

City of Soledad Storm Drain Master Plan Update



Department of Public Works

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Prepared by

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The following report has been prepared under the supervision of the undersigned, who certifies that they are a Registered Civil Engineer in the State of California.

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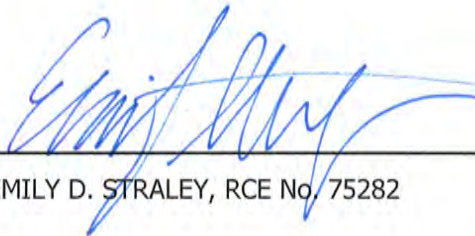

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Chapter 1 Introduction

1.1 Overview

This City of Soledad storm drain master plan provides a capacity analysis and a recommended capital improvement program (CIP) to provide a 10-year level of service. This chapter provides a general discussion of the Soledad area setting, storm drain network, and history of flooding. This chapter also gives a brief description of the master plan process.

1.2 Setting

The City of Soledad is located in Monterey County approximately 26 miles southeast of Salinas along Highway 101, and covers a total area of 4.6 square miles. The City is surrounded by agricultural land in the Salinas Valley along the eastern bank of the Salinas River. The City is bounded by Highway 101 on the southwest, San Vicente Road on the west, agriculture on the north, and Bryant Canyon Rd and the Bryant Canyon Channel on the east. The study area is shown in Figure 1-1, below.

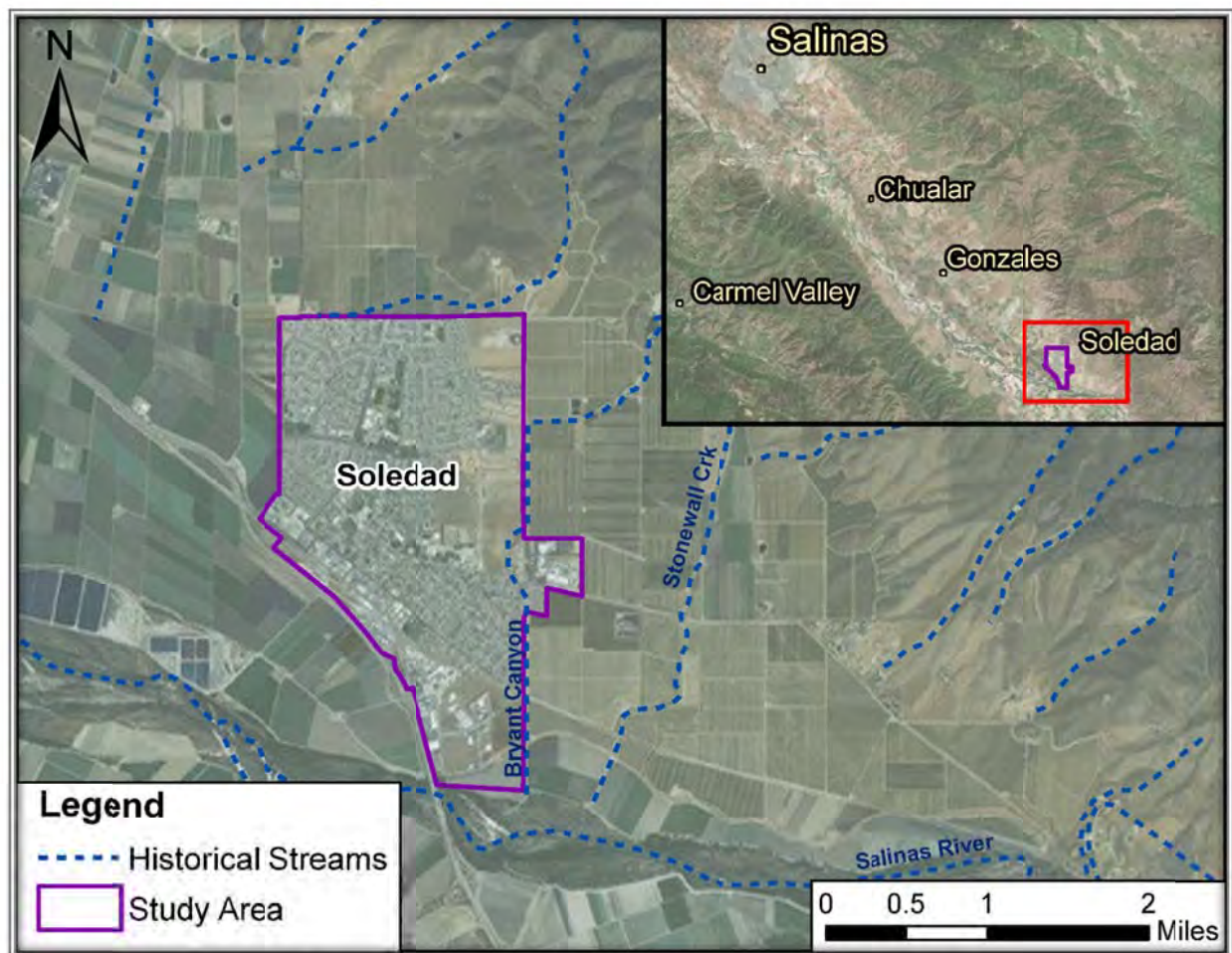


Figure 1-1: City of Soledad Master Pan Study Area



While the City rests at the base of the Gabilan Mountain Range, drainage from the mountains flows either north of the City through agricultural land or east of the City into the Bryant Canyon Channel.

Elevations within the study area range from about 185 feet NAVD near the southwest corner of the City to 342 feet NAVD at the base of the mountains on the northeast corner of the City. Soledad sits on a mild grade, with drainage generally from the northeast to the southwest towards the Salinas River.

1.3 Soils

The USDA Natural Resources Conservation Service (NRCS) has classified soils into four hydrologic soil groups (A, B, C, and D) according to their infiltration rates. Group A soils have low runoff potential when thoroughly wet and typically consist of sand or gravel type soils. Group B soils are moderately well draining when thoroughly wet and consist of loamy sand or sandy loam textures. Group C soils have moderately high runoff potential when thoroughly wet and consist of loam, silt loam, sandy clay loam, clay loam, and silty clay loam textures. Group D soils have high runoff potential when thoroughly wet and consist of clayey textures. All soils with a water table within 24-inches of the surface are in Group D. The Soledad area consists of 0.4% Group A soils, 76.3% Group B soils, 1.4% Group C soils, and 21.9% Group D soils, as shown in Figure 2-3.

1.4 Climate

Soledad is characterized by tepid, windy summers, with average monthly temperatures not above 72°F. Winters are cool and moist. Soledad experiences average summertime highs of 86°F and lows of 53°F, with average wintertime highs of 63°F and lows of 37°F. Mean Annual Precipitation in Soledad is 12 inches, occurring mostly between November and March, and entirely as rainfall.

1.5 Flood Protection Facilities

Precipitation that falls within Soledad generates stormwater runoff. This runoff is conveyed through the storm drain networks and ultimately discharged to various detention and retention basins throughout the City, to Bryant Canyon Channel, to the Salinas River, or the retention basin at the wastewater treatment plant south of Highway 101. The existing drainage network consists of eight separate systems, some of which are interconnected. Potential improvements to one system may impact the performance of other systems. Most of the streets in Soledad have traditional curb and gutter lined streets which limit attenuation before runoff reaches a catch basin.

Some flood protection facilities including culverts, channels, pump stations, and outfalls fall within various jurisdictional limits. Bryant Canyon Channel on the east side and the Salinas River on the south side of the City fall within Monterey County Water Resources Agency (MCWRA) jurisdiction. Highway 101 forms a part of the City's southern limit, and falls within Caltrans jurisdiction. Some pipes and a pump station lie beneath the Union Pacific Railroad. Improvement projects and new construction within the railroad's right of way fall within UPRR jurisdiction.

1.6 Flooding Issues within Soledad

Flooding in Soledad has been caused historically by overflow from Bryant Canyon Channel and inadequate capacity of local storm drainage systems. A flood study was performed on Bryant Canyon in 2005 that focused on overtopping of the Channel into the eastern part of the City during a 100-year event. Improvements to provide 100-year flood protection have already been recommended to Monterey County Water Resources Agency in that study.



Areas within the City with known flooding problems have been identified by Schaaf & Wheeler and City staff. These areas are detailed in Chapter 4.

A Monterey County Flood Insurance Study, effective 2009, and Flood Insurance Rate Map (FIRM) panels were used to identify flooding locations during a 100-year storm event. Urban areas in Soledad fall outside of FEMA 100-year floodplains.

1.7 References

Bryant Canyon Hydrologic Analysis Memo. Schaaf & Wheeler. July 2003.

City of Soledad 2007 Storm Drain Master Plan. RM Associates. September 2007.

Existing Storm Drain System Map. City of Soledad – Department of Public Works. January 2008.

FEMA. Flood Insurance Rate Panels FM06053C0612G, FM06053C0612G, and FM06053C0616G.

Flood Insurance Study: Monterey County, California and Incorporated Areas. Federal Emergency Management Agency. 2009.

Salinas River National Wildlife Refuge Comprehensive Conservation Plan. US Fish & Wildlife Service. December 2002.

Storm Drain Impact Fee Study. Hanna & Brunetti. May 2000.

Stormwater Technical Guidance for Low Impact Development. County of Santa Barbara Water Resources Division. February 2014.

Technical Memorandum: Bryant Canyon Channel Evaluation Metz Road Upstream to 90 Degree Bend. Schaaf & Wheeler. December 2005.

Chapter 2 Data

2.1 Overview

Schaaf & Wheeler reviewed and utilized readily available land use, topographic, geographical, and storm drain system data within the Soledad Storm Drain Master Plan Area (study area). Some data was missing or incorrect, and efforts were made to add to the collective data. Where necessary, assumptions and engineering judgment were used to complete remaining data gaps (please refer to Section 2.4 for a summary of assumptions applied to data gaps). This chapter summarizes the findings and data acquired as part of the Soledad Storm Drain Master Plan (SDMP). Data limitations, assumptions, and impacts are also summarized.

2.2 Data Sources

All project data and results are in vertical datum NAVD88 (feet) and State Plane (California Zone IV) coordinate system.

Topography and Aerial Imagery

LiDAR point data was obtained from the USGS EarthExplorer system, consisting of elevation data measured on the NAVD88 datum. This high resolution aerial data provides topographic information with an accuracy of half of a foot for ground returns where no water pooling occurs. A terrain model of the city and some surrounding area was built from these LiDAR point clouds. High resolution 2011 USGS aerial imagery was used for the study as well.

GIS Data

The City of Soledad did not have storm drain network GIS data. A Public Works map in PDF format dated January 2008 was traced by Schaaf & Wheeler to create pipe, channel, and node GIS shapefiles. The PDF map contained diameters for most pipes. Because the data was traced, diameters from the original PDF document were manually entered into the pipe shapefile attribute fields in ArcGIS. This was supplemented with data from a 1999 AutoCAD drawing of the system provided by the City. Other data received from the City included City Limits, Parcels, Zoning, and Street locations.

Schaaf and Wheeler identified missing data on the existing system layout map, as well as items in need of verification. In order to accurately model the system, information needed included:

- Missing pipe sizes
- Location and size of retention/infiltration basins
- Connections between sub-systems
- Ground elevations at all nodes (manholes, inlets, and outfalls)
- Invert elevations at all nodes

Due to the limited attribute data available for the storm system, a number of steps were taken to collect or approximate data necessary to compile a master plan level analysis. These steps include measurements described in the *Field Measurements and As-Builts* section and estimation techniques described in *Data Quality* and *Data Assumptions* sections in this chapter



Field Measurements & As-Builts

Schaaf & Wheeler spent approximately four days in the field verifying key locations within the system, measuring pipe diameters and invert depths, and estimating detention and retention basin depth and area. Collecting accurate pipe diameters was the highest priority. Unlike sanitary sewer modeling, storm water systems are designed to surcharge (flow under pressure). Invert elevations become less critical than pipe diameter because the system's hydraulic grade lines (HGLs) are not governed by open channel flow dynamics. Interpolation was used to determine missing information not available from City provided data or field research.

Schaaf and Wheeler obtained CalTrans as-built drawings for Highway 101 (dated January 1, 1999). As-built plans were assumed to be accurate and up-to-date.

Land Use Data and Runoff Characteristics

Two land use scenarios were analyzed for the storm drain master plan: existing land use, and near-term future land use. The existing land use is based on the City's existing zoning, which has been adjusted using aerial imagery to account for land that is currently zoned but remains open space. The existing land use in Soledad is primarily residential, interspersed with open space, educational facilities, industrial, and commercial as shown in Figure 2-1 and summarized in Table 2-1.

The near-term future land use condition is based on development planned to occur within the next 10 years and that has the potential to increase flow to existing pipes included in this study. As discussed in Chapter 3 – Methodology, the near-term future land use condition is used to create the CIP presented in Chapter 6, and determine phasing of the improvements. Near-term future land use is based on the existing land use with the addition of developments indicated by the city which include the build out of residential parcels in the Miravale development, the development of open space near Gabilan Drive and Bryant Canyon Road, and additional commercial and industrial development at the south end of the City. The near-term future land use is shown in Figure 2-2: City of Soledad Near-Term Future Land Use.

Rainfall runoff is determined by soil classification, land use, and percentage of impervious surface. Soil classification data is produced by the National Resource Conservation Service (NRCS), and is based on Hydrologic Soil Group (A, B, C, or D). Soil groups within the study area are shown in **Figure 2-3**. The Curve Number methodology, described in Chapter 3, is used for surface runoff calculations. NRCS runoff Curve Numbers (CN) are assigned to City land use designations based on hydrologic soil group as shown in , which also contains the percent impervious for each land use type. Percent impervious and curve number values are based on values from the Bryant Canyon Hydrologic Analysis Technical Memorandum dated July 29, 2003.



Table 2-1: Existing and Near-Term Future Land Use Summary

Use Code	Land Use	Existing Land Use		Near-Term Future Land Use	
		Area (Acres)	%	Area (Acres)	%
C-C	Commercial Community	4	0.3%	4	0.3%
C-2	Commercial Convenience	6	0.4%	23	1.6%
C-1	Commercial General	21	1.5%	90	6.3%
H-C	Commercial Highway	41	2.9%	43	3.0%
C-R	Commercial-Residential	4	0.3%	4	0.3%
M	Industrial	35	2.5%	16	1.1%
R-1.5	Low Density Residential	17	1.2%	17	1.2%
R-2	Medium Density Residential	69	4.9%	75	5.3%
R-3	Multi-Family Residential	41	2.9%	44	3.1%
O-S	Open Space/Wildlife	264	21.4%	159	11.2%
P-F	Public/Institutional/Rec	144	10.5%	149	10.5%
R-1	Single-Family Residential	438	30.9%	504	35.5%
ST	Streets/Roads	275	20.5%	290	20.5%

Table 2-2: Soil Groups and Imperviousness

Symbol	Land Use	Impervious	Curve Number by Soil Group (AMC I-1/2)			
			A	B	C	D
C-1	Commercial General	0.80	44	58	71	74
C-2	Commercial Convenience	0.85	64	68	78	79
C-C	Commercial Community	0.85	64	68	78	79
C-R	Commercial-Residential	0.80	44	58	71	74
H-C	Commercial Highway	0.98	44	58	71	74
M	Industrial	0.90	44	58	71	74
M-2	Heavy Industrial	0.95	64	68	78	79
M-B	Industrial Buffer	0.60	44	58	71	74
O	Office	0.85	44	58	71	74
O-S	Open Space/Wildlife	0.05	35	51	65	72
P-F	Public/Institutional/Rec	0.20	44	58	71	74
PUD	Planned Unit Development	0.65	44	60	74	80
R-1	Single-Family Residential	0.65	44	58	71	74
R-1.5	Low Density Residential	0.70	44	58	71	74
R-2	Medium Density Residential	0.75	44	58	71	74
R-3	Multi-Family Residential	0.80	64	68	78	79
ST	Streets/Roads	0.98	44	58	71	74

