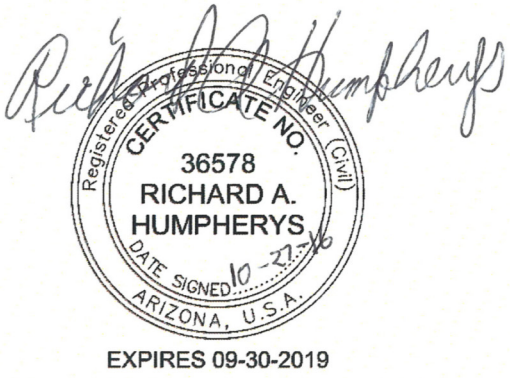
CITY OF GOODYEAR

2016 INTEGRATED WATER MASTER PLAN

FINAL
November 2016



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CITY OF GOODYEAR

2016 INTEGRATED WATER MASTER PLAN

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LIST OF ABBREVIATIONS

%	percent
2016 IWMP	2016 Integrated Water Resources Master Plan
A.A.C.	Arizona Administrative Code
AACE	Association for the Advancement of Cost Engineers
AADF	average annual daily flow
ADD	average daily demand
ADEQ	Arizona Department of Environmental Quality
ADF	average daily flow
ADOT	Arizona Department of Transportation
ADWR	Arizona Department of Water Resources
AFY	acre-feet per year
AMAs	active management areas
AMWUA	Arizona Municipal Water Users Association
APP	Aquifer Protection Permit
ARV	air release valve
AS&R	annual storage and recovery
ASLD	Arizona State land Department
Avg	average
AWBA	Arizona Water Bank Authority
AWS	Assured Water Supply
AWSA	Arizona Water Settlement Act
AZPDES	Arizona Pollutant Discharge Elimination System
BID	Buckeye Irrigation District
CAGRD	Central Arizona Groundwater Replenishment District
CAP	Central Arizona Project
CAWCD	Central Arizona Water Conservation District
CECs	contaminants of emergency concern
cfs	cubic feet per second
CIP	Capital Improvement Plan
CIPP	cast-in-place pipe
City	City of Goodyear
CMOM	Capacity, Management, Operations, and Maintenance
CSIF	CAP-SRP Interconnect Facility
d/D	depth of dry weather flow to pipe diameter
D/DBPR	Stage 1 and Stage 2 Disinfectants/Disinfection By-Products Rule
DAWS	Designation of Assured Water Supply
DBPs	disinfection by-products
DEM	digital elevation model
DMOM	distribution management, operation and maintenance
DPR	direct potable reuse
EDU	equivalent dwelling unit
EMR	Estrella Mountain Ranch
FBRR	Filter Backwash Recycle Rule
fps	feet per second
ft bgs	feet below ground surface
ft/day	feet per day
ft/sec	feet per second
FY	fiscal year
GAC	granular activated carbon

GE	General Electric
General Plan	Goodyear 2025 General Plan
GIS	Geographic Information Services
GMA	Groundwater Management Act
gpad	gallons per acre per day
gpcd	gallons per capita per day
gpd	gallons per day
gpm	gallons per minute
GRIC	Gila River Indian Community
GSF	groundwater savings facilities
HERO	High Efficiency RO
HOA	Homeowners Association
hp	horsepower
HSI	HydroSystems, Inc.
IESWTR	Interim Enhanced Surface Water Treatment Rule
IFC	International Fire Code
IGFR	Irrigation Grandfathered Rights
IIP	Infrastructure Improvement Plan
in	inch/inches
IWMP	Integrated Water Resources Master Plan
LCR	Lead and Copper Rule
LF	linear foot/feet
LS	lift station
LT2ESWTR	Long Term 2 Enhanced Surface Water Treatment Rule
LTSCs	long-term storage credits
M&I	municipal and industrial
MAF	million acre-feet
MAFY	million acre-feet per year
MAG	Maricopa Association of Governments
MCESD	Maricopa County Environmental Services Department
MD	maximum day
MD/AD	maximum day/average day
MDBP	microbial/disinfection by-product
MDD	maximum daily demand
MG	million gallons
mgd	million gallons per day
mi	mile/miles
MM	maximum monthly
MM/AD	maximum month/average day
MM/ADD	maximum month to average daily demand
MOV	motor operated valve
MPA	Municipal Planning Area
MSIDD	Maricopa Stanfield Irrigation District
MWD	Maricopa Water District
NIA	non-Indian agricultural
NPDES	National Pollutant Discharge Elimination System
PCE	tetrachloroethylene
PGA	Phoenix Goodyear Airport
PGAN	Phoenix Goodyear Airport North
PGAS	Phoenix Goodyear Airport South
PH/AD	peak hour/average day

PH/MD	peak hour/maximum day
PHF	peak hour flow
PRP	principle responsible party
PRVs	pressure reducing valves
PS	pump station
psi	pounds per square inch
PWSs	public water systems
RAS	return activated sludge
RID	Roosevelt Irrigation District
RO	reverse osmosis
RUSRA	Artificial Recharge and Underground Storage and Recovery Act
RV	Rainbow Valley
SAT	soil aquifer treatment
SCADA	supervisory control and data acquisition
SDWA	Safe Drinking Water Act
SOPs	standard operating procedures
SPC	system pressure criteria
SRP	Salt River Project
SSOs	sanitary sewer overflows
SWTR	Surface Water Treatment Rule
TCE	trichloroethylene
TCR	Total Coliform Rule
TDS	total dissolved solids
THM	trihalomethane
UAW	unaccounted for water
UCMR	Unregulated Contaminant Monitoring Rule
US&R	underground storage and recovery
USBR	United States Bureau of Reclamation
USEPA	United States Environmental Protection Agency
USF	Underground Storage Facility Permit
USGS	United States Geological Survey
VCP	vitrified clay pipe
VFDs	variable frequency drives
VIP	vadose zone injection project
VZ	vadose
WAIV	wind aided intensified evaporation
WAS	waste activated sludge
WPA	water planning area
WQARF	Water Quality Assurance Revolving Fund
WRF	water reclamation facility
WS	Water Storage Permit
WSRV	West Salt River Valley
WTP	water treatment plant

Chapter 1

INTRODUCTION AND PROJECT SUMMARY

1.1 BACKGROUND

The City of Goodyear (City) is committed to providing reliable and safe water service to its customers and collecting and treating wastewater so that it can be beneficially reused in a manner that protects public health and the environment. Goodyear maintains a 100-year designation of assured water supply that demonstrates the City's ability to provide continuous availability of physical water resources and the legal right to use them to serve the City's customers.

The 2016 Integrated Water Master Plan (2016 IWMP) presented here was initiated by Goodyear to plan the City's water systems using a common set of assumptions, and to develop a roadmap to guide the City as it continues to grow. One of the purposes of the 2016 IWMP is to make certain that planning is done in a coordinated manner with the same set of assumptions for water, wastewater, and reclaimed water systems. The capital improvement program has clearly defined actions that will enable the City to have the water resources and infrastructure in place to serve Goodyear's growing and vibrant community. Goodyear staff from the Water Resources, Planning, Engineering, Public Works, Water and Wastewater Operations, Economic Development, and Finance Departments as well as City Management worked together with Carollo Engineers to develop the 2016 IWMP.

The previous integrated master plan was completed in 2007. Since that time, a major recession has occurred that significantly changed the rate of growth. In addition, a number of changes have occurred and a variety of development plans have changed. Therefore, it became important to update the master plan to re-establish a set of plans that the City can use to plan water related infrastructure to serve its citizens.

1.1.1 Alignment with Goodyear's General Plan

The Goodyear 2025 General Plan (General Plan) contains the City's vision for growth through buildout and contains an approach to achieve this vision through established community goals, objectives, and policies. The planning framework for the 2016 IWMP was developed using the General Plan study area, land use plan, and growth assumptions to reach a buildout population of approximately 760,000 residents. Infrastructure recommendations with capital costs in the 2016 IWMP are for the 2020 and 2025 planning periods. Concepts for how the City's water resources, water, wastewater, and reclaimed water systems develop over time are based on the assumption that the City will grow to a population of 760,000 per the General Plan.

1.1.2 Scope of Work

The scope of work for the 2016 IWMP was developed to provide Goodyear with a plan to expand the water, wastewater, and reclaimed water systems over the next 10 years and to provide an estimate of buildout requirements. The scope included updates to the City's water resources, water system, wastewater system, and reclaimed water system master plans.

The 2016 IWMP contains the following items:

- New population and development projections based on the City's residential development entitlement database and the 2025 General Plan land use plan.
- Water demand, wastewater flow, and reclaimed water availability projections were developed using the City's water production, customer billing and wastewater flow data.
- Goodyear's water resources master plan was updated with new information on future supply acquisition, fully utilizing the City's Central Arizona Project (CAP) allocation, and developing new groundwater wells.
- Hydraulic models were developed for the water, wastewater, and reclaimed water systems using the City's Geographic Information Service (GIS) data. The models were validated using data collected in the field and available operations information, to make certain they reasonably represented operational conditions.
- The water system hydraulic model was used to evaluate the capacity of the existing system, size future infrastructure, and make recommendations for capital improvements.
- Water system recommendations include new wells, treatment facilities, storage reservoirs, booster pump stations, and distribution system mains.
- The wastewater system hydraulic model was used to evaluate the capacity of the existing system, size future infrastructure and make recommendations for capital improvements.
- Wastewater system recommendations include new sewers, lift stations, and treatment capacity.
- The reclaimed water system hydraulic model was used to evaluate the capacity of the existing system to deliver reclaimed water to the City's future vadose zone injection well project.
- Reclaimed water use strategies were recommended that may provide additional opportunities for recharge by working with developments that have reclaimed water delivery commitments to match average reclaimed water production with peak season irrigation demand.

- Recommendations were provided for future water campuses in the north and south service areas that include water production, wastewater treatment and recharge facilities.

1.1.3 Report Organization

The report includes:

- Executive Summary Brochure – Summarizes the major findings and recommendations of the 2016 IWMP in a graphical format.
- Chapter 1 – Introduction and Recommendation Summary.
- Chapter 2 – Planning Framework and Water Resources, including population, water demand, wastewater flow, and reclaimed water availability projections. Also includes a description of Goodyear's available water resources and an analysis of the physical and legal availability of water to meet projected demands for normal and drought years.
- Chapter 3 – Water System Master Plan Update, including an evaluation of Goodyear's water system infrastructure and recommendations for improvements needed to deliver potable water. Specific projects needed through year 2025, including estimated timing and project budgets are identified.
- Chapter 4 – Wastewater System Master Plan Update, including an evaluation of Goodyear's wastewater system infrastructure and recommendations for improvements needed to collect and treat wastewater. Specific projects needed through year 2025, including estimated timing and project budgets are identified.
- Chapter 5 – Reclaimed Water System Master Plan Update, including an evaluation of Goodyear's reclaimed water supplies and infrastructure to identify water delivery and recharge and recovery requirements. Specific projects needed through year 2025, including estimated timing and project budgets are identified.

1.2 PLANNING SUMMARY

1.2.1 2016 IWMP Planning Area

The City has five water planning areas (WPAs) that have been used to organize water supplies and capital improvements to serve the unique needs of each area. These WPAs are as follows:

1. WPA 1 (North) - located north of Interstate 10. The majority of this area receives water supply and wastewater services from Liberty Utilities. The remaining portion is supplied water from EPCOR and wastewater services from the City.
2. WPA 2 (Central) - located between Interstate 10 and the Gila River.
3. WPA 3 (Sierra Estrella) - located between the Gila River and Pecos Road.
4. WPA 4 (Rainbow Valley) - located between Pecos and Patterson Roads.

5. WPA 5 (Sonoran Valley) - located between Patterson Road and the southern municipal boundary.

1.2.1.1 Planning Periods and Population Projections

The 2016 IWMP addresses four planning periods: current (2015), year 2020, year 2025 and buildout. There is no projected growth in WPA 4 and WPA 5 by year 2025. The estimated 2015 water service area population is 49,619. Future growth estimates were based on geographical locations of likely development by years 2020 and 2025 provided by City staff, and result in a residential growth rate of approximately 4.4 percent annually. Growth rates of 4 percent and higher were also considered. The projected combined population of WPA 2 and WPA 3 for each planning period through year 2025 is summarized in Table 1.1.

Table 1.1 Population Projections Through Year 2025
2016 Integrated Water Master Plan
City of Goodyear

Water Planning Area	Planning Year		
	2015	2020	2025
WPA 2 & 3 (1)	49,619	60,701	73,517

Note:
(1) Water service area population only. Does not include the Liberty Utilities or EPCOR water service areas.

The projected buildout population for the 2016 IWMP is 763,780, which assumes full growth of all areas that could potentially develop within the City's current municipal boundary. The buildout population projections by WPA are summarized in Table 1.2.

Table 1.2 Buildout Population Projections
2016 Integrated Water Master Plan
City of Goodyear

Water Planning Area	Estimated Buildout Population (1)
WPA 2	109,587
WPA 3	90,627
WPA 4	303,316
WPA 5	214,750
Subtotal	**718,280**
Liberty Utilities/EPCOR (2)	45,500
Grand Total	**763,780**

Notes:
(1) Assumes development of all areas with development potential as currently defined in the 2025 General Plan.
(2) Figure from the 2025 General Plan.

1.2.1.2 Water Demand Projections

Water demand projections were developed for planning years 2015 through 2025 using the City's current historical water production, customer billing and land use data as a basis for future demands. The projected demands through year 2025 are summarized in Table 1.3. The projected demand growth is greater than the projected population growth because land areas planned for development include commercial and industrial areas that do not add population.

Table 1.3 Water Demand Projections Through Year 2025
2016 Integrated Water Master Plan
City of Goodyear

Water Planning Area	2015 Average Daily Demand		2020 Average Daily Demand		2025 Average Daily Demand	
	(mgd)	(AFY)	(mgd)	(AFY)	(mgd)	(AFY)
WPA 2	6.7	7,483	8.5	9,556	11.3	12,795
WPA 3	1.7	1,871	3.1	3,497	4.4	4,864
Grand Total	**8.4**	**9,354**	**11.6**	**13,053**	**15.7**	**17,658**

The projected buildout, average daily water demand for the 2016 IWMP is 120.7 million gallons per day (mgd) (135,208 acre-feet per year [AFY]), which is fourteen times greater than the City's current average daily demand. This is the projected demand to support a buildout population of 763,780, which includes development in some areas that do not currently hold development entitlements.

Excluding WPA1 where the City does not provide potable water, the estimated buildout, average daily water demand for the areas in the City that hold development entitlements is 38.1 mgd (42,659 AFY). The estimated population for these areas is 193,133. Table 1.4 summarizes the projected buildout water demand for the areas that currently hold development entitlements and for all areas with and without development entitlements.

Table 1.4 Buildout Water Demand Projections
2016 Integrated Water Master Plan
City of Goodyear

Water Planning Area	Areas With Development Entitlements Only - Average Daily Demand		All Areas With or Without Development Entitlements Average Daily Demand	
	(mgd)	(AFY)	(mgd)	(AFY)
WPA 2	18.9	21,153	27.9	31,245
WPA 3	11.9	13,312	15.1	16,924
WPA 4	5.9	6,584	43.9	49,412
WPA 5	1.7	1,609	33.8	37,896
Grand Total	**38.1**	**42,659**	**120.7**	**135,208**

1.3 WATER RESOURCE CHALLENGES

As the City grows towards buildout, it faces multiple challenges in providing the water needed to sustain a population of approximately 760,000. The City currently does not have all of the water resources needed to serve the buildout population and the specific water supplies needed to serve the buildout population have not been completely identified. In addition to cost and logistical challenges, there are legal and technical challenges that make some solutions infeasible today, but the legal and technical challenges can be overcome to provide additional water supply options in the future. The challenges and potential solutions are addressed below in the following time periods:

1. 2015 through 2020
2. 2021 through 2040
3. Beyond 2040

Water provided by the Central Arizona Project has provided water for much of the rapid growth that has occurred in Arizona over the past thirty years. Now the CAP water is essentially fully allocated so there will be increased demand for water to enable growth to continue. The days of a "just in time" approach to planning water supplies are long gone; so the City should take additional steps beginning now to lay the groundwork for having additional water supplies to enable Goodyear to grow in the future.

1.3.1 Water Supplies, 2015 to 2020

The City's wells currently take water from the West Salt River Valley (WSRV) Groundwater Sub-basin. The City has completed studies to show that the City is limited to withdrawing 13,191 AFY of groundwater through the City's current wells in the WSRV. Table 1.3 shows that between year 2020 and year 2025, the City's demands will exceed 13,191 AFY, meaning a new physical supply must be in place by year 2020. **Once demands exceed 13,191 AFY, the City will need a new physical water supply.** Although it may be possible to increase the physical groundwater supply somewhat with recharge, the best way to increase the physical water supply is to obtain direct delivery of the CAP water allocation that Goodyear already has the right to receive.

The City should continue to do the following to obtain the water supplies needed through 2020:

1. Additional wells in the WSRV groundwater basin should be constructed as outlined in this 2016 IWMP so that the City has the capability to withdraw water up to its allocation limit and also supply maximum daily demands.
2. Continue to implement aquifer storage facilities so that reclaimed water from the Goodyear WRP not being used for irrigation or industrial purposes is recharged to replenish the aquifer.

3. Purchase the City's full allotment of CAP water each year to recharge while this water is not required to supply demands. This stored water will help protect the City against future droughts.

4. Continue to renew permits for Goodyear's existing recharge facilities and engage in hydrological investigations to identify favorable sites for recharge in WPA 2.

5. Explore the possibility of establishing service line interconnections with EPCOR and the City of Avondale to provide water to meet peak demands on a temporary basis. A larger interconnect with Liberty Utilities was considered, and would require that Goodyear provide credits and assist with well production capabilities.

1.3.2 Water Supplies, 2021 to 2040

The issues identified below will need to be addressed to provide water for additional growth through 2040.

Issue 1. The City currently has 17,742 AFY of CAP water rights that are available for direct delivery or recharge. When fully utilized, CAP water will provide for growth until approximately 2040 at the growth rates projected in this master plan. However, Goodyear currently does not have a direct, physical connection to a CAP water supply, so Arizona Department of Water Resources (ADWR) is not recognizing the City's full allocation. Goodyear is required to obtain a direct physical CAP water supply. Due to the time required to construct infrastructure for a CAP water supply, Goodyear should proceed now to select and develop a CAP water supply option.

Issue 2. Wells that are located a long distance from the point of use are considered to be in a "well field" by ADWR and therefore the use of these well fields is restricted. ADWR will allow wells in the productive part of the Rainbow Valley aquifer to be used for development six miles to the north if this development is constructed as a stand-alone water supply system with no possibility of water from the Rainbow Valley aquifer going to the WSRV aquifer's service area.

Issue 3. The Rainbow Valley Groundwater Sub-basin covers WPA 4 and WPA 5. The physical water supply that is withdrawn from the Rainbow Valley Aquifer needs to be replenished either by natural recharge, recharging reclaimed water, or bringing in another water supply to be recharged if there is to be a sustainable water supply. As the designated water provider, the City is obligated to replenish water taken from the aquifer that is beyond the rate of natural recharge. Surface water may be needed to help start Rainbow Valley development.

Issue 4. Well water quality in Goodyear is poor, and most if not all wells drilled in the future will produce water high in arsenic, nitrates, or total dissolved solids (TDS). Treatment for all these constituents is expensive, but treatment for TDS produces a brine stream that cannot be returned to the natural environment. The current best technology to dispose of brine is

evaporation ponds that use large land areas. Other technologies are available but are not yet economically viable.

To address each of these water supply issues, the City should do the following:

1. Obtain a direct CAP water supply and treatment solution so that the City's full CAP allocation can be used. The CAP surface water supply will:
    a. Reduce the need for well fields in Rainbow Valley,
    b. Reduce the draw on the Rainbow Valley aquifer,
    c. Reduce the need for brine disposal facilities. Using CAP water first instead of developing well supplies buys time for better brine disposal techniques to be developed and to become more economical.
2. Maximize the use of reclaimed water for aquifer storage. To maximize the benefit of reclaimed water, the City will need to:
    a. Retain ownership of reclaimed water for all future development so that through the use of aquifer storage and recovery, potable water supplies can be made available to the developments that produced the wastewater. Reclaimed water is the most reliable and least expensive water supply and can potentially make up for up to 30 percent of the City's water needs.
    b. Re-negotiate agreements with current developments to maximize the reclaimed water flow back to the City.
    c. As developments are constructed in Rainbow Valley, construct aquifer storage and recovery facilities to beneficially use reclaimed water. As the timing of development in Rainbow Valley becomes more clear, the cost of a recharge facility will need to be included in the Infrastructure Improvement Plan (IIP).
    d. Revise the City's policies on the use of reclaimed water to direct the use of this water to aquifer storage instead of landscaping and water features.
3. Implement water conservation measures to reduce water use with a goal of reducing the percentage of outdoor water use by half through buildout to extend the benefit of current water resources.

1.3.3 Water Supplies, 2040 and Beyond

The following issues will need to be addressed in addition to the issues identified in Sections 1.3.1 and 1.3.2.

Issue 5. The City needs an additional 14,535 AFY of physical water supplies just to serve developments where the City has already been committed to supply water.

Issue 6. The City does not have the water resources needed to serve the entire service area to support a population of 760,000 by buildout. Additional water supplies of 40,500 AFY will need to be obtained to support the growth in the General Plan.

The following recommendations will help the City to have a sustainable water supply support the growth in the General Plan in addition to the recommendations in Sections 1.3.1 and 1.3.2:

1. Lease additional CAP water from Indian communities that may have water to lease. Due to the competition for remaining leases, the City should seek to obtain this lease as soon as possible.
2. Continue to pursue additional CAP non-Indian agricultural (NIA) water, which will be made available by year 2020. The City should also pursue any additional NIA water that becomes available after 2020.
3. Treating reclaimed water for potable use is currently illegal without the water going through a natural barrier first. However, the technology is available to safely treat reclaimed water and laws in several states have been changed to allow direct potable reuse. The practice is being evaluated in Arizona and could become legal at some future time. When it becomes legal, additional water supply options become available to the City. The City can also reduce the water needed for aquifer storage and recovery. Goodyear should monitor changes to the regulations on direct potable reuse as a means of strengthening its water resources portfolio.
4. Monitor brine management technologies and implement improved technologies when lower costs or smaller evaporation ponds become a possibility.
5. Pursue opportunities to purchase or lease water that currently flows in the Buckeye Irrigation Canal. This potential water source is physically located in Goodyear and is therefore more accessible than remote water sources. As development occurs, the irrigation that this canal water is used for will go away, potentially freeing this water up for lease or purchase.
6. Pursue additional water supplies that may include the Harquahala well field water.

1.4 CAP WATER SUPPLY ALTERNATIVES

Several options have been identified to deliver treated CAP water into the Goodyear water distribution system. These options are:

Option 1. Purchase capacity in the White Tanks WTP that is owned by EPCOR and transport water through EPCOR's Aqua Fria District transmission main to the intersection of Camelback and Perryville Roads. Construct a pipeline from that location to the planned Silva site at the intersection of Citrus and Harrison Roads.

Option 2. Purchase capacity in the White Tanks WTP that is owned by EPCOR and construct a new, dedicated pipeline from the WTP to the Silva site. Obtaining water treated at the White Tanks WTP provides the convenience of using an existing facility.

Option 3. Construct a turnout on the Beardsley Canal near the Indian School Road alignment and construct a dedicated pipeline to carry raw water to a proposed water treatment plant site west of the 157th Avenue WRP, on land that would need to be purchased by the City. This proposed site will be referred to as the "Water Campus."

Option 4. Construct a turnout on the Beardsley Canal near the Indian School Road alignment and construct a dedicated pipeline to carry raw water to a proposed water treatment plant site on land that will need to be purchased near Citrus Road and south of the RID Canal. After treatment, the water would be delivered to the Goodyear distribution system.

Option 5. Wheel the City's CAP water through the Salt River Project (SRP) canal system to the end of the Grand Canal near 99th Avenue, where a 96-inch pipeline goes south to the Gila River. Construct a pipeline beginning at the intersection of Broadway and 99th Avenue that connects to the 96-inch SRP pipeline and goes west across the Aqua Fria River to the proposed water campus for treatment.

Characteristics of one or more of these options include the following:

1. White Tanks WTP. The City would purchase capacity in the White tanks WTP that could be reimbursed through impact fees. The City would not have physical ownership in the plant. The cost for 6.6 mgd of capacity is $30 million. A breakdown of the components of this treatment cost is not available. However, for the purpose of comparing options, this cost is assumed to include treatment that meets or exceeds water quality standards at the plant. EPCOR is making improvements to avoid past summertime shutdowns due to turbidity, and the cost of these improvements is included. Goodyear would pay a bulk rate for the water, and would participate in the proportional cost of upgrades in the plant over time. The City would pay for water at an agreed upon bulk rate. EPCOR has 80 mgd of capacity in the Beardsley Canal, and Goodyear's water allotment would be included in the 80 mgd of capacity.
2. Option 1. Option 1 is intended to be an initial phase of Option 2, where the cost of a portion of the transmission main between the White Tanks WTP and the Silva site is deferred for several years. EPCOR may need the full capacity of its transmission main to serve its customers sometime between 2020 and 2025.
3. Beardsley Canal Capacity. If the City were to wheel CAP water through the Beardsley Canal to its own treatment plant, the Beardsley Canal has capacity as far south as Indian School Road, where the canal capacity is 60 - 75 cubic feet per second (cfs) and current users take about 20 cfs of capacity. Goodyear needs about 25 cfs of capacity, so the canal has adequate capacity. Goodyear would pay a wheeling charge to the Maricopa Water District (MWD) for water delivery. Most of the time water is CAP water, but occasionally water is delivered from the reservoir downstream from Lake Pleasant and has a lower quality. The wheeling charge would be somewhere between $16 and $25 per acre-foot.

4. Goodyear Water Campus. The concept of a water campus near the 157th Avenue WRP is to establish a location for surface water treatment that is central to Goodyear that could treat surface water from several sources, and deliver into the distribution system at a location that minimizes travel distances and therefore minimizes trihalomethane (THM) formation in the distribution system. Water treatment in Goodyear provides an advantage over treatment at a distant location from a THM water quality perspective. In addition to treating CAP water, the water campus could treat Buckeye Canal water also at some time in the future. When direct potable reuse (DPR) becomes legal, reclaimed water from the 157th Avenue WRP could be delivered to the water campus for treatment.
5. Water treatment near the Silva site. The purpose of water treatment at a location west of the Silva site is to reduce water transmission main costs for water taken from the Beardsley Canal.
6. Goodyear water treatment plant cost options. The cost estimates for water treatment are based on the costs that others have paid for similar treatment in Arizona. The costs are based on the assumption that the solids stream would be delivered to the 157th Avenue Water Reclamation Plant. There may be efficiencies to be gained by having all the solids handling in one place. The solids flow rate from the plant could vary between 5 gpm and 50 gpm, which is a small flow for the capacity of a 6-mgd plant. The cost includes ozone treatment, which is not required, but makes plant operation easier. The cost also includes $5.6 million for contingencies.
7. Managing THM levels. Water treated at the White Tanks WTP would need to have additional treatment with GAC contactors at the Silva site to manage THM levels.
8. pH and alkalinity treatment. Surface water treated at any location would need additional treatment to manage pH and alkalinity levels to avoid water quality problems when this surface water is introduced into the Goodyear system, which has been supplied by wells up to this point. Well water may also be blended with the surface water to avoid water quality problems. Wells are planned in the vicinity of the Silva site and could also be planned near the water campus.
9. Wheeling water through SRP. The SRP system has capacity for Goodyear's CAP water. The City would lease a part of the capacity in the CAP - SRP interconnect, and pay a wheeling charge. The SRP board would need to approve the wheeling agreement. If managed correctly, water from the SRP system could be delivered by gravity from the 96-inch pipeline.
10. Each option includes the cost of storage and pumping into the distribution system.

The cost of each option was calculated assuming an initial supply of 6.6 mgd, to have a comparison with the EPCOR option. Pipelines and storage costs were set to provide only the amount needed for 6.6 mgd. The planning level cost estimates for each option varied between $64 million and $85 million. This cost range is within the accuracy of the cost estimates for a Class 4 estimate; so, the decision as to the preferred option will be based

on other factors. However, the City will need additional CAP water treatment beyond 6.6 mgd; so additional costs were calculated for the total CAP water right of 15.8, or 16 mgd. For treatment at a Goodyear plant, reasonable economies of scale could be obtained with conventional treatment in increments of 8 mgd; so, the costs of an 8-mgd option and a 16-mgd option were calculated. The full pipeline cost was calculated with the initial 8 mgd so that only one pipe is constructed to carry the ultimate flow. The cost range to provide a Phase 1 treatment capacity of 8 mgd with transmission pipelines large enough to supply 16 mgd varies between $87 million and $108 million. The total cost of Phase 1 plus Phase 2 varies between $143 million and $158 million. A major factor in the cost of providing a surface water supply is the cost of the pipeline to deliver the water.

1.4.1 CAP Supply Decision Factors

The following factors will be a part of the decision process to select the preferred CAP water delivery option:

1. Partnering with other entities. Each of the water treatment and delivery options will require partnering with one or more entities. Options 1 and 2 require a partnership with EPCOR and MWD. Options 3 and 4 require a partnership with MWD. Option 5 requires a partnership with SRP. Each partnership provides benefits to the City, but could also contains risks if the objectives of the parties diverge. Goodyear should evaluate the risks associated with each partnership.
2. The partnership with EPCOR provides the benefit of convenience, and most likely would be able to deliver treated water sooner than other options. However, Goodyear would not be in a good position to manage costs, and THM formation would be more of a challenge due to the distance between the treatment plant and customers.
3. Water treatment at the water campus location provides the best long term location for a treatment facility because the potential for THMs is reduced, and because this treatment facility could treat water from other sources in the future when this water becomes available.
4. Water treatment somewhere near the Silva site offers the advantage of lower pipeline construction costs in the near term. This site would still be useful to treat water from the Buckeye Canal, and also DPR, but additional piping would be required for these potential future sources.
5. Selecting one water treatment option for the initial phase, then considering a different option in the future was also considered. However, obtaining CAP water from two different sources removes the potential for economies of scale that could be obtained when using one large plant for CAP treatment, and the pipeline costs would be high, so having two different CAP water sources would not be economical in the long term.

1.5 WATER AND WASTEWATER CAPITAL IMPROVEMENTS

The water and wastewater systems were evaluated to determine improvements that were needed to serve current customers to the desired standard. Table 1.5 shows the capital projects needed to bring the water system up to current standards. These projects are the same ones that are listed in Technical Memorandum No. 1 Five Year Capital Improvement Program.

The City has identified specific areas where growth is planned in the next ten years. For the water system this growth will require pipes in the areas to be served, wells to provide additional supply, storage, and pumping facilities. Table 1.6 shows the capital projects that are needed for growth through 2025. Once the alternatives have been selected, the City can program in the capital costs.

For the wastewater system, additional sewer mains will be required. Each of the WRPs will also need to be expanded. Table 1.7 shows the capital projects needed to bring the wastewater collection system up to current standards. These projects are the same ones listed in Technical Memorandum No. 1 Five Year Capital Improvement Program. Table 1.8 shows the wastewater projects that are needed for new developments through 2025.

The reclaimed water system does not have any capital improvements that are needed by 2025. However, the following are recommended for the reclaimed water system by year 2020.

1. Continue the Goodyear vadose zone injection project (VIP) by installing sufficient vadose zone wells to recharge all reclaimed water from the Goodyear WRF that is not committed to other uses as flows to the 157th Avenue WRP increase with growth.
2. Conduct hydrologic investigations to site recharge facilities in WPA 4 in favorable locations. This should be done in the next 5 years to establish locations for future facilities in the southern planning area to guide future development infrastructure plans.

Table 1.5 5-Year Water System CIP Project Summary - Projects for Existing Deficiencies
2016 Integrated Water Master Plan
City of Goodyear

Project Number	Priority	Description	Justification	Location	Consequence of not Implementing Project	FY 2016 Costs	FY 2017 Costs	FY 2018 Costs	FY 2019 Costs	FY 2020 Costs	Total Project Cost	Summarized Total Project Cost
	-	CAP contract capital charges	Pay for CIP water supply.	Goodyear City	No access to CAP water.	$284,000	$284,000	$284,000	$284,000	$284,000	$1,420,000	$1,420,000
WA1510	1	Equip Adaman Well 3 (1,300 gpm) & Arsenic Treatment	Increase water supply.	North of Camelback Road along Sarival	Failure of other water supplies causes a failure of Goodyear's ability to deliver water on high water demand days, City fails to meet performance criteria for water supply.	$1,722,000	$-	$-	$-	$-	$1,722,000	$5,713,000
		Connect the Adaman Well to the Sarival transmission main with 1/2 mile of 12-inch main and 1/2 mile of 24 inch main	Deliver Adaman well water.	Sarival Avenue	Failure to use new Adaman well.	$1,645,000	$-	$-	$-	$-	$1,645,000	
		Arsenic Treatment for Adaman Well 3. Assumed 70% supply treated/30% supply blended.	Comply with water quality standards.	Site 21	Water supply does not meet state and federal water quality standards.	$2,346,000	$-	$-	$-	$-	$2,346,000	
IWMP_W1	2	Groundwater well siting study	Determine favorable locations for new groundwater wells in the north and south service areas.	Goodyear City	Wells may not be located to legally and physically deliver water.	$100,000	$-	$-	$-	$-	$100,000	$100,000
IWMP_W2	3	New Site 12 Well (1,200 gpm)	Increase water supply.	Assume well water can be delivered to Site 12 pending groundwater siting study	Satisfy water supply performance criteria.	$3,247,000	$-	$-	$-	$-	$3,247,000	$6,108,000
		Pipeline from new well to Site 12	Deliver water to Site 12 for treatment.	Undetermined well location to Site 12	Satisfy water supply performance criteria.	$644,000	$-	$-	$-	$-	$644,000	
		RO treatment for well	Comply with water quality standards.	Undetermined well location to Site 12	Water supply does not meet state and federal water quality standards.	$2,167,000	$-	$-	$-	$-	$2,167,000	
		Land for well site	Increase water supply.	Near Site 12	Satisfy water supply performance criteria.	$50,000	$-	$-	$-	$-	$50,000	
WA1502	4	Site 12 Pumps (+ 1,800 gpm)	Meet peak hour pumping requirements.	Site 12	Failure to supply peak demands.	$727,000	$-	$-	$-	$-	$727,000	$727,000
IWMP_W3	5	8-inch brine line for RO concentrate	Water treatment requirements.	Near Site 12	RO concentrate is not disposed of legally and properly.	$430,000	$-	$-	$-	$-	$430,000	$430,000
IWMP_W4	6	Booster Pump Station 13 Reservoir Rehabilitation	Existing 1.5 MG Steel tank leaks and full use of the storage is not possible. Interior coating is failing; numerous corrosion locations on floor & walls.	Booster PS 13	Loss of storage capacity can hinder firefighting capabilities. Corrosion can lead to severe leaks and tank foundation being undermined.	$250,000	$-	$-	$-	$-	$250,000	$250,000
IWMP_W5	78	Well 19 production improvement	Well production has dropped from 1200 gpm in 2010, to 850 gpm in 2014.	Well 19	Loss of production here requires a makeup somewhere else - system wide. This pump operates 365 days.	$300,000	$-	$-	$-	$-	$300,000	$300,000
IWMP_W6	8	Well 19 Block Wall	Protect integrity of Well 19.	Well 19	Well 19 susceptible to damage.	$69,303	$-	$-	$-	$-	$69,303	$69,303

Table 1.5 5-Year Water System CIP Project Summary - Projects for Existing Deficiencies
2016 Integrated Water Master Plan
City of Goodyear

Project Number	Priority	Description	Justification	Location	Consequence of not Implementing Project	FY 2016 Costs	FY 2017 Costs	FY 2018 Costs	FY 2019 Costs	FY 2020 Costs	Total Project Cost	Summarized Total Project Cost
IWMP_W7	9	New Site 12 Well (1,200 gpm)	Increase water supply.	Assume well water can be delivered to Site 12 pending groundwater siting study	Satisfy water supply performance criteria.	$-	$3,247,000	$-	$-	$-	$3,247,000	$6,108,000
		Pipeline from new well to Site 12	Deliver water to Site 12 for treatment.	Undetermined well location to Site 12	Satisfy water supply performance criteria.	$-	$644,000	$-	$-	$-	$644,000	
		RO treatment for well	Comply with water quality standards.	Undetermined well location to Site 12	Water supply does not meet state and federal water quality standards.	$-	$2,167,000	$-	$-	$-	$2,167,000	
		Land for well site	Increase water supply.	Near Site 12	Satisfy water supply performance criteria.	$-	$50,000	$-	$-	$-	$50,000	
IWMP_W8	10	Well 18A casing and screen replacement - Re-drill and equip well using municipal standards	Well production has reduced since 1998 and the Johnson screens have many holes resulting in sand and filter pack being pumped out.	Well 18A	Loss of water production to meet water demands.	$-	$1,000,000	$-	$-	$-	$1,000,000	$1,000,000
IWMP_W9	11	Well 18B casing and screen replacement - Re-drill and equip well using municipal standards	Well production has reduced since 1998 and the Johnson screens have many holes resulting in sand and filter pack being pumped out.	Well 18B	Loss of water production to meet water demands.	$-	$1,000,000	$-	$-	$-	$1,000,000	$1,000,000
IWMP_W10	12	Bullard RO Campus filter assembly rehabilitation or replacement	The South filter assemblies are corroding excessively due to leaks.	Bullard RO Campus	Loss of filter assemblies could result in damage to RO membranes and loss of production; high O&M costs.	$-	$75,000	$-	$-	$-	$75,000	$75,000
IWMP_W11	13	Bullard RO Campus SST piping improvements	SST influent piping has developed multiple pin holes caused by corrosion.	Bullard RO Campus	Loss of influent piping will shut down the RO process.	$-	$60,000	$-	$-	$-	$60,000	$60,000
IWMP_W12	14	Add an additional 1,000 gpm pump at Site 13	Meet fire flow requirements.	Site 13	Failure to provide sufficient fire flow for emergency events.	$-	$-	$798,000	$-	$-	$798,000	$798,000
IWMP_W13	15	Well 1 redrill and re-equip at a new site using municipal standards.	Old irrigation well with slot cuts in casing installed 1940 +/-. Past useful life.	Well 1	Loss of water production to meet water demands.	$-	$-	$6,108,000	$-	$-	$6,108,000	$6,108,000
IWMP_W14	16	1.2 MG storage capacity for north service area	Meet system water storage requirements.	North service area - actual location to be determined	Failure to satisfy storage performance criteria.	$-	$-	$-	$4,039,000	$-	$4,039,000	$4,539,000
		Land for 1.2 MG reservoir	Land is required for a storage site.	to be determined	Additional storage not possible.	$-	$-	$-	$500,000	$-	$500,000	
IWMP_W15	17	Well 3 well redrill and re-equip using municipal standards.	Old irrigation well with slot cuts in casing installed 1960 +/-. Casing is fragile and City does not brush to clean.	Well 3	Loss of water production to meet water demands.	$-	$-	$-	$1,000,000	$-	$1,000,000	$1,000,000
IWMP_W16	18	Replace mains in Sarival Estates	Address leaks/failures.	Northwest corner of Sarival and Lower Buckeye Road	Water leaks and pipeline failures continue to occur, with corresponding costs.	$-	$-	$-	$-	$2,904,000	$2,904,000	$2,904,000

Table 1.5 5-Year Water System CIP Project Summary - Projects for Existing Deficiencies
2016 Integrated Water Master Plan
City of Goodyear

Project Number	Priority	Description	Justification	Location	Consequence of not Implementing Project	FY 2016 Costs	FY 2017 Costs	FY 2018 Costs	FY 2019 Costs	FY 2020 Costs	Total Project Cost	Summarized Total Project Cost
IWMP_W17	19	Create DMOM plan	Proactive management of distribution system.	N/A	Water distribution system maintenance and capacity management not consistently implemented, increasing the risk of infrastructure failures and/or failure to deliver water.	$-	$-	$-	$-	$100,000	$100,000	$100,000
IWMP_W18	20	Booster Pump Stations "cans" corrosion evaluation study - all pump stations	Field site visits noted numerous pump stations were significant corrosion was observed at the interface of the pump "can" and the concrete. How bad is the corrosion?	At various pump stations	Loss of pumping capability to meet water demands if "cans" collapse into the pumps	$-	$-	$-	$-	$150,000	$150,000	$150,000
Subtotal						**$13,981,303**	**$8,527,000**	**$7,190,000**	**$5,823,000**	**$3,438,000**	**$38,959,303**	**$38,959,303**
WATER 5-YEAR CIP TOTAL						**$38,959,303**						

ENR CCI = 9886 Costs are not escalated in future years.

Table 1.6 10-Year Water System CIP Project Summary - Growth Related Projects
2016 Integrated Water Master Plan
City of Goodyear

Project Number	Priority	Description	Justification	Location	Consequence of Not Implementing Project	FY 2016 Costs	FY 2017 Costs	FY 2018 Costs	FY 2019 Costs	FY 2020 Costs	FY 2021 Costs	FY 2022 Costs	FY 2023 Costs	FY 2024 Costs	FY 2025 Costs	Total Cost
IWMP_W2	1	Additional Land Cost for New Site 12 Well	Increase water supply.	Near Site 12	Water Supply Criteria not met.	$100,000	$-	$-	$-	$-	$-	$-	$-	$-	$-	$100,000
IWMP_W7	1	Additional Land Cost for New Site 12 Well	Increase water supply.	Near Site 12	Water Supply Criteria not met.	$-	$100,000		$-	$-	$-	$-	$-	$-	$-	$100,000
IWMP_W19	1	New Well (1,300 gpm)	Serve future growth.	Near Silva Site	Inability to meet projected maximum day demands.	$-	$-	$3,247,000	$-	$-	$-	$-	$-	$-	$-	$3,247,000
		Pipeline for new well	Deliver water from well site to treatment location.	From new well to Silva Site		$-	$-	$644,000	$-	$-	$-	$-	$-	$-	$-	$644,000
		RO Treatment for new well	Comply with water quality standards.	Silva Site		$-	$-	$2,167,000	$-	$-	$-	$-	$-	$-	$-	$2,167,000
		Land for well site	Land is required to site infrastructure.	Near Silva Site		$-	$-	$150,000	$-	$-	$-	$-	$-	$-	$-	$150,000
IWMP_W13	1	Additional Land Cost for Relocated Well 1	Increase water supply.	TBD	Needed to continue Well 1 production.	$-	$-	$100,000	$-	$-	$-	$-	$-	$-	$-	$100,000
IWMP_W20	2	New Well (1,300 gpm)	Serve future growth.	Near Silva Site	Inability to meet projected maximum day demands.	$-	$-	$-	$3,247,000	$-	$-	$-	$-	$-	$-	$3,247,000
		Pipeline for new well	Deliver water from well site to treatment location.	From new well to Silva Site		$-	$-	$-	$644,000	$-	$-	$-	$-	$-	$-	$644,000
		RO Treatment for new well	Comply with water quality standards.	Silva Site		$-	$-	$-	$2,167,000	$-	$-	$-	$-	$-	$-	$2,167,000
		Land for well site	Land is required to site infrastructure.	Near Silva Site		$-	$-	$-	$150,000	$-	$-	$-	$-	$-	$-	$150,000
IWMP_W15	2	Water treatment and land for a relocated Well 3	Old irrigation well needs rehabilitation, is located in the vicinity of a Superfund site plume.	TBD	Needed to continue Well 3 production.	$-	$-	$-	$5,258,000	$-	$-	$-	$-	$-	$-	$5,258,000
IWMP_W21	3	New Well (1,300 gpm)	Serve future growth.	Near Silva Site	Inability to meet projected maximum day demands.	$-	$-	$-	$-	$3,247,000	$-	$-	$-	$-	$-	$3,247,000
		Pipeline for new well	Deliver water from well site to treatment location.	From new well to Silva Site		$-	$-	$-	$-	$644,000	$-	$-	$-	$-	$-	$644,000
		RO Treatment for new well	Comply with water quality standards.	Silva Site		$-	$-	$-	$-	$2,167,000	$-	$-	$-	$-	$-	$2,167,000
		Land for well site	Land is required to site infrastructure.	Near Silva Site		$-	$-	$-	$-	$150,000	$-	$-	$-	$-	$-	$150,000
IWMP_W22	4	2.6 MG storage reservoir	Serve future growth. Needed for well treatment and blending schemes.	Silva Site	Inability to meet projected demands in WPA 2, particularly north west Goodyear.	$-	$6,800,000	$-	$-	$-	$-	$-	$-	$-	$-	$6,800,000
		8.8 mgd (6,100 gpm) booster station				$-	$4,800,000	$-	$-	$-	$-	$-	$-	$-	$-	$4,800,000
IWMP_W24	5	1 Rainbow Valley Well	Provides 1.5 mgd of supply to WPA 3/4 and reduces the amount of water needed from the north (WPA 2) to serve developments in the south.	WPA 4	Places more burden on water production and infrastructure in the north (WPA 2) to serve the south.	$-	$-	$-	$-	$-	$-	$-	$-	$-	$3,247,000	$3,247,000
		Well Transmission Pipeline (1 RV Well)				$-	$-	$-	$-	$-	$-	$-	$-	$-	$10,500,000	$10,500,000
		Well Treatment (1 RV Well)				$-	$-	$-	$-	$-	$-	$-	$-	$-	$2,167,000	$2,167,000
		Land (1 RV Well)				$-	$-	$-	$-	$-	$-	$-	$-	$-	$150,000	$150,000
IWMP_W25	-	New 16-in water main (5,610 LF) Broadway Road from Citrus Road to Cotton Lane	Serve future growth and expand the distribution system.	WPA 2	Inability to serve future development.	$-	$-	$-	$1,641,500	$-	$-	$-	$-	$-	$-	$1,641,500
IWMP_W26	-	New 12-in water main (5,280 LF) Van Buren Street from Perryville Road to Citrus Road	Serve future growth and expand the distribution system.	WPA 2	Inability to serve future development.	$-	$-	$-	$-	$1,286,000	$-	$-	$-		$-	$1,286,000

Table 1.6 10-Year Water System CIP Project Summary - Growth Related Projects
2016 Integrated Water Master Plan
City of Goodyear

Project Number	Priority	Description	Justification	Location	Consequence of Not Implementing Project	FY 2016 Costs	FY 2017 Costs	FY 2018 Costs	FY 2019 Costs	FY 2020 Costs	FY 2021 Costs	FY 2022 Costs	FY 2023 Costs	FY 2024 Costs	FY 2025 Costs	Total Cost
IWMP_W27	-	New 16-in water main (2,640 LF) Citrus Road from Van Buren Street to Roosevelt Street	Serve future growth and expand the distribution system.	WPA 2	Inability to serve future development.	$-	$-	$-	$-	$772,500	$-	$-	$-		$-	$772,500
IWMP_W28	-	New 24-in water main (2,640 LF) Van Buren from Citrus to 174th Avenue	Serve future growth and expand the distribution system.	WPA 2	Inability to serve future development.	$-		$1,001,600	$-	$-	$-	$-	$-		$-	$1,001,600
IWMP_W29	-	New 24-in water main (2,640 LF) Citrus Road from Harrison Street to Van Buren Street	Serve future growth and expand the distribution system.	WPA 2	Inability to serve future development.	$-		$1,001,600	$-	$-	$-	$-	$-		$-	$1,001,600
IWMP_W30	-	New 16-in water main (5,280 LF) Litchfield Road from Yuma Road to Van Buren Street	Serve future growth and expand the distribution system.	WPA 2	Inability to serve future development.	$-	$-	$-	$-	$-	$1,544,900	$-	$-		$-	$1,544,900
IWMP_W31	-	New 16-in water main (650 LF) Litchfield Road from El Cielo Street to MC85	Serve future growth and expand the distribution system.	WPA 2	Inability to serve future development.	$-	$-	$-	$-	$-	$190,200	$-	$-		$-	$190,200
IWMP_W32	-	New 12-in water main (4,300 LF) Litchfield Road from Broadway Road to La Tierra Street	Serve future growth and expand the distribution system.	WPA 2	Inability to serve future development.	$-	$-	$-	$-	$-	$-	$1,155,800	$-		$-	$1,155,800
IWMP_W33	-	New 16-in water main (7,920 LF) Broadway Road from Estrella to 143rd Avenue	Serve future growth and expand the distribution system.	WPA 2	Inability to serve future development.	$-	$-	$-	$-	$-	$-	$2,317,400	$-		$-	$2,317,400
IWMP_W34	-	New 12-in water main (2,680 LF) Broadway Road from 143rd Avenue to Litchfield Road	Serve future growth and expand the distribution system.	WPA 2	Inability to serve future development.	$-	$-	$-	$-	$-	$-	$-	$-	$720,400	$-	$720,400
IWMP_W35	-	New 12-in water main (3,430 LF) 143rd Avenue from Broadway to North of El Sol Street	Serve future growth and expand the distribution system.	WPA 2	Inability to serve future development.	$-	$-	$-	$-	$-	$-	$-	$-	$922,000	$-	$922,000
IWMP_W36	-	New 12-in water main (3,940 LF) Loop completion in CantaMia	Serve future growth and expand the distribution system.	WPA 3	Inability to serve future development.	$-	$-	$1,059,100		$-	$-	$-	$-	$-	$-	$1,059,100
IWMP_W37	-	New 16-in water main (1,300 LF) connection from CantaMia north loop to Willis Road	Serve future growth and expand the distribution system.	WPA 3	Inability to serve future development.	$-	$-	$380,400		$-	$-	$-	$-	$-	$-	$380,400
IWMP_W38	-	New 12-in water main (8.790 LF) south of Westar to Rainbow Valley Road	Serve future growth and expand the distribution system.	WPA 3	Inability to serve future development.	$-	$-	$2,362,800		$-	$-	$-	$-	$-	$-	$2,362,800
IWMP_W39	-	New 12-in water main (1,930 LF) connection from Calistoga Drive to the west	Serve future growth and expand the distribution system.	WPA 3	Inability to serve future development.	$-	$-	$-	$518,800	$-	$-	$-	$-	$-	$-	$518,800

Table 1.6 10-Year Water System CIP Project Summary - Growth Related Projects
2016 Integrated Water Master Plan
City of Goodyear

Project Number	Priority	Description	Justification	Location	Consequence of Not Implementing Project	FY 2016 Costs	FY 2017 Costs	FY 2018 Costs	FY 2019 Costs	FY 2020 Costs	FY 2021 Costs	FY 2022 Costs	FY 2023 Costs	FY 2024 Costs	FY 2025 Costs	Total Cost
IWMP_W40	-	New 12-in water main (1,570 LF) Mountain Vista Drive from 182nd to 184th Avenue	Serve future growth and expand the distribution system.	WPA 3	Inability to serve future development.	$-	$-	$-	$422,000	$-	$-	$-	$-	$-	$-	$422,000
IWMP_W41	-	New 12-in water main (3,500 LF) 184th Avenue from Calistoga Drive to south of Mountain Vista Drive	Serve future growth and expand the distribution system.	WPA 3	Inability to serve future development.	$-	$-	$-	$940,800	$-	$-	$-	$-	$-	$-	$940,800
IWMP_W42	-	New 16-in water main (8,400 LF) East of Rainbow Valley Road from west of Willis Road to the west	Serve future growth and expand the distribution system.	WPA 3	Inability to serve future development.	$-	$-	$-	$2,457,800	$-	$-	$-	$-	$-	$-	$2,457,800
IWMP_W43	-	New 12-in water main (17,000 LF) connection north east of Estrella and Cotton Lane	Serve future growth and expand the distribution system.	WPA 3	Inability to serve future development.	$-	$-	$-	$-	$-	$-	$-	$-	$4,569,600	$-	$4,569,600
IWMP_W44		1.5 MG of Redundant storage for Site 13	Take the original storage down for maintenance.	WPA3	Redundancy, inability to fully maintain current Site 13 reservoir.	$-	$-	$-	$-	$-	$-	$-	$4,000,000	$-	$-	$4,000,000
Subtotal						***$100,000***	***$11,700,000***	***$12,113,500***	***$17,446,900***	***$8,266,500***	***$1,735,100***	***$3,473,200***	***$4,000,000***	***$6,212,000***	***$16,064,000***	***$81,111,200***
WATER 10-YEAR CIP TOTAL						**$81,111,000**										

Table 1.7 Wastewater CIP Project Summary Five-year CIP for 2015 System Deficiencies
2016 Integrated Water Master Plan
City of Goodyear

Project Number	Priority	Description	Justification	Location	Consequence of not Implementing the Project	FY 2016 Costs	FY 2017 Costs	FY 2018 Costs	FY 2019 Costs	FY 2020 Costs	Total Project Costs
WW-1	1	Rainbow Valley WRF Influent Pump Station	Lack of instrumentation on the piping system prevents monitoring pump performance and wetwell levels	Rainbow Valley WRF	Potential spill from overflowing wetwell; premature pump failure	$70,100					$70,100
WW-2	2	Rainbow Valley WRF Sludge Holding Tanks	Significant piping and valving improvements are required to enable process operations to be efficient	Rainbow Valley WRF	Potential violations of discharge permit due to lack of process redundancy	$157,700					$157,700
WW-3	3	Goodyear WRF (157th Avenue) Solids Handling Facility upgrade	Rehabilitation and upgrade of existing equipment and installation of finer screening unit for process improvement	Goodyear WRF	Potential violations of discharge permit due to lack of process redundancy, and aging equipment	$1,351,900					$1,351,900
WW-4	4	Perryville Grinder Station - screen and auger installation	Solids from Perryville Prison are not removed from the collection system and cause debris issues at the Goodyear WRF	Perryville Grinder Station	Potential for backup of collection system at prison; increased O&M at Goodyear WRF to remove debris	$300,000					$300,000
WW-5	5	Replace Wells Fargo force main	Continual problem with surcharging of wetwell and pumps cannot be fully utilized	Wells Fargo Lift Station	Potential for backup in collection system is high	$556,000					$556,000
WW-6	6	Upsize approximately 300 LF of gravity sewer pipeline	Continual problem with surcharging and debris accumulation; O&M costs are high	Prison connection to Goodyear system	Potential for backup in collection system is high	$190,000					$190,000
WW-7	7	Lift Station 12 - Rainbow Valley Lift Station Influent piping and wetwell rehabilitation	Influent piping has corroded and fallen off its connection resulting in need to operate wetwell with higher level than best practices; wetwell re-coating	Rainbow Valley Lift Station	Loss of capacity in wetwell for pump cycling risking potential backup in collection system	$148,000					$148,000
WW-8	8	Lift Station 7 - Ricardo Lift Station pumps replacement, guide rails, chains and wetwell coatings, Lift Station 8 - Irene Lift Station pumps replacement, guide rails, chains and wetwell coatings	Pumps need replacement along with piping and guide rails; wetwell coating needs rehabilitation	Lift Station 7 and 8	Potential failure of pumps to operate and subsequent spill, backup in collection system	$335,000					$335,000
WW-9	9	Implement CMOM program	Proactively manage collection system to prevent spills and reduce life cycle operating costs	Citywide	Collection system is not systematically maintained so the risk of sewer overflows increases; maintenance costs increase as repairs must be done after failures occur.	$225,000					$225,000
WW-10	10	Rehabilitation of severely corroded sewer manholes that force mains discharge into	Precast concrete manholes have been severely corroded due to high H_2S and are at risk of failing	Various locations in collection system	Potential for manhole collapse causing disruption and/or injury if the manhole is located in a roadway	$270,000					$270,000
WW-11	11	Goodyear WRF (157th Avenue) South Digester Rehabilitation	Aging and cracked digester needs repair or replacement to prevent leakage into the aquifer	Goodyear WRF	Potential Contamination of the Aquifer; violation of discharge permit	$315,000					$315,000
WW-12	12	Rehabilitation of QS 59 small diameter sewer pipelines and associated manholes using no-dig CIPP methods	Existing small diameter VCP sewer pipes have numerous cracks and allow significant root intrusion resulting in excessive maintenance	QS 59	Potential sewer line backup and subsequent overflow of sewage, violation of permit	$1,600,000					$1,600,000
WW-13	13	Goodyear WRF (157th Avenue) Solids Handling Facility upgrade	Addition of third centrifuge for process redundancy	Goodyear WRF	Potential violations of discharge permit due to lack of process redundancy, and aging equipment		$1,204,300				$1,204,300

Table 1.7 Wastewater CIP Project Summary Five-year CIP for 2015 System Deficiencies
2016 Integrated Water Master Plan
City of Goodyear

Project Number	Priority	Description	Justification	Location	Consequence of not Implementing the Project	FY 2016 Costs	FY 2017 Costs	FY 2018 Costs	FY 2019 Costs	FY 2020 Costs	Total Project Costs
WW-14	14	Lift Station 5 - Bio Flora Lift Station pump replacement; piping	Pumps need replacement along with piping and guide rails	Lift Station 5	Potential failure of pumps to operate and subsequent spill, backup in collection system		$184,000				$184,000
WW-15	15	Corgett WRF Influent Pump Station and Headworks Improvements	Need to address wetwell corrosion, replace grit removal and washer/compactor equipment	Corgett WRF	Potential violations of discharge permit due to aging equipment and process inefficiencies		$793,400				$793,400
WW-16	16	Rainbow Valley WRF waterline extension	Need to connect to domestic water system for supply of water at the WRF; addition of fire hydrant	Rainbow Valley WRF	Continue to haul potable water to site for lab and personnel use; lack of firefighting capability on site		$123,500				$123,500
WW-17	17	Rainbow Valley WRF Aeration Basin improvements and membrane replacement	Replace failed aeration membranes, and make significant upgrades to air piping for process improvements	Rainbow Valley WRF	Potential violations of discharge permit due to lack of process redundancy, and failed equipment		$237,600				$237,600
WW-18	18	Rainbow Valley WRF RAS/WAS Pump Station improvements	Addition of VFDs on pump motors, MOV for control valve and piping from ARVs to wetwell	Rainbow Valley WRF	Potential spill from ARVs discharging to ground; potential premature equipment failure; inefficient use		$51,700				$51,700
WW-19	19	Rainbow Valley solids Handling Area improvements	Improvements to solids handling area	Rainbow Valley WRF	Potential violations from dewatered solids spilling onto the ground rather than into bin or concrete slab		$63,200				$63,200
WW-20	20	Lift Station 10 - Lum Lift Station - pump replacement	Pumps need replacement along with ARVs and piping, wetwell coatings need rehabilitation	Lift Station 10 - Lum	Potential failure of pumps to operate and subsequent spill, backup in collection system		$167,000				$167,000
WW-21	21	Rehabilitation of severely corroded sewer manholes within collection system	Precast concrete manholes have been severely corroded due to high H_2S and need rehabilitation	Various locations in collection system	Potential for manhole collapse causing disruption and/or injury if the manhole is located in a roadway		$500,000				$500,000
WW-22	22	Lift Station 6 - (Lost Lift Station) - pump replacement and wetwell rehabilitation	Pump station is 28 years old - pumps have outlived useful life; wetwell is highly corroded; site security	Lift Station 6 (Lost Lift Station)	Potential failure of pumps to operate and subsequent spill, backup in collection system			$275,000			$275,000
WW-23	23	Lift Station 3 - Palm Valley Lift Station pumps replacement; generator panel; wetwell coating	Pumps need replacement along with piping and guide rails; wetwell coating needs rehabilitation	Lift Station 3	Potential failure of pumps to operate and subsequent spill, backup in collection system			$90,000			$90,000
WW-24	24	Corgett WRF Chlorine Contact Basin Improvements	Optimize chlorine dosing to ensure proper chlorine levels in effluent	Corgett WRF	Over spending chemicals, discharging effluent with too high chlorine levels			$157,300			$157,300
WW-25	25	Lift Station 12 - Rainbow Valley Lift Station Pump Replacement	Area being served is growing and there is no redundancy at the lift station	Rainbow Valley Lift Station	Potential failure of pumps to operate and subsequent spill, backup in collection system			$101,000			$101,000
WW-26	26	Rehabilitation of severely corroded sewer manholes that force mains discharge into	Precast concrete manholes have been severely corroded due to high H_2S and are at risk of failing	Various locations in collection system	Potential for manhole collapse causing disruption and/or injury if the manhole is located in a roadway			$500,000			$500,000
WW-27	27	Rehabilitation of severely corroded sewer manholes within collection system	Precast concrete manholes have been severely corroded due to high H_2S and need rehabilitation	Various locations in collection system	Potential for manhole collapse causing disruption and/or injury if the manhole is located in a roadway				$500,000		$500,000
WW-28	28	Rainbow Valley WRF Tertiary Filter Unit Replacement	Existing traveling bridge filter unit is at the end of its useful life and needs to be replaced	Rainbow Valley WRF	Potential violation of discharge permit				$552,000		$552,000

Table 1.7 Wastewater CIP Project Summary Five-year CIP for 2015 System Deficiencies
2016 Integrated Water Master Plan
City of Goodyear

Project Number	Priority	Description	Justification	Location	Consequence of not Implementing the Project	FY 2016 Costs	FY 2017 Costs	FY 2018 Costs	FY 2019 Costs	FY 2020 Costs	Total Project Costs
WW-29	29	Lift Station 13 - Las Brisas Lift Station install third 70-hp pump	Pump needed for redundancy and reliability	Lift Station 13	Loss of capacity of lift station for pump cycling risking potential backup in collection system				$102,000		$102,000
WW-30	30	Lift Station 12 - Rainbow Valley Lift Station Pump Replacement	Area being served is growing and there is no redundancy at the lift station	Rainbow Valley Lift Station	Potential failure of pumps to operate and subsequent spill, backup in collection system				$101,000		$101,000
WW-31	31	Corgett WRF Scum Pump Station addition/ Chemical Storage and Feed system	Scum should be sent to digesters not to influent pump station; relocate chemical storage tanks	Corgett WRF	Process remains inefficient and more costly to operate; comply with Best Practices					$86,400	$86,400
WW-32	32	Lift Station 2 - Del Camino Lift Station wetwell rehabilitation	Wetwell concrete strength is compromised due to corrosion	Lift Station 2	Potential to disrupt lift station operations if concrete spalls off					$70,000	$70,000
WW-33	22	Lift Station 12 - Rainbow Valley Lift Station Pump Replacement	Area being served is growing and there is no redundancy at the lift station	Rainbow Valley Lift Station	Potential failure of pumps to operate and subsequent spill, backup in collection system					$101,000	$101,000
WW-34	34	Rehabilitation of severely corroded sewer manholes within collection system	Precast concrete manholes have been severely corroded due to high H_2S and need rehabilitation	Various locations in collection system	Potential for manhole collapse causing disruption and/or injury if the manhole is located in a roadway					$1,000,000	$1,000,000
Subtotal						**$5,518,700**	**$3,324,700**	**$1,123,300**	**$1,255,000**	**$1,257,400**	**$12,479,100**
					Five-Year Wastewater CIP Grand Total		**$12,479,100**				

ENR CCI = 9886 Costs are not escalated in future years.

Table 1.8 10-Year Wastewater System CIP Project Summary - Growth Related Projects
2016 Integrated Water Master Plan
City of Goodyear

Project Number	Priority	Description	Justification	Location	Consequence of not Implementing the Project	FY 2016 Costs	FY 2017 Costs	FY 2018 Costs	FY 2019 Costs	FY 2020 Costs	FY 2021 Costs	FY 2022 Costs	FY 2023 Costs	FY 2024 Costs	FY 2025 Costs	Total Project Costs
IMWP_WW34	-	Replace Pumps at the CantaMia Lift Station	Pumps need replacement to meet projected flows	CantaMia Lift Station	Potential spill from overflowing wetwell; premature pump failure	$-	$-	$-	$-	$-	$-	$-	$-	$148,000	$-	$148,000
IMWP_WW35	-	New 15-in sewer (1,840 LF) Elwood Road from West of 175th to east of 175th Avenue	Serve future growth and expand the collection system	WPA 2	Inability to serve future development	$-	$-	$-	$417,300	$-	$-	$-	$-	$-	$-	$417,300
IMWP_WW36	-	New 8-in sewer (3,700 LF) Estrella Parkway from Van Buren to Goodyear Boulevard	Serve future growth and expand the collection system	WPA 2	Inability to serve future development	$-	$-	$-	$730,400	$-	$-	$-	$-	$-	$-	$730,400
IMWP_WW37	-	New 8-in sewer (2,440 LF) and 12-in sewer (2,650 LF) 144th Avenue from Van Buren to Yuma	Serve future growth and expand the collection system	WPA 2	Inability to serve future development	$-	$-	$-	$1,053,000	$-	$-	$-	$-	$-	$-	$1,053,000
IMWP_WW38	-	New 21-in sewer (4,100 LF) Yuma Road from Bullard to Camino Oro	Serve future growth and expand the collection system	WPA 2	Inability to serve future development	$-	$-	$-	$1,042,100	$-	$-	$-	$-	$-	$-	$1,042,100
IMWP_WW39	-	New 8-in sewer (1,960 LF) Estrella Parkway from San Miguel to Spring	Serve future growth and expand the collection system	WPA 3	Inability to serve future development	$-	$-	$-	$386,900	$-	$-	$-	$-	$-	$-	$386,900
IMWP_WW40	-	New 8-in sewer (1,580 LF) West of Desert Trumpet Road	Serve future growth and expand the collection system	WPA 3	Inability to serve future development	$-	$-	$-	$311,900	$-	$-	$-	$-	$-	$-	$311,900
IMWP_WW41	-	New 8-in sewer (2,590 LF) West of Thistle Landing Drive	Serve future growth and expand the collection system	WPA 3	Inability to serve future development	$-	$-	$-	$511,300	$-	$-	$-	$-	$-	$-	$511,300
IMWP_WW42	-	New 8-in sewer (3,095 LF) West EMR Development	Serve future growth and expand the collection system	WPA 3	Inability to serve future development	$-	$-	$-	$611,900	$-	$-	$-	$-	$-	$-	$611,900
IMWP_WW43	-	New 8-in sewer (6,400 LF) Northwest on Rainbow Valley Road	Serve future growth and expand the collection system	WPA 3	Inability to serve future development	$-	$-	$-	$1,263,400	$-	$-	$-	$-	$-	$-	$1,263,400
IMWP_WW44	-	New 8-in sewer (2,640 LF) North of Rainbow Valley Road	Serve future growth and expand the collection system	WPA 3	Inability to serve future development	$-	$-	$-	$523,100	$-	$-	$-	$-	$-	$-	$523,100
IMWP_WW45	-	New 8-in sewer (2,880 LF) East of Willis Road	Serve future growth and expand the collection system	WPA 3	Inability to serve future development	$-	$-	$-	$568,500	$-	$-	$-	$-	$-	$-	$568,500
IMWP_WW46	-	New 8-in sewer (1,760 LF) Perryville Road from Camelback to south of Elm	Serve future growth and expand the collection system	WPA 3	Inability to serve future development	$-	$-	$-	$347,400	$-	$-	$-	$-	$-	$-	$347,400

Table 1.8 10-Year Wastewater System CIP Project Summary - Growth Related Projects
2016 Integrated Water Master Plan
City of Goodyear

Project Number	Priority	Description	Justification	Location	Consequence of not Implementing the Project	FY 2016 Costs	FY 2017 Costs	FY 2018 Costs	FY 2019 Costs	FY 2020 Costs	FY 2021 Costs	FY 2022 Costs	FY 2023 Costs	FY 2024 Costs	FY 2025 Costs	Total Project Costs
IMWP_WW47	-	New 8-in sewer (860 LF) Citrus Road from Minnezona to Campbell	Serve future growth and expand the collection system	WPA 3	Inability to serve future development	$-	$-	$-	$169,800	$-	$-	$-	$-	$-	$-	$169,800
IMWP_WW48	-	New 8-in sewer (5,264 LF) Minnezona Avenue from Perryville to Citrus	Serve future growth and expand the collection system	WPA 3	Inability to serve future development	$-	$-	$-	$1,040,300	$-	$-	$-	$-	$-	$-	$1,040,300
IMWP_WW49	-	New 12-in sewer (2,500 LF) Elwood Road from Citrus to west of 175th Avenue	Serve future growth and expand the collection system	WPA 2	Inability to serve future development	$-	$-	$-	$-	$-	$-	$-	$-	$541,200	$-	$541,200
IMWP_WW50	-	New 8-in sewer (2,560 LF) Citrus Road from Lower Buckeye to Elwood	Serve future growth and expand the collection system	WPA 2	Inability to serve future development	$-	$-	$-	$-	$-	$-	$-	$-	$505,300	$-	$505,300
IMWP_WW51	-	New 8-in sewer (2,990 LF) North of Las Brisas Lift Station	Serve future growth and expand the collection system	WPA 2	Inability to serve future development	$-	$-	$-	$-	$-	$-	$-	$-	$590,200	$-	$590,200
IMWP_WW52	-	Perryville from South of I-10 to Roosevelt, then east to Citrus Road	Serve future growth and expand the collection system	WPA 2	Inability to serve future development	$-	$-	$-	$-	$-	$-	$-	$-	$1,270,000	$-	$1,270,000
IMWP_WW53	-	New 10-in sewer (3,404 LF) and 12-in sewer (469 LF) Van Buren Street from Perryville to east of Citrus	Serve future growth and expand the collection system	WPA 2	Inability to serve future development	$-	$-	$-	$-	$-	$-	$-	$-	$774,000	$-	$774,000
IMWP_WW54	-	New 8-in sewer (1,219 LF) and 12-in sewer (1437 LF) Citrus Road from Roosevelt to Van Buren	Serve future growth and expand the collection system	WPA 2	Inability to serve future development	$-	$-	$-	$-	$-	$-	$-	$-	$552,000	$-	$552,000
IMWP_WW55		South of Roosevelt and West of Citrus to East of Perryville	Serve future growth and expand the collection system	WPA 2	Inability to serve future development	$-	$-	$-	$-	$-	$-	$-	$-	$1,327,000	$-	$1,327,000
IMWP_WW56	-	New 8-in sewer (4,390 LF) Litchfield Road from Lower Buckeye to Broadway	Serve future growth and expand the collection system	WPA 2	Inability to serve future development	$-	$-	$-	$-	$-	$-	$-	$-	$866,600	$-	$866,600
IMWP_WW57	-	New 10-in sewer (2,730 LF) and 12-in sewer (2,670 LF) Broadway Road from Bullard to Litchfield	Serve future growth and expand the collection system	WPA 2	Inability to serve future development	$-	$-	$-	$-	$-	$-	$-	$-	$1,164,300	$-	$1,164,300
IMWP_WW58	-	New 8-in sewer (2,690 LF) 143rd Avenue from El Sol to Broadway	Serve future growth and expand the collection system	WPA 2	Inability to serve future development	$-	$-	$-	$-	$-	$-	$-	$-	$533,000	$-	$533,000
IMWP_WW59	-	New 12-in sewer (5,090 LF) Bullard Avenue from Van Buren to Yuma	Serve future growth and expand the collection system	WPA 2	Inability to serve future development	$-	$-	$-	$-	$-	$-	$-	$-	$1,099,600	$-	$1,099,600

Table 1.8 10-Year Wastewater System CIP Project Summary - Growth Related Projects
2016 Integrated Water Master Plan
City of Goodyear

Project Number	Priority	Description	Justification	Location	Consequence of not Implementing the Project	FY 2016 Costs	FY 2017 Costs	FY 2018 Costs	FY 2019 Costs	FY 2020 Costs	FY 2021 Costs	FY 2022 Costs	FY 2023 Costs	FY 2024 Costs	FY 2025 Costs	Total Project Costs
IMWP_WW60	-	New 8-in sewer (1,920 LF) Upstream of Lost Lift Station	Serve future growth and expand the collection system	WPA 3	Inability to serve future development	$-	$-	$-	$-	$-	$-	$-	$-	$379,000	$-	$379,000
IMWP_WW61	-	New 8-in sewer (1,330 LF) San Miguel east of Estrella	Serve future growth and expand the collection system	WPA 3	Inability to serve future development	$-	$-	$-	$-	$-	$-	$-	$-	$262,500	$-	$262,500
IMWP_WW62	-	New 8-in sewer (1,660 LF) Coyote Train Drive east of Estrella	Serve future growth and expand the collection system	WPA 3	Inability to serve future development	$-	$-	$-	$-	$-	$-	$-	$-	$327,700	$-	$327,700
IMWP_WW63	-	New 8-in sewer (690 LF) Wind Drift Road east of Estrella	Serve future growth and expand the collection system	WPA 3	Inability to serve future development	$-	$-	$-	$-	$-	$-	$-	$-	$136,200	$-	$136,200
IMWP_WW64	-	Expansion of the Goodyear WRF from 6.0 to 8.0 mgd	Serve future growth	Goodyear WRF	Inability to treat future projected wastewater flows	$-	$-	$-	$-	$-	$-	$-	$-	$44,000,000	$-	$44,000,000
IMWP_WW65	-	Expansion of the Corgett WRF to 1.2 mgd	Serve future growth	Corgett WRF	Inability to treat future projected wastewater flows	$-	$-	$-	$-	$-	$-	$-	$-	$26,400,000	$-	$26,400,000
IMWP_WW66	-	Expansion of Rainbow Valley WRF including redundancy (1.2 mgd capacity assumed)	Serve future growth	Rainbow Valley WRF	Inability to treat future projected wastewater flows	$-	$-	$26,400,000	$-	$-	$-	$-	$-	$-	$-	$26,400,000
IWMP_WW67		Replace pumps at the Bio Flora lift station	serve future growth	WPA 2	Insufficient lift station capacity			$150,000								$150,000
IWMP_WW68		Replace pumps at the Palm Valley lift station	Serve future growth	WPA 2	Insufficient lift station capacity			$150,000								$150,000
Subtotal						***$-***	***$-***	***$26,700,000***	***$8,977,300***	***$***	***$-***	***$-***	***$-***	***$80,876,600***	***$-***	***$116,553,900***
10-Year Wastewater CIP Grand Total												**$116,553,900**				

ENR CCI = 9886 Costs are not escalated in future years.

Chapter 2

DEMAND PROJECTIONS AND WATER RESOURCES

2.1 INTRODUCTION

This chapter presents the planning framework and projections that form the basis for the 2016 IWMP. This framework contains a set of assumptions and criteria that have been agreed upon with the City and guide the outcome of this study. The infrastructure recommendations from this study could change if the underlying assumptions change; therefore, the planning framework and assumptions are defined in the following sections so that the foundation of the recommendations can be well understood. The planning framework includes the following:

- Land use assumptions, land areas to be developed by buildout, and the phasing of development in interim years,
- Population projections,
- Water resource availability and needs,
- Current/future water resources portfolio,
- Water demand projections,
- Wastewater flow projections, and
- Reclaimed water availability projections.

Land use development forms the basis for preparing growth trend patterns and projecting future water demands, wastewater flows, and reclaimed water availability. The land use plan serves as the common framework for the individual elements of the IWMP, namely the water resources, water system, wastewater system, and reclaimed water system master plans, and ultimately defines the infrastructure required to meet the City's needs as it grows towards buildout.

Population projections are an important component of an integrated master planning framework because they are used to define the growth rates between planning years and establish the buildout population distribution, which should reflect the City's vision for growth. The population projections in the IWMP were correlated with the Goodyear's 2025 General Plan Land Use Plan in order to define the timing for development in each planning year. Population projections can also be used to verify the reasonableness of water demand or wastewater flow projections by calculating the estimated gallon per person per day (gpcd) demand or flow for each planning year and comparing the projected gpcd to current gpcd values.

The IWMP water demand, wastewater flow, and reclaimed water demand projections are based on the Land Use Plan, development commitments, and population projections because of the inherent interconnections and relationships between this information. Water demands determine the amount of wastewater that will be produced, which in turn

determines how much reclaimed water is available to be utilized for beneficial uses. It is important to have a common planning framework for the demand and flow projections so that all of the individual elements of the IWMP are based on the same set of planning assumptions and boundary conditions.

Planning periods were selected by the City for the IWMP to represent current conditions, 5- and 10-year planning horizons and an ultimate development condition. The four planning periods for the IWMP include:

- 2015 (Current condition)
- 2020
- 2025
- Buildout

The buildout planning period is not specifically associated with a given year; rather it was intended to represent the condition in which the City would reach full development of all developable land areas within the planning boundary. The phasing of development in each planning period was done using future growth areas identified by the City. Water demand, wastewater flow, and reclaimed water availability projections were developed for each planning period. Infrastructure recommendations are also organized by planning period.

2.2 GROWTH PROJECTIONS

2.2.1 Planning Area

The City's planning area encompasses over 250 square miles. The Liberty Utilities service area is located within the City's planning area; however, residents in this area do not receive water or wastewater service from the City. The EPCOR Water utility service area is also located within the City's planning area and residents in this area do not receive water service from the City but the City does provide wastewater service to this area. Arizona Water Company provides water service to a small area on the northeast corner of Van Buren and Perryville Road. The Utility of Greater Buckeye Inc. provides service to an area at the southeast corner of Yuma Road and Citrus Road. There are also some areas that have homes with septic systems and therefore do not contribute flows to the City's wastewater system. The population projections in this master plan account for all areas within the City's planning area with the estimated Liberty Utilities and EPCOR service area residents tabulated separately. The potable water demands from the Liberty Utilities and EPCOR service areas are not included in this plan. The wastewater flow projections do not include the estimated flows from the Liberty Utilities service area.

The City's planning area is divided into four WPAs. WPA 2, or the Central planning area, includes areas between I-10 and the Gila River. WPA 3, or the Sierra Estrella planning area, includes areas between the Gila River and Pecos Road. WPA 4, or the Rainbow Valley planning area, includes the area between Pecos Road and Patterson Road. WPA 5,

or the Sonoran Valley planning area, includes the area between Patterson Road and the south municipal planning area boundary.

The study area for the IWMP is the City of Goodyear's planning area, which was evaluated by each of the WPAs as shown in Figure 2.1.

2.2.2 General Plan Land Use Element

The IWMP is based on the City's General Plan land use element, which defines the City's vision for growth and establishes policies and goals related to development planning considering land use, public facilities and services, community design, and economic development. The City's land use element also guides future growth, revitalization, and preservation efforts in the City. The City's land use plan defines the types and locations of future development, and is shown in Figure 2.2.

2.2.3 Development Entitlements

The number of units (homes) that are allowed within a development is determined by the number of entitled units that have been approved for that development by the City. The City's Planning Department tracks the number of units with preliminary and full entitlement within each development. Preliminary entitlements indicate that the zoning process has been started for a development and the number of units proposed is under review by the City. Full entitlements indicate that the approval process is complete and that development can begin. Areas with full entitlements represent areas where the City has made firm commitments to provide water and wastewater service. Areas with preliminary entitlements or no entitlements, do not have firm commitments from the City to provide water and wastewater service.

The City's development entitlement database was used to tabulate the number of homes with full entitlements and preliminary entitlements. There are some areas within the City's planning area where known developments are planned but have not yet been granted preliminary or full entitlement. There are also approximately 15,000 acres of Arizona State Land Department (ASLD) lands within the City's planning area. Some of these lands have preliminary entitlements but none are fully entitled. The City's General Plan Land Use Plan also identifies potential development areas that have not been entitled, are not ASLD lands, but are within the planning area. All of these areas were included in the IWMP growth projections and future buildout planning scenario.

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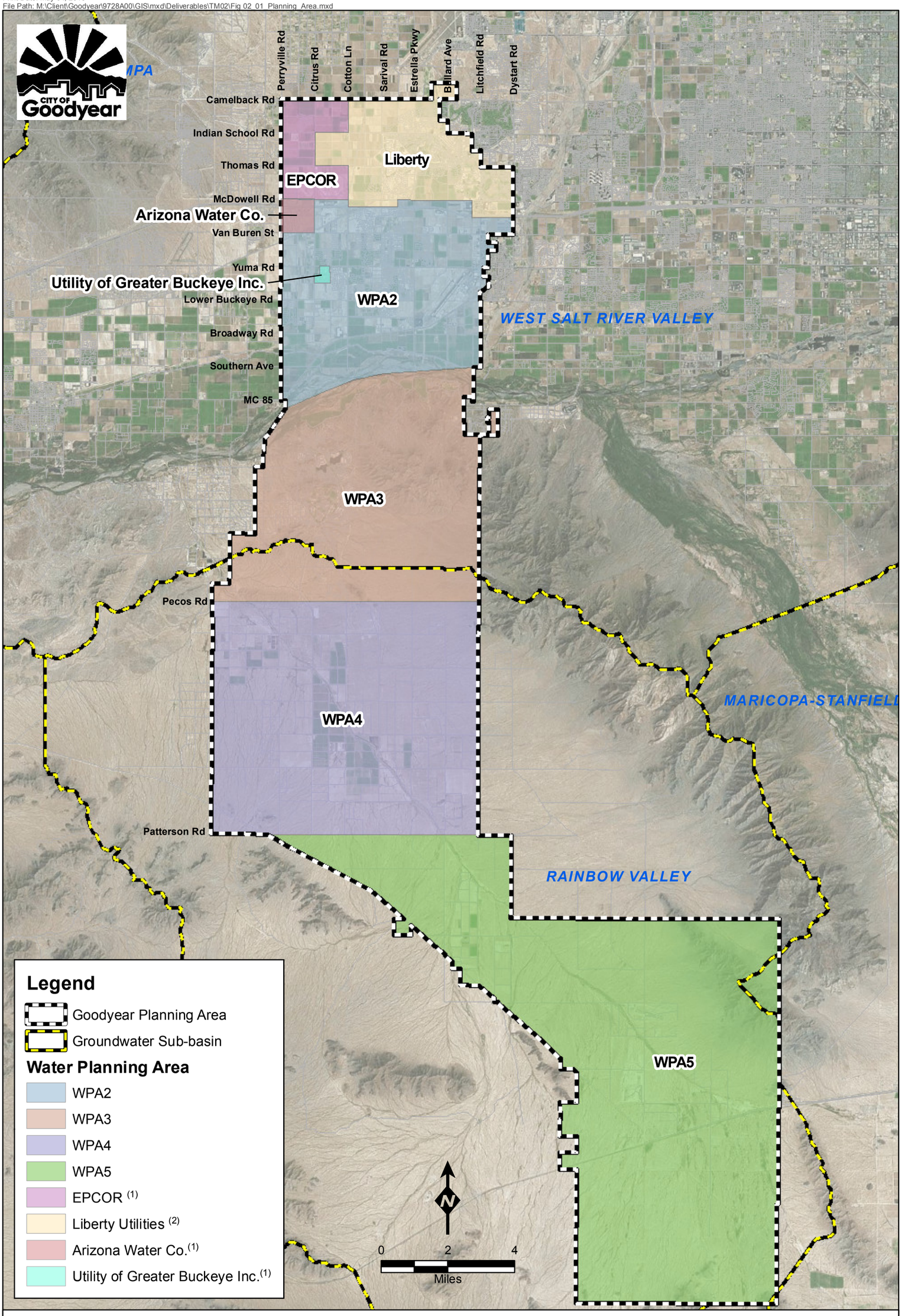

(1) Goodyear does not provide water service in the service area but does provide wastewater service.
(2) Goodyear does not provide water or wastewater service in the Liberty Utilities service area.

