APPENDIX S

Grayson Outlying Service Area Summary

WEST YOST ASSOCIATES
Consulting Engineers

TECHNICAL MEMORANDUM

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SENT VIA: EMAIL

TO: Tamorah Bryant, City of Modesto

FROM: Roberto Vera, PE, RCE #83500
Amy Kwong, PE, RCE #73213

REVIEWED BY: Gerald Nakano, PE, RCE #29524

SUBJECT: City of Modesto – Water Master Plan
Grayson Outlying Service Area Summary

The City of Modesto (City) serves a number of outlying service areas that are detached from the City's contiguous water service area and water system. One of these outlying service areas is the Town of Grayson. The last water system evaluation performed for the City's Grayson water service area was performed for the 2010 Engineer's Report[1]. Since then, there have been few changes to the water system serving the Grayson service area. This technical memorandum (TM) summarizes the updated annual water production and recommended facility improvements for the Grayson service area.

This TM is organized into the following sections:

- Service Area Description
- Existing Water Production
- Projected Buildout Water Production
- Recommended Water System Improvements

[1] City of Modesto's 2010 Water System Engineer's Report Evaluation of the Existing and Buildout Water System for the Grayson Outlying Service Area, March 30, 2010, West Yost Associates.

SERVICE AREA DESCRIPTION

The Town of Grayson is located approximately 14 miles west of the City of Modesto along County Road J16 (Grayson Road). The Grayson service area is approximately 120 acres, primarily residential, and is considered to be essentially built out. The Grayson service area was originally provided with water service by the Del Este Water Company. In the mid 1990's, the City acquired the Del Este Water Company and began providing water service. The limited, future areas for potential development in the Grayson service area are located primarily in the south, with a small amount of infill development.

Figure 1 shows the Grayson water service area boundary, existing water supply facilities, and existing pipelines. Due to water quality issues at both existing groundwater wells (Wells 274 and 295), pumped groundwater has historically been treated through a centrally located ion exchange (IX) system located at the Well 295 site, and then this treated water is stored in Tank 9 (also located on the Well 295 site) prior to being pumped into the distribution system. The Grayson water system has no interconnections with other water systems, and there are no nearby water utilities with the potential for interconnection.

Well 274 has historically produced sand, and is being operated at a reduced flow rate of around 150 gpm (instead of the well's flow capacity of around 350 to 450 gpm), to mitigate these sand production concerns. Because of these concerns, and the fact that this well has reached the end of its useful life, this well is scheduled for replacement in 2018.

The City has also acquired property adjacent to the Well 274 site, large enough to accommodate the new Well 274 replacement well, a centralized well treatment system, and a new storage tank, if needed, since the both the existing storage tank and ion exchange treatment system at the Well 295 site are in need of significant repair and/or replacement. (the City is in the process of conducting an evaluation of the cost-effectiveness of repairing or replacing both the treatment system and storage tank). Tank 9 is currently operated at lower levels due to potential structural instability issues.

The Grayson water service area water system includes two wells (Wells 274 and 295), one 0.22 million gallon (MG)[2] at-grade steel tank (Tank 9) and booster pump station (BPS) equipped with two 50 horsepower (HP) pumps, and approximately 16,700 linear feet of water distribution pipelines. Existing pipelines vary in size from 4 to 10 inches in diameter, and are comprised of welded steel and polyvinyl chloride (PVC) pipe. Table 1 summarizes the key characteristics of the existing pipelines within the Grayson service area.

[2] Equal to total gross volume; due to structural instability concerns, available volume is only 0.16 MG.

Table 1. Summary of Pipeline Lengths by Diameter in the Grayson Service Area[(a)]

Pipe Diameter, inches	Length of Pipelines, feet	Length of Pipelines, miles	Percent of Water System
4	5,963	1.1	35.7
6	4,415	0.8	26.5
8	5,640	1.1	33.8
10	665	0.1	4.0
Total	**16,683**	**3.1**	**100**

(a) Based on the hydraulic model submitted as part of the 2010 Engineer's Report.

EXISTING WATER PRODUCTION

Table 2 provides a summary of the Grayson service area's annual water production from 2009 to 2015. The Grayson water system has been fully metered since 2003.

