Crescent City Storm Drain Master Plan

City Of Crescent City

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→ **The Power of Commitment**

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The Power of Commitment

Executive Summary

The Storm Drain Master Plan (SDMP) provides Crescent City with a comprehensive assessment of existing stormwater system performance, drainage deficiencies, and guidance of long-term capital investment decisions. The Plan was developed to reduce flooding risks, protect public health and safety, and enhance resilience to increasing precipitation intensity and tidal influence. The analyses and recommendations presented in this plan are based on extensive field data collection, hydrologic and hydraulic (H&H) modeling, and a prioritization framework.

This report is subject to, and must be read in conjunction with, the limitations set out in **Section 1.2 (Scope and Limitations)** and the assumptions and qualifications contained throughout the report.

Background and Purpose

Crescent City is situated within a highly dynamic coastal environment and experiences some of the highest average annual precipitation totals in California. Much of the City's storm drain infrastructure was constructed incrementally over the past several decades, often as part of roadway or site-specific improvements rather than as an integrated drainage system. As a result, portions of the system are undersized, aging, or tidally constrained, leading to recurrent flooding along critical transportation corridors, in residential and commercial neighborhoods, and near publicly accessible facilities.

The purpose of this Storm Drain Master Plan is to evaluate the performance of the existing storm drain system under current and future conditions, identify locations and causes of flooding, and develop a prioritized Capital Improvement Program (CIP) that supports the phasing and sequencing of capital planning and implementation. The overall objective of the SDMP is to support investment decisions that reduce flood risk and improve storm drain system reliability.

Approach and Methodology

The SDMP was developed using an integrated approach that included data collection, H&H modeling, systemwide evaluation, project development, and prioritization and phasing. Key elements of the approach included:

- **Data Collection**: Field surveys were conducted to inventory and assess approximately 67,000 linear feet of storm drain pipe, 405 drainage inlets, 67 manholes, and 10 outfalls. Data collection included verification of infrastructure location, depth, material, condition, and outfall characteristics, as well as confirmation of watershed boundaries and surface flow routing.
- **Hydrologic and Hydraulic Modeling**: A PCSWMM model was developed to simulate existing and proposed drainage conditions (based on proposed CIPs) throughout the City. The model incorporates both one-dimensional (pipe/junction) and two-dimensional (surface flooding) analyses to evaluate flood extent, depth, duration, and volume. Existing and future conditions were evaluated using the 2-, 10-, and 50-year, 24-hour SCS Type IA design storms based on NOAA Atlas 14 precipitation data, with tidal boundary conditions applied at coastal outfalls. Climate change projections were incorporated to assess mid-century and late-century increases in precipitation intensity.
- **Drainage Deficiency Analysis**: Flooding locations and capacity-limited infrastructure were identified and grouped into ten drainage groups based on downstream outfall connectivity. These findings informed development of an idealized hydraulic solution and subsequent CIP development.
- **Capital Improvement Project Development**: Potential CIPs were developed to address identified deficiencies through conveyance upgrades, inlet enhancements, surface flow relief, outfall improvements, and detention or storage where feasible.
- **Prioritization and Phasing**: CIPs were evaluated using a weighted prioritization framework addressing public safety, property impacts, infrastructure condition, regulatory complexity, feasibility, water quality, and trash capture opportunities.

Drainage Deficiency Analysis Results

The drainage deficiency analysis confirms that flooding in Crescent City is driven by a combination of flat coastal topography, tidally influenced outfalls, undersized or deteriorating infrastructure, and increasingly intense rainfall. Under existing conditions, flooding is concentrated in low-lying areas, along Highway 101 and other major arterials, and within older residential and commercial neighborhoods with limited drainage capacity. Modeled results indicate that flood extent, depth, and duration increase notably under larger storm events and future climate projections.

The drainage deficiency analysis identified capacity constraints and operational issues across all ten drainage groups, with significant flooding in Drainage Groups 5, 4, 2, and 3. These areas include drainage infrastructure assessed to be in emerging or critical condition and exhibit recurring flooding near critical roadways and dense development.

Capital Improvement Projects and Costs

The SDMP identifies a set of Capital Improvement Projects organized by drainage group. Proposed improvements collectively provide substantial reductions in modeled flooding under present-day design storms and meaningful resilience benefits under future climate scenarios. Planning-level opinions of probable cost were developed for each CIP, including construction, engineering and construction management, and anticipated environmental compliance and permitting.

The total program-level Class V cost for implementation of all recommended CIPs is **$53,000,000**, reflecting the extent of infrastructure upgrades required to achieve the desired level of service across the City. These estimates establish a reasonable planning foundation for budgeting, grant applications, and coordination with funding agencies.

Prioritization and Recommended Phasing

Based on the prioritization analysis, drainage groups were classified into High, Medium, and Low priority categories to support strategic sequencing of capital investments:

– **High Priority**: Drainage Groups 5, 4, 2, and 3, which affect critical access routes, experience extensive flooding near homes and businesses, and contain aging infrastructure in poor condition.
– **Medium Priority**: Drainage Groups 8, 9, 10, and 1, where flooding impacts are more localized but improvements still provide measurable risk reduction and asset renewal benefits.
– **Low Priority**: Drainage Groups 6 and 7, which experience limited flooding and fewer impacts to critical facilities or transportation corridors.

A phased implementation strategy was developed to account for hydraulic interdependencies, constructability, and regulatory complexity. **Near-term (Phase A)** projects focus on downstream improvements that increase system capacity and provide the greatest systemwide benefit, followed by **mid-term (Phase B)** and **long-term (Phase C)** projects as funding and coordination allow.

Conclusions

This Storm Drain Master Plan provides Crescent City with a framework to reduce flood risk, improve stormwater system performance, and plan for future climate conditions. The Plan integrates robust technical analysis with implementation guidance and establishes a prioritized and phased set of CIPs for capital investment. As projects advance, continued coordination with regulatory agencies, refinement of cost estimates, and periodic updates to the SDMP are recommended to incorporate new data, completed improvements, and evolving community needs.

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1. Introduction

The City of Crescent City (City) is located in Del Norte County near the coastal Oregon border in California, approximately 85 miles north of Eureka, CA. Like other communities on California's North Coast, the City records some of the highest mean annual precipitation totals in the State. From 1991 – 2020, the City observed a mean annual precipitation total of 52.9 inches (NOAA, 2020). The purpose of the City's stormwater drainage system is to provide conveyance of rainfall from developed areas within the City's boundary to outfall points. Residents and property owners benefit from this system because it reduces flooding which reduces property damage and increases public health and safety.

The City is in need of an updated inventory of existing stormwater infrastructure and recommended improvements to the stormwater drainage system to assist in keeping residents from being subjected to flooding in their homes, yards, streets, and other locations where services are accessed. A significant proportion of the stormwater infrastructure was constructed in piece-wise projects over the course of 50+ years, with many of these projects having non-stormwater related goals but stormwater elements, such as road improvements, parking lots, public facilities, etc. Furthermore, the California Department of Water Resources' Climate Change Technical Advisory Group has forecasted an increase in precipitation intensity for all design storms as a result of climate change. The Storm Drain Master Plan includes data collection of the existing infrastructure, an analysis of hydrology and hydraulic drainage deficiencies, and an equity-informed list of proposed projects that prioritize the most critical areas requiring drainage enhancement. The Crescent City Storm Drain Master Plan considers the area located within the City's boundary illustrated below in **Figure 1**.

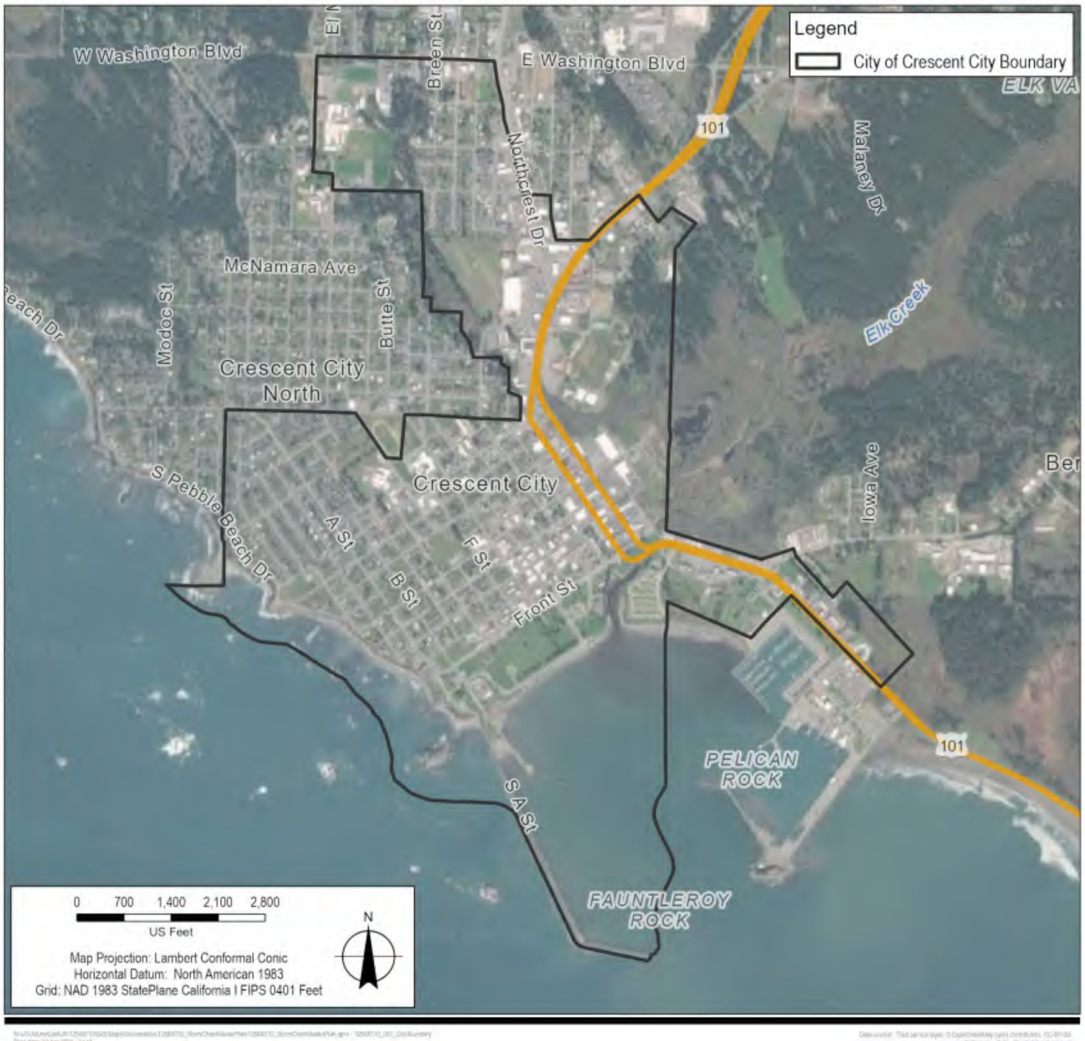

Figure 1.1 City of Crescent City Boundary.

1.1 Purpose

The purpose of the Storm Drain Master Plan is to propose stormwater drainage system improvements that provide a certain level of service to the community. The drainage system improvements were developed to mitigate flooding in homes, yards, streets, and other locations where services are accessed. *The overall objective of the Storm Drain Master Plan is to inform capital investment and sequencing of drainage infrastructure improvements for Crescent City*. The scope of work to prepare the Master Plan included the following tasks:

1. **Inventory.** Update inventory of existing storm drain system via mapping and field surveying.
2. **Base Condition H&H Model.** Develop hydrology and hydraulics drainage deficiency analysis of the existing stormwater infrastructure using PCSWMM modelling software.
3. **Flood Evaluation.** Identify potential flood hazards and problem areas in each drainage basin under simulated design storm scenarios.
4. **Proposed Condition H&H Model.** Update hydrology and hydraulics drainage analysis in PCSWMM with proposed improvements to evaluate its projected reduction in flood impacts.
5. **Recommend Improvements.** Identify and prioritize an equity-informed list capital improvements projects (CIP) with cost estimates based on the City's priorities, anticipated costs, and projected reduction in flood impacts.

1.2 Scope and Limitations

This report: has been prepared by GHD for City Of Crescent City and may only be used and relied on by City Of Crescent City for the purpose agreed between GHD and City Of Crescent City as set out in section 1.3 of this report.

GHD otherwise disclaims responsibility to any person other than City Of Crescent City arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report (refer section 1.3 of this report). GHD disclaims liability arising from any of the assumptions being incorrect.

Accessibility of documents

If this report is required to be accessible in any other format, this can be provided by GHD upon request and at an additional cost if necessary.

1.3 Assumptions

The Hydrology and Hydraulics (H&H) analysis supporting development of the Capital Improvement Projects (CIPs) was prepared based on assumptions regarding outfall boundary conditions and the accuracy of GPS equipment used during field data collection. Model reliability is dependent on the quality and completeness of available data describing existing, planned, and partially constructed storm drainage infrastructure, which was supplemented and refined through field reconnaissance. The datasets used to develop and support flow routing and modeling assumptions are documented in the flow routing metadata provided in **Appendix A**.

2. Project Background

2.1 Summary of Existing Storm Drain System

The existing storm drain network is a combination of open channel flow, underground conduit gravity flow systems, and storm water detention basins. The City’s storm drainage routes to ten (10) outfalls, nine (9) of which are considered tidally influenced outfalls and one (1) that drains eastward into the adjacent Elk River Estuary. See Section 3 below for further details of the City’s existing storm drain infrastructure inventory. The City’s understanding of the existing storm drainage infrastructure is based on historic knowledge of its maintenance crew and does not have detailed documentation of the pipe diameter, material and relative condition. However, most drainage inlets and connecting conduit locations are known, see Figure 2.1 below for the preliminary storm drain infrastructure data provided by the City. Through field data collection, the location, depth, and relative condition of the manholes and drainage inlets in the system were documented and utilized in the H&H analysis. Additionally, the conduit material, buried depth, diameter, and relative condition were recorded and documented through field data collection. See Section 3 below for further details of field data collection methodology and results.

Figure 2.1 Existing Storm Drain Infrastructure Map in Crescent City.

2.2 Regulatory Requirements

As of 2025, Del Norte County does not have a single, standalone stormwater drainage manual. Del Norte County typically defers to California Department of Transportation's (CalTrans) stormwater design standards. Stormwater drainage systems in Del Norte County are regulated by permits issued by the California State Water Resources Control Board.

2.2.1 NPDES Phase II MS4 Permit

In 2013, the California State Water Resources Control Board (SWRCB) permitted the City's storm drain system under the National Pollutant Discharge Elimination System (NPDES) General Permit for Waste Discharge Requirements for

Stormwater Discharges from Small Municipal Separate Storm Sewer Systems (MS4s), hereby known as the Phase II MS4 Permit. The Phase II MS4 Permit required the City to develop and implement a stormwater management program and establish legal authority to enforce stormwater controls through ordinances and policies. The stormwater management program intends to create and maintain facility inventories and maps, illicit discharge detection and elimination programs, pollution prevention and good housekeeping practices, construction and post-construction runoff controls, and asset maintenance plans for MS4 infrastructure.

Phase II MS4 Permittees must develop a Long-term Asset Operation and Improvement Plan within five years of the permit's effective date and update it annually as new storm drain system components are inventoried and assessed. The plan must include a prioritized schedule for maintenance, rehabilitation, replacement, and installation of new assets, along with a list of known infrastructure repairs, deferred maintenance needs, and a 20-year forecast of implementation costs. It must also include a financial strategy comparing projected costs to available funding sources to ensure sustained asset management and service performance.

The Storm Drain Master Plan intends to assist the City in meeting the requirements of the Long-term Asset Operation and Improvement Plan.

2.2.2 Trash Capture

In 2015, the SWRCB adopted statewide Trash Provisions to address the pervasive impacts trash has on the beneficial uses of the state's surface waters. The provisions prohibit the deposition of trash where it may be discharged into waters of the State and apply to all municipal separate storm sewer system (MS4), industrial, and construction NPDES permittees.

As a permittee under the current Phase II MS4 Permit, the City of Crescent City is subject to the provisions. On June 1, 2017, State Water Resources Control Board Executive Director sent 13383 Orders to traditional and non-traditional Small MS4 permittees informing them of the Trash Provisions. However, a review of the letters in the State Water Board's Stormwater Multiple Application and Report Tracking System (SMARTS) does not show a record of a letter having been sent to the City. As such, it is not known if the City was officially notified of their requirements under the Trash Provisions.

The Trash Provisions specifically require that Phase II MS4 permittees implement trash controls in Priority Land Uses within their jurisdictions. Priority Land Use Areas are defined as the following:

- High Density Residential – All land uses with at least ten (10) developed dwelling units/acre.
- Industrial – Land uses where the primary activities on the developed parcels involve product manufacture, storage, or distribution (e.g., manufacturing businesses, warehouses, equipment storage lots, junkyards, wholesale businesses, distribution centers, or building material sales yards).
- Commercial – Land uses where the primary activities on the developed parcels involve the sale or transfer of goods or services to consumers (e.g., business or professional buildings, shops, restaurants, theaters, vehicle repair shops, etc.).
- Mixed Urban – Land uses where high-density residential, industrial, and/or commercial land uses predominate collectively (i.e., are intermixed).
- Public Transportation Stations – Facilities or sites where public transit agencies' vehicles load or unload passengers or goods (e.g., bus stations and stops).

An exhibit showing the City's Priority Land Uses is provided in **Attachment 1**.

Under the provisions, permittees are required to comply with the discharge prohibitions through one of two measures, defined in the provisions as Tracks:

- Track 1 – Install, operate, and maintain full capture systems for storm drains that capture runoff from priority land use areas, or

- Track 2 – Install, operate, and maintain any combination of full capture systems, multi-benefit projects, other treatment controls, and/or institutional controls. The discharger shall demonstrate that such combination achieves full capture system equivalency.

Institutional controls are non-structural best management practices (i.e., no structures are involved) that may include, but not be limited to, street sweeping, sidewalk trash bins, collection of the trash, anti-litter educational and outreach programs, producer take-back for packaging, and ordinances.

A full capture system is defined as a treatment control, or series of treatment controls, including, but not limited to, a multi-benefit project or a low-impact development control that traps all particles that are 5 mm or greater, and has a design treatment capacity that is either: a) of not less than the peak flow rate, Q, resulting from a one-year, one-hour, storm in the subdrainage area, or b) appropriately sized to, and designed to carry at least the same flows as, the corresponding storm drain. Typical systems used for this approach include catch basin inserts and high flow capacity inline pipe systems such as proprietary hydrodynamic separators. Because these devices often contain a series of weirs and screens to direct and treat stormwater flows, the devices can often have a significant hydraulic impact on the storm drain system in which they are installed.

3. Equity Analysis

Understanding the locations of and impacts to disadvantaged populations and communities with equity concerns is an important aspect of city planning in general and is necessary to be in alignment with the ultimate goal of supporting communities to not only survive, but to thrive. This Equity Analysis applied data analysis and geospatial mapping tools to public data to provide a contextual presentation of disadvantaged[1] populations and communities with equity concerns, including physical and socioeconomic vulnerabilities.

The equity analysis finds that Crescent City is disadvantaged under both California state definitions (AB 1550 and Water Code 79505.5) and federal Justice40 and Inflation Reduction Act criteria, at both the citywide level and across all census block groups intersecting the city. Using a demographic index derived from American Community Survey and EPA EJScreen data, including income, race and ethnicity, age, education, and life expectancy, the analysis shows that socioeconomic vulnerability in Crescent City is higher than the California average. Citywide conditions include lower median household income, higher poverty and unemployment rates, a high proportion of renter-occupied housing, and elevated disability rates. NOAA Fisheries' Community Social Vulnerability Index further identifies high vulnerability related to poverty, labor force structure, housing burden, and personal disruption, reinforcing the conclusion that the community experiences overlapping social and economic stressors.

At the census block group level, the analysis provides additional refinement to distinguish relative levels of vulnerability within the city, even though all block groups qualify as disadvantaged for funding eligibility. Block Group 060150001012 ranks highest in potential socioeconomic vulnerability based on the demographic index and cumulative scoring, reflecting concentrated poverty, housing burden, and related stressors, while other block groups exhibit progressively lower, though still elevated, levels of vulnerability relative to the state mean. Environmental exposure indicators such as underground storage tanks and traffic proximity are generally low compared to state and national averages, but flood risk and coastal hazards remain important considerations given the city's location. Overall, the findings are intended to inform equitable prioritization of storm drain improvement projects so that infrastructure investments and benefits are directed toward areas and populations with the greatest combined social and economic vulnerability.

The cumulative equity scores are applied to each drainage project in the GIS dataset and the complete equity analysis technical memorandum with maps is provided in **Appendix B**.

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[1] Disadvantaged as defined in accordance with Final Designation of Disadvantaged Communities Pursuant to Senate Bill 535. May 2022. ***Final Designation of Disadvantaged Communities Pursuant to SB535, 2022 (ca.gov)**. Accessed 3/26/2024. More information: **Low-Income or Disadvantaged Communities Designated by California - Dataset - California Natural Resources Agency Open Data**. Accessed 3/26/2024.

4. Data Collection Field Surveys

Data Collection → Model → Analysis → Project → Priority → Phase

Data collection was performed to develop a full inventory of the City's storm drain infrastructure and to support the H&H analysis used for Storm Drain Master Plan and CIP development. Efforts included verification of watershed and sub-watershed boundaries, surface flow routing, and expansion and conformance of the digital elevation model (DEM) to adequately capture contributing drainage areas. Using PCSWMM watershed delineation outputs, hydrologists field-verified flow directions, boundaries, and areas of permissible flooding, with data prioritized in lower-elevation and higher-energy portions of the system where model sensitivity is greatest. Concurrent field investigations documented existing drainage infrastructure, including detailed condition assessments and elevation data for junctions, conduits, and outfalls using GPS-based surveying and standardized field forms. Background studies, historical as-built records, permit information, and known flood incident reports were reviewed and incorporated to validate field data and refine model assumptions. Collected and processed field data were integrated into the PCSWMM model to represent existing conditions, calibrate hydraulic parameters, and establish a basis for identifying deficiencies and evaluating CIP alternatives. Additional details on data requirements, review of available data, and field surveys of existing drainage infrastructure are provided in **Appendix C**.

5. Computational Model Development

Data Collection → ***Model*** → Analysis → Project → Priority → Phase

The City's stormwater system performance was evaluated using a H&H model developed in PCSWMM. The model integrates field-collected storm drain infrastructure data, high-resolution topographic information, and watershed delineation to represent existing drainage conditions throughout the City. Design storms corresponding to the 2-, 10-, and 50-year, 24-hour return periods were applied using NOAA Atlas 14 precipitation data, with downstream boundary conditions defined for both tidally influenced and non-tidal outfalls. The model simulates dual drainage behavior by representing both the underground pipe network and surface conveyance pathways and applies one-dimensional and two-dimensional analyses to quantify the location, depth, duration, and extent of flooding. The resulting model outputs form the basis for identifying drainage deficiencies and evaluating the effectiveness of proposed improvements. Additional details on model development, assumptions, and parameterization are provided in **Appendix D**.

6. Drainage Deficiency Analysis of Existing Conditions

Data Collection → Model → ***Analysis*** → Project → Priority → Phase

6.1 Overview of Flooding

To assess the drainage performance of the existing drainage network (Base Conditions), the hydraulic performance was assessed through a hydrologic analysis utilizing the 10-year, 24-hour design storm and 50-year, 24-hour design storm with accompanying tidal outfall conditions. See **Appendix D** for further details on the design storm selection and for tidal outfall conditions analysis. The 1-dimensional analysis was developed to assess the points of drainage failure, for example an overflowing drainage inlet. The 2-dimensional analysis was developed to assess the extent, depth and duration of flooding throughout the City. The modeled extent, depth and duration of flooding under a 10-year, 24-hour design storm within City boundaries is presented below in **Figure 6.1**. The modeled extent, depth and duration of flooding under a 50-year, 24-hour design storm within City boundaries is presented below in **Figure 6.2**.

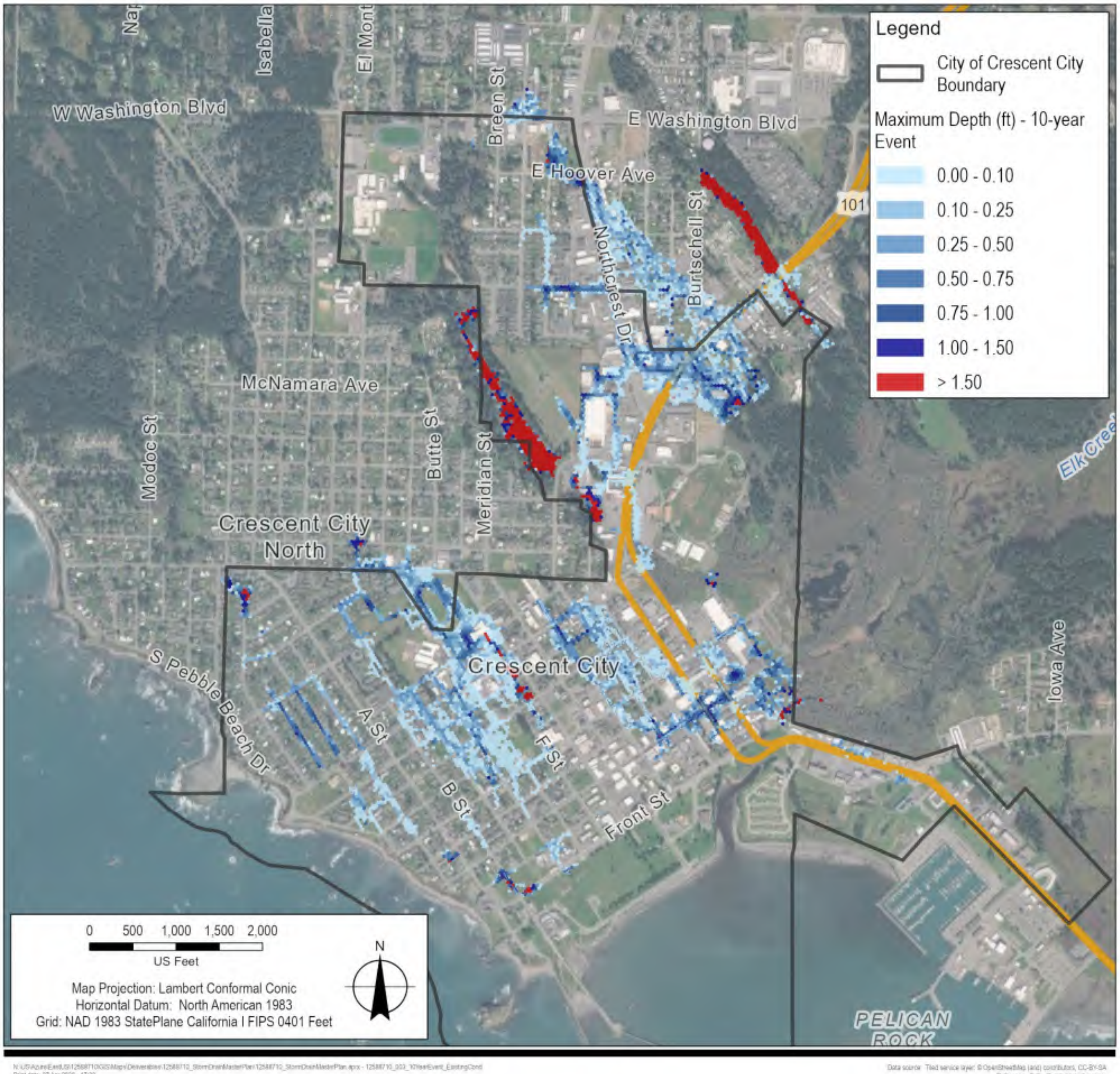

Figure 6.1 ***Flooding Extent and Depth under Existing Condition – 10-year, 24-hour SCS Type 1A Storm***

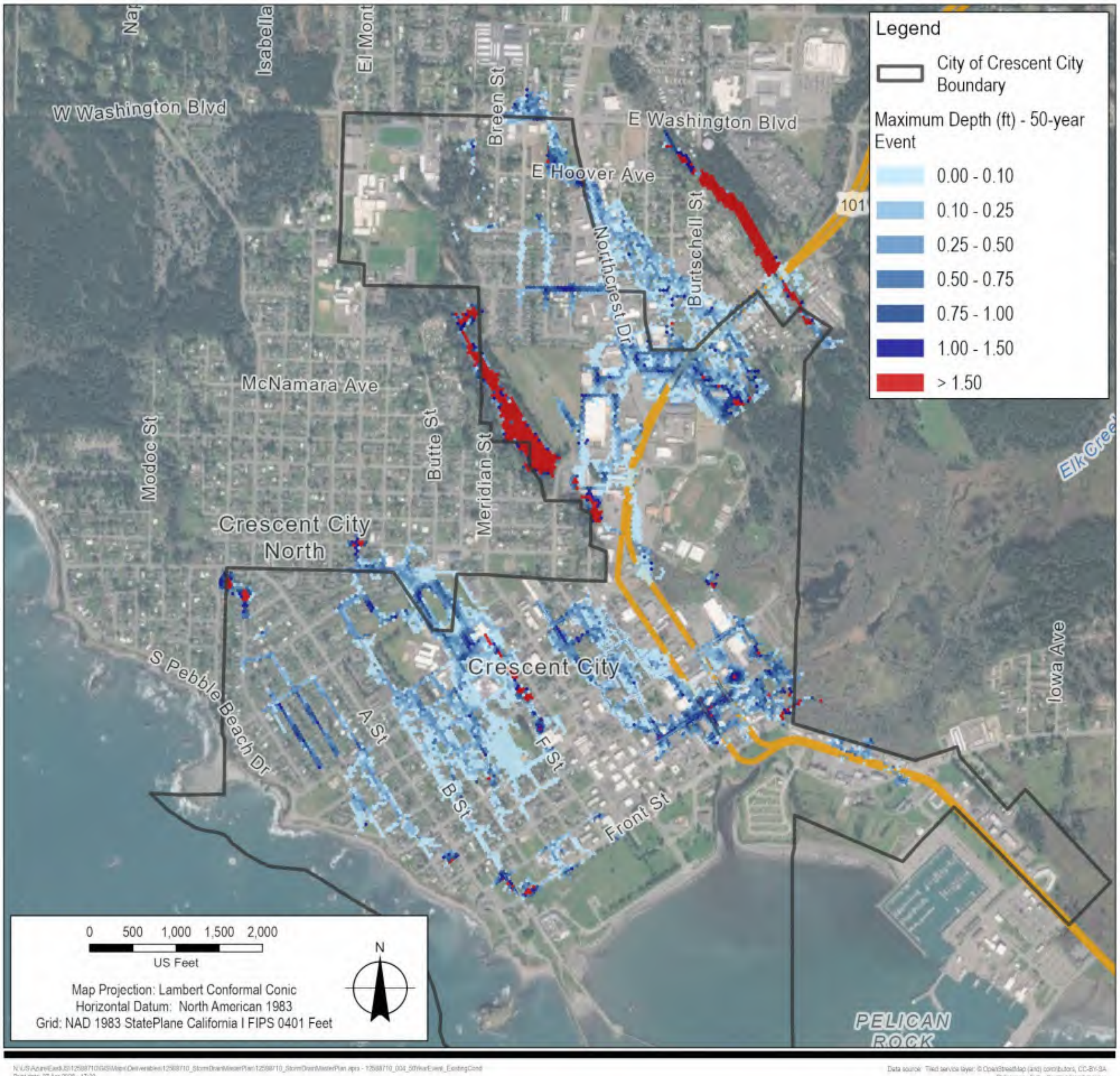

Figure 6.2 Flooding Extent and Depth under Existing Condition – 50-year, 24-hour SCS Type 1A Storm

6.2 Summary of Systemwide Performance

Under a 10-year, 24-hour duration SCS Type 1A storm, the model shows that flooding in Crescent City is concentrated in low-lying coastal and near-coastal areas, major roadway corridors, and older residential/commercial neighborhoods where storm drainage capacity is limited and outfalls are tidally influenced. Recurring flooding is commonly observed at street sag points, intersections, and along collector and arterial roadways, particularly where surface flow converges upstream of constrained pipes or tidal backwater conditions.

Along Highway 101, flooding is documented in multiple drainage groups, notably near Wilson Avenue, the fairgrounds area, and where the highway transitions to divided sections, indicating sensitivity to both roadway geometry and downstream constraints. In central Crescent City west of Highway 101, systemic flooding occurs along C Street, 2nd Street, 3rd Street, 4th Street, 5th Street, F Street, J Street, and L Street, with repeated impacts at intersections such as 2nd & B, 3rd & J, 5th & F, 4th & J, and 8th & F, reflecting cumulative effects of flat topography and dense drainage networks.

Southern and southwestern residential areas experience localized flooding along Gary Street, Gainard Street, Condor Street, and W 9th Street, while additional coastal flooding affects areas near W 5th Street, Taylor Street, Wendell Street, and W 4th Street, where outfall performance is directly influenced by tidal conditions. Several drainage groups indicate that debris-restricted or poorly performing outfalls (particularly along the coast and near Lighthouse Way) can reroute flows into adjacent drainage systems, exacerbating flooding on nearby streets such as 2nd Street despite minimal flooding within the contributing drainage group itself.

Overall, flooding patterns consistently align with tidally influenced outfalls, undersized or aging pipe infrastructure, flat coastal topography, and roadway sag locations, with impacts concentrated in public rights-of-way but occasionally extending into adjacent parking lots, parks, and low-lying private properties.

6.3 Summary of Flooding by Drainage Group

To group the specific drainage deficiencies, the City’s drainage infrastructure was first divided into ten drainage groups based on the downstream outfalls the infrastructure drains to. After the drainage groups were established, all grate inlets, culvert inlets, and manholes with flooding in the model were further investigated to determine the potential cause of flooding. The cause of the deficiencies was used to inform the development of CIPs in **Section 7**. A key map of the drainage groups is presented in **Figure 6.3**.

