Basis of Design Report

2021-2023 Annual Storm Drain Repairs

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Executive Summary

Introduction:

Harris & Associates (Harris) was retained by the Town of Moraga (Town) to conduct an investigation of the Town's storm drain system that included inspection and assessment of approximately 30,000 lineal feet of Public storm drain pipe, provide rehabilitation recommendations, prioritize improvements and present the findings in a Basis of Design Report (BOD). Information presented in the BOD represents planning-level construction recommendations and estimates, which will help to program the required future implementation of the recommended improvements. Furthermore, the information presented in the BOD will assist the Town on how to proceed with prioritizing, phasing, and making design decisions.

Background:

The Town of Moraga's Storm Drain Network is comprised of approximately 29 miles of storm drain infrastructure, of which approximately 21 miles are within the Town's right of way and easements and, therefore, publicly maintained by the Town, with the remainder being privately maintained. Included in the storm drain infrastructure are ditches and natural creeks that are routed through large underground culverts at roadways undercrossing. Prior to any master plan development, the Town initially began addressing storm drain rehabilitation on an as-needed basis with individual projects as a response to drainage issues. Projects would be scoped based on the area of the Town that needed attention or grouped in with other projects for minor repairs.

Beginning in 1998, the Town's Camino Pablo & Larch Avenue Drainage Project was an example of a reactive response to a discovered issue of the need to rehabilitate the pipelines along these two streets. The drainage system in this area was in need of repair in order to improve capacity and the overall quality of the storm drain network. At the time, there was no capital improvement program in place for storm drain rehabilitation; thus, any drainage needs were addressed as individual projects on an as-needed basis. It was found that a more proactive system needed to be developed in order to address other deficient areas of the storm drain network throughout the Town and to improve the level of service of the town-wide storm drain system.

The Town's complete storm drain network went through an investigation between 2006 and 2008 to analyze the conditions of pipes, catch basins, manholes, inlets, and other related features. The study was done to compile what areas needed repairs and monitor when the repairs would need to be completed. As a result, the Town would be able to schedule annual repairs based on necessity and annual budgets. Many of the storm drain improvements that followed began to be more proactive and systematic.

In 2015, the Town of Moraga developed a Storm Drain Master Plan to establish a capital improvements program (CIP) that would assess and rehabilitate storm drain system conditions

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within the Town limits. The objective was to increase the level of service throughout the existing drainage system and ensure that the system was being improved based on priority and was routinely updated over the course of several CIP projects. The initial master plan assessment included video inspection of pipelines, field investigations of creek culverts and drainage features (including manholes, catch basins, etc.), as-built research, and related improvement construction costs. The Master Plan also included a broken down evaluation of the existing drainage system based on hydrologic and hydraulic calculations and provided general recommendations and guidelines for repairs. Storm drain capacity improvement projects were also included that significantly increased the projected cost to upgrade and rehabilitate the Town's storm drain system. The improvement program created from the Master Plan is an overall guideline to be used for annual budgeting and is intended to assist with scoping out and prioritizing necessary storm drain maintenance and repairs.

The CIP projects that followed the preparation of the Master Plan in 2015, 2016, and 2018 integrated identified storm drain repairs into the Town's street rehabilitation projects in different areas of the Town. The Town had taken the opportunity to include the necessary storm drain repairs for these areas to improve the drainage systems. In general, the storm drain repairs for these areas included point repairs, lining, and removal and replacement of pipe depending on the severity of the defects. Overall, the storm drain systems were getting improved annually, as referenced by the Master Plan.

After heavy rainfall in 2016, the Town experienced repeated failed storm drain infrastructure, which caused major sinkholes and triggered maintenance work to unclog pipes filled with debris and sediment. The Town had not previously experienced significant flooding caused by undersized pipes; thus, the focus following the heavy storm events was to address the existing condition of the pipelines and not capacity issues. As a result, the Town prepared a 2019 addendum to the Master Plan and developed a Storm Water Operations & Maintenance (O&M) Program to address and rehabilitate the aging publicly maintained storm drainage infrastructure.

Since then, the Town has continued to annually provide services to investigate pipe conditions and rehabilitate lines based on the annual budget to address ongoing concerns regarding the level of service of the storm drain network. The Town is ensuring that any necessary improvements are made within the capital improvement projects and monitoring areas that may need to be addressed in future work. As part of this Project, Harris & Associates is assisting the Town with navigating the storm drain improvements needed within 2021-2023.

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Purpose & Need Summary:

The purpose and need for this BOD are threefold:

- First and foremost, to assess and identify the needed improvements for the Town's storm drainage system.
- Secondly, to identify and prepare construction documents to address the most pressing improvements, and
- Finally, to identify future improvements needed to the Town's storm drainage infrastructure.

Conclusion:

This BOD provides a tool for officials of Moraga to utilize to reduce both recurring problems, reduce changes of future flooding issues and lessen the possibility of more serious stormwater related risks of private and/or public property damage. This BOD and recommended improvements are a starting point for addressing the identified needed improvements to the storm drainage system when funding becomes available. It is anticipated that Town staff and/or their consultants will perform a more detailed study and/or alternatives analysis to identify the most affordable and effective improvements with information gathered as part of the design phase (detailed topography, utility conflicts, easements, etc.). Additional study will also clarify further exactly which portions of each facility are Town-owned and which are private.

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Section 1 Introduction

1.1 Purpose

The Town of Moraga has retained Harris to provide design services and prepare construction documents for the 2021-2023 Annual Storm Drain Repair Project (CIP 21-205). The purpose of this "Basis of Design Report" (BOD) is to summarize progress to date, describe the design approach and present a preliminary assessment of design recommendations. Along with this report, Harris is submitting a cost analysis of proposed storm drain repairs as well as recommendations for one storm drain improvement project that fits within the Town's budget. This BOD was developed in collaboration with Town staff direction and suggestions. Upon the Town's acceptance of this BOD, Harris will proceed with the development of a 60% Plans, Specifications, and Estimate (PS&E) package.

This BDM has been prepared based on current available information. Modifications may be made as issues are further identified and resolved.

1.2 Project Description

Based on the information in the 2015 Storm Drain Management Plan and 2019 Addendum, of the 21 miles of storm drain pipeline within the Town, 88% are reinforced concrete pipe (RCP), 7% are corrugated metal pipes (CMP), and the remaining are polyvinyl chloride (PVC) or high-density polyethylene (HDPE) pipes. Harris completed an analysis of the Town's GIS information and previous inspection reports to determine that there are approximately 1,000 LF of CMP and 17,000 LF of pipes equal to and greater than 36-inch diameter (various materials), totaling 18,000 LF of pipelines within the public right-of-way to be assessed. After discussion with the Town, the Town opted to also include storm drain pipes and culverts smaller than the 36-inch diameter to bring the total to 30,000 LF of publicly maintained storm drain pipe for assessment and repair recommendations.

As part of the 2021-2023 Annual Storm Drain Repair Project (CIP 21-205), the Town and Harris teams collaborated to video inspect and assess infrastructure and identify ongoing pipe failures, as well as develop a basis of design for storm drain pipe repair recommendations. The storm drains identified for repair within this report are proposed to be constructed in 2023. Due to a construction budget of $1.3 million, several of the storm drain lines discussed in this report may be repaired in future phases. **Figure 1** shows the locations of the storm drain network within the Town, while **Table 1-1** summarizes the total linear foot of the storm drain pipe to be assessed.

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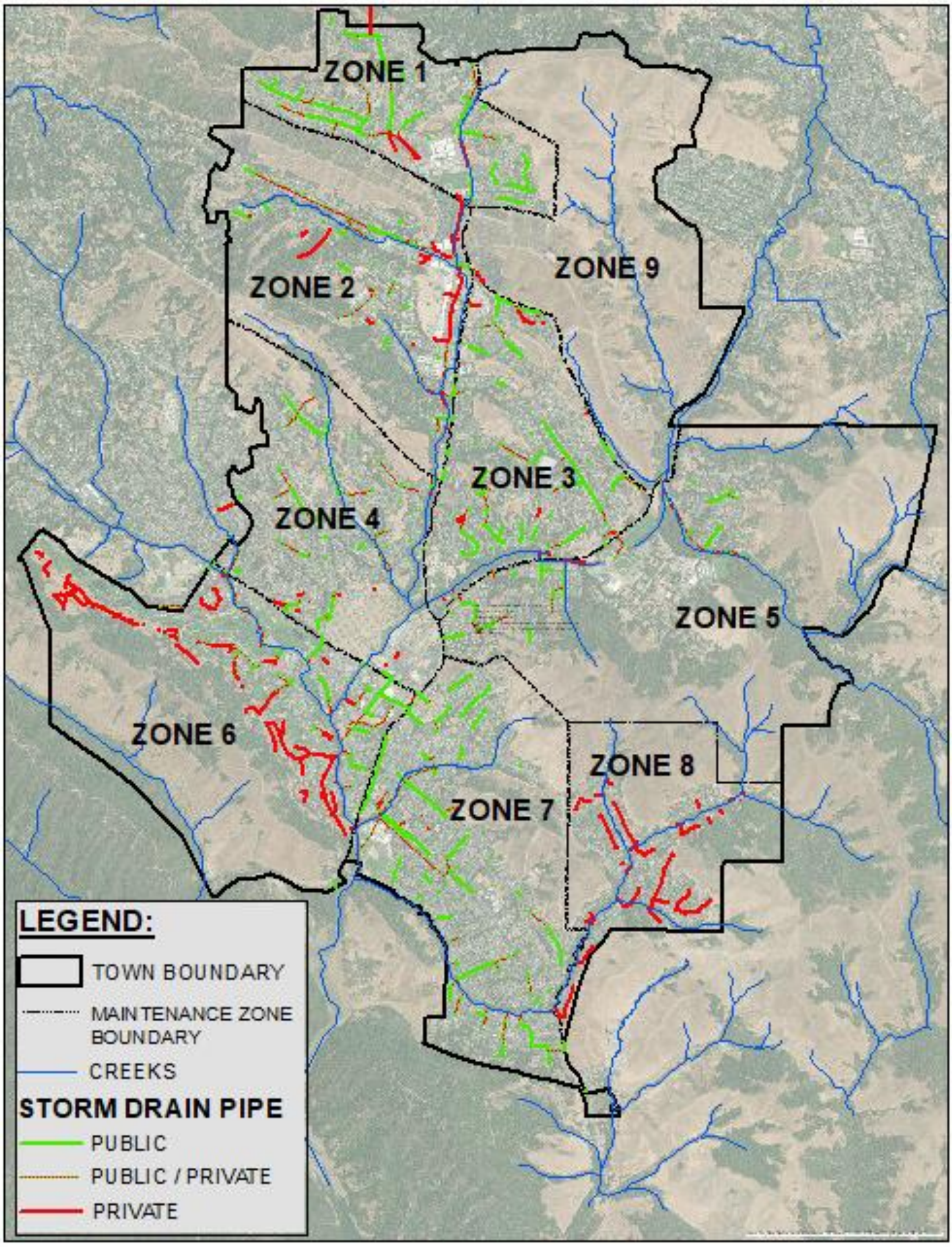


Figure 1. Town of Moraga Annual Storm Drain Repairs Vicinity Map

Table 1-1: Quantity of Storm Drain Pipe Assessment

TYPE OF SD PIPES	TOTAL LINEAR FEET
PIPES ≥ 36-INCH (non-CMP)	17,000 LF
CMP PIPES	1,000 LF
ADDED PIPES/CULVERTS < 36"	12,000 LF
TOTAL STORM DRAIN PIPES TO BE ASSESSED IN PROJECT	**APPROX 30,000 LF**

* The estimated total number of storm drain pipes to be inspected includes 5 % heavy cleaning and 1 % light cleaning. Adjustments in the above scope of work will modify actual number of storm drain pipes inspected.

1.3 Work Completed to Date

A. Kick-off meeting was held on April 26, 2022.

B. Harris identified pipes to be inspected that are ≥ 36" in diameter, and CMP pipes not yet inspected on May 24, 2022.

C. Town directed Harris to include pipes < 36" that would pose a grave consequence as a result of its failure on May 31, 2022.

D. Harris finalized the list of pipes to be inspected on June 20, 2022.

E. Presidio Systems Inc. (Presidio), the closed-circuit television (CCTV) subconsultant, performed storm drain CCTV beginning July 2022 (submitted encroachment permit on June 27, 2022, and received the encroachment permit on July 15, 2022).

F. Presidio simultaneously provided storm drain CCTV information to Harris while an ongoing CCTV investigation was performed.

G. Presidio completed CCTV inspections for project pipelines in August 2022.

H. Harris analyzed completed CCTV information and prepared recommendations for pipeline repairs in September 2022.

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Section 2 Basis of Design and Assessments

Due to aging infrastructure and environmental conditions, storm drain pipe conditions within the Town have deteriorated over time and/or became clogged with debris. A municipality can address this deterioration and accumulated debris via various treatments and methodologies and regular maintenance, as detailed further within this Section. When determining the most appropriate method of pipe restoration, several factors must be considered, including but not limited to CCTV investigations, PACP ratings, rehabilitation intrusiveness, environmental factors, and cost-effectiveness.

2.1 Design Standards & References

The following are drawing standards and references used for the preliminary design:

- Latest Edition of Contra Costa County Standard Plans
- Moraga Storm Drain Master Plan
- 2019 Addendum to the Storm Drain Master Plan
- Manual on Uniform Traffic Control Devices (California MUTCD) 2014 edition, Rev3.

2.2 CCTV Investigations and PACP Ratings

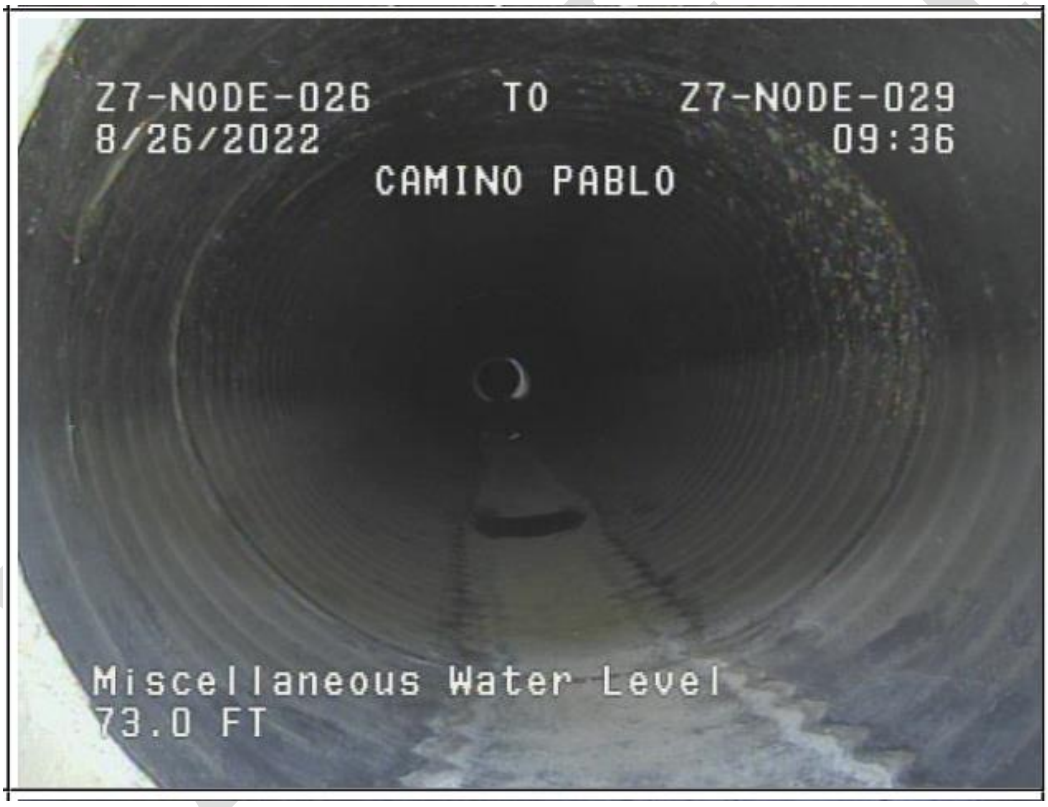
In order to appropriately assess the 30,000 LF (180 pipe segments) of storm drain pipes proposed for inspection, Harris facilitated and analyzed the CCTV work performed by Presidio. Presidio's services included cleaning, CCTV inspection, preparing the summary report, and issuing the report and CCTV video to Harris. Within the report details, Presidio provided a pipe condition quick rating score (QRS) based on the severity of defects found within the pipe. These ratings follow the National Association of Sewer Service Companies (NASSCO) Pipeline Assessment and Certification Program (PACP) Condition Grading System. In general, the structural and operational and maintenance (O&M) defects within a pipe are graded from 1 to 5, increasing in severity, with five being the most significant. Grades are assigned based on the significance of the defect, extent of damage, percentage of restriction to flow capacity, or the amount of wall loss due to deterioration. The defects within each pipe are summarized in a CCTV report using the PACP Quick Rating and pipe graphic showing the position, distance, rating, and continuity along the pipe. Using the CCTV report, Harris was able to analyze and confirm the rehabilitation method recommended for each pipe segment based on the investigated pipe conditions. **Table 2-1 and 2-2** summarize the grade descriptions provided by PACP. The CCTV reports prepared by Presidio can be found in **Appendix A**.

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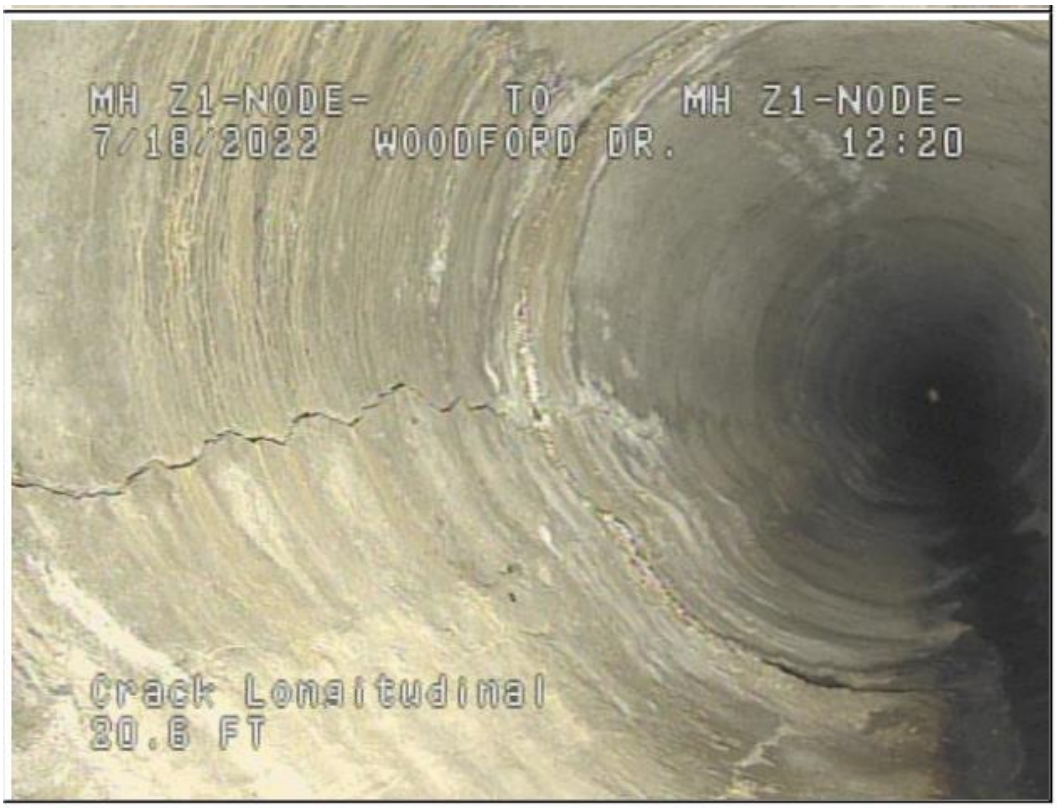
Table 2-1: Structural Defect Grades

Grade	Description	Likelihood of Failure	Examples
1	Excellent Condition –Minor Defects	Unlikely in the foreseeable future	Surface Damage – Roughness Increased Crack – Circumferential
2	Good Condition – Minor to Moderate Defects	Unlikely to fail for at least 20 years	Surface Damage – Aggregate Visible Crack – Longitudinal
3	Fair Condition – Moderate Defects	May fail within 10-20 years	Joint Offset or Separation – Medium Crack – Multiple or at Hinges
4	Poor Condition – Significant Defects	Likely to fail within 5-10 years	Joint Offset or Separation – Large Hole or Broken – No Soil/Voids Visible
5	Immediate Attention Needed	Has failed or likely to fail within 5 years	Hole or Broken – Soil/Voids Visible Total Collapse

Based on the examples listed in Table 2-1, below are photo examples for each PACP Grade Rating for structural deficiencies:



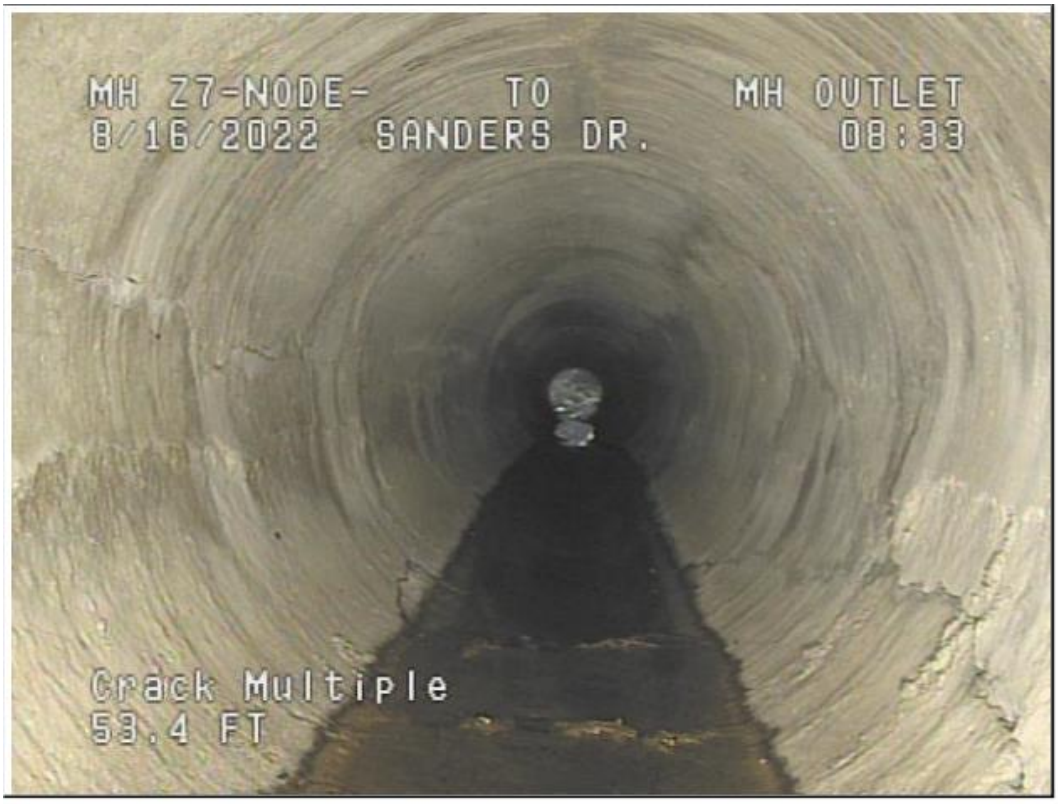
Grade 1 – Minor Surface Damage



Grade 2 – Minor Longitudinal Cracking



Grade 3 – Medium Joint Offset



Grade 4 – Severe Cracking



Grade 5 – Broken Hole with Visible Soil

Table 2-2: O&M Defect Grades

Grade	O&M Obstruction (%)
1	N/A
2	≤10% Obstruction of Flow
3	<10% to ≤20% Obstruction of Flow
4	<20% to ≤30% Obstruction of Flow
5	>30% Obstruction of Flow

Harris used the following process to efficiently identify and evaluate critical defects based on Presidio's storm drain CCTV and inspection reports. The segments analyzed were selected based on the following criteria:

- Segments with at least one Grade 3 or higher Structural Defect
- Segments with at least one Grade 3 or higher O&M defect

Typical Grade 3 to 5 structural defects include, but are not limited to: cracks, fractures, broken pipe, joint offsets, pipe wall holes, deformed pipe cross-sections, surface damage, and collapse of the pipe. An example of a Grade 3 structural defect is when the pipe is observed to have a damaged surface due to corrosion. If left untreated, this could cause the pipe to corrode further and create a hole in the future. An example of Grade 4 structural defect is the presence of a hole within the wall that spans less than two clock positions. This will cause flow within the pipe to drain into and contaminate the surrounding earth. The defect is upgraded to a Grade 5 when soil is visible within the hole or when the hole spans more than two clock positions, signifying the surrounding earth is entering or will enter the pipe, contaminate flow and create a void.

