Special Called Workshop Meeting Agenda

CITY COMMISSIONERS OF THE CITY OF WILDWOOD

Mayor/Commissioner – Ed Wolf – Seat 1

Commissioner/Mayor Pro-Tem Pamala Harrison-Bivins – Seat 2

Robby Strickland – Seat 3

Don C. Clark – Seat 4

Julian Green – Seat 5

Bill Ed Cannon – City Manager

Special Called Workshop Meeting Agenda

Monday, March 18, 2013

6:00 PM

City Hall Commission Chamber

PLEASE TURN OFF ALL CELL PHONES AND PAGERS

Persons with disabilities needing assistance to participate in any of these proceedings should contact the City Clerk's Department, ADA Coordinator, at 352-330-1330, Ext. 102, forty-eight (48) hours in advance of the meeting.

F.S.S. 286.0105A - If a person decides to appeal any decision made by the Commission with respect to any matter considered at this meeting, they will need a record of the proceedings, and that for such purpose they may need to ensure that a verbatim record of the proceedings is made, which record includes the testimony and evidence upon which the appeal is to be based.
The City of Wildwood DOES NOT provide this verbatim record.

City Hall Commission Chamber - 100 N. Main Street, Wildwood, FL 34785

AGENDA

- THE MEETING IS CALLED TO ORDER BY THE MAYOR
- ~~INVOCATION~~
- ~~FLAG SALUTE~~

1. ~~**TIMED ITEMS AND PUBLIC HEARINGS**~~
   a. ~~None~~

2. **REPORTS AND PUBLIC INPUT / SPECIAL PRESENTATION(S)**
   a. Special Presentations
      1. Champagne Farms Water Treatment Plant Preliminary Design Report – Richard Busche, Kimley-Horn and Associates, Inc. (Attachments on your iPad)

   ~~**b. City Manager**~~
      ~~1. None~~

   ~~**c. City Attorney**~~
      ~~1. None~~

   ~~**d. City Clerk**~~
      ~~1. None~~

   ~~**e. Commission Members**~~
      ~~1. None~~

   ~~**f. Public Forum (10 minute time limit)**~~
      ~~1. None~~

   ~~**g. Notes and Reports**~~
      ~~1. None~~

3. ~~**NEW BUSINESS – ACTION REQUIRED**~~
   a. ~~**MINUTES**~~
      1. ~~None~~

   b. ~~**ORDINANCES FIRST READING ONLY (READ ONLY – NO VOTE)**~~
      1. ~~None~~

   c. ~~**RESOLUTIONS FOR APPROVAL**~~
      1. ~~None~~

   d. ~~**APPOINTMENTS**~~
      1. ~~None~~

   e. ~~**CONTRACTS AND AGREEMENTS**~~
      1. ~~None~~

   f. ~~**FINANCIAL**~~
      1. ~~Bills for Approval (Attachments – Staff Recommends Approval)~~

   g. ~~**GENERAL ITEMS FOR CONSIDERATION**~~
      1. ~~None~~

4. **ADJOURN**

Champagne Farms
Preliminary Design Report

Prepared by:

Kimley-Horn
and Associates, Inc.

Champagne Farm Preliminary Design Report

City of Wildwood
Utilities Department

Prepared for:

The City of Wildwood

Prepared by:

Kimley-Horn and Associates, Inc.

142173080
November 2012
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Ocala, Florida 34471
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MALCOLM LEWIS BRYANT
LICENSE
No. 65582
STATE OF
FLORIDA
PROFESSIONAL ENGINEER

THIS IS TO CERTIFY THAT THE ENCLOSED ENGINEERING CALCULATIONS WERE PERFORMED BY ME OR UNDER MY DIRECT SUPERVISION.

Malcolm L. Bryant, PE
Florida Registration Number 65582
CA 00000696

Date: 11/5/2012

Champagne Farm Preliminary Design Report

City of Wildwood
Utilities Department

Prepared for:

The City of Wildwood

Prepared by:

Kimley-Horn and Associates, Inc.

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_____

Malcolm L. Bryant, PE
Florida Registration Number 65582
CA 00000696

Date: _____

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List of Acronyms

AADF	Annual Average Daily Flow
AAFF	Average Available Fire Flow
AWS	Alternative Water Supply
BEBR	Bureau of Economic and Business Research
CIP	Cast Iron Pipe
CR	County Road
CUP	Consumptive Use Permit
DIP	Ductile Iron Pipe
F	Fahrenheit
FAC	Florida Administrative Code
FDEP	Florida Department of Environmental Protection
fps	Feet Per Second
Ft	Feet
GIS	Geographic Information System
gpcd	Gallons per Capita Day
GPD	Gallons per Day
gpm	Gallons per Minutes
GST	Ground Storage Tank
HOA	Homeowners Association
Hp	Pump Head
hp	Horsepower
HSP	High Service Pumps
ISO	Insurance Services Office
LDC	Land Development Code
LSSA	Lift Station Service Area
MFLs	Minimum Flows and Levels
MG	Million Gallons
mg/L	Milligram per Liter
MGD	Million Gallons per Day
MOR	Monthly Operating Report
NE	Northeast
NW	Northwest
PAR	Public Access Reuse
psi	Pounds per square inch
PVC	Polyvinyl Chloride
PWS	Potable Water System
RIB	Rapid Infiltration Basin
SCADA	Supervisory Control and Data Acquisition
SE	Southeast
SW	Southwest
SWFWMD	Southwest Florida Water Management District
TDS	Total Dissolved Solids
WMD	Water Management District
WRAMS	Water Resources Assessment and Management Study
WRF	Water Reclamation Facility
WTF	Water Treatment Facility
WTP	Water Treatment Plant
WUP	Water Use Permit

Executive Summary

The City of Wildwood (City) is anticipating significant growth in the City's utility service territory over the next 20 years. In response to this anticipated future demand, the City is planning for a new regional water treatment facility. The City currently has two Lower Floridan Aquifer (LFA) wells that were constructed on the Champagne Farm property. The wells have been tested and can provide suitable water quality and production for a new regional water supply and treatment facility.

Water quality testing was conducted at the time the wells were constructed. The wells show elevated concentrations of total sulfides, odor (indicative of sulfides), and water hardness (as calcium carbonate – $CaCO_3$). While the water hardness levels are considered as "elevated", the reported concentrations are similar to the current concentrations in the City's distribution system. Therefore, the only recommended form of treatment beyond disinfection is for the removal of sulfides.

Because Champagne Farm is relatively close to residential properties, odor control should be a design consideration. With that in mind, this report recommends a packed tower aerator with pH adjustment for sulfide removal. A significant advantage of packed tower aeration is the ability for odor control during treatment. However, it is recommended that additional testing be performed to verify the previous testing results. The costs associated with treatment components are significant and additional testing to justify the inclusion or exclusion of additional treatment equipment should be considered.

The ultimate capacity of the Champagne Farm WTP is estimated to be 6.0 Million Gallons per Day (MGD) to meet the projected 20-year demands. However, the City has the opportunity to approach construction of the plant in a phased plan. The first phase would include the construction of the necessary components to provide 4.5 MGD which should be adequate to accommodate the anticipated growth for the next 10 years. Expansion to 6.0 MGD can be delayed until the actual growth requires additional capacity to meet demands.

Opinions of probable cost were developed for each of the phases. The estimated cost of design and construction for Phase I is $8,238,000. The estimated design and construction cost for the Phase II is $1,230,000. These cost opinions represent conservative planning level values based on recent construction costs of similar projects. The actual construction costs will depend on a variety of factors including cost of labor and materials and at the time of construction. In addition to the cost of constructing the treatment plant, the cost of additional infrastructure improvements associated with Champagne Farm WTP needed to be considered to fully understand the total cost of the new WTP. These infrastructure improvements include watermains that will connect the new plant to the existing system and existing water mains that will need to be upgraded.

An extensive analysis of the existing distribution system was performed to identify the location and magnitude of the necessary additional infrastructure projects. Analyses were performed for present day and future conditions using the City's water system hydraulic model. The model results show that some significant infrastructure projects will be required to accommodate a new Champagne Farm regional WTP. The following are the two most significant projects that will be required:

- Construct 17,200' of 24" watermain along CR-475 to connect Champagne Farm to the existing system on SR-44. Approximate cost of construction - $4,206,000
- Construct 23,700' of 24" watermain to connect Champagne Farm to the North near C-214. Approximate cost construction - $5,814,000.

Additionally, the model results show that the Coleman WTP will provide a majority of the water required by future demands. Due to Champagne Farm's proximity relative to the anticipated future growth, the Champagne Farm WTP will provide a smaller fraction of the water required by the future demands. Therefore, even with a new WTP at Champagne Farm, the Coleman Facility will require expansion and additional distribution system improvements.

According to City staff, the Champagne Farm location was selected because it was outside the "cone of influence" of Lake Deaton and Lake Okahumpka. However, a review of the planned developments with City staff shows that a majority of the large scale future developments will be located in the southeast section of the City's service territory. At this time, there are no large scale developments planned in the Champagne Farm area. Therefore, it is recommended that the City consider alternative locations for a new regional WTP. While a regional WTP can be located at Champagne Farm site, there are other potential locations that are closer to the anticipated developments which could be more cost effective. Any new location could still use the LFA as the water source. The regional hydrogeological characteristics indicate that other LFA sources within the City's service territory are likely to be similar to that found at the Champagne Farm site. Therefore, the treatment alternatives contained in this report are not likely to change for alternative locations.

1.0 Introduction

1.1 Background

The City of Wildwood is anticipating significant growth in the Wildwood area over the next 20 years. This growth will provide the City with the opportunity to expand the existing utility systems and provide potable water service to new customers. In response to this anticipated future demand, the City is planning for a new regional water treatment facility.

Just to the northeast of Wildwood is the Villages community. Significant growth has occurred in the Villages over the last 20 years. This development has expanded rapidly and is now adjacent to the city limits of Wildwood. According to the Southwest Florida Water Management District (SWFWMD) water use permit (WUP), the Villages is currently permitted for groundwater withdrawals of 23,065,639 gallons per day (annual average). With this much water demand in the vicinity of the City's existing system and wells, there has been increased pressure from the SWFWMD to pursue alternative water supply sources.

In response to this pressure from neighboring developments, as well as from aging and diminishing capacity of existing water treatment plants, the City began to investigate the options for constructing a new regional water supply facility. During the City's 2007 water use permit modification, the City received approval to evaluate a new Lower Floridan Aquifer (LFA) well field at the Champagne Farm site. According to City staff, this site was selected for the following reasons: 1) The location is outside the cone of influence from the Villages wells and 2) The location is within close proximity of anticipated future development near a proposed I-75 interchange at CR 466.

The City completed construction and testing of the Champagne Farm LFA wells in 2010. The test report prepared by BFA Environmental Consultants (dated December 2010) found that the new wells can provide suitable water quality and production potential for a new regional water supply and treatment facility. Based on these results, the City decided to move forward with preliminary design of the new Champagne Farm water treatment plant and seek designation of the Champagne Farm wells as an alternative water supply source.

1.2 General Description of Project

As previously discussed, the City has developed two wells and would like to proceed with designing a regional water treatment plant at the Champagne Farm site. This preliminary design report establishes the basis of design for the future water treatment plant. Included in this report is a review of the following design elements:

- Development of the exploratory wells into production wells.
- Raw water pretreatment system evaluation
- Primary treatment alternatives
- Preliminary site plan layout
- Phasing of the plant build-out

- Chemical bulk storage containers and/or facilities.
- Architectural aspects of the plant design
- Instrumentation and control aspects of the plant – S.C.A.D.A.
- Emergency power source for the plant
- Security features of the new plant.

1.3 Scope and Objectives

The primary objective of this report is to describe and address the design components for developing the Champagne Farm site into a regional water supply facility. This includes the site specific design elements and distribution system improvements necessary for the system to provide adequate flow rates and pressures to City patrons.

More specifically, the scope of this report is composed of the following elements:

- Analyze present demands and project future water demands placed on the distribution system.
- Analyze the existing water treatment plants and existing distribution system to identify limiting factors. This includes the existing WTP capacities and limiting sections of the distribution system.
- Present a summary of the current permitting status and regulatory issues affecting the water system including network limitations, treatment limitations, permit compliance issues and regulatory concerns.
- Provide a preliminary design of the Champagne Farm WTP and an opinion of probable cost to construct the plant.
- Based on projected future demands and system hydraulic properties, provide recommendations for water distribution system improvements.
- Present a preliminary project schedule.

2.0 Water Quality

The City's current water supply is provided by seven wells penetrating the Upper Floridan Aquifer (UFA) at five different sites. Water quality in the UFA is excellent with the only required treatment consisting of hydrogen sulfide removal and disinfection by chlorination. Although the water produced in the existing plants has moderate to high hardness characteristics, current treatment does not include water softening.

The City's finished water quality goals are to produce finished water with concentrations of all regulated contaminants being less than maximum contaminant level (MCL) contained in Florida statutes. Since the Florida statutes do not include an MCL for hardness, the hardness water quality goal for the purposes of this report is to continue producing water having hardness similar to that of the current water supply which is approximately 170 mg/L as $CaCO_3$.

Water quality in the Lower Florida Aquifer (LFA) has been determined from the two Champagne Farm test wells constructed by the City in 2010. This information is presented in Table 2-1 below. Where appropriate, this table includes the MCL for each contaminant as contained in the Florida Statutes.

Table 2-1: Water Quality Test Results

Well ID	Sample ID	Sample Description	Interval ft. BLS	Date Sampled	Sodium mg/l	Potassium mg/l	Calcium mg/l	Magnesium mg/l	Chloride mg/l	Sulfate mg/l	Carbonate mg/l	Bicarbonate mg/l	Hardness mg/l	Iron mg/l	Sulfide mg/l	TDS mg/l	Silica mg/L	TOC mg/L	Odor TON
UF-1	S-1	Monitor Well UF-1 - UFA	80-200	2/3/2010	29.70	4.48	72.0	24.6	10.0	16.2	1U	165		0.029	0.34	280			
CF-1	S-1 Step 1	Step Drawdown Test 3	600-1000	8/2/2010	7.77	1.19	53.8	12.4	8.0	115.0	1U	165	185	0.081	0.02U		13.9	0.85	
CF-1	S-2 Step 4	Step Drawdown Test 3	600-1000	8/2/2010	7.06	1.24	50.8	11.8	10.0	105.0	1U	135	175	0.042	0.02U		14.0	1.20	
CF-1	S-3	Step Drawdown Test 3 (DW)	600-1000	8/2/2010	7.46	1.00	53.0	12.0	10.8	112.5				0.020		362	15.1		100
CF-2	S-2	Reverse Air Discharge	400	2/3/2010	40.20	4.88	77.7	33.4	9.0	94.8	1U	130		0.350	0.2U	310			
CF-2	S-3	Reverse Air Discharge	600	2/5/2010	44.30	4.77	65.1	31.6	9.0	100.0	1U	120		0.275	0.52	325			
CF-2	S-4 @ Step 1	Step Drawdown Test 1	155-600	2/11/2010	18.80	2.21	64.8	31.2	10.0	95.3	1U	120		0.115	0.2U	445	22.9		
CF-2	S-5 @ Step 4	Step Drawdown Test 1	155-600	2/11/2010	19.30	2.11	65.9	28.6	8.0	97.6	1U	125		0.076	0.2U	440			
CF-2	S-10	Single Packer Test 1	350-600	2/19/2010	26.00	2.52	92.0	23.7	9.0	115.0	1U	125		0.065	0.2U	340			
CF-2	S-14	Straddle Packer Test 5	575-625	3/31/2010	7.77	1.47	63.2	16.2	12.0	135.0	1U	170		0.072	0.2U	390		2.40	
CF-2	S-6	Reverse Air Discharge	800	3/2/2010	9.25	1.58	110.0	37.1	12.0	98.7	1U	160		0.295	0.2U	360			
CF-2	S-11	Single Packer Test 2	595-850	3/5/2010	7.60	1.36	71.5	16.9	12.0	96.7	1U	150		0.110	0.2U	360			
CF-2	S-13	Straddle Packer Test 4	880-930	3/26/2010	20.40	2.52	115.0	24.9	12.0	160.0	1U	165		0.140	0.2U	490		2.60	
CF-2	S-7	Reverse Air Discharge	1000	3/16/2010	25.50	2.92	155.0	46.6	12.0	140.0	1U	175		0.670	0.70	295			
CF-2	S-9	Geophysical - Thief Sample	1090	3/23/2010	24.80	2.87	120.0	27.3	15.0	165.0	1U	175		0.485	0.2U	455	26.5		
CF-2	S-12	Single Packer Test 3	855-1100	3/26/2010	26.00	2.73	135.0	28.1	12.0	150	1U	170		0.120	0.2U	480		2.40	
CF-2	S-8	Reverse Air Discharge	1100	3/18/2010	25.10	2.64	150.0	36.5	14.0	145.0	1U	175		0.395	0.34	285			
CF-2	S-15 @ Step 1	Step Drawdown Test 2 - LFA	593-1100	5/11/2010	31.10	2.68	80.3	16.5	12.0	120.0	1U	155		0.115	0.2U	385	26.3	1.20	
CF-2	S-16 @ Step 4	Step Drawdown Test 2 - LFA	593-1100	5/11/2010	43.10	2.52	82.2	17.4	11.0	125	1U	150		0.046	0.2U	390	28.0	1.10	
CF-2	S-17 @ 1/2 hr	27 hr Constant Rate APT	593-1100	8/16/2010	6.60	1.36	71.2	14.30	8.0	110	1U	115	235	0.094	0.190	235	21.9		
CF-2	S-18 @ 8 hr	27 hr Constant Rate APT	593-1100	8/16/2010	6.27	1.27	67.8	14.20	10.0	130	1U	150	230	0.011	0.02U	230	17.1		
CF-2	S-19 @ 16 hr	27 hr Constant Rate APT	593-1100	8/17/2010	5.85	1.14	64.4	13.40	9.0	135	1U	150	215	0.006	0.02U	215	17.7		
CF-2	S-20 @ 24 hr	27 hr Constant Rate APT	593-1100	8/17/2010	6.81	1.36	72.2	15.00	9.0	135	1U	145	240	0.007	0.190	240	16.7		
CF-2	S-21 @ 25 hr	27 hr Constant Rate APT (DW	593-1100	8/17/2010	6.95				10.0	135				0.290		420			125
CF-2	S-22 @ 26 hr	27 hr Constant Rate APT	593-1100	8/17/2010	10.50	1.28	89.9	19.30	8.0	125	1U	145	305	0.019	0.02U	305	9.9	0.92	
		MAXIMUM RESULT			44.30	4.88	155.00	46.60	15.00	165.00	0.00	175.00	305.00	0.67	0.70	490.00	28.00	2.60	
		FL Drinking Water - MCLs			160 mg/l				250 mg/l	250 mg/l				0.3 mg/l		500 mg/l			

Note: Florida Driking Water Paramters were sampled for Wells CF-1 (S-3) & CF-2 at (S-21)

The results show that water quality in the LFA is good with only the following four contaminants showing a concern: hydrogen sulfide, iron, hardness, and total dissolved solids. The following is a discussion of these four parameters based on the sample results presented in Table 2-1.

