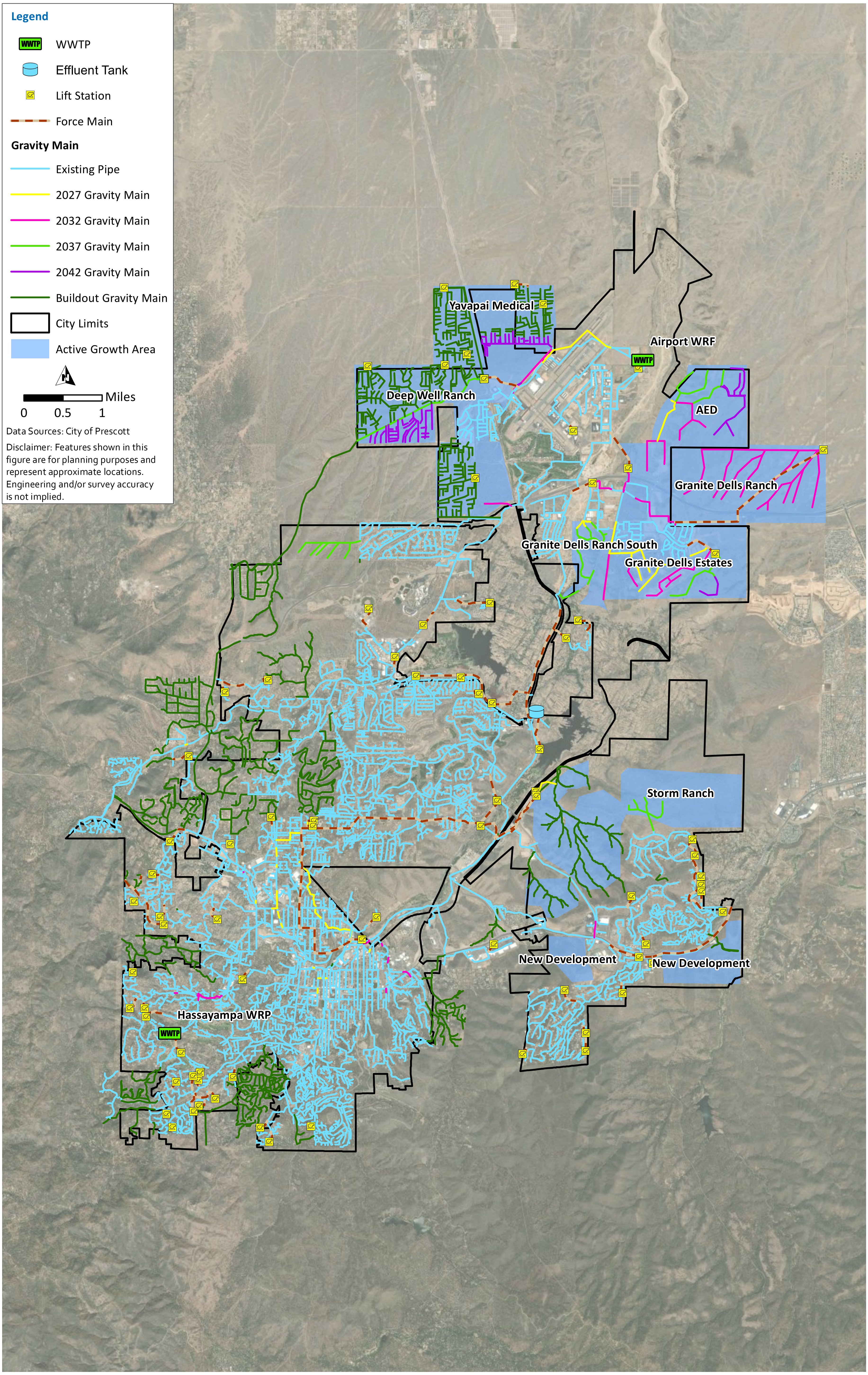

Figure 6.2 Active Growth Areas Conceptual Infrastructure Layout

Appendix 2A

WASTEWATER MODEL DIURNAL PATTERNS

Table 2A.1 Wastewater Model Diurnal Patterns

	Time	Banning Creek	City Lights	Copper Basin	Forest Trails	Hassayampa 1	Hassayampa 2	Main VA	North Force Main	Pinion Oaks	Prescott Heights	Prescott Lakes Parkway	Robinson
Weekday	0:00	0.84	0.59	0.84	0.52	0.65	0.88	0.72	0.71	0.78	0.68	0.71	0.62
	1:00	0.71	0.53	0.78	0.62	0.56	0.85	0.63	0.64	0.65	0.61	0.71	0.54
	2:00	0.66	0.48	0.74	0.33	0.47	0.85	0.55	0.50	0.53	0.56	0.59	0.50
	3:00	0.65	0.44	0.74	0.35	0.46	0.87	0.52	0.48	0.48	0.54	0.67	0.47
	4:00	0.68	0.46	0.74	0.47	0.50	0.82	0.53	0.45	0.50	0.55	0.53	0.53
	5:00	0.85	0.52	0.79	0.48	0.51	0.85	0.54	0.49	0.43	0.62	0.79	0.59
	6:00	0.99	0.88	0.91	0.57	0.69	1.01	0.66	0.55	0.52	0.81	0.71	0.79
	7:00	1.12	1.19	1.07	0.91	1.06	1.08	0.90	0.65	0.74	1.03	0.92	0.98
	8:00	1.17	1.43	1.16	1.24	1.29	1.14	1.14	0.92	1.10	1.25	1.09	1.14
	9:00	1.19	1.46	1.19	1.58	1.59	1.17	1.27	1.13	1.39	1.35	1.15	1.23
	10:00	1.17	1.44	1.17	1.63	1.76	1.15	1.35	1.20	1.59	1.46	1.30	1.37
	11:00	1.08	1.34	1.16	1.57	1.62	1.13	1.36	1.44	1.47	1.36	1.25	1.30
	12:00	1.14	1.40	1.10	1.50	1.38	0.98	1.34	1.54	1.35	1.22	1.35	1.28
	13:00	1.12	1.38	1.03	1.47	1.22	1.06	1.27	1.42	1.27	1.22	1.20	1.20
	14:00	1.08	1.19	1.08	1.37	1.08	0.90	1.23	1.46	1.15	1.16	1.22	1.19
	15:00	1.05	1.24	1.05	1.16	1.00	0.98	1.17	1.35	1.12	1.15	1.17	1.15
	16:00	1.06	1.17	1.06	1.21	0.99	1.02	1.10	1.24	1.09	1.09	1.17	1.09
	17:00	1.09	1.16	1.09	1.10	1.06	0.98	1.14	1.18	1.09	1.10	1.16	1.18
	18:00	1.10	1.09	1.11	1.14	1.06	1.06	1.17	1.16	1.15	1.16	1.13	1.25
	19:00	1.09	1.18	1.13	1.15	1.08	1.03	1.20	1.22	1.24	1.16	1.03	1.41
	20:00	1.11	1.01	1.08	0.96	1.12	1.05	1.19	1.18	1.22	1.08	1.20	1.31
	21:00	1.08	0.92	1.08	1.08	1.06	1.08	1.11	1.09	1.17	1.02	1.04	1.12
	22:00	1.02	0.83	1.01	0.96	0.95	1.12	1.02	1.10	1.03	0.97	1.05	0.99
	23:00	0.94	0.66	0.92	0.65	0.84	0.92	0.88	0.91	0.94	0.85	0.85	0.76

	Time	Banning Creek	City Lights	Copper Basin	Forest Trails	Hassayampa 1	Hassayampa 2	Main VA	North Force Main	Pinion Oaks	Prescott Heights	Prescott Lakes Parkway	Robinson
Weekend	0:00	0.81	0.47	0.86	0.40	0.58	0.78	0.78	0.70	0.67	0.74	0.85	0.68
	1:00	0.69	0.40	0.78	0.66	0.51	0.80	0.66	0.59	0.68	0.65	0.49	0.59
	2:00	0.69	0.34	0.79	0.22	0.43	0.90	0.60	0.59	0.56	0.61	0.65	0.57
	3:00	0.66	0.27	0.74	0.73	0.40	0.83	0.54	0.70	0.48	0.58	0.78	0.53
	4:00	0.65	0.30	0.78	0.53	0.40	0.74	0.54	0.46	0.49	0.57	0.46	0.50
	5:00	0.72	0.32	0.76	0.48	0.39	0.85	0.53	0.43	0.48	0.62	0.61	0.54
	6:00	0.87	0.40	0.81	0.55	0.47	0.76	0.58	0.51	0.50	0.70	0.65	0.67
	7:00	0.98	0.96	1.00	0.51	0.83	0.84	0.70	0.58	0.64	0.83	0.80	0.83
	8:00	1.10	1.37	1.13	1.24	1.12	1.03	0.95	0.72	0.91	1.03	1.04	1.07
	9:00	1.17	1.67	1.23	1.88	1.43	1.03	1.19	1.08	1.28	1.25	1.05	1.29
	10:00	1.17	1.68	1.25	1.70	1.63	1.20	1.38	1.18	1.53	1.62	1.33	1.49
	11:00	1.15	1.72	1.24	1.79	1.56	1.18	1.46	1.28	1.61	1.46	1.42	1.42
	12:00	1.14	1.61	1.16	1.64	1.37	0.85	1.43	1.66	1.40	1.37	1.33	1.50
	13:00	1.18	1.49	1.14	1.35	1.15	1.20	1.36	1.59	1.31	1.30	1.16	1.27
	14:00	1.17	1.33	1.10	1.32	1.22	1.22	1.28	1.51	1.28	1.17	1.26	1.19
	15:00	1.12	1.32	1.06	1.29	1.38	1.18	1.24	1.43	1.12	1.09	1.24	1.13
	16:00	1.08	1.24	1.08	1.09	1.36	1.12	1.13	1.39	1.17	1.13	1.26	1.14
	17:00	1.13	1.09	1.06	1.11	1.34	1.04	1.17	1.32	1.14	1.10	1.07	1.21
	18:00	1.13	1.07	1.06	1.07	1.36	1.15	1.16	1.32	1.11	1.16	1.19	1.21
	19:00	1.12	1.12	1.09	0.96	1.36	1.12	1.17	1.18	1.24	1.11	1.14	1.16
	20:00	1.11	1.16	1.02	0.88	1.21	1.08	1.18	1.10	1.24	1.06	0.99	1.20
	21:00	1.14	1.07	1.02	0.95	0.99	1.12	1.11	1.00	1.16	1.00	1.10	1.06
	22:00	1.08	0.88	0.93	0.94	0.83	0.95	0.98	0.89	1.07	0.99	1.19	0.93
	23:00	0.97	0.72	0.90	0.73	0.71	1.03	0.88	0.77	0.94	0.86	0.94	0.82

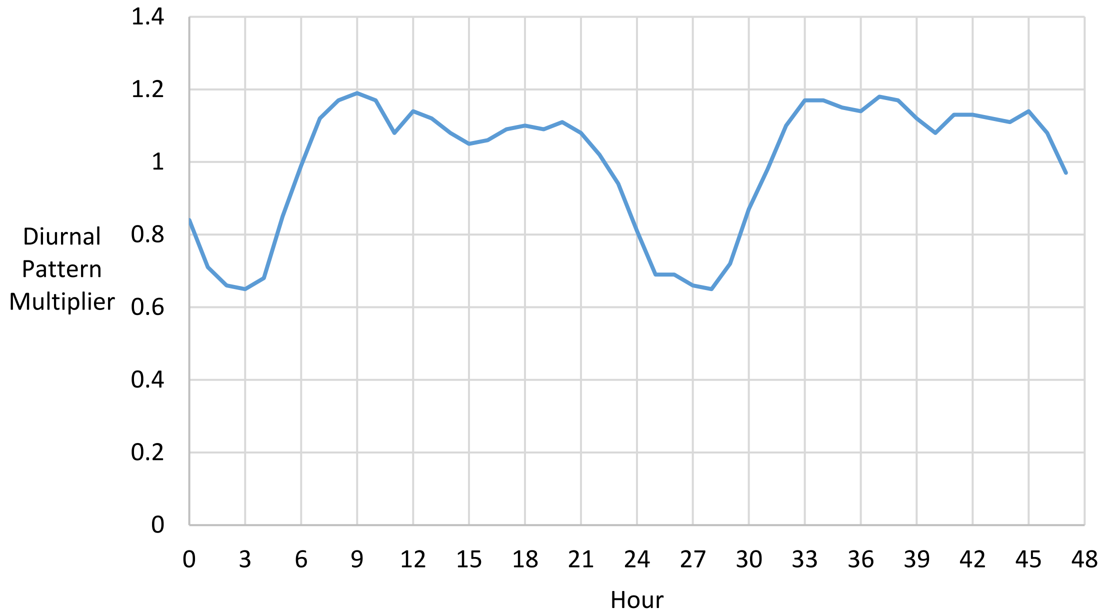

Figure 2A.1 Banning Creek

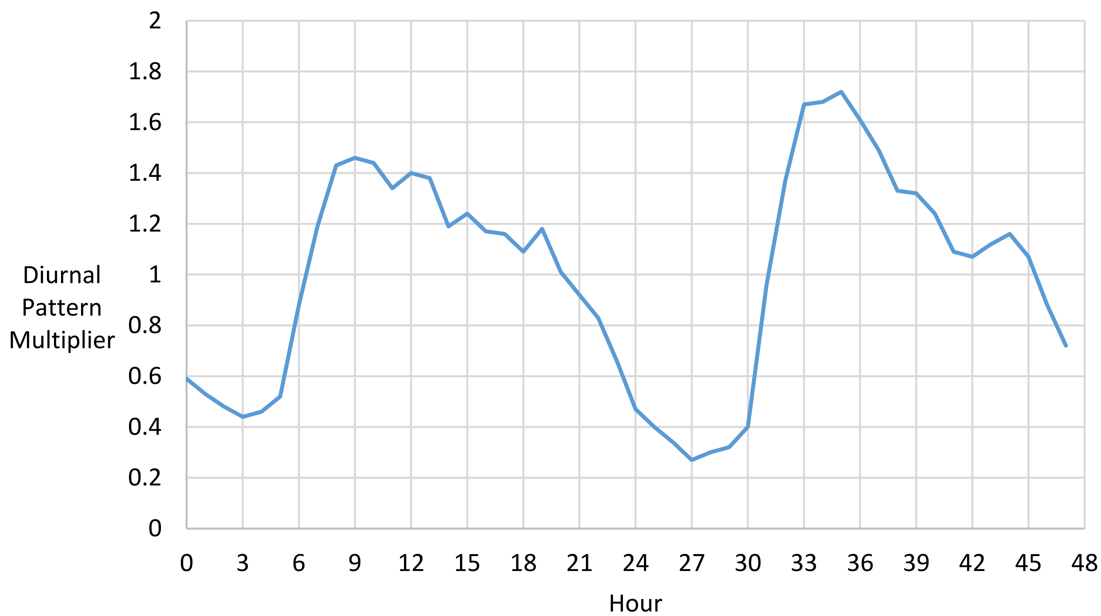

Figure 2A.2 City Lights

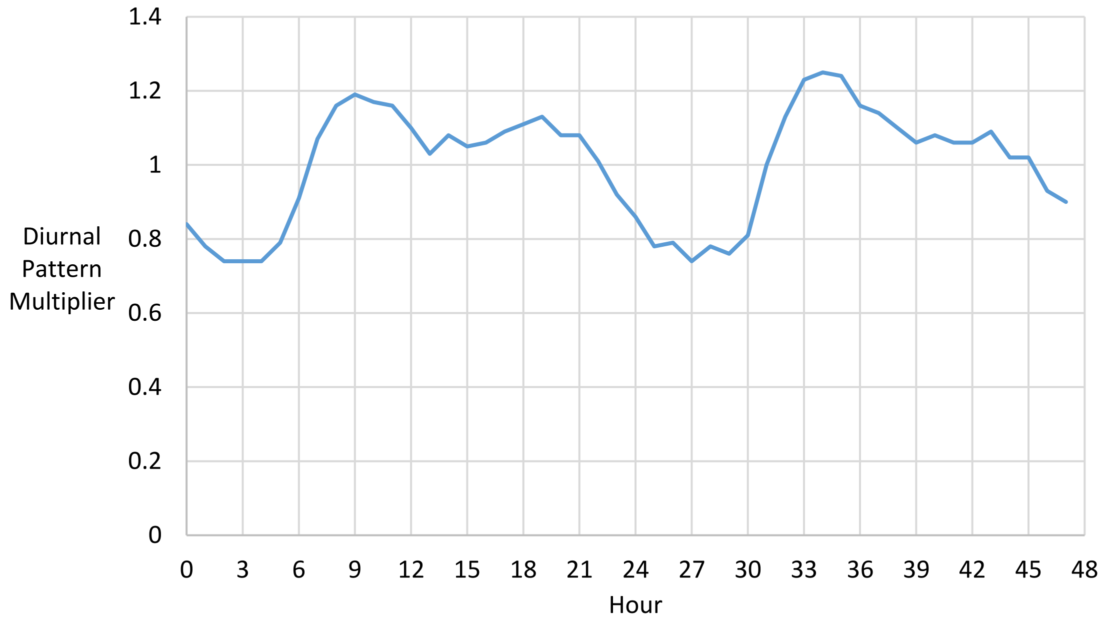

Figure 2A.3 Copper Basin

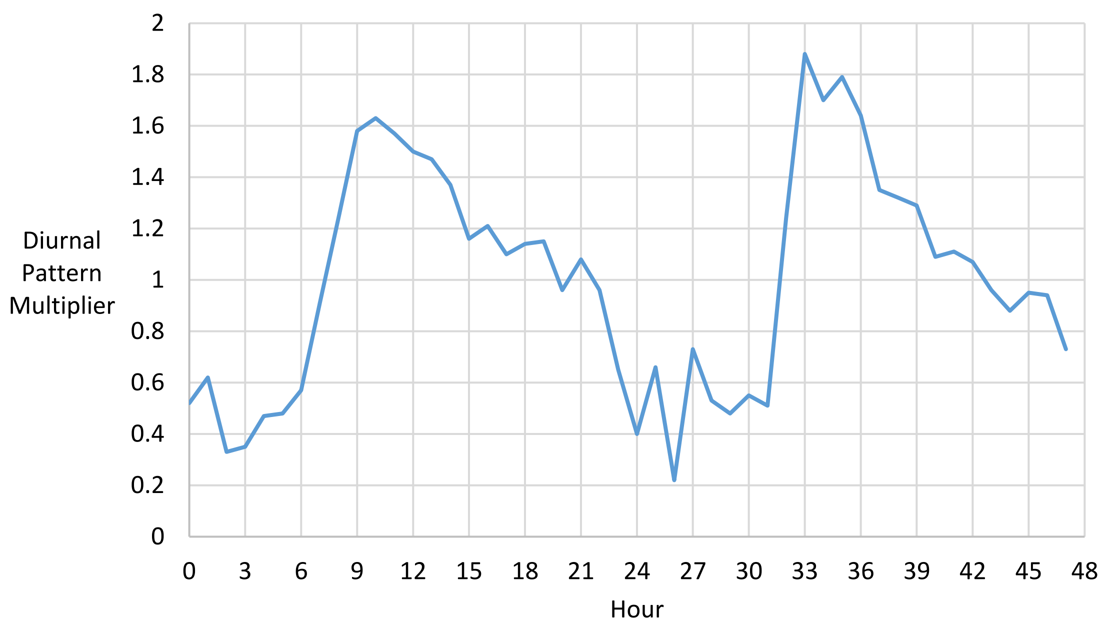

Figure 2A.4 Forest Trails

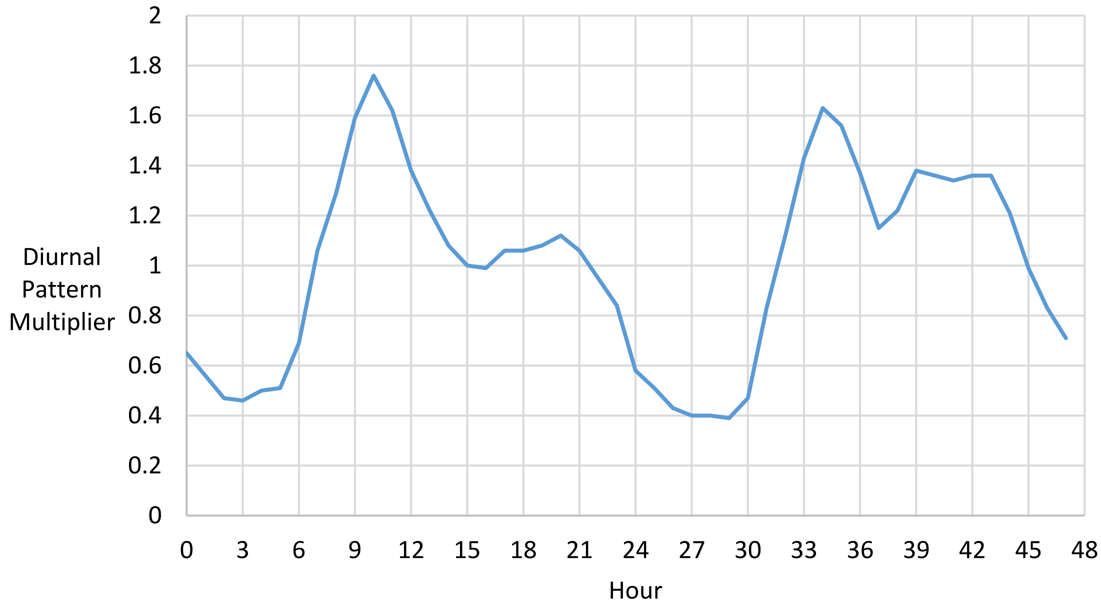

Figure 2A.5 Hassayampa #1

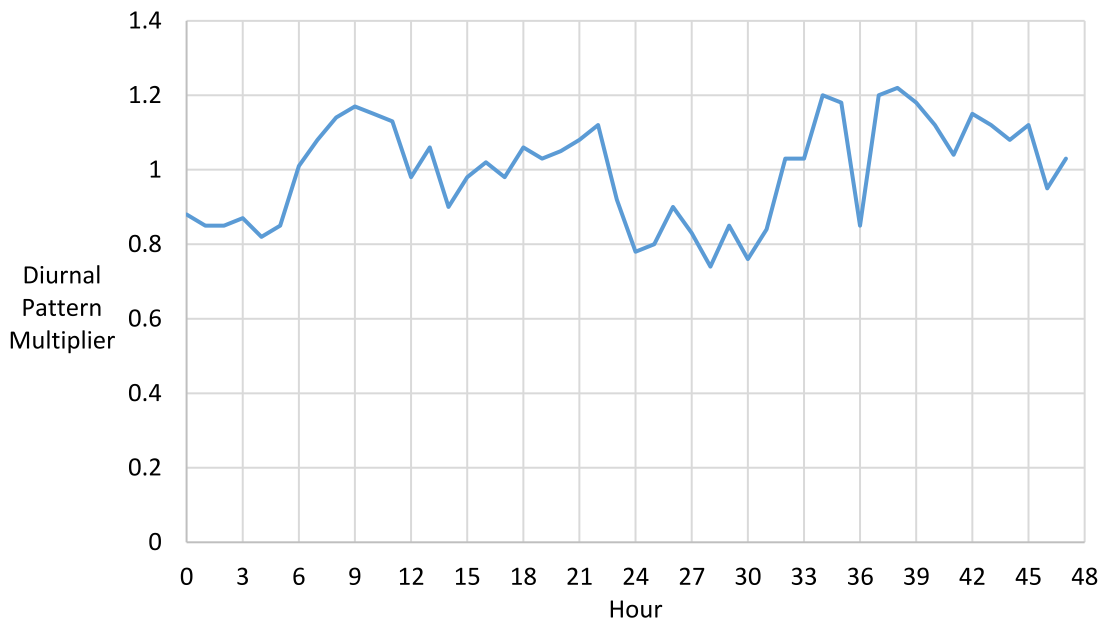

Figure 2A.6 Hassayampa #2

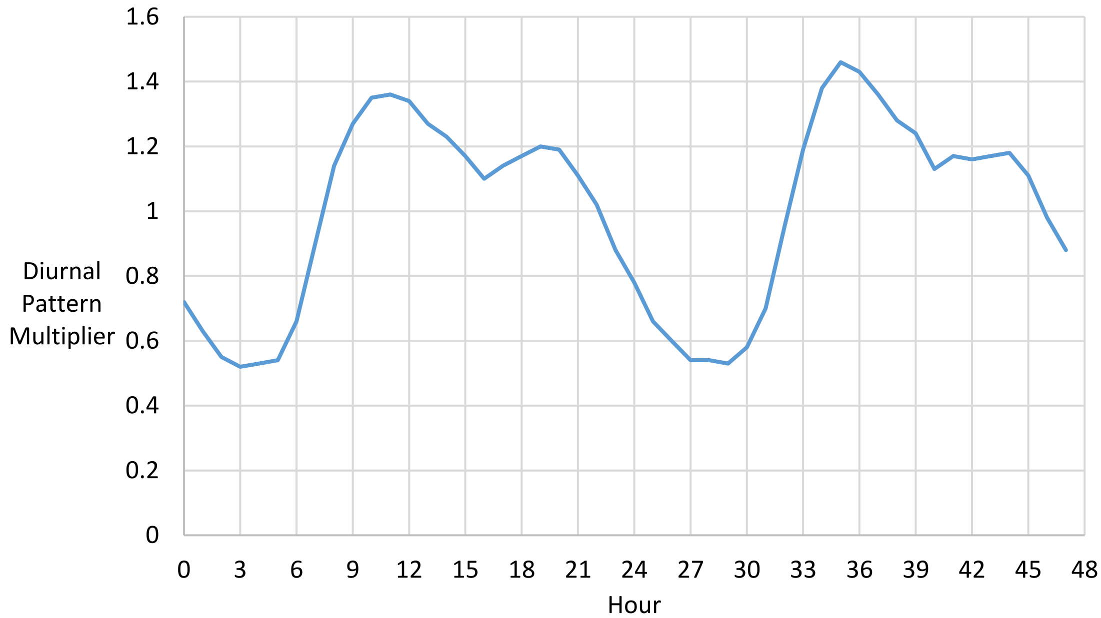

Figure 2A.7 Main VA

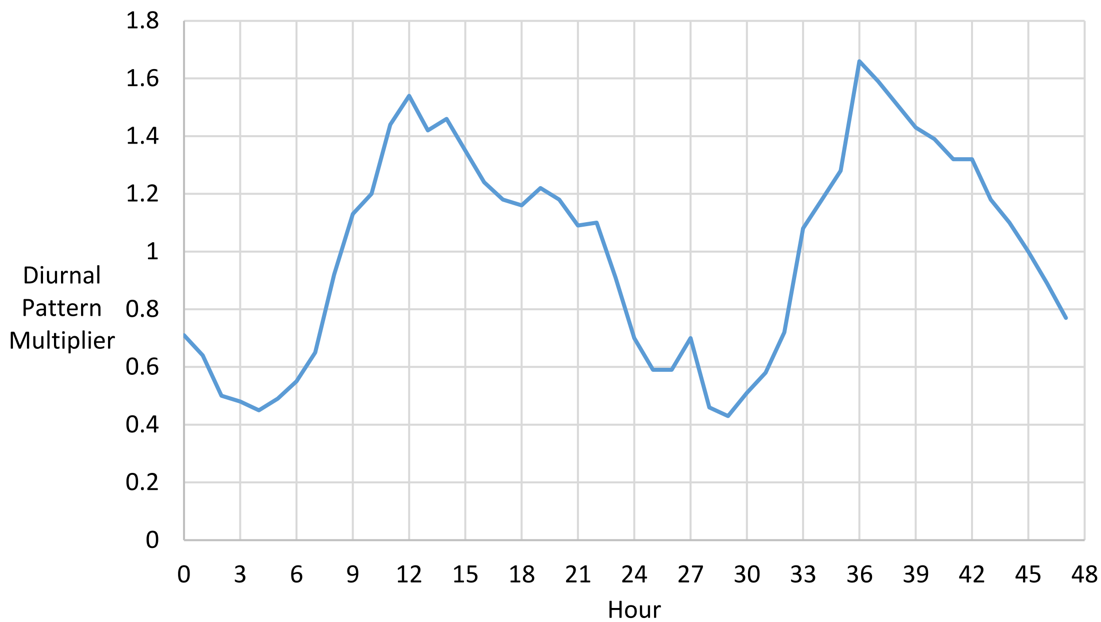

Figure 2A.8 North Force Main

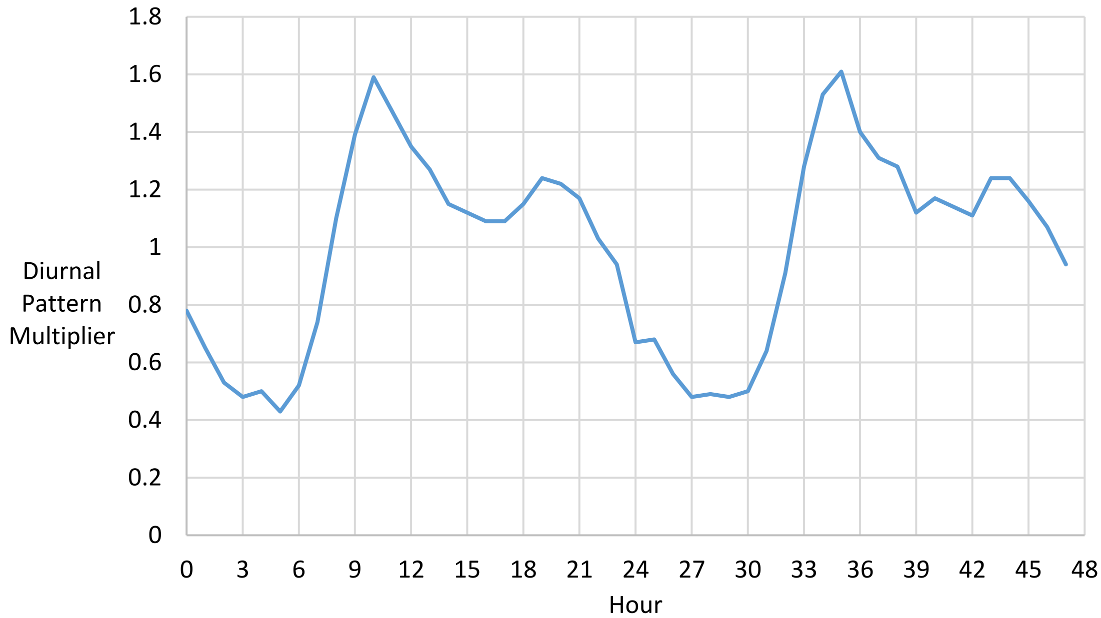

Figure 2A.9 Pinion Oaks

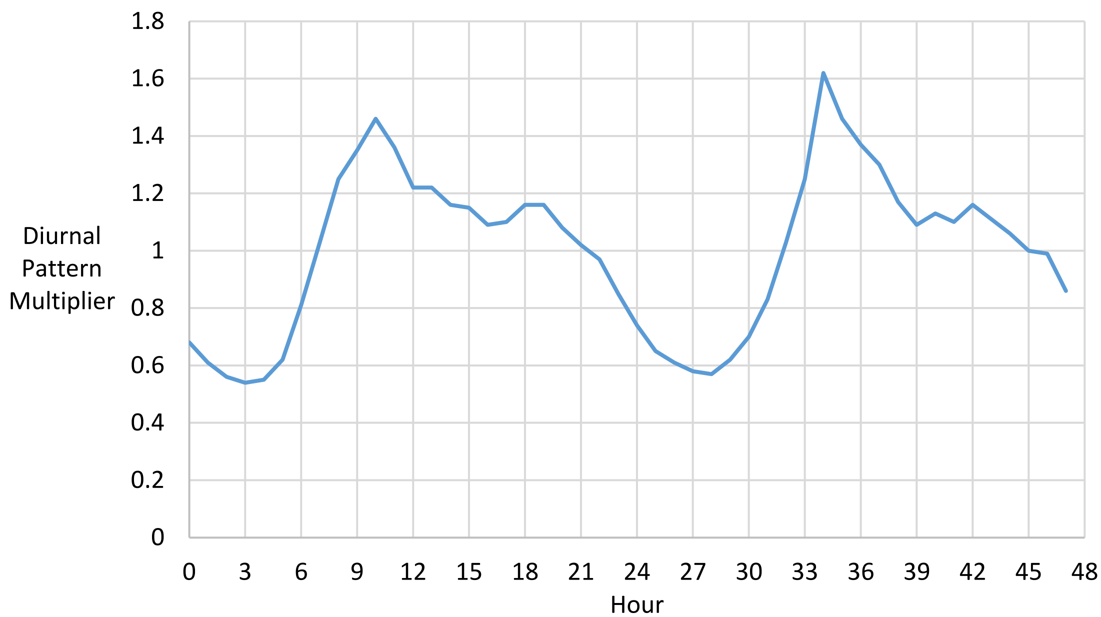

Figure 2A.10 Prescott Heights

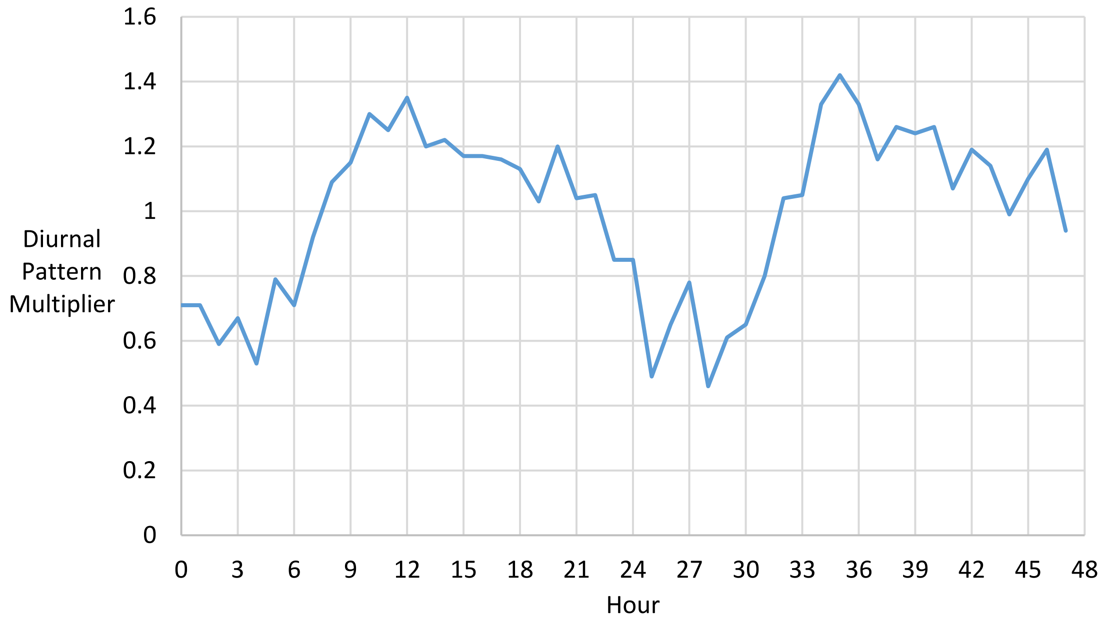

Figure 2A.11 Prescott Lakes Parkway

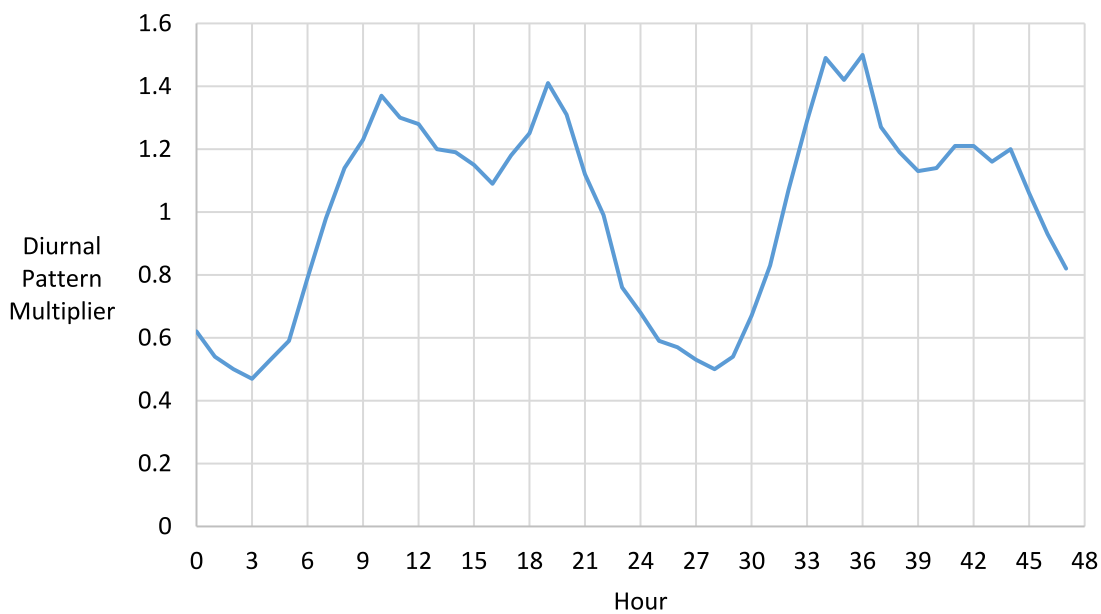

Figure 2A.12 Robinson

Appendix 3A

WATER SYSTEM FIELD TEST RESULTS

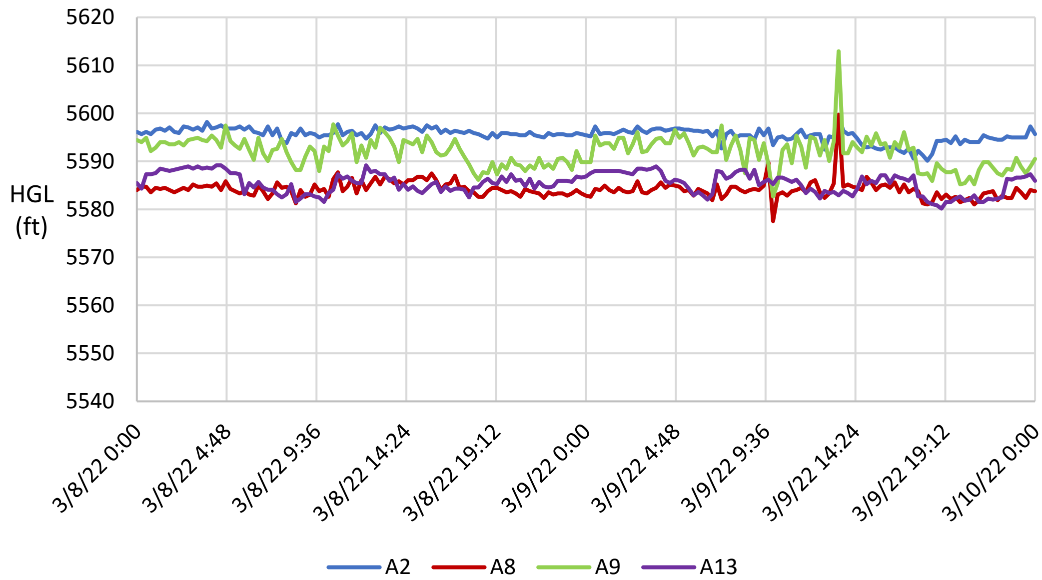

Figure 3A.1 Pressure Test Sites A2, A8, A9, and A13 (Zone 0) HGL

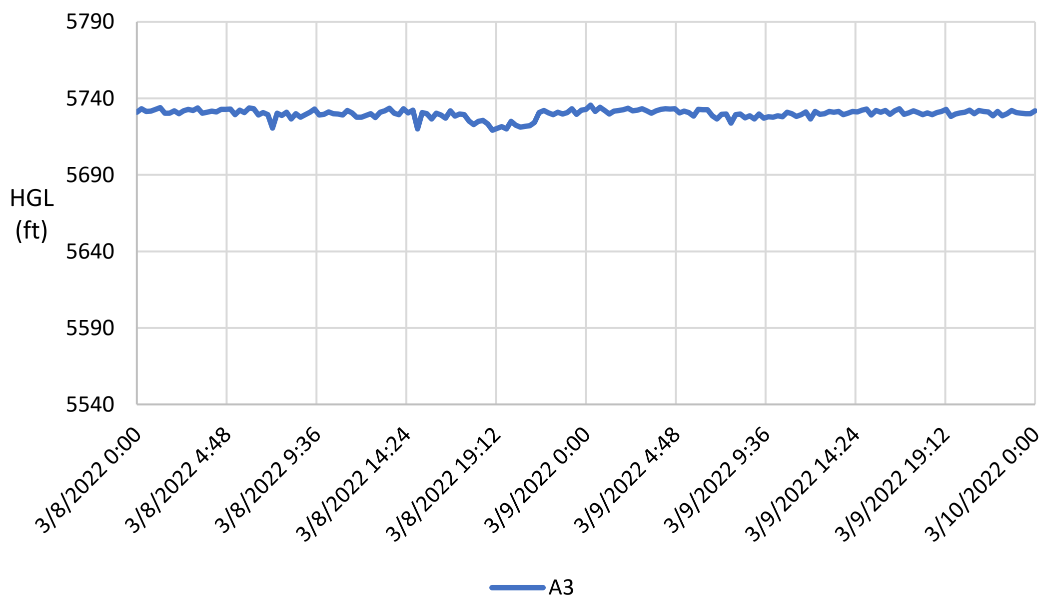

Figure 3A.2 Pressure Test Site A3 (Zone 62) HGL

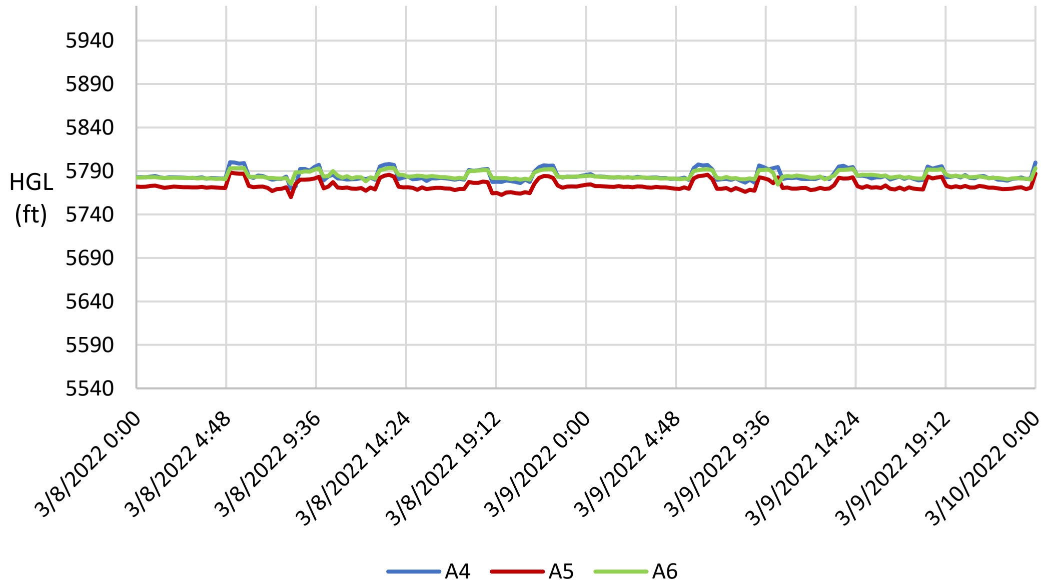

Figure 3A.3 Pressure Test Sites A4, A5, and A6 (Zone 48) HGL

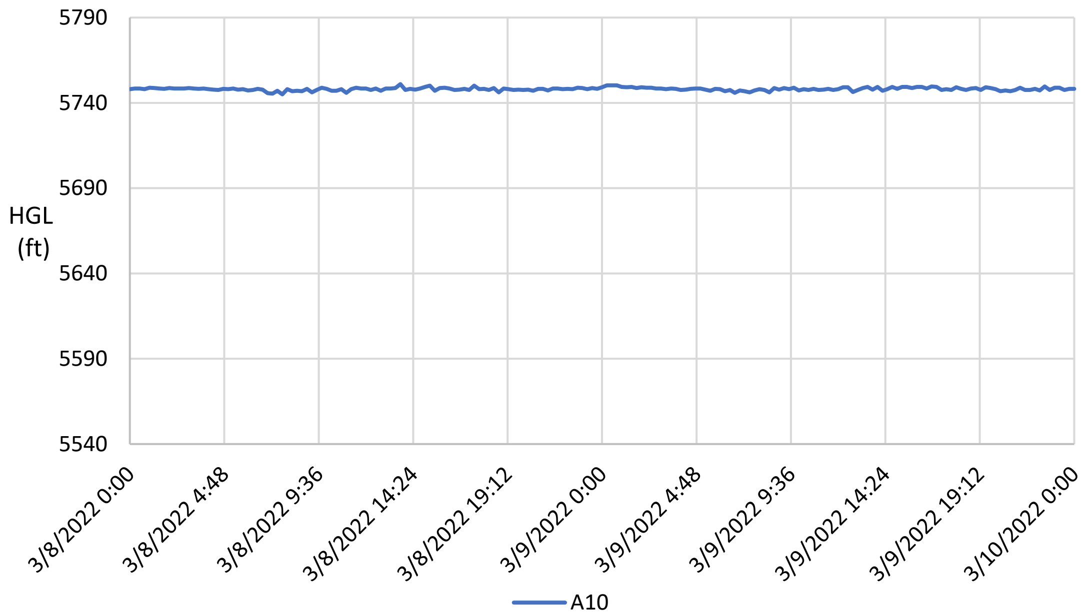

Figure 3A.4 Pressure Test Site A10 (Zone 40) HGL

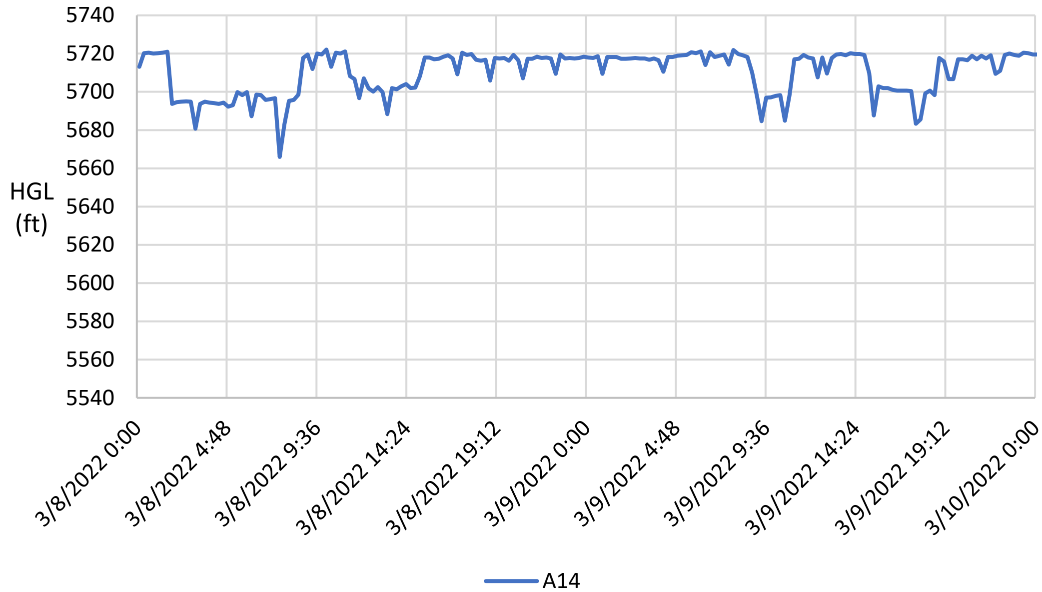

Figure 3A.5 Pressure Test Site A14 (Zone 39) HGL

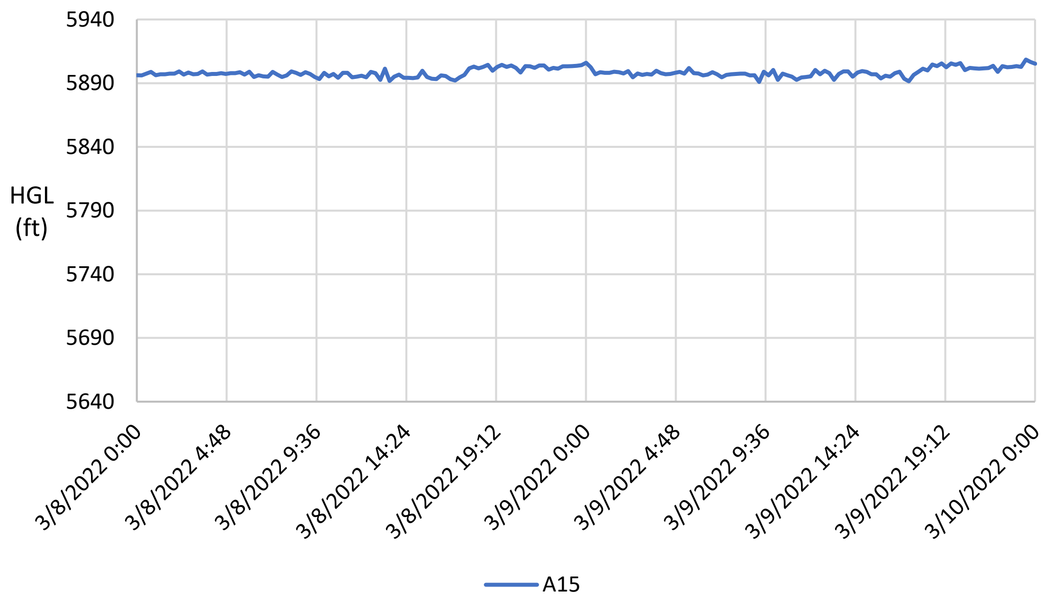

Figure 3A.6 Pressure Test Site A15 (Zone 7) HGL

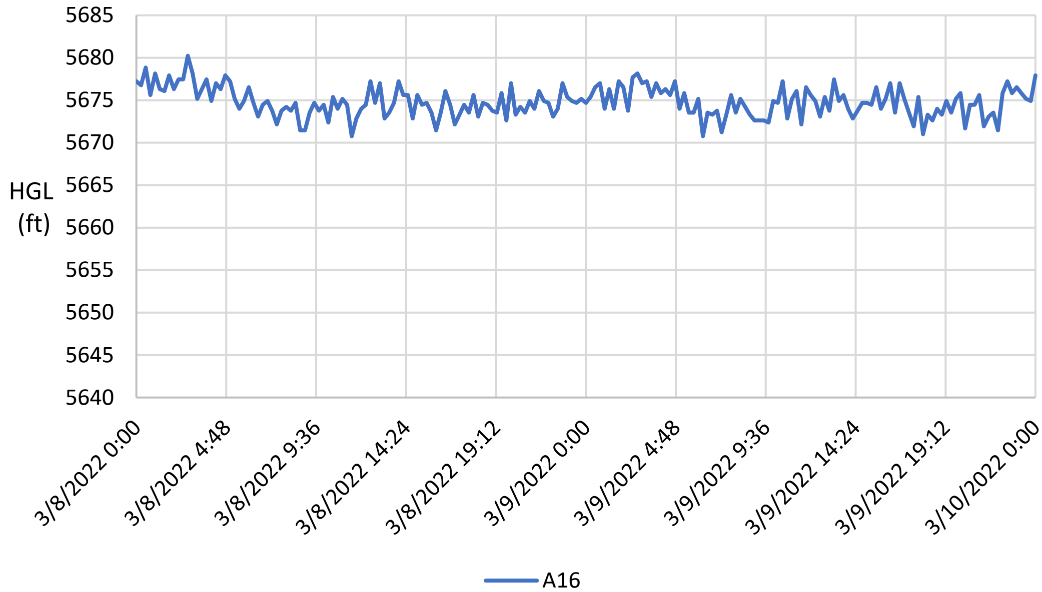

Figure 3A.7 Pressure Test Site A16 (Zone 11) HGL

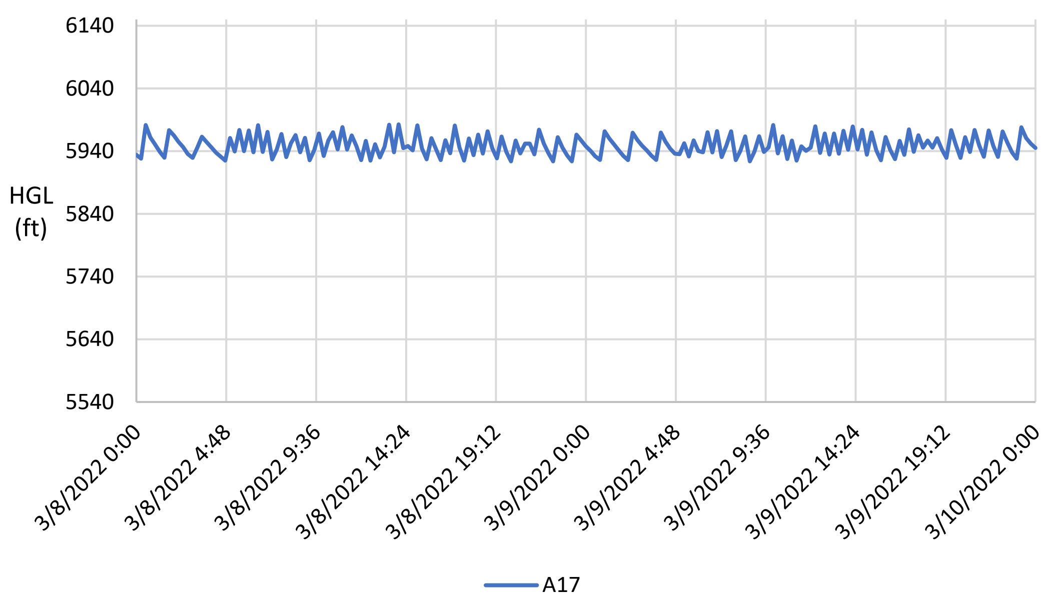

Figure 3A.8 Pressure Test Site A17 (Zone 61) HGL

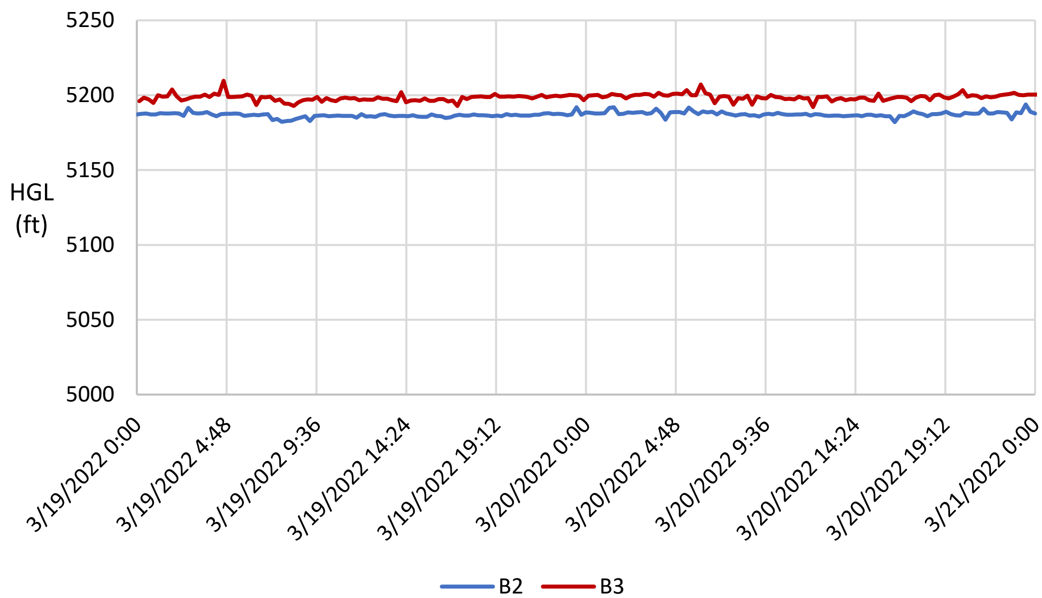

Figure 3A.9 Pressure Test Sites B2 and B3 (Zone 12) HGL

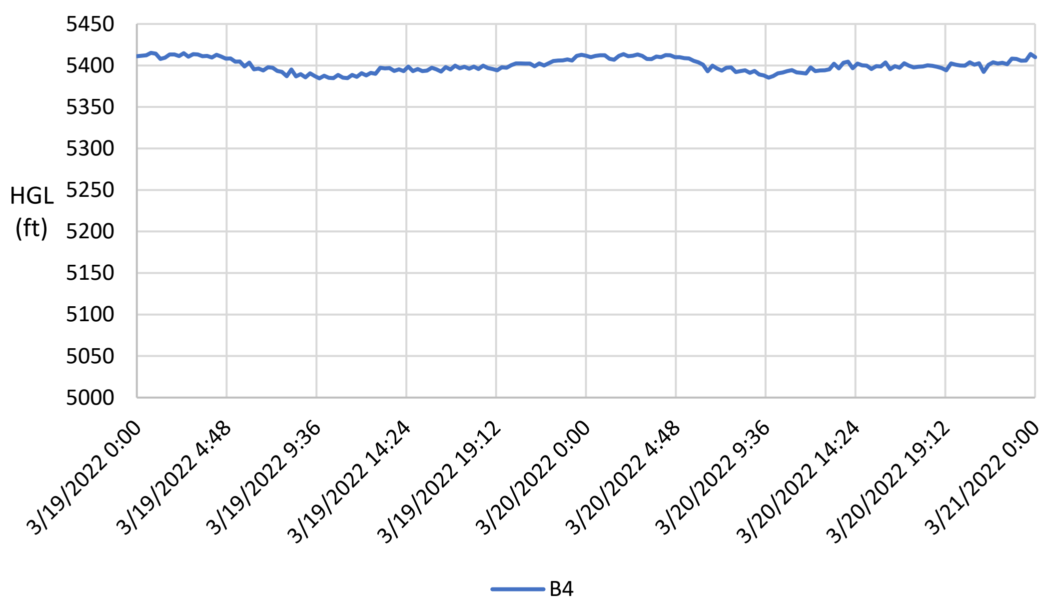

Figure 3A.10 Pressure Test Site B4 (Zone 58) HGL

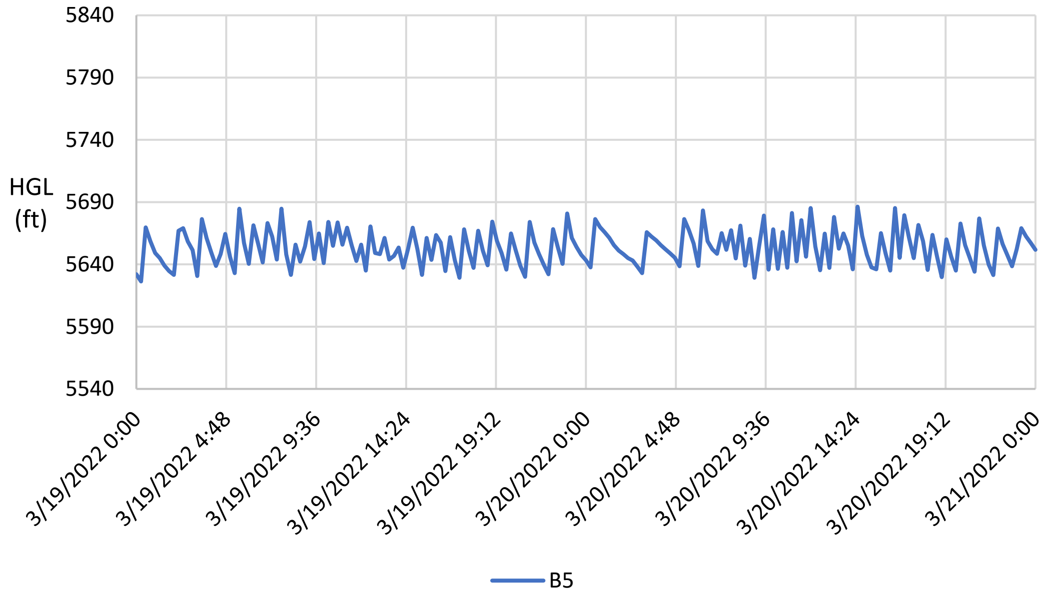

Figure 3A.11 Pressure Test Site B5 (Zone 51) HGL

Appendix 3B

BOOSTER PUMPING ANALYSIS SUMMARY

Booster Pump Station	Zone(s) Served	Capacity (gpm)			2022 Required Capacity (gpm)(1)	Firm Pumping Capacity (gpm)(2)	Elevated Storage Supply (gpm)(3)	2022 Surplus / (Deficit)	Buildout Required Capacity (gpm)	Buildout Surplus / (Deficit)	Analysis Assumptions	Recommendation
		Total	Firm	Fire Pump								
Zone 65 (Arrowhead)	65	130	65		1,002	65	0	(937)	1,002	(937)		1,000 gpm high-capacity pump(5)
Zone 40 (Cedarwood)	40	700	350	1,000	1,653	1,350	0	(303)	1,678	(328)		1,500 gpm high-capacity fire pump (replace 1,000 gpm fire pump) to enhance the fire flow from the original 1,000 gpm fire flow design and upsize the connection pipe to 10 inches(5)
Zone 31 (Cristy Vista)	31	150	75	1,000	1,002	1,075	0	73	1,002	73		
Zone 33 (Foothills)	33, 34, 84	800	400		1,568	400	3,500	2,332	1,562	2,388	67% of the Southeast Regional Tank capacity for 2 hours	
Zone 23 (Forest Mountain)	23	44	22	1,000	1,005	1,022	0	17	1,005	17		
Zone 61 (Forest Trails)	61	440	220	1,000	1,581	1,250	0	(361)	1,597	(377)		1,500 gpm high-capacity fire pump (replace 1,000 gpm fire pump) to enhance the fire flow from the original 1,000 gpm fire flow design to 1,500 gpm(5)
Zone 54/55 (Frontier Village)	54, 55	550	275		4,064	275	4,190	401	4,245	220	67% of the (new) Zone 56 Tank capacity for 4 hours & the (new) Zone 56 BPS	

Booster Pump Station	Zone(s) Served	Capacity (gpm)			2022 Required Capacity (gpm)(1)	Firm Pumping Capacity (gpm)(2)	Elevated Storage Supply (gpm)(3)	2022 Surplus / (Deficit)	Buildout Required Capacity (gpm)	Buildout Surplus / (Deficit)	Analysis Assumptions	Recommendation
		Total	Firm	Fire Pump								
Zone 94 (Granite Springs)	94	84	42		1,002	42	0	(960)	1,002	(960)		1,000 gpm high-capacity pump not feasible, possible piping reconfiguration needed. The pump was originally not designed for fire flow condition(5)
Zone 16 (Haisley)	16	750	375		1,680	375	1,350	45	1,705	20	67% of the Haisley Tank capacity for 2 hours	
Zone 22 (High Valley)	22	206	103	500	1,008	603	0	(405)	1,016	(413)		1,000 gpm high-capacity fire pump (replace 500 gpm fire pump)(5)
Zone 48 (Iron Springs)	48, 50, 61, 62, 65	2,580	1,720		4,526	1,720	1,120	(1,686)	4,364	(1,524)	67% of the Forest Trails Tank for 4 hours	2,600 gpm pumping solution (addresses storage deficiency in Zone 48)
Zone 32 (Juniper)	32	90	45		1,011	45	0	(966)	1,011	(966)		Connection to Zone 33 / Southeast Regional Tank
Zone 51 (Longview)	51	660	220	1,000	1,543	1,110	0	(103)	1,547	(107)		Connection to Northwest Regional Tank
Zone 60 (Lower Rancho Vista)	60	80	40		1,003	40	0	(963)	1,005	(965)		1,000 gpm high-capacity fire pump and upsize the connection pipe to 8 inches(5)
Zone 27 (Lower Thumb Butte)	23, 24, 25, 27, 28, 93	1,788	894		1,267	894	2,790	2,417	1,350	2,334	67% of the Upper Thumb Butte Tank capacity for 2 hours	

Booster Pump Station	Zone(s) Served	Capacity (gpm)			2022 Required Capacity (gpm)(1)	Firm Pumping Capacity (gpm)(2)	Elevated Storage Supply (gpm)(3)	2022 Surplus / (Deficit)	Buildout Required Capacity (gpm)	Buildout Surplus / (Deficit)	Analysis Assumptions	Recommendation
		Total	Firm	Fire Pump								
Zone 41 (Mingus)	40, 41	2,000	1,000		4,034	1,000	2,090	(944)	4,389	(1,299)	67% of (new) Mingus 0.75 MG Tank capacity for 4 hours	
Zone 39 (Pioneer plus White Spar)	39	6,300	4,510		4,543	4,510	3,710	3,677	4,560	3,660	67% of the Indian Hills Tank capacity for 4 hours	
Zone 56 (Prescott Canyon)	54,55,56	1,800	1,200		4,118	1,200	4,190	1,272	4,246	1,144	67% of the (new) Zone 56 Tank capacity for 4 hours & the (new) Zone 56 BPS	
Zone 7 (Prescott Lakes plus Yavapai Hills Lower)	1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 81, 82, 85, 87	1,760	1,180		4,602	1,180	3,600	178	4,832	(52)	67% of the East Regional Tank capacity for 4 hours	No change. Evaluated with Zone 7 (Yavapai Lower) Booster Station and East Regional Tank for fire flow support.
Zone 30 (Prescott Pines)	30,31	1,180	320	590	1,071	910	0	(161)	1,082	(172)	Original Fire flow less than 1,500 gpm	No change; original fire flow criteria was 500 gpm.
Zone 76 (Prescott Resort)	76	2,600	2,100		2,525	2,500	0	(425)	2,539	(439)		Add 500 gpm capacity fire pump(5)
Zone 6 (Ranch I)	6	340	170	1,000	1,058	1,170	0	112	1,079	91		
Zone 5 (Ranch II)	5	300	150	1,000	1,024	1,150	0	126	1,026	124		
Zone 4 (Ranch III)	1, 2, 3, 4, 82, 83, 85	340	170		1,016	170	0	(846)	1,115	(945)		1,000 gpm high-capacity pump(5)
Zone 82 (Ranch IV)	82	66	33		1,001	22	0	(968)	1,001	(968)		1,000 gpm high-capacity pump and upsize the connection pipe to 8 inches(5)
Zone 19 (Sierra Vista)	19, 21, 22, 63	2,850	1,425		1,224	1,425	0	201	1,049	376		

Booster Pump Station	Zone(s) Served	Capacity (gpm)			2022 Required Capacity (gpm)[1]	Firm Pumping Capacity (gpm)[2]	Elevated Storage Supply (gpm)[3]	2022 Surplus / (Deficit)	Buildout Required Capacity (gpm)	Buildout Surplus / (Deficit)	Analysis Assumptions	Recommendation
		Total	Firm	Fire Pump								
Zone 52 (Southview)	51,52,53	1,400	700		1,652	700	3,500	2,548	1,704	2,496	67% of the Southeast Regional Tank capacity for 2 hours	
Zone 91 (Trailwalk)	91	320	160	1,000	1,542	1,160	0	(382)	1,550	(390)		1,500 gpm high-capacity fire pump (replace 1,000 gpm fire pump) and upsize the connection pipe to 10 inches[5]
Zone 21 (Upper Rancho Vista)	21,22	140	70		1,020	60	280	(670)	1,021	(671)	67% of the Upper Rancho Vista Tank for 2 hours	1,000 gpm high-capacity pump and upsize the connection pipe to 8 inches[5]
Zone 24 (Upper Thumb Butte)	24	476	238		1,057	238	2,790	1,971	1,070	1,958	67% of the Upper Thumb Butte Tank capacity for 2 hours	
Zone 16 (Virginia)	16, 32, 33	4,200	2,100		1,701	2,100	625	1,024	1,564	1,161	67% of the Haisley Tank capacity for 2 hours	
Zone 50 (Vista del Cerro)	50	680	440		1,007	440	0	(567)	1,009	(569)		1,000 gpm high-capacity pump[5]
Zone 8 (Yavapai Hills Upper)	8	440	195	1,000	1,512	1,195	0	(317)	1,542	(347)		No change, the system was designed for 1,000 gpm fire flow not 1,500 gpm
Zone 101	101	1,440	940	1,000	1,527	1,940	0	413	1,729	211		

Notes:
(1) Maximum day demand + 10%, plus fire demand.
(2) Firm booster pumping capacity plus fire pump (if available).
(3) Where available, support from elevated storage services the zone; 67% percent of the storage tank was assumed to be available for the duration equivalent to the fire flow required for the zone(s) within pipe velocity capacity constraints.
(4) Assumed the design capacity of the Zone 56/76 booster station and Zone 56 tank.
(5) These projects were proposed to meet the pumping capacity criteria, and they are not included in the CIP.

Appendix 3C

PRESSURE ZONE SCHEMATIC

To be included as separate file.

Appendix 3D

EMERGENCY OPERATIONS AND REDUNDANCY EVALUATION (FROM 2018 STUDY)

The Emergency Operations and Redundancy evaluation results presented in the following sections was primarily developed in the 2013 Water and Wastewater Models Study. Some adjustments have been made with input from City staff.

3.3.5 Emergency Operations and Redundancy

The City wishes to have plans in place to help protect the water system from events that would compromise the City's ability to provide reliable water service. Events that could cause problems with the water system may be outside of the City's control to a large extent, although there are events that the City can control.

A methodology that is commonly applied to the plan to protect the City against risks is to identify the common types of disasters that could occur, determine the probability of the disaster occurring, and then evaluate the effectiveness of mitigating activities. Therefore, the relative risk to the City of a particular disaster may be quantified as follows:

$$Risk = P \times C \times E$$

where:

P = Probability of a specific disaster event

C = Consequence of the disaster event

E = Effectiveness of mitigating measures that the City could put into place

In collaboration with the City, potential threats to the water distribution system were developed that address loss of supply, equipment failure, water demands, human and nature caused threats. Mitigation strategies were also developed for infrastructure, water system operations, and customers. To define and evaluate the risks that the City could face, the water system was divided into 18 different service areas. Then, each threat and mitigation measure was scored using a scale of 1 to 5 with 1 representing the lowest probability/consequence of a disaster event or highest effectiveness of a mitigation measure and 5 representing the highest probability/consequence of a disaster event or lowest effectiveness of a mitigation measure. Finally, a ranking was developed for the overall system, so that the risks, consequences, and mitigating actions could be considered effectively for each potential threat. Using this scoring method, the higher the score, the higher the risk. The events that are a threat to the City are listed in Table 3.14.

Table 3.14 Possible Threats to the Prescott Water Distribution System City of Prescott 2013 Water and Wastewater Models	
1. Loss of Supply	a. Well hydrogeological failure
2. Equipment Failure	a. Main rupture
	b. Power outage with no permanent generator
	c. Power outage with a permanent generator
	d. Pump failure
	e. PRV failure
	f. Communications equipment failure
	g. Well equipment failure
	h. Pneumatic tanks failure
	i. Backflow Contamination
3. Extreme Demands	a. Maximum Day
	b. Maximum Day plus Fire Flow
	c. Average Day plus Fire Flow
	d. Forest fire (demands for fighting)
4. Human Caused	a. Vandalism/terrorism
	b. Chemical contamination
	c. Accident
5. Nature Caused	a. Storm
	b. Flood
	c. Earthquake
	d. Forest fire (damages facilities)
	e. extreme drought

Table 3.15 shows the mitigation strategies that have been identified to address the threats listed in Table 3.14. Infrastructure mitigation refers to upgrades for or replacement of physical system components. Operational mitigation includes items the City can do with existing infrastructure within normal distribution system operating parameters. Customer mitigation includes end use restrictions that can be used to reduce water delivery risks.

Table 3.15 Mitigation Strategies to Reduce Water Delivery Risks City of Prescott 2013 Water and Wastewater Models		
	Mitigation Strategies	**Actions Taken**
1. Infrastructure Mitigation Strategies	a. Provide second or third supply to service area	Consider for Mingus and Thumb Butte.
	b. Satisfy storage criteria	Done as part of model studies
	c. Satisfy water transmission performance criteria	Done as part of model studies
	d. Install permanent backup generator	Consider for strategic facilities if site lacks a generator
	e. Maintain spare parts inventory	Recommend for entire system
	f. Ensure pump stations satisfy demand with firm capacity	Done as part of the model studies
	g. Develop sufficient well supplies to satisfy performance criteria	Recommended in the model studies
2. Operational Mitigation Strategies	a. Open zone boundary valves	Identify valves ahead of time using model
	b. Pre-arranged bypass pumping contract	Recommend in model study report
	c. Valve exercising program	Already doing for zone valves
	d. Bottled and trucked in water supply	Recommend in model study report
	e. Use portable backup generator	
	f. Hydrant testing program	
3. Customer Management Strategies	a. Restrict outside water use	See drought management plan
	b. Restrict water use to only health and safety uses	See drought management plan
	c. Vacate area	

Table 3.16 shows the risk evaluation for each of the areas that have been identified for a unique risk evaluation. This risk evaluation was completed by City of Prescott staff in the 2013 Water and Wastewater Models Study.

Table 3.16 Risk Ranking by Water Service Area
City of Prescott 2013 Water and Wastewater Models

Risk = P x C x E		Airport				Chino Distribution System				Chino Transmission				East Regional			
		Probability	Consequence	Effectiveness	Risk	Probability	Consequence	Effectiveness	Risk	Probability	Consequence	Effectiveness	Risk	Probability	Consequence	Effectiveness	Risk
1. Loss of Supply	a. Well hydrogeological failure	1	1	1	1					5	5	3	75	0			
2. Equipment failure	a. Main rupture	1	1	1	1	1	1	1	1	3	5	4	60	3	5	1	15
	b. Power outage with no permanent generator	3	1	1	3					3	5	5	75	3	3	1	9
	c. Power outage with a permanent generator	1	1	1	1												
	d. Pump failure									3	3	5	45	3	1	1	3
	e. PRV failure	3	1	1	3	5	5	3	75	0			0	3	4	3	36
	f. Communications equipment failure	1	1	1	1					3	1	1	3	3	3	1	9
	g. Well equipment failure	1	1	1	1					3	3	3	27	0			
	h. Pneumatic tanks failure													3	5	3	45
3. Extreme demands	a. Peak hour	5	1	1	5	1	1	1	1	3	1	1	3	3	1	1	3
	b. Maximum day																
	c. Building fire	3	1	1	3	1	1	1	1	3	1	1	3	3	1	1	3
	d. Forest fire (demands for fighting)	1	1	1	1	1	1	1	1	3	3	1	9	5	3	1	15
4. Human caused	a. Vandalism/terrorism	1	1	1	1	1	1	1	1	1	5	3	15	1	1	1	1
	b. Chemical contamination	1	5	3	15	1	1	1	1	1	5	3	15	1	3	3	9
	c. Accident	1	3	1	3	1	1	1	1	3	5	3	45	3	3	3	27
5. Nature caused	a. Storm	5	1	1	5	5	1	1	5	5	5	3	75	3	1	1	3
	b. Flood	1	1	1	1	3	1	1	3	3	3	3	27	3	1	1	3
	c. Earthquake	1	1	1	1	1	1	1	1	1	5	3	15	1	3	1	3
	d. Forest fire (damages facilities)	1	1	1	1	1	1	1	1	1	1	1	1	5	3	1	15
	e. Extreme drought																
Risk Totals					**47**				**92**				**493**				**199**

Table 3.16 Risk Ranking by Water Service Area
City of Prescott 2013 Water and Wastewater Models

Risk = P x C x E		Thumb Butte				Northwest Regional				Mingus				North-South			
		Probability	Consequence	Effectiveness	Risk	Probability	Consequence	Effectiveness	Risk	Probability	Consequence	Effectiveness	Risk	Probability	Consequence	Effectiveness	Risk
1. Loss of Supply	a. Well hydrogeological failure	0				0				0			0	0			
2. Equipment Failure	a. Main rupture	4	5	3	60	3	3	1	9	3	3	1	9	5	3	1	15
	b. Power outage with no permanent generator	3	3	1	9	3	1	1	3	3	3	1	9	3	1	1	3
	c. Power outage with a permanent generator																
	d. Pump failure	1	1	1	1	1	1	1	1	5	5	3	75	0			0
	e. PRV failure	3	3	1	9	3	3	1	9	0			0	1	1	1	1
	f. Communications equipment failure	3	1	1	3	3	1	1	3	3	3	1	9	3	3	1	9
	g. Well equipment failure	0				0				0			0	0			0
	h. Pneumatic tanks failure									3	5	4	60				
3. Extreme Demands	a. Peak hour	3	1	1	3	1	1	1	1	5	4	3	60	3	1	1	3
	b. Maximum day																
	c. Building fire	3	1	1	3	1	1	1	1	3	3	3	27	3	1	1	3
	d. Forest fire (demands for fighting)	5	3	1	15	3	1	1	3	1	3	3	9	1	1	1	1
4. Human Caused	a. Vandalism/terrorism	3	1	1	3	3	1	1	3	1	1	1	1	3	1	1	3
	b. Chemical contamination	1	3	1	3	3	3	3	27	3	3	3	27	5	5	3	75
	c. Accident	1	1	1	1	1	1	1	1	3	1	1	3	5	1	1	5
5. Nature Caused	a. Storm	3	1	1	3	3	1	1	3	3	1	1	3	3	3	1	9
	b. Flood	1	1	1	1	1	1	1	1	1	1	1	1	3	3	1	9
	c. Earthquake	1	3	1	3	1	3	1	3	1	3	1	3	1	3	1	3
	d. Forest fire (damages facilities)	5	4	3	60	3	1	1	3	1	3	3	9	1	1	1	1
	e. Extreme drought																
Risk Totals					**174**				**71**				**305**				**140**

Table 3.16 Risk Ranking by Water Service Area
City of Prescott 2013 Water and Wastewater Models

Risk = P x C x E		Iron Springs				Indian Hills				Copper Basin				Haisley			
		Probability	Consequence	Effectiveness	Risk	Probability	Consequence	Effectiveness	Risk	Probability	Consequence	Effectiveness	Risk	Probability	Consequence	Effectiveness	Risk
1. Loss of Supply	a. Well hydrogeological failure	0				0				0				0			
2. Equipment Failure	a. Main rupture	3	5	3	45	3	1	1	3	3	1	1	3	3	5	3	45
	b. Power outage with no permanent generator	3	3	1	9	3	1	1	3	5	1	1	5	3	1	1	3
	c. Power outage with a permanent generator																
	d. Pump failure	1	1	1	1	1	1	1	1	1	1	1	1	3	4	3	36
	e. PRV failure	3	5	1	15	0				1	1	1	1	1	1	1	1
	f. Communications equipment failure	3	1	1	3	3	1	1	3	3	1	1	3	3	3	3	27
	g. Well equipment failure	0				0				0				0			
	h. Pneumatic tanks failure	3	5	4	60												
	i. Backflow contamination																
3. Extreme Demands	a. Maximum Day	3	5	3	45	3	1	1	3	3	1	1	3	3	1	1	3
	b. Maximum Day plus Fire Flow																
	c. Average Day plus Fire Flow	3	1	1	3	3	1	1	3	3	1	1	3	3	1	1	3
	d. Forest fire (demands for fighting)	3	3	1	9	1	1	1	1	5	5	1	25	5	5	3	75
4. Human Caused	a. Vandalism/terrorism	1	1	1	1	1	1	1	1	3	1	1	3	5	1	1	5
	b. Chemical contamination	1	3	3	9	3	5	3	45	1	3	1	3	3	3	1	9
	c. Accident	1	1	1	1	3	1	1	3	1	1	1	1	1	1	1	1
5. Nature Caused	a. Storm	3	1	1	3	3	1	1	3	3	1	1	3	3	1	1	3
	b. Flood	1	1	1	1	3	3	1	9	1	1	1	1	1	1	1	1
	c. Earthquake	1	3	1	3	1	3	1	3	1	3	1	3	1	3	1	3
	d. Forest fire (damages facilities)	3	3	1	9	1	1	1	1	5	5	1	25	5	5	3	75
	e. Extreme drought																
Risk Totals					**217**				**82**				**83**				**290**

Table 3.16 Risk Ranking by Water Service Area
City of Prescott 2013 Water and Wastewater Models

Risk = P x C x E		Prescott Pines				Southeast/Robinson				Zone 56/Frontier				Northeast			
		Probability	Consequence	Effectiveness	Risk	Probability	Consequence	Effectiveness	Risk	Probability	Consequence	Effectiveness	Risk	Probability	Consequence	Effectiveness	Risk
1. Loss of Supply	a. Well hydrogeological failure	0				0				0							
2. Equipment Failure	a. Main rupture	3	5	3	45	3	3	1	9	5	3	1	15	1	5	1	5
	b. Power outage with no permanent generator	3	3	1	9	3	3	1	9	3	3	1	9				
	c. Power outage with a permanent generator																
	d. Pump failure	3	5	3	45	2	4	3	24	3	5	3	45				
	e. PRV failure	0								5	5	3	75	3	5	3	45
	f. Communications equipment failure	3	3	3	27	3	3	1	9	3	5	1	15				
	g. Well equipment failure	0				0				0							
	h. Pneumatic tanks failure	3	5	3	45					3	5	5	75				
	i. Backflow contamination																
3. Extreme Demands	a. Maximum Day	1	1	1	1	3	1	1	3	3	3	1	9	3	1	1	3
	b. Maximum Day plus Fire Flow																
	c. Average Day plus Fire Flow	3	1	1	3	3	1	1	3	3	5	5	75	3	5	3	45
	d. Forest fire (demands for fighting)	5	5	5	125	5	1	1	5	3	1	1	3	1	1	1	1
4. Human Caused	a. Vandalism/terrorism	1	1	1	1	3	1	1	3	3	1	1	3	1	1	1	1
	b. Chemical contamination	3	3	1	9	3	5	1	15	3	5	3	45	1	5	1	5
	c. Accident	1	1	1	1	1	1	1	1	1	1	1	1				
5. Nature Caused	a. Storm	3	1	1	3	3	1	1	3	3	1	1	3	3	1	1	3
	b. Flood	1	1	1	1	1	1	1	1	1	1	1	1	3	3	4	36
	c. Earthquake	1	3	1	3	1	3	1	3	1	3	1	3	1	3	1	3
	d. Forest fire (damages facilities)	5	5	5	125	5	1	1	5	3	1	1	3	1	1	1	1
	e. Extreme drought																
Risk Totals					**443**				**93**				**380**				**148**

Table 3.17 summarizes the total relative risk by area.

Table 3.17 Summary of Total Relative Risk by Area
City of Prescott 2013 Water and Wastewater Models

Water Service Areas	Risk Score
Chino Transmission	493
Prescott Pines: East Valley View, Cristy Vista, Cathedral Pines	443
Zone 56/Frontier: Zone 56, Prescott Canyon Resort	380
Mingus: Eagle Ridge, Cedarwood, Zone 48	305
Haisley: Hidden Valley Ranch	290
Iron Springs: Granite Mountain, Wildwood, Kingswood, Yakashba, South Forty, Burnt Ranch	217
East Regional: Yavapai Hills/Ranch	199
Thumb Butte: Upper Hassayampa, Zone 24, Zone 27	177
Northeast Regional: Dells, Heritage Park, Private Road, Granite Gate	148
North-South: Downtown, Virginia	140
Southeast/Robinson: Nathan Lane, Skyview, Robinson, Newport Heights, City Lights	93
Chino	92
Copper Basin: Zone 19, Timberidge, High Valley Ranch, The Village, Copper Canyon Village	83
Indian Hills: Whitespar, Zone 39	82
Northwest Regional: Southview, Hokaygon, Northwest Regional Tank	71
Airport	47

The overall risk scores in Table 3.17 range from 47 to 493 and provide a relative ranking of water service areas that could be negatively impacted by the potential threats identified by City staff. Some service areas inherently contain more risk, such as the Chino transmission main that has multiple ways where a failure could be catastrophic, or the Prescott Pines area where a forest fire is an ongoing threat. These areas will have a higher risk even after the City has completed preventative actions. The following guidance is provided in interpreting the relative risk scores by water service area:

- Score 0 – 100: Represent low risk for impacts from potential threats. Although all areas of the system should be maintained, these areas could have a lower priority than high risk areas for risk mitigation activities.

- Score 101 – 200: Represent moderately low risk for impacts to potential threats. These areas do not require immediate attention for risk mitigation. However, the City should continue to monitor conditions and re-assess potential threats as required.

- Score 201 – 300: Represent moderate risk for impacts to potential threats. These areas do not require immediate attention for risk mitigation. However, the City should continue to monitor conditions and re-assess potential threats as required. If opportunities to increase reliability and redundancy arise as part of preventative maintenance or infrastructure replacement projects, the City should consider them.

- Score 301 – 400: Represent moderately high risk for impacts to potential threats. The City should look for opportunities to increase reliability and redundancy in these areas as part of preventative maintenance or infrastructure replacement projects.

- Score 401 – 500: Represent high risk for impacts to potential threats. These areas include the most critical assets in the City's water system. Infrastructure that serves these areas should continue to be prioritized from a preventative maintenance standpoint to mitigate risk associated with infrastructure failures.

Table 3.18 summarizes the total relative risk by type of event.

