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Water & Wastewater Impact Fee Update

Exhibit F: Capital Improvements Plan Wastewater Facilities

Prepared for:

City of Fort Worth Water Department



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1.0 INTRODUCTION

In accordance with Texas Local Government Code (TLGC), Chapter 395, the City of Fort Worth has commissioned Freese and Nichols, Inc. (FNI), to conduct an Impact Fee Study. This report establishes the engineering basis for the fee schedule, updating the previous study completed in 2009.

Impact fees provide the City of Fort Worth a mechanism for recouping the cost associated with expanding the municipal wastewater system to accommodate growth in the service area. The City of Fort Worth owns and operates a system comprised of treatment facilities, lift stations, and pipelines that are continuously improved and expanded. The schedule for future investment in the wastewater system is known as the Capital Improvements Plan (CIP). The CIP was updated as a part of this study with capital project scope and cost provided by previously commissioned master planning documents and input from Fort Worth Water Department staff.

The report describes the basis for establishing which City of Fort Worth wastewater facilities are eligible to be included in the impact fee analysis. Next, the criteria for measuring infrastructure capacity are explained for each infrastructure type. Finally, the additional facilities required to accommodate growth during the study period are summarized.

2.0 CAPACITY CRITERIA

2.1 Wastewater Treatment Plants

The Texas Commission on Environmental Quality (TCEQ) recommends a minimum of 100 gallons per capita per day (gpcd) for municipal base flow. The 2011 master plan determined that the existing loading for the City of Fort Worth and its wholesale customers is 97 gpcd. The 2011 master plan recommends using 110 gpcd and an additional 10 gpcd to account for groundwater infiltration (GWI) to raise the total per capita for future growth to 120 gpcd. The 2011 master plan determined that the current usage per employee per day for the City of Fort Worth is 37 gallons per employee per day. Additionally, the master plan recommends using 40 gped for future commercial growth.

The following formula was then used for the calculation of average day flow:

$$Q_{avg} = [(2010 \text{ Residential} \times 2010 \text{ gpcd}) + (2010 \text{ Non-residential} \times 2010 \text{ gpcd})] + [(Population \text{ Growth} \times Growth \text{ gpcd}) + (Employment \text{ Growth} \times Growth \text{ gped})]$$

Where:	Q_{avg}	= Average day wastewater flow
	2010 Residential Flow	= 993,278 (from 2011 <i>Wastewater System Master Plan</i>)
	2010 Non-res. Flow	= 522,487 (from 2011 <i>Wastewater System Master Plan</i>)
	2010 gpcd	= 97 gpcd (from 2011 <i>Wastewater System Master Plan</i>)
	2010 gped	= 37 gped (from 2011 <i>Wastewater System Master Plan</i>)
	Population Growth	= Population Growth from 2010 to 2013/2023 for Impact Fees
	Growth gpcd	= 120 gpcd (from 2011 <i>Wastewater System Master Plan</i>)
	Employment Growth	= Employment Growth from 2010 to 2013/2023 for Impact Fees
	Growth gped	= 40 gped (from 2011 <i>Wastewater System Master Plan</i>)

The following is a calculation of the annual average day wastewater flows. The population and employment growth projections were taken from the *Exhibit B: Land Use Assumptions- Wastewater Facilities*. The population and employment projections for the TRA Denton Creek Regional Wastewater System and TRA Central Regional Wastewater System were subtracted from the total wastewater service area population and employment projections as well as proposed Capital Improvement Projects (CIP).

Exhibit F – Capital Improvements Plan: Wastewater Facilities

2013 Annual Average Flow

$$2010 \text{ Residential Flow} = 993,278 \times 97 \text{ gpcd} = 96.3 \text{ mgd}$$

$$2010 \text{ Non-residential Flow} = 522,487 \times 37 \text{ gpcd} = 19.3 \text{ mgd}$$

$$\text{Growth in Residential Flow} = (1,026,085 - 993,278) \times 120 \text{ gpcd} = 3.9 \text{ mgd}$$

$$\text{Growth in Non-residential Flow} = (575,222 - 522,487) \times 40 \text{ gpcd} = 2.1 \text{ mgd}$$

$$Q_{avg} = [(96.3 \text{ mgd}) + (19.3 \text{ mgd})] + [(3.9 \text{ mgd}) + (2.1 \text{ mgd})]$$

$$Q_{avg} = 121.6 \text{ mgd}$$

2023 Annual Average Flow

$$2010 \text{ Residential Flow} = 993,278 \times 97 \text{ gpcd} = 96.3 \text{ mgd}$$

$$2010 \text{ Non-residential Flow} = 522,487 \times 37 \text{ gpcd} = 19.3 \text{ mgd}$$

$$\text{Growth in Residential Flow} = (1,293,720 - 993,278) \times 120 \text{ gpcd} = 36.0 \text{ mgd}$$

$$\text{Growth in Non-residential Flow} = (689,908 - 522,487) \times 40 \text{ gpcd} = 6.7 \text{ mgd}$$