Hydrogen Sulfide

The water quality test results show total sulfide concentrations ranging from 0.02 mg/L to 0.70 mg/L. While the majority of the total sulfide concentrations are below the 0.30 mg/L threshold level for treatment, the reported odor values (100 and 125 TON) in both wells are relatively high. Since odor is an indication of hydrogen sulfide (H_2S) presence, the reported odor values suggest a relatively high concentration of H_2S.

It is not unusual that total sulfide levels reported by the laboratory are lower than that found in the well water due to the high volatility of H_2S gas. Often, the H_2S gas will escape during sample collection and storage resulting in lower than actual reported levels. Additionally, hydrogen sulfide is known for varying significantly in concentration on almost a daily basis. For the purposes of this report, treatment for total sulfides should be anticipated until additional testing demonstrates acceptable levels. A total sulfide concentration of 1.0 mg/L will be assumed.

Iron

Iron concentrations measured in Well #1 ranged from 0.020 mg/L to 0.081 mg/L. Concentrations measured in Well #2 ranged from 0.007 mg/L to 0.395 mg/L. The FDEP secondary drinking water standard MCL is 0.30 mg/L. The iron concentration data for both wells were collected during various stages of well construction. Most of the water samples with iron concentrations greater than 0.30 mg/L were collected using the reverse air drilling process. In fact, values shown for iron concentration in Well #2 are consistently in the range of 0.1 mg/L except for 5 tests during which the water was produced using the reverse air process. All other iron concentrations measured during the constant rate pump testing were less than the MCL.

Since the reverse air process allows contaminants from the well driller's air compressor and air delivery piping to be included in the water being tested, contamination of the water samples cannot be ruled out. However, one sample (S-21) collected during constant rate pumping did have a measured iron concentration of 0.29 mg/L. Nonetheless, a significant majority of the test results show iron concentrations to be significantly lower than the MCL. For the purposes of this report iron will be assumed to have a concentration less than 0.30 mg/L. This concentration of iron does not require additional treatment.

Hardness ($CaCO_3$)

Water hardness (as calcium carbonate – $CaCO_3$) ranged from 175 to 185 mg/L in Well #1 and 215 to 240 mg/L in Well #2. While the FDEP does not have a MCL for water harness, the following guidelines are used for classifying water hardness.

Concentration	Classification
0 - 75	Soft Water
75 - 150	Moderately Hard Water
150 - 300	Hard Water
Over 300	Very Hard Water

Using the above guidelines, the Champagne Farm water source is considered "hard water". However, this hardness value is not significantly higher than that of the existing water supply wells. Recent distribution system test results showed hardness concentrations ranging between 170 and 200 mg/L. Since the LFA water source has hardness concentrations similar to that of the current City distribution system, no hardness treatment is recommended for the Champagne Farm site.

Total Dissolved Solids (TDS)

The TDS concentrations ranged from 215 to 490 mg/L in both wells. These levels are below the FDEP MCL of 500 mg/L. While a degradation of water quality could push the TDS concentrations beyond the MCL, no treatment for TDS is recommended at this time.

3.0 New Treatment Facility Design

3.1 Plant Design

The purpose of this section is to identify finished water quality goals and identify the treatment processes required to meet these goals. The treatment requirements will be based on the reported available raw water quality from the LFA supply wells at the Champagne Farm site. This section will also identify and discuss a phased development approach for the Champagne Farm facility.

The City desires to have the wells at Champagne Farm designated as alternative water supply (AWS) wells. The governing body that determines whether a water supply will be granted the AWS designation is the local water management district. Preliminary indication from SWFWMD is that water quality in the Champagne Farm wells is too good to meet their definition of an "alternative water supply". However, the SWFWMD generally agrees that the Champagne Farm wells would be considered a "different source" from the Upper Floridan aquifer.

Water Treatment Components

Based on the water quality results presented in Section 2, the following is a discussion of the anticipated treatment components for the Champagne Farm WTP.

Hydrogen Sulfide

Hydrogen sulfide removal, when present at concentrations greater than the 0.3 mg/L, can be performed by aeration alone or oxidation followed by filtration. There are a number of aeration processes, from the simple tray type aerator to membrane degasification. There are also a number of the oxidizing agents, from common chlorine to ozone. State regulations prohibit oxidation of hydrogen sulfide concentrations greater than 0.3 mg/L unless there is filtration following the oxidation process. This regulation is based on the fact that oxidation of hydrogen sulfide produces elemental sulfur which can produce cloudy water and the sulfur can convert back to other sulfur compounds in the distribution system or customer plumbing. The effect of this regulation is that treatment by aeration must reduce the concentration of hydrogen sulfide to a concentration of the less than 0.3 mg/L.

Oxidation followed by filtration is a relatively extensive treatment process because of the filters and the associated backwashing facilities. Filtration facilities for a plant of this general size could be expected to carry a construction cost of $1-$2 per gallon of treatment capacity. Aeration generally carries an estimated construction cost of the $.05-$.50 per gallon of treatment capacity. Since there is no other contaminant requiring filtration for treatment, oxidation followed by filtration will not be considered at this facility. Also, membrane degasification would offer the opportunity to avoid a clearwell and transfer pumps. However, this treatment methodology is still unproven for municipal water systems in Florida. Therefore, membrane degasification will not be considered as a treatment option for this project.

Hydrogen sulfide removal from water by aeration is directly affected by pH of the water. Natural well water will have a pH in the range of 7.5. At that pH level, hydrogen sulfide

removal will be relatively inefficient since a majority of the hydrogen sulfide in the water is not in gaseous form and therefore will not be removed from the water. Aeration can only remove hydrogen sulfide that is in the gaseous form. At a pH of 6.0 almost all of the hydrogen sulfide present in the water is in the gaseous form and will be removed by an efficient form of aeration.

Aeration can be accomplished by either a tray aerator or packed tower aerator. A tray aerator operates at a fairly low hydrogen sulfide removal rate and will generally not remove more than 40% of the hydrogen sulfide present in the water without pH adjustment. Based on the assumption that hydrogen sulfide in this water is at approximately 1.0 mg/L, a tray aerator would not reduce hydrogen sulfide concentrations to the level required by state statutes without pH adjustment. A second difficulty associated with tray type aerators is that the hydrogen sulfide gas released from the water, which has the rotten egg odor, cannot be collected and treated. This creates the possibility that there will be impacts to neighboring property from this odor.

Packed tower aeration can be configured to achieve 95% removal of the hydrogen sulfide present in the water provided pH adjustment of the water is included in the aeration equipment. Additionally, packed tower aerators allow for collection and treatment of the hydrogen sulfide gas waste product. Complete removal of the hydrogen sulfide will reduce operating costs that are associated with chlorination of the finished water. Each part of hydrogen sulfide present in the finished water requires approximately 8 parts chlorine for complete oxidation. Accordingly, a lower concentration of hydrogen sulfide will lower the amount of chlorine used in the finished water. The packed tower treatment process will also accommodate the varying concentrations of sulfide expected to be present.

This report recommends pH reduction and a packed tower aerator for hydrogen sulfide removal. Optionally, if the potential odor associated with a tray aeration system is not a concern, tray aeration with pH reduction may provide a lower cost alternative.

Hardness

Reducing hardness of the finished water is not currently recommended since the water quality data available on the Champagne Farm LFA wells shows the hardness of that water to be approximately the same as the water in the UFA. Also, the existing customers have historically accepted the harder water quality currently distributed by the City's system. However, the various water treatment plants are all interconnected in the distribution system and should produce equivalent quality water. The following discussion is applicable in the event hardness reduction is considered at the Champagne Farm facility.

Reducing hardness present in the raw water requires removal of calcium and magnesium. The traditional method of reducing hardness is through the lime softening process which requires addition of slaked lime in an up-flow reactor followed by filtration. Support facilities for this process include storage of dry bulk lime, filter backwash facilities, and lime sludge thickening/disposal facilities. A more streamlined treatment process uses nanofiltration membranes in a process referred to as membrane softening. Currently the capital cost of these two processes is approximately the same, in the range of the $1.50 to $2.50 per gallon of treatment capacity. However, the lime softening process requires significantly more operator attention, space, and removes only the calcium and magnesium present in the raw water.

Membrane softening removes the hardness, iron, sulfate, total organic carbon, color, and most other dissolved solids present in the water. The membrane softening process is frequently automated to minimize operator attention. In general, lime softening plants cannot be fully automated and therefore require a higher degree of operator attention - increasing operating costs. The membrane softening process can be configured to remove all or only some of the hardness present in the raw water. This feature allows a reduction to be made in construction cost by reducing the production capacity of the membrane treatment facility since it is not required to treat the entire capacity of the water plant. A portion of the plant capacity is treated with membrane softening to remove all of the hardness and this water is then blended with water that has not been treated for hardness removal. The ratio of water treated and water not treated is varied to produce water of a predictable hardness that is satisfactory to customers. As an example, assuming the raw water has a hardness of 175 mg/L and the design criteria is to achieve a 40% reduction in hardness to a value of the 105 mg/L, approximately 50% of the raw water would require treatment by membranes removing 90% of the hardness. Half of the water would then have a hardness of 18 mg/L; the other half a hardness of 175 which when blended would have a hardness of 95 mg/L.

Implementing membrane softening would also position the water treatment system to accommodate any future degradation of the raw water quality. The facilities required for the initial phase of water production at the Champagne Farm water treatment plant would include a building of approximately 1,500 $ft.^2$ to house the membrane treatment equipment, two membrane treatment trains each capable of producing 0.75 MGD, and chemical feed equipment for scale inhibitor and pH adjustment. Water produced through the membrane softening process would be blended with water from the wells for aeration to remove hydrogen sulfide. The membrane treatment process generates a stream of water referred to as concentrate which contains the hardness and other dissolved contaminants that were present in the raw water. A plant of this nature would operate at about 85% recovery meaning for every gallon of raw water pumped from the ground, 0.85 gallons of drinking water would be produced and 0.15 gallons of concentrate would be produced. A disposal method is needed for this concentrate stream. Options for disposing of the concentrate will need to be explored during the design of the treatment plant.

Water Treatment Capacity

Section 3 of this report presents a discussion and tabulation of existing water treatment plants, general discussion of the facilities at each plant, production capacity of each plant, and recommendations for eliminating 3 of the plants. Section 4 also presents projections of future water requirements at the 5, 10, and 20 year planning horizons. To meet the demand projections, the Champagne Farm WTP is recommended to have a maximum day production capacity of 4.5 MGD at the end of the ten-year planning horizon and 6.0 MGD at the 20 year planning horizon. These are maximum day requirements which also coincide with the required water treatment production capacity. A factor of 2.0 is assumed to represent the difference between average day demand and maximum day demand which would lead to average day requirements of 2.25 MGD and 3.0 MGD for the 10 year and 20 year periods respectively.

Finished Water Storage

Regulations contained in the Florida statutes establish a minimum requirement for storage of finished water at water plants. This requirement is to store 25% of a plant's rated daily capacity (maximum day demand) plus fire flow for the length of time required by the entity establishing the rate of fire flow. There are methods of reducing the storage requirement in the event it is appropriate and needed for a specific site. However, when planning a water plant it is recommended to include as much storage as possible to accommodate emergency situations. It is assumed that the fire flow requirement will be 1,000 GPM for four hours which leads to the requirement for 360,000 gallons of finished water storage. With a rated capacity of 4.5 MGD, the minimum amount of finished water storage that would meet requirements of the Florida statutes is 1,125,000 gallons plus fire flow storage of 360,000 gallons for a total of 1,485,000 gallons. Build-out requirement would be 1,500,000 gallons plus the fire flow requirement for a total of 1,860,000 gallons. Therefore, two one-million gallon ground storage tanks are proposed for providing the necessary finished water storage.

High service pumping

High service pumping capacity must equal peak hour requirements with the largest pump out of service. A factor of 4.0 is assumed to represent the difference between average day demand and peak hour demand which leads to high service pumping capacity requirements of 9.0 MGD and 12.0 MGD, respectively. It is recommended that the ten-year planning horizon be met with 4 pumps each having a capacity of 3.0 MGD. Build-out capacity of 12.0 MGD would be met with the original four pumps at a rated capacity of 12.0 MGD and one additional pump having a capacity of 3.0 MGD.

Degasification (Aeration)

Removal of hydrogen sulfide is a required treatment process in order to meet water quality standards. Although degasifiers are not considered mechanical equipment and therefore may not require redundancy on that basis, redundancy is needed to allow water production in the event a degasifier requires cleaning or other maintenance. Blowers associated with the degasifiers must include redundant units. It is recommended that two packed tower aerators, each capable of treating 3,125 GPM, be installed during Stage I. No additional degasifiers would be required through build-out.

Clear Well and Transfer Pumps

Florida statutes require that there be redundant wet wells at water plants when the wet well is necessary for the plant to produce drinking water. Experience has demonstrated that concrete structures require maintenance which confirms the redundancy requirement. Two clear wells are recommended to be constructed for Stage I and these would be sufficient through build-out. Each clear well is recommended to have a capacity of approximately 40,000 gallons of useful storage in order to provide contact time of about 3 minutes. There are currently proposed regulations which may require that water plants operate with a chlorine contact time that can be predicted to eliminate bacterial and microbial contamination. This contact time will be provided by the recommended clearwell capacity. It is assumed that this water plant will be using free chlorine and not combined chlorine.

Chemical Handling

The proposed water treatment system at Champagne Farm will include storing and handling chlorine, acid, and possibly corrosion inhibitor.

Liquid chlorine is proposed to be used at this site. Facilities to support chlorine injection include storage tanks located inside of the building to reduce decomposition of the stored chlorine, a day tank, and a minimum of three chemical metering pumps, all within an enclosed building.

Sulfuric acid is proposed to lower pH of the raw water prior to degasification. There are other options, such as, carbon dioxide, hydrochloric acid, or citric acid. The agent to be used for reducing pH would be established during the design process for the facility. However, building space will be required for storage of a liquid acid, a day tank, and a minimum of three chemical metering pumps.

Corrosion inhibitor is apparently being used at least one of the existing plants. Any decision as to continuation of the adding corrosion inhibitor at the other plants or the Champagne Farm facility would be made during design. However, space will be provided for handling of a corrosion inhibitor.