Typical O&M defects Grade 3 to 5 include but are not limited to: deposits in the pipes, roots intruding, infiltration, and obstacles/obstructions. These defects block pipe cross-sectional areas or indicate the settlement of debris and significantly affect the rate of deterioration. The higher grades are related to the high severity of deposits obstructing flow and preventing stormwater to pass through pipelines.

2.3 Storm Drain Pipe Cleaning

Light and heavy cleaning of the storm drain pipe was performed at various locations in order to clear any existing debris for video inspections and assist with re-establishing flow through the pipe. During the initial CCTV attempts, certain pipelines were identified to have heavy debris that blocked flow capacity and video access to inspect the full length of the pipes. These pipes were listed for additional cleaning in order to obtain a full inspection report to better determine any rehabilitation needs. A hydro-jet-vacuum removal method was used to push the debris downstream into a catch basin or access point with high-pressure water and vacuumed using a hose attached to a Vactor Truck. The following pipes were cleared of debris and resulted in 10 CY of debris.

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Table 2-3: Storm Drain Pipes Cleaned

No.	ADDRESS	ZONE	MATERIAL	SIZE	LENGTH (lf)	UNIQUE ID
1.	327 Moraga Rd	1	RCP	60"	191	L-0116
2.	177 Natalie Dr	1	RCP	36"	23	Z1_LINK_0033
3.	162 Natalie Dr	1	RCP	36"	364	Z1_LINK_0034
4.	1 Willow Springs Ln	3	RCP	18"	34	Z3_LINK_0155
5.	171 Hazelwood Pl	6	RCP	30"	374	Z6_LINK_0013
6.	141 Oxford Dr	7	RCP	36"	214	Z7_LINK_0046
7.	1198 Cedarwood Dr	7	RCP	30"	242	Z7_LINK_0051b
8.	425 Deerfield Dr	7	RCP	42"	241	Z7_LINK_0181
9.	431 Deerfield Dr	7	RCP	36"	184	Z7_LINK_0182
10.	Canyon Road	7	RCP	30"	528	Z7_LINK_0241
11.	Canyon Road	7	RCP	36"	341	Z7_LINK_0241A
12.	Canyon Road	7	RCP	48"	228	Z7_LINK_0257
13.	1003 Camino Pablo	7	RCP	36"	71	Z7_LINK_0260
14.	1007 Camino Pablo	7	RCP	36"	54	Z7_LINK_0262
			TOTAL LENGTH		3,089	

Since the amount of debris cleared as part of the scope of this work was reached with the above-listed segments, additional pipes have been identified for cleaning. Of the 14 segments (3,089 LF) cleaned, only 3 segments (approximately 32 LF) needed minor repairs (approximately 1%). The following lines are pending cleaning:

Table 2-4: Storm Drain Pipes Identified for Additional Cleaning [1]

No.	ADDRESS	ZONE	MATERIAL	SIZE	LENGTH (lf)	UNIQUE ID
1.	45 Buckingham Dr	1	RCP	30"	221	Z1_LINK_0045
2.	3743 Campolindo Dr	1	RCP	48"	140	Z1_LINK_0050
3.	390 Calle La Mesa	1	RCP	30"	65	Z1_LINK_0100
4.	3803 Paseo Grande	1	RCP	48"	77	Z1_LINK_0152
5.	109 Goodfellow Dr	2	RCP	15"	30	L-0681
6.	33 Laird Dr	2	RCP	24"	38	Z2_LINK_0069
7.	276 Scofield Dr	2	HDPE	36"	33	Z2_LINK_0245
8.	Stafford Dr @ St Marys Road	3	HDPE	36"	55	L-0317
9.	25 Lucas Dr	3	RCP	36"	200	L-0625
10.	99 Lynwood Pl	4	RCP	30"	50	Z4_LINK_0104
11.	1003 Wickham Dr	5	RCP	36"	47	Z5_LINK_0001
12.	1049 Wickham Dr	5	RCP	36"	393	Z5_LINK_0074
13.	1708 Spyglass Ln	6	HDPE	18"	23	L-0178
14.	St Andrews Dr @ San Pablo Creek	6	CMP	55"	331	L-0448
15.	119 Hazelwood Pl	6	RCP	48"	400	Z6_LINK_0009
16.	1049 Sanders Dr	7	RCP	36"	60	Z7_LINK_0071
17.	197 Walford Dr	7	RCP	30"	90	Z7_LINK_0107
18.	356 Deerfield Dr	7	RCP	30"	43	Z7_LINK_0169

[1] Location where portions of pipe segments are on private property (pp), the PP owners will be notifies of their responsibilities and work will be coordinated.

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19.	1009 Camino Pablo	7	RCP	36"	7	Z7_LINK_0264
			TOTAL	LENGTH	2,303 LF	

The amount of accumulated debris can be attributed to various factors, mainly the slope of the pipe being flat, preventing the stormwater flows from reaching a velocity that can allow the pipe to self-clean or where the upstream tributary area is primarily undeveloped. Additional field investigation is warranted to identify locations where debris is entering the storm drain system to identify where inlet controls are needed to prevent debris from entering the storm drain system. It is noted that the debris accumulation requires coordination with owners of certain private property storm drain pipes.

2.4 Storm Drain Pipe Repair Assessment

Of the 180 segments inspected, 60 (or 33%) of them were identified to have Grades 3 or higher per the criteria above and were analyzed for repair recommendations. The repair methods included were determined based on the findings from the CCTV report analyses. Repair recommendations included removal and replacement, point repairs, pipe liners, heavy cleaning, and reinspection, depending on the severity of defects and cost-effectiveness. Detailed CCTV reports generated by Presidio can be found in **Appendix A** for all inspected segments. **Appendix B** includes Table B-1, which summarizes the observed recommended improvements for storm drain lines for all segments with a QRS 3-5. **Appendix C** includes maps of the recommended Project for the Town's construction budget of $1.3 million.

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2.5 Storm Drain Rehabilitation Alternatives

After determining the existing conditions of the storm drain pipes and assessing recommended repairs, Harris also researched the applicability of six (6) rehabilitation method alternatives to achieve the Town's rehabilitation and construction goals. In recommending repairs such as replacement or pipe liner, there are different methods and materials to consider based on where each pipe is located in order to find the most cost-effective and least-intrusive combination. The benefits and limitations of each alternative are summarized in **Table 2-3** at the end of this subsection.

2.5.1 Replacement



Replacement is considered as a repair alternative for pipes with serious structural deficiencies that would not be a good candidate for invert paving or lining rehabilitation. Sections of the storm drain line that were deemed structurally deficient would need to be excavated and replaced by open trench methods. The open cut trench method involves excavating down to and exposing the existing pipe so that it can be repaired or replaced, and then the trench backfilled. When the open cut trench excavation is located under pavement, the existing pavement must be saw cut and removed, the excavated trench would then be filled with granular backfill (compacted stone or sand to prevent settlement), and the pavement must be replaced to match the length of the pipe replacement. This method would require further investigation into any nearby existing utilities that may be affected by the open trench construction. In addition, this method is more costly than other alternatives due to the open trench excavation installation of a new section of pipe and the trench and surface restoration associated with it. When feasible, it is recommended to consider other repair methodologies since they are less costly, have less impact on the public and environment, and may provide a comparable service life to new pipe installation.

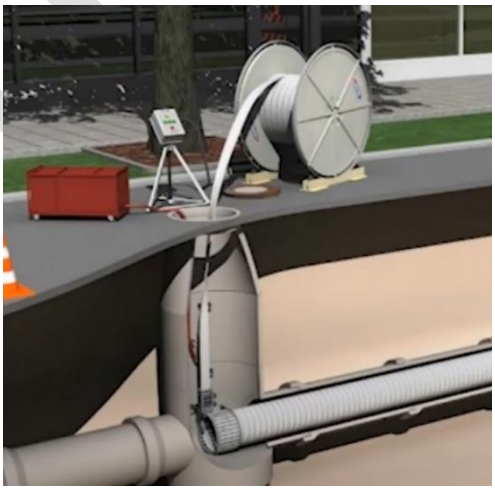
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2.5.2 Cured-In-Place Pipe (CIPP)



CIPP liner is a material comprised of a continuous woven felt tube that is saturated with a chemical resin, which strengthens after fully cured. It is inserted into an existing pipe by inversion methods or pulling-in-place and is a type of trenchless repair method. CIPP is dependent on a number of factors to provide a satisfactory structural pipe, including heat to cure the resin, uniform saturation of the felt, and clean and dry conditions of the pipe. In order to install the CIPP liner, existing flows will need to be diverted to a different pipe within the storm drain system. While this method is less intrusive than an open trench repair, the disposal of the curing water will need to be considered due to the chemicals within the CIPP resin, which can have an adverse effect on aquatic habitats in high concentrations.

2.5.3 Spiral Wound Pipe Liner



Spiral Wound Pipe Liner is another trenchless alternative to CIPP liner in which the pipe interior is lined with an interlocking ribbon of PVC material, creating a watertight pipe that expands inside of the defective pipe. The back side of the PVC ribbon has ribs which strengthens the liner. Steel band reinforcement is also available within the PVC ribbon for larger diameter repairs. This alternative has an added advantage in that it does not require flow diversions and can be installed in wet and low-flow pipe conditions. There is also no temperature or chemical dependent process required to install the liner, and typically the material is ready to be installed at full strength and shelf-ready for use. However, the installation process requires a specialty contractor and may not be efficient for short pipe lengths due to the construction installation process.

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2.5.4 Slip Lining



Slip lining is another method of repair liner for larger diameter pipes where CIPP liner or Spiral Wound Pipe Liner are not possible or cost-effective. A smaller diameter pipe is placed inside the existing damaged pipe, and the remaining annular space between the existing and new pipe is grouted. The liner pipe material can range from RCP, HDPE, or fiberglass-reinforced polymer mortar, and many others. With this method, the overall inside diameter of the pipe would decrease once the slip liner is installed, but often it does not result in a decrease in hydraulic capacity as long as the friction factor of the liner pipe is appropriately lower than the friction factor of the existing pipe being repaired, such as HDPE inside of CMP. This construction method requires a specialty contractor to install the liner due to the complexity and may not be economical for shorter pipe lengths.

2.5.5 Invert Paving



Invert paving entails bracing the existing culvert from the inside of the pipe, cutting out the rusted pipe invert, and pouring back in place a reinforced concrete slab. This repair only protects the invert of the pipe, not the entire pipe, as do other lining repair options, and is typically only recommended if cost savings are necessary. This repair solution is typically limited to larger culverts since it requires construction teams to be inside the pipe to perform the repair; thus, it will not be a suitable repair method for pipes smaller than a 36-inch diameter.

2.5.6 Fiber Reinforced Cementitious Mortar or Geopolymer via Spray Application



Fiber-reinforced cementitious mortar or geopolymer via spray application, also commonly referred to as fiber-reinforced centrifugally cast concrete or geopolymer, is a material that is spin-cast onto the inside of typically CMP to a 1" -3" thickness. The spin-cast apparatus is mounted on a sled that is pulled through the CMP at a controlled rate of speed. Additionally, the material can be manually applied if the shape doesn't permit it to be applied robotically. Both fiber-reinforced mortar and geopolymer provide structural repairs and have a 28-day

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compressive strength of 8,000 PSI. There is a small reduction in pipe diameter, but the reduction in surface roughness will increase hydraulic capacity when used on CMP. This repair method is cost-effective for short lengths of pipe. Cementous mortar has been used in spray applications for a long time, while geopolymer is a relatively new material. However, the geopolymer material has better spray ability, cures quicker, and bonds better to the pipe surface than the mortar material. Water flows can be reintroduced to the CMP approximately three to four hours after the application of the geopolymer material.

2.5.7 Summary of Alternative Methods

Table 2-3 summarizes the pros and cons of each alternative method detailed within this subsection.

Table 2-3: Summary of Alternative Methods

Method	Pros	Con
Replacement	• Provides new pipe • Adequate structural strength • No increase/decrease in pipe capacity • Does not require specialty contractor	• Highest capital cost • Most intrusive method for repair and restoration • Will require heavy coordination with the public to perform work (road closures, ground disturbance, etc.)
Cured-In-Place Pipe Liner	• Adequate structural strength • Minimal impact on hydraulic capacity • Less intrusive	• High capital cost • Requires specialty contractor • May not be economical for short pipe lengths and high mobilization/demobilization fixed costs for installation • Requires handling and disposal of curing water • Requires more quality control and testing to ensure the liner is properly cured
Spiral Wound Pipe Liner	• Adequate structural strength • Less intrusive • Provides an equivalent or greater hydraulic capacity • Attaining specified strength requirements and testing the final product is not necessary • Can be installed in wet, low-flow conditions • Minimal equipment required	• Moderate capital cost • Requires specialty contractor • May not be economical for short pipe lengths
Slip Lining	• Adequate structural strength • Can provide equivalent or greater hydraulic capacity • Less intrusive	• Moderate capital cost • Requires specialty contractor • May not be economical for short pipe lengths

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Method	Pros	Con
Invert Paving	• Low capital cost • Adequate structural strength for pipe invert • Does not require a specialty contractor • Slight decrease in hydraulic capacity	• Only protects pipe invert and not entire circumference
Fiber Reinforced Cementitious Mortar or Geopolymer via Spray Application	• Adequate structural strength • Minimal impact on hydraulic capacity • Less intrusive • Minimal equipment • Cost effective for short pipe lengths	• Moderate capital cost • Requires specialty contractor

2.6 GIS Mapping

Harris downloaded relevant storm drain and right-of-way (ROW) information from the Town's Storm Drain Web Map for Asset Inspection and will incorporate the data into the project plans. This information does not constitute a legal survey and was used only to identify the locations of the storm drain lines and prepare the repair exhibits in **Appendix C.** The web map identifies the storm drain system by link and node numbers that are assigned to locate each feature based on residential zones. In total, the Town of Moraga is divided into seven (7) residential subdivision zones and correlates with the identification numbering used in the tables and exhibits. The repair exhibits include ROW, storm drain link identification numbers, street names, and other items as detailed in the key legends. Harris did not conduct any separate ROW surveying.

2.7 Topographic Survey

Once the identified replacement segments are finalized, a field survey of the street segments and recorded roadway widths, utility covers, and other items of note will be performed. Our subconsultant, LCC Engineering and Surveying, Inc, will perform ground surveys for select street segments that require more in-depth topography. The elevations for the survey will be based on NGS Published GPS Control monuments of record (based on CCS Zone III, NAD83, with NAVD 88 elevations).

2.8 Utility Facility Information

With respect to open trench excavation, identifying underground utilities ahead of time and coordinating with respective agencies will help in preparing storm drain repair recommendations and feasibility. Obtaining and analyzing any potential conflicts early on is crucial to avoid delays and issues during construction. Harris will request utility facility information from all utility agencies thought to have facilities within the project limits where storm drain lines will be replaced via an open trench. It will also be requested that the utility agencies notify Harris of

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any planned improvements within the project areas to coordinate scheduling. The following affected utility companies and agencies have been contacted with respect to this Project:

- AT&T (Cable, Phone, & Internet)
- Comcast (Cable, Phone, & Internet)
- Pacific Gas & Electric (PG&E) (Gas & Electric)
- Central Contra Costa Sanitary District (CCCSD) (Sanitary Sewer)
- East Bay Municipal Utility District (EBMUD) (Water)
- Town of Moraga (Storm Drain)

All utility correspondence will be monitored and tracked. The Town of Moraga also provided GIS maps of storm drainage facilities**.**

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Section 3 Storm Drain Pipe Repair Recommendation

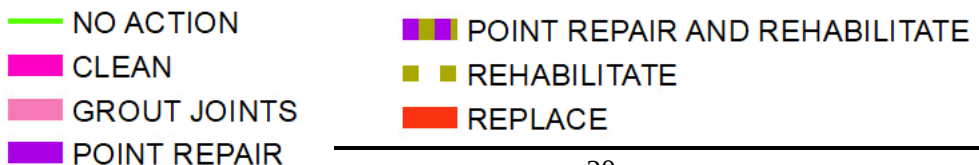
3.1 Storm Drain Project Recommendation

In 2015, the Town of Moraga developed the Storm Drain Management Plan to establish a capital improvements program (CIP) that would assess and rehabilitate storm drain system conditions within the Town limits. The objective was to increase the level of service throughout the existing drainage system and ensure that the system was routinely updated over the course of several CIP projects. After a heavy rainfall in 2016 that resulted in repeated failed storm drain lines, the Town created an addendum in 2019 to further address the aging infrastructure, such as clogged pipes, sinkholes, and broken storm drain pipes. As part of the 2021-2023 Annual Storm Drain Repair Project (CIP21-205), the Town and Harris teams collaborated to video inspect and assess infrastructure and identify ongoing pipe failures, as well as develop a basis of design for storm drain pipe repair recommendations. The following criteria were used to select repair methods for the improvement project, balancing both cost-effectiveness and treatment-suitability:

- Light / Heavy cleaning and CCTV inspections of pipe segments to analyze the severity of defects and quality of the existing pipe.
- Analysis of the location for the pipe recommendations to determine the suitability of the available construction methods.
- Locations of the recommended pipes in relation to environmental features, such as outlets to creeks, in order to avoid negative impacts and environmental permitting
- Input from Town staff regarding previously used treatments.
- Costs of treatments and available construction budget per the American Rescue Plan Act (ARPA) funding.

Due to the number of pipes within the project area and the cost of improvements, Harris recommends improving and rehabilitating pipes with grade ratings of 5 (most severe) and pipes with damaged or blocked inverts – a total of 19 storm drain pipelines. Pipes with heavy debris build-up were also included in this list as they received an Operations and Maintenance rating of 4 and higher. The selected pipes were also analyzed by location to ensure that the storm drain lines did not have an outlet to creeks or ditches due to environmental permitting and impacts. **Table 3-1** summarizes the pipe locations that were analyzed and are recommended for improvement for the storm drain project. The lines are listed in order of Maintenance Zone location. Maps of the recommended storm drain lines for the Project are included in **Appendix C**.

The following legend shows the various improvements proposed on Table 3-1:



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Table 3-1: Proposed Storm Drain Project Recommendations

No.	Closest Address	Facility ID (QRS Rating)	Ex Pipe Dia. (in)	Ex Pipe Material	Ex Pipe Length (ft)	Recommended Prop Improvements (See TABLE 3-3 for Opinion of Cost)
1.	327 Moraga Rd	L-0116 (QRS=3)	60	RCP	176	Rehabilitation – Invert Paving (approx. 8 ft)



LOCATION MAP



Photo 1

Broken soil visible at invert

No.	Closest Address	Facility ID (QRS Rating)	Ex Pipe Dia. (in)	Ex Pipe Material	Ex Pipe Length (ft)	Recommended Prop Improvements (See TABLE 3-3 for Opinion of Cost)
2.	2 Woodford Dr	Z1_LINK_0007 (QRS=3)	42	RCP	402	Heavy Cleaning and Install CIPP liner (entire length)



LOCATION MAP



Photo 2
Infiltration



Photo 3
Deposits attached and infiltration

No.	Closest Address	Facility ID (QRS Rating)	Ex Pipe Dia. (in)	Ex Pipe Material	Ex Pipe Length (ft)	Recommended Prop Improvements (See TABLE 3-3 for Opinion of Cost)
3.	24 Woodford Dr	Z1_LINK_0026 (QRS=3)	36	RCP	30	Point Repair (approx. 12 ft)



LOCATION MAP



Photo 4
Deposits attached

No.	Closest Address	Facility ID (QRS Rating)	Ex Pipe Dia. (in)	Ex Pipe Material	Ex Pipe Length (ft)	Recommended Prop Improvements (See TABLE 3-3 for Opinion of Cost)
4.	92 Redwood Ln	L-0003 (QRS=3)	24	CMP	236	Rehabilitate (entire length)



LOCATION MAP



Photo 5
Corrosion

No.	Closest Address	Facility ID (QRS Rating)	Ex Pipe Dia. (in)	Ex Pipe Material	Ex Pipe Length (ft)	Recommended Prop Improvements (See TABLE 3-3 for Opinion of Cost)
5.	Moraga Rd s/o Dolores Ct	120' U/S to N-0037 (QRS=4)	18	CMP	120	1. Point Repair (approx. 8 ft) 2. CIPP line pipe (approx. 80 ft)



LOCATION MAP



Photo 6
Broken pipe at invert



Photo 7
Broken pipe at invert

No.	Closest Address	Facility ID (QRS Rating)	Ex Pipe Dia. (in)	Ex Pipe Material	Ex Pipe Length (ft)	Recommended Prop Improvements (See TABLE 3-3 for Opinion of Cost)
6.	350 Bedford Pl	Z3_LINK_0003 (QRS=5)	18	RCP	34	Point Repair (approx. 8 ft)



