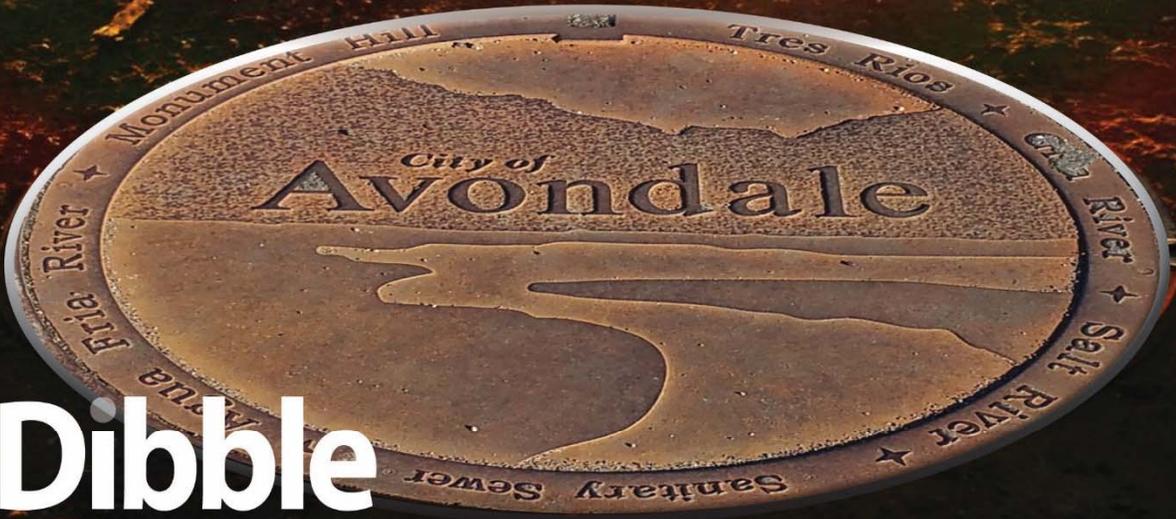




CITY OF AVONDALE LARGE DIAMETER SANITARY SEWER  
CONDITION ASSESSMENT & REHABILITATION PROGRAM 2014

Dibble Project No. 101451 | March 2015



Prepared for

**Dibble**  
**Engineering**<sup>®</sup>

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## Executive Summary

This report includes the condition assessment findings, along with recommendations and Engineer's Preliminary Opinion of Probable Costs for pipe rehabilitation and/or reassessment for a portion of the City of Avondale's large diameter sanitary sewer system. Avondale's large diameter sanitary sewer collection system is comprised of pipe segments ranging from 15-inches to 48-inches in diameter, and total approximately 38.7 miles (204,525 linear feet) of pipe. The pipe segments in City of Avondale's sewer system have a total length approximately 230 miles (1,230,000 linear feet).

The limits of Large Diameter Sanitary Sewer Condition Assessment 2014 were established by City of Avondale's Wastewater Collections Staff. The assessment contained 124 sanitary sewer pipe segments totaling approximately 8.6 miles (45,249 linear feet). There are 129 manholes within the limits of assessment. Pipe segments range from 21-inches to 36-inches in diameter, consisting of 20% Vitrified Clay Pipe (VCP) and 80% T-lock PVC Lined Concrete Pipe. Pipe age ranges from 11 to 29 years old.

### Large Diameter Condition Assessment 2014 Pipe Length by Size, Material, and Age

Pipe Diameter	Pipe Material	Year of Installation	Pipe Age (Years)	Pipe Length	Total Length	%
21	VCP	1986	29	5,398		
21	VCP	1987	28	1,365	6,763	15%
24	VCP	1995	20	2,456	2,456	5%
24	CONC T-LOCK	1986	29	649		
24	CONC T-LOCK	2004	11	2,121	2,770	6%
30	CONC T-LOCK	1986	29	3,081	3,081	7%
30	CONC T-LOCK	1994	21	1,002		
30	CONC T-LOCK	2004	11	3,489	4,491	10%
36	CONC T-LOCK	1986	29	5,416		
36	CONC T-LOCK	1994	21	20,273	25,689	57%
<b>Project Total =</b>				<b>45,249</b>	<b>feet*</b>	

\* 22% of total large diameter pipe in system

Assessment was accomplished in four (4) phases:

1. Identification and coding of defects observed in the pipe interior using National Association of Sewer Service Companies (NASSCO) Pipeline Assessment Certification Program (PACP) closed circuit television (CCTV) Inspection Procedures. CCTV inspection was done during live flow conditions, and the pipes were not cleaned prior to inspection as a cost saving measure.
2. Assigning NASSCO PACP Condition Grade Scores to each pipe assessed and mapping locations in Geographical Information System (GIS) format.
3. Develop rehabilitation recommendations and Engineer's Preliminary Opinion of Probable Costs.
4. Prioritization of rehabilitation projects according to risk.



**Previous Pipe Condition Assessment**

The previous sanitary sewer condition assessment was conducted in 2009 as part of Avondale’s Sanitary Sewer Evaluation & Rehabilitation Program. The Sanitary Sewer Evaluation and Rehabilitation Study included condition assessment and recommendations for pipe and manhole rehabilitation for select reaches of Avondale’s sanitary sewer system, with pipe segments ranging from 8-inches to 36-inches in diameter. The 2009 report also recommended condition assessment of the sanitary sewer system be conducted every five (5) years.

Since the 2009 Condition Assessment, Avondale has acquired CCTV equipment and have implemented a cleaning and CCTV inspection program for pipes 12-inches or less in diameter. The City has elected to assign the assessment of Large Diameter Sewers to others. Avondale has completed a portion of the manhole rehabilitation, as city funding permits. To date, none of the pipe segments highlighted for rehabilitation have been repaired, due to lack of funding.

**Pipe Condition Assessment**

Assessment of pipe condition was conducted by CCTV inspection following NASSCO PACP pipe condition coding procedure. The NASSCO PACP condition grading system assigns standardized condition codes for structural and operation/maintenance (O&M) observations and defects using close-circuit-television (CCTV) inspection. Structural defects will be noted as defective pipe that generally will require some level of construction to resolve. O&M defects include pipe obstructions that may interfere with the operations of the pipe. O&M problems can be resolved by preventative maintenance procedures such as cleaning or trenchless removal of obstruction, but can create increased rate of deterioration.

PACP coded defects are assigned a Pipe Condition Grade of 1 to 5 with definitions as follows:

**NASSCO Pipe Condition Grades**

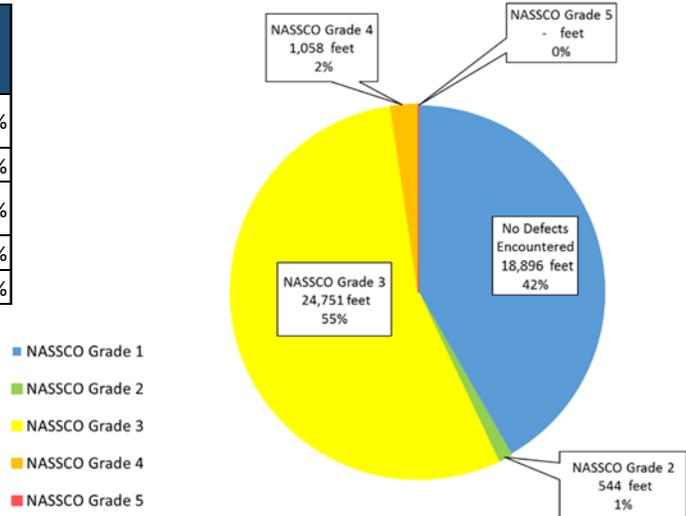
General Grade	General Condition	Condition Definition
5	Extremely Poor	Most Significant Defect requiring immediate attention
4	Poor	Significant Defects
3	Fair	Moderate Defects
2	Good	Minor to Moderate Defects
1	Excellent	Minor defect

Structural Defects: Approximately 43% of the pipe assessed were found to be in “Excellent or Good” structural condition (NASSCO Grade 1 or Grade 2). 55% of the pipe assessed was found to be in “Fair” structural condition (NASSCO Grade 3). 2% of the pipe assessed was found to be in “Poor” structural condition (NASSCO Grade 4). No pipe segments were found to be in “Extremely Poor” (NASSCO Grade 5) structural condition.

The majority of structural defects observed within the T-Lock Lined Concrete Pipe were lining feature defects including detached PVC lining, detached joint weld strips, lining splits, lining bulges, and lining pinholes. Four (4) structural defects including cracks and fractures were encountered in the VCP assessed.

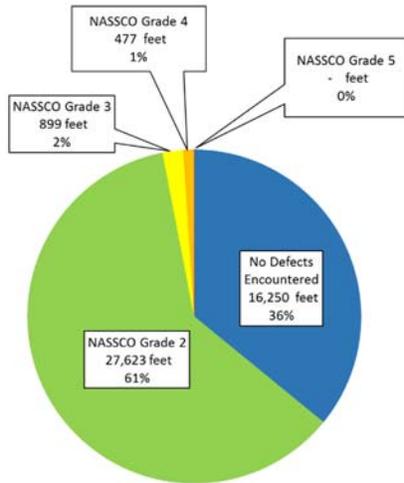
### NASSCO PACP Structural Condition Grade

Structural Condition Grade	Footage (LF)	Number of Pipes	%
NASSCO Grade 1	18,896	64	42%
NASSCO Grade 2	544	2	1%
NASSCO Grade 3	24,751	56	55%
NASSCO Grade 4	1,058	2	2%
NASSCO Grade 5	-	-	0%
	<b>45,249</b>	<b>124</b>	



Operation & Maintenance (O&M) Defects: O&M defects are those defects that are non-structural but impede the normal operation of the pipe such as grease build up or root intrusion. No O&M defects were observed in 36% of the pipe assessed. Minor grease and encrustation deposits were noted in 61% of the pipe assessed (NASSCO Grade 2). 3% of the pipe assessed were found to be in “Fair” or “Poor” O&M condition: Two (2) pipe segments were found to have “Fair” O&M defects (NASSCO Grade 3). One (1) pipe segment was found to have a “Poor” O&M defect (NASSCO Grade 4). No pipe segments were found to be in “Extremely Poor” O&M condition (NASSCO Grade 5).

### NASSCO PACP O&M Grade



O&M Condition Grade	Footage (LF)	Number of Pipes	%
NASSCO Grade 1	16,250	75	36%
NASSCO Grade 2	27,623	46	61%
NASSCO Grade 3	899	2	2%
NASSCO Grade 4	477	1	1%
NASSCO Grade 5	-	-	0%
	<b>45,249</b>	<b>124</b>	

### **Manhole Condition Assessment**

NASSCO assessment of the manhole interior is outside the scope of this project. However manholes were viewed from the surface and as could be seen from the inlet location using CCTV images to formulate a general state of condition for City use in prioritizing future assessments. Manholes were assigned a general condition rating of “Poor”, “Fair”, or “Good”, based on pipe invert perspective from the pipe CCTV investigation and notes taken from the surface. Manhole condition findings are summarized in **Table A.3** included in **Appendix A** and shown in **Exhibit D** included in **Appendix B**.

### **Previous Condition Assessment Comparison**

2009 Condition Assessment Inspection Areas 9, 10, 11, 12, 13, and 14 were evaluated as part of this condition assessment. Defects encountered in 2009 are sorted by Inspection Area and listed under pipes described by their upstream and downstream manhole in Table 3.3 of the 2009 Condition Assessment report. Comparison of defects encountered in the 2009 condition assessment with the current condition assessment is summarized in **Table A.6 in Appendix A**. Defects within the VCP assessed have a rate of deterioration ranging from slow to moderate, with defects located near the pipe joint having moderate rate of deterioration. Defects within the PVC-Lined Concrete Pipe have rate of deterioration ranging from slow to fast, with detached liners at the joint, liner bulges and splits having moderate to fast rate of deterioration.

### **Pipe Rehabilitation Recommendations**

Recommendations include cleaning, pipe rehabilitation, do nothing, or condition reassessment. The prioritization of the projects identified in this report was accomplished using a risk-based approach. A criticality or risk analysis, using COA’s GIS data, NASSCO PACP structural condition ratings, and custom tools created in ArcMap®, was conducted to evaluate risk of failure for each pipe. Factors that contribute to a pipe segment’s risk of failure are both the likelihood (condition) and consequence if the pipe were to fail.

Pipes recommended for rehabilitation were grouped into two phases. The first phase is comprised of pipe segments with NASSCO Condition Grade 4 structural defects, along with notable NASSCO Condition Grade 3 structural defects occurring through the length of pipe, and pipe segments with structural defects that cause obstruction in conveyance of flow. Notable structural defects include fractures, lining bulges with exposed concrete, detached weld joints, detached lining, and signs of exposed or missing aggregate. Pipe segments recommended for rehabilitation within close proximity were included for economy of scale cost savings measure. Project areas are sorted by highest to lowest risk of failure within the first phase to make up seven (7) independent areas of work.

The second phase of pipe rehabilitation work includes pipe segments that were found to have four (4) or less notable NASSCO Condition Grade 3 structural defects. These pipe segments were grouped with other pipe segments recommended for rehabilitation in close proximity for economy of scale to create

seven (7) independent project work areas. The seven (7) work areas of the second phase are then sorted by highest to lowest risk of failure.

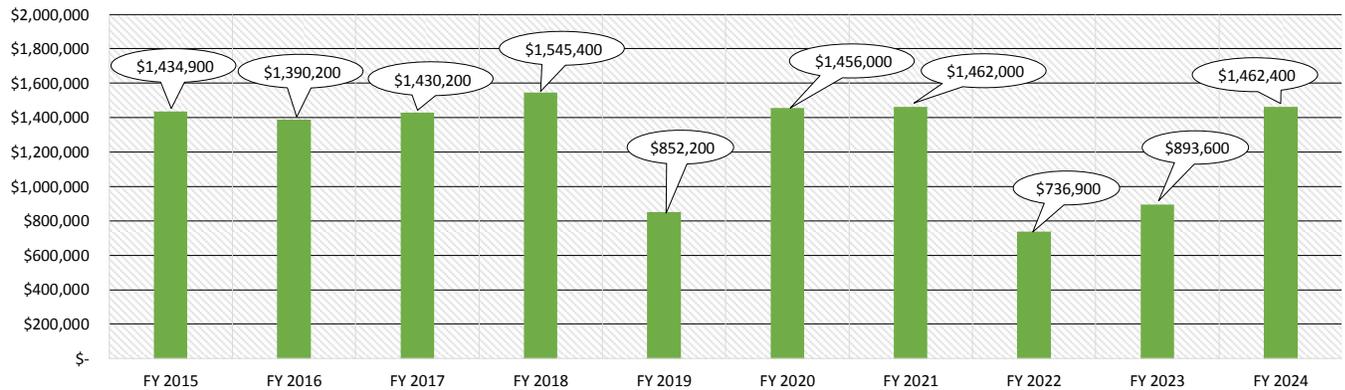
Pipe segments identified for rehabilitation that have not been completed within five (5) years' time, should reassessed. Rehabilitation project prioritization should be reevaluated based on reassessment findings.

**Preliminary Opinion of Probable Costs**

Engineer’s Preliminary Opinion of Probable Costs (Preliminary Costs) for the identified repairs is approximately \$12,663,250. Preliminary cost includes a 20% contingency, engineering design fees, construction administration and inspection (CA & I) fees, and estimate of contractor’s cost for insurance, bonds, and taxes. Engineering fees for design phase services are estimated at 10% of construction cost. Engineering CA & I fees are estimated at 10% of construction cost.

Preliminary Costs were organized into individual projects assuming an annual budget allocation of approximately \$1.5 million for Large Diameter Pipe Rehabilitation. The assumed annual budget of \$1.5 million was based on conversations with City of Avondale Wastewater Collections Staff. The figure below shows allocation of pipe repair costs from 2015 – 2024.

**Large Diameter Sewer Rehabilitation Preliminary Costs 2015 - 2024**



## I. City of Avondale Large Diameter Sanitary Sewer Condition Assessment & Rehabilitation Program 2014

Avondale’s large diameter sanitary sewer collection system is comprised of pipe segments ranging from 15-inches to 48-inches in diameter, and total approximately 38.7 miles (204,525 linear feet) of pipe. The pipe segments in City of Avondale’s sewer system have a total length approximately 230 miles (1,230,000 linear feet). Dibble Engineering conducted condition assessment for 124 segments of pipe within City of Avondale’s Large Diameter Sanitary Sewer System that were selected by City of Avondale (COA) Wastewater Collections Staff for condition assessment as part of COA’s Sewer Evaluation and Rehabilitation Program. Findings including defects that could potentially lead to future pipe failure, recommendations for pipe rehabilitation & repair, and preliminary opinion of probable costs are included in this report.

Pipe segments selected for assessment totaling approximately 8.6 miles (45,249 linear feet) that were grouped into three (3) priority inspection areas by COA Wastewater Collections Staff. Priority inspection areas are shown in **Figure 1**. There are 129 manholes within the limits of assessment.

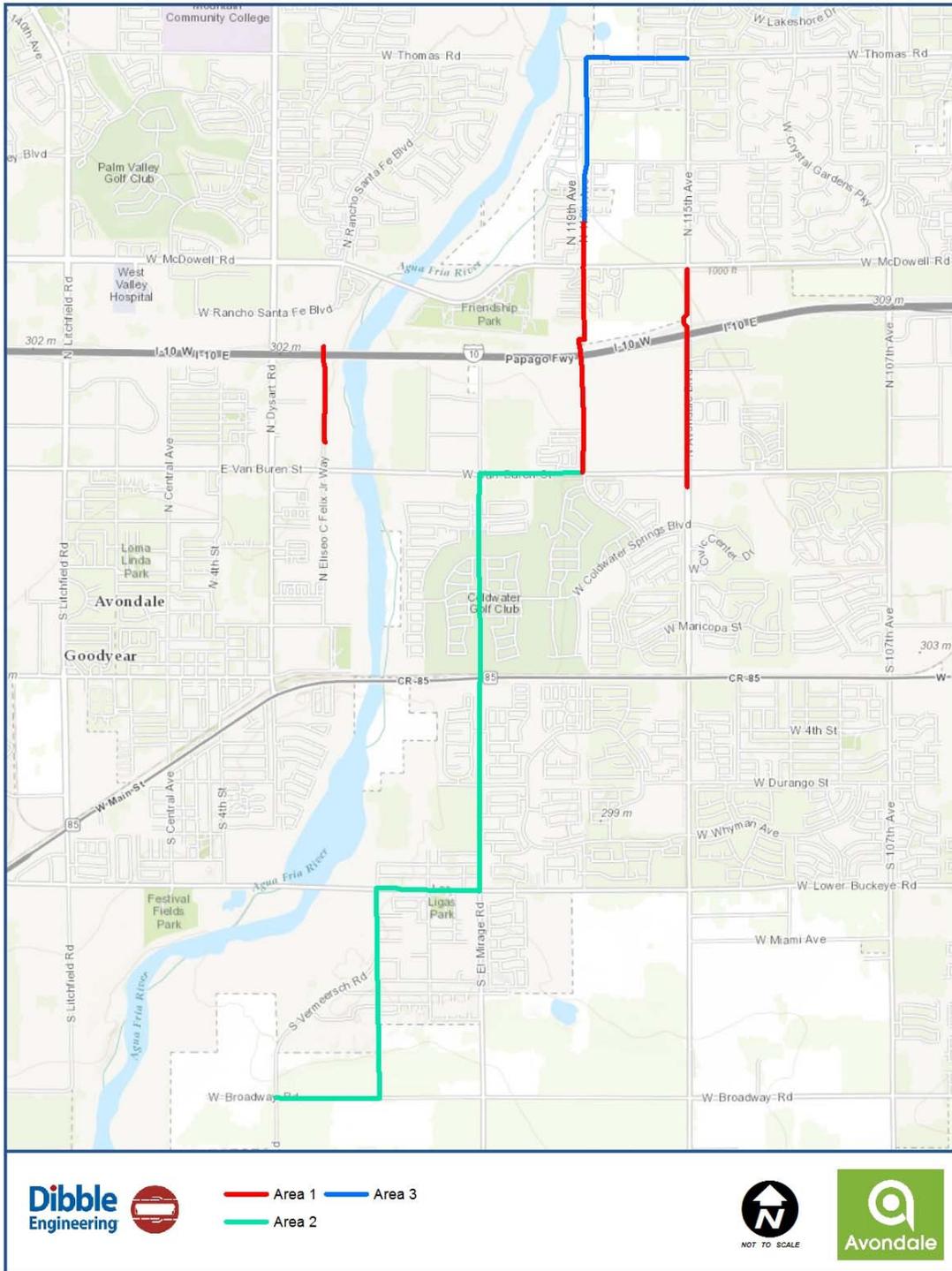
The pipe segments assessed range in size from 21-inches to 36-inches in diameter. 20% of the pipe assessed is vitrified clay pipe (VCP). 80% of the pipe assessed is T-Lock PVC Lined concrete pipe (CONC T-LOCK). Pipe age ranges from 11 to 29 years as shown in **Table 1**.

**Table 1 –Large Diameter Condition Assessment 2014 Pipe Length by Size, Material, and Age**

Pipe Diameter	Pipe Material	Year of Installation	Pipe Age (Years)	Pipe Length	Total Length	%
21	VCP	1986	29	5,398		
21	VCP	1987	28	1,365	6,763	15%
24	VCP	1995	20	2,456	2,456	5%
24	CONC T-LOCK	1986	29	649		
24	CONC T-LOCK	2004	11	2,121	2,770	6%
30	CONC T-LOCK	1986	29	3,081	3,081	7%
30	CONC T-LOCK	1994	21	1,002		
30	CONC T-LOCK	2004	11	3,489	4,491	10%
36	CONC T-LOCK	1986	29	5,416		
36	CONC T-LOCK	1994	21	20,273	25,689	57%
<b>Project Total =</b>					<b>45,249</b>	<b>feet*</b>

\* 22% of total large diameter pipe in system

Figure 1 – Avondale Priority Inspection Areas 1, 2, & 3

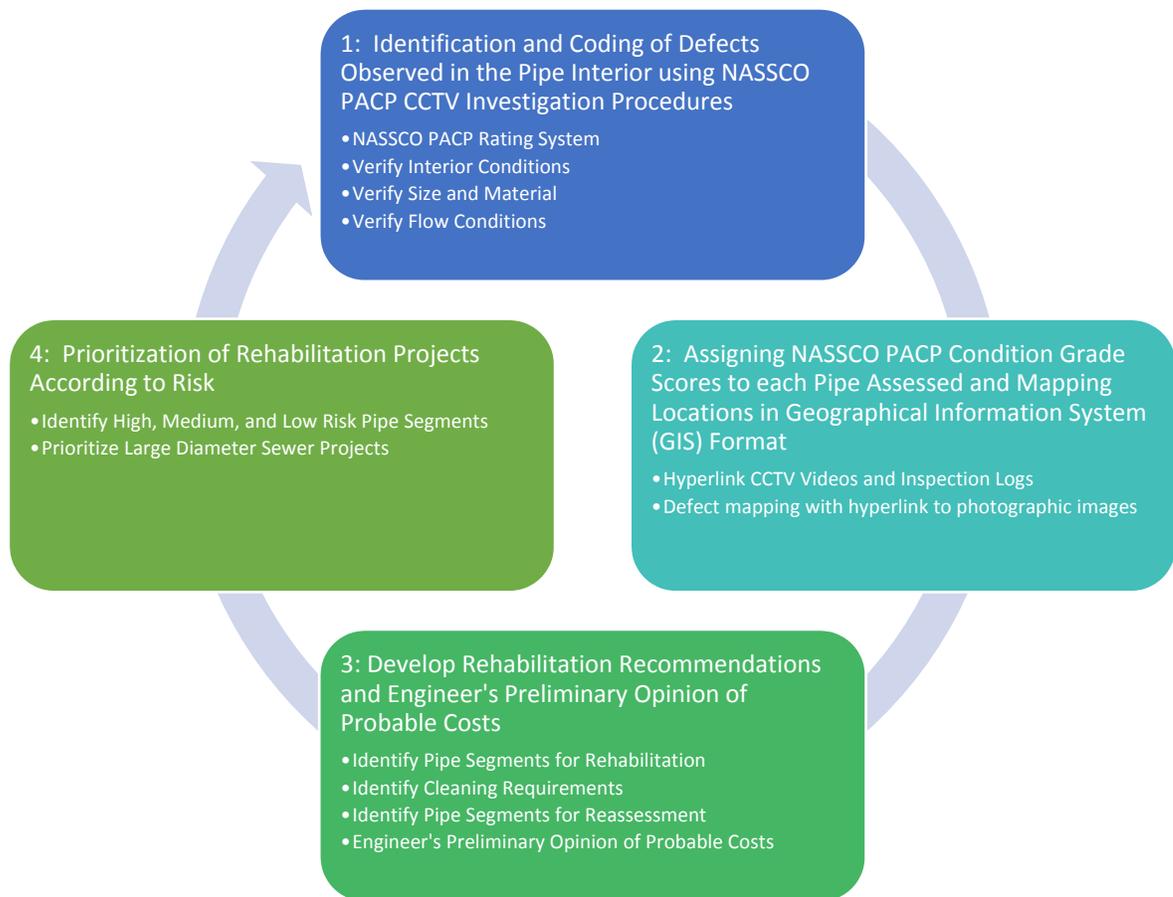


The interior condition of the large diameter sewer pipe was assessed using National Association of Sewer Service Companies Assessment (NASSCO) Pipeline Assessment Certification Program (PACP) Standards and Condition Grade Rating Procedures using closed circuit television (CCTV) equipment.

The work was accomplished in four (4) phases as illustrated in **Figure 2** to develop a list of repair projects with corresponding opinion of probable costs. Project phases are listed as follows:

1. Identification and coding of defects observed in the pipe interior using National Association of Sewer Service Companies (NASSCO) Pipeline Assessment Certification Program (PACP) CCTV Inspection Procedures.
2. Assigning NASSCO PACP Condition Grade Scores to each pipe assessed and mapping locations in Geographical Information System (GIS) format.
3. Develop rehabilitation recommendations and Engineer's Preliminary Opinion of Probable Costs.
4. Prioritization of rehabilitation projects according to risk.

**Figure 2 – Large Diameter Condition Assessment 2014 Phases**



## II. Data Collection and Management

The following data was collected as part of Avondale's Large Diameter Condition Assessment 2014:

- CCTV videos, inspection logs, and photographic images of 124 pipe segments
- Defect observations with codes assigned according to NASSCO standards.
- Depth of Manhole from Rim to Invert measurement at 21 manholes.<sup>1</sup>

Data collected was managed using a GIS database in ArcMap®. The GIS data is saved on an external hard drive included as **Appendix E**. The pipe segments and manholes referred to in this report use the same unique identifier attribute as utilized in Avondale's existing Sewer GIS mapping data contained in the program field "Feat-ID".

### A. CCTV Inspection and NASSCO PACP Condition Assessment

CCTV inspection of the pipe interior was collected using conventional CCTV equipment and following the NASSCO Procedures. CCTV inspection was conducted during live sanitary sewer flow conditions. The pipes were not cleaned prior to inspection as a cost saving measure. Remote transporters equipped with CCTV cameras were launched into the sewers from a truck equipped with Granite XP® condition assessment software. Observations and defects encountered were assigned NASSCO PACP codes.

CCTV investigation requirements are summarized as follows:

- CCTV survey footage starts and ends where the pipe is connected to an upstream or downstream manhole (from manhole wall to manhole wall).
- Where survey was abandoned due to obstruction, the remainder of the pipe was assessed by reversal.
- Photographic images were taken at observations and defects encountered.
- CCTV video camera paused at the center of each manhole center encountered and panned upward to provide a view of the manhole interior from the pipe invert perspective.

### B. Field Coordination

Field reconnaissance was conducted prior to mobilization to identify any access constraints (i.e. buried manholes, locked gates, easements) prior to CCTV inspection. Twenty (20) buried manholes were identified. Avondale's staff assisted in locating and uncovering the manholes to gain access for CCTV inspection.

### C. Geographical Information System (GIS) Mapping of NASSCO PACP Condition Assessment

The CCTV data was analyzed to assign NASSCO PACP Observation/Defect code. Utilizing the defects coded assigned a condition grade of each pipe can be formulated using NASSCO standards. Condition Grade Scores were mapped using GIS. A hyperlink to the CCTV video was added to the pipe shapefile

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<sup>1</sup> Measurement of manhole rim to invert depth for the remaining 108 manholes was not requested as these manholes were recently surveyed by others.

attributes. Individual PACP observations and defect codes were mapped in GIS with hyperlink to video screen shots that were taken during the CCTV inspection for City's reference.

An ArcMap® map of the pipe segments assessed is saved to the portable external hard drive included in **Appendix E**. The map is organized using data driven pages, with hyperlinks to the CCTV investigation videos, log documents, and individual photographic images that was collected.

Step by step procedures for program use is contained in **Appendix E**.

#### D. Manhole Depth

Approximate distance from manhole rim elevation to invert elevation was measured and recorded for manholes selected by Avondale's Wastewater Collections Staff using a conventional tape measure. Distance from manhole rim to pipe invert was measured on 21 of the 129 manholes within the project limits. Measurement of depth from rim to invert elevation was not requested for 108 of the manholes as these were recently surveyed by others.

Accuracy of measurement is approximately plus or minus a tenth of a foot. Measurements were provided as an ArcGIS point shapefile along with GPS coordinates and taken from rim elevation to center invert elevation of the manhole. Measured manhole depths were subtracted from the rim elevation attributes provided in Avondale's manhole GIS shapefile saved to the external hard drive included in **Appendix E**.

Manhole depth measurements were not taken by Dibble staff. Accuracy of measurements should not be relied upon for design purposes.

### III. Pipe Condition Assessment

Pipe interior condition was assessed using CCTV inspection and the NASSCO PACP Condition Grading System. NASSCO PACP condition scores were determined using the PACP Quick Rating method. NASSCO PACP Quick Rating Condition Assessment is shown in **Figures B1 through B125** in **Appendix B** and summarized in **Table A.1** included in **Appendix A**. It is important to note that CCTV was recorded during live flows and that defects below the water surface in the pipe are not visible and therefore unknown.

#### A. NASSCO PACP Condition Grading System

The NASSCO PACP Condition Grading System assigns standardized defect codes to formulate a condition rating for a pipe for structural and operation & maintenance (O&M) conditions. PACP defect codes are assigned a Condition Grade of 1 to 5. NASSCO Defect Condition Grade Definitions are summarized in **Table 2**.

**Table 2 – NASSCO Pipe Condition Grades**

Grade	Condition	Condition Definition
5	Extremely Poor	Most Significant Defect
4	Poor	Significant Defect
3	Fair	Moderate Defect
2	Good	Minor to Moderate Defect
1	Excellent	Minor Defect

The PACP Condition Grading System assigns pipe ratings based on the number of occurrences of each defect; one rating for structural defects and one for O&M defects. The PACP Quick Rating method was used in this report. NASSCO PACP Condition Grades are summarized in **Table A.1** included in **Appendix A**.

The PACP Quick Rating method is a four (4) character score which is read as follows:

- 1<sup>st</sup> character is the highest severity defect grade occurring in the pipe segment
- 2<sup>nd</sup> character is the number of defect occurrences of the highest severity defect grade
  - “A” is used if number of defect occurrence is between 10 and 14, “B” is used if number is between 15 and 19, and “C” is used if number of defect occurrence is between 20 and 24.
- 3<sup>rd</sup> character is the next highest severity defect grade occurring in the pipe segment
- 4<sup>th</sup> character is the number of occurrences of the next highest severity defect grade
  - “A” is used if number of defect occurrence is between 10 and 14, “B” is used if number is between 15 and 19, and “C” is used if number of defect occurrences is between 20 and 24.

The PACP Quick Rating is used as a numerical method of ranking pipes from worst to best condition.

Structural Quick Ratings are determined using only structural grade defects. O&M Quick Ratings are determined using only O&M grade defects. An example Quick Rating determination is shown below:

A PACP Quick Rating of 5432 indicates that the pipe segment has four (4) occurrences of defects coded with Condition Grade of 5 and two (2) occurrences of defects coded with Condition Grade of 3.

A PACP Quick Rating of 5B32 indicates the pipe segment has between 15 and 19 occurrences of Condition Grade 5 defects and two (2) occurrences of Condition Grade 3 defects.

### B. T-Lock PVC Lined Concrete Pipe Structural Defects

Structural defects that are typically encountered in T-Lock PVC Lined concrete pipe include lining detachment, detached weld strips (particularly at the joints), lining blisters, lining bulges, lining pinholes, and lining splits. Examples of the structural defects encountered as part of this condition assessment are shown in **Table 3**.

T-Lock PVC Lining defects that are known to have moderate to fast rate of deterioration are also of concern as they can quickly lead to lining detachment that leaves large areas of exposed concrete substrate. Lining defects known to have moderate/fast rate of deterioration include detached lining, detached weld strips at lining joints, lining bulges, and lining splits where concrete substrate is exposed and subject to deterioration from the corrosive environment within the sewer.

### C. VCP Structural Defects

Defects of concern that are found in vitrified clay pipe (VCP) include cracks, fractures, broken or collapsed pipe, and root intrusion. Joint defects in VCP are of particular concern.

**Table 3 – Example of Structural Defects Encountered**

SEVERITY	DESCRIPTION	NASSCO PACP CODE	PHOTOGRAPHIC IMAGE FROM CCTV
Rating  3 Fair	Moderate Defect	LFD Lining Feature Detached	

**Table 3 – Example of Structural Defects Encountered (Continued)**

SEVERITY	DESCRIPTION	NASSCO PACP CODE	PHOTOGRAPHIC IMAGE FROM CCTV
Rating  3 Fair	Moderate Defect	LFPH Lining Feature Pinhole	
Rating  3 Fair	Moderate Defect	LFB Lining Feature Blistered	
Rating  3 Fair	Moderate Defect	LFD Lining Feature Detached	
Rating  4 Poor	Significant Defect	SAMC Surface Aggregate Missing	

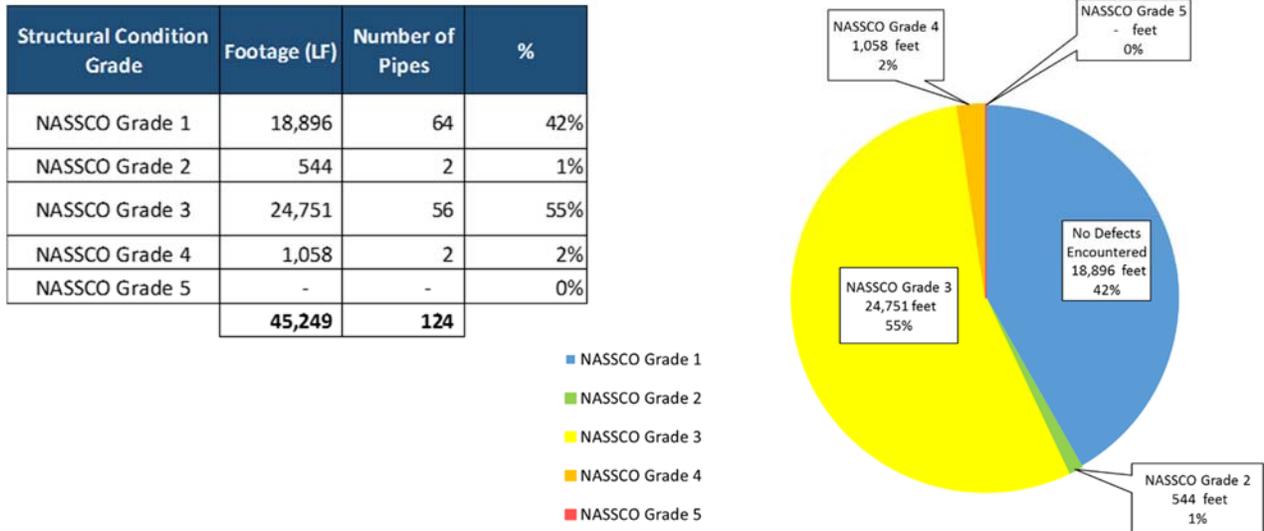
**Table 3 – Example of Structural Defects Encountered (Continued)**

SEVERITY	DESCRIPTION	NASSCO PACP CODE	PHOTOGRAPHIC IMAGE FROM CCTV
Rating  3 Fair	Moderate Defect	LFD Lining Feature Detached	
Rating  3 Fair	Moderate Defect	LFD@ Joint Lining Feature Detached At Joint	
Rating  3 Fair	Moderate Defect	FL Fracture Longitudinal	
Rating  4 Poor	Significant Defect	FM Fracture Multiple	
Rating  3 Fair	Moderate Defect	FL Fracture Longitudinal	

## 1. NASSCO PACP Structural Condition Grade

**Figure 3** shows the percentage of pipe by structural condition grade. Approximately 42% of the pipe assessed was found to have no structural defects. Condition Grade 2 defects (“Minor to Moderate”) were found in 1% of the pipe assessed. Condition Grade 3 defects (“Moderate”) were found in approximately 55% of the pipe assessed. Condition Grade 4 defects (“Significant”) were found in approximately 2% of the pipe assessed. None of the pipe assessed were found to have Condition Grade 5 (“Most Significant”) defects. NASSCO PACP structural condition grades for each pipe segment are summarized in **Table A.1** in **Appendix A**.

**Figure 3 – NASSCO PACP Structural Condition Grade**



**Grade 2:** Two of the 24-inch diameter VCP pipe segments assessed for condition were found to have “Minor to Moderate” NASSCO Structural Defects with a Grade Condition of 2. Condition Grade 2 defects are minor in severity and small in size. Deterioration within the pipe is not yet evident.

**Grade 3:** 55% of the pipe assessed for condition were found to have “Moderate” structural defects with NASSCO PACP Condition Grade of 3. The majority of PACP Condition Grade 3 Structural defects noted were lining feature defects within the T-Lock PVC Lined Concrete Pipe including detached PVC Lining, detached joint weld strips, lining splits, lining bulges, and lining pinholes. According to NASSCO PACP, lining feature defects do not have a varied level of severity (i.e. detached lining at the joint has the same severity level as a pinhole). Thus, it is important to look at each of the pipe lining defects noted when assessing the overall condition of T-lock PVC Lined concrete pipe.

- One PACP Grade 3 defect was noted in the VCP pipe assessed: a longitudinal fracture within segment SS15171003 (24-inch diameter VCP).

