# CITY OF ARVIN

## 2019 SEWER MASTER PLAN
## VOLUME 1 - REPORT


Harris & Associates

VEOLIA

# SEWER MASTER PLAN
# FOR THE
# CITY OF ARVIN

**Adopted:**

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| | |
|---|---|
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| Date: 5/7/2020 | Date: |

# Acknowledgements

The Sewer Master Plan was prepared by Harris and Associate, Inc.

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And with assistance from the City of Arvin

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## Abbreviations and Acronyms

The following abbreviations and acronyms are commonly used throughout the report. As a convention, each abbreviation or acronym is written out in full the first time it appears in each chapter and is abbreviated thereafter.

| | |
|---|---|
| ADWF | Average Dry Weather Flow |
| CCTV | Closed-circuit television |
| CI | Commercial & Institutional |
| CIMIS | California Irrigation Management Information System |
| CIP | Capital Improvement Program |
| CIPP | cured-in-place pipe |
| City | City of Arvin |
| COF | Consequence of Failure |
| CP | Concrete Pipe |
| CSD | Arvin Community Services District |
| ENR | Engineering News Review |
| $ET_0$ | evapotranspiration index |
| fps | feet per second |
| GIS | Geographic Information System |
| GPD | gallons per day |
| HDR | High Density Residential |
| IS & MND | Initial Study and Mitigated Negative Declaration |
| LDR | Low Density Residential |
| LOF | Likelihood of Failure |
| MACP | Manhole Assessment and Certification Program |
| MDR | Medium Density Residential |
| MFR | Multi-Family Residential |
| MGD | millions of gallons per day |
| NASSCO | National Association of Sewer Service Companies |
| PDWF | Peak Dry Weather Flow |
| PVC | polyvinyl chloride |
| RCP | Reinforced Concrete Pipe |
| RWQCB | Regional Water Quality Control Board |
| SFR | Single Family Residential |
| SSMP | Sanitary Sewer Management Plan |
| WRP | Water Reclamation Plant |

# Executive Summary

## Background

### Purpose

The City of Arvin (City) requires a comprehensive Capital Improvement Plan (CIP) for its wastewater collection system.  A CIP is an investment strategy for the physical assets of the system.  The CIP serves three inter-related purposes: (1) it identifies the capital improvements needed to provide reliable service to the City's sewer ratepayers, (2) it provides a basis for setting rates and impact fees, and (3) it satisfies a regulatory requirement of the City's discharge permit administered by the Regional Water Quality Control Board (RWQCB).

### Study Area

This Sewer Master Plan represents implementation of the General Plan with respect to utility services.  The Study Area is consistent with the City Boundary defined in the General Plan.

### Planning Horizon

For purposes of recommending improvements and accommodating growth and development, the planning horizon for the Sewer Master Plan is 20 years.

### Existing System

The water reclamation plant and the wastewater collection system are operated and maintained by Veolia North America.

The wastewater collection system consists of approximately 38 miles of pipe ranging in diameter from 6 inches to 18 inches.  There are 763 manholes.  There is one small pump station serving a small area southeast of the intersection of Sycamore Road and A Street.  Wastewater flows by gravity toward the southwest to the water reclamation plant located west to of the City on El Camino Real.

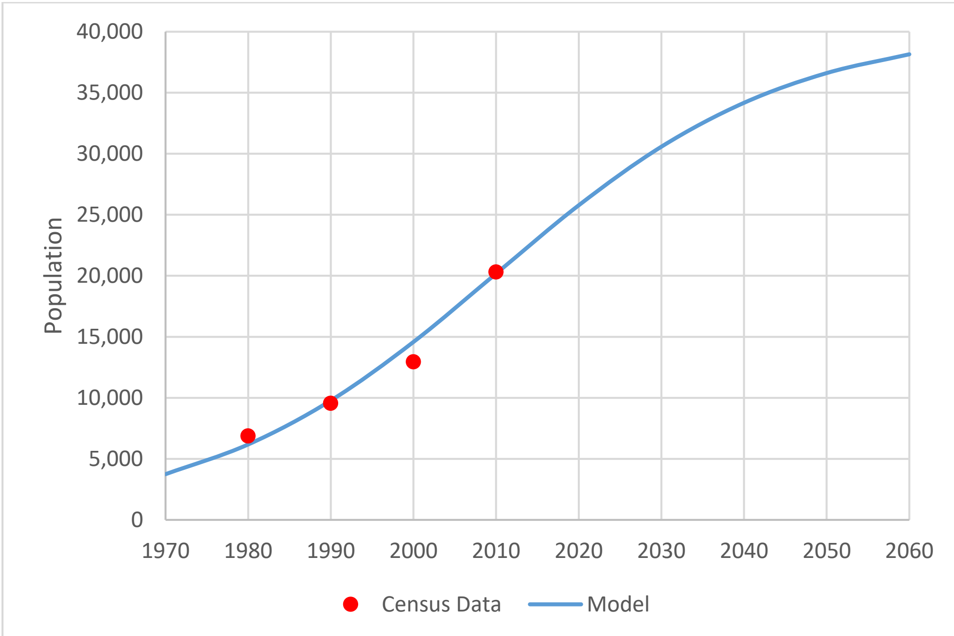
### Land Use

Land use designations and areas are shown in the table below, according to the General Plan.  Land use is one of the primary drivers for estimating wastewater generation.

| Land Use Description | Area (acres) |
|---|---|
| Estate Residential | 343.3 |
| Residential Reserve | 179.1 |
| Low Density Residential (LDR) | 968.7 |
| Medium Density Residential (MDR) | 18.03 |
| High Density Residential (HDR) | 158.1 |
| General Commercial | 152.7 |
| Light Industrial | 365.8 |
| Heavy Industrial | 595.2 |
| Agricultural | 17.9 |
| Public Facilities | 15.7 |
| Schools | 159.8 |
| Parks | 45.2 |
| Totals | 3,019.5 |

## Population

A population projection was prepared using US Census data and build-out of land use, as shown below. Population projection is one of the primary drivers for the timing of future wastewater generation.



## Analysis

### Wastewater Generation

Based on analysis of land use, water use and wastewater influent records, wastewater generation by customer class is shown below.

| Model Results | MFR[1] | SFR[2] | CI[3] | IND[4] | Total |
|---|---|---|---|---|---|
| Existing Wastewater Generation (MGD) | 0.175 | 0.801 | 0.119 | 0.013 | 1.108 |
| Build-Out Wastewater Generation (MGD) | 0.272 | 2.053 | 0.211 | 0.100 | 2.636 |

Based on wastewater generation by customer class and population projection, projected wastewater generation is shown below.

| Year | Population | Wastewater Generation (MGD) |
|---|---|---|
| 2060 | 38,148 | 1.8 |
| 2050 | 36,610 | 1.7 |
| 2040 | 34,174 | 1.6 |
| 2030 | 30,576 | 1.4 |
| 2020 | 25,777 | 1.2 |

### Hydraulic Analysis

A computer model of the backbone of the wastewater collection system was used to determine whether pipes are correctly sized. No pipes were found to be undersized under existing conditions; however, the pipe in Sycamore Road between Walnut Drive and Comanche Drive should be upgraded to accommodate future growth north of Sycamore Road.

### Condition Assessment

The pump station and the older more vulnerable pipes and manholes were inspected visually or via video. Nearly 12 miles of pipes and 255 manholes were inspected. Infrastructure showing excessive wear, deterioration or structural damage was recommended for mitigation.

[1] Multi-Family Residential
[2] Single Family Residential
[3] Commercial and Institutional
[4] Industrial

## Recommendations

The hydraulic analysis and the condition assessment resulted in hundreds of small repair and replacement recommendations. Based on engineering judgment, recommended improvements for pipe capacity, pipe condition and manhole condition were arranged into logical projects considering proximity, similarity of recommended work, limiting disruption to the community, economies of scale and perceived urgency.

The projects were organized by priority into a CIP in two parts. The first part involves improvements recommended to address existing conditions. The second part involves improvements required to support future development.

The table below provides a summary of recommendations to address existing conditions.

| Improvements for Existing Conditions | Priority | Estimated Cost (2020 dollars) |
|---|---|---|
| Pump Rehabilitation and Replacement | As Needed | $100,000 |
| Comanche Drive Pipeline Project | High | 563,000 |
| West Smothermon Park Pipeline Project | High | 2,221,000 |
| Southwest Kovacevich Park Pipeline Project | High | 2,429,000 |
| A Street Pipeline Project | High | 1,449,000 |
| Campus Drive Alley Pipeline Project | High | 890,000 |
| Meyer Street Pipeline Project | Medium | 1,563,000 |
| Southeast Kovacevich Park Pipeline Project | Medium | 1,829,000 |
| West Di-Giorgio Park Pipeline Project | Medium | 890,000 |
| Haven Drive Pipeline Project | Medium | 1,162,000 |
| East Di Giorgio Park Pipeline Project | Low | 1,231,000 |
| Langford Avenue Pipeline Project | Low | 639,000 |
| Plum Tree Drive Alleys Pipeline Project | Low | 985,000 |
| Small Pipeline Replacement Projects | Low | 588,000 |
| Small Spot Repair Projects | Low | 240,000 |
| Stand-Alone Manhole Repair and Replacement | Low | 1,419,000 |
| Total | | $18,198,000 |

The table below provides a summary of recommendations to support development.

| Future Projects | Estimated Cost (2020 dollars) |
|---|---|
| West Sycamore Road Pipeline Project | $614,000 |
| Millux Road Pipeline and Pump Station Project | 4,948,000 |
| Potato-Sycamore Alignment Economic Study | 60,000 |
| Total | $5,622,000 |

# Chapter 1 – Introduction

## 1.1. – General Background

Chapter 1 is intended to help orient the reader regarding the purpose, context, setting and organization of this Sewer Master Plan. Additional information regarding the organization of the report is provided in Appendix R.

## 1.2. – Purpose

The City of Arvin (City) requires a comprehensive Capital Improvement Plan (CIP) for its wastewater collection system. A CIP is an investment strategy for the physical assets of the system. The CIP serves three inter-related purposes: (1) it identifies the capital improvements needed to provide reliable service to the City's sewer ratepayers, (2) it provides a basis for setting rates and impact fees, and (3) it satisfies a regulatory requirement of the City's discharge permit administered by the Regional Water Quality Control Board (RWQCB).

Sewer service must be available continuously to all ratepayers. The sewer system must be constructed and operated in a way that minimizes the possibility of overflow. There are standards in place to assure this level of service is achieved. The CIP represents application of those standards.

Operation of the sewer system is an enterprise. Revenue generated through rates funds sewer system expenses including investment in rehabilitation, replacement and deployment of new assets. The CIP provides a recommendation for the cost and schedule of investment in assets.

RWQCB requires a Sanitary Sewer Management Plan (SSMP) for each permitted system. The CIP is a component of the SSMP and demonstrates to RWQCB that planning is current for investment to minimize the environmental impact of overflows.

## 1.3. – Study Area

This Sewer Master Plan represent implementation of the General Plan with respect to utility service. The Study Area is consistent with the City Boundary as shown on page LU-9 of the General Plan.

## 1.4. – Study Period

Historical data from 2016, 2017 and 2018 were used to develop and understanding of existing conditions.

For purposes of recommending improvements and accommodating growth and development, the planning horizon is 20 years.

## 1.5. – Sources of Information

Information was gathered from three primary sources: the City, the wastewater collection system operator Veolia North America (Veolia), and the Arvin Community Services District (CSD).

The City owns the wastewater collection system and is responsible for authorizing development within the City boundary.

Veolia is under contract to operate and maintain the City's wastewater collection system.

CSD is in charge of retail potable water distribution to City customers, the source of wastewater generation.

This Sewer Master Plan relies heavily on the following documents and data sources:

- City of Arvin 2012 General Plan
- Geographic Information System (GIS) of the wastewater collection system provided by Veolia
- Wastewater influent records provided by Veolia
- Closed circuit television (CCTV) video footage of existing sewer mains provided Veolia
- Water production and sales records provided CSD

# Chapter 2 – Existing System

## 2.1. – General Background

The wastewater collection system consists of approximately 38 miles of pipe ranging in diameter from 6 inches to 18 inches.

There is one pump station serving the southeast portion of the system. Sewage is collected from the area general bounded by El Camino Real on the south, Gregg Lane on the west, Derby Street on the east and Trino Avenue on the north and is pumped via a force main to the trunkline in Sycamore Avenue.

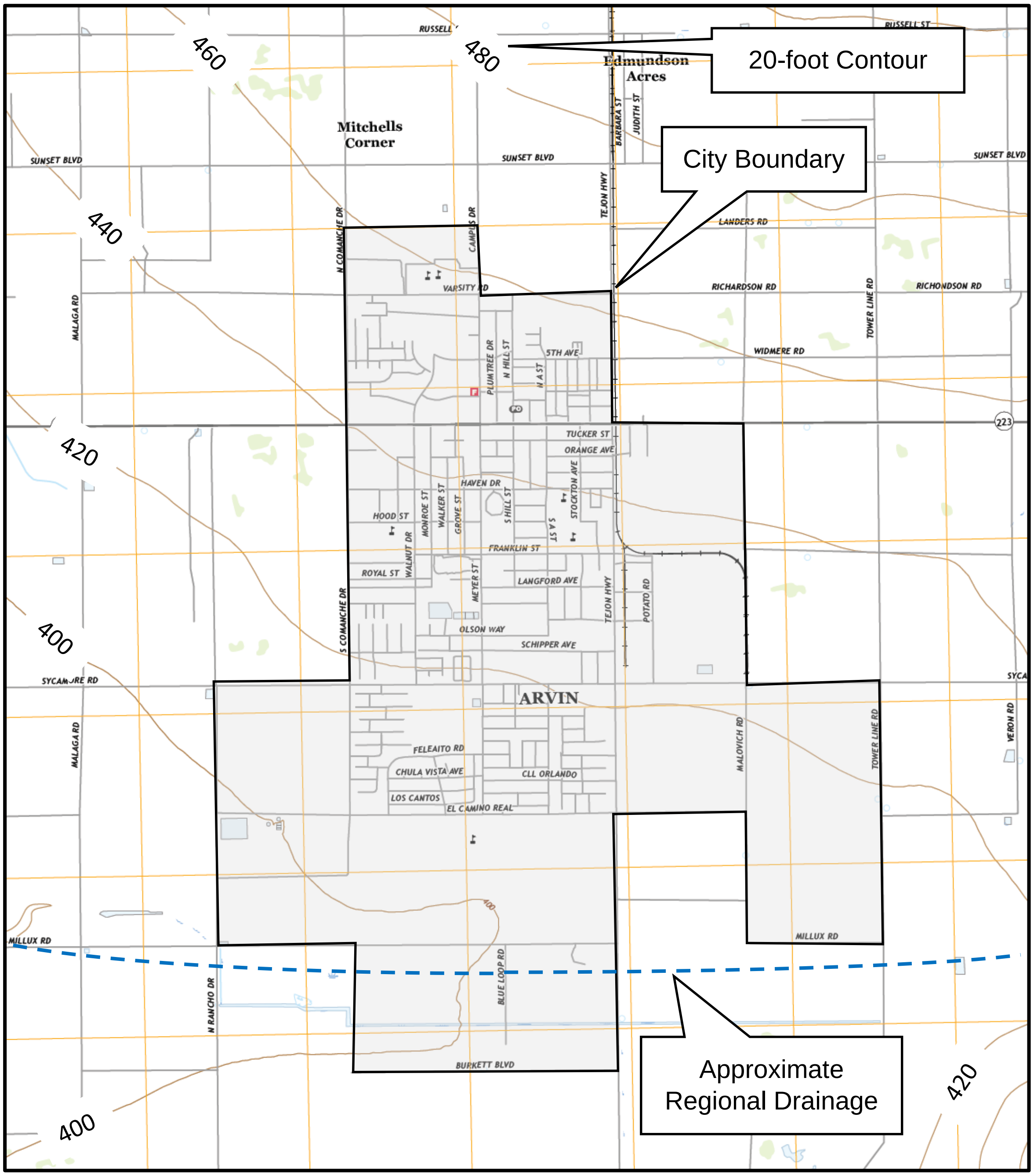
With the exception of the pump station, all wastewater flows by gravity to the WRP located to the southwest of the City.

## 2.2. – Physical Setting

The City is located in Kern County approximately 14 miles southeast of Bakersfield. The terrain within the City boundary is very flat.

Figure 2.1 is an excerpt from the United State Geological Survey (USGS) 2018 topographic map for the region. The map shows the City boundary, elevation contours at 20-foot interval, and the approximate alignment of regional drainage. In general, the area within the City boundary drains to the southwest toward a low point in the south at a gradient of approximately 0.005.

**Figure 2.1 – Topographical Setting**



## 2.3. – Infrastructure

Table 2.1 provides a summary of existing pipe sorted by diameter.

**Table 2.1 – Length Existing Pipe by Diameter**

| Diameter (in) | Length (ft) |
|---|---|
| 6 | 21,000 |
| 8 | 130,430 |
| 10 | 15,750 |
| 12 | 8,380 |
| 15 | 17,580 |
| 18 | 5,760 |
| Total | 198,900 |

There are 763 manholes.

The pump station consists of two 10-horsepower pumps, a sump, an electrical panel, a control panel and a telemetry transmitter.

# Chapter 3 – Land Use and Population

## 3.1. – General Background

Land use and population are the primary demographics that govern engineering decision-making concerning utility capacity. These demographics define the nature and intensity of wastewater generation consistent with the City's vision for growth and development.

## 3.2. – Use of the General Plan

The Land Use Element of the General Plan guides the implementation of the Sewer Master Plan.

Table 3.1 provides a summary of land use within the City Boundary by designation and area according to the General Plan. Build-Out area represents the City's vision for land use distribution per the General Plan. Occupied area represents the locations where wastewater is currently generated. Vacant area represents the locations of future wastewater generation.

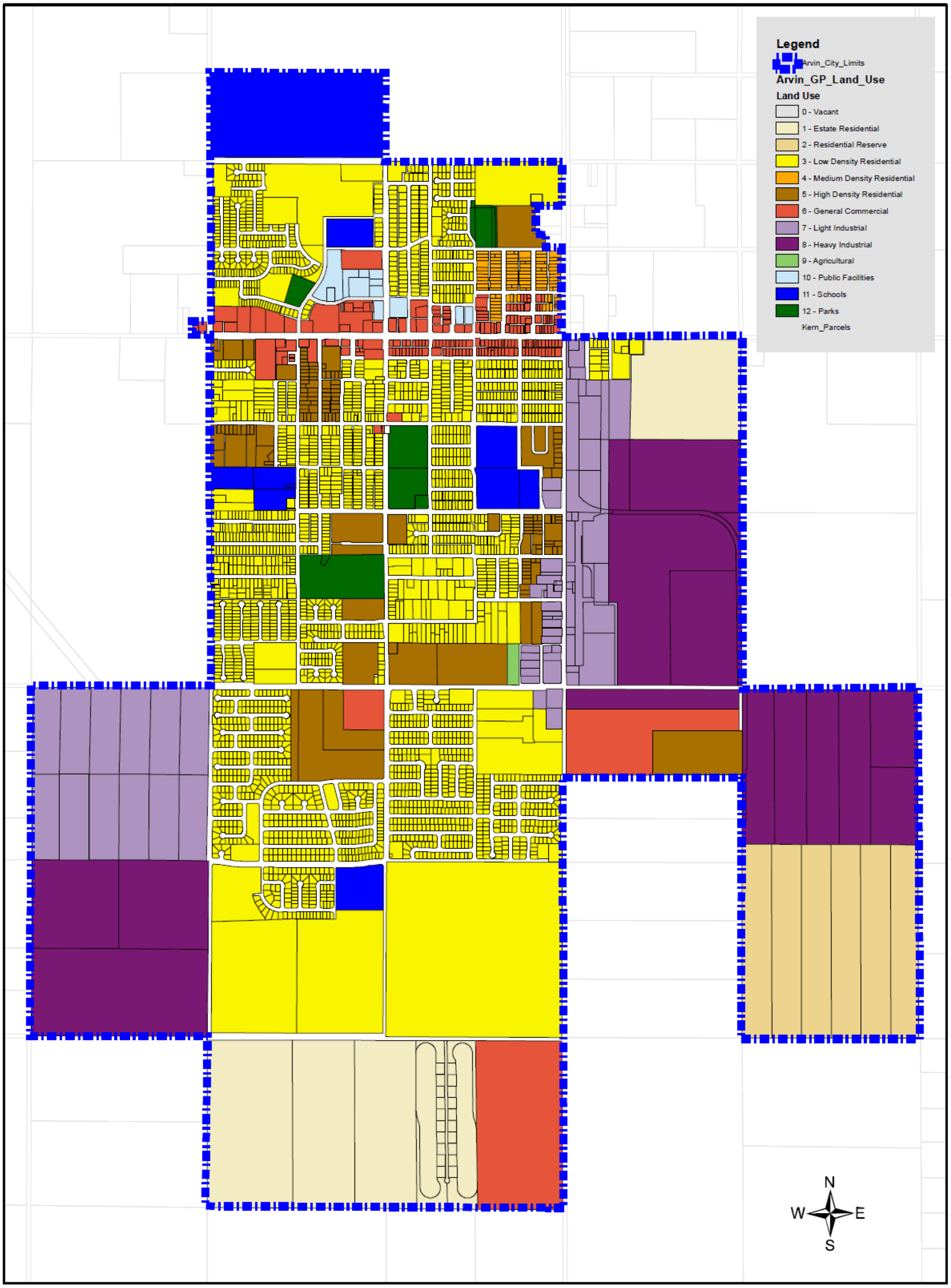
**Table 3.1 – Land Use Summary**

| Land Use Description | Area (acres) |
|---|---|
| Estate Residential | 343.3 |
| Residential Reserve | 179.1 |
| Low Density Residential (LDR) | 968.7 |
| Medium Density Residential (MDR) | 18.03 |
| High Density Residential (HDR) | 158.1 |
| General Commercial | 152.7 |
| Light Industrial | 365.8 |
| Heavy Industrial | 595.2 |
| Agricultural | 17.9 |
| Public Facilities | 15.7 |
| Schools | 159.8 |
| Parks | 45.2 |
| Totals | 3,019.5 |

Figure 3.1 is the land use map from the General Plan.

Figure 3.2 shows known current and future development.

## Figure 3.1 – General Plan Land Use



## Figure 3.2 – Current and Future Development

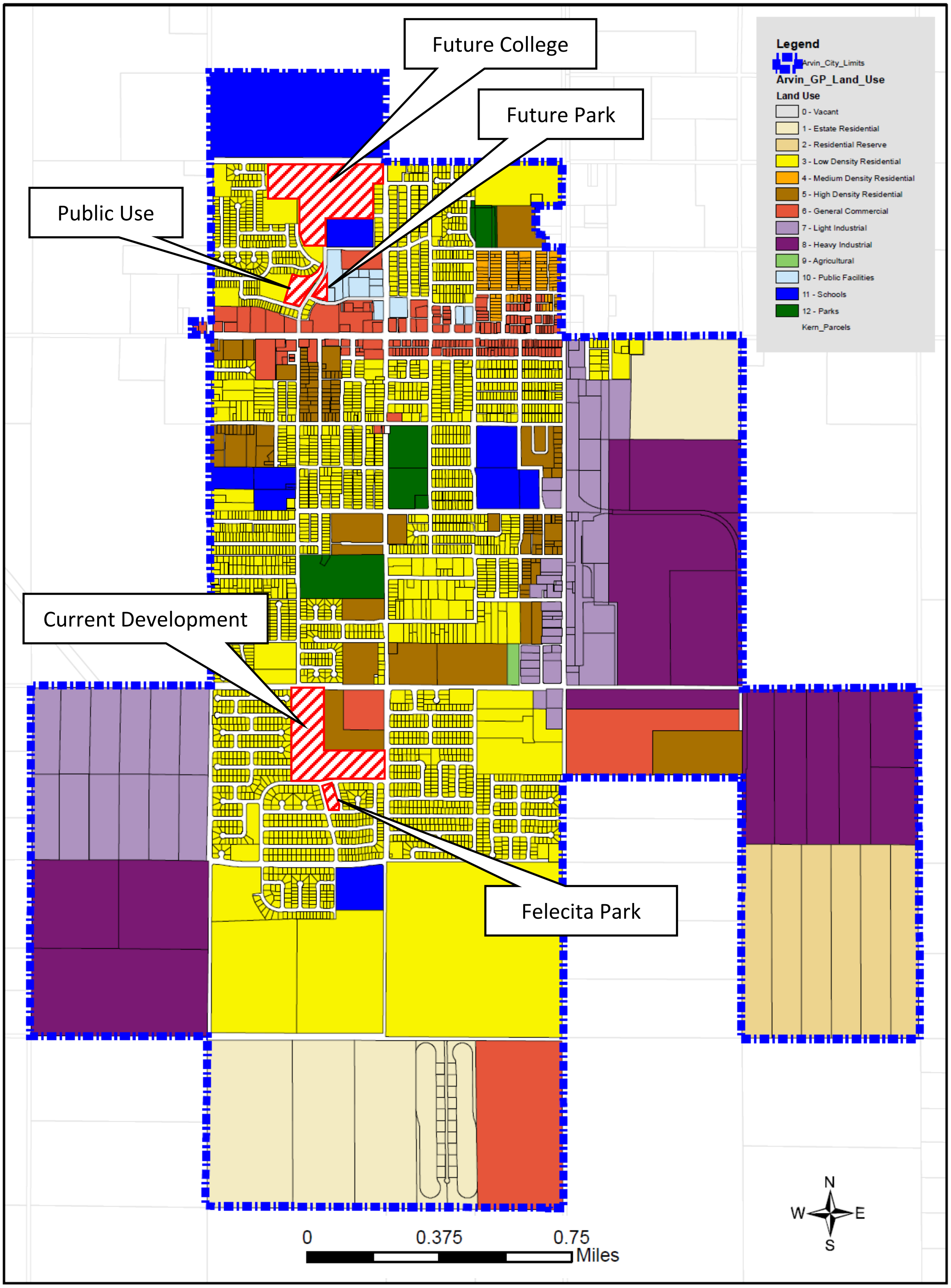


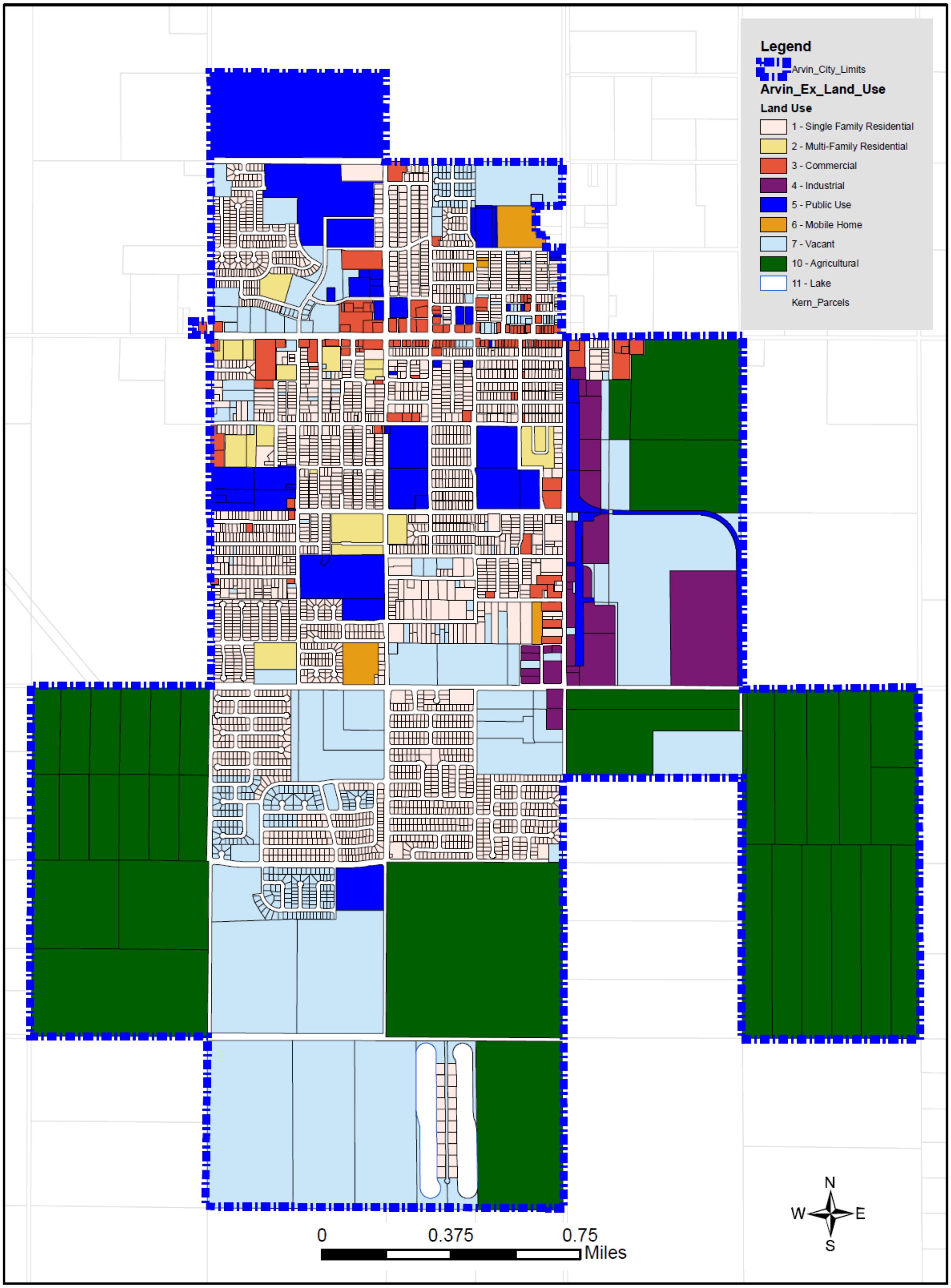
Table 3.2 provides a breakdown of occupied and vacant areas within the City Boundary organized by General Plan land use designation. Occupancy was determined based on review of aerial photography and cross-referenced to potable water billing records. Occupied areas represent the locations where wastewater is currently generated. Vacant areas represent the locations of future wastewater generation.