LOCATION MAP

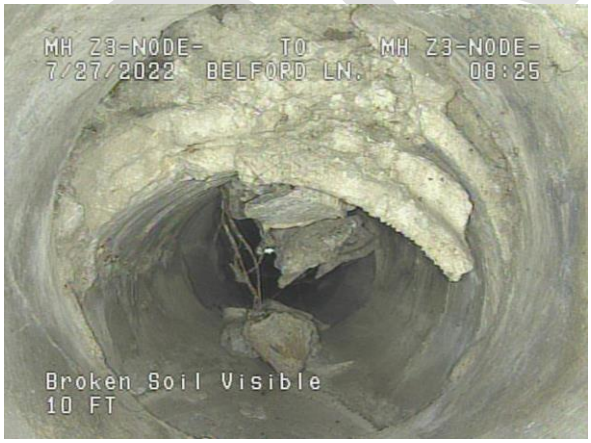
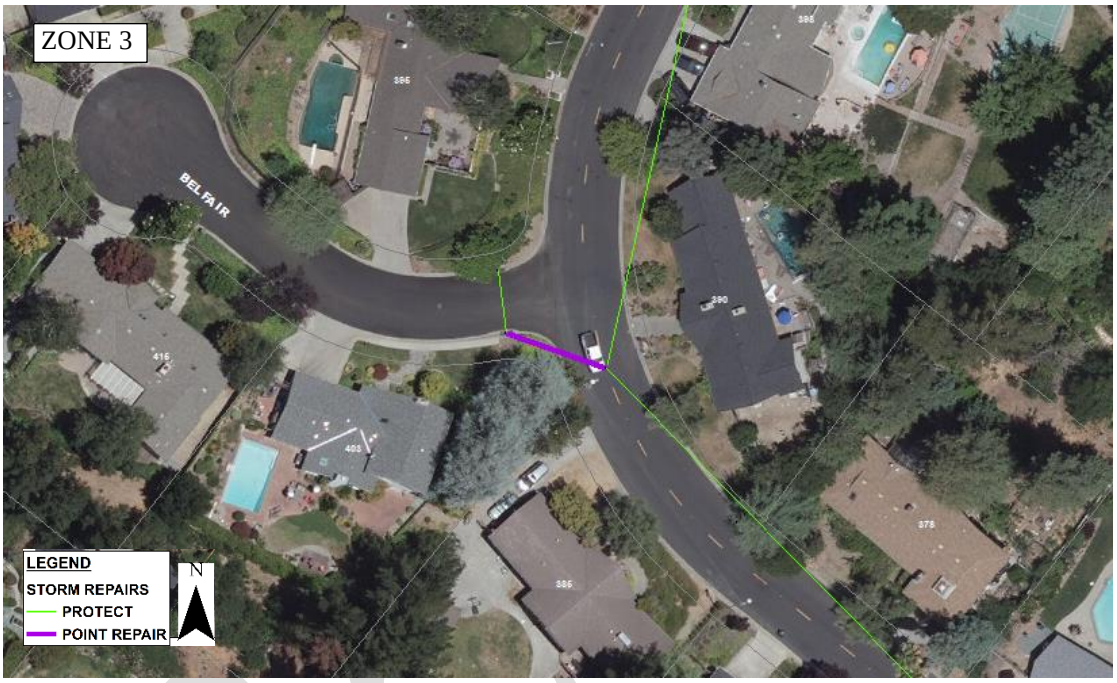


Photo 8
Collapsed Pipe

No.	Closest Address	Facility ID (QRS Rating)	Ex Pipe Dia. (in)	Ex Pipe Material	Ex Pipe Length (ft)	Recommended Prop Improvements (See TABLE 3-3 for Opinion of Cost)
7.	421 Belfair Pl	Z3_LINK_0030 (QRS=4)	18	RCP	50	Point Repair (approx. 8 ft)



LOCATION MAP



Photo 9
Mortar attached to pipe



Photo 10
Mortar attached to pipe

No.	Closest Address	Facility ID (QRS Rating)	Ex Pipe Dia. (in)	Ex Pipe Material	Ex Pipe Length (ft)	Recommended Prop Improvements (See TABLE 3-3 for Opinion of Cost)
8.	619 Carroll Dr	Z3_LINK_0087 (QRS=4)	21	RCP	33	Point Repair (approx. 16 ft)



LOCATION MAP



Photo 11
Joint offset

No.	Closest Address	Facility ID (QRS Rating)	Ex Pipe Dia. (in)	Ex Pipe Material	Ex Pipe Length (ft)	Recommended Prop Improvements (See TABLE 3-3 for Opinion of Cost)
9.	104 Donald Dr	Z3_LINK_0102 (QRS=5)	12	CMP	58	Remove and replace pipe (entire length)



LOCATION MAP



Photo 12
CMP deterioration at invert



Photo 13
Pipe debris

No.	Closest Address	Facility ID (QRS Rating)	Ex Pipe Dia. (in)	Ex Pipe Material	Ex Pipe Length (ft)	Recommended Prop Improvements (See TABLE 3-3 for Opinion of Cost)
10.	195 Devin Dr	Z3_LINK_0119 (QRS=4)	18	RCP	65	Point Repair (approx. 12 ft)



LOCATION MAP



Photo 14
Joint offset and deposits attached

No.	Closest Address	Facility ID (QRS Rating)	Ex Pipe Dia. (in)	Ex Pipe Material	Ex Pipe Length (ft)	Recommended Prop Improvements (See TABLE 3-3 for Opinion of Cost)
11.	310 Donald Dr	Z3_LINK_0213 (QRS=4)	30	RCP	320	Remove and replace pipe (entire length)



LOCATION MAP

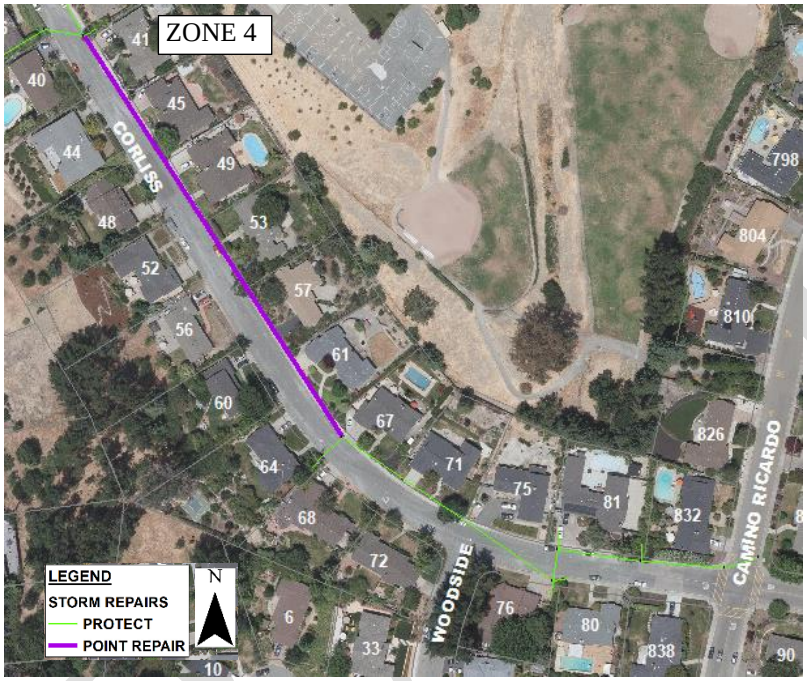


Photo 15
Attached deposits not allowing flows



Photo 16
Pipe debris

No.	Closest Address	Facility ID (QRS Rating)	Ex Pipe Dia. (in)	Ex Pipe Material	Ex Pipe Length (ft)	Recommended Prop Improvements (See TABLE 3-3 for Opinion of Cost)
12.	37 Corliss Dr	Z4_LINK_0053 (QRS=5)	36	RCP	605	Point Repair (approx. 8 ft)



LOCATION MAP



Photo 17
Broken pipe at soffit

No.	Closest Address	Facility ID (QRS Rating)	Ex Pipe Dia. (in)	Ex Pipe Material	Ex Pipe Length (ft)	Recommended Prop Improvements (See TABLE 3-3 for Opinion of Cost)
13.	729 Camino Ricardo	Z4_LINK_0124 (QRS=5)	36	RCP	208	Invert Paving (approx. 50 ft)



LOCATION MAP

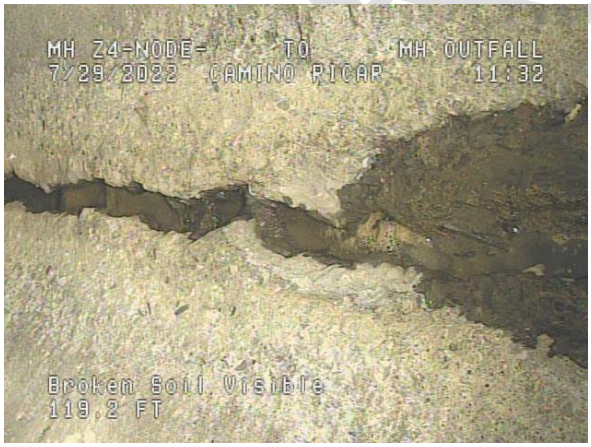


Photo 18
Broken pipe at invert



Photo 19
Broken pipe at invert

No.	Closest Address	Facility ID (QRS Rating)	Ex Pipe Dia. (in)	Ex Pipe Material	Ex Pipe Length (ft)	Recommended Prop Improvements (See TABLE 3-3 for Opinion of Cost)
14.	18 Ashbrook Pl	Z4_LINK_0143 (QRS=5)	30	RCP	202	Point Repair (approx. 20 ft)



LOCATION MAP



Photo 20
Broken pipe invert

No.	Closest Address	Facility ID (QRS Rating)	Ex Pipe Dia. (in)	Ex Pipe Material	Ex Pipe Length (ft)	Recommended Prop Improvements (See TABLE 3-3 for Opinion of Cost)
15.*	1003 Wickham Dr	Z5_LINK_0001 (QRS=5)	36	RCP	47	Heavy Cleaning and Reinspect Pipe. Note: D/S Private Pipe requires cleaning Z5_LINK_0072



LOCATION MAP



Photo 21
Heavy Debris

No.	Closest Address	Facility ID (QRS Rating)	Ex Pipe Dia. (in)	Ex Pipe Material	Ex Pipe Length (ft)	Recommended Prop Improvements (See TABLE 3-3 for Opinion of Cost)
16.*	1049 Wickham Dr	Z5_LINK_0074 (QRS=4)	36	RCP	393	Heavy Cleaning and Re-inspect Pipe (approx. 16 ft)



LOCATION MAP



Photo 22
Heavy Debris

No.	Closest Address	Facility ID (QRS Rating)	Ex Pipe Dia. (in)	Ex Pipe Material	Ex Pipe Length (ft)	Recommended Prop Improvements (See TABLE 3-3 for Opinion of Cost)
17.	1049 Wickham Dr	Z6_LINK_0062 (QRS=4)	42	RCP	196	Point Repair (approx. 8 ft)



LOCATION MAP



Photo 23
Broken pipe at joint

No.	Closest Address	Facility ID (QRS Rating)	Ex Pipe Dia. (in)	Ex Pipe Material	Ex Pipe Length (ft)	Recommended Prop Improvements (See TABLE 3-3 for Opinion of Cost)
18.	1051 Camino Pablo	L-0219 (QRS=4)	36	CMP	170	Clean and Install Geopolymer Lining (entire length)



LOCATION MAP



Photo 24
Heavy Debris



Photo 25
Pipe deterioration

No.	Closest Address	Facility ID (QRS Rating)	Ex Pipe Dia. (in)	Ex Pipe Material	Ex Pipe Length (ft)	Recommended Prop Improvements (See TABLE 3-3 for Opinion of Cost)
19.	5 Thune Ave	Z7_LINK_0039 (QRS=3)	30	RCP	630	Install CIPP Liner (entire length)



LOCATION MAP

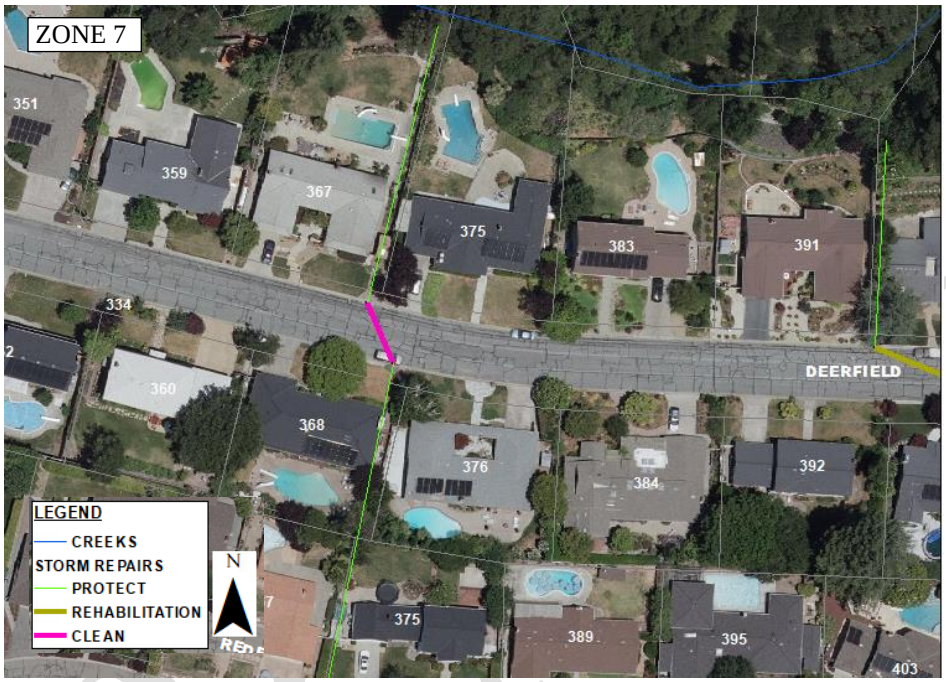


Photo 26
Crack longitudinal hinge



Photo 27
Crack Multiple locations

No.	Closest Address	Facility ID (QRS Rating)	Ex Pipe Dia. (in)	Ex Pipe Material	Ex Pipe Length (ft)	Recommended Prop Improvements (See TABLE 3-3 for Opinion of Cost)
20.	356 Deerfield Dr	Z7_LINK_0169 (QRS=3)	30	RCP	43	Heavy clean and re-inspect (entire length)



LOCATION MAP



Photo 28
Heavy debris

No.	Closest Address	Facility ID (QRS Rating)	Ex Pipe Dia. (in)	Ex Pipe Material	Ex Pipe Length (ft)	Recommended Prop Improvements (See TABLE 3-3 for Opinion of Cost)
21.	425 Deerfield Dr	Z7_LINK_0181 (QRS=5)	42	RCP	241	Rehabilitation by Grouting Invert (approx. 8 ft)



LOCATION MAP

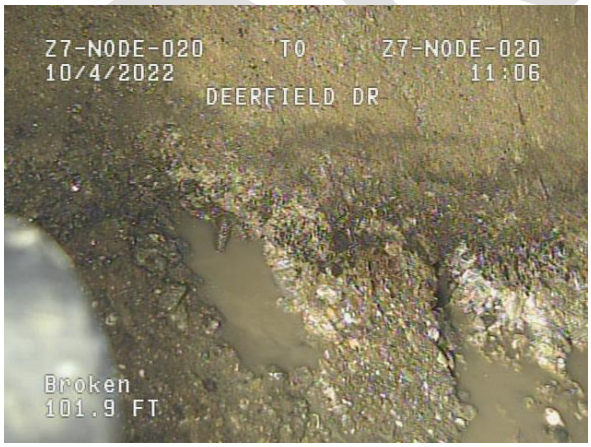


Photo 29
Broken invert pipe – Soil visible

No.	Closest Address	Facility ID (QRS Rating)	Ex Pipe Dia. (in)	Ex Pipe Material	Ex Pipe Length (ft)	Recommended Prop Improvements (See TABLE 3-3 for Opinion of Cost)
22.	431 Deerfield Dr	Z7_LINK_0182 (QRS=4)	36	RCP	182	Rehabilitation by Grouting Invert (approx. 16 ft)



LOCATION MAP



Photo 30
Broken invert pipe – Soil visible



Photo 31
Broken invert pipe – Soil visible

* BLOCKED PIPE INVERTS DUE TO EXCESSIVE DEBRIS AND RELATED LOSS OF PIPE CAPACITY HAVE CONTRIBUTED TO THE URGENCY OF THIS RECOMMENDATION.

As shown in the table above, our team narrowed the proposed treatments to five (5) options:

1. Remove and Replace Pipe
2. Geopolymer Spray on Liner
3. CIPP Line Pipe
4. Point Repair
5. Heavy Cleaning

From visual inspections, Harris found that a majority of the pipes with a Grade 5 rating would need to be either removed and replaced or repaired with pipe liner or heavy-cleaned and re-inspected due to excessive debris and loss of capacity. The approach in choosing the repair selection was to increase the structural strength where necessary and to save any existing pipe that was in good condition for cost-effectiveness. Since the pipes chosen above had severe defects or debris/capacity issues, many needed to be replaced as new, lined, or heavy-cleaned and re-inspected. Defects within these pipes included missing inverts, exposed soil through the pipes, and heavy sediments, such as boulders and calcium deposits, that could not be removed with heavy cleaning.

3.2 Cost Analysis

Harris completed a high-level cost analysis of the proposed pavement treatments for the Town's budgeting purposes. The following table highlights the unit cost of the most significant/costly items of work which have the greatest effect on overall construction costs. These unit costs are based on bidding results from recent projects that are similar to this pipe rehabilitation project. The unit costs used to develop our opinion of construction costs reflect our present understanding of prices, and an 8% inflation cost per year has been added to the total Construction Cost.

Table 3-2: Unit Costs of Significant Items

NO.	ITEM	UNIT COST	UNIT	ASSOCIATED TREATMENT
1.	Remove and Replace 12" Pipe	$425	LF	Remove existing pipe and install RCP by open trench
2.	Remove and Replace 18" Pipe	$450	LF	Remove existing pipe and install RCP by open trench
3.	Remove and Replace 24" Pipe	$500	LF	Remove existing pipe and install RCP or HDPE by open trench

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NO.	ITEM	UNIT COST	UNIT	ASSOCIATED TREATMENT
4.	Remove and Replace 30" Pipe	$550	LF	Remove existing pipe and install RCP by open trench
5.	Remove and Replace 36" Pipe	$650-900	LF	Remove existing pipe and install RCP or HDPE by open trench
6.	Rehabilitate pipe by CIPP Method (18" - 96" pipe)	$150-$920	LF	CIPP Liner
7.	Grout Invert	$120	LF	Grout Invert of Pipe
8.	Point Repair	$5,500	EA	Point Repair Storm Drain Pipe (12", 15", 18", 24", 30") (RCP, HDPE, CMP)
9.	Cleaning	$25	LF	Heavy Cleaning
10.	Inspection	$4	LF	Reinspection by CCTV

Using the above bid items, Harris calculated our opinion of probable construction costs (See Table 3-3). Included in the summary are the additional costs of mobilization, traffic control, storm drain improvements, and restorations. Costs that are not included, such as environmental permits and undetermined design elements, are covered by a 30% contingency. Inflation is not accounted for in the costs described in Table 3-1.

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Table 3-3: Summary of Treatment Costs (Proposed Project)

No.	Closest Address	Facility ID (QRS)	Ex Pipe Dia. (in)	Ex Pipe Material	Ex Pipe Length (ft)	Recommended Proposed Improvements	Opinion of Probable Construction Cost
ZONE 1							
1.	327 Moraga Rd	L-0116 (QRS=3)	60	RCP	176	Rehabilitation – Inver Paving (approx. 8 ft)	$2,600
2.	2 Woodford Dr	Z1_LINK_0007 (QRS=3)	42	RCP	402	Heavy Cleaning and Install CIPP liner (entire length)	$245,400
3.	24 Woodford Dr	Z1_LINK_0026 (QRS=5)	36	RCP	30	Point Repair (approx. 12 ft)	$9,400
ZONE 2							
4.	92 Redwood Ln	L-0003 (QRS=3)	24	CMP	236	Rehabilitate (entire length)	$63,200
5.	Moraga Rd s/o Dolore Ct	120' U/S to N-0037 (QRS=4)	18	CMP	120	1. Point Repair (approx. 8 ft) 2. Install CIPP liner (approx. 80')	$28,200
ZONE 3							
6.	350 Bedford Pl	Z3_LINK_0003 (QRS=5)	18	RCP	34	Point Repair (approx. 8 ft)	$6,600
7.	421 Belfair Pl	Z3_LINK_0030 (QRS=4)	18	RCP	50	Point Repair (approx. 8 ft)	$6,600
8.	619 Carroll Dr	Z3_LINK_0087 (QRS=4)	21	RCP	33	Point Repair (approx. 16 ft)	$13,200
9.	104 Donald Dr	Z3_LINK_0102 (QRS=5)	12	CMP	58	Remove and replace pipe (entire length)	$31,300
10.	195 Devin Dr	Z3_LINK_0119 (QRS=4)	18	RCP	65	Point Repair (approx. 12 ft)	$8,500
11.	310 Donald Dr	Z3_LINK_0213 (QRS=4)	30	RCP	320	Remove and replace pipe (entire length)	$211,000
ZONE 4							
12.	37 Corliss Dr	Z4_LINK_0053 (QRS=5)	36	RCP	605	Point Repair (approx. 8 ft)	$6,600
13.	729 Camino Ricardo	Z4_LINK_0124 (QRS=5)	36	RCP	208	Rehabilitation - Invert Paving (approx. 50')	$7,200

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No.	Closest Address	Facility ID (QRS)	Ex Pipe Dia. (in)	Ex Pipe Material	Ex Pipe Length (ft)	Recommended Proposed Improvements	Opinion of Probable Construction Cost
14.	18 Ashbrook Pl	Z4_LINK_0143 (QRS=5)	30	RCP	202	Remove and Replace Pipe (approx. 20 ft)	$13,200
ZONE 5							
15.	1003 Wickham Dr	Z5_LINK_0001 (QRS=5)	36	RCP	47	Heavy Cleaning and Re-inspect Note: D/S Private Pipe requires cleaning Z5_LINK_0072	$1,600
16.	1049 Wickham Dr	Z5_LINK_0074 (QRS=4)	36	RCP	393	Heavy Cleaning and Reinspect (approx. 20 ft)	$700
ZONE 6							
17.	1049 Wickham Dr	Z6_LINK_0062 (QRS=4)	42	RCP	196	Point Repair (approx. 8 ft)	$6,800
ZONE 7							
18.	1051 Camino Pablo	L-0219 (QRS=4)	36	HDPE	170	Clean and Rehabilitate w/ Geopolymer Liner (entire length)	$86,700
19.	5 Thune Ave	Z7_LINK_0039	30	RCP	630	Rehabilitation by Installing CIPP liner (entire length)	$283,300
20.	356 Deerfield Dr	Z7_LINK_0169 (QRS=3)	30	RCP	43	Heavy Clean and re-inspect (entire length)	$1,600
21.	425 Deerfield Dr	Z7_LINK_0181 (QRS=5)	42	RCP	241	Rehabilitation by Grouting Invert (approx. 8 ft)	$2,900
22.	431 Deerfield Dr	Z7_LINK_0182 (QRS=4)	36	RCP	182	Rehabilitation by Grouting Invert (approx. 16 ft)	$4,300
						TOTAL	**$1,353,170**

Note: A 30% contingency was applied to the opinions of probable construction cost total amount to account for other unknown design elements. An 8% escalation cost was added to account for inflation for storm drains constructed next year.