Table 2. Summary of Grayson Service Area Annual Production from 2009 to 2015[(a)]

Year	Well 274, gallons	Well 295, gallons	Total Production		
			gallons	af	mgd
2009	44,616,912	43,951,899	88,568,811	272	0.24
2010	27,495,804	36,770,240	64,266,044	197	0.18
2011	23,990,614	32,144,165	56,134,778	172	0.15
2012	30,715,547	38,767,025	69,482,572	213	0.19
2013	32,549,662	47,573,407	80,123,068	246	0.22
2014	17,892,531	44,447,123	62,339,654	191	0.17
2015	18,289,750	33,560,553	51,850,303	159	0.14

(a) Data provided by City staff in March 2016, from the file "*monthly well flow totals 2002 to present.xls*".

Table 3 below summarizes the estimated peaking factors used to estimate maximum day and peak hour demands at buildout. The peaking factors presented in Table 3 are based on a review of production data provided by the City from 2013[3].

Table 3. Summary of Grayson Service Area Peaking Factors

Demand Condition	2013 Peaking Factor
Average Day	--
Maximum Day	1.57 x Average Day Demand
Peak hour	3.1 x Average Day Demand

[3] Peaking factors presented in 2010 Engineers report were based on data from 2003 through 2007, and are higher than the estimates used to develop Table 3.

PROJECTED BUILDOUT WATER PRODUCTION

In the 2010 Engineer's Report, the baseline water demand for the Grayson service area was based on the average annual water production from 2001 through 2006 (approximately 179 af/yr). In this WMP, the existing baseline water demand for the Grayson service area has been updated to represent the average annual water production from 2000 through 2013. Data from 2014 and 2015 were omitted from the average annual water production because the prolonged drought conditions have significantly reduced water use, which would not represent typical water use. As summarized in Appendix D, the existing baseline water demand for the Grayson service area has been updated to 234 af/yr. This increase from the 2010 Engineer's Report is attributed to additional development that has occurred since 2006.

In the 2010 Engineer's Report, the buildout water demand for the Grayson service area was projected to be 302 af/yr. As shown in Table 4, the current projected buildout water demand for the Grayson service area is 258 af/yr, which is approximately a 15 percent decrease from the projection included in the 2010 Engineer's Report.

Table 4. Projected Buildout Water Production for the Grayson Service Area[a]

Demand Component	Demand, af
Residential[b]	18
Commercial[c]	4
Future: Total	22
Future: UAFW (10 percent)	2
Future: Total with UAFW	**24**
Existing: 2000-2013 Average Water Production	**234**
Existing and Future: Projected Water Production Required at Buildout	**258**

[a] Source: Appendix D - Projected Water Demand (Outlying Service Areas), Table 5.
[b] Calculated based on approximately 5.9 acres of vacant residential land and a residential unit demand factor of 3.00 af/ac/yr.
[c] Calculated based on approximately 1.3 acres of vacant commercial land and a commercial unit demand factor of 2.75 af/ac/yr.

WATER SYSTEM EVALUATION

The Grayson service area water system was evaluated to confirm that the improvements previously recommended from the 2010 Engineer's Report are still applicable. As previously mentioned, Well 274 is currently scheduled for replacement in 2018 to re-establish the full supply capacity at this location. A third, new groundwater well was also recommended in the 2010 Engineer's report.

To evaluate the Grayson service area water system, an evaluation of supply, pumping and storage capacity (under buildout demand conditions) was conducted to confirm sizing of future facilities. Results of these analyses are discussed in the following sections.

Buildout Water Demands

The Grayson service area water demands at buildout are summarized in Table 5. Water demand estimates were developed using the projected buildout water production estimates and the updated peaking factors discussed in the sections above.

Table 5. Grayson Service Area Buildout Water System Demands

Demand Condition	2013 Peaking Factor	Buildout Demand	
		mgd	gpm
Average Day		0.23	160
Maximum Day	1.57 x Average Day Demand	0.36	251
Peak hour	3.1 x Average Day Demand	0.71	496

Supply and Pumping Capacity Evaluation

The City's supply capacity criterion described in Chapter 6 requires that the City provide sufficient supply capacity to meet the maximum day demand. The existing available supply capacity (with Replacement Well 274 reestablished at a supply capacity of 450 gpm), compared with the buildout maximum day demand is summarized in Table 6. As shown, there is an overall future supply capacity surplus of 535 gpm (0.77 mgd), assuming that neither well needs to be taken out of service for repairs or maintenance.