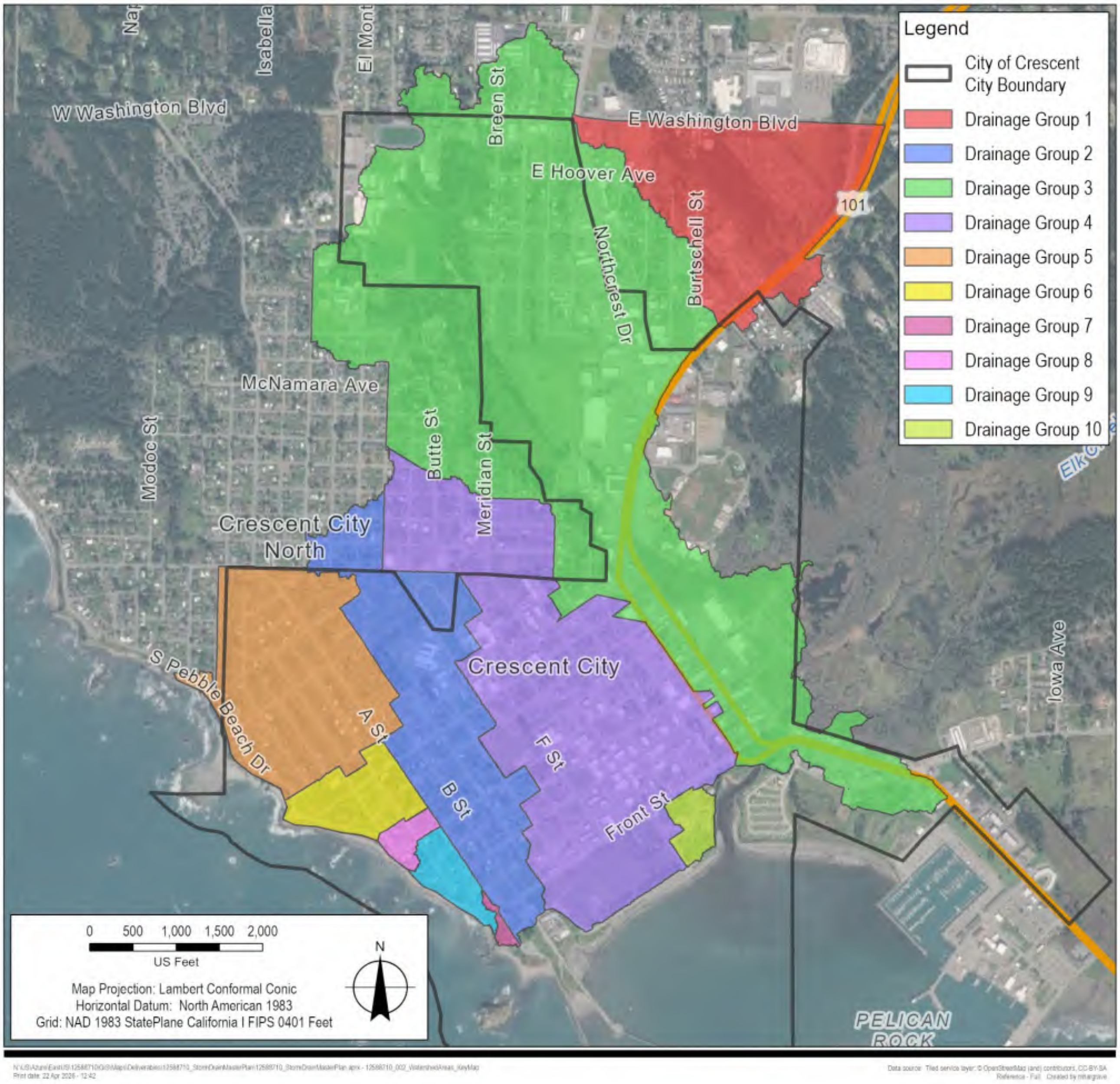

Figure 6.3 Key Map of Drainage Groups – Existing Conditions

6.3.1 Drainage Group 1

Drainage Group 1 collects stormwater from Highway 101 and a few residential areas west of Highway 101. The stormwater is discharged into a tributary of Elk Creek at normal depth. Under the simulated 10-year storm and tidal event, flooding occurs on the southbound side of Highway 101. **Figure 6.4** presents a map of the storm drain system, subcatchments, and junctions with flooding within Drainage Group 1 under the simulated 10-year storm and tidal event. **Table 6.1** provides the lengths of existing storm drain pipes by material and nominal diameter within Drainage Group 1. **Table 6.2** provides the quantities of drainage inlets and manholes as well as flood volume and duration within Drainage Group 1.

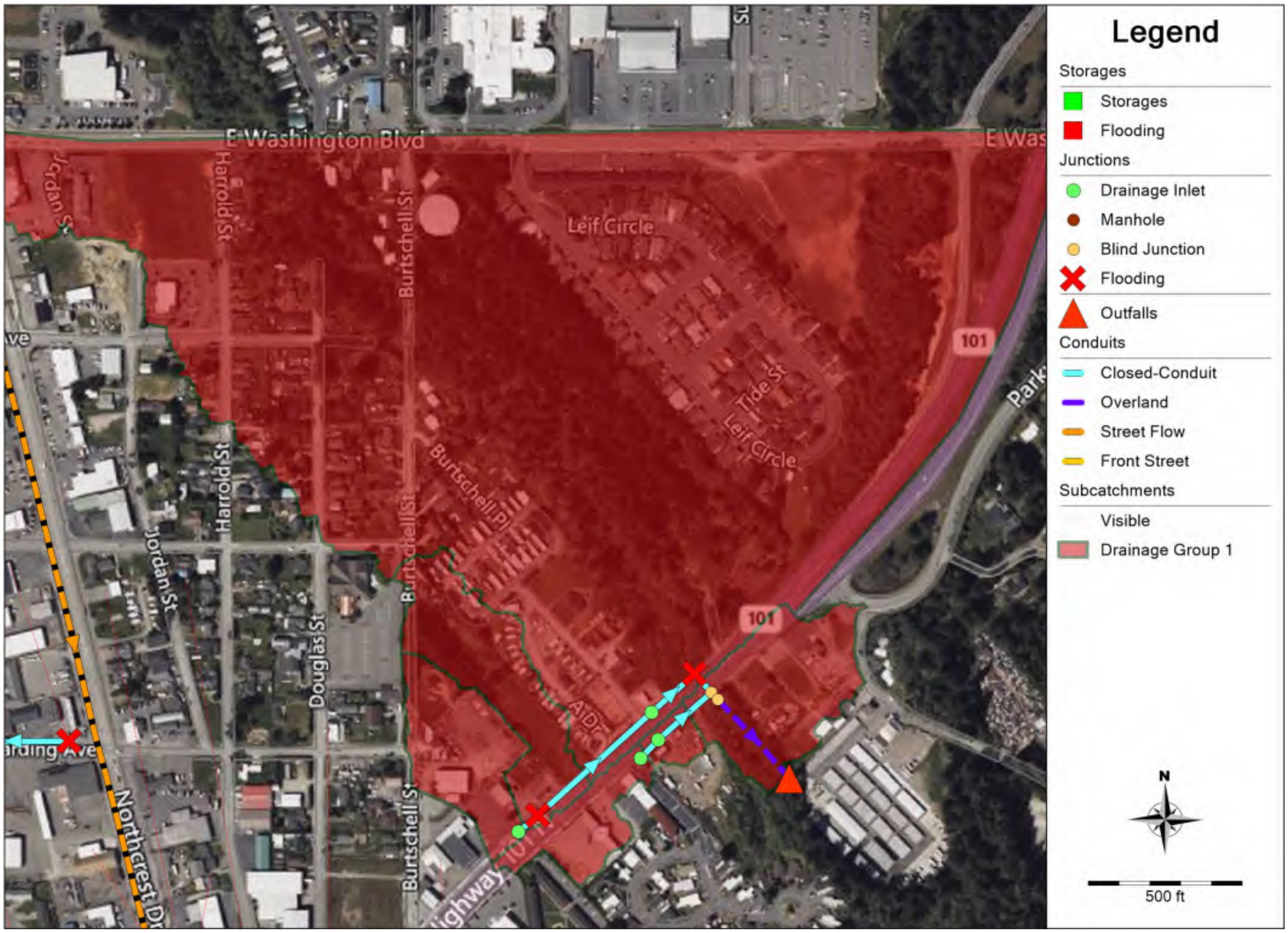

Figure 6.4 Flooding Location(s) within Drainage Group 1 for the 10-year Storm and Tidal Event.

Table 6.1 Existing Pipe Network by Material, Diameter, and Linear Feet within Drainage Group 1

Material	Diameter (ft)	Linear Feet (ft)
Concrete	1	843.75
Concrete	1.5	230.04
HDPE	1.5	81.51

Table 6.2 Existing Number of Drainage Inlets and Manholes within Drainage Group 1

Type	Number	Total flooded volume (MG)	Maximum Flood Rate (cfs)	Maximum Duration of Flooding (hrs)	Maximum Duration of Surcharge (hrs)
DI	6	9.80	96.51	22.75	22.88
MH	0	-	-	-	-

6.3.2 Drainage Group 2

Drainage Group 2 collects stormwater from few residential areas approximately located between A Street, E Street, and Pacific Avenue. It also collects stormwater from Jon Hamilton Elementary School and parts of Crescent Elk

Elementary School including the athletic field. The stormwater is discharged at an outfall along the beach near B Street Pier and into Crescent Harbor at a tidal depth. Most storm drains are located within the right-of-way, but one storm drain between 6th Street and 5th Street is routed under private property along B Street. Under the simulated 10-year storm and tidal event, flooding occurs all along the eastern tributary of the storm drain system as far upstream as Pacific Avenue. Some flooding also occurs at the intersection of 2nd Street and B Street. **Figure 6.5** presents a map of the storm drain system, subcatchments, and junctions with flooding within Drainage Group 2 under the simulated 10-year storm and tidal event. **Table 6.3** provides the lengths of existing storm drain pipes by material and nominal diameter within Drainage Group 2. **Table 6.4** provides the quantities of drainage inlets and manholes as well as flood volume and duration within Drainage Group 2.

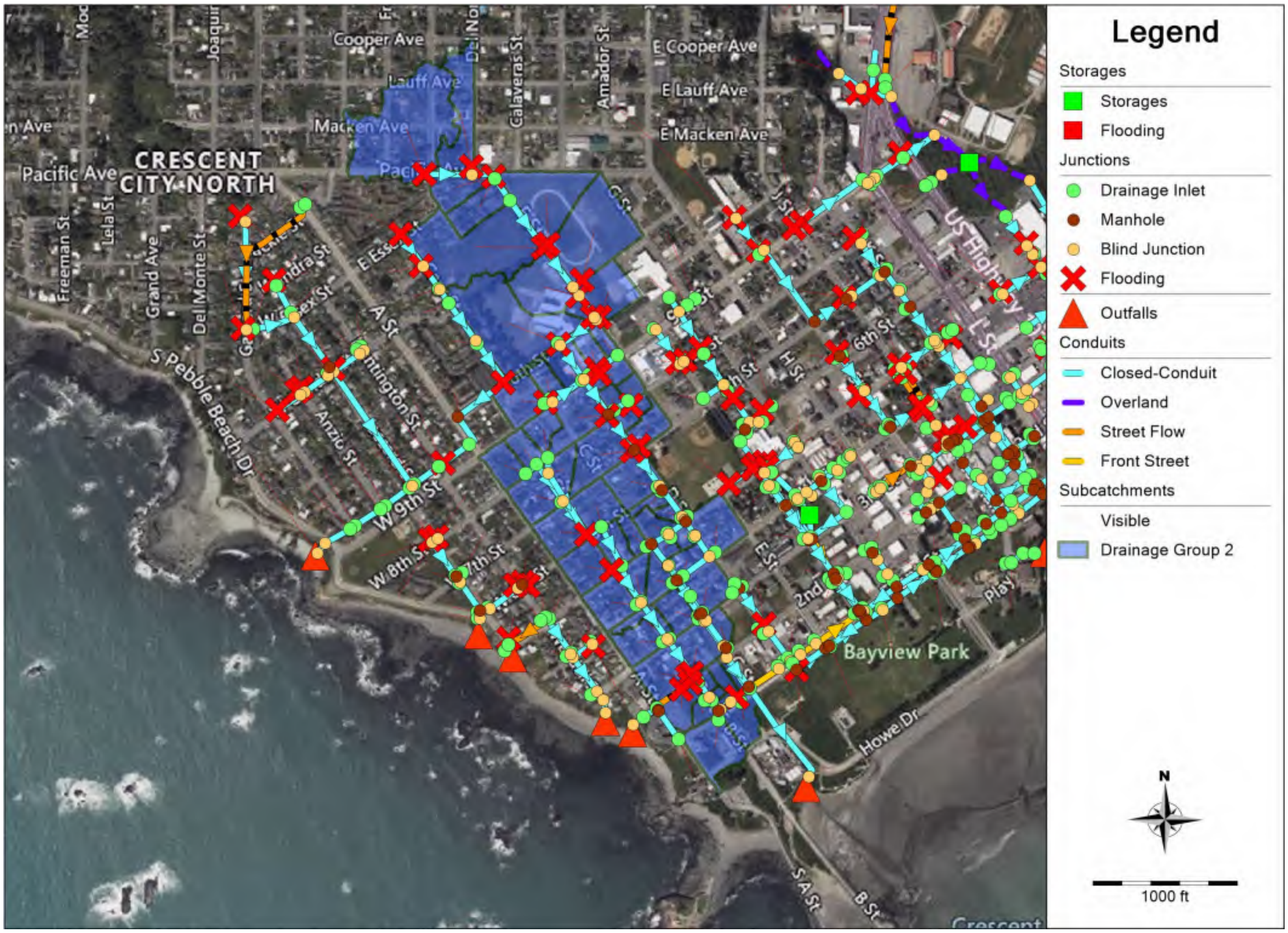

Figure 6.5　Flooding Location(s) within Drainage Group 2 for the 10-year Storm and Tidal Event

Table 6.3　Existing Pipe Network by Material, Diameter, and Linear Feet within Drainage Group 2

Material	Diameter (ft)	Linear Feet (ft)
Concrete	0.5	13.60
Concrete	0.67	15.71
Concrete	0.75	75.42
Concrete	0.83	108.19
Concrete	1	4710.84
HDPE	1	441.98

Material	Diameter (ft)	Linear Feet (ft)
Concrete	1.25	745.48
HDPE	1.25	52.01
HDPE	1.3	39.06
Concrete	1.5	80.52
HDPE	1.5	58.26
HDPE	2	553.94
Concrete	2	3764.68
Concrete	3	1225.22
HDPE	4	10.62
Concrete	4	783.52

Table 6.4 Quantities of Junctions and Flooding Results within Drainage Group 2 for the 10-year Storm and Tidal Event

Type	Number	Total flooded volume (MG)	Maximum Flood Rate (cfs)	Maximum Duration of Flooding (hrs)	Maximum Duration of Surcharge (hrs)
DI	69	6.70	14.67	22.62	23.65
MH	11	-	-	-	22.61

6.3.3 Drainage Group 3

Drainage Group 3 collects stormwater from the streets, commercial areas, and industrial areas along Highway 101 south of Drainage Group 1. It also collects stormwater from the Del Norte County Veterans Cemetery and residential areas north and west of the cemetery. The stormwater is discharged at an outfall into Elk Creek between the crossing of Highway 101 southbound and Elk Creek's mouth into Crescent Bay. Most storm drains are located within the right-of-way, but some storm drains are routed under residential private property and commercial parking lots. Furthermore much of the stormwater northwest of Highway 101 is routed into a network of natural channels and storages. Under the simulated 10-year storm and tidal event, flooding occurs along Highway 101 near its intersection with Wilson Avenue, near the Del Norte County Fairgrounds, and in the commercial area where Highway 101 splits into a divided highway. **Figure 6.6** presents a map of the storm drain system, subcatchments, and junctions with flooding within Drainage Group 3 under the simulated 10-year storm and tidal event. **Table 6.5** provides the lengths of existing storm drain pipes by material and nominal diameter within Drainage Group 3. **Table 6.6** provides the quantities of drainage inlets and manholes as well as flood volume and duration within Drainage Group 3.

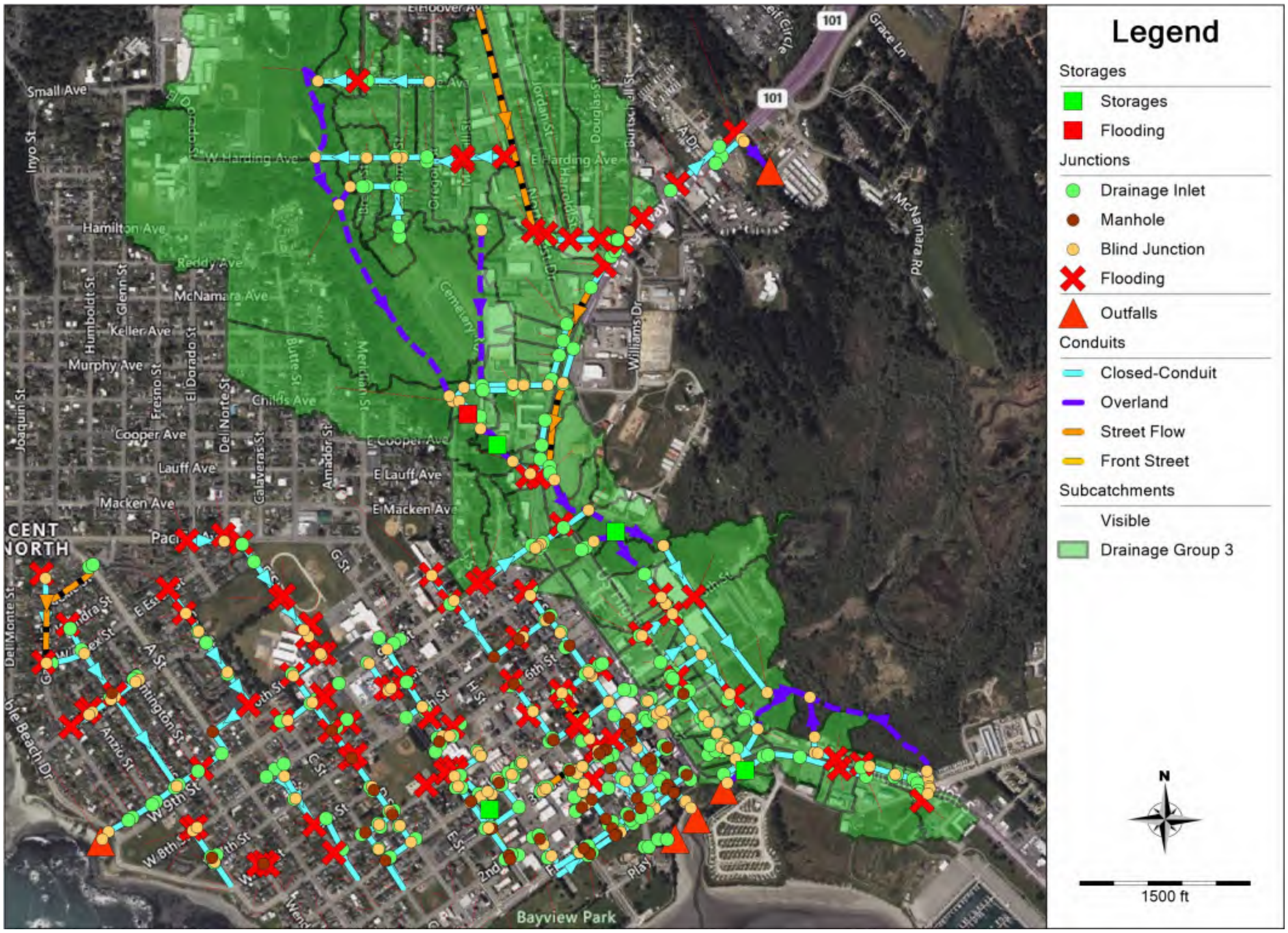

Figure 6.6 Flooding Location(s) within Drainage Group 3 for the 10-year Storm and Tidal Event

Table 6.5 Existing Pipe Network by Material, Diameter, and Linear Feet within Drainage Group 3

Material	Diameter (ft)	Linear Feet (ft)
PVC	0.5	95.54
PVC	0.67	598.80
CMP	0.75	40.75
PVC	0.75	26.80
Concrete	1	6043.95
PVC	1	22.35
HDPE	1.2	20.77
Concrete	1.25	1652.55
HDPE	1.25	124.52
CMP	1.5	180.65
Concrete	1.5	6511.89
HDPE	1.5	139.53
Concrete	2	1901.31

Material	Diameter (ft)	Linear Feet (ft)
Concrete	2.25	195.49
Concrete	2.5	1722.75
Concrete	2.75	225.64
Concrete	3	1176.30
Concrete	4	82.12
Concrete	6	547.50

Table 6.6 Quantities of Junctions and Flooding Results within Drainage Group 3 for the 10-year Storm and Tidal Event

Type	Number	Total flooded volume (MG)	Maximum Flood Rate (cfs)	Maximum Duration of Flooding (hrs)	Maximum Duration of Surcharge (hrs)
DI	129	17.58	19.43	23.18	23.56
MH	1	-	-	-	-

6.3.4 Drainage Group 4

Drainage Group 4 collects stormwater from the streets, residential areas, and commercial areas west of Highway 101 in between Drainage Group 2 and 3 in the heart of Crescent City. It also collects stormwater from Bayview Park and the residential area north of Pacific Avenue. The stormwater is discharged at an outfall into Elk Creek between the crossing of Highway 101 southbound and Elk Creek's mouth into Crescent Bay, downstream of the outfall for Drainage Group 3. Most storm drains are located within the right-of-way, but some storm drains are routed under residential and commercial private property. Under the simulated 10-year storm and tidal event, flooding occurs at the intersection of 5th Street and F Street, 8th Street and F Street, 5th Street and J Street, and 4th Street and J Street. Flooding also occurs near Highway 101 southbound. **Figure 6.7** presents a map of the storm drain system, subcatchments, and junctions with flooding within Drainage Group 4 under the simulated 10-year storm and tidal event. **Table 6.7** provides the lengths of existing storm drain pipes by material and nominal diameter within Drainage Group 4. **Table 6.8** provides the quantities of drainage inlets and manholes as well as flood volume and duration within Drainage Group 4.

Figure 6.7 Flooding Location(s) within Drainage Group 4 for the 10-year Storm and Tidal Event

Table 6.7 Existing Pipe Network by Material, Diameter, and Linear Feet within Drainage Group 4

Material	Diameter (ft)	Linear Feet (ft)
Concrete	0.25	19.18
PVC	0.5	9.84
Concrete	0.67	33.40
HDPE	0.67	23.12
PVC	0.67	81.72
Concrete	0.75	173.83
HDPE	0.8	198.80
Concrete	0.83	107.72
CMP	1	111.04
Concrete	1	6808.71
HDPE	1	365.39
PVC	1	374.95
CMP	1.2	24.16

Material	Diameter (ft)	Linear Feet (ft)
CMP	1.25	619.48
Concrete	1.25	1361.27
HDPE	1.25	290.42
Concrete	1.33	210.18
HDPE	1.33	69.78
HDPE	1.4	94.86
CMP	1.5	460.13
Concrete	1.5	3279.52
HDPE	1.5	165.23
PVC	1.5	250.24
Concrete	1.6	29.09
CMP	1.83	375.73
Concrete	1.83	241.25
CMP	2	43.41
Concrete	2	4464.49
HDPE	2	367.84
Concrete	2.5	844.95
HDPE	2.5	25.79
Concrete	2.67	193.30
CMP	3	956.35
Concrete	3	2628.42
HDPE	3	886.92
Concrete	4	1339.90
PVC	4	125.60
Concrete	4.5	33.79
HDPE	4.5	9.01
Concrete	5	5.69
Concrete	6	8.95
CMP	8	14.26

Table 6.8 Quantities of Junctions and Flooding Results within Drainage Group 4 for the 10-year Storm and Tidal Event

Type	Number	Total flooded volume (MG)	Maximum Flood Rate (cfs)	Maximum Duration of Flooding (hrs)	Maximum Duration of Surcharge (hrs)
DI	168	11.27	42.90	23.19	23.56
MH	59	0.02	2.02	0.41	23.46

6.3.5 Drainage Group 5

Drainage Group 5 collects stormwater from the streets and residential areas between 9th Street, Pacific Avenue, Gary Street, and S Pebble Beach Drive. The stormwater is discharged at an outfall into the Pacific Ocean south of Preston Island. The upstream storm drains are located within the right-of-way, and the downstream storm drains along W 9th Avenue are routed under residential private property. Under the simulated 10-year storm and tidal event, flooding occurs along W Condor Street, Gainard Street, and Gary Street. **Figure 6.8** presents a map of the storm drain system, subcatchments, and junctions with flooding within Drainage Group 5 under the simulated 10-year storm and tidal event. **Table 6.9** provides the lengths of existing storm drain pipes by material and nominal diameter within Drainage Group 5. **Table 6.10** provides the quantities of drainage inlets and manholes as well as flood volume and duration within Drainage Group 5.

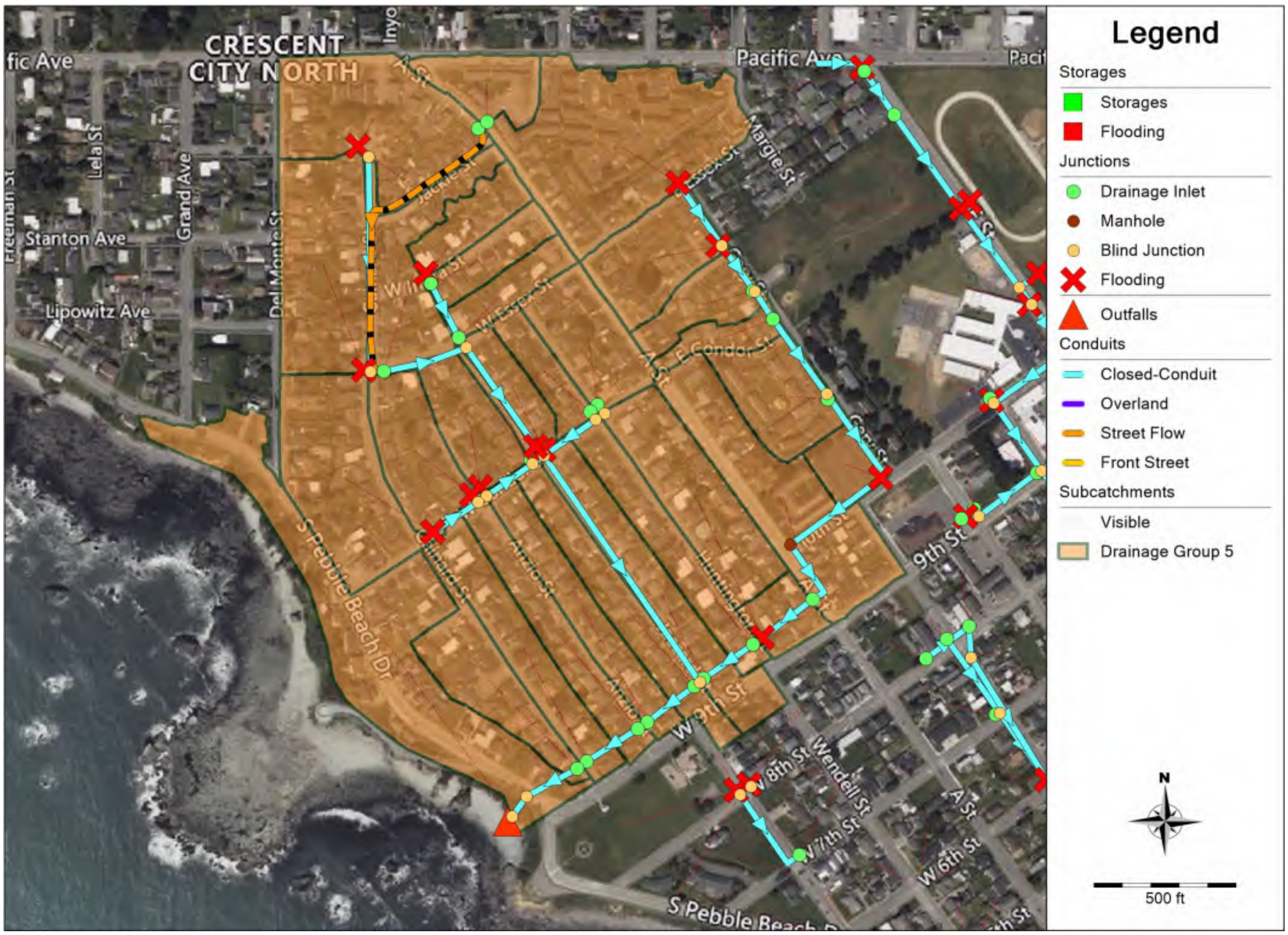

Figure 6.8 Flooding Location(s) within Drainage Group 5 for the 10-year Storm and Tidal Event

Table 6.9 Existing Pipe Network by Material, Diameter, and Linear Feet within Drainage Group 5

Material	Diameter (ft)	Linear Feet (ft)
Concrete	0.67	38.19
Concrete	1	1897.02
CMP	1.5	211.23
Concrete	1.5	1692.37

Material	Diameter (ft)	Linear Feet (ft)
Concrete	2	2387.69
Concrete	3	269.18
Concrete	3.5	210.83
Concrete	4	325.92

Table 6.10 Quantities of Junctions and Flooding Results within Drainage Group 5 for the 10-year Storm and Tidal Event

Type	Number	Total flooded volume (MG)	Maximum Flood Rate (cfs)	Maximum Duration of Flooding (hrs)	Maximum Duration of Surcharge (hrs)
DI	30	1.79	11.43	15.67	23.13
MH	2	0.02	1.82	0.68	17.85

6.3.6 Drainage Group 6

Drainage Group 6 collects stormwater from the streets and residential areas between W 9th Street, W 6th Street, A Street, and S Pebble Beach Drive. It also collects stormwater from Brother Jonathan Park and Cemetery. The stormwater is discharged at an outfall into the Pacific Ocean south of the parking area for Brother Jonathan Cemetery. The storm drains are all located within the right-of-way. Under the simulated 10-year storm and tidal event, flooding occurs at the intersection of W 8th Street and Taylor Street. **Figure 6.9** presents a map of the storm drain system, subcatchments, and junctions with flooding within Drainage Group 6 under the simulated 10-year storm and tidal event. **Table 6.11** provides the lengths of existing storm drain pipes by material and nominal diameter within Drainage Group 6. **Table 6.12** provides the quantities of drainage inlets and manholes as well as flood volume and duration within Drainage Group 6.

Figure 6.9 ***Flooding Location(s) within Drainage Group 6 for the 10-year Storm and Tidal Event***

Table 6.11 ***Existing Pipe Network by Material, Diameter, and Linear Feet within Drainage Group 6***

Material	Diameter (ft)	Linear Feet (ft)
Concrete	0.5	26.26
Concrete	0.75	42.73
HDPE	0.75	53.17
Concrete	1	723.52
HDPE	1.25	47.90
Concrete	1.5	11.51
Concrete	2	238.92
Concrete	2.5	62.98
Concrete	3	37.80
CMP	4	111.00

Table 6.12 Quantities of Junctions and Flooding Results within Drainage Group 6 for the 10-year Storm and Tidal Event

Type	Number	Total flooded volume (MG)	Maximum Flood Rate (cfs)	Maximum Duration of Flooding (hrs)	Maximum Duration of Surcharge (hrs)
DI	11	0.20	5.93	2.34	2.34
MH	3	-	-	-	0.61

6.3.7 Drainage Group 7

Drainage Group 7 collects stormwater from the Lighthouse Way and the Oceanfront Lodge. The stormwater is intended to be discharged at an outfall into the Pacific Ocean near the Oceanfront Lodge, however, the storm drain along between A Street and the outfall is clogged with sediment and debris. The stormwater flows out into 2nd Street and into the storm drain system in Drainage Group 2. Under the simulated 10-year storm and tidal event, no flooding occurs within the drainage group, however, the accumulated sediment and debris to the outfall causes flooding along 2nd Street in Drainage Group 2. **Figure 6.10** presents a map of the storm drain system, subcatchments, and junctions within Drainage Group 7 under the simulated 10-year storm and tidal event. **Table 6.13** provides the lengths of existing storm drain pipes by material and nominal diameter within Drainage Group 7. **Table 6.14** provides the quantities of drainage inlets and manholes as well as flood volume and duration within Drainage Group 7.