**Table 3.2 – Occupied and Vacant Areas**

| Land Use Description | Occupied (acres) | Vacant (acres) |
|---|---|---|
| Estate Residential | 10.4 | 332.8 |
| Residential Reserve | 0.0 | 179.1 |
| Low Density Residential (LDR) | 560.6 | 408.1 |
| Medium Density Residential (MDR) | 18.0 | 0.0 |
| High Density Residential (HDR) | 101.7 | 56.3 |
| General Commercial | 56.5 | 96.3 |
| Light Industrial | 85.1 | 280.7 |
| Heavy Industrial | 40.2 | 555.0 |
| Agricultural | 17.9 | 0.0 |
| Public Facilities | 4.5 | 11.2 |
| Schools | 124.1 | 35.7 |
| Parks | 44.8 | 0.4 |
| Totals | 1063.8 | 1955.6 |

Figure 3.3 shows the distribution of occupied and vacant areas within the City Boundary. Areas designated as Vacant or Agricultural are not currently occupied.

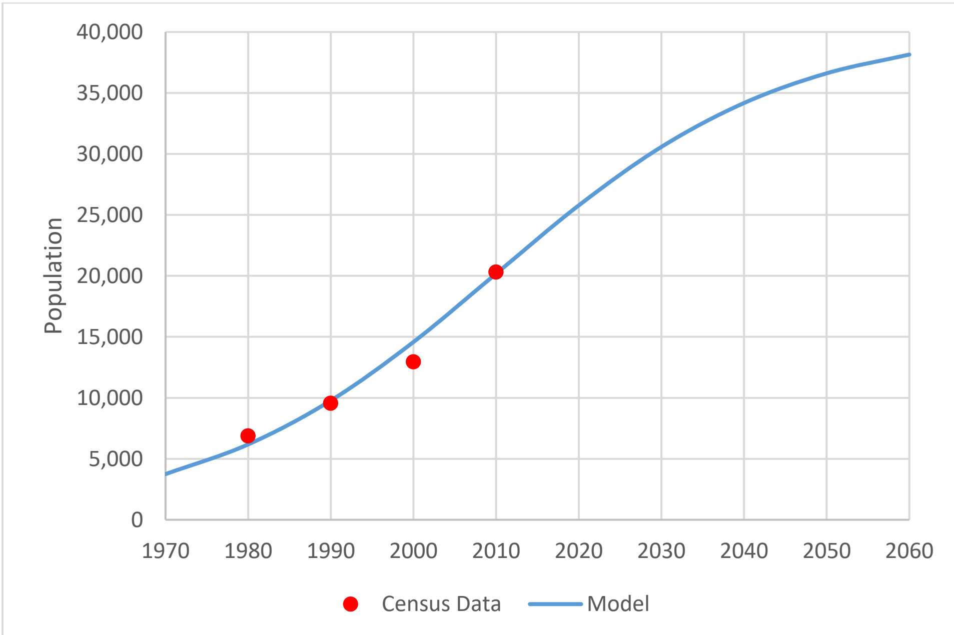
## Figure 3.3 – Current Occupancy



## 3.3. – Population Projection

Figure 3.4 shows a population model for the City based on historical data acquired from the US Census and information from the General Plan concerning growth.

**Figure 3.4 – Population Projection**




The population model has the following curve:

$$P = \frac{P_{max}}{1 + e^{-ct}} = \frac{40{,}355}{1 + e^{-0.057(2010 - year)}}$$

Where:

$P$ is population

$c$ is a calibrated population growth factor

$P_{max}$ is the Build-Out population per the General Plan[5]

[5] The population at build-out assumes complete construction of residential land use at the highest allowable density at the current number of persons per household at complete occupancy.

# Chapter 4 – Wastewater Generation

## 4.1. – General Background

This chapter factors for calculating wastewater generation based on land use. Additional information regarding the derivation of these factors is provided in Appendix S.

## 4.2. – Water Use and Wastewater Generation Correlation

Table 4.1 shows the relationships between potable water sales, wastewater generation and occupied area by customer class.

**Table 4.1 – Development of Wastewater Generation Factors**

| Sector | MFR | SFR | CI | Industrial |
|---|---|---|---|---|
| Water Sales (MGD[6]) | 0.269 | 1.397 | 0.120 | 0.044 |
| Wastewater Generation (MGD) | 0.175 | 0.801 | 0.119 | 0.013 |
| Occupied Area (acres) | 101.74 | 589.08 | 185.05 | 125.26 |
| **Wastewater Generation Factor (GPD[7]/acre)** | **1,720** | **1,360** | **643** | **104** |

- Occupied Area is the acreage associated with each customer class per the current General Plan.
- Wastewater Generation Factor is Wastewater Generation divided by Occupied Area for each customer class.

[6] MGD = millions of gallons per day
[7] GPD = gallons per day

Table 4.2 provides a summary of existing build-out wastewater generation organized by customer class.

**Table 4.2 – Summary of Existing and Build-Out Wastewater Generation**

| Model Results | MFR | SFR | CI | Industrial[8] | Total |
|---|---|---|---|---|---|
| Existing Wastewater Generation (MGD) | 0.175 | 0.801 | 0.119 | 0.013 | 1.108 |
| Build-Out Wastewater Generation (MGD) | 0.272 | 2.053 | 0.211 | 0.100 | 2.636 |

## 4.3. – Projection

The average wastewater influent from 2016 through 2018 is 1.1 MGD.

Based on the population model presented in Figure 3.4, the average population for the same period is 24,148.

The per capita wastewater generation rate for the system is estimated at 46 GPD per person:

$$\frac{Q}{P} = \frac{1.1\ MGD}{24{,}148\ people} \cong 46\ gallons\ per\ day\ per\ person$$

Where:

*Q* is average wastewater influent at the WRP

*P* is population

Applying a wastewater generate rate of 46 GPD per person to the population projection yields the wastewater generation projection shown in Table 4.3.

**Table 4.3 – Project Population and Wastewater Generation**

| Year | Population | Wastewater Generation (MGD) |
|---|---|---|
| 2060 | 38,148 | 1.8 |
| 2050 | 36,610 | 1.7 |
| 2040 | 34,174 | 1.6 |
| 2030 | 30,576 | 1.4 |
| 2020 | 25,777 | 1.2 |

[8] Build-Out wastewater generation for industrial land use assumes future customers are similar to existing customers. This may change if water-intensive or worker-intensive industries are developed in the future.

# Chapter 5 – Hydraulic Analysis

## 5.1. – General Background

Hydraulic analysis is primarily concerned with pipe capacity. Wastewater flows by gravity from the location it enters the sewer system to the water reclamation plant (WRP). Capacity for gravity flow is a function of pipe size and pipe slope. The goal of hydraulic analysis is to determine the capacity of pipes in the collection system and to compare that capacity to the existing and future needs of wastewater generation.

## 5.2. – Design Criteria

Design criteria represent the standards that new or replacement pipelines are required to follow. Design criteria are also used as a benchmark for analyzing the capacity of the existing collection system.

### 5.2.1. – Design Discharge

Pipes must be designed to support the Peak Dry Weather Flow (PDWF). PDWF is the Average Dry Weather Flow (ADWF) times a peaking factor of 1.8:

$$PDWF = (1.8)ADWF$$

ADWF and PDWF are volumetric flow rates, typically given in units of gallons of wastewater generated per day (GPD) or millions of gallons of wastewater generated per day (MGD).

### 5.2.2. – Depth to Diameter Ratio Criteria

The maximum design depth to diameter ratio for pipes 12 inches or smaller in diameter is 0.50 or half-full:

$$\frac{depth}{Diameter} = \frac{d}{D} = 0.50$$

The maximum design depth to diameter ratio for pipes larger than 12 inches in diameter is 0.75 or three-quarters-full:

$$\frac{depth}{Diameter} = \frac{d}{D} = 0.75$$

Criteria for maximum depth to diameter ratio are conservative and are intended to allow for additional loading not known at the time of design. This additional loading may include infill, densification (i.e. conversion from single family residential to multi-family residential), redevelopment, repurposing of industrial and commercial development, expansion of the City boundary, extension of service beyond the City boundary, etc.

### 5.2.3. – Velocity Criteria

Minimum velocity: 2 feet per second at half full

The minimum velocity constraint is intended to assure pipe self-cleaning. At velocities below two feet per second, solids tend to accumulate on the bottom of the pipe, which may lead to an overflow.

Maximum velocity: 10 feet per second at half full

The maximum velocity constraint is intended to reduce the likelihood of pipe failure due to the momentum of the flowing wastewater. At velocities above ten feet per second, stress at bends or joints may cause pipe segments to separate.

### 5.2.4. – Manning's Roughness Coefficient

Gravity flow in a pipe is calculated using Manning's Equation:

$$v = \left(\frac{1.486}{n}\right) R_h^{2/3} S^{1/2}$$

Where:

$v$ is velocity in feet per second

$n$ is Manning's roughness coefficient (unitless)

$R_h$ is the hydraulic radius in feet

$S$ is the slope or gradient of the pipe (unitless)

Hydraulic radius is the cross-sectional area of flow divided by the wetted perimeter and can be expressed as:

$$R_h = \frac{A}{P_w}$$

Where:

$A$ is the cross-sectional area of flow in square feet

$P_w$ is the wetted perimeter in feet

Manning's roughness coefficient represents the roughness of the interior of the pipe. Note that roughness tends to deteriorate with age and tends to improve following cleaning or flushing of the pipe.

For design purposes, the following Manning's roughness coefficients are assumed for new materials:

- 0.11 for PVC pipe
- 0.13 for all other pipe materials

## 5.3. – Hydraulic Model

The hydraulic model is a computer simulation of all pipelines in the collection system 10 inches in diameter or larger. It was constructed using SewerGEMS software by Bentley. Additional information regarding the construction and calibration of the hydraulic is provided in Appendix A.

All output form the hydraulic model referenced in this report is provided in Appendix U.

A schematic of the hydraulic model showing pipe diameter is provided in Figure 5.1.

## Figure 5.1 – Hydraulic Model Schematic by Pipe Diameter

## 5.4. – Modeling Results for Existing Conditions

### 5.4.1. – Existing Average Conditions: Minimum Velocity Constraint

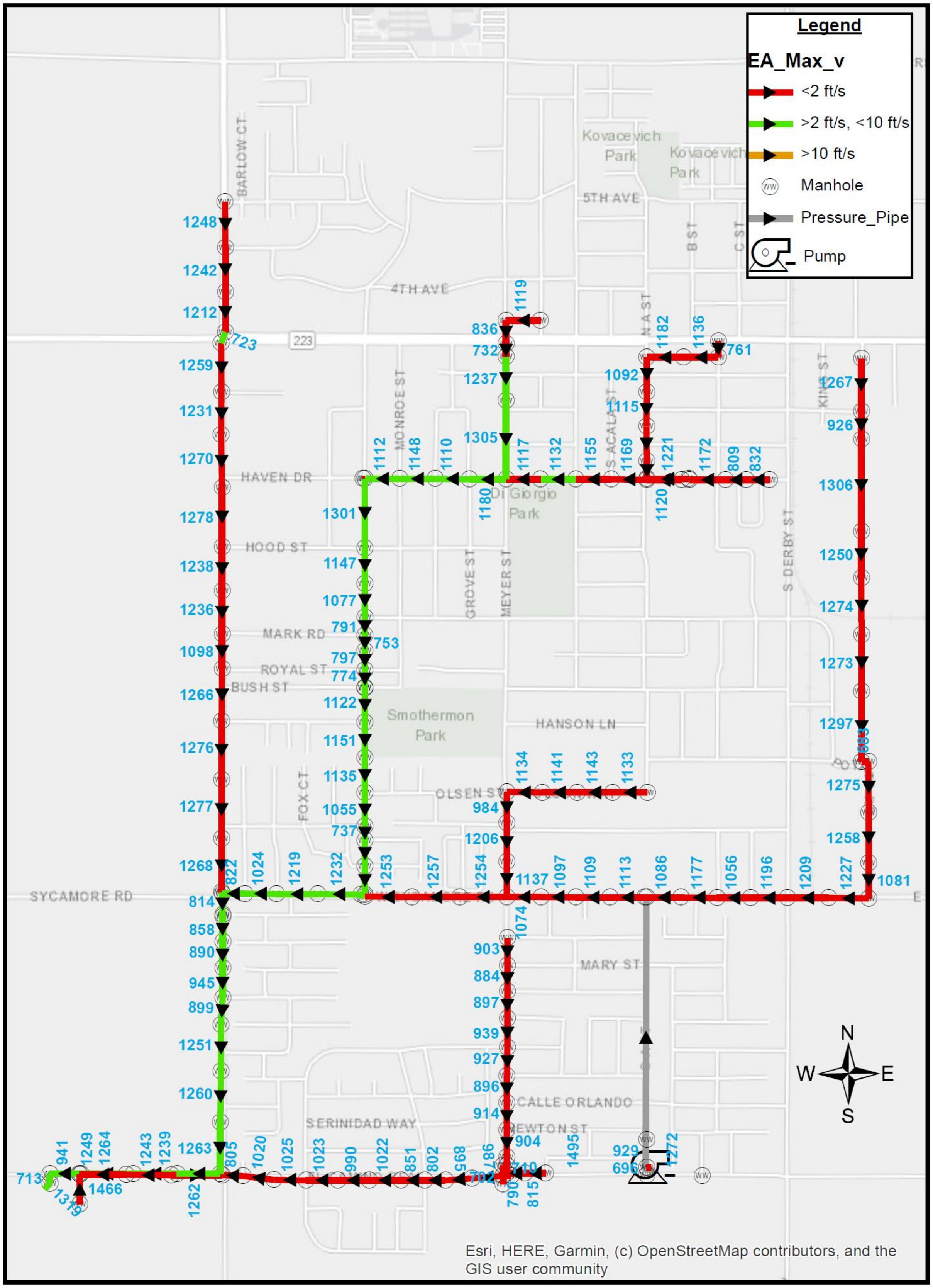
Under existing average flow conditions, pipes that do not meet the minimum velocity criterion of 2 fps are shown in red in Figure 5.2. The minimum velocity constraint is intended to assure the pipes are self-cleaning. At velocities below two feet per second, solids tend to accumulate on the bottom of the pipe, which may lead to blockage and overflow.

Approximately 68% of the pipes in the model cannot achieve the minimum velocity. The most likely cause of this deficiency is an unintended consequence of aggressive water conservation. The system was designed using wastewater generation standards that predate the current water consumption trends in the City. Aggressive water conservation is a recent mandate by the state, and one of the results is that sewer systems tend to be overdesigned for the new lower wastewater generation rates.

Oversized pipes need to be cleaned more frequently than properly sized pipes. The impacts of water conservation have resulted in an incremental increase in requirements for cleaning and flushing of the sewer system.

It is recommended to continue current operations and maintenance practices to keep the oversized pipes free of accumulated solids and debris, and to consider replacement with properly sized pipe only when scheduled for replacement due to age and condition.

## Figure 5.2 – Existing Average Flow: Minimum Velocity Constraint

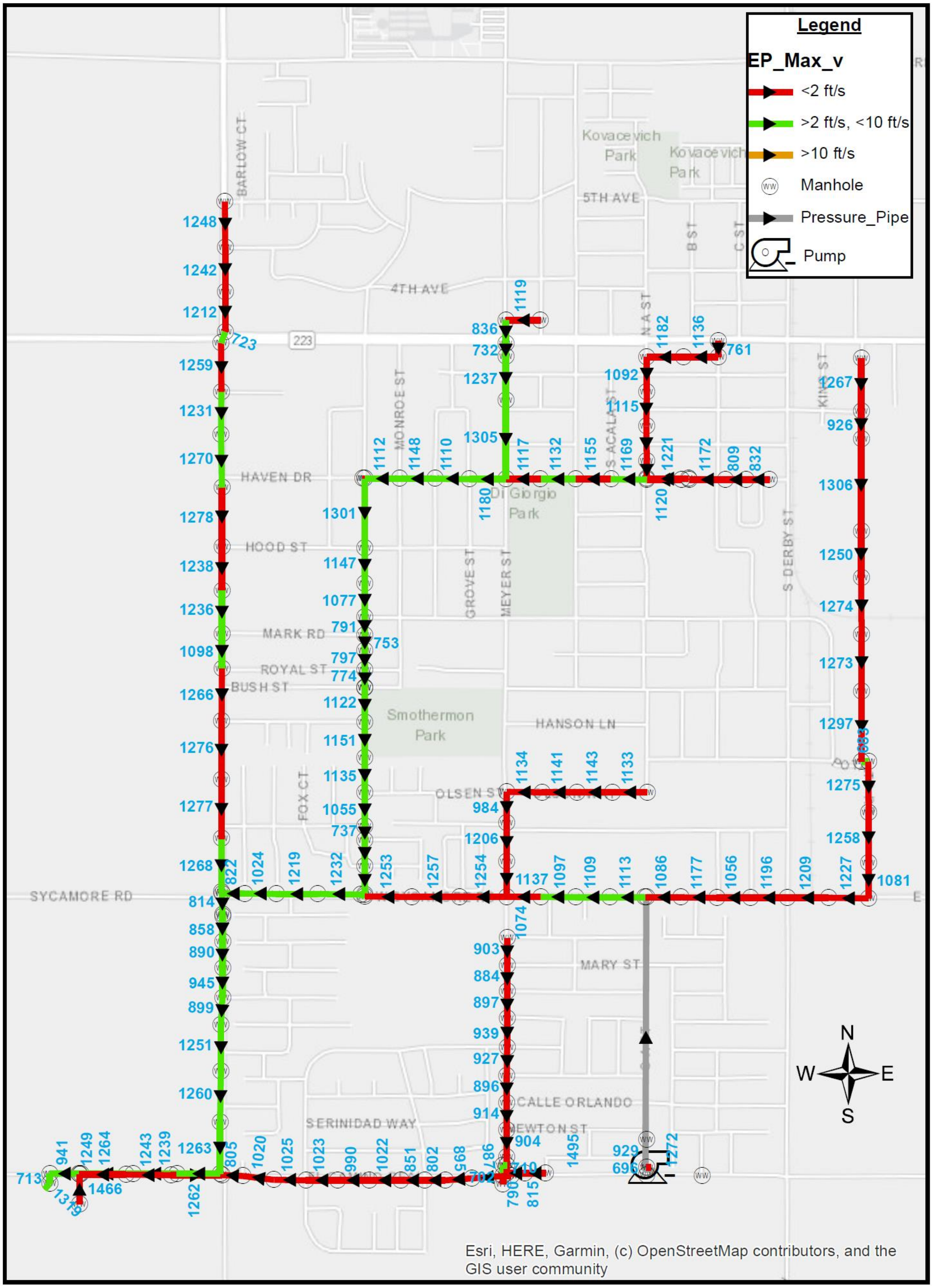


### 5.4.2. – Existing Peak Conditions: Maximum Velocity Constraint

Under existing peak flow conditions, pipes that exceed the maximum velocity of 10 fps are shown in orange in Figure 5.3. The maximum velocity constraint is intended to reduce the likelihood of pipe failure due to the momentum of the flowing wastewater. At velocities above ten feet per second, stress at bends or joints may cause pipe segments to separate.

No pipes exceed the maximum velocity constraint under existing conditions.

## Figure 5.3 – Existing Peak Conditions: Maximum Velocity Constraint



### 5.4.3. – Existing Peak Conditions: Maximum Depth Ratio Constraint

Under existing peak flow conditions, pipes that exceed the maximum depth to diameter ratio of 0.5 are shown in red in Figure 5.4. The maximum design capacity of a pipe 12 inches in diameter or less is half-full and the design capacity of a pipe greater than 12 inches in diameter is three-quarters-full. As pipes approach 100% full, the flow characteristics change from gravity flow to pressurized flow. Under pressurized flow conditions, two issues occur:

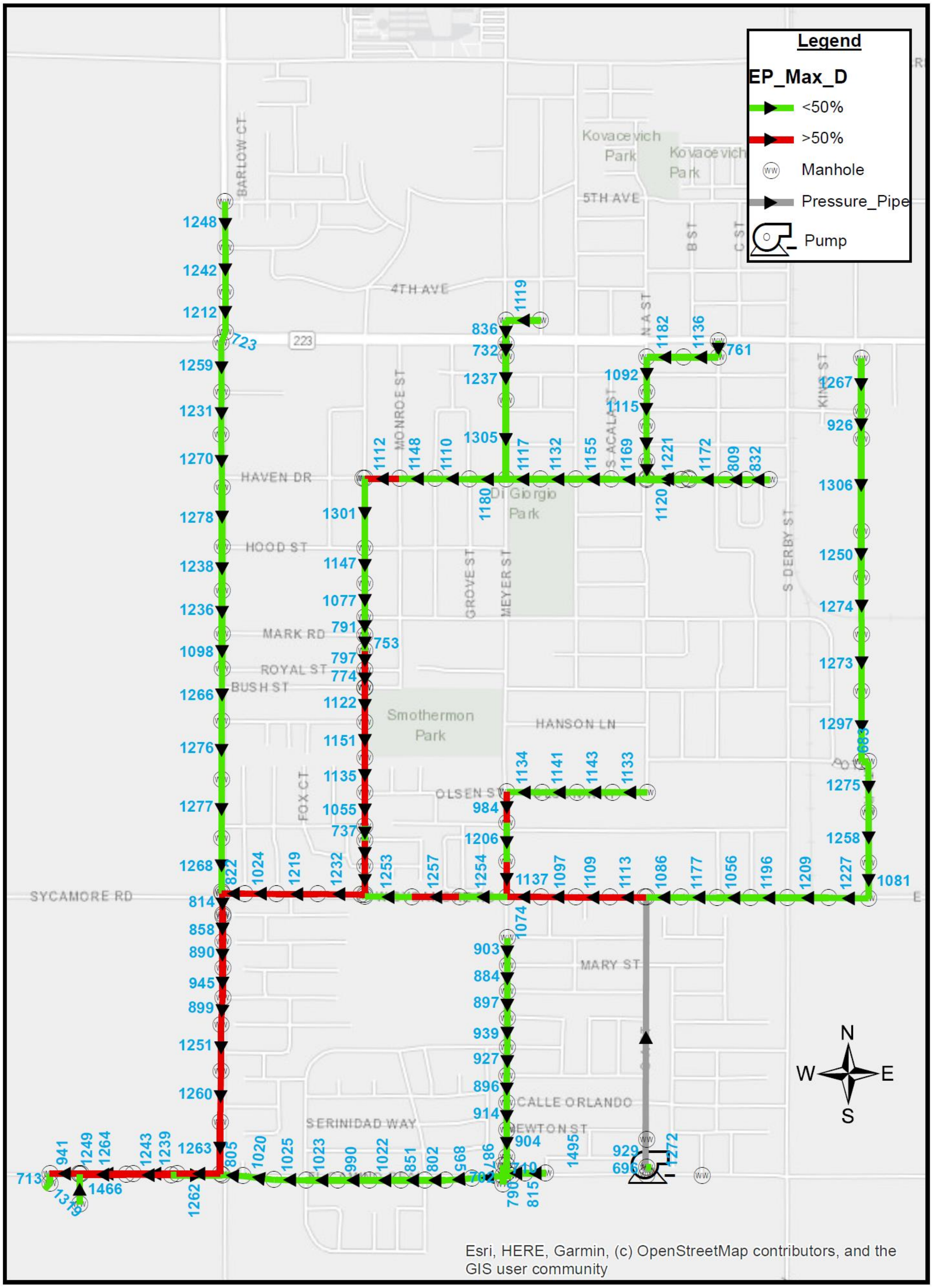
(1) excess pressure weakens bends and joints in the pipelines causing pipe segments to leak or separate

(2) excess flow builds up in manholes causing them to overflow

No pipes exceed 100% full. No pipes exceed their design capacity

No improvements are recommended concerning existing maximum pipe depth to diameter ratio.

**Figure 5.4 – Existing Peak Conditions: Depth to Diameter Ratio Constraint**



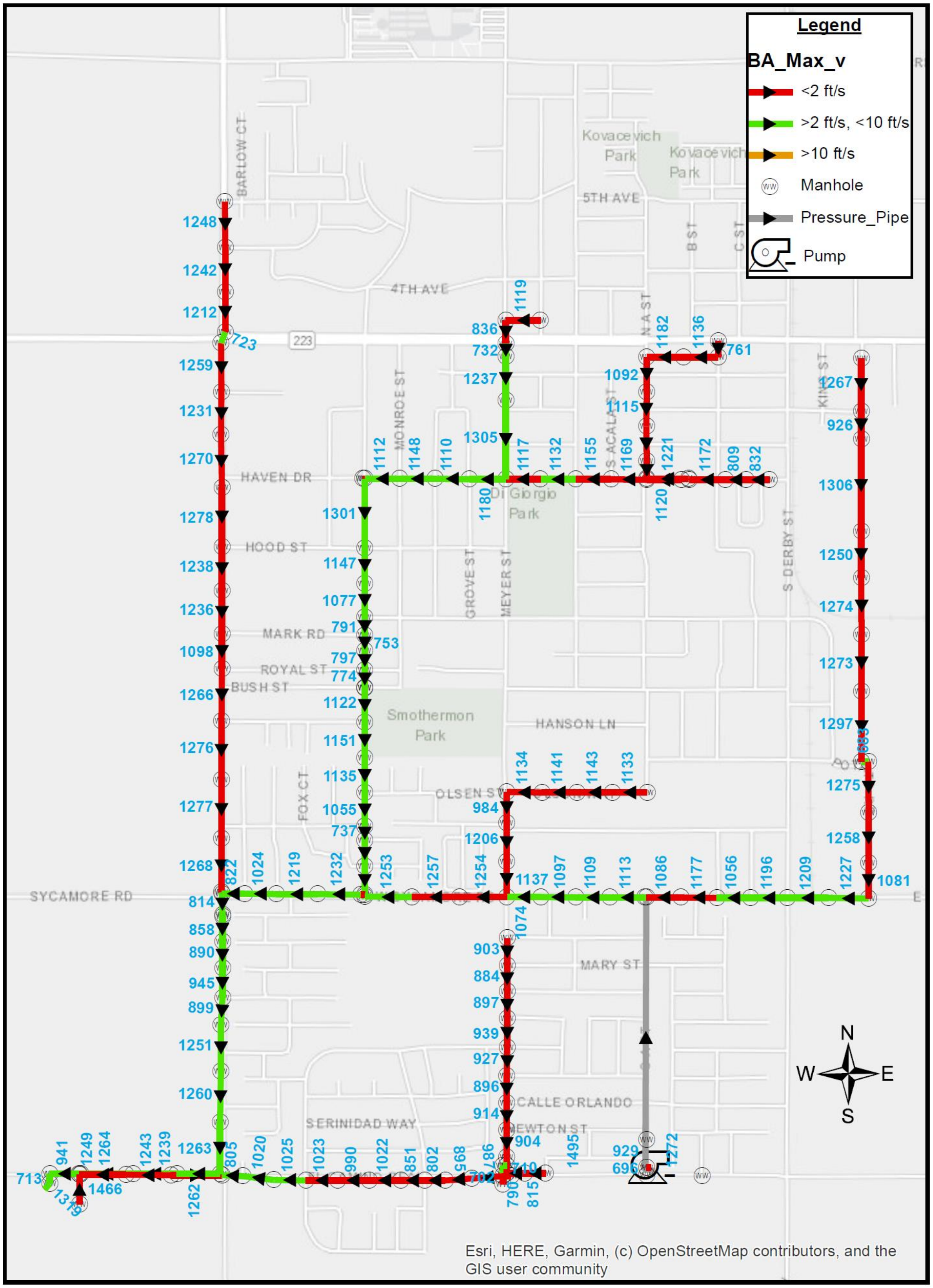
## 5.5. – Modeling Results for Build-Out Conditions

### 5.5.1. – Build-Out Average Conditions – Minimum Velocity

Under build-out average flow conditions, pipes that do not meet the minimum velocity criterion of 2 fps are shown in red in Figure 5.5. The minimum velocity constraint is intended to assure pipes are self-cleaning. At velocities below two feet per second, solids tend to accumulate on the bottom of the pipe, which may lead to blockage and overflow.

Approximately 58% of the pipes in the model cannot achieve the minimum velocity. These pipes are candidates for size reduction when determined to be replaced due to age and condition.