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The total construction contract budget for the 2021-2023 Annual Storm Drain Repairs is $1,300,000. As discussed earlier in this BDM, the completion of this Project is planned for construction in 2023 and the storm drain segments not chosen for repair at this time will be constructed in the future. **Table 3-4** below is a cost summary of the storm drains for future projects:

Table 3-4: Summary of Treatment Costs (Future)

No.	Closest Address	Facility ID (QRS)	Ex Pipe Dia. (in)	Ex Pipe Material	Ex Pipe Length (ft)	Recommended Proposed Improvements	Opinion of Probable Construction Cost
ZONE 1							
1.	337 Moraga Rd	L-0115 (QRS=3)	60	RCP	76	Fine Root removal and seal and grout pipe joints. (approx. 8 ft)	$1,800
2.	20 Betlin Pl	Z1_LINK_0027 (QRS=3)	36	RCP	187	Seal Infiltration Point.	$1,400
3.	151 Natalie Dr	Z1_LINK_0039 (QRS=3)	30	RCP	39	1. Point Repair (approx. 8 ft) 2. Install CIPP Liner (entire length)	$26,800
4.	45 Buckingham Dr	Z1_LINK_0045 (QRS=3)	30	RCP	221	Heavy Cleaning at ends of pipe.	$2,700
5.	3743 Campolindo Dr	Z1_LINK_0050 (QRS=3)	48	RCP	140	Heavy Cleaning and Re-inspect Pipe (entire length)	$5,600.00
6.	390 Calle La Mesa	Z1_LINK_0100 (QRS=4)	30	RCP	65	Heavy Cleaning and Re-inspect Pipe (approx. 25 ft)	$2,000.00
7.	3803 Paseo Grande	Z1_LINK_0152 (QRS=3)	48	RCP	77	Heavy Cleaning and Re-inspect Pipe (entire length)	$3,200
8.	170 Paseo del Rio (Portion in private property)	Z1_LINK_0161 (QRS=3)	42	RCP	317	Point Repair (approx. 8 ft)	$10,100
ZONE 2							
9.	109 Goodfellow Dr	L-0681 (QRS=2)	15	RCP	30	Remove Heavy Roots (approx. 12 ft) and re-inspect pipe	$2,000

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No.	Closest Address	Facility ID (QRS)	Ex Pipe Dia. (in)	Ex Pipe Material	Ex Pipe Length (ft)	Recommended Proposed Improvements	Opinion of Probable Construction Cost
10.	102 Ascot Ct (Portion in private property)	Z2_LINK_0036 (QRS=3)	18	RCP	155	No Action. Inspect in 5 years.	$0
11.	142 Ascot Ct	Z2_LINK_0047 (QRS=3)	18	RCP	192	No Action. Inspect in 5 years.	$0
12.	33 Laird Dr	Z2_LINK_0069 (QRS=3)	24	RCP	38	Heavy Cleaning and re-inspect (approx. 26 ft)	$1,600
13.	Rheem Blvd @ Center St	Z2_LINK_0184 (QRS=3)	24	RCP	156	No Action. Inspect in 5 years.	$0
14.	Moraga Rd @ Rheem Blvd	Z2_LINK_0211 (QRS=3)	30	RCP	101	Point Repair (approx. 8 ft)	$7,700
15.	276 Scofield Dr	Z2_LINK_0245 (QRS=3)	36	HDPE	33	Clean and Re-inspect (entire length)	$1,400
ZONE 3							
16.	29 Williams Dr	L-0225 (QRS=3)	21	RCP	38	No Action. Inspect in 5 years.	$0
17.	Stafford Dr @ St Marys Rd	L-0317 (QRS=3)	36	HDPE	55	Clean and Re-inspect (entire length)	$2,300
18.	25 Lucas Dr	L-0625 (QRS=3)	36	RCP	200	Remove obstruction downstream.	$2,000
19.	1 Willow Springs	Z3_LINK_0155 (QRS=1)	18	RCP	33	Remove Roots (Several Locations) and grout joints	$1,400
20.	393 Donald Dr	Z3_LINK_0210 (QRS=3)	36	RCP	607	Heavy cleaning (incrustation) and install CIPP liner (entire length)	$360,800
21.	330 Donald Dr	Z3_LINK_0212 (QRS=3)	30	RCP	710	Remove and replace pipe (entire length)	$546,100
ZONE 4							
22.	99 Lynwood Pl	Z4_LINK_0104 (QRS=3)	30	RCP	50	Heavy clean and re-inspect pipe withing Town's R/W	$2,100.00
23.	760 Camino Ricardo	Z4_LINK_0122 (QRS=3)	60	RCP	612	No Action. Re-inspect in future for mineral build-up.	$0.00
24.	675 Camino Ricardo	Z4_LINK_0125 (QRS=3)	36	RCP	292	No Action. Re-inspect in future for mineral build-up.	$0.00

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No.	Closest Address	Facility ID (QRS)	Ex Pipe Dia. (in)	Ex Pipe Material	Ex Pipe Length (ft)	Recommended Proposed Improvements	Opinion of Probable Construction Cost
25.	675 Camino Ricardo	Z4_LINK_0141 (QRS=4)	36	RCP	510	No Action. Re-inspect in the future for mineral build-up.	$0.00
ZONE 5							
26.	1097 Wickham Dr	L-0295 (QRS=3)	36	RCP	203	No Action. Inspect in 5 years.	$0
27.	1030 Alta Mesa Dr	Z5_LINK_0011 (QRS=3)	30	RCP	424	No Action. Inspect in 5 years.	$0
28.	1450 St Marys Rd	Z5_LINK_0039 (QRS=3)	48	RCP	42	Point Repair (approx. 12 ft) Outlets to open space. Clean outlet	$16,000
29.	1073 Wickham Dr	Z5_LINK_0075 (QRS=3)	36	RCP	210	Seal and grout annular space around tap break-in. Any exposed reinforcing steel should be treated with corrosion inhibitor and covered with mortar.	$3,400
ZONE 6							
30.	1708 Spyglass Ln	L-0178 (QRS=3)	18	RCP	23	Heavy Clean and Re-inspect Pipe (entire length)	$1,000
31.	St Andrews Dr @ San Pablo Creek	L-0448 (QRS=3)	54	CMP	331	Cleaning and Re-inspect Pipe (entire length)	$13,100
32.	119 Hazelwood Pl	Z6_LINK_0009 (QRS=3)	48	RCP	400	Heavy Cleaning and Re-inspect Pipe (approx. 170)	$6,800
33.	St Andrews Dr @ Country Club Dr	Z6_LINK_0076 (QRS=3)	55	RCP	203	No Action. Inspect in 5 years.	$0
ZONE 7							
34.	1049 Sanders Dr	Z7_LINK_0071 (QRS=3)	36	RCP	60	Heavy Cleaning and Re-inspect Pipe (entire length)	$2,500

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No.	Closest Address	Facility ID (QRS)	Ex Pipe Dia. (in)	Ex Pipe Material	Ex Pipe Length (ft)	Recommended Proposed Improvements	Opinion of Probable Construction Cost
35.	197 Walford Dr	Z7_LINK_0107 (QRS=3)	30	RCP	90	Heavy Cleaning and Re-inspect Pipe (entire length)	$3,700
36.	1084 Sanders Dr	Z7_LINK_0147 (QRS=3)	30	RCP	122	Install CIPP liner (entire length)	$64,000
37.	13 Gloria Ct	Z7_LINK_0150	24	RCP	213	Remove and Replace Pipe (entire length)	$149,000
38.	1009 Camino Pablo	Z7_LINK_0264 (QRS=3)	36	RCP	7	Heavy Clean and Re-inspect Pipe (entire length)	$900
						TOTAL	**$1,613,820**

Note: A 30% contingency was applied to the opinions of probable construction cost to account for other unknown design elements. An 8% escalation cost was added for inflation for storm drains constructed in future phases (assumes 3-years).

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Appendix A: Presidio CCTV Reports

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APPENDIX A
CIP 21-205 ANNUAL STORM DRAIN REPAIRS
PIPELINE INSPECTION LIST

No.	Facility ID	U/S Node	D/S Node	Diameter	Material	Length (ft)	Address
ZONE 1							
1	L-0115	N-0038	N-0028	60"	RCP	76	337 Moraga Rd, Moraga, CA 94556
2	L-0116	Z1_NODE_0003	N-0038	60"	RCP	176	327 Moraga Rd, Moraga, CA 94556
3	L-0379		Z1_NODE_0186	24"	CMP	39	3706 Campolindo Dr, Moraga, CA 94556
4	L-0547		Z1_NODE_0079	15"	CMP	20	2 Corte Santa Clara, Moraga, CA 94556
5	Z1_LINK_0007	Z1_NODE_0008	Z1_NODE_0003	42"	RCP	402	2 Woodford Dr, Moraga, CA 94556
6	Z1_LINK_0026 *		Z1_NODE_0040	36"	RCP	30	24 Woodford Dr, Moraga, CA 94556
7	Z1_LINK_0027	Z1_NODE_0041	Z1_NODE_0040	36"	RCP	187	20 Betlin Pl, Moraga, CA 94556
8	Z1_LINK_0028	Z1_NODE_0048	Z1_NODE_0041	36"	RCP	341	47 Woodford Drive, Moraga, CA 94556
9	Z1_LINK_0029	Z1_NODE_0049	Z1_NODE_0048	36"	RCP	47	Woodford Dr @ Natalie Drive, Moraga, CA 94556
10	Z1_LINK_0033	Z1_NODE_0052	Z1_NODE_0048	36"	RCP	48	177 Natalie Dr, Moraga, CA 94556
11	Z1_LINK_0034	Z1_NODE_0053	Z1_NODE_0052	36"	RCP	370	162 Natalie Dr, Moraga, CA 94556
12	Z1_LINK_0035	Z1_NODE_0058	Z1_NODE_0053	36"	RCP	205	155 Natalie Drive, Moraga, CA 94556
13	Z1_LINK_0036		Z1_NODE_0058	30"	RCP	40	Blumert Place @ Natalie Drive
14	Z1_LINK_0039	Z1_NODE_0059	Z1_NODE_0058	30"	RCP	39	151 Natalie Dr, Moraga, CA 94556
15	Z1_LINK_0040	Z1_NODE_0060	Z1_NODE_0059	30"	RCP	241	145 Natalie Dr, Moraga, CA 94556
16	Z1_LINK_0045	Z1_NODE_0044	Z1_NODE_0043	30"	RCP	221	45 Buckingham Dr, Moraga, CA 94556
17	Z1_LINK_0048		Z1_NODE_0012	48"	RCP	146	3743 Campolindo Dr, Moraga, CA 94556
18	Z1_LINK_0050 *	Z1_NODE_0012	N-0517	48"	RCP	140	3743 Campolindo Dr, Moraga, CA 94556
19	Z1_LINK_0084 *	Z1_NODE_0108	Z1_NODE_0102	48"	RCP	489	3850 Paseo Grande, Moraga, CA 94556
20	Z1_LINK_0084a	Z1_NODE_0114	Z1_NODE_0108	48"	RCP	234	3862 Paseo Grande, Moraga, CA 94556
21	Z1_LINK_0085	Z1_NODE_0119	Z1_NODE_0114	36"	RCP	247	3843 Campolindo Dr, Moraga, CA 94556
22	Z1_LINK_0088	Z1_NODE_0138	Z1_NODE_0130	30"	RCP	449	3888 Campolindo Dr, Moraga, CA 94556
23	Z1_LINK_0100	Z1_NODE_0097	Z1_NODE_0096	30"	RCP	65	390 Calle La Mesa, Moraga, CA 94556
24	Z1_LINK_0139	Z1_NODE_0115	Z1_NODE_0114	42"	RCP	33	3864 Paseo Grande, Moraga, CA 94556
25	Z1_LINK_0140	Z1_NODE_0122	Z1_NODE_0115	42"	RCP	497	3898 Paseo Grande, Moraga, CA 94556
26	Z1_LINK_0141	Z1_NODE_0141	Z1_NODE_0122	30"	RCP	596	3928 Paseo Grande, Moraga, CA 94556
27	Z1_LINK_0152	Z1_NODE_0103	Z1_NODE_0102	48"	RCP	77	3803 Paseo Grande, Moraga, CA 94556
28	Z1_LINK_0161 *	Z1_NODE_0190	Z1_NODE_0111	42"	RCP	317	170 Paseo del Rio, Moraga, CA 94556
ZONE 2							
29	L-0003	N-0006	Z2_NODE_0148	24"	CMP	236	92 Redwood Ln, Moraga, CA 94556
30	L-0205 *	N-0005	Z2_NODE_0132	42"	RCP	138	10 Harold Dr, Moraga, CA 94556
31	L-0381		N-0006	24"	CMP	20	92 Redwood Ln, Moraga, CA 94556
32	L-0681	N-0551	N-0552	15"	RCP	30	109 Goodfellow Dr, Moraga, CA 94556
33	L-0682	N-0552		18"	CMP	39	111 Goodfellow Dr, Moraga, CA 94556
34	Z2_LINK_0025	Z2_NODE_0038	Z2_NODE_0039	36"	RCP	37	2141 Ascot Dr, Moraga, CA 94556
35	Z2_LINK_0036	Z2_NODE_0054		18"	RCP	155	102 Ascot Ct, Moraga, CA 94556
36	Z2_LINK_0047	Z2_NODE_0083		18"	RCP	192	142 Ascot Ct, Moraga, CA 94556
37	Z2_LINK_0048	Z2_NODE_0084	Z2_NODE_0083	18"	RCP	28	142 Ascot Ct, Moraga, CA 94556
38	Z2_LINK_0057	Z2_NODE_0089	Z2_NODE_0090	18"	RCP	29	1951 Ascot Dr, Moraga, CA 94556
39	Z2_LINK_0063	Z2_NODE_0080	Z2_NODE_0079	18"	RCP	246	1907 Ascot Dr, Moraga, CA 94556
40	Z2_LINK_0064	Z2_NODE_0081	Z2_NODE_0080	18"	RCP	34	1909 Ascot Dr, Moraga, CA 94556
41	Z2_LINK_0069	Z2_NODE_0097	Z2_NODE_0095	24"	RCP	38	33 Laird Dr, Moraga, CA 94556
42	Z2_LINK_0088	Z2_NODE_0126	Z2_NODE_0125	18"	RCP	33	258 Scofield Dr, Moraga, CA 94556
43	Z2_LINK_0184	Z2_NODE_0217	Z2_NODE_0219	24"	RCP	156	Rheem Blvd @ Center Street, Moraga, CA
44	Z2_LINK_0189 *	Z2_NODE_0247	Z2_NODE_0219	96"	CMP / RCP	242	390 Moraga Rd, Moraga, CA 94556
45	Z2_LINK_0211	Z2_NODE_0216	Z2_NODE_0217	30"	RCP	101	Moraga Road @ Rheem Blvd
46	Z2_LINK_0245	Z2_NODE_0114	Z2_NODE_0113	36"	HDPE	33	276 Scofield Dr, Moraga, CA 94556
47	* 120 U/S TO N-0037		N-0037	18"	CMP	120	Moraga Road s/o Dolores Ct, Moraga

*** INSPECTION OF PIPE WITHING PUBLIC R/W ONLY**

APPENDIX A
CIP 21-205 ANNUAL STORM DRAIN REPAIRS
PIPELINE INSPECTION LIST

No.	Facility ID	U/S Node	D/S Node	Diameter	Material	Length (ft)	Address
ZONE 3							
48	L-0134	Z3_NODE_0314	Z3_NODE_0217	30"	RCP	61	31 Lucas Dr, Moraga, CA 94556
49	L-0145	N-0221	N-0219	30"	RCP	63	Rheem Blvd w/o Via Barcelona
50	L-0220	N-0090	N-0089	18"	RCP	66	21 Haven Ct, Moraga, CA 94556
51	L-0225	N-0086	N-0085	21"	RCP	38	29 Williams Dr, Moraga, CA 94556
52	L-0317	N-0223	N-0224	36"	HDPE	55	Stafford Dr @ St Marys Road
53	L-0319	Z3_NODE_0030	Z3_NODE_0029	24"	RCP	218	261 Alderbrook Pl, Moraga, CA 94556
54	L-0625	Z3_NODE_0217		36"	RCP	200	25 Lucas Dr, Moraga, CA 94556
55	L-0635	Z3_NODE_0220		36"	RCP	118	444 Rheem Blvd, Moraga, CA 94556
56	Z2_LINK_0234	Z3_NODE_0281	Z2_NODE_0211	36"	RCP	47	495 Moraga Rd, Moraga, CA 94556
57	Z3_LINK_0003	Z3_NODE_0007	Z3_NODE_0006	18"	RCP	34	350 Bedford Pl, Moraga, CA 94556
58	Z3_LINK_0008		Z3_NODE_0013	30"	RCP	150	178 Longfield Pl, Moraga, CA 94556
59	Z3_LINK_0030	Z3_NODE_0041	Z3_NODE_0040	18"	RCP	50	421 Belfair Pl, Moraga, CA 94556
60	Z3_LINK_0031	Z3_NODE_0042	Z3_NODE_0041	18"	RCP	29	420 Belfair Pl, Moraga, CA 94556
61	Z3_LINK_0059	Z3_NODE_0269	N-0044	24"	CMP	46	735 Moraga Rd, Moraga, CA 94556
62	Z3_LINK_0065	Z3_NODE_0081	Z3_NODE_0073	18"	RCP	220	468 Kingsford Dr, Moraga, CA 94556
63	Z3_LINK_0069	Z3_NODE_0079	Z3_NODE_0073	30"	RCP	186	492 Kingsford Dr, Moraga, CA 94556
64	Z3_LINK_0070	Z3_NODE_0086	Z3_NODE_0079	24"	RCP	135	402 Kingsford Dr, Moraga, CA 94556
65	Z3_LINK_0071	Z3_NODE_0087	Z3_NODE_0086	24"	RCP	99	405 Kingsford Dr, Moraga, CA 94556
66	Z3_LINK_0072	Z3_NODE_0088	Z3_NODE_0087	24"	RCP	410	424 Kingsford Dr, Moraga, CA 94556
67	Z3_LINK_0087	Z3_NODE_0099	Z3_NODE_0098	21"	RCP	33	619 Carroll Dr, Moraga, CA 94556
68	Z3_LINK_0089	Z3_NODE_0097	Z2_NODE_0030	36"	RCP	71	675 Moraga Rd, Moraga, CA 94556
69	Z3_LINK_0094	Z3_NODE_0112	Z3_NODE_0113	21"	RCP	31	74 Redwing Pl, Moraga, CA 94556
70	Z3_LINK_0119	Z3_NODE_0137	Z3_NODE_0136	18"	RCP	65	195 Devin Dr, Moraga, CA 94556
71	Z3_LINK_0155	Z3_NODE_0244	Z3_NODE_0243	18"	RCP	33	1 Willow Springs Ln, Moraga, CA 94556
72	Z3_LINK_0173	Z3_NODE_0174	Z3_NODE_0173	18"	RCP	31	159 Draeger Dr, Moraga, CA 94556
73	Z3_LINK_0195	Z3_NODE_0218	Z3_NODE_0281	36"	Unknown	13	495 Moraga Rd, Moraga, CA 94556
74	Z3_LINK_0197	Z3_NODE_0277	Z3_NODE_0220	36"	RCP	384	476 Rheem Blvd, Moraga, CA 94556
75	Z3_LINK_0210	Z3_NODE_0148	Z3_NODE_0144	36"	RCP	607	393 Donald Dr, Moraga, CA 94556
76	Z3_LINK_0212	Z3_NODE_0158	Z3_NODE_0149	30"	RCP	710	330 Donald Dr, Moraga, CA 94556
77	Z3_LINK_0213	Z3_NODE_0160	Z3_NODE_0158	30"	RCP	320	310 Donald Dr, Moraga, CA 94556
78	Z3_LINK_0240	N-0219	Z3_NODE_0223	30"	RCP	165	Rheem Blvd e/o Woodminster Drive, Moraga, CA
79	Z3_LINK_0242	Z3_NODE_0308	Z3_NODE_0277	36"	RCP	13	478 Rheem Blvd, Moraga, CA 94556
80	Z3_LINK_0259	Z3_NODE_0313	Z3_NODE_0314	30"	RCP	9	31 Lucas Dr, Moraga, CA 94556
ZONE 4							
81	L-0249	N-0534	N-0160	48"	RCP	147	5 Avila Pl, Moraga, CA 94556
82	L-0338	N-0144	N-0143	36"	RCP	45	Moraga Valley Ln @ Moraga Way, Moraga, CA
83	Z4_LINK_0050 *	Z4_NODE_0160	Z4_NODE_0071	36"	RCP	317	63 Corliss Dr, Moraga, CA 94556
84	Z4_LINK_0051	Z4_NODE_0159	Z4_NODE_0071	36"	RCP	38	77 Corliss Dr, Moraga, CA 94556
85	Z4_LINK_0053	Z4_NODE_0161	Z4_NODE_0160	36"	RCP	605	37 Corliss Dr, Moraga, CA 94556
86	Z4_LINK_0104		Z4_NODE_0104	30"	RCP	50	99 Lynwood Pl, Moraga, CA 94556
87	Z4_LINK_0120	Z4_NODE_0137		60"	RCP	261	791 Camino Ricardo, Moraga, CA 94556
88	Z4_LINK_0122	Z4_NODE_0138	Z4_NODE_0137	60"	RCP	612	760 Camino Ricardo, Moraga, CA 94556
89	Z4_LINK_0123		Z4_NODE_0138	60"	RCP	464	760 Camino Ricardo, Moraga, CA 94556
90	Z4_LINK_0124	Z4_NODE_0141	Z4_NODE_0140	36"	RCP	208	729 Camino Ricardo, Moraga, CA 94556
91	Z4_LINK_0125	Z4_NODE_0195	Z4_NODE_0141	36"	RCP	292	675 Camino Ricardo, Moraga, CA 94556
92	Z4_LINK_0141		Z4_NODE_0195	36"	RCP	510	675 Camino Ricardo, Moraga, CA 94556
93	Z4_LINK_0142	Z4_NODE_0142	Z4_NODE_0141	36"	RCP	58	5 Ashbrook Pl, Moraga, CA 94556
94	Z4_LINK_0143	Z4_NODE_0143	Z4_NODE_0142	30"	RCP	202	18 Ashbrook Pl, Moraga, CA 94556
95	Z4_LINK_0144	Z4_NODE_0144	Z4_NODE_0143	30"	RCP	460	50 Ashbrook Pl, Moraga, CA 94556
96	Z4_LINK_0145	Z4_NODE_0145	Z4_NODE_0144	30"	RCP	156	62 Ashbrook Pl, Moraga, CA 94556
97	Z4_LINK_0146	Z4_NODE_0146	Z4_NODE_0145	24"	RCP	400	91 Ashbrook Pl, Moraga, CA 94556
98	Z4_LINK_0152	Z4_NODE_0206	Z4_NODE_0144	30"	RCP	45	51 Ashbrook Pl, Moraga, CA 94556
99	Z4_LINK_0181		Z4_NODE_0040	30"	RCP	280	Moraga Way @ Ivy Drive, Moraga, CA

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APPENDIX A
CIP 21-205 ANNUAL STORM DRAIN REPAIRS
PIPELINE INSPECTION LIST