$$Q_{avg} = [(96.3 \text{ mgd}) + (19.3 \text{ mgd})] + [(36.0 \text{ mgd}) + (6.7 \text{ mgd})]$$

$$Q_{avg} = 158.3 \text{ mgd}$$

The net increase in annual average flow for the study period is:

$$\text{Increase in Annual Average Flow} = 2023 \text{ Annual Average Flow} - 2013 \text{ Annual Average Flow}$$

$$\text{Increase in Annual Average Flow} = 158.3 \text{ mgd} - 121.6 \text{ mgd}$$

$$\text{Increase in Annual Average Flow} = 36.7 \text{ mgd}$$

The 2011 *Wastewater System Master Plan* did not use a straight average flow to peak flow peaking factor because the City utilized an extended period simulation model to determine the projected peak flows. The model used the RTK method which calculates a different peaking factor for each scenario dependent on amount of rainfall, peaking time, and recession time. From the 2011 *Wastewater System Master Plan* the historical annual average flow to peak hour flow ratio is 2.87 and is used to calculate the 2013 peak flow.

The following formula was used for the calculation of peak flow:

$$Q_{Peak} = Q_{avg} \times PF$$

Where: Q_{avg} = Average day wastewater flow
 PF = Average day wastewater flow to peak flow peaking factor

Exhibit F – Capital Improvements Plan: Wastewater Facilities

2013 Peak Flow

$$Q_{avg} = 121.6 \text{ mgd}$$

$$PF = 2.87$$

$$Q_{peak} = 121.6 \text{ mgd} \times 2.87$$

$$Q_{peak} = 349 \text{ mgd}$$

The peaking factor for the calculation of 2023 peak flow is reduced from 2.87 to 2.67 to provide a credit for reducing rain dependent inflow and infiltration with near term CIP improvements made to the wastewater collection system. The 2023 peak flow calculation is:

2023 Peak Flow

$$Q_{avg} = 158.3 \text{ mgd}$$

$$PF = 2.67$$

$$Q_{peak} = 158.3 \text{ mgd} \times 2.67$$

$$Q_{peak} = 423 \text{ mgd}$$

2.2 Lift Stations and Force Mains

The City currently has 30 lift stations located throughout the wastewater service area to convey flow against gravity and ultimately to the Village Creek WRF. A table showing existing lift station capacities can be found in **Appendix A**. Lift station deficiencies were calculated using information from the 2011 *Wastewater System Master Plan* and near term planned improvements. The data below shows the lift station deficiencies for each time period:

	2013	2023
Population*	1,026,085	1,293,720
Employment*	575,222	689,908
Lift Station Deficiency	36.3 mgd	65.4 mgd

*Excludes the TRA Denton Creek and TRA Central population/employment estimates

The net increase in lift station deficiencies is:

$$\text{Increase in Lift Station Deficiencies} = 65.4 \text{ mgd} - 36.3 \text{ mgd} = 29.1 \text{ mgd}$$

3.0 ELIGIBLE FACILITIES

This section establishes the types of City of Fort Worth wastewater facilities that are eligible for inclusion in the calculation of the impact fee. Projects included in the CIP can serve to rehabilitate and renew the system, enhance the system to improve efficiency and meet regulatory requirements, increase the system capacity, or achieve a combination of these objectives. Only those projects warranted by capacity issues derived from growth occurring during the study period (2013 to 2023) can be included in the impact fee calculation. Additionally, projects are excluded from the impact fee calculation if the costs cannot be accurately delineated or if alternate mechanisms for cost recovery are in place. Financing costs associated with the wastewater system have been excluded due to the dynamic nature of the financial markets, and the uncertainty this introduces, consistent with previous City of Fort Worth Impact Fee studies. Wastewater interceptors and collection piping have been excluded from this study due to alternate cost recovery mechanisms in place, consistent with the previous impact fee study. Facilities included in the impact fee study are wastewater treatment facilities, lift stations, and engineering studies.

Figure F-1 and **Figure F-2**, showing existing and proposed facilities, respectively, are included at the end of this section.

3.1 Wastewater Treatment Plants

The TCEQ 75/90 rules state that when a plant reaches 75% of the permitted annual average flow (75% of 166 is 124.5 MGD) for three consecutive months, the facility must begin planning for its next expansion. In addition, the rule states that when a facility reaches 90% of the permitted annual average flow (90% of 166 is 149.4 MGD), the facility must be in construction of its next expansion.

The existing average day wastewater treatment capacity is 166 mgd. An additional 36.7 mgd of capacity will be required during the study period, as calculated in Section 2.1. The 2013 Village Creek WRF projected average day flows and peak flow rates for the VCWRF are 121.6 mgd and 349 mgd, respectively. The 2023 Village Creek WRF projected average day flows and peak flow rates for the VCWRF are 158.3 mgd and 423 mgd, respectively. According to the **Figure F-3**, the Village Creek WRF could potentially reach the 75% capacity level in 2014 and the 90% capacity level in 2019.