## Figure 5.5 – Build-Out Average Conditions: Minimum Velocity Constraint

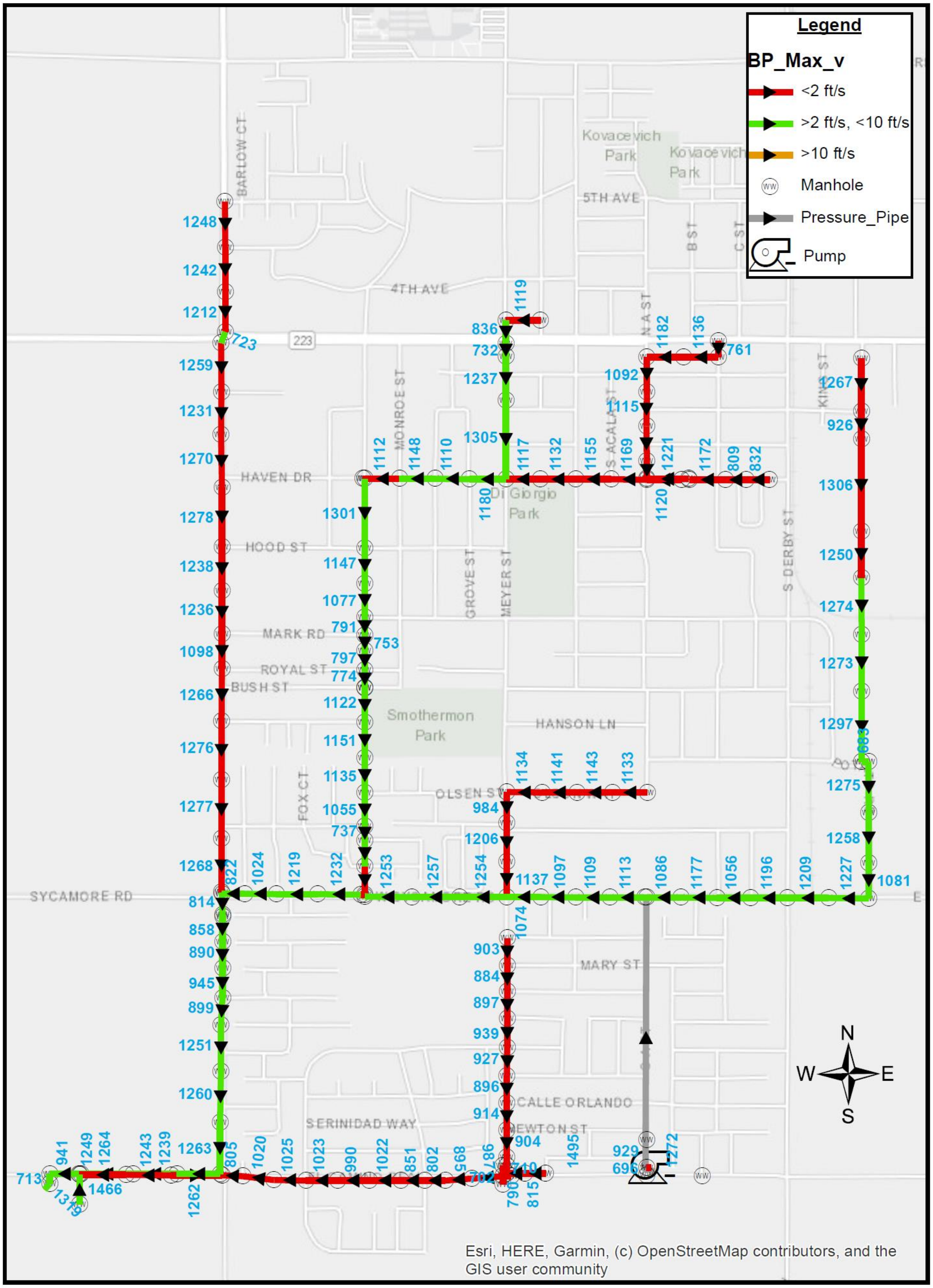


### 5.5.2. – Build-Out Peak Conditions – Maximum Velocity

Under build-out peak flow conditions, pipes that exceed the maximum velocity of 10 fps are shown in orange in Figure 5.6. The maximum velocity constraint is intended to reduce the likelihood of pipe failure due to the momentum of the flowing wastewater. At velocities above ten feet per second, stress at bends or joints may cause pipe segments to separate.

No pipes exceed the maximum velocity constraint under build-out conditions.

## Figure 5.6 – Build-Out Peak Conditions: Maximum Velocity Constraint

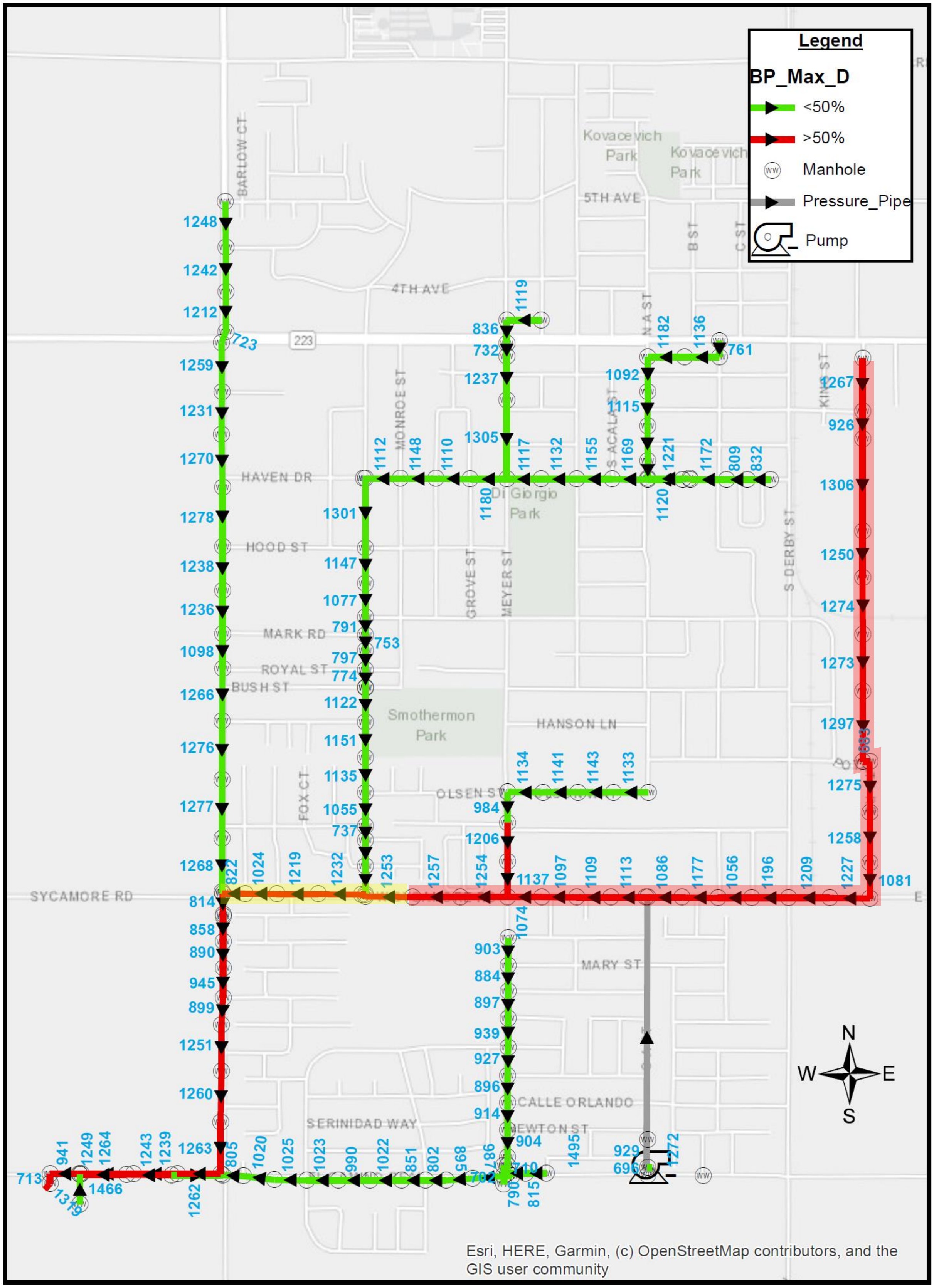


### 5.5.3. – Build-Out Peak Conditions – Maximum Depth Constraint

Under build-out peak flow conditions, pipes that exceed the maximum depth to diameter ratio of 0.5 are shown in red The maximum design capacity of a pipe 12 inches in diameter or less is half-full and the design capacity of a pipe greater than 12 inches in diameter is three-quarters-full. As pipes approach 100% full, the flow characteristics change from gravity flow to pressurized flow. Under pressurized flow conditions, (1) excess pressure weakens bends and joints in the pipelines causing pipe segments to leak or separate, and (2) excess flow tends to build up in manholes causing them to overflow.

28% of pipes exceed their design capacity. All of these pipes are located in Potato Road and Sycamore Road. The pipes highlighted in pink exceed 100% full, and the pipes highlighted in yellow are between 75% full and 100% full.

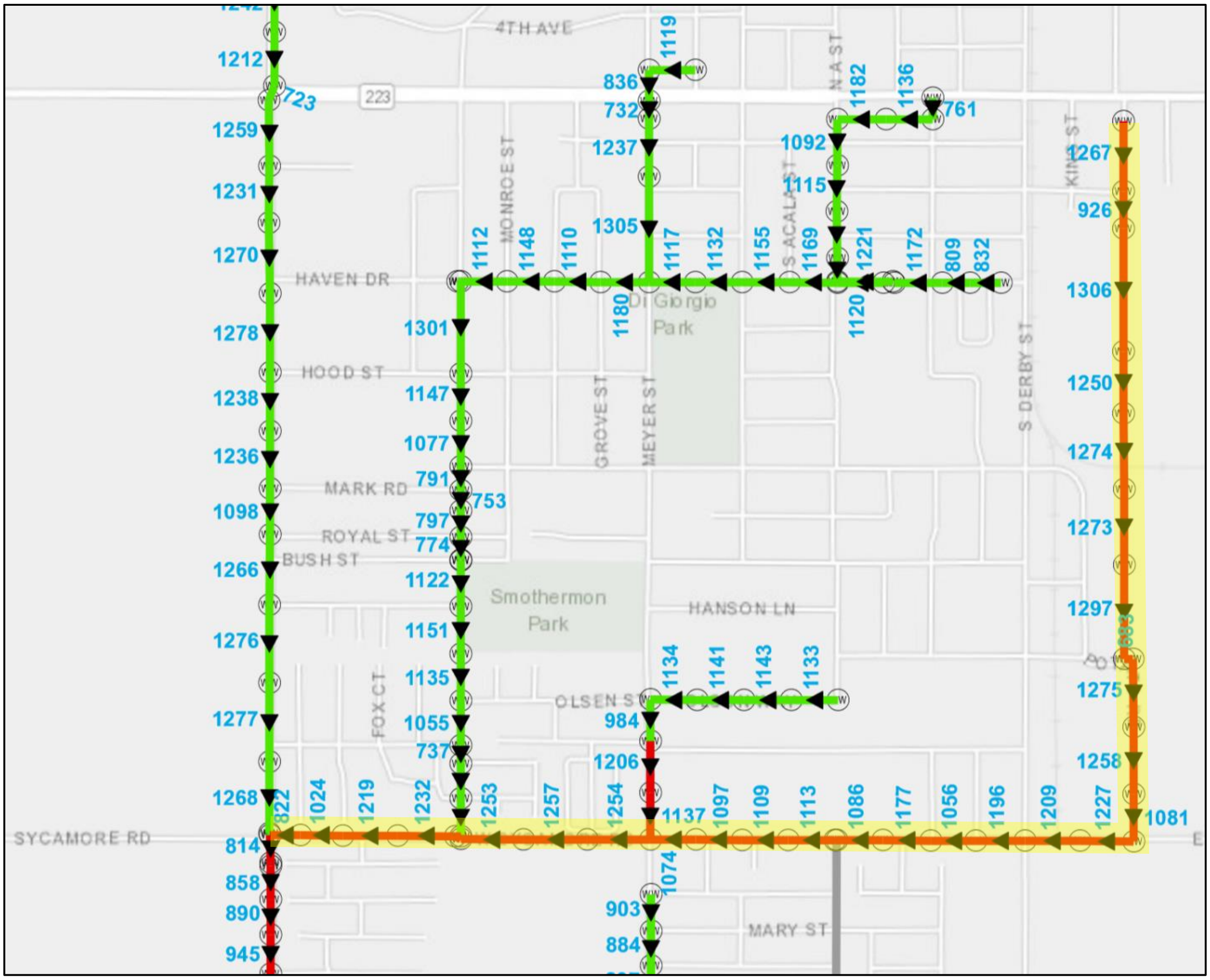
**Figure 5.7 – Build-Out Peak Conditions: Depth to Diameter Ratio Constraint**



## 5.6. – Hydraulic Analysis

All pipes in Potato Road and Sycamore Road were found to exceed the design depth to diameter ratio under build-out conditions (see the highlighted alignment in Figure 5.8). The primary reason for the design depth to diameter ratio exceedance is wastewater generation due to future development northeast of the intersection of Derby Street and Sycamore Road. Furthermore, the pipe in Sycamore Road between Walnut Drive and Comanche Drive is influenced by all future development north of Sycamore Road.

**Figure 5.8 – Potato/Sycamore Alignment**



### 5.6.1. – Recommendation for Potato-Sycamore Alignment

At build-out, development of the area designated for light industrial, heavy industrial and estate residential land uses located generally northeast of the intersection of Derby Street and Sycamore Road will generate wastewater at a rate that exceeds the capacity of the existing trunklines highlighted in Figure 5.8. We understand this area is not currently scheduled for development and is not anticipated for development within the next 20 years. In the event development of this area proceeds more quickly, additional study will be required to determine (1) the wastewater generation rates of the specific industries and residential densities to be included and (2) the best course of action for the City.

The capacity of the Potato-Sycamore Alignment is constrained by a segment of pipe in Sycamore Road between Kovacevich Street and Stockton Avenue with the following hydraulic characteristics:

- Diameter: 10 inches
- Slope: 0.0017
- Manning Number: 0.013

Per the hydraulic model, the peak loading on this pipe under existing conditions is approximately 236,000 gallons per day.

Applying Manning's Equation for gravity pipe flow, the design depth to diameter ratio of 0.75 is approximately 532,000 gallons per day.

This implies that the loading on the Potato-Sycamore Alignment can increase by 125% over current use before exceeding the design depth to diameter ratio.

$$\frac{Q_{allowable} - Q_{existing}}{Q_{existing}} = \frac{532{,}000 - 236{,}000}{236{,}000} \cong 125\%$$

The surplus loading is equivalent to about 87,000 gallons per day of average wastewater generation (Note that modeling considers the peak flow, not the average flow). That is sufficient capacity to support a population increase in the subject area of about 1,880 people. Future growth in this area will likely be a mixture of residential, light industrial and heavy industrial land use, so a more sophisticated estimate of average wastewater generation will be required.

Monitor growth northeast of the intersection of Derby Street and Sycamore Road. Interested developers should prepare a sewer study to determine future wastewater generation. That wastewater generation should be verified and modeled to determine whether the capacity of the Potato-Sycamore Alignment is sufficient and, if not, what type of mitigation is required.

### 5.6.2. – Recommendation for the West Sycamore Alignment

There are no known development projects that are anticipated to result in an exceedance of design capacity at a depth to diameter ratio of 0.75 within the next 20 years with the exception of the 15-inch trunkline in Sycamore Road between Walnut Drive and Comanche Drive. Generally, all wastewater generation northeast of the intersection of Sycamore Road and Walnut Drive as well as the discharge from the lift station are directed to this trunkline. Approximately 90% of all wastewater generation passes through this 15-inch diameter pipe.

The capacity of the West Sycamore alignment is constrained by a segment of pipe in Sycamore Road between Villa Drive and Comanche Drive with the following hydraulic characteristics:

- Diameter: 15 inches
- Slope: 0.0033
- Manning Number: 0.013

Per the model, the peak loading on this pipe under existing conditions is approximately 2,131,000 gallons per day at a depth to diameter ratio of 0.72.

Applying Manning's Equation for gravity pipe flow, the design capacity at a depth to diameter ratio of 0.75 is approximately 2,187,000 gallons per day.

This implies that the loading on the West Sycamore alignment can increase by only 2.6% over current use before exceeding the design depth to diameter ratio.

$$\frac{Q_{allowable} - Q_{existing}}{Q_{existing}} = \frac{2{,}187{,}000 - 2{,}131{,}000}{2{,}131{,}000} \cong 2.6\%$$

**Based on the projected population growth rate and corresponding increase in wastewater generation, the design capacity of the West Sycamore alignment will be exceeded within five years.**

Per the hydraulic model, the build-out loading on the West Sycamore alignment is approximately 2,583,000 gallons per day at a depth to diameter ratio of 0.839. This exceeds the design depth to diameter ratio.

Assuming replacement at a similar slope with a single pipe, the new diameter should be 20 inches or larger.

The following options will mitigate the undersized sewer main in the West Sycamore alignment.

**Option 1**

Replace approximately 1,320 feet of existing 15-inch sewer in Sycamore Road between Walnut Drive and Comanche Drive with new 24-inch pipe.

**Option 2**

Install approximately 1,320 feet of 18-inch sewer parallel to the existing 15-inch sewer in Sycamore Road between Walnut Drive and Comanche Drive.

**Option 3**

Divert existing and future loading via a new sewer and lift station to serve areas east of Derby Street and south of El Camino Real to reduce the load on the subject pipe. This would be a developer-driven project.

**Option 4**

Install a new 1,300-foot force main from the pump station at the intersection of El Camino Real and A Street to the intersection of El Camino Real and Meyer Street. This would reduce the loading in West Sycamore Road and delay the need for more capacity.

## 5.7. – Hydraulic Requirements for New Development

Over the next 20 years, five known developments are anticipated to be connected to the City's wastewater collection system. In addition, there will likely be infill and densification projects whose specific locations are not known at this time. Per Table 4.3, wastewater generation is anticipated to increase by 0.5 MGD to a total of 1.6 MGD by 2040.

In general, new development over the next 20 years north of El Camino Real and west of A Street can be supported by the existing collection system, and new development south of El Camino Real and east of A Street will require major new backbone sewer infrastructure. The primary elements of the new infrastructure include a trunkline in Millux Road flowing west to Comanche Drive and a pump station in the vicinity of the intersection of Millux Road and Comanche Drive discharging via a force main north to El Camino Real.

This concept is discussed in more detail in the CIP.

# Chapter 6 – Condition Assessment

## 6.1. – General Background

Condition assessment is primarily concerned with system performance. Infrastructure has a limited practical service life. In the case of sewer pipes and manholes, materials tend to deteriorate over time due to exposure to wastewater from the inside and exposure to the environment from the outside.

Wastewater is corrosive and abrasive to the pipe interior. Over time, corrosion and abrasion can wear away the pipe material to a point of structural failure. Exposure of the exterior of a pipe to the environment includes contact with corrosive soil and subsurface water associated with water table fluctuation and infiltration of precipitation and runoff from irrigation or agricultural. Deterioration makes a pipe vulnerable to failure, and failure may result a service outage or an overflow.

Pipes are also subject to physical damage or displacement. A gravity flow sewer relies on precise design and construction. A broken or displaced pipe will disrupt the normal flow of wastewater. Examples of physical processes that may lead to obstruction of flow and eventually pipe failure include differential settling, poor construction technique, excessive traffic load, accidental contact during excavation, use of heavy equipment above or near the pipe alignment and root intrusion. A major concern for the City are pipes located in alleys, which may be exposed to all of the physical processes described above in addition to deterioration.

In the case of the pump station, normal usage causes mechanical system to wear. Excessive wear makes pump station components vulnerable to mechanical failure. The pump station design includes redundancy, so the failure of single component will not result in a service outage. However, a mechanical failure must be corrected immediately to restore redundancy. The goal of condition assessment is to identify and mitigate the likelihood of system failure.

## 6.2. – Pump Station Assessment

### 6.2.1. – Methodology

The pump station was inspected by the following methods: review of engineering drawings, review of maintenance reports, review of telemetry records, site inspection, discussion with Veolia staff. A complete inspection report is provided in Appendix B.

#### 6.2.1.1. – Review of Engineering Drawings

Engineering drawings were reviewed to gain an understanding of the pump station layout, design and capacity.

#### 6.2.1.2. – Review of Maintenance Reports

Maintenance reports were reviewed to gain an understanding of work performed on the pump station since its installation.

#### 6.2.1.3. – Review of Telemetry Records

Telemetry records were reviewed to gain an understanding of operational control and typical run time of the pumps.

#### 6.2.1.4. – Site Inspection

The pump station was inspected by an engineer during a routine cleaning so every part of the station could be visually accounted for. Operators provided feedback on pump station performance during the inspection.

### 6.2.2. – Determination

Pumps should be rewound or replaced on a 7-year basis, as needed based on pump performance.

No growth is anticipated to impact the pump station, so increasing capacity is not a concern.

The pump station is well monitored and well maintained. Electrical and control elements should last beyond the 20-year planning horizon of this Sewer Master Plan.

The pump station is near and up gradient to several large undeveloped areas south of El Camino Real. It is likely that new development south of El Camino Real will require new trunklines and a new pump station. **The City should consider decommissioning the existing pump station in favor of a new larger pump station to be sited and constructed as needed to support development in the southern portion of the City.** For this reason, improvements to the existing pump station should be limited to meeting near-term needs. These near-term needs include motor rewinding and motor replacement on a regular basis. The exact timing of motor rewinding and motor replacement will depend on a drop in pump efficiency. Over the course of the next 20 years, each pump is anticipated to require rewinding twice and replacement once.

## 6.3. – Pipeline Assessment

### 6.3.1. – Methodology

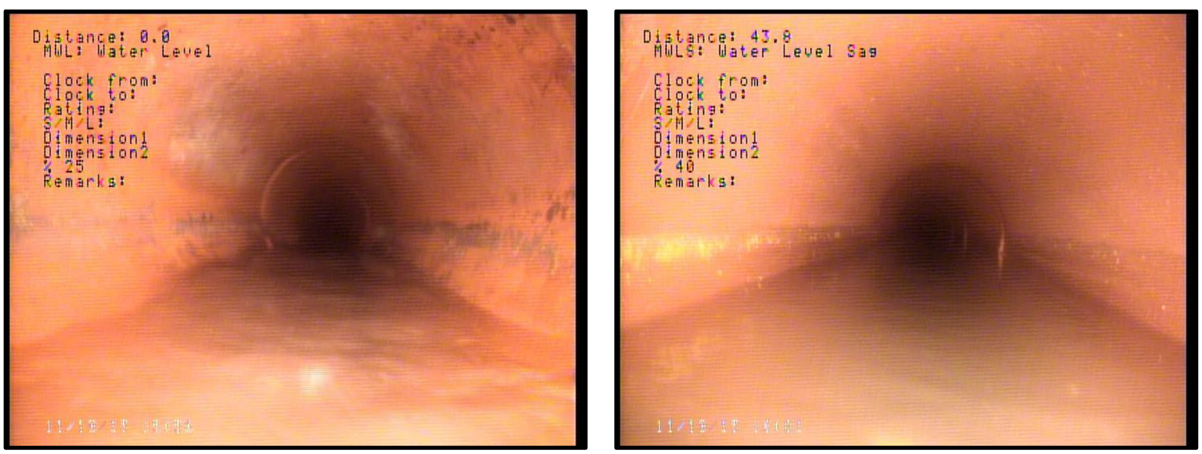
The condition of a pipe is assessed by a NASSCO[9] certified engineer. The engineer makes a determination about a suitable course of action based on the assessment. There are four possible outcomes: replacement, lining, spot repair or do nothing.

#### 6.3.1.1. – Replacement

Pipes that have already failed or that exhibit structural damage are candidates for replacement. Replacement means the old pipe is removed or abandoned in place and a new pipe is installed to take its place. Replacement is typically recommended for the entire length of a pipe reach (i.e. the pipe connecting two manholes).

Figure 6.1 shows a view of the same pipe upstream and downstream of a sag. This pipe sag is located in Haven Drive east of Santa Rosa Street. The sag causes pipe velocity to slow and depth to increase at the low point of the sag interfering with normal flow. This pipe is vulnerable of exceeding the design depth to diameter ratio of 0.75 under peak condition making is susceptible to overflow.

**Figure 6.1 – Example of Pipe Recommended for Replacement**




[9] NASSCO = National Association of Sewer Service Companies

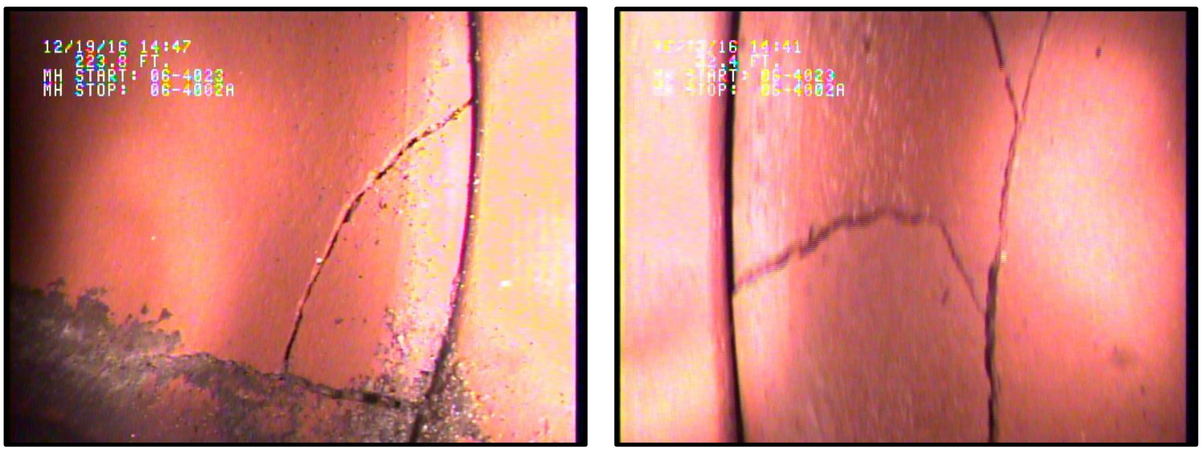
6.3.1.2. – Lining

Pipes that show deterioration to a point they can no longer function as designed but are still structurally sound and aligned are candidates for lining. Lining greatly extends the service life of the existing pipe while minimizing excavation.

A common form of lining is cured in place pipe (CIPP) in which a malleable pipe infused with resin is inserted inside the existing pipe and filled with steam or hot water. The lining takes the shape of the interior of the existing pipe.

Figure 6.2 shows two instances in the same pipe of cracking at the joint. The pipe also shows minor deterioration but no structural or alignment defect. This pipe is located in S. Hill Street immediately southwest of Di Giorgio Park. Lining will prevent continued cracking at the joints, which may otherwise lead to a collapse is not addressed.

**Figure 6.2 – Example of Pipe Recommended for Lining**



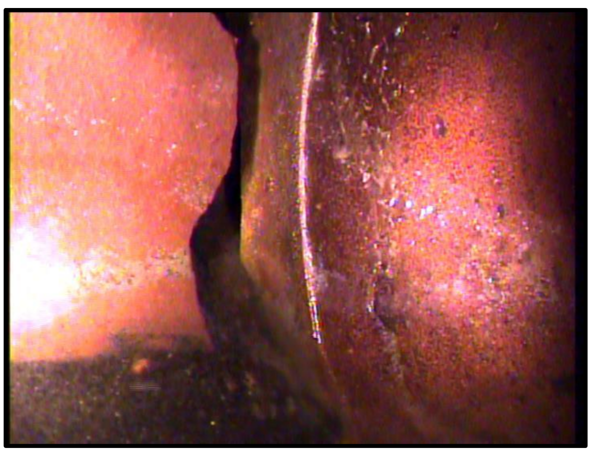
6.3.1.3. – Spot Repair

Some pipes have localized defects such as cracks or root intrusion.  If left unchecked, these defects may leads to more serious problems or even failures.  Spot repair is recommended to address these localized defects while leaving the rest of the pipe alone.

A spot repair is limited to only the defective portion of a pipe.  A sewer pipe typically consists of a number of pipe segments fitted together end to end.  To perform a spot repair, a limited excavation is made to expose the defective pipe segments, which are removed and replaced with new pipe segments.  CCTV helps to pin-point the location and nature of the defect and the number of impacted pipe segments, making spot repair an efficient rehabilitation method.  Precise locations and photographs of defects recommended for spot repair are provided in the appendices associate with capital projects.

Figure 6.3 shows two examples of broken pipes with soil entering the system.  The pipe on the left is located in Monroe Street between Hood Street and Haven Drive.  The pipe on the right is located in Monroe Street south of Big Bear Boulevard.  Although the breaks are severe, they are localized so only a small repair is required.

**Figure 6.3 – Examples of Pipes Recommended for Spot Repair**



6.3.1.4. – Do Nothing

Pipes that would not significantly benefit from repairs over the next 20 years are not recommended for mitigation.

Figure 6.4 shows a pipe in good condition with no visible defects and no sagging. This pipe is located in La Rosa Avenue west of Vista Avenue.

**Figure 6.4 – Example of Pipe in Good Condition**

### 6.3.2. – Prioritization of Review

All pipes in the collection system are maintained by Veolia who has them assessed on a regular basis by a NASSCO certified technician. A remote camera is inserted into a pipe via a manhole. It videos the interior of the length of the pipe to the next manhole where it is retrieved; this distance is called a reach. Any defects noted on the video are recorded and assigned a score by the technician per NASSCO standards. A reach with a high score tends to indicate a pipe with multiple defects. Such a pipe may fail in time if the defects are not repaired.