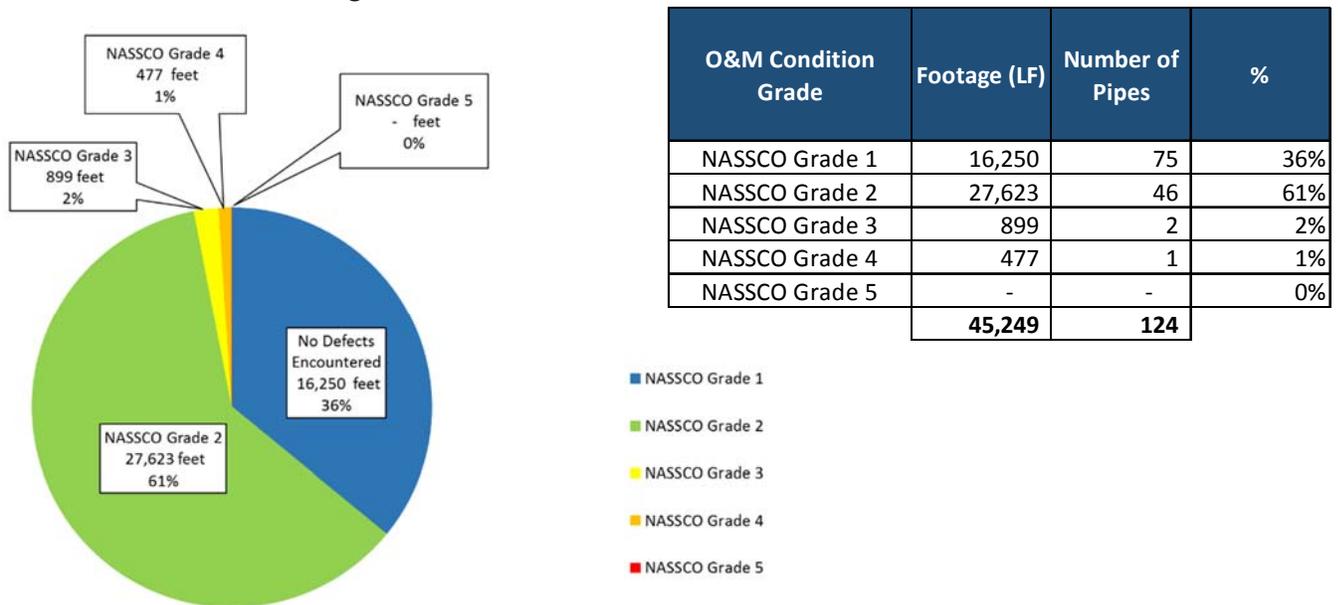
**Grade 4:** Two pipe segments were found to have “Significant” Condition Grade 4 structural defects: 1) SS17142002 (24-inch diameter VCP) and 2) SS17162003 (36-inch diameter T-Lock PVC Lined Concrete Pipe).

- SS17142002 was found to have one instance of a PACP Condition Grade 4 defect: a circumferential fracture just north of MH17142001.
- SS17162003 was found to have one instance of a PACP Condition Grade 4 defect: missing aggregate at a lining split seven (7) feet from MH17162002.

2. NASSCO PACP Operational & Maintenance (O&M) Condition Grade

As shown in **Figure 4**, no defects were encountered within 36% of the pipe assessed. 61% of the pipe was found to have NASSCO PACP Condition Grade of 2 defects. NASSCO PACP Condition Grade 3 defects were found in 2% of the pipe. NASSCO PACP Condition Grade 4 defects were found in 1% of the pipe. There were no Condition Grade 5 O&M defects encountered in any of the pipes assessed.

**Figure 4 – NASSCO PACP O&M Condition Grade**



**Grade 3:** Two (2) of the pipe segments assessed for condition were found to have NASSCO PACP Condition Grade defects with severity level of 3. The majority of PACP Condition Grade 3 defects noted were grease or encrustation deposits at the water level.

**Grade 4:** One (1) of the pipe segments assessed for condition was found to have a NASSCO PACP Condition Grade 4 defect. The defect encountered is a large accumulation of attached debris in Pipe Segment SS17163001, located in Van Buren Street, east of Fairway Drive. The accumulation of debris is attributed to a detached PVC Lining Joint.

Examples of O&M defects encountered are shown in **Table 4**. NASSCO PACP O&M Condition Grades for each pipe segment are summarized in **Table A.1** included in **Appendix A**.

Three (3) pipe segments were found to have O&M items of concern:

- Pipe segment SS16171005 downstream manhole, located on 119<sup>th</sup> Avenue north of I-10, connects to the pipe at the 3:00 o'clock position. This manhole could be removed and replaced

as part of the rehabilitation in Project 1E. Project 1E is described in **Section VI Project Summary** of this report.

- A Tap Break In was encountered in pipe segment SS17163001, at approximately 350 feet downstream of MH17164001, located in Van Buren Street east of Fairway Drive. A manhole could be installed at this Tap Break In to accommodate a bypass pumping operation to complete rehabilitation work in Project 1C. Project 1C is described in **Section VI Project Summary** of this report.
- Encrustation deposits above the water level were observed at every joint in pipe segment SS16174001 (located underneath the Agua Fria River Channel north of I-10 on Avondale Boulevard). This may be indication that infiltration is occurring during wet periods of the year. Infiltration was not observed at time of investigation.

**Table 4 – Example of O&M Defects Encountered**

SEVERITY	DESCRIPTION	NASSCO PACP CODE	PHOTOGRAPHIC IMAGE FROM CCTV
Rating  2 Good	Minor to Moderate Defect	DAGS Deposits Attached Grease	
Rating  2 Good	Minor to Moderate Defect	ISSR Intruding Sealing Ring	
Rating  4 Poor	Significant Defect	DAR Deposits Attached Ragging	

**Table 4 – Example of O&M Defects Encountered**

SEVERITY	DESCRIPTION	NASSCO PACP CODE	PHOTOGRAPHIC IMAGE FROM CCTV
Rating  2 Good	Minor to Moderate Defects	DAGS Deposits Attached Grease	
Rating  2 Good	Minor to Moderate Defects	ISSR Intruding Sealing Ring	
Rating  2 Good	Minor to Moderate Defects	DAE Deposits Attached Encrustation	

#### D. Previous Condition Assessment Comparison

The previous sanitary sewer condition assessment was conducted in 2009 as part of Avondale’s Sanitary Sewer Evaluation & Rehabilitation Program. The Sanitary Sewer Evaluation and Rehabilitation Study included condition assessment and recommendations for pipe and manhole rehabilitation for select reaches of Avondale’s sanitary sewer system, with pipe segments ranging from 8-inches to 36-inches in diameter. The 2009 report also recommended condition assessment of the sanitary sewer system be conducted every five (5) years.

Since the 2009 Condition Assessment, Avondale has acquired CCTV equipment and have implemented a cleaning and CCTV inspection program for pipes 12-inches or less in diameter. The City has elected to assign the assessment of Large Diameter Sewers to others. Avondale has completed a portion of the manhole rehabilitation, as city funding permits. To date, none of the pipe segments highlighted for rehabilitation have been repaired, due to lack of funding.

2009 Condition Assessment Inspection Areas 9, 10, 11, 12, 13, and 14 were evaluated as part of this condition assessment. Defects encountered in 2009 are sorted by Inspection Area and listed under pipes described by their upstream and downstream manhole in Table 3.3 of the 2009 Condition Assessment report. A number of the defects encountered in 2009 are listed in pipe segments that have different manhole identifications than shown in the City's current GIS, indicating that manhole identification features have been revised since the 2009 condition assessment. To identify pipe segments for comparison, the pipe segments were assumed to be identical if they were within the same vicinity, listed the same pipe size and material, and listed the same upstream manhole identification. Comparison of defects encountered in the 2009 condition assessment with the current condition assessment is summarized in **Table A.6 in Appendix A**. Defects within the VCP assessed have a rate of deterioration ranging from slow to moderate, with defects located near the pipe joint having moderate rate of deterioration. Defects within the PVC-Lined Concrete Pipe have rate of deterioration ranging from slow to fast, with detached liners at the joint, liner bulges and splits having moderate to fast rate of deterioration.

## IV. Manhole Condition

NASSCO assessment of the manhole interior is outside the scope of this project. However, manholes were viewed from the surface and as could be seen from the inlet location using CCTV images to formulate a general state of condition for city use in prioritizing future assessments. Based on conversations with Avondale, the City has been actively working to repair defective manholes since the previous condition assessment report was done in 2009 and has completed rehabilitation in approximately 46 manholes. A general condition assessment of the 129 manholes within the project limits was accomplished from the pipe invert perspective by CCTV camera, along with notes taken at the surface. Manholes were assigned a condition rating of “Poor”, “Fair”, or “Good”. Manhole condition findings are summarized in **Table A.3** included in **Appendix A** and shown in **Exhibit D** included in **Appendix B**.

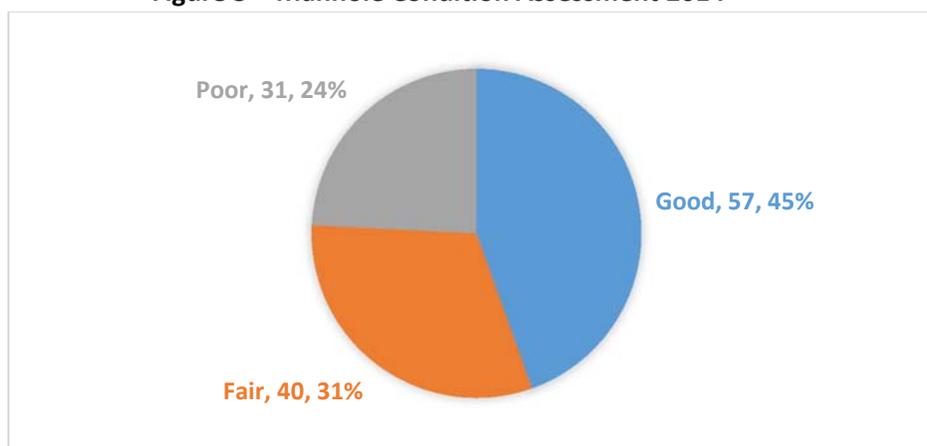
Buried Manholes: Twenty (20) manholes were found to be buried within the project limits. The buried manholes along 119th Avenue were excavated to facilitate CCTV inspection and were brought to grade by COA’s Wastewater Collections maintenance crew with new rings, covers, and concrete collars. MH17164001 could not be located through field inspection of the area and could not be located with CCTV. See **Table 5** for a list of the buried manholes encountered.

“Good” Condition Manholes: Fifty-seven (57) or 45% of the manholes within the project limits were found to be in “Good” condition. Some manholes were noted as having signs of recent rehabilitation.

“Fair” Condition Manholes: Forty (40) or 31% of the manholes within the project limits were found to be in “Fair” condition. Defects noted within the “Fair” manholes include visible aggregate, occurring on the bench and below the bench. Detached T-Lock PVC Lining was noted on some of the manhole walls and at some of the pipe connections based on a view from the invert perspective.

“Poor” Condition Manholes: Thirty-one (31) or 24% of the manholes within the project limits were found to be in “Poor” condition. Defects noted within the “Poor” manholes include projecting and visible aggregate, occurring on the walls, on the bench, and below the bench. Detached PVC Lining was noted on some of the manhole walls and at the pipe connections based on a view from the invert perspective.

**Figure 5 – Manhole Condition Assessment 2014**



Four (4) manholes were found to have O&M items of possible concern:

- MH16171003 makes connection to the pipe at the 3:00 o'clock position. This manhole could be removed and replaced for as part of the pipe rehabilitation in Project 1E. Project 1E is described in **Section VI Project Summary**.
  - MH16171003 is the downstream manhole to Pipe Segment SS16171005. The manhole is located on 119<sup>th</sup> Avenue north of Roosevelt Avenue.
- An internal drop with metallic clamps was found within MH17154001. The internal structure will have to be removed and reinstalled to accommodate future cleaning or rehabilitation work.
  - MH17154001 is downstream manhole to Pipe Segment SS17163003. The manhole is located at Van Buren Street and Fairbanks Drive.
- MH21154022 is installed over Pipe Segment SS21154022 on El Mirage Road, but there is no connection between the pipe and the manhole. There is no access to the pipe from this manhole.
  - MH21154022 is downstream manhole to Pipe Segment SS21154002. The manhole is located on El Mirage Road north of Calle Hermosa Lane.
- A hanging sealing ring (NASSCO PACP Code ISSRH) was found in MH15171021. Potential of infiltration during wet weather may exist at this location. Infiltration was not observed at time of investigation.
  - MH15171021 is downstream manhole to SS15171032. The manhole is located at intersection of 119<sup>th</sup> Avenue and Monte Vista Road.
- MH17164001. This manhole was not located through field inspection of the area and could not be located with CCTV.
  - MH17164001 is upstream manhole to Pipe Segment SS17163001, located in Van Buren Street west of Fairbanks Drive.

Manholes shown in **Table 5** are referred to the City as requiring additional work to gain access or requiring excavation and grade rings installed to raise the lid to ground surface if the City wishes.

**Table 5 – Buried Manholes – Adjust to Grade**

Item	FEAT_ID	LOCATION	DESCRIPTION	COMMENT
2	MH13173002	119th Ave & Thomas Rd	DS MH to SS13173001	PAVED OVER
4	MH14171001	E of 118th Dr on Thomas Rd	DS MH to SS14171002	VERIFY LOCATION - PAVED OVER
12	MH14173002	119th Ave S of Virginia Ave	DS MH to SS14173001	BURIED IN EASEMENT
13	MH14173003	119th Ave S of Baker Ave	DS MH to SS14173002	BURIED IN 6 FEET OF DIRT IN FIELD
34	MH16172002	Avondale Blvd N of I-10	US MH to SS16172003	LOCATED - BURIED IN DIRT
36	MH16172004	Avondale Blvd N of I-10	US MH to SS16174001	LOCATED - BURIED IN DIRT
40	MH16173002	119th Ave N of I-10	US MH to SS16173003	LOCATED - BURIED IN DIRT
42	MH16174001	Avondale Blvd N of I-10	DS MH to SS16174001	LOCATED - BURIED IN DIRT
54	MH17162001	119th Ave & Roosevelt St	US MH to SS17162003	LOCATED - BURIED IN DIRT
55	MH17162002	On dirt road ~ 600 ft N of 119th Ave & Roosevelt St	US MH to SS17162003	LOCATED - BURIED IN DIRT
58	MH17164001	Van Buren St S of 120th Ln	DS MH to SS17164034	PAVED OVER
61	MH17164003	On dirt road ~ 70 ft N of 119th Ave & Roosevelt St	DS MH to SS17162003	LOCATED - BURIED IN DIRT
77	MH17164004	119th Ave N of Van Buren St	US MH to SS17164004	LOCATED - BURIED IN DIRT
81	MH18154001	Fairway Dr N of Madison St	DS MH to SS18154002	PAVED OVER
83	MH19152012	On Golf Course N of CR-85	US MH to SS19161018	BURIED ON GOLF COURSE
85	MH19152014	On Golf Course S of Coldwater Springs Blvd	US MH to SS19152014	BURIED IN GRASS AREA
86	MH19161017	On Golf Course N of CR-85	US MH to SS19163027	BURIED ON GOLF COURSE
88	MH19163007	On Golf Course N of CR-85	DS MH to SS19163026	BURIED ON GOLF COURSE
88	MH19163022	On Golf Course N of CR-85	DS MH to SS19163027	BURIED ON GOLF COURSE
124	MH23144002	Easement S end of 127th Ave (S of Illini St)	DS MH to SS23144002	BURIED IN EASEMENT
125	MH24132005	Dysart Rd & Broadway Rd	DS MH to SS2314302	BURIED ON GOLF COURSE

## V. Pipe Risk Assessment

The prioritization of the projects identified in this report was accomplished using a risk-based approach. A criticality or risk analysis, using COA's GIS data, NASSCO PACP structural condition ratings, and custom tools created in ArcMap®, was conducted to evaluate risk of failure for each pipe. Factors that contribute to a pipe segment's risk of failure include the likelihood (condition) and the consequence if the pipe were to fail. Likelihood of Failure (LoF), Consequence of Failure (CoF), and Risk of Failure (RoF) scores were assigned as described in the following paragraphs. Pipe segments were then grouped by score into four (4) categories: "Low", "Medium", "High", and "Critical" as shown in **Table 6** on the following page. Pipe segment LoF, CoF, and RoF scores for each pipe segment are summarized in **Table A.2** located in **Appendix A** and shown in **Figures B1 – B125** in **Appendix B**.

### A. Pipe Failure

Pipe failure is defined as the inability to convey flow due to obstruction and/or pipe wall collapse. Pipe collapse in large diameter sewer pipes is of particular concern as it can cause surcharging and large volumes of sanitary sewer to overflow.

Voids in the pipe wall are a cause of concern as they eventually lead to the development of larger soil cavities exterior to the pipe as soil drops into the pipe and is washed away over time. Left unaddressed, a void in the pipe wall may ultimately lead to the occurrence of sink holes as the existing surface or pavement collapses as underlying soils are washed away.

### B. Likelihood of Failure Score

A Likelihood of Failure (LoF) Score was assigned to pipe segments using the NASSCO PACP Quick Rating based on CCTV investigation findings and the equations listed below.

$$\text{Likelihood of Failure (LoF) Score} = \frac{\text{First Two Digits of the NASSCO PACP Quick Rating}}{10} \quad (\text{Equation 1})$$

Example: PACP Quick Rating = 3251

$$\text{PACP Quick Rating} = \frac{32}{10} = 3.2 \quad (\text{Example Equation 1})$$

If the PACP Quick Rating's second digit is a letter, the second digit is replaced with a zero and the following equation is applied.

$$\text{Likelihood of Failure (LoF) Score} = \frac{\text{First Digit of the NASSCO PACP Quick Rating followed by a zero}}{10} + 0.9 \quad (\text{Equation 2})$$

Example: PACP Quick Rating = 3C51

$$\text{PACP Quick Rating} = \frac{30}{10} + 0.9 = 3.9 \quad (\text{Example Equation 2})$$

Pipe segments were grouped into either "Low", "Medium", "High", or "Critical" LoF category based on the LoF Score received. LoF scores range between 5, most likely to fail, and 1, least likely to fail. A map

**Table 6 – Risk of Failure Analysis**

Likelihood of Failure (LoF) Score												
Likelihood of Failure Score Approach	Take the first two digits of the PACP Quick Rating Score and divide it by 10. If the PACP Quick Rating's second digit is a letter, replace the letter with the number zero, divide by 10, and add 0.9 to the result of the division.											
	<b>&lt; 2 - Low</b>	<b>3 - Medium</b>	<b>4 - High</b>		<b>5 - Critical</b>							
Consequence of Failure (CoF) Score												
Consequence of Failure Score Approach	Identify and assign value to possible consequences due to pipe failure.											
	<b>&lt; 5 - Low</b>	<b>6 to 7 - Medium</b>		<b>8 to 9 - High</b>			<b>&gt; 9 - Critical</b>					
Description of Adverse Impact due to Pipe Failure or Collapse	Economic			Environmental			Social				Total Consequence of Failure Score	
	Removal and Replacement	Increase Operation and Maintenance	Environmental Cleanup	Cross Contamination	Pollution	Odor	Public Image	Disruption of Traffic Flow	Disruption of Emergency Services	Damage to Private Property		
Pipe is Located Near	Park/Recreational Area	1	1				1	1			4	
	Golf Course	1	1				1	1		1	5	
	Hospital	2					1	1	1	1	6	
	Fire Station/Police	2					1	1	1	1	6	
	School	2					1	1	1	1	6	
	Potable Waterline	2			2		1	1			6	
	Storm Drain System	2		2		1	1	1			7	
	Aquifer Recharge System	3		2		1	1	1			8	
	Reclaimed Water System	3		2		1	1	1			8	
	Arterial Street	4	1				1	1	1	1	9	
	Highway	5	1				1	1	1	1	10	
River	4	1	2	1	1	1	1			11		
Risk of Failure (RoF) Score = Likelihood of Failure Score (LoF) * Consequence of Failure Score (CoF)												
RoF Score is...	0 < 12						Low					
	12 <> 32						Medium					
	32 <> 40						High					
	> 40						Critical					
Example: Pipe has a NASSCO PACP Quick Rating of 5B21 and is located on the Golf Course												
RoF = LoF * CoF = 5.9 * 5 = 29.5 (Low)												
Example: Pipe has a NASSCO PACP Quick Rating of 4231 and is located near a School												
RoF = LoF * CoF = 4.2 * 6 = 25.2 (Medium)												
Example: Pipe has a NASSCO PACP Quick Rating of 4321 and is located near Aquifer Recharge Basin												
RoF = LoF * CoF = 4.3 * 9 = 38.7 (High)												
Example: Pipe has a NASSCO PACP Quick Rating of 5431 and is located under the Highway												
RoF = LoF * CoF = 5.4 * 10 = 54.0 (Critical)												

showing LoF of the pipes assessed for condition is shown in **Exhibit B in Appendix B**. “Low”, “Medium”, “High”, or “Critical” LoF designations are summarized in **Table 7** and described as follows:

**“Low” LoF (LoF <= 2.9):** “Low” LoF pipes (LoF less than or equal to 2.9) have defects with NASSCO PACP Condition Grade of 2 or less.

**“Medium” LoF (LoF 3.0 < 3.9):** “Medium” LoF pipes (LoF between 3.0 and 3.9) have defects with a NASSCO PACP Condition Grade of 3.

**“High” LoF (LoF 4.0 < 4.9):** “High” LoF pipes (LoF between 4.0 and 4.9) have defects with NASSCO PACP Condition Grade of 4.

**“Critical” LoF (LoF 5.0 < 5.9):** “Critical” LoF pipes (LoF between 5.0 and 5.9) have defects with NASSCO PACP Condition Grade of 5.

**Table 7 – Pipe Likelihood of Failure (LoF) Summary**

Likelihood of Failure	Footage (LF)	Number of Pipes	%
No Defects Observed	18,896	64	42%
< = 2.9 (Low)	544	2	1%
3.0 to 3.9 (Medium)	24,751	56	55%
4.0 to 4.9 (High)	1,058	2	2%
5.0 to 5.9 (Critical)	-	-	0%
	<b>45,249</b>	<b>124</b>	

### C. Consequence of Failure Score

While failure in any large diameter sewer pipe would be catastrophic, there are a number of consequences to be considered if pipe failure were to occur. A Consequence of Failure (CoF) Score was assigned based on the pipe segment’s proximity to nearby facilities of concern. Pipes in close proximity to facilities of concern were assigned a CoF Score considering several economic, environmental, and social impacts to the City in the matrix shown in **Table 6**. Consequence of Failure scoring was accomplished by proximity analysis in ArcMap®. Facilities of concern include:

- Parks/Recreational Areas
- Schools
- Hospital/Police/Fire Station
- Potable Water Mains
- Storm Drain System
- Aquifer Recharge System
- Reclaimed Water System
- Arterial Street
- Highway
- River

The impacts of failure in proximity to these areas can be grouped into three categories: Economic, Environmental, and Social types of costs.

Economic: Pipe replacement costs vary depending on the pipe segment location (i.e. in residential street, under a highway, in the dirt, etc.). A failed pipe in close proximity to high traffic area will required more stringent traffic control measures and increase in traffic control costs. If the failed pipe is located in an area that is difficult to reach, the failure could increase the City’s costs for operation and maintenance. Pipe failure near the river or storm drain system could have additional costs associated with environmental cleanup of the spilled sewage.

Environmental: The adverse environmental impacts associated with an environmental CoF include cross contamination, pollution, and odor. Pipe failure in near proximity to a waterline is a potential source of cross contamination with the City’s water supply. Avondale also has an Aquifer Recharge system, where storm water is captured and allowed to drain to various aquifer recharge basins throughout the City. A large sewer pipe failure in close proximity to one of these basins could potentially discharge into and contaminate one of these aquifer recharge basins.

Social: The adverse social impacts associated with social CoF include negative public image, disruption of traffic flow, disruption of emergency services, and damage to private property. The exact cost of social impacts cannot be accurately quantified but could be significant.

Pipe segments in close proximity to facilities of concern were assigned a Consequence of Failure Score based on the matrix shown in **Table 6**. Pipes were grouped into either “Low”, “Medium”, “High”, or “Critical” CoF category based on the range of CoF Score received. LoF scores range between 11 (high) and 5 (low) consequence of failure.

#### D. Risk of Failure (RoF) Score

A Risk of Failure (RoF) Score was computed for to each pipe based on Equation 3.

$$\text{Risk of Failure (RoF) Score} = \text{Likelihood of Failure (LoF) Score} \times \text{Consequence of Failure (CoF) Score} \quad (\text{Equation 3})$$

Pipes with RoF values less than 12 are grouped into the “Low” RoF category, pipes with RoF value between 12 and 32 are grouped into the “Medium” RoF category, pipes with RoF value between 32 and 40 are grouped into “High” RoF category, and pipes with RoF greater than 40 are grouped into the “Critical” RoF category. Pipes with RoF scores range between 180 (greatest risk of failure) and 0 (least risk of failure). Pipe RoF values are summarized in **Table 8**. Rehabilitation projects were grouped into two phases based on condition, with projects in each phase sorted from “High” RoF to “Low” RoF.

**Table 8 – Pipe Risk of Failure (RoF) Summary**

Risk of Failure	Footage (LF)	Number of Pipes	%
< 12 (Low)	26,922	80	59%
12 - 32 (Medium)	3,686	12	8%
32 - 40 (High)	919	2	2%
> 40 (Critical)	13,722	30	30%
	<b>45,249</b>	<b>124</b>	

## VI. Rehabilitation Recommendations

Recommendations include pipe rehabilitation, cleaning, do nothing, and condition reassessment. Pipe recommendations are summarized in **Table A.4** in **Appendix A**. Manhole recommendations are summarized in **Table A.5** in **Appendix A**. Rehabilitation Recommendations are shown in **Exhibit E** in **Appendix B**.

### A. Pipe Repairs

Pipe segments that are recommended for rehabilitation include:

- Pipe segments with “High” likelihood of failure (Condition Grade 4).
- T-Lock PVC Lined Concrete Pipe with lining defects and signs of concrete substrate deterioration (Condition Grade 3)
- T-Lock PVC Lined Concrete Pipe with Detached Joint Weld Strips at Joint (Condition Grade 3)
- Flow obstructions

**Pipe deterioration has not progressed to the levels where open cut replacement is necessary.**

However, cost of open cut replacement can be explored during design. Three (3) trenchless methods of construction listed below are potential options for pipe rehabilitation:

- 1) Cured-in-Place-Pipe (CIPP) Rehabilitation,
- 2) T-Lock PVC Lining Repair (for T-Lock PVC Lined Concrete Pipe), and
- 3) Slip Lining.

#### 1. Cured-in-place-pipe (CIPP) Rehabilitation

Cured-in-place-pipe (CIPP) rehabilitation is a trenchless construction method that is used to repair existing sewer pipe 4-inches to 124-inches in diameter. In the CIPP rehabilitation process, a resin-impregnated flexible felt tube is typically inserted into the existing pipe through an existing upstream manhole using water. Air pressure can be used for insertion if the diameter is less than approximately 42-inches. The resin is then cured inside the existing pipe using hot water or steam to form a tight-fitting, jointless, corrosion-resistant lining on the interior of the pipe. Service laterals that are encountered are typically reinstated from within the pipe using remote controlled cutting devices.

The thickness of CIPP lining will vary depending on design criteria requirements, partially or fully-deteriorated pipe condition, soil parameters, presence of ground water, pipe ovality, and applicable live loads.

A bypass pumping operation, cleaning, and removal of protruding objects, obstructions, and debris is usually necessary prior to CIPP rehabilitation. In large diameter T-



**Figure 6 – Typical 36-inch Diameter CIPP Installation**

lock lined concrete sewer pipes, significant detached PVC Lining should be removed prior to CIPP rehabilitation to minimize wrinkles in the installed lining.

## 2. T-Lock PVC Lining Concrete Pipe Patch Repairs

Construction of T-Lock PVC Lining repairs require sewage bypass, dewatering, and man entry for repairs and inspection. Defects encountered in the T-Lock PVC Lining can be repaired by “welding” new PVC sheeting to make patch repairs where necessary. PVC Lining repairs typically include the installation of new T-Lock PVC Lining pipe joint material at each PVC Lining joint encountered.

Prior to installation of the new lining joint or patch, any detached weld strips and lining material will need to be removed. Any deteriorated concrete material behind the detached lining should be removed by water or grit blasting to sound material. Any voids encountered should be filled with grout back to original pipe dimensions. Existing PVC Lining integrity and proper repair installation is verified by spark, probe, and other non-destructive testing methods.

## 3. Slip Lining

Pipes can be replaced by sliding a new pipe inside the existing pipe. This method is known in the industry as “Slip Lining”. The semi-trenchless construction method requires a small excavation to be dug to expose a segment of the pipe that is large enough to insert a new segment of pipe. The top half of the pipe is removed at the insertion pit, and a new smaller diameter pipe, is pushed into the interior of the existing sanitary sewer pipe.

A benefit of the slip lining method of construction is that the new pipe can be installed during live flows, omitting the high cost of bypass pumping operation. After the new pipe insertion is complete, the lining pipe is secured in place by grouting the annulus.

Pipe materials suitable for slip lining include Glass Reinforced Pipe (Hobas®), fusible HDPE or PVC pipe, or restrained joint ductile iron pipe. New pipe size diameter is typically 10% less than the existing pipe diameter, to ensure adequate clearance for the insertion process. It is important to verify the collection system capacity requirements, as slip lining renewal reduces the diameter of the existing pipe by at least 6-inches in diameter corresponding to a reduction in system capacity.

## B. Cleaning Recommendations

Pipe segments where grease and encrustation deposits are encountered should be scheduled for cleaning. The list of pipe segments identified for cleaning does not include pipe segments that are recommended for rehabilitation as these pipe segments should be cleaned and televised as part of the rehabilitation process. Cleaning recommendations are summarized in **Table A.4** in **Appendix A** shown in **Exhibit D** in **Appendix B**.

## C. Reassessment Recommendations

It is recommended that the T-Lock PVC Lined pipe segments having structural defects be scheduled for reassessment in 5 years. Pipe segments that have not been rehabilitated before the reassessment is due should be included in the reassessment scope of work. Rehabilitation project prioritization should be reevaluated based on reassessment findings.

Additionally, pipe segments with the following structural defects should be reassessed in 5 to 10 years.

- VCP with minor cracks
- Lining pinholes
- Lining bulges without signs of concrete substrate deterioration
- Lining splits without signs of concrete substrate deterioration

Reassessment recommendations are summarized in **Table A.4** in **Appendix A** and shown in **Exhibit D** in **Appendix B**.

#### D. Manhole Recommendations

It is recommended that a NASSCO MACP Level 2 Condition Assessment be conducted on manholes noted as being in visually “Poor” condition to further scrutinize condition and determine appropriate methods for rehabilitation. Manhole condition assessment recommendations are summarized in **Table A.5** in **Appendix A**.

Twenty (20) manholes were found to be buried. Manholes found to be buried along 119<sup>th</sup> Avenue were excavated to facilitate CCTV inspection, and then raised to grade with new manhole covers and concrete collars. The remaining buried manholes should be adjusted to grade at City preference for future maintenance purposes. The buried manholes along with their location and description are summarized in **Table 5** in **Section III Manhole Condition Assessment**.



## VII. Project Summary

Recommendations include pipe cleaning, two (2) phases of pipe rehabilitation, pipe reassessment, and manhole condition assessment. Pipe and manhole reassessment recommendations is discussed previously in **Section VI Rehabilitation Recommendations**. Pipe cleaning, reassessment, and rehabilitation recommendations are summarized in **Table A.4** in **Appendix A**. Manhole condition assessment recommendations are summarized in **Table A.5** in **Appendix A**.

### A. Large Diameter Sewer Rehabilitation

It is recommended that rehabilitation of structurally deteriorated pipe segments be accomplished by trenchless rehabilitation in lieu of open cut construction methods. Pipe segments recommended for rehabilitation were grouped into two phases as described in the following paragraphs.

### B. Large Diameter Sewer Rehabilitation - First Phase

The first phase of rehabilitation includes “High” LoF (NASSCO PACP Condition Grade 4 or more) pipe segments, “Medium” LoF pipe segments (NASSCO PACP Condition Grade 3 or more) having notable structural defects throughout the pipe, along with pipes with structural defects that cause obstruction in conveyance of flow. Notable structural defects include fractures, lining bulges with exposed concrete, detached weld joints, detached lining, and signs of exposed or missing aggregate. Pipe segments recommended for rehabilitation within close proximity were included for economy of scale cost savings measure. Project work areas are sorted by highest to lowest risk of failure. Pipe segments included in the first phase of pipes to be rehabilitated are shown in **Table 9** and in the figures included in **Appendix B**.

**Table 9 – Large Diameter Sewer Rehabilitation 2015 - 2018**

Project	Location	Feat-ID	Pipe Diameter	Pipe Type	Pipe Length (ft)
1A	Avondale Boulevard & I-10	SS16174001	24	T-lock Lined Concrete	173
		SS16174002	24	T-lock Lined Concrete	115
		SS16174003	24	T-lock Lined Concrete	592
1B	Eliseo Felix Jr. Way South of I-10	SS17142002	24	Vitrified Clay Pipe	505
1C	Van Buren Street & Fairway Drive	SS17163003	36	T-lock Lined Concrete	510

**Table 9 – Large Diameter Sewer Rehabilitation 2015 – 2018 (Continued)**

Project	Location	Feat-ID	Pipe Diameter	Pipe Type	Pipe Length (ft)
1C	Van Buren Street & Fairway Drive	SS18152008	36	T-lock Lined Concrete	517
		SS17163002	36	T-lock Lined Concrete	517
1D	119 <sup>th</sup> Avenue & Van Buren Street	SS17164001	36	T-lock Lined Concrete	21
		SS17164005	36	T-lock Lined Concrete	523
		SS17164006	36	T-lock Lined Concrete	520
		SS17164035	36	T-lock Lined Concrete	45
		SS17164034	36	T-lock Lined Concrete	67
1E	119 <sup>th</sup> Avenue from Palm Lane to I-10	SS15173002	30	T-lock Lined Concrete	560
		SS15173003	30	T-lock Lined Concrete	538
		SS16171004	30	T-lock Lined Concrete	571
		SS16171005	30	T-lock Lined Concrete	375
		SS16171002	30	T-lock Lined Concrete	232
1F	El Mirage Road & Durango Street	SS20154038	36	T-lock Lined Concrete	669

### C. Large Diameter Sewer Rehabilitation - Second Phase

The second phase of Large Diameter Sewer Rehabilitation includes “Medium” LoF (NASSCO Condition Grade 3) pipe segments that were found to have four (4) or less notable structural defects. Similar to the first phase of sewer rehabilitation, pipe segments included in the second phase were grouped together based on location to make seven (7) independent project work areas as shown in the **Table 10** and in the figures included in **Appendix B**. Project work areas are sorted by highest to lowest risk of pipe failure. Rehabilitation recommendations are summarized in **Table A.4** in **Appendix A**. Pipe segment rehabilitation that has not been completed within five (5) years should reassessed within five (5) years’ time. The prioritization of remaining rehabilitation projects should be reevaluated based on reassessment findings.

**Table 10 – Large Diameter Sewer Rehabilitation 2019 - 2025**

Project	Location	Feat-ID	Pipe Diameter	Pipe Type	Pipe Length (ft)
2A	119 <sup>th</sup> Avenue South of I-10	SS17162001	36	T-lock Lined Concrete	554
		SS17162002	36	T-lock Lined Concrete	533
		SS17162003	36	T-lock Lined Concrete	555
		SS17164003	36	T-lock Lined Concrete	554
		SS17164004	36	T-lock Lined Concrete	553
2B	Coldwater Golf Course S of Grant Street N of MC-85	SS19163027	36	T-lock Lined Concrete	594
2C	Lower Buckeye Rd & El Mirage Rd	SS22154021	36	T-lock Lined Concrete	657
2D	127 <sup>TH</sup> Avenue S of Pioneer Street	SS22144003	36	T-lock Lined Concrete	366
2E	127 <sup>th</sup> Avenue S of Elwood St	SS23142022	36	T-lock Lined Concrete	262
2F	119 <sup>TH</sup> Avenue N of I-10	SS16173003	30	T-lock Lined Concrete	541
		SS16164001	30	T-lock Lined Concrete	152
2G	Avondale Rd & McDowell Rd	SS16172001	24	T-lock Lined Concrete	491

#### D. Bypass Pumping Operation

A large sewage bypass pumping operation will be required to divert flows around the pipe rehabilitation work area to maintain uninterrupted service during construction. A very elementary conceptual bypass pumping system schematic was developed to assist in estimating bypass pump system costs. Conceptual bypass pumping system schematic layout is shown on the figures in **Appendix C**. Conceptual bypass pumping system schematic should not be relied upon for design purposes.

Noise mitigation may be necessary to keep bypass pumping equipment in compliance with applicable noise ordinances. Bypass system access points may also require odor mitigation. Cost of temporary onsite odor control, if required, varies on a case by case basis. Costs for temporary onsite odor control have not been evaluated at this time and are not included in Preliminary Costs provided in this report. If required, costs for temporary onsite odor control using carbon canisters or chemical dosing could be considered during project design phase.

#### E. Traffic Control

To minimize impacts to traffic, sewer bypass system discharge piping can be installed below existing pavement grade at major intersections and at locations where maintenance of access is critical to accommodate vehicle passage during construction. Assumptions of location of excavations for below grade bypass discharge piping are shown in the conceptual bypass system piping schematics in the figures in **Appendix C**. Excavation limits for routing bypass pump discharge piping below grade are assumed to be shallow (less than 3 feet deep). It is recommended that existing utilities shown to be within the excavation areas be verified during the design phase to identify any possible utility conflicts.