Table 3.18 Total Relative Risk by Type of Event
City of Prescott 2013 Water and Wastewater Models

		Relative Risk by Event
1. Loss of Supply	a. Well hydrogeological failure	76
2. Equipment Failure	a. Main rupture	340
	b. Power outage with no permanent generator	158
	c. Power outage with a permanent generator	1
	d. Pump failure	278
	e. PRV failure	270
	f. Communications equipment failure	124
	g. Well equipment failure	28
	h. Pneumatic tanks failure	285
	i. Backflow contamination	
3. Extreme Demands	a. Maximum Day	149
	b. Maximum Day plus Fire Flow	0
	c. Average Day plus Fire Flow	182
	d. Forest fire (demands for fighting)	298
4. Human Caused	a. Vandalism/terrorism	46
	b. Chemical contamination	312
	c. Accident	95
5. Nature Caused	a. Storm	130
	b. Flood	97
	c. Earthquake	56
	d. Forest fire (damages facilities)	335
	e. Extreme drought	0

The following conclusions are drawn from the risk evaluation by service area:

1. The Chino pumping and transmission system is the highest risk infrastructure in the City's water system due to the risk of failure from well failure, power outages, and main ruptures. A failure of this system is likely to affect the entire service area and therefor have a high consequence of failure. This system is at risk from water supply, equipment failures, and natural events. More than any other service area, this system needs to have the routine maintenance and backup systems to protect the City of Prescott water supply.
2. The Prescott Pines area is the next highest risk area for the City because of the risk from fires originating to the south of the City. The 2013 model update study provides recommendations to improve the water supply and storage in this area to reduce the protect residences from fire.
3. The third highest risk area is the Zone 56/Frontier Village area. This service area includes a major transportation corridor and commercial businesses. The greatest risks are due to equipment failure, fires, and chemical spills.

The following conclusions are drawn by viewing the event total relative risks in Table 3.19:

1. The three highest risks are main ruptures, forest fires, and chemical contamination. These events cannot be prevented by City staff, but the City should be prepared to respond to these events to minimize the potential for damage if and when these events happen.
2. The next highest risks are pneumatic tank failure, pump failure, and PRV failure. These risks can be mitigated by proactive maintenance of these facilities.
3. The third level of events for which the City is at risk includes storms, power outages, building fires, and peak demands. These types of events are likely to occur most years and are the "routine" emergencies that the City would be prepared to handle.

Appendix 4A

WATER SYSTEM CIP PROJECTS

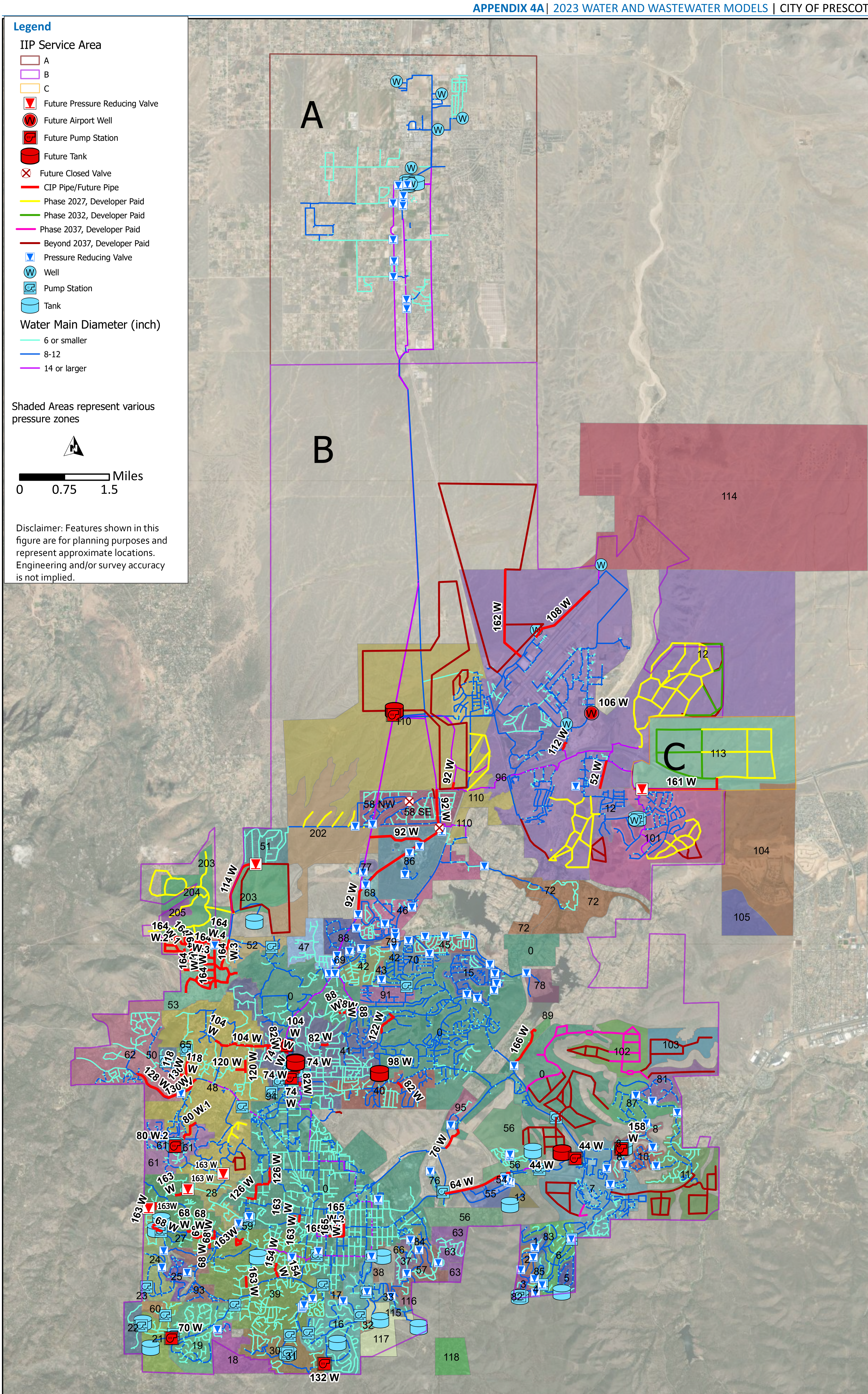

Figure 4.A Water System CIP Projects

Appendix 4B

WATER UNIT COST DETAIL

Engineers...Working Wonders With Water™

PROJECT :	**2023 Water and Wastewater Models**	**LOCATION FACTOR:**	**1.00**
JOB # :	**200600A.00**	**DATE :**	July-22
CLIENT :	**City of Prescott**	**ENR :**	13168
ELEMENT :	**Water Main Construction, 6-in w/hydrant**	**BY :**	LW

	DESCRIPTION	QUAN	UNIT	MATERIAL & LABOR	SUB	UNIT COST	SUBTOTAL	TOTAL
Pipe	6" CL 52 CLDI MJ PIPE IN OPEN TRENCH	1	LF	$ 32.60	$0.00	$ 32.60	$ 32.60	
	6" ADDER FOR RESTRAINED JOINTS	0.25	LF	$ 6.92	$0.00	$ 6.92	$ 1.73	
	TOTAL PIPING (per LF)							**$ 34.33**
Excavation	EARTHWORK							
& Backfill	Cat 225 Trackhoe, 1-1/2CY Bucket, Class B (Medium Digging), 0-16' D	0.48	CY	$ 3.05	$0.00	$ 3.05	$ 1.46	
	Hand Excavation, Class B Material to 5' Depth	0.01	CY	$ 105.08	$0.00	$ 105.08	$ 1.56	
	8' D X 2' W Trench and Manhole Boxes	0.01	Day	$ 28.00	$0.00	$ 28.00	$ 0.28	
	Imported Pipe Bed & Zone/Confined Structure Backfill, Class B Material	0.30	CY	$ 58.79	$0.00	$ 58.79	$ 17.72	
	Imported Trench Backfill/Unconfined Struct. BF, Class B Material	0.17	CY	$ 60.54	$0.00	$ 60.54	$ 10.09	
	Controlled Density Fill (CDF)	0.02	CY	$ 90.00	$0.00	$ 90.00	$ 1.67	
	10% Site Specific Requirements	1.00	LS	$ 3.11	$0.00	$ 3.11	$ 3.11	
	20 CY Dump Truck, 20 Miles/Round Trip	1.20	CY	$ 7.15	$0.00	$ 7.15	$ 8.54	
	TOTAL EARTHWORK (per LF)							**$ 44.43**
Paving	ASPHALT PAVEMENT CUTTING	8.0	inFT	$ 0.64	$0.00	$ 0.64	$ 5.12	
Demo &	REMOVE 4"-6" ASPHALT PAVEMENT	0.4	SY	$ 0.68	$0.11	$ 0.79	$ 0.29	
Replacement	4" AC PAVING ON 8" ABC	0.4	SY	$ 54.80	$4.38	$ 59.18	$ 21.92	
	TOTAL PAVING (per LF)							**$ 27.33**
Fittings	8" 90° CLDI MJ BEND	2	EA	$ 1,063.98	$0.00	$ 1,063.98	$ 2,127.95	
& Valves	8" DI MJ GATE VALVE, NON-RISING STEM	1	EA	$ 1,964.80	$0.00	$ 1,964.80	$ 1,964.80	
	C.I. Valve Box	1	EA	$ 1,472.50	$0.00	$ 1,472.50	$ 1,472.50	
	Air Release Valve Assembly	1	EA	$ 1,045.32	$0.00	$ 1,045.32	$ 1,045.32	
Optional	8" 90° CLDI MJ BEND	4	EA	$ 3,344.35	$0.00	$ 3,344.35		
	12" X 12" CLDI MJ TEE OR WYE	1	EA	$ 2,586.54	$0.00	$ 2,586.54		
	12" X 12" CLDI MJ CROSS	1	EA	$ 2,736.54	$0.00	$ 2,736.54		
	12" CLDI MJ X BELL ADAPTER	12	EA	$ 1,412.27	$0.00	$ 1,412.27		
	TOTAL (per Mile)						$ 6,610.57	
	TOTAL FITTING & VALVES (per LF)							**$ 1.25**
	TOTAL HYDRANT (per LF)							**$ 25.00**
	OVERHEAD (10%)							**$ 13.23**
	CONSTRUCTION PROFIT (6%)							**$ 7.94**
	SALES TAX (65% of above costs at 8.4%)							**$ 7.18**
	BIDDING CONTINGENCY (30%)							**$ 39.70**
	GENERAL CONDITIONS (10%)							**$ 13.23**
	CONSTRUCTION COST, LF							**$ 214**
	PROJECT COST, LF (140%)							**$ 300**

Engineers...Working Wonders With Water™

PROJECT :	2023 Water and Wastewater Models	LOCATION FACTOR:	1.00
JOB # :	200600A.00	DATE :	July-22
CLIENT :	City of Prescott	ENR :	13168
ELEMENT :	Water Main Construction, 8-in w/hydrant	BY :	LW

	DESCRIPTION	QUAN	UNIT	MATERIAL & LABOR	SUB	UNIT COST	SUBTOTAL	TOTAL
Pipe	8" CL 52 CLDI MJ PIPE IN OPEN TRENCH	1	LF	$ 35.35	$0.00	$ 35.35	$ 35.35	
	8" ADDER FOR RESTRAINED JOINTS	0.25	LF	$ 7.50	$0.00	$ 7.50	$ 1.87	
	TOTAL PIPING (per LF)							**$ 37.22**
Excavation	EARTHWORK							
& Backfill	Cat 225 Trackhoe, 1-1/2CY Bucket, Class B (Medium Digging), 0-16' D	0.50	CY	$ 3.05	$0.00	$ 3.05	$ 1.54	
	Hand Excavation, Class B Material to 5' Depth	0.02	CY	$ 105.08	$0.00	$ 105.08	$ 1.63	
	8' D X 2' W Trench and Manhole Boxes	0.01	Day	$ 28.00	$0.00	$ 28.00	$ 0.28	
	Imported Pipe Bed & Zone/Confined Structure Backfill, Class B Material	0.35	CY	$ 58.79	$0.00	$ 58.79	$ 20.83	
	Imported Trench Backfill/Unconfined Struct. BF, Class B Material	0.14	CY	$ 60.54	$0.00	$ 60.54	$ 8.24	
	Controlled Density Fill (CDF)	0.02	CY	$ 90.00	$0.00	$ 90.00	$ 1.36	
	10% Site Specific Requirements	1.00	LS	$ 3.25	$0.00	$ 3.25	$ 3.25	
	20 CY Dump Truck, 20 Miles/Round Trip	1.25	CY	$ 7.15	$0.00	$ 7.15	$ 8.96	
	TOTAL EARTHWORK (per LF)							**$ 46.10**
Paving	ASPHALT PAVEMENT CUTTING	8.0	inFT	$ 0.64	$0.00	$ 0.64	$ 5.12	
Demo &	REMOVE 4"-6" ASPHALT PAVEMENT	0.4	SY	$ 0.68	$0.11	$ 0.79	$ 0.31	
Replacement	4" AC PAVING ON 8" ABC	0.4	SY	$ 54.80	$4.38	$ 59.18	$ 23.02	
	TOTAL PAVING (per LF)							**$ 28.44**
Fittings	8" 90° CLDI MJ BEND	2	EA	$ 1,063.98	$0.00	$ 1,063.98	$ 2,127.95	
& Valves	8" DI MJ GATE VALVE, NON-RISING STEM	1	EA	$ 1,964.80	$0.00	$ 1,964.80	$ 1,964.80	
	C.I. Valve Box	1	EA	$ 1,472.50	$0.00	$ 1,472.50	$ 1,472.50	
	Air Release Valve Assembly	1	EA	$ 1,045.32	$0.00	$ 1,045.32	$ 1,045.32	
	TOTAL (per Mile)						$ 6,610.57	
	TOTAL FITTING & VALVES (per LF)							**$ 1.25**
	TOTAL HYDRANT (per LF)							**$ 25.00**
	OVERHEAD (10%)							**$ 13.80**
	CONSTRUCTION PROFIT (6%)							**$ 8.28**
	SALES TAX (65% of above costs at 8.4%)							**$ 7.49**
	BIDDING CONTINGENCY (30%)							**$ 41.40**
	GENERAL CONDITIONS (10%)							**$ 13.80**
	CONSTRUCTION COST, LF							**$ 223**
	PROJECT COST, LF (140%)							**$ 312**

Engineers...Working Wonders With Water™

PROJECT :	**2023 Water and Wastewater Models**	**LOCATION FACTOR:**	**1.00**
JOB # :	**200600A.00**	**DATE :**	July-22
CLIENT :	**City of Prescott**	**ENR :**	13168
ELEMENT :	**Water Main Construction, 12-inch w/hyrdant**	**BY :**	LW

	DESCRIPTION	QUAN	UNIT	MATERIAL & LABOR	SUB	UNIT COST	SUBTOTAL	TOTAL
Pipe	12" CL 52 CLDI MJ PIPE IN OPEN TRENCH	1	LF	$ 48.85	$0.00	$ 49	$ 48.85	
	12" ADDER FOR RESTRAINED JOINTS	0.25	LF	$ 10.30	$0.00	$ 10.30	$ 2.57	
	TOTAL PIPING (per LF)							**$51.42**
Excavation	EARTHWORK							
& Backfill	Cat 225 Trackhoe, 1-1/2CY Bucket, Class B (Medium Digging), 0-16' D	0.83	CY	$ 3.05	$0.00	$ 3.05	$ 2.52	
	Hand Excavation, Class B Material to 5' Depth	0.03	CY	$ 105.08	$0.00	$ 105.08	$ 2.69	
	8' D X 2' W Trench and Manhole Boxes	0.01	Day	$ 28.00	$0.00	$ 28.00	$ 0.28	
	Imported Pipe Bed & Zone/Confined Structure Backfill, Class B Material	0.47	CY	$ 58.79	$0.00	$ 58.79	$ 27.50	
	Imported Trench Backfill/Unconfined Struct. BF, Class B Material	0.32	CY	$ 60.54	$0.00	$ 60.54	$ 19.34	
	Controlled Density Fill (CDF)	0.04	CY	$ 90.00	$0.00	$ 90.00	$ 3.19	
	10% Site Specific Requirements	1.00	LS	$ 5.23	$0.00	$ 5.23	$ 5.23	
	20 CY Dump Truck, 20 Miles/Round Trip	2.01	CY	$ 7.15	$0.00	$ 7.15	$ 14.40	
	TOTAL EARTHWORK (per LF)							**$75.16**
Paving	ASPHALT PAVEMENT CUTTING	8.0	inFT	$ 0.64	$0.00	$ 1	$ 5.12	
Demo &	REMOVE 4"-6" ASPHALT PAVEMENT	0.4	SY	$ 0.68	$0.11	$0.79	$ 0.34	
Replacement	4" AC PAVING ON 8" ABC	0.4	SY	$ 54.80	$4.38	$59.18	$ 25.21	
	TOTAL PAVING (per LF)							**$30.66**
Fittings	12" 90° CLDI MJ BEND	2	EA	$ 1,507.27	$0.00	$1,507.27	$ 3,014.54	
& Valves	12" DI MJ GATE VALVE, NON-RISING STEM	1	EA	$ 3,592.60	$0.00	$3,592.60	$ 3,592.60	
	C.I. Valve Box	1	EA	$ 1,472.50	$0.00	$1,472.50	$ 1,472.50	
	Air Release Valve Assembly	1	EA	$ 1,045.32	$0.00	$1,045.32	$ 1,045.32	
	TOTAL (per Mile)						$ 9,124.96	
	TOTAL FITTING & VALVES (per LF)							**$1.73**
	TOTAL HYDRANT (per LF)							**$25.00**
	OVERHEAD (10%)							**$18.40**
	CONSTRUCTION PROFIT (6%)							**$11.04**
	SALES TAX (65% of above costs at 8.4%)							**$9.98**
	BIDDING CONTINGENCY (30%)							**$55.19**
	GENERAL CONDITIONS (10%)							**$18.40**
	CONSTRUCTION COST, LF							**$297**
	PROJECT COST, LF (%)							**$416**

Engineers...Working Wonders With Water™

PROJECT : 2023 Water and Wastewater Models
JOB # : 200600A.00
CLIENT : City of Prescott
ELEMENT : Water Main Construction, 16-inch

LOCATION FACTOR: 1.00
DATE : July-22
ENR : 13168
BY : LW

	DESCRIPTION	QUAN	UNIT	MATERIAL & LABOR	SUB	UNIT COST	SUBTOTAL	TOTAL
Pipe	16" CL 52 CLDI MJ PIPE IN OPEN TRENCH	1	LF	$61.71	$0.00	$ 62	$ 62	
	16" ADDER FOR RESTRAINED JOINTS	0.25	LF	$15.50	$0.00	$ 15.50	$ 3.87	
	TOTAL PIPING (per LF)							**$65.58**
Excavation	EARTHWORK							
& Backfill	Cat 225 Trackhoe, 1-1/2CY Bucket, Class B (Medium Digging), 0-16' D	0.86	CY	$3.05	$0.00	$ 3.05	$ 2.63	
	Hand Excavation, Class B Material to 5' Depth	0.03	CY	$105.08	$0.00	$ 105.08	$ 2.80	
	8' D X 2' W Trench and Manhole Boxes	0.01	Day	$28.00	$0.00	$ 28.00	$ 0.28	
	Imported Pipe Bed & Zone/Confined Structure Backfill, Class B Material	0.57	CY	$58.79	$0.00	$ 58.79	$ 33.25	
	Imported Trench Backfill/Unconfined Struct. BF, Class B Material	0.24	CY	$60.54	$0.00	$ 60.54	$ 14.80	
	Controlled Density Fill (CDF)	0.03	CY	$90.00	$0.00	$ 90.00	$ 2.44	
	10% Site Specific Requirements	1.00	LS	$5.38	$0.00	$ 5.38	$ 5.38	
	20 CY Dump Truck, 20 Miles/Round Trip	2.11	CY	$7.15	$0.00	$ 7.15	$ 15.10	
	TOTAL EARTHWORK (per LF)							**$76.69**
Paving	ASPHALT PAVEMENT CUTTING	8.0	inFT	$.64	$0.00	$ 1	$ 5.12	
Demo &	REMOVE 4"-6" ASPHALT PAVEMENT	0.7	SY	$.68	$0.11	$0.79	$ 0.53	
Replacement	4" AC PAVING ON 8" ABC	0.7	SY	$54.80	$4.38	$59.18	$ 39.46	
	TOTAL PAVING (per LF)							**$45.10**
Fittings	16" 90° CLDI MJ BEND	2	EA	$2,503.73	$0.00	$2,503.73	$5,007.45	
& Valves	16" DI MJ GATE VALVE, NON-RISING STEM	1	EA	$3,533.99	$0.00	$3,533.99	$3,533.99	
	C.I. Valve Box	1	EA	$1,472.50	$0.00	$1,472.50	$1,472.50	
	Air Release Valve Assembly	1	EA	$1,045.32	$0.00	$1,045.32	$1,045.32	
	TOTAL (per Mile)						$ 11,059	
	TOTAL FITTING & VALVES (per LF)							**$2.09**
	OVERHEAD (10%)							**$18.95**
	CONSTRUCTION PROFIT (6%)							**$11.37**
	SALES TAX (65% of above costs at 8.4%)							**$10.28**
	BIDDING CONTINGENCY (30%)							**$56.84**
	GENERAL CONDITIONS (10%)							**$18.95**
	CONSTRUCTION COST, LF (%)							**$306**
	PROJECT COST, LF (%)							**$428**

Engineers...Working Wonders With Water™

PROJECT :	2023 Water and Wastewater Models	LOCATION FACTOR:	1.00
JOB # :	200600A.00	DATE :	July-22
CLIENT :	City of Prescott	ENR :	13168
ELEMENT :	Water Main Construction, 24-inch	BY :	LW

	DESCRIPTION	QUAN	UNIT	MATERIAL & LABOR	SUB	UNIT COST	SUBTOTAL	TOTAL
Pipe	24" CL 52 CLDI MJ PIPE IN OPEN TRENCH	1	LF	$123.11	$0.00	$ 123	$ 123	
	24" ADDER FOR RESTRAINED JOINTS	0.25	LF	$24.98	$0.00	$ 24.98	$ 6.24	
	TOTAL PIPING (per LF)							**$129.35**
Excavation	EARTHWORK							
& Backfill	Cat 225 Trackhoe, 1-1/2CY Bucket, Class B (Medium Digging), 0-16' D	1.20	CY	$ 3.05	$0.00	$ 3.05	$ 3.67	
	Hand Excavation, Class B Material to 5' Depth	0.04	CY	$ 105.08	$0.00	$ 105.08	$ 3.91	
	8' D X 2' W Trench and Manhole Boxes	0.01	Day	$ 28.00	$0.00	$ 28.00	$ 0.28	
	Imported Pipe Bed & Zone/Confined Structure Backfill, Class B Material	1.02	CY	$ 58.79	$0.00	$ 58.79	$ 60.02	
	Imported Trench Backfill/Unconfined Struct. BF, Class B Material	0.09	CY	$ 60.54	$0.00	$ 60.54	$ 5.63	
	Controlled Density Fill (CDF)	0.01	CY	$ 90.00	$0.00	$ 90.00	$ 0.93	
	10% Site Specific Requirements	1.00	LS	$ 7.35	$0.00	$ 7.35	$ 7.35	
	20 CY Dump Truck, 20 Miles/Round Trip	2.92	CY	$ 7.15	$0.00	$ 7.15	$ 20.87	
	TOTAL EARTHWORK (per LF)							**$102.67**
Paving	ASPHALT PAVEMENT CUTTING	8.0	inFT	$ 0.64	$0.00	$ 1	$ 5.12	
Demo &	REMOVE 4"-6" ASPHALT PAVEMENT	0.8	SY	$ 0.68	$0.11	$0.79	$ 0.66	
Replacement	4" AC PAVING ON 8" ABC	0.8	SY	$ 54.80	$4.38	$59.18	$ 49.87	
	TOTAL PAVING (per LF)							**$55.65**
Fittings	24" 90° CLDI MJ BEND	2	EA	$4,691.81	$0.00	$4,691.81	$9,383.62	
&Valves	24" DI MJ GATE VALVE, NON-RISING STEM	1	EA	$9,585.21	$0.00	$9,585.21	$9,585.21	
	C.I. Valve Box	1	EA	$1,472.50	$0.00	$1,472.50	$1,472.50	
	Air Release Valve Assembly	1	EA	$1,045.32	$0.00	$1,045.32	$1,045.32	
	TOTAL (per Mile)						$ 21,486.66	
	TOTAL FITTING & VALVES (per LF)							**$4.07**
	OVERHEAD (10%)							**$29.17**
	CONSTRUCTION PROFIT (6%)							**$17.50**
	SALES TAX (65% of above costs at 8.4%)							**$15.83**
	BIDDING CONTINGENCY (30%)							**$87.52**
	GENERAL CONDITIONS (10%)							**$29.17**
	CONSTRUCTION COST, LF							**$471**
	PROJECT COST, LF (140%)							**$659**

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PROJECT : 2023 Water and Wastewater Models
JOB # : 200600A.00
CLIENT : City of Prescott
ELEMENT : Drill Well, 700 feet deep

ENR: 13168
DATE: 1-Jul-22

ITEM NO.	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	ADJUSTMENT	UNIT PRICE	TOTAL
1	Mobilization and Demobilization	1	LS	$ 45,018.07	1.71	$ 76,986.75	$ 76,986.75
2	Well Drilling	700	LF	$ 110.00	1.71	$ 188.11	$ 131,680.00
3	Casing & Gravel Pack Installation	500	LF	$ 350.00	1.71	$ 598.55	$ 299,272.73
4	Stainless Steel Screen & Gravel Pack Installation	200	LF	$ 550.90	1.71	$ 942.12	$ 188,423.38
5	Well Logging and Sampling	1	LS	$ 50,000.00	1.71	$ 85,506.49	$ 85,506.49
6	Well Development and Testing	1	LS	$ 38,000.00	1.71	$ 64,984.94	$ 64,984.94
7	Contractor Overhead & Profit (16%)						$ 135,500
8	Sales Tax (65% of above costs at 8.35%)						$ 53,940
9	Contingency (30%)						$ 127,030
10	General Conditions (10%)						$ 127,030
	CONSTRUCTION COST						**$ 1,290,000**
	PROJECT COST						**$ 1,806,000**

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PROJECT :	**2023 Water and Wastewater Models**	ENR:	13168
JOB # :	**200600A.00**	DATE:	1-Jul-22
CLIENT :	**City of Prescott**		
ELEMENT :	**Well Site Construction, 150 hp, 750 gpm**		

ITEM NO.	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	Mobilization and Demobilization	1	LS	$ 65,881.65	$ 65,881.65
2	150HP Well Pump & 400 ft Pipe Column	1	LS	$ 128,259.74	$ 128,259.74
3	Well Pad (6' x 6' 12")	1.5	CY	$ 769.56	$ 1,154.34
4	Piping Support Pad - (6'x12'x8")	1.75	CY	$ 769.56	$ 1,346.73
5	Piping - 10" MJ DIP & Excavation	300	LF	$ 149.31	$ 1,346.73
6	10" DIP MJ Fittings	8	EA	$ 2,525.21	$ 20,201.70
7	10" DIP BF Valve	2	EA	$ 3,058.65	$ 6,117.31
8	10" DIP Check Valve	2	EA	$ 6,347.56	$ 12,695.12
9	Misc Pipe Supports	1	LS	$ 855.06	$ 855.06
10	Shade Cover over Electrical Equipment	200	SF	$ 34.20	$ 6,840.52
11	Electrical Equipment Slab (10' x 20' x 8")	5	CY	$ 684.05	$ 3,420.26
12	Electrical Serivce, Conduit & Wiring	1	LS	$ 384,779.22	$ 384,779.22
13	RTU in NEMA Enclosure with Antenna	1	LS	$ 34,202.60	$ 34,202.60
14	Pole & Base	1	LS	$ 855.06	$ 855.06
15	Flow Meter, Transmitter and Instrumentation	2	LS	$ 23,240.66	$ 46,481.33
16	Equipment Testing & Start-up	1	LS	$ 10,260.78	$ 10,260.78
17	Contractor Overhead & Profit (16%)				$ 115,950
18	Sales Tax (65% of above costs at 8.35%)				$ 46,160
19	Contingency (30%)				$ 108,700
20	General Conditions (10%)				$ 108,700
	TOTAL CONSTRUCTION COST				**$ 1,104,000**
	TOTAL PROJECT COST				**$ 1,546,000**

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PROJECT : **2023 Water and Wastewater Models**
JOB # : **200600A.00**
CLIENT : **City of Prescott**
ELEMENT : **Drill Well, 1,100 feet deep**

ENR: 13168
DATE: 1-Jul-22

ITEM NO.	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	Mobilization and Demobilization	1	LS	$ 113,600	$ 113,600
2	Well Drilling	1100	LF	$ 190	$ 206,900
3	Casing & Gravel Pack Installation	900	LF	$ 600	$ 538,700
4	Stainless Steel Screen & Gravel Pack Installation	200	LF	$ 940	$ 188,400
5	Well Logging and Sampling	1	LS	$ 111,200	$ 111,200
6	Well Development and Testing	1	LS	$ 90,600	$ 90,600
7	Contractor Overhead & Profit (16%)				$ 199,900
8	Sales Tax (65% of above costs at 8.35%)				$ 79,590
9	Bidding Contingency (30%)				$ 187,410
10	General Conditions (10%)				$ 187,410
	TOTAL CONSTRUCTION COST				**$ 1,904,000**
	TOTAL PROJECT COST				**$ 2,666,000**

Engineers...Working Wonders With Water®

PROJECT:	2023 Water and Wastewater Models	ENR:	13168
JOB NO.:	200600A.00	DATE:	1-Jul-22
CLIENT:	City of Prescott		
ELEMENT:	Well Site Construction, 400 hp, 1,400 gpm		

ITEM NO.	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	Mobilization and Demobilization	1	LS	$ 94,900	$ 94,900
2	400HP Well Pump & 900 ft Pipe Column	1	LS	$ 183,000	$ 183,000
3	Well Pad (6' x 6' 12")	1.5	CY	$ 770	$ 1,150
4	Piping Support Pad - (6'x12'x8")	1.75	CY	$ 770	$ 1,350
5	Piping - 12" MJ DIP & Excavation	300	LF	$ 310	$ 92,100
6	12" DIP MJ Fittings	8	EA	$ 2,920	$ 23,400
7	12" DIP Valve	2	EA	$ 5,300	$ 10,700
8	12" DIP Check Valve	2	EA	$ 9,900	$ 19,800
9	Misc Pipe Supports	1	LS	$ 860	$ 860
10	Shade Cover over Electrical Equipment	200	SF	$ 34	$ 6,800
11	Electrical Equipment Slab (10' x 20' x 8")	5	CY	$ 680	$ 3,420
12	Electrical Serivce, Conduit & Wiring	1	LS	$ 427,500	$ 427,500
13	RTU in NEMA Enclosure with Antenna	1	LS	$ 34,200	$ 34,200
14	Pole & Base	1	LS	$ 860	$ 860
15	Flow Meter, Transmitter and Instrumentation	2	LS	$ 23,200	$ 46,500
16	Security Allowance	1	LS	$ 12,800.00	$ 12,800
17	Site Lighting	4	EA	$ 4,790.00	$ 19,200
18	Access Gate	1	EA	$ 2,570.00	$ 2,570
19	CMU Wall	300	LF	$ 180.00	$ 55,500
20	Site 4" ABC Finish	5625	SF	$ 0.50	$ 2,890
21	Concrete Drive	1	EA	$ 1,710.00	$ 1,710
22	Asphalt Driveway	1	LS	$ 2,910.00	$ 2,910
23	Equipment Testing & Start-up	1	LS	$ 10,300.00	$ 10,300
24	Contractor Overhead & Profit (16%)				$ 168,710
25	Sales Tax (65% of above costs at 8.35%)				$ 67,170
29	Contingency (30%)				$ 158,160
30	General Conditions (10%)				$ 158,160
	TOTAL CONSTRUCTION COST				**$ 1,607,000**
	TOTAL PROJECT COST				**$ 2,250,000**

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PROJECT :	**2023 Water and Wastewater Models**	**LOCATION FACTOR:**	**1.000**
		DATE :	July-22
JOB # :	**200600A.00**	**ENR as of Jun-2018**	11069
		ENR for Jul-2022	13168
CLIENT :	**City of Prescott**	**ENR Factor:**	1.19
ELEMENT :	**Booster Pump Station, 1.5 mgd**	**BY :**	LW

	DESCRIPTION	QUAN	UNIT	MATERIAL & LABOR	ENR	UNIT COST	SUBTOTAL	TOTAL
	Mobilization and Demobilization	1	LS	$ 93,641.94	Y	$ 111,399.13	$111,399.13	
	Material Testing	1	LS	$ 2,500.00	N	$ 2,500.00	$ 2,500.00	
	12" CL 52 CLDI MJ PIPE IN OPEN TRENCH	300	LF	$48.85	N	$ 48.85	$ 14,655.24	
	12" DIP MJ Fittings	4	EA	$ 6,612.89	Y	$ 7,866.88	$ 31,467.53	
	125 hp Vertical Turbine Pump w/ Pump Can	2	EA	$ 42,000.00	Y	$ 49,964.41	$ 99,928.81	
	12" Discharge Piping FL DIP (10 FT per pump)	2	EA	$ 1,027.07	Y	$ 1,221.83	$ 2,443.66	
	12" F X F AWWA SWING CHECK VALVE	2	EA	$6,780.63	N	$ 6,780.63	$ 13,561.26	
	12" FL BFV	2	EA	$ 1,955.00	N	$ 1,955.00	$ 3,910.00	
	12" DIP FL Fittings	4	EA	$ 2,456.00	Y	$ 2,921.73	$ 11,686.91	
	12" DIP FL Pipe - Manifold	30	LF	$ 102.71	N	$ 102.71	$ 3,081.30	
	10" Flowmeter	1	EA	$ 6,700.00	N	$ 6,700.00	$ 6,700.00	
	12" Reducers	2	EA	$ 578.00	N	$ 578.00	$ 1,156.00	
	12" FL BFVs	2	EA	$ 3,121.00	N	$ 3,121.00	$ 6,242.00	
	Pressure Transmitters and Instrumentation	2	LS	$ 8,623.64	Y	$ 10,258.93	$ 20,517.86	
	Piping Support Pad - (10'x20'x12")	7.5	CY	$ 646.77	Y	$ 769.42	$ 5,770.62	
	Misc Pipe Supports	1	LS	$ 1,500.00	N	$ 1,500.00	$ 1,500.00	
	Chlorine Fiberglass Enclosure	1	LS	$ 8,960.00	Y	$ 10,659.07	$ 10,659.07	
	Chlorine Building Slab (6'x6'x8")	1	CY	$ 327.34	N	$ 327.34	$ 327.34	
	Chlorine Equipment & Piping	1	LS	$ 4,480.00	Y	$ 5,329.54	$ 5,329.54	
	5,000 gallon hydromatic tank w/ air comp & controls	1	LS	$ 173,275.20	N	$ 173,275.20	$173,275.20	
	Tank and A/C Pad (10'x20'x12")	7.5	CY	$ 646.77	Y	$ 769.42	$ 5,770.62	
	Electrical Service, Swichgear, Panels, Wiring, and Cond	1	LS	$ 151,720.46	N	$ 151,720.46	$151,720.46	
	125 hp Motor VFDs	2	EA	$ 33,000.00	N	$ 33,000.00	$ 66,000.00	
	Electrical Pre-Cast Vault/Buidling	1	LS	$ 50,000.00	N	$ 50,000.00	$ 50,000.00	
	Emergency Generator w/ Fuel Tank	1	LS	$ 48,292.36	Y	$ 57,449.98	$ 57,449.98	
	Generator Pad (15'x20'x18")	17	CY	$ 450.00	Y	$ 535.33	$ 9,100.66	
	RTU in NEMA Enclosure with Antenna	1	LS	$ 28,745.45	Y	$ 34,196.41	$ 34,196.41	
	Pole & Base	1	LS	$ 718.64	Y	$ 854.91	$ 854.91	
	Security Allowance	1	LS	$ 7,500.00	N	$ 7,500.00	$ 7,500.00	
	Site Lighting	4	EA	$ 2,800.00	N	$ 2,800.00	$ 11,200.00	
	Access Gate	1	EA	$ 2,155.91	Y	$ 2,564.73	$ 2,564.73	
	CMU Wall	590	LF	$ 184.87	N	$ 184.87	$109,073.18	
	Site 4" ABC Finish	21780	SF	$ 0.45	Y	$ 0.54	$ 11,659.55	
	Concrete Drive	1	EA	$ 1,437.27	Y	$ 1,709.82	$ 1,709.82	
	Asphalt Driveway	1	LS	$ 2,443.36	Y	$ 2,906.69	$ 2,906.69	
								$1,047,818.50
	OVERHEAD (10%)							**$104,781.85**
	CONSTRUCTION PROFIT (6%)							**$62,869.11**
	SALES TAX (65% of above costs at 8.4%)							**$56,870.35**
	BIDDING CONTINGENCY (30%)							**$314,345.55**
	GENERAL CONDITIONS (10%)							**$104,781.85**
	CONSTRUCTION COST, LF							**$1,691,467**
	PROJECT COST, LF (140%)							**$2,368,054**

Engineers...Working Wonders With Water™

PROJECT :	2023 Water and Wastewater Models	LOCATION FACTOR:	1.000
		DATE :	July-22
JOB # :	200600A.00	ENR as of Jun-2018	11069
		ENR for Jul-2022	13168
CLIENT :	City of Prescott	ENR Factor:	1.19
ELEMENT :	Booster Pump Station, 2 mgd	BY :	LW

	DESCRIPTION	QUAN	UNIT	MATERIAL & LABOR	ENR	UNIT COST	SUBTOTAL	TOTAL
	Mobilization and Demobilization (10%)	1	LS	$ 112,061.77	Y	$ 133,311.89	$133,311.89	
	Material Testing	1	LS	$ 3,593.18	Y	$ 4,274.55	$ 4,274.55	
	12" CL 52 CLDI MJ PIPE IN OPEN TRENCH	300	LF	$48.85	N	$ 48.85	$ 14,655.24	
	12" DIP MJ Fittings	4	EA	$ 6,612.89	Y	$ 7,866.88	$ 31,467.53	
	125 hp Vertical Turbine Pump w/ Pump Can	2	EA	$ 60,365.45	Y	$ 71,812.47	$143,624.94	
	12" Discharge Piping FL DIP (10 FT per pump)	2	EA	$ 1,027.07	Y	$ 1,221.83	$ 2,443.66	
	12" F X F AWWA SWING CHECK VALVE	2	EA	$6,780.63	N	$ 6,780.63	$ 13,561.26	
	12" FL BFV	2	EA	$ 1,955.00	N	$ 1,955.00	$ 3,910.00	
	12" DIP FL Fittings	4	EA	$ 2,456.00	Y	$ 2,921.73	$ 11,686.91	
	12" DIP FL Pipe - Manifold	30	LF	$ 102.71	N	$ 102.71	$ 3,081.30	
	10" Flowmeter	1	EA	$ 6,700.00	N	$ 6,700.00	$ 6,700.00	
	12" Reducers	2	EA	$ 578.00	N	$ 578.00	$ 1,156.00	
	12" FL BFVs	2	EA	$ 3,121.00	N	$ 3,121.00	$ 6,242.00	
	Pressure Transmitters and Instrumentation	2	LS	$ 8,623.64	Y	$ 10,258.93	$ 20,517.86	
	Piping Support Pad - (10'x20'x12")	7.5	CY	$ 646.77	Y	$ 769.42	$ 5,770.62	
	Misc Pipe Supports	1	LS	$ 1,500.00	N	$ 1,500.00	$ 1,500.00	
	Chlorine Fiberglass Enclosure	1	LS	$ 8,960.00	Y	$ 10,659.07	$ 10,659.07	
	Chlorine Building Slab (6'x6'x8")	1	CY	$ 327.34	N	$ 327.34	$ 327.34	
	Chlorine Equipment & Piping	1	LS	$ 4,480.00	Y	$ 5,329.54	$ 5,329.54	
	5,000 gallon hydromatic tank w/ air comp & controls	1	LS	$ 173,275.20	N	$ 173,275.20	$173,275.20	
	Tank and A/C Pad (10'x20'x12")	7.5	CY	$ 646.77	Y	$ 769.42	$ 5,770.62	
	Electrical Service, Swichgear, Panels, Wiring, and Con	1	LS	$ 192,899.92	N	$ 192,899.92	$192,899.92	
	125 hp Motor VFDs	2	EA	$ 47,430.00	Y	$ 56,424.09	$112,848.18	
	Electrical Pre-Cast Vault/Buidling	1	LS	$ 71,863.64	Y	$ 85,491.05	$ 85,491.05	
	Emergency Generator w/ Fuel Tank	1	LS	$ 48,292.36	Y	$ 57,449.98	$ 57,449.98	
	Generator Pad (15'x20'x18")	17	CY	$ 646.77	Y	$ 769.42	$ 13,080.07	
	RTU in NEMA Enclosure with Antenna	1	LS	$ 28,745.45	Y	$ 34,196.41	$ 34,196.41	
	Pole & Base	1	LS	$ 718.64	Y	$ 854.91	$ 854.91	
	Security Allowance	1	LS	$ 10,779.55	N	$ 10,779.55	$ 10,779.55	
	Site Lighting	4	EA	$ 4,024.36	Y	$ 4,787.49	$ 19,149.98	
	Access Gate	1	EA	$ 2,155.91	Y	$ 2,564.73	$ 2,564.73	
	CMU Wall	590	LF	$ 184.87	N	$ 184.87	$109,073.18	
	Site 4" ABC Finish	21780	SF	$ 0.45	Y	$ 0.54	$ 11,659.55	
	Concrete Drive	1	EA	$ 1,437.27	Y	$ 1,709.82	$ 1,709.82	
	Asphalt Driveway	1	LS	$ 2,443.36	Y	$ 2,906.69	$ 2,906.69	
								$1,253,929.57
	OVERHEAD (10%)							**$125,392.96**
	CONSTRUCTION PROFIT (6%)							**$75,235.77**
	SALES TAX (65% of above costs at 8.4%)							**$68,057.03**
	BIDDING CONTINGENCY (30%)							**$376,178.87**
	GENERAL CONDITIONS (10%)							**$125,392.96**
	CONSTRUCTION COST, LF							**$2,024,187**
	PROJECT COST, LF (140%)							**$2,833,862**

Engineers...Working Wonders With Water™

PROJECT :	2023 Water and Wastewater Models	LOCATION FACTOR:	1.000
		DATE :	July-22
JOB # :	200600A.00	ENR as of Jun-2018	11069
		ENR for Jul-2022	13168
CLIENT :	City of Prescott	ENR Factor:	1.19
ELEMENT :	Booster Pump Station, 3 mgd	BY :	LW

	DESCRIPTION	QUAN	UNIT	MATERIAL & LABOR	ENR	UNIT COST	SUBTOTAL	TOTAL
	Mobilization and Demobilization (10%)	1	LS	$ 136,167.61	Y	$ 161,988.90	$161,988.90	
	Material Testing	1	LS	$ 3,593.18	Y	$ 4,274.55	$ 4,274.55	
	12" CL 52 CLDI MJ PIPE IN OPEN TRENCH	300	LF	$48.85	N	$ 48.85	$ 14,655.24	
	12" DIP MJ Fittings	4	EA	$ 6,612.89	Y	$ 7,866.88	$ 31,467.53	
	125 hp Vertical Turbine Pump w/ Pump Can	3	EA	$ 70,023.93	Y	$ 83,302.48	$249,907.43	
	12" Discharge Piping FL DIP (10 FT per pump)	3	EA	$ 1,027.07	Y	$ 1,221.83	$ 3,665.50	
	12" F X F AWWA SWING CHECK VALVE	2	EA	$6,780.63	N	$ 6,780.63	$ 13,561.26	
	12" FL BFV	3	EA	$ 1,955.00	N	$ 1,955.00	$ 5,865.00	
	12" DIP FL Fittings	6	EA	$ 2,456.00	Y	$ 2,921.73	$ 17,530.37	
	12" DIP FL Pipe - Manifold	30	LF	$ 102.71	N	$ 102.71	$ 3,081.30	
	10" Flowmeter	1	EA	$ 6,700.00	N	$ 6,700.00	$ 6,700.00	
	12" Reducers	3	EA	$ 578.00	N	$ 578.00	$ 1,734.00	
	12" FL BFVs	3	EA	$ 3,121.00	N	$ 3,121.00	$ 9,363.00	
	Pressure Transmitters and Instrumentation	2	LS	$ 8,623.64	Y	$ 10,258.93	$ 20,517.86	
	Piping Support Pad - (10'x20'x12")	10	CY	$ 646.77	Y	$ 769.42	$ 7,694.16	
	Misc Pipe Supports	1	LS	$ 1,500.00	N	$ 1,500.00	$ 1,500.00	
	Chlorine Fiberglass Enclosure	1	LS	$ 8,960.00	Y	$ 10,659.07	$ 10,659.07	
	Chlorine Building Slab (6'x6'x8")	1	CY	$ 327.34	N	$ 327.34	$ 327.34	
	Chlorine Equipment & Piping	1	LS	$ 4,480.00	Y	$ 5,329.54	$ 5,329.54	
	5,000 gallon hydromatic tank w/ air comp & controls	1	LS	$ 200,999.23	Y	$ 239,114.45	$239,114.45	
	Tank and A/C Pad (10'x20'x12")	7.5	CY	$ 646.77	Y	$ 769.42	$ 5,770.62	
	Electrical Service, Swichgear, Panels, Wiring, and Con	1	LS	$ 245,149.68	N	$ 245,149.68	$245,149.68	
	125 hp Motor VFDs	2	EA	$ 47,430.00	Y	$ 56,424.09	$112,848.18	
	Electrical Pre-Cast Vault/Buidling	1	LS	$ 71,863.64	Y	$ 85,491.05	$ 85,491.05	
	Emergency Generator w/ Fuel Tank	1	LS	$ 48,292.36	Y	$ 57,449.98	$ 57,449.98	
	Generator Pad (15'x20'x18")	17	CY	$ 646.77	Y	$ 769.42	$ 13,080.07	
	RTU in NEMA Enclosure with Antenna	1	LS	$ 28,745.45	Y	$ 34,196.41	$ 34,196.41	
	Pole & Base	1	LS	$ 718.64	Y	$ 854.91	$ 854.91	
	Security Allowance	1	LS	$ 10,779.55	Y	$ 12,823.66	$ 12,823.66	
	Site Lighting	4	EA	$ 4,024.36	Y	$ 4,787.49	$ 19,149.98	
	Access Gate	1	EA	$ 2,155.91	Y	$ 2,564.73	$ 2,564.73	
	CMU Wall	590	LF	$ 184.87	N	$ 184.87	$109,073.18	
	Site 4" ABC Finish	21780	SF	$ 0.45	Y	$ 0.54	$ 11,659.55	
	Concrete Drive	1	EA	$ 1,437.27	Y	$ 1,709.82	$ 1,709.82	
	Asphalt Driveway	1	LS	$ 2,443.36	Y	$ 2,906.69	$ 2,906.69	
								$1,523,665.01
	OVERHEAD (10%)							**$152,366.50**
	CONSTRUCTION PROFIT (6%)							**$91,419.90**
	SALES TAX (65% of above costs at 8.4%)							**$82,696.92**
	BIDDING CONTINGENCY (30%)							**$457,099.50**
	GENERAL CONDITIONS (10%)							**$152,366.50**
	CONSTRUCTION COST, LF							**$2,459,614**
	PROJECT COST, LF (140%)							**$3,443,460**

Engineers...Working Wonders With Water™

PROJECT :	2023 Water and Wastewater Models	LOCATION FACTOR:	1.000
		DATE :	July-22
JOB # :	200600A.00	ENR as of Jun-2018	11069
		ENR for Jul-2022	13168
CLIENT :	City of Prescott	ENR Factor:	1.19
ELEMENT :	Booster Pump Station, 4 mgd	BY :	LW

	DESCRIPTION	QUAN	UNIT	MATERIAL & LABOR	ENR	UNIT COST	SUBTOTAL	TOTAL
	Mobilization and Demobilization (10%)	1	LS	$ 146,863.65	Y	$ 174,713.22	$174,713.22	
	Material Testing	1	LS	$ 3,593.18	Y	$ 4,274.55	$ 4,274.55	
	16" CL 52 CLDI MJ PIPE IN OPEN TRENCH	300	LF	$61.71	N	$ 61.71	$ 18,511.50	
	16" DIP MJ Fittings	4	EA	$ 3,079.59	Y	$ 3,663.57	$ 14,654.27	
	125 hp Vertical Turbine Pump w/ Pump Can	3	EA	$ 53,760.00	Y	$ 63,954.44	$191,863.32	
	12" Discharge Piping FL DIP (10 FT per pump)	3	EA	$ 1,072.97	Y	$ 1,276.44	$ 3,829.31	
	12" F X F AWWA SWING CHECK VALVE	3	EA	$6,780.63	N	$ 6,780.63	$ 20,341.89	
	12" FL BFV	3	EA	$ 3,120.98	N	$ 3,120.98	$ 9,362.94	
	16" DIP FL Fittings	4	EA	$ 3,079.59	Y	$ 3,663.57	$ 14,654.27	
	16" DIP FL Pipe - Manifold	30	LF	$ 181.04	N	$ 181.04	$ 5,431.20	
	12" Flowmeter	1	EA	$ 8,288.88	N	$ 8,288.88	$ 8,288.88	
	16" Reducers	2	EA	$ 1,066.57	N	$ 1,066.57	$ 2,133.14	
	16" FL BFVs	2	EA	$ 2,576.86	N	$ 2,576.86	$ 5,153.72	
	Pressure Transmitters and Instrumentation	2	LS	$ 8,623.64	Y	$ 10,258.93	$ 20,517.86	
	Piping Support Pad - (10'x20'x12")	7.5	CY	$ 646.77	Y	$ 769.42	$ 5,770.62	
	Misc Pipe Supports	1	LS	$ 1,920.00	Y	$ 2,284.09	$ 2,284.09	
	Chlorine Fiberglass Enclosure	1	LS	$ 8,960.00	Y	$ 10,659.07	$ 10,659.07	
	Chlorine Building Slab (6'x6'x8")	1	CY	$ 317.37	N	$ 317.37	$ 317.37	
	Chlorine Equipment & Piping	1	LS	$ 4,480.00	Y	$ 5,329.54	$ 5,329.54	
	5,000 gallon hydromatic tank w/ air comp & controls	1	LS	$ 241,461.82	Y	$ 287,249.91	$287,249.91	
	Tank and A/C Pad (10'x20'x12")	7.5	CY	$ 646.77	Y	$ 769.42	$ 5,770.62	
	Electrical Service, Swichgear, Panels, Wiring, and Con	1	LS	$ 271,312.43	N	$ 271,312.43	$271,312.43	
	125 hp Motor VFDs	3	EA	$ 47,430.00	Y	$ 56,424.09	$169,272.27	
	Electrical Pre-Cast Vault/Buidling	1	LS	$ 71,863.64	Y	$ 85,491.05	$ 85,491.05	
	Emergency Generator w/ Fuel Tank	1	LS	$ 82,499.45	Y	$ 98,143.71	$ 98,143.71	
	Generator Pad (15'x20'x18")	17	CY	$ 646.77	Y	$ 769.42	$ 13,080.07	
	RTU in NEMA Enclosure with Antenna	1	LS	$ 28,745.45	Y	$ 34,196.41	$ 34,196.41	
	Pole & Base	1	LS	$ 718.64	Y	$ 854.91	$ 854.91	
	Security Allowance	1	LS	$ 10,779.55	Y	$ 12,823.66	$ 12,823.66	
	Site Lighting	4	EA	$ 4,024.36	Y	$ 4,787.49	$ 19,149.98	
	Access Gate	1	EA	$ 2,155.91	Y	$ 2,564.73	$ 2,564.73	
	CMU Wall	590	LF	$ 184.87	N	$ 184.87	$109,073.18	
	Site 4" ABC Finish	21780	SF	$ 0.45	Y	$ 0.54	$ 11,659.55	
	Concrete Drive	1	EA	$ 1,437.27	Y	$ 1,709.82	$ 1,709.82	
	Asphalt Driveway	1	LS	$ 2,443.36	Y	$ 2,906.69	$ 2,906.69	
								$1,643,349.75
	OVERHEAD (10%)							**$164,334.97**
	CONSTRUCTION PROFIT (6%)							**$98,600.98**
	SALES TAX (65% of above costs at 8.4%)							**$89,192.81**
	BIDDING CONTINGENCY (30%)							**$493,004.92**
	GENERAL CONDITIONS (10%)							**$164,334.97**
	CONSTRUCTION COST, LF							**$2,652,818**
	PROJECT COST, LF (140%)							**$3,713,946**

Engineers...Working Wonders With Water™

PROJECT :	**2023 Water and Wastewater Models**	**LOCATION FACTOR:**	**1.000**
		DATE :	July-22
JOB # :	**200600A.00**	**ENR as of Jun-2018**	11069
		ENR for Jul-2022	13168
CLIENT :	**City of Prescott**	**ENR Factor:**	1.19
ELEMENT :	**Booster Pump Station, 6 mgd**	**BY :**	LW

	DESCRIPTION	QUAN	UNIT	MATERIAL & LABOR	ENR	UNIT COST	SUBTOTAL	TOTAL
	Mobilization and Demobilization	1	LS	$ 184,535.09	Y	$ 219,528.24	$219,528.24	
	Material Testing	1	LS	$ 3,593.18	Y	$ 4,274.55	$ 4,274.55	
	20" CL 52 CLDI MJ PIPE IN OPEN TRENCH	300	LF	$102.81	N	$ 102.81	$ 30,841.50	
	20" DIP MJ Fittings	4	EA	$ 4,947.11	Y	$ 5,885.22	$ 23,540.90	
	125 hp Vertical Turbine Pump w/ Pump Can	4	EA	$ 60,365.45	Y	$ 71,812.47	$287,249.89	
	12" Discharge Piping FL DIP (10 FT per pump)	4	EA	$ 2,919.89	Y	$ 3,473.58	$ 13,894.34	
	12" F X F AWWA SWING CHECK VALVE	4	EA	$6,780.63	N	$ 6,780.63	$ 27,122.52	
	12" FL BFV	4	EA	$ 1,954.96	N	$ 1,954.96	$ 7,819.84	
	20" DIP FL Fittings	4	EA	$ 5,817.68	N	$ 5,817.68	$ 23,270.72	
	20" DIP FL Pipe - Manifold	30	LF	$ 283.53	N	$ 283.53	$ 8,505.90	
	20" Flowmeter	1	EA	$ 16,409.97	Y	$ 19,521.77	$ 19,521.77	
	20" Reducers	2	EA	$ 1,488.06	N	$ 1,488.06	$ 2,976.12	
	20" Fxf BFVs	2	EA	$ 7,696.75	N	$ 7,696.75	$ 15,393.50	
	Pressure Transmitters and Instrumentation	2	LS	$ 8,623.64	Y	$ 10,258.93	$ 20,517.86	
	Piping Support Pad - (10'x20'x12")	7.5	CY	$ 646.77	Y	$ 769.42	$ 5,770.62	
	Misc Pipe Supports	1	LS	$ 2,155.91	Y	$ 2,564.73	$ 2,564.73	
	Chlorine Fiberglass Enclosure	1	LS	$ 10,060.91	Y	$ 11,968.75	$ 11,968.75	
	Chlorine Building Slab (6'x6'x8")	1	CY	$ 456.15	Y	$ 542.65	$ 542.65	
	Chlorine Equipment & Piping	1	LS	$ 5,030.45	Y	$ 5,984.37	$ 5,984.37	
	5,000 gallon hydromatic tank w/ air comp & controls	1	LS	$ 173,275.20	N	$ 173,275.20	$173,275.20	
	Tank and A/C Pad (10'x20'x12")	7.5	CY	$ 646.77	Y	$ 769.42	$ 5,770.62	
	Electrical Service, Swichgear, Panels, Wiring, and Con	1	LS	$ 383,150.60	Y	$ 455,806.95	$455,806.95	
	125 hp Motor VFDs	4	EA	$ 47,430.00	Y	$ 56,424.09	$225,696.36	
	Electrical Pre-Cast Vault/Buidling	1	LS	$ 71,863.64	Y	$ 85,491.05	$ 85,491.05	
	Emergency Generator w/ Fuel Tank	1	LS	$ 150,913.64	Y	$ 179,531.20	$179,531.20	
	Generator Pad (15'x20'x18")	17	CY	$ 646.77	Y	$ 769.42	$ 13,080.07	
	RTU in NEMA Enclosure with Antenna	1	LS	$ 28,745.45	Y	$ 34,196.41	$ 34,196.41	
	Pole & Base	1	LS	$ 718.64	Y	$ 854.91	$ 854.91	
	Security Allowance	1	LS	$ 10,779.55	Y	$ 12,823.66	$ 12,823.66	
	Site Lighting	4	EA	$ 4,024.36	Y	$ 4,787.49	$ 19,149.98	
	Access Gate	1	EA	$ 2,155.91	Y	$ 2,564.73	$ 2,564.73	
	CMU Wall	590	LF	$ 184.87	N	$ 184.87	$109,073.18	
	Site 4" ABC Finish	21780	SF	$ 0.45	Y	$ 0.54	$ 11,659.55	
	Concrete Drive	1	EA	$ 1,437.27	Y	$ 1,709.82	$ 1,709.82	
	Asphalt Driveway	1	LS	$ 2,443.36	Y	$ 2,906.69	$ 2,906.69	
								$2,064,879.13
	OVERHEAD (10%)							**$206,487.91**
	CONSTRUCTION PROFIT (6%)							**$123,892.75**
	SALES TAX (65% of above costs at 8.4%)							**$112,071.31**
	BIDDING CONTINGENCY (30%)							**$619,463.74**
	GENERAL CONDITIONS (10%)							**$206,487.91**
	CONSTRUCTION COST, LF							**$3,333,283**
	PROJECT COST, LF (140%)							**$4,666,596**

Engineers...Working Wonders With Water™

PROJECT :	2023 Water and Wastewater Models	LOCATION FACTOR:	1.000
		DATE :	July-22
JOB # :	200600A.00	ENR as of Jun-2018	11069
		ENR for Jul-2022	13168
CLIENT :	City of Prescott	ENR Factor:	1.19
ELEMENT :	Booster Pump Station, 8 mgd	BY :	LW

	DESCRIPTION	QUAN	UNIT	MATERIAL & LABOR	ENR	UNIT COST	SUBTOTAL	TOTAL
	Mobilization and Demobilization (10%)	1	LS	$ 206,644.54	Y	$ 245,830.27	$245,830.27	
	Material Testing	1	LS	$ 3,593.18	Y	$ 4,274.55	$ 4,274.55	
	24" CL 52 CLDI MJ PIPE IN OPEN TRENCH	300	LF	$123.11	N	$ 123.11	$ 36,932.55	
	24" DIP MJ Fittings	4	EA	$ 6,613.16	Y	$ 7,867.20	$ 31,468.82	
	125 hp Vertical Turbine Pump w/ Pump Can	5	EA	$ 60,365.45	Y	$ 71,812.47	$359,062.36	
	12" Discharge Piping FL DIP (10 FT per pump)	5	EA	$ 2,919.89	Y	$ 3,473.58	$ 17,367.92	
	12" F X F AWWA SWING CHECK VALVE	5	EA	$6,780.63	N	$ 6,780.63	$ 33,903.14	
	12" FL BFV	5	EA	$ 1,954.96	N	$ 1,954.96	$ 9,774.80	
	24" DIP FL Fittings	4	EA	$ 4,745.67	N	$ 4,745.67	$ 18,982.68	
	24" DIP FL Pipe - Manifold	30	LF	$ 291.99	N	$ 291.99	$ 8,759.70	
	20" Flowmeter	1	EA	$ 18,426.25	Y	$ 21,920.40	$ 21,920.40	
	24" Reducers	2	EA	$ 1,909.55	N	$ 1,909.55	$ 3,819.10	
	24" FL BFVs	2	EA	$ 5,642.90	N	$ 5,642.90	$ 11,285.80	
	Pressure Transmitters and Instrumentation	2	LS	$ 8,623.64	Y	$ 10,258.93	$ 20,517.86	
	Piping Support Pad - (10'x20'x12")	7.5	CY	$ 646.77	Y	$ 769.42	$ 5,770.62	
	Misc Pipe Supports	1	LS	$ 2,155.91	Y	$ 2,564.73	$ 2,564.73	
	5,000 gallon hydromatic tank w/ air comp & controls	1	LS	$ 241,461.82	Y	$ 287,249.91	$287,249.91	
	Tank and A/C Pad (10'x20'x12")	7.5	CY	$ 646.77	Y	$ 769.42	$ 5,770.62	
	Electrical Service, Swichgear, Panels, Wiring, and Conduit	1	LS	$ 456,861.91	Y	$ 543,496.04	$543,496.04	
	125 hp Motor VFDs	5	EA	$ 47,430.00	Y	$ 56,424.09	$282,120.44	
	Electrical Pre-Cast Vault/Buidling	1	LS	$ 71,863.64	Y	$ 85,491.05	$ 85,491.05	
	Emergency Generator w/ Fuel Tank	1	LS	$ 150,913.64	Y	$ 179,531.20	$179,531.20	
	Generator Pad (15'x20'x18")	17	CY	$ 646.77	Y	$ 769.42	$ 13,080.07	
	RTU in NEMA Enclosure with Antenna	1	LS	$ 28,745.45	Y	$ 34,196.41	$ 34,196.41	
	Pole & Base	1	LS	$ 718.64	Y	$ 854.91	$ 854.91	
	Security Allowance	1	LS	$ 10,779.55	Y	$ 12,823.66	$ 12,823.66	
	Site Lighting	4	EA	$ 4,024.36	Y	$ 4,787.49	$ 19,149.98	
	Site 4" ABC Finish	21780	SF	$ 0.45	Y	$ 0.54	$ 11,659.55	
	Concrete Drive	1	EA	$ 1,437.27	Y	$ 1,709.82	$ 1,709.82	
	Asphalt Driveway	1	LS	$ 2,443.36	Y	$ 2,906.69	$ 2,906.69	
								$2,312,275.66
	20% SITE SPECIFIC REQUIREMENTS							**$462,455.13**
	OVERHEAD (10%)							**$231,227.57**
	CONSTRUCTION PROFIT (6%)							**$138,736.54**
	SALES TAX (65% of above costs at 8.4%)							**$125,498.76**
	BIDDING CONTINGENCY (30%)							**$693,682.70**
	GENERAL CONDITIONS (10%)							**$231,227.57**
	CONSTRUCTION COST, LF							**$4,195,104**
	PROJECT COST, LF (140%)							**$5,873,145**

Engineers...Working Wonders With Water™

PROJECT : 2023 Water and Wastewater Models
JOB # : 200600A.00
CLIENT : City of Prescott
DATE: July 2022
ELEMENT : Tank Construction, 0.5 MG

ENR: 13168

BY : LW

	DESCRIPTION	QUAN	UNIT	MATERIAL & LABOR	ENR	UNIT COST	SUBTOTAL	TOTAL
	Material Test	1	LS	$ 3,590.00	Y	$ 4,270.77	$ 4,270.77	
	Site Grading	10000	CY	$ 50.00	Y	$ 59.48	$594,814.35	
	24" CL 52 CLDI MJ PIPE IN OPEN TRENCH	300	LF	$123.11	N	$ 123.11	$ 36,932.55	
	24" DIP MJ Fittings	8	EA	$ 6,600.00	Y	$ 7,851.55	$ 62,812.39	
	24" DIP Valve	3	EA	$ 6,900.00	Y	$ 8,208.44	$ 24,625.31	
	Backfill	2800	CY	$ 10.00	N	$ 10.00	$ 28,000.00	
	Vapor Barrier	7000	SF	$ 0.50	Y	$ 0.59	$ 4,163.70	
	0.5 MG Steel Tank	1	LS	$ 443,828.00	N	$ 443,828.00	$443,828.00	
	Level Transmitter and Instrumentation	1	LS	$ 10,800.00	Y	$ 12,847.99	$ 12,847.99	
	Tank Painting	3500	SF	$ 2.70	Y	$ 3.21	$ 11,241.99	
								$1,223,537.05
	OVERHEAD (10%)							**$122,353.71**
	CONSTRUCTION PROFIT (6%)							**$73,412.22**
	SALES TAX (65% of above costs at 8.4%)							**$66,407.47**
	BIDDING CONTINGENCY (30%)							**$367,061.12**
	GENERAL CONDITIONS (10%)							**$122,353.71**
	CONSTRUCTION COST, LF							**$1,975,125**
	PROJECT COST, LF (140%)							**$2,765,175**

Engineers...Working Wonders With Water™

PROJECT : 2023 Water and Wastewater Models
JOB # : 200600A.00
CLIENT : City of Prescott
DATE: July 2022
ELEMENT : Tank Construction, 1 MG

ENR: 13168
BY : LW

	DESCRIPTION	QUAN	UNIT	MATERIAL & LABOR	ENR	UNIT COST	SUBTOTAL	TOTAL
	Material Test	1	LS	$ 3,470.00	Y	$ 4,128.01	$ 4,128.01	
	Site Grading	10000	CY	$ 48.00	Y	$ 57.10	$571,021.77	
	24" CL 52 CLDI MJ PIPE IN OPEN TRENCH	300	LF	$123.11	N	$ 123.11	$ 36,932.55	
	24" DIP MJ Fittings	8	EA	$ 6,400.00	Y	$ 7,613.62	$ 60,908.99	
	24" DIP Valve	3	EA	$ 6,700.00	Y	$ 7,970.51	$ 23,911.54	
	Backfill	2800	CY	$ 10.00	N	$ 10.00	$ 28,000.00	
	Vapor Barrier	8000	SF	$ 0.50	Y	$ 0.59	$ 4,758.51	
	1.0 MG Steel Tank	1	LS	$ 702,284.00	N	$ 702,284.00	$702,284.00	
	Level Transmitter and Instrumentation	1	LS	$ 10,400.00	Y	$ 12,372.14	$ 12,372.14	
	Tank Painting	3650	SF	$ 2.60	Y	$ 3.09	$ 11,289.58	
								$1,455,607.09
	OVERHEAD (10%)							$145,560.71
	CONSTRUCTION PROFIT (6%)							$87,336.43
	SALES TAX (65% of above costs at 8.4%)							$79,003.07
	BIDDING CONTINGENCY (30%)							$436,682.13
	GENERAL CONDITIONS (10%)							$145,560.71
	CONSTRUCTION COST, LF							$2,349,750
	PROJECT COST, LF (140%)							$3,289,650

Engineers...Working Wonders With Water™

PROJECT : 2023 Water and Wastewater Models
JOB # : 200600A.00
CLIENT : City of Prescott **ENR:** 13168
DATE: July 2022
ELEMENT : Tank Construction, 1.5 MG **BY :** LW

	DESCRIPTION	QUAN	UNIT	MATERIAL & LABOR	ENR	UNIT COST	SUBTOTAL	TOTAL
	Material Test	1	LS	$ 3,470.00	Y	$ 4,128.01	$ 4,128.01	
	Site Grading	10000	CY	$ 48.00	Y	$ 57.10	$571,021.77	
	24" CL 52 CLDI MJ PIPE IN OPEN TRENCH	300	LF	$123.11	N	$ 123.11	$ 36,932.55	
	24" DIP MJ Fittings	8	EA	$ 6,400.00	Y	$ 7,613.62	$ 60,908.99	
	24" DIP Valve	3	EA	$ 6,700.00	Y	$ 7,970.51	$ 23,911.54	
	Backfill	2800	CY	$ 10.00	N	$ 10.00	$ 28,000.00	
	Vapor Barrier	8000	SF	$ 0.50	Y	$ 0.59	$ 4,758.51	
	1.0 MG Steel Tank	1	LS	$ 936,800.00	N	$ 936,800.00	$936,800.00	
	Level Transmitter and Instrumentation	1	LS	$ 10,400.00	Y	$ 12,372.14	$ 12,372.14	
	Tank Painting	3650	SF	$ 2.60	Y	$ 3.09	$ 11,289.58	
								$1,690,123.09
	OVERHEAD (10%)							**$169,012.31**
	CONSTRUCTION PROFIT (6%)							**$101,407.39**
	SALES TAX (65% of above costs at 8.4%)							**$91,731.43**
	BIDDING CONTINGENCY (30%)							**$507,036.93**
	GENERAL CONDITIONS (10%)							**$169,012.31**
	CONSTRUCTION COST, LF							**$2,728,323**
	PROJECT COST, LF (140%)							**$3,819,653**

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PROJECT : **2023 Water and Wastewater Models**
JOB # : **200600A.00** **ENR:** 13168
CLIENT : **City of Prescott**
DATE: **July 2022**
ELEMENT : **Tank Construction, 2 MG** **BY :** LW

	DESCRIPTION	QUAN	UNIT	MATERIAL & LABOR	ENR	UNIT COST	SUBTOTAL	TOTAL
	Material Test	1	LS	$ 3,470.00	Y	$ 4,128.01	$ 4,128.01	
	Site Grading	10000	CY	$ 48.00	Y	$ 57.10	$ 571,021.77	
	24" CL 52 CLDI MJ PIPE IN OPEN TRENCH	300	LF	$123.11	N	$ 123.11	$ 36,932.55	
	24" DIP MJ Fittings	8	EA	$ 6,380.45	Y	$ 7,590.37	$ 60,722.93	
	24" DIP Valve	3	EA	$ 6,697.71	Y	$ 7,967.79	$ 23,903.36	
	Backfill	4150	CY	$ 10.00	N	$ 10.00	$ 41,500.00	
	Vapor Barrier	10600	SF	$ 0.49	Y	$ 0.58	$ 6,178.93	
	2 MG Steel Tank	1	LS	$ 1,111,264.00	N	$1,111,264.00	$ 1,111,264.00	
	Level Transmitter and Instrumentation	1	LS	$ 10,400.00	Y	$ 12,372.14	$ 12,372.14	
	Tank Painting	3650	SF	$ 2.63	Y	$ 3.13	$ 11,419.84	
								$1,879,443.54
	OVERHEAD (10%)							**$187,944.35**
	CONSTRUCTION PROFIT (6%)							**$112,766.61**
	SALES TAX (65% of above costs at 8.4%)							**$102,006.80**
	BIDDING CONTINGENCY (30%)							**$563,833.06**
	GENERAL CONDITIONS (10%)							**$187,944.35**
	CONSTRUCTION COST, LF							**$3,033,939**
	PROJECT COST, LF (140%)							**$4,247,514**

Appendix 4C

WATER CIP MAPS

Project Number: **44 W**

Planning Period: FY 2027

Description: Zone 56 Tank and Pipeline and Zone 7 Pump Station

44 W.1 Replace Lower Yavapai Hills Pump Station
44 W.2 New Zone 56 Storage Tank

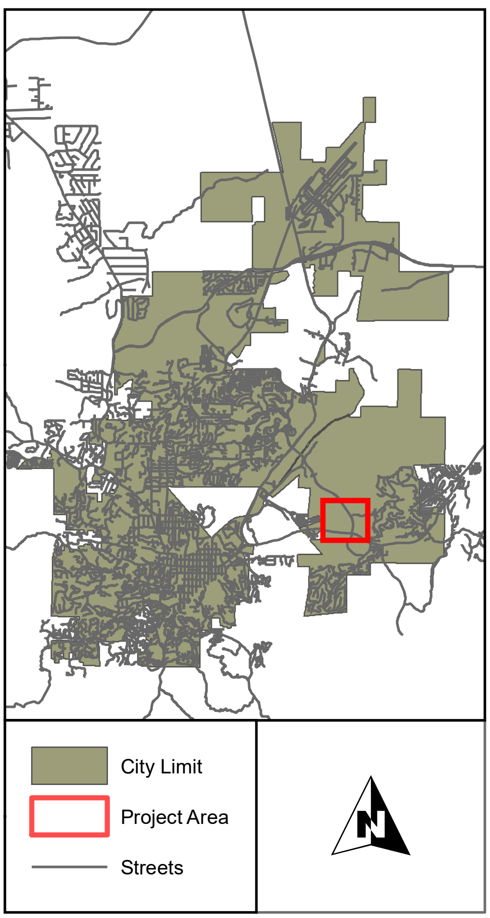
Justification: 44 W.1 - Provide increased water supply to Zone 7 and downstream pressure zones as part of the Zone 56 improvements. Provides second supply to Yavapai Hills area and will also support additional growth.
44 W.2 - This project provides additional storage for Pressure Zone 56 and other Pressure Zones along the SR 69 corridor through buildout.

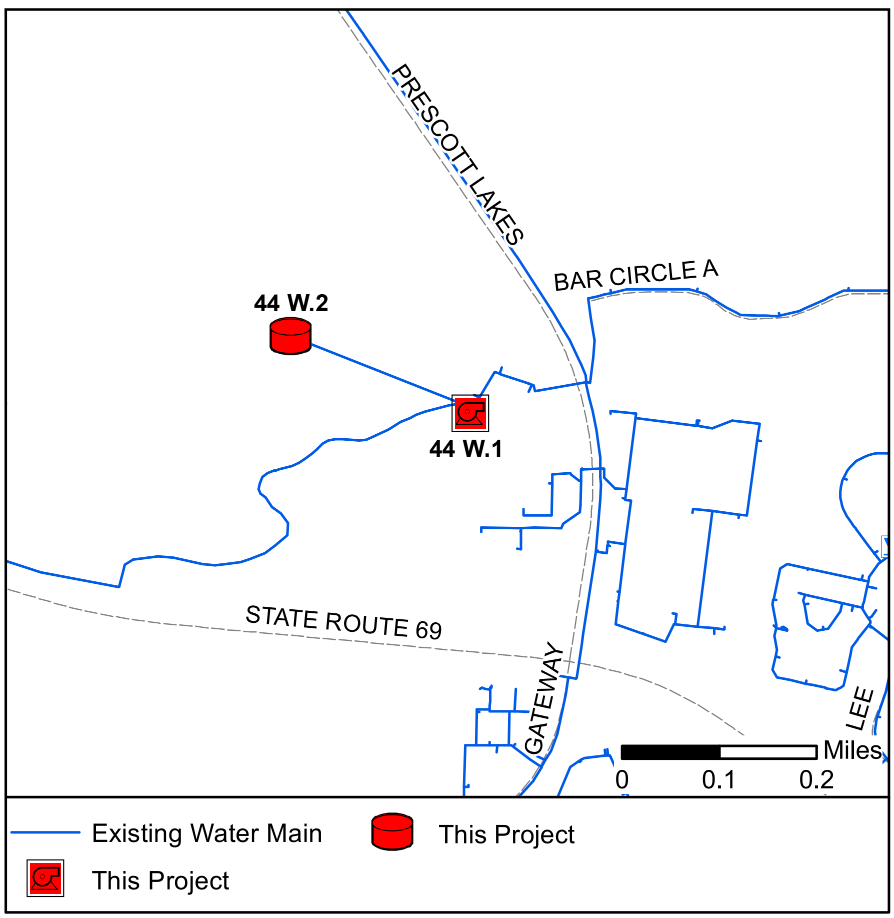
Project Details:

Project	Type	Capacity / Size	Length	Construction Cost	Project Cost
44 W.1	Pump	1,600 gpm	-	$2,460,000	$3,444,000
44 W.2	Tank	1.5 MG	-	$2,728,000	$3,819,000

IIP Information:

IIP Service Area: B	% Fees (Growth): 25%	% Rates: 75%





Project Number: **52 W** **Planning Period:** Buildout

Description: Heckthorn Road Water Main (DA)
52 W.1 New Water Main from Centerpointe/Side Rd to Heckthorn Road

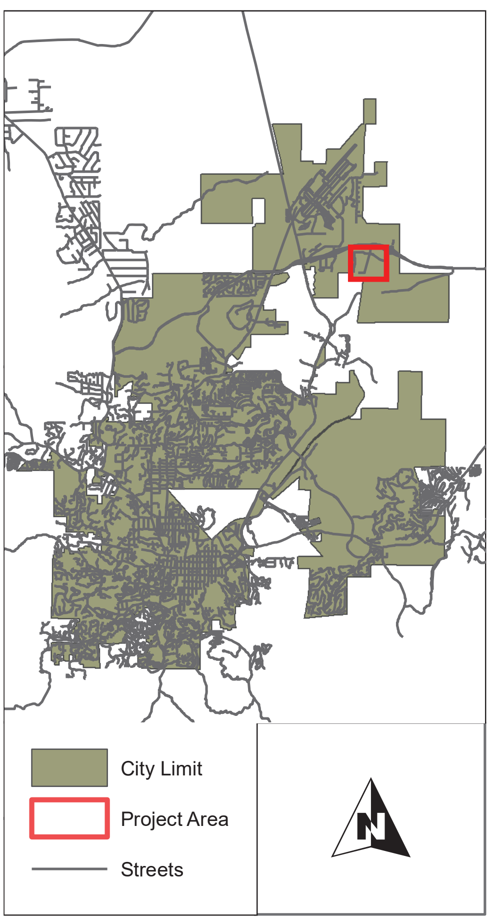
Justification: 52 W.1 - Included in Granite Dells Ranch Holdings Development Agreement (p 46 of 57; CIP Project Number W4:30).

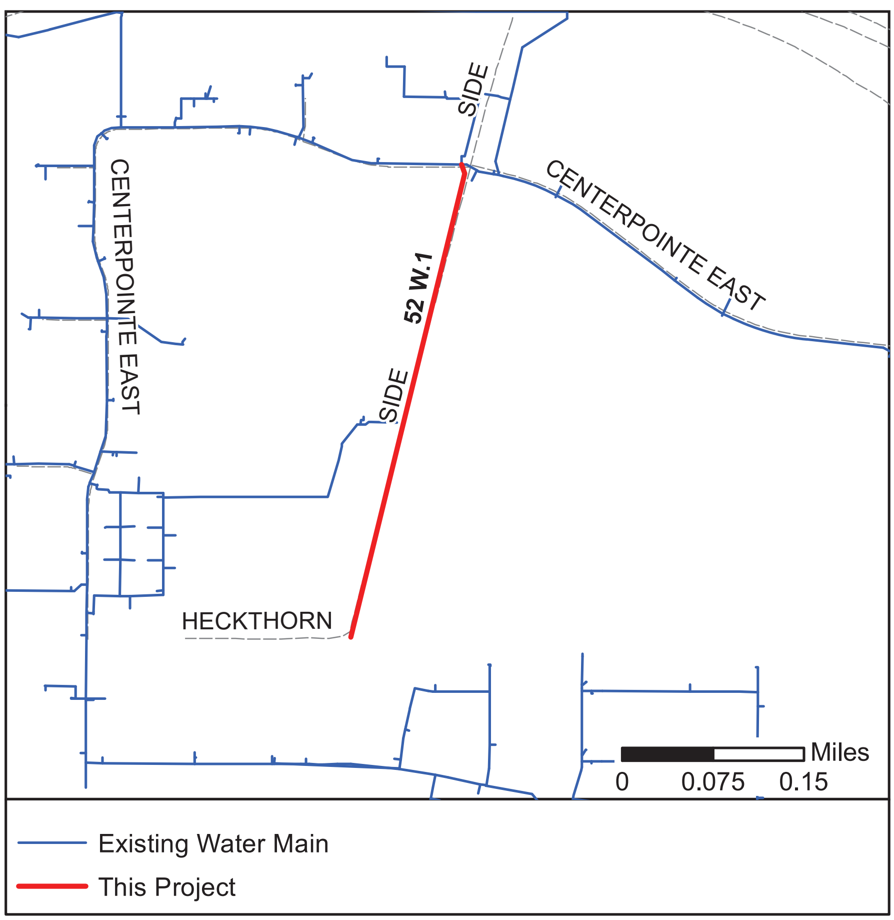
Project Details:

Project	Type	Capacity / Size	Length	Construction Cost	Project Cost
52 W.1	Pipe	12	2,105	$625,000	$875,000

IIP Information:

IIP Service Area: B	% Fees (Growth): 100%	% Rates: 0%





Project Number: **64 W** **Planning Period:** FY 2032

Description: SR69 Corridor Water Main
64 W.1 Upsize water main along Hwy 69 from new Zone 56/76 booster pump station to connect with the 16-inch main.

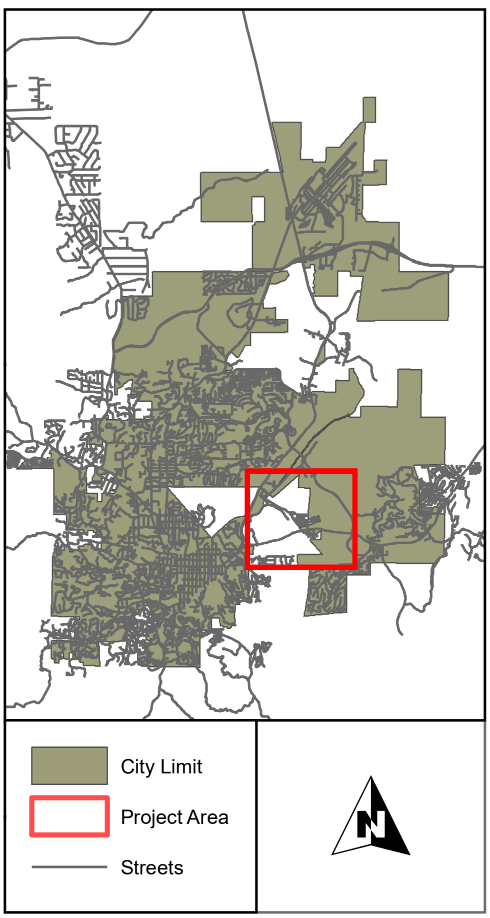
Justification: 64 W.1 - This project provides additional capacity along SR 69 corridor to supply the new Zone 56 Tank through buildout (Project 2A) and is necessary to consolidate Pressure Zones 54 and 55 and make them part of Pressure Zone 56 .

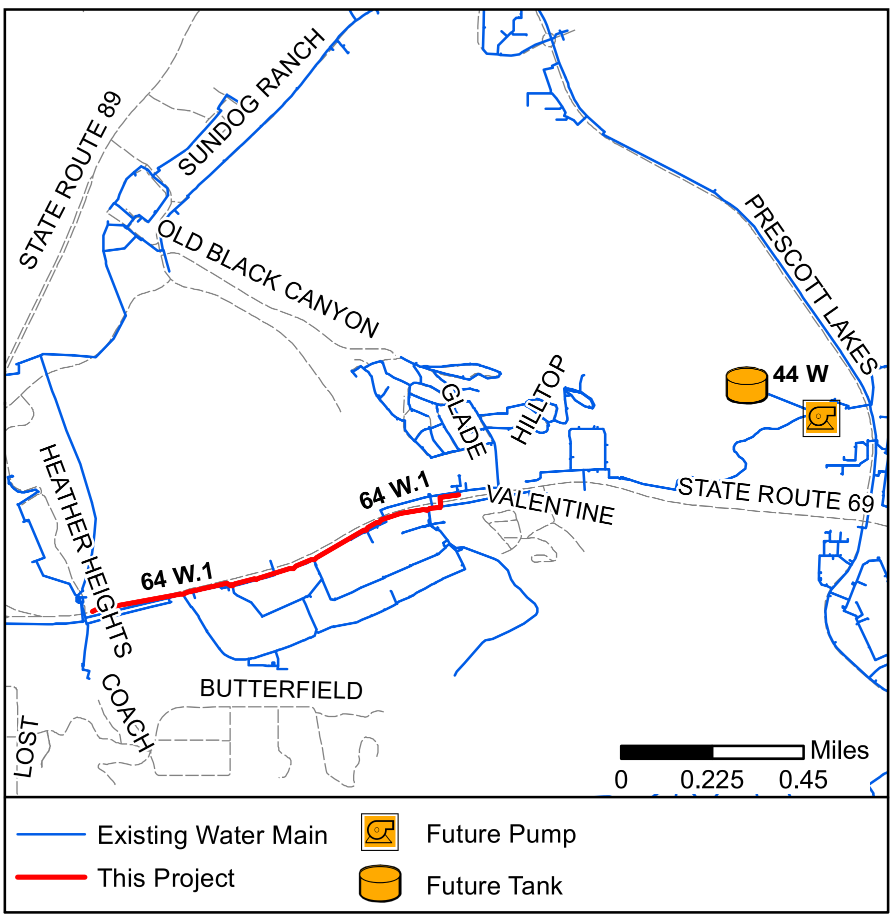
Project Details:

Project	Type	Capacity / Size	Length	Construction Cost	Project Cost
64 W.1	Pipe	16	7,826	$2,395,000	$3,353,000

IIP Information:

IIP Service Area: B	% Fees (Growth): 25%	% Rates: 75%





City of Prescott 2023 Water and Wastewater Models

Printing Date: July 14, 2023
File Path: C:\Users\mgaona\OneDrive - Carollo Engineers\Documents\Prescott\200600\2023 CIP W FIgures\CIP_64W.mxd

Project Number: 68 W **Planning Period:** FY 2027

Description: Zone 24/27 Water Pipeline Upsizing - Thumb Butte Rd. to Upper Thumb Butte Tank
68 W.1 New Zone 27 water main from the cross of Thumb Butte Rd.
68 W.2 Upsize water main from Zone 24 Pump Station to Zone 24 Tank.
68 W.3 New water main in Zone 39 connecting Sherwood Dr. and Rustic Timbers Ln.