Of the entire existing collection system, 25% of the pipes were reviewed. The goal was to review those pipes most likely to require improvement over the next 20 years.

Three concepts went into the prioritization of the 25%: hot spots, pipes receiving high NASSCO scores for defects, and older original reinforced concrete pipes.

As of this writing, there is a high level of confidence that these pipes have the highest likelihood of failure in the entire collection system. It is recommended to update the prioritization in ten years based on the most current available information to account for changes in system performance.

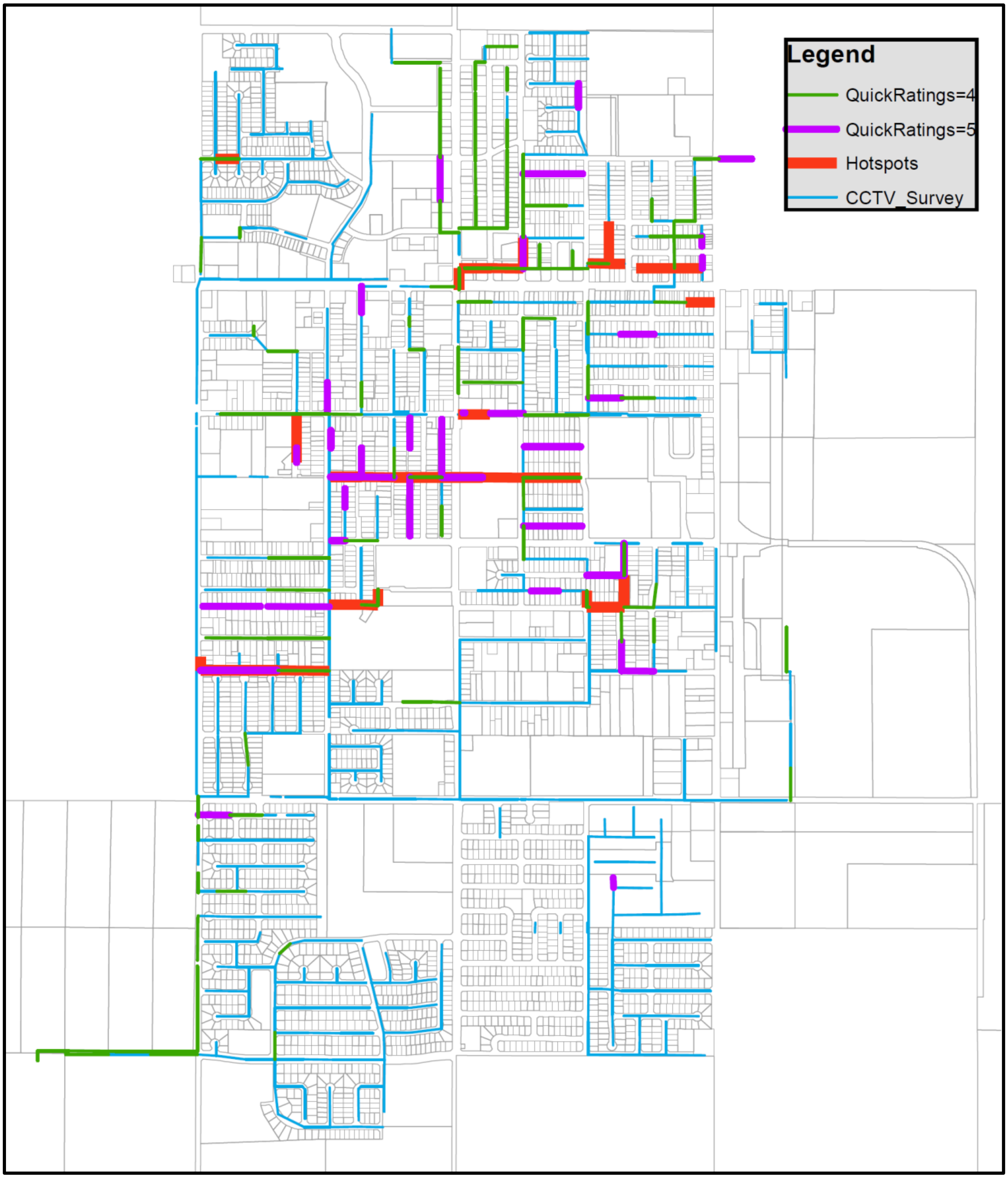
#### 6.3.2.1. – Hot Spots & High NASSCO Scores for Defects

Some pipes are known to operators to be deficient (aka Hot Spots). These pipes require a higher than average amount of maintenance to keep them operational.

Figure 6.5 shows the locations of hot spots and reaches receiving a NASSCO Quick Rating[10] of 4 or 5.

[10] Quick Rating is a scoring system developed by NASSCO to indicate the severity of a defect found via CCTV. A rating of 5 indicates a defect recommended for mitigation within 5 years, and a rating of 4 indicates a defect recommended for mitigation within 10 years.

**Figure 6.5 – Hot Spots and Quick Ratings**




Not surprisingly, there is significant overlap between the Hot Spots and the Quick Ratings.

### 6.3.2.2. – Older Original Reinforced Concrete Pipes

Original reinforced concrete pipes, generally located in the northeastern portion of the City, have exceeded the recommended service life for their material. The Army Corps of Engineering recommends a design service life of 70 to 100 years for concrete pipe, and the City's original concrete pipes are at least 80 years old.

Figure 6.6 is a map showing pipe materials. Pipes designated as CP (Concrete Pipe) and RCP (Reinforced Concrete Pipe) are generally located within the red box in the oldest part of the City. Table 6.1 provides a breakdown of all pipes by material and diameter.

**Table 6.1 – Pipe Material Breakdown**

| Diameter (inches) | CP (feet) | CT (feet) | PVC (feet) | RCP (feet) | VCP (feet) | Unknown (feet) | Total (feet) | Percentage of System |
|---|---|---|---|---|---|---|---|---|
| 6 | 0 | 4,170 | 2,810 | 0 | 10,720 | 3,310 | 21,010 | 10% |
| 8 | 12,250 | 3,610 | 48,160 | 2,550 | 41,330 | 24,010 | 131,910 | 66% |
| 10 | 0 | 0 | 3,810 | 160 | 7,410 | 4,370 | 15,750 | 8% |
| 12 | 0 | 1,250 | 2,640 | 230 | 2,850 | 1,410 | 8,380 | 4% |
| 15 | 0 | 3,460 | 4,750 | 0 | 9,160 | 210 | 17,580 | 9% |
| 18 | 0 | 0 | 1,370 | 0 | 4,380 | 0 | 5,750 | 3% |
| Total | 12,250 | 12,490 | 63,540 | 2,940 | 75,850 | 33,310 | 200,380 | 100% |
| Percentage of System | 6% | 6% | 32% | 1% | 38% | 17% | 100% | |

CP = concrete pipe

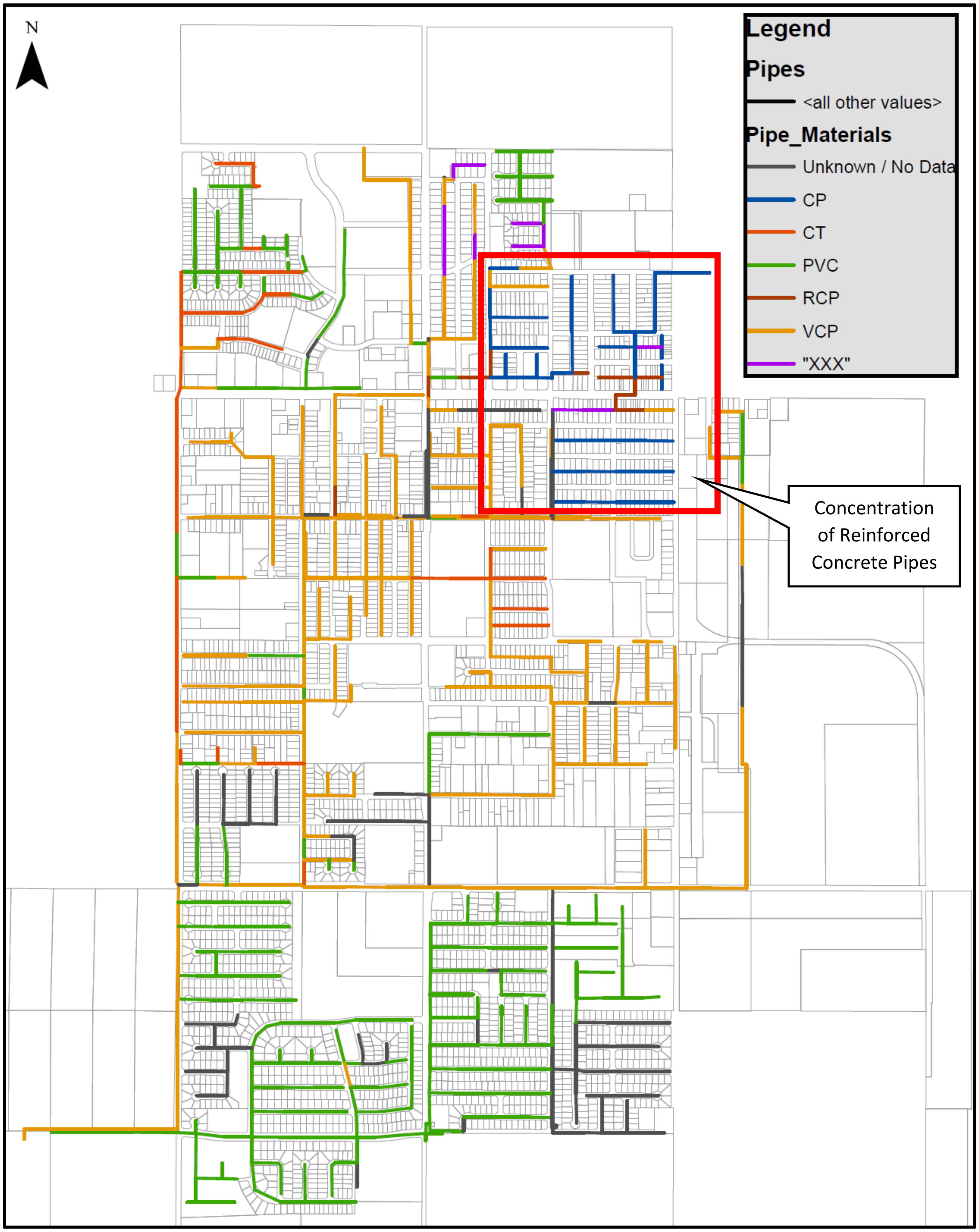
CT = clay tile

PVC = polyvinyl chloride

RCP = reinforce concrete pipe

VCP = vitrified clay pipe

## Figure 6.6 – Pipe Material

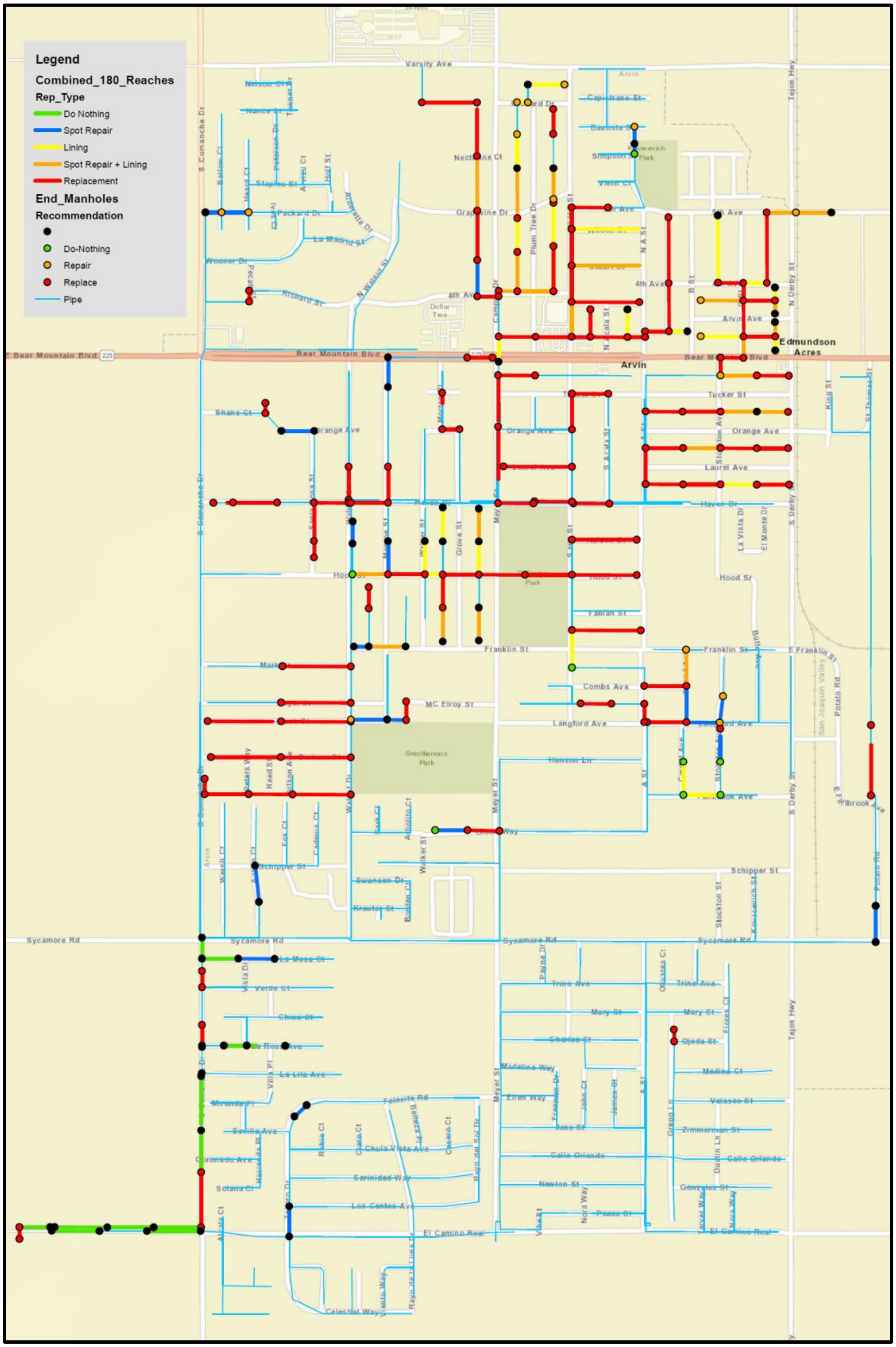


### 6.3.3. – Reaches Reviewed

From these sets of high-priority pipes (i.e. hot spots, older reinforced concrete pipe and high NASSCO scores), 180 reaches were selected for detailed review.

Figure 6.7 shows the location of the 180 reaches that were reviewed and the recommended course of action based on those reviews.

## Figure 6.7 – Recommendations for Reviewed Pipes and Connecting Manholes



## 6.4. – Manhole Assessment

### 6.4.1. – Hazard Planning

Prior to being deployed for manhole inspection, the Harris field engineering team underwent NASSCO certification and safety training.

Each two-man crew included at least one inspector who has completed the NASSCO Manhole Assessment and Certification Program (MACP).

Based on the requirements of the inspection process and the local conditions, a Project Hazard Analysis was prepared and inspectors attended a manhole inspection safety review meeting to make them aware of the potential hazards. The Project Hazard Analysis is provided in Appendix C.

### 6.4.2. – Methodology

The condition of a manhole is assessed by a NASSCO certified engineer. For purposes of this sewer master plan, the Harris field engineering team conducted NASSCO Level1 manhole inspections: a 20-point inspection including visual assessment from outside the manhole and video assessment of the interior of the manhole. The engineer makes a determination about a suitable course of action based on the assessment. There are three possible outcomes: replacement, repair or do nothing.

6.4.2.1. – Replacement

Manholes that have already failed or that exhibit structural damage are candidates for replacement.  Replacement means the old manhole is removed and a new manhole is installed to take its place.  Figure 6.12 shows one of the older brick construction manholes in the northeast portion of the City, which is recommended for replacement due to severe deterioration and compromised structural integrity.

**Figure 6.8 – Example of Manhole Recommended for Replacement**

6.4.2.2. – Repair

Manholes that show deterioration or defects but are still structurally sound are candidates for repair.  Figure 6.13 shows a manhole with a moderate deterioration.

**Figure 6.9 – Example of Manhole Recommended for Repair**

Manhole repair is aimed at separating the sewer system from the environment in terms of eliminating ingress and egress.  Water leaking into the manhole from outside may increase the load on the WRP, which impacts treatment efficiency.  Wastewater leaking out of the manhole may adversely impact the local aquifer.  Cracks, holes and gaps in joints between manhole components are filled with grout and coated with a sealant.  If necessary, the soil surrounding the manhole is stabilized with engineered fill and the pavement surrounding the rim is replaced.

6.4.2.3. – Do Nothing

Manholes that would not significantly benefit from repairs over the next 20 years are not recommended for mitigation. Figure 6.14 shows a manhole in good condition.

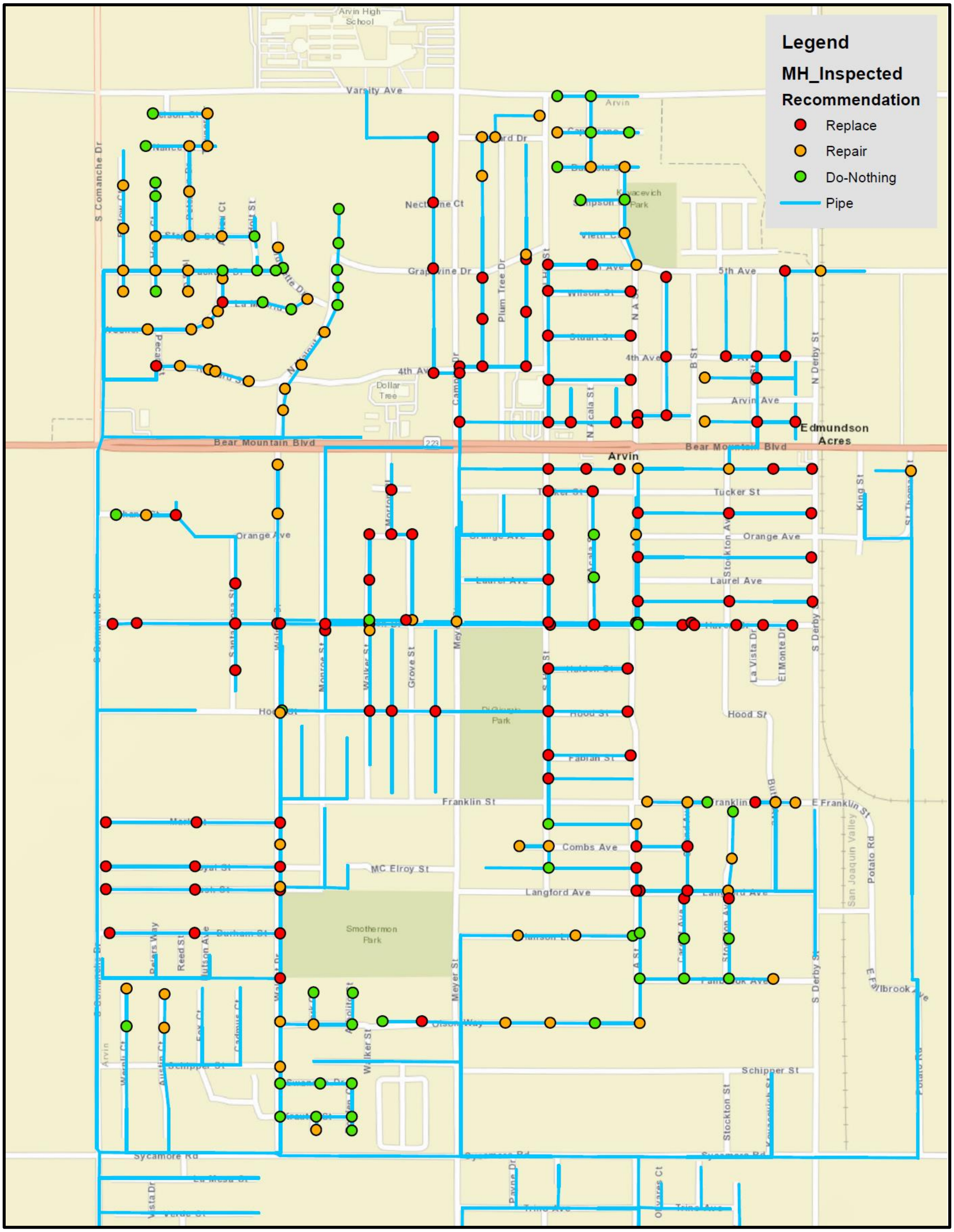
**Figure 6.10 – Example of Manhole in Good Condition**

### 6.4.3. – Coverage and Inspection Results

Manholes north of Sycamore Road were targeted for inspection. Manholes south of Sycamore Road are relatively new and were determined unlikely to exhibit deterioration or structural defects at this time. Most manholes north of Sycamore Road were visually inspected; however, some inspections were deferred for safety reasons. High traffic areas including Bear Mountain Boulevard and Comanche Drive were deferred. Manholes in certain alleyways were determined to be inaccessible when the inspection team attempted to locate them. For capital budgeting purposes, a statistical analysis was conducted to estimate the number of manhole replacements and repairs the City should anticipate out of the manholes north of Sycamore Road that were not visually accounted for. Refer to the project titled *Stand-Alone Manhole Repair and Replacement* in Chapter 7 for the results of the statistical analysis.

Figure 6.11 provides a map of the manhole inspection and the recommendation for each.

## Figure 6.11 – Results of Manhole Inspections



6.4.3.1. – Replacement

Manholes that have already failed or that exhibit structural damage are candidates for replacement. Replacement means the old manhole is removed and a new manhole is installed to take its place. Figure 6.12 shows one of the older brick construction manholes in the northeast portion of the City, which is recommended for replacement due to severe deterioration and compromised structural integrity.

**Figure 6.12 – Example of Manhole Recommended for Replacement**

6.4.3.2. – Repair

Manholes that show deterioration or defects but are still structurally sound are candidates for repair.  Figure 6.13 shows a manhole with a moderate deterioration.

**Figure 6.13 – Example of Manhole Recommended for Repair**

6.4.3.3. – Do Nothing

Manholes that would not significantly benefit from repairs over the next 20 years are not recommended for mitigation.  Figure 6.14 shows a manhole in good condition.

**Figure 6.14 – Example of Manhole in Good Condition**

# Chapter 7 – Capital Improvement Program

## 7.1. – General Background

The Capital Improvement Program (CIP) is the culmination of the master planning process. The preceding chapters provide support for the recommendation of capital improvements necessary to ensure continuous uninterrupted sewer service to ratepayers and minimize the likelihood of overflows.

The CIP is intended to facilitate the preparation of a rate study to ensure adequate revenues for the wastewater collection and treatment system to continue operating as an enterprise entity, specifically with regard to capital investment.

With respect to Proposition 218 rules on benefit assessment, care was taken to separate investment in improvements intended to benefit existing ratepayers and improvements required to support future growth and development.

## 7.2. – Planning Level Cost Assumptions

Sewer replacement and rehabilitation projects from 2018 and 2019 for the City of Bakersfield, the Kern Sanitation Authority and the City of Shafter were used as a basis for cost estimating.

### 7.2.1. – Construction Costs

Construction costs represent labor and materials. For planning purposes, construction costs are calculated as a unit cost times a quantity. The construction costs for an individual project is often the sum of construction costs for a number of smaller project components.

Table 7.1 provides unit costs by pipe diameter for replacement, lining and spot repair.

**Table 7.1 – Pipe Unit Costs**

| Diameter (inches) | Replacement ($/foot) | Lining ($/foot) | Spot Repair ($/foot) |
|---|---|---|---|
| **8** | 240 | 100 | 500 |
| **10** | 250 | 110 | 540 |
| **12** | 260 | 120 | 580 |
| **15** | 270 | 135 | 620 |
| **18** | 280 | 155 | 650 |
| **24** | 300 | 190 | 700 |

Table 7.2 provides unit costs for manhole improvements.

**Table 7.2 – Manhole Unit Costs**

| Manhole Replacement ($/manhole) | Manhole Repair ($/manhole) |
|---|---|
| 8,000 | 2,000 |

Table 7.3 provides unit costs for pump improvements.

**Table 7.3 – Pump Unit Costs**

| Pump Replacement ($/pump) | Pump Rewind ($/pump) |
|---|---|
| 20,000 | 10,000 |

### 7.2.2. – Soft Costs

Table 7.4 provides project cost escalation factors for soft costs.

**Table 7.4 – Soft Costs**

| Factor | Percentage of Construction Costs |
|---|---|
| **Engineering and Construction Management** | 25% |
| **Contingencies** | 20% |
| **Administrative** | 5% |

Soft costs are presented as a percentage of construction costs.

- **Engineering and Construction Management** represents the cost of research, surveying, preliminary and final engineering design, and management of construction.
- **Contingencies** represent unknowns and unanticipated efforts and may include costs for permitting, processing easement requests, public outreach, stakeholder facilitation, environmental assessment, unforeseen site conditions during construction, and a wide variety of other expenses.
- **Administrative** represents the impact on City resources, which may include legal, finance, engineering review, bidding, project management, inspection, etc.

### 7.2.3. – Time-Based Cost Escalation

In project descriptions, total construction costs are provided in 2020 dollars. In the implementation schedule, total construction costs are escalated to reflect the cost at the time of procurement. For planning purposes, annual cost escalation is set at 3.1% based on a 10-year average of the Engineering News Record (ENR) construction cost index.

## 7.3. – Prioritization Methodology

### 7.3.1. – Development of Projects

Based on engineering judgment, recommended improvements for pipe capacity, pipe condition and manhole condition were arranged into logical projects considering proximity, similarity of recommended work, limiting disruption to the community, economies of scale and perceived urgency.

### 7.3.2. – Evaluation Parameters

A detailed project prioritization matrix is provided in Appendix V. The matrix provides a score and ranking for each project based on the parameters discussed below.

#### 7.3.2.1. – Nature of Deficiency and Mitigation

Consideration was given to the nature of deficiencies in terms of whether a pipe was identified as a hot spot, an older reinforced concrete pipe, or a high NASSCO Quick rating. Consideration was also given to the nature of the mitigation in terms of replacement, lining or spot repair for pipe and replacement or repair for manholes.

#### 7.3.2.2. – Likelihood of Failure

Likelihood of Failure (LOF) is related to the capacity and performance analyses conducted in this master plan. Based on Harris' engineering opinion and application of NASSCO standards, LOF represents the probability of a catastrophic failure that may result in a service outage or overflow.

#### 7.3.2.3. – Consequence of Failure

Consequence of Failure (COF) is related to the level of disruption a failure would cause to the community based on a review the number and type of ratepayers potentially impacted. Some pipes serve critical infrastructure such as government institutions and commercial zones that would severely disrupt the community if taken offline due to catastrophic failure. Some pipes serve a very large number of customers making them more critical than pipes serving only a few. These consequences also play a part in project prioritization.

7.3.2.4. – Perceived Urgency

The perceived urgency is a combination of LOF and COF. The reasoning behind perceived urgency is provided for each project to justify prioritization and to assist with implementation of the capital improvement program as conditions evolve.

## 7.4. – Overview of Recommended Projects

The CIP is presented as two distinct sets of projects in the following subsections. The first set involves improvements recommended to address existing conditions. The second set involves improvements required to support future development. Projects are separated in this fashion to clearly identify the beneficiaries of the improvements.

Table 7.5 provides a summary of recommendations to address existing conditions.

**Table 7.5 – Improvements for Existing Conditions**

| Improvements for Existing Conditions | Priority | Estimated Cost (2020 dollars) |
|---|---|---|
| Pump Rehabilitation and Replacement | As Needed | $100,000 |
| Comanche Drive Pipeline Project | High | 563,000 |
| West Smothermon Park Pipeline Project | High | 2,221,000 |
| Southwest Kovacevich Park Pipeline Project | High | 2,429,000 |
| A Street Pipeline Project | High | 1,449,000 |
| Campus Drive Alley Pipeline Project | High | 890,000 |
| Meyer Street Pipeline Project | Medium | 1,563,000 |
| Southeast Kovacevich Park Pipeline Project | Medium | 1,829,000 |
| West Di-Giorgio Park Pipeline Project | Medium | 890,000 |
| Haven Drive Pipeline Project | Medium | 1,162,000 |
| East Di Giorgio Park Pipeline Project | Low | 1,231,000 |
| Langford Avenue Pipeline Project | Low | 639,000 |
| Plum Tree Drive Alleys Pipeline Project | Low | 985,000 |
| Small Pipeline Replacement Projects | Low | 588,000 |
| Small Spot Repair Projects | Low | 240,000 |
| Stand-Alone Manhole Repair and Replacement | Low | 1,869,000 |
| Total | | $18,648,000 |

Table 7.6 provides a summary of future projects.

**Table 7.6 – Developer-Driven Improvements**

| Future Projects | Estimated Cost (2020 dollars) |
|---|---|
| West Sycamore Road Pipeline Project | $614,000 |
| Millux Road Pipeline and Pump Station Project | 4,948,000 |
| Potato-Sycamore Alignment Economic Study | 60,000 |
| Total | $5,622,000 |

## 7.5. – Projects to Address Existing Conditions

The subsections that follow present projects to address existing conditions. Sufficient detail is provided on each project to move directly into preliminary design. This level of detail is intended to facilitate implementation of the capital improvement program.