Table 6. Grayson Service Area Comparison of Available versus Required Supply to Meet Buildout Maximum Day Demand

Available or Required Capacity	Available or Required Supply Capacity	
	gpm	mgd
Supply		
Replacement Well 274	450	0.65
Well 295	336	0.48
Total Supply Capacity	**786**	**1.13**
Demand		
Buildout Maximum Day Demand	251	0.36
Supply Capacity Surplus	**535**	**0.77**

In addition to providing sufficient, reliable supply capacity to meet the maximum day demand, the City's pumping capacity criteria requires that the City provide sufficient firm reliable pumping capacity to meet the greater of either a maximum day demand with a fire flow event or a peak hour event. Table 7 compares the available firm pumping capacity with the required firm pumping capacity, under buildout water demand conditions.

Table 7. Grayson Service Area Comparison of Available versus Required Pumping Capacity to Meet Buildout Demands

Available or Required Capacity	Criteria	Available or Required Pumping Capacity	
		gpm	mgd
Required Maximum Day Demand Plus Fire Flow	Maximum Day Demand plus Fire Flow	1,751	2.52
Required Peak Hour Demand	Buildout Peak Hour Demand	496	0.71
	Pumping Capacity Requirement	**1,751**	**2.52**
Tank 9 Booster Pumping Capacity	Total Existing BPS Capacity (2 units at 450 gpm each) Firm Capacity: Total minus One Unit; Assumes Well 295 and 274 Continue to be pumped into Tank 9	450	0.65
	Total Existing Available Firm Capacity	**450**	**0.65**
	Pumping Capacity Surplus (Deficit)	**(1,301)**	**(1.87)**
Additional Capacity from Recommended Tank 9 BPS Expansion	Assumes addition of Two units (each @ 450 gpm)	900	1.30
	Pumping Capacity With Tank 9 BPS Expansion Surplus (Deficit)	**(401)**	**(0.58)**
Additional Capacity from Recommended New Well	Assumes new 400 gpm Well (discharging Directly into Grayson System)	400	0.58
	Pumping Capacity Surplus with New Well and Tank 9 BPS Expansion	**(1)**	**0.00**

As illustrated on Table 7, there will be a pumping capacity deficit of approximately 1,300 gpm under buildout conditions. The 2010 Engineer's Report recommended that an additional well (in addition to Wells 274 and 295) be constructed and that the Tank 9 booster pump station be expanded with an additional 900 gpm of booster pumping capacity. As shown on Table 7, implementation of these improvements mitigates the pumping capacity deficit under buildout demand conditions.

It should be noted that the additional well was recommended for additional supply flexibility in the event that groundwater quality at existing wells continues to deteriorate and/or to provide a redundant supply source in the event that one of the two existing well had to be taken out of service for any reason.

Storage Capacity Evaluation

The City's storage capacity criterion described in Chapter 6 requires that sufficient storage capacity be provided to meet operation, fire, and emergency storage requirements. The existing available storage capacity (existing Tank 9 and groundwater storage credits) compared with the required storage capacity under buildout conditions is summarized in Table 8. As shown, there is an overall future storage capacity surplus of 0.34 MG. This assumes that the Replacement Well 274 can produce up to 450 gpm and is equipped with a backup generator.

Although there is a storage capacity surplus, Tank 9 is reported to have structural concerns and is approaching the end of its useful life and should be replaced.

Table 8. Grayson Service Area Comparison of Available versus Required Storage Capacity to Meet Buildout Conditions

Available or Required Capacity	Criteria	Available or Required Supply Capacity, MG
Operational Storage Requirement	0.25 x Maximum Day Demand	0.09
Fire Storage Requirement	1,500 gpm for 2 hours	0.18
Emergency Storage Requirement	1 X Average Day Demand	0.23
	Storage Capacity Requirement	**0.50**
Tank 9 Capacity	Available Volume (due to structural limitations)	0.16
Groundwater Storage Credit	60% of Reliable Pumping Capacity of Well 295	0.29
	60% of the Reliable Pumping Capacity of the New Well 274	0.39
	Total Existing Available Firm Capacity	**0.84**
	Storage Capacity Surplus (Deficit)	**0.34**

RECOMMENDED WATER SYSTEM IMPROVEMENTS

Because the currently projected buildout water demand for the Grayson service area (258 af/yr) is slightly lower than the buildout water demands that were evaluated in the 2010 Engineer's Report (302 af/yr), it was assumed that the recommended capital improvements from the 2010 Engineer's Report are still applicable and are required to address water system deficiencies. Additionally, some of the recommended capital improvements were to address either fire flow or supply reliability deficiencies, which would be required regardless of the projected water demand. Therefore, the capital improvements identified for the Grayson service area in the 2010 Engineer's Report are still recommended in this WMP.