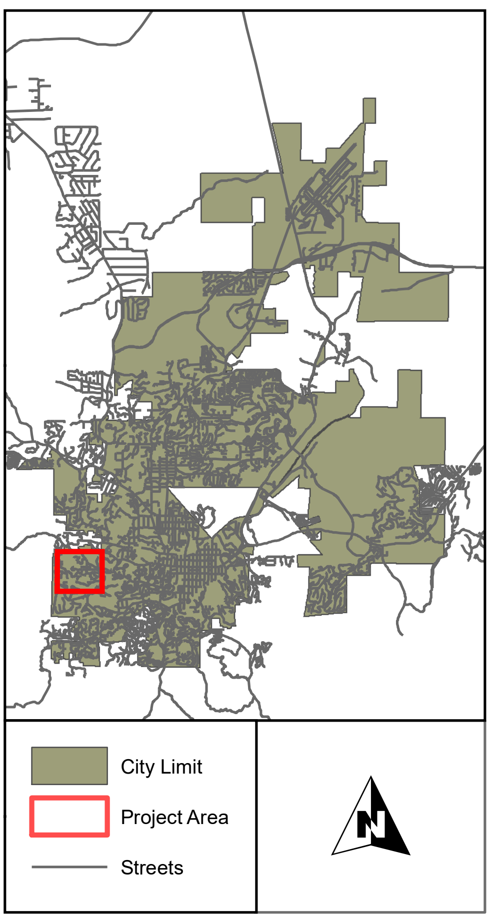
Justification: 68 W.1 - This project will modify the Zone 27 boundary and serve existing and future development by supplying maximum day, peak hour and fire flows to Zone 27.
68 W.2 - This project will serve existing and future development by supplying maximum day, peak hour and fire flows to Zone 24
68 W.3 This project will provide looping for Zone 39 to improve fire flow pressures and flows.

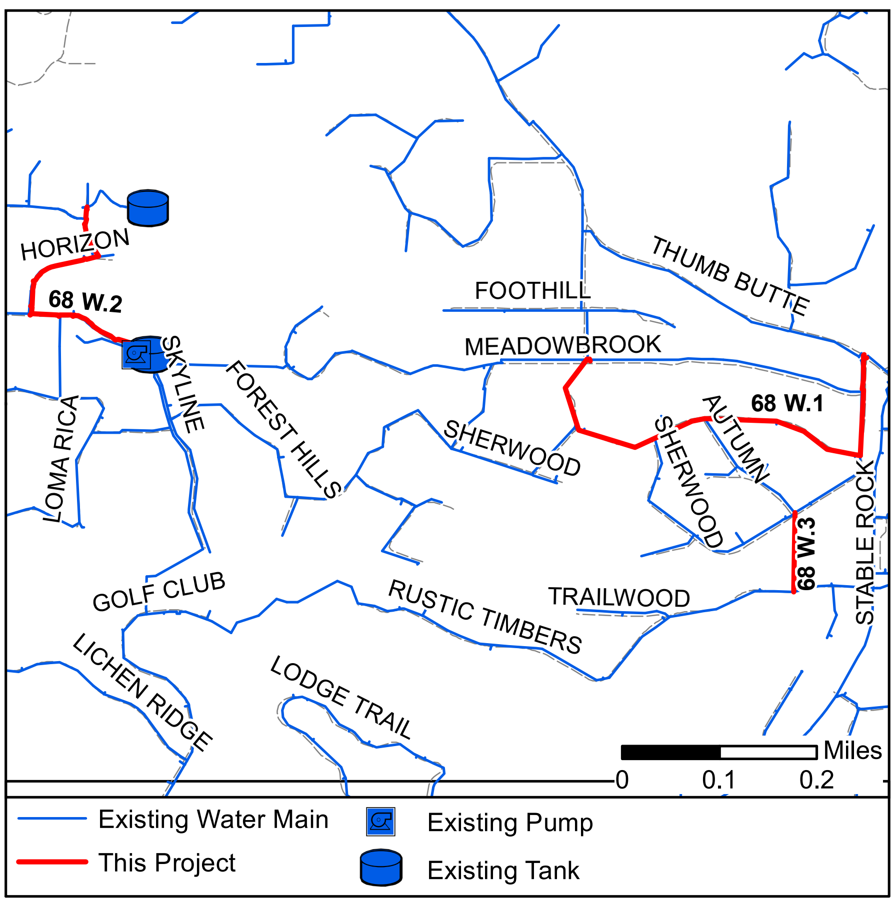
Project Details:

Project	Type	Capacity / Size	Length	Construction Cost	Project Cost
68 W.1	Pipe	8	3,364	$750,000	$1,050,000
68 W.2	Pipe	12	2,453	$729,000	$1,021,000
68 W.3	Pipe	12	523	$155,000	$217,000

IIP Information:

IIP Service Area: B	% Fees (Growth): 30%	% Rates: 70%





City of Prescott 2023 Water and Wastewater Models
Printing Date: October 27, 2023
File Path: M:\Client\Prescott\200600\GIS\pdf\CIP Water FIgures\CIP_52W\CIP_68W.mxd

Project Number: 70 W **Planning Period:** Buildout

CITY OF PRESCOTT ARIZONA

Description: Upper Rancho Vista Pump Station Upgrade

70 W.1 Upper Rancho Vista Booster Pump Upsize

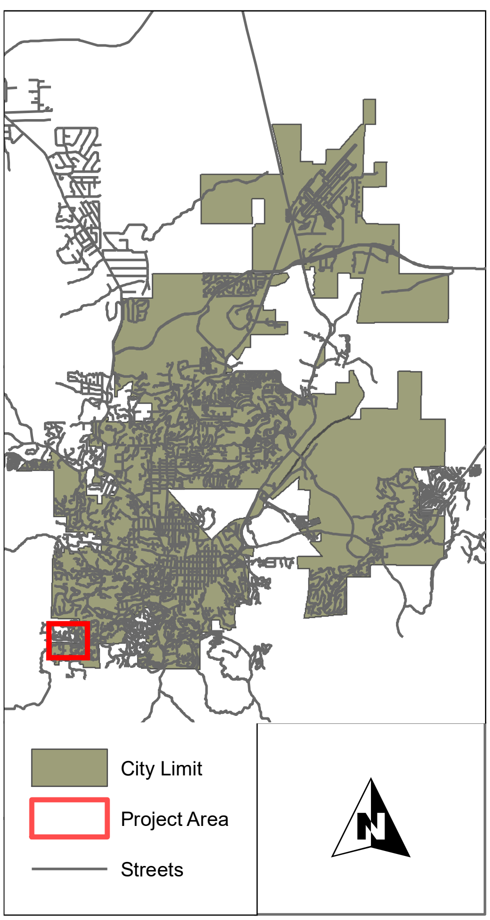
Justification: 70 W.1 - This project will increase the capacity of the Upper Rancho Vista Booster pump Station to provide buildout demands.

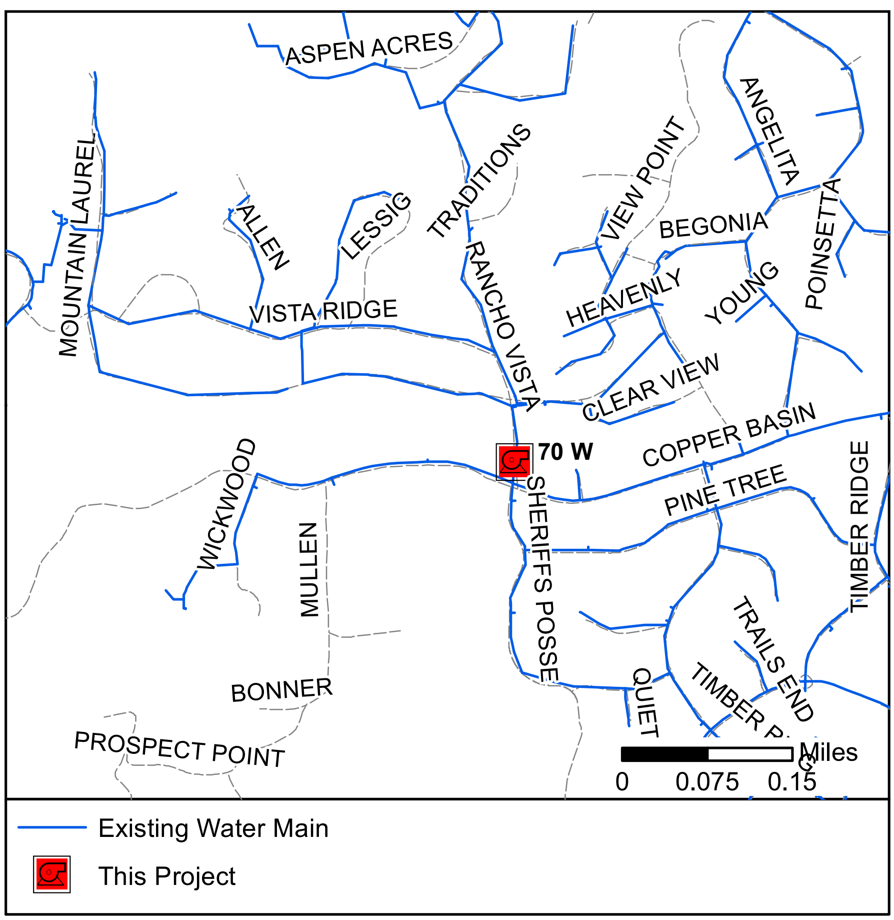
Project Details:

Project	Type	Capacity / Size	Length	Construction Cost	Project Cost
68 W.1	Pump	150 gpm	-	$732,000	$1,025,000

IIP Information:

IIP Service Area: B	% Fees (Growth): 0%	% Rates: 100%





City of Prescott 2023 Water and Wastewater Models

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Printing Date: July 17, 2023

File Path: C:\Users\mgaona\OneDrive - Carollo Engineers\Documents\Prescott\200600\2023 CIP W FIgures\CIP_70W.mxd

Project Number: **74 W** **Planning Period:** FY 2027

Description: Zone 41 Mingus Pump Station, Tank and Pipeline
74 W.1 Replace Mingus tanks
74 W.2 Mingus Pump Station Replacement
74 W.3 This project will connect the new Mingus tanks to the Mingus booster pump station and extend the water line along Douglas Ave. to connect Mingus tanks to the Zone 0 pipe along Northside Dr.

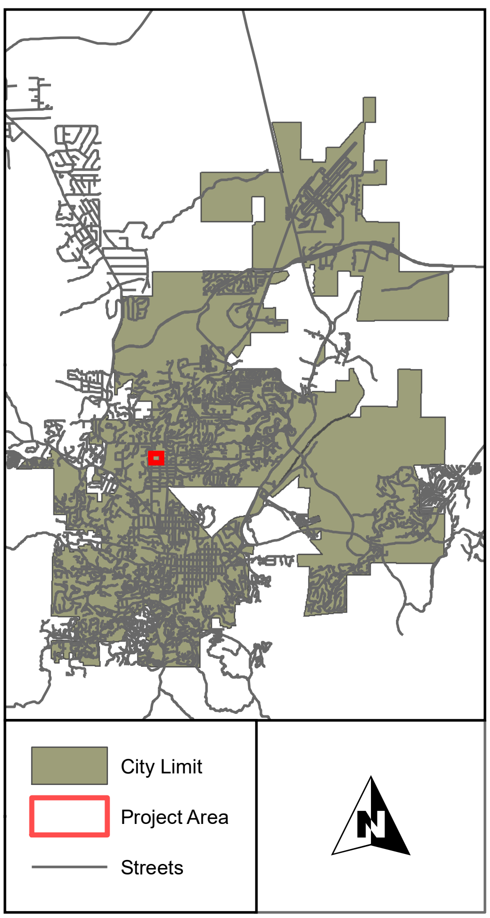
Justification: 74 W.1 - The purpose of this project is to provide sufficient storage for Pressure Zones 41 and 40.
74 W.2 - Replacement of aging facility.
74 W.3 - This project will connect the new Mingus tank to the Mingus booster pump station.

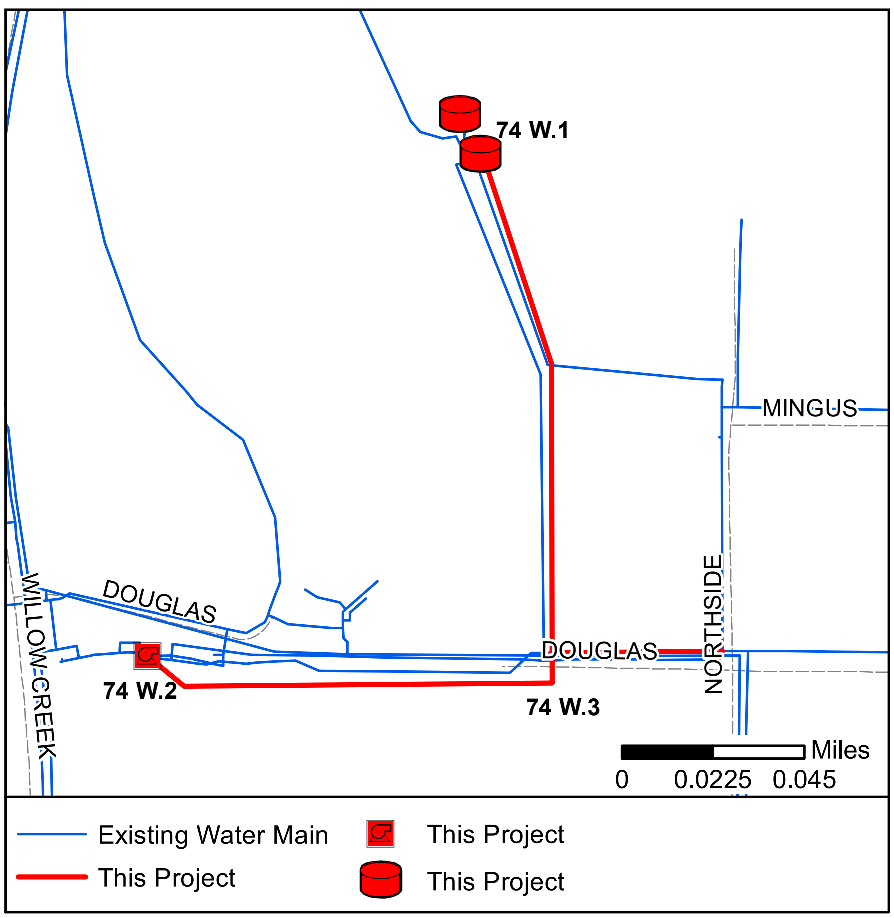
Project Details:

Project	Type	Capacity / Size	Length	Construction Cost	Project Cost
74 W.1	Tank	0.75 MG	-	$2,350,000	$3,290,000
74 W.2	Pump	4 * 750 gpm + 1 * 300 gpm jockey pump	-	$5,376,000	$7,526,000
74 W.3	Pipe	12	935	$278,000	$389,000

IIP Information:

IIP Service Area: N/A	% Fees (Growth): 0%	% Rates: 100%





Project Number: **76 W**

Planning Period: FY 2027

Description: Quaka Crossing - YPIT Water Main Upgrade
76 W.1 - Sundog Ranch Road Connector Water line between Yavapai Connector and Old Black Canyon Hwy.

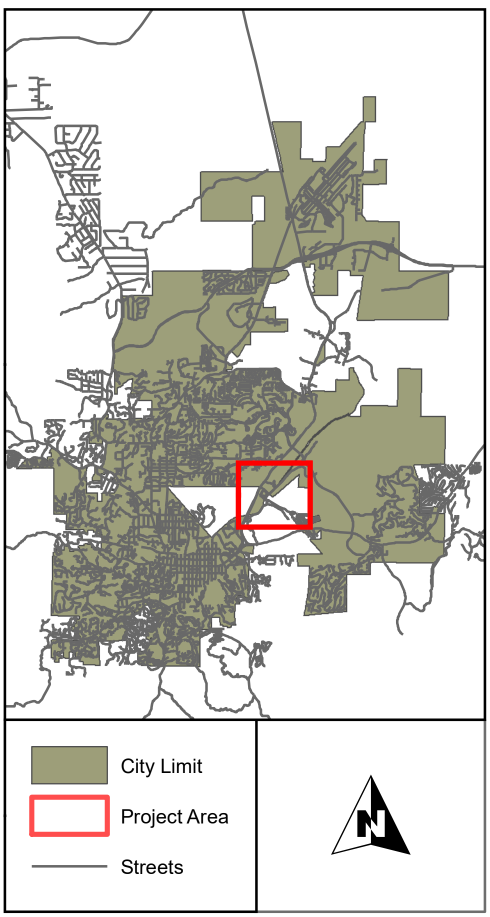
Justification: 76 W.1 - This project will improve fire flows in Zone 0 for the YPIT Reservation and provide for the Storm Ranch Development.

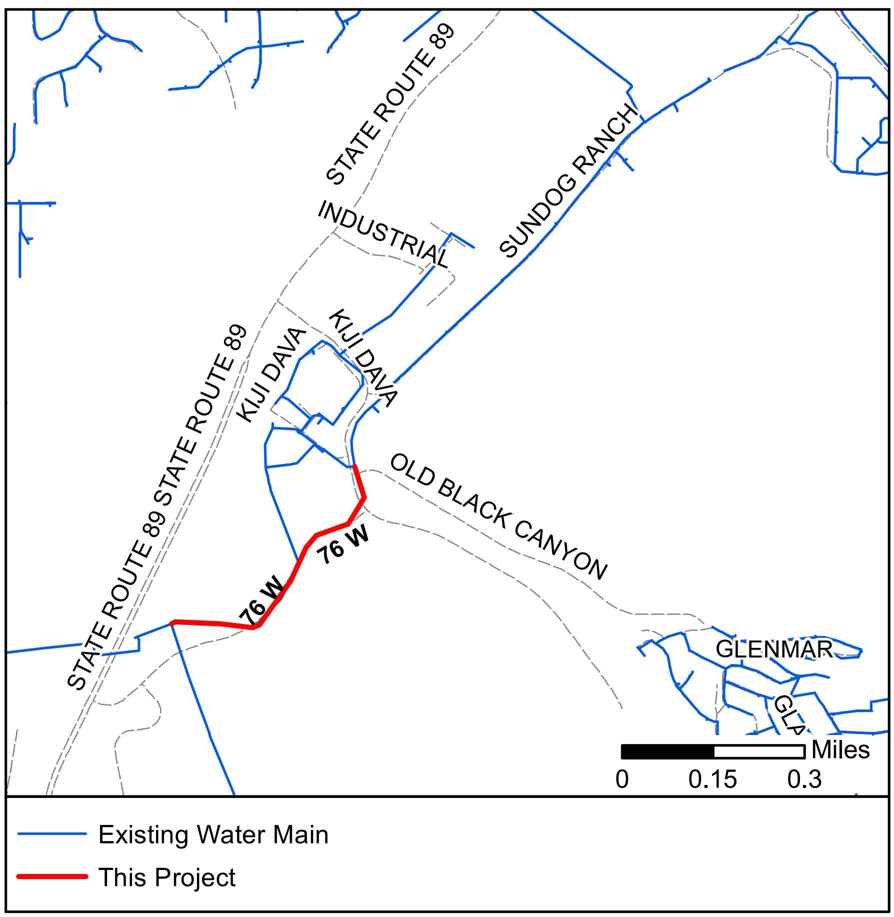
Project Details:

Project	Type	Capacity / Size	Length	Construction Cost	Project Cost
76 W.1	Pipe	12	2,750	$817,000	$1,144,000

IIP Information:

IIP Service Area: B	% Fees (Growth): 0%	% Rates: 100%





Project Number: 80 W **Planning Period:** FY 2027, 2032

Description: Zone 61 Water Main Upgrade
80 W.1 - New Zone 61 Water Main - Distribution loop along Forest View Dr. from Woods to Enchanted Canyon Rd.
80 W.2 - Pump Station - Forest Trails
80 W.1 is FY 2032 project; 80 W.2 is FY 2027 project.

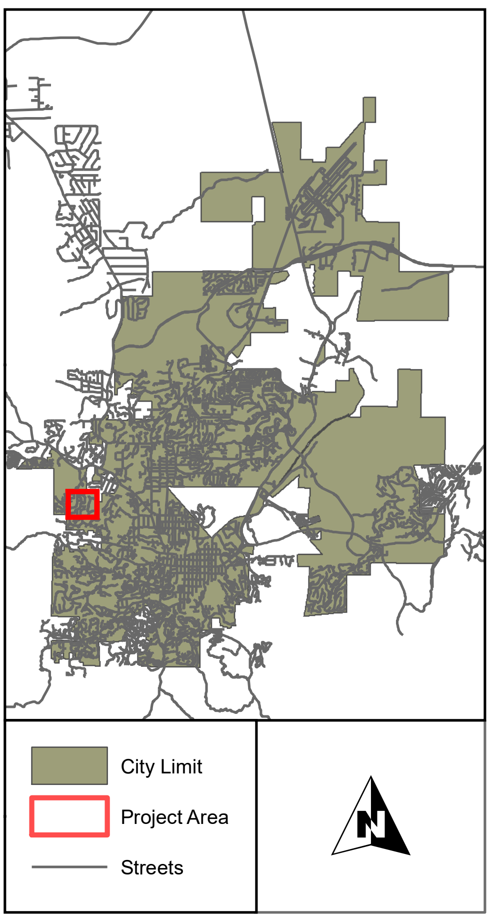
Justification: 80 W.1 - This project will provide looping for Zone 61 to improve fire flow pressures and flows.
80 W.2 - This project will help meet the Zone 61 pumping capacity requirement.

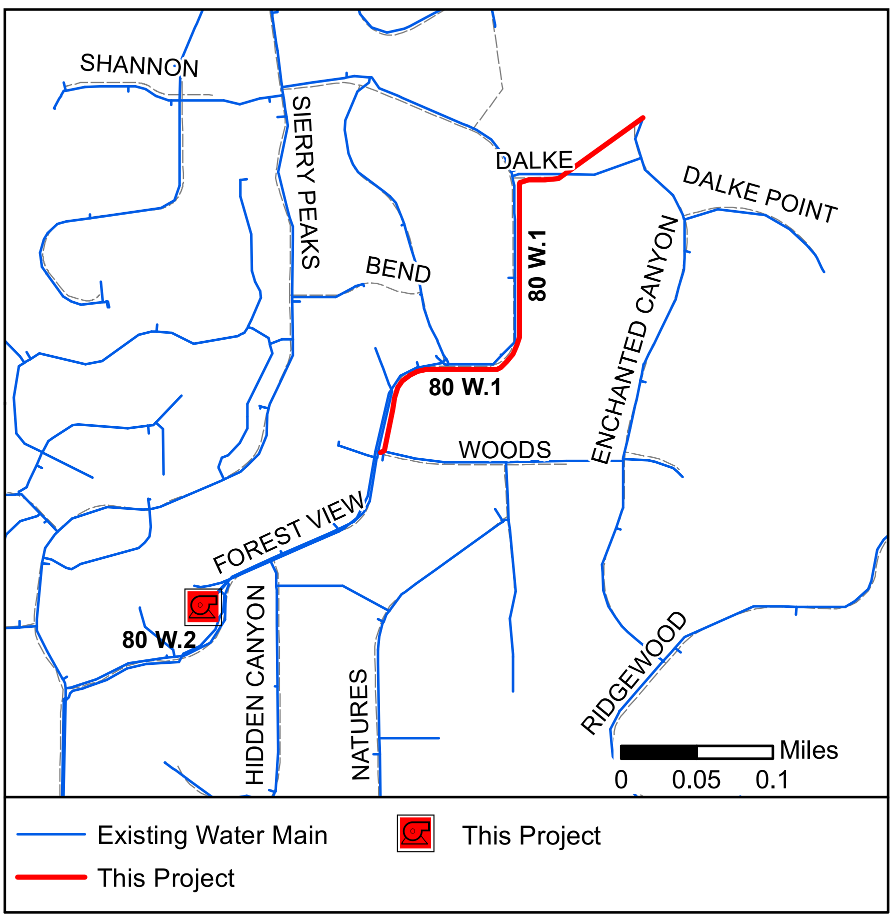
Project Details:

Project	Type	Capacity / Size	Length	Construction Cost	Project Cost
80 W.1	Pipe	8	1,800	$401,000	$561,000
80 W.2	Pump Station	1,500 gpm	-	$2,460,000	$3,444,000

IIP Information:

IIP Service Area: B	% Fees (Growth): 0%	% Rates: 100%





City of Prescott 2023 Water and Wastewater Models

Printing Date: November 29, 2023
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Project Number: 82 W **Planning Period:** BUILDOUT

Description: Zone 40 and 41 Water Main Upgrades
82 W.1 New Zone 41 Water Main - Garland St. from Willow Creek Rd. to Moall Dr.
82 W.2 New Zone 41 Water Main - Victoria St. from Stevens Rd. to Green Ln.
82 W.4 New Zone 41 Water Main - Northside Dr. from Flora to Rosser Rd.
82 W.5 New Zone 40 Water Main - Eagleview Rd. from Rosser to Soaring Rd.

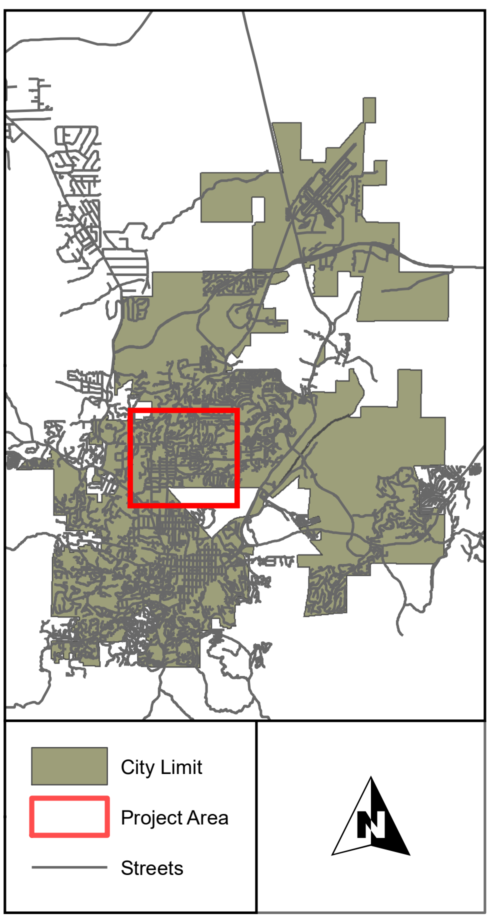
Justification: 82 W.1 - 82 W.4 This project will provide looping for Zone 41 to improve fire flow pressures and flows.
82 W.5 This project will provide looping for Zone 40 to improve fire flow pressures and flows.

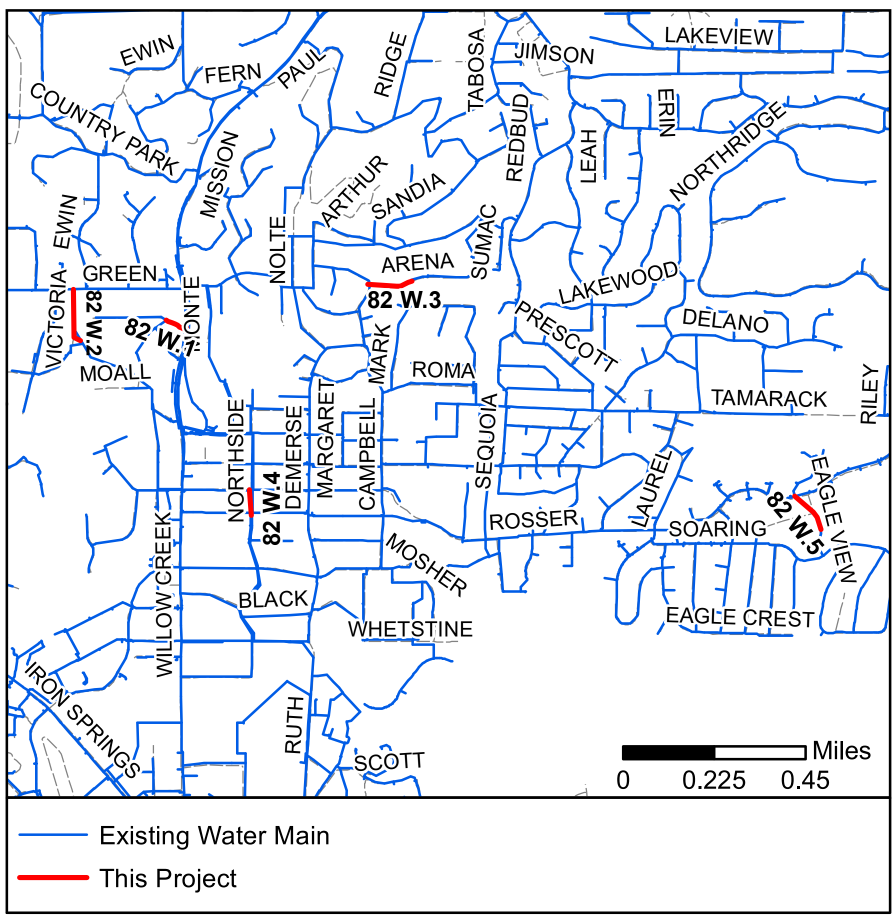
Project Details:

Project	Type	Capacity / Size	Length	Construction Cost	Project Cost
82 W.1	Pipe	8	300	$67,000	$94,000
82 W.2	Pipe	8	725	$162,000	$227,000
82 W.3	Pipe	8	585	$130,000	$182,000
82 W.4	Pipe	8	335	$75,000	$105,000
82 W.5	Pipe	8	565	$126,000	$176,000

IIP Information:

IIP Service Area: B	% Fees (Growth): 25%	% Rates: 75%





City of Prescott 2023 Water and Wastewater Models
Printing Date: October 27, 2023
File Path: M:\Client\Prescott\200600\GIS\pdf\CIP Water FIgures\CIP_52W\CIP_82W.mxd

Project Number: **88 W**

Planning Period: FY 2032

Description: Zone 42 Pipeline Upgrade
88 W.1 Water main loop connections - River Oaks & Shinnery and Valley/Tabosa

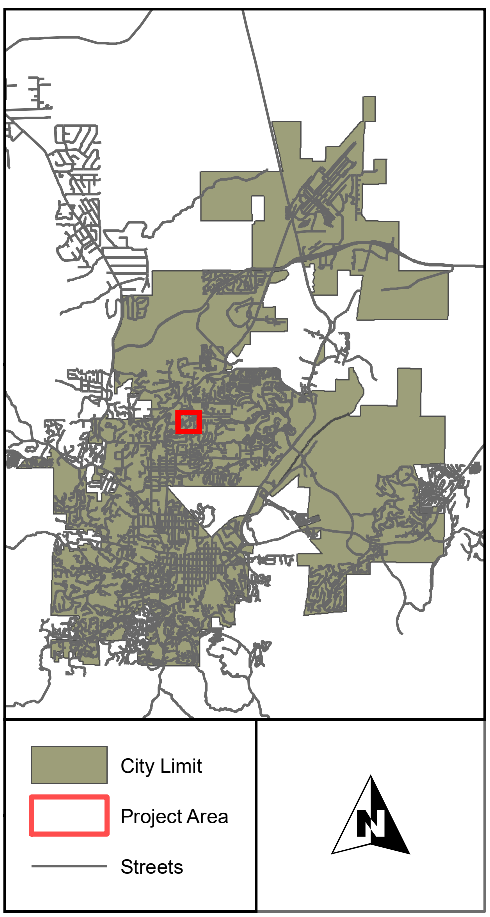
Justification: 88 W.1 This project will provide looping to the southern part of Pressure Zone 42 that becomes part of Pressure Zone 0 in Project 50 W to increase reliability and provide additional fire flows.

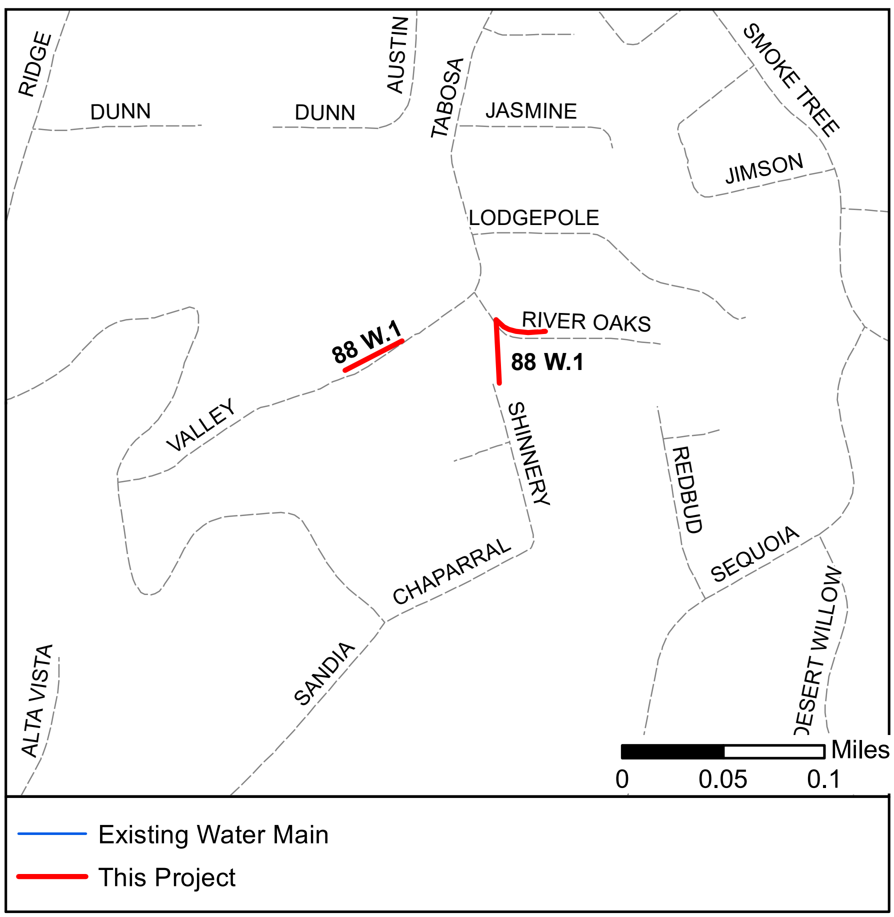
Project Details:

Project	Type	Capacity / Size	Length	Construction Cost	Project Cost
88 W.1	Pipe	8	474	$106,000	$148,000

IIP Information:

IIP Service Area: N/A	% Fees (Growth): 0%	% Rates: 100%





Project Number: **92 W** ***Planning Period:*** FY 2027, 2032, 2037

Description: Zone 110 New Transmission Main
92 W.1 Southeast Offsite Water Bore Pioneer Parkway.
92 W.2 New 18-inch transmission main to replace the existing 12-inch pipe cross the Zone 58 SE.
92 W.3 New 18-inch transmission main along Dobberteen Dr. to provide a second feed to Embry Riddle.
92 W.4 New 18-inch transmission main along across Embry Riddle to replace the existing 12-inch pipe.
92 W.5 New closed valve between Zone 58 NW and Zone 58 SE.
92 W.6 New closed valve between Pinon Oaks & Embry Riddle
92 W.1, 92W.5 - W.6 are FY 2027 projects; 92 W.2 - W.3 are FY 2032 projects; 92 W.4 is FY 2037 project.

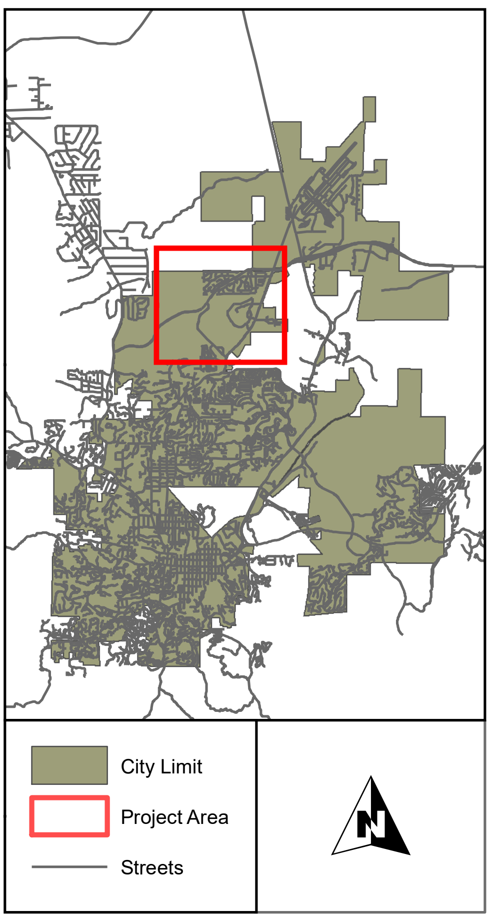
Justification:
92 W.1 This project will connect Zone 110 with Zone 58 SE.
92 W.2 This project will increase the pipe supply capacity to Zone 58 SE.
92 W.3 This project will provide a second feed to Embry Riddle.
92 W.4 This project will increase the pipe supply capacity from Zone 0 to Embry Riddle and Zone 46.
92 W.5 This project will split the Zone 58 into Zone 58 NW and Zone 58 SE.
92 W.6 This project will isolate Zone 110 and Zone 0.

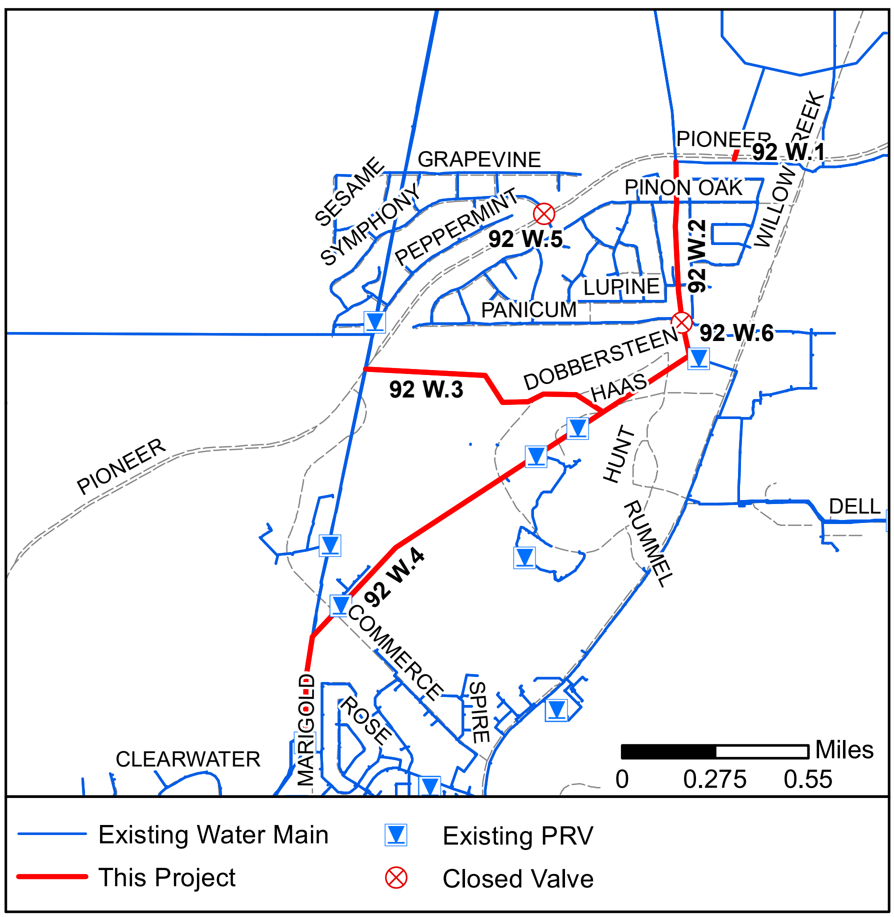
Project Details:

Project	Type	Capacity / Size	Length	Construction Cost	Project Cost
92 W.1	Pipe	16	282	$173,000	$242,000
92 W.2	Pipe	18	3,025	$1,059,000	$1,483,000
92 W.3	Pipe	18	4,086	$1,430,000	$2,002,000
92 W.4	Pipe	18	9,099	$3,185,000	$4,459,000
92 W.5	Valve	12	1	$15,000	$21,000
92 W.6	Valve	12	1	$15,000	$21,000

IIP Information:

IIP Service Area: B	% Fees (Growth): 50%	% Rates: 50%





Project Number: **98 W**

Planning Period: FY 2032

Description: Zone 40 Cedarwood Tank Upsizing
98 W.1 Upsize the Cedarwood Tank

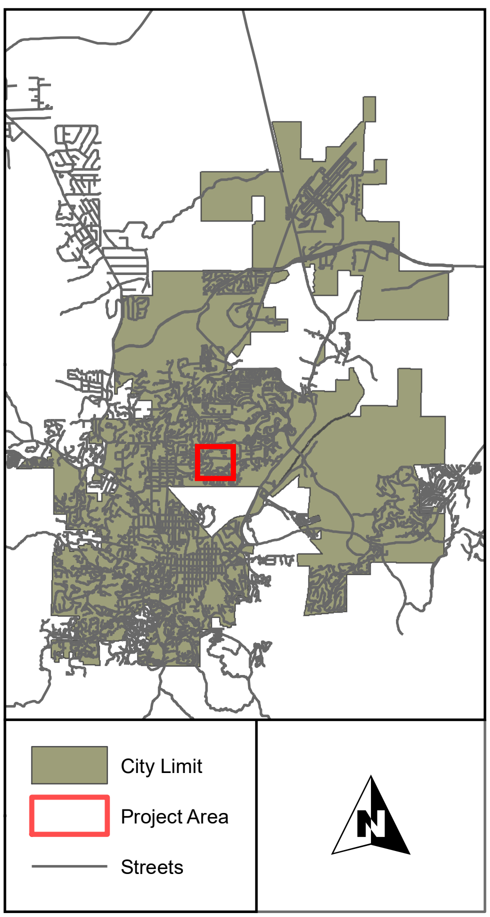
Justification: 98 W.1 This project will provide additional capacity in the Cedarwood tank to provide fire flows to Pressure Zone 40. Removing Cedarwood Tank was also considered and evaluated, however, the Zone 40 Mingus Tank is not large enough to also meet the Zone 41 tank capacity requirement. The buildout tank storage deficit of Zone 41 is 0.15 MG.

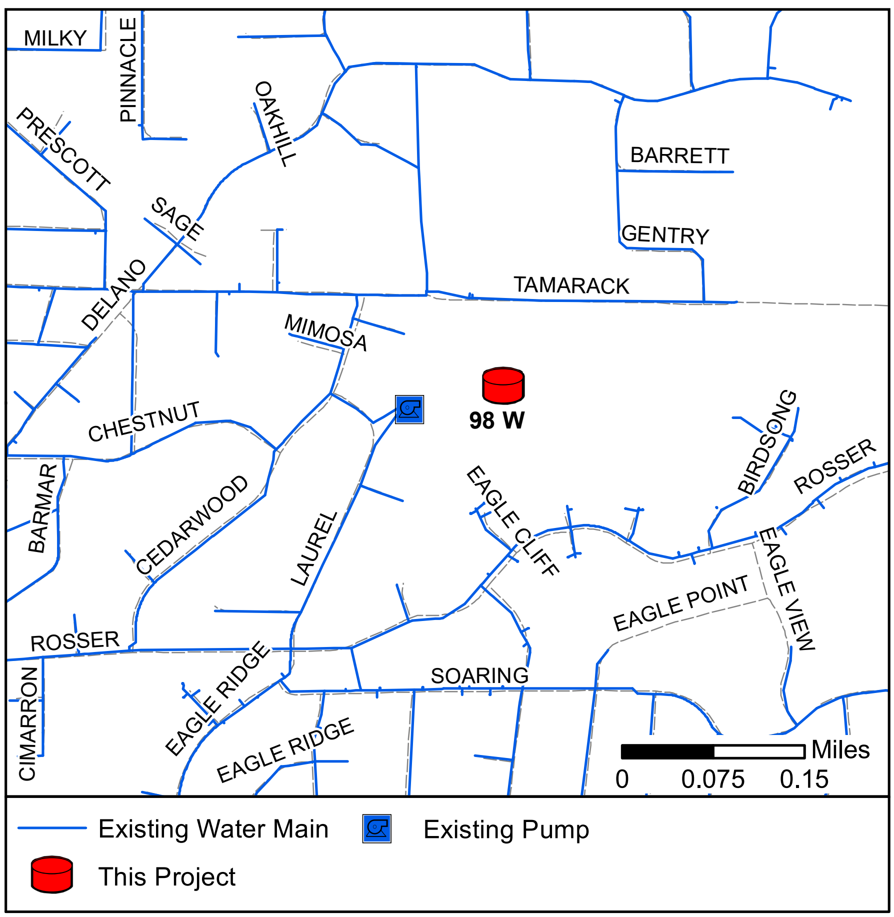
Project Details:

Project	Type	Capacity / Size	Length	Construction Cost	Project Cost
98 W.1	Tank	0.5 MG	-	$2,350,000	$3,290,000

IIP Information:

IIP Service Area: B	% Fees (Growth): 0%	% Rates: 100%





City of Prescott 2023 Water and Wastewater Models

Printing Date: October 27, 2023

File Path: M:\Client\Prescott\200600\GIS\pdf\CIP Water FIgures\CIP_52W\CIP_98W.mxd

Planning Period: BUILDOUT

Project Number: 104 W

Description: New booster pump station near Green Ln. and Meadow Ridge Dr.
104 W.1 New water main connected to 30-in water main in Willow Creek Rd. at Green Ln. extending west to near Green Ln. and Meadow Ridge Dr.
104 W.2 New booster pump station near Green Ln. and Meadow Ridge Dr.
104 W.3 Upsize water main along Yakashba (west extension of Green Ln.) to Peaceful Mesa Dr.

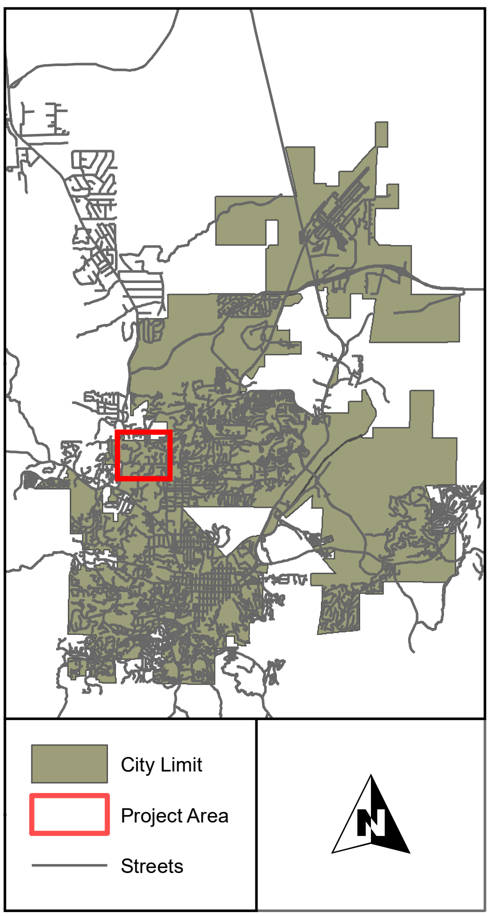
Justification: 104 W.1 This project, along with 104 W.2 addresses storage and fire flow requirement deficiencies for Iron Springs (Pressure Zone 48).
104 W.2 This project, along with Project 104 W.1 and 104 W.3 addresses storage and fire flow requirement deficiencies for Iron Springs (Pressure Zone 48). With Project 104 W.1, a pumping capacity of 1,000 gpm is an appropriate pumping capacity given the limitations of the existing 6-in water mains downstream of this proposed booster pump station project. Fire flows are improved in Zone 48 but the performance criteria is not satisfied at all locations in the Zone.
104 W.3 This project, along with Projects 104 W.1 and 104 W.2 addresses storage and fire flow requirement deficiencies for Iron Springs (Pressure Zone 48).

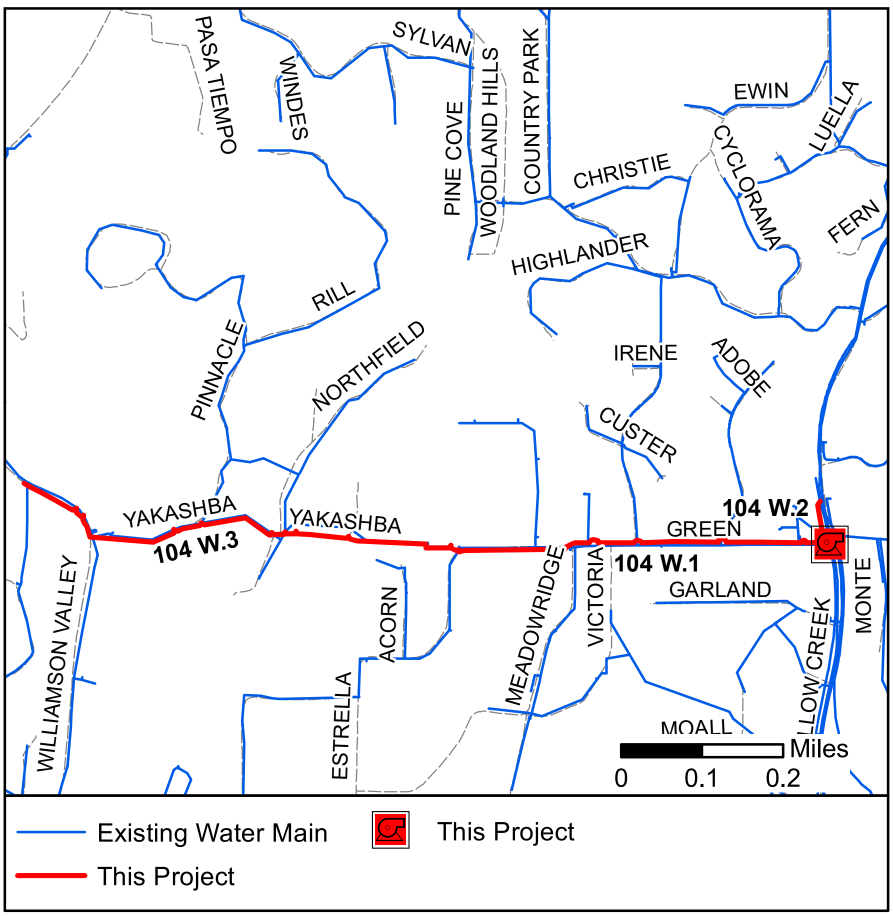
Project Details:

Project	Type	Capacity / Size	Length	Construction Cost	Project Cost
104 W.1	Pipe	12	2,020	$599,000	$840,000
104 W.2	Pump	1,000 gpm	-	$1,691,000	$2,367,000
104 W.3	Pipe	12	3,970	$1,179,000	$1,651,000

IIP Information:

IIP Service Area: B	% Fees (Growth): 0%	% Rates: 100%





Project Number: **106 W**

Planning Period: FY 2032

Description: Production Well No.6 AP - New
106 W.1 Future Airport Well No. 6

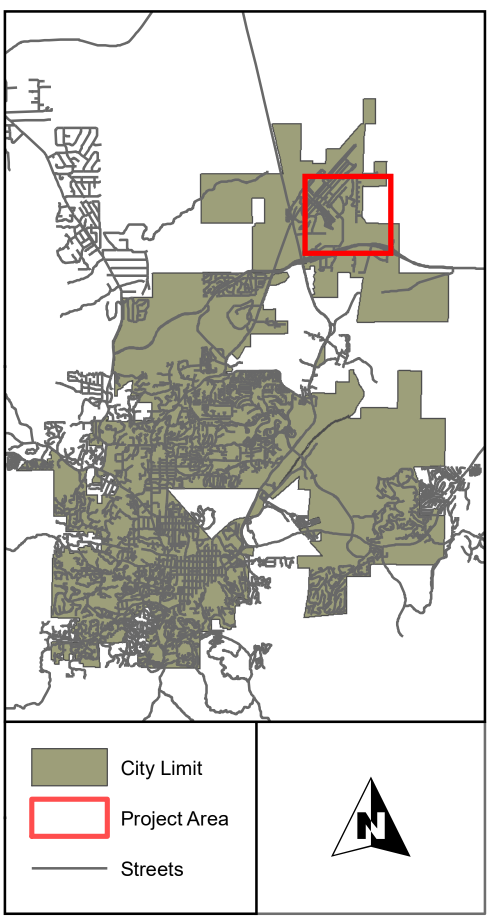
Justification: 106 W.1 - This project serves existing and future development in Pressure Zone 12 by providing additional water supplies. In conjunction with Project 92 W, this project can serve existing and future development in the City of Prescott by sending supplies in excess of Zone 12 demands to the rest of Prescott. Note: wellhead treatment costs are not included.

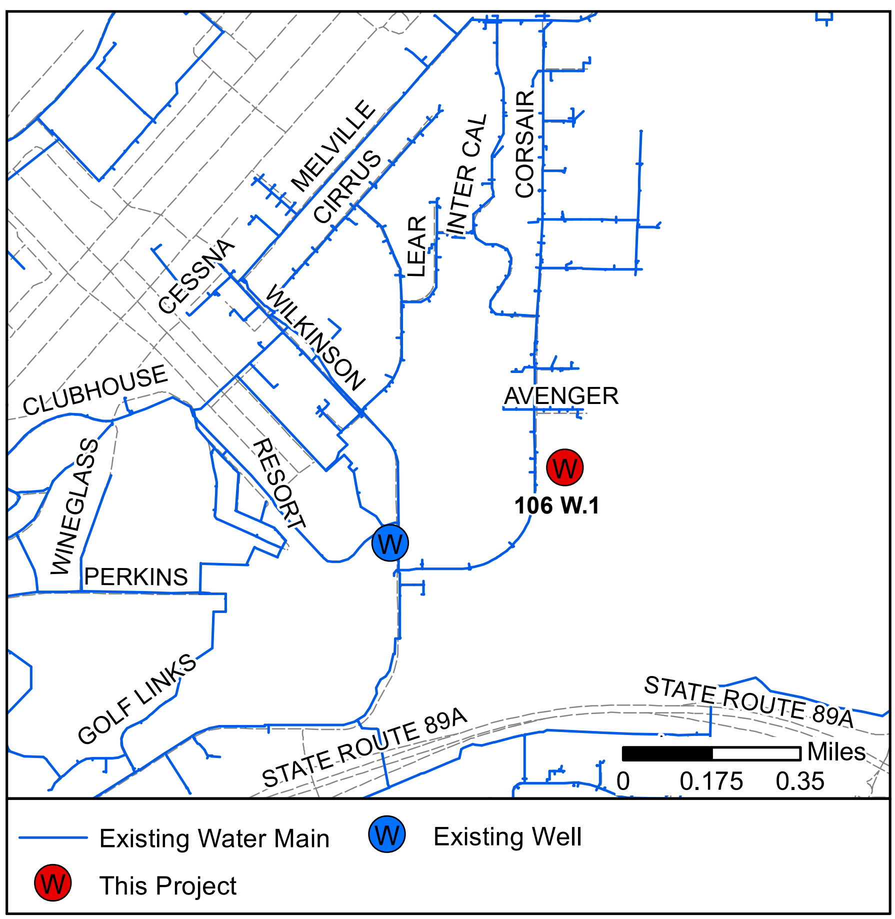
Project Details:

Project	Type	Capacity / Size	Length	Construction Cost	Project Cost
106 W.1	Well	950 gpm	-	$3,511,000	$4,915,000

IIP Information:

IIP Service Area: B	% Fees (Growth): 100%	% Rates: 0%





City of Prescott 2023 Water and Wastewater Models

Project Number: 108 W **Planning Period:** FY 2027

Description: North Airport Distribution System Loop
108 W.1 North Airport Distribution System Loop

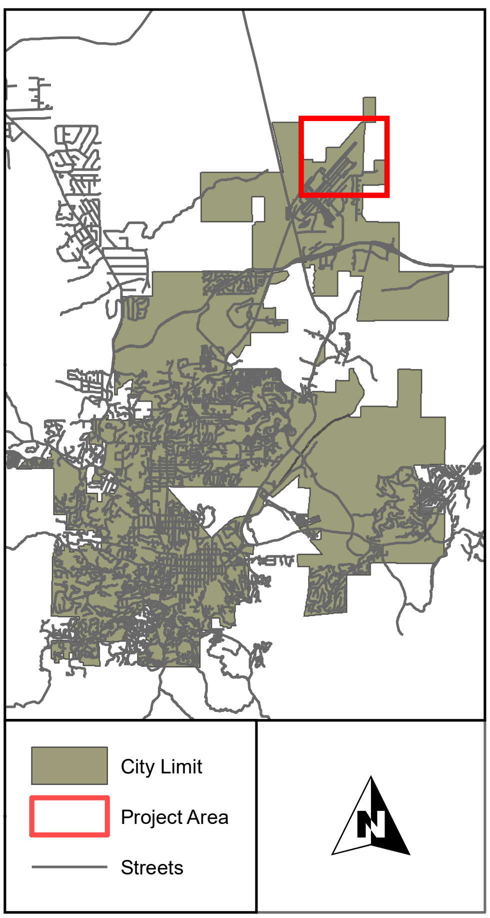
Justification: 108 W.1 - This project serves existing and future development in Pressure Zone 12 by completing a distribution system loop around the Prescott Airport.

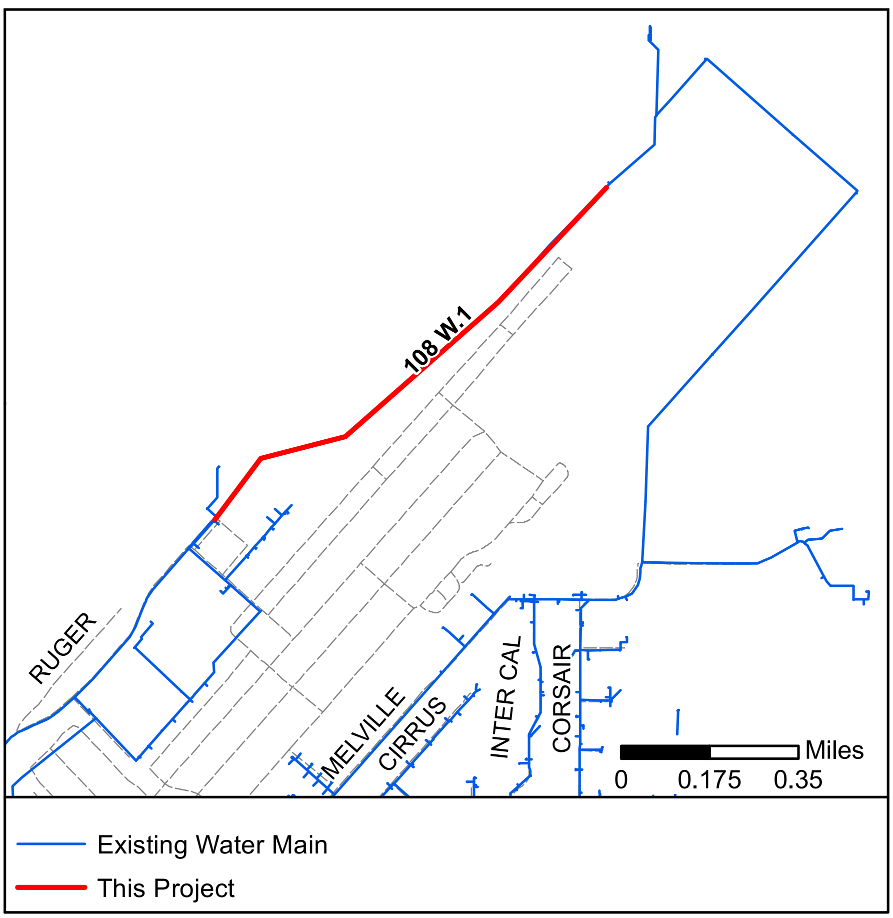
Project Details:

Project	Type	Capacity / Size	Length	Construction Cost	Project Cost
108 W.1	Pipe	12	4,975	$1,478,000	$2,069,000

IIP Information:

IIP Service Area: B	% Fees (Growth): 75%	% Rates: 25%





Project Number: **112 W** **Planning Period:** FY 2027

Description: Wilkinson/Larry Caldwell Drive Water Main Upsizing
112 W.1 Upsize water main along Larry Caldwell Dr. from connection at Larry Caldwell Dr. and Wilkinson Dr.

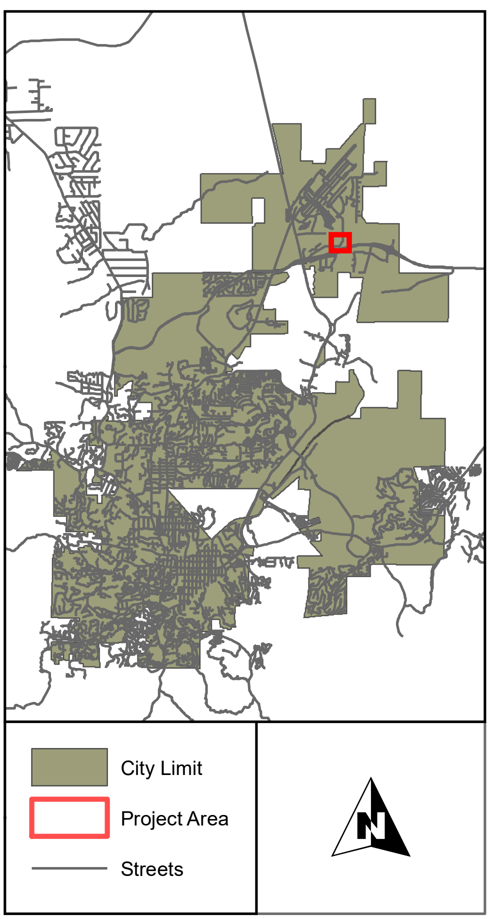
Justification: 112 W.1 This project serves existing and future development in Pressure Zone 12 by providing a second feed from the Future Pressure Zone 12 tank to the area directly south/southeast of the Prescott Airport.

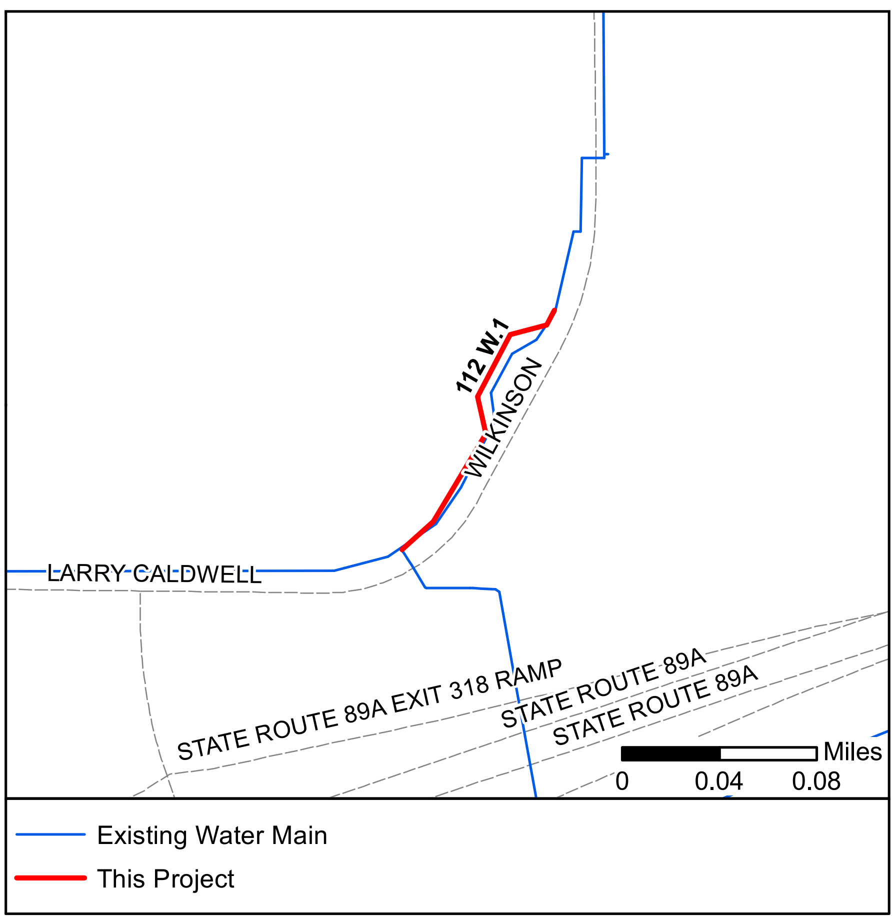
Project Details:

Project	Type	Capacity / Size	Length	Construction Cost	Project Cost
112 W.1	Pipe	16	703	$215,000	$301,000

IIP Information:

IIP Service Area: B	% Fees (Growth): 75%	% Rates: 25%





Project Number: **114 W** **Planning Period:** FY 2027

Description: Zone 52 Water Main Connect to Northwest Regional Tank

114 W.1 Water main to connect Zone 51 to Northwest Regional Tank

114 W.2 PRV on the new water main connecting from Northwest Regional Tank to Zone 51

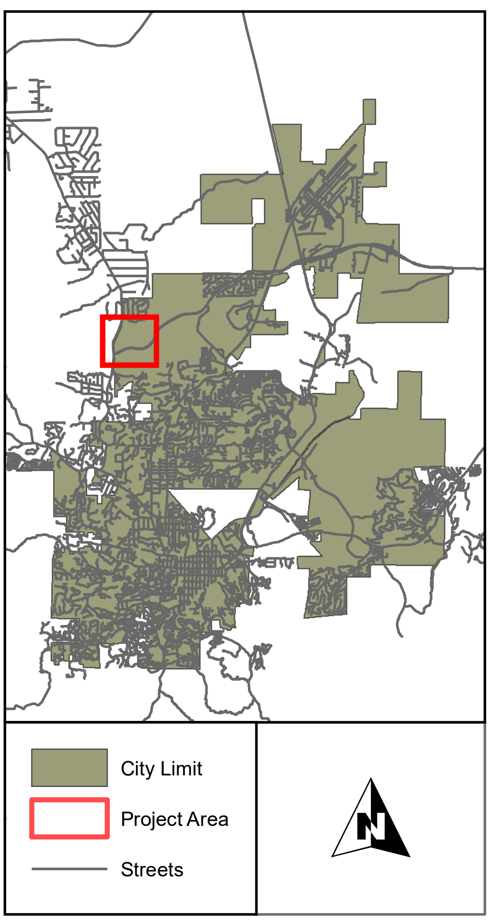
Justification: 114 W.1 - W.2 This project will allow the Longview tank to be decommissioned.

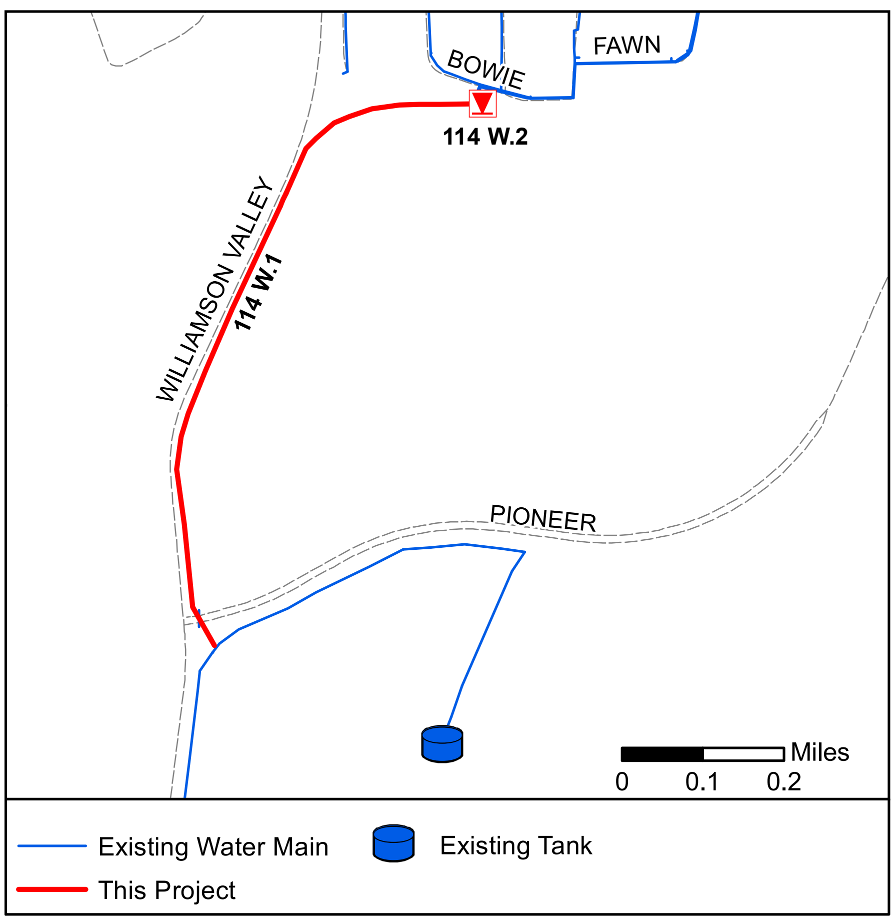
Project Details:

Project	Type	Capacity / Size	Length	Construction Cost	Project Cost
114 W.1	Pipe	12	4,587	$1,362,000	$1,907,000
114 W.2	PRV	12	-	$252,000	$353,000

IIP Information:

IIP Service Area: B	% Fees (Growth): 35%	% Rates: 65%





City of Prescott 2023 Water and Wastewater Models

Printing Date: April 06, 2023

File Path: C:\Users\mgaona\Documents\Prescott\200600\2023 CIP W FIgures\CIP_114W.mxd

Project Number: **118 W** **Planning Period:** FY 2032

Description: Arrowhead Distribution System Loop

118 W.1 8-inch main distribution system loop in Arrowhead Rd from Iron Springs to Sidewinder

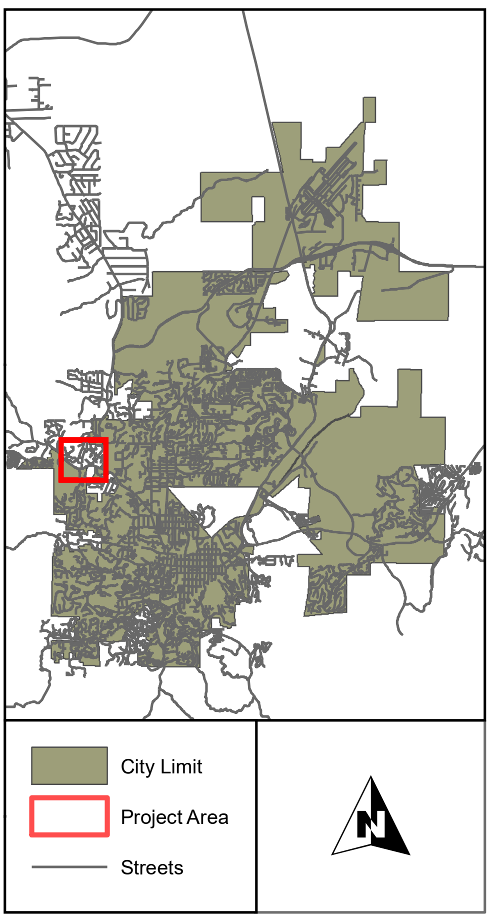
Justification: 118 W.1 This project will provide looping to improve fire flow pressures and flows.

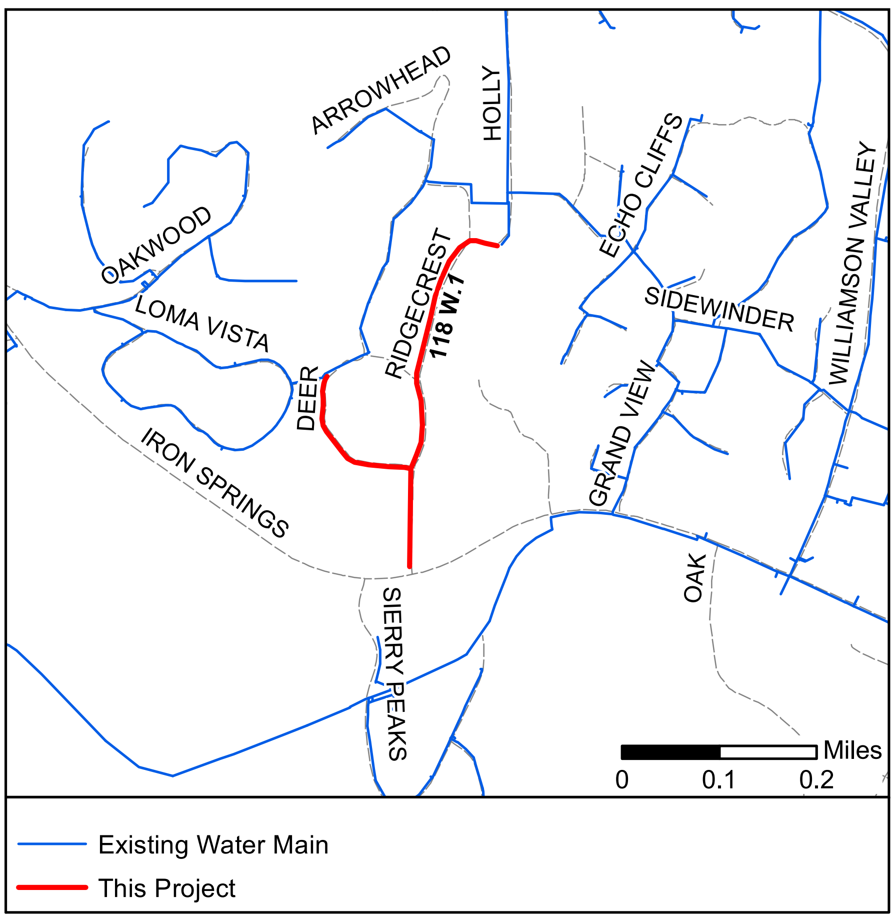
Project Details:

Project	Type	Capacity / Size	Length	Construction Cost	Project Cost
118 W.1	Pipe	8	3,000	$669,000	$937,000

IIP Information:

IIP Service Area: N/A	% Fees (Growth): 0%	% Rates: 100%





Project Number: **120 W** ***Planning Period:*** FY 2032

Description: Zone 48 Distribution Loop

120 W.1 8-inch main distribution system loop in Whitecloud, Meadowridge and Estrella in Zone 48

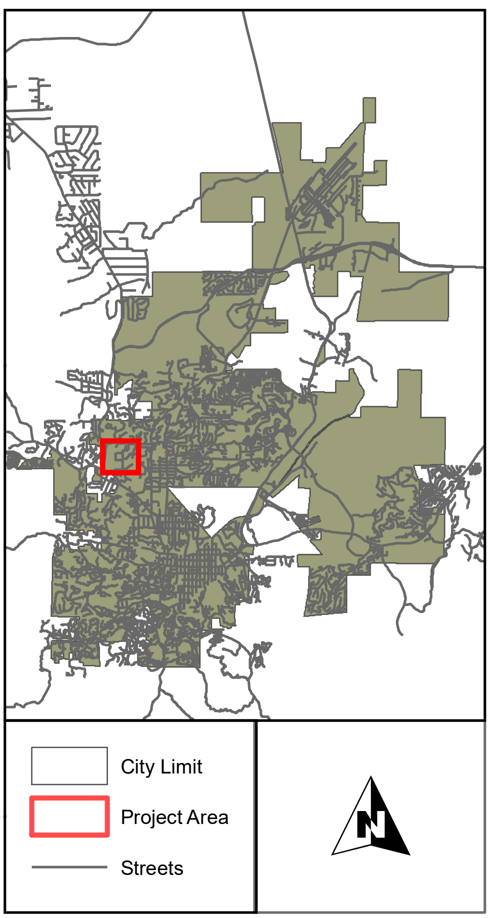
Justification: 120 W.1 This project will provide looping to improve fire flow pressures and flows.

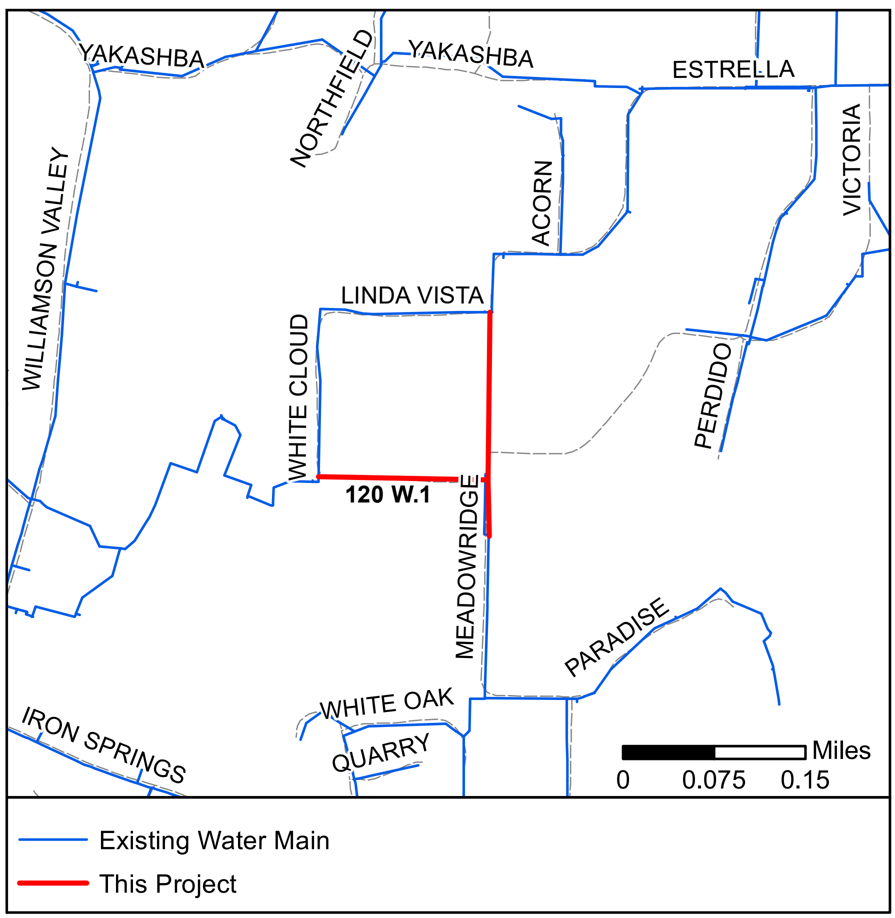
Project Details:

Project	Type	Capacity / Size	Length	Construction Cost	Project Cost
120 W.1	Pipe	8	1,715	$382,000	$535,000

IIP Information:

IIP Service Area: N/A	% Fees (Growth): 0%	% Rates: 100%





Project Number: **122 W** **Planning Period:** FY 2032

Description: Stoney Creek and Northridge Water Main Upsizing

122 W.1 Upsize water main along Stoney Creek and Northridge 8-in to 12-in

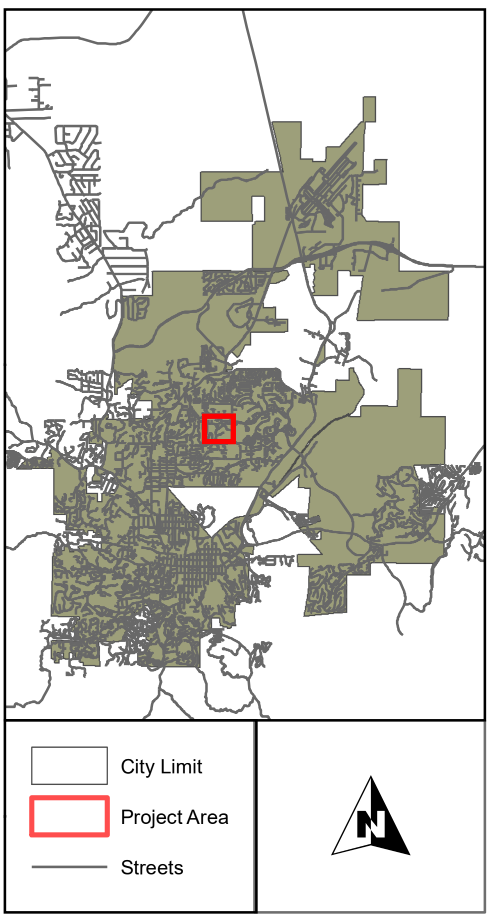
Justification: 122 W.1 This project will improve fire flow and peak hour pressures in Pressure Zone 0 area.

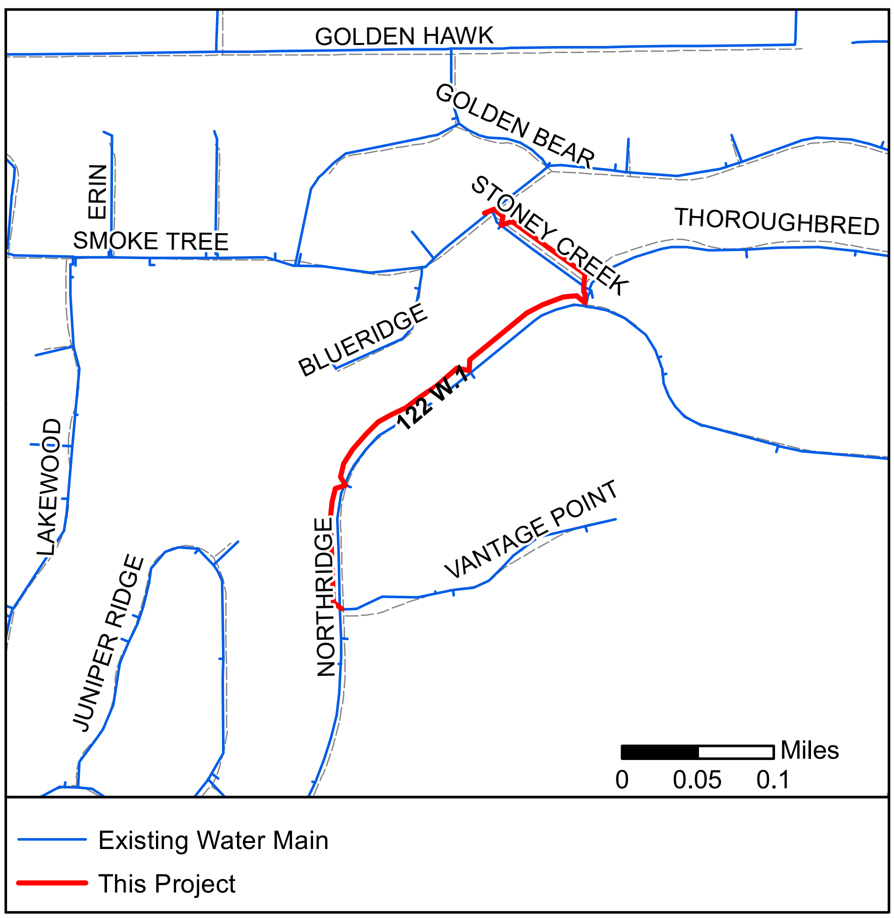
Project Details:

Project	Type	Capacity / Size	Length	Construction Cost	Project Cost
122 W.1	Pipe	12	2,200	$653,000	$914,000

IIP Information:

IIP Service Area: N/A	% Fees (Growth): 0%	% Rates: 100%





Project Number: **126 W** **Planning Period:** FY 2032

Description: Gail Gardner Upsizing from Fair to Linwood
126 W.1 Upsize 12-in main on Gail Gardner from Fair to Linwood

CITY OF PRESCOTT ARIZONA

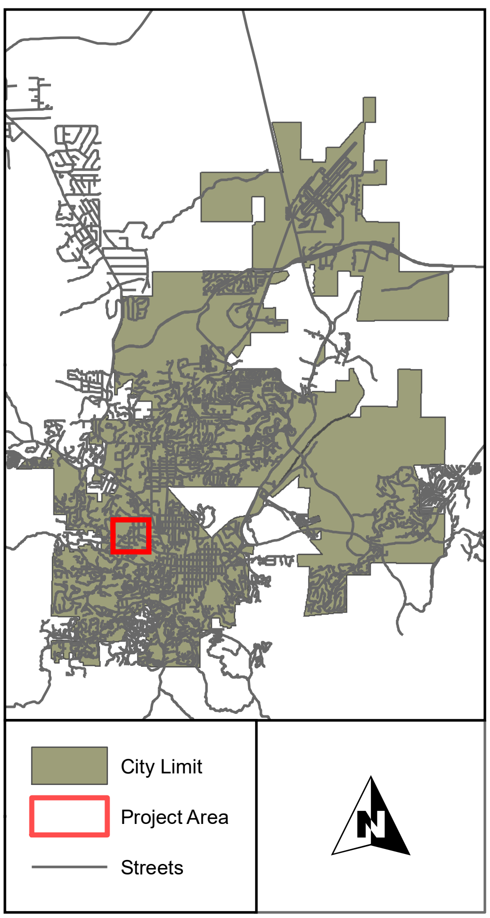
Justification: 126 W.1 This project will provide additional capacity to deliver estimated peak hour demands and fire flows at buildout

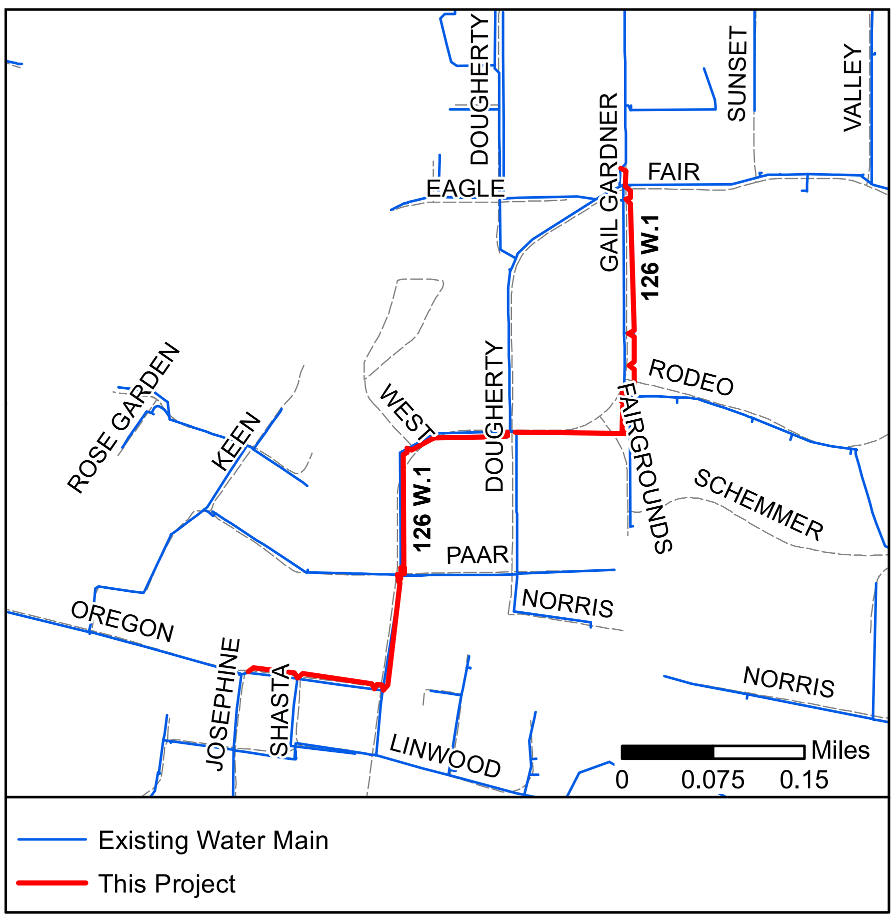
Project Details:

Project	Type	Capacity / Size	Length	Construction Cost	Project Cost
126 W.1	Pipe	12	4,155	$1,234,000	$1,728,000

IIP Information:

IIP Service Area: N/A	% Fees (Growth): 0%	% Rates: 100%





City of Prescott 2023 Water and Wastewater Models
Printing Date: April 06, 2023
File Path: C:\Users\mgaona\Documents\Prescott\200600\2023 CIP W FIgures\CIP_126W.mxd

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Project Number: **128 W** **Planning Period:** FY 2042

CITY OF PRESCOTT ARIZONA

Description: Pine Lakes Rd. and Iron Springs Rd. Upsizing
128 W.1 Upzsize 8-in main on Pine Lakes Rd.