Each project includes the following elements:

**Title**

Titles are intended to be concise and descriptive in nature. They include the general location of the project and the type of improvement.

**Description**

Descriptions provide details regarding the location, type and quantity of work to be performed. The descriptions work in conjunction with the maps showing project extent.

**Cost Estimate**

Based on the type and quantity of work to be performed, project costs are estimated by applying the planning cost assumptions provided in Section 6.1. Costs are given in 2020 dollars.

**Justification**

Justifications provide the rationale for the recommended projects.

**Perceived Urgency**

Discussions surrounding perceived urgency are an extension of the project justification and a description of the possible consequences of deferring project implementation.

**Prioritization**

A brief statement based on relative perceived urgency. The projects are presented in this chapter in the order of perceived urgency from highest to lowest.

**Reach Number Reference (if needed)**

The fundamental unit of a wastewater collection system is a reach: a portion of pipeline between two consecutive manholes. For ease of reference, reaches in each project map are numbered. Additional citation and identification of reference materials are provided in the indicated appendices. These materials are intended to facilitate preparation of bidding documents and communication with bidders.

**Map Showing Project Extent (if needed)**

Maps taken from the GIS show the extent and detail of work to be performed. The maps work in conjunction with the descriptions.

### 7.5.1. – Pump Rehabilitation and Replacement

**Description**

Rehabilitate or replace pumps at the pump station, as needed.  There are two pumps at the pump station.  Over the course of the next 20 years, each pump is anticipated to require rehabilitation twice and replacement once.

**Cost Estimate**

$100,000

**Justification**

Pumps lose efficiency as they wear.  Mechanical infrastructure requires ongoing monitoring and maintenance.  The pump station is designed with two pumps for redundancy.  When a pump fails or cannot achieve adequate performance, it must be rehabilitated or replaced immediately while the second pump continues to operate.

**Perceived Urgency**

Redundancy is essential.  If both pumps fail, emergency measures will need to be taken to provide temporary pumping until the station is restored to full operation.

**Prioritization**

The City should maintain a reserve fund for pump rehabilitation or replacement, which may occur at any time.

### 7.5.1. – Comanche Drive Pipeline Project

**Description**

The project is generally located in Comanche Drive between Sycamore Road and El Camino Real. Replace 1110 feet of existing 18-inch pipe with new 18-inch pipe, and replace 8 manholes as shown in Figure 7.1.

**Cost Estimate**

$563,000

**Justification**

CCTV assessment of Reaches 1, 2, 3, and 4 revealed significant sagging, which impedes the normal flow of wastewater. It is unlikely that solids will accumulate at the sags due to relatively high velocity under average flow conditions; however, there is a possibility that the pipe will exceed 100% full at the sags under peak conditions. Replacement is recommended to correct the alignment of the pipes and restore normal flow.

Manhole assessment revealed 8 manholes that would benefit from replacement at the same time the pipes are replaced.

**Perceived Urgency**

*Likelihood of Failure*

Hydraulic analysis reveals this trunkline exceeds the design depth to diameter ratio of 0.5 under existing flow conditions, which will only increase under future flow conditions. LOF is high.

*Consequence of Failure*

This trunkline carries over 90% of the City wastewater; a failure would be catastrophic to the system. COF is high.

*Consequence of Not Implementing the Project*

The likelihood of an overflow will remain until the sags are repaired. The magnitude of the potential overflow is very high. An overflow may result in temporary loss of service to 90% of the City's customers. An overflow will result in violation of the City's wastewater discharge permit. The City must report discharge violations to the RWQCB and may be subject to associated fines or other actions.

**Prioritization**

This is a high priority project.

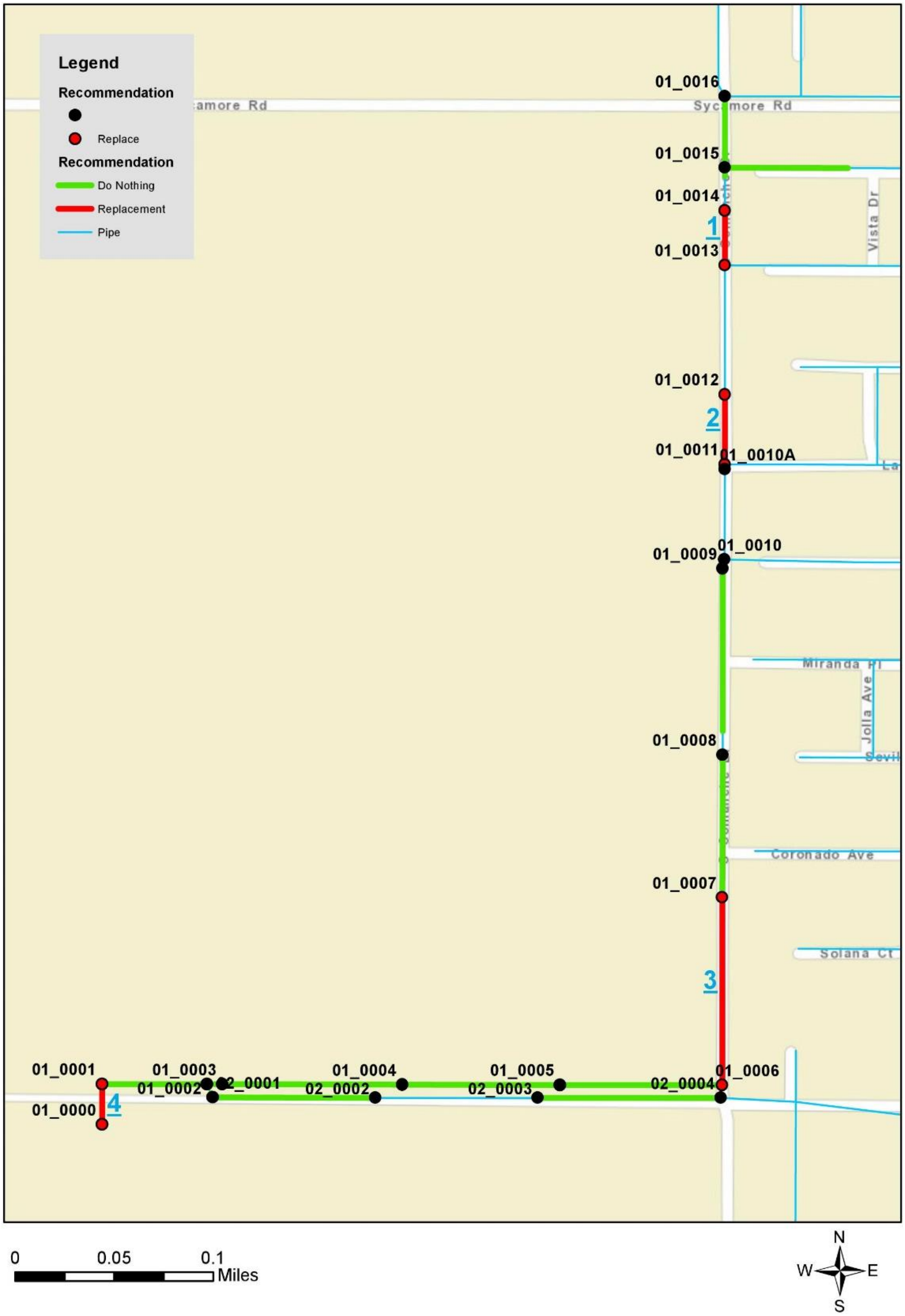
### Reach Number Reference

Table 7.7 identifies project-related reaches by number and manholes by designation. A reach is a portion of a pipeline between two consecutive manholes. Reaches are labeled in blue and manholes are labeled in black in Figure 7.1. Additional materials concerning project-related reaches and manholes are provided in Appendix O.

**Table 7.7 – Reaches for Comanche Drive Pipeline Project**

| Reach Number | Upstream Manhole | Downstream Manhole |
|---|---|---|
| 1 | 01-0014 | 01-0013 |
| 2 | 01-0012 | 01-0011 |
| 3 | 01-0007 | 01-0006 |
| 4 | 01-0001 | 01-0000 |

**Figure 7.1 – Extent of Comanche Drive Pipeline Project**



### 7.5.2. – West Smothermon Park Pipeline Project

**Description**

The project is located west of Smothermon Park generally bounded by Mark Street on the north, Walnut Drive on the east, Comanche Drive on the west and the alley parallel to and south of Durham Street on the south with some additional pipes in and about Bush Street east of Walnut Drive. Replace 4004 feet of existing 6-inch pipe with new 8-inch pipe, replace 1976 feet of existing 8-inch pipe with new 8-inch pipe, spot repair 33 feet of existing pipe, replace 17 manholes, and repair 1 manhole as shown in Figure 7.2.

**Cost Estimate**

$2,221,000

**Justification**

CCTV assessment revealed significant sagging in Reach 3, which impedes normal flow of wastewater. Accumulation of solids at the low point of the sag may lead to blockage and overflow. Replacement is recommended to correct the alignment of the pipe and restore normal flow.

No video was available for Reaches 1, 2, 3, 6, 7, 8, 9, 10, 11, 12, and 13 due to impassible obstructions in the pipe. For planning purposes, replacement was recommended to be conservative.

CCTV assessment of Reach 4 revealed a localized sag and high depth to diameter ratio. CCTV assessment of Reach 5 revealed a severely offset joint. Spot repairs should be performed on these reaches to the correct the alignment of the pipes.

Manhole assessment revealed 17 manholes that would benefit from replacement at the same time Reaches 1, 2, 3, 6, 7, 8, 9, 10, 11 and 12 are replaced.

Manhole assessment of Manhole 03_0014 revealed significant corrosion damage and should be repaired to extend its service life.

**Perceived Urgency**

*Likelihood of Failure*

This project area has seven reaches that are known hotspots. Based on partial CCTV footage, several alignments appears to include sags and offset joints. LOF is high.

*Consequence of Failure*

This is a large area serving about 150 local residential customers. COF is moderate.

*Consequence of Not Implementing the Project*

Large portions of this project area are already known to be problematic and other portions cannot be videoed due to structural defects. The likelihood of an overflow will remain until the sags and structural defects are repaired. An overflow may result in temporary loss of service to dozens of local customers. An overflow will result in violation of the City's wastewater discharge permit. The City must report discharge violations to the RWQCB and may be subject to associated fines or other actions.

Costs for operations and maintenance associated with these pipelines will continue and may increase as a result of ongoing deterioration and the impacts of infill development.

**Prioritization**

This is a high priority project.

**Reach Number Reference**

Table 7.8 identifies project-related reaches by number and manholes by designation. A reach is a portion of a pipeline between two consecutive manholes. Reaches are labeled in blue and manholes are labeled in black in Figure 7.2. Additional materials concerning project-related reaches and manholes are provided in Appendix N.

**Table 7.8 – Reaches for West Smothermon Park Pipeline Project**

| Reach Number | Upstream Manhole | Downstream Manhole |
|---|---|---|
| 1 | 03-6014 | 03-0017 |
| 2 | 03-6005 | 03-0015 |
| 3 | 03-6009 | 03-6008 |
| 4 | 03-6008 | 03-6007 |
| 5 | 03-6007 | 03-0014 |
| 6 | 03-6003 | 03-0013 |
| 7 | 03-6004 | 03-6003 |
| 8 | 03-6001 | 03-0012 |
| 9 | 03-6002 | 03-6001 |
| 10 | 03-5001 | 03-0011 |
| 11 | 03-5003 | 03-5001 |
| 12 | 03-5005 | 03-5003 |
| 13 | 03-5006 | 03-5005 |

**Figure 7.2 – Extent of West Smothermon Park Pipeline Project**

### 7.5.3. – Southwest Kovacevich Park Pipeline Project

#### Description

The project is located southwest of Kovacevich Park generally bounded by 5th Avenue on the north, B Street on the east, Hill Street on the west and Bear Mountain Boulevard on the south with some additional pipes in and about Bear Mountain Boulevard west of Hill Street. Replace 227 feet of existing 6-inch pipe with new 8-inch pipe, replace 4361 feet of existing 8-inch pipe with new 8-inch pipe, replace 335 feet of existing 10-inch pipe with new 10-inch pipe, line 226 feet of existing 12-inch pipe with CIPP, line 1729 feet of existing 8-inch pipe with CIPP, perform spot repair on 83 feet of existing pipe, and replace 21 manholes as shown in Figure 7.3.

#### Cost Estimate

$2,429,000

#### Justification

CCTV assessment revealed multiple sags, alignment issues and material deterioration in Reaches 7, 9, 10, 12, 14, 16, 18, 19, and 20, which impedes the normal flow of wastewater. Accumulation of solids at the low point of a sag may lead to blockage and overflow. Replacement is recommended to correct the alignment of the pipes and restore normal flow.

No video was available for Reaches 1, 2, 4, 6, 13, 17, and 22 due to impassible obstructions in the pipe. For planning purposes, replacement was recommended to be conservative.

CCTV assessment of Reaches 5 and 8 revealed localized sagging, and material deterioration. Spot repairs are recommended to correct the alignment of the pipes, followed by CIPP lining to extend the service life of the pipes.

CCTV assessment of Reaches 3, 11, 15, and 21 revealed extensive cracking throughout the pipes and material deterioration. Full CIPP lining is recommended to extend the service life of the pipe.

Manhole assessment revealed 21 manholes that warrant replacement. Two of these manholes are severely deteriorated and show structural damage. Nineteen of these manholes would benefit from replacement at the same time Reaches 1, 2, 4, 6, 7, 9, 10, 12, 13, 14, 16, 17, 18, 19, 20 and 22 are replaced.

#### Perceived Urgency

*Likelihood of Failure*

Much of the infrastructure in the northeast portion of the City is very old and original. Seven of these reaches are hotspots, which require additional maintenance. Twelve are older reinforced concrete pipes, which have exceeded the average life cycle for this material. Most of these reaches are deteriorated and prone to failure. LOF is high.

*Consequence of Failure*

This project is large serving approximately 200 residential customers and 12 commercial customers immediately north of Bear Mountain Boulevard. Additional residential customers north of 5th Avenue are dependent on the trunklines in Hill Street and in the alley north of Bear Mountain Boulevard. A failure in Reaches 19, 20 and 21 would cause the most disruption to service. COF is moderate.

*Consequence of Not Implementing the Project*

The older reinforced concrete pipe may collapse. The likelihood of an overflow will remain until the sags are repaired. A collapse or overflow may result in temporary loss of service for hundreds of residential customers and a dozen commercial customers. An overflow will result in violation of the City's wastewater discharge permit. The City must report discharge violations to the RWQCB and may be subject to associated fines or other actions.

Costs for operations and maintenance associated with these pipelines will continue and may increase as a result of ongoing deterioration and the impact of infill development.

### Prioritization

This is a high priority project.

### Reach Number Reference

Table 7.9 identifies project-related reaches by number and manholes by designation. A reach is a portion of a pipeline between two consecutive manholes. Reaches are labeled in blue and manholes are labeled in black in Figure 7.3. Additional materials concerning project-related reaches and manholes are provided in Appendix F.

**Table 7.9 – Reaches for Southwest Kovacevich Park Pipeline Project**

| Reach Number | Upstream Manhole | Downstream Manhole |
|---|---|---|
| 1 | 07-2008 | 07-2007 |
| 2 | 07-2007 | 07-2005 |
| 3 | 07-2006 | 07-2005 |
| 4 | 07-2005 | 07-2003 |
| 5 | 07-2004 | 07-2003 |
| 6 | 07-2003 | 07-2001 |
| 7 | 07-2002 | 07-2001 |
| 8 | 07-2001 | 07-0006 |
| 9 | 07-4005 | 07-4004 |
| 10 | 07-4004 | 07-4002 |
| 11 | 07-4003 | 07-4002 |
| 12 | 07-4002 | 07-4001 |
| 13 | 07-4001 | 07-0009 |
| 14 | 07-0009 | 07-0009 |
| 15 | 07-3002 | 07-0008 |
| 16 | 07-0008 | 07-0007 |
| 17 | 07-3001 | 07-0007 |
| 18 | 07-0007 | 07-0006 |
| 19 | 07-0006 | 07-0005 |
| 20 | 07-0005 | 07-0004 |
| 21 | 07-0004 | 07-0003 |
| 22 | 03-9007 | 03-9006 |

## Figure 7.3 – Extent of Southwest Kovacevich Park Pipeline Project

### 7.5.4. – A Street Pipeline Project

#### Description

The project includes pipelines in three alleys that flow west to A Street generally bounded by Tucker Street on the north, Derby Street on the east, A Street on the west, and Haven Drive on the south. Replace 2611 feet of existing 8-inch pipe with new 8-inch pipe, replace 321 feet of existing 10-inch pipe with new 10-inch pipe, line 1268 feet of existing pipe with CIPP, perform spot repair on 106 feet of existing pipe, and replace 14 manholes as shown in Figure 7.4.

#### Cost Estimate

$1,449,000

#### Justification

CCTV assessment revealed sagging and excessive pipe depth to diameter ratio in Reaches 3, 4, 5, 6, 8, 9, 10, 11, and 13, which impedes the normal flow of wastewater. Accumulation of solids at the low point of the sags may lead to blockage and overflow. Replacement is recommended to correct the alignment of the pipes and restore normal flow.

CCTV assessment of Reaches 1, 2, and 7 revealed localized sagging and significant material deterioration. Spot repairs are recommended to correct the alignment of pipes followed by CIPP lining to extend the service life of the pipes. **Reach 1 has a collapsed lateral causing debris to enter the pipe and should be spot repaired as soon as possible.**

CCTV assessment of Reach 12 revealed minor cracking and material deterioration throughout the pipe. Full CIPP lining is recommended to extend the service life of the pipe.

Manhole assessment revealed 14 manholes that would benefit from replacement at the same time Reaches 3, 4, 5, 6, 8, 9, 10, 11 and 13 are replaced.

#### Perceived Urgency

*Likelihood of Failure*

Almost all of the reaches are highly deteriorated older reinforced concrete pipes that have exceeded the average service life for this material. LOF is high.

*Consequence of Failure*

This is a medium-sized project serving approximately 120 residential customers. Reach 9 is part of a critical trunkline serving the northeastern portion of the City. COF is moderately low for this area.

*Consequence of Not Implementing the Project*

The older reinforced concrete pipes may collapse. The likelihood of an overflow will remain until the sags are repaired. A collapse or overflow may result in temporary loss of service for dozens of residential customers. An overflow will result in violation of the City's wastewater discharge permit. The City must report discharge violations to the RWQCB and may be subject to associated fines or other actions.

Costs for operations and maintenance associated with these pipelines will continue and may increase as a result of ongoing deterioration.

**Prioritization**

This is a high priority project.

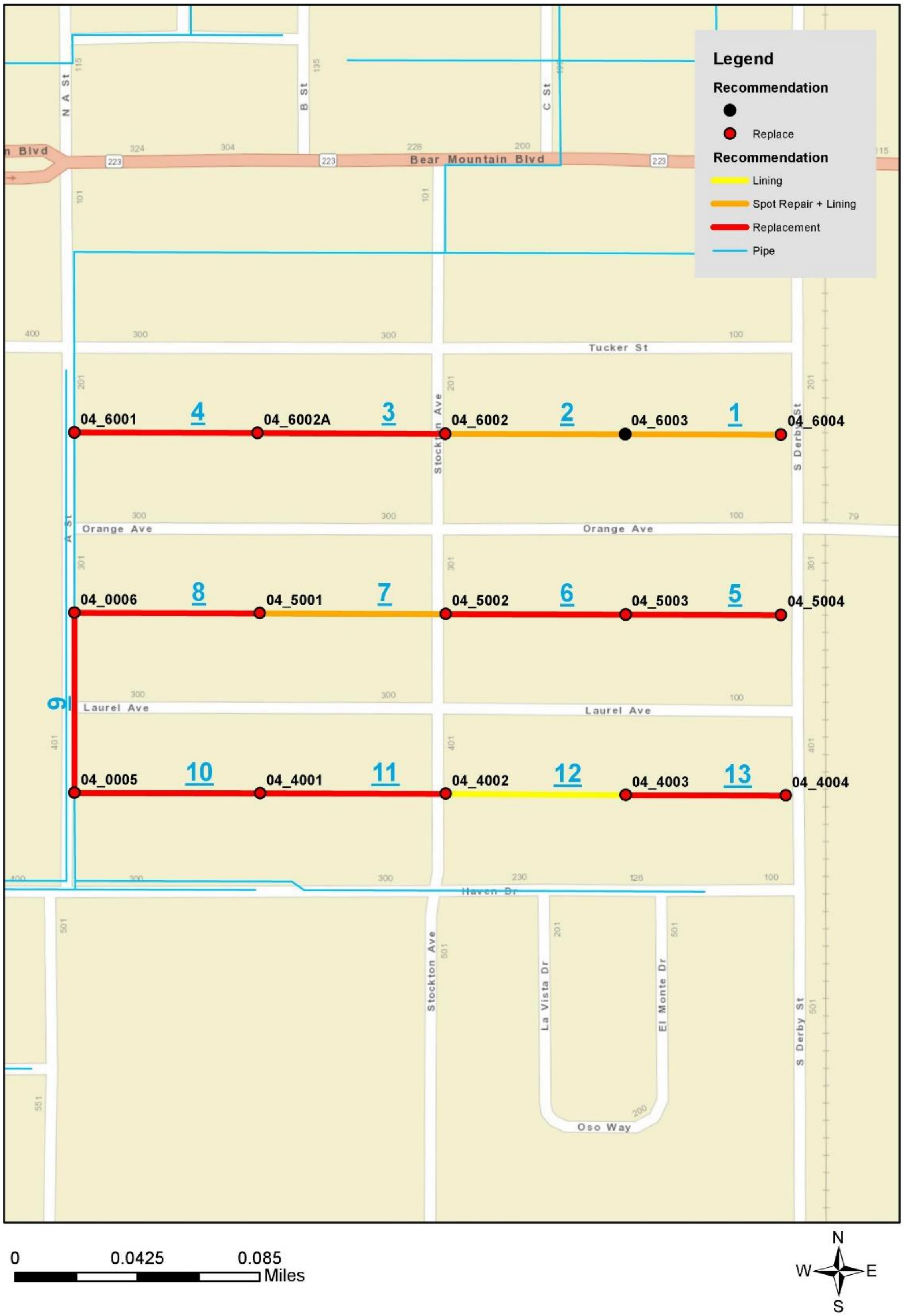
**Reach Number Reference**

Table 7.10 identifies project-related reaches by number and manholes by designation. A reach is a portion of a pipeline between two consecutive manholes. Reaches are labeled in blue and manholes are labeled in black in Figure 7.4. Additional materials concerning project-related reaches and manholes are provided in Appendix H.

**Table 7.10 – Reaches for A Street Pipeline Project**

| Reach Number | Upstream Manhole | Downstream Manhole |
|---|---|---|
| 1 | 04-6004 | 04-6003 |
| 2 | 04-6003 | 04-6002 |
| 3 | 04-6002 | 04-6002A |
| 4 | 04-6002A | 04-6001 |
| 5 | 04-5004 | 04-5003 |
| 6 | 04-5003 | 04-5002 |
| 7 | 04-5002 | 04-5001 |
| 8 | 04-5001 | 04-0006 |
| 9 | 04-0006 | 04-0005 |
| 10 | 04-4001 | 04-0005 |
| 11 | 04-4002 | 04-4001 |
| 12 | 04-4003 | 04-4002 |
| 13 | 04-4004 | 04-4003 |

## Figure 7.4 – Extent of A Street Pipeline Project



### 7.5.5. – Campus Drive Alley Pipeline Project

**Description**

The project is located in the alley west of Campus Drive between Varsity Avenue and Bear Mountain Boulevard. Replace 1634 feet of existing 8-inch pipe with new 8-inch pipe, line 198 feet of existing pipe with CIPP, perform spot repair on 135 feet of existing pipe, and replace seven manholes as shown in Figure 7.5

**Cost Estimate**

$890,000

**Justification**

CCTV assessment revealed severe sagging in Reaches 1, 2, 4, and 6, which prevents normal flow of wastewater. Accumulation of solids at the low point of a sag may lead to blockage and overflow. Replacement is recommended to correct the alignment of the pipes and restore normal flow.

CCTV assessment revealed cracking and minor sagging in Reach 3. Spot repairs are recommended to correct the alignment of the pipe, followed by CIPP lining to reduce deterioration and extend the service life of the pipe.

CCTV assessment revealed minor sags in Reach 5. Spot repairs are recommended to correct the alignment of the pipe.

Manhole assessment revealed seven manholes that would benefit from replacement at the same time Reaches 1, 2, 4 and 6 are replaced.

**Perceived Urgency**

*Likelihood of Failure*

The sagging in all the reaches presents a moderate likelihood of overflow during peak flow conditions. LOF is moderate.

*Consequence of Failure*

This pipeline serves Arvin High School, Kern County Fire Station No. 54, the Community Services District Headquarters and Evergreen Arvin Healthcare Center. Loss of sewer service at these institutions and facilities would be disruptive to the entire City. COF is high.

*Consequence of Not Implementing the Project*

The likelihood of an overflow will continue to increase as the pipeline ages and wastewater generation increases due to growth. An overflow may result in temporary loss of service for multiple critical institutions and facilities, as well as a dozen residential customers on Campus Drive. An overflow will result in violation of the City's wastewater discharge permit. The City must report discharge violations to the RWQCB and may be subject to associated fines or other actions.

Excessive costs for operations and maintenance associated with this pipeline will continue and may increase as a result of ongoing deterioration.

**Prioritization**

This is a high priority project.

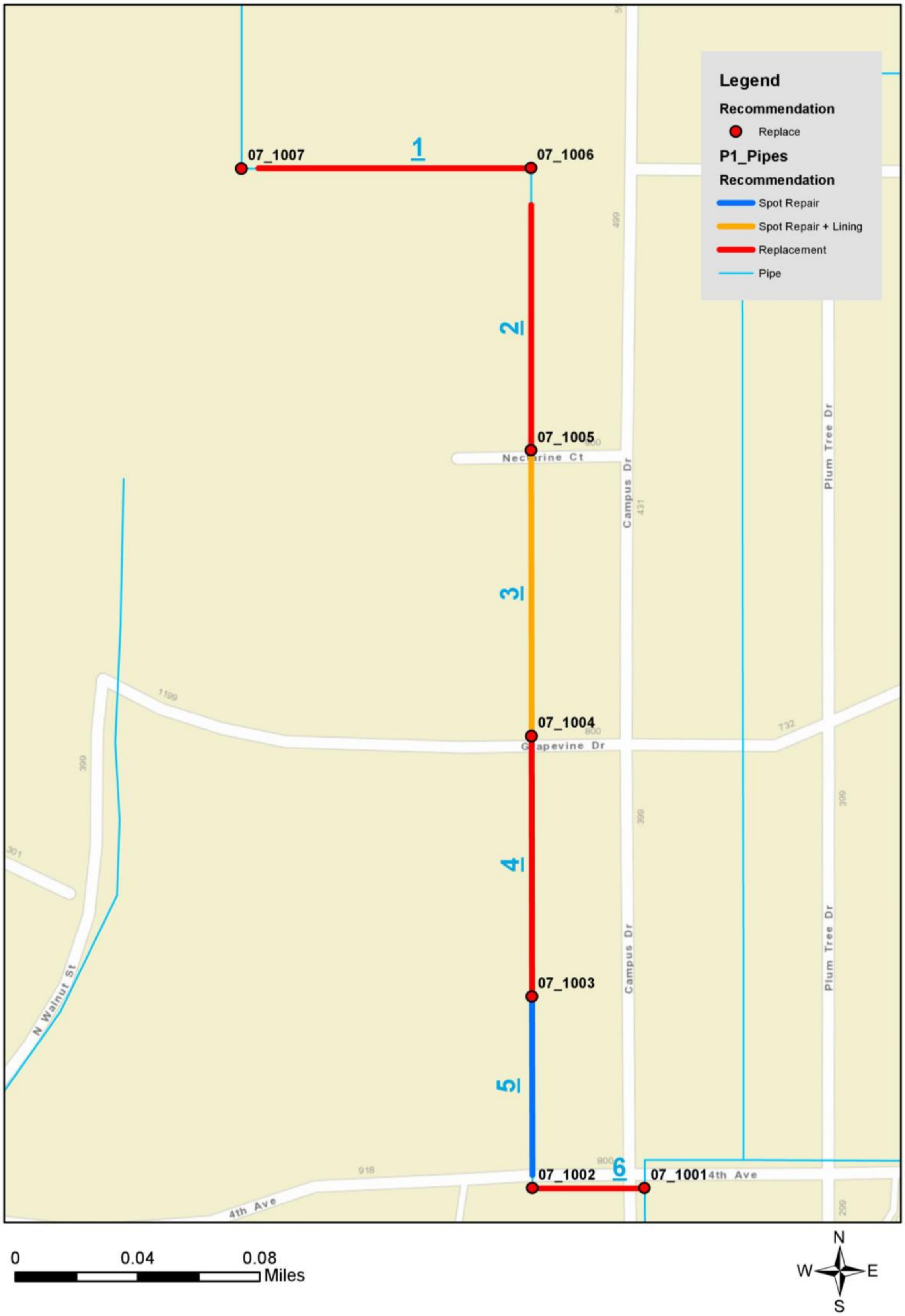
**Reach Number Reference**

Table 7.11 identifies project-related reaches by number and manholes by designation. A reach is a portion of a pipeline between two consecutive manholes. Reaches are labeled in blue and manholes are labeled in black in Figure 7.5. Additional materials concerning project-related reaches and manholes are provided in Appendix D.