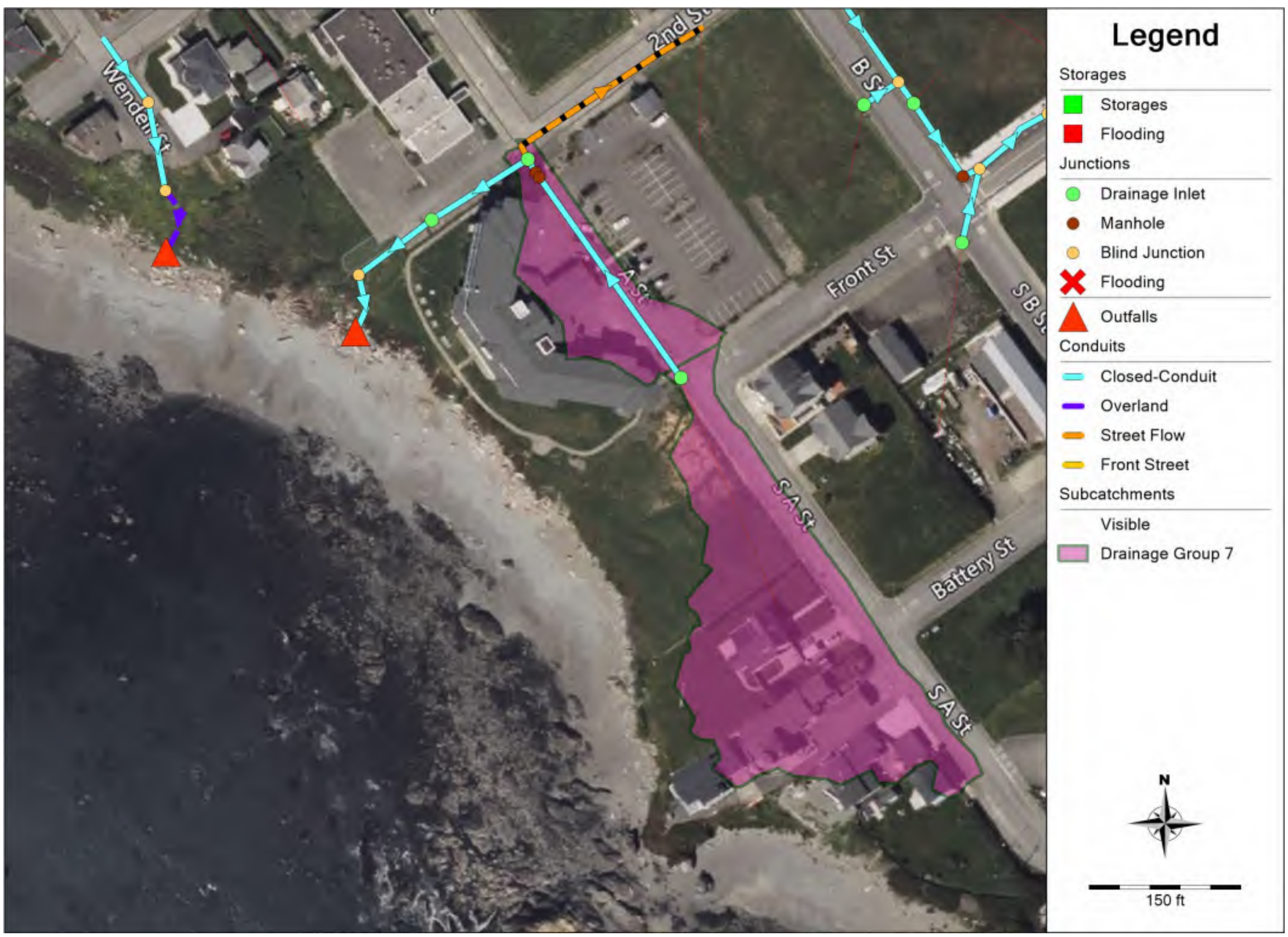

Figure 6.10 Flooding Location(s) within Drainage Group 7 for the 10-year storm and tidal event.

Table 6.13 Existing Pipe Network by Material, Diameter, and Linear Feet within Drainage Group 7

Material	Diameter (ft)	Linear Feet (ft)
CMP	1.5	14.96
Concrete	1.5	6.05
HDPE	1.5	239.22
Concrete	2	258.82

Table 6.14 Quantities of Junctions and Flooding Results within Drainage Group 7 for the 10-year Storm and Tidal Event

Type	Number	Total flooded volume (MG)	Maximum Flood Rate (cfs)	Maximum Duration of Flooding (hrs)	Maximum Duration of Surcharge (hrs)
DI	3	-	-	-	-
MH	2	-	-	-	22.95

6.3.8 Drainage Group 8

Drainage Group 8 collects stormwater between W 6th Street, W 5th Street, Taylor Street, and A Street. The stormwater is discharged at an outfall into the Pacific Ocean near the transition of W 5th Street into Taylor Street. Under the simulated 10-year storm and tidal event, flooding occurs at the intersection of Wendell Street and W 5th Street and at the transition W 5th Street into Taylor Street. **Figure 6.11** presents a map of the storm drain system, subcatchments, and junctions within Drainage Group 8 under the simulated 10-year storm and tidal event. **Table 6.15** provides the lengths of existing storm drain pipes by material and nominal diameter within Drainage Group 8. **Table 6.16** provides the quantities of drainage inlets and manholes as well as flood volume and duration within Drainage Group 8.

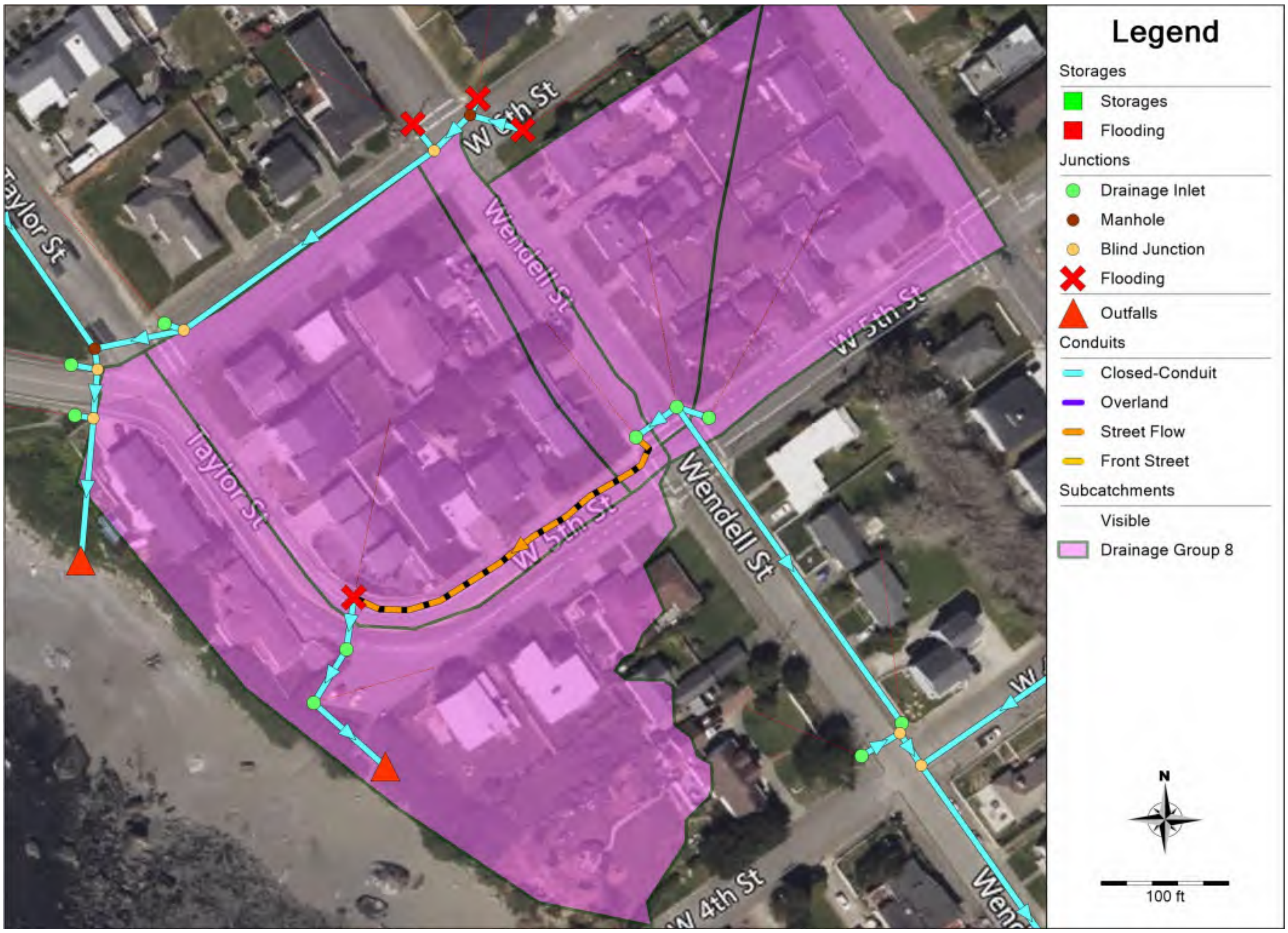

Figure 6.11 *Flooding Location(s) within Drainage Group 8 for the 10-year storm and tidal event.*

Table 6.15 *Existing Pipe Network by Material, Diameter, and Linear Feet within Drainage Group 8*

Material	Diameter (ft)	Linear Feet (ft)
Concrete	1	65.70
Concrete	1.5	89.23
Concrete	2	74.55

Table 6.16 *Quantities of Junctions and Flooding Results within Drainage Group 8 for the 10-year Storm and Tidal Event*

Type	Number	Total flooded volume (MG)	Maximum Flood Rate (cfs)	Maximum Duration of Flooding (hrs)	Maximum Duration of Surcharge (hrs)
DI	6	0.02	1.43	0.71	3.98
MH	0	-	-	-	-

6.3.9 Drainage Group 9

Drainage Group 9 collects stormwater between W 5th Street, 2nd Street, and A Street up to the coast. The stormwater is discharged at an outfall into the Pacific Ocean near the south end of Wendell Street. Under the simulated 10-year storm and tidal event, flooding occurs on W 4th Street in between Wendell Street and A Street. **Figure 6.12** presents a map of the storm drain system, subcatchments, and junctions within Drainage Group 9 under the simulated 10-year storm and tidal event. **Table 6.17** provides the lengths of existing storm drain pipes by material and nominal diameter within Drainage Group 9. **Table 6.18** provides the quantities of drainage inlets and manholes as well as flood volume and duration within Drainage Group 9.

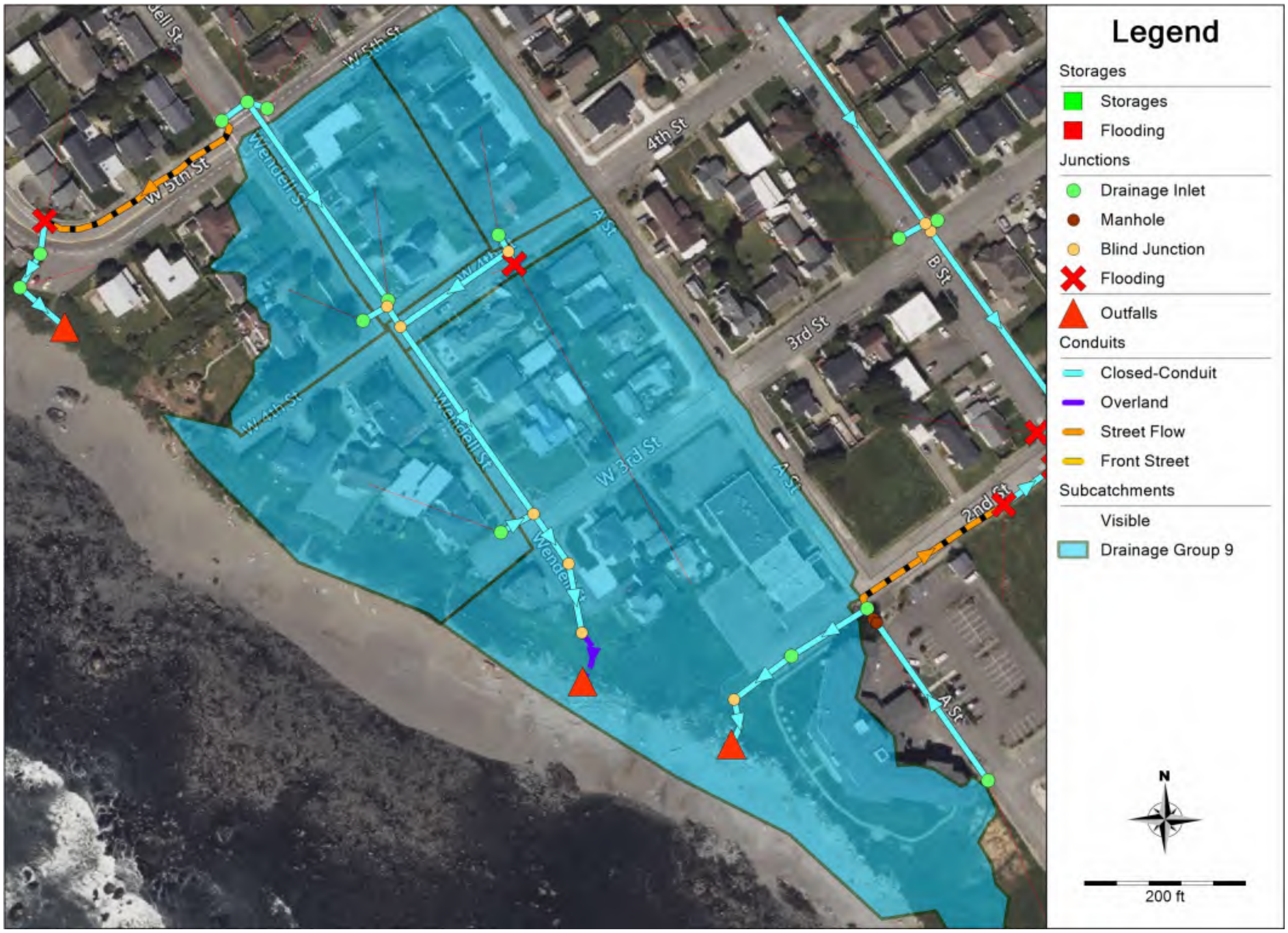

Figure 6.12 Flooding Location(s) within Drainage Group 9 for the 10-year storm and tidal event.

Table 6.17 Existing Pipe Network by Material, Diameter, and Linear Feet within Drainage Group 9

Material	Diameter (ft)	Linear Feet (ft)
CMP	1	301.29
Concrete	1	63.95
Concrete	1.5	682.99
PVC	1.5	24.04

Table 6.18 Quantities of Junctions and Flooding Results within Drainage Group 9 for the 10-year Storm and Tidal Event

Type	Number	Total flooded volume (MG)	Maximum Flood Rate (cfs)	Maximum Duration of Flooding (hrs)	Maximum Duration of Surcharge (hrs)
DI	5	0.09	7.12	0.82	0.82

Type	Number	Total flooded volume (MG)	Maximum Flood Rate (cfs)	Maximum Duration of Flooding (hrs)	Maximum Duration of Surcharge (hrs)
MH	0	-	-	-	-

6.3.10 Drainage Group 10

Drainage Group 10 collects stormwater from Beachfront Park, Play Street, and Howe Street. The stormwater is discharged at an outfall into Elk Creek between the crossing of Highway 101 southbound and Elk Creek's mouth into Crescent Bay, downstream of the outfall for Drainage Group 4. Under the simulated 10-year storm and tidal event, no flooding occurs. **Figure 6.13** presents a map of the storm drain system, subcatchments, and junctions within Drainage Group 10 under the simulated 10-year storm and tidal event. **Table 6.19** provides the lengths of existing storm drain pipes by material and nominal diameter within Drainage Group 10. **Table 6.20** provides the quantities of drainage inlets and manholes as well as flood volume and duration within Drainage Group 10.

Figure 6.13 Flooding Location(s) within Drainage Group 10 for the 10-year storm and tidal event.

Table 6.19 Existing Pipe Network by Material, Diameter, and Linear Feet within Drainage Group 10

Material	Diameter (ft)	Linear Feet (ft)
HDPE	1.5	39.72

Material	Diameter (ft)	Linear Feet (ft)
Concrete	1.75	103.99
Concrete	2	150.89

Table 6.20 Quantities of Junctions and Flooding Results within Drainage Group 10 for the 10-year Storm and Tidal Event

Type	Number	Total flooded volume (MG)	Maximum Flood Rate (cfs)	Maximum Duration of Flooding (hrs)	Maximum Duration of Surcharge (hrs)
DI	4	-	-	-	-
MH	0	-	-	-	-

6.4 Deficiency Analysis

Utilizing the results from the Base Conditions 1D and 2D Models, a drainage deficiency analysis was conducted to identify drainage deficiencies and provide an idealized solution that mitigates flooding. This subsection details the deficiency analysis approach and the development of the idealized solution.

6.4.1 Approach

The approach of the drainage deficiency analysis was to first identify capacity-limited segments within the drainage system. Capacity-limited segments were identified by flooding at nodes for any duration greater than 5-minutes. Capacity-limiting segments within the drainage system were then iteratively modified starting upstream and working downstream until the minimum conveyance passage was identified to relieve flooding. By starting upstream and working downstream, instances of flooding caused by an upstream project were addressed and grouped together as a project. **Section 7** includes more details of how potential projects were identified and grouped together.

6.4.2 Idealized Solution and Limitations

After insufficient drainage infrastructure was identified in the deficiency analysis, the idealized solution was developed to provide volumetric conveyance requirements to mitigate site flooding under the 10-year, 24-hour SCS Type 1A design storm. The idealized solution has limitations that should be further developed in the design phase of the projects, including but not limited to, minimum buried depth requirements, surface load requirements and pipe material, best engineering practices in upsizing downstream pipe diameters, potential areas for supplemental drainage detention basins, etc. Though the ideal drainage project resolves the flooding, it may not conform to best practices for upgrading the downstream pipe segments to either conform or increase in diameter. During project implementation, consideration of downstream pipe conveyance should be considered as needed to conform to best practices. These considerations factor into project prioritization and phasing (**Section 8** & **Section 9**). In the design phase, flooding in areas with low consequences may be determined to be permissible. If any proposed project components deviate from the components recommended in their respective CIP during the design development phase, the PCSWMM model should be updated with the revised project components and re-simulated to verify unintended flooding does not occur.

7. Development of Potential Capital Improvement Projects (CIP)

Data Collection → Model → Analysis → ***Project*** → Priority → Phase

7.1 Approach to CIP Development

Potential CIP Projects were identified using the drainage deficiency analysis and initially sized with the idealized solution, discussed in detail in Section 6.4. The idealized solution identifies individual specific improvements that would resolve the system deficiencies. The development of a CIP Project involves grouping several individual specific drainage improvements that are related to resolving flooding in a specific area. The types are discussed in Section 7.2. The CIP Projects are organized by drainage group and are sequenced so that resolving one flooding condition does not create a downstream capacity problem. The sequencing process is further discussed in Section 7.4. In general, CIPs are focused on resolving flooding within a drainage group; however, several CIPs are dependent on the improved drainage of other CIPs and are part of an overall strategy of minimizing flooding City wide. As an example, Outfall 5 has capacity for higher flows and improvements in Drainage Group 5 are structured to intercept runoff from other impacted drainage groups (2 and 5). The sequencing of CIPs is further discussed in Section 9.

7.2 Types of Drainage Improvements Considered

Based on the drainage deficiency analysis and hydrologic and hydraulic modeling results, a range of stormwater system improvement strategies were evaluated to reduce the extent, depth, and duration of flooding under the design storm conditions. The evaluated strategies focus on addressing capacity limitations, improving surface runoff capture, relieving overland flow constraints, enhancing outfall performance (particularly in tidally influenced areas), and incorporating detention where feasible to attenuate peak flows. Improvement concepts were developed at both localized and system scales and were assessed individually and in combination to understand their effectiveness in mitigating identified deficiencies. These strategies informed the development of CIPs and were refined through iterative modeling to ensure proposed measures provide measurable flood reduction benefits. The types of improvement strategies considered include:

1. **Conveyance Upgrades**: Upsizing or replacing undersized storm drain pipes and culverts to improve hydraulic capacity and reduce upstream surcharge and surface flooding.
2. **Inlet Enhancements**: Installation of new drainage inlets, replacement or expansion of existing inlets, and improved inlet spacing to increase surface runoff capture efficiency and reduce street ponding.
3. **Surface Flow Relief**: Modifications to surface flow paths, including use of dual drainage concepts, street flow routing, and overland relief pathways to safely convey excess flow when underground capacity is exceeded.
4. **Outfall Modifications**: Improvements to existing outfalls to reduce backwater effects, improve discharge reliability under tidal conditions, and protect outfalls from debris blockage, scour, and coastal influences.
5. **Detention and Storage Opportunities**: Use of existing or new detention basins, storage areas, and other flow attenuation features to temporarily store runoff and reduce peak downstream flows.

7.3 Environmental Compliance and Permitting

A preliminary assessment of anticipated environmental review and permitting requirements for each proposed CIP was conducted to supplement the Class V cost estimate (Section 7.6) and prioritization assessment (Section 8). Each CIP was screened based on its location, proposed scope, downstream receiving waters, and potential interaction with regulatory constraints, including the Coastal Zone, FEMA-mapped floodplains, natural or undisturbed areas, wetlands, and sensitive coastal or riparian resources. Based on this screening, projects were assigned to permitting cost tiers reflecting the type and complexity of anticipated approvals, such as CEQA documentation, Coastal Development Permits (CDP), and state and federal resource agency permits (e.g., CDFW Section 1602, RWQCB Section 401, USACE Section 404, and FEMA Floodplain Development Permits). Class V cost estimates were developed using a tier-based approach based on recent permitting experience on similar municipal infrastructure projects. A table with the full assessment is included in **Appendix E**. The table documents assumptions, exclusions, and a cost by CIP and total cost by drainage group.

7.4 Potential Capital Improvement Projects

All potential CIPs are defined below and organized by its associated drainage group and recommended construction sequence within the drainage group. Drainage group number is represented as “DG#” and recommended construction sequence is represented as “.#” afterwards. The division of drainage groups are presented in greater detail in Section 6.3. To avoid unintended downstream flooding as a result of upstream drainage improvements, the recommended construction sequence of CIPs within a drainage group starts with the most downstream CIP first and then moves upstream. This subsection provides a summary of the design criteria, developed projects, preliminary project construction cost estimate, and a summary of recommended operation and maintenance practices of each CIP.

Some of the boundaries of the drainage groups changed during the development of the CIPs as some CIPs modify the routing of stormwater to different outfalls to relieve flow from other drainage groups. **Figure 7.1** shows the updated key map of the drainage groups under the potential CIPs.

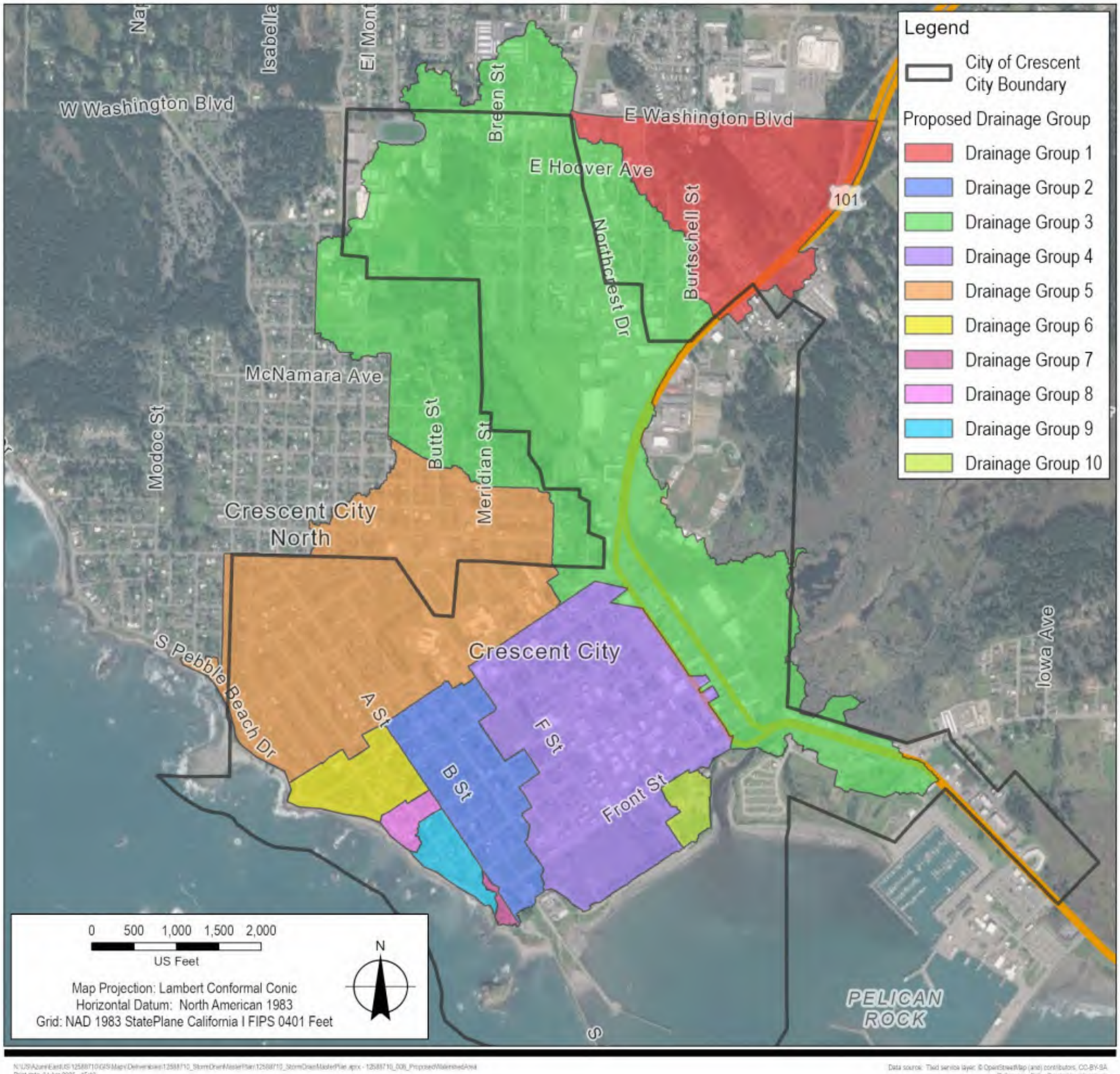

Figure 7.1 Key Map of Drainage Groups – Proposed Conditions

7.4.1 DG1.1

Capital Improvement Project DG1.1 consists of approximately 780 linear feet of pipe upgrade shown below in **Figure 7.2**. This project is not within the City's jurisdiction as it is located entirely within the Caltrans right of way. Pipe upsizing varies along the alignment based on local hydraulic constraints. The following improvements are included in the CIP:

- Upsizing approximately 80 linear feet of existing pipe on Highway 101 to 3-foot diameter HDPE pipe
- Upsizing approximately 700 linear feet of existing pipe Highway 101 to 2-foot diameter HDPE pipe
- Installing 4 new drainage inlets

DG1.1 is anticipated to be processed under CEQA as a Categorical Exemption, given the work is confined to the existing Caltrans-managed Hwy 101 ROW with no outfall modification. Anticipated approvals include coordination with Caltrans as the construction lead and a County Coastal Development Permit (CDP) for the coastal-zone segment if confirmed, with avoidance considerations due to proximity to the Elk Creek tributary corridor. This assessment assumes construction remains within paved areas, riparian vegetation can be avoided, the outfall is protected in place, and any floodplain interaction remains minimal based on mapped proximity to Zone A.

DG1.1 is classified as a Third-priority equity project based on its location within a Census Block Group with an equity score of 22.

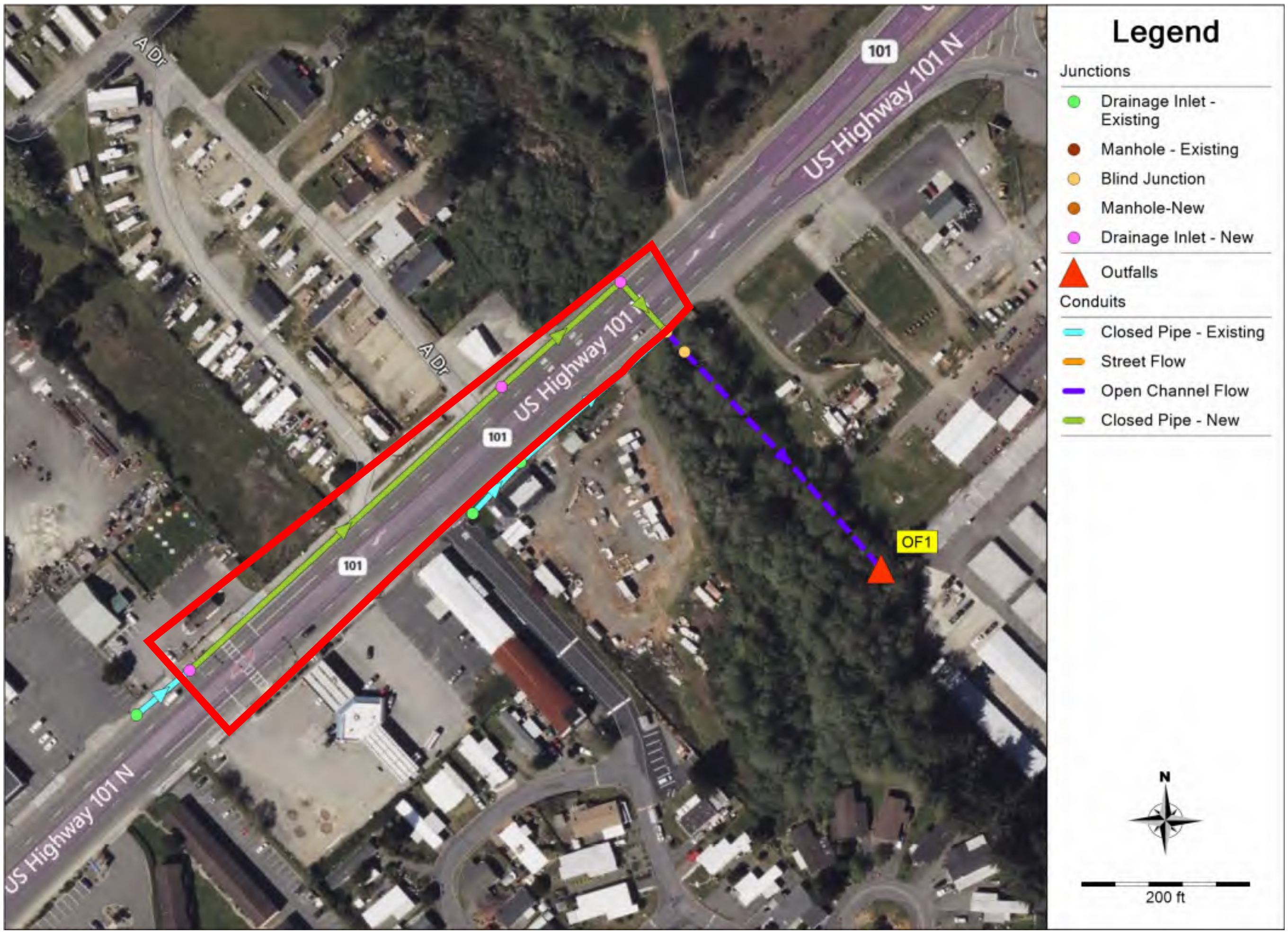

Figure 7.2 CIP DG1.1

7.4.2 DG2.1B

Capital Improvement Project DG2.1B consists of approximately 1850 linear feet of pipe upgrade shown below in **Figure 7.3**. Pipe upsizing varies along the alignment based on local hydraulic constraints. The following improvements are included in the CIP:

- Upsizing approximately 1500 linear feet of existing pipe from 9th Street to 5th Street to 2.5-foot diameter HDPE pipe
- Upsizing approximately 200 linear feet of existing pipe from the corner of 5th Street and D Street to 2-foot diameter HDPE pipe
- Replacing approximately 150 linear feet of existing lateral pipes

– Installing 11 new drainage inlets and 4 new manholes for maintenance access

DG2.1B is anticipated to require streamlined CEQA documentation (likely Categorical Exemption) because it is primarily a developed urban ROW upsizing project with no outfall work at B Street Pier. Environmental approvals are expected to be minimal, with potential coastal-zone considerations limited to the downstream segment near the harbor if coastal jurisdiction is confirmed. This assessment assumes all work stays within existing ROW, the outfall is protected in place, and no sensitive habitats are disturbed because the alignment is largely within developed streets.

DG2.1B is classified as a First-priority equity project based on its location within a Census Block Group with an equity score of 12.

Figure 7.3 *CIP DG2.1B*

7.4.3 DG2.2

Capital Improvement Project DG2.2 consists of approximately 1000 linear feet of pipe upgrade shown below in **Figure 7.4**. Pipe upsizing varies along the alignment based on local hydraulic constraints. The following improvements are included in the CIP:

– Upsizing approximately 200 linear feet of existing pipe to 1.5-foot diameter HDPE pipe
– Upsizing approximately 600 linear feet of existing pipe to 3-foot diameter HDPE pipe
– Replacing approximately 200 linear feet of existing lateral pipes
– Installing 9 new drainage inlets and 3 new manholes for maintenance access

DG2.2 is anticipated to be processed under CEQA (likely Categorical Exemption) for pipeline upsizing within a developed urban ROW. If any portion is confirmed within the Coastal Zone, a City CDP may be required for the coastal-zone segment; otherwise, permitting is expected to be limited to CEQA documentation. This assessment assumes work remains within existing ROW, no new discharge point is created, and the coastal-zone boundary is verified during design to confirm whether a CDP trigger applies.

DG2.2 is classified as a Second-priority equity project based on its location within a Census Block Group with an equity score of 18.

