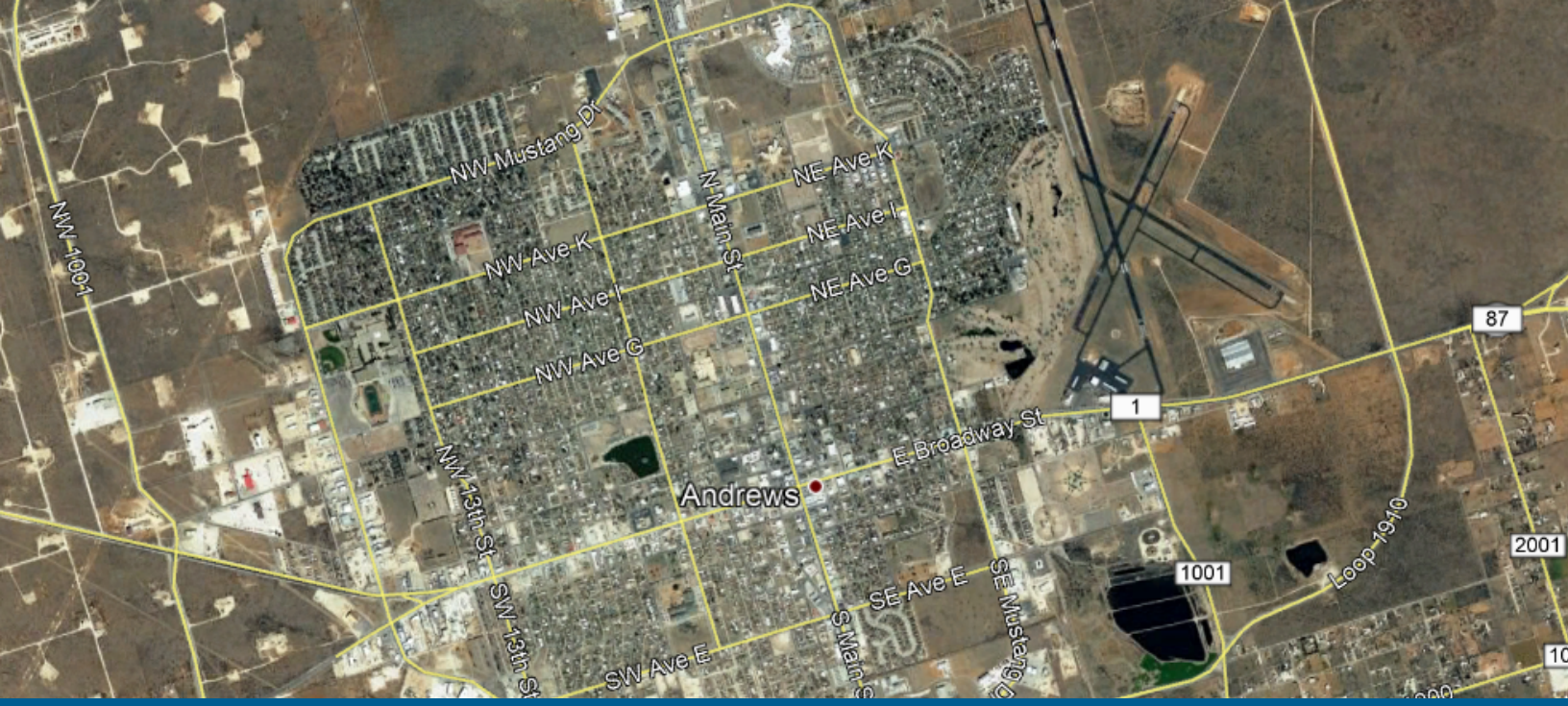

INFRASTRUCTURE MASTER PLAN

WATER / WASTEWATER / STORMWATER

PREPARED FOR:

- Andrews Economic Development Corporation
- City of Andrews

PREPARED BY:

Freese and Nichols, Inc.
1500 Broadway, Suite 1150
Lubbock, Texas 79401
806-686-2700

FREESE AND NICHOLS

Andrews Economic Development Corporation Move Ahead

City of Andrews

Innovative approaches
Practical results
Outstanding service

INFRASTRUCTURE MASTER PLAN

Prepared for:

Andrews Economic Development Corporation

In cooperation with:

City of Andrews

STATE OF TEXAS
HEATHER RAE KEISTER
100095
LICENSED PROFESSIONAL ENGINEER

09-08-2020

FREESE AND NICHOLS, INC.
TEXAS REGISTERED
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STATE OF TEXAS
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EXECUTIVE SUMMARY

Andrews Economic Development Corporation retained Freese and Nichols, Inc. (FNI) to conduct an Infrastructure Master Plan to evaluate water, wastewater, and stormwater system needs. This study includes preparation of a comprehensive Water and Wastewater Capital Improvement Plan (CIP) and a Risk Based Assessment (RBA). The Master Plan also includes a drainage study over the proposed development areas to determine what the potential areas of high flood risk as well as a capital improvement plan to recommend mitigation measures as needed in the developing watersheds. Based on this hydrological analysis, maps were made of flood risk areas and areas of interest for the Capital Improvement Plan.

The areas of planned development identified as the focus of this project include a proposed 250-lot residential development in the northwest quadrant of the city, north of NW Avenue O and west of NW 7th Street and proposed industrial development in the southwest quadrant of the city inside Loop 1910, between Kermit Highway and Mustang Drive. FNI utilized growth rate projections from the City of Andrews Comprehensive Plan to determine overall population increase through 2040.

The water/wastewater capacity analysis included developing projected water demands and wastewater flows to determine future needs for each system. FNI then conducted an evaluation of each system based on TCEQ regulatory requirements for water storage and pumping capacity, as well as wastewater treatment plant capacity. Triggers for facility improvements were driven by projected growth to maintain these regulatory requirements and keep the City in good standing with the TCEQ. Expansion of water and sewer lines into new growth area is typically triggered once new growth and development commences. Desktop analyses of the water and wastewater system highlighted the need for potential upsizing of existing water and wastewater lines in order to provide and maintain a high level of service to the customers of the City of Andrews. The goal of the capacity CIP is to address existing deficiencies in the system, as well as provide capacity for future demands in the water and wastewater systems. Projects were identified in planning periods defined as Short-Term (2020 – 2030) or Long-Term (2030 – 2040) needs. Detailed descriptions, drivers/triggers, and planning level opinion of probable construction costs were developed and detailed in this report.

FNI developed an RBA program for the City's water distribution and wastewater collection systems. The goal of the RBA program is to develop a more proactive approach to maintaining the City's water and wastewater lines through effective rehabilitation and renewal. Industry best practices and organizations

typically recommend a utility replace 1 – 2% per year of their existing systems in order to maintain and improve system performance and reduce breaks, leaks, blockages, stoppages, or SSOs. FNI conducted a desktop RBA to assign condition and criticality scores to each water and wastewater line. Overall risk scores were calculated and summarized from grades of Very Low Risk to Very High Risk. Recommended actions were developed for each water and wastewater line based on the risk score. The actions range from infrastructure upgrades/replacements to inspections and monitoring of the lines. FNI split the City into 12 zones in order to help the City prioritize areas and promote an equitable method of system renewal.

The stormwater analysis included a playa-level hydrologic analysis and flood hazard assessment for the identified focus areas. The goal of the study was to evaluate the existing watershed condition as a baseline, analyze the impact of the projected development to measure system performance, identify any deficiencies, and determine improvements needed to address deficiencies and meet projected future conditions. The areas included in the analysis totaled 6.2-square miles. The hydrologic models were evaluated for the 5, 10, 25, 50, 100, and 500-year storm events for existing and ultimate conditions for the watersheds. The major elements of the scope of this project to be addressed in this report include drainage modeling, drainage project identification, and a drainage CIP.

The final portion of this report is a funding opportunities assessment. This includes looking at current water and wastewater utility rates compared to the CIP costs developed by FNI to determine the adequacy of the existing rates to pay for capital improvements. Other funding programs and mechanisms detailed in this report include:

- TWDB Funding Opportunities
- Stormwater Utility Fees
- Water, Wastewater, Roadway Impact Fees
- 4B Sales Tax Funds
- Establishment of Special Districts
- Sales Tax Reallocation Election

Recommendations were developed for the City of Andrews to explore funding options to assist in the payment of CIP projects as well as system renewal/rehabilitation.

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APPENDICES

1.0 INTRODUCTION

In July 2019, Andrews Economic Development Corporation contracted Freese and Nichols, Inc. (FNI) to prepare an Infrastructure Master Plan in anticipation of projected growth in specific areas within the City of Andrews in cooperation with the City of Andrews. Included in this effort was an evaluation of the water, wastewater, and stormwater systems. For the evaluation of the water and wastewater systems, FNI developed population projections, water demands and wastewater load projections, completed an analysis of the water and wastewater systems for existing and future needs, performed a risk based assessment of the systems, and developed a Capital Improvements Plan (CIP) for any projected gaps. The stormwater system evaluation included a playa-level hydrologic analysis and flood hazard assessment, establishment of regulatory water surface elevations for the playas located within the study area, and development of a Capital Improvements Plan for any identified needs. FNI also performed a high-level evaluation of utility rates and research into potential funding opportunities for the identified CIP projects.

1.1 Scope of Work

The scope of work consisted of the following major tasks:

Population, Water Demands, and Wastewater Flow Projections: FNI developed population, water demand, and wastewater flow projections for the existing and future planning years. These projections were established to be consistent with historical usage trends and aligns with the City of Andrews Comprehensive Plan.

Water and Wastewater System Analysis: Hydraulic analyses of the City's existing water distribution system and wastewater collection system was performed to identify capacity and regulatory related deficiencies under existing and projected water demands and wastewater flows.

Water and Wastewater System CIP: The results of the analysis were used to develop water and wastewater systems capacity related CIP. A business case and opinion of probable construction cost was developed for each recommendation.

Water and Wastewater System Risk-Based Assessment: A desktop RBA of the City's water distribution system and wastewater collection system was performed to identify lines that are candidates for a renewal program. Available information, such as line age, material, diameter, and proximity to water bodies, was evaluated to determine each line's overall risk.

Stormwater Drainage Modeling and CIP: FNI conduced playa-level modeling for the City of Andrews for proposed development areas. A CIP including mapping and detailed costs was developed to address the identified needs from the modeling and analysis.

Funding Opportunity Assessment: FNI performed a high-level review of the City's utility rates and evaluated available options for the City of Andrews to potentially secure funding to assist in the payment of identified CIP projects.

1.2 List of Abbreviations

The frequently used abbreviations in this report are shown in the **Table 1-1**.

Table 1-1: List of Abbreviations

Abbreviation	Actual
CBG	Census Block Group
CIP	Capital Improvement Plan
COF	Consequence of Failure
CWSRF	Clean Water State Revolving Fund
Dfund	Texas Water Development Fund
DWSRF	Drinking Water State Revolving Fund
EPA	Environmental Protection Agency
EST	Elevated Storage Tank
ETJ	Extra-Territorial Jurisdiction
FFD	Future Fully Developed
FIF	Flood Infrastructure Fund
FNI	Freese and Nichols, Inc.
ft	Feet
GIS	Geographic Information System
gpcd	Gallons per Capita per Day
gpm	Gallons per Minute
GST	Ground Storage Tank
LOF	Likelihood of Failure
MG	Million Gallons
MGD	Million Gallons per Day
O&M	Operations and Maintenance
RBA	Risk Based Assessment
SSO	Sanitary Sewer Overflow
SWIFT	State Water Implementation Fund for Texas
TCEQ	Texas Commission on Environmental Quality
TWDB	Texas Water Development Board
WRP	Water Reclamation Plant
WTP	Water Treatment Plant

2.0 POPULATION PROJECTIONS

Population and non-residential development are important elements in Master Planning. Water demands and wastewater flows depend on the residential population and non-residential development served by the system and determine the sizing and location of system infrastructure. A thorough analysis of historical and projected City demographics, along with land use, provides the basis for projecting future water demands and wastewater flows.

2.1 Population Growth

Historical population data from 2010 to 2019 was evaluated for this study and is shown in **Table 2-1**. The historical populations shown in **Table 2-1** include the U.S. Census estimates as of July 1st of each year. The average growth rates since 2010 is 2.74% (U.S. Census).

Table 2-1: Historical Population and Growth Rate

Year	Population*	Annual Growth Rate
2010	11,088	--
2011	11,584	4.47%
2012	12,155	4.93%
2013	12,682	4.34%
2014	13,198	4.07%
2015	13,765	4.30%
2016	13,548	-1.58%
2017	13,400	-1.09%
2018	13,762	2.70%
2019	14,109	2.52%
Average Growth Rate		**2.74%**

* Population Data from US Census Records

City staff provided land use information for portions of the City's extra-territorial jurisdiction (ETJ) with near-term development potential and a utility billing database which included monthly water usage and meter address for every water account for 12 months in 2018/2019 in editable tabular electronic format. FNI created an electronic shapefile of the City's water customers showing location and usage by assigning a spatial location to each meter through a process called geocoding. Parcels with a non-residential land use and an active billing meter associated with the same address were assumed to be already developed.

Table 2-2 shows the projected population by planning year based on various growth rates from the City's Comprehensive Plan.

Table 2-2: Projected Populations based on Growth Rate

Year	Projected Population (1.0% Growth Rate)	Projected Population (2.0% Growth Rate)	Projected Population (3.0% Growth Rate)
2020	14,250	14,391	14,532
2025	14,977	15,889	16,847
2030	15,741	17,543	19,530
2040	17,388	21,385	26,247

Note: Compound Annual Growth Rates from the *City of Andrews Comprehensive Plan*

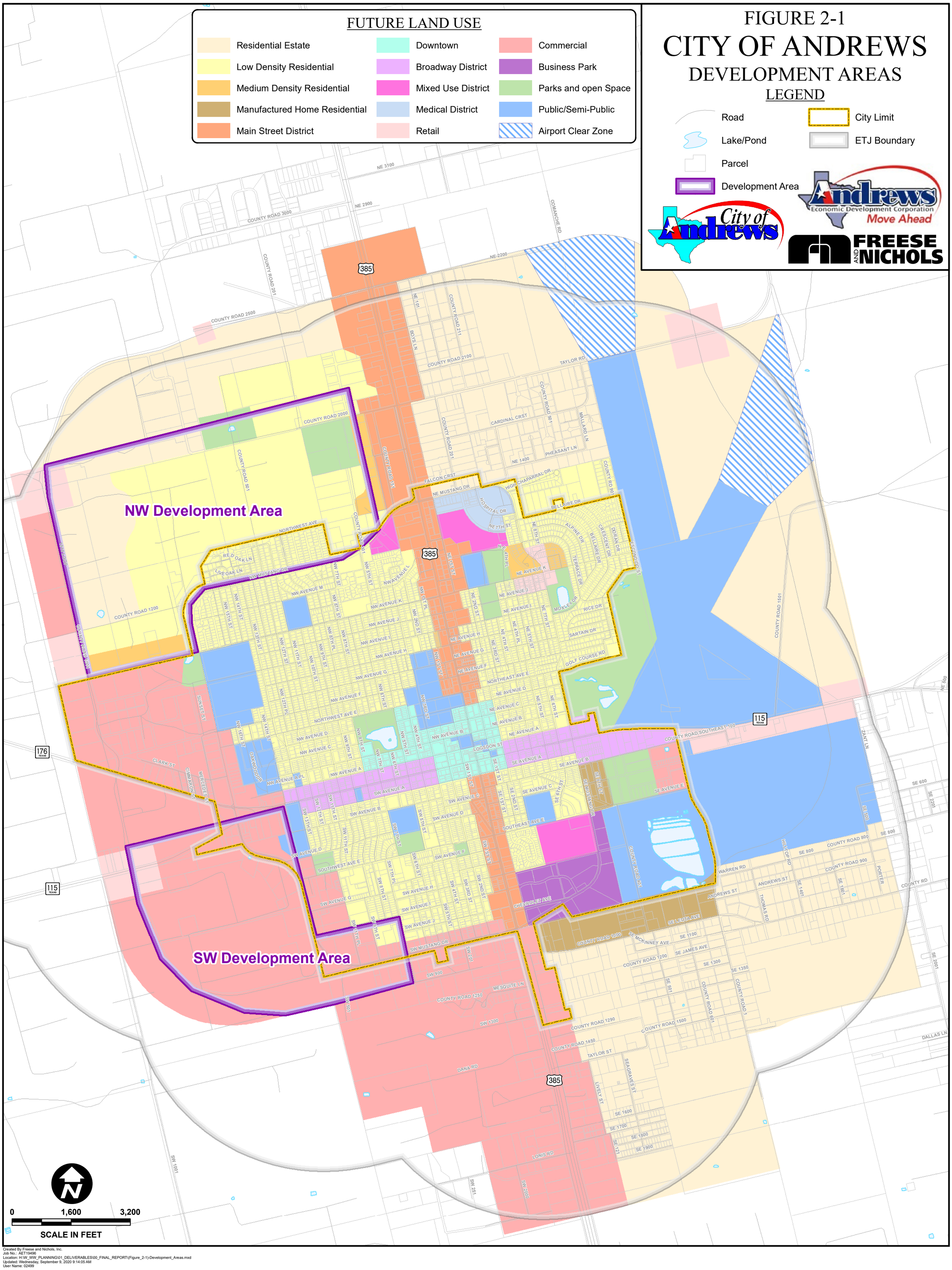
FNI and City staff reviewed the historical population growth rates and information on several planned developments to establish the population and non-residential projections and an average annual growth rate of 2.0%.

These projections serve as the basis for determining future water demands and wastewater flows that can predict potential system deficiencies. The magnitude and distribution of the growth in population and non-residential development dictates where future infrastructure is required. It is important to note that projecting future population is challenging, especially for relatively small geographic areas, because it can be difficult to predict the rate and location of development.

Existing and future population and non-residential acreage projections were developed for each Census Block Group (CBG) within the City's ETJ. A CBG is a geographical unit used by the U.S. Census Bureau to collect and tabulate decennial census data. CBGs are formed by streets, roads, railroads, streams, and other bodies of water, other visible physical and cultural features, and the legal boundaries shown on Census Bureau maps. Spatial distribution of the existing non-residential acreage was determined from land use data provided in the City. FNI utilized the future land use plan and information on several planned developments to spatially distribute future population projections.

Figure 2-1 shows the major development areas with respect to the City's Future Land Use Plan from the 2013 *City of Andrews Comprehensive Plan*.

FIGURE 2-1
CITY OF ANDREWS
DEVELOPMENT AREAS



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3.0 WATER DISTRIBUTION SYSTEM ANALYSIS

3.1 Existing Water Distribution System

The City's water service area covers approximately 3,100 acres within Andrews County. The existing water distribution system includes two elevated storage tanks (ESTs), two ground storage tanks (GSTs), and one high service pump station. The City operates in one pressure plane, with a total of 80.70 miles of water lines ranging in diameter from 1-inch to 20-inches. The City also owns and operates one groundwater well field and own the water rights to two additional well fields, which supply water to the high service pump station. A schematic detailing the existing water distribution system obtained from the Texas Commission on Environmental Quality (TCEQ) is included in **Appendix A**. **Table 3-1** presents the City's existing elevated storage facilities. **Table 3-2** presents the City's existing ground storage facilities. **Table 3-3** presents the City's existing pumping facilities. **Table 3-4** presents the City's existing groundwater well fields.

Table 3-1: Existing Elevated Storage Facilities

Facility	Capacity (MG)
Central EST	0.50
West	0.50
Total Elevated Storage	**1.00**

Table 3-2: Existing Ground Storage Facilities

Facility	Capacity (MG)
Water Plant #1	1.40
Water Plant #2	1.40
Total Ground Storage	**2.80**

Table 3-3: Existing Pumping Facilities

Pump Station	No. of Pumps	Firm Capacity (gpm)	Total Capacity (gpm)
Water Plant High Service PS	4	4,500	7,300
Total Pumping Capacity		**4,500**	**7,300**

Table 3-4: Existing Groundwater Well Fields

Well Field	No. of Wells	Firm Capacity (gpm)	Total Capacity (gpm)
Florey Field	9	2,405	3,005
University Field	10	4,180	4,880
DCP Field	2	324	704
Total Well Capacity		**6,909**	**8,589**

The existing water distribution system, including facilities, is shown on **Figure 3-1**.

FIGURE 3-1
CITY OF ANDREWS
EXISTING WATER SYSTEM
LEGEND

- Hydrant
- Elevated Storage Tank
- Ground Storage Tank
- Pump Station (PS)
- Water Plant (WTP)
- 8" and Smaller Water Line
- 10" and Larger Water Line
- Road
- Lake/Pond
- Parcel
- Andrews County Airport
- City Limit
- ETJ Boundary

Andrews Water Plant
Total Pumping Capacity: 7,300 gpm
(1) - 600 gpm Pump
(1) - 1,400 gpm Pump
(1) - 2,500 gpm Pump
(1) - 2,800 gpm Pump
(2) - 1.4 MGD Ground Storage Tanks

0.5 MG Central
Elevated Storage Tank

0.5 MG West
Elevated Storage Tank

Andrews County Airport

0 1,400 2,800
SCALE IN FEET

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3.2 Water Demands

A water utility must be able to supply water at rates that fluctuate over a wide range. Yearly, monthly, daily, and hourly variations in water use occur, with higher use during dry years and in hot months. Rates most important to the hydraulic design and operation of a distribution system are average day, maximum day, and peak hour. Average day use is the total annual water use divided by the number of days in the year. The average day rate is used as a basis for estimating maximum day and peak hour demands. Maximum day demand is the maximum quantity of water used on any one day of the year. Pumping facilities are typically designed based on the maximum day rate. Peak hour use is the peak rate at which water is required during any one hour of the year. Since minimum distribution pressures are usually experienced during peak hour, the sizes and locations of distribution facilities are generally determined based on this condition.

3.2.1 Historical Water Demands

The City provided historical average daily and maximum daily pumping volumes from 2014 to 2019. Historical average day usage, maximum day usage, maximum day peaking factors, and overall per capita usage are summarized in **Table 3-5**.

Table 3-5: Historical Water Demands

Year	Overall Population	Overall Avg. Day Demand (MGD)	Overall Avg. Day Per Capita (gpcd)	Overall Max. Day Demand (MGD)	Overall Max. Day/Avg. Day Ratio
2014	13,198	2.20	166	--	--
2015	13,765	2.13	155	--	--
2016	13,548	2.22	164	4.33	1.95
2017	13,400	2.36	176	4.21	1.78
2018	13,762	2.66	193	4.16	1.56
2019*	14,109	2.51	178	4.07	1.62
	Average**	**2.31**	**171**	**4.23**	**1.77**

* 2019 Data through July 2019.
**Average values do not include 2019 data.

Historical per-capitas over the past 5+ years range from 155 gallons per capita per day (gpcd) to 193 gpcd with an average of 171 gpcd. The average day to maximum day peaking factor ranges from 1.56 to 1.95 with an average value of 1.77.

3.2.2 Projected Water Demands

The evaluation of the historical data in **Table 3-5** provided the basis for determining the design criteria used to project water demands. When determining water demand design criteria, it is necessary to look at dry years and hot months when water usage is generally high. FNI determined that an overall water per capita usage of 180 gpcd should be maintained for future planning periods. An overall average day to maximum day peaking factor of 1.75 is recommended based on the historical data. TCEQ states that a maximum day to peak hour peaking factor of 1.25 must be used where historical verified data is not present and the utility meets the minimum requirements for elevated storage capacity (which the City currently does). **Table 3-6** summarizes the design criteria used to project water demands. **Table 3-7** summarizes the total system wide projected water demands for the next 5, 10, and 20-years.

Table 3-6: Water Demand Design Criteria

Overall Average Day Water Per Capita Usage (gpcd)	Maximum Day to Average Day Peaking Factor	Peak Hour to Maximum Day Peaking Factor
180	1.80	1.25

Table 3-7: Projected Water Demands

Year	Overall Population*	Overall Avg. Day Demand (MGD)	Overall Avg. Day Per Capita (gpcd)	Overall Max. Day/Avg. Day Ratio	Overall Max. Day Demand (MGD)	Overall Peak Hour/Max. Day Ratio	Overall Peak Hour Demand (MGD)
2020	14,391	2.59	180	1.75	4.53	1.25	5.67
2025	15,889	2.86	180	1.75	5.01	1.25	6.26
2030	17,543	3.16	180	1.75	5.53	1.25	6.91
2040	21,385	3.85	180	1.75	6.74	1.25	8.42

* Assumes a 2.0% Annual Growth Rate from the *City of Andrews Comprehensive Plan*

3.3 Water TCEQ Regulatory Requirement Compliance

In order to properly plan and provide water service for future planning periods, it is necessary to know how much water is needed for storage and distribution. According to *TCEQ Drinking Water Watch* information, the City had an estimated 5,371 service connections in 2019. A people per connection of 2.63 was calculated utilizing the 2019 population of 14,109. The future estimated connections for the City of Andrews based on this ratio is summarized on **Table 3-8**.

Table 3-8: Estimated Connection Projections

Planning Year	Population	Connections
2020	14,391	5,472
2025	15,889	6,041
2030	17,543	6,670
2040	21,385	8,131

The City is required to meet the TCEQ minimum elevated storage capacity requirement of 100 gallons per connection, and the total storage (elevated and ground) requirement of 200 gallons per connection. The TCEQ requirements for pumping capacity are summarized in **Table 3-9**. The amount of elevated storage affects the minimum required TCEQ pumping capacity. Elevated storage capacity equal to or greater than 200 gallons per connection decreases the amount of required pumping to 0.6 gpm per connection.

Table 3-9: TCEQ Service Pumping Requirements

Condition	Service Pumping Capacity Requirement*
≥ 200 gallons per connection of elevated storage	Two service pumps with a minimum combined capacity of 0.6 gpm per connection at each pressure plane.
< 200 gallons per connection of elevated storage	The lesser of (a) or (b):
	(a) Total pumping capacity of 2.0 gpm per connection
	(b) Total capacity of at least 1,000 gpm and the ability to meet peak hourly demands with the largest pump out of service

*Capacity requirement from TAC §290.45(b)(2)(F)

In addition to the required TCEQ criteria, FNI evaluated the water system's pumping and storage capacities against criteria developed by FNI to provide a high level of service for operational needs. These criteria are typically more stringent than TCEQ requirements and take into consideration many additional factors including operational flexibility, fire protection, emergency reserve, and energy efficiency.

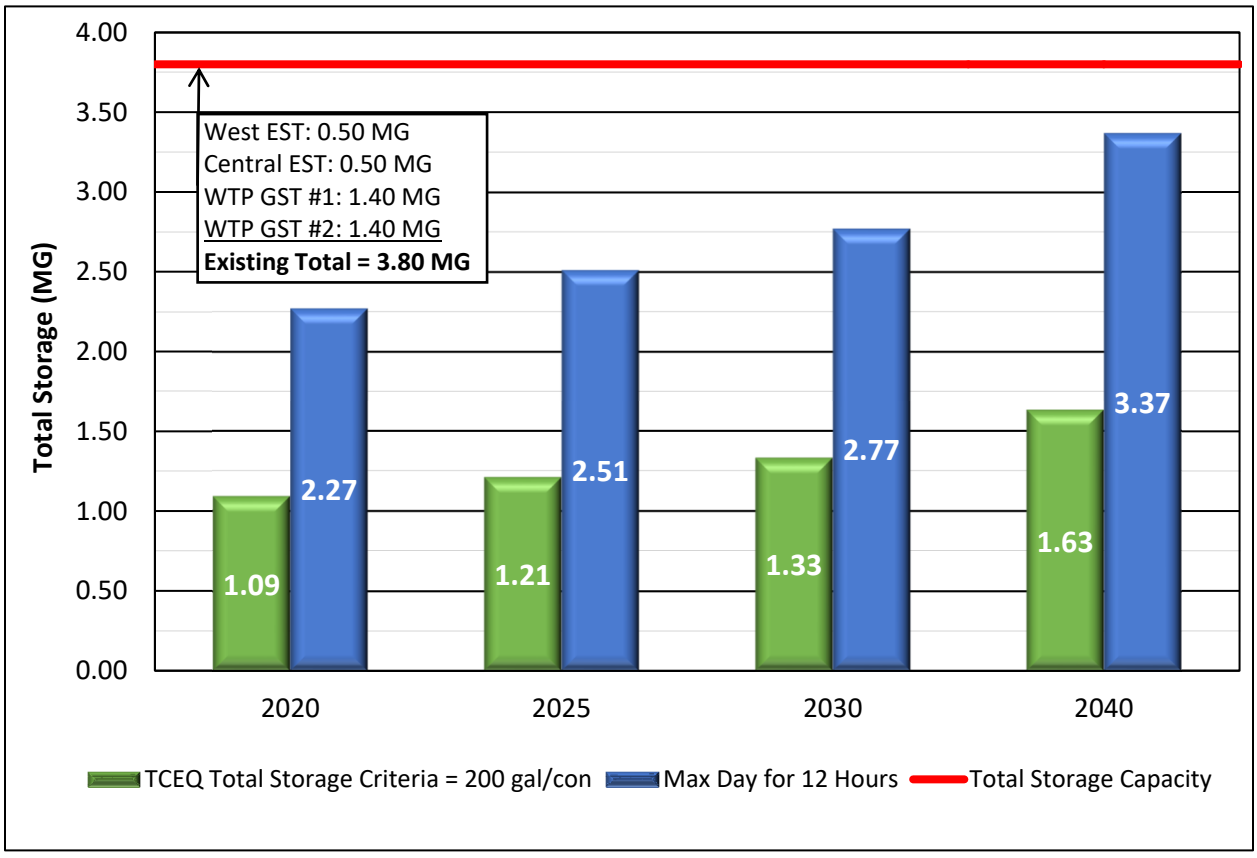
The design criteria for the required total storage tank capacity is providing adequate storage for maximum day demands for 12 hours. The design criteria used to determine the required elevated storage tank capacity is providing adequate storage for the greater of twice the peaking volume (40% of peak hour demands for 4 hours) or the peaking volume plus fire volume (2,000 gpm of fire flow for 4 hours). The design criteria used to determine the required firm pumping capacity is meeting 125% of the maximum day demands. **Table 3-10** summarizes the recommended pumping and storage design criteria.