No.	Facility ID	U/S Node	D/S Node	Diameter	Material	Length (ft)	Address
ZONE 5							
100	L-0293 *	Z5_NODE_0058	Z5_NODE_0008	48"	RCP	65	1022 Alta Mesa Dr, Moraga, CA 94556
101	L-0295 *	Z5_NODE_0109	Z5_NODE_0107	36"	RCP	203	1097 Wickham Dr, Moraga, CA 94556
102	L-0693	N-0557	N-0556	30"	PVC	57	Bollinger Cyn Rd NW of Josepth Drive
103	Z5_LINK_0001	Z5_NODE_0086	Z5_NODE_0064	36"	RCP	47	1003 Wickham Dr, Moraga, CA 94556
104	Z5_LINK_0011	Z5_NODE_0074	Z5_NODE_0008	30"	RCP	424	1030 Alta Mesa Dr, Moraga, CA 94556
105	Z5_LINK_0019b *	Z5_NODE_0008	Z5_NODE_0009a	36"	RCP	228	1495 Camino Peral, Moraga, CA 94556
106	Z5_LINK_0020	Z5_NODE_0009b	Z5_NODE_0010	42"	RCP	133	1495 Camino Peral, Moraga, CA 94556
107	Z5_LINK_0021	Z5_NODE_0010	Z5_NODE_0011	42"	RCP	187	1485 Camino Peral, Moraga, CA 94556
108	Z5_LINK_0028	Z5_NODE_0011	Z5_NODE_0019	42"	RCP	124	1471 Camino Peral, Moraga, CA 94556
109	Z5_LINK_0031	Z5_NODE_0019	Z5_NODE_0018	42"	RCP	203	1457 Camino Peral, Moraga, CA 94556
110	Z5_LINK_0038 *	Z5_NODE_0014	Z5_NODE_0013	48"	RCP	65	1454 St Marys Rd, Moraga, CA 94556
111	Z5_LINK_0039	Z5_NODE_0013	Z3_NODE_0001	48"	RCP	42	1450 St Marys Rd, Moraga, CA 94556
112	Z5_LINK_0074	Z5_NODE_0166	Z5_NODE_0086	36"	RCP	393	1049 Wickham Dr, Moraga, CA 94556
113	Z5_LINK_0075	Z5_NODE_0107	Z5_NODE_0166	36"	RCP	210	1073 Wickham Dr, Moraga, CA 94556
114	Z5_LINK_0078	Z5_NODE_0089	Z5_NODE_0166	30"	RCP	23	1048 Wickham Dr, Moraga, CA 94556
115	Z5_LINK_0122	Z5_NODE_0144	Z5_NODE_0143	30"	RCP	310	1911 Russell Dr, Moraga, CA 94556
116	Z5_LINK_0123	Z5_NODE_0145	Z5_NODE_0144	30"	RCP	41	1910 Russell Dr, Moraga, CA 94556
117	Z5_LINK_0124	Z5_NODE_0146	Z5_NODE_0145	30"	RCP	143	22 San Pablo Ct, Moraga, CA 94556
118	Z5_LINK_0125	Z5_NODE_0147	Z5_NODE_0146	30"	RCP	164	1903 Joseph Dr, Moraga, CA 94556
ZONE 6							
119	L-0089	N-0279	Z6_NODE_0181	36"	RCP	28	804 Augusta Dr, Moraga, CA 94556
120	L-0090 *	N-0285	Z6_NODE_0181	48"	RCP	459	847 Augusta Dr, Moraga, CA 94556
121	L-0161	N-0209	N-0240	55"	CMP	33	St Andrews Dr @ San Pablo Creek, Moraga, California, 94556
122	L-0176 *	Z6_NODE_0153	Z6_NODE_0152	48"	RCP	530	585 Augusta Dr, Moraga, CA 94556
123	L-0177	N-0198	Z6_NODE_0153	36"	RCP	49	1707 Spyglass Ln, Moraga, CA 94556
124	L-0178	N-0541	N-0198	18"	RCP	23	1708 Spyglass Ln, Moraga, CA 94556
125	L-0195	Z6_NODE_0127	N-0357	48"	RCP	439	928 Country Club Dr, Moraga, CA 94556
126	L-0196	N-0357	N-0358	48"	RCP	31	1673 School St, Moraga, CA 94556
127	L-0216 *	Z6_NODE_0117	Z6_NODE_0123	72"	RCP	44	Moraga Way s/o Miramonte Dr, Moraga, CA
128	L-0234	N-0313	N-0465	18"	CMP	17	1282 Moraga Way, Moraga, CA 94556
129	L-0292	Z6_NODE_0128	Z6_NODE_0127	48"	RCP	72	1019 Viader Dr, Moraga, CA 94556
130	L-0448		N-0209	55"	CMP	331	St Andrews Dr @ San Pablo Creek, Moraga, California, 94556
131	Z6_LINK_0002	Z6_NODE_0008	Z6_NODE_0007	36"	RCP	27	1843 School St, Moraga, CA 94556
132	Z6_LINK_0003	Z6_NODE_0009	Z6_NODE_0008	30"	RCP	61	14 Kinston Ct, Moraga, CA 94556
133	Z6_LINK_0004	Z6_NODE_0010	Z6_NODE_0009	30"	RCP	212	1871 School St, Moraga, CA 94556
134	Z6_LINK_0009 *	Z6_NODE_0019	N-0345	48"	RCP	400	119 Hazelwood Pl, Moraga, CA 94556
135	Z6_LINK_0013	Z6_NODE_0020	Z6_NODE_0019	30"	RCP	376	171 Hazelwood Pl, Moraga, CA 94556
136	Z6_LINK_0062	Z6_NODE_0074		42"	RCP	196	1682 St Andrews Dr, Moraga, CA 94556
137	Z6_LINK_0065	Z6_NODE_0070	Z6_NODE_0074	36"	RCP	68	696 Augusta Dr, Moraga, CA 94556
138	Z6_LINK_0076	Z6_NODE_0090	Z6_NODE_0089	54"	RCP	203	St Andrews Dr s/o Country Club Dr, Moraga, CA
139	Z6_LINK_0077	Z6_NODE_0091	Z6_NODE_0090	55"	RCP	181	St Andrews Dr n/o Country Club Dr, Moraga, CA
140	Z6_LINK_0108	Z6_NODE_0129	Z6_NODE_0128	36"	RCP	48	935 Country Club Dr, Moraga, CA 94556
141	Z6_LINK_0115 *	Z6_NODE_0152	Z6_NODE_0142	48"	RCP	213	629 Augusta Dr, Moraga, CA 94556

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APPENDIX A
CIP 21-205 ANNUAL STORM DRAIN REPAIRS
PIPELINE INSPECTION LIST

No.	Facility ID	U/S Node	D/S Node	Diameter	Material	Length (ft)	Address
ZONE 7							
142	L-0219	Z7_NODE_0321	Z7_NODE_0303	36"	CMP	170	1051 Camino Pablo, Moraga, CA 94556
143	L-0297	Z7_NODE_0174	Z7_NODE_0175	36"	RCP	48	1117 Sanders Dr, Moraga, CA 94556
144	Z7_LINK_0004	Z7_NODE_0009	Z7_NODE_0283	30"	RCP	87	1003 Larch Ave, Moraga, CA 94556
145	Z7_LINK_0038 *	Z7_NODE_0051	N-0450	36"	RCP	53	93 Thune Ave, Moraga, CA 94556
146	Z7_LINK_0039	Z7_NODE_0053	Z7_NODE_0051	30"	RCP	630	5 Thune Ave, Moraga, CA 94556
147	Z7_LINK_0040	Z7_NODE_0054	Z7_NODE_0053	30"	RCP	53	1105 Larch Ave, Moraga, CA 94556
148	Z7_LINK_0046	Z7_NODE_0063	Z7_NODE_0062	36"	RCP	213	141 Oxford Dr, Moraga, CA 94556
149	Z7_LINK_0051b	Z7_NODE_0042	Z7_NODE_0268	30"	RCP	243	1198 Cedarwood Dr, Moraga, CA 94556
150	Z7_LINK_0071	Z7_NODE_0077	Z7_NODE_0076	36"	RCP	60	1049 Sanders Dr, Moraga, CA 94556
151	Z7_LINK_0076	Z7_NODE_0086	Z7_NODE_0085	30"	RCP	89	98 Wandel Dr, Moraga, CA 94556
152	Z7_LINK_0079	Z7_NODE_0089	Z7_NODE_0087	30"	RCP	292	1062 Country Club Dr, Moraga, CA 94556
153	Z7_LINK_0080	Z7_NODE_0099	Z7_NODE_0089	24"	RCP	207	1067 Country Club Dr, Moraga, CA 94556
154	Z7_LINK_0106	Z7_NODE_0120	Z7_NODE_0119	24"	RCP	33	1335 Rimer Dr, Moraga, CA 94556
155	Z7_LINK_0107	Z7_NODE_0121	Z7_NODE_0120	30"	RCP	90	197 Walford Dr, Moraga, CA 94556
156	Z7_LINK_0117	Z7_NODE_0130	Z7_NODE_0128	36"	RCP	260	162 Tharp Dr, Moraga, CA 94556
157	Z7_LINK_0132	Z7_NODE_0145	Z7_NODE_0149	30"	RCP	53	302 Deerfield Dr, Moraga, CA 94556
158	Z7_LINK_0139	Z7_NODE_0158	Z7_NODE_0157	42"	RCP	34	220 Deerfield Dr, Moraga, CA 94556
159	Z7_LINK_0147	Z7_NODE_0167		30"	RCP	122	1084 Sanders Dr, Moraga, CA 94556
160	Z7_LINK_0148	Z7_NODE_0168	Z7_NODE_0167	30"	RCP	56	2 Carr Dr, Moraga, CA 94556
161	Z7_LINK_0150	Z7_NODE_0170	Z7_NODE_0168	24"	RCP	213	13 Gloria Ct, Moraga, CA 94556
162	Z7_LINK_0169	Z7_NODE_0190	Z7_NODE_0189	30"	RCP	43	356 Deerfield Dr, Moraga, CA 94556
163	Z7_LINK_0181	Z7_NODE_0203	Z7_NODE_0202	42"	RCP	241	425 Deerfield Dr, Moraga, CA 94556
164	Z7_LINK_0182	Z7_NODE_0204	Z7_NODE_0203	36"	RCP	182	431 Deerfield Dr, Moraga, CA 94556
165	Z7_LINK_0187	Z7_NODE_0209	Z7_NODE_0205	36"	RCP	304	470 Tharp Dr, Moraga, CA 94556
166	Z7_LINK_0208	Z7_NODE_0251	Z7_NODE_0250	30"	RCP	38	1157 Sanders Dr, Moraga, CA 94556
167	Z7_LINK_0211		Z7_NODE_0254	36"	RCP	36	1164 Larch Ave, Moraga, CA 94556
168	Z7_LINK_0241	Z7_NODE_0283	Z7_NODE_0005	30"	RCP	869	Canyon Road s/o Larch Ave, Moraga, CA
169	Z7_LINK_0243	Z7_NODE_0264	Z7_NODE_0267	42"	HDPE	105	9 Duarte Ct, Moraga, CA 94556
170	Z7_LINK_0253	Z7_NODE_0005	Z7_NODE_0284	42"	RCP	86	1001 Camino Pablo, Moraga, CA 94556
171	Z7_LINK_0257	Z7_NODE_0284	Z7_NODE_0287	48"	RCP	231	Canyon Road s/o Camino Pablo, Moraga, CA
172	Z7_LINK_0258b	Z7_NODE_0287		48"	RCP	187	Canyon Rd n/o Constance Pl, Moraga, CA
173	Z7_LINK_0260	Z7_NODE_0294	Z7_NODE_0291	36"	CMP	68	1003 Camino Pablo, Moraga, CA 94556
174	Z7_LINK_0262	Z7_NODE_0291	Z7_NODE_0270	36"	CMP	51	1007 Camino Pablo, Moraga, CA 94556
175	Z7_LINK_0264	Z7_NODE_0270	N-0454	36"	RCP	7	1009 Camino Pablo, Moraga, CA 94556
176	Z7_LINK_0274	Z7_NODE_0311	Z7_NODE_0047	48"	RCP	440	1107 Camino Pablo, Moraga, CA 94556
177	Z7_LINK_0286	Z7_NODE_0303	Z7_NODE_0302	30"	CMP	12	1100 Rimer Dr, Moraga, CA 94556
178	Z7_LINK_0290	Z7_NODE_0267	Z7_NODE_0298	42"	HDPE	73	1031 Camino Pablo, Moraga, CA 94556
179	Z7_LINK_0291	Z7_NODE_0298	Z7_NODE_0300	42"	HDPE	101	1027 Camino Pablo, Moraga, CA 94556
180	Z7_LINK_0293	Z7_NODE_0112	Z7_NODE_0110	18"	RCP	167	18 Wandel Dr, Moraga, CA 94556

*** INSPECTION OF PIPE WITHING PUBLIC R/W ONLY**

ZONE 1 - EAST AREA

CORTE FORTUNA
CORTE SANTA CLARA
CORTE YOLANDA
CALLE LA MESA
Z1_LINK_0103
Z1_LINK_0062
Z1_LINK_0194
L-0549
L-0142
L-0141
CAMPOLINDO
Z1_LINK_0051
Z1_LINK_0052
Z1_LINK_0053
Z1_LINK_0050
LENELLE
L-0107
L-0687
L-0108
L-0246
L-0666
L-0619
WIMPOLE
LUCIA
Z1_LINK_0040
Z1_LINK_0035
Z1_LINK_0034
Z1_LINK_0030
Z1_LINK_0018
Z1_LINK_0017
Z1_LINK_0016
Z1_LINK_0027
Z1_LINK_0028
BETLIN
WOODFORD
CAMELFORD
Z1_LINK_0007
L-0116
L-0115
L-0113
L-0112
L-0392
L-0111
L-0110
L-0385
Z1_LINK_0013
Z1_LINK_0045
Z1_LINK_0046
Z1_LINK_0199
NATALIE
BUCKINGHAM
NATVIDAD
HANSEN
MORAGA
Text

LEGEND

- Moraga Creeks

STORM DRAIN QRS

- QRS 5
- QRS 4
- QRS 3
- QRS 0-2
- INSPECTED BY OTHERS
- NOT INSPECTED

N

0 250 500 750 1,000 Feet

A-5

ZONE 1 - WEST AREA

Z1_LINK_0163
PASEO DEL RIO
CORTE ROYAL
CALLE LA MESA
QUINTAS
M5
Z1_LINK_0162
Z1_LINK_0172
L-0002
VIA GRANADA
Z1_LINK_0161
Z1_LINK_0158
Z1_LINK_0157
Z1_LINK_0136
CORTE AIRES
CORTE DE ORO
Z1_LINK_0135
CALLE LA MONTANA
L-0001
Z1_LINK_0120
CORTE MATEO
Z1_LINK_0119
Z1_LINK_0094
Z1_LINK_0092
L-0302
CORTE DEL CAMPO
Z1_LINK_0089
Z1_LINK_0115
CORTE DE ROSAS
Z1_LINK_0088
Z1_LINK_0109
Z1_LINK_0113
Z1_LINK_0134
Z1_LINK_0133
Z1_LINK_0132
Z1_LINK_0087
Z1_LINK_0105
Z1_LINK_0085
Z1_LINK_0143
Z1_LINK_0142
PASEO DEL CAMPO
CORTE ANNETTE
Z1_LINK_0141
PASEO GRANDE
CORTE ENCINA
Z1_LINK_0140
Z1_LINK_0147
CORTE PINTO
L-0377
CORTE FRESCA
Z1_LINK_0139
Z1_LINK_0084a
Z1_LINK_0084
CORTE LA RADA
CORTE AZUL
CAMPOLINDO
Z1_LINK_0154
Z1_LINK_0155
Z1_LINK_0152
Z1_LINK_0082
L-0301
Z1_LINK_0101
CORTE YOLANDA
Z1_LINK_0103
CALLE LA MESA
L-0107
M6

LEGEND

- Moraga Creeks

STORM DRAIN QRS

- QRS 5
- QRS 4
- QRS 3
- QRS 0-2
- INSPECTED BY OTHERS
- NOT INSPECTED

N

0 200 400 600 800 Feet

A-6

ZONE 2 - NORTH AREA

LEGEND

- Moraga Creeks

STORM DRAIN QRS

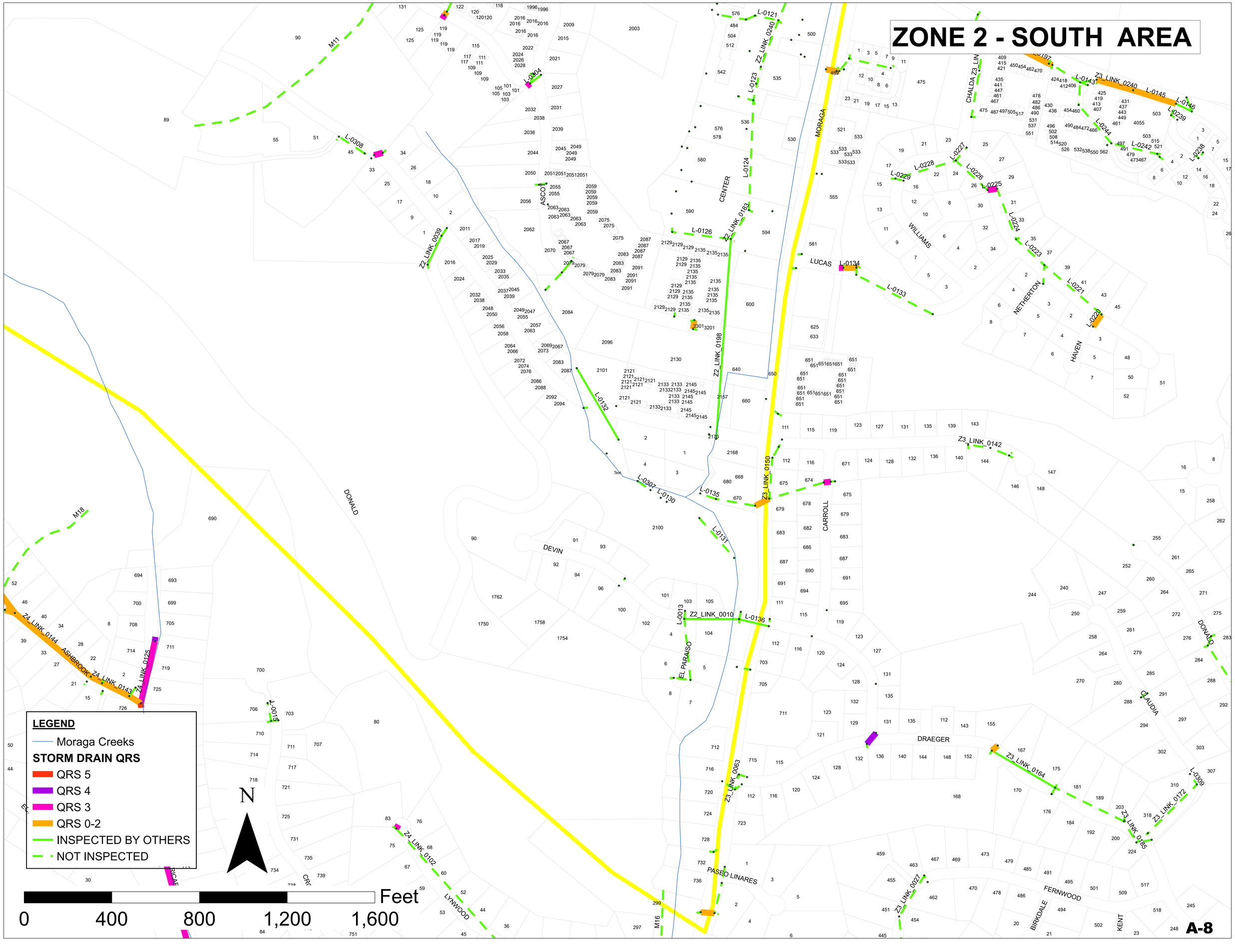
- QRS 5
- QRS 4
- QRS 3
- QRS 0-2
- INSPECTED BY OTHERS
- NOT INSPECTED

N

0 400 800 1,200 1,600 Feet

A-7

ZONE 2 - SOUTH AREA



ZONE 3 - NORTH AREA

LEGEND

- Moraga Creeks

STORM DRAIN QRS

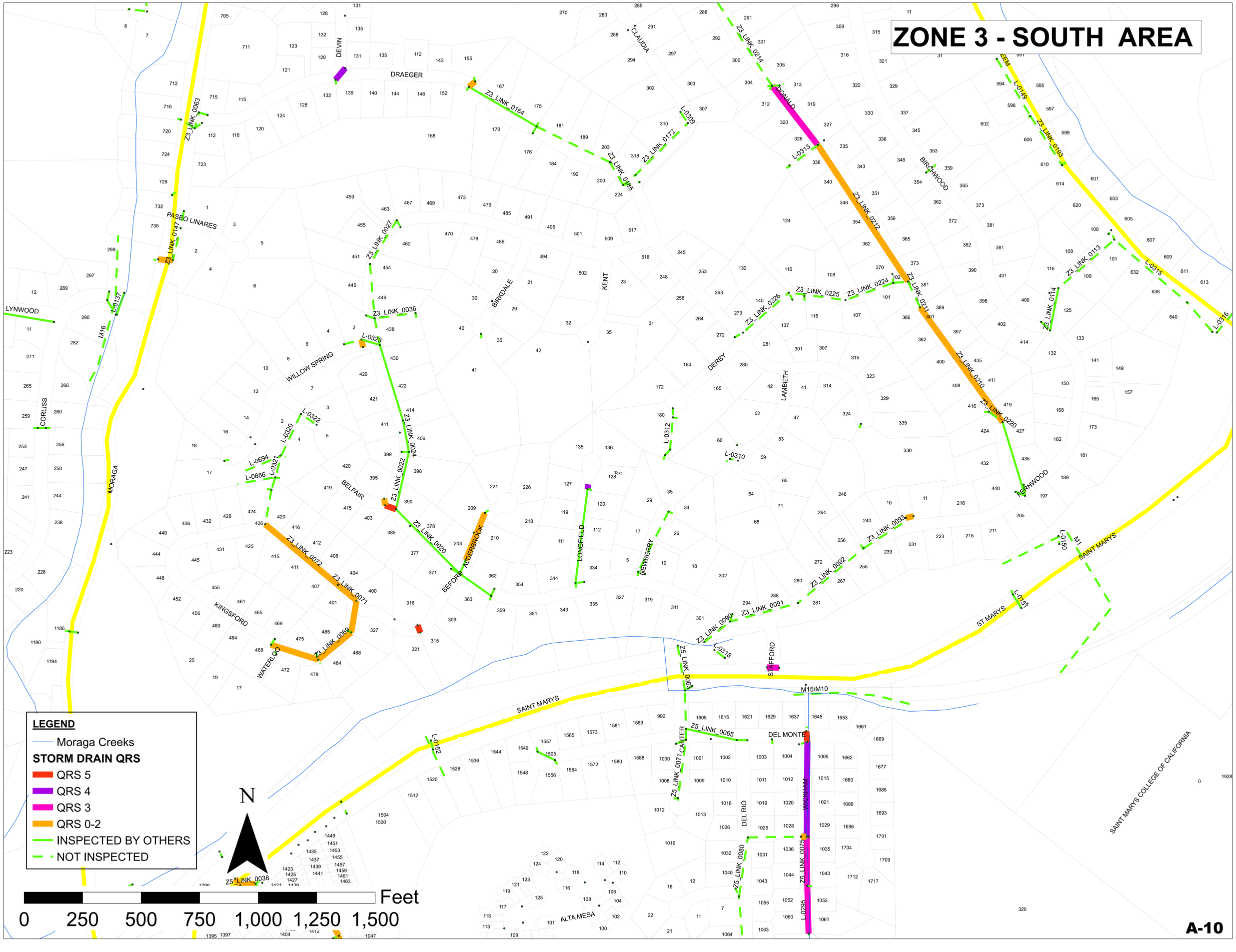
- QRS 5
- QRS 4
- QRS 3
- QRS 0-2
- INSPECTED BY OTHERS
- NOT INSPECTED

N

0 250 500 750 1,000 1,250 1,500 Feet

A-9

ZONE 3 - SOUTH AREA



LEGEND

- Moraga Creeks

STORM DRAIN QRS

- QRS 5
- QRS 4
- QRS 3
- QRS 0-2
- INSPECTED BY OTHERS
- NOT INSPECTED

N

0 250 500 750 1,000 1,250 1,500 Feet

A-10

ZONE 4 - NORTH AREA

LEGEND

- Moraga Creeks

STORM DRAIN QRS

- QRS 5
- QRS 4
- QRS 3
- QRS 0-2
- INSPECTED BY OTHERS
- NOT INSPECTED

N

0 250 500 750 1,000 1,250 1,500 Feet

RISA
FIESTA
CORTE DEL REY
DANZA
RAE
CORAL
EASTWOOD
PUEBLO
RYDAL
CARISBROOK
WILLIAMS
THORNDALE
RAMONA
ARROYO
SULLIVAN
WAKEFIELD
HARDIE
FIELDBROOK
WARFIELD
ECHO HILL
ARCHER
WOODSIDE
CORLISS
CAMINO RICARDO
ASHBROOK
DONALD
DEVIN
LYNNWOOD
GREENFIELD
WINSLOW
YORK
CROSSBROOK
ASHFORD
DANEFIELD