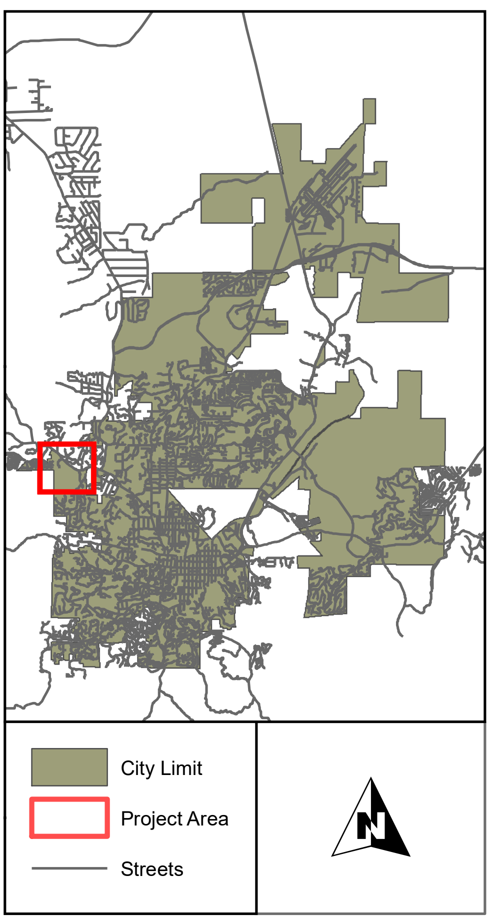
Justification: 128 W.1 This project will provide additional capacity to deliver estimated peak hour demands and fire flows at buildout

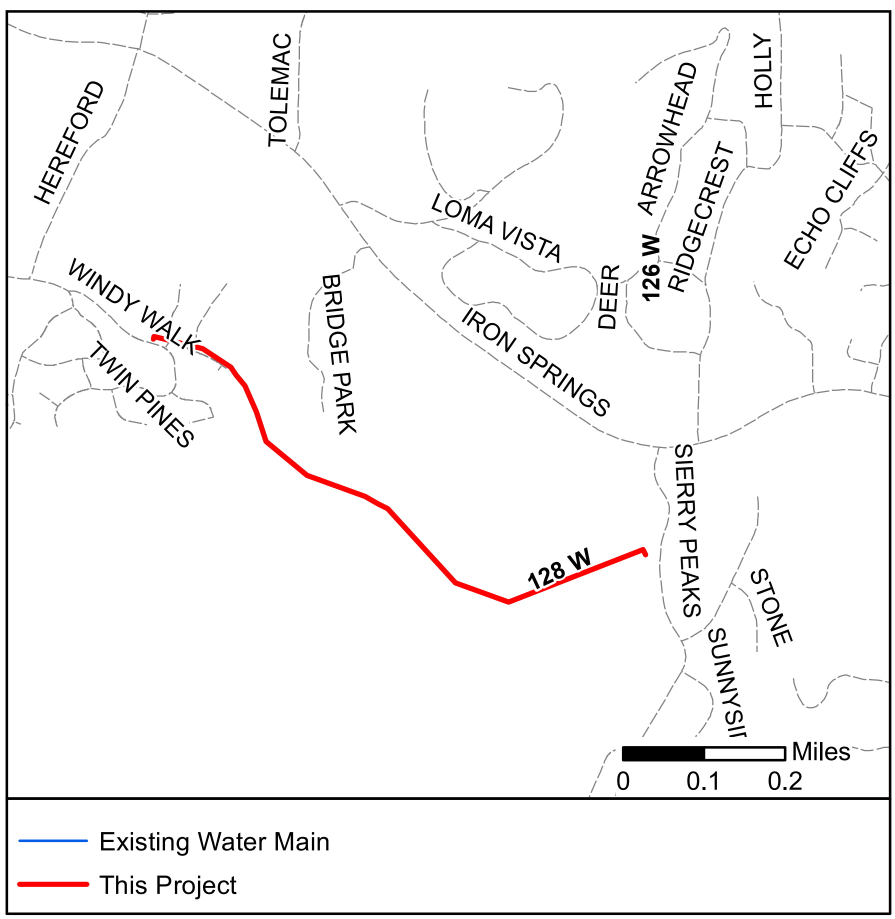
Project Details:

Project	Type	Capacity / Size	Length	Construction Cost	Project Cost
128 W.1	Pipe	12	4,025	$1,195,000	$1,673,000

IIP Information:

IIP Service Area: B	% Fees (Growth): 0%	% Rates: 100%





City of Prescott 2023 Water and Wastewater Models

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Printing Date: October 27, 2023
File Path: M:\Client\Prescott\200600\GIS\pdf\CIP Water FIgures\CIP_52W\CIP_128W.mxd

Project Number: **130 W** **Planning Period:** FY 2042

Description: Pine Lakes Rd. and Iron Springs Rd. Upsizing.
130 W.1 Upsize 8-in main on Iron Springs Rd.

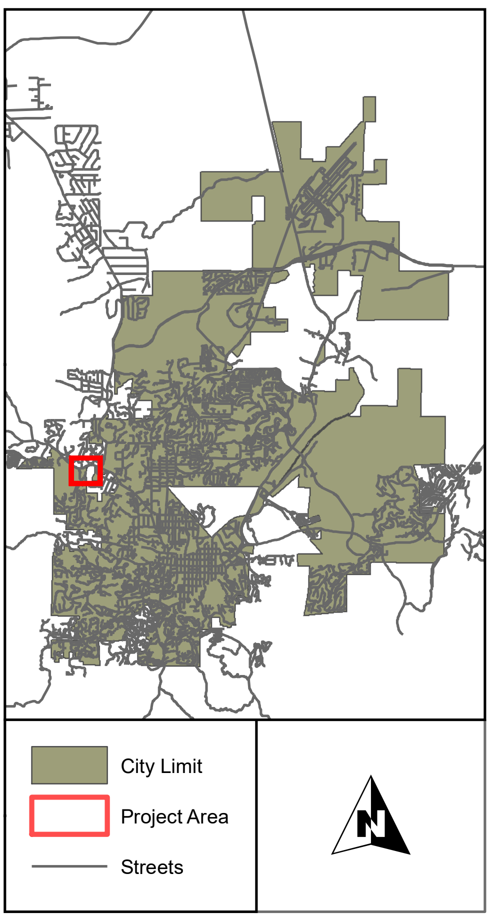
Justification: 130 W.1 This project will provide additional capacity to deliver estimated peak hour demands and fire flows at buildout.

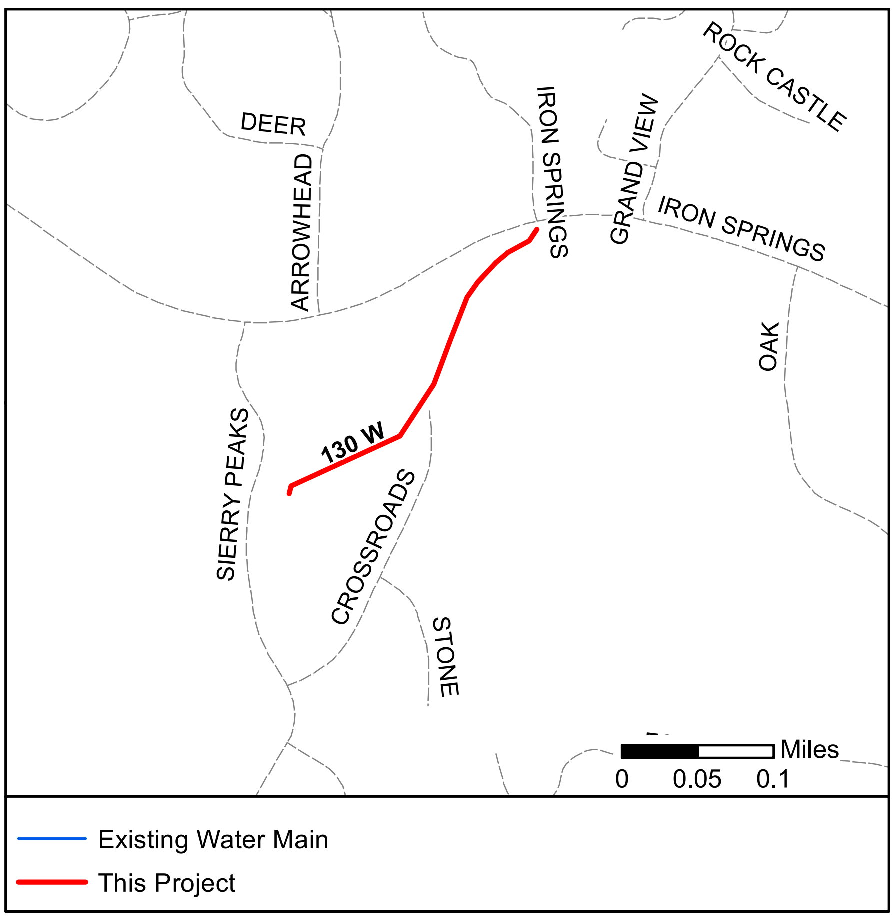
Project Details:

Project	Type	Capacity / Size	Length	Construction Cost	Project Cost
130 W.1	Pipe	12	1,720	$511,000	$715,000

IIP Information:

IIP Service Area: B	% Fees (Growth): 0%	% Rates: 100%





Project Number: **132 W** **Planning Period:** FY 2042

Description: Zone 30 Pump Station

132 W.1 Zone 30 Booster Pump Station at Hidden Valley and Valley Ranch between Zone 16 and Zone 30.

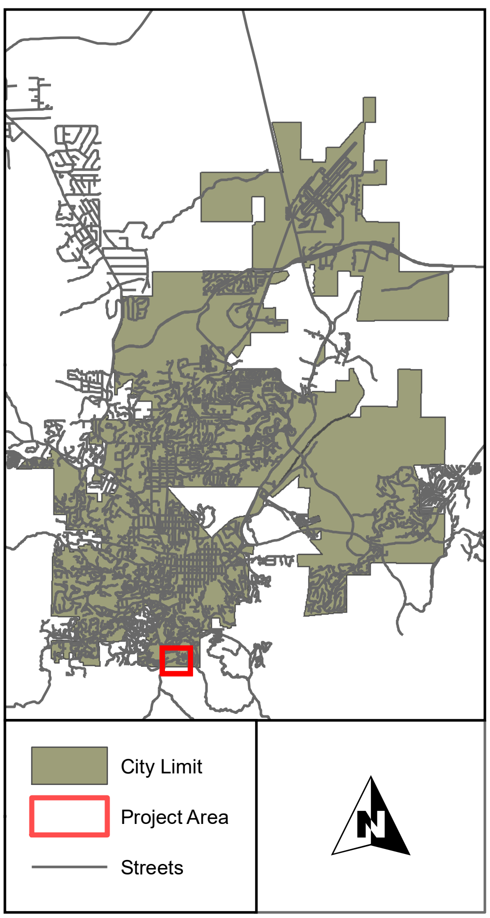
Justification: 132 W.1 This project would construct a booster pump station at Hidden Valley Drive to provide emergency fire flow for Zones 30 and 31 at buildout.

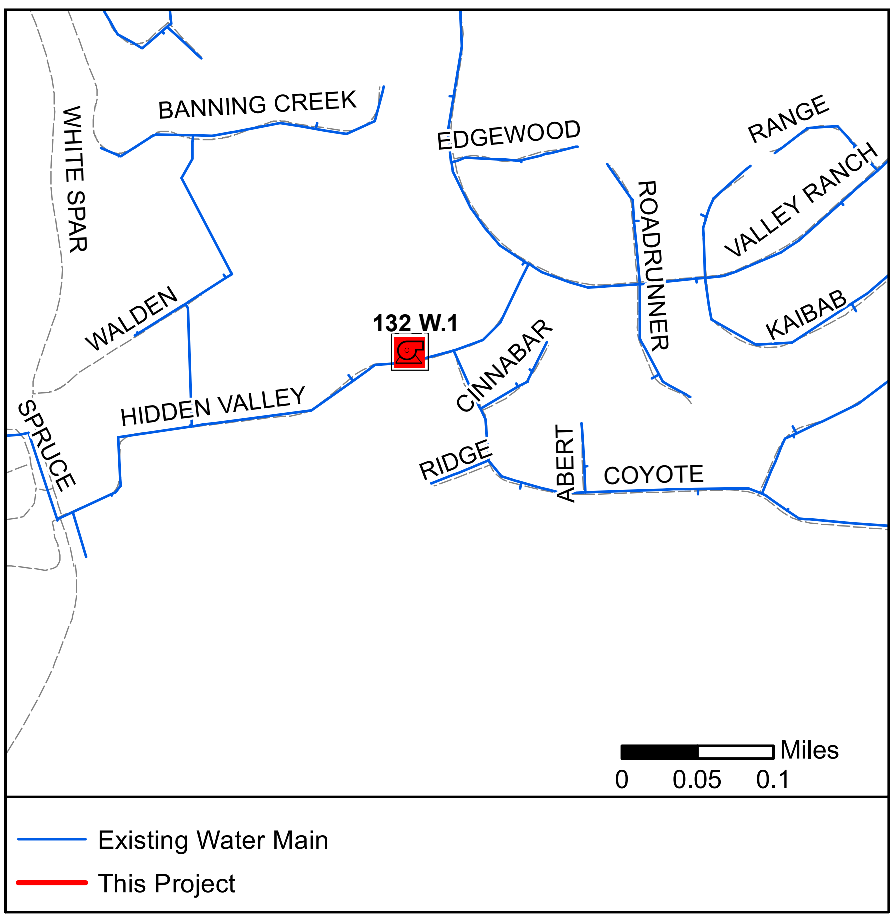
Project Details:

Project	Type	Capacity / Size	Length	Construction Cost	Project Cost
132 W.1	Pump	850 gpm	-	$1,691,000	$2,367,000

IIP Information:

IIP Service Area: N/A	% Fees (Growth): 0%	% Rates: 100%





Project Number: **154 W** **Planning Period:** FY 2032

Description: Evergreen Main Upsizing
154 W.1 Upsize main from N Evergreen Rd. to Copper Basin Rd. along Highland Ave.

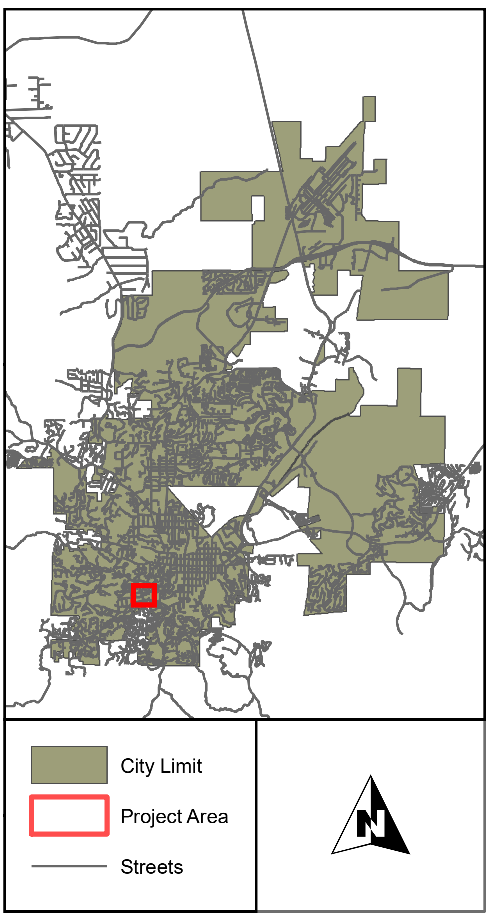
Justification: 154 W.1 This project will improve fire flow and peak hour pressures

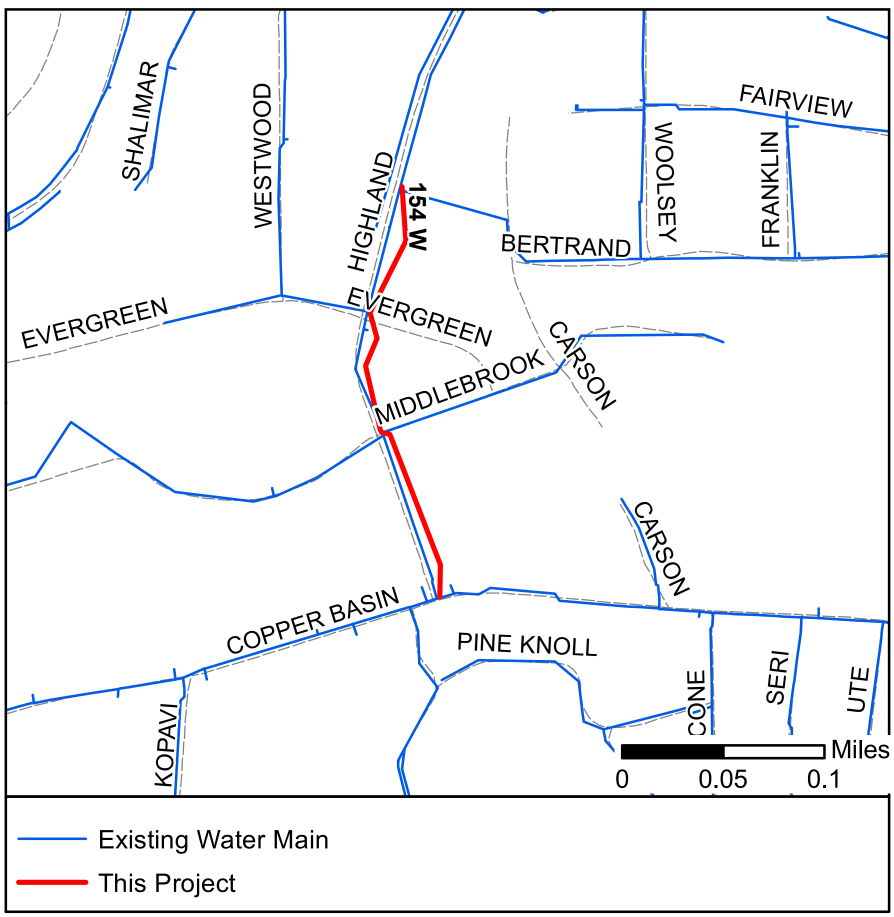
Project Details:

Project	Type	Capacity / Size	Length	Construction Cost	Project Cost
154 W.1	Pipe	12	1,140	$339,000	$475,000

IIP Information:

IIP Service Area: B	% Fees (Growth): 0%	% Rates: 100%





City of Prescott 2023 Water and Wastewater Models
Printing Date: October 27, 2023
File Path: M:\Client\Prescott\200600\GIS\pdf\CIP Water FIgures\CIP_52W\CIP_154W.mxd

Project Number: **158 W** **Planning Period:** FY 2032

Description: Upper Yavapai Hills Booster Pump Station
158 W.1 Upsize Upper Yavapai Hills Booster Pump Station

CITY OF PRESCOTT ARIZONA

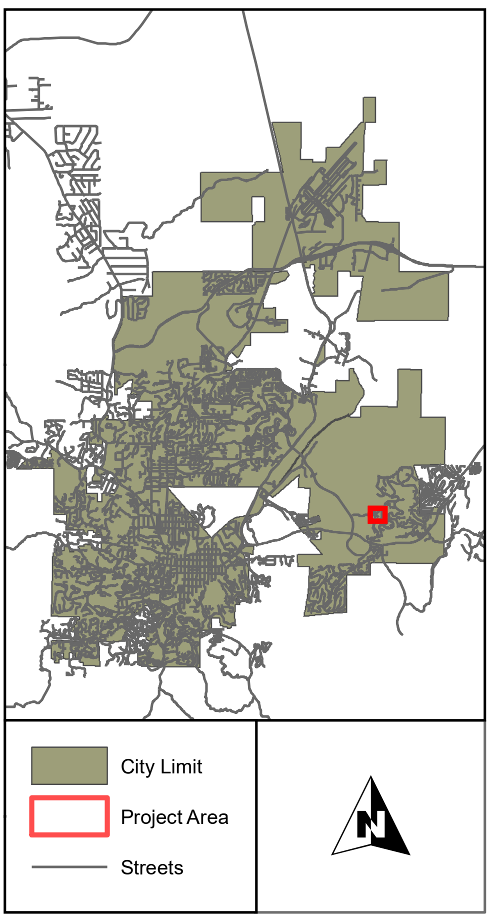
Justification: 158 W.1 This project will provide capacity to meet maximum day and peak hour demands.

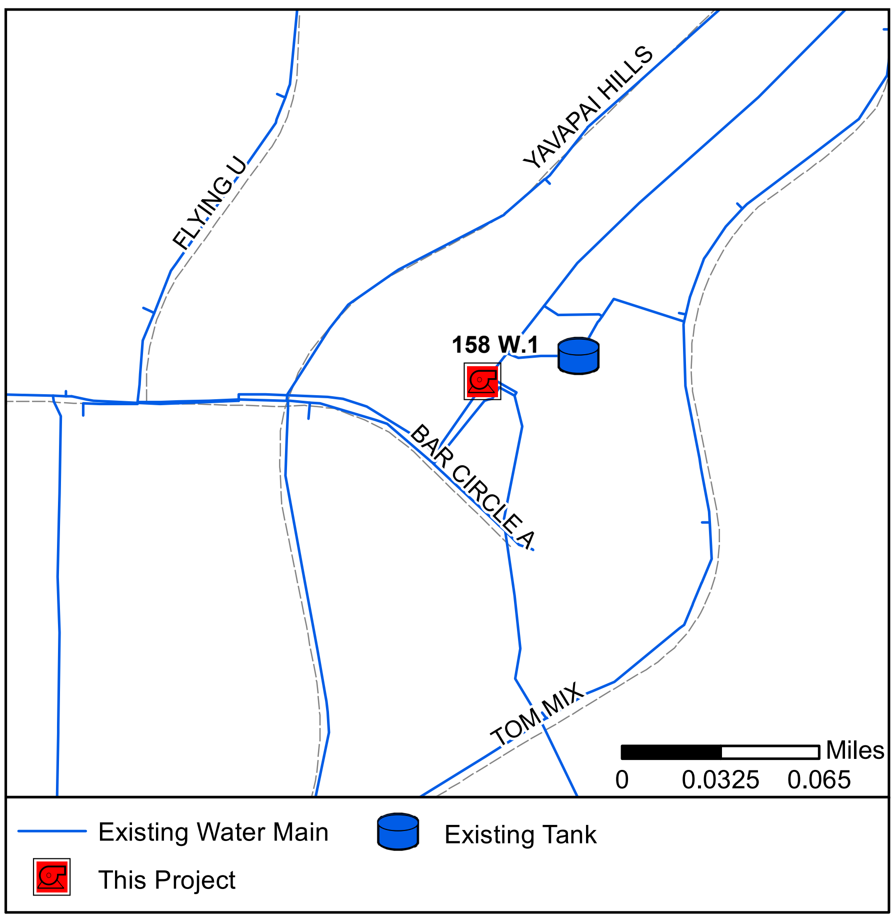
Project Details:

Project	Type	Capacity / Size	Length	Construction Cost	Project Cost
158 W.1	Pump	1,000 gpm	-	$1,691,000	$2,367,000

IIP Information:

IIP Service Area: N/A	% Fees (Growth): 0%	% Rates: 100%





City of Prescott 2023 Water and Wastewater Models

Printing Date: April 06, 2023
File Path: C:\Users\mgaona\Documents\Prescott\200600\2023 CIP W FIgures\CIP_158W.mxd

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Project Number: **161 W** ***Planning Period:*** FY 2027

Description: Section 32 and 33

161 W.1 New water main west of Section 32 along Highway 89 connecting to Granite Dells Parkway
161 W.2 New PRV on the new water main west of Section 32 along Highway 89 connecting to Granite Dells Parkway

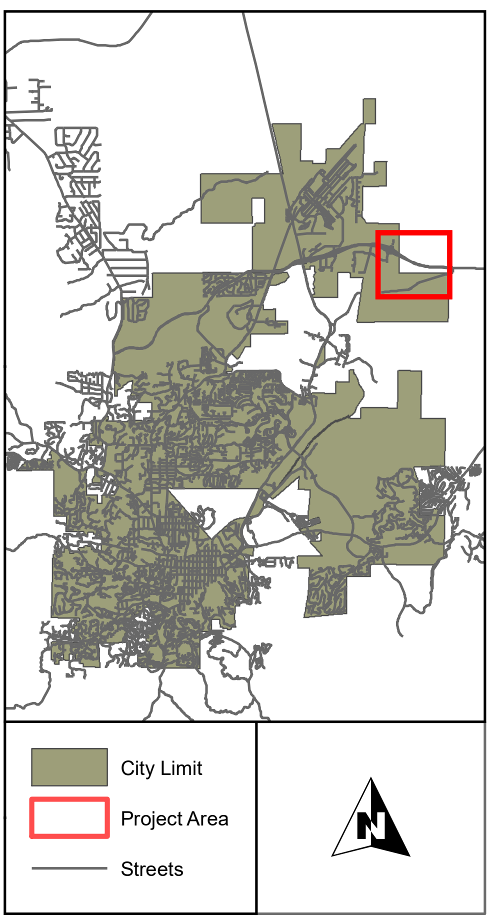
Justification: 161 W.1 - W.2 This project serves future development in Pressure Zone 113

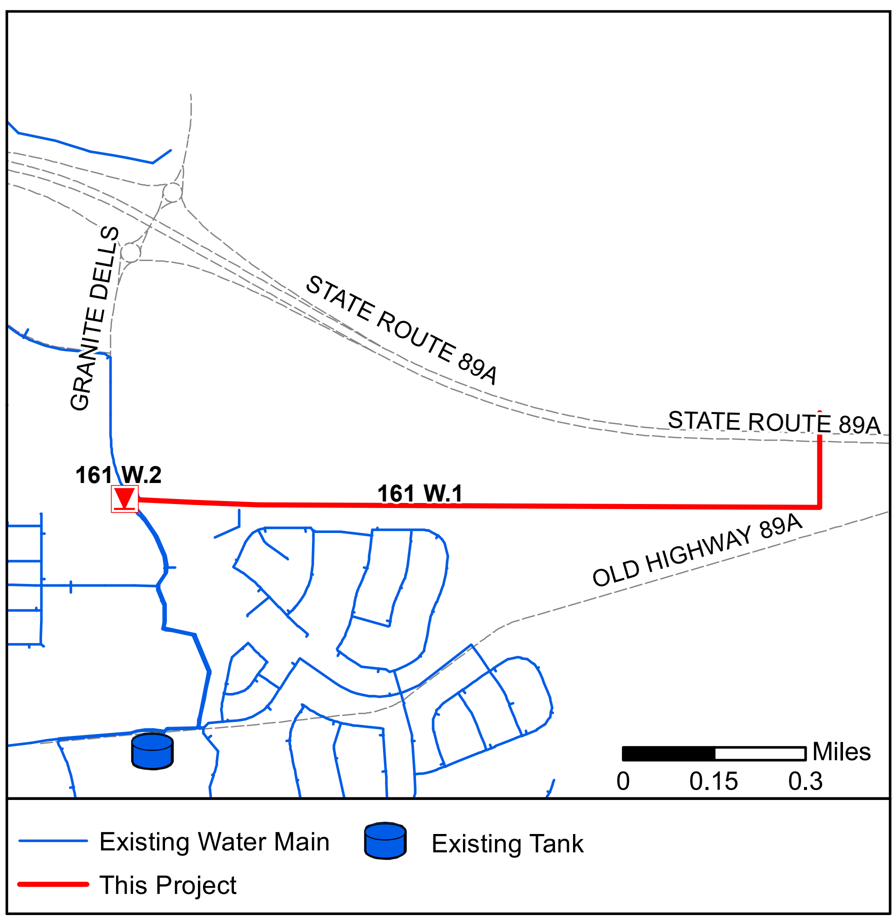
Project Details:

Project	Type	Capacity / Size	Length	Construction Cost	Project Cost
161 W.1	Pipe	16	1,957	$599,000	$839,000
161 W.2	PRV	12	1	$252,000	$353,000

IIP Information:

IIP Service Area: C	% Fees (Growth): 100%	% Rates: 0%





Project Number: **162 W** **Planning Period:** FY 2027

Description: Deep Well Ranch
162 W.1 New 16-inch water main connecting from Zone 12 existing pipe to supply the annexation area northwest of the airport.

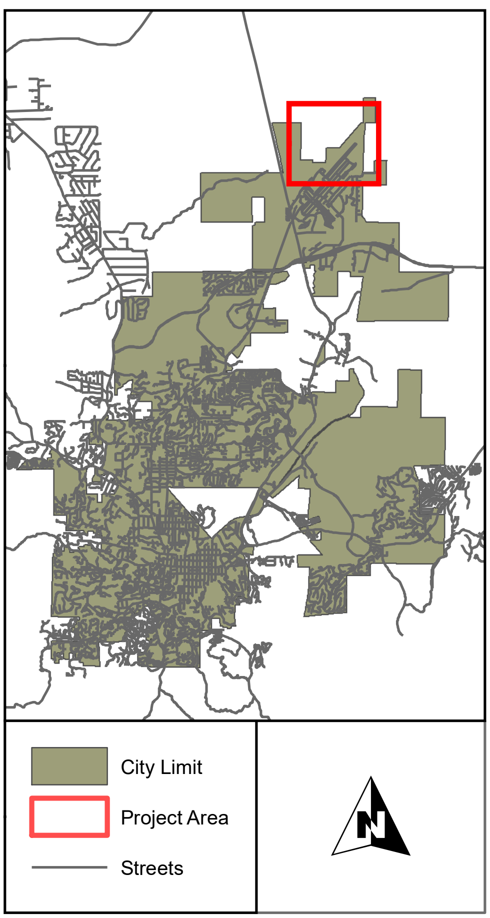
Justification: 162 W.1 This project will supply the annexation area northwest of the airport.

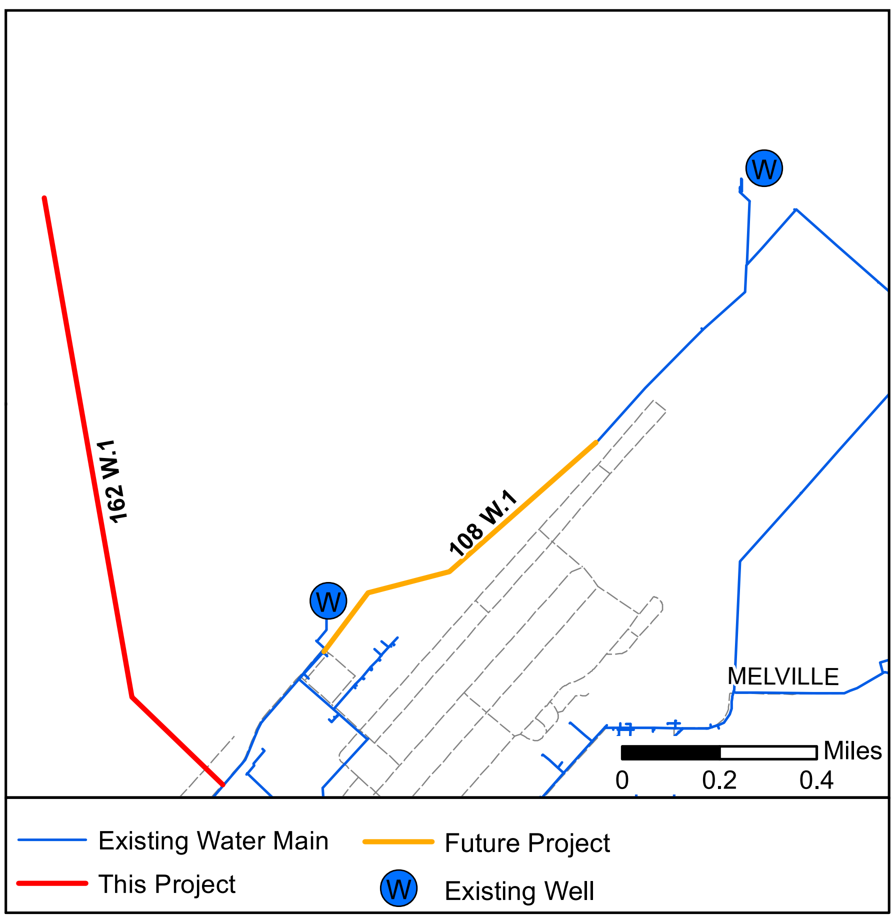
Project Details:

Project	Type	Capacity / Size	Length	Construction Cost	Project Cost
162 W.1	Pipe	16	6,913	$2,115,000	$2,961,000

IIP Information:

IIP Service Area: B	% Fees (Growth): 100%	% Rates: 0%





Project Number: 163 W

Planning Period: FY 2027

CITY OF PRESCOTT ARIZONA

Description: Citywide Water Main Replacement

163 W.1 New 6-inch water main along Brush Street connecting with the pipes on Western Avenue and Gurley Street.

163 W.2 New water main along Willow Street connecting to the pipe

163 W.3 New water main along Cherry Drive connecting with the pipes on Middlebrook Road and Linden Road.

163 W.4 New water main along the Country Club Circle.

163 W.5 New water main along Parker Drive to connect Zone 24 and 27.

163 W.6 New PRV station and vault from Zone 24 with Zone 27.

163 W.7 New PRV station and vault from Zone 27 to Zone 28.

163 W.8 New PRV station and vault from Zone 48 to Zone 28.

163 W.9 New water main on W Idylwild Rd to complete the loop

Justification: 163 W.1 - W.2 This project will improve fire flow and peak hour pressures in Zone 0.

163 W.3 - W.4 This project will improve fire flow and peak hour pressures in Zone 39.

163 W.5 - W.6 This project will increase water supply to Zone 27 and improve fire flow and peak hour pressures in Zone 27.

163 W.7 - W.8 This project will increase water supply to Zone 28 and improve fire flow and peak hour pressures in Zone 28.

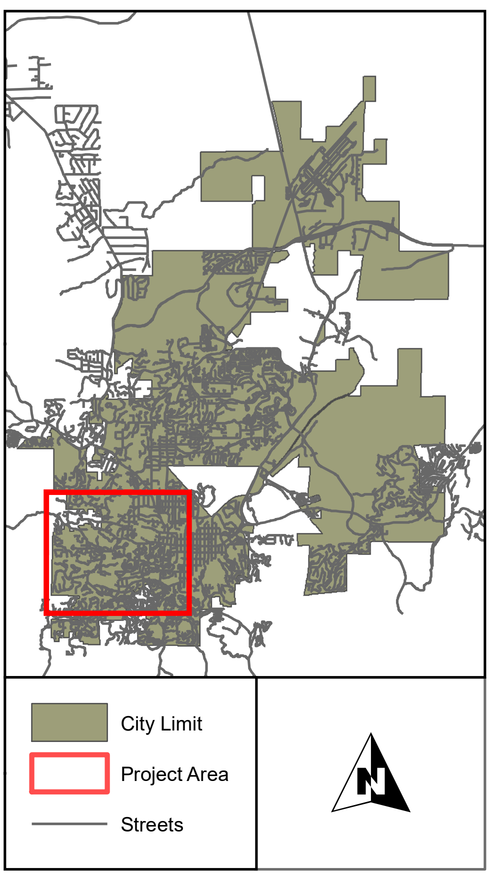
163 W.9 This project will complete the pipe loop and improve fire flow and peak hour

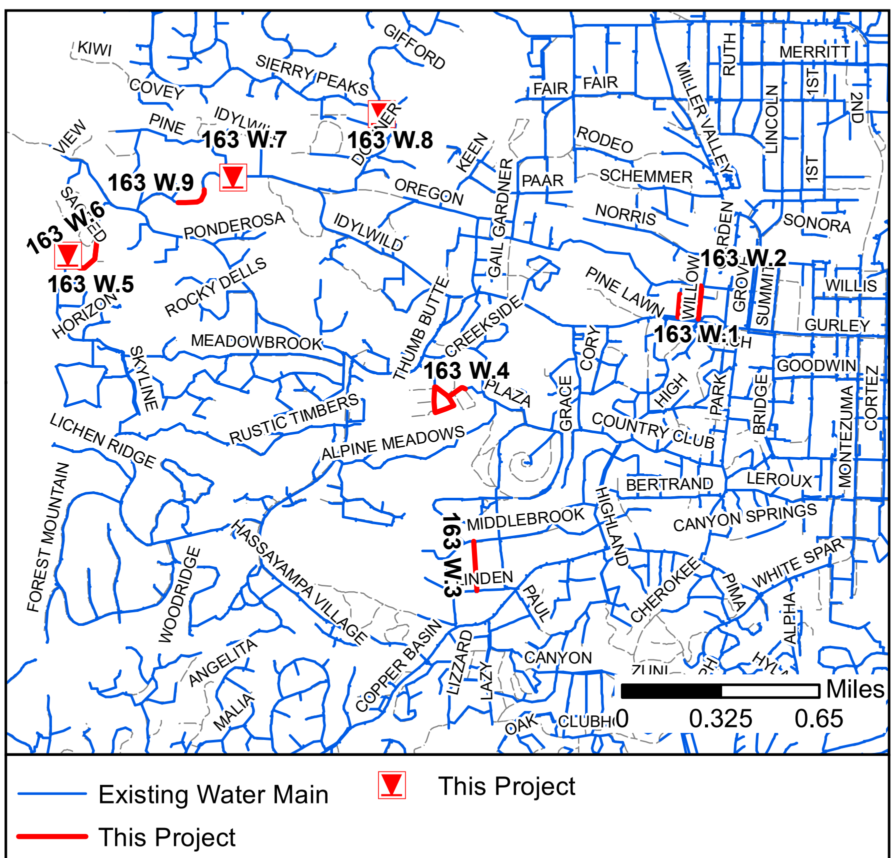
Project Details:

Project	Type	Capacity / Size	Length	Construction Cost	Project Cost
163 W.1	Pipe	6	601	$129,000	$181,000
163 W.2	Pipe	8	712	$159,000	$223,000
163 W.3	Pipe	6	859	$184,000	$258,000
163 W.4	Pipe	8	1,627	$363,000	$508,000
163 W.5	Pipe	8	1,231	$275,000	$385,000
163 W.6	PRV	6	1	$152,000	$213,000
163 W.7	PRV	6	1	$152,000	$213,000
163 W.8	PRV	6	1	$152,000	$213,000
163 W.9	Pipe	12	720	$214,000	$300,000

IIP Information:

IIP Service Area: B	% Fees (Growth): 25%	% Rates: 75%





Project Number: 164 W **Planning Period:** FY 2027

Description: Citywide Water Main Replacement Program
164 W.1 New 4-inch pipes in Ho Kay Gan development
164 W.2 New 6-inch pipes in Ho Kay Gan development
164 W.3 New 8-inch pipes in Ho Kay Gan development
164 W.4 New 12-inch pipes in Ho Kay Gan development

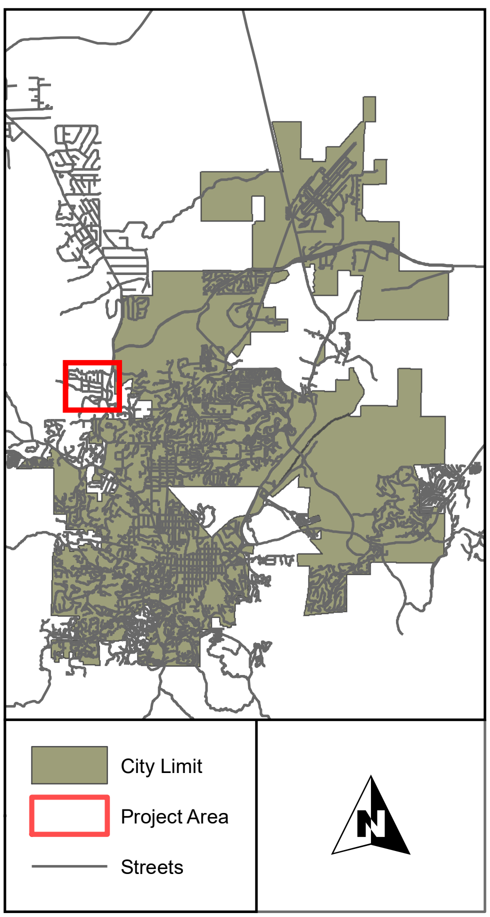
Justification: 164 W.1 - 164 W.4 This project will supply Ho Kay Gan development

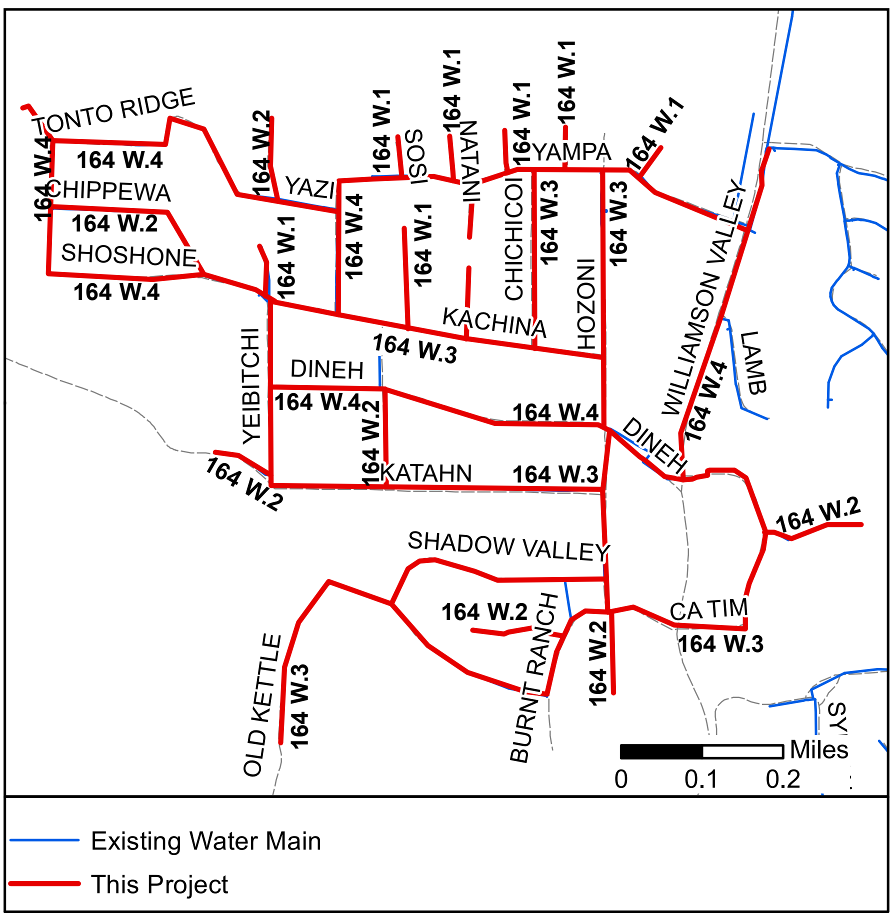
Project Details:

Project	Type	Capacity / Size	Length	Construction Cost	Project Cost
164 W.1	Pipe	4	3,453	$691,000	$967,000
164 W.2	Pipe	6	6,582	$1,409,000	$1,973,000
164 W.3	Pipe	8	14,120	$3,149,000	$4,409,000
164 W.4	Pipe	12	14,415	$4,281,000	$5,993,000

IIP Information:

IIP Service Area: B	% Fees (Growth): 0%	% Rates: 100%





City of Prescott 2023 Water and Wastewater Models

Project Number: **165 W** **Planning Period:** FY 2027

Description: Citywide Water Main Replacement Program

165 W.1 New 8-inch pipe replacement in downtown
165 W.2 New 10-inch pipe replacement in downtown

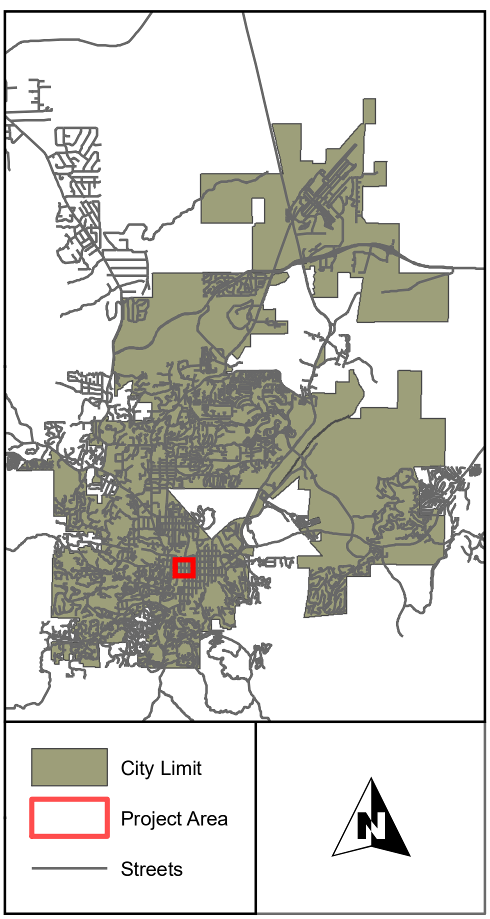
Justification: 165 W.1 - 165 W.2 This project will replace the pipes in the downtown area and improve the fireflow.

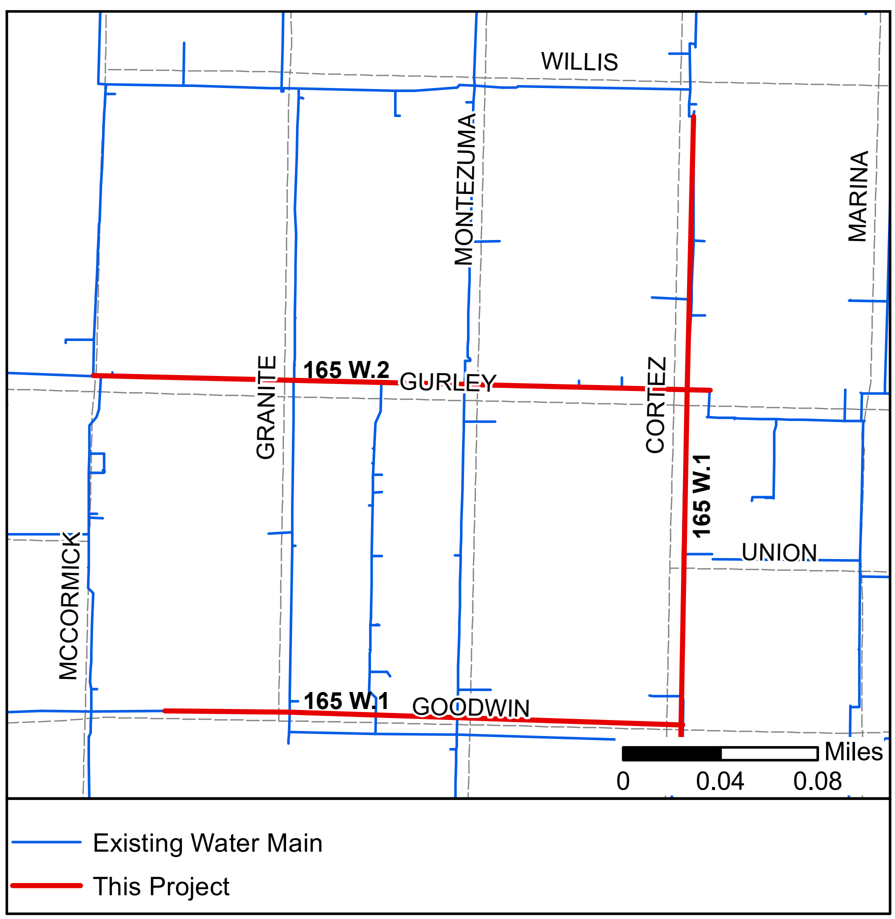
Project Details:

Project	Type	Capacity / Size	Length	Construction Cost	Project Cost
165 W.1	Pipe	8	2,480	$553,000	$774,000
165 W.2	Pipe	10	1,339	$343,000	$480,000

IIP Information:

IIP Service Area: B	% Fees (Growth): 0%	% Rates: 100%





Project Number: **166 W** ***Planning Period:*** FY 2027

Description: Storm Ranch Water Main
166 W.1 New 12-inch pipe on Sundog Ranch Rd connecting with Prescott Lakes Pkwy

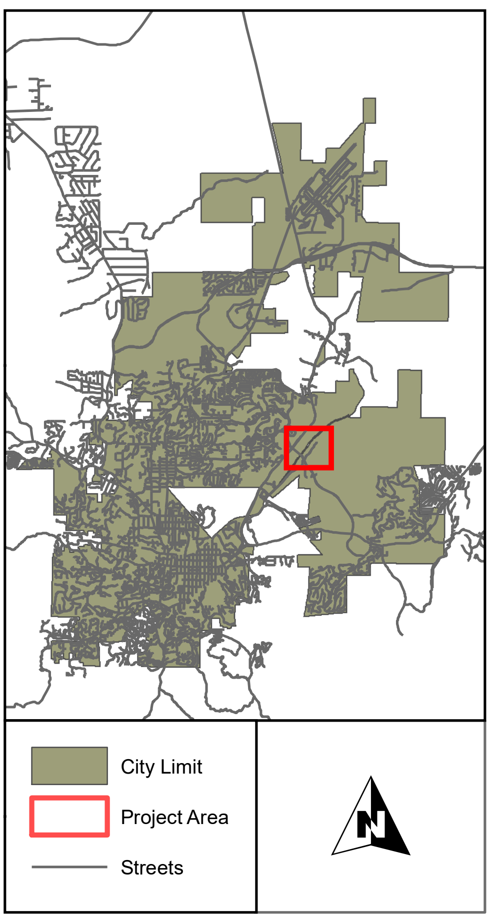
Justification: 166 W.1 - This project will supply water in Storm Ranch development

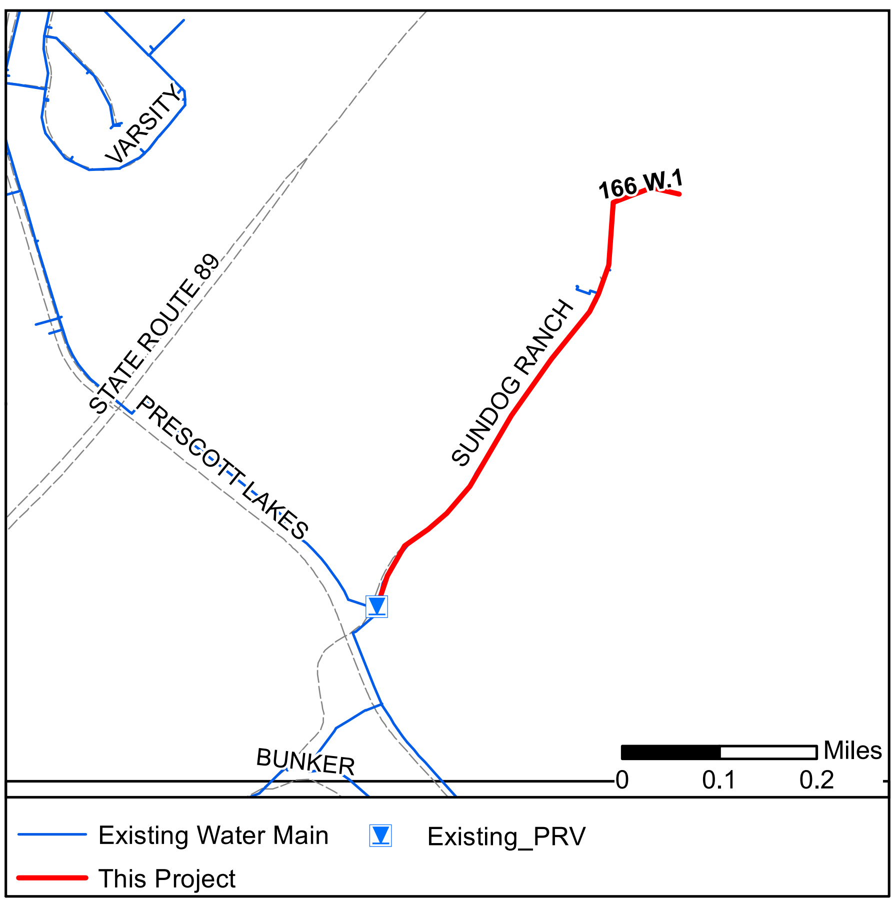
Project Details:

Project	Type	Capacity / Size	Length	Construction Cost	Project Cost
166 W.1	Pipe	12	3,300	$422,500	$592,000

IIP Information:

IIP Service Area: B	% Fees (Growth): 50%	% Rates: 50%



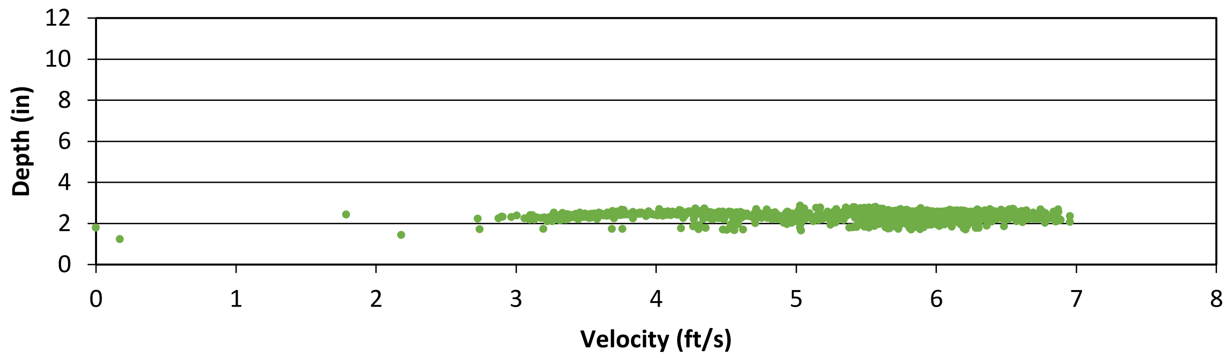


Appendix 5A

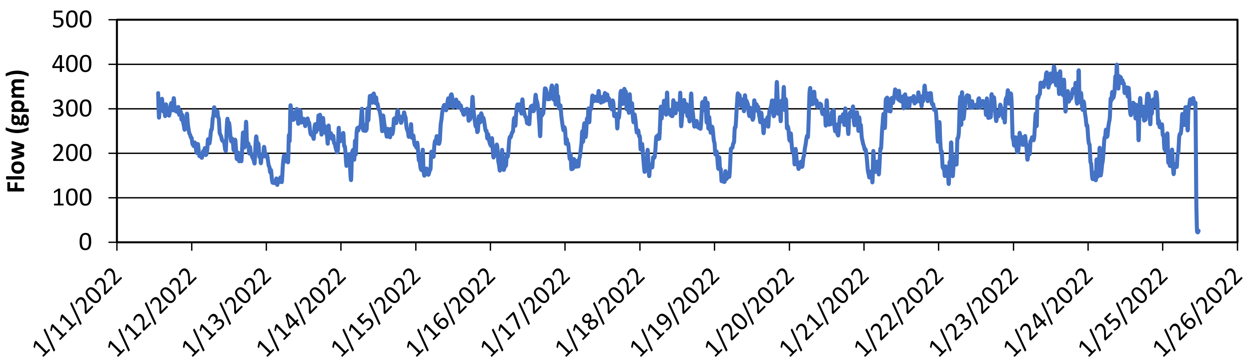
WASTEWATER SYSTEM FIELD TEST RESULTS

City of Prescott
2023 Water and Wastewater Models
FLOW METER SITE 1 DATA

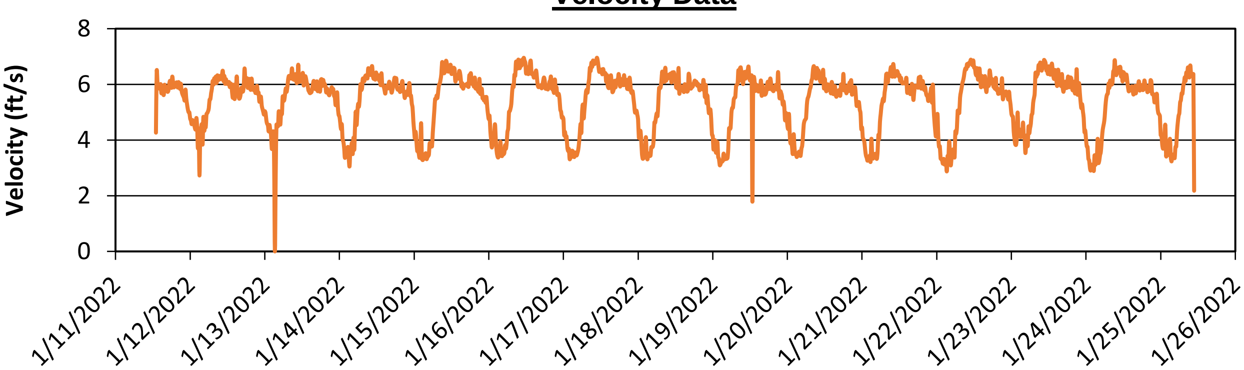
Scattergraph



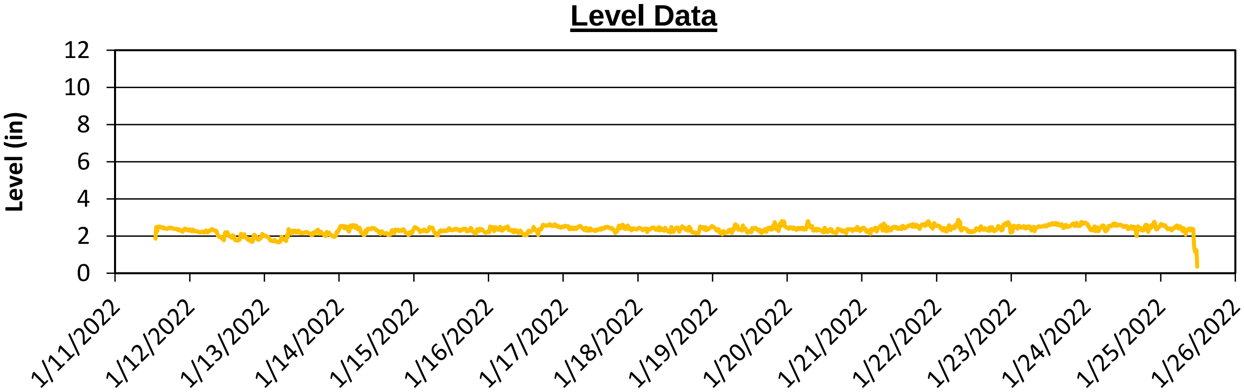
Flow Data



Velocity Data

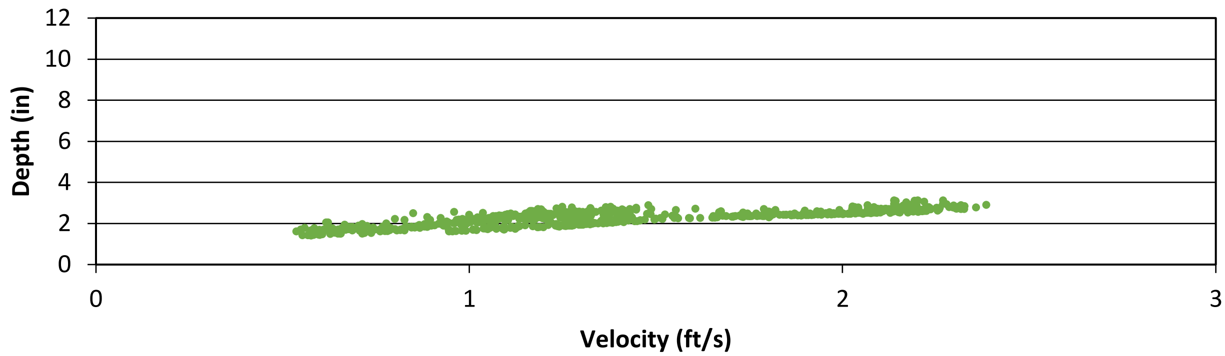


Level Data

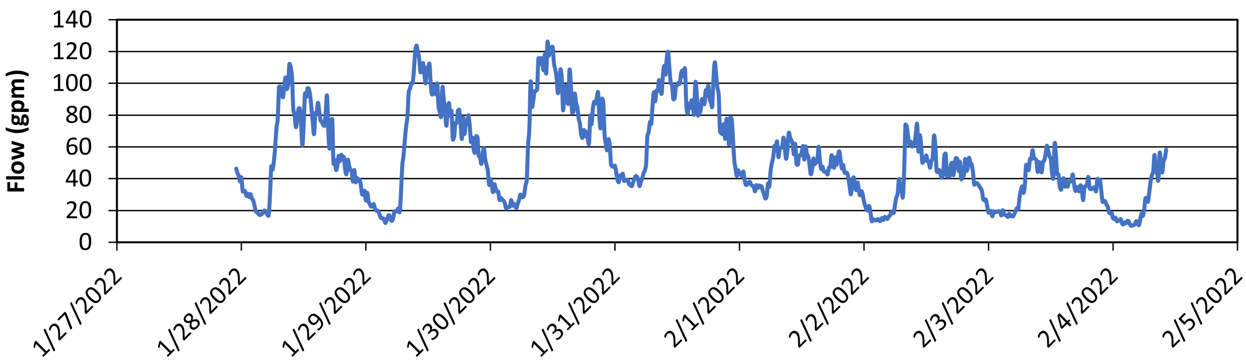


City of Prescott
2023 Water and Wastewater Models
FLOW METER SITE 2 DATA

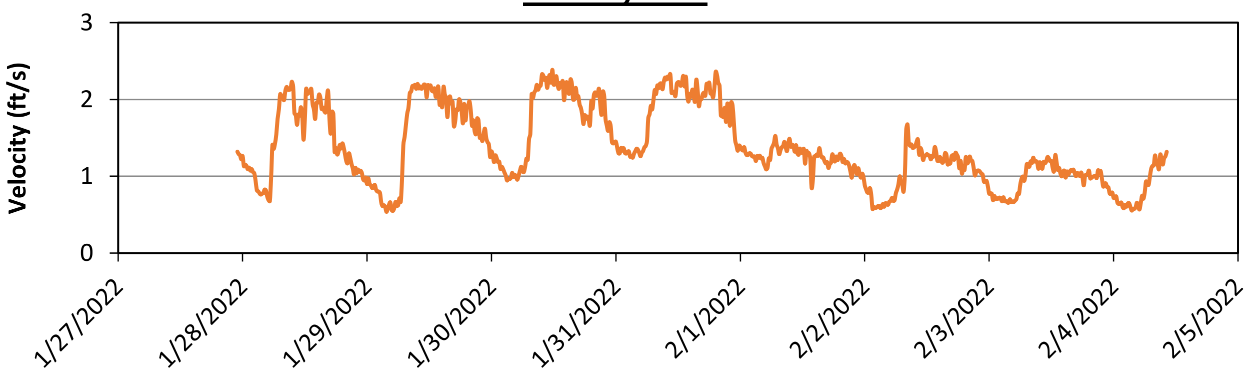
Scattergraph



Flow Data



Velocity Data



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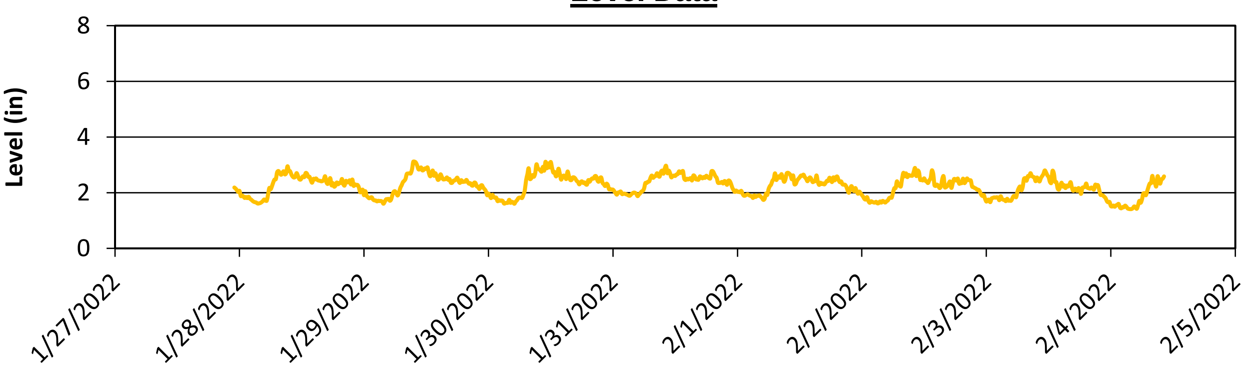
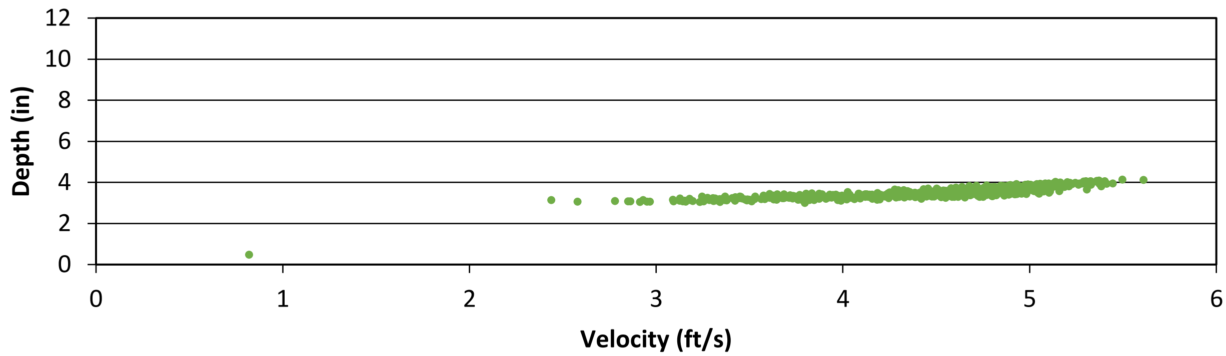
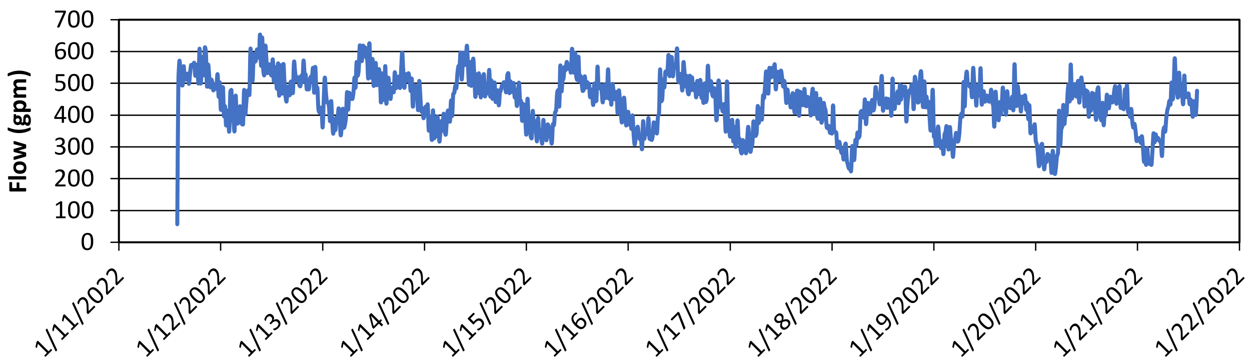


City of Prescott
2023 Water and Wastewater Models
FLOW METER SITE 3 DATA

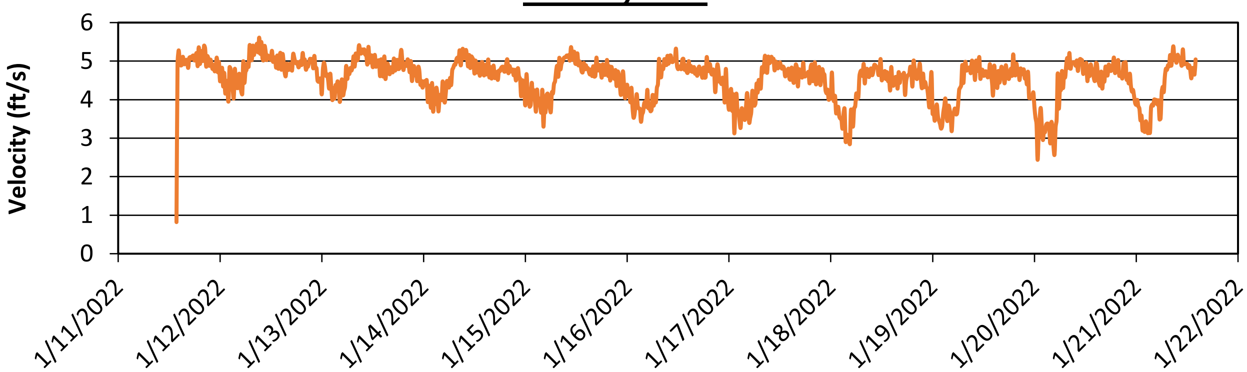
Scattergraph



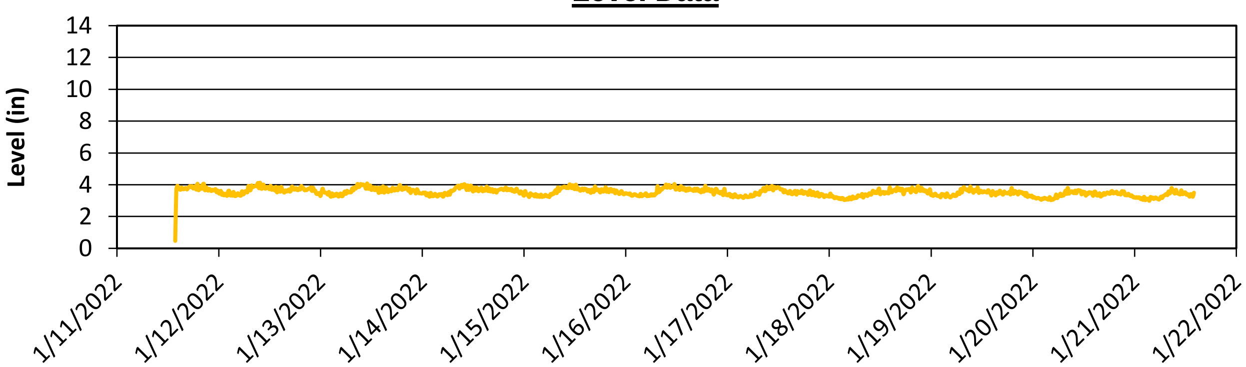
Flow Data



Velocity Data

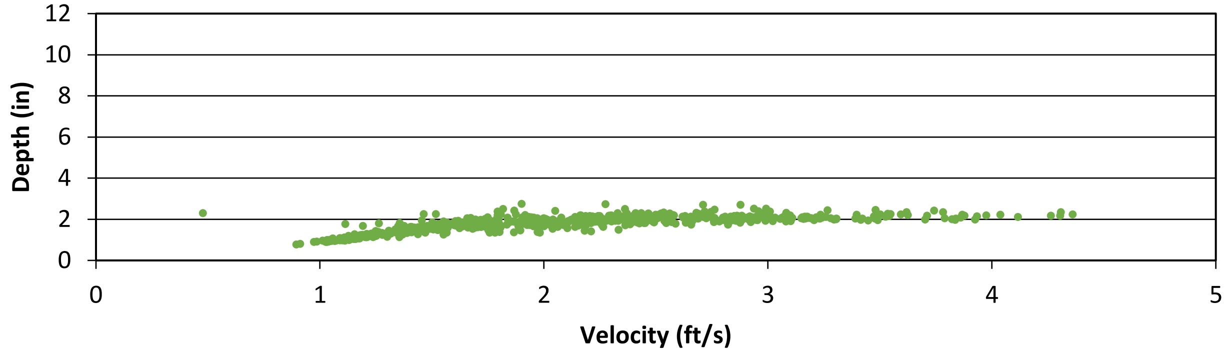


Level Data

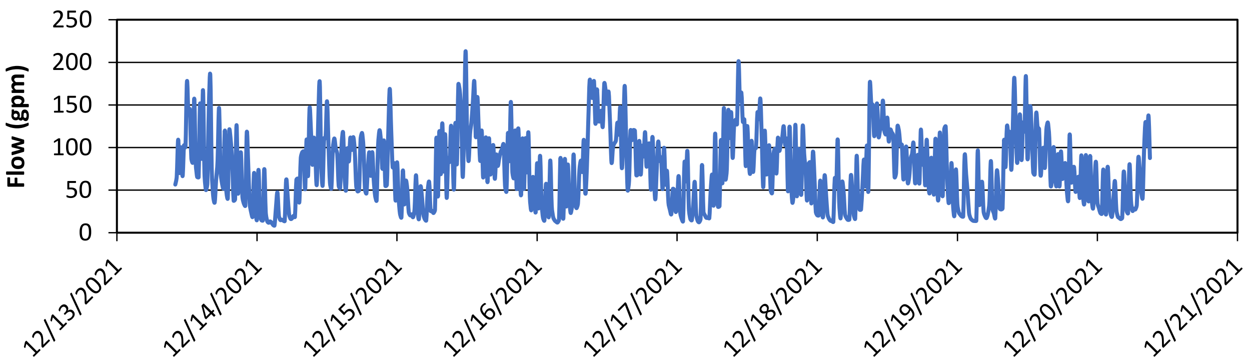


City of Prescott
2023 Water and Wastewater Models
FLOW METER SITE 4 DATA

Scattergraph



Flow Data



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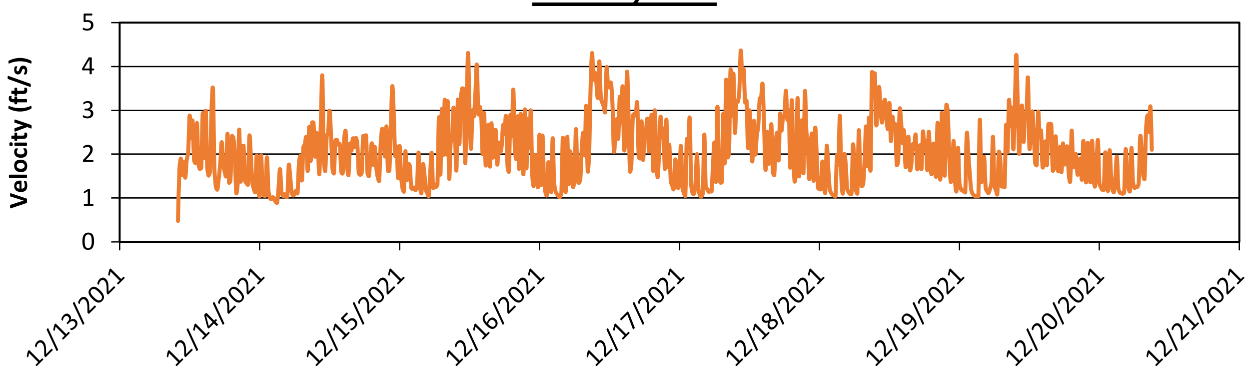
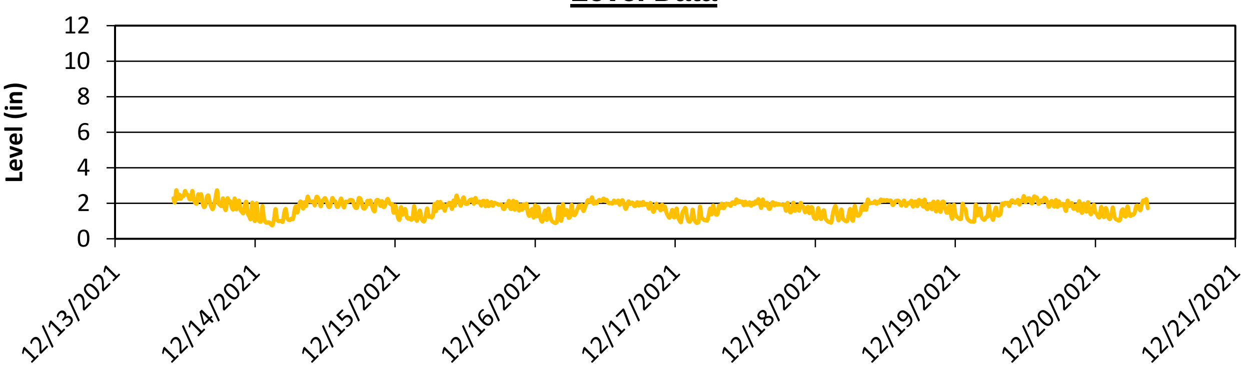
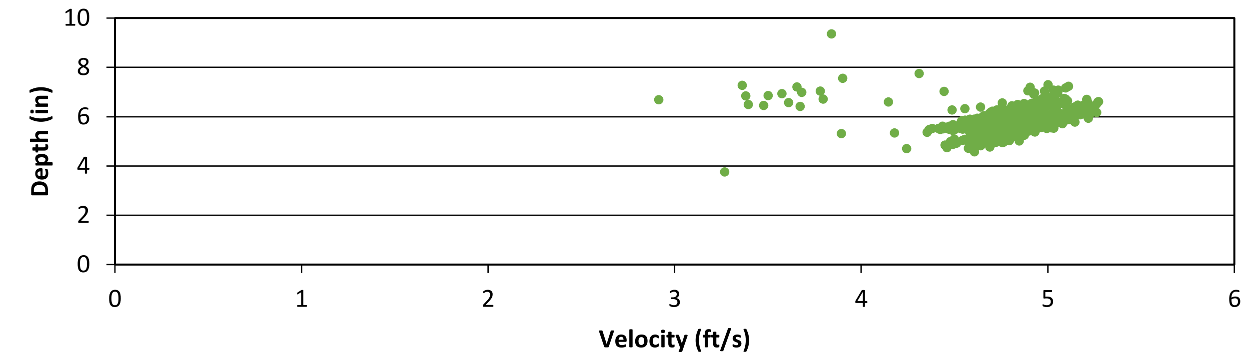


Level Data



City of Prescott
2023 Water and Wastewater Models
FLOW METER SITE 5 DATA

Scattergraph



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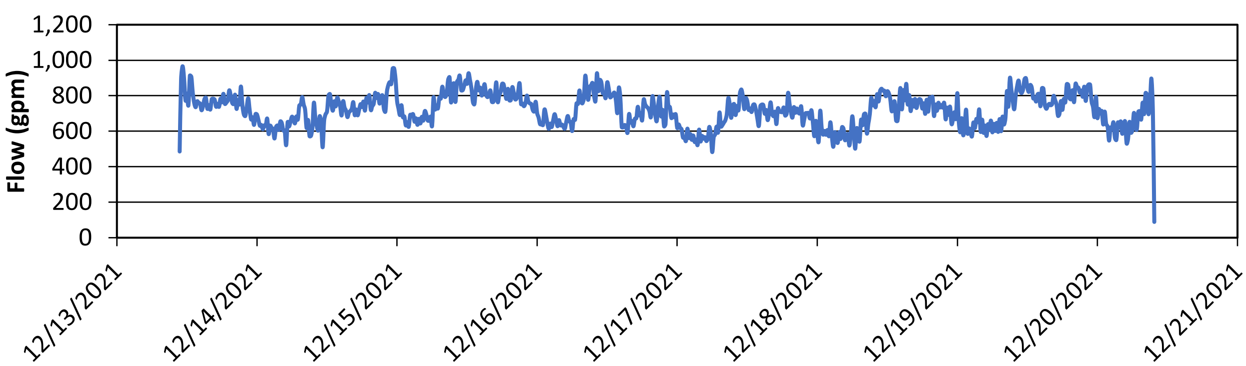
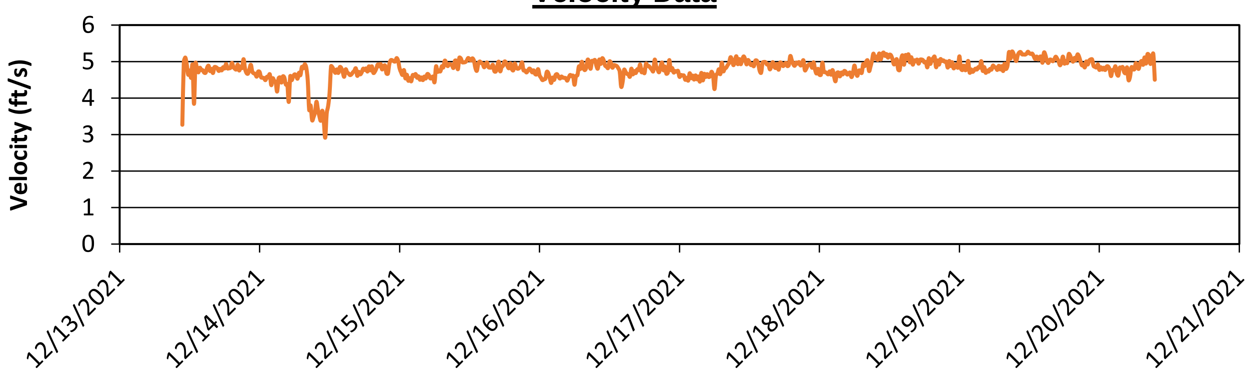
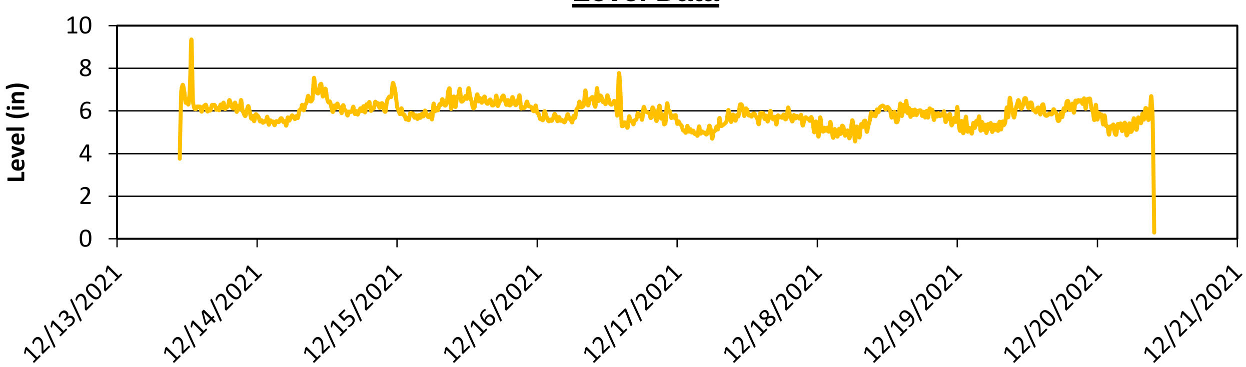