The following formula was used for the calculation of the allocation for the Village Creek WRF Peak flow diversion structure:

Exhibit F – Capital Improvements Plan: Wastewater Facilities

$$\text{Study Period} = \frac{2023 \text{ Peak Flow}}{2023 \text{ VCWRF Peak Flow Capacity}} - \frac{2013 \text{ VCWRF Peak Flow Capacity} - 2013 \text{ Peak Flow}}{2013 \text{ Peak Flow}} \times 100\%$$

$$\% \text{ Allocation for Study Period} = \frac{423 \text{ mgd}}{469 \text{ mgd}} - \frac{369 \text{ mgd} - 349 \text{ mgd}}{349 \text{ mgd}} \times 100\% = 85\%$$

The following wastewater treatment plant capital projects are eligible for inclusion in the impact fee calculation:

1. Mary’s Creek WRF site selection and land purchase
% Allocated for Study Period = 10%
2. Village Creek WRF Peak Flow Diversion Structure
% Allocated for Study Period = 85%
3. Mary’s Creek WRC Phase 1 (Permitting and Engineering)
% Allocated for Study Period = 100%
4. Village Creek WRF Replace Primary Clarifiers 1-12 & Grit System (Phase 2B of 191 mgd expansion)
% Allocated for Study Period = 40%
5. Village Creek WRF Expansion to 191 MGD (Phase 2A - secondary systems expansion - aeration, clarifier, filter, hydraulics, pumping)
% Allocated for Study Period = 40%
6. Village Creek WRF Expansion to 191 MGD Capacity - Solids Treatment and Dewatering
% Allocated for Study Period = 40%

3.2 Lift Stations

Section 2.2 calculated the net increase in lift station deficiencies to be 29.1 mgd. The wastewater CIP lists several lift station projects, which are eligible for inclusion in the impact fee calculation. These lift station projects will provide an additional 96.7 mgd of capacity. The allocation of the lift stations is calculated below:

$$\text{Study Period} = \frac{\text{Increase in Lift Station Deficiencies}}{\text{Capacity of Proposed Lift Station Projects}} \times 100\%$$

$$\% \text{ Allocation for Study Period} = \frac{29.1 \text{ mgd}}{96.7 \text{ mgd}} \times 100\% = 30.1\%$$

 Exhibit F – Capital Improvements Plan: Wastewater Facilities

The remaining 69.9% of the costs of these projects will be allocated to future growth beyond the study period.

Figure F-4 provides the comparison of the lift station projects and the lift station capacity required for future growth.

3.3 Engineering Studies

There are nine studies which have been included in the calculation of the wastewater impact fees. The studies are as follows:

1. **Wastewater Facilities Plan-** The Wastewater Facilities Plan updated the wastewater treatment plant needs for the period of 2000 through 2020. Twelve years of the twenty year study was for existing customers. Eight years of the twenty year study was for the study period. The calculation of the allocation was as follows:

Existing Customers	=	12/20	=	60%
Study Period	=	8/20	=	40%

% Allocation for Study Period = 40%

2. **2011 Wastewater System Master Plan-** The 2011 master plan was an update of the 1999 study and includes the planning period 2010 through 2030. Two years of the twenty year study was for existing customers. Ten of the twenty years in the planning period are included in the impact fee study period. Therefore 50% is allocated to the study period and the remaining 40% is allocated to the period beyond the study period.

Existing Customers	=	2/20	=	10%
Study Period	=	10/20	=	50%
Beyond Study Period	=	8/20	=	40%

% Allocation for Study Period = 50%

3. **Conveyance Study-** The Wastewater Conveyance Study is a 20-year planning document for the period 2000 through 2020. Twelve years of the twenty year study was for existing customers. Eight years of the twenty year study was for the study period. The calculation of the allocation was as follows:

Existing Customers	=	12/20	=	60%
Study Period	=	8/20	=	40%

% Allocation for Study Period = 40%

4. **2004 Impact Fee Study-** The 2004 Impact Fee Study provides impact fees for the study period 2004 through 2014. Therefore, eight years of the ten-year study period for the existing customers, and the remaining two years is for the study period. One half of the study is for the water impact fee update and the other half is for the wastewater impact fee update.

Exhibit F – Capital Improvements Plan: Wastewater Facilities

Existing Customers = 8/10 = 80%
 Study Period = 2/10 = 20%
% Allocation for Study Period = 20%

5. **2009 Impact Fee Study-** The 2009 Impact Fee Study provides impact fees for the study period 2009 through 2019. Therefore, three years of the ten-year study period for the existing customers, and the remaining seven years are for the study period. One half of the study is for the water impact fee update and the other half is for the wastewater impact fee update.

Existing Customers = 3/10 = 30%
 Study Period = 7/10 = 70%
% Allocation for Study Period = 70%

6. **2012 Impact Fee Study-** The 2012 Impact Fee Study will provide impact fees for the study period 2013 through 2023. Therefore, ten years of the ten-year study period are allocated to the study period. One half of the study is for the water impact fee update and the other half is for the wastewater impact fee update.

Study Period = 10/10 = 100%
% Allocation for Study Period = 100%

7. **2015 Impact Fee Study-** The 2015 Impact Fee Study will provide impact fees for the study period 2015 through 2025. Therefore, seven years of the ten-year study period are allocated to the study period, and the remaining three years are for the period beyond the study period. One half of the study is for the water impact fee update and the other half is for the wastewater impact fee update.