Table 3-10: FNI Pumping and Storage Design Criteria

Facility	FNI Design Criteria
Total Storage	Maximum day demands for 12 hours.
Elevated Storage	Greater of twice the peaking volume (40% of peak hour demands for 4 hours) or the peaking volume plus fire volume (2,000 gpm of fire flow for 4 hours).
Pumping	125% of maximum day demands.

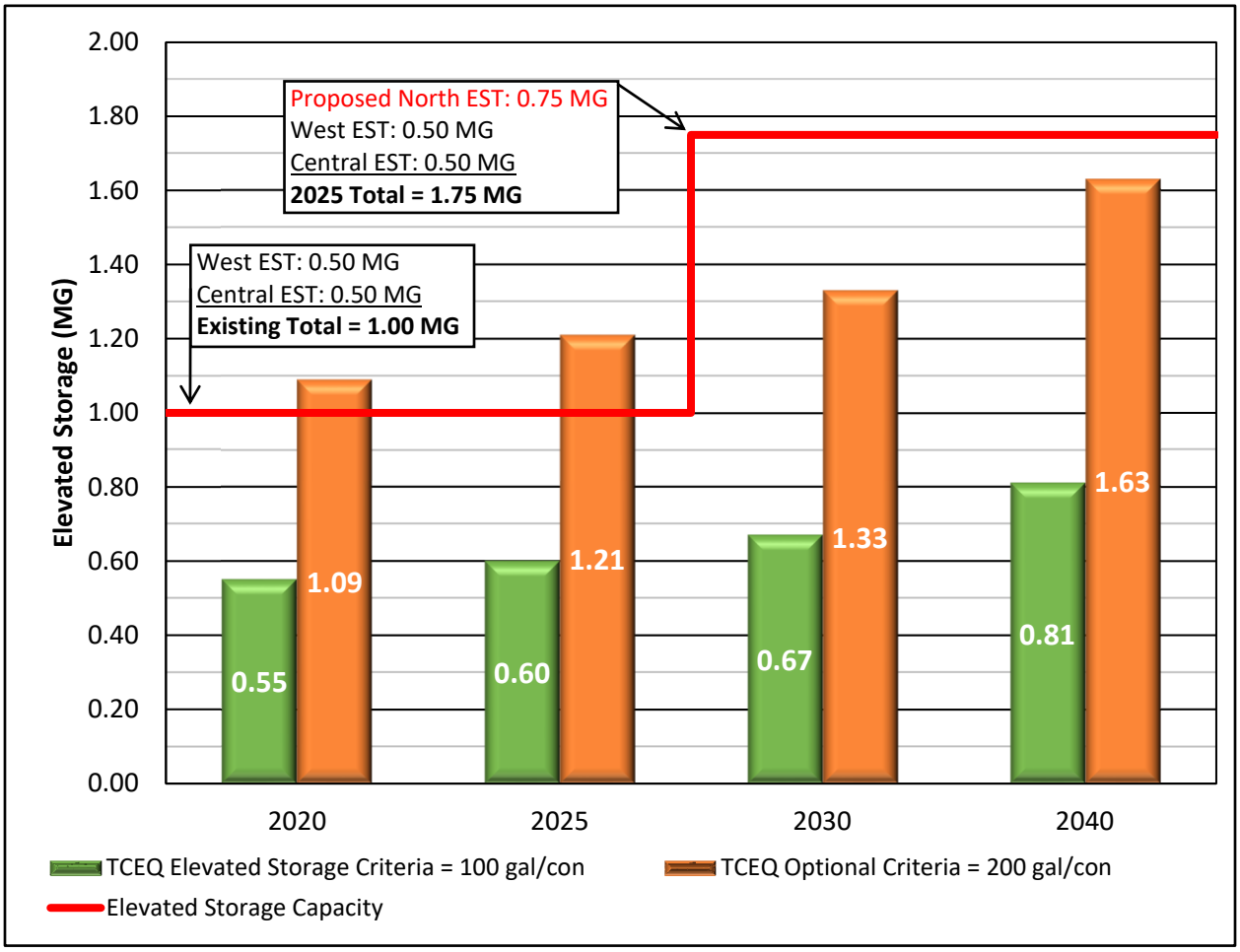
Figures 3-2 through **3-4** show required versus proposed total storage, elevated storage, and pumping capacity for the City's water distribution system. The vertical bars represent the water demand for the planning period, and the horizontal red line is the capacity in the system at the given time. The capacity changes over time with the proposed expansion or decommissioning of facilities in order to meet the design criteria. **Figure 3-2** shows the water system total storage regulatory requirements.

Figure 3-2: Water System Total Storage Regulatory Requirement



From a regulatory perspective, the City of Andrews has enough total storage to meet projected demands through the 20-year planning period. **Figure 3-3** shows the elevated storage regulatory requirements for the City of Andrews.

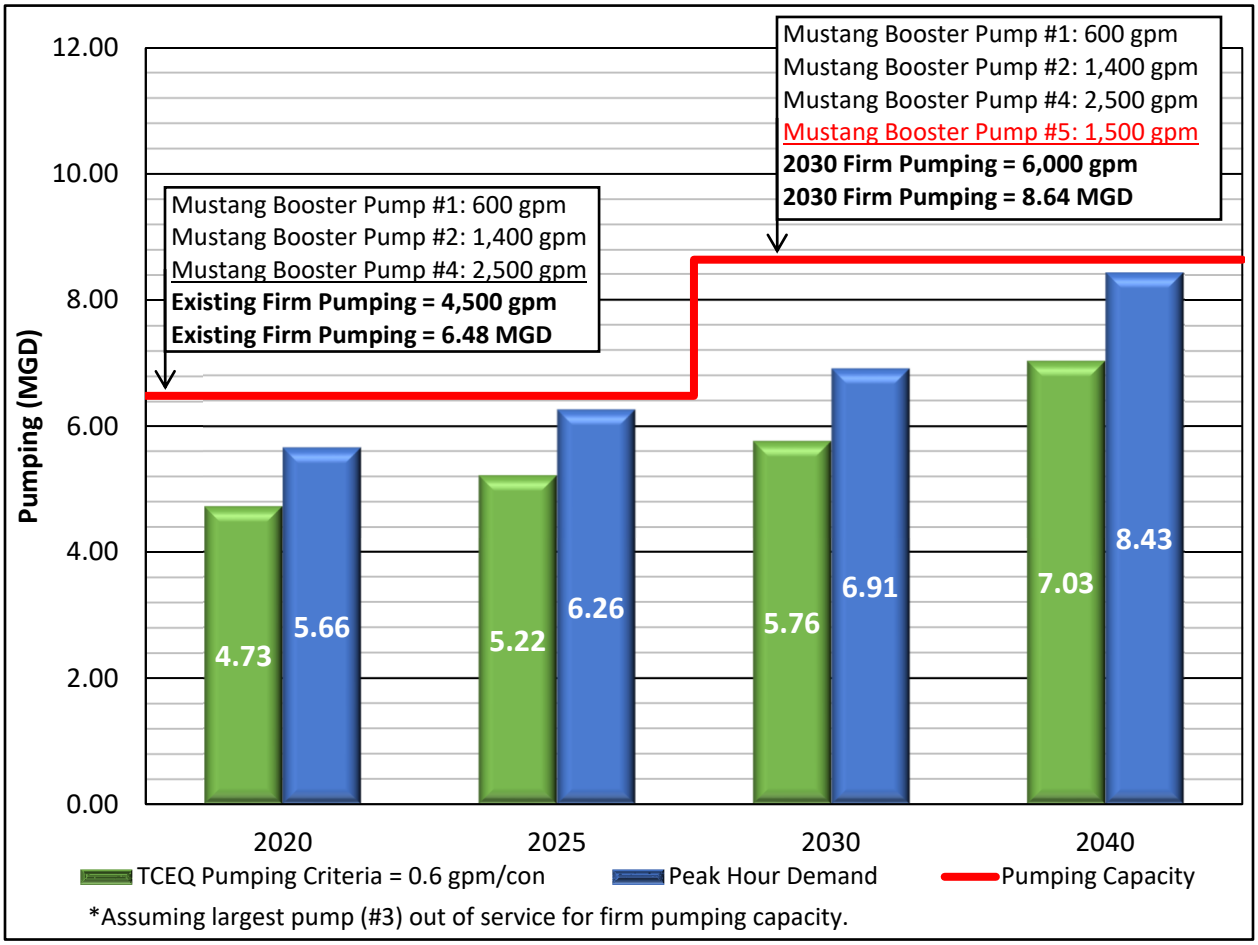
Figure 3-3: Water System Elevated Storage Regulatory Requirement



The City currently meets the required 100 gallons/connection but not the optional 200 gallons/connection illustrated in **Table 3-9**. It is recommended in the future to add elevated storage to meet the optional requirement within the next 10-years. A 0.75 MG elevated tank will provide capacity through the next 20-years and beyond depending on growth and development patterns.

For the pumping capacity evaluation, the City cannot meet the 2.0 gallons/minute/connection which is from the second portion of **Table 3-9**. FNI then looked at requirement (b) which states the total pumping capacity of at least 1,000 gpm and the ability to meet peak hourly demands with the largest pump out of service (firm capacity). **Figure 3-4** shows the pumping capacity regulatory requirements for the City of Andrews.

Figure 3-4: Water System Pumping Capacity Regulatory Requirement



FNI does not recommend any additional pumping improvements for the short-term planning period (0-10 years) as the City meets the pumping criteria of a total capacity of at least 1,000 gpm and the ability to meet peak hourly demands with the largest pump out of service. However, projected growth and development will require an expansion of the City's firm pumping capacity once the number of connections and required capacity exceeds the 6.48 MGD firm pumping capacity. It is recommended to add another 1,500 MGD pump to meet projections through 2040 and beyond.

3.4 Water Distribution System Desktop Analysis

Desktop hydraulic analyses were conducted to identify deficiencies in the City's water distribution system to establish a CIP to reinforce the existing system and meet projected water demands through 2040.

Various combinations of improvements and modifications were investigated to determine the most appropriate approach for meeting projected demands.

Parameters used in developing the CIP included increasing system reliability, simplifying system operations, meeting required fire flows, and maintaining adequate residual pressures. FNI recommends looping dead-end water lines and extending service out to serve new projected growth.

The water distribution system was evaluated to determine which additional transmission lines are needed, and when they should be in service. Water system improvements were developed to accommodate the anticipated growth through 2040. Challenges facing the water system include meeting storage and pumping requirements and extending service to areas of growth in the northwestern and southwestern portions of the City where little or no infrastructure currently exists. The basis for the CIP recommendations is discussed further in **Section 3.6**.

3.5 Water System Risk Based Assessment

FNI developed an RBA program for the City's water distribution system. The goal of the RBA program is to develop a more proactive approach to maintaining the City's water lines through effective rehabilitation and renewal.

An asset's condition is represented by the likelihood of failure (LOF). Condition parameters and scoring are based on a combination of physical and operational data, which are used to develop an estimate of the assumed condition of each line. An asset's criticality is generally defined as the measure of the consequence of failure (COF) of an asset through loss of service, damage, regulatory impact, and/or public impact. Accordingly, social, environmental, and economic parameters should all be used to judge the consequence of asset failure.

Proactive asset rehabilitation and renewal planning requires an understanding of the current and expected future condition of system assets as those assets age and deteriorate over time. Categorizing lines according to their probability of failure (a function of the asset condition) and the potential consequence of failure (a function of the size, type of asset, and location in the system) forms the basis of a risk-based prioritization of asset renewal needs. Thus, asset condition assessment, consequence of failure assessment, and overall risk rating all serve a critical purpose in rehabilitation and inspection program prioritization efforts and overall asset management planning.

3.5.1 Water System Condition Parameters

The condition of the City's water lines was assessed based on their material, age, available work order data, and soil characteristics. At this time, the City does not maintain electronic work order records tied to the asset ID, so work order data was geocoded and assigned to the nearest water line based on the associated address. The condition parameters used for this study include:

- **Material:** based on supplied GIS data
- **Age:** based on supplied GIS data
- **Work Order History:** based on the number of work orders associated with closest water line in proximity
- **Soil Characteristics:** based on the hydrologic group of the soil

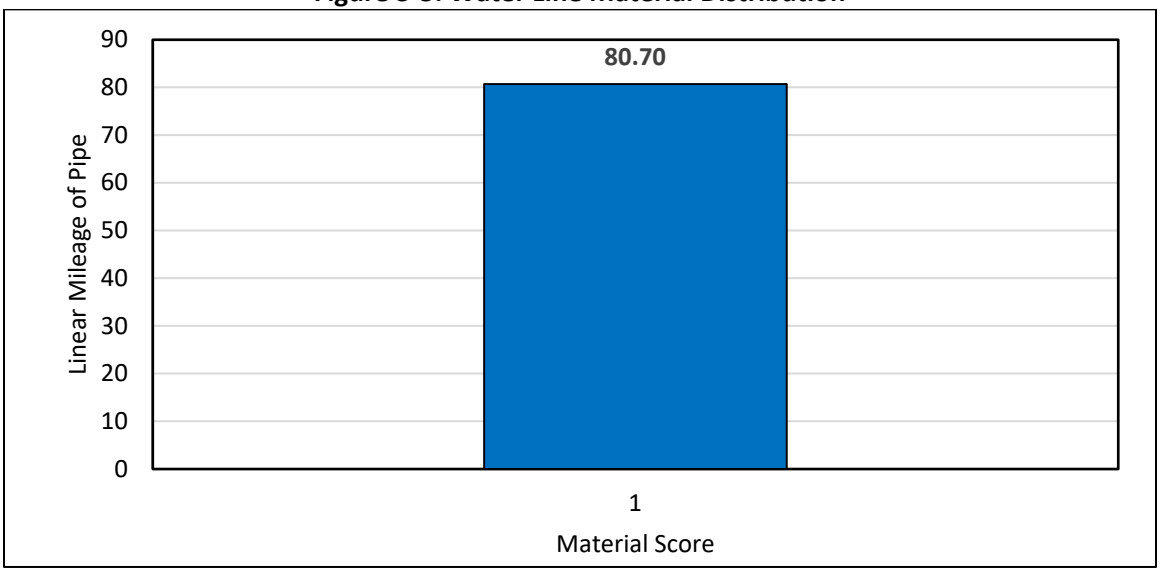
Weighting, criteria, and scoring for each parameter used in the water line condition assessment is presented in **Table 3-11**. A series of charts summarizing the water line condition assessment were developed for each parameter. The higher the score, the higher the likelihood of failure of the asset.

Table 3-11: Water Line Condition Assessment Parameters

Parameter	Weight	Category	Score
Pipe Material	40%	Asbestos Cement (A.C.)	10
		Cast Iron (C.I.) / Unknown	8
		Ductile Iron (D.I.)	6
		Concrete	4
		Copper / Steel	3
		P.V.C / H.D.P.E.	1
Pipe Age	30%	Older than 50 years	10
		41 – 50 years / Unknown	8
		31 – 40 years	6
		21 – 30 years	4
		0 – 20 years	2
Work Order History	20%	4 or more Work Orders	10
		3 Work Orders	7
		2 Work Orders	5
		1 Work Order	3
		No Work Orders	1
Soil Characteristics	10%	Hydro Group Code D	10
		Hydro Group Code C	7
		Hydro Group Code B	3
		Hydro Group Code A	1

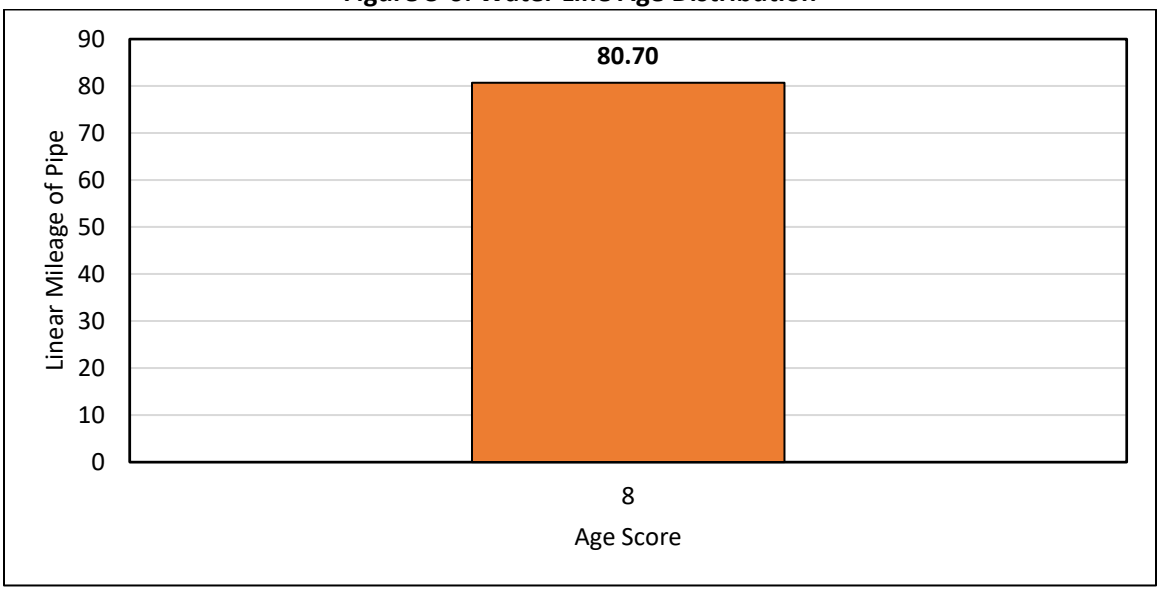
Water line material score by length is summarized in **Figure 3-5**. This figure shows that all the water system is made of PVC pipe.

Figure 3-5: Water Line Material Distribution



Water line age score by length is summarized in **Figure 3-6**. This figure shows that the water system age is mostly unknown at this time.

Figure 3-6: Water Line Age Distribution



Water line work order data score by length is summarized in **Figure 3-7**. A majority of the distribution system does not have associated work orders, as shown in this figure.

Figure 3-7: Water Line Work Order History Distribution

Water line soil characteristics score by length is summarized in **Figure 3-8**. Most of the distribution system is in Hydro Group B soil. Hydro Group B consists chiefly of silt loam with a moderate infiltration rate and well drained soils. **Table 3-12** summarizes the Hydro Group soil types.

Figure 3-8: Water Line Soil Characteristics Distribution

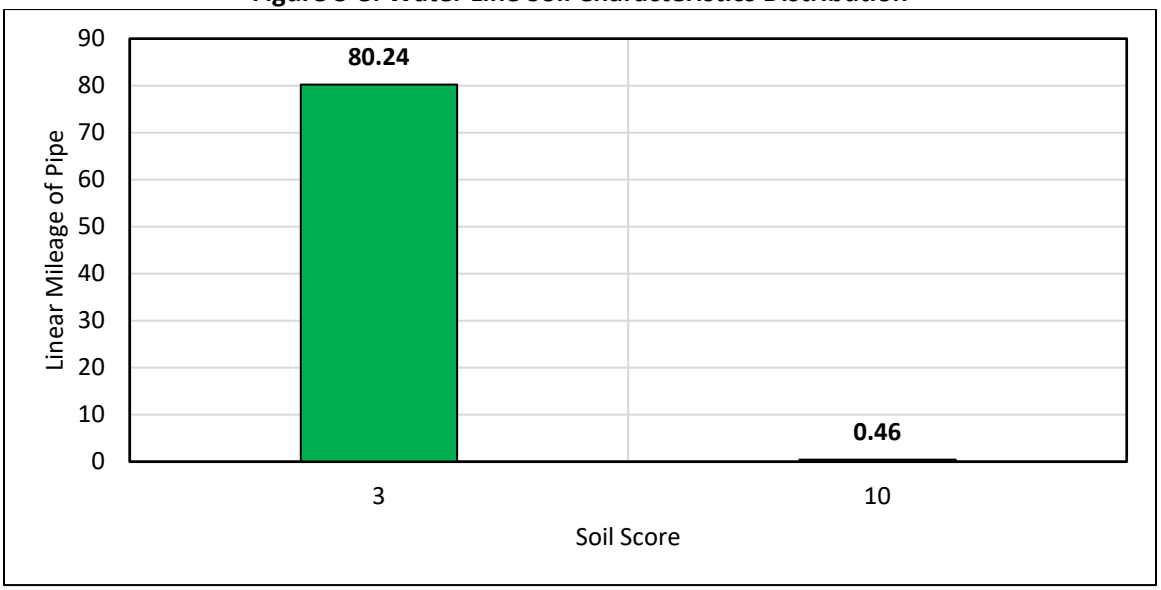


Table 3-12: Hydro Group Soil Descriptions

Hydro Group	Description
Group A (Score 1)	Sand, loamy sand or sandy loam types of soils. This group has low runoff potential and high infiltration rates even when thoroughly wetted. They consist chiefly of deep, well to excessively drained sands or gravels and have a high rate of water transmission.
Group B (Score 3)	Silt loam or loam. This group has a moderate infiltration rate when thoroughly wetted and consists chiefly or moderately deep to deep, moderately well to well drained soils with moderately fine to moderately coarse textures.
Group C (Score 7)	Sandy clay loam. This group has low infiltration rates when thoroughly wetted and consist chiefly of soils with a layer that impedes downward movement of water and soils with moderately fine to fine structure.
Group D (Score 10)	Clay loam, silty clay loam, sandy clay, silty clay, or clay. This group has the highest runoff potential. They have very low infiltration rates when thoroughly wetted and consist chiefly of clay soils with a high swelling potential, soils with a permanent high water table, high corrosivity, soils with a claypan or clay layer at or near the surface and shallow soils over nearly impervious material.

3.5.2 Water System Condition Assessment Results

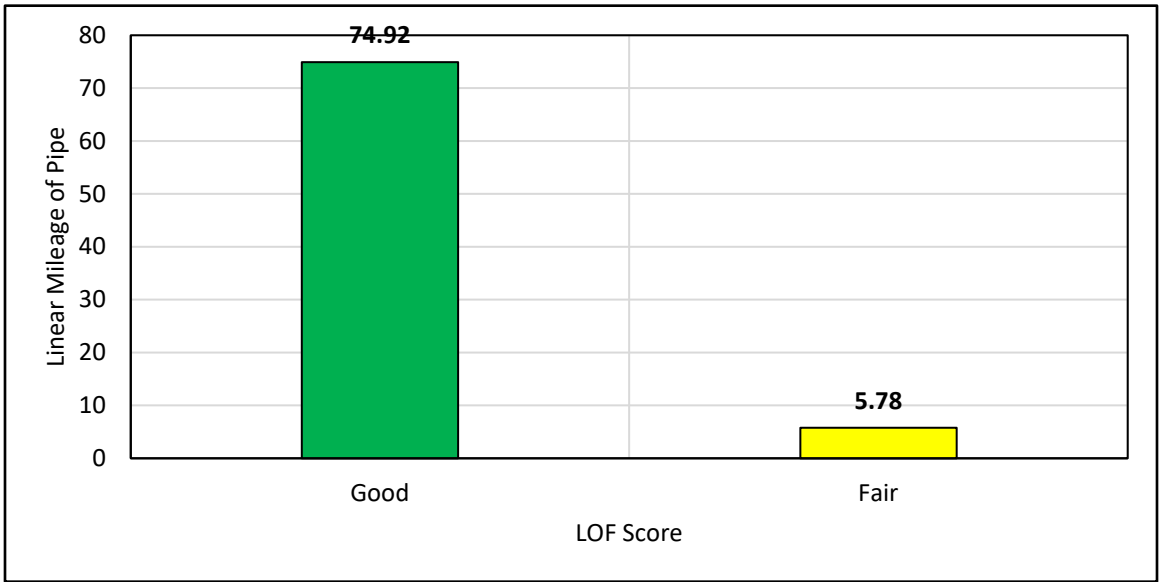
Water line condition scores were calculated for each segment by totaling the weighted individual scores for each parameter to develop a LOF score. The water line condition scores were then grouped into ranges, and qualitative descriptions of Very Good to Very Poor condition were assigned. The definitions for each scoring range are presented in **Table 3-13**. Results of the water line condition assessment are presented in **Figure 3-9**. Mapping of the water system LOF distribution based on the scoring parameters can be found in **Appendix B Figure B-1**.

Based on the weightings and scores, 0.00% of the distribution system is estimated to be in poor or very poor condition. This is most likely due to the unknown age and material scoring from the GIS.

Table 3-13: Water Line LOF Score Range and Results

Total LOF Score	LOF Score Range	Length (mi)	% of System
Very Good	0.0 - 2.0	0.00	0.00%
Good	2.1 - 4.0	74.92	92.84%
Fair	4.1 - 6.0	5.78	7.16%
Poor	6.1 - 8.0	0.00	0.00%
Very Poor	8.1 - 10.0	0.00	0.00%
	Total	**80.70**	**100.00%**

Figure 3-9: Water Line LOF Score Distribution



3.5.3 Water System Criticality Parameters

The criticality of the City's water lines was assessed based on accessibility, customers served, pipe resiliency, critical customers served, and proximity to the Water Treatment Plant (WTP). The criticality parameters used for this study include:

- **Access Issues:** highway, railway, arterial road crossing, and water body crossings based on GIS data
- **Customers Served:** based on the water line diameter
- **Resiliency:** based on water line redundancy (i.e. looped vs. dead-end mains)
- **Critical Customers Served:** defined by number of high profile/critical customers within a 1,000-ft radius
- **Proximity to WTP:** defined by proximity to the WTP within incremental buffers of the pipe (1/8, 1/4, 1/2, 1-mile buffers were used)

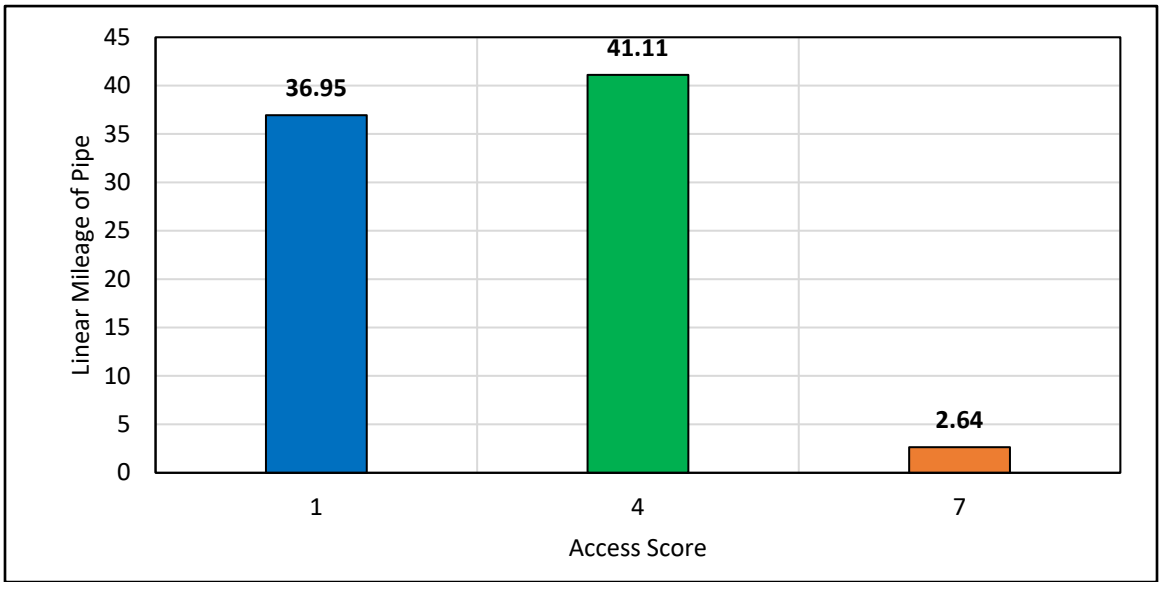
Weighting, criteria, and scoring for each parameter used in the water line criticality assessment are presented in **Table 3-14**. A series of charts summarizing the water line criticality assessment were developed for each parameter. The higher the score, the higher the consequence of failure of the asset. Unlike condition, the criticality of a line rarely changes, as it is based on proximity to certain features or line size.