Z4_LINK_0156
Z4_LINK_0144
Z4_LINK_0143
Z4_LINK_0125
Z4_LINK_0122
Z4_LINK_0128
Z4_LINK_0130
Z4_LINK_0102
Z4_LINK_0096
Z4_LINK_0114
Z4_LINK_0054
Z4_LINK_0064
Z4_LINK_0053
Z4_LINK_0050
Z4_LINK_0079
Z4_LINK_0078
L-0277
L-0276
L-0275
L-0014

A-11

ZONE 4 - SOUTH AREA

CORTE SOMBRITA
CORTE HOLGANZA
IVY
RAMONA
M2
HARDIE
IDLEWOOD
MIRAMONTE
Z6_LINK_0103
Z6_LINK_0126
SULLIVAN
Z4_LINK_0079
Z4_LINK_0078
WOODSIDE
FIELDBROOK
DANEFIELD
YORK
ASHFORD
CORLISS
Z4_LINK_0042
M14
L-0014
CROSSBROOK
COURTER
L-0332
L-0329
L-0328
L-0333
L-0330
MORAGA VALLEY
MAISON
PARSON BROWN
L-0202
L-0203
CAMINO RICARDO
AVILLA
L-0249
L-0250
L-0247
L-0201
WHITING
L-0233
MORAGA
SAINT MARYS
AUGUSTA
L-0170
L-0174
L-0172
L-0182
L-0177
L-0176
L-0180
SPYGLASS
Z6_LINK_0115
Z6_LINK_0146
Z6_LINK_0093
Z6_LINK_0066
Z6_LINK_0072
Z6_LINK_0110
L-0188
Z6_LINK_0076
SAINT ANN
L-0105
Z6_LINK_0082
L-0158
L-0159
CYPRESS PT
L-0154
L-0293
L-0197
CCCSD
Z4_LINK_0188
VIADER Z6_LINK_0182
L-0290
L-0291
L-0292
L-0195
L-0192
SCHOOL
L-0193
L-0190
Z6_LINK_0030
Z6_LINK_0034
Z6_LINK_0036
COUNTRY CLUB
M4
Z6_LINK_0113
CANYON
CANYON
Z7_LINK_0059
L-0267
L-0289

LEGEND

- Moraga Creeks

STORM DRAIN QRS

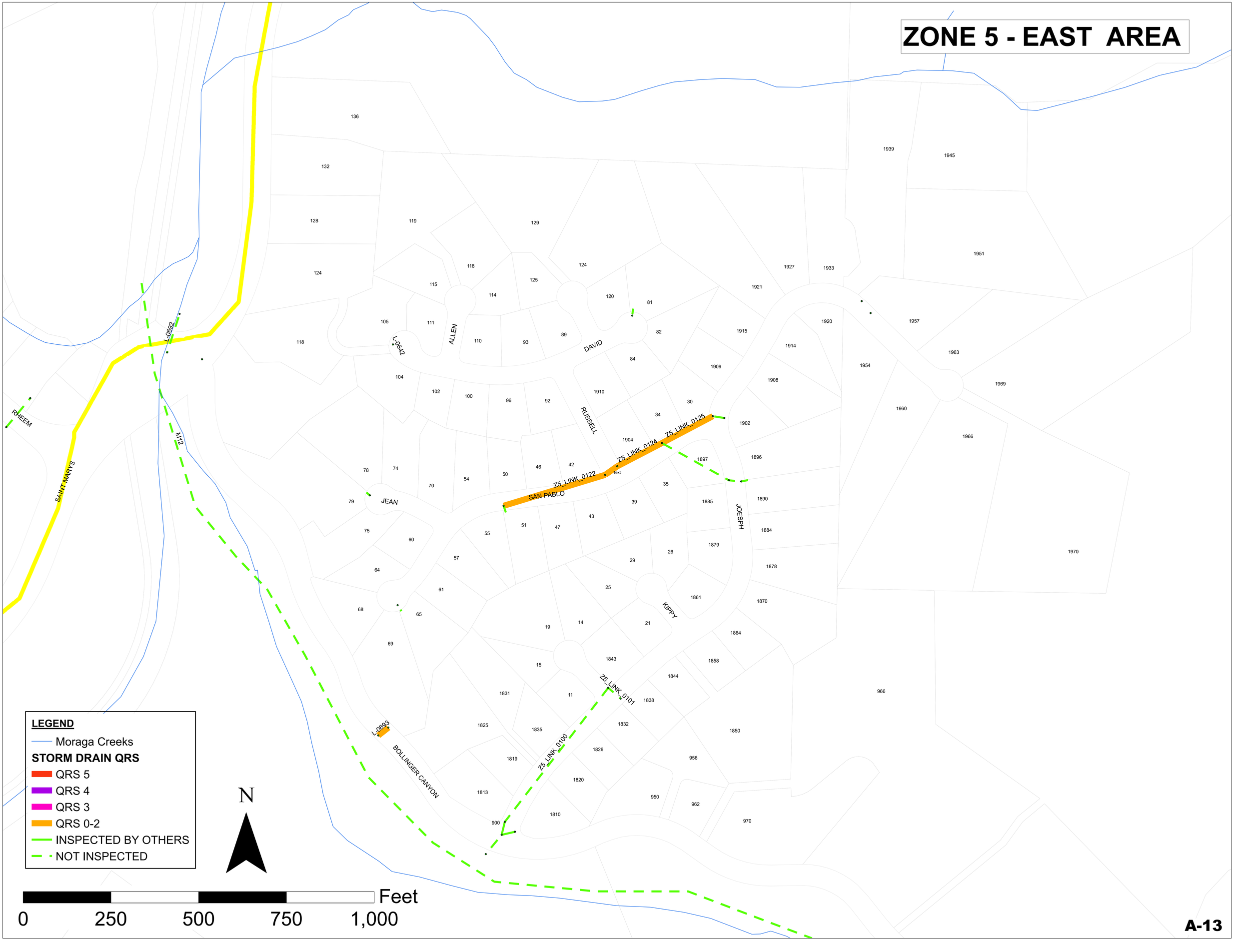
- QRS 5
- QRS 4
- QRS 3
- QRS 0-2
- INSPECTED BY OTHERS
- NOT INSPECTED

N

0 250 500 750 1,000 1,250 1,500 Feet

A-12

ZONE 5 - EAST AREA



LEGEND

- Moraga Creeks

STORM DRAIN QRS

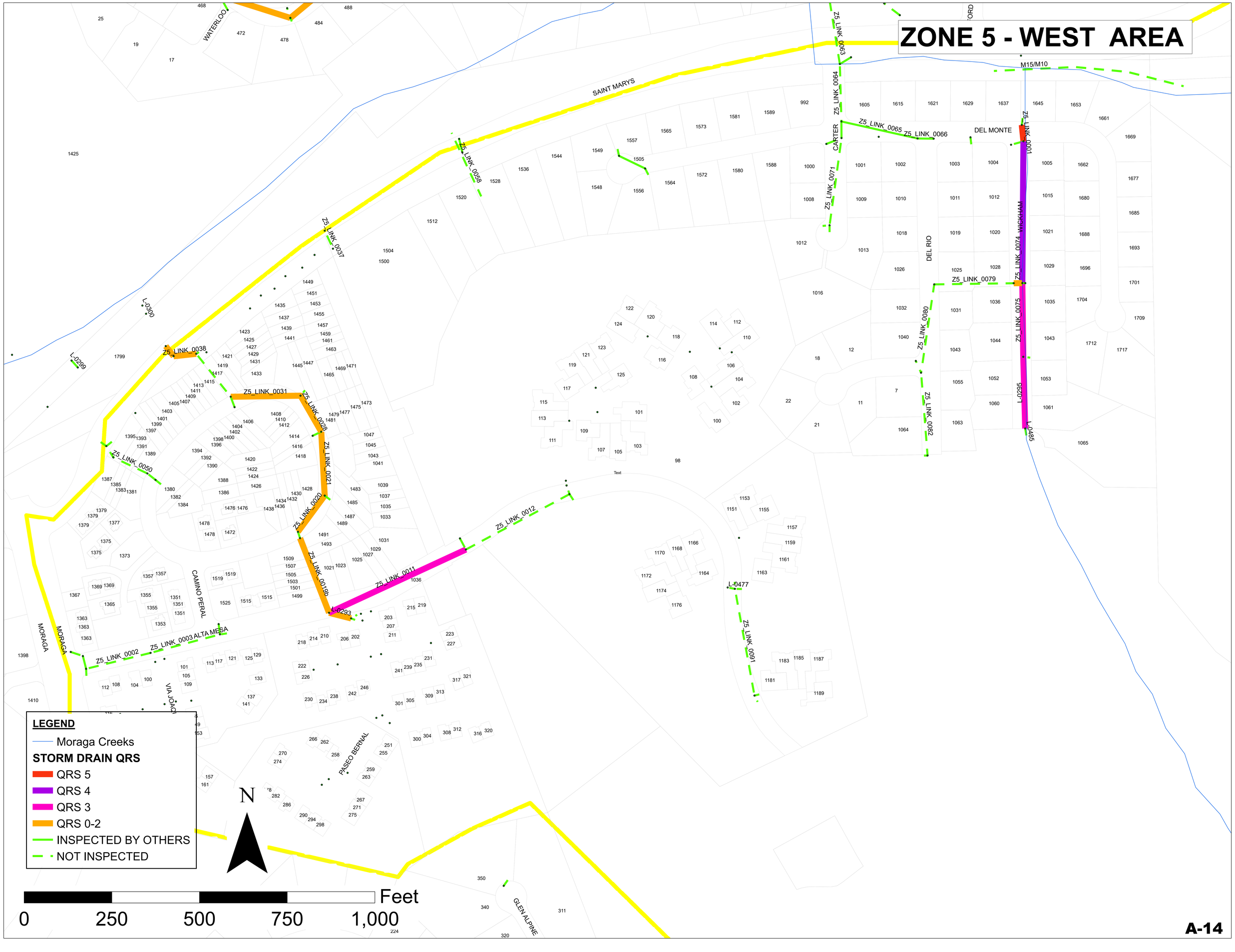
- QRS 5
- QRS 4
- QRS 3
- QRS 0-2
- INSPECTED BY OTHERS
- NOT INSPECTED

N

0 250 500 750 1,000 Feet

A-13

ZONE 5 - WEST AREA



LEGEND

- Moraga Creeks

STORM DRAIN QRS

- QRS 5
- QRS 4
- QRS 3
- QRS 0-2
- INSPECTED BY OTHERS
- NOT INSPECTED

ZONE 6 - NORTH AREA

Feet

0 250 500 750 1,000

N

LEGEND

- Moraga Creeks

STORM DRAIN QRS

- QRS 5
- QRS 4
- QRS 3
- QRS 0-2
- INSPECTED BY OTHERS
- NOT INSPECTED

MORAGA
IVY
MIRAMONTE
M2
Z4_LINK_0021
HARDIE
IDLEWOOD
Z6_LINK_0103
Z6_LINK_0089
L-0101
Z6_LINK_0126
FIELDBROOK
HARDIE
CORLISS
COURTER
L-0331
L-0332
L-0329
L-0335
L-0336
MORAGA VALLEY
L-0328
L-0327
L-0326
L-0451
PARSON BROWN
MAISON
L-0330
AVILA
L-0203
L-0675
L-0202
L-0488
CAMINO RICARDO
Z4_LINK_0011
L-0200
L-0252
L-0249
L-0250
L-0247
L-0669
WHITING
L-0668
L-0655
L-0654
L-0653
Z6_LINK_0077
SAINT ANN
L-0478
Z6_LINK_0076
L-0446
Z6_LINK_0075b
L-0164
L-0105
Z6_LINK_0082
COUNTRY CLUB
CYPRESS PT
L-0236
AUGUSTA
L-0174
L-0170
L-0173
L-0172
L-0182
L-0177
L-0176
L-0066
L-0065
L-0064
SKYGLASS
L-0063
L-0062
Z6_LINK_0114
Z6_LINK_0115
Z6_LINK_0146
L-0180
L-0181
Z6_LINK_0093_L-0183
1600

ZONE 6 - SOUTH AREA

LEGEND

- Moraga Creeks

STORM DRAIN QRS

- QRS 5
- QRS 4
- QRS 3
- QRS 0-2
- INSPECTED BY OTHERS
- NOT INSPECTED

N

0 250 500 750 1,000 Feet

A-16

ZONE 7 - NORTH AREA

LEGEND

- Moraga Creeks

STORM DRAIN QRS

- QRS 5
- QRS 4
- QRS 3
- QRS 0-2
- INSPECTED BY OTHERS
- NOT INSPECTED

N

0 250 500 750 1,000 1,250 1,500 Feet

A-17

ZONE 7 - SOUTH AREA

LEGEND

- Moraga Creeks

STORM DRAIN QRS

- QRS 5
- QRS 4
- QRS 3
- QRS 0-2
- INSPECTED BY OTHERS
- NOT INSPECTED

N

0 250 500 750 1,000 1,250 1,500 Feet

A-18

Appendix B: Storm Drain Observed Recommendations

DRAFT

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DRAFT

APPENDIX B

Table B-1: Summary of Storm Drain Line Observations (Grade 3 or Higher)

No.	Facility ID	Material	Diameter (in)	Length (ft)	Closest Address	Recommended Proposed Improvements
				ZONE 1		
1	L-0115	RCP	60	76	337 Moraga Rd	1. Fine Root removal 2. Seal and Grout pipe joints (approx. 8 ft)
2	L-0116	RCP	60	176	327 Moraga Rd	Invert Paving (approx. 8 ft)
3	Z1_LINK_0007	RCP	42	402	2 Woodford Dr	Heavy Cleaning and Install CIPP liner (entire length)
4	Z1_LINK_0026	RCP	36	30	24 Woodford Dr (Portion in private property)	Point Repair (approx. 12 ft)
5	Z1_LINK_0027	RCP	36	187	20 Betlin Pl	Seal infiltration point. Inspect in the future for mineral buildup.
6	Z1_LINK_0039	RCP	30	39	151 Natalie Dr	1. Point Repair (approx. 8 ft) 2. Install CIPP liner (entire length)
7	Z1_LINK_0045	RCP	30	221	45 Buckingham Dr	Heavy Cleaning at ends of pipe.
8	Z1_LINK_0050	RCP	48	140	3743 Campolindo Dr (Portion in private property)	Heavy Cleaning and Reinspect Pipe (entire length)
9	Z1_LINK_0100	RCP	30	65	390 Calle La Mesa	Heavy Cleaning and Reinspect Pipe (approx. 25 ft)
10	Z1_LINK_0152	RCP	48	77	3803 Paseo Grande	Heavy Cleaning and Reinspect Pipe (entire length)
11	Z1_LINK_0161	RCP	42	317	170 Paseo del Rio (Portion in private property)	Point Repair (approx. 8 ft)
				ZONE 2		
12	L-0003	CMP	24	236	92 Redwood Ln	Install CIPP Liner (entire length)
13	L-0681	RCP	15	30	109 Goodfellow Dr	Remove Heavy Roots (approx. 12 ft) and reinspect pipe
14	Z2_LINK_0036	RCP	18	155	102 Ascot Ct (Portion in private property)	No Action. Inspect in 5 years.
15	Z2_LINK_0047	RCP	18	192	142 Ascot Ct	No Action. Inspect in 5 years.
16	Z2_LINK_0069	RCP	24	38	33 Laird Dr	Heavy Cleaning and reinspect (approx. 26 ft)
17	Z2_LINK_0184	RCP	24	156	Rheem Blvd @ Center St	No Action. Inspect in 5 years.
18	Z2_LINK_0211	RCP	30	101	Moraga Rd @ Rheem Blvd	Point Repair (approx. 8 ft)
19	Z2_LINK_0245	HDPE	36	33	276 Scofield Dr	Clean and Reinspect (entire length)
20	120' U/S TO N-0037	CMP	18	120	Moraga Rd s/o Dolores Ct (Portion in private property)	1. Point Repair (approx. 8 ft) 2. Install CIPP liner (approx. 80')
				ZONE 3		
21	L-0225	RCP	21	38	29 Williams Dr	No Action. Inspect in 5 years.
22	L-0317	HDPE	36	55	Stafford Dr @ St Marys Rd	Clean and Reinspect (entire length)
23	L-0625	RCP	36	200	25 Lucas Dr	Remove obstruction downstream.
24	Z3_LINK_0003	RCP	18	34	350 Bedford Pl	Point Repair (8 ft)
25	Z3_LINK_0030	RCP	18	50	421 Belfair Pl	Point Repair (approx. 8 ft)
26	Z3_LINK_0087	RCP	21	33	619 Carroll Dr	Point Repair (approx. 16 ft)
27	Z3_LINK_0102	CMP	12	58	104 Donald Dr (Portion in private property)	Remove and replace pipe (entire length)
28	Z3_LINK_0119	RCP	18	65	195 Devin Dr	Point Repair (approx. 12 ft)
29	Z3_LINK_0155	RCP	18	33	1 Willow Springs Ln	Remove Roots (Several Locations) and grout joints
30	Z3_LINK_0210	RCP	36	607	393 Donald Dr	Heavy cleaning (incrustation) and install CIPP liner (entire length)
31	Z3_LINK_0212	RCP	30	710	330 Donald Dr	Remove and replace pipe (entire length)
32	Z3_LINK_0213	RCP	30	320	310 Donald Dr	Remove and replace pipe (entire length)
				ZONE 4		
33	Z4_LINK_0053	RCP	36	605	37 Corliss Dr	Point Repair (approx. 8 ft)
34	Z4_LINK_0104	RCP	30	50	99 Lynwood Pl	Heavy clean and reinspect pipe withing Town's R/W
35	Z4_LINK_0122	RCP	60	612	760 Camino Ricardo	No Action. Reinspect in future for mineral buildup.
36	Z4_LINK_0124	RCP	36	208	729 Camino Ricardo	Pipe Rehabilitation - Invert Paving (approx. 50')
37	Z4_LINK_0125	RCP	36	292	675 Camino Ricardo	No Action. Reinspect in future for mineral buildup.
38	Z4_LINK_0141	RCP	36	510	675 Camino Ricardo	No Action. Reinspect in future for mineral buildup.
39	Z4_LINK_0143	RCP	30	202	18 Ashbrook Pl	Remove and Replace Pipe (approx. 20 ft)
				ZONE 5		
40	L-0295	RCP	36	203	1097 Wickham Dr	No Action. Inspect in 5 years.
41	Z5_LINK_0001	RCP	36	47	1003 Wickham Dr	Heavy Cleaning and Reinspect Pipe NOTE: D/S Private Pipe requires cleaning Z5_LINK_0072
42	Z5_LINK_0011	RCP	30	424	1030 Alta Mesa Dr	No Action. Inspect in 5 years.
43	Z5_LINK_0039	RCP	48	42	1450 St Marys Rd	Point Repair (approx. 12 ft) Outlets to open space. Clean outlet
44	Z5_LINK_0074	RCP	36	393	1049 Wickham Dr	Heavy Cleaning and reinspect Note: this line is upstream of Z5_LINK_0001, which was also identified for heavy cleaning
45	Z5_LINK_0075	RCP	36	210	1073 Wickham Dr	Seal and grout annular space around tap break-in. Any exposed reinforcing steel should be treated with corrosion inhibitor and covered with mortar.