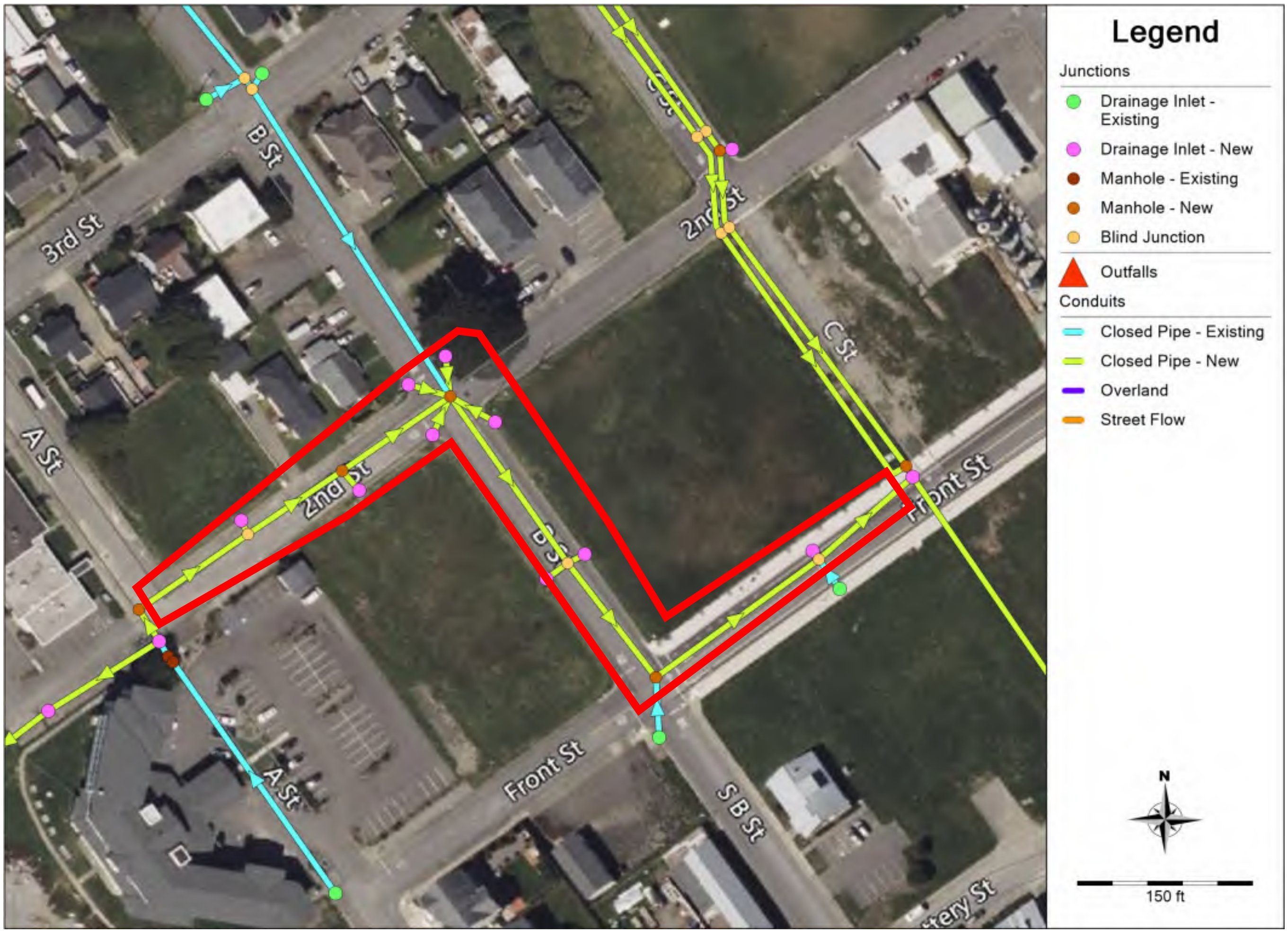

Figure 7.4 *CIP DG2.2*

7.4.4 DG2.2B

Capital Improvement Project DG2.2B consists of approximately 850 linear feet of pipe upgrade shown below in **Figure 7.5**. This CIP drains B St between 6th and 2nd and connects existing pipes under houses or private property. The following improvements are included in the CIP:

- Upsizing approximately 750 linear feet of existing pipe to 2-foot diameter HDPE pipe
- Replacing approximately 100 linear feet of existing lateral pipes
- Installing 6 new drainage inlets and 3 new manholes for maintenance access

DG2.2B is anticipated to qualify for CEQA Categorical Exemption because it is a conveyance improvement with limited environmental triggers and no coastal-zone overlap identified. No coastal or resource-agency permits are anticipated based on the developed setting and absence of mapped sensitive resources in the screening. This assessment assumes any required easement acquisition is handled separately (outside environmental scope), construction remains within previously disturbed areas, and no outfall or jurisdictional water feature is directly affected.

DG2.2B spans multiple Census Block Groups with equity scores of 12 and 18 and is classified as a First- to Second-priority equity project.

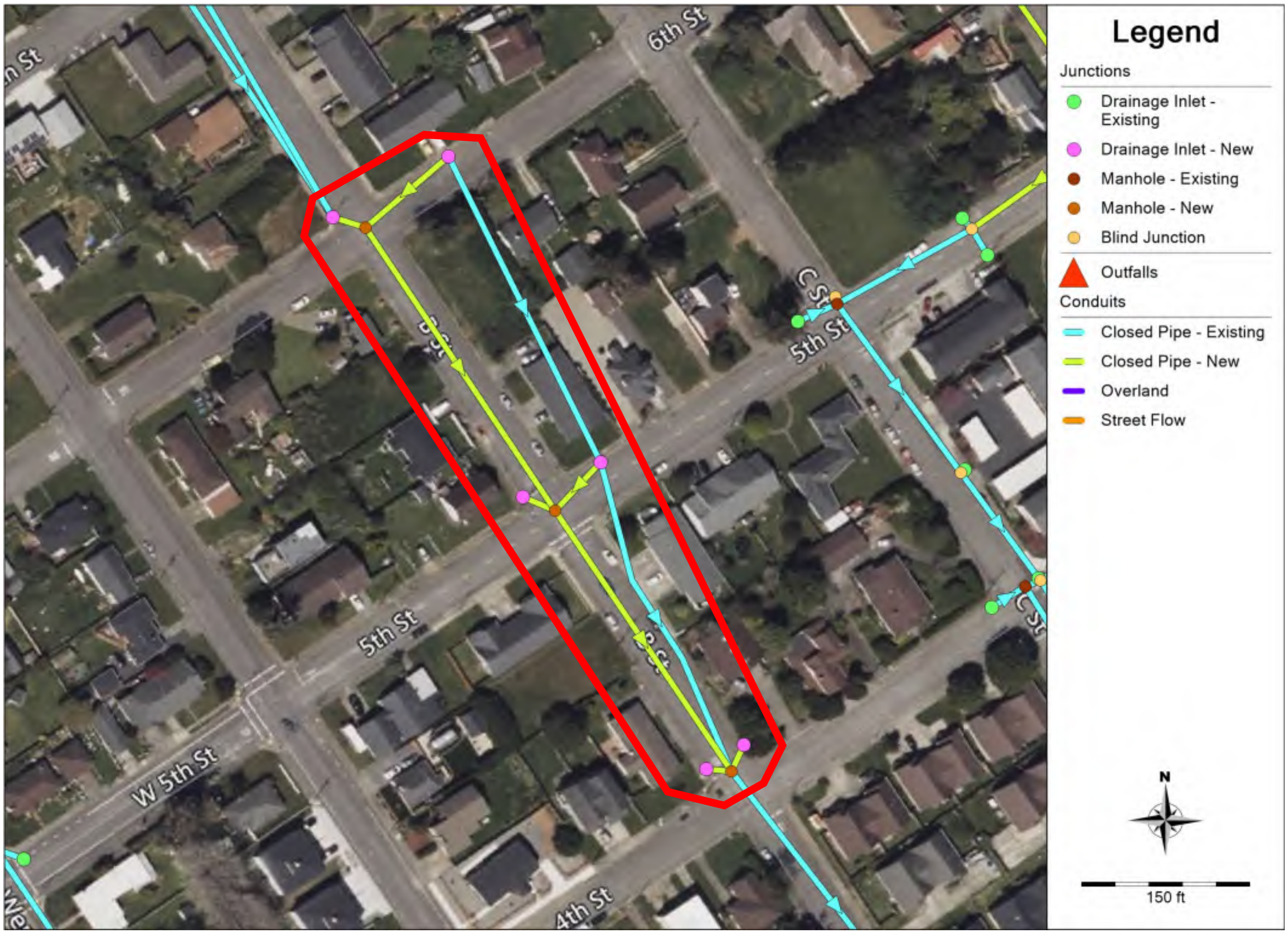

Figure 7.5 *CIP DG2.2B*

7.4.5 DG3.1A

Capital Improvement Project DG3.1A consists of approximately 2700 linear feet of pipe upgrade shown below in **Figure 7.6**. This CIP drains the area east of Highway 101 at the south end of the city. The area is tidally influenced and receives water from up basin limiting improvements in that region Pipe upsizing varies along the alignment based on local hydraulic constraints. The following improvements are included in the CIP:

– Upsizing approximately 350 linear feet of existing pipe to 2.5-foot diameter HDPE pipe
– Upsizing approximately 2350 linear feet of existing pipe to 2-foot diameter HDPE pipe
– Replacing approximately 25 linear feet of existing lateral pipes
– Installing 8 new drainage inlets

DG3.1A is anticipated to require CEQA documentation beyond a simple exemption screening due to its intersection with a freshwater marsh setting and mapped Zone A floodplain. Potential approvals may include a FEMA Floodplain Development Permit and resource-agency permits such as CDFW 1602 and RWQCB 401 if jurisdictional waters or wetlands are crossed or disturbed. This assessment assumes the project remains outside the Coastal Zone, the outfall is not modified, and wetland delineation/jurisdiction will be confirmed during design to refine permit needs.

DG3.1A is classified as a Third-priority equity project based on its location within a Census Block Group with an equity score of 22.

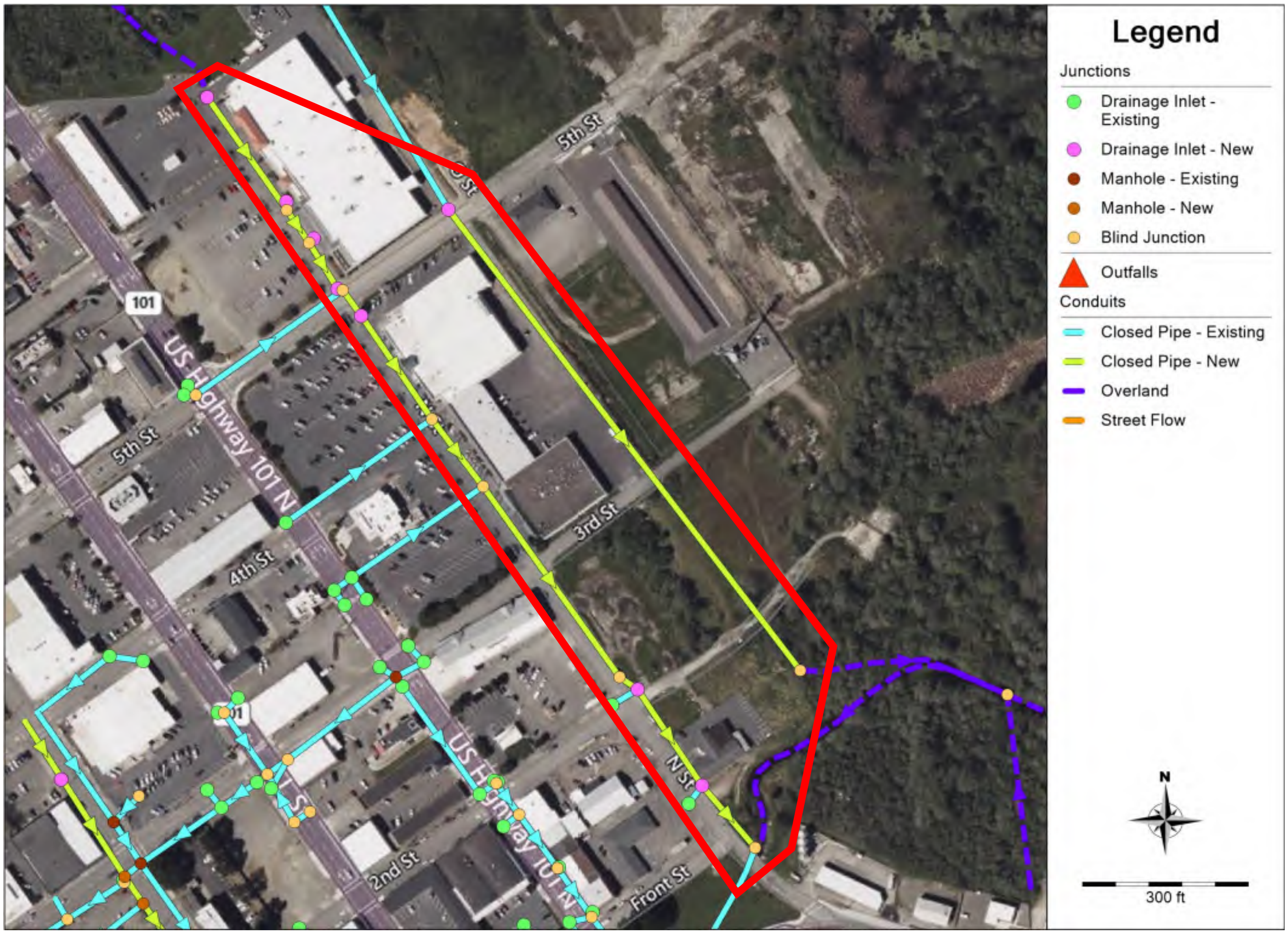

Figure 7.6 *CIP DG3.1A*

7.4.6 DG3.1B

Capital Improvement Project DG3.1B consists of approximately 1750 linear feet of pipe upgrade shown below in **Figure 7.7**. The following improvements are included in the CIP:

- Upsizing approximately 1600 linear feet of existing pipe to 2-foot diameter HDPE pipe
- Replacing approximately 150 linear feet of existing lateral pipes
- Installing 11 new drainage inlets

DG3.1B is anticipated to require CEQA documentation because the alignment transitions from developed ROW into a wetland/natural area at the eastern portion. Potential approvals include CDFW 1602 and, if federal jurisdiction is present, USACE 404 with RWQCB 401, depending on whether work crosses jurisdictional drainage features. This assessment assumes the project remains outside the Coastal Zone, the outfall is protected in place, and wetland extent/jurisdiction will be verified to confirm whether 1602/404/401 are triggered.

DG3.1B spans multiple Census Block Groups with equity scores of 18 and 22 and is classified as a Second- to Third-priority equity project.

Figure 7.7 *CIP DG3.1B*

7.4.7 DG3.2A

Capital Improvement Project DG3.2A consists of approximately 1100 linear feet of pipe upgrade shown below in **Figure 7.8**. Pipe upsizing varies along the alignment based on local hydraulic constraints. The following improvements are included in the CIP:

- Upsizing approximately 550 linear feet of existing pipe to 2.5-foot diameter HDPE pipe
- Upsizing approximately 350 linear feet of existing pipe to 2-foot diameter HDPE pipe
- Replacing approximately 200 linear feet of existing lateral pipes
- Installing 11 new drainage inlets and 2 new manholes for maintenance access

DG3.2A is anticipated to be processed under CEQA as a Categorical Exemption because it is standard pipe upsizing within a developed urban ROW outside the Coastal Zone. No coastal or resource-agency permits are anticipated based on the screening, provided no jurisdictional drainage is directly affected. This assessment assumes construction stays within existing disturbed ROW, avoids any unmapped drainage features, and does not modify the downstream outfall.

DG3.2A is classified as a Fourth-priority equity project based on its location within a Census Block Group with an equity score of 23.

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Figure 7.8 CIP DG3.2A

7.4.8 DG3.2B

Capital Improvement Project DG3.2B consists of approximately 3900 linear feet of pipe addition or upgrade shown below in **Figure 7.9**. This CIP directs flow from East Washington Blvd and East Hoover Ave away from Northcrest Drive. Pipe upsizing varies along the alignment based on local hydraulic constraints. The following improvements are included in the CIP:

- Add approximately 950 linear feet of 3-foot diameter HDPE pipe from East Hoover Ave & Oregon Street to California Street & East Coolidge Ave
- Add approximately 300 linear feet of 2.5-foot diameter HDPE pipe connecting the existing East Washington Blvd system to the East Coolidge Ave system
- Add approximately 450 linear feet of 1-foot diameter HDPE pipe from Northcrest Drive & East Hoover Ave to East Hoover Ave & Oregon Street
- Upsizing approximately 650 linear feet of existing pipe along East Coolidge Ave to 3-foot diameter HDPE pipe
- Upsizing approximately 400 linear feet of existing pipe along East Washington Blvd and Oregon Street to 2.5-foot diameter HDPE pipe
- Replacing or adding approximately 400 linear feet of lateral pipes
- Installing 21 new drainage inlets and 6 new manholes for maintenance access

DG3.2B is anticipated to require CEQA documentation, with the level potentially increasing if any tie-ins or interactions with jurisdictional drainage features occur at the western end. Resource-agency permits such as CDFW 1602 and potentially USACE 404/RWQCB 401 may be needed if work affects a creek/drainage feature, but could remain limited if improvements stay within developed ROW. This assessment assumes the project does not impact Elk Creek or other jurisdictional waters, the outfall is protected in place, and the larger construction scale alone does not drive permitting unless resource impacts are present.

DG3.2B is classified as a Fourth-priority equity project based on its location within a Census Block Group with an equity score of 23.

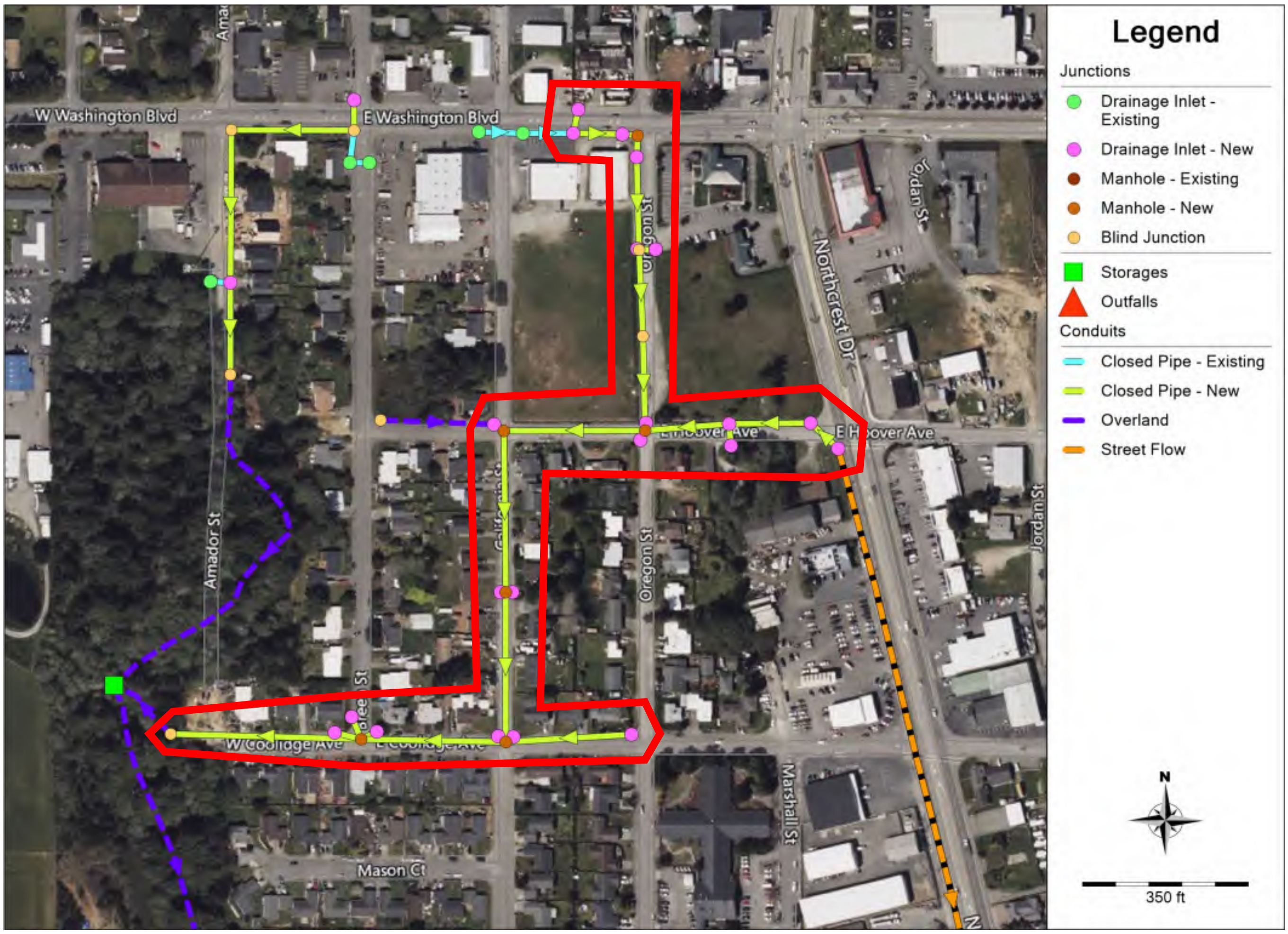

Figure 7.9 *CIP DG3.2B*

7.4.9 DG3.2C

Capital Improvement Project DG3.2C consists of approximately 850 linear feet of pipe upgrade shown below in **Figure 7.10**. This CIP drains East Washington Blvd from Amador Street and Breen Street and directs flow to the greenway/creek. The following improvements are included in the CIP:

– Upsizing approximately 800 linear feet of existing pipe to 2-foot diameter HDPE pipe
– Replacing or adding approximately 50 linear feet of lateral pipes
– Installing 2 new drainage inlets

DG3.2C is anticipated to require CEQA at the Initial Study/Negative Declaration level due to its direct connection/discharge to a greenway/creek and partial Coastal Zone overlap. Expected approvals include CDFW 1602, RWQCB 401, and potentially USACE 404, plus a City CDP for the coastal-zone segment and supporting biological surveys. This assessment assumes the greenway/creek is potentially jurisdictional (to be confirmed), the design avoids unnecessary in-channel work, and the discharge connection is refined during design to define exact agency triggers.

DG3.2C is classified as a Fourth-priority equity project based on its location within a Census Block Group with an equity score of 23.

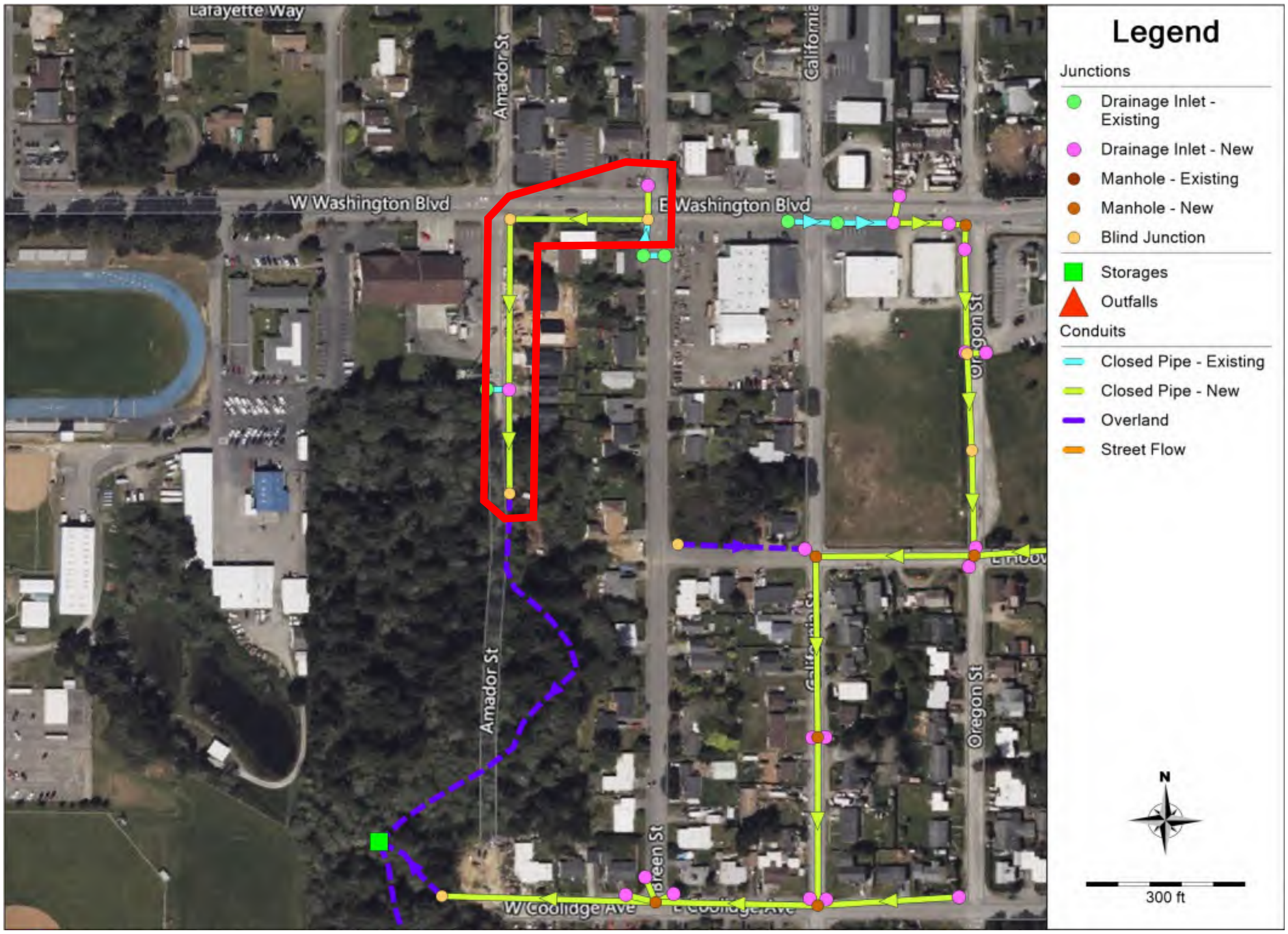

Figure 7.10 *CIP DG3.2C*

7.4.10 DG3.3A

Capital Improvement Project DG3.3A consists of approximately 400 linear feet of pipe upgrade shown below in **Figure 7.11**. This CIP drains flooding that occurs at the South end of the city which may impact Highway 101 and Elk Valley Rd. Pipe upsizing varies along the alignment based on local hydraulic constraints. The following improvements are included in the CIP:

- Upsizing approximately 350 linear feet of existing pipe to 1.5-foot diameter HDPE pipe
- Upsizing approximately 50 linear feet of existing pipe to 1-foot diameter HDPE pipe
- Installing 3 new drainage inlets

DG3.3A is anticipated to require CEQA documentation because the northern extent may intersect floodplain/wetland conditions and partially overlaps the Coastal Zone. Potential approvals include CDFW 1602, RWQCB 401, and possibly USACE 404, with FEMA and LCP/CDP applicability dependent on where construction limits ultimately fall.

This assessment assumes the primary work remains within developed ROW, and permit requirements will be refined based on the final extent of construction at the northern terminus and confirmation of mapped resources.

DG3.3A spans multiple Census Block Groups with equity scores of 22 and 35 and is classified as a Third- to Fifth-priority equity project.

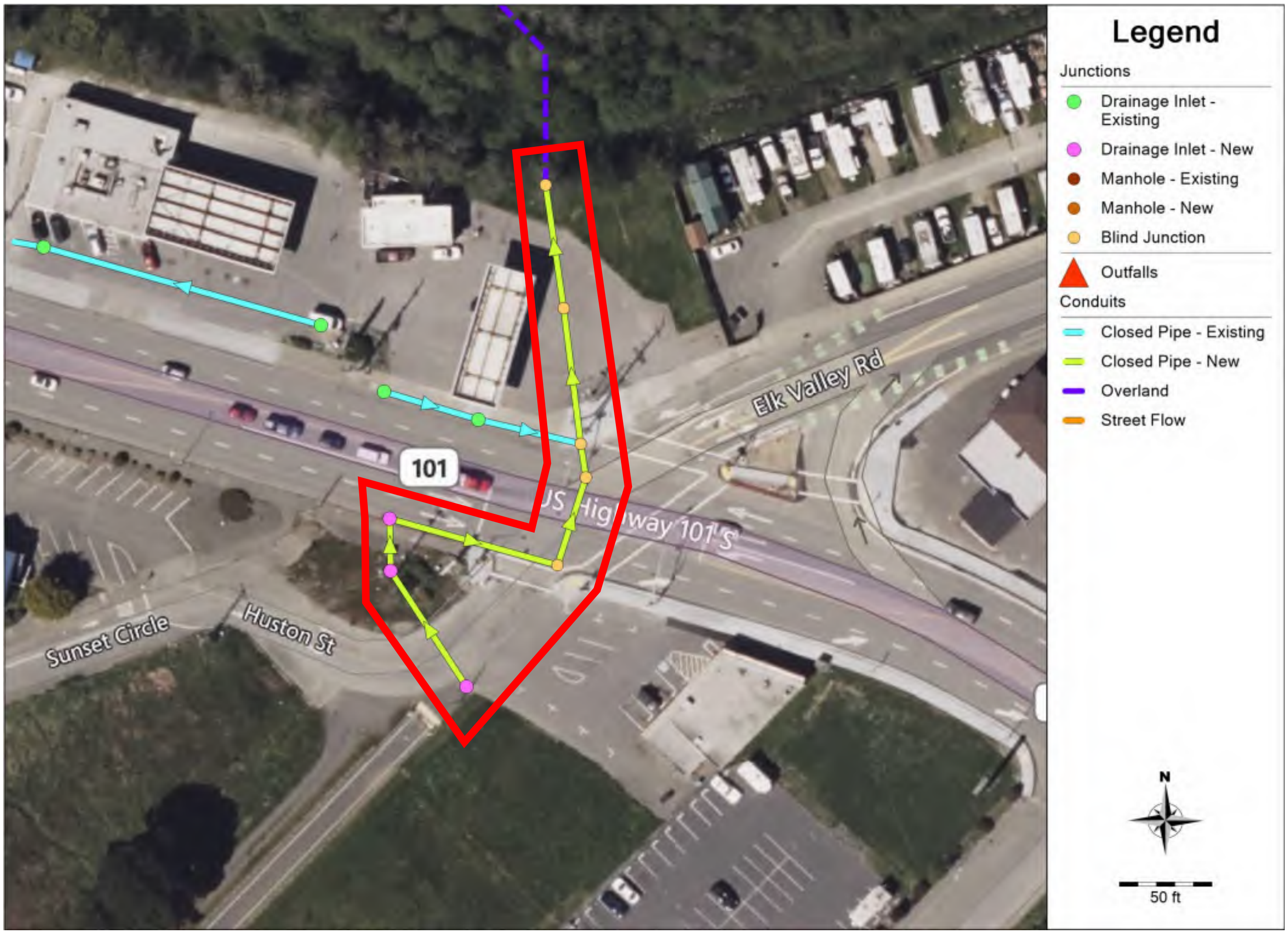

Figure 7.11 *CIP DG3.3A*

7.4.11 DG3.3B

Capital Improvement Project DG3.3B consists of approximately 1300 linear feet of pipe upgrade shown below in **Figure 7.12**. This CIP alleviates flooding along Highway 101 at the south end of the City near the North/South split. This project intersects the Caltrans right of way. The following improvements are included in the CIP:

- Upsizing approximately 1300 linear feet of existing pipe to 2.5-foot diameter HDPE pipe
- Installing 7 new drainage inlets

DG3.3B is anticipated to require CEQA documentation with Caltrans typically serving as the CEQA lead due to construction within/adjacent to the Hwy 101 ROW. Anticipated approvals include a City CDP for the Coastal Zone segment and potential floodplain review (as indicated by mapped conditions), along with standard coordination requirements associated with Caltrans ROW work. This assessment assumes the project remains within existing transportation corridors, avoids expansion into sensitive habitats, and does not modify the receiving outfall.

DG3.3B spans multiple Census Block Groups with equity scores of 22 and 35 and is classified as a Third- to Fifth-priority equity project.

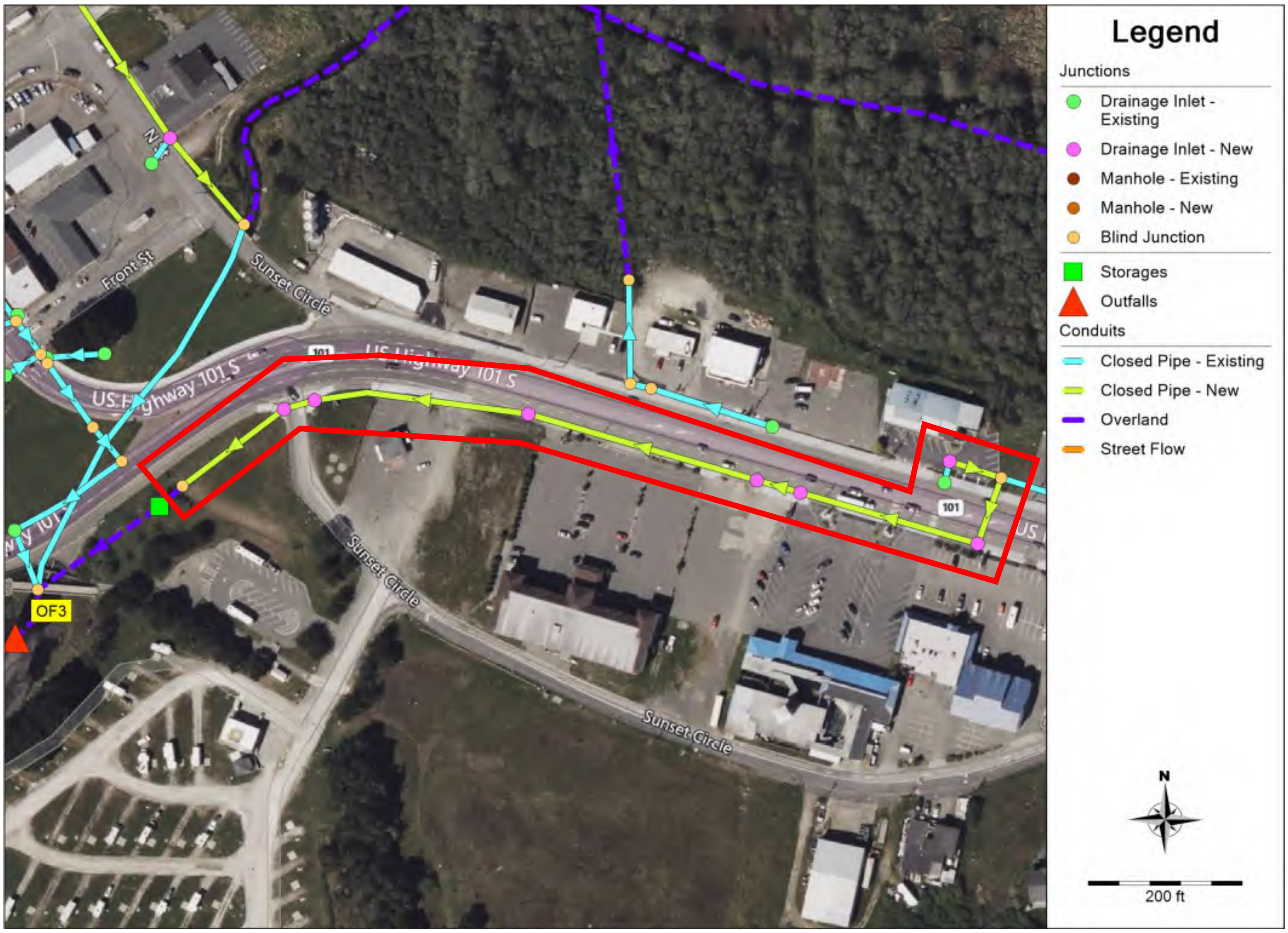

Figure 7.12 CIP DG3.3B

7.4.12 DG4.1A

Capital Improvement Project DG4.1A consists of approximately 1900 linear feet of pipe upgrade shown below in **Figure 7.13**. This CIP is intended to resolve the flooding at 5th & J and 4th & J by increasing capacity down K St. Pipe upsizing varies along the alignment based on local hydraulic constraints. The following improvements are included in the CIP:

– Upsizing approximately 900 linear feet of existing pipe to 3-foot diameter HDPE pipe
– Upsizing approximately 400 linear feet of existing pipe to 2.5-foot diameter HDPE pipe
– Upsizing approximately 350 linear feet of existing pipe to 1.5-foot diameter HDPE pipe
– Replacing approximately 250 linear feet of existing lateral pipes
– Installing 11 new drainage inlets and 10 new manholes for maintenance access

DG4.1A is anticipated to be processed under CEQA as a Categorical Exemption because it is pipe upsizing within a fully developed downtown street grid with no identified environmental triggers. No coastal or resource-agency permits are anticipated based on the developed setting and screening. This assessment assumes construction remains in existing ROW, avoids work in jurisdictional waters, and permitting can be bundled with DG4.1B to streamline documentation.