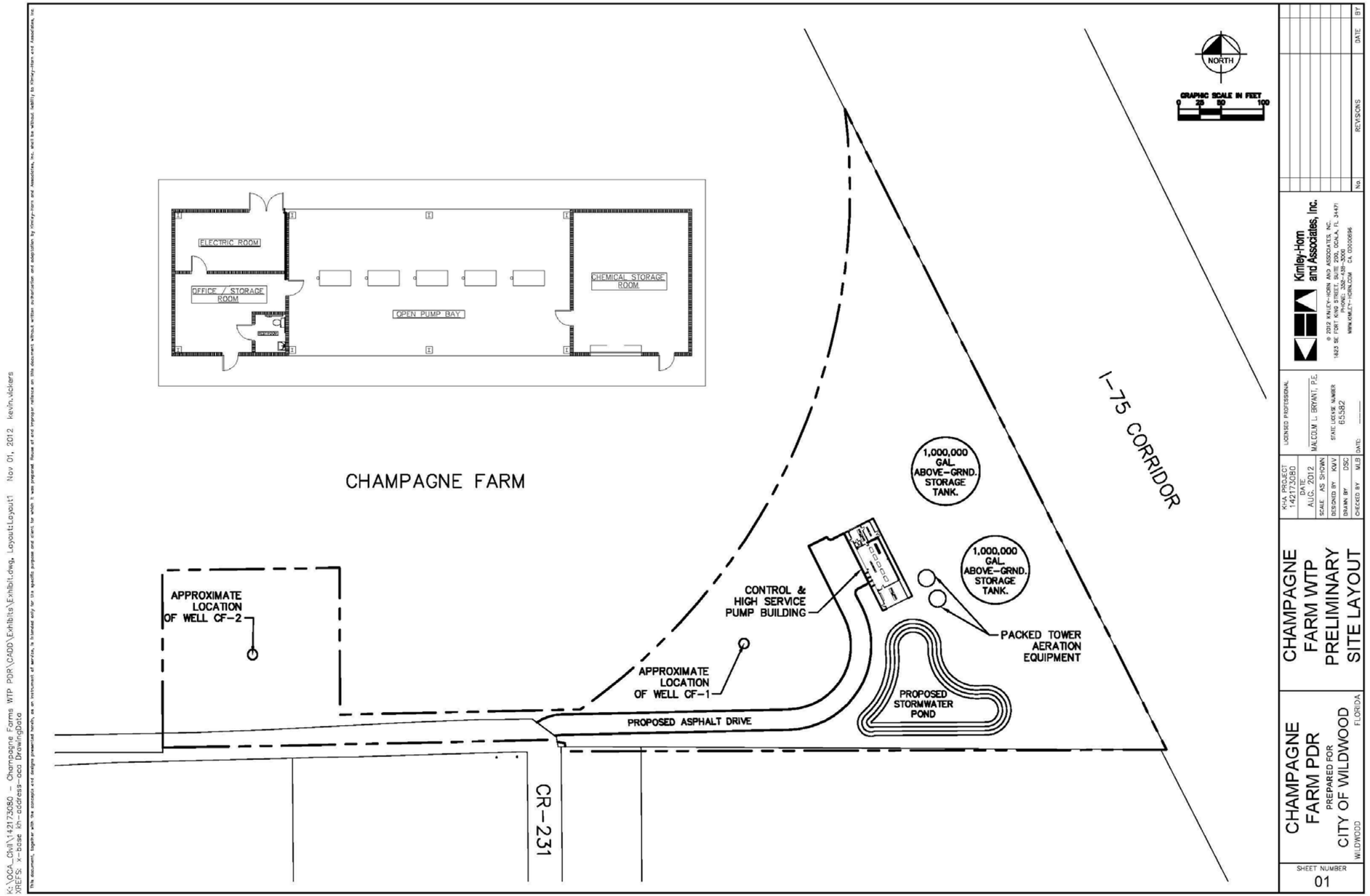
The preliminary recommendation is a 900 $ft.^2$ building with extended ceiling height to accommodate bulk storage tanks.

Emergency generator

Stage I will include an emergency generator capable of powering both wells, two degasifier blowers, and 12.0 MGD in high service pump capacity. The generator will be sized such that it will serve the plant through buildout. .

See the following page for a Preliminary Site Layout Plan.

Figure 3-1: Preliminary Site Plan



3.2 Permitting Requirements

All new water treatment plant construction must be approved and permitted by the FDEP. The FDEP is responsible for permitting construction of new facilities while the water management districts are responsible for permitting ground water withdrawal quantities.

Prior to submitting an FDEP permit application, a pre-application meeting with FDEP staff should be held. The purpose of the pre-application meeting is to establish the City's intent and discuss the required information that will need to be submitted during the permitting process. The next step in the process is to submit an application to FDEP. In addition to the application, the following design documents are required to be included in the application package:

- Basis of Design Engineering Report – The Basis of Design is a narrative of the design process and components. It summarizes the calculations for the design of the plant and includes a description of the individual plant components.
- Construction Plans.
- Project Construction Specifications.

Additional permits that may be required for the treatment plant site and transmission system are listed below:

- SWFWMD Environmental Resource Permit
- SWFWMD Water Use Permit
- Sumter County Right-of-Way Permit
- FDOT Right-of-Way Permit

3.3 Construction Cost Opinion

The following is a discussion of the phasing of construction for the Champagne Farm WTP and associated construction costs for each phase. These costs are preliminary and intended to give the City a planning level estimate for probable design and construction costs for the treatment facility.

The first phase of plant construction will be rated for 4.5 MGD. This phase will include the bulk of the construction for the plant. The first phase will require developing the test wells into production wells, the site preparation work and grading, construction of the control and high service pump building, construction of the treatment systems, construction of the ground storage tanks, and emergency back-up generator. The estimated design and construction cost for phase I is $8,238,000.

The second phase of construction will be to increase the rated treatment capacity from 4.5 MGD to 6.0 MGD. This capacity expansion will require the addition of a new high service pump, increased chemical system storage and delivery capacity, expansion of the electrical systems, and expansion of the control systems. The estimated design and construction cost for the phase II is $1,230,000.

See Appendix G for a detailed breakdown of the opinion of probable costs.

3.4 Preliminary Project Schedule

A preliminary project schedule is shown in Figure 3-2 of this section. It highlights the main permitting and design requirements. Also included is an estimated construction schedule. The total number of days for permitting and construction is estimated at 420 days.

3.5 Potential Funding Sources

A study was conducted by Angie Brewer & Associates, LC to investigate funding sources for Wildwood utility projects. Included in the study is a review of funding sources that may be available to assist in the design and construction of the Champagne Farm WTP. Three potential funding sources were identified by the report: 1) Florida Rural Water Association Loan Programs 2) State Revolving Fund Loan Program (SRF) – Drinking Water and 3) Water and Waste Disposal Systems for Rural Communities.

Florida Rural Water Association Loan Programs

This program is administered by the Florida Rural Water Association. The objective of the program is to assist communities in acquiring interim financing for construction projects. The program allows communities to have access to competitive fixed rate loan funds at a low cost of borrowing. The salient requirement for this program is that the recipient community must have received either a permanent loan commitment from the US Department of Agriculture-Rural Development (UDARD) or from the Department of Environmental Protection-State Revolving Fund (DEP-SRF) for construction funding. The loans are used during the construction period and are paid off with the USDARD/DEP-SRF funds once the project is complete. The funding cycle frequency is ongoing and applications can be submitted on an ongoing basis. The amount of funding available is determined on a project by project basis. The potential loan funding level available from this program would be the total construction cost.

State Revolving Fund Loan Program (SRF) – Drinking Water

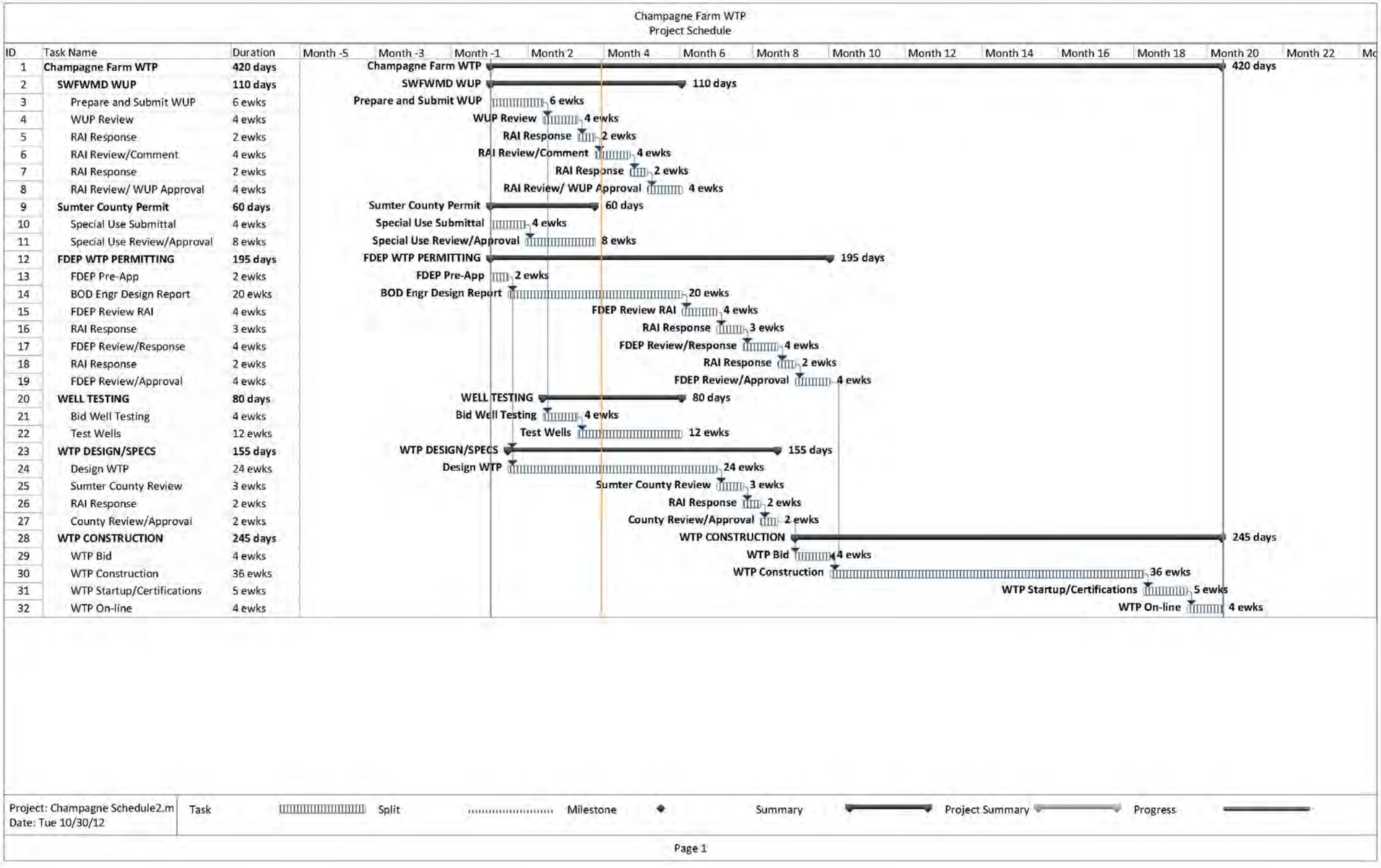
This program is administered by the Florida Department of Environmental Protection. The goal of the Drinking Water State Revolving Fund Program is to provide low-interest loans to eligible entities for planning, designing, and constructing public water facilities. Construction grants are also available to financially disadvantaged communities with public health risk projects. Pre-construction loans and grants are available to small community water systems with public health risk problems. Funds are made available for construction loans to rate-based public water systems of $75,000 or more. The funding cycle frequency is ongoing. Application frequency is ongoing with "readiness to proceed" being due in June/July each year. The potential loan funding level available from this program would be the total construction cost.

Water and Waste Disposal Loan and Grant Program

This program is administered by the United States Department of Agriculture's Development Department. The goal of the program is to provide long-term low-interest loans, direct grants and loan guarantees to rural communities with a population less than

10,000 persons. The purpose of the loans and grants is to fund new, improved and expanded water storage and distribution systems, as well as waste treatment and disposal systems. The funding cycle frequency is ongoing and applications can be submitted on an ongoing basis. The potential loan funding level available from this program would be the total construction cost.

Figure 3-2: Project Schedule



4.0 Existing Water System

4.1 Introduction

This section discusses the location, condition, and capacity of the existing potable water systems owned and operated by the City. Also included is a summary of the current permitting status and regulatory issues affecting water systems, including network limitations, treatment limitations, permit compliance issues and regulatory concerns.

4.2 Water Supply Permitting Agencies

4.2.1 Florida Department of Environmental Protection (FDEP)

The Florida Department of Environmental Protection is responsible for permitting the design and construction of new potable water supply systems that provide water to 25 or more people for at least 60 days each year or serves 15 or more service connections. Very small water systems that do not fit the above description are regulated by the Florida Department of Health and individual county health departments. The construction of water wells, both public and private, and the quantities of water that may be extracted, are regulated by the Water Management Districts.

After water treatment plants have been built, FDEP is responsible for monitoring the plant for conformance with drinking water standards. Most notably, the FDEP inspects the plants at regular times and generates a Sanitary Survey Report. All the components of the plant are inspected during the sanitary survey, including the well heads, disinfection systems, storage facilities, high service pumps, treatment components (i.e. - aeration equipment), and the records that are required on-site. Any deficiencies observed during the inspection are noted and included in the Sanitary Survey Report.

4.2.2 Southwest Florida Water Management District (SWFWMD)

SWFWMD is responsible for permitting and monitoring the quantities of groundwater pumped to potable water supply systems. The City of Wildwood has one water use permit (WUP) issued by SWFWMD. All active wells and facilities are permitted under this single WUP (Permit #20008135.009). A total of 4.98 MGD annual average and 7.657 MGD peak monthly flows are permitted for this system. Currently, 1.640 MGD of the total permitted capacity is assigned to wells CF-1 and CF-2, which are the Champagne Farm wells. Table 4-1, below summarizes information regarding the City's water use permit issued by SWFWMD.

According to the SWFWMD website, none of the wells owned and operated by the City fall within a Water Use Caution Area (WUCA). Water Use Caution Areas are defined by the district as "a geographic region within the District which exhibits

resource problems, or is predicted to exhibit resource problems, and for which special regulations are enacted by the Governing Board.

Table 4-1 : Water System Permit					
Permit Number	Permit Type	Issuing Agency	Wells	Date of Issue	Date of Expiration
20008135.009	Individual Water Use Permit	SWFWMD	12	1/25/2012	7/29/2013

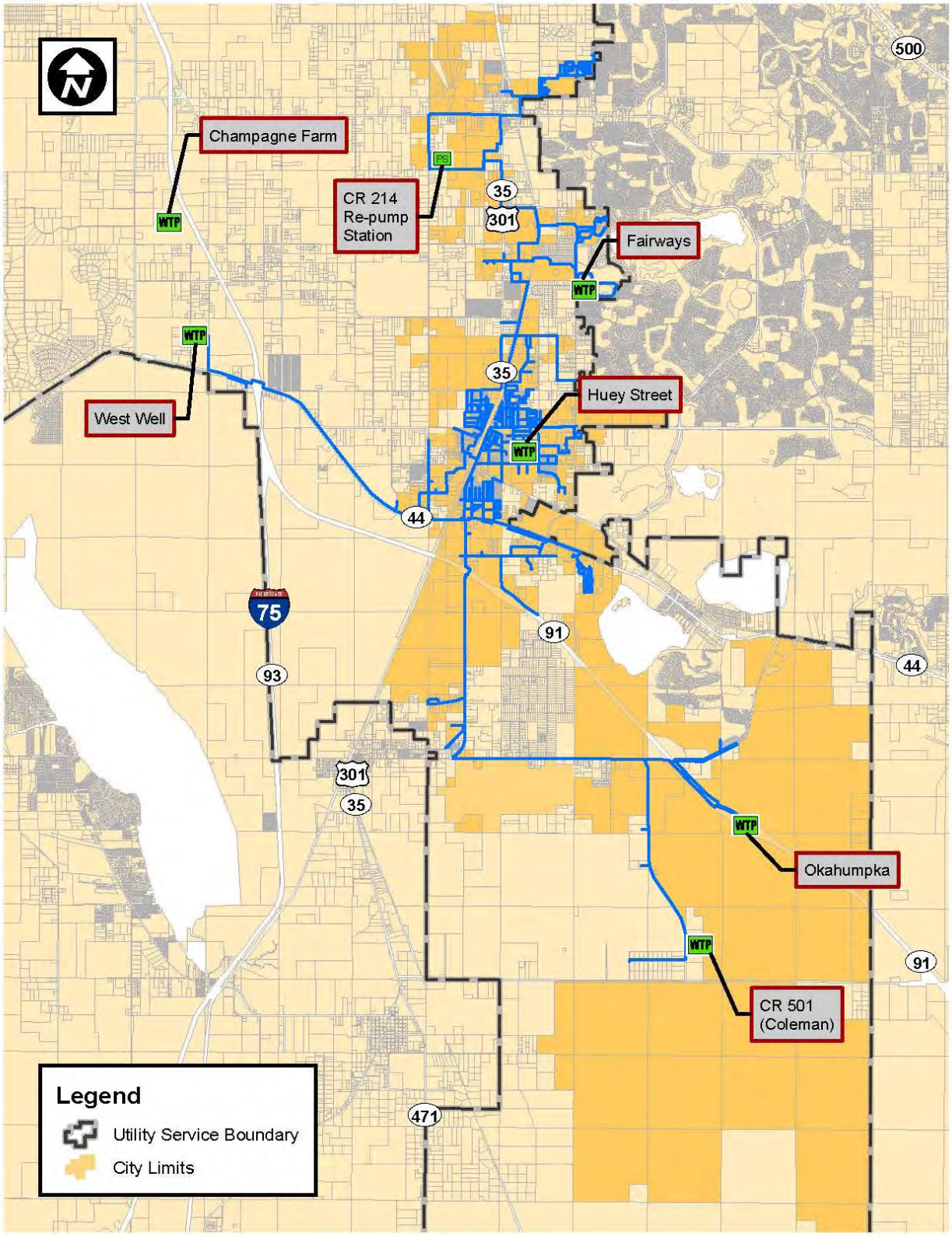
4.3 Distribution System

City of Wildwood's system is identified by the FDEP as PWS-ID No. 660-0331. According to the Sanitary Survey Report dated October 26, 2011, the total population served by the system is 13,815 with approximately 3,945 connections to the distribution system. The design capacity of the system is 5,038,000 gpd and storage capacity is 2,074,000 gallons. According to the FDEP Sanitary Survey Report dated December 7, 2011, no significant deficiencies were observed for the City's Potable Water System.