**Table 7.11 – Reaches for Campus Drive Alley Pipeline Project**

| Reach Number | Upstream Manhole | Downstream Manhole |
|---|---|---|
| 1 | 07-1007 | 07-1006 |
| 2 | 07-1006 | 07-1005 |
| 3 | 07-1005 | 07-1004 |
| 4 | 07-1004 | 07-1003 |
| 5 | 07-1004 | 07-1002 |
| 6 | 07-1002 | 07-1001 |

**Figure 7.5 – Extent of Campus Drive Alley Pipeline Project**



### 7.5.6. – Meyer Street Pipeline Project

**Description**

The project includes pipelines generally bounded by Bear Mountain Boulevard on the north, Acala Street on the east, Meyer Street on the west, and Haven Drive on the south. Replace 1952 feet of existing 6-inch pipe with new 8-inch pipe, 1808 feet of existing 12-inch pipe with new 12-inch pipe, and replace 14 manholes as shown in Figure 7.6.

**Cost Estimate**

$1,563,000

**Justification**

CCTV assessment revealed sagging and excessive pipe depth to diameter ratio in Reaches 1, 2, 3, and 7, which impedes the normal flow of wastewater. Accumulation of solids at the low point of the sags may lead to blockage and overflow. Replacement is recommended to correct the alignment of the pipes and restore normal flow.

No video was available for Reaches 4, 5, 6, 8, and 9 due to impassible obstructions in the pipe. For planning purposes, replacement was recommended to be conservative.

Manhole assessment revealed 14 manholes that would benefit from replacement at the same time the pipelines are replaced.

**Perceived Urgency**

*Likelihood of Failure*

This project area contains two pipes that are known hotspots and others that are sagging significantly. LOF is moderately low.

*Consequence of Failure*

This is a medium-sized project serving 44 residential, four commercial and four institutional customers. Reaches 7 and 9 are part of the backbone of the wastewater collection system; nearly all wastewater generation northeast of the intersection of Haven Drive and Meyer Street passes through this alignment. COF is moderate.

*Consequence of Not Implementing the Project*

The likelihood of an overflow will remain until the sags are repaired. An overflow may result in temporary loss of service to much of the northeast quarter of the City. An overflow will result in violation of the City's wastewater discharge permit. The City must report discharge violations to the RWQCB and may be subject to associated fines or other actions.

Costs for operations and maintenance associated with these pipelines will continue and may increase as a result of ongoing deterioration and the impacts of development.

**Prioritization**

This is a medium priority project.

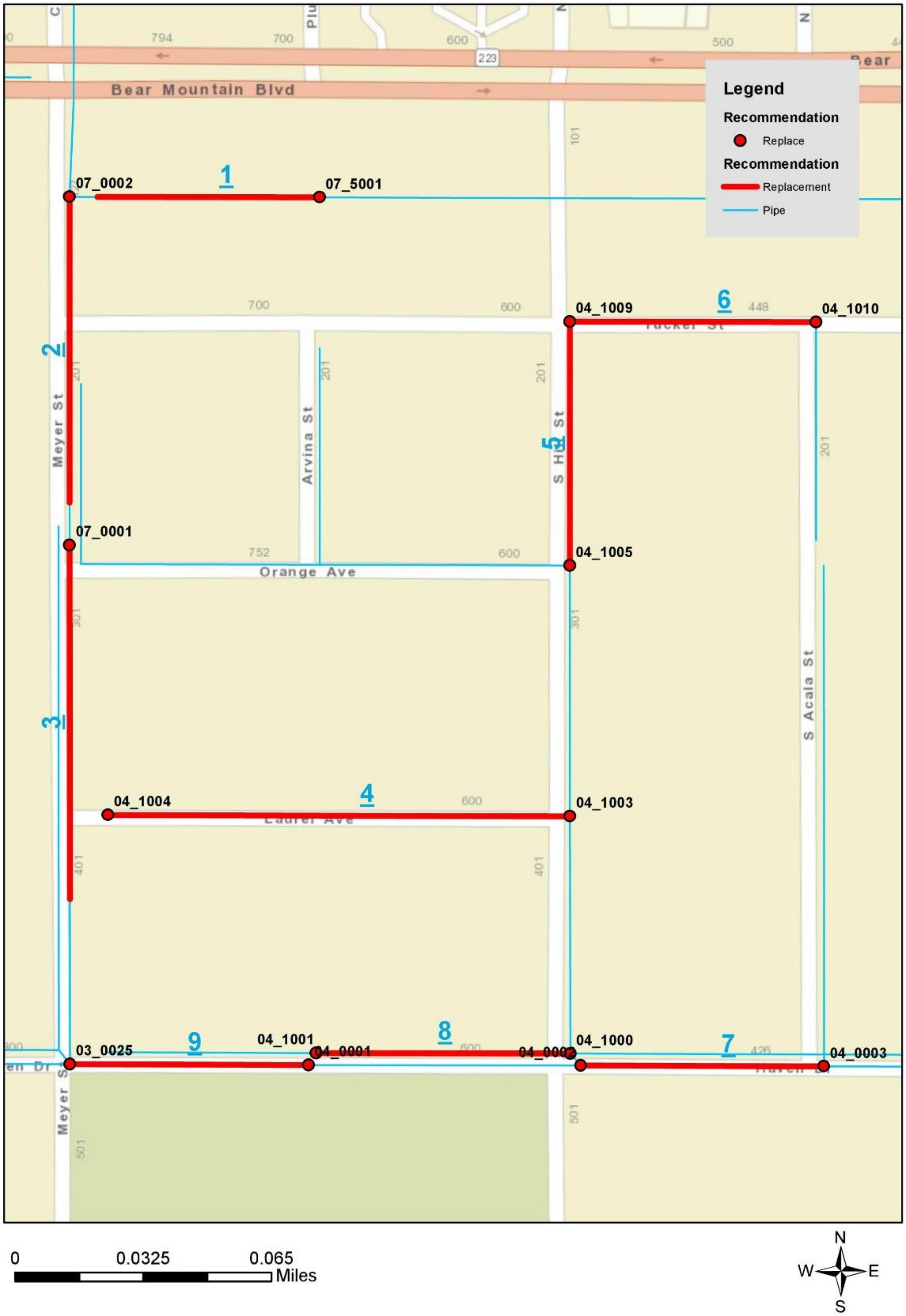
**Reach Number Reference**

Table 7.12 identifies project-related reaches by number and manholes by designation. A reach is a portion of a pipeline between two consecutive manholes. Reaches are labeled in blue and manholes are labeled in black in Figure 7.6 Additional materials concerning project-related reaches and manholes are provided in Appendix I.

**Table 7.12 – Reaches for Meyer Street Pipeline Project**

| Reach Number | Upstream Manhole | Downstream Manhole |
|---|---|---|
| 1 | 07-5001 | 07-0002 |
| 2 | 07-0002 | 07-0001 |
| 3 | 07-0001 | 03-0025 |
| 4 | 04-1004 | 04-1003 |
| 5 | 04-1009 | 04-1005 |
| 6 | 04-1010 | 04-1009 |
| 7 | 04-0003 | 04-0002 |
| 8 | 04-1001 | 04-1000 |
| 9 | 04-0001 | 03-0025 |

## Figure 7.6 – Extent of Meyer Street Pipeline Project



### 7.5.7. – Southeast Kovacevich Park Pipeline Project

**Description**

The project is located southeast of Kovacevich Park generally bounded by 5th Avenue on the north, Derby Street on the east, B Street on the west and the alley south of Bear Mountain Boulevard on the south and includes an additional pipe in 5th Avenue east of Derby Street. Replace 2438 feet of existing 8-inch pipe with new 8-inch pipe, line 3070 feet of existing pipe with CIPP, perform spot repair on 161 feet of existing pipe, replace 13 manholes, and repair 3 manholes as shown in Figure 7.7

**Cost Estimate**

$1,829,000

**Justification**

CCTV assessment revealed multiple sags, alignment issues, and material deterioration in Reaches 3, 6, 7, 9, 12, 14, 18, and 19, which impedes the normal flow of wastewater. Accumulation of solids at the low point of the sags may lead to blockage and overflow. Depth in excess of 75% of the pipe diameter is a concern in these reaches and several CCTV surveys were abandoned due to the camera being submerged. Replacement is recommended to correct the alignment of the pipes and restore normal flow.

No video was available for Reach 21 due to an impassible obstruction in the pipe. For planning purposes, replacement was recommended to be conservative.

CCTV assessment of Reaches 1, 2, 8, 11, 15, 17, and 20 revealed localized sagging and extensive material deterioration. Spot repairs are recommended to correct the alignment of the pipe, followed by CIPP lining to extend the service life of the pipe.

CCTV assessment of Reaches 4, 5, 10, 13, and 16 revealed extensive cracking, fracturing, and material deterioration. Full CIPP lining is recommended to extend the service life of the pipe.

Manhole assessment revealed 13 manholes that would benefit from replacement at the same time Reaches 3, 6, 7, 9, 12, 14, 18, 19 and 21 are replaced.

Manhole assessment revealed 3 manholes that are deteriorating and have extensive corrosion damage. Repairs are recommended for these manholes to extend their service life.

Manhole 04-018 has never been found and is recommended for replacement.

### Perceived Urgency

*Likelihood of Failure*

Much of the infrastructure in the northeast portion of the City is very old and original. Three of these reaches are hotspots, which require additional maintenance. Seventeen are older reinforced concrete pipes, which have exceeded the average service life cycle for this material. Most of these reaches are deteriorated and prone to failure. LOF is high.

*Consequence of Failure*

This project is relatively small serving approximately 50 residential customers north of Arvin Avenue and 26 commercial customers along Bear Mountain Boulevard and C Street. COF is low.

*Consequence of Not Implementing the Project*

The older reinforced concrete pipes may collapse. The likelihood of an overflow will remain until the sags are repaired. A collapse or overflow may result in temporary loss of service for dozens of residential and commercial customers. An overflow will result in violation of the City's wastewater discharge permit. The City must report discharge violations to the RWQCB and may be subject to associated fines or other actions.

Costs for operations and maintenance associated with these pipelines will continue and may increase as a result of ongoing deterioration and the impact of infill development.

### Prioritization

This is a medium priority project.

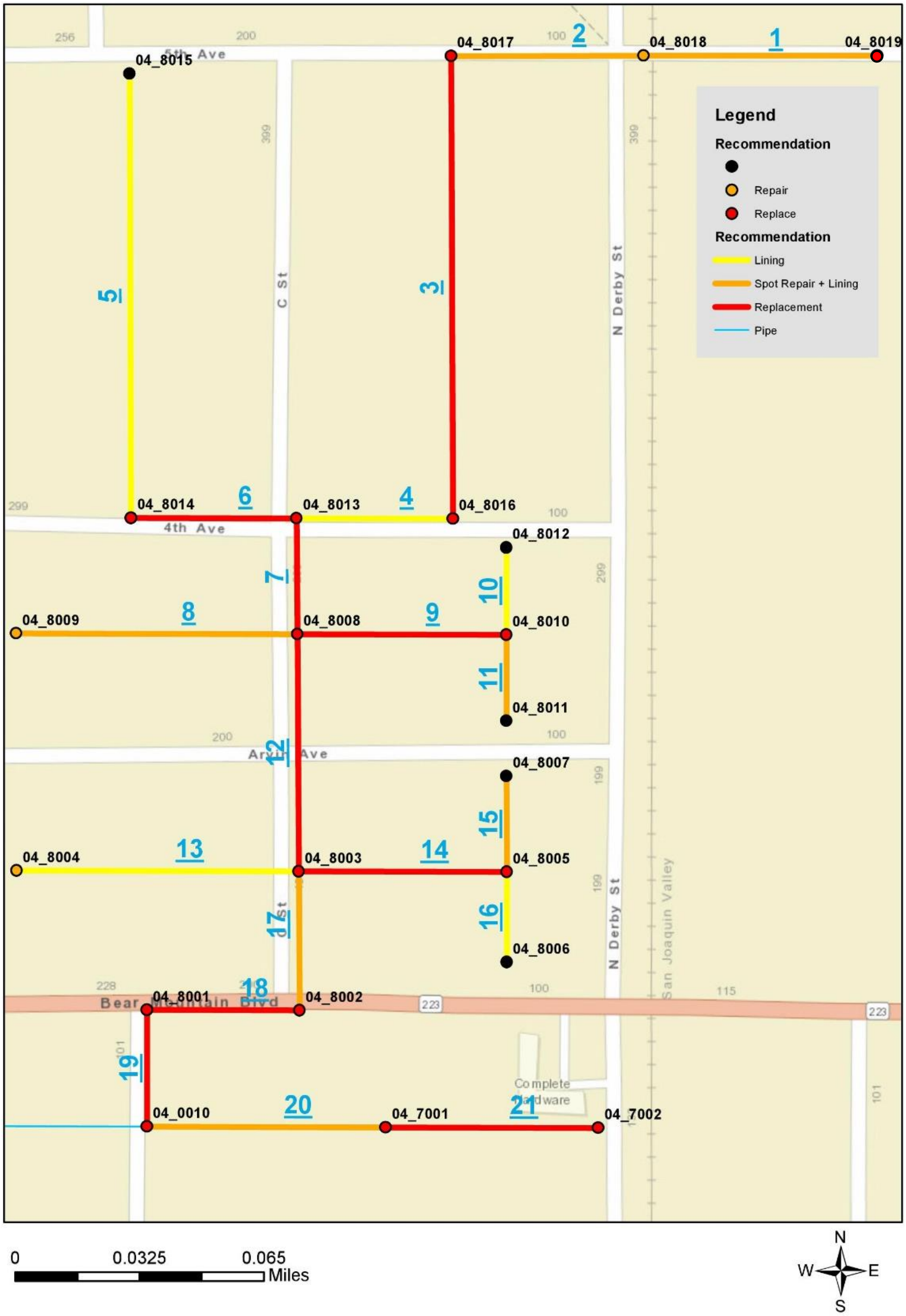
### Reach Number Reference

Table 7.13 identifies project-related reaches by number and manholes by designation. A reach is a portion of a pipeline between two consecutive manholes. Reaches are labeled in blue and manholes are labeled in black in Figure 7.7 Additional materials concerning project-related reaches and manholes are provided in Appendix G.

**Table 7.13 – Reaches for Southeast Kovacevich Park Pipeline Project**

| Reach Number | Upstream Manhole | Downstream Manhole |
|---|---|---|
| 1 | 04-8019 | 04-8018 |
| 2 | 04-8018 | 04-8017 |
| 3 | 04-8017 | 04-8016 |
| 4 | 04-8016 | 04-8013 |
| 5 | 04-8015 | 04-8014 |
| 6 | 04-8014 | 04-8013 |
| 7 | 04-8013 | 04-8008 |
| 8 | 04-8009 | 04-8008 |
| 9 | 04-8010 | 04-8008 |
| 10 | 04-8012 | 04-8010 |
| 11 | 04-8011 | 04-8010 |
| 12 | 04-8008 | 04-8003 |
| 13 | 04-8004 | 04-8003 |
| 14 | 04-8005 | 04-8003 |
| 15 | 04-8007 | 04-8005 |
| 16 | 04-8006 | 04-8005 |
| 17 | 04-8003 | 04-8002 |
| 18 | 04-8002 | 04-8001 |
| 19 | 04-8001 | 04-0010 |
| 20 | 04-7001 | 04-0010 |
| 21 | 04-7002 | 04-7001 |

## Figure 7.7 – Extent of Southeast Kovacevich Park Pipeline Project



### 7.5.8. – West Di-Giorgio Park Pipeline Project

#### Description

The project is located west of Di-Giorgio Park generally bounded by Haven Drive on the north, Meyer Street on the east, Walnut Drive on the west and Franklin Street on the south. Replace 938 feet of existing 8-inch pipe with new 8-inch pipe, line 2656 feet of existing pipe with CIPP, perform spot repair on 57 feet of existing pipe, and replace 7 manholes as shown in Figure 7.8.

#### Cost Estimate

$890,000

#### Justification

CCTV assessment revealed sagging and excessive pipe depth to diameter ratio in Reaches 8 and 11, which impedes the normal flow of wastewater. Accumulation of solids at the low point of the sags may lead to blockage and overflow. Replacement is recommended to correct the alignment of the pipes and restore normal flow.

No video was available for Reach 14 due to an impassible obstruction in the pipe. For planning purposes, replacement was recommended to be conservative.

CCTV assessment of Reach 4 revealed extreme material deterioration and structural defects. The pipe has degraded too much for lining to be effective, so replacement is recommended.

CCTV assessment of Reaches 2, 10, 12, 13, and 15 revealed localized cracking, breaks, and short sags. Spot repairs are recommended to correct the alignment of the pipes and fix spots that may collapse followed by CIPP lining to extend the service life of the pipes.

CCTV assessment of Reaches 5, 6, 7, and 9 revealed material deterioration and extensive cracking throughout the pipes. Full CIPP lining is recommended to extend the service lives of these reaches.

CCTV assessment of Reaches 3 and 16 revealed localized breaks with soil intruding into the pipe. Holes present a likelihood of collapse and blockages due to soil intrusion. Spot repairs are recommended to fix the holes and structural defects.

CCTV assessment of Reach 1 was abandoned near the end of the reach due to an intruding tap. The intruding tap is straining the structural integrity of the pipe and should be spot repaired to prevent further degradation.

Manhole assessment revealed 7 manholes that would benefit from replacement at the same time Reaches 4, 8, 11 and 14 are replaced.

**Perceived Urgency**

*Likelihood of Failure*

This project area contains four reaches that are known hotspots.  Additional reaches have degraded structurally and need attention to extend their service life, but are not likely collapse.  LOF is moderately high.

*Consequence of Failure*

This is a medium-sized project serving about 150 residential customers and one neighborhood commercial customer.  COF is low.

*Consequence of Not Implementing the Project*

The likelihood of an overflow will remain until the sags, intrusions and structural defects are repaired.  An overflow may result in temporary loss of service to up to 150 local customers.  An overflow will result in violation of the City's wastewater discharge permit.  The City must report discharge violations to the RWQCB and may be subject to associated fines or other actions.

Costs for operations and maintenance associated with these pipelines will continue and may increase as a result of ongoing deterioration and the impact of minor infill development projects.

**Prioritization**

This is a medium priority project.

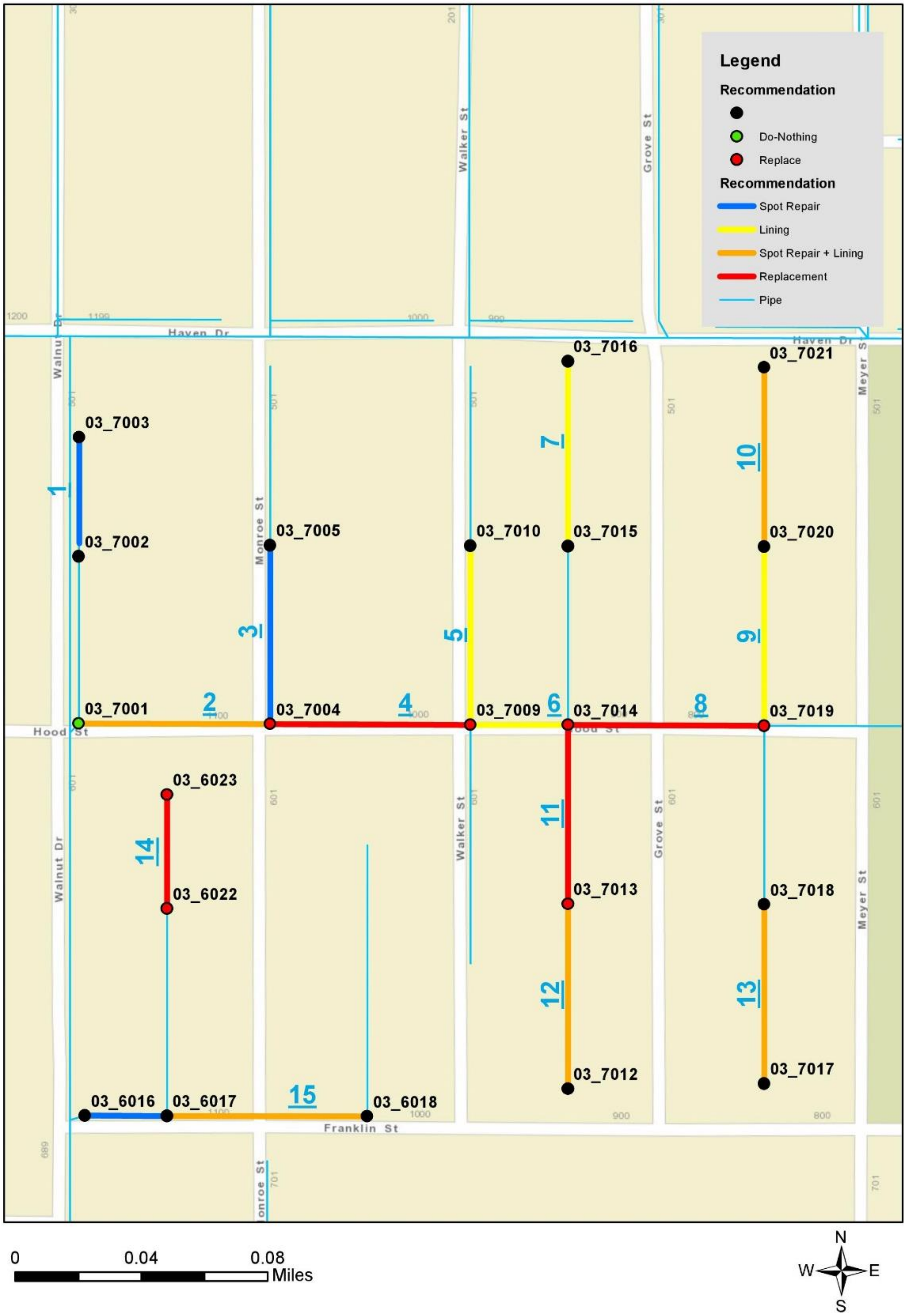
**Reach Number Reference**

Table 7.14 identifies project-related reaches by number and manholes by designation.  A reach is a portion of a pipeline between two consecutive manholes.  Reaches are labeled in blue and manholes are labeled in black in Figure 7.8  Additional materials concerning project-related reaches and manholes are provided in Appendix K.

**Table 7.14 – Reaches for West Di-Giorgio Park Pipeline Project**

| Reach Number | Upstream Manhole | Downstream Manhole |
|---|---|---|
| 1 | 03-7003 | 03-7002 |
| 2 | 03-7004 | 03-7001 |
| 3 | 03-7005 | 03-7004 |
| 4 | 03-7009 | 03-7004 |
| 5 | 03-7010 | 03-7009 |
| 6 | 03-7014 | 03-7009 |
| 7 | 03-7016 | 03-7015 |
| 8 | 03-7019 | 03-7014 |
| 9 | 03-7020 | 03-7019 |
| 10 | 03-7021 | 03-7020 |
| 11 | 03-7003 | 03-7002 |
| 12 | 03-7004 | 03-7001 |
| 13 | 03-7005 | 03-7004 |
| 14 | 03-7009 | 03-7004 |
| 15 | 03-7010 | 03-7009 |
| 16 | 03-7014 | 03-7009 |

## Figure 7.8 – Extent of West Di-Giorgio Park Pipeline Project



### 7.5.9. – Haven Drive Pipeline Project

#### Description

The project includes pipelines in Haven Drive, Monroe Street, Santa Rosa Street and Walnut Drive. Replace 563 feet of existing 6-inch pipe with new 8-inch pipe, replace 1899 feet of existing 8-inch pipe with new 8-inch pipe, replace 335 feet of existing 15-inch pipe with new 15-inch pipe, and replace 12 manholes as shown in Figure 7.9

#### Cost Estimate

$1,162,000

#### Justification

CCTV assessment revealed sagging and excessive pipe depth to diameter ratio in Reaches 1, 2, 4, 5, 6, 7, 8, 9, and 10, which impedes the normal flow of wastewater. Accumulation of solids at the low point of the sags may lead to blockage and overflow. Replacement is recommended to correct the alignment of the pipes and restore normal flow.

No video was available for Reach 3 due to an impassible obstruction in the pipe. For planning purposes, replacement was recommended to be conservative.

Manhole assessment revealed 12 manholes that would benefit from replacement at the same time the pipelines are replaced.

#### Perceived Urgency

*Likelihood of Failure*

This project contains two reaches that are known hotspots. Nine of the ten reaches are sagging, making them susceptible to overflow. LOF is moderate.

*Consequence of Failure*

This project serves 26 single family residential units, one large multi-family residential complex and one church. Reach 2 is part of the backbone of the wastewater collection system; nearly all wastewater generation northeast of the intersection of Haven Drive and Walnut Drive passes through this alignment. COF is moderate.

*Consequence of Not Implementing the Project*

The likelihood of an overflow will remain until the sags are repaired. An overflow may result in temporary loss of service to much of the northeast quarter of the City. An overflow will result in violation of the City’s wastewater discharge permit. The City must report discharge violations to the RWQCB and may be subject to associated fines or other actions.

Costs for operations and maintenance associated with these pipelines will continue and may increase as a result of ongoing deterioration and the impact of development.

**Prioritization**

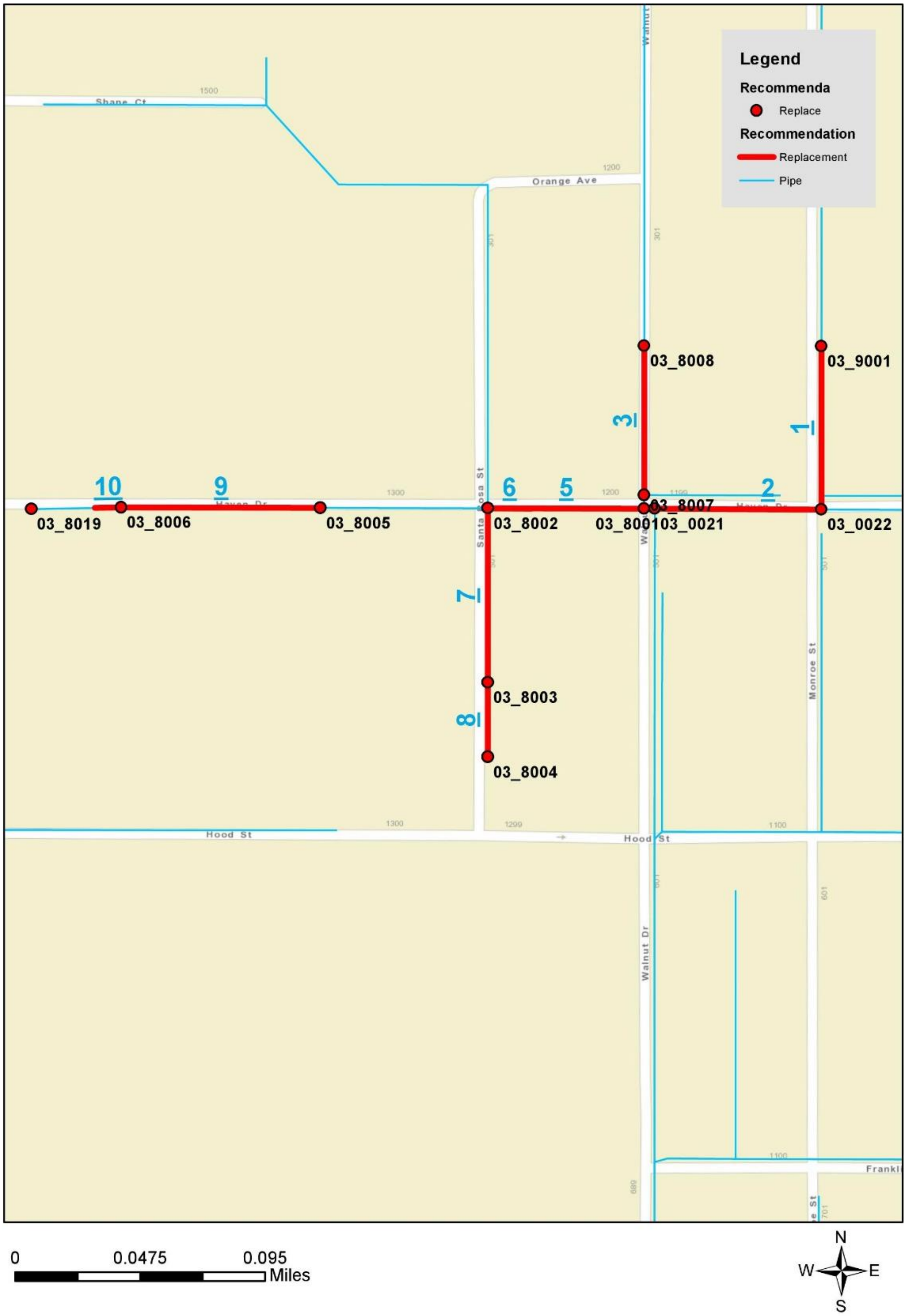
This is a medium priority project.

Table 7.15 identifies project-related reaches by number and manholes by designation. A reach is a portion of a pipeline between two consecutive manholes. Reaches are labeled in blue and manholes are labeled in black in Figure 7.9 Additional materials concerning project-related reaches and manholes are provided in Appendix J.