DG4.1A is classified as a Second-priority equity project based on its location within a Census Block Group with an equity score of 18

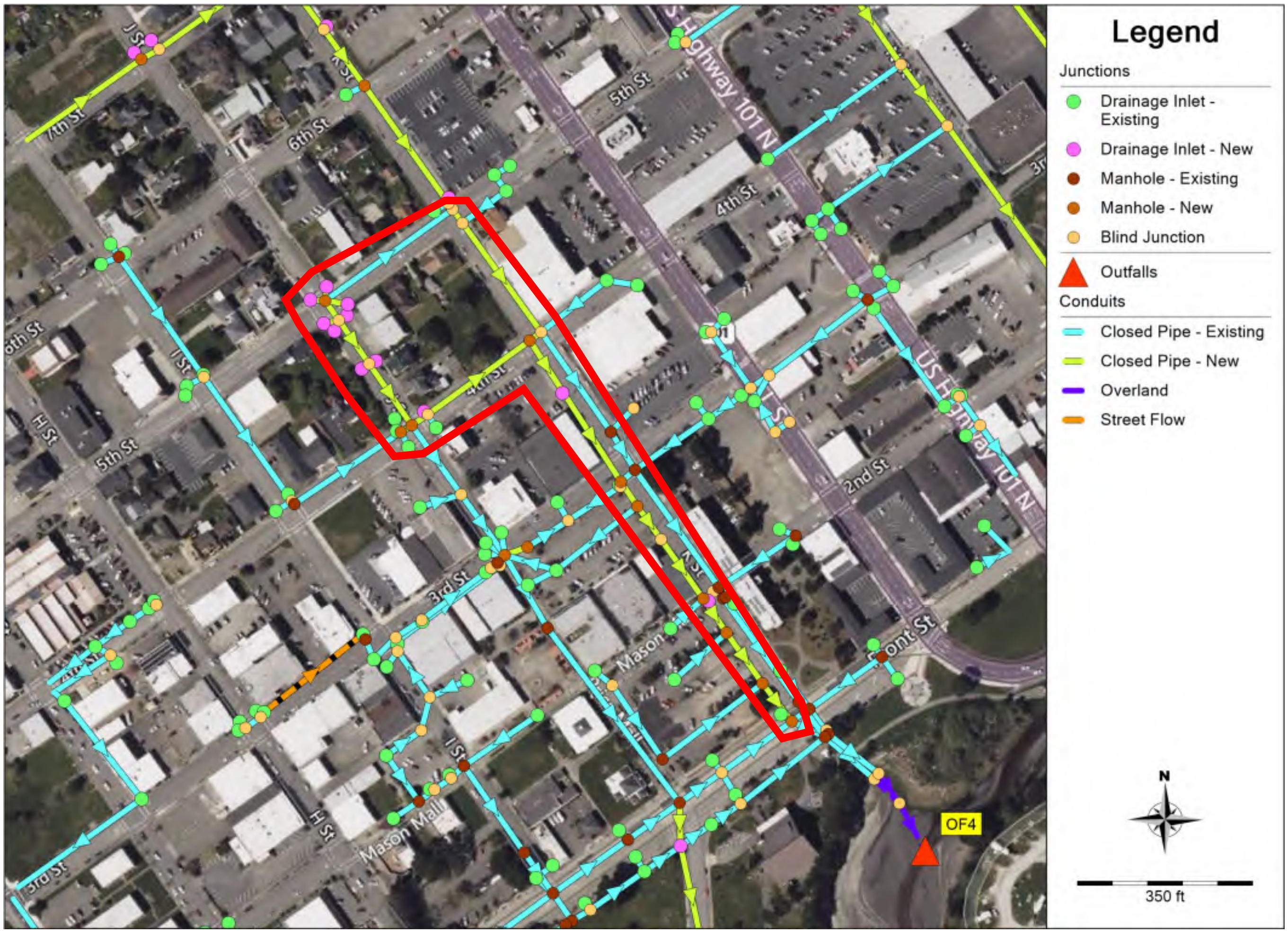

Figure 7.13 CIP DG4.1A

7.4.13 DG4.1B

Capital Improvement Project DG4.1B consists of approximately 1850 linear feet of pipe upgrade shown below in **Figure 7.14**. This CIP is intended to resolve the flooding on J & 7th and 8th & K. This project is hydraulically dependent on the downstream capacity provided by DG4.1A. Pipe upsizing varies along the alignment based on local hydraulic constraints. The following improvements are included in the CIP:

- Upsizing approximately 1200 linear feet of existing pipe to 2.5-foot diameter HDPE pipe
- Upsizing approximately 300 linear feet of existing pipe to 2-foot diameter HDPE pipe
- Upsizing approximately 100 linear feet of existing pipe to 1.5-foot diameter HDPE pipe
- Replacing approximately 250 linear feet of existing lateral pipes
- Installing 11 new drainage inlets and 5 new manholes for maintenance access

DG4.1B is anticipated to be processed under CEQA documentation bundled with DG4.1A, likely as a Categorical Exemption for downtown ROW improvements. No additional coastal or resource-agency permits are anticipated because the setting is fully developed and outside identified sensitive constraints. This assessment assumes DG4.1B is included under a single environmental submittal with DG4.1A, with no outfall modification and no disturbance beyond existing paved ROW.

DG4.1B is classified as a Second-priority equity project based on its location within a Census Block Group with an equity score of 18.

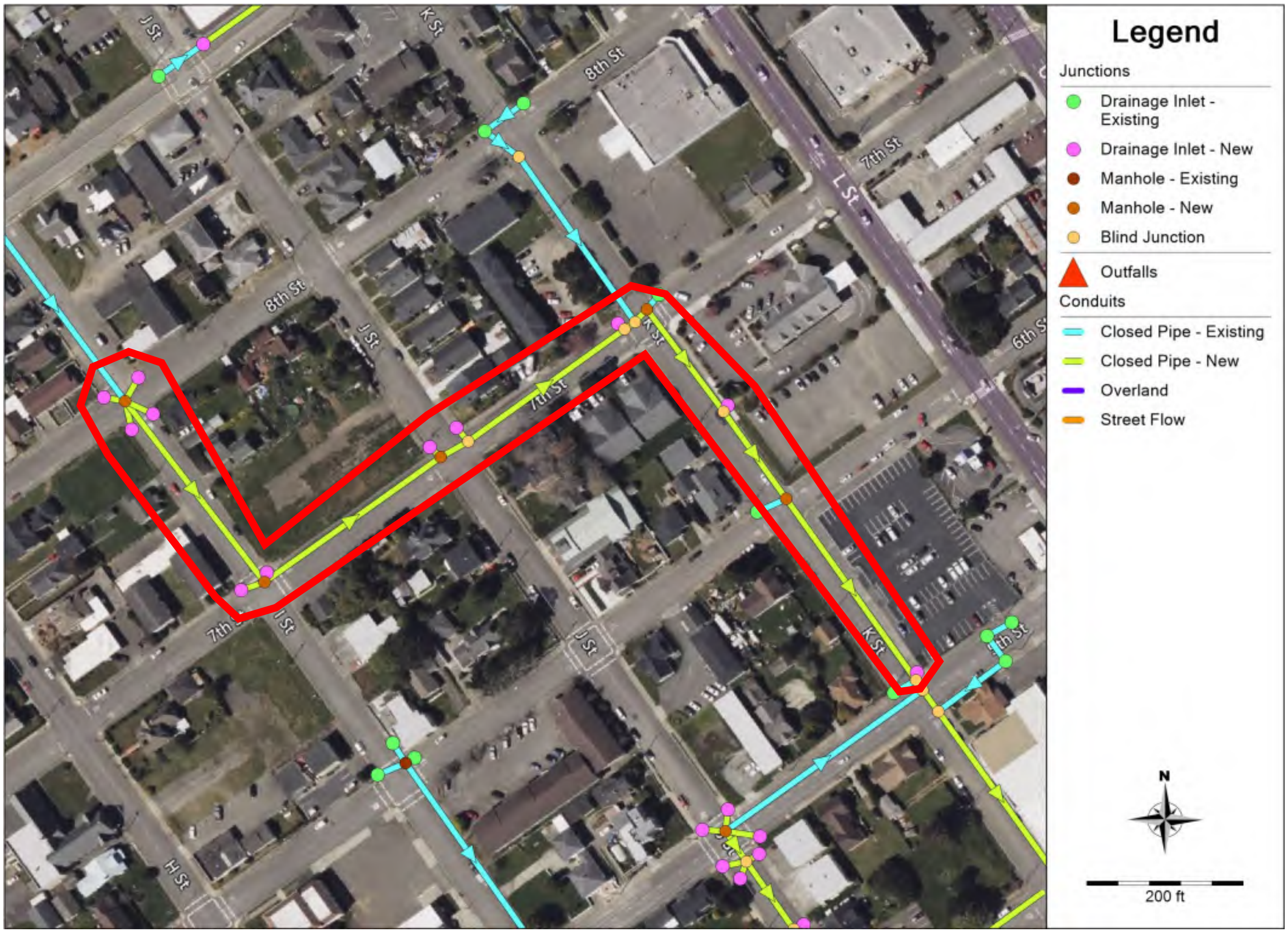

Figure 7.14 *CIP DG4.1B*

7.4.14 DG4.2

Capital Improvement Project DG4.2 consists of approximately 1100 linear feet of pipe upgrade shown below in **Figure 7.15**. This project is hydraulically dependent on the downstream capacity provided by DG10.1. Pipe upsizing varies along the alignment based on local hydraulic constraints. The following improvements are included in the CIP:

– Upsizing approximately 600 linear feet of existing pipe to 4-foot diameter HDPE pipe
– Upsizing approximately 350 linear feet of existing pipe to 2-foot diameter HDPE pipe
– Replacing approximately 150 linear feet of existing lateral pipes
– Installing 3 new drainage inlets and 4 new manholes for maintenance access

DG4.2 is anticipated to require CEQA (likely Categorical Exemption) for ROW pipe upsizing, with a City CDP potentially required if the southern segment is confirmed within the Coastal Zone. No other resource-agency permits are expected based on the developed setting unless unanticipated drainage features are encountered during design. This assessment assumes the alignment remains within disturbed ROW, the coastal-zone boundary is verified to confirm CDP applicability, and the project remains dependent on downstream system conditions (DG10.1) without modifying outfalls.

DG4.2 is classified as a Second-priority equity project based on its location within a Census Block Group with an equity score of 18.

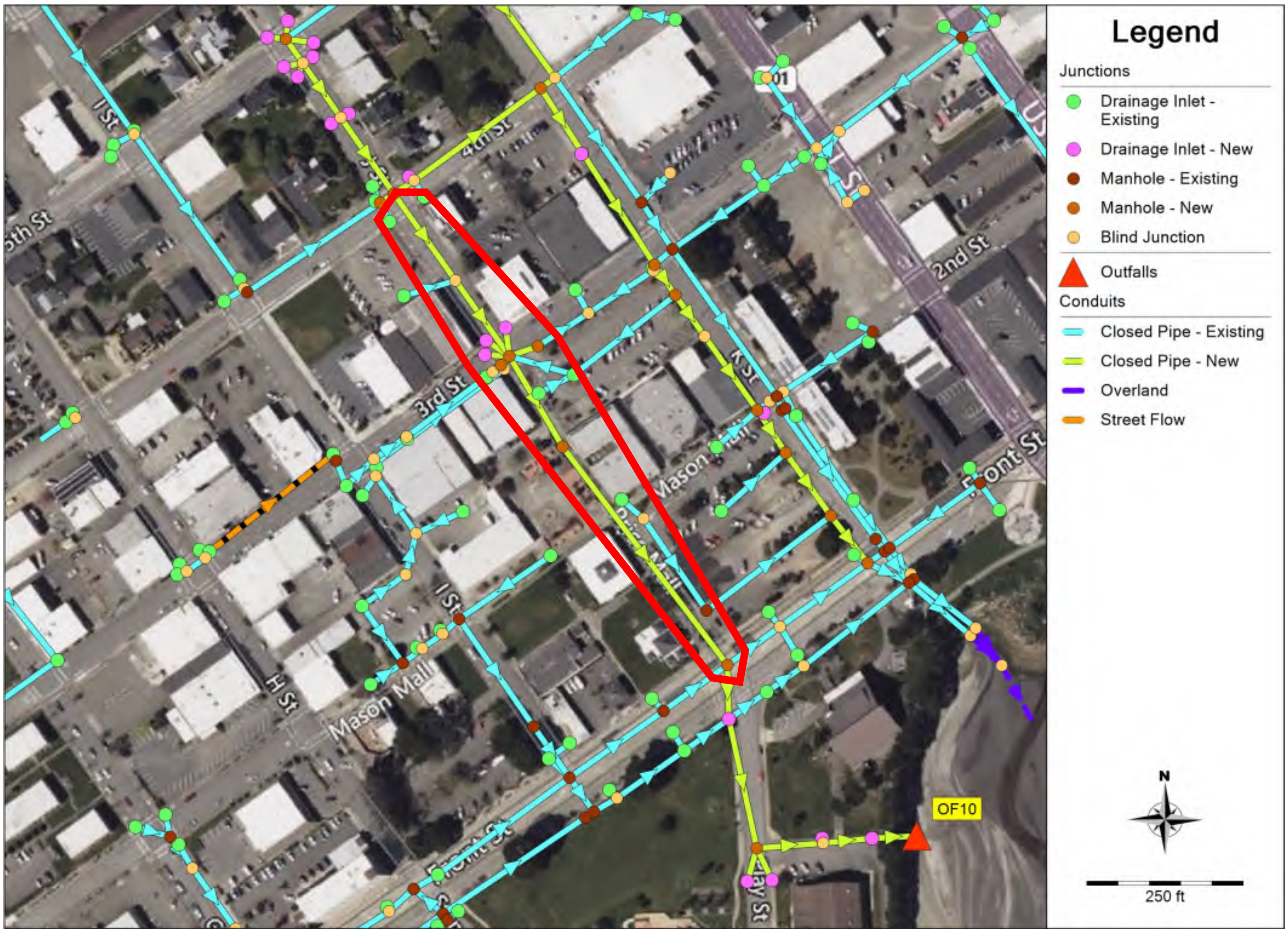

Figure 7.15 CIP DG4.2

7.4.15 DG4.3

Capital Improvement Project DG4.3 consists of approximately 1650 linear feet of pipe upgrade shown below in **Figure 7.16**. This project is hydraulically dependent on the downstream capacity provided by DG10.1.Pipe upsizing varies along the alignment based on local hydraulic constraints. The following improvements are included in the CIP:

- Upsizing approximately 100 linear feet of existing pipe to 3-foot diameter HDPE pipe
- Upsizing approximately 700 linear feet of existing pipe to 2-foot diameter HDPE pipe
- Upsizing approximately 600 linear feet of existing pipe to 1-foot diameter HDPE pipe
- Replacing approximately 350 linear feet of existing lateral pipes
- Installing 9 new drainage inlets and 4 new manholes for maintenance access

DG4.3 is anticipated to require only minimal CEQA documentation because it is standard pipe upsizing within developed ROW and outside the Coastal Zone per screening. No coastal or resource-agency permits are anticipated if the work remains within existing disturbed corridors and avoids jurisdictional waters. This assessment assumes permitting can be bundled with DG4.2 where practical, and no outfall modifications or new discharge points are included in the scope.

DG4.3 is classified as a Second-priority equity project based on its location within a Census Block Group with an equity score of 18.

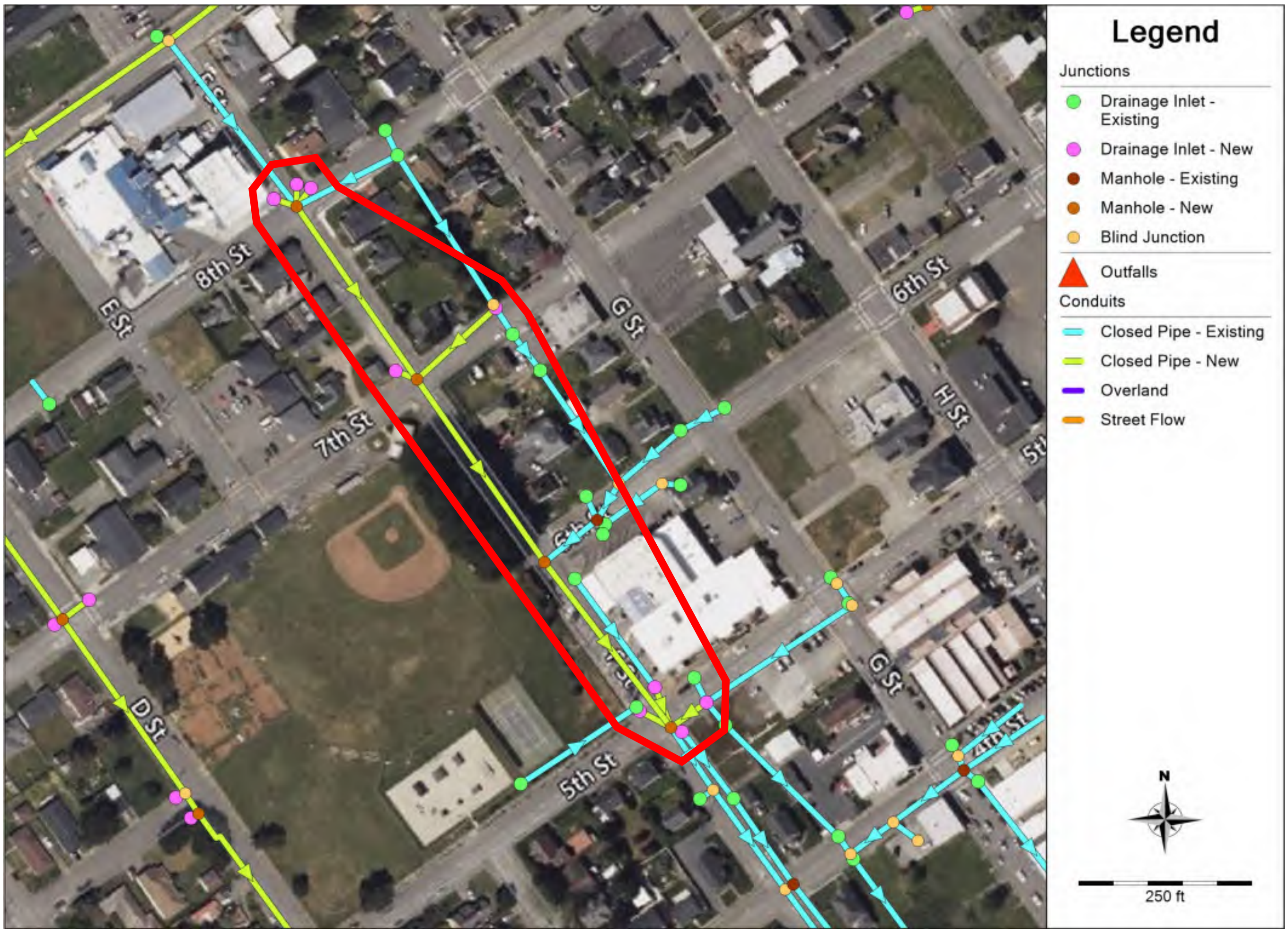

Figure 7.16 CIP DG4.3

7.4.16 DG5.1

Capital Improvement Project DG5.1 consists of approximately 4400 linear feet of pipe addition or upgrade shown below in **Figure 7.17**. This CIP adds a cross-town interceptor that routes the Northwestern drainage groups to Outfall 5. Pipe upsizing varies along the alignment based on local hydraulic constraints. The following improvements are included in the CIP:

- Adding approximately 2200 linear feet of 4.5-foot diameter HDPE pipe down 9th Street running West from D street to Outfall 5
- Adding approximately 600 linear feet of 4-foot diameter HDPE pipe
- Adding approximately 1300 linear feet of existing pipe to 3-foot diameter HDPE pipe
- Upsizing approximately 200 linear feet of existing pipe to 2.5-foot diameter HDPE pipe
- Replacing approximately 100 linear feet of existing lateral pipes
- Installing 8 new drainage inlets and 5 new manholes for maintenance access

DG5.1 is anticipated to require CEQA Categorical Exemption but with heightened coastal review due to its downstream segment within the City Coastal Zone and proximity to coastal resources near Outfall 5. Anticipated approvals include a City CDP (potentially appealable) and supporting biological/cultural documentation if sensitive habitat (ESHA) or coastal bluff considerations are confirmed near the outfall vicinity. This assessment assumes the interceptor is constructed within paved roadway, the existing outfall is protected in place, and coastal resource effects can be avoided or minimized through alignment and standard BMPs.

DG5.1 spans multiple Census Block Groups with equity scores of 12 and 18 and is classified as a First- to Second-priority equity project.

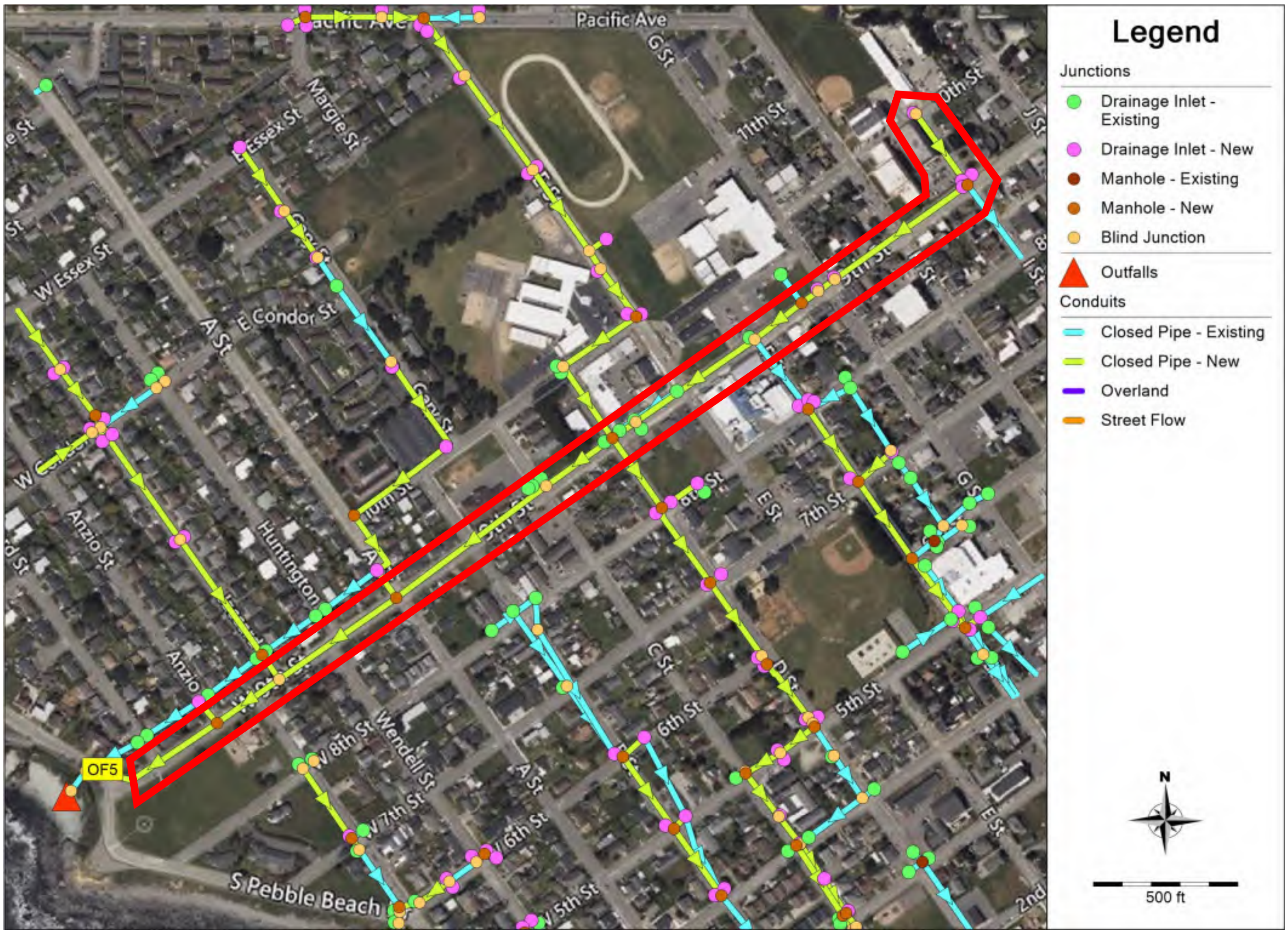

Figure 7.17 CIP DG5.1

7.4.17 DG5.2

Capital Improvement Project DG5.2 consists of approximately 3050 linear feet of pipe upgrade shown below in **Figure 7.18**. This CIP addresses flooding on Pacific Ave and is hydraulically dependent on the downstream capacity provided by DG5.1. Pipe upsizing varies along the alignment based on local hydraulic constraints. The following improvements are included in the CIP:

- Upsizing approximately 900 linear feet of existing pipe to 3-foot diameter HDPE pipe
- Upsizing approximately 1000 linear feet of existing pipe to 2.5-foot diameter HDPE pipe
- Upsizing approximately 600 linear feet of existing pipe to 2-foot diameter HDPE pipe
- Replacing approximately 550 linear feet of existing lateral pipes
- Installing 14 new drainage inlets and 3 new manholes for maintenance access

DG5.2 is anticipated to have minimal incremental environmental review because it is a developed ROW upsizing project that is hydraulically tied to DG5.1. Environmental compliance is expected to be addressed by bundling DG5.2 under the DG5.1 CDP and CEQA package, with no separate resource-agency permits anticipated. This assessment assumes DG5.2 remains outside the Coastal Zone, stays within existing ROW, and does not add outfall work or new environmental triggers beyond DG5.1.

DG5.2 spans multiple Census Block Groups with equity scores of 23, 18, and 12 and is classified as a First- to Fourth-priority equity project.

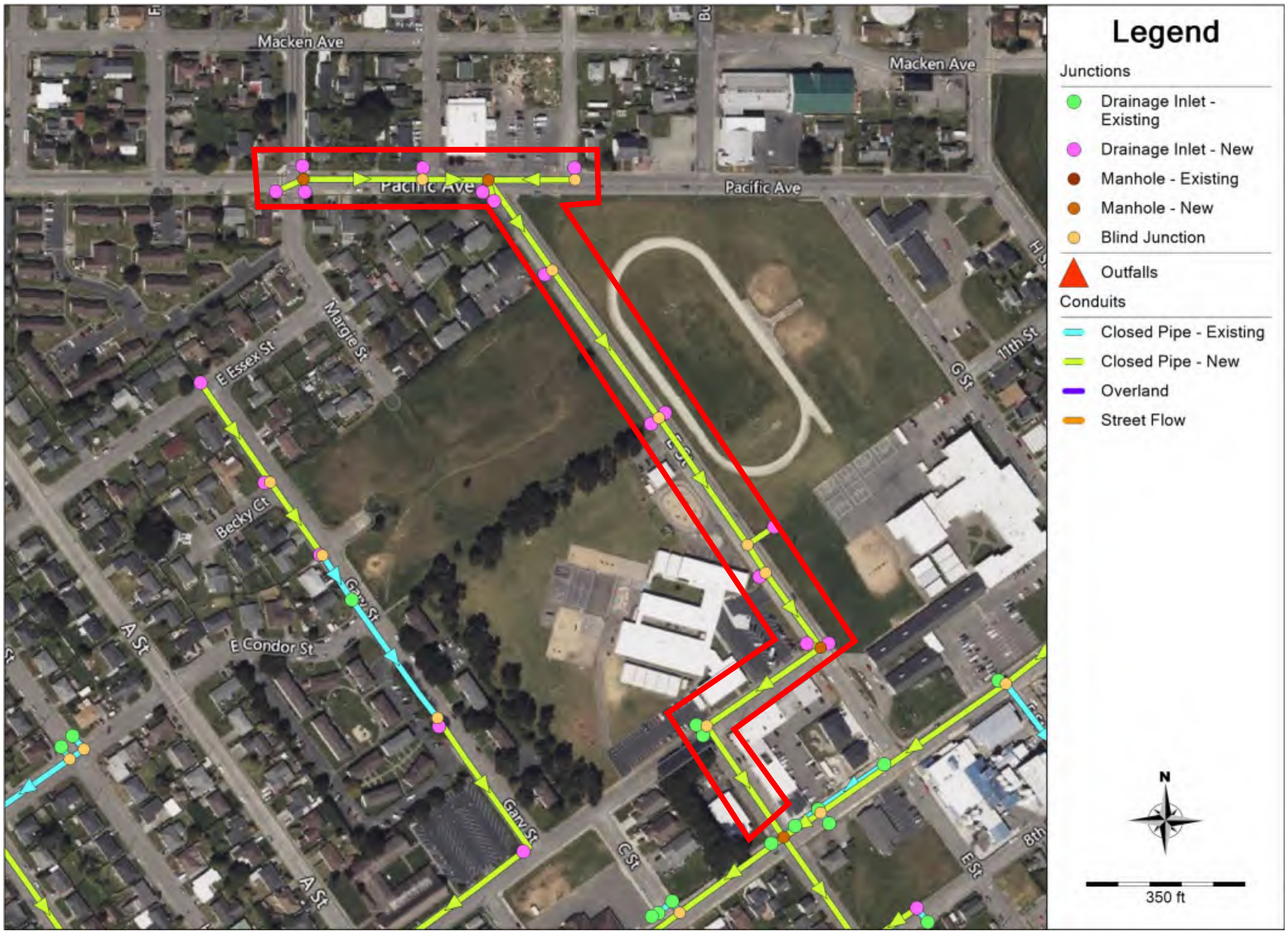

Figure 7.18 CIP DG5.2

7.4.18 DG5.3

Capital Improvement Project DG5.3 consists of approximately 1500 linear feet of pipe upgrade shown below in **Figure 7.19**. This drainage group drains flooding in the neighborhood along Gary St. This project is hydraulically dependent on the downstream capacity provided by DG5.1. Pipe upsizing varies along the alignment based on local hydraulic constraints. The following improvements are included in the CIP:

- Upsizing approximately 1000 linear feet of existing pipe to 2.5-foot diameter HDPE pipe
- Upsizing approximately 450 linear feet of existing pipe to 2-foot diameter HDPE pipe
- Replacing approximately 50 linear feet of existing lateral pipes
- Installing 6 new drainage inlets and 1 new manhole for maintenance access

DG5.3 is anticipated to require streamlined CEQA (likely Categorical Exemption) as a developed residential ROW upsizing project dependent on DG5.1. Environmental permitting is expected to be managed through bundling with DG5.1 if the group is permitted together, with limited incremental scope added to the lead submittal. This assessment assumes the work remains within disturbed ROW, avoids sensitive resources, and does not modify the outfall or create new coastal-zone triggers.

DG5.3 is classified as a First-priority equity project based on its location within a Census Block Group with an equity score of 12.

Figure 7.19 CIP DG5.3

7.4.19 DG5.4

Capital Improvement Project DG5.4 consists of approximately 3300 linear feet of pipe upgrade shown below in **Figure 7.20**. Pipe upsizing varies along the alignment based on local hydraulic constraints. The following improvements are included in the CIP:

- Upsizing approximately 1400 linear feet of existing pipe to 3-foot diameter HDPE pipe
- Upsizing approximately 850 linear feet of existing pipe to 2.5-foot diameter HDPE pipe
- Upsizing approximately 700 linear feet of existing pipe to 2-foot diameter HDPE pipe
- Replacing approximately 350 linear feet of existing lateral pipes
- Installing 15 new drainage inlets and 5 new manholes for maintenance access

DG5.4 is anticipated to require CEQA documentation consistent with ROW improvements, with the permitting approach expected to be most efficient if bundled with the DG5 package. No standalone coastal or resource-agency permits are anticipated based on screening if the alignment remains outside the Coastal Zone and avoids jurisdictional waters. This assessment assumes the increased project length does not, by itself, trigger additional permits, and that DG5.4 can be included as a "ride-along" under DG5.1's environmental documentation where applicable.

DG5.4 is classified as a First-priority equity project based on its location within a Census Block Group with an equity score of 12.