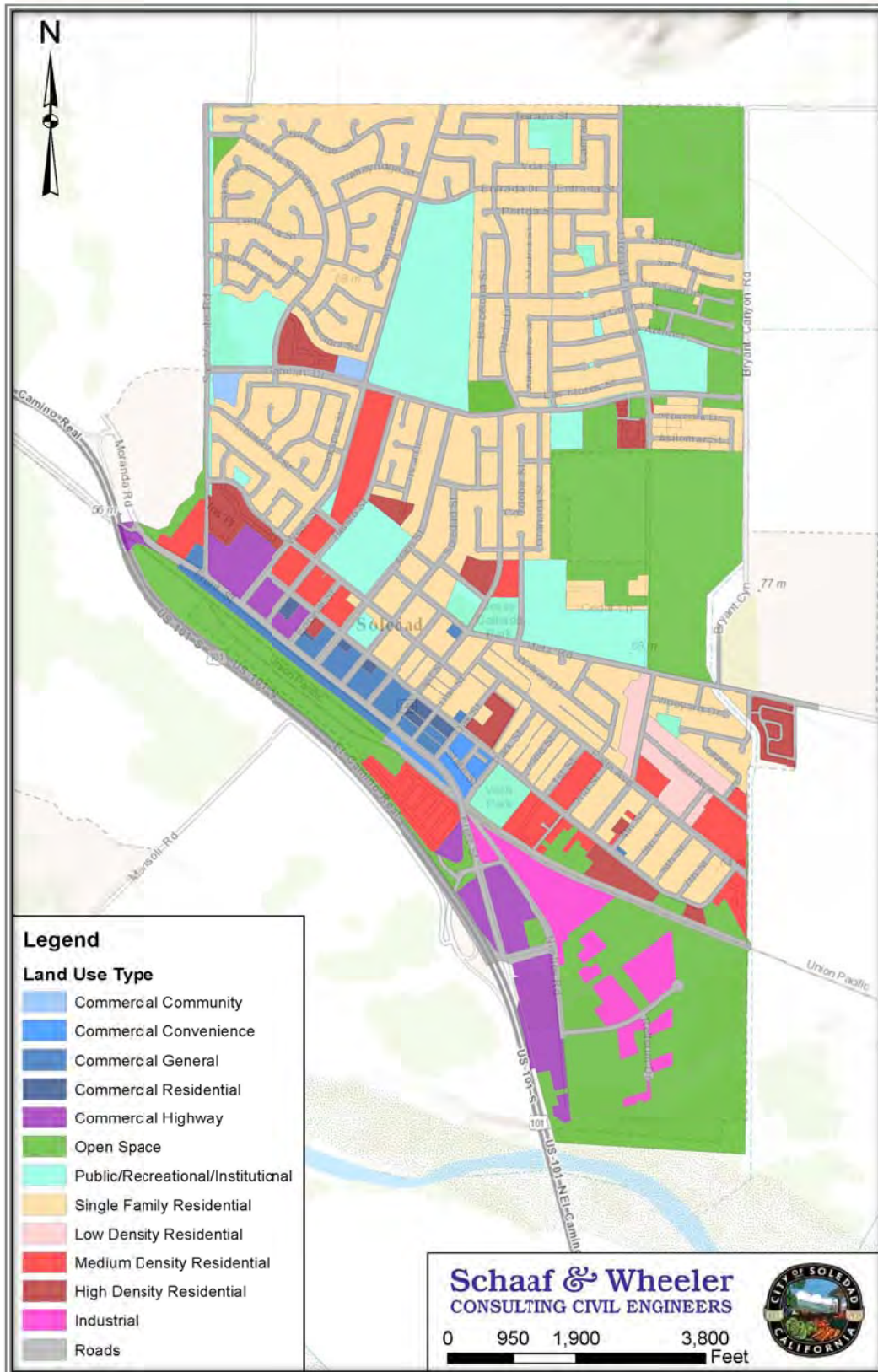


Figure 2-1: City of Soledad Existing Land Use

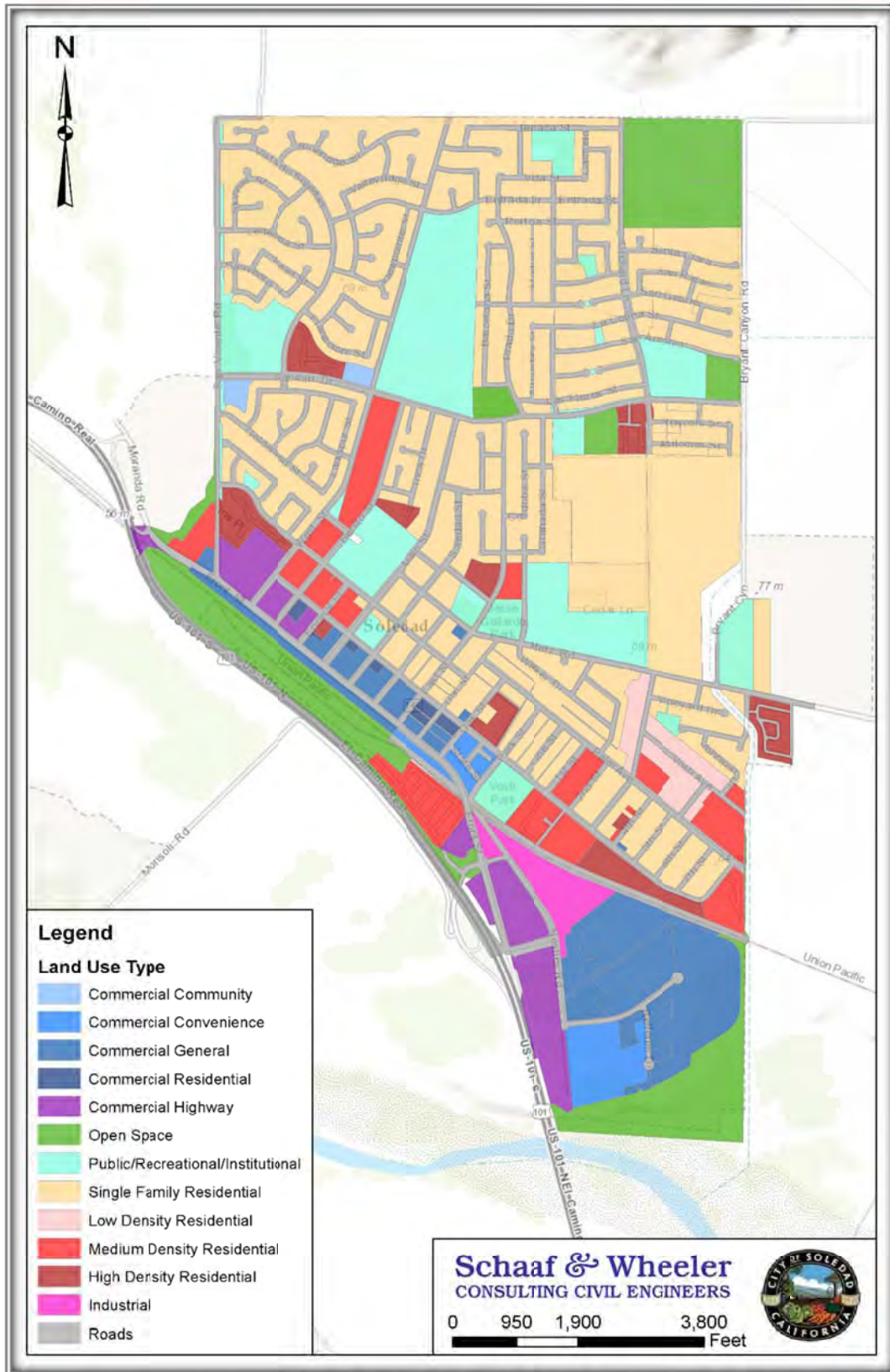


Figure 2-2: City of Soledad Near-Term Future Land Use

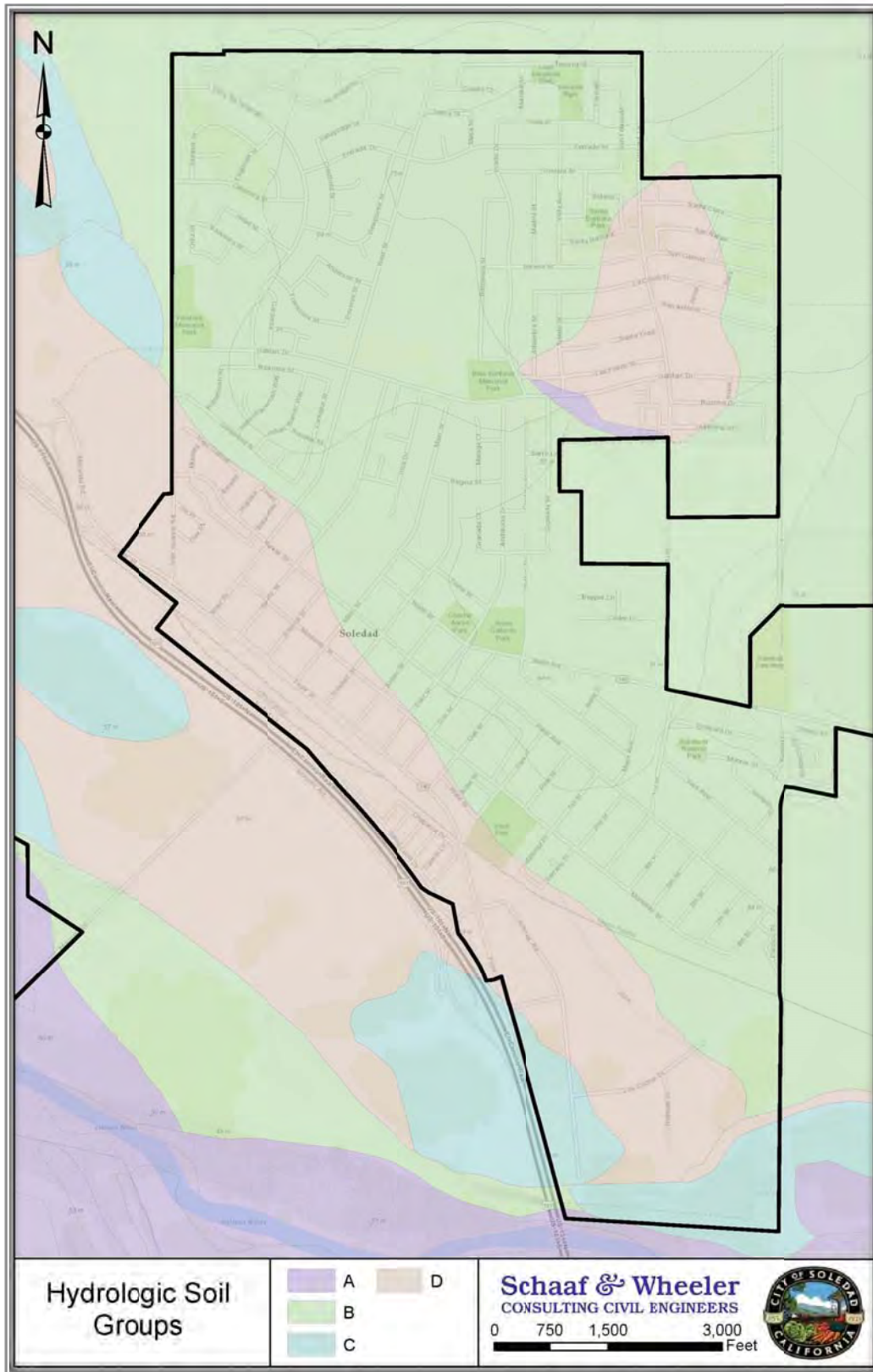


Figure 2-3: Hydrologic Soil Groups within Limits of the Study Area



2.3 Data Quality

There is some variation in quality and accuracy of data collected and available for the Soledad SDMP. At the start of the project, GIS data was manually traced from existing maps with little attribute data and without confirmation of spatial accuracy. For pipes with diameters and material types shown on existing maps, new attributes were populated, but accuracy of the data was unknown. Field verification confirmed some diameters, but showed that others were not correct.

There are an estimated total of 20 linear miles of pipe and 773 nodes (including manholes, inlets, and outfalls) in the study area. The hydraulic model primarily contains pipes 15 inches in diameter or larger, with some smaller pipes deemed necessary to model the function of Blas Santana Memorial Park as a basin. Because no rim or invert elevations were known for the system at the start of the study, methods described in Section 2.4 were used to assign the missing node data.

2.4 Modeled Data Assumptions

Schaaf & Wheeler compared original system data provided by the City in PDF format with record drawings and data collected in the field to verify pipe sizes and materials, system layout, and invert depths. Corrections were entered into the system GIS files with data sources noted. Remaining unknown pipe diameters were assigned based on the diameters of surrounding pipes.

Elevations of manhole and catch basin rims and inverts were unknown for the entire system at the start of this study. To create a uniform ground surface for hydraulic modeling, rim elevations at all system nodes were extracted to a point shapefile from the LiDAR terrain model. The invert depth at 19 nodes was field measured and used to calculate invert elevation. The remaining inverts were assigned based on either applying interpolation between nodes with field measured invert depths, or by assuming a minimum pipe cover of 3-feet. The method of assigning elevation data is preserved in the "Description" field of the final GIS database utilized to create the system model.

The terrain model was used to estimate surface areas for the detention and retention basins in the model. Elevations were extracted at 5 points along the basin rim and averaged to estimate the elevation of the top of the basin. A similar procedure was used to estimate the elevation of the basin invert. Side slopes were estimated using field observation and the terrain model.

Chapter 3 Methodology

3.1 Overview

The criteria used to evaluate storm drain system performance must be technically sound yet simple to understand and apply. Ideally, the same methodology used to analyze system performance for this report will also continue to be used for future infrastructure design. Schaaf & Wheeler applied NRCS hydrology methods to estimate storm runoff from current and near-term future land uses for the Soledad Storm Drain Master Plan. This method is being used along with MIKE-URBAN, storm drain modeling software by DHI, to determine system performance and necessary improvements. Physical parameters used in the model are based on the City provided and field gathered data, along with other information detailed in Chapter 2 - Data. Storm drain evaluation criteria described in the following section have been discussed with and agreed upon by the City of Soledad.

3.2 Evaluation Criteria

The NRCS Unit Hydrograph Method was used to estimate storm runoff in Soledad. This method was used because it allows for the development of a flood hydrograph using a design storm, an appropriate infiltration technique, varying antecedent moisture conditions, storage within the watershed, and a synthetic unit hydrograph. The storm duration used for rainfall simulation was 24-hours. The precipitation pattern is based on the pattern used in the Bryant Canyon Channel analysis completed by Schaaf & Wheeler, which is based upon the three-day December 1955 rainfall event, considered to be the storm of record for northern California.

This master plan effort includes modeling the hydrology for the 10-year event which is then used to analyze the stormwater drainage system. The 10-year level-of-service standard is consistent with the City's previous storm drain master plan completed in 2007, and the City's storm drain design standards for residential and local facilities. The City's Storm Drain Design Standard states that main trunk lines and conduits in commercial and industrial areas be designed to convey the 25-year storm, but it would be prohibitively expensive for the City to improve existing systems to meet this standard. The 10-year storm event is used as the design event for all pipes included in the model for the purposes of this report. Improvements are recommended that reduce the hydraulic grade to no higher than 0.5 feet above the gutter elevation at any node. This will minimize the risk to private property and public safety.

3.3 GIS Based Modeling

The MIKE-URBAN by DHI software with MOUSE solver was selected to model the City of Soledad storm drain system because it is tested and reliable software with a GIS interface. MIKE is a package of software programs designed by the Danish Hydraulic Institute (DHI) for the analysis, design and management of urban drainage systems, including storm water sewers and sanitary sewers. The MIKE-URBAN (MU) model works within the ArcMap GIS interface and can simulate runoff, open channel flow, pipe flow, water quality, and sediment transport. The City's modeling package consists of two interrelated products:

1. MOUSE is a group of hydrologic, hydraulic, water quality and sediment transport modeling modules which can be used together or independently. The modules used in the Soledad Storm Drain model include the Surface Runoff Module, which computes surface runoff using one of five computational methods; and the Hydrodynamic Pipe Flow Module, which calculates an implicit finite-difference numerical solution of the St. Venant flow equations for the modeled pipe network.



2. MIKE-URBAN (MU) is an ArcMap based program which includes tools specifically designed to develop urban drainage models. MU provides a graphical user interface for data input and editing and serves as a bridge between ArcMap GIS and the MOUSE modeling program. Capabilities of MU include import and export of model data, network editing and gap-filling, catchment delineation, and network simplification. MU can also be used to present results including plan, longitudinal, and cross-section views; animation of results; presentation of flooding including water depth and pressure; and overlay of results on background graphics such as maps or aerial photos.

The City of Soledad model consists of a pipe network, including manholes and catch basins, five retention/detention basins, and the catchments contributing runoff to the pipe network.

Operation

Two separate calculations are performed by MU for the Soledad model: a runoff calculation estimating the amount of water entering the storm drain system during a design rainfall event, and the network flow calculation which replicates how the storm drain system will convey flows to outlet locations. Flows resulting from the runoff calculation are used as inflows for the subsequent network flow calculation. The MU runoff model offers a choice of five runoff routing descriptions: Time-Area routing, Kinematic wave/Non-linear reservoir, Linear Reservoir Method (in two sub-variants: Dutch runoff model and French runoff model), and the Unit Hydrograph Method (UHM). The Soledad storm drain model uses the UHM model with the NRCS dimensionless hydrograph and NRCS Curve Number loss method to calculate surface runoff. A simulation can be started at any point during the chosen design storm to assess surface runoff for any period of the design storm, with computations made based on a user-specified time step.

The MU network flow model offers a choice of three flow description approximations: Dynamic Wave, Diffusive Wave, and Kinematic Wave; distinguished by the set of forces each takes into account. The Soledad storm drain model uses the most comprehensive flow description, Dynamic Wave, which incorporates the effects of gravitational, friction, pressure gradient and inertial forces. Because it accounts for all major forces affecting flow conditions, this equation allows the model to accurately simulate fast transients and backwater profiles. The simulation of flooding at a node is accommodated by the insertion of an artificial "basin" above the node which will store water when the water level rises above the ground level. The surface area of the "basin" gradually increases (up to a maximum of 1000 times the node surface area) with rising water levels at the node, replicating the effects of flooding.

Water stored in the "basin" begins to reenter the system when the outflow from the node becomes greater than the inflow. Alternatively, the model's 2-dimensional capabilities can be used to simulate overland spills from the drainage system. The pipe flow simulation can be executed using either a constant or variable time step, and can be run for any portion of the time interval specified by the input rainfall time series and corresponding calculated runoff hydrograph.

Input and Output

MU surface runoff calculations require two types of input data: boundary data and urban catchment data. Boundary data for the run-off computation consists of an input rainfall time series representing the design storm event for the model. Urban catchment data includes the boundaries of each drainage catchment, along with relevant physical and hydrologic parameters including surface area, basin lag time, and curve number. Drainage catchments for the City are shown in Figure 3-1.

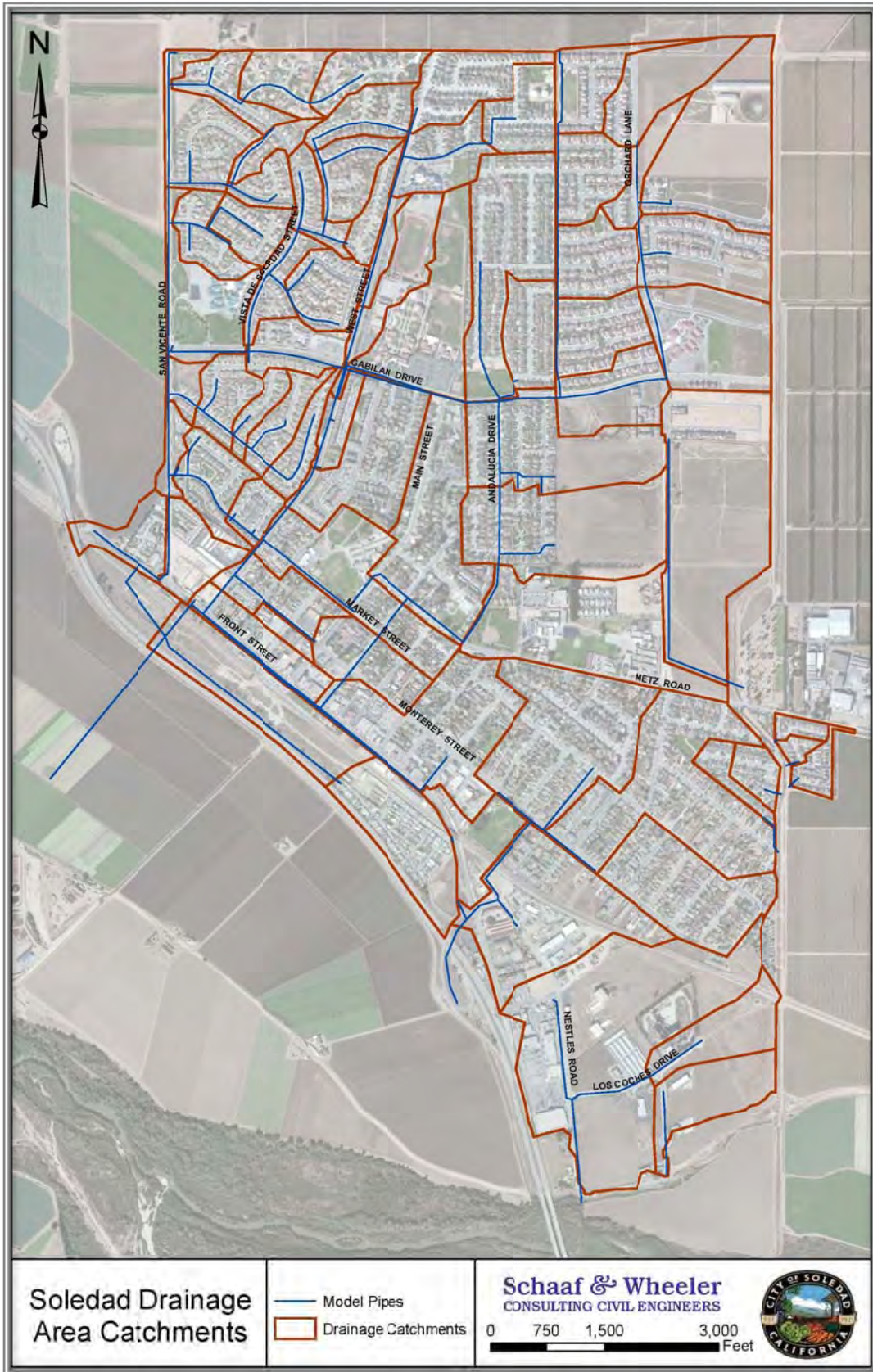


Figure 3-1: Soledad Drainage Area Catchments



MU pipe flow calculations require network data, operational data, and boundary data as input. Network data consists of the pipe network elements including nodes (manholes, inlets, basins, and outfalls) and links (pipes, culverts, and open channels). Parameters required to describe nodes include x and y coordinates of the node, a unique name, node type, depth and invert levels, and water levels at outlets. Parameters required to describe links include the name of upstream and downstream nodes, shape and dimensions, material or roughness, and upstream and downstream inverts. Network data also includes structural system elements, such as gates, pumps, and weirs, which are modeled as functional relationships connecting two nodes in the system, or associated with one node in the case of free flow out of the system.

Operational data consists of parameters which describe how these elements function in the network. Boundary data for the pipe flow computation can include any external loading, inflow discharges, water levels at interaction points with receiving waters, pump performance curves, as well as the results of a run-off calculation.

Output from the pipe flow computation includes the calculated water level at each node, pump discharges, weir discharges, water level in network branches, discharge in network branches, water velocity in network branches, water volume in the system, and time step data. Output is viewed using GIS, MU, or the MIKE-VIEW program. Results may be displayed in plan view or as a profile for a selected network section, and may be viewed as a temporal animation or at maximum or minimum values. Additional outputs which can be derived from MU pipe flow results using GIS include: water depth, flooding level, pressure in closed conduits, percentage pipe filling, and the flow calculated for each link.

3.4 Surface Runoff Calculations

As described above, the first step of the MU model is to complete a stormwater runoff calculation that determines the amount of water entering the storm drain system from a specific rainfall event. Boundary and catchment data must be input to the model to complete this calculation.

Boundary Data

Methods used in this master plan to estimate peak storm water flow rates and volumes require the input of precipitation data. Since it is impossible to anticipate the impact of every conceivable storm, precipitation frequency analyses are often used to design facilities that control storm runoff. A common practice is to construct a design storm, which is a rainfall pattern used in hydrologic models to estimate surface runoff. A design storm is used in lieu of a single historic storm event to ensure that local rainfall statistics (i.e. depth, duration and frequency) are preserved. When combined with regional specific data for land use and loss rates, the model should produce runoff estimates that are consistent with historical events in the area. In other words, the ten-year design storm pattern used for MU modeling creates results consistent with a ten-year storm runoff event.

Precipitation frequency analyses are based on concepts of probability and statistics. Engineers generally assume that frequency (probability) of a rainfall event is coincident with frequency of direct storm water runoff, although runoff is determined by a number of factors (particularly land use conditions in the basin) in addition to the precipitation event.

Rainfall

The design storm for the City of Soledad Storm Drain Master Plan was calculated using the precipitation pattern from the December 1955 rainfall event, considered to be the storm of record for northern California, and NOAA precipitation frequency estimates for rainfall. The design rainfall pattern is distributed in 5-minute time



increments with a fraction of the total rainfall occurring in each interval. The total rainfall depth is based on NOAA precipitation frequency estimates for the Soledad rain gage. The total depth of rainfall for the 10 year, 24 hour storm is 2.29 inches. The Mean Annual Precipitation (MAP) in Soledad is 12-inches based on the Monterey County MAP figure produced by the Monterey County Water Resources Agency. The 10-year storm intensity graph for a MAP of 12-inches with a total depth of 2.29 inches is shown in Figure 3-2. This methodology is consistent with previous hydrologic analyses done in the past for this area, particularly the Bryant Canyon Hydrologic Analysis Technical Memorandum (Schaaf & Wheeler, 2003).

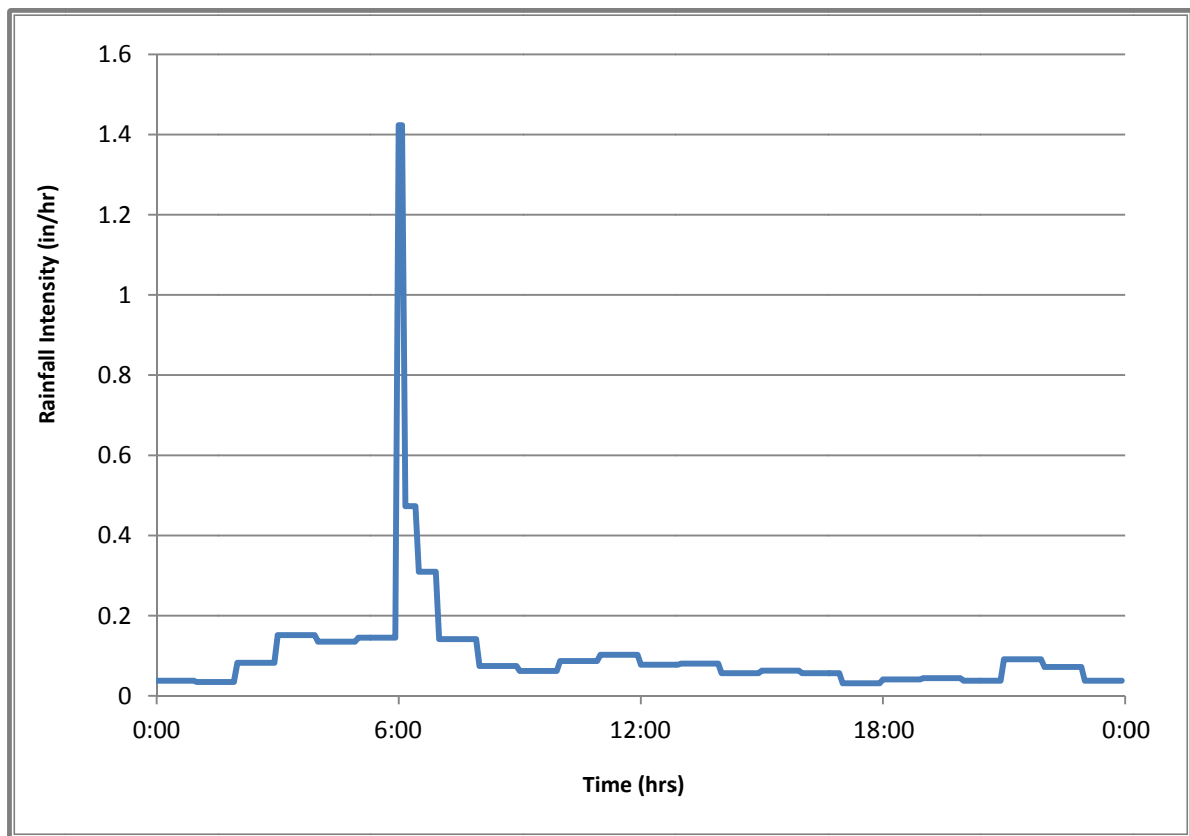


Figure 3-2: Soledad 10-Year, 24-Hour Storm Intensity Graph

Catchment Data

Urban catchment data includes the boundaries of each drainage catchment, along with relevant physical and hydrologic parameters including surface area, land use characteristics, basin lag, and curve number. Soledad is divided into drainage areas, called catchments. Because this area is relatively flat, use of automated delineation routines in MU was not appropriate. The delineations completed by Schaaf & Wheeler rely heavily on engineering judgment and on experience in using contours, storm drainage system layout, and aerial imagery.