Velocity Data

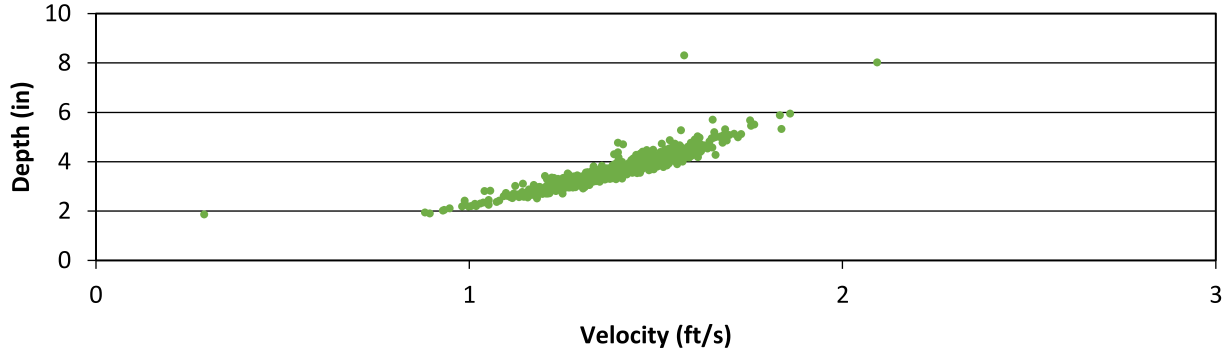


Level Data

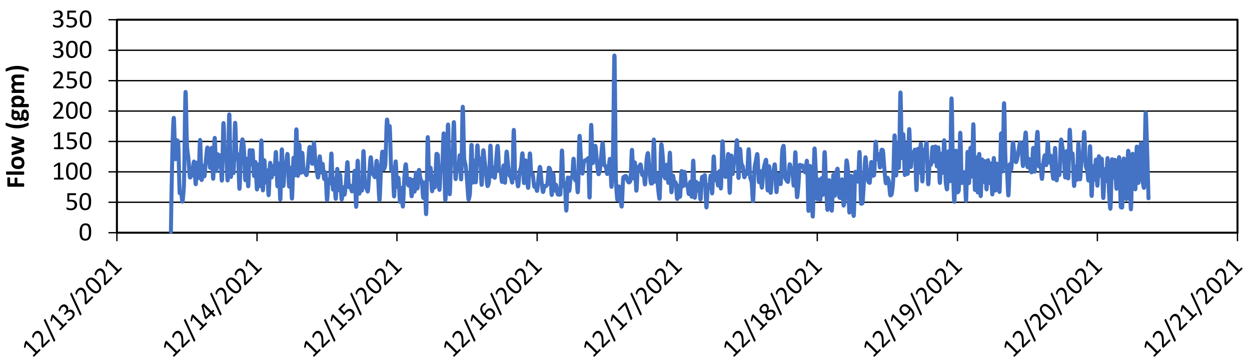


City of Prescott
2023 Water and Wastewater Models
FLOW METER SITE 6 DATA

Scattergraph



Flow Data



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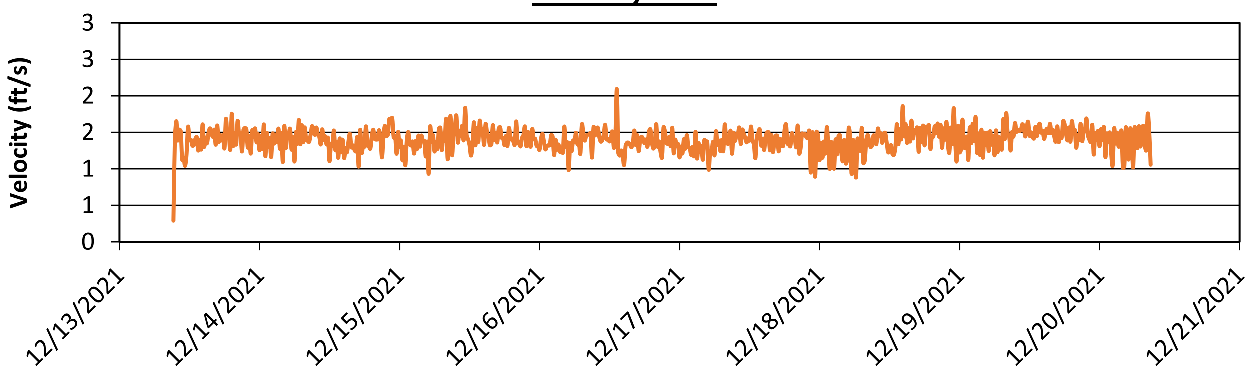

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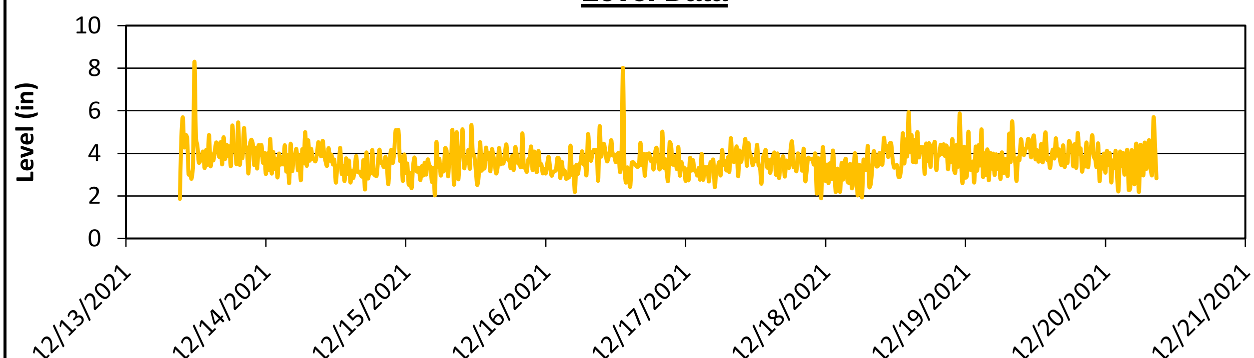
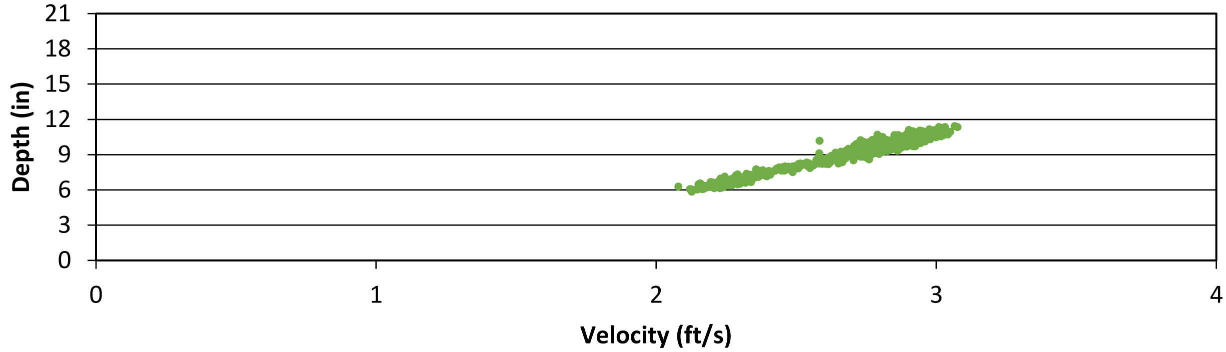


City of Prescott
2023 Water and Wastewater Models
FLOW METER SITE 7 DATA

Scattergraph



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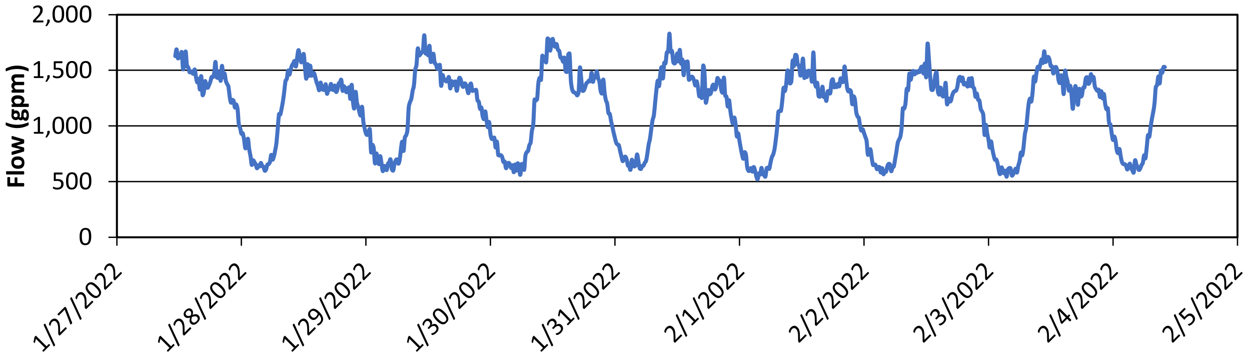
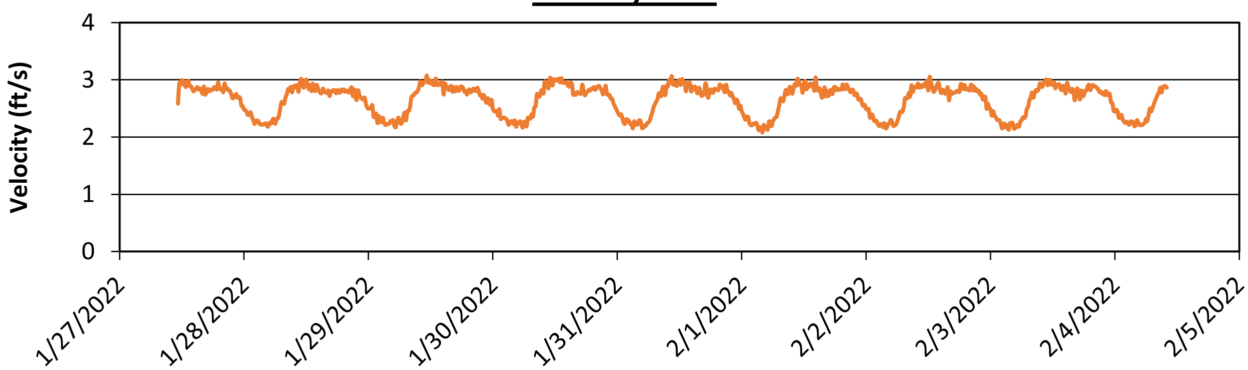


Velocity Data



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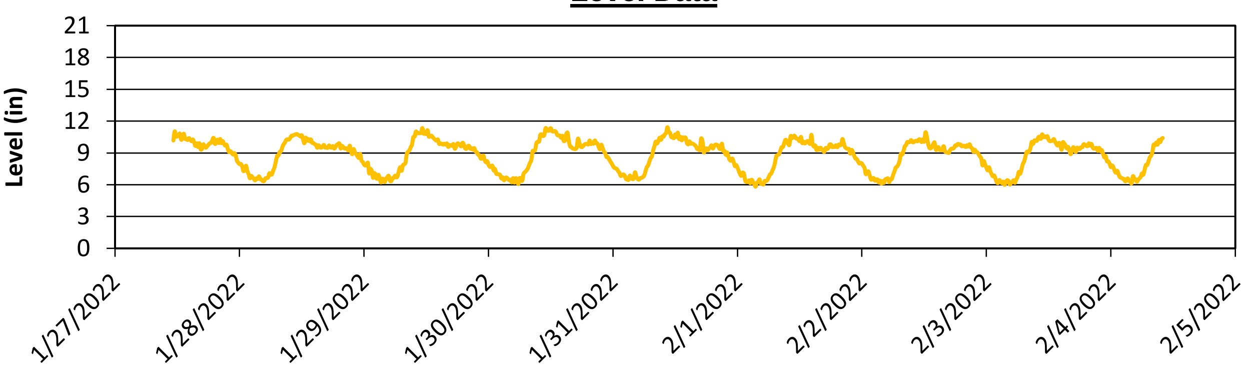
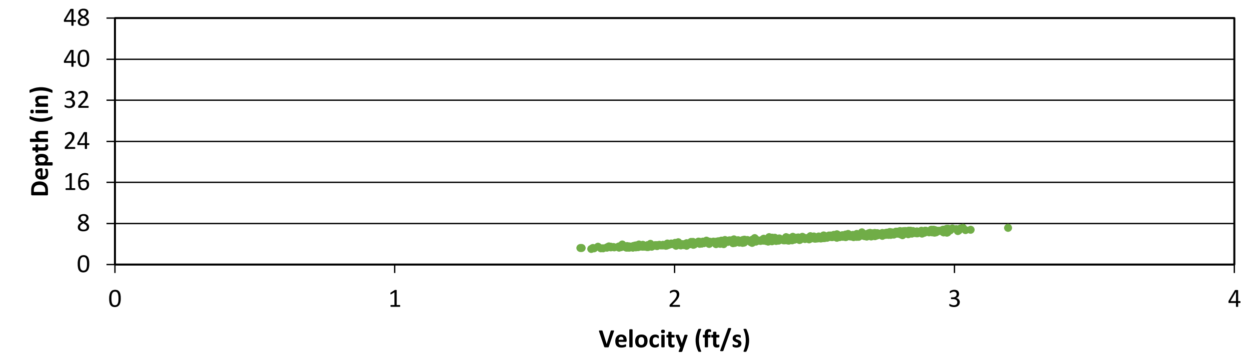
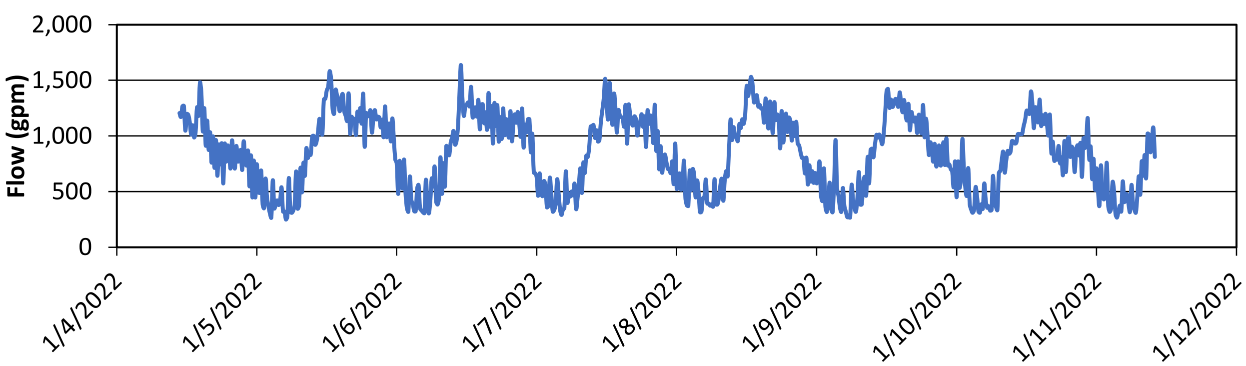


City of Prescott
2023 Water and Wastewater Models
FLOW METER SITE 8 DATA

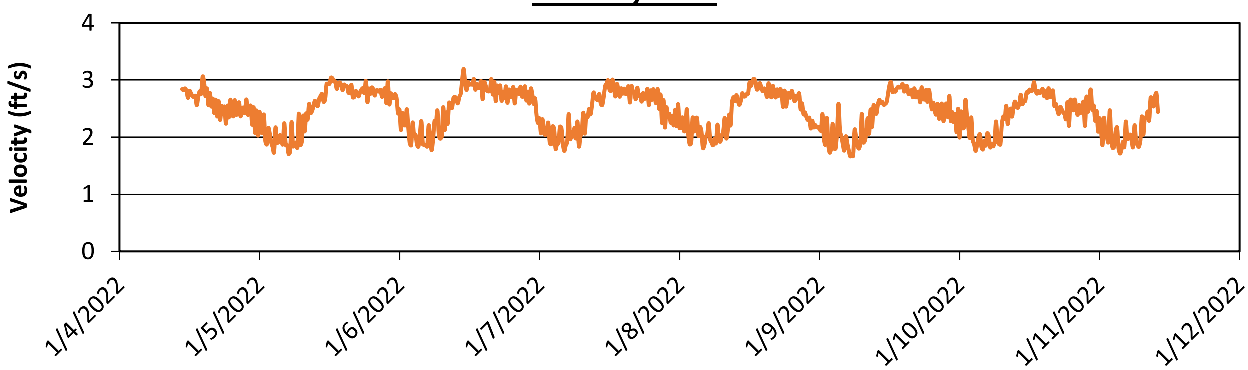
Scattergraph



Flow Data



Velocity Data



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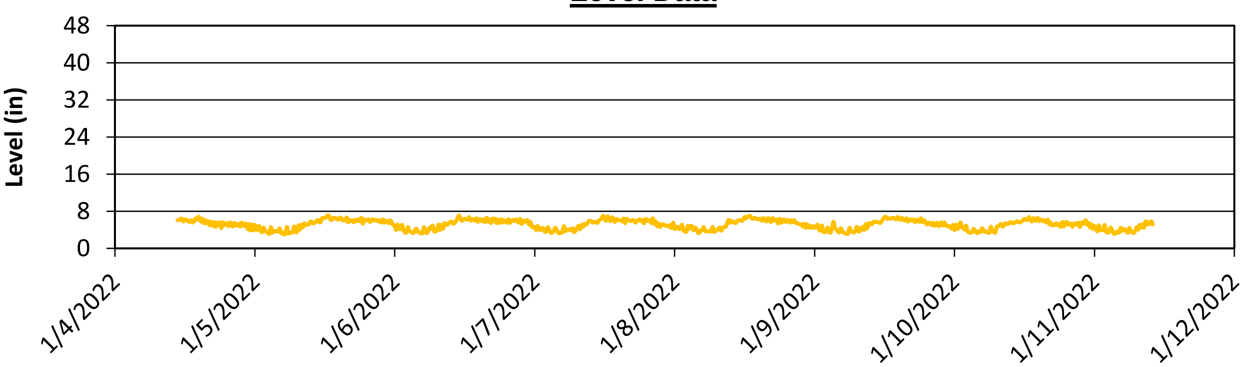
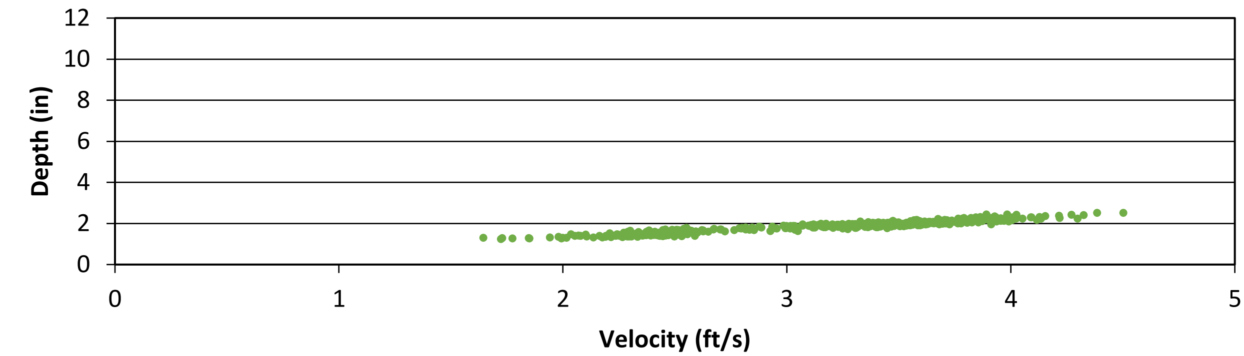


City of Prescott
2023 Water and Wastewater Models
FLOW METER SITE 9 DATA

Scattergraph



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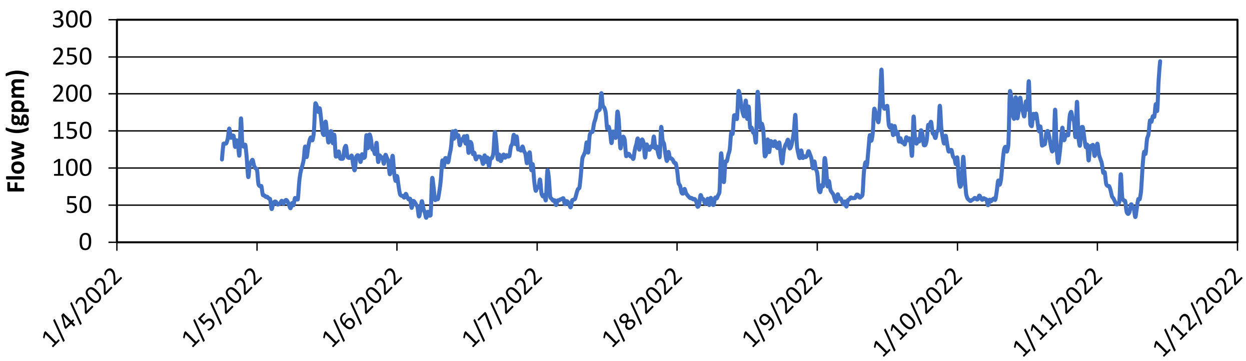
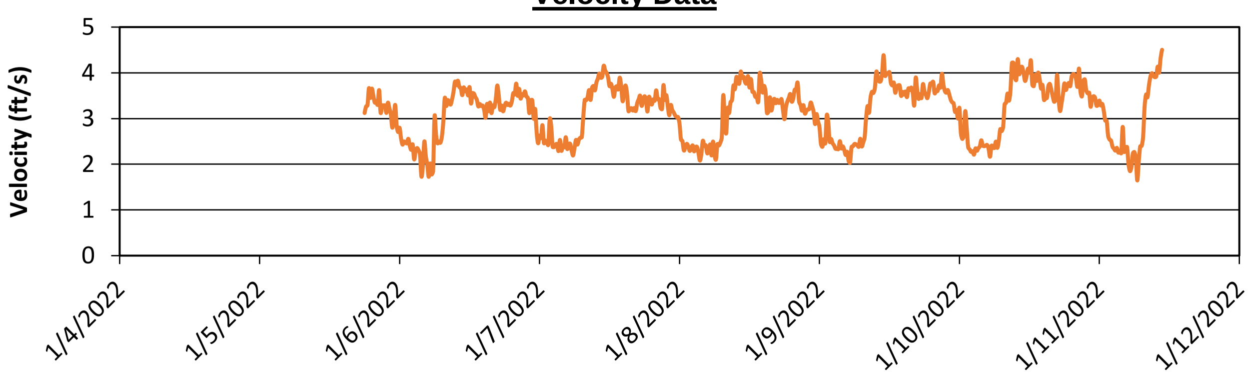


Velocity Data



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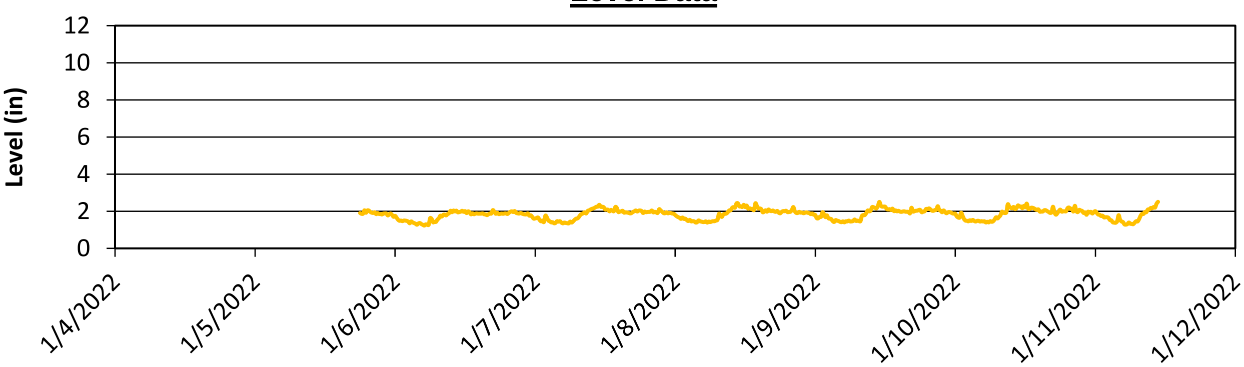
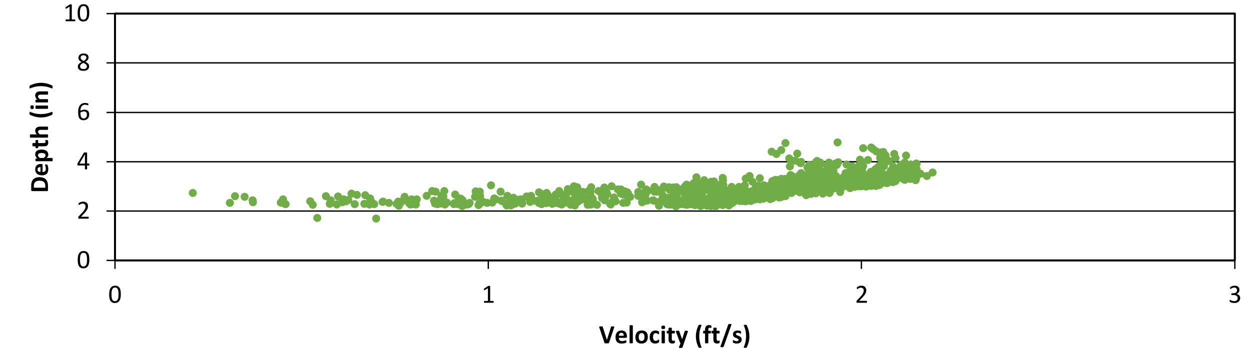
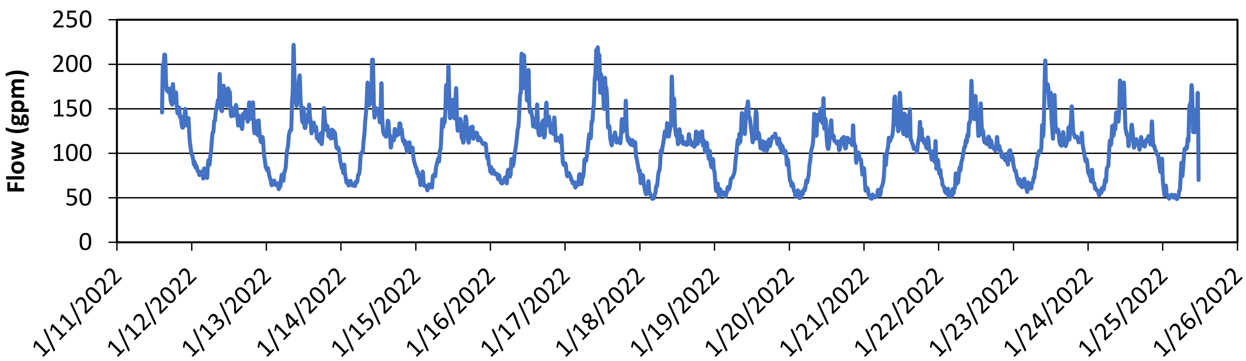


City of Prescott
2023 Water and Wastewater Models
FLOW METER SITE 10 DATA

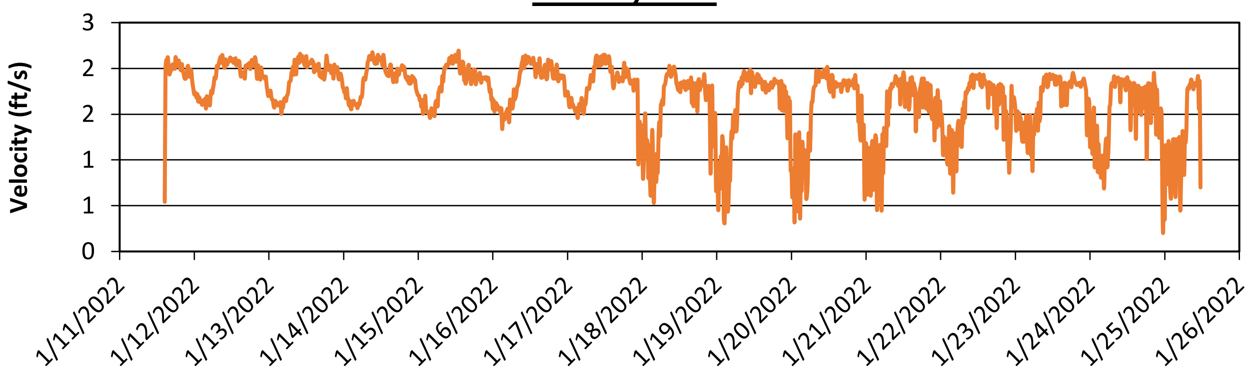
Scattergraph



Flow Data



Velocity Data



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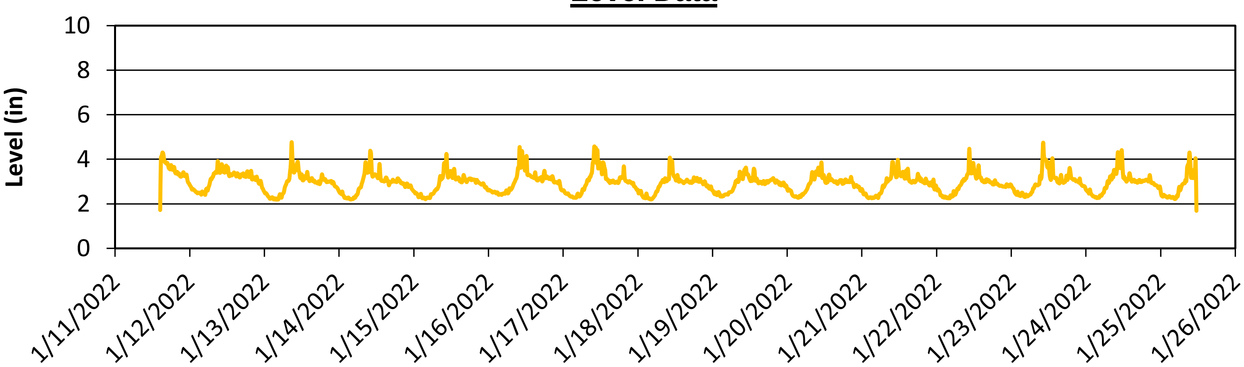
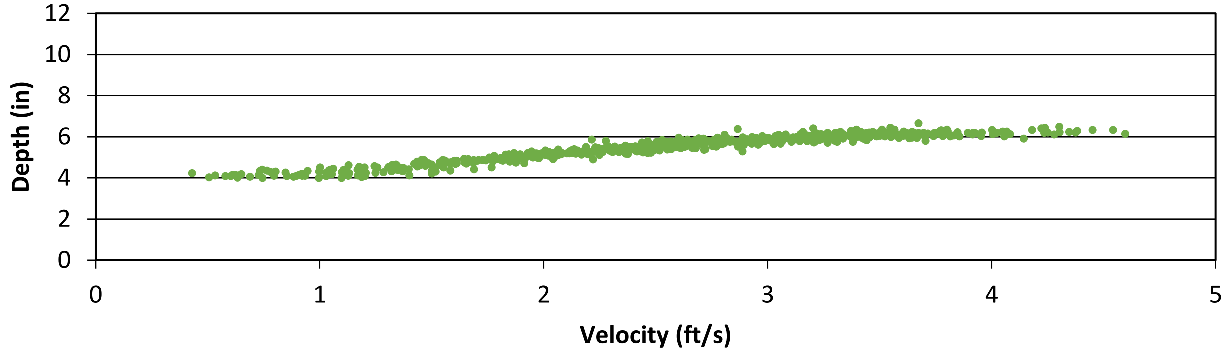
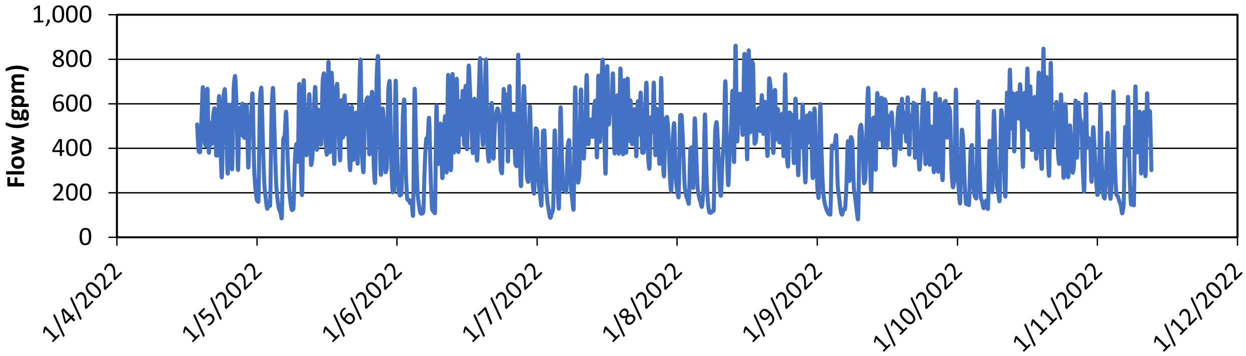


City of Prescott
2023 Water and Wastewater Models
FLOW METER SITE 11 DATA

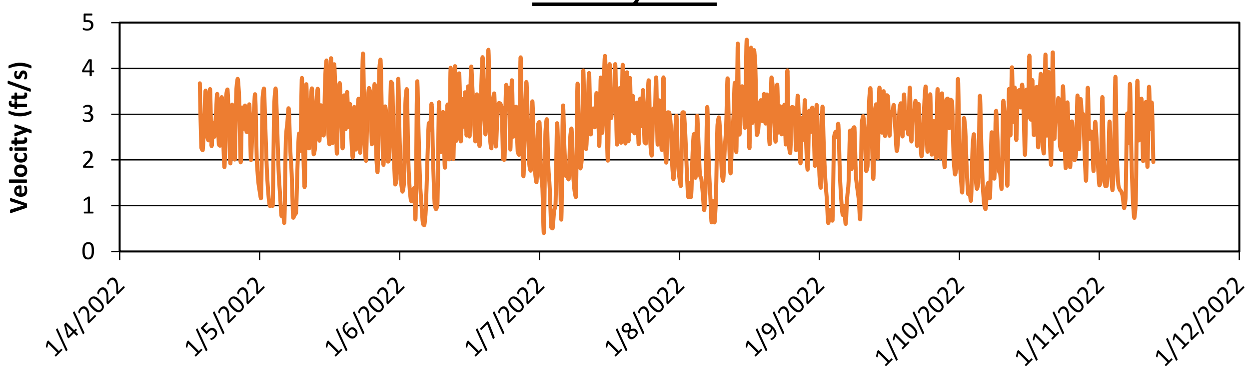
Scattergraph



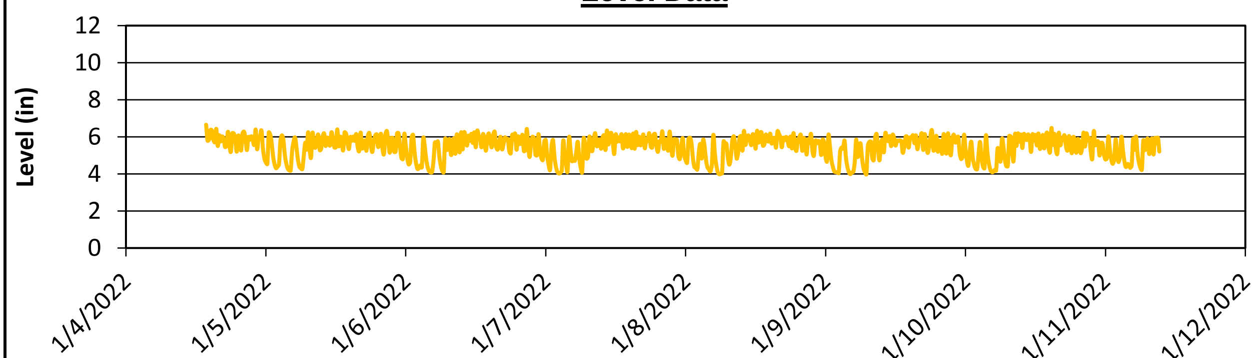
Flow Data



Velocity Data

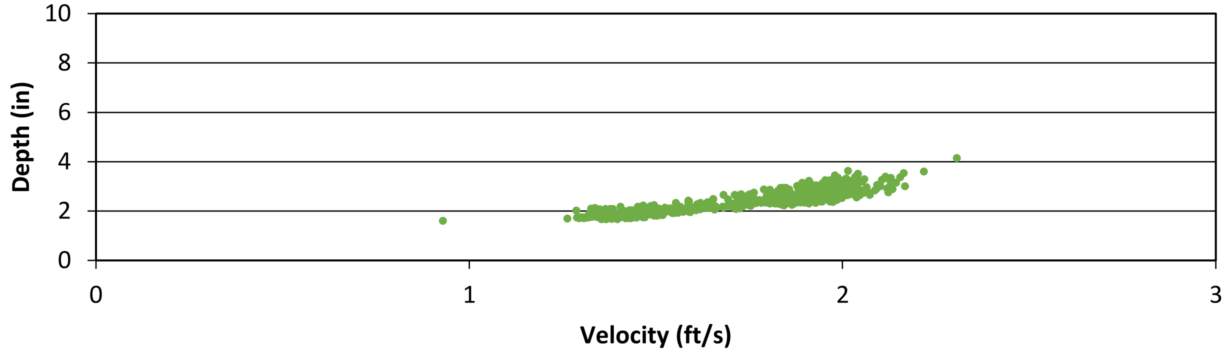


Level Data

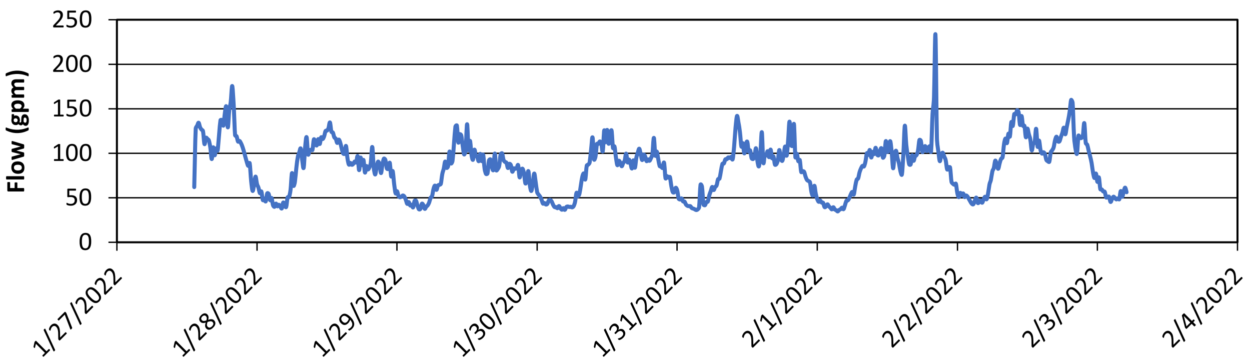


City of Prescott
2023 Water and Wastewater Models
FLOW METER SITE 12 DATA

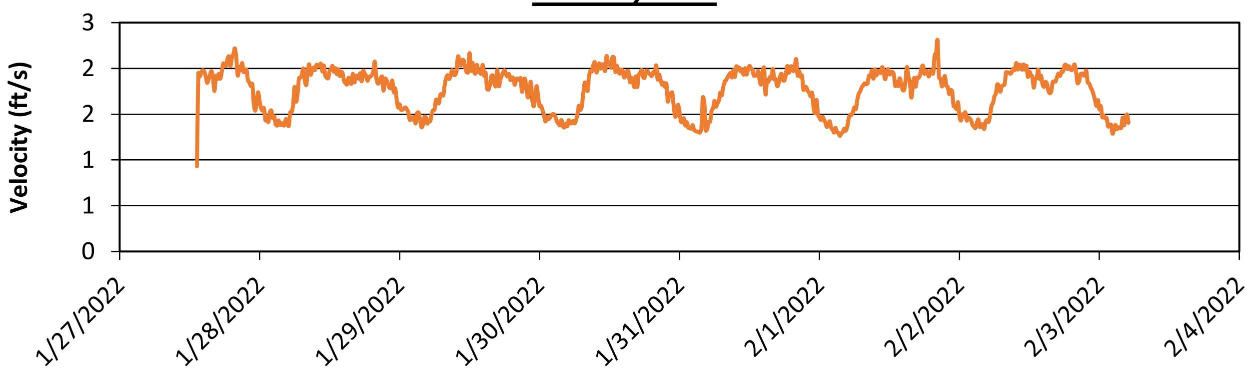
Scattergraph



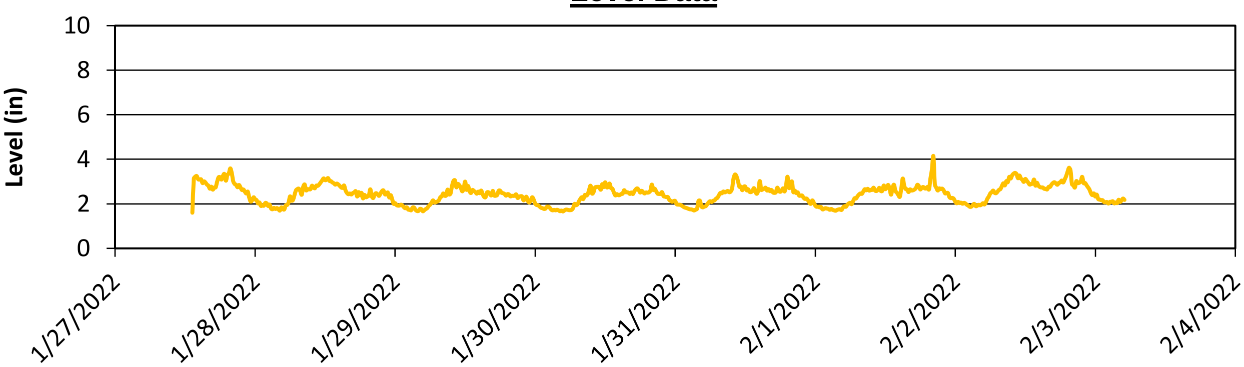
Flow Data



Velocity Data



Level Data

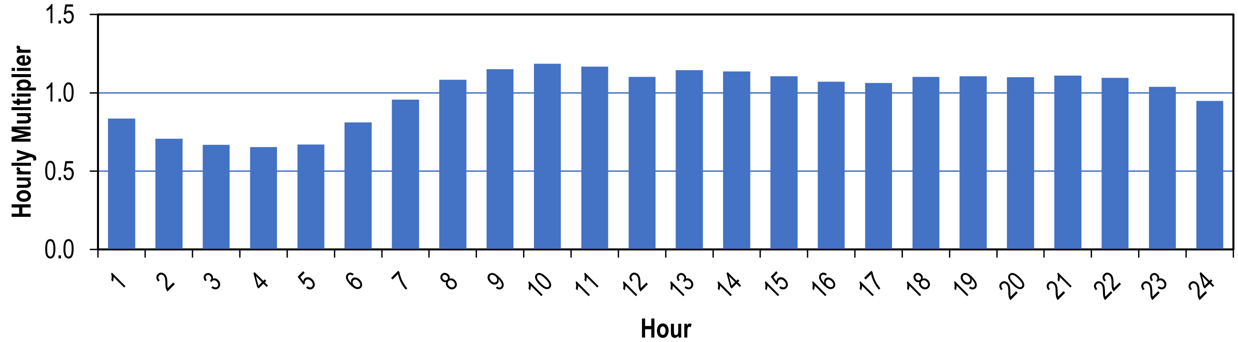


Appendix 5B

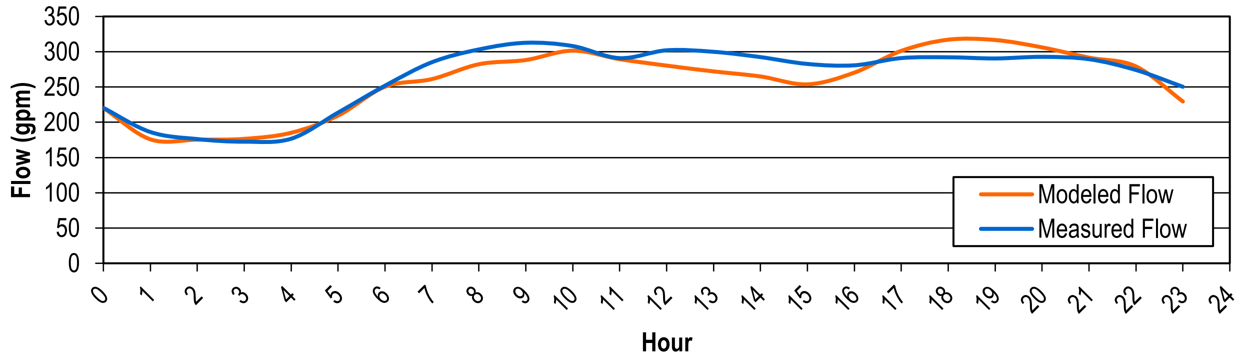
WASTEWATER MODEL CALIBRATION GRAPHS

City of Prescott
2023 Water and Wastewater Models
FLOW METER SITE 1 CALIBRATION

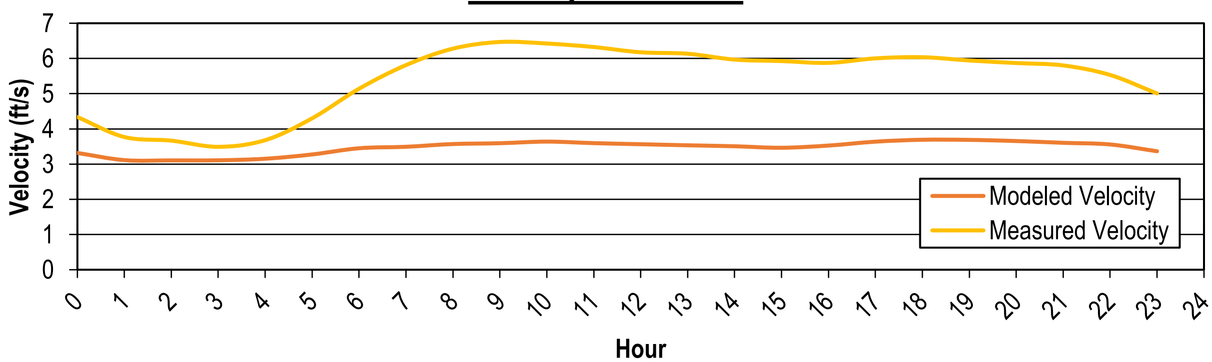
Calibrated Diurnal Pattern



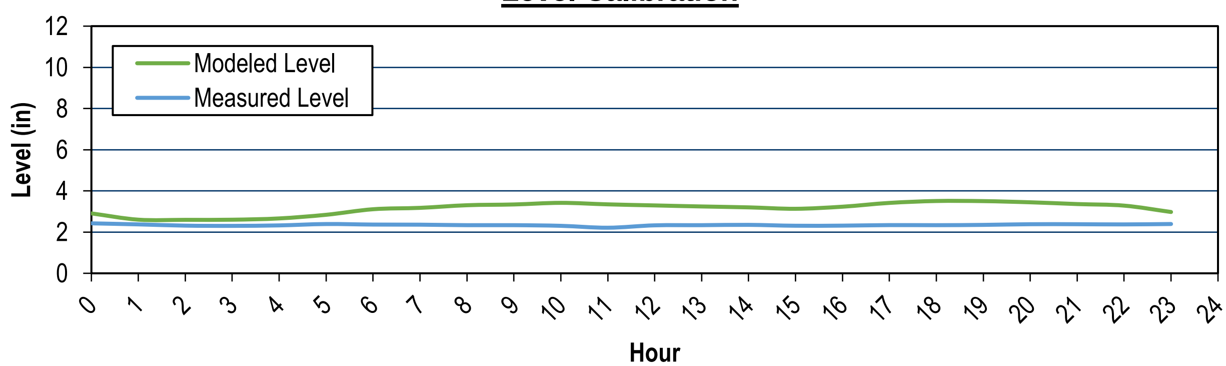
Flow Calibration



Velocity Calibration

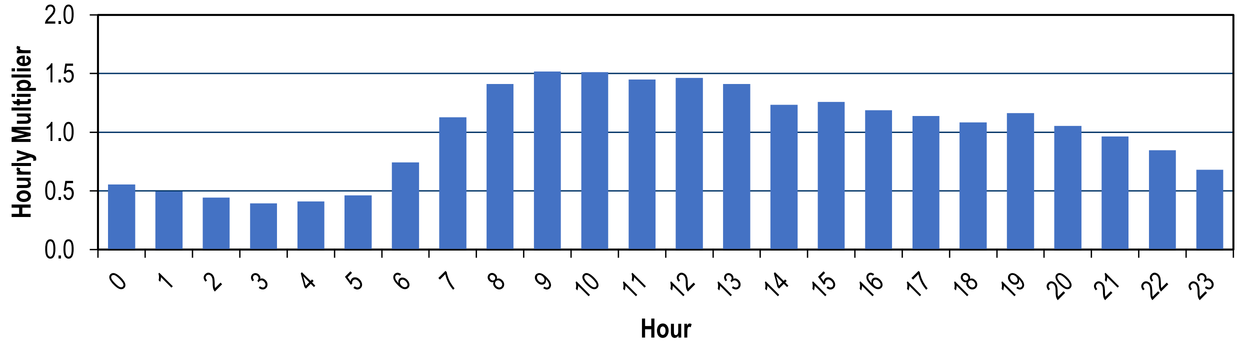


Level Calibration

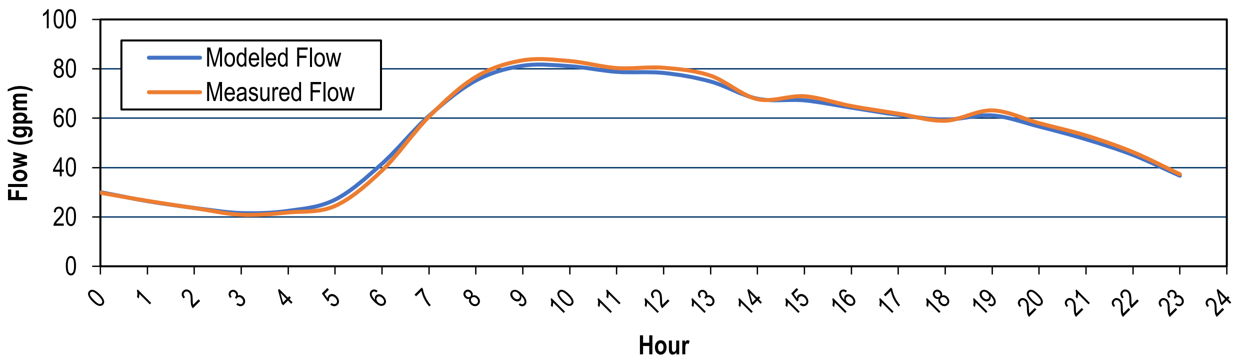


City of Prescott
2023 Water and Wastewater Models
FLOW METER SITE 2 CALIBRATION

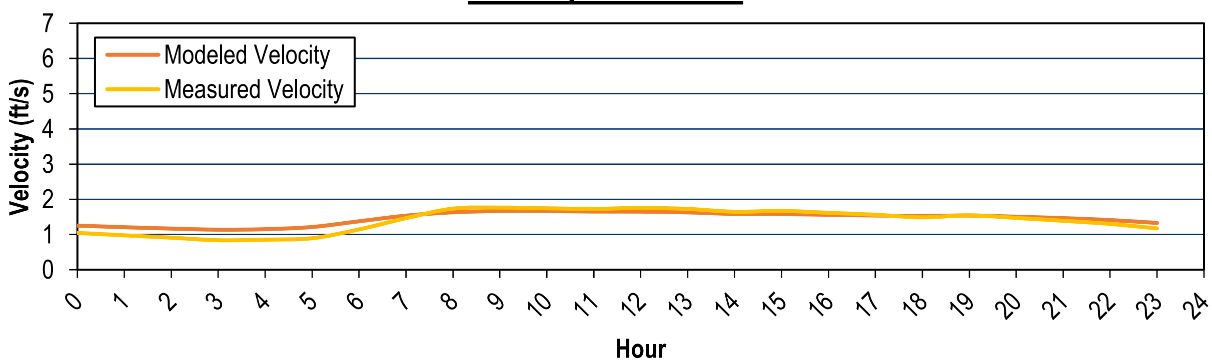
Calibrated Diurnal Pattern



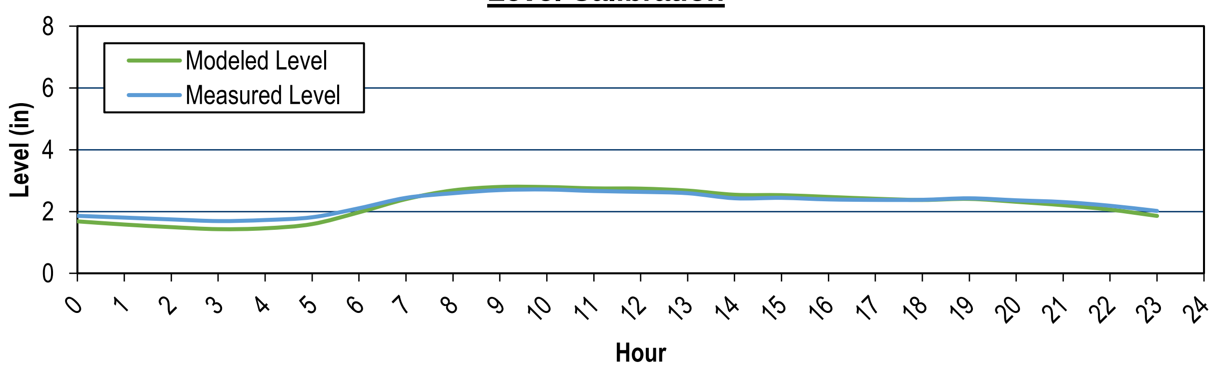
Flow Calibration



Velocity Calibration



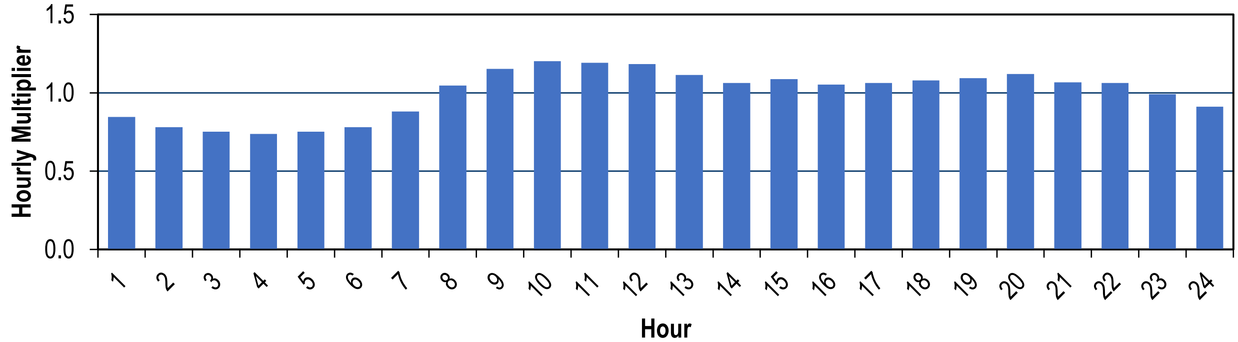
Level Calibration



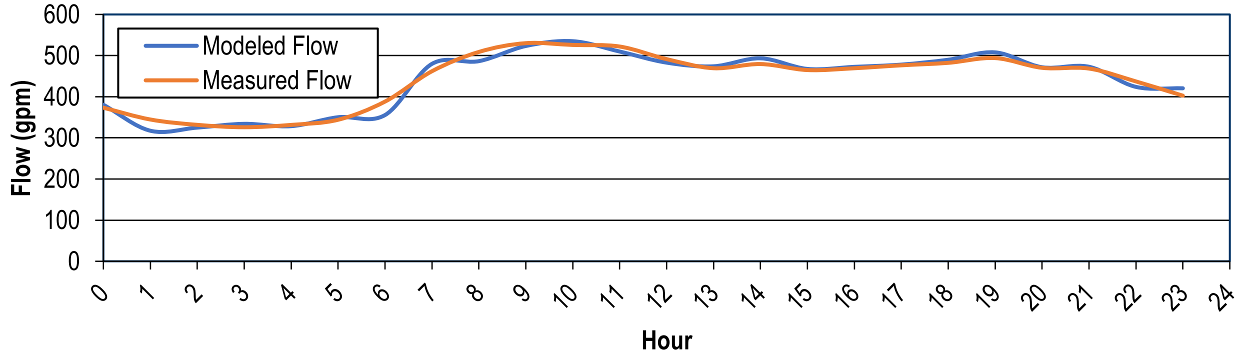
City of Prescott
2023 Water and Wastewater Models
FLOW METER SITE 3 CALIBRATION

carollo

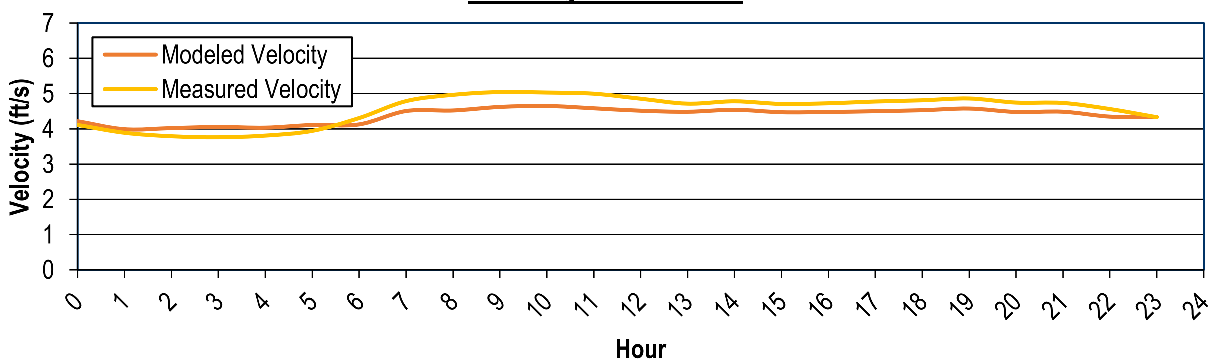
Calibrated Diurnal Pattern



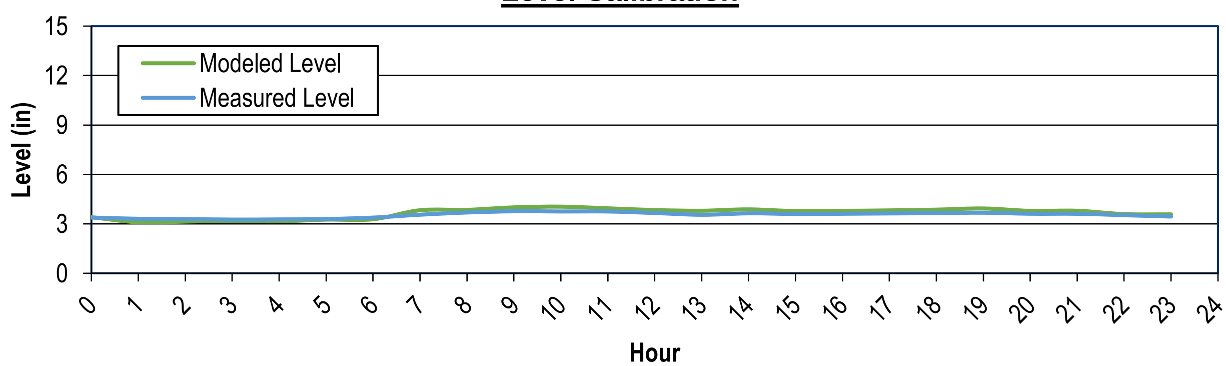
Flow Calibration



Velocity Calibration

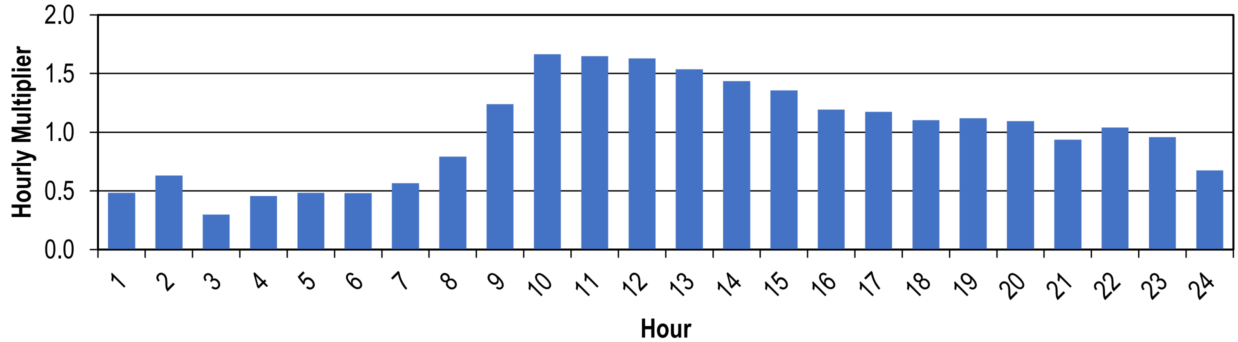


Level Calibration

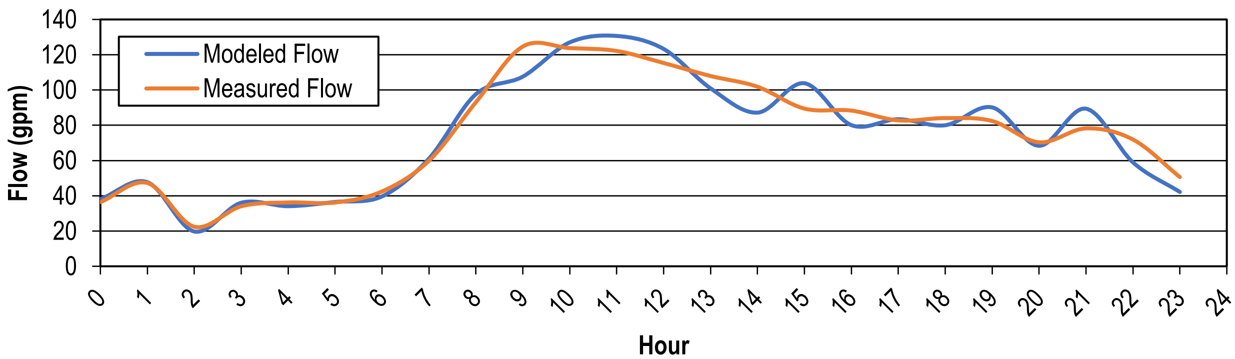


City of Prescott
2023 Water and Wastewater Models
FLOW METER SITE 4 CALIBRATION

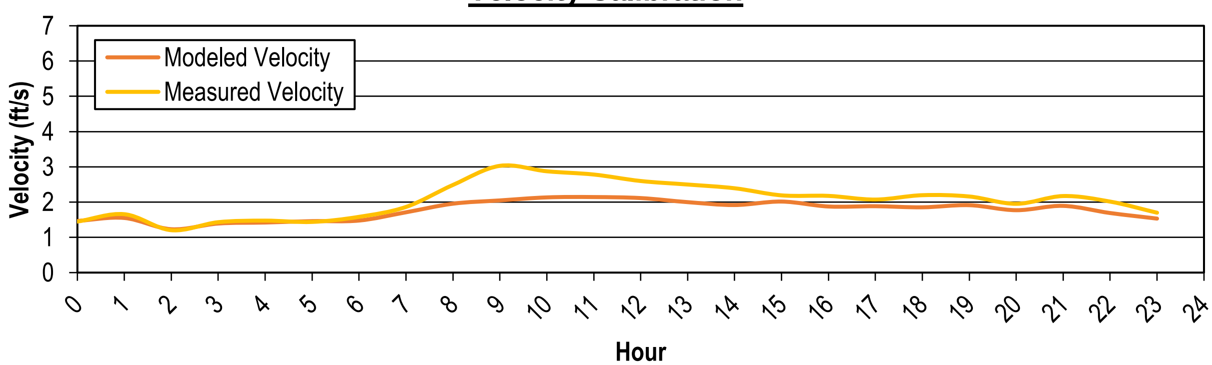
Calibrated Diurnal Pattern



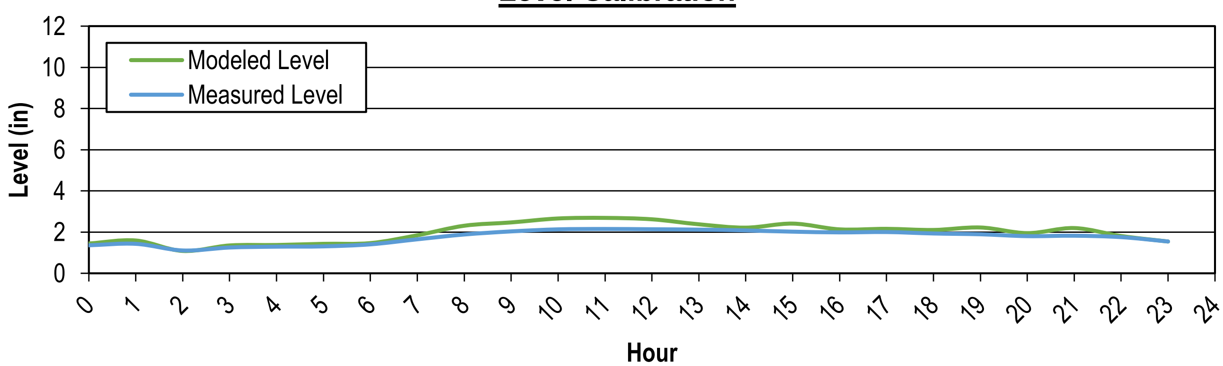
Flow Calibration



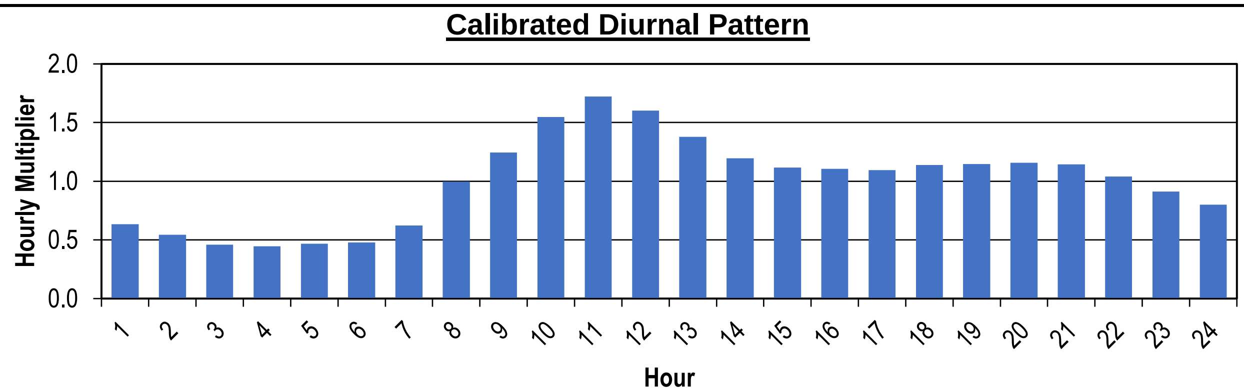
Velocity Calibration

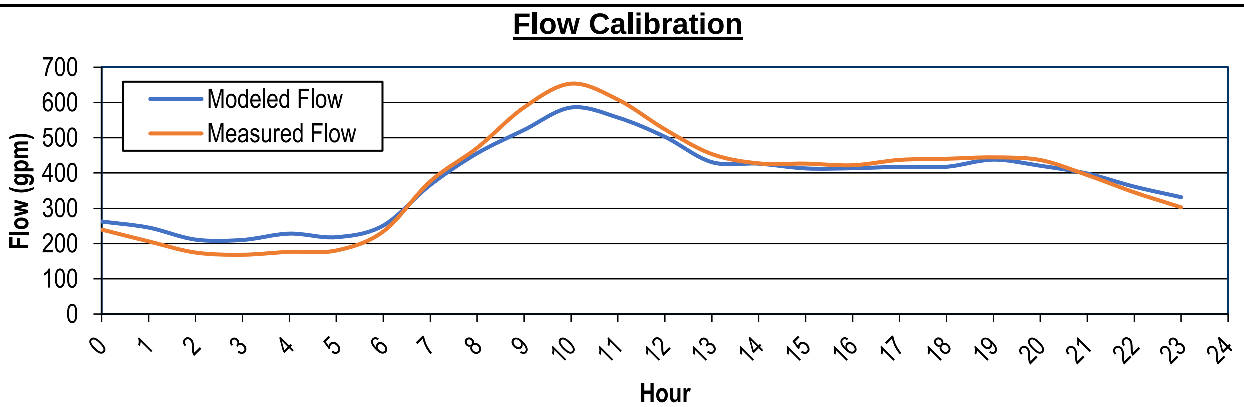


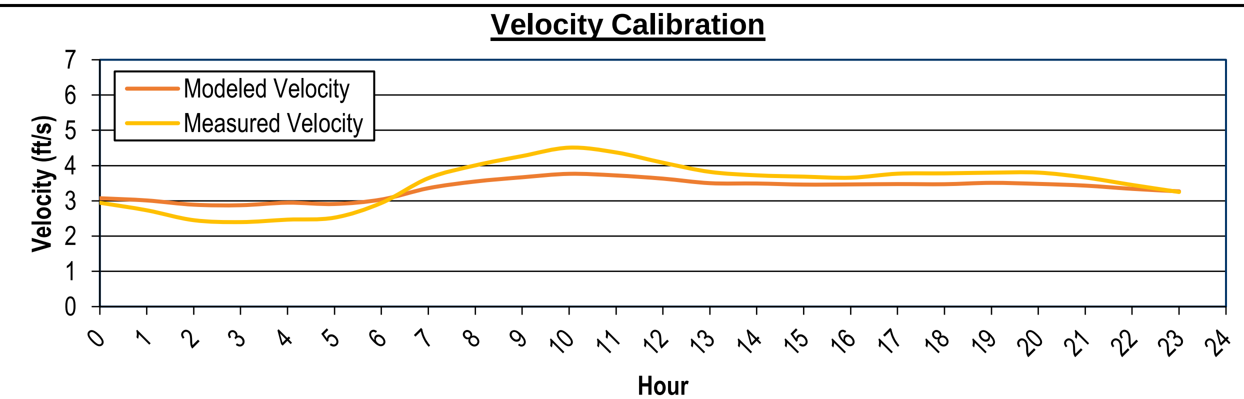
Level Calibration

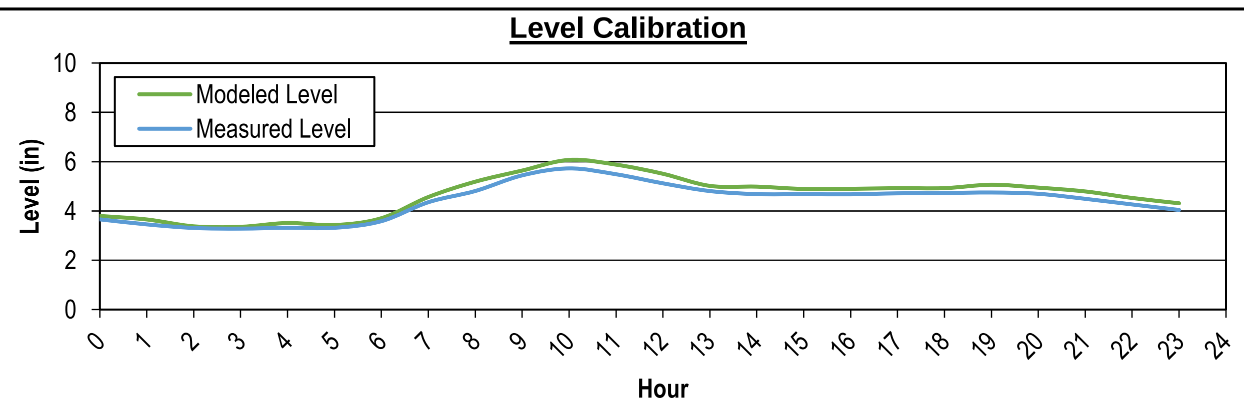


City of Prescott
2023 Water and Wastewater Models
FLOW METER SITE 5 CALIBRATION



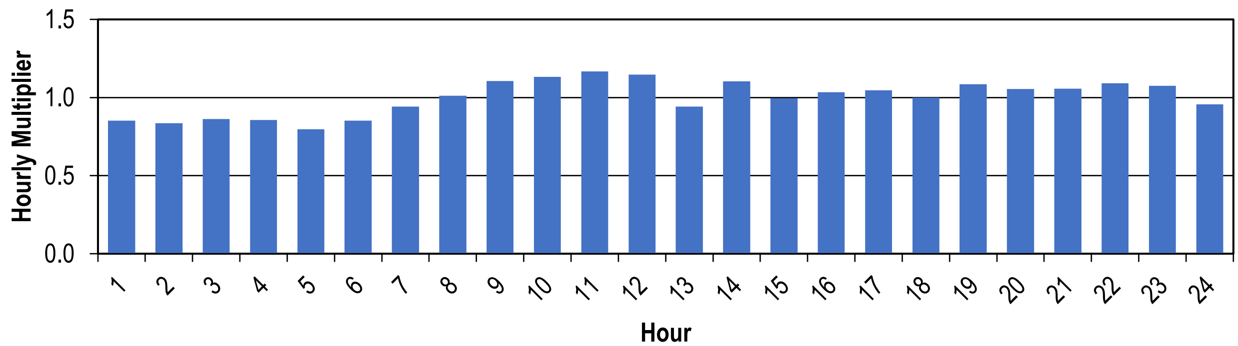




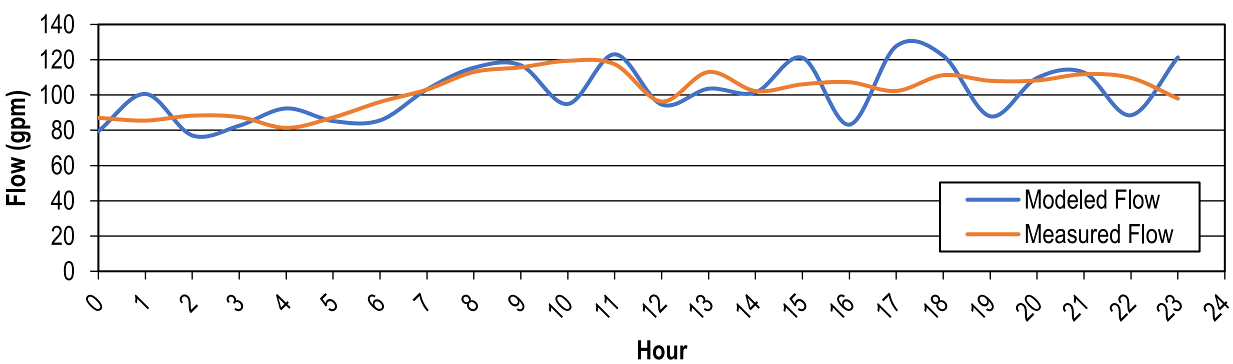


City of Prescott
2023 Water and Wastewater Models
FLOW METER SITE 6 CALIBRATION

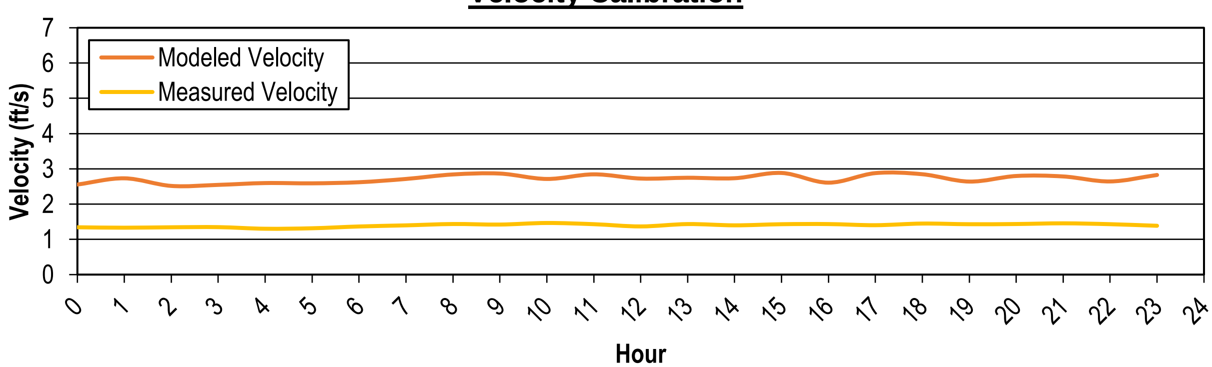
Calibrated Diurnal Pattern



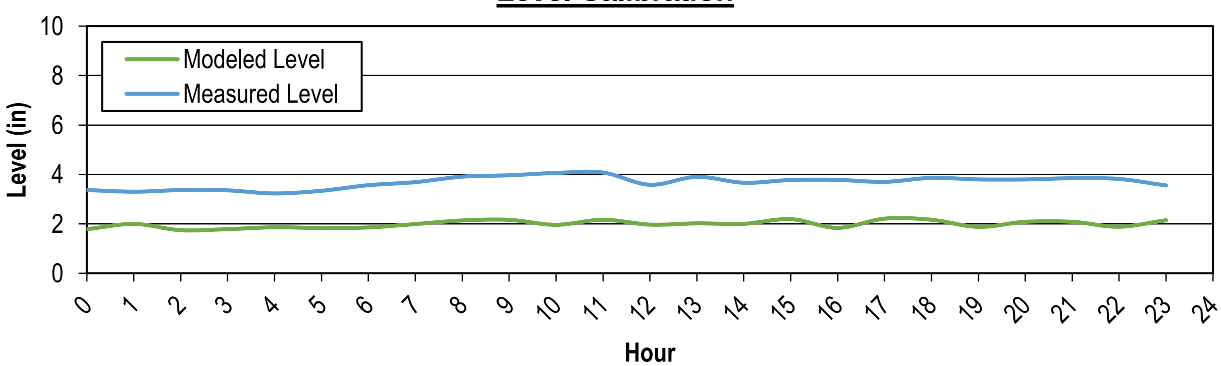
Flow Calibration



Velocity Calibration

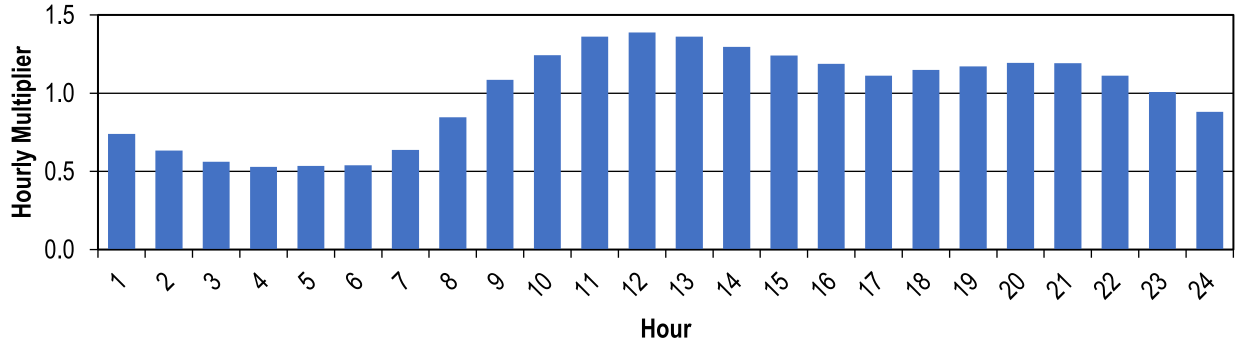


Level Calibration

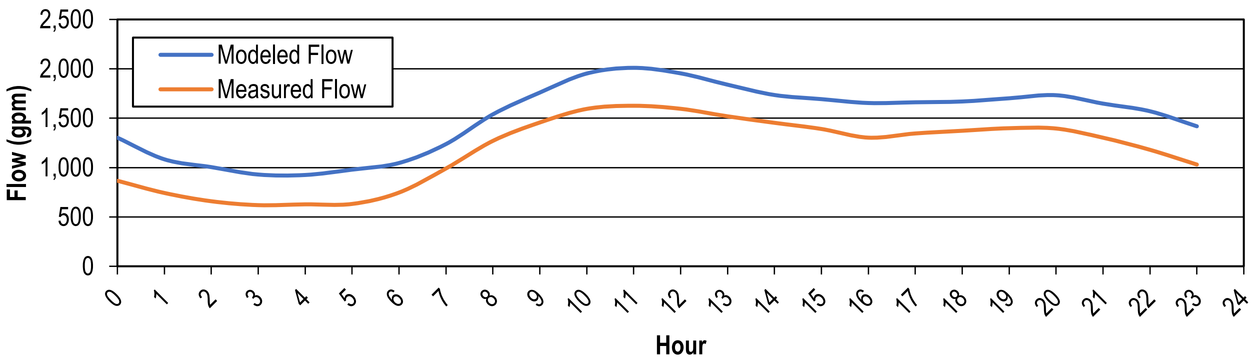


City of Prescott
2023 Water and Wastewater Models
FLOW METER SITE 7 CALIBRATION

Calibrated Diurnal Pattern



Flow Calibration



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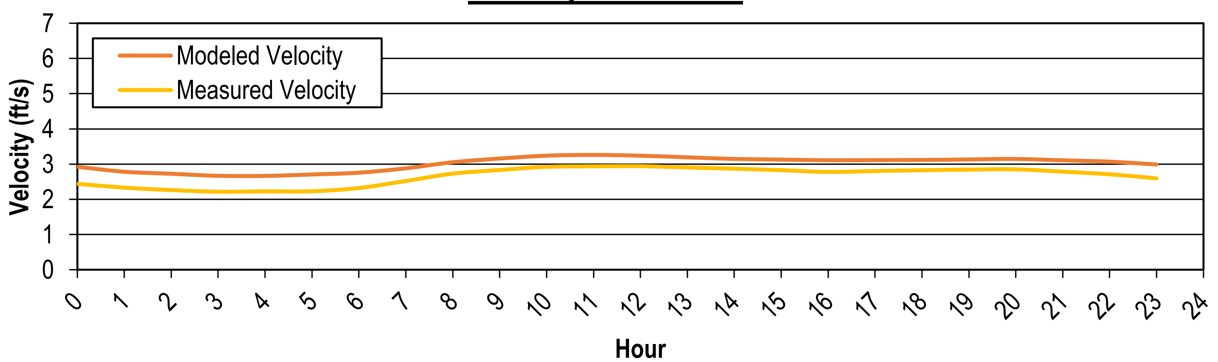

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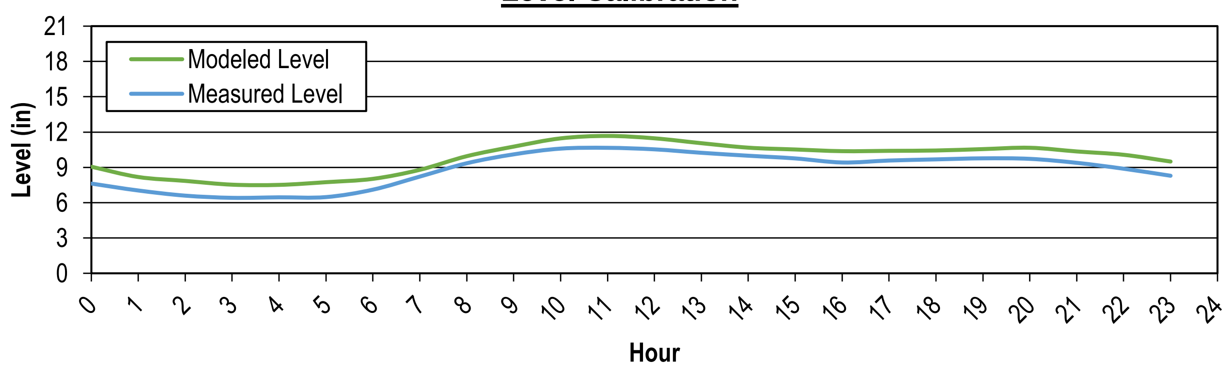

City of Prescott
2023 Water and Wastewater Models
FLOW METER SITE 8 CALIBRATION

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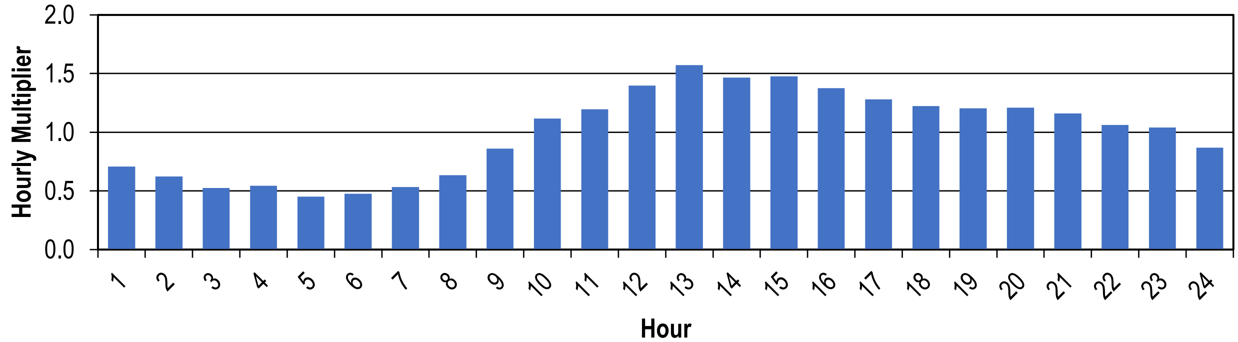