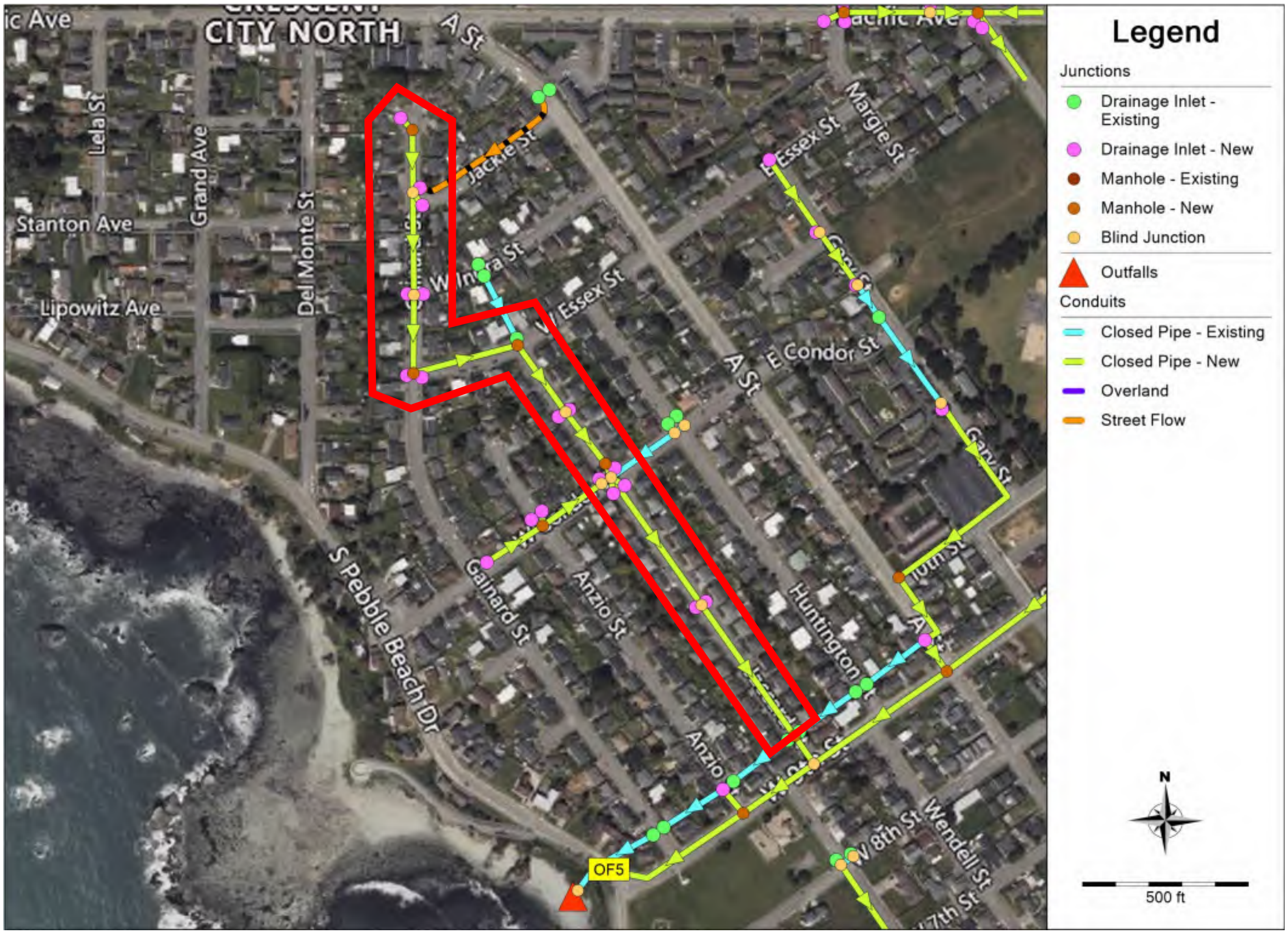

Figure 7.20 *CIP DG5.4*

7.4.20 DG5.5

Capital Improvement Project DG5.5 consists of approximately 550 linear feet of pipe upgrade shown below in **Figure 7.21**. This project is hydraulically dependent on the downstream capacity provided by DG5.1 and DG5.4. The following improvements are included in the CIP:

– Upsizing approximately 450 linear feet of existing pipe to 1.5-foot diameter HDPE pipe
– Replacing approximately 100 linear feet of existing lateral pipes
– Installing 3 new drainage inlets and 1 new manhole for maintenance access

DG5.5 is anticipated to require minimal CEQA documentation (likely Categorical Exemption) because it is a small-scale developed residential ROW improvement. Environmental permitting is expected to be addressed most efficiently by bundling with DG5.1 and other DG5 CIPs, with no separate coastal or resource-agency permits anticipated. This assessment assumes the work remains fully within disturbed ROW, does not modify the outfall, and adds only minor incremental description to the bundled environmental package.

DG5.5 is classified as a First-priority equity project based on its location within a Census Block Group with an equity score of 12.

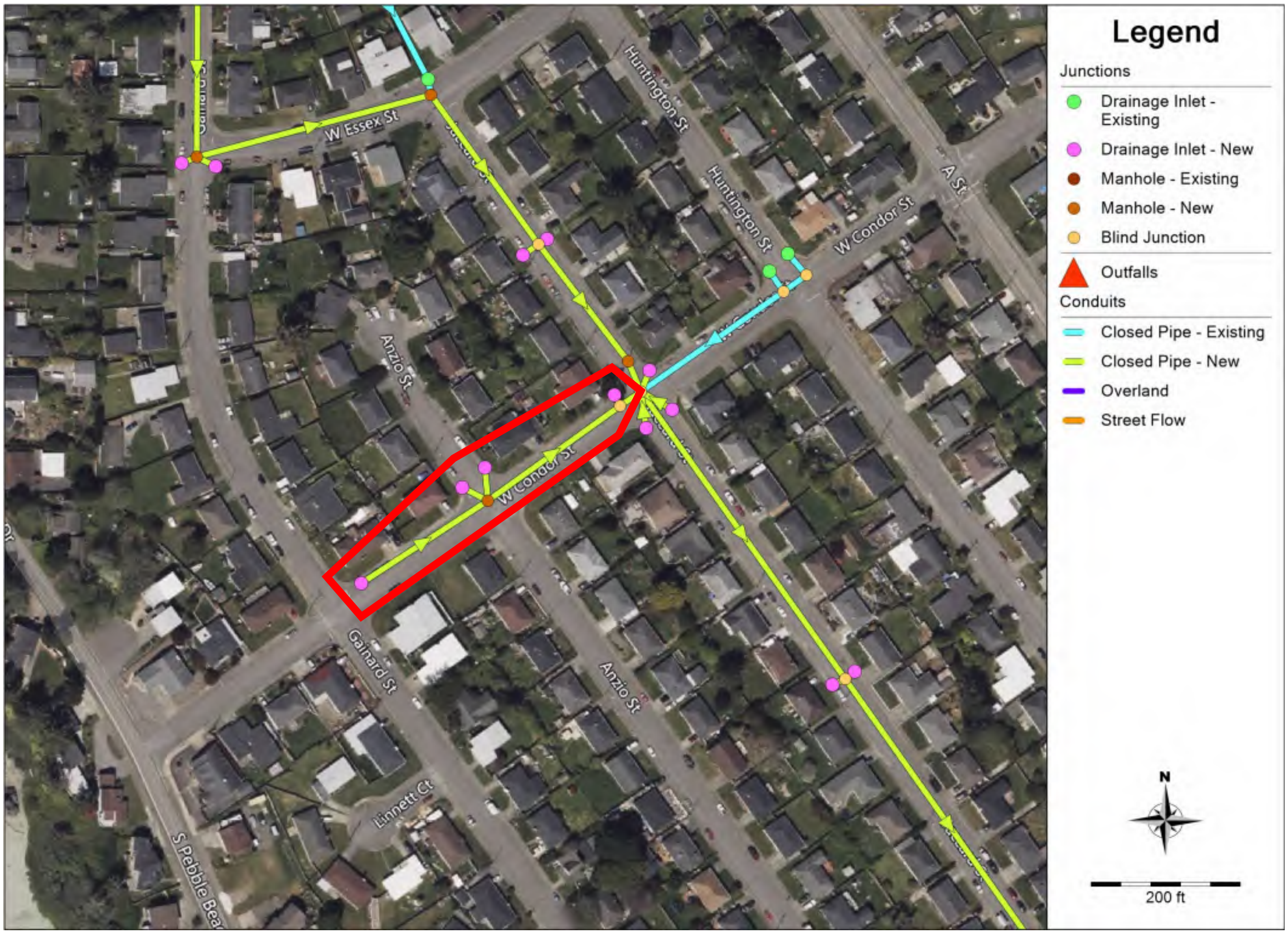

Figure 7.21 CIP DG5.5

7.4.21 DG6.1

Capital Improvement Project DG6.1 consists of approximately 650 linear feet of pipe upgrade shown below in **Figure 7.22**. Pipe upsizing varies along the alignment based on local hydraulic constraints. The following improvements are included in the CIP:

– Upsizing approximately 50 linear feet of existing pipe to 2-foot diameter HDPE pipe
– Upsizing approximately 450 linear feet of existing pipe to 1.5-foot diameter HDPE pipe
– Replacing approximately 150 linear feet of existing lateral pipes
– Installing 8 new drainage inlets and 3 new manholes for maintenance access

DG6.1 is anticipated to require coastal-zone environmental review due to its location within one block of the Pacific Ocean, with CEQA documentation and a City CDP that may be appealable depending on final limits near the beach. Additional considerations may include cultural resources review and potential tribal coordination because the Brother Jonathan Cemetery is identified as a historic/cultural resource in the project vicinity. This assessment assumes the work remains within mostly urban ROW, the existing outfall is not modified, and any cultural requirements are addressed through standard CEQA cultural screening and consultation protocols if triggered.

DG6.1 spans multiple Census Block Groups with equity scores of 12 and 18 and is classified as a First- to Second-priority equity project.

Figure 7.22 *CIP DG6.1*

7.4.22 DG7.1

Capital Improvement Project DG7.1 consists of approximately 400 linear feet of pipe upgrade shown below in **Figure 7.23**. This CIP repairs failed pipe sections leading to Outfall 7 and adds relief from flow to DG2.2 The following improvements are included in the CIP:

– Replace approximately 400 linear feet of existing pipe with 1-foot diameter HDPE pipe
– Installing 2 new drainage inlets and 1 new manhole for maintenance access

DG7.1 is anticipated to require CEQA documentation potentially at the Initial Study/Negative Declaration level due to its coastal bluff/ESHA setting and Coastal Zone location near Outfall 7. Anticipated approvals include an appealable City CDP, biological survey/ESHA verification, and potentially USACE 404 with RWQCB 401 if any portion of work is determined to occur within federal/jurisdictional areas. This assessment assumes the work is limited to pipe repair in a small footprint, the outfall is protected in place, and any separate sediment/debris cleanout seaward of the mean high tide line would be evaluated and permitted separately if pursued.

DG7.1 is classified as a Second-priority equity project based on its location within a Census Block Group with an equity score of 18.

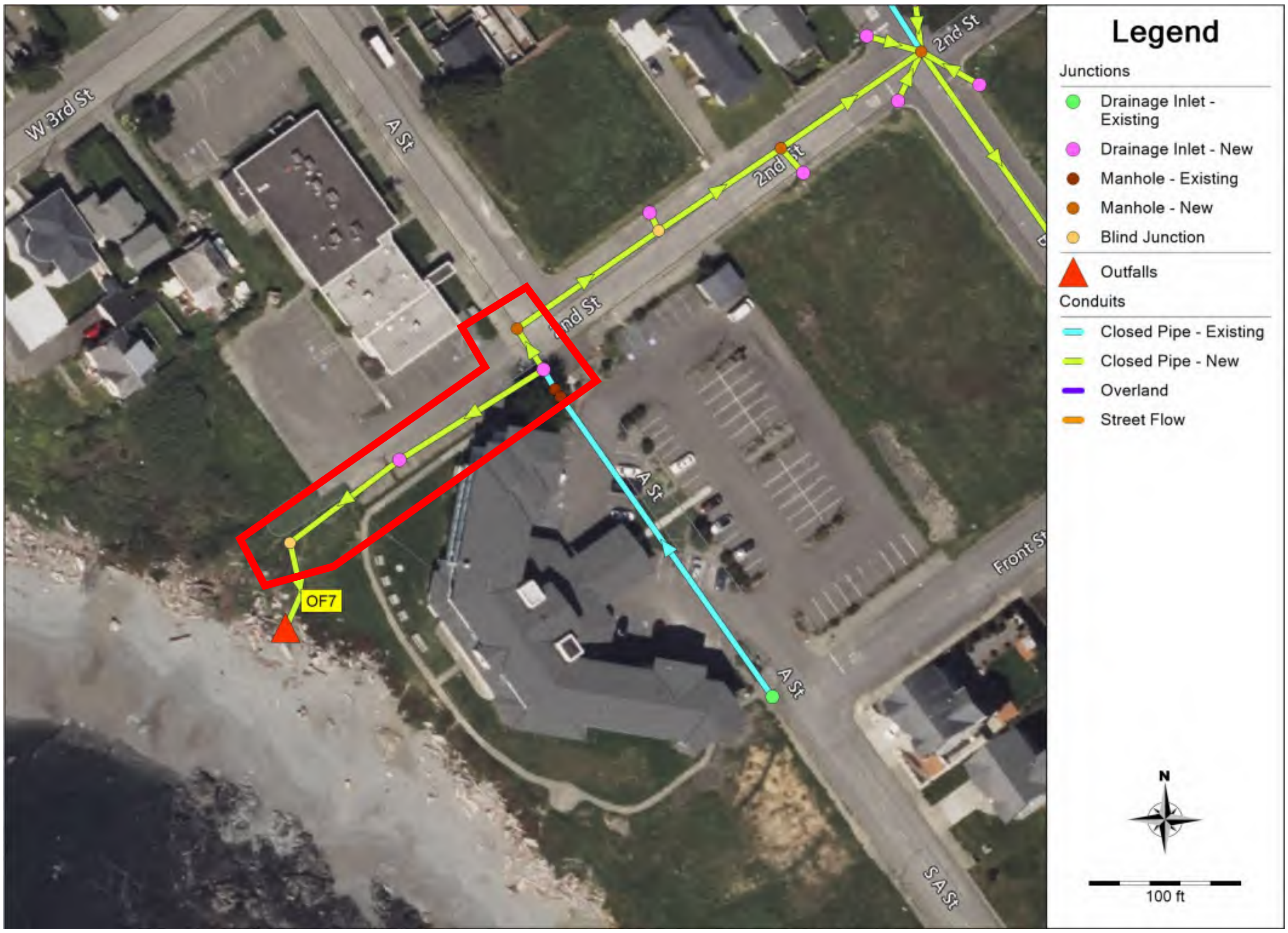

Figure 7.23 *CIP DG 7.1*

7.4.23 DG8.1

Capital Improvement Project DG8.1 consists of approximately 550 linear feet of pipe upgrade shown below in **Figure 7.24**. The following improvements are included in the CIP:

– Adding approximately 300 linear feet of 1-foot diameter HDPE pipe connecting the corner of West 5th Street & Wendell Street to Outfall 8
– Upsizing approximately 100 linear feet of existing pipe to 2-foot diameter HDPE pipe
– Replacing approximately 150 linear feet of existing lateral pipes
– Installing 7 new drainage inlets and 2 new manholes for maintenance access

DG8.1 is anticipated to require CEQA documentation potentially at the Initial Study/Negative Declaration level because it installs a new connection to an existing outfall within the Coastal Zone. Anticipated approvals include an appealable City CDP, biological survey/ESHA verification near the coastal bluff/outfall vicinity, and potential USACE 404/RWQCB 401 depending on the exact connection point relative to coastal jurisdictional boundaries. This assessment assumes the project connects to an existing outfall without modifying it, and that the final terminus is landward of the mean high tide line (if the connection occurs seaward, the permitting tier and agencies could escalate).

DG8.1 spans multiple Census Block Groups with equity scores of 12 and 18 and is classified as a First- to Second-priority equity project.

Figure 7.24 *CIP DG8.1*

7.4.24 DG9.1

Capital Improvement Project DG9.1 consists of approximately 700 linear feet of pipe upgrade shown below in **Figure 7.25**. The following improvements are included in the CIP:

– Upsizing approximately 600 linear feet of existing pipe to 2-foot diameter HDPE pipe
– Replacing approximately 150 linear feet of existing lateral pipes
– Installing 5 new drainage inlets and 2 new manholes for maintenance access

DG9.1 is anticipated to require CEQA documentation with coastal review because the alignment lies within the Coastal Zone strip near Wendell/A Street and may intersect native vegetation near the western terminus. Anticipated approvals include an appealable City CDP and biological survey/ESHA verification, with no outfall modification assumed. This assessment assumes construction stays within existing ROW, avoids unnecessary disturbance of coastal bluff vegetation, and the existing outfall is protected in place.

DG9.1 is classified as a Second-priority equity project based on its location within a Census Block Group with an equity score of 18.

Figure 7.25 *CIP DG9.1*

7.4.25 DG10.1

Capital Improvement Project DG10.1 consists of approximately 600 linear feet of pipe upgrade shown below in **Figure 7.26**. It is recommended to protect the existing outfall in place. Pipe upsizing varies along the alignment based on local hydraulic constraints. The following improvements are included in the CIP:

– Adding approximately 300 linear feet of 4-foot diameter HDPE pipe connecting the Front Street system to Outfall 10
– Upsizing approximately 250 linear feet of existing pipe to 4-foot diameter HDPE pipe
– Replacing approximately 50 linear feet of existing lateral pipes
– Installing 5 new drainage inlets and 1 new manhole for maintenance access

DG10.1 is anticipated to require CEQA Initial Study/Mitigated Negative Declaration-level review because it occurs in the Beachfront Park/Elk Creek mouth corridor, which is a high-resource setting with floodplain mapping and potential sensitive species/habitat concerns. Anticipated approvals include an appealable City CDP, biological assessment (with potential ESA/CESA considerations), possible CDFW 1602 and USACE 404/RWQCB 401 depending on any work in or near Elk Creek, a FEMA Floodplain Development Permit, and cultural resources screening (Phase I if warranted). This assessment assumes the outfall is protected in place, the design can avoid direct in-channel work and habitat impacts to the maximum extent feasible, and permit needs will be refined once final construction limits and avoidance measures are defined during design.

DG10.1 is classified as a Second-priority equity project based on its location within a Census Block Group with an equity score of 18.

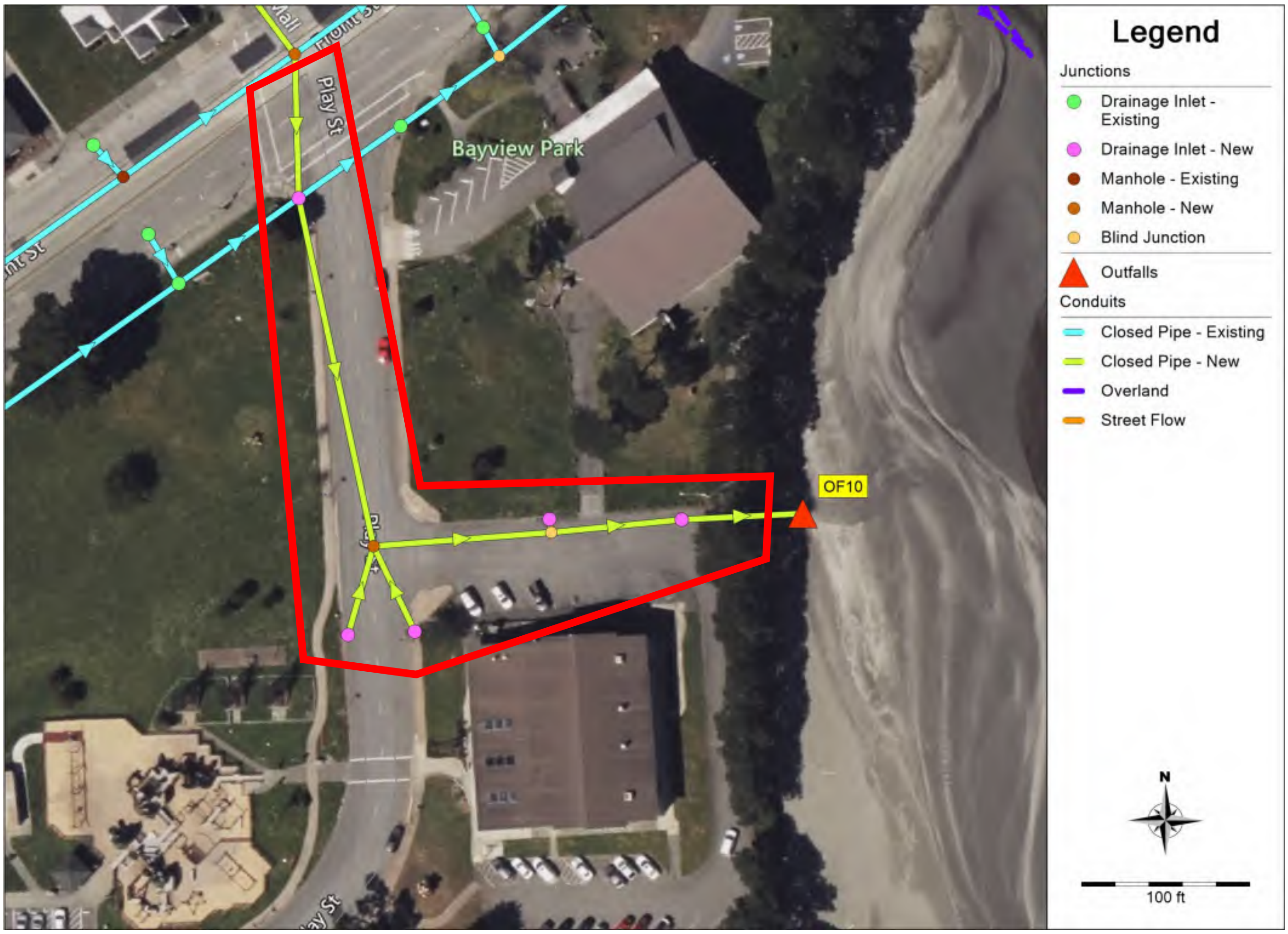

Figure 7.26 *CIP DG10.1*

7.5 Model Results with Proposed Improvements

To assess the efficacy of the proposed CIPs, 2D modelled flood depths and extents were generated with the assumption that all CIPs would be constructed. The figures below show the modelled 2D maximum flood depth and extent results after implementation of the proposed improvements for a 10-year, 24-hour duration SCS Type 1A storm event under present day (**Figure 7.27**) and the mid-century (**Figure 7.28**) and late century climate projections (**Figure 7.29**). The present-day results show a significant reduction in flood extent relative to existing conditions, however, there is a notable increase in the maximum flood extents and depths in Drainage Group 1 and Drainage Group 3 in the mid-century and late-century climate projected increase in precipitation intensity relative to present-day conditions. **Table 7.1** summarized the change in flood results by drainage group between Existing Conditions and Proposed Improvements for the 10-year, 24-hour SCS Type 1A storm event for present day as well as mid-century and late-century climate projections.

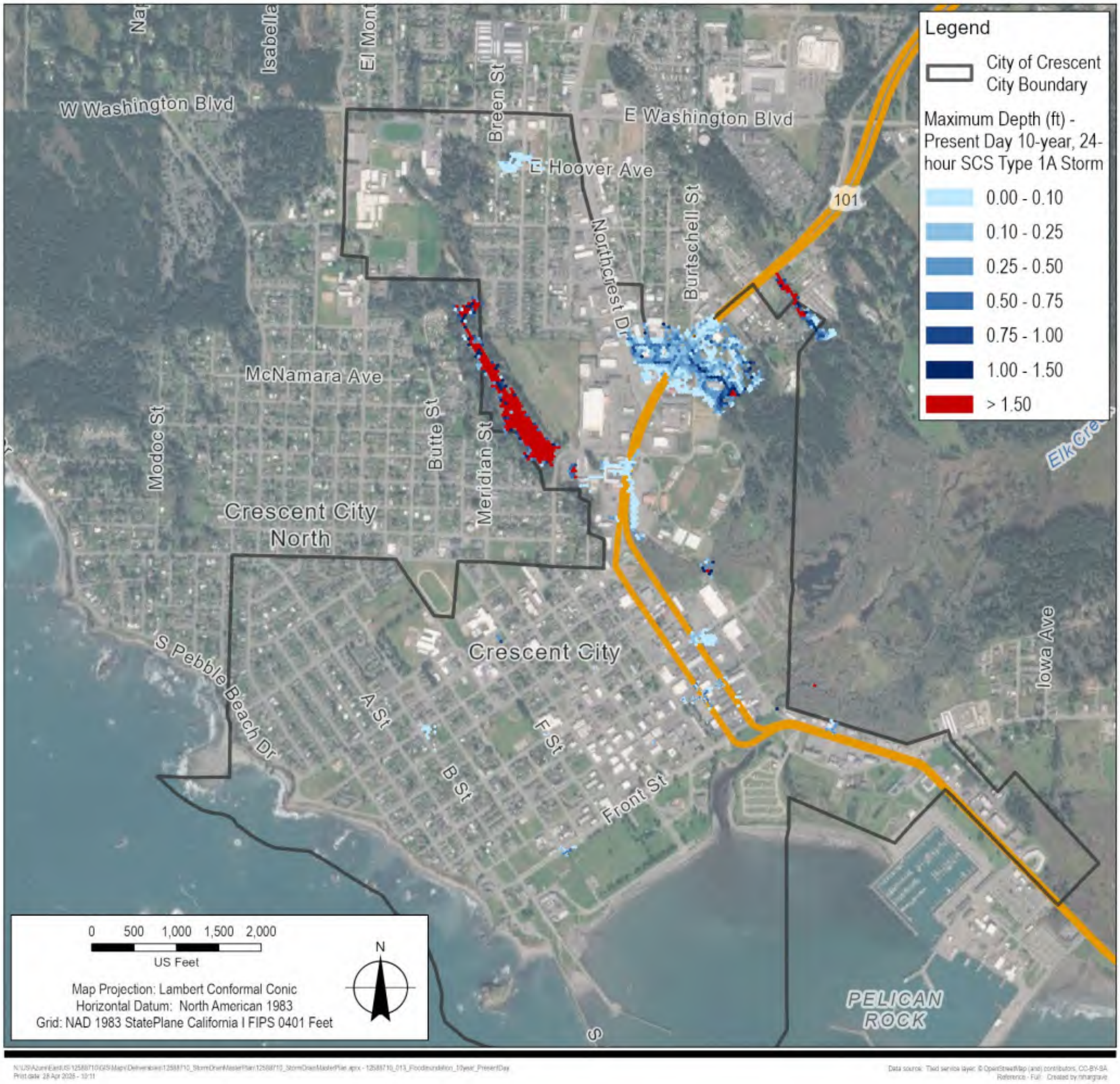

Figure 7.27 Flooding Extent and Depth under Proposed Condition – Present Day 10-year, 24-hour SCS Type 1A Storm

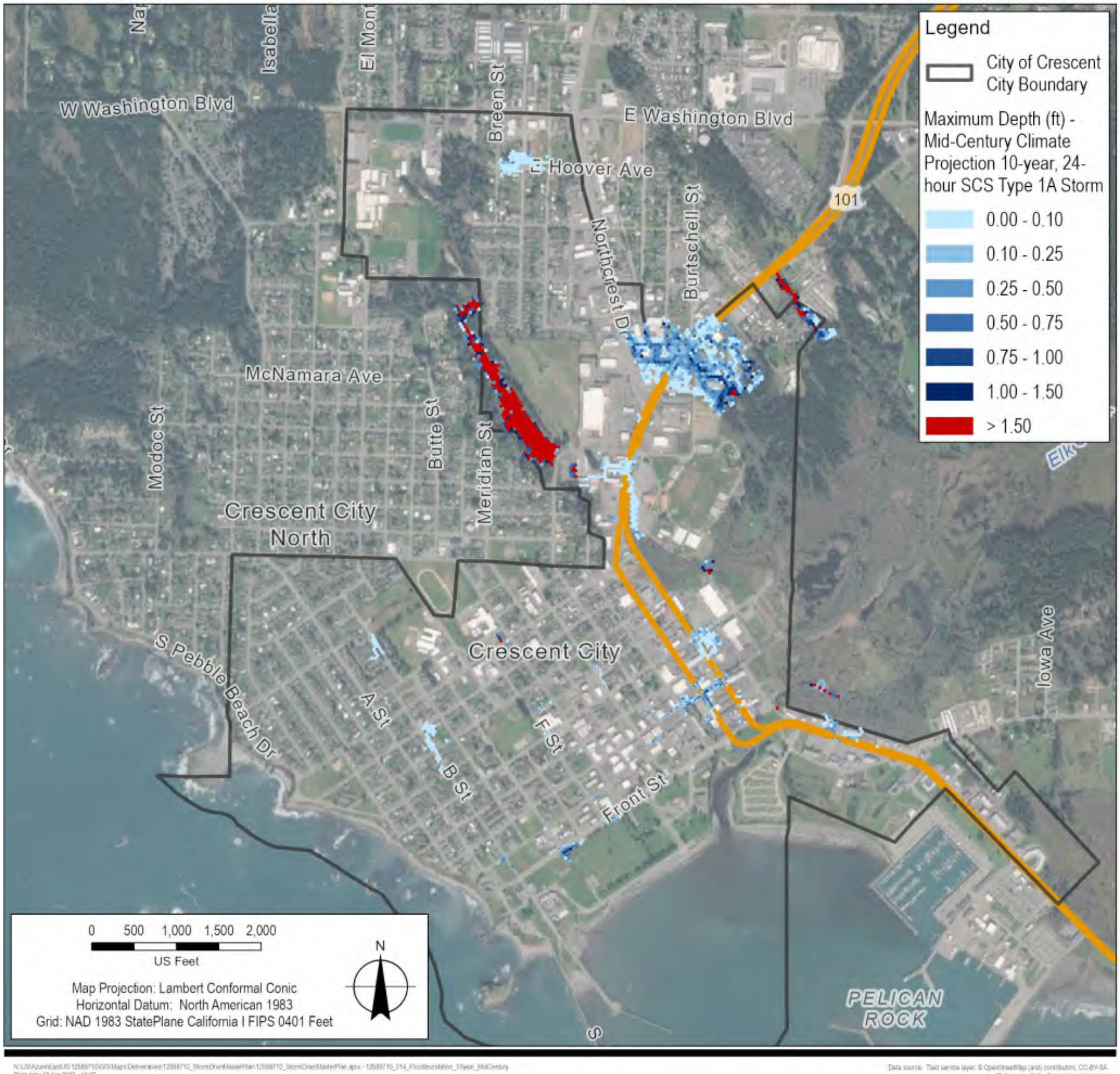

Figure 7.28 Flooding Extent and Depth under Proposed Condition – Mid-Century Climate Projection 10-year, 24-hour SCS Type 1A Storm

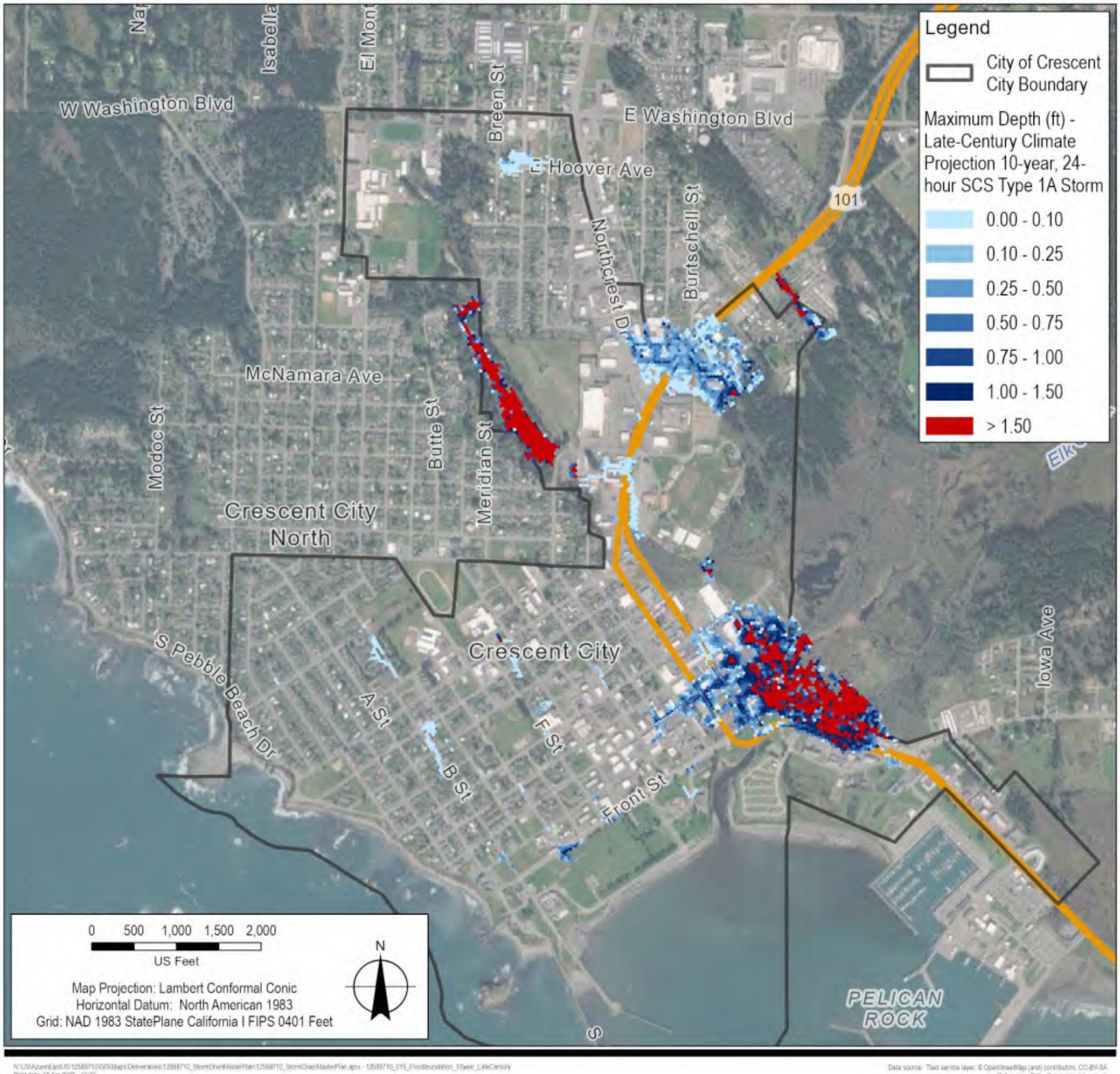

Figure 7.29 Flooding Extent and Depth under Proposed Condition – Late-Century Climate Projection 10-year, 24-hour SCS Type 1A Storm

Table 7.1 Comparison of Model Results between Existing Conditions and Proposed Improvements

Drainage Group	Existing Conditions Present Day 10-Year Storm Event			Proposed Conditions Present Day 10-Year Storm Event			Proposed Conditions Mid-Century 10-Year Storm Event			Proposed Conditions Late Century 10-Year Storm Event		
	Total Flood Volume (MG)	Maximum Flood Rate (cfs)	Maximum Duration of Flooding (hrs)	Total Flood Volume (MG)	Maximum Flood Rate (cfs)	Maximum Duration of Flooding (hrs)	Total Flood Volume (MG)	Maximum Flood Rate (cfs)	Maximum Duration of Flooding (hrs)	Total Flood Volume (MG)	Maximum Flood Rate (cfs)	Maximum Duration of Flooding (hrs)
DG1	9.8	65.8	22.4	0	0	0	0	0	0	0	0.2	0
DG2	6.8	14.7	22.6	0	0.3	0.1	0.1	6.1	0.5	315.2	4679.3	3.6
DG3	20.1	19.4	23.2	7.7	19.4	23.1	10.0	20.9	23.1	80.0	5051.1	23.2
DG4	12.3	42.9	23.2	0.9	9.1	22.8	1.4	11.8	22.9	242.7	1883.8	22.9
DG5	1.9	11.4	15.7	0	10.4	0.2	0.1	12.3	0.3	0.1	13.3	0.4
DG6	0.2	5.9	2.3	0	0	0	0	0	0	0	0.1	0.1
DG7	0	0	0	0	0	0	0	0	0	0	0	0
DG8	0	1.4	0.7	0	0	0	0	0	0	0	0	0
DG9	0.1	7.1	0.8	0	0	0	0	0	0	0	0	0
DG10	0	0	0	0	0	0	0	0	0	12.0	144.2	4.9

7.6 CIP Opinion of Probable Costs

Opinions of probable construction costs were primarily estimated based on estimated quantity of storm drain pipe and catch basins and manholes added or replaced by each CIP. These quantities were also used to estimate costs associated with pipe removal, AC pavement removal, and AC pavement restoration. Traffic control, dewatering, and excavation shoring/bracing costs were also estimated. Based on the percentages of the construction subtotal, mobilization/demobilization, bonds and insurance, contractor overhead and profit, and construction contingency were estimated. Engineering services and construction management was estimated by calculating a percentage of the total probably construction cost estimate. A summary of estimated costs for opinion of probable construction, engineering/construction management, and permitting & environmental compliance for each CIP and Drainage Group is presented in **Table 7.2**.