PLANNING AREA
FIGURE 2.1
CITY OF GOODYEAR
2016 INTEGRATED WATER MASTER PLAN

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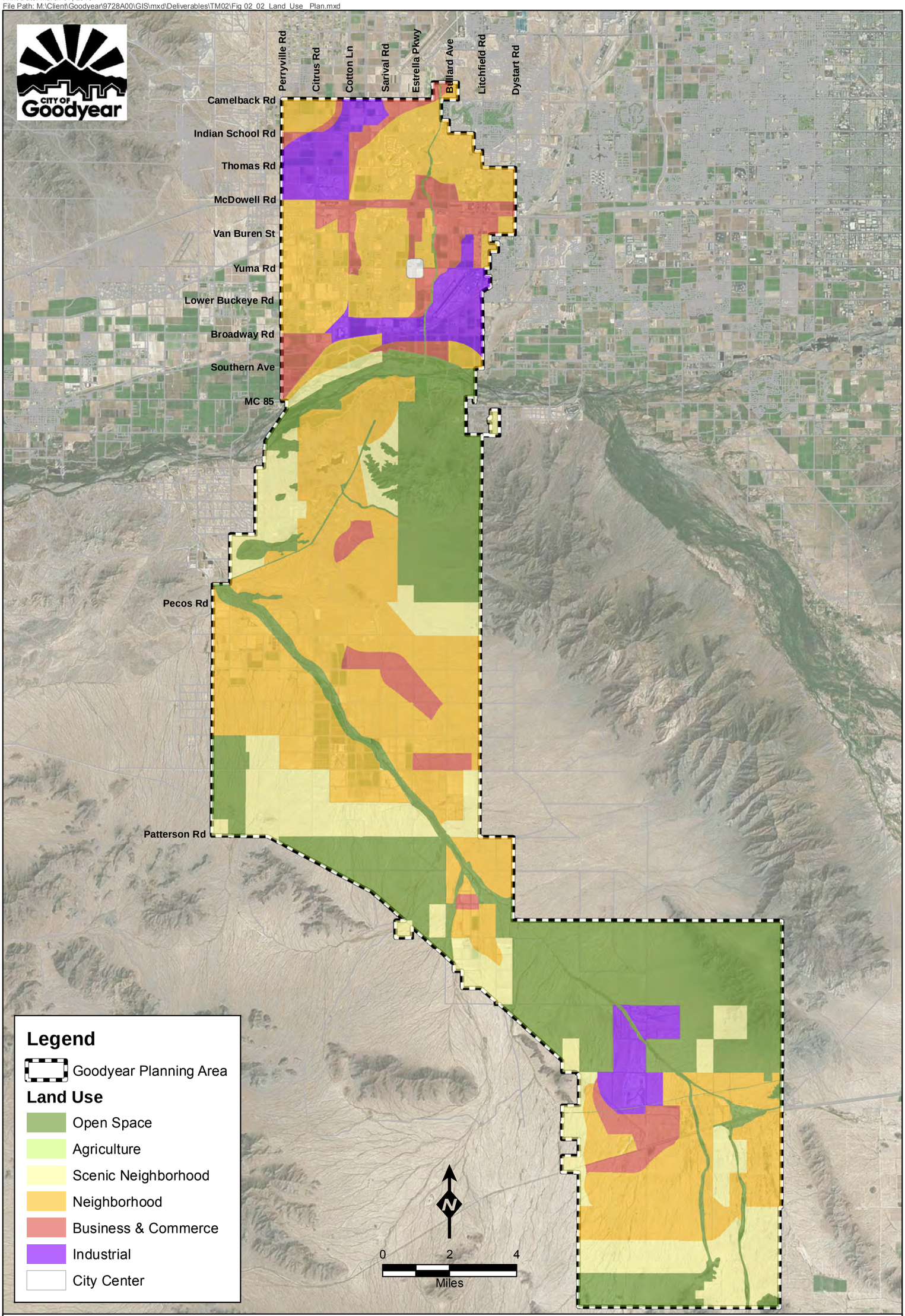

LAND USE PLAN

FIGURE 2.2

CITY OF GOODYEAR

2016 INTEGRATED WATER MASTER PLAN

2.2.4 Major Development Areas

There are several developments in the City's southern planning area that are new or expanding. Many of these are master planned, residential communities that include some non-residential development to support those that will make these areas their home. The following are known developments in the southern planning area:

- CantaMia at Estrella
- Estrella West
- Golf Village at Estrella
- King Ranch
- Montecito at Estrella
- Mountain Ranch at Estrella
- Park Village at Estrella
- Sierra Vista Foothills
- Estrella Highlands
- Madeira
- McCrae Holdings
- Rainbow Valley
- Amaranth

Figure 2.3 shows the locations of the major commercial and residential development areas.

2.2.5 Near-term Growth Projections

The City identified potential growth areas that are likely to develop by years 2020 and 2025. These areas include both residential and non-residential development in WPA 2 and WPA 3. There is no growth projected in WPA 4 or WPA 5 prior to year 2025. The 5- and 10-year growth areas are shown in Figure 2.4.

The City's current population is approximately 78,000, including residents that have Liberty Utilities or EPCOR Water service. The City's water service area population is approximately 50,000. The City's GIS parcel data was used to estimate the proportion of residents in WPA 2 and WPA 3. Currently, approximately 70 percent of the City's water service area residents are in WPA 2 and 30 percent of the City's residents are in WPA 3.

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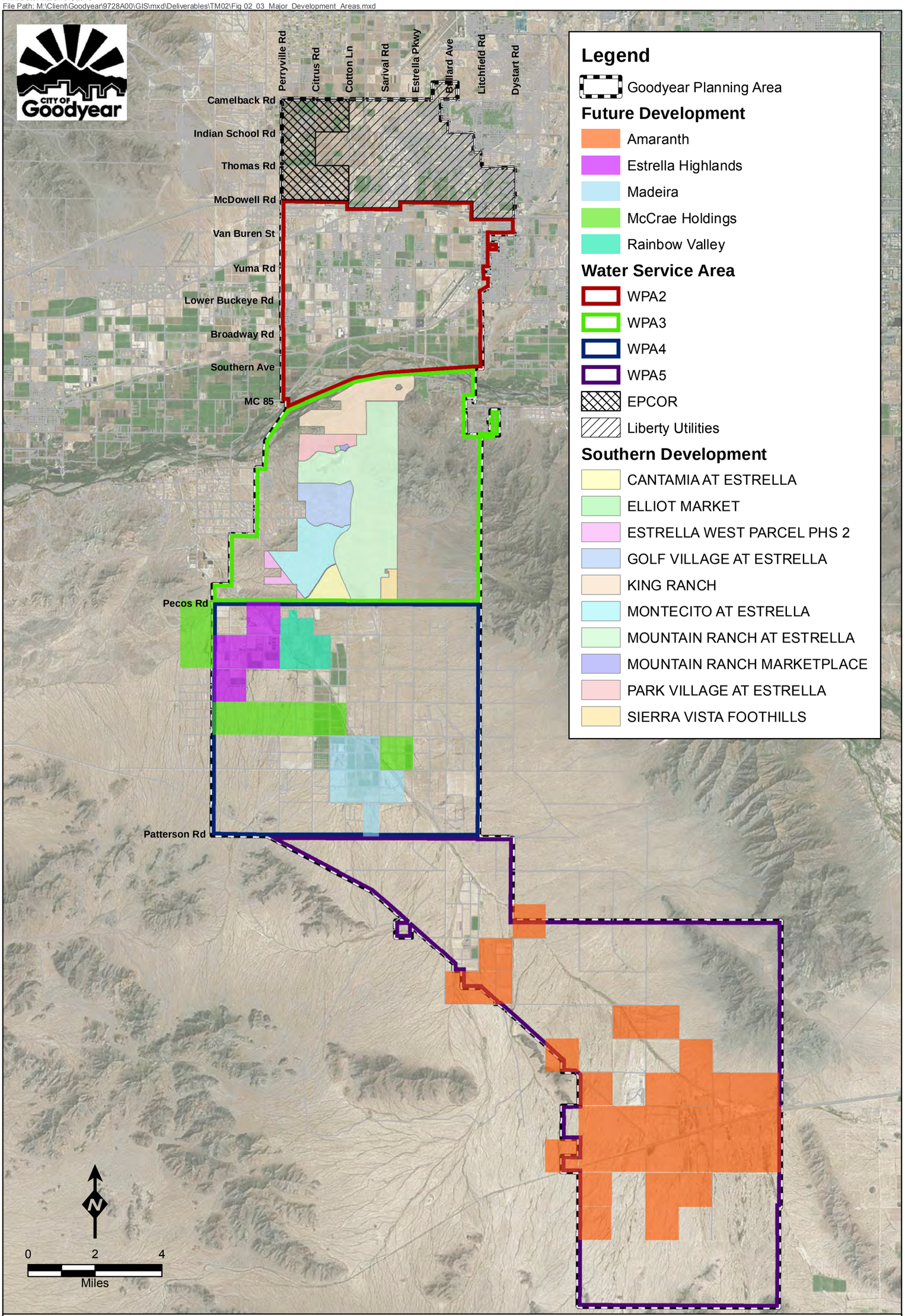

MAJOR DEVELOPMENT AREAS
FIGURE 2.3

CITY OF GOODYEAR
2016 INTEGRATED WATER MASTER PLAN

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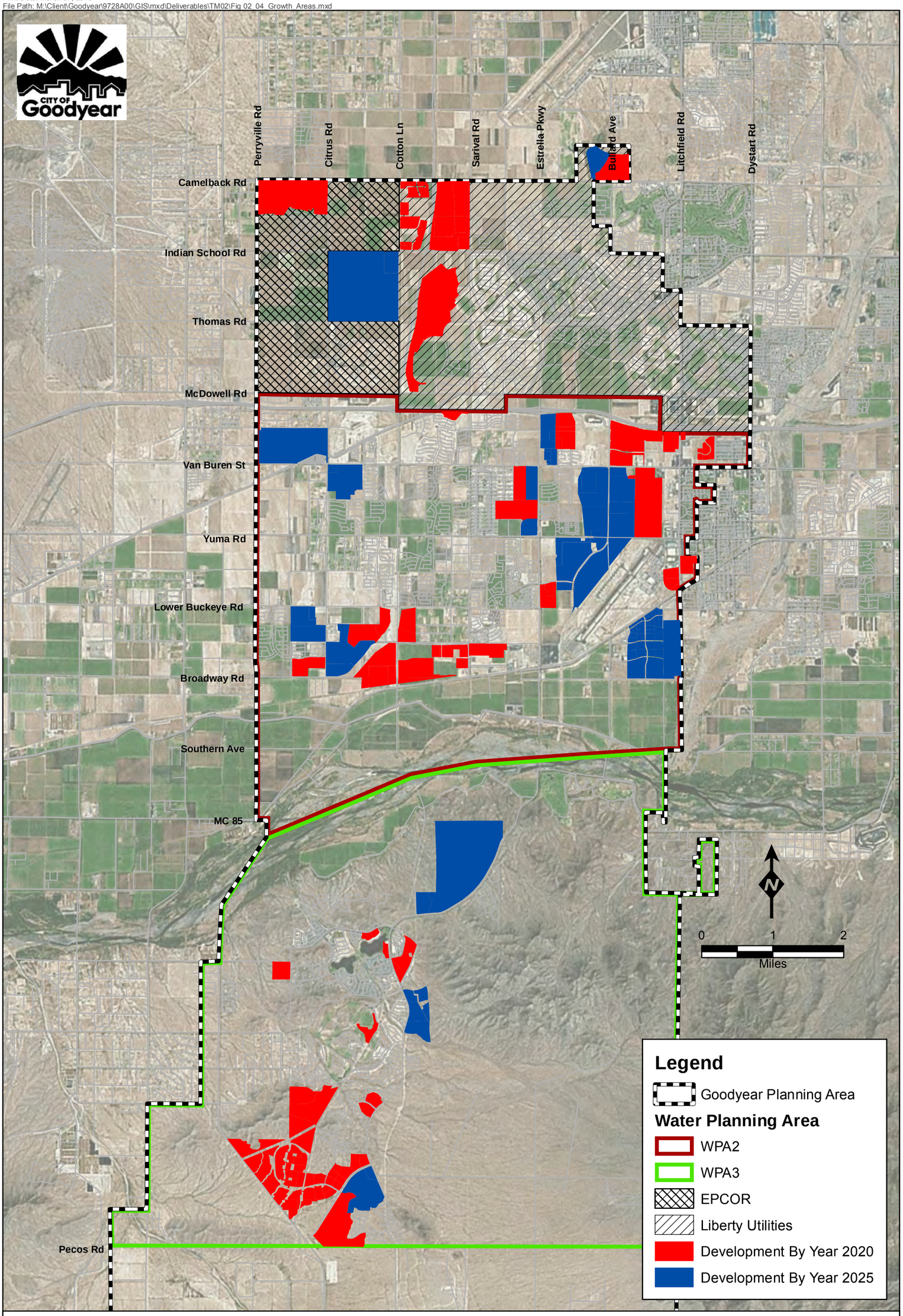


5- AND 10-YEAR GROWTH AREAS

FIGURE 2.4

CITY OF GOODYEAR

2016 INTEGRATED WATER MASTER PLAN

Populations for the 5- and 10-year growth areas were estimated using the City's GIS parcel data to calculate the number of homes that are expected to be added by each planning year, assuming 2.8 people per home. The City's water service area population is expected to be 60,701 by year 2020 and 73,517 by year 2025. The 5- and 10-year growth rates in WPA 3 are expected to be greater than the growth rates in WPA 2. By year 2020, approximately 60 percent of the City's residents will be in WPA 2 and 40 percent of the City's residents will be in WPA 3.

Table 2.1 summarizes the estimated current water service area population and the population growth expected by years 2020 and 2025. Figure 2.5 shows the population growth and distribution by WPA for each planning year.

Table 2.1 Near-term Population Projections
2016 Integrated Water Master Plan
City of Goodyear

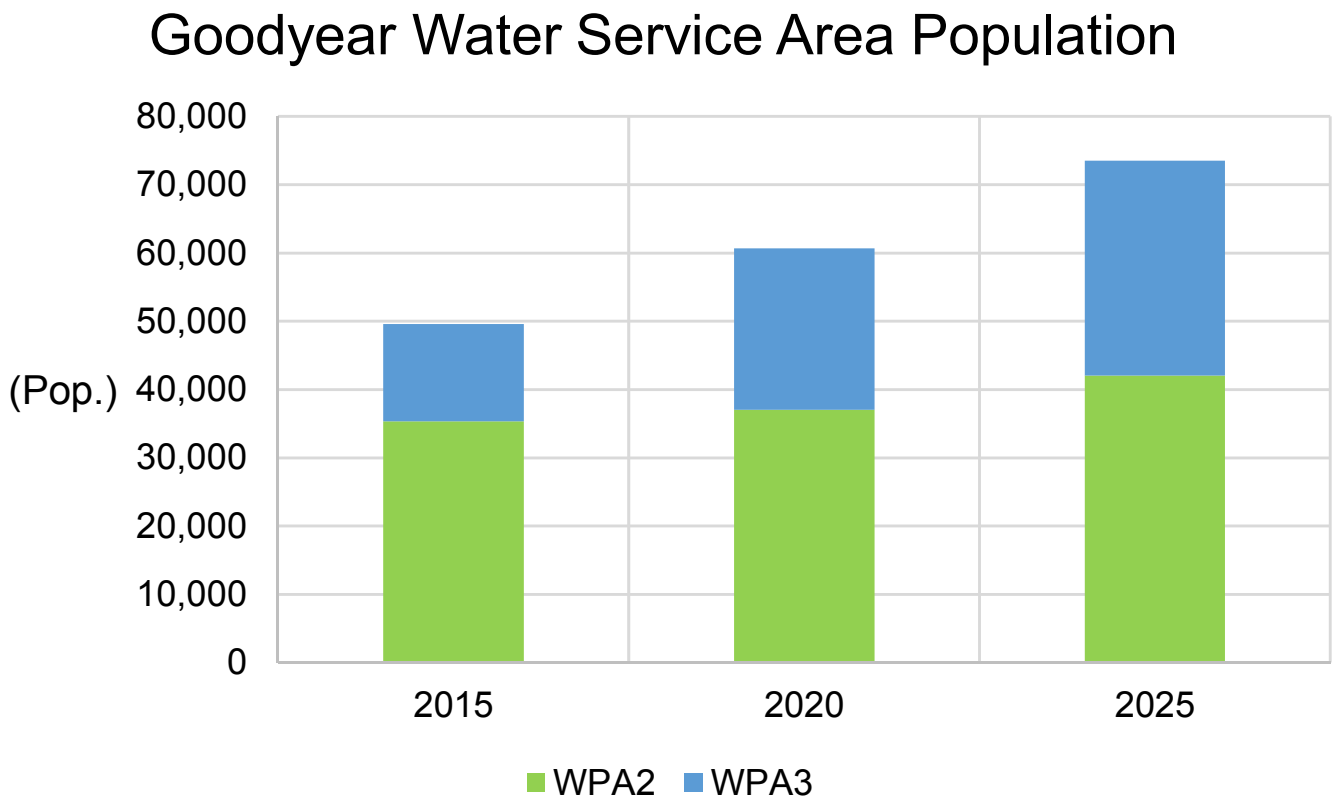
Water Planning Area	Planning Year		
	2015	2020	2025
WPA 2	35,356	37,027	42,020
WPA 3	14,263	23,674	31,497
Total (1)	**49,619**	**60,701**	**73,517**

Note:
(1) Water service area population only. Does not include the Liberty Utilities or EPCOR water service areas.

2.2.6 Buildout Growth Projections

The City's General Plan states that Goodyear's buildout population is expected to reach 760,000. The City's development entitlement database was used to categorize growth areas by Entitlement Level. These Entitlement Levels define the City's commitment to allow development based on agreements that are in effect as of July 2015. The Entitlement Level definitions are as follows:

- Entitlement Level 1 - Lands with full entitlements
- Entitlement Level 2 - Lands with preliminary entitlements and ASLD lands with the zoning process started
- Entitlement Level 3 - ASLD lands without the zoning process started and other future known developments without preliminary or full entitlements
- Entitlement Level 4 - All other areas within the City planning boundary as defined in the City's General Plan land use



NEAR-TERM GROWTH PROJECTIONS

FIGURE 2.5

CITY OF GOODYEAR
2016 INTEGRATED WATER MASTER PLAN

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Population projections were based on several assumptions. Where the number of parcels was known for a specific development (e.g., from the City's development entitlement database), those values were used to determine the potential number of homes associated with that development. Where the number of parcels was unknown, the City's General Plan land use was used to estimate the potential number of homes assuming a density of three homes per acre for the "Neighborhood" land use and 2 homes per acre for the "Scenic Neighborhood" land use. It was assumed that there would be 2.8 people per home for all development types.

Table 2.2 summarizes the estimated buildout population for each WPA by Entitlement Level. The estimated buildout water service population is 718,280. The Liberty Utilities and EPCOR buildout population estimate of 45,500 from the General Plan was used to calculate a total buildout population of 763,780.

The General Plan's projected buildout population for the planning area is 762,700, which is within 0.2 percent of and compares favorably with the IWMP buildout population estimate. The IWMP therefore supports the General Plan by accounting for the potential growth required to support the City's envisioned buildout population.

Table 2.2 Buildout Population Projections
2016 Integrated Water Master Plan
City of Goodyear

Water Planning Area	Entitlement Level				
	1	2	3	4	Total
WPA 2	81,612	0	4,602	23,374	109,587
WPA 3	68,166	2,850	2,285	17,325	90,627
WPA 4	38,652	160,586	47,054	57,025	303,316
WPA 5	4,704	115,125	35,148	59,773	214,750
Total	**193,133**	**278,561**	**89,088**	**157,498**	**718,280**
Liberty Utilities / EPCOR					45,500
				Grand Total	**763,780**
				General Plan Buildout Population	**762,700**
				Difference	**1,080**
				Percent Difference (%)	**0.2%**

Figure 2.6 shows the lands that could potentially develop by buildout by Entitlement Level. The areas without Entitlement Level designations are defined as open space or wild life corridors in the General Plan land use. These areas were assumed to remain as natural desert in perpetuity and that there would not be any development in these areas that would require water or wastewater service.

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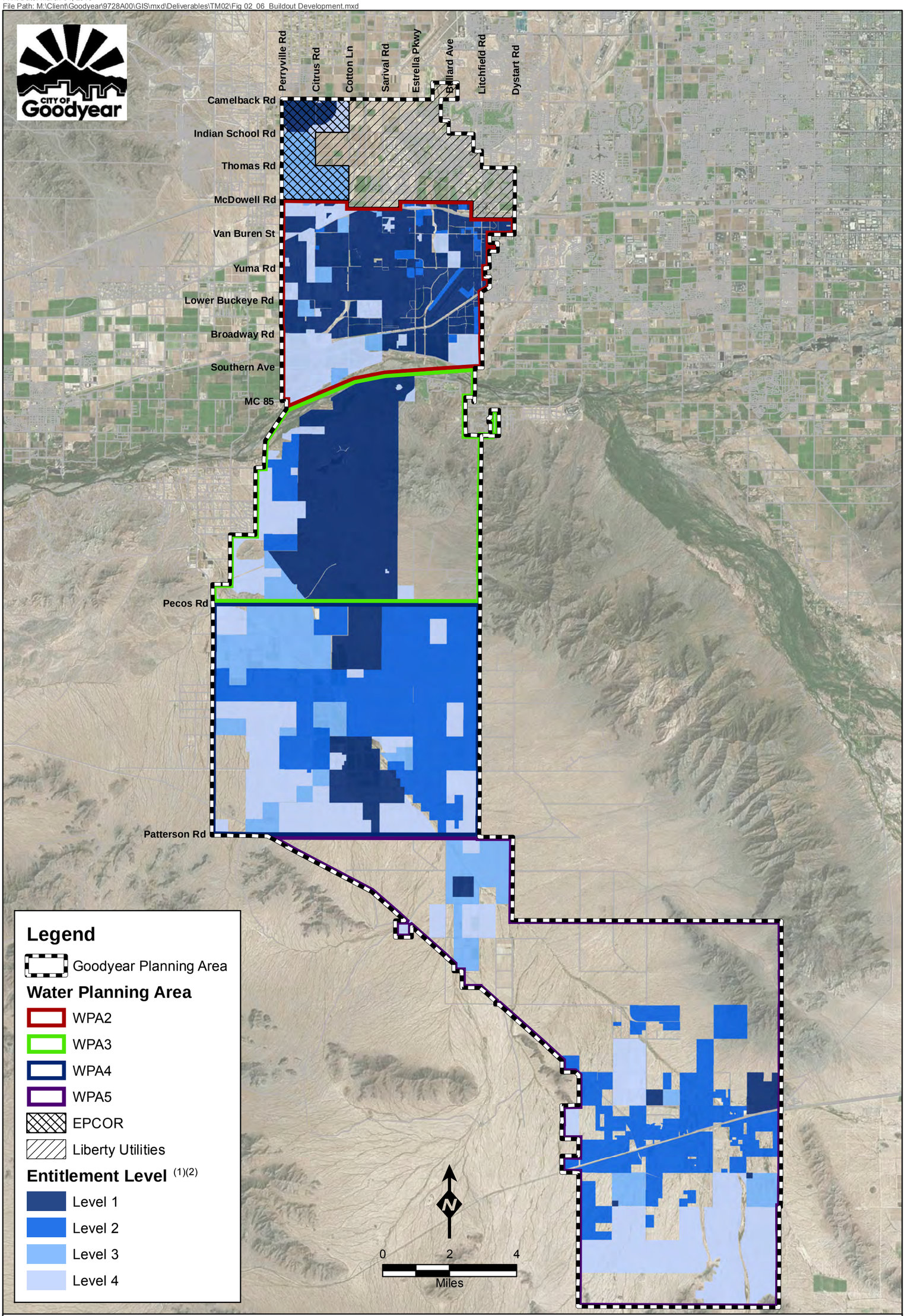


(1) Goodyear does not provide water service in the EPCOR service area but does provide wastewater service.
(2) Goodyear does not provide water or wastewater service in the Liberty Utilities service area.

BUILDOUT DEVELOPMENT BY LEVEL
FIGURE 2.6
CITY OF GOODYEAR
2016 INTEGRATED WATER MASTER PLAN

2.3 WATER DEMAND PROJECTIONS

2.3.1 Unit Water Demands

Unit water demands are an estimate of average annual water use expressed on a per acre, per home, or other unit (e.g., square foot, employee, etc.) basis. The City's customer billing and water production records were used in conjunction with the City's GIS data to develop unit water demands for residential, commercial, and industrial development. The following sections describe the methodology used to develop the unit water demands.

2.3.1.1 Customer Billing Database and Water Production Records

The City's water customer billing database includes a record of monthly water use by location for approximately 15,800 individual accounts. The City's water production records were compared to the City's water billing records to verify the completeness of the billing database. The water produced and water billed by the City from 2010 through 2014 is summarized in Table 2.3. The City's non-revenue water (water produced less water billed) ranges from 0.9 to 1.1 mgd, which represents approximately 14 percent of the total water produced. Goodyear's non-revenue water includes City use and unmetered use, including brine losses. The City's "unaccounted for water" is the difference between the water produced and the water metered (billed or unbilled). The City's unaccounted for water ranges from 0.5 to 0.7 mgd, which represents approximately 8 percent of the total water produced. This unaccounted for water is similar to other communities that use only groundwater.

For future water resources planning, a non-revenue water factor of 14 percent was used in the IWMP.

Table 2.3 Historical Water Produced and Billed
2016 Integrated Water Master Plan
City of Goodyear

Description	Water Use (mgd)				
	2010	2011	2012	2013	2014
Water Produced (1)	7.2	7.7	7.9	7.9	7.9
Water Billed (1)	6.2	6.8	6.8	6.8	6.8
City Use (metered, unbilled, RO brine) (1)	0.4	0.4	0.6	0.4	0.4
Unaccounted for Water (UAW) (2)	0.5	0.5	0.5	0.7	0.7
City Use + UAW (%)	13%	12%	14%	14%	13%
UAW (%)	7%	7%	7%	9%	8%

Notes:
(1) From annual City management reports (i.e., "MGMT2012.xlsx", "MGMT2013.xlsx", etc.)
(2) Water Produced - Water Billed - City Use = UAW

2.3.1.2 Unit Demands

Unit water demands were calculated for residential and non-residential (commercial and industrial) development using the City's year water customer billing database records collected between October 2013 and September 2014. The total number of meters and water consumption were summed by water meter rate class as summarized in Table 2.4.

Table 2.4 Unit Water Demands by Water Meter Classification
2016 Integrated Water Master Plan
City of Goodyear

Water Meter Rate Class	Number of Meters	Percent of Total	2014 Cons. (gpd)	Percent of Total (%)	2014 Unit Cons. (gpd/ Residential meter)
Apartments	35	0.2%	108,934	1.6%	7
Commercial	258	1.6%	467,951	7.1%	31
Church	15	0.1%	26,008	0.4%	2
Car Washes	1	0.0%	548	0.0%	0
Industrial	34	0.2%	190,929	2.9%	13
Hydrant	1	0.0%	49,025	0.7%	3
Institutional	8	0.1%	27,956	0.4%	2
Irrigation	344	2.2%	1,546,564	23.3%	103
Laundromat	1	0.0%	3,781	0.1%	0
Multi-purpose meter	8	0.1%	155,033	2.3%	10
Phoenix-Goodyear Airport	1	0.0%	47,427	0.7%	3
Residential	15,047	95.4%	3,877,005	58.4%	258
Schools	19	0.1%	136,414	2.1%	9
Total	**15,772**	**100%**	**6,637,575**	**100%**	**--**

Note:
(1) Data source: City of Goodyear water customer billing records October 2013 - September 2014.

Approximately 95 percent of the City's water meters are associated with residential development and represent 58 percent of the City's current water demand. Two percent of the City's water meters are associated with landscape irrigation but account for over 23 percent of the City's water demand. The remaining three percent of the City's water meters are associated with commercial and industrial uses and represent approximately 19 percent of the City's water demand.

A unit consumption rate was calculated for each water meter rate class based on the number of residential meters as shown in the last column of Table 2.4. This was done to determine a residential meter unit rate for future demand projections for the IWMP that

would include water use associated with future residential development including apartments, churches, institutional buildings, and schools. This results in a unit rate of 278 gpd/meter.

Landscape irrigation is also a component of residential demand and needs to be incorporated into the meter unit rate. The City's irrigation water meter rate class includes landscape meters in both residential (i.e., homeowner's association parks) and non-residential (i.e., commercial landscapes) development. To determine the landscape irrigation component of residential water use, the City's land use plan was associated with the City's water meter locations. The 2014 water use for irrigation meters associated with land areas classified as residential, open space and roads was 1,127,019 gpd, which is equivalent to 75 gpd per residential meter (1,127,019 gpd / 15,047 residential meters = 75 gpd/meter).

A non-revenue water factor of 14 percent was also incorporated into the residential unit meter rate, which resulted in an overall residential meter unit consumption rate of 402 gpd/meter ([278 gpd / meter + 75 gpd/meter] x 1.14 = 402 gpd/meter). This is approximately 3 percent higher than the City's average day demand equivalent dwelling unit (EDU) value of 390 gpd, which was used in the City's 2014 Infrastructure Improvement Plan (IIP). Future residential water demand projections in the IWMP are based on the 402 gpd/connection value.

The City uses a value of 2.8 people per home for planning purposes, recognizing that actual densities can be greater or less than that. The City's current residential gpcd based on water consumption is 126 ([278 gpd + 75 gpd per home] / 2.8 people per home = 126 gpcd). The City's current residential gpcd based on water production, which includes an additional 14 percent for non-revenue water, is 144 (402 gpd per home / 2.8 people per home = 144 gpcd).

Both of these gpcd values are important metrics for the City in future water resources planning and in monitoring the impacts of water conservation efforts. The gpcd based on water consumption provides a benchmark for current water use within individual homes because it is the water that customers actually use and have control over. This metric can be useful when evaluating local changes such as installing water efficient fixtures or appliances, removing turf, or making similar changes to reduce water use.

The gpcd based on water production includes the City's non-revenue water factor, which could change in the future as new water supplies are developed. As CAP direct delivery is phased into the City's water supply, the percent of overall water production that goes to waste (RO brine concentrate) will decrease. Similarly, if new groundwater production wells generate brine in greater quantities than are observed today, the percent of overall water production that goes to waste will increase. In addition to these factors, the condition of the water distribution system (presence of leaks) can also impact the City's non-revenue water factor.

Non-residential unit water demands were developed for commercial and industrial land use classifications on a per acre basis. Aerial photos of three commercial land use areas were inspected to determine the developed acreage by counting building rooftops. The total water use for these areas was then divided by the number of developed acres to calculate unit water demands based on acreage. The estimated commercial unit water demand ranged between 655 and 1,620 gallons per acre per day (gpad).

The City currently uses 2,033 gpad for commercial unit water demands as outlined in the 2007 IWMP. By comparison, other valley cities use values that range from 700 gpad to 1,850 gpad. It is recommended that the City use 1,700 gpad to estimate commercial water demands for water resources planning. This value is greater than the highest observed unit water demand in the current IWMP analysis without being overly conservative, which could lead to over predicting the water resources needed to serve the City at buildout.

There are very few fully developed industrial corridors in Goodyear. An aerial photo of an industrial area near MC85 and Cotton Lane was inspected to determine the developed acreage by counting building rooftops. The total water use was then used to compute a unit water demand for the industrial land use classification. The estimated industrial unit water demand is 310 gpad.

The City currently uses 1,568 gpad for industrial unit water demands as outlined in the 2007 IWMP. By comparison, other valley cities use values that range from 690 gpad to 1,237 gpad. It is recommended that the City use 1,000 gpad to estimated industrial water demands for water resources planning. This value is more than three times greater than the City's observed unit water demand in the current IWMP but is still significantly less than the value the City is currently using. The reason 1,000 gpad is recommended instead of 310 gpad is because the City has very few industrial customers at this time and it is prudent to maintain this level of conservatism given the unknowns associated with potential future development.

The unit water demands used in the IWMP are summarized in Table 2.5.

Table 2.5 Unit Water Demands
2016 Integrated Water Master Plan
City of Goodyear

Land Use Type	Unit Water Demand (1)	
	2007 IWMP	**2016 IWMP**
Residential	390 gpd/meter	402 gpd/meter
Commercial	2,033 gpad	1,700 gpad
Industrial	1,568 gpad	1,000 gpad

Note:
(1) Includes non-revenue water

2.3.1.3 Current Demands

The City's 2014 average daily water demand was approximately 8.0 mgd as shown in Table 2.3. The distribution of demands for year 2014 was determined by analyzing water customer billing data, which showed that 80 percent of demands are north of the Gila River (WPA 2) and 20 percent of demands are south of the Gila River (WPA 3).

For planning year 2015, the average daily water demand was calculated to be 8.4 mgd, which was based on a 4.4 percent growth factor provided by the City. The distribution of water demands between planning areas was assumed to remain unchanged at 80 percent for WPA 2 and 20 percent for WPA 3.

2.3.1.4 Historic per Capita Water Use

Per-capita water use is one metric that can be used to estimate water use trends in demand forecasting and is expressed as gallons per capita (or person) per day (gpcd). A composite gpcd is calculated based on total water use and includes both residential and non-residential demands. The composite gpcd is different than the residential gpcd estimates described in Section 2.3.1.2, which are typically used to evaluate water use efficiency within individual homes. The City's composite per capita water use between 2009 and 2014 ranged between 174 and 208 gpcd as shown in Table 2.6.

Table 2.6 Historical Total Per-Capita Water Use
2016 Integrated Water Master Plan
City of Goodyear

Year	Estimated Service Area Population (1)	Total Water Production (mgd)	Per Capita Water Use (gpcd)
2009	37,132	7.5	202
2010	38,617	7.2	186
2011	36,998	7.7	208
2012	40,500	7.9	194
2013	42,456	7.9	187
2014	45,067	7.9	174

Note:
(1) Estimate provided by City of Goodyear

2.3.1.5 Peaking Factors

On a system wide basis, since 2009, the City's average daily demand (ADD) has ranged between 7.2 and 7.9 mgd. In 2014 the City's ADD was 7.9 mgd. Since 2009, the City's maximum monthly (MM) production occurred between June and August and water production was between 30 and 40 percent higher during the maximum month than the average daily production for that year. Table 2.7 summarizes the monthly water production

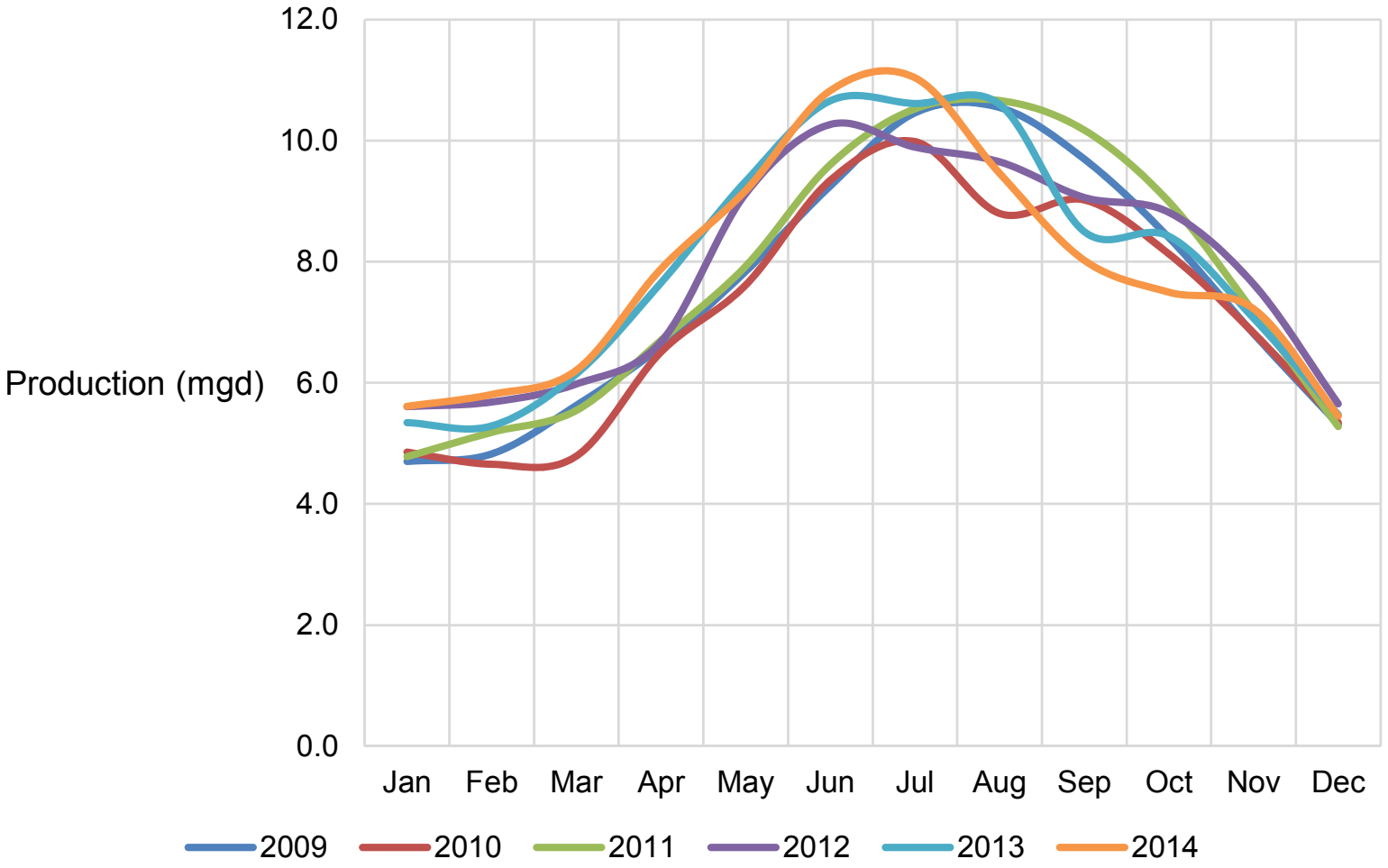
values, average daily demand values, and maximum month to average daily demand (MM/ADD) peaking factors from 2009 through 2014.

Figure 2.7 shows the historical monthly water production values for 2009 through 2014.

The City's maximum water production day is generally during the maximum month. Currently the City does not have a supervisory control and data acquisition (SCADA) system to measure daily water production; so an assumption was made to estimate the maximum daily water production requirements for infrastructure planning in each planning year. The maximum day (MD) to average daily demand factor of 1.7 used in the 2007 IWMP was maintained in the current IWMP and provides a conservative estimate of potential maximum daily demands. The City is currently implementing a SCADA system using the operations budget.

Table 2.7 Historical Monthly Water Production
2016 Integrated Water Master Plan
City of Goodyear

Month	Production (mgd)					
	2009	**2010**	**2011**	**2012**	**2013**	**2014**
January	4.7	4.9	4.8	5.6	5.3	5.6
February	4.8	4.7	5.2	5.7	5.3	5.8
March	5.6	4.8	5.5	6.0	6.1	6.2
April	6.6	6.5	6.7	6.7	7.7	7.9
May	7.8	7.6	7.9	9.1	9.3	9.2
June	9.2	9.3	9.6	10.3	10.7	10.8
July	10.5	10.0	10.5	9.9	10.6	11.0
August	10.5	8.8	10.7	9.6	10.6	9.5
September	9.7	9.0	10.2	9.1	8.5	8.0
October	8.4	8.1	9.0	8.8	8.4	7.5
November	6.8	6.8	7.2	7.6	7.1	7.2
December	5.3	5.3	5.3	5.7	5.5	5.5
Average Daily Demand (ADD)	**7.5**	**7.2**	**7.7**	**7.9**	**7.9**	**7.9**
Maximum Month (MM)	**10.5**	**10.0**	**10.7**	**10.3**	**10.7**	**11.0**
MM/ADD	**1.41**	**1.40**	**1.38**	**1.31**	**1.35**	**1.41**



HISTORICAL WATER PRODUCTION

FIGURE 2.7

CITY OF GOODYEAR
2016 INTEGRATED WATER MASTER PLAN

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2.3.1.6 Projected Future Demand

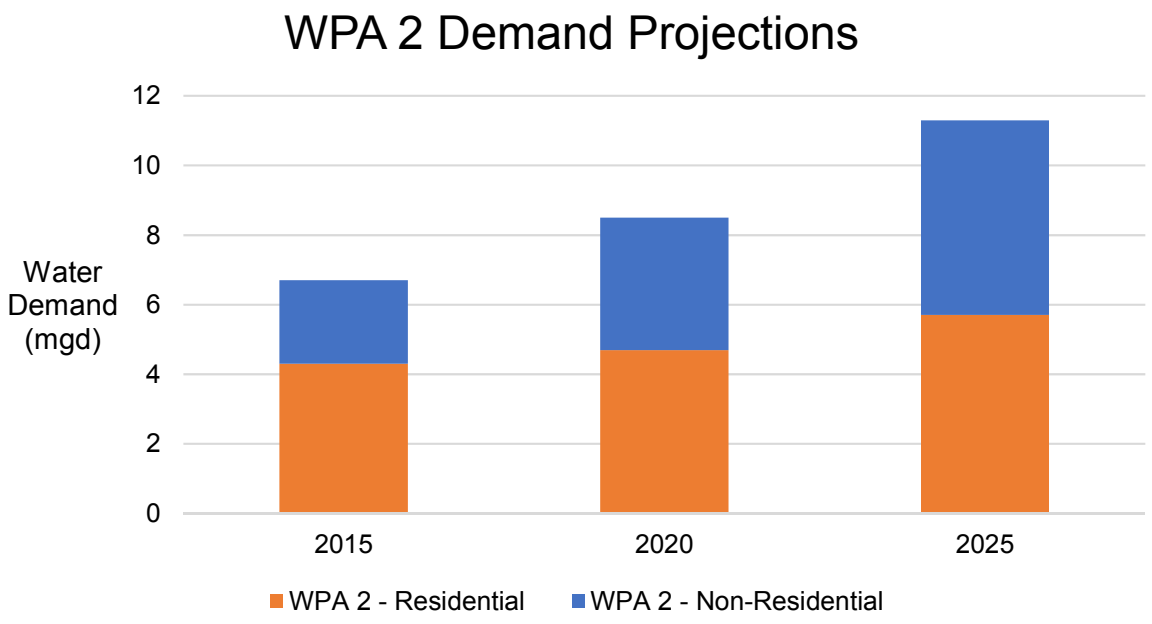
Water demand projections were developed using the future development areas identified by the City and the unit water demand factors summarized previously in Table 2.5. Table 2.8 contains the near term demand projections for years 2015, 2020 and 2025.

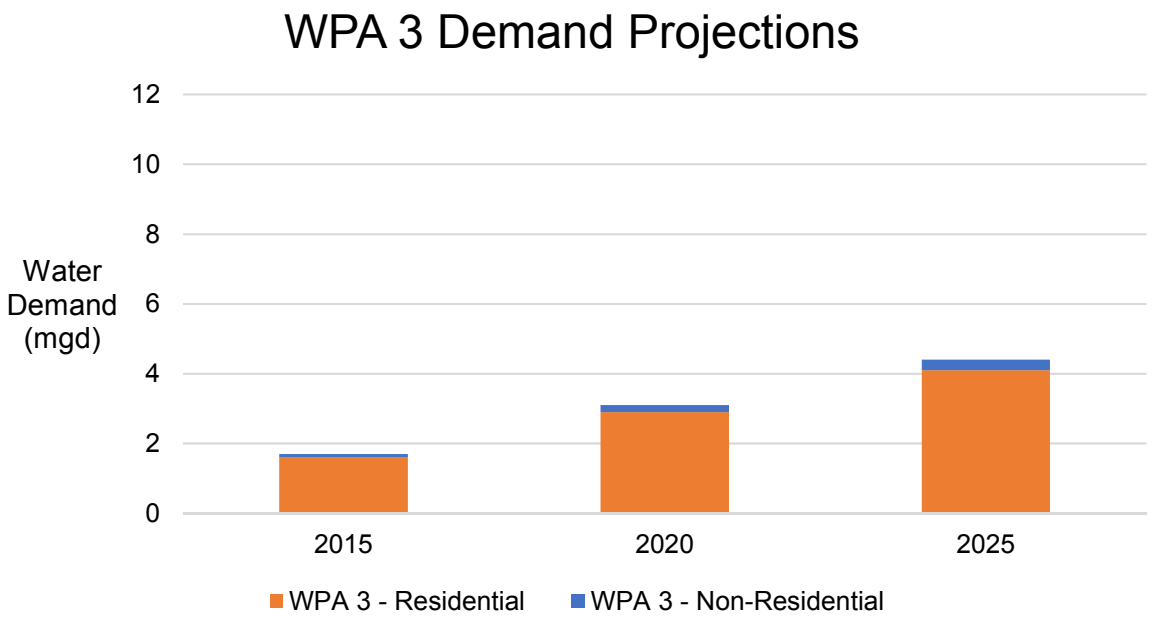
Figure 2.8 illustrates the near term projected increase in water demands in WPA 2 is expected to be primarily from non-residential development while the projected increase in water demands in WPA 3 is expected to be from residential development.

Table 2.8 Near Term Average Daily Water Demand Projections
2016 Integrated Water Master Plan
City of Goodyear

Demand Component	Demand Projections (mgd)		
	2015	**2020**	**2025**
WPA 2			
Residential	4.3	4.7	5.7
Commercial	1.7	2.4	3.6
Industrial	0.7	1.4	2.0
Subtotal	***6.7***	***8.5***	***11.3***
WPA 3			
Residential	1.6	2.9	4.1
Commercial	0.1	0.2	0.3
Industrial	0.0	0.0	0.0
Subtotal	***1.7***	***3.1***	***4.4***
Total (1)	**8.4**	**11.6**	**15.7**

Note:
(1) Includes non-revenue water factor of 14% which includes both City use (unbilled) and unaccounted for water.
(2) Growth in water use is a function of the types of developing land use and therefore does not correlate directly to an increase in population.





NEAR TERM WATER DEMAND PROJECTIONS THROUGH YEAR 2025

FIGURE 2.8

CITY OF GOODYEAR

2016 INTEGRATED WATER MASTER PLAN

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The potential buildout water demands based on Entitlement Level, defined in Section 2.6, are summarized in Table 2.9. These demand projections are based on the unit demands in Table 2.5. The values in Table 2.9 are incremental demands for each Entitlement Level (i.e., the total Level 1 water demand is 42,659 AFY; the total Entitlement Level 1 + Entitlement Level 2 water demand is 42,659 AFY + 47,074 AFY = 89,733 AFY). The total potential buildout demand for all Entitlement Levels, which represents full development of the City's planning area, is 135,208 AFY or 120.7 mgd.

Table 2.9 Buildout Water Demand Projections
2016 Integrated Water Master Plan
City of Goodyear

	Water Demand Projections (AFY) [1] Entitlement Level				
Water Planning Area	**1**	**2**	**3**	**4**	**Total**
WPA 2	21,153	1,441	1,088	7,563	31,245
WPA 3	13,312	458	367	2,786	16,924
WPA 4	6,584	25,822	7,566	9,170	49,412
WPA 5	1,609	19,353	5,827	11,106	37,896
Total	**42,659**	**47,074**	**14,849**	**30,625**	**135,208**
Entitlement Levels 1 - 2		**89,733**			
Entitlement Levels 1 - 3			**104,582**		
Entitlement Levels 1 - 4				**135,208**	
	Water Demand Projections (mgd) [1]				
WPA 2	18.9	1.3	1.0	6.8	27.9
WPA 3	11.9	0.4	0.3	2.5	15.1
WPA 4	5.9	23.1	6.8	8.2	43.9
WPA 5	1.4	17.3	5.2	9.9	33.8
Total	**38.1**	**42.0**	**13.3**	**27.3**	**120.7**
Entitlement Levels 1 - 2		**80.1**			
Entitlement Levels 1 - 3			**93.4**		
Entitlement Levels 1 - 4				**120.7**	

Note:
(1) Based on 402 gpd/residential meter or 144 gpcd for the residential demand component. Commercial demands use 1,700 gpad and Industrial demands use 1,000 gpad.

2.4 WASTEWATER FLOW PROJECTIONS

2.4.1 Flow Monitoring

Two flow monitoring field studies were conducted to collect data that were used to measure wastewater flows in the collection system. Data collected in these studies were from both temporary flowmeters installed in manholes and permanent flowmeters at wastewater facilities between December 2014 and January 2015. The sites for flow monitoring were selected to characterize system wastewater flows by collection basin.

The data collected in both studies included the volumetric flow rate, flow velocity, and flow depth in the pipe. Data was recorded every 15 minutes at each site and the temporary flowmeters were installed between two and four weeks at each location.

The first study included ten flowmeters installed in the Goodyear WRF service area (WPA 2) and included meters to capture all flow to the Goodyear WRF except from the BioFlora Lift Station. Daily flow records from the Goodyear WRF and records from the BioFlora Lift Station were used to validate the flow volumes recorded by the temporary flowmeters.

The second study included three flowmeters installed in the Corgett WRF service area and two flow meters installed in the Rainbow Valley WRF service areas (WPA 3). All flow contributions to the Corgett WRF were captured except from approximately 100 homes along Sweet Acacia Drive. All flow contributions to the Rainbow Valley WRF were captured. Daily flow records from the Corgett and Rainbow Valley WRFs were used to validate the flow volumes recorded by the temporary flowmeters.

The flow monitoring basins for the flow monitoring studies are shown in Figure 2.9.

2.4.2 Unit Wastewater Loads

Unit wastewater loads were calculated using a percent "water to wastewater" value for residential and non-residential land use types. The percent water to wastewater values were determined based on review of the City's water production, wastewater flow records, and parcel information for residential, commercial, and industrial land uses. Wastewater flows from the Perryville Prison are itemized separately because the City does not provide water service to the prison and the flow volume is significant relative to the total flow to the Goodyear WRF. Similarly, two developments: Canada Village and Sedella are itemized separately because they are in the EPCOR water service area but return sewer flows to Goodyear. Including flows from areas the City does not provide water service to in the water to wastewater ratio calculations will result in over predictions of future wastewater flows in WPA 2. Table 2.10 summarizes the water to wastewater factors by WRF basin.

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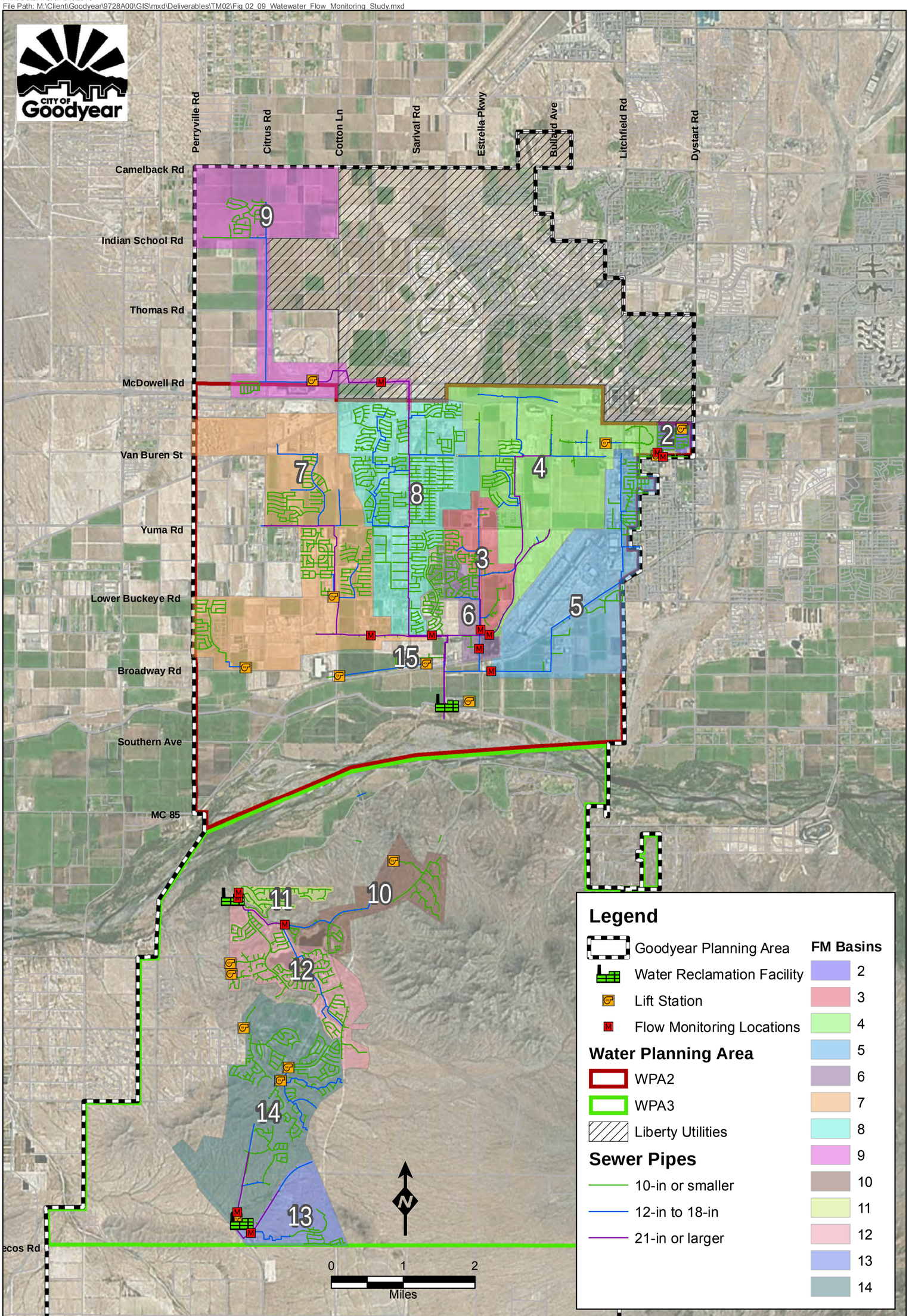


WASTEWATER FLOW MONITORING STUDY

FIGURE 2.9

CITY OF GOODYEAR

2016 INTEGRATED WATER MASTER PLAN

carollo

Table 2.10 Water to Wastewater Factors by Land Use Type 2016 Integrated Water Master Plan City of Goodyear			
	2014 Water Demand (mgd)	**Water to Wastewater Factor (%) (1)**	**Wastewater Flow (mgd)**
Goodyear WRF			
Perryville Prison	NA	NA	0.6
Sedella & Canada Village (EPCOR Water)	NA	NA	0.08
Residential	4.2	35%	1.5
Commercial	1.6	60%	1.0
Industrial	0.6	60%	0.4
Subtotal	***6.4***	***--***	***3.5***
2014 Average Annual Daily Flow (AADF)			**3.3**
Difference			-0.2
Percent Difference (%)			-5%
Corgett WRF			
Residential	0.8	35%	0.28
Commercial	0.1	60%	0.06
Industrial	0.0	60%	0.00
Subtotal	***0.9***	***--***	***0.34***
2014 AADF			**0.37**
Difference			0.03
Percent Difference (%)			8%
Rainbow Valley WRF			
Residential	0.7	35%	0.25
Commercial	0.0	60%	0.00
Industrial	0.0	60%	0.00
Subtotal	***0.7***	***--***	***0.25***
2014 AADF			**0.24**
Difference			0.01
Percent Difference (%)			-2%
Total	**8.0**	**--**	**4.1**
Goodyear, Corgett & Rainbow Valley Total			**3.9**
Difference			-0.15
Percent Difference (%)			-4%

Note:
(1) Represents the percent of water demand that becomes wastewater.

The overall water to wastewater ratio for the Goodyear WRF service area for the estimated portion of flow that is returned from the City's water customers is approximately 40 percent (2.6 mgd / 6.4 mgd x 100 = 40 percent). The overall water to wastewater ratio for the combined Corgett and Rainbow Valley WRF service areas is 38 percent (0.6 mgd / 1.6 mgd x 100 = 38 percent). To be conservative for planning future wastewater return rates and reclaimed water availability, an overall 40 percent water to wastewater factor was used system wide for all current and future development.

The wastewater unit loads for residential, commercial, and industrial development that correlate with the water to wastewater factors presented in Table 2.10 are summarized in Table 2.11.

Table 2.11 Unit Wastewater Load
2016 Integrated Water Master Plan
City of Goodyear

Land Use	Unit Wastewater Load
Residential	140 gpd/meter
Commercial	1,020 gpad
Industrial	600 gpad

2.4.3 Current Flows

Between 2010 and 2014 the City's wastewater AADF was between 3.74 and 3.95 mgd. Table 2.12 summarizes the AADF to each of the City's WRFs since 2010 and shows that there has been relatively little change in flows from year to year over the past 5 years.

2.4.4 Peaking Factors

Historical flow data from the Goodyear, Corgett, and Rainbow Valley WRFs was used to develop peaking factors for the MM and MD flow to AADF observed over the past 5 years. Table 2.13 summarizes the flow values and peaking factors by WRF.

Table 2.12 Historical Average Annual Daily Wastewater Flows
2016 Integrated Water Master Plan
City of Goodyear

Year	Goodyear (mgd)	Corgett (mgd)	Rainbow Valley (mgd)	Total (mgd)	Percent of Potable Water (%) [1]
2010	3.08	0.48	0.18	3.74	43%
2011	3.12	0.44	0.19	3.75	40%
2012	3.26	0.46	0.20	3.92	41%
2013	3.31	0.42	0.22	3.95	41%
2014	3.27	0.37	0.24	3.88	40%

Note:

(1) Adjustment for Perryville and EPCOR Water service area customers assumed constant 0.68 mgd (0.6 mgd from Perryville and 0.08 mgd from Sedella and Canada Village).

Table 2.13 Historical Wastewater Flows and Peaking Factors
2016 Integrated Water Master Plan
City of Goodyear

	Year				
	2010	**2011**	**2012**	**2013**	**2014**
Goodyear WRF					
AADF (mgd)	3.08	3.12	3.26	3.31	3.27
MM (mgd)	3.26	3.33	3.62	3.52	3.50
MD (mgd)	3.94	4.01	4.38	4.50	4.34
MM/AADF Peaking Factor	1.06	1.07	1.11	1.06	1.07
MD/AADF Peaking Factor	1.28	1.29	1.34	1.36	1.33
Corgett WRF					
AADF (mgd)	0.48	0.44	0.46	0.42	0.37
MM (mgd)	0.54	0.51	0.51	0.50	0.40
MD (mgd)	0.60	0.62	0.64	0.60	0.46
MM/AADF Peaking Factor	1.11	1.15	1.09	1.19	1.08
MD/AADF Peaking Factor	1.23	1.41	1.38	1.42	1.23
Rainbow Valley WRF					
AADF (mgd)	0.18	0.19	0.20	0.22	0.24
MM (mgd)	0.20	0.21	0.22	0.25	0.27
MD (mgd)	0.26	0.30	0.27	0.31	0.35
MM/AADF Peaking Factor	1.10	1.13	1.10	1.13	1.12
MD/AADF Peaking Factor	1.47	1.58	1.34	1.42	1.48

Figure 2.10 shows the historical flows for each WRF. There is variation in the flows to the Goodyear WRF on a seasonal, monthly, and daily basis. Over the past five years, the maximum monthly flow has been between 0.18 and 0.36 mgd (6 to 11 percent) greater than the average annual daily flow. The maximum daily flow has been between 0.86 and 1.2 mgd (28 to 34 percent) higher than the annual average daily flow.

There appears to be little variation in the flows to both the Corgett and Rainbow Valley WRFs. Over the past five years, the Corgett WRF maximum monthly flow has been between 0.06 and 0.1 mgd (8 to 19 percent) greater than the average annual daily flow. The maximum daily flow has been between 0.09 and 0.18 mgd (23 to 42 percent) greater than the annual average daily flow. Over the past five years the Rainbow Valley WRF maximum monthly flow has been between 0.02 and 0.03 mgd (10 to 13 percent) greater than the average annual daily flow. The maximum daily flow has been between 0.07 and 0.11 mgd (34 to 58 percent) greater than the annual average daily flow.

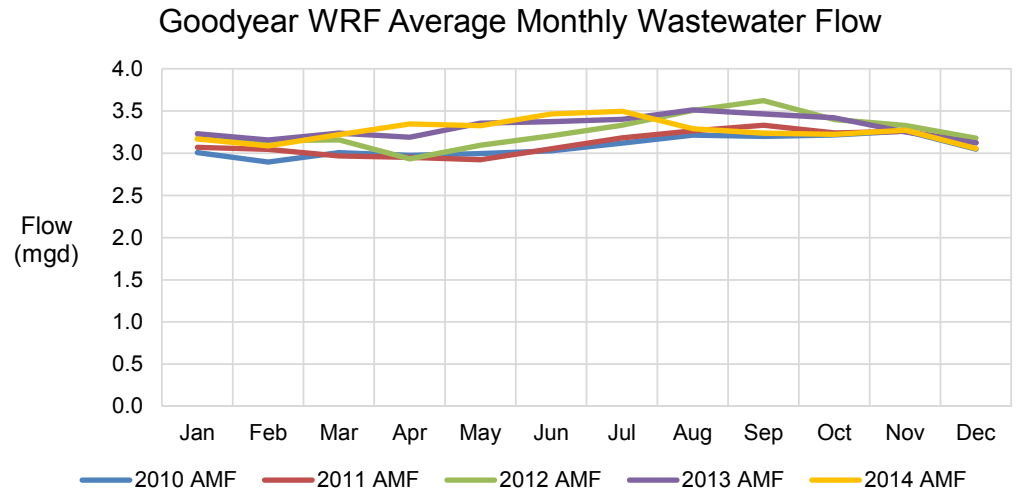
Wastewater flows vary throughout the day and are a function of the water demand at any given time. Typical residential wastewater flows are greater in the morning hours and late afternoon/early evening corresponding to the times when people are generally in their homes and using water. The flow monitoring data collected during the field test were used to develop diurnal flow patterns for each flow monitoring basin. The peaking factors derived from the diurnal flow patterns are used to evaluate the capacity of the collection system. The average daily flow (ADF), peak hour flow (PHF), and corresponding peaking factor (PHF/ADF) for each flow monitoring basin are shown in Table 2.14. Peaking factors for future development will use the measured factors from this table where the development is similar.

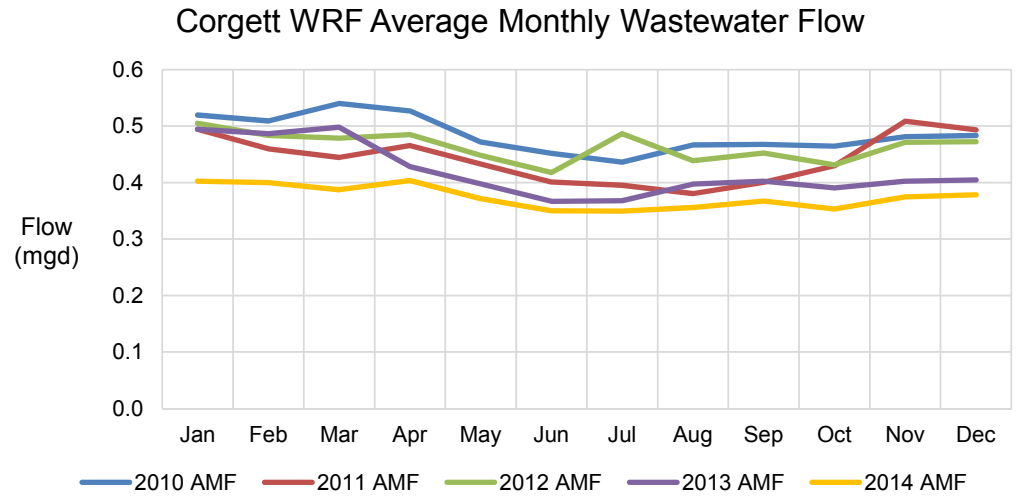
Figure 2.11 shows an example of a diurnal flow pattern from the flow monitoring field test for Flowmeter Basin 4, which outfalls to the Goodyear WRF. Similar diurnal patterns were developed for the other flow monitoring basins and were used in the wastewater model calibration and analysis.

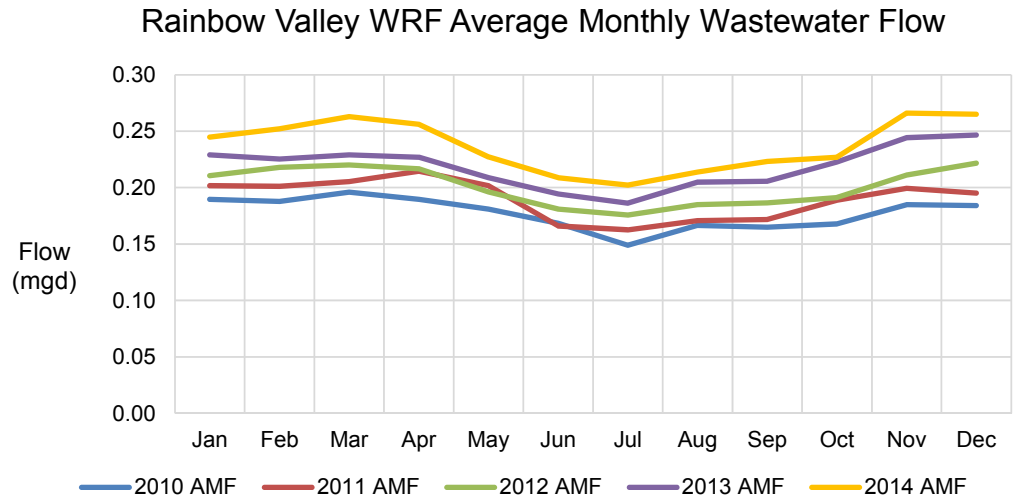
2.4.5 Projected Future Flows

Wastewater flow projections were developed using the future development areas identified by the City and the unit wastewater load factors described previously. Table 2.15 contains the flow projections by WRF basin for 2015, 2020, and 2025.

Figure 2.12 illustrates the projected increase in wastewater flows in the Goodyear WRF service area (WPA 2) will increase to 4.7 mgd AADF by year 2020 and 6.2 mgd AADF by year 2025. The rate of growth and increase in wastewater flows is proportionately greater in the Corgett and Rainbow Valley WRF service areas (WPA 3) and is expected to increase to 1.1 mgd AADF by year 2020 and 1.7 mgd AADF by year 2025.







HISTORICAL WASTEWATER FLOWS

FIGURE 2.10

CITY OF GOODYEAR

2016 INTEGRATED WATER MASTER PLAN

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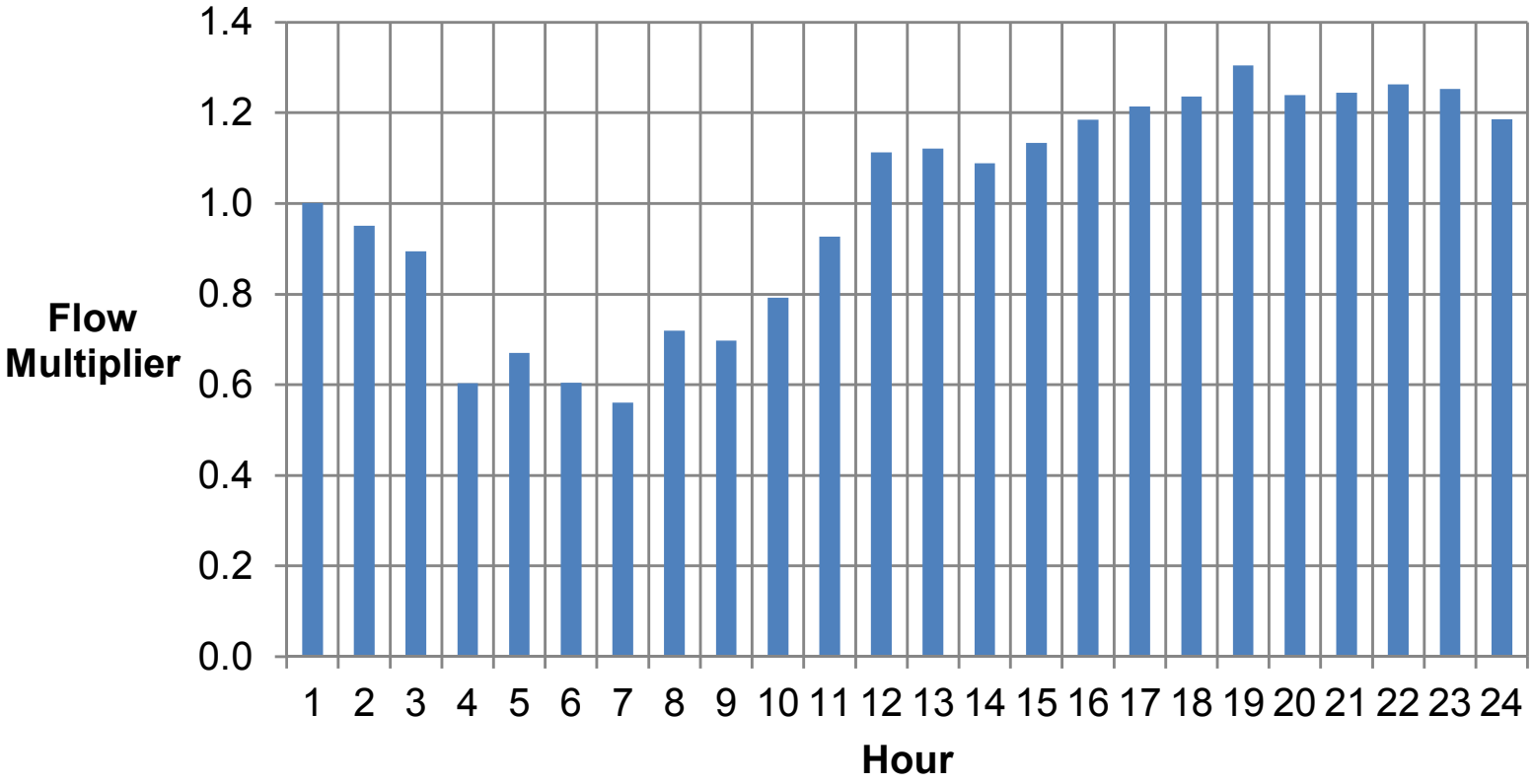
Table 2.14 Flow Monitoring Results – Average Day and Peak Hour Flows
2016 Integrated Water Master Plan
City of Goodyear

Flowmeter	Start	End	ADF (gpm)[1]	PHF (gpm) [1]	PHF/ADF
1	12/16/2014	1/13/2015	104	241	2.31
2	12/15/2014	1/13/2015	73	130	1.78
3	12/9/2014	1/13/2015	66	183	2.76
4	12/6/2014	1/13/2015	423	640	1.51
5	12/11/2014	1/13/2015	131	240	1.84
6	12/5/2014	1/13/2015	1	5	6.11
7	12/16/2014	1/13/2015	155	361	2.32
8	12/11/2014	1/13/2015	739	1,108	1.50
9	12/15/2014	1/13/2015	236	370	1.57
10	1/14/2015	1/29/2015	5	14	2.70
11	1/14/2015	1/29/2015	42	98	2.32
12	1/14/2015	1/28/2015	285	410	1.44
13	1/14/2015	1/29/2015	14	29	2.13
14	1/14/2015	1/28/2015	79	154	1.96

Note:

(1) For the day selected as the representative day for the basin and was used in the wastewater model calibration. For Sites 1 - 9 this day is 12/30/2015. For Sites 11 - 14 this day is 1/20/2015.



EXAMPLE DIURNAL FLOW PATTERN

FIGURE 2.11

CITY OF GOODYEAR
2016 INTEGRATED WATER MASTER PLAN

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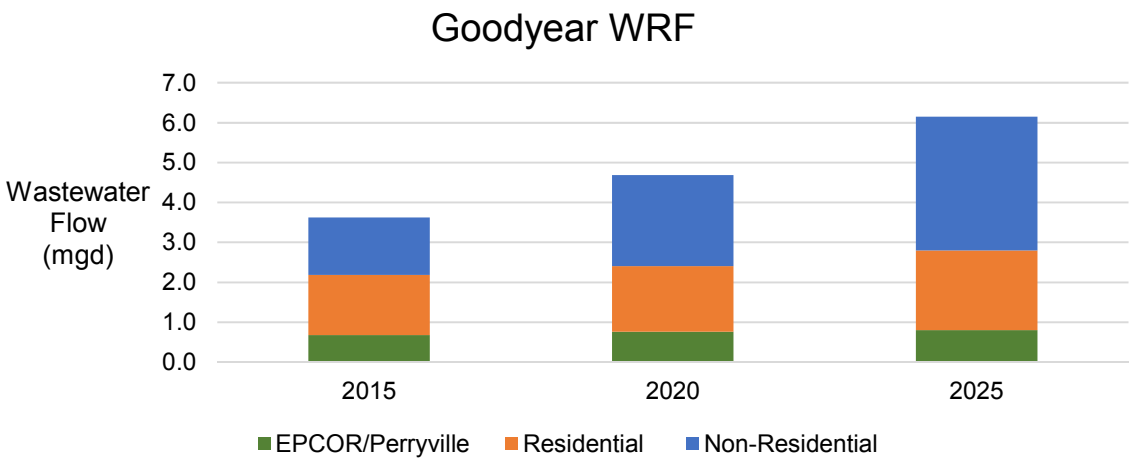
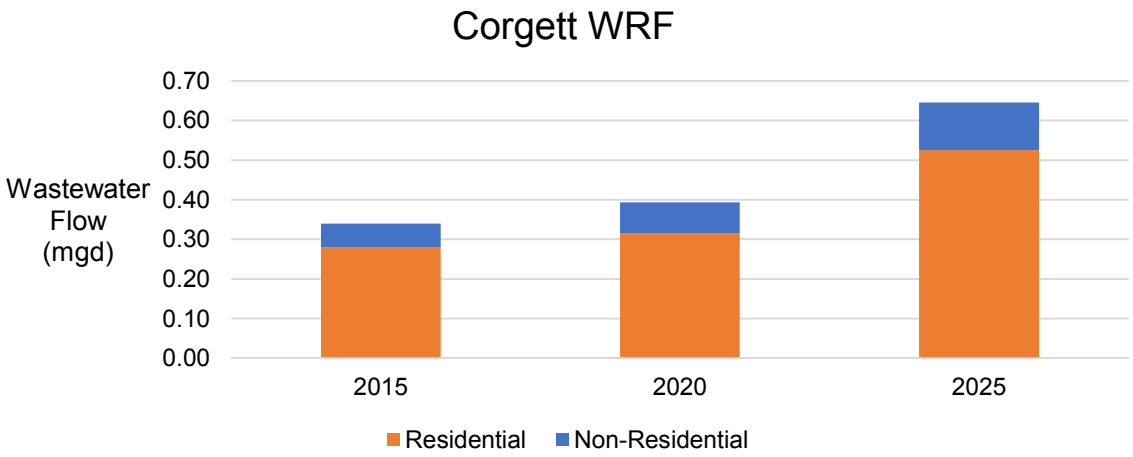
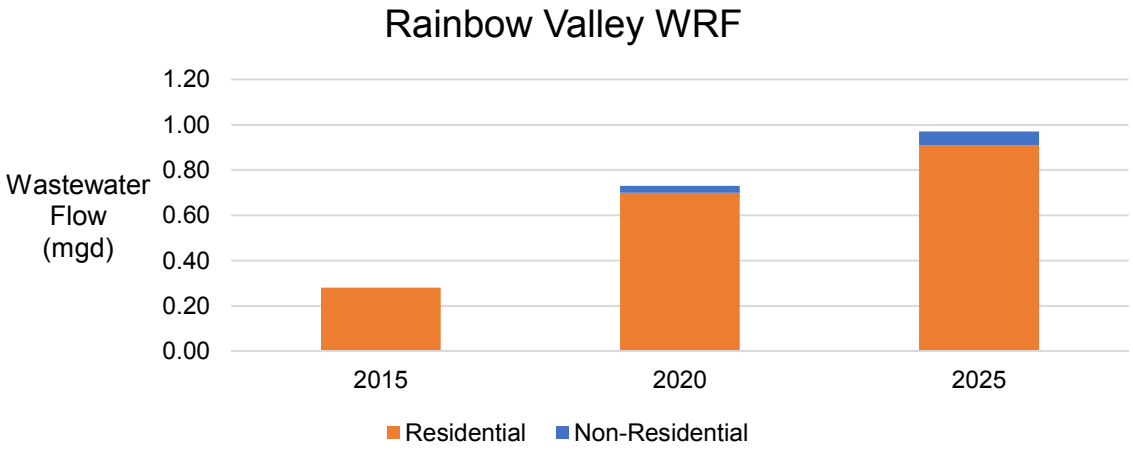
Table 2.15 Near Term Wastewater Flow Projections 2016 Integrated Water Master Plan City of Goodyear			
	Flow Projections (mgd)		
Flow Component	**2015**	**2020**	**2025**
Goodyear WRF			
Perryville Prison	0.6	0.6	0.6
EPCOR Water Service Area	0.08	0.16	0.20
Residential	1.5	1.7	2.0
Commercial	1.0	1.4	2.3
Industrial	0.4	0.8	1.2
Subtotal	***3.6***	***4.7***	***6.2***
Corgett WRF			
Residential	0.3	0.3	0.53
Commercial	0.06	0.08	0.12
Industrial	0.0	0.0	0.0
Subtotal	***0.3***	***0.4***	***0.6***
Rainbow Valley WRF			
Residential	0.28	0.70	0.9
Commercial	0.00	0.03	0.06
Industrial	0.00	0.0	0.0
Subtotal	***0.28***	***0.73***	***0.97***
Total	**4.2**	**5.8**	**7.8**







WASTEWATER FLOW PROJECTIONS THROUGH YEAR 2025

FIGURE 2.12

CITY OF GOODYEAR

2016 INTEGRATED WATER MASTER PLAN

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The potential buildout wastewater flows based on Entitlement Level, defined in Section 2.6, are summarized in Table 2.16. The values in Table 2.16 are incremental flows for each entitlement level. The total potential buildout flow for all entitlement levels, which represents full development of the City's planning area, is 49.9 mgd AADF.

Table 2.16 Buildout Wastewater Flows
2016 Integrated Water Master Plan
City of Goodyear

Water Planning Area	Wastewater Flow (mgd) Entitlement Level				
	1	**2**	**3**	**4**	**Total**
EPCOR	0.3	0.0	1.0	0.3	**1.6**
WPA 2	7.6	0.5	0.4	2.7	**11.2**
WPA 3	4.8	0.2	0.1	1.0	**6.0**
WPA 4	2.4	9.2	2.7	3.3	**17.6**
WPA 5	0.6	6.9	2.1	4.0	**13.5**
Total	**15.5**	**16.8**	**6.3**	**11.2**	**49.9**

2.5 RECLAIMED WATER PROJECTIONS

Reclaimed water flow estimates are based upon the wastewater flows into each water reclamation facility. The reclaimed water produced by each plant is estimated to be 85 percent of the wastewater flow. The City has an agreement that allows the Newland Development Group to provide reclaimed water for irrigation and other non-potable uses within the Newland communities. The reclaimed water from the Corgett and Rainbow Valley WRFs is therefore not available to the City for recharge until such time as Newland communities has more reclaimed water than it needs. Table 2.17 summarizes the reclaimed water flow projections by WRF service area and includes an estimate of the future reclaimed water flows that will be retained by the Newland communities. To benefit from any excess reclaimed water that Newland communities may have at some time in the future, the City will need to construct a recharge facility to take the water.