The existing distribution system covers a large area measuring approximately seven miles wide (east to west) and 13 mile long (north to south). With the anticipated future development, the distribution system will increase to approximately seven miles wide (east to west) and 17.5 miles long (north to south). The following is a summary of the existing distribution system pipe size (diameter) and lengths. The pipe materials include PVC, galvanized, asbestos-cement, and ductile iron pipe. The distribution system also includes five treatment facilities, one re-pump facility, one elevated water storage tank, four ground storage tanks, and three hydropneumatic tanks.

Pipe Size (diameter)	**Total Length of Pipe (feet)**
16 – inch	5,200
12 –inch	134,800
10 – inch	38,900
8 – inch	175,400
8 – inch (dry)	6,200
6 - inch	21,500
4 – inch	8,800
2 - inch	60,100

Figure 4-1: System Overview



4.4 Existing Water Treatment and Storage Facilities

This section contains a detailed discussion of the existing water treatment plants. The discussion includes a capacity analysis of each plant as a whole as well as a capacity analysis of the component systems (wells, storage systems, disinfection systems, and high service pumps).

Establishing the production limitation of each plant is important and will help the City understand the hydraulic contribution of each WTP. To determine the existing utilization of each water treatment plant, the monthly operating reports (MOR) were reviewed for the 2011 calendar year. The capacity of the entire system and the individual plants were calculated using the rules established by the Florida Administrative Code Section 62-555. See Appendix A for a summary of the calculations.

The City's water system is currently operating with five water treatment plants. However, the City has the desire to construct a new regional water treatment plant at the Champagne Farm site and decommission the Fairways, West Well, and Okahumpka Service Plaza water treatment plants.

4.4.1 CR-501 (Coleman) WTP

The Coleman WTP is located at 469 CR-501, Wildwood. According to the 2011 MOR's, the plant produces an average of 1,397,134 gpd (970 gpm) for the system. The maximum daily production for this plant in 2011 was 2,024,000 gpd (1,406 gpm).

The raw water source for the Coleman WTP is ground water from the UFA. Ground water is pumped into the plant using two ground water wells. See Table 4-2 for a summary of the wells and well pumps. The wells are permitted by SWFWMD to pump an average of 1,000,000 gpd and a peak of 1,537,500 gpd each. Combined, the two wells are permitted to pump an average of 2,000,000 gpd average day and 3,075,000 gpd peak. With the largest well out of service, a total of 750 gpm (1.08 MGD) can be added to the plant.

Table 4-2: Coleman WTP Wells

Well Number	Dia. (in.)	Total Depth (ft.)	Casing Depth (ft.)	Well Yield (gpm)	Pump Type	Pump Horse-power	Pump Capacity (gpm)	Pump Capacity (gpd)
SE 1	12	360	128	900	Vertical Turbine	25	1,000	1,440,000
SE 2	12	360	176	600	Vertical Turbine	20	750	1,080,000

Treatment of the raw ground water is by a cascading tray aeration system and gas chlorination. This plant is equipped with two aerators (one mounted on each of the ground storage tanks) with a combined treatment capacity of 5,300 gpm (7,632,000 gpd). Currently, only the aerator on the 500,000 gallon tank is in operation. The

treatment capacity of this unit is 3,500 gallons per minute (gpm). The second aerator, which has a treatment capacity of 1,800 gpm, is not currently in operation. With the largest aerator out of service, the treatment capacity of the plant is 1,800 gpm or 2.59 MGD.

Finished water storage is provided by two on-site concrete ground storage tanks. The first storage tank is a 500,000 gallon circular concrete tank equipped with a cascading tray aeration system for hydrogen sulfide removal. The second tank is a 1,000,000 gallon circular tank equipped with a cascading tray aeration system for hydrogen sulfide removal. These two storage tanks represent approximately 58.5% of the total storage capacity of the entire distribution system.

Disinfection is provided by flow proportional elemental chlorine gas injection. Storage of the chlorine gas is in 150 lb. cylinders on-site. A stand-alone chlorine storage/dosing room prechlorinates the water before it enters the control room where the high service pumps are housed. In addition to chlorine, polyphosphate is injected into the water system at this plant.

High service pumps provide final delivery of water into the distribution. The plant is equipped with three high service pumps plus a jockey pump. See Table 4-3 below for a summary of the pump capacities. With the largest pump out of service, the combined capacity of the high service pumps is 2,200 gpm (3.17 MGD).

Table 4-3: Coleman Pump Capacities

Pump Number	Pump Type	Horsepower	Capacity (gpm)
HSP 1	Centrifugal	60	1,100
HSP 2	Centrifugal	60	1,100
HSP 3	Centrifugal	60	1,100
Jockey	Centrifugal	20	400

The calculated capacity of this plant is 1,728,000 gpd (1,200 gpm). This represents approximately 36% of the total capacity of the water treatments plants. The limiting capacity of this plant appears to be the production capabilities of the ground water wells. At the current daily volume reported by the MORs, the plant is operating at an average of 970 gpm. With the largest well out of service, the plant is capable of replacing that flow at a rate of 750 gpm. The storage capacity of the plant can compensate for the difference between the outflow and inflow, but only for a finite period of time.

4.4.2 Huey Street WTP

The Huey Street WTP is located at 801 Huey Street, Wildwood. According to 2011 MOR's, the plant produces an average of 320,685 gpd (223 gpm). The maximum daily production for this plant in 2011 was 609,000 gpd (423 gpm).

The raw water source for the Huey Street WTP is ground water from the UFA. Ground water is pumped into the plant using a single ground water well. See Table 4-4 for a summary of the well and well pump capacity. The well is permitted by SWFWMD to pump an average of 600,000 gpd and a peak of 922,750 gpd. No redundant pumping system is provided at this site.

Table 4-4: Huey WTP Well

Well Number	Dia. (in.)	Total Depth (ft.)	Casing Depth (ft.)	Well Yield (gpm)	Pump Type	Pump Horse-power	Pump Capacity (gpm)	Pump Capacity (gpd)
11	12	202	168	500	Vertical Turbine	40	500	720,000

The quality of the ground water at the Huey Street WTP is such that no treatment, other than disinfection, is required. Disinfection for this plant is provided by flow proportional sodium hypochlorite liquid injection. On-site chemical storage consists of a 500 gallon storage tank. In addition to chlorine, polyphosphate is injected into water system at this plant.

The on-site storage for this plant provided by a 500,000 gallon elevated steel storage tank. This storage tank is the only elevated storage tank on the system. It contains fully treated water and floats on the distribution system to help maintain pressure and support local fire flows. The on-site water storage capacity of this plant represents approximately 19.5% of the total storage capacity of the whole system.

The calculated capacity of this plant is 600,000 gpd (417 gpm). With the plant flowing at an average of 320,685 gpd and considering the total plant capacity, the plant is currently flowing at 53% of capacity. This plant's capacity represents approximately 15.2% of the total capacity of the system. With only one source for raw water for the plant, the limiting capacity factor for this plant is the well production.

4.4.3 West Well WTP

The West Well WTP is located at 8763 CR 131, Wildwood on private property. The West Well WTP consists of a hydropneumatic tank and well pump. It is equipped with one ground water well that pumps from the UFA. See Table 4-5 for a summary of the well and well pump.

Table 4-5: West Well WTP Well							
Well Number	Dia. (in.)	Total Depth (ft.)	Casing Depth (ft.)	Well Yield (gpm)	Pump Type	Pump Horse-power	Pump Capacity (gpm)
WW 44	6	110	57	300	Submersible	25	300

The on-site storage for this plant is in a 22,000 gallon hydro-pneumatic tank. This hydro-pneumatic tank represents 0.9% of the total storage capacity of the whole distribution system.

The quality of the ground water at the West Well WTP is such that no treatment, other than disinfection, is required. Disinfection for this plant is provided by flow proportional sodium hypochlorite liquid injection.

The calculated capacity of this plant is 312,000 gpd (217 gpm). This represents approximately 7.9% of the total capacity of the water treatments plants. According to the monthly operating reports, this plant is currently producing an average of 157,301 gpd (109 gpm). The plant is currently operating at 50.4% of capacity.

4.4.4 Okahumpka Service Plaza WTP

The Okahumpka Service Plaza WTP is located at milepost 299 on Florida's Turnpike. The Okahumpka Service Plaza is equipped with two ground water wells that pump from the UFA. See Table 4-6 for a summary of the wells and well pumps.

Table 4-6: Okahumpka WTP Well							
Well Number	Dia. (in.)	Total Depth (ft.)	Casing Depth (ft.)	Well Yield (gpm)	Pump Type	Pump Horse-power	Pump Capacity (gpm)
SP 1	8	430	187	240	Submersible	15	240
SP 2	8	515	90	340	Submersible	20	340

On-site storage for this plant is provided by a 5,000 gallon hydro-pneumatic tank and a 28,500 ground storage tank. With a total water storage capacity of 33,500 gallons, this plant represents approximately 1.3% of the total storage capacity of the whole system. Disinfection for this plant is provided by flow proportional sodium hypochlorite liquid injection.

The calculated capacity of this plant is 720,000 gpd (500 gpm). This represents approximately 18.2% of the total capacity of the water treatments plants. According to the MOR's, this plant is currently producing an average of 173,340 gpd (120 gpm). The plant is currently operating at 24.1% of capacity.

4.4.5 Fairways WTP

The Fairways WTP is located at 5124 CR 125B-1, Wildwood. The plant is equipped with a hydropneumatic tank and one ground water well that pumps from the UFA. See Table 4-7 for a summary of the well and well pump.

Table 4-7: Fairways WTP Well

Well Number	Dia. (in.)	Total Depth (ft.)	Casing Depth (ft.)	Well Yield (gpm)	Pump Type	Pump Horse-power	Pump Capacity (gpm)
FW 1	10	160	70	500	Vertical Turbine	50	700

On-site storage for this plant is provided by a 10,000 gallon hydro-pneumatic tank. This hydro-pneumatic tank represents 0.4% of the total storage capacity of the whole distribution system. Disinfection for this plant is provided by a flow proportional sodium hypochlorite liquid injection.

The calculated capacity of this plant is 600,000 gpd (417 gpm). This represents approximately 15.2% of the total capacity of the water treatments plants. According to the MOR's, this plant is currently producing an average of 57,732 gpd (40 gpm). The plant is currently operating at 9.6% of capacity.

4.4.6 CR-214 Re-Pump Station

The CR 214 re-pump station consists of a ground storage tank and high service pumps. It does not currently have wells on-site. All water that enters this re-pump facility comes from a 12" watermain that comes from the City. The on-site storage for this plant is provided by a 500,000 gallon concrete ground storage. The ground storage tank is equipped with a top mounted cascade tray aerator. This re-pump station represents approximately 19.5% of the total storage capacity of the whole system.

Table 4-8: Coleman Pump Capacities

Pump Number	Pump Type	Horsepower	Capacity (gpm)
HSP 1	Centrifugal	40	750
HSP 2	Centrifugal	60	1,100
HSP 3	Centrifugal	60	1,100

4.5 Flow Data

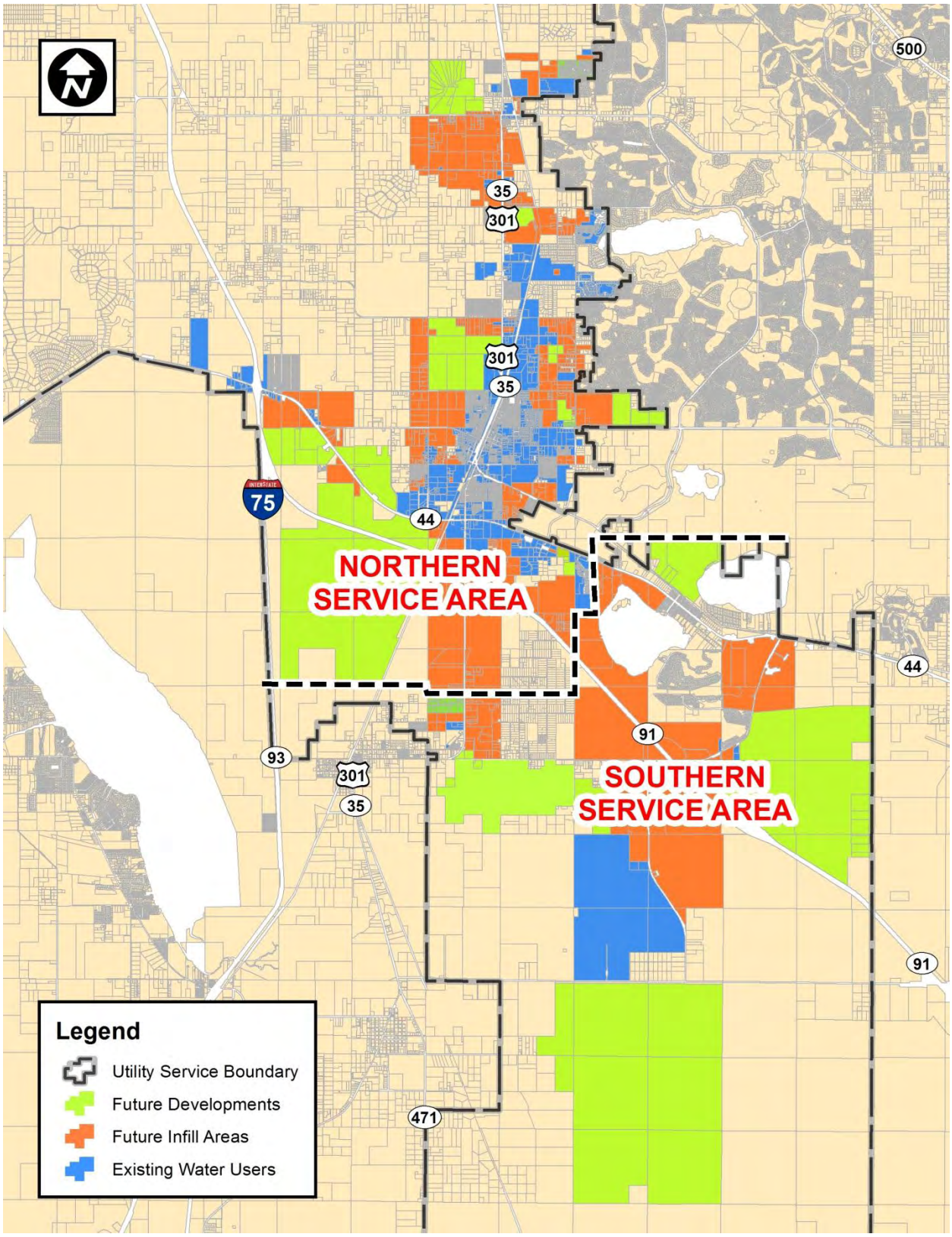
The water demands for each of the water treatment plants were determined from the MOR data submitted to the FDEP for the period of January 2011 to December 2011. See Table 4-9 below for a summary of the City's average daily flow and Maximum daily flow for this time period. The City also provided billing information for individual users.

Table 4-9: Existing Potable Water Flows

WTP	Base Flows		Permitted Flows		Percentage of Permitted Flow	Percent of System Flow
	Average	Maximum	Average	Maximum		
Huey Street	320,685	609,000	600,000	922,750	**53.4**	**15.2**
CR-501	1,397,134	2,024,000	2,000,000	3,075,000	**69.9**	**66.3**
West Well	157,301	404,000	246,900	379,609	**70.2**	**8.2**
Service Plaza	173,340	514,000	366,300	563,186	**42.9**	**7.5**
Fairways	57,732	235,000	91,200	140,222	**63.3**	**2.7**
Total =	**2,106,192**	**3,786,000**	**3,304,400**	**5,080,767**		

Based on the billing data provided by the City, the water demands are about evenly split between the southern and northern portions of the service territory. See Exhibit 3-2 for a map showing the existing service territory. At the present year, the southern demands (primarily the Coleman Federal Prison) account for 56.1% of the total demands in the system, while the northern demands consist of the remaining 43.9%. It is important to note that with the expected growth and infill expansion of the City's system, the changing demands will require different flows from each plant. The City also plans to take a few of the smaller plants offline. With all of these changes, the spatial orientation of the demand percentages will change with time.

Figure 4-2: City of Wildwood Service Area



5.0 Demand Projections

5.1 Introduction

This section presents a discussion of the projected growth and future demands anticipated for the water system. Growth is an important element in evaluating the distribution system because it provides a roadmap of the demands that will be placed on the utility infrastructure. Identifying and locating these demands allows for proper analysis and planning of capital improvements that can efficiently and cost-effectively service existing and new customers.

Changes in demands served by the City of Wildwood are anticipated to occur in three ways. First, there will be fluctuations in demands within the areas currently served by the City resulting from population fluctuations and industrial uses (infill). Secondly, there will be increased demands associated with physical expansion of the distribution system to bring existing non-served customers onto the network. And finally, there will be demand increases driven by new development.

5.2 Methodology for Determining Growth

The basis used for determining the future population growth was a model developed by the Southwest Florida Water Management District (SWFWMD). SWFWMD's growth model is based in ArcGIS and is a combination of the population projections made by the University of Florida's Bureau of Economic and Business Research (BEBR) and the US Census block-level data. The SWFWMD model has population data at the parcel level for the entire county, which allows for projecting populations for any service area. The populations are projected by SWFWMD for the following years: 2010, 2015, 2020, 2025, 2030, and 2035. For a further discussion of the methodologies used by the SWFWMD in developing the parcel level growth projections, see Appendix D.