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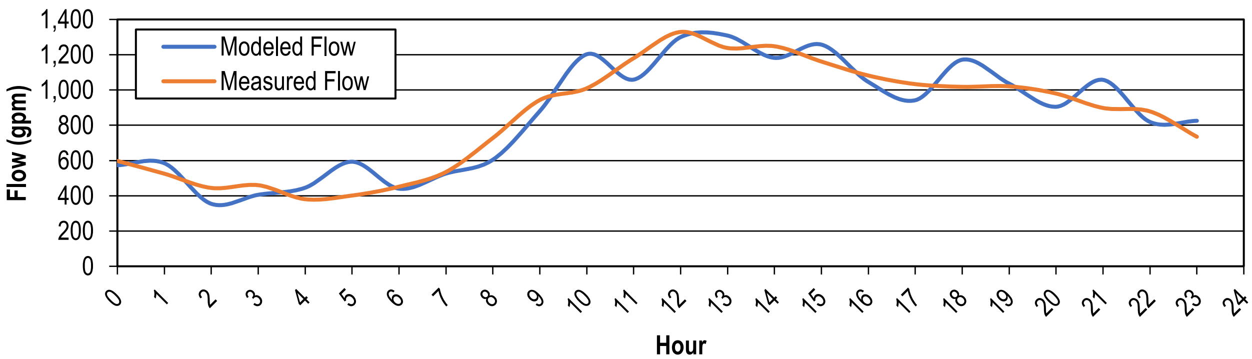

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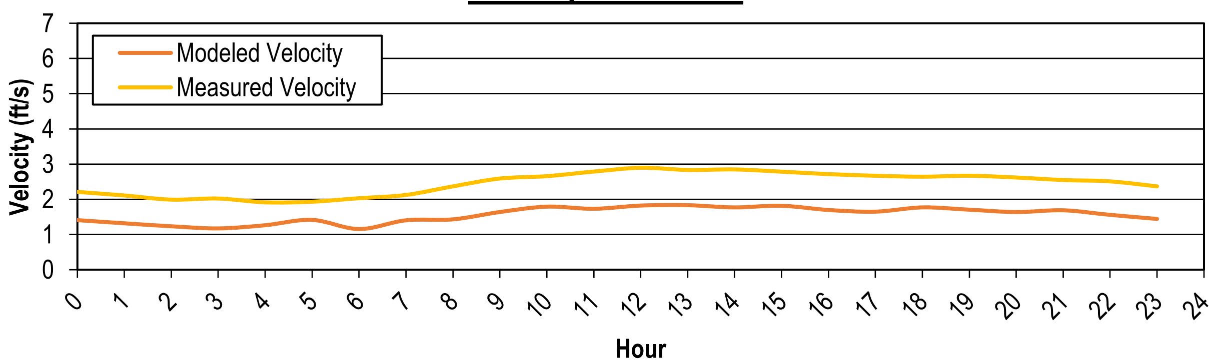

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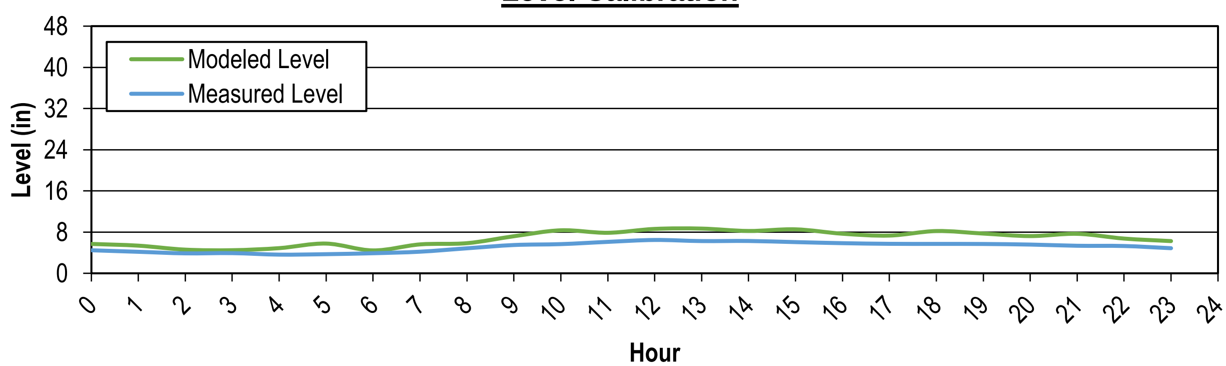
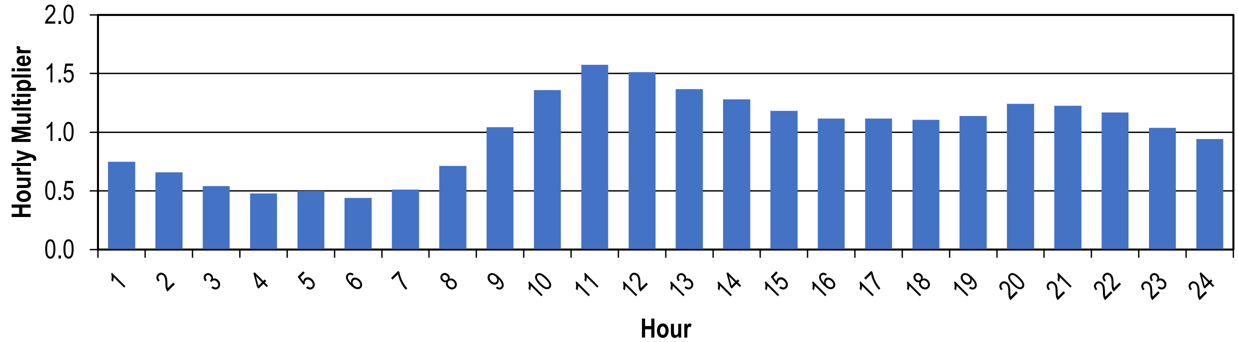


City of Prescott
2023 Water and Wastewater Models
FLOW METER SITE 9 CALIBRATION

Calibrated Diurnal Pattern



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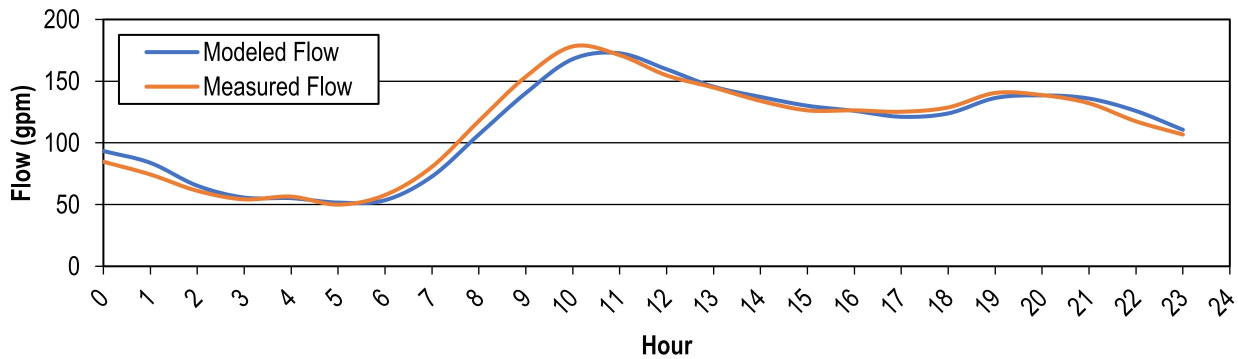

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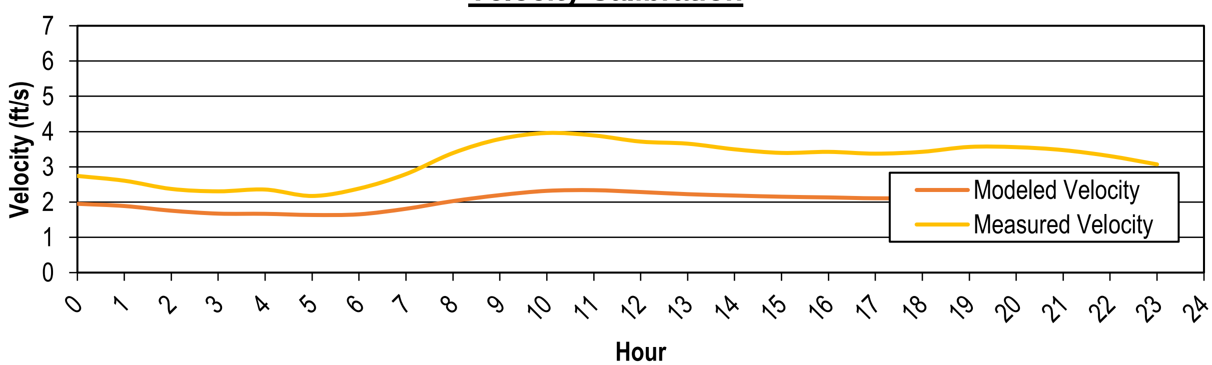

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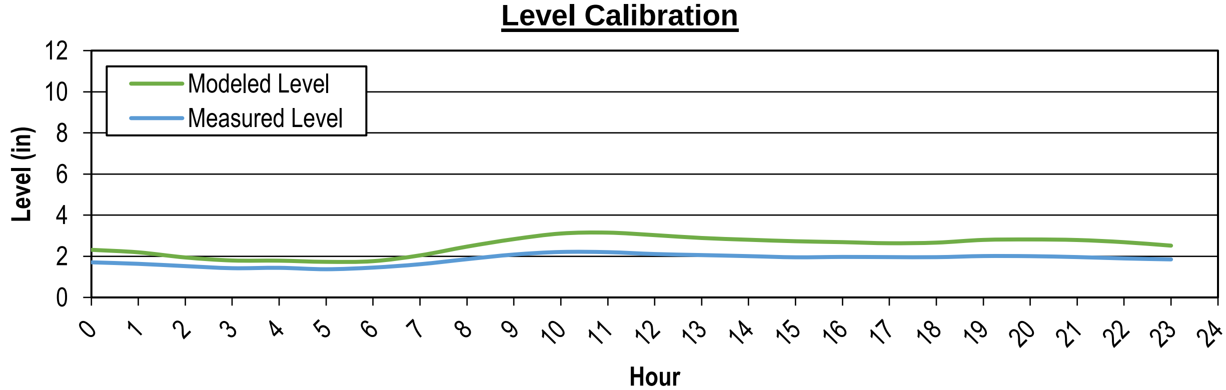
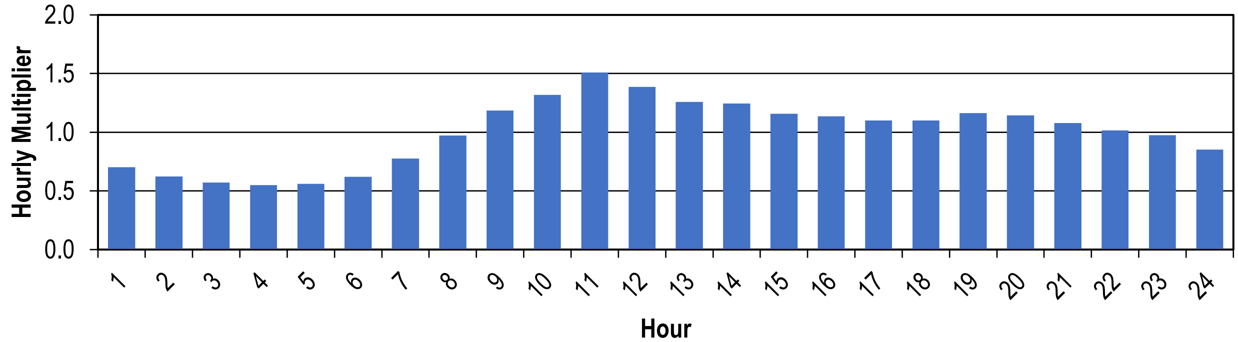


City of Prescott
2023 Water and Wastewater Models
FLOW METER SITE 10 CALIBRATION

Calibrated Diurnal Pattern



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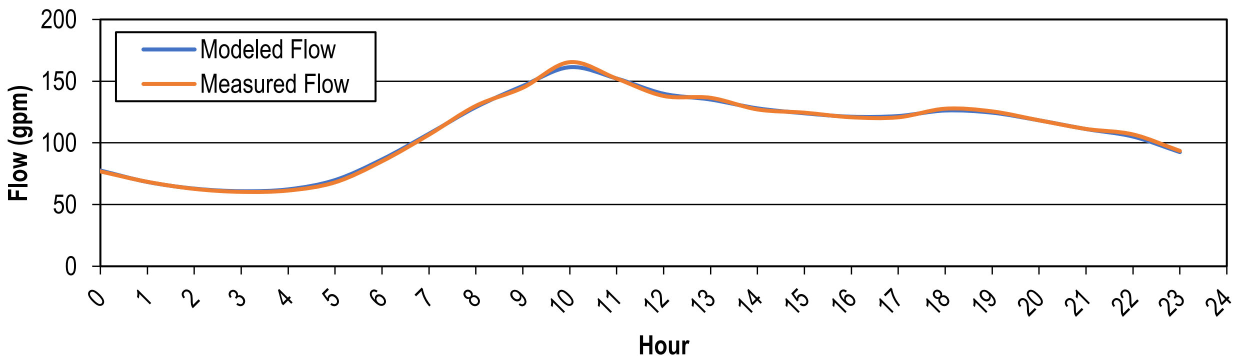

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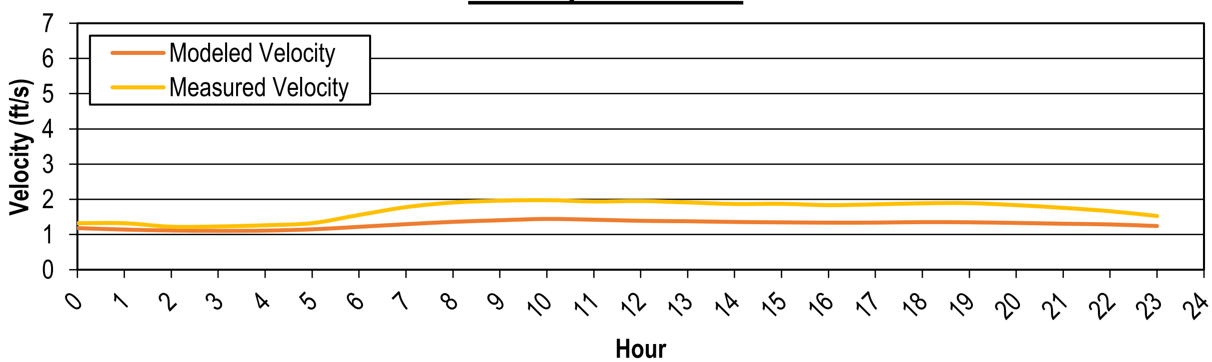

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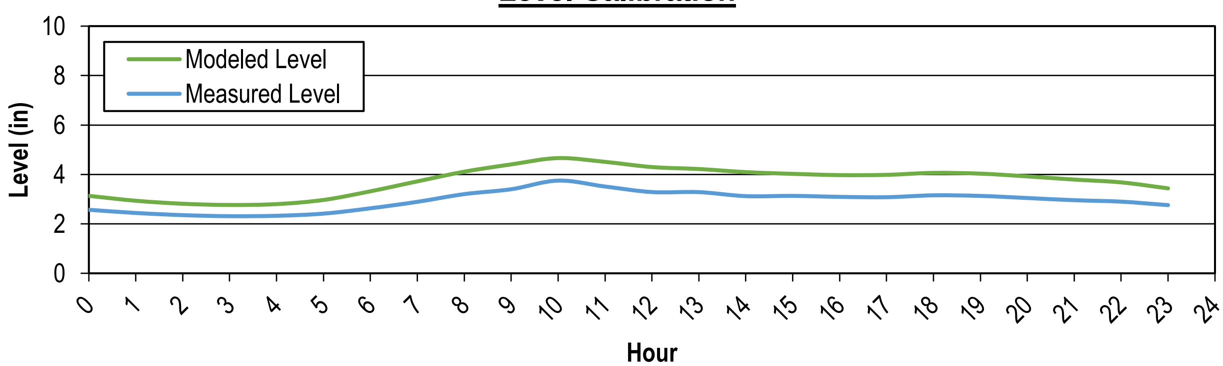
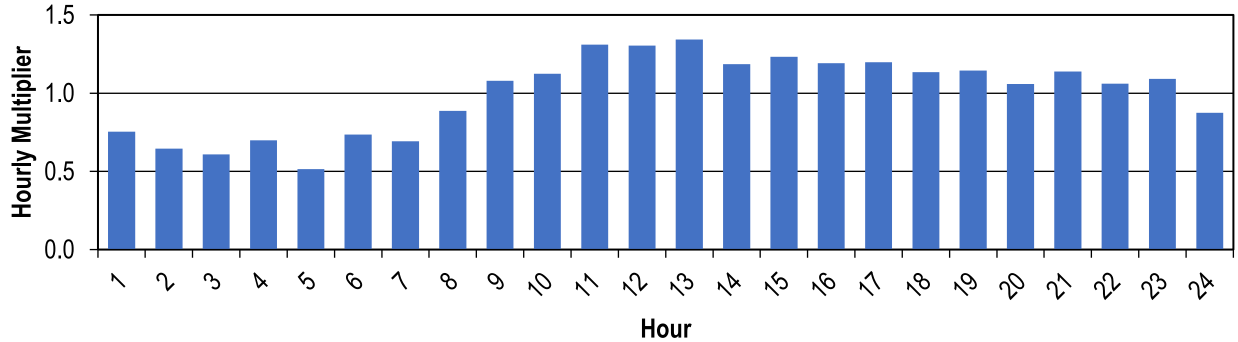
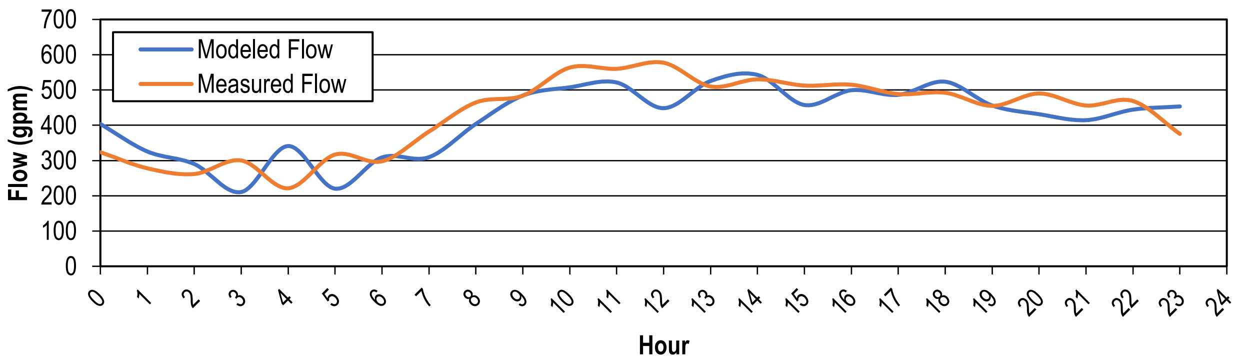


City of Prescott
2023 Water and Wastewater Models
FLOW METER SITE 11 CALIBRATION

Calibrated Diurnal Pattern



Flow Calibration



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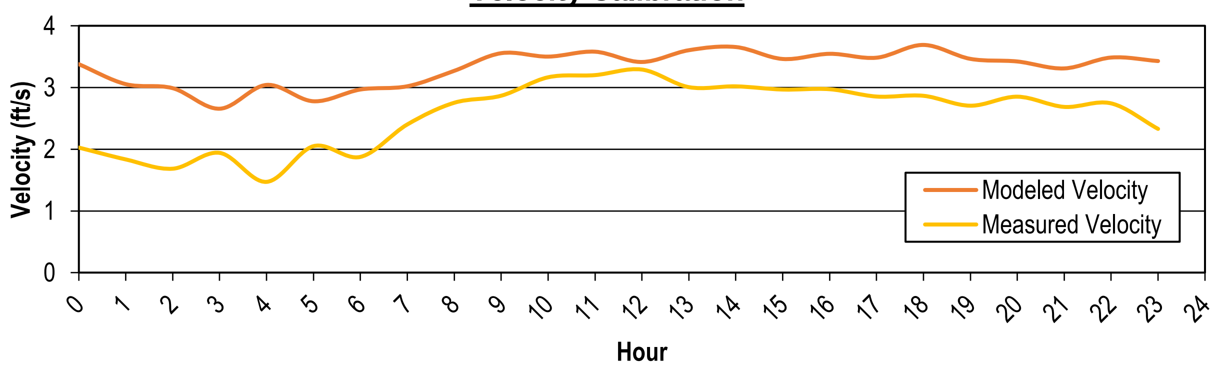

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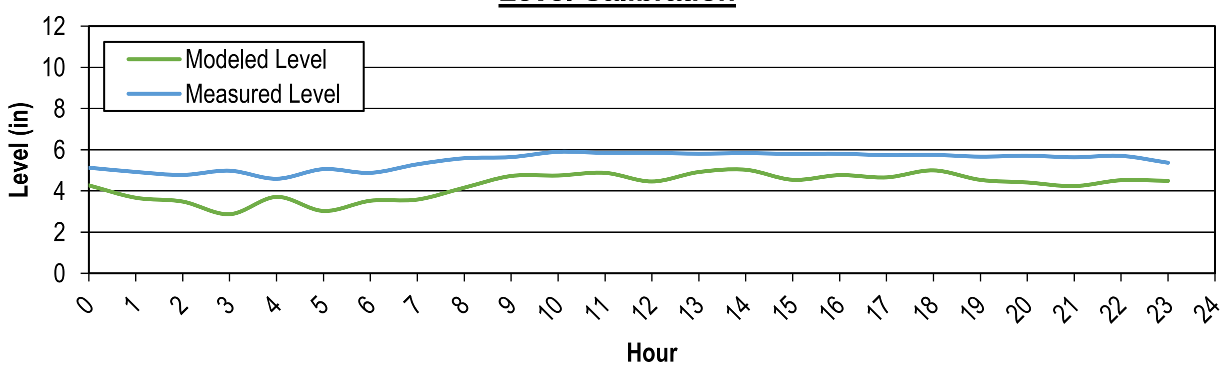
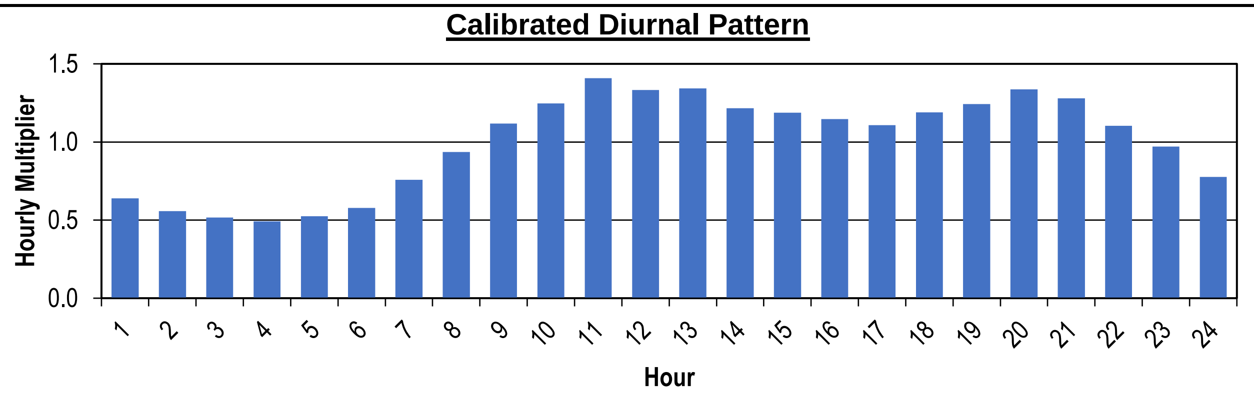
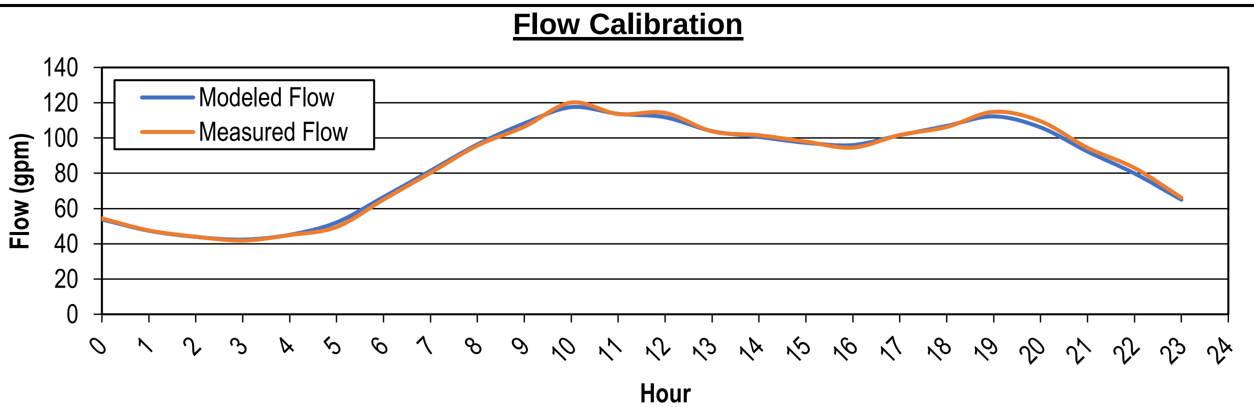
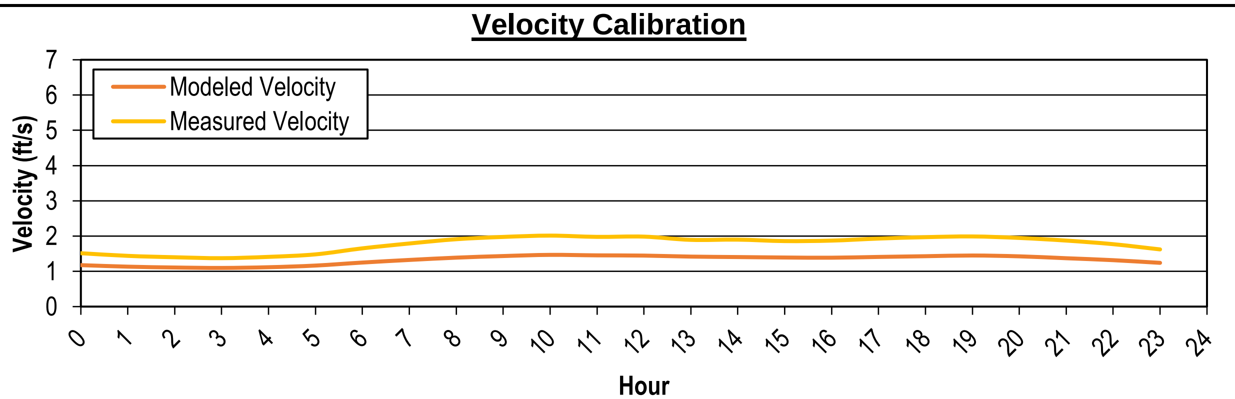
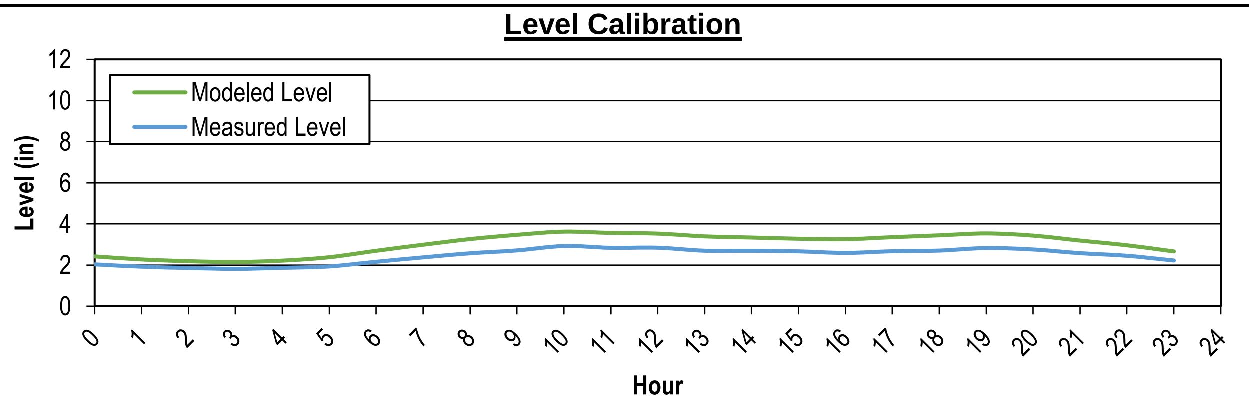


City of Prescott
2023 Water and Wastewater Models
FLOW METER SITE 12 CALIBRATION





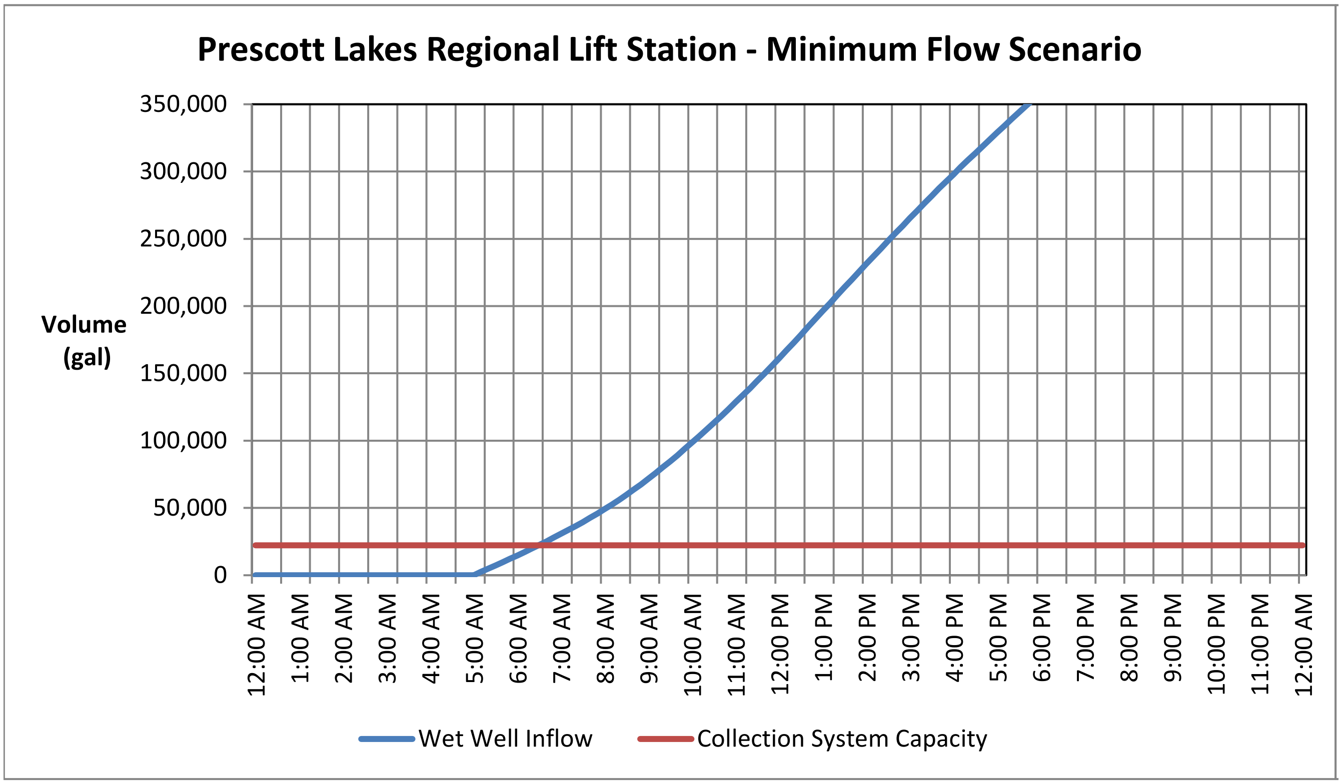


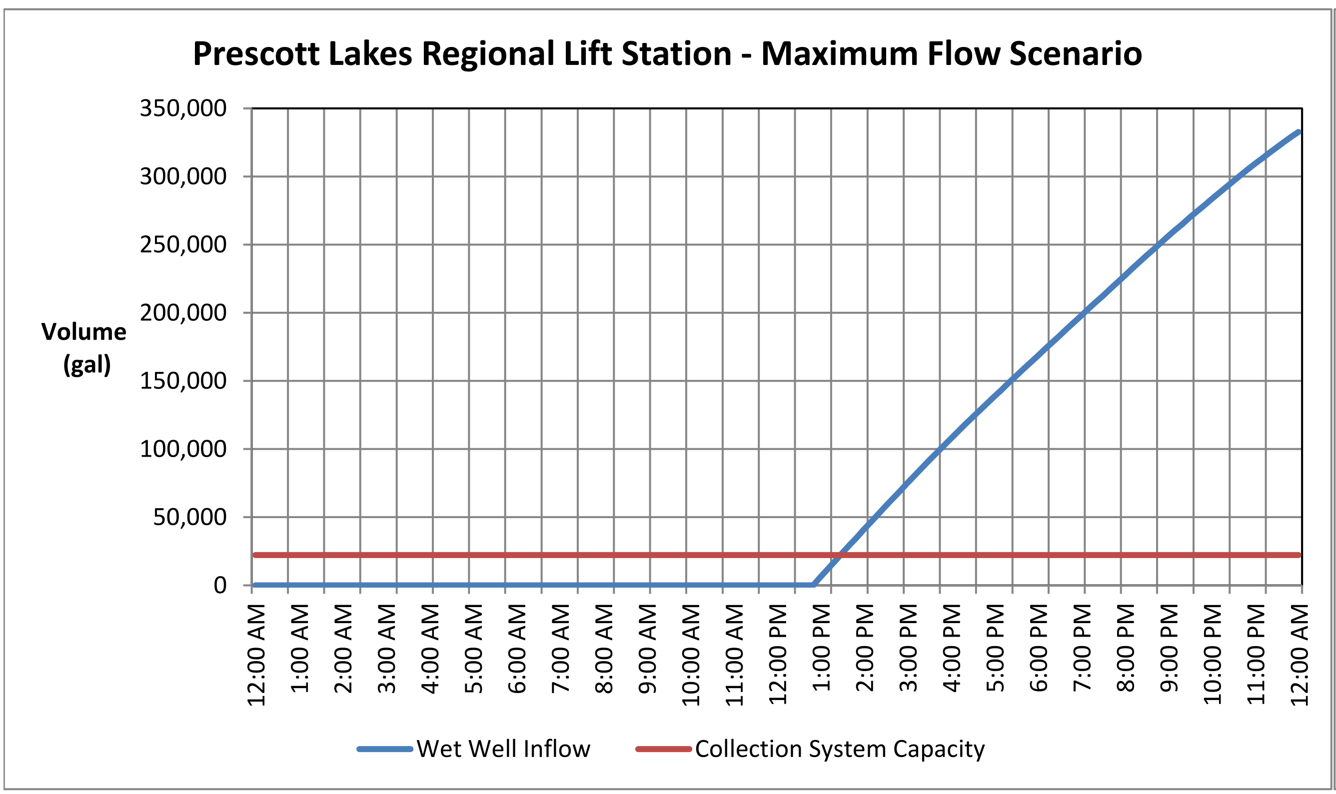


Appendix 5C

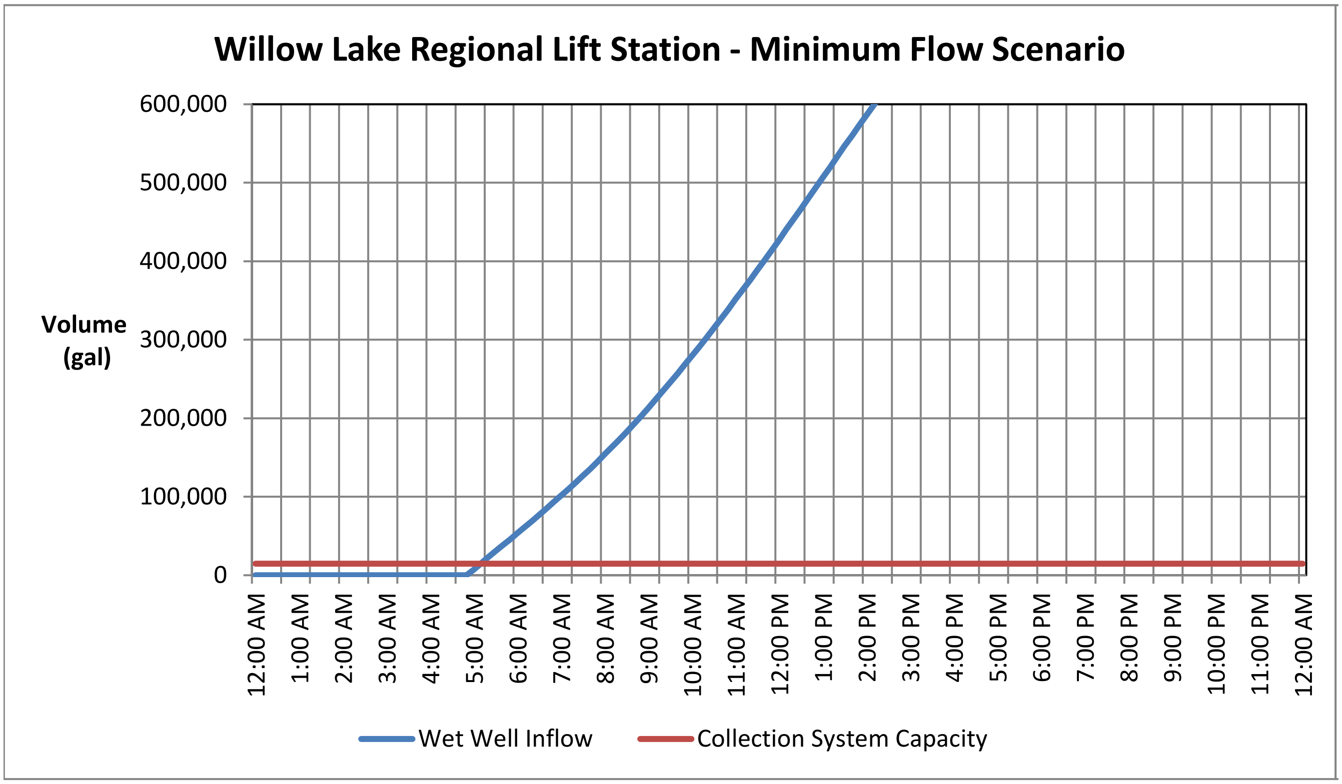
REGIONAL LIFT STATION CAPACITY ANALYSIS GRAPHS

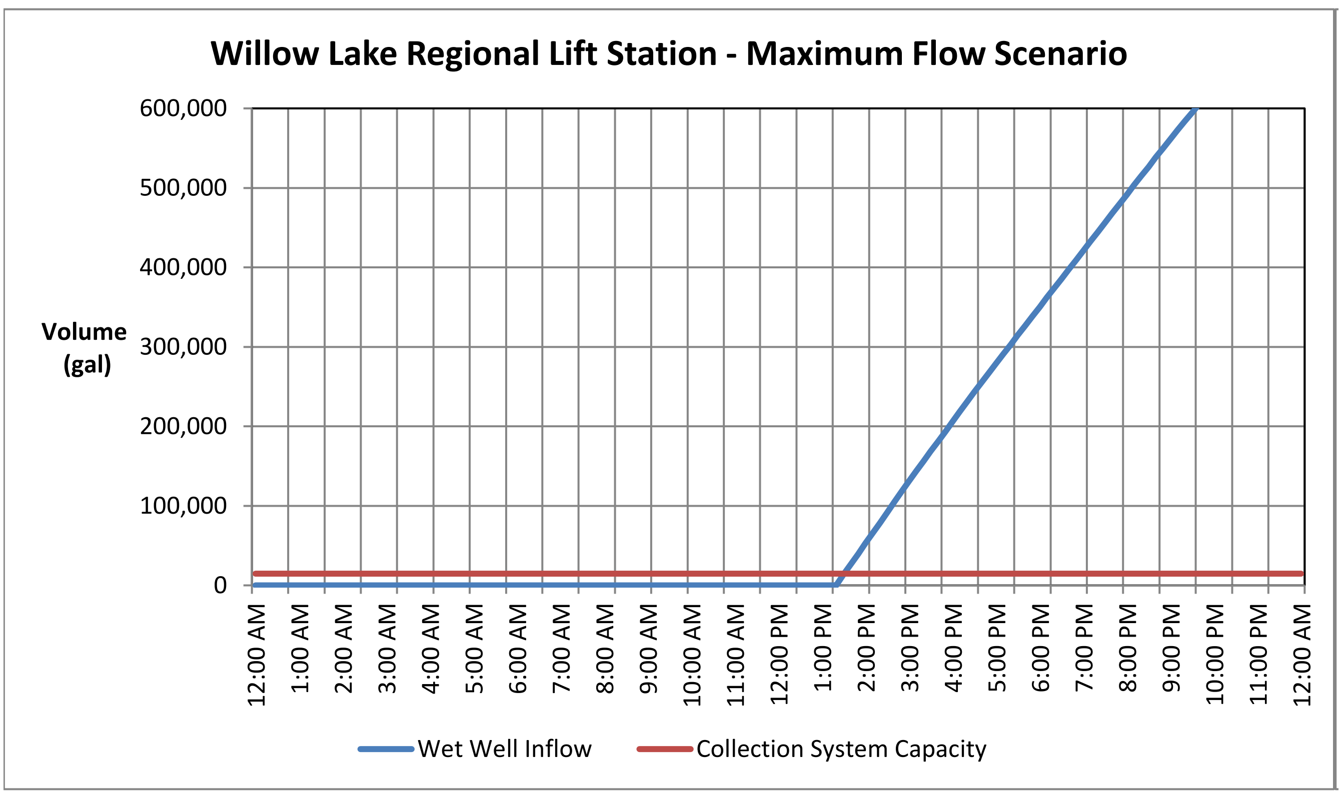
Lift Station Time to Spill Analysis
2023 Water and Wastewater Models
2022 FLOW CONDITIONS



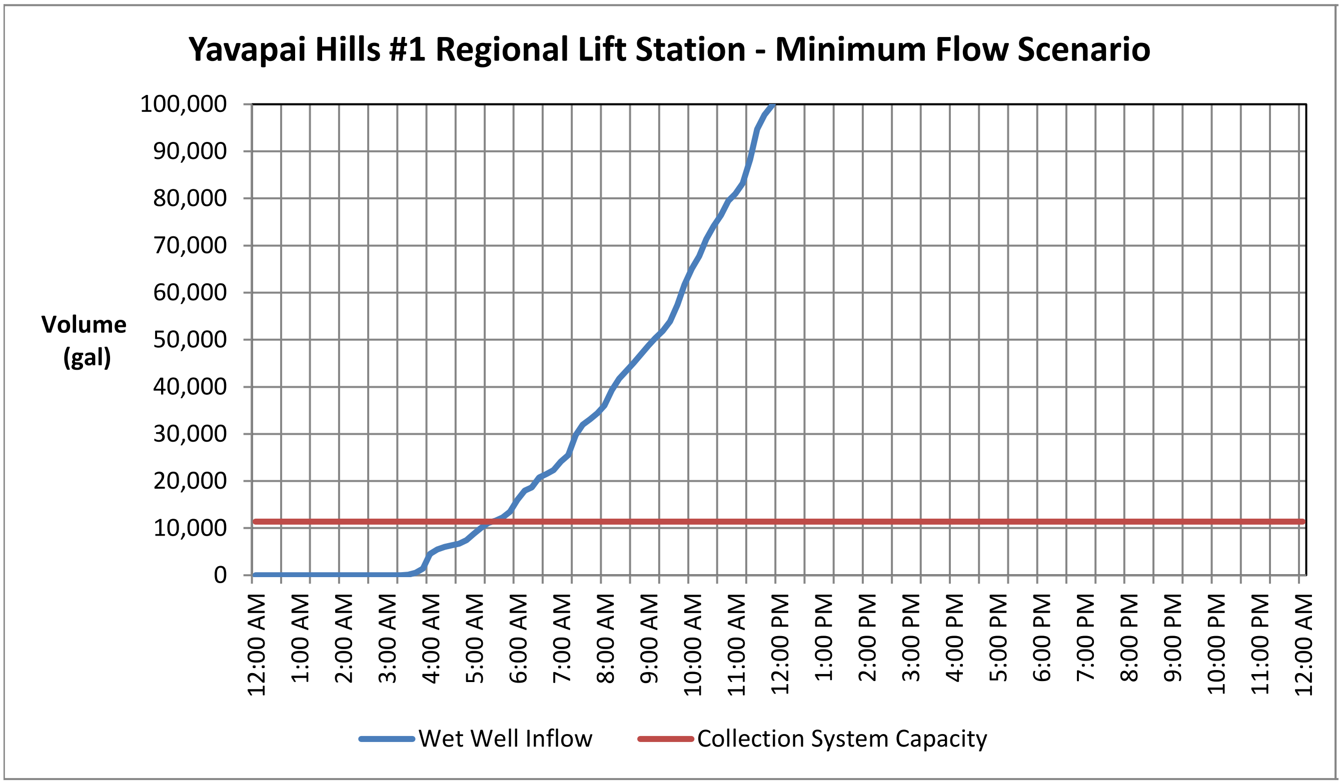


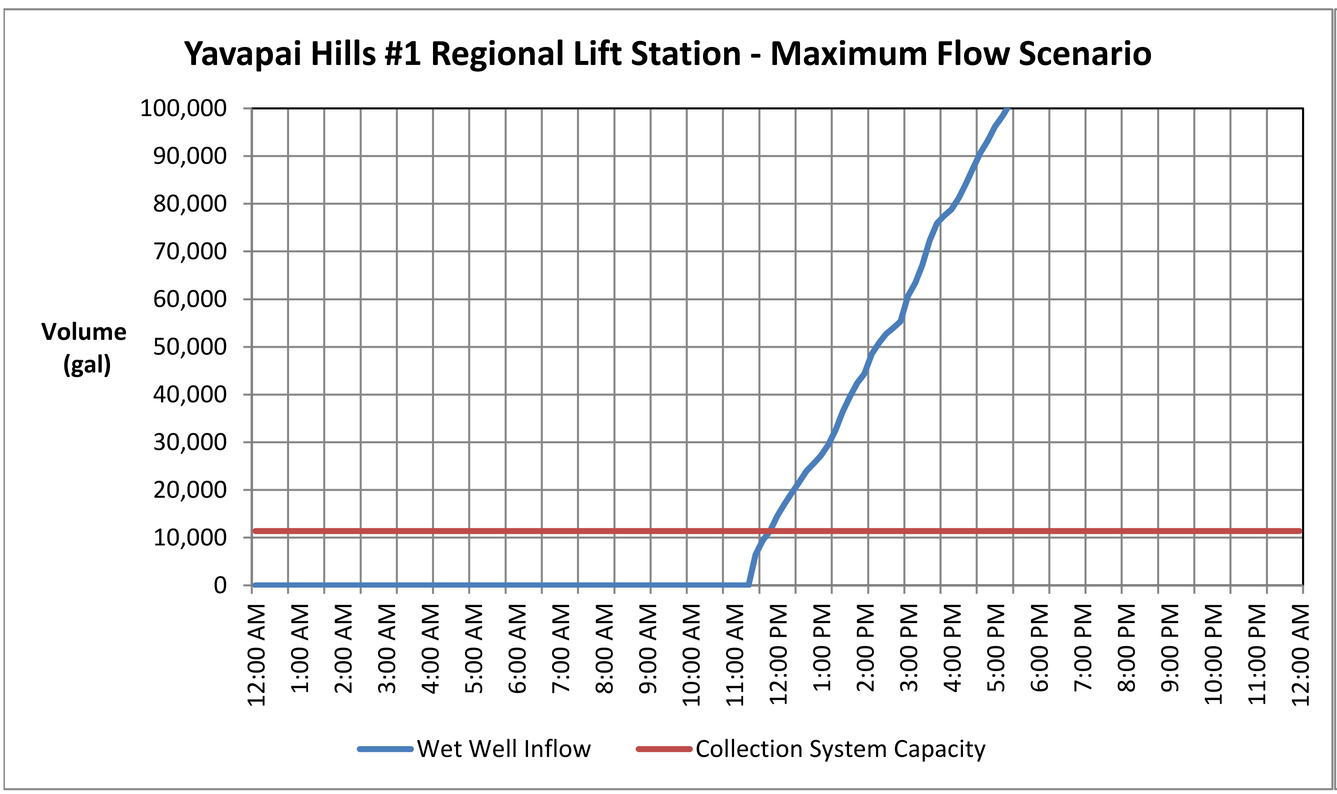
Lift Station Time to Spill Analysis
2023 Water and Wastewater Models
2022 FLOW CONDITIONS



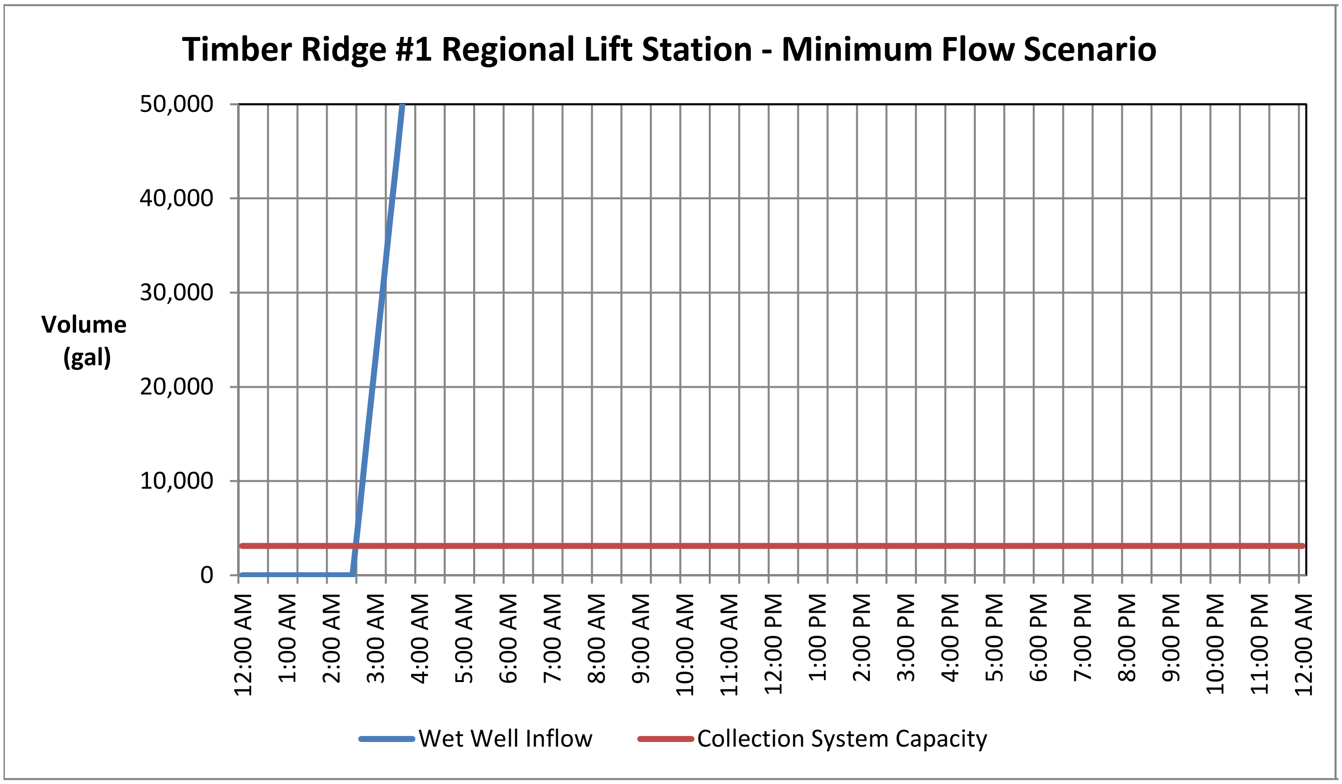


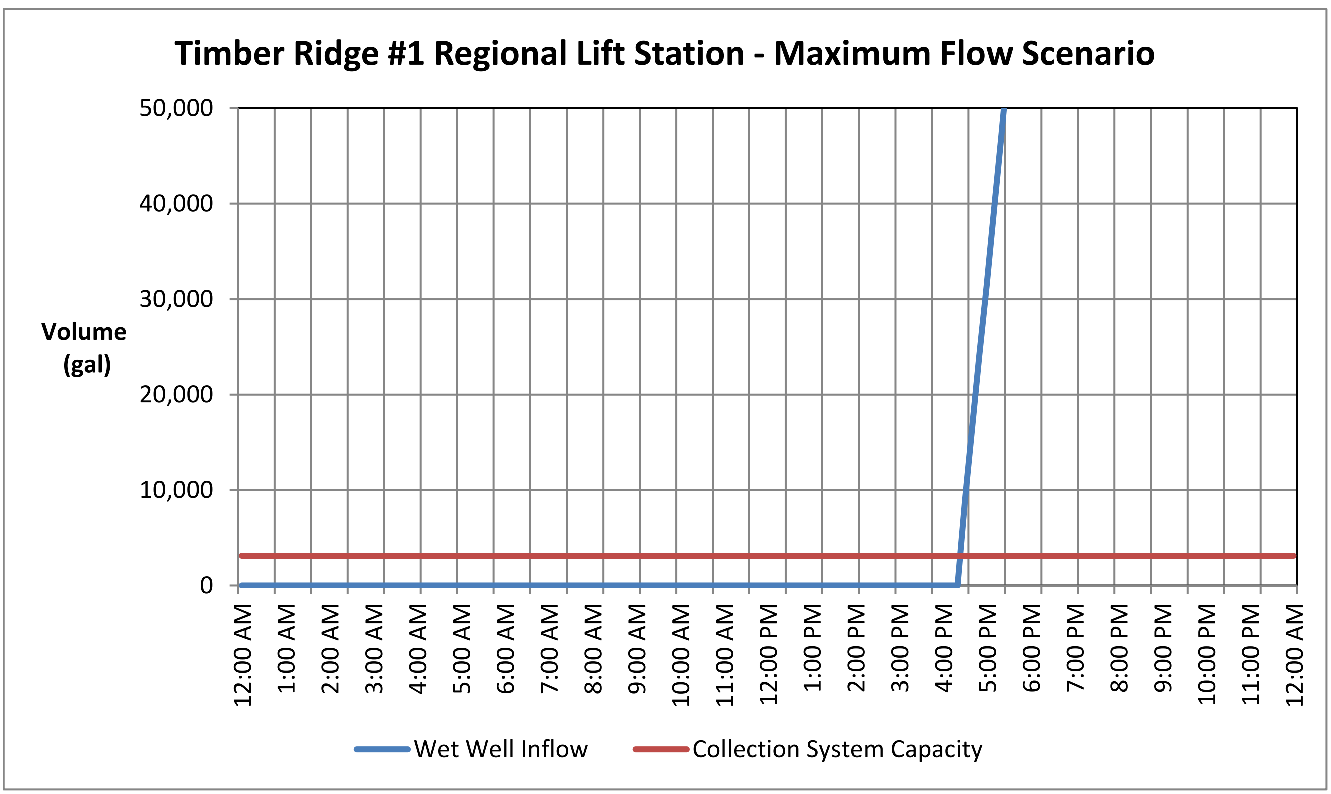
Lift Station Time to Spill Analysis
2023 Water and Wastewater Models
2022 FLOW CONDITIONS



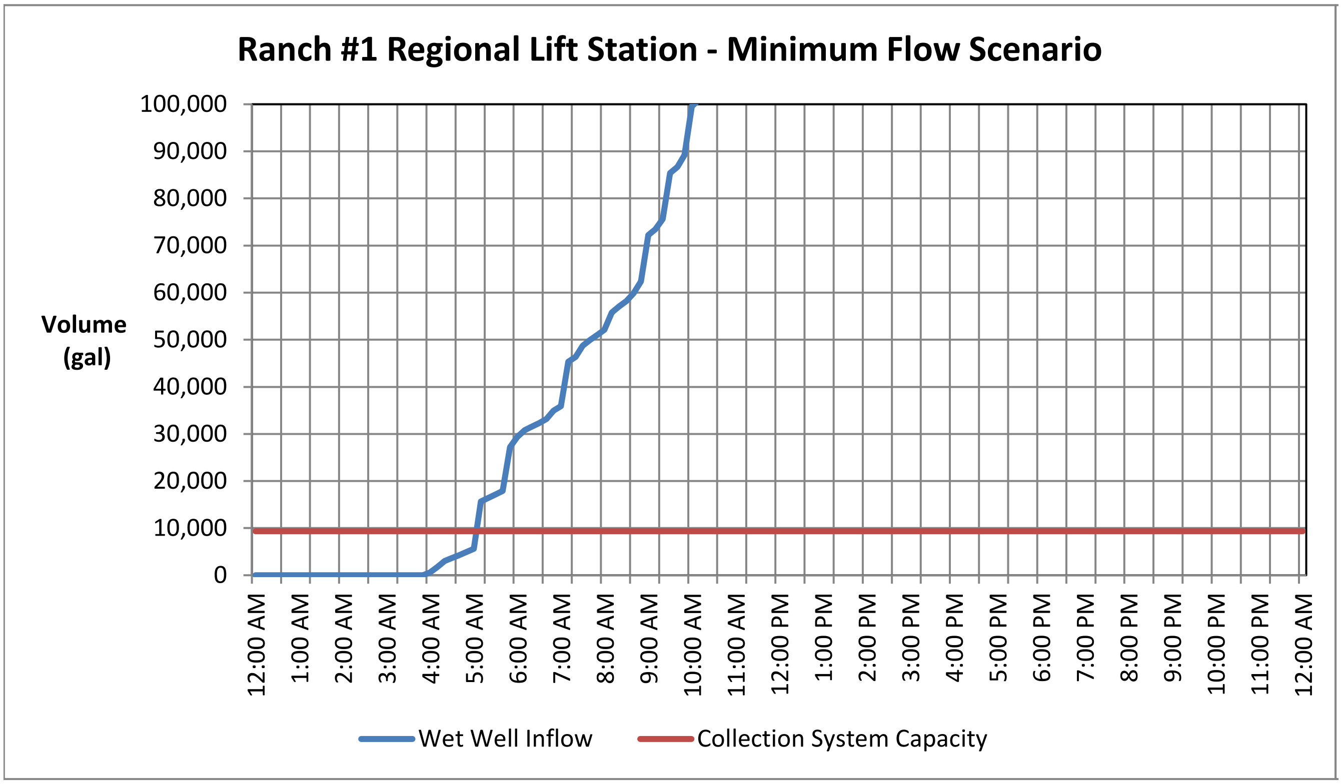


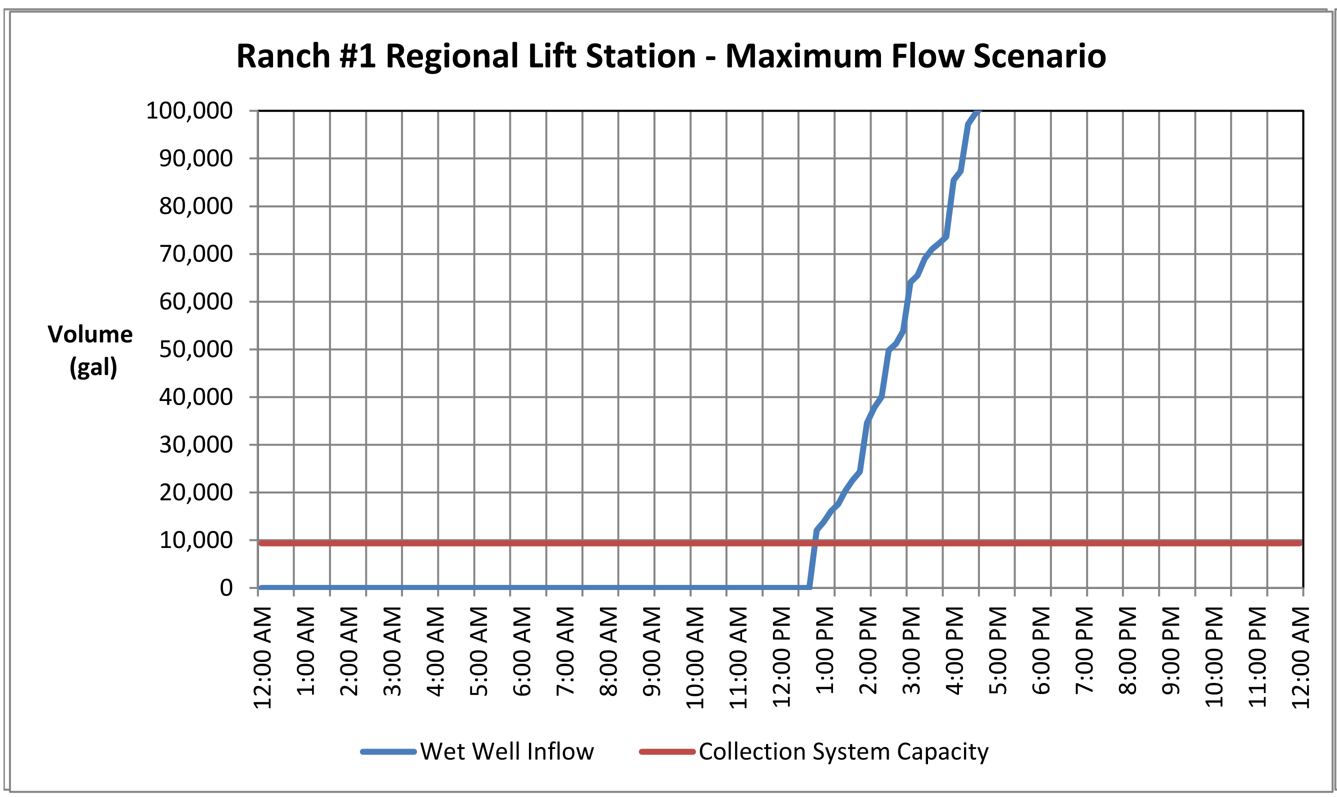
Lift Station Time to Spill Analysis
2023 Water and Wastewater Models
2022 FLOW CONDITIONS



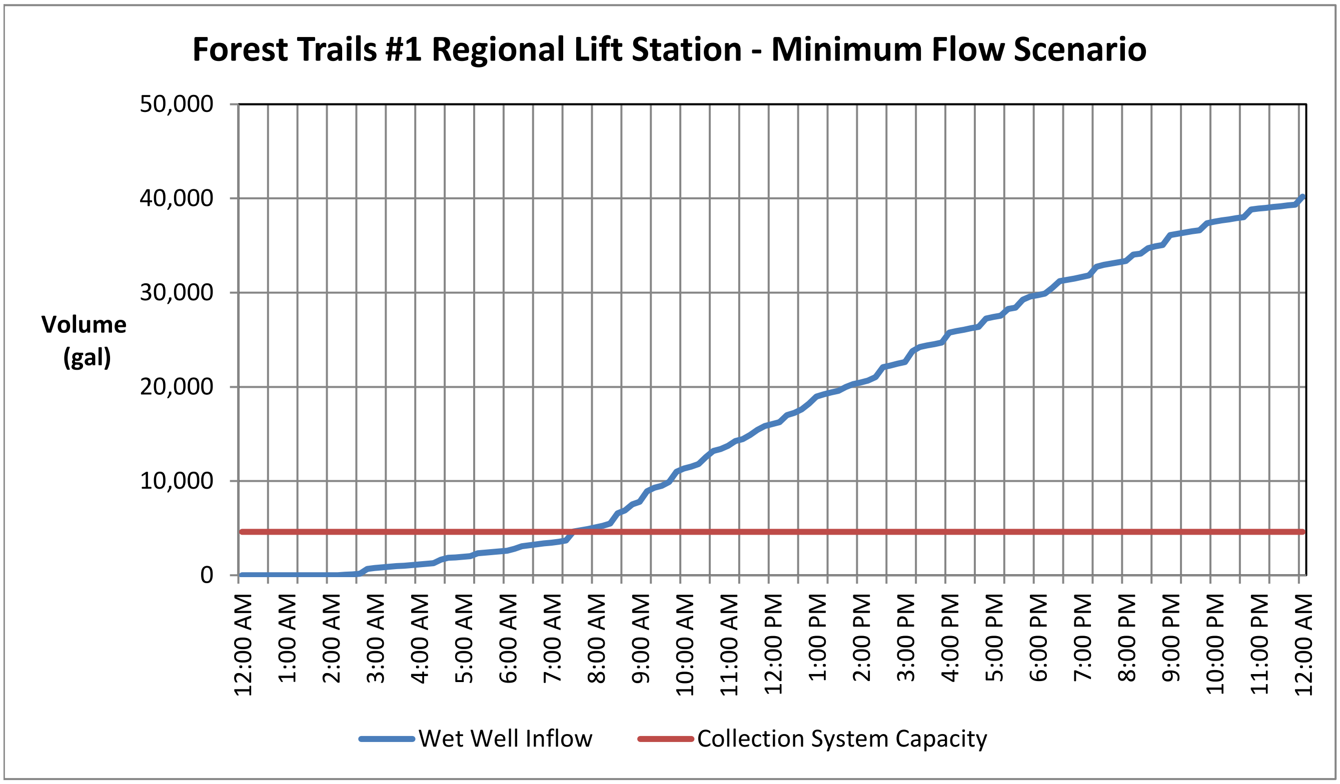


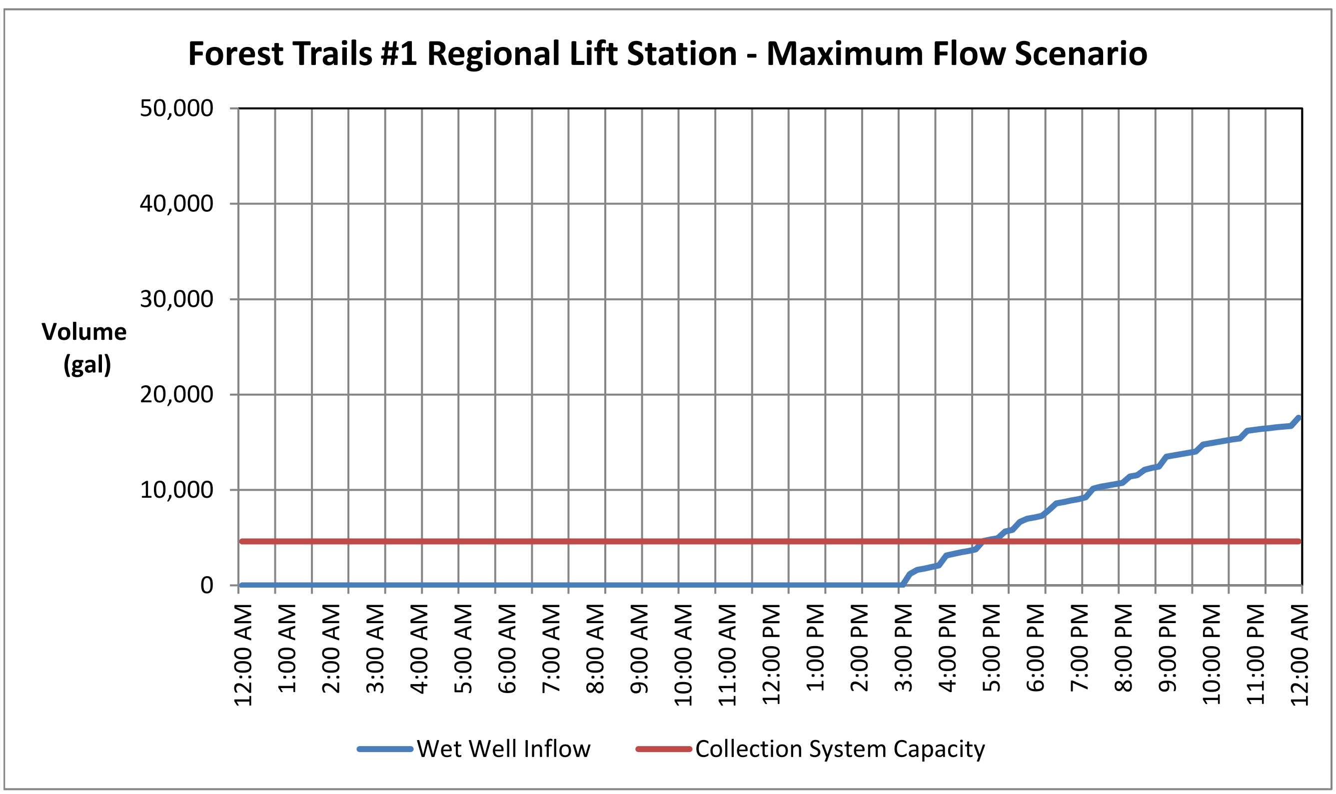
Lift Station Time to Spill Analysis
2023 Water and Wastewater Models
2022 FLOW CONDITIONS





Lift Station Time to Spill Analysis
2023 Water and Wastewater Models
2022 FLOW CONDITIONS





Appendix 5D

WASTEWATER SYSTEM SCHEMATIC

To be included as separate file.

Appendix 6A

WASTEWATER SYSTEM CIP PROJECTS

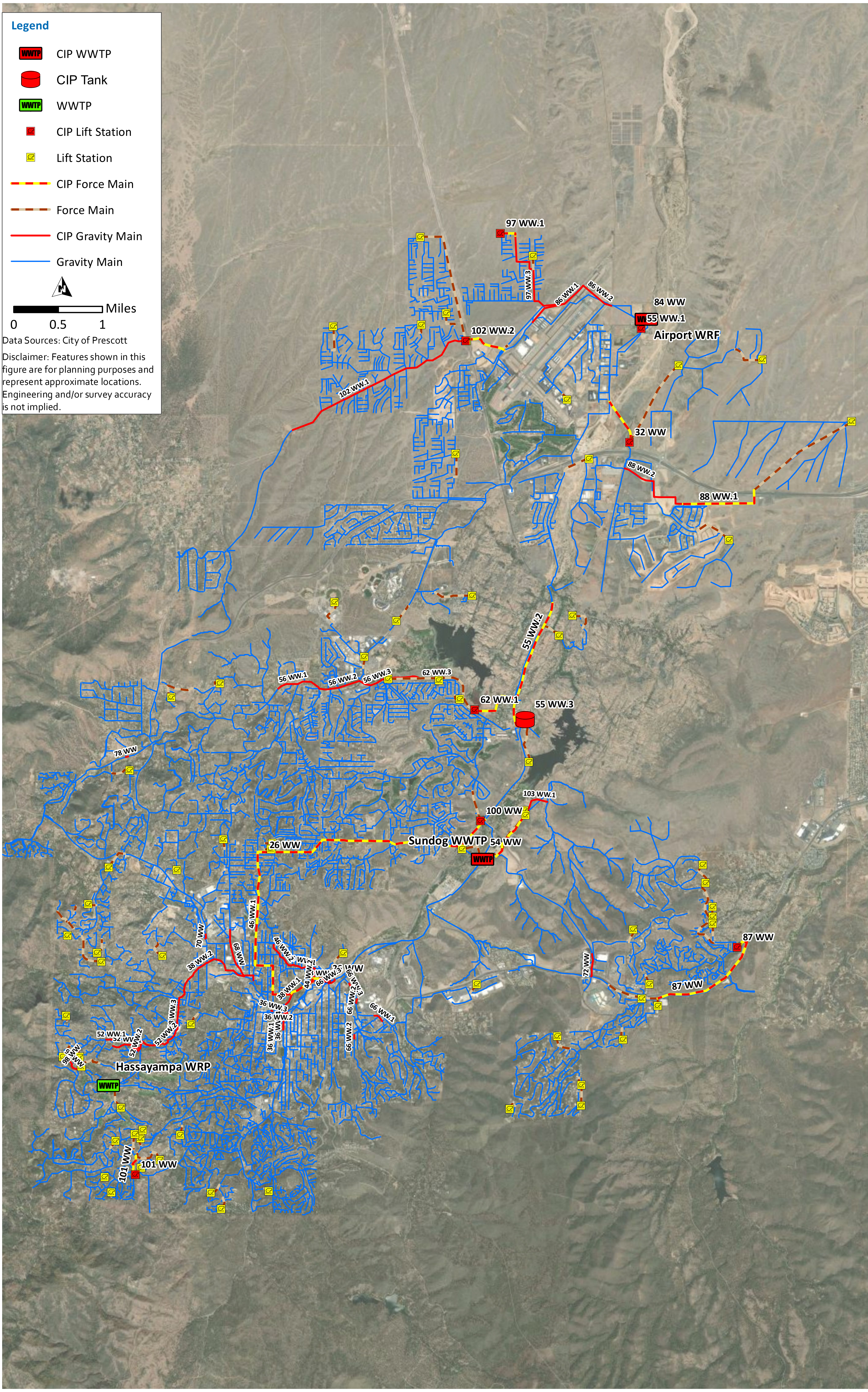


Figure 6A Wastewater Collection System CIP Projects

Project Number: **26 WW** **Planning Period:** FY 2023

CoP Project Name: Sundog Trunk Main Phase C

Description: 26 WW Sundog Trunk Main Phase C - Lift Station
26 WW Sundog Trunk Main Phase C - Force Main

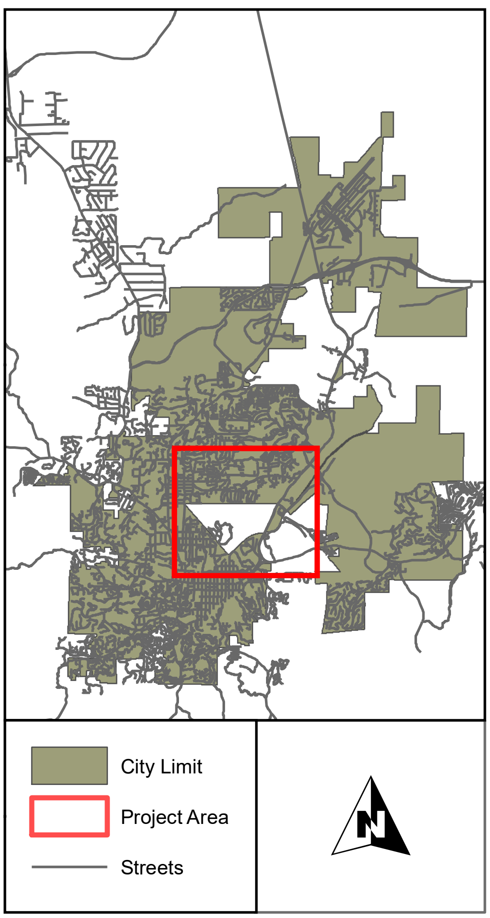
Justification: 26 WW - 26 WW Addresses capacity limitation estimated by buildout.

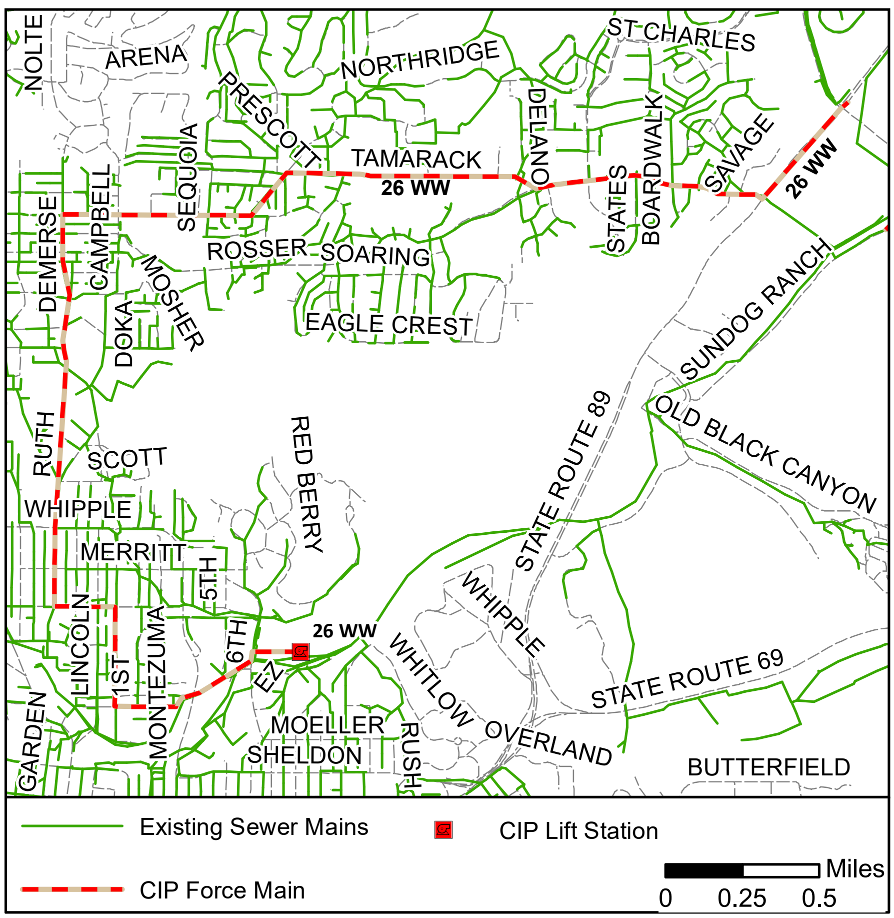
Project Details:

Project	Type	Capacity / Size	Length	Construction Cost	Project Cost
26 WW	Lift Station	9	-	$6,193,000	$8,670,000
26 WW	Force Main	18	27,892	$20,362,200	$28,507,000

IIP Information:

IIP Service Area: A	% Fees (Growth): 35%	% Rates: 65%





City of Prescott 2023 Water and Wastewater Models

Printing Date: October 23, 2023

File Path: M:\Client\Prescott\200600\Model\Wastewater\WW Models 02092023\WW 26 CIP.mxd

Project Number: 32 WW **Planning Period:** FY 2027

CoP Project Name: Granite Dells Ranch Development (DA) Wastewater Requirements - Airport East Regional Lift Station and Pipelines

Description: 32 WW Granite Dells Development - New Lift Station from Hwy 89/Sideroad to Granite Dells Development
32 WW Granite Dells Development - New Sewer Force Main from Hwy 89/Sideroad to Granite Dells Development

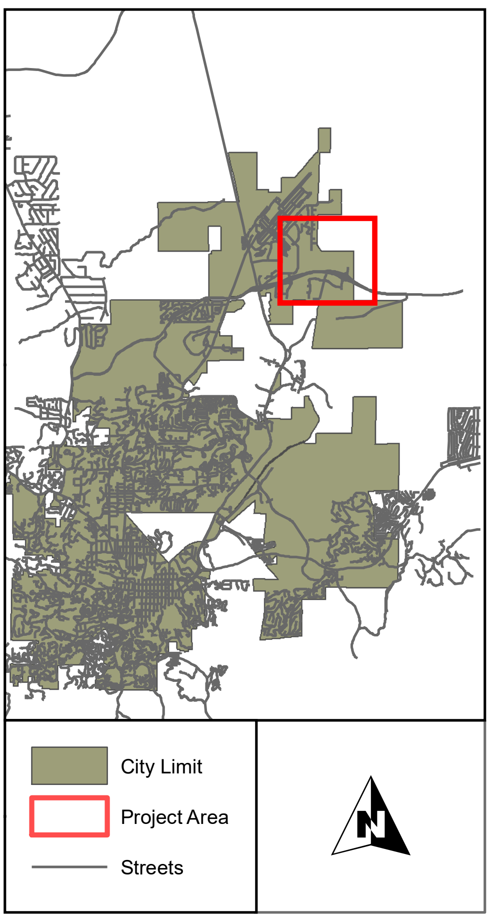
Justification: 32 WW Serve growth area
32 WW 10-in DI force main from the Granite Dells Lift Station northwesterly 951 LF across Granite Creek connecting to the existing gravity sewer trunk line to the Airport WRP

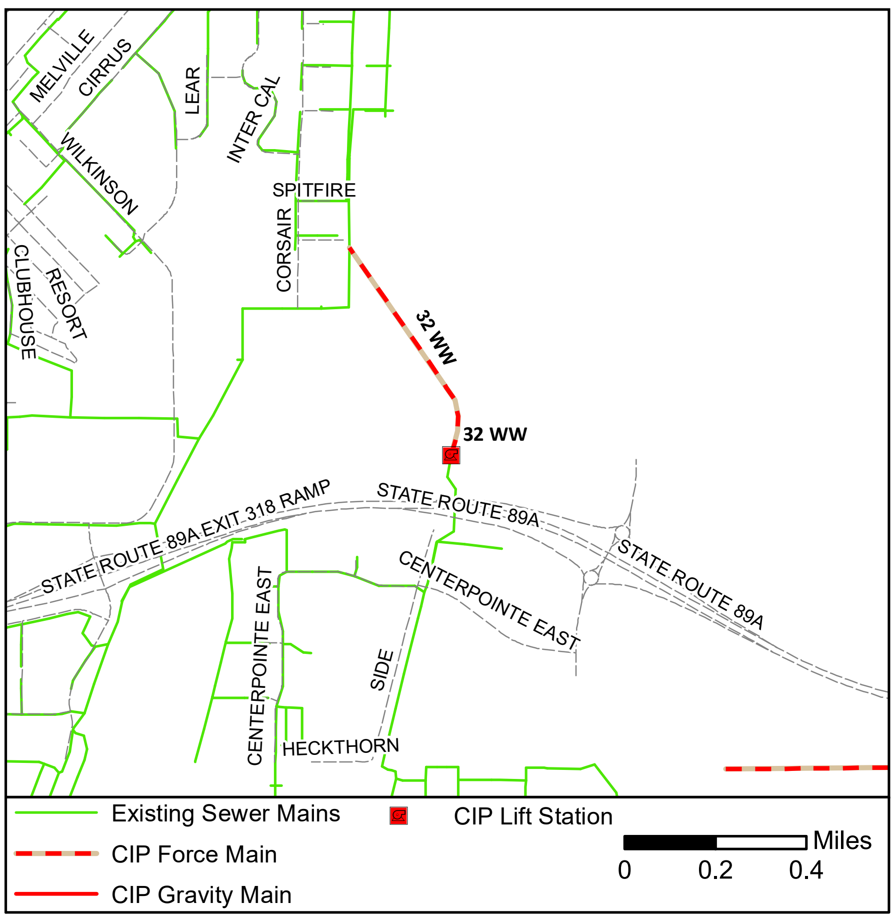
Project Details:

Project	Type	Capacity / Size	Length	Construction Cost	Project Cost
32 WW.1	Lift Station	1	1	$1,800,000	$2,340,000
32 WW.2	Force Main	10	2,430	$862,000	$1,207,000

IIP Information:

IIP Service Area: A	% Fees (Growth): 100%	% Rates: 0%





Project Number: **36 WW** **Planning Period:** FY 2032

CoP Project Name: Montezuma and Gurley Street Improvements or Montezuma Trunk Main Upsizing

CITY OF PRESCOTT

Description: 36 WW Montezuma and Gurley Street Improvements

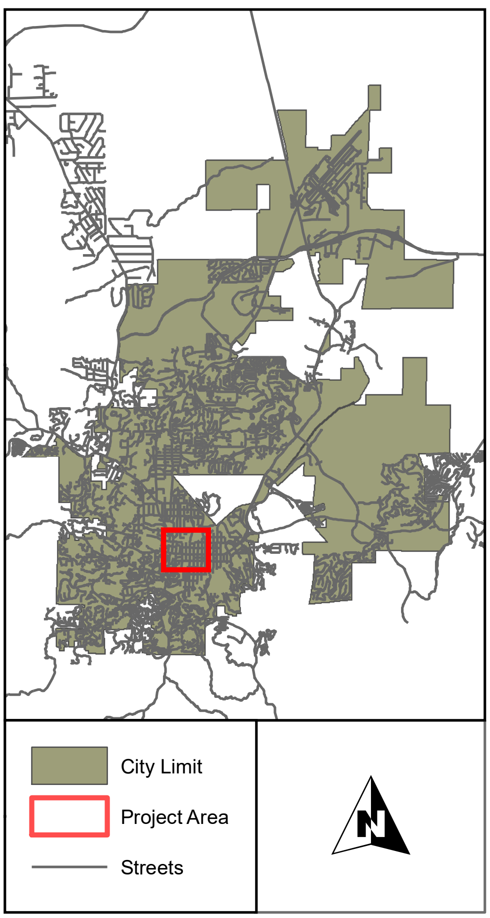
Justification: Addresses capacity limitation estimated by buildout.