Table 3-14: Water Line Criticality Assessment Parameters

Parameter	Weight	Category	Score
Access Issues	10%	River/Stream/Railroad	10
		State Highway	7
		Major Collector/Arterial Road	4
		No Crossing	1
Customers Served (Diameter)	20%	Greater than 12-inches	10
		12-inches	8
		10-inches	5
		8-inches	3
		Less than 8-inches	1
Pipe Resiliency	10%	Non-Redundant Pipe	7
		Redundant Pipe	3
Critical Customers Served	30%	4 or more Critical Customers	10
		2 OR 3 Critical Customers	7
		1 Critical Customer	4
		Does Not Serve Critical Customer	1
Proximity to WTP	30%	1/8 Mile	10
		1/4 Mile	7
		1/2 Mile	4
		1 Mile	2
		Not in Proximity to WTP	1

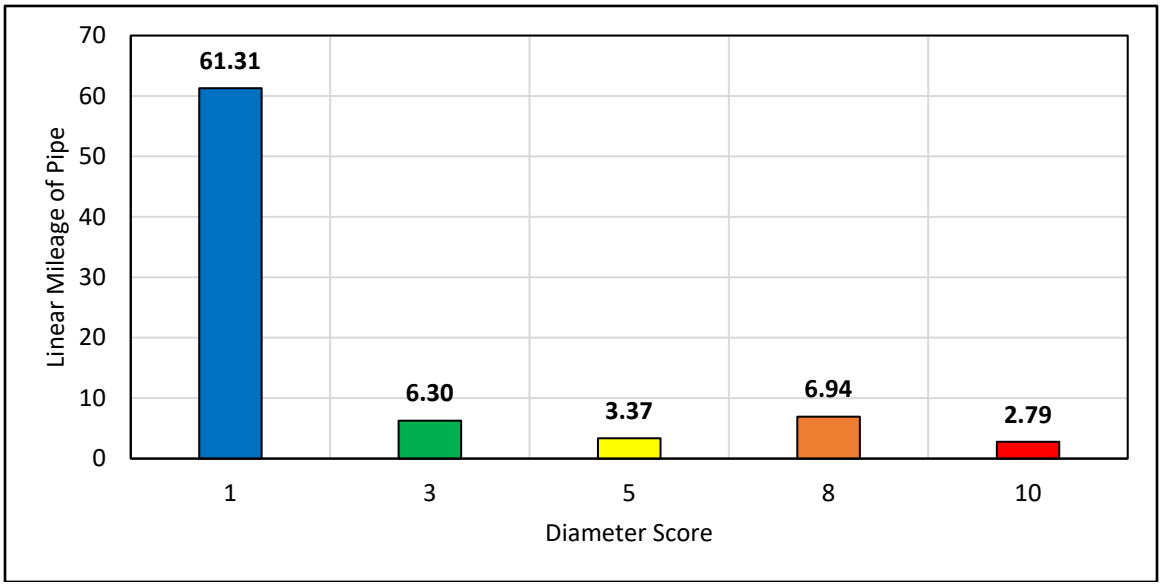
Water line accessibility score by length is presented in **Figure 3-10**. Most of the distribution system either does not have any access issues or is located in minor streets. However, a number of water lines cross or are near main highways such as SH 115 and US 385 that may represent significant access issues.

Figure 3-10: Water Line Access Issues Distribution



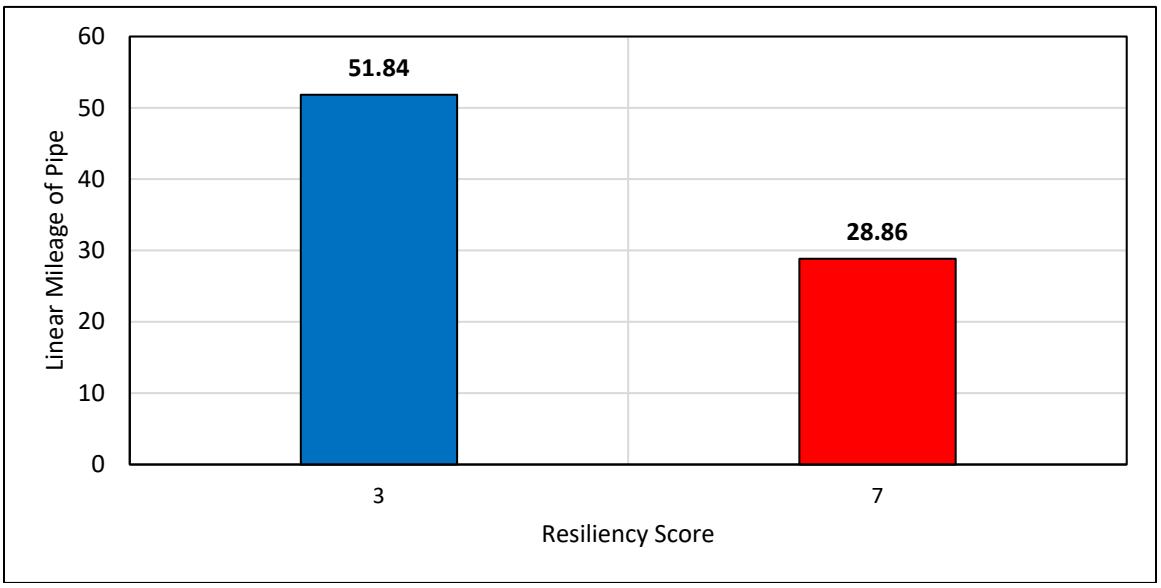
Water line population served score by length is presented in **Figure 3-11**. Most of the distribution system is made of lines smaller than 8-inches. The larger diameter pipes can be observed near the Andrews Water Treatment Plant.

Figure 3-11: Water Line Customers Served Distribution



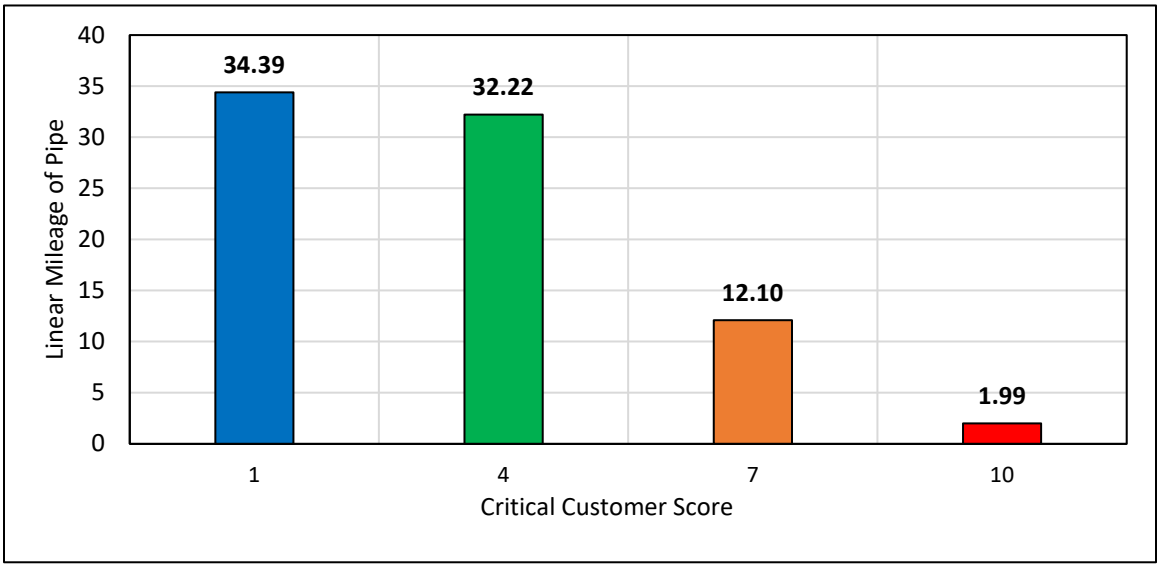
Water line resiliency score by length is presented in **Figure 3-12**. This figure shows that most of the water system is redundant. Approximately 36% of the system is non-redundant.

Figure 3-12: Water Line Resiliency Distribution



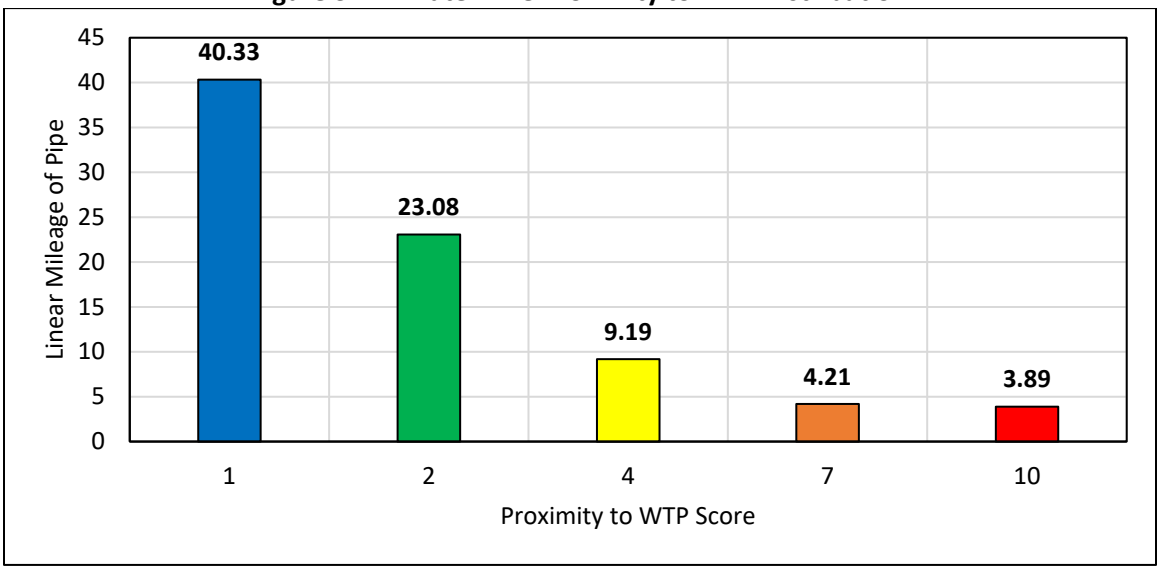
Water line critical customers served score by length is presented in **Figure 3-13**. FNI analyzed critical customer proximity to determine the number of critical customers within 1,000-ft radius of a water line. Critical customers considered include the Andrews County Airport, Andrews ISD campuses, medical buildings, municipal buildings, police buildings , the WTP, and the WRP. Most of the higher scoring pipes are observed near the middle of the water system where many critical customers are centered.

Figure 3-13: Water Line Critical Customers Proximity Distribution



Water line proximity to WTP score by length is presented in **Figure 3-14**. Higher pipe criticality is observed near the WTP in the northeast portion of the system and criticality reduces towards the southwest portion of the system.

Figure 3-14: Water Line Proximity to WTP Distribution



3.5.4 Water System Criticality Assessment Results

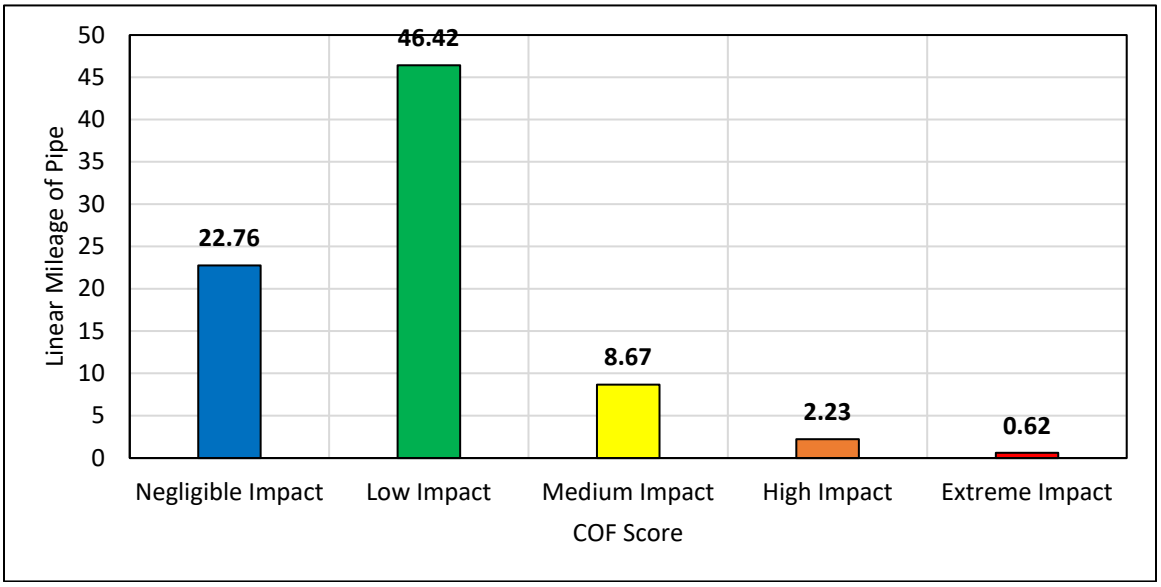
Water line criticality scores were calculated for each line segment by totaling the weighted individual scores for each parameter to develop a total COF score. The water line criticality scores were then grouped into ranges, and descriptive scores of Negligible Impact to Extreme Impact were assigned. The definitions for each scoring range are presented in **Table 3-15**. Results of the water line criticality assessment are presented in **Figure 3-15**. Mapping of the water system COF distribution based on the scoring parameters can be found in **Appendix B Figure B-2**.

Based on the weightings and scores, approximately 3.53% of the distribution system is estimated to have a high or extreme consequence of failure. The areas indicating high and extreme consequence of failure are the lines primarily located near the WTP.

Table 3-15: Water Line COF Score Range and Results

Total COF Score	COF Score Range	Length (mi)	% of System
Negligible Impact	0.0 - 2.0	22.76	28.20%
Low Impact	2.1 - 4.0	46.42	57.52%
Medium Impact	4.1 - 6.0	8.67	10.75%
High Impact	6.1 - 8.0	2.23	2.76%
Extreme Impact	8.1 - 10.0	0.62	0.77%
	Total	**80.70**	**100.00%**

Figure 3-15: Water Line COF Score Distribution



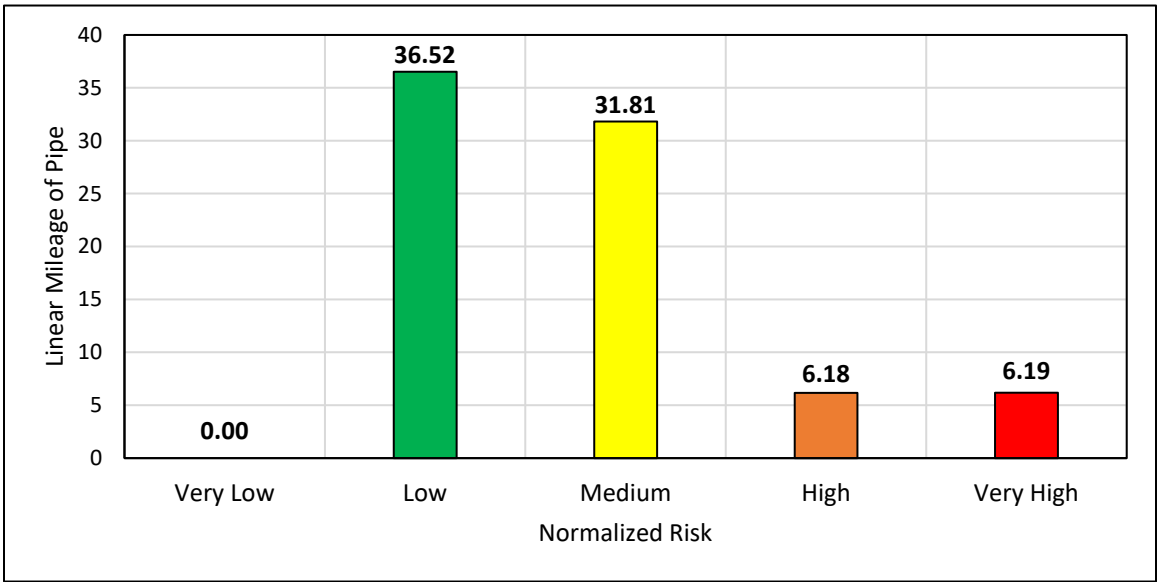
3.5.5 Water System Normalized Risk Score

A total risk score was assigned to each water line by multiplying the total condition (LOF) and criticality (COF) scores. A normalized risk score was assigned to each water line by scaling up the risk scores so that the maximum risk score equals 100. The result is a maximum normalized risk score of 100 with higher scores representing water lines in very poor quality and of extreme criticality. The water line normalized risk scores were then grouped into ranges, and descriptive scores of Very Low to Very High were assigned. The water line RBA results are summarized in **Table 3-16** and displayed on **Figure 3-16**.

Table 3-16: Water Line Normalized Risk Scoring Results

Normalized Risk Grade	Risk Score Range	Length (mi)	% of System
Very Low	0.0 – 10.0	0.00	0.00%
Low	10.1 – 30.0	36.52	45.25%
Medium	30.1 – 50.0	31.81	39.42%
High	50.1 – 70.0	6.18	7.66%
Very High	70.1 - 100.0	6.19	7.67%
	Total	**80.70**	**100.00%**

Figure 3-16: Water Line Normalized Risk Score Distribution



The results of the risk assessment show 45.25% of the water lines to have a risk grade of Low. Conversely, 15.33% of the water lines are scored with a risk grade of High or Very High. Mapping of the water system Total Risk distribution based on the LOF/COF scoring parameters can be found in **Appendix B**, **Figure B-3**.

3.5.6 Water System Risk-Based Recommendations

A renewal CIP was developed for the City of Andrews to maintain the integrity and level of service of the water distribution system. A decision tree was developed in InfoAsset Planner to identify water lines as renewal candidates. The recommended improvements help to mitigate the overall risk of the water distribution system by improving the condition. The decision tree provides a general action for each asset based on the condition and criticality data. The result of the decision tree is a general recommendation and should be refined by an engineering analysis at the time of renewal.

The City of Andrews does not have internal inspection data on the water line assets at this time. In the decision tree, lines with three or more work orders are identified for replacement. Non-standard water lines that are less than 6-inches in diameter are also flagged for replacement. Water lines that are in alleys, have high or very high-risk scores, or are within 0.25 miles of the WTP are flagged for replacement under city initiatives. The results of the decision tree are shown graphically in **Figure 3-17**. The water decision tree which shows how the actions are developed is shown on **Figure 3-18**. The spatial mapping distribution of the renewal actions in the water system can be found in **Appendix B**, **Figure B-4**. A brief description of each decision tree action is included below.

Alleyway Replacement Initiative

These projects consist of replacing the water lines that fall within an alleyway. The alleyway replacement initiative program will allow the City to be proactive in maintaining the condition and capacity of the water system.

Long-Term Renewal Program

These projects call for the replacement of water lines that do not have any other immediate concerns but can be renewed to maintain the capacity and condition of the water system in the long-term.

Medium-Term Renewal Program

These projects consist of replacing the water lines within a 0.25 mile of the WTP. This program will allow the City to renew the lines near the WTP that may experience high corrosion levels.

Short-Term Renewal Program

These projects consist of the replacing the lines that have a normalized risk score of high or greater. This short-term renewal program will allow the City to be proactive in maintaining the condition and capacity of the water system.

Small Diameter Replacement Initiative

These projects consist of the replacement of the water lines that are less than 6-inches in diameter. This small diameter renewal program will allow the City to be proactive in maintaining the condition and capacity of the water system.

Structural Replacement

These projects call for the replacement of the water lines that have three or more work orders. This renewal program will allow the City to address recorded issues in the water system.

Figure 3-17: Water System Renewal Action Summary

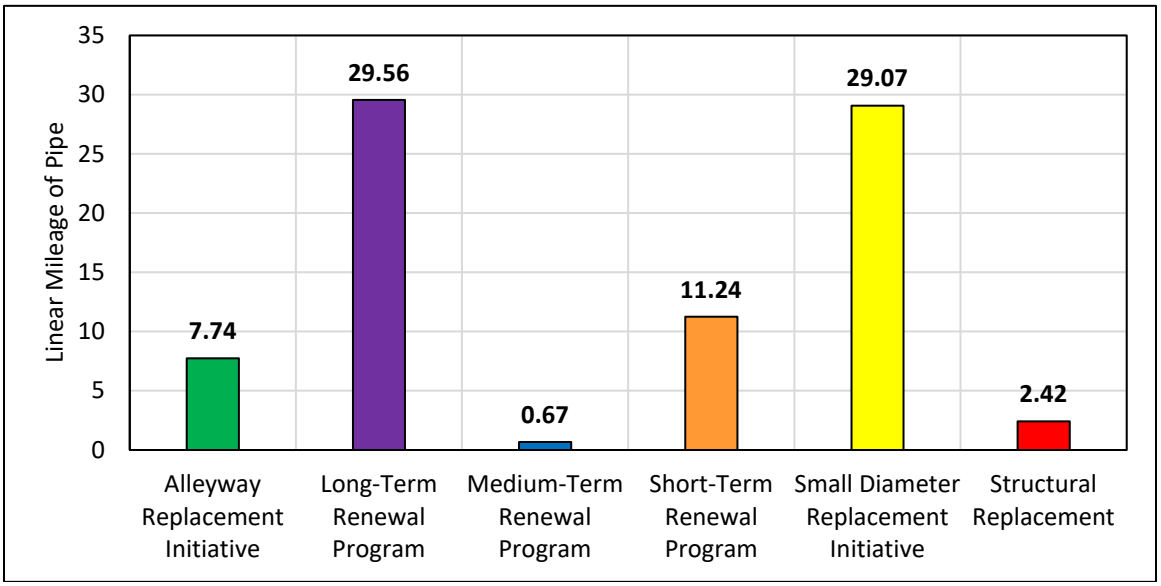
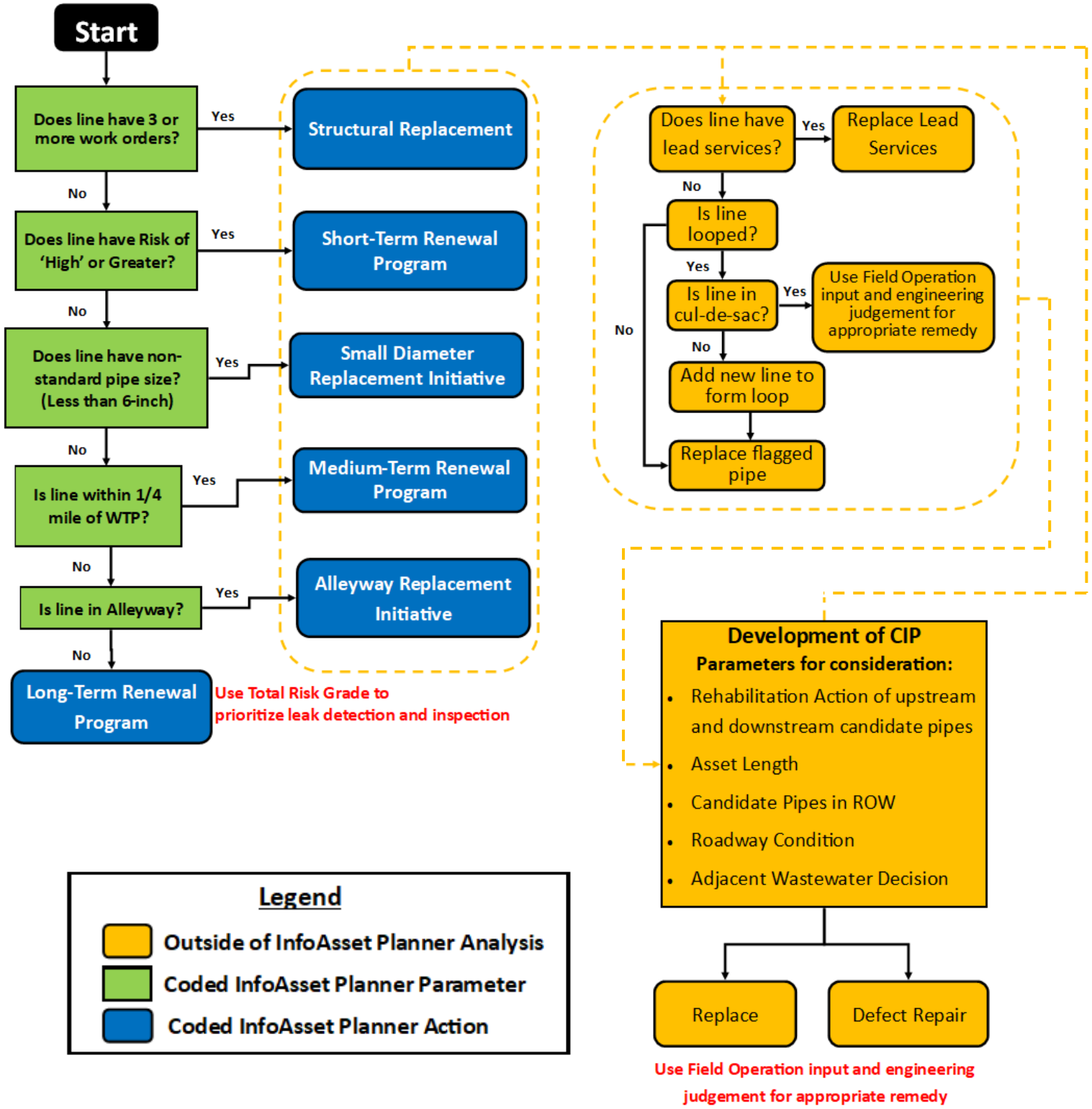


Figure 3-18: Water Line Risk Based Assessment Decision Tree



3.5.7 Water System Renewal Planning Cost Estimates

Industry best practices and organizations typically recommend a utility replace 1 – 2% a year of their existing system in order to maintain and improve distribution system performance and reduce line breaks, fire flow issues, and low pressures. Planning level renewal cost estimates were calculated for each asset. These costs are for planning and budgeting purposes only and are not to be considered as a detailed opinion of probable construction cost. The unit cost for the water line renewal projects was assumed to be $18/dia-inch/LF and does not include allowance for contingency, mobilization, or overhead.

Table 3-17 summarizes the water line costs by type of renewal projects for all risk grades throughout the water distribution system. The water system was separated into 12 zones similar to the wastewater zones to help future project planning and phasing.