In addition, it is assumed that the replacement of Well 274 will require a new IX treatment system because it has not been determined whether the existing IX system at Well 295 will be sufficient to meet the needs of both Well 295 and the Well 274 replacement. As previously mentioned, the City will be performing an evaluation to determine whether it is more cost-effective to fix the existing IX treatment system at Well 295 or replaced the entire unit with a new treatment system that would meet the needs of both Well 295 and the Well 274 replacement.

Tank 9 is being operated at lower levels due to structural concerns and is being evaluated for potential repairs. As a result of these concerns, and the fact that this tank is approaching the end of its useful life, it is recommended that the City replace Tank 9.

The recommended capital improvements to the existing Grayson water system are shown on Figure 2 and include the following:

- Construct a new treatment system to treat water from Well 295 and Replacement Well 274;
- Construct a new 400 gpm well (separate from the Well 274 replacement) with backup generator to meet fire flow demands;
- Install a backup generator at Well 274 replacement;
- Install a backup generator at existing BPS;
- Increase BPS with 900 gpm of additional pumping capacity;
- Replace Tank 9; and
- Construct 4,600 linear feet of upsized pipeline.

Buildout water demands in the Grayson service area can be adequately met with the construction of the existing water system improvements as summarized above.

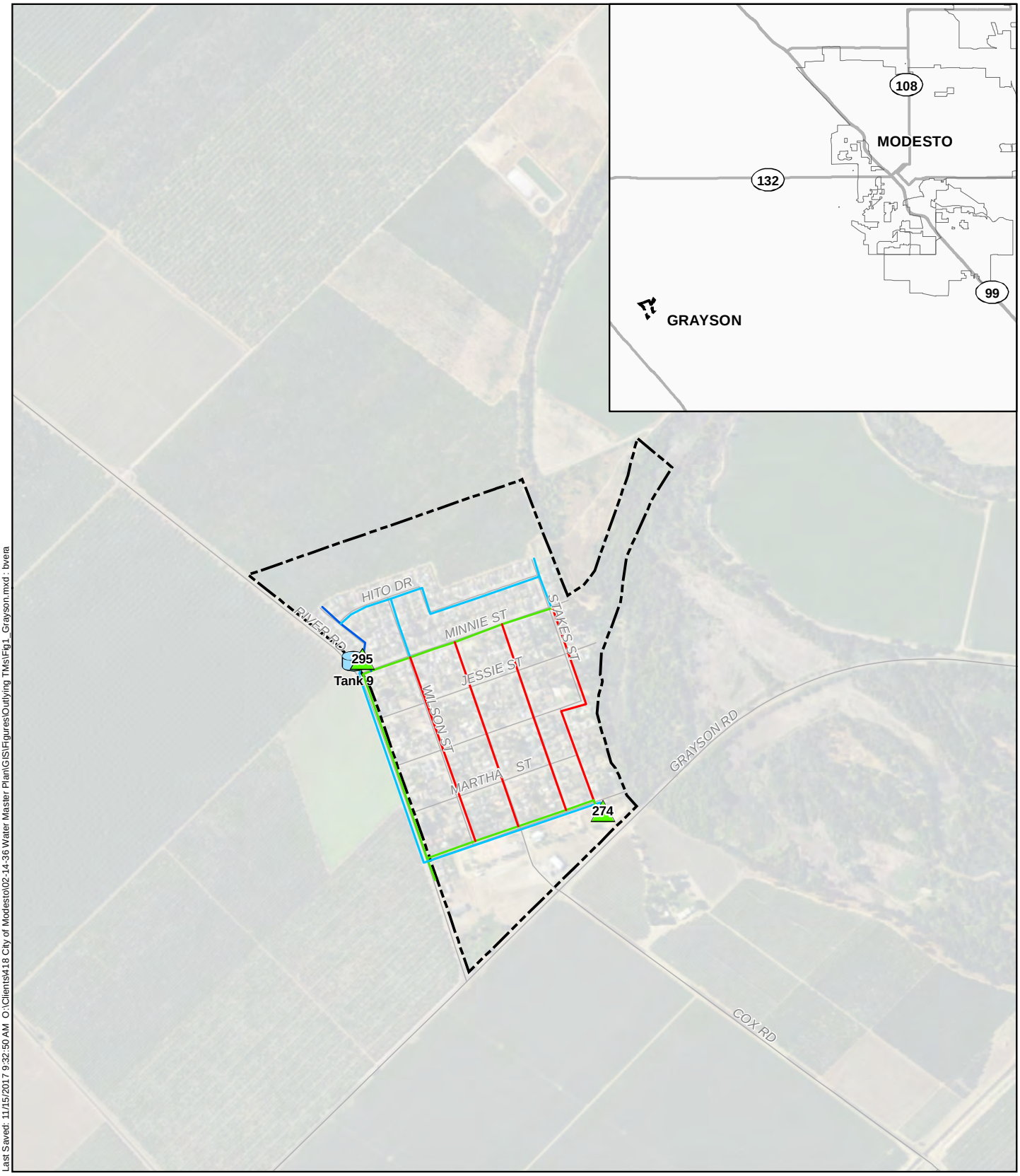
The recommended capital improvements to the Grayson service area are anticipated to cost approximately $9.4M, as detailed in Table 9. The capital costs are presented in March 2017 dollars at an Engineering News Record (ENR) construction cost index (CCI) of 11609.44 for San Francisco. These costs include a markup of 50 percent on the estimated construction cost to account for administration, design, and engineering costs and other contingencies. The costs for the facilities do not include costs for annual operation and maintenance, or costs for acquisition of right of ways.