Study Period = 7/10 = 70%
 Beyond Study Period = 3/10 = 30%
% Allocation for Study Period = 70 %

8. **2018 Impact Fee Study-** The 2018 Impact Fee Study will provide impact fees for the study period 2018 through 2028. Therefore, four years of the ten-year study period is allocated to the study period, and the remaining six years are for the period beyond the study period. One half of the study is for the water impact fee update and the other half is for the wastewater impact fee update.

Study Period = 4/10 = 40%
 Beyond Study Period = 6/10 = 60%
% Allocation for Study Period = 40 %

9. **2021 Wastewater System Master Plan-** The 2021 master plan will be an update of the 2011 study and includes the planning period 2021 through 2041. Two of the twenty years in the planning period are included in the impact fee study period. Therefore 10% is allocated to the study period and the remaining 90% is allocated to the period beyond the study period.

Study Period = 2/20 = 10%

Exhibit F – Capital Improvements Plan: Wastewater Facilities

Beyond Study Period = 18/20 = 90%
% Allocation for Study Period = 10%

10. **2021 Impact Fee Study**- The 2021 Impact Fee Study will provide impact fees for the study period 2021 through 2031. Therefore, one year of the ten-year study period is allocated to the study period, and the remaining nine years are for the period beyond the study period. One half of the study is for the water impact fee update and the other half is for the wastewater impact fee update.

Study Period = 1/10 = 10%
Beyond Study Period = 9/10 = 90%
% Allocation for Study Period = 10%

Appendix B describes each Wastewater CIP project for the 2013-2023 planning period. The purpose of each project, the portion that are allocated to growth and the current status is also included.

4.0 GROWTH RELATED CIP

Table 4-1 summarizes the growth related costs of the eligible facilities. **Appendix C** shows the detailed development of the costs and capacities of the eligible facilities.

Table 4-1 2013-2023 Growth Related CIP

Wastewater Facility	Total Growth Related Cost	% Allocated to 2013-2023 Impact Fees	2013-2023 Growth Related Cost
Treatment Plants	\$184,367,000	46.5%	\$91,202,300
Lift Stations	\$75,081,550	30.1%	\$22,599,547
Engineering Studies	\$8,914,932	38.1%	\$3,397,835
TOTAL			\$117,199,681

4.1 Service Units

The differentiated costs between customer types are allocated through the application of the equivalent meter concept. Since the 5/8" x 3/4" water meter is the most frequently used meter by the residential customer, a factor has been calculated to relate the capacities of other meter sizes to the 5/8" x 3/4" meter capacity. **Table 4-2** presents the factors developed using capacity information from the American Water Works Association (AWWA) Standard C700-02, Cold-Water Meters – Displacement Type, Bronze Main Case and AWWA Standard C701-07, Cold-Water Meters – Turbine Type, for Customer Service.

Table 4-2 AWWA Meter Equivalency Factors

Meter Size	5/8" x 3/4" Equivalency Factor
5/8" x 3/4"	1.00
3/4"	1.50
1"	2.50
1-1/2"	5.00
2"	8.00
3"	21.75
4"	37.50
6"	80.00
8"	140.00
10"	210.00

Exhibit F – Capital Improvements Plan: Wastewater Facilities

Appendix D contains the number of water meters for residential and non-residential customers by meter size for the City as well as for the wholesale customers who provided this information to Freese and Nichols, Inc. The number of equivalent meters is also calculated for the City and wholesale customers.

The next calculation step determines population per residential meter and employment per non-residential meter. **Table 4-3** summarizes this calculation for the City of Fort Worth and wholesale customers using 2012 information.

Table 4-3 Development of 2013 Population and Employment by Equivalent Meter

Description	Residential	Non-Residential
City of Fort Worth		
Number of Equivalent Meters	252,602	117,463
Population / Employment	706,632	447,297
Population per Equivalent Meter	2.80	--
Employment per Equivalent Meter	--	3.81
Wholesale Customers		
Number of Equivalent Meters	120,830	46,383
Population / Employment	319,453	127,925
Population per Equivalent Meter	2.64	--
Employment per Equivalent Meter	--	2.76

FNI did not receive meter count information from six of Fort Worth’s wholesale water customers; however, their meter counts were estimated based on growth since the previous impact fee study. The number of equivalent meters used to calculate the wholesale customers’ population/employment per equivalent meter in Table 4-3 is the total number of equivalent meters served by Fort Worth for all wholesale customers. In order to more accurately estimate the population/employment per equivalent meter, Freese and Nichols, Inc. divided the number of equivalent meters by the sum of population or employment served by Fort Worth.