Table 3-17: Water Line Renewal Plan Cost Estimates – All Risk Grades

Zone	Decision Tree Action	All Risk Grades		% of System
		Cost ($)	Length (mi)	
1	Alleyway Replacement Initiative	$1,253,600	1.83	2.27%
	Long-Term Renewal Program	$3,425,300	4.58	5.67%
	Small Diameter Replacement Initiative	$1,482,800	2.60	3.22%
	Structural Replacement	$84,800	0.15	0.19%
	Zone 1 Total	**$6,246,500**	**$6,246,500**	**9.16%**
2	Alleyway Replacement Initiative	$494,100	0.73	0.90%
	Long-Term Renewal Program	$1,663,700	2.30	2.85%
	Short-Term Renewal Program	$1,643,000	1.57	1.95%
	Small Diameter Replacement Initiative	$842,700	1.48	1.83%
	Structural Replacement	$50,700	0.09	0.11%
	Zone 2 Total	**$4,694,200**	**$4,694,200**	**6.17%**
3	Alleyway Replacement Initiative	$522,100	0.75	0.93%
	Long-Term Renewal Program	$1,091,300	1.61	1.99%
	Medium-Term Renewal Program	$225,100	0.36	0.45%
	Short-Term Renewal Program	$4,348,500	3.96	4.90%
	Small Diameter Replacement Initiative	$1,254,800	2.20	2.73%
	Zone 3 Total	**$7,441,800**	**$7,441,800**	**8.88%**
4	Alleyway Replacement Initiative	$235,100	0.41	0.51%
	Long-Term Renewal Program	$1,397,900	1.75	2.17%
	Short-Term Renewal Program	$30,900	0.02	0.02%
	Small Diameter Replacement Initiative	$1,582,400	2.77	3.43%
	Structural Replacement	$146,300	0.15	0.19%
	Zone 4 Total	**$3,392,600**	**$3,392,600**	**5.10%**
5	Alleyway Replacement Initiative	$316,600	0.56	0.69%
	Long-Term Renewal Program	$1,460,600	2.23	2.76%
	Short-Term Renewal Program	$30,100	0.16	0.20%
	Small Diameter Replacement Initiative	$2,048,300	3.59	4.45%

Zone	Decision Tree Action	All Risk Grades		% of System
		Cost ($)	Length (mi)	
	Structural Replacement	$336,800	0.59	0.73%
Zone 5 Total		**$4,192,400**	**7.13**	**8.83%**
6	Long-Term Renewal Program	$763,400	1.29	1.60%
	Medium-Term Renewal Program	$180,200	0.32	0.40%
	Short-Term Renewal Program	$1,807,800	2.65	3.28%
	Small Diam Replacement Initiative	$979,900	1.72	2.13%
	Structural Replacement	$483,800	0.85	1.05%
Zone 6 Total		**$4,215,100**	**6.83**	**8.46%**
7	Alleyway Replacement Initiative	$287,900	0.38	0.47%
	Long-Term Renewal Program	$1,490,300	2.39	2.96%
	Small Diam Replacement Initiative	$1,430,700	2.51	3.11%
Zone 7 Total		**$3,208,900**	**5.28**	**6.54%**
8	Alleyway Replacement Initiative	$110,000	0.19	0.24%
	Long-Term Renewal Program	$1,529,100	2.28	2.83%
	Short-Term Renewal Program	$1,227,100	1.65	2.04%
	Small Diam Replacement Initiative	$1,908,700	3.35	4.15%
	Structural Replacement	$147,700	0.19	0.24%
Zone 8 Total		**$4,922,600**	**7.66**	**9.50%**
9	Alleyway Replacement Initiative	$150,800	0.26	0.32%
	Long-Term Renewal Program	$2,059,600	2.73	3.38%
	Short-Term Renewal Program	$815,200	1.23	1.52%
	Small Diam Replacement Initiative	$1,816,700	3.18	3.94%
	Structural Replacement	$31,800	0.06	0.07%
Zone 9 Total		**$4,874,100**	**7.46**	**9.23%**
10	Alleyway Replacement Initiative	$346,800	0.61	0.76%
	Long-Term Renewal Program	$761,900	1.32	1.64%
	Small Diam Replacement Initiative	$1,260,300	2.21	2.74%
Zone 10 Total		**$2,369,000**	**4.14**	**5.14%**
11	Alleyway Replacement Initiative	$372,200	0.65	0.81%
	Long-Term Renewal Program	$1,415,400	2.00	2.48%
	Small Diam Replacement Initiative	$1,493,800	2.62	3.25%
	Structural Replacement	$194,400	0.34	0.42%
Zone 11 Total		**$3,475,800**	**5.61**	**6.96%**
12	Alleyway Replacement Initiative	$828,700	1.36	1.69%
	Long-Term Renewal Program	$4,628,400	5.09	6.31%
	Small Diam Replacement Initiative	$475,000	0.83	1.03%
Zone 12 Total		**$5,932,100**	**7.28**	**9.03%**
Grand Total		**$54,965,100**	**80.70**	**100.00%**

Table 3-18 summarizes the water line costs by type of renewal projects for the "High" and "Very High" risk grades, respectively.

Table 3-18: Water Line Renewal Plan Cost Estimate – High and Very High Risk Grades

Zone	Decision Tree Action	High and Very High-Risk Grades		% of System
		Cost ($)	Length (mi)	
1	Alleyway Replacement Initiative	-	-	-
	Long-Term Renewal Program	-	-	-
	Small Diameter Replacement Initiative	-	-	-
	Structural Replacement	-	-	-
Zone 1 Total		**$0**	**0.00**	**0.00%**
2	Alleyway Replacement Initiative	-	-	-
	Long-Term Renewal Program	-	-	-
	Short-Term Renewal Program	$1,643,000	1.57	1.95%
	Small Diameter Replacement Initiative	-	-	-
	Structural Replacement	-	-	-
Zone 2 Total		**$1,643,000**	**1.57**	**1.95%**
3	Alleyway Replacement Initiative	-	-	-
	Long-Term Renewal Program	-	-	-
	Medium-Term Renewal Program	-	-	-
	Short-Term Renewal Program	$4,348,500	3.96	4.91%
	Small Diameter Replacement Initiative	-	-	-
Zone 3 Total		**$4,348,500**	**3.96**	**4.91%**
4	Alleyway Replacement Initiative	-	-	-
	Long-Term Renewal Program	-	-	-
	Short-Term Renewal Program	$30,900	0.02	0.02%
	Small Diameter Replacement Initiative	-	-	-
	Structural Replacement	$146,300	0.15	0.19%
Zone 4 Total		**$177,200**	**0.17**	**0.21%**
5	Alleyway Replacement Initiative	-	-	-
	Long-Term Renewal Program	-	-	-
	Short-Term Renewal Program	$90,300	0.16	0.20%
	Small Diameter Replacement Initiative	-	-	-
	Structural Replacement	-	-	-
Zone 5 Total		**$90,300**	**0.16**	**0.20%**
6	Long-Term Renewal Program	-	-	-
	Medium-Term Renewal Program	-	-	-
	Short-Term Renewal Program	$1,807,800	2.65	3.28%
	Small Diameter Replacement Initiative	-	-	-
	Structural Replacement	$483,800	0.85	1.05%
Zone 6 Total		**$2,291,600**	**3.50**	**4.34%**
7	Alleyway Replacement Initiative	-	-	-
	Long-Term Renewal Program	-	-	-
	Small Diameter Replacement Initiative	-	-	-
Zone 7 Total		**$0**	**0.00**	**0.00%**
8	Alleyway Replacement Initiative	-	-	-
	Long-Term Renewal Program	-	-	-
	Short-Term Renewal Program	$1,227,100	1.65	2.04%
	Small Diameter Replacement Initiative	-	-	-

Zone	Decision Tree Action	High and Very High-Risk Grades		% of System
		Cost ($)	Length (mi)	
	Structural Replacement	$48,400	0.07	0.09%
	Zone 8 Total	**$1,275,500**	**1.72**	**2.13%**
9	Alleyway Replacement Initiative	-	-	-
	Long-Term Renewal Program	-	-	-
	Short-Term Renewal Program	$815,200	1.23	1.52%
	Small Diameter Replacement Initiative	-	-	-
	Structural Replacement	$31,800	0.06	0.07%
	Zone 9 Total	**$847,000**	**1.29**	**1.60%**
10	Alleyway Replacement Initiative	-	-	-
	Long-Term Renewal Program	-	-	-
	Small Diameter Replacement Initiative	-	-	-
	Zone 10 Total	**$0**	**0.00**	**0.00%**
11	Alleyway Replacement Initiative	-	-	-
	Long-Term Renewal Program	-	-	-
	Small Diameter Replacement Initiative	-	-	-
	Structural Replacement	-	-	-
	Zone 11 Total	**$0**	**0.00**	**0.00%**
12	Alleyway Replacement Initiative	-	-	-
	Long-Term Renewal Program	-	-	-
	Small Diameter Replacement Initiative	-	-	-
	Zone 12 Total	**$0**	**0.00**	**0.00%**
	Grand Total	**$10,673,100**	**12.37**	**15.33%**

3.6 Water Distribution System Capital Improvements Plan

The goal of the capacity CIP is to address existing deficiencies in the system and provide capacity for future demands in the water distribution system. CIP alternatives were analyzed and phased into the planning period in which they become hydraulically necessary. Where existing facilities need to be upgraded, the recommended improvements are sized to meet projected future projected demands.

The recommended projects for the water system capacity CIP are presented on **Figure 3-19**. Locations shown for new lines and other recommended improvements were generalized for hydraulic analyses. Specific alignments and sites will be determined as part of the design process. It is assumed that the proposed improvements are considered replacement water lines, unless otherwise stated. Capital costs were calculated for the recommended improvements. The costs are in 2020 dollars and include an allowance for engineering, surveying, and contingencies. **Table 3-19** summarizes the cost of the water system capacity CIP by planning period for the City. Detailed project descriptions are included in the following sections, and **Appendix C** contains a planning level opinion of probable cost description for each individual project.

FIGURE 3-19
CITY OF ANDREWS
WATER SYSTEM
CAPITAL IMPROVEMENTS PLAN

PROPOSED IMPROVEMENTS

Short-Term Improvements

- Elevated Storage Tank
- Water Line

Long-Term Improvements

- Water Plant
- Water Line

LEGEND

- Hydrant
- Elevated Storage Tank
- Ground Storage Tank
- Pump Station
- Water Plant
- 8" and Smaller Water Line
- 10" and Larger Water Line
- Road
- Lake/Pond
- Parcel
- Andrews County Airport
- City Limit
- ETJ Boundary

0.75 MG North
Elevated Storage Tank

0.5 MG Central
Elevated Storage Tank

0.5 MG West
Elevated Storage Tank

Andrews Water Plant
Total Pumping Capacity: 7,300 gpm
(1) - 600 gpm Pump
(1) - 1,400 gpm Pump
(1) - 2,500 gpm Pump
(1) - 2,800 gpm Pump
(2) - 1.4 MGD Ground Storage Tanks
(1) - 1,500 gpm Pump
Total Pumping Capacity: 8,800 gpm

Project timing is subject to change based on development patterns. The utility alignment shown on this figure are for illustration purposes only and do not set the alignment. The alignment will be determined at the time of engineering design of the utility.

Andrews County Airport

0 1,400 2,800
SCALE IN FEET

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Table 3-19: Water System CIP Cost Summary

Project Number	Water Project Name	Cost ($)
Short-Term Projects		
1	12-inch NW 5th Street and 16-inch Taylor Road Water Line Extension	$ 2,087,100
2	12-inch NW 12th Street and 16-inch NW 2000 Water Line Extension	$ 1,964,500
3	Proposed 0.75 MG North Elevated Storage Tank	$ 3,794,400
4	12-inch NE/NW Avenue E Water Line Replacement	$ 1,605,700
5	12-inch NW Mustang Drive Water Line Extension Phase #2	$ 1,151,200
6	12-inch NW/SW Mustang Drive Water Line Extension Phase #3	$ 1,982,400
7	12-inch SW Avenue E Water Line Extension	$ 2,287,400
	Short-Term Total	**$ 14,872,700**
Long-Term Projects		
8	16-inch Water Treatment Plant Transmission Line Extension	$ 3,958,800
9	Water Treatment Plant High Service Pump Station Expansion	$ 2,421,900
10	12-inch County Road 1500 Water Line Extension	$ 678,800
11	12-inch SW Loop 1910 Water Line Extension Phase #1	$ 1,339,600
12	12-inch SW Loop 1910 Water Line Extension Phase #2	$ 2,125,900
13	12-inch SW Loop 1910 Water Line Extension Phase #3	$ 1,587,700
14	12-inch West Highway 115 Water Line Extension	$ 1,743,200
15	8-inch SW Water Line Extension	$ 915,000
16	8-inch SW 7th Place Water Line Extension	$ 855,200
17	12-inch NW Water Line Extension Phase #1	$ 1,761,200
18	12-inch NW Water Line Extension Phase #2	$ 2,287,400
19	8-inch NW Water Line Extension	$ 879,100
20	8-inch NE 1st Street Water Line Extension	$ 849,200
	Long-Term Total	**$ 21,403,000**
	Grand Total	**$ 36,275,700**

3.6.1 Short-Term Recommended Water System Improvements

The following projects were selected to be part of the short-term CIP because they address existing deficiencies or provide service to new growth areas.

Project #1: 12-inch NW 5th Street and 16-inch Taylor Road Water Line Extension

This project consists of extending a 12-inch water line from the existing 12-inch water line along NW Mustang Drive to the proposed 16-inch water line along NW 2000. This project also consists of extending a 16-inch line from the proposed 16-inch water line along NW 2000 to the existing 12-inch water line near the intersection of Northeast 2000 and Boys Lane. This project will extend water service to future

development in the northwest portion of the City. Specific timing of improvements are subject to change based on how development occurs.

Project #2: 12-inch NW 12th Street and 16-inch NW 2000 Water Line Extension

This project consists of extending a 12-inch water line from the existing 10-inch water line along NW Avenue O to the intersection of County Road 501 and NW 2000. This project also consists of extending a 16-inch water line from the intersection of County Road 501 and NW 2000 to the proposed 16-inch water line along NW 2000. This project will extend water service to future development in the northwest portion of the City. Specific timing of improvements are subject to change based on how development occurs.

Project #3: Proposed 0.75 MG North Elevated Storage Tank

This project consists of a new 0.75 MG elevated storage tank near the intersection of NW 2nd St and NW 1500. This project also consists of extending a 12-inch water line from the proposed elevated storage tank to the proposed 12-inch water line along NW 5th Street. This project will expand the City's elevated storage capacity to meet the TCEQ elevated storage requirement of having at least 200 gallons per connection of elevated storage.

Project #4: 12-inch NE/NW Avenue E Water Line Replacement

This project consists of replacing the existing 8-inch water line along NW Avenue E with a 12-inch water line from the existing 12-inch water line at the intersection of NW Avenue E and Mustang Drive to the existing 12-inch water line at the intersection of NE Avenue E and 3rd Street. This project will provide additional transmission capacity to serve existing customers and future growth in the southwest portion of the City.

Project #5: 12-inch NW Mustang Drive Water Line Extension Phase #2

This project consists of extending a 12-inch water line along Mustang Drive from the existing 12-inch water line at the intersection of NW Mustang Drive and NW Avenue K to the existing 12-inch water line at the intersection of NW Mustang Drive and NW Avenue E. This project will provide additional transmission capacity to serve existing customers and future growth in the southwest portion of the City.

Project #6: 12-inch NW/SW Mustang Drive Water Line Extension Phase #3

This project consists of extending a 12-inch water line along Mustang Drive from the existing 12-inch water line at the intersection of NW Mustang Drive and NW Avenue E to the proposed 12-inch water line at the intersection of SW Mustang Drive and SW Avenue E. This project will provide additional transmission capacity to serve existing customers and future growth in the southwest portion of the City.

Project #7: 12-inch SW Avenue E Water Line Extension

This project consists of extending a 12-inch water line along SW Avenue from the proposed 12-inch water line at the intersection of SW Avenue E and SW Mustang Drive to the existing 12-inch water line at the intersection of SW Avenue E and U.S. Highway 385. This project will provide additional transmission capacity to serve existing customers and future growth in the southwest portion of the City.

3.6.2 Long-Term Recommended Water System Improvements

The following projects were selected to be part of the long-term CIP because they address projected future deficiencies or provide service to new growth areas.

Project #8: 16-inch Water Treatment Plant Transmission Line Extension

This project consists of extending a 16-inch water line from the Water Treatment Plant to the existing 12-inch water line near the intersection of Boys Lane and NE 2000. This project will provide additional transmission capacity to serve existing customers and future growth in the northwest portion of the City.

Project #9: Water Treatment Plant High Service Pump Station Expansion

This project consists of expanding the pumping capacity of the Water Treatment Plant High Service Pump Station to a total pumping capacity of 8,800 gpm. This project will expand the City's pumping capacity to meet the TCEQ pumping requirement of having a firm capacity of at least 0.6 gpm per connection. Based on current demand projections, it is anticipated the City will need this pump station expansion near the end of the 10-year planning period (2030). Specific timing of these improvements are subject to change based on how development occurs.

Project #10: 12-inch County Road 1500 Water Line Extension

This project consists of extending a 12-inch water line from the proposed North elevated storage tank to the proposed 16-inch water line along NE 2000. This project will provide additional transmission capacity to serve existing customers and future growth in the northwest portion of the City.

Project #11: 12-inch SW Loop 1910 Water Line Extension Phase #1

This project consists of extending a 12-inch water line along SW Loop 1910 from the proposed 12-inch water line at the intersection of SW Loop 1910 and 7th Place to the existing 12-inch water line at the intersection of South U.S. Highway 385 and SW Loop 1910. This project will extend water service to future development in the southwest portion of the City. Specific timing of improvements are subject to change based on how development occurs.

Project #12: 12-inch SW Loop 1910 Water Line Extension Phase #2

This project consists of extending a 12-inch water line along SW Loop 1910 and SW Mustang Drive from the proposed 12-inch water line at the intersection of SW Mustang Drive and SW Avenue E to the proposed 12-inch water line at the intersection of SW Loop 1910 and SW 7th Place. This project will extend water service to future development in the southwest portion of the City. Specific timing of improvements are subject to change based on how development occurs.

Project #13: 12-inch SW Loop 1910 Water Line Extension Phase #3

This project consists of extending a 12-inch water line along Loop 1910 from the proposed 12-inch water line at the intersection of SW Mustang Drive and SW Loop 1910 to approximately 2,000 feet south of West Highway 115. This project will extend water service to future development in the southwest portion of the City. Specific timing of improvements are subject to change based on how development occurs.

Project #14: 12-inch West Highway 115 Water Line Extension

This project consists of extending a 12-inch water line along West Highway 115 from the proposed 12-inch water line at the intersection of SW Mustang Drive and West Highway 115 to approximately 2,000 feet south of Highway 115. This project will extend water service to future development in the southwest portion of the City. Specific timing of improvements are subject to change based on how development occurs.

Project #15: 8-inch SW Water Line Extension

This project consists of extending an 8-inch water line from the proposed 12-inch water line at the intersection of SW Mustang Drive and SW Avenue E to approximately 2,000 feet south of Highway 115. This project will extend water service to future development in the southwest portion of the City. Specific timing of improvements are subject to change based on how development occurs.

Project #16: 8-inch SW 7th Place Water Line Extension

This project consists of extending an 8-inch water line along SW 7th Place from the proposed 12-inch water line at the intersection of SW Avenue and SW 7th Place to the proposed 12-inch water line at the intersection of Loop 1910 and SW 7th Place. This project will provide additional transmission capacity to serve existing customers and future growth in the southwest portion of the City.

Project #17: 12-inch NW Water Line Extension Phase #1

This project consists of extending a 12-inch water line along NW 2000 from the proposed 12-inch water line near the intersection of NW 501 and NW 2000 to NW Loop 1910. This project will extend water service to future development in the northwest portion of the City. Specific timing of improvements are subject to change based on how development occurs.

Project #18: 12-inch NW Water Line Extension Phase #2

This project consists of extending a 12-inch water line along NW 1200 and Loop 1910 from the existing 12-inch water line near the intersection of NW Mustang Drive and NW 1200 to the proposed 12-inch water line at Loop 1910. This project will extend water service to future development in the northwest portion of the City. Specific timing of improvements are subject to change based on how development occurs.

Project #19: 8-inch NW Water Line Extension

This project consists of extending an 8-inch water line between the proposed 12-inch NW Water Line Extensions. This project will extend water service to future development in the northwest portion of the City. Specific timing of improvements are subject to change based on how development occurs.

Project #20: 8-inch NE 1st Street Water Line Extension

This project consists of extending an 8-inch water line along NE 1st Street from the existing 6-inch water line near the intersection of NE 1st Street and NE Avenue K to the existing 12-inch water line at the intersection of NE 1st Street and NE Mustang Drive. This project will provide additional transmission capacity to serve existing customers and future growth in the northwest portion of the City.

4.0 WASTEWATER COLLECTION SYSTEM ANALYSIS

4.1 Existing Wastewater Collection System

The City's wastewater service area covers approximately 3,100 acres within Andrews County. Within the service area, there are approximately 54.48 miles of sewer gravity lines that are owned, maintained, and operated by the City. The wastewater lines range from 4 to 12-inches in diameter and convey an annual average wastewater flow of approximately 1.08 MGD to the City's Water Reclamation Plant (WRP). The City currently owns and operates one WRP in the southeast corner of the City. The City's WRP has an existing permitted average day capacity of 1.6 MGD.

The wastewater collection system is primarily a gravity flow system that follows the major drainage features of the service area. There are currently four lift stations in the wastewater collection system, which pump wastewater flow into gravity sewers. These lift stations are required because of local topographic constraints. The existing wastewater collection system is shown on **Figure 4-1**. Information on the City's WRP Permit can be found in **Appendix D**.

FIGURE 4-1
CITY OF ANDREWS
EXISTING WASTEWATER SYSTEM
LEGEND

- Manhole
- Lift Station
- Water Reclamation Plant
- 8" and Smaller Wastewater Line
- 10" and Larger Wastewater Line
- Force Main
- Road
- Lake/Pond
- Parcel
- Andrews County Airport
- City Limit
- ETJ Boundary

City of Andrews

Andrews Economic Development Corporation — Move Ahead

FREESE AND NICHOLS

Lift Station

Lift Station

Lift Station

Lift Station

8" F.M.

6" F.M.

6" F.M.

City of Andrews
Water Reclamation Plant
Avg. Day Permitted Capacity: 1.60 MGD

WRP

Andrews County Airport

0 1,400 2,800

SCALE IN FEET

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4.2 Wastewater Flows

A wastewater utility must be able to convey wastewater flows that fluctuate due to the effects of rainfall on the wastewater collection system. Average day flow is the total annual wastewater production divided by the number of days in the year. Treatment facilities are typically designed based on the average day flow. Peak wet weather flow is the peak rate at which wastewater is contributed to the collection system during any one hour of the year. Since the highest flow rates are experienced during peak wet weather flows, the sizes and locations of collection system facilities are generally determined based on this condition. To determine locations where future wastewater system improvements are necessary, existing and future wastewater load projections were developed using historical flow data and existing and future population projections.

4.2.1 Historical Wastewater Flows

The City provided historical average daily and maximum daily treated flow rates to the WRP from 2014 to 2019. Historical average day flows, peak day flows, peak day peaking factors, and overall per capita flows are summarized in **Table 4-1**.

Table 4-1: Historical Wastewater Flows

Year	Overall Population	Overall Avg. Day Flow (MGD)	Overall Avg. Day Per Capita (gpcd)	Overall Peak Day Flow (MGD)	Overall Peak Day/Avg. Day Ratio	Annual Recorded Rainfall (inches)*	Annual Wastewater Return Rate
2014	13,198	1.08	82	1.96	1.82	10.53	49%
2015	13,765	1.03	75	1.46	1.42	16.95	48%
2016	13,548	0.96	71	1.60	1.66	14.24	43%
2017	13,400	0.98	73	1.68	1.72	11.69	41%
2018	13,762	1.01	73	1.36	1.35	12.86	38%
2019*	14,037	1.18	84	1.90	1.60	10.26	47%
	Average* **	**1.01**	**75**	**1.55**	**1.58**	**12.76**	**45%**

*Historical Rainfall Data from TWDB TexMesonet website.
** 2019 Data through July. Population is an assumed 2% increase from the 2018 population.
**Average values do not include 2019 data. Once 2019 is complete, the data will be updated and incorporated into the averages.

Historical per-capitas over the past 5+ years range from 71 gpcd to 84 gpcd with an average of 75 gpcd. The peak day to average day peaking factor ranges from 1.35 to 1.82 with an average value of 1.58.

4.2.2 Projected Wastewater Flows

The evaluation of historical data in **Table 4-1** provided a basis for determining the design criteria used to project wastewater flows. Based on the review of this data FNI utilized a citywide overall average day flow per capita of 75 gpcd and a citywide peaking factor of 1.60 to project peak wet weather flows. **Table 4-2** summarizes the design criteria used to project wastewater flows. **Table 4-3** summarize the total system wide projected wastewater flows for the next 5, 10, and 20-years.

Table 4-2: Wastewater Flow Design Criteria

Overall Average Day Wastewater Per Capita Flow (gpcd)	Overall Peak Day/Avg. Day Ratio
180	1.60

Table 4-3: Projection Wastewater Flows

Year	Overall Population*	Overall Avg. Day Flow (MGD)	Overall Peak Day Flow (MGD)
2020	14,391	1.08	1.73
2025	15,889	1.19	1.91
2030	17,543	1.32	2.11
2040	21,385	1.60	2.57

*Assumes a 2.0% Annual Growth Rate from the *City of Andrews Comprehensive Plan*

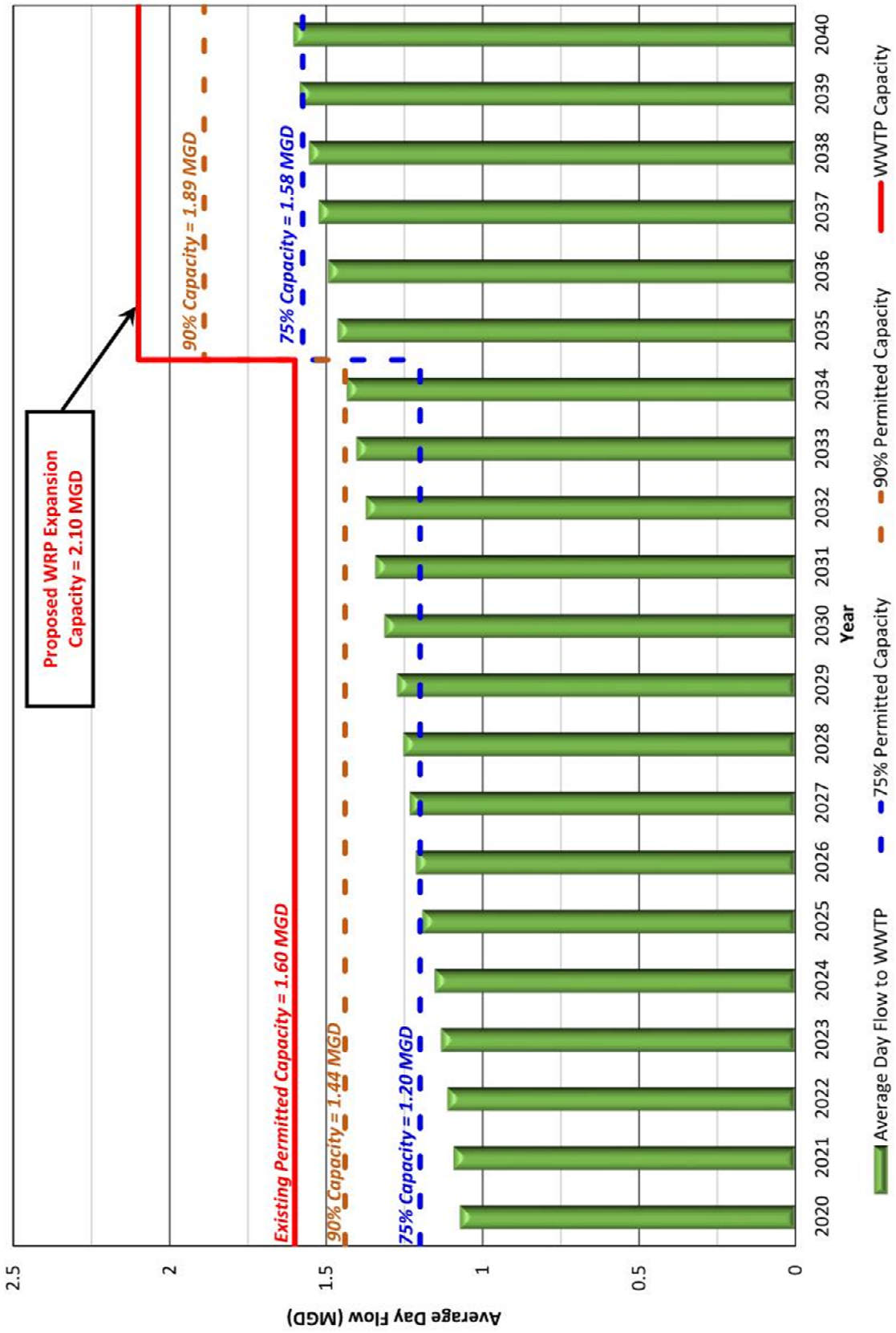
4.3 Wastewater TCEQ Regulatory Requirement Compliance

A major component of a wastewater system is a treatment plant. There is currently one WRP that is owned, maintained, and operated by the City. The capacity of the WRP versus projected flows was evaluated to determine the timing of required capacity improvements.