## VIII. Engineer’s Preliminary Opinion of Probable Costs

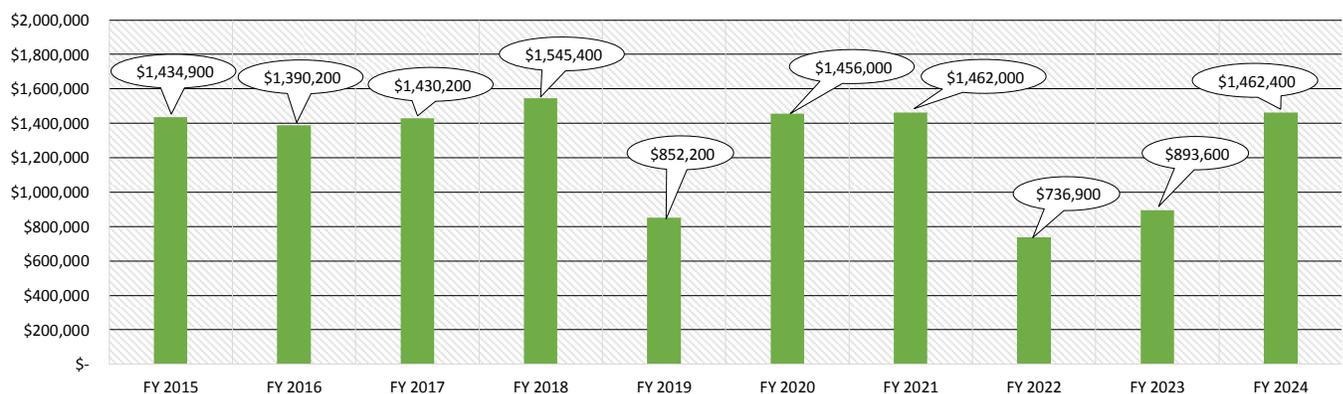
The Engineer’s Preliminary Opinion of Probable Design and Construction Costs (Preliminary Costs) for identified repairs is approximately \$12,663,250. Engineer’s Preliminary Opinion of Probable Design and Construction Costs provided in this report are determined based on the assumption that pipe rehabilitation method will be addressed by trenchless CIPP Rehabilitation.

For planning purposes, an estimated cost for NASSCO MACP Level 2 condition assessment and manhole rehabilitation in “Poor” manholes located upstream and downstream of CIPP rehabilitation limits was included in the cost estimates for each of the projects listed in **Section VII Project Summary**. Estimated costs for manhole rehabilitation includes costs for NASSCO MACP Level 2 condition assessment, repair of the existing manhole coating system, removal and replacement of manhole cover and frame, and concrete collar. Estimated costs do not include excavation work or manhole replacement. Actual method of manhole rehabilitation or repair should be determined based on NASSCO MACP Level 2 condition assessment findings.

Preliminary costs depicted in this report include a 20% contingency for unknown conditions that may be encountered, engineering design fees, construction administration and inspection services (CA & I) fees, and estimate of contractor’s cost for insurance, bonds, and taxes. Engineering fees for design phase services are assumed to be 10% of construction cost. Engineering CA & I fees are assumed to be 10% of construction cost.

Projects and corresponding design and construction costs were assembled based on an assumed capital improvement budget for Large Diameter Pipe Rehabilitation from 2015 – 2024 to be a maximum of \$1.5 million per year. The assumed annual budget was based on conversations with COA Wastewater Collections Staff. Based on an allocation level of \$1.5 million per year, it will take until the year 2024 to address the repairs identified. The allocation of preliminary costs is depicted in **Figure 7**. A summary and breakdown of the Preliminary Engineer’s Opinion of Probable Costs is included in **Appendix D**.

**Figure 7 – Large Diameter Sewer Rehabilitation Preliminary Costs 2015 - 2024**



# Appendix A

Report Tables

Table A.1 - Summary of NASSCO PACP Rating by Pipe Segment

Pipe	SEGMENT-ID = FEAT-ID	QS	Upstream MH = FEAT-ID	Upstream MH Rim to Invert Depth	Downstream MH = FEAT-ID	Downstream MH Rim to Invert Depth	Pipe Size	Pipe Type	CCTV Footage	CCTV Date	NASSCO PACP RATING							
											Structural Pipe Rating	Quick Rating - Structural	Structural Pipe Rating Index	O&M Pipe Rating	Quick Rating - O&M	O&M Pipe Rating Index	Overall Pipe Rating	Overall Pipe Rating Index
1	SS13173001	13-17	MH13173001	N/A	MH13173002	N/A	21"	VCP	590.8	11/11/14	0	0	0	232	2V00	2	232	2
2	SS14171002	14-17	MH14171001	N/A	MH13173001	N/A	21"	VCP	611.3	11/11/14	0	0	0	240	2W00	2	240	2
3	SS14171003	14-17	MH13173002	N/A	MH14171014	N/A	21"	VCP	509.4	11/11/14	0	0	0	206	2S00	2	206	2
4	SS14171004	14-17	MH14171012	N/A	MH14171002	N/A	21"	VCP	131.2	11/11/14	0	0	0	50	2D00	2	50	2
5	SS14171005	14-17	MH14171014	N/A	MH14171012	N/A	21"	VCP	413.2	11/11/14	0	0	0	164	2O00	2	164	2
6	SS14171006	14-17	MH14171002	N/A	MH14173008	N/A	21"	VCP	282.1	11/11/14	0	0	0	110	2J00	2	110	2
7	SS14171007	14-17	MH14172023	N/A	MH14171001	N/A	21"	VCP	73.5	11/10/14	0	0	0	0	0	0	0	0
8	SS14172028	14-17	MH14172024	N/A	MH14172022	N/A	21"	VCP	34.1	11/10/14	0	0	0	0	0	0	0	0
9	SS14172029	14-17	MH14172022	N/A	MH14172023	N/A	21"	VCP	474.2	11/11/14	0	0	0	0	0	0	0	0
10	SS14172030	14-17	MH14172025	N/A	MH14172024	N/A	21"	VCP	496.8	11/11/14	0	0	0	188	2Q00	2	188	2
11	SS14172031	14-17	MH13174002	N/A	MH14172025	N/A	21"	VCP	286.8	11/11/14	0	0	0	80	2G00	2	80	2
12	SS14173001	14-17	MH14173008	N/A	MH14173002	N/A	21"	VCP	261.6	11/11/14	0	0	0	0	0	0	0	0
13	SS14173002	14-17	MH14173002	N/A	MH14173003	N/A	21"	VCP	543.3	11/20/14	0	0	0	432	2Z00	2	432	2
14	SS14173003	14-17	MH14173003	N/A	MH14173004	N/A	21"	VCP	539.5	11/12/14	0	0	0	210	2T00	2	210	2
15	SS15171031	15-17	MH14173004	N/A	MH15171020	N/A	21"	VCP	331.7	11/12/14	0	0	0	118	2J00	2	118	2
16	SS15171032	15-17	MH15171020	N/A	MH15171021	N/A	21"	VCP	579.3	11/11/14	0	0	0	2	2100	2	2	2
17	SS15171033	15-17	MH15171040	N/A	MH15171026	N/A	21"	VCP	397.1	11/11/14	3	3100	3	2	2100	2	5	2.5
18	SS15171052	15-17	MH15171021	N/A	MH15171040	N/A	21"	VCP	17.9	11/11/14	0	0	0	0	0	0	0	0
19	SS15173001	15-17	MH15171026	N/A	MH15173001	N/A	21"	VCP	189.1	11/11/14	0	0	0	0	0	0	0	0
20	SS15173002	15-17	MH15173001	N/A	MH15173002	N/A	30"	CONC_T-LOCK	559.8	10/6	15	3500	3	352	2Z00	2	367	2.027624
21	SS15173003	15-17	MH15173002	N/A	MH16171008	N/A	30"	CONC_T-LOCK	538.2	10/6	312	3500	3	176	2P00	2	488	2.541667
22	SS16143002	16-14	MH16143002	27.08	MH16143005	24.17	24"	VCP	431.6	8/29	2	2100	2	4	2200	2	6	2
23	SS16143003	16-14	MH16143005	24.17	MH17142004	23.58	24"	VCP	154.3	8/29	0	0000	0	4	2200	2	4	2
24	SS16164001	16-16	MH16173004	N/A	MH16164001		30"	CONC_T-LOCK	152.1	10/22	9	3300	3	0	0	0	9	3
25	SS16164002	16-16	MH16164001		MH16164002	N/A	24"	CONC_T-LOCK	244.6	10/13	0	0	0	0	0	0	0	0
26	SS16164003	16-16	MH16164002	N/A	MH16164003	N/A	24"	CONC_T-LOCK	404	10/13	0	0	0	0	0	0	0	0
27	SS16171001	16-17	MH16171006	N/A	MH16173002	N/A	30"	CONC_T-LOCK	58.1	10/7	0	0	0	0	0	0	0	0
28	SS16171002	16-17	MH16171003	N/A	MH16171006	N/A	30"	CONC_T-LOCK	232.2		3	3100	3	0	0	0	3	3
29	SS16171003	16-17	MH16171008	N/A	MH16171004	N/A	30"	CONC_T-LOCK	55.5	10/6	0	0	0	0	0	0	0	0
30	SS16171004	16-17	MH16171004	N/A	MH16171005	N/A	30"	CONC_T-LOCK	570.6	10/7	351	3V00	3	214	2T00	2	565	2.522321
31	SS16171005	16-17	MH16171005	N/A	MH16171003	N/A	30"	CONC_T-LOCK	375	10/7	33	3A00	3	0	0	0	33	3
32	SS16172001	16-17	MH16172006	17.90	MH16172001	N/A	24"	CONC_T-LOCK	491.2	10/7	15	3500	3	0	0	0	15	3
33	SS16172002A	16-17	MH16172001	N/A	MH16172007	N/A	24"	CONC_T-LOCK	91.5	10/7	30	3A00	3	0	0	0	30	3
34	SS16172002B	16-17	MH16172007	N/A	MH16172002	N/A	24"	CONC_T-LOCK	250.5	10/7	15	0.5	3	0	0	0	15	3
35	SS16172003	16-17	MH16172002	N/A	MH16172003	20.70	24"	CONC_T-LOCK	325.5	10/7	174	3J00	3	0	0	0	174	3
36	SS16172004	16-17	MH16172003	20.70	MH16172004	19.90	24"	CONC_T-LOCK	80.8	10/14	0	0	0	60	2E00	2	60	2
37	SS16173003	16-17	MH16173002	N/A	MH16173004	N/A	30"	CONC_T-LOCK	540.6	10/8	21	3700	3	0	0	0	21	3
38	SS16174001	16-17	MH16172004	19.90	MH16174001	Buried	24"	CONC_T-LOCK	172.8	10/14	0	0	0	60	2E00	2	60	2
39	SS16174002	16-17	MH16174001	Buried	MH16174002	20.50	24"	CONC_T-LOCK	115.3	10/14	3	3100	3	42	2C00	2	45	2.045455
40	SS16174003	16-17	MH16174002	20.50	MH16174003	21.50	24"	CONC_T-LOCK	593.4	10/7	669	3Z00	3	0	0	0	669	3
41	SS16174004	16-17	MH16174003	21.50	MH16174004	20.90	30"	CONC_T-LOCK	504.7	10/7	36	3A00	3	0	0	0	36	3
42	SS16174004A	16-17	MH16174004	20.90	MH16174004A	20.90	30"	CONC_T-LOCK	20.6	10/8	0	0	0	0	0	0	0	0
43	SS17142001	17-14	MH17142001	22.08	MH17142002	Unable to Open MH	24"	VCP	112.8	8/29	2	2100	2	46	2C00	2	48	2
44	SS17142002	17-14	MH17142003	Unable to Open MH	MH17142001	22.08	24"	VCP	503	8/29	11	4231	3.67	4	2200	2	15	3
45	SS17142003	17-14	MH17142004	23.58	MH17142003	Unable to Open MH	24"	VCP	624.4	10/15	0	0	0	500	2Z00	2	500	2
46	SS17144012	17-14	MH17144003		MH LIFT STN	N/A	24"	VCP	17	10/15	0	0	0	0	0	0	0	0

Table A.1 - Summary of NASSCO PACP Rating by Pipe Segment

Pipe	SEGMENT-ID = FEAT-ID	QS	Upstream MH = FEAT-ID	Upstream MH Rim to Invert Depth	Downstream MH = FEAT-ID	Downstream MH Rim to Invert Depth	Pipe Size	Pipe Type	CCTV Footage	CCTV Date	NASSCO PACP RATING							
											Structural Pipe Rating	Quick Rating - Structural	Structural Pipe Rating Index	O&M Pipe Rating	Quick Rating - O&M	O&M Pipe Rating Index	Overall Pipe Rating	Overall Pipe Rating Index
47	SS17144013	17-14	MH17144004	21.42	MH17144003		24"	VCP	25.5	10/15	0	0	0	0	0	0	0	0
48	SS17144014	17-14	MH17142002	Unable to Open MH	MH17144004	21.42	24"	VCP	604.1	8/29	0	0000	0	4	2200	2	4	2
49	SS17162001	17-16	MH16164003	N/A	MH17162001	N/A	36"	CONC_T-LOCK	553.7	10/13	315	3T00	3	0	0	0	315	3
50	SS17162002	17-16	MH17162001	N/A	MH17162002	N/A	36"	CONC_T-LOCK	63.2	10/14	3	3100	3	0	0	0	3	3
51	SS17162002	17-16	MH17162001	N/A	MH17162002	N/A	36"	CONC_T-LOCK	469.3	10/13	21	3700	3	0	0	0	21	3
52	SS17162003	17-16	MH17162002	N/A	MH17164003	N/A	36"	CONC_T-LOCK	555.1	10/13	18	3600	3	0	0	0	18	3
53	SS17163001	17-16	MH17164001	N/A	MH17163001	N/A	36"	CONC_T-LOCK	477	10/23/14	9	3300	3	4	4100	4	13	3.25
54	SS17163002	17-16	MH17163001	N/A	MH17163002	N/A	36"	CONC_T-LOCK	523.6	10/23/14	414	3Z00	3	3	3100	3	417	3
55	SS17163003	17-16	MH17163002	N/A	MH17154001	N/A	36"	CONC_T-LOCK	509.4	11/8/14	42	3A00	3	0	0	0	42	3
56	SS17164001	17-16	MH17164007	N/A	MH17164002	N/A	36"	CONC_T-LOCK	21	11/7/14	3	3100	3	0	0	0	3	3
57	SS17164003	17-16	MH17164003	N/A	MH17164004	N/A	36"	CONC_T-LOCK	553.8	10/14	9	3300	3	0	0	0	9	3
58	SS17164004	17-16	MH17164004	N/A	MH17164007	N/A	36"	CONC_T-LOCK	553.1	10/14	318	3T00	3	0	0	0	318	3
59	SS17164005	17-16	MH17164002	N/A	MH17164005	N/A	36"	CONC_T-LOCK	498.1	10/23/14	264	3P00	3	0	0	0	264	3
60	SS17164006	17-16	MH17164005	N/A	MH17164006	N/A	36"	CONC_T-LOCK	520.5	10/23/14	27	3900	3	0	0	0	27	3
61	SS17164034	17-16	MH17164016	N/A	MH17164001	N/A	36"	CONC_T-LOCK	73.6	11/17/14	6	3200	3	0	0	0	6	3
62	SS17164035	17-16	MH17164006	N/A	MH17164016	N/A	36"	CONC_T-LOCK	45	10/23/14	3	3100	3	0	0	0	3	3
63	SS17172001	17-17	MH16174004A	20.90	MH17172001	20.60	30"	CONC_T-LOCK	390	10/8	15	3500	3	0	0	0	15	3
64	SS17172002	17-17	MH17172001	20.60	MH17172002	20.10	30"	CONC_T-LOCK	374.2	10/8	12	3400	3	0	0	0	12	3
65	SS17172005	17-17	MH17172003	19.60	MH17174001	19.30	30"	CONC_T-LOCK	320.5	10/8	15	3500	3	0	0	0	15	3
66	SS17172015	17-17	MH17172002	20.10	MH17172010	20.10	30"	CONC_T-LOCK	11.1	10/8	0	0	0	0	0	0	0	0
67	SS17172016	17-17	MH17172010	20.10	MH17172003	19.60	30"	CONC_T-LOCK	241.1	10/8	6	3200	3	0	0	0	6	3
68	SS17174001	17-17	MH17174001	19.30	MH17174002	19.60	30"	CONC_T-LOCK	244.2	10/8	0	0	0	0	0	0	0	0
69	SS17174002	17-17	MH17174002	19.60	MH17174003	20.90	30"	CONC_T-LOCK	404.8	10/8	0	0	0	160	2000	2	160	2
70	SS17174003	17-17	MH17174003	20.90	MH17174004	22.50	30"	CONC_T-LOCK	384	10/8	0	0	0	4	2200	2	4	2
71	SS18152006	18-15	MH18152002	N/A	MH18152003	N/A	36"	CONC_T-LOCK	216.4	10/23/14	3	3100	3	0	0	0	3	3
72	SS18152007	18-15	MH18152004	N/A	MH18152002	N/A	30"	CONC_T-LOCK	485	10/23/14	3	3100	3	0	0	0	3	3
73	SS18152008	18-15	MH17154001	N/A	MH18152004	N/A	30"	CONC_T-LOCK	517	10/23/14	12	3400	3	0	0	0	12	3
74	SS18154001	18-15	MH18154008	N/A	MH19152015	N/A	36"	CONC_T-LOCK	478.8	10/22/14	6	3200	3	0	0	0	6	3
75	SS18154002	18-15	MH18154001	N/A	MH18154008	N/A	36"	CONC_T-LOCK	228.2	10/23/14	0	0	0	0	0	0	0	0
76	SS18154003	18-15	MH18154021	N/A	MH18154001	N/A	36"	CONC_T-LOCK	507.1	10/23/14	9	3300	3	0	0	0	9	3
77	SS18154004	18-15	MH18152003	N/A	MH18154021	N/A	36"	CONC_T-LOCK	198.3	11/19/14	3	3100	3	0	0	0	3	3
78	SS18172001	18-17	MH17174004	22.50	MH18172001	22.90	30"	CONC_T-LOCK	593.3	10/9	3	3100	3	232	2V00	2	235	2.008547
79	SS19152014	19-15	MH19152014	N/A	MH19152012	N/A	36"	CONC_T-LOCK	532.9	10/22/14	0	0	0	192	2R00	2	192	2
80	SS19152015	19-15	MH19152013	N/A	MH19152014	N/A	36"	CONC_T-LOCK	117.9	10/22/14	0	0	0	40	2C00	2	40	2
81	SS19152016	19-15	MH19152015	N/A	MH19152013	N/A	36"	CONC_T-LOCK	382.3	10/22/14	9	3300	3	0	0	0	9	3
82	SS19161018	19-16	MH19152012	N/A	MH19161017	N/A	36"	CONC_T-LOCK	72.8	10/22/14	0	0	0	22	2A00	2	22	2
83	SS19163010	19-16	MH19163007	N/A	MH19163021	N/A	36"	CONC_T-LOCK	285.2	11/8/14	9	3300	3	0	0	0	9	3
84	SS19163025	19-16	MH19163021	N/A	MH20161026	N/A	36"	CONC_T-LOCK	283.1	10/24/14	3	3100	3	0	0	0	3	3
85	SS19163026	19-16	MH19163022	N/A	MH19163007	N/A	36"	CONC_T-LOCK	412.2	11/8/14	0	0	0	0	0	0	0	0
86	SS19163027	19-16	MH19161017	N/A	MH19163022	N/A	36"	CONC_T-LOCK	594.1	11/12/14	3	3100	3	234	2V00	2	237	2.008475
87	SS20152015	20-15	MH20161025	N/A	MH20152014	N/A	36"	CONC_T-LOCK	700.5	10/24/14	0	0	0	266	2Y00	2	266	2
88	SS20154037	20-15	MH20152014	N/A	MH20163005	N/A	36"	CONC_T-LOCK	26.8	10/24/14	0	0	0	2	2100	2	2	2
89	SS20154038	20-15	MH20163025	N/A	MH20154034	N/A	36"	CONC_T-LOCK	669.3	10/24/14	6	3200	3	0	0	0	6	3
90	SS20161035	20-16	MH20161026	N/A	MH20161025	N/A	36"	CONC_T-LOCK	552.5	10/24/14	0	0	0	0	0	0	0	0
91	SS20163026	20-16	MH20163005	N/A	MH20163025	N/A	36"	CONC_T-LOCK	680.8	10/24/14	0	0	0	2	2100	2	2	2
92	SS21152002	21-15	MH21161001	N/A	MH21161003	N/A	36"	CONC_T-LOCK	16	10/24/14	0	0	0	0	0	0	0	0
93	SS21152003	21-15	MH20154034	N/A	MH21161001	N/A	36"	CONC_T-LOCK	16.1	10/24/14	0	0	0	0	0	0	0	0
94	SS21152004	21-15	MH21161002	N/A	MH21152001	N/A	36"	CONC_T-LOCK	576.4	10/24/14	222	3M00	3	164	2000	2	386	2.474359

Table A.1 - Summary of NASSCO PACP Rating by Pipe Segment

Pipe	SEGMENT-ID = FEAT-ID	QS	Upstream MH = FEAT-ID	Upstream MH Rim to Invert Depth	Downstream MH = FEAT-ID	Downstream MH Rim to Invert Depth	Pipe Size	Pipe Type	CCTV Footage	CCTV Date	NASSCO PACP RATING							
											Structural Pipe Rating	Quick Rating - Structural	Structural Pipe Rating Index	O&M Pipe Rating	Quick Rating - O&M	O&M Pipe Rating Index	Overall Pipe Rating	Overall Pipe Rating Index
95	SS21152005	21-15	MH21152001	N/A	MH21154021	N/A	36"	CONC_T-LOCK	263.8	10/24/14	0	0	0	2	2100	2	2	2
96	SS21153014	21-15	MH21153013	N/A	MH21144004	N/A	36"	CONC_T-LOCK	616.3	11/7/14	9	3300	3	0	0	0	9	3
97	SS21153015	21-15	MH21153014	N/A	MH21153013	N/A	36"	CONC_T-LOCK	50.8	10/30/14	0	0	0	0	0	0	0	0
98	SS21153016	21-15	MH21154015	N/A	MH21153014	N/A	36"	CONC_T-LOCK	710.7	11/20/14	0	0	0	0	0	0	0	0
99	SS21154020	21-15	MH21154016	N/A	MH21154015	N/A	36"	CONC_T-LOCK	640.2	10/29/14	0	0	0	0	0	0	0	0
100	SS21154021	21-15	MH21154020	N/A	MH21154016	N/A	36"	CONC_T-LOCK	656.8	10/30/14	6	3200	3	0	0	0	6	3
101	SS21154023	21-15	MH21154017	N/A	MH21154020	N/A	36"	CONC_T-LOCK	142.4	10/30/14	0	0	0	4	2200	2	4	2
102	SS21154024	21-15	MH21154018	N/A	MH21154017	N/A	36"	CONC_T-LOCK	217.8	10/25/14	0	0	0	0	0	0	0	0
103	SS21154026	21-15	MH21154019	N/A	MH21154018	N/A	36"	CONC_T-LOCK	286.7	10/25/14	0	0	0	0	0	0	0	0
104	SS21154030	21-15	MH21154021	N/A	MH21154022	N/A	36"	CONC_T-LOCK	12.3	11/8/14	0	0	0	0	0	0	0	0
105	SS21154031	21-15	MH21154022	N/A	MH21163001	N/A	36"	CONC_T-LOCK	281.7	11/8/14	0	0	0	0	0	0	0	0
106	SS21161002	21-16	MH21161003	N/A	MH21161002	N/A	36"	CONC_T-LOCK	565.1	10/24/14	9	3300	3	2	2100	2	11	2.75
107	SS21163001	21-16	MH21163001	N/A	MH21154019	N/A	36"	CONC_T-LOCK	299.6	10/25/14	0	0	0	0	0	0	0	0
108	SS22142001	22-14	MH22142002	N/A	MH22142001	N/A	36"	CONC_T-LOCK	304.5	10/30/14	0	0	0	120	2K00	2	120	2
109	SS22142002	22-14	MH22142003	N/A	MH22142002	N/A	36"	CONC_T-LOCK	329.4	10/30/14	0	0	0	116	2J00	2	116	2
110	SS22142003	22-14	MH21144004	N/A	MH22142003	N/A	36"	CONC_T-LOCK	718.4	11/7/14	3	3100	3	0	0	0	3	3
111	SS22144001	22-14	MH22144001	N/A	MH23142016	N/A	36"	CONC_T-LOCK	343.2	10/30/14	0	0	0	0	0	0	0	0
112	SS22144003	22-14	MH22142001	N/A	MH22144002	N/A	36"	CONC_T-LOCK	366.3	10/30/14	3	3100	3	144	2M00	2	147	2.013699
113	SS22144004	22-14	MH22144002	N/A	MH22144003	N/A	36"	CONC_T-LOCK	489	10/30/14	0	0	0	136	2L00	2	136	2
114	SS22144005	22-14	MH22144003	N/A	MH22144001	N/A	36"	CONC_T-LOCK	156.5	10/30/14	0	0	0	60	2E00	2	60	2
115	SS23142016	23-14	MH23142012	N/A	MH23144002	N/A	36"	CONC_T-LOCK	560	11/8/14	0	0	0	0	0	0	0	0
116	SS23142018	23-14	MH23142013	N/A	MH23142012	N/A	36"	CONC_T-LOCK	114.6	10/31/14	0	0	0	0	0	0	0	0
117	SS23142020	23-14	MH23142014	N/A	MH23142013	N/A	36"	CONC_T-LOCK	156.2	10/31/14	0	0	0	0	0	0	0	0
118	SS23142021	23-14	MH23142015	N/A	MH23142014	N/A	36"	CONC_T-LOCK	223	10/31/14	0	0	0	0	0	0	0	0
119	SS23142022	23-14	MH23142016	N/A	MH23142015	N/A	36"	CONC_T-LOCK	261.9	10/31/14	9	3300	3	0	0	0	9	3
120	SS23143002	23-14	MH23143002	N/A	MH24132005	N/A	36"	CONC_T-LOCK	102	11/7/14	0	0	0	0	0	0	0	0
121	SS23144001	23-14	MH23144001	N/A	MH24142002	N/A	36"	CONC_T-LOCK	651.5	11/9/14	9	3300	3	0	0	0	9	3
122	SS23144002	23-14	MH23144002	N/A	MH23144001	N/A	36"	CONC_T-LOCK	672	11/8/14	15	3500	3	0	0	0	15	3
123	SS24141001	24-14	MH24141001	N/A	MH23143002	N/A	36"	CONC_T-LOCK	554.7	11/7/14	3	3100	3	182	2Q00	2	185	2.01087
124	SS24141002	24-14	MH24141002	N/A	MH24141001	N/A	36"	CONC_T-LOCK	663.1	11/7/14	9	3300	3	0	0	0	9	3
125	SS24142001	24-14	MH24142001	N/A	MH24141002	N/A	36"	CONC_T-LOCK	662.5	11/7/14	3	3100	3	0	0	0	3	3
126	SS24142002	24-14	MH24142002	N/A	MH24142001	N/A	36"	CONC_T-LOCK	652.3	10/31/14	216	3M00	3	0	0	0	216	3

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**Table A.2 - Avondale Large Diameter Condition Assessment 2014**

**Pipe Segment Likelihood of Failure, Consequence of Failure, and Risk of Failure Summary**



Project	Pipe	Pipe Segment	Pipe Size	Pipe Type	GIS Length	CCTV Footage	Structural LoF Score	O&M LoF Score	CoF Score	RoF Score	
	1	SS13173001	21	VCP	588	590.8	0	2.9	24	0	
	2	SS14171002	21	VCP	599	611.3	0	2.9	24	0	
	3	SS14171003	21	VCP	505	509.4	0	2.9	28	0	
	4	SS14171004	21	VCP	95	131.2	0	2.9	15	0	
	5	SS14171005	21	VCP	413	413.2	0	2.9	19	0	
	6	SS14171006	21	VCP	313	282.1	0	2.9	15	0	
	7	SS14171007	21	VCP	82	73.5	0	0	24	0	
	8	SS14172028	21	VCP	35	34	0	0	24	0	
	9	SS14172029	21	VCP	471	474.2	0	0	24	0	
	10	SS14172030	21	VCP	494	496.8	0	2.9	24	0	
	11	SS14172031	21	VCP	286	286.8	0	2.9	24	0	
	12	SS14173001	21	VCP	227	261.6	0	0	15	0	
	13	SS14173002	21	VCP	541	543.3	0	2.9	6	0	
	14	SS14173003	21	VCP	541	539.5	0	2.9	6	0	
	15	SS15171031	21	VCP	321	331.7	0	2.9	6	0	
	16	SS15171032	21	VCP	609	579.3	0	2.1	6	0	
	17	SS15171033	21	VCP	396	397.1	3.1	2.1	24	74.4	
	18	SS15171052	21	VCP	17	17.9	0	0	6	0	
	19	SS15173001	21	VCP	212	189.1	0	0	24	0	
1E	20	SS15173002	30	CONC T-LOCK	597	559.8	3.5	2.9	6	21	
1E	21	SS15173003	30	CONC T-LOCK	513	538.2	3.9	2.9	15	58.5	
	22	SS16143002	24	VCP	429	431.6	2.1	2.2	25	52.5	
	23	SS16143003	24	VCP	154	154.3	0	2.2	15	0	
2G	24	SS16164001	30	CONC T-LOCK	153	152.1	3.4	0	9	30.6	
	25	SS16164002	24	CONC T-LOCK	244	244.6	0	0	8	0	
	26	SS16164003	24	CONC T-LOCK	412	404	0	0	10	0	
	27	SS16171001	30	CONC T-LOCK	120	58.1	0	0	15	0	
1E	28	SS16171002	30	CONC T-LOCK	287	231	3.1	0	15	46.5	
	29	SS16171003	30	CONC T-LOCK	56	55.5	0	0	24	0	
1E	30	SS16171004	30	CONC T-LOCK	576	570.6	3.9	2.9	15	58.5	
1E	31	SS16171005	30	CONC T-LOCK	331	375	3.9	3.1	15	58.5	
2H	32	SS16172001	24	CONC T-LOCK	492	491.2	3.5	0	1	3.5	
	33	SS16172002A	24	CONC T-LOCK	75	91.5	3.9	0	1	3.9	
	34	SS16172002B	24	CONC T-LOCK	238	250.5	3.5	0	1	3.5	
	35	SS16172003	24	CONC T-LOCK	326	325.5	3.9	0	9	35.1	
	36	SS16172004	24	CONC T-LOCK	90	80.8	0	2.9	9	0	
2G	37	SS16173003	30	CONC T-LOCK	484	540.6	3.7	0	1	3.7	
1A	38	SS16174001	24	CONC T-LOCK	177	172.8	0	2.9	8	0	
1A	39	SS16174002	24	CONC T-LOCK	100	115.3	3.1	2.9	10	31	
1A	40	SS16174003	24	CONC T-LOCK	592	593.4	3.9	0	10	39	
	41	SS16174004	30	CONC T-LOCK	520	504.7	3.9	0	15	58.5	
	42	SS16174004A	30	CONC T-LOCK	390	20.6	0	0	1	0	
	43	SS17142001	24	VCP	112	112.8	2.1	2.9	15	31.50	
1B	44	SS17142002	24	VCP	496	503	4.2	2.2	15	63	
	45	SS17142003	24	VCP	625	624.4	0	2.9	15	0	
	46	SS17144012	24	VCP	17	17	CCTV Tractor Cannot Fit			15	0
	47	SS17144013	24	VCP	27	25.5	0	0	15	0	

**Table A.2 - Avondale Large Diameter Condition Assessment 2014**

**Pipe Segment Likelihood of Failure, Consequence of Failure, and Risk of Failure Summary**



Project	Pipe	Pipe Segment	Pipe Size	Pipe Type	GIS Length	CCTV Footage	Structural LoF Score	O&M LoF Score	CoF Score	RoF Score
	48	SS17144014	24	VCP	597	604.1	0	2.2	15	0
2A	49	SS17162001	36	CONC T-LOCK	540	553.7	3.9	0	1	3.9
2A	50	SS17162002	36	CONC T-LOCK	532	532.5	3.7	0	1	3.7
2A	51	SS17162003	36	CONC T-LOCK	542	555.1	4.1	0	1	4.1
	52	SS17163001	36	CONC T-LOCK	407	477	3.3	4.1	20	66
1C	53	SS17163002	36	CONC T-LOCK	517	523.6	3.9	3.1	1	3.9
1C	54	SS17163003	36	CONC T-LOCK	506	509.4	3.9	0	24	93.5
1D	55	SS17164001	36	CONC T-LOCK	22	21	3.1	0	5	15.5
2A	56	SS17164003	36	CONC T-LOCK	554	553.8	3.3	0	15	49.5
2A	57	SS17164004	36	CONC T-LOCK	550	553.1	3.9	0	5	19.5
1D	58	SS17164005	36	CONC T-LOCK	523	498.1	3.9	0	5	19.5
1D	59	SS17164006	36	CONC T-LOCK	518	520.5	3.9	0	20	78
1D	60	SS17164034	36	CONC T-LOCK	67	73.6	3.2	0	5	16
1D	61	SS17164035	36	CONC T-LOCK	46	45	3.1	0	5	15.5
	62	SS17172001	30	CONC T-LOCK	390	390	3.5	0	1	3.5
	63	SS17172002	30	CONC T-LOCK	371	374.2	3.4	0	9	30.6
	64	SS17172005	30	CONC T-LOCK	318	320.5	3.5	0	15	52.5
	65	SS17172015	30	CONC T-LOCK	5	11.1	0	0	1	0
	66	SS17172016	30	CONC T-LOCK	245	241.1	3.2	0	1	3.2
	67	SS17174001	30	CONC T-LOCK	244	244.2	0	0	1	0
	68	SS17174002	30	CONC T-LOCK	401	404.8	0	2.9	15	0
	69	SS17174003	30	CONC T-LOCK	377	384	0	2.2	15	0
	70	SS18152006	36	CONC T-LOCK	215	216.4	3.1	0	24	74.4
	71	SS18152007	30	CONC T-LOCK	487	485	3.1	0	24	74.4
1C	72	SS18152008	30	CONC T-LOCK	517	517	3.4	0	24	81.6
	73	SS18154001	36	CONC T-LOCK	474	478.8	3.2	0	29	92.8
	74	SS18154002	36	CONC T-LOCK	228	228.2	0	0	29	0
	75	SS18154003	36	CONC T-LOCK	502	507.1	3.3	0	29	95.7
	76	SS18154004	36	CONC T-LOCK	201	198.3	3.1	2.1	29	89.9
	77	SS18172001	30	CONC T-LOCK	589	593.3	3.1	2.9	24	74.4
	78	SS19152014	36	CONC T-LOCK	531	532.9	0	2.9	9	0
	79	SS19152015	36	CONC T-LOCK	119	117.9	0	2.9	33	0
	80	SS19152016	36	CONC T-LOCK	383	382.3	3.3	0	33	108.9
	81	SS19161018	36	CONC T-LOCK	74	72.8	0	2.9	20	0
	82	SS19163010	36	CONC T-LOCK	281	285.2	3.3	0	20	66
	83	SS19163025	36	CONC T-LOCK	283	283.1	3.1	0	39	120.9
	84	SS19163026	36	CONC T-LOCK	412	412.2	0	0	20	0
2C	85	SS19163027	36	CONC T-LOCK	594	594.1	3.1	2.9	20	62
	86	SS20152015	36	CONC T-LOCK	693	700.5	0	2.9	24	0
	87	SS20154037	36	CONC T-LOCK	26	26.8	0	2.1	24	0
1F	88	SS20154038	36	CONC T-LOCK	672	669.3	3.2	0	24	76.8
	89	SS20161035	36	CONC T-LOCK	549	552.5	0	0	24	0
	90	SS20163026	36	CONC T-LOCK	678	680.8	0	2.1	24	0
	91	SS21152002	36	CONC T-LOCK	14	16	0	0	24	0
	92	SS21152003	36	CONC T-LOCK	16	16.1	0	0	24	0
	93	SS21152004	36	CONC T-LOCK	569	576.4	3.9	2.9	15	58.5
	94	SS21152005	36	CONC T-LOCK	262	263.8	0	2.1	24	0

**Table A.2 - Avondale Large Diameter Condition Assessment 2014**  
**Pipe Segment Likelihood of Failure, Consequence of Failure, and Risk of Failure Summary**



Project	Pipe	Pipe Segment	Pipe Size	Pipe Type	GIS Length	CCTV Footage	Structural LoF Score	O&M LoF Score	CoF Score	RoF Score
	95	SS21153014	36	CONC T-LOCK	565	616.3	3.3	0	6	19.8
	96	SS21153015	36	CONC T-LOCK	51	50.8	0	0	9	0
	97	SS21153016	36	CONC T-LOCK	715	710.7	0	0	19	0
	98	SS21154020	36	CONC T-LOCK	639	640.2	0	0	34	0
2D	99	SS21154021	36	CONC T-LOCK	653	656.8	3.2	0	19	61
	100	SS21154023	36	CONC T-LOCK	142	142.4	0	2.2	9	0
	101	SS21154024	36	CONC T-LOCK	218	217.8	0	0	24	0
	102	SS21154026	36	CONC T-LOCK	286	286.7	0	0	24	0
	103	SS21154030	36	CONC T-LOCK	12	12.3	0	0	24	0
	104	SS21154031	36	CONC T-LOCK	309	281.7	0	0	24	0
	105	SS21161002	36	CONC T-LOCK	564	565.1	3.3	2.1	9	29.7
	106	SS21163001	36	CONC T-LOCK	285	299.6	0	0	24	0
	107	SS22142001	36	CONC T-LOCK	293	304.5	0	2.9	18	0
	108	SS22142002	36	CONC T-LOCK	337	329.4	0	2.9	9	0
	109	SS22142003	36	CONC T-LOCK	724	718.4	3.1	0	15	46.5
	110	SS22144001	36	CONC T-LOCK	342	343.2	0	0	15	0
2E	111	SS22144003	36	CONC T-LOCK	357	366.3	3.1	2.9	18	55.8
	112	SS22144004	36	CONC T-LOCK	487	489	0	2.9	18	0
	113	SS22144005	36	CONC T-LOCK	155	156.5	0	2.9	9	0
	114	SS23142016	36	CONC T-LOCK	561	560	0	0	1	0
	115	SS23142018	36	CONC T-LOCK	114	114.6	0	0	1	0
	116	SS23142020	36	CONC T-LOCK	154	156.2	0	0	15	0
	117	SS23142021	36	CONC T-LOCK	224	223	0	0	15	0
2F	118	SS23142022	36	CONC T-LOCK	263	261.9	3.3	0	15	49.5
	119	SS23143002	36	CONC T-LOCK	97	102	0	0	24	0
	120	SS23144001	36	CONC T-LOCK	651	651.5	3.3	0	1	3.3
	121	SS23144002	36	CONC T-LOCK	671	672	3.5	0	1	3.5
	122	SS24141001	36	CONC T-LOCK	554	554.7	3.1	2.9	1	3.1
	123	SS24141002	36	CONC T-LOCK	663	663.1	3.3	0	1	3.3
	124	SS24142001	36	CONC T-LOCK	662	662.5	3.1	0	1	3.1
	125	SS24142002	36	CONC T-LOCK	652	652.3	3.9	0	1	3.9

## Table A.3 - Avondale Large Diameter Sewer Condition Assessment 2014 Manhole Condition Notes



Item	FEAT_ID	Manhole Condition Rating	Comment
1	MH13173001	Fair	
2	MH13173002	Poor	Buried. Adjust to Grade - Poor from Invert Perspective
3	MH13174002	Fair	
4	MH14171001	Good	Buried. Adjust to Grade - Good from Invert Perspective
5	MH14171002	Good	
6	MH14171012	Fair	
7	MH14171014	Good	
8	MH14172022	Good	
9	MH14172023	Fair	
10	MH14172024	Good	
11	MH14172025	Good	
12	MH14173002	Fair	Buried. Adjust to Grade - Fair from Invert Perspective*
13	MH14173003	Fair	Buried. Adjust to Grade - Fair from Invert Perspective
14	MH14173004	Good	
15	MH14173008	Good	
16	MH15171020	Fair	
17	MH15171021	Fair	
18	MH15171026	Fair	
19	MH15171040	Good	
20	MH15173001	Good	
21	MH15173002	Good	
22	MH16143002	Fair	
23	MH16143005	Fair	
24	MH16162001	Fair	
25	MH16164001	Good	
26	MH16164002	Good	
27	MH16164003	Good	Buried. Adjust to Grade - Good from Invert Perspective*
28	MH16171003	Good	Connects at 3'0 Clock - Recent Rehabilitation - Rebuild MH for CIPP Installation
29	MH16171004	Good	Recent Rehabilitation
30	MH16171005	Good	
31	MH16171006	Good	
32	MH16171008	Good	Recent Rehabilitation
33	MH16172001	Poor	
34	MH16172002	Fair	Buried. Adjust to Grade - Fair from Invert Perspective
35	MH16172003	Poor	
36	MH16172004	Good	Buried. Adjust to Grade - Good from Invert Perspective
37	MH16172006	Poor	PVC Turn Back Detached at Pipe Connection, Aggregate Visible
38	MH16172007	Poor	
39	MH16173001	Good	
40	MH16173002	Good	Buried. Good from Invert Perspective - Recent Rehabilitation*
41	MH16173004	Good	
42	MH16174001	Fair	Buried. Adjust to Grade - Fair from Invert Perspective
43	MH16174002	Good	
44	MH16174003	Poor	
45	MH16174004	Good	
46	MH16174004A	Good	
47	MH17142001	Fair	
48	MH17142002	Fair	Aggregate Visible on Walls & Bench -
49	MH17142003	Fair	Aggregate Visible on Walls & Bench -
50	MH17142004	Good	
51	MH17144003	Poor	Projecting Aggregate on Walls & Bench -

\*COA ordered adjustment to grade during this condition Assessment.  
Adjustment to Grade is anticipated to be complete before February 2015.