The projected increase in equivalent meters between 2013 and 2023 uses the ratios in Table 4-2 and the population and employment projections for 2013 and 2023 from Exhibit B: Land Use Assumptions-Wastewater Facilities report. The calculation is shown below:

City of Fort Worth

Residential = Population Change / Population per Equivalent Meter
 = (922,692 – 706,632) / 2.80
 = 77,165

Exhibit F – Capital Improvements Plan: Wastewater Facilities

Non- Residential = Employment Change / Employment per Equivalent Meter
 = (532,335 – 447,297) / 3.81
 = 22,320

Fort Worth Total = Residential + Non-Residential
 = 77,165 + 22,320
 = 99,485

Wholesale Customers

Residential = Population Change / Population per Equivalent Meter
 = (371,028 – 319,453) / 2.64
 = 19,536

Non- Residential = Employment Change / Employment per Equivalent Meter
 = (157,573 – 127,925) / 2.76
 = 10,742

Wholesale Total = Residential + Non-Residential
 = 19,536 + 10,742
 = 30,278

Grand Total = Fort Worth Total + Wholesale Total
 = 99,485 + 30,278
 = 129,763

4.2 Impact Fee Calculations

Impact fees are the quotient of the total cost of expansion for the study period from Table 4-1 divided by the increase in equivalent meters. This fee equals the maximum wastewater impact fee for a 5/8" x 3/4" water meter size.

Maximum Wastewater Impact Fee = Cost of Expansion / Increase in Equivalent Meters
 = \$117,199,681 / 129,763
 = \$903 per 5/8" x 3/4" equivalent meter

The wastewater impact fees for meters other than 5/8" x 3/4" are the product of fee per 5/8" x 3/4" equivalent meter multiplied by the respective equivalent meter factor from Table 4-2. The maximum allowable wastewater impact fees are provided in **Table 4-4**, as well as the resulting impact fee at a 50% collection rate.

Exhibit F – Capital Improvements Plan: Wastewater Facilities

Table 4-4 Proposed Wastewater Impact Fees

Meter Size	5/8" x 3/4" Equivalency Factor	Maximum Allowable Impact Fee	Proposed Impact Fee (Collected at 50%)
5/8" x 3/4"	1.00	\$903	\$452
3/4"	1.50	\$1,355	\$678
1"	2.50	\$2,258	\$1,129
1-1/2"	5.00	\$4,515	\$2,258
2"	8.00	\$7,224	\$3,612
3"	21.75	\$19,640	\$9,820
4"	37.50	\$33,863	\$16,932
6"	80.00	\$72,240	\$36,120
8"	140.00	\$126,420	\$63,210
10"	210.00	\$189,630	\$94,815

FIGURE F-1 CITY OF FORT WORTH 2012 WASTEWATER IMPACT FEE STUDY EXISTING FACILITIES

LEGEND

-  Lift Station
-  Existing Water Reclamation Center
-  Water Wholesale Customer
-  Non-Wholesale Customer
-  Stream
-  City Limit
-  ETJ Boundary
-  County Boundary
-  Lake