APPENDIX B

Table B-1: Summary of Storm Drain Line Observations (Grade 3 or Higher)						
No.	**Facility ID**	**Material**	**Diameter (in)**	**Length (ft)**	**Closest Address**	**Recommended Proposed Improvements**
ZONE 6						
46	L-0178	RCP	18	23	1708 Spyglass Ln	Heavy Cleaning and Reinspect Pipe (entire length)
47	L-0448	CMP	55	331	St Andrews Dr @ San Pablo Creek	Cleaning and Reinspect Pipe (entire length)
48	Z6_LINK_0009	RCP	48	400	119 Hazelwood Pl (Portion in private property)	Heavy Cleaning and Reinspect Pipe (approx. 170)
49	Z6_LINK_0062	RCP	42	196	1682 St Andrews Dr	Point Repair (approx. 8ft)
50	Z6_LINK_0076	RCP	54	203	St Andrews Dr @ Country Club Dr	No Action. Inspect in 5 years.
ZONE 7						
51	L-0219	CMP	36	170	1051 Camino Pablo	Clean and Rehabilitate with Geopolymer liner (entire length)
52	Z7_LINK_0039	RCP	30	630	5 Thune Ave	Install CIPP liner (entire length)
53	Z7_LINK_0071	RCP	36	60	1049 Sanders Dr	Heavy Cleaning and Reinspect Pipe (entire length)
54	Z7_LINK_0107	RCP	30	90	197 Walford Dr	Heavy Cleaning and Reinspect Pipe (entire length)
55	Z7_LINK_0147	RCP	30	122	1084 Sanders Dr	Install CIPP liner (entire length)
56	Z7_LINK_0150	RCP	24	213	13 Gloria Ct	Remove and replace pipe (entire length)
57	Z7_LINK_0169	RCP	30	43	356 Deerfield Dr	Heavy Clean and reinspect pipe (entire length)
58	Z7_LINK_0181	RCP	42	241	425 Deerfield Dr	Rehabilitation by Grouting Invert (approx. 8 ft)
59	Z7_LINK_0182	RCP	36	182	431 Deerfield Dr	Rehabilitation by Grouting Invert (approx. 16 ft)
60	Z7_LINK_0264	RCP	36	7	1009 Camino Pablo	Heavy Cleaning and Reinspect Pipe (entire length)

ZONE 1 - EAST AREA

CORTE FORTUNA
CORTE SANTA CLARA
CORTE YOLANDA
CALLE LA MESA
CAMPOLINDO
LENELLE
LUCIA
WIMPOLE
CAMELFORD
BETLIN
WOODFORD
NATALIE
BUCKINGHAM
HANSEN
NATVIDAD
FRANCISCA
MORAGA

Z1_LINK_0103
Z1_LINK_0062
Z1_LINK_0194
Z1_LINK_0051
Z1_LINK_0052
Z1_LINK_0053
Z1_LINK_0050
Z1_LINK_0040
Z1_LINK_0035
Z1_LINK_0018
Z1_LINK_0017
Z1_LINK_0016
Z1_LINK_0007
Z1_LINK_0027
Z1_LINK_0028
Z1_LINK_0043
Z1_LINK_0030
Z1_LINK_0034
Z1_LINK_0013
Z1_LINK_0045
Z1_LINK_0046
Z1_LINK_0199

L-0549
L-0142
L-0141
L-0107
L-0687
L-0108
L-0246
L-0666
L-0619
L-0385
L-0110
L-0111
L-0382
L-0112
L-0113
L-0115
L-0116
L-0114

LEGEND

- Moraga Creeks

STORM DRAIN REPAIRS

- NO ACTION
- CLEAN
- GROUT JOINTS
- POINT REPAIR
- POINT REPAIR AND REHABILITATE
- REHABILITATE

N

0 250 500 750 1,000 Feet

B-3

ZONE 1 - WEST AREA

Z1_LINK_0163
PASEO DEL RIO
CORTE ROYAL
CALLE LA MESA
QUINTAS
M5
Z1_LINK_0162
Z1_LINK_0172
L-0002
VIA GRANADA
CORTE DE ORO
CORTE AIRES
Z1_LINK_0136
Z1_LINK_0135
CALLE LA MONTANA
L-0001
Z1_LINK_0161
Z1_LINK_0158
Z1_LINK_0120
CORTE MATEO
Z1_LINK_0119
Z1_LINK_0094
Z1_LINK_0092
L-0302
CORTE DEL CAMPO
Z1_LINK_0115
CORTE DE ROSAS
Z1_LINK_0089
Z1_LINK_0088
Z1_LINK_0109
Z1_LINK_0113
Z1_LINK_0134
Z1_LINK_0157
Z1_LINK_0143
Z1_LINK_0142
PASEO DEL CAMPO
CORTE ANNETTE
Z1_LINK_0141
PASEO GRANDE
CORTE ENCINA
Z1_LINK_0147
CORTE PINTO
Z1_LINK_0140
Z1_LINK_0087
Z1_LINK_0133
Z1_LINK_0132
Z1_LINK_0105
Z1_LINK_0085
Z1_LINK_0139
Z1_LINK_0084a
CORTE FRESCA
CORTE LA RADA
Z1_LINK_0084
CAMPOLINDO
Z1_LINK_0154
Z1_LINK_0155
Z1_LINK_0152
Z1_LINK_0082
CORTE AZUL
M6
L-0107
CORTE YOLANDA
Z1_LINK_0103
CALLE LA MESA
Z1_LINK_0101
L-0301
L-0377

LEGEND

STORM DRAIN REPAIRS

- NO ACTION
- CLEAN
- POINT REPAIR

N

0 200 400 600 800 Feet

B-4

ZONE 2 - NORTH AREA

LEGEND

- Moraga Creeks

STORM DRAIN REPAIRS

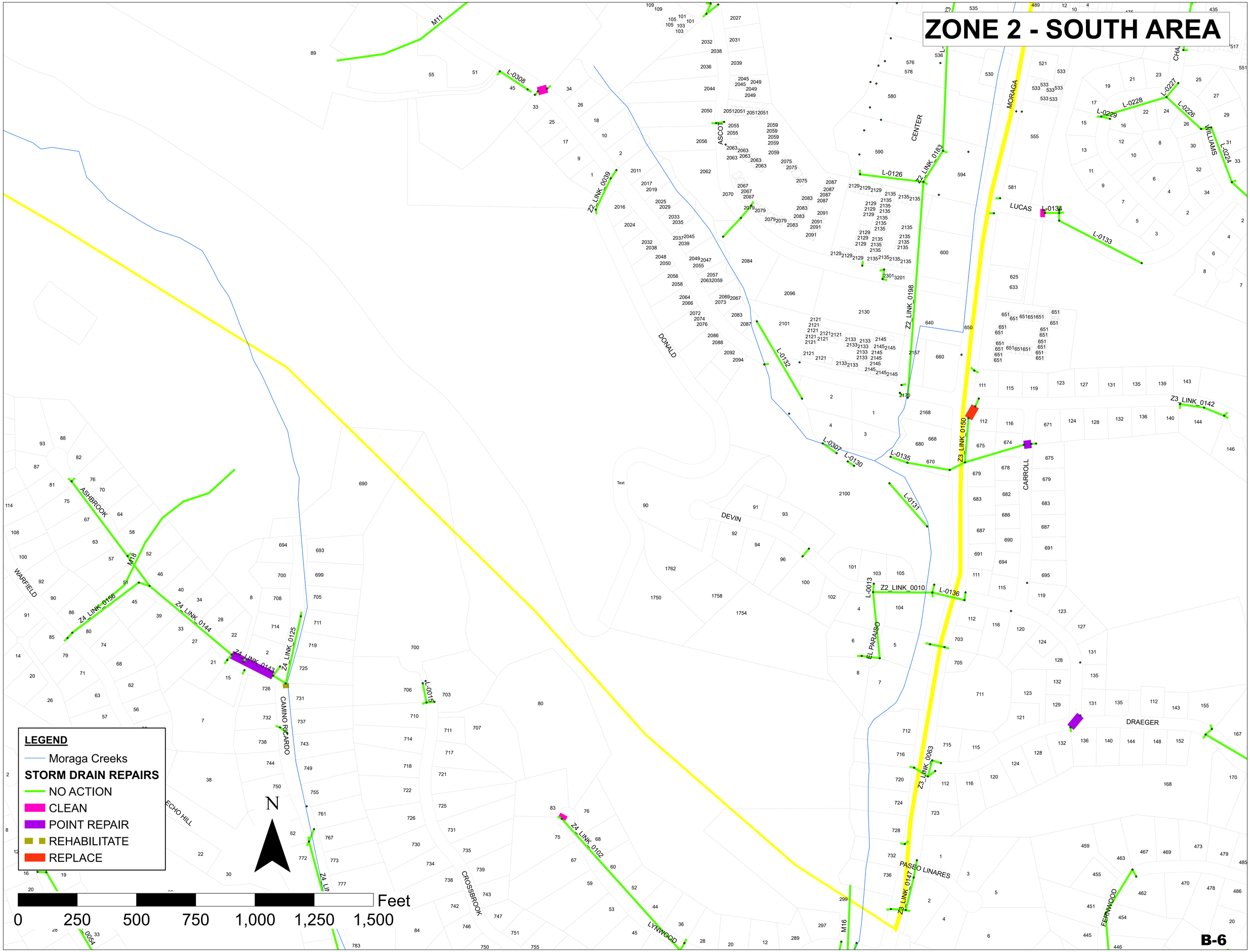
- NO ACTION
- CLEAN
- GROUT JOINTS
- POINT REPAIR
- POINT REPAIR AND REHABILITATE
- REHABILITATE

N

0 250 500 750 1,000 1,250 1,500 Feet

B-5

ZONE 2 - SOUTH AREA



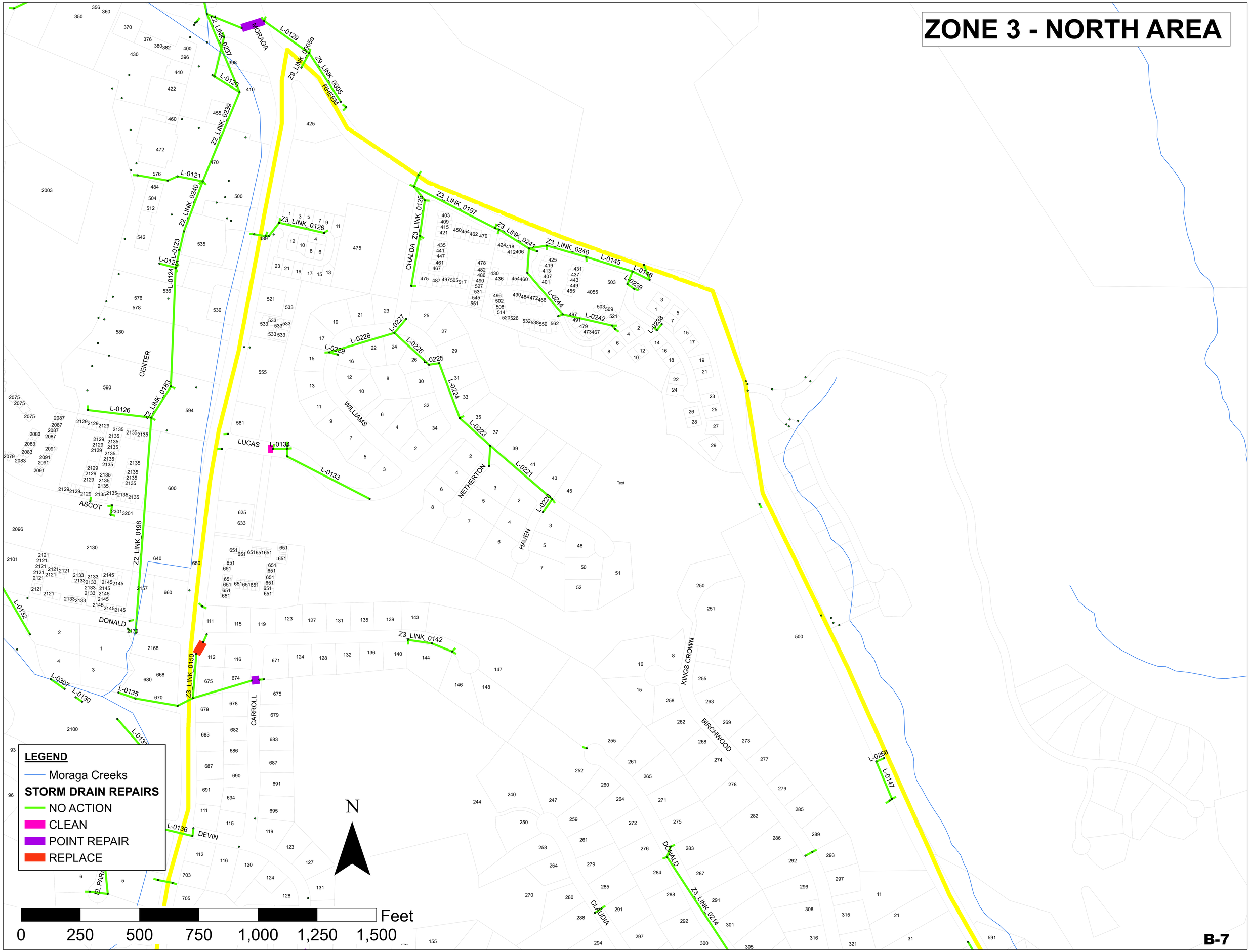
LEGEND

- Moraga Creeks

STORM DRAIN REPAIRS

- NO ACTION
- CLEAN
- POINT REPAIR
- REHABILITATE
- REPLACE

ZONE 3 - NORTH AREA



B-7

ZONE 3 - SOUTH AREA

LEGEND

- Moraga Creeks

STORM DRAIN REPAIRS

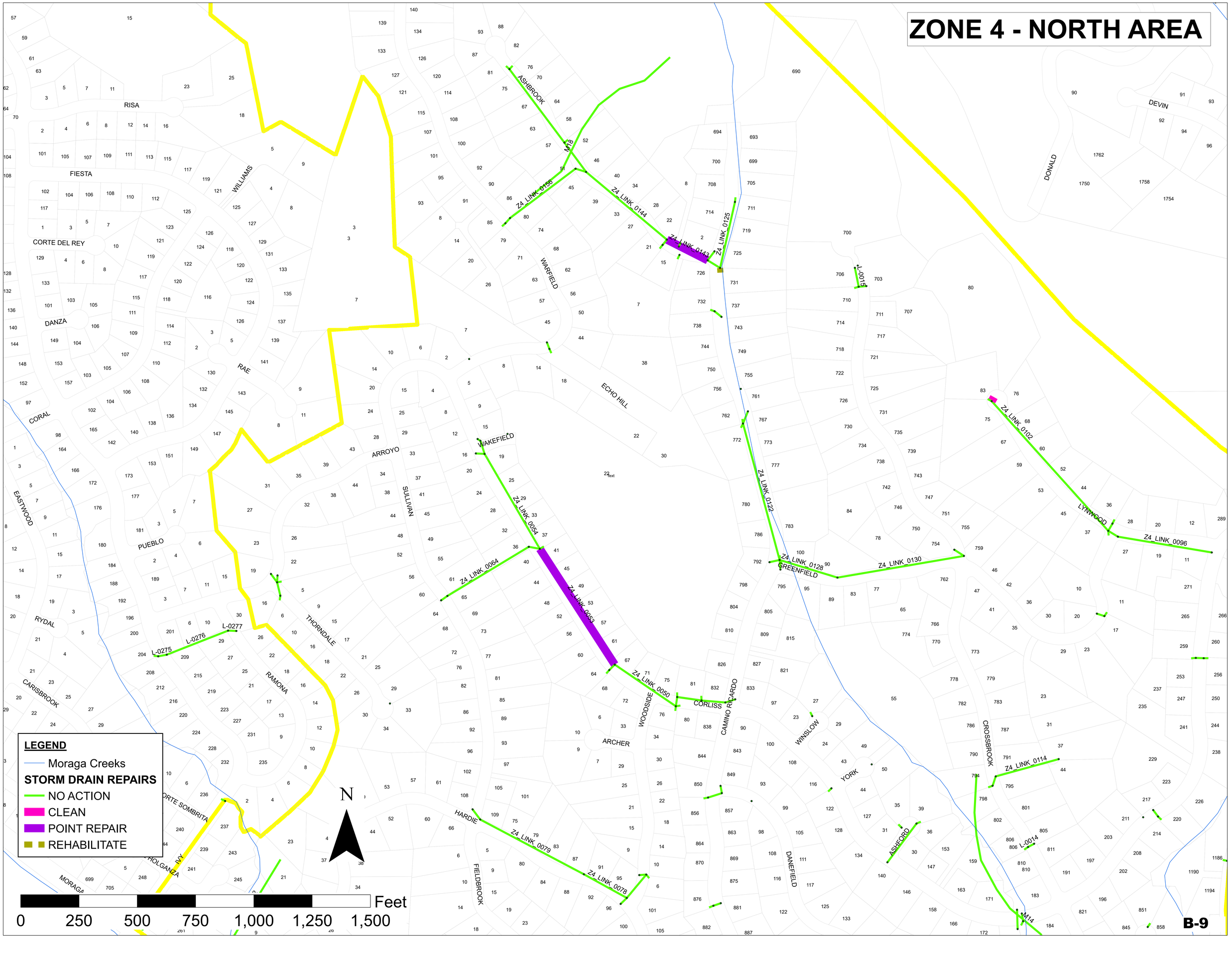
- NO ACTION
- CLEAN
- GROUT JOINTS
- POINT REPAIR
- REHABILITATE
- REPLACE

N

0 250 500 750 1,000 1,250 1,500 Feet

B-8

ZONE 4 - NORTH AREA



LEGEND

- Moraga Creeks

STORM DRAIN REPAIRS

- NO ACTION
- CLEAN
- POINT REPAIR
- REHABILITATE

ZONE 4 - NORTH AREA

CORTE SOMBRITA
CORTE HOLGANZA
IVY
RAMONA
M2
HARDIE
IDLEWOOD
Z6_LINK_0103
MIRAMONTE
Z6_LINK_0128
SULLIVAN
Z4_LINK_0079
Z4_LINK_0078
WOODSIDE
FIELDBROOK
DANEFIELD
YORK
ASHFORD
CORLISS
CROSSBROOK
L-0014
Z4_LINK_0042
M14
MORAGA
SAINT MARYS
COURTER
L-0332
L-0329
L-0328
L-0330
PARSON BROWN
MAISON
MORAGA VALLEY
L-0336
L-0203
L-0202
CAMINO RICARDO
AVILA
L-0201
WHITING
L-0250
L-0249
L-0247
L-0253
AUGUSTA
L-0170
L-0174
L-0172
L-0182
L-0177
L-0176
L-0180
Z6_LINK_0115
Z6_LINK_0093
Z6_LINK_0146
SPYGLASS
L-0064
Z6_LINK_0066
Z6_LINK_0072
L-0110
L-0188
L-0184
Z6_LINK_0076
SAINT ANN
L-0105
Z6_LINK_0082
L-0158
L-0159
CYPRESS PT
L-0154
L-0233
L-0197
L-0193
L-0192
SCHOOL
L-0190
Z6_LINK_0030
Z6_LINK_0034
CCCSD
Z4_LINK_0188
VIADER
L-0291
L-0292
L-0290
L-0289
Z6_LINK_0036
COUNTRY CLUB
Z6_LINK_0113
CANYON
CANYON
Z4_LINK_0059
L-0267
M4

LEGEND

- Moraga Creeks

STORM DRAIN REPAIRS

- NO ACTION
- CLEAN
- POINT REPAIR

N

0 250 500 750 1,000 1,250 1,500 Feet

ZONE 5 - EAST AREA

L-0315
RHEEM
L-0316
L-0692
M12
SAINT MARYS
ALLEN
SANTA CATALINA
DAVID
RUSSELL
Z5_LINK_0125
SAN PABLO
JEAN
JOESPH
KIPPY
L-0693
BOLLINGER CANYON
Z5_LINK_0100
SAINT MARYS COLLEGE OF CALIFORNIA

136
132
128
119
129
124
118
124
115
125
114
120
81
607
609
611
613
636
640
105
111
110
93
89
82
118
1921
1927
1933
1939
1945
1951
1915
1920
1957
1914
1963
84
1909
1954
1908
1969
104
102
100
96
92
1910
34
30
1902
1960
1904
1966
1897
1896
78
74
70
54
50
46
42
35
79
1885
1890
39
43
51
47
1884
75
60
55
1879
57
29
26
Text
1970
64
1878
61
25
1861
1870
68
65
19
14
21
1864
69
1843
15
1858
1844
1831
11
1838
966
1825
1835
1832
1850
1819
1826
956
1820
1813
950
962
1810
900
970