## Table A.3 - Avondale Large Diameter Sewer Condition Assessment 2014 Manhole Condition Notes



Item	FEAT_ID	Manhole Condition Rating	Comment
52	MH17144004	Poor	Projecting Aggregate on Walls & Bench -
53	MH17154001	Fair	Internal Drop with Steel Clamp Pipe Supports
54	MH17162001	Poor	Buried. Adjust to Grade - Aggregate Visible & Detached Liner on Walls & Bench*
55	MH17162002	Poor	Buried. Adjust to Grade - Aggregate Visible & Detached Liner on Walls & Bench*
56	MH17163001	Fair	Aggregate Visible on Walls & Bench -
57	MH17163002	Poor	
58	MH17164001	MH Not Found	CCTV did not encounter MH17164001
59	MH17164002	Good	
60	MH17164003	Poor	Detached Liner with Projecting Aggregate on Walls & Bench -
61	MH17164004	Good	Buried. Adjust to Grade - Good from Invert Perspective*
62	MH17164005	Fair	
63	MH17164006	Fair	
64	MH17164007	Poor	PVC Turn Back Detached - Aggregate Visible on Walls & Bench
65	MH17164016	Fair	PVC Turn Back Detached - Aggregate Visible Below Bench
66	MH17172001	Good	
67	MH17172002	Fair	
68	MH17172003	Good	
69	MH17172010	Fair	
70	MH17174001	Good	
71	MH17174002	Good	
72	MH17174003	Poor	MH Behind Fence / Exposed Aggregate below bench
73	MH17174004	Good	
74	MH18152002	Fair	Detached Liner & Aggregate Visible on Walls & Bench
75	MH18152003	Fair	Detached Liner & Aggregate Visible on Walls & Bench
76	MH18152004	Poor	
77	MH18154001	Fair	Buried. Adjust to Grade - Fair from Invert Perspective
78	MH18154008	Fair	
79	MH18154021	Fair	
80	MH18172001	Good	
81	MH19152012	Poor	Buried. Adjust to Grade - Aggregate Visible Below Bench
82	MH19152013	Fair	Aggregate Visible with Detached Liner on Walls & Bench
83	MH19152014	Poor	Buried. Adjust to Grade - Aggregate Visible on Walls
84	MH19152015	Poor	Aggregate Visible on and Below Bench
85	MH19161017	Poor	Buried. Adjust to Grade - Aggregate Projecting, Detached Liner, on Walls & Bench
86	MH19163007	Poor	Buried. Adjust to Grade - Aggregate Visible on Walls and Bench
87	MH19163021	Fair	Aggregate Visible below Bench & on Walls - Detached Liner on Walls
88	MH19163022	Poor	Buried. Adjust to Grade - Aggregate Visible & Detached Liner on Walls view from Invert
89	MH20152014	Fair	Aggregate Visible below Bench
90	MH20154034	Poor	Liner Detached at Pipe Connection
91	MH20161025	Good	Aggregate Visible below Bench
92	MH20161026	Good	
93	MH20163005	Fair	
94	MH20163025	Good	Aggregate Visible Below Bench
95	MH21144004	Poor	Aggregate Visible on Walls & Bench -
96	MH21152001	Good	Aggregate Visible Below Bench
97	MH21153013	Fair	Aggregate Visible Below Bench

\*COA ordered adjustment to grade during this condition Assessment.  
Adjustment to Grade is anticipated to be complete before February 2015.

## Table A.3 - Avondale Large Diameter Sewer Condition Assessment 2014 Manhole Condition Notes



Item	FEAT_ID	Manhole Condition Rating	Comment
98	MH21153014	Fair	Aggregate Visible Below Bench
99	MH21154015	Good	Aggregate Visible Below Bench
100	MH21154016	Fair	Aggregate Visible Below Bench
101	MH21154017	Poor	Aggregate Visible & Projecting, Detached Liner, on Walls & Bench
102	MH21154018	Poor	Aggregate Visible & Projecting, Detached Liner, on Walls & Bench
103	MH21154019	Fair	Aggregate Visible Below Bench
104	MH21154020	Poor	
105	MH21154021	Fair	PVC Turn Back Detached at Pipe Connection - Aggregate Visible Below Bench
106	MH21154022	Good	Pipe does not cut out - No Access from Manhole
107	MH21161001	Poor	PVC Turn Back Detached at Pipe Connection - Aggregate Visible Below Bench
108	MH21161002	Good	Aggregate Visible Below Bench
109	MH21161003	Fair	Aggregate Visible Below Bench
110	MH21163001	Good	Aggregate Visible Below Bench
111	MH22142001	Poor	Aggregate Visible on Walls & Bench -
112	MH22142002	Poor	Aggregate Visible & Projecting, Detached Liner, on Walls & Bench
113	MH22142003	Poor	Aggregate Visible & Projecting, on Walls & Bench
114	MH22144001	Good	Aggregate Visible Below Bench
115	MH22144002	Good	Aggregate Visible Below Bench
116	MH22144003	Fair	PVC Turn Back Detached at Pipe Connection
117	MH23142012	Good	Recent Rehabilitation
118	MH23142013	Good	Recent Rehabilitation
119	MH23142014	Good	Recent Rehabilitation
120	MH23142015	Good	Recent Rehabilitation
121	MH23142016	Poor	Aggregate Visible below Bench & on Walls
122	MH23143002	Good	Recent Rehabilitation
123	MH23144001	Good	
124	MH23144002	Good	Buried. Adjust to Grade - Good from Invert Perspective
125	MH24132005	Good	Buried. Adjust to Grade - Good from Invert Perspective
126	MH24141001	Good	
127	MH24141002	Good	
128	MH24142001	Good	
129	MH24142002	Good	

\*COA ordered adjustment to grade during this condition Assessment.  
Adjustment to Grade is anticipated to be complete before February 2015.

**Table A.4- Avondale Large Diameter Condition Assessment 2014  
Pipe Recommendations**



Project	Pipe	Pipe Segment	Pipe Size	Pipe Type	GIS Length	CCTV Footage	Rehabilitation Recommendations			
							CIPP Liner	Clean	Reassess in 5 - 10 Years	Do Nothing
	1	SS13173001	21	VCP	588	590.8		X		
	2	SS14171002	21	VCP	599	611.3		X		
	3	SS14171003	21	VCP	505	509.4		X		
	4	SS14171004	21	VCP	95	131.2		X		
	5	SS14171005	21	VCP	413	413.2		X		
	6	SS14171006	21	VCP	313	282.1		X		
	7	SS14171007	21	VCP	82	73.5				X
	8	SS14172028	21	VCP	35	34				X
	9	SS14172029	21	VCP	471	474.2				X
	10	SS14172030	21	VCP	494	496.8		X		
	11	SS14172031	21	VCP	286	286.8		X		
	12	SS14173001	21	VCP	227	261.6				X
	13	SS14173002	21	VCP	541	543.3		X		
	14	SS14173003	21	VCP	541	539.5		X		
	15	SS15171031	21	VCP	321	331.7		X		
	16	SS15171032	21	VCP	609	579.3		X		
	17	SS15171033	21	VCP	396	397.1		X	X	
	18	SS15171052	21	VCP	17	17.9				X
	19	SS15173001	21	VCP	212	189.1				X
1E	20	SS15173002	30	CONC T-LOCK	597	559.8	X			
1E	21	SS15173003	30	CONC T-LOCK	513	538.2	X			
	22	SS16143002	24	VCP	429	431.6		X	X	
	23	SS16143003	24	VCP	154	154.3		X		
2G	24	SS16164001	30	CONC T-LOCK	153	152.1	X		X	
	25	SS16164002	24	CONC T-LOCK	244	244.6				X
	26	SS16164003	24	CONC T-LOCK	412	404				X
	27	SS16171001	30	CONC T-LOCK	120	58.1				X
1E	28	SS16171002	30	CONC T-LOCK	287	231	X			
	29	SS16171003	30	CONC T-LOCK	56	55.5				X
1E	30	SS16171004	30	CONC T-LOCK	576	570.6	X			
1E	31	SS16171005	30	CONC T-LOCK	331	375	X			
2H	32	SS16172001	24	CONC T-LOCK	492	491.2	X		X	
	33	SS16172002A	24	CONC T-LOCK	75	91.5			X	
	34	SS16172002B	24	CONC T-LOCK	238	250.5			X	
	35	SS16172003	24	CONC T-LOCK	326	325.5			X	
	36	SS16172004	24	CONC T-LOCK	90	80.8			X	
2G	37	SS16173003	30	CONC T-LOCK	484	540.6	X		X	
1A	38	SS16174001	24	CONC T-LOCK	177	172.8	X			
1A	39	SS16174002	24	CONC T-LOCK	100	115.3	X			
1A	40	SS16174003	24	CONC T-LOCK	592	593.4	X			
	41	SS16174004	30	CONC T-LOCK	520	504.7			X	
	42	SS16174004A	30	CONC T-LOCK	390	20.6				X
	43	SS17142001	24	VCP	112	112.8		X	X	
1B	44	SS17142002	24	VCP	496	503	X			
	45	SS17142003	24	VCP	625	624.4		X		

**Table A.4- Avondale Large Diameter Condition Assessment 2014  
Pipe Recommendations**



Project	Pipe	Pipe Segment	Pipe Size	Pipe Type	GIS Length	CCTV Footage	Rehabilitation Recommendations			
							CIPP Liner	Clean	Reassess in 5 - 10 Years	Do Nothing
	46	SS17144012	24	VCP	17	17				
	47	SS17144013	24	VCP	27	25.5				X
	48	SS17144014	24	VCP	597	604.1		X	X	
2A	49	SS17162001	36	CONC T-LOCK	540	553.7	X		X	
2A	50	SS17162002	36	CONC T-LOCK	532	532.5	X		X	
2A	51	SS17162003	36	CONC T-LOCK	542	555.1	X		X	
	52	SS17163001	36	CONC T-LOCK	407	477	X	X	X	
1C	53	SS17163002	36	CONC T-LOCK	517	523.6	X			
1C	54	SS17163003	36	CONC T-LOCK	506	509.4	X			
1D	55	SS17164001	36	CONC T-LOCK	22	21	X			
2A	56	SS17164003	36	CONC T-LOCK	554	553.8	X		X	
2A	57	SS17164004	36	CONC T-LOCK	550	553.1	X		X	
1D	58	SS17164005	36	CONC T-LOCK	523	498.1	X			
1D	59	SS17164006	36	CONC T-LOCK	518	520.5	X			
1D	60	SS17164034	36	CONC T-LOCK	67	73.6	X			
1D	61	SS17164035	36	CONC T-LOCK	46	45	X			
	62	SS17172001	30	CONC T-LOCK	390	390			X	
	63	SS17172002	30	CONC T-LOCK	371	374.2			X	
	64	SS17172005	30	CONC T-LOCK	318	320.5			X	
	65	SS17172015	30	CONC T-LOCK	5	11.1				X
	66	SS17172016	30	CONC T-LOCK	245	241.1			X	
	67	SS17174001	30	CONC T-LOCK	244	244.2				X
	68	SS17174002	30	CONC T-LOCK	401	404.8		X		
	69	SS17174003	30	CONC T-LOCK	377	384		X		
	70	SS18152006	36	CONC T-LOCK	215	216.4			X	
	71	SS18152007	30	CONC T-LOCK	487	485			X	
1C	72	SS18152008	30	CONC T-LOCK	517	517	X			
	73	SS18154001	36	CONC T-LOCK	474	478.8			X	
	74	SS18154002	36	CONC T-LOCK	228	228.2				X
	75	SS18154003	36	CONC T-LOCK	502	507.1			X	
	76	SS18154004	36	CONC T-LOCK	201	198.3		X	X	
	77	SS18172001	30	CONC T-LOCK	589	593.3		X	X	
	78	SS19152014	36	CONC T-LOCK	531	532.9		X		
	79	SS19152015	36	CONC T-LOCK	119	117.9		X		
	80	SS19152016	36	CONC T-LOCK	383	382.3			X	
	81	SS19161018	36	CONC T-LOCK	74	72.8		X		
	82	SS19163010	36	CONC T-LOCK	281	285.2			X	
	83	SS19163025	36	CONC T-LOCK	283	283.1			X	
	84	SS19163026	36	CONC T-LOCK	412	412.2				X
2C	85	SS19163027	36	CONC T-LOCK	594	594.1	X		X	
	86	SS20152015	36	CONC T-LOCK	693	700.5		X		
	87	SS20154037	36	CONC T-LOCK	26	26.8		X	X	
1F	88	SS20154038	36	CONC T-LOCK	672	669.3	X			
	89	SS20161035	36	CONC T-LOCK	549	552.5				X
	90	SS20163026	36	CONC T-LOCK	678	680.8		X		

**Table A.4- Avondale Large Diameter Condition Assessment 2014  
Pipe Recommendations**



Project	Pipe	Pipe Segment	Pipe Size	Pipe Type	GIS Length	CCTV Footage	Rehabilitation Recommendations			
							CIPP Liner	Clean	Reassess in 5 - 10 Years	Do Nothing
	91	SS21152002	36	CONC T-LOCK	14	16				X
	92	SS21152003	36	CONC T-LOCK	16	16.1		X		
	93	SS21152004	36	CONC T-LOCK	569	576.4		X	X	
	94	SS21152005	36	CONC T-LOCK	262	263.8		X		
	95	SS21153014	36	CONC T-LOCK	565	616.3			X	
	96	SS21153015	36	CONC T-LOCK	51	50.8				X
	97	SS21153016	36	CONC T-LOCK	715	710.7				X
	98	SS21154020	36	CONC T-LOCK	639	640.2				X
2D	99	SS21154021	36	CONC T-LOCK	653	656.8	X		X	
	100	SS21154023	36	CONC T-LOCK	142	142.4		X		
	101	SS21154024	36	CONC T-LOCK	218	217.8				X
	102	SS21154026	36	CONC T-LOCK	286	286.7				X
	103	SS21154030	36	CONC T-LOCK	12	12.3				X
	104	SS21154031	36	CONC T-LOCK	309	281.7				X
	105	SS21161002	36	CONC T-LOCK	564	565.1		X	X	
	106	SS21163001	36	CONC T-LOCK	285	299.6				X
	107	SS22142001	36	CONC T-LOCK	293	304.5		X		
	108	SS22142002	36	CONC T-LOCK	337	329.4		X		
	109	SS22142003	36	CONC T-LOCK	724	718.4			X	
	110	SS22144001	36	CONC T-LOCK	342	343.2				X
2E	111	SS22144003	36	CONC T-LOCK	357	366.3	X		X	
	112	SS22144004	36	CONC T-LOCK	487	489		X		
	113	SS22144005	36	CONC T-LOCK	155	156.5		X		
	114	SS23142016	36	CONC T-LOCK	561	560				X
	115	SS23142018	36	CONC T-LOCK	114	114.6				X
	116	SS23142020	36	CONC T-LOCK	154	156.2				X
	117	SS23142021	36	CONC T-LOCK	224	223				X
2F	118	SS23142022	36	CONC T-LOCK	263	261.9	X		X	
	119	SS23143002	36	CONC T-LOCK	97	102				X
	120	SS23144001	36	CONC T-LOCK	651	651.5			X	
	121	SS23144002	36	CONC T-LOCK	671	672			X	
	122	SS24141001	36	CONC T-LOCK	554	554.7		X	X	
	123	SS24141002	36	CONC T-LOCK	663	663.1			X	
	124	SS24142001	36	CONC T-LOCK	662	662.5			X	
	125	SS24142002	36	CONC T-LOCK	652	652.3			X	

# Table A.5 - Avondale Large Diameter Sewer Condition Assessment 2014 Manhole Recommendations



Item	FEAT_ID	Manhole Condition Rating	Comment	Project	Recommendation	
					0-3 Years	
					Adjust to Grade	NASSCO MACP Level 2 Condition Assessment
					\$ 1,350.00	\$ 350.00
		EA	EA			
1	MH13173001	Fair				
2	MH13173002	Poor	Buried. Adjust to Grade - Poor from Invert Perspective	OTHER	1	1
3	MH13174002	Fair				
4	MH14171001	Good	Buried. Adjust to Grade - Good from Invert Perspective		1	
5	MH14171002	Good				
6	MH14171012	Fair				
7	MH14171014	Good				
8	MH14172022	Good				
9	MH14172023	Fair				
10	MH14172024	Good				
11	MH14172025	Good				
12	MH14173002	Fair	Buried. Adjust to Grade - Fair from Invert Perspective*		0	
13	MH14173003	Fair	Buried. Adjust to Grade - Fair from Invert Perspective		1	
14	MH14173004	Good				
15	MH14173008	Good				
16	MH15171020	Fair				
17	MH15171021	Fair				
18	MH15171026	Fair				
19	MH15171040	Good				
20	MH15173001	Good				
21	MH15173002	Good				
22	MH16143002	Fair				
23	MH16143005	Fair				
24	MH16162001	Fair				
25	MH16164001	Good				
26	MH16164002	Good				
27	MH16164003	Good	Buried. Adjust to Grade - Good from Invert Perspective*		0	
28	MH16171003	Good	Connects at 3'0 Clock - Recent Rehabilitation - Rebuild MH for CIPP Installation	1E		
29	MH16171004	Good	Recent Rehabilitation			
30	MH16171005	Good				
31	MH16171006	Good				
32	MH16171008	Good	Recent Rehabilitation			
33	MH16172001	Poor		2H		1
34	MH16172002	Fair	Buried. Adjust to Grade - Fair from Invert Perspective		1	
35	MH16172003	Poor		OTHER		1
36	MH16172004	Good	Buried. Adjust to Grade - Good from Invert Perspective		1	
37	MH16172006	Poor	PVC Turn Back Detached at Pipe Connection, Aggregate Visible	2H		1
38	MH16172007	Poor		OTHER		1
39	MH16173001	Good				
40	MH16173002	Good	Buried. Good from Invert Perspective - Recent Rehabilitation*		0	
41	MH16173004	Good				
42	MH16174001	Fair	Buried. Adjust to Grade - Fair from Invert Perspective		1	
43	MH16174002	Good				
44	MH16174003	Poor		1A		1
45	MH16174004	Good				
46	MH16174004A	Good				
47	MH17142001	Fair				
48	MH17142002	Fair	Aggregate Visible on Walls & Bench -			
49	MH17142003	Fair	Aggregate Visible on Walls & Bench -			
50	MH17142004	Good				
51	MH17144003	Poor	Projecting Aggregate on Walls & Bench -	OTHER		1
52	MH17144004	Poor	Projecting Aggregate on Walls & Bench -	OTHER		1
53	MH17154001	Fair	Internal Drop with Steel Clamp Pipe Supports			
54	MH17162001	Poor	Buried. Adjust to Grade - Aggregate Visible & Detached Liner on Walls & Bench*	OTHER	0	1
55	MH17162002	Poor	Buried. Adjust to Grade - Aggregate Visible & Detached Liner on Walls & Bench*	OTHER	0	1
56	MH17163001	Fair	Aggregate Visible on Walls & Bench -			
57	MH17163002	Poor		1C		1
58	MH17164001	MH Not Found	CCTV did not encounter MH17164001	OTHER	0	0
59	MH17164002	Good				
60	MH17164003	Poor	Detached Liner with Projecting Aggregate on Walls & Bench -	2B		1
61	MH17164004	Good	Buried. Adjust to Grade - Good from Invert Perspective*	1D	0	
62	MH17164005	Fair				
63	MH17164006	Fair				
64	MH17164007	Poor	PVC Turn Back Detached - Aggregate Visible on Walls & Bench	1D		1
65	MH17164016	Fair	PVC Turn Back Detached - Aggregate Visible Below Bench			
66	MH17172001	Good				
67	MH17172002	Fair				

\*COA ordered adjustment to grade during this condition Assessment.  
Adjustment to Grade is anticipated to be complete before February 2015.

**Table A.5 - Avondale Large Diameter Sewer Condition Assessment 2014  
Manhole Recommendations**



Item	FEAT_ID	Manhole Condition Rating	Comment	Project	Recommendation	
					0-3 Years	
					Adjust to Grade	NASSCO MACP Level 2 Condition Assessment
					\$ 1,350.00	\$ 350.00
					EA	EA
68	MH17172003	Good				
69	MH17172010	Fair				
70	MH17174001	Good				
71	MH17174002	Good				
72	MH17174003	Poor	MH Behind Fence / Exposed Aggregate below bench	OTHER		1
73	MH17174004	Good				
74	MH18152002	Fair	Detached Liner & Aggregate Visible on Walls & Bench			
75	MH18152003	Fair	Detached Liner & Aggregate Visible on Walls & Bench			
76	MH18152004	Poor		1C		1
77	MH18154001	Fair	Buried. Adjust to Grade - Fair from Invert Perspective		1	
78	MH18154008	Fair				
79	MH18154021	Fair				
80	MH18172001	Good				
81	MH19152012	Poor	Buried. Adjust to Grade - Aggregate Visible Below Bench	OTHER	1	1
82	MH19152013	Fair	Aggregate Visible with Detached Liner on Walls & Bench			
83	MH19152014	Poor	Buried. Adjust to Grade - Aggregate Visible on Walls	OTHER	1	1
84	MH19152015	Poor	Aggregate Visible on and Below Bench	OTHER		1
85	MH19161017	Poor	Buried. Adjust to Grade - Aggregate Projecting, Detached Liner, on Walls & Bench		1	
86	MH19163007	Poor	Buried. Adjust to Grade - Aggregate Visible on Walls and Bench		1	
87	MH19163021	Fair	Aggregate Visible below Bench & on Walls - Detached Liner on Walls			
88	MH19163022	Poor	Buried. Adjust to Grade - Aggregate Visible & Detached Liner on Walls view from Invert	OTHER	1	1
89	MH20152014	Fair	Aggregate Visible below Bench			
90	MH20154034	Poor	Liner Detached at Pipe Connection	OTHER		1
91	MH20161025	Good	Aggregate Visible below Bench			
92	MH20161026	Good				
93	MH20163005	Fair				
94	MH20163025	Good	Aggregate Visible Below Bench			
95	MH21144004	Poor	Aggregate Visible on Walls & Bench -	OTHER		1
96	MH21152001	Good	Aggregate Visible Below Bench			
97	MH21153013	Fair	Aggregate Visible Below Bench			
98	MH21153014	Fair	Aggregate Visible Below Bench			
99	MH21154015	Good	Aggregate Visible Below Bench			
100	MH21154016	Fair	Aggregate Visible Below Bench			
101	MH21154017	Poor	Aggregate Visible & Projecting, Detached Liner, on Walls & Bench	OTHER		1
102	MH21154018	Poor	Aggregate Visible & Projecting, Detached Liner, on Walls & Bench	OTHER		1
103	MH21154019	Fair	Aggregate Visible Below Bench			
104	MH21154020	Poor		2D		1
105	MH21154021	Fair	PVC Turn Back Detached at Pipe Connection - Aggregate Visible Below Bench			
106	MH21154022	Good	Pipe does not cut out - No Access from Manhole			
107	MH21161001	Poor	PVC Turn Back Detached at Pipe Connection - Aggregate Visible Below Bench	OTHER		1
108	MH21161002	Good	Aggregate Visible Below Bench			
109	MH21161003	Fair	Aggregate Visible Below Bench			
110	MH21163001	Good	Aggregate Visible Below Bench			
111	MH22142001	Poor	Aggregate Visible on Walls & Bench -	2E		1
112	MH22142002	Poor	Aggregate Visible & Projecting, Detached Liner, on Walls & Bench	OTHER		1
113	MH22142003	Poor	Aggregate Visible & Projecting, on Walls & Bench	OTHER		1
114	MH22144001	Good	Aggregate Visible Below Bench			
115	MH22144002	Good	Aggregate Visible Below Bench			
116	MH22144003	Fair	PVC Turn Back Detached at Pipe Connection			
117	MH23142012	Good	Recent Rehabilitation			
118	MH23142013	Good	Recent Rehabilitation			
119	MH23142014	Good	Recent Rehabilitation			
120	MH23142015	Good	Recent Rehabilitation			
121	MH23142016	Poor	Aggregate Visible below Bench & on Walls	2F		1
122	MH23143002	Good	Recent Rehabilitation			
123	MH23144001	Good				
124	MH23144002	Good	Buried. Adjust to Grade - Good from Invert Perspective		1	
125	MH24132005	Good	Buried. Adjust to Grade - Good from Invert Perspective		1	
126	MH24141001	Good				
127	MH24141002	Good				
128	MH24142001	Good				
129	MH24142002	Good				

\*COA ordered adjustment to grade during this condition Assessment.  
Adjustment to Grade is anticipated to be complete before February 2015.



# Table A.6 - Avondale Large Diameter Sewer Condition Assessment 2014

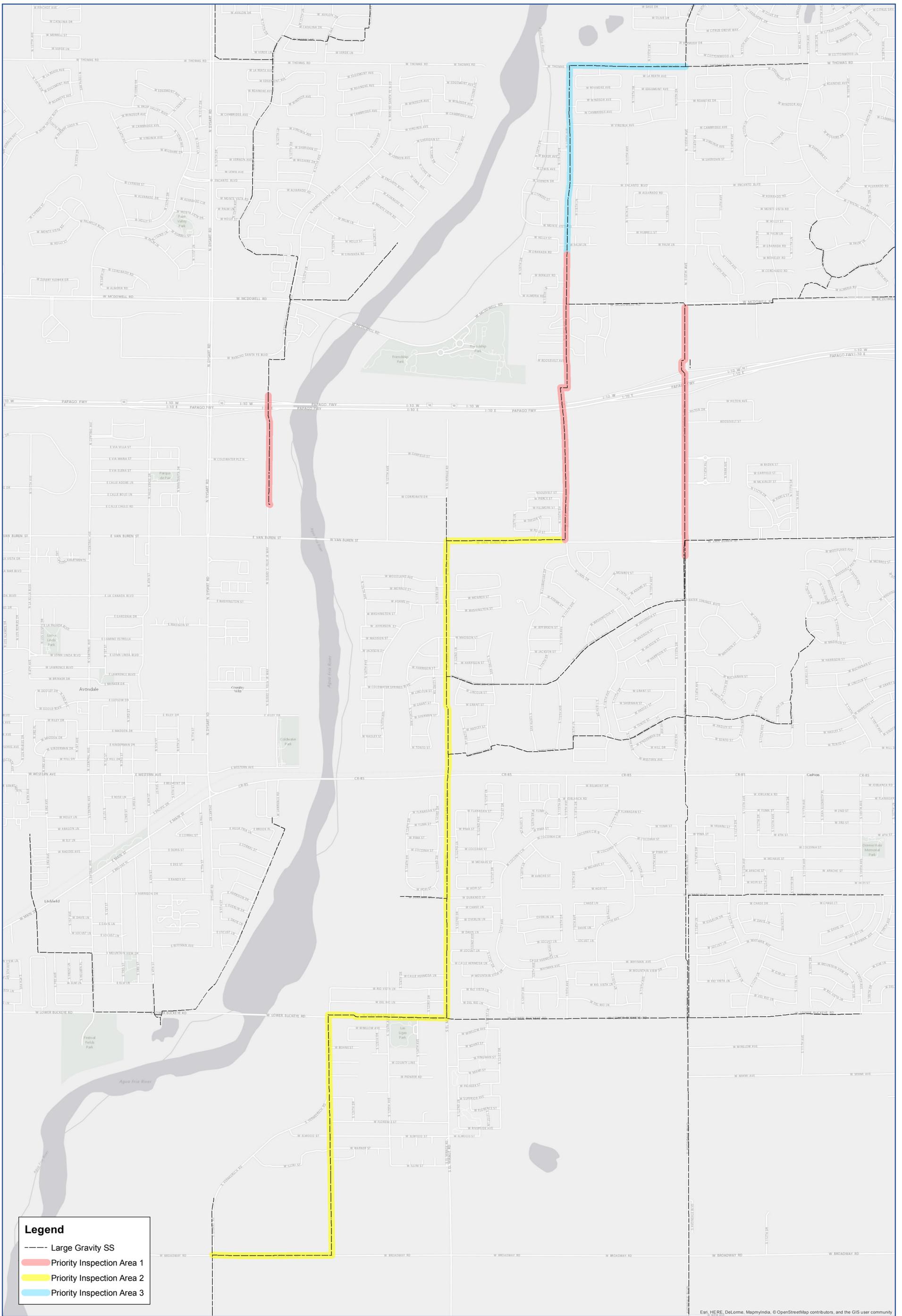
## Pipe Condition Assessment Comparison



Pipe Segment	Upstream MH	Downstream MH	Pipe Diameter	Pipe Material	2009 Defect	2009 Inspection Area	2014 Inspection Area	2014 Defect	2014 Rate of Deterioration	2009 Recommendation	2014 Recommendation
SS16143002	MH16143002	MH16143005	24	VCP	Longitudinal Crack	9	1	CS	Slow	Re-inspect in 1-5 Years	Clean and Re-inspect in 1-5 Years
SS17142002	MH17142003	MH17142001	24	VCP	Longitudinal Crack	9	1	FL	Moderate	Re-inspect in 1-5 Years	Rehabilitate in 1-5 years
SS17142002	MH17142003	MH17142001	24	VCP	No Defect Noted	9	1	FL	Moderate	Re-inspect in 1-5 Years	Rehabilitate in 1-5 years
SS17142002	MH17142003	MH17142001	24	VCP	Circumferential Crack	9	1	FM	Moderate	Re-inspect in 1-5 Years	Rehabilitate in 1-5 years
SS15173003	MH15173002	MH16171008	30	CONC_T-LOCK	Lining peeling at MH	10	1	No Defect Noted	Slow	Rehabilitate or Replace	Rehabilitate in 1-5 years
SS15173003	MH15173002	MH16171008	30	CONC_T-LOCK	No Defect Noted	10	1	Liner Detached at Joint	Moderate	Rehabilitate or Replace	Rehabilitate in 1-5 years
SS16171002	MH16171003	MH16171006	30	CONC_T-LOCK	Hole in Liner	10	1	Liner Bulge	Moderate	Rehabilitate or Replace	Rehabilitate in 1-5 years
SS16171002	MH16171003	MH16171006	30	CONC_T-LOCK	Hole in Liner	10	1	Liner Bulge	Moderate	Rehabilitate or Replace	Rehabilitate in 1-5 years
SS16171002	MH16171003	MH16171006	30	CONC_T-LOCK	Detached Liner	10	1	Repair Patch	N/A	Rehabilitate or Replace	Rehabilitate in 1-5 years
SS16171002	MH16171003	MH16171006	30	CONC_T-LOCK	Detached Liner	10	1	Repair Patch	N/A	Rehabilitate or Replace	Rehabilitate in 1-5 years
SS16173003	MH16173002	MH16173004	30	CONC_T-LOCK	Blistered Liner	10	1	Liner Blister	Slow	Rehabilitate or Replace	Rehabilitate in 5-10 years, Reassess in 1-5 years
SS16173003	MH16173002	MH16173004	30	CONC_T-LOCK	No Defect Noted	10	1	Liner Detached at Joint	Moderate	Rehabilitate or Replace	Rehabilitate in 5-10 years, Reassess in 1-5 years
SS16173003	MH16173002	MH16173004	30	CONC_T-LOCK	Lining peeling at MH	10	1	No Defect Noted	Slow	Rehabilitate or Replace	Rehabilitate in 5-10 years, Reassess in 1-5 years
SS16164001	MH16173004	MH16164001	30	CONC_T-LOCK	Buckled Liner	10	1	Detached Liner at Pipe Size Change	Moderate	Rehabilitate or Replace	Rehabilitate in 5-10 years, Reassess in 1-5 years
SS16164001	MH16173004	MH16164001	30	CONC_T-LOCK	Hole in Liner	10	1	Liner Bulge	Moderate	Rehabilitate or Replace	Rehabilitate in 5-10 years, Reassess in 1-5 years
SS16164001	MH16173004	MH16164001	30	CONC_T-LOCK	Lining peeling at MH	10	1	No Defect Noted	Slow	Rehabilitate or Replace	Rehabilitate in 5-10 years, Reassess in 1-5 years
SS17162001	MH16164003	MH17162001	36	CONC_T-LOCK	Buckled Liner	11	1	Blisters throughout	Moderate	Rehabilitate or Replace	Rehabilitate in 5-10 years, Reassess in 1-5 years
SS17162001	MH16164003	MH17162001	36	CONC_T-LOCK	Detached Liner at Joint	11	1	Detached Liner at Joint	Slow	Rehabilitate or Replace	Rehabilitate in 5-10 years, Reassess in 1-5 years
SS17162001	MH16164003	MH17162001	36	CONC_T-LOCK	Liners buckled at Joints throughout	11	1	Liner Blisters Throughout	Moderate	Rehabilitate or Replace	Rehabilitate in 5-10 years, Reassess in 1-5 years
SS17162002	MH17162001	MH17162002	36	CONC_T-LOCK	Buckled Liner	11	1	No Defect Noted	Slow	Rehabilitate or Replace	Rehabilitate in 5-10 years, Reassess in 1-5 years
SS17162002	MH17162001	MH17162002	36	CONC_T-LOCK	Hole in Liner	11	1	Liner Bulge	Moderate	Rehabilitate or Replace	Rehabilitate in 5-10 years, Reassess in 1-5 years
SS17162002	MH17162001	MH17162002	36	CONC_T-LOCK	Hole in Liner	11	1	Liner Bulge	Moderate	Rehabilitate or Replace	Rehabilitate in 5-10 years, Reassess in 1-5 years
SS17162002	MH17162001	MH17162002	36	CONC_T-LOCK	Hole in Liner	11	1	Liner Bulge	Moderate	Rehabilitate or Replace	Rehabilitate in 5-10 years, Reassess in 1-5 years
SS17162002	MH17162001	MH17162002	36	CONC_T-LOCK	Hole in Liner	11	1	Liner Bulge	Moderate	Rehabilitate or Replace	Rehabilitate in 5-10 years, Reassess in 1-5 years
SS17162002	MH17162001	MH17162002	36	CONC_T-LOCK	Hole in Liner	11	1	Liner Bulge	Moderate	Rehabilitate or Replace	Rehabilitate in 5-10 years, Reassess in 1-5 years
SS17162002	MH17162001	MH17162002	36	CONC_T-LOCK	Detached Liner	11	1	Detached Liner at Joint	Slow	Rehabilitate or Replace	Rehabilitate in 5-10 years, Reassess in 1-5 years
SS17162002	MH17162001	MH17162002	36	CONC_T-LOCK	Hole in Liner	11	1	Liner Bulge	Moderate	Rehabilitate or Replace	Rehabilitate in 5-10 years, Reassess in 1-5 years
SS17162003	MH17162002	MH17164003	36	CONC_T-LOCK	Split in Liner	11	1	Liner Bulge	Fast	Rehabilitate or Replace	Rehabilitate in 5-10 years, Reassess in 1-5 years
SS20154037	MH20152014	MH20163005	36	CONC_T-LOCK	Liner Detached	14	2	No Defect Noted	Slow	Re-inspect in 1-5 Years	Clean and Re-inspect in 1-5 Years

# Appendix B

Condition Assessment Figures



**Legend**

- Large Gravity SS
- Priority Inspection Area 1
- Priority Inspection Area 2
- Priority Inspection Area 3