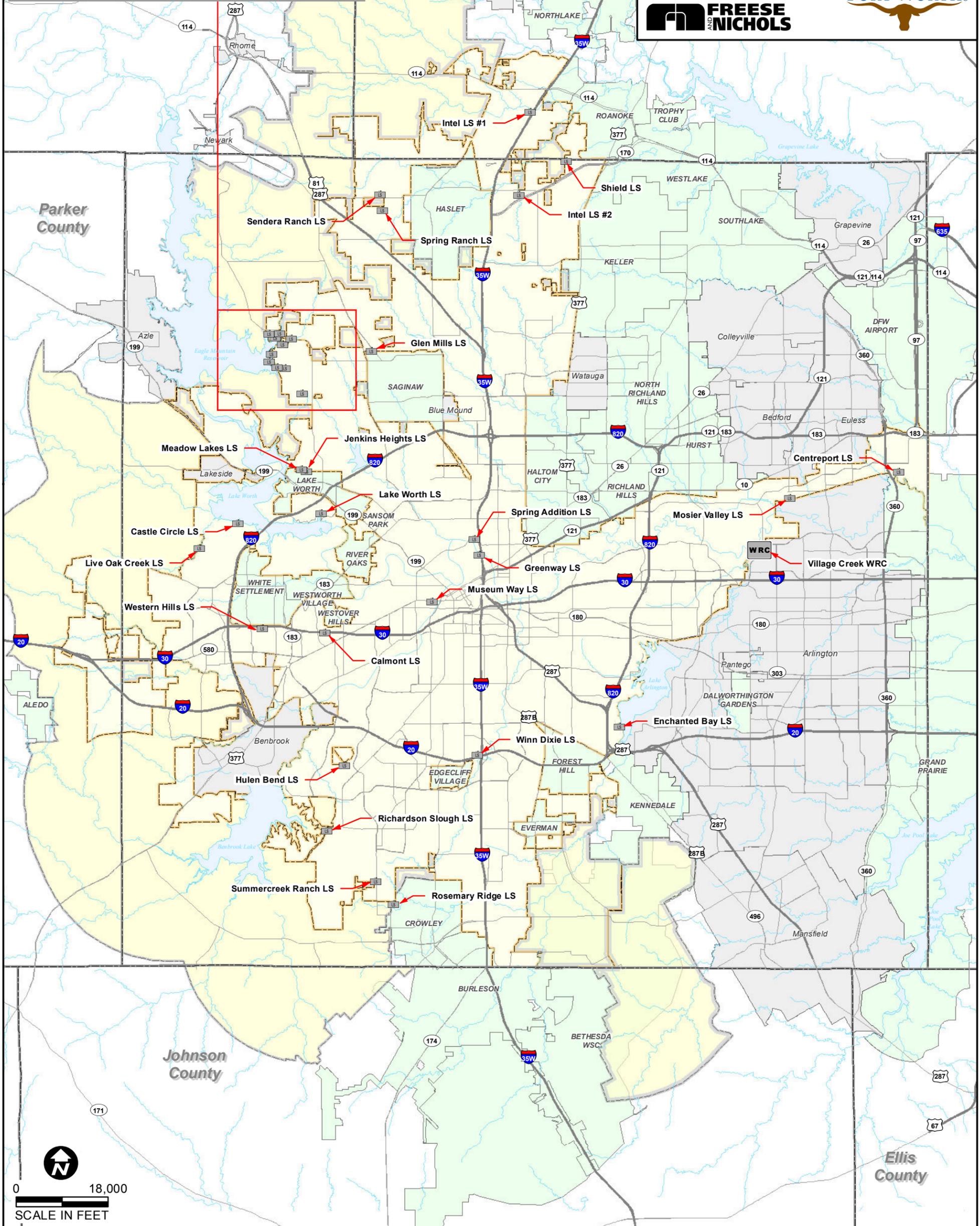
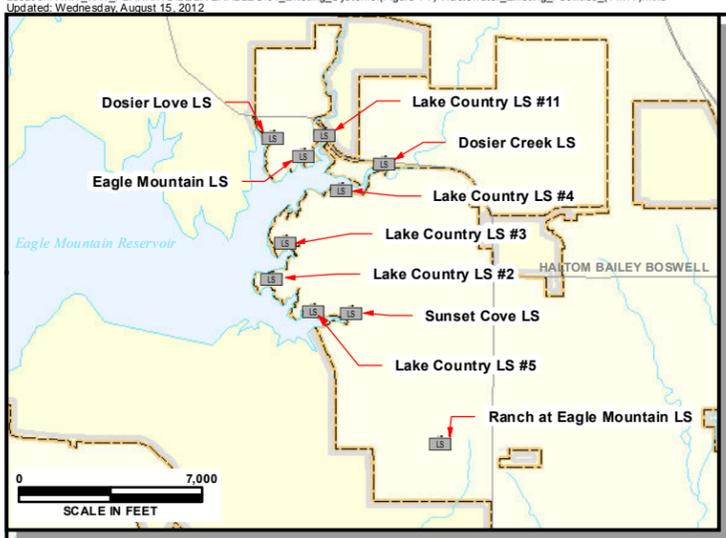