The basis for the capacity evaluation is the TCEQ 75/90 rule as described further in TCEQ §305.126. If the average daily flow to the WRP exceeds 75% of the permitted capacity for three consecutive months, the utility must begin planning improvements to the WRP. The utility should be constructing improvements to the WRP when average daily flows reach 90% of the permitted capacity for three consecutive months.

Figure 4-2 show the projected average day wastewater flows to the WRP, from **Section 4.2.2**, compared to the capacity of the WRP and the timing of recommended expansions. Based on the projected wastewater flows, the WRP is projected to exceed 90% of capacity in 2035 and 100% of capacity in 2040. Based on these projections, an expansion to a permitted capacity of 2.1 MGD is recommended by 2035.

Figure 4-2: WRP Expansion Planning



4.4 Wastewater Collection System Desktop Analysis

Desktop hydraulic analyses were conducted to identify deficiencies in the City's wastewater collection system to establish a CIP to reinforce the existing system and meet projected wastewater flows through 2040. Various combinations of improvements and modifications were investigated to determine the most appropriate approach for conveying projected flows.

Parameters used in developing the CIP included utilizing natural drainage features to convey projected flows by gravity where possible and increasing downstream wastewater infrastructure capacity to account for upstream growth.

The wastewater collection system was evaluated to determine which additional interceptor lines are needed, and when they should be in service. Wastewater system improvements were developed to accommodate the anticipated growth through 2040. Challenges facing the wastewater system include planning around the major drainage features of the service area and extending service to areas of growth in the NWern and SWern portions of the City where little or no infrastructure currently exists. The basis for the CIP recommendations are discussed further in **Section 4.6**.

4.5 Wastewater System Risk Based Assessment

FNI developed an RBA program for the City's wastewater collection system. The goal of the RBA program is to develop a more proactive approach to maintaining the City's wastewater lines through effective rehabilitation and renewal. FNI conducted a desktop RBA to assign condition and criticality scores to each wastewater gravity line.

4.5.1 Wastewater System Condition Parameters

The condition of the City's wastewater lines was assessed based on their material, age, available work order data, and soil characteristics. At this time, the City does not maintain electronic work order records tied to the asset ID, so work order data was geocoded and assigned to the nearest wastewater line based on the associated address. The condition parameters used for this study include:

- **Material:** based on supplied GIS data
- **Age:** based on supplied GIS data
- **Work Order History:** based on the number of work orders associated with closest wastewater line in proximity
- **Soil Characteristics:** based on the hydrologic group of the soil

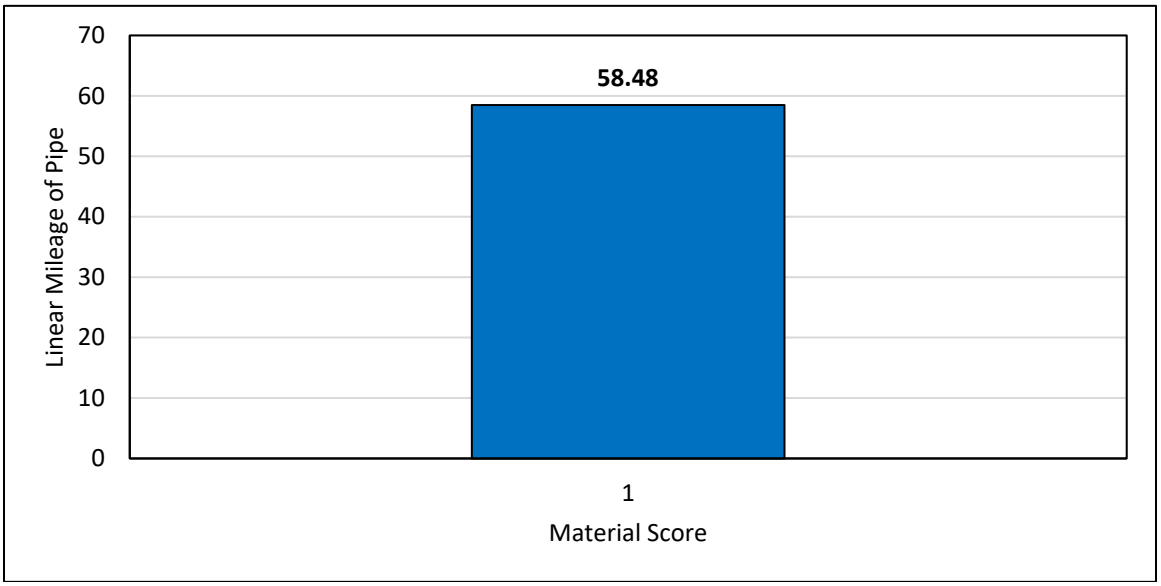
Weighting, criteria and scoring for each parameter used in the wastewater lines condition assessment is presented in **Table 4-4**. A series of charts summarizing the wastewater line condition assessment were developed for each parameter. The higher the score, the higher the likelihood of failure of the asset.

Table 4-4: Wastewater Line Condition Assessment Parameters

Parameter	Weight	Category	Score
Pipe Material	30%	Asbestos Cement (A.C.)	10
		Cast Iron (C.I.) / Unknown	8
		Ductile Iron (D.I.)	6
		Concrete	4
		Copper / Steel	3
		P.V.C / H.D.P.E.	1
Pipe Age	20%	Older than 50 years	10
		41 – 50 years / Unknown	8
		31 – 40 years	6
		21 – 30 years	4
		0 – 20 years	2
Work Order History	40%	4 or more Work Orders	10
		3 Work Orders	7
		2 Work Orders	5
		1 Work Order	3
		No Work Orders	1
Soil Characteristics	10%	Hydro Group Code D	10
		Hydro Group Code C	7
		Hydro Group Code B	3
		Hydro Group Code A	1

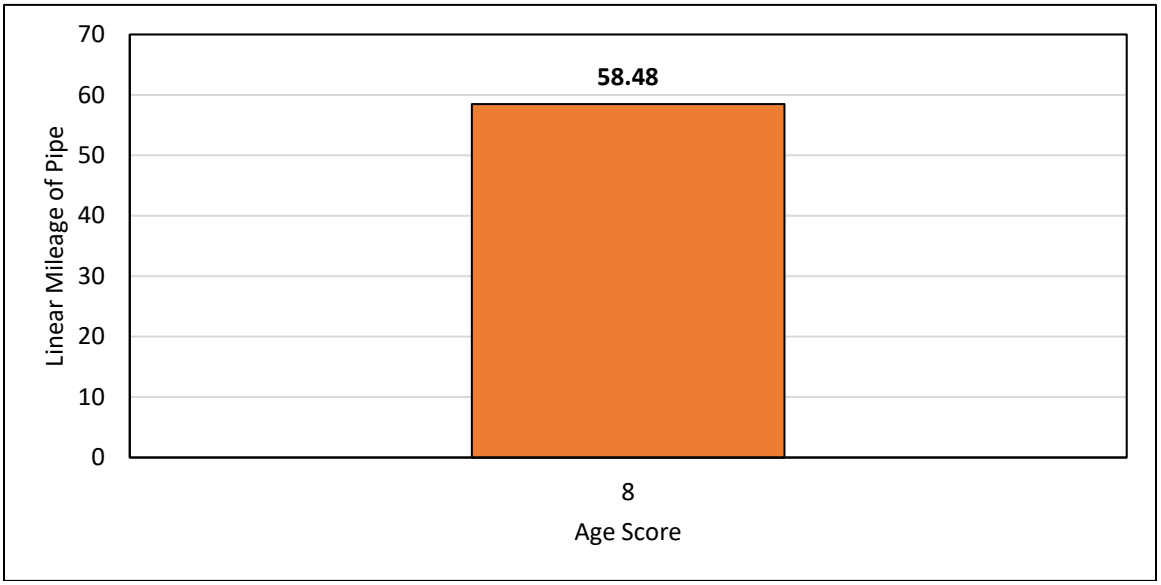
Wastewater line material score by length is summarized in **Figure 4-3**. This figure shows that all the wastewater system is made of PVC pipe.

Figure 4-3: Wastewater Line Material Distribution



Wastewater line age score by length is summarized in **Figure 4-4**. This figure shows that the wastewater system age is mostly unknown at this time.

Figure 4-4: Wastewater Line Age Distribution



Wastewater line work order data score by length is summarized in **Figure 4-5**. A majority of the wastewater system does not have associated work orders, as shown in this figure.

Figure 4-5: Wastewater Line Work Order History Distribution

Wastewater line soil characteristics score by length is summarized in **Figure 4-6**. All of the wastewater system is in Hydro Group B soil. Hydro Group B consists chiefly of silt loam with a moderate infiltration rate and well drained soils. **Table 4-5** summarizes the Hydro Group soil types.

Figure 4-6: Wastewater Line Soil Characteristics Distribution

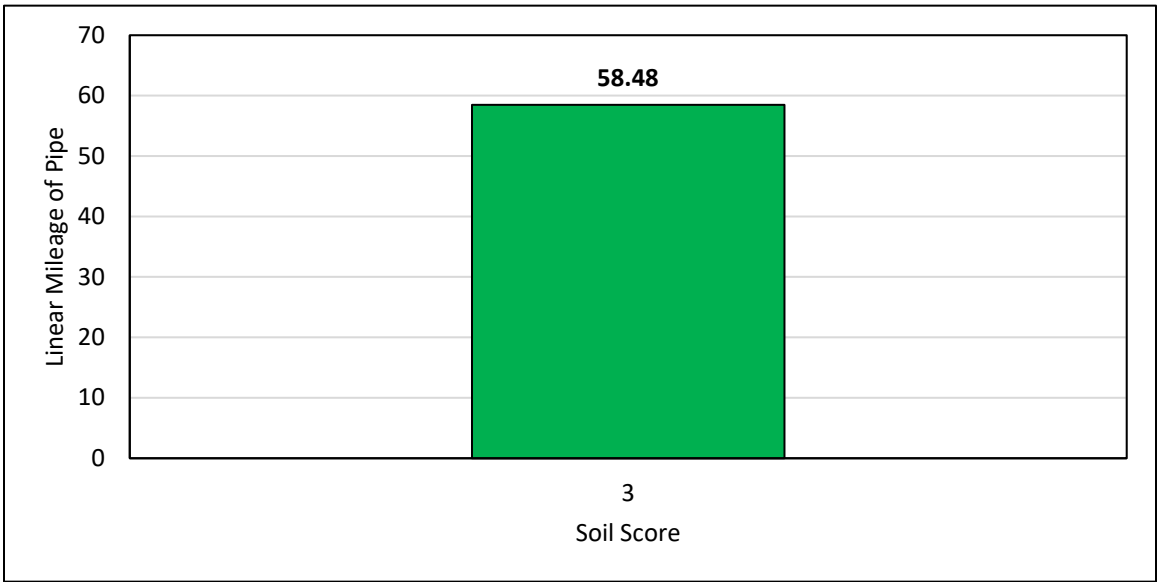


Table 4-5: Hydro Group Soil Descriptions

Hydro Group	Description
Group A (Score 1)	Sand, loamy sand or sandy loam types of soils. This group has low runoff potential and high infiltration rates even when thoroughly wetted. They consist chiefly of deep, well to excessively drained sands or gravels and have a high rate of water transmission.
Group B (Score 3)	Silt loam or loam. This group has a moderate infiltration rate when thoroughly wetted and consists chiefly or moderately deep to deep, moderately well to well drained soils with moderately fine to moderately coarse textures.
Group C (Score 7)	Sandy clay loam. This group has low infiltration rates when thoroughly wetted and consist chiefly of soils with a layer that impedes downward movement of water and soils with moderately fine to fine structure.
Group D (Score 10)	Clay loam, silty clay loam, sandy clay, silty clay, or clay. This group has the highest runoff potential. They have very low infiltration rates when thoroughly wetted and consist chiefly of clay soils with a high swelling potential, soils with a permanent high water table, high corrosivity, soils with a claypan or clay layer at or near the surface and shallow soils over nearly impervious material.

4.5.2 Wastewater System Condition Assessment Results

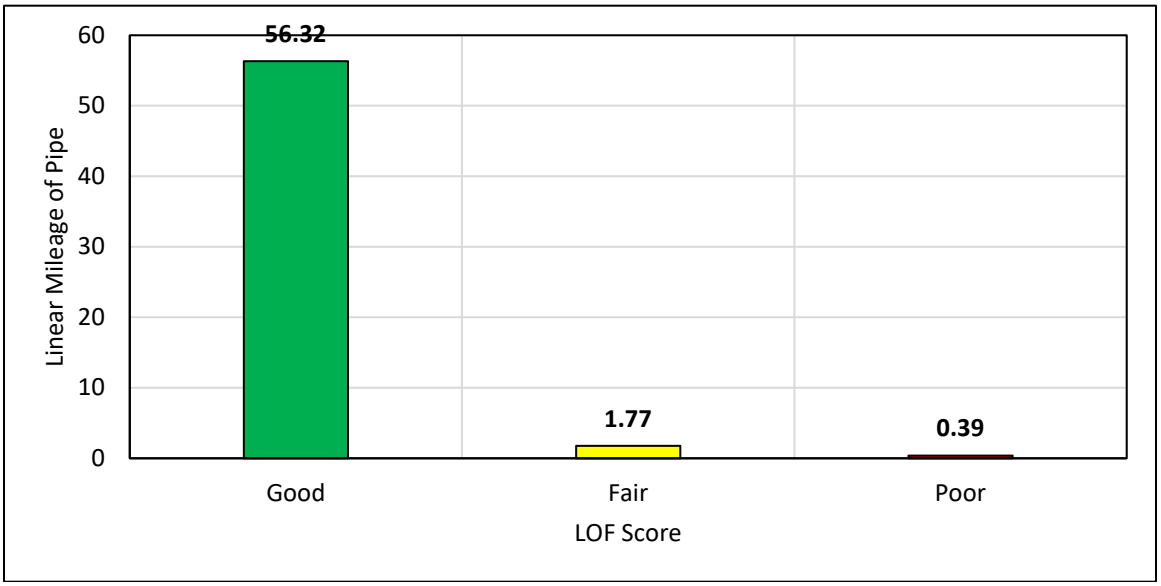
Wastewater line condition scores were calculated for each segment by totaling the weighted individual scores for each parameter to develop a LOF score. The wastewater line condition scores were then grouped into ranges, and qualitative descriptions of Very Good to Very Poor condition were assigned. The definitions for each scoring range are presented in **Table 4-6**. Results of the wastewater line condition assessment are presented in **Figure 4-7**. Mapping of the wastewater system LOF distribution based on the scoring parameters can be found in **Appendix E**, **Figure E-1**.

Based on the weightings and scores, approximately 0.66% of the collection system is estimated to be in poor condition. This distribution is similar to the work order history distribution.

Table 4-6: Wastewater Line LOF Score Range and Results

Total LOF Score	LOF Score Range	Length (mi)	% of System
Very Good	0.0 - 2.0	0.00	0.00%
Good	2.1 - 4.0	56.32	96.31%
Fair	4.1 - 6.0	1.77	3.03%
Poor	6.1 - 8.0	0.39	0.66%
Very Poor	8.1 - 10.0	0.00	0.00%
	Total	**58.48**	**100.00%**

Figure 4-7: Wastewater Line LOF Score Distribution



4.5.3 Wastewater System Criticality Parameters

The criticality of the City's wastewater lines was assessed based on accessibility, customers served, potential environmental concerns, and critical customers served.

- **Access Issues:** highway, railway, arterial road crossing, and water body crossings based on GIS data
- **Customers Served:** based on the wastewater line diameter
- **Potential Environmental Issues:** based on proximity to water bodies, parks, or 1,000-ft of a water supply location
- **Critical Customers Served:** based on the number of high profile/critical customers served within a 1,000-ft radius.

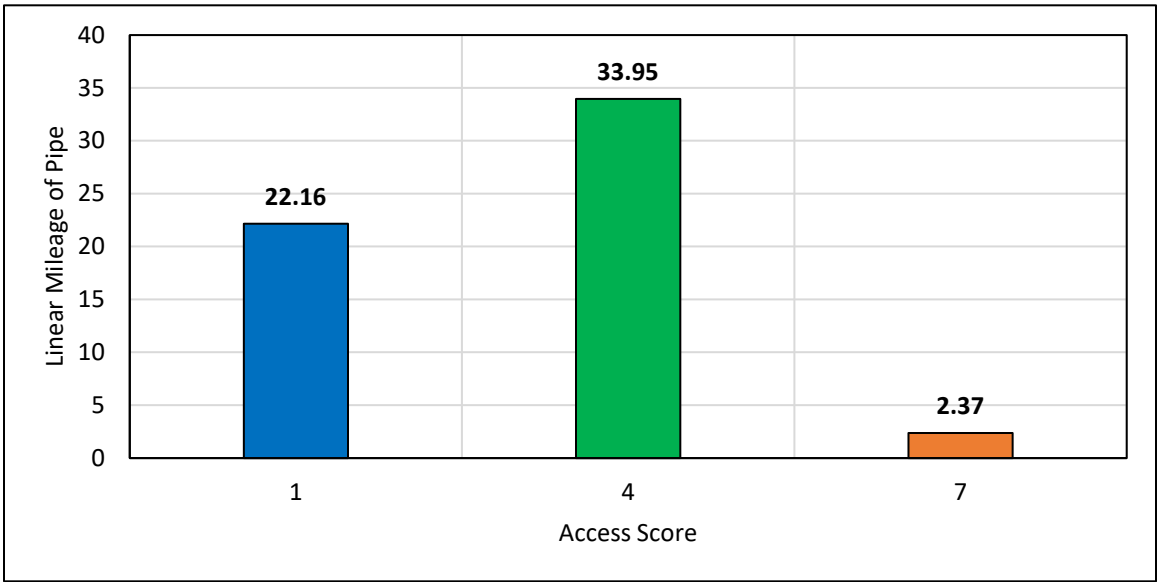
Weighting, criteria, and scoring for each parameter used in the wastewater line criticality assessment are presented in **Table 4-7**. A series of charts summarizing the wastewater line criticality assessment were developed for each parameter. The higher the score, the higher the consequence of failure of the asset. Unlike condition, the criticality of a line rarely changes, as it is based on proximity to certain features or line size.

Table 4-7: Wastewater Line Criticality Assessment Parameters

Parameter	Weight	Category	Score
Access Issues	20%	River/Stream/Railroad	10
		State Highway	7
		Major Collector/Arterial Road	4
		No Crossing	1
Customers Served (Diameter)	30%	Greater than 12-inches	10
		12-inches	8
		10-inches	5
		8-inches	3
		Less than 8-inches	1
Environmental Concerns	20%	Within 500 ft. of Water Body	10
		Within Parks/ Open Spaces	7
		Within 1000 ft. of Water Supply Location	5
		None	1
Critical Customers Served	30%	4 or more Critical Customers	10
		2 OR 3 Critical Customers	7
		1 Critical Customer	4
		Does Not Serve Critical Customer	1

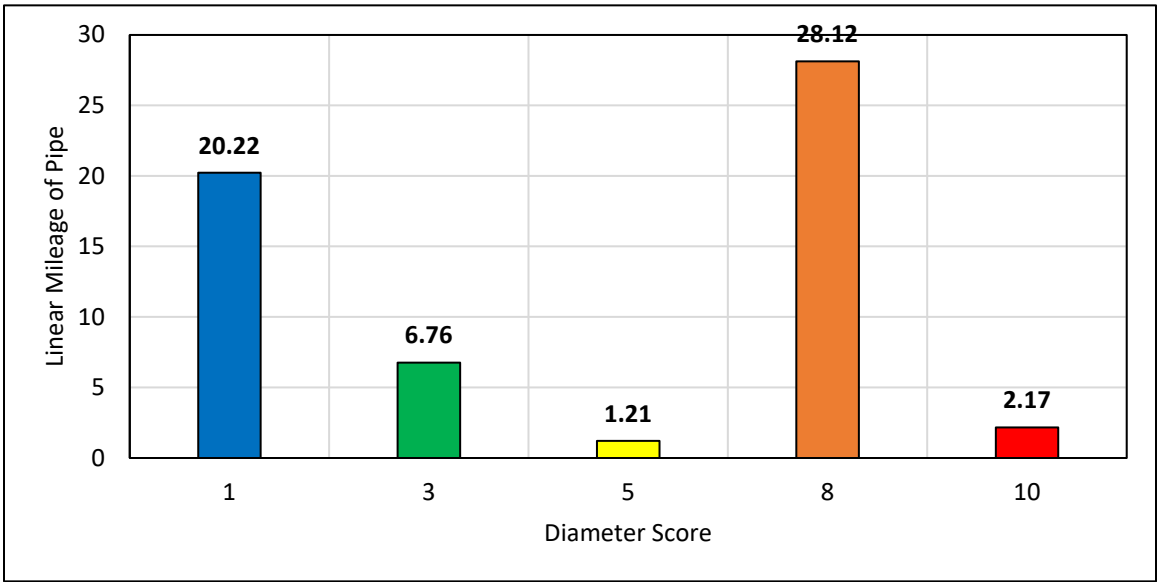
Wastewater line accessibility score by length is presented in **Figure 4-8**. Most of the collection system either does not have any access issues or is located in minor streets. However, a number of wastewater lines that cross or are near main highways such as SH 115 and US 385 may represent significant access issues.

Figure 4-8: Wastewater Line Access Issues Distribution



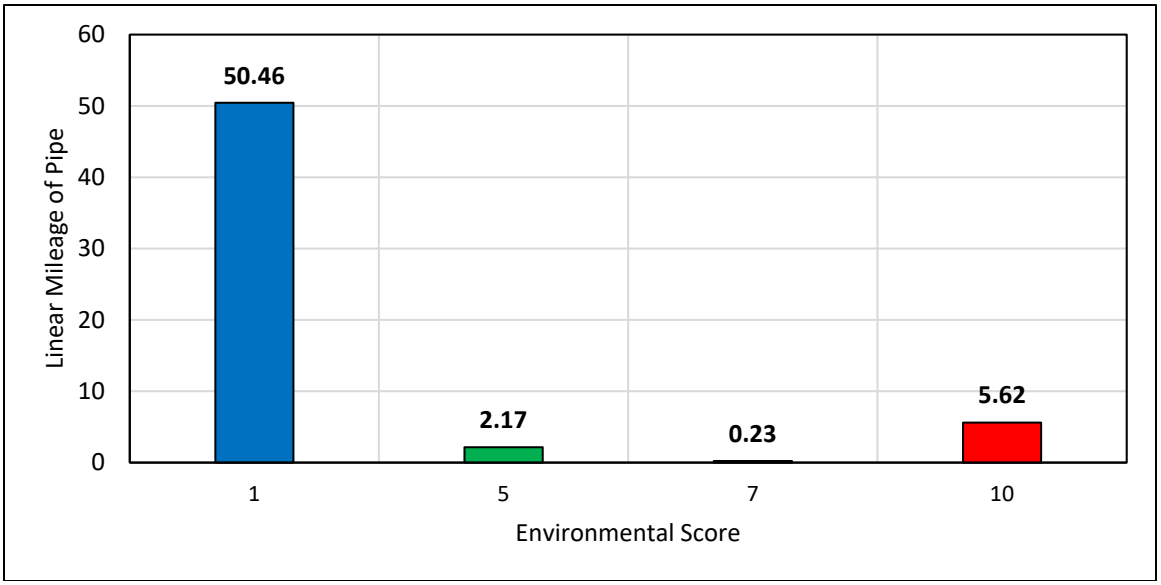
Wastewater line customers served score by length is presented in **Figure 4-9.** Most of the collection system is made of 12-inch lines. The smaller diameter pipes can be observed near the WTP.

Figure 4-9: Wastewater Line Customers Served Distribution



Wastewater line potential environmental issues score by length is presented in **Figure 4-10**. Most of the collection system does not have environmental concerns. However, a number of wastewater lines are near water bodies near Lakeside Park and the WTP that may present a significant environmental concern.

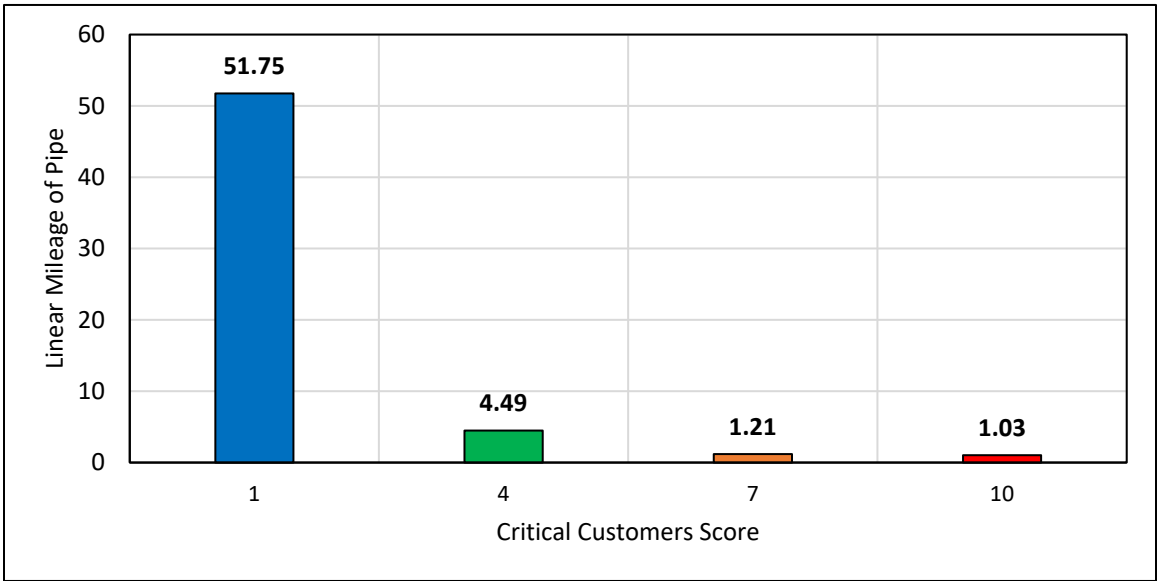
Figure 4-10: Wastewater Line Environmental Issues Distribution



Wastewater line critical customers served score by length is presented in **Figure 4-11**. FNI conducted a downstream flow trace to determine the number of critical customers the wastewater lines serve within

a 1,000-ft buffer. Critical customers considered include the Andrews County Airport, Andrews ISD campuses, medical buildings, municipal buildings, police buildings, the WTP, and the WRP. Most of the higher scoring pipes are observed near the WRP.

Figure 4-11: Wastewater Line Critical Customers Proximity Distribution



4.5.4 Wastewater System Criticality Assessment Results

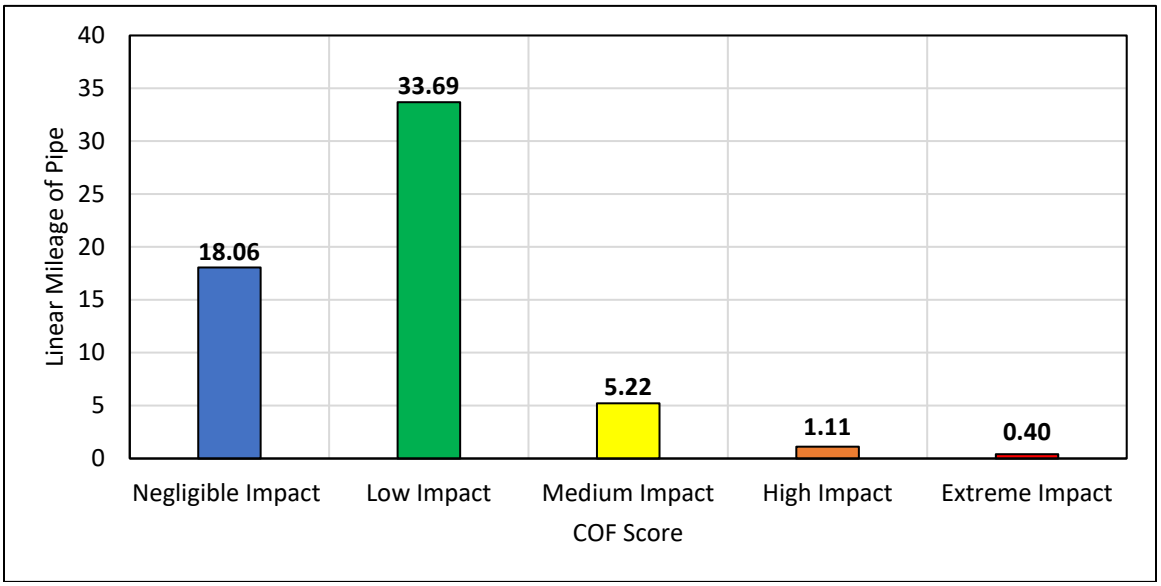
Wastewater line criticality scores were calculated for each line segment by totaling the weighted individual scores for each parameter to develop a total COF score. The wastewater line criticality scores were then grouped into ranges, and descriptive scores of Negligible Impact to Extreme Impact were assigned. The definitions for each scoring range are presented in **Table 4-8**. Results of the wastewater line criticality assessment are presented in **Figure 4-12**. Mapping of the wastewater system COF distribution based on the scoring parameters can be found in **Appendix E**, **Figure E-2**.