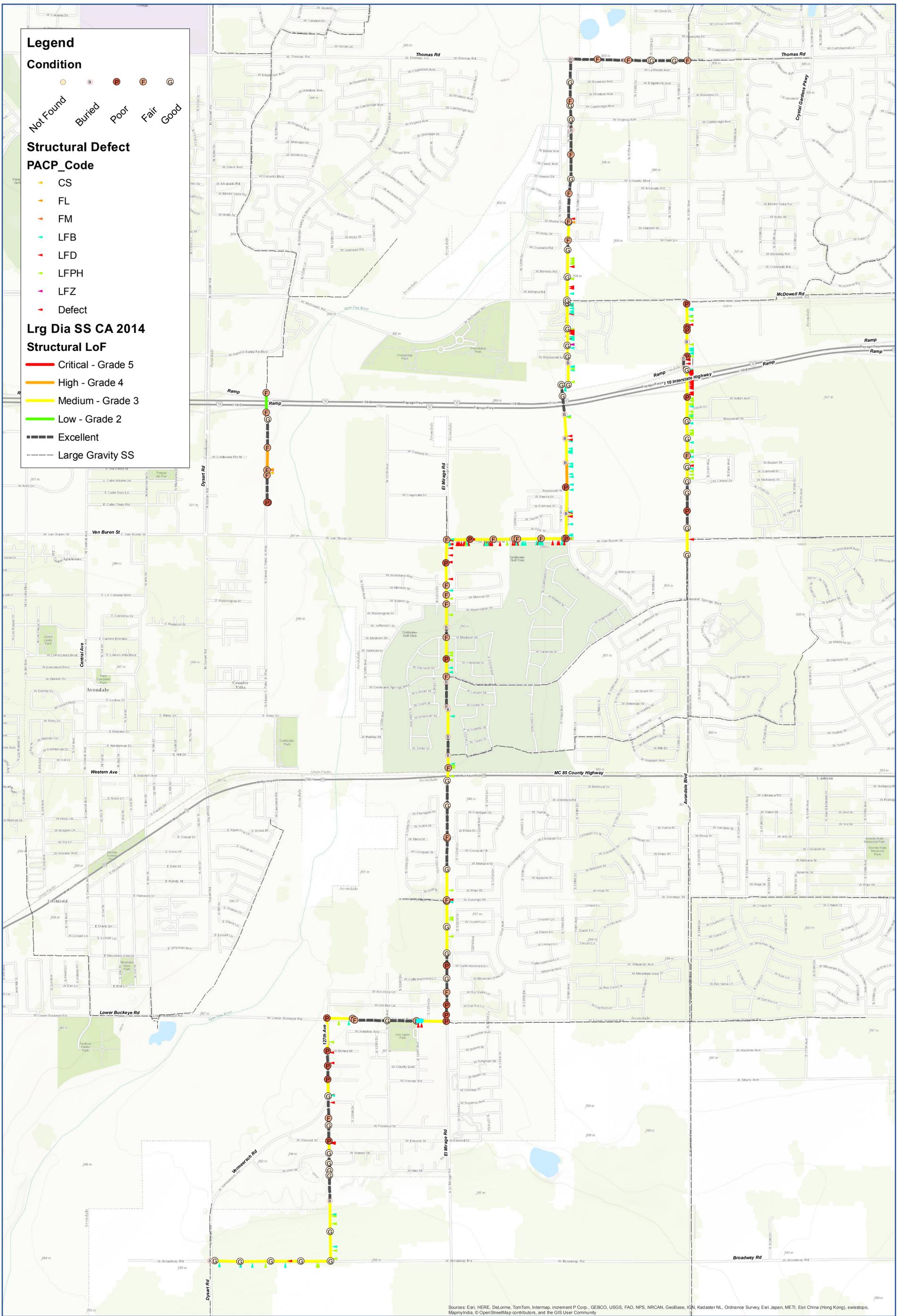
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**Exhibit A**  
**Avondale Large Diameter Sewer Condition Assessment 2014**  
**Priority Inspection Areas**



NOT TO SCALE



Sources: Esri, HERE, DeLorme, TomTom, Intermap, Incept P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community

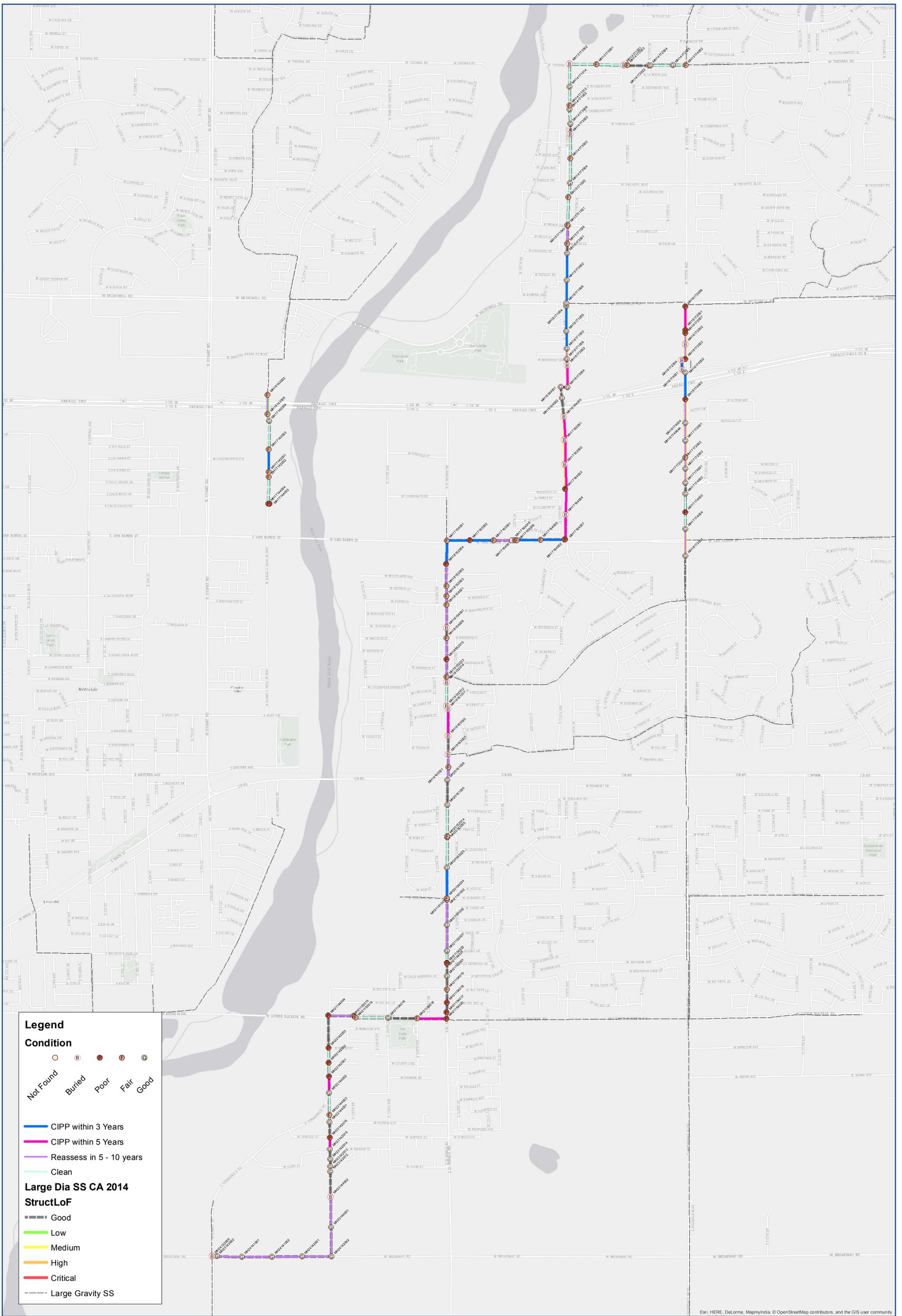


**Exhibit B**  
**Avondale Large Diameter Sewer Condition Assessment 2014**  
**Likelihood of Failure (LoF) Map**



NOT TO SCALE





**Legend**

**Condition**

- Not Found
- Buried
- Poor
- Fair
- Good

- CIPP within 3 Years
- CIPP within 5 Years
- Reassess in 5 - 10 years
- Clean

**Large Dia SS CA 2014**

**StructLoF**

- Good
- Low
- Medium
- High
- Critical
- Large Gravity SS

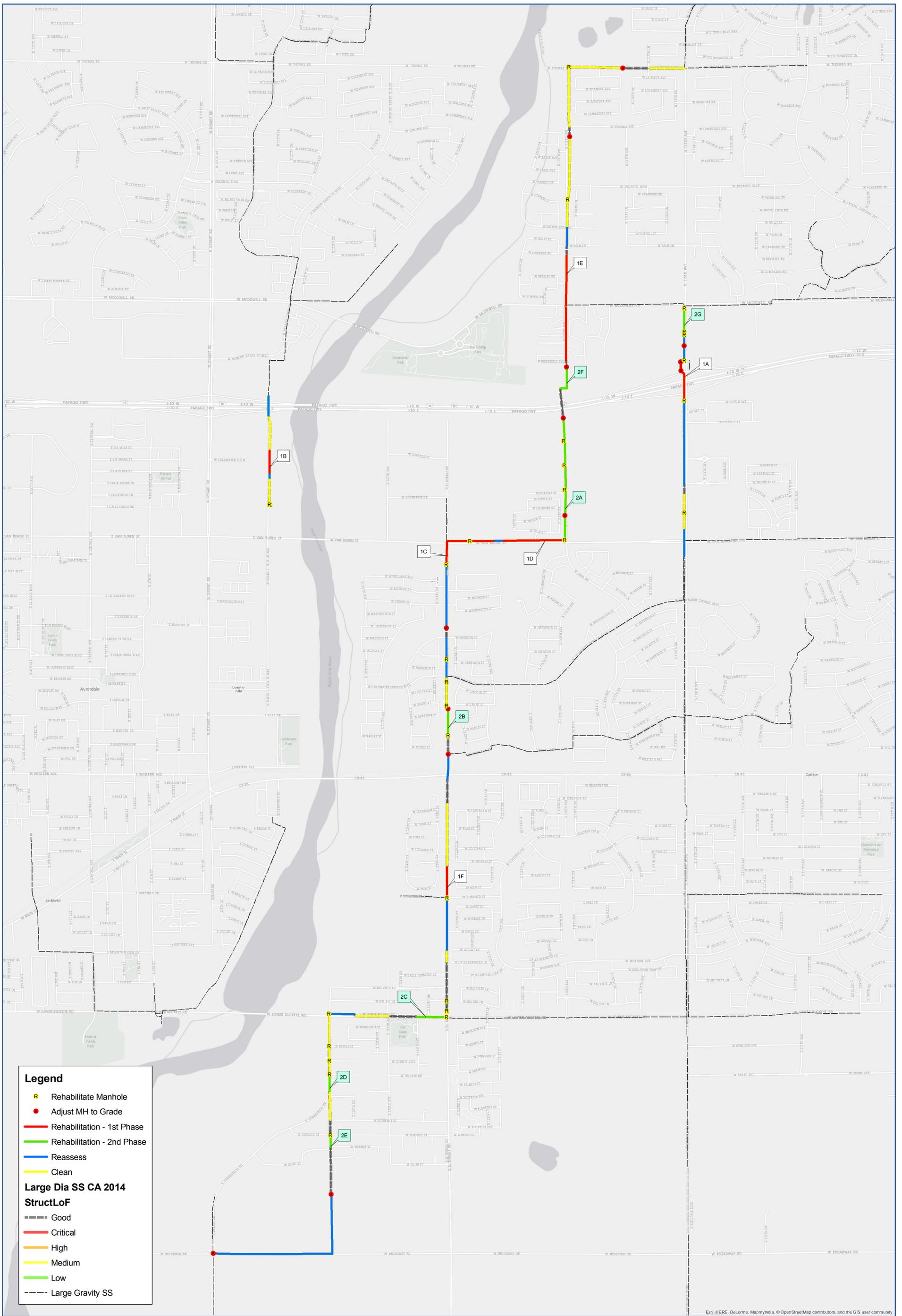
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**Exhibit D**  
**Avondale Large Diameter Sewer Condition Assessment 2014**  
**Manhole Condition**



NOT TO SCALE



**Legend**

- R Rehabilitate Manhole
- Adjust MH to Grade
- Rehabilitation - 1st Phase
- Rehabilitation - 2nd Phase
- Reassess
- Clean

**Large Dia SS CA 2014**

**StructLoF**

- Good
- Critical
- High
- Medium
- Low
- Large Gravity SS

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# Exhibit E Avondale Large Diameter Sewer Condition Assessment 2014 Rehabilitation Recommendations

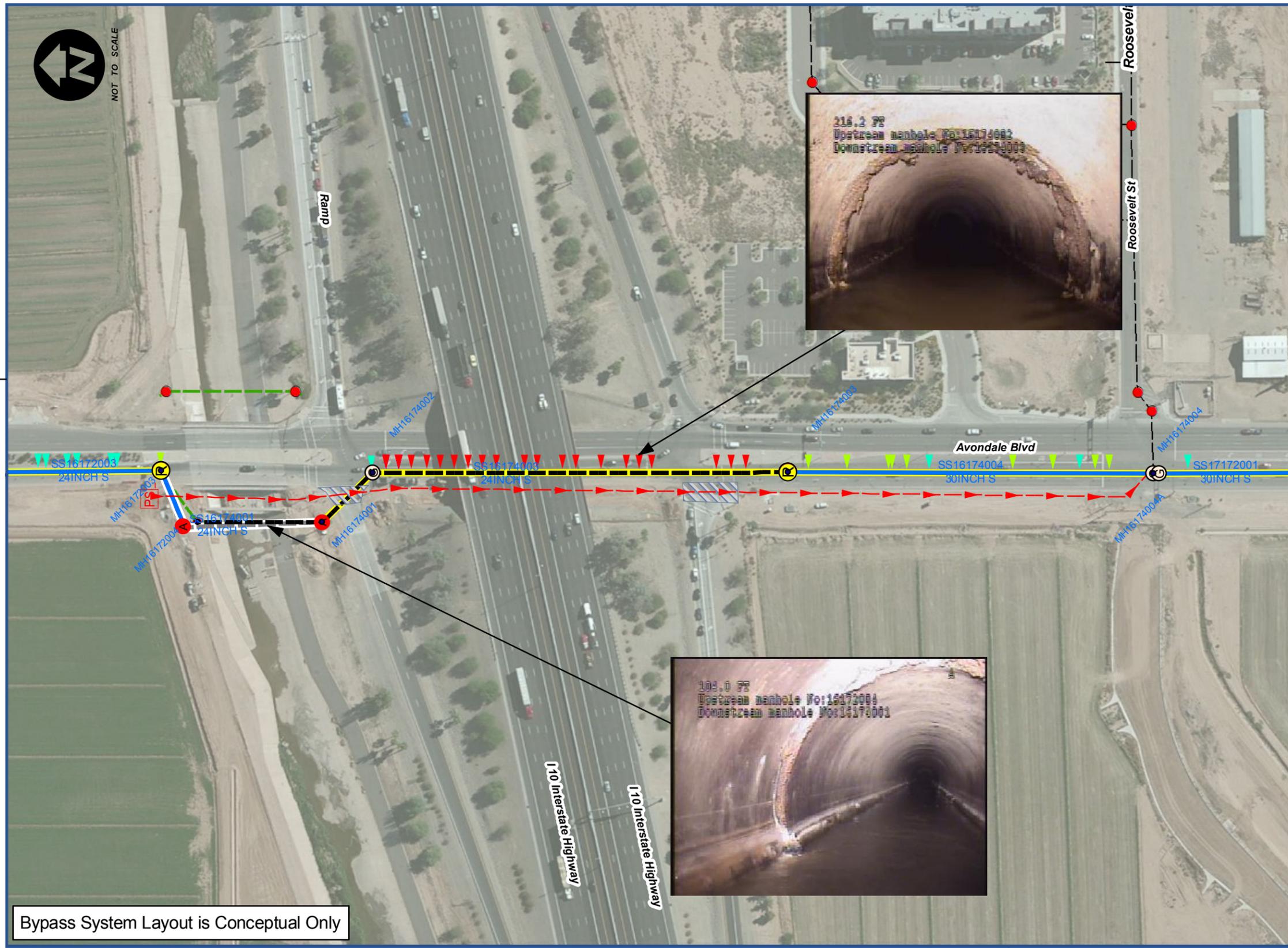
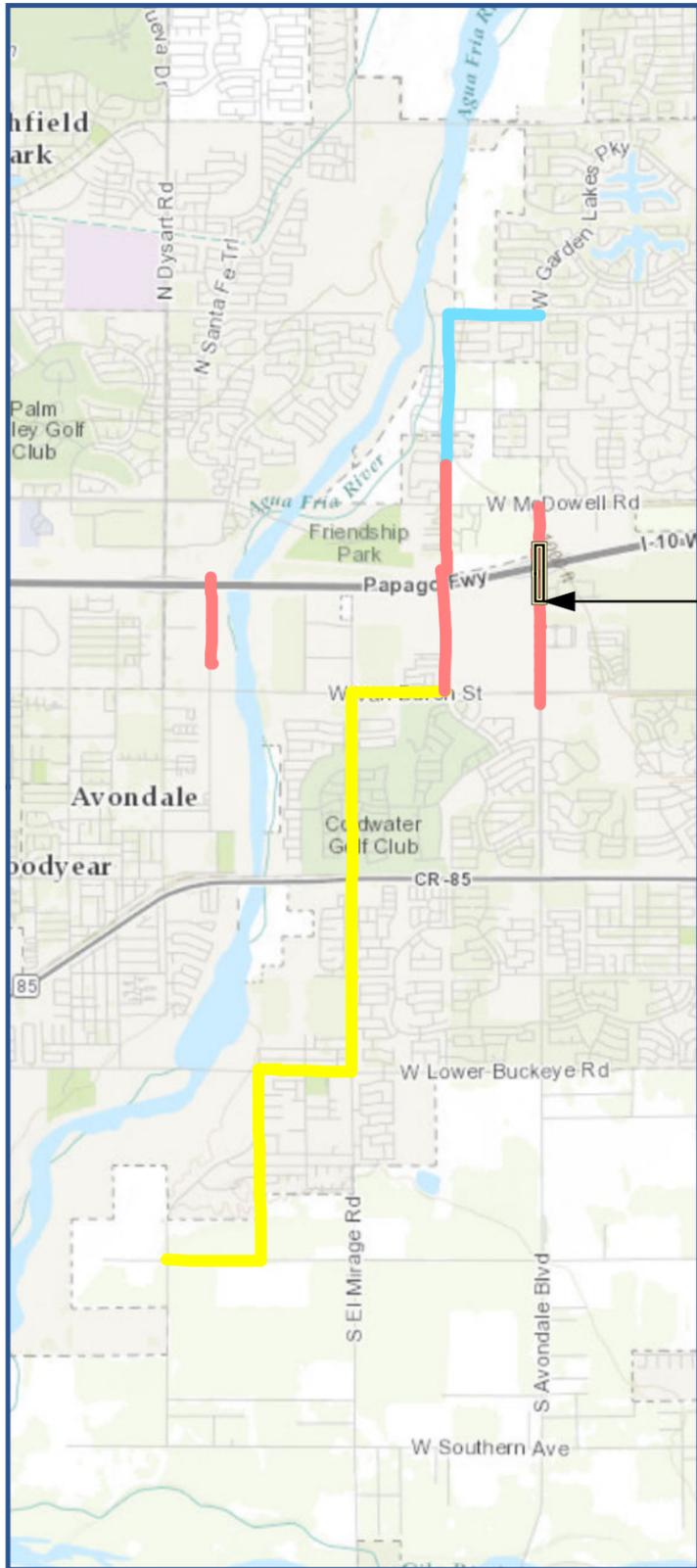


NOT TO SCALE

# Appendix C

Rehabilitation Project Figures

**PROJECT VICINITY MAP**



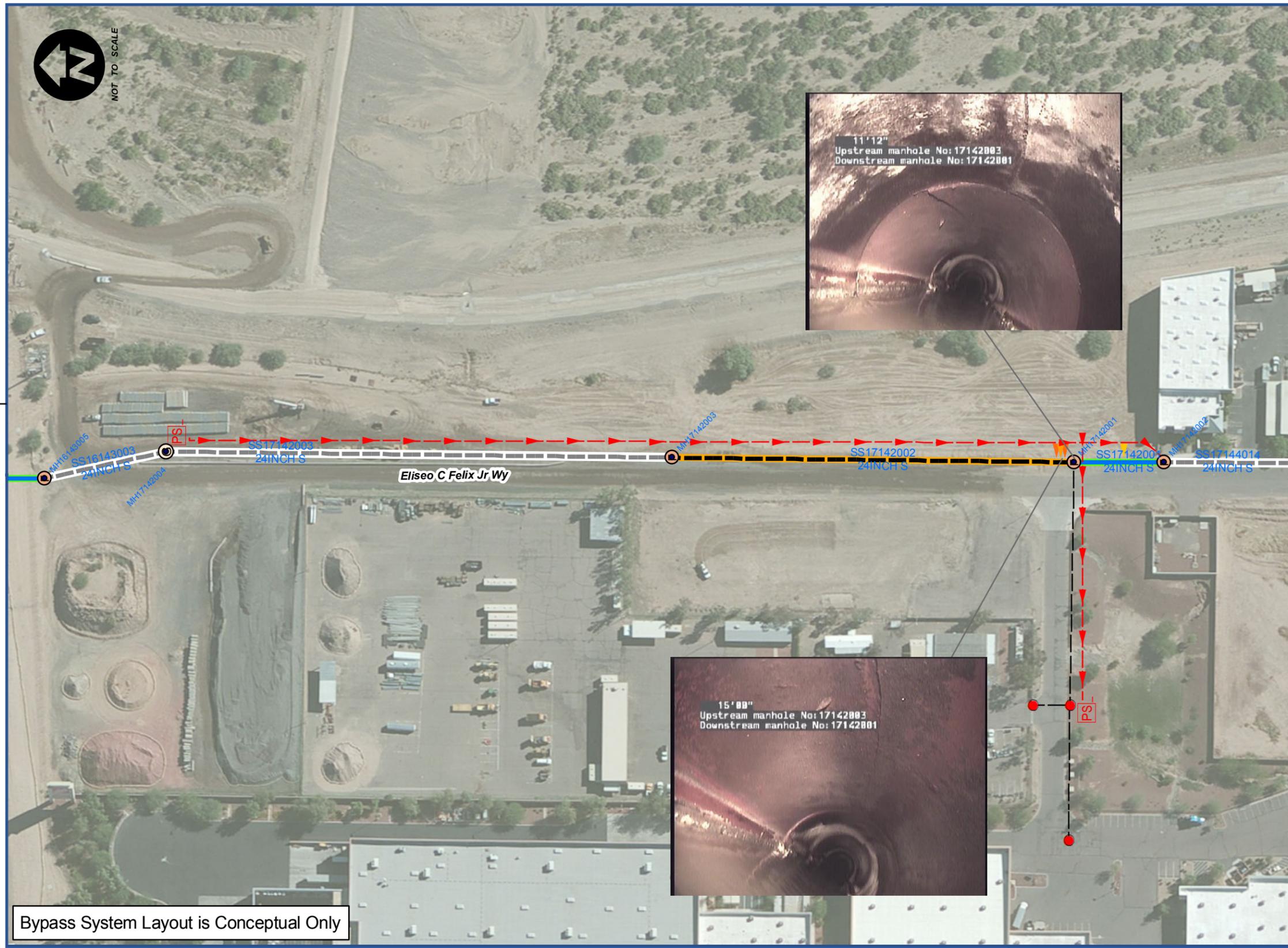
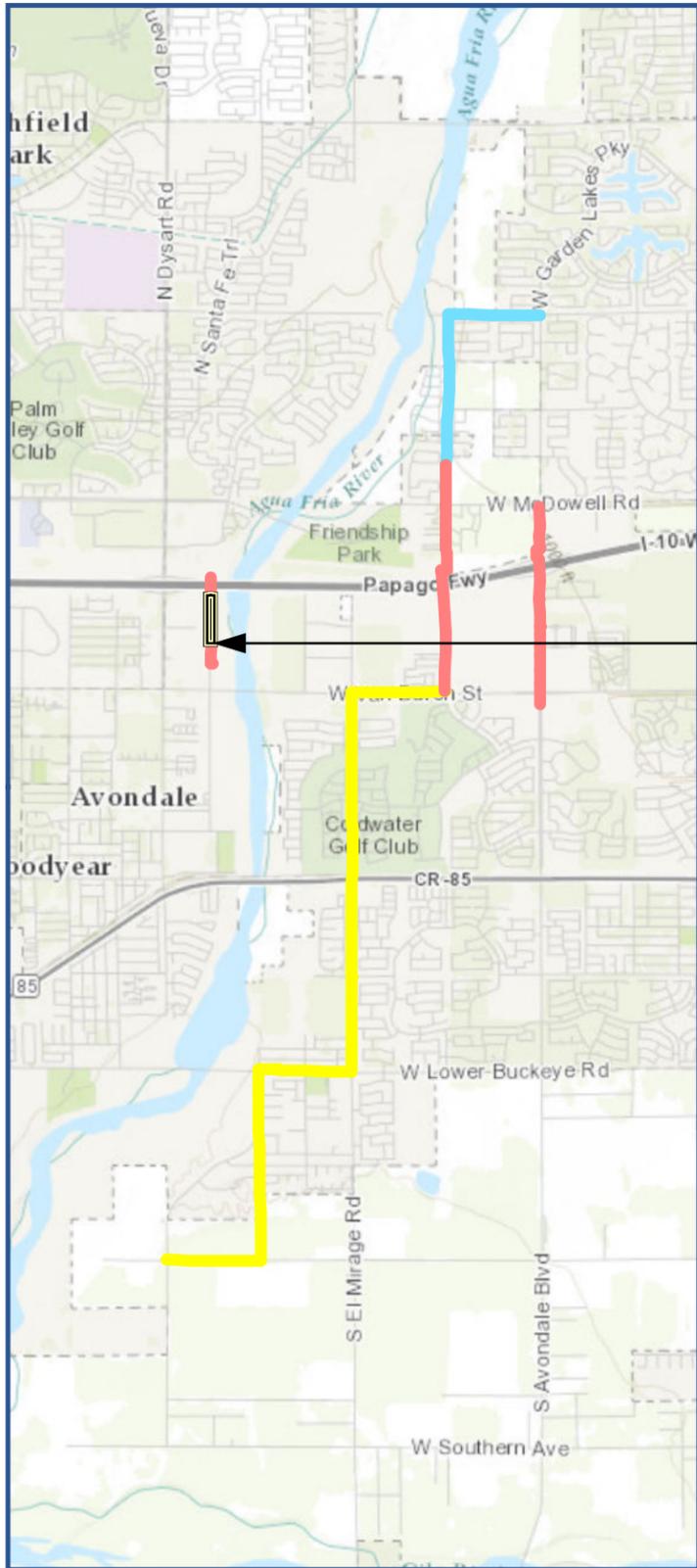
Service Layer Credits: Sources: Esri, HERE, DeLorme, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community  
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Legend		Structural Defect		Bypass Pipes		MH CA 2014 Condition	
<b>Lrg Dia SS CA 2014</b>	<b>Structural LoF</b>	<b>PACF_Code</b>	<b>Structural Defect</b>	<b>Bypass Pipes</b>	<b>SS MH</b>	<b>Good</b>	<b>Adjust MH to Grade</b>
— Good	— Critical	CS	— Rehabilitate	— Bypass Trench	● SS MH	⊙ Good	● Adjust MH to Grade
— High	— Medium	FL	— Reassess	— SS Gravity DIAMETER	● SS MH	⊙ Buried	● Rehabilitate MH
— Low	— Low	FM	— Clean	— 4-15 INCH SS	● SS MH	⊙ Fair	
		LFB	— PS Bypass Pump Station	— 16-48 INCH SS	● SS MH		
		LFD					



**AVONDALE LARGE DIAMETER SEWER REHABILITATION 2014 PROJECT 1A**

**PROJECT VICINITY MAP**



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 Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community,

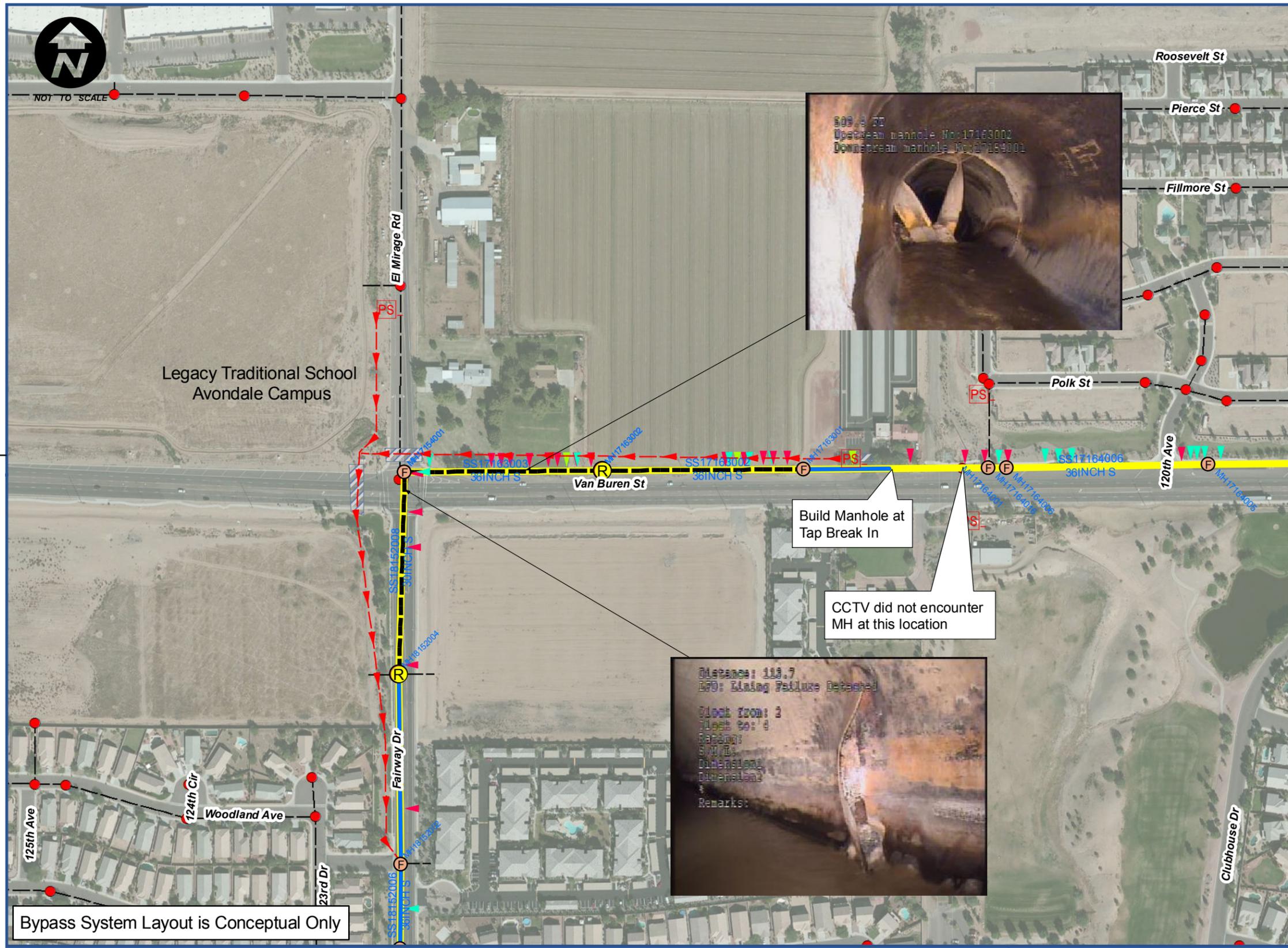
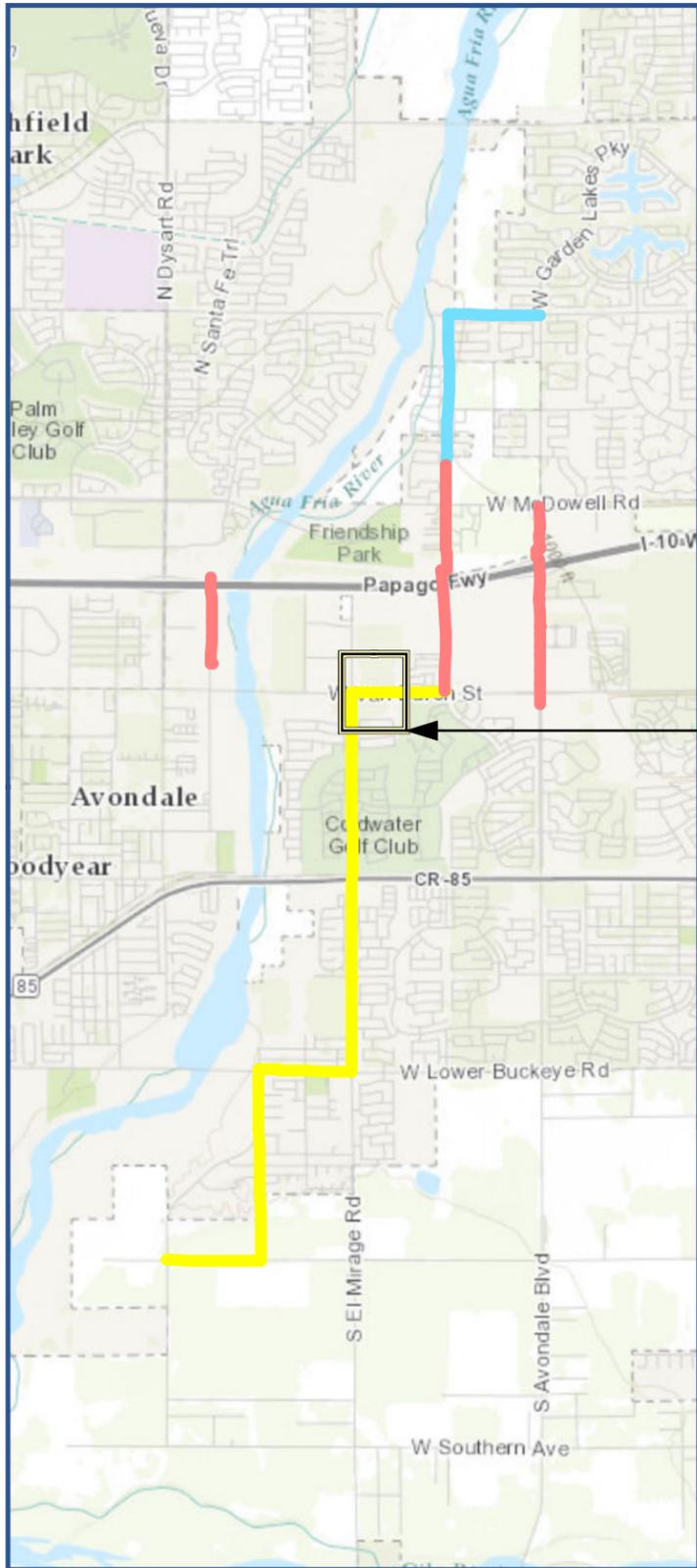
**Legend**

- |                           |                          |                       |                  |                     |                      |                             |
|---------------------------|--------------------------|-----------------------|------------------|---------------------|----------------------|-----------------------------|
| <b>Lrg Dia SS CA 2014</b> | <b>Structural Defect</b> | <b>Structural LoF</b> | <b>PACF_Code</b> | <b>Bypass Pipes</b> | <b>SS MH</b>         | <b>MH CA 2014 Condition</b> |
| — Good                    | — Rehabilitate           | — Critical            | — CS             | — Bypass Trench     | — SS MH              | — Good                      |
| — High                    | — Reassess               | — Medium              | — FL             | — SS Gravity        | — Adjust MH to Grade | — Adjust MH to Grade        |
| — Low                     | — Clean                  | — Low                 | — FM             | — 4-15 INCH SS      | — Buried             | — Buried                    |
|                           | — PS Bypass Pump Station |                       | — LFB            | — 16-48 INCH SS     | — Poor               | — Poor                      |
|                           |                          |                       | — LFD            |                     | — Fair               | — Fair                      |
|                           |                          |                       |                  |                     |                      | — Rehabilitate MH           |



**AVONDALE LARGE DIAMETER SEWER REHABILITATION 2014 PROJECT 1B**

PROJECT VICINITY MAP



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Legend

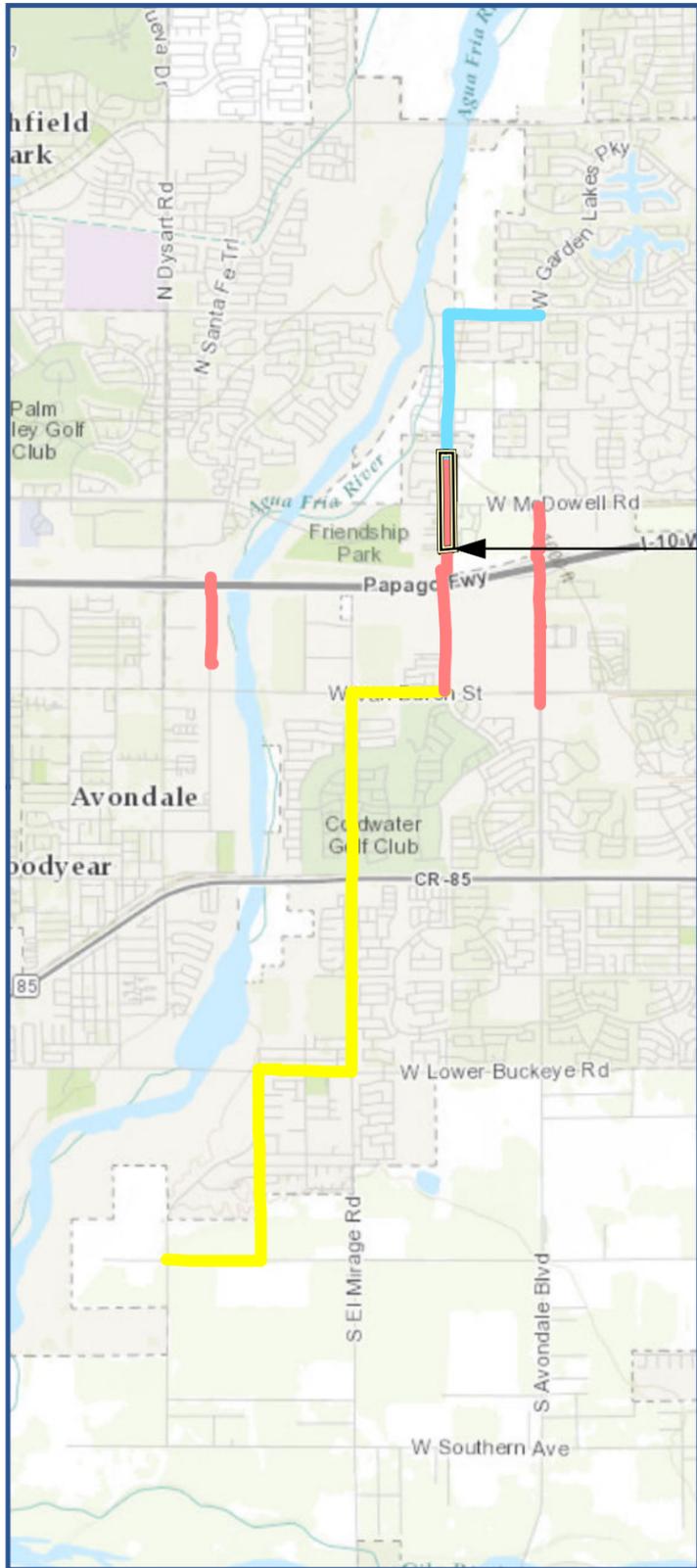
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|---------------------------|--------------------------|-----------------------|------------------|-------------------|----------------------|----------------------|
| <b>Lrg Dia SS CA 2014</b> | <b>Structural Defect</b> | <b>Structural LoF</b> | <b>PACF_Code</b> | <b>SS Gravity</b> | <b>MH CA 2014</b>    | <b>Condition</b>     |
| — Good                    | — Rehabilitate           | — Critical            | — CS             | — 4-15 INCH SS    | ● SS MH              | ⊙ Good               |
| — High                    | — Reassess               | — Medium              | — FL             | — 16-48 INCH SS   | ● Adjust MH to Grade | ● Adjust MH to Grade |
| — Low                     | — Clean                  | — Low                 | — FM             |                   | ● Buried             | ● Buried             |
|                           | — LFPH                   |                       | — LFB            |                   | ● Poor               | ● Poor               |
|                           | — LFZ                    |                       | — LFD            |                   | ● Fair               | ● Fair               |
|                           | — PS Bypass Pump Station |                       |                  |                   |                      |                      |