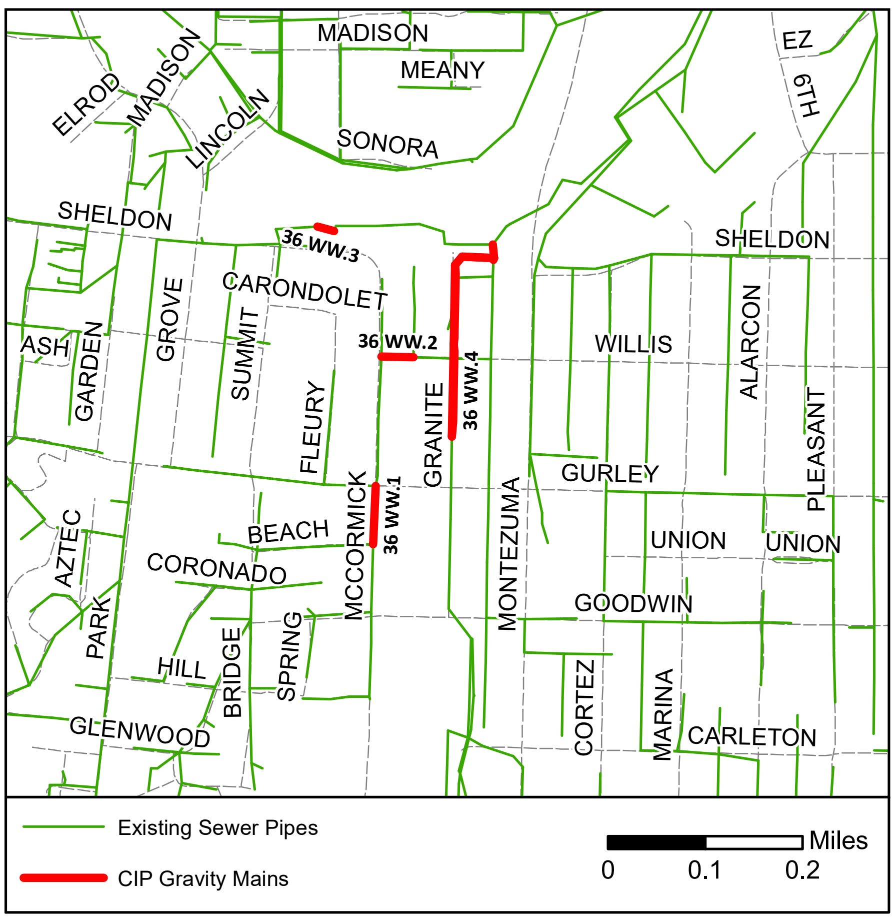
Project Details:

Project	Type	Capacity / Size	Length	Construction Cost	Project Cost
36 WW.1	Gravity Main	8	513	$154,000	$216,000
36 WW.2	Gravity Main	10	172	$62,000	$87,000
36 WW.3	Gravity Main	12	92	$39,000	$55,000
36 WW.4	Gravity Main	18	2,347	$1,540,000	$2,156,000

IIP Information:

IIP Service Area: A	% Fees (Growth): 25%	% Rates: 75%





City of Prescott 2023 Water and Wastewater Models

Printing Date: November 20, 2023

File Path: M:\Client\Prescott\200600\Model\Wastewater\WW Models 02092023\WW 36 CIP.mxd

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Project Number: 38 WW **Planning Period:** FY 2027

CoP Project Name: Hassayamapa Sewer Trunk Main Upsizing

Description: 38 WW.1 Hassayampa Trunk Main - Sonora Dr to Sundog Phase C Lift Station
38WW.2 Hassayampa Trunk Main - Oregon Ave to Miller Valley Rd
38WW.3 Hassayampa Trunk Main - Gurly St to Oregon Ave

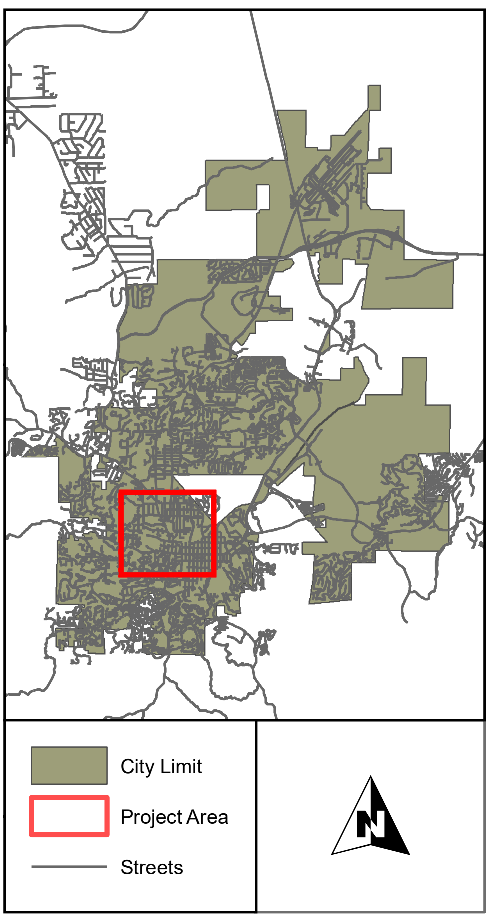
Justification: Addresses capacity limitation estimated by buildout.

Project Details:

Project	Type	Capacity / Size	Length	Construction Cost	Project Cost
38 WW.1	Gravity Main	18	3,196	$2,098,000	$2,937,000
38 WW.2	Gravity Main	15	5,618	$2,945,000	$4,123,000
38 WW.3	Gravity Main	15	1,445	$758,000	$1,061,000

IIP Information:

IIP Service Area: A	% Fees (Growth): 25%	% Rates: 75%



City of Prescott 2023 Water and Wastewater Models

Printing Date: October 23, 2023

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Project Number: 44 WW **Planning Period:** FY 2037

CoP Project Name: 5th Street, 6th Street and Hillside Sewer Main Upsize

Description: 44 WW.1 - 44 WW.2 5th Street, 6th Street and Hillside Sewer Main Upsize

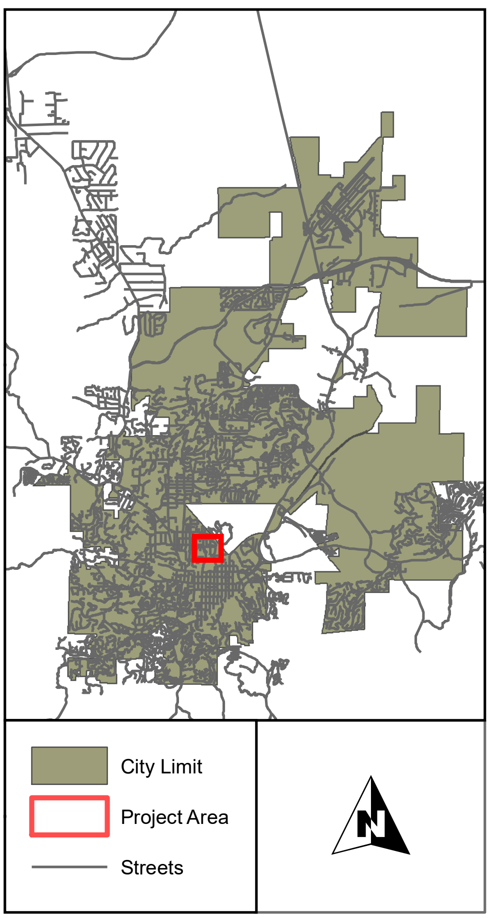
Justification: Addresses capcity limitation in existing system

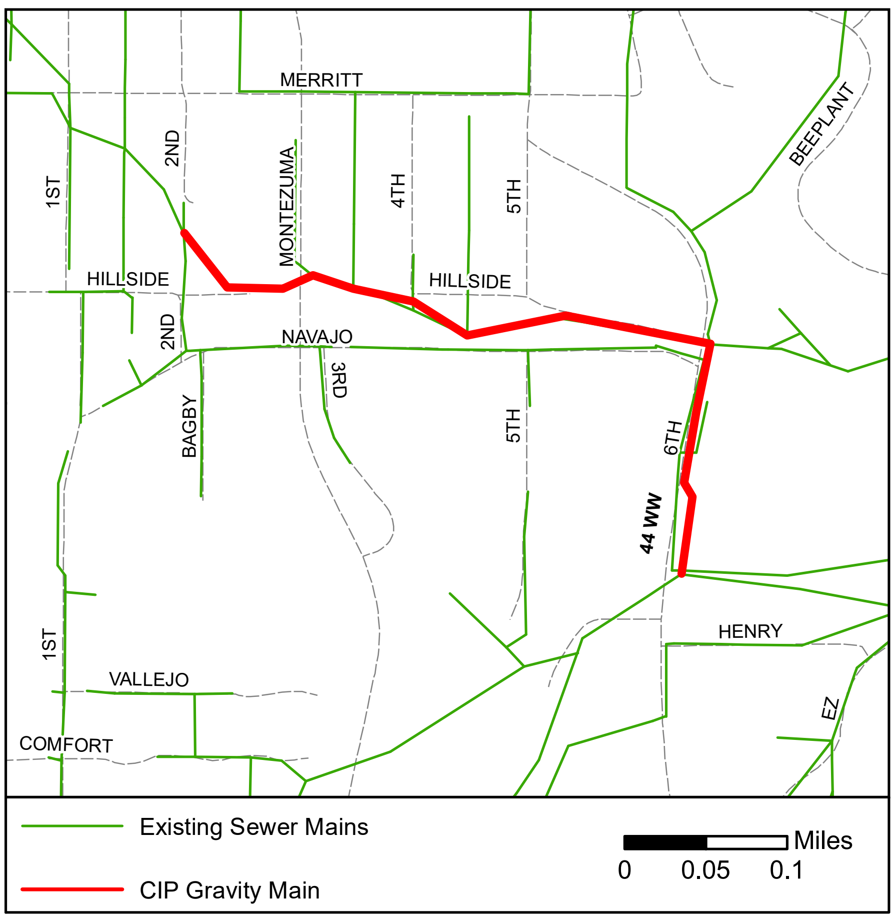
Project Details:

Project	Type	Capacity / Size	Length	Construction Cost	Project Cost
44 WW.1	Gravity Main	15	1,867	$979,000	$1,371,000
44 WW.2	Gravity Main	18	772	$502,000	$703,000

IIP Information:

IIP Service Area: A	% Fees (Growth): 10%	% Rates: 90%





Project Number: **46 WW** **Planning Period:** FY 2032

CoP Project Name: Sun Street Sewer Main Upgrade

CITY OF PRESCOTT

Description: 46 WW.1 New Sewer Connection on Ruth Dr from Whetstine Ave to Sun St
46 WW.2 Upsize sewer from Cambell St to 2nd St (diagonal

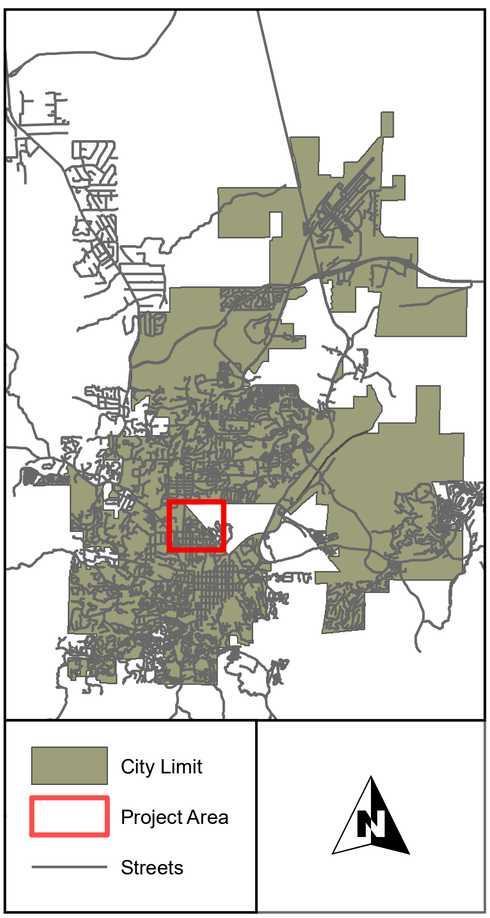
Justification: Addresses capacity limitation in existing system.

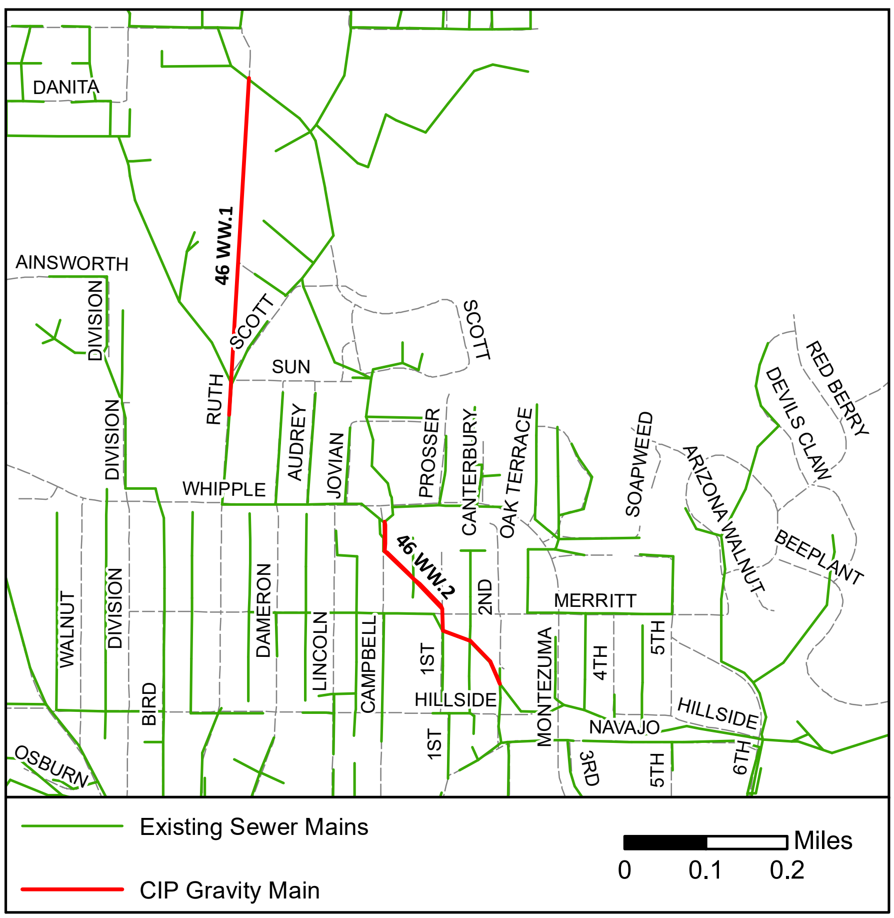
Project Details:

Project	Type	Capacity / Size	Length	Construction Cost	Project Cost
46 WW.1	Gravity Main	10	2,380	$863,000	$1,208,000
46 WW.2	Gravity Main	12	2,281	$972,000	$1,361,000

IIP Information:

IIP Service Area: --	% Fees (Growth): 0%	% Rates: 100%





City of Prescott 2023 Water and Wastewater Models

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Project Number: **52 WW** **Planning Period:** FY 2032

CoP Project Name: Thumb Butte Rd Upsizing

Description: 52 WW.1 Hassayampa - Upsize Meadowbrook Rd at Butte Canyon Dr
52 WW.2 Hassayampa - Upsize Meadowbrook Rd from Sherwood Dr to Plaza Dr

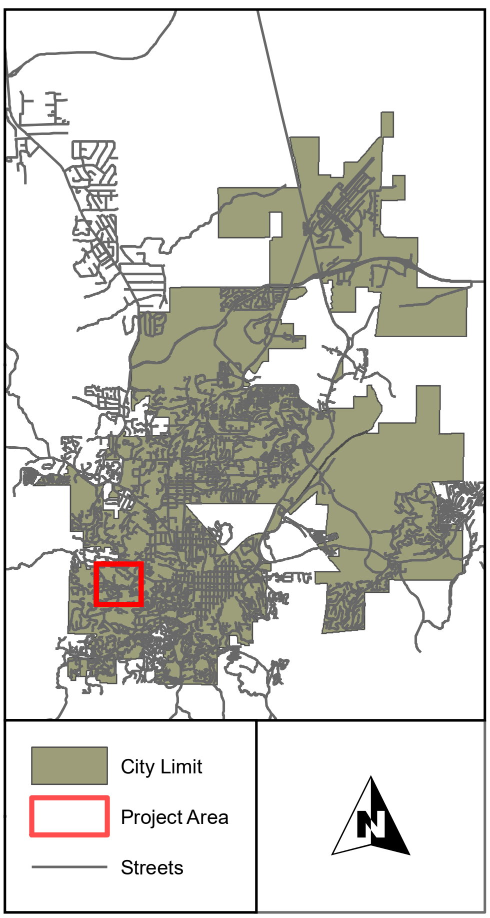
Justification: Addresses capacity limitation estimated by buildout.

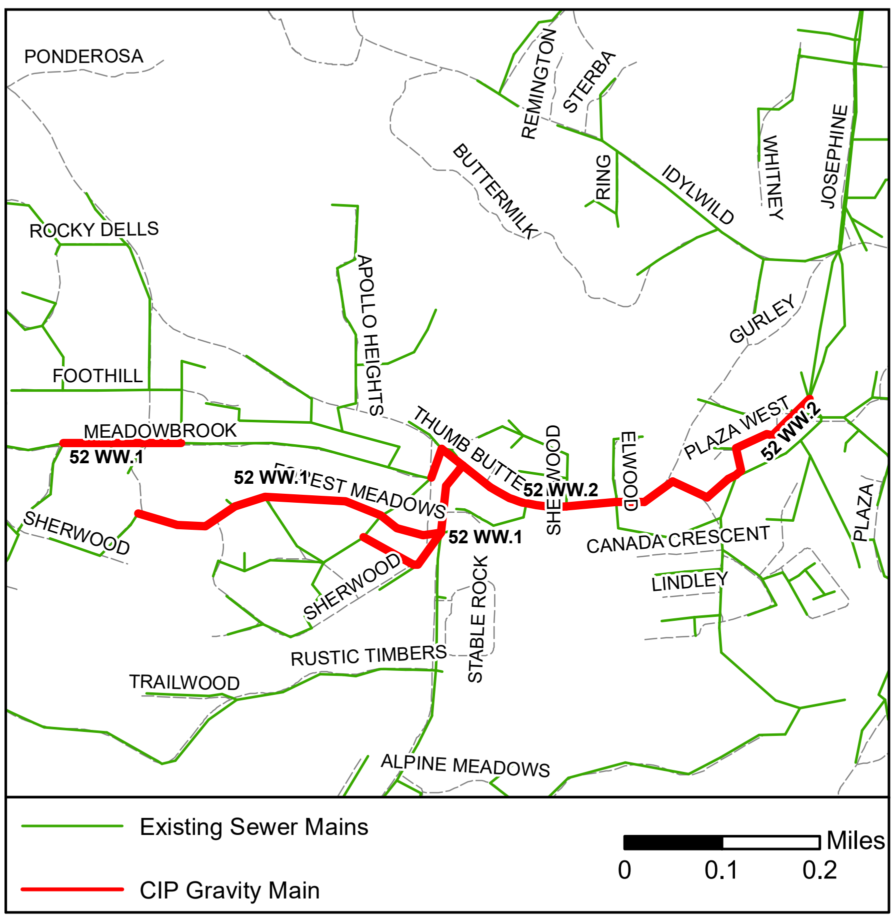
Project Details:

Project	Type	Capacity / Size	Length	Construction Cost	Project Cost
52 WW.1	Gravity Main	8	2,930	$879,000	$1,231,000
52 WW.2	Gravity Main	15	3,013	$1,580,000	$2,212,000

IIP Information:

IIP Service Area: --	% Fees (Growth): 0%	% Rates: 100%





Project Number: **54 WW** ***Planning Period:*** FY 2027

CoP Project Name: Centralization - Sundog Equalization and Plant Decommissioning

Description: 54 WW Centralization - Sundog Equalization and Plant Decommissioning

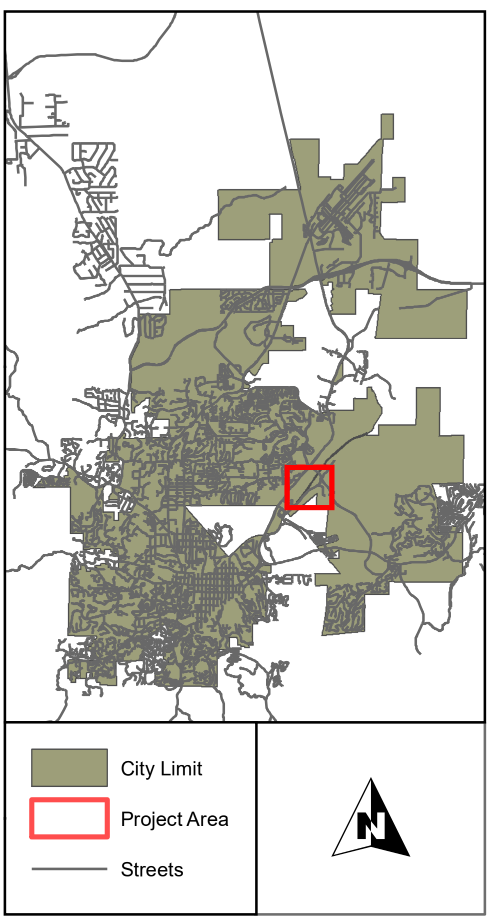
Justification: Centralization of the sewer system. Project cost provided by City of Prescott.

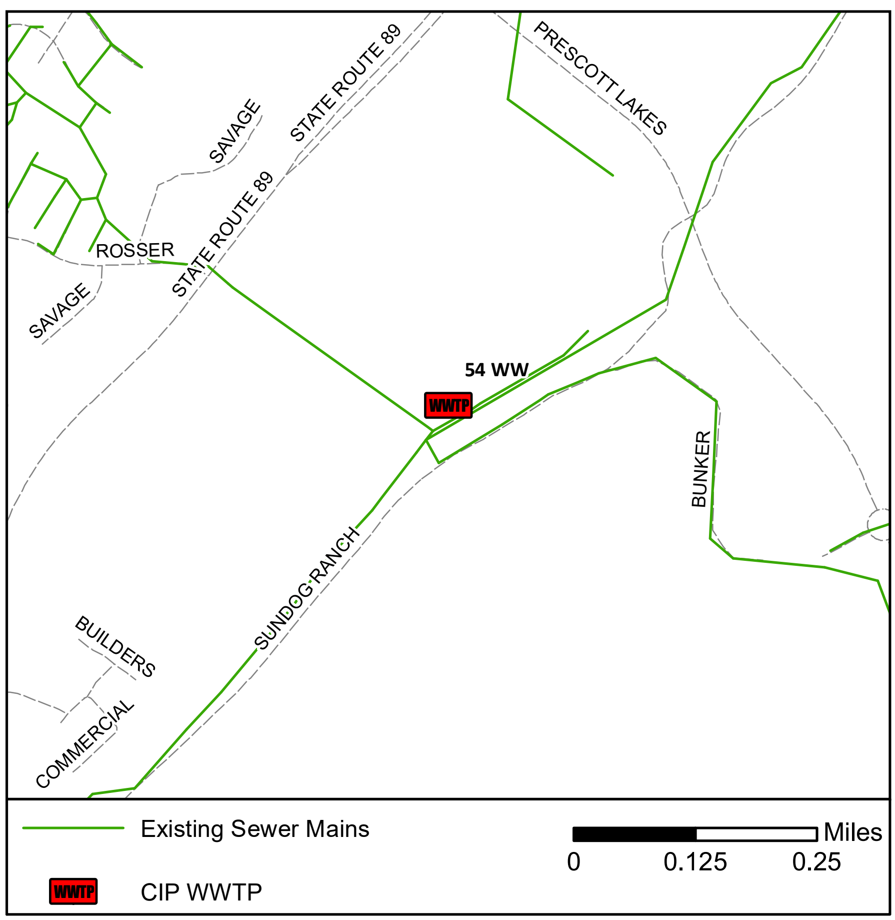
Project Details:

Project	Type	Capacity / Size	Length	Construction Cost	Project Cost
54 WW	WWTP	--	--	--	$2,300,000

IIP Information:

IIP Service Area: A	% Fees (Growth): 20%	% Rates: 80%





City of Prescott 2023 Water and Wastewater Models

Printing Date: November 08, 2023
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Project Number: **55 WW** **Planning Period:** FY 2027

CoP Project Name: Centralization - Effluent Tank and Pipeline

Description: 55 WW.1 Centralization - Airport WRF Effluent Pump Station
55 WW.2 Centralization - Airport WRF Effluent Line to Watson Lake Park
55 WW.3 Centralization - Watston Lake Park Effluent Tank

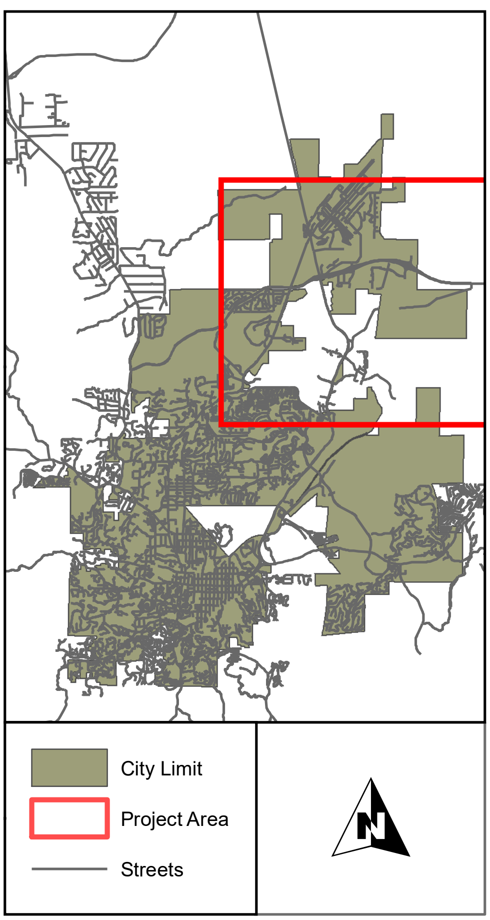
Justification: Centralization of the sewer system. Effluent pumping to new tank at Watson Lake Park.

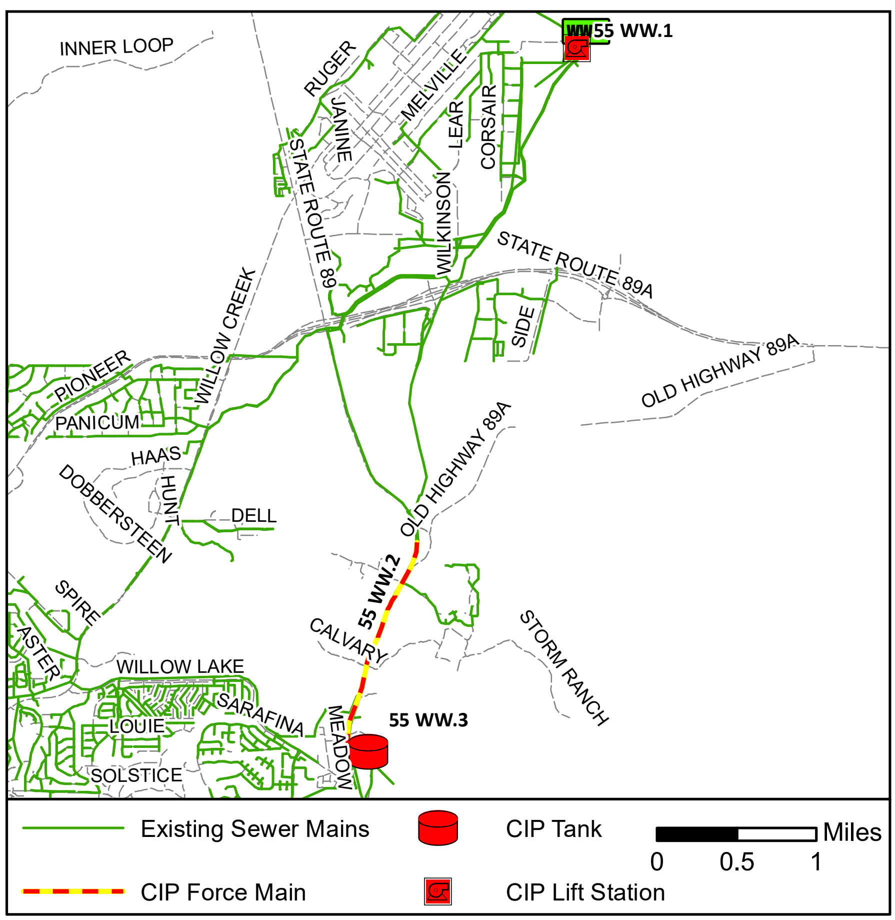
Project Details:

Project	Type	Capacity / Size	Length	Construction Cost	Project Cost
55 WW.1	Lift Station	3	--	$3,144,000	$4,402,000
55 WW.2	Force Main	18	8,666	$6,326,000	$8,856,000
55 WW.3	Tank	1.5	--	$2,728,000	$3,819,000

IIP Information:

IIP Service Area: A	% Fees (Growth): 20%	% Rates: 80%





Project Number: **56 WW** ***Planning Period:*** FY 2027

CoP Project Name: Willow Creek Trunk Main Upsize

Description: 56 WW.1 - 56 WW.3 Upsize Willow Creek Trunk Main from Willow Lake Regional Lift Station west to Cottonwood Ln

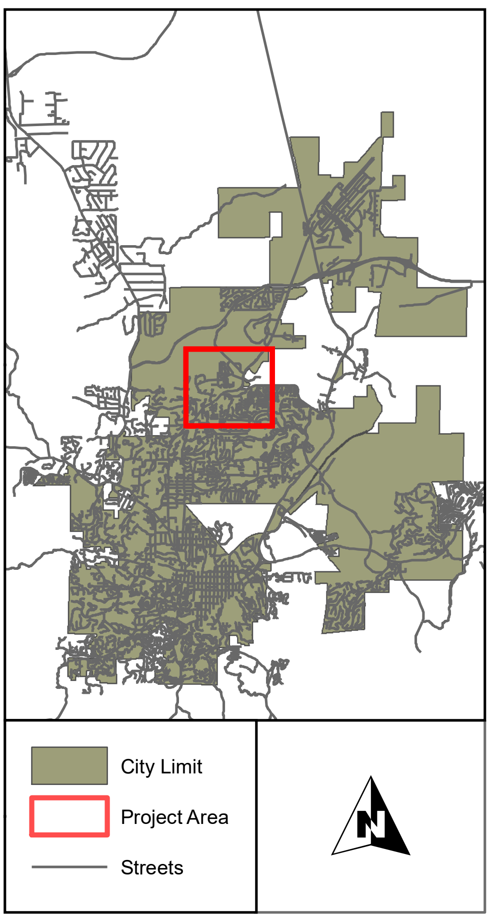
Justification: Addresses capacity limitation estimated by buildout.

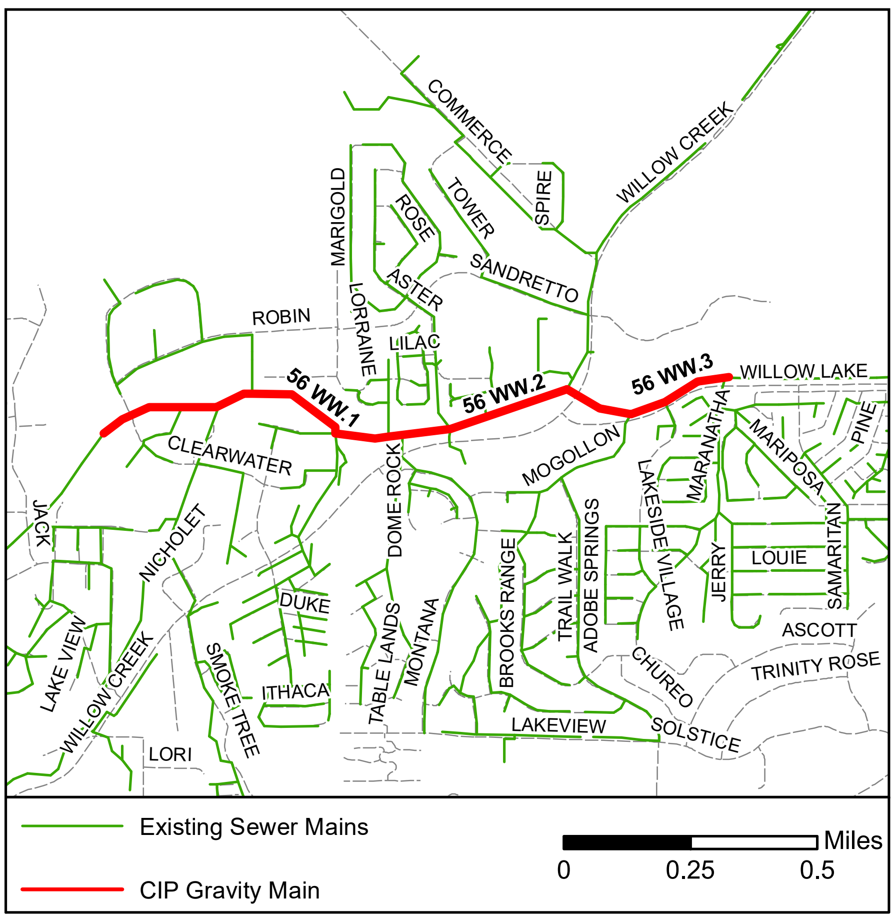
Project Details:

Project	Type	Capacity / Size	Length	Construction Cost	Project Cost
56 WW.1	Gravity Main	12	4,967	$2,117,000	$2,964,000
56 WW.2	Gravity Main	15	3,926	$2,058,000	$2,881,000
56 WW.3	Gravity Main	18	1,795	$1,178,000	$1,649,000

IIP Information:

IIP Service Area: A	% Fees (Growth): 25%	% Rates: 75%





Project Number: **62 WW** **Planning Period:** FY 2027

CoP Project Name: Willow Lake Gravity Sewer

Description: 62 WW.1 Prescott Lakes Regional Lift Station
62 WW.2 Prescott Lakes Regional Lift Station - Force Main
62 WW.3 Prescott Lakes Regional Lift Station - Gravity Main

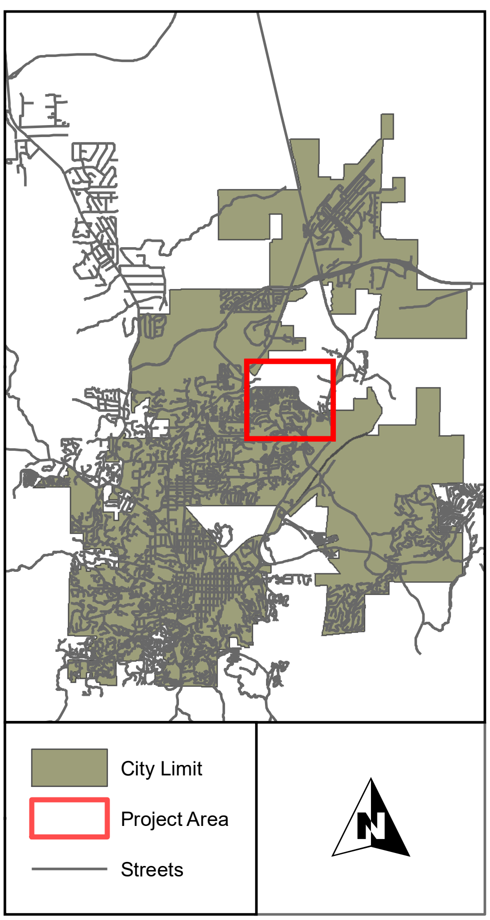
Justification: 62 WW.1 - 62 WW.3 Replace WLR and WLE lift stations

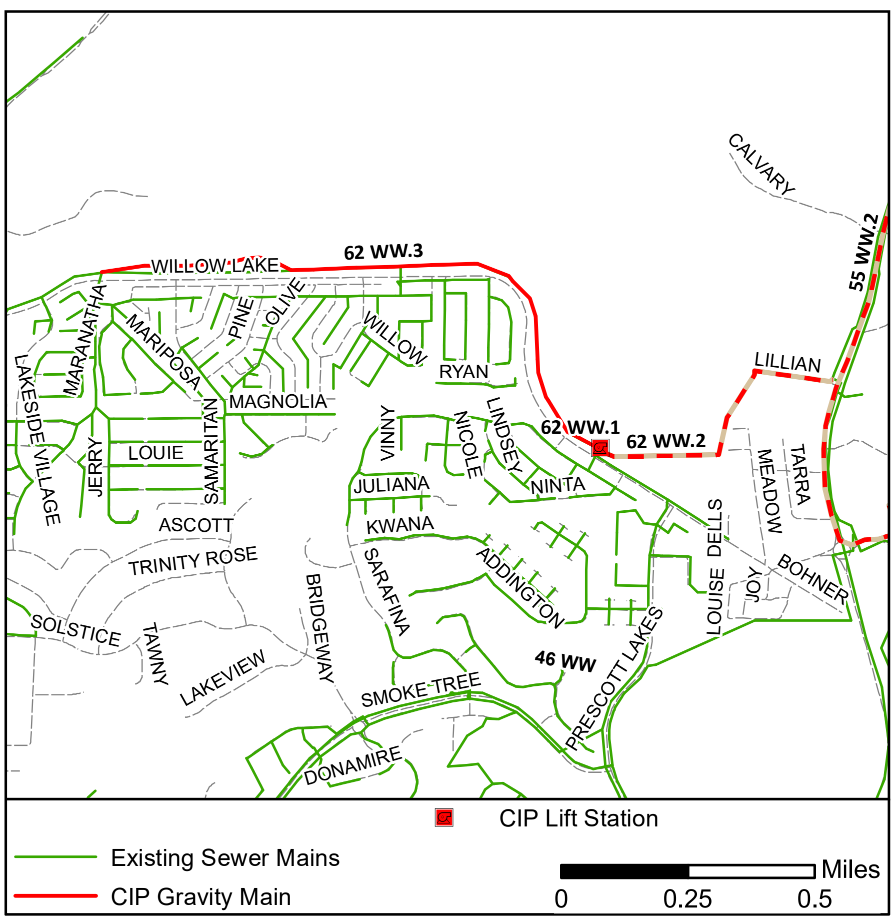
Project Details:

Project	Type	Capacity / Size	Length	Construction Cost	Project Cost
62 WW.1	Lift Station	4	1	$3,463,000	$4,848,000
62 WW.2	Force Main	18	3,050	$2,227,000	$3,118,000
62 WW.3	Gravity Main	24	6,500	$6,066,000	$8,492,000

IIP Information:

IIP Service Area: A	% Fees (Growth): 25%	% Rates: 75%





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Project Number: **66 WW**

Planning Period: FY 2027

CoP Project Name: Gurley, Sheldon, EZ Street and Roughrider Improvements

CITY OF PRESCOTT

Description: 66 WW.1 - 66 WW.3 Gurly, Sheldon, EZ Street and Roughrider Improvements

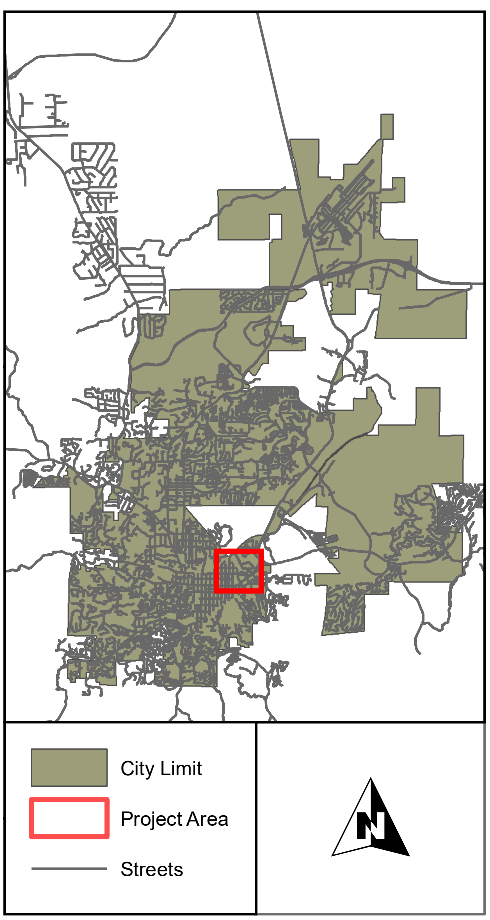
Justification: Addresses capacity limitation estimated by system.

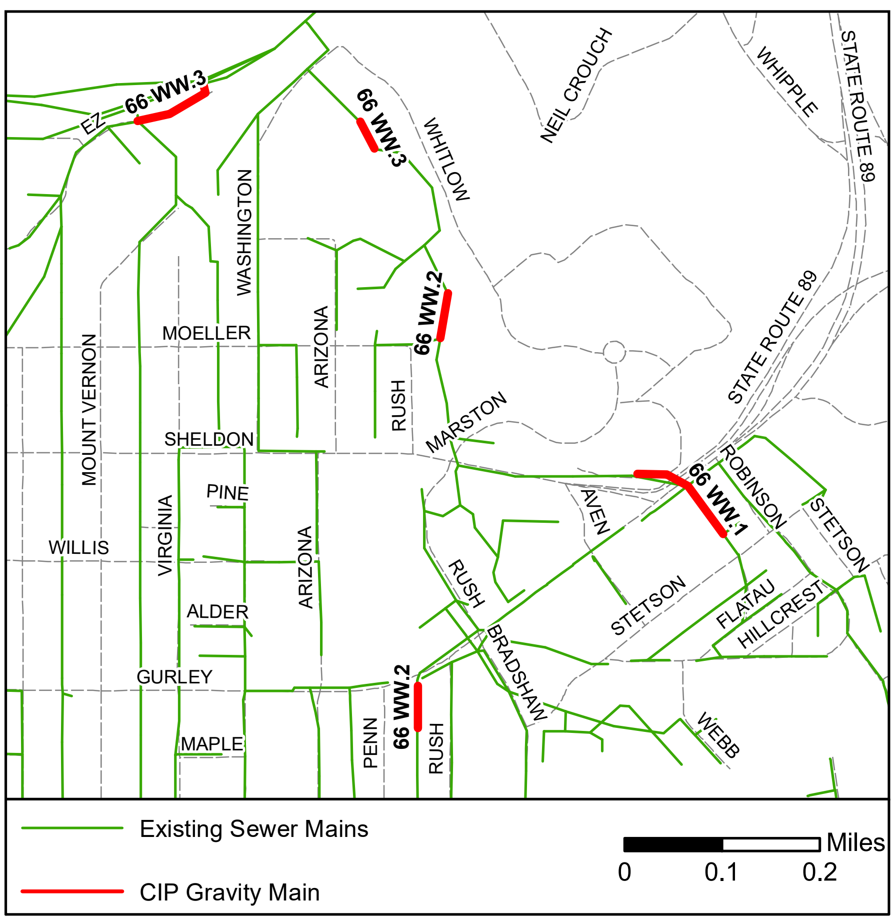
Project Details:

Project	Type	Capacity / Size	Length	Construction Cost	Project Cost
66 WW.1	Gravity Main	8	612	$184,000	$258,000
66 WW.2	Gravity Main	10	478	$173,000	$242,000
66 WW.3	Gravity Main	12	644	$274,000	$384,000

IIP Information:

IIP Service Area: A	% Fees (Growth): 0%	% Rates: 100%





City of Prescott 2023 Water and Wastewater Models

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Printing Date: October 27, 2023

File Path: M:\Client\Prescott\200600\Model\Wastewater\WW Models 02092023\WW 66 CIP.mxd

Project Number: **68 WW** **Planning Period:** FY 2042

CoP Project Name: Fair St and Miller Valley Collector Main

Description: 68 WW Fair St. and Miller Valley Rd. to Willow Creek Rd

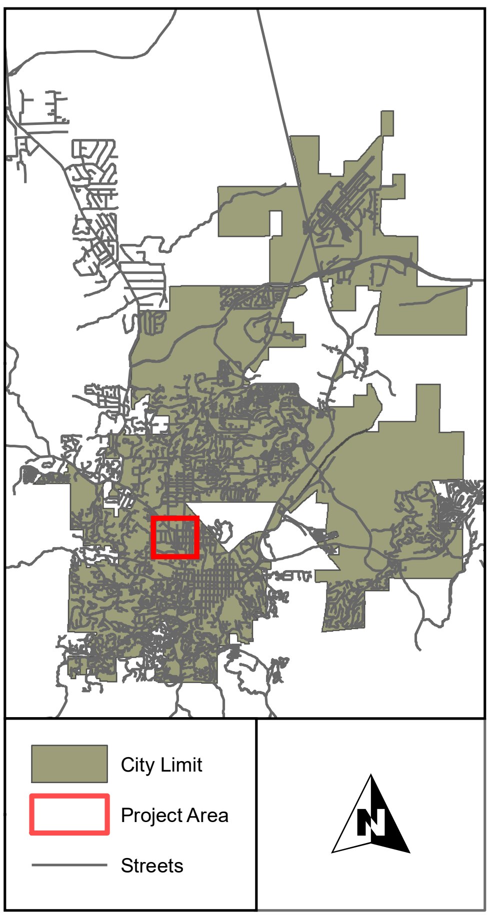
Justification: Addresses capacity limitation estimated by buildout.

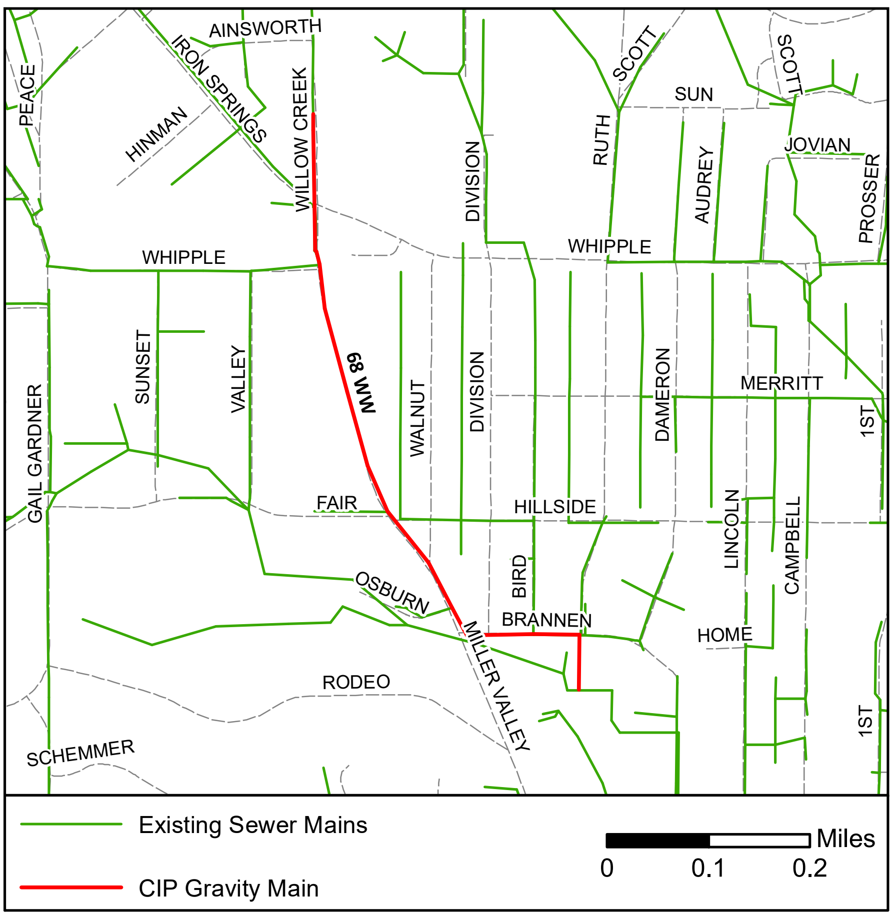
Project Details:

Project	Type	Capacity / Size	Length	Construction Cost	Project Cost
70 WW.1	Gravity Main	10	176	$64,000	$90,000

IIP Information:

IIP Service Area: --	% Fees (Growth): 0%	% Rates: 100%





Project Number: **70 WW**

Planning Period: FY 2032

CoP Project Name: Peace Lane and Gail Gardner Way

Description: 70 WW Peace Lane and Gail Gardner Way

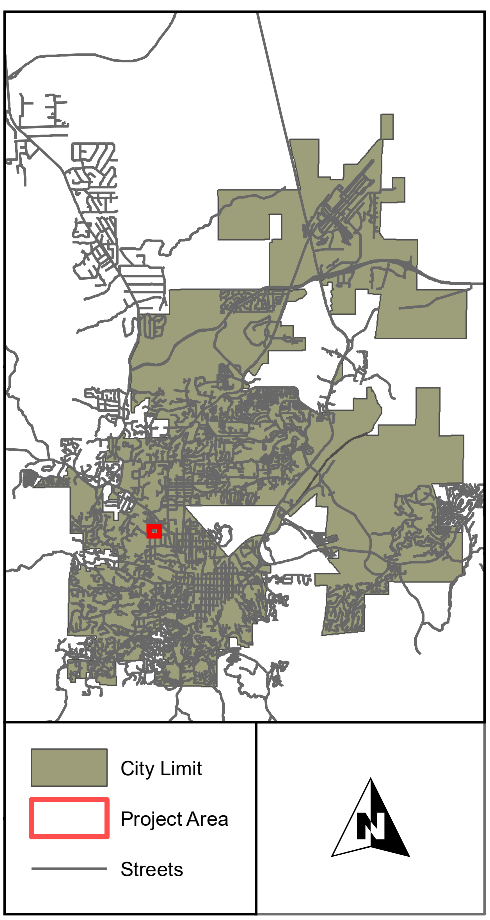
Justification: Addresses capacity limitation estimated by buildout.

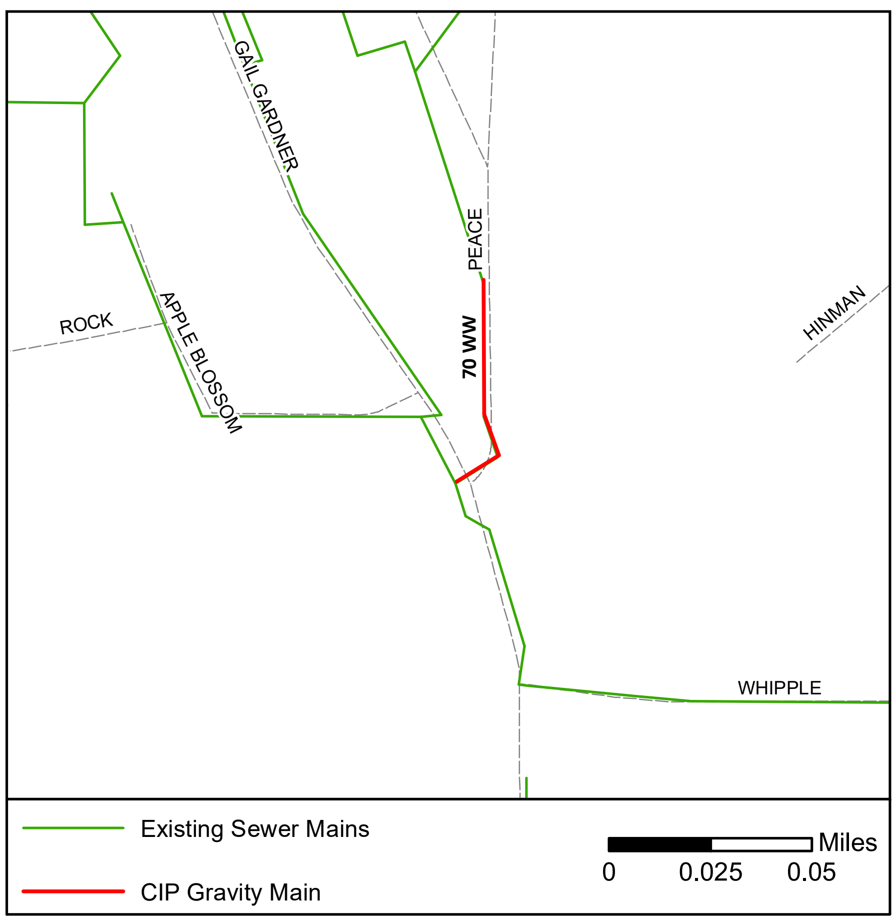
Project Details:

Project	Type	Capacity / Size	Length	Construction Cost	Project Cost
70 WW	Gravity Main	10	176	$64,000	$90,000

IIP Information:

IIP Service Area: --	% Fees (Growth): 0%	% Rates: 100%





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Printing Date: October 23, 2023

File Path: M:\Client\Prescott\200600\Model\Wastewater\WW Models 02092023\WW 70 CIP.mxd

Project Number: 72 WW **Planning Period:** FY 2032

CoP Project Name: Prescott Lakes Parkway Sewer Upsizing

Description: 72 WW Upsize sewer on Prescott Lakes Pkwy north of Hwy 69

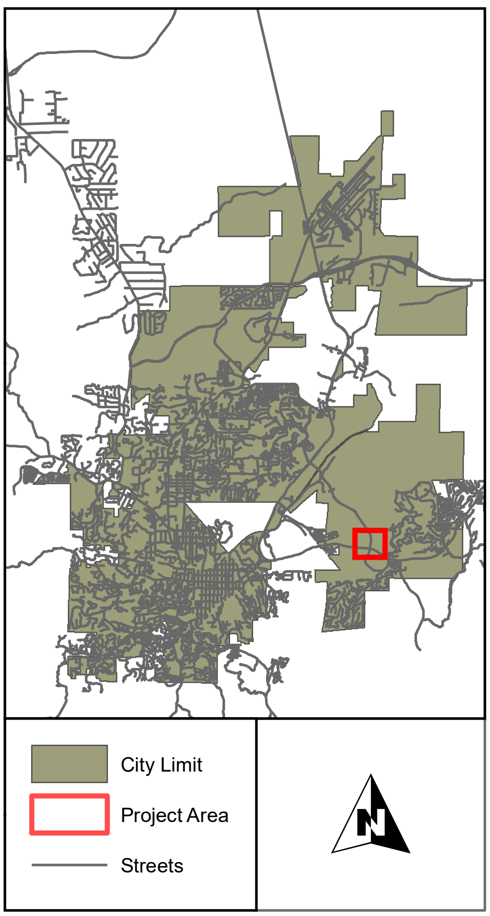
Justification: Addresses capacity limitation in existing system during peak flows.

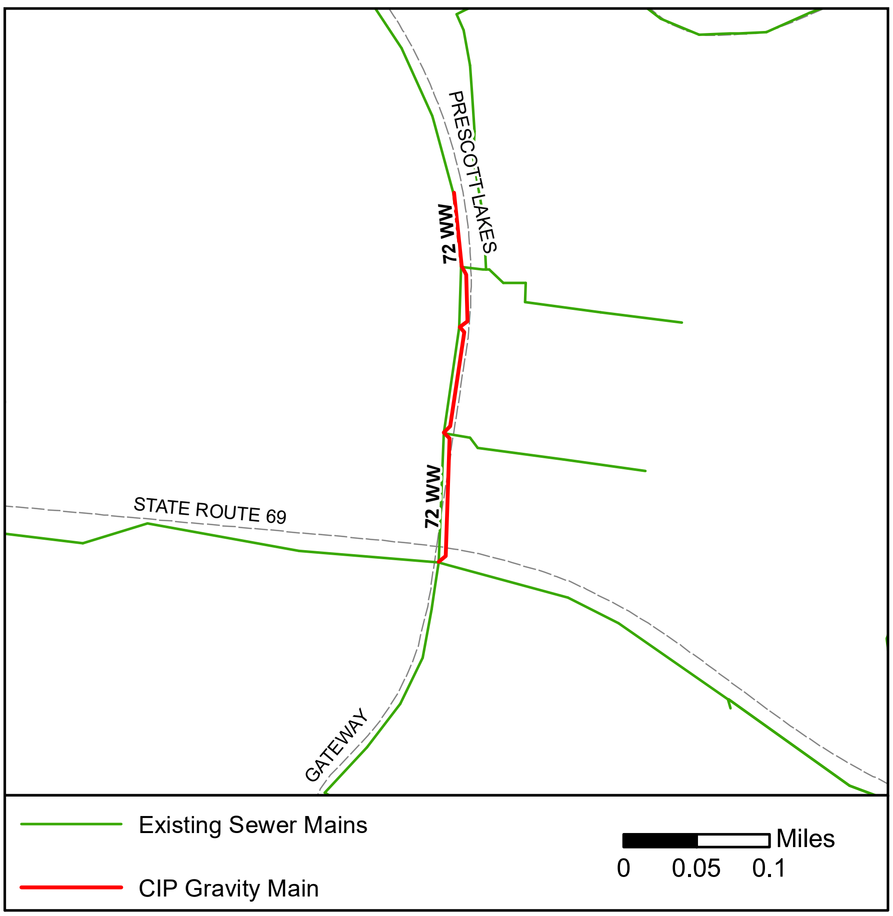
Project Details:

Project	Type	Capacity / Size	Length	Construction Cost	Project Cost
72 WW	Gravity Main	15	1,077	$565,000	$791,000

IIP Information:

IIP Service Area: A	% Fees (Growth): 25%	% Rates: 75%





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File Path: M:\Client\Prescott\200600\Model\Wastewater\WW Models 02092023\WW 72 CIP.mxd

Project Number: 78 WW

Planning Period: FY 2032

CoP Project Name: Shadow Valley Dr and Archers Path

Description: 78 WW Shadow Valley Drive and Archers Path

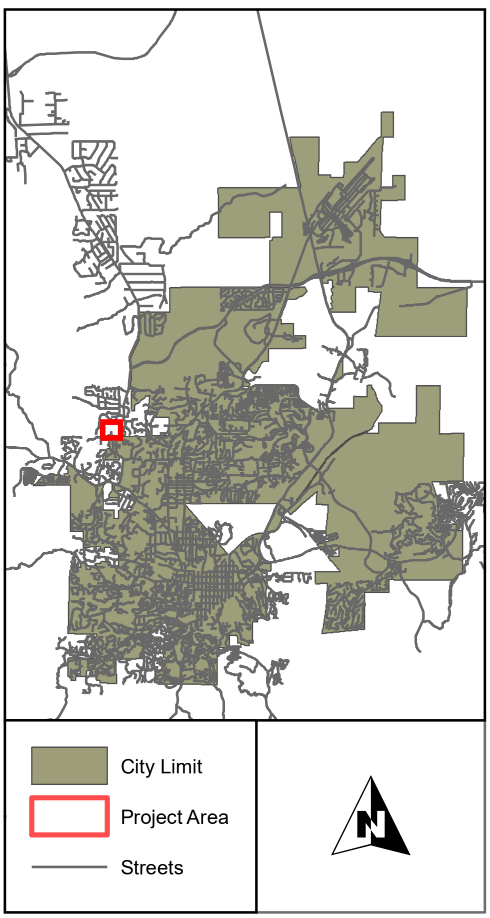
Justification: Larger diameter needed due to low-slope pipe.

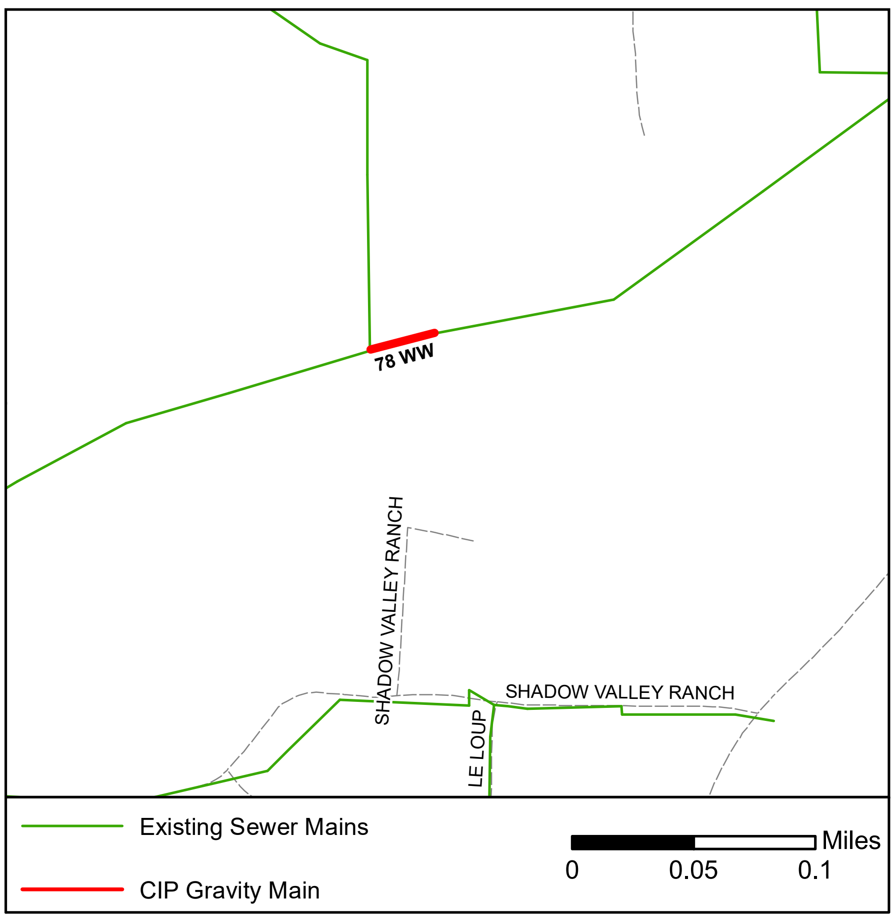
Project Details:

Project	Type	Capacity / Size	Length	Construction Cost	Project Cost
78 WW	Gravity Main	12	145	$62,000	$87,000

IIP Information:

IIP Service Area: A	% Fees (Growth): 0%	% Rates: 100%





Project Number: **84 WW** **Planning Period:** FY 2027

CoP Project Name: Centralization

CITY OF PRESCOTT

Description: 84 WW.1 Centralization - Airport WRF Solids Handling Facility and New Centrifuge
84 WW.2 Centralization - Airport WRF Expansion Phase 2

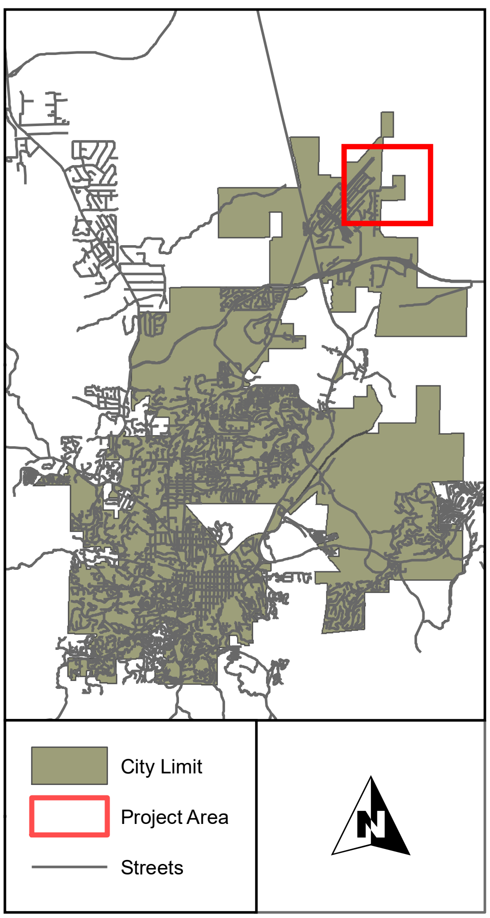
Justification: Centralization of the sewer system. Project cost provided by City of Prescott.

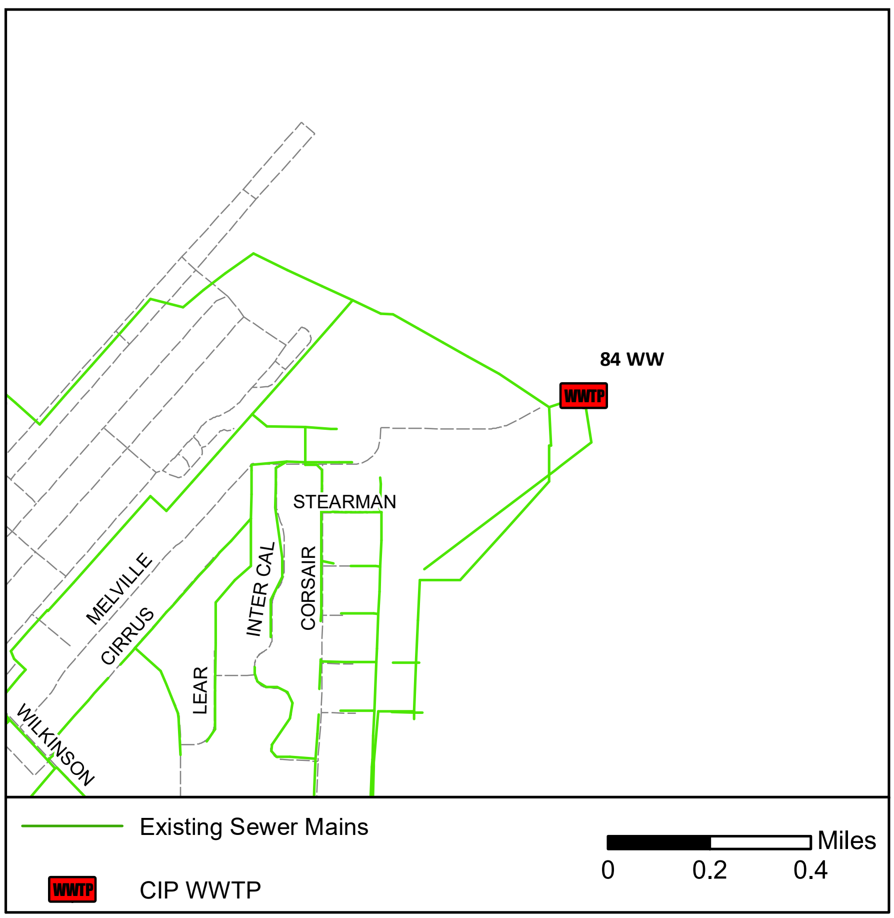
Project Details:

Project	Type	Capacity / Size	Length	Construction Cost	Project Cost
84 WW.1	WWTP	--	--	--	$13,000,000
84 WW.2	WWTP	--	--	--	$25,000,000

IIP Information:

IIP Service Area: A	% Fees (Growth): 20%	% Rates: 80%





Project Number: **86 WW** **Planning Period:** FY 2027

CoP Project Name: Ruger Road Phase 2 and Phase 3

CITY OF PRESCOTT

Description: 86 WW.1 - 86 WW.2 Airport Ruger Road Trunk Main Extension

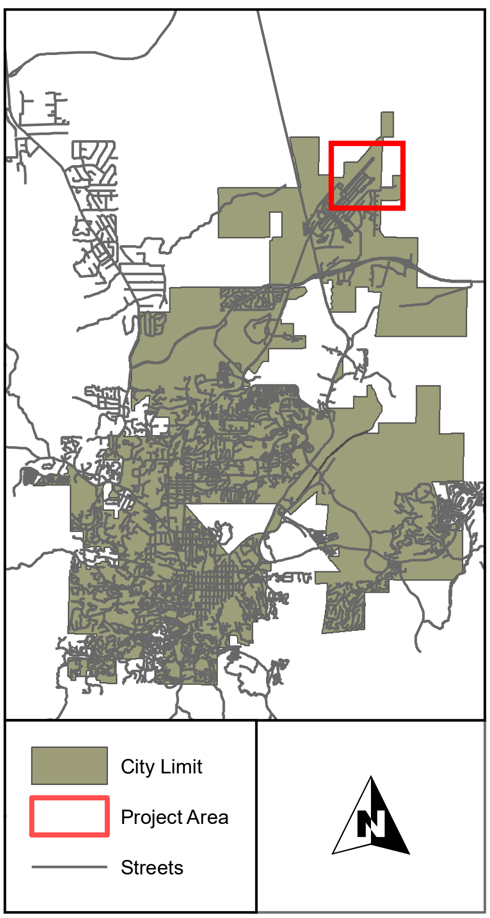
Justification: Convey flows from future developments to collection system.

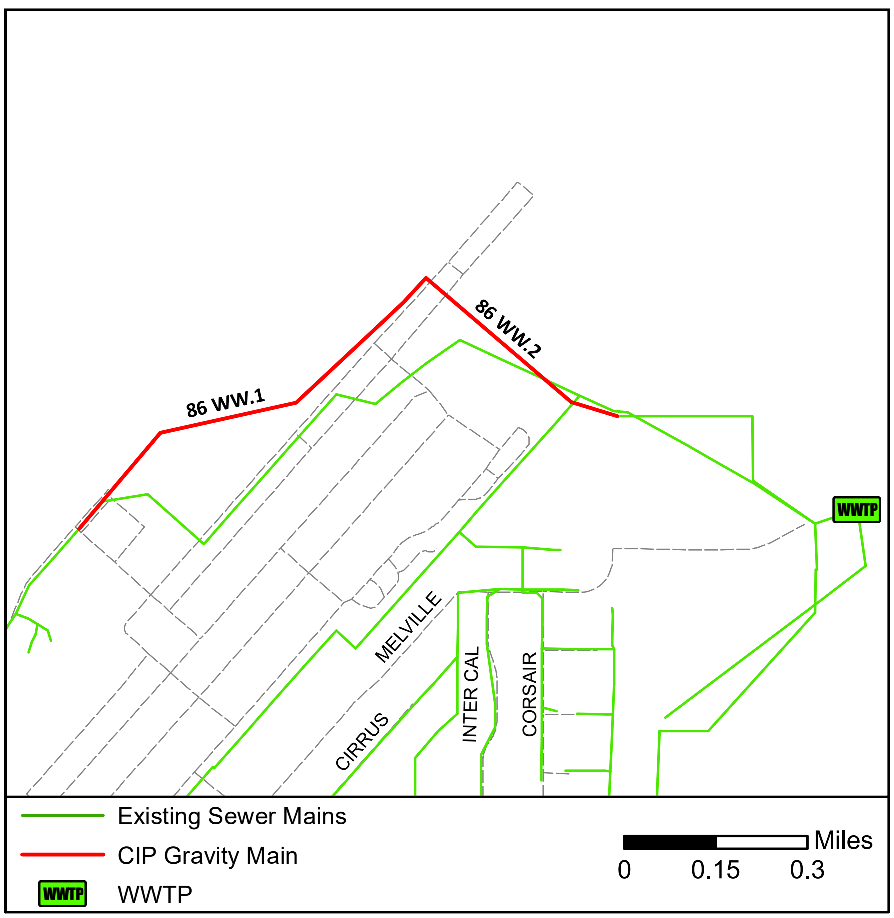
Project Details:

Project	Type	Capacity / Size	Length	Construction Cost	Project Cost
86 WW.1	Gravity Main	24	2,963	$2,765,000	$3,871,000
86 WW.2	Gravity Main	30	2,625	$2,169,000	$3,037,000

IIP Information:

IIP Service Area: A	% Fees (Growth): 90%	% Rates: 10%





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Printing Date: November 08, 2023

File Path: M:\Client\Prescott\200600\Model\Wastewater\WW Models 02092023\WW 86 CIP.mxd

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Project Number: 87 WW **Planning Period:** FY 2027/2032

CoP Project Name: Yavapai Hills #1 Lift Station Rehab

Description: 87 WW Yavapai Hills Lift Station (2027)
87 WW Yavapai Hills Lift Station - Force Main (2032)

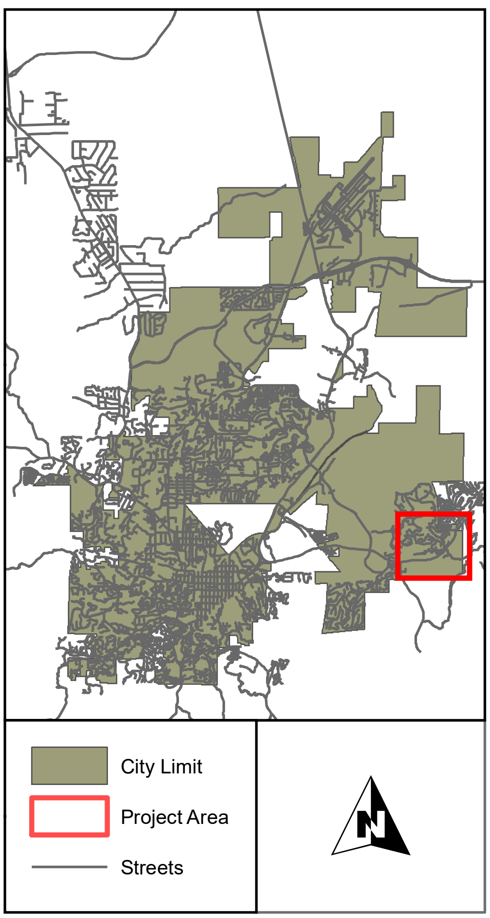
Justification: Lift station rehabilitation.

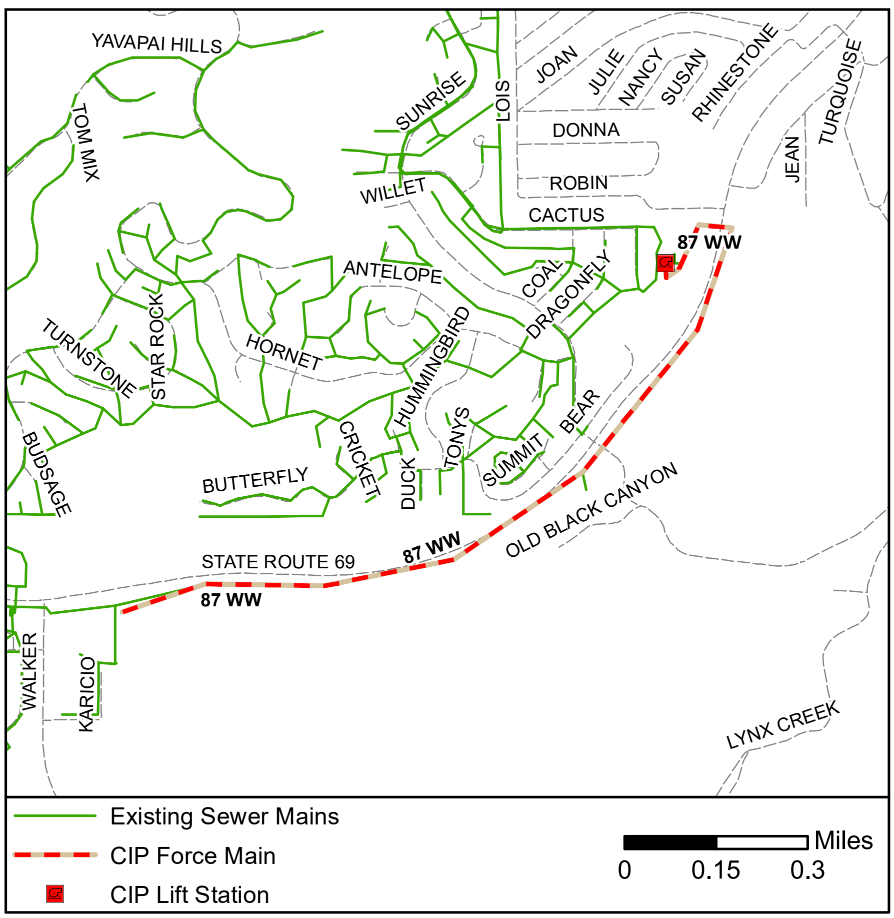
Project Details:

Project	Type	Capacity / Size	Length	Construction Cost	Project Cost
87 WW	Lift Station	3	1	$3,144,000	$4,402,000
87 WW	Force Main	16	7,781	$4,730,000	$6,622,000

IIP Information:

IIP Service Area: A	% Fees (Growth): 60%	% Rates: 40%





Project Number: **88 WW** **Planning Period:** FY 2032

CoP Project Name: Section 32 & 33 Force Main and Gravity Main

CITY OF PRESCOTT

Description: 88 WW.1 Section 32/33 Force Main
88 WW.2 Section 32 & 33 Gravity Main

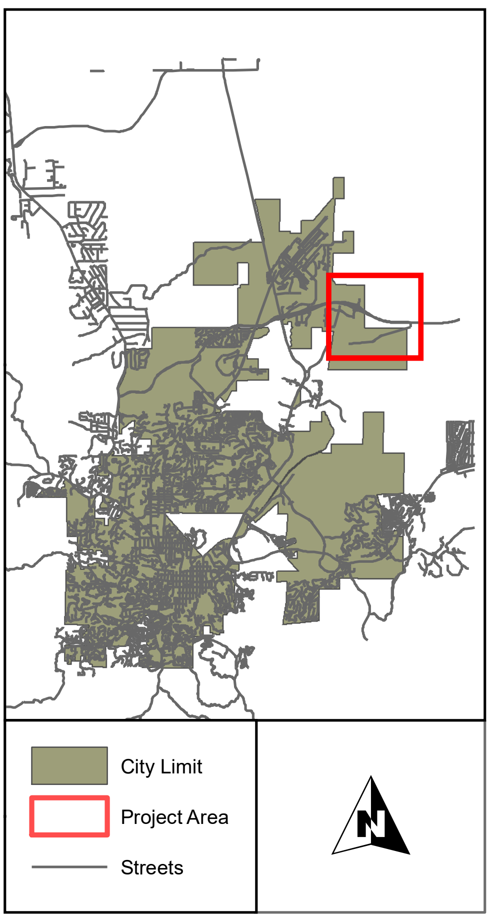
Justification: Convey flows from Section 32/33 Development to collection system. City responsible for force main from existing system to State Route 89A.

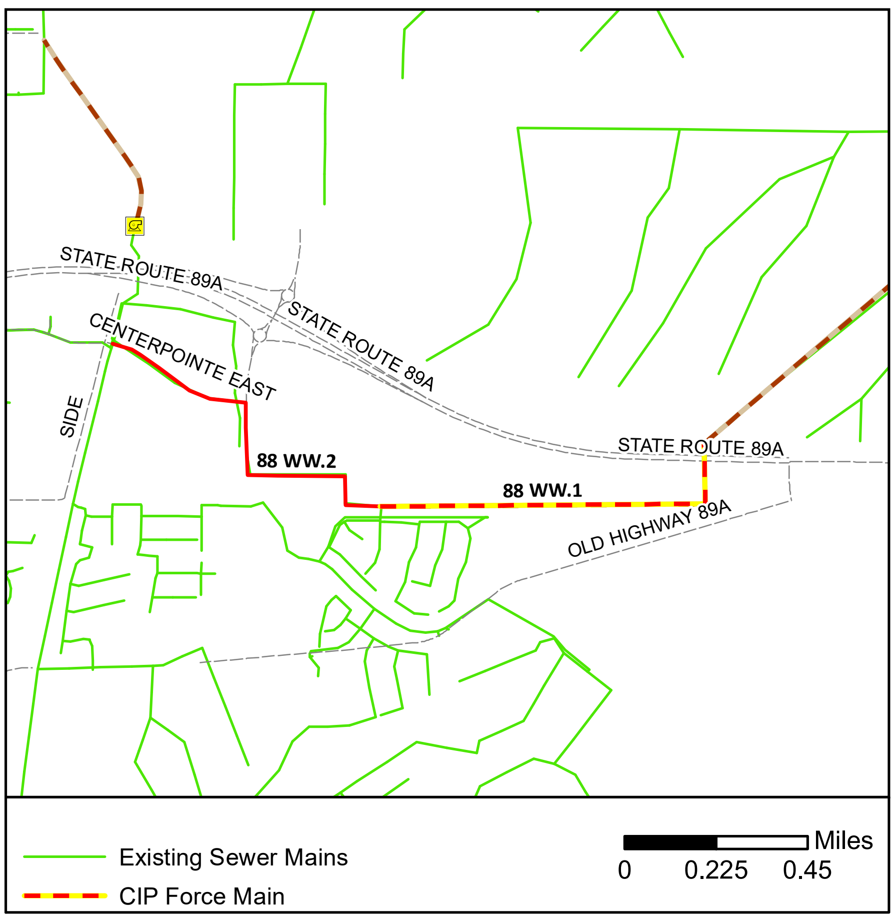
Project Details:

Project	Type	Capacity / Size	Length	Construction Cost	Project Cost
88 WW.1	Force Main	8	5,000	$1,401,000	$1,961,000
88 WW.2	Gravity Main	12	4,977	$2,121,000	$2,969,000

IIP Information:

IIP Service Area: B	% Fees (Growth): 100%	% Rates: 0%





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Project Number: **97 WW** **_Planning Period:_** FY 2042

CoP Project Name: Yavapai Medical Center Lift Station and Sewer Main

Description: 97 WW.1 - Yavapai Medical Center Lift Station
97 WW.2 - Yavapai Medical Center Force Main
97 WW.3 - Yavapai Medical Center Gravity Main

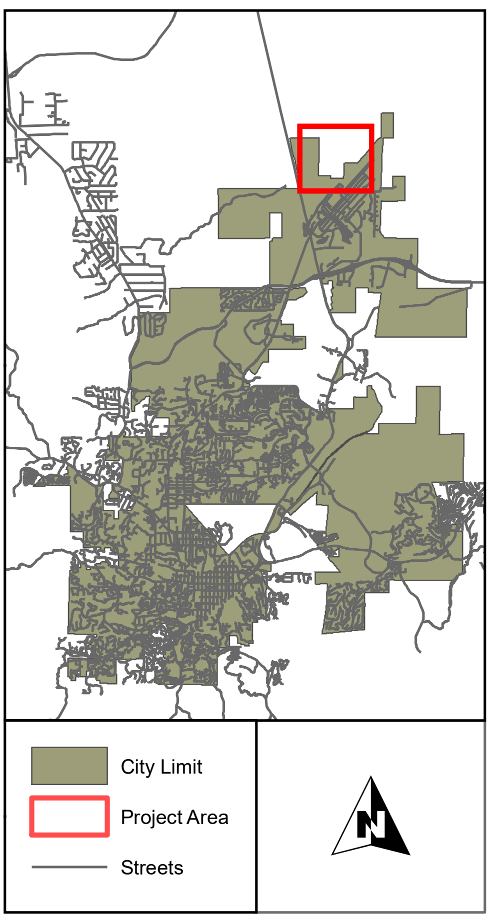
Justification: Convey flows from future developments to collection system. City responsible for 2,650 ft of gravity main of 16-inch diameter or larger.

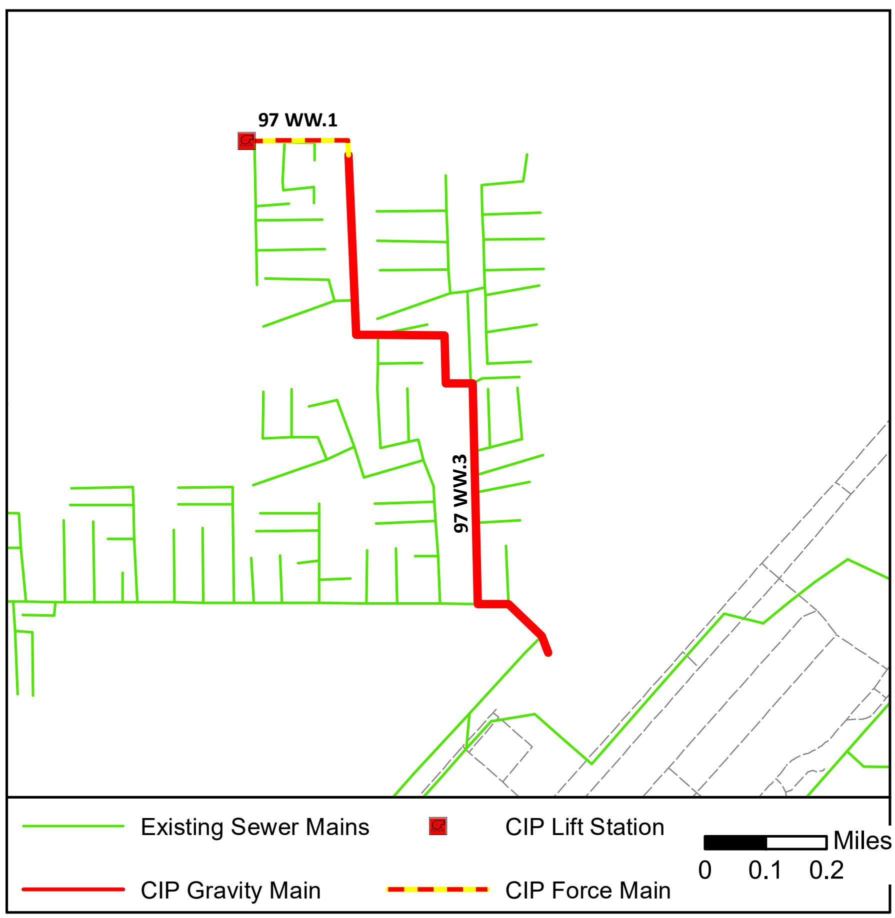
Project Details:

Project	Type	Capacity / Size	Length	Construction Cost	Project Cost
97 WW.1	Lift Station	1	1	$1,800,000	$2,340,000
97 WW.2	Force Main	8	1,010	$283,000	$396,000
97 WW.3	Gravity Main	16	2,650	$1,526,000	$2,136,000

IIP Information:

IIP Service Area: A	% Fees (Growth): 100%	% Rates: 0%





City of Prescott 2023 Water and Wastewater Models
Printing Date: October 23, 2023
File Path: M:\Client\Prescott\200600\Model\Wastewater\WW Models 02092023\WW 97 CIP.mxd

Project Number: **98 WW** **Planning Period:** FY 2027

CoP Project Name: Skyline Sewer Realignment

Description: 98 WW Skyline Sewer Realignment. Unit cost doubled due to small project length and difficult excavation.