A unit hydrograph is a numerical representation of the time response of catchment runoff caused by one inch of excess rainfall applied uniformly over a unit of time. Many different techniques are available to estimate unit hydrographs. The NRCS-dimensionless unit hydrograph is used in the Soledad storm drain models because it is consistent with previous studies in the Soledad area. Direct runoff is calculated by subtracting losses, such as soil infiltration, from the rate of rainfall. The Curve Number (CN) method reflects these potential losses for a given soil type and land use.



Soledad is mainly low density residential developments and open space (recreational and undeveloped), with interspersed commercial, medium/high density residential, and industrial parcels. The majority of the developed parcels have high concentrations of impervious surfaces that include buildings, roads, parking lots and sidewalks. Schaaf & Wheeler used imperviousness tables from a previous Bryant Canyon Hydrology study, and validated them with aerial imagery. There is a degree of uncertainty in applying standard values to all similar land uses; however, this is adequate at a master planning level. The impervious percentages for each land use category are discussed in detail in Chapter 2, Data.

NRCS Curve Number

As mentioned previously, the NRCS Curve Number (CN) methodology was used to determine basin runoff. This methodology relies on the use of curve numbers to characterize basin infiltration and runoff potential. Curve numbers are based on a combination of land use, soil characteristics, and antecedent moisture condition. Land use and soil types are discussed in detail in Chapter 2, Data. Antecedent moisture condition (AMC) is defined as the moisture content of a soil prior to any precipitation event. AMC is characterized by the SCS as:

AMC I	soils are dry
AMC II	average conditions
AMC III	heavy rainfall, saturated soil

The AMC for a 10-year event in Soledad is 1.5, which falls between AMC I and AMC II. AMC 1.5 is appropriate for 10-year storm event according to the "Bryant Canyon Hydrology" memo by Schaaf & Wheeler dated May 8, 2002.

Curve numbers vary from 0 to 100, with 0 equating to no runoff from a basin and 100 indicating that all precipitation will run off. Curve number values for various land uses and soil types shown in **Table 2-2**. Weighted curve numbers were assigned to each catchment applying the CN from Table 2-2 to the pervious area, and applying a CN of 100 to the impervious area and calculating the mean. Curve Numbers were calculated for the pervious area within each catchment in Soledad using GIS techniques. Land use and soil hydrologic conditions were intersected and the appropriate CN was applied to each area. The pervious area of each catchment was then assigned a CN based on the area-weighted mean. The CN for each catchment's impervious area was set to 100

Model Calibration – Basin Lag

Lag times were initially calculated using the US Army Corps of Engineers lag equation. This equation uses basin length, shape, slope and land use to estimate lag. Schaaf & Wheeler used the terrain model discussed in Chapter 2, Data, to estimate basin flow paths and slopes. GIS routines were used to determine basin centroids and centroid lengths. The resulting lag times were shorter than anticipated based on engineering judgment.

The lag times were verified by calculating the peak runoff for various basins using the unit hydrograph method and basin lag time calculated using the US Army Corps lag equation. The peak runoff for the basins was then calculated using the rational method. The peaks were compared and the basin lag equation was adjusted until the peak runoff from the two methods roughly matched. The basin lag equation was adjusted by removing the D/2 term, where D equals the unit hydrograph duration, and adding 5 minutes (0.083 hour) to produce the



following lag equation. Any lag times calculated below 10 minutes were raised to 10 minutes, which is a typical time used for roof to gutter flow time.

$$t_{lag} = (0.862) * 24 * N * \left(\frac{L * L_c}{\sqrt{S}} \right)^{0.38} + 0.083$$

where:

- t_{lag} SCS basin lag (hours)
- N watershed roughness (calculated per catchment)
- L longest flow path from catchment divide to outlet (miles)
- L_c length along flow path from a point perpendicular with the basin centroid to its outlet (miles)
- S effective slope along main watercourse (feet/mile)

3.5 Pipe Flow Calculations

Detailed analyses of peak stormwater discharge are performed by the MU program, which also determines the flow condition in each drainage system element. The MU technical manual should be referenced for a more detailed description.

Closed Conduits

Pipes are modeled as one-dimensional closed conduit links which connect two nodes in the models. The conduit link is described by a constant cross-section along its length, constant bottom slope, and straight alignment. Unsteady flow in closed conduits is calculated using conservation of continuity and momentum equations, distinguishing between pipes flowing partially full (free surface flow), and those flowing full (pressurized flow). Most pipes within the Soledad model are modeled as reinforced concrete pipe (RCP) with a Manning's 'n' of 0.013.

Junction Losses

Hydraulic losses at junctions (manholes, inlets, intersections) can be significant in pressurized drainage systems. Losses can vary due to construction methods, condition, and shape. Schaaf & Wheeler has performed a sensitivity analysis of the loss coefficients used in MU to determine the most realistic model parameters. The MU Weighted Inlet Energy Method is used for this study.

Outlet Boundary Conditions

Pipe network outlets can be modeled with either a free outfall or a water surface elevation (fixed or variable with time) which captures backwater effects due to water levels in receiving bodies (ponds, streams, etc). Three systems drain to retention basins with no outlet. For the purposes of this report it is assumed that the basins are empty at the beginning of the storm and no infiltration occurs during the storm duration. The other systems drain to the Bryant Canyon Channel or the Salinas River. The 10-year water surface elevation for these outlets for current channel condition was taken from the Bryant Canyon Channel analysis completed by Schaaf & Wheeler in



2005. These elevations are lower than the invert of the outlets, so the outlets were assigned a free outfall boundary condition.

3.6 Comparison to Previous Reports

The methodology used in this master plan analysis differs from methodology used in the City of Soledad 2007 Storm Drain Master Plan. While both reports apply use the 10-year design standard for the development of CIPs, the methodologies used are different. The 2007 report utilized the rational method for the hydrologic analysis, and did not use a dynamic model for the hydraulic analysis. A field investigation was not completed as part of the 2007 model. Instead, rim elevations were extracted from GIS contour maps, and invert elevations were all assumed based on depths below rims of six feet plus the diameter of the pipe. Schaaf & Wheeler field investigations revealed pipe cover depths ranging three to 13 feet. The 2007 report includes analysis for future buildout per the General Plan adopted in 2005, which includes agricultural land to the north and west of the existing urbanized area. This study only analyzed the impact of the near-future land use condition. The 2007 CIP is comparable to the CIP presented in this report, which increases the confidence in the results of the master plan analysis.

Chapter 4 Storm Drain Collection Systems

4.1 Overview

The performance analysis of Soledad's storm drain collection system forms the essential core of this master plan. This chapter describes major storm drain facilities, retention/detention basins, and the known drainage issues. Areas requiring system improvements are identified and prioritized. For purposes of conciseness and readability, this chapter presents the 10-year predicted flooding depths for the existing land use condition, those projects that are required to alleviate or minimize flooding based on the 10-year standard, and the additional projects required for the implementation of the near-term future land use condition.

4.2 Evaluation of Storm Drain System Capacity

Criteria

Soledad's storm drain system has been analyzed for the existing land use condition to determine its performance during the design 10-year storm. Areas of significant flooding are recognized herein and recommended improvements to establish system performance in accordance with criteria outlined in Chapter 3 are summarized. The improved collection systems were then analyzed with the near-term future land use condition to determine whether further improvements are required to maintain the 10-year flood standard once future development occurs. A phasing plan was then developed for the removal of the retention basin that serves the Miravale II development.

Additional flow capacity requirements are determined by upsizing existing pipes in the MU model until the hydraulic grade is reduced to no higher than 0.5 feet above the gutter elevation at any node. It is impractical to entirely remove predicted flooding throughout the project area, either due to local topography (for example, at minor, localized 'bathtub' areas) or infeasibility of improvements, but the majority of model predicted flooding can be mitigated with the capital improvements proposed herein.

Prioritizing Deficiencies and Needed Improvements

Soledad is separated into nine drainage areas for this study, delineated around separate drainage systems, outfalls, and topographic features. It should be noted that neither private drainage systems nor site-specific drainage characteristics (i.e. individual parcels) have been analyzed as that level of detail is not necessary to determine improvements at the master planning level. These models can be refined in the future to more precisely account for these site-specific drainage characteristics during the development of detailed drainage studies.

Recommended improvements are described in the following discussion for each sub-area, and discussed in detail in Appendix A. In some locations, the hydraulic grade line (HGL) predicted by the one-dimensional (1D) model at individual nodes in the system may be greater than actual water surface elevation during a storm event. This is due to limitations and assumptions inherent in the 1D modeling software. In order to confirm predictive model results, Schaaf & Wheeler discussed model results with experienced City staff and compared results with those of previous drainage studies and master plan documents. Locations for recommended system improvements are based on the results of this complete process, not solely on model results. As such, some locations predicted to have flooding surcharge based on model results alone are not recommended for improvements. For example, the



top of a drainage system where water from a catchment is added to the model, but in reality water enters that point through pipes smaller than 15-inches.

Recommendations are developed and prioritized based on the above process, combined with the anticipated severity of flooding for each location and the benefit/cost relationship of each proposed improvement. The following color code highlights project prioritization:

Pipe Color	Improvement Priority	Priority Description
Red	High Priority	Projects under this category have a large area of flooding where the 10-year maximum flood depth is greater than 12-inches. These projects improve locations with the deepest and longest flooding situations. They may also be located at the downstream end of many projects, as they would logically be constructed first. Areas of significant historical flooding fall into this category.
Yellow	Moderate Priority	This category has conditions similar to high priority, but has a smaller area affected by flooding. The length and depth of flooding is less than that of a high priority improvement.
Green	Low Priority	Low priority improvements are generally smaller projects that generally address nuisance flooding. The area of flooding is much smaller and/or briefer in duration than that of moderate and high priority projects.

This section outlines the ultimate improvements needed to achieve a 10-year level of service by alleviating or minimizing predicted flooding within the City. Each improvement was grouped with nearby improvements that could be undertaken simultaneously and named using a major street where possible. The naming convention is used to identify the improvements in maps and tables. A complete CIP with tables detailing storm drain network improvement projects including existing pipe size, recommended pipe size, and costs for each improvement is provided in Chapter 6, Capital Improvement Program.

4.3 Soledad Systems

For the purpose of this analysis, Soledad’s storm drainage facilities are split into nine drainage areas: Upper San Vicente, Lower San Vicente, Blas Santana, Central, Miravale, Orchard, Caltrans, Metz-Greenleaf, and Los Coches as shown in Figure 4-1. These areas have all been analyzed in a single MU model.

Runoff from outside of the City does not generally enter the City’s collection systems. Runoff from Jack Creek to the north drains through a culvert crossing San Vicente Road and into farm land to the west. Drainage from the east and northeast enters Bryant Canyon Channel and drains to Salinas River.

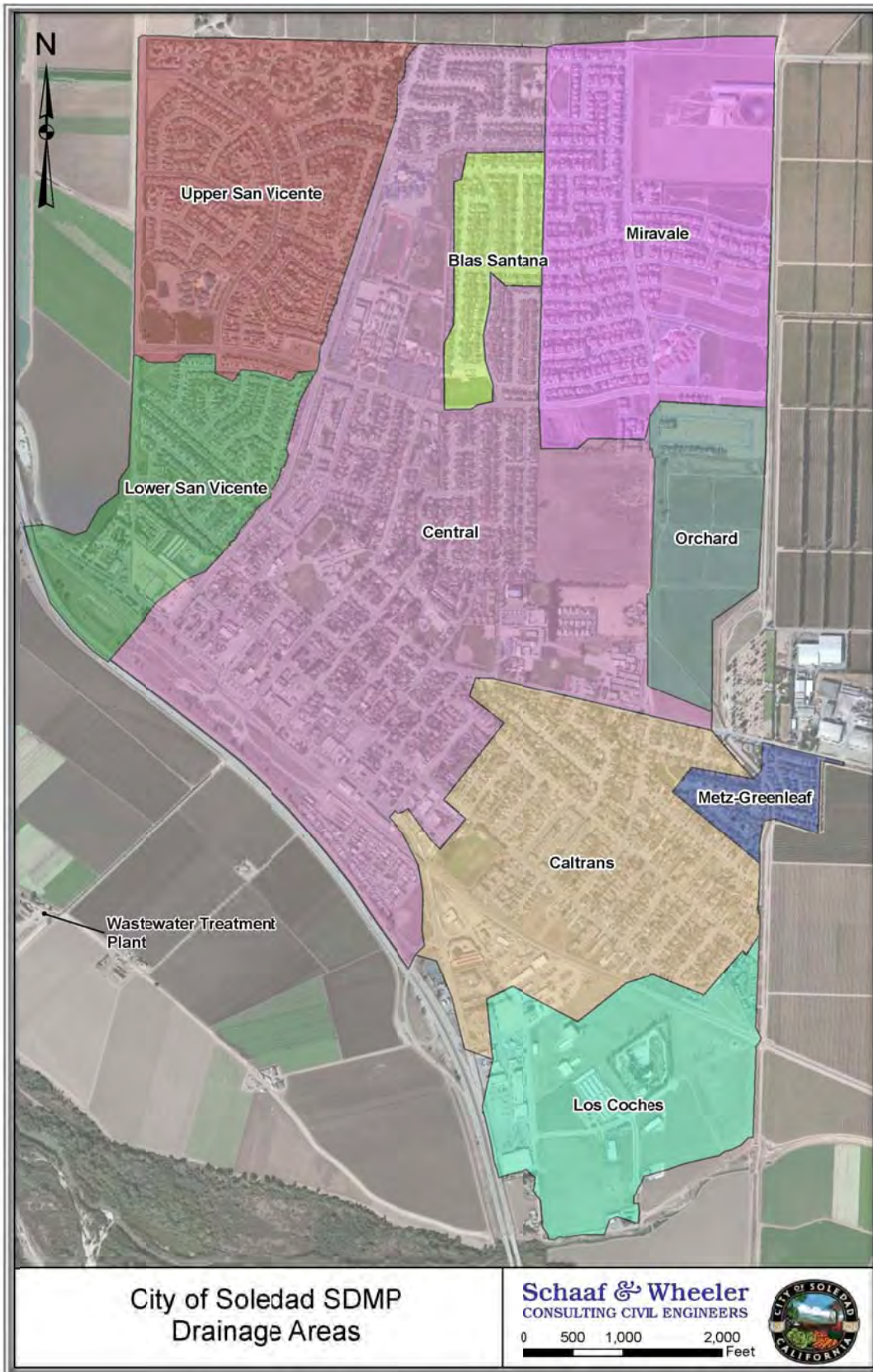


Figure 4-1: Drainage Areas in the City of Soledad



Upper San Vicente Drainage Area

Characteristics

The Upper San Vicente drainage area is approximately 177 acres and flows to the southwest corner where it connects with the Lower San Vicente system. The modeled collection system consists of 88 nodes (manholes and inlets), 18,714 linear feet of pipe, and the Veterans Memorial Park detention basin. The area is mostly residential, with the exception of Veterans Memorial Park and Ledesma Elementary School.

Historic Problem Areas

During the December 10-12, 2014 storm, surface drainage from north of the City overtopped the culvert and flowed down San Vicente into City collection systems. This runoff contained large amounts of sediment. The culvert on the north side of the City falls under MCWRA's jurisdiction. Coordination with MCWRA to improve the culvert is recommended.

Identified Deficiencies

The MU analysis of the Upper San Vicente system for the 10-year storm event with existing land use condition shows flooding occurring at six of the 88 nodes, with a cluster of four near Entrada Drive and Crestfield Street. MU predicts a flooding depth of less than 6-inches at 3 nodes, flooding depths between 6-inches and 12-inches at one node, and a flooding depth of greater than 12-inches at two nodes. A map of the 10-year flooding depths predicted by the MU analysis of the existing storm drain system is presented in Figure 4-2.

Prioritized Improvements

There is one low priority improvement project for Upper San Vicente, shown in Figure 4-3. This project would likely eliminate nuisance flooding. Due to its small size, it may only get built if there is other street work or redevelopment occurring in the area.

Near-term Future Improvements

No near-term future land use changes are proposed for the Upper San Vicente area. No additional improvements are required.