AVONDALE LARGE DIAMETER SEWER REHABILITATION 2014 PROJECT 1C



**PROJECT VICINITY MAP**



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**Legend**

- Lrg Dia SS CA 2014 Structural LoF**
- Good
  - Critical
  - High
  - Medium
  - Low

- Structural Defect PACP\_Code**
- CS
  - FL
  - FM
  - LFB
  - LFD

- LFPH
- LFZ
- Rehabilitate
- Reassess
- Clean
- Bypass Pump Station

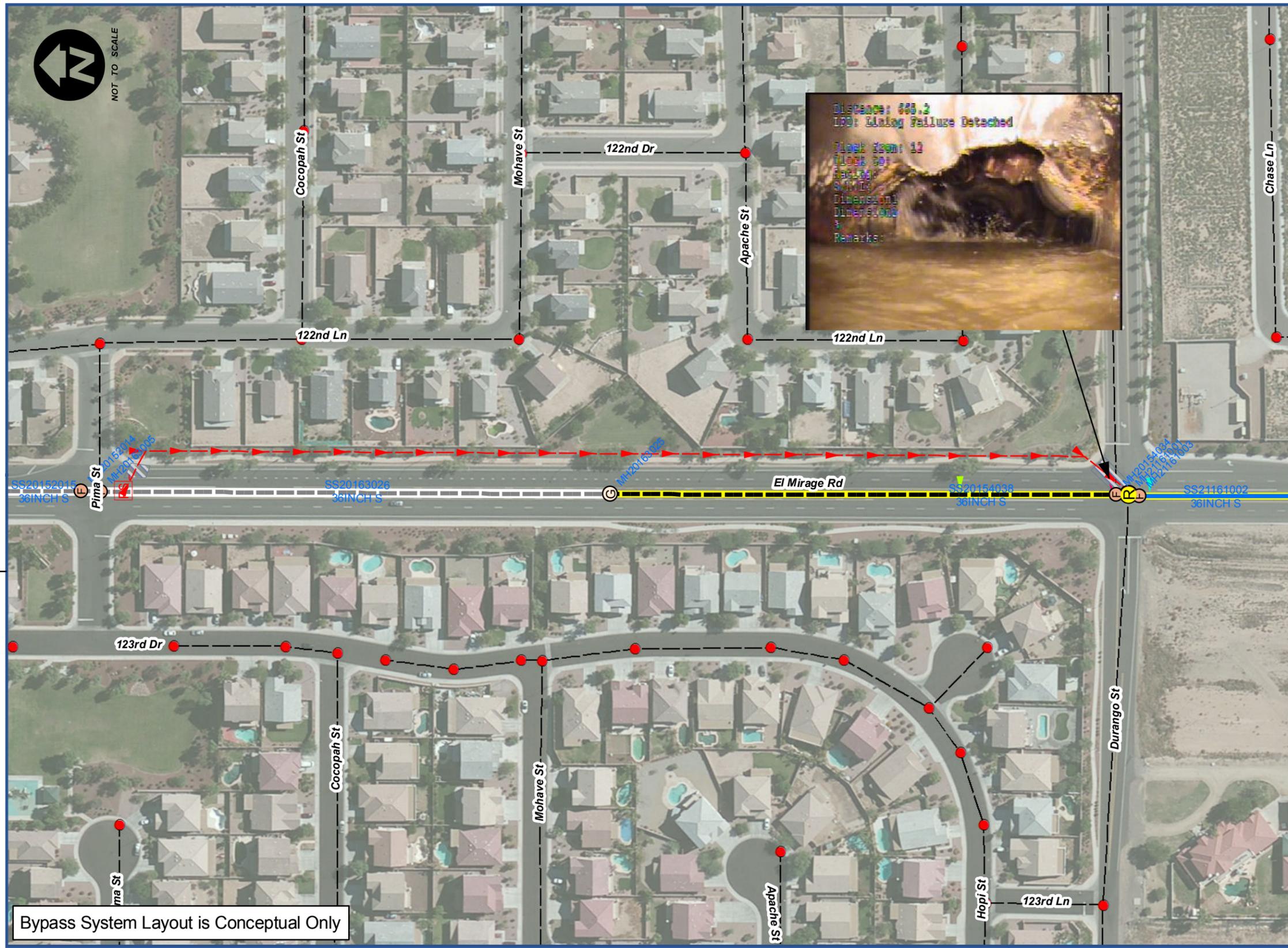
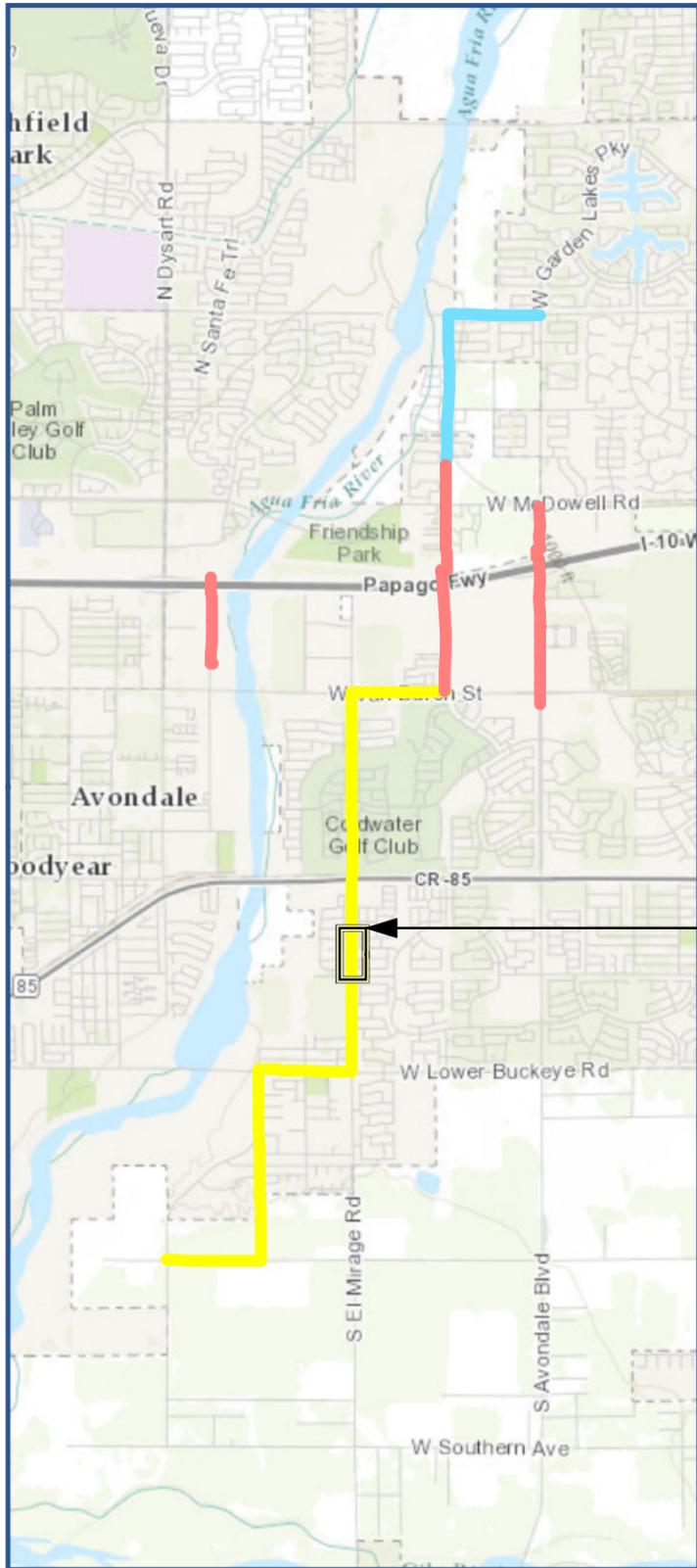
- Bypass Pipes**
- Bypass Trench
  - SS Gravity DIAMETER
  - 4-15 INCH SS
  - 16-48 INCH SS

- SS MH MH CA 2014 Condition**
- Good
  - Adjust MH to Grade
  - Buried
  - Poor
  - Fair
  - Rehabilitate MH



**AVONDALE LARGE DIAMETER SEWER REHABILITATION 2014 PROJECT 1E**

**PROJECT VICINITY MAP**



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**Legend**

- Lrg Dia SS CA 2014 Structural LoF**
- Good
  - Critical
  - High
  - Medium
  - Low
- Structural Defect PACP\_Code**
- CS
  - FL
  - FM
  - LFB
  - LFD

- LFPH
- LFZ
- Rehabilitate
- Reassess
- Clean
- Bypass Pump Station

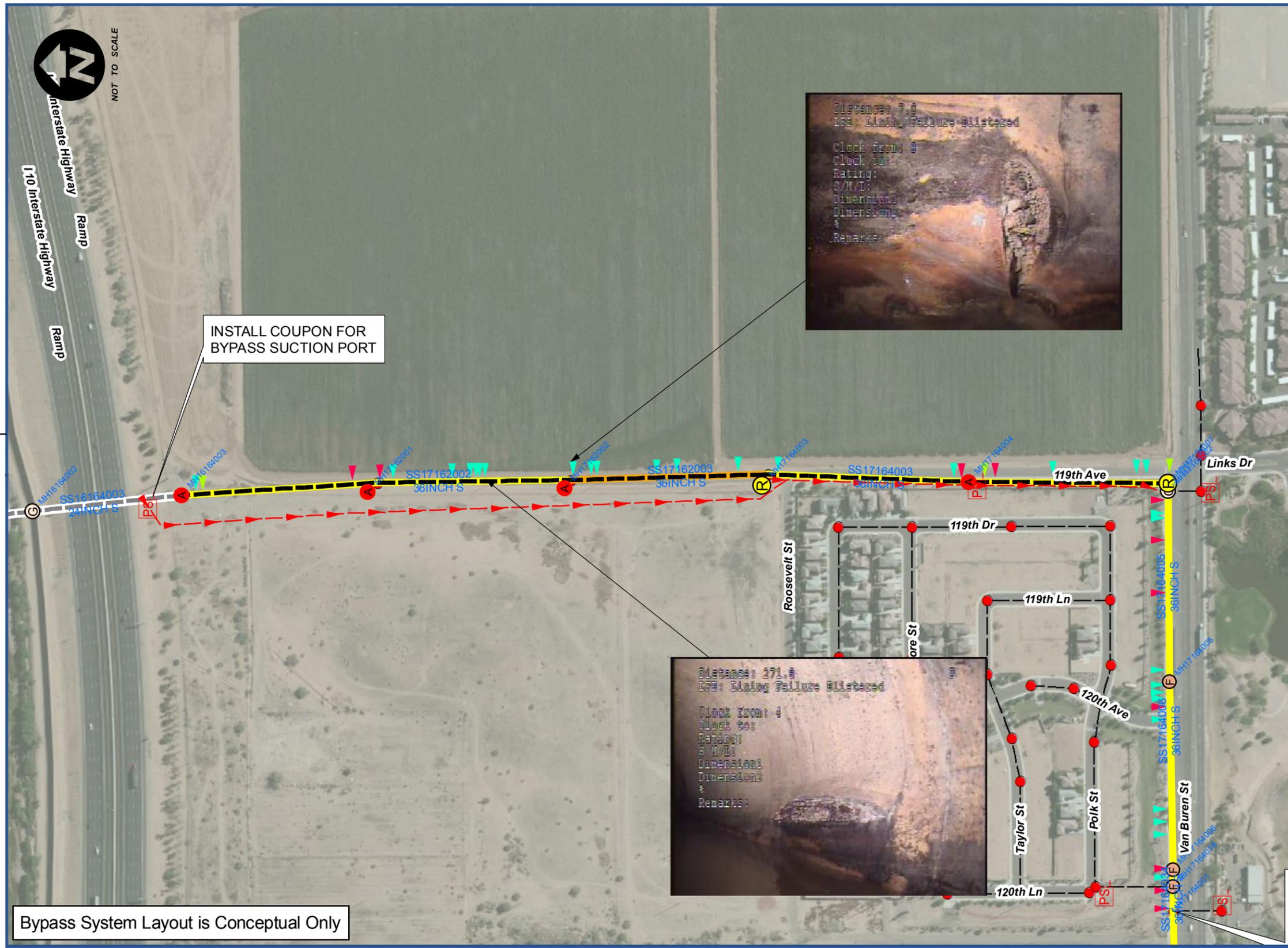
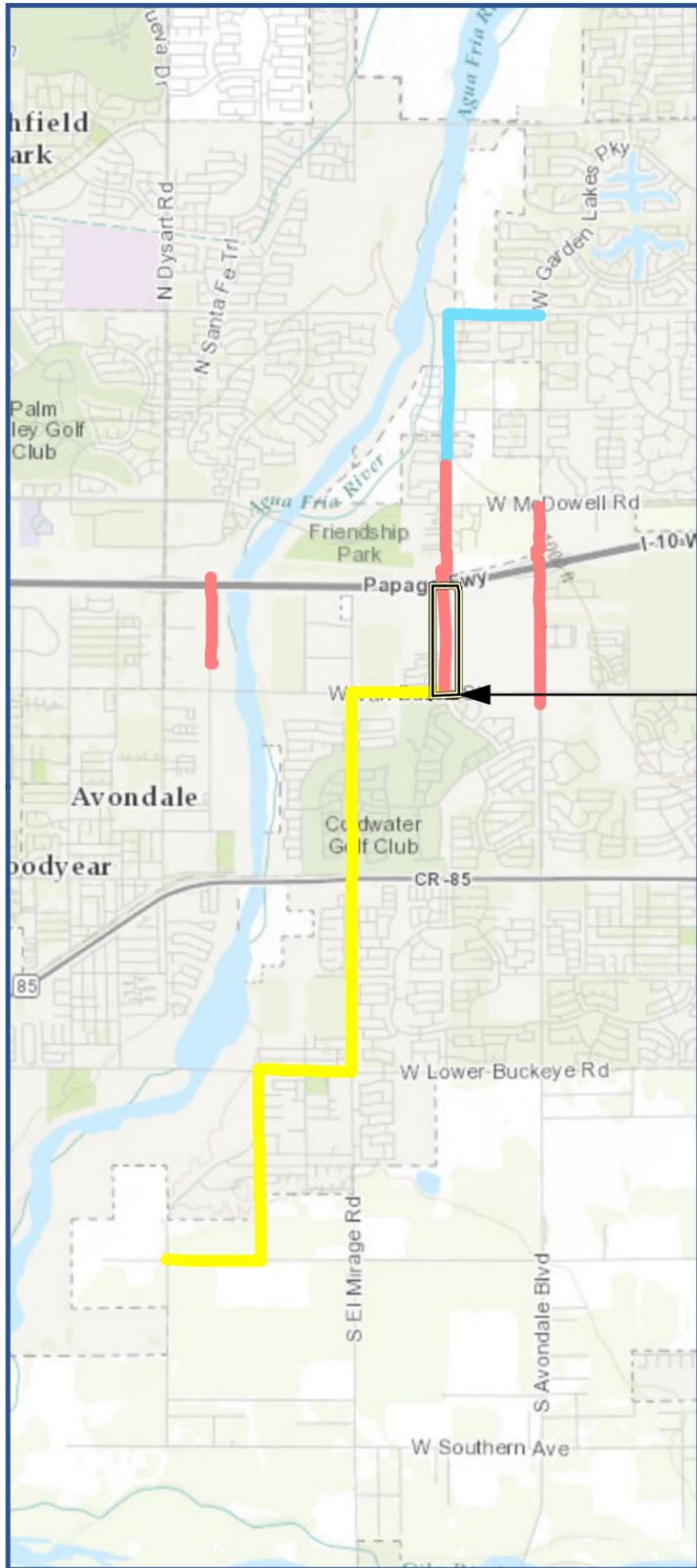
- Bypass Pipes
- Bypass Trench
- SS Gravity DIAMETER
- 4-15 INCH SS
- 16-48 INCH SS

- SS MH MH CA 2014 Condition**
- Good
  - Adjust MH to Grade
  - Buried
  - Poor
  - Fair
  - Rehabilitate MH



**AVONDALE LARGE DIAMETER SEWER REHABILITATION 2014 PROJECT 1F**

**PROJECT VICINITY MAP**



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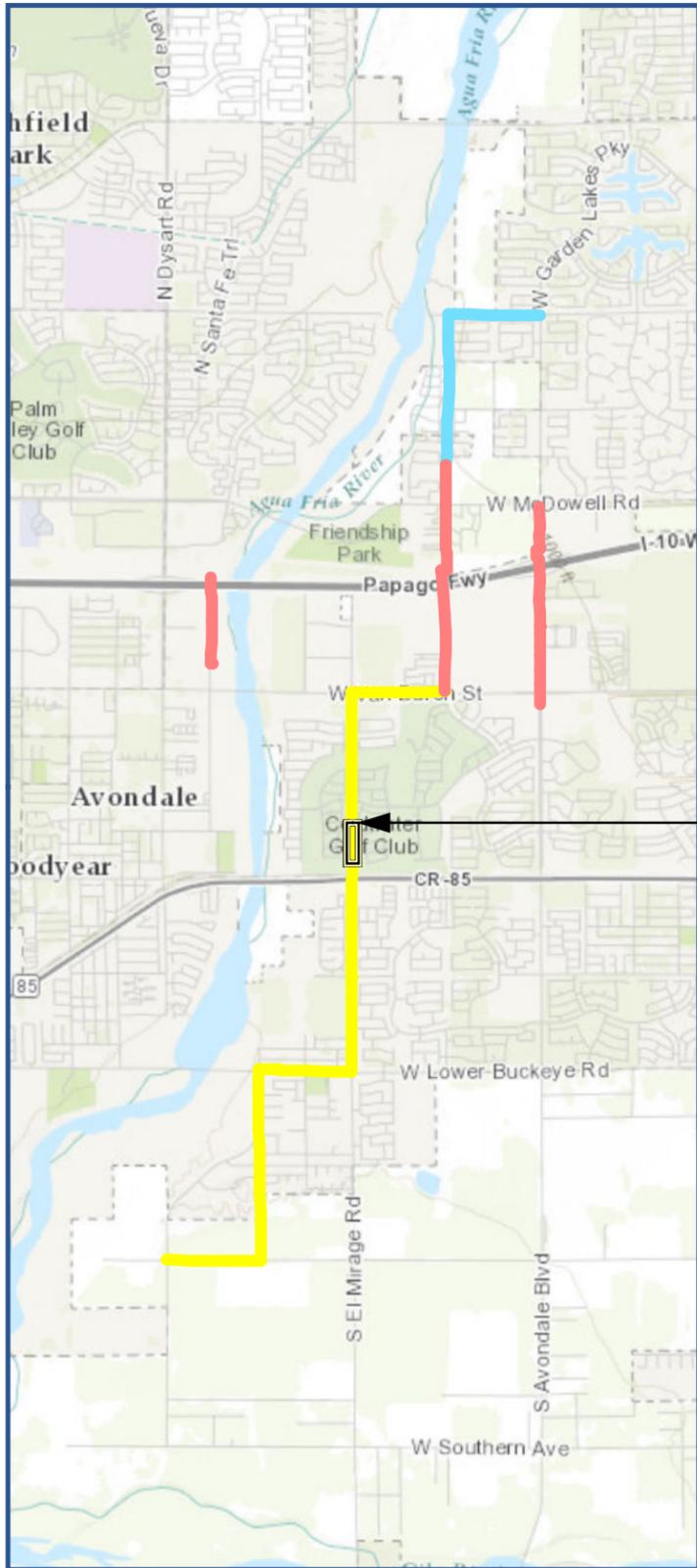
**Legend**

- |                           |                          |                      |                      |
|---------------------------|--------------------------|----------------------|----------------------|
| <b>Lrg Dia SS CA 2014</b> | <b>Structural Defect</b> | <b>SS MH</b>         | <b>Condition</b>     |
| — Good                    | — Rehabilitate           | ● SS MH              | ⊙ Good               |
| — Critical                | — Reassess               | ● Adjust MH to Grade | ⊙ Adjust MH to Grade |
| — High                    | — Clean                  | ● Buried             | ⊙ Buried             |
| — Medium                  | — Bypass Pump Station    | ● Poor               | ⊙ Poor               |
| — Low                     |                          | ● Fair               | ⊙ Fair               |
| <b>Structural LoF</b>     | <b>PACP_Code</b>         |                      |                      |
| — Good                    | CS                       |                      |                      |
| — Critical                | FL                       |                      |                      |
| — High                    | FM                       |                      |                      |
| — Medium                  | LFB                      |                      |                      |
| — Low                     | LFD                      |                      |                      |
|                           | LFPH                     |                      |                      |
|                           | LFZ                      |                      |                      |



**AVONDALE LARGE DIAMETER SEWER REHABILITATION 2014 PROJECT 2A**

**PROJECT VICINITY MAP**



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 Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community,

**Legend**

- Lrg Dia SS CA 2014 Structural LoF**
- Good
  - Critical
  - High
  - Medium
  - Low
- Structural Defect PACP\_Code**
- CS
  - FL
  - FM
  - LFB
  - LFD

- LFPH
- LFZ
- Rehabilitate
- Reassess
- Clean
- PS - Bypass Pump Station

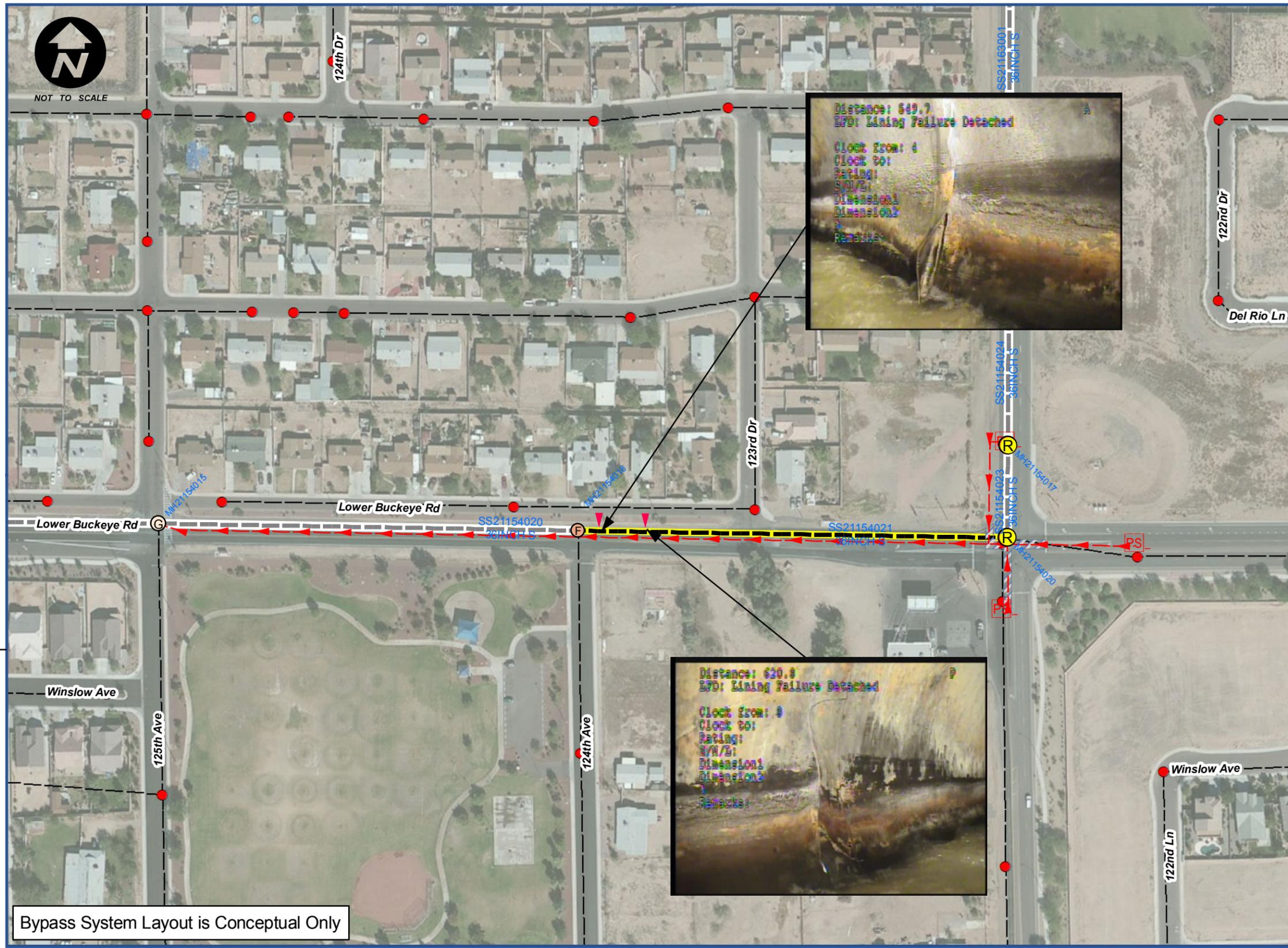
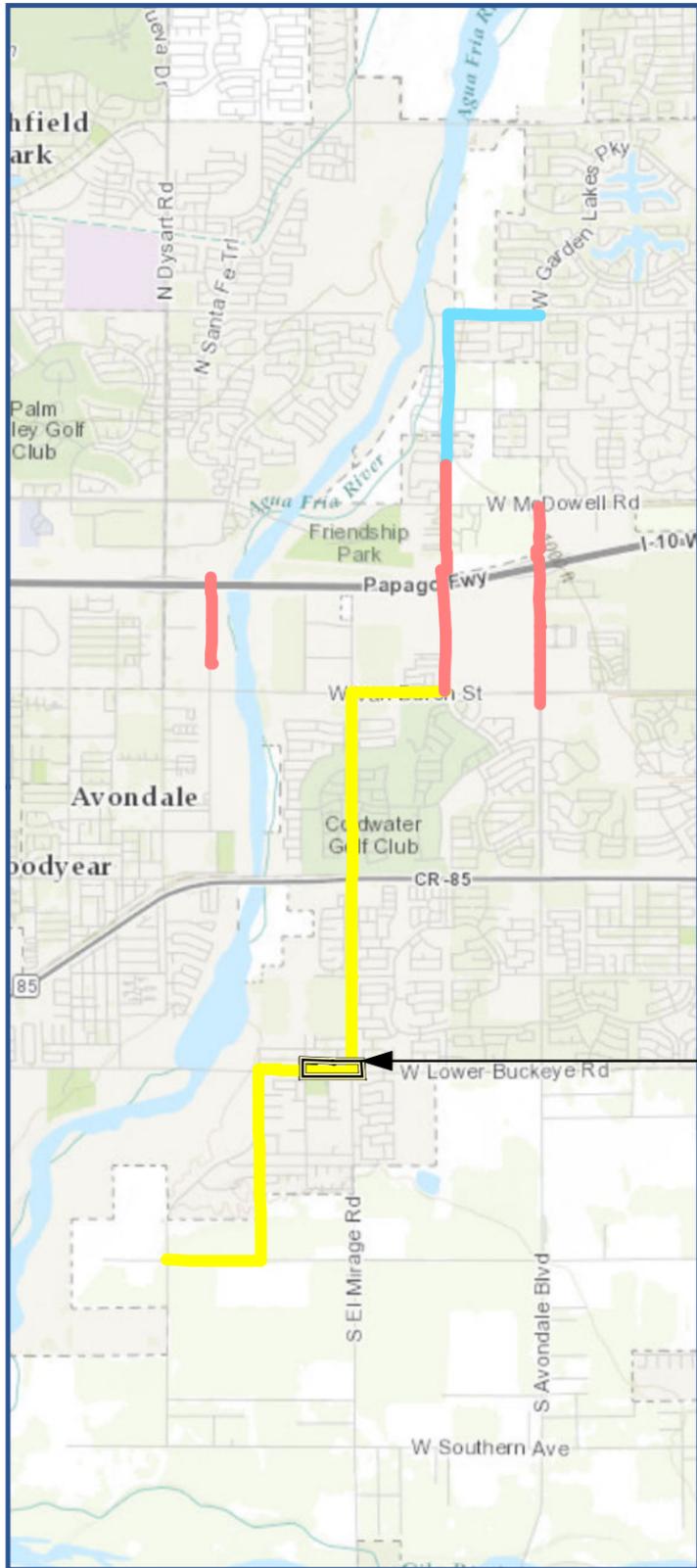
- Bypass Pipes
- Bypass Trench
- SS Gravity DIAMETER
- 4-15 INCH SS
- 16-48 INCH SS

- SS MH
- Good
- Adjust MH to Grade
- Buried
- Poor
- Fair



**AVONDALE LARGE DIAMETER SEWER REHABILITATION 2014 PROJECT 2B**

**PROJECT VICINITY MAP**



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 Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community,

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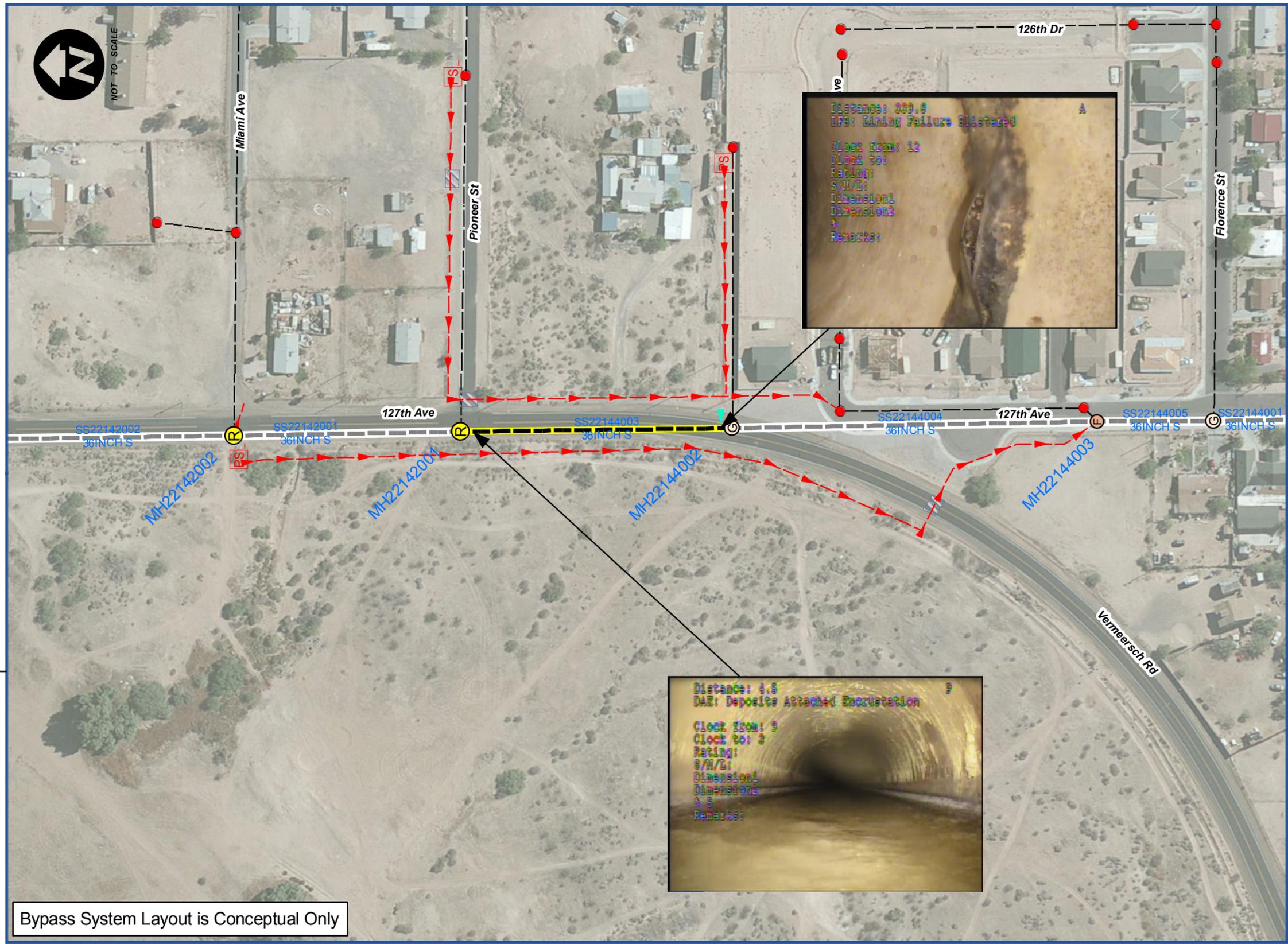
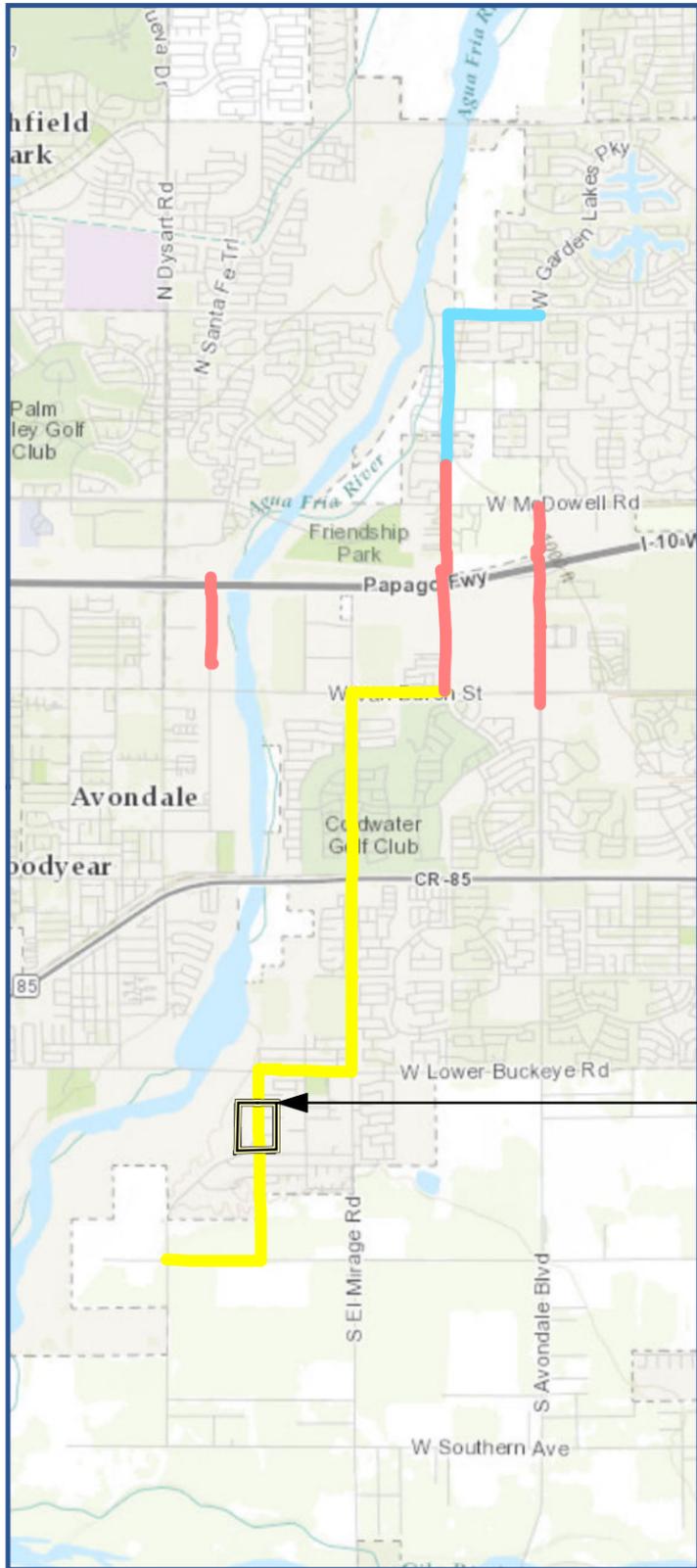
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|---------------------------|--------------------------|-----------------------|------------------|
| <b>Lrg Dia SS CA 2014</b> | <b>Structural Defect</b> | <b>Structural LoF</b> | <b>PACF_Code</b> |
| — Good                    | — LFPH                   | — Critical            | — CS             |
| — High                    | — LFZ                    | — High                | — FL             |
| — Medium                  | — Rehabilitate           | — Low                 | — FM             |
| — Low                     | — Reassess               |                       | — LFB            |
|                           | — Clean                  |                       | — LFD            |
|                           | — PS Bypass Pump Station |                       |                  |

- |                 |              |                      |
|-----------------|--------------|----------------------|
| — Bypass Pipes  | ● SS MH      | ⊙ Good               |
| ▨ Bypass Trench | ● MH CA 2014 | ⊙ Adjust MH to Grade |
| — SS Gravity    | ● Condition  | ⊙ Buried             |
| — DIAMETER      | ● Poor       | ⊙ Rehabilitate MH    |
| — 4-15 INCH SS  | ● Fair       |                      |
| — 16-48 INCH SS |              |                      |