Based on the weightings and scores, approximately 2.58 % of the collection system is estimated to have a high or extreme impact consequence of failure. The high consequence of failure distribution is similar to the critical customer distribution.

Table 4-8: Wastewater Line COF Score Range and Results

Total COF Score	COF Score Range	Length (mi)	% of System
Negligible Impact	0.0 - 2.0	18.06	30.90%
Low Impact	2.1 - 4.0	33.69	57.61%
Medium Impact	4.1 - 6.0	5.22	8.92%
High Impact	6.1 - 8.0	1.11	1.90%
Extreme Impact	8.1 - 10.0	0.40	0.68%
	Total	**58.48**	**100.00%**

Figure 4-12: Wastewater Line COF Score Distribution



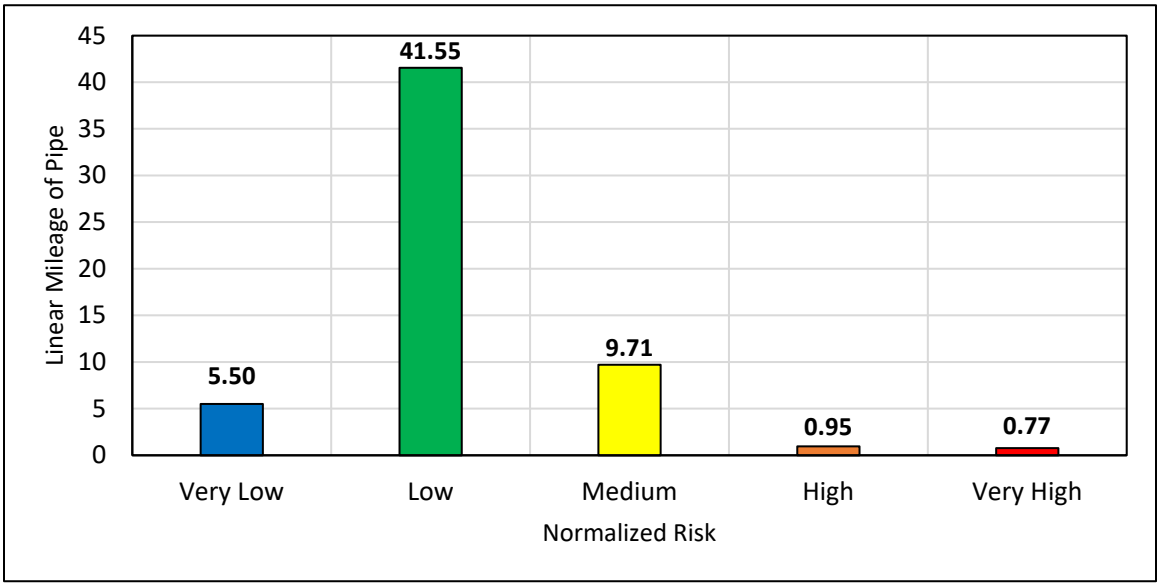
4.5.5 Wastewater System Normalized Risk Score

A total risk score was assigned to each wastewater line by multiplying the total condition (LOF) and criticality (COF) scores. A normalized risk score was assigned to each wastewater main by scaling up the risk scores so that the maximum risk score equals 100. The result is a maximum normalized risk score of 100 with higher scores representing wastewater lines in very poor quality and of extreme criticality. The wastewater line total risk scores were then grouped into ranges, and descriptive scores of Very Low to Very High were assigned. The wastewater line risk-based assessment results are summarized in **Table 4-9** and displayed on **Figure 4-13**.

Table 4-9: Wastewater Line Normalized Risk Scoring Results

Normalized Risk Grade	Risk Score Range	Length (mi)	% of System
Very Low	0.0 – 10.0	5.50	9.41%
Low	10.1 – 30.0	41.55	71.04%
Medium	30.1 – 50.0	9.71	16.60%
High	50.1 – 70.0	0.95	1.63%
Very High	70.1 - 100.0	0.77	1.31%
	Total	**58.48**	**100.00%**

Figure 4-13: Wastewater Line Normalized Risk Score Distribution



The results of the risk assessment show 80.45% of the wastewater lines to have a risk grade of Very Low or Low. Conversely, 2.94% of the wastewater lines are scored with a risk grade of High or Very High. Mapping of the wastewater system Total Risk distribution based on the LOF/COF scoring parameters can be found in **Appendix E Figure E-3**.

4.5.6 Wastewater System Risk-Based Recommendations

Industry best practices and organizations typically recommend a utility replace 1 – 2% per year of their existing system in order to maintain and improve collection system performance and reduce blockages, stoppages, or SSOs. Rehabilitation of 2% of the infrastructure each year results in the complete rehabilitation of the wastewater collection system every 50 years which is the typical design life expectancy of new wastewater pipe when properly installed. Effective rehabilitation programs may significantly reduce frequency and volume of sanitary sewer overflows and are more cost effective than

emergency response when an asset fails. The EPA states that "proactive rehabilitation and replacement planning provides the best opportunity for capital cost savings. By rehabilitating or replacing sewers and other components before they fail, the utility automatically avoids costs such as emergency contractor fees, staff overtime, unplanned repairs, and SSO cleanup costs. Proactive planning also allows the utility to assess the relative economic costs and benefits of rehabilitation vs. replacement."

A renewal CIP was developed for the City of Andrews to maintain the integrity of the wastewater collection system. A decision tree was developed in InfoAsset Planner to identify wastewater candidate assets for renewal. The recommended improvements help to mitigate the overall risk of the wastewater collection system by improving the condition. The decision tree provides a general action for every asset based on the current condition and criticality data. The result of the decision tree is a general recommendation and should be refined by an engineering analysis at the time of renewal.

The City of Andrews does not have internal inspection data on the wastewater line assets at this time. In the decision tree, lines with high or very high risk are identified for replacement. Wastewater lines that are in alleys are also flagged for replacement. Wastewater lines with high or very high LOF, lines greater than 12-inches in diameter, and lines with a medium risk score are flagged for inspection under city initiatives.

The results of the decision tree are shown graphically in **Figure 4-14**. The sewer gravity main decision tree is shown on **Figure 4-15**. Spatial mapping distribution of the renewal actions in the wastewater system can be found in **Appendix E**, **Figure E-4**. A brief description of each decision tree action is included below. A brief description of each decision tree action is included below.

Alleyway Replacement Initiative

These projects consist of replacing the wastewater lines that fall within an alleyway. The alleyway replacement initiative program will allow the City to be proactive in maintaining the condition and capacity of the wastewater system.

Intermediate-Term CCTV Inspection Program

These projects call for the CCTV inspection of wastewater lines that have a medium risk score or lines that are not in the alleyway.

Intermediate-Term Large Diameter Inspection Program

These projects call for the inspection of wastewater lines that are larger than 12-inches and have a medium risk score.

Long-Term Large Diameter Inspection Program

These projects call for the inspection of wastewater lines that are larger than 12-inches and do not have a medium risk score.

Short-Term CCTV Inspection Program

These projects consist of CCTV inspection of lines that have an LOF score of high or very high and that are less than 12-inches in diameter.

Short-Term Large Diameter Inspection Program

These projects call for the inspection of lines that have an LOF score of high or very high and are greater than 12-inches in diameter. Currently, the wastewater data did not provide results for this recommendation.

Short-Term Renewal Program

These projects consist of the replacing the lines that have a normalized risk score of high or very high. This short-term renewal program will allow the City to be proactive in maintaining the condition and capacity of the wastewater system.

Figure 4-14: Wastewater System Renewal Action Summary

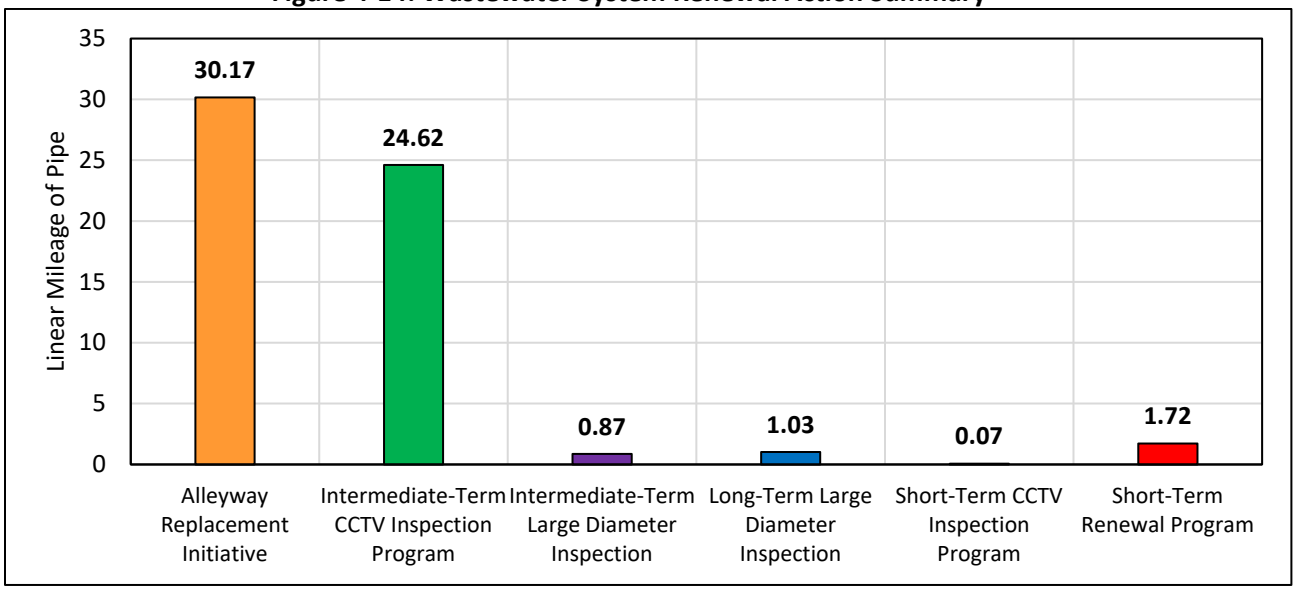
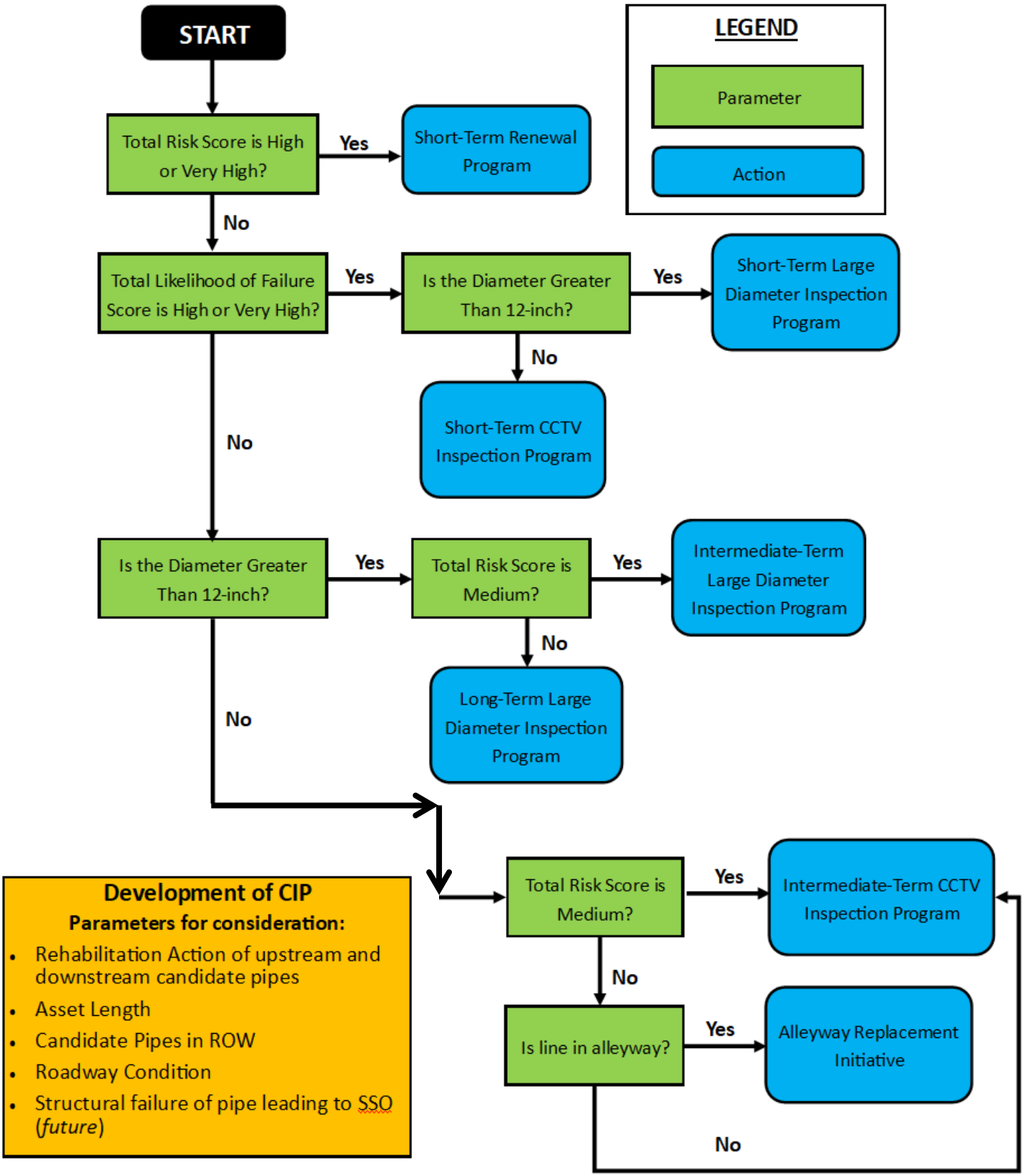


Figure 4-15: Wastewater Line Risk Based Assessment Decision Tree



4.5.7 Wastewater System Renewal Planning Cost Estimates

Planning level renewal cost estimates were calculated for each asset based on the action from the decision tree. These costs are for planning and budgeting purposes only and are not to be considered as a detailed opinion of probable construction cost. The unit cost for the wastewater line renewal projects was assumed to be $18/dia-inch/LF and the unit cost for CCTV inspection was assumed to be $4/LF. These costs do not include allowance for contingency, mobilization, or overhead.

Tables 4-10 and **4-11** summarize the sewer gravity main costs by type of renewal projects for all risk grades and for "High" and "Very High" risk grades, respectively. The wastewater system was separated into 12 zones similar to the water system zones to help future project planning and phasing.

Table 4-10: Wastewater Line Renewal Plan Cost Estimates – All Risk Grades

Zone	Decision Tree Action	All Risk Grades		% of System
		Cost ($)	Length (mi)	
1	Alleyway Replacement Initiative	$3,541,500	3.78	6.46%
	Intermediate-Term CCTV Inspection Program	$55,700	2.63	4.50%
Total		**$3,597,200**	**6.41**	**10.96%**
2	Alleyway Replacement Initiative	$972,100	1.29	2.21%
	Intermediate-Term CCTV Inspection Program	$41,100	1.94	3.32%
Total		**$1,013,200**	**3.23**	**5.53%**
3	Alleyway Replacement Initiative	$2,457,700	3.39	5.80%
	Intermediate-Term CCTV Inspection Program	$38,900	1.83	3.13%
Total		**$2,496,600**	**5.22**	**8.93%**
4	Alleyway Replacement Initiative	$2,990,900	2.62	4.48%
	Intermediate-Term CCTV Inspection Program	$35,300	1.67	2.86%
Total		**$3,026,200**	**4.29**	**7.34%**
5	Alleyway Replacement Initiative	$3,076,400	4.14	7.08%
	Intermediate-Term CCTV Inspection Program	$47,800	2.26	3.86%
	Short-Term Renewal Program	$93,300	0.08	0.14%
Total		**$3,217,500**	**6.48**	**11.08%**
6	Alleyway Replacement Initiative	$2,082,800	3.42	5.85%
	Intermediate-Term CCTV Inspection Program	$57,700	2.72	4.65%
	Short-Term CCTV Inspection Program	$1,500	0.07	0.12%
	Short-Term Renewal Program	$569,400	0.50	0.86%

Zone	Decision Tree Action	All Risk Grades		% of System
		Cost ($)	Length (mi)	
Total		**$2,711,400**	**6.71**	**11.48%**
7	Alleyway Replacement Initiative	$1,290,100	1.13	1.93%
	Intermediate-Term CCTV Inspection Program	$44,000	2.08	3.56%
	Short-Term Renewal Program	$386,400	0.34	0.58%
Total		**$1,720,500**	**3.55**	**6.07%**
8	Alleyway Replacement Initiative	$1,791,900	2.28	3.90%
	Intermediate-Term CCTV Inspection Program	$43,100	2.03	3.47%
	Short-Term Renewal Program	$212,700	0.19	0.32%
Total		**$2,047,700**	**4.50**	**7.69%**
9	Alleyway Replacement Initiative	$1,441,400	2.19	3.75%
	Intermediate-Term CCTV Inspection Program	$42,500	2.00	3.42%
	Short-Term Renewal Program	$406,800	0.36	0.62%
Total		**$1,890,700**	**4.55**	**7.79%**
10	Alleyway Replacement Initiative	$2,024,200	1.89	3.23%
	Intermediate-Term CCTV Inspection Program	$41,800	1.97	3.37%
	Intermediate-Term Large Diameter Inspection	$5,500	0.26	0.44%
	Long-Term Large Diam Inspection	$5,300	0.25	0.43%
Total		**$2,076,800**	**4.37**	**7.47%**
11	Alleyway Replacement Initiative	$2,162,000	2.38	4.07%
	Intermediate-Term CCTV Inspection Program	$29,500	1.39	2.38%
	Intermediate-Term Large Diameter Inspection	$9,800	0.46	0.79%
Total		**$2,201,300**	**4.23**	**7.24%**
12	Alleyway Replacement Initiative	$1,325,300	1.65	2.82%
	Intermediate-Term CCTV Inspection Program	$44,300	2.09	3.57%
	Intermediate-Term Large Diameter Inspection	$3,300	0.15	0.25%
	Long-Term Large Diam Inspection	$16,600	0.78	1.32%
	Short-Term Renewal Program	$297,400	0.27	0.46%
Total		**$1,686,900**	**4.94**	**8.42%**
Total Replacement		**$25,330,400**	**29.62**	**50.66%**
Total CCTV		**$2,355,600**	**28.86**	**49.34%**
Total		**$27,686,000**	**58.48**	**100.00%**

Table 4-11: Wastewater Line Renewal Plan Cost Estimate – High and Very High Risk Grades

Zone	Decision Tree Action	High and Very High Risk Grades		% of System
		Cost ($)	Length (mi)	
1	Alleyway Replacement Initiative	-	-	-
	Intermediate-Term CCTV Inspection Program	-	-	-
Total		**$0**	**0.00**	**0.00%**
2	Alleyway Replacement Initiative	-	-	-
	Intermediate-Term CCTV Inspection Program	-	-	-
Total		**$0**	**0.00**	**0.00%**
3	Alleyway Replacement Initiative	-	-	-
	Intermediate-Term CCTV Inspection Program	-	-	-
Total		**$0**	**0.00**	**0.00%**
4	Alleyway Replacement Initiative	-	-	-
	Intermediate-Term CCTV Inspection Program	-	-	-
Total		**$0**	**0.00**	**0.00%**
5	Alleyway Replacement Initiative	-	-	-
	Intermediate-Term CCTV Inspection Program	-	-	-
	Short-Term Renewal Program	$93,300	0.08	0.14%
Total		**$93,300**	**0.08**	**0.14%**
6	Alleyway Replacement Initiative	-	-	-
	Intermediate-Term CCTV Inspection Program	-	-	-
	Short-Term CCTV Inspection Program	-	-	-
	Short-Term Renewal Program	$569,400	0.49	0.84%
Total		**$569,400**	**0.49**	**0.84%**
7	Alleyway Replacement Initiative	-	-	-
	Intermediate-Term CCTV Inspection Program	-	-	-
	Short-Term Renewal Program	$386,400	0.34	0.58%
Total		**$386,400**	**0.34**	**0.58%**
8	Alleyway Replacement Initiative	-	-	-
	Intermediate-Term CCTV Inspection Program	-	-	-
	Short-Term Renewal Program	$212,700	0.19	0.32%
Total		**$212,700**	**0.19**	**0.32%**
9	Alleyway Replacement Initiative	-	-	-

Zone	Decision Tree Action	High and Very High Risk Grades		% of System
		Cost ($)	Length (mi)	
	Intermediate-Term CCTV Inspection Program	-	-	-
	Short-Term Renewal Program	$406,800	0.36	0.62%
	Total	**$406,800**	**0.36**	**0.62%**
10	Alleyway Replacement Initiative	-	-	-
	Intermediate-Term CCTV Inspection Program			
	Intermediate-Term Large Diameter Inspection			
	Long-Term Large Diam Inspection	-	-	-
	Total	**$0**	**0.00**	**0.00%**
11	Alleyway Replacement Initiative	-	-	-
	Intermediate-Term CCTV Inspection Program	-	-	-
	Intermediate-Term Large Diameter Inspection	-	-	-
	Total	**$0**	**0.00**	**0.00%**
12	Alleyway Replacement Initiative	-	-	-
	Intermediate-Term CCTV Inspection Program	-	-	-
	Intermediate-Term Large Diameter Inspection	-	-	-
	Long-Term Large Diam Inspection	-	-	-
	Short-Term Renewal Program	$495,600	0.26	0.44%
	Total	**$495,600**	**0.26**	**0.44%**
	Total Replacement	**$2,164,200**	**1.72**	**2.94%**
	Total CCTV	**$0**	**0.00**	**0.00%**
	Total	**$2,164,200**	**1.72**	**2.94%**

4.6 Wastewater Collection System Capital Improvements Plan

The goal of the CIP is to address existing deficiencies in the system, as well as provide capacity for future flows in the wastewater collection system. CIP alternatives were analyzed and adjusted through discussions with Andrews Economic Development Corporation and City staff. Where existing facilities need to be upgraded, the recommended improvements are sized to carry projected future sewer flows.

The recommended projects for the wastewater system capacity CIP are presented on **Figure 4-16**. Locations shown for new interceptors and other recommended improvements were generalized for hydraulic analyses. Specific alignments and sites will be determined as part of the design process. It is

assumed that the proposed improvements are considered replacement wastewater lines unless otherwise stated. Capital costs were calculated for the recommended improvements. The costs are in 2020 dollars and include an allowance for engineering, surveying, and contingencies. The costs do not include any factors to account for the ongoing COVID-19 government-enforced closures worldwide which could potentially impact material, equipment, and/or labor costs on projects. In addition, the impact on construction schedules due to the COVID-19 pandemic is unknown. **Table 4-12** summarizes the cost of the wastewater system capacity CIP by planning period. **Appendix F** contains a detailed cost description of each individual project.

FIGURE 4-16
CITY OF ANDREWS
WASTEWATER SYSTEM CAPITAL IMPROVEMENTS PLAN

PROPOSED IMPROVEMENTS

- Lift Station
- Water Reclamation Plant
- Wastewater Line
- Force Main

LEGEND

- Manhole
- Lift Station
- Water Reclamation Plant
- 8" and Smaller Wastewater Line
- 10" and Larger Wastewater Line
- Force Main
- Road
- Lake/Pond
- Parcel
- Andrews County Airport
- City Limit
- ETJ Boundary

Project timing is subject to change based on development patterns. The utility alignment shown on this figure are for illustration purposes only and do not set the alignment. The alignment will be determined at the time of engineering design of the utility.

Proposed 1.0 MGD Lift Station (1)

Lift Station (8" F.M.)

Lift Station (8" F.M.)

Lift Station (6" F.M.)

Lift Station (6" F.M.)

City of Andrews
Water Reclamation Plant
Avg. Day Permitted Capacity: 1.60 MGD
Expand Capacity to 2.10 MGD

Andrews County Airport

0 1,400 2,800
SCALE IN FEET

Created By Freese and Nichols, Inc.
Job No.: AET19496
Location: H:\W_WW_PLANNING\01_DELIVERABLES\00_FINAL_REPORT\(Figure_4-16)-WW_System_CIP.mxd
Updated: Tuesday, September 1, 2020 3:48:27 PM
User Name: 02499

Table 4-12: Wastewater Capacity CIP Cost Summary

Project Number	Wastewater Project Name	Cost ($)
Short-Term Projects		
-	-	$ -
	Short-Term Total	**$ -**
Long-Term Projects		
1	Proposed NW 12th St. Lift Station and Force Main	$ 2,517,600
2	12-inch NW Gravity Main Extension Phase #1	$ 1,345,500
3	18-inch SW Mustang Drive Gravity Main Replacement	$ 3,640,400
4	15-inch NW Mustang Drive Gravity Main Replacement	$ 2,898,200
5	12-inch SW Gravity Main Extension	$ 1,258,800
6	12-inch Highway 115 Gravity Main Extension	$ 1,001,700
7	Water Reclamation Plant Expansion	$ 10,465,000
8	12-inch NW Gravity Main Extension Phase #2	$ 1,720,800
9	12-inch County Road 1200 Gravity Main Extension	$ 1,492,100
	Long-Term Total	**$ 26,340,100**
	Wastewater CIP Total	**$ 26,340,100**

4.6.1 Short-Term Recommended Wastewater System Improvements

Through discussions with Andrews Economic Development Corporation and City staff, it was determined that no short-term wastewater CIP are necessary. Short-term wastewater CIP might become necessary depending on when and where projected development occurs.

4.6.2 Long-Term Recommended Wastewater System Improvements

The following projects were selected to be part of the long-term CIP because they address projected future deficiencies or provide service to new growth areas.

Project #1: Proposed NW 12th St. Lift Station and Force Main

This project consists of a 1.0 MGD lift station at the intersection of NW 2000 and NW 12th Street. This project also consists of an 8-inch force main from the proposed lift station to the existing 12-inch gravity main at the intersection of NW 1200 and NW Mustang Drive. This project will extend wastewater service to future development in the NW portion of the City. Specific timing of improvements are subject to change based on how development occurs.

Project #2: 12-inch NW Gravity Main Extension Phase #1

This project consists of extending a 12-inch gravity main from the proposed lift station at the intersection of County Road 2000 and County Road 501 to approximately 3,500 feet to the NE. This project will extend wastewater service to future development in the NW portion of the City. Specific timing of improvements are subject to change based on how development occurs.

Project #3: 18-inch SW Mustang Drive Gravity Main Replacement

This project consists of replacing the existing 12-inch gravity main along Mustang Drive with an 18-inch gravity main from intersection of Mustang Drive and Avenue I to the intersection of Mustang Drive and Clark Street. This project will provide additional conveyance capacity to serve existing customers and future growth in the NW and southwest portions of the City.

Project #4: 15-inch NW Mustang Drive Gravity Main Replacement

This project consists of replacing the existing 12-inch gravity main along Mustang Drive with a 15-inch gravity main from the proposed 18-inch gravity main at the intersection of Mustang Drive and Clark Street to the proposed 8-inch force main at the intersection of County Road 1200 and Mustang Drive. This project will provide additional conveyance capacity to serve existing customers and future growth in the NW portions of the City.

Project #5: 12-inch SW Gravity Main Extension

This project consists of extending a 12-inch gravity main from the existing 20-inch gravity main at the intersection of Mustang Drive and Avenue I to approximately 3,800 feet to the west. This project will extend wastewater service to future development in the southwest portion of the City. Specific timing of improvements are subject to change based on how development occurs.

Project #6: 12-inch Highway 115 Gravity Main Extension

This project consists of extending a 12-inch gravity main from the existing 12-inch gravity main near the intersection of Mustang Drive and State Highway 115 to approximately 2,800 feet to the NW. This project will extend wastewater service to future development in the southwest portion of the City. Specific timing of improvements are subject to change based on how development occurs.

Project #7: Water Reclamation Plant Expansion

This project consists of expanding the treatment capacity of the Water Reclamation Plant to 2.10 MGD. This project will expand the City's treatment capacity to meet average day flow projections. TCEQ regulations require the City to be planning for the next expansion once 75% of its average day capacity is utilized. The rules then specify being in construction once 90% is utilized. Based on current flow projections, it is anticipated the City will need to start planning the expansion around 2026 and be in construction by the year 2034. Specific timing of these improvements are subject to change based on how development occurs.