To ensure adequate continued adequate and reliable service for the Grayson service area customers, the City should also develop and implement a rehabilitation and replacement program for the service area's aging pipelines. Many of the pipelines in this area are undersized (4 or 6 inches in diameter, and many are bare steel pipelines), and these pipelines don't meet the City's current minimum pipeline standards. It is recommended that the City prioritize the rehabilitation and replacement program around replacement of these undersized 4 or 6-inch diameter steel pipelines with 8-inch PVC pipelines. The decision to repair or replace other existing facilities should be based primarily on facility condition.

Table 9. Recommended CIP Program for Grayson Service Area[a]

Category Number	CIP Reason	Item	Unit	Quantity	Unit Cost[b], $	Cost[c], $
Pipelines						
9	Fire Flow	Replace 6-inch diameter pipelines along Minnie Street from Tank 9 to Laird Road to 8-inch	LF	810	121	98,000
9	Fire Flow	Replace 4-inch diameter pipelines along Laird Road from Minnie Street to Amelia Street to 8-inch	LF	700	121	85,000
9	Fire Flow	Replace 4-inch diameter pipelines along Stakes and Charles Street from Minnie to Mary Street to 8-inch	LF	1,640	121	198,000
9	Fire Flow	Replace 6-inch diameter pipelines along River Road from Mary Street to Amelia Street to 8-inch	LF	750	121	91,000
9	Fire Flow	Replace 6-inch diameter pipeline along Mary Street from Laird to River Road to 8-inch	LF	710	121	86,000
Wells[d]						
10	Supply	New or replacement well with 400 gpm capacity, backup generator, and SCADA	LS	1	2,300,000	2,300,000
Wellhead Treatment						
11	Supply	Construct new IX treatment system[e]	LS	1	1,500,00 [f]	1,500,000
Backup Generators						
12	Supply	Well 274 Replacement	LS	1	159,000	159,000
12	Supply	BPS	LS	1	159,000	159,000
Tank 9 Replacement and BPS Upgrade						
18	Supply	Add two new pumps (50 HP each)	LS	1	1,219,638	1,220,000
18	Supply	Replace Tank 9	LS	1	400,000	400,000
					Subtotal (Overall Program)	6,296,000
					50% Contingency & Other Costs[g]	3,148,000
					Total Opinion of Probable Construction Cost	**9,444,000**

(a) Does not include site specific facilities.
(b) All unit prices presented in March 2017 dollars (San Francisco ENR Construction Cost Index = 11609.44). Unit prices based on combination of cost curves, construction cost guidelines and similar construction projects.
(c) Rounded to the nearest $1,000.
(d) Does not include costs for any wellhead treatment facilities required to meet water quality standards, if necessary. Includes land acquisition costs.
(e) City should perform an evaluation to determine whether the existing IX treatment system at Well 295 could be replaced with another treatment system that would meet the needs of both Well 295 and the Well 274 replacement.
(f) Cost derived from USBR's WaTER Program fact sheets, which are based on March 2001 dollars, escalated to March 2017 dollars.
(g) Soft cost and contingency mark-ups of 50% include: construction contingency (20%), engineering (10%), construction management (10%), and program implementation (10%).