**Table 7.15 – Reaches for Haven Drive Pipeline Project**

| Reach Number | Upstream Manhole | Downstream Manhole |
|---|---|---|
| 1 | 03-9001 | 03-0022 |
| 2 | 03-0022 | 03-0021 |
| 3 | 03-8008 | 03-8007 |
| 4 | 03-8001 | 03-0021 |
| 5 | 03-8002 | 03-8007 |
| 6 | 03-8002 | 03-8001 |
| 7 | 03-8003 | 03-8002 |
| 8 | 03-8004 | 03-8003 |
| 9 | 03-8006 | 03-8005 |
| 10 | 03-8019 | 03-8006 |

## Figure 7.9 – Extent Haven Drive Pipeline Project



### 7.5.10. – East Di Giorgio Park Pipeline Project

#### Description

The project is located east of Di Giorgio Park generally bounded by Holden Street on the north, A Street on the east, Hill Street on the west and Langford Avenue on the south and includes a pipeline that crosses Di Giorgio Park. Replace 2059 feet of existing 6-inch pipe with new 8-inch pipe, replace 899 feet of existing 8-inch pipe with new 8-inch pipe, line 345 feet of existing pipe with CIPP, and replace 9 manholes as shown in Figure 7.10.

#### Cost Estimate

$1,231,000

#### Justification

CCTV assessment revealed sagging for more than one-third the length of Reach 7, which impedes normal flow of wastewater. Accumulation of solids at the low point of the sag may lead to blockage and overflow. Replacement is recommended to correct the alignment of the pipe and restore normal flow.

No video was available for Reaches 1, 2, 3, 4, and 5 due to impassible obstructions in the pipes. For planning purposes, replacement was recommended to be conservative.

CCTV assessment of Reach 6 revealed extensive cracking throughout the pipe. Full CIPP lining should be implemented to extend the service life of the pipe.

Manhole assessment revealed 9 manholes that would benefit from replacement at the same time Reaches 1, 2, 3, 4, 5 and 7 are replaced.

#### Perceived Urgency

*Likelihood of Failure*

This project area contains three reaches that are known hotspots. The infrastructure in this area appears to be old and relatively degraded. LOF is moderate.

*Consequence of Failure*

This is a small project serving about 70 residential customers. COF is low.

*Consequence of Not Implementing the Project*

The likelihood of an overflow will remain until the sags are repaired. An overflow may result in temporary loss of service to up to 70 local customers. An overflow will result in violation of the City's wastewater discharge permit. The City must report discharge violations to the RWQCB and may be subject to associated fines or other actions.

Costs for operations and maintenance associated with these pipelines will continue and may increase as a result of ongoing deterioration.

#### Prioritization

This is a low priority project.

### Reach Number Reference

Table 7.16 identifies project-related reaches by number and manholes by designation. A reach is a portion of a pipeline between two consecutive manholes. Reaches are labeled in blue and manholes are labeled in black in Figure 7.10. Additional materials concerning project-related reaches and manholes are provided in Appendix L.

**Table 7.16 – Reaches for East Di Giorgio Park Pipeline Project**

| Reach Number | Upstream Manhole | Downstream Manhole |
|---|---|---|
| 1 | 03-7026 | 03-7025 |
| 2 | 03-7024 | 03-7023 |
| 3 | 03-7023 | 03-7022 |
| 4 | 03-7022 | 03-7019 |
| 5 | 06-4024 | 06-4023 |
| 6 | 06-4023 | 06-4002A |
| 7 | 06-5004 | 06-5003 |

**Figure 7.10 – Extent of East Di Giorgio Park Pipeline Project**

### 7.5.11. – Langford Avenue Pipeline Project

**Description**

**The project is located in Langford Avenue between Stockton Avenue and A Street generally bounded by Franklin Street on the north, Stockton Avenue on the east, A Street on the west and Fallbrook Avenue on the south. Replace 945 feet of existing 8-inch pipe with new 8-inch pipe, line 977 feet of existing pipe with CIPP, perform spot repair on 85 feet of existing pipe, replace 7 manholes, and repair 3 manholes as shown in**

| Reach Number | Upstream Manhole | Downstream Manhole |
|---|---|---|
| 1 | 06-4016 | 06-4015 |
| 2 | 06-4019 | 06-4015 |
| 3 | 06-4015 | 06-4001 |
| 4 | 06-5002 | 06-5001 |
| 5 | 06-5001 | 06-0015 |
| 6 | 06-4001 | 06-0015 |
| 7 | 06-4002 | 06-4001 |
| 8 | 06-4013 | 06-4002 |
| 9 | 06-3007 | 06-3006 |
| 10 | 06-3002 | 06-3001 |
| 11 | 06-3004 | 06-3001 |

Figure 7.11.

**Cost Estimate**

$639,000

**Justification**

CCTV assessment of Reaches 2, 4, 5, and 6 revealed significant sagging, which impedes the normal flow of wastewater. Accumulation of solids at the low point of the sag may lead to blockage and overflow. Replacement is recommended to correct the alignment of the pipes and restore normal flow.

CCTV assessment of Reach 1 revealed a localized sag at the end of the pipe as well as extensive cracking throughout. The sag should be spot repaired to correct the alignment of the pipe, followed by CIPP lining to extend the service life of the pipe.

CCTV assessment of Reaches 10 and 11 revealed minor cracking and structural defects throughout the pipe.  Although these defects are not do not indicate impending collapse, they are preliminary signs of deterioration and should be repaired before more extensive structural damage occurs.  Full CIPP lining is recommended to extend the service life of these pipes.

CCTV assessment of reaches 3, 7, 8, and 9 revealed localized structural defects in small areas that should be spot repaired to prevent collapse.

Manhole assessment revealed 7 manholes that warrant replacement.  Six of the seven manholes would benefit from replacement at the same time Reaches 2, 4 and 6 are replaced.

Manhole 06-3007 could not be opened for inspection.  For planning purposes, replacement was recommended to be conservative.

Manhole assessment revealed 3 manholes that have incurred significant corrosion and structural damage.  These are recommended for repaired to extend their service life.

**Perceived Urgency**

*Likelihood of Failure*

This project area has four reaches that are known hotspots.  Condition assessment in this area revealed that the infrastructure is old and degraded, but failure is not imminent.  LOF is moderate.

*Consequence of Failure*

This is a small area serving approximately 45 local residential customers.  COF is low.

*Consequence of Not Implementing the Project*

The likelihood of an overflow will remain until the sags and structural defects are repaired.  An overflow may result in temporary loss of service to up to 45 local customers.  An overflow will result in violation of the City's wastewater discharge permit.  The City must report discharge violations to the RWQCB and may be subject to associated fines or other actions.

Costs for operations and maintenance associated with these pipelines will continue and may increase as a result of ongoing deterioration and the impact of infill development.

**Prioritization**

This is a low priority project.

**Reach Number Reference**

**Table 7.17 identifies project-related reaches by number and manholes by designation.  A reach is a portion of a pipeline between two consecutive manholes.  Reaches are labeled in blue and manholes are labeled in black in**

| Reach Number | Upstream Manhole | Downstream Manhole |
|---|---|---|

| | | |
|---|---|---|
| 1 | 06-4016 | 06-4015 |
| 2 | 06-4019 | 06-4015 |
| 3 | 06-4015 | 06-4001 |
| 4 | 06-5002 | 06-5001 |
| 5 | 06-5001 | 06-0015 |
| 6 | 06-4001 | 06-0015 |
| 7 | 06-4002 | 06-4001 |
| 8 | 06-4013 | 06-4002 |
| 9 | 06-3007 | 06-3006 |
| 10 | 06-3002 | 06-3001 |
| 11 | 06-3004 | 06-3001 |

Figure 7.11. Additional materials concerning project-related reaches and manholes are provided in Appendix M.

**Table 7.17 – Reaches for Langford Avenue Pipeline Project**

| Reach Number | Upstream Manhole | Downstream Manhole |
|---|---|---|
| 1 | 06-4016 | 06-4015 |
| 2 | 06-4019 | 06-4015 |
| 3 | 06-4015 | 06-4001 |
| 4 | 06-5002 | 06-5001 |
| 5 | 06-5001 | 06-0015 |
| 6 | 06-4001 | 06-0015 |
| 7 | 06-4002 | 06-4001 |
| 8 | 06-4013 | 06-4002 |
| 9 | 06-3007 | 06-3006 |
| 10 | 06-3002 | 06-3001 |

| | | |
|---|---|---|
| **11** | **06-3004** | **06-3001** |

**Figure 7.11 – Extent of Langford Avenue Pipeline Project**


Legend
Recommendation
Do-Nothing
Repair
Replace
Recommendation
Spot Repair
Lining
Spot Repair + Lining
Replacement
Pipe
06_4016
06_4019
06_4015
06_4013
06_5002
06_5001
06_0015
06_4001
06_4002
06_3007
06_3002
06_3006
06_3001
06_3004
1
2
3
4
6
7
8
9
10
11
Combs Ave
Langford Ave
Fallbrook Ave
A St
Strand Ave
Cardiff Ave
Stockton Ave
0
0.03
0.06
Miles
N
W
E
S

### 7.5.12. – Plumtree Drive Alleys Pipeline Project

**Description**

The project is generally located in the alleys east and west of Plumtree Drive between Orchard Drive and 4th Avenue. Replace 641 feet of existing 8-inch pipe with new 8-inch pipe, line 2987 feet of existing pipe with CIPP, perform spot repair on 250 feet of existing pipe, replace 9 manholes, and repair 5 manholes as shown in Figure 7.12.

**Cost Estimate**

$985,000

**Justification**

CCTV assessment revealed extensive cracking throughout Reaches 1, 2, 3, 5, and 10 with emphasis at the joints. Full CIPP lining is recommended to extend the service life of these pipes.

CCTV assessment revealed fracturing, cracking, and localized sagging in Reaches 4, 6, 7, 8, and 11. Spot repairs are recommended to correct the alignment issues, followed by CIPP lining to reduce deterioration and extend the service life of these pipes.

CCTV assessment revealed multiple sags and structural defects in Reach 9, which prevents normal flow of wastewater and makes it vulnerable to failure. Accumulation of solids at the low point of the sag may lead to blockage and overflow. Replacement is recommended to correct the alignment of the pipe, restore normal flow and prevent a catastrophic structural failure.

No video was available for Reach 12 due to an impassible obstruction in the pipe. For planning purposes, replacement was recommended to be conservative.

Manhole assessment revealed nine manholes that would benefit from replacement. Five of these manholes are severely deteriorated brick construction. Four of these manholes would benefit from replacement at the same time Reaches 9 and 12 are replaced.

Manhole assessment revealed five manholes with signs of deterioration, cracking and ingress. Repairs are recommended for these manholes to extend their service life.

**Perceived Urgency**

*Likelihood of Failure*

Sagging in Reach 9 is high priority due to the likelihood of overflow during peak conditions. The structural defects in the rest of the reaches are becoming severe and denote advanced deterioration. LOF is moderately high.

*Consequence of Failure*

No commercial or institutional interests are served by the project-related pipelines. COF is low.

*Consequence of Not Implementing the Project*

The likelihood of an overflow will remain until the sags are repaired. An overflow may result in temporary loss of service for up to approximately 100 residential customers. An overflow will result in violation of the City's wastewater discharge permit, although flow in the subject pipelines is relatively low and no growth is anticipated to increase flow in the future. The City must report discharge violations to the RWQCB and may be subject to associated fines or other actions.

Costs for operations and maintenance associated with this pipeline will continue and may increase as a result of ongoing deterioration.

**Prioritization**

This is a low priority project.

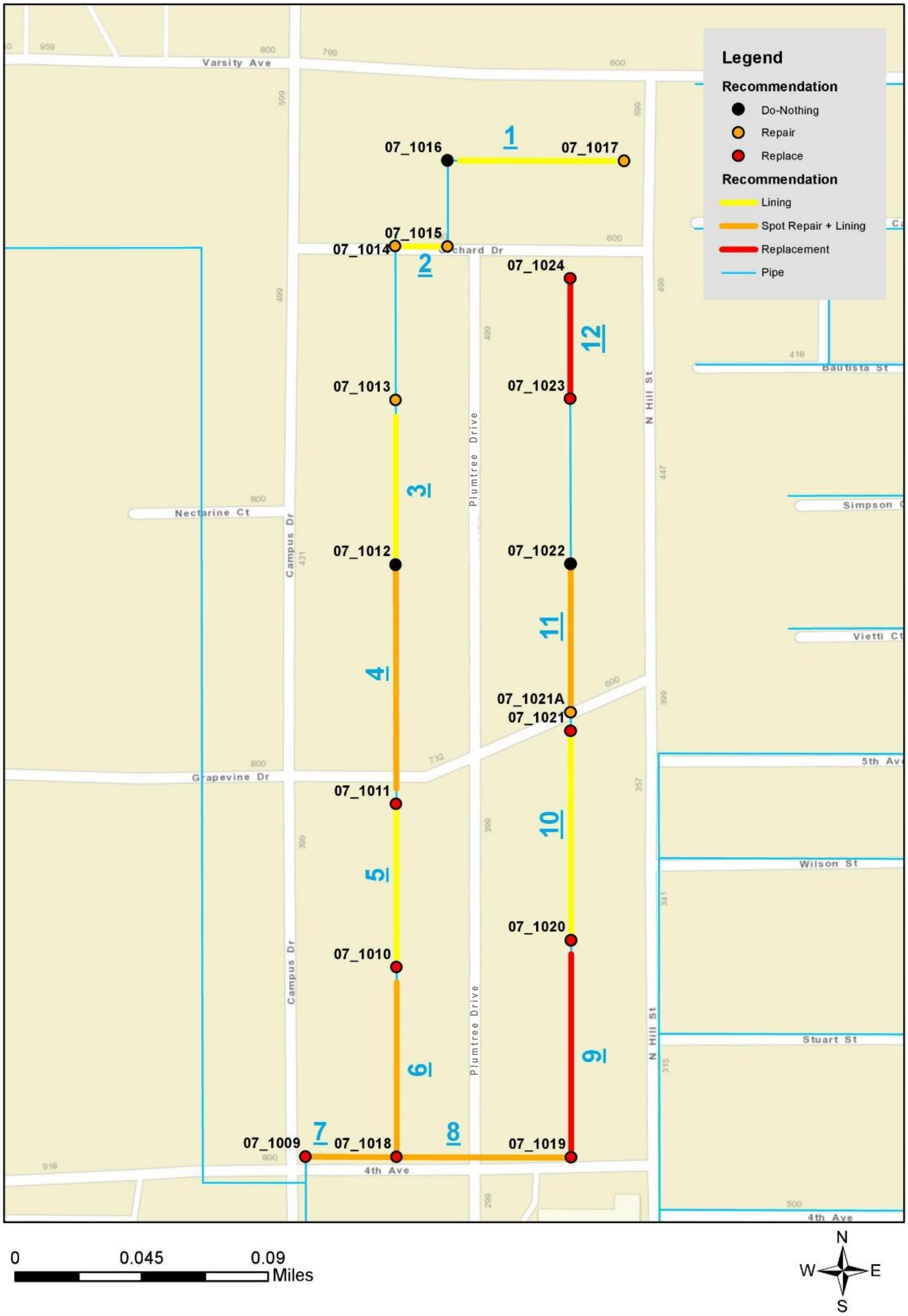
**Reach Number Reference**

Table 7.18 project-related reaches by number and manholes by designation. A reach is a portion of a pipeline between two consecutive manholes. Reaches are labeled in blue and manholes are labeled in black in Figure 7.12. Additional materials concerning project-related reaches and manholes are provided in Appendix E.

**Table 7.18 – Reaches for Plumtree Drive Alleys Pipeline Project**

| Reach Number | Upstream Manhole | Downstream Manhole |
|---|---|---|
| 1 | 07-1017 | 07-1016 |
| 2 | 07-1015 | 07-1014 |
| 3 | 07-1024 | 07-1023 |
| 4 | 07-1013 | 07-1012 |
| 5 | 07-1012 | 07-1011 |
| 6 | 07-1011 | 07-1010 |
| 7 | 07-1010 | 07-1018 |
| 8 | 07-1018 | 07-1009 |
| 9 | 07-1019 | 07-1018 |
| 10 | 07-1020 | 07-1019 |
| 11 | 07-1021 | 07-1020 |
| 12 | 07-1022 | 07-1021A |

**Figure 7.12 – Extent of Plumtree Drive Alleys Pipeline Project**



### 7.5.13. – Small Pipeline Replacement Projects

#### Description

This project is not confined to a specific area; rather, to take advantage of economies of scale, six small replacement projects were combined. Replace 1080 feet of existing 8-inch pipe with new 8-inch pipe, and replace 13 manholes as shown in Figure 7.13 and Figure 7.14.

#### Cost Estimate

$588,000

#### Justification

CCTV assessment of Reaches 1, 2, 3, 4, and 5 revealed significant sagging, which impedes the normal flow of wastewater. Accumulation of solids at the low point of a sag may lead to blockage and overflow. Replacement is recommended to correct the alignment of the pipes and restore normal flow.

No video was available for Reach 6 due to an impassible obstruction in the pipe. For planning purposes, replacement was recommended to be conservative.

Manhole assessment revealed 13 manholes that would benefit from replacement at the same time the pipes are replaced.

#### Perceived Urgency

*Likelihood of Failure*

Six of the seven reaches exhibit sagging. LOF is moderate.

*Consequence of Failure*

These individual replacements impact very few customers. COF is low.

*Consequence of Not Implementing the Project*

Although the reaches in this area are not known hotspots, the sags increase the likelihood of failure in the future. As time goes on, operations and maintenance costs will likely increase to alleviate issues as they occur due to non-normal flow.

#### Prioritization

This is a low priority project.

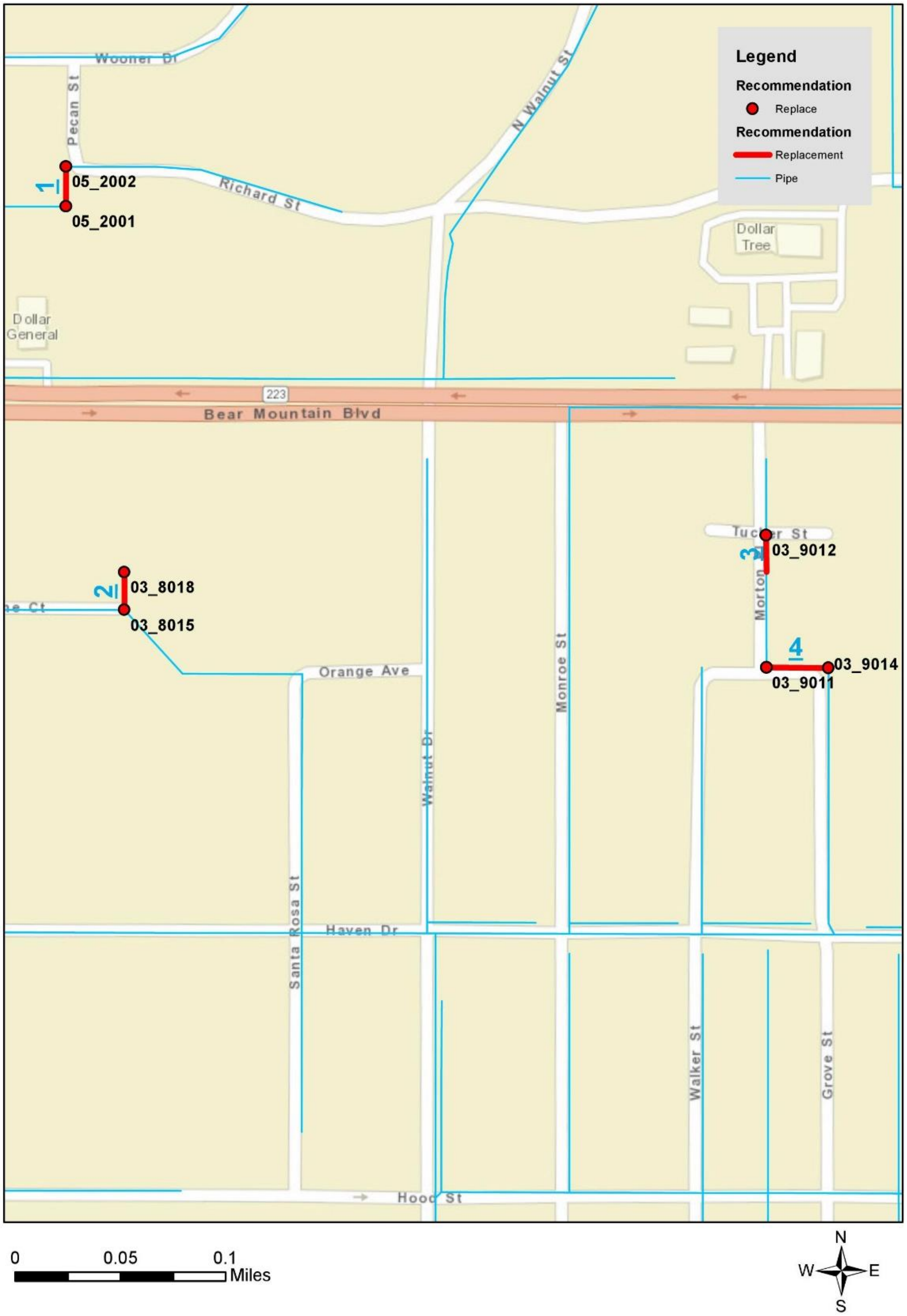
### Reach Number Reference

Table 7.19 identifies project-related reaches by number and manholes by designation. A reach is a portion of a pipeline between two consecutive manholes. Reaches are labeled in blue and manholes are labeled in black in Figure 7.13 and Figure 7.14. Additional materials concerning project-related reaches and manholes are provided in Appendix P.

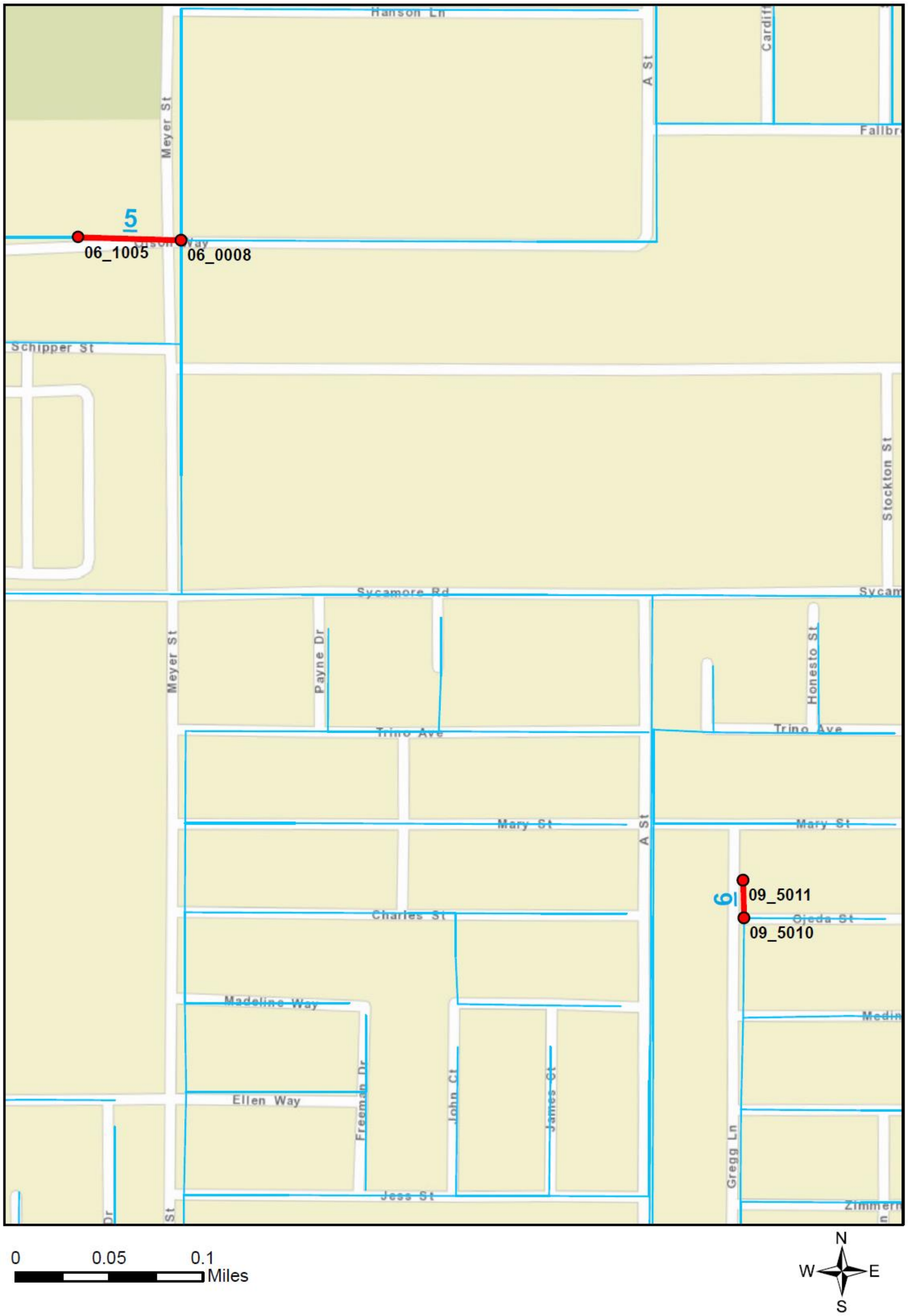
**Table 7.19 – Reaches for Small Pipeline Replacement Projects**

| Reach Number | Upstream Manhole | Downstream Manhole |
|---|---|---|
| 1 | 05-2002 | 05-2001 |
| 2 | 03-8018 | 03-8015 |
| 3 | 03-9012 | 03-9011 |
| 4 | 03-9011 | 03-9014 |
| 5 | 06-1005 | 06-0008 |
| 6 | 09-5011 | 09-5010 |

## Figure 7.13 – Extent of Small Pipeline Replacement Projects (1)



## Figure 7.14 – Extent of Small Pipeline Replacement Projects (2)



#### 7.5.14. – Small Spot Repair Projects

**Description**

This project is not confined to a specific area; rather, to take advantage of economies of scale, ten small spot repair projects were combined. Spot repair 303 feet of existing pipe, and repair 3 manholes as shown in Figure 7.15 and Figure 7.16.

**Cost Estimate**

$240,000

**Justification**

CCTV assessment of Reaches 2, 3, 5, 6, 7, 8, 9 and 10 revealed minor sagging, which impedes the normal flow of wastewater. Accumulation of solids at the low point of the sag may lead to blockage and overflow. Spot repairs are recommended on the sagging areas to correct the alignment of the pipes and restore normal flow.

CCTV assessment of Reaches 1 and 4 revealed localized breaks where sections of pipe are missing and soil is intruding. These reaches may fail structurally and will require frequent cleaning to prevent blockage due to soil intrusion. Spot repairs are recommended to repair the breaks.

Manhole assessment revealed three manholes that exhibit corrosion damage and minor structural defects. These manholes are not likely to collapse, but should be repaired to extend their service life.

**Perceived Urgency**

*Likelihood of Failure*

Reaches 2 and 6 are known hotspots. However, the other pipes included in this project show relatively low levels of deterioration. With spot repairs, service life of these pipes can be extended greatly. LOF is low.

*Consequence of Failure*

Very few customers are impacted. COF is low.

*Consequence of Not Implementing the Project*

Operations and maintenance costs will continue to increase as conditions of these pipes deteriorate.

**Prioritization**

This is a low priority project.