**AVONDALE LARGE DIAMETER SEWER REHABILITATION 2014 PROJECT 2C**

**PROJECT VICINITY MAP**



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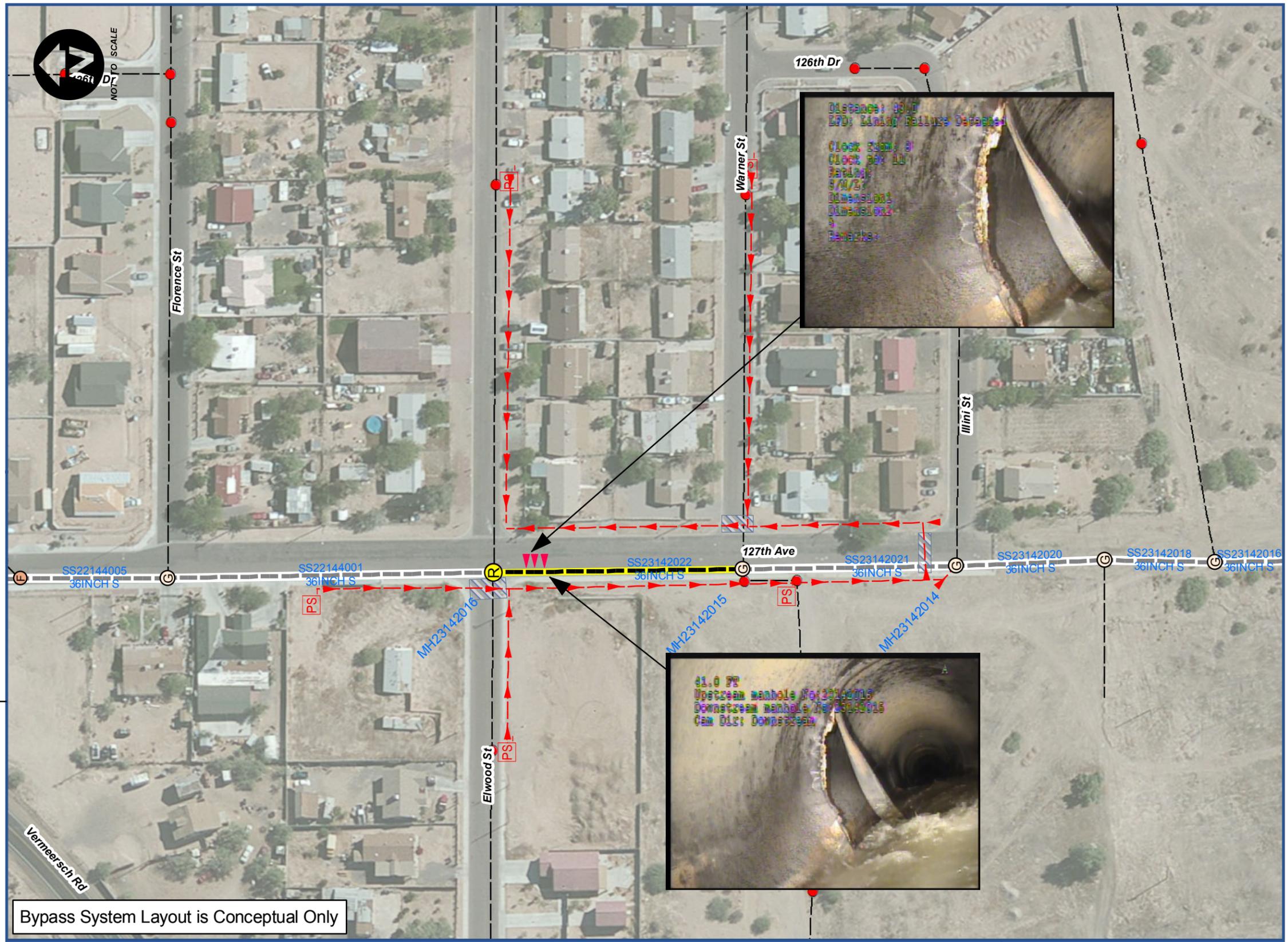
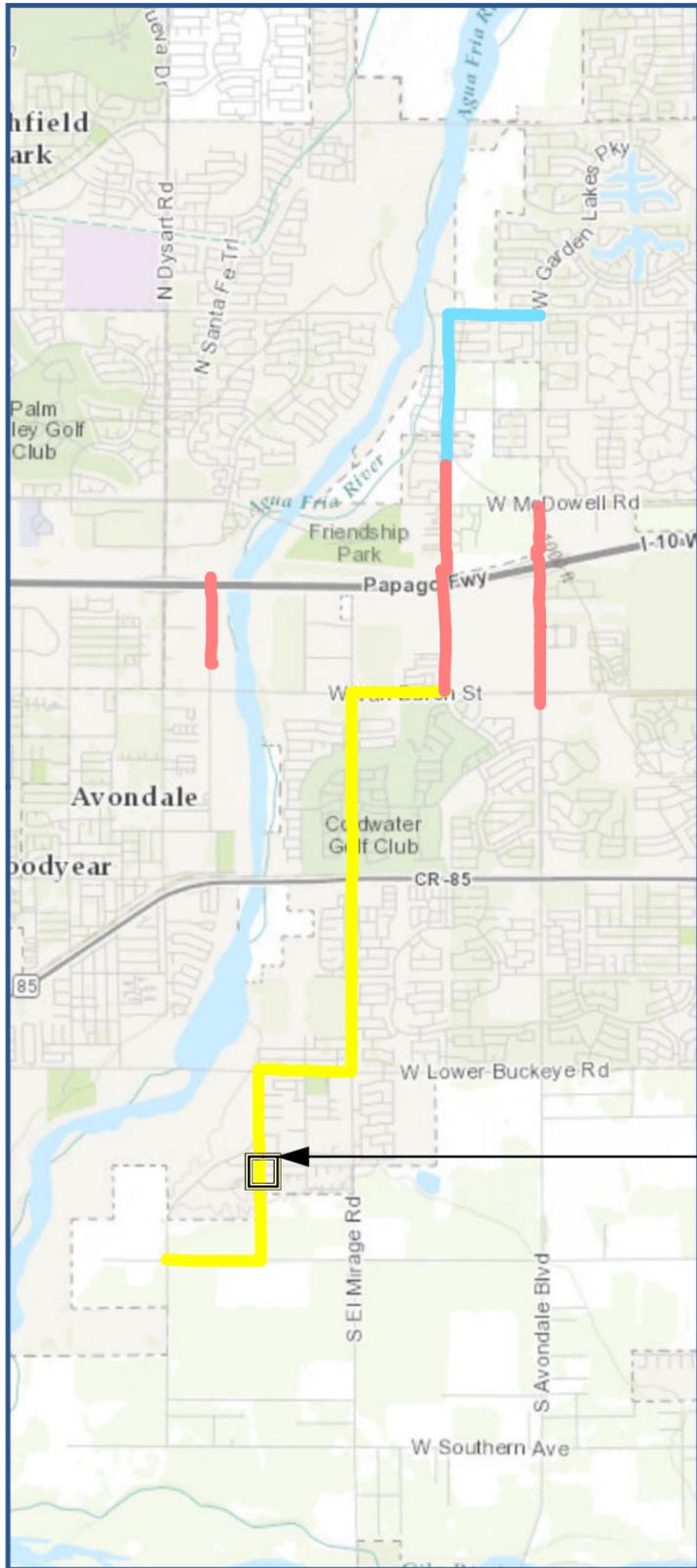
**Legend**

- |                           |                          |                   |                      |                           |                        |
|---------------------------|--------------------------|-------------------|----------------------|---------------------------|------------------------|
| <b>Lrg Dia SS CA 2014</b> | <b>Structural Defect</b> | <b>SS Gravity</b> | <b>Bypass Pipes</b>  | <b>SS MH</b>              | <b>Good</b>            |
| <b>Structural LoF</b>     | <b>PACP_Code</b>         | <b>DIAMETER</b>   | <b>Bypass Trench</b> | <b>Adjust MH to Grade</b> | <b>Rehabilitate MH</b> |
| — Good                    | CS                       | — 4-15 INCH SS    | ▨                    | ⓐ                         | Ⓡ                      |
| — Critical                | FL                       | — 16-48 INCH SS   | ▨                    | ⓐ                         | Ⓡ                      |
| — High                    | FM                       |                   | ▨                    | ⓑ                         | Ⓡ                      |
| — Medium                  | LFB                      |                   | ▨                    | ⓐ                         | Ⓡ                      |
| — Low                     | LFD                      |                   | ▨                    | ⓑ                         | Ⓡ                      |
|                           | LFPH                     |                   | ▨                    | ⓐ                         | Ⓡ                      |
|                           | LFZ                      |                   | ▨                    | ⓑ                         | Ⓡ                      |
|                           | Rehabilitate             |                   | ▨                    | ⓐ                         | Ⓡ                      |
|                           | Reassess                 |                   | ▨                    | ⓑ                         | Ⓡ                      |
|                           | Clean                    |                   | ▨                    | ⓐ                         | Ⓡ                      |
|                           | PS - Bypass Pump Station |                   | ▨                    | ⓑ                         | Ⓡ                      |
|                           |                          |                   | ▨                    | ⓐ                         | Ⓡ                      |
|                           |                          |                   | ▨                    | ⓑ                         | Ⓡ                      |



**AVONDALE LARGE DIAMETER SEWER REHABILITATION 2014 PROJECT 2D**

**PROJECT VICINITY MAP**



Bypass System Layout is Conceptual Only

Service Layer Credits: Sources: Esri, HERE, DeLorme, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community  
 Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community,

**Legend**

- |                           |                          |                       |                  |
|---------------------------|--------------------------|-----------------------|------------------|
| <b>Lrg Dia SS CA 2014</b> | <b>Structural Defect</b> | <b>Structural LoF</b> | <b>PACF_Code</b> |
| — Good                    | — Rehabilitate           | — Critical            | — CS             |
| — High                    | — Reassess               | — High                | — FL             |
| — Medium                  | — Clean                  | — Medium              | — FM             |
| — Low                     | — Bypass Pump Station    | — Low                 | — LFB            |
|                           |                          |                       | — LFD            |

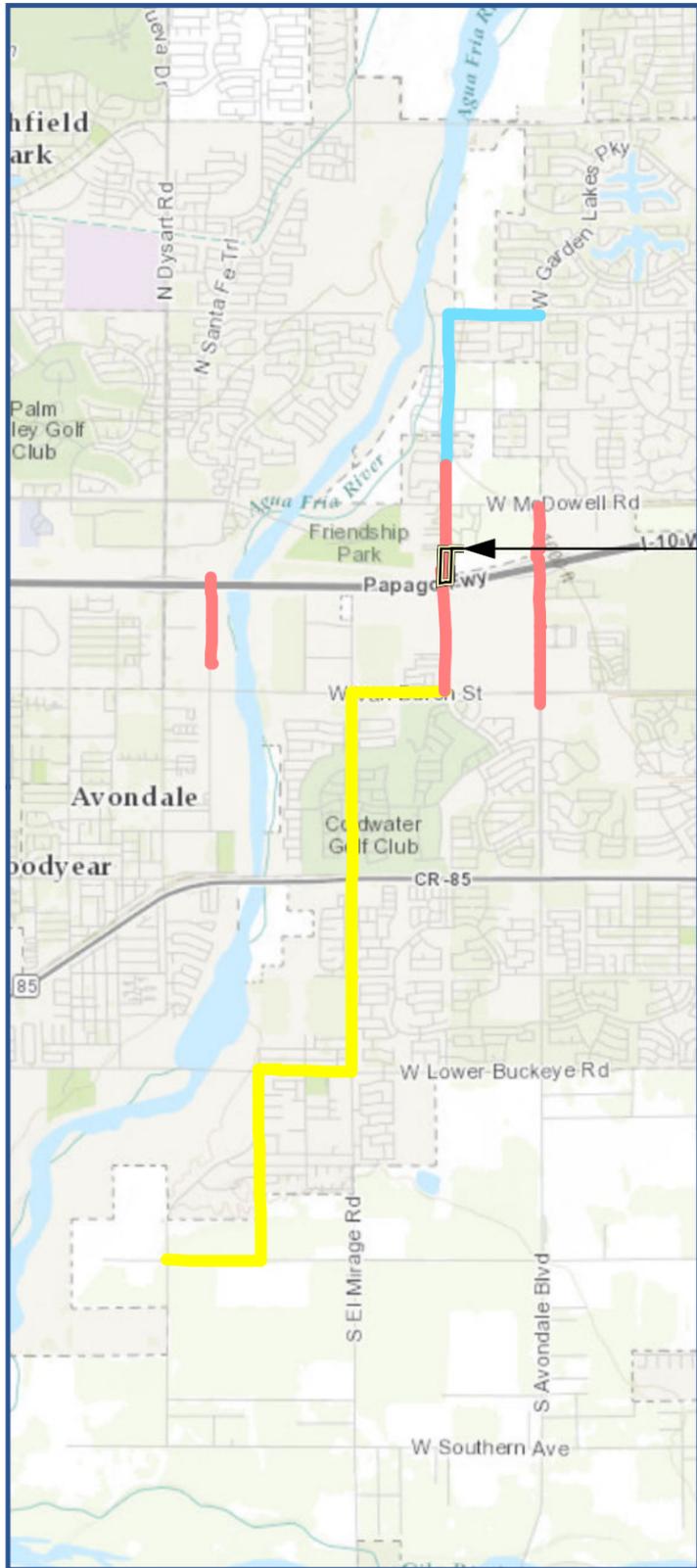
- Bypass Pipes
- Bypass Trench
- SS Gravity
- DIAMETER
- 4-15 INCH SS
- 16-48 INCH SS

- SS MH
- ⓐ Adjust MH to Grade
- ⓑ Buried
- ⓐ Poor
- ⓑ Fair
- Ⓒ Good
- Ⓓ Rehabilitate MH



**AVONDALE LARGE DIAMETER SEWER REHABILITATION 2014 PROJECT 2E**

**PROJECT VICINITY MAP**



Bypass System Layout is Conceptual Only

Service Layer Credits: Sources: Esri, HERE, DeLorme, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community  
Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community,

**Legend**

- Lrg Dia SS CA 2014 Structural LoF**
- Good
  - Critical
  - High
  - Medium
  - Low

- Structural Defect PACP\_Code**
- CS
  - FL
  - FM
  - LFB
  - LFD

- LFPH
- LFZ
- Rehabilitate
- Reassess
- Clean
- PS - Bypass Pump Station

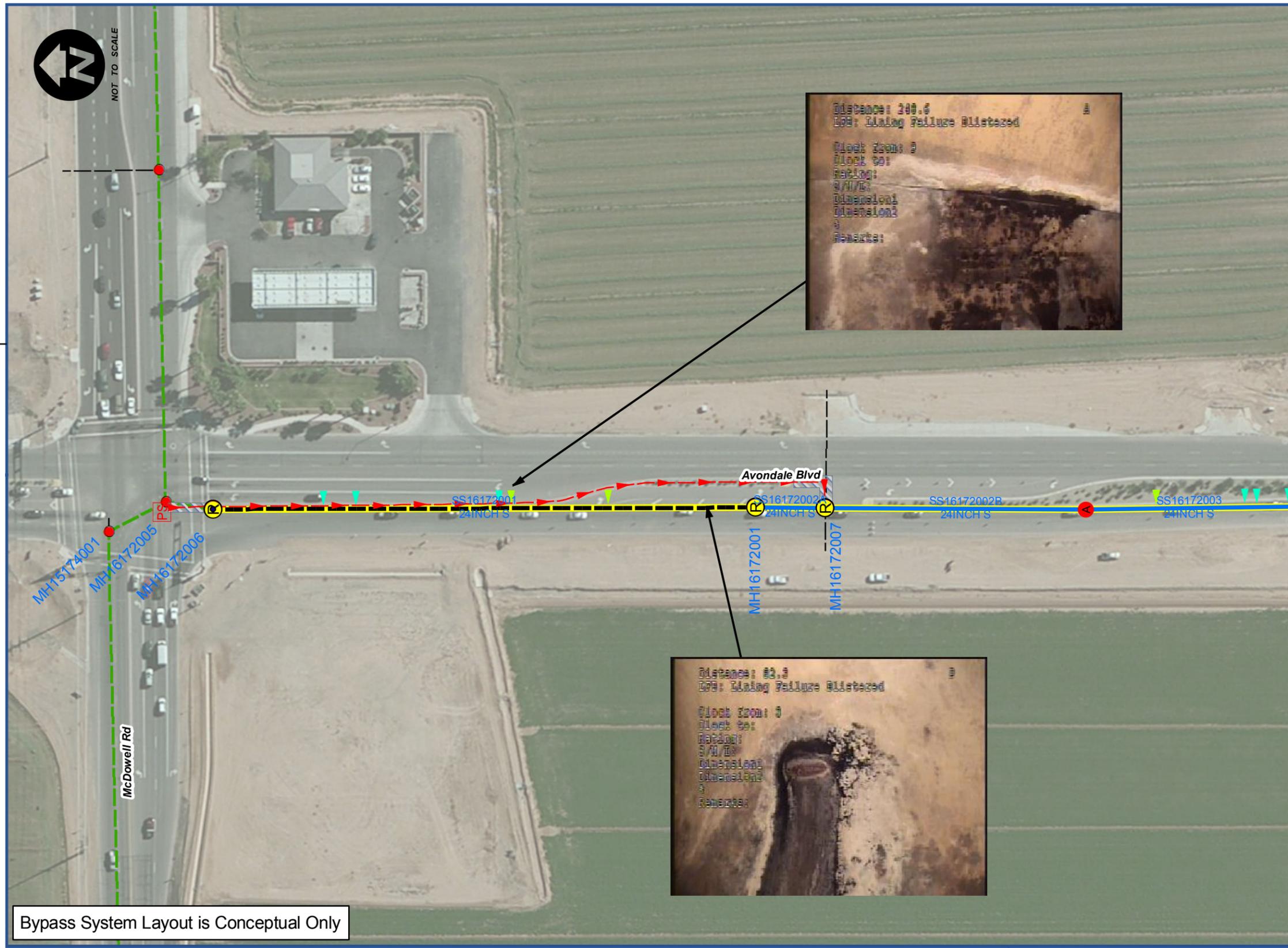
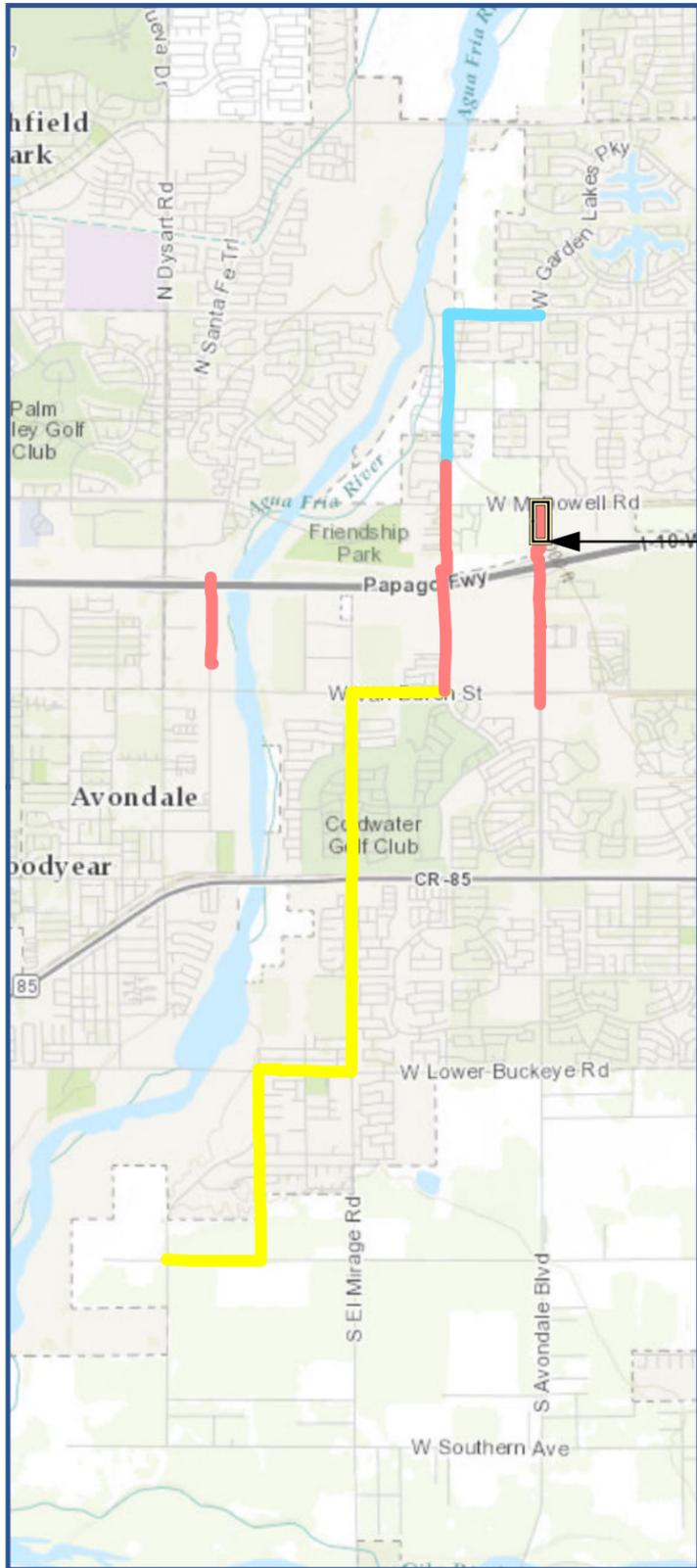
- Bypass Pipes
- Bypass Trench
- SS Gravity DIAMETER
- 4-15 INCH SS
- 16-48 INCH SS

- SS MH MH CA 2014 Condition**
- Good
  - Adjust MH to Grade
  - Buried
  - Poor
  - Fair
  - Rehabilitate MH



**AVONDALE LARGE DIAMETER SEWER REHABILITATION 2014 PROJECT 2F**

**PROJECT VICINITY MAP**



Bypass System Layout is Conceptual Only

Service Layer Credits: Sources: Esri, HERE, DeLorme, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community  
 Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community,

**Legend**

- Lrg Dia SS CA 2014 Structural Defect**
- Good
  - Critical
  - High
  - Medium
  - Low
- Structural Defect**
- CS
  - FL
  - FM
  - LFB
  - LFD
- PACF\_Code**
- Rehabilitate
  - Reassess
  - Clean
  - Bypass Pump Station

- LFPH
- LFZ

- Bypass Pipes
- Bypass Trench
- SS Gravity DIAMETER
- 4-15 INCH SS
- 16-48 INCH SS

- SS MH
- Good
- Adjust MH to Grade
- Buried
- Rehabilitate MH
- Poor
- Fair



**AVONDALE LARGE DIAMETER SEWER REHABILITATION 2014 PROJECT 2G**

# Appendix D

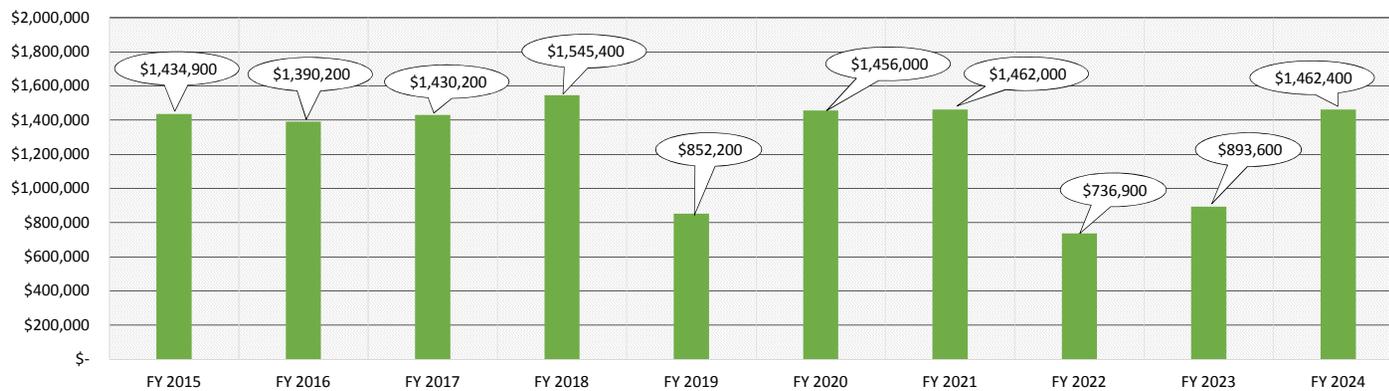
Engineer's Opinion of Probable Cost Tables

# City of Avondale Large Diameter Sewer Rehabilitation Engineer's Preliminary Opinion of Probable Cost



Year	Project	Description	Pipe Segments	Pipe Length	MH Condition Assessment & Rehabilitation	Construction Cost	Engineering Fees & Testing (@ 20%)	Total Cost	
2015	Project 1A Design*	Rehab Design Costs	0	6,596	1	\$ -	\$ 65,927	\$ 65,927	
2015	Project 1A: I-10 & Avondale and Project 1B Design*	24-inch Conc T-Lock CIPP	3	880	1	\$ 659,270	\$ 109,369	\$ 768,639	
2015	Project 1B: Eliseo C Felix Jr Way S of I-10 and Project 1C Design*	24-inch VCP CIPP	1	505	2	\$ 434,423	\$ 159,162	\$ 593,585	
2015	Manhole Condition Assessment	NASSCO MACP Level 2	0	0	29		\$ 6,650	\$ 6,650	
2016	Project 1C: Van Buren and Fairway Drive and Project 1D Design*	36-inch Conc T-Lock CIPP	3	1,544	2	\$ 1,157,200	\$ 232,960	\$ 1,390,160	
2017	Project 1D: Van Buren & Links Drive and Project 1E Design*	36-inch Conc T-Lock CIPP	5	1,354	1	\$ 1,172,403	\$ 257,728	\$ 1,430,131	
2018	Project 1E: 119th Avenue from W Palm Ln to 1,250 feet North of I-10	30-inch Conc T-Lock CIPP	4	2,313	1	\$ 1,404,879	\$ 140,487.85	\$ 1,545,366	
2019	Project 1F: El Mirage Road & Durango Street	36-inch Conc T-Lock CIPP	1	669	0	\$ 602,871	\$ 120,574.10	\$ 723,445	
2019	Project 2A Design*	Rehab Design Costs	0	3,656	5	\$ -	\$ 128,721	\$ 128,721	
2020	Reasses Pipes (5-10 Years)	Reassess Pipe Costs	35	0	0	\$ -	\$ 40,000	\$ 40,000	
2020	Project 2A Pipe Rehabilitation	36-inch Conc T-Lock CIPP	4	2,748	0	\$ 1,287,205	\$ 128,721	\$ 1,415,926	
2021	Project 2B Design*	30-inch Conc T-Lock CIPP	1	593	0		\$ 45,643	\$ 45,643	
2021	Project 2B Pipe Rehabilitation & Project 2C Design*	36-inch Conc T-Lock CIPP	1	594	0	\$ 456,433	\$ 116,813	\$ 573,246	
2021	Project 2C Pipe Rehabilitation & Project 2D Design*	36-inch Conc T-Lock CIPP	1	657	1	\$ 711,697	\$ 131,334	\$ 843,031	
2022	Project 2D Pipe Rehabilitation & Project 2E Design*	36-inch Conc T-Lock CIPP	1	366	1	\$ 601,647	\$ 135,177	\$ 736,824	
2023	Project 2E Pipe Rehabilitation & Project 2F Design*	36-inch Conc T-Lock CIPP	1	262	1	\$ 750,119	\$ 143,465	\$ 893,584	
2024	Project 2F Pipe Rehabilitation & Project 2G Design*	30-inch Conc T-Lock CIPP	2	693	0	\$ 684,531	\$ 127,568	\$ 812,099	
2024	Project 2G Pipe Rehabilitation	24-inch Conc T-Lock CIPP	1	491	2	\$ 591,150	\$ 59,115	\$ 650,264	
						<b>Cost Total</b>	<b>\$ 10,513,826</b>	<b>\$ 2,149,415</b>	<b>\$ 12,663,241</b>

\*Cost for Design is estimated at 10% of Construction Cost



Year	Probable Costs (Rounded to the Nearest \$100)
FY 2014	\$ -
FY 2015	\$ 1,434,900
FY 2016	\$ 1,390,200
FY 2017	\$ 1,430,200
FY 2018	\$ 1,545,400
FY 2019	\$ 852,200
FY 2020	\$ 1,456,000
FY 2021	\$ 1,462,000
FY 2022	\$ 736,900
FY 2023	\$ 893,600
FY 2024	\$ 1,462,400
FY 2025	\$ -
FY 2026	\$ -
FY 2027	\$ -

# Avondale Large Diameter Sewer Rehabilitation

Project 1A: I-10 & Avondale

Preliminary Engineer's Opinion of Probable Costs



3	Pipe Segments - Feat-ID =	USMH	DSMH	Length
	SS16174001	MH16174001	MH16174002	173
	SS16174002	MH16174002	MH16174003	115
	SS16174003	MH16172004	MH16174001	592
1	MH Work	Rehabilitate	Adjust to Grade	Rehab Depth
	MH16174003	X		22

BID ITEM(S)	DESCRIPTION OF WORK	ESTIMATE QUANTITY	UNIT	UNIT PRICE	CONTRACT PRICE
1	Mobilization & Demobilization	1	LS	\$ 8,500.00	\$ 8,500.00
2	General Conditions	3	MO	\$ 30,000.00	\$ 90,000.00
<b>Sub-Total Direct Cost =</b>					<b>\$ 98,500.00</b>
3	Cured-in-place sewer lining of 21-in	0	LF	\$ 65.00	\$ -
4	Cured-in-place sewer lining of 24-in	880	LF	\$ 90.00	\$ 79,200.00
5	Cured-in-place sewer lining of 30-in	0	LF	\$ 135.00	\$ -
6	Cured-in-place sewer lining of 36-in	0	LF	\$ 185.00	\$ -
7	Cleaning & Pre-Rehab CCTV	880	LF	\$ 8.00	\$ 7,040.00
8	Post-Rehab CCTV	880	LF	\$ 1.50	\$ 1,320.00
9	Trenchless Removal of Obstructions	31	EA	\$ 150.00	\$ 4,650.00
10	Point Repair - 21 inch pipe	0	EA	\$ 10,500.00	\$ -
11	Point Repair - 24 inch pipe	0	EA	\$ 12,000.00	\$ -
12	Point Repair - 30 inch pipe	0	EA	\$ 15,000.00	\$ -
13	Point Repair - 36 inch pipe	0	EA	\$ 18,000.00	\$ -
14	Install Manhole, 60-inch diameter, < 20 feet in de	0	EA	\$ 10,000.00	\$ -
15	Adjust Manhole to Grade	0	EA	\$ 1,350.00	\$ -
16	Level 2 MACP Assessment	1	EA	\$ 300.00	\$ 300.00
17	Rehabilitate Manhole	22	VF	\$ 472.50	\$ 10,395.00
18	Clean Manhole	22	VF	\$ 157.50	\$ 3,465.00
19	Bypass Pump System	1	LS	\$ 165,000.00	\$ 165,000.00
20	Traffic Control	3	PIPE	\$ 36,000.00	\$ 108,000.00
<b>Sub -Total Subcontractors =</b>					<b>\$ 379,370.00</b>
21	Owner's Allowance	0	%	\$ -	\$ -
22	Contingency	20	%	\$ 95,600.00	\$ 95,600.00
<b>Allowances &amp; Contingency =</b>					<b>\$ 95,600.00</b>

O & P	12.0%	\$ 11,900.00
Sub M-up	5.0%	\$ 23,800.00
<b>Total Cost =</b>		<b>\$ 609,170.00</b>
Insurance	0.8%	\$ 4,600.00
Bonds	1.0%	\$ 6,200.00
Sales Tax	6.2%	\$ 38,500.00
2nd Tax	2.0%	\$ 800.00
<b>Total =</b>		<b>\$ 659,270.00</b>

Construction Installation Total =	\$	659,270.00
Engineering Design Phase Services (10%) = *	\$	65,927.00
Engineering Construction Phase Services (10%) = *	\$	65,927.00
Engineering Quality Control Inspection and Testing (included above) =		
<b>Project Total =</b>	<b>\$</b>	<b>791,124.00</b>

\*For planning purposes, Engineering Design and Construction Fees are assumed to be 10% of Construction.

# Avondale Large Diameter Sewer Rehabilitation

Project 1B: Eliseo C Felix Jr Way S of I-10  
 Preliminary Engineer's Opinion of Probable Costs



<b>1</b>	<b>Pipe Segments - Feat-ID =</b>	<b>USMH</b>	<b>DSMH</b>	<b>Length</b>	<b>\$/Pipe</b>
	SS17142002	MH17142003	MH17142001	505	\$ 434,422.50
<b>2</b>	<b>MH Work</b>	<b>Rehabilitate</b>	<b>Adjust to Grade</b>	<b>Rehab Depth</b>	
	MH17144004				
	MH17144003				

BID ITEM(S)	DESCRIPTION OF WORK	ESTIMATE QUANTITY	UNIT	UNIT PRICE	CONTRACT PRICE
1	Mobilization & Demobilization	1	LS	\$ 8,500.00	\$ 8,500.00
2	General Conditions	1	MO	\$ 30,000.00	\$ 30,000.00
<b>Sub-Total Direct Cost =</b>					<b>\$ 38,500.00</b>
3	Cured-in-place sewer lining of 21-in	505	LF	\$ 65.00	\$ 32,825.00
4	Cured-in-place sewer lining of 24-in	0	LF	\$ 90.00	\$ -
5	Cured-in-place sewer lining of 30-in	0	LF	\$ 135.00	\$ -
6	Cured-in-place sewer lining of 36-in	0	LF	\$ 185.00	\$ -
7	Cleaning & Pre-Rehab CCTV	505	LF	\$ 8.00	\$ 4,040.00
8	Post-Rehab CCTV	505	LF	\$ 1.50	\$ 757.50
9	Trenchless Removal of Obstructions	0	EA	\$ 150.00	\$ -
10	Point Repair - 21 inch pipe	0	EA	\$ 10,500.00	\$ -
11	Point Repair - 24 inch pipe	0	EA	\$ 12,000.00	\$ -
12	Point Repair - 30 inch pipe	0	EA	\$ 15,000.00	\$ -
13	Point Repair - 36 inch pipe	0	EA	\$ 18,000.00	\$ -
14	Install Manhole, 60-inch diameter, < 20 feet in de	0	EA	\$ 10,000.00	\$ -
15	Level 2 MACP Assessment	0	EA	\$ 300.00	\$ -
16	Rehabilitate Manhole	0	VF	\$ 472.50	\$ -
17	Clean Manhole	0	VF	\$ 157.50	\$ -
18	Bypass Pump System	1	LS	\$ 204,000.00	\$ 204,000.00
19	Traffic Control	1	PIPE	\$ 36,000.00	\$ 36,000.00
<b>Sub -Total Subcontractors =</b>					<b>\$ 277,622.50</b>
20	Owner's Allowance	0	%	\$ -	\$ -
21	Contingency	20	%	\$ 63,300.00	\$ 63,300.00
<b>Allowances &amp; Contingency =</b>					<b>\$ 63,300.00</b>

O & P	12.0%	\$ 4,700.00
Sub M-up	5.0%	\$ 17,100.00
<b>Total Cost =</b>		<b>\$ 401,222.50</b>
Insurance	0.8%	\$ 3,100.00
Bonds	1.0%	\$ 4,100.00
Sales Tax	6.2%	\$ 25,400.00
2nd Tax	2.0%	\$ 600.00
<b>Total =</b>		<b>\$ 434,422.50</b>

Construction Installation Total =	\$	434,422.50
Engineering Design Phase Services (10%) = *	\$	43,442.25
Engineering Construction Phase Services (10%) = *	\$	43,442.25
Engineering Quality Control Inspection and Testing (included above) =		
<b>Project Total =</b>	<b>\$</b>	<b>521,307.00</b>

\*For planning purposes, Engineering Design and Construction Fees are assumed to be 10% of Construction.

# Avondale Large Diameter Sewer Rehabilitation

Project 1C: Van Buren and Fairway Drive

Preliminary Engineer's Opinion of Probable Costs



3	Pipe Segments - Feat-ID =	USMH	DSMH	Length
	SS17163003	MH17163002	MH17154001	510
	SS18152008	MH17154001	MH18152004	517
	SS17163002	MH17163001	MH17143002	517
2	MH Work	Rehabilitate	Adjust to Grade	Rehab Depth
	MH17163002	X		21
	MH18152004	X		17

BID ITEM(S)	DESCRIPTION OF WORK	ESTIMATE QUANTITY	UNIT	UNIT PRICE	CONTRACT PRICE
1	Mobilization & Demobilization	1	LS	\$ 8,500.00	\$ 8,500.00
2	General Conditions	2	MO	\$ 30,000.00	\$ 60,000.00
<b>Sub-Total Direct Cost =</b>					<b>\$ 68,500.00</b>
3	Cured-in-place sewer lining of 21-in	0	LF	\$ 65.00	\$ -
4	Cured-in-place sewer lining of 24-in	0	LF	\$ 90.00	\$ -
5	Cured-in-place sewer lining of 30-in	517	LF	\$ 135.00	\$ 69,795.00
6	Cured-in-place sewer lining of 36-in	1,027	LF	\$ 185.00	\$ 189,995.00
7	Cleaning & Pre-Rehab CCTV	1,544	LF	\$ 8.00	\$ 12,352.00
8	Post-Rehab CCTV	1,544	LF	\$ 1.50	\$ 2,316.00
9	Trenchless Removal of Obstructions	34	EA	\$ 150.00	\$ 5,100.00
10	Point Repair - 21 inch pipe	0	EA	\$ 10,500.00	\$ -
11	Point Repair - 24 inch pipe	0	EA	\$ 12,000.00	\$ -
12	Point Repair - 30 inch pipe	0	EA	\$ 15,000.00	\$ -
13	Point Repair - 36 inch pipe	0	EA	\$ 18,000.00	\$ -
14	Install Manhole, 60-inch diameter, < 20 feet in depth	1	EA	\$ 30,000.00	\$ 30,000.00
15	Adjust Manhole to Grade	0	EA	\$ 1,350.00	\$ -
16	Level 2 MACP Assessment	2	EA	\$ 300.00	\$ 600.00
17	Rehabilitate Manhole	38	VF	\$ 472.50	\$ 17,955.00
18	Clean Manhole	38	VF	\$ 157.50	\$ 5,985.00
19	Bypass Pump System	1	LS	\$ 370,200.00	\$ 370,200.00
20	Traffic Control	2	PIPE	\$ 36,000.00	\$ 72,000.00
<b>Sub -Total Subcontractors =</b>					<b>\$ 776,298.00</b>
21	Owner's Allowance	0	%	\$ -	\$ -
22	Contingency	20	%	\$ 169,000.00	\$ 169,000.00
<b>Allowances &amp; Contingency =</b>					<b>\$ 169,000.00</b>

O & P	12.0%	\$ 8,300.00
Sub M-up	5.0%	\$ 47,300.00
<b>Total Cost =</b>		<b>\$ 1,069,398.00</b>
Insurance	0.8%	\$ 8,100.00
Bonds	1.0%	\$ 10,800.00
Sales Tax	6.2%	\$ 67,500.00
2nd Tax	2.0%	\$ 1,400.00
<b>Total =</b>		<b>\$ 1,157,200.00</b>

Construction Installation Total =	\$	1,157,200.00
Engineering Design Phase Services (10%) = *	\$	115,720.00
Engineering Construction Phase Services (10%) = *	\$	115,720.00
Engineering Quality Control Inspection and Testing (included above) =		
<b>Project Total =</b>	<b>\$</b>	<b>1,388,640.00</b>

\*For planning purposes, Engineering Design and Construction Fees are assumed to be 10% of Construction.