For future population projections in and around Wildwood, growth was broken down and analyzed in three classifications: 1) Population growth within the areas currently connected to City utilities (no physical expansion), 2) Existing population in areas around the City that can be added to the City's utility system by physically expanding the system, and 3) Population growth occurring in new developments planned around the City that would require expansion to connect.

5.2.1 Existing Areas Served

To establish the basic demand growth, no physical expansion of the City's network was assumed (meaning that no new pipes would be constructed to service new customers; only property with current access to the City's Utilities would be considered). See Exhibit 3-1 for a map showing the City's existing service Territory. For this scenario, the data provided by the SWFWMD was reduced to only the parcels that fell within 200 feet of existing infrastructure. Using straight line

interpolation, the projected ERUs for the 5-year, 10-year and 20-year periods were determined. Table 5-1 summarizes the projected populations.

Table 5-1 : ERU Projections – Existing Services

	2012 (Present) (GPD)	5-year (2017) (GPD)	10-year (2022) (GPD)	20-year (2032) (GPD)
Existing Service Areas	4,162	4,377	4,676	5,260
Coleman Federal Prison	3,488	3,488	3,488	3,488
Total =	**7,650**	**7,865**	**8,164**	**8,748**
Total Demand =	**2,107,800**	**2,162,600**	**2,238,900**	**2,387,800**

5.2.2 Infill Areas

A second important contributor to an increase in the demand can be realized through physically expanding the system. The City worked with KHA to develop a plan for how and when the City would pursue expanding the distribution system to provide water service to presently non-served properties in and around Wildwood. A total of seven infill areas were identified for possible expansion in the future. The SWFWMD data was used to determine the present, 5-year, 10-year, and 20-year population projections for these infill areas. Table 5-2 below summarizes the total population to be served in the respective time frame.

Table 5-2 : ERU Projections – Infill Areas

	2012 (Present) (GPD)	5-year (2017) (GPD)	10-year (2022) (GPD)	20-year (2032) (GPD)
Infill Area 1 (North)	0	967	1,118	1354
Infill Area 2 (West)	0	113	201	11
Infill Area 3 (East)	0	663	796	1,100
Infill Area 4 (West SR 44)	0	9	26	58
Infill Area 5 (East SR 44)	0	64	207	552
Infill Area 6 (US 301)	0	57	104	217
Infill Area 7 (CR-501)	0	31	39	55
Total =	**0**	**1,905**	**2,490**	**3,747**
Total Demand =	**0**	**571,500**	**747,000**	**1,124,100**

5.2.3 Future Developments

The projected increase in Equivalent Residential Units (ERUs) associated with future large scale developments is approximately 25,388. The ERU increase was developed with city staff by identifying future planned developments and

anticipated or approved development densities For projecting the pace of building for the 5-year, 10-year, and 20-year, a percentage of build out was estimated for each of the time periods. It was estimated that for the 5-year, 10-year and 20-year timelines, an approximate 10%, 50%, and 100% build out would be expected. This development pace was reviewed with city staff and was used in the analysis. If development happens at a rate slower or faster than anticipated, the proposed improvements can be delayed or expedited to meet the needs of the customers. See Table 5-3 for the projected populations.

Table 5-3 : ERU Projections – Future Developments

	2012 (Present) (GPD)	5-year (2017) (GPD)	10-year (2022) (GPD)	20-year (2032) (GPD)
301 S. Office Complex	0	3	7	13
Amprop Corners, Inc.	0	29	59	117
CFUS (IMRT Center)	0	5	11	21
Harry Harmer Industrial Park	0	2	3	6
Hi-End Development	0	100	200	400
Homes in Partnership	0	4	9	17
Lake Andrew Preserve	0	48	95	190
Lakeside Landings	0	26	52	103
Maricamp, LLC	0	41	81	162
Mercantile Bank	0	0	1	1
Oxford Crossings Partnership	0	121	242	483
Parkwood Sumter Properties	0	43	43	43
Triumph South	0	9	17	34
Turkey Run	0	16	33	65
Turkey Run (Future)	0	70	123	410
Landstone DRI	0	417	2083	7666
Wildwood Springs DRI	0	294	883	2944
Southern Oaks DRI	0	233	1167	4293
Tradewinds Village PD	0	83	248	825
Wildwood Crossings	0	11	65	201
Quadventure	0	17	103	316
O'Dell PD	0	36	215	718
Monarch Ranch	0	112	675	2069
Sumter LLC	0	26	158	486
Lee Capital	0	43	260	796
Total =	**0**	**1,789**	**6,829**	**22,379**
Total Demand =	**0**	**537,400**	**2,080,500**	**6,704,300**

Below is a summary table of the total demands generated by all growth and future developments.

Table 5-4 : Demand Totals				
	2012 (Present) (GPD)	5-year (2017) (GPD)	10-year (2022) (GPD)	20-year (2032) (GPD)
Existing Services	**2,107,800**	**2,162,600**	**2,238,900**	**2,387,800**
Infill Areas	**0**	**571,500**	**747,000**	**1,124,100**
Future Developments	**0**	**537,400**	**2,080,500**	**6,704,300**
Total =	**2,107,800**	**3,271,500**	**5,066,400**	**10,216,200**

Based on conversations with City staff, KHA also reviewed the ERU projections over a longer build-out period. With a longer build-out period, the infrastructure improvements and plant upgrades/improvements are still required, but they can occur over a longer timeline. See Table 5-4 below is a summary of the total demands for the 5-year, 10-year, and 20-year periods that reflect an increased build-out period extending beyond 20-years.

Table 5-5 : ERU Projections – Totals				
	2012 (Present) (GPD)	5-year (2017) (GPD)	10-year (2022) (GPD)	20-year (2032) (GPD)
Existing Services	**2,107,800**	**2,162,600**	**2,238,900**	**2,387,800**
Infill Areas	**0**	**571,500**	**747,000**	**1,124,100**
Future Developments	**0**	**133,900**	**635,200**	**2,612,000**
Total =	**2,107,800**	**2,868,000**	**3,621,100**	**6,123,900**

6.0 Water System Analysis and Methodology

6.1 Introduction

This section provides an overview of the methodologies that were used in developing the hydraulic model. The hydraulic model allows for the analysis of the existing system and the system as it might exist in the future. The future system is likely to be different from the existing system because of increased demands and/or changes in the water treatment plant configuration or distribution system configuration. An analysis of the distribution system was performed to assess the improvements that will be necessary to accommodate the changes in demand and system configuration.

Also included in this section is a detailed analysis of the existing distribution system for the Present, 5-Year, 10-Year, and 20-Year planning time lines. In analyzing the improvements and system configurations over time, it allows for selecting projects and configurations that make sense for the long term and most efficiently utilize funds for capital improvements.

6.2 Hydraulic Model Development

The software used for the model development was Bentley WaterCAD V8i (SELECTseries 1). WaterCAD is a computer based program that, with user input, calculates a wide variety of system parameters. The most useful output from the calculations is the pressure and available fire flow results. These results assist designers in identifying locations in the system where the pressures or available fire flows are below minimum acceptable values. The model can be used to assess the existing system as it is to date and how the system will respond to future increases in demand. It also allows the designer to modify or add/remove system components and establish how the water system responds to the changes. This feature is very useful for identifying capital improvement projects that will help the system's hydraulic performance.

The model operates primarily based on user input. All the elements of the existing system (i.e. - pipes, valves, junctions, water treatment plants, demands, etc.) must be input into the model. The water treatment plants provide the water sources for the model and the piping network distributes the water throughout the system to meet the demands. Calibration of the model is accomplished using fire hydrant flow and pressure information gathered in the field. The fire flow demands are input into the model and the corresponding pressures are checked to ensure that the model is reasonably predicting what was observed in the field. In the calibration process, elements within the model (i.e. - pipe frictional coefficients) may be adjusted to truth the model against field observations.

The existing model was developed in several steps listed below:

- The existing pipe network layout of each of the public water supply systems was determined using previously developed GIS mapping.
- The existing demand distribution was determined in the following manner:
    - The City provided approximately one year of billing information.

- The existing billing data provided the demands per active water service. To avoid over complicating the model, groups of individual demands within the vicinity of a junction nodes was assigned to that junction.

- The operating pressures were obtained from City Utility Staff and actual plant data. The following operating pressures were used in the model:

Table 6-1: Existing System Operating Pressures

WTP	Operating Pressures		Model Pressure
	Minimum	Maximum	
CR-501	57 psi	62 psi	57 psi
Service Plaza	45 psi	70 psi	54 psi
West Well	50 psi	95 psi	72.5 psi
Huey Street	56.4 psi	56.6 psi	56.4 psi
Fairways	56 psi	70 psi	63 psi
CR-214 Re-Pump Station HSP #1	45 psi	70 psi	55 psi
CR-214 Re-Pump Station HSP #2	40 psi	70 psi	
CR-214 Re-Pump Station HSP #3	40 psi	70 psi	

- Before proposed improvements could be evaluated for the system, the hydraulic model had to be calibrated to ensure that it accurately reflected the conditions of the system in the field. The follow steps were taken to calibrate the model:
  - Data Collection:
    - City staff conducting fire hydrant flow/pressure tests at 14 locations in the City from May 16 to May 18, 2012. KHA staff were present during the testing and recorded the pressures and flow readings for each of the tests. Each test used two hydrants (one pressure hydrant, one flow hydrant). Three readings were recorded for each pair of hydrants. First, the flow hydrant was completely closed and a static pressure reading was taken at the pressure hydrant. Second, the flow hydrant was opened partially. A flow reading and the residual pressure measurement were recorded for the partial flow condition. Finally, the flow hydrant was opened fully and the corresponding flow rate and residual pressure was recorded. See Appendix B for the hydrant flow/pressure results.
  - Model Calibration:
    - The fire hydrant flow data were entered into the model and the pipe C values were adjusted to accurately reflect the pressure readings that were observed in the field. Model predictions that were within 15% of the actual collected data were considered acceptable. The data that fell out of that acceptable range were analyzed to determine the cause of the variation and supplemental data collection was performed to truth the model.

6.3 System Hydraulic Standards

Before identifying system deficiencies, system hydraulics standards needed to be established. The following hydraulic standards were used to evaluate the hydraulic model for deficiencies:

- Minimum System Pressure: 20 psi
- Maximum System Pressure: 80 psi
- Typical Network Operating Pressure Range: 40-70 psi
- Fire Flow Demand: 1,000 gpm (minimum),

6.4 Methodology

With the model properly calibrated, the proposed system configurations could be modeled. The approach for modeling the system was to add the Champagne Farm WTP and remove various plants to see how the plants and distribution system reacted to the changes. The model was analyzed with the select treatment plants either on or offline and the resulting changes in available fire flows, system pressures, and net flows out of the remaining plants were noted. Since significant growth is expected over the next 20 years, many of the scenarios were run with increased demands for the 5-year, 10-year, and 20-year design year periods.

Before connecting the new Champagne Farm WTP, the plant's operating pressure had to be estimated. In order to keep the Champagne Farm WTP from competing with the CR-501 WTP, the pressure was set to the level required to keep the total head at the plant equivalent to the CR-501 WTP. The pressure that resulted in Champagne having the same total head as CR-501 was approximately 62 psi, which is well within the acceptable range for a WTP.

Special attention was paid to the net flows coming from each plant in the various scenarios. Since each plant has a given maximum capacity, the model results were checked against those capacities to ensure the scenario stayed within those limits. Any scenario allowing flow greater than capacity would require that the plant be expanded to accommodate the additional demand. With several of the scenarios removing plants from the network, it was also important to verify and assess the plant or plants that would be carrying those additional demands and ensuring that the plant would be capable of meeting that additional demand.

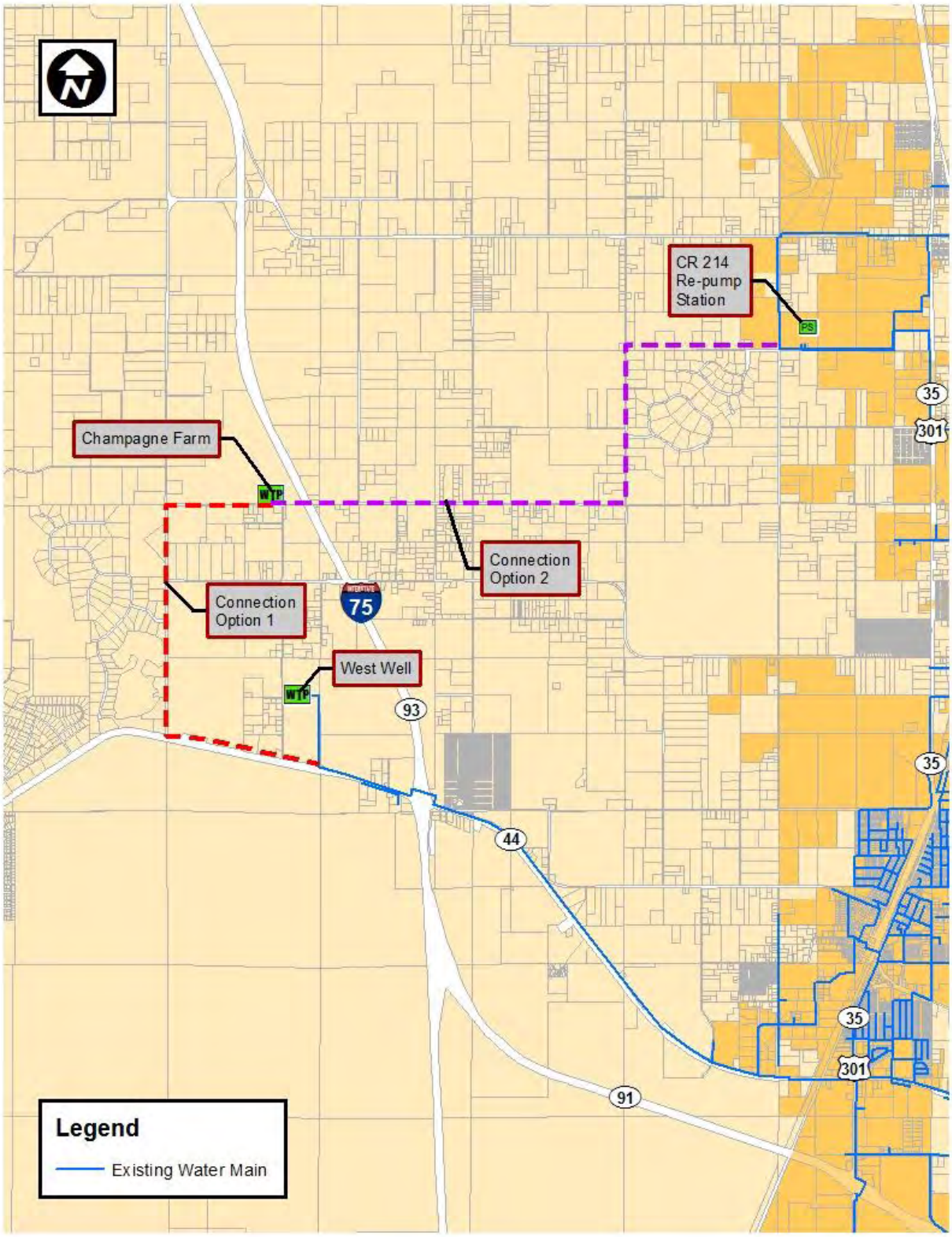
A very specific methodology was used to determine the necessary capacity of the Champagne Farm WTP. Since the existing distribution network is already in place, there is a natural tendency for the system to dictate how much water will ultimately be able to flow out of the plant to meet demands. This "system sizing" can be tempered by making modifications to the network (ie – upsizing lines or adding new lines) and checking the resulting model results. Several additional scenarios were considered to see how the total demand coming from Champagne Farm WTP would be influenced and the results of those scenarios are included in the scenarios section below.

6.5 Scenarios

A total of 78 physical scenarios were modeled to evaluate the impact of adding the Champagne Farm WTP, various proposed system improvements, and physical expansion and growth of the City. The discussion is organized chronologically for the present; 5-year, 10-year, and 20-year design time frames to illustrate the influence and limitations of constructing a water treatment plant at Champagne Farm. A summary is included at the end to summarize the results of the analysis and how it may impact the design of the Champagne Farm WTP. For a description of each scenario, as well as the model results for each scenario, see Appendix F.

In the scenarios that include the Champagne Farm WTP being connected to the system, there were two options for making the connection. Several of the scenarios only include one connection between Champagne Farm and the existing distribution system. For the single connection option, a watermain connects the plant to the existing 12" watermain on SR 44 where the West Well WTP currently connects to the system. The second connection option includes two connections to the City system. This connection is to the northeast and meets with the existing system near at the intersection of CR-214 and CR-209. This route will include a crossing the Interstate 75 corridor.

Figure 6.1: Champagne Farm Water Connections



6.5.1 Present Year (2012) Analysis

Included in this section are the results of scenarios for the present system configuration as well as scenarios that remove one or more of the existing plants from the system. Also included is a discussion of the scenarios that include adding Champagne Farm WTP and loading the system with some of the future developments.

Scenario 23: Present System

Scenario 23 models the present conditions of the system at maximum daily flows. This scenario is the basis for analyzing other scenarios for deficiencies or improvements resulting from modifying the city's system. All existing water treatment plants are connected to the distribution system and operating in this scenario. Table 6-2 below summarizes the results of the scenario.