Project #8: 12-inch NW Gravity Main Extension Phase #2

This project consists of extending a 12-inch gravity main from the proposed lift station at the intersection of County Road 2000 and County Road 501 to approximately 5,100 feet to the southwest. This project will extend wastewater service to future development in the NW portion of the City. Specific timing of improvements are subject to change based on how development occurs.

Project #9: 12-inch County Road 1200 Gravity Main Extension

This project consists of extending a 12-inch gravity main from the existing 12-inch gravity main at the intersection of Mustang Drive and Avenue K to near the intersection of Loop 1910 and County Road 1200. This project will extend wastewater service to future development in the NW portion of the City. Specific timing of improvements are subject to change based on how development occurs.

5.0 STORMWATER DRAINAGE SYSTEM ANALYSIS

FNI completed a playa-level hydrologic analysis and flood hazard assessment for the study area, which can be found in **Appendix G, Figure G-1**: Drainage Area Map.

In addition to the watersheds where the proposed development is anticipated, FNI also analyzed the watersheds located in between. There is a total of six watersheds included over a total area of 6.2 square miles. The evaluation focused on the ability of the receiving playa lakes to handle the anticipated development and identification of potential flood risk. Capital Improvements projects were identified in the two key focus watersheds to mitigate the increased risks resulting from the anticipated development. FNI also established a regulatory water surface elevation for the affected playas.

5.1 Hydrologic Methodology

Hydrologic inputs were identified for each sub-basin starting with the existing watershed condition, including the drainage areas, curve numbers, and times of concentration. Hydrologic models were developed using the United States Army Corps of Engineer's *Hydrologic Engineering Center Hydrologic Modeling System (HEC-HMS) version 4.3 (USACE, 2017)*. From this data the projected peak water surface elevations in the playas were developed for the existing condition. The future land use information was incorporated, and this exercise repeated for future, fully developed (FFD) watershed conditions. Changes in the projected peak water surface elevations in the playas were compared in order to determine the impacts of development.

Conceptual solutions for the proposed development areas (NW, Southwest) were introduced to mitigate the increases in peak water surface elevation. The following sections describe the methodology and conclusions resulting from the study.

5.1.1 Precipitation

Synthetic storm models were created for the 10-, 25-, 50-, 100-, and 500-year 24-hour return periods. Rainfall input data was calculated from the tables provided in the USGS TP40 (*Depth-Duration Frequency of Precipitation for Texas, 1998*). **Table 5-1** shows the rainfall depths used to develop the frequency storms in HEC-HMS.

Table 5-1: Precipitation (in) for Frequency Storms in HEC-HMS

Duration	Frequency (Return Period)				
	10-yr	25-yr	50-yr	100-yr	500-yr
5 min.	0.87	1.07	1.28	1.5	2.13
15 min.	1.14	1.4	1.65	1.9	2.6
1 hr.	2	2.45	2.89	3.3	4.6
2 hr.	2.45	3.08	3.65	4.28	6.05
3 hr.	2.6	3.25	3.85	4.5	6.4
6 hr.	2.85	3.5	4.2	4.8	7
12 hr.	3.1	3.9	4.5	5.3	7.75
24 hr.	4	5	5.75	6.7	8.9

5.1.2 Drainage Area Delineation

The Andrews development watersheds were delineated based on the available topographic data and aerial photography (ESRI, 2015). Drainage areas were delineated at selected design points such as road crossings and basin high points. The best data available to generate the topography of the area were 5-foot contours and, as such, there was some interpolation made on where the boundaries of watersheds should be based on the latest aerial photography. A total of 6 drainage areas were delineated for the Andrews development watershed. **Figure G-1** in **Appendix G** shows the drainage area maps included in the analysis.

5.1.3 Land Use Assumptions

The existing and proposed land use information for the study area was taken from the latest available data, the 2013 Comprehensive Plan. The proposed land use data was supplemented with preliminary layouts for proposed developments in the NWern and southwestern quadrants of the city. See **Figure G-2** and **G-3** in **Appendix G** for existing and proposed future land use data.

5.1.4 Infiltration Losses

Runoff for each sub-basin was determined through use of the Soil Conservation Service (SCS) Curve Number method. Hydrologic soil types for the watershed were determined from data obtained from Natural Resources Conservation Service (NRCS). Hydrologic soil types are classified as A, B, C, or D with Soil Type A being sandy with high infiltration rates and Soil Type D being clayey with low infiltration rates (USDA, 2018). **Figure G-4** in **Appendix G** shows the Hydrologic Soils Maps for the study area.

Certain developed conditions on the west side of the area of concern did not have an SCS curve number associated with it due to unknown development. This area was assumed to be Commercial along Loop 1910 frontage and Low Density Residential elsewhere. **Table 5-2**, provides curve numbers used in the analysis of the study area.

Table 5-2: TR-55 Curve Numbers

Land Use	Soil Type			
	A	B	C	D
	CN			
Commercial	89	92	94	95
High Density Residential	77	85	90	92
Industrial	81	88	91	93
Low Density Residential 2 Acres	46	65	77	82
Medium Density Residential Quarter	61	75	83	87
Open Space - Fair	49	69	79	84
Open Space - Good	39	61	74	80
Pasture - Fair	49	69	79	84
Paved Parking Lots	98	98	98	98
Paved Streets and Roads	98	98	98	98
Water	100	100	100	100
Woods - Good	30	55	70	77

5.1.5 Times of Concentration

Consistent with the SCS Unit Hydrograph method, the times of concentration were determined according to the United States Department of Agriculture TR-55 methodology (USDA, 1986). The time of concentration (T_c) is calculated by the summation of the travel times of the storm flow over different segments of the basin and can be used to estimate the lag time ($0.6*T_c$). There are three types of flow conditions considered for time of concentration: 1) sheet flow, 2) shallow concentrated flow, and 3) concentrated flow. The latter is broken into channel, swale, and pipe flow. Several standard assumptions were implemented in the time of concentration calculations.

Sheet flow takes place in the most upper reaches of the drainage area. Sheet flow is where flow travels across a surface in wide sheets but has not yet formed into a concentrated flow. Per industry standards, sheet flow path lengths were limited to 100 ft for undeveloped soil covers, and 50 ft for smooth surfaces. Shallow concentrated flow starts to collect into defined flow paths after sheet flow. The shallow concentrated flow travel time is calculated from the velocity and distance of travel. The velocity is

determined based on the slope and surface over which the water travels. Once the flow path reaches a channel, swale or pipe, the flow becomes concentrated flow. These locations were determined by contours and aerials GIS information. For the concentrated portion of a flow path, average velocities of 3 ft/s and 6 ft/s were assumed, per industry standards, for swales and channels, respectively.

Standard assumptions were made to estimate ultimate lag times for drainage areas that are currently undeveloped. The longest flow paths remained the same under existing and ultimate conditions, but changes were made to the calculation assumptions for ultimate conditions. Any continuous section of gutter flow or roadway section that would reasonably direct the flow path was categorized as channelized flow. In areas that are currently undeveloped and non-residential development is predicted to occur based on the Future Land Use maps, the sheet flow was categorized as "smooth surfaces" and limited to 50-feet and the shallow concentrated flow was assumed to be "paved" for ultimate time of concentration values.

Table 5-3 located below provides the hydrologic parameters for the six watersheds analyzed as part of the study.

Table 5-3: Andrews Development Hydrologic Parameters

Drainage Area	Area (acres)	Existing CN	Ultimate CN	Existing T_c (min)	Ultimate T_c (min)
1	855	69	87	47.91	47.91
2	521	70	86	78.58	78.58
3	250	67	72	54.80	54.80
4	941	61	70	127.20	127.20
5	937	65	70	97.00	97.00
6	497	61	69	64.13	64.13

5.2 Hydraulic Analysis Results

Hydrologic model results indicate that there is a degree of inundation of the NW study area during the 50,100, and 500-year rainfall events. While a drainage easement is planned along the eastern edge of the development, the inundation extends beyond the proposed easement area into the proposed residential subdivision. The inundated area also extends into the area previously studied by FNI, near NW Mustang Drive and US-385. The recommendations made as part of that effort are still valid to improve conditions in this location and at this time. Hydrologic model results for the southwest study area indicate that the proposed development is well outside any inundated area but contributes to the increase in the projected peak water surface elevation in the receiving playa. The Existing and FFD conditions maps for the study

area are shown on **Figure G-5** and **G-6** in **Appendix G**. **Tables 5-4** and **5-5** show the anticipated differences in volume of runoff to each playa for the 100-year and 500-year design storms.

Table 5-4: Drainage 100-year Volumes

Location Label	Existing Volume (ac-ft)	Ultimate Volume (ac-ft)	Volume increase (ac-ft)	Percent Increase
1	229	366	137	59.8%
2	143	216	73	51.0%
3	63	73	10	15.9%
4	186	254	68	36.6%
5	217	255	38	17.5%
6	101	133	32	31.7%

Table 5-5: Drainage 500-year Volumes

Location Label	Existing Volume (ac-ft)	Ultimate Volume (ac-ft)	Volume increase (ac-ft)	Percent Increase
1	362	519	157	43.4%
2	225	310	85	37.8%
3	101	113	12	11.9%
4	317	402	85	26.8%
5	355	403	48	13.5%
6	170	210	40	23.5%

5.3 Stormwater System Capital Improvement Plan

The goal of the CIP is to address potential areas of flooding in the post-developed area of interest and provide capacity for future demands. Upon completion of the drainage analysis, CIP alternatives were analyzed and phased into the planning period in which they become necessary. Where existing watersheds need to be upgraded, the recommended improvements are sized to meet projected demands.

5.3.1 Proposed CIP for NW Development Area

The future fully developed (FFD) conditions 100-year and 500-year peak water surface elevations were plotted and compared to the layout of the proposed residential development. Based on that comparison we see that portions of the development would be inundated both in existing watershed conditions as well as FFD for the 100-year and 500-year storms.

FNI recommends a two-fold approach, fill to bring all structures to be elevated 6-inches above the 500-year peak WSE and excavation elsewhere in the inundated area to offset that fill. A degree of excavation along the drainage area will allow the existing drainage basin to have enough capacity to retain the

floodplain outside of the proposed development area. Excavation should occur outside of the proposed development and preferably inside a dedicated drainage impoundment easement. FNI identified the locations with recommended cut and fill on **Figure G-7** in **Appendix G**. The projected excavation quantities and costs are presented in **Table 5-6**:

Table 5-6: Excavation Demand Projection

100-Year Storm Proposed Excavation				
Description	**Quantity**	**Unit**	**Unit Price**	**Total**
Pond Excavation	37,359	CY	$ 15.00	$ 560,385
Hydromulch	26,620	SY	$ 1.00	$ 26,620
			100-Year Grand Total	**$ 587,005**
500-Year Storm Proposed Excavation				
Description	**Quantity**	**Unit**	**Unit Price**	**Total**
Pond Excavation	52,620	CY	$ 15.00	$ 789,305
Hydromulch	26,620	SY	$ 1.00	$ 26,620
			500-Year Grand Total	**$ 815,925**

An alternative to a CIP would be for the City to require excavation by the developer at the time of platting for all developed flows. This is a standard industry practice and is a feasible solution for the proposed type of development, especially considering the proposed layout would require fill within the inundated area.

The recommended improvements near the intersection of NW Mustang Drive and US-385 identified through a previous FNI effort are also recommended for this NW development area. Those improvements included addition of a culvert beneath NW Mustang Drive and channel improvements, all of which will convey runoff from the area that is currently shown as inundated area to the NW to the property acquired by the City of Andrews. These improvements would allow reclamation of the property at the southwest corner of the intersection of NW Mustang Drive and US-385. The projected quantities and cost are presented in **Table 5-7**. The costs shown in **Table 5-7** reflect only the culvert and channel grading and excludes fill excavation that will be necessary to offset contributing developed flows for future development. **Figure G-8** in **Appendix G** shows the Mustang Drive improvements.

Table 5-7: Excavation Demand Projection

100-Year Storm Proposed Excavation				
Description	**Quantity**	**Unit**	**Unit Price**	**Total**
Channel Excavation	400	CY	$ 15.00	$ 6,000
Channel Clearing and Grubbing	0.5	AC	$ 8,000.00	$ 4,000
Hydromulch	2,350	SY	$ 1.00	$ 2,350
24" RCP	1,500	LF	$ 90.00	$ 135,000
Headwall	2	EA	$ 6,000.00	$ 12,000
			100-Year Grand Total	**$ 159,350**

5.3.2 Proposed CIP for Southwest Development Area

The future fully developed (FFD) conditions 100-year and 500-year peak water surface elevations were plotted and compared to the layout of the proposed industrial development. Based on that comparison we see that none of the proposed development would be inundated in existing or FFD conditions for the 100-year and 500-year storms, but that development in these areas has an influence on the receiving playa's PWSE.

FNI recommends excavation to mitigate developed flows as a CIP in the amount of 113.55 acre-feet, the increase in runoff volume in the 500-year event as a result of the proposed development only. Under this scenario, excavation would occur in the existing inundated area and preferably inside a dedicated drainage impoundment easement. The existing and ultimate runoff volumes are presented in **Table 5-8** below:

Table 5-8: Existing and Ultimate Runoff Volumes

Storm Runoff Volume (Acre-Feet)		
Description	**100-Year Volume**	500-Year Volume
Existing	229.48	362.05
Ultimate	365.61	518.84
SW Development Impact	326.40	475.60

The projected CIP quantities and cost are presented in **Table 5-9.**

Table 5-9: Excavation Demand Projection

500-Year Storm Proposed Excavation				
Description	**Quantity**	**Unit**	**Unit Price**	**Total**
Excavation	183,194	CY	$ 15.00	$ 2,747,910
Hydromulch	91,500	SY	$ 1.00	$ 91,500
			500-Year Grand Total	**$ 2,839,410**

Figure G-9 in **Appendix G** shows the Southwest development area improvements. An alternative to a CIP would be for the City to require on-site detention at the time of platting for all developed flows. This is a standard industry practice and is a feasible solution for the proposed type of development. The CIP identifies the total volume of excavation needed to accommodate the increase in runoff attributed to the proposed development over that entire area. It would also allow for incremental detention to be constructed as development occurs or for there to be a plan similar to that which has been proposed in the NW study area that includes regional detention that accommodates the entire area.

6.0 FUNDING OPPORTUNITIES ASSESSMENT

The City of Andrews provides retail water and wastewater services to approximately 5,000 customers. The City maintains approximately 81 miles of water mains, 60 miles of wastewater mains, and 260 fire hydrants. In 2019, the City produced/purchased 745.15 million gallons and sold 704.35 million gallons to its estimated service population of 14,109. The purpose of the Funding Opportunities Assessment is to compare the CIP costs developed by FNI to available utility revenue in order to determine the adequacy of the existing rates to pay for capital improvements.

6.1 Water and Wastewater Utility Rate Assessment

Historically, the City of Andrews' water and wastewater fund has operated relatively sustainably, when not taking into account transfers out of the fund. **Table 6-1** summarizes the historical population, connections, expenses, and revenues for the City's water and wastewater funds. In Fiscal Years 2018 and 2019, transfers out of the fund totaled $500,000 and $1,000,000 respectively, and resulted in deficits. **Table 6-1** does not include those transfers.

During Fiscal Years 2018, 2019, and 2020 (estimate), Operation and Maintenance (O&M) expenses averaged $4.3 million per year, while water and wastewater fund revenues averaged $4.2 million per year (**Table 6-1**). Andrews' water and wastewater fund did not have any debt service during that time period.

Table 6-1: Historical Population, Connections, Expenses, Revenues

	Historical		Estimate
	2017-18	**2018-19**	**2019-20**
Population	13,762	14,109	14,391*
Water Connections	5,333	5,439	5,472*
Wastewater Connections	5,333	5,439	5,472*
Expenses			
O&M Expenses	$4,103,460	$4,386,166	$4,393,282
Debt Service Expenses	-	-	-
Total Expenses	**$4,103,460**	**$4,386,166**	**$4,393,282**
Revenues			
Total Revenues	$4,304,812	$4,101,723	$4,320,907
Surplus / (Shortfall)	$201,352	($284,433)	($72,375)

*Assumes 2% growth rate.

6.1.1 Potential Reduction in Revenues Due to COVID-19

Water and wastewater utilities across the country have experienced reduced revenues associated with the COVID-19 pandemic and related economic/financial strains and are expected to continue to experience reduced revenues for the next few years. The American Water Works Association and the Association of Metropolitan Water Agencies partnered to conduct a study to quantify the potential reductions in revenue, and their report found that the potential nation-wide reduction in revenue "is estimated to be approximately $13.9 billion representing an overall 16.9 percent impact on drinking water sector revenues." This report assumes a 16.9 percent reduction to Andrews' revenues in Fiscal Years 2021, 2022 and 2023, with a recovery in Fiscal Years 2024 and 2025.

6.1.2 New Debt Service Associated with CIP

Expenses are projected to exceed revenues beginning in Fiscal Year 2021 due to the reduced revenues associated with COVID-19. Beginning in Fiscal Year 2022, that gap is estimated to further widen as a result of both the reduced revenues and the addition of debt service expenses associated with a substantial Capital Improvements Plan (CIP) initiative. The cost of the short-term (ten year) water, wastewater and stormwater CIP projects totals nearly $15 million based on preliminary engineering estimates. For the purpose of this analysis, it was assumed that between Fiscal Years 2021 and 2030, the city would issue approximately $1.5 million of bonds each year, for a total of $15 million. The resulting debt service would increase the city's expenses by approximately $100,000 per year each year between Fiscal Years 2021 and 2030. By Fiscal Year 2030, the new debt service associated with the short-term CIP would be $1 million annually.

As mentioned earlier, the City of Andrews' water and wastewater fund has operated relatively sustainably over the past several Fiscal Years. Should there be funds available in a reserve account that could be applied towards future CIP expenses, those reserves would help reduce debt service payments and alleviate rate adjustments. Andrews' policy is to maintain six months of operating expenses as cash on hand.

6.1.3 Future Operation and Maintenance Expenses

Between Fiscal Years 2018 and 2021, increases in O&M expenses (less transfers) averaged approximately 1.6 percent, which was used to project future O&M expenses. It is important to note that the Fiscal Year 2021 O&M expenses is a budgeted amount, not an actual or estimate.

6.1.4 Future Total Revenue and Expenses

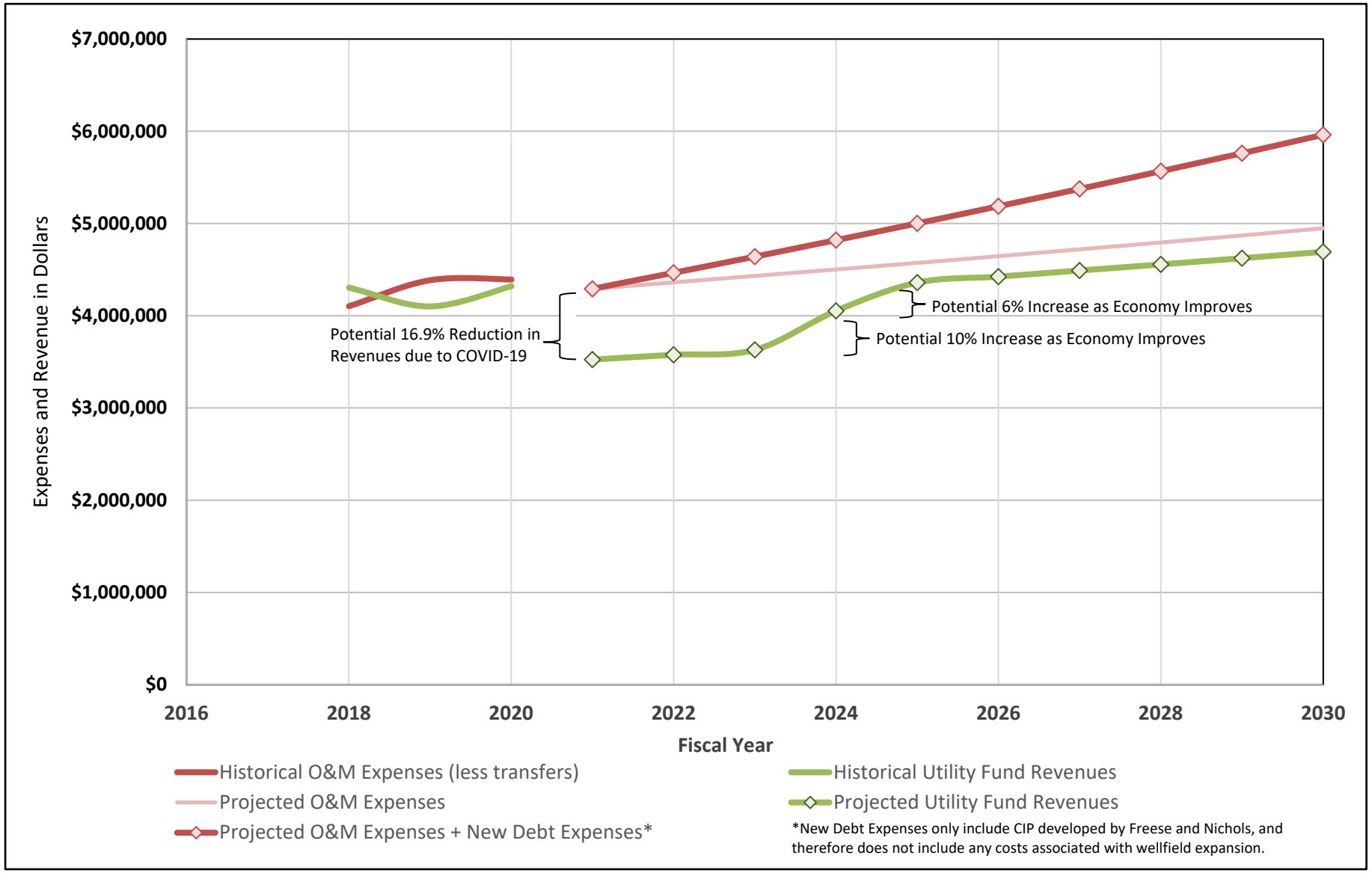
Table 6-2 summarizes the City's projected expenses and revenues to Fiscal Year 2029. **Figure 6-1** presents the City's historical and projected expenses and revenues to Fiscal Year 2029. Between Fiscal Years 2021 to 2029, revenues will grow from approximately $3.6 million per year to $4.7 million per year if water and wastewater rates are held current. In Fiscal Year 2021, revenues are projected to be $3.6 million (17.2 percent below pre-COVID-19 levels). Assuming they have an underlying 1.5 percent per year increase from 2021 to 2030 and increase by a further 10 percent in 2024 and six percent in 2025 (recovering from the COVID-19 downturn), and increase by 1.5 percent per year thereafter, revenues will reach $4.7 million by 2030.

Total expenses (to include O&M expenses and new debt service expenses) will grow from $4.5 million in Fiscal Year 2022 to $6.0 million in Fiscal Year 2030 (**Table 6-2**, **Figure 6-1**).

Table 6-2: Projected Expenses and Revenues

	Projected								
	2021-22	**2022-23**	**2023-24**	**2024-25**	**2025-26**	**2026-27**	**2027-28**	**2028-29**	**2029-2030**
Expenses									
O&M Expenses	$4,362,479	$4,431,737	$4,502,094	$4,573,569	$4,646,179	$4,719,941	$4,794,874	$4,870,997	$4,948,328
New Debt Service Expenses	$103,914	$209,907	$318,019	$428,294	$540,774	$655,504	$772,528	$891,893	$1,013,645
Total Expenses	**$4,466,393**	**$4,641,644**	**$4,820,113**	**$5,001,863**	**$5,186,953**	**$5,375,445**	**$5,567,402**	**$5,762,890**	**$5,961,973**
Revenues									
Total Revenues	**$3,577,784**	**$3,630,842**	**$4,053,156**	**$4,360,059**	**$4,424,718**	**$4,490,336**	**$4,556,927**	**$4,624,506**	**$4,693,086**
Additional Revenue Needed	**$888,609**	**$1,010,802**	**$766,957**	**$641,804**	**$762,235**	**$885,109**	**$1,010,475**	**$1,138,384**	**$1,268,887**

Figure 6-1: Historical and Projected Expenses and Revenues



6.2 Potential TWDB Funding Opportunities

Texas Water Development Board (TWDB) programs would be the best alternative to traditional revenue/general obligation bonds sold on the open market. TWDB loans are typically at below-market interest rates and could offer some amount of principal forgiveness for eligible disadvantaged communities or "green" projects. The five primary TWDB programs that could fund the City's future CIP expenses are the Clean Water State Revolving Fund, the Drinking Water State Revolving Fund, the State Water Implementation Fund for Texas, the Flood Infrastructure Fund, and the Texas Water Development Fund.

TWDB's Clean Water State Revolving Fund (CWSRF) was authorized by the Clean Water Act, and provides low-cost financial assistance for planning, acquisition, design, and construction of wastewater, reuse, and stormwater infrastructure. Andrews is eligible to apply for the CWSRF, and all of the wastewater and stormwater CIP projects recommended in this memo would be eligible for CWSRF. This is primarily a loan program, with principal forgiveness (similar to a grant) available on a limited basis for green projects. For loans, there are two interest rate tiers: 1.65 percent below market rates or 1.30 percent below market rates. The amount of subsidy depends on different levels of program requirements called Equivalency or Non-Equivalency. **Table 6-3** shows the terms which TWDB can offer a municipality such as Andrews with an AA credit rating, under its CWSRF program.

Table 6-3: Terms of TWDB's CWSRF program for AA utility (rates as of 6/12/20)

Program Type	Term (Years)	Market Rate	TWDB Rate	Absolute Subsidy to Interest Rate
CWSRF Non-Equivalency	20	1.45%	0.15%	1.3%
CWSRF Equivalency	20	1.45%	0%	1.65%
CWSRF Non-Equivalency	30	1.62%	0.32%	1.3%
CWSRF Equivalency	30	1.62%	0%	1.65%

TWDB's Drinking Water State Revolving Fund (DWSRF) was authorized by the Safe Drinking Water Act, and provides low-cost financial assistance for planning, acquisition, design, and construction of water infrastructure. Andrews is eligible to apply, and all of the water CIP projects recommended in this memo would be eligible for DWSRF. This is primarily a loan program, with principal forgiveness (similar to a grant) available on a limited basis for green projects. For loans, there are two interest rate tiers: 1.55 percent below market rates or 1.25 percent below market rates. The amount of subsidy depends on different levels of program requirements called Equivalency or Non-Equivalency. **Table 6-4** shows the terms which TWDB can offer a municipality such as Andrews with an AA credit rating, under its DWSRF program.

Table 6-4: Terms of TWDB's DWSRF program for AA utility (rates as of 6/12/20)

Program Type	Term (Years)	Market Rate	TWDB Rate	Absolute Subsidy to Interest Rate
DWSRF Non-Equivalency	20	1.45%	0.2%	1.25%
DWSRF Equivalency	20	1.45%	0%	1.55%
DWSRF Non-Equivalency	30	1.62%	0.37%	1.25%
DWSRF Equivalency	30	1.62%	0.07%	1.55%

TWDB's State Water Implementation Fund for Texas (SWIFT) helps communities develop and optimize water supplies at cost-effective rates. The program provides low-interest loans, extended repayment terms, deferral of loan repayments, and incremental repurchase terms for projects with state ownership aspects. Alternative water management strategy projects are not eligible, so Andrews' wellfield expansion would not be eligible for SWIFT funding. However, water conservation initiatives implemented by Andrews would be eligible for SWIFT funding. At its June 4, 2020 Board meeting, the TWDB approved the subsidies for the 2021 funding cycle, which are in addition to the favorable rates that TWDB receives due to the program's AAA credit rating (**Table 6-5**).

Table 6-5: Terms of TWDB's SWIFT program for the 2021 Funding Cycle

Program Type	Relative Subsidy to Interest Rate
20 Year Tax-Exempt	Up to 25%
20 Year Taxable	Up to 20%
21-25 Year Tax-Exempt	Up to 18%
21-25 Year Taxable	Up to 14%
26-30 Year Tax-Exempt	Up to 14%
26-30 Year Taxable	Up to 10%

TWDB's Flood Infrastructure Fund (FIF) was passed by the Legislature and approved by Texas voters through a constitutional amendment in 2019. The FIF provides financial assistance in the form of low-cost loans and grants for flood control, flood mitigation, and drainage projects. FIF rules allow for a wide range of flood projects, including structural and non-structural projects as well as nature-based solutions. This funding opportunity is intended to help the entire state plan and prepare for future flood events, not just areas of the state that were impacted by Hurricane Harvey or other disasters. While applications for the first round were due June 15, 2020, there will be future rounds.