Table 2.17 Reclaimed Water Flow Projections
2016 Integrated Water Master Plan
City of Goodyear

Flow Component	Flow Projections (mgd)		
	2015	2020	2025
Goodyear WRF			
Perryville Prison	0.51	0.51	0.51
EPCOR Water Service Area	0.07	0.14	0.17
Residential	1.28	1.40	1.70
Commercial	0.87	1.22	1.84
Industrial	0.36	0.71	1.02
Subtotal	***3.1***	***4.0***	***5.2***
Corgett WRF			
Residential	0.24	0.27	0.45
Commercial	0.03	0.04	0.06
Industrial	0.00	0.00	0.00
Subtotal	***0.3***	***0.3***	***0.5***
Rainbow Valley WRF			
Residential	0.24	0.60	0.77
Commercial	0.00	0.01	0.03
Industrial	0.00	0.00	0.00
Subtotal	***0.24***	***0.61***	***0.80***
Total	**3.6**	**4.9**	**6.5**
Newland Reclaimed Water (1)	**0.6**	**1.0**	**1.5**

Note:
(1) Development agreements between the Newland communities and the City state that the reclaimed water generated from the Newland developments will be available to the Newland communities for non-potable reuse.

The potential buildout reclaimed water flows based on Entitlement Level, defined in Section 2.6, are summarized in Table 2.18. The values in Table 2.18 are incremental flows for each entitlement level and include the total reclaimed water expected to be generated at the City's WRFs. The total potential reclaimed water available for all Entitlement Levels, which represents full development of the City's planning area, is 47,143 AFY or 42.0 mgd.

Table 2.18 Buildout Reclaimed Water Available 2016 Integrated Water Master Plan City of Goodyear					
Water Planning Area	**Reclaimed Water Available (AFY) Entitlement Level**				
	1	**2**	**3**	**4**	**Total**
EPCOR	238	0	725	209	**1,172**
WPA 2	7,192	490	370	2,571	**10,623**
WPA 3	4,526	156	125	947	**5,754**
WPA 4	2,239	8,780	2,573	3,118	**16,708**
WPA 5	547	6,580	1,981	3,776	**12,885**
Total	**14,742**	**16,005**	**5,774**	**10,622**	**47,143**
	Reclaimed Water Available (mgd)				
EPCOR	0.2	0.0	0.6	0.2	**1.0**
WPA 2	6.4	0.4	0.3	2.3	**9.5**
WPA 3	4.0	0.1	0.1	0.8	**5.1**
WPA 4	2.0	7.8	2.3	2.8	**14.9**
WPA 5	0.5	5.9	1.8	3.4	**11.5**
Total	**13.2**	**14.3**	**5.1**	**9.5**	**42.0**

Note:
(1) This table shows potential total reclaimed water produced. Reclaimed water actually available to the City would be reduced by the amount taken by Newland communities or other developments.

2.5.1 Reclaimed Water Uses

Reclaimed water is currently used for both non-potable uses and recharge. Newland communities has a limited non-potable (purple pipe) water distribution system from the Rainbow Valley WRF, which serves the Estrella (Newland) communities in WPA 3. Currently the Newland development, Estrella Mountain Ranch (EMR), uses reclaimed water from the Rainbow Valley WRF to irrigate the EMR golf course. The current flows to the Rainbow Valley WRF are not sufficient to meet the full irrigation demands; so a non-potable well is used to supplement the reclaimed water supplies. Reclaimed water from the Corgett WRF is currently discharged into a wash. In the future it may be connected to the EMR reclaimed water system for Newland Community to use or delivered to a recharge facility that the City would construct, depending on negotiations.

In WPA 2, the Goodyear Ballpark is irrigated with remediated groundwater but also can be irrigated with reclaimed water. The majority of the reclaimed water available at the Goodyear WRF is recharged at the Goodyear Soil Aquifer Treatment (SAT) site. The City is

currently developing a vadose zone well project that will increase the City's recharge capacity.

The City currently has agreements associated with the Newland and Amaranth developments in which the developments retain the right to use the reclaimed water generated at the WRFs that serve those developments. Reclaimed water that is not used by the developer would be returned to the City for aquifer recharge. Developers benefit from recharged reclaimed water because this water can be recovered as a potable water source.

Reclaimed water is increasingly being seen as a very reliable water resource that is generated within a community. For cities that want additional water resources to grow, reclaimed water is reliable and one of the least expensive water supplies. The recommended highest and best use of reclaimed water for Goodyear is to strengthen the City's water resources portfolio by recharging reclaimed water to the aquifer. This allows the City to recover this water at times and locations that provide the greatest benefit to the City. Historically, reclaimed water has been viewed a product to be disposed; so reclaimed water was put to use in ponds, fountains, and green spaces. Purple pipe systems that increase the availability of this water can actually increase total water use by enabling the use of this water for landscaping, water features, expanded green spaces, and other applications. During times of drought when water supplies for public health and safety are reduced, reclaimed water that has already been committed for another purpose is not available for basic needs. By focusing on a reclaimed water strategy that relies on recharge and recovery, the City retains control of reclaimed water and can deploy this water where it provides the greatest benefit. The City should expand the current strategy of using reclaimed water generated within its boundaries for aquifer recharge and recovery.

In the future, the City will need to work with developers to establish agreements for reclaimed water that address the City's critical need to recharge reclaimed water for aquifer sustainability to strengthen the City's water resource portfolio. Developers benefit from this approach because it helps the City to meet its groundwater replenishment obligations for a sustainable water supply. Maintaining a viable aquifer supply is necessary for continued development within the City.

Where reclaimed water is used for landscape irrigation, it will have seasonal demand fluctuations with more water being needed in the summer and less being needed in the winter. Reclaimed water production is relatively constant from month to month. Therefore aquifer storage and recovery should be used so that the summer peak reclaimed water demands do not exceed the reclaimed water supply available in that month.

The City may need to update current policies, regulations, and development guidelines to make sure that reclaimed water is planned for aquifer recharge. One exception to the policy of using reclaimed water for recharge may be when a commercial or industrial customer returns more than 80 percent of the reclaimed water to the sewer for reuse. The City may

want to have the flexibility to use reclaimed water for an industrial application when doing so would be the best use for this water resource.

2.6 WATER RESOURCES

2.6.1 Water Resources – Summary of Laws and Regulations

The State of Arizona water laws and regulations have been developed and enacted over the past several decades to achieve safe yield with respect to groundwater use, and to provide for and promote orderly utilization of the State's renewable water resources. The laws governing water rights and water utilization in the State of Arizona are complex, but necessary to protect and efficiently use this valuable resource. There are a myriad of rules, regulations, court decisions, and other legal agreements that govern the quantity of water available to Goodyear, how it can be conveyed to the City, and how and where it can be used. It is important to understand the legal and institutional issues that form the basis for water use in Goodyear as the City looks to protect its current water supplies, and plan for acquisition of future water supplies to serve growth.

Arizona water law has a bifurcated system of water rights such that groundwater is managed under the 1980 Groundwater Management Act (GMA), and surface water rights are managed under the prior appropriation system. The following sections summarize and highlight some of the key components of several regulations and institutional constraints that are important to water resources planning for the City. Since these brief regulation summaries are interpretations, the City is encouraged to rely on official regulatory language and legal interpretation when implementing management strategies.

2.6.1.1 1980 Groundwater Management Act

Prior to 1980, many cities, private water companies, and other water users, that depended on groundwater supplies, observed declining groundwater levels. The Arizona State Legislature determined that the continued decline of groundwater levels threatened the economy and welfare of the State. To reverse this trend, the Legislature passed the GMA or Groundwater Code, which is intended to regulate the use of groundwater to maintain a balance between withdrawal and natural and artificial recharge. This balance is referred to as "Safe Yield."

The GMA created four initial "Active Management Areas" (AMAs) in locations that were experiencing severe groundwater overdraft, and were potentially at risk for continued declining groundwater levels with existing and projected urban growth. Goodyear is within the Phoenix AMA. The primary management goal of the Phoenix AMA is to reach safe yield of groundwater use by 2025.

The GMA has five primary provisions that apply to Goodyear and the Phoenix AMA:

- Establishment of a program of groundwater rights and permits.
- Preparation of five water management plans for each AMA that includes mandatory conservation requirements.
- Development of a program that demonstrates an assured water supply for new growth.
- Metering and measuring water pumped from all large wells.
- Reports of annual water withdrawal and use.

The GMA established rights pertaining to groundwater pumping within an AMA. These rights included:

- Service Area Rights – allowing water providers (Goodyear) to withdraw and transport as much groundwater as required within their service area boundaries to serve the needs of their customers. Service area rights are unique in that they have the ability to be expanded, and they are the only groundwater right that can still be created within an AMA. There are specific procedures for expanding/extending existing service area rights, and for establishing new or "satellite" service areas.
- Irrigation Grandfathered Rights (IGFR) – a right to use groundwater to irrigate specific land areas, which must have been irrigated between 1975 and 1980. Upon development by a City, the water right is converted to a Service Area Right.
- Type 1 Non-Irrigation Grandfathered Right – a right to use groundwater for irrigation on lands permanently retired from farming and converted to non-irrigation use after January 1, 1965, but prior to the date of designation of the AMA. A Type 1 right has the right to withdraw three acre-feet of groundwater per acre per year.
- Type 2 Non-Irrigation Grandfathered Right – groundwater that was being legally withdrawn and used for non-irrigation purposes in any of the five years prior to the date of the AMA designation. The right is based on historical pumping of groundwater for a non-irrigation use and equals the maximum amount of water pumped in any one year between 1975 and 1980. Type 2 rights can be transferred for use on other tracts of land.

These groundwater right provisions will become particularly important to Goodyear as it extends its service further into Rainbow Valley.

2.6.1.2 Assured Water Supply (AWS)

The Assured Water Supply (AWS) program was instituted as part of the 1980 GMA, and was strengthened with the adoption of the AWS rules in 1995. Under these rules, persons wishing to develop lands within an AMA must demonstrate that sufficient renewable water supplies are available to meet the proposed new development's demands for 100 years.

Only after a sufficient renewable supply is demonstrated can a development be approved for sale to the public. Goodyear has a Designation of Assured Water Supply (DAWS), which covers its entire service area and any new subdivisions approved to be served by the designated provider are deemed to have an assured water supply.

Some of the requirements necessary to prove an Assured Water Supply include:

- Sufficient water supplies must be physically, legally, and continuously available for a 100-year period.
- The water provider must have financial capability to install the required facilities.
- The quality of the water sources must meet Arizona Department of Environmental Quality (ADEQ) requirements.
- Uses of the water must be consistent with the Management Goal of the AMA.
- Uses of the water must be consistent with the water provider's conservation requirements of the Management Plan.

The AWS Rules limit the amount of groundwater a municipal provider may withdraw "consistent with the management goal" of the AMA. The volume of groundwater a provider may withdraw is determined from several components and is recorded in the provider's "Groundwater Allowance Account." The initial, or "Phase-In," groundwater allowance is computed as a percentage of the provider's historic water use. The amount of allowable groundwater use can be increased by an incidental recharge factor which is calculated as a percentage of water use and increases as water use increases. The groundwater allowance may be increased by credits obtained by the extinguishment of IGFR water rights. A provider may also increase its allowable groundwater pumping by becoming a member service area of the Central Arizona Groundwater Replenishment District (CAGRD).

The City’s 2014 DAWS application includes a tabulation of the groundwater physically available by groundwater basin within the City’s service area. The total groundwater determined to be physically available to the City is 13,191 AFY in the West Salt River Valley (WSRV) basin and 9,349 AFY in the Rainbow Valley (RV) Basin as shown in Table 2.19. In addition, Table 2.19 shows the amount of physical water supply designated by the ADWR for other developments in Rainbow Valley. The amount of approved groundwater supply for these other developers amounts to 31,351 AFY. Once service is established by Goodyear for these developments, the developers will convey their approved physical supplies to the City for use in its DAWS. Water conveyed to the City as part of a development agreement would be used only to serve that development and not for other dry land development, current or future.

In addition to the physical supply designation from ADWR, the City or developers need to find funding to fulfill groundwater replenishment obligations. Water that is taken from the ground will ultimately need to be replenished using CAP water or another surface water source to avoid depleting the aquifer.

Table 2.19 Groundwater Physical Availability from the City's 2015 Designation of Assured Water Supply 2016 Integrated Water Master Plan City of Goodyear	
Source of Supply	**DAWS Approved Volume (AFY)**
Adaman	4,467
City Groundwater WSRV (1)	8,724
West Salt River Valley Total	**13,191**
City Groundwater RV (1)	253
Estrella Highlands Development	3,414
Newland Communities	9,096
McRae Holdings	3,961
Madiera Developments	5,496
Rainbow Valley Development	1,682
Amaranth Development	16,798
Rainbow Valley Total	**40,700**

The City needs to establish a way to obtain the funding to collect money from new development to purchase water to fulfill replenishment obligations. The City faces a significant challenge in obtaining funding to purchase additional water rights because available water resources are limited, and the price of water is expected to rise, so purchasing water that is currently available would be very beneficial to development. However, current impact fee laws only allow impact fees to be levied for expenses that will occur within fifteen years.

The groundwater storage volumes shown in Table 2.19 have been demonstrated to be physically available based on groundwater modeling. The groundwater model simulates existing and projected demands over a 100-year period and is subject to specific criteria required by ADWR. These criteria include demonstrating that the water is of adequate quality as well as demonstrating that water levels will not exceed 1,000 feet below land surface after 100 years of simulated groundwater pumping. Near-term changes in demands or groundwater pumping intensity by the City or others may change future groundwater modeling results; so the groundwater determined to be physically available the next time the City updates its DAWS may change. Even though the groundwater has been shown to be physically available, the City, as a designated water provider, must still replenish groundwater pumped beyond the incidental recharge allotment to avoid depleting the aquifer. Groundwater replenishment means that the groundwater pumped needs to be replaced through recharge to avoid depleting the aquifer.

2.6.1.3 Central Arizona Groundwater Replenishment District

In 1990, the State Legislature authorized legislation to establish Groundwater Replenishment Districts for the purpose of replenishing groundwater that is pumped in excess of safe yield. The CAGRD, which is a division of the Central Arizona Water Conservation District (CAWCD), was established in 1993 with voluntary membership. The purpose of CAGRD is to provide a mechanism for landowners and water providers to demonstrate an AWS under the AWS rules. The CAGRD recharges unused CAP water, or other renewable water supplies, in order to offset groundwater pumping by its members. CAWCD owns and operates a number of underground water storage facilities including the Agua Fria, Hieroglyphic Mountains, Tonopah Desert, and Superstition Mountains projects in which CAGRD stores water.

Goodyear has membership in CAGRD as a Member Service Area with a replenishment agreement for a maximum of 15,940 AFY. This agreement provides Goodyear with the legal right to withdraw water from the aquifer, but does not provide the City with a physical supply. The ADWR determines the amount of groundwater that can be pumped, and Goodyear's withdrawals need to remain within the physical pumping limits.

2.6.1.4 Underground Water Storage and Savings

In 1986, the State promulgated the Artificial Recharge and Underground Storage and Recovery Act (RUSRA) to regulate recharge, storage, and recovery of all classes of water. The RUSRA allows renewable supplies to be recharged and stored underground to meet future demands, and encourages the use of excess renewable supplies, such as CAP water and reclaimed water, that would otherwise remain unused.

Underground storage and recovery (US&R) projects are facilities where water is recharged with the expectation of recovering it for future use. Underground storage projects involve two types of permits, namely the Underground Storage Facility (USF) Permit and the Water Storage (WS) Permit. The USF permit regulates the "how" of underground storage, and the WS permit is issued for the purposes of accruing credits. The USF has two types of physical facilities, namely constructed and managed. Constructed facilities include facilities that are actually built such as spreading basins, injection wells, and vadose zone wells. The managed facility permit governs when water is discharged to a natural stream and water is allowed to infiltrate through natural processes.

The Act was amended in 1990 to include provisions for a third type of recharge identified as Groundwater Savings Facilities (GSF). Using a GSF is an "indirect" method of recharging which allows a water provider to deliver reclaimed water or CAP water for use by another party such as an agricultural irrigation district in lieu of pumped groundwater. The water provider gains storage credits for the amount of water not pumped by the irrigation district. Initially, unlimited credits could be obtained. However, the law was modified to allow only that water used by agricultural irrigators in excess of their own CAP allocation can be counted as credits.

An amendment to the RUSRA was added which established "annual storage and recovery (AS&R)" accounts. This addition to the RUSRA allows for the use of recharge facilities and wells to store and recover water on an annual basis without having to construct costly treatment and conveyance facilities. Water stored under an AS&R permit must be recovered in the same calendar year as it was stored.

Water stored in these types of underground storage facilities requires a recovery well permit in order to recover the stored water credits. An existing well may be permitted as a recovery well provided that it is demonstrated that other wells in the vicinity will not be harmed by the recovery of the stored water. The water recovered from the well retains the identity of the water when it was stored.

Goodyear has several opportunities through existing permits to store CAP water either on an annual basis or for LTSCs. Currently, the City is using AS&R to replenish its groundwater pumping that is in excess of allowable quantities. In addition to CAP water, the City currently recharges and stores reclaimed water at the Soil Aquifer Treatment site via recharge basins. The City is also implementing a reclaimed water storage project through the use of a vadose zone recharge project.

2.6.2 Water Resources Portfolio

The City of Goodyear has developed a water resources portfolio that includes surface water supplies from the Colorado River (CAP), groundwater, and reclaimed water. The City owns ten wells and operates twelve potable groundwater production wells and also receives bulk groundwater deliveries from the Adaman Mutual Water Company. The City also has a delivery agreement with Liberty Utilities to provide water during high demand times or in emergencies. Goodyear currently utilizes its reclaimed water supply for direct non-potable reuse. The City also has a vadose zone well reclaimed water recharge and storage project being constructed that can be used to replenish groundwater pumping and for drought protection.

The following water resources are the major components of the City's existing water resources portfolio, each of which is discussed in subsequent sections:

1. Colorado River Supplies consisting of the CAP Municipal and Industrial (M&I) allocation, and the GRIC lease.
2. Groundwater that can be legally pumped consisting of the Incidental Recharge allowance as determined by the ADWR.
3. Groundwater that is available through a bulk water delivery agreement with the Adaman Mutual Water Company.
4. Groundwater that is available through a water delivery agreement with the Liberty Utilities.
5. Reclaimed water.

6. Remediated groundwater from the Phoenix Goodyear Airport North (PGAN) and Phoenix Goodyear Airport South (PGAS) projects from 2014 through 2025.
7. Long term storage credits derived from recharge and storage of reclaimed water and unused CAP water.
8. The City has a CAGRD contract that provides the legal right to pump groundwater as long as pumping does not exceed physical supply limits.

The yield and delivery capability of each of Goodyear's water resources is impacted by the following conditions:

1. Hydrologic/climatologic effects, i.e., drought impacts and climate change,
2. Regulatory restrictions on the location of use,
3. Impacts from groundwater contamination and remediation activities at the City's Superfund sites,
4. Location of service area demand in relation to source delivery, and
5. Capacity of infrastructure to deliver the resource.

The following sections discuss each of Goodyear's water resources from the perspective of resource evaluation, drought yield implications, and operational considerations.

2.6.2.1 Colorado River Supplies

The CAP is designed to deliver approximately 1.5 million acre-feet (MAF) of Colorado River water annually to central and southern Arizona. The estimated annual water supply available for delivery from the CAP in normal water years is 1.415 MAF. A total of 555,801 acre-feet has been contracted by M&I entities, 462,801 acre-feet are committed to Native American communities, and 397,168 acre-feet are under contract for agricultural purposes.

2.6.2.1.1 Resource Evaluation

Currently, Goodyear has a subcontract for 10,742 AFY of M&I priority CAP water. In addition, the City has a GRIC lease for 7,000 AFY of CAP water. These supplies may be used anywhere within the City's service area.

The City does not have a physical connection to receive CAP water into the distribution system. Therefore, the City currently manages a portion of its CAP supply for annual storage and recovery to offset groundwater pumping that falls outside the City's legal groundwater withdrawal limits. The City uses CAP recharge facilities to recharge its water orders to obtain long term storage credits that are then used to meet pumping replenishment obligations. The recharge facilities are permitted for only twenty years, so ADWR does not recognize this approach as a continuous supply per the DAWS rules. Therefore, ADWR does not recognize the City's full CAP water allocation. To overcome this

limitation, the City has provided EPCOR with a notice of intent to negotiate an agreement to treat and deliver the City's CAP water.

2.6.2.1.2 Drought Yield Implications

Due to drought and over-allocation of the Colorado River resources, shortages to the CAP water supply are expected to occur. Under normal year conditions, the CAP is expected to be able to deliver 1.5 million acre-feet per year (MAFY) to the subcontractors. During times of a moderate shortage (20 percent cut back with a 10 - 40 percent probability of occurrence), the CAP is expected to be able to deliver about 1.0 MAFY. However, under a severe shortage condition (50-55 percent cut back with a low probability of occurrence), the CAP is expected to be able to deliver only about 0.6 MAFY. The M&I subcontractor's water supply will not be affected until a shortage on the Colorado reaches 600,000 AFY.

Recent drought conditions have increased the awareness of the impact of future potential drought conditions on the long-term water supply availability to M&I users. However, a combination of reservoir operating guidelines, storage criteria agreements, and water banking arrangements may reduce the potential for severe shortage impacts to M&I users.

Based on studies by the United States Bureau of Reclamation (USBR) and CAWCD, Colorado River supply conditions should result in normal water supply yields for the near future. This expectation is based on modeling results of the Upper Colorado River Basin and demand patterns within Arizona. Shortage conditions that could occur in the next 10 - 20 years are anticipated to impact the City's water resources and infrastructure planning.

In 1996, the Arizona Water Bank Authority (AWBA) was created to store underground the unused portion of Arizona's share of the Colorado River water. The AWBA is in the process of storing unused CAP water for the following purposes:

- Firming a percentage of subcontracted amounts in times of shortages or disruption of the CAP system,
- Meeting the management plan objectives of the Arizona Groundwater Code,
- Assisting in the settlement of Native American water right claims, and
- Exchanging water supplies to assist Colorado River communities.

In January 2014, a draft report by the AWBA, ADWR, and the CAP was released entitled "Recovery of Water Stored by the Arizona Water Banking Authority." This report outlined strategies for firming M&I subcontractors which included direct recovery, indirect recovery, and credit exchange methods for providing the firming coverage. Shortage amounts and timing of these shortage conditions are also discussed based on recent Colorado River modeling studies. In general, the report stated that shortages to the Non-Indian Agriculture (NIA) water priority might impact users by about 2025. Also, the modeling suggested that

shortages to M&I contracts might not occur until 2035. For shortages to the M&I priority pool, the AWBA will distribute credits provided the following conditions exist:

- AWBA has credits available to firm the supply,
- CAP's recovery schedule is consistent with statutes, rules and policies,
- Credits will be used to benefit the county for which they were accrued, and
- The shortage to the M&I priority pool is less than 20 percent.

The City's GRIC lease water supply is federally firmed by the United States, and therefore the City should order their GRIC lease water prior to ordering their CAP subcontract water to the extent possible. This ensures that if there are declared shortages on the CAP any portion of the GRIC lease would not be reduced, and could be used fully before the City would need to use other reduced supplies, supplemented with LTSCs.

Water supply delivery strategies for Goodyear are assessed under varying water supply yields resulting from various drought scenarios, and identifying the infrastructure needed to deliver the water. The drought scenarios investigated for Goodyear assumed that severe (30 percent cutback) and extreme (50 percent cutback) drought conditions could adversely affect the City's CAP water supplies. The results of these drought scenarios are presented in Section 2.7.3.

2.6.2.1.3 Operational Considerations

CAP water can be ordered year-round, although the CAWCD has a policy that limits a subcontractor to 11 percent of their total CAP supply delivered per month. Since the CAP is not operating at full capacity yet, this peak delivery rate has not been strictly enforced. While it is not known if and when the peak limit will be enforced, it is prudent for Goodyear to assume that it will, and to plan its infrastructure accordingly. This results in a peak delivery factor of 1.32 times the annual average supply being used by the City in any one year.

The CAP system is an interruptible supply and outages are possible as a result of infrastructure failures, and outages for periodic maintenance. While shutdowns have not occurred, the CAP has indicated that in the future, short dry-ups are anticipated every two to three years for maintenance purposes. In those years when a CAP outage is scheduled, the CAP dry-ups would occur during the November to March time period. During these times the City will need to meet average daily demands with groundwater supplies. Outages occurring during other months would require additional well capacity/pumping and/or water use restrictions.

2.6.2.1.4 CAP Non-Indian Agriculture (NIA) Water

NIA water priority subcontracts are the lowest priority or most junior water right associated with the CAP supplies. If a shortage is declared on the Colorado River, agricultural priority water will realize 100 percent cut in supply before the municipal (M&I) supplies would be affected. Because NIA water is the most susceptible to shortages, the USBR has recommended to ADWR that about 70 percent of an NIA water supply can be deemed firm in order to be used for AWS purposes. Goodyear submitted an application for an allocation of 2,000 AFY of NIA water. However ADWR's 2014 Reallocation Phase recommendations did not include Goodyear's request.

The Arizona Water Settlement Act (AWSA) resulted in 96,000 acre-feet of CAP NIA water to be reallocated. ADWR currently has reallocated about half of this supply. ADWR has indicated that it will reallocate the remaining Phase I NIA supply in about 2019 - 2020. This remaining supply will be prioritized and allocated to entities that can demonstrate a water supply shortage within a specified period of time to be determined by ADWR.

In addition, CAWCD has a policy in place to market excess CAP water for specifically NIA use, and is considered the highest priority use for Excess Water. As part of the overall water allocation resolution, the NIA subcontractors are being required to give up claims to long-term NIA water allocations. Goodyear should remain vigilant regarding the management and disposition of this water supply to obtain additional as part of a sustainable solution for the Rainbow Valley developments.

2.6.2.2 Groundwater

The AWS rules adopted by ADWR require that for a groundwater resource to be considered physically available, it must not cause the static water level to drop below 1,000 feet below land surface over a 100-year pumping period. On March 11, 2011, Goodyear received its re-designation of AWS effective until December 31, 2016.

Goodyear's legal availability of groundwater is limited by the GMA, which includes the volume of groundwater in the City's AWS Groundwater Allowance Account. The account includes groundwater in the following categories:

- Groundwater allowance,
- Accrued incidental recharge, and
- Annual and long term storage credits.

Annual and long-term storage credits are accrued by recharging renewable supplies (CAP, and reclaimed water), which can be used to offset groundwater pumping which exceeds the City's legal groundwater pumping limit.

2.6.2.2.1 Water Resource Evaluation

Goodyear has a one-time allocation of groundwater that may be pumped as part of the "phase-in" to safe yield in the Phoenix AMA. This quantity was established in 1995 by the AWS rules and was computed to be 7.5 times the amount of water Goodyear provided to its customers in 1994. Per the 2011 AWS designation, the Phase-In Allowance was computed to be 865.81 AFY for a 100-year period. The Phase in allowance, which if used, would not incur a replenishment obligation with the CAGRD.

Under the AWS rules, the City is allowed an Incidental Recharge allocation of 4.0 percent of its total 2015 annual water demand per its 2011 Decision and Order. The formula was based upon the estimated volume of water recharged to the groundwater aquifer from the City's water distribution system through leaks and delivery to end users. The amount of incidental recharge will increase as water use increases in the City in the future. In the 2011 AWS designation, the City's incidental recharge volume was calculated to be 495.43 AFY. The pending 2015 modification to the City's DAWS is likely to incorporate an increase in the incidental recharge factor to 5.1 percent. Incidental recharge is important in that it is not counted against the City as a CAGRD replenishment obligation when reported to ADWR in the annual water use reporting.

The AWS Groundwater Allowance Account is the amount of groundwater pumping legally available to Goodyear that does not have to be offset with groundwater recharge credits. In 2015, the City's Groundwater Allowance Account totaled approximately 57,000 acre-feet (or 570 AFY for 100 years), which can be used for drought protection or for emergency purposes.

Goodyear has been managing the use of a portion of its CAP water supply allocation to provide AS&R credits to offset groundwater pumping that falls outside of the City's legal pumping limit. In 2014, Goodyear stored and recovered 8,171 acre-feet in the Superstition Mountains and Hieroglyphics Mountains recharge projects. In the future, Goodyear may elect to use a portion of its accumulated LTSCs together with CAP AS&R to offset groundwater pumping outside of legal limits. The amount of CAP water that is budgeted for purchase in the next five years is limited to the water needed to serve existing customers. Because the City currently has a CAP right that is not fully used, the City could seek ways to obtain additional benefits from this water. In the near term, options for using this CAP water include the following:

1. Recharge the CAP water to obtain additional LTSCs to strengthen the City's water storage account.
2. Partner with other CAGRD cities to obtain revenue by leasing the City's CAP water to other organizations.
3. Work with water brokers who would recharge the CAP water and give the City a portion of the LTSCs while retaining a portion for the service they are providing.

The unused portion of the City's CAP allocation could be purchased and recharged to build up LTSCs. In addition, in the interim until about 2030, the City could investigate strategies to leverage this water through a cost sharing partnered arrangement to gain some additional LTSCs.

In the future as demands increase, all CAP water supplies will be treated and delivered to meet demands. Reclaimed water will be recharged and recovered to offset groundwater pumping, and accruals to the LTSC account will cease.

Each of the CAWCD's USF permits has a finite life, and needs to be renewed through an ADWR re-permitting process. The re-permitting timetable ranges from 2019 through 2028 as shown in Table 2.20. Goodyear, as well as others, has expressed some concern over the longevity of these storage facilities, and the ability to re-permit some of these facilities due to groundwater level rise or other issues. The storage facilities that will require re-permitting in the near term include the Agua Fria and Hieroglyphic recharge projects. Goodyear should be proactive and work with recharge facility owners to re-permit their facilities in a timely fashion.

Under Arizona State statutes and regulations governing recharge and recovery activities, a percentage of the recharged volume is deemed non-recoverable in order to provide a general benefit to the aquifer (cut to the aquifer). The current "cut" to the aquifer percentage applied to recharge of renewable water supplies for accrual of long-term storage credits is 5 percent. In general, there is no "cut to the aquifer" for recharge of effluent, annual storage and recovery, or CAGRD replenishment or replenishment reserves.

In developing the Fourth Management Plan, ADWR is proposing to modify the "cut to the aquifer" policy in order to facilitate a more comprehensive approach to aquifer management. ADWR's proposed "Enhanced Aquifer Management: Alternative Cut to the Aquifer" concept includes the following:

1. Recovery within 1 mile of USF – 0% cut,
2. Recovery outside 1 mile of USF, but in same sub-basin – 10% cut,
3. Recovery in a separate sub basin – 20% cut,
4. All sources to be treated the same,
5. LTSCs and AS&R to be treated the same.

Table 2.20 Recharge Facility Capacity
2016 Integrated Water Master Plan
City of Goodyear

Underground Storage Facility	Start Date	End Date	Total Facility Storage Capacity (acre-feet)	Goodyear's Total Storage Capacity (acre-feet)	Goodyear's Annual Capacity (acre-feet)	Total Recharged in 2014 (acre-feet)	USF Operator	Type of Water
Agua Fria Managed		5/31/2019	750,000		13,000	0	CAWCD	CAP
Agua Fria Constructed		5/31/2019	750,000		13,000	0	CAWCD	CAP
Hieroglyphic Mountain		12/31/2021	630,000		14,265	610	CAWCD	CAP
Tonopah Desert	3/31/2014	9/1/2025	2,000,000	289,000	17,000	0	CAWCD	CAP
Superstition Mountain	3/31/2014	1/15/2028	56,500	56,500	56,500	7,561	CAWCD	CAP
City of Goodyear (SAT)	6/10/2014	6/9/2016 -	7,500	7,500	3,750	1,233.06	Goodyear	Reclaimed
City of Goodyear VIP (1)	8/18/2015	8/18/2035	132,800	132,800	5,000 - 8,300	0	Goodyear	Reclaimed

Note:
(1) Phased storage: 5,000 AFY for 5 years, 6,000 AFY for 5 years, 7,000 AFY for 4 years, 8.300 AFY for 6 years

In 2013, the Arizona Municipal Water Users Association (AMWUA) put forth a proposed aquifer management goal and concept for consideration. The AMWUA proposal is briefly summarized as follows:

1. Reclaimed water recovery, same sub-basin – 100% for Constructed USF, 50% for Managed USF,
2. Reclaimed water recovery, separate sub-basin – 80% for constructed USF, 50% for Managed USF,
3. Recovery of other water types (CAP), same sub-basin – 95% for Constructed USF, 100% for AS&R, and
4. Recovery of other types of water (CAP), separate sub-basin – 80% for Constructed USF, 80% for AS&R.

The stakeholder meetings continued throughout 2014, without a conclusion being reached, and ADWR tabled the matter for further study. At this point, it is uncertain how the process will end, and what "cut to the aquifer" percentages will be in place for future regulations.

The City has a bulk water sale and treatment agreement with the Adaman Mutual Water Company (Adaman) to provide groundwater from outside of the City's service area. The agreement with Adaman is to provide up to 11,200 AFY (10 mgd) of groundwater. However, in the City's current AWS, ADWR only approved 4,467 AFY of groundwater to be available to the City. The Decision and Order limited the delivery of bulk water from Adaman due to the maximum physically available groundwater in the area.

Goodyear also has a bulk water agreement with Liberty Water in the amount of 74 AFY, which is groundwater from outside the City's service area.

Groundwater pumped and treated at the PGAN and PGAS Superfund treatment facilities is available to Goodyear as remediated groundwater in accordance with Arizona Law. The maximum total volume of remediated groundwater is projected to be 4,151 AFY for the years 2013 through 2025, with a projected total volume of 50,000 acre-feet available to Goodyear for the recovery period.

The PGAN and PGAS superfund sites have a significant impact on Goodyear's water system operation. The City has had to abandon three wells that were impacted by this contaminated groundwater. The operation of Wells 1 and 3 is expected to be impacted by the groundwater plumes. Recharge facilities also cannot be located in a manner that affects movement of the groundwater plume.

2.6.2.2.2 Drought Yield Implications

Groundwater pumping is essentially drought proof, and is an excellent physical source during periods of reduced surface water yields. However, there are concerns related to sustainability of physical groundwater supplies in the West Salt River Valley and Rainbow Valley aquifers.

After the City receives reduced surface water it will be important to maintain sufficient well capacity to pump groundwater to replace surface water shortages during droughts and emergencies. The criteria and pumping capability needs are discussed in the Water System Master Plan, Chapter 3.

The implications of increased well pumping for certain drought scenarios are discussed in detail in Section 3.7.3.

2.6.2.2.3 Operational Considerations

Goodyear has developed, and continues to develop, a number of groundwater production wells throughout its service area. Groundwater pumping is not subject to canal delivery limitations, seasonal dry-ups, or drought impacts in the same manner as surface water supplies, making groundwater production wells ideal for purposes of meeting peaking, standby, drought, and emergency needs.

Wells are permitted according to ADWR rules and regulations, which include annual withdrawal rate/volume limitations. ADWR's well rules, approved in 2006, allow for 100 percent of the original duty cycle of a well to be available to replacement wells used for municipal purposes. Per ADEQ requirements, the largest well in each pressure zone is held in reserve when calculating the total available groundwater. This is commonly known as "firm capacity." Groundwater quality including levels of TDS, nitrates, fluoride, and arsenic is a major concern to Goodyear. Most of the City's wells need treatment, which significantly increases water supply costs. The City has two reverse osmosis treatment facilities that serve multiple wells. The City also has a treatment facility for the Adaman well supplies. Water treatment is expected for any new well site.

2.6.2.3 Reclaimed Water

The City of Goodyear has been treating wastewater to produce a reclaimed water supply that is either delivered directly to customers, or made available for recharge to provide storage credits to offset future groundwater withdrawals that fall outside the City's legal pumping limits. Goodyear uses 100 percent of the reclaimed water produced at the Goodyear WRF. The reclaimed water produced at the Corgett and Rainbow Valley WRFs is returned to the Estrella Mountain Ranch (Newland Development) community for non-potable uses or discharged into a nearby wash.

2.6.2.3.1 Reclaimed Water Resource Evaluation

The goal of Goodyear's reclaimed water management program is to beneficially use all of the reclaimed water produced by the City through either reuse or recharge. Current reclaimed water from the 157th Avenue WRF is planned for recharge.

Reclaimed water from the Rainbow WRF is used to irrigate a golf course. Reclaimed water from the Corgett WRF is not currently beneficially reused, but in the not too distant future this water will be used to fill ponds in the public areas. Newland Communities owns and operates its own reclaimed water distribution system to provide irrigation within the development.

Irrigation water demands vary seasonally, with peak demands occurring during the summer months, and low demands during the winter or during precipitation events. Since the reclaimed water produced from the water reclamation facilities is relatively constant, storage and recovery facilities are needed to manage supplies in response to seasonal demands.

Additional reclaimed water generated from new growth needs to be used for aquifer storage and recovery to the highest extent possible.

As previously discussed, Goodyear is currently developing a vadose zone recharge project that includes wells and associated USF and WS permits to store excess reclaimed water for later recovery or to be banked as LTSCs.

2.6.2.3.2 Drought Yield Implications

Similar to groundwater, reclaimed water is not affected by drought, and remains relatively constant throughout the year. When the City must impose its Water Conservation and Curtailment Plan, which cuts back on water use, some reductions in reclaimed water supply may also be experienced.

2.6.2.3.3 Strategy for Future Reclaimed Water Use

Current reclaimed water utilization is based on executed agreements between the City and the end users. These agreements specify a certain reclaimed water delivery amount, or committed capacity. Because of the importance of reclaimed water in the City's water resource portfolio, the City should structure development agreements so that the City retains the reclaimed water for recharge. This helps to provide the water resource that is needed for continued growth. The City should also seek opportunities to restructure existing agreements with developers to increase the amount of recharge that is available to the City.

Reclaimed water will be stored underground in recharge facilities that are or will be constructed by the City, for later recovery or to remain in storage as LTSCs. The City should continue to pursue maximizing its reclaimed water recharge capability to offset groundwater pumping. Expanding non-potable and direct reuse systems is recommended only when needed to serve an industrial or commercial customer that returns a high percentage of the reclaimed water through the collection system. The City already has the ability to recover reclaimed water through wells in its potable water system. This gives the City a lot of flexibility to determine where the reclaimed water will be used.

2.7 WATER SUPPLY VERSUS DEMAND

2.7.1 Water Supply vs. Demand, 5- and 10-Year Planning Horizon

Table 2.21 presents a summary of physical and legal water supply availability versus demands for years 2015 through 2025. This table displays the results for the Northern Planning area (WPA 2 & WPA 3) only since development may not occur in the Southern Planning Area (WPA 4 & WPA 5) prior to year 2025. The renewable water supply consists of surface water, City incidental recharge (West Salt River Sub-basin) groundwater, and reclaimed water. Management of the existing water resources to meet demands is relying on increasing use of GRIC lease and CAP supplies for either AS&R and/or direct delivery. Use of this water resource is increased in the table so that the total water supplies are equal to the demands. There is also increased dependence on continued recharge of reclaimed water amounting to 5,460 AFY by year 2025. If the City could increase the amount of reclaimed water recharge during this period, it would reduce the need to use CAP water.

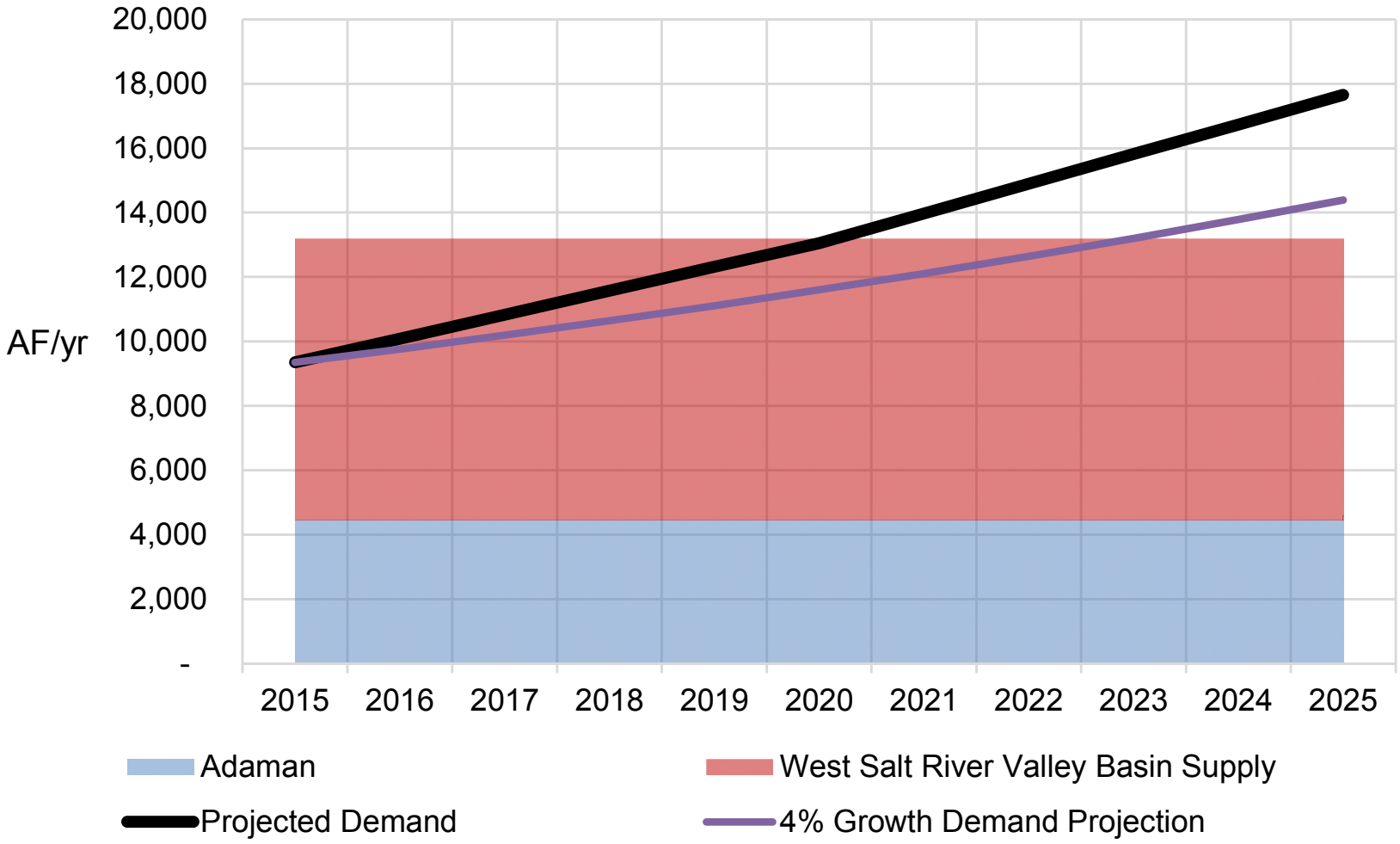
By the year 2020, additional CAP surface water supplies will need to be physically delivered to meet the increasing demand since groundwater physical supply limitations will be reached by 2020 and exceeded by 2021 if additional surface water is not provided. **It is crucial that direct delivery of a new physical water supply be in place between 2020 and 2025.** Figure 2.13 shows the demand growth versus available supplies through the year 2025.

Several options exist to develop a new short term water supply include an in lieu exchange with the Adaman water Company and adding wells in Rainbow Valley that use Type 1 or Type 2 water rights, or establishing a connection to the EPCOR Water Company to purchase CAP water for several years until the City's ultimate CAP water treatment and delivery solution is in place.

Table 2.21 Water Resources Summary - Existing Water Resources for 5- and 10-Year Planning Horizon
2016 Integrated Water Master Plan
City of Goodyear

PHYSICAL SUPPLY			
	Annual Demand (AFY) (1)		
Planning Area	**2015**	**2020**	**2025**
WPA 2	7,483	9,556	12,795
WPA 3	1,871	3,497	4,864
Total Demand (2)	**9,354**	**13,053**	**17,658**
	Renewable Supply (AFY)		
Surface Water			
CAP M&I	0	1,325	4,294
CAP GRIC Lease	4,752	7,000 (3)	7,000 (3)
Subtotal Surface Water	***4,752***	***8,325 (4)***	***11,294 (4)***
Renewable Groundwater			
Phase In (5)	866	866	866
Incidental Recharge (6)	479	668	904
LTSC	206	0	0
CAGRD (7)	0	0	0
Subtotal Renewable Groundwater	***685***	***668***	***904***
Reclaimed Water			
Reclaimed Water Produced (8)	3,451	4,460	5,860
Direct Reuse	(400)	(400)	(400)
Net Available for Recharge	3,051	4,060	5,460
Total Renewable Supplies	**9,354**	**13,053**	**17,658**
Surplus / (Deficit)	0	0	0

Notes:
(1) Assumes 402 gpd/home for residential development, 1,700 gpad for commercial development and 1,000 gpad for industrial development.
(2) WPA 4 and WPA 5 do not have any projected demands for years 2015 - 2025.
(3) Direct delivery of a portion of GRIC lease.
(4) Total City CAP water right is 17,742 AFY (10,742 M&I + 7,000 GRIC lease). Values shown in table represent the amount of CAP water needed for direct delivery and to fulfill the City's groundwater replenishment obligation.
(5) "Phase In" groundwater must be replenished and is not considered renewable groundwater but is included here for accounting only.
(6) 5.12 % of Annual Average Demand.
(7) The City has the option to replenish up to 15,940 AFY through CAGRD.
(8) Does not include Newland reclaimed water.



WATER DEMAND GROWTH THROUGH 2025 VS. WATER SUPPLY

FIGURE 2.13

CITY OF GOODYEAR
2016 INTEGRATED WATER MASTER PLAN

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One option to use CAP water would be to use a portion of the CAP lease (4,467 AFY) through an in lieu arrangement with Adaman as a strategy to deliver a new "physical" surface water supply, because the City's CAP water allocation is not fully utilized. This arrangement has been documented in a City report entitled "Adaman Well Development, Storage, Booster, and Pipeline Project, Design Concept Report", 2008. This report outlines the preliminary design and operational requirements to implement this project. Implementing an in lieu exchange project for CAP and/or GRIC lease water effectively utilizes this surface water source in the short term, allowing Goodyear additional time to fund and implement its CAP surface water treatment plant and delivery system.

The 2008 report indicated that Goodyear proposed such an in lieu exchange program whereby it would provide its excess CAP and other surface water allocations to Adaman for irrigation purposes in lieu of the groundwater that Adaman pumps. Goodyear would receive long-term storage credits for the exchange water. The report also states that Adaman is agreeable to Goodyear's proposal and has indicated that it would be willing to retire the irrigation wells in the southern portion of its service area if an in lieu arrangement can be reached. Goodyear could then build replacement wells for the retired irrigation wells and use the new production wells in the Adaman Project.

The 2008 report further states that Goodyear's CAP surface water supply would generally be delivered by the CAP Canal and the MWD Beardsley Canal. The MWD agricultural irrigation delivery system branches off the Beardsley Canal to a series of irrigation laterals. MWD has an irrigation lateral that currently delivers water to Adaman at Northern Avenue and the Arizona Route 303 alignment. MWD could also make deliveries to Adaman through other irrigation laterals in Glendale Avenue and Bethany Home Road which currently extend to Cotton Lane. Arizona Department of Transportation (ADOT) has installed 24-inch irrigation piping under the 303 alignment at the Glendale and Bethany Home alignments in anticipation of future irrigation laterals that MWD could use to serve Adaman.

Based on discussions with MWD, the capacities of the three laterals are 4.9 mgd, 4 mgd, and 6.5 mgd for the Northern, Glendale, and Bethany Home laterals respectively. Thus the 2008 report concluded and recommended that Goodyear pursue a 5 mgd in lieu arrangement.

Thus the City would provide its CAP allocation or Indian lease water to Adaman in-lieu of the groundwater pumping that Adaman currently relies on. However, in order to meet the intent of the rules, Adaman would have to use its other surface water supply allotments from MWD first. The surface water allotments vary from year to year, but generally average about 2,600 AFY which would have to be used first, which would leave around 7,400 AFY currently available for an in lieu exchange. As agricultural lands in the Adaman service area develop, the amount of water demand available for an in lieu exchange will decrease. Since the Adaman service area is adjacent to Luke Air Force Base these areas may develop more slowly due to land use restrictions.

2.7.2 Water Supply vs. Demand, Buildout Conditions

Table 2.22 presents the renewable water supply balance for the buildout condition for the entire City. The demands presented here are based on the Entitlement Level methodology discussed previously in Section 2.2.6 and illustrated geographically in Figure 2.6. The renewable water supply availability for the Entitlement Level 1 lands shows a deficit of 14,535 AFY.

At buildout for the Entitlement Level 2 – 4 lands, renewable supply deficits occur totaling 81,940 AFY. As the City plans to obtain additional water resources to serve customers, priority should be given to developing water supplies for lands where Entitlement Level 1 commitments have been made.

The projected supply shortfalls for the Entitlement Levels at buildout are very significant, challenging, and costly to manage. The following paragraphs describe opportunities for Goodyear to implement to manage these shortfalls.

Goodyear has been striving to implement water conservation measures to help achieve the City's development goals. It is recommended that the City take all possible steps to implement "aggressive" conservation measures to help mitigate these water supply shortfalls. Aggressive conservation as used in this document is achieving 100 gpcd for residential water demands. No demand reduction was assumed for non-residential (commercial or industrial) demands. Section 2.8 provides a thorough discussion of alternative water conservation measures, their effectiveness, and expected demand reductions that can be achieved. Implementing "aggressive" conservation measures will require changes in the City's water conservation practices, including the policies for development standards and requirements. Making the best use of the water resources the City already has is the most cost effective approach for Goodyear to manage a portion of the projected shortfalls. The approaches, ordinances, and regulations required to achieve aggressive conservation can be implemented and managed by in-house staff.

Table 2.23 presents the resulting reduced demand by applying aggressive conservation, and the benefit of deficit reduction achieved. For Entitlement Level 1-4, aggressive conservation has reduced the buildout demand from 135,208 AFY to 100,156 AFY. Correspondingly, the renewable supply deficit has been reduced from 81,940 AFY to 48,682 AFY.

A second opportunity to mitigate the renewable supply shortfall is to implement aquifer storage and recovery of a portion of the Rainbow Valley developer reclaimed water supply. The strategy for developing this supply has been discussed in Section 2.5.1. The strategy developed in Section 2.5.1 demonstrates the ability for the City to recharge and recover up to 8,467 AFY of reclaimed water from future developments. Table 2.24 incorporates this additional renewable supply in the reclaimed water supply north and south. With aggressive conservation in place and incorporating the additional renewable reclaimed water supply, the Entitlement Level 4 renewable supply deficit has been reduced from 48,682 AFY to 40,215 AFY.

Table 2.22 Water Resource Supply and Demand at Buildout by Entitlement Level
2016 Integrated Water Master Plan
City of Goodyear

Planning Area	Annual Demand (AFY)			
	Level 1	**Level 1 - 2**	**Level 1 - 3**	**Level 1 - 4**
North (WPA 2 & WPA 3)	34,466	36,365	37,820	48,170
South (WPA 4 & WPA 5)	8,193	53,369	66,762	87,039
Total Demand	**42,659**	**89,733**	**104,583**	**135,208**
	Renewable Supply (AFY)			
Surface Water				
CAP M&I	10,742	10,742	10,742	10,742
CAP GRIC	7,000	7,000	7,000	7,000
Subtotal Surface Water	***17,742***	***17,742***	***17,742***	***17,742***
Renewable Groundwater				
Phase-in (4)	866	866	866	866
Incidental Recharge (1)	2,184	4,594	5,355	6,923
Subtotal Renewable Groundwater	***2,184***	***4,594***	***5,355***	***6,923***
Reclaimed Water (2)				
City Reclaimed Water North	8,308	8,954	10,049	13,546
City Reclaimed Water South	290	4,047	8,600	15,458
Direct Reuse (3)	(400)	(400)	(400)	(400)
Net Available for Recharge	8,198	12,600	18,249	28,604
Total Renewable Supplies	**28,124**	**34,937**	**41,346**	**53,268**
Surplus / (Deficit)	(14,535)	(54,797)	(63,237)	(81,940)

Notes:

(1) Based on total demand for north and south planning areas (5.12% of Annual Average Demand).
(2) Does not include reclaimed water from Newland or Amaranth developments.
(3) Includes Goodyear service area direct reuse and Palo Verde generating station agreement.
(4) Phase in allowance incurs a replenishment obligation, so is not renewable, not included in total.

Table 2.23 Water Resources Shortfall Mitigation - With Aggressive Conservation 2016 Integrated Water Master Plan City of Goodyear				
	Annual Demand (AFY)			
Planning Area	**Level 1**	**Level 1 - 2**	**Level 1 - 3**	**Level 1 - 4**
North (WPA 2 & WPA 3)	27,156	28,916	30,036	38,399
South (WPA 4 & WPA 5)	6,078	37,798	47,181	61,757
Total Demand	**33,234**	**66,715**	**77,217**	**100,156**
	Renewable Supply (AFY)			
Surface Water				
CAP M&I	10,742	10,742	10,742	10,742
CAP GRIC	7,000	7,000	7,000	7,000
Subtotal Surface Water	***17,742***	***17,742***	***17,742***	***17,742***
Renewable Groundwater				
Phase-in (4)	866	866	866	866
Incidental Recharge (1)	1,702	3,416	3,953	5,128
Subtotal Renewable Groundwater	***1,702***	***3,416***	***3,953***	***5,128***
Reclaimed Water (2)				
City Reclaimed Water North	8,308	8,954	10,049	13,546
City Reclaimed Water South	290	4,047	8,600	15,458
Direct Reuse (3)	(400)	(400)	(400)	(400)
Net Available for Recharge	8,198	12,600	18,249	28,604
Total Renewable Supplies	**27,641**	**33,758**	**39,945**	**51,474**
Surplus / (Deficit)	(5,593)	(32,957)	(37,272)	(48,682)

Notes:

(1) Based on total demand after conservation for north and south planning areas (5.12% of Annual Average Demand).
(2) Does not include reclaimed water from Newland or Amaranth developments.
(3) Includes Goodyear service area direct reuse and Palo Verde generating station agreement.
(4) Phase-in incurs a CAGRD replenishment obligation, so is not renewable, not included in total.

Table 2.24 Water Resources Shortfall Mitigation - Conservation Impacts & Reclaimed Water From Developers
2016 Integrated Water Master Plan
City of Goodyear

	Annual Demand (AFY)			
Planning Area	**Level 1**	**Level 1 - 2**	**Level 1 - 3**	**Level 1 - 4**
North (WPA 2 & WPA 3)	27,156	28,916	30,036	38,399
South (WPA 4 & WPA 5)	6,078	37,798	47,181	61,757
Total Demand	**33,234**	**66,715**	**77,217**	**100,156**
	Renewable Supply (AFY)			
Surface Water				
CAP M&I	10,742	10,742	10,742	10,742
CAP GRIC	7,000	7,000	7,000	7,000
Subtotal Surface Water	***17,742***	***17,742***	***17,742***	***17,742***
Renewable Groundwater				
Phase-in (4)	866	866	866	866
Incidental Recharge (1)	1,702	3,416	3,953	5,128
Subtotal Renewable Groundwater	***1,702***	***3,416***	***3,953***	***5,128***
Reclaimed Water (2)				
City Reclaimed Water North	10,011	10,656	11,810	15,415
City Reclaimed Water South	1,455	10,628	15,182	22,056
Direct Reuse (3)	(400)	(400)	(400)	(400)
Net Available for Recharge	11,066	20,884	26,591	37,071
Total Renewable Supplies	**30,509**	**42,042**	**48,287**	**59,941**
Surplus / (Deficit)	(2,725)	(24,673)	(28,930)	(40,215)
New CAP Water Lease	3,000	10,000	10,000	10,000
New Renewable Supply	0	15,000	19,200	30,500
Total New Supplies	**3,000**	**25,000**	**29,200**	**40,500**
Surplus / (Deficit)	275	327	270	285

Notes:
(1) Based on total demand after conservation for north and south planning areas (5.12% of Annual Average Demand).
(2) Does include reclaimed water from Newland or Amaranth developments.
(3) Includes Goodyear service area direct reuse.
(4) Incurs a CAGRD replenishment obligation, so is not renewable, not included in total.

In addition, the City has been pursuing the acquisition of an additional 10,000 AFY of CAP lease water from Indian Communities to help offset the build out water supply shortfall. The additional 10,000 AFY of CAP lease water is dependent upon availability, and would reduce the renewable supply deficit to 30,215 AFY for the Entitlement Level 4 development scenario as shown in Table 2.24. If Goodyear was able to lease additional CAP water, it would help Goodyear to reduce its water supply shortfall even further. It can be seen from Table 2.22 through Table 2.24 that the CAP lease is critical to meeting the City's Entitlement Level 1 commitments, even with conservation and developer reclaimed water. Given the minimal amount of CAP water available for lease, it is imperative that the City pursue this lease at the earliest possible time or there is a risk that it will not be available.

It should also be noted that with aggressive conservation, additional developer reclaimed water recharge, and a new CAP water lease, Entitlement Level 1 development scenario demands can be met. Shortfalls still remain for Entitlement Levels 2 - 4 of up to 30,215 AFY, requiring additional renewable supplies. Table 2.24 shows that the total new supplies required amount to 25,000, 29,200, and 40,500 AFY for Entitlement Levels 2, 3, and 4, respectively.

It is uncertain at this time what the final negotiated price for a new CAP water lease might be, but it could be in the range of $3,000-$4,000 per acre-foot.

To continue growing, the City should identify, pursue, and acquire the additional required renewable water supplies at the earliest possible time. If the City wants to fully build out according to the General Plan, it needs to aggressively purchase water rights while water rights are still available, as a "just in time" strategy for procuring additional water resources is not likely to be successful because of the competition for remaining available water.

The following paragraphs discuss potential opportunities for Goodyear to vet and develop to serve additional growth.

1. Future NIA Reallocation

CAWCD has developed a policy for marketing Excess Water for non-Indian agriculture use from 2004 through 2030. Ag water supplies will be reduced by 100,000 AFY in 2017, another 75,000 AFY in 2024, and the remaining 225,000 AFY in 2030. ADWR has identified goals for reallocation of the NIA water as follows: to reduce groundwater overdraft; to provide an additional source of water to areas with limited physical availability of groundwater; and to meet the near-term demands for existing municipal water providers. The results of analyses concerning Rainbow Valley renewable water supply have resulted in AWS supply designations of about 41,000 AFY of groundwater availability for 100 years. However, this is based on an aquifer dewatering approach and is not sustainable. The challenge here is to develop an NIA renewable supply to mitigate the shortfall.

The concept would be to acquire 32,000 AFY of NIA water during the ADWR reallocation process, wheel it through the CAP canal to the Santa Rosa Canal, then to the Maricopa-Stansfield Irrigation District canal, and pump the supply to recharge facilities in WPA 5. The recharge water would offset groundwater declines and become available as a renewable supply to meet demands. Since ADWR has determined that NIA water is only 70 percent firm for AWS purposes, the City would need to acquire 46,000 AFY of NIA water, or purchase other water supplies.

The NIA supply approach benefits Goodyear by providing a second supply source to the Community from the south in addition to providing more water for development. In addition, CAP water probably has a better quality than the groundwater, which would improve the aquifer water quality in Rainbow Valley over time.

2. Water from the Buckeye Canal

The Buckeye Canal passes through Goodyear, and serves irrigation lands that someday are expected to develop. This could free up canal water for other uses that perhaps includes increasing the City's potable water supply. Water from this canal is attractive as a water supply because these canals convey a substantial amount of water through the City and would likely be much less expensive than importing water from afar. There are a number of issues that need to be investigated to determine the viability of this canal as a water source. These issues include:

1. What is the volume of water potentially available and what portion of the water is surface water, groundwater, and reclaimed water?
2. What are the legal issues that would need to be addressed in using this water?
3. Since reclaimed water is comingled in the canals with other water, would ADWR allow the reclaimed and surface water portions of this water to be recharged?
4. Can Goodyear qualify as a bulk water customer and deliver treated water as potable?

Additional study is recommended so that the City can plan to take advantage of this water source at some future time.

3. Harquahala Groundwater

Another approach could include developing the groundwater supply from the Harquahala Basin and transporting the supply to Goodyear. This concept would involve well development, pumping, transmission, storage, water treatment, and delivery to the City potable water system. Given the quality of the Harquahala groundwater, it is not likely that this water supply would be used for recharge and recovery. There is potential to develop a partnered project with other communities that may improve the economic viability of this project.

The cost of developing this water supply and operational strategies are discussed in Chapter 3, Water System Master Plan.

4. Colorado River Supplies

Possible Colorado River water supply alternatives have been put forward such as land fallowing in the Yuma area, among others. Development of a Colorado River supply would assume delivery through the CAP Canal, again requiring a wheeling agreement. Since this would be a new supply to the Canal, consideration would have to be given to CAP canal shareholder delivery capacity requirements first, resulting in a variable delivery schedule. If the delivery schedule is variable, a storage mechanism would be required to balance out the demand requirements.

5. Regional Partnerships

The City could partner with other West Valley communities to develop a regional water supply solution. These partnerships could identify new water resources, or water sources that could be developed from water that is not currently being used to its full potential.

These potential buildout supply alternatives can be further studied independently to determine their feasibility, project requirements, and costs to develop the required water supply.

2.7.3 Drought Conditions and Mitigation

As previously discussed, two drought scenarios have been analyzed for this Integrated Water Master Plan, namely a severe CAP water reduction of 30 percent and an extreme surface water reduction of 50 percent. Since these drought scenarios are not anticipated to impact M&I supplies prior to 2025, only Goodyear's buildout condition is presented and discussed.

The City's existing surface water supplies that could be affected by these drought shortages are the 10,742 AFY CAP supply and the 7,000 AFY GRIC lease, totaling 17,742 AFY. Accordingly, Goodyear's surface water supply would be reduced to 12,419 AFY and 8,871 AFY for the 30 percent and 50 percent drought scenarios respectively. The supply amounts requiring firming are 5,323 AFY and 8,871 AFY for the 30 and 50 percent drought scenarios.

Since the City is pursuing a new CAP lease for an additional 10,000 AFY of surface water, future near term surface water supplies could total 27,742 AFY. Future drought reductions impacting this surface water supply could result in a supply availability of 19,419 AFY and 13,871 AFY for the 30 percent and 50 percent drought scenarios respectively. The supply amounts requiring firming are 8,323 AFY and 13,871 AFY for the 30 and 50 percent drought scenarios. Table 2.25 summarizes the City's existing and potential future GRIC water resources under normal and drought conditions.

Table 2.25 Potential CAP Drought Reductions 2016 Integrated Water Master Plan City of Goodyear			
	Availability (AFY)		
Water Resource	Normal Year	30% Drought	50% Drought
M&I	10,742	7,519	5,371
Existing GRIC Lease	7,000	4,900	3,500
Existing Subtotal	***17,742***	***12,419***	***8,871***
Future CAP Lease	10,000	7,000	5,000
Future Total	**27,742**	**19,419**	**13,871**

There are several options available to Goodyear for mitigating the impact of these potential shortfalls. These include:

1. ADWR's drought exemption which can be authorized by the Director of ADWR. This exemption allows 80 percent of the surface water shortfall to be made up from groundwater (drought pumping) without incurring a replenishment obligation. This applies to Goodyear's legal groundwater replenishment obligation, and can only be implemented if there is physical groundwater available to pump to replace the surface water shortage. This implies that if additional drought groundwater pumping is allowed, additional wells will be required to pump the increased supply.

2. A second measure of protection is provided by the AWBA. The AWBA has the obligation to provide "firming" water supplies for a 20 percent cutback in CAP water supplies. The AWBA has developed scenarios for replacement, and is currently developing an operating plan for these replacement obligations. Two scenarios are available for the AWBA firming water supply. One includes providing replacement water to the CAP canal for users to withdraw, treat, and deliver. Another includes requiring the user to pump "make up" water from its own wells, which would be offset by the AWBA. The GRIC lease may be federally firmed by the United States; however, details of how this would be done are uncertain.

3. A third opportunity for Goodyear to mitigate the shortfall is for the City to implement its demand management program. This program is embodied in Ordinance No. 07-1077: Water Use Restrictions. This Ordinance states that the City Council may by resolution place any restrictions which it deems necessary, and to employ the most current version of the City's Water Conservation and Curtailment Plan as guidance to implement voluntary and mandatory water use restrictions. This program could be implemented to help the City mitigate its surface water shortfalls during a drought. Implementing this program could reduce the number of "drought wells" needed to respond to a shortage.

4. Another component of the drought mitigation plan involves addressing the magnitude and duration of droughts during a 100-year water supply scenario. Several organizations have analyzed and evaluated information concerning the frequency and duration of potential droughts. While there are no firm conclusions, some have suggested drought response preparations should be based on the occurrence of two to three droughts per a 100-year period, each lasting 6 years. This Integrated Water Master Plan has incorporated this approach.

ADWR allows 80 percent of the surface water shortfall to be made up from groundwater pumping (drought pumping) without a replenishment obligation. Assuming no City curtailment and applying the ADWR drought exemption, 3 - 30 percent droughts lasting 6 years each would produce a replenishment obligation of 19,170 acre-feet. Similarly, 3 - 50 percent drought lasting 6 years each would produce a replenishment obligation of 31,932 acre-feet. These replacement obligations would be made up from LTSCs.

Using the same strategy for replenishment obligations including a future new CAP lease, replenishment obligations for the 30 and 50 percent reduction scenarios would amount to 29,970 acre-feet and 49,932 acre-feet respectively.

Assuming that the physical replacement water supply would come from the groundwater supply, additional wells may be required to pump the drought supply. Groundwater supplies and wells required to meet demands during drought are discussed in Section 3.7.3.

2.7.4 Rainbow Valley Physical Supply Sustainability

In 2014, Goodyear conducted a hydrologic study for the Rainbow Valley portion of the City's service area in support of its AWS application. The hydrologic study was based on existing AWS demands from developer projects plus a new amount of City pumping. These pumping demands were simulated in the hydrologic modeling analysis in a manner so as not to violate the AWS rule requirement of not creating aquifer drawdowns exceeding 1,000 feet below ground surface (ft bgs) over a 100-year period. The simulated modeling results for the three pumping wells produced drawdowns of 993.11, 990.70, and 976.75 ft bgs, respectively. The results of the study demonstrated that the City could pump 9,349 AFY for the 100-year period in addition to the developer committed pumping. The resulting water budget for this scenario showed that the Rainbow Valley pumping was based on natural aquifer recharge of 4,859 AFY, and **aquifer dewatering pumping from storage** of 43,432 AFY.

Current development plans do not provide any new water sources to recharge the aquifer or to offset the dewatering pumping. Over time, the available aquifer storage will decline. When the City and other water users seek renewal of their designation of assured water supply in the future, the available physical supply determination of groundwater will decline due to dewatering. This means that future allowable pumping out of this aquifer will be reduced. A water supply based on groundwater pumping that dewaters the aquifer is not

sustainable. New supplies will need to be developed and delivered to Rainbow Valley. If no other supplies are provided, the long term sustainable supply will be reduced and development will not be able to continue.

2.8 WATER CONSERVATION

2.8.1 Water Conservation Trends

Most Maricopa County Cities are experiencing a decreasing trend in per capita water usage over the past 15 years as older plumbing fixtures are replaced with more efficient fixtures, landscaping water use declines, and personal habits change as the awareness of water conservation increases. In addition to increasing the City's available water resources, increased conservation will also reduce energy, equipment wear, and water treatment costs on a per customer basis – providing additional cost benefits to the City.

Water efficient clothes washers, dishwashers, toilets, and plumbing fixtures will reduce wastewater flows but may increase waste concentrations – leading to treatment and capacity considerations for higher waste concentrations. Decreased wastewater flows will result in a decrease in available reclaimed water, which needs to be considered in reclaimed water flow estimations.

2.8.2 Goodyear's Current Conservation Program

Goodyear currently implements a variety of water conservation practices that raise awareness of water conservation, help customers adopt good water management and irrigation practices, and help high water users learn to reduce water consumption. The City recently prepared a Master Water Conservation Plan which recommended the formation of a Water Conservation Committee to engage stakeholders in prioritizing options that the City can take to achieve aggressive conservation.

As a municipal water provider, Goodyear has a legal obligation to reduce per capita groundwater reuse as a part of the 1980 Groundwater Management Act. Table 2.26 lists the water conservation practices that are currently implemented by the City.

Table 2.26 Water Conservation Practices Implemented by the City of Goodyear 2016 Integrated Water Master Plan City of Goodyear	
Conservation Program (or BMP)	**Description**
1.1 Messaging program/advertising	City uses H2O 365 brand for year-round messaging efforts.
1.1 Messaging program/advertising	Annual Peak demand campaign (May-August): Desert Dan (hero) and Max(imum) Use battle to reduce peak demand in campaign targeting outdoor use and family audiences.
1.1 Messaging program/advertising	AMWUA membership provides AMWUA website and links to City website.
1.2 Events/programs/presentations	Activities and brochures are distributed at large City events, movie and concert series, and community events throughout the year.
1.2 Events/programs/presentations	AMWUA membership provides representation at regional, professional events and conferences. Staff support AMWUA events.
1.5 Free Material Distribution	AMWUA membership provides xeriscape, irrigation guidelines, and lawn care and removal print materials.
1.5 Free Material Distribution	City distributes rain gauges, shower timers, free home audit kits, and other water conservation tools to schools, conservation classes, targeted presentations, and during peak demand season.
1.5 Free Material Distribution	City website (www.goodyearaz.gov/h2o365), INFOCUS resident newsletter (6-8/year), City Hall and Public Work racks, and new releases provide free information to residents. Bill inserts (2x/year) reach customers.
2.1 Adult education/training; speakers' bureau	Staff provide professional development and resources for K-12 teachers. They conduct facility tours and assist with curricular adaptations.
2.1 Adult education/training; speakers' bureau	City presents three series of free classes on desert horticulture, irrigation, and water resource topics annually.
2.1 Adult education/training; speakers' bureau	Staff address audiences requesting speakers, including Homeowners Association (HOA) Academy and HOA meetings.
2.1 Adult education/training; speakers' bureau	AMWUA membership provides SMARTSCAPE xeriscape training for contractors and profession.

Table 2.26 Water Conservation Practices Implemented by the City of Goodyear 2016 Integrated Water Master Plan City of Goodyear	
Conservation Program (or BMP)	**Description**
2.1 Adult education/training; speakers' bureau	Staff provide Water Conservation Planning for Large Landscape overview annually for larger properties for property managers and boards.
2.2 Youth conservation education	Staff visit classrooms to teach; guide site tours (with pre-and post-visit lessons).
2.3 New homeowner landscape information	HOAs distribute landscaping watering guides and class information to new residents with welcoming packets.
3.1 Residential audit program	Home Irrigation Check-ups (since 1/09) free to customers; at cost to other City residents. Check-ups include brief indoor survey, review of water history and monthly water budget, personalized tips. Program reduced participant usage over 2.7 million gallons in first 11 months.
3.2 Landscape consultations for residential and non-residential customers	On-site consultations provided to residents (Home Irrigation Check-ups) and community associations (HOA Irrigation Tune-ups -up to 24 hours of analysis free).
3.3 Water budgeting assistance for non-residential customers	HOA Irrigation Tune-ups include this service.
3.6 High water use inquiry resolution	Staff complete checklist onsite with customer. Refer for Home Irrigation Checkup if source not identified. (109 in first 7 months of Fiscal Year [FY] 2010). Program participants reduce usage an average of 20%, continuing over 3 years following initial Checkup.
3.7 High water use customer notification	Staff make calls as they receive monthly update from billing department.
3.8 Water waste investigations	Staff contact complainant within 2 business days, visit site, and provide education and enforcement follow-up as required. Code Compliance assists Water Conservation.
3.9 Top 1% outreach program	Top 100 Residential Customer Outreach Letters to top 100 customers (62 of top 100 in 2008 dropped consumption in 2009 saving over 5.19 MG, 13 discontinued service, 48 dropped below top 100.)

Table 2.26 Water Conservation Practices Implemented by the City of Goodyear 2016 Integrated Water Master Plan City of Goodyear	
Conservation Program (or BMP)	**Description**
4.1 Leak detection program	Full system study completed 2007. All new development prior to the 2-year warranty period is required to conduct a Leak Detection and make any necessary repairs. Staff now move and read data loggers on weekly basis to maintain system integrity.
4.4 Other physical system improvements	City facility audit conducted 2008 identified potential water savings of 40% at sites/facilities over 2 years old. CIP necessary to realize 98% of these savings is being programmed.
5.1 Low water-use landscaping requirement	City Code 5-1-1-B Appropriate Use of Landscaping Rights of way shall comply with ADWR requirements.
5.1 Low water-use landscaping requirement	City Code 5-1-4-B Single Family and Two Family Water Conservation Guidelines Meet Third Management Plan requirements.
5.2 Water tampering/water waste prohibitions	City Code 14-7-6 (Unauthorized Use of Water and Penalties) and 14-7-8 (Waste of Water Prohibition) prohibitions.
5.3 Plumbing code requirements	City Code Article 9-12 Low Flow Fixtures and devices establish minimum standards.
5.14 Other ordinance, condition of service or tariff	City Code 14-7-7 (Water Use Restrictions) outlines Conservation and Curtailment plan and penalties for violations.
6.14 Other rebates or incentives	Reclaimed water price set at 70% of residential Tier 2.
7.4 Conduct a quantitative analysis for water savings	Staff track individual and aggregate savings of residential audit and all future incentive programs.
7.9 Other research or innovation program	AMWUA membership provides benefits from collaborative research.
Conservation rate structure	Current rate structure (2016-2000) annually increases cost steps between tiers. There are 4 residential, 3 commercial, and 2 irrigation tiers. The second and third residential tier rates are approximately 2 and 3 times the first, with the fourth tire almost 5 times the first tier rate. Irrigation rates are the highest.

In addition to these practices currently in place, in 2008, the City enacted the "Water Conservation and Curtailment Plan," which has a goal of reducing water use by 10 percent by 2015 (this target has been achieved) and an additional 5 percent by 2020. To achieve these goals, the City is taking action in the following areas:

1. Increasing water use efficiency by the City,
2. Strengthening the public culture of water conservation,
3. Assuring the water conservation program is fiscally sound,
4. Providing financial incentives for conservation, and
5. Recommending use of appropriate water saving technologies

2.8.3 Goodyear Water Conservation as a Water Resource Strategy

As the City of Goodyear develops strategies to serve new customers and provide the economic benefits of growth, water conservation becomes an important part of the plan. Water conservation is now no longer just a requirement to satisfy requirements of the State of Arizona or a "good thing to do" to be responsible citizens, it is a water resource strategy that can significantly reduce the water resource requirements of Goodyear, and it will reduce the cost of the infrastructure, water treatment, and energy needed to provide water over the costs that would be required without conservation. With this vision for water conservation, the City's conservation program should add to its current conservation practices the policies and requirements for future development that will provide permanent reductions in water use. Water conservation should transition from being primarily a voluntary "feel good" activity to a way of life for Goodyear's citizens. Many of the practices will need to be implemented by policy for new developments and homes, where it is much easier to design low water use into developments than it will be to implement retrofits. As customers move into low water use homes and neighborhoods, water conservation becomes a way of life.

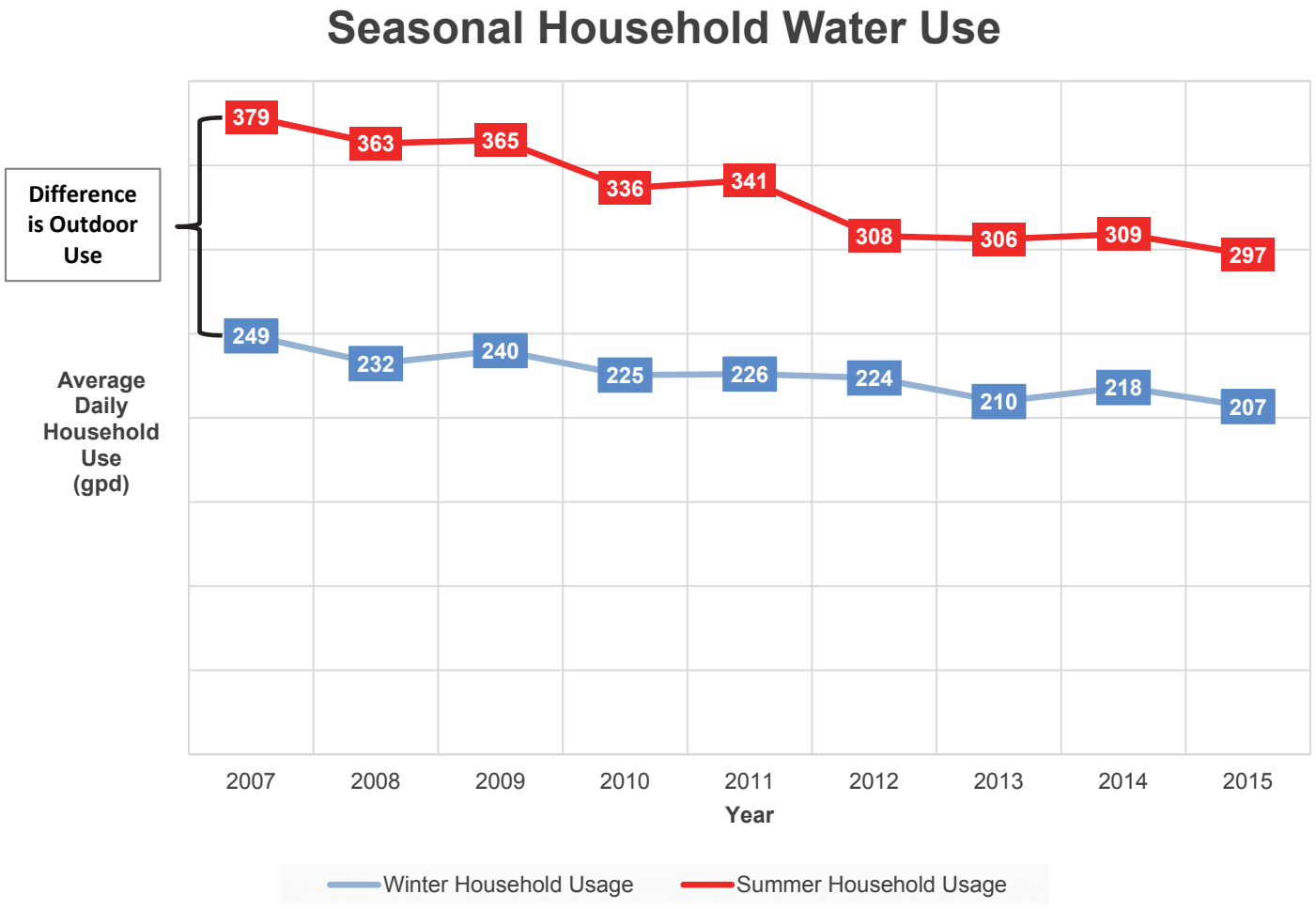
The term "aggressive conservation" is used in this document to refer to water conservation measures that would significantly reduce water use to assist the City in extending the City's water resource portfolio. The policies that provide for reduced water use would be set by the City to include the preferences of citizens, but in general would include significantly reduced turf areas not only in homes, but in parks and open spaces. The goal would be to reduce outdoor water use by half for all land use types that do to include commercial and industrial. Indoor water use will decrease over time as plumbing fixtures become more efficient. This also includes reductions in non-revenue water when treated CAP water becomes a larger portion of the City's treated water supply. As shown in Table 2.22, by buildout water demands might be reduced by over 30,000 acre-feet over the unit demand rates that are typical of today's Goodyear customers.

Water conservation for commercial and industrial customers is harder to quantify, and therefore additional conservation for these customers is not assumed, although additional conservation could occur and should be pursued where possible. To achieve aggressive conservation levels, water use would need to be reduced in a manner similar to the way the City of Tucson has reduced water demands. A suggested target for aggressive conservation would be to reduce outdoor residential and green space water use by half. When expanding its conservation program, the City will want to focus efforts where the greatest gains can be obtained. Table 2.27 shows the City's water usage broken down by meter category. The largest two water use categories are irrigation water use, and residential customer water use. Even minor reductions in the water use of these two categories would make a meaningful difference in the City's water use.

Table 2.27 City of Goodyear Water Use by Meter Category
2016 Integrated Water Master Plan
City of Goodyear

Description	Number of Meters	Percent of Total Meters	2014 Consumption (gpd)	Percent of Total
Apartments	35	0.2%	108,934	1.6%
Commercial	258	1.6%	467,951	7.1%
Church	15	0.1%	26,008	0.4%
Car Washes	1	0.0%	548	0.0%
Industrial	34	0.2%	190,929	2.9%
Hydrant	1	0.0%	49,025	0.7%
Institutional	8	0.1%	27,956	0.4%
Irrigation	344	2.2%	1,546,564	23.3%
Laundry	1	0.0%	3,781	0.1%
Multi-Purpose Meter	8	0.1%	155,033	2.3%
PGA	1	0.0%	47,427	0.7%
Residential	15,047	95.4%	3,877,005	58.4%
Schools	19	0.1%	136,414	2.1%
Total	**15,772**		**6,637,575**	

Figure 2.14 illustrates Goodyear's historical seasonal household use trends. The majority of the difference between the summer usage and winter usage is outdoor water use. Over the past 8 years the City's residential customers have been using less water as both the summer and winter use curves trend down. Further, the difference between the summer and winter usage is decreasing, suggesting that outdoor water use is decreasing. Further reductions will occur in indoor water use as the proportion of homes with efficient appliances and plumbing fixtures increases. Further reduction in outdoor water use will occur as policies for reduced outdoor water use are implemented.