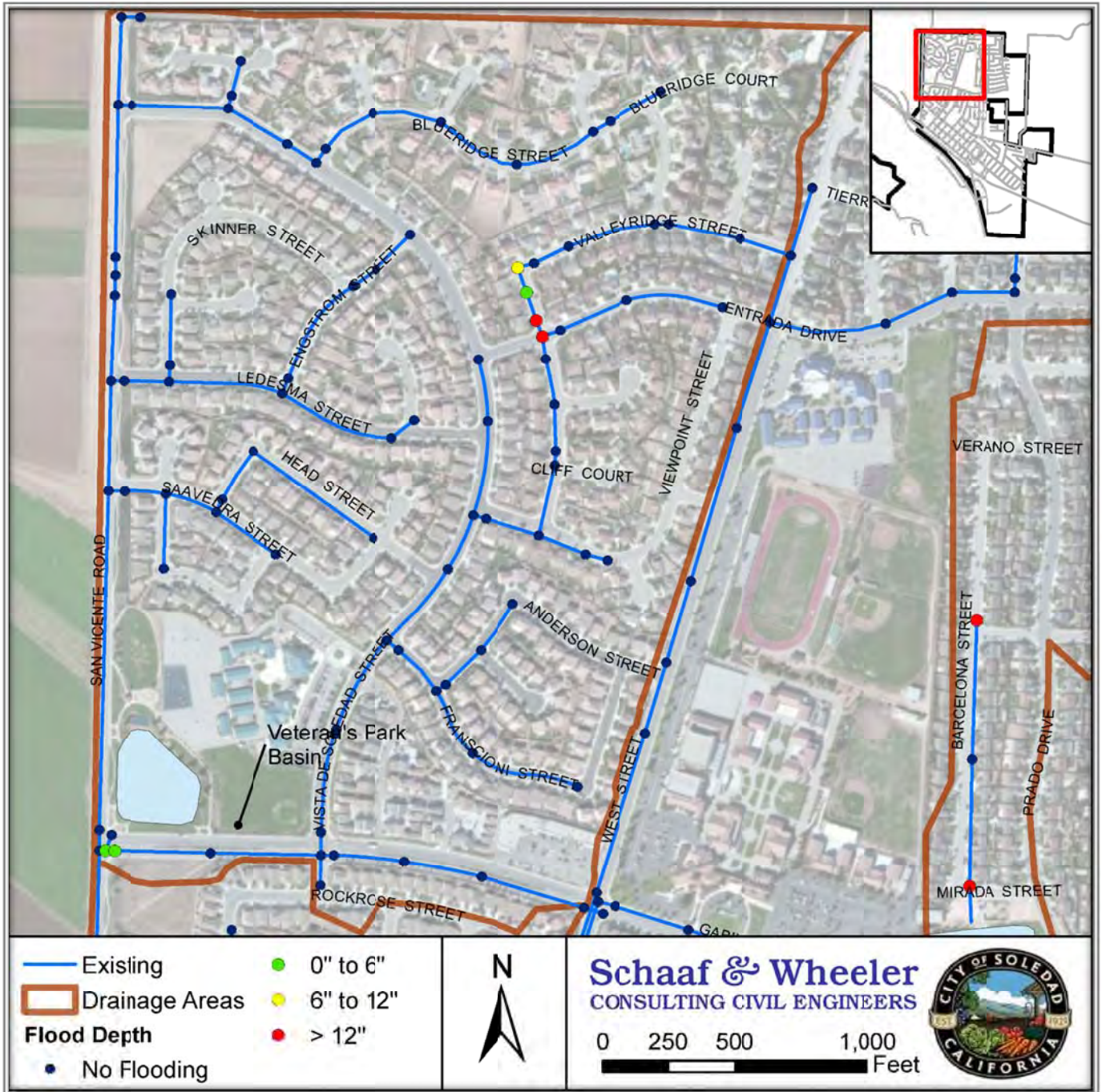


Figure 4-2: Upper San Vicente Area 10-Year System Capacity

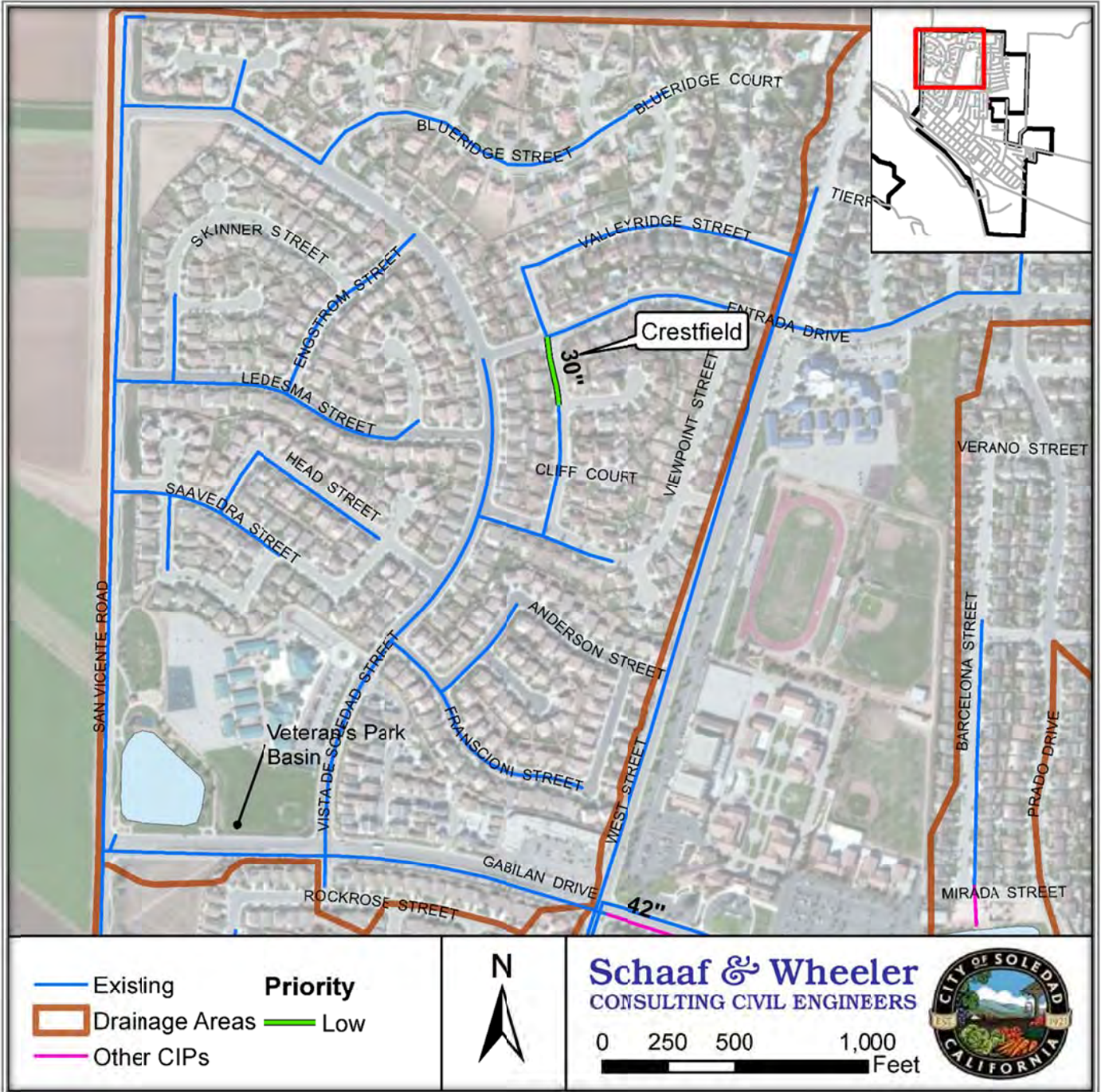


Figure 4-3: Prioritized Improvements for Upper San Vicente Area



Lower San Vicente Drainage Area

Characteristics

The Lower San Vicente drainage area is approximately 98 acres and flows to a retention basin at San Vicente Road and Front Street. Lower San Vicente is predominantly residential, with a commercial area along Front Street. The modeled collection system is comprised of 54 nodes (manholes and inlets), 1,841 linear feet of pipe, 1 retention basin, and 1 detention basin.

Just upstream of San Vicente Road and Front Street, the San Vicente Road main line size decreases from 84-inches to 18-inches, creating a choke point which forces flow into the two upstream detention basins (Market St & San Vicente, and Veterans Memorial Park in Upper San Vicente) during the storm peak. The basin at San Vicente Road and Front Street does not have an outlet; it drains through infiltration.

Historic Problem Areas

No problem areas have been identified in this area by City staff or previous master plan documents.

Identified Deficiencies

The existing conditions model indicates that flooding occurs at 24 nodes. Flooding at 11 nodes is less than 0.5 foot, flooding at five nodes is between 0.5 and 1.0 foot, and flooding at eight nodes is greater than 1.0 foot.

The highest flooding is due to the change in pipe size from 84 inches to 18 inches at the choke point on San Vicente Street and filling of the basin between the UPRR and Highway 101. Flow backs up into the detention basin on the corner of Market Street and San Vicente Street, but insufficient capacity causes flooding of 1.0 to 2.0 feet on Market Street. The model shows flooding at the basin itself of less than 0.5 foot. Flooding depths predicted by the 1D MU model with no improvement are shown in Figure 4-4.

Prioritized Improvements

There are two recommended high priority improvement projects in the Lower San Vicente drainage area, shown in Figure 4-5. These improvements would alleviate flooding caused by the choke point, and will allow the additional flow due to improvements upstream of Lower San Vicente to pass through the drainage area. The San Vicente Basin Overflow improvement is a high priority project which includes a new 42-inch pipe from the retention basin at San Vicente Road and Front Street to the existing 60-inch pipe which outfalls to the retention basin at the wastewater treatment plant. This project includes increasing the depth of the basin by 4-feet to provide additional capacity.

The San Vicente improvement is a high priority project which consists of upsizing the pipes in San Vicente between Front Street and Market Street to 84-inches in order to match the diameter of the upstream pipe. This project cannot be constructed until the San Vicente Basin Overflow improvement is in place.

Near-term Future Improvements

No near-term future land use changes are proposed for the Lower San Vicente area. No additional improvements are required



Figure 4-4: Lower San Vicente Area 10-Year System Capacity



Figure 4-5: Prioritized Improvements for Lower San Vicente



Central Drainage Area

Characteristics

The Central drainage area is approximately 499 acres and flows to a 60-inch pipe at the southwest corner which outlets to a retention basin at the wastewater treatment plant on Morisoli Road. The land use includes a mix of residential, open area, public recreation, institutional (Soledad High School and Main Street Middle School), and commercial parcels. The modeled collection system consists of 24,166 linear feet of pipe and 85 nodes (manholes and inlets).

Historic Problem Areas

According to City staff, manholes on West Street on the south side of the City are bolted down due to surcharge during large storms. Previous master plan documents indicate similar model results and potential flooding concerns

Identified Deficiencies

The MU analysis of the Central system for the 10-year storm event with the existing land use condition shows flooding occurring at 37 nodes. MU predicts a flooding depth of less than 6-inches at 3 nodes. Flooding depths of between 6- and 12-inches occur at 9 nodes, with the remaining 25 nodes experiencing flooding depths greater than 12-inches. The most severe flooding is concentrated in the system branches in Market Street and North Street, in Andalucia Drive, and in Monterey Street. A map of the 10-year flooding depths predicted by MU of the existing storm drainage system is presented in Figure 4-6.

Prioritized Improvements

The five Central drainage area prioritized improvements that are required to alleviate or minimize flooding during a 10-year storm event are shown in Figure 4-7.

High priority improvements are recommended at two locations. The Gabilan improvement allows for the removal of the Miravale retention basin and consists of new 36-inch and 42-inch diameter pipe in Gabilan Drive. This project cannot be constructed until the improvements recommended for the Lower San Vicente area are in place. The Soledad Bypass improvement consists of a new 30-inch pipe on Soledad Street connecting the existing pipe in North Street to the 48-inch pipe in Front Street. The Andalucia improvement is a moderate priority improvement which consists of upsizing approximately 1,760 feet of pipe to 30-inches in order to increase capacity to meet the 10-year level of service.

Low priority improvements are recommended at two locations. These projects would eliminate nuisance flooding and may only get built if there are significant land use, roadway, or redevelopment projects in the area.

Near-term Future Improvements

Near-term future land use changes in the Central area include development of the open space in the north east corner of the area. MU analysis of the improved system with near-term land use does not predict flooding at any of the 85 nodes. No additional improvements are required.

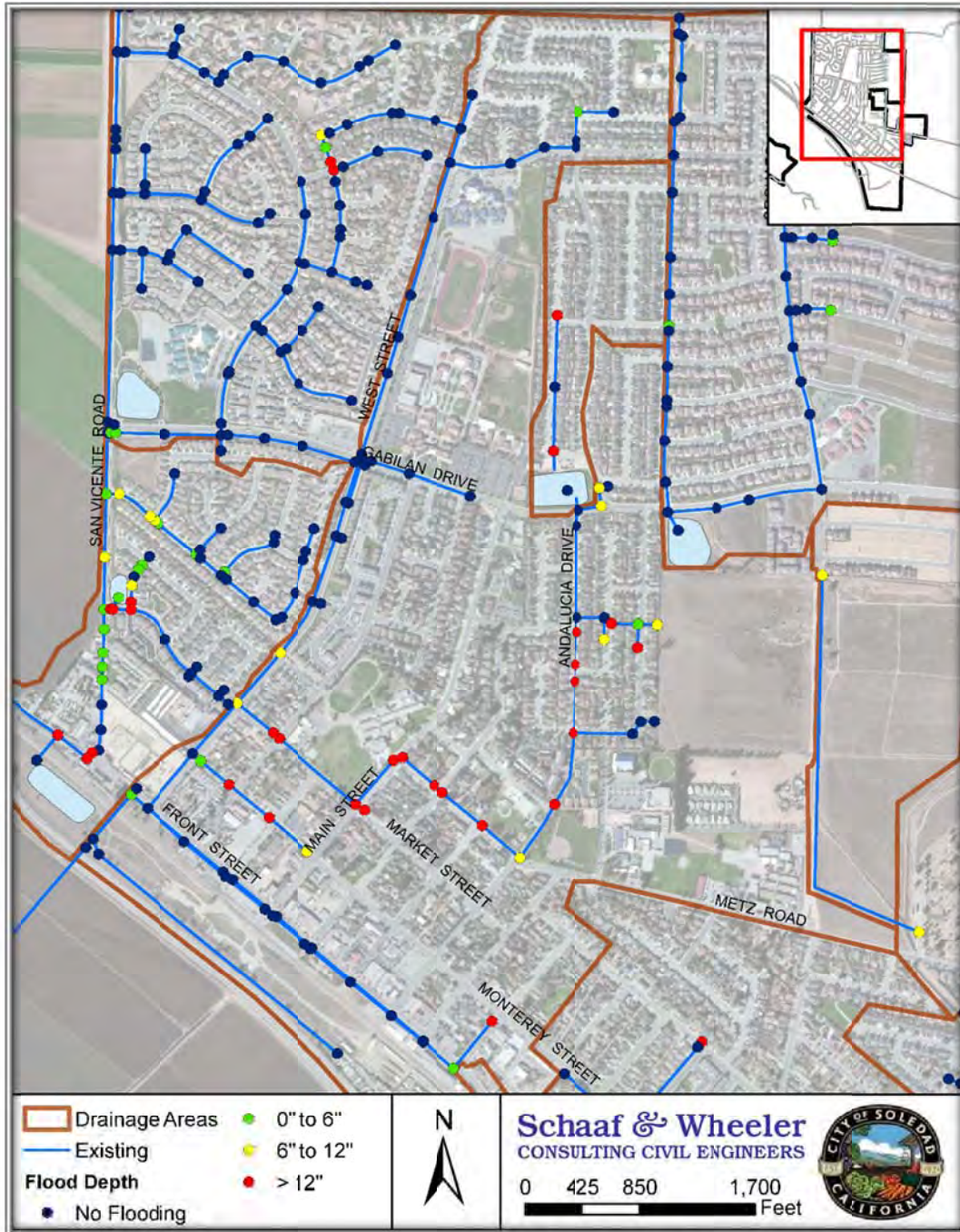


Figure 4-6: Central area 10-Year System Capacity

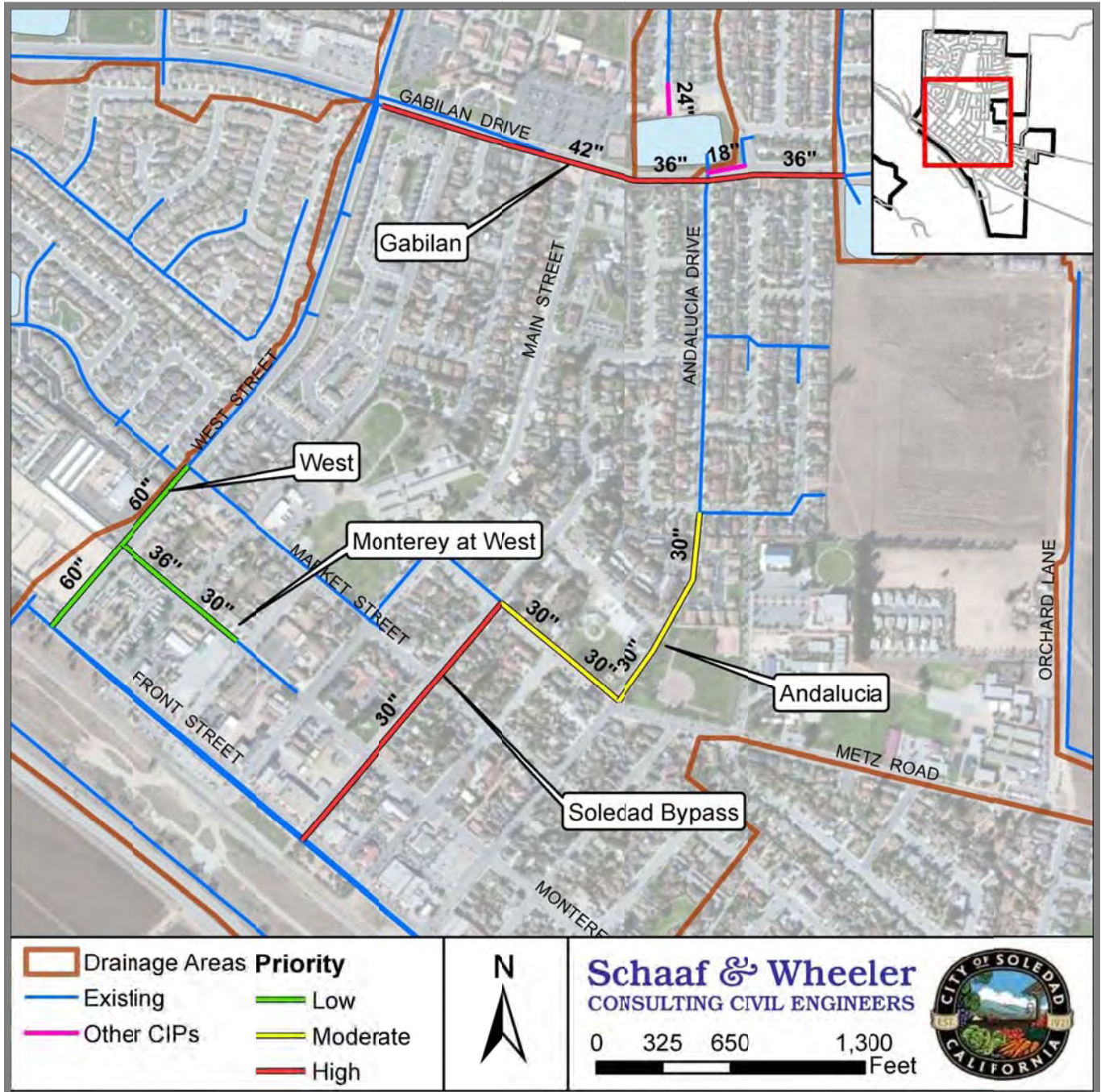


Figure 4-7: Prioritized Improvements for Central Area



Blas Santana Drainage Area

Characteristics

The Blas Santana drainage area is approximately 39 acres and drains to the southwest into the Blas Santana Memorial Park detention basin. The detention basin outlets to the Central system through a pipe in its southeast corner.

The land use in the drainage area is predominantly residential. The modeled collection system consists of approximately 1,300 linear feet of pipe, 3 nodes (manholes and inlets), and the Blas Santana Memorial Park detention basin.

Historic Problem Areas

No flooding concerns have been identified by City staff or past documents for this area.

Identified Deficiencies

MU analysis of the Blas Santana system for the 10-year storm event with the existing land use condition shows flooding depths greater than 12-inches occurring at 2 nodes. A map of the 10-year flooding depths predicted by MU of the existing storm drainage system is presented in Figure 4-8.

Prioritized Improvements

The Blas Santana area prioritized improvements that are required to alleviate or minimize flooding during a 10-year storm event are shown in Figure 4-9. The Barcelona improvement is a moderate priority project recommended to provide a 10-year level of service in Barcelona Street. The Gabilan at Prado improvement is a low priority project that will increase flow out of the Blas Santana Memorial Park detention basin.

Near-term Future Improvements

No near-term future land use changes are proposed for the Blas Santana area. No additional improvements are required.

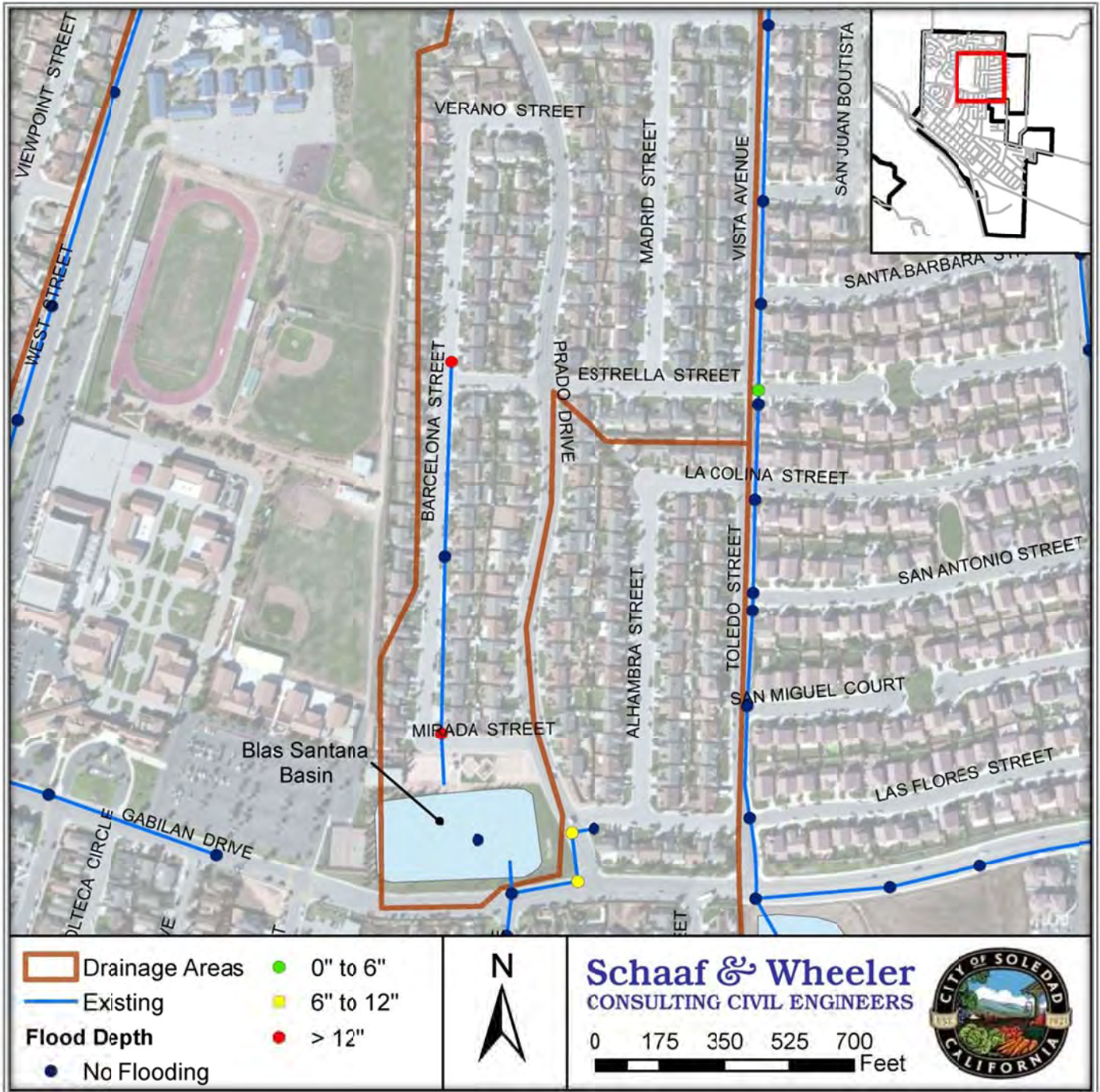


Figure 4-8: Blas Santana Area 10-Year System Capacity



Figure 4-9: Prioritized Improvements for Blas Santana Area



Miravale Drainage Area

Characteristics

The Miravale drainage area is approximately 203 acres and drains to a retention basin at the southwest corner. The area is predominantly residential, with interspersed open area/agricultural parcels. The modeled collection system consists of approximately 8,220 linear feet of pipe, 38 nodes (manholes and inlets), and the Gabilan-Toledo retention basin.

Historic Problem Areas

According to City staff, the Miravale retention basin has spilled during large storm events, releasing flow to the open area to the south.

Identified Deficiencies

MU analysis of the Miravale system for the 10-year storm event with the existing land use condition shows flooding depths of less than 6-inches at 3 nodes. A map of flooding depths predicted by MU of the existing storm drainage system is presented in Figure 4-10.

The City has expressed a desire to remove the Miravale retention basin and turn that area into a park. Removal of the basin requires connecting the Miravale system to either the Bryant Canyon Channel or the Central system.

Prioritized Improvements

No capacity related improvements are recommended for the Miravale system. The Gabilan improvement project recommended as part of the Central system improvements must be constructed prior to removing the Miravale retention basin.

Near-term Future Improvements

Near-term future land use changes in the Miravale area include the build out of the residential development. MU analysis of the improved system with near-term land use does not predict flooding at any of the nodes. No additional improvements are required.

Orchard Drainage Area

Characteristics

The Orchard drainage area is approximately 64 acres of undeveloped land. Runoff is currently routed through a drainage ditch with an outfall directly to Bryant Canyon Channel. The area is slated for the Miravale II development of single family residential homes. No improvements are required for the area with the existing land use condition. (No figure is included for this area.)

Near-term Future Improvements

The Miravale II development plan includes in-tract improvements which include converting a portion of the existing ditch into an in-street pipeline. The southern portion of the existing ditch will remain and continue to convey flows to Bryant Canyon Channel.