TWDB's Texas Water Development Fund (DFund) is a state funded loan program that does not receive federal subsidies, and enables TWDB to fund water, wastewater, and stormwater components in a single loan. The

interest rate on a DFund loan varies depending on market conditions. In order to be eligible for DFund, the project must be consistent with the current TWDB State Water Plan. Application period is year-round, and the first step in the application process is scheduling a pre-application conference with TWDB.

6.3 Stormwater Utility Fee

6.3.1 Legal Basis and Limitations for a Stormwater Utility

A stormwater utility is a legal mechanism provided to municipalities by the State of Texas to generate revenue to finance the City's cost of providing services related to the management of stormwater in the City. The Texas Municipal Drainage Utility Systems Act [Local Government Code 552 Subchapter C] authorizes cities in Texas to establish a municipal stormwater utility system to "protect the public health and safety in municipalities from loss of life and property caused by surface water overflows, surface water stagnation, and pollution arising from non-point source runoff within the boundaries of the established service area…" [LGC 552.042(3)]. To provide these services, municipalities are authorized to assess fees to users of the stormwater utility system. The stormwater utility fee is considered a service fee and must be based on the projected cost of providing stormwater service within the City's jurisdiction. Following are some stormwater-related costs that are allowed by State law [LGC 552.044(2)] to be included in the development of the projected revenue needs for stormwater service:

- Property acquisition
- Service fees (architectural, engineering, legal, surveys, etc.)
- Capital (equipment, machinery, furniture, facilities, etc.)
- Funding and finance costs for construction projects
- Debt service
- Administration

When developing the fee rate for users, classification of affected properties must be nondiscriminatory, equitable, and reasonable. Specific requirements and allowances to exempt certain property owners and property types, respectively, are established in the state legislature. The statute [LGC 552.053(c)] and recent amendments [LGC 580.003] specifically restrict a municipality from assessing the stormwater utility fee on certain types of property:

- Property with proper construction and maintenance of a wholly sufficient and privately owned drainage system [LGC 552.053(c)(1)]
- Property held and maintained in its natural state, until such time that the property is developed, and all of the public infrastructure constructed has been accepted by the municipality in which the property is located for maintenance [LGC 552.053(c)(2)]
- A subdivided lot, until a structure has been built on the lot and a certificate of occupancy has been issued by the municipality in which the property is located [LGC 552.053(c)(3)]
- A State agency or institution of higher education [LGC 580.003]

The City is also provided the ability to exempt certain properties from the stormwater utility fee without regard to the properties' impacts to the stormwater system. The following property types are allowed by law [LGC 552.053(a), (b), and (d)] to be exempted from paying a stormwater utility fee:

- State property
- County property
- Municipal property
- School district property
- Property owned by a tax-exempt religious institution
- Property used for cemetery purposes if the cemetery is closed to new interments and does not accept new burials

Revisions to the Texas statutes [LGC 580.003] in June 2003 added State property to the list of required exemptions from the stormwater utility fee. This revision overrides the previous exemption status of State property from optional to mandatory. Developed property owned by State agencies and public institutions of higher education are considered to be State property. Private institutions of higher education are also required to be exempt from the stormwater utility fee per the Texas Education Code 61.003 (15). The stormwater utility service area is comprised of land that contributes overland flow into the watersheds in the municipality. The service area cannot extend farther than the City's jurisdiction.

6.3.2 Stormwater Utility Policy

This summary report provides an introductory overview of an assessment of the feasibility for the City of Andrews to finance its stormwater-related activities through revenues from a stormwater utility fee. The City is one of many municipalities subject to federal stormwater quality regulations that require the City to further protect and enhance water quality in creeks and lakes through the development of a stormwater quality management program. As an operator of a municipal separate stormwater system (MS4) as defined by the U.S. Environmental Protection Agency, the City is required to develop a multi-faceted program to protect stormwater quality before it enters creeks, rivers, and lakes. The program includes a number of measures to protect stormwater quality, such as the following:

- Storm system maintenance
- Structural and non-structural water quality protection measures
- Storm system mapping and inspections
- Public education, outreach, and involvement
- City ordinances regulating construction activity, illicit discharges, and post-construction runoff

- City staff training and operations improvements

The purpose of the utility fee is to develop a mechanism to finance compliance activities, system maintenance, stormwater planning, capital improvements, as well as associated administration and other stormwater-related costs with revenues from the stormwater utility fee. The City strives to develop a fair and equitable fee based on the projected cost of providing stormwater services in the City. A means to appeal the rates for any property will be established, and exempted properties will not be required to pay stormwater utility fees.

The following general goals and policies have been established for the City's stormwater utility. The goals provide a basis for the purpose and intended benefit of the utility for the community in Andrews.

1) Serve as the primary stable source of new stormwater-related funding.
2) Finance some or all of the following specific activities:
   a) Stormwater Ordinances and Design Criteria modifications
   b) Ongoing implementation and maintenance of a Stormwater Quality Management Program to comply with Federal and State MS4 regulations and permit requirements
   c) Engineering studies and design
   d) Capital improvements to the stormwater system infrastructure
   e) Proactive maintenance for existing infrastructure
   f) Equipment for drainage maintenance
   g) staffing for maintenance, compliance, engineering, and/or administration activities
3) Provide a mechanism to benefit the quality of life in Andrews by improving and integrating the management of water resources with other aspects of the City such as park systems.
4) Encourage development in the City that minimizes adverse stormwater impacts through better site design and proper management of the City's stormwater resources.
5) Provide a fair and equitable method to assess fees for developed properties' impacts to the City's stormwater system.
6) Allow for the issuance of bonds to finance stormwater capital improvement projects.

6.3.3 Key Policy Issues

At the initial planning stage, the City must consider a series of key policy issues that will shape the framework of the stormwater utility development process. Multiple options are available to cities to shape their stormwater utility according to their particular needs and goals. Some potential policy options are summarized below:

- The funds generated by the stormwater utility should be focused on projects with a high probability of being constructed.
- The utility fee could be based on the amount of impervious area for each property.
- Policies or decisions regarding exemptions for certain property owners (as allowed by law) must be considered. Several options could be evaluated through the stormwater utility rate model for the City's consideration.
- The draft stormwater utility ordinance could include incentives for property owners to minimize their impact on the drainage system, thus reducing their stormwater utility fee.

- Public outreach is of significant importance.
    - Community meetings could be held to educate citizens regarding the City's stormwater system and its problems, how those problems affect them, what needs to be done to address those problems, and present funding recommendations.
    - An overview of the stormwater utility development process will be provided to the public.
    - Ample opportunity will be given to the public to, ask questions, provide input, and identify stormwater problem areas.
    - Residents will have the opportunity to become a member of a Steering Committee, which will provide feedback during the stormwater utility fee development process.
    - A website will be developed to provide information to the community. The website will also provide the community an opportunity to submit comments and express interest in becoming a member of the Stormwater Steering Committee.
    - The City could envision a phased fee implementation over multiple years with incremental fee increases until full implementation is achieved.

6.4 Water, Wastewater, and Roadway Impact Fees

An impact fee is a charge imposed by a political subdivision on new development to pay for the construction or expansion of off-site capital improvements that are necessitated by and attributable to the new development. The legal basis for impact fees is that they must meet the "rational nexus" and "rough proportionality" tests. First, there must be a reasonable connection between the "need" for additional facilities and the new development. Second, it must be shown that the fee payer will "benefit" in some way from the fee. The Texas Local Government Code, Title 12, Subtitle C, Chapter 395 governs the types of capital improvements projects that can be charged to new development in municipalities, counties, and certain other local governments. The following pages summarize the code.

6.4.1 Who can establish an impact fee?

Political subdivisions (municipalities) may establish impact fees on land within their control. For roadways, impact fees may only be charged within the city limits and may not include the entity's extraterritorial jurisdictions (ETJs). However, a drainage impact fee may be applied to a political subdivision's ETJ. A municipality may contract with an area outside of its boundaries and ETJ to provide capital improvements and may charge a drainage impact fee to do such work.

6.4.2 How can an impact fee be used?

Specific requirements apply to the use of funds for impact fees. For drainage, fees collected can only be assessed within the watershed boundaries of the basin in which the fees are expended (in the city limits or its ETJ). Conversely, roadway fees collected must be spent within specific service areas in which they were collected and

only within the city limits. Impact fees can only be used to pay for the construction of capital improvements or facility expansions, and are limited to:

- Construction contract price.
- Surveying and engineering fees.
- Land acquisition costs (including purchase of land, court costs, attorney fees and expert witness fees); and
- Costs associated with having qualified professionals prepare or update the entity's CIP.

Interest charges and other finance costs associated with capital improvements or facility expansions identified in the CIP may be included if the fee is applied toward the principal and interest on bonds, notes, or other obligations. An impact fee can be pledged as security to pay the debt service on a bond, note, or other obligations provided certain conditions are met. Impact fees cannot be adopted or used to pay for:

- Construction, acquisition, or expansion of public facilities not included in the CIP.
- Repair, operation, or maintenance of existing or new capital improvements or facility expansions.
- Upgrading, updating, expanding, or replacing existing capital improvements to serve existing development to meet stricter requirements.
- Upgrading, updating, expanding, or replacing existing capital improvements to provide better service to existing development.
- Administrative or operating costs of the political subdivision.
- Principal payments and interest or other finance charges on bonds or other indebtedness, except as allowed by Section 395.012.

6.4.3 What are the key components of an impact fee study?

The key components of an impact fee study include land use assumptions, the capital improvement plan, and the resultant impact fee. The land use assumptions (LUA) provides a description of the service area and projections of changes in land uses, densities, intensities, and population in the service area over a ten-year planning period. The capital improvements plan describes facilities the political subdivision intends to initiate over the planning period. The following items must be included:

- A description of the existing capital improvements within the service area and the costs to upgrade, update, improve, expand, or replace the improvements to meet existing needs and usage.
- An analysis of the total capacity, the level of current usage, and commitments for usage of capacity of the existing capital improvements.
- A description of the capital improvements or facility expansions and their costs necessitated by and attributable to new development in the service area based on the approved land use assumptions.
- A definitive table establishing the specific level or quantity of use, consumption, generation, or discharge of a service unit for each category of capital improvements or facility expansions and an equivalency or conversion table establishing the ratio of a service unit to various types of land uses, including residential, commercial, and industrial;
- The total number of projected service units necessitated by and attributable to new development within the service area based on the approved land use assumptions.

- The projected demand for capital improvements or facility expansions required by new service units projected over a reasonable period of time, not to exceed 10 years; and
- A plan for awarding:
  - a) a credit for the portion of ad valorem tax and utility service revenues generated by new service units during the program period that is used for the payment of improvements, including the payment of debt, that are included in the capital improvements plan (Section 395.014(7)(a)); or
  - b) in the alternative, a credit equal to 50 percent of the total projected cost of implementing the capital improvements plan (Section 395.014(7)(b)).

The resultant impact fee is based on the cost of necessitated improvements divided by the total number or projected service units of growth (based on the land use assumptions) anticipated in the ten-year planning period.

6.4.4 What is the maximum fee that can be charged?

The impact fee per service unit may not exceed the dollar amount attributed to new development divided by the total number of new units projected to occur within a 10-year planning period.

6.4.5 What is the allowed timeframe for collecting impact fees?

A new development platted before the implementation of an impact fee may not be assessed the impact fee on a service unit *if* a valid building permit is issued within one year of the city's adoption of the impact fee. The city must assess impact fees before or at the time of recordation of the plat. Land with new or proposed development without platting may be assessed the impact fee at any time during the development and building process. The fee may be collected at either the time of recordation of the plat or connection to the city's water or wastewater system or at the time the city issues the building permit or certificate of occupancy. The city may enter into an agreement with a landowner of a recorded plat specifying the time and method of payment of the impact fees.

Fees may only be collected for projects identified in the Capital Improvements Plan specifically prepared as part of the Impact Fee adoption process. Except for roadways, construction of identified improvements must begin within two years of collection of fees and must be complete within five years of collection of fees. Developers may construct improvements in lieu of impact fees. (Section 395.019)

6.4.6 Can additional fees be charged?

Once the impact fee has been assessed or an agreement for payment of impact fee has been executed, additional impact fees or increases may *not* be assessed against the tract of land, unless the number of service units to be developed increases.

6.4.7 Who is exempt from impact fees?

The city may reduce or waive an impact fee for any service that would qualify as affordable housing. If the affordable housing is not constructed, the city may reverse its decision to reduce or waive the impact fee and the city may assess as impact fee at any time during the development approval or building process or after the building process if an impact fee was not already assessed. Political subdivisions and other governmental entities may pay impact fees. School districts are not required to pay impact fees unless the district's board of trustee's consents to the payment by entering a contract with the city.

6.4.8 Refunds

Refunds shall be paid to owners who paid the impact fee when existing facilities were available, and service was denied. Except for roadways, refunds shall be paid to landowners who paid the impact fee if the city does not provide service within two years of collecting the fee or service is not available in a reasonable time considering the improvement needed but no later than five years from the date of payment. Any refund shall include interest. All refunds shall be paid to the record owner of the property at the time the refund is paid.

6.4.9 Adoption of Impact Fees

In order to impose an impact fee, the city must adopt an ordinance establishing a public hearing date to consider the land use assumptions and capital improvements plan for the designated service area. On or before the date of notice of public hearing is published, the city must make available the land use assumptions, time period of projections, and a description of the capital improvement facilities that may be proposed. Public notice must be made at least 30 days in advance of the public hearing. (Additional details for public notice are found in Section 395.044 of the Code.) Following the adoption of the land use assumptions and the CIP, the city shall adopt an order or resolution setting a public hearing to discuss the proposed impact fee. The public hearing must be held by the City Council to discuss the proposed ordinance imposing an impact fee. Public notice of the hearing must be posted at least 30 days in advance. The rules for this public notice are described in Section 395.049.

The CIP advisory committee (Section 395.058) shall file written comments on the proposed impact fee at least 5 business days before the date of the public hearing on the imposition of the impact fees. Following the hearing, the city has 30 days to approve or disapprove the imposition of the impact fee. The impact fee may not be adopted as an emergency measure. The Planning and Zoning Commission may serve as the CIP advisory committee provided at least one member of the committee is a representative of the real estate, development or building industry who is not an employee of a government entity. If drainage impact fees are to be adopted in the City's ETJ, a representative from the ETJ must also be on the CIP advisory committee. Records of all public hearings

must be prepared. These records must be made available for public inspection for at least 10 years after the date of the public hearing.

6.4.10 Additional Information

Any new development that has paid an impact fee is entitled to permanent use and benefit of the services associated with the fee. The new development is entitled to receive immediate service from existing facilities that have capacity to do so. Section 395.024 provides details on the type of interest bearing account that must be used for the collected fees. The interest earned on this account is subject to the same restrictions as the fees themselves (must be used for projects specified in the CIP). The account records shall be made available to the public upon request.

If the city imposes an impact fee, the city is required to update the land use assumptions and CIP at least every five years. A public hearing is required prior to adopting updated land use assumptions, CIP, and impact fee. (Section 395.055 provides hearing and notice requirements.) A moratorium may not be placed on new development while awaiting the completion of the land use assumptions, a CIP, or an impact fee. An appeals process is outlined in Section 395.077 of the Code. If the city imposes an impact fee, it must submit a certificate of compliance with the attorney general each year. The details of the certification are found in Section 395.082. The CIP advisory committee assists with filing semiannual reports with respect to the progress of the capital improvements plan and report to the political subdivision any perceived inequities in implementing the plan or imposing the impact fee.

6.5 4B Sales Tax Fund

6.5.1 Purpose

The use of the sales tax for economic development purposes has been one of the most popular and effective tools used by cities to promote economic development. Since the authorization for the local option tax took effect in 1989, more than 586 cities have levied an economic development sales tax. These cities have cumulatively raised more than $573 million annually in additional sales tax revenue dedicated to the promotion of local economic development. Of these cities, 101 have adopted a Type A economic development sales tax, 367 cities have adopted a Type B economic development sales tax, and 118 cities have adopted both a Type A and a Type B sales tax.

6.5.2 Constraints

There are several important differences between Type A and Type B sales taxes for economic development. Type A and Type B taxes can be distinguished on the following grounds: 1) the authorized use of the tax proceeds; 2) the oversight procedure regarding project expenditures; and 3) the means for adopting and altering the tax by election.

The Type B tax also can be used to fund the provision of land, buildings, equipment, facilities, expenditures, targeted infrastructure and improvements that are for the creation or retention of primary jobs for projects such as manufacturing and industrial facilities, research and development facilities, military facilities, including closed or realigned military bases, transportation facilities, sewage or solid waste disposal facilities, recycling facilities, air or water pollution control facilities, distribution centers, small warehouse facilities, primary job training facilities for use by institutions of higher education, regional or national corporate headquarters facilities, eligible job training classes, certain career centers and certain infrastructural improvements that promote or develop new or expanded business enterprises. However, unlike the Type A tax, the Type B tax can additionally fund projects that are typically considered to be community development initiatives. For example, authorized categories under Type B include, among other items, land, buildings, equipment, facilities, expenditures, and improvements for professional and amateur sports facilities, park facilities and events, entertainment and tourist facilities, and affordable housing. Also, the Type B tax may be expended for the development of water supply facilities or water conservation programs.

If the city is eligible to adopt a Type B tax, it may propose a tax rate equal to one-eighth, one-fourth, three-eighths or one-half of one percent. The city may not adopt a sales tax rate that would result in a combined rate of all local sales taxes that would exceed two percent.

6.5.3 Benefits

Every Texas city is eligible to adopt a Type B sales tax if the combined local sales tax rate does not exceed two percent.

6.5.4 Potential Applications

Type B corporations may provide land, buildings, equipment, facilities, and improvements found by the board of directors to promote or develop new or expanded business enterprises that create or retain primary jobs, including a project to provide:

- Transportation facilities (including but not limited to airports, hangars, airport maintenance and repair facilities, air cargo facilities, related infrastructure located on or adjacent to an airport facility, ports, mass commuting facilities and parking facilities),
- Sewage or solid waste disposal facilities,
- Air or water pollution control facilities,
- Facilities for furnishing water to the public,
- Public safety facilities,
- Streets and roads,
- Drainage and related improvements,
- Demolition of existing structures,
- General municipally owned improvements,
- Any improvements or facilities that are related to any of those projects and any other projects that the board in its discretion determines promoted or develops new or expanded business enterprises that create or retain primary jobs.

6.5.5 Potential Roadblocks

Any drainage improvements would have to be approved by the Type B corporation board.

6.6 Establishment of Special Districts

A special district is a political subdivision established to provide a single public service (such as water supply or sanitation) within a specific geographic area.

6.6.1 Public Improvement District (PID)

A PID is a special assessment area created at the request of the property owners in the district. These owners pay a supplemental assessment with their taxes, which the PID uses for services above and beyond existing City services. A PID may be formed to perform any of the following improvements:

- Water, wastewater, health and sanitation, or drainage improvements
- Street and sidewalk improvements
- Mass transit improvements
- Parking improvements
- Library improvements
- Etc.

6.6.2 Water Control and Improvement District (WCID)

A WCID is a political subdivision of the State of Texas, and is empowered to purchase, construct, operate, and maintain everything necessary to provide water, wastewater, and drainage services. Through “general law,” a district may be created by the TCEQ or the county commissioners court. WCIDs have broad authority to supply

and store water for domestic, commercial, and industrial use; to operate sanitary wastewater systems; and to provide irrigation, drainage, and water quality services.

6.6.3 Municipal Utility District (MUD)

A MUD is a special-purpose district that provides public utilities (such as electricity, natural gas, sewage treatment, waste collection/management, wholesale telecommunications, water) to district residents. MUDs engage in the supply of water, conservation, irrigation, drainage, firefighting, solid waste (garbage) collection and disposal (including recycling activities), wastewater (sewage) treatment, and recreational facilities. A MUD can require its customers to use its solid waste services as a condition for receiving other MUD services. A MUD may provide solid waste and recycling services through a private company. While they can develop, maintain, or acquire parks or recreational facilities, MUDs are prohibited from issuing bonds to pay for these facilities. They can, however, set and charge user fees.

6.6.4 Drainage District (DD)

Most DDs (or drainage improvement districts, DID) are administered by an internal drainage board (IDB), which are single purpose local drainage authorities, dealing with the drainage and water level management of clean water only. Each DD has a defined area, and the IDB only has powers to deal with matters affecting that area. An example of an established DD in Texas is the City of Garland. The established a DD to assist residential and commercial property owners who are experiencing property damage due to erosion from creeks or other bodies of water within the City.

6.6.5 Local Improvement District (LID)

A LID is a method by which a group of property owners can share in the cost of transportation infrastructure improvements or other types of public improvements such as installing water and sanitary sewer lines. Most LIDs involve improving a street, building sidewalks, and installing a stormwater management system. A LID can also be used to install sidewalks on existing streets that previously have been accepted for maintenance by the City. When property owners decide they want to form a LID, they assume responsibility to pay for the project if the project is approved by City Council. The City works with property owners to determine the scope of the project and develops an assessment methodology. A variety of methods are used, including square footage, linear footage, or equivalent dwelling unit. Sometimes a combination of these methods is used, but square footage is most commonly used for projects in residential areas.

6.6.6 Flood Control District (FCD)

The role of the FCD is to reduce flood risk and conserve stormwater runoff while improving water quality, providing recreation opportunities, and enhancing open space where feasible. An example of this is the Harris County FCD roles which include widening and deepening bayous to carry more stormwater and reduce the size of floodplains, excavating stormwater detention basins to safely store millions of gallons of stormwater, implementing voluntary home buyouts, and maintaining drainage infrastructure by addressing erosion, slope failure, and sediment build-up. FCDs are generally capital improvement programs that address flooding from a regional perspective.

6.6.7 Tax Increment Reinvestment Zone (TIRZ)

A TIRZ is a political subdivision of a municipality or county in Texas created to implement tax increment financing. They may be initiated by the city or county or by petition of owners whose total holdings in the zone consist of a majority of the appraised property value. To get funding for a TIRZ area, applicants should follow three steps:

1. Property owners possessing 50% or more of the appraised value of a district submit a petition to the county, city, or town requesting a TIRZ be set up, or the local government may decide to create one. A specific lifetime for the TIRZ is determined. A TIRZ may only be city-initiated if less than 10% of its land area consists of residential area.
2. For the purposes of existing tax-collecting entities (water districts, counties, etc.) the assessed values of properties within the new TIRZ are frozen. It is assumed that property values will increase over the lifetime of the TIRZ; the property taxes collected on this increase constitute the "increment".
3. The municipality or county passes an ordinance establishing a governing board for the TIRZ and the zone as a legal entity itself. The board then meets to create a budget for the lifetime of the zone, establishing what projects it will undertake and how they will be financed. This plan is passed as another ordinance.

6.6.8 Municipal Development District (MDD)

An MDD is created to generate economic development and growth opportunities within the boundaries of the district. To create an MDD, a City must call an election through an order that defines the proposed boundaries of the district. The ballot at this election must be printed to allow voting for or against the proposition. In the order calling the election, the City may provide that the district boundaries will automatically conform to future changes in the city's boundaries. If the voters turn down the creation of the district, a subsequent election to establish a district may not be held within a year of the first election. The MDD is funded through a local sales tax. State law permits a tax rate of one-eighth to one-half of one percent.

6.7 Sales Tax Reallocation Election (HB 157)

On June 20, 2015 Governor Abbott signed H.B. 157 into law. The law allows for cities to hold an election to reallocate sales tax revenue. Cities may hold elections to adopt sales taxes (general revenue or dedicated) in any increment of one-eighth of one percent, so long as the total city sales tax does not exceed the maximum two-percent local sales tax cap. In other words, cities now have increased flexibility to reallocate city sales taxes in a way that makes sense to the city and its residents. The election can be initiated at the discretion of the city council or by a petition signed 20 percent of the number of voters who cast ballots in the most recent regular municipal elections.

6.8 Funding Opportunities Summary and Recommendations

It is recommended that the City of Andrews perform a water and wastewater rate study to develop a multi-year plan of rates that will provide sufficient revenue to implement needed capital improvements and allow the water and wastewater system to be self-supporting. This should be conducted every five years using accepted industry standards and practices, specifically the American Water Works Association (AWWA) Manual 1 (M1) “Principles of Water Rates, Fees, and Charges”, as well as the Water Environment Federation (WEF) Manual of Practice No. 27 “Financing and Charges for Wastewater Systems”.

DWSRF is a funding mechanism for drinking water projects. CWSRF is a funding mechanism for wastewater and stormwater projects. The two are not interchangeable save one type of project. Both funding programs may fund advanced metering projects like AMR/AMI. It may be preferable to fund advanced meter system projects with the CWSRF due to lower rates for CWSRF. Dfund rates are not subsidized and are essentially market rate. Dfund rates will always be higher than either the CWSRF or the DWSRF.

Outside of the grants offered, the FIF provides 0% interest rate loans for all project categories (stormwater related). The CWSRF provides subsidized rates off market rates. The CWSRF loan rate will only be 0% when the market rate is low enough. FIF Abridged Applications were due June 15, 2020. The total funding available is $793 million. The TWDB received 281 applications for a total request of $2.8 billion. At this time, it is unknown if the TWDB will receive any additional funding for the program in the foreseeable future. In his Texas Water Conference opening session address, FIF sponsor Rep. Dade Phelan (R-Beaumont) acknowledged that even though he would like to request more money from the State’s Rainy Day Fund for the FIF in the next session, with COVID-19 the next legislative session will certainly focus on healthcare and small business needs. It is unlikely the next legislature will consider more funding for the FIF, but there is a possibility of that happening post the COVID-19 pandemic. To access FIF grant funds, the project area must have a low Annual Median Household Income (AMHI) as compared

to the Texas AMHI. The City of Andrews is not currently eligible for Category 1 FIF funds, which offer a 75% grant, due to there not being a disaster declaration. The other categories would offer a 15% grant, so there are benefits if projects make the State eligible list.

No federal or state stormwater laws or regulations require stormwater utility fees; however, LGC 552 Subchapter C specifically allows municipalities in Texas to establish stormwater utility fees on most developed properties as a means of dedicated funding for stormwater management, whether flood protection or water quality protection. The rate is at the City's discretion but must be based on the cost of providing stormwater service. In Texas residential properties' stormwater utility fees typically range from $3-$8 per month, although some cities have higher fees. Andrews is not currently subject to municipal separate storm sewer system (MS4) stormwater quality regulations like cities in larger urbanized areas. Stormwater quality requirements related to construction activity of 1 acre or more do apply to developments in Andrews. Certain industrial sites, including municipal landfills, municipal airports, and wastewater treatment plants are also subject to stormwater quality requirements, known as multi-sector general permits. The proposed developments this study is evaluating would be subject to these requirements. It is recommended for the City of Andrews to perform a feasibility study to determine the impacts of a stormwater utility and if it would make sense to implement.

It is also recommended for the City to perform an Impact Fee Feasibility Analysis to determine the applicability and impact of an impact fee program for the City of Andrews. Impact fees can be used for any water and wastewater projects where capacity is increased to serve new growth and development. Each project in the recommended water and wastewater capacity CIP has a growth component where a portion (some or all) of the project is eligible for impact fees. Many cities throughout the state fund projects partially using impact fees and the other portion from water/sewer revenues from rate payers. The City would have to develop an Impact Fee specific CIP and can only use impact fee funds on these specific projects. The Infrastructure Master Plan CIP from this study can be used as the Impact Fee CIP. Since all of the projects in the Master Plan CIP are at least partially eligible for Impact Fees, then it would make sense to utilize this as a supplemental funding mechanism to help pay for the construction of the water and wastewater infrastructure required to serve new growth and development.

Impact fees are collected at the time a building permit is pulled. If a current landowner decides to develop for new growth, typically the land is platted into smaller lots. Once a builder/developer starts to pull building permits, they are assessed the impact fee. The fee is typically rolled into the construction of the home/apartment/commercial building and ultimately passed on to the customer. This analysis will consist of benchmarking with other utilities and calculating collections that could have been gained over the last 10 years and potentially the next 10-years. The feasibility study does not include developing land use projections or the

implementation of impact fees. If the City decides to move forward with the impact fee process, Phase 2 will consist of the implementation of the impact fee program. Implementation includes calculating the allowable impact fee rates, coordination with a Capital Improvements Advisory Committee, and adoption of the proposed impact fee ordinance. Data from the Infrastructure Master Plan will assist to expedite the process and reduce the overall cost of the program implementation.