SEASONAL HOUSEHOLD WATER USE TRENDS

FIGURE 2.14

CITY OF GOODYEAR
2016 INTEGRATED WATER MASTER PLAN

carollo

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The conservation goal is expected to be achieved gradually over time until buildout. The following measures would be helpful to achieve aggressive conservation:

1. Enact development policies and regulations that limit the use of turf in yards and common spaces. Turf is the major water user outdoors and consistently accounts for almost 25 percent of Goodyear's total potable demand. By designing developments and open spaces to use xeriscaping and natural landscaping instead of turf, outdoor water use will be reduced significantly. Recent partial audits of landscape meters suggest that waste from leak and overwatering may account for as much as 40 percent of the total usage and make large water savings improvements achievable.
2. Design open spaces to capture and use stormwater for desert landscaping. Stormwater can be collected and used to provide the water needed for natural, desert landscaping. Use of stormwater can enhance the beauty of Arizona's native plants to make attractive communities in the desert. Research and work has been done at the University of Arizona to provide guidance on ways to use stormwater retention to benefit native landscaping.
3. Restrict the use of residential swimming pools that use large amounts of water.
4. Modify current reclaimed water policies to discourage use of reclaimed water for outdoor water use so that reclaimed water can be recharged to the aquifer.
5. Replace toilets in homes and buildings constructed before 1993 with ultra-low flush toilets. The City estimates that approximately 940 homes were built before 1993. Although most of Goodyear was built after 1993 and therefore has low flush toilets, additional reductions in water use can be had through low water use toilets.
6. Indoor reductions in water use have been occurring in the United States with more efficient appliances and plumbing fixtures. These reductions will continue to occur naturally as existing appliances wear out and homes are remodeled, so indoor water use reductions related to appliances probably do not need proactive action by the City. However, the City should continue to evaluate new water savings technology (hot water circulation devices), evaluate current plumbing codes, and institute policies that promote water savings in homes.
7. Use the Water Conservation Committee to engage stakeholders to assure success of City's water conservation strategies by recommending policies that are the most amenable to City residents.

2.9 STRATEGIES TO MANAGE WATER SUPPLIES AND DEMANDS

The City does not currently have the water resources needed to serve the entire service area by buildout. Additional water supplies will need to be obtained to enable continued growth. Water supplies available for purchase or lease are becoming more expensive as development continues to occur in Arizona and unused water supplies become scarcer.

The following recommendations will help the City to have a sustainable water supply that is sufficient to meet the needs of City residents:

1. Purchase additional Indian lease water or NIA water. The City needs an additional 13,821 acre-feet of water to serve the developments where water has already been committed. This water can come from a CAP lease, recharging reclaimed water, and increased conservation. Due to the competition for remaining, currently available water rights, the City should seek to obtain this lease while it is still available. An even greater purchase, if possible, would benefit the City's water resource portfolio.
2. Implement aggressive water conservation measures to reduce the amount of water that new developments use. A target for the City's consideration would be to reduce outdoor water use by half.
3. Establish policies that require reclaimed water from new development to be used by the City for aquifer storage and recovery to augment the City's water portfolio. Reclaimed water is the most reliable and lease expensive water supply for up to 30 percent of the City's water needs. The City will need to maximize the benefit of this water by using it for aquifer storage and recovery.
4. The City's current groundwater physical supplies are limited and the City will need a new physical supply by 2020. This physical supply could include water delivered through a new interconnect with EPCOR, wheeling water through SRP's system, then piping this water to a Goodyear plant, additional wells serving EMR in Rainbow Valley, increased physical supply through Liberty Utilities, or an in lieu exchange with Adaman Water Company. The City should start now to establish the additional physical supplies needed by 2020.
5. On an annual basis, purchase the City's full allotment of CAP water to recharge until this water is required to supply current demands. This stored water will help protect the City against future droughts.
6. Continue pursuing additional CAP NIA water to provide water resources that could be used to enable growth. A portion of the NIA water will be made available by 2020. The City should seek to take advantage of any additional NIA water that becomes available after 2020.

7. Pursue opportunities to purchase or lease water that currently flows in the Buckeye irrigation canal. Water in this canal will need treatment to A+ standards for recharge, but this potential water source is physically located in Goodyear and therefore is more accessible than other water sources. As development occurs, this water supply might be purchased. Goodyear should undertake a study to determine the legal issues that would need to be overcome before obtaining a right to this water. Negotiations should ascertain supply availability, canal operations, bulk water delivery potential, and recharge opportunities for LTSCs.

8. Goodyear's water management strategies depend on aquifer storage and recovery facilities to store reclaimed water and excess CAP water. Goodyear will need to ensure that the permits for existing recharge facilities are renewed in a timely way. Hydro geologic investigations will need to be undertaken to identify additional recharge facilities as the need for recharge capacity increases.

Chapter 3

WATER SYSTEM MASTER PLAN

3.1 INTRODUCTION

This section of the City's IWMP is the water system master plan. This section describes the City's existing water supply, treatment, and distribution system and provides an evaluation of future infrastructure needs. The plan includes the following items:

1. Documentation of the existing and future water system service areas
2. Documentation of the City's existing water supply, treatment, and distribution infrastructure.
3. Water system performance criteria used to evaluate supply, treatment, storage, and booster pumping requirements for current and future conditions.
4. An overview of the water quality regulations that impact Goodyear's water system operations.
5. An evaluation of the infrastructure required to serve current and future customers.
6. Capital improvement recommendations for the infrastructure needed to serve growth and to address deficiencies identified for the years 2020 and 2025 capital improvement planning periods.

The water system infrastructure that will be needed to serve customers in planning areas WPA 4 and WPA 5 are not provided in detail and do not have capital costs associated with them because no development is planned in these areas in the next ten years. Water supply infrastructure alternatives that will be needed beyond year 2025 are presented so that the City can continue pursuing additional water supplies to enable growth that is consistent with the 2025 General Plan, and so that development plans can be prepared with an understanding of what the backbone water infrastructure will be like.

3.2 DESCRIPTION OF EXISTING WATER SYSTEM

3.2.1 Pressure Zones

The City's water distribution system is currently comprised of five pressure zones as shown in Figure 3.1. The north, or central planning area zone is north of the Gila River. The south pressure zones are between the Gila River and Pecos Road. The South Zone 1 and South Zone 2 pressure zones each have sub zones where pressures are controlled with pressure reducing valves (PRVs). The City's pressure zone boundaries are set to provide water service pressures that generally range between 40 and 80 pounds per square inch (psi) for typical operating conditions. The north pressure zone has some low elevation areas near the Gila River but there are no water system customers in these areas at this time. As these areas develop, a new pressure zone may be needed to keep pressures within an acceptable operating range.

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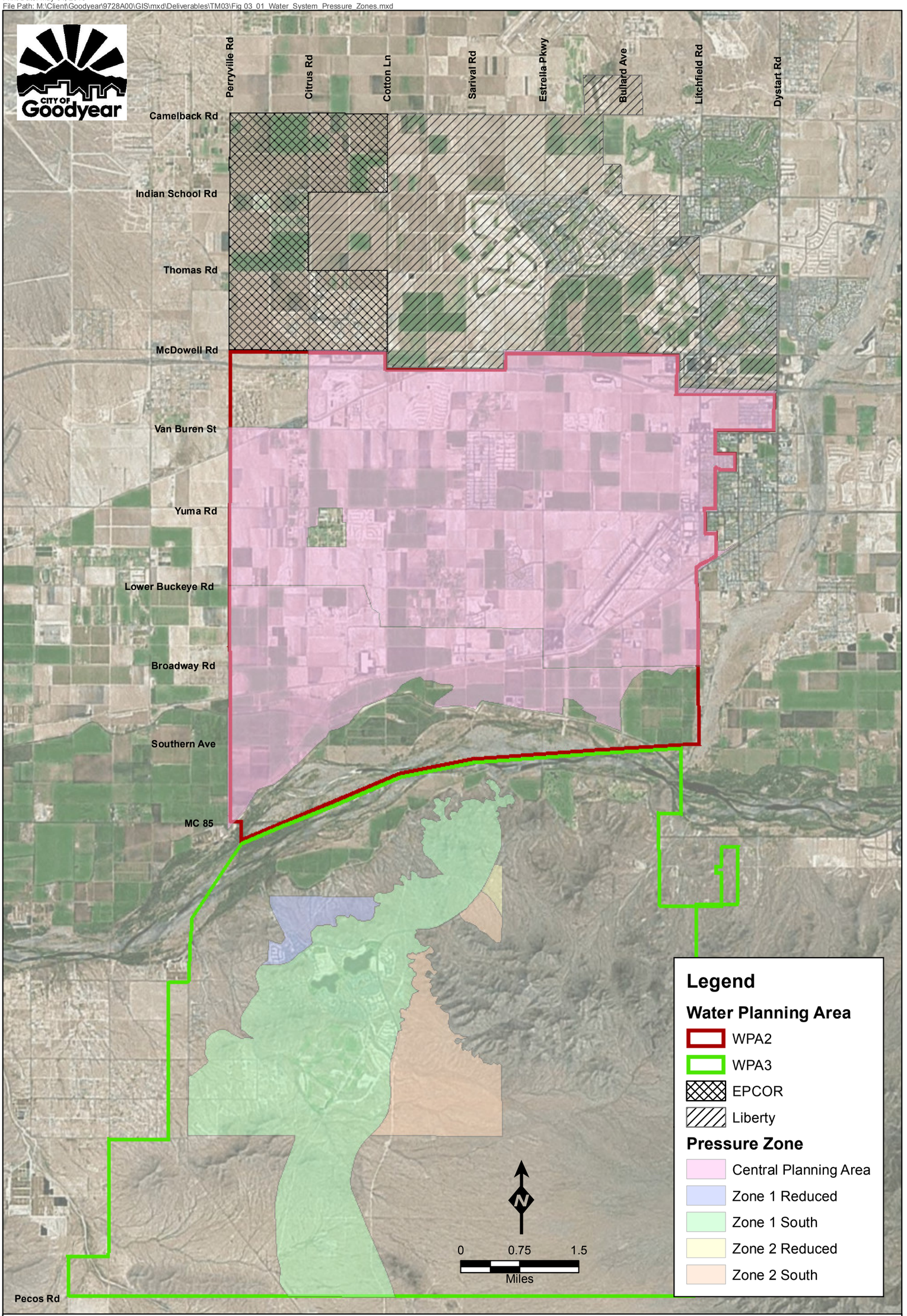

WATER SYSTEM PRESSURE ZONES

FIGURE 3.1

CITY OF GOODYEAR

2016 INTEGRATED WATER MASTER PLAN

3.2.2 Water Production

Currently, all of the City's physical water supplies are from groundwater sources. The City has ten City wells located within the City's service area and purchases water from two wells owned by the Adaman Mutual Water Company (Adaman), which are located outside the City's service area, which the City has permission from ADWR to use. The ten City wells are within the WSRV groundwater sub-basin. The annual recovery limit based on the City's current DAWS for these wells or other new City wells that would be located in the WSRV groundwater sub-basin is 8,724 AFY (7.8 mgd). The groundwater supplies outside the City's service area from Adaman are limited to 4,467 AFY (4.0 mgd). Therefore, the total allowable annual average production from City wells in the WSRV groundwater sub-basin and the Adaman wells is 13,191 AFY (11.8 mgd).

The City also has an agreement with Liberty Utilities (Liberty) to receive water through two interconnections. These interconnections can be turned off by Liberty during Liberty's high demand times or in times of emergency. In the City's DAWS, the City's water supplies from Liberty are stated as approximately 74 AFY (0.07 mgd), however in recent years these deliveries have been increased to between 150 and 250 AFY (0.13 - 0.22 mgd). The City must provide LTSCs for the water provided by Liberty.

All of the City's wells except Well 3 require treatment or are used in blending schemes to meet water quality requirements. The City's major water production sites include:

- Bullard Water Campus - RO treatment is provided to Wells 19 and 22. Wells 1, 11, and 20 are blended with the RO product water in the finished water reservoir. Blending schemes are important to maintain capacity at the Bullard Water Campus and the loss of one well, may impact the ability of the City to use another well.
- Site 12 - RO treatment is provided for Well 12.
- Site 21 - Arsenic treatment is provided for Adaman Wells 1 and 2
- Site 18 - Arsenic treatment is provided for Well 18B, which is blended with water from Wells 6 and 18A in the finished water reservoir.

The Phoenix-Goodyear Airport (PGA) superfund site groundwater contamination plume is near and moving towards Wells 1 and 3. Additionally, the Western Avenue Water Quality Assurance Revolving Fund (WQARF) tetrachloroethylene (PCE) plume is of serious concern to Well 1. If the contamination reaches these wells, the City will need to remove them from service. The City is monitoring the groundwater contamination plume migration and is exploring options to replace the water production that would be lost if Wells 1 and 3 were decommissioned.

Table 3.1 summarizes the City's water production capacity from the City and Adaman wells.

Table 3.1 Production Wells in 2015
2016 Integrated Water Master Plan
City of Goodyear

Name	Production Capacity (gpm) [1]	Firm Capacity (gpm) [2]
Well 1 [3]	500	500
Well 3 [3]	425	425
Well 6	455	455
Well 11	458	458
Well 12 [4]	600	600
Well 18A	807	807
Well 18B [5]	325	325
Well 19 [4][5]	540	540
Well 20	1,600	0
Well 22 [4]	1,680	0
Adaman Well 1	1,340	1,340
Adaman Well 2	500	500
Total	**9,230**	**5,950**
Total (mgd)	**13.3**	**8.6**

Notes:
(1) From City's 2014 DAWS Application.
(2) Defined as the capacity with the largest well (Well 22) out of service. Well 20 would also be out of service when calculating "Firm" capacity because it requires blending with Well 22 prior to distribution
(3) These wells may be impacted by the PGA superfund site and the Western Ave WQARF site is potentially impacting Well 1. The City is monitoring the migration of the contamination plume with respect to these wells.
(4) Pumping rates have been reduced by 17% to account for brine loss.
(5) Production capacity is slowly decreasing at this well site.

3.2.3 Storage

The City currently has ten storage reservoirs with eight in the north pressure zone that provide a combined 7.8 million gallons (MG) of available capacity and two in the south pressure zones that provide a combined 6 MG of available capacity. Table 3.2 summarizes the capacity of the City's reservoirs by pressure zone.

Table 3.2 Storage Reservoirs in 2015 2016 Integrated Water Master Plan City of Goodyear		
North Pressure Zone	**Rated Capacity (MG)**	**Available Capacity (1) (MG)**
Site 3	0.18	0.16
Site 7	0.75	0.68
Site 8	0.75	0.65
Site 10	0.75	0.67
Site 11	2.0	1.7
Site 12	2.0	1.5
Site 18	1.0	0.8
Site 21	2.0	1.6
Total	**9.4**	**7.8**
South Pressure Zones		
Site 13	1.5	1.3
Site 23	5.0	4.7
Total	**6.5**	**6.0**

Note:

(1) Less than the actual rated capacity of the reservoir. Indicates estimate of usable capacity after accounting for the reservoir overflow elevation and the space needed to keep pumps from running dry.

3.2.4 Booster Pump Stations

The City currently has ten booster pump stations, which are associated with the storage reservoirs. Eight of the booster pump stations are in the north pressure zone and two are in the south pressure zone. Table 3.3 summarizes the capacity of the City's booster pump stations by pressure zone.

Table 3.3 Booster Pump Stations in 2015 2016 Integrated Water Master Plan City of Goodyear			
North Pressure Zone	**Number of Pumps**	**Total Capacity (gpm)**	**Firm Capacity (gpm) (1)**
Site 3	2	1,000	500
Site 7	3	1,500	1,000
Site 8	2	1,000	500
Site 10	2	1,000	500
Site 11	6	5,600	4,800
Site 12	3	2,000	1,000
Site 18	3	2,800	1,840
Site 21	5	7,040	5,200
Total		**21,940**	**15,340**
South Pressure Zones			
Site 13 (Zone 1)	5	6,400	3,400
Site 23	5	11,070	7,710
Total		**17,470**	**11,110**
Site 13 (Zone 2)	2	1,000	500

Note:
(1) Defined as capacity with the largest pump out of service.

3.2.5 Distribution / Transmission Mains

The City's water distribution system contains over 380 miles of distribution system piping and transmission mains ranging in size from 4 to 36 inches. The City's water distribution system including the locations of treatment facilities, wells, reservoirs, and booster pump stations is shown in Figure 3.2.

3.3 WATER QUALITY

To ensure that safe drinking water is provided to its customers and provide guidance for capital improvement planning related to water treatment and distribution system infrastructure, the City of Goodyear has established water quality treatment standards for its current and future water supply facilities. This section presents these standards and provides policy justifications and regulatory basis for each.

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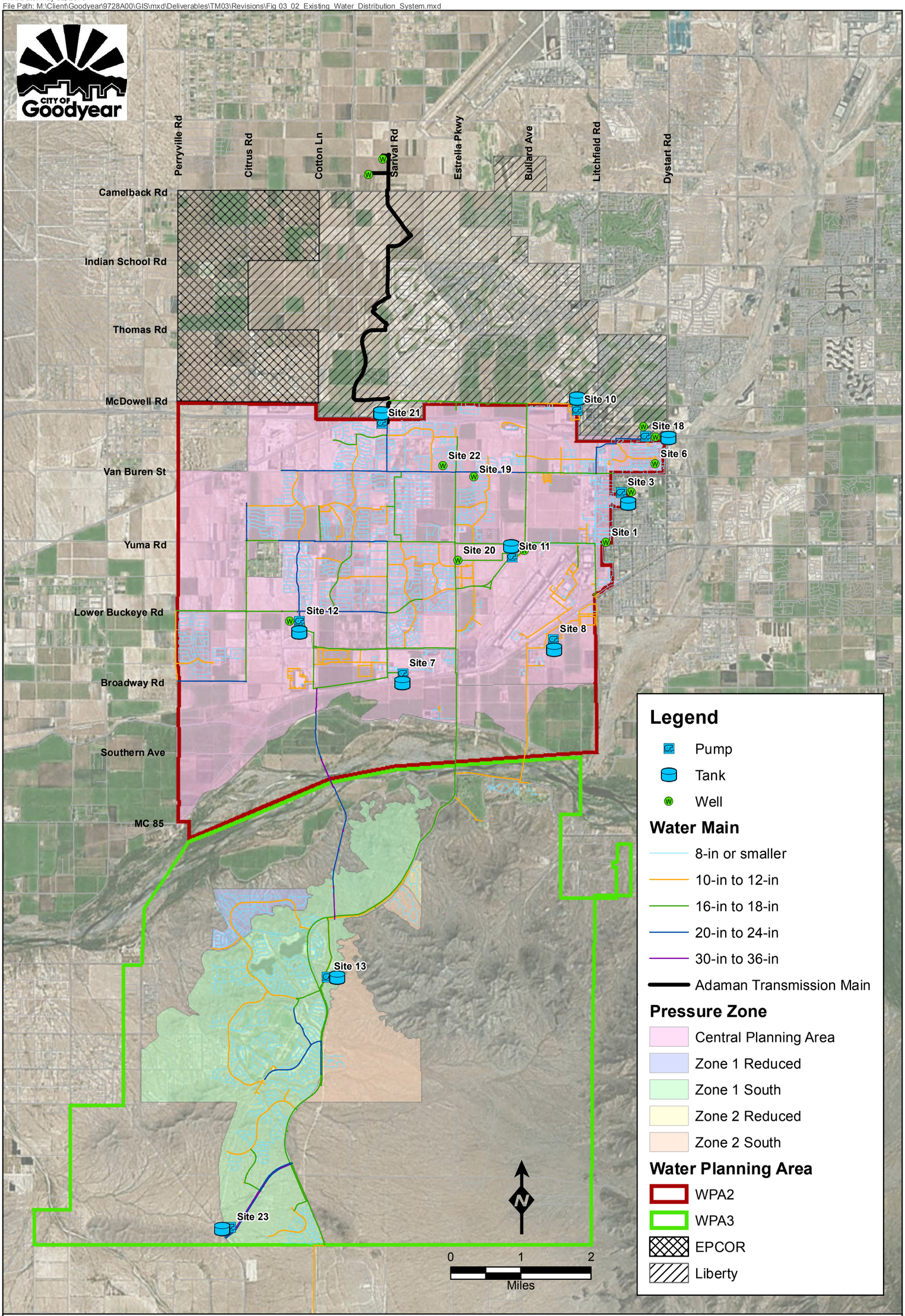

2015 WATER DISTRIBUTION SYSTEM

FIGURE 3.2

CITY OF GOODYEAR

2016 INTEGRATED WATER MASTER PLAN

3.3.1 Regulatory Background

The Safe Drinking Water Act (SDWA) of 1974 established primary drinking water regulations designed to ensure the distribution of safe drinking water. These regulations were the first to be implemented at all public water systems (PWSs) in the United States, covering both chemical and microbial contaminants. These regulations consisted of standards for 18 parameters, referred to as the National Interim Primary Drinking Water Regulations. They remained in place for over 10 years with minor revisions, including a revised fluoride standard, addition of total trihalomethanes standard, and interim regulations for radionuclides in potable water.

In 1986, Congress passed widespread amendments to the SDWA, which significantly altered the rate at which the United States Environmental Protection Agency (USEPA) was to set drinking water standards. These amendments resulted in a three-fold increase in the number of contaminants regulated. Also, at that time, the National Interim and revised Primary Drinking Water Regulations promulgated prior to 1986 were redefined as National Primary Drinking Water Regulations.

The 1986 amendments to the SDWA greatly enhanced the existing law by recognizing source water protection, operator training, funding for water system improvements, and public information as important components of safe drinking water. Among others, the 1996 amendments required the USEPA to develop rules to balance risks between microbial pathogens and disinfection by-products (DBPs), named the Microbial/Disinfection By-Product (MDBP) Rules. Several rules emerged from this requirement, including the Interim Enhanced Surface Water Treatment Rule, the Stage 1 and Stage 2 Disinfectants and Disinfection By-Products Rules, and the Long Term 1 and Long Term 2 Enhanced Surface Water Treatment Rules.

In Arizona, water quality is regulated by the ADEQ. ADEQ has been granted primacy by the USEPA to administer regulations promulgated under the SDWA. Arizona's Administrative Code, Title 18 "Environmental Quality," Chapter 4 "Department of Environmental Quality Safe Drinking Water" contains Arizona's water quality regulation. In Maricopa County, ADEQ delegates a significant portion of the regulatory enforcement responsibilities to the Maricopa County Environmental Services Department (MCESD).

3.3.2 Overview

A number of drinking water regulations apply to the City of Goodyear's current and potential future water treatment operations. Certain rules, such as the MDBP regulations, dictate finished water quality requirements while others, such as the Unregulated Contaminant Monitoring Rule (UCMR) impose monitoring requirements on the water system for contaminants not yet regulated. The regulations relevant to Goodyear now and in the future include:

- National Primary and Secondary Drinking Water Regulations
- Regulations pertaining to chemical contaminants
  - Lead and Copper Rule (LCR)
  - Radionuclides Rule
  - Arsenic Rule
- MDBP Regulations / Regulations pertaining to microbial contaminants and disinfection byproducts.
  - Surface Water Treatment Rule (SWTR)
  - Interim Enhanced Surface Water Treatment Rule (IESWTR)
  - Long Term 2 Enhanced Surface Water Treatment Rule (LT2ESWTR)
  - Stage 1 and Stage 2 Disinfectants/Disinfection By-Products Rule (D/DBPR)
  - Total Coliform Rule (TCR)
  - Filter Backwash Recycling Rule (FBRR)
- Regulations pertaining to monitoring of unregulated contaminants
  - Unregulated Contaminant Monitoring Program (UCMR)
- Future regulations pertaining to contaminants of emerging concern (CECs)

Compliance with each of these regulations is discussed in the Appendix A.

3.4 WATER SYSTEM PERFORMANCE CRITERIA

The City's water distribution system infrastructure evaluated and recommended in this master plan is intended to provide acceptable levels of performance and reliability, while being sensitive to cost. As new infrastructure is planned and analyzed with the use of a hydraulic model, agreed upon "standards of measurement" are necessary to evaluate the adequacy of the infrastructure. These "standards of measurement" are the water system performance criteria that the City of Goodyear has established for the IWMP.

3.4.1 Overview

Performance criteria address water supply redundancy, water system reliability, and system operational requirements. Performance criteria are more general than design criteria, which provide specific requirements that must be incorporated into new infrastructure.

Performance criteria are based on legal requirements and engineering best practices. According to the Arizona Administrative Code (A.A.C.), public water systems shall be designed using good engineering practice (R-18-5-502). The water system performance criteria for the IWMP include 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 performance criteria established in the City's 2007 Integrated Water Master Plan. These "standards of measurement" are considered good engineering practice and provide the City acceptable levels of water system performance and reliability.

3.4.1.1 Water Supply Redundancy

Water supply redundancy refers to the degree to which water can still be supplied to the City in the event that one or more of the water supply sources is unavailable. Decisions concerning the extent of redundancy are often policy decisions influenced by the price a utility is willing to pay for the redundancy compared with the risk of having to implement water use restrictions or provide a lower level of service to the customer. Under some conditions, it may be more economical for the City to implement water use restrictions than to build infrastructure that will be used only on infrequent occasions when a particular water source may be unavailable. Water supply redundancy needs depend on the unique water supplies of each city. Most communities in central Arizona that rely on surface water seek to provide redundant or backup water supplies for outages of canals that deliver SRP or CAP water supplies under average day demand conditions. For communities that rely on groundwater, holding one or more production well in reserve (firm capacity) is a common way to provide water supply redundancy.

3.4.1.2 Water System Reliability

The City's water system reliability is dependent on the reliability of all the components within the system as well as the reliability of support systems and services outside of the City's control (Adaman wells and power supply). The level of reliability provided is usually based on historic 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.

The level of reliability provided by the system is a function of the reliability of the major system components:

- Raw water sources
- Treatment processes and/or facilities
- Major transmission mains
- Power sources
- Booster stations
- Storage tanks

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

- Sufficient groundwater production to meet maximum-day demand.
- Reserve system storage to meet emergency conditions, in addition to fire and normal operational needs.
- Transmission capability to deliver water to the distribution system.
- Looped transmission and distribution system network to provide multiple pathways for water to reach customers.
- Sufficient booster pumping capabilities with a pump station or the largest pump in a station out of service.

3.4.1.3 Water System Operational Requirements

Water system operational requirements refer to the level of service provided by a utility to the customer. Levels of service include many parameters, such as minimum and maximum 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 storage volume and flow to meet firefighting demands. The water system is considered to be adequate when system demand conditions are satisfied while meeting system performance criteria, such as system pressure, velocity, and head loss.

3.4.2 Water Production Facilities

Production facilities for the water system should have sufficient capacity to meet the demands of the maximum day of the year. For systems served with groundwater wells, it is standard practice to evaluate production capabilities based on "firm" capacity, or the capacity with the largest well out of service in each pressure zone.

For Goodyear, the largest production well is Well 22 at the Bullard Water Campus. Treated water from Well 22 is blended with water from the City's second largest well, Well 20 to meet water quality requirements. Because of this, when Well 22 is removed from service, Well 20 cannot be used. Therefore, Goodyear's "firm" capacity results in two wells removed from service.

3.4.3 Fire Flow

The City of Goodyear's Fire Department has adopted the 2006 International Fire Code (IFC 2006) as documented in Chapter 5 of Goodyear's City Code. Depending on the type of use, construction, fire area, the required fire flow and duration ranges from 1,500 gpm for 2 hours to 8,000 gpm for 4 hours as show in IFC 2006 Appendix B, Table B105.1. The IFC 2006 allows reductions in fire flow requirements for structures with approved automatic sprinkler systems and installation practices, which can be granted at the discretion of Goodyear's Fire Marshall.

For the purposes of the water system master plan system evaluations and future system planning, master planning fire flow requirements were developed that are general and based on land use. For single-family residential land uses the master planning fire flow requirement is 1,500 gpm for 2 hours. For commercial and industrial land uses the master planning fire flow requirement is 3,500 gpm for 4 hours.

The actual fire flow requirements for future, individual structures shall be determined in accordance with the IFC 2006 (or the City's currently adopted standard) as documented in the Goodyear City Code.

It is assumed that a major fire will not occur during the peak hour demand condition since the chance of this happening is minimal. Rather, it is more likely that a fire could occur under maximum day demand conditions. Therefore, in the system evaluations, fire demand will be applied under maximum day demand conditions.

3.4.4 Pump Stations

Usually pumping stations are the most critical components in a distribution system with respect to meeting reliability/redundancy criteria, because these facilities are subject to disruption by the following conditions:

- Power outage
- Mechanical failure
- Line breaks
- Table 3.4 summarizes these conditions and the criteria to be employed for reliability in this master plan update.

Table 3.4 Pump Station Reliability Criteria 2016 Integrated Water Master Plan City of Goodyear		
Condition	**Result**	**Mitigating Criteria**
Power Outage	Creates loss of pumping capacity at one or more pumping facilities.	Provide emergency backup power supply generation or dual power feed to critical facilities.
Mechanical Failure	Creates loss of pumping capacity due to one or more pumps at a facility being out of service.	Provide sufficient pumping capacity at each booster pumping station to meet maximum day demands with any one pump or the largest pump out of service (referred to as "firm capacity" of the station). This allows for pumps to be out of service due to mechanical failure or unscheduled maintenance.
Line Break	Occurs at or near the booster station, creating a loss of all or a portion of the pumping capacity at the facility.	A line break at or near a booster station disrupting supply is usually mitigated through multiple pumping facilities, storage, and PRV facilities (where available).

For line breaks affecting critical pumping facilities, reliability/redundancy criteria are established so that average day demand conditions can be met for each pressure zone.

A pump station pumping to a closed system, with no other water sources or elevated storage, should be sized for the larger of peak hour demand or maximum day plus fire flow demand. Diurnal demands (peak hour) and fire demands will be met from ground storage, and the booster stations will need to be able to pump this flow from the reservoirs. Pump stations should be designed based on the capacity that can be consistently provided with the largest pump out of service (firm capacity). In addition, pump stations that deliver water into higher pressure zones must be sized to meet the demands of both zones, the parent and subordinate zones.

The following summarizes pump station criteria:

- When pumping to a closed system, the capacity equals the larger of 120 percent of peak hour demand or maximum day plus fire flow demand.
- The allowance for reliability and uncertainties in demand projections equals 10 percent of the station's firm capacity.
- Pump stations should be sized to meet demands with the largest pump out of service (firm capacity).
- When multiple booster stations supply a zone, average annual water demands should be supplied with the largest booster station out of service.

The firm capacity of booster stations that pump from reservoirs is often set so that half of the reservoir can be emptied in a six-hour period.

3.4.5 Transmission / Distribution Mains

Water system piping serves three basic purposes:

- To transfer water from the source of production to storage
- To distribute water from the source of storage to the consumer
- To provide a conduit to supply firefighting water

Transmission and distribution mains are sized for the greater of the following two demand conditions:

- Maximum day demand plus fire flow, or
- 120 percent of Peak hour demand

The following pressure criteria are recommended to assess the adequacy of the water transmission/distribution system under the two demand conditions:

- **Peak Hour Demand:** Pressures must be greater than 40 psi and less than or equal to 80 psi. Criteria are established to account for distribution system and backflow prevention facility head loss in order to achieve a minimum service pressure of 40 psi.
- **Maximum Day Demand plus Fire Flow Condition:** A minimum of 20 psi at the point of maximum fire draft.

The water velocity criteria under maximum day demand conditions are as follows:

- Velocity $\leq$ 5 feet per second (fps) for pipes < 36 inches diameter
- Velocity $\leq$ 6 fps for pipes $\geq$ 36 inches diameter

The water velocity criteria under peak hour demand condition is as follows:

- Velocity $\leq$ 7 fps

The water velocity criteria under fire demand condition is as follows:

- Velocity $\leq$ 10 fps

3.4.6 Storage Facilities

Since production facilities are typically designed to operate at a steady rate over an extended period of time, storage reservoirs are planned to accommodate fluctuating demands. The factors included in designing reservoir capacity are diurnal demand fluctuations, fire demand, and emergency reserve storage. In some situations, it may be prudent to have an additional storage volume to provide operational storage. Storage

facilities should be designed and operated to meet these conditions, while achieving storage turnover to minimize water quality degradation.

The City's current water storage capacity standard is to provide an amount equal to the average daily demand during the peak month of the year (maximum month conditions), which is outlined in A.A.C. R18-5-503A.

In the future, as the City's water system expands, storage capacity will increase and water sources will likely change from exclusively groundwater to a blend between groundwater and CAP surface water. As this occurs, the City will need to be aware of the age of water stored in reservoirs and the potential to form disinfection by-products due to the organic compounds found in surface water. Storage will need to be managed in a way to maintain adequate supplies to meet demands and also maintain adequate water quality. An adjustment in the City's storage performance criteria may be warranted when CAP water becomes available, or when the City grows to a point that its storage needs change.

3.4.7 Development Factors Affecting Performance Criteria

The previously discussed performance criteria apply to pressure zones that have achieved growth generally greater than 50 percent of the expected build out population, with well-developed infrastructure including looped pipelines and a significant percentage of storage and booster pumping facilities in place.

In growth oriented communities where new pressure zones are being established and proposed developments are located long distances from existing services, the initial population is low and new infrastructure does not usually achieve the criteria recommended for mature pressure zones while in the early stages of development. This is often referred to as "Satellite" development, where stand-alone water supply and delivery infrastructure must be used initially to serve customers until connections can be made to the City's system. These conditions typically occur for the following types of growth/development:

1. Growth in a new pressure zone that is not yet connected to the City's system.
2. Growth in an existing or new pressure zone that is connected to the City's system by a single feed or "umbilical cord" type infrastructure.

Under these growth and development conditions, water usage patterns can vary significantly from patterns observed in mature pressure zones, and can greatly affect peaking factors and required storage and booster pumping. The peaking factors for the City's existing pressure zones were based on the previous master plan. When the City's SCADA system is fully operational, data will be available to more precisely calculate peaking factors.

- Maximum Day/Average Day = 1.7
- Peak Hour/Maximum Day = 1.7
- Peak Hour/Average Day = 2.89

For new growth areas or "Satellite" developments, it is not uncommon to experience peaking factors that exceed these values. A typical Peak Hour/Maximum Day factor for these conditions would be 2.5, or Peak Hour/Average Day factor of 4.0 or higher. The reasons for the higher peaking factor include:

1. Significantly greater proportionate share of construction water use compared to normal per capita usage during the early stages of new development. High construction water usage typically occurs at the same time of peak daily per capita water demand.
2. The character that a satellite development displays is much like a "bedroom" community, where the resident's water use patterns are all similar and are not buffered by other types of non-residential and commercial water use.

Fire flow demands also affect the requirements for booster pumping and storage capacity. Typically for new, small developments, the maximum day plus fire flow demand condition will control the sizing of booster pumping and storage facilities. While for development in mature pressure zones, the peak hour demand condition will usually control the sizing of booster pumping and storage facilities.

Therefore, considering these development factors, the performance criteria may be modified at the discretion of the City to account for satellite growth conditions.

The City's water system performance criterion is summarized in Table 3.5.

Table 3.5 Water System Performance Criteria
2016 Integrated Water Master Plan
City of Goodyear

Description	Criteria
Demand and Production Criteria	
Peaking Factors (1)	
Maximum Day/Average Day (MD/AD)	1.7
Maximum Month/Average Day (MM/AD)	1.36
Peak Hour/Maximum Day (PH/MD)	1.7
Peak Hour/Average Day (PH/AD)	2.89
Production (2)	Supply Maximum Day Demand
Storage Criteria (3)	Equal to the average daily demand during the peak month of the year (maximum month demand)

Table 3.5 Water System Performance Criteria 2016 Integrated Water Master Plan City of Goodyear	
Description	**Criteria**
Transmission/Distribution	
Velocity Criteria	
Maximum Day	
Pipe < 36 inches	<5 feet per second (fps)
Pipe ≥ 36 inches	<6 fps
Peak Hour	≤7 fps
Fire Flow Condition	<10 fps, <20 psi
System pressure criteria (SPC)	40 psi ≤ SPC ≤ 80 psi
Size Criteria (Minimum Diameter, inches)	
Section Lines/Major Arterial	16
Minor Arterials	12
All Other Lines	8
Booster Pump Station Criteria	
Without Elevated Storage (4)	The larger of 120% of Peak Hour Demand or Maximum Day plus Fire Flow of 3,500 gpm
Firm Capacity (5)	Capacity with the largest pump out of service
Fire Demand Criteria	
Master Planning Fire Flow Requirements (6)	Residential = 1,500 gpm for 2 hours
	Commercial/Industrial/Schools = 3,500 gpm for 4 hours

Notes:

(1) Peaking factors are estimates taken from the 2007 Integrated Water Master Plan. These peaking factors are typical of similarly sized communities in Arizona. Without a SCADA system, it is difficult to precisely measure peaking factors.
(2) Per industry best practices, production requirements should be met with largest well out of service (Mays, Larry W. *Water Distribution Systems Handbook.* McGraw Hill, 2000, pp 3.7. For Goodyear, the largest well (Well 22) is required to use Well 20 (blending); therefore, firm capacity results in the two largest wells out of service.
(3) Arizona Administrative Code: A.A.C. R18-5-503A.
(4) 2007 Integrated Water Master Plan criteria & industry best practice.
(5) Engineering Bulletin No. 10, Chapter 3, Section C(1).
(6) Master Planning Fire Flow Requirements are general and applied for system planning purposes. The 2006 IFC allows reductions in fire flow requirements for structures with approved automatic sprinkler systems and installation practices, which can be granted at the discretion of the City Fire Marshall.

3.5 MODEL PREPARATION

3.5.1 Hydraulic Model

Carollo created a new water system hydraulic model using the City's most current GIS data for the 2016 IWMP. The following sections describe how the model was created and validated.

3.5.2 Infrastructure

Several data sources were provided by the City and were used to create the water model. A description of each data source that was used is listed below:

- **GIS Data** – pipes, nodes and facility location data for all water system infrastructure including wells, booster pump stations, storage reservoirs and treatment locations.
- **Water System Schematics** – schematic representations of the City's water sites from the 2007 IWMP.
- **Operations Data** – Water distribution system operational data provided from operator logs including totalized daily flows, pressures, and tank levels was used in the model validation.

The water model includes a representation of all water mains 4 inches and larger and facilities including wells, reservoirs and booster pump stations. This model is an "all mains" model, meaning that all system pipes (excluding service connections) are represented. A quality review of the GIS data was performed using tools in the modeling software to verify pipe connectivity and pressure zone boundaries.

3.5.3 Ground Elevations

Ground elevations for the model nodes that represent locations of demands in the system were extracted from a Digital Elevation Model (DEM) obtained from the United States Geological Survey (USGS) Seamless Data Distribution website. The accuracy range of these elevations is appropriate for master planning purposes. Elevations for facility components such as tank base and pump discharge elevations were taken from facility data provided by City staff. The elevation range for each pressure zone is:

- **North Zone** – 895 feet to 1015 feet
- **South Zone 1** – 935 feet to 1085 feet
- **South Zone 2** – 990 feet to 1105 feet

3.5.4 Future Facilities

Future facilities were added model scenarios for each planning year including years 2015, 2020, and 2025. The location of future facilities, including new distribution mains, correlated to the 5- and 10-year growth areas identified by the City's planning department previously identified in Figure 2.4.

3.5.5 Demands

Average annual water demands for each planning year were based on the City's water customer billing database. Demands were imported into the model by geographically referencing the City's water meter locations with the nearest model junction nodes. This method of allocating demands resulted in most of Goodyear's existing demand being allocated to locations in the model that were close to the location of actual water use, which is considered a sufficient level of accuracy for master planning purposes.

Future water demands were allocated using the geographical location of potential development for the 5- and 10-year planning periods. These demands were added to the existing customer demands from the customer meter billing database.

The peaking factors summarized in Table 3.5 were used to represent maximum day and peak hour conditions.

Fire demands were allocated to model junctions that were located adjacent to actual hydrant locations using the City's fire hydrant GIS data. The City's land use plan was used to assign residential or non-residential fire flow demands to each model junction that represented a fire hydrant. If a junction representing a hydrant was located in a residential land use area, it was assigned a fire demand of 1,500 gpm and if it was located in a non-residential land use area, it was assigned a fire demand of 3,500 gpm.

3.5.6 Model Validation

The model was calibrated for a day in June 2015 and represents a maximum day demand condition. The model is used to predict steady state conditions, which represents a "snapshot" of system conditions at a given time.

A field test was designed to record system pressures at key locations in the distribution system in both the north and south pressure zones. Pressure transducers were placed at 19 sites in the distribution system. The sites were selected collaboratively with City staff and included locations at water production facilities and locations in the distribution system. The pressure transducers collected data every minute over a two-week period from June 1 - 15, 2015. Figure 3.3 shows the locations where the pressure transducers were placed for the field test.

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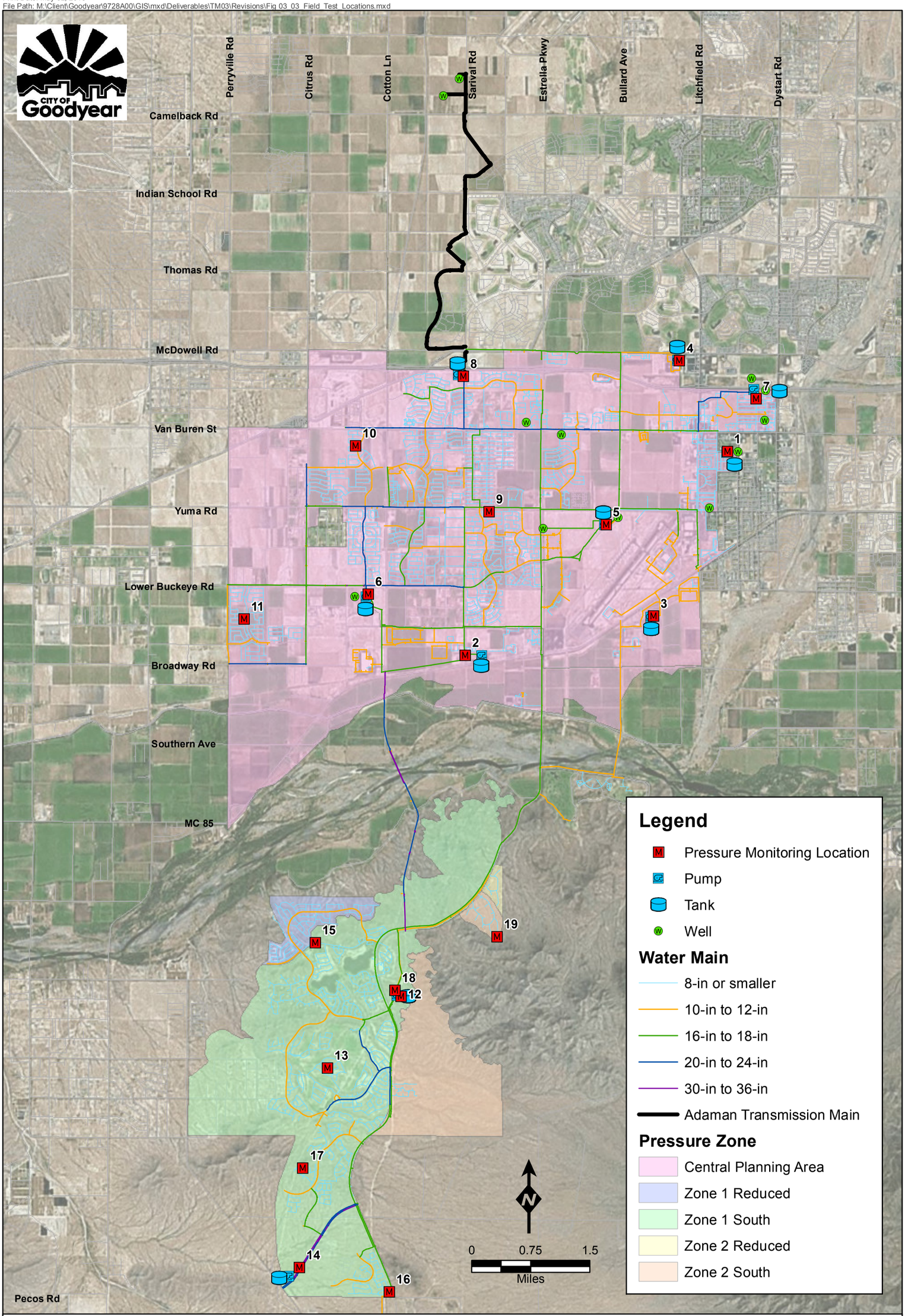

FIELD TEST LOCATIONS

FIGURE 3.3

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The City does not have SCADA data that records tank levels, booster pump flows or discharge pressures. However, logs from the daily water operator reads for each site were provided for the days during the field test and used as references to the extent possible in the model validation.

The model was calibrated for pressures using the data collected during the field test. The goal of the calibration was to achieve reasonable correlations between the field observed and model predicted system pressure values. When evaluating correlations between field data and model results, a correlation of +/- 5 percent is considered good, +/- 10-15 percent is considered acceptable, and a difference greater than 15 percent suggests an unresolved anomaly.

For the 19 sites monitored, 2 locations the pressure loggers did not record data (presumably an equipment problem), 8 locations had good correlations with the model data, 6 locations had acceptable correlations with the model data, and three locations appeared to have unresolved anomalies associated with them. A specific site survey or local investigations along with additional pressure testing is recommended to identify potential closed valves would be needed to resolve these anomalies. Table 3.6 summarizes the pressure calibration results.

Overall the model provides a reasonable representation of Goodyear's existing water system and is appropriate for use in master planning analysis including evaluating system capacity, predicting pressures during peak demand conditions, simulating fire flow conditions, and planning new infrastructure.

Table 3.6 Pressure Calibration Results
2016 Integrated Water Master Plan
City of Goodyear

Site [1]	Pressure (psi) [2]			Model Pressure (psi)	Difference (Avg. versus Model)	
	Min	Avg	Max		(psi)	(%)
1	56	65	75	61	4	6%
2	-	-	-	-	-	-
3	62	74	86	63	11	14%
4	47	58	69	51	7	12%
5	59	70	81	68	2	3%
6	67	79	92	68	11	14%
7	36	43	51	56	-13	**-29%**
8	39	49	59	47	1	3%
9	37	46	55	54	-8	**-18%**
10	45	56	67	48	8	14%
11	65	77	90	73	4	6%
12	-	-	-	-	-	-
13	46	51	56	68	-17	**-34%**
14	55	63	70	63	-1	-1%
15	88	94	101	94	0	0%
16	34	42	51	41	1	2%
17	32	38	45	39	-1	-3%
18	77	82	89	78	4	5%
19	41	46	56	45	1	3%

Notes:
(1) The pressure transducers at sites 2 and 12 did not record data due to equipment problems.
(2) Observed on June 5, 2015.

3.6 YEARS 2015 TO 2025 WATER SYSTEM EVALUATION

An earlier task of the IWMP was to evaluate the water system to determine water infrastructure needs for current customers. The results of this evaluation are documented in the technical memorandum "Five-Year Capital Improvement Program - May 2015" (Five-Year CIP). This section includes recommendations for water production, storage, booster pumping, and distribution system improvements for planning years 2015 through 2025. The recommendations from the Five-Year CIP are also included because the 5- and 10-year recommendations build upon them.

3.6.1 Water Production

The City currently uses 12 total water production wells including 10 City wells and 2 Adaman wells. The firm supply of these wells is 8.6 mgd, which is not sufficient to meet the estimated maximum day demand for current (year 2015) or future conditions. The estimated supply deficit ranges from 5.6 mgd in year 2015 to 18.0 mgd in year 2025. Table 3.7 summarizes the estimated maximum day demands for each planning year compared to the available firm supply.

Table 3.7 Water Supply Requirements
2016 Integrated Water Master Plan
City of Goodyear

WPA 2 & 3	Supply and Demand by Planning Year (mgd)		
	2015	**2020**	**2025**
Maximum Day Demand	14.2	19.7	26.6
2015 Firm Supply (1)	8.6	8.6	8.6
Surplus / (Deficit)	**(5.6)**	**(11.1)**	**(18.0)**

Note:
(1) Defined as capacity with the largest well (Well 22) out of service. Well 20 would also be out of service in the "Firm" capacity calculation because it requires blending with the treated water from Well 22 prior to distribution.

New physical supplies are needed immediately to provide capacity to meet customer demands. The City currently has three new wells in their 5-year CIP including equipping a third Adaman well and drilling two new wells in the City's service area. The Adaman well is expected to have a capacity of 1.9 mgd (1,300 gpm) and the two City wells are expected to have a capacity of 1.7 mgd (1,200 gpm) each. At these production rates, the projected capacity from these three new wells will be 5.3 mgd, which would nearly meet the year 2015 supply deficit. Because the actual production capacity of new wells may be more or less than the planned capacity, it is recommended that the City move forward with bringing these three wells online and then re-evaluating additional production needs once the new well capacities are known.

To meet the projected maximum day demands in years 2020 and 2025, additional physical supplies will be needed beyond the three wells that are currently in the City's CIP. These physical supplies could include either new production wells or direct delivery of CAP water. The following sections describe options the City has to add water production capacity.

3.6.1.1 New Well Supplies

Siting new wells in the City's service area will be challenging due to restrictions regarding impacting existing wells (both City owned and private) and constraints of the superfund sites. In addition, proximity to the Gila River, the Buckeye brackish (waterlogged) area and the hard rock in WPA 3 will limit locations for new wells. It is recommended that the City

immediately engage in a well siting study to determine feasible locations for new wells as there is the potential to need six or more new production wells to achieve 11.1 mgd of firm production capacity by year 2020, including the three new wells from the Five-Year CIP.

Based on the water quality of the City's existing water production wells, new well supplies are expected to need some level of treatment either for total dissolved solids (TDS), arsenic, or nitrates. This may present challenges to the City in determining if well treatment should be centralized or provided at individual well sites. Developing blending strategies for new supplies may provide the City flexibility in minimizing treatment costs but could present challenges related to timing and sequencing of new supplies and when these supplies can be on-line and delivering water to customers.

3.6.1.2 Existing Well Rehabilitation

The IWMP included an initial phase of a water and wastewater asset management program, which is documented in the technical memorandum "Water and Wastewater Facilities Condition Assessment - Phase I Summary Report - May 2015." Site visits, inspections, and desktop analyses were completed between December 2014 and January 2015 for the City's existing well sites. Five wells, Wells 1, 3, 18A, 18B, and 19, were identified as needing rehabilitation so that they can continue producing water. Rehabilitation requires re-drilling and re-equipping the well to current municipal standards. When space is available, it is generally preferred to rehabilitate wells on the same site as the original wells. This allows the use of existing equipment to the extent possible.

Well 1 is within the Western Avenues WQARF site and has already been impacted by PCE. PCE levels are highest when the well is first turned on and reach non-detection after several hours of operation. The levels of PCE have not yet exceeded the 5 ppb MCL, but are close. Well 3 is just east of the PGA-North Superfund Site of which trichloroethylene (TCE) is the primary concern. The Principle Responsible Party (PRP) has been working to keep the contaminant plume from migrating to the well, however, the City and PRP are working on a well response plan. The total production capacity from these two wells is 1.3 mgd (Well 1 = 0.7 mgd, Well 3 = 0.6 mgd). If the plume reaches these wells, the City will cease using them for potable supplies. These wells could be re-drilled with replacement wells. ADWR regulations require that replacement wells be located no greater distance than 660 feet from the original well. ADWR may allow the City to exceed the 660 foot requirement for these wells due to the location of the groundwater contamination plume. However, it still may be challenging for the City to identify locations where replacement wells could be placed in this part of Goodyear due to existing development and land availability.

Wells 1, 3, 18A, and 18B should remain in the City's CIP for rehabilitation. These wells are relied on in the years 2020 and 2025 water supply analysis. The loss of these wells would require making up the water production from another source. The recommended well siting

study should examine the well replacement locations for Wells 1 and 3, to determine if ADWR grants an exemption of the 660-foot rule for re-drilling an existing well.

3.6.1.3 Bullard RO Campus Well 20

The Bullard RO Campus is the City's largest water production facility. City Wells 19 and 22 are configured to pump to the RO treatment facility. City Wells 1, 11, and 20 are configured to pump to the Bullard RO Campus finished water reservoir where they are blended with the treated water from Wells 19 and 22. Well 22 is the City's largest production well at 2.4 mgd and Well 20 is the City's second largest production well at 2.3 mgd. If Well 22 is taken out of service (firm capacity), Well 20 must also be taken out of service in order for water quality requirements to be met with the blended waters in the finished water reservoir.

Well 20 is configured to pump to the RO treatment facility, but does not do so because of the sand this well pumps.

The City has a Streets Department CIP project to widen Estrella Parkway north of West Goodyear Boulevard (ST1404). This will require re-locating Well 20, as it is directly adjacent to Estrella Parkway. If Well 20 needs to be relocated anyway, the new well pump could be pumped to the Bullard RO system so that it does not need to be taken out of service if Well 22 goes down as long as the re-drilled Well 20 does not pump too much sand.

3.6.1.4 In Lieu CAP Water Exchange

As discussed in Chapter 2, a CAP "in-lieu" exchange with Adaman would provide Goodyear's CAP water allocations to Adaman for irrigation purposes in lieu of the groundwater that Adaman would otherwise pump. This would allow Adaman to retire irrigation wells in the southern portion of its service area and allow Goodyear to construct replacement wells and increase production. The City conducted a study in 2008 to evaluate this option and the recommendation was for Goodyear to pursue a 5 mgd "in lieu" arrangement with Adaman.

3.6.1.5 Rainbow Valley Groundwater Development

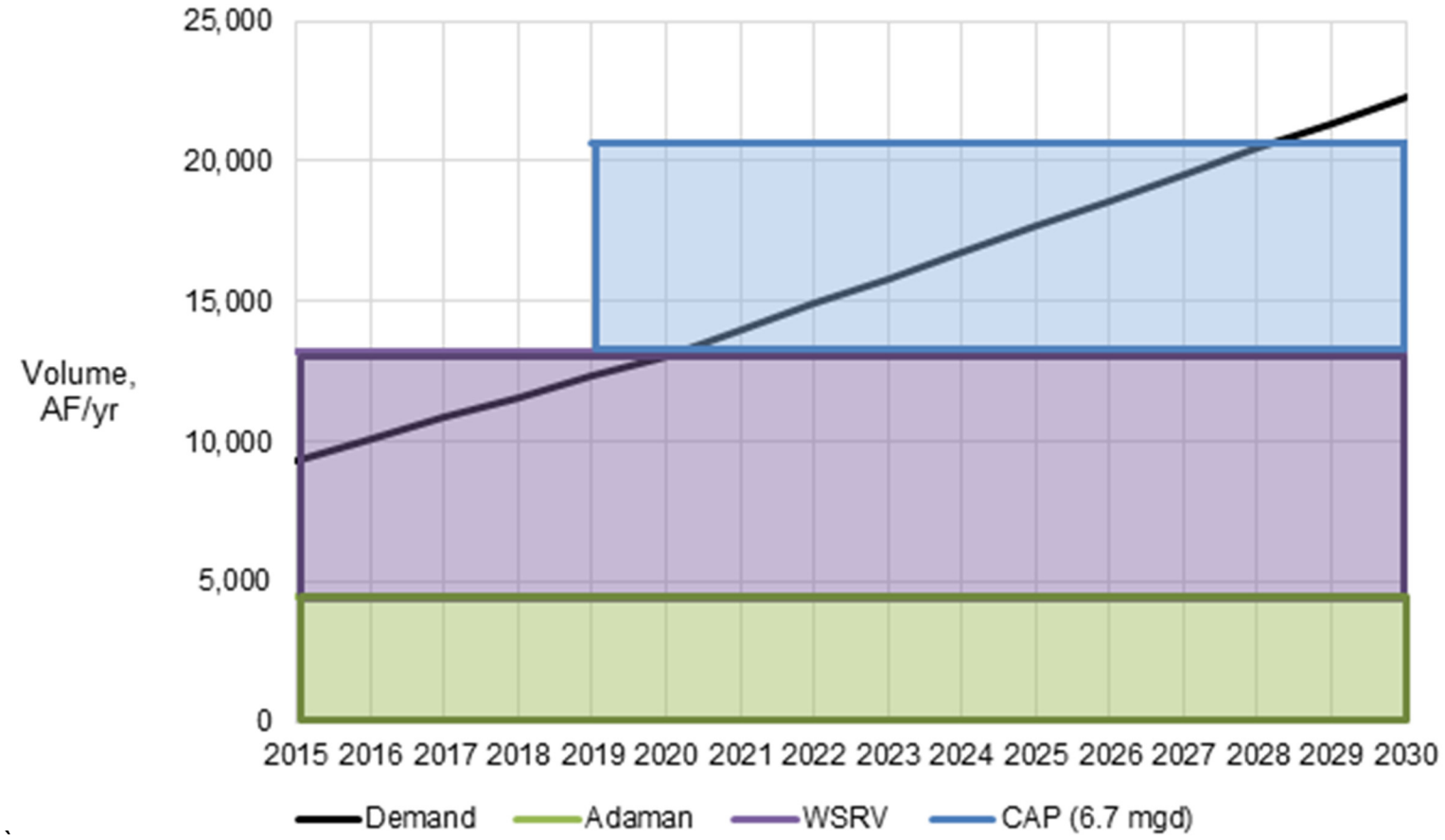
The City is currently exploring an option to develop groundwater resources in Rainbow Valley that could be conveyed to Site 23 for treatment and distribution in the southern pressure zone (WPA 3). There may be an opportunity for the City to partner with the Newland Development group (Newland) to construct a well at the southern end of WPA 4 and a transmission line that would run north to WPA 3. The location of this potential well is outside the City's water service area and ADWR would need to approve this approach. If successful, this new supply could potentially satisfy much of the demand in WPA 3 and reduce the need to send groundwater production from WPA 2 to the south.

3.6.1.6 Potential Short-term Supply Mitigation

The City has plans to rehabilitate or construct new well supplies in the next five years. Because it will take time to identify well sites, and design and construct new wells, it is recommended that the City explore other options to meet maximum day (summer) demands in the next 1 to 2 years. The City has an agreement with Liberty to provide supplies to meet peak demands and emergencies through two interconnect points. Based on June 2015 water production records, the City received between 0.1 and 1.3 mgd from Liberty's system through the western interconnect. The City should explore establishing similar interconnections with EPCOR and with the City of Avondale. This will require discussions, intergovernmental agreements, and the construction of new pipes and valves. A connection to the EPCOR system may be possible on Camelback Road east of Citrus Road. Additional investigations would be required and water system modeling is recommended to determine the size and location of the water delivery points to make certain that the water system performance criteria in each system can be met. A connection to the Avondale System could be made in several locations. There is a 16-inch City of Avondale water main in Dysart from Van Buren to I-10, which could connect to a looped 8-inch network in the north eastern corner of Goodyear's water system.

3.6.1.7 Direct Delivery of CAP Water

The City's annual physical water production capacity is limited by pumping restrictions in its service area within the WSRV groundwater sub-basin set by ADWR. The City's annual pumping limit in the WSRV groundwater sub-basin is 8,724 AFY (7.8 mgd) and the annual pumping limit from Adaman is 4,467 AFY (4.0 mgd). As illustrated in Figure 3.4, once annual demands increase beyond 13,191 AFY (11.8 mgd), the City will need a new physical water supply beyond what is provided by City and Adaman wells. Direct delivery of CAP water would provide the City with this needed additional physical supply. However, the City does not have the infrastructure in place that is required to directly deliver their CAP water allocation to their customers. The City currently recharges CAP water in several recharge facilities owned and operated by CAWCD. This recharge benefits the City by meeting groundwater replenishment obligations for groundwater that is pumped from City wells. In order to deliver CAP water directly to customers the City would need a way to convey the water to the City and treat it prior to distribution. Five alternatives were developed to enable the City to treat and deliver CAP water to their customers. To provide a valid comparison, each alternative is assumed to provide a constant flow of 6.7 mgd with no peaking capability. Water would be available by 2020. However, the City may choose to construct the pipeline that would ultimately supply the City's entire water right instead of a pipeline sized to only convey 6.7 mgd.



PHYSICAL WATER AVAILABILITY AND PROJECTED DEMAND

FIGURE 3.4

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2016 INTEGRATED WATER MASTER PLAN

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These options include opportunities to partner with EPCOR to purchase capacity at the White Tanks WTP or constructing a new City WTP near the Silva Site or a water campus near the Goodyear WRF. The following sections describe each of these alternatives, opinion of probable costs, and issues that must be considered and addressed by the City. It was assumed that the first phase of these facilities would provide 6.7 mgd of capacity. In order for the City to use its full CAP allocation these facilities would need to be expanded to 15.8 mgd (17,742 AFY).

The following sections describe the analysis for the first phase of capacity (6.7 mgd) for each option, which would be needed between year 2020 and year 2025.

3.6.1.7.1 Option 1 - Partner with EPCOR and Wheel Water through the EPCOR Distribution System to Silva Site

The City could purchase capacity at the White Tanks WTP and wheel water through the EPCOR distribution system by connecting with the line that serves the Verrado development in Buckeye. A new 5.4-mile, 24-inch transmission main would be needed at Citrus and Camelback Roads extending east then south to the City's Silva Site as shown in Figure 3.5. The transmission main would need to cross Interstate 10 and the RID Canal. The 24-inch transmission main is based on the assumption that Goodyear takes a constant base flow from the plant and peak flows are provided by wells. Additional pumping capacity at the White Tanks WTP will be needed to provide the head needed to deliver 6.7 mgd through EPCOR's distribution system.

A 2.6-MG storage reservoir and 6,100-gpm booster pump station would be needed at the Silva Site to blend water from EPCOR with the City's groundwater supplies. Granular activated carbon (GAC) treatment will be needed to address disinfection by-products and infrastructure to adjust pH and alkalinity will be needed as part of the source blending strategy. The Silva site has 8.37 acres, of which 2-2.5 acres will be needed for a fire station.

Water transmission mains from the Silva site would be required to connect to the distribution system. Water age and chemistry should be evaluated to determine the level of treatment needed at the Silva Site to keep disinfection by-products within acceptable levels.

Under this option, the City will purchase treatment capacity, rather than physical infrastructure from EPCOR. Due to legal constraints on the operation of private water utilities in Arizona, EPCOR is not offering physical ownership in the treatment plant infrastructure. The City will need to determine if capacity ownership can be funded with impact fees.

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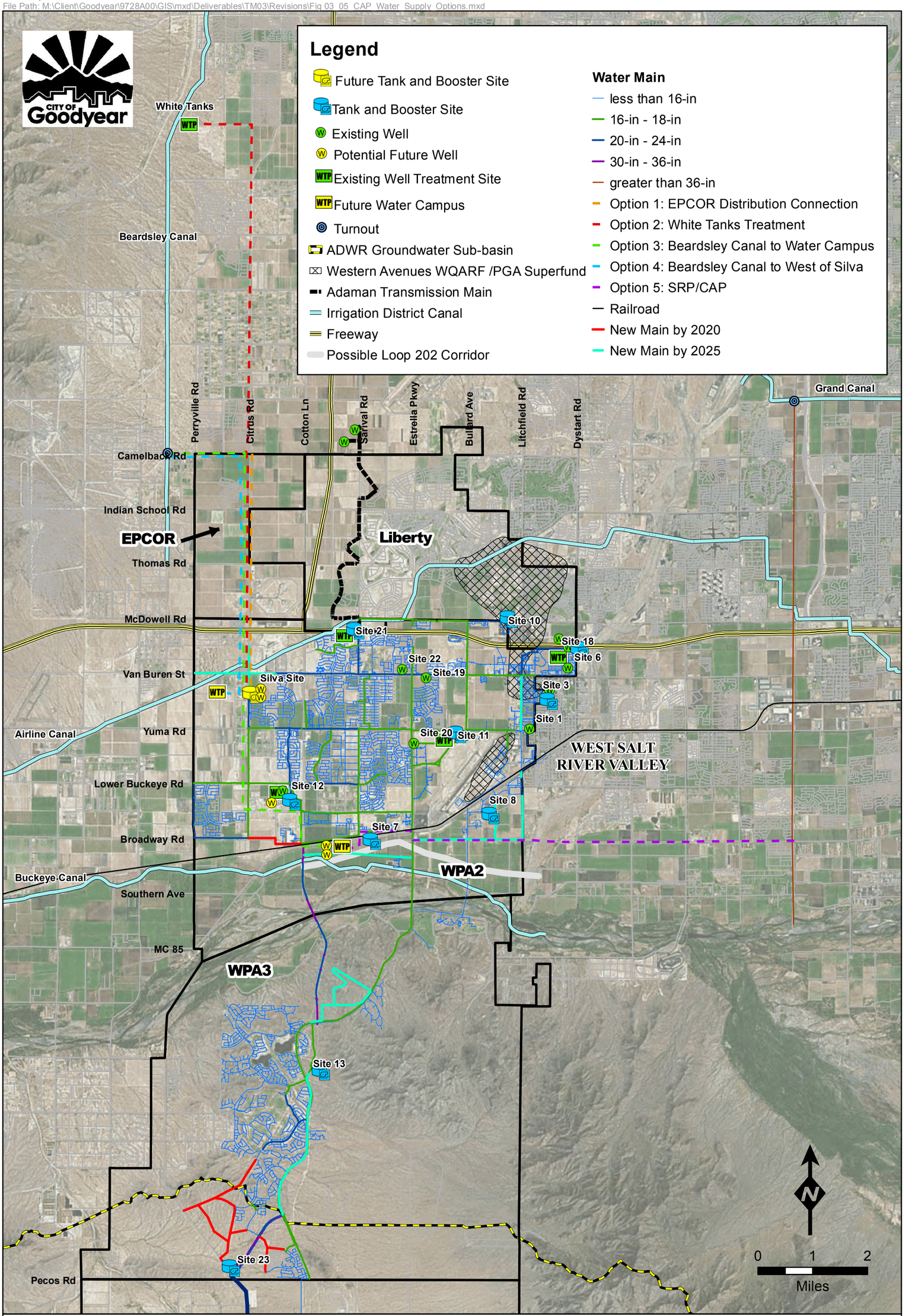

CAP WATER SUPPLY OPTIONS

FIGURE 3.5

CITY OF GOODYEAR

2016 INTEGRATED WATER MASTER PLAN

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The estimated project cost for this option is $64,166,000. Because it requires the least amount of infrastructure, it consequently has the lowest cost. However, it only provides a temporary solution. As EPCOR's system expands and demands increase there will be less capacity in the EPCOR transmission mains to send water to Goodyear. Option 1 could be valuable as a first phase for Option 2, and Goodyear would benefit by being able to defer the pipe cost from the treatment plant to Perryville/Camelback Road by several years. The City should work closely with EPCOR to determine a probable timeline for how long this option could be in place prior making a final decision.

3.6.1.7.2 Option 2 - Partner with EPCOR and Construct a Dedicated Water Transmission Main to Silva Site

The City could purchase capacity at the White Tanks WTP and deliver water to Goodyear through a new 11.5 mile, 24-inch transmission main that would extend from the WTP to the east and south to the Silva Site as shown in Figure 3.5. The transmission main would need to cross Interstate 10 and the RID Canal. A finished water pump station would be needed at the WTP to deliver water to Goodyear.

A 2.6-MG storage reservoir and 6,100-gpm booster pump station would be needed at the Silva Site to blend water from EPCOR with the City's groundwater supplies. GAC treatment will be needed to address disinfection by-products and infrastructure to adjust pH and alkalinity will be needed as part of the source blending strategy. Due to the elevation difference between the White Tanks WTP and the Silva Site, water could be moved primarily by gravity. However, a low head pump station may be used to control flow into the transmission main.

Under this option, the City will purchase treatment capacity, rather than physical infrastructure from EPCOR. Due to legal constraints on the operation of private water utilities in Arizona, EPCOR is not offering physical ownership in the treatment plant infrastructure. The City will need to determine if capacity ownership can be funded with impact fees.

The estimated project cost for this option is $78,596,000. A benefit of purchasing ownership in an existing WTP is that the City would likely be able to directly deliver CAP water sooner than if it built a new WTP, However, the City would give up a degree of control over decisions that determine the timing of future expansions.

3.6.1.7.3 Option 3 - Construct a new WTP with a Transmission Main from the Beardsley Canal to a Goodyear Water Campus

The City could construct a new WTP west of the Goodyear WRF on land that the City would need to purchase to create a "Water Campus" that would serve WPA 2 and WPA 3. A new 12.3-mile, 24-inch transmission main would be needed from a new turnout structure on the Beardsley Canal at Indian School Road extending east then south to the City as shown in Figure 3.5. The transmission main would need to cross Interstate 10, the RID Canal and the railroad along MC85 to reach the future Water Campus site. A low head pump station would be used to move water from the canal to the transmission main. However, water could be moved to Goodyear primarily by gravity.

A 2.6-MG storage reservoir and 6,100-gpm booster pump station would be needed at the Water Campus to store finished water and provide a means to blend with the City's groundwater supplies. It will be necessary to adjust pH and alkalinity as part of the source blending strategy. This water supply option delivers water into the distribution system without long transmission mains, so additional GAC contactors would not be required.

Under this option, the City would own and operate all of the water transmission and treatment infrastructure for its CAP supplies. Creating a Water Campus positions the City to take advantage of other future supplies that may be available through the BID Canals or DPR. It also positions the City to seek partnering opportunities with the cities of Buckeye and/or Avondale. While both of these communities primarily use groundwater today, both retain CAP water rights and may at some point in the future desire to directly deliver these supplies to their customers.

The estimated project cost for this option is $85,650,000. For this option to be feasible, there needs to be sufficient capacity in the Beardsley Canal to convey the City's CAP water. Preliminary discussions with MWD indicate that the canal capacity at Camelback Road is 60-75 cfs. There is 20 cfs of current peak demand, so there appears to be sufficient capacity for the CIty's total allotment of 25 cfs.

3.6.1.7.4 Option 4 - Construct a New WTP with a Transmission Main from the Beardsley Canal to the Silva Site

The City could construct a new WTP on land that would be purchased west of Citrus and south of Harrison. Although the Silva site is nearby, it is not large enough unless adjacent land could be purchased. A new 7.9-mile, 24-inch transmission main would be needed from a new turnout structure on the Beardsley Canal extending east then south to the Silva Site as shown in Figure 3.5. The transmission main would need to cross Interstate 10 and the RID Canal. A low head pump station would be needed to move water from the canal to the transmission main. However, water could be moved to Goodyear primarily by gravity.

A 2.6-MG storage reservoir and 6,100-gpm booster pump station would be needed at the Water Campus to store finished water and provide a means to blend with the City's groundwater supplies. It will be necessary to adjust pH and alkalinity as part of the source blending strategy. GAC contactors are not needed for this option because the water treatment is located close to the distribution system.

Under this option, the City would own and operate all of the water transmission and treatment infrastructure for its CAP supplies. There are still opportunities for regional partnerships with the City of Buckeye and Avondale. This site is several miles from the BID Canal and the Goodyear WRF so using BID water or engaging in DPR will require additional infrastructure including pumping.

The estimated project cost for this option is $73,692,000. For this option to be viable beyond 6.7 mgd, the City will need to purchase additional land adjacent to the Silva Site. The Silva Site is approximately 9 acres and would need to be 15 - 20 acres to accommodate a 16-mgd WTP.

3.6.1.7.5 Option 5 - Construct a New WTP with a Transmission Main from the SRP System to a Goodyear Water Campus

The City could construct a new WTP west of the Goodyear WRF and south of the proposed SR30 corridor to create a "Water Campus" that would serve WPA 2 and WPA 3. A new 7.2-mile, 24-inch transmission main would be needed from a new turnout structure on the SRP system. At the end of the Grand Canal, there is a 96-inch pipeline in 99th Avenue that extends to the Gila River to provide an emergency outfall for the SRP system. The new turnout would be located near Broadway Road and extend west to the City as shown in Figure 3.5. This transmission main would need to cross the Agua Fria River, which may require micro-tunneling or another trenchless method of construction if required by the agencies having jurisdiction on that project.

It may be possible to move the water from the 99th Avenue pipeline to Goodyear by gravity. Additional investigations are required to determine the pressure rating of the 96-inch pipe and if SRP can operate the pipeline with sufficient pressure to allow water to flow by gravity.

A 2.6-MG storage reservoir and 6,100-gpm booster pump station would be needed at the Water Campus to store finished water and provide a means to blend with the City's groundwater supplies. It will be necessary to adjust pH and alkalinity as part of the source blending strategy. Due to the proximity of the treatment plant to the distribution system, GAC contactors would not be needed.

Like Options 3 and 4, under this option the City would own and operate all of the water transmission and treatment infrastructure for its CAP supplies. This plant provides the potential for regional partnerships with the cities of Buckeye and Avondale and the City would be positioned well to utilize supplies from BID Canal or DPR in the future.

The estimated project cost for this option is $74,696,000. For this option to be feasible, the City will need to establish an agreement with SRP to wheel water through their canal and conveyance systems. Initial discussions with SRP indicate that there is sufficient capacity in the CAP-SRP Interconnect Facility (CSIF) and in the canals and pipelines.

Table 3.8 summarizes the estimated project costs for Options 1 through 5, which range from $64 M to $85 M. By comparison, the estimated project costs to install 6.7 mgd of well capacity including the required treatment, brine disposal and land costs is approximately $56 M. However, developing additional well capacity will be challenging in WPA 2 due to spacing requirements from existing wells, water quality (i.e., TDS, arsenic and nitrates) and the annual physical ground water pumping limit of 13,191 AFY (11.7 mgd) that the City must stay within.

Appendix B contains itemized project cost estimates for the five CAP direct delivery options.

Table 3.8 Options to Directly Deliver CAP Water by Year 2025
2016 Integrated Water Master Plan
City of Goodyear

Option	Description	Estimated Cost ($)
1	Partner with EPCOR and wheel water through the EPCOR distribution system to Silva Site	$64,166,000
2	Partner with EPCOR and construct a dedicated water transmission main to Silva Site	$78,596,000
3	Construct a new WTP with a transmission main from the Beardsley Canal to a Goodyear Water Campus	$85,650,000
4	Construct a new WTP with a transmission main from the Beardsley Canal to the Silva Site	$73,692,000
5	Construct a new WTP with a transmission main from the SRP system to a Goodyear Water Campus	$74,696,000

Note:
(1) See Appendix B for itemized infrastructure costs

3.6.1.8 New Supply Recommendations

If a surface water supply is not implemented near year 2020, additional wells located outside of the West Salt River Valley sub-basin will be needed to meet maximum day demands. Between years 2020 and 2025 the physical water withdrawal limit within the Central Planning Area will be reached, meaning that a new water supply will needed for the Central Planning Area to meet projected demands. Table 3.9 summarizes the supply and demand balance with the recommended additional new supplies including those that were recommended in the Five-Year CIP.

Table 3.9 Recommended Water Supplies
2016 Integrated Water Master Plan
City of Goodyear

WPA 2 & 3	Supply and Maximum Demand by Planning Year (mgd)		
	2015	**2020**	**2025**
Maximum Day Demand	14.2	19.7	26.6
2015 Firm Supply (1)	8.6	8.6	8.6
Surplus / (Deficit)	**(5.6)**	**(11.1)**	**(18.0)**
New Well Capacity	5.3 (2)	11.1 (3)	11.1 (3)
New Physical Supply (4)	0	0	6.9
Total New Supply	**5.3**	**11.1**	**18.0**

Notes:
(1) Defined as capacity with the largest well (Well 22) out of service. Well 20 would also be out of service in the "Firm" capacity calculation because it requires blending with the treated water from Well 22 prior to distribution.
(2) Recommended in Five-Year CIP document and included in the City's current CIP. Actual capacity may be greater or less than planned capacity. Re-evaluate the number of wells required to reach the required capacity after installing the wells recommended in the Five-Year CIP.
(3) Additional 3 wells at 1,300 gpm capacity each. Actual capacity may be greater or less than planned capacity.
(4) Could include "in-lieu" CAP exchange, direct delivery of CAP water, or groundwater development in the Rainbow Valley groundwater sub-basin.

3.6.2 Storage Reservoirs

3.6.2.1 North Pressure Zone

The City currently has 8 storage reservoirs in the north pressure zone with a total usable capacity of 7.8 MG. This capacity accounts for the space in the reservoirs needed to keep pumps from running dry. Table 3.10 summarizes the storage requirement for each planning year compared to the available capacity.

Table 3.10 Water Storage Requirements - North Pressure Zone
2016 Integrated Water Master Plan
City of Goodyear

North Pressure Zone	Storage by Planning Year (MG)		
	2015	**2020**	**2025**
Storage Requirement	9.1	11.6	15.5
Existing Capacity	7.8	7.8	7.8
Surplus / (Deficit)	**(1.3)**	**(3.8)**	**(7.7)**

Additional storage is needed to provide capacity to meet operational and fire flow requirements. The City has one 1.2 MG reservoir in the 5-year CIP, which is planned to be associated with one of the new production wells. By year 2020 approximately 4 MG of total storage will need to be added to the system and by year 2025 approximately 8 MG of storage will needed. This additional storage may be a combination of reservoirs associated with new groundwater production sites and storage associated with a future CAP water delivery location.

3.6.2.2 South Pressure Zone

The City currently has 2 storage reservoirs in the south pressure zone with a total usable capacity of 6.0 MG. This capacity accounts for the space in the reservoirs needed to keep the pumps from running dry. Table 3.11 summarizes the storage requirement for each planning year compared to the available capacity. The south pressure zone has sufficient storage capacity for all planning years.

Table 3.11 Water Storage Requirements - South Pressure Zone
2016 Integrated Water Master Plan
City of Goodyear

South Pressure Zone	Storage by Planning Year (MG)		
	2015	2020	2025
Storage Requirement	2.3	4.2	5.8
Existing Capacity	6.0	6.0	6.0
Surplus / (Deficit)	**4.3**	**1.8**	**0.2**

Site 13, however, does not have redundant storage for when the reservoir needs to be taken out of service for maintenance; so additional storage is being recommended for that site.

3.6.2.3 New Storage Recommendations

Additional storage is needed in the north pressure zone in each planning year beginning in year 2015. One of the recommended locations for new storage is at the Silva Site (City owned property at Citrus and Harrison), which has been previously planned as a future water supply facility location. Table 3.12 summarizes the recommended storage reservoirs for each planning year including the storage recommendation from the Five-Year CIP.

3.6.3 Booster Pump Stations

The City's booster pumping performance criteria state that the firm booster pump capacity must be able to supply the largest of 120 percent of the peak hour demand or maximum day demands plus fire flow. In addition, the maximum day demand of any pressure zone that receives water from a lower pressure zone, must be added to the lower pressure zone's pumping requirements.

Table 3.12 Water Storage Recommendations - North Pressure Zone 2016 Integrated Water Master Plan City of Goodyear			
	Storage by Planning Year (MG)		
North Pressure Zone	**2015**	**2020**	**2025**
Storage Requirement	9.1	11.6	15.5
Existing Capacity	7.8	7.8	7.8
Surplus / (Deficit)	**(1.3)**	**(3.8)**	**(7.7)**
New Storage Reservoir (1)	1.2	1.2	1.2
Reservoir at Silva Site (2)	0	2.6	2.6
Reservoir for future CAP Site (3)	0	0	4.0
Total New Storage Capacity	**1.2**	**3.8**	**7.8**

Notes:
(1) Recommended in Five-Year CIP document and included in the City's current CIP. Assumed to be associated with planned new well capacity.
(2) Assumed to be associated with new well capacity for the three wells recommended for year 2020 (not included in the Five-Year CIP).
(3) To be associated with a future CAP water treatment plant.

3.6.3.1 North Pressure Zone

The City currently has eight booster pump stations in the north pressure zone with a cumulative firm capacity of 15,340 gpm. Table 3.13 summarizes the booster pumping requirement for each planning year compared to the available firm booster pumping capacity for the North Pressure Zone.

Table 3.13 Booster Pumping Requirements - North Pressure Zone 2016 Integrated Water Master Plan City of Goodyear			
	Booster Pumping by Planning Year (gpm)		
North Pressure Zone	**2015**	**2020**	**2025**
North Pumping Requirement	16,091	20,526	27,414
South Pumping Requirement	1,972	3,638	5,038
Total Pumping Requirement	**18,063**	**24,164**	**32,452**
Existing Firm Capacity	15,340	15,340	15,340
Surplus / (Deficit)	**(2,723)**	**(8,824)**	**(17,122)**

An additional 2,800 gpm of booster pumping capacity is needed for the north pressure zone. By year 2020 another 6,100 gpm (8,900 gpm total) of booster pumping capacity must be added to the system and by year 2025 an additional 8,300 gpm (17,200 gpm total) must be added to the system.

3.6.3.2 South Pressure Zone

The City currently has two booster pump stations in the south pressure zone. Site 13 has a booster pump station that is split to serve South Zone 1 and South Zone 2. Table 3.14 summarizes the booster pumping requirement for each planning year compared to the available firm booster pumping capacity for South Zone 1.

Table 3.14 Booster Pumping Requirements - South Pressure Zone 1
2016 Integrated Water Master Plan
City of Goodyear

	Booster Pumping by Planning Year (gpm)		
South Pressure Zone 1	**2015**	**2020**	**2025**
Pumping Requirement	5,362	7,272	10,073
Existing Firm Capacity	11,185	11,185	11,185
Surplus / (Deficit)	**5,823**	**3,913**	**1,112**

There is sufficient booster pumping capacity available for South Zone 1 to meet the pumping requirements in each planning year through year 2025.