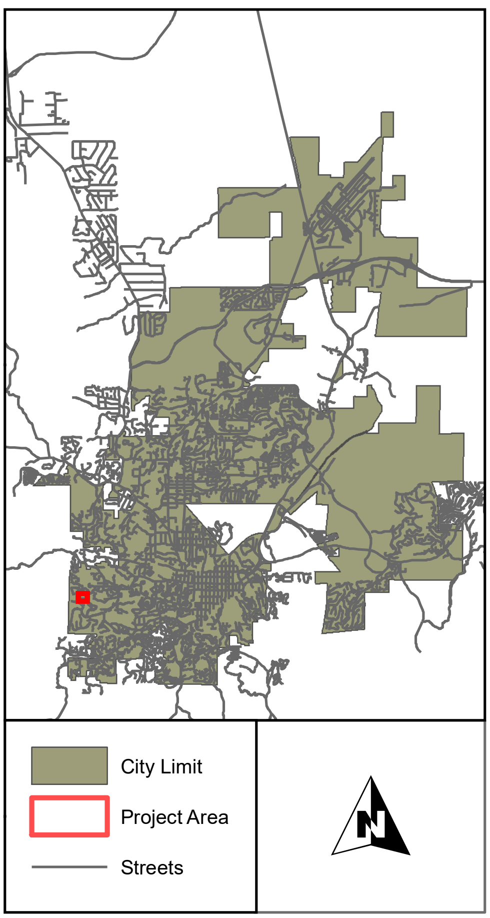
Justification: Abandon Skyline Lift Station

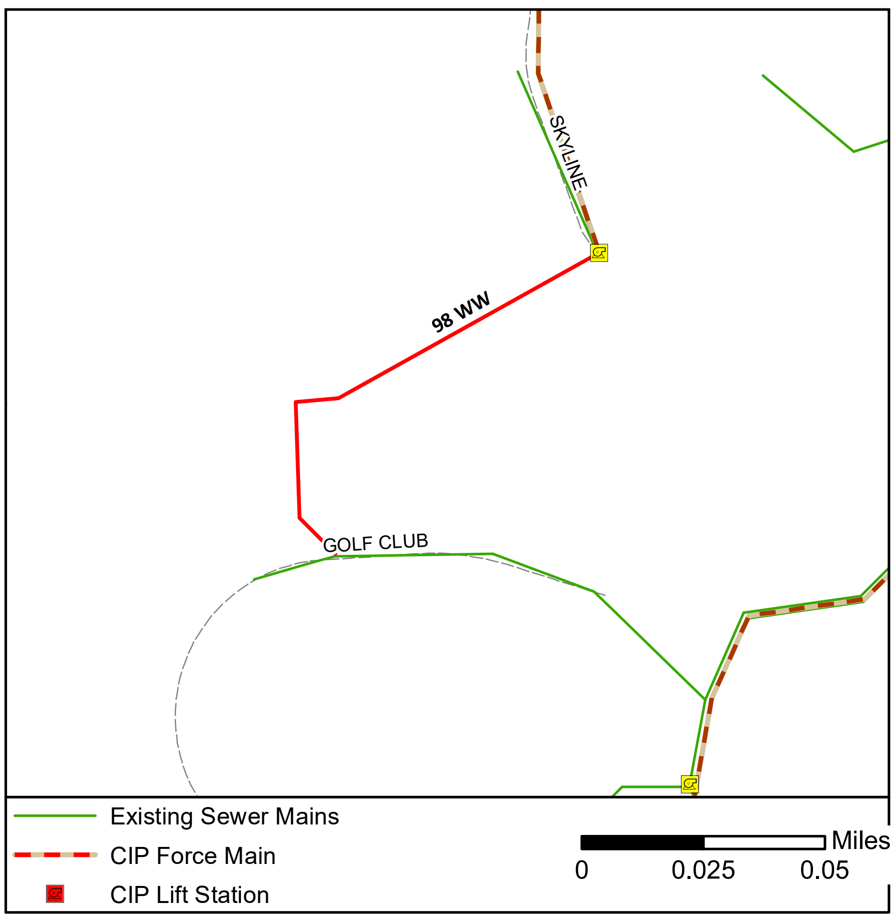
Project Details:

Project	Type	Capacity / Size	Length	Construction Cost	Project Cost
98 WW	Gravity Main	8	250	$150,000	$210,000

IIP Information:

IIP Service Area: A	% Fees (Growth): 0%	% Rates: 100%





Project Number: **99 WW**

Planning Period: FY 2023

CoP Project Name: Loma Rica Lift Station Abandonment

Description: 99 WW Loma Rica Lift Station Abandonment. Unit costs increased by 20% due to difficult excavation.

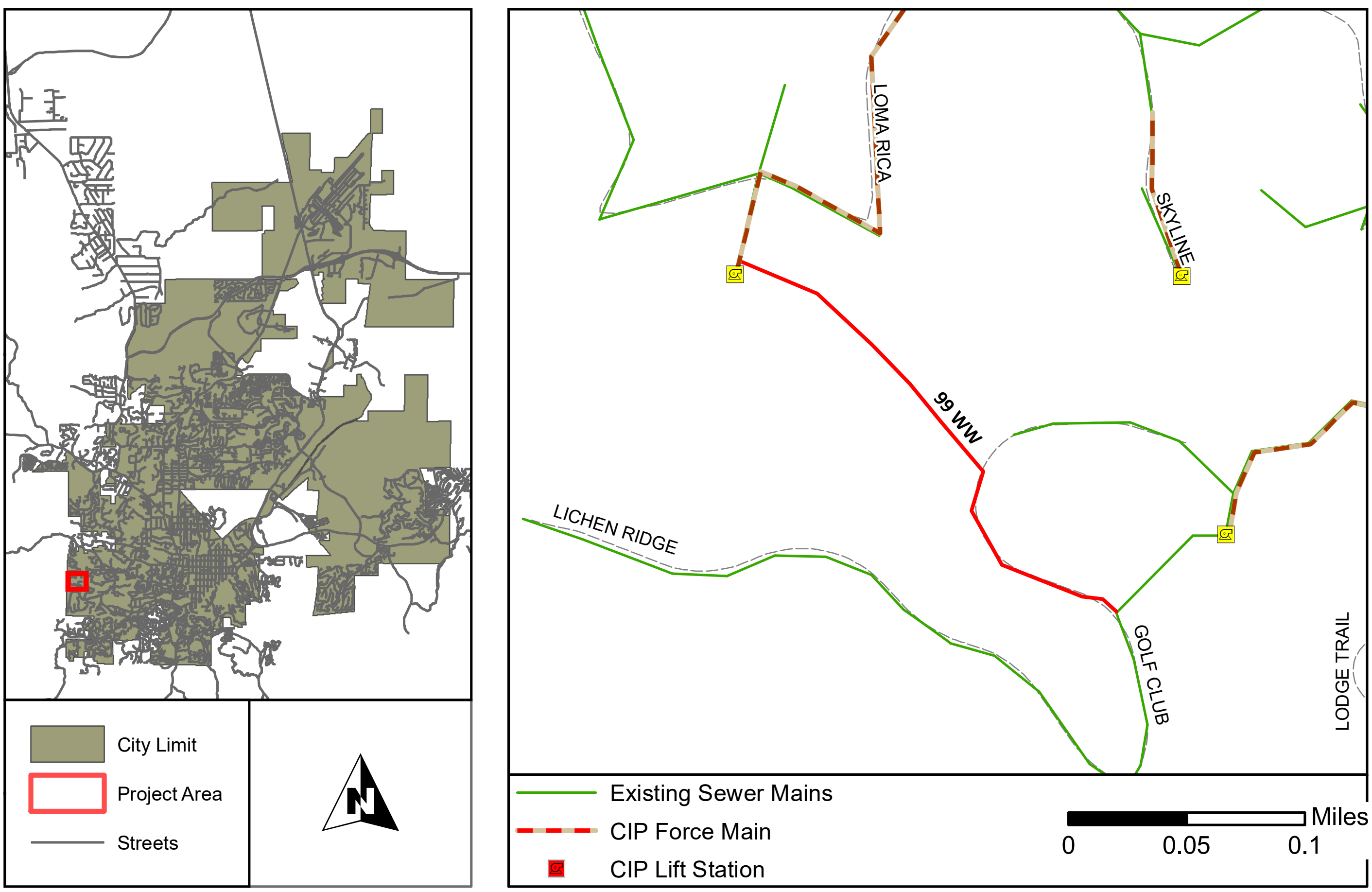
Justification: Abandon Loma Rica Lift Station

Project Details:

Project	Type	Capacity / Size	Length	Construction Cost	Project Cost
99 WW	Gravity Main	8	1,269	$457,000	$640,000

IIP Information:

IIP Service Area: A	% Fees (Growth): 0%	% Rates: 100%



Project Number: **100 WW** **Planning Period:** FY 2027

CoP Project Name: Prescott Lakes Parkway Lift Station

Description: 100 WW Prescott Lakes Parkway Lift Station

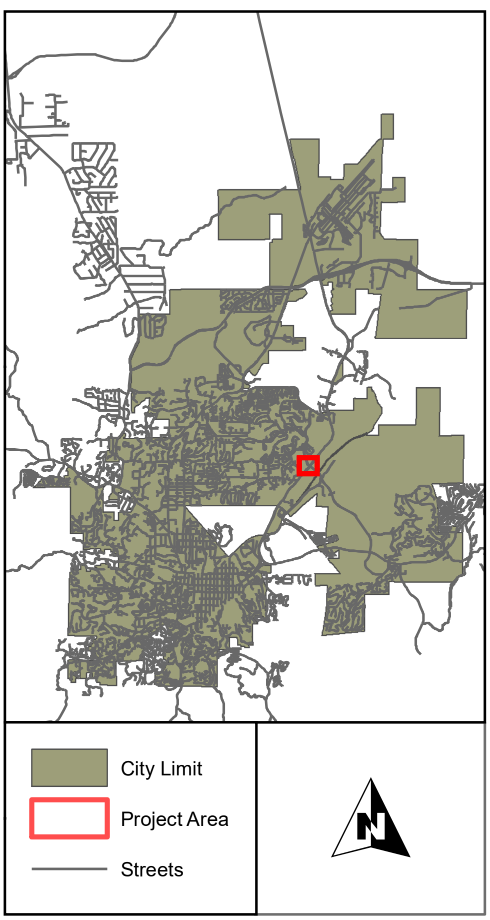
Justification: Convey flows from future developments to collection system. Force main already constructed.

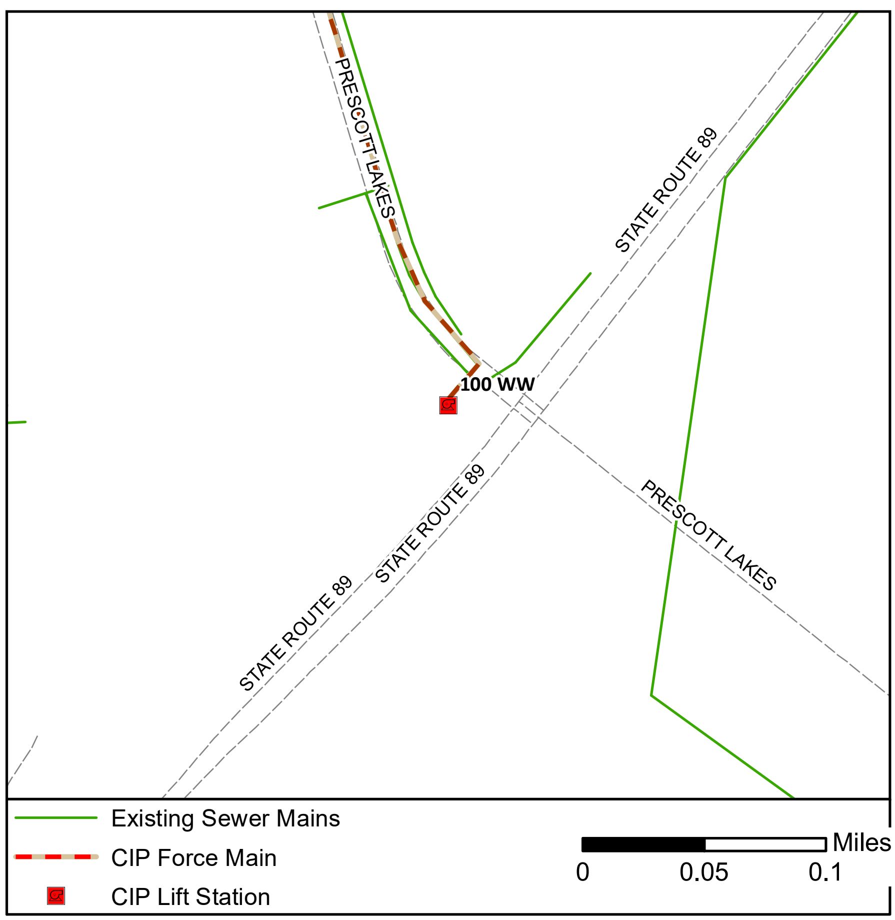
Project Details:

Project	Type	Capacity / Size	Length	Construction Cost	Project Cost
100 WW	Lift Station	0.2	1	$974,000	$1,364,000

IIP Information:

IIP Service Area: A	% Fees (Growth): 100%	% Rates: 0%





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Printing Date: October 23, 2023

File Path: M:\Client\Prescott\200600\Model\Wastewater\WW Models 02092023\WW 100 CIP.mxd

Project Number: **101 WW** **Planning Period:** FY 2027

CoP Project Name: Timber Ridge #1 Lift Station Rehab

Description: 101 WW Timber Ridge #1 Lift Station Rehabilitation
101 WW Timber Ridge #1 Lift Station Rehabilitation - Force Main

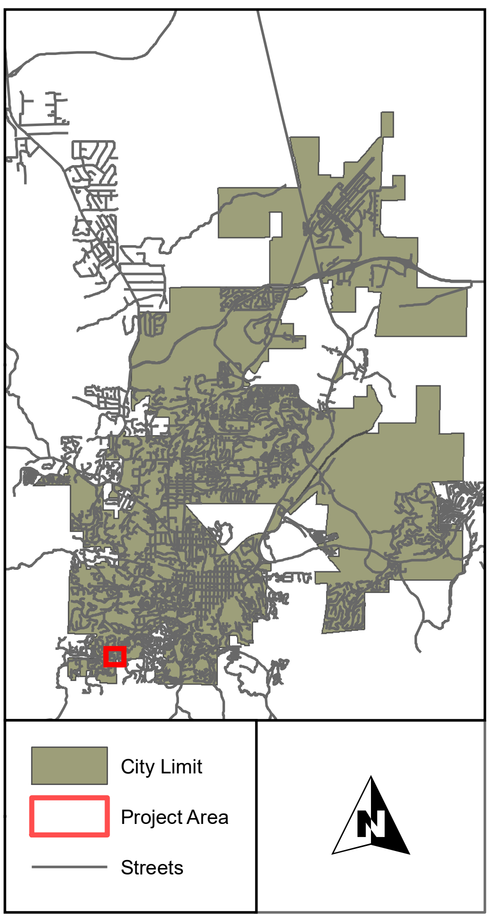
Justification: Lift station rehabilitation.

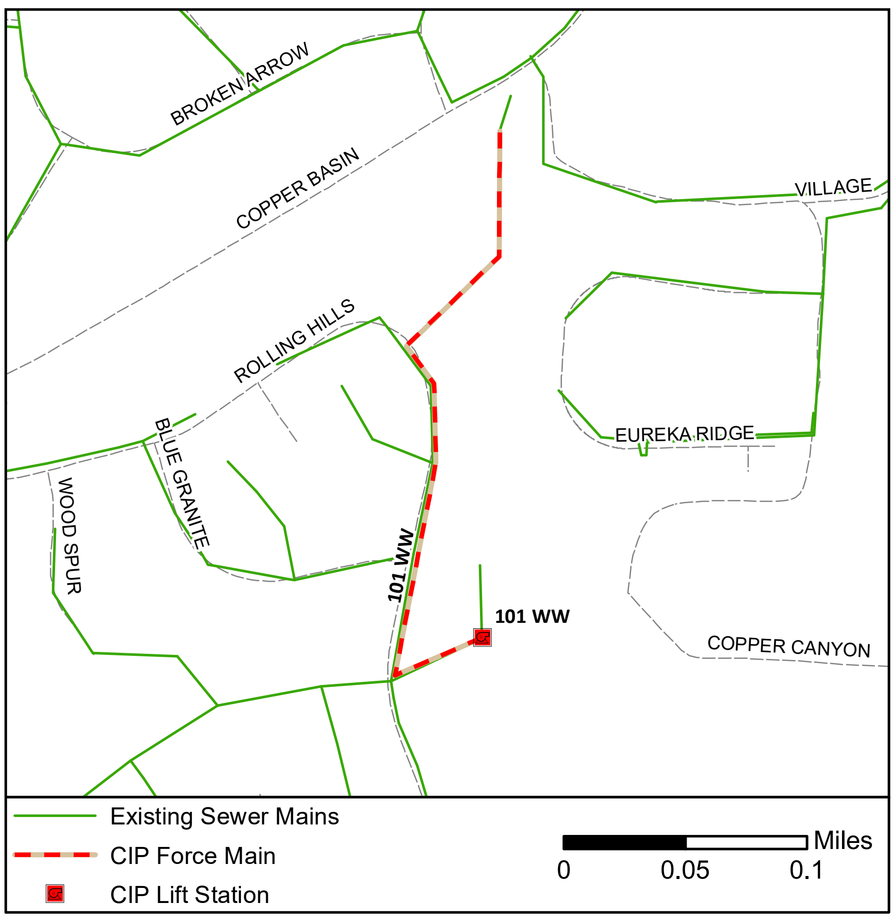
Project Details:

Project	Type	Capacity / Size	Length	Construction Cost	Project Cost
101 WW	Lift Station	1	1	$1,800,000	$2,340,000
101 WW	Force Main	8	1,469	$412,000	$577,000

IIP Information:

IIP Service Area: A	% Fees (Growth): 0%	% Rates: 100%





Project Number: **102 WW** **Planning Period:** FY 2037

CoP Project Name: Deep Well Ranch Trunkline and Lift Station

Description: 102 WW.1 - Deep Well Ranch Trunkline
102 WW.2 - Deep Well Ranch Lift Station
102 WW.3 - Deep Well Ranch Force Main

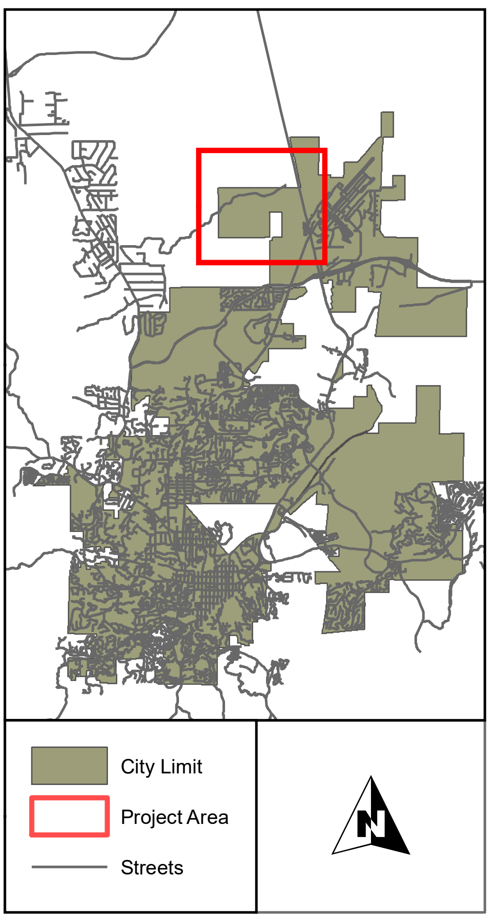
Justification: Convey flows from future developments to collection system.

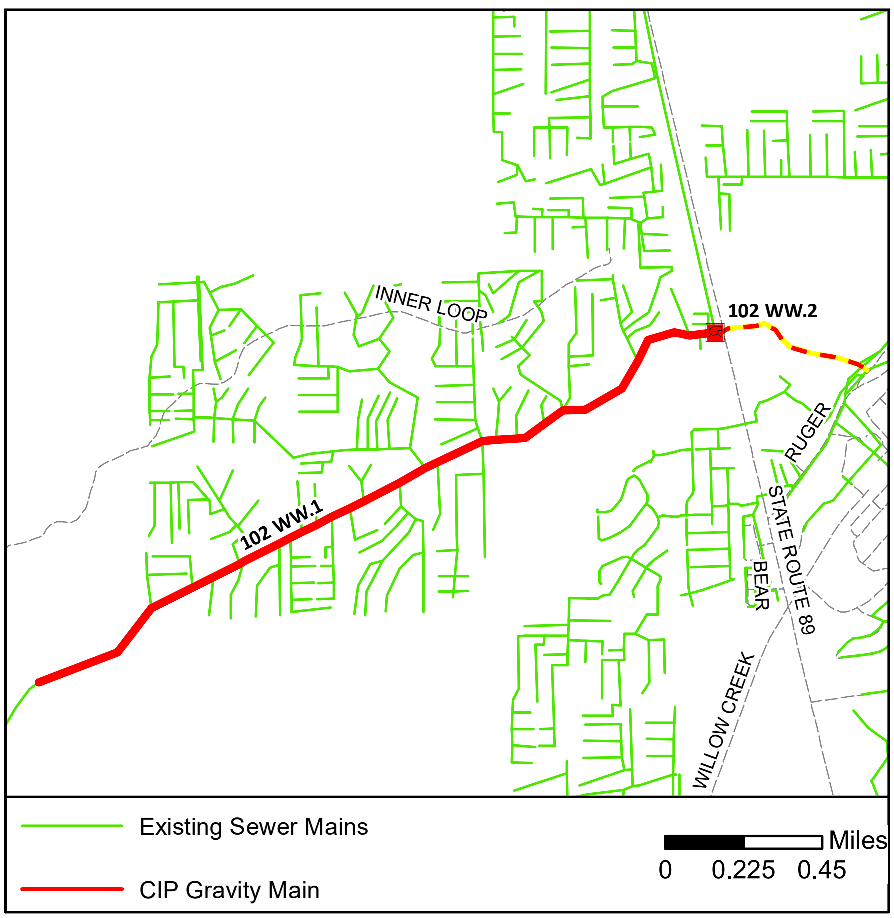
Project Details:

Project	Type	Capacity / Size	Length	Construction Cost	Project Cost
102 WW.1	Gravity Main	12	11,991	$5,110,000	$7,154,000
102 WW.2	Lift Station	1	1	$1,800,000	$2,340,000
102 WW.3	Force Main	8	2,660	$745,000	$1,043,000

IIP Information:

IIP Service Area: A	% Fees (Growth): 100%	% Rates: 0%





City of Prescott 2023 Water and Wastewater Models

Printing Date: November 08, 2023
File Path: M:\Client\Prescott\200600\Model\Wastewater\WW Models 02092023\WW 102 CIP.mxd

Project Number: **103 WW** **Planning Period:** FY 2027

CoP Project Name: Storm Ranch Trunkline and Force Main

Description: 103 WW.1 - Storm Ranch Trunkline
103 WW.2 - Storm Ranch Force Main
Lift station to be paid for by developer.

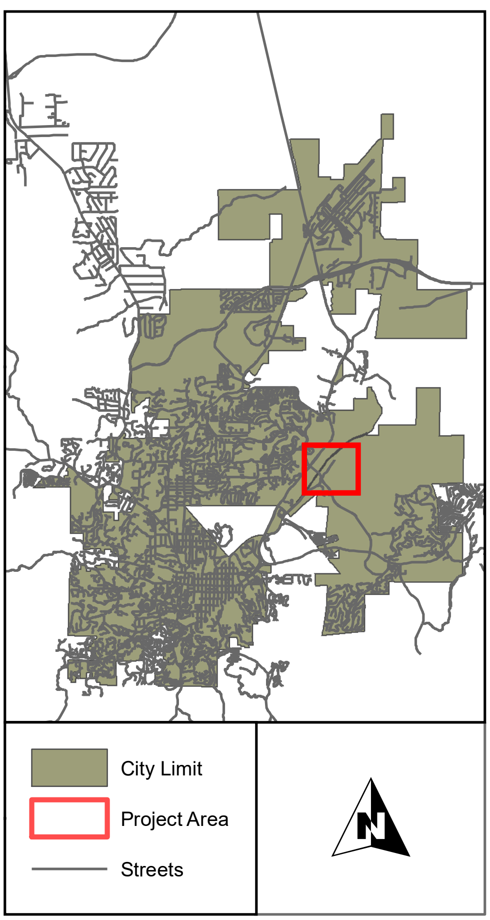
Justification: Convey flows from future developments to collection system.
103 WW.1 - City is responsible for paying the difference over 8 inch . Cost estimated as the difference between a 8 and 12-inch sewer main.
103 WW.2 - City is responsible for anything larger than minimum size required. Cost estimated as difference between a 4 and 6-inch force main.

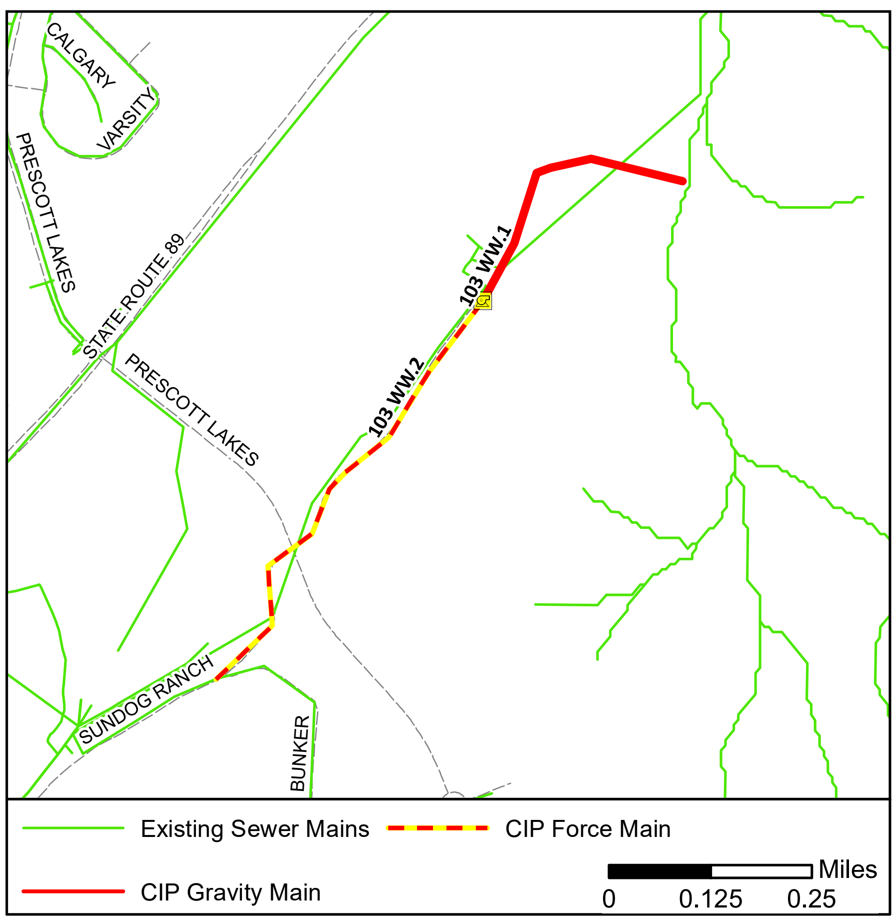
Project Details:

Project	Type	Capacity / Size	Length	Construction Cost	Project Cost
103 WW.1	Gravity Main	12	1,700	$214,000	$300,000
103 WW.2	Force Main	6	2,900	$83,000	$116,000

IIP Information:

IIP Service Area: A	% Fees (Growth): 100%	% Rates: 0%





Appendix 6B

WASTEWATER UNIT COST DETAIL

PROJECT :	Prescott Comprehensive Utility Master Plan	LOCATION FACTOR:	1.00
JOB # :	200600	DATE :	July-22
CLIENT :	City of Prescott	ENR :	13168
ELEMENT :	8" PVC Gravity Main	BY :	JSH

	ITEM NO. (Carollo Code)	DESCRIPTION	QUAN	UNIT	MATERIAL & LABOR	SUB	UNIT COST	SUBTOTAL	TOTAL
PIPE	1526511003	8" SDR-26 PVC SEWER PIPE, IN TRENCH	1	LF	$ 58.57	$0.00	$ 58.57	$ 58.57	
		TOTAL PIPING (per LF)							**$ 58.57**
EXCAV		EARTHWORK							
& BACKFILL	0230025040	Cat 225 Trackhoe, 1-1/2CY Bucket, Class C (Har	0.68	CY	$ 4.11	$0.00	$ 4.11	$ 2.80	
	0230025005	Hand Excavation, Class B Material to 5' Depth	0.02	CY	$ 105.08	$0.00	$ 105.08	$ 2.22	
	0226023007	8' D X 2' W Trench and Manhole Boxes	0.01	Day	$ 28.00	$0.00	$ 28.00	$ 0.28	
	0230025062	Imported Pipe Bed & Zone/Confined Structure Ba	0.32	CY	$ 58.79	$0.00	$ 58.79	$ 18.78	
	0230025070	Native Trench Backfill/Unconfined Struct. BF, Cla	0.33	CY	$ 13.38	$0.00	$ 13.38	$ 4.47	
	0230025073	Controlled Density Fill (CDF)	0.04	CY	$ 90.00	$0.00	$ 90.00	$ 3.34	
		10% Site Specific Requirements	1.00	LS	$ 2.86	$0.00	$ 2.86		
	0230027014	20 CY Dump Truck, 20 Miles/Round Trip	1.82	CY	$ 7.15	$0.00	$ 7.15		
		TOTAL EARTHWORK (per LF)							**$ 31.89**
PAVING	0222011001	ASPHALT PAVEMENT CUTTING	8.0	inFT	$ 0.64	$0.00	$ 0.64	$ 5.12	
DEMO &	0222011005	REMOVE 4"-6" ASPHALT PAVEMENT	0.6	SY	$ 0.68	$0.11	$ 0.79	$ 0.45	
REPLACEMENT	0274243021	4" AC PAVING ON 8" ABC	0.6	SY	$ 54.80	$4.38	$ 59.18	$ 33.98	
		TOTAL PAVING (per LF)							**$ 39.55**
MANHOLES	0258011003	48" X 8' Deep Precast Manhole, No Ring, Cover,	4	EA	$ 3,445.82	$0.00	$3,445.82	$13,783.27	
	0258013064	24" Dia. X 400 LB Heavy Traffic Manhole Frame	4	EA	$ 459.24	$0.00	$459.24	$ 1,837	
	0258013073	Concrete Manhole Invert, Single Channel	4	EA	$ 387.26	$0.00	$387.26	$ 1,549	
		TOTAL (per 1/4 Mile)						$ 17,169	
		TOTAL MANHOLES (per LF)							**$ 13.01**
		OVERHEAD (10%)							**$ 14.30**
		CONSTRUCTION PROFIT (6%)							**$ 8.58**
		SALES TAX (65% of above costs at 8.35%)							**$ 7.76**
		CONTINGENCY (30%)							**$42.91**
		GENERAL CONDITIONS (10%)							**$14.30**
		VOLATILE MARKET ADJUSTMENT (30%)							**$69.26**
		CONSTRUCTION COST, LF							**$ 300.14**
		PROJECT COST, LF (140%)							**$ 420.20**

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PROJECT :	**Prescott Comprehensive Utility Master Plan**		**LOCATION FACTOR:**	**1.00**
JOB # :	**200600**		**DATE :**	July-22
CLIENT :	**City of Prescott**		**ENR :**	**13168**
ELEMENT :	**10" PVC Gravity Main**		**BY :**	JSH

	ITEM NO. (Carollo Code)	DESCRIPTION	QUAN	UNIT	MATERIAL & LABOR	SUB	UNIT COST	SUBTOTAL	TOTAL
PIPE	1526511004	10" SDR-26 PVC SEWER PIPE, IN TRENCH	1	LF	$ 74.15	$0.00	$ 74.15	$ 74.15	
		TOTAL PIPING (per LF)							**$ 74.15**
EXCAV		EARTHWORK							
& BACKFILL	0230025040	Cat 225 Trackhoe, 1-1/2CY Bucket, Class C (Har	1.01	CY	$ 4.11	$0.00	$ 4.11	$ 4.13	
	0230025005	Hand Excavation, Class B Material to 5' Depth	0.03	CY	$ 105.08	$0.00	$ 105.08	$ 3.27	
	0226023007	8' D X 2' W Trench and Manhole Boxes	0.01	Day	$ 28.00	$0.00	$ 28.00	$ 0.28	
	0230025062	Imported Pipe Bed & Zone/Confined Structure Ba	0.39	CY	$ 58.79	$0.00	$ 58.79	$ 22.95	
	0230025070	Native Trench Backfill/Unconfined Struct. BF, Cla	0.56	CY	$ 13.38	$0.00	$ 13.38	$ 7.54	
	0230025073	Controlled Density Fill (CDF)	0.06	CY	$ 90.00	$0.00	$ 90.00	$ 5.64	
		10% Site Specific Requirements	1.00	LS	$ 3.82	$0.00	$ 3.82		
	0230027014	20 CY Dump Truck, 20 Miles/Round Trip	2.59	CY	$ 7.15	$0.00	$ 7.15		
		TOTAL EARTHWORK (per LF)							**$ 43.81**
PAVING	0222011001	ASPHALT PAVEMENT CUTTING	8.0	inFT	$ 0.64	$0.00	$ 0.64	$ 5.12	
DEMO &	0222011005	REMOVE 4"-6" ASPHALT PAVEMENT	0.6	SY	$ 0.68	$0.11	$ 0.79	$ 0.48	
REPLACEMENT	0274243021	4" AC PAVING ON 8" ABC	0.6	SY	$ 54.80	$4.38	$ 59.18	$ 36.17	
		TOTAL PAVING (per LF)							**$ 41.77**
MANHOLES	0258011003	48" X 8' Deep Precast Manhole, No Ring, Cover,	4	EA	$ 3,445.82	$0.00	$3,445.82	$13,783.27	
	0258013064	24" Dia. X 400 LB Heavy Traffic Manhole Frame	4	EA	$ 459.24	$0.00	$459.24	$ 1,837	
	0258013073	Concrete Manhole Invert, Single Channel	4	EA	$ 387.26	$0.00	$387.26	$ 1,549	
		TOTAL (per 1/4 Mile)						$ 17,169	
		TOTAL MANHOLES (per LF)							**$ 13.01**
		OVERHEAD (10%)							**$ 17.27**
		CONSTRUCTION PROFIT (6%)							**$ 10.36**
		SALES TAX (65% of above costs at 8.35%)							**$ 9.38**
		CONTINGENCY (30%)							**$51.82**
		GENERAL CONDITIONS (10%)							**$17.27**
		VOLATILE MARKET ADJUSTMENT (30%)							**$83.65**
		CONSTRUCTION COST, LF							**$ 362.49**
		PROJECT COST, LF (140%)							**$ 507.49**

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PROJECT :	**Prescott Comprehensive Utility Master Plan**	**LOCATION FACTOR:**	**1.00**
JOB # :	**200600**	**DATE :**	July-22
CLIENT :	**City of Prescott**	**ENR :**	**13168**
ELEMENT :	**12" PVC Gravity Main**	**BY :**	JSH

	ITEM NO. (Carollo Code)	DESCRIPTION	QUAN	UNIT	MATERIAL & LABOR	SUB	UNIT COST	SUBTOTAL	TOTAL
PIPE	1526511005	12" SDR-26 PVC SEWER PIPE, IN TRENCH	1	LF	$ 96.72	$0.00	$ 96.72	$ 96.72	
		TOTAL PIPING (per LF)							**$ 96.72**
EXCAV		EARTHWORK							
& BACKFILL	0230025040	Cat 225 Trackhoe, 1-1/2CY Bucket, Class C (Hard	1.10	CY	$ 4.11	$0.00	$ 4.11	$ 4.53	
	0230025005	Hand Excavation, Class B Material to 5' Depth	0.03	CY	$ 105.08	$0.00	$ 105.08	$ 3.58	
	0226023007	8' D X 2' W Trench and Manhole Boxes	0.01	Day	$ 28.00	$0.00	$ 28.00	$ 0.28	
	0230025062	Imported Pipe Bed & Zone/Confined Structure Bacl	0.47	CY	$ 58.79	$0.00	$ 58.79	$ 27.50	
	0230025070	Native Trench Backfill/Unconfined Struct. BF, Class	0.58	CY	$ 13.38	$0.00	$ 13.38	$ 7.69	
	0230025073	Controlled Density Fill (CDF)	0.06	CY	$ 90.00	$0.00	$ 90.00	$ 5.75	
		10% Site Specific Requirements	1.00	LS	$ 4.36	$0.00	$ 4.36		
	0230027014	20 CY Dump Truck, 20 Miles/Round Trip	2.83	CY	$ 7.15	$0.00	$ 7.15		
		TOTAL EARTHWORK (per LF)							**$ 49.33**
PAVING	0222011001	ASPHALT PAVEMENT CUTTING	8.0	inFT	$ 0.64	$0.00	$ 0.64	$ 5.12	
DEMO &	0222011005	REMOVE 4"-6" ASPHALT PAVEMENT	0.6	SY	$ 0.68	$0.11	$ 0.79	$ 0.51	
REPLACEMENT	0274243021	4" AC PAVING ON 8" ABC	0.6	SY	$ 54.80	$4.38	$ 59.18	$ 38.36	
		TOTAL PAVING (per LF)							**$ 43.99**
MANHOLES	0258011003	48" X 8' Deep Precast Manhole, No Ring, Cover, E	4	EA	$ 3,445.82	$0.00	$3,445.82	$13,783.27	
	0258013064	24" Dia. X 400 LB Heavy Traffic Manhole Frame &	4	EA	$ 459.24	$0.00	$459.24	$ 1,837	
	0258013073	Concrete Manhole Invert, Single Channel	4	EA	$ 387.26	$0.00	$387.26	$ 1,549	
		TOTAL (per 1/4 Mile)						$ 17,169	
		TOTAL MANHOLES (per LF)							**$ 13.01**
		OVERHEAD (10%)							**$ 20.31**
		CONSTRUCTION PROFIT (6%)							**$ 12.18**
		SALES TAX (65% of above costs at 8.35%)							**$ 11.02**
		CONTINGENCY (30%)							**$60.92**
		GENERAL CONDITIONS (10%)							**$20.31**
		VOLATILE MARKET ADJUSTMENT (30%)							**$98.33**
		CONSTRUCTION COST, LF							**$ 426.11**
		PROJECT COST, LF (140%)							**$ 596.56**

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PROJECT :	**Prescott Comprehensive Utility Master Plan**	**LOCATION FACTOR:**	**1.00**
JOB # :	**200600**	**DATE :**	July-22
CLIENT :	**City of Prescott**	**ENR :**	**13168**
ELEMENT :	**15" PVC Gravity Main**	**BY :**	JSH

	ITEM NO. (Carollo Code)	DESCRIPTION	QUAN	UNIT	MATERIAL & LABOR	SUB	UNIT COST	SUBTOTAL	TOTAL
PIPE	1526511018	15" SDR-35 PVC SEWER PIPE, IN TRENCH	1	LF	$ 117.65	$0.00	$ 117.65	$ 117.65	
		TOTAL PIPING (per LF)							**$ 117.65**
EXCAV		EARTHWORK							
& BACKFILL	0230025040	Cat 225 Trackhoe, 1-1/2CY Bucket, Class C (Har	1.56	CY	$ 4.11	$0.00	$ 4.11	$ 6.40	
	0230025005	Hand Excavation, Class B Material to 5' Depth	0.05	CY	$ 105.08	$0.00	$ 105.08	$ 5.06	
	0226023007	8' D X 2' W Trench and Manhole Boxes	0.01	Day	$ 28.00	$0.00	$ 28.00	$ 0.28	
	0230025062	Imported Pipe Bed & Zone/Confined Structure Ba	0.60	CY	$ 58.79	$0.00	$ 58.79	$ 35.07	
	0230025070	Native Trench Backfill/Unconfined Struct. BF, Cla	0.87	CY	$ 13.38	$0.00	$ 13.38	$ 11.59	
	0230025073	Controlled Density Fill (CDF)	0.10	CY	$ 90.00	$0.00	$ 90.00	$ 8.67	
		10% Site Specific Requirements	1.00	LS	$ 5.84	$0.00	$ 5.84		
	0230027014	20 CY Dump Truck, 20 Miles/Round Trip	3.92	CY	$ 7.15	$0.00	$ 7.15		
		TOTAL EARTHWORK (per LF)							**$ 67.07**
PAVING	0222011001	ASPHALT PAVEMENT CUTTING	8.0	inFT	$ 0.64	$0.00	$ 0.64	$ 5.12	
DEMO &	0222011005	REMOVE 4"-6" ASPHALT PAVEMENT	0.7	SY	$ 0.68	$0.11	$ 0.79	$ 0.55	
REPLACEMENT	0274243021	4" AC PAVING ON 8" ABC	0.7	SY	$ 54.80	$4.38	$ 59.18	$ 41.65	
		TOTAL PAVING (per LF)							**$ 47.32**
MANHOLES	0258011007	60" X 8' Deep Precast Manhole, No Ring, Cover,	4	EA	$ 5,019.36	$0.00	$5,019.36	$20,077.45	
	0258013064	24" Dia. X 400 LB Heavy Traffic Manhole Frame	4	EA	$ 459.24	$0.00	$459.24	$ 1,837	
	0258013073	Concrete Manhole Invert, Single Channel	4	EA	$ 387.26	$0.00	$387.26	$ 1,549	
		TOTAL (per 1/4 Mile)						$ 23,463	
		TOTAL MANHOLES (per LF)							**$ 17.78**
		OVERHEAD (10%)							**$ 24.98**
		CONSTRUCTION PROFIT (6%)							**$ 14.99**
		SALES TAX (65% of above costs at 8.35%)							**$ 13.56**
		CONTINGENCY (30%)							**$74.94**
		GENERAL CONDITIONS (10%)							**$24.98**
		VOLATILE MARKET ADJUSTMENT (30%)							**$120.98**
		CONSTRUCTION COST, LF							**$ 524.25**
		PROJECT COST, LF (140%)							**$ 733.95**

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PROJECT :	Prescott Comprehensive Utility Master Plan	LOCATION FACTOR:	1.00
JOB # :	200600	DATE :	July-22
CLIENT :	City of Prescott	ENR :	13168
ELEMENT :	18" PVC Gravity Main	BY :	JSH

	ITEM NO. (Carollo Code)	DESCRIPTION	QUAN	UNIT	MATERIAL & LABOR	SUB	UNIT COST	SUBTOTAL	TOTAL
PIPE	1526511007	18" SDR-26 PVC SEWER PIPE, IN TRENCH	1	LF	$ 150.58	$0.00	$ 150.58	$ 150.58	
		TOTAL PIPING (per LF)							**$ 150.58**
EXCAV		EARTHWORK							
& BACKFILL	0230025040	Cat 225 Trackhoe, 1-1/2CY Bucket, Class C (Har	2.19	CY	$ 4.11	$0.00	$ 4.11	$ 9.00	
	0230025005	Hand Excavation, Class B Material to 5' Depth	0.07	CY	$ 105.08	$0.00	$ 105.08	$ 7.12	
	0226023007	8' D X 2' W Trench and Manhole Boxes	0.01	Day	$ 28.00	$0.00	$ 28.00	$ 0.28	
	0230025062	Imported Pipe Bed & Zone/Confined Structure Ba	0.78	CY	$ 58.79	$0.00	$ 58.79	$ 45.96	
	0230025070	Native Trench Backfill/Unconfined Struct. BF, Cla	1.27	CY	$ 13.38	$0.00	$ 13.38	$ 17.00	
	0230025073	Controlled Density Fill (CDF)	0.14	CY	$ 90.00	$0.00	$ 90.00	$ 12.71	
		10% Site Specific Requirements	1.00	LS	$ 7.94	$0.00	$ 7.94		
	0230027014	20 CY Dump Truck, 20 Miles/Round Trip	5.44	CY	$ 7.15	$0.00	$ 7.15		
		TOTAL EARTHWORK (per LF)							**$ 92.08**
PAVING	0222011001	ASPHALT PAVEMENT CUTTING	8.0	inFT	$ 0.64	$0.00	$ 0.64	$ 5.12	
DEMO &	0222011005	REMOVE 4"-6" ASPHALT PAVEMENT	0.8	SY	$ 0.68	$0.11	$ 0.79	$ 0.62	
REPLACEMENT	0274243021	4" AC PAVING ON 8" ABC	0.8	SY	$ 54.80	$4.38	$ 59.18	$ 46.58	
		TOTAL PAVING (per LF)							**$ 52.32**
MANHOLES	0258011007	60" X 8' Deep Precast Manhole, No Ring, Cover,	4	EA	$ 5,019.36	$0.00	$5,019.36	$20,077.45	
	0258013064	24" Dia. X 400 LB Heavy Traffic Manhole Frame	4	EA	$ 459.24	$0.00	$459.24	$ 1,837	
	0258013073	Concrete Manhole Invert, Single Channel	4	EA	$ 387.26	$0.00	$387.26	$ 1,549	
		TOTAL (per 1/4 Mile)						$ 23,463	
		TOTAL MANHOLES (per LF)							**$ 17.78**
		OVERHEAD (10%)							**$ 31.28**
		CONSTRUCTION PROFIT (6%)							**$ 18.77**
		SALES TAX (65% of above costs at 8.35%)							**$ 16.97**
		CONTINGENCY (30%)							**$93.83**
		GENERAL CONDITIONS (10%)							**$31.28**
		VOLATILE MARKET ADJUSTMENT (30%)							**$151.46**
		CONSTRUCTION COST, LF							**$ 656.33**
		PROJECT COST, LF (140%)							**$ 918.86**

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PROJECT :	Prescott Comprehensive Utility Master Plan	LOCATION FACTOR:	1.00
JOB # :	200600	DATE :	July-22
CLIENT :	City of Prescott	ENR :	13168
ELEMENT :	24" PVC Gravity Main	BY :	JSH

	ITEM NO. (Carollo Code)	DESCRIPTION	QUAN	UNIT	MATERIAL & LABOR	SUB	UNIT COST	SUBTOTAL	TOTAL
PIPE	1526511009	24" SDR-26 PVC SEWER PIPE, IN TRENCH	1	LF	$ 226.15	$0.00	$ 226.15	$ 226.15	
		TOTAL PIPING (per LF)							**$ 226.15**
EXCAV		EARTHWORK							
& BACKFILL	0230025040	Cat 225 Trackhoe, 1-1/2CY Bucket, Class C (Har	3.50	CY	$ 4.11	$0.00	$ 4.11	$ 14.37	
	0230025005	Hand Excavation, Class B Material to 5' Depth	0.11	CY	$ 105.08	$0.00	$ 105.08	$ 11.36	
	0226023007	8' D X 2' W Trench and Manhole Boxes	0.01	Day	$ 28.00	$0.00	$ 28.00	$ 0.28	
	0230025062	Imported Pipe Bed & Zone/Confined Structure Ba	1.12	CY	$ 58.79	$0.00	$ 58.79	$ 66.01	
	0230025070	Native Trench Backfill/Unconfined Struct. BF, Cla	2.13	CY	$ 13.38	$0.00	$ 13.38	$ 28.49	
	0230025073	Controlled Density Fill (CDF)	0.24	CY	$ 90.00	$0.00	$ 90.00	$ 21.29	
		10% Site Specific Requirements	1.00	LS	$ 6.61	$0.00	$ 6.61		
	0230027014	20 CY Dump Truck, 20 Miles/Round Trip	8.53	CY	$ 7.15	$0.00	$ 7.15		
		TOTAL EARTHWORK (per LF)							**$ 141.80**
PAVING	0222011001	ASPHALT PAVEMENT CUTTING	8.0	inFT	$ 0.64	$0.00	$ 0.64	$ 5.12	
DEMO &	0222011005	REMOVE 4"-6" ASPHALT PAVEMENT	0.9	SY	$ 0.68	$0.11	$ 0.79	$ 0.71	
REPLACEMENT	0274243021	4" AC PAVING ON 8" ABC	0.9	SY	$ 54.80	$4.38	$ 59.18	$ 53.16	
		TOTAL PAVING (per LF)							**$ 58.98**
MANHOLES	0258011007	60" X 8' Deep Precast Manhole, No Ring, Cover,	4	EA	$ 5,019.36	$0.00	$5,019.36	$20,077.45	
	0258013064	24" Dia. X 400 LB Heavy Traffic Manhole Frame	4	EA	$ 459.24	$0.00	$459.24	$ 1,837	
	0258013073	Concrete Manhole Invert, Single Channel	4	EA	$ 387.26	$0.00	$387.26	$ 1,549	
		TOTAL (per 1/4 Mile)						$ 23,463	
		TOTAL MANHOLES (per LF)							**$ 17.78**
		OVERHEAD (10%)							**$ 44.47**
		CONSTRUCTION PROFIT (6%)							**$ 26.68**
		SALES TAX (65% of above costs at 8.35%)							**$ 24.14**
		CONTINGENCY (30%)							**$133.41**
		GENERAL CONDITIONS (10%)							**$44.47**
		VOLATILE MARKET ADJUSTMENT (30%)							**$215.37**
		CONSTRUCTION COST, LF							**$ 933.26**
		PROJECT COST, LF (%)							**$ 1,306.56**

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PROJECT :	**Prescott Comprehensive Utility Master Plan**	**LOCATION FACTOR:**	**1.00**
JOB # :	**200600**	**DATE :**	July-22
CLIENT :	**City of Prescott**	**ENR :**	**13168**
ELEMENT :	**30" VCP Gravity Main**	**BY :**	JSH

	ITEM NO. (Carollo Code)	DESCRIPTION	QUAN	UNIT	MATERIAL & LABOR	SUB	UNIT COST	SUBTOTAL	TOTAL
PIPE	1526411011	30" C-700 VCP IN OPEN TRENCH	1	LF	$ 112.63	$0.00	$ 112.63	$ 112.63	
		TOTAL PIPING (per LF)							**$ 112.63**
EXCAV		EARTHWORK							
& BACKFILL	0230025040	Cat 225 Trackhoe, 1-1/2CY Bucket, Class C (Har	4.50	CY	$ 4.11	$0.00	$ 4.11	$ 18.50	
	0230025005	Hand Excavation, Class B Material to 5' Depth	0.14	CY	$ 105.08	$0.00	$ 105.08	$ 14.63	
	0226023007	8' D X 2' W Trench and Manhole Boxes	0.01	Day	$ 28.00	$0.00	$ 28.00	$ 0.28	
	0230025062	Imported Pipe Bed & Zone/Confined Structure Ba	1.70	CY	$ 58.79	$0.00	$ 58.79	$ 100.18	
	0230025070	Native Trench Backfill/Unconfined Struct. BF, Cla	2.48	CY	$ 13.38	$0.00	$ 13.38	$ 33.19	
	0230025073	Controlled Density Fill (CDF)	0.28	CY	$ 90.00	$0.00	$ 90.00	$ 24.81	
		10% Site Specific Requirements	1.00	LS	$ 6.61	$0.00	$ 6.61		
	0230027014	20 CY Dump Truck, 20 Miles/Round Trip	10.96	CY	$ 7.15	$0.00	$ 7.15		
		TOTAL EARTHWORK (per LF)							**$ 191.58**
PAVING	0222011001	ASPHALT PAVEMENT CUTTING	8.0	inFT	$ 0.64	$0.00	$ 0.64	$ 5.12	
DEMO &	0222011005	REMOVE 4"-6" ASPHALT PAVEMENT	1.1	SY	$ 0.68	$0.11	$ 0.79	$ 0.86	
REPLACEMENT	0274243021	4" AC PAVING ON 8" ABC	1.1	SY	$ 54.80	$4.38	$ 59.18	$ 64.66	
		TOTAL PAVING (per LF)							**$ 70.64**
MANHOLES	0258011007	60" X 8' Deep Precast Manhole, No Ring, Cover,	4	EA	$ 5,385.28	$0.00	$5,385.28	$21,541.12	
	0258013064	24" Dia. X 400 LB Heavy Traffic Manhole Frame	4	EA	$ 459.24	$0.00	$459.24	$ 1,837	
	0258013073	Concrete Manhole Invert, Single Channel	4	EA	$ 387.26	$0.00	$387.26	$ 1,549	
		TOTAL (per 1/4 Mile)						$ 24,927	
		TOTAL MANHOLES (per LF)							**$ 18.88**
		OVERHEAD (10%)							**$ 39.37**
		CONSTRUCTION PROFIT (6%)							**$ 23.62**
		SALES TAX (65% of above costs at 8.35%)							**$ 21.37**
		CONTINGENCY (30%)							**$118.12**
		GENERAL CONDITIONS (10%)							**$39.37**
		VOLATILE MARKET ADJUSTMENT (30%)							**$190.68**
		CONSTRUCTION COST, LF							**$ 826.29**
		PROJECT COST, LF (%)							**$ 1,156.80**

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PROJECT :	Prescott Comprehensive Utility Master Plan	LOCATION FACTOR:	1.00
JOB # :	200600	DATE :	July-22
CLIENT :	City of Prescott	ENR :	13168
ELEMENT :	8" PVC Force Main	BY :	JSH

	ITEM NO. (Carollo Code)	DESCRIPTION	QUAN	UNIT	MATERIAL & LABOR	SUB	UNIT COST	SUBTOTAL	TOTAL
PIPE	1526521013	8" SCH 40 PVC PIPE IN A TRENCH	1	LF	$ 60.47	$0.00	$ 60.47	$ 60.47	
		TOTAL PIPING (per LF)							**$ 60.47**
EXCAV		EARTHWORK							
& BACKFILL	0230025040	Cat 225 Trackhoe, 1-1/2CY Bucket, Class C (Hard Digging), 0-16' D	0.68	CY	$ 4.11	$0.00	$ 4.11	$ 2.80	
	0230025005	Hand Excavation, Class B Material to 5' Depth	0.02	CY	$ 105.08	$0.00	$ 105.08	$ 2.22	
	0226023007	8' D X 2' W Trench and Manhole Boxes	0.01	Day	$ 28.00	$0.00	$ 28.00	$ 0.28	
	0230025062	Imported Pipe Bed & Zone/Confined Structure Backfill, Class B Material	0.32	CY	$ 58.79	$0.00	$ 58.79	$ 18.78	
	0230025070	Native Trench Backfill/Unconfined Struct. BF, Class A Material	0.33	CY	$ 13.38	$0.00	$ 13.38	$ 4.47	
	0230025073	Controlled Density Fill (CDF)	0.04	CY	$ 90.00	$0.00	$ 90.00	$ 3.34	
		10% Site Specific Requirements	1.00	LS	$ 2.86	$0.00	$ 2.86		
	0230027014	20 CY Dump Truck, 20 Miles/Round Trip	1.82	CY	$ 7.15	$0.00	$ 7.15		
		TOTAL EARTHWORK (per LF)							**$ 31.89**
PAVING	0222011001	ASPHALT PAVEMENT CUTTING	8.0	inFT	$ 0.64	$0.00	$ 0.64	$ 5.12	
DEMO &	0222011005	REMOVE 4"-6" ASPHALT PAVEMENT	0.6	SY	$ 0.68	$0.11	$ 0.79	$ 0.45	
REPLACEMENT	0274243021	4" AC PAVING ON 8" ABC	0.6	SY	$ 54.80	$4.38	$ 59.18	$ 33.98	
		TOTAL PAVING (per LF)							**$ 39.55**
FITTINGS	1525115103	8" 90° CLDI MJ BEND	2	EA	$ 1,063.98	$0.00	$1,063.98	$2,127.95	
& VALVES									
		TOTAL (per 1/4 Mile)						$ 2,128	
		TOTAL FITTING & VALVES (per LF)							**$ 1.61**
		OVERHEAD (10%)							**$ 13.35**
		CONSTRUCTION PROFIT (6%)							**$ 8.01**
		SALES TAX (65% of above costs at 8.35%)							**$ 7.25**
		CONTINGENCY (30%)							**$40.06**
		GENERAL CONDITIONS (10%)							**$13.35**
		VOLATILE MARKET ADJUSTMENT (30%)							**$64.67**
		CONSTRUCTION COST, LF							**$ 280.22**
		PROJECT COST, LF (140%)							**$ 392.30**

Carollo Engineers...Working Wonders With Water™

PROJECT :	**Prescott Comprehensive Utility Master Plan**	**LOCATION FACTOR:**	**1.00**
JOB # :	**200600**	**DATE :**	July-22
CLIENT :	**City of Prescott**	**ENR :**	**13168**
ELEMENT :	**10" PVC Force Main**	**BY :**	JSH

	ITEM NO. (Carollo Code)	DESCRIPTION	QUAN	UNIT	MATERIAL & LABOR	SUB	UNIT COST	SUBTOTAL	TOTAL
PIPE	1526521014	10" SCH 40 PVC PIPE IN A TRENCH	1	LF	$ 81.78	$0.00	$ 81.78	$ 81.78	
		TOTAL PIPING (per LF)							**$ 81.78**
EXCAV		EARTHWORK							
& BACKFILL	0230025040	Cat 225 Trackhoe, 1-1/2CY Bucket, Class C (Hard Digging), 0-16' D	1.01	CY	$ 4.11	$0.00	$ 4.11	$ 4.13	
	0230025005	Hand Excavation, Class B Material to 5' Depth	0.03	CY	$ 105.08	$0.00	$ 105.08	$ 3.27	
	0226023007	8' D X 2' W Trench and Manhole Boxes	0.01	Day	$ 28.00	$0.00	$ 28.00	$ 0.28	
	0230025062	Imported Pipe Bed & Zone/Confined Structure Backfill, Class B Material	0.39	CY	$ 58.79	$0.00	$ 58.79	$ 22.95	
	0230025070	Native Trench Backfill/Unconfined Struct. BF, Class A Material	0.56	CY	$ 13.38	$0.00	$ 13.38	$ 7.54	
	0230025073	Controlled Density Fill (CDF)	0.06	CY	$ 90.00	$0.00	$ 90.00	$ 5.64	
		10% Site Specific Requirements	1.00	LS	$ 3.82	$0.00	$ 3.82		
	0230027014	20 CY Dump Truck, 20 Miles/Round Trip	2.59	CY	$ 7.15	$0.00	$ 7.15		
		TOTAL EARTHWORK (per LF)							**$ 43.81**
PAVING	0222011001	ASPHALT PAVEMENT CUTTING	8.0	inFT	$ 0.64	$0.00	$ 0.64	$ 5.12	
DEMO &	0222011005	REMOVE 4"-6" ASPHALT PAVEMENT	0.6	SY	$ 0.68	$0.11	$ 0.79	$ 0.48	
REPLACEMENT	0274243021	4" AC PAVING ON 8" ABC	0.6	SY	$ 54.80	$4.38	$ 59.18	$ 36.17	
		TOTAL PAVING (per LF)							**$ 41.77**
FITTINGS	1525115103	8" 90° CLDI MJ BEND	2	EA	$ 1,063.98	$0.00	$1,063.98	$2,127.95	
& VALVES									
		TOTAL (per 1/4 Mile)						$ 2,128	
		TOTAL FITTING & VALVES (per LF)							**$ 1.61**
		OVERHEAD (10%)							**$ 16.90**
		CONSTRUCTION PROFIT (6%)							**$ 10.14**
		SALES TAX (65% of above costs at 8.35%)							**$ 9.17**
		CONTINGENCY (30%)							**$50.69**
		GENERAL CONDITIONS (10%)							**$16.90**
		VOLATILE MARKET ADJUSTMENT (30%)							**$81.83**
		CONSTRUCTION COST, LF							**$ 354.59**
		PROJECT COST, LF (140%)							**$ 496.43**

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PROJECT :	Prescott Comprehensive Utility Master Plan	LOCATION FACTOR:	1.00
JOB # :	200600	DATE :	July-22
CLIENT :	City of Prescott	ENR :	13168
ELEMENT :	14" PVC Force Main	BY :	JSH

	ITEM NO. (Carollo Code)	DESCRIPTION	QUAN	UNIT	MATERIAL & LABOR	SUB	UNIT COST	SUBTOTAL	TOTAL
PIPE	1526521016	14" SCH 40 PVC PIPE IN A TRENCH	1	LF	$ 126.75	$0.00	$ 126.75	$ 126.75	
		TOTAL PIPING (per LF)							**$ 126.75**
EXCAV		EARTHWORK							
& BACKFILL	0230025040	Cat 225 Trackhoe, 1-1/2CY Bucket, Class C (Hard Digging), 0-16' D	1.50	CY	$ 4.11	$0.00	$ 4.11	$ 6.15	
	0230025005	Hand Excavation, Class B Material to 5' Depth	0.05	CY	$ 105.08	$0.00	$ 105.08	$ 4.86	
	0226023007	8' D X 2' W Trench and Manhole Boxes	0.01	Day	$ 28.00	$0.00	$ 28.00	$ 0.28	
	0230025062	Imported Pipe Bed & Zone/Confined Structure Backfill, Class B Material	0.55	CY	$ 58.79	$0.00	$ 58.79	$ 32.45	
	0230025070	Native Trench Backfill/Unconfined Struct. BF, Class A Material	0.86	CY	$ 13.38	$0.00	$ 13.38	$ 11.46	
	0230025073	Controlled Density Fill (CDF)	0.10	CY	$ 90.00	$0.00	$ 90.00	$ 8.56	
		10% Site Specific Requirements	1.00	LS	$ 5.52	$0.00	$ 5.52		
	0230027014	20 CY Dump Truck, 20 Miles/Round Trip	3.77	CY	$ 7.15	$0.00	$ 7.15		
		TOTAL EARTHWORK (per LF)							**$ 63.77**
PAVING	0222011001	ASPHALT PAVEMENT CUTTING	8.0	inFT	$ 0.64	$0.00	$ 0.64	$ 5.12	
DEMO &	0222011005	REMOVE 4"-6" ASPHALT PAVEMENT	0.7	SY	$ 0.68	$0.11	$ 0.79	$ 0.54	
REPLACEMENT	0274243021	4" AC PAVING ON 8" ABC	0.7	SY	$ 55.95	$4.48	$ 60.43	$ 41.41	
		TOTAL PAVING (per LF)							**$ 47.07**
FITTINGS	1525115105	12" 90° CLDI MJ BEND	2	EA	$ 1,507.27	$0.00	$1,507.27	$3,014.54	
& VALVES									
		TOTAL (per 1/4 Mile)						$ 3,015	
		TOTAL FITTING & VALVES (per LF)							**$ 2.28**
		OVERHEAD (10%)							**$ 23.99**
		CONSTRUCTION PROFIT (6%)							**$ 14.39**
		SALES TAX (65% of above costs at 8.35%)							**$ 13.02**
		CONTINGENCY (30%)							**$ 71.96**
		GENERAL CONDITIONS (10%)							**$ 23.99**
		VOLATILE MARKET ADJUSTMENT (30%)							**$116.17**
		CONSTRUCTION COST, LF							**$ 503.39**
		PROJECT COST, LF (140%)							**$ 704.74**

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PROJECT :	Prescott Comprehensive Utility Master Plan	LOCATION FACTOR:	1.00
JOB # :	200600	DATE :	July-22
CLIENT :	City of Prescott	ENR :	13168
ELEMENT :	18" PVC Force Main	BY :	JSH

	ITEM NO. (Carollo Code)	DESCRIPTION	QUAN	UNIT	MATERIAL & LABOR	SUB	UNIT COST	SUBTOTAL	TOTAL
PIPE	1526521018	18" SCH 40 PVC PIPE IN A TRENCH	1	LF	$ 198.90	$0.00	$ 198.90	$ 198.90	
		TOTAL PIPING (per LF)							**$ 198.90**
EXCAV		EARTHWORK							
& BACKFILL	0230025040	Cat 225 Trackhoe, 1-1/2CY Bucket, Class C (Hard Digging), 0-16' D	2.19	CY	$ 4.11	$0.00	$ 4.11	$ 9.00	
	0230025005	Hand Excavation, Class B Material to 5' Depth	0.07	CY	$ 105.08	$0.00	$ 105.08	$ 7.12	
	0226023007	8' D X 2' W Trench and Manhole Boxes	0.01	Day	$ 28.00	$0.00	$ 28.00	$ 0.28	
	0230025062	Imported Pipe Bed & Zone/Confined Structure Backfill, Class B Material	0.78	CY	$ 58.79	$0.00	$ 58.79	$ 45.96	
	0230025070	Native Trench Backfill/Unconfined Struct. BF, Class A Material	1.27	CY	$ 13.38	$0.00	$ 13.38	$ 17.00	
	0230025073	Controlled Density Fill (CDF)	0.14	CY	$ 90.00	$0.00	$ 90.00	$ 12.71	
		10% Site Specific Requirements	1.00	LS	$ 7.94	$0.00	$ 7.94		
	0230027014	20 CY Dump Truck, 20 Miles/Round Trip	5.44	CY	$ 7.15	$0.00	$ 7.15		
		TOTAL EARTHWORK (per LF)							**$ 92.08**
PAVING	0222011001	ASPHALT PAVEMENT CUTTING	8.0	inFT	$ 0.64	$0.00	$ 0.64	$ 5.12	
DEMO &	0222011005	REMOVE 4"-6" ASPHALT PAVEMENT	0.8	SY	$ 0.68	$0.11	$ 0.79	$ 0.62	
REPLACEMENT	0274243021	4" AC PAVING ON 8" ABC	0.8	SY	$ 54.80	$4.38	$ 59.18	$ 46.58	
		TOTAL PAVING (per LF)							**$ 52.32**
FITTINGS	1525115108	18" 90° CLDI MJ BEND	2	EA	$ 3,024.25	$0.00	$3,024.25	$6,048.49	
& VALVES									
		TOTAL (per 1/4 Mile)						$ 6,048	
		TOTAL FITTING & VALVES (per LF)							**$ 4.58**
		OVERHEAD (10%)							**$ 34.79**
		CONSTRUCTION PROFIT (6%)							**$ 20.87**
		SALES TAX (65% of above costs at 8.35%)							**$ 18.88**
		CONTINGENCY (30%)							**$104.36**
		GENERAL CONDITIONS (10%)							**$34.79**
		VOLATILE MARKET ADJUSTMENT (30%)							**$168.47**
		CONSTRUCTION COST, LF							**$ 730.04**
		PROJECT COST, LF (140%)							**$ 1,022.06**

PROJECT : **Prescott Comprehensive Utility Master Plan** — **LOCATION FACTOR:** **1.000**

JOB # : **200600** — **DATE :** July-22

ENR as of May 2018 **10972**

CLIENT : **City of Prescott** — **ENR for Sep-2018** **13168**

ENR FACTOR: **1.20**

ELEMENT : **200,000 GPD Lift Station** — **BY :** JSH

	DESCRIPTION	QUAN	UNIT	MATERIAL & LABOR	ENR	UNIT COST	SUBTOTAL	TOTAL
	Mobilization and Demobilization (10%)	1	LS	$ 42,204.47	N	$ 42,204.47	$ 42,204.47	
	Material Testing	1	LS	$ 3,466.88	Y	$ 4,160.76	$ 4,160.76	
	200,000 GDP Packaged Sewage Lift Station	1	LS	$ 248,300.00	N	$ 248,300.00	$ 248,300.00	
	Electrical Service, etc.	1	LS	$ 14,898.00	Y	$ 17,879.77	$ 17,879.77	
	Electrical Shade Canopy	1	LS	$ 5,144.04	Y	$ 6,173.60	$ 6,173.60	
	Emergency Generator w/ Fuel Tank	1	LS	$ 23,112.55	Y	$ 27,738.43	$ 27,738.43	
	Generator Pad (10'x20'18")	5.5	CY	$ 624.04	Y	$ 748.94	$ 4,119.16	
	Security Allowances	1	LS	$ 10,000.00	Y	$ 12,001.46	$ 12,001.46	
	Site Lighting	4	EA	$ 2,057.62	Y	$ 2,469.44	$ 9,877.78	
	Access Gate	1	EA	$ 2,080.13	Y	$ 2,496.46	$ 2,496.46	
	CMU Wall	400	LS	$ 183.91	N	$ 183.91	$ 73,563.77	
	Site 4" ABC Finish	21,780	SF	$ 0.43	Y	$ 0.52	$ 11,239.85	
	Concrete Drive	1	EA	$ 1,386.75	Y	$ 1,664.30	$ 1,664.30	
	Asphalt Driveway	1	LS	$ 2,357.48	Y	$ 2,829.32	$ 2,829.32	
								$464,249.13
	OVERHEAD (10%)							**$46,424.91**
	CONSTRUCTION PROFIT (6%)							**$27,854.95**
	SALES TAX (65% of above costs at 8.35%)							**$25,197.12**
	CONTINGENCY (30%)							**$139,274.74**
	GENERAL CONDITIONS (10%)							**$46,424.91**
	VOLATILE MARKET ADJUSTMENT (30%)							**$224,827.73**
	CONSTRUCTION COST, LF							**$974,253.49**
	PROJECT COST, LF (120%)							**$1,363,954.89**

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PROJECT :	**Prescott Comprehensive Utility Master Plan**	**LOCATION FACTOR:**	**1.000**
JOB # :	**200600**	**DATE :**	July-22
		ENR as of May 2018	**10972**
CLIENT :	**City of Prescott**	**ENR for Sep-2018**	**13168**
		ENR FACTOR:	**1.20**
ELEMENT :	**800,000 GPD Lift Station**	**BY :**	JSH

DESCRIPTION	QUAN	UNIT	MATERIAL & LABOR	ENR	UNIT COST	SUBTOTAL	TOTAL
Mobilization and Demobilization (10%)	1	LS	$ 52,872.83	N	$ 52,872.83	$ 52,872.83	
Material Testing	1	LS	$ 3,466.88	Y	$ 4,160.76	$ 4,160.76	
200,000 GDP Packaged Sewage Lift Station	1	LS	$ 347,300.00	N	$ 347,300.00	$ 347,300.00	
Electrical Service, etc.	1	LS	$ 20,838.00	Y	$ 25,008.64	$ 25,008.64	
Electrical Shade Canopy	1	LS	$ 5,144.04	Y	$ 6,173.60	$ 6,173.60	
Emergency Generator w/ Fuel Tank	1	LS	$ 23,574.81	Y	$ 28,293.21	$ 28,293.21	
Generator Pad (10'x20'18")	5.5	CY	$ 624.04	Y	$ 748.94	$ 4,119.16	
Security Allowances	1	LS	$ 10,000.00	Y	$ 12,001.46	$ 12,001.46	
Site Lighting	4	EA	$ 2,057.62	Y	$ 2,469.44	$ 9,877.78	
Access Gate	1	EA	$ 2,080.13	Y	$ 2,496.46	$ 2,496.46	
CMU Wall	400	LS	$ 183.91	N	$ 183.91	$ 73,563.77	
Site 4" ABC Finish	21,780	SF	$ 0.43	Y	$ 0.52	$ 11,239.85	
Concrete Drive	1	EA	$ 1,386.75	Y	$ 1,664.30	$ 1,664.30	
Asphalt Driveway	1	LS	$ 2,357.48	Y	$ 2,829.32	$ 2,829.32	
							$581,601.14
OVERHEAD (10%)							**$58,160.11**
CONSTRUCTION PROFIT (6%)							**$34,896.07**
SALES TAX (65% of above costs at 8.35%)							**$31,566.40**
CONTINGENCY (30%)							**$174,480.34**
GENERAL CONDITIONS (10%)							**$58,160.11**
VOLATILE MARKET ADJUSTMENT (30%)							**$281,659.25**
CONSTRUCTION COST, LF							**$1,220,523.43**
PROJECT COST, LF (120%)							**$1,708,732.81**

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PROJECT :	**Prescott Comprehensive Utility Master Plan**	**LOCATION FACTOR:**	**1.000**
JOB # :	**200600**	**DATE :**	July-22
		ENR as of May 2018	**10972**
CLIENT :	**City of Prescott**	**ENR for Sep-2018**	**13168**
		ENR FACTOR:	**1.20**
ELEMENT :	**3 MGD Pump Station**	**BY :**	JSH

	DESCRIPTION	QUAN	UNIT	MATERIAL & LABOR	ENR	UNIT COST	SUBTOTAL	TOTAL
	Mobilization and Demobilization (10%)	1	LS	$ 133,776.21	Y	$ 160,550.96	$ 160,550.96	
	Material Testing	1	LS	$ 3,466.88	Y	$ 4,160.76	$ 4,160.76	
	Piping - 6"	300	LF	$ 63.00	N	$ 63.00	$ 18,900.00	
	6" Fittings	4	EA	$ 3,190.23	Y	$ 3,828.74	$ 15,314.96	
	75 hp Pump	2	EA	$ 45,765.63	Y	$ 54,925.43	$ 109,850.86	
	6" Discharge Piping (10 FT per pump)	2	EA	$ 513.63	N	$ 513.63	$ 1,027.26	
1511415012	6" F X F Awwa Swing Check Valve	2	EA	$ 2,919.85	N	$ 2,919.85	$ 5,839.69	
1511611015	6" 150# Flanged Cast Steel Plug Valve	3	EA	$ 647.44	N	$ 647.44	$ 1,942.31	
	6" Flowmeter	1	EA	$ 3,250.00	N	$ 3,250.00	$ 3,250.00	
1133231005	Mechanical Bar Screen System, 10'	1	EA	$ 12,891.55	N	$ 12,891.55	$ 12,891.55	
	Wetwell Excavation (Dual)	148	CY	$ 47.91	N	$ 47.91	$ 7,090.68	
	Wetwell Construction (Dual)	59	CY	$ 1,248.08	N	$ 1,248.08	$ 73,960.30	
	Pressure Transmitters and Instrumentation	2	LS	$ 8,320.52	Y	$ 9,985.84	$ 19,971.67	
	Piping Support Pad - (10'x20'x12")	10	CY	$ 624.04	Y	$ 748.94	$ 7,489.39	
	Pipe Shade Canopy	1	LS	$ 20,593.29	N	$ 20,593.29	$ 20,593.29	
	Misc Pipe Supports	1	LS	$ 1,500.00	N	$ 1,500.00	$ 1,500.00	
	Electrical Service, Swichgear, Panels, Wiring,	1	LS	$ 147,002.89	Y	$ 176,424.90	$ 176,424.90	
	75 hp Motor VFDs	2	EA	$ 45,762.86	Y	$ 54,922.11	$ 109,844.21	
	Electrical Pre-Cast Vault/Buidling	1	LS	$ 69,337.66	Y	$ 83,215.30	$ 83,215.30	
	Emergency Generator w/ Fuel Tank	1	LS	$ 46,594.91	Y	$ 55,920.69	$ 55,920.69	
	Generator Pad (15'x20'x18")	17	CY	$ 624.04	Y	$ 748.94	$ 12,731.96	
	RTU in NEMA Enclosure with Antenna	1	LS	$ 27,735.06	Y	$ 33,286.12	$ 33,286.12	
	Pole & Base	1	LS	$ 693.38	Y	$ 832.16	$ 832.16	
	Security Allowance	1	LS	$ 10,400.65	Y	$ 12,482.30	$ 12,482.30	
	Site Lighting	4	EA	$ 3,882.91	Y	$ 4,660.06	$ 18,640.23	
	Odor Control System	1	LS	$ 395,000.00	N	$ 395,000.00	$ 395,000.00	
	Pump Removal Crane	1	EA	$ 8,865.00	N	$ 8,865.00	$ 8,865.00	
	Access Gate	1	EA	$ 2,080.13	Y	$ 2,496.46	$ 2,496.46	
	CMU Wall	590	LF	$ 183.91	N	$ 183.91	$ 108,506.57	
	Site 4" ABC Finish	21780	SF	$ 0.43	Y	$ 0.52	$ 11,239.85	
	Concrete Drive	1	EA	$ 1,386.75	Y	$ 1,664.30	$ 1,664.30	
	Asphalt Driveway	1	LS	$ 2,357.48	Y	$ 2,829.32	$ 2,829.32	
								$1,498,313.06
	OVERHEAD (10%)							**$149,831.31**
	CONSTRUCTION PROFIT (6%)							**$89,898.78**
	SALES TAX (65% of above costs at 8.35%)							**$81,320.94**
	CONTINGENCY (30%)							**$449,493.92**
	GENERAL CONDITIONS (10%)							**$149,831.31**
	VOLATILE MARKET ADJUSTMENT (30%)							**$725,606.79**
	CONSTRUCTION COST, LF							**$3,144,296.10**
	PROJECT COST, LF (120%)							**$4,402,014.55**

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PROJECT :	**Prescott Comprehensive Utility Master Plan**	**LOCATION FACTOR:**	**1.000**
JOB # :	**200600**	**DATE :**	July-22
		ENR as of May 2018	**10972**
CLIENT :	**City of Prescott**	**ENR for Sep-2018**	**13168**
		ENR FACTOR:	**1.20**
ELEMENT :	**6 MGD Pump Station**	**BY :**	JSH

	DESCRIPTION	QUAN	UNIT	MATERIAL & LABOR	ENR	UNIT COST	SUBTOTAL	TOTAL
	Mobilization and Demobilization (10%)	1	LS	$ 196,673.13	Y	$ 236,036.43	$ 236,036.43	
	Material Testing	1	LS	$ 3,466.88	Y	$ 4,160.76	$ 4,160.76	
	Piping - 6"	300	LF	$ 63.00	N	$ 63.00	$ 18,900.00	
	6" Fittings	4	EA	$ 3,190.23	Y	$ 3,828.74	$ 15,314.96	
	75 hp Pump	4	EA	$ 45,765.63	Y	$ 54,925.43	$ 219,701.72	
	8" Discharge Piping (10 FT per pump)	4	EA	$ 616.24	N	$ 616.24	$ 2,464.96	
1511415013	8" F X F Awwa Swing Check Valve	4	EA	$ 3,787.68	N	$ 3,787.68	$ 15,150.73	
1511611016	8" 150# Flanged Cast Steel Plug Valve	5	EA	$ 673.55	N	$ 673.55	$ 3,367.75	
	8" Flowmeter	1	EA	$ 4,550.00	N	$ 4,550.00	$ 4,550.00	
1133231005	Mechanical Bar Screen System, 10'	2	EA	$ 12,891.55	N	$ 12,891.55	$ 25,783.11	
	Wetwell Excavation (Dual)	296	CY	$ 47.91	N	$ 47.91	$ 14,181.36	
	Wetwell Construction (Dual)	104	CY	$ 1,248.08	N	$ 1,248.08	$ 129,800.32	
	Pressure Transmitters and Instrumentation	3	LS	$ 8,320.52	Y	$ 9,985.84	$ 29,957.51	
	Piping Support Pad - (10'x20'x12")	10	CY	$ 624.04	Y	$ 748.94	$ 7,489.39	
	Pipe Shade Canopy	1	LS	$ 20,593.29	N	$ 20,593.29	$ 20,593.29	
	Misc Pipe Supports	1	LS	$ 1,500.00	N	$ 1,500.00	$ 1,500.00	
	Electrical Service, Swichgear, Panels, Wiring,	1	LS	$ 250,967.15	Y	$ 301,197.18	$ 301,197.18	
	75 hp Motor VFDs	3	EA	$ 45,762.86	Y	$ 54,922.11	$ 164,766.32	
	Electrical Pre-Cast Vault/Buidling	1	LS	$ 69,337.66	Y	$ 83,215.30	$ 83,215.30	
	Emergency Generator w/ Fuel Tank	2	LS	$ 79,599.64	Y	$ 95,531.18	$ 191,062.35	
	Generator Pad (15'x20'x18")	17	CY	$ 624.04	Y	$ 748.94	$ 12,731.96	
	RTU in NEMA Enclosure with Antenna	1	LS	$ 27,735.06	Y	$ 33,286.12	$ 33,286.12	
	Pole & Base	1	LS	$ 693.38	Y	$ 832.16	$ 832.16	
	Security Allowance	1	LS	$ 10,400.65	Y	$ 12,482.30	$ 12,482.30	
	Site Lighting	4	EA	$ 3,882.91	Y	$ 4,660.06	$ 18,640.23	
	Odor Control System	1	LS	$ 500,000.00	N	$ 500,000.00	$ 500,000.00	
	Pump Removal Crane	1	EA	$ 8,865.00	N	$ 8,865.00	$ 8,865.00	
	Access Gate	1	EA	$ 2,080.13	Y	$ 2,496.46	$ 2,496.46	
	CMU Wall	590	LF	$ 183.91	N	$ 183.91	$ 108,506.57	
	Site 4" ABC Finish	21780	SF	$ 0.43	Y	$ 0.52	$ 11,239.85	
	Concrete Drive	1	EA	$ 1,386.75	Y	$ 1,664.30	$ 1,664.30	
	Asphalt Driveway	1	LS	$ 2,357.48	Y	$ 2,829.32	$ 2,829.32	
								$2,202,767.71
	OVERHEAD (10%)							**$220,276.77**
	CONSTRUCTION PROFIT (6%)							**$132,166.06**
	SALES TAX (65% of above costs at 8.35%)							**$119,555.22**
	CONTINGENCY (30%)							**$660,830.31**
	GENERAL CONDITIONS (10%)							**$220,276.77**
	VOLATILE MARKET ADJUSTMENT (30%)							**$1,066,761.85**
	CONSTRUCTION COST, LF							**$4,622,634.70**
	PROJECT COST, LF (120%)							**$6,471,688.58**

Engineers...Working Wonders With Water™

PROJECT :	**Prescott Comprehensive Utility Master Plan**	**LOCATION FACTOR:**	**1.000**
JOB # :	**200600**	**DATE :**	July-22
		ENR as of May 2018	**10972**
CLIENT :	**City of Prescott**	**ENR for Sep-2018**	**13168**
		ENR FACTOR:	**1.20**
ELEMENT :	**9 MGD Pump Station**	**BY :**	JSH

	DESCRIPTION	QUAN	UNIT	MATERIAL & LABOR	ENR	UNIT COST	SUBTOTAL	TOTAL
	Mobilization and Demobilization (10%)	1	LS	$ 262,677.73	Y	$ 315,251.58	$ 315,251.58	
	Material Testing	1	LS	$ 3,466.88	Y	$ 4,160.76	$ 4,160.76	
	Piping - 6"	300	LF	$ 63.00	N	$ 63.00	$ 18,900.00	
	8" Fittings	4	EA	$ 3,828.27	Y	$ 4,594.48	$ 18,377.93	
	75 hp Pump	5	EA	$ 45,765.63	Y	$ 54,925.43	$ 274,627.15	
1511415013	8" F X F Awwa Swing Check Valve	4	EA	$ 3,787.68	N	$ 3,787.68	$ 15,150.73	
1511611016	8" 150# Flanged Cast Steel Plug Valve	5	EA	$ 673.55	N	$ 673.55	$ 3,367.75	
	8" Flowmeter	1	EA	$ 4,550.00	N	$ 4,550.00	$ 4,550.00	
1133231005	Mechanical Bar Screen System, 10'	2	EA	$ 12,891.55	N	$ 12,891.55	$ 25,783.11	
	Mechanical Bar Screen System, 10'	2	EA	$ 12,891.55	N	$ 12,891.55	$ 25,783.11	
	Wetwell Excavation (Dual)	370	CY	$ 47.91	N	$ 47.91	$ 17,726.70	
	Wetwell Construction (Dual)	126	CY	$ 1,248.08	N	$ 1,248.08	$ 157,258.08	
	Pressure Transmitters and Instrumentation	4	LS	$ 8,320.52	Y	$ 9,985.84	$ 39,943.35	
	Piping Support Pad - (10'x20'x12")	10	CY	$ 624.04	Y	$ 748.94	$ 7,489.39	
	Pipe Shade Canopy	1	LS	$ 20,593.29	N	$ 20,593.29	$ 20,593.29	
	Misc Pipe Supports	1	LS	$ 1,500.00	N	$ 1,500.00	$ 1,500.00	
	Electrical Service, Swichgear, Panels, Wiring,	1	LS	$ 363,007.21	Y	$ 435,661.59	$ 435,661.59	
	75 hp Motor VFDs	5	EA	$ 45,762.86	Y	$ 54,922.11	$ 274,610.53	
	Electrical Pre-Cast Vault/Buidling	1	LS	$ 69,337.66	Y	$ 83,215.30	$ 83,215.30	
	Emergency Generator w/ Fuel Tank	2	LS	$ 145,609.09	Y	$ 174,752.14	$ 349,504.28	
	Generator Pad (15'x20'x18")	17	CY	$ 624.04	Y	$ 748.94	$ 12,731.96	
	RTU in NEMA Enclosure with Antenna	1	LS	$ 27,735.06	Y	$ 33,286.12	$ 33,286.12	
	Pole & Base	1	LS	$ 693.38	Y	$ 832.16	$ 832.16	
	Security Allowance	1	LS	$ 10,400.65	Y	$ 12,482.30	$ 12,482.30	
	Site Lighting	4	EA	$ 3,882.91	Y	$ 4,660.06	$ 18,640.23	
	Odor Control System	1	LS	$ 635,000.00	N	$ 635,000.00	$ 635,000.00	
	Pump Removal Crane	1	EA	$ 8,865.00	N	$ 8,865.00	$ 8,865.00	
	Access Gate	1	EA	$ 2,080.13	Y	$ 2,496.46	$ 2,496.46	
	CMU Wall	590	LF	$ 183.91	N	$ 183.91	$ 108,506.57	
	Site 4" ABC Finish	21780	SF	$ 0.43	Y	$ 0.52	$ 11,239.85	
	Concrete Drive	1	EA	$ 1,386.75	Y	$ 1,664.30	$ 1,664.30	
	Asphalt Driveway	1	LS	$ 2,357.48	Y	$ 2,829.32	$ 2,829.32	
								$2,942,028.89
	OVERHEAD (10%)							**$294,202.89**
	CONSTRUCTION PROFIT (6%)							**$176,521.73**
	SALES TAX (65% of above costs at 8.35%)							**$159,678.62**
	CONTINGENCY (30%)							**$882,608.67**
	GENERAL CONDITIONS (10%)							**$294,202.89**
	VOLATILE MARKET ADJUSTMENT (30%)							**$1,424,773.11**
	CONSTRUCTION COST, LF							**$6,174,016.79**
	PROJECT COST, LF (120%)							**$8,643,623.51**