Table 7.2 Cost Estimate Summary by CIP and Drainage Group

Drainage Group	CIP	Opinion of Probable Construction Cost	Engineering/Construction Management	Environmental Compliance & Permitting	Total
DG1	DG1.1	$663,000	$225,000	$10,000	**$898,000**
DG2	DG2.1B	$1,485,000	$505,000	$5,000	$1,995,000
	DG2.2	$1,236,000	$420,000	$25,000	$1,681,000
	DG2.2B	$863,000	$293,000	$5,000	$1,161,000
	DG 2 Subtotals	$3,584,000	$1,218,000	$35,000	**$4,837,000**
DG3	DG3.1A	$2,295,000	$780,000	$60,000	$3,135,000
	DG3.1B	$1,560,000	$530,000	$45,000	$2,135,000
	DG3.2A	$1,685,000	$573,000	$3,000	$2,261,000
	DG3.2B	$3,545,000	$1,205,000	$50,000	$4,800,000
	DG3.2C	$718,000	$244,000	$80,000	$1,042,000
	DG3.3A	$331,000	$112,000	$60,000	$503,000
	DG3.3B	$1,182,000	$402,000	$50,000	$1,634,000
	DG 3 Subtotals	$11,316,000	$3,846,000	$348,000	**$15,510,000**
DG4	DG4.1A	$2,409,000	$819,000	$5,000	$3,233,000
	DG4.1B	$1,779,000	$605,000	$2,000	$2,386,000
	DG4.2	$1,280,000	$435,000	$10,000	$1,725,000
	DG4.3	$1,332,000	$453,000	$3,000	$1,788,000
	DG 4 Subtotals	$6,800,000	$2,312,000	$20,000	**$9,132,000**
DG5	DG5.1	$5,390,000	$1,833,000	$40,000	$7,263,000
	DG5.2	$2,277,000	$774,000	$5,000	$3,056,000
	DG5.3	$1,273,000	$433,000	$5,000	$1,711,000
	DG5.4	$3,024,000	$1,028,000	$8,000	$4,060,000
	DG5.5	$519,000	$176,000	$2,000	$697,000
	DG 5 Subtotals	$12,483,000	$4,244,000	$60,000	**$16,787,000**
DG6	DG6.1	$942,000	$320,000	$10,000	**$1,272,000**
DG7	DG7.1	$243,000	$83,000	$60,000	**$386,000**

Drainage Group	CIP	Opinion of Probable Construction Cost	Engineering/Construction Management	Environmental Compliance & Permitting	Total
DG8	DG8.1	$554,000	$188,000	$60,000	**$802,000**
DG9	DG9.1	$696,000	$237,000	$40,000	**$973,000**
DG10	DG10.1	$1,692,000	$575,000	$80,000	**$2,347,000**

8. Evaluation and Prioritization of Capital Improvement Projects (CIP)

Data Collection → Model → Analysis → Project → ***Priority*** → Phase

8.1 Prioritization Framework

To support in the development of drainage enhancement projects for the Storm Drain Master Plan, a list of project criteria has been developed to support in proposed project prioritization, and to be utilized as a tool to highlight opportunities for grant funding to support further project development. Project criteria were determined in collaboration with the City. **Table 8.1** below presents the weighted project criteria.

Table 8.1 Prioritization Scoring Criteria

Prioritization Criteria	Criteria Description	Evaluation Criteria	Score	Criteria Scoring Weight[2]
Health and Safety				
Impact to Life / Access to Critical Roads	The risk of human life and safety the proposed project would mitigate. Do current flooding extents limit access to critical roads? Critical roads can be roads that allow access into and out of the City and roads for first responders to hospitals.	Flooding extent is reduced to shoulder of arterials. OR Flooding extent is reduced to ½ driving lane on collector.	Meets Criteria = 1 Does not meet criteria = 0	5
Private and Public Property				
Impact to Property / Flooding near Houses	The risk to property the proposed project would mitigate. Is flooding extent reduced to the right-of-way by the proposed project?	Flooding extent does not intersect with private property lines.	Meets Criteria = 1 Does not meet criteria = 0	4
Environment				

[2] Criteria Scoring Weight:
1 – Least Important
5 – Most Important

Prioritization Criteria	Criteria Description	Evaluation Criteria	Score	Criteria Scoring Weight[2]
Water Quality	Does the proposed project have opportunities to address water quality?	At least one catch basin insert in proposed project.	Meets Criteria = 1 Does not meet criteria = 0	2
Regulatory Protected Areas	What permits are anticipated for the project implementation?	Project is not in a floodplain or a natural, undisturbed area.	Meets Criteria = 1 Does not meet criteria = 0	3
Special Species Protection (ESA potential)	Does project have the potential to encounter protected species?	Project is not on the beach, does not discharge on the beach, or is in a natural, undisturbed area.	Meets Criteria = 1 Does not meet criteria = 0	2
Trash Capture	Opportunities to incorporate trash capture devices.	Feasibility of installing at least one trash capture device within the proposed CIP (catch basin or pipe end).	Meets Criteria = 1 Does not meet criteria = 0	2
Feasibility				
Proposed Pipe under Pavement	Do project components cross under pavement?	No storm drain pipes under pavement with flooding/surcharging junctions.	Meets Criteria = 1 Does not meet criteria = 0	4
Existing Pipe under Private Property	Do existing storm drain pipes run under private property parcels? Does the CIP propose a redundant conveyance in City's right-of-way.	Existing storm drain pipes are under private property. Proposed CIP provides redundant conveyance in right-of-way.	Meets Criteria = 1 Does not meet criteria = 0	3
Infrastructure Properties				
Condition	Overall condition of the existing stormwater infrastructure.	Stormwater infrastructure in critical condition or has emerging issues.	1 – Critical 0.5 – Emerging 0 - Good	5

8.2 Application of Prioritization Criteria

The mitigation of flooding in one area of a drainage group could cause additional flooding in another area of a drainage group. For example, any conveyance upgrade to increase hydraulic capacity such as a larger diameter pipe in an upstream area of a drainage group could cause unintended flooding downstream. To reduce the risk of unintended flooding caused by improvements and to support the sequencing approach further illustrated in Section 9, the prioritization scoring was applied to full drainage groups as opposed to individuals CIPs within a drainage group.

The prioritization scoring based on the criteria presented in **Table 8.1** was applied primarily by review of the modelling results, locations of proposed improvements, and other available GIS data:

Health and Safety – To evaluate if a potential CIP could mitigate the risk of flooding to health and safety, the maps of the drainage groups were reviewed to determine if Highway 101 or major arterials connecting residential areas to Highway 101 are present. Then under existing conditions, the modeled flood extent under a 10-year, 24-hour durations storm event in the drainage group was reviewed to determine if the flooding extends into these critical roads. Lastly, under proposed conditions, the modeled flood extent under the same storm event was reviewed to evaluate if the change in flood extent is reduced based on the evaluation criteria above.

Private and Public Property – The maps of the drainage groups were reviewed to determine if private or public property are present. Then under existing conditions, the modeled flood extent under a 10-year, 24-hour durations storm event in the drainage group was reviewed to determine if the flooding intersects with the parcels of private and public property. Lastly, under proposed conditions, the modeled flood extent under the same storm event was reviewed to evaluate if the change in flood extent is reduced based on the evaluation criteria above.

Water Quality – To determine if the CIPs within a drainage group had opportunities to improve water quality, the maps of the drainage groups were reviewed to determine the presence of one proposed catch basin. A new catch basin offers the opportunity to install a new catch basin insert designed to treat water before entering the storm drain system.

Regulatory Protected Areas – The maps of the drainage groups were reviewed to identify the presence of natural, undisturbed areas and floodplains intersecting with the potential CIPs. The permitting process for CIPs within this drainage group would take longer and be more challenging.

Special Species Protection – The maps of the drainage groups were reviewed to identify if potential CIPs were on a beach, discharge to a beach, or were in a natural, undisturbed area. Any drainage groups with CIPs that meet these criteria could require Endangered Species Act (ESA) permitting which could extend the complexity and duration of the environmental permitting process.

Trash Capture – To determine if the CIPs within a drainage group had opportunities to incorporate trash capture devices in accordance with the Trash Provisions to the NPDES Phase II MS4 permit (Section 2.2.2), the maps of the drainage groups were reviewed to determine the presence of one proposed catch basin. A new catch basin offers the opportunity to install a trash capture device.

Proposed Pipe under Pavement – The maps of the drainage groups were reviewed to identify if the potential CIPs were located in the paved right-of-way. These CIPs would be slightly more challenging to construct than CIPs in parks because they would require traffic control and patch paving.

Existing Pipe under Private Property – The maps of the drainage groups were reviewed to determine if the existing pipes ran under private property parcels and the proposed CIPs provided redundant conveyance along the City's right-of-ways.

Condition – The maps of the drainage groups were reviewed to determine if there were existing stormwater infrastructure assessed to have emerging issues or in critical condition during field survey. Drainage groups with CIPs that propose replacement of this infrastructure scored higher in the prioritization.

8.3 CIP Prioritization Results

8.3.1 Drainage Group 1

Drainage Group 1 includes CIP DG1.1. Based on the prioritization scoring criteria, Drainage Group 1 scores 15/30. A key map of the CIP in Drainage Group 1 is presented in **Figure 8.1**. The summary of the weighted prioritization scoring criteria, opinion of probable construction cost, engineering/construction management cost, and permitting/environmental compliance cost is presented in **Table 8.2**.

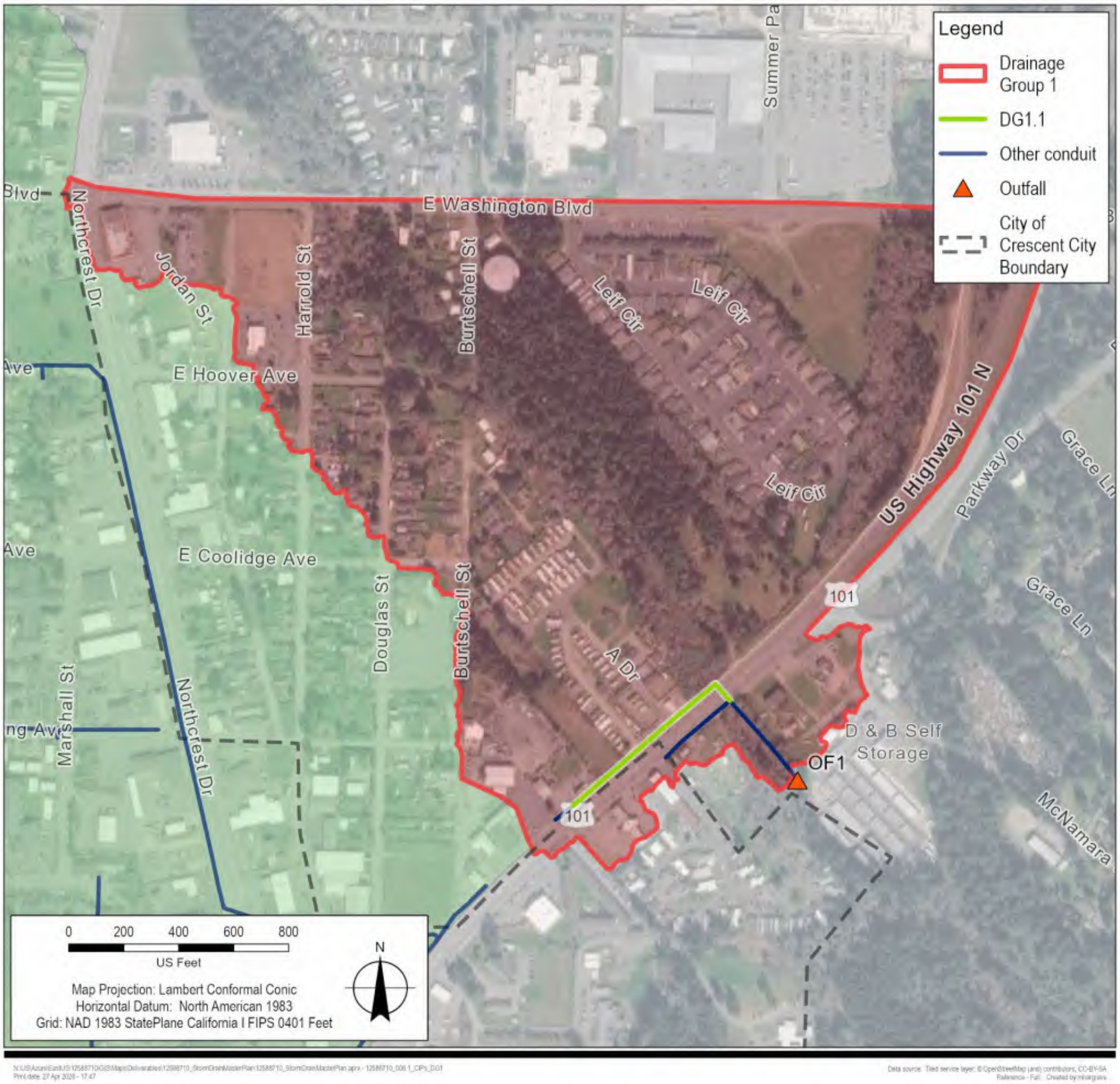

Figure 8.1 *Drainage Group 1 – CIP Key Map*

Table 8.2 *Drainage Group 1 Prioritization Score*

Prioritization Criteria	Notes/Comments	Weighted Score
Impact to Life / Access to Critical Roads	Flooding extent reduced on Highway 101.	5
Impact to Property / Flooding near Houses	Flood extent does not intersect with private property lines.	4
Water Quality	New drainage inlets offer the opportunity to install catch basin inserts.	2

Prioritization Criteria	Notes/Comments	Weighted Score
Regulatory Protected Areas	Proposed project drains to regulatory floodplain (Elk Creek basin).	0
Special Species Protection (ESA potential)	No outfalls on beaches.	2
Trash Capture	New drainage inlets offer the opportunity to install trash capture devices.	2
Proposed Pipe under Pavement	All proposed improvements are located under pavement.	0
Existing Pipe under Private Property	No existing pipes are located under private property.	0
Condition	All existing drainage features are in good condition.	0
	TOTAL PRIORITIZATION SCORE	**15/30**
	Opinion of Probable Construction Cost	$663,000
	Engineering/Construction Management	$225,000
	Environmental Compliance & Permitting	$10,000
	TOTAL COST	**$898,000**

8.3.2 Drainage Group 2

Drainage Group 2 includes CIP DG2.1B, DG2.2, and DG2.2B. Based on the prioritization scoring criteria, Drainage Group 2 scores 21.5/30. A key map of the CIPs in Drainage Group 2 is presented in **Figure 8.2**. The summary of the weighted prioritization scoring criteria, opinion of probable construction cost, engineering/construction management cost, and permitting/environmental compliance cost is presented in **Table 8.3**.

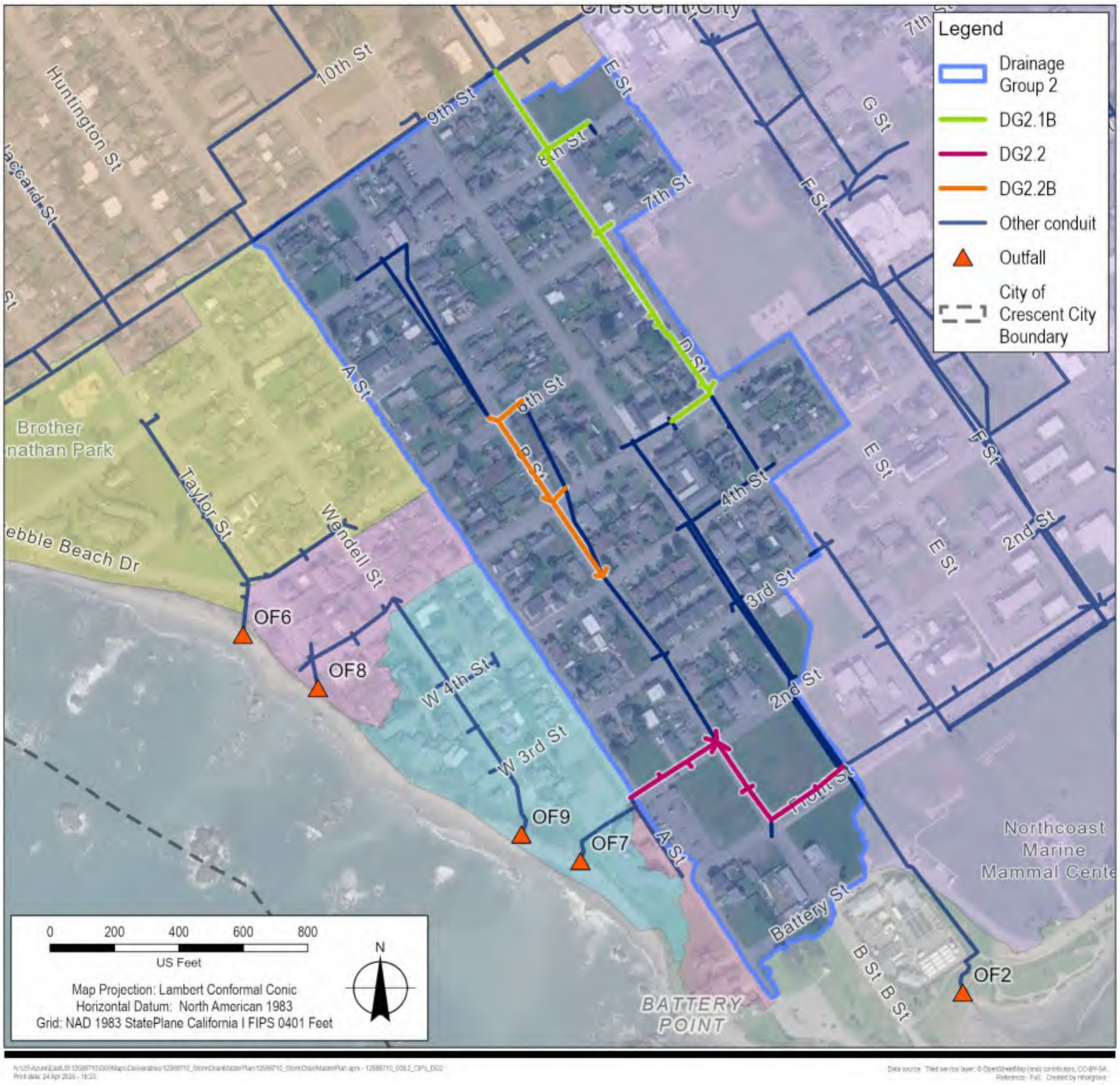

Figure 8.2 Drainage Group 2 – CIP Key Map

Table 8.3 Drainage Group 2 Prioritization Score

Prioritization Criteria	Notes/Comments	Weighted Score
Impact to Life / Access to Critical Roads	Flooding elimination on 9th St, a major arterial connecting residential areas to Highway 101.	5
Impact to Property / Flooding near Houses	Flood extent does not intersect with private property lines.	4
Water Quality	New drainage inlets offer the opportunity to install catch basin inserts.	2
Regulatory Protected Areas	Project does not intersect with natural, undisturbed area.	3
Special Species Protection (ESA potential)	Drainage Group discharges onto a beach.	0

Prioritization Criteria	Notes/Comments	Weighted Score
Trash Capture	New drainage inlets offer the opportunity to install trash capture devices.	2
Proposed Pipe under Pavement	All proposed improvements are located under pavement.	0
Existing Pipe under Private Property	Existing storm drain pipes are under private property. Proposed CIP provides redundant conveyance in right-of-way.	3
Condition	Some existing drainage features were assessed to have emerging issues.	2.5
	TOTAL PRIORITIZATION SCORE	**21.5/30**
	Opinion of Probable Construction Cost	$3,584,000
	Engineering/Construction Management	$1,218,000
	Environmental Compliance & Permitting	$35,000
	TOTAL COST	**$4,837,000**

8.3.3 Drainage Group 3

Drainage Group 3 includes CIP DG3.1A, DG3.1B, DG3.2A, DG3.2B, DG3.2C, DG3.3A, and DG3.3B. Based on the prioritization scoring criteria, Drainage Group 3 scores 18/30. A key map of the CIPs in Drainage Group 3 is presented in **Figure 8.3**. The summary of the weighted prioritization scoring criteria, opinion of probable construction cost, engineering/construction management cost, and permitting/environmental compliance cost is presented in **Table 8.4**.

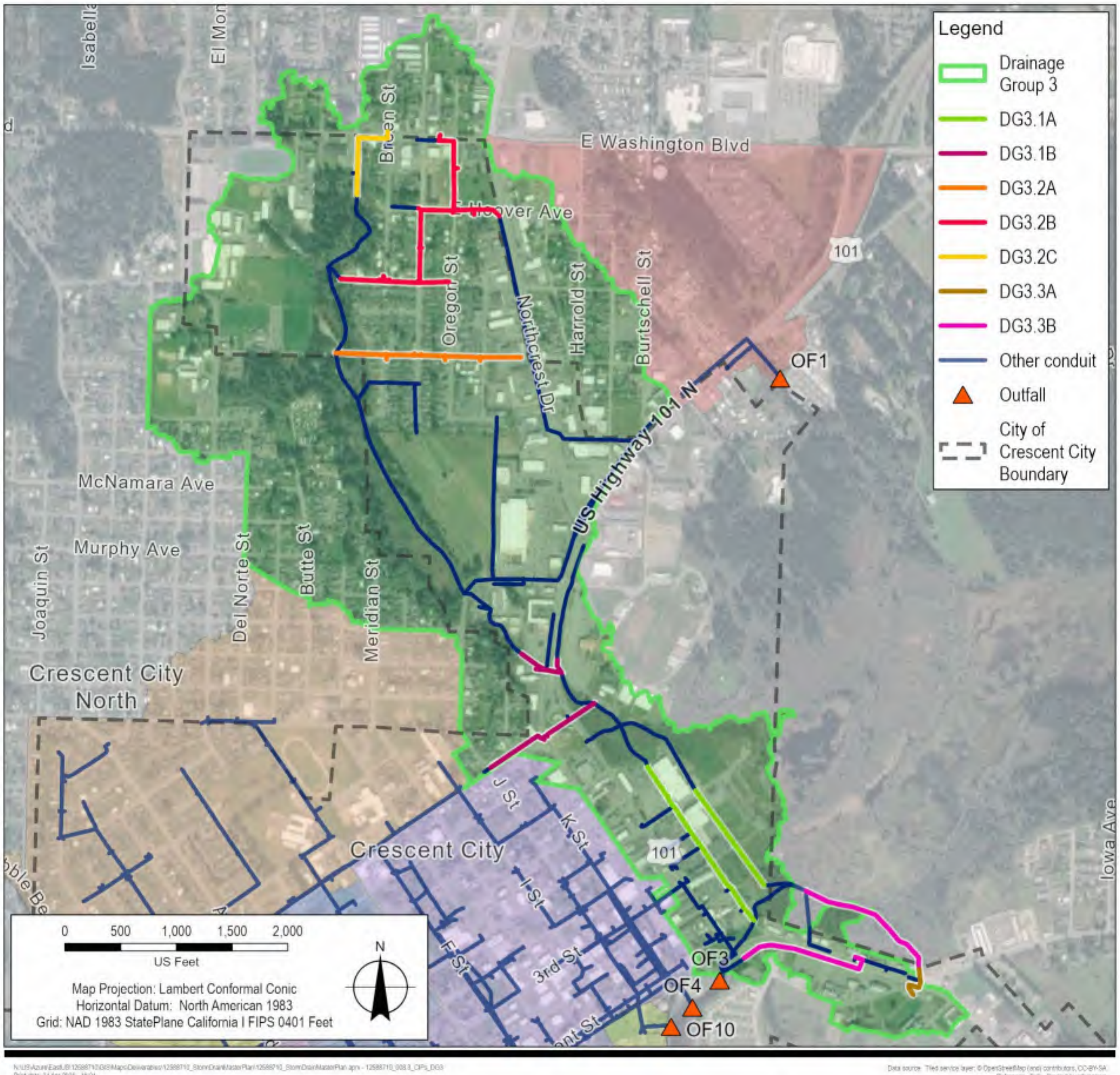

Figure 8.3 Drainage Group 3 – CIP Key Map

Table 8.4 Drainage Group 3 Prioritization Score

Prioritization Criteria	Notes/Comments	Weighted Score
Impact to Life / Access to Critical Roads	Flooding extent along Highway 101 North through downtown nearly eliminated; minor flooding is projected to continue near the intersection with 5th St.	5
Impact to Property / Flooding near Houses	Flood extent does not intersect with private property lines.	4
Water Quality	New drainage inlets offer the opportunity to install catch basin inserts.	2
Regulatory Protected Areas	Proposed project drains to regulatory floodplain (Elk Creek basin).	0

Prioritization Criteria	Notes/Comments	Weighted Score
Special Species Protection (ESA potential)	Drainage Group discharges into a natural, undisturbed area.	0
Trash Capture	New drainage inlets offer the opportunity to install trash capture devices.	2
Proposed Pipe under Pavement	All proposed improvements are located under pavement.	0
Existing Pipe under Private Property	Existing storm drain pipes are under private property. Proposed CIP remains under private property.	0
Condition	Some existing drainage features were assessed to be in critical condition.	5
	TOTAL PRIORITIZATION SCORE	**18/30**
	Opinion of Probable Construction Cost	$11,316,000
	Engineering/Construction Management	$3,846,000
	Environmental Compliance & Permitting	$348,000
	TOTAL COST	**$15,510,000**

8.3.4 Drainage Group 4

Drainage Group 4 includes CIP DG4.1A, DG4.1B, DG4.2, and DG4.3. Based on the prioritization scoring criteria, Drainage Group 4 scores 24/30. A key map of the CIPs in Drainage Group 4 is presented in **Figure 8.4**. The summary of the weighted prioritization scoring criteria, opinion of probable construction cost, engineering/construction management cost, and permitting/environmental compliance cost is presented in **Table 8.5**.

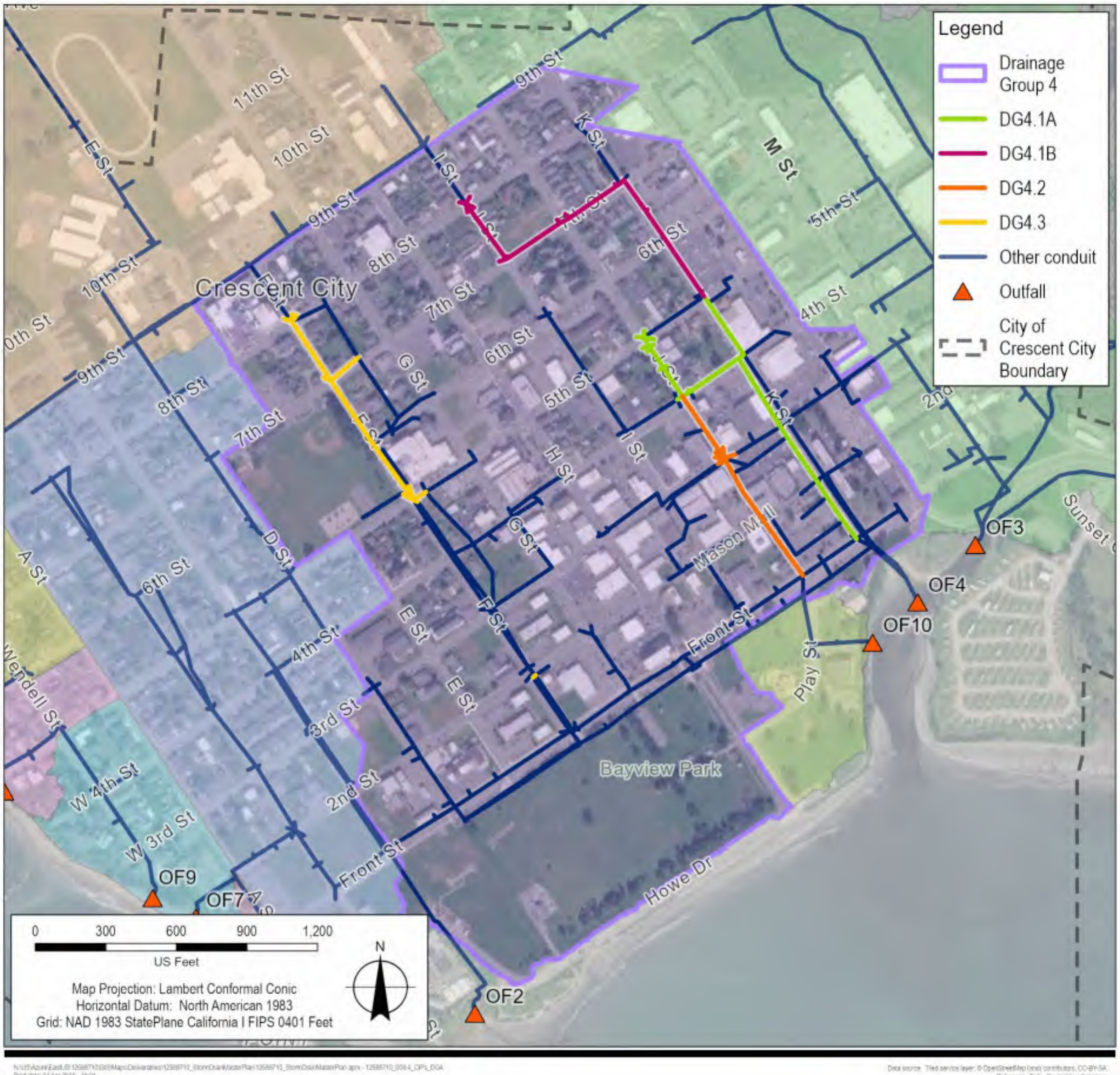

Figure 8.4 Drainage Group 4 – CIP Key Map

Table 8.5 Drainage Group 4 Prioritization Score

Prioritization Criteria	Notes/Comments	Weighted Score
Impact to Life / Access to Critical Roads	Flooding extent along multiple arterials connected to Highway 101 and downtown are significantly reduced or eliminated.	5
Impact to Property / Flooding near Houses	Flooding extent under existing conditions extensively intersects with private property. Proposed improvements significantly reduce the flooding extent.	4
Water Quality	New drainage inlets offer the opportunity to install catch basin inserts.	2
Regulatory Protected Areas	Project does not intersect with natural, undisturbed area.	3

Prioritization Criteria	Notes/Comments	Weighted Score
Special Species Protection (ESA potential)	Drainage Group discharges onto a beach.	0
Trash Capture	New drainage inlets offer the opportunity to install trash capture devices.	2
Proposed Pipe under Pavement	All proposed improvements are located under pavement.	0
Existing Pipe under Private Property	Existing storm drain pipes are under private property. Proposed CIP provides redundant conveyance in right-of-way.	3
Condition	Some existing drainage features were assessed to be in critical condition.	5
	TOTAL PRIORITIZATION SCORE	**24/30**
	Opinion of Probable Construction Cost	$6,800,000
	Engineering/Construction Management	$2,312,000
	Environmental Compliance & Permitting	$20,000
	TOTAL COST	**$9,132,000**

8.3.5 Drainage Group 5

Drainage Group 5 includes CIP DG5.1, DG5.2, DG5.3, DG5.4, and DG5.5. Based on the prioritization scoring criteria, Drainage Group 5 scores 24/30. A key map of the CIPs in Drainage Group 5 is presented in **Figure 8.5**. The summary of the weighted prioritization scoring criteria, opinion of probable construction cost, engineering/construction management cost, and permitting/environmental compliance cost is presented in **Table 8.6**.