Table 3.15 summarizes the booster pumping requirement for each planning year compared to the available firm pumping capacity for South Zone 2.

Table 3.15 Booster Pumping Requirements - South Pressure Zone 2
2016 Integrated Water Master Plan
City of Goodyear

	Booster Pumping by Planning Year (gpm)		
South Pressure Zone 2	**2015**	**2020**	**2025**
Pumping Requirement	1,609	1,648	1,706
Existing Firm Capacity	550	550	550
Surplus / (Deficit)	**(1,059)**	**(1,098)**	**(1,156)**

Additional booster pumping capacity is needed for South Zone 2 to meet pumping requirements. Because the Site 13 booster pump station is the only supply source for this pressure zone, this facility is critical to maintain to make certain there is a way to supply water to the customers in this area. An additional 1,200 gpm of booster pumping capacity would meet the projected pumping requirement through year 2025. This capacity is needed primarily to meet residential fire flow pumping requirements.

3.6.3.3 New Booster Pumping Recommendations

Additional booster pumping is needed in the north pressure zone to meet projected demands in each planning year. Table 3.16 summarizes the booster pumping recommendations for the north pressure zone including those included in the Five-Year CIP.

Table 3.16 Booster Pumping Recommendations - North Pressure Zone 2016 Integrated Water Master Plan City of Goodyear			
	Booster Pumping by Planning Year (gpm)		
North Pressure Zone	2015	2020	2025
North Pumping Requirement	16,091	20,526	27,414
South Pumping Requirement	1,972	3,638	5,038
Total Pumping Requirement	**18,063**	**24,164**	**32,452**
Existing Firm Capacity	15,340	15,340	15,340
Surplus / (Deficit)	**(2,723)**	**(8,824)**	**(17,122)**
Increased booster capacity at Site 12 (1)	2,800	2,800	2,800
Silva Site Booster Station (2)	0	6,100	6,100
Future CAP Site Booster Station (3)	0	0	8,300
Total New Booster Capacity	**2,800**	**8,900**	**17,200**

Notes:
(1) Recommended in Five-Year CIP document and included in the City's current CIP. Assumed to be associated with planned new well capacity.
(2) Assumed to be associated with new well capacity for the three wells recommended for year 2020 (not included in the Five-Year CIP).
(3) To be associated with a future CAP water treatment plant.

For the South Zone 2 pressure zone, an additional 1,200 gpm is needed at Site 13 to meet projected demands including fire flow requirements.

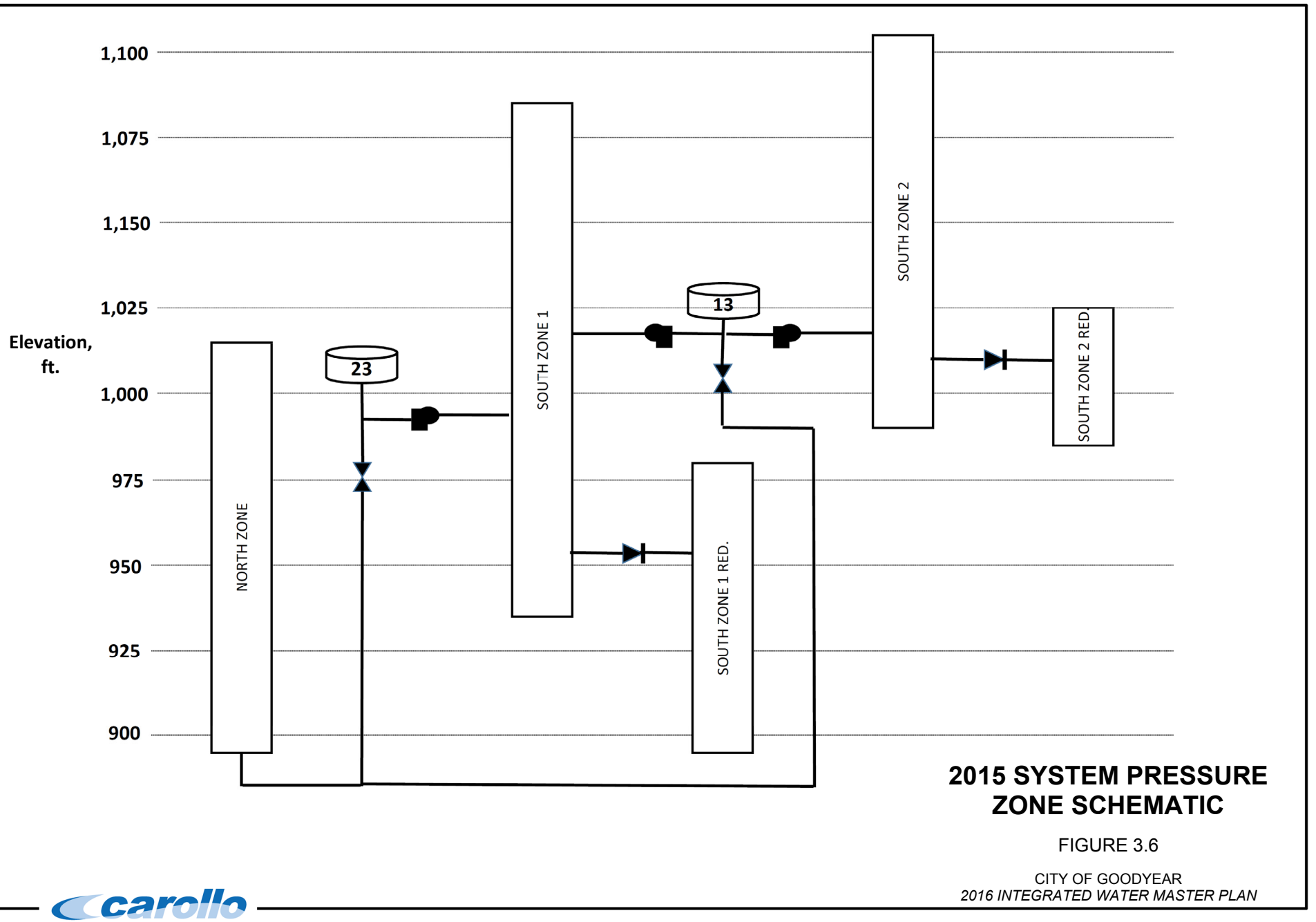
3.6.4 Distribution System

The ability of the distribution system to deliver peak hour demands was evaluated using the calibrated hydraulic model for each planning year. The hydraulic model was also used to evaluate fire flow events under maximum day demand conditions.

3.6.4.1 Pressure Zones

The City currently has five pressure zones as shown in Figure 3.6. All supplies originate in the North pressure zone, including those that meet demands in the south pressure zones. Water that fills the Site 13 and 23 reservoirs is re-pumped to the South Zones 1 and 2. Each of the South Zones has a reduced pressure zone, meaning the flow into them is regulated by PRVs, which are designed to keep operating pressures within acceptable ranges.

As the City continues to grow and the water distribution system expands, additional pressure zones will be required.



2015 SYSTEM PRESSURE ZONE SCHEMATIC

FIGURE 3.6

CITY OF GOODYEAR
2016 INTEGRATED WATER MASTER PLAN

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3.6.4.2 Year 2015 Peak Hour Pressures

All but one location in the distribution system met the minimum required pressure criteria of 40 psi for existing (2015) conditions as shown in Figure 3.7. All areas in the North Pressure Zone are predicted to be able to achieve the minimum required service pressure. Customers south of Lower Buckeye may see pressures that exceed 80 psi. Managing pressures in the North Pressure Zone may require individual service line PRVs in areas where pressures are predicted to exceed 80 psi, in accordance with the City's adopted plumbing code. The model predicted that there are several areas south of Lower Buckeye Road that are predicted to have pressures between 80 and 90 psi during peak hour conditions.

The City should verify the pressures in these areas through additional system monitoring in the short term. The long-term plans for the North Pressure Zone includes a future zone boundary along Lower Buckeye Road as discussed in Section 3.6.4.3, which should provide service pressures within the allowable 40 - 80 psi range.

There were several areas in the South Pressure Zones that were predicted to have pressures outside the 40 - 80 psi service range outlined in the City's performance criteria. These areas include:

- South Pressure Zone 1 - Approximately south of Elliot Road between San Miguel Drive and Estrella Parkway (80 - 100 psi)
- South Pressure Zone 1 - Near Westar Drive and Sunward Drive (80 - 90 psi)
- South Pressure Zone 1 - Near Westar Drive north of Wind Drift Drive (30 - 40 psi)
- South Pressure Zone 1 Reduced - Near Sweet Acacia Drive and West San Carlos Drive (80 - 90 psi)
- South Pressure Zone 2 - Near Estrella Parkway and Krista Drive (80 - 90 psi)
- South Pressure Zone 2 - South San Marcos Circle (38 - 40 psi)

Managing pressures in the South Pressure Zones will be challenging due to the natural topography and elevation ranges. For example, in South Pressure Zone 1 some areas are predicted to have pressures exceeding 80 psi, while others have pressures less than 40 psi. There is sufficient pumping capacity in Sites 13 and 23 to provide the flow and pressures to achieve greater than 40 psi through South Pressure Zone 1. Areas with pressures exceeding 80 psi should have service line PRVs to meet the required plumbing code criteria.

The model predicts that pressures on the 16-inch transmission main from the North Pressure Zone that fills the Site 23 reservoir has negative pressures along Estrella Parkway from Desert View Lane to Willis Road and on to the Site 23 Reservoir.

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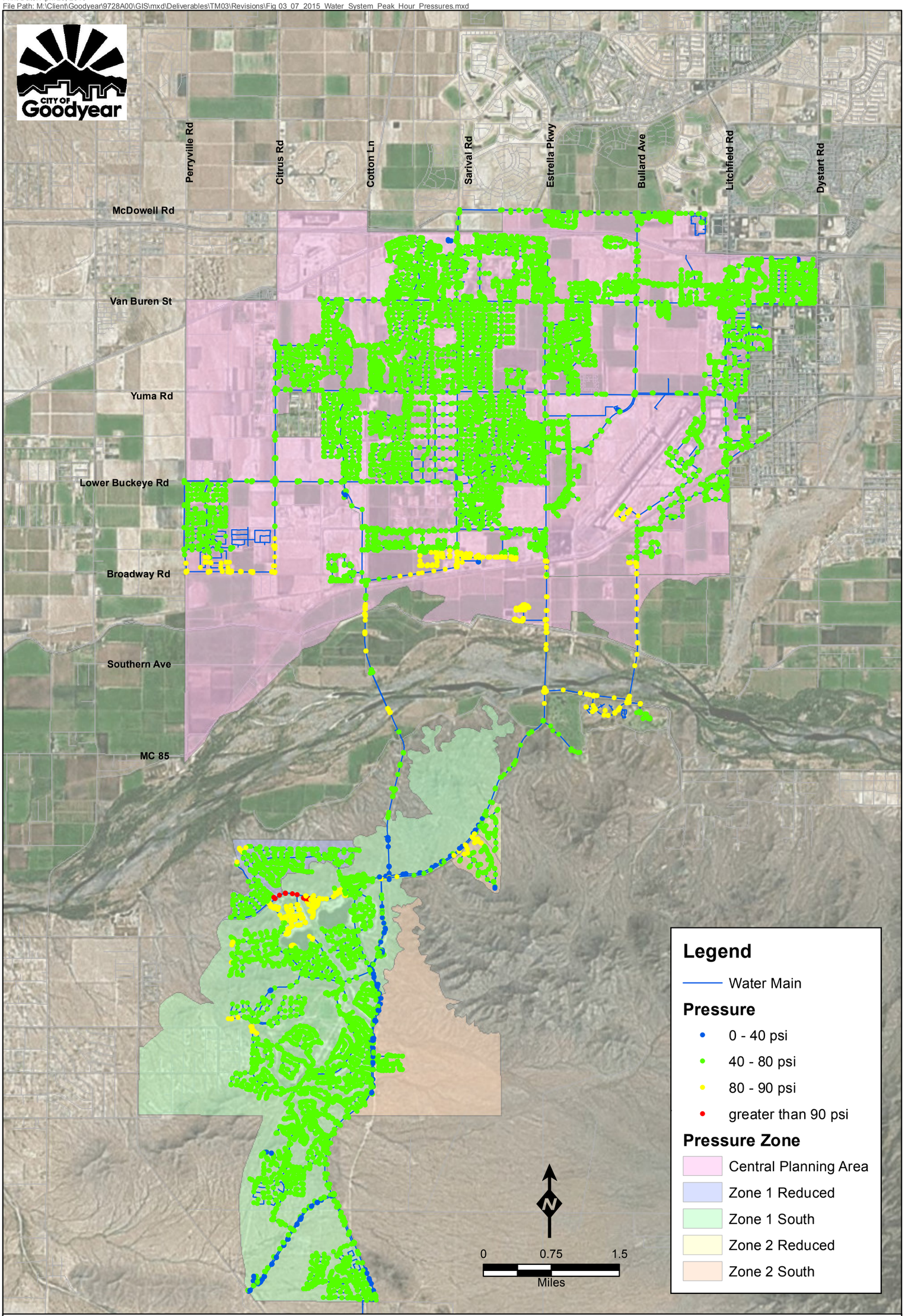

2015 WATER SYSTEM PEAK HOUR PRESSURES

FIGURE 3.7

CITY OF GOODYEAR

2016 INTEGRATED WATER MASTER PLAN

3.6.4.3 Years 2020 and 2025 Pressures

The hydraulic model was used to evaluate future peak hour conditions for years 2020 and 2025. New water distribution mains were added in locations where growth is predicted with 5 and 10 years and to complete distribution system loops needed to serve these areas. In general, the areas identified with pressures outside the 40 - 80 psi service range were the same areas identified in the existing (2015) system analysis. Figure 3.8 shows the results of the year 2025 peak hour evaluation.

The locations in the North Pressure Zone predicted to have pressures between 80 and 90 psi increased from the existing system analysis to include the southern half of the Las Brisas development and the Commerce Industrial Park. The 2007 IWMP and a 2012 study by CVL for the West Goodyear Central Planning Area identified a future water system pressure zone boundary in the North Pressure Zone that would extend along Lower Buckeye to serve development both in West Goodyear and north of the Gila River. The 2012 CVL study recommended separate service lines and booster pump stations from a future water production facility located at the Silva Site to serve this new pressure zone.

An alternative to this approach would be to serve these lower elevation areas with PRV stations. Pressures could be regulated within acceptable ranges and this would eliminate the need for separate pumping and distribution systems to serve this area. The lowest elevation along the Gila River is 890 feet. If PRVs were installed along Lower Buckeye, which is approximately 940 feet, there would be an approximate 50 foot elevation range for this new reduced pressure zone. This is equivalent to a static head of approximately 22 psi, meaning that if the PRVs at Lower Buckeye could be set to a pressure of approximately 58 psi, which would result in approximately 80 psi (neglecting head losses through pipes) in the lowest elevations of the reduced zone. A future Loop 202 freeway that may be located north of the Gila River will likely influence the boundary of a future reduced pressure zone. Figure 3.9 shows potential locations for PRVs for a future reduced North Pressure Zone.

3.6.4.4 Fire Flow Conditions

The hydraulic model was used to simulate fire events for a current (2015) maximum day demand condition. The City's land use plan was used to assign residential or commercial fire demands to locations in the model nearest the actual locations of fire hydrants. While most areas in the distribution system were able to achieve the required fire flow, there were several areas that did not. Figure 3.10 shows the available fire flow at these locations, which are summarized in Table 3.17 along with recommended actions for the City to take for each site. In addition to the recommendations in Table 3.17, the 5 year CIP for existing customers includes an expansion of the pump station at Site 13 to provide sufficient fire flow pressure to the South Zone 2 area.

Master planning fire flow requirements are more general than building specific requirements that are determined by the City Fire Marshall in the development approval process. Areas in the hydraulic model that do not meet the master planning fire flow requirements, may not be "deficient" if the area is built out and the existing building specific fire flow requirements are less than the master planning standard.

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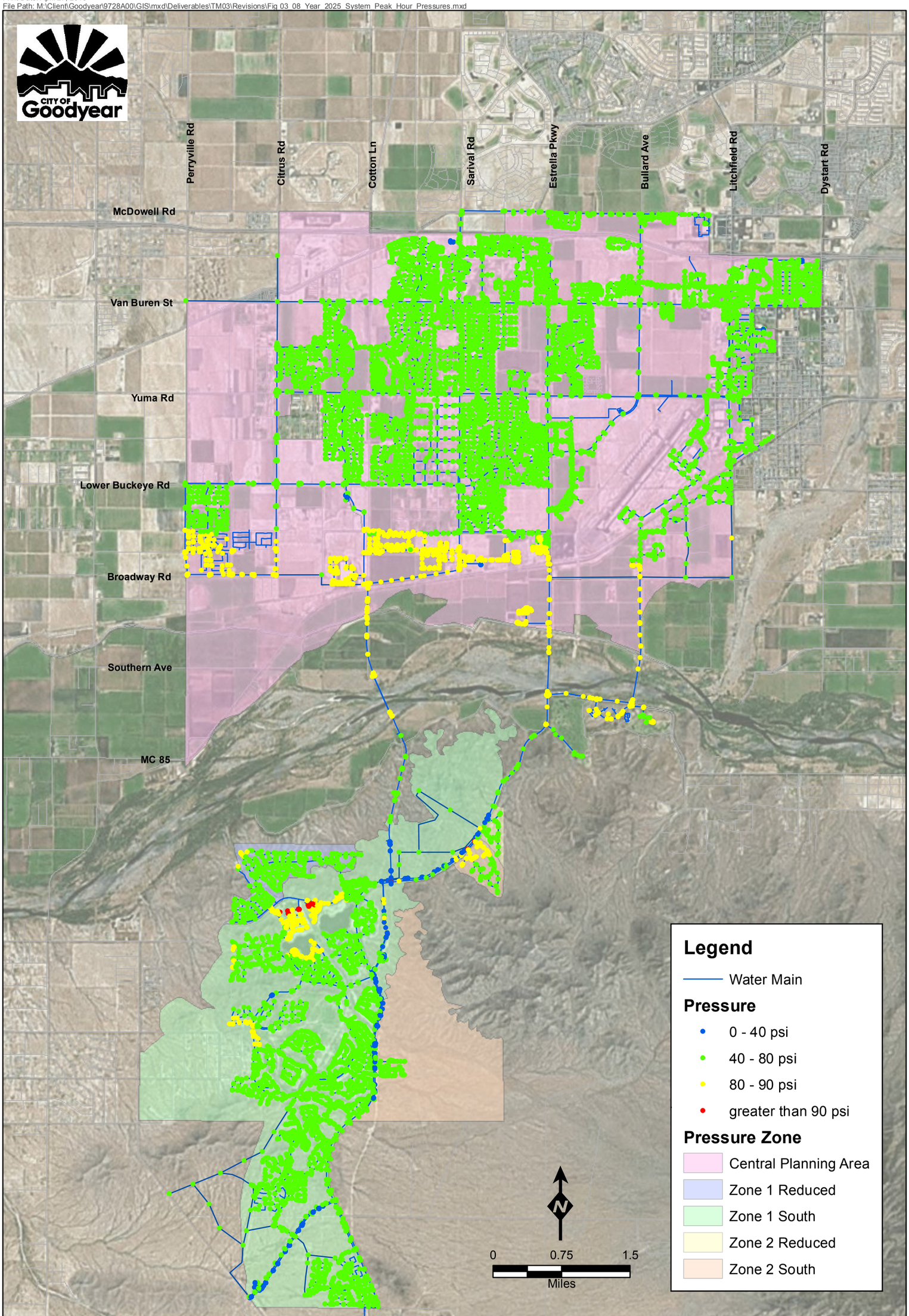

YEAR 2025 SYSTEM PEAK HOUR PRESSURES

FIGURE 3.8

CITY OF GOODYEAR

2016 INTEGRATED WATER MASTER PLAN

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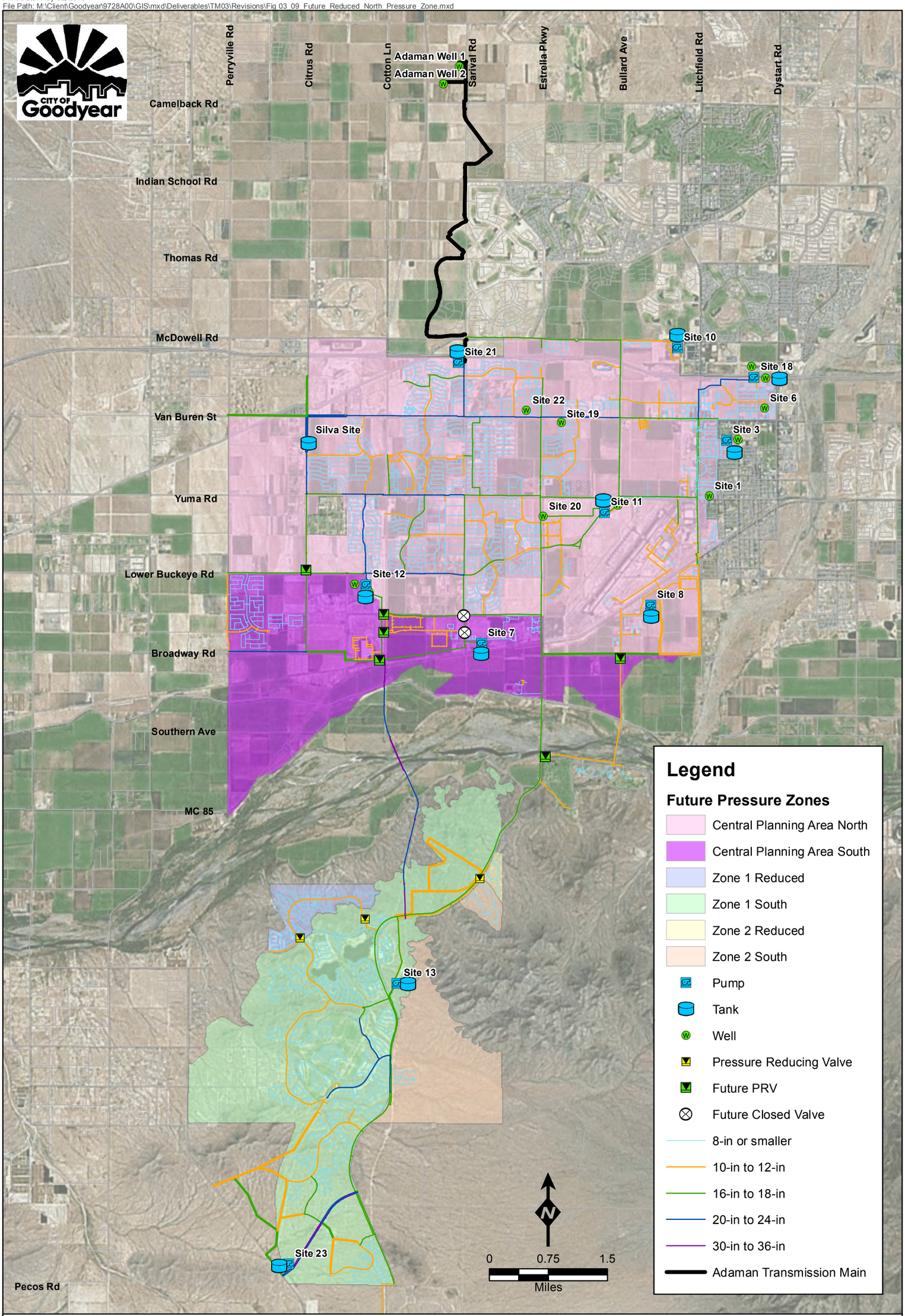

FUTURE REDUCED NORTH PRESSURE ZONES

FIGURE 3.9

CITY OF GOODYEAR

2016 INTEGRATED WATER MASTER PLAN

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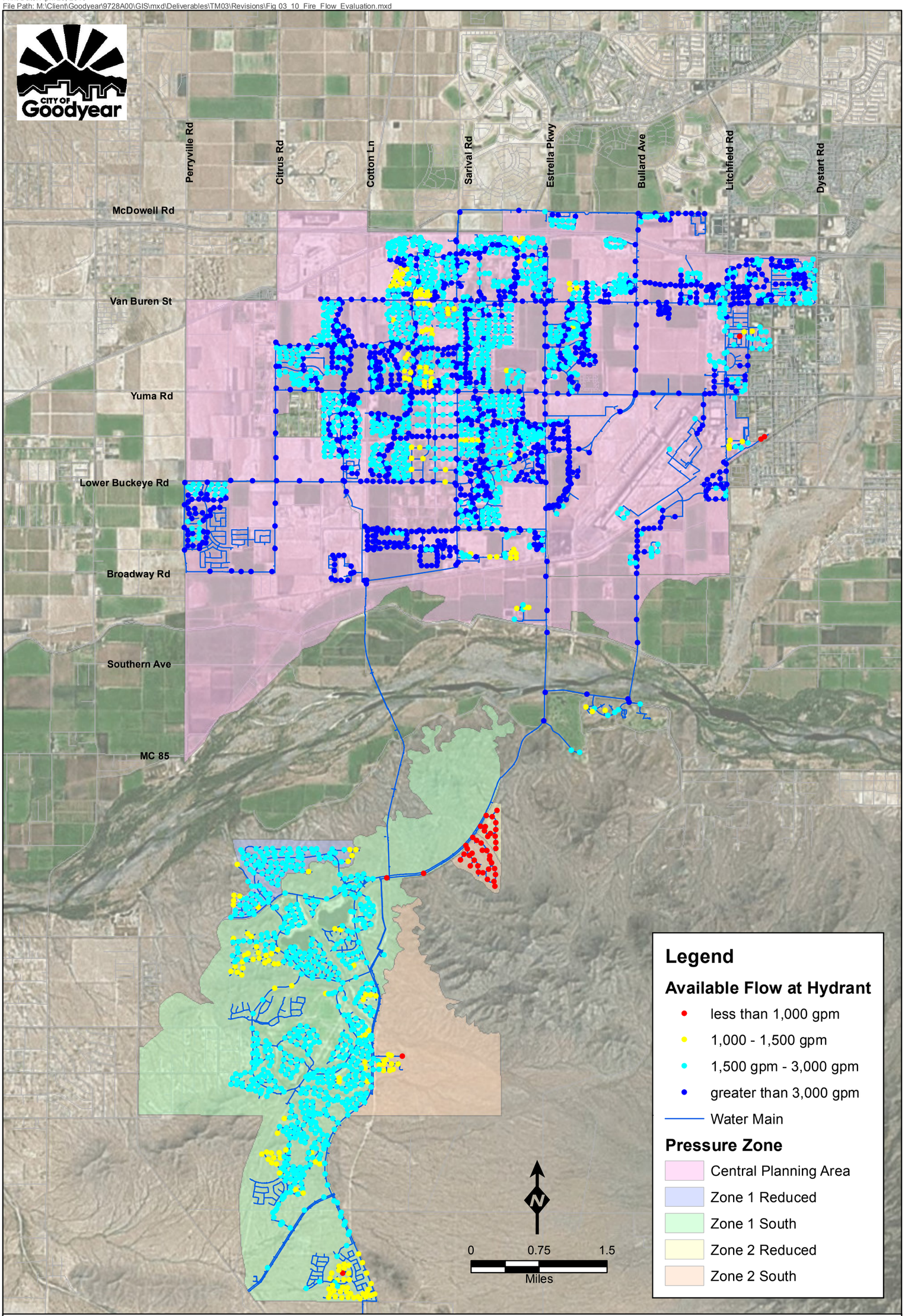

FIRE FLOW EVALUATION

FIGURE 3.10

CITY OF GOODYEAR

2016 INTEGRATED WATER MASTER PLAN

Table 3.17 Locations Where Minimum Fire Flow Pressures Were Not Met, as Predicted by the Model 2016 Integrated Water Master Plan City of Goodyear

No.	Approximate Location	Reason	Recommend	Hydrant ID
1	Estrella & Roosevelt (SW)	1 other hydrant meets criteria, 2 do not	Check building FF req.	FH56-177
2	Sarival & Baden (SE)	Undeveloped, Loop is complete.	Conduct FF test	No ID
3	Yuma & Estrella (NW)	3 hydrants meet criteria but is a school	Conduct FF test	FH66-148
4	Bullard & Fillmore (SW)	2 hydrants meet criteria but is a school	Conduct FF test	FH57-111
5	Dysart & Van Buren (NW)	Check building fire flow requirements.	Check building FF req.	FH59-134
6	Fillmore & Litchfield (SW)	Dual 6 in, check connectivity & if fire flow requirements > 2,800 gpm	Conduct FF test	FH58-70
7	Van Buren & 143rd (SE)	Near power sub-station. ~3,000 gpm achieved	Conduct FF test	FH68-32
8	Litchfield & La Pasada	4 in mains. Check fire flow requirement	Conduct FF test	FH69-19
9a	La Loma Linda & Central (NW)	6 in loop only. Check fire flow requirement	Conduct FF test	FH69-51
9b	La Padada & Central (NW)	8 in dead end. Check fire flow requirement	Conduct FF test	FH69-77
10	Litchfield & La Loma Linda (S)	6 in distribution. Recommend upsize.	Conduct FF test	FH68-29
11a	Goodyear - undeveloped	Check fire flow requirement. May be difficult to test	Conduct FF test	FH78-20
11b	Goodyear - undeveloped	Check fire flow requirement. May be difficult to test	Conduct FF test	FH87-35

Table 3.17 Locations Where Minimum Fire Flow Pressures Were Not Met, as Predicted by the Model 2016 Integrated Water Master Plan City of Goodyear

No.	Approximate Location	Reason	Recommend	Hydrant ID
11c	MC85 & Central	6 in dead end.	Conduct FF test	FH79-8
12	MC85 & Litchfield (NE)	Check fire flow requirement. Recommend loop	Conduct FF test	FH79-15
13	Elwood & Sarival (NE)	Check fire flow requirement.	Conduct FF test	FH86-109
14	Westar & 178th	Is a school. Check fire flow requirement.	Check building FF req.	FH145-142
15	Estrella & Wind Song (NE)	Is a school. Check fire flow requirement.	Check building FF req.	FH145-151
16	Elliot & San Miguel (SE)	Is a school. Check fire flow requirement.	Check building FF req.	FH124-136
17	Corgett WRF	Check fire flow requirement.	Conduct FF test	FH124-135
18	Estrella & Krista (Development)	S13Z2 Pumps need upsize.	Conduct FF test	FH126-10

Carollo recommends that the City verify the fire flow that can be achieved at each location identified in Table 3.17 either through hydrant flow tests or by checking the fire flow requirements of the existing structures. If after these investigations, the City determines these locations do not meet the specific fire flow requirements for each area, some distribution system mains will need to be upsized. The City's hydraulic model was used to size replacement pipes to allow each of these areas meet fire flow. Table 3.18 summarizes the needed infrastructure improvements to meet the master planning fire flow requirements. These areas are shown in Figure 3.11.

Table 3.18 Fire Flow Improvements
2016 Integrated Water Master Plan
City of Goodyear

Location Number	Length (ft)					
	6-in	8-in	10-in	12-in	16-in	Total New Pipe
Location 1	--	--	--	1,327	--	1,327
Location 2	--	195	1,433	--	--	1,628
Location 3	--	--	1,290	1,419	--	2,708
Location 4	--	2,155	--	--	--	2,155
Location 5	--	311	868	--	--	1,179
Location 6	--	--	--	2,597	--	2,597
Location 7	--	--	--	376	--	376
Location 8	2,565	161	--	--	--	2,726
Location 9	--	--	--	3,983	1,095	5,078
Location 10	--	--	1,976	258	--	2,234
Location 11	--	--	3,061	1,887	--	4,948
Location 12	--	--	1,208	813	--	2,021
Location 13	--	--	3,746	2,883	--	6,629
Location 14	--	--	1,177	--	--	1,177
Location 15	--	--	--	990	--	990
Location 16	--	--	--	189	--	189
Location 17	--	--	--	1,884	--	1,884
Location 18	--	--	--	--		0
	2,565	**2,822**	**14,758**	**18,605**	**1,095**	**39,845**
	0.49	**0.53**	**2.80**	**3.52**	**0.21**	**7.55**

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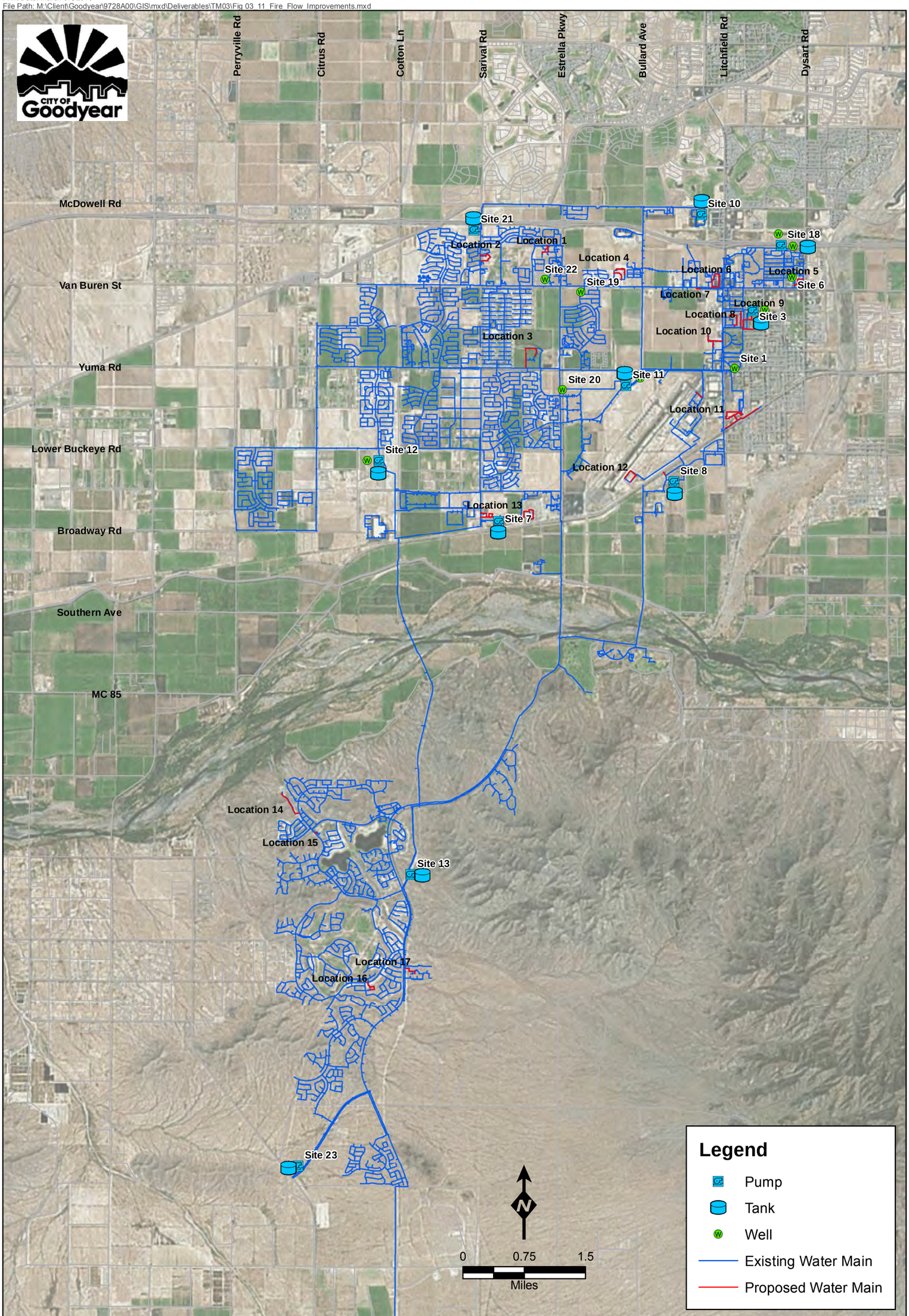

FIRE FLOW IMPROVEMENTS

FIGURE 3.11

CITY OF GOODYEAR

2016 INTEGRATED WATER MASTER PLAN

3.6.4.5 New Distribution System Mains to Serve Growth

Figure 3.12 shows locations where new distribution system mains are needed to serve growth. These areas include completing distribution system loops and water mains within and around new or expanding developments. Table 3.19 lists the locations, diameters, and estimated lengths of water mains needed by years 2020 and 2025.

Table 3.19 Future Water Mains
2016 Integrated Water Master Plan
City of Goodyear

No.	Location	Diameter	Length	Phase
1	Broadway Road from Citrus Road to Cotton Lane	16	5,610	2020
2	Loop completion in CantaMia	12	3,940	2020
3	Connection from CantaMia north loop to Willis	16	1,300	2020
4	South of Westar to Rainbow Valley Road	12	8,790	2020
5	Connection from Calistoga Drive west	12	1,930	2020
6	Mountain Vista Drive from 182nd Drive to 184th	12	1,570	2020
7	184th from Calistoga Drive to south of Mountain Vista Drive	12	3,500	2020
8	East of Rainbow Valley Road from West of Willis to the west	16	8,400	2020
9	Van Buren Street from Perryville Road to Citrus Road	12	5,280	2025
10	Citrus Road from Van Buren Street to Roosevelt Street	16	2,640	2025
11	Van Buren Street from Citrus to 174th Ave	24	2,640	2025
12	Citrus Road from Harrison Street to Van Buren Street	24	2,640	2025
13	Litchfield Road from Yuma Road to Van Buren Street	16	5,280	2025
14	Litchfield Road from El Cielo Street to MC85	16	650	2025
15	Litchfield Road from Broadway Road to La Tierra Street	12	4,300	2025
16	Broadway Road from Estrella Parkway to 143rd Ave	16	7,920	2025
17	Broadway Road from 143rd Ave to Litchfield Road	12	2,680	2025
18	143rd Ave from Broadway Road to North of El Sol Street	12	3,430	2025
19	Looping connection northeast of Estrella Parkway and Cotton Lane	12	17,000	2025

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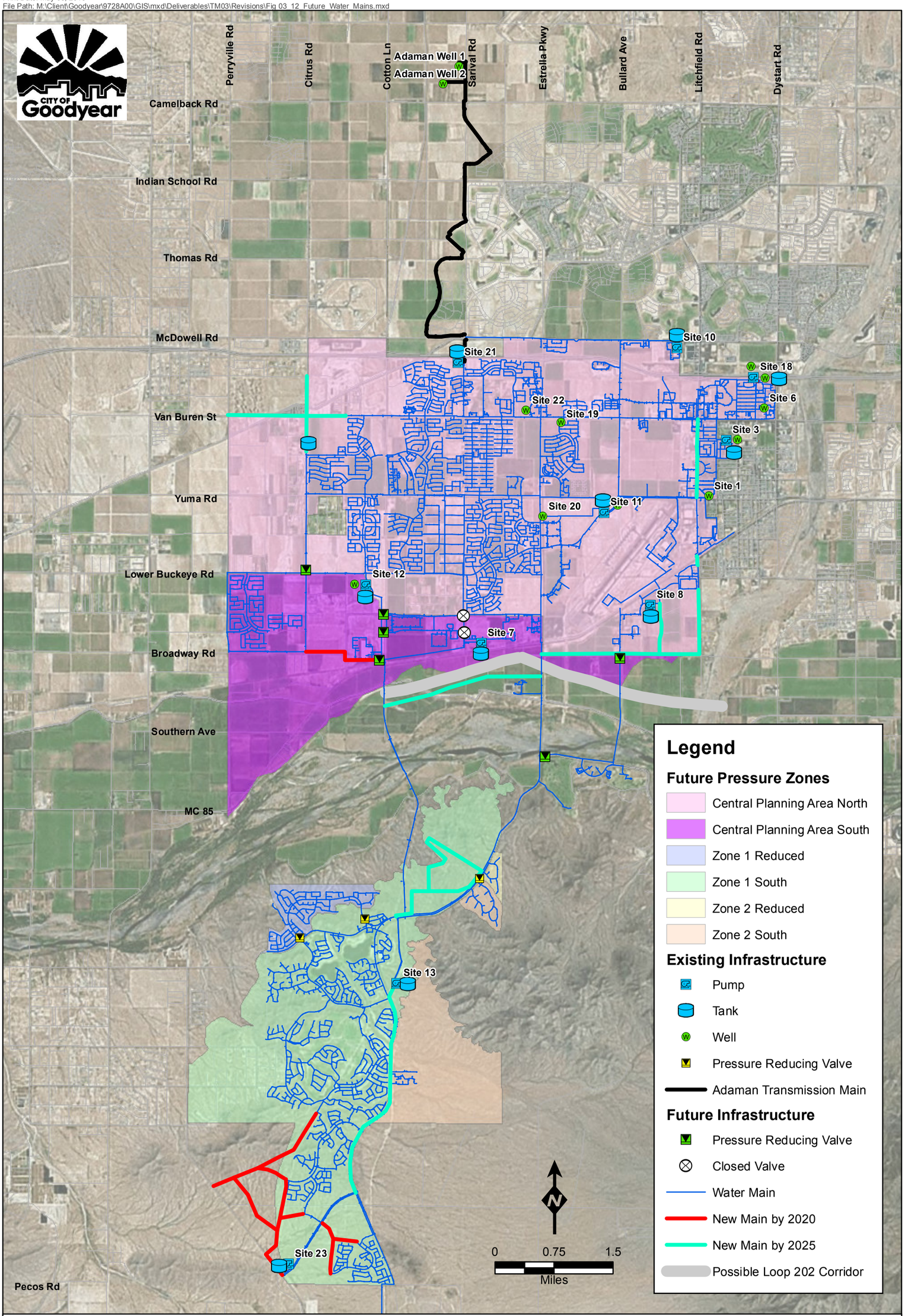

2025 WATER MAINS

FIGURE 3.12

CITY OF GOODYEAR
2016 INTEGRATED WATER MASTER PLAN

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3.6.5 Distribution System Repair and Replacement Requirements

As components in the distribution system age, it will be increasingly important for the City to proactively manage their water system assets to maintain system reliability and to maximize the service life of pumps, valves and other mechanical equipment. Many utilities are adopting distribution management, operation and maintenance (DMOM) programs to minimize risk associated with equipment failures, cross connections, back-flow, and to maintain adequate water quality at all times.

Drivers for such programs include regulatory compliance for current and potential future rules, protection of public health, and efficient operation of the distribution system including pressure management and minimizing risks associated with water storage facilities. The City engaged in Phase I of a water system asset management program with the 2016 IWMP. This task included an inventory of the existing system, site inspections of all water facilities and a desktop condition assessment. The Phase I recommendations included rehabilitation of several City wells and some components of the Bullard Water Campus.

As the City moves forward with this newly established Asset Management program the following steps are recommended:

1. Establish performance goals for chlorine residual, pressure management, main break frequency, water quality preservation, hydraulic reliability, and physical security.
2. Continue to meet current regulations and monitor proposed rules by USEPA and ADEQ to anticipate future requirements that the City may need to meet.
3. Document the City's practices and standard operating procedures (SOPs) for maintaining the distribution system and responding to emergencies.
4. Continue to allocate financial and man-power resources to sufficiently maintain and operate the distribution system.
5. Implement training for the City's water system operators using the City's asset inventory, performance goals, SOPs to reinforce the City's approach to distribution system management and performance expectations.
6. Develop a risk-based condition assessment approach to identify water mains that need replacement. Coordinate water main replacement activities with streets department capital improvement projects when possible.
7. Maintain a cross-connection control program to protect public health.
8. Maintain a water loss control program to track revenue and non-revenue water to make certain the City's non-revenue water stays within an acceptable range (generally less than 10 percent per ADWR rules).

9. Maintain a water meter replacement program to reduce the risk of lost revenue due to malfunctioning meters.
10. Maintain a program to exercise valves and fire hydrants.
11. Monitor water age in the distribution system particularly when surface water sources are blended with groundwater in the future. System flushing may be necessary to maintain water quality during low demand times.
12. Maintain a public notification program to inform the public about issues related to distribution system operations (i.e., system flushing).

3.7 INFRASTRUCTURE PLAN 2026 TO BUILDOUT

This section of the water master plan describes water supply and transmission system infrastructure that would be constructed after 2025. The purpose of this section is twofold:

1. Identify the known water supplies that could be obtained to serve the City and show how these water supplies could be connected into the water distribution system.
2. Provide a conceptual layout of the transmission systems that serve the City so that developers will know how to connect distribution system piping into the City's water supply system.

Although construction of water supply systems described in this section may not occur in the next ten years, land and water purchases, legal work, planning, and some design work will need to be accomplished within the next ten years. Planning level costs are provided for some water supply alternatives to give a relative comparison between alternatives. When these alternatives become better defined, further refinement of these costs can be accomplished prior to adding these costs to a CIP.

The future water demands in each water planning area that will be served are summarized in this section. The aggressive conservation described in the water resources section is assumed for the water infrastructure that is planned. If the planned level of water conservation is not achieved, then either water supply infrastructure requirements will be greater, or the population that can be served will decrease.

The infrastructure and costs for water supply options that are described in this section apply to water supply alternatives whose viability still needs to be proven through additional investigations. To supply the 760,000 people that the 2025 General Plan indicates may reside in Goodyear by buildout, the alternatives will need to be proven, and the costs to supply water will be the sum of the viable alternatives. The costs for water supply will also change if conservation goals are not reached or if the reclaimed water potential is not fully achieved. Going forward, the City should align development and growth expectations with the water supplies that will be needed to serve City water customers.

3.7.1 Projected Water Demands

3.7.1.1 WPA 2

Assuming aggressive water conservation, the buildout average daily water demand for WPA 2 could reach as high as 23.1 mgd if development occurs in all land areas planned for development. Table 3.20 summarizes the projected buildout average daily and maximum daily water demands by Entitlement Level for WPA 2. Water supplies must be able to meet the maximum daily demand conditions, which are estimated to be 1.7 times the average daily demand. A reduction in outdoor water use could reduce the average day to maximum day peaking factor. Once the City's SCADA system is operational, it will be possible to determine if a lower peaking factor would be more appropriate.

Table 3.20 Buildout Water Demands by Entitlement Level - WPA 2
2016 Integrated Water Master Plan
City of Goodyear

Entitlement Level	Water Demand Without Conservation (1) (mgd)		Water Demand With Conservation (2) (mgd)	
	ADD	MDD (3)	ADD	MDD (1)(3)
1	18.9	32.1	15.3	26.0
1, 2	20.2	34.3	16.6	28.2
1, 2, 3	21.1	35.9	17.4	29.6
1, 2, 3, 4	27.9	47.4	23.1	39.3

Notes:
(1) 140 gpcd for residential use, 1,700 gpad for commercial use and 1,000 gpad for industrial use
(2) 100 gpcd for residential use, 1,700 gpad for commercial use and 1,000 gpad for industrial use
(3) ADD x 1.7

3.7.1.2 WPA 3

Assuming aggressive conservation, the buildout average daily water demand for WPA 3 could reach as high as 11.2 mgd if development occurs in all potentially developable areas. Table 3.21 summarizes the projected buildout average daily and maximum daily water demands by Entitlement Level for WPA 3. Water supplies must be able to meet the maximum daily demand conditions, which are estimated to be 1.7 times the average daily demand.

Table 3.21 Buildout Water Demands by Entitlement Level - WPA 3 2016 Integrated Water Master Plan City of Goodyear				
Entitlement Level	Water Demand Without Conservation (1) (mgd)		Water Demand With Conservation (2) (mgd)	
	ADD	MDD (3)	ADD	MDD (1)(3)
1	11.9	20.2	8.9	15.1
1, 2	12.3	20.9	9.2	15.6
1, 2, 3	12.7	21.6	9.5	16.2
1, 2, 3, 4	15.1	25.7	11.2	19.0

Notes:
(1) 140 gpcd for residential use, 1,700 gpad for commercial use and 1,000 gpad for industrial use
(2) 100 gpcd for residential use, 1,700 gpad for commercial use and 1,000 gpad for industrial use
(3) ADD x 1.7

3.7.1.3 WPA 4

There is currently no development in WPA 4 and no growth is projected in this water planning area in the next ten years. However, there are several known developments that are in various stages of planning including:

- Estrella Region 2
- Madiera
- Estrella Highlands
- Rainbow Valley
- McRae Holdings

Both Estrella Region 2 and Madiera are Newland developments and both have fully approved entitlements (Entitlement Level 1). The Newland developments in WPA 4 do not have an Assured Water Supply, rather the agreements with the City state that the developments will be covered under Goodyear's DAWS.

Estrella Highlands, Rainbow Valley and McRae Holdings do not hold development entitlements (Entitlement Level 3) but have submitted Analyses of Assured Water Supply to ADWR that have been approved, effectively reserving groundwater for use in these developments. The ADWR approval is good for ten years after which it can be renewed for another ten years if development has not yet occurred. If these approvals expire prior to 2025, the developments may approach the City sooner than later seeking to establish entitlement agreements.

Assuming aggressive conservation, the buildout average daily water demand for WPA 4 could be as high as 30.7 mgd if development occurs in all available areas. Table 3.22 summarizes the projected buildout average daily and maximum daily water demands by Entitlement Level for WPA 4. Water supplies must be able to meet the maximum daily demand conditions, which are estimated to be 1.7 times the average daily demand.

Table 3.22 Buildout Water Demands by Entitlement Level - WPA 4
2016 Integrated Water Master Plan
City of Goodyear

Entitlement Level	Water Demands Without Conservation (1) (mgd)		Water Demand With Conservation (2) (mgd)	
	ADD	MDD (3)	ADD	MDD (1)(3)
1	5.9	10.0	4.2	7.1
1, 2	29.0	49.3	20.3	34.5
1, 2, 3	35.7	60.7	25.0	42.5
1, 2, 3, 4	43.9	74.6	30.7	52.2

Notes:
(1) 140 gpcd for residential use, 1,700 gpad for commercial use and 1,000 gpad for industrial use
(2) 100 gpcd for residential use, 1,700 gpad for commercial use and 1,000 gpad for industrial use
(3) ADD x 1.7

3.7.1.4 WPA 5

Groundwater will likely be the initial source of supply and may end up being the primary source of supply for developments in WPA 5. Assuming aggressive conservation, the buildout average daily water demand for WPA 5 could be as high as 24.5 mgd if development occurs in all available areas. Table 3.23 summarizes the projected buildout average daily and maximum daily water demands by Entitlement Level for WPA 5. Water supplies must be able to meet the maximum daily demand conditions, which are estimated to be 1.7 times the average daily demand.

Table 3.23 Buildout Water Demands by Entitlement Level - WPA 5 2016 Integrated Water Master Plan City of Goodyear				
Entitlement Level	Water Demand Without Conservation (1) (mgd)		Water Demand With Conservation (2) (mgd)	
	ADD	MDD (3)	ADD	MDD (1)(3)
1	1.4	2.4	1.2	2.0
1, 2	18.7	31.8	13.5	23.0
1, 2, 3	23.9	40.6	17.2	29.2
1, 2, 3, 4	33.8	57.5	24.5	41.7

Notes:
(1) 140 gpcd for residential use, 1,700 gpad for commercial use and 1,000 gpad for industrial use
(2) 100 gpcd for residential use, 1,700 gpad for commercial use and 1,000 gpad for industrial use
(3) ADD x 1.7

3.7.2 Water Supply Alternatives

As the City continues to grow, new supplies will be needed in WPAs 2 - 5 to serve new customers. Physical supplies will likely be a combination of groundwater and surface water resources. The City aspires to grow to fill a large planning area, and providing water to serve customers is an essential part of fulfilling that vision. For the City to be in control of its destiny for water supply, it will need to begin transitioning to water supply strategies that work effectively for larger cities. Most of the larger Maricopa County cities that have CAP water have also constructed CAP water treatment plants. The major difference between Goodyear and these other communities is that Goodyear will need a longer pipeline to obtain access to the CAP water supply, although Gilbert and Chandler constructed a pipeline of a similar distance to obtain their CAP water supply.

The City can benefit from economies of scale with surface water treatment by considering ways to treat CAP water as well as potential canal water sources that run through the City in one facility. Well water that can reasonably be transported to such a treatment facility would also provide opportunities for blending and more economical treatment.

Water from new wells that the City may drill throughout its service area is expected to need treatment for arsenic, nitrates, and TDS. Wellhead treatment is expensive, so the City should plan regional well treatment facilities whenever possible to enable the City to benefit from economies of scale. Regional facilities also provide better opportunities for brine disposal.

The water supply strategies that provide good potential for the City are described in the following sections. Capital costs for the infrastructure needed for each option is provided at the end of the chapter with the other capital project costs, in Table 3.36 (page 3-84). The City will need to further investigate each alternative to establish the viability of that alternative.

In Section 3.6.1.7, five options were evaluated to enable the City to utilize 6.7 mgd of their current CAP water allocation. Options 1 and 2 involved purchasing capacity at the EPCOR White Tanks WTP and Options 3 through 5 involved building a new, City WTP. The following sections present the additional infrastructure needed for the City to utilize its full CAP water allocation of 17,742 AFY (15.8 mgd).

Option 1, wheeling water through the EPCOR distribution system, was not carried forth in this analysis because it was determined that this would provide temporary capacity only.

3.7.2.1 Option 2 Partner with EPCOR and Construct a Dedicated Water Transmission Main to Silva Site

The EPCOR White Tanks Plant is located adjacent to the Beardsley Canal on Cactus Road. Goodyear's preliminary agreement with EPCOR to negotiate on participation at the plant demonstrates that the City will have the capacity to use the physical CAP supplies it owns, as was required for its most recent DAWS to ADWR. This shows a good faith effort to ADWR that Goodyear is working towards obtaining a physical CAP water supply.

If Goodyear were to get water from EPCOR, the White Tanks plant would need to be expanded to treat water for Goodyear. A pipeline would need to be constructed from the White Tanks plant to a point of delivery in Goodyear. Negotiations on water quality and cost would need to be made. Goodyear faces the following challenges associated with purchasing water treatment and delivery services from EPCOR:

1. EPCOR is offering terms for water delivery based on a cost per unit of water plus $30M for capacity ownership in the plant. No ownership of physical infrastructure in the White Tanks plant or a pipeline to Goodyear is available. EPCOR will legitimately expect to turn a profit that would be a cost in addition to the cost of constructing infrastructure and delivering water. Goodyear customers will then need to make a large investment in infrastructure that it will not own.
2. The White Tanks treatment plant is located twelve miles from the Goodyear City boundary. Water from the plant will need to travel south from the point of entry up to another twelve - fifteen miles to the point of use. The travel time from treatment to delivery will likely cause higher DBPs in the distribution system. It is possible to reduce the potential for DBP levels by using GAC at the plant. However, this is an expensive process and could create challenges with other EPCOR customers close to the plant that may not need and therefore would not want to pay for GAC treatment. Goodyear will likely need to manage higher DBP levels than if treatment occurred within the City.
3. Goodyear will be dependent upon a third party for the single largest water supply in the City. This opens the potential for contractual risks associated with this water supply. Although it is common for cities to make agreements together related to the delivery of water, over time conditions, relationships, and business drivers can change, so an acceptable contractual arrangement today may not be desirable at

some time into the future. With a large investment in infrastructure that it would not own, and a high level of dependency on water from this arrangement, Goodyear should carefully evaluate terms of third party agreements.

3.7.2.1.1 White Tanks Treatment and Delivery Infrastructure

If the City chose to take water from the White Tanks plant, water could be conveyed by gravity to Goodyear because the elevation of the White Tanks WTP is approximately 1320 feet and the elevation of northwest Goodyear is approximately 990 feet.

The pipeline from the White Tanks plant to Goodyear would need to be sized appropriately for the flows that Goodyear would need. However, as flows would likely be lower during the initial years of operation, DBP formation would be a challenge in the pipeline with low water velocities.

To adjust PH levels, re-chlorinate, manage DBP levels, and control distribution system operation, the City would want water from the White Tanks plant to be delivered to a site with storage, re-treatment, and a pump station to deliver water into the distribution system. The City would need to find a site for these facilities, which could include the Silva site, although additional land may need to be purchased at this site. Blending well water with the CAP water would also be a benefit provided by this site.

3.7.2.1.2 Feasibility of Water Purchase from EPCOR

The City should address the following issues in evaluating the option to purchase water treatment and transmission services from EPCOR:

1. Determine the water quality performance guarantees that will be provided to Goodyear, measured at the point of delivery. Determine the remedies in the event of a failure to deliver.
2. Determine the costs of bulk water delivery and how these costs may change over time.

3.7.2.1.3 Option 2 Water Supply Costs

The full costs of water delivery from the White Tanks plant would need to be negotiated with EPCOR. Currently, it is understood that treatment costs for 6.7 mgd of capacity are $30 M ($4.50 per gallon of capacity).

The opinion of probable project costs for 16 mgd of capacity at the White Tanks Plant is $72,000,000 plus the cost of transportation infrastructure. If the City intends to pursue this option, a 30-inch pipeline rather than a 24-inch pipeline is recommended to accommodate the City's full CAP allocation. This would increase the first phase cost by approximately $4.2 M. Appendix B contains itemized costs for Option 2 at 16 mgd of capacity.

3.7.2.2 Option 3 - Construct a new WTP with a transmission main from the Beardsley Canal to a Goodyear Water Campus

One of the City's aspirations is to be in control of their own destiny from a water supply perspective. One way to help achieve this is for the City to construct infrastructure to obtain, treat, and deliver CAP water. The City's current CAP allocation includes an M&I allocation of 10,742 AFY and a 7,000 AFY GRIC lease for a total of 17,742 AFY (15.8) mgd. CAP water will likely be the largest single water supply for the City, so the City should own and operate this infrastructure. Treatment facilities can be located to provide additional water supply benefits beyond just the CAP water.

The Beardsley Canal takes CAP water just downstream from Lake Pleasant and delivers water to farmers that irrigate lands between Lake Pleasant and Goodyear, as well as to the White Tanks WTP owned by EPCOR. The operating portion of the canal extends south/southwest of the White Tanks WTP to Indian School Road. Over time, development is expected to reduce the irrigation demand, freeing up canal capacity for municipal water uses. If a turnout from the canal could be constructed near Indian School Road, then the pipeline length would be shorter than a similar pipeline from the White Tanks WTP.

The location of the City's water treatment plant is important to maximize the benefits of the supplies potentially available to Goodyear. The plant would require about 20 acres, depending on the ultimate plant capacity. If a water campus were sited adjacent to the Goodyear WRF, it could provide the following benefits:

1. Treated potable water would have a shorter distance to travel to WPA 3 and WPA 4, which would reduce the level of disinfection byproducts.
2. The technology is available today for direct potable reuse. The legal framework for direct potable reuse is expected to be in place in Arizona long before the City will have exhausted other water supply options. By placing a potable water treatment facility in the vicinity of a water reclamation facility, the City has the option to implement direct potable reuse if it chooses to do so at some future time.
3. The Buckeye Canal is nearby, so if water from this canal could be obtained, it would be a convenient location to treat this water as well.
4. If the City was able to obtain water from the Harquahala groundwater basin either delivered through a pipeline or an in lieu exchange with another water provider, this water could also be delivered to this location for treatment.
5. Wells drilled within a couple miles of this site could pump water here for treatment or blending.

3.7.2.2.1 CAP Water Treatment and Delivery Infrastructure

Figure 3.3 shows a potential canal turnout location and a pipe alignment to a potential water campus site location. At this possible turnout location, the ground elevation is approximately 1200 feet so a low-head pump station would be needed only to lift water out of the canal

and to control the flow. Water would flow primarily by gravity to Goodyear to any of the potential plant sites. A 30-inch water transmission main would be required to transport the City's full CAP allocation without seasonal peaking. For this cost analysis, it was assumed that the City's current allocation of 15.8 mgd would be the maximum amount of water that could be treated and delivered in any month, so the costs are based on a 30-inch pipeline. The City could build in the extra capacity to receive 1.32 times the average annual allocation in a given month, or 20.9 mgd (15.8 mgd x 1.32); however, it would require a 36-inch main and an additional 5 mgd of treatment capacity. For all options, seasonal peaking is assumed to be addressed with Goodyear's wells.

A conventional water treatment plant is recommended if the City intends to treat its full CAP allocation. Goodyear would have a treatment plant size similar to the Greenway plant in Peoria. The treatment plant can be constructed in multiple phases. A treatment plant should include the capability to adjust PH of the water to avoid water discoloration associated with introducing surface water into a water distribution system that has been served exclusively with well water. Blending the surface water with well water may also help to improve water taste and color. The City should consider drilling wells within a couple miles of a surface water plant to provide some well water for mixing.

Pumping raw water to a treatment site within the City reduces potential DBP and chlorine residual problems associated with greater water age when compared with a remote water treatment plant that then pumps treated water to the City. A local treatment plant also provides Goodyear with the ability to manage and optimize treatment processes to achieve water quality suitable for blending with groundwater sources.

3.7.2.2.2 Feasibility Planning for a CAP Treatment Plant with a Turnout on the Beardsley Canal

The following issues would need to be addressed before designing a pipeline and treatment plant:

1. Make legal arrangements with the MWD to transport water in the Beardsley Canal.
2. Complete a pipeline corridor study to identify a pipeline route, including an I-10 Freeway crossing.

3.7.2.2.3 Option 3 Water Supply Costs

Water from a new treatment plant in Goodyear would deliver water into the WPA 2 water distribution system, and water would also be transported south to WPA 3 and WPA 4 The opinion of probable project costs for a 16 mgd of capacity Goodyear WTP with supplies from the Beardsley Canal is $158,251,000. If the City intends to pursue this option, a 30-inch pipeline is recommended to accommodate the City's full CAP allocation. Table 3.36 at the end of Chapter 3 contains itemized costs for Option 3 at 16 mgd of capacity.

3.7.2.3 Option 4 - Construct a New WTP with a Transmission Main from the Beardsley Canal to the Silva Site

This option is similar to Option 3 except that the location of the WTP is in northwest Goodyear at the Silva Site. The water quality, canal capacity, turnout location, and raw water transmission pipeline would also be the same except the pipeline would be about 5 miles shorter. The City would also need to purchase additional land adjacent to the Silva Site to accommodate a 16-mgd plant.

3.7.2.3.1 Option 4 Water Supply Costs

The opinion of probable project costs for a 16-mgd Goodyear WTP at the Silva Site with supplies from the Beardsley Canal is $148290,000. If the City intends to transport 16 mgd, a 30-inch pipeline is recommended to transport the City's full CAP allocation. Table 3.36 at the end of Chapter 3 contains costs of Option 4 at 16 mgd of capacity.

3.7.2.4 Option 5 - Construct a new WTP with a transmission main from the SRP system to a Goodyear Water Campus

This option is similar to Option 3 except that the water source would be from the SRP canal and conveyance systems. Source water from the SRP system is expected to have less turbidity than water coming from the Beardsley Canal. This would potentially result in cost savings by reducing or eliminating the need for pretreatment. In this option, the location of the WTP is adjacent to the Goodyear WRF, which provides the same benefits as Option 3 with providing a finished water source closer to the distribution system in WPA 2, WPA 3, and WPA 4.

3.7.2.4.1 Feasibility Planning for a CAP Treatment Plant with a Turnout on the SRP System

The following issues would need to be addressed before designing a pipeline and treatment plant:

1. Make legal arrangements with SRP to transport water through the SRP canal system.
2. Identify a location to take water from the SRP canal (potentially near the Broadway Road alignment).
3. Complete a pipeline corridor study to identify a pipeline route, including crossing the Agua Fria River.

3.7.2.4.2 Option 5 Water Supply Costs

The opinion of probable project costs for a 16-mgd Goodyear WTP near the Goodyear WRF with supplies from the SRP system is $143,397,000. If the City intends to transport 16 mgd, a 30-inch pipeline is recommended to transport the City's full CAP allocation. Table 3.36 at the end of Chapter 3 contains itemized costs for Option 5 at 16 mgd of capacity.

3.7.2.5 Obtain Buckeye Irrigation District Canal Water

The City may be able to acquire BID water in WPA 2 that could be delivered to planning areas WPA 2, WPA 3, and WPA 4 for distribution. The legal framework to do so would need to be established. There are approximately 7,500 acres of irrigated land in Goodyear's WPA 2 that are being irrigated. If these land areas were receiving 3 AF/acre then there would be approximately 22,500 AF of water that could be made available. One way to use this water would be to treat the surface or reclaimed water portions to A+ standards and deliver it to WPA 4 for recharge. However, in the future DPR may become legal in Arizona, and when this time comes it would be best to treat this canal water to potable standards for delivery into the distribution system. Groundwater portions of this water cannot be recharged to obtain groundwater credits. A more promising approach to use this water would be to treat the water to potable standards and deliver this water into the distribution system after it becomes legal in Arizona to have DPR. The water treatment plant at a Goodyear water campus as discussed above for CAP water could be expanded to treat this water. There is no way to store this water for seasonal water demand variations, so Goodyear would need to base load this water source and use wells and CAP water for seasonal peaking. Goodyear could recharge the surface and reclaimed water portions of this treated water if ADWR determined it was possible to do so.

3.7.2.5.1 Water Treatment and Delivery Infrastructure

The infrastructure needed to use Buckeye Canal water is as follows:

1. A pump forebay and pump station would be needed on each canal to remove water from the canal.
2. A pipeline from the canal pump station to the Goodyear water campus would need to be constructed.
3. Water treatment capacity would need to be added at the water campus.
4. Water storage and pumping capacity would need to be constructed to deliver water into the distribution system.

3.7.2.5.2 Issues to Address

The following issues would need to be investigated and resolved with a positive outcome to use Buckeye Canal water:

1. Determine the legal framework under which irrigation water ownership could be purchased, and this legal framework may be unique to the Buckeye Canal. Work with other communities, the irrigation districts, and ADWR to establish a legal framework for using irrigation district water.
2. Address any regulatory issues associated with ADWR regarding water in these two canals that would need to be overcome to use this water in the manner intended.

3. Determine if the reclaimed water from Phoenix water reclamation plants retains its reclaimed water status. Use of this water for potable use would occur only when Arizona laws change to allow reclaimed water to be treated for potable use.

4. Determine any contaminants that are in this canal water that would require additional treatment.

5. Determine the amount of water that could become available from this canal and the cost of wheeling water through the canal.

3.7.2.5.3 Infrastructure Costs

Table 3.24 lists the planning level infrastructure costs to obtain Buckeye Canal irrigation water.

Table 3.24 Water and Infrastructure Costs for BID Canal Water
2016 Integrated Water Master Plan
City of Goodyear

Item	Size	Length	Project Cost
BID Canal intake structure			$1,900,000
Pump station at BID Canal	10 mgd		$4,800,000
Water transmission main from BID to proposed Goodyear water campus (1)	24 inch	0.3 miles	$700,000
BID Canal water treatment	8 mgd		$38,200,000
Pump station to distribution - BID Canal	15 mgd		$6,200,000
		Total	**$51,800,000**

Note:
(1) Goodyear water campus as proposed would be located adjacent to the existing Goodyear WRF on 157th Avenue, north of the Gila River.

3.7.2.6 Harquahala Well Field Development

The Harquahala groundwater basin is located about 40 miles west of Goodyear. If the farmland in this groundwater basin were to be retired, groundwater could be pumped from wells and delivered through a transmission system to the Goodyear water campus for treatment and delivery into the Goodyear distribution system.

3.7.2.6.1 Issues to Address

The following issues need to be addressed to obtain Harquahala water:

1. Negotiate agreements with land owners for purchase or lease of this water. Determine legal arrangements needed to take this groundwater and move it across groundwater basins.

2. Determine water treatment that would be required.

3. Conduct planning studies to identify well locations and pipeline corridors.

4. Identify, purchase land that could be used for pumping, storage facilities.

3.7.2.6.2 Infrastructure Costs

Table 3.25 lists the infrastructure and cost requirements for Harquahala water to be delivered to Goodyear.

Table 3.25 Harquahala Water Supply Infrastructure Requirements
2016 Integrated Water Master Plan
City of Goodyear

Item	No.	Size	Length	Project Cost
Wells	39	1,200 gpm		$109,200,000
Land for wells, storage, pumping	39 acres			$2,000,000
Well transmission mains		12 in	40 miles	$51,500,000
Operational storage in Harquahala	1	5 MG		$10,100,000
Pump station in Harquahala	1	25 mgd		$8,000,000
Water transmission main from Harquahala to Goodyear water campus	1	42 in	44.2 miles	$136,200,000
Arsenic, nitrate, TDS treatment	1	22 mgd		$66,000,000
Pumping into distribution system	1	36 mgd		$10,000,000
Water cost	25,000 AFY			$100,000,000
			Total	**$492,200,000**

3.7.2.7 Wheel CAP Water through Maricopa Stanfield Irrigation District

WPA 5 is far from the other water supply sources that are being considered for Goodyear so there may be other water supply and delivery options to serve WPA 5 that would be less expensive for Goodyear. One option would be to explore the possibility of wheeling the water farther down the CAP Canal to the Santa Rosa Canal, and then to the Maricopa Stanfield Irrigation District (MSIDD) Canal. Then a pump station could be located along the canal and a pipeline would take the water to WPA 5. This water could initially be recharged for groundwater credits, but the City would ultimately want to construct a surface water treatment plant in WPA 5.

The City's current CAP water allocation is already being planned for treatment at the Goodyear water campus. However, if efforts to obtain BID water, as well as Harquahala water are successful, then CAP water may be freed up for use in WPA 5. If the City were able to acquire NIA CAP water, this water could also be used to serve development in WPA 5.

3.7.2.7.1 Issues to Address

The following issues would need to be investigated and proven viable before water could be wheeled to Goodyear via the Maricopa Stanfield Canal:

1. What legal constraints would need to be overcome to wheel water through the Maricopa Stanfield Canal system?
2. What arrangements would the Maricopa Stanfield Irrigation and Drainage Company need to be able to agree to wheel water to Goodyear?
3. What CAP or other water rights could be purchased or leased for this water supply option?

3.7.2.7.2 Infrastructure Costs

The infrastructure required to deliver water to WPA 5 via the Maricopa Stanfield Canal is shown in Table 3.26.

Table 3.26 Infrastructure and Costs to Deliver CAP Water to WPA 5 Via the Maricopa Stanfield Canals
2016 Integrated Water Master Plan
City of Goodyear

Item	Size	Length	Project Cost
Water Transmission Main from Maricopa-Stanfield to Goodyear Water Campus	30 inch	13 miles	$30,800,000
Pump Station at Maricopa Stanfield	15 mgd		$6,200,000
Land for Treatment Facilities	20 Acres		$1,000,000
CAP Water Treatment - Phase I	6 mgd		$45,000,000
CAP Water Treatment - Phase II	6 mgd		$45,000,000
Storage - Phase I	3 MG		$7,200,000
Storage - Phase II	3 MG		$7,200,000
Pump Station to Distribution - Phase I	10 mgd		$4,800,000
Pump Station to Distribution - Phase II	10 mgd		$4,800,000
		Total	**$152,000,000**

3.7.2.8 Future Well Development in WPA 2

Additional groundwater will still be needed to meet maximum daily demands in WPA 2 and WPA 3 at buildout. The physical groundwater supply that Goodyear is entitled to in the WSRV groundwater sub-basin (WPA 2 and WPA 3) is 13,191 AFY. Current groundwater firm production capability is about 9,634 AFY (8.6 mgd), assuming continuous well operation and wells out of service for redundancy. Future well supplies will be needed to meet maximum day demands with the largest well out of service.

Groundwater production in WPA 2 is used to meet demands in WPA 3 because most of the development in WPA 3 is located in hard rock areas where groundwater production is not feasible. Meeting demands in WPA 2 with CAP water would allow excess groundwater production to go south to WPA 3.

In addition to supplying water demand, wells will be needed to supply peak flows that may not be supplied by CAP or other water sources. Table 3.27 summarizes the WPA 2 and WPA 3 maximum day demands and supplies. An additional 10,000 AFY GRIC lease would help the City to meet maximum day demands, but additional supplies would be needed. Wells can provide the additional maximum day demands for each entitlement level except Level 4. The limitation in well pumping capability is likely to be the number of available locations in WPA 2 to drill a well. Meeting Level 4 maximum day demands would require an additional water supply, or a reduction in maximum daily demand peaking factor. A reduction in the maximum day demand peaking factor is likely with successfully implemented conservation measures.

Up to 6 new wells with 11.1 mgd of capacity are recommended by planning year 2020. These wells are in addition to the wells recommended in the 5-year rate study to serve existing customers. These wells would count towards the capacity required to meet the maximum day demands.

Table 3.27 WPA 2 and WPA 3 Water Supply Requirements at Buildout 2016 Integrated Water Master Plan City of Goodyear				
Description	**Supply/Demand (mgd)**			
	Level 1	**Level 2**	**Level 3**	**Level 4**
WPA 2 and WPA 3 Maximum Day Demand	**41.2**	**43.9**	**45.6**	**58.3**
Existing CAP (17,742 AFY) (1)	20.9	20.9	20.9	20.9
Existing Groundwater Supply	8.6	8.6	8.6	8.6
Subtotal Existing Supplies	**29.5**	**29.5**	**29.5**	**29.5**
Supply Surplus / (Deficit)	(-11.7)	(-14.4)	(-16.1)	(-28.8)
Future 10,000 AFY CAP Lease (1)(2)	11.8	11.8	11.8	11.8
Well Capacity Recommended by 2025	11.1	11.1	11.1	11.1
Water Supply Capacity for WPA 2 and WPA 3 that can serve WPA 4	11.2	8.5	6.8	-5.9

Notes:

(1) Based on 11% of the Annual allocation available in a given month. For example: 17,742 AF x 11% = 1,952 AF 1 MG = 3.07 AF, therefore 1,952 AF / 3.07 AF = 636 MG / 30.4 days per month = 20.9 mgd.

(2) If additional CAP lease is not obtained, maximum day supply deficits will need to be made up with other supplies, reduced demands, or a reduced maximum daily peaking factor

3.7.2.9 Future Well Development in WPA 4

ADWR will allow the City to develop a well field in Rainbow Valley provided that this water only serves customers in WPA 3 and WPA 4 and not customers in WPA 2. Wells in Rainbow Valley could provide a portion of the new supply needed by 2020 for demands in WPA 3.

Water supplies for WPA 4 will include both water from the Goodyear Water Campus treatment plant, and wells located in WPA 4. Surface water supplies are preferred to avoid issues associated with brine disposal. Initial development in WPA 4 will likely be satellite systems served by wells. The Rainbow Valley (RV) groundwater sub-basin has limited renewable groundwater resources through incidental and natural recharge, so most of the water taken from this basin will need to be physically replenished through recharge. Table 3.28 shows the number of wells that would be required if wells were the only supply. Depending on the average well capacity, up to 44 wells would be required by buildout. Without imported supplies, it may be difficult, if not impractical, to site up to 44 wells in WPA 4. In addition, wells that require RO treatment will generate a brine stream that will be disposed of through evaporation ponds. Even though there is not currently a good way to dispose of brine streams other than evaporation ponds or dilution through blending with wastewater streams, new technology could improve options available to the City at a future date.

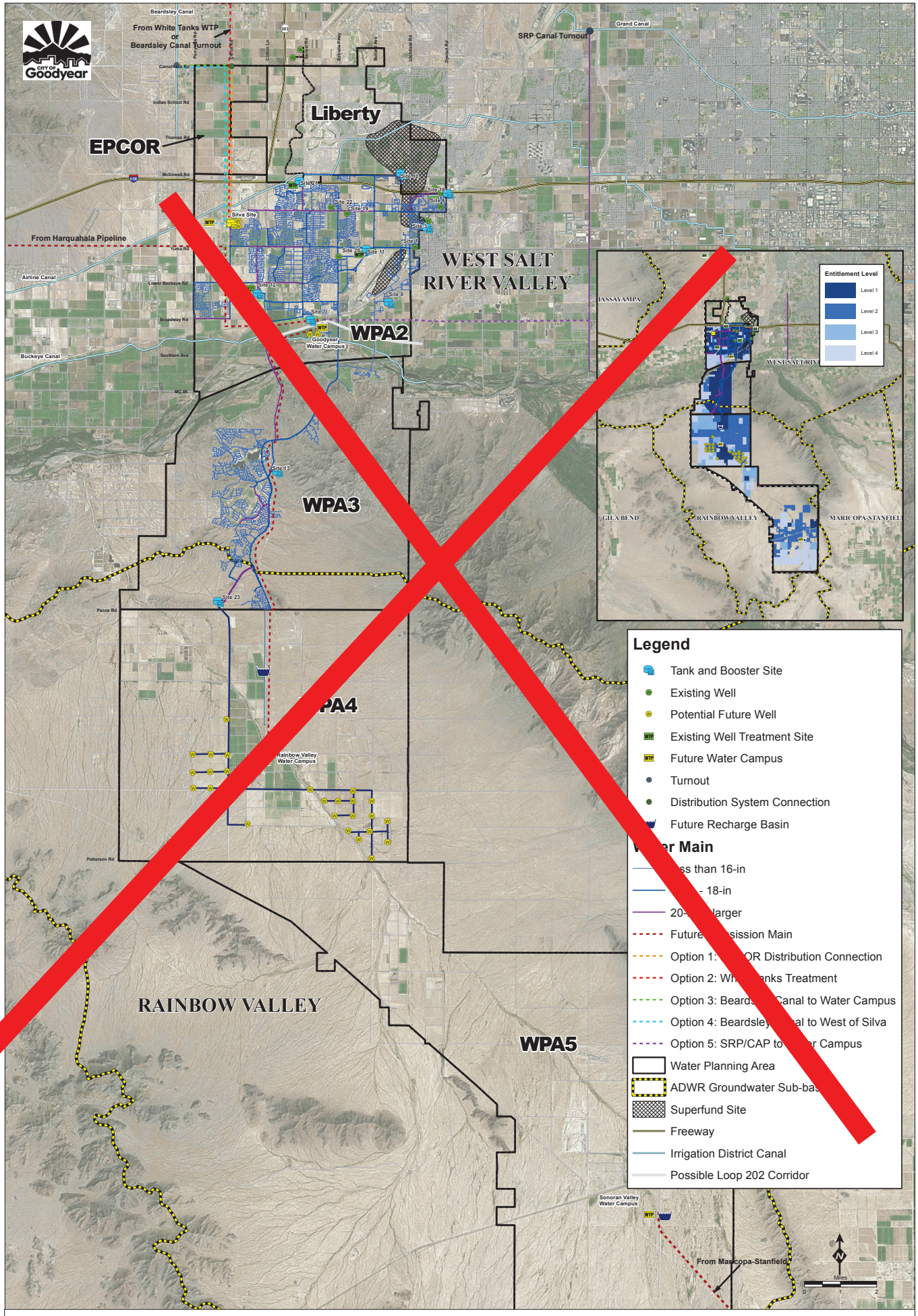
Table 3.28 WPA 4 Water Supply Requirements at Buildout 2016 Integrated Water Master Plan City of Goodyear				
Description	Supply/Demand (mgd)			
	Level 1	Level 2	Level 3	Level 4
WPA 4 Maximum Daily Demand	**9.7**	**47.8**	**59.0**	**72.4**
Wells Needed at 1,600 gpm per well (1)	6	22	27	33
Wells Needed at 1,200 gpm per well (1)	7	29	36	44
Note: (1) 1,600 gpm = 2.3 mgd, 1,200 gpm = 1.7 mgd. Includes one additional well for redundancy.				

As the land area develops, it will be better to import surface water supplies to avoid the need to find locations for so many wells. If the City is able to obtain some water from the Buckeye Canal then this would further reduce the number of wells required to serve the area. Figure 3.13 shows the water transmission system that will be used to deliver water from the Water Campus to WPA 4.

A conceptual layout of new well supplies is also shown in Figure 3.13. Twenty-six potential well sites are shown throughout the southern area of WPA 4 based on an analysis conducted by HSI, Inc. for the Newland development group in 2007. The southern area of WPA 4 was chosen for future water production because it is believed that the water quality here is better than in the northern area of WPA 4. Groundwater treatment will still likely be needed and a centralized treatment facility located on the northwestern area of the Madiera development may be a favorable location for not only water production but for wastewater treatment and reclaimed water recharge. A Rainbow Valley water campus in WPA 4 would reduce costs by centralizing treatment operations. Recharge facilities will need to be sited to provide the annual storage and recovery that will be needed to physically replenish the groundwater that will be pumped.

3.7.2.10 WPA 5 Well Development

WPA 5 is geographically isolated from WPA 2 - 4 and will likely be established as a satellite service area. Wells will be required to serve initial development in WPA 5 and may eventually be supplemented by CAP water wheeled through the Maricopa Stanfield Irrigation District Canals.



CITY OF GOODYEAR WATER INFRASTRUCTURE PLAN

FIGURE 3.13

CITY OF GOODYEAR

2016 INTEGRATED WATER MASTER PLAN

carollo

If wells are relied on to meet all of the projected maximum day demands in WPA 5, as many as 34 future production wells may be required. The ultimate number of wells for WPA 5 will be dictated by physical availability as determined by ADWR. Annual storage and recovery (surface or reclaimed water) within WPA 5 will provide the largest amount of groundwater production.

The number of wells needed to meet maximum day demands in WPA 5 is dependent on the production capacity of the wells. Table 3.29 shows the number of estimated wells needed assuming a range of 1,200 - 1,600 gpm (1.7 - 2.3 mgd) production capacity per well.