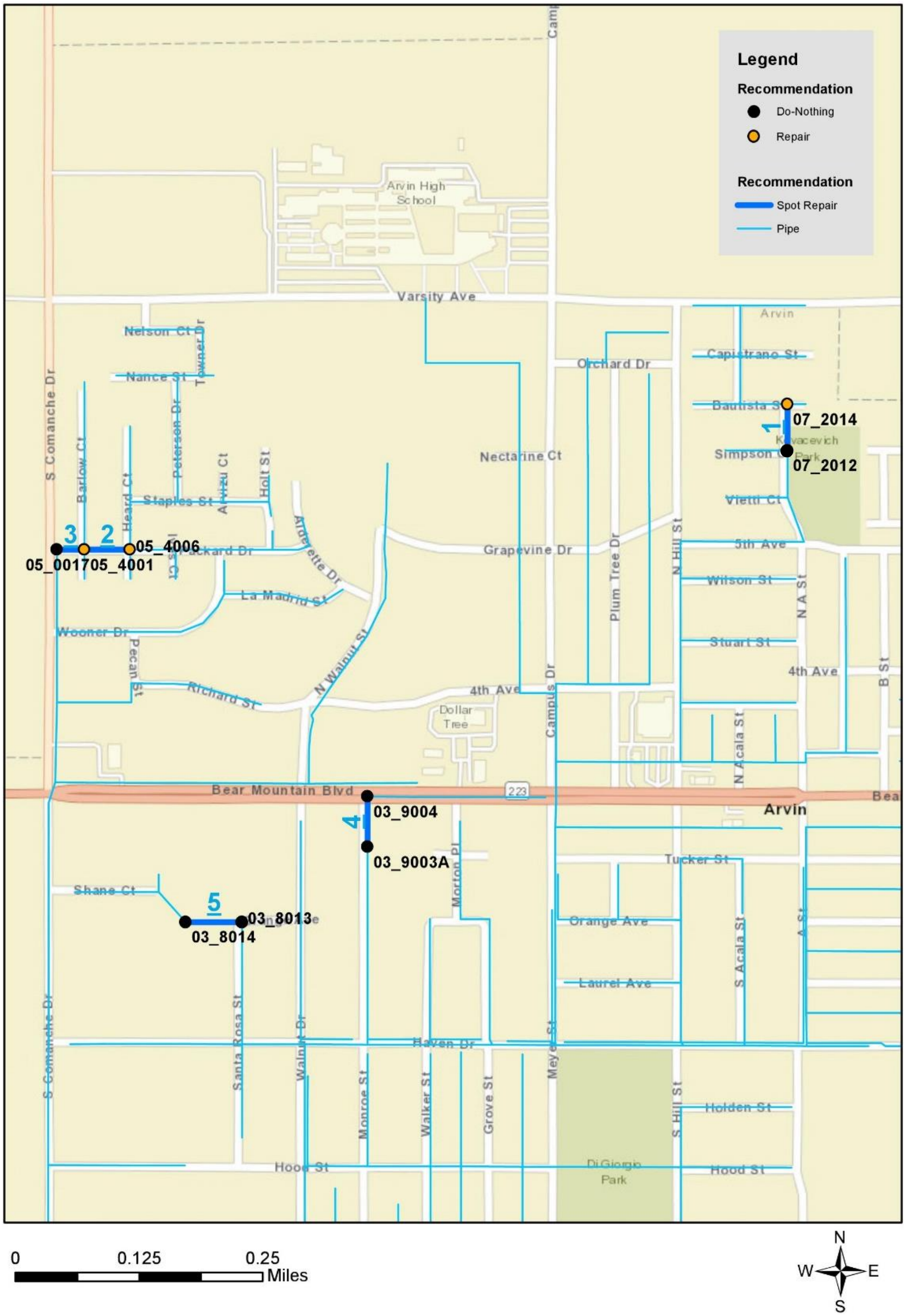
**Reach Number Reference**

Table 7.20 identifies project-related reaches by number and manholes by designation. A reach is a portion of a pipeline between two consecutive manholes. Reaches are labeled in blue and manholes are labeled in black in Figure 7.15 and Figure 7.16. Additional materials concerning project-related reaches and manholes are provided in Appendix Q.

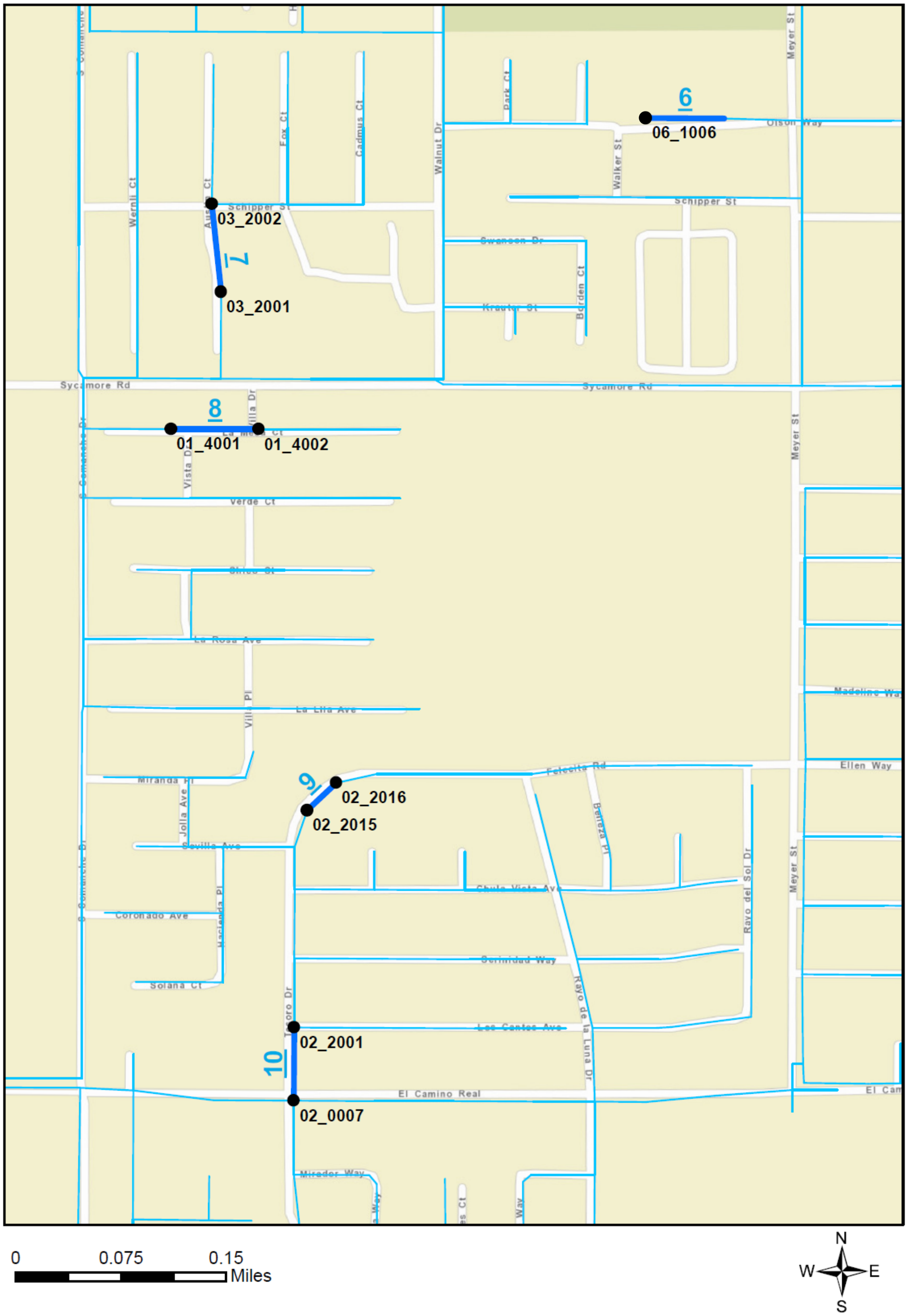
**Table 7.20 – Reaches for Small Spot Repair Projects**

| Reach Number | Upstream Manhole | Downstream Manhole |
|---|---|---|
| 1 | 07-2014 | 07-2012 |
| 2 | 05-4006 | 05-4001 |
| 3 | 05-4001 | 05-0017 |
| 4 | 03-9004 | 03-9003 |
| 5 | 03-8014 | 03-8013 |
| 6 | 06-1006 | 06-1005 |
| 7 | 03-2002 | 03-2001 |
| 8 | 01-4002 | 01-4001 |
| 9 | 02-2016 | 02-2015 |
| 10 | 02-2001 | 02-0007 |

## Figure 7.15 – Extent of Small Spot Repair Projects (1)



## Figure 7.16 – Extent of Small Spot Repair Projects (2)



### 7.5.15. – Stand-Alone Manhole Repair and Replacement

#### Description

Repair 62 manholes and replace 24 manholes at various locations throughout the City, as shown in Figure 7.17. Based on statistical analysis, a portion of the uninspected manholes north of Sycamore Road will also require mitigation within the 20-year planning horizon; although, the precise locations cannot be determined at this time. For capital planning purposes, the City should anticipate an additional 93 repairs and 43 replacements.

#### Cost Estimate

$1,869,000

#### Justification

Maintenance of manholes is necessary to reduce ingress, egress and the likelihood of collapse. Ingress (runoff or groundwater leaking into a manhole) has a negative impact on WTP capacity. Egress (wastewater leaking out of a manhole) has a negative impact on the environment, especially the local aquifer. Deterioration and structural defects may lead to collapse

#### Perceived Urgency

The manholes identified in Figure 7.17 are generally isolated from other deficiencies in the collection system.

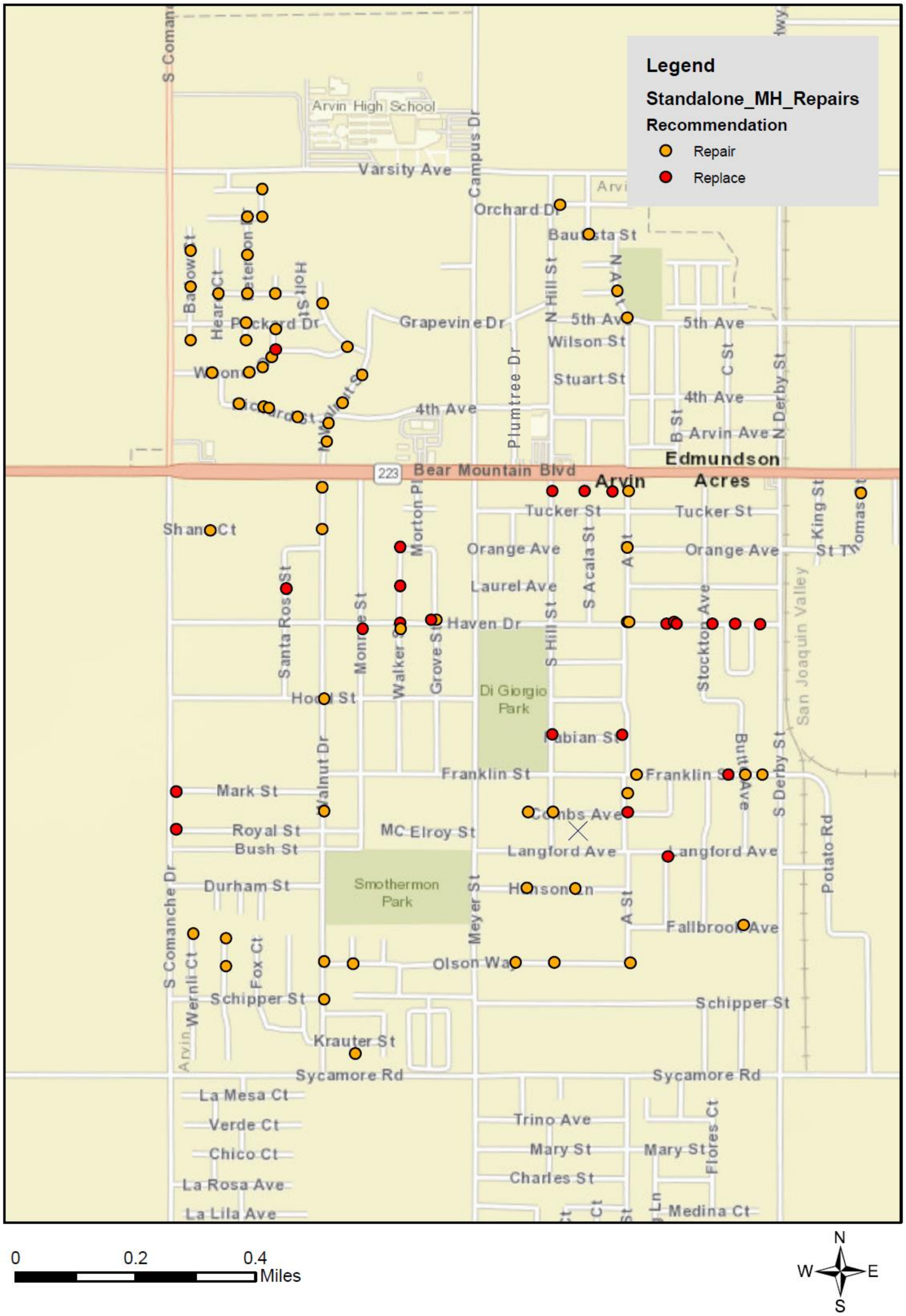
The manholes recommended for replacement may be vulnerable to collapse due to structural failure. A collapse may result in an outage or overflow. A collapse may cause damage to the roadway surface in the vicinity of the manhole.

The manholes recommended for repair are less prone to failure, but their service lives would be extended as a result of mitigation.

#### Priority

This is a low priority project.

## Figure 7.17 – Extent of Stand-Alone Manholes



## 7.6. – Projects to Address Future Conditions

### 7.6.1. – West Sycamore Road Pipeline Project

**Description**

This project is located in Sycamore Road between Walnut Drive and Comanche Drive. Replace approximately 1,320 feet of existing 15-inch sewer in Sycamore Road between Walnut Drive and Comanche Drive with new 24-inch pipe and install five new manholes as shown in Figure 7.14.

**Cost Estimate**

$641,000

**Justification**

Hydraulic analysis revealed that this pipeline is undersized to support anticipated growth over the next 20 years within the design capacity of the pipe.

The need for this project is contingent on the pace and timing of development north and south of El Camino Real. If development in the north precedes development in the south, this project will be required to provide capacity for the additional wastewater generation. If development in the south precedes development in the north, new infrastructure in Millux Road and reconfiguration of the pump station may alleviate the hydraulic constraint in West Sycamore Road.

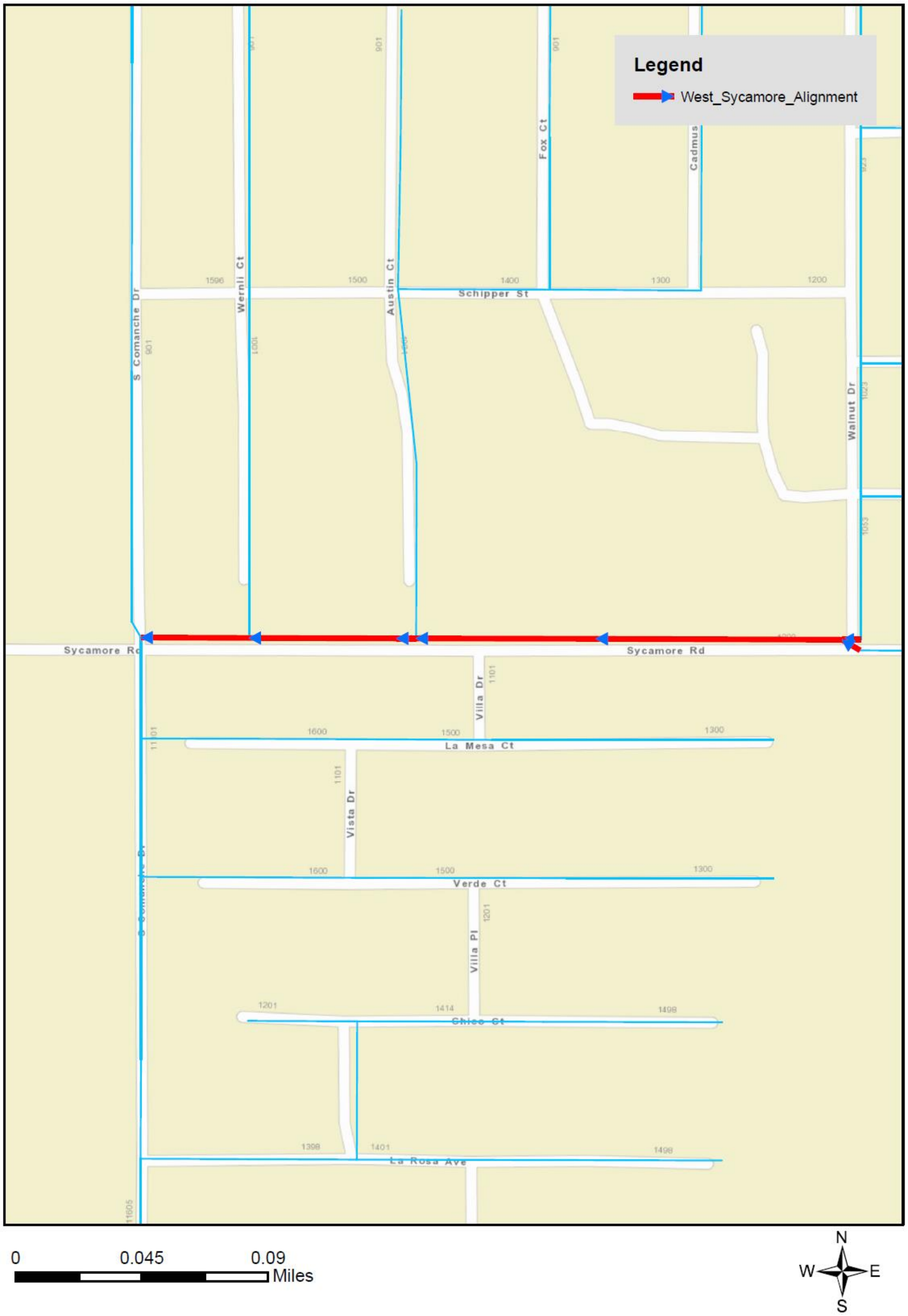
**Perceived Urgency**

In the near future, the depth to diameter ratio of the pipe will exceed 0.75 under peak flow conditions. In the event actual flow exceeds the projected peak flow, the pipe may overflow.

**Priority**

This project is contingent upon growth north of Sycamore Road and construction of infrastructure in Millux Road (see Millux Road Pipeline and Pump Station Project).

**Figure 7.18 – Extent of West Sycamore Road Pipeline Project**



### 7.6.2. – Millux Road Pipeline and Pump Station Project

**Description**

The project is generally located in Millux Road between Malovich Road and Comanche Road, as shown in Figure 7.19. Install 6,700 feet of new 15-inch pipe between the intersection of A street and El Camino Real and the intersection of Millux Road and Comanche Drive (Reach 1 and Reach 2). Construct a pump station in the vicinity of the intersection of Millux Road and Comanche Drive. Install a 6-inch force main in Comanche Drive between Millux Road and El Camino Real (Reach 3).

The City would benefit from redirecting flow from the existing pump station to the new trunkline, and then decommissioning the existing pump station.

A future alignment is shown in Millux Road between Malovich Road and A Street as a dashed red line. This will be a developer-driven most likely beyond the planning horizon of this Sewer Master Plan.

**Cost Estimate**

$4,948,000

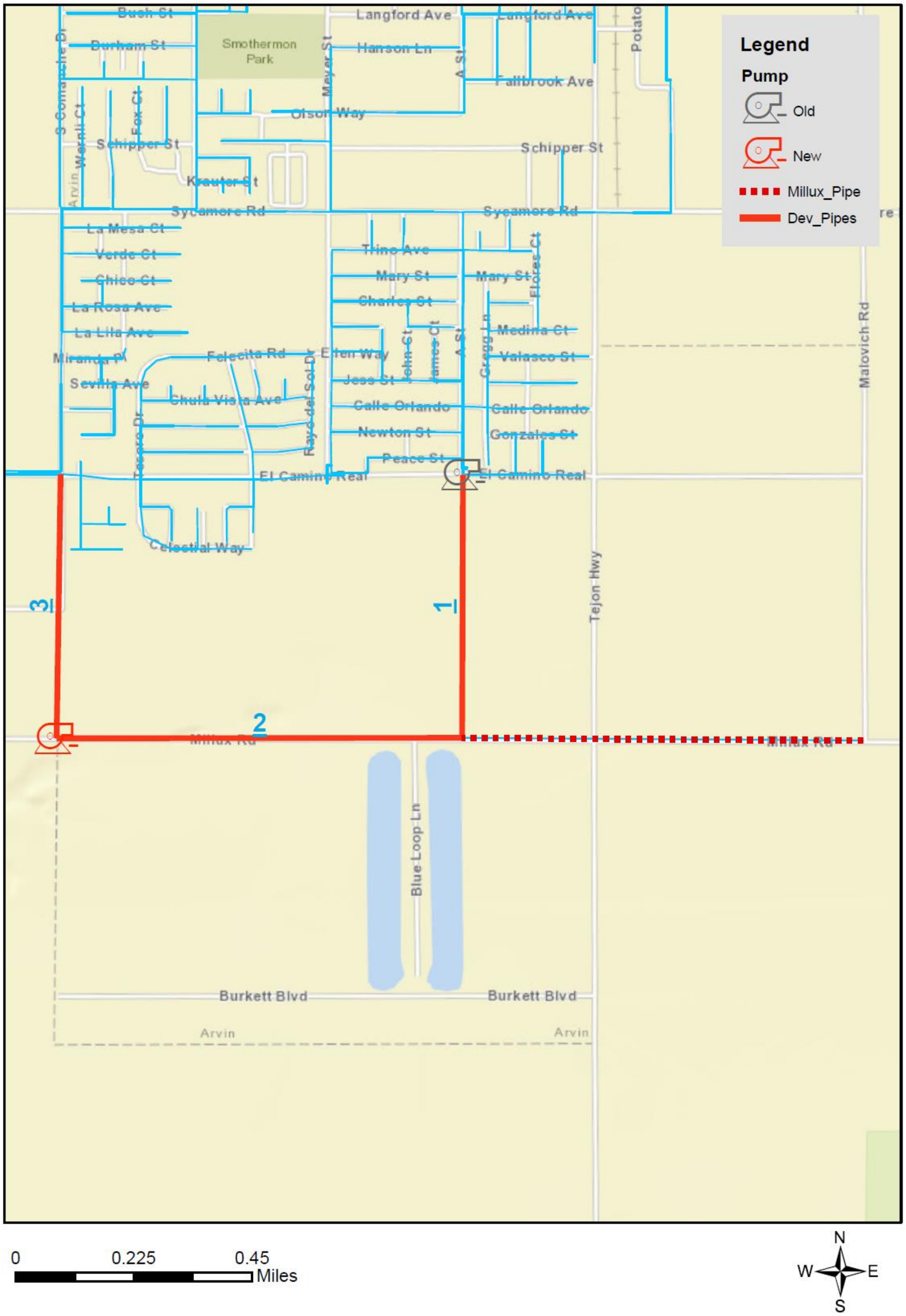
**Justification**

Based on topography and the location of the Water Reclamation Plant, hydraulic analysis revealed that additional capacity is needed to support growth south of El Camino Real and east of A Street.

**Priority**

This project is contingent upon growth south of El Camino Real and east of A Street.

**Figure 7.19 – Extent of Millux Road Pipeline and Pump Station Project**



### 7.6.3. – Potato-Sycamore Alignment Economic Study

**Description**

Conduct an economic analysis for the future development of areas designated for industrial land use northeast of the intersection of Derby Street and Sycamore Road.

**Cost Estimate**

$60,000

**Justification**

Hydraulic assessment shows the Potato-Sycamore Alignment has insufficient capacity to support build-out wastewater generation.

CCTV assessment revealed two reached in Potato Road that would benefit from repair or replacement.

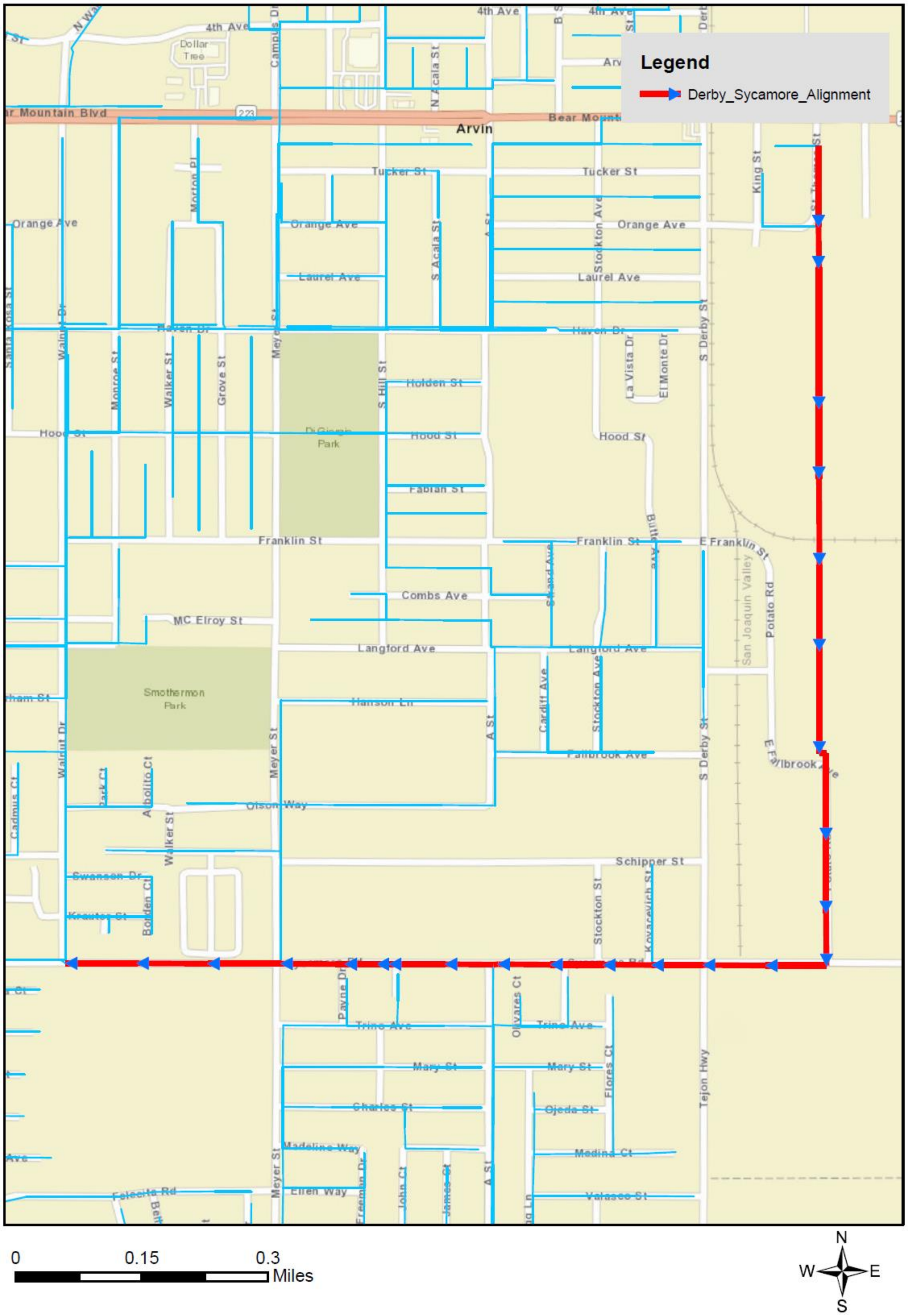
Much of the pipeline in Potato Road is inaccessible. It is understood that up to five manholes are buried, and the condition of the pipes between these manholes is unknown.

The City has enacted a Cannabis Ordinance. In the event growers choose to develop the industrial area northeast of the intersection of Derby Street and Sycamore Road, the City should have an understanding of the associated utility impacts and be prepared to work with developers to make appropriate utility improvements as a condition of development.

**Priority**

This project is contingent upon industrial development in the City.

**Figure 7.20 – Extent of Potato-Sycamore Alignment**



## 7.7. – Implementation Schedule

### Assumptions

- The projects recommended to improve existing conditions will be implemented over the course of 20 years.
- Pipeline and manhole projects will be implemented in the order shown in Table 7.5, which represents prioritization based on perceived urgency.
- Pump repair and replacement will occur on a three-year basis at a weighted average amount.
- Two annual costs are provided for each project: 2020 dollars and escalated cost. An annual cost escalation of 3.1% has been applied with 2020 as Year Zero.
- Procurement for the total construction cost occurs the year a project is initiated.
- Developer-driven projects are not included in the schedule.
- Projects related to environmental mitigation are not included in the schedule.

Table 7.21 shows the recommended schedule based on the listed assumptions.

**Table 7.21 – CIP Schedule**

| Year | Horizon | Project | Annual Allocation (2020 Dollars) | Annual Allocation (Escalated Cost) |
|---|---|---|---|---|
| 2020 | 0 | Comanche Drive Pipeline Project | 563,000 | 563,000 |
| 2021 | 1 | West Smothermon Park Pipeline Project | 2,221,000 | 2,290,000 |
| 2022 | 2 | Pump Rehabilitation and Replacement | 17,000 | 18,000 |
| 2023 | 3 | Southwest Kovacevich Park Pipeline Project | 2,429,000 | 2,662,000 |
| 2024 | 4 | | | 0 |
| 2025 | 5 | A Street Pipeline Project<br>Pump Rehabilitation and Replacement | 1,449,000<br>17,000 | 1,688,000<br>20,000 |
| 2026 | 6 | Campus Drive Alley Pipeline Project | 890,000 | 1,069,000 |
| 2027 | 7 | | | 0 |
| 2028 | 8 | Meyer Street Pipeline Project<br>Pump Rehabilitation and Replacement | 1,563,000<br>17,000 | 1,995,000<br>22,000 |
| 2029 | 9 | | | 0 |
| 2030 | 10 | Southeast Kovacevich Park Pipeline Project | 1,829,000 | 2,482,000 |
| 2031 | 11 | Pump Rehabilitation and Replacement | 17,000 | 24,000 |
| 2032 | 12 | West Di-Giorgio Park Pipeline Project | 890,000 | 1,284,000 |
| 2033 | 13 | Haven Drive Pipeline Project | 1,162,000 | 1,728,000 |
| 2034 | 14 | East Di Giorgio Park Pipeline Project<br>Pump Rehabilitation and Replacement | 1,231,000<br>17,000 | 1,887,000<br>26,000 |
| 2035 | 15 | Langford Avenue Pipeline Project | 639,000 | 1,010,000 |
| 2036 | 16 | Plum Tree Drive Alleys Pipeline Project | 985,000 | 1,605,000 |
| 2037 | 17 | Small Pipeline Replacement Projects<br>Pump Rehabilitation and Replacement | 588,000<br>17,000 | 988,000<br>29,000 |
| 2038 | 18 | Small Spot Repair Projects | 240,000 | 416,000 |
| 2039 | 19 | Stand-Alone Manhole Repair and Replacement | 1,869,000 | 3,338,000 |