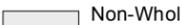
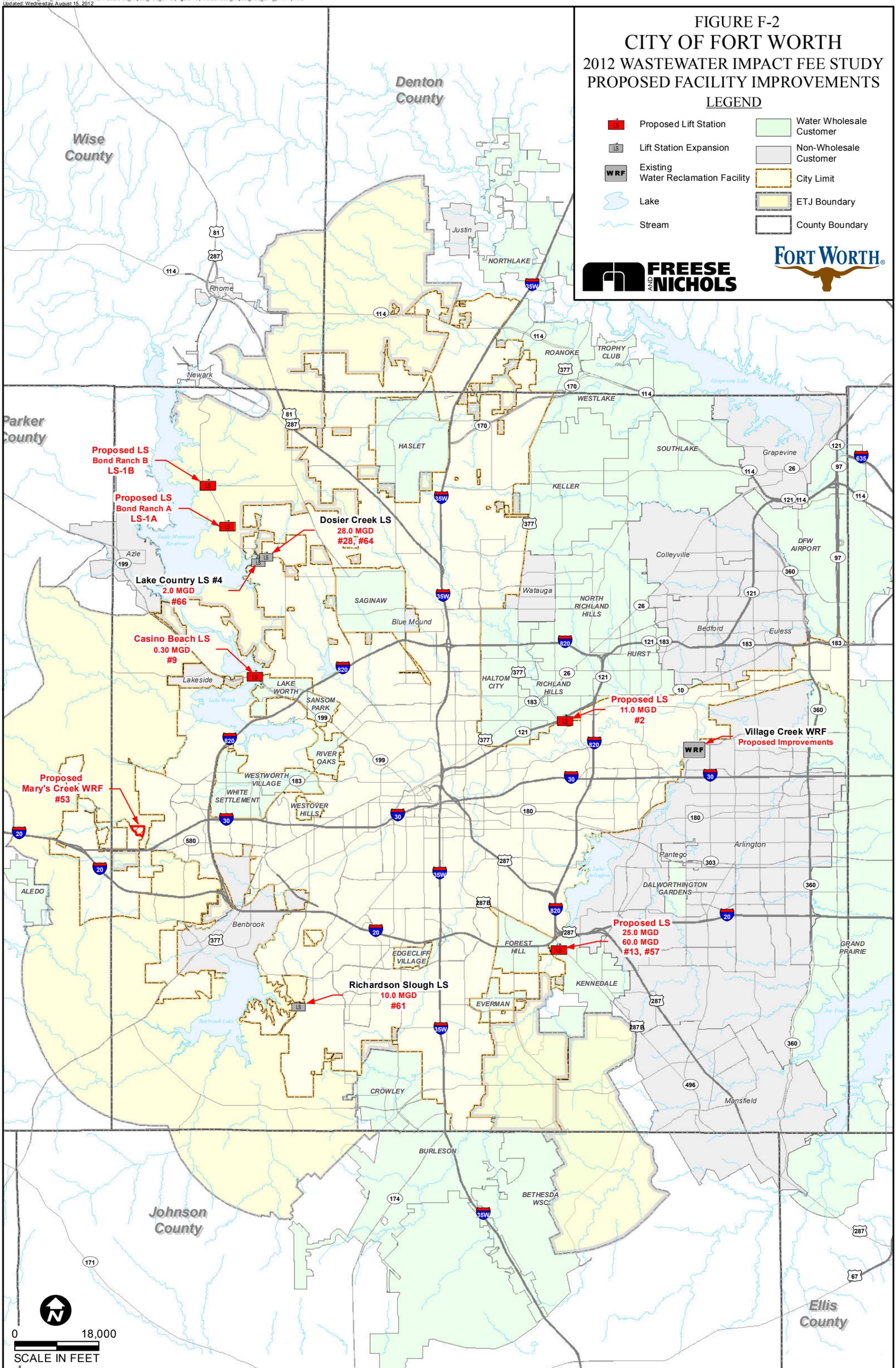