Table 3.29 WPA 5 Water Supply Requirements at Buildout
2016 Integrated Water Master Plan
City of Goodyear

Description	Supply/Demand (mgd)			
	Level 1	Level 2	Level 3	Level 4
WPA 5 Maximum Daily Demand	**2.4**	**30.9**	**39.6**	**55.9**
Wells Needed at 1,600 gpm per well (1)	2	15	19	26
Wells Needed at 1,200 gpm per well (1)	3	20	25	34

Note:
(1) 1,600 gpm = 2.3 mgd, 1,200 gpm = 1.7 mgd. Includes one additional well for redundancy.

A well siting study would be needed to determine favorable locations for groundwater production, water quality conditions, and treatment requirements. It is highly likely that these wells will require a similar level of treatment as the City's existing wells and that brine disposal will also be required.

It may not be feasible to install 34 production wells in WPA 5. If the City was able to obtain sufficient CAP water rights, a surface water treatment plant with water wheeled through the Santa Rosa and Maricopa Stanfield Irrigation District Canals might become a more feasible option than many wells.

3.7.2.11 Regional Water Supply Partnerships

Goodyear may be able to partner with other West Valley Cities to identify and develop an additional water supply to serve the City. The timing, costs, and potential benefits of a regional partnership are not quantifiable at this time, but the City should continue to work through WestCAPS or other organizations to find a solution West Valley water supply challenges.

3.7.3 Water Supplies for Drought

Surface water supplies have an important difference from groundwater supplies because surface water supplies can be reduced during times of drought. During times of drought, water demands can be curtailed so when planning drought contingencies it is prudent to plan infrastructure to supply only average day demands with alternative supplies when surface water supplies are reduced.

The consequences of a 30 percent or 50 percent drought on the CAP supply will affect WPA 2 and WPA 3 directly. Table 3.30 summarizes the water supply strategy for WPA 2 and WPA 3 by Entitlement Level for the moderate drought scenario and Table 3.31 summarizes the water supply strategy for the severe drought scenario. Average day demands can be met for both drought scenarios for WPA 2 assuming an additional CAP lease is acquired. The wells that need to be in place to supply peak demand conditions for normal water years are sufficient to meet average day demand conditions for drought years.

Table 3.30 WPA 2 and WPA 3 Water Supply Strategy for Moderate Drought at Buildout
2016 Integrated Water Master Plan
City of Goodyear

Description	Supply/Demand (mgd)			
	Level 1	**Level 2**	**Level 3**	**Level 4**
WPA 2 and WPA 3 Average Daily Demand	**24.2**	**25.8**	**26.8**	**34.3**
30% Reduced CAP (12,419 AFY) (1)	14.6	14.6	14.6	14.6
Existing Groundwater Supply	8.6	8.6	8.6	8.6
30% Reduced Future 10,000-AFY CAP Water Lease (1)(2) (7,000 AFY)	8.3	8.3	8.3	8.3
Well capacity recommended by 2025	11.1	11.1	11.1	11.1
Subtotal Future Supplies	***42.6***	***42.6***	***42.6***	***42.6***
Surplus / (Deficit)	18.4	16.8	15.8	8.3

Notes:
(1) Based on 11% of the Annual allocation available in a given month. For example: 17,742 AF x 11% = 1,952 AF 1 MG = 3.07 AF, therefore 1,952 AF / 3.07 AF = 636 MG / 30.4 days per month = 20.9 mgd x 70% = 14.6 mgd.
(2) If CAP lease is not obtained, supply deficits will need to be made up with additional groundwater.

Table 3.31 WPA 2 and WPA 3 Water Supply Strategy for Severe Drought at Buildout
2016 Integrated Water Master Plan
City of Goodyear

Description	Supply/Demand (mgd)			
	Level 1	Level 2	Level 3	Level 4
WPA 2 and WPA 3 Average Daily Demand	**24.2**	**25.8**	**26.8**	**34.3**
50% Reduced CAP (17,742 AFY) (1)	10.5	10.5	10.5	10.5
Existing Groundwater Supply	8.6	8.6	8.6	8.6
50% Reduced Future 10,000-AFY CAP Water Lease (1)(2)	5.9	5.9	5.9	5.9
Well capacity recommended by 2025	11.1	11.1	11.1	11.1
Subtotal Future Supplies	***36.1***	***36.1***	***36.1***	***36.1***
Surplus / (Deficit)	11.9	10.3	9.3	1.8

Notes:
(1) Based on 11% of the Annual allocation available in a given month. For example: 17,742 AF x 11% = 1,952 AF 1 MG = 3.07 AF, therefore 1,952 AF / 3.07 AF = 636 MG / 30.4 days per month = 20.9 mgd x 50% = 10.5 mgd.
(2) If CAP lease is not obtained, supply deficits will need to be made up with additional groundwater.

3.7.4 Well Production and Brine Management

Brine concentrate management will be an issue that the City will increasingly need to address as it constructs wells that require RO treatment. Currently the City places the RO waste stream into the collection system, essentially diluting the stream, but increasing the overall salinity of the reclaimed water coming from the Goodyear WRF. Salinity levels of Goodyear's reclaimed water have reached levels that have started to cause concern for the use of this water for irrigation. Goodyear is undertaking a project to recharge reclaimed water, so these salts will be placed back in the ground and will ultimately increase salinity levels in potable water wells. As technologies improve, Goodyear will probably want to reduce the salinity levels of reclaimed water that is recharged so that the salinity of the City's wells does not increase.

There are proven technologies available today to manage RO waste streams, and this is an area where technology continues to develop. When Goodyear needs to manage RO waste streams in the future, the City will most likely benefit from technologies that are not commercially available today. For the water supply and reclaimed water planning in this master plan, we have assumed a waste stream of 15-20 percent for new wells, which is consistent with Goodyear's current experience with RO waste streams. In the future with different or additional technology, it may be possible to reduce this waste stream flow to 7-10 percent or even 3-5 percent of new well pumping capacity.

The following are technologies that are currently available to manage RO waste streams:

1. The City partnered with the United States Bureau of Reclamation and CH2M Hill to create a demonstration vertical wetland at the Bullard Water Campus for stabilizing brine prior to blending and discharging to the Gila River. This technology doesn't reduce the total dissolved solids, but could reduce toxicity associated with heavy metals, selenium, nitrate, perchlorate, etc. Even with the wetland, brine discharge to the Gila River would require a large reclaimed water stream to dilute the brine. It has limited capacity and flexibility to handle brine from any future facilities and continues to pose regulatory challenges and environmental concerns. It cannot be a sustainable and sufficient brine management solution for the City by itself.
2. Add a lime concentrate stabilization process. This is a readily available technology and the RO waste stream could be reduced to about 7 percent of the well capacity using this technology.
3. General Electric (GE) holds the license of a process called High Efficiency RO (HERO) that can also reduce the brine stream to about 5-10 percent of the well stream.
4. Mixing technology in brine ponds can speed evaporation rates by 2-3 times, reducing land requirements for evaporation ponds.
5. Wind Aided Intensified Evaporation (WAIV) technology that utilizes curtain-like structures to improve air and water contact is claimed to increase evaporation rates by 10-25 times, reducing the land requirements for evaporation ponds. Some have expressed concern that if airborne salts are generated from these facilities, downstream neighbors might be adversely affected.

In addition to these technologies, Carollo has done pilot testing using new technologies that have reduced brine streams to 3-5 percent of the well capacity, and there are other technologies not mentioned here that may be able to provide similar benefits. One of the biggest costs for evaporation ponds is the land where the evaporation ponds would be located, so technologies that reduce the brine stream or increase evaporation rates can have significant land cost savings over more conventional brine management strategies.

ADEQ and MCESD will require a sound design and a good strategy prior to permitting an evaporation pond. Ponds work best that are in multiple compartments. Small ponds can be permitted more easily than large ponds. Ponds can be expanded as the need arises. The City should identify several sites both in WPA 2 and Rainbow Valley that are in close proximity to well fields and well RO treatment facilities that could become brine ponds. These lands could also be located in places that are less desirable for development to keep land costs down. Brine ponds will need to be fenced and protected from children and wildlife.

The following actions are recommended to manage brine concentrate:

1. Due to challenges associated with brine disposal, surface water supplies should be developed first, where possible, to delay the need for brine disposal facilities. In time, new technologies may be developed to reduce brine disposal challenges.
2. Brine management is an essential part of Goodyear's water supply management strategy. Goodyear is currently engaged in a research project at the Bullard water campus to evaluate ways to use the brine stream from that facility. Goodyear should continue to collaborate with others and participate in brine management research to help develop methods and technologies that address Goodyear's needs, and so that it can deploy the most favorable brine management technologies.
3. Land for brine ponds should be purchased for wells that are expected to be treated at the Silva site and for site 12. Land near the Gila River or other locations near the proposed Goodyear water campus could be purchased, as well as land near the well fields in Rainbow Valley.
4. As new wells are constructed, pilot test emerging brine management technologies on a small scale to see what works well for Goodyear. Then implement successful technologies at other sites.

Seek to implement brine management that eliminates the need to discharge brine into the collection system so that reclaimed water that is recharged does not increase salinity levels in the aquifer.

3.8 WATER SYSTEM CAPITAL IMPROVEMENTS

This section summarizes the proposed water system infrastructure projects and recommendations of the 2016 IWMP.

3.8.1 Unit Costs

3.8.1.1 Cost Estimate Accuracy

Unit costs have been developed for the capital improvements for each project recommended herein. This cost estimate was prepared in accordance with the guidelines of the Association for the Advancement of Cost Engineers (AACE) International for a Class 4 estimate. Table 3.32 summarizes the AACE International cost estimate classification system, the level of project definition (percent of design), uses, cost estimating methodologies and expected accuracy of Class 1 through 5 estimates. Design work would need to be undertaken to obtain more precise cost estimates.

Table 3.32 AACE Cost Estimate Classification Summary 2016 Integrated Water Master Plan City of Goodyear				
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%

3.8.1.2 Project Cost Development Methodology

To develop project costs for each capital improvement project, unit costs for pipelines, pump stations, and other infrastructure are developed based on information from R.S. Means and other unit cost sources including bid tabs. When multiplied by the capacity or size of the facility, the unit construction cost is the cost that the City should expect to pay a contractor to construct the facility. The City will have other expenses including design, inspection, contingency, and project management that are included in the overall project cost. The project cost is obtained by multiplying the construction cost by a factor of 1.4. Table 3.33 contains an opinion of probable unit construction costs for the recommended projects. The unit cost development is included in Appendix C.

Table 3.33 Unit Cost Summary 2016 Integrated Water Master Plan City of Goodyear		
Component	**Construction Cost (Unit)**	**Project Cost [(1)] (Unit)**
Water Mains		
8-inch (with hydrants)	$178/LF	$249/LF
12-inch (no hydrants)	$174/LF	$244/LF
12-inch (with hydrants)	$192/LF	$269/LF
16-inch	$209/LF	$293/LF
20-inch	$235/LF	$330/LF
24-inch	$271/LF	$379/LF
30-inch	$320/LF	$448/LF
36-inch	$375/LF	$524/LF
42-inch	$417/LF	$584/LF
Water Production and Treatment		
800 gpm Well	$1.7 M	$2.4 M
1,300 gpm Well	$2.3 M	$3.2 M
Arsenic Treatment	$1.27/gpd	$1.79/gpd
RO Treatment, brine discharge to sewer	$1.43/gpd	$2.00/gpd
Booster Pumping		
1,200 gpm	$0.97/gpd	$1.36/gpd
1,800 gpm (site expansion)	$0.74/gpd	$1.03/gpd
3,600 gpm	$0.52/gpd	$0.73/gpd
6,100 gpm	$0.39/gpd	$0.54/gpd
8,400 gpm	$0.31/gpd	$0.43/gpd
Storage Reservoir		
1 - 1.5 MG	$2.4/gal	$3.4/gal
3 MG	$1.7/gal	$2.4/gal
5 MG	$1.5/gal	$2.0/gal

Note:
(1) Construction Cost x 1.4 (engineering design, inspection, and project management).

3.8.2 Project Summary

Table 3.34 summarizes the recommendations from the 5-year CIP. These recommendations are to provide the required infrastructure to serve current customers. Table 3.35 summarizes the recommendations for planning years 2020 and 2025. These projects provide the required information to serve growth. Table 3.36 shows the costs of water transmission, treatment, storage, pumping, and delivery into the water distribution system for each of the water treatment alternatives. The capital costs for the selected option will need to be included in the City's Capital Improvement Plan.

Table 3.34 5-Year Water System CIP Project Summary - Projects for Existing Deficiencies
2016 Integrated Water Master Plan
City of Goodyear

Project Number	Priority	Description	Justification	Location	Consequence of not Implementing Project	FY 2016 Costs	FY 2017 Costs	FY 2018 Costs	FY 2019 Costs	FY 2020 Costs	Total Project Cost	Summarized Total Project Cost
	-	CAP contract capital charges	Pay for CIP water supply.	Goodyear City	No access to CAP water.	$284,000	$284,000	$284,000	$284,000	$284,000	$1,420,000	$1,420,000
WA1510	1	Equip Adaman Well 3 (1,300 gpm) & Arsenic Treatment	Increase water supply.	North of Camelback Road along Sarival	Failure of other water supplies causes a failure of Goodyear's ability to deliver water on high water demand days, City fails to meet performance criteria for water supply.	$1,722,000	$-	$-	$-	$-	$1,722,000	$5,713,000
		Connect the Adaman Well to the Sarival transmission main with 1/2 mile of 12-inch main and 1/2 mile of 24 inch main	Deliver Adaman well water.	Sarival Avenue	Failure to use new Adaman well.	$1,645,000	$-	$-	$-	$-	$1,645,000	
		Arsenic Treatment for Adaman Well 3. Assumed 70% supply treated/30% supply blended.	Comply with water quality standards.	Site 21	Water supply does not meet state and federal water quality standards.	$2,346,000	$-	$-	$-	$-	$2,346,000	
IWMP_W1	2	Groundwater well siting study	Determine favorable locations for new groundwater wells in the north and south service areas.	Goodyear City	Wells may not be located to legally and physically deliver water.	$100,000	$-	$-	$-	$-	$100,000	$100,000
IWMP_W2	3	New Site 12 Well (1,200 gpm)	Increase water supply.	Assume well water can be delivered to Site 12 pending groundwater siting study	Satisfy water supply performance criteria.	$3,247,000	$-	$-	$-	$-	$3,247,000	$6,108,000
		Pipeline from new well to Site 12	Deliver water to Site 12 for treatment.	Undetermined well location to Site 12	Satisfy water supply performance criteria.	$644,000	$-	$-	$-	$-	$644,000	
		RO treatment for well	Comply with water quality standards.	Undetermined well location to Site 12	Water supply does not meet state and federal water quality standards.	$2,167,000	$-	$-	$-	$-	$2,167,000	
		Land for well site	Increase water supply.	Near Site 12	Satisfy water supply performance criteria.	$50,000	$-	$-	$-	$-	$50,000	
WA1502	4	Site 12 Pumps (+ 1,800 gpm)	Meet peak hour pumping requirements.	Site 12	Failure to supply peak demands.	$727,000	$-	$-	$-	$-	$727,000	$727,000
IWMP_W3	5	8-inch brine line for RO concentrate	Water treatment requirements.	Near Site 12	RO concentrate is not disposed of legally and properly.	$430,000	$-	$-	$-	$-	$430,000	$430,000
IWMP_W4	6	Booster Pump Station 13 Reservoir Rehabilitation	Existing 1.5 MG Steel tank leaks and full use of the storage is not possible. Interior coating is failing; numerous corrosion locations on floor & walls.	Booster PS 13	Loss of storage capacity can hinder firefighting capabilities. Corrosion can lead to severe leaks and tank foundation being undermined.	$250,000	$-	$-	$-	$-	$250,000	$250,000
IWMP_W5	78	Well 19 production improvement	Well production has dropped from 1200 gpm in 2010, to 850 gpm in 2014.	Well 19	Loss of production here requires a makeup somewhere else - system wide. This pump operates 365 days.	$300,000	$-	$-	$-	$-	$300,000	$300,000
IWMP_W6	8	Well 19 Block Wall	Protect integrity of Well 19.	Well 19	Well 19 susceptible to damage.	$69,303	$-	$-	$-	$-	$69,303	$69,303

Table 3.34 5-Year Water System CIP Project Summary - Projects for Existing Deficiencies
2016 Integrated Water Master Plan
City of Goodyear

Project Number	Priority	Description	Justification	Location	Consequence of not Implementing Project	FY 2016 Costs	FY 2017 Costs	FY 2018 Costs	FY 2019 Costs	FY 2020 Costs	Total Project Cost	Summarized Total Project Cost
IWMP_W7	9	New Site 12 Well (1,200 gpm)	Increase water supply.	Assume well water can be delivered to Site 12 pending groundwater siting study	Satisfy water supply performance criteria.	$-	$3,247,000	$-	$-	$-	$3,247,000	$6,108,000
		Pipeline from new well to Site 12	Deliver water to Site 12 for treatment.	Undetermined well location to Site 12	Satisfy water supply performance criteria.	$-	$644,000	$-	$-	$-	$644,000	
		RO treatment for well	Comply with water quality standards.	Undetermined well location to Site 12	Water supply does not meet state and federal water quality standards.	$-	$2,167,000	$-	$-	$-	$2,167,000	
		Land for well site	Increase water supply.	Near Site 12	Satisfy water supply performance criteria.	$-	$50,000	$-	$-	$-	$50,000	
IWMP_W8	10	Well 18A casing and screen replacement - Re-drill and equip well using municipal standards	Well production has reduced since 1998 and the Johnson screens have many holes resulting in sand and filter pack being pumped out.	Well 18A	Loss of water production to meet water demands.	$-	$1,000,000	$-	$-	$-	$1,000,000	$1,000,000
IWMP_W9	11	Well 18B casing and screen replacement - Re-drill and equip well using municipal standards	Well production has reduced since 1998 and the Johnson screens have many holes resulting in sand and filter pack being pumped out.	Well 18B	Loss of water production to meet water demands.	$-	$1,000,000	$-	$-	$-	$1,000,000	$1,000,000
IWMP_W10	12	Bullard RO Campus filter assembly rehabilitation or replacement	The South filter assemblies are corroding excessively due to leaks.	Bullard RO Campus	Loss of filter assemblies could result in damage to RO membranes and loss of production; high O&M costs.	$-	$75,000	$-	$-	$-	$75,000	$75,000
IWMP_W11	13	Bullard RO Campus SST piping improvements	SST influent piping has developed multiple pin holes caused by corrosion.	Bullard RO Campus	Loss of influent piping will shut down the RO process.	$-	$60,000	$-	$-	$-	$60,000	$60,000
IWMP_W12	14	Add an additional 1,000 gpm pump at Site 13	Meet fire flow requirements.	Site 13	Failure to provide sufficient fire flow for emergency events.	$-	$-	$798,000	$-	$-	$798,000	$798,000
IWMP_W13	15	Well 1 redrill and re-equip at a new site using municipal standards.	Old irrigation well with slot cuts in casing installed 1940 +/-. Past useful life.	Well 1	Loss of water production to meet water demands.	$-	$-	$6,108,000	$-	$-	$6,108,000	$6,108,000
IWMP_W14	16	1.2 MG storage capacity for north service area	Meet system water storage requirements.	North service area - actual location to be determined	Failure to satisfy storage performance criteria.	$-	$-	$-	$4,039,000	$-	$4,039,000	$4,539,000
		Land for 1.2 MG reservoir	Land is required for a storage site.	to be determined	Additional storage not possible.	$-	$-	$-	$500,000	$-	$500,000	
IWMP_W15	17	Well 3 well redrill and re-equip using municipal standards.	Old irrigation well with slot cuts in casing installed 1960 +/-. Casing is fragile and City does not brush to clean.	Well 3	Loss of water production to meet water demands.	$-	$-	$-	$1,000,000	$-	$1,000,000	$1,000,000
IWMP_W16	18	Replace mains in Sarival Estates	Address leaks/failures.	Northwest corner of Sarival and Lower Buckeye Road	Water leaks and pipeline failures continue to occur, with corresponding costs.	$-	$-	$-	$-	$2,904,000	$2,904,000	$2,904,000

Table 3.34 5-Year Water System CIP Project Summary - Projects for Existing Deficiencies
2016 Integrated Water Master Plan
City of Goodyear

Project Number	Priority	Description	Justification	Location	Consequence of not Implementing Project	FY 2016 Costs	FY 2017 Costs	FY 2018 Costs	FY 2019 Costs	FY 2020 Costs	Total Project Cost	Summarized Total Project Cost
IWMP_W17	19	Create DMOM plan	Proactive management of distribution system.	N/A	Water distribution system maintenance and capacity management not consistently implemented, increasing the risk of infrastructure failures and/or failure to deliver water.	$-	$-	$-	$-	$100,000	$100,000	$100,000
IWMP_W18	20	Booster Pump Stations "cans" corrosion evaluation study - all pump stations	Field site visits noted numerous pump stations were significant corrosion was observed at the interface of the pump "can" and the concrete. How bad is the corrosion?	At various pump stations	Loss of pumping capability to meet water demands if "cans" collapse into the pumps	$-	$-	$-	$-	$150,000	$150,000	$150,000
Subtotal						**$13,981,303**	**$8,527,000**	**$7,190,000**	**$5,823,000**	**$3,438,000**	**$38,959,303**	**$38,959,303**
					WATER 5-YEAR CIP TOTAL	**$38,959,303**						

ENR CCI = 9886Costs are not escalated in future years.

Table 3.35 10-Year Water System CIP Project Summary - Growth Related Projects
2016 Integrated Water Master Plan
City of Goodyear

Project Number	Priority	Description	Justification	Location	Consequence of Not Implementing Project	FY 2016 Costs	FY 2017 Costs	FY 2018 Costs	FY 2019 Costs	FY 2020 Costs	FY 2021 Costs	FY 2022 Costs	FY 2023 Costs	FY 2024 Costs	FY 2025 Costs	Total Cost
IWMP_W2	1	Additional Land Cost for New Site 12 Well	Increase water supply.	Near Site 12	Water Supply Criteria not met.	$100,000	$-	$-	$-	$-	$-	$-	$-	$-	$-	$100,000
IWMP_W7	1	Additional Land Cost for New Site 12 Well	Increase water supply.	Near Site 12	Water Supply Criteria not met.	$-	$100,000		$-	$-	$-	$-	$-	$-	$-	$100,000
IWMP_W19	1	New Well (1,300 gpm)	Serve future growth.	Near Silva Site	Inability to meet projected maximum day demands.	$-	$-	$3,247,000	$-	$-	$-	$-	$-	$-	$-	$3,247,000
		Pipeline for new well	Deliver water from well site to treatment location.	From new well to Silva Site		$-	$-	$644,000	$-	$-	$-	$-	$-	$-	$-	$644,000
		RO Treatment for new well	Comply with water quality standards.	Silva Site		$-	$-	$2,167,000	$-	$-	$-	$-	$-	$-	$-	$2,167,000
		Land for well site	Land is required to site infrastructure.	Near Silva Site		$-	$-	$150,000	$-	$-	$-	$-	$-	$-	$-	$150,000
IWMP_W13	1	Additional Land Cost for Relocated Well 1	Increase water supply.	TBD	Needed to continue Well 1 production.	$-	$-	$100,000	$-	$-	$-	$-	$-	$-	$-	$100,000
IWMP_W20	2	New Well (1,300 gpm)	Serve future growth.	Near Silva Site	Inability to meet projected maximum day demands.	$-	$-	$-	$3,247,000	$-	$-	$-	$-	$-	$-	$3,247,000
		Pipeline for new well	Deliver water from well site to treatment location.	From new well to Silva Site		$-	$-	$-	$644,000	$-	$-	$-	$-	$-	$-	$644,000
		RO Treatment for new well	Comply with water quality standards.	Silva Site		$-	$-	$-	$2,167,000	$-	$-	$-	$-	$-	$-	$2,167,000
		Land for well site	Land is required to site infrastructure.	Near Silva Site		$-	$-	$-	$150,000	$-	$-	$-	$-	$-	$-	$150,000
IWMP_W15	2	Water treatment and land for a relocated Well 3	Old irrigation well needs rehabilitation, is located in the vicinity of a Superfund site plume.	TBD	Needed to continue Well 3 production.	$-	$-	$-	$5,258,000	$-	$-	$-	$-	$-	$-	$5,258,000
IWMP_W21	3	New Well (1,300 gpm)	Serve future growth.	Near Silva Site	Inability to meet projected maximum day demands.	$-	$-	$-	$-	$3,247,000	$-	$-	$-	$-	$-	$3,247,000
		Pipeline for new well	Deliver water from well site to treatment location.	From new well to Silva Site		$-	$-	$-	$-	$644,000	$-	$-	$-	$-	$-	$644,000
		RO Treatment for new well	Comply with water quality standards.	Silva Site		$-	$-	$-	$-	$2,167,000	$-	$-	$-	$-	$-	$2,167,000
		Land for well site	Land is required to site infrastructure.	Near Silva Site		$-	$-	$-	$-	$150,000	$-	$-	$-	$-	$-	$150,000
IWMP_W22	4	2.6 MG storage reservoir	Serve future growth. Needed for well treatment and blending schemes.	Silva Site	Inability to meet projected demands in WPA 2, particularly north west Goodyear.	$-	$6,800,000	$-	$-	$-	$-	$-	$-	$-	$-	$6,800,000
		8.8 mgd (6,100 gpm) booster station				$-	$4,800,000	$-	$-	$-	$-	$-	$-	$-	$-	$4,800,000
IWMP_W24	5	1 Rainbow Valley Well	Provides 1.5 mgd of supply to WPA 3/4 and reduces the amount of water needed from the north (WPA 2) to serve developments in the south.	WPA 4	Places more burden on water production and infrastructure in the north (WPA 2) to serve the south.	$-	$-	$-	$-	$-	$-	$-	$-	$-	$3,247,000	$3,247,000
		Well Transmission Pipeline (1 RV Well)				$-	$-	$-	$-	$-	$-	$-	$-	$-	$10,500,000	$10,500,000
		Well Treatment (1 RV Well)				$-	$-	$-	$-	$-	$-	$-	$-	$-	$2,167,000	$2,167,000
		Land (1 RV Well)				$-	$-	$-	$-	$-	$-	$-	$-	$-	$150,000	$150,000
IWMP_W25	-	New 16-in water main (5,610 LF) Broadway Road from Citrus Road to Cotton Lane	Serve future growth and expand the distribution system.	WPA 2	Inability to serve future development.	$-	$-	$-	$1,641,500	$-	$-	$-	$-	$-	$-	$1,641,500
IWMP_W26	-	New 12-in water main (5,280 LF) Van Buren Street from Perryville Road to Citrus Road	Serve future growth and expand the distribution system.	WPA 2	Inability to serve future development.	$-	$-	$-	$-	$1,286,000	$-	$-	$-		$-	$1,286,000

Table 3.35 10-Year Water System CIP Project Summary - Growth Related Projects
2016 Integrated Water Master Plan
City of Goodyear

Project Number	Priority	Description	Justification	Location	Consequence of Not Implementing Project	FY 2016 Costs	FY 2017 Costs	FY 2018 Costs	FY 2019 Costs	FY 2020 Costs	FY 2021 Costs	FY 2022 Costs	FY 2023 Costs	FY 2024 Costs	FY 2025 Costs	Total Cost
IWMP_W27	-	New 16-in water main (2,640 LF) Citrus Road from Van Buren Street to Roosevelt Street	Serve future growth and expand the distribution system.	WPA 2	Inability to serve future development.	$-	$-	$-	$-	$772,500	$-	$-	$-		$-	$772,500
IWMP_W28	-	New 24-in water main (2,640 LF) Van Buren from Citrus to 174th Avenue	Serve future growth and expand the distribution system.	WPA 2	Inability to serve future development.	$-		$1,001,600	$-	$-	$-	$-	$-		$-	$1,001,600
IWMP_W29	-	New 24-in water main (2,640 LF) Citrus Road from Harrison Street to Van Buren Street	Serve future growth and expand the distribution system.	WPA 2	Inability to serve future development.	$-		$1,001,600	$-	$-	$-	$-	$-		$-	$1,001,600
IWMP_W30	-	New 16-in water main (5,280 LF) Litchfield Road from Yuma Road to Van Buren Street	Serve future growth and expand the distribution system.	WPA 2	Inability to serve future development.	$-	$-	$-	$-	$-	$1,544,900	$-	$-		$-	$1,544,900
IWMP_W31	-	New 16-in water main (650 LF) Litchfield Road from El Cielo Street to MC85	Serve future growth and expand the distribution system.	WPA 2	Inability to serve future development.	$-	$-	$-	$-	$-	$190,200	$-	$-		$-	$190,200
IWMP_W32	-	New 12-in water main (4,300 LF) Litchfield Road from Broadway Road to La Tierra Street	Serve future growth and expand the distribution system.	WPA 2	Inability to serve future development.	$-	$-	$-	$-	$-	$-	$1,155,800	$-		$-	$1,155,800
IWMP_W33	-	New 16-in water main (7,920 LF) Broadway Road from Estrella to 143rd Avenue	Serve future growth and expand the distribution system.	WPA 2	Inability to serve future development.	$-	$-	$-	$-	$-	$-	$2,317,400	$-		$-	$2,317,400
IWMP_W34	-	New 12-in water main (2,680 LF) Broadway Road from 143rd Avenue to Litchfield Road	Serve future growth and expand the distribution system.	WPA 2	Inability to serve future development.	$-	$-	$-	$-	$-	$-	$-	$-	$720,400	$-	$720,400
IWMP_W35	-	New 12-in water main (3,430 LF) 143rd Avenue from Broadway to North of El Sol Street	Serve future growth and expand the distribution system.	WPA 2	Inability to serve future development.	$-	$-	$-	$-	$-	$-	$-	$-	$922,000	$-	$922,000
IWMP_W36	-	New 12-in water main (3,940 LF) Loop completion in CantaMia	Serve future growth and expand the distribution system.	WPA 3	Inability to serve future development.	$-	$-	$1,059,100		$-	$-	$-	$-	$-	$-	$1,059,100
IWMP_W37	-	New 16-in water main (1,300 LF) connection from CantaMia north loop to Willis Road	Serve future growth and expand the distribution system.	WPA 3	Inability to serve future development.	$-	$-	$380,400		$-	$-	$-	$-	$-	$-	$380,400
IWMP_W38	-	New 12-in water main (8.790 LF) south of Westar to Rainbow Valley Road	Serve future growth and expand the distribution system.	WPA 3	Inability to serve future development.	$-	$-	$2,362,800		$-	$-	$-	$-	$-	$-	$2,362,800
IWMP_W39	-	New 12-in water main (1,930 LF) connection from Calistoga Drive to the west	Serve future growth and expand the distribution system.	WPA 3	Inability to serve future development.	$-	$-	$-	$518,800	$-	$-	$-	$-	$-	$-	$518,800

Table 3.35 10-Year Water System CIP Project Summary - Growth Related Projects
2016 Integrated Water Master Plan
City of Goodyear

Project Number	Priority	Description	Justification	Location	Consequence of Not Implementing Project	FY 2016 Costs	FY 2017 Costs	FY 2018 Costs	FY 2019 Costs	FY 2020 Costs	FY 2021 Costs	FY 2022 Costs	FY 2023 Costs	FY 2024 Costs	FY 2025 Costs	Total Cost
IWMP_W40	-	New 12-in water main (1,570 LF) Mountain Vista Drive from 182nd to 184th Avenue	Serve future growth and expand the distribution system.	WPA 3	Inability to serve future development.	$-	$-	$-	$422,000	$-	$-	$-	$-	$-	$-	$422,000
IWMP_W41	-	New 12-in water main (3,500 LF) 184th Avenue from Calistoga Drive to south of Mountain Vista Drive	Serve future growth and expand the distribution system.	WPA 3	Inability to serve future development.	$-	$-	$-	$940,800	$-	$-	$-	$-	$-	$-	$940,800
IWMP_W42	-	New 16-in water main (8,400 LF) East of Rainbow Valley Road from west of Willis Road to the west	Serve future growth and expand the distribution system.	WPA 3	Inability to serve future development.	$-	$-	$-	$2,457,800	$-	$-	$-	$-	$-	$-	$2,457,800
IWMP_W43	-	New 12-in water main (17,000 LF) connection north east of Estrella and Cotton Lane	Serve future growth and expand the distribution system.	WPA 3	Inability to serve future development.	$-	$-	$-	$-	$-	$-	$-	$-	$4,569,600	$-	$4,569,600
IWMP_W44		1.5 MG of Redundant storage for Site 13	Take the original storage down for maintenance.	WPA3	Redundancy, inability to fully maintain current Site 13 reservoir.	$-	$-	$-	$-	$-	$-	$-	$4,000,000	$-	$-	$4,000,000
Subtotal						***$100,000***	***$11,700,000***	***$12,113,500***	***$17,446,900***	***$8,266,500***	***$1,735,100***	***$3,473,200***	***$4,000,000***	***$6,212,000***	***$16,064,000***	***$81,111,200***
WATER 10-YEAR CIP TOTAL						**$81,111,000**										

Table 3.36 City of Goodyear Water Supply Options, Planning Level Costs
(Costs include infrastructure related to raw water delivery, treatment, and pumping to distribution)
2016 Integrated Water Master Plan
City of Goodyear

Item	Option 1	Option 2	Option 3	Option 4	Option 5
ASSUMPTIONS					
Phase 1 flow, mgd	6.67	6.67	8	8	8
Phase 2 flow, mgd	13.34	13.34	16	16	16
Is the pipe sized to deliver the phase 2 flow in Phase 1?	yes	yes	yes	yes	yes
Is the pipe sized to use the surface water plant for a baseload or peak flows?	baseload	baseload	baseload	baseload	baseload
Pipeline diameter from Raw water supply to treatment, and to Distribution, in.	30	30	30	30	30
PHASE I COSTS					
Land acquisition, 20 acres at $150,000 per acre,			$3,000,000	$3,000,000	$3,000,000
Diversion structure from canal or pipeline or pump station into pipeline to Goodyear	$3,618,000	$3,618,000	$1,900,000	$1,900,000	$1,900,000
Transmission main from water source to Goodyear treatment or distribution	$12,773,000	$27,203,000	$29,095,000	$18,687,000	$17,031,000
Freeway or river crossing for transmission main	$400,000	$400,000	$400,000	$400,000	$1,635,000
Canal and railroad crossings	$75,000	$75,000	$125,000	$75,000	$0
2.6 MG storage reservoir at treatment site	$6,800,000	$6,800,000	$6,800,000	$6,800,000	$6,800,000
Booster station capacity into distribution system, peak flows for surface water + 2 wells, 20 mgd	$7,000,000	$7,000,000	$7,000,000	$7,000,000	$7,000,000
Water transmission mains from Goodyear water campus to distribution (1320 ft. of 24 in., 3960 ft. of 30 in.) or 1 mile of 36 in. for plant near Silva site	$0	$0	$2,270,000	$2,767,000	$2,270,000
Water transmission (24 inches) between Site 13 and Site 23, 3 miles		$6,000,000	$6,000,000	$6,000,000	$6,000,000
Subtotal: Land, Storage, Pumping, Transmission	***$30,666,000***	***$51,096,000***	***$56,590,000***	***$46,629,000***	***$45,636,000***

Table 3.36 City of Goodyear Water Supply Options, Planning Level Costs
(Costs include infrastructure related to raw water delivery, treatment, and pumping to distribution)
2016 Integrated Water Master Plan
City of Goodyear

Item	Option 1	Option 2	Option 3	Option 4	Option 5
ITEMIZED SURFACE WATER TREATMENT PLANT COSTS					
General Conditions			$1,607,769	$1,607,769	$1,607,769
Site Construction			$2,679,614	$2,679,614	$2,679,614
Yard Piping			$1,607,769	$1,607,769	$1,607,769
Treatment Facility					
Intake Structure and Bar Screen			$656,519	$656,519	$656,519
Pre-Sedimentation Basin			$1,635,824	$1,635,824	$1,635,824
Raw Water Pump Station			$1,156,153	$1,156,153	$1,156,153
Ozone Contact Basin			$1,782,617	$1,782,617	$1,782,617
Rapid Mix, Flocculation and Sedimentation			$2,336,687	$2,336,687	$2,336,687
Filtration			$3,176,913	$3,176,913	$3,176,913
Finished Water Reservoir and Pump Station			$2,553,431	$2,553,431	$2,553,431
Wastewater Recovery Basin and Pump Station			$471,199	$471,199	$471,199
Sludge Thickener and Pump Station			$826,498	$826,498	$826,498
Chemical Storage and Feed System			$577,174	$577,174	$577,174
Operation Building and Lab			$329,237	$329,237	$329,237
Sludge Handling and Dewatering Facility			$930,818	$930,818	$930,818
EI&C			$5,359,228	$5,359,228	$5,359,228
Water Treatment Plant Direct Costs			**$25,904,834**	**$25,904,834**	**$25,904,834**

Table 3.36 City of Goodyear Water Supply Options, Planning Level Costs
(Costs include infrastructure related to raw water delivery, treatment, and pumping to distribution)
2016 Integrated Water Master Plan
City of Goodyear

Item	Option 1	Option 2	Option 3	Option 4	Option 5
Design Contingency (for items that may need to be designed but are not itemized above.)			$5,180,967	$5,180,967	$5,180,967
General Contractor Overhead, Profit & Risk			$3,108,580	$3,108,580	$3,108,580
Escalation to Mid-Point			$1,367,775	$1,367,775	$1,367,775
Sales Tax (Based on 50% Materials) @ 4%			$1,422,486	$1,422,486	$1,422,486
Bid Market Allowance @ 0%			$0	$0	$0
Water Treatment Plant Construction Cost			**$36,984,642**	**$36,984,642**	**$36,984,642**
Water Treatment Feasibility, planning study			$400,000	$400,000	$400,000
Engineering Design @ 10% of construction costs			$3,698,000	$3,698,000	$3,698,000
Construction Management @ 10% of construction costs			$3,698,000	$3,698,000	$3,698,000
General Contingency			$5,000,000	$5,000,000	$5,000,000
Water Treatment Plant Project Cost			**$49,781,000**	**$49,781,000**	**$49,781,000**
GAC Contractors for TTHM removal	$4,200,000	$4,200,000			
PH, Alkalinity adjustment	$1,500,000	$1,500,000	$1,500,000	$1,500,000	$1,500,000
Single line item treatment cost for EPCOR	$30,000,000	$30,000,000			
TOTAL WATER TREATMENT PLANT COSTS	**$35,700,000**	**$35,700,000**	**$51,281,000**	**$51,281,000**	**$51,281,000**
TOTAL WATER SUPPLY COSTS, PHASE I	**$66,366,000**	**$86,796,000**	**$107,871,000**	**$97,910,000**	**$96,917,000**

Table 3.36 City of Goodyear Water Supply Options, Planning Level Costs
(Costs include infrastructure related to raw water delivery, treatment, and pumping to distribution)
2016 Integrated Water Master Plan
City of Goodyear

Item	Option 1	Option 2	Option 3	Option 4	Option 5
PHASE 2 COSTS					
2.6 MG reservoir		$6,800,000	$6,800,000	$6,800,000	$6,800,000
20 mgd booster pumping station expansion		$7,000,000	$7,000,000	$7,000,000	$7,000,000
Expand canal turnout structure			$1,900,000	$1,900,000	
Low head pumping expansion at canal turnout			$2,000,000	$2,000,000	
Expand pumping to 16 mgd at EPCOR plant		$6,880,000			
Phase 2 Subtotal: Land, Storage, Pumping, Transmission	***n/a***	***$20,680,000***	***$17,700,000***	***$17,700,000***	***$13,800,000***
EPCOR treatment expansion to 16 mgd		$36,000,000			
Goodyear WTP expansion to 16 mgd			$30,480,000	$30,480,000	$30,480,000
PH, Alkalinity adjustment		$2,200,000	$2,200,000	$2,200,000	$2,200,000
GAC Contactors. TTHM removal		$4,200,000			
Phase 2 Subtotal: Water Treatment		***$42,400,000***	***$32,680,000***	***$32,680,000***	***$32,680,000***
PHASE 2 COST TOTAL		**$63,080,000**	**$50,380,000**	**$50,380,000**	**$46,480,000**
PHASE 1 AND PHASE 2 WATER SUPPLY COST TOTAL		**$149,876,000**	**$158,251,000**	**$148,290,000**	**$143,397,000**

Notes:
(1) All costs are in 2015 dollars. Costs will need to be escalated for future years.
(2) Costs are based on planning level estimates. Feasibility studies and preliminary designs have not yet been completed. Costs may change as designs progress.
(3) The treatment plant costs include over $10M in contingencies. An infrastructure contingency of 10% is included in the project costs.

3.8.3 Implementation Plan

The following recommendations are made to help Goodyear take the steps required to meet water supply redundancy requirements and provide the reliability the City's customers have come to expect.

3.8.3.1 Recommendations Related to Water Supply in the Next Ten Years

1. The City should work to obtain additional CAP or CAP NIA lease water to satisfy water supply commitments and to provide for growth. The City should seek to obtain this water as soon as practical because there are no other water supplies that are as readily available for the price.
2. Engage in a well siting study for the north (WPA 2) and south (WPA 4) service areas.
3. Develop new physical supplies by year 2020 from a direct CAP supply or from wells in Rainbow Valley.
4. Wells 1 and 3 need to be re-drilled and re-equipped to municipal standards. It may be necessary to seek an exception from ADWR to the 660-foot rule for re-drilling wells because of aquifer water quality issues.
5. Wells 18A, 18B, and 19 should be rehabilitated to extend the life of these wells.
6. Find a suitable location to relocate Well 20 and equip with a pump that can deliver directly to the RO plant.
7. Explore the possibility of establishing service line interconnections with Liberty Utilities, EPCOR and the City of Avondale to provide water to meet peak demands until a direct CAP supply can be obtained.

3.8.3.2 Feasibility Planning for a CAP Treatment Plant

The following issues would need to be addressed before designing a pipeline and treatment plant:

1. Evaluate the five options for obtaining a CAP water supply.
2. Negotiate agreements with partners.
3. Complete corridor studies for pipelines that will need to be constructed.
4. Complete a treatment plant master plan for Options 3-5, and a water quality study to address pH, alkalinity, and THM levels for Options 1 and 2.

3.8.3.3 Issues to be Addressed to Validate BID Canal Water as a Supply Option

1. Determine the legal framework under which irrigation water ownership could be obtained. Work with other communities, the irrigation district, and ADWR to establish a legal framework for using irrigation district water.

2. Address any regulatory issues associated with ADWR regarding water in this canal that would need to be overcome to use this water for recharge or as a potable supply.
3. Determine the amount of water that could become available from this canal.

3.8.3.4 Issues that Would Need to be Resolved to Obtain Harquahala Basin Water

1. Form partnerships with other communities to develop the water supply.
2. Negotiate agreements with land owners for purchase or lease of this water. Determine legal arrangements needed to take this groundwater and move it across groundwater basins.
3. Determine water treatment that would be required.
4. Conduct planning studies to identify well locations and pipeline corridors.
5. Identify, purchase land that could be used for pumping, storage facilities.

3.8.3.5 Feasibility of CAP Water Treatment and Delivery from EPCOR

The City should address the following issues in evaluating the option to purchase water treatment and transmission services from EPCOR:

1. Determine the infrastructure that will be required to treat and deliver water to Goodyear, and how will the infrastructure for transmission and treatment be paid for.
2. Determine the water quality performance guarantees that will be provided to Goodyear. Determine the remedies in the event of a failure to deliver.
3. Determine the costs of bulk water delivery and how these costs may change over time.

3.8.3.6 Actions to Manage Brine Concentrate

1. Brine management is an essential part of Goodyear's water supply management strategy. Goodyear is currently engaged in a research project at the Bullard water campus to evaluate ways to use the brine stream from that facility. Goodyear should continue to collaborate with others and participate in brine management research to help develop methods and technologies that address Goodyear's needs, and so that it can deploy the most favorable brine management technologies.
2. Land for brine ponds should be purchased for wells that are expected to be treated at the Silva site and for Site 12. Land near the Gila River or other locations near the proposed Goodyear water campus could be purchased, as well as land near the well fields in Rainbow Valley.
3. As new wells are constructed, pilot test emerging brine management technologies on a small scale to see what works well for Goodyear. Then implement successful technologies at other sites.

WASTEWATER SYSTEM MASTER PLAN

4.1 INTRODUCTION

This section of the City's IWMP is the wastewater system master plan. The plan includes the following items:

1. Documentation of the existing and future wastewater system service areas
2. Documentation of the City's existing wastewater collection and treatment infrastructure.
3. Wastewater system performance criteria used to evaluate treatment, collection system and lift station capacity for current and future conditions.
4. An overview of the wastewater and reclaimed water quality regulations that impact Goodyear's wastewater system operations.
5. An evaluation of the infrastructure required to serve current and future customers.
6. Capital improvement recommendations for the infrastructure needed to serve growth and to address deficiencies identified for the years 2020 and 2025 capital improvement planning periods.

The wastewater system infrastructure that will be needed to serve customers in planning areas WPA 4 and WPA 5 are not provided in detail and do not have capital costs associated with them because no development is planned in these areas in the next ten years. However, a regional wastewater system framework is included for these areas to guide infrastructure development that is needed beyond year 2025 to allow the City to continue pursuing growth opportunities in these areas. The expansion of the City's wastewater system must be consistent with the availability of water resources needed to serve growth.

4.2 DESCRIPTION OF EXISTING WASTEWATER SYSTEM

4.2.1 Water Reclamation Facilities and Service Areas

The City's wastewater collection system includes four wastewater services areas as shown in Figure 4.1. The Goodyear WRF service area includes all of the areas between the I-10 Freeway and the Gila River as well as five square miles north of the I-10 Freeway. The Corgett WRF service area is located generally south of the Gila River and serves the northern part of the EMR community. The Rainbow Valley WRF service area is located north of Pecos Road and serves the southern part of the EMR community. The Liberty Utilities service area, located generally north of the I-10 Freeway and east of Citrus Road, was not evaluated in the IWMP because the flows from these areas are not managed by the City.

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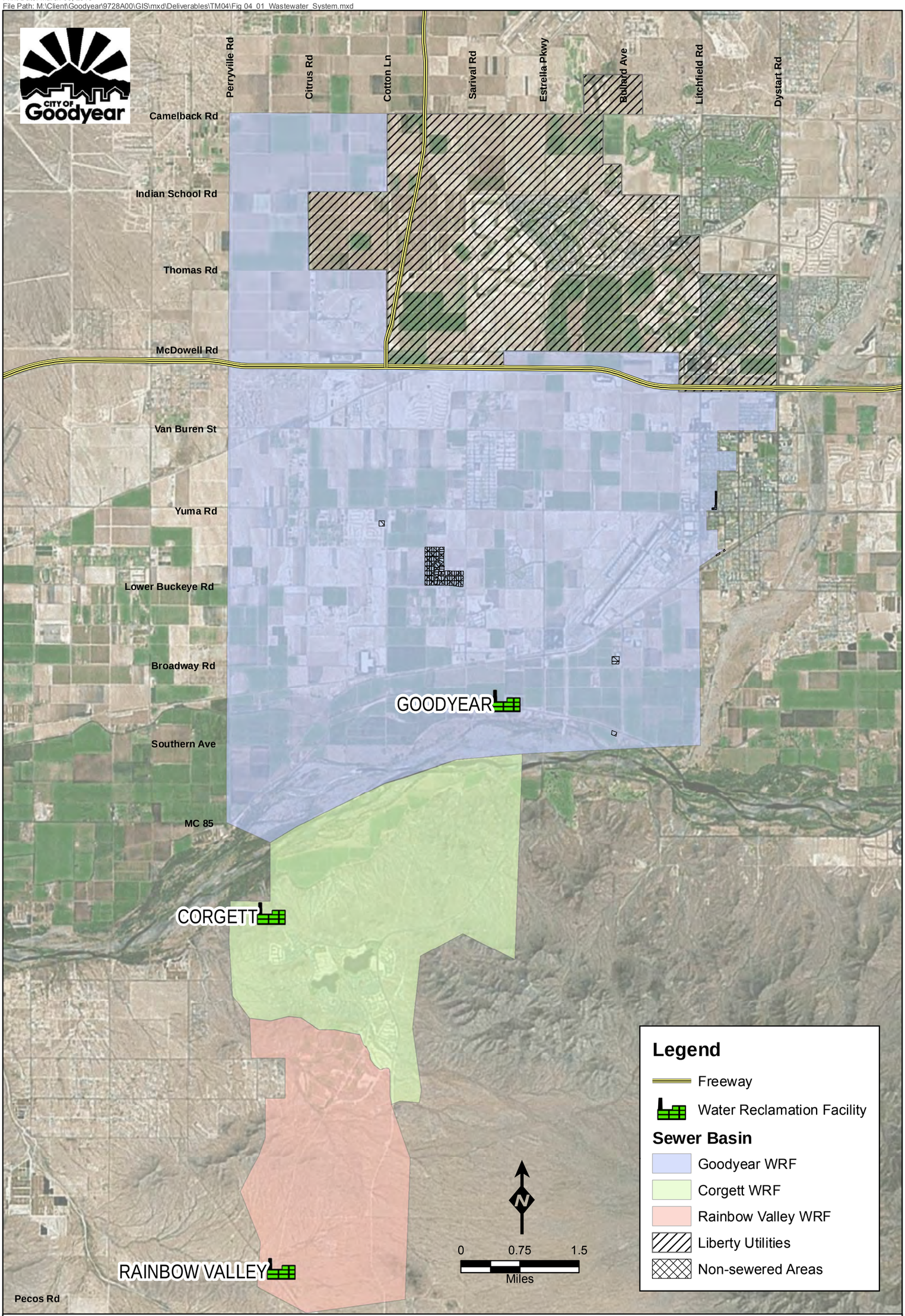

WASTEWATER SYSTEM SERVICE AREAS

FIGURE 4.1

CITY OF GOODYEAR
2016 INTEGRATED WATER MASTER PLAN

carollo

Goodyear's WRF service areas follow natural drainage basins, which minimizes pumping operation and maintenance costs and allows most development to be served by gravity sewers. The City has 12 lift stations that are required to convey flow from homes that are built in mountainous terrain or where natural grades require pumping wastewater to locations where it can continue to flow downstream by gravity. There are some areas in the City where homes have individual septic systems and therefore do not contribute flows to the City's sewers. It was assumed that these areas would be served by septic systems in perpetuity.

As the City's wastewater system expands, the Goodyear and Corgett WRF service areas are not expected to change drastically. The Rainbow Valley WRF service area may expand towards the south depending on the timing and location of future growth south of Pecos Road. New WRFs and service area boundaries will need to be established to serve development south of Pecos Road (WPAs 4 and 5).

4.2.1.1 Goodyear Water Reclamation Facility

The Goodyear WRF is located on 157th Avenue just north of the BID Canal. Wastewater is conveyed to this facility through two interceptors (24-inch and 36-inch) that enter the plants influent pump station from the north. The current treatment capacity is 4.0 mgd AADF; but the City is in the process of expanding the plant capacity to 6.0 mgd AADF. The 2014 flows to the Goodyear WRF are 3.3 mgd AADF.

4.2.1.2 Corgett Water Reclamation Facility

The Corgett WRF is located northwest in the EMR community west of San Gabriel Drive. Wastewater is conveyed to this facility through a 24-inch interceptor that enters the plant from the east. The current treatment capacity is 0.8 mgd AADF. The 2014 flows to the Corgett WRF are 0.34 mgd AADF.

4.2.1.3 Rainbow Valley Water Reclamation Facility

The Rainbow Valley WRF is located on the northeast corner of the Rainbow Valley Road and Willis Road intersection southwest of the Montecito development in the Estrella community. Wastewater is conveyed to this facility through a 30-inch gravity sewer on the north and a 21-inch gravity sewer on the south. The current treatment capacity is 0.8 mgd AADF. The 2014 flows to the Rainbow Valley WRF are 0.24 mgd AADF.

4.2.2 Lift Stations and Force Mains

The City currently has 12 operating lift stations, not including the WRF influent pump stations. There are six lift stations in the Goodyear service area, three lift stations in the Corgett service area, and three lift stations in the Rainbow Valley service area. There are nearly five miles of force mains associated with the City's lift stations, which range in size

from 4 to 18 inches in diameter. A summary of the lift stations including a description of equipment, design flows, and operational set points is included in Table 4.1.

4.2.3 Perryville Grinder Station

The Perryville grinder station is located south of the Perryville Prison along McDowell Road. Loading from the prison can vary and can significantly increase flows along the McDowell and Sarival sewer interceptors.

4.2.4 Gravity Sewer Collection Mains

The City's sewer collection system contains over 230 miles of gravity sewer mains, ranging in size from 4 to 60 inches in diameter. The City's wastewater collection system including the locations of water reclamation facilities, gravity mains, lift stations and force mains is shown in Figure 4.2.

4.3 WASTEWATER AND RECLAIMED WATER REGULATIONS

The City is required to meet federal, state, and local regulations regarding wastewater and reclaimed water that are in place to protect public health and the environment. The federal regulations regarding wastewater include the National Pollutant Discharge Elimination System (NPDES) and National Pretreatment Standards Program. State laws and regulations include the State Surface Water Quality Standards, the Arizona Pollutant Discharge Elimination System (AZPDES), and the Aquifer Protection Permit (APP) Program. The State also has an optional Capacity, Management, Operations, and Maintenance (CMOM) Program established under the APP Program, which Goodyear does not currently have. A budget for a Goodyear CMOM plan was included in the recommendations for the 5-year CIP for existing customers. State reclaimed water regulations are from the A.A.C. (R-18-11 Article 3). Regional regulations include the Maricopa Association of Governments (MAG) 208 Regional Water Management Plan and the Maricopa County Health Code.

Each of these regulations and programs along with their applicability to Goodyear are described further in Appendix C.

4.4 WASTEWATER SYSTEM PERFORMANCE CRITERIA

This section describes the "standards of measurement" that were used to evaluate the performance of the existing wastewater system, as well as define the capacity requirements of future improvements. The capacities of gravity sewers, force mains, and lift stations were based on these performance and design criteria. These performance criteria are based upon the A.A.C., City design standards, and common engineering practices.

Table 4.1 Lift Station Information
2016 Integrated Water Master Plan
City of Goodyear

Name	Facility ID [1]	Existing Firm Capacity (gpm) [2]	No. of Pumps	Size / Manufacturer / Year Installed	Design Flow (gpm)	Pump Controls [3]		Wetwell Bottom Elev. (ft)	Wetwell Dimensions	Force Main Diameter (in)	Generator
						On (ft)	Off (ft)				
Goodyear WRF											
Bio Flora	LS86-1	250	2	5 hp / Flygt / 2010	250	Lead = 4.5 Lag = 6.5	Lead = 1.5 Lag = 1.5	892.62	22.88' deep / 8' dia.	6	Portable
Del Camino	LS59-2	300	2	2.4 hp / Flygt / 2010	300	Lead = 8.0 Lag = 6.0	Lead = 1.2 Lag = 2.0	967.34	17.66' deep / 5' dia.	8	On-site / Diesel
Las Brisas	LS83-1	325	2	70 hp / Flygt / 2012	325	Lead = 6.49 Lag = 7.65	Lead = 2.9 Lag = 2.9	872.00	37.80' deep / 21' x 16'	(1) 8 (1) 10	On-site / Diesel
Palm Valley	LS58-1	330	2	10 hp / Flygt / 2010	330	Lead = 18.0 Lag = 15.0	Lead = 2.4 Lag = 6.3	950.20	37.00' deep / 7' dia.	8	On-site / Diesel
Perryville [4]	LS44-1	--	1	--	--	--	--	--	--	15	--
Rubbermaid	LS95-1	220	2	5 hp / Flygt / 2010	220	Lead = 3.5 Lag = 4.0	Lead = 1.5 Lag = 1.5	885.50	25.00' deep / 6' dia.	4	Portable
Wells Fargo	LS59-1	250	2	3 hp / Flygt / 2010	250	Lead = 8.0 Lag = 6.0	Lead = 1.5 Lag = 2.0	954.50	28.00' deep / 8' dia.	6	On-site / Diesel
Corgett WRF											
Irene	LS134-2	122	2	5 hp / Flygt / 1988	122	Lead = 3.5 Lag = 4.0	Lead = 1.5 Lag = 1.5	950.50	16.00' deep / 5' dia.	4	Portable
Lost	LS116-1	710	2	47 hp / Flygt / 1987	710	Lead = 3.5 Lag = 4.5	Lead = 2.0 Lag = 2.0	940.17	26.83' deep / 7' dia.	8	Portable
Ricardo	LS134-1	120	2	5 hp / Flygt/ 1988	120	Lead = 3.5 Lag = 4.0	Lead = 1.5 Lag = 1.5	949.50	12.00' deep / 5' dia.	4	Portable
Rainbow Valley WRF											
CantaMia	LS164-1	250	2	5 hp / Flygt / 2011	250	Lead = 4.5 Lag = 5.0	Lead = 1.5 Lag = 1.5	960.00	31.34' deep / 6' dia.	4	Portable
Lum	LS134-3	475	2	45 hp / Flygt / 2004	475	Lead = 7.0 Lag = 6.0	Lead = 2.5 Lag = 3.0	947.00	20.00' deep / 5' dia.	8	On-site / Natural Gas
Rainbow Valley	LS144-2	3,200	3	(2) 125 hp, (1) 60 hp / Moorese Fairbanks, Flygt / 2004	3,200	Lead = 7.5 Lag = 8.5	Lead = 3.8 Lag = 3.8	973.10	30.00' deep / 18' x 12'	(2) 12	On-site / Diesel

Notes:
(1) From City's GIS database
(2) Based on City's lift station flow records and verified with the values documented in the 2007 IWMP, where applicable.
(3) Feet from bottom of the wetwell. Hydro Ranger settings provided by City.
(4) Perryville grinder station discharges to a 15-in gravity sewer line.

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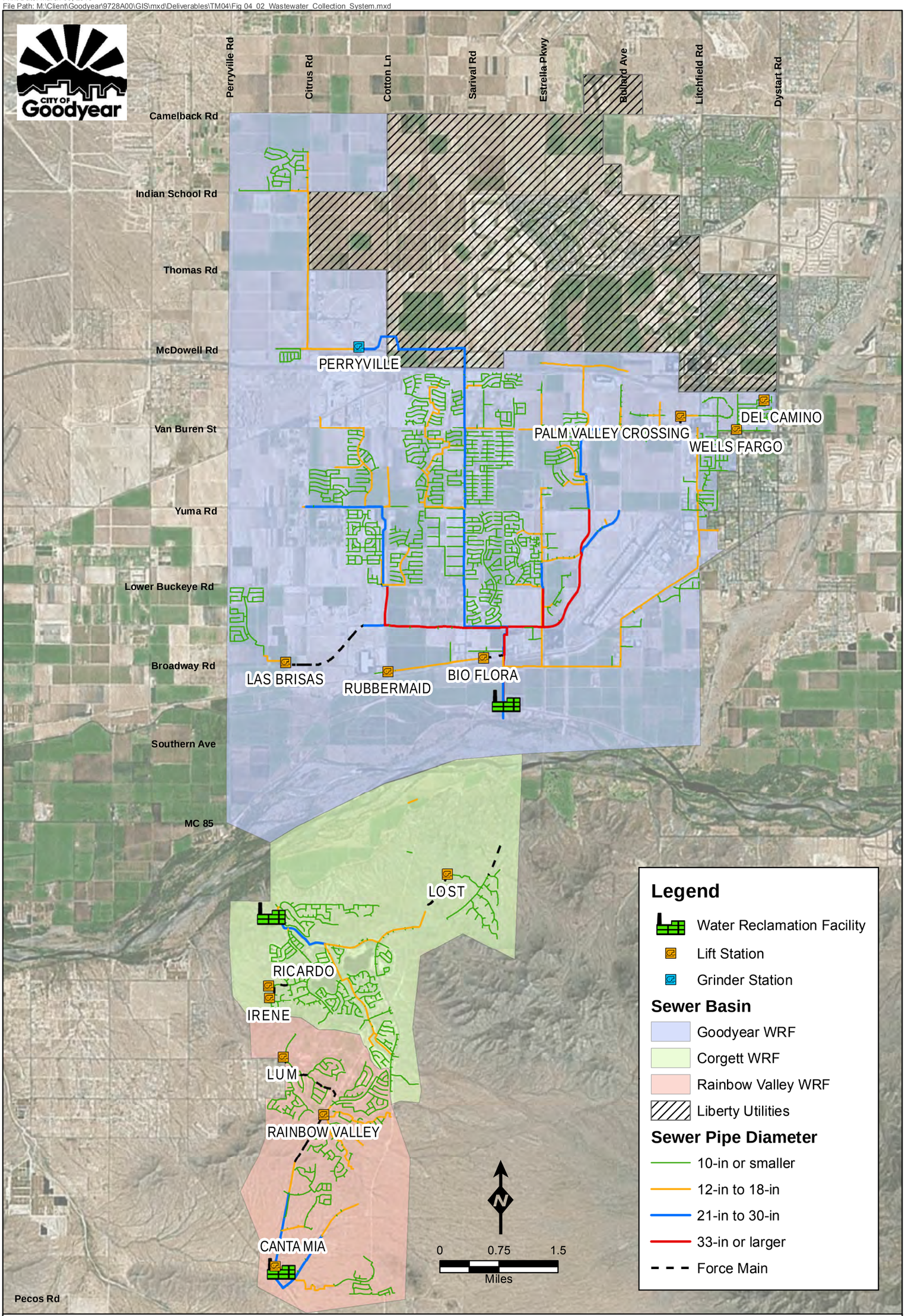

2015 WASTEWATER COLLECTION SYSTEM

FIGURE 4.2

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4.4.1 Pipe Capacities

Sewer capacities are dependent on many factors. These include roughness of pipe, maximum allowable depth of flow, and limiting velocity and slope. The Continuity Equation and Manning's Equation are used for steady-flow hydraulic calculations. 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 was used for this project, except where modified during calibration. It should also be noted that ADEQ, through R18-9-E301-D, requires the use of 0.013 for the design of all new construction.

4.4.2 Minimum Slopes

In order to minimize the settlement of solids in the flow and promote scour, it is standard design practice to specify that a minimum velocity of 2 fps be maintained when the pipe is flowing half full. The City of Goodyear requires 2.5 fps be maintained in gravity sewers that are 8-inches in diameter or smaller. At these velocities, sewer flows will typically provide self-cleaning for the pipe. Due to the hydraulics of a circular pipe, the velocity for half pipe flow approaches the velocity of nearly full pipe flow. Table 4.2 lists the minimum slopes for maintaining self-cleaning velocities with d/D = 0.5 or 1.0. The minimum slope listed in the table is 0.0008 ft/ft, which is the minimum practical slope for gravity sewer construction. Greater slopes are desirable if they are compatible with existing topography.

ADEQ regulations require velocities not to exceed 10 fps in gravity sewer mains.

4.4.3 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. Since GIS data is available for the City's existing sewer mains, this information will be used for the sewer inverts in the hydraulic model when available. For master planning purposes, proposed sewer inverts were matched at manholes when smaller sewers joined a larger sewers and the minimum velocity criteria cited above was used when sizing future pipes.

4.4.4 Manholes

It is recommended that manholes be placed according to the maximum allowable manhole spacing shown in Table 4.3.

4.4.5 Lift Stations

A firm pumping capacity equal to the peak daily flow is often used to determine the size of lift stations. The lift station should be able to provide a "firm" pumping capacity with the largest pump out of service.

Table 4.2 Recommended Minimum Slopes for Circular Pipes
2016 Integrated Water Master Plan
City of Goodyear

Pipe Size (inches)	Minimum Slope [1] [2] (ft/ft)	Pipe Capacity [3]	
		(mgd)	(gpm)
8	0.0052	0.56	392
10	0.0025	0.71	493
12	0.0020	1.03	717
15	0.0015	1.62	1,126
18	0.0012	2.36	1,638
21	0.0010	3.25	2,255
24	0.0008	4.15	2,880
30	0.0008	7.52	5,221
> = 36	0.0008	12.23	8,490

Notes:
(1) Slopes are calculated using Manning's Equation for full pipe flow (d/D = 1.0) with a minimum velocity of 2 fps for all diameters except for 8 inches for which the minimum slope corresponds to 2.5 fps.
(2) Sewers larger than 24 inches should have a slope ≥ 0.0008.
(3) Pipe Capacity based on full pipe flow or d/D = 1.0.

Table 4.3 Recommended Maximum Manhole Spacing
2016 Integrated Water Master Plan
City of Goodyear

Sewer Pipe Diameter (inches)	Maximum Manhole Spacing (feet)
10" and less	400
12" and larger	500

4.4.5.1 Normal Operation

Lift station wetwell sizing takes into consideration the fill time, based on average flow, and the minimum pump cycle time. The A.A.C. (R18-9-E301-D) requires that the minimum wetwell volume in gallons be 1/4 of the product of the minimum pump cycle time, in minutes, and the total pump capacity, in gallons per minute. The volume of the wetwell should provide a retention period not to exceed 30 minutes of average daily design flow. In addition, regional lift stations should be provided with additional wetwell capacity for redundancy. When selecting the minimum cycle time, the pump manufacturer's duty cycle recommendations shall be utilized. Starting and stopping more than seven times an hour for any one pump is not recommended.

4.4.5.2 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. Six of the City's lift stations are equipped with standby generators to provide a backup power supply. The City has portable generators that can be used at the remaining six lift stations during power outages. In addition, five of the City's lift stations are tied into the SCADA system but all 12 lift stations and the grinder station are monitored by a remote terminal unit that is installed at each station to relay power fail and high level alarms to on-duty operators.

Specific wetwell sizing and back-up power requirements should be based on individual station location, response time, capacities, and severity of impacts from any sanitary sewer overflow.

4.4.6 Force Mains

Force mains should be sized for normal operating velocities between 2 and 6 fps to provide scour velocity so that the solids deposited while the pumps are off will be transported when the pumps are operating.

Manholes to which force mains discharge to should be constructed with corrosion resistant coatings to prevent attack of concrete by sulfates. Force mains should be dropped into manholes to prevent raw sewage from splashing against the manhole walls and releasing odors. Odor control of discharges from force mains may be required if they are located in close proximity to homes/businesses or in areas of frequent odor complaints.

4.4.7 Gravity Sewer Planning Guidelines

The following are some additional general sewer planning guidelines:

- Gravity sewers should be designed and constructed to have a minimum 4 feet of cover or sufficient depth to serve the ultimate drainage area.
- Gravity sewers should be designed and constructed with a minimum 4 feet of separation between the flowline of drainage ditches and the crown of the sewer.
- Gravity sewers and force mains should have a minimum separation of 6 feet from potable water mains unless they are encased in concrete as per ADEQ requirements.
- Manholes with sewers intersecting at greater than or equal to 90-degree angles should provide 0.2 foot of invert drop across the manhole. Other manholes should provide a minimum 0.1 foot of invert drop.

4.4.8 Pipe Evaluation and Design

When designing sewers, it is common practice to adopt variable flow depth criteria for various pipe sizes. This criterion is expressed as a ratio of maximum depth of dry weather flow to pipe diameter (d/D). Design d/D ratios typically range from 0.5 to 1.0, with the lower

values typically used for smaller pipes that may experience flow peaks greater than planned or may experience blockages from debris.

The City's performance criteria from the 2007 IWMP state that new sewer pipes should be sized for 60 percent full (d/D = 0.6) during peak hour, dry weather flows, and for 65 percent full (d/D = 0.65) for peak hour, wet weather flows. Existing sewers will be evaluated based on a flow depth criteria of 0.9 at peak hour, wet weather 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 maximum design capacity of the pipe.

The hydraulic criteria used for sizing new, proposed 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. This approach allows full use of existing sewer capacity and avoids upsizing sewers prematurely.

4.4.9 Wet Weather Peak Factors

The Arizona Administrative Code requires that any point in a sewer system be able to accommodate a peak wet weather flow. This is accomplished by adding a wet weather infiltration and inflow rate based on either a percentage of peak dry weather flow or a gallons per acre rate of flow on top of base design flows. One requirement of the optional CMOM plans as defined in A.A.C. R18-9-C305 is to maintain sufficient capacity to convey base flows and the peak wet weather flow of a 10-year, 24-hour storm event. Goodyear does not currently have a CMOM plan and therefore has flexibility in determining appropriate wet weather peaking factors to use for their system. If the City pursued a CMOM plan and the optional APP, it would be necessary to use a 10-year, 24-hour design storm for capacity evaluations. However, the City can choose to develop a CMOM plan without obtaining the CMOM permit and can continue to use wet weather peaking factors for system modeling and evaluations.

Design and evaluation of proposed future sewers should include a wet weather factor applied to peak hour flows. For purposes of this study, new pipes were evaluated to allow a flow depth criteria of 0.6 for dry weather peak hour flows and 0.65 for wet weather peak hour flows. Existing pipes were evaluated to allow a flow depth criteria of 0.9 for dry weather peak hour flows and up to, but not exceeding, 1.0 for wet weather peak hour flows. Allowing pipes to flow at higher capacities during wet weather events allows the City to be able to design and accommodate wet weather events without unduly stressing capital budgets with upsizing existing pipes or over-sizing future infrastructure.

4.4.10 Criteria Summary

Table 4.4 summarizes the performance and design criteria used to evaluate the wastewater system.

Table 4.4 Wastewater System Criteria Summary
2016 Integrated Water Master Plan
City of Goodyear

Description		Criteria	
Pipe Size (inches)	Minimum Slope (1) (2) (ft/ft)	Pipe Capacity (3) (mgd)	Pipe Capacity (3) (gpm)
8	0.0052	0.56	392
10	0.0025	0.71	493
12	0.0020	1.03	717
15	0.0015	1.62	1,126
18	0.0012	2.36	1,638
21	0.0010	3.25	2,255
24	0.0008	4.15	2,880
30	0.0008	7.52	5,221
≥ 36	0.0008	12.23	8,490

Notes:
(1) Slopes are calculated using Manning's Equation for pipes flowing full (d/D = 1.0) with a minimum velocity of 2 fps for all diameters except for 8 inches for which the minimum slope corresponds to 2.5 fps.
(2) Sewers larger than 24 inches should have a slope ≥ 0.0008.
(3) Pipe Capacity based on full pipe flow or d/D = 1.0.

Flow Velocity in feet per second (fps)	
Gravity Mains	2 fps ≤ V ≤ 10 fps
Force Mains	3 fps ≤ V ≤ 7 fps
Flow Depth, d/D	
d/D for New Sewer Pipes - Peak Dry Weather Flow	= 0.60
d/D for New Sewer Pipes - Peak Wet Weather Flow	= 0.65
d/D for Evaluating Existing Mains - Peak Wet Weather Flow	= 0.90
Wet Weather Factors (applied to peak hour flows)	
In the North Planning Area	1.4
In the South Planning Areas	1.4
Headloss in Existing Pipes	
Gravity Pipes	Manning's N = 0.013
Pressure Pipes	Hazen William's C = 120
Changes in Pipe Size	
When a smaller sewer joins a larger one	Sewer crowns will be matched
Headloss at Manholes	
Manholes with pipelines intersecting at 90 degrees or greater	Provide 0.2' Invert Drop
Manholes with pipelines intersecting at less than 90 degrees	Provide 0.1' Invert Drop

4.5 MODEL PREPARATION

4.5.1 Existing Model

A new wastewater system hydraulic model using the City's most current GIS data was created for the 2016 IWMP. The collection system hydraulic model was created using the H2OMap Sewer software by Innovyze. The following sections describe how the model was created and validated.

4.5.2 Infrastructure

Several data sources were provided by the City and were used to create the wastewater model. A description of each data source that was used is listed below:

- **GIS Data** – pipes, manholes, and facility location data for all wastewater system infrastructure including lift stations and water reclamation facilities.
- **Lift Station Data** – the physical data for each lift station including the number and size of pumps, pump controls, wetwell dimensions, and force main diameters from the City's wastewater operations personnel.
- **Operations Data** – Wastewater collection system operational data provided from operator logs including totalized daily flows for lift stations and water reclamation facilities.

The wastewater model includes a representation of all sewer pipes 4 inches and larger and all lift stations. The model is an "all pipes" model, meaning that all system pipes (excluding service connections) are represented. A quality review of the GIS data was performed using tools in the modeling software to verify pipe connectivity, collection system geometry (relationship of ground elevations to pipe and manhole invert elevations) and collection basin boundaries.

4.5.3 Pipe Invert Elevations

Pipe invert elevations were taken from the City's GIS data and reviewed in the model using network review tools in the software. These tools identify pipes with adverse or flat pipe slopes and connectivity between manholes and pipes. Areas where there appeared to be topology or other data errors were reviewed and corrected in areas where resolutions could be reasonably determined through engineering judgment. Examples of corrections made include fixing pipe flow directions (reverse upstream/downstream inverts) or making certain pipes were physically connected to adjacent manholes.

4.5.4 Future Facilities

Future facilities were added to model scenarios for each planning year including years 2015, 2020, and 2025. The locations of future facilities, including new collection mains or lift stations, correlated with the 5- and 10-year growth areas identified by the City's planning department previously identified in Figure 2.4 in Chapter 2.

4.5.5 Loads

Average annual daily flows (AADF) for each planning year in the model were based on the ratio of the City's average annual water demand that becomes wastewater. These wastewater loads were imported into the model by geographically referencing the City's water meter locations with the nearest model manhole. This method of allocating loads resulted in most of Goodyear's existing wastewater flow allocated to locations in the model that were close to the locations of actual wastewater sources, which is considered a sufficient level of accuracy for master planning purposes.

There are three locations in Goodyear's system that collect wastewater flows from areas that the City does not provide water service to, and are therefore not included in the City's water customer billing or water meter GIS databases. These include the Perryville Prison, Canada Village, and Sedella. The Perryville flows run through a grinder station that is equipped with a flowmeter, therefore historical flow data was used to estimate Perryville flows for the model. For the residential areas, aerial photography was used to estimate the number of developed homes in Canada Village and Sedella and loading rates per home were applied for these areas.

Future wastewater loads were allocated using the geographical location of potential development for the 5- and 10-year planning periods. These loads were added to the existing customer loads from the water meter database.

Diurnal peaking factors were applied using data from the flow monitoring field test conducted for the IWMP to estimate dry weather peaking factors. A wet weather peaking factor of 1.3 was applied system wide to evaluate potential impacts from storm events.

4.5.6 Model Validation

The 2015 model was calibrated using the flow monitoring data from a study conducted from December 2014 and January 2015. A summary of the model calibration results is in Appendix D.

4.5.6.1 Flow Monitoring

Flow monitoring field tests were performed in 15 locations throughout Goodyear's collection system as described in Chapter 2. The flow monitoring data collected from these field tests provided flow rate, flow velocity, and flow depth information in key sewers. From these data, diurnal patterns were generated and brought into the hydraulic model in the basins upstream of each respective flow monitoring location. In addition, model predicted flows were compared to observed field test flows at each location as part of the model calibration. The flow monitoring locations and basins for the field tests are shown in Figure 4.3 shows the locations where the flow meters were placed for the field test.

4.5.6.2 Model Calibration

The field tests were done in two groups and were conducted at different times, so calibration of the entire hydraulic model could not be done using observed flow data from the same day. Where possible, the same day of flow monitoring data was used to calibrate basins that were up or downstream of each other. For the Goodyear WRF service area, December 30, 2014 was chosen as the calibration day because most of the upstream flow monitoring basins appeared to have reasonably good correlations on that day. The day selected for flow monitoring Basin 3 in the Goodyear WRF service area was January 5, 2015. This day was selected because only partial data for December 30 was available at this site and the data that was available looked very similar to the data recorded on January 5th at the same times of the day. For the Corgett WRF and Rainbow Valley WRF service areas, January 20, 2015 was chosen as the calibration day.

Model calibration is an iterative process whereby adjustments are made to model inputs until the flow rate, flow depth, and flow velocity of the model calibration pipes matches those observed during the flow monitoring field studies. Figure 4.4 shows an example of a calibration graph for flow monitoring Basin 5.

Loads in the model were adjusted in each flow monitoring basin individually to match the average flows observed during the field tests. Loads were also adjusted in upstream basins to improve the correlation between field test data and model results in downstream basins. Diurnal patterns were also adjusted when necessary to help match the timing of the modeled flow peaks with the observed flow peaks for the calibration day. Pipe roughness coefficients were adjusted in some cases to improve the correlation between the observed and modeled flow depths and velocities in the pipes where the flow monitoring sensors were located.