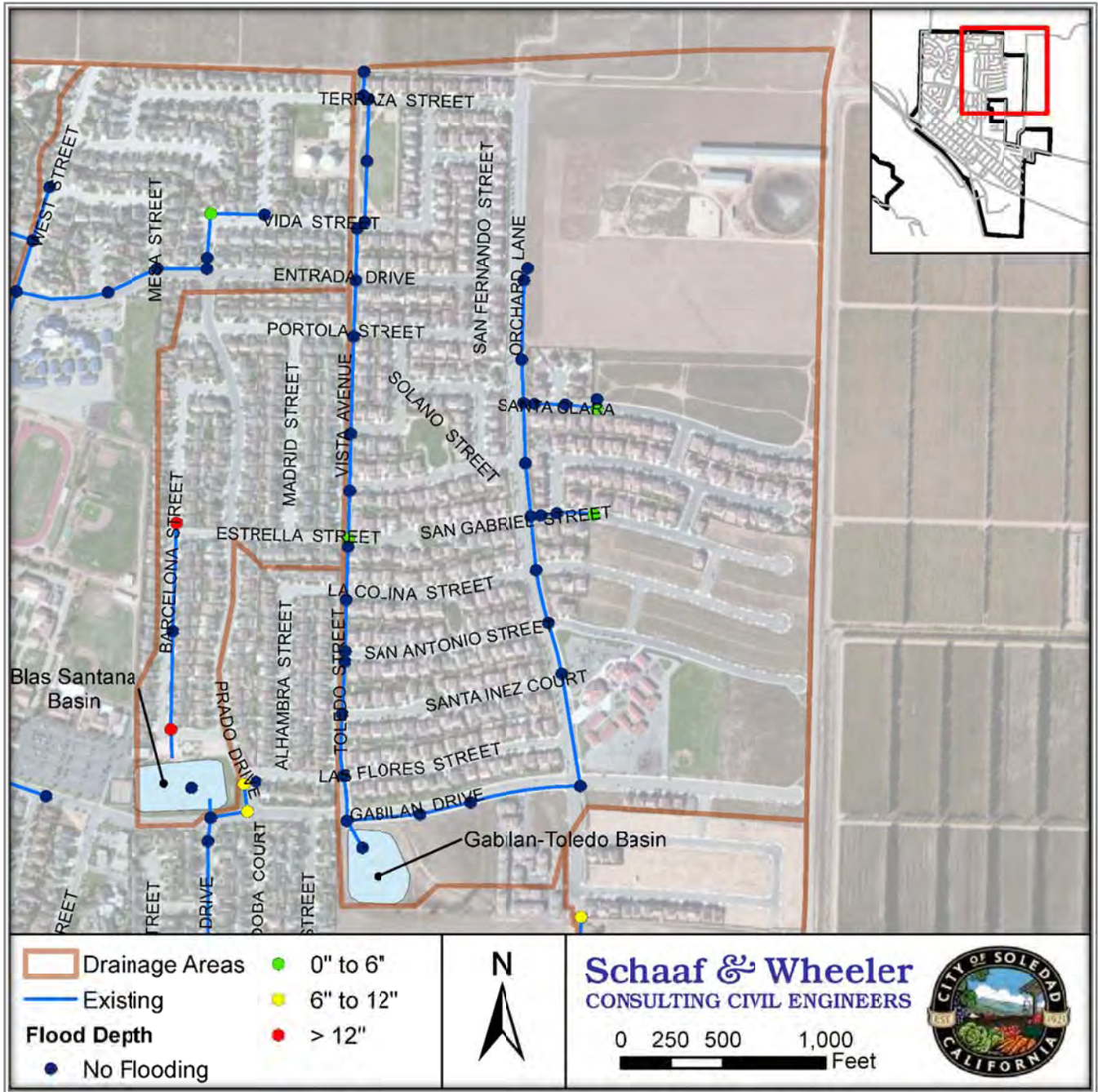


Figure 4-10: Miravale Area 10-Year System Capacity



Caltrans Drainage Area

Characteristics

The Caltrans drainage area is approximately 199 acres and flows to a ditch that runs parallel to Highway 101 which outlets to the Salinas River. The land use in the northern part of the area is residential, while the southern part is largely industrial and commercial. The modeled collection system consists of 4,624 linear feet of pipe and 17 nodes (manholes and inlets).

Historic Problem Areas

According to City staff, flooding has historically occurred on Monterey Street southeast of First Street. Previous master plan documents have included recommendations to alleviate flooding in this area.

Identified Deficiencies

MU analysis of the Caltrans system for the 10-year storm event with the existing land use condition shows flooding depths greater than 12-inches occurring at 6 nodes. A map of the flooding depths predicted by MU of the existing storm drainage system is presented in Figure 4-11.

Prioritized Improvements

The Caltrans area prioritized improvements that area required to alleviate or minimize flooding during a 10-year storm event are shown in Figure 4-12.

The Vosti Park and Nestles improvement is a high priority project that consists of upsizing existing pipe through Vosti Park, under the railroad, and along Nestles Road to the outfall.

The Monterey at First improvement is a moderate priority project that consists of upsizing existing pipe in Monterey Street from 2nd Street to Vosti Park.

The First improvement is a low priority project that consists of upsizing existing pipe in 1st Street from Palm Ave to Monterey Street. This project would eliminate nuisance flooding and may only get built if there are other land use, roadway, or redevelopment projects in the area.

Near-term Future Improvements

No near-term future land use changes are proposed for the Caltrans area. No additional improvements are required.

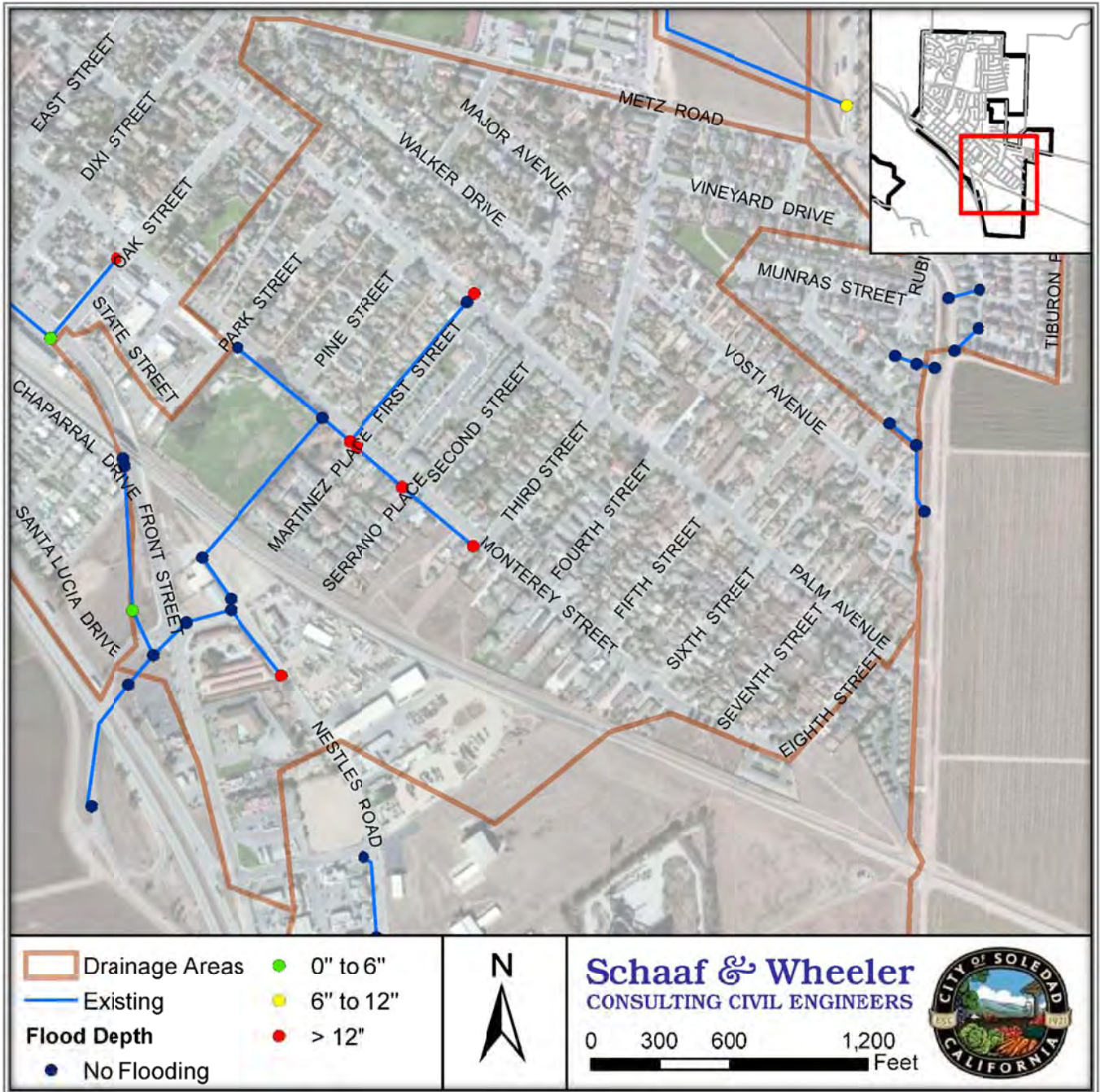


Figure 4-11: Caltrans Area 10-Year System Capacity



Figure 4-12: Prioritized Improvements for Caltrans Area



Los Coches Drainage Area

Characteristics

The Los Coches drainage area is approximately 124 acres and flows south to the Salinas River. The land use is predominantly industrial east of Nestle Road and commercial west of Nestle Road. The modeled collection system consists of 4,460 linear feet of pipe, 19 nodes (manholes and inlets), and 2 outlets.

Historic Problem Areas

No flooding concerns have been identified by City staff or past documents for this area.

Identified Deficiencies

MU analysis of the Los Coches system for the 10-year storm event with the existing land use condition shows flooding occurring at 5 nodes. MU predicts flooding depths between 6- and 12-inches at 1 node, and flooding depths greater than 12-inches at 4 nodes. A map of the flooding depths predicted by MU of the existing storm drainage system is presented in Figure 4-13.

Prioritized Improvements

The Los Coches area prioritized improvements that are required to alleviate or minimize flooding during a 10-year storm event are shown in Figure 4-14. The Los Coches Drive improvement is a moderate priority project that consists of upsizing approximately 900 linear feet of pipe to reduce flooding in the industrial area east of Nestle Road.

Near-term Future Improvements

Near-term future land use changes in the Los Coches area include additional commercial development. MU analysis of the improved system with near-term land use does not predict flooding at any of the nodes. No additional improvements are required.

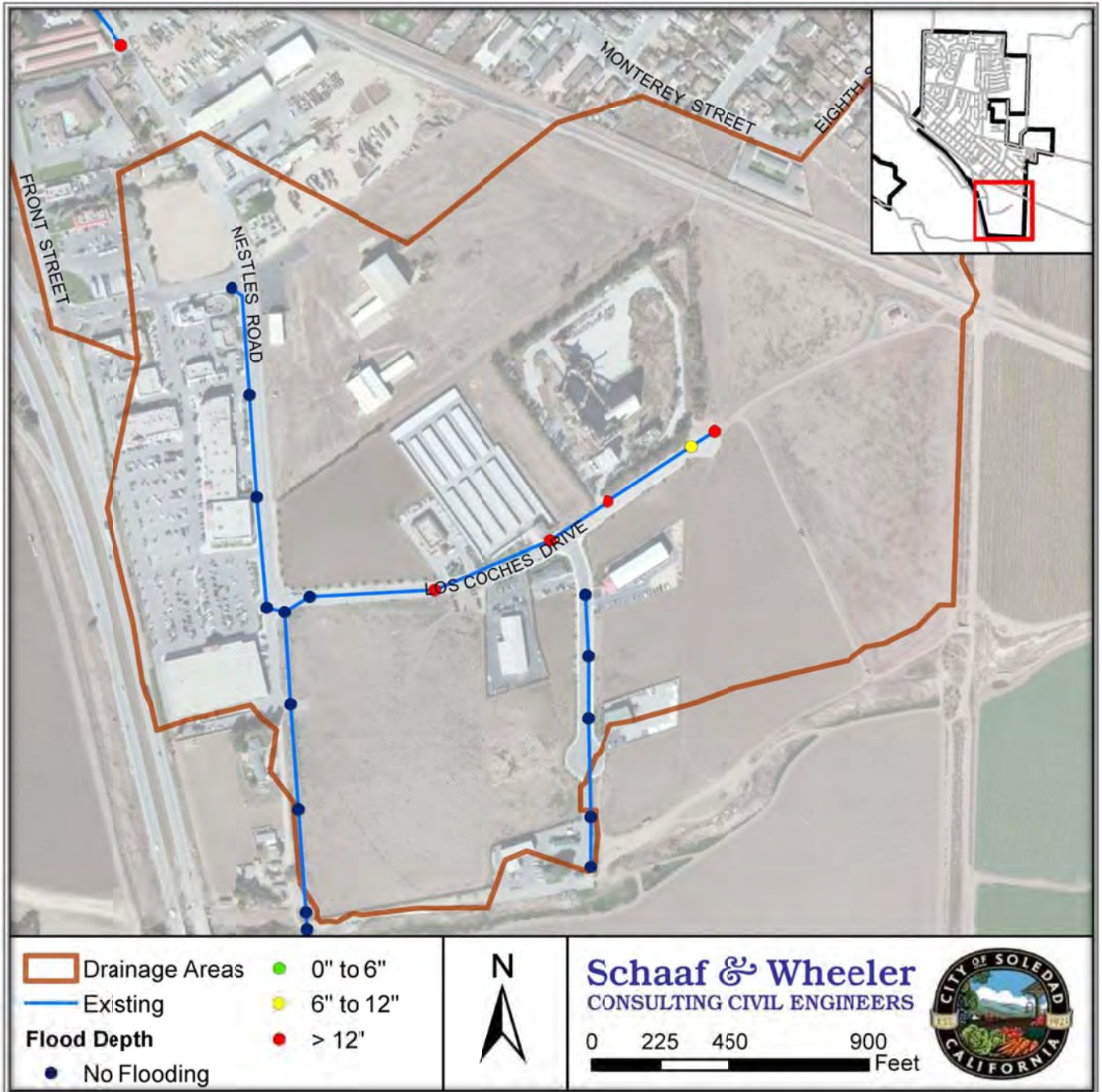


Figure 4-13: Los Coches Area 10-Year System Capacity



Figure 4-14: Prioritized Improvements for Los Coches Area



Metz-Greenleaf Drainage Area

Characteristics

The Metz-Greenleaf drainage area is approximately 21 acres and flows into the Bryant Canyon Channel. The land use is predominantly residential. The modeled collection systems consist of 950 linear feet of pipe, 7 nodes (manholes and inlets), and five outfalls.

Historic Problem Areas

No flooding concerns have been identified by City staff or past documents for this area.

Identified Deficiencies

MU analysis of the Metz-Greenleaf system for the 10-year storm event existing land use condition shows no flooding occurring at any of the 7 nodes. A map of the 10-year flooding depths predicted by the MU analysis of the existing storm drainage system is presented in Figure 4-15.

Prioritized Improvements

There are no recommended prioritized improvements in the Metz-Greenleaf area that are required to alleviate or minimize flooding during a 10-year storm event.

Near-term Future Improvements

No near-term future land use changes are proposed for the Metz-Greenleaf area. No additional improvements are required.

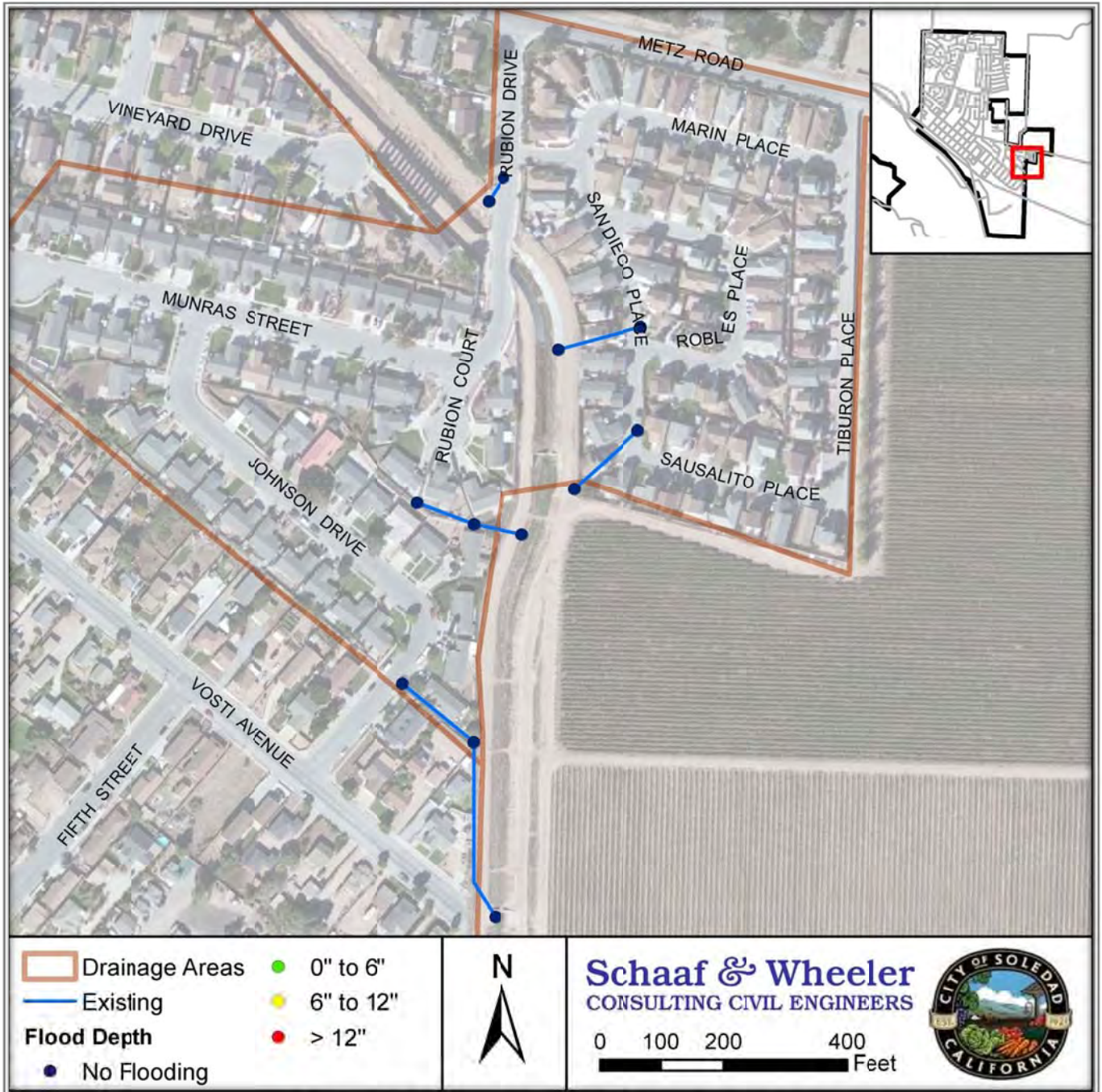


Figure 4-15: Metz-Greenleaf Area 10-Year System Capacity.

Chapter 5 Regulatory Requirements

5.1 Overview

The most significant regulatory requirements for the City's stormwater management are found in State's Construction General Permit and the City's National Pollutant Discharge Elimination System (NPDES) permit. The City is also responsible for floodplain management to meet FEMA National Flood Insurance Program requirements. City projects and drainage facilities may also be required to have permits from the US Army Corps of Engineers (USACE), the Central Coast Regional Water Quality Control Board, Monterey County Water Resources Agency, and/or Monterey County Resource Management Agency. This chapter provides a general outline of the various legal and regulatory requirements of these programs.

5.2 Construction General Permit

The State of California requires Soledad dischargers whose projects disturb one or more acres of soil or whose projects disturb less than one acre but are part of a larger common plan of development that in total disturbs one or more acres, to obtain coverage under the General Permit for Discharges of Storm Water Associated with Construction Activity Construction General Permit Order 2009-0009-DWQ. Construction activity subject to this permit includes clearing, grading and disturbances to the ground such as stockpiling, or excavation, but does not include regular maintenance activities performed to restore the original line, grade, or capacity of the facility.

The Construction General Permit requires the development and implementation of a Storm Water Pollution Prevention Plan (SWPPP). The SWPPP should contain a site map(s) which shows the construction site perimeter, existing and proposed buildings, lots, roadways, storm water collection and discharge points, general topography both before and after construction, and drainage patterns across the project. The SWPPP must list Best Management Practices (BMPs) the discharger will use to protect storm water runoff and the placement of those BMPs. Additionally, the SWPPP must contain a visual monitoring program; a chemical monitoring program for "non-visible" pollutants to be implemented if there is a failure of BMPs; and a sediment monitoring plan if the site discharges directly to a water body listed on the 303(d) list for sediment.

5.3 NPDES Permit

The City of Soledad Phase II Municipal Permit is not a part of the Monterey Regional Stormwater Pollution Prevention Program. The City developed and adopted its own Stormwater Management Plan¹ (SWMP) to meet State and Federal requirements of the NPDES Phase II Permit (Permit No. CAS000004) in 2004. As a condition of State Water Resources Control Board Order No. 2003-0005-DWQ, the City also produces an annual stormwater management program annual report².

The City is currently in the process of implementing its updated Stormwater Program and Ordinances to comply with the updated Phase II Permit (SWRCB Order No. 2013-0001-DWQ) and the Central Coast Water Quality Control Board. The City has made available a post-construction checklist and references to technical guidance manuals that will aid applicants in complying with requirements of the NPDES.