Table 6-2 : Model Results for Present System Configuration

	Avg. System Pressure (psi)	Min. System Pressure (psi)	Avg. Available Fire Flow (gpm)	Min. Available Fire Flow (gpm)
Present	61.9	37.7* / 48.3*	2,005	807

* = the first pressure represents the lowest system pressure in north section of the system that receives water from the CR-214 station. The second pressure represents the lowest system pressure for the rest of the system.

Scenario 70: West Well Decommissioned

The City requested a scenario model that includes removing the West Well WTP from the network with the remainder of the system remaining the same. Scenario 70 models the City's water system under the condition that this plant is removed. In this scenario, all of the demands and water treatment plants were set up for the present day maximum daily flow condition. The only difference is that the West Well WTP plant was disconnected from the system. The results indicate that neither the normal system pressures nor available fire flows are heavily influenced by removing West Well from the System. See Table 6-3 for a summary of the model results for this scenario.

While the removal of West Well does not have a significant impact to the system pressures or fire flows, it should be noted that it is currently the only back-up source of water for the I-75 interchange at SR 44. Since West Well is the only source of redundancy for this area, it is not recommended that this plant be decommissioned until an alternative source of back-up for the interchange is in place. Constructing a treatment plant at Champagne Farm and connecting to the system on SR 44 will provide the back-up needed.

Table 6-3 : Model Results for Scenario 70				
	Avg. System Pressure (psi)	Min. System Pressure (psi)	Avg. Available Fire Flow (gpm)	Min. Available Fire Flow (gpm)
Present	61.9	37.7* / 48.3*	2,005	807
West Well Decommissioned	61.9	37.7 / 48.3	1,919	807
Net Change	0	0 / 0	86	0

Scenario 71: Fairways Decommissioned

The City requested a scenario model that includes removing the Fairway WTP from the network with the remainder of the system remaining the same. In this scenario, all of the demands and water treatment plants were set up for the present maximum daily flow conditions. The only difference is that the Fairways WTP plant was disconnected from the system. The results indicate that the average system pressure is influenced by this change by about 10 psi. The bulk of the areas seeing a reduction in pressure are in the northern section of the service area around the Fairways WTP.

There is also a slight impact to the available fire flows. This scenario assumes that the CR-214 actuator valve opens when the pressures warrant and the CR-214 plant is allowed to support flows in the City when fire flow demands require. The results from this scenario indicate that the CR-214 pump station will be more heavily relied upon to support fire flows in the northern portion of the service territory. See Table 6-4 for a summary of the model results for these scenarios.

Table 6-4 : Model Results for Scenario 71				
	Avg. System Pressure (psi)	Min. System Pressure (psi)	Avg. Available Fire Flow (gpm)	Min. Available Fire Flow (gpm)
Present	61.9	37.7* / 48.3*	2,005	807
Fairways Decommission (with CR-214 open)	60.8	37.7 / 37.9	1,961	795
Net Change	-0.9	0 / -10.4	-44	-12

Scenario 72: Okahumpka Service Plaza Decommissioned

The City requested a scenario model that includes removing the Okahumpka Service Plaza WTP from the network with the remainder of the system remaining the same. In this scenario, all of the demands and water treatment plants were set up for the present maximum daily flow conditions. The only difference is that the Okahumpka Service Plaza WTP plant was disconnected from the system. The model results indicate that the overall system pressures and available fire flows in the City are not influenced by this change. The biggest affect is at the service plaza. The average and

minimum system pressures are reduced by over 1 psi. The available fire flows are significantly reduced by this change. The average is reduced by 671 gpm and the minimum is reduced by 614 gpm. The reduction if available fire flows should be considered before taking this plant offline.

The biggest impact to system performance is a reduction to the available fire flows. Both the average available and minimum available fire flows decrease as a result of removing the Okahumpka Service Plaza WTP. The significant reduction in the minimum available fire flow is isolated to the fire hydrants located at the Okahumpka Service Plaza. See Table 6-5 for a summary of the model results for this scenario.

Table 6-5 : Model Results for Scenario 72

	Avg. System Pressure (psi)	Min. System Pressure (psi)	Avg. Available Fire Flow (gpm)	Min. Available Fire Flow (gpm)
Present (City Results)	62.0	37.7* / 48.7*	2,005	807
Okahumpka Decommission (City Results)	61.9	37.7 / 48.2	2,004	806
Present (Service Plaza Results)	60.1	57.1	1,315	1,240
Okahumpka Decommission (Service Plaza Results)	58.8	55.6	644	626
Net Change (City)	-0.1	0 / -0.5	-1	-1
Net Change (Service Plaza)	-1.3	-1.5	-671	-614

Scenario 2: West Well, Fairways, and Okahumpka Decommissioned

After reviewing the results of removing each of the plants the City desires to decommission individually, a scenario that decommissions all three of these plants was modeled. In this scenario, all of the demands and water treatment plants were set up for the present day maximum daily flow conditions. The only difference is that the West Well, Fairways and Okahumpka Service Plaza plants were disconnected from the system. Under this scenario, there's a general reduction in pressure throughout the city system (excluding the Okahumpka Service Plaza). The average pressure decreases by about 9 psi and the minimum pressure decreases by approximately 13 psi. The weakest areas for pressure are at the high points in the systems. The pressure decreases local to the service plaza are smaller than for the city. The average and minimum pressures are reduced by about 4 psi each.

The available fire flows are also impacted by decommissioning the plants. The largest decreases in available fire flows are around the Okahumpka Service Plaza area. At the Service plaza, the average available fire flow decreases by 673 gpm and the minimum available fire flow decreases by 616 gpm. For the remainder of the City's system, the decrease in average available fire flow and minimum available fire flow is 30 gpm and 13 gpm, respectively. The larger decrease at the service plaza is due to the service plaza's isolation from a water treatment plant (once the Okahumpka plant is decommissioned) and that it is located on a dead-end line.

Overall, the available fire flows are still adequate for the City's system. However, some form of improvement will need to be done to increase the flows at the service plaza. See Table 6-6 for a summary of the model results for this scenario.

Table 6-6 : Model Results for Scenario 2

	Avg. System Pressure (psi)	Min. System Pressure (psi)	Avg. Available Fire Flow (gpm)	Min. Available Fire Flow (gpm)
Present (City Results)	62.0	37.7* / 48.7*	2,005	807
Three Plants Decommissioned (City Results)	53.1	37.7 / 35.9	1,975	794
Present (Service Plaza Results)	60.1	57.1	1,315	1,240
Three Plants Decommissioned (Service Plaza Results)	55.9	52.3	642	624
Net Change (City)	-8.9	0.0 / -12.8	-30	-13
Net Change (Service Plaza)	-4.2	-4.8	-673	-616

Scenario 20: West Well, Fairways, and Okahumpka Decommission with Champagne Farm Added

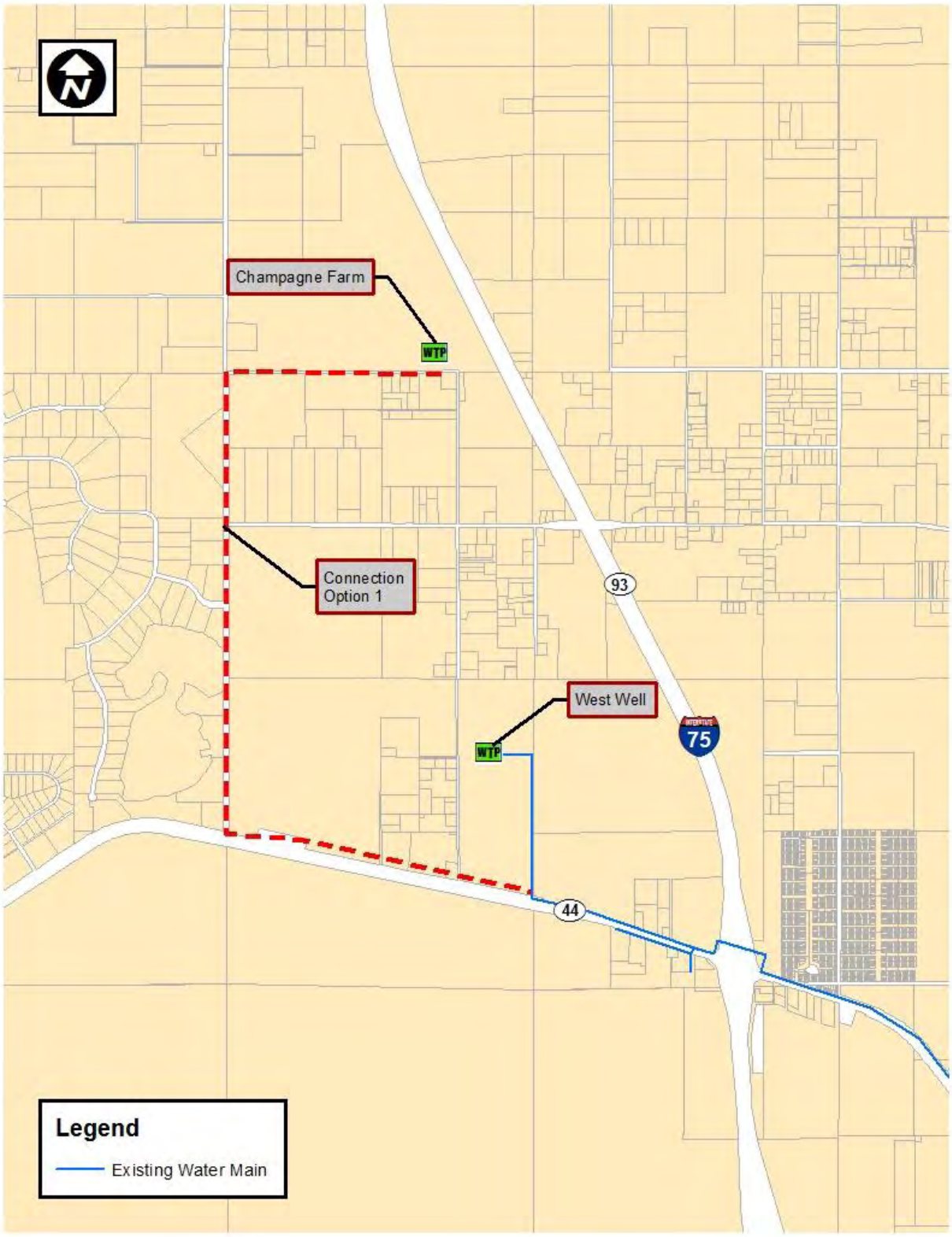
This scenario analyzes the system with the new Champagne Farm WTP connected to the system and the West Well, Fairways, and Okahumpka Service Plaza WTP's decommissioned. For scenario 20, the Champagne Farm WTP was modeled with only one connection to the distribution system at present maximum daily flow conditions. This single connection is a 24" water main that runs west on CR 231, then south on N. CR 475, and connects to the existing system by running east on SR 44. See Exhibit 6-2 for a location map depicting the route of this connection.

The Champagne Farm WTP increases the average system pressure, minimum system pressure, average available fire flow, and minimum available fire flow relative to the scenario without the Champagne WTP. The pressure improvements are fairly widespread in the system. The area showing the most weakness in available fire flows is around the Okahumpka Service Plaza. This is due to the fact that this location is isolated from a water treatment plant (once the Okahumpka plant is decommissioned) and is on a dead-end line. Overall, the available fire flows are above the minimum of 1,000 gpm. See Table 6-7 for a summary of the model results for this scenario.

Table 6-7 : Model Results for Scenario 20

	Avg. System Pressure (psi)	Min. System Pressure (psi)	Avg. Available Fire Flow (gpm)	Min. Available Fire Flow (gpm)
Three Plants Decommissioned	53.2	37.7* / 35.5*	1,859	624
With Champagne Farm	61.7	37.7* / 46.2*	2,036	645
Net Change	**8.5**	**10.7**	**177**	**21**

Figure 6-2: Champagne Farm Connection Option 1



Scenario 55: Champagne Farm with Two Connections and CR-214 Offline

The City requested a scenario model with the CR-214 plant offline. This analysis was performed to see if a connection from the Champagne Farm WTP could allow for the CR-214 re-pump station to be shut-down and/or replaced with an elevated storage tank. To take the CR-214 plant offline, a replacement water and pressure source for the northern section of the service territory is needed. In this scenario, the replacement source is a second connection from the Champagne Farm WTP. The connection would be achieved by a watermain constructed across Interstate I-75 and connecting to the existing system at the intersection of CR-214 and CR-209. In addition to these improvements, this scenario assumes that the West Well, Fairways, and Okahumpka Service Plaza WTPs have been decommissioned and Champagne Farm is connected to the existing water main on SR 44. This scenario also assumes present maximum daily flow conditions.

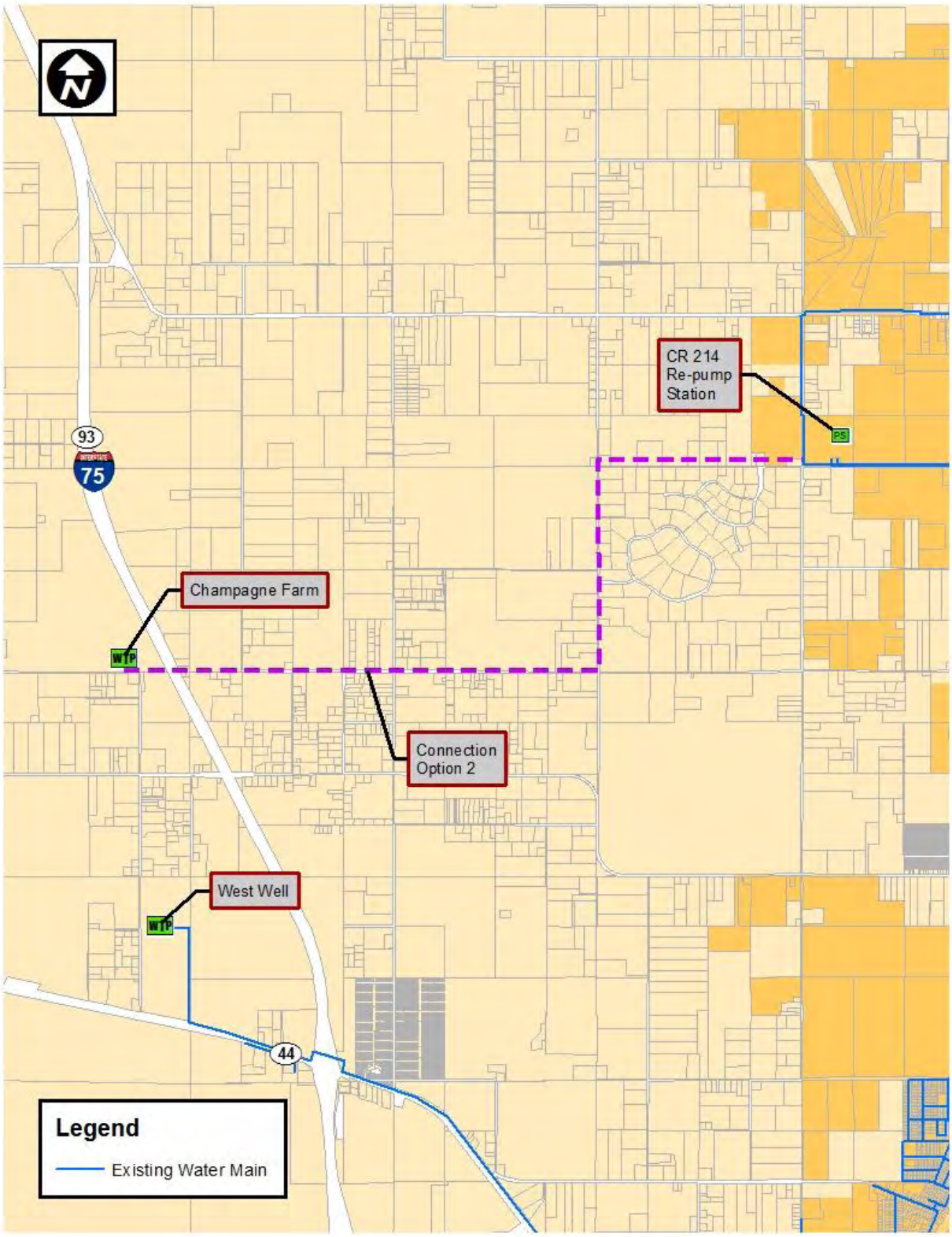
The results of the analysis indicate that the Champagne Farm WTP can meet the demands that the CR-214 re-pump station is currently handling. The results also indicate that the connection from Champagne Farm will slightly increase the pressures and fire flows in the area currently served by CR-214. See Exhibit 5-3 for a location map depicting the route of this connection. See Table 6-8 for a summary of the model results for this scenario.

Table 6-8 : Model Results for Scenario 55

	Avg. System Pressure (psi)	Min. System Pressure (psi)	Avg. Available Fire Flow (gpm)	Min. Available Fire Flow (gpm)
With CR-214 Pump Station	54.1	37.7	1,590	1,032
With Champagne WTP	57.5	41.1	1,626	1,069
Net Change	3.4	3.4	36	37

The values shown in the table above only include the results from the section of the model that are served by the CR-214 re-pump station.

Figure 6-3: Champagne Farm Connection Option 2



Scenario 14: Analysis of Champagne Farm as a Back-up for CR-501 (Coleman) WTP

An analysis was conducted to determine if the new Champagne plant would provide adequate flows to back up the system if the CR-501 WTP is shut down. This scenario was modeled under present maximum daily flow conditions and with a single connection from Champagne Farm to the existing distribution system at SR 44. In addition to these improvements, this scenario assumes that the West Well, Fairways, and Okahumpka Service Plaza WTPs have been decommissioned and Champagne Farm is connected with one connection. See Table 6-9 for a summary of the model results for this scenario.