Symbology

- Active Well
- 4-inch Pipeline
- 6-inch Pipeline
- 8-inch Pipeline
- 10-inch Pipeline
- Existing Tank and BPS
- Grayson Service Area

N

0 500 1,000

Scale in Feet

MODESTO CALIFORNIA

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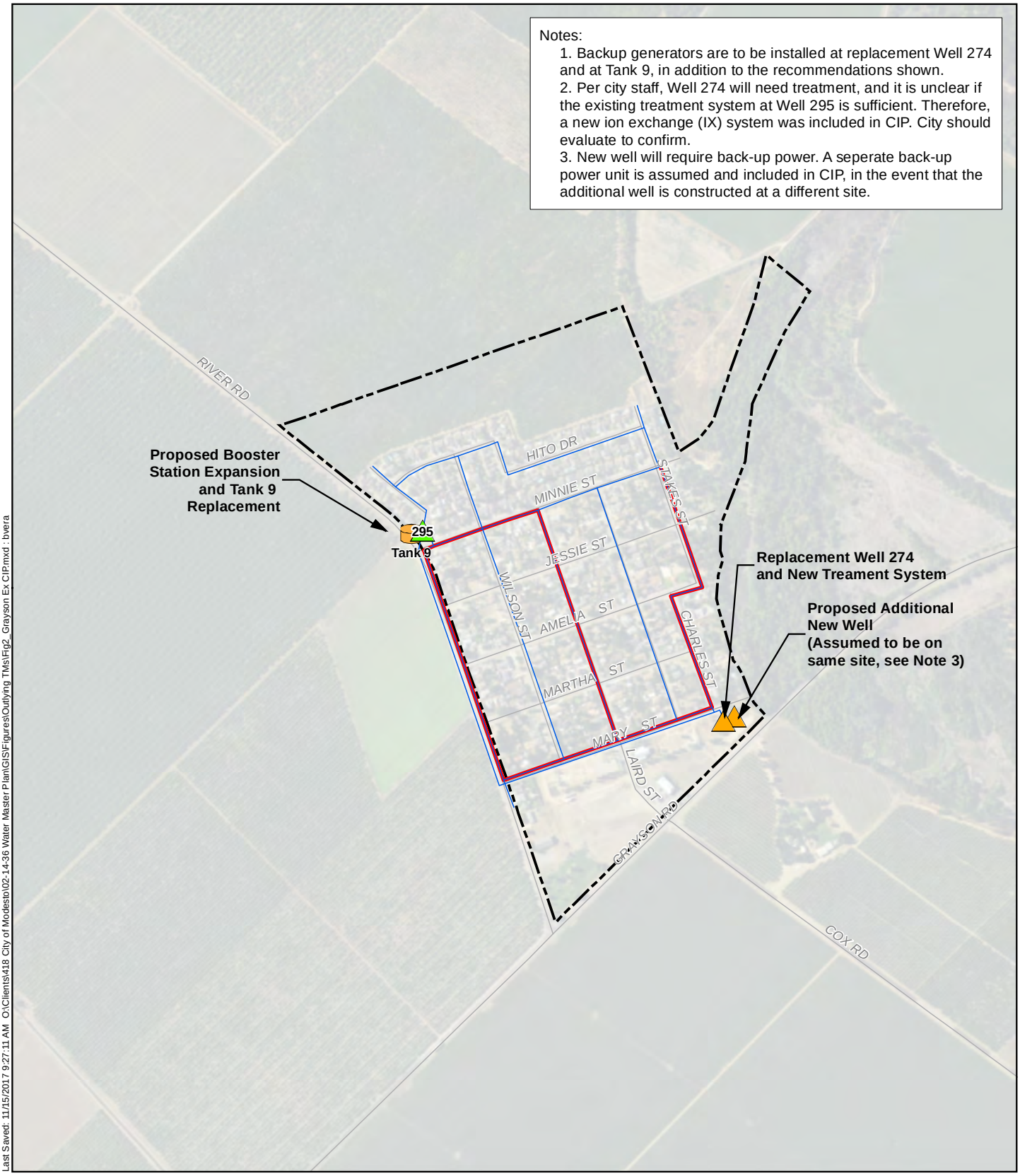
FIGURE 1

City of Modesto Water Master Plan

GRAYSON EXISTING WATER SYSTEM



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Symbology

- Active Well
- Proposed Well
- Existing Pipeline
- Recommended upsize to 8" pipeline
- Existing Tank and BPS Location
- Grayson Service Area

N

0 400 800

Scale in Feet

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FIGURE 2

City of Modesto Water Master Plan

GRAYSON EXISTING CIP RECOMMENDATIONS