FIGURE F-2
CITY OF FORT WORTH
2012 WASTEWATER IMPACT FEE STUDY
PROPOSED FACILITY IMPROVEMENTS

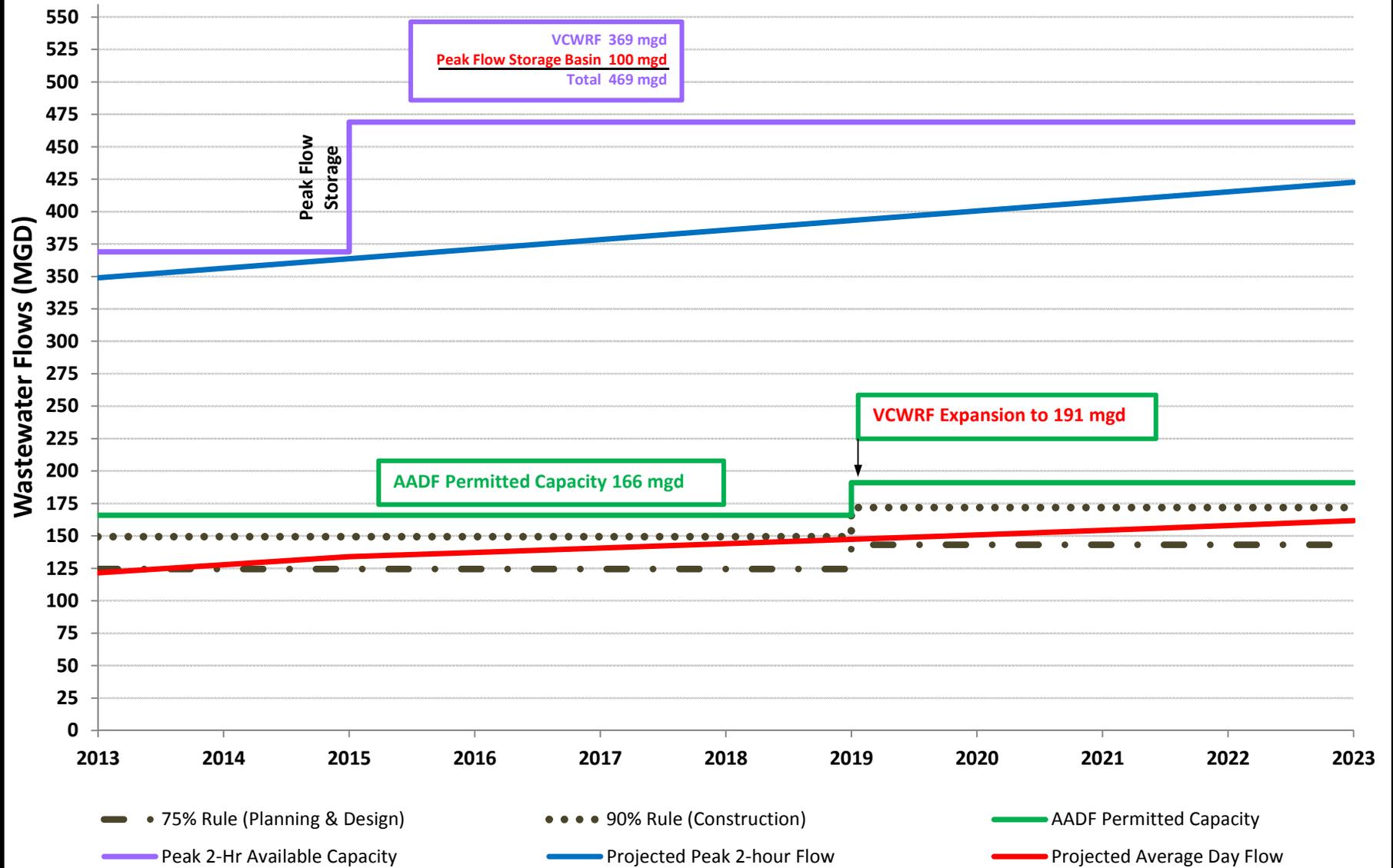
LEGEND

- | | | | |
|---|-------------------------------------|---|--------------------------|
|  | Proposed Lift Station |  | Water Wholesale Customer |
|  | Lift Station Expansion |  | Non-Wholesale Customer |
|  | Existing Water Reclamation Facility |  | City Limit |
|  | Lake |  | ETJ Boundary |
|  | Stream |  | County Boundary |

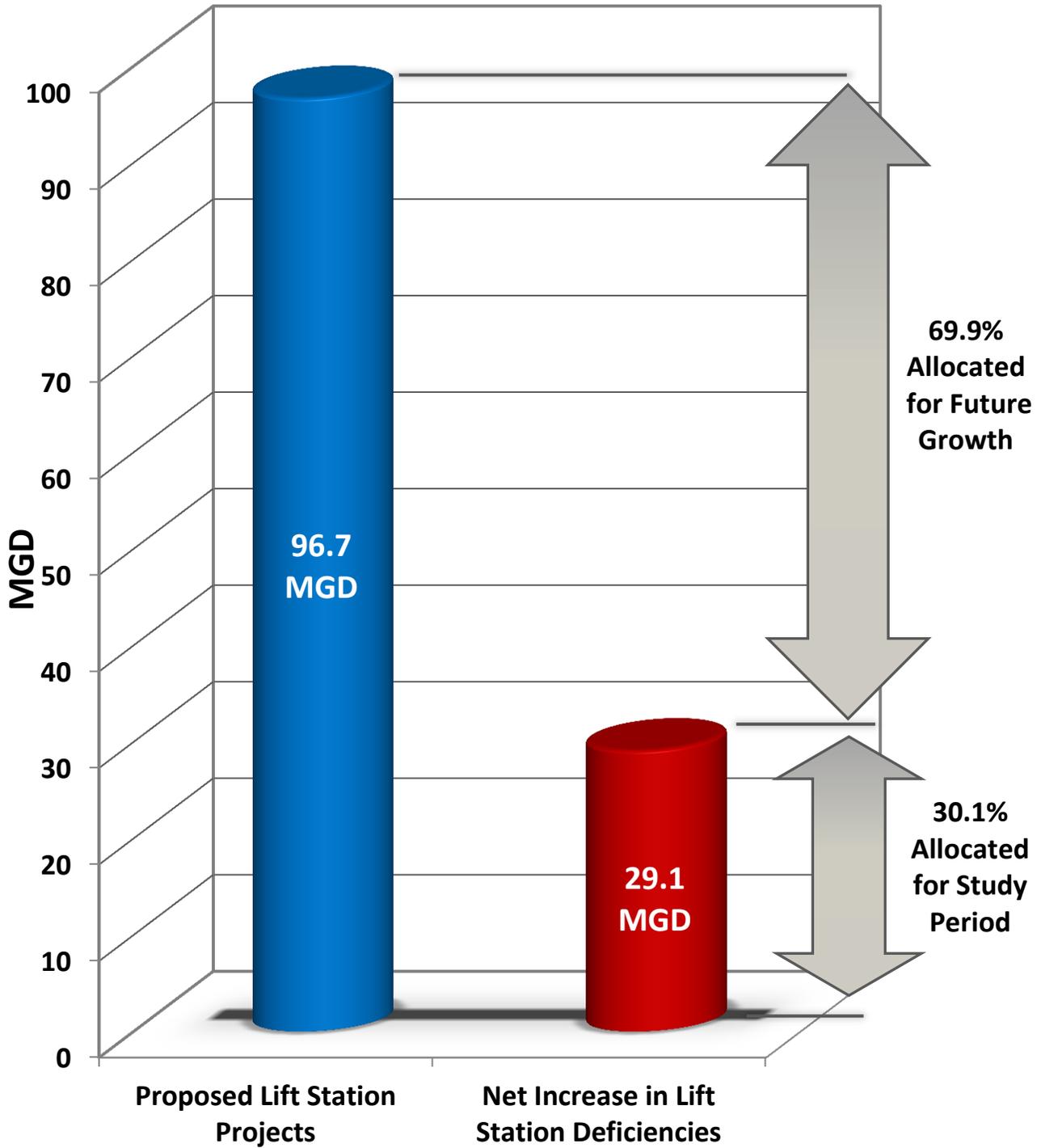


0 18,000
 SCALE IN FEET

Figure F-3 Wastewater Treatment Plant Expansion Schedule



**Figure F-4
Lift Station Allocation**



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