With the current infrastructure, the Champagne Farm WTP will not provide back up for the CR-501 plant in the event of a shut down. There are two likely reasons for this failure. First, the demands in the southern portion of the distribution system, primarily the Coleman Federal Prison, are a significant portion of the total demands in the system. Second, the distance from Champagne Farm site to the southern portion of system is excessive. The pipe network between the two plants (Champagne Farm and CR-501) is approximately 16.4 miles long and consists primarily of 12" watermain. The combination of large maximum daily flows at the Prison and a significant travel distance from Champagne Farm to the Prison results in a very large frictional loss in the pipes. A scenario was also run with the second connection from Champagne Farm. The results of this scenario were very similar to Scenario 14. The second connection did not increase the pressures or available fire flows above acceptable minimum values.

To investigate what would happen if the large frictional losses could be reduced, additional scenarios that connected Champagne Farm to the CR-501 WTP with a 24" water main were modeled. Constructing a 24" water main over this distance would be a significant infrastructure undertaking but would result in significantly lower frictional losses in the line. Under this alternative, the Champagne Farm Plant will back up the CR-501 plant in under present demands. However, in future scenarios, where demands are increased due to growth, Champagne fails to provide backup flows at adequate pressures.

Table 6-9 : Model Results for Scenario 14

	Avg. System Pressure (psi)	Min. System Pressure (psi)	Avg. Available Fire Flow (gpm)	Min. Available Fire Flow (gpm)
With CR-501 Online	61.7	37.7* / 46.2*	2,036	645
With CR-501 Offline	37.9	37.7 / -83.6	N/A	N/A
Net Change	23.8	0 / -129.8	N/A	N/A

N/A values for fire flows represent a condition where the pressures cannot be maintained for any quantity of fire flow, so the model does not generate fire flows.

Scenario 65 and 66: East SR 44 Analysis

These two scenarios analyze how the distribution system and Champagne Farm WTP respond to the demands from the Baker/Villages and Southern Oaks developments at full build out. The demands associated with these two developments are quite significant, especially Southern Oaks. At full build out, these developments account for approximately 3,144 additional equivalent residential units (ERU). These demands were included in the model in addition to the present maximum daily demands.

Scenario 65 assumes that the Champagne Farm WTP is not constructed. The results of this scenario were compared to the scenario that includes the Champagne Farm WTP (Scenario 66). These scenarios assume that the West Well, Fairways, and Okahumpka Service Plaza WTPs have been decommissioned and the system is operating at maximum daily flow conditions. Additionally, serving these developments will require construction of a watermain extending from the end of the 12" watermain on SR 44 at Wildwood Country Estates down to the intersection with CR-468 and continuing on CR-468 until it intersects with the existing 8" watermain on CR-468 at the Turnpike.

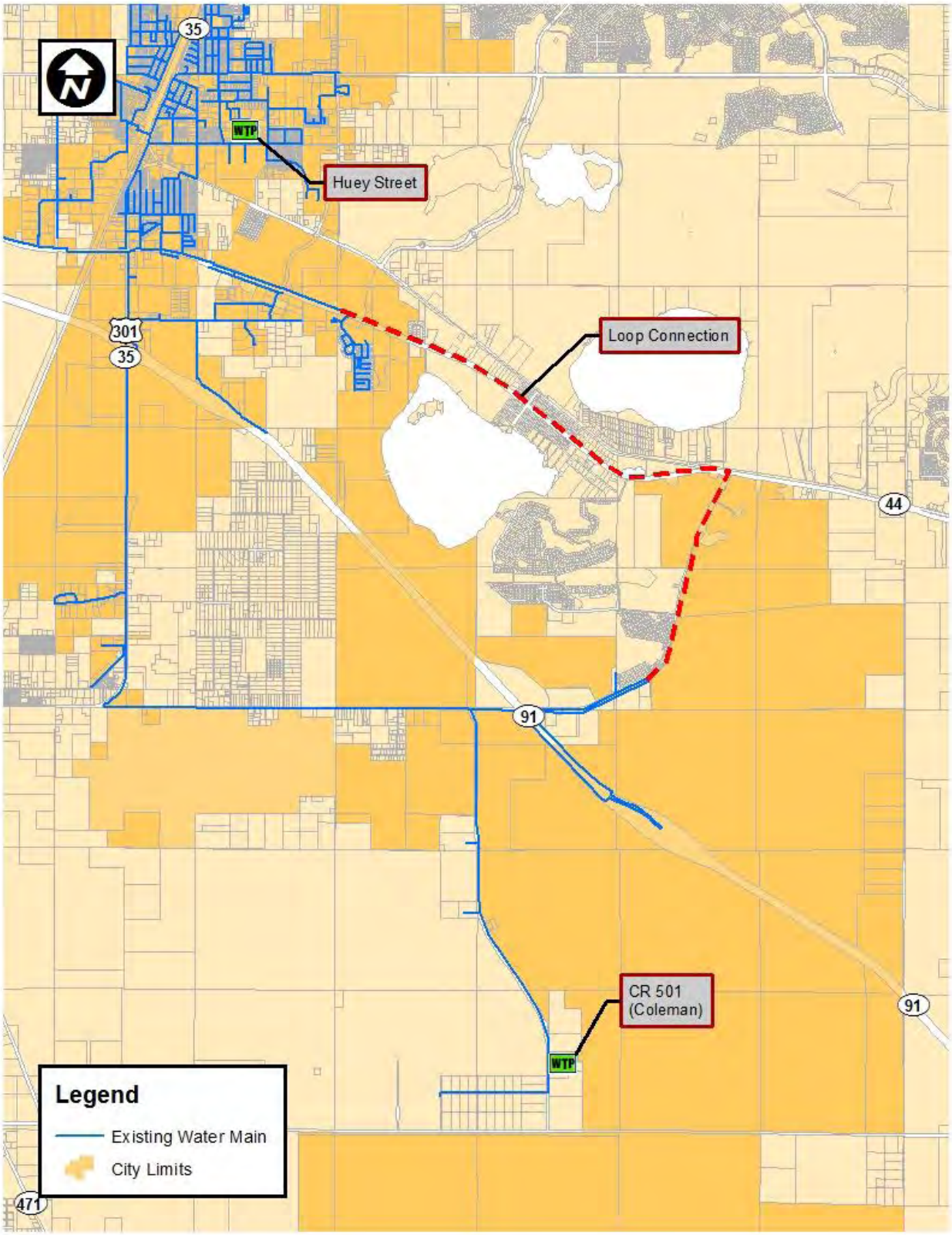
The results of scenario 65 clearly demonstrate that the existing system cannot support the demands from the Baker/Villages and Southern Oaks developments. The results of the model are summarized in the Table 6-10 below. Negative pressures were observed for a significant portion of the service area south and east of the intersection of US 301 and SR 44. Fire flows were not calculated for this scenario by the model because pressures are already below the 20 psi threshold at maximum daily flows.

For scenario 66, the Champagne Farm WTP was connected with a single 24" water main connection to the water main on SR 44. There are some negative pressures that result in the system in this scenario as well. However, the flow from Champagne Farm significantly increases the pressure in the portion of the service area south and east of the intersection of US 301 and SR 44. This area is still the general area of weakness for the system under these conditions. Ultimately, these two scenarios demonstrate that Champagne Farm has limited ability to keep up with large demands in the eastern and southern sections of the system.

Table 6-10 : Model Results for Scenario 65/66

	Avg. System Pressure (psi)	Min. System Pressure (psi)	Avg. Available Fire Flow (gpm)	Min. Available Fire Flow (gpm)
Present	-52.8	37.7 / -97.0	N/A	N/A
With Champagne WTP	31.1	37.7 / -7.2	N/A	N/A
Net Change	83.9	0 / 89.8	N/A	N/A

Figure 6-4: SR 44 / CR-468 Water Main



Scenario 73: East SR 44 Analysis with 24" Loop Connection from Coleman WTP and second Champagne Farm connection –

In light of the results from scenario 65 and 66, an alternative scenario that includes up-sizing the water main coming from the Coleman WTP to the east side of the Turnpike on CR-468 and looping the system on SR 44. This scenario includes connecting the 12" watermain that dead-ends on east SR 44 to the existing 12" watermain at the intersection of CR-468 and CR-501 with a watermain. The segment between the Coleman WTP and the Southern Oaks development was modeled with a 24" water main and the remainder of connection was modeled with a 24" water main as well. See Exhibit 6-5 for a location map depicting these improvements. The size of the water main loop was based on further analysis in future scenario. A 24" watermain is sufficiently sized to support future scenarios and will avoid having to replace the line in the future. This scenario assumes that the West Well, Fairways, and Okahumpka Service Plaza WTPs have been decommissioned and the system is operating at maximum daily flow conditions. This scenario also assumes that a second connection from Champagne Farm is connected to the north.

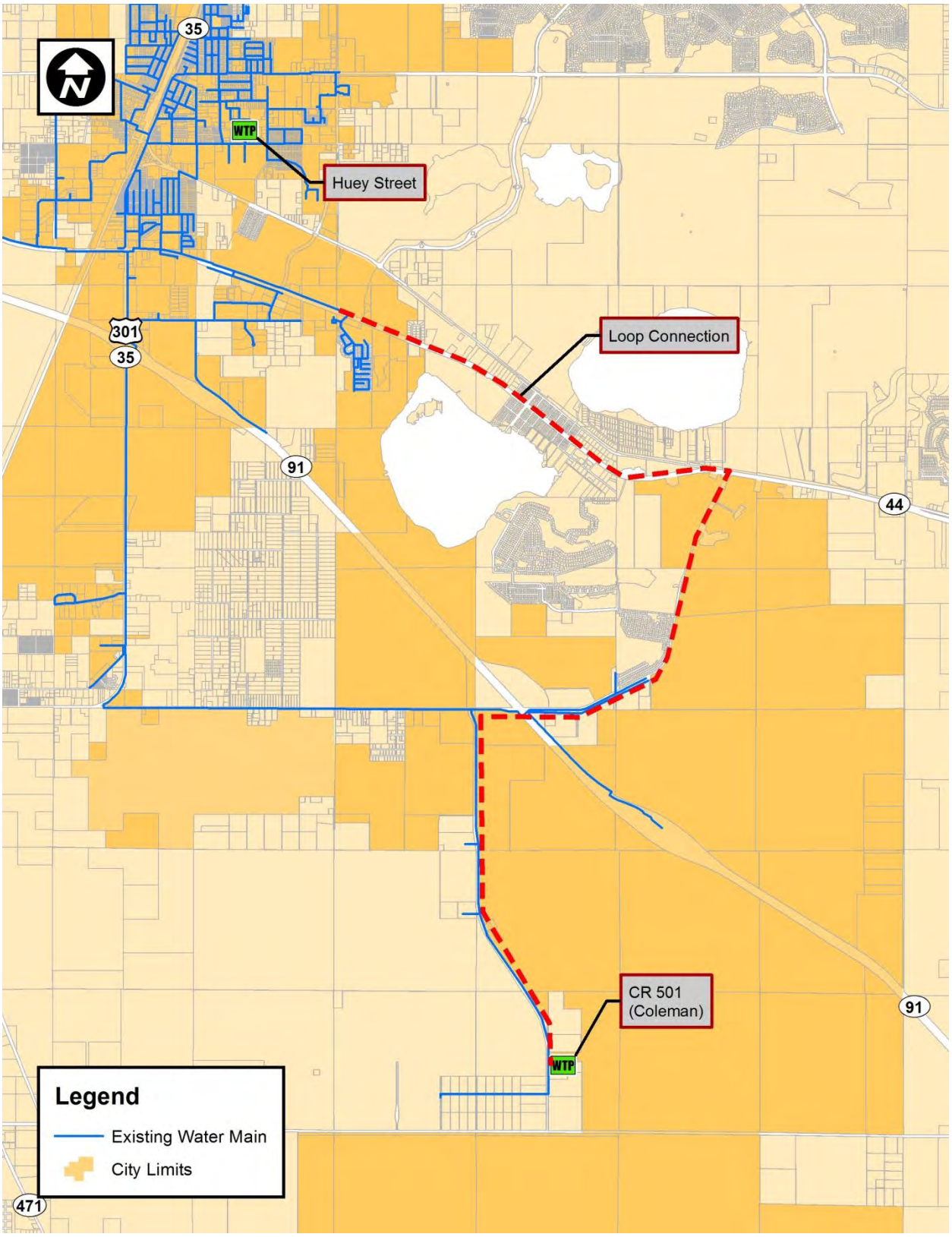
The results of this scenario show significant improvements to both pressures and fire flows. With the construction of the 24" connection between the Coleman WTP and the Southern Oaks Development relieves the system from trying to provide adequate flows to Southern Oaks through 12" water mains. The average system pressures and available fire flows are increased to satisfactory levels. With the exception of the fire hydrants at the Okahumpka Service Plaza, all fire hydrants in the model are flowing above 1,000 gpm. The results of the model are summarized in the Table 6-11 below.

An important note to make about this scenario is that the flow coming from the Coleman WTP is 3,881 gpm. This exceeds the capacity of the existing high service pumps at the plant. The total combined capacity of the high service pumps is 3,300 gpm. This means that the capacity of the high service pumps at the Coleman WTP would have to be increased. Other systems in the plant may need to be expanded/upgraded to accommodate these flows as well.

Table 6-11 : Model Results Scenario 73

	Avg. System Pressure (psi)	Min. System Pressure (psi)	Avg. Available Fire Flow (gpm)	Min. Available Fire Flow (gpm)
Without Coleman line upsize	31.1	37.7 / -7.2	N/A	N/A
With Coleman line upsize	63.8	37.7 / 55.6	2,146	681
Net Change	32.7	62.8	-	-

Figure 6-5: Coleman WTP to Southern Oaks Water Main Upgrade



Scenario 78: Existing System with CR-214 Re-pump Station Offline

The City requested an analysis of the existing system with the CR-214 re-pump station offline. This analysis was performed to see if the existing system can support the north end of the service area and allow for the CR-214 re-pump station to be taken offline. This scenario also assumes present maximum daily flow conditions. The results of the analysis are summarized in Table 6-12.

Both the system pressures and available fire flows decrease from taking the CR-214 re-pump station offline. The decrease in pressure is not significant and is mostly concentrated in the northern portion of the service area (which was previously served by the CR-214 re-pump station). The largest decline is in the available fire flows. The decrease in the average and minimum available fire flows is significant and lowers available fire flows below the acceptable level. Similar to the pressure changes, the decrease in available fire flows is concentrated in the northern portion of the service area.

Table 6-12 : Model Results Scenario 78

	Avg. System Pressure (psi)	Min. System Pressure (psi)	Avg. Available Fire Flow (gpm)	Min. Available Fire Flow (gpm)
Existing System	61.9	37.7	2,005	807
System with CR-214 Offline	58.4	31.0	1,498	376
Net Change	-3.5	-6.7	-507	-431

6.5.2 Future Analysis (5-Year, 10-Year, 20-Year)

Included in this section are the results of scenarios that were analyzed for the 5-year, 10-Year, and 20-Year design timeline. In these scenarios, the following assumptions were made:

- West Well WTP decommissioned
- Fairways WTP decommissioned
- Okahumpka Service Plaza WTP decommissioned
- CR-214 Re-Pump station is taken offline
- Champagne Farm WTP is constructed with two connections to the distribution system.
- A 24" water main loop is constructed along SR 44 and CR-468.
- The water main running from the Coleman WTP to the intersection of CR-501 and CR-468 is upgraded to 24".
- The water main running east on CR-468 from the intersection of CR-501 and CR-468 to the dead-end on CR-468 is upgraded to 24".
- For the 10-year and 20-year scenarios, the Huey Street WTP is equipped with an additional 500 gpm well.

Scenario 74: 5-year Projection

The primary change for this scenario is that growth in the existing service area, growth in infill areas, and new developments is considered in the model. The increase in total demands from the present to 5-year timeline is 1.54 MGD. The additional demands will approximately double the total system demands over the next 5-years. The increased water demands associated with the growth were input into the model and analyzed. This scenario was analyzed at maximum daily flow conditions. The results of the model are summarized in Table 6-13 below.

Table 6-13 : Model Results for Scenario 74

	Avg. System Pressure (psi)	Min. System Pressure (psi)	Avg. Available Fire Flow (gpm)	Min. Available Fire Flow (gpm)
5-year System Results	63.4	40.8 / 48.7	1,954	722

The system pressures and available fire flows are acceptable for the 5-year timeline. The only weakness in available fire flow is at the Turnpike Plaza. This location is isolated from a water treatment plant (once the Okahumpka plant is decommissioned) and is on a dead-end line.

A notable result from the model is the flow rates that are coming from each of the water treatment plants. The Huey Street WTP is flowing well below its design capacity and the Coleman WTP is flowing above its design capacity. Thus, in the 5-year scenario, the Coleman WTP will need to be expanded to meet demands. The Champagne Farm WTP is flowing at about 1,200 gpm at maximum daily flow conditions. When fire flow is considered (1,500 gpm), the required capacity of the Champagne Farm WTP is 4.0 MGD. See Table 6-14 below for a summary of the WTP flows in the 5-year time line.