LEGEND

Moraga Creeks

STORM DRAIN REPAIRS

NO ACTION

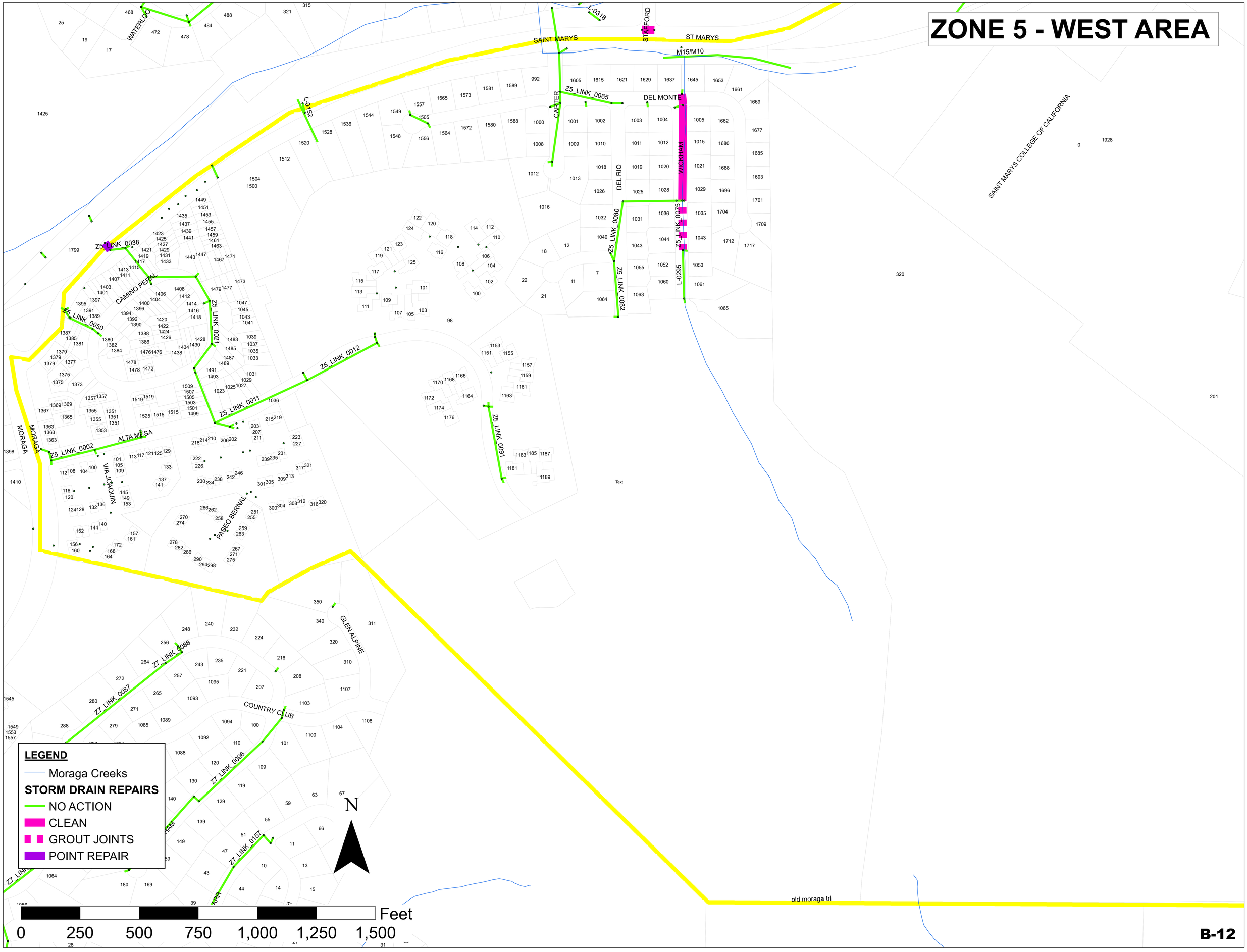
N

0 250 500 750 1,000 1,250 1,500 Feet

1925

B-11

ZONE 5 - WEST AREA



B-12

ZONE 6 - EAST AREA

LEGEND

Moraga Creeks

STORM DRAIN REPAIRS

NO ACTION

CLEAN

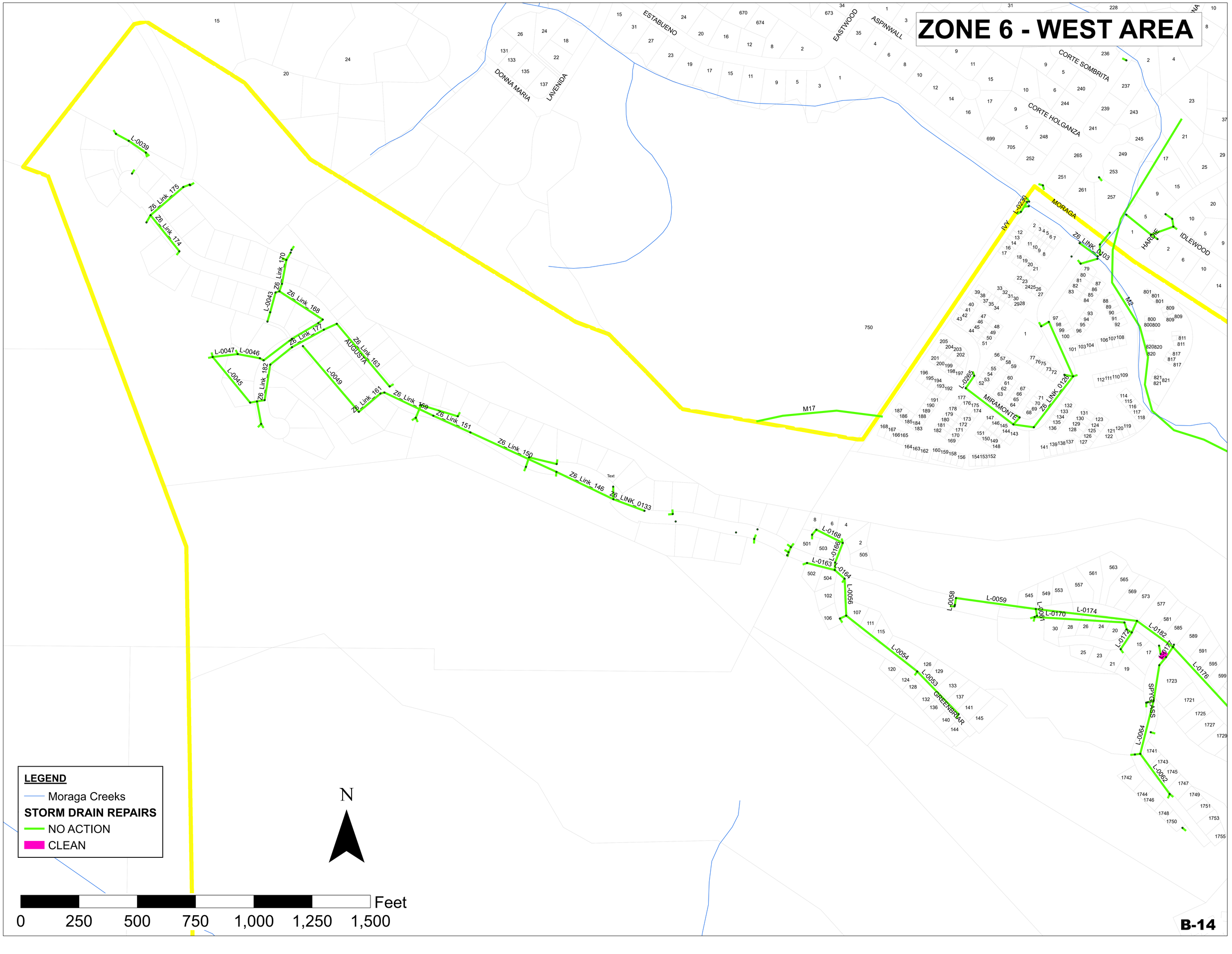
POINT REPAIR

N

0 250 500 750 1,000 1,250 1,500 Feet

B-13

ZONE 6 - WEST AREA



LEGEND

- Moraga Creeks

STORM DRAIN REPAIRS

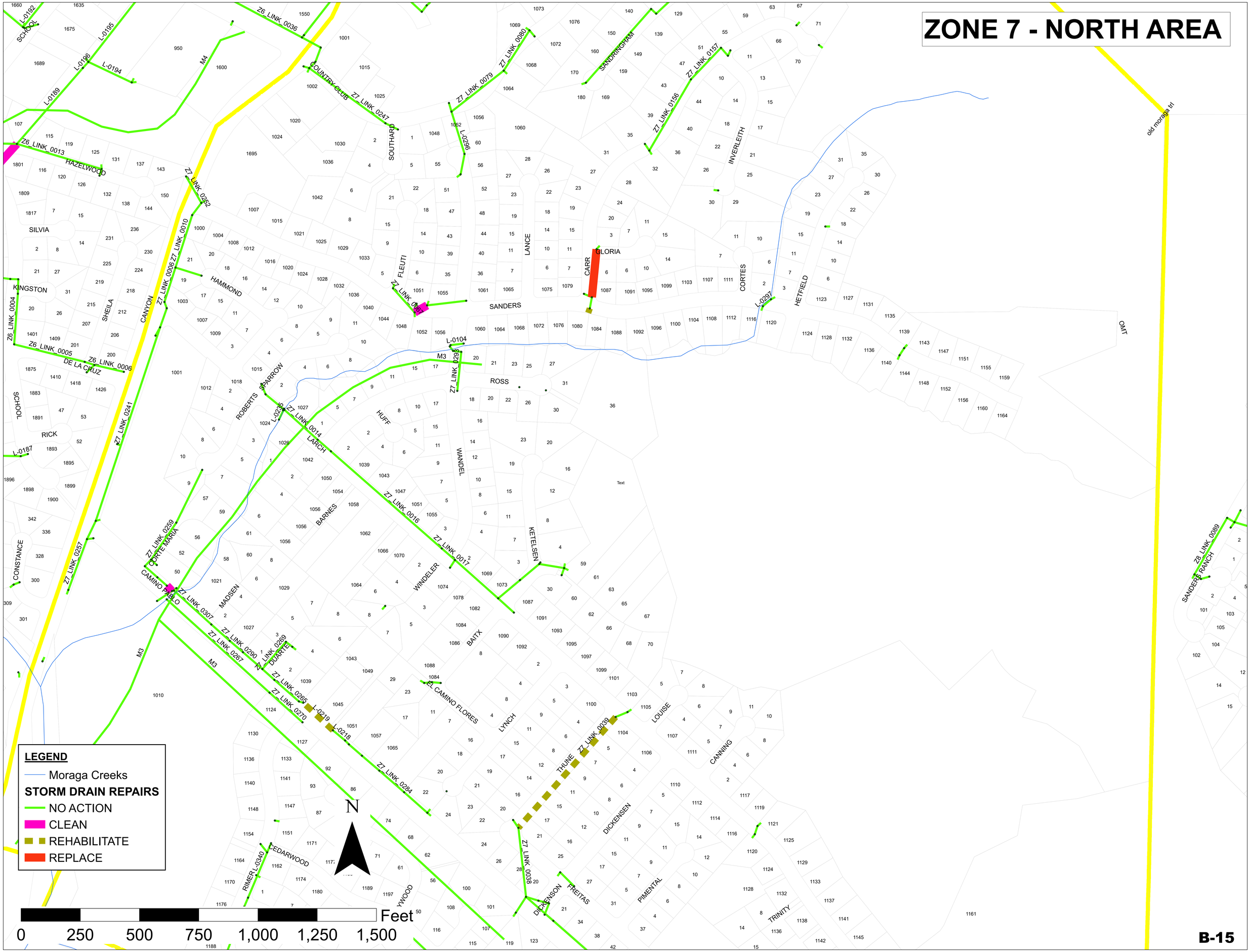
- NO ACTION
- CLEAN

N

0 250 500 750 1,000 1,250 1,500 Feet

B-14

ZONE 7 - NORTH AREA



LEGEND

- Moraga Creeks

STORM DRAIN REPAIRS

- NO ACTION
- CLEAN
- REHABILITATE
- REPLACE

N

0 250 500 750 1,000 1,250 1,500 Feet

B-15

ZONE 7 - SOUTH AREA

LEGEND

- Moraga Creeks

STORM DRAIN REPAIRS

- NO ACTION
- CLEAN
- REHABILITATE

N

0 250 500 750 1,000 1,250 1,500 Feet

B-16

Appendix C: Storm Drain Project Recommendations

DRAFT

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DRAFT

APPENDIX C

Table C-1: Proposed Storm Drain Project Recommendations						
No.	**Facility ID**	**Material**	**Diameter (in)**	**Length (ft)**	**Closest Address**	**Recommended Proposed Improvements**
ZONE 1						
1	L-0116	RCP	60	176	327 Moraga Rd	Invert Paving (approx. 8 ft)
2	Z1_LINK_0007	RCP	42	402	2 Woodford Dr	Heavy Cleaning and Install CIPP liner (entire length)
3	Z1_LINK_0026	RCP	36	30	24 Woodford Dr (Portion in private property)	Point Repair (approx. 12 ft)
ZONE 2						
4	L-0003	CMP	24	236	92 Redwood Ln	Install CIPP Liner (entire length)
5	120' U/S TO N-0037	CMP	18	120	Moraga Rd s/o Dolores Ct (Portion in private property)	1. Point Repair (approx. 8 ft) 2. Install CIPP liner (approx. 80')
ZONE 3						
6	Z3_LINK_0003	RCP	18	34	350 Bedford Pl	Point Repair (8 ft)
7	Z3_LINK_0030	RCP	18	50	421 Belfair Pl	Point Repair (approx. 8 ft)
8	Z3_LINK_0087	RCP	21	33	619 Carroll Dr	Point Repair (approx. 16 ft)
9	Z3_LINK_0102	CMP	12	58	104 Donald Dr (Portion in private property)	Remove and replace pipe (entire length)
10	Z3_LINK_0119	RCP	18	65	195 Devin Dr	Point Repair (approx. 12 ft)
11	Z3_LINK_0213	RCP	30	320	310 Donald Dr	Remove and replace pipe (entire length)
ZONE 4						
12	Z4_LINK_0053	RCP	36	605	37 Corliss Dr	Point Repair (approx. 8 ft)
13	Z4_LINK_0124	RCP	36	208	729 Camino Ricardo	Pipe Rehabilitation - Invert Paving (approx. 50')
14	Z4_LINK_0143	RCP	30	202	18 Ashbrook Pl	Remove and Replace Pipe (approx. 20 ft)
ZONE 5						
15	Z5_LINK_0001	RCP	36	47	1003 Wickham Dr	Heavy Cleaning and Reinspect Pipe NOTE: D/S Private Pipe requires cleaning Z5_LINK_0072
16	Z5_LINK_0074	RCP	36	393	1049 Wickham Dr	Heavy Cleaning and reinspect Note: this line is upstream of Z5_LINK_0001, which was also identified for heavy cleaning
ZONE 6						
17	Z6_LINK_0062	RCP	42	196	1682 St Andrews Dr	Point Repair (approx. 8ft)
ZONE 7						
18	L-0219	CMP	36	170	1051 Camino Pablo	Clean and Rehabilitate with Geopolymer liner (entire length)
19	Z7_LINK_0039	RCP	30	630	5 Thune Ave	Install CIPP liner (entire length)
20	Z7_LINK_0169	RCP	30	43	356 Deerfield Dr	Heavy Clean and reinspect pipe (entire length)
21	Z7_LINK_0181	RCP	42	241	425 Deerfield Dr	Rehabilitation by Grouting Invert (approx. 8 ft)
22	Z7_LINK_0182	RCP	36	182	431 Deerfield Dr	Rehabilitation by Grouting Invert (approx. 16 ft)

ZONE 1 IMPROVEMENTS

CORTE YOLANDA
CALLE LA MESA
MORAGA
CAMPOLINDO
LENELLE
NATALIE
LUCIA
WIMPOLE
BETLIN
WOODFORD
CAMELFORD
BUCKINGHAM
Z-LINK-007
L-0116
HANSEN
NATVIDAD
FRANCISCA

STORM DRAIN LEGEND

- CREEKS
- NO ACTION
- POINT REPAIR
- REHABILITATE

N

0 125 250 500 750 1,000
Feet

C-2

Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

ZONE 2 IMPROVEMENTS

PASEO GRANDE
CORTE FRESCA
CAMPOLINDO
HAROLD
SCOFIELD
LA SALLE
HANSEN
JOSEFA
FRANCISCA
BENEDITA
MORAGA
DOLORES
RHEEM
ASCOT
CENTER
L-0116
Z2_LINK_0125b

STORM DRAIN LEGEND

- CREEKS
- NO ACTION
- REHABILITATE
- POINT REPAIR AND REHABILITATE

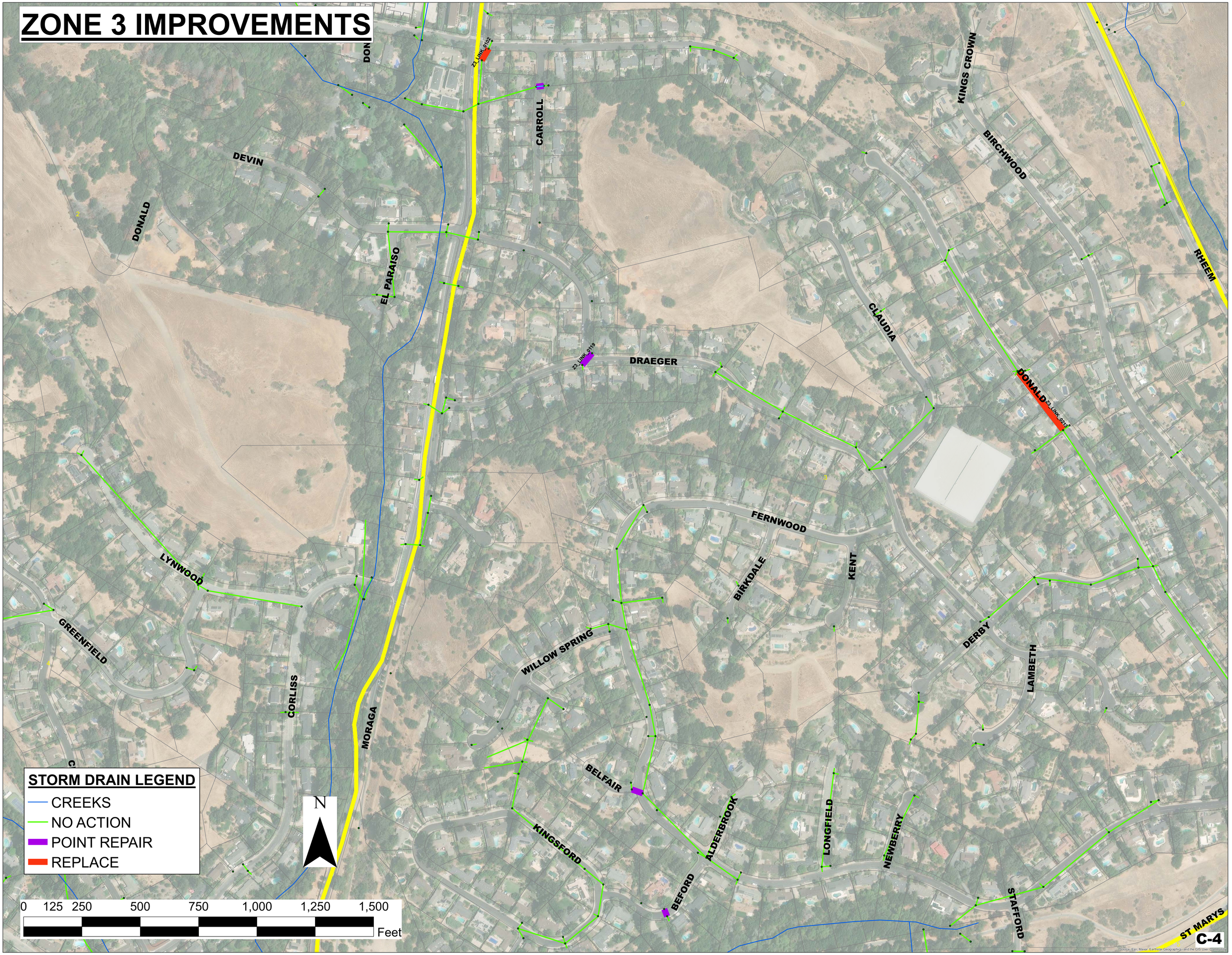
N

0 125 250 500 750 1,000 1,250 1,500
Feet

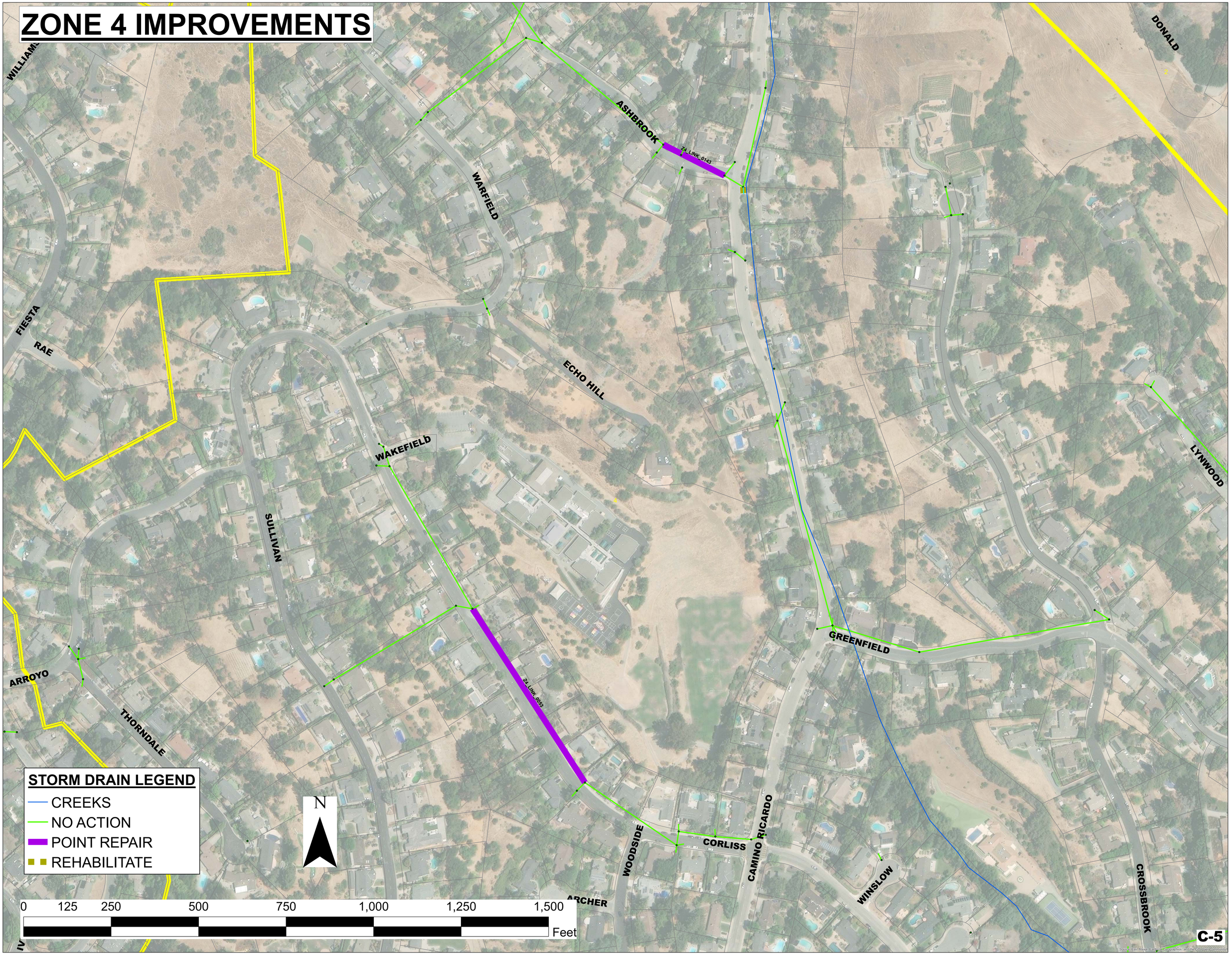
C-3

Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

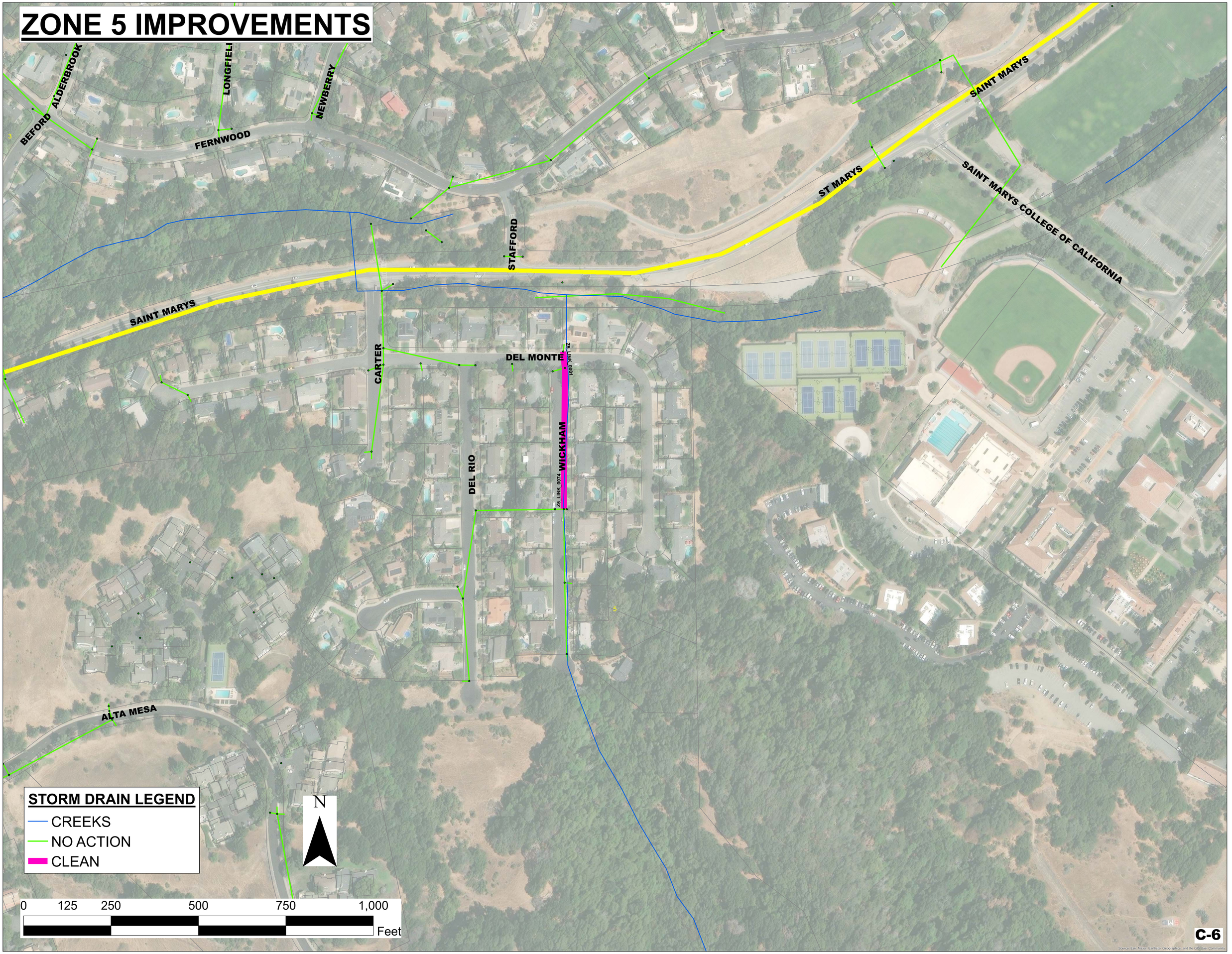
ZONE 3 IMPROVEMENTS



ZONE 4 IMPROVEMENTS



ZONE 5 IMPROVEMENTS



ZONE 6 IMPROVEMENTS



ZONE 7 IMPROVEMENTS

AUGUSTA
CANYON
MADS
DUARTE
WINDELER
LARCH
BAITX
CAMINO PABLO
L-0219
LYNCH
THUNE
ZT_LINK_0039
LOUISE
CANNING
DICKENSEN
GAYWOOD
CEDARWOOD
JUNIPER
FREITAS
PIMENTAL
TRINITY
WHITETHORNE
SELBORNE
BROOKFIELD
OXFORD
CROCKETT
BRANDT
LISA
REED
SANDERS RANCH
HODGES
EILEEN
KAZAR
SARAH
TIA
RIMER
WALFORD
THARP
SHUEY
PEMBROOK
AMBERWOOD
MARIE
MAYFIELD
FAIRFIELD
OMT
DEERFIELD
LAKEFIELD
ZT_LINK_0181
ZT_LINK_0182
STONEFIELD
REDFIELD
MILLFIELD
OMT

STORM DRAIN LEGEND

- CREEKS
- NO ACTION
- CLEAN
- REHABILITATE

N

0 125 250 500 750 1,000 1,250 1,500 1,750 2,000
Feet

C-8

Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community