# Avondale Large Diameter Sewer Rehabilitation

Project 1D: Van Buren & Links Drive

Preliminary Engineer's Opinion of Probable Costs



5	Pipe Segments - Feat-ID =	USMH	DSMH	Length
	SS17164001	MH17164002	MH17164005	21
	SS17164005	MH17164007	MH17164002	523
	SS17164006	MH17164005	MH17164006	520
	SS17164035	MH17164006	MH17164016	45
	SS17164034	MH17164016	MH17164001	245
1	MH Work	Rehabilitate	Adjust to Grade	Rehab Depth
	MH17164007	X		20

BID ITEM(S)	DESCRIPTION OF WORK	ESTIMATE QUANTITY	UNIT	UNIT PRICE	CONTRACT PRICE
1	Mobilization & Demobilization	1	LS	\$ 8,500.00	\$ 8,500.00
2	General Conditions	3	MO	\$ 30,000.00	\$ 90,000.00
<b>Sub-Total Direct Cost =</b>					<b>\$ 98,500.00</b>
3	Cured-in-place sewer lining of 21-in	0	LF	\$ 65.00	\$ -
4	Cured-in-place sewer lining of 24-in	0	LF	\$ 90.00	\$ -
5	Cured-in-place sewer lining of 30-in	0	LF	\$ 135.00	\$ -
6	Cured-in-place sewer lining of 36-in	1,354	LF	\$ 185.00	\$ 250,490.00
7	Cleaning & Pre-Rehab CCTV	1,354	LF	\$ 8.00	\$ 10,832.00
8	Post-Rehab CCTV	1,354	LF	\$ 1.50	\$ 2,031.00
9	Trenchless Removal of Obstructions	3	EA	\$ 150.00	\$ 450.00
10	Point Repair - 21 inch pipe	0	EA	\$ 10,500.00	\$ -
11	Point Repair - 24 inch pipe	0	EA	\$ 12,000.00	\$ -
12	Point Repair - 30 inch pipe	0	EA	\$ 15,000.00	\$ -
13	Point Repair - 36 inch pipe	0	EA	\$ 18,000.00	\$ -
14	Install Manhole, 60-inch diameter, < 20 feet in de	0	EA	\$ 10,000.00	\$ -
15	Adjust Manhole to Grade	0	EA	\$ 1,350.00	\$ -
16	Level 2 MACP Assessment	1	EA	\$ 300.00	\$ 300.00
17	Rehabilitate Manhole	20	VF	\$ 472.50	\$ 9,450.00
18	Clean Manhole	20	VF	\$ 157.50	\$ 3,150.00
19	Bypass Pump System	1	LS	\$ 371,000.00	\$ 371,000.00
20	Traffic Control	3	PIPE	\$ 36,000.00	\$ 108,000.00
<b>Sub -Total Subcontractors =</b>					<b>\$ 755,703.00</b>
21	Owner's Allowance	0	%	\$ -	\$ -
22	Contingency	20	%	\$ 170,900.00	\$ 170,900.00
<b>Allowances &amp; Contingency =</b>					<b>\$ 170,900.00</b>

O & P	12.0%	\$ 11,900.00
Sub M-up	5.0%	\$ 46,400.00
<b>Total Cost =</b>		<b>\$ 1,083,403.00</b>
Insurance	0.8%	\$ 8,200.00
Bonds	1.0%	\$ 11,000.00
Sales Tax	6.2%	\$ 68,400.00
2nd Tax	2.0%	\$ 1,400.00
<b>Total =</b>		<b>\$ 1,172,403.00</b>

Construction Installation Total =	\$ 1,172,403.00
Engineering Design Phase Services (10%) = *	\$ 117,240.30
Engineering Construction Phase Services (10%) = *	\$ 117,240.30
Engineering Quality Control Inspection and Testing (included above) =	
<b>Project Total =</b>	<b>\$ 1,406,883.60</b>

\*For planning purposes, Engineering Design and Construction Fees are assumed to be 10% of Construction.

**Avondale Large Diameter Sewer Rehabilitation**  
**Project 1E: 119th Avenue from W Palm Ln to 1,250 feet North of I-10**  
**Preliminary Engineer's Opinion of Probable Costs**



4	Pipe Segments - Feat-ID =	USMH	DSMH	Length
	SS15173002	MH15173002	MH16171008	597
	SS15173003	MH16171004	MH16171005	538
	SS16171004	MH16171005	MH16171003	571
	SS16171005	MH15173001	MH15173002	375
	SS16171002	MH16171003	MH16171006	232
1	MH Work	Rem & Repl	MH Depth	
	MH16171003	X	17	

BID ITEM(S)	DESCRIPTION OF WORK	ESTIMATE QUANTITY	UNIT	UNIT PRICE	CONTRACT PRICE
1	Mobilization & Demobilization	1	LS	\$ 8,500.00	\$ 8,500.00
2	General Conditions	4	MO	\$ 30,000.00	\$ 120,000.00
<b>Sub-Total Direct Cost =</b>					<b>\$ 128,500.00</b>
3	Cured-in-place sewer lining of 21-in	0	LF	\$ 65.00	\$ -
4	Cured-in-place sewer lining of 24-in	0	LF	\$ 90.00	\$ -
5	Cured-in-place sewer lining of 30-in	2,313	LF	\$ 135.00	\$ 312,255.00
6	Cured-in-place sewer lining of 36-in	0	LF	\$ 185.00	\$ -
7	Cleaning & Pre-Rehab CCTV	2,313	LF	\$ 8.00	\$ 18,504.00
8	Post-Rehab CCTV	2,313	LF	\$ 1.50	\$ 3,469.50
9	Trenchless Removal of Obstructions	9	EA	\$ 150.00	\$ 1,350.00
10	Point Repair - 21 inch pipe	0	EA	\$ 10,500.00	\$ -
11	Point Repair - 24 inch pipe	0	EA	\$ 12,000.00	\$ -
12	Point Repair - 30 inch pipe	0	EA	\$ 15,000.00	\$ -
13	Point Repair - 36 inch pipe	0	EA	\$ 18,000.00	\$ -
14	Install Manhole, 60-inch diameter, < 20 feet in de	1	EA	\$ 30,000.00	\$ 30,000.00
15	Level 2 MACP Assessment	0	EA	\$ 300.00	\$ -
16	Rehabilitate Manhole	0	VF	\$ 472.50	\$ -
17	Clean Manhole	0	VF	\$ 157.50	\$ -
18	Bypass Pump System	1	LS	\$ 385,000.00	\$ 385,000.00
19	Traffic Control	4	PIPE	\$ 36,000.00	\$ 144,000.00
<b>Sub -Total Subcontractors =</b>					<b>\$ 894,578.50</b>
20	Owner's Allowance	0	%	\$ -	\$ -
21	Contingency	20	%	\$ 204,700.00	\$ 204,700.00
<b>Allowances &amp; Contingency =</b>					<b>\$ 204,700.00</b>

O & P	12.0%	\$ 15,500.00
Sub M-up	5.0%	\$ 55,000.00
<b>Total Cost =</b>		<b>\$ 1,298,278.50</b>
Insurance	0.8%	\$ 9,800.00
Bonds	1.0%	\$ 13,100.00
Sales Tax	6.2%	\$ 82,000.00
2nd Tax	2.0%	\$ 1,700.00
<b>Total =</b>		<b>\$ 1,404,878.50</b>

Construction Installation Total =	\$	1,404,878.50
Engineering Design Phase Services (10%) = *	\$	140,487.85
Engineering Construction Phase Services (10%) = *	\$	140,487.85
Engineering Quality Control Inspection and Testing (included above) =		
<b>Project Total =</b>	<b>\$</b>	<b>1,685,854.20</b>

\*For planning purposes, Engineering Design and Construction Fees are assumed to be 10% of Construction.

# Avondale Large Diameter Sewer Rehabilitation

Project 1F: El Mirage Road & Durango Street  
 Preliminary Engineer's Opinion of Probable Costs



1	Pipe Segments - Feat-ID =	USMH	DSMH	Length
	SS20154038	MH20163005	MH20154034	669.3

BID ITEM(S)	DESCRIPTION OF WORK	ESTIMATE QUANTITY	UNIT	UNIT PRICE	CONTRACT PRICE
1	Mobilization & Demobilization	1	LS	\$ 8,500.00	\$ 8,500.00
2	General Conditions	1	MO	\$ 30,000.00	\$ 30,000.00
<b>Sub-Total Direct Cost =</b>					<b>\$ 38,500.00</b>
3	Cured-in-place sewer lining of 21-in	0	LF	\$ 65.00	\$ -
4	Cured-in-place sewer lining of 24-in	0	LF	\$ 90.00	\$ -
5	Cured-in-place sewer lining of 30-in	0	LF	\$ 135.00	\$ -
6	Cured-in-place sewer lining of 36-in	669	LF	\$ 185.00	\$ 123,765.00
7	Cleaning & Pre-Rehab CCTV	669	LF	\$ 8.00	\$ 5,352.00
8	Post-Rehab CCTV	669	LF	\$ 1.50	\$ 1,003.50
9	Trenchless Removal of Obstructions	1	EA	\$ 150.00	\$ 150.00
10	Point Repair - 21 inch pipe	0	EA	\$ 10,500.00	\$ -
11	Point Repair - 24 inch pipe	0	EA	\$ 12,000.00	\$ -
12	Point Repair - 30 inch pipe	0	EA	\$ 15,000.00	\$ -
13	Point Repair - 36 inch pipe	0	EA	\$ 18,000.00	\$ -
14	Install Manhole, 60-inch diameter, < 20 feet in de	1	EA	\$ 30,000.00	\$ 30,000.00
15	Level 2 MACP Assessment	0	EA	\$ 300.00	\$ -
16	Rehabilitate Manhole	0	VF	\$ 472.50	\$ -
17	Clean Manhole	0	VF	\$ 157.50	\$ -
18	Bypass Pump System	1	LS	\$ 205,000.00	\$ 205,000.00
19	Traffic Control	1	PIPE	\$ 36,000.00	\$ 36,000.00
<b>Sub -Total Subcontractors =</b>					<b>\$ 401,270.50</b>
20	Owner's Allowance	0	%	\$ -	\$ -
21	Contingency	20	%	\$ 88,000.00	\$ 88,000.00
<b>Allowances &amp; Contingency =</b>					<b>\$ 88,000.00</b>

O & P	12.0%	\$ 4,700.00
Sub M-up	5.0%	\$ 24,500.00
<b>Total Cost =</b>		<b>\$ 556,970.50</b>
Insurance	0.8%	\$ 4,200.00
Bonds	1.0%	\$ 5,700.00
Sales Tax	6.2%	\$ 35,200.00
2nd Tax	2.0%	\$ 800.00
<b>Total =</b>		<b>\$ 602,870.50</b>

Construction Installation Total =	\$	602,870.50
Engineering Design Phase Services (10%) = *	\$	60,287.05
Engineering Construction Phase Services (10%) = *	\$	60,287.05
Engineering Quality Control Inspection and Testing (included above) =		
<b>Project Total =</b>	<b>\$</b>	<b>723,444.60</b>

\*For planning purposes, Engineering Design and Construction Fees are assumed to be 10% of Construction.

# Avondale Large Diameter Sewer Rehabilitation

Project 2A: 119th Avenue S of I-10 N of Van Buren Street

Preliminary Engineer's Opinion of Probable Costs



4	Pipe Segments - Feat-ID =	USMH	DSMH	Length
	SS17162001	MH16164003	MH17162001	553.7
	SS17162002	MH17162001	MH17162002	532.5
	SS17162003	MH17162002	MH17164003	555.1
	SS17164003	MH17164003	MH17164004	553.8
	SS17164004	MH17164004	MH17164007	553

BID ITEM(S)	DESCRIPTION OF WORK	ESTIMATE QUANTITY	UNIT	UNIT PRICE	CONTRACT PRICE
1	Mobilization & Demobilization	1	LS	\$ 8,500.00	\$ 8,500.00
2	General Conditions	4	MO	\$ 30,000.00	\$ 120,000.00
<b>Sub-Total Direct Cost =</b>					<b>\$ 128,500.00</b>
3	Cured-in-place sewer lining of 21-in	0	LF	\$ 65.00	\$ -
4	Cured-in-place sewer lining of 24-in	0	LF	\$ 90.00	\$ -
5	Cured-in-place sewer lining of 30-in	0	LF	\$ 135.00	\$ -
6	Cured-in-place sewer lining of 36-in	2,748	LF	\$ 185.00	\$ 508,398.50
7	Cleaning & Pre-Rehab CCTV	2,748	LF	\$ 8.00	\$ 21,984.80
8	Post-Rehab CCTV	2,748	LF	\$ 1.50	\$ 4,122.15
9	Trenchless Removal of Obstructions	12	EA	\$ 150.00	\$ 1,800.00
10	Point Repair - 21 inch pipe	0	EA	\$ 10,500.00	\$ -
11	Point Repair - 24 inch pipe	0	EA	\$ 12,000.00	\$ -
12	Point Repair - 30 inch pipe	0	EA	\$ 15,000.00	\$ -
13	Point Repair - 36 inch pipe	0	EA	\$ 18,000.00	\$ -
14	Install Manhole, 60-inch diameter, < 20 feet in de	0	EA	\$ 30,000.00	\$ -
15	Level 2 MACP Assessment	0	EA	\$ 300.00	\$ -
16	Rehabilitate Manhole	0	VF	\$ 472.50	\$ -
17	Clean Manhole	0	VF	\$ 157.50	\$ -
18	Bypass Pump System	1	LS	\$ 236,000.00	\$ 236,000.00
19	Traffic Control	1	PIPE	\$ 36,000.00	\$ 36,000.00
<b>Sub -Total Subcontractors =</b>					<b>\$ 808,305.45</b>
20	Owner's Allowance	0	%	\$ -	\$ -
21	Contingency	20	%	\$ 187,400.00	\$ 187,400.00
<b>Allowances &amp; Contingency =</b>					<b>\$ 187,400.00</b>

O & P	12.0%	\$ 15,500.00
Sub M-up	5.0%	\$ 49,800.00
<b>Total Cost =</b>		<b>\$ 1,189,505.45</b>
Insurance	0.8%	\$ 9,000.00
Bonds	1.0%	\$ 12,000.00
Sales Tax	6.2%	\$ 75,100.00
2nd Tax	2.0%	\$ 1,600.00
<b>Total =</b>		<b>\$ 1,287,205.45</b>

Construction Installation Total =	\$	1,287,205.45
Engineering Design Phase Services (10%) = *	\$	128,720.55
Engineering Construction Phase Services (10%) = *	\$	128,720.55
Engineering Quality Control Inspection and Testing (included above) =		
<b>Project Total =</b>	<b>\$</b>	<b>1,544,646.54</b>

\*For planning purposes, Engineering Design and Construction Fees are assumed to be 10% of Construction.

# Avondale Large Diameter Sewer Rehabilitation

Project 2B: Golf Course N of CR-85

Preliminary Engineer's Opinion of Probable Costs



1	Pipe Segments - Feat-ID =	USMH	DSMH	Length
	SS19163027	MH19161017	MH19163022	594

BID ITEM(S)	DESCRIPTION OF WORK	ESTIMATE QUANTITY	UNIT	UNIT PRICE	CONTRACT PRICE
1	Mobilization & Demobilization	1	LS	\$ 8,500.00	\$ 8,500.00
2	General Conditions	1	MO	\$ 30,000.00	\$ 30,000.00
<b>Sub-Total Direct Cost =</b>					<b>\$ 38,500.00</b>
3	Cured-in-place sewer lining of 21-in	0	LF	\$ 65.00	\$ -
4	Cured-in-place sewer lining of 24-in	0	LF	\$ 90.00	\$ -
5	Cured-in-place sewer lining of 30-in	0	LF	\$ 135.00	\$ -
6	Cured-in-place sewer lining of 36-in	594	LF	\$ 185.00	\$ 109,890.00
7	Cleaning & Pre-Rehab CCTV	594	LF	\$ 8.00	\$ 4,752.00
8	Post-Rehab CCTV	594	LF	\$ 1.50	\$ 891.00
9	Trenchless Removal of Obstructions	2	EA	\$ 150.00	\$ 300.00
10	Point Repair - 21 inch pipe	0	EA	\$ 10,500.00	\$ -
11	Point Repair - 24 inch pipe	0	EA	\$ 12,000.00	\$ -
12	Point Repair - 30 inch pipe	0	EA	\$ 15,000.00	\$ -
13	Point Repair - 36 inch pipe	0	EA	\$ 18,000.00	\$ -
14	Install Manhole, 60-inch diameter, < 20 feet in depth	0	EA	\$ 30,000.00	\$ -
15	Level 2 MACP Assessment	0	EA	\$ 300.00	\$ -
16	Rehabilitate Manhole	0	VF	\$ 472.50	\$ -
17	Clean Manhole	0	VF	\$ 157.50	\$ -
18	Bypass Pump System	1	LS	\$ 142,000.00	\$ 142,000.00
19	Traffic Control	1	PIPE	\$ 36,000.00	\$ 36,000.00
<b>Sub -Total Subcontractors =</b>					<b>\$ 293,833.00</b>
20	Owner's Allowance	0	%	\$ -	\$ -
21	Contingency	20	%	\$ 66,500.00	\$ 66,500.00
<b>Allowances &amp; Contingency =</b>					<b>\$ 66,500.00</b>

O & P	12.0%	\$ 4,700.00
Sub M-up	5.0%	\$ 18,100.00
<b>Total Cost =</b>		<b>\$ 421,633.00</b>
Insurance	0.8%	\$ 3,200.00
Bonds	1.0%	\$ 4,300.00
Sales Tax	6.2%	\$ 26,700.00
2nd Tax	2.0%	\$ 600.00
<b>Total =</b>		<b>\$ 456,433.00</b>

Construction Installation Total =	\$	456,433.00
Engineering Design Phase Services (10%) = *	\$	45,643.30
Engineering Construction Phase Services (10%) = *	\$	45,643.30
Engineering Quality Control Inspection and Testing (included above) =		
<b>Project Total =</b>	<b>\$</b>	<b>547,719.60</b>

\*For planning purposes, Engineering Design and Construction Fees are assumed to be 10% of Construction.

# Avondale Large Diameter Sewer Rehabilitation

Project 2C: Lower Buckeye Rd & El Mirage Rd  
Preliminary Engineer's Opinion of Probable Costs



<b>1</b>	<b>Pipe Segments - Feat-ID =</b>	<b>USMH</b>	<b>DSMH</b>	<b>Length</b>
	SS21154021	MH21154020	MH21154016	657
<b>1</b>	<b>Manhole - Feat-ID =</b>	<b>Rehabilitate</b>	<b>Adjust to Grade</b>	<b>Rehab Depth</b>
	MH21154020	X		17

BID ITEM(S)	DESCRIPTION OF WORK	ESTIMATE QUANTITY	UNIT	UNIT PRICE	CONTRACT PRICE
1	Mobilization & Demobilization	1	LS	\$ 8,500.00	\$ 8,500.00
2	General Conditions	1	MO	\$ 30,000.00	\$ 30,000.00
<b>Sub-Total Direct Cost =</b>					<b>\$ 38,500.00</b>
3	Cured-in-place sewer lining of 21-in	0	LF	\$ 65.00	\$ -
4	Cured-in-place sewer lining of 24-in	0	LF	\$ 90.00	\$ -
5	Cured-in-place sewer lining of 30-in	0	LF	\$ 135.00	\$ -
6	Cured-in-place sewer lining of 36-in	657	LF	\$ 185.00	\$ 121,545.00
7	Cleaning & Pre-Rehab CCTV	657	LF	\$ 8.00	\$ 5,256.00
8	Post-Rehab CCTV	657	LF	\$ 1.50	\$ 985.50
9	Trenchless Removal of Obstructions	2	EA	\$ 150.00	\$ 300.00
10	Point Repair - 21 inch pipe	0	EA	\$ 10,500.00	\$ -
11	Point Repair - 24 inch pipe	0	EA	\$ 12,000.00	\$ -
12	Point Repair - 30 inch pipe	0	EA	\$ 15,000.00	\$ -
13	Point Repair - 36 inch pipe	0	EA	\$ 18,000.00	\$ -
14	Install Manhole, 60-inch diameter, < 20 feet in depth	0	EA	\$ 30,000.00	\$ -
15	Level 2 MACP Assessment	1	EA	\$ 300.00	\$ 300.00
16	Rehabilitate Manhole	17	VF	\$ 472.50	\$ 8,032.50
17	Clean Manhole	17	VF	\$ 157.50	\$ 2,677.50
18	Bypass Pump System	1	LS	\$ 306,000.00	\$ 306,000.00
19	Traffic Control	1	PIPE	\$ 36,000.00	\$ 36,000.00
<b>Sub -Total Subcontractors =</b>					<b>\$ 481,096.50</b>
20	Owner's Allowance	0	%	\$ -	\$ -
21	Contingency	20	%	\$ 104,000.00	\$ 104,000.00
<b>Allowances &amp; Contingency =</b>					<b>\$ 104,000.00</b>

O & P	12.0%	\$ 4,700.00
Sub M-up	5.0%	\$ 29,300.00
	<b>Total Cost =</b>	<b>\$ 657,596.50</b>
Insurance	0.8%	\$ 5,000.00
Bonds	1.0%	\$ 6,700.00
Sales Tax	6.2%	\$ 41,500.00
2nd Tax	2.0%	\$ 900.00
	<b>Total =</b>	<b>\$ 711,696.50</b>

Construction Installation Total =	\$	711,696.50
Engineering Design Phase Services (10%) = *	\$	71,169.65
Engineering Construction Phase Services (10%) = *	\$	71,169.65
Engineering Quality Control Inspection and Testing (included above) =		
<b>Project Total =</b>	<b>\$</b>	<b>854,035.80</b>

\*For planning purposes, Engineering Design and Construction Fees are assumed to be 10% of Construction.

# Avondale Large Diameter Sewer Rehabilitation

Project 2D: 127th Avenue S of Pioneer St

Preliminary Engineer's Opinion of Probable Costs



<b>1</b>	<b>Pipe Segments - Feat-ID =</b>	<b>USMH</b>	<b>DSMH</b>	<b>Length</b>
	SS22144003	MH22142001	MH22144002	366
<b>1</b>	<b>Manhole - Feat-ID =</b>	<b>Rehabilitate</b>	<b>Adjust to Grade</b>	<b>Rehab Depth</b>
	MH22142001	X		17

BID ITEM(S)	DESCRIPTION OF WORK	ESTIMATE QUANTITY	UNIT	UNIT PRICE	CONTRACT PRICE
1	Mobilization & Demobilization	1	LS	\$ 8,500.00	\$ 8,500.00
2	General Conditions	1	MO	\$ 30,000.00	\$ 30,000.00
<b>Sub-Total Direct Cost =</b>					<b>\$ 38,500.00</b>
3	Cured-in-place sewer lining of 21-in	0	LF	\$ 65.00	\$ -
4	Cured-in-place sewer lining of 24-in	0	LF	\$ 90.00	\$ -
5	Cured-in-place sewer lining of 30-in	0	LF	\$ 135.00	\$ -
6	Cured-in-place sewer lining of 36-in	366	LF	\$ 185.00	\$ 67,710.00
7	Cleaning & Pre-Rehab CCTV	366	LF	\$ 8.00	\$ 2,928.00
8	Post-Rehab CCTV	366	LF	\$ 1.50	\$ 549.00
9	Trenchless Removal of Obstructions	1	EA	\$ 150.00	\$ 150.00
10	Point Repair - 21 inch pipe	0	EA	\$ 10,500.00	\$ -
11	Point Repair - 24 inch pipe	0	EA	\$ 12,000.00	\$ -
12	Point Repair - 30 inch pipe	0	EA	\$ 15,000.00	\$ -
13	Point Repair - 36 inch pipe	0	EA	\$ 18,000.00	\$ -
14	Install Manhole, 60-inch diameter, < 20 feet in depth	0	EA	\$ 30,000.00	\$ -
15	Level 2 MACP Assessment	1	EA	\$ 300.00	\$ 300.00
16	Rehabilitate Manhole	17	VF	\$ 472.50	\$ 8,032.50
17	Clean Manhole	17	VF	\$ 157.50	\$ 2,677.50
18	Bypass Pump System	1	LS	\$ 282,000.00	\$ 282,000.00
19	Traffic Control	1	PIPE	\$ 36,000.00	\$ 36,000.00
<b>Sub -Total Subcontractors =</b>					<b>\$ 400,347.00</b>
20	Owner's Allowance	0	%	\$ -	\$ -
21	Contingency	20	%	\$ 87,800.00	\$ 87,800.00
<b>Allowances &amp; Contingency =</b>					<b>\$ 87,800.00</b>

O & P	12.0%	\$ 4,700.00
Sub M-up	5.0%	\$ 24,500.00
	<b>Total Cost =</b>	<b>\$ 555,847.00</b>
Insurance	0.8%	\$ 4,200.00
Bonds	1.0%	\$ 5,700.00
Sales Tax	6.2%	\$ 35,100.00
2nd Tax	2.0%	\$ 800.00
	<b>Total =</b>	<b>\$ 601,647.00</b>

Construction Installation Total =	\$	601,647.00
Engineering Design Phase Services (10%) = *	\$	60,164.70
Engineering Construction Phase Services (10%) = *	\$	60,164.70
Engineering Quality Control Inspection and Testing (included above) =		
<b>Project Total =</b>	<b>\$</b>	<b>721,976.40</b>

\*For planning purposes, Engineering Design and Construction Fees are assumed to be 10% of Construction.

# Avondale Large Diameter Sewer Rehabilitation

Project 2E: 127th Avenue S of Elwood St

Preliminary Engineer's Opinion of Probable Costs



<b>1</b>	<b>Pipe Segments - Feat-ID =</b>	<b>USMH</b>	<b>DSMH</b>	<b>Length</b>
	SS23142022	MH23142016	MH23142015	262
<b>1</b>	<b>Manhole - Feat-ID =</b>	<b>Rehabilitate</b>	<b>Adjust to Grade</b>	<b>Rehab Depth</b>
	MH23142016	X		17

BID ITEM(S)	DESCRIPTION OF WORK	ESTIMATE QUANTITY	UNIT	UNIT PRICE	CONTRACT PRICE
1	Mobilization & Demobilization	1	LS	\$ 8,500.00	\$ 8,500.00
2	General Conditions	1	MO	\$ 30,000.00	\$ 30,000.00
<b>Sub-Total Direct Cost =</b>					<b>\$ 38,500.00</b>
3	Cured-in-place sewer lining of 21-in	0	LF	\$ 65.00	\$ -
4	Cured-in-place sewer lining of 24-in	0	LF	\$ 90.00	\$ -
5	Cured-in-place sewer lining of 30-in	0	LF	\$ 135.00	\$ -
6	Cured-in-place sewer lining of 36-in	262	LF	\$ 185.00	\$ 48,470.00
7	Cleaning & Pre-Rehab CCTV	262	LF	\$ 8.00	\$ 2,096.00
8	Post-Rehab CCTV	262	LF	\$ 1.50	\$ 393.00
9	Trenchless Removal of Obstructions	3	EA	\$ 150.00	\$ 450.00
10	Point Repair - 21 inch pipe	0	EA	\$ 10,500.00	\$ -
11	Point Repair - 24 inch pipe	0	EA	\$ 12,000.00	\$ -
12	Point Repair - 30 inch pipe	0	EA	\$ 15,000.00	\$ -
13	Point Repair - 36 inch pipe	0	EA	\$ 18,000.00	\$ -
14	Install Manhole, 60-inch diameter, < 20 feet in depth	0	EA	\$ 30,000.00	\$ -
15	Level 2 MACP Assessment	1	EA	\$ 300.00	\$ 300.00
16	Rehabilitate Manhole	17	VF	\$ 472.50	\$ 8,032.50
17	Clean Manhole	17	VF	\$ 157.50	\$ 2,677.50
18	Bypass Pump System	1	LS	\$ 411,000.00	\$ 411,000.00
19	Traffic Control	1	PIPE	\$ 36,000.00	\$ 36,000.00
<b>Sub -Total Subcontractors =</b>					<b>\$ 509,419.00</b>
20	Owner's Allowance	0	%	\$ -	\$ -
21	Contingency	20	%	\$ 109,600.00	\$ 109,600.00
<b>Allowances &amp; Contingency =</b>					<b>\$ 109,600.00</b>

O & P	12.0%	\$ 4,700.00
Sub M-up	5.0%	\$ 31,000.00
	<b>Total Cost =</b>	<b>\$ 693,219.00</b>
Insurance	0.8%	\$ 5,200.00
Bonds	1.0%	\$ 7,000.00
Sales Tax	6.2%	\$ 43,800.00
2nd Tax	2.0%	\$ 900.00
	<b>Total =</b>	<b>\$ 750,119.00</b>

Construction Installation Total =	\$	750,119.00
Engineering Design Phase Services (10%) = *	\$	75,011.90
Engineering Construction Phase Services (10%) = *	\$	75,011.90
Engineering Quality Control Inspection and Testing (included above) =		
<b>Project Total =</b>	<b>\$</b>	<b>900,142.80</b>

\*For planning purposes, Engineering Design and Construction Fees are assumed to be 10% of Construction.

# Avondale Large Diameter Sewer Rehabilitation

Project 2F: 115th Avenue N of I-10

Preliminary Engineer's Opinion of Probable Costs



2	Pipe Segments - Feat-ID =	USMH	DSMH	Length
	SS16173003	MH16173002	MH16173004	540.6
	SS16164001	MH16173004	MH16164001	152

BID ITEM(S)	DESCRIPTION OF WORK	ESTIMATE QUANTITY	UNIT	UNIT PRICE	CONTRACT PRICE
1	Mobilization & Demobilization	1	LS	\$ 8,500.00	\$ 8,500.00
2	General Conditions	2	MO	\$ 30,000.00	\$ 60,000.00
<b>Sub-Total Direct Cost =</b>					<b>\$ 68,500.00</b>
3	Cured-in-place sewer lining of 21-in	0	LF	\$ 65.00	\$ -
4	Cured-in-place sewer lining of 24-in	0	LF	\$ 90.00	\$ -
5	Cured-in-place sewer lining of 30-in	693	LF	\$ 135.00	\$ 93,501.00
6	Cured-in-place sewer lining of 36-in	0	LF	\$ 185.00	\$ -
7	Cleaning & Pre-Rehab CCTV	693	LF	\$ 8.00	\$ 5,540.80
8	Post-Rehab CCTV	693	LF	\$ 1.50	\$ 1,038.90
9	Trenchless Removal of Obstructions	3	EA	\$ 150.00	\$ 450.00
10	Point Repair - 21 inch pipe	0	EA	\$ 10,500.00	\$ -
11	Point Repair - 24 inch pipe	0	EA	\$ 12,000.00	\$ -
12	Point Repair - 30 inch pipe	0	EA	\$ 15,000.00	\$ -
13	Point Repair - 36 inch pipe	0	EA	\$ 18,000.00	\$ -
14	Install Manhole, 60-inch diameter, < 20 feet in depth	0	EA	\$ 30,000.00	\$ -
15	Level 2 MACP Assessment	0	EA	\$ 300.00	\$ -
16	Rehabilitate Manhole	0	VF	\$ 472.50	\$ -
17	Clean Manhole	0	VF	\$ 157.50	\$ -
18	Bypass Pump System	1	LS	\$ 257,000.00	\$ 257,000.00
19	Traffic Control	2	PIPE	\$ 36,000.00	\$ 72,000.00
<b>Sub -Total Subcontractors =</b>					<b>\$ 429,530.70</b>
20	Owner's Allowance	0	%	\$ -	\$ -
21	Contingency	20	%	\$ 99,700.00	\$ 99,700.00
<b>Allowances &amp; Contingency =</b>					<b>\$ 99,700.00</b>

O & P	12.0%	\$ 8,300.00
Sub M-up	5.0%	\$ 26,500.00
	<b>Total Cost =</b>	<b>\$ 632,530.70</b>
Insurance	0.8%	\$ 4,800.00
Bonds	1.0%	\$ 6,400.00
Sales Tax	6.2%	\$ 40,000.00
2nd Tax	2.0%	\$ 800.00
	<b>Total =</b>	<b>\$ 684,530.70</b>

Construction Installation Total =	\$	684,530.70
Engineering Design Phase Services (10%) = *	\$	68,453.07
Engineering Construction Phase Services (10%) = *	\$	68,453.07
Engineering Quality Control Inspection and Testing (included above) =		
<b>Project Total =</b>	<b>\$</b>	<b>821,436.84</b>

\*For planning purposes, Engineering Design and Construction Fees are assumed to be 10% of Construction.

# Avondale Large Diameter Sewer Rehabilitation

Project 2G: 115th Avenue N of I-10

Preliminary Engineer's Opinion of Probable Costs



1	Pipe Segments - Feat-ID =	USMH	DSMH	Length
	SS16172001	MH16172006	MH16172001	491
2	Manhole - Feat-ID =	Rehabilitate	Adjust to Grade	Rehab Depth
	MH16172006	X		17
	MH16172001	X		18

BID ITEM(S)	DESCRIPTION OF WORK	ESTIMATE QUANTITY	UNIT	UNIT PRICE	CONTRACT PRICE
1	Mobilization & Demobilization	1	LS	\$ 8,500.00	\$ 8,500.00
2	General Conditions	1	MO	\$ 30,000.00	\$ 30,000.00
<b>Sub-Total Direct Cost =</b>					<b>\$ 38,500.00</b>
3	Cured-in-place sewer lining of 21-in	0	LF	\$ 65.00	\$ -
4	Cured-in-place sewer lining of 24-in	491	LF	\$ 90.00	\$ 66,285.00
5	Cured-in-place sewer lining of 30-in	0	LF	\$ 135.00	\$ -
6	Cured-in-place sewer lining of 36-in	0	LF	\$ 185.00	\$ -
7	Cleaning & Pre-Rehab CCTV	491	LF	\$ 8.00	\$ 3,928.00
8	Post-Rehab CCTV	491	LF	\$ 1.50	\$ 736.50
9	Trenchless Removal of Obstructions	1	EA	\$ 150.00	\$ 150.00
10	Point Repair - 21 inch pipe	0	EA	\$ 10,500.00	\$ -
11	Point Repair - 24 inch pipe	0	EA	\$ 12,000.00	\$ -
12	Point Repair - 30 inch pipe	0	EA	\$ 15,000.00	\$ -
13	Point Repair - 36 inch pipe	0	EA	\$ 18,000.00	\$ -
14	Install Manhole, 60-inch diameter, < 20 feet in depth	0	EA	\$ 30,000.00	\$ -
15	Level 2 MACP Assessment	2	EA	\$ 300.00	\$ 600.00
16	Rehabilitate Manhole	35	VF	\$ 472.50	\$ 16,537.50
17	Clean Manhole	35	VF	\$ 157.50	\$ 5,512.50
18	Bypass Pump System	1	LS	\$ 227,000.00	\$ 227,000.00
19	Traffic Control	2	PIPE	\$ 36,000.00	\$ 72,000.00
<b>Sub -Total Subcontractors =</b>					<b>\$ 392,749.50</b>
20	Owner's Allowance	0	%	\$ -	\$ -
21	Contingency	20	%	\$ 86,300.00	\$ 86,300.00
<b>Allowances &amp; Contingency =</b>					<b>\$ 86,300.00</b>

O & P	12.0%	\$ 4,700.00
Sub M-up	5.0%	\$ 24,000.00
<b>Total Cost =</b>		<b>\$ 546,249.50</b>
Insurance	0.8%	\$ 4,100.00
Bonds	1.0%	\$ 5,600.00
Sales Tax	6.2%	\$ 34,500.00
2nd Tax	2.0%	\$ 700.00
<b>Total =</b>		<b>\$ 591,149.50</b>

Construction Installation Total =	\$	591,149.50
Engineering Design Phase Services (10%) = *	\$	59,114.95
Engineering Construction Phase Services (10%) = *	\$	59,114.95
Engineering Quality Control Inspection and Testing (included above) =		
<b>Project Total =</b>	<b>\$</b>	<b>709,379.40</b>

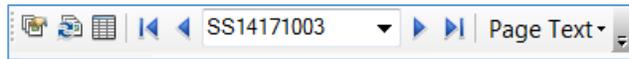
\*For planning purposes, Engineering Design and Construction Fees are assumed to be 10% of Construction.

# Appendix E

CCTV and GIS Data and Hyperlink Map

(saved to external hard drive attached)

To use data driven map features in ArcGIS® in the map saved to the portable external hard drive included in **Appendix E**, select the “Data Driven Pages” toolbar from the “Toolbars” menu in the Customize Tab to add the toolbar to the workstation. The “Data Driven Pages” toolbar looks like this:



. Click the ‘Set Up Data Driven Pages’ button  and select “Enable Data Driven Pages” using Index Layer with Data Frame: “Structural”, Layer: “Lrg Dia SS CA 2014”, Name Field: “Feat-ID”, Sort Field: “Feat-ID”, and Optional Field for Rotation: “Rotate”.

To access the map’s hyperlink features in ArcGIS®, identify the pipe feature using the identification button  then scroll down and click on the field marked “Video” or “CCTVlog”. Observation/defect point snapshot hyperlinks can be accessed from the Structural or Operation & Maintenance defect shapefiles in the map. Hyperlinks can also be accessed using the hyperlink tool , or by right clicking on the hyperlink field and selecting “**View Hyperlink**”.

The map’s hyperlink features were setup using relative paths to allows the user to plug the external hard drive into any computer and use hyperlinking features without having to reformat map links. The user can copy and paste the folder saved to the external hard drive to any computer and continue to use the hyperlinking features.