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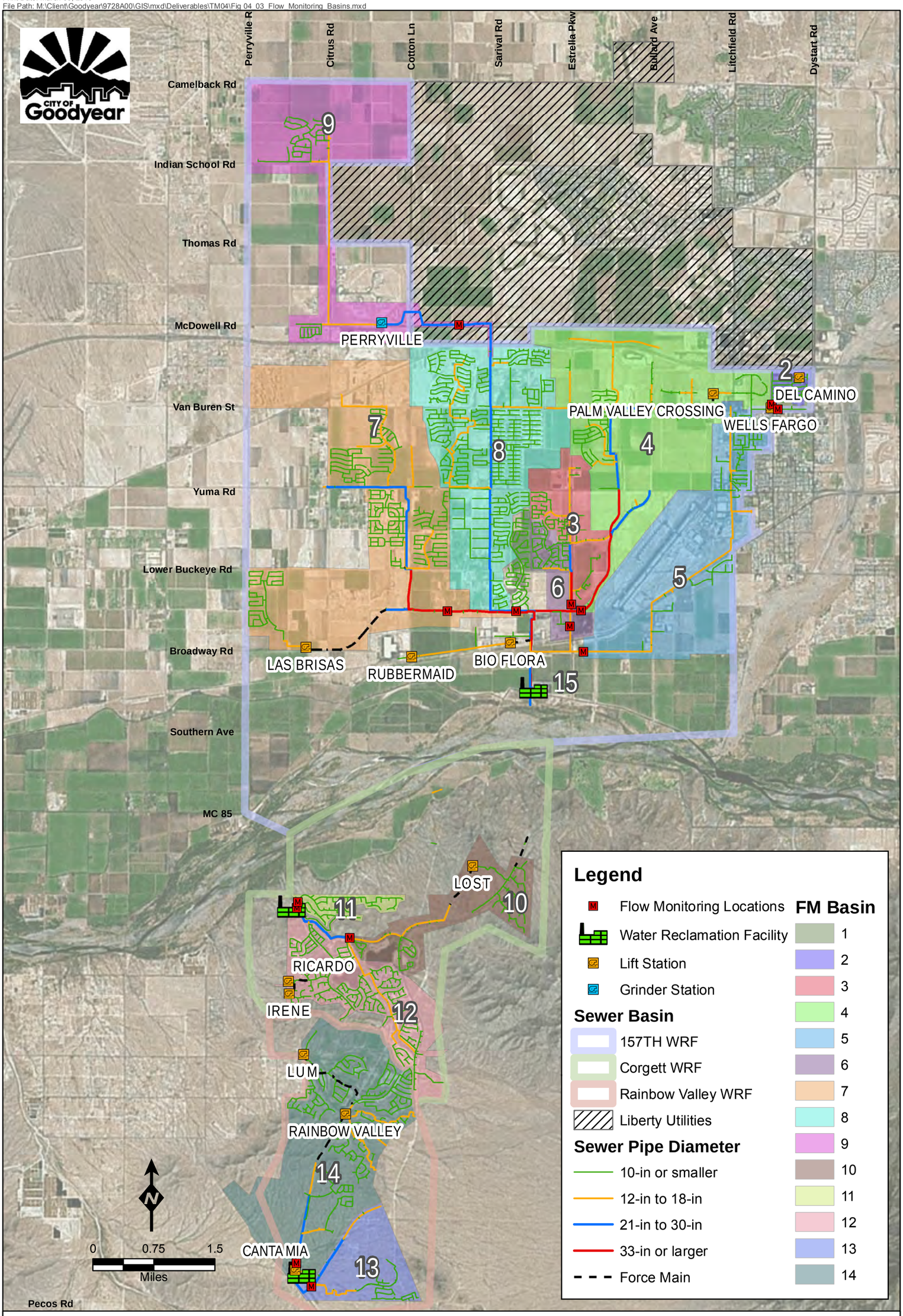

FLOW MONITORING BASINS

FIGURE 4.3

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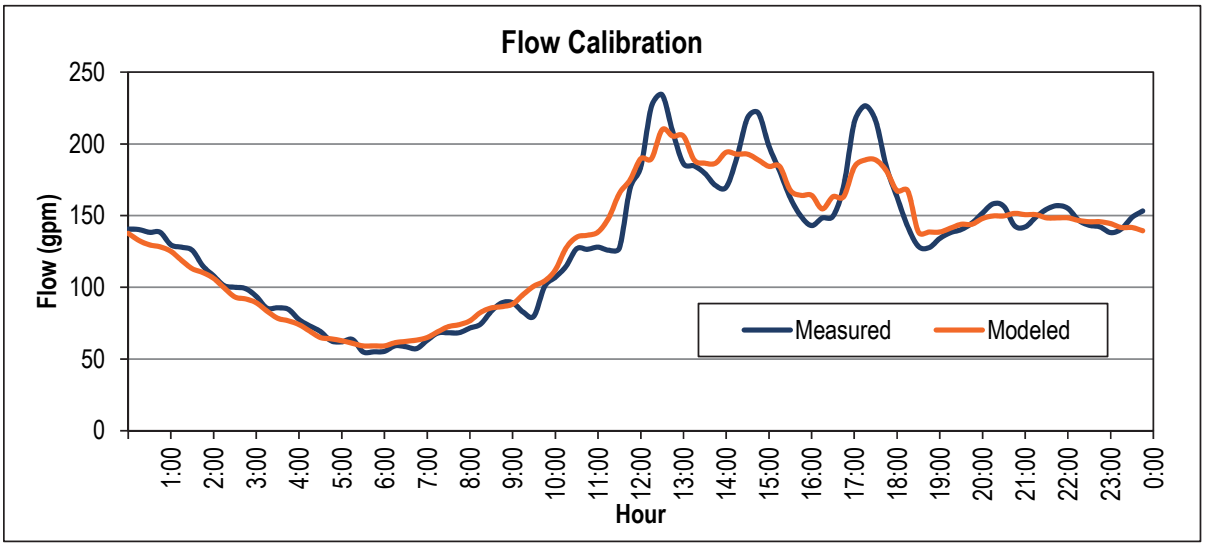

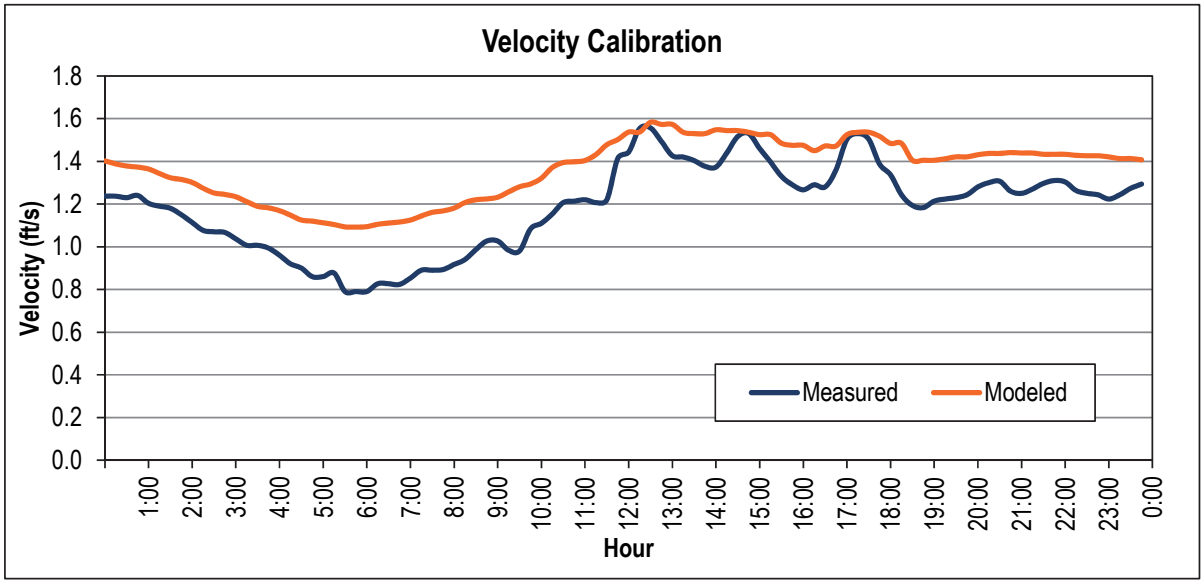

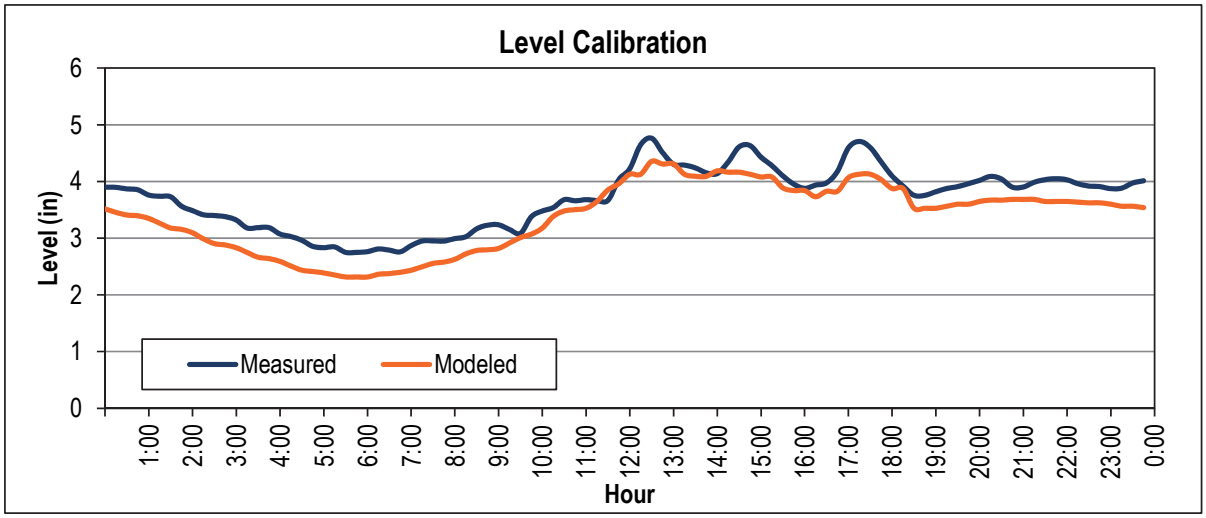

EXAMPLE MODEL CALIBRATION GRAPH

FIGURE 4.4

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Table 4.5 shows the average and peak flows observed during the flow monitoring compared to the average and peak flow calculated in the model for each flow monitoring basin. The percent differences between the observed and modeled flows are generally low for average daily flows, which indicate a strong correlation between the observed and modeled systems. In Table 4.5, a negative percent difference means that the observed flow was lower than the modeled flow and a positive percent difference means that the observed flow was higher than the modeled flow. A difference of 10 percent between modeled and observed flows is acceptable for wastewater planning purposes.

Table 4.5 Calibration Results
2016 Integrated Water Master Plan
City of Goodyear

Flow Basin	Average Flow (gpm)		Difference		Peak Flow (gpm)		Difference	
	Field	Model	(gpm)	(%)	Field	Model	(gpm)	(%)
1	104	104	0	0.0%	240	219	-21	-9%
2	73	72	-1	-0.8%	130	179	49	38%
3	111	111	0	0.0%	175	167	-8	-4%
4	423	423	0	-0.2%	629	554	-75	-12%
5	131	131	0	0.2%	234	210	-24	-10%
6	1	1	0	11%	5	4	-1	-10%
7	155	157	2	1.3%	338	416	78	23%
8	739	741	2	0.2%	1,103	1,039	-64	-6%
9	236	238	2	1.0%	370	352	-18	-5%
10	5	5	0	0.0%	14	13	-1	-4%
11	42	42	0	0.2%	97	86	-11	-11%
12	283	282	-1	-0.3%	401	422	21	5%
13	14	14	0	-0.6%	27	25	-2	-6%
14	79	74	-5	-5.5%	143	239	-96	67%

Load adjustments were used to bring the modeled average daily flows to the goal of within plus or minus 10 percent of observed flows. Adjustments to diurnal patterns were made to match the modeled peak flows to the observed flows. For nine of the flow basins, the modeled peak flows were within 10 percent of the observed peak flows and for two of the flow basins, the modeled peak flows were between 10 and 12 percent of the observed peak flows. For the remaining three flow basins, the peak flows were between 23 and 67 percent greater than the observed flows. In each of these basins, there are lift stations upstream of the flow monitoring points that impact the observed peak flows. These differences suggest a unique peaking factor or an unresolved anomaly. A follow up flow monitoring test or other

investigation is recommended to determine if the flows at these three locations are correct. Overall the model provides a reasonable representation of Goodyear's existing wastewater system and is appropriate for use in master planning analysis including evaluating system capacity and planning new infrastructure.

4.6 YEARS 2015 TO 2025 WASTEWATER SYSTEM EVALUATION

This section describes the evaluation of Goodyear's existing wastewater collection system under current and future flow conditions using the hydraulic model. It also provides a capacity analysis of lift stations and water reclamation facilities. Infrastructure deficiencies are described and capital improvements are identified.

An earlier task of the IWMP was to evaluate the wastewater system to determine infrastructure needs for current customers. The results of this evaluation are documented in the technical memorandum "Five-Year Capital Improvement Program - May 2015" (Five-Year CIP). This section includes recommendations for planning years 2015 through 2025. The recommendations from the Five-Year CIP are also included because the 5- and 10-year recommendations build upon them.

4.6.1 Water Reclamation Facilities

The City's water reclamation facilities have sufficient capacity to serve the current needs of each respective service area. However, in the future expansions will be required to accommodate the projected flows. Maricopa County requires that wastewater treatment facilities begin to design expansions once average flows reach 80 percent of the rated design capacity, and further requires construction to have commenced once average flows reach 90 percent of the rated design capacity.

The Goodyear WRF is currently undergoing an expansion to 6.0 mgd AADF. By year 2025, the projected flows are expected to reach 6.0 mgd, meaning design for the next expansion would be required when flows reach 4.8 mgd (shortly after year 2020) and construction would need to commence when flows reach 5.4 mgd, which would be prior to year 2025. If actual flows are more or less than the projected flows, this timeline would need to be adjusted accordingly.

The Corgett WRF is expected to have sufficient capacity through year 2025. However, an expansion design would need to be underway by the time flows reach 0.64 mgd (between year 2020 and year 2025). The Rainbow Valley WRF will need to be expanded by year 2018 to treat the projected flows. Design of the expansion will need to commence once flows reach 0.64 mgd and construction will need to begin by the time flows reach 0.72 mgd.

Neither the Corgett nor Rainbow Valley WRFs have capacity redundancy built into their treatment processes. When these plants are expanded, Maricopa County will require redundancy to be incorporated into the design, which will result in additional costs. Further, at the time these facilities are expanded, the remaining useful life of the existing equipment will need to be evaluated to determine if it can be integrated efficiently in the capacity expansion. It is the City's understanding that Maricopa County will require another clarifier at the Corgett WRF prior to year 2025, with or without an expansion to achieve the required level of treatment capacity redundancy. The Corgett WRF site is approximately 3 acres, which may limit the extent to which redundant and expanded capacity can be added to this site.

Table 4.6 summarizes the current capacity of the City's WRFs, the estimated flows for each planning year, and the estimated timing for future expansions.

Table 4.6 Water Reclamation Facilities
2016 Integrated Water Master Plan
City of Goodyear

WRF	Existing Capacity (mgd)	Estimated Average Daily Flow (mgd)			Expansion Required (1)
		2015	2020	2025	
Goodyear	6.0 (2)	3.5	4.5	6.0	Before year 2025
Corgett	0.8	0.4	0.5	0.7	Before year 2025
Rainbow Valley	0.8	0.3	0.8	1.0	Before year 2020
Total	**7.6**	**4.2**	**5.8**	**7.7**	**--**

Notes:
(1) Maricopa County requires that once flow reach 80% of capacity, the design of additional capacity must be initiated and once flows reach 90% of capacity, construction of expanded facilities must be underway.
(2) Expansion from 4.0 to 6.0 mgd commenced in year 2015.

One of the recommendations of the IWMP is for the City to continue to look for ways to increase indoor and outdoor water conservation. Improvements in indoor water conservation in some communities have been observed to cause increased loading rates at water reclamation facilities, which can consume treatment plant capacity. In some cases this has led to de-rating of water reclamation facilities and required significant improvements to restore capacity. Therefore, in addition to monitoring flow volume, it is recommended that the City monitor wastewater flow strength to make certain the City maintains sufficient treatment capacity at the water reclamation facilities. Wastewater strength has been increasing across Arizona and will continue to increase with conservation and low water use fixtures.

4.6.2 Collection System Capacity

The capacity assessment of the existing sewers was completed using the calibrated wastewater hydraulic model. The evaluation was based on the peak hour plus wet-weather wastewater loads and the performance criteria described previously. Most of the existing pipes have sufficient capacity to convey peak hour, wet weather flows ($d/D \leq 0.90$). There were some areas where the model predicted limited capacity. Among these was the north interceptor coming into the Wells Fargo Lift Station, and the interceptors downstream of the Wells Fargo and Palm Valley Lift Stations. In total there were 19 areas where the model predicted $d/D > 0.90$. The hydraulic model profiles were reviewed for each area and the model input data was checked against the City's GIS data for accuracy. All of these areas have flat or adverse slopes. It is possible that these are data entry errors from the City's GIS but it is also possible some of these areas may be constructed in this way. It is recommended that invert surveys be conducted for each area as soon as practical to verify the GIS data, which was used in the hydraulic model. These pipes are shown in Figure 4.5 and Table 4.7 lists the general location and pipe diameter for each area. After the invert surveys are complete, it is recommended that the hydraulic model be updated accordingly if discrepancies are found.

Hydraulic modeling scenarios for the years 2020 and 2025 indicated the same capacity limitations as the year 2015 scenarios. A wet weather analysis was run for the year 2025 condition to identify areas in the system that could be potentially stressed during storm events. There were several additional areas in addition to those identified in the 2015 analysis, that show capacity limitations as shown in Figure 4.6.

The City has observed high flows downstream of the Perryville grinder station. The sewers along McDowell and Sarival Road downstream of this station are 24-inch and 30-inch lines, which appear to be represented correctly in the hydraulic model based on a comparison of as-builts in this area. The hydraulic model did not identify capacity limitations in this area, however it is possible that sediment deposits could be impacting flow capacity and causing operational problems.

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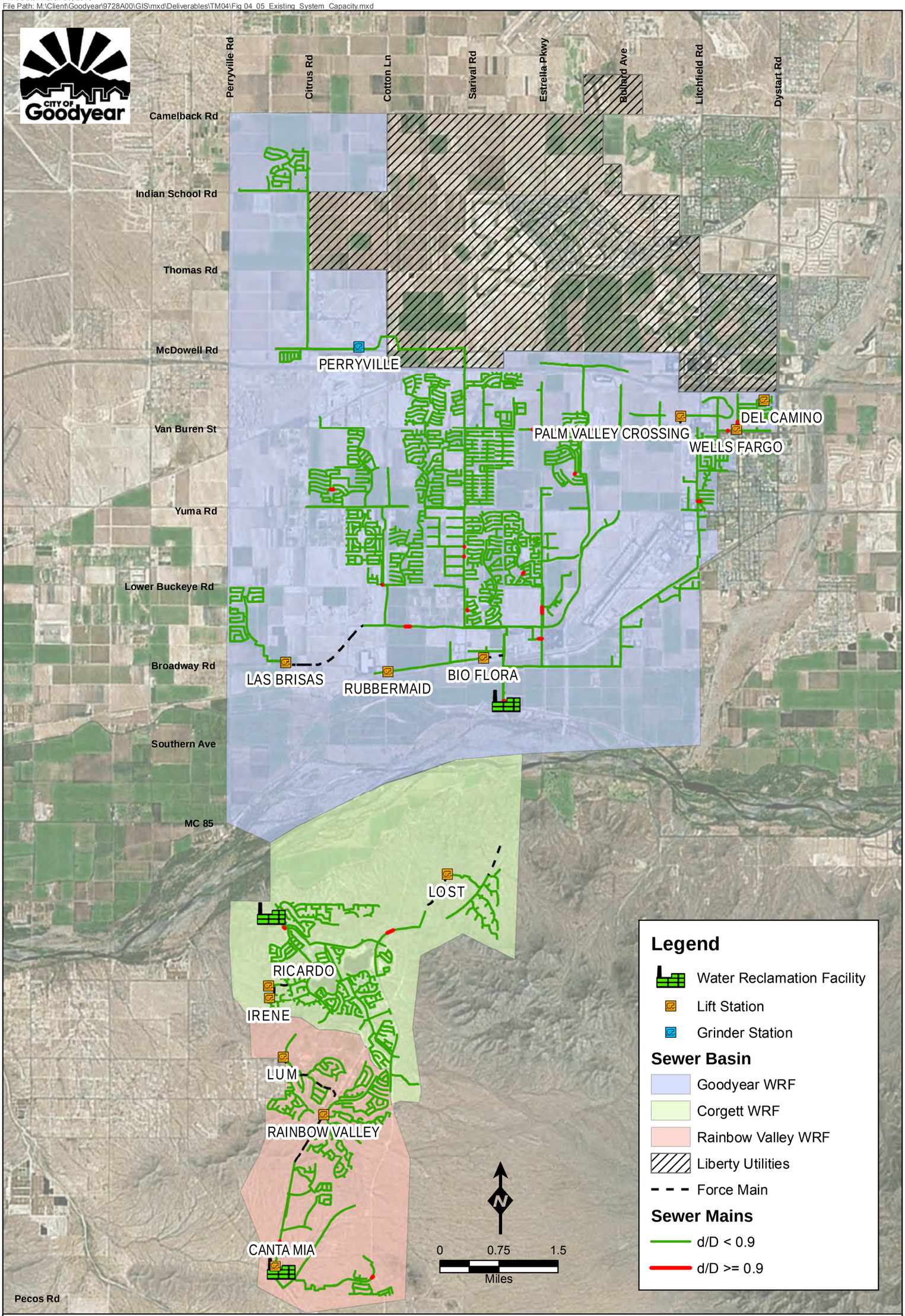

2015 COLLECTION SYSTEM CAPACITY - DRY WEATHER FLOW

FIGURE 4.5

CITY OF GOODYEAR
2016 INTEGRATED WATER MASTER PLAN

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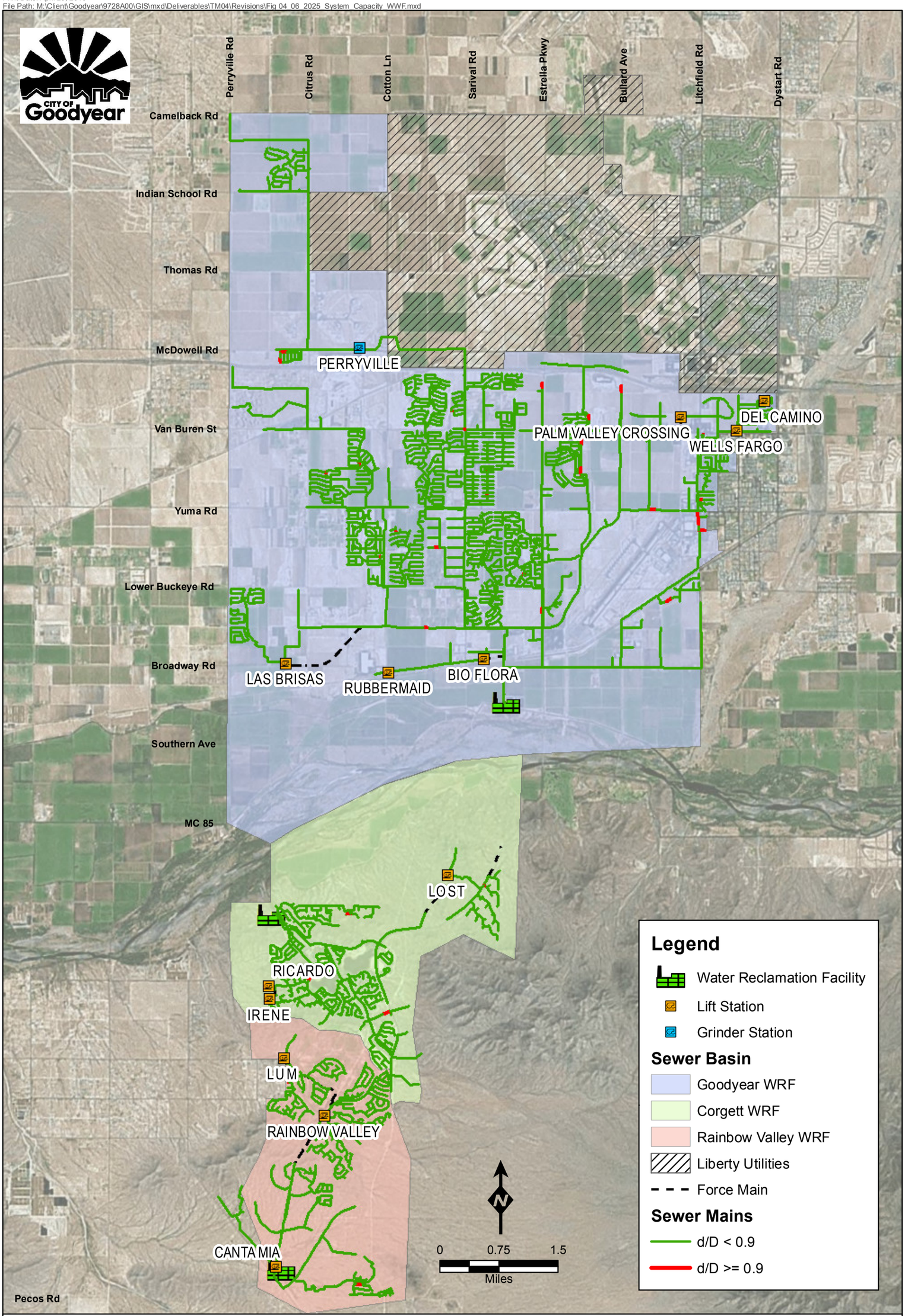

2025 COLLECTION SYSTEM CAPACITY - WET WEATHER FLOW

FIGURE 4.6

CITY OF GOODYEAR

2016 INTEGRATED WATER MASTER PLAN

carollo

Table 4.7 Pipes Identified by the Hydraulic Model with Limited Capacity 2016 Integrated Water Master Plan City of Goodyear		
No.	**Pipe Diameter (in)**	**Location**
1	8	Upstream of the Wells Fargo Lift Station
2	8	Downstream of the Wells Fargo Lift Station
3	18	Downstream of the Palm Valley Lift Station
4	6	Santa Cruz Drive east of Litchfield
5	12	Van Buren Street west of Estrella
6	12	Van Buren Street east of Estrella
7	21	Van Buren Street east of 151st Avenue
8	10	Hadley Road and 176th Avenue
9	54	Elwood Road and 169th Avenue
10	10	157th Avenue and Hammond
11	8	162nd Avenue and Superior
12	12	Estrella North of Elwood
13	8	Ilini west of Estrella
14	18	Estrella Parkway north of Elliot
15	10	San Miguel Road north of Spring
16	24	24-inch line to Corgett WRF west of San Gabriel
17	8	Ocotillo west of 183rd
18	30	30-inch line to Rainbow Valley WRF north of Rainbow Valley Road
19	8	Province Parkway and 176th

4.6.3 Lift Stations

The lift stations were evaluated based on their firm pumping capacity and the estimated upstream, dry weather peak flow from the hydraulic model. All of the City's lift stations have sufficient capacity for current flows.

The Bio Flora and Palm Valley Lift Stations are estimated to have insufficient capacity for the projected year 2020 flows and the CantaMia Lift Station is estimated to have insufficient capacity for the projected year 2025 flows. New pumps for these lift stations have been planned in the CIP. Table 4.8 summarizes the modeled flows compared to the firm capacity for each of the City's lift stations for each planning year.

Table 4.8 Lift Station Capacity Analysis
2016 Integrated Water Master Plan
City of Goodyear

Lift Station	Firm Capacity (1) (gpm)	Inflows by Planning Year (2) (gpm)			Upsize Required
		2015	2020	2025	
Goodyear WRF					
Bio Flora	250	210	**292**	**292**	**Yes**
Del Camino	300	16	16	16	No
Las Brisas	325	119	150	163	No
Palm Valley	330	309	**370**	**370**	**Yes**
Rubbermaid	220	27	94	94	No
Wells Fargo	250	245	248	248	No
Corgett WRF					
Irene	122	8	8	8	No
Lost	710	24	24	24	No
Ricardo	120	3	9	9	No
Rainbow Valley WRF					
CantaMia	250	30	148	**297**	**Yes**
Lum	475	111	117	117	No
Rainbow Valley	3,200	260	350	350	No

Notes:
(1) Capacity with the largest pump out of service. For duplex systems, this is equivalent to the capacity of a single pump.
(2) Model estimated peak flows into the lift station wetwell. Bold values indicate flows that are greater than the lift station firm capacity.

The Wells Fargo Lift Station was previously identified for rehabilitation in the Phase I Asset Management task of the 2016 IWMP. Although the model predicted flows are less than the firm pumping capacity of that station, there are operational problems with the discharge manhole filling quickly when the lift station is running. The discharge manhole is located less than 100 feet from the lift station in Van Buren Street. It is a shallow manhole and will fill if both pumps are running. Consequently, only one pump is set to operate at this station and according to City operations staff, it runs almost constantly. It is recommended that a new force main be installed to convey the Wells Fargo Lift Station flow along Van Buren to the 12-inch line in Litchfield Road.

The Phase I Asset management task of the IWMP identified pump replacements at the following lift stations within the next five years due to aging equipment and other rehabilitation measures required to maintain these facilities:

- Ricardo
- Irene
- Bio Flora
- Lum
- Lost
- Palm Valley
- Rainbow Valley
- Las Brisas (add 3rd pump)

It is recommended that the City verify the upstream flows to the CantaMia Lift Station through flow monitoring prior to upsizing pumps. It is also recommended to field verify the pumping capacity of the individual pumps at lift stations on a regular basis, particularly if the pumps are greater than 10 years old. The design capacities used in the IWMP analysis, are based on new pumps at the beginning of their service life. Once pumps age, their capacity can decrease. It is good practice to periodically verify the actual pumping capacity through a field test in order to gauge the wear on equipment and estimate remaining useful life.

4.6.4 Future Sewer Mains

Approximately 8.3 miles of new sewers will be needed by year 2020 to serve the 5-year growth areas and approximately 8.1 miles of new sewers will be needed by year 2025 to serve the 10-year growth areas. Figure 4.7 shows the locations where new sewers will need to be constructed as development occurs.

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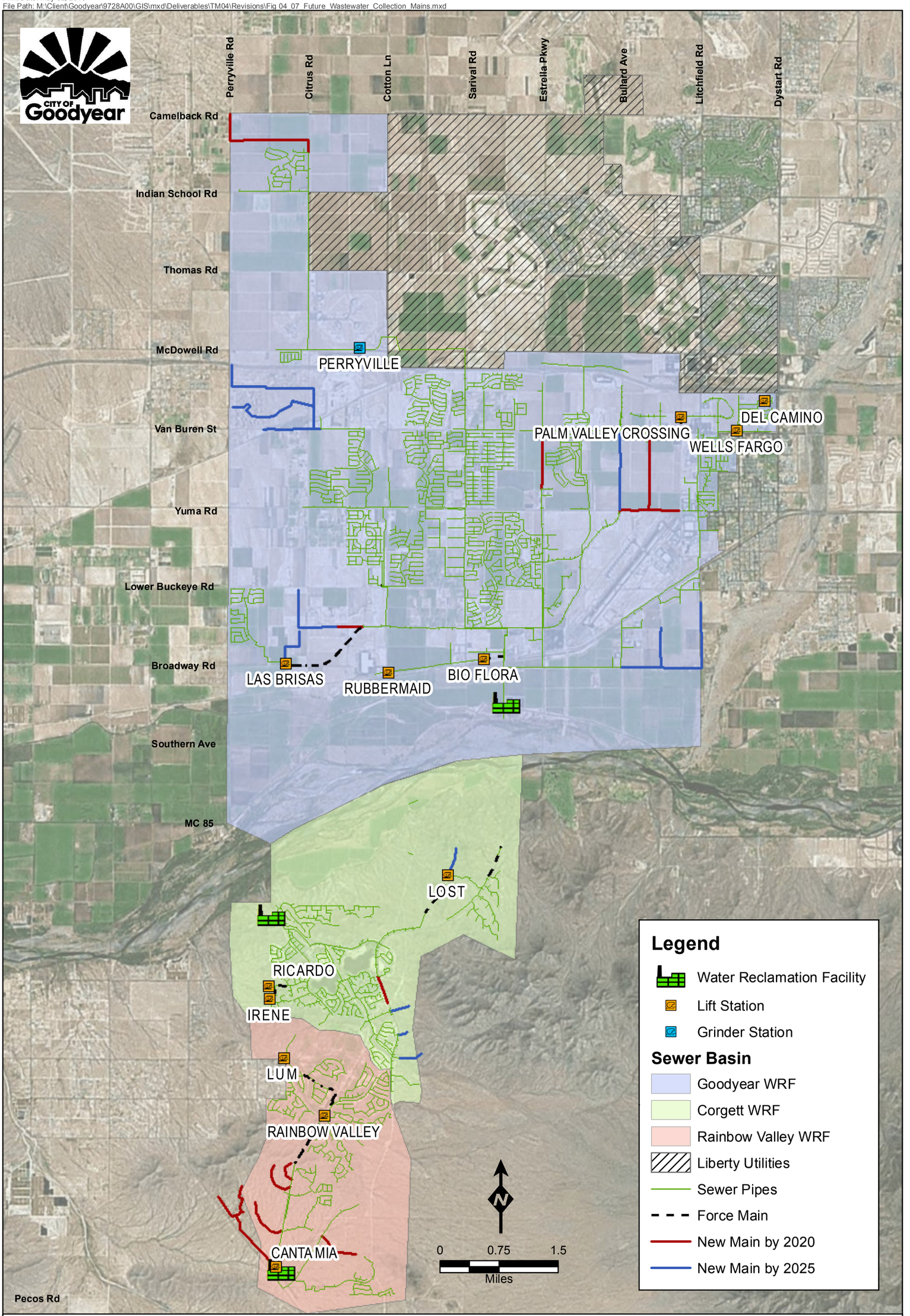


2025 WASTEWATER MAINS

FIGURE 4.7

CITY OF GOODYEAR

2016 INTEGRATED WATER MASTER PLAN

Table 4.9 and Table 4.10 summarize the diameter, length, and approximate location of the gravity sewer mains needed for planning years 2020 and 2025 respectively.

Table 4.9 Gravity Sewer Mains Needed by Year 2020
2016 Integrated Water Master Plan
City of Goodyear

No.	Location	Diameter (in)	Length (ft)	Length (mi)
1	Elwood Road from west of 175th Avenue to east of 175th Avenue	15	1,839	0.35
2	Estrella Parkway from Van Buren to Goodyear Boulevard	8	3,705	0.70
3	144th Avenue from Van Buren to Yuma	8	2,438	0.46
		12	2,645	0.50
4	Yuma Road from Bullard Avenue to Camino Oro	21	4,087	0.77
5	Estrella Parkway from San Miguel to Spring	8	1,960	0.37
6	West of Desert Trumpet Road	8	1,574	0.30
7	West of Thistle Landing Drive	8	2,587	0.49
8	West EMR Development	8	3,095	0.59
9	Northwest on Rainbow Valley Road	8	6,394	1.21
10	North of Rainbow Valley Road	8	2,641	0.50
11	East of Willis Road	8	2,880	0.55
12	Perryville Road from Camelback to south of Elm	8	1,760	0.33
13	Citrus Road from Minnezona to Campbell	8	860	0.16
14	Minnezona Avenue from Perryville to Citrus	8	5,264	1.00
		Total	**43,729**	**8.3**

Table 4.10 Gravity Sewer Mains Needed by Year 2025
2016 Integrated Water Master Plan
City of Goodyear

No.	Location	Diameter (in)	Length (ft)	Length (mi)
1	Elwood Road from Citrus to west of 175th Avenue	12	2,507	0.47
2	Citrus Road from Lower Buckeye to Elwood	8	2,557	0.48
3	North of Las Brisas Lift Station	8	2,983	0.57
4	South of McDowell and East of Perryville to Roosevelt to Citrus Road	8	6,436	1.22
5	Van Buren Street from east of Perryville to east of Citrus	8	3,404	0.645
		12	469	0.09
6	Citrus Road from Roosevelt to Van Buren	8	1,219	0.23
		12	1,437	0.27
7	Litchfield Road from Lower Buckeye to Broadway	8	4,390	0.83
8	Broadway Road from Bullard to Litchfield	10	2,730	0.52
		12	2,667	0.51
9	143rd Avenue from El Sol to Broadway	8	2,691	0.51
10	Bullard Avenue from Van Buren to Yuma	12	5,092	0.96
11	Upstream of Lost Lift Station	8	1,916	0.36
12	San Miguel east of Estrella	8	1,329	0.25
13	Coyote Trail Drive east of Estrella	8	1,654	0.31
14	Wind Drift Road east of Estrella	8	684	0.13
15	South of Roosevelt and West of Citrus Road to East of Perryville	8	2,901	0.55
		10	2,123	0.402
		12	1,370	0.26
		Total	**48,052**	**9.567**

4.6.5 Collection System Repair and Replacement Requirements

As the City's collection system ages, it will be increasingly important for the City to proactively manage the collection system to maintain system reliability and to maximize the service life of manholes, lift stations and other system components. Many utilities are adopting CMOM programs to minimize risk associated with collection system component failure and protect public health and the environment.

Infrastructure failures in the collection system including blockages in pipes, power failures at lift stations, or collapsed manholes can result in sanitary sewer overflows (SSOs). Regular maintenance activities such as pipe cleaning, updating mechanical equipment, and performing manhole inspections can reduce the likelihood of SSOs but may not eliminate them entirely.

The focus of CMOM programs is on proactive maintenance of the collection system, having operations procedures in place to respond to emergencies, and in doing field and desktop analysis to assure capacity in the collection system. While the City is not currently required to have a CMOM program under federal or state regulations, it would be prudent to establish a program because of the benefits it provides in maintaining assets the City has invested in and also reduces the risks of SSOs, which can result in fines levied against the City. The State of Arizona has an optional CMOM Permit written in Rule under the APP Program (A.A.C. R18-9-C305), which outlines the requirements for CMOM plans. The intent of this permit is to encourage wastewater utilities to proactively manage their systems and in exchange, ADEQ can exercise leniency when determining appropriate responses (including fines) when taking action following SSOs.

The City engaged in Phase I of a wastewater system asset management program with the 2016 IWMP. This task included an inventory of the existing system, interviews with collection system operations staff, site inspections of all lift stations, and a desktop condition assessment. The Phase I recommendations included improvements for the Wells Fargo lift station, and rehabilitation of the lift station force main outfall manholes.

It is recommended that this newly established Asset Management program be continued by conducting manhole and pipeline condition assessment inspections for all sewer interceptors (generally 12-inch and larger lines) in the City's system. Pipeline inspections can be completed by hiring a contractor or they can be performed by City staff if equipment (i.e., a camera truck) and appropriate training is provided. Generally utilities establish a desired inspection schedule (i.e., "all pipes 12 inches and larger to be inspected once every three years") and conduct a cost analysis to determine if they are best served by acquiring equipment and staff to perform inspections or by contracting it out. Some utilities elect to perform inspections of smaller lines (less than 12 inches) "in house" and contract inspections of larger interceptors. As Goodyear develops measures and goals for wastewater system asset management, these factors should be considered in developing a program for pipeline inspections.

Once conditions are known through physical inspection, rehabilitation and replacement measures should be identified and budgeted appropriately in the City's CIP.

It is also recommended that the City develop a CMOM plan in accordance with A.A.C R18-9-C305 within the next two years. While the CMOM APP is optional, developing a proactive capacity assurance and maintenance program for the City's wastewater system will help identify infrastructure degradation before it becomes a problem and enable the City to continue to provide the level of service its customers have come to expect.

4.7 INFRASTRUCTURE PLAN 2026 TO BUILDOUT

This section of the wastewater master plan describes the wastewater system expansion strategies and infrastructure that would be constructed after year 2025. The purpose of this section is to:

1. Identify the future water reclamation facility locations, estimated required capacities, and collection basins and verify alignment with the MAG 208 Water Quality Management Plan.
2. Provide a conceptual layout of the collection system infrastructure for the City so that developers will know how to connect their systems in a way that will align with the City's wastewater master plan.

Although the construction of the wastewater system components described in this section may not occur in the next ten years, land purchases, planning and some preliminary design work need to be accomplished within that time. Some of the water reclamation facilities in WPA 4 and WPA 5 are intended to be water campuses where potable water treatment, storage, and transmission infrastructure would be located. The City should coordinate efforts to site water reclamation facilities with the work being done on the water system. Planning level costs are provided for the major infrastructure needed to develop the buildout system.

The future wastewater flows in each water planning area are summarized in this section. The aggressive conservation described in Chapter 2 is assumed for the wastewater infrastructure that is planned. However, it was assumed that aggressive water conservation would be achieved mostly through reductions in outdoor use that would not return as sewer flows. Therefore, if the planned level of water conservation is not achieved and additional water supplies are not acquired, the population served by the City's available water resources would decrease and the impact to the wastewater master plan would be that less of the planned infrastructure would be needed.

The infrastructure and costs for the wastewater system described in this section apply to the City's 2025 General Plan estimated population of 760,000 people. Development and growth will be driven by water that is available to serve the City's water customers. Adjustments to the wastewater master plan will be needed if growth plans change.

4.7.1 Projected Wastewater Flows

Wastewater flows were developed based on the water demands for each water planning area as described in Chapter 2. For wastewater system planning, collection basins were expanded or created for each water planning area that corresponded with topography favorable for gravity sewers as shown in Figure 4.8.

4.7.2 Goodyear WRF Service Area

The Goodyear WRF Service Area includes all lands in the municipal planning area (MPA) north of the Gila River except the Liberty Utilities Service Area. All wastewater flows north of the Gila River are conveyed to the Goodyear WRF located at 157th Avenue just north of the Buckeye Irrigation District canal.

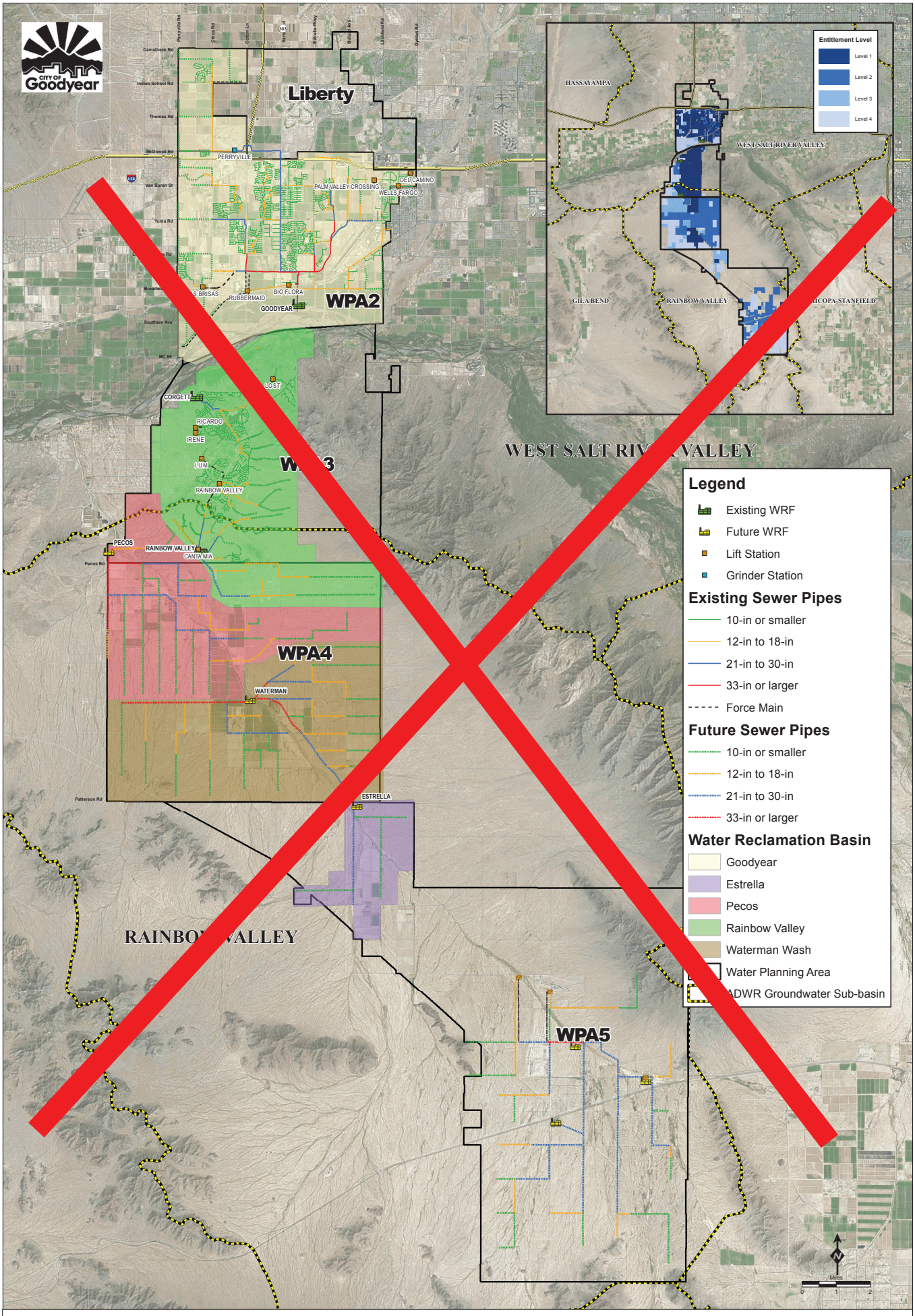
The buildout average annual daily flow for the Goodyear WRF could reach as high as 12.8 mgd if development occurs in all available land areas as currently planned (Entitlement Levels 1 - 4). Table 4.11 summarizes the projected buildout average annual daily and peak hour flows by Entitlement Level for the Goodyear WRF Service Area (WPA 2). For long-term planning purposes, a peak hour to average annual daily flow peaking factor of 2.0 was assumed for buildout conditions at the Goodyear WRF.

Table 4.11 Buildout Wastewater Flows by Entitlement Level - Goodyear WRF
2016 Integrated Water Master Plan
City of Goodyear

Entitlement Level	Wastewater Flow (mgd)	
	AADF (1)	PHF (2)
1	7.9	15.8
1, 2	8.4	16.8
1, 2, 3	9.8	19.6
1, 2, 3, 4	12.8	25.6

Notes:
(1) 140 gpcd for residential use. Assumes 40% of water demand becomes wastewater flow.
(2) AADF x 2.0

Growth in the Goodyear WRF Service Area is expected to occur north of I-10, west along Perryville Road and south to the Gila River. Based on ground elevations, the majority of the Goodyear WRF service are will be able to be served by gravity sewers. Areas that develop near the Gila River and south of the Goodyear WRF, will need lift stations to convey flows to the WRF. Figure 4.9 shows the buildout Goodyear WRF Service Area.



CITY OF GOODYEAR WASTEWATER INFRASTRUCTURE PLAN

FIGURE 4.8

CITY OF GOODYEAR

2016 INTEGRATED WATER MASTER PLAN

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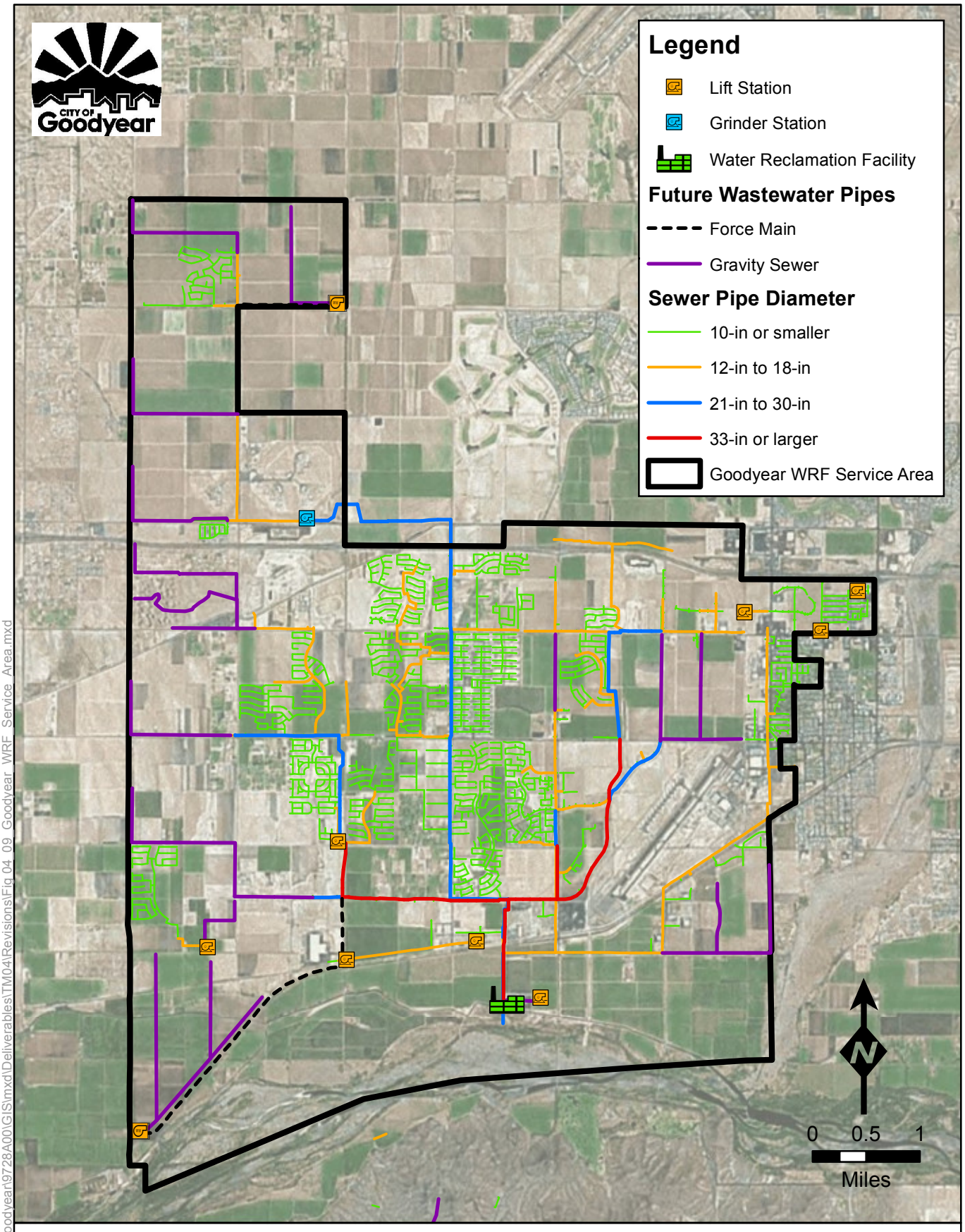

BUILDOUT GOODYEAR WRF SERVICE AREA INFRASTRUCTURE

FIGURE 4.9

CITY OF GOODYEAR

2016 INTEGRATED WATER MASTER PLAN

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4.7.3 Corgett WRF Service Area

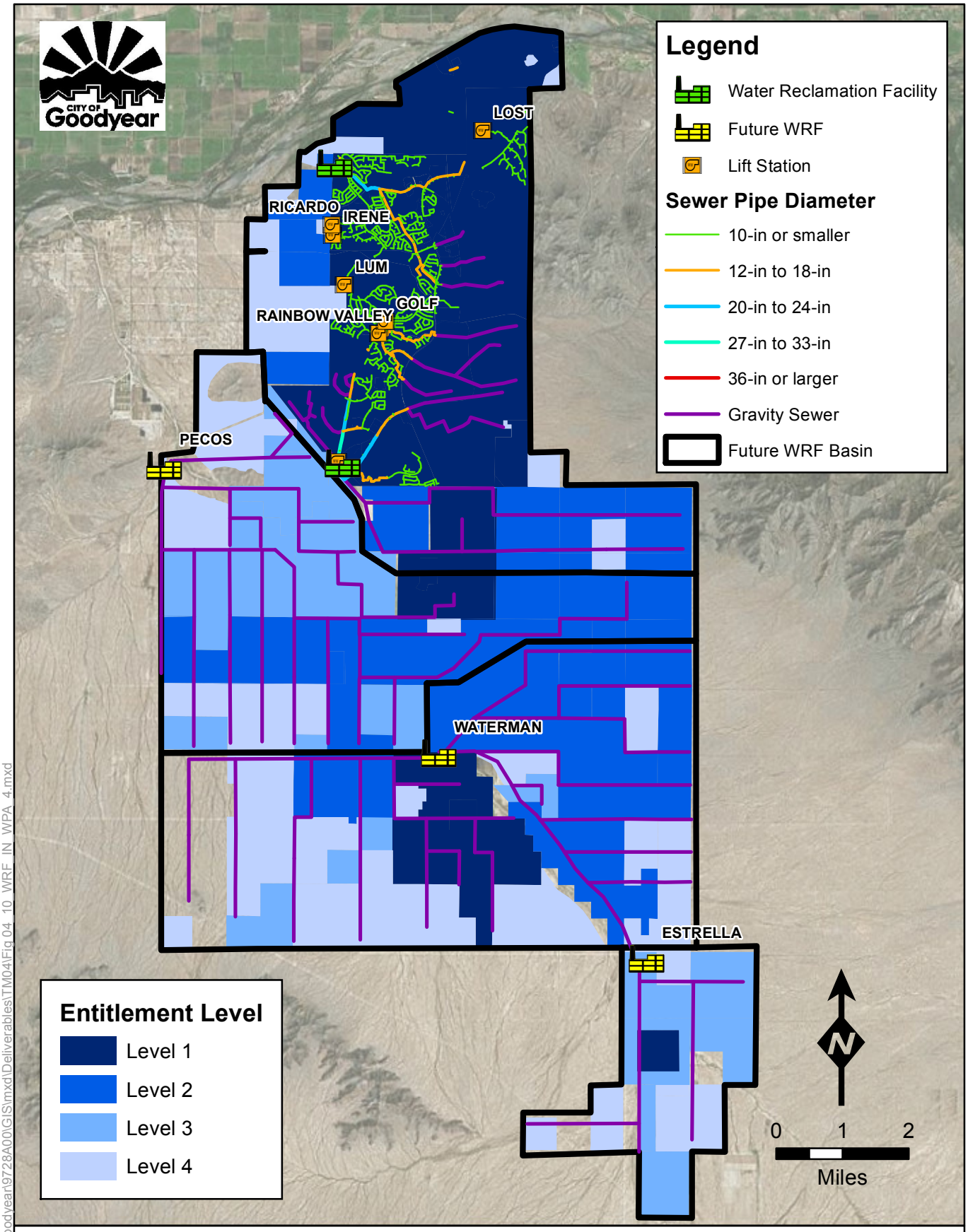
The Corgett WRF is located in the northern area of WPA 3 and includes much of the Estrella Mountain Ranch development and will be expanded as growth occurs. The buildout average annual daily wastewater flow for the Corgett WRF could reach as high as 2.5 mgd if development occurs in all available areas as currently planned (Entitlement Levels 1 - 4). Table 4.12 summarizes the projected buildout average annual daily and peak hour wastewater flows by Entitlement Level for the Corgett WRF Service Area. For planning purposes a peak hour to average annual daily flow peaking factor of 2.0 was assumed for buildout conditions at the Corgett WRF.

Table 4.12 Buildout Wastewater Flows by Entitlement Level - Corgett WRF
2016 Integrated Water Master Plan
City of Goodyear

Entitlement Level	Wastewater Flow (mgd)	
	AADF (1)	PHF (2)
1	2.2	4.4
1, 2	2.3	4.6
1, 2, 3	2.3	4.6
1, 2, 3, 4	2.5	5.0

Notes:
(1) 140 gpcd for residential use. Assumes 40% of water demand becomes wastewater flow
(2) AADF x 2.0

Figure 4.10 shows the future Corgett WRF Service area and the additional mains that will be needed to serve the expanded service area.



FUTURE WRF SERVICE AREAS IN WPA 3 & 4

FIGURE 4.10

CITY OF GOODYEAR

2016 INTEGRATED WATER MASTER PLAN

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4.7.4 Rainbow Valley WRF Service Area

The Rainbow Valley WRF is located in the southern part of WPA 3 and currently serves all development north of Pecos Road up to the Corgett WRF Service Area boundary as shown in Figure 4.10. As growth occurs, the southern boundary of the Rainbow Valley WRF will be shifted approximately 1 mile south to serve new development in the north eastern section of WPA 4.

The buildout average annual daily wastewater flow for the Rainbow Valley WRF could reach as high as 5.7 mgd if development occurs in all available areas as currently planned (Entitlement Levels 1 - 4). Table 4.13 summarizes the projected buildout average annual daily and peak hour wastewater flows by Entitlement Level for the Rainbow Valley WRF Service Area. For planning purposes a peak hour to average annual daily flow peaking factor of 2.0 was assumed for buildout conditions at the Rainbow Valley WRF.

Table 4.13 Buildout Wastewater Flows by Entitlement Level - Rainbow Valley WRF
2016 Integrated Water Master Plan
City of Goodyear

Entitlement Level	Wastewater Flow (mgd)	
	AADF (1)	PHF (2)
1	3.4	7.8
1, 2	5.1	10.2
1, 2, 3	5.2	10.4
1, 2, 3, 4	5.7	11.4

Notes:
(1) 140 gpcd for residential use. Assumes 40% of water demand becomes wastewater flow
(2) AADF x 2.0

4.7.5 Pecos WRF Service Area

The Pecos WRF is a future WRF that is located due west of the Rainbow Valley WRF along Pecos Road and is aligned with the City's western municipal boundary at Perryville Road as shown in Figure 4.10. This WRF is planned to serve the northern portion of WPA 4 and could potentially serve the portion of the expanded Rainbow Valley WRF service area mentioned previously depending on the timing of development. Alternatively, a lift station could deliver wastewater from the Pecos Basin to the Rainbow Valley WRF.

The buildout average annual daily wastewater flow for the Pecos WRF could reach as high as 9.1 mgd if development occurs in all available areas as currently planned (Entitlement Levels 1 - 4). Table 4.14 summarizes the projected buildout average annual daily and peak hour wastewater flows by Entitlement Level for the Pecos WRF Service Area. For planning purposes a peak hour to average annual daily flow peaking factor of 2.0 was assumed for buildout conditions at the Pecos WRF.

Table 4.14 Buildout Wastewater Flows by Entitlement Level - Pecos WRF
2016 Integrated Water Master Plan
City of Goodyear

Entitlement Level	Wastewater Flow (mgd)	
	AADF (1)	PHF (2)
1	0.6	1.2
1, 2	4.4	8.8
1, 2, 3	7.5	15.0
1, 2, 3, 4	9.1	18.2

Notes:
(1) 140 gpcd for residential use. Assumes 40% of water demand becomes wastewater flow
(2) AADF x 2.0

4.7.6 Waterman Wash WRF Service Area

The Waterman Wash WRF is a future WRF located near the northern boundary of the Madiera development in WPA 4 and is planned to serve the development in the southern half of WPA 4 as shown in Figure 4.10.

The buildout average annual daily wastewater flow for the Waterman Wash WRF could reach as high as 11.9 mgd if development occurs in all available areas as currently planned (Entitlement Levels 1 - 4). Table 4.15 summarizes the projected buildout average annual daily and peak hour wastewater flows by Entitlement Level for the Waterman Wash WRF Service Area. For planning purposes a peak hour to average annual daily flow peaking factor of 2.0 was assumed for buildout conditions at the Waterman Wash WRF.

Table 4.15 Buildout Wastewater Flows by Entitlement Level - Waterman Wash WRF 2016 Integrated Water Master Plan City of Goodyear		
Entitlement Level	**Wastewater Flow (mgd)**	
	AADF (1)	**PHF (2)**
1	1.6	3.2
1, 2	8.4	16.8
1, 2, 3	8.9	17.8
1, 2, 3, 4	11.9	23.8

Notes:
(1) 140 gpcd for residential use. Assumes 40% of water demand becomes wastewater flow
(2) AADF x 2.0

4.7.7 Estrella WRF Service Area

The Estrella WRF is a future WRF located in WPA 5 along Patterson Road near the eastern City boundary along Dysart Road as shown in Figure 4.10.

The buildout average annual daily wastewater flow for the Estrella WRF could reach as high as 2.6 mgd if development occurs in all available areas as currently planned (Entitlement Levels 1 - 4). Table 4.16 summarizes the projected buildout average annual daily and peak hour wastewater flows by Entitlement Level for the Estrella WRF Service Area. For planning purposes a peak hour to average annual daily flow peaking factor of 2.0 was assumed for buildout conditions at the Estrella WRF.

Alternatively, wastewater flows in the Estella Basin could flow by gravity to the Waterman WRF.

Table 4.16 Buildout Wastewater Flows by Entitlement Level - Estrella WRF 2016 Integrated Water Master Plan City of Goodyear		
Entitlement Level	**Wastewater Flow (mgd)**	
	AADF (1)	**PHF (2)**
1	0.2	0.4
1, 2	0.2	0.4
1, 2, 3	1.9	3.8
1, 2, 3, 4	2.6	5.2

Notes:
(1) 140 gpcd for residential use. Assumes 40% of water demand becomes wastewater flow
(2) AADF x 2.0

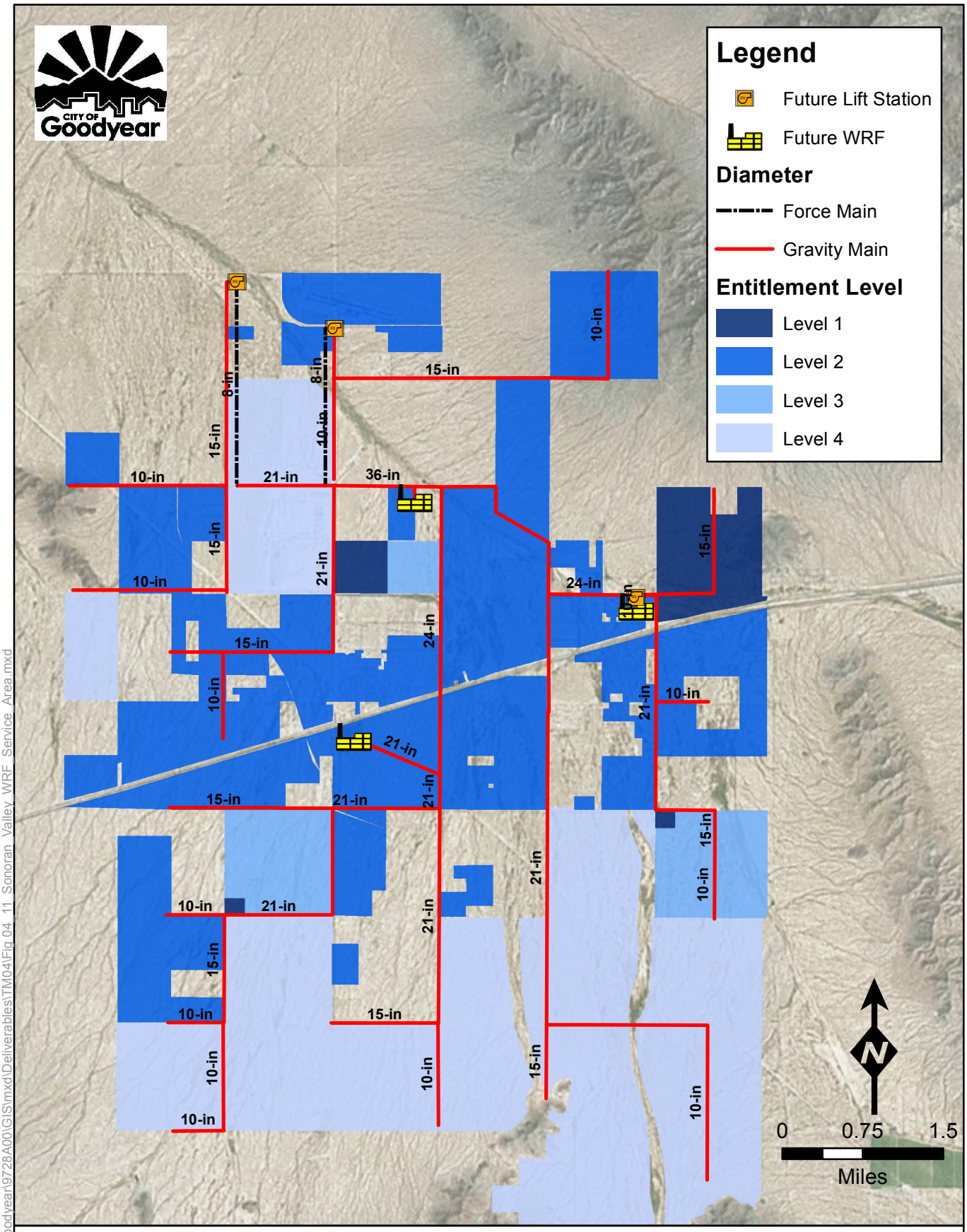
4.7.8 Sonoran Valley WRF Service Area

The buildout average annual daily wastewater flow of the Sonoran Valley WRF Service Area includes all those from WPA 5 except those from the Estrella WRF. Flows could reach as high as 10.9 mgd if development occurs in all available areas as currently planned (Entitlement Levels 1 - 4). Table 4.17 summarizes the projected buildout average annual daily and peak hour wastewater flows by Entitlement Level for the Sonoran Valley WRF Service Area. For planning purposes a peak hour to average annual daily flow peaking factor of 2.0 was assumed for buildout conditions at the Sonoran Valley WRF. Figure 4.11 shows the conceptual location of future WRFs and interceptors in WPA 5.

Table 4.17 Buildout Wastewater Flows by Entitlement Level - Sonoran Valley WRF
2016 Integrated Water Master Plan
City of Goodyear

Entitlement Level	Wastewater Flow (mgd)	
	AADF (1)	PHF (2)
1	0.4	0.8
1, 2	7.3	14.6
1, 2, 3	7.7	15.4
1, 2, 3, 4	10.9	21.8

Notes:
(1) 140 gpcd for residential use. Assumes 40% of water demand becomes wastewater flow
(2) AADF x 2.0



FUTURE WRF SERVICE AREAS IN WPA 5

FIGURE 4.11

CITY OF GOODYEAR

2016 INTEGRATED WATER MASTER PLAN

Date: March 09, 2016
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The location of future treatment facilities shown in Figure 4.11 is based on the locations identified in the MAG 208 plan. The actual location of treatment facilities will need to be based on actual development plans, which are as yet, largely undefined for WPA 5. It is recommended that the capacity of future water reclamation facilities be maximized in order for the City to benefit from potential cost savings due to economies of scale that occur with regional facilities. This may result in one or two water reclamation facilities serving the Sonoran Valley rather than three.

4.7.9 Compliance with MAG 208 Plan

The MAG 208 Water Quality Management Plan identifies six WRFs in the Goodyear Service Area that would serve customers in WPAs 2 - 4. An amendment to the MAG 208 Plan identifies an additional four WRFs that would ultimately serve customers in WPA 5. Table 4.18 summarizes these facilities, their proposed capacities and the WPA they would serve.

Table 4.18 Goodyear Water Reclamation Facilities Identified in the MAG 208 Water Quality Management Plan
2016 Integrated Water Master Plan
City of Goodyear

WRF	Ultimate Capacity (mgd) [1]	IWMP Flow Projection (mgd) [2]	Water Planning Area
Goodyear (157th)	15.0	12.8	WPA 2
Corgett	2.0	2.5	WPA 3
Rainbow Valley	6.0	5.7	WPA 3/4
Pecos	8.0	9.1	WPA 4
Waterman Wash	10.0	11.9	WPA 4
Estrella [2]	2.7	2.6	WPA 5
SLWRF	4.75	10.9	WPA 5
SRWRF	24		WPA 5
S23WRF	0.6		WPA 5
S28WRF	0.6		WPA 5

Notes:
(1) From MAG 208 Water Quality Management Plan
(2) Projected flows based on full development of service area (Entitlement Levels 1 - 4) Not explicitly defined in the MAG 208 Plan

In general the planned capacity of the WRFs is close to the projected future flows for each service basin. Given the level of accuracy possible with flow projections and uncertainties associated with future growth, no action is recommended to adjust the capacities of the

WRFs as stated in the MAG 208 plan at this point. In the future as development plans progress, the City should compare projections with the planned capacities and take actions to modify the MAG 208 plan, if appropriate.

4.8 WASTEWATER SYSTEM CAPITAL IMPROVEMENTS

This section summarizes the proposed wastewater system infrastructure projects and recommendations of the 2016 IWMP.

4.8.1 Unit Costs

4.8.1.1 Cost Estimate Accuracy

Unit costs have been developed for the capital improvements for each project recommended herein. This cost estimate was prepared in accordance with the guidelines of the AACE International for a Class 4 estimate. Table 4.19 summarizes the AACE International cost estimate classification system, the level of project definition (percent of design), uses, cost estimating methodologies and expected accuracy of Class 1 through 5 estimates. Design work would need to be undertaken to obtain more precise cost estimates.

Table 4.19 AACE Cost Estimate Classification Summary
2016 Integrated Water Master Plan
City of Goodyear

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%

4.8.1.2 Project Cost Development Methodology

To develop project costs for each capital improvement project, unit costs for gravity sewers, lift stations and other infrastructure are developed based on information from R.S. Means and other unit cost sources including bid tabs. When multiplied by the capacity or size of the facility, the unit construction cost is the cost that the City should expect to pay a contractor to construct the facility. The City will have other expenses including design, inspection, contingency, and project management that are included in the overall project cost. The project cost is obtained by multiplying the construction cost by a factor of 1.4. Table 4.20 contains an opinion of probable unit construction costs for the recommended projects. The unit cost development is included in Appendix E.

Table 4.20 Unit Cost Summary
2016 Integrated Water Master Plan
City of Goodyear

Component	Construction Cost (Unit)	Project Cost [1] (Unit)
Gravity Mains		
8-inch	$141/LF	$198/LF
10-inch	$154/LF	$216/LF
15-inch	$162/LF	$226/LF
21-inch	$182/LF	$254/LF
24-inch	$197/LF	$275/LF
Wastewater Treatment		
New Plant Construction or Expansion [2]	$12/gpd	$17/gpd
Lift Stations		
0.1 - 0.9 mgd	$0.52/mgd	$0.73/mgd
1.0 - 2.0 mgd	$0.46/mgd	$0.64/mgd
2.0 - 7.0 mgd	$0.43/mgd	$0.60/mgd
Force Mains		
6-inch	$141/LF	$197/LF
8-inch	$148/LF	$207/LF

Notes:
(1) Construction Cost x 1.4 (engineering design, inspection, and project management).
(2) Based on cost data presented in WRRF06-08 - Low-Cost Treatment Technologies for Small-Scale Water Reclamation Plants, escalated to year 2015 values.
(3) ENR CCI: 9886

4.8.2 Project Summary

Table 4.21 summarizes the recommendations from the Five-Year CIP. These recommendations are to provide the required infrastructure to serve current customers. Table 4.22 summarizes the recommendations for planning years 2020 and 2025. These projects provide the required information to serve growth.

Table 4.21 Wastewater CIP Project Summary Five-year CIP for 2015 System Deficiencies
2016 Integrated Water Master Plan
City of Goodyear

Project Number	Priority	Description	Justification	Location	Consequence of not Implementing the Project	FY 2016 Costs	FY 2017 Costs	FY 2018 Costs	FY 2019 Costs	FY 2020 Costs	Total Project Costs
WW-1	1	Rainbow Valley WRF Influent Pump Station	Lack of instrumentation on the piping system prevents monitoring pump performance and wetwell levels	Rainbow Valley WRF	Potential spill from overflowing wetwell; premature pump failure	$70,100					$70,100
WW-2	2	Rainbow Valley WRF Sludge Holding Tanks	Significant piping and valving improvements are required to enable process operations to be efficient	Rainbow Valley WRF	Potential violations of discharge permit due to lack of process redundancy	$157,700					$157,700
WW-3	3	Goodyear WRF (157th Avenue) Solids Handling Facility upgrade	Rehabilitation and upgrade of existing equipment and installation of finer screening unit for process improvement	Goodyear WRF	Potential violations of discharge permit due to lack of process redundancy, and aging equipment	$1,351,900					$1,351,900
WW-4	4	Perryville Grinder Station - screen and auger installation	Solids from Perryville Prison are not removed from the collection system and cause debris issues at the Goodyear WRF	Perryville Grinder Station	Potential for backup of collection system at prison; increased O&M at Goodyear WRF to remove debris	$300,000					$300,000
WW-5	5	Replace Wells Fargo force main	Continual problem with surcharging of wetwell and pumps cannot be fully utilized	Wells Fargo Lift Station	Potential for backup in collection system is high	$556,000					$556,000
WW-6	6	Upsize approximately 300 LF of gravity sewer pipeline	Continual problem with surcharging and debris accumulation; O&M costs are high	Prison connection to Goodyear system	Potential for backup in collection system is high	$190,000					$190,000
WW-7	7	Lift Station 12 - Rainbow Valley Lift Station Influent piping and wetwell rehabilitation	Influent piping has corroded and fallen off its connection resulting in need to operate wetwell with higher level than best practices; wetwell re-coating	Rainbow Valley Lift Station	Loss of capacity in wetwell for pump cycling risking potential backup in collection system	$148,000					$148,000
WW-8	8	Lift Station 7 - Ricardo Lift Station pumps replacement, guide rails, chains and wetwell coatings, Lift Station 8 - Irene Lift Station pumps replacement, guide rails, chains and wetwell coatings	Pumps need replacement along with piping and guide rails; wetwell coating needs rehabilitation	Lift Station 7 and 8	Potential failure of pumps to operate and subsequent spill, backup in collection system	$335,000					$335,000
WW-9	9	Implement CMOM program	Proactively manage collection system to prevent spills and reduce life cycle operating costs	Citywide	Collection system is not systematically maintained so the risk of sewer overflows increases; maintenance costs increase as repairs must be done after failures occur.	$225,000					$225,000
WW-10	10	Rehabilitation of severely corroded sewer manholes that force mains discharge into	Precast concrete manholes have been severely corroded due to high H_2S and are at risk of failing	Various locations in collection system	Potential for manhole collapse causing disruption and/or injury if the manhole is located in a roadway	$270,000					$270,000
WW-11	11	Goodyear WRF (157th Avenue) South Digester Rehabilitation	Aging and cracked digester needs repair or replacement to prevent leakage into the aquifer	Goodyear WRF	Potential Contamination of the Aquifer; violation of discharge permit	$315,000					$315,000
WW-12	12	Rehabilitation of QS 59 small diameter sewer pipelines and associated manholes using no-dig CIPP methods	Existing small diameter VCP sewer pipes have numerous cracks and allow significant root intrusion resulting in excessive maintenance	QS 59	Potential sewer line backup and subsequent overflow of sewage, violation of permit	$1,600,000					$1,600,000
WW-13	13	Goodyear WRF (157th Avenue) Solids Handling Facility upgrade	Addition of third centrifuge for process redundancy	Goodyear WRF	Potential violations of discharge permit due to lack of process redundancy, and aging equipment		$1,204,300				$1,204,300

Table 4.21 Wastewater CIP Project Summary Five-year CIP for 2015 System Deficiencies
2016 Integrated Water Master Plan
City of Goodyear

Project Number	Priority	Description	Justification	Location	Consequence of not Implementing the Project	FY 2016 Costs	FY 2017 Costs	FY 2018 Costs	FY 2019 Costs	FY 2020 Costs	Total Project Costs
WW-14	14	Lift Station 5 - Bio Flora Lift Station pump replacement; piping	Pumps need replacement along with piping and guide rails	Lift Station 5	Potential failure of pumps to operate and subsequent spill, backup in collection system		$184,000				$184,000
WW-15	15	Corgett WRF Influent Pump Station and Headworks Improvements	Need to address wetwell corrosion, replace grit removal and washer/compactor equipment	Corgett WRF	Potential violations of discharge permit due to aging equipment and process inefficiencies		$793,400				$793,400
WW-16	16	Rainbow Valley WRF waterline extension	Need to connect to domestic water system for supply of water at the WRF; addition of fire hydrant	Rainbow Valley WRF	Continue to haul potable water to site for lab and personnel use; lack of firefighting capability on site		$123,500				$123,500
WW-17	17	Rainbow Valley WRF Aeration Basin improvements and membrane replacement	Replace failed aeration membranes, and make significant upgrades to air piping for process improvements	Rainbow Valley WRF	Potential violations of discharge permit due to lack of process redundancy, and failed equipment		$237,600				$237,600
WW-18	18	Rainbow Valley WRF RAS/WAS Pump Station improvements	Addition of VFDs on pump motors, MOV for control valve and piping from ARVs to wetwell	Rainbow Valley WRF	Potential spill from ARVs discharging to ground; potential premature equipment failure; inefficient use		$51,700				$51,700
WW-19	19	Rainbow Valley solids Handling Area improvements	Improvements to solids handling area	Rainbow Valley WRF	Potential violations from dewatered solids spilling onto the ground rather than into bin or concrete slab		$63,200				$63,200
WW-20	20	Lift Station 10 - Lum Lift Station - pump replacement	Pumps need replacement along with ARVs and piping, wetwell coatings need rehabilitation	Lift Station 10 - Lum	Potential failure of pumps to operate and subsequent spill, backup in collection system		$167,000				$167,000
WW-21	21	Rehabilitation of severely corroded sewer manholes within collection system	Precast concrete manholes have been severely corroded due to high H_2S and need rehabilitation	Various locations in collection system	Potential for manhole collapse causing disruption and/or injury if the manhole is located in a roadway		$500,000				$500,000
WW-22	22	Lift Station 6 - (Lost Lift Station) - pump replacement and wetwell rehabilitation	Pump station is 28 years old - pumps have outlived useful life; wetwell is highly corroded; site security	Lift Station 6 (Lost Lift Station)	Potential failure of pumps to operate and subsequent spill, backup in collection system			$275,000			$275,000
WW-23	23	Lift Station 3 - Palm Valley Lift Station pumps replacement; generator panel; wetwell coating	Pumps need replacement along with piping and guide rails; wetwell coating needs rehabilitation	Lift Station 3	Potential failure of pumps to operate and subsequent spill, backup in collection system			$90,000			$90,000
WW-24	24	Corgett WRF Chlorine Contact Basin Improvements	Optimize chlorine dosing to ensure proper chlorine levels in effluent	Corgett WRF	Over spending chemicals, discharging effluent with too high chlorine levels			$157,300			$157,300
WW-25	25	Lift Station 12 - Rainbow Valley Lift Station Pump Replacement	Area being served is growing and there is no redundancy at the lift station	Rainbow Valley Lift Station	Potential failure of pumps to operate and subsequent spill, backup in collection system			$101,000			$101,000
WW-26	26	Rehabilitation of severely corroded sewer manholes that force mains discharge into	Precast concrete manholes have been severely corroded due to high H_2S and are at risk of failing	Various locations in collection system	Potential for manhole collapse causing disruption and/or injury if the manhole is located in a roadway			$500,000			$500,000
WW-27	27	Rehabilitation of severely corroded sewer manholes within collection system	Precast concrete manholes have been severely corroded due to high H_2S and need rehabilitation	Various locations in collection system	Potential for manhole collapse causing disruption and/or injury if the manhole is located in a roadway				$500,000		$500,000
WW-28	28	Rainbow Valley WRF Tertiary Filter Unit Replacement	Existing traveling bridge filter unit is at the end of its useful life and needs to be replaced	Rainbow Valley WRF	Potential violation of discharge permit				$552,000		$552,000

Table 4.21 Wastewater CIP Project Summary Five-year CIP for 2015 System Deficiencies
2016 Integrated Water Master Plan
City of Goodyear

Project Number	Priority	Description	Justification	Location	Consequence of not Implementing the Project	FY 2016 Costs	FY 2017 Costs	FY 2018 Costs	FY 2019 Costs	FY 2020 Costs	Total Project Costs
WW-29	29	Lift Station 13 - Las Brisas Lift Station install third 70-hp pump	Pump needed for redundancy and reliability	Lift Station 13	Loss of capacity of lift station for pump cycling risking potential backup in collection system				$102,000		$102,000
WW-30	30	Lift Station 12 - Rainbow Valley Lift Station Pump Replacement	Area being served is growing and there is no redundancy at the lift station	Rainbow Valley Lift Station	Potential failure of pumps to operate and subsequent spill, backup in collection system				$101,000		$101,000
WW-31	31	Corgett WRF Scum Pump Station addition/ Chemical Storage and Feed system	Scum should be sent to digesters not to influent pump station; relocate chemical storage tanks	Corgett WRF	Process remains inefficient and more costly to operate; comply with Best Practices					$86,400	$86,400
WW-32	32	Lift Station 2 - Del Camino Lift Station wetwell rehabilitation	Wetwell concrete strength is compromised due to corrosion	Lift Station 2	Potential to disrupt lift station operations if concrete spalls off					$70,000	$70,000
WW-33	22	Lift Station 12 - Rainbow Valley Lift Station Pump Replacement	Area being served is growing and there is no redundancy at the lift station	Rainbow Valley Lift Station	Potential failure of pumps to operate and subsequent spill, backup in collection system					$101,000	$101,000
WW-34	34	Rehabilitation of severely corroded sewer manholes within collection system	Precast concrete manholes have been severely corroded due to high H_2S and need rehabilitation	Various locations in collection system	Potential for manhole collapse causing disruption and/or injury if the manhole is located in a roadway					$1,000,000	$1,000,000
Subtotal						**$5,518,700**	**$3,324,700**	**$1,123,300**	**$1,255,000**	**$1,257,400**	**$12,479,100**
Five-Year Wastewater CIP Grand Total							**$12,479,100**				

ENR CCI = 9886 Costs are not escalated in future years.