Summary

The current NPDES permit is significantly more detailed and prescriptive than the previous permit. Instead of general water quality goals, the effective permit contains both required performance standards and, in many

¹ http://www.waterboards.ca.gov/water_issues/programs/stormwater/swmp/soledad_swmp.pdf

² http://www.swrcb.ca.gov/rwqcb3/water_issues/programs/stormwater/muni_phase2/soledad/index.shtml



cases, proscribed methods to meet those standards. Permit requirements that are summarized herein focus on specific requirements in the new effective permit

The City has been granted the current NPDES permit on the basis of the following six program elements:

- Public Education and Outreach on Storm Water Impacts
- Public Involvement/Participation
- Illicit Discharge Detection and Elimination
- Construction Site Storm Water Runoff Control
- Post-Construction Storm Water Management in New Development and Redevelopment
- Pollution Prevention/Good Housekeeping for Municipal Operations

An ordinance is currently being developed that will provide the City with an enforcement mechanism for its stormwater management plan, including authority to:

- Prohibit non-stormwater discharges into the City's storm sewer system
- Require erosion and sediment controls from construction site stormwater runoff and ensure compliance in implementing these controls
- Address post-construction stormwater runoff from new- and re-development areas.

5.4 FEMA Regulations

Typical insurance policies do not cover the potentially devastating consequences of flooding. Even after a catastrophic event wherein houses and businesses are completely destroyed, property owners remain liable for their mortgage balances without the equity to cover them. The National Flood Insurance Program was created in 1968 for the expressed purpose of providing flood coverage even in the absence of a Presidential declaration of disaster. The intent of flood insurance is to proactively prepare for future flood damages on an equitable basis nation-wide.

FEMA Regulations

The National Flood Insurance Program (NFIP) as administered by the Federal Emergency Management Agency (FEMA) allows property owners within participating communities to purchase insurance that protects against losses from flooding. Damages to structures and contents are covered by the flood insurance, which may be purchased through residential and commercial insurance agents. To participate in the NFIP, the City adopted and enforces a floodplain management ordinance (Section 15.30 of the Soledad Code of Ordinances) to reduce future flood risks to new construction in Special Flood Hazard Areas. In return, the Federal Government makes flood insurance available in the City.

Participation in NFIP

The National Flood Insurance Act of 1968 allows FEMA to make flood insurance available only where the community has adopted adequate floodplain management regulations. The initial Flood Insurance Rate Map (FIRM) for the City of Soledad was established July 18, 1983, and the City has been a participant in the NFIP since November 1978. Soledad was included in a countywide Flood Insurance Study (FIS) for Monterey County,



CA and Incorporated Areas therein, effective April 2, 2009. The updated flood insurance rate map (FIRM) includes the entire geographic area of Monterey County. Most of Soledad lies outside of the 100-year flood plain.

5.5 Other State and Federal Regulations

Fish and Game

National Marine Fisheries Services lists steelhead in the Salinas River as a threatened species. Minimum flows must be maintained during migration periods between December 1 and May 31. This resource is managed by the Monterey County Water Resources Agency, through scheduled releases from San Antonio and Nacimiento Reservoirs. The California Department of Fish and Wildlife requires protection of fish and game resources in lakes and streams.

US Army Corps of Engineers (USACE)

Under Section 404 of the Clean Water Act (CWA), the USACE regulates certain activities that “discharge dredged or fill material into waters of the United States.” Waters of the U.S. are defined to generally include such resources as tidal waters, most rivers, lakes, and streams, and certain types of wetlands. Channel stabilization and stream maintenance activities that propose to place fill (e.g. culverts, gabions, rock rip rap, logs, etc.) in the channel must obtain a permit from USACE.

USACE issues two types of permits under Section 404: general permits and standard (individual) permits. General permits are issued by USACE to streamline the permit process, while individual permits are more rigorously reviewed and are reserved for projects that impact more than 1/3 acre of tidal waters or non-tidal waters greater than 1/2 acre. Specifically, the USACE Nationwide Permit (NWP) program authorizes 43 different categories of activities, each of which is governed by specific conditions for the particular NWP, as well as 27 general conditions that apply to all NWPs.

For any construction of improvements that impact waters of the US, including alteration of existing outfalls, construction of new outfalls, and any construction in marshes, wetlands, or tidal waters, a USACE permit is required.

Chapter 6 Capital Improvements

6.1 Overview

Chapter 4, Collection Systems, discusses Soledad's storm drain collection system and recommends prioritized capital improvements to address the deficiencies identified by the MU model. This chapter provides a Capital Improvement Program (CIP) that uses these priorities to provide an overall guideline for the City to use in preparing annual budgets. Exigent circumstances and future in-field experiences may necessitate deviations from the recommended Master Plan Storm Drain CIP. A master plan is intended to be just that; a tool for planning. Capital improvement priorities are not intended to be hard and fast.

The near-term future land use condition is used as the project scenario with the existing land use condition as the baseline scenario for the Capital Improvement Program (CIP). This study and proposed CIP is merely the starting point. It is anticipated that City staff and/or their consultants will perform a more detailed study or alternatives analysis to find more affordable or effective improvements with information gathered as part of the design process (detailed topography, utility conflicts, easements, etc).

6.2 Capital Improvement Priorities

The proposed Soledad storm drainage CIP is divided into three priority levels for funding and implementation. The total cost associated with all CIP projects is shown for each priority level in Table 6-1. These costs include a 30% contingency cost and a 20% increase for engineering, administrative, and inspection costs.

Table 6-1: Summary of prioritized 10-year CIP project costs.

Priority Level	Length (ft)	Cost
High Priority Capital Improvements	6,544	\$6,910,000
Moderate Priority Capital Improvements	4,868	\$3,840,000
Low Priority Capital Improvements	1,525	\$1,060,000
Total Capital Improvement Program	12,937	\$11,810,000

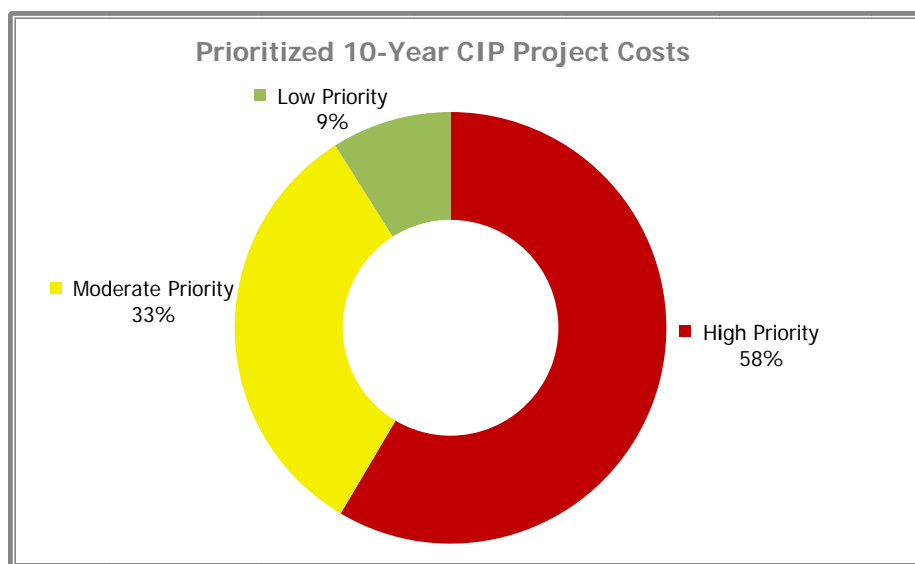


Figure 6-1: CIP Priority Percentages



6.3 Alternative Construction Methods

Two types of projects are traditionally utilized to increase storm drain system capacity: install a new relief storm drain parallel to the system lacking capacity, or replace pipes of insufficient size with larger diameter pipe in the same alignment. This CIP has been developed assuming pipe replacement with a larger diameter pipe.

The two alternatives can be made equivalent to one another using the following formula, assuming that pipe material and length are equal:

$$D_R = (D_e^{2.63} + D_p^{2.63})^{0.38}$$

- Where
- D_R = diameter of replacement pipe;
 - D_e = diameter of overloaded pipe; and
 - D_p = diameter of parallel relief pipe.

Equivalent parallel diameters, to the nearest standard sizes, are summarized in Table 6-2.

Table 6-2: Table of Equivalent Parallel Pipe Diameters in Inches

		Improved Diameter (inches)												
		12	15	18	21	24	30	36	42	48	54	60	72	84
Existing Diameter (inches)	12	--	12	15	18	21	27	33	39	42	48	54	60	72
	15	--	--	12	16	21	27	33	39	42	48	54	60	72
	18	--	--	--	14	18	24	33	39	42	48	54	60	72
	21	--	--	--	--	15	24	30	39	42	48	54	60	72
	24	--	--	--	--	--	21	30	36	39	48	54	60	72
	30	--	--	--	--	--	--	24	33	36	48	54	60	72
	36	--	--	--	--	--	--	--	24	30	39	48	54	72
	42	--	--	--	--	--	--	--	--	30	36	42	54	72
	48	--	--	--	--	--	--	--	--	--	30	36	48	72
	54	--	--	--	--	--	--	--	--	--	--	30	36	54
	60	--	--	--	--	--	--	--	--	--	--	--	30	54
72	--	--	--	--	--	--	--	--	--	--	--	--	42	

Assuming the existing pipe is adequate in terms of condition, the installation of a new parallel pipe is typically more cost effective than pipe replacement since the required pipe size is smaller and the existing pipe does not need to be removed. This does not take into account the long term maintenance associated with a parallel system. Selection of a capacity improvement strategy will vary from project to project, and will be governed by field constraints such as conflicting utilities, rights-of-way, environmental concerns, permit requirements, and traffic control.



Traditional cut and cover methods of construction will be employed for most storm drain construction. However, the use of trenchless methods such as bore and jack, directional drilling, cured-in-place pipe (CIPP), slip-lining, and others, may increasingly find application in special circumstances where existing development encroaches upon pipe alignment or disruption of other services and land uses is too costly. This is particularly the case in Soledad where recommended pipe improvements cross the Union Pacific Railroad line.

6.4 Cost of Improvements

Costs estimates have been developed using information from other projects, cost estimating guides (*Current Construction Costs*, Saylor Publications, Inc.), and engineering judgment, and are in 2015 dollars. The cost per linear foot of improvement used for cost estimates are shown in Table 6-3. Connection (manhole or catch basin) replacement cost estimates ranged from \$11,800 to \$13,270 depending on connecting pipe diameters. All estimates are based on the Engineering News Report (ENR) January 2015 index of 9971. Costs include open trenching in roadway up to ten feet in depth. New outfall costs were estimated to be \$40,000 per outfall. It should be noted that wide variations in actual outfall costs are expected due to location of outfall, whether energy dissipation is required, etc. Costs do not include permitting or any environmental documentation. Most of these improvement projects are expected to qualify for negative declarations from permitting agencies.

Table 6-3: Cost (in 2015 Dollars) Per Linear Foot of Pipe and Per Connection by Pipe Diameter

Diameter (inches)	2014 Dollar per Linear Foot of Pipe (LF)	2014 Dollar per Connection
15	\$250	\$11,850
18	\$270	\$11,930
21	\$300	\$12,000
24	\$325	\$12,080
27	\$350	\$12,150
30	\$375	\$12,230
33	\$400	\$12,305
36	\$425	\$12,380
42	\$475	\$12,530
45	\$500	\$12,605
48	\$525	\$12,680
54	\$575	\$12,830
60	\$625	\$12,970
66	\$675	\$13,120
72	\$725	\$13,270
78	\$780	\$13,360
84	\$830	\$13,570
90	\$870	\$13,720
96	\$950	\$14,000
5'x5'	\$850	\$20,000
6'x6'	\$1,120	\$22,740
6'x10'	\$1,450	\$21,000
8'x8'	\$1,570	\$22,000



6.5 Capital Improvement Program

The proposed Storm Drain Capital Improvement Program pipeline improvement costs and pipe lengths based on priority level are summarized in. Table 6-4 outlines the CIP cost allowances by drainage area and project name. Maps of the improvement projects are shown in Appendix A. The detailed CIP is provided in Appendix B.

Table 6-4: Project and Priority Summary by Drainage Area

Drainage Area	Project	Diameter(s)	Length	Priority	CIP Total
Blas Santana	Barcelona	24	300	Low	\$ 200,000
	Gabilan at Prado	18	180	Low	\$ 120,000
Caltrans	First	30, 36	785	Low	\$ 520,000
	Monterey at First	42, 48	459	Moderate	\$ 460,000
	Vosti Park and Nestles	48, 54, 60	1,414	High	\$ 1,340,000
Central	Andalucia	30	1,761	Moderate	\$ 1,190,000
	Gabilan	36, 42	2,287	High	\$ 1,820,000
	Monterey at West	30, 36	728	Moderate	\$ 560,000
	Soledad Bypass	30	1,495	High	\$ 950,000
	West	60	1,020	Moderate	\$ 900,000
Los Coches	Los Coches Drive	30, 36	900	Moderate	\$ 730,000
Lower San Vicente	San Vicente	84	1,098	High	\$ 1,500,000
	San Vicente Basin Overflow	42	250	High	\$ 240,000
	San Vicente Basin Excavation	N/A	N/A	High	\$ 1,060,000
Upper San Vicente	Crestfield	30	260	Low	\$ 220,000

Total lengths and costs for each drainage area are summarized in Table 6-5.

Table 6-5: Total Cost of CIPs and Length of Pipe by Drainage Area

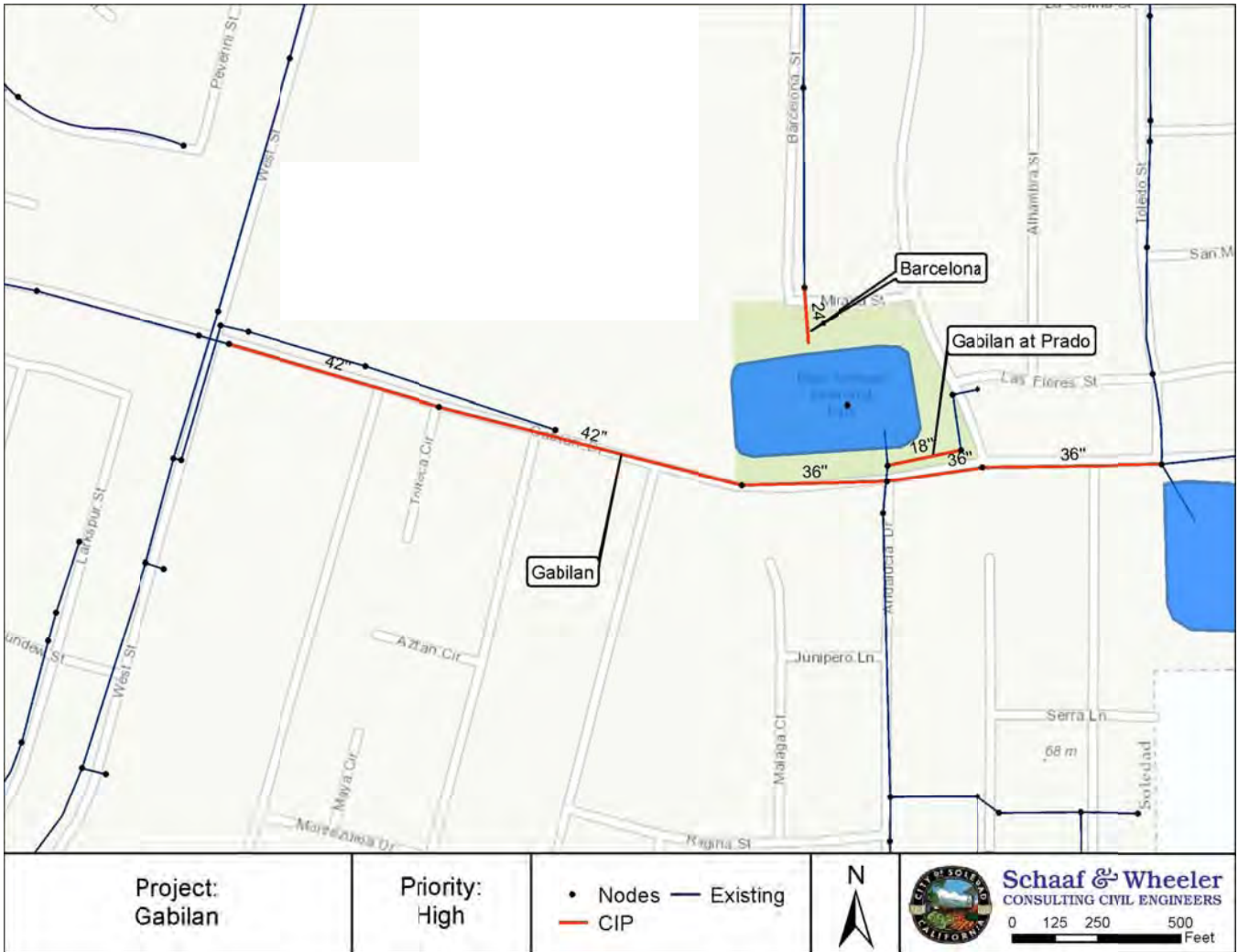
Drainage Area	Length	CIP Cost
Blas Santana	480	\$ 320,000
Caltrans	2,658	\$ 2,361,000
Central	7,291	\$ 5,420,000
Los Coches	900	\$ 773,000
Lower San Vicente	1,348	\$ 2,800,000
Upper San Vicente	260	\$ 236,000
Total	12,937	\$ 11,810,000



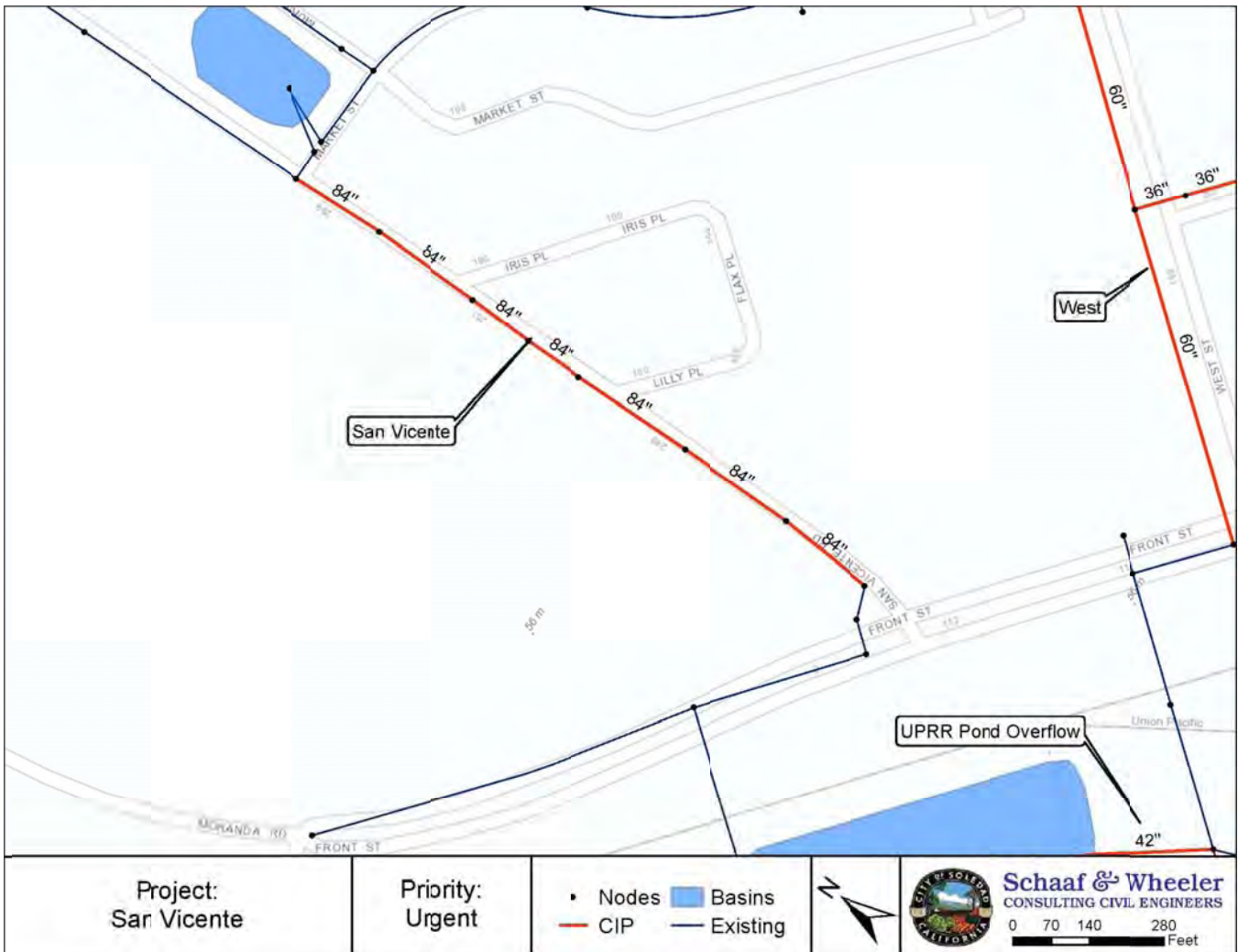
Appendix A

Project Sheets

A. Project ID: 1	B. Project Name: Gabilan									
C. Project Location: Gabilan Drive between West St. and Toledo St.										
D. Priority: High										
E. Project Description: In order to allow for removal of the Gabilan-Toledo retention basin, the Miravale system will require outlet to a different system. Construction of new lines along Gabilan Drive is recommended. This project cannot be constructed until the San Vicente and San Vicente Pond Overflow and Excavation projects are complete.										
<table border="1"> <thead> <tr> <th>Ex Diam (in)</th> <th>Imp Diam (in)</th> <th>Length (ft)</th> </tr> </thead> <tbody> <tr> <td>N/A</td> <td>36</td> <td>1,010</td> </tr> <tr> <td>N/A</td> <td>42</td> <td>1,277</td> </tr> </tbody> </table>		Ex Diam (in)	Imp Diam (in)	Length (ft)	N/A	36	1,010	N/A	42	1,277
Ex Diam (in)	Imp Diam (in)	Length (ft)								
N/A	36	1,010								
N/A	42	1,277								
F. Construction Subtotal..... \$1,170,000 G. Total Construction Cost..... \$1,520,000 H. Estimated CIP..... \$1,820,000										