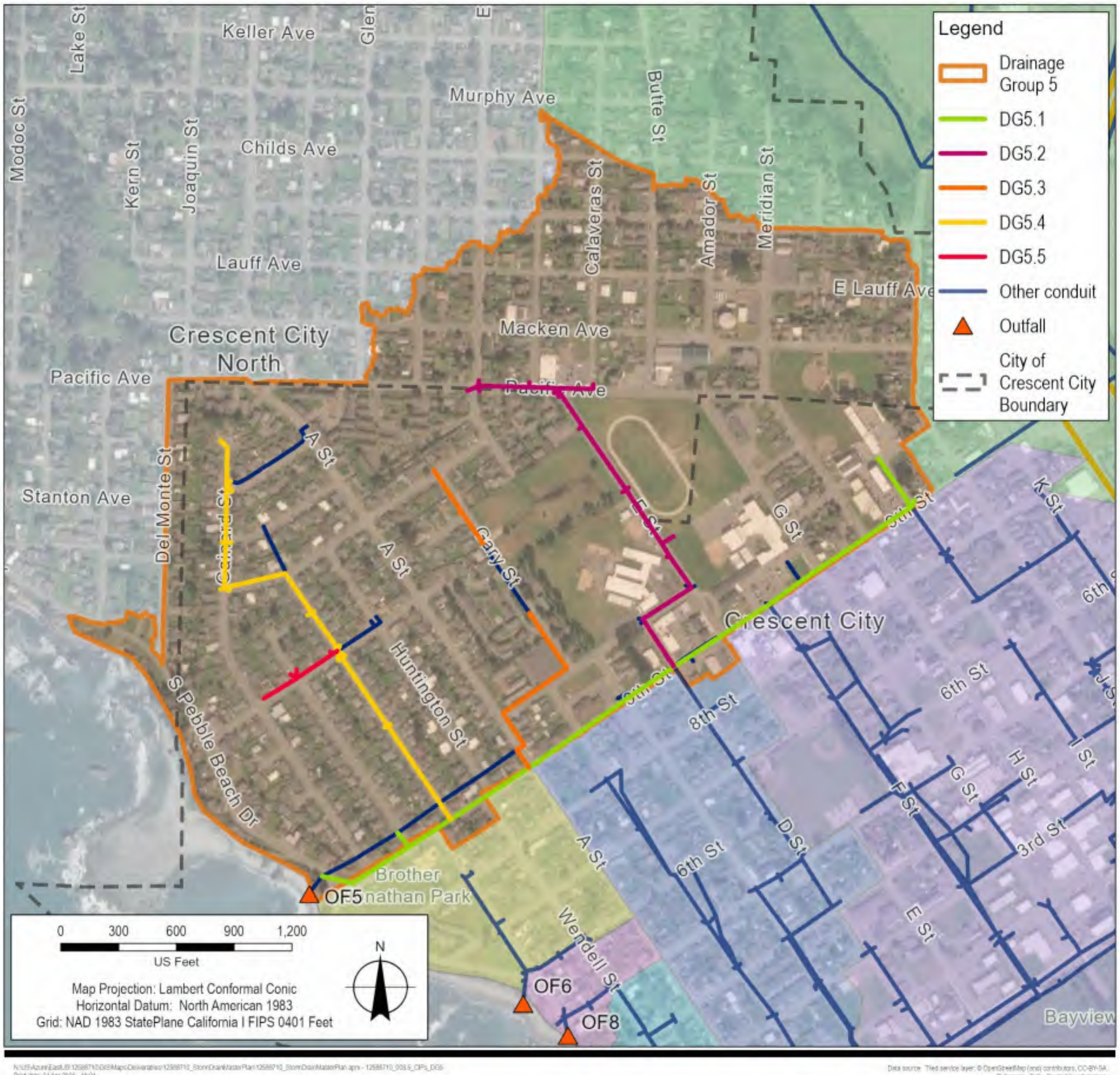

Figure 8.5 Drainage Group 5 – CIP Key Map

Table 8.6 Drainage Group 5 Prioritization Score

Prioritization Criteria	Notes/Comments	Weighted Score
Impact to Life / Access to Critical Roads	Flooding elimination on 9th St, a major arterial connecting residential areas to Highway 101. Flooding is also eliminated along Pacific Ave and E St, major collectors to 9th Ave.	5
Impact to Property / Flooding near Houses	Flooding extent under existing conditions extensively intersects with private property. Proposed improvements significantly reduce the flooding extent.	4
Water Quality	New drainage inlets offer the opportunity to install catch basin inserts.	2
Regulatory Protected Areas	Project does not intersect with natural, undisturbed area.	3

Prioritization Criteria	Notes/Comments	Weighted Score
Special Species Protection (ESA potential)	Drainage Group discharges onto a beach.	0
Trash Capture	New drainage inlets offer the opportunity to install trash capture devices.	2
Proposed Pipe under Pavement	All proposed improvements are located under pavement.	0
Existing Pipe under Private Property	Existing storm drain pipes are under private property. Proposed pipes provides redundant conveyance in right-of-way.	3
Condition	Some existing drainage features were assessed to be in critical condition.	5
	TOTAL PRIORITIZATION SCORE	**24/30**
	Opinion of Probable Construction Cost	$12,483,000
	Engineering/Construction Management	$4,244,000
	Environmental Compliance & Permitting	**$120,000**
	TOTAL COST	**$16,787,000**

8.3.6 Drainage Group 6

Drainage Group 6 includes CIP DG6.1. Based on the prioritization scoring criteria, Drainage Group 6 scores 11/30. A key map of the CIP in Drainage Group 6 is presented in **Figure 8.6**. The summary of the weighted prioritization scoring criteria, opinion of probable construction cost, engineering/construction management cost, and permitting/environmental compliance cost is presented in **Table 8.7**.

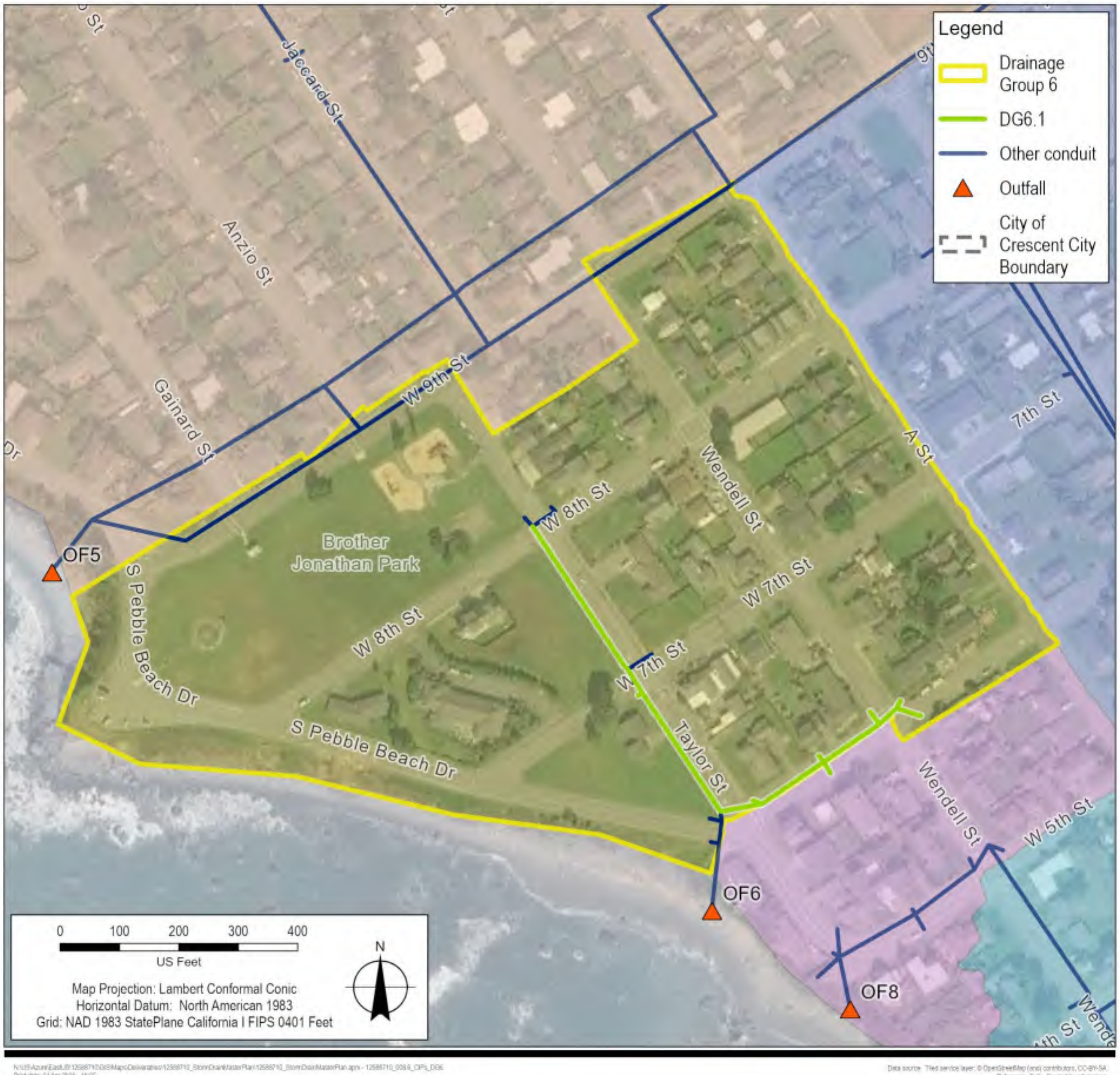

Figure 8.6 Drainage Group 6 – CIP Key Map

Table 8.7 Drainage Group 6 Prioritization Score

Prioritization Criteria	Notes/Comments	Weighted Score
Impact to Life / Access to Critical Roads	Though flooding is projected to occur under existing conditions, there are no major arterials nor other critical roads.	0
Impact to Property / Flooding near Houses	Proposed improvements eliminates the flooding extent projected to intersect with private property under existing conditions	4
Water Quality	New drainage inlets offer the opportunity to install catch basin inserts.	2
Regulatory Protected Areas	Project does not intersect with natural, undisturbed area.	3

Prioritization Criteria	Notes/Comments	Weighted Score
Special Species Protection (ESA potential)	Drainage Group discharges onto a beach.	0
Trash Capture	New drainage inlets offer the opportunity to install trash capture devices.	2
Proposed Pipe under Pavement	Most proposed improvements are located under pavement.	0
Existing Pipe under Private Property	Existing pipe to outfall is aligned under private property. No proposed pipes provide redundant conveyance or realigns outfall.	0
Condition	No existing infrastructure is in emerging nor critical condition.	0
	TOTAL PRIORITIZATION SCORE	**11/30**
	Opinion of Probable Construction Cost	$942,000
	Engineering/Construction Management	$320,000
	Environmental Compliance & Permitting	$10,000
	TOTAL COST	**$1,272,000**

8.3.7 Drainage Group 7

Drainage Group 7 includes CIP DG7.1. Based on the prioritization scoring criteria, Drainage Group 7 scores 12/30. A key map of the CIP in Drainage Group 7 is presented in **Figure 8.7**. The summary of the weighted prioritization scoring criteria, opinion of probable construction cost, engineering/construction management cost, and permitting/environmental compliance cost is presented in **Table 8.8**.

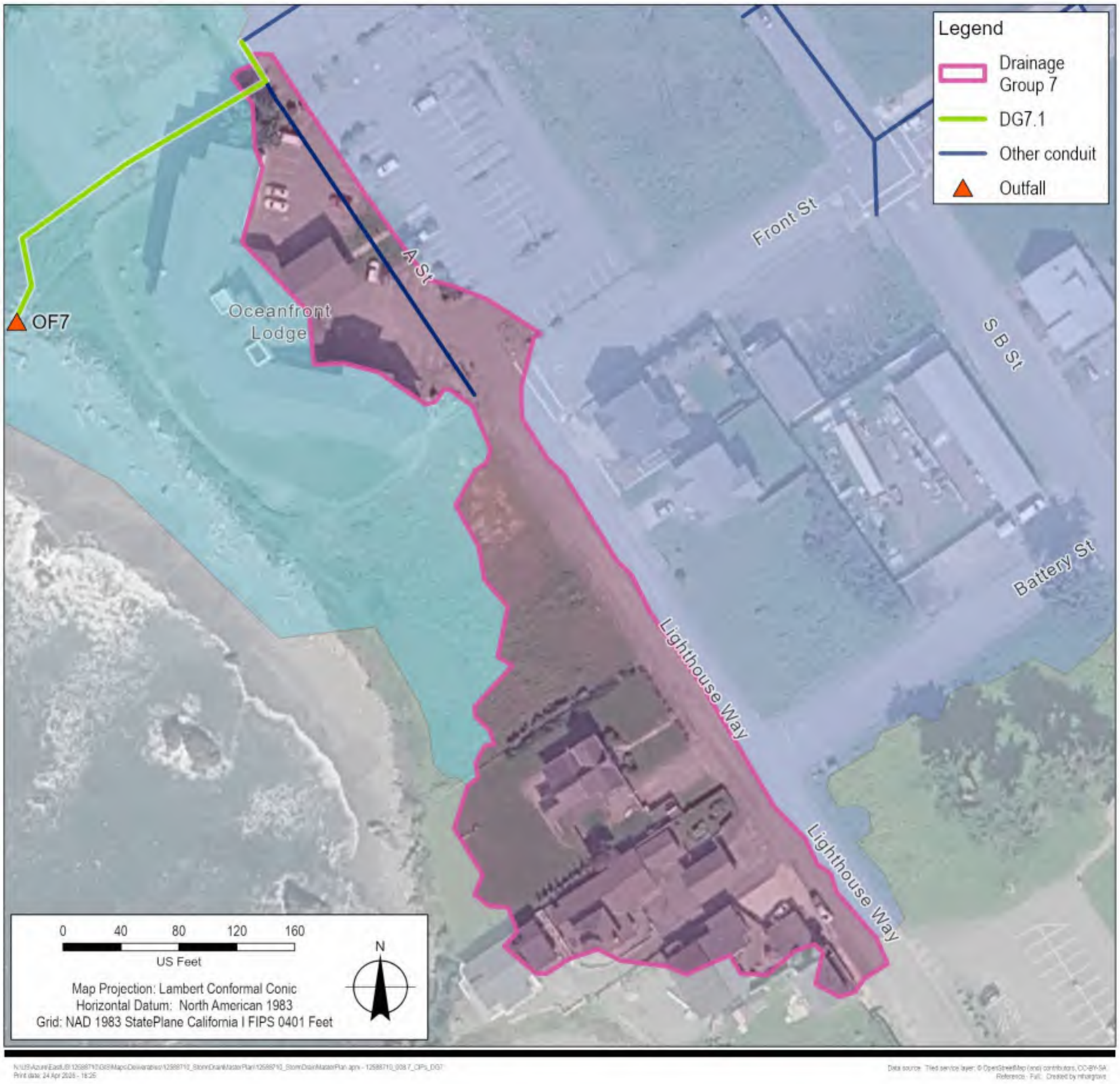

Figure 8.7 Drainage Group 7 – CIP Key Map

Table 8.8 Drainage Group 7 Prioritization Score

Prioritization Criteria	Notes/Comments	Weighted Score
Impact to Life / Access to Critical Roads	No flooding is projected under existing conditions.	0
Impact to Property / Flooding near Houses	No flooding is projected under existing conditions.	0
Water Quality	New drainage inlets offer the opportunity to install catch basin inserts.	2
Regulatory Protected Areas	Project does not intersect with natural, undisturbed area.	3
Special Species Protection (ESA potential)	Drainage Group discharges onto a beach.	0

Prioritization Criteria	Notes/Comments	Weighted Score
Trash Capture	New drainage inlets offer the opportunity to install trash capture devices.	2
Proposed Pipe under Pavement	Some proposed improvements are located under pavement.	0
Existing Pipe under Private Property	Existing piping are located under private property. No proposed pipes provide redundant conveyance.	0
Condition	Most existing infrastructure is in critical condition.	5
	TOTAL PRIORITIZATION SCORE	**12/30**
	Opinion of Probable Construction Cost	$243,000
	Engineering/Construction Management	$83,000
	Environmental Compliance & Permitting	$60,000
	TOTAL COST	**$386,000**

8.3.8 Drainage Group 8

Drainage Group 8 includes CIP DG8.1. Based on the prioritization scoring criteria, Drainage Group 8 scores 16/30. A key map of the CIP in Drainage Group 8 is presented in **Figure 8.8**. The summary of the weighted prioritization scoring criteria, opinion of probable construction cost, engineering/construction management cost, and permitting/environmental compliance cost is presented in **Table 8.9**.

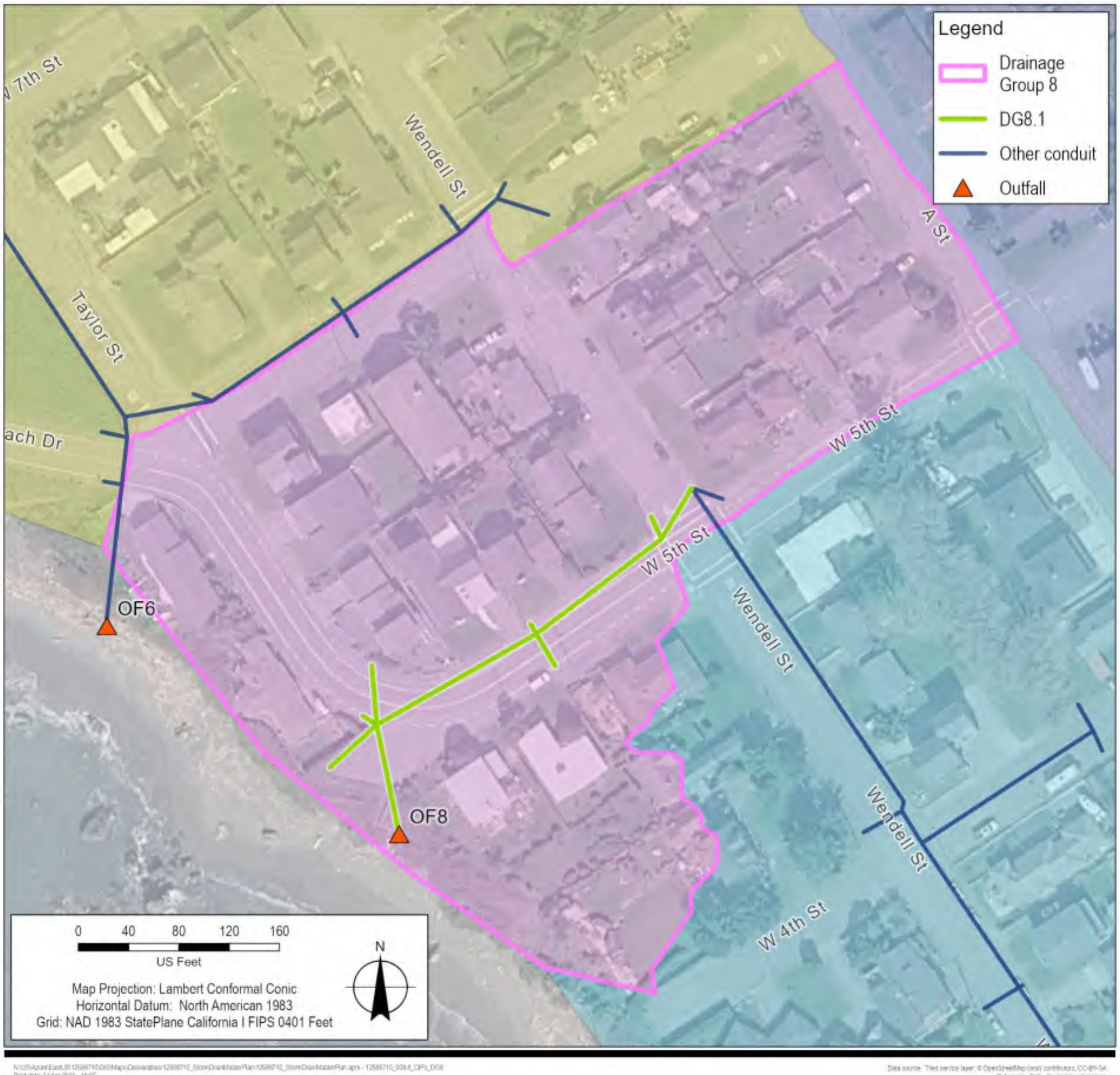

Figure 8.8 Drainage Group 8 – CIP Key Map

Table 8.9 Drainage Group 8 Prioritization Score

Prioritization Criteria	Notes/Comments	Weighted Score
Impact to Life / Access to Critical Roads	Though flooding is projected under existing conditions, the roads are not significant arterials nor critical roads.	0
Impact to Property / Flooding near Houses	Flooding extent is eliminated from private property under proposed conditions.	4
Water Quality	New drainage inlets offer the opportunity to install catch basin inserts.	2
Regulatory Protected Areas	Project does not intersect with natural, undisturbed area.	3
Special Species Protection (ESA potential)	Drainage Group discharges onto a beach.	0

Prioritization Criteria	Notes/Comments	Weighted Score
Trash Capture	New drainage inlets offer the opportunity to install trash capture devices.	2
Proposed Pipe under Pavement	Most proposed improvements are located under pavement.	0
Existing Pipe under Private Property	No existing/proposed pipes are located under private property.	0
Condition	Some existing infrastructure is in critical condition.	5
	TOTAL PRIORITIZATION SCORE	**16/30**
	Opinion of Probable Construction Cost	$554,000
	Engineering/Construction Management	$188,000
	Environmental Compliance & Permitting	$60,000
	TOTAL COST	**$802,000**

8.3.9 Drainage Group 9

Drainage Group 9 includes CIP DG9.1. Based on the prioritization scoring criteria, Drainage Group 9 scores 16/30. A key map of the CIP in Drainage Group 9 is presented in **Figure 8.9**. The summary of the weighted prioritization scoring criteria, opinion of probable construction cost, engineering/construction management cost, and permitting/environmental compliance cost is presented in **Table 8.10**.

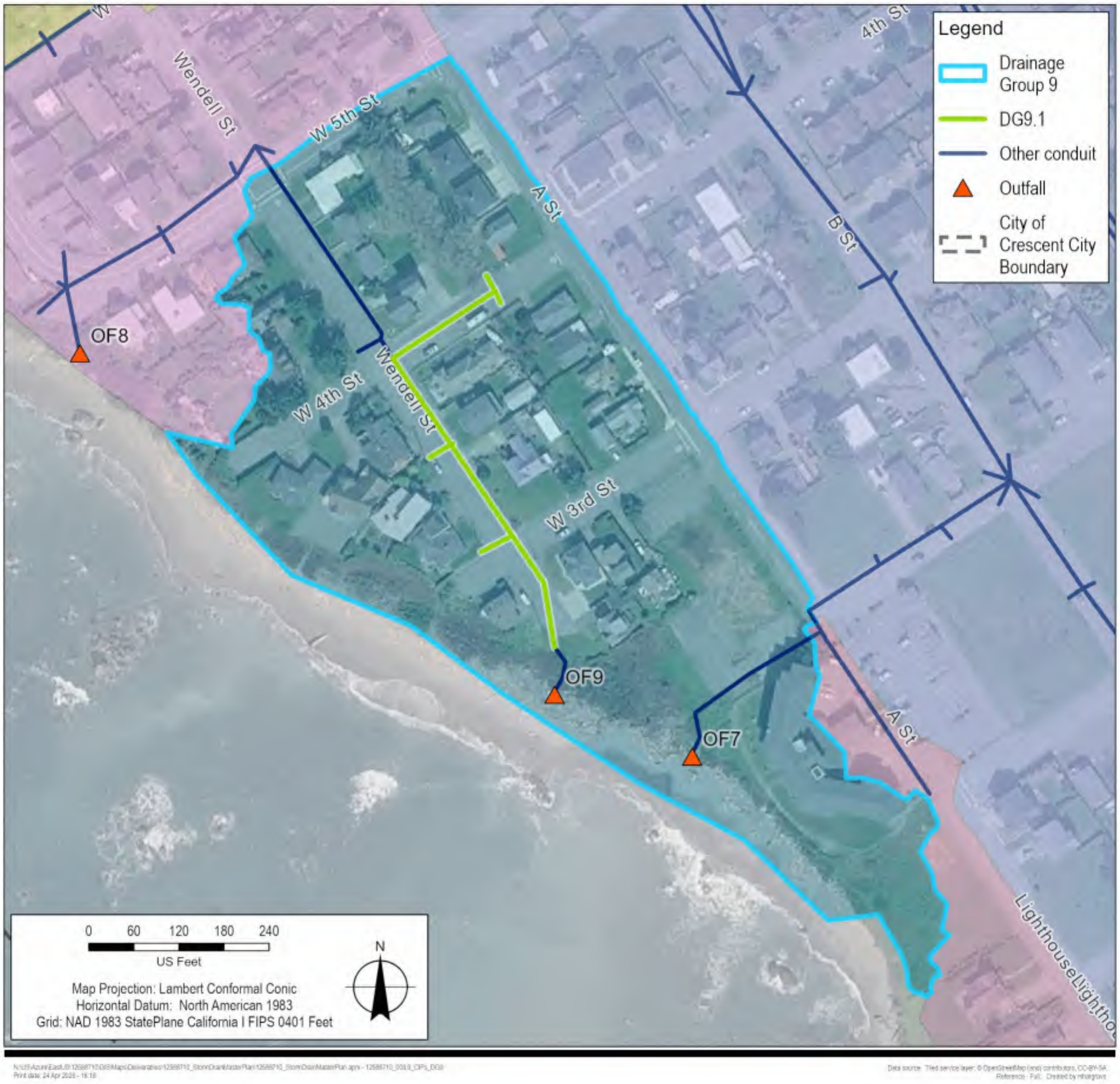

Figure 8.9 Drainage Group 9 – CIP Key Map

Table 8.10 Drainage Group 9 Prioritization Score

Prioritization Criteria	Notes/Comments	Weighted Score
Impact to Life / Access to Critical Roads	Though flooding is projected under existing conditions, the roads are not significant arterials nor critical roads.	0
Impact to Property / Flooding near Houses	Flooding extent is eliminated from private property under proposed conditions.	4
Water Quality	New drainage inlets offer the opportunity to install catch basin inserts.	2
Regulatory Protected Areas	Project does not intersect with natural, undisturbed area.	3
Special Species Protection (ESA potential)	Drainage Group discharges onto a beach.	0

Prioritization Criteria	Notes/Comments	Weighted Score
Trash Capture	New drainage inlets offer the opportunity to install trash capture devices.	2
Proposed Pipe under Pavement	Most proposed improvements are located under pavement.	0
Existing Pipe under Private Property	No existing/proposed pipes are located under private property.	0
Condition	Some existing infrastructure is in critical condition.	5
	TOTAL PRIORITIZATION SCORE	**16/30**
	Opinion of Probable Construction Cost	$696,000
	Engineering/Construction Management	$237,000
	Environmental Compliance & Permitting	$40,000
	TOTAL COST	**$973,000**

8.3.10 Drainage Group 10

Drainage Group 10 includes CIP DG10.1. Based on the prioritization scoring criteria, Drainage Group 10 scores 16/30. A key map of the CIP in Drainage Group 10 is presented in **Figure 8.10**. The summary of the weighted prioritization scoring criteria, opinion of probable construction cost, engineering/construction management cost, and permitting/environmental compliance cost is presented in **Table 8.11**.

Figure 8.10 Drainage Group 10 – CIP Key Map

Table 8.11 Drainage Group 10 Prioritization Score

Prioritization Criteria	Notes/Comments	Weighted Score
Impact to Life / Access to Critical Roads	Though no flooding in drainage group is projected under existing conditions, it would be connected to Drainage Group 4 to relieve its significant flooding along arterials and critical roads under existing conditions. Flooding is nearly eliminated under proposed conditions.	5
Impact to Property / Flooding near Houses	Flooding extent is eliminated from private property under proposed conditions.	4
Water Quality	New drainage inlets offer the opportunity to install catch basin inserts.	2
Regulatory Protected Areas	Project does not intersect with natural, undisturbed area.	3
Special Species Protection (ESA potential)	Drainage Group discharges onto a beach.	0

Prioritization Criteria	Notes/Comments	Weighted Score
Trash Capture	New drainage inlets offer the opportunity to install trash capture devices.	2
Proposed Pipe under Pavement	Most proposed improvements are located under pavement.	0
Existing Pipe under Private Property	No existing/proposed pipes are located under private property.	0
Condition	No existing infrastructure is in critical condition or has an emerging issue.	0
	TOTAL PRIORITIZATION SCORE	**16/30**
	Opinion of Probable Construction Cost	$1,692,000
	Engineering/Construction Management	$575,000
	Permitting & Environmental Compliance	$80,000
	TOTAL COST	**$2,347,000**

8.4 Summary of Prioritization Outcomes

The prioritization analysis grouped the City's drainage groups into **High**, **Medium**, and **Low** priority levels based on total weighted scores derived from flooding impacts, infrastructure condition, regulatory considerations, and feasibility. These prioritization levels provide a clear, systemwide framework for sequencing investments and focusing near-term resources on projects that deliver the greatest benefit to public safety, property protection, and stormwater system performance. **Table 8.12** presents a summary of the prioritization scoring by drainage group.

High Priority Drainage Groups

Drainage Groups 5, 2, 4, and 3 were classified as High Priority, with total scores ranging from 18 to 24. These drainage groups consistently scored high in categories related to impacts to critical roadways and access, flooding near homes, and poor or deteriorating infrastructure condition. Drainage Group 5 ranked highest overall due to extensive flooding impacts affecting both private property and major arterial corridors, combined with multiple CIPs that significantly improve system capacity. Drainage Groups 2 and 4 also scored strongly as their proposed improvements substantially reduce flooding along key transportation routes and within dense residential and commercial areas. Drainage Group 3, while subject to greater regulatory constraints and feasibility challenges, remains a high priority due to widespread flooding along Highway 101 and the presence of aging infrastructure in critical condition.

Medium Priority Drainage Groups

Drainage Groups 8, 9, 10, and 1 were identified as Medium Priority, with total scores clustering around 15 to 16. These drainage groups generally experience localized flooding impacts that affect neighborhood streets and limited private property, but they do not consistently impact critical roadways or emergency access routes. While the proposed improvements in these areas are effective at reducing modeled flooding and often address aging infrastructure, the overall severity, extent, and consequences of flooding are lower relative to the high-priority drainage groups. As a result, these projects are well suited for implementation in later program phases or as funding opportunities become available.

Low Priority Drainage Groups

Drainage Groups 7 and 6 were categorized as Low Priority, with the lowest total scores in the prioritization framework. These drainage groups have relatively limited flooding impacts under existing conditions, minimal effects on critical transportation corridors or private property, and fewer infrastructure condition concerns compared to other areas of the system. While improvements in these drainage groups provide localized benefits and may support long-term system resiliency, they do not currently warrant near-term implementation when compared to higher-risk areas elsewhere in the City.

Table 8.12 *Drainage Group Prioritization Summary*

Drainage Group	Weighted Prioritization Score									Final Assessment	
	Impact to Life / Access to Critical Roads	Impact to Property / Flooding near Houses	Water Quality	Regulatory Protected Areas	Special Species Protection (ESA potential)	Trash Capture	Proposed Pipe under Pavement	Existing Pipe under Private Property	Condition	TOTAL SCORE	Prioritization Level
DG5	5	4	2	3	0	2	0	3	5	24	**HIGH**
DG4	5	4	2	3	0	2	0	3	5	24	
DG2	5	4	2	3	0	2	0	3	2.5	21.5	
DG3	5	4	2	0	0	2	0	0	5	18	
DG8	0	4	2	3	0	2	0	0	5	16	MEDIUM
DG9	0	4	2	3	0	2	0	0	5	16	
DG10	5	4	2	3	0	2	0	0	0	16	
DG1	5	4	2	0	2	2	0	0	0	15	
DG7	0	0	2	3	0	2	0	0	5	12	LOW
DG6	0	4	2	3	0	2	0	0	0	11	

9. Recommended Phasing of Capital Improvement Program

Data Collection → Model → Analysis → Project → Priority → ***Phase***

9.1 Recommended CIP Phasing and Sequencing

The prioritization score and level assessed for each drainage group was used to inform the recommended phasing. As stated in Section 8, the prioritization was applied to full drainage groups as opposed to CIPs due to the hydraulic connectivity of CIPs within a drainage group. The recommended CIP sequencing within a drainage group phase factored in other considerations such as hydraulic constraints, constructability, and coordination with other CIPs.

The recommended drainage group phasing is divided into **Near-Term (Phase A), Mid-Term (Phase B),** and **Long-Term (Phase C)** projects.

9.1.1 Near-Term – Phase A

9.1.1.1 Drainage Group 10

CIP DG10.1 is recommended to be the first project in the Near-Term Phase. Although Drainage Group 10 was assessed to be medium priority based on the prioritization scoring criteria, the flood relief benefits of the proposed CIPs in high priority Drainage Group 2 and Drainage Group 4 are dependent on the improvements proposed under CIP DG10.1. In addition to an intertie between Drainage Group 10 and Drainage Group 2 and 4, the increase in hydraulic capacity under CIP DG10.1 would increase the downstream hydraulic capacity to convey stormwater to another outfall (OF10), providing significant relief for OF2 and OF4. Furthermore, the constructability and permitting complexity is anticipated to be lower than many other proposed CIPs and would provide the most benefit for the lowest cost compared to any other CIP.

9.1.1.2 Drainage Group 5

As the highest-ranking drainage group in the prioritization scoring (tied with Drainage Group 4), the CIPs proposed under Drainage Group 5 are recommended as the second set of projects in the Near-Term Phase. The new stormwater main along 9th St proposed under CIP DG5.1 intercepts stormwater from the upper reaches of Drainage Group 2 and 4 and re-routes it to OF5. This improvement alone would not only reduces flooding on a critical road connecting residential areas to Highway 101 (critical for health and safety/emerging vehicle access) but also provides additional flood relief to the Drainage Group 2 and 4. The existing outfall OF5 has sufficient capacity to convey the maximum projected stormwater rate from the upper reaches of these drainage groups under a 10-year, 24-hour storm event (present day). The recommended sequence of CIPs in each drainage group is primarily based on the "start downstream, then work upstream" best practice to ensure downstream capacity is sufficient for the proposed upstream improvements. However, to provide immediate flood relieve benefits to Drainage Group 4, some upstream CIPs are prioritized in the sequence. Based on this best practice and need for immediate flood relief to the downtown core (Drainage Group 4), the recommended sequencing of CIP construction in Drainage Group 5 is:

DG