Table 4.22 10-Year Wastewater System CIP Project Summary - Growth Related Projects
2016 Integrated Water Master Plan
City of Goodyear

Project Number	Priority	Description	Justification	Location	Consequence of not Implementing the Project	FY 2016 Costs	FY 2017 Costs	FY 2018 Costs	FY 2019 Costs	FY 2020 Costs	FY 2021 Costs	FY 2022 Costs	FY 2023 Costs	FY 2024 Costs	FY 2025 Costs	Total Project Costs
IMWP_WW34	-	Replace Pumps at the CantaMia Lift Station	Pumps need replacement to meet projected flows	CantaMia Lift Station	Potential spill from overflowing wetwell; premature pump failure	$-	$-	$-	$-	$-	$-	$-	$-	$148,000	$-	$148,000
IMWP_WW35	-	New 15-in sewer (1,840 LF) Elwood Road from West of 175th to east of 175th Avenue	Serve future growth and expand the collection system	WPA 2	Inability to serve future development	$-	$-	$-	$417,300	$-	$-	$-	$-	$-	$-	$417,300
IMWP_WW36	-	New 8-in sewer (3,700 LF) Estrella Parkway from Van Buren to Goodyear Boulevard	Serve future growth and expand the collection system	WPA 2	Inability to serve future development	$-	$-	$-	$730,400	$-	$-	$-	$-	$-	$-	$730,400
IMWP_WW37	-	New 8-in sewer (2,440 LF) and 12-in sewer (2,650 LF) 144th Avenue from Van Buren to Yuma	Serve future growth and expand the collection system	WPA 2	Inability to serve future development	$-	$-	$-	$1,053,000	$-	$-	$-	$-	$-	$-	$1,053,000
IMWP_WW38	-	New 21-in sewer (4,100 LF) Yuma Road from Bullard to Camino Oro	Serve future growth and expand the collection system	WPA 2	Inability to serve future development	$-	$-	$-	$1,042,100	$-	$-	$-	$-	$-	$-	$1,042,100
IMWP_WW39	-	New 8-in sewer (1,960 LF) Estrella Parkway from San Miguel to Spring	Serve future growth and expand the collection system	WPA 3	Inability to serve future development	$-	$-	$-	$386,900	$-	$-	$-	$-	$-	$-	$386,900
IMWP_WW40	-	New 8-in sewer (1,580 LF) West of Desert Trumpet Road	Serve future growth and expand the collection system	WPA 3	Inability to serve future development	$-	$-	$-	$311,900	$-	$-	$-	$-	$-	$-	$311,900
IMWP_WW41	-	New 8-in sewer (2,590 LF) West of Thistle Landing Drive	Serve future growth and expand the collection system	WPA 3	Inability to serve future development	$-	$-	$-	$511,300	$-	$-	$-	$-	$-	$-	$511,300
IMWP_WW42	-	New 8-in sewer (3,095 LF) West EMR Development	Serve future growth and expand the collection system	WPA 3	Inability to serve future development	$-	$-	$-	$611,900	$-	$-	$-	$-	$-	$-	$611,900
IMWP_WW43	-	New 8-in sewer (6,400 LF) Northwest on Rainbow Valley Road	Serve future growth and expand the collection system	WPA 3	Inability to serve future development	$-	$-	$-	$1,263,400	$-	$-	$-	$-	$-	$-	$1,263,400
IMWP_WW44	-	New 8-in sewer (2,640 LF) North of Rainbow Valley Road	Serve future growth and expand the collection system	WPA 3	Inability to serve future development	$-	$-	$-	$523,100	$-	$-	$-	$-	$-	$-	$523,100
IMWP_WW45	-	New 8-in sewer (2,880 LF) East of Willis Road	Serve future growth and expand the collection system	WPA 3	Inability to serve future development	$-	$-	$-	$568,500	$-	$-	$-	$-	$-	$-	$568,500
IMWP_WW46	-	New 8-in sewer (1,760 LF) Perryville Road from Camelback to south of Elm	Serve future growth and expand the collection system	WPA 3	Inability to serve future development	$-	$-	$-	$347,400	$-	$-	$-	$-	$-	$-	$347,400

Table 4.22 10-Year Wastewater System CIP Project Summary - Growth Related Projects
2016 Integrated Water Master Plan
City of Goodyear

Project Number	Priority	Description	Justification	Location	Consequence of not Implementing the Project	FY 2016 Costs	FY 2017 Costs	FY 2018 Costs	FY 2019 Costs	FY 2020 Costs	FY 2021 Costs	FY 2022 Costs	FY 2023 Costs	FY 2024 Costs	FY 2025 Costs	Total Project Costs
IMWP_WW47	-	New 8-in sewer (860 LF) Citrus Road from Minnezona to Campbell	Serve future growth and expand the collection system	WPA 3	Inability to serve future development	$-	$-	$-	$169,800	$-	$-	$-	$-	$-	$-	$169,800
IMWP_WW48	-	New 8-in sewer (5,264 LF) Minnezona Avenue from Perryville to Citrus	Serve future growth and expand the collection system	WPA 3	Inability to serve future development	$-	$-	$-	$1,040,300	$-	$-	$-	$-	$-	$-	$1,040,300
IMWP_WW49	-	New 12-in sewer (2,500 LF) Elwood Road from Citrus to west of 175th Avenue	Serve future growth and expand the collection system	WPA 2	Inability to serve future development	$-	$-	$-	$-	$-	$-	$-	$-	$541,200	$-	$541,200
IMWP_WW50	-	New 8-in sewer (2,560 LF) Citrus Road from Lower Buckeye to Elwood	Serve future growth and expand the collection system	WPA 2	Inability to serve future development	$-	$-	$-	$-	$-	$-	$-	$-	$505,300	$-	$505,300
IMWP_WW51	-	New 8-in sewer (2,990 LF) North of Las Brisas Lift Station	Serve future growth and expand the collection system	WPA 2	Inability to serve future development	$-	$-	$-	$-	$-	$-	$-	$-	$590,200	$-	$590,200
IMWP_WW52	-	Perryville from South of I-10 to Roosevelt, then east to Citrus Road	Serve future growth and expand the collection system	WPA 2	Inability to serve future development	$-	$-	$-	$-	$-	$-	$-	$-	$1,270,000	$-	$1,270,000
IMWP_WW53	-	New 10-in sewer (3,404 LF) and 12-in sewer (469 LF) Van Buren Street from Perryville to east of Citrus	Serve future growth and expand the collection system	WPA 2	Inability to serve future development	$-	$-	$-	$-	$-	$-	$-	$-	$774,000	$-	$774,000
IMWP_WW54	-	New 8-in sewer (1,219 LF) and 12-in sewer (1437 LF) Citrus Road from Roosevelt to Van Buren	Serve future growth and expand the collection system	WPA 2	Inability to serve future development	$-	$-	$-	$-	$-	$-	$-	$-	$552,000	$-	$552,000
IMWP_WW55		South of Roosevelt and West of Citrus to East of Perryville	Serve future growth and expand the collection system	WPA 2	Inability to serve future development	$-	$-	$-	$-	$-	$-	$-	$-	$1,327,000	$-	$1,327,000
IMWP_WW56	-	New 8-in sewer (4,390 LF) Litchfield Road from Lower Buckeye to Broadway	Serve future growth and expand the collection system	WPA 2	Inability to serve future development	$-	$-	$-	$-	$-	$-	$-	$-	$866,600	$-	$866,600
IMWP_WW57	-	New 10-in sewer (2,730 LF) and 12-in sewer (2,670 LF) Broadway Road from Bullard to Litchfield	Serve future growth and expand the collection system	WPA 2	Inability to serve future development	$-	$-	$-	$-	$-	$-	$-	$-	$1,164,300	$-	$1,164,300
IMWP_WW58	-	New 8-in sewer (2,690 LF) 143rd Avenue from El Sol to Broadway	Serve future growth and expand the collection system	WPA 2	Inability to serve future development	$-	$-	$-	$-	$-	$-	$-	$-	$533,000	$-	$533,000
IMWP_WW59	-	New 12-in sewer (5,090 LF) Bullard Avenue from Van Buren to Yuma	Serve future growth and expand the collection system	WPA 2	Inability to serve future development	$-	$-	$-	$-	$-	$-	$-	$-	$1,099,600	$-	$1,099,600

Table 4.22 10-Year Wastewater System CIP Project Summary - Growth Related Projects
2016 Integrated Water Master Plan
City of Goodyear

Project Number	Priority	Description	Justification	Location	Consequence of not Implementing the Project	FY 2016 Costs	FY 2017 Costs	FY 2018 Costs	FY 2019 Costs	FY 2020 Costs	FY 2021 Costs	FY 2022 Costs	FY 2023 Costs	FY 2024 Costs	FY 2025 Costs	Total Project Costs
IMWP_WW60	-	New 8-in sewer (1,920 LF) Upstream of Lost Lift Station	Serve future growth and expand the collection system	WPA 3	Inability to serve future development	$-	$-	$-	$-	$-	$-	$-	$-	$379,000	$-	$379,000
IMWP_WW61	-	New 8-in sewer (1,330 LF) San Miguel east of Estrella	Serve future growth and expand the collection system	WPA 3	Inability to serve future development	$-	$-	$-	$-	$-	$-	$-	$-	$262,500	$-	$262,500
IMWP_WW62	-	New 8-in sewer (1,660 LF) Coyote Train Drive east of Estrella	Serve future growth and expand the collection system	WPA 3	Inability to serve future development	$-	$-	$-	$-	$-	$-	$-	$-	$327,700	$-	$327,700
IMWP_WW63	-	New 8-in sewer (690 LF) Wind Drift Road east of Estrella	Serve future growth and expand the collection system	WPA 3	Inability to serve future development	$-	$-	$-	$-	$-	$-	$-	$-	$136,200	$-	$136,200
IMWP_WW64	-	Expansion of the Goodyear WRF from 6.0 to 8.0 mgd	Serve future growth	Goodyear WRF	Inability to treat future projected wastewater flows	$-	$-	$-	$-	$-	$-	$-	$-	$44,000,000	$-	$44,000,000
IMWP_WW65	-	Expansion of the Corgett WRF to 1.2 mgd	Serve future growth	Corgett WRF	Inability to treat future projected wastewater flows	$-	$-	$-	$-	$-	$-	$-	$-	$26,400,000	$-	$26,400,000
IMWP_WW66	-	Expansion of Rainbow Valley WRF including redundancy (1.2 mgd capacity assumed)	Serve future growth	Rainbow Valley WRF	Inability to treat future projected wastewater flows	$-	$-	$26,400,000	$-	$	$-	$-	$-	$-	$-	$26,400,000
IWMP_WW67		Replace pumps at the Bio Flora lift station	serve future growth	WPA 2	Insufficient lift station capacity			$150,000								$150,000
IWMP_WW68		Replace pumps at the Palm Valley lift station	Serve future growth	WPA 2	Insufficient lift station capacity			$150,000								$150,000
Subtotal						***$-***	***$-***	***$26,700,000***	***$8,977,300***	***$***	***$-***	***$-***	***$-***	***$80,876,600***	***$-***	***$116,553,900***
10-Year Wastewater CIP Grand Total												**$116,553,900**				

ENR CCI = 9886 Costs are not escalated in future years.

Chapter 5

RECLAIMED WATER SYSTEM MASTER PLAN

5.1 INTRODUCTION

This section of the City's IWMP is the reclaimed water system master plan. The plan includes the following items:

1. Documentation of the City's existing reclaimed water infrastructure.
2. Documentation of the City's current reclaimed water use strategy and recommendations for reclaimed water use policy changes.
3. Reclaimed water system performance criteria used to evaluate reclaimed water delivery infrastructure and recharge requirements for current and future conditions.
4. An evaluation of the infrastructure required to serve current and future reclaimed water customers.
5. Capital improvement recommendations for the infrastructure needed to serve growth and to address deficiencies identified for the years 2020 and 2025 capital improvement planning periods.

The reclaimed water system infrastructure that will be needed in Water Planning Area 4 (WPA 4) and WPA 5 are not provided in detail and do not have capital costs associated with them because no development is planned in these areas in the next 10 years. However, a regional reclaimed water system framework is included for these areas to guide infrastructure development that is needed beyond year 2025 to allow the City to continue pursuing growth opportunities in these areas.

The expansion of the City's reclaimed water system is focused on aquifer recharge for later recovery to the potable water system. It is imperative that the City plan appropriately for the recharge facilities that will be needed in the Rainbow Valley groundwater sub-basin as these are integral to the long-term sustainability of the City's water resources. The City must take the necessary steps to secure recharge locations in accordance with the 2016 IWMP recommendations and obtain the necessary permits that will be required with the ADWR and the ADEQ.

5.2 DESCRIPTION OF EXISTING RECLAIMED WATER SYSTEM

5.2.1 Water Reclamation Facilities and Service Areas

The City's current reclaimed water system includes two water reclamation service areas associated with the areas north and south of the Gila River. The Goodyear WRF produces reclaimed water that is being recharged. Some reclaimed water is used for irrigation but expansion for irrigation is not planned. Currently the majority of the City's reclaimed water from the Goodyear WRF goes to the SAT site, which will soon be phased out. The City intends to continue reclaimed water recharge through vadose zone wells and initiated the

first phase of a design project for these wells in 2015. Reclaimed water produced at the Corgett and Rainbow Valley WRFs is owned by the EMR community and is used to fill lakes and irrigate turf including a golf course. Historically, reclaimed water from the Corgett WRF has been discharged to the Corgett Wash but will soon be connected to the EMR system and used for non-potable reuse. The City has no ownership or control of the volume of reclaimed water generated by the EMR communities or the infrastructure used to deliver this reclaimed water.

The City's current reclaimed water service areas are shown in Figure 5.1. Liberty Utilities (Liberty) operates the Palm Valley WRF, which provides wastewater service to the City of Goodyear residents in this area. Reclaimed water from the Palm Valley WRF is used for landscape irrigation and can also be recharged. Liberty recently entered into a partnership with the Central Arizona Project (CAP) to develop a recharge project near Camelback Road and Bullard Avenue. The Liberty reclaimed water system was not evaluated in the IWMP except with regard to the interconnect capacity between Goodyear's and Liberty's systems.

5.2.1.1 Goodyear Service Area

The City's reclaimed water distribution system in the north has connections to allow reclaimed water to be sent to the following locations:

- Goodyear SAT site
- The Palo Verde Nuclear Power Generating Station (Palo Verde)
- The Goodyear Sports Complex
- Other municipal non-potable uses
- The Gila River (emergency discharge)
- The Liberty Utilities reclaimed water distribution system

Most reclaimed water from the Goodyear WRF is sent to the SAT site for recharge or to Palo Verde. When the Palo Verde system is undergoing maintenance (during April and October) and the flow cannot otherwise be recharged at the SAT site, the City can discharge reclaimed water to the Gila River. Reclaimed water can also be sent to the Goodyear Sports Complex for turf irrigation. This site is configured to also be irrigated with remediated groundwater, which is currently the primary irrigation source. Reclaimed water is delivered for non-potable municipal use including landscape irrigation at the public works administration building, the fleet facility, and process water on-site at the Goodyear WRF. Reclaimed water is also delivered through reuse hydrants for construction activities or dust control. The City is currently scheduled to complete a vadose zone injection well project in 2016 that will include 5 recharge wells.

The Liberty Utilities connection provides a means of disposal but there is also potential for the City to send flow to the future Liberty/EPCOR recharge site through Liberty's distribution system.

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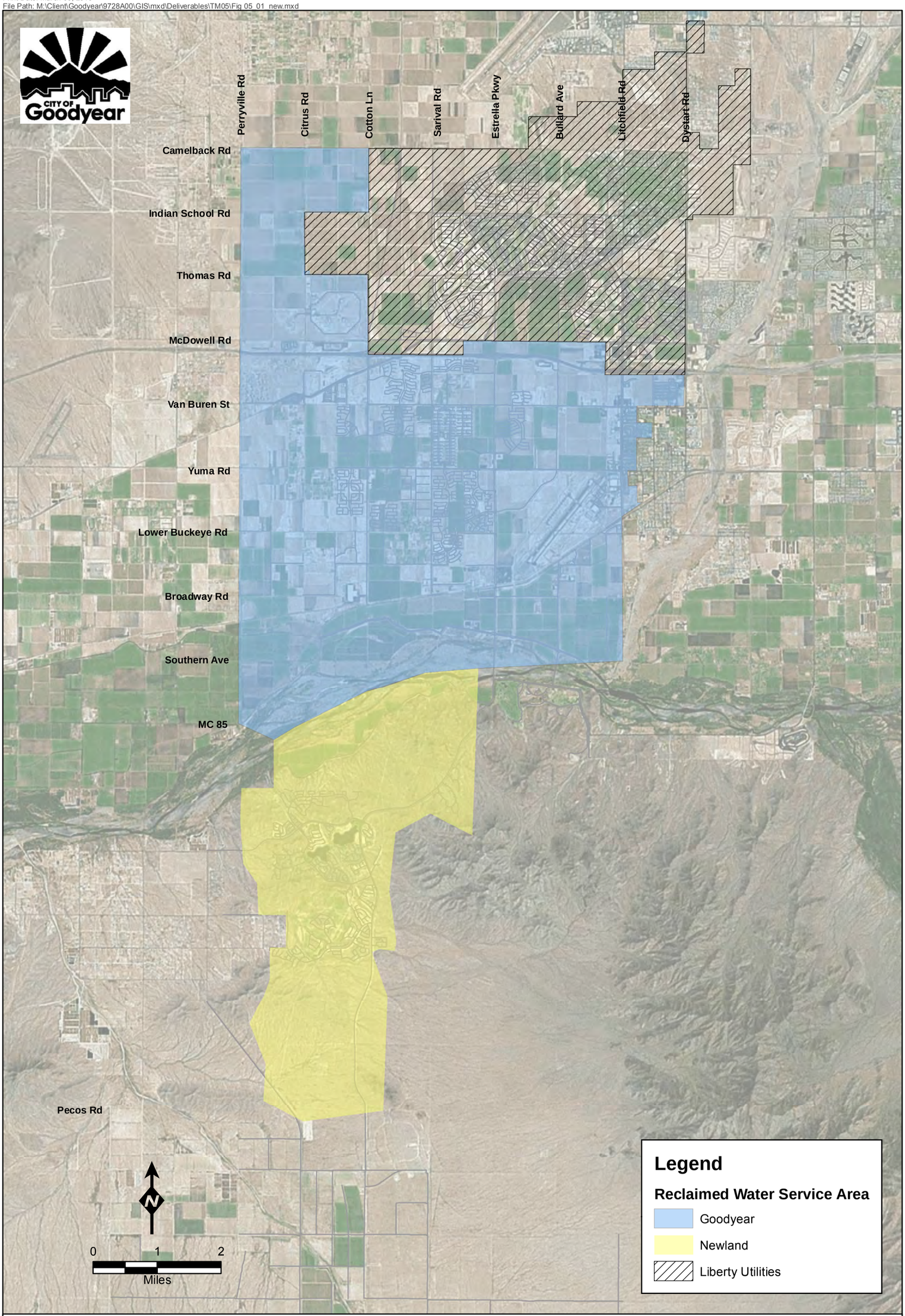

RECLAIMED WATER SERV ICE AREAS

FIGURE 5.1

CITY OF GOODYEAR

2016 INTEGRATED WATER MASTER PLAN

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5.2.1.2 Newland Service Area

The reclaimed water in the south is delivered to the Newland EMR development through a distribution system that was built by the developer to provide non-potable water for landscape irrigation and filling lakes that are then used to irrigate the Estrella Golf Club. Historical reclaimed water supplies from the Corgett and Rainbow Valley WRFs has not been sufficient to meet the EMR development irrigation demands. To address this, Newland installed a raw water transmission line that supplements the reclaimed system with non-potable water from a well field south of Pecos Road in WPA 4. If reclaimed water supplies increase in the south to the point where they can meet the EMR irrigation demands, supplies from the non-potable wells may be discontinued. However, current projections indicate that Newland may never reach a position to stop using supplies from non-potable wells.

5.2.1.3 Future Service Areas

As development occurs in WPA 4 and WPA 5 the City's reclaimed water system will need to expand to serve these areas. Some developments have agreements to receive reclaimed water for non-potable uses, which will require new reclaimed water distribution systems, storage reservoirs, and booster pump stations. Recharge facilities that may include recharge basins, injection wells or some combination will also be needed to accommodate reclaimed water flows when system demands are low and to provide a sustainable long-term water supply in the Rainbow Valley Groundwater sub-basin.

5.2.2 Reclaimed Water Infrastructure

The City's reclaimed water distribution system includes approximately 11 miles of reclaimed water mains ranging in size from 4 to 30 inches in diameter. These pipes run from the Goodyear WRF to several locations including the Gila River, BID canal, Goodyear Ball Park, SAT site and an interconnect with the Liberty reclaimed water distribution system. The City's vadose injection project (VIP) recharge wells will be supplied from extensions from this system.

The Newland development in WPA 3 owns a reclaimed water system that includes approximately 27.1 miles of reclaimed water mains ranging in size from 2 to 24 inches in diameter. This pipe network is supplied from the Corgett and Rainbow Valley WRFs. The Newland system also includes a non-potable water connection from a well in WPA 4. This non-potable system includes approximately 11 miles of raw water transmission mains ranging in size up to 24 inches in diameter. The City's reclaimed water and Newland reclaimed and non-potable water systems including the locations of water reclamation facilities, distribution lines, and meters is shown in Figure 5.2.

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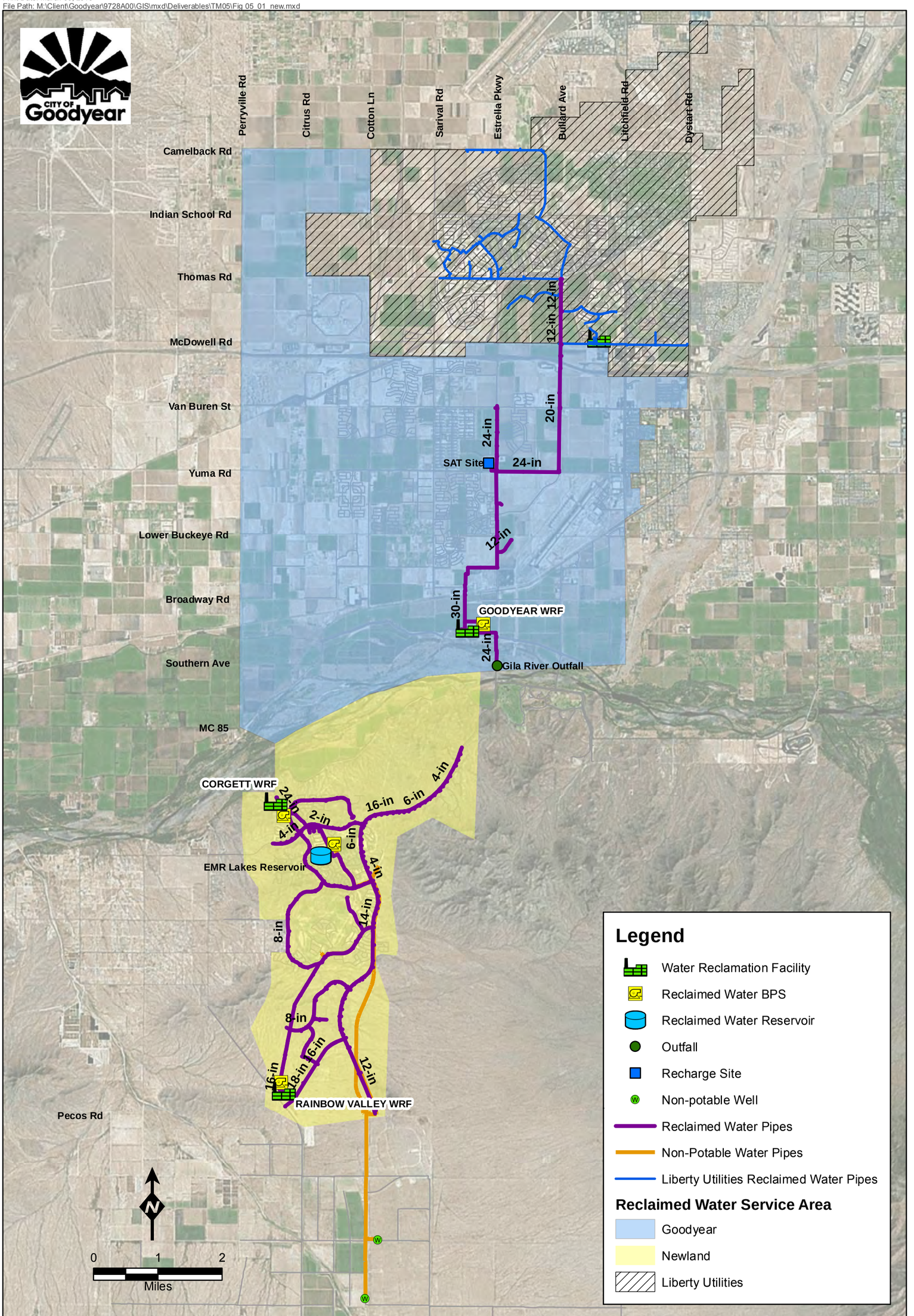

2015 RECLAIMED WATER DISTRIBUTION SYSTEM

FIGURE 5.2

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5.3 RECLAIMED WATER REGULATIONS

State reclaimed water regulations are outlined in the Arizona Administrative Code (A.A.C. R-18-11 Article 3), which lists water quality standards and allowable end uses. All of the City's WRFs produce Class A+ reclaimed water, which allows the greatest flexibility in direct reuse options and provides the required water quality needed to enable recharge wells to work as intended.

5.4 RECLAIMED WATER SYSTEM PERFORMANCE CRITERIA

The City's reclaimed water system infrastructure recommended in this master plan is intended to provide acceptable levels of performance and reliability, while being sensitive to cost. The reclaimed water system has lower safety and reliability requirements when compared with a potable water system because reclaimed water is not used for public consumption, health, and safety. Performance requirements therefore focus primarily on making sure that the reclaimed water system provides sufficient capacity and reliability to accept the reclaimed water from the WRFs and ensure that the water can be delivered to customers or to recharge sites. The following is a listing of the criteria that the reclaimed water system should satisfy.

1. **Pumping –** The firm capacity of the pump stations in the reclaimed water system needs to be able to pump the peak hour flows, which are the sum of the irrigation demands and flow to recharge locations.
2. **Storage –** Storage facilities should be capable of storing the daily difference between water supplies and demands.
3. **Recharge –** Recharge facilities need to be capable of recharging all of the water produced by the WRFs for a period of several days to a week in the event that winter storms eliminate the need for outdoor irrigation. The total recharge flow rate capacity in each basin should equal the total reclaimed water flow in the basin plus 10 percent. For recharge wells there should be an additional 10 percent excess capacity for mechanical redundancy and also for well redevelopment.
4. **Distribution Pipe Velocity –** Pipe velocities should not exceed 7 feet per second when delivering peak hour demands.
5. **System Pressure –** For pressurized distribution systems the pressure range should be greater than 40 psi and less than 80 psi.

5.5 MODEL PREPARATION

5.5.1 Existing Model

A reclaimed water distribution system model was developed using the City's GIS data and operational information about the reclaimed water distribution facilities provided by City staff. This model was developed in the Infowater software by Innovyze as described in the following sections.

5.5.2 Infrastructure

The reclaimed water model includes all of the City's reclaimed water infrastructure including the Newland non-potable well supply to the EMR system. A description of each data source that was used to create the model is listed below:

- **GIS Data –** Pipes, hydrants, meter locations, and facility location data for all reclaimed water system infrastructure including storage reservoirs, booster stations and water reclamation facilities.
- **Pump Stations –** The physical data for the reclaimed water pump stations including the number and size of pumps, pump controls, design flows, and head were provided by the City's wastewater operations personnel.
- **Operations Data –** Monthly reclaimed water deliveries were provided for each customer or end use demand. Supervisory control and data acquisition (SCADA) data for the reclaimed water system was not available.

The reclaimed water model includes a representation of all distribution and transmission lines 2 inches and larger. The model is an "all pipes" model, meaning that all system pipes (excluding service connections) are represented. A quality review of the GIS data was performed using tools in the modeling software to verify pipe connectivity.

5.5.3 Ground Elevations

Ground elevations for the model nodes that represent the locations of pipe connections and demands in the system were extracted from the DEM obtained from the USGS Seamless Data Distribution website. Elevations for facilities including tank base and pump discharge elevations were taken from facility data provided by City staff where available. The elevation ranges in the two reclaimed water service areas is:

- **Goodyear Service Area –** 895 - 1010 feet
- **Newland Service Area –** 900 - 1090 feet

5.5.4 Future Facilities

The future VIP recharge locations were added to the model for planning years 2020 and 2025. No additional direct reuse (i.e., landscape irrigation) customers were added to the future model scenarios because it is strongly recommended that the City limit direct reuse of reclaimed water in the future and instead recharge as much reclaimed water as possible and/or practical. The IWMP recommendations for future reclaimed water utilization strategies are included in Section 5.7.

5.5.5 Demands

Average annual water demands for each customer were based on monthly billing records. The location of each demand was associated with a model junction that was geographically closest to the actual location of use, which provides a sufficient level of accuracy for master planning purposes.

The model is used to predict steady state conditions, which represents a "snapshot" of system conditions at a given time.

5.5.6 Model Validation

Data was not available to validate the model. However, the model results were reviewed for reasonableness and were determined to be appropriate for use for master planning purposes and planning new infrastructure.

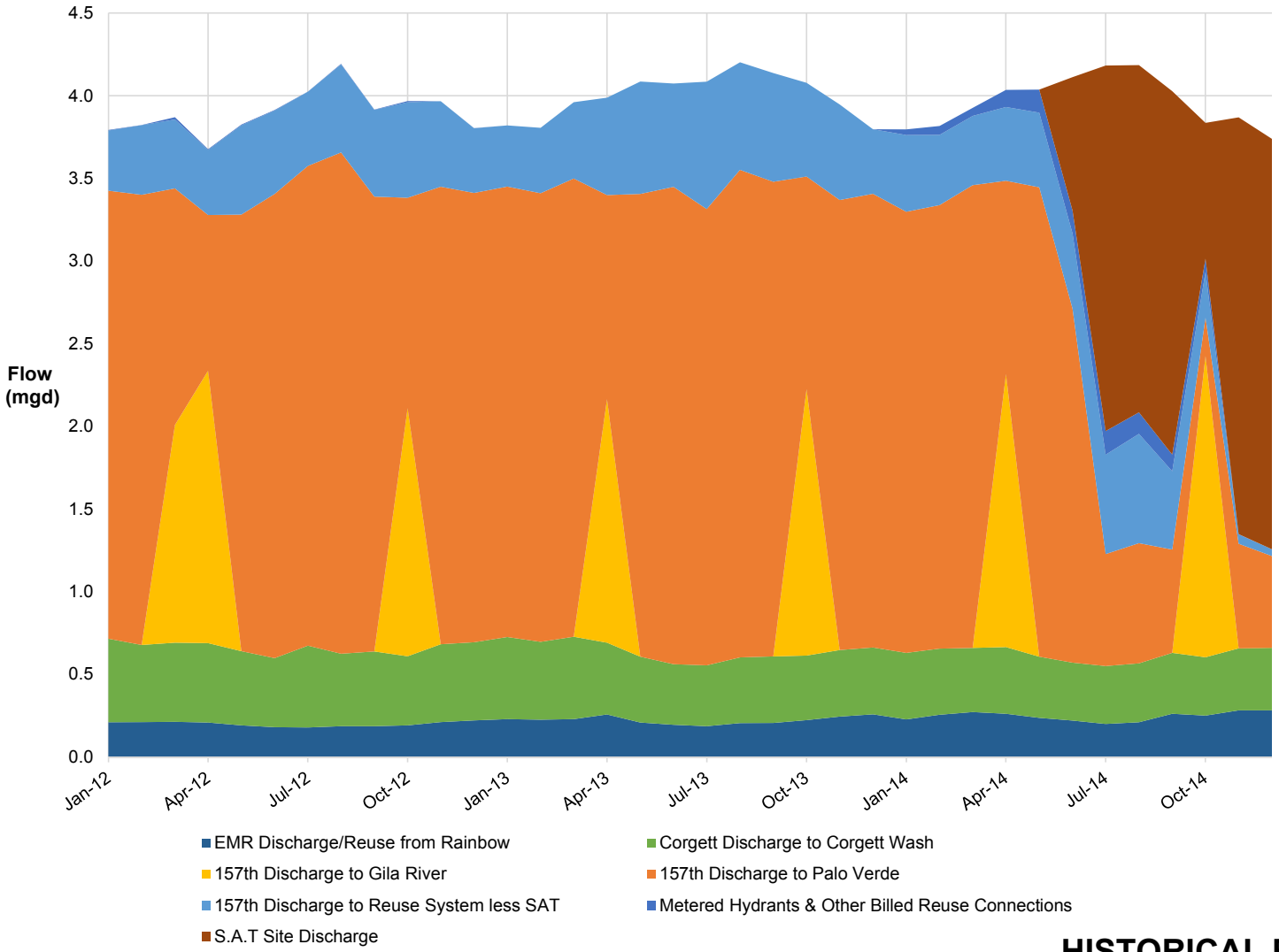
5.6 YEARS 2015 TO 2025 RECLAIMED WATER SYSTEM EVALUATION

This section describes the evaluation of Goodyear's existing reclaimed water system.

5.6.1 Historical Reclaimed Water Use

Over the past three years, the City's reclaimed water use strategy has been direct reuse through turf irrigation, dust control and other non-potable uses including reclaimed water deliveries to the Palo Verde Nuclear Generating Station. Goodyear recognizes the value of reclaimed water recharge in its long-term water resources planning to strengthen the City's physical and legal water supplies. The City has more recently emphasized the need for reclaimed water recharge at the SAT site and in 2015 engaged in a VIP that is intended to increase the City's recharge capacity to accommodate the projected reclaimed water flows from the Goodyear WRF.

A summary of the City's historical reclaimed water use is shown in Table 5.1 and a graphical representation of the City's reclaimed water use is shown in Figure 5.3.



HISTORICAL RECLAIMED WATER USE

FIGURE 5.3

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2016 INTEGRATED WATER MASTER PLAN

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Table 5.1 Historical Reclaimed Water Use
2016 Integrated Water Master Plan
City of Goodyear

Description	WRF	Estimated Average Daily Flow (mgd)		
		2012	2013	2014
Direct Reuse (1)	Goodyear	0.47	0.56	0.40
Palo Verde (2)	Goodyear	2.39	2.54	1.48
Buckeye Irrigation District	Goodyear	0	0	0
Discharge to Gila River	Goodyear	0.37	0.26	0.29
SAT Site (3)	Goodyear	0	0	1.09
Corgett Wash	Corgett	0.46	0.42	0.37
EMR (4) Golf Course/Turf Irrigation	Rainbow Valley	0.20	0.22	0.25
Hydrants (5)	All	0	0	0.08
Total		**3.9**	**4.0**	**4.0**

Notes:
(1) Includes Goodyear Ball Park.
(2) Palo Verde Nuclear Power Generating Facility.
(3) Soil aquifer treatment site recharge facility.
(4) Estrella Mountain Ranch.
(5) Includes construction water and water used for dust control.

5.6.2 Reclaimed Water Utilization Strategy Years 2015 - 2025

5.6.2.1 Goodyear WRF Service Area

Reclaimed water flow projections in the Goodyear WRF service area are expected to increase from approximately 3.1 mgd (2,150 gpm) in 2015 to 4.0 mgd (2,775 gpm) by year 2020 and to 5.2 mgd (3,610 gpm) by year 2025. The City intends to recharge the maximum amount of reclaimed water available after meeting the current non-potable reuse demands in the Goodyear WRF service area. This will enable the City to maximize the benefit of their reclaimed water resources through physical replenishment of the aquifer and by accruing credits in their water resources portfolio that can be used to offset potable groundwater pumping. The City does not intend to increase non-potable reuse demands in the Goodyear WRF service area in cases where providing these supplies would increase demands. Some limited direct reuse demand may be added to the system in cases where it reduces or eliminates potable water demand.

The City's VIP project will be constructed in multiple phases. Phase I requires a minimum of four recharge wells for permitting but will allow up to (five recharge wells total). The capacity of each recharge well is estimated to be between 400 and 600 gpm. The actual capacity may be more or less than this and will be determined from actual use.

Table 5.2 summarizes the estimated reclaimed water flows to the Goodyear WRF and the estimated VIP recharge capacity required for each planning year. By planning year 2020, an additional three recharge wells are recommended (eight total wells, including those from Phase I) and by year 2025, three more recharge wells are recommended (11 total wells, including those from Phases I and II). Except for year 2015, the planned VIP recharge capacity is sufficient to accommodate projected flows up through year 2025. The VIP Underground Storage Facility permitted capacity is sufficient to accommodate the projected flows from 2015 through year 2025.

Table 5.2 shows that for years 2020 and 2025 there is expected to be some "surplus" recharge capacity based on the recharge well phasing schedule and assumed capacities. The City's reclaimed water system performance criteria state that additional recharge capacity is needed to accommodate seasonal flow variations (i.e., in winter months when irrigation demand is low) and to handle flows when wells are out of service. The City has the ability to manage reclaimed water by discharging to the Gila River if the recharge wells are out of service. Therefore, the primary reason for the City to maintain surplus recharge capacity is to maximize reclaimed water recharge credits for the City's water resources portfolio.

Once the vadose zone wells are constructed, if the actual well capacities are less than 400 gpm per well, additional wells would be required to achieve the needed recharge rates and recharge redundancy. If the actual recharge capacity per well is 600 gpm or greater, then fewer wells would be required.

Recharge well capacity will vary over time. Soil conditions, age of equipment, and maintenance practices can all cause changes in recharge rates. It is imperative that vadose zone well capacity be actively managed so that the City can recharge all available reclaimed water and so that the VIP can be a successful, long-term recharge project. The City can maintain recharge well capacity either through rehabilitation measures or new well development.

5.6.2.2 Interconnect with Liberty Utilities

Goodyear's reclaimed water system can discharge to the Liberty Utilities reclaimed water system through an interconnect facility located on Bullard Ave and Edgemont Ave. Delivering reclaimed water to Liberty's system could provide a way for the City to recharge reclaimed water at the Liberty/EPCOR recharge project. The Goodyear reclaimed water main at this location is 12 inches in diameter, which limits the flow through this line. The hydraulic model estimates that with the current pump station at the Goodyear WRF operating at firm capacity (largest pump out of service), the maximum flow that could be delivered to Liberty would be 1,800 gpm at 20 psi at the interconnect and a maximum velocity of 5 ft/sec through the 12-inch line. The actual flows that could be delivered to Liberty's system may be less than this if that system is operating at a higher hydraulic gradeline.

Table 5.2 Goodyear WRF Reclaimed Water Flows and Recharge Capacity Required 2016 Integrated Water Master Plan City of Goodyear			
	Reclaimed Water Flow or Capacity (1) (gpm)		
Service Area	**2015**	**2020**	**2025**
EPCOR Water Service Area	400	450	475
Goodyear WRF	1,740	2,310	3,170
Total	**2,140**	**2,760**	**3,645**
Direct Reuse (2)	330	330	330
Net Reclaimed Water to Recharge	**1,810**	**2,430**	**3,315**
VIP Well No.			
Phase I - No. 1	400	400	400
Phase I - No. 2	400	400	400
Phase I - No. 3	400	400	400
Phase I - No. 4	400	400	400
Phase I - No. 5	400	400	400
Phase II - No. 6	0	400	400
Phase II - No. 7	0	400	400
Phase II - No. 8	0	400	400
Phase III - No. 9	0	0	400
Phase III - No. 10	0	0	400
Phase III - No. 11	0	0	400
Total Recharge Well Capacity	**2,000**	**3,200**	**4,400**
Surplus / (Deficit) (3)	**190**	**770**	**1,085**

Notes:

(1) Recharge well capacity is estimated to be between 400 and 600 gpm per well. To be conservative in planning, 400 gpm capacity per well is assumed.
(2) Based on Historical records from 2012 - 2014 that show an average of 0.48 mgd (330 gpm).
(3) Difference between "Net Reclaimed Water to Recharge" and "Total Recharge Well Capacity".

5.6.2.3 Newland Service Area (Corgett WRF and Rainbow Valley WRF)

Between years 2015 and 2025 the total reclaimed water generated at the Corgett and Rainbow Valley WRFs is expected to increase from 0.54 mgd (375 gpm) to 1.31 mgd (900 gpm). This reclaimed water is committed to Newland through a series of development agreements and is expected to be used for turf irrigation.

Table 5.3 summarizes the projected reclaimed water flows for the Newland Service Area for years 2015 through 2025.

Table 5.3 Newland Service Area Flows by Planning Year
2016 Integrated Water Master Plan
City of Goodyear

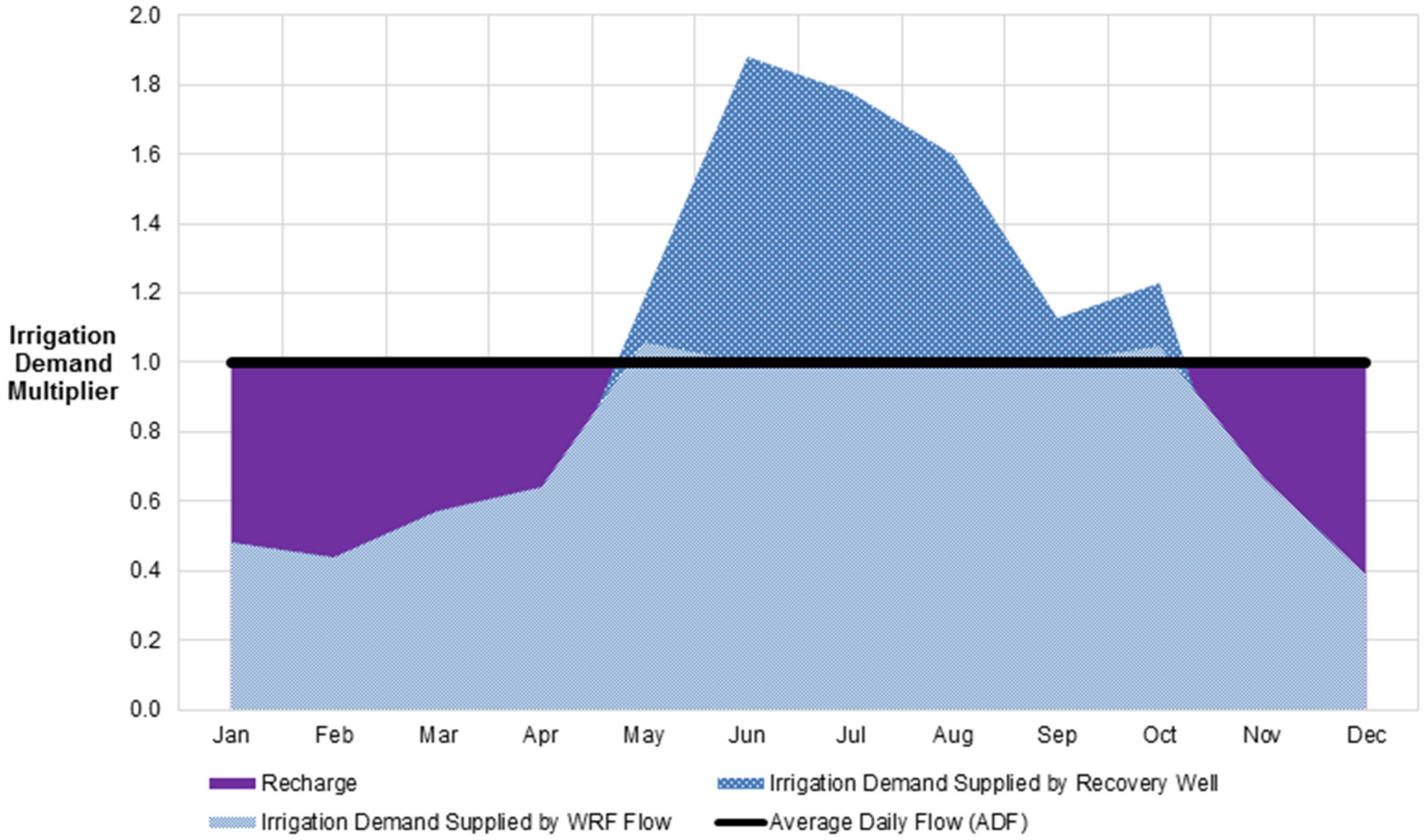
WRF	Reclaimed Water Flow (mgd)		
	2015	2020	2025
Corgett	0.27	0.31	0.51
Rainbow Valley	0.24	0.61	0.80
Total	**0.51**	**0.92**	**1.31**

5.6.3 Approaches To Meet Direct Reuse Commitments

The City has agreements in place to provide reclaimed water to a development for non-potable uses, typically irrigation. Landscape irrigation has seasonal peak demands, which result in more water applied in the summer months and less water applied in the winter. Wastewater flow rates are based on indoor water use (toilets, showers, laundry, and other water fixtures) and are generally constant throughout the year, which results in relatively constant reclaimed water production. Figure 5.4 shows an example of a typical seasonal irrigation demand. The shaded area represents the monthly water demand, which is lowest between December and February and highest in June. The black line represents the average daily demand.

For irrigated systems, if the peak seasonal water demand is greater than the reclaimed water supply, an additional supply is needed to meet demands. This can be achieved by using a recovery well in the summer months and then offsetting that use by recharging reclaimed water during times of the year when supply is more than the demand as shown in Figure 5.4.

The City may choose to limit reclaimed water irrigation so that the peak seasonal demand is less than or equal to the reclaimed water that is available. This approach enables monthly recharge throughout the year and eliminates the need for a secondary supply like a recovery well, to meet seasonal demands. This approach also results in a net gain in reclaimed water long-term storage credits and in the water stored in the aquifer. Long-term storage credits are a valuable component of the City's water resources portfolio especially when coupled with physical groundwater replenishment in the area where it is being withdrawn and treated for potable uses. Figure 5.5 shows an example of an irrigation demand adjusted so that the peak seasonal demand is equal to the reclaimed water that is available.



TYPICAL MONTHLY IRRIGATION DEMAND

FIGURE 5.4

CITY OF GOODYEAR

2016 INTEGRATED WATER MASTER PLAN

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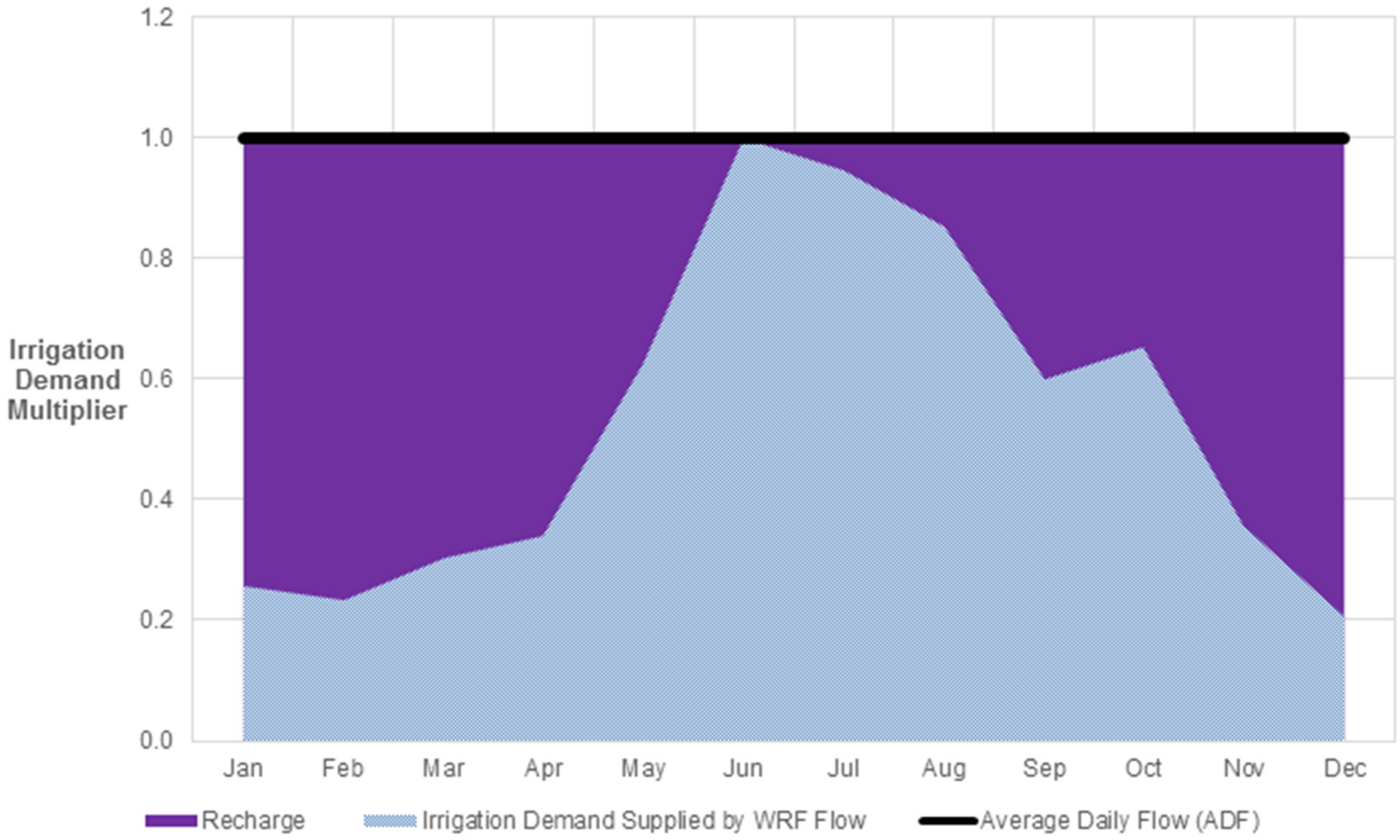

PEAK IRRIGATION DEMAND SET TO RECLAIMED WATER AVAILABLE

FIGURE 5.5

CITY OF GOODYEAR

2016 INTEGRATED WATER MASTER PLAN

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5.6.4 Recommended Policy Changes

Reclaimed water is increasing in value as a water supply to serve potable water needs through recharge and then recovery. Therefore, it is important for Goodyear to maximize reclaimed water recharge and then recovery as a potable supply to significantly expand the City's water resource portfolio. To accomplish this, there are several design standards and policies that should be changed as described below.

The City's Engineering Design Standards and Policy manual contains several requirements related to reclaimed water. Three policies that have been temporarily suspended are:

- A requirement that prohibits potable water use for dust suppression for construction and requires either reclaimed water or irrigation water to be used (Section 5.2.1 (C)).
- A requirement for all new developments to design and construct reclaimed water transmission lines, distribution lines, services and associated equipment (Section 5.2.4(A)(1)).
- A requirement to use reclaimed water on all open space areas, rights-of-way, and parks and for developments to design and install the infrastructure required to use reclaimed water (Section 5.2.4 (A)(1)(b)).

As important as reclaimed water is to the City's long-term water resources sustainability, it is recommended that the City revise its reclaimed water use policies to encourage water conservation and not create unnecessary demand. It is strongly recommended that the City evaluate ultra-low or no water use alternatives to make the City landscape attractive wherever possible and reserve as much reclaimed water as possible for recharge.

It is recommended that the City implement the following concepts in future reclaimed water use policies:

- Stop the use of reclaimed water for construction.
- Establish policies that discourage or minimize the use of turf in all areas of the City.
- Serve schools and parks with potable water, which has a higher price than reclaimed water, to incentivize water conservation.
- Establish a policy that allows the City to maintain control of reclaimed water resources for recharge and recovery.
- Discontinue the practice of providing developers the "right of first refusal" for reclaimed water resources in development agreements.
- Remove the requirement from the City's Engineering Design Standards that requires new developments to design and construct reclaimed water transmission lines, distribution lines, services and associated equipment.

5.6.5 Reclaimed Water System Repair and Replacement Requirements

As the City's reclaimed water system ages, it will be important for the City to actively maintain equipment to maximize the service life of pump stations, water mains, and other system components. Similar to the water system (DMOM) and collection system (CMOM), it is recommended that the City establish a program to regularly inspect and repair aging equipment in the reclaimed water system.

The Phase I asset management program initiated with the 2016 IWMP did not include all reclaimed water system components. However, it is recommended that the City incorporate reclaimed water assets in this program to inventory the existing system, conduct interviews with system operations staff, and conduct site inspections of all above ground reclaimed water assets.

5.7 INFRASTRUCTURE PLAN 2026 TO BUILDOUT

This section of the reclaimed water master plan describes the reclaimed water system expansion strategies and infrastructure that would be constructed after year 2025. The purpose of this section is to:

1. Identify possible future recharge locations in conjunction with the water reclamation facility locations identified in the wastewater master plan.
2. Provide a conceptual layout of the reclaimed water system infrastructure for the City so that as the system expands, it will align with the City's overall vision for reclaimed water management.

Although the construction of the reclaimed water system components described in this section may not occur in the next ten years, land purchases, planning and some preliminary design work need to be accomplished within that time. Some of the water reclamation facilities in WPA 4 and WPA 5 are intended to be water campuses where potable water treatment, storage, and transmission infrastructure would be located along with wastewater reclamation and reclaimed water recharge facilities. The City should coordinate efforts to expand the reclaimed water system with the work being done on the water and wastewater systems. Planning level costs are provided for the major infrastructure needed to develop the buildout system.

The future reclaimed water flows in each water planning area are summarized in this section. The aggressive conservation described in Chapter 2 is assumed for the reclaimed water infrastructure that is planned. However, it was assumed that aggressive water conservation would be achieved mostly through reductions in outdoor use that would not return as sewer and reclaimed water flows. Therefore, if the planned level of water conservation is not achieved and additional water supplies are not acquired the population served by the City's available water resources would be limited.

The reclaimed water that has been previously committed to future developments is accounted for in the reclaimed water system infrastructure planning. Because there is a degree of uncertainty regarding future development plans, flow and capacity ranges are provided where appropriate to allow the City to evaluate potential infrastructure impacts of future development.

The infrastructure and costs for the reclaimed water system described in this section apply to the City's 2025 General Plan estimated population of 760,000 people. Development and growth will be driven by water that is available to serve the City's water customers. Adjustments to the reclaimed water master plan will be needed if growth plans change.

5.7.1 Recharge Strategy

Much of what is currently known about the geology, groundwater, and recharge capability of the Rainbow Valley portion of Goodyear's future service area has been captured in a 2007 Hydro Systems, Inc. (HSI) report entitled "Water Resources Implementation Plan for the Estrella Mountain Ranch, City of Goodyear South Planning Area." This report presents a thorough discussion of the geology, hydrology, well utilization, and reclaimed water management for the proposed EMR development. The following discussion summarizes the reclaimed water management strategies recommended in the HSI report.

The groundwater recharge plan portion of the report presented the known facts concerning the geology and hydrology of the basin as they impact recharge, as well as a review of the various methods of recharge. Also presented was a detailed plan for phasing and scheduling various recharge components to meet the needs of the EMR development. Four methods of recharge were evaluated, namely infiltration basins, vadose zone (VZ) wells, ASR wells, and recharge trenches. Several factors affect each of these recharge methods, such as costs, available land area, water quality, depth to groundwater, geology, soil conditions, and perching layers.

It will be important to locate the recharge facilities in such a manner as to protect and improve the groundwater quality, and to provide a barrier to keep the poor quality, high TDS groundwater from migrating to potable production wells. Also, the recharge facilities should be located near the regions of greatest groundwater drawdown in order to reduce declines due to pumping. Figures provided in the HSI report document the aquifer TDS conditions and the impact of pumping and recharge on the long-term aquifer water quality.

5.7.1.1 Infiltration Basins

After evaluating the various methods available, HSI concluded that it was important to match the recharge method with the quality of the source water. The initial phases of development are based on direct reuse with excess water going to golf course ponds and ultimately recharge. Given the quality of the water, infiltration basins with wetting and drying cycles and surface soil removal, was proposed by HSI as the preferred technology in the initial phases of development.

The efficiency of infiltration basins is dependent upon soil lithology between the land surface and the groundwater table. The report noted that five exploratory infiltration soil borings had been drilled and analyzed near the proposed Waterman Wash WRF. The testing results of the finest grained soil materials indicated infiltration rates ranging from 0.28 to 0.45 feet per day (ft/day). HSI concluded that these values represented reasonable soil infiltration rates for planning purposes. To be conservative, the land area requirements for basin recharge planning in the IWMP are based on 0.3 ft/day.

It will be challenging for the City to operate recharge basins that percolate 0.3 ft/day and the City should explore options to improve recharge rates when infiltration basins are used. Some communities have improved recharge rates in poorly performing basins by trenching though confining clay layers and filling them with gravel material. An appropriate solution for Goodyear must be determined based on hydrogeological investigations at the selected recharge sites and potentially will require pilot testing various trenching and/or drilling methods.

5.7.1.2 Aquifer Storage and Recovery Wells

In future phases of development as reclaimed water quality improves, HSI recommended adding ASR wells. For comparison to the direct injection wells, HSI considered two injection rates, namely 600 gpm and 1,000 gpm. These injection rates were based on local production rates of existing wells and the need to spread high quality water over a larger area within the aquifer. However, the report stated that no actual injection data for Rainbow Valley existed at the time of the study.

In order to properly design the injection wells and obtain recharge permits, it will be necessary to obtain site-specific data regarding the actual injection rates. A pilot injection well project is recommended in order to obtain this data.

5.7.1.3 Riparian Recharge Projects

The City should consider developing a recharge project that provides both water resources benefits and establishes a community amenity. Facilities like the Town of Gilbert's Riparian Preserve, City of Chandler Veteran's Oasis Park, or the City of Phoenix Tres Rios Wetlands combine infiltration basins with natural habitat for desert wildlife, walking trails, interpretive centers and other facilities that attract community members to visit these areas.

Riparian recharge projects in WPA 4 and WPA 5 could also provide "direct reuse" for the Newland and Amaranth communities as opposed to using reclaimed water for turf irrigation in parks, golf courses or other high intensity uses. Examples of riparian recharge projects are shown in Figure 5.6.

RIPARIAN RECHARGE PROJECTS

FIGURE 5.6

CITY OF GOODYEAR

2016 INTEGRATED WATER MASTER PLAN

carollo

pw:\\Carollo/Documents\Client/AZ/Goodyear/9728A00/Deliverables/MP\Fig 05_06

5.7.2 Projected Reclaimed Water Flows

Reclaimed water flows were developed based on the water demands and wastewater flows for each water planning area as described in Chapter 2. For reclaimed water system planning, the groundwater sub basins were used to summarize reclaimed water flows and recharge requirements. WPA 2 and 3 are in the West Salt River Valley groundwater sub-basin and WPA 4 and 5 are in the Rainbow Valley groundwater sub-basin as shown in Figure 5.7.

5.7.3 West Salt River Valley Groundwater Sub-basin

Within Goodyear's wastewater service area, the West Salt River Valley groundwater sub-basin includes all lands in the WPA 2, WPA 3 and the EPCOR service area. Geographically, these areas include all wastewater service areas north of Pecos Road and include all existing development in Goodyear except the Liberty Utilities service area.

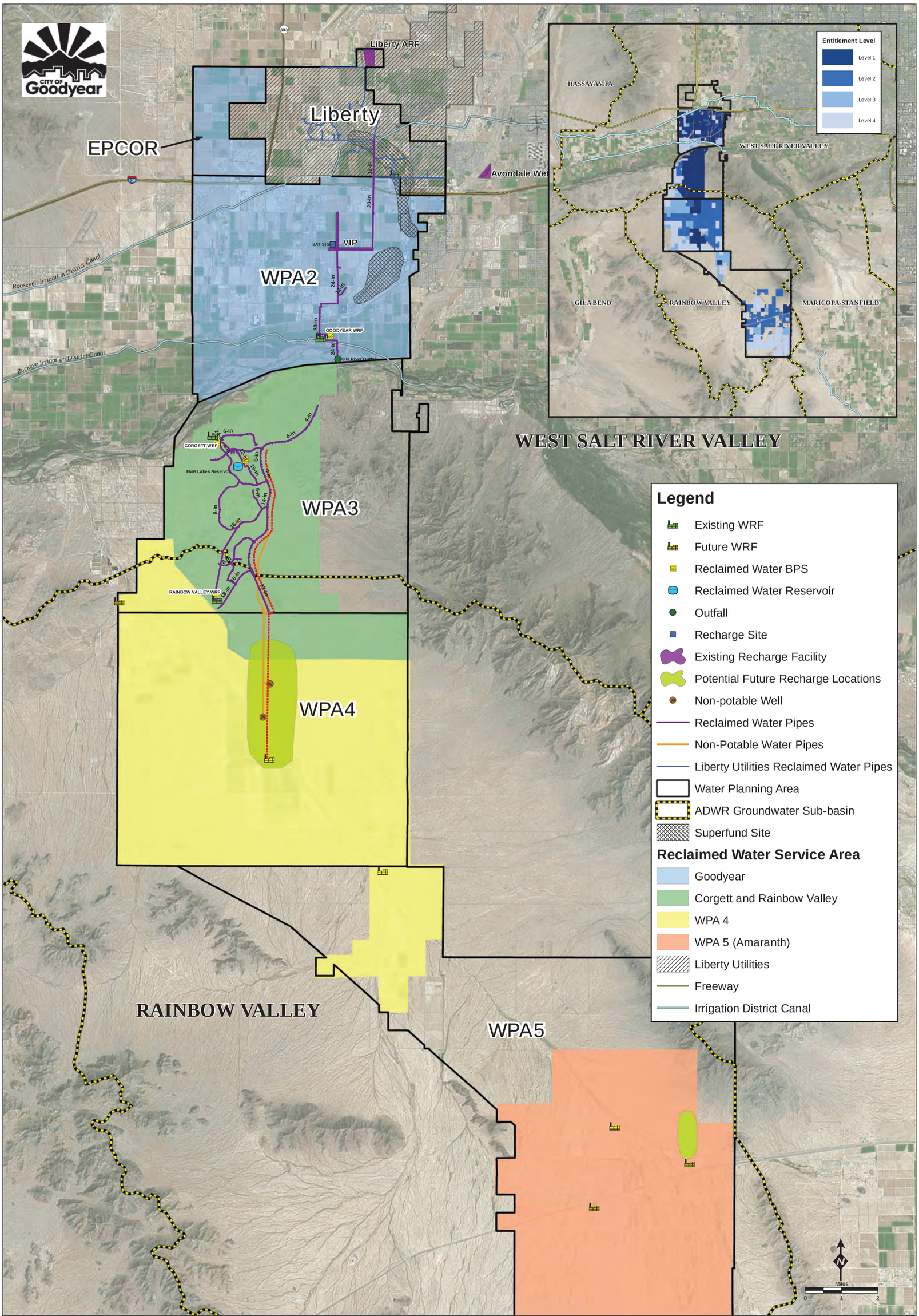
5.7.3.1 Reclaimed Water Flow Projections

The buildout average annual daily reclaimed water flow for the West Salt River Valley groundwater sub-basin could reach as high as 13,546 AFY (11.9 mgd) if development occurs in all available land areas as currently planned (Entitlement Level 1 - 4). Table 5.4 summarizes the projected buildout average annual daily flows by Entitlement Level for WPA 2 and WPA 3. These projections represent the reclaimed water flow that would be available to the City. Reclaimed water that has been committed to the Newland developments is not included.

Table 5.4 City Buildout Reclaimed Water Flows by Entitlement Level - West Salt River Valley Groundwater Sub-basin
2016 Integrated Water Master Plan
City of Goodyear

Entitlement Level	Reclaimed Water Flow (AFY)		
	WPA 2 (1)	WPA 3 (2)	Total
1	7,430	878	**8,308**
1, 2	7,920	1,034	**8,954**
1, 2, 3	9,015	1,034	**10,049**
1, 2, 3, 4	11,795	1,751	**13,546**

Notes:
(1) Treated at the Goodyear WRF.
(2) Treated at the Corgett and Rainbow Valley WRFs. Does not include reclaimed water that has been committed to the Newland developments.



CITY OF GOODYEAR RECLAIMED WATER INFRASTRUCTURE PLAN

FIGURE 5.7
CITY OF GOODYEAR
2016 INTEGRATED WATER MASTER PLAN

The total buildout reclaimed water available in the West Salt River Valley Groundwater Sub-basin including the Newland development flows are summarized in Table 5.5. The Newland reclaimed water flow is 4,003 AFY (3.6 mgd) of the 5,754 AFY (5.1 mgd) of reclaimed water flow for WPA 3 for Entitlement Level 4.

The reclaimed water committed to Newland is primarily intended for direct reuse (land scape irrigation). The extent of direct reuse will be partially dictated by how much development actually occurs, the wastewater flows from those developments, and the design of community amenities (parks, landscaping, etc.). Because these development plans are not yet finalized, there is an opportunity for the City to work with Newland to seek ways to increase aquifer storage to help provide a sustainable potable water supply.

Table 5.5 Total Buildout Reclaimed Water Flows by Entitlement Level - West Salt River Valley Groundwater Sub-basin
2016 Integrated Water Master Plan
City of Goodyear

Entitlement Level	Reclaimed Water Flow (AFY)		
	WPA 2 (1)	WPA 3 (2)	Total
1	7,430	4,526	**11,956**
1, 2	7,920	4,682	**12,602**
1, 2, 3	9,015	4,807	**13,822**
1, 2, 3, 4	11,795	5,754	**17,550**

Notes:
(1) Treated at the Goodyear WRF
(2) Treated at the Corgett and Rainbow Valley WRFs. Does include reclaimed water that has been committed to the Newland developments.

5.7.3.2 Recharge Requirements

Due to the geology in WPA 3, all recharge in the West Salt River Valley Groundwater Sub-basin will most likely need to be done in WPA 2. The City's VIP underground storage facility (USF) is currently permitted for up to 8,300 AFY of recharge, which is sufficient for Goodyear's near-term needs but not for buildout. Neighboring recharge facilities in the West Salt River Valley Groundwater Sub-basin include the Liberty/SRP recharge project and the City of Avondale Wetlands. It may be difficult for the City to find an additional recharge site in WPA 2 that will meet the City's ultimate recharge requirement for flows generated in WPA 2 and WPA 3. Table 5.6 summarizes the recharge requirements for the West Salt River Valley Groundwater Sub-basin that does not include reclaimed water committed to Newland.

Table 5.6 Reclaimed Water Recharge Requirement for the West Salt River Valley Groundwater Sub-basin - City Reclaimed Water
2016 Integrated Water Master Plan
City of Goodyear

Service Area / Capacity	Reclaimed Water Flow (AFY)			
	Level 1	Level 2	Level 3	Level 4
Goodyear WRF Total (1)	7,430	7,920	9,015	11,795
City Direct Reuse (2)	800	800	800	800
Net Required Recharge	6,630	7,120	8,935	10,995
Goodyear VIP Capacity	8,300	8,300	8,300	8,300
Surplus/(Deficit)	**1,670**	**1,180**	**(635)**	**(2,695)**
Corgett & Rainbow Valley WRFs (3)	878	1,034	1,034	1,751
Total WSRV Capacity Needed (4)	**878**	**1,034**	**1,669**	**4,446**

Notes:
(1) Includes flow from EPCOR water service area and Goodyear WRF service area.
(2) Estimated based on existing direct reuse demands (~600 AFY) plus 200 AFY of additional future demand.
(3) Reclaimed water from developments that do not have reclaimed water delivery agreements with the City.
(4) Currently no infrastructure exists to pump reclaimed water north to WPA 2. This water could be pumped to the Rainbow Valley groundwater sub-basin (WPA 4) for recharge if favorable recharge locations are not found in WPA 3.

Goodyear's VIP USF permitted capacity is sufficient to meet the recharge requirements for WPA 2 for Entitlement Levels 1 through 3. An additional 635 AFY of recharge capacity is needed to meet WPA 2 Entitlement Level 3 recharge requirements and 2,695 AFY of recharge capacity is needed to meet the WPA 2 Entitlement Level 4 recharge requirements. For WPA 3, there is estimated to be between 878 AFY (Entitlement Level 1) and 1,751 AFY (Entitlement Level 4) of reclaimed water that will be produced from developments that do not have reclaimed water delivery agreements with the City, meaning that the City can recharge this water. Because there is currently no infrastructure to move this water north to a recharge site in WPA 2, it is recommended that this water be pumped to Rainbow Valley (WPA 4) for recharge if a favorable site cannot be found in WPA 3.

A total of 4,446 AFY of additional recharge capacity will be needed to accommodate the projected Entitlement Level 4 reclaimed water flows in the West Salt River Valley Groundwater Sub-basin.

Table 5.7 summarizes the recharge requirements for the West Salt River Valley Groundwater Sub-basin that includes the reclaimed water committed to Newland assuming a strategy is developed to match Newland's seasonal irrigation demand peaks with the average annual reclaimed water flow production.

Table 5.7 Reclaimed Water Recharge Requirement for the West Salt River Valley Groundwater Sub-basin - City and Developer Reclaimed Water 2016 Integrated Water Master Plan City of Goodyear

Service Area / Capacity	Reclaimed Water Flow (AFY)			
	Level 1	Level 2	Level 3	Level 4
Goodyear WRF Total (1)	7,430	7,920	9,015	11,795
City Direct Reuse (2)	800	800	800	800
Net Required Recharge	6,630	7,120	8,935	10,995
Goodyear VIP Capacity	8,300	8,300	8,300	8,300
WPA2 Recharge Capacity Surplus/(Deficit)	**1,670**	**1,180**	**(635)**	**(2,695)**
Corgett & Rainbow Valley WRFs (3)	2,586	2,742	2,800	3,625
Total WPA3 Capacity Needed (4) Surplus/(Deficit)	**-2,586**	**-2,742**	**-3,435**	**-6,320**

Notes:
(1) Includes flow from EPCOR water service area and Goodyear WRF service area.
(2) Estimated based on existing direct reuse demands (~600 AFY) plus 200 AFY of additional future demand.
(3) Reclaimed water from developments that do not have reclaimed water delivery agreements with the City and reclaimed water from the Newland development that is available for recharge in months when reclaimed water supply is greater than demand.
(4) Currently no infrastructure to pump reclaimed water north to WPA 2. Could be pumped to Rainbow Valley groundwater sub-basin (WPA 4) for recharge if favorable recharge locations are not found in WPA 3.

The reclaimed water recharge requirements do not change for WPA 2 as outlined in Table 5.6. However, the reclaimed water that would be available for recharge from the Newland developments increases significantly. For WPA 3, there is estimated to be 2,586 AFY of recharge capacity required for Entitlement Level 1 and 3,625 AFY of recharge capacity required for Entitlement Level 4.

A total of 6,320 AFY of additional recharge capacity will be needed to accommodate the projected Entitlement Level 4 reclaimed water flows in the West Salt River Valley Groundwater Sub-basin.

5.7.3.3 Reclaimed Water Recharge Infrastructure Requirements

The City will need to develop up to 6,320 AFY of physical recharge capacity for the flows generated in the West Salt River Valley groundwater sub-basin either through spreading basins, VZ, or ASR wells or some combination of infrastructure. It was assumed that flows generated north of the Gila River (WPA 2) would be recharged in that area and that flows generated south of the Gila River (WPA 3) would be pumped to WPA 4 for recharge.

Therefore, up to 2,695 AFY (Entitlement Level 4) of physical and permitted recharge capacity is needed in WPA 2 and up to 3,625 AFY (Level 4) of physical and permitted recharge capacity is needed to accommodate flows from WPA 3. The recharge requirements for WPA 3 are accounted for in the recharge requirement calculations for the flows from WPA 4 in Section 5.7.4.3.

5.7.4 Rainbow Valley Groundwater Sub-basin Reclaimed Water

The Rainbow Valley groundwater sub-basin includes all of WPA 4 and WPA 5. There is currently no development in these areas but there are several known developments including:

- Estrella Region 2
- Madiera
- Estrella Highlands
- Rainbow Valley
- McRae Holdings
- Amaranth

The Estrella Region 2 (Newland), Madiera (Newland), and Amaranth developments have established reclaimed water delivery commitments with the City.

5.7.4.1 Reclaimed Water Flow Projections

The buildout average annual daily reclaimed water flow for the Rainbow Valley groundwater sub-basin could reach as high as 15,457 AFY (13.8 mgd) if development occurs in all available areas as currently planned (Entitlement Level 1 - 4). Table 5.8 summarizes the projected buildout average annual daily reclaimed water flows by Entitlement Level for WPA 4 and WPA 5. These projections represent the reclaimed water flow that would be available to the City. Reclaimed water that has been committed to the Newland or Amaranth developments is not included.

Table 5.8	City Buildout Reclaimed Water Flows by Entitlement Level - Rainbow Valley Groundwater Sub-basin 2016 Integrated Water Master Plan City of Goodyear		
Entitlement Level	**Reclaimed Water Flow (AFY)**		
	WPA 4 (1)	**WPA 5 (2)**	**Total**
1	0	290	**290**
1, 2	3,422	625	**4,047**
1, 2, 3	5,994	2,606	**8,600**
1, 2, 3, 4	9,075	6,382	**15,457**

Notes:
(1) Includes the future Pecos, Waterman Wash, and Estrella WRFs.
(2) Includes the future WRFs that will serve the Amaranth development.

The total reclaimed water available in the Rainbow Valley Groundwater Sub-basin including the Newland and Amaranth development flows are summarized in Table 5.9. The development reclaimed water flows are 14,136 AFY (12.6 mgd) of the 29,593 AFY (26.4 mgd) of reclaimed water flow for WPA 4 and WPA 5 for Entitlement Level 4.

Table 5.9	Total Buildout Reclaimed Water Flows by Entitlement Level - Rainbow Valley Groundwater Sub-basin 2016 Integrated Water Master Plan City of Goodyear		
Entitlement Level	**Reclaimed Water Flow (AFY)**		
	WPA 4 (1)	**WPA 5 (2)**	**Total**
1	2,239	547	**2,786**
1, 2	11,018	7,127	**18,145**
1, 2, 3	13,591	9,109	**22,700**
1, 2, 3, 4	16,708	12,885	**29,593**

Notes:
(1) Includes the future Pecos, Waterman Wash, and Estrella WRFs.
(2) Includes the future WRFs that will serve the Amaranth development.

The reclaimed water committed to the Newland and Amaranth developments in WPA 4 and WPA 5 is primarily intended for direct reuse (land scape irrigation). Similar to the approach taken for the Newland developments in WPA 3 outline above, the peak reclaimed water demand estimates for these future developments were matched to the annual reclaimed water flow that would be generated from them. This approach results in reclaimed water available to the City for recharge in all but the peak summer month(s).

Table 5.10 summarizes the estimated annual flow split between Newland and the City for the developments in WPA 4 and Table 5.11 summarizes the estimated annual flow split between Amaranth and the City for the development in WPA 5.

Table 5.10 City and Newland Reclaimed Water Flow Allocation by Entitlement Level - WPA 4
2016 Integrated Water Master Plan
City of Goodyear

Entitlement Level	Reclaimed Water Flow (AFY)		
	Newland Direct Reuse (1)	City Recharge (2)	Total
1	1,191	1,045	**2,236**
2	4,041	3,546	**7,587**
3	4,041	3,546	**7,587**
4	4,060	3,563	**7,623**

Notes:
(1) Committed to the Newland developments for direct reuse (landscape irrigation). Assumes peak summer irrigation demand is equal to average annual reclaimed water produced.
(2) Recharge of portion of Newland reclaimed water flow produced in months where reclaimed water supply exceeds demand.

Table 5.11 City and Amaranth Reclaimed Water Flow Allocation by Entitlement Level - WPA 5
2016 Integrated Water Master Plan
City of Goodyear

Entitlement Level	Reclaimed Water Flow (AFY)		
	Amaranth Direct Reuse (1)	City Recharge (2)	Total
1	137	120	**257**
2	3,459	3,035	**6,494**
3	3,459	3,035	**6,494**
4	3,459	3,035	**6,494**

Notes:
(1) Committed to the Amaranth developments for direct reuse (landscape irrigation). Assumes peak summer irrigation demand is equal to average annual reclaimed water produced.
(2) Recharge of portion of Amaranth reclaimed water flow produced in months where reclaimed water supply exceeds demand.

5.7.4.2 Recharge Requirements

Reclaimed water recharge requirements for WPA 4 and WPA 5 are based on the reclaimed water flow available to the City. Table 5.12 summarizes the recharge requirements for the Rainbow Valley Groundwater Sub-basin and does not include the reclaimed water that has been committed to developments. 15,457 AFY of recharge capacity is required to accommodate the projected flows from the Entitlement Levels 1 - 4 developments in Rainbow Valley.

Table 5.12 Reclaimed Water Recharge Requirement for the Rainbow Valley Groundwater Sub-basin - City Reclaimed Water
2016 Integrated Water Master Plan
City of Goodyear

Service Area	Reclaimed Water Flow (AFY)			
	Level 1	Level 2	Level 3	Level 4
WPA 4 Developments	0	3,422	5,994	9,075
WPA 5 Developments	290	625	2,606	6,382
Total RV Capacity Needed	**290**	**4,047**	**8,600**	**15,457**

Table 5.13 summarizes the recharge requirements for the Rainbow Valley Groundwater Sub-basin that include the reclaimed water that has been committed to developers assuming a strategy is developed to match the development's seasonal irrigation demand peaks with the average annual reclaimed water flow production as described previously. With these additional flows, 22,055 AFY of recharge capacity is required to accommodate the projected flows from the Entitlement Levels 1 - 4 developments in Rainbow Valley.

Table 5.13 Reclaimed Water Recharge Requirement for the Rainbow Valley Groundwater Sub-basin - City and Developer Reclaimed Water
2016 Integrated Water Master Plan
City of Goodyear

Service Area	Reclaimed Water Flow (AFY)			
	Level 1	Level 2	Level 3	Level 4
WPA 4 Developments	1,045	6,968	9,540	12,638
WPA 5 Developments	410	3,660	5,641	9,417
Total RV Capacity Needed	**1,455**	**10,628**	**15,181**	**22,055**

5.7.4.3 Reclaimed Water Recharge Infrastructure Requirements

The percolation basin and injection well recharge rates from the HSI report were used to estimate the number of acres of recharge basins and number of wells that would be needed to accommodate the projected reclaimed water flows. Recharge locations will be needed in both WPA 4 and 5 to serve the developments in these areas. It was assumed that reclaimed water that is available to the City for recharge from WPA 3 would be pumped to a site in WPA 4.

Table 5.14 summarizes the reclaimed water recharge flows from WPA 3 and WPA 4 and the estimated acres of percolation basins assuming 0.3 ft/day percolation rate (HSI, report). When recharge basins are constructed, there are techniques that can be used that could improve the recharge rates. Therefore, an estimate of the required acres assuming a 1.0 ft/day percolation rate is also provided. For the areas that will return reclaimed water to the City, between 14 and 168 acres of recharge basins will be required assuming all development occurs as planned (through Entitlement Level 4) and the percolation rate is 0.3 inch per day (in/day). If additional reclaimed water is returned from the developments that have reclaimed water delivery commitments, between 56 and 252 acres of recharge basins will be required assuming all Entitlement Level 4 development occurs and the percolation rate is 0.3 ft/day.

Because of the relative uncertainty of actual long-term recharge rates and the volumes of water that will need to be recharged, it is recommended that recharge facilities be placed in areas where they can be easily expanded.

Table 5.14 Estimated Recharge Basin Acreage for WPA 4
2016 Integrated Water Master Plan
City of Goodyear

Service Area	Reclaimed Water Flow (AFY)			
	Level 1	**Level 2**	**Level 3**	**Level 4**
City Reclaimed Water Only				
Total Capacity Needed	**878**	**4,456**	**7,028**	**10,826**
Acreage Required (0.3 ft/day)	14	69	109	168
Acreage Required (1.0 ft/day)	4	21	33	50
City and Developer Reclaimed Water				
Total Capacity Needed	**3,631**	**9,710**	**12,340**	**16,263**
Acreage Required (0.3 ft/day)	56	151	192	252
Acreage Required (1.0 ft/day)	17	45	57	76

Table 5.15 summarizes the number of recharge wells that would be required to accommodate the WPA 3 and WPA 4 flows. For the areas that will return reclaimed water to the City, between 1 and 12 recharge wells would be required, assuming 600 gpm per well, not including additional wells for redundancy. If additional reclaimed water is returned from the developments that have reclaimed water delivery commitments, between 4 and 17 recharge wells will be required, assuming 600 gpm per well, not including additional wells for redundancy.

Table 5.15 Estimated Recharge Wells for WPA 4 2016 Integrated Water Master Plan City of Goodyear				
	Reclaimed Water Flow (gpm)			
Service Area	Level 1	Level 2	Level 3	Level 4
City Reclaimed Water Only				
Total Capacity Needed	**544**	**2,763**	**4,358**	**6,713**
Number of Wells (600 gpm/well)	1	5	8	12
City and Developer Reclaimed Water				
Total Capacity Needed	**2,251**	**6,021**	**7,651**	**10,084**
Number of Wells (600 gpm/well)	4	11	13	17

Table 5.16 summarizes the reclaimed water recharge flows from WPA 5 and the estimated acres of percolation basins assuming 0.3 ft/day percolation rate (HSI, report). When recharge basins are constructed, there are techniques that can be used that could improve the recharge rates. Therefore, an estimate of the required acres assuming a 1.0 ft/day percolation rate is also provided. For the areas that will return reclaimed water to the City, between 5 and 99 acres of recharge basins will be required assuming all development occurs as planned (through Entitlement Level 4) and the percolation rate is 0.3 in/day. If additional reclaimed water is returned from the developments that have reclaimed water delivery commitments, between 6 and 146 acres of recharge basins will be required assuming all Entitlement Level 4 development occurs and the percolation rate is 0.3 ft/day.

Table 5.16 Estimated Recharge Basin Acreage for WPA 5 2016 Integrated Water Master Plan City of Goodyear				
	Reclaimed Water Flow (AFY)			
Service Area	Level 1	Level 2	Level 3	Level 4
City Reclaimed Water Only				
Total Capacity Needed	**290**	**625**	**2,606**	**6,382**
Acreage Required (0.3 ft/day)	5	10	40	99
Acreage Required (1.0 ft/day)	1	3	12	30
City and Developer Reclaimed Water				
Total Capacity Needed	**410**	**3,660**	**5,641**	**9,417**
Acreage Required (0.3 ft/day)	6	57	88	146
Acreage Required (1.0 ft/day)	2	17	26	44

Table 5.17 summarizes the number of recharge wells that would be required to accommodate the WPA 5 flows. For the areas that will return reclaimed water to the City, between one and seven recharge wells would be required, assuming 600 gpm per well, not including additional wells for redundancy. If additional reclaimed water is returned from the developments that have reclaimed water delivery commitments, between one and ten recharge wells will be required, assuming 600 gpm per well, not including additional wells for redundancy.

Table 5.17 Estimated Recharge Wells for WPA 5
2016 Integrated Water Master Plan
City of Goodyear

Service Area	Reclaimed Water Flow (gpm)			
	Level 1	**Level 2**	**Level 3**	**Level 4**
City Reclaimed Water Only				
Total Capacity Needed	**180**	**388**	**1,616**	**3,957**
Number of Wells (600 gpm/well)	1	1	3	7
City and Developer Reclaimed Water				
Total Capacity Needed	**254**	**2,269**	**3,498**	**5,839**
Number of Wells (600 gpm/well)	1	4	6	10

5.8 RECLAIMED WATER SYSTEM CAPITAL IMPROVEMENTS

This section summarizes the proposed reclaimed water system infrastructure projects and recommendations of the 2016 IWMP.

5.8.1 Unit Costs

5.8.1.1 Cost Estimate Accuracy

Unit costs have been developed for the capital improvements for each project recommended herein. This cost estimate was prepared in accordance with the guidelines of the AACE International for a Class 4 estimate. Table 5.18 summarizes the AACE International cost estimate classification system, the level of project definition (percent of design), uses, cost estimating methodologies, and expected accuracy of Class 1 through 5 estimates. Design work would need to be undertaken to obtain more precise cost estimates.

Table 5.18 AACE Cost Estimate Classification Summary 2016 Integrated Water Master Plan City of Goodyear				
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%

5.8.1.2 Project Cost Development Methodology

To develop project costs for each capital improvement project, unit costs for pipes, pump stations and other infrastructure are developed based on information from R.S. Means and other unit cost sources including bid tabs. When multiplied by the capacity or size of the facility, the unit construction cost is the cost that the City should expect to pay a contractor to construct the facility. The City will have other expenses including design, inspection, contingency, and project management that are included in the overall project cost. The project cost is obtained by multiplying the construction cost by a factor of 1.4. Table 5.19 contains an opinion of probable unit construction costs for reclaimed water projects.

Table 5.19 Unit Cost Summary 2016 Integrated Water Master Plan City of Goodyear		
Component	**Construction Cost (Unit)**	**Project Cost [(1)] (Unit)**
Infiltration Basins (per acre)	$60,000	$84,000
Vadose Zone Well (600 gpm)	$600,000	$840,000
ASR Well (600 gpm)	$1,800,000	$2,500,000
12-inch Distribution Main	$174/LF	$244/LF
16-inch Distribution Main	$209/LF	$293/LF
Land		$150,000/acre
Notes: (1) Construction Cost x 1.4 (engineering design, inspection, and project management). ENR CCI: 9886		

5.8.2 Project Summary

With the exception of the currently planned VIP, there are no improvements needed for the reclaimed water distribution system for planning years 2020 and 2025. If the City wishes to increase the capacity of the reclaimed water line that delivers water to the Liberty system, it will require upsizing the existing 12-inch main to a size that will accommodate the amount of flow the City wishes to deliver. The City should engage in a recharge siting study for WPA 2 to determine how the additional 2,510 AFY of recharge capacity required to serve development through Entitlement Level 4. This siting study should include an evaluation of the opportunity to partner with Liberty/EPCOR in their recharge project.

The City should also engage in a recharge siting study for WPA 4. The 2007 HSI study referenced in this Report identifies several areas that are favorable to recharge. The City should engage Newland and other potential developers in WPA 4 in discussions about the recharge strategy for WPA 4, the need for long-term water resources sustainability and the need for aquifer recharge to provide a sustainable potable water supply.