A. Project ID: 2	B. Project Name: San Vicente												
C. Project Location: San Vicente Rd. & Market St. to San Vicente Rd. & Front St.													
D. Priority: High													
<p>E. Project Description: The existing pipes in San Vicente Road lack capacity required to convey 10-year storm runoff. Upsizing the pipes in San Vicente Rd to achieve a 10-year level of service and convey runoff from the Miravale system and potential future development is recommended.</p> <table border="1" data-bbox="500 489 1122 659"> <thead> <tr> <th>Ex Diam (in)</th> <th>Imp Diam (in)</th> <th>Length (ft)</th> </tr> </thead> <tbody> <tr> <td>18</td> <td>84</td> <td>422</td> </tr> <tr> <td>24</td> <td>84</td> <td>470</td> </tr> <tr> <td>30</td> <td>84</td> <td>200</td> </tr> </tbody> </table>		Ex Diam (in)	Imp Diam (in)	Length (ft)	18	84	422	24	84	470	30	84	200
Ex Diam (in)	Imp Diam (in)	Length (ft)											
18	84	422											
24	84	470											
30	84	200											
F. Construction Subtotal \$960,000													
G. Total Construction Cost \$1,250,000													
H. Estimated CIP \$1,500,000													



Project:
San Vicente

Priority:
Urgent

- Nodes
- CIP
- Existing

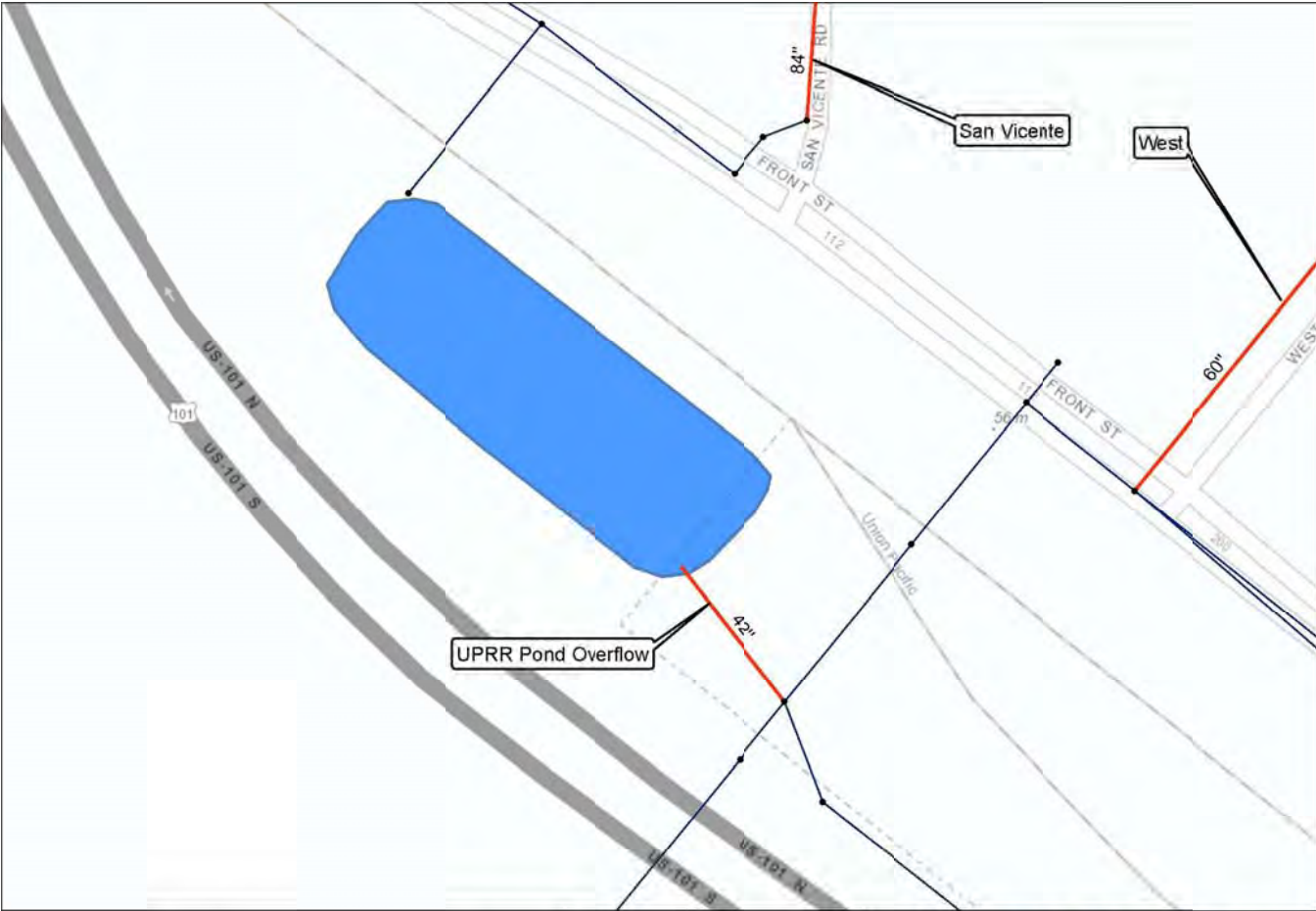




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0 70 140 280
Feet

A. Project ID: 3	B. Project Name: Soledad Bypass						
C. Project Location: Soledad St. from North St. to Front St.							
D. Priority: High							
E. Project Description: The Central system is severely impacted by the 10-year event. Bypassing flow from the pipes in North Street to the existing 48" pipe in Front Street to achieve a 10-year level of service is recommended.							
<table border="1"> <thead> <tr> <th>Ex Diam (in)</th> <th>Imp Diam (in)</th> <th>Length (ft)</th> </tr> </thead> <tbody> <tr> <td>N/A</td> <td>30</td> <td>1,495</td> </tr> </tbody> </table>		Ex Diam (in)	Imp Diam (in)	Length (ft)	N/A	30	1,495
Ex Diam (in)	Imp Diam (in)	Length (ft)					
N/A	30	1,495					
F. Construction Subtotal \$610,000							
G. Total Construction Cost \$790,000							
H. Estimated CIP \$950,000							

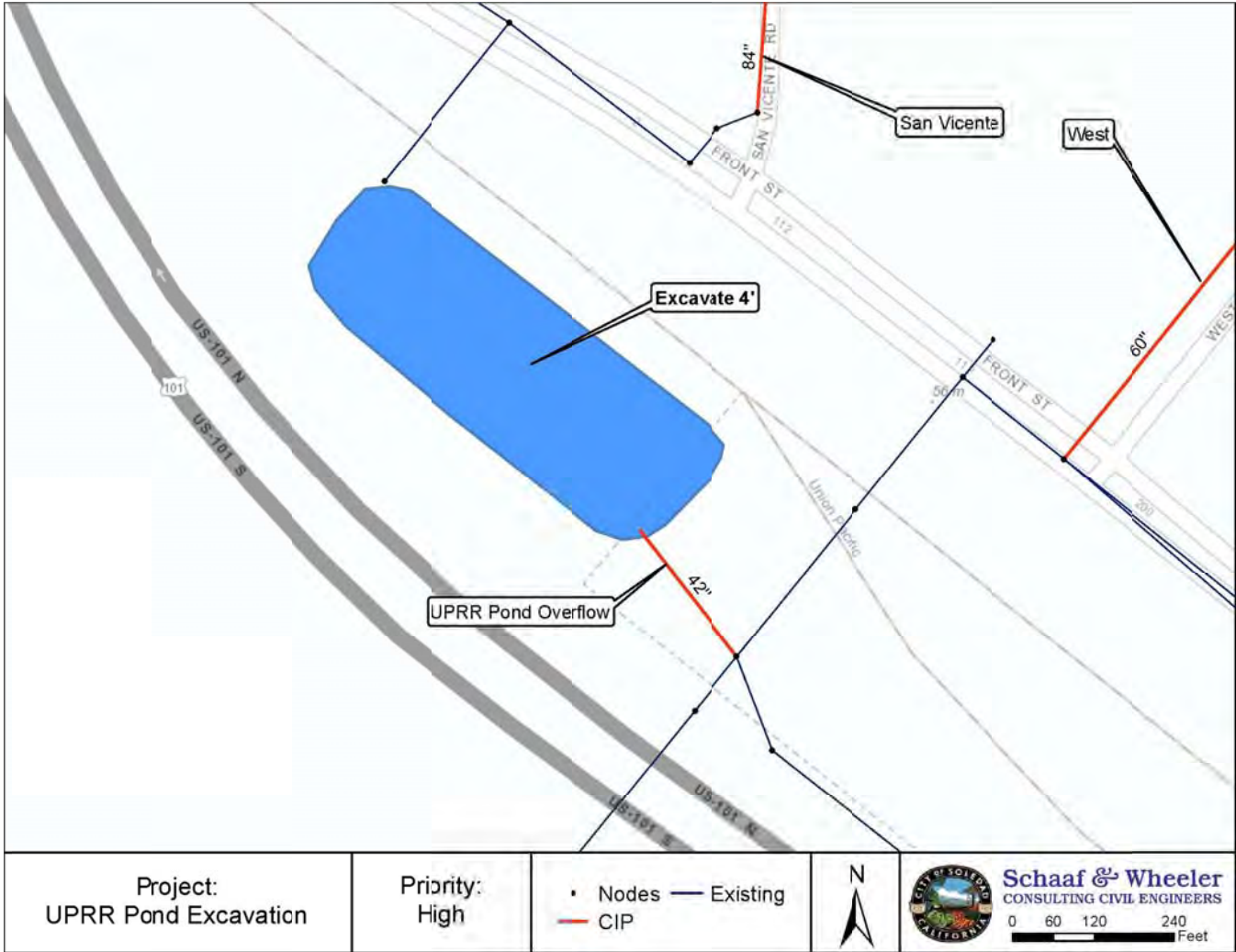


A. Project ID: 4	B. Project Name: San Vicente Pond Overflow						
C. Project Location: Front Street between West St. and San Vicente Rd.							
D. Priority: High							
<p>E. Project Description: Surge occurs on San Vicente Rd. and Front St. when levels increase in the Front St. retention pond. Construction of a 42 inch overflow pipe connecting the San Vicente retention pond to the 60" WWTP line is recommended.</p> <table border="1" data-bbox="488 489 1131 577"> <thead> <tr> <th>Ex Diam (in)</th> <th>Imp Diam (in)</th> <th>Length (ft)</th> </tr> </thead> <tbody> <tr> <td>N/A</td> <td>42</td> <td>250</td> </tr> </tbody> </table>		Ex Diam (in)	Imp Diam (in)	Length (ft)	N/A	42	250
Ex Diam (in)	Imp Diam (in)	Length (ft)					
N/A	42	250					
F. Construction Subtotal\$150,000							
G. Total Construction Cost.....\$200,000							
H. Estimated CIP.....\$240,000							

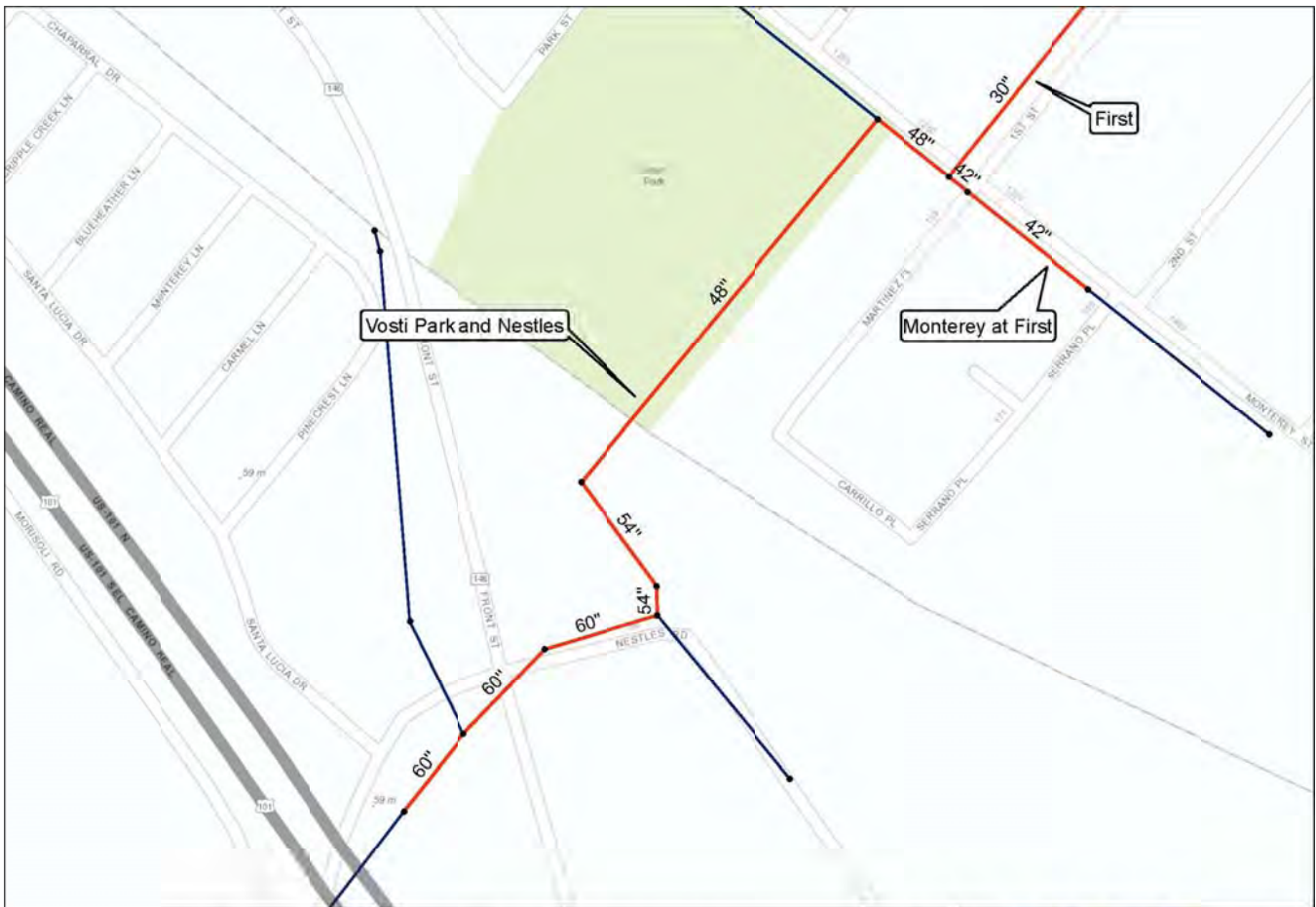


Project: UPRR Pond Overflow	Priority: High	<ul style="list-style-type: none"> • Nodes — Existing — CIP 		 <p>Schaaf & Wheeler CONSULTING CIVIL ENGINEERS</p> <p>0 60 120 240 Feet</p>
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I. Project ID: 5	J. Project Name: San Vicente Pond Excavation		
K. Project Location: Retention Pond between UPRR Tracks and Hwy 101			
L. Priority: High			
M. Project Description: If the Miravale development is completed and the Toledo retention basin is converted to a park, the pond near Front St. will require additional capacity to prevent flooding on San Vicente and Market St. Increasing the depth of the pond by 4 feet is recommended.			
<table border="1"> <tr> <th>Volume (CY)</th> </tr> <tr> <td style="text-align: center;">5,500</td> </tr> </table>		Volume (CY)	5,500
Volume (CY)			
5,500			
N. Construction Subtotal..... \$680,000			
O. Total Construction Cost..... \$880,000			
P. Estimated CIP..... \$1,060,000			

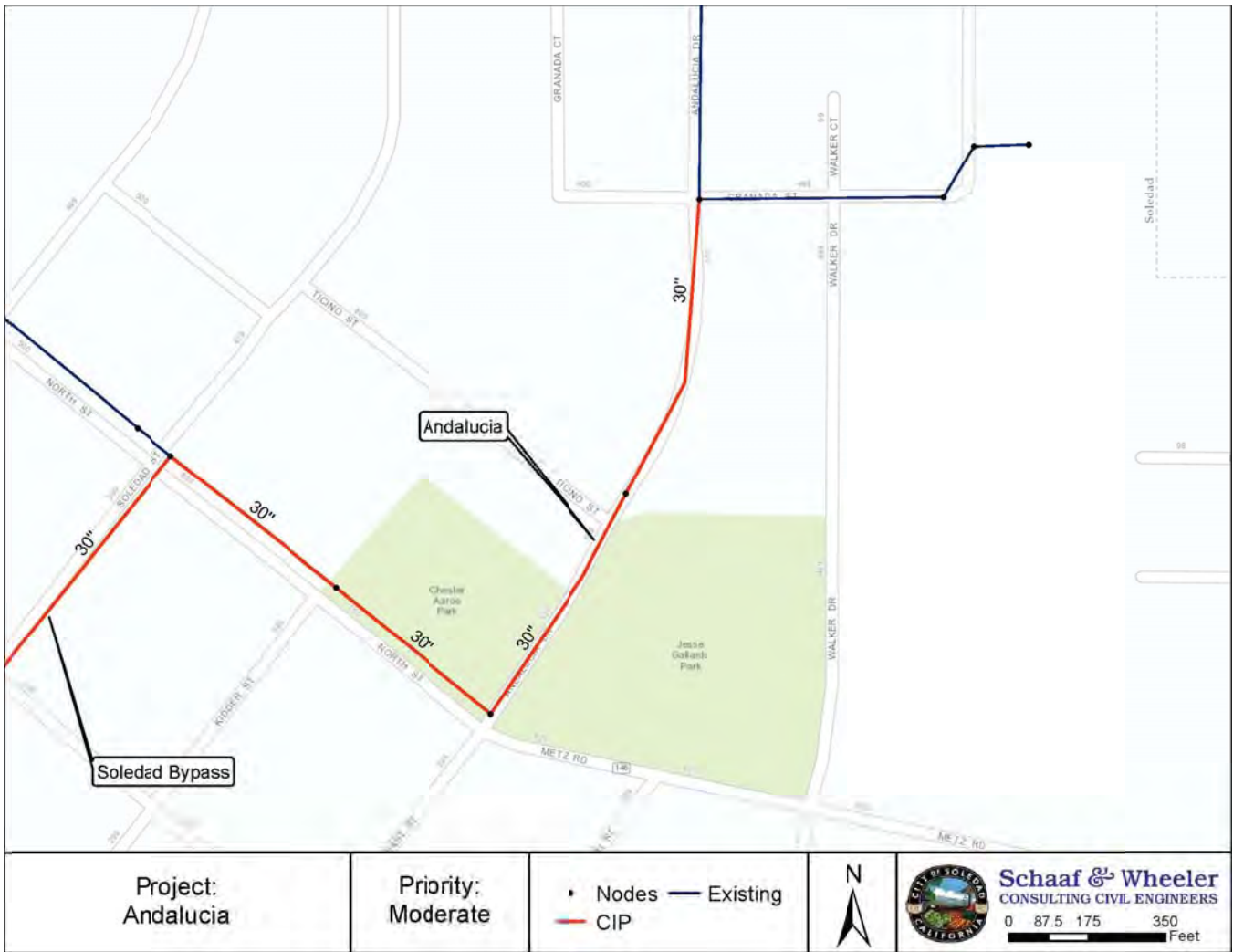


A. Project ID: 6	B. Project Name: Vosti Park & Nestles												
C. Project Location: Monterey St. near Vosti Park, under the UPRR, and to the Front St. and Nestles Rd. Outfall													
D. Priority: High													
E. Project Description: Pipes in Monterey St. lack the capacity to convey a 10-year event. Upsizing the existing pipes or installing equivalent parallel lines to provide a 10-year level of service is recommended.													
<table border="1"> <thead> <tr> <th>Ex Diam (in)</th> <th>Imp Diam (in)</th> <th>Length (ft)</th> </tr> </thead> <tbody> <tr> <td>42</td> <td>48</td> <td>586</td> </tr> <tr> <td>42</td> <td>54</td> <td>265</td> </tr> <tr> <td>42</td> <td>60</td> <td>563</td> </tr> </tbody> </table>		Ex Diam (in)	Imp Diam (in)	Length (ft)	42	48	586	42	54	265	42	60	563
Ex Diam (in)	Imp Diam (in)	Length (ft)											
42	48	586											
42	54	265											
42	60	563											
F. Construction Subtotal\$860,000													
G. Total Construction Cost\$1,120,000													
H. Estimated CIP\$1,340,000													



Project: Vosti Park and Nestles	Priority: High	<ul style="list-style-type: none"> • Nodes — Existing — CIP 		<p>Schaaf & Wheeler CONSULTING CIVIL ENGINEERS 0 87.5 175 350 Feet</p>
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A. Project ID: 7	B. Project Name: Andaluca						
C. Project Location: North St. at Soledad St. to Andaluca Dr. at Granada Ct.							
D. Priority: Moderate							
E. Project Description: The existing pipes on North and Andaluca Dr. lack the capacity required to convey the 10-year event. Upsizing these pipes or adding an equivalent parallel line to provide a 10-year level of service is recommended.							
<table border="1"> <thead> <tr> <th>Ex Diam (in)</th> <th>Imp Diam (in)</th> <th>Length (ft)</th> </tr> </thead> <tbody> <tr> <td>24</td> <td>30</td> <td>1,763</td> </tr> </tbody> </table>		Ex Diam (in)	Imp Diam (in)	Length (ft)	24	30	1,763
Ex Diam (in)	Imp Diam (in)	Length (ft)					
24	30	1,763					
F. Construction Subtotal\$760,000							
G. Total Construction Cost\$990,000							
H. Estimated CIP\$1,190,000							