Table 6-14 : Flows from WTPs under Scenario 74

	Huey Street (gpm)	Coleman (gpm)	Champagne (gpm)
Flow from WTP (5-year)	206	2,851	1,184

Scenario 75: 10-year projection

This scenario is the same as Scenario 74 but with two exceptions. The first exception is that this scenario includes additional demands for the existing service area, infill areas and new developments for the 10-year growth projection. The increase in total demands from the 5-year to 10-year timeline is 1.79 MGD. The increased water demands associated with the 10-year projections were input into the model and analyzed. This scenario was analyzed at maximum daily flow conditions.

The second exception is that this scenario includes installing a new 500 gpm well at the Huey Street WTP. The new well at Huey is needed to help support the growth (additional demand) in and around the downtown area. The total capacity of the Huey Street wells in this scenario is 1,000 gpm. In the model, the Huey Street WTP was limited to a total flow of 1,000 gpm (equals the total well capacity with the new well) during maximum daily flow conditions. During the fire flow analysis, Huey Street was allowed to flow without limit into the distribution system. The results of the model are summarized in Table 6-15 below.

Table 6-15 : Model Results for Scenario 75

	Avg. System Pressure (psi)	Min. System Pressure (psi)	Avg. Available Fire Flow (gpm)	Min. Available Fire Flow (gpm)
5-year System Results	63.4	40.8 / 48.7	1,954	722
10-year System Results	61.6	40.3 / 46.3	2,067	700
Total Change	-1.8	-0.5 / -2.4	113	-22

The model results show a slight decline in both pressure and available fire flows between the 5-year and 10-year timelines. However, the system pressures and available fire flows are still acceptable for the 10-year timeline. The only slight weakness in available fire flow is at the Turnpike Plaza. All other fire flows are greater than 1,000 gpm.

A significant result from the model is the flow rate being provided by each of the water treatment plants. The model shows the Coleman WTP providing a majority of the additional demanded in the system. In the 10-year scenario, the Coleman WTP is flowing at 5,903 gpm. This is a rate equivalent to the WTP operating at an 8.5 MGD capacity. This would represent a significant expansion to the existing Coleman WTP. The Champagne Farm WTP is flowing at 1,536 gpm at maximum daily flow conditions. When fire flow is considered (1,500 gpm), the required capacity of the Champagne Farm WTP is 4.5 MGD. The Huey Street WTP is flowing at 812 gpm, which is within the capacity of the plant with the new well included. See Table 6-16 below for a summary of the WTP flows in the 5-year time line.

Table 6-16 : Flows from WTPs under Scenario 75

	Huey Street (gpm)	Coleman (gpm)	Champagne (gpm)
Flow from WTP (5-year)	206	2,851	1,184
Flow from WTP (10-year)	812	4,406	1,536

Scenario 76: 20-year projection

This scenario is the same as Scenario 74 but with additional demands from growth. The increase in total demands from the 10-year to 20-year timeline is 5.15 MGD. The total system demand for the 20-year projection totals 10.22 MGD. The increased

water demands associated with the 20-year projections were input into the model and analyzed at maximum daily flow conditions.

The model results show a decline in both pressure and available fire flows between the 10-year and 20-year timelines. The decline in pressures is widespread and centers on the downtown area. These results show inadequate pressures in many locations during maximum daily flow. An improvement will be needed to support the downtown.

Table 6-17 : Model Results for Scenario 76

	Avg. System Pressure (psi)	Min. System Pressure (psi)	Avg. Available Fire Flow (gpm)	Min. Available Fire Flow (gpm)
10-year System Results	61.6	40.3 / 46.3	2,067	700
20-year System Results	42.7	38.7 / 21.9	1,778	594
Total Change	-18.9	-1.6 / -24.4	-289	-106

Flows from all three WTP increased between year 10 and 20. The results, shown in Table 6-18 below, show that the Coleman WTP is taking on a majority of the additional demands.

Table 6-18 : Flows from WTPs under Scenario 76

	Huey Street (gpm)	Coleman (gpm)	Champagne (gpm)
Flow from WTP (10-year)	812	4,406	1,536
Flow from WTP (20-year)	1,000	9,837	2,985

Scenario 77: 20-year Projection with Powell Road Water Main

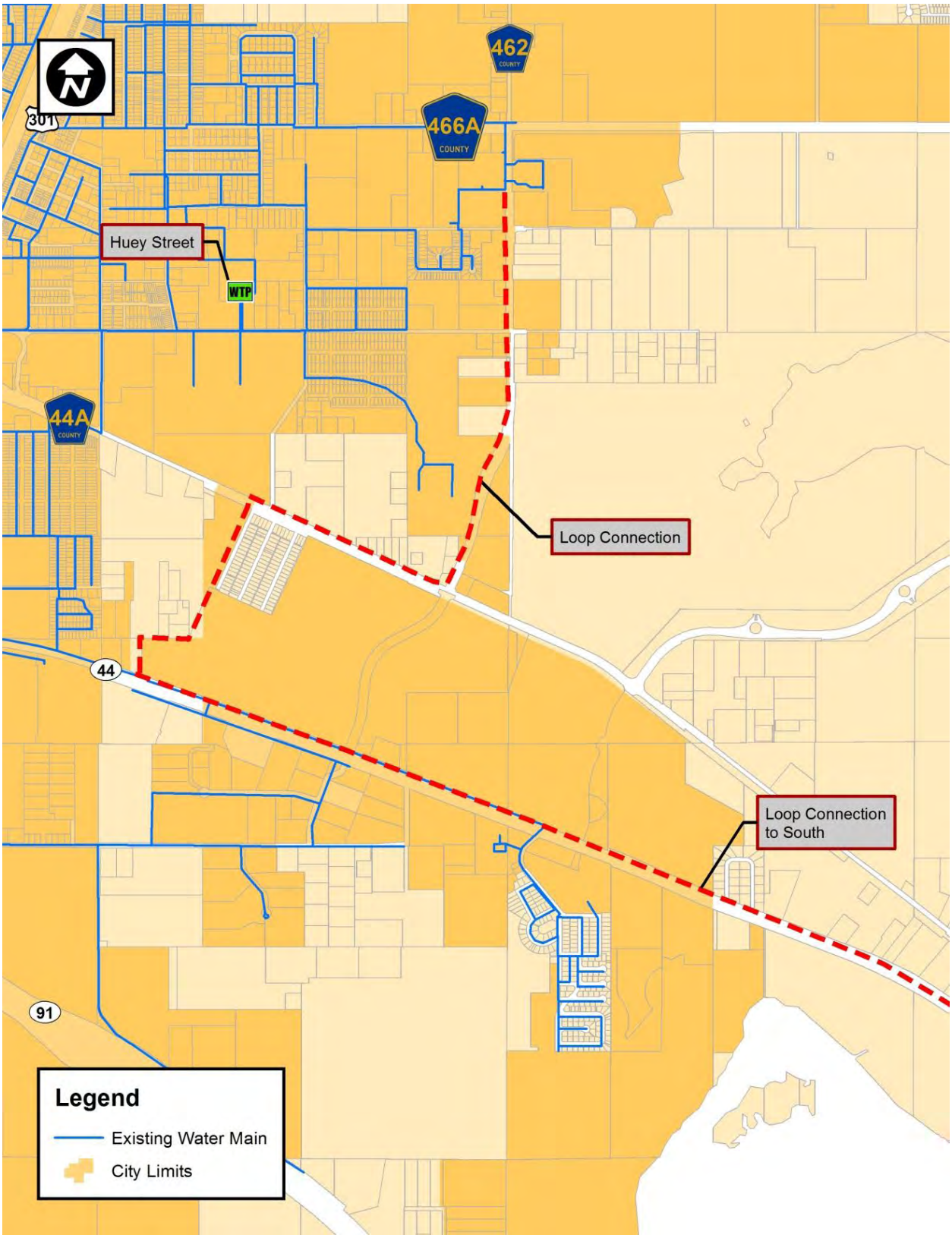
This scenario presents a solution to the pressure problems that were observed in Scenario 76. It includes four improvements. The first is the upgrade of the 12" watermain on SR 44 to a 24" water main between Heritage Boulevard and NE 41st View. The second improvement is a 24" water main that would be constructed to the Northeast through easements the City would need to obtain through land on the north side of SR 44 to CR-44A. The third improvement would be a 24" water main constructed along CR-44A to the intersection with Powell Road. The fourth improvement would be a 24" water main constructed along Powell Road extending from CR-44A to the water main on Powell Road north of the intersection with CR 466A. See Exhibit 5-6 for a location map showing the improvements. The results of the analysis, summarized in Table 6-19, show increases in pressures and average available fire flows as compared to Scenario 76.

Table 6-19 : Model Results for Scenario 77				
	Avg. System Pressure (psi)	Min. System Pressure (psi)	Avg. Available Fire Flow (gpm)	Min. Available Fire Flow (gpm)
20-year w/o Powell Rd. WM	42.7	38.7 / 21.9	1,778	594
20-year with Powell Rd. WM	49.2	39.3 / 33.0	1,891	582
	6.5	0.6 / 11.1	113	-12

The addition of this improvement changes the distribution of flows coming from each of the WTPs. The flow coming from the Huey Street WTP remains the same. The flow from the Coleman WTP increases and flow from the Champagne Farm WTP decrease. The flow from the Coleman WTP is at a rate of 10,208 gpm. This is equivalent to the WTP operating at a 14.7 MGD capacity. The Champagne Farm WTP is flowing at 2,616 gpm at maximum daily flow conditions. When fire flow is considered (1,500 gpm), the required capacity of the Champagne Farm WTP is 6.0 MGD. See Table 6-20 below for a summary of the WTP flows in the 5-year time line.

Table 6-20 : Flows from WTPs under Scenario 77			
	Huey Street (gpm)	Coleman (gpm)	Champagne (gpm)
(20-year) – W/o Powell WM	1,000	9,837	2,985
(20-year) – With Powell WM	1,000	10,205	2,616

Figure 6-6: Powell Road Water Main



6.5.3 Analysis Summary

Constructing the Champagne Farm WTP and associated transmission system improvements will allow the City to decommission the West Well, Fairways, and Okahumpka Service Plaza water treatment plants.

Construction of the second Champagne Farm connection to the north could allow for the decommissioning of the CR-214 Re-pump station. A beneficial alternative to decommissioning the plant would be to construct an elevated storage tank at the site and keep it connected to help with fire flows in the northern portion of the system. Another alternative could be to bring the existing re-pump station up to a desired reliable operating condition by modifying the electrical systems.

The Champagne Farm WTP will not provide complete back-up to the system in the event that the Coleman WTP is offline. Even with significant infrastructure improvements, Champagne Farm cannot provide back-up beyond the 5-year timeline.

There are some significant infrastructure improvements that will be required to connect Champagne Farm to the City's distribution system and to get the system to perform over the 20-year timeline. The following is a discussion of the improvements that will be needed in addition to constructing the WTP:

Water main to connect the Champagne Farm WTP to SR 44 – One connection for the Champagne Farm WTP to the existing system would be achieved through a 24" water main that runs west on CR 231, then south on N. CR 475, and connects to the existing system by running east on SR 44. An alternative route that runs south on CR 231 was considered for this connection. However, due to the limited right of way, number of driveways, and number of trees within the existing right of way on CR 231, the route on CR 475 was considered the best alternative. The total length of pipe required to make this connection is approximately 17,200'. This connection allows for the decommissioning of the West Well WTP and helps provide redundancy for the I-75 interchange.

Water main to connect Champagne Farm to north side of system near CR-214 – A second connection for the Champagne Farm WTP to the existing system would be achieved through a 24" water main that runs east from the WTP, crosses under Interstate 75, runs east along CR-222, then runs north on CR-223, and runs east on CR-214 and connects to the existing watermain at the intersection of CR-214 and CR-209. The total length of pipe required to make this connection is approximately 23,700. Making this connection will allow the City to take the CR-214 re-pump station offline.

SR 44 East water main loop - This is a water main constructed along SR 44 and CR-468 to provide service to some of the new develops included in the future demand projections. Based on the model results, this water main will need to be 24" diameter. This line will be required at some point in the future regardless of whether or not Champagne Farm is constructed.

24" line upgrade from Coleman under the Turnpike to Southern Oaks – The Southern Oaks development will generate a significant water demand in the future

and is located much closer to the Coleman WTP than the Champagne Farm WTP. The most efficient way to provide water to this development is by upgrading the existing lines and constructing new 24" lines in the corridor between the Coleman WTP and the Southern Oaks development.

New Huey Street Well – A second well at the Huey Street WTP is recommended to help the pressure and flows in the downtown area. The new well would be the same size as the existing well (500 gpm). Based on the demand projections, this new well would need to be constructed by 2022 (10-year demand).

Coleman Plant Expansion – Based on the modeling results, the system demands significant volumes of water from the Coleman WTP. At some point in the future, the plant will need to be expanded. The ultimate capacity of the plant is estimated to be 16.8 MGD (10,205 gpm max. daily + 1,500 gpm fire flow). Based on the demand projections, this expansion represents the required capacity at 2032 (20-year).

Powell Road Water Main Extension - This project is required between the 10-year and 20-year timeline. It includes the following improvement to increase the pressures and fire flows in the down town area:

1) Upgrade of the 12" watermain on SR 44 to a 24" water main between Heritage Boulevard and NE 41st View.
2) A 24" water main that would be constructed to the Northeast through easements the City would need to obtain through land on the north side of SR 44 to CR-44A.
3) A 24" water main constructed along CR-44A to the intersection with Powell Road.
4) A 24" water main constructed along Powell Road extending from CR-44A to the existing water main on Powell Road north of the intersection with CR 466A.

While the Champagne Farm site can help support the City's water demands, there are some disadvantages to locating a new regional plant in this location. The primary disadvantage is the distance that the site is from the bulk of current and future demands. Water must travel long distances through the distribution system before it reaches many of the larger demands. That travel distance equates to frictional losses in the system that will limit the ability of a Champagne Farm WTP to meet future needs. The modeling has shown in future scenarios that the Coleman plant will carry a significant portion of the future demands, with Champagne Farm meeting the remainder. Therefore, even with a new WTP at Champagne Farm, the Coleman Facility will have to be expanded to meet demands.

The interchange that the Champagne Farm WTP was intended to support is not planned for construction in the foreseeable future. In June 2011, Sumter County requested to move the interchange project to the FDOT's "unfunded project" list. While the interchange remains on the Lake-Sumter Metropolitan Planning Organization's 2035 long range transportation plan, it is currently ranked at the lowest priority. Based on this information, it is recommended that the City investigate an alternative location for a new regional WTP.

7.0 Recommended Distribution System Capital Improvement Projects

7.1 Introduction

This section provides a discussion of capital improvement project developed by investigating alternatives for addressing current deficiencies and meeting future demands. Included in this chapter is a project list, with probable costs of construction, for recommended projects at the present year, 5-year, 10-year, and 20-year planning projections. Many of the projects are large enough that they likely to be constructed in phases, and so they are included in more than one of the time periods. See Appendix E for a detailed breakdown of the estimated construction costs for each of the capital improvement projects.

7.2 Projects

Water main to connect the Champagne Farm WTP to SR 44 – One connection for the Champagne Farm WTP to the existing system would be achieved through a 24" water main that runs west on CR 231, then south on N. CR 475, and connects to the existing system by running east on SR 44. The total length of pipe required to make this connection is approximately 17,200'. This connection allows for the decommissioning of the West Well WTP and helps provide redundancy for the I-75 interchange. The estimated design and construction cost for this project is approximately $4,206,000.

Water main to connect Champagne Farm to north side of system near CR-214 – A second connection for the Champagne Farm WTP to the existing system would be achieved through a 24" water main that runs east from the WTP, crosses under Interstate 75, runs east along CR-222, then runs north on CR-223, and runs east on CR-214 and connects to the existing watermain at the intersection of CR-214 and CR-209. The total length of pipe required to make this connection is approximately 23,700. The estimated design and construction cost for this project is approximately $5,814,000.

SR 44 East water main loop - This is a water main constructed along SR 44 and CR-468 to provide service to some of the new developments included in the future demand projections. Based on the model results, this water main will need to be 24" diameter. The total length of pipe required to make this connection is approximately 23,800'. This line will be required at some point in the future regardless of whether or not Champagne is constructed. The estimated design and construction cost for this project is approximately $5,868,000.

CR-501/CR-468 Water Main Replacement – The Southern Oaks development will generate a significant water demand in the future and is located much closer to the Coleman WTP than the Champagne Farm WTP. The most efficient way to provide water to this development is by upgrading the existing lines and constructing new 24" lines in the corridor between the Coleman WTP and the Southern Oaks development. The total length of

pipe required to make this connection is approximately 21,900'. The estimated design and construction cost for this project is approximately $5,382,000.

New Huey Street Well – A second well at the Huey Street WTP is recommended to help the pressure and flows in the downtown area. The new well would be the same size as the existing well (500 gpm). The estimated design and construction cost for this project is approximately $204,000.

Coleman Plant Expansion – Based on the modeling results, the system demands significant volumes of water from the Coleman WTP. At some point in the future, the plant will need to be expanded. The ultimate capacity of the plant is estimated to be 16.8 MGD (10,205 gpm max. daily + 1500 gpm fire flow). The estimated design and construction cost for this project is approximately $36,888,000.

Powell Road Water Main Extension - This project is required between the 10-year and 20-year timeline. The total length of pipe required to make this connection is approximately 15,900'. The estimated design and construction cost for this project is approximately $3,972,000.