Project:
Andaluca

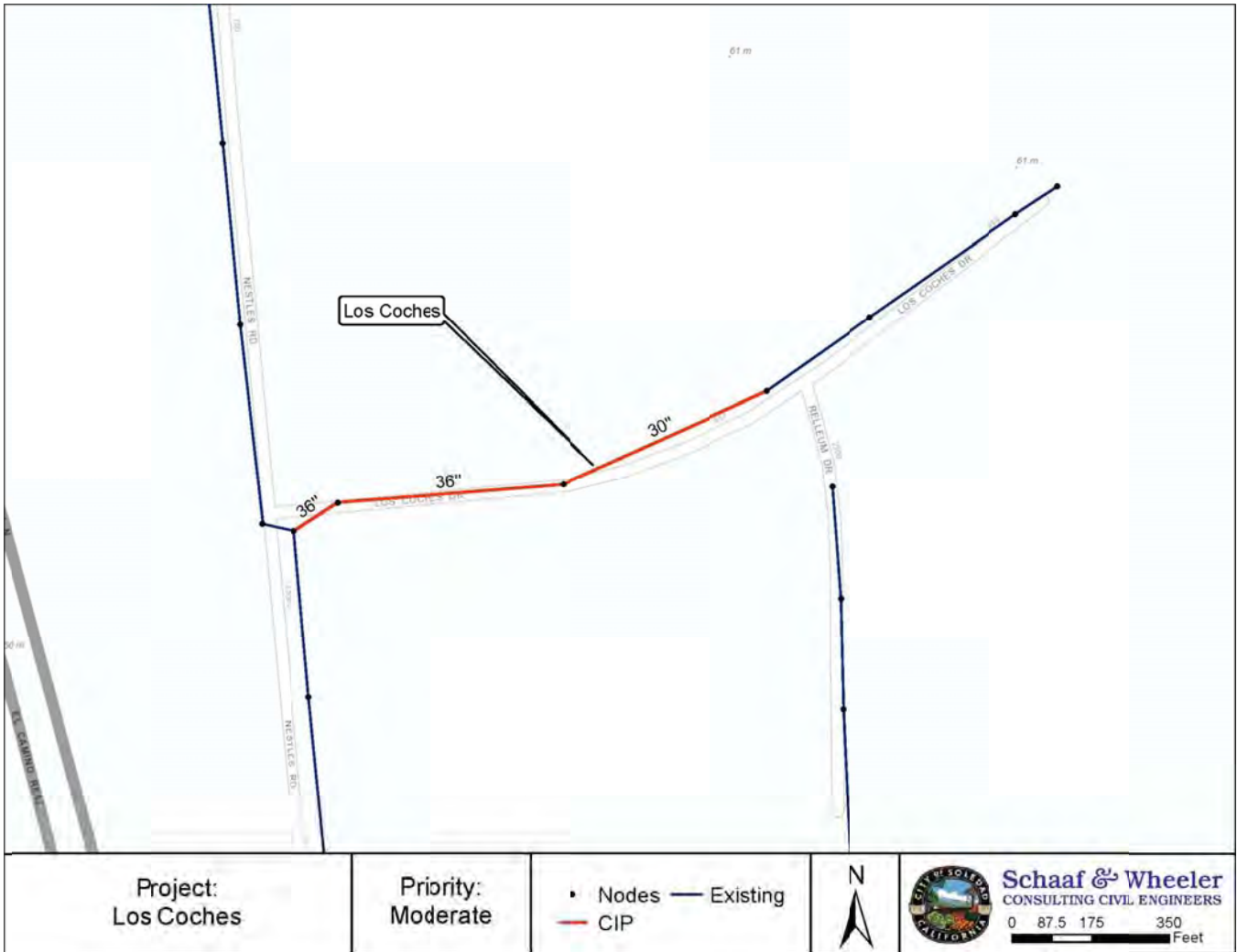
Priority:
Moderate

• Nodes — Existing
— CIP



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0 87.5 175 350
Feet

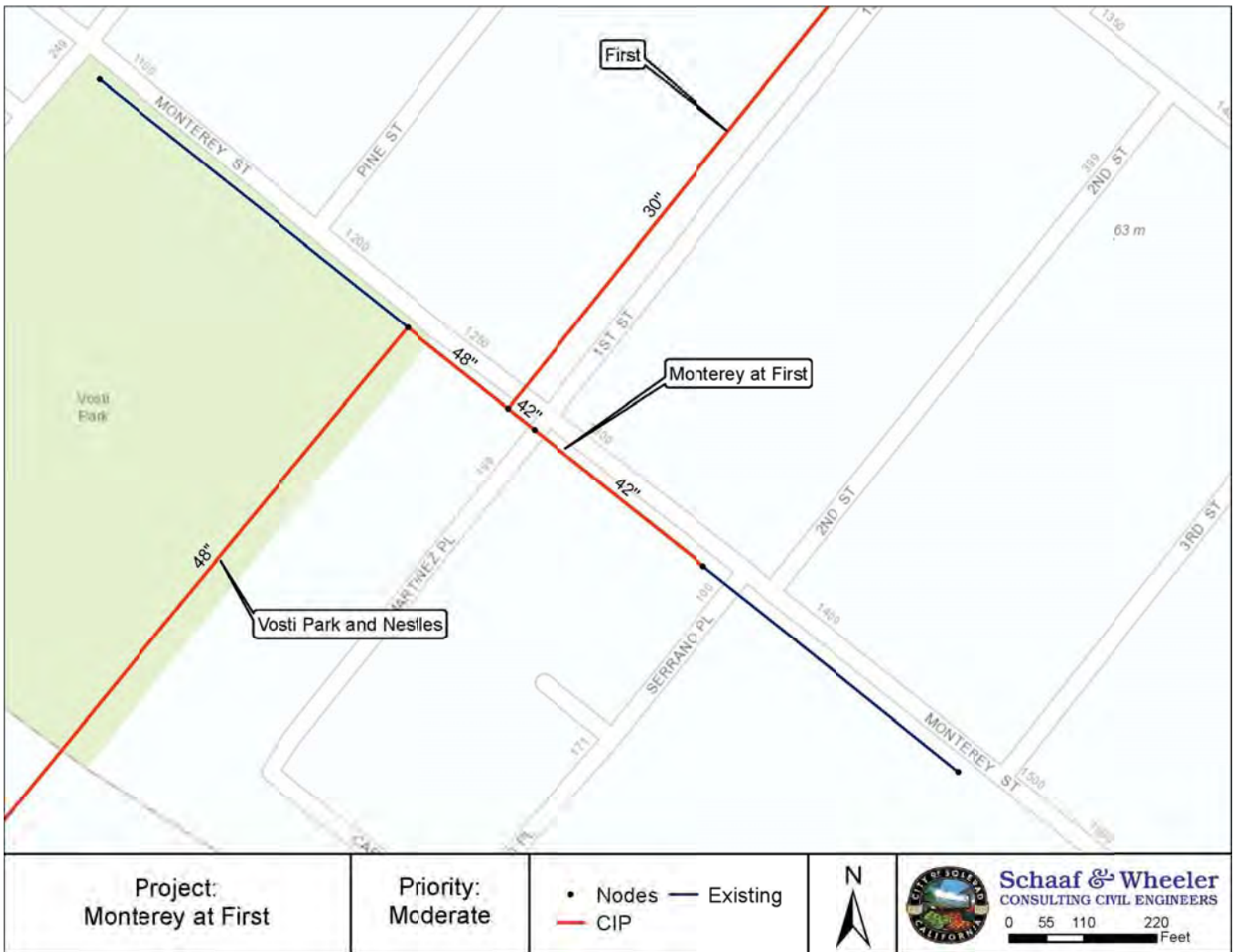
A. Project ID: 8	B. Project Name: Los Coches									
C. Project Location: Los Coches Dr. from Nestles Rd. to Relleum Dr.										
D. Priority: Moderate										
<p>E. Project Description: The existing pipes on Los Coches Dr. lack the capacity required to convey the 10-year event runoff. This area is mostly industrial and open space, but potential for future development will require modification. Upsizing these pipes to provide a 10-year level of service is recommended.</p> <table border="1" data-bbox="492 491 1128 627"> <thead> <tr> <th>Ex Diam (in)</th> <th>Imp Diam (in)</th> <th>Length (ft)</th> </tr> </thead> <tbody> <tr> <td>24</td> <td>30</td> <td>404</td> </tr> <tr> <td>24</td> <td>36</td> <td>500</td> </tr> </tbody> </table>		Ex Diam (in)	Imp Diam (in)	Length (ft)	24	30	404	24	36	500
Ex Diam (in)	Imp Diam (in)	Length (ft)								
24	30	404								
24	36	500								
F. Construction Subtotal \$470,000										
G. Total Construction Cost \$610,000										
H. Estimated CIP \$730,000										



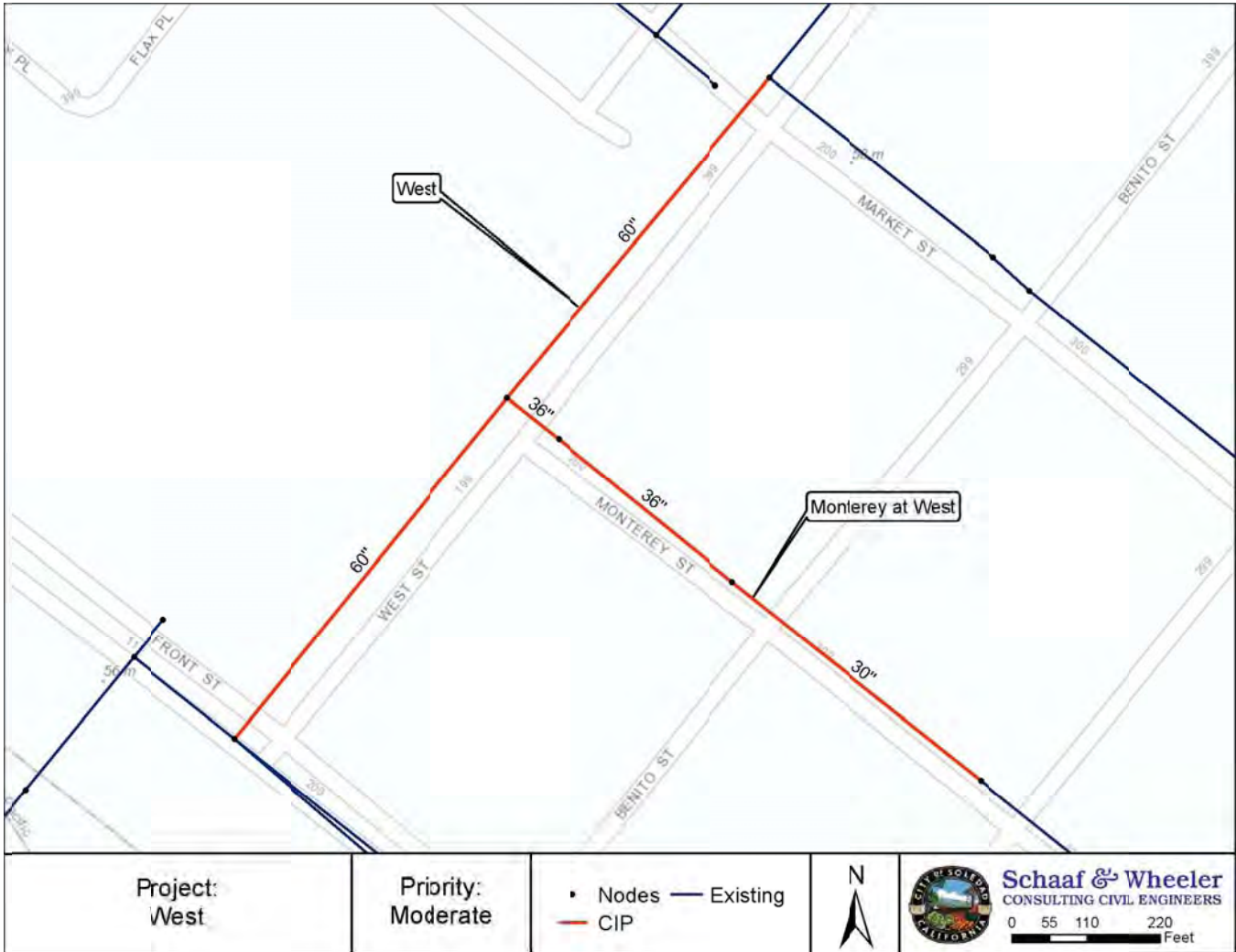
A. Project ID: 9	B. Project Name: Monterey at West									
C. Project Location: Monterey St. between Encinal St. and West St.										
D. Priority: Low										
E. Project Description: The pipes in Monterey St. between Encinal St. and West St. lack the capacity required to convey the 10-year event runoff. Upsizing these pipes to achieve a 10-year level of service is recommended.										
<table border="1"> <thead> <tr> <th>Ex Diam (in)</th> <th>Imp Diam (in)</th> <th>Length (ft)</th> </tr> </thead> <tbody> <tr> <td>24</td> <td>30</td> <td>380</td> </tr> <tr> <td>24</td> <td>36</td> <td>348</td> </tr> </tbody> </table>		Ex Diam (in)	Imp Diam (in)	Length (ft)	24	30	380	24	36	348
Ex Diam (in)	Imp Diam (in)	Length (ft)								
24	30	380								
24	36	348								
F. Construction Subtotal\$360,000 G. Total Construction Cost\$470,000 H. Estimated CIP\$560,000										



A. Project ID: 10	B. Project Name: Monterey at First									
C. Project Location: Monterey St. between 2nd St. and the northeast corner of Vosti Park										
D. Priority: High										
E. Project Description: The existing pipes in Monterey St. between Second St. and Vosti Park lack the capacity required to convey 10-year event runoff. Upsizing these pipes to achieve a 10-year level of service is recommended.										
<table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Ex Diam (in)</th> <th>Imp Diam (in)</th> <th>Length (ft)</th> </tr> </thead> <tbody> <tr> <td>30</td> <td>42</td> <td>303</td> </tr> <tr> <td>30</td> <td>48</td> <td>156</td> </tr> </tbody> </table>		Ex Diam (in)	Imp Diam (in)	Length (ft)	30	42	303	30	48	156
Ex Diam (in)	Imp Diam (in)	Length (ft)								
30	42	303								
30	48	156								
F. Construction Subtotal \$290,000										
G. Total Construction Cost \$380,000										
H. Estimated CIP \$460,000										



A. Project ID: 11	B. Project Name: West						
C. Project Location: West St. between Market St. and Front St.							
D. Priority: Low							
<p>E. Project Description: The pipes along West St. are undersized and have historically experienced surcharge. Upsizing the pipes to reduce flooding on West St. and along Market St. is recommended.</p> <table border="1" data-bbox="492 457 1130 543"> <thead> <tr> <th>Ex Diam (in)</th> <th>Imp Diam (in)</th> <th>Length (ft)</th> </tr> </thead> <tbody> <tr> <td>48</td> <td>60</td> <td>1,020</td> </tr> </tbody> </table>		Ex Diam (in)	Imp Diam (in)	Length (ft)	48	60	1,020
Ex Diam (in)	Imp Diam (in)	Length (ft)					
48	60	1,020					
F. Construction Subtotal\$580,000							
G. Total Construction Cost.....\$750,000							
H. Estimated CIP.....\$900,000							



A. Project ID: 12	B. Project Name: Barcelona						
C. Project Location: Corner of Barcelona & Mirada into Blas Santana Memorial Park							
D. Priority: Low							
<p>E. Project Description: The pipe draining the system north of the park is undersized, causing moderate levels of surcharge at the catch basin on Mirada Street for the 10-year event. Upsizing the pipe to achieve a 10-year level of service is recommended.</p> <table border="1" data-bbox="500 489 1122 575"> <thead> <tr> <th>Ex Diam (in)</th> <th>Imp Diam (in)</th> <th>Length (ft)</th> </tr> </thead> <tbody> <tr> <td>21</td> <td>24</td> <td>300</td> </tr> </tbody> </table>		Ex Diam (in)	Imp Diam (in)	Length (ft)	21	24	300
Ex Diam (in)	Imp Diam (in)	Length (ft)					
21	24	300					
F. Construction Subtotal \$130,000							
G. Total Construction Cost \$170,000							
H. Estimated CIP \$200,000							



A. Project ID: 13	B. Project Name: Crestfield						
C. Project Location: Crestfield St. between Entrada Dr. and Sentinel Ct.							
D. Priority: Low							
<p>E. Project Description: Pipes in Crestfield St. downstream of the pipe junction at Entrada Drive lack the capacity required to convey the 10-year event runoff. Upsizing the two pipes to provide a 10-year level of service is recommended.</p> <table border="1" data-bbox="483 457 1136 541"> <thead> <tr> <th>Ex Diam (in)</th> <th>Imp Diam (in)</th> <th>Length (ft)</th> </tr> </thead> <tbody> <tr> <td>24</td> <td>30</td> <td>260</td> </tr> </tbody> </table>		Ex Diam (in)	Imp Diam (in)	Length (ft)	24	30	260
Ex Diam (in)	Imp Diam (in)	Length (ft)					
24	30	260					
F. Construction Subtotal.....\$140,000							
G. Total Construction Cost.....\$180,000							
H. Estimated CIP.....\$220,000							



Project:
Crestfield

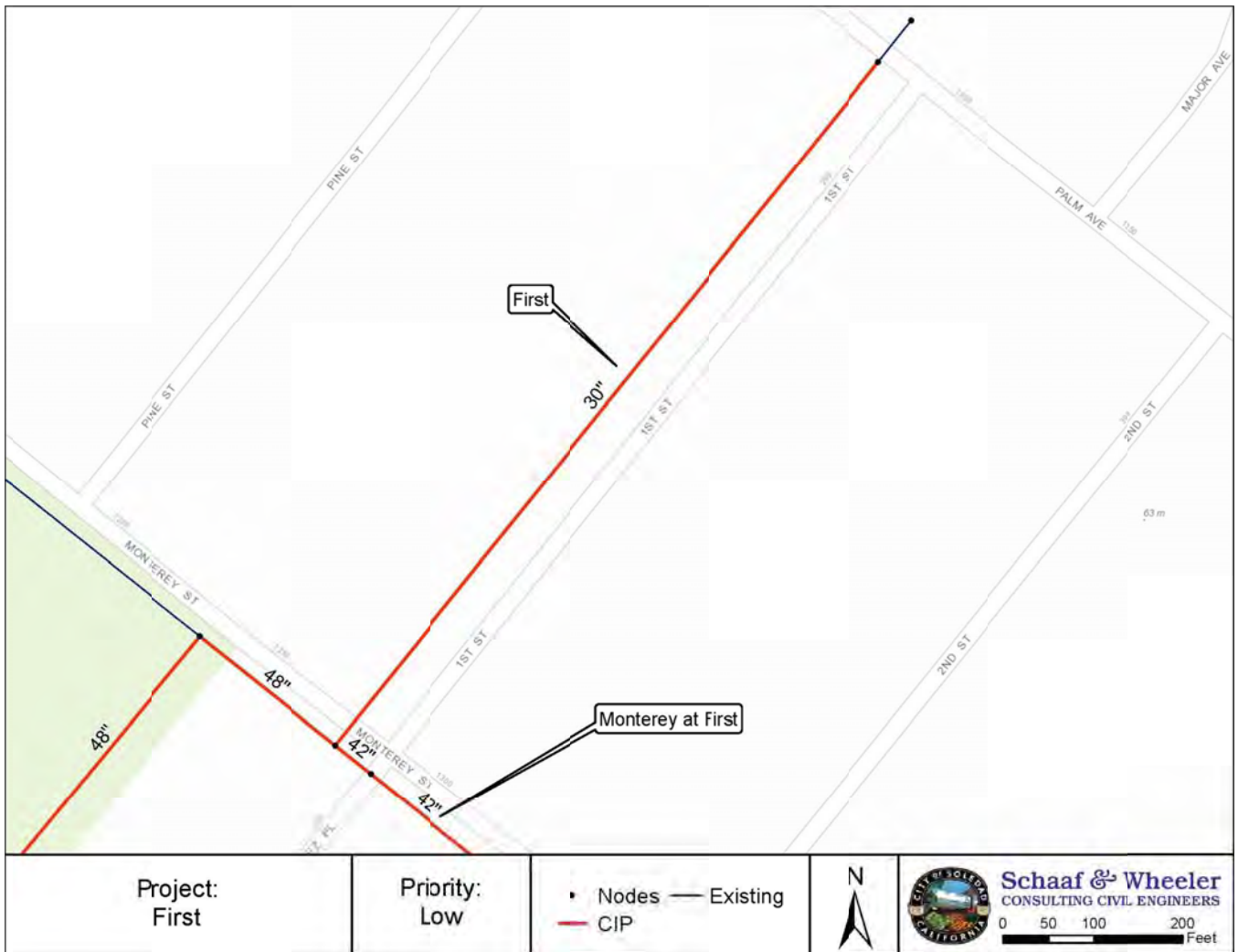
Priority:
Low

• Nodes — Existing
— CIP



Schaaf & Wheeler
CONSULTING CIVIL ENGINEERS
0 25 50 100
Feet

A. Project ID: 14	B. Project Name: First									
C. Project Location: First Street upstream of junction at Monterey Street										
D. Priority: Low										
E. Project Description: Pipes in First Street between Palm Ave. and Monterey St. receiving drainage from a large area and lack the capacity required to convey the 10-year event runoff. Upsizing these pipes to achieve a 10-year level of service is recommended.										
<table border="1"> <thead> <tr> <th>Ex Diam (in)</th> <th>Imp Diam (in)</th> <th>Length (ft)</th> </tr> </thead> <tbody> <tr> <td>24</td> <td>30</td> <td>380</td> </tr> <tr> <td>24</td> <td>36</td> <td>348</td> </tr> </tbody> </table>		Ex Diam (in)	Imp Diam (in)	Length (ft)	24	30	380	24	36	348
Ex Diam (in)	Imp Diam (in)	Length (ft)								
24	30	380								
24	36	348								
F. Construction Subtotal\$330,000 G. Total Construction Cost\$430,000 H. Estimated CIP\$520,000										



A. Project ID: 15	B. Project Name: Gabilan at Prado						
C. Project Location: Blas Santa Park near Gabilan Dr. and Prado Dr.							
D. Priority: Low							
E. Project Description: There is minor flooding on Prado Dr. at Las Flores St. due to an undersized pipe in Blas Santa Park. Upsizing this pipe to achieve a 10-year level of service is recommended.							
<table border="1"> <thead> <tr> <th>Ex Diam (in)</th> <th>Imp Diam (in)</th> <th>Length (ft)</th> </tr> </thead> <tbody> <tr> <td>15</td> <td>18</td> <td>180</td> </tr> </tbody> </table>		Ex Diam (in)	Imp Diam (in)	Length (ft)	15	18	180
Ex Diam (in)	Imp Diam (in)	Length (ft)					
15	18	180					
F. Construction Subtotal\$80,000							
G. Total Construction Cost\$100,000							
H. Estimated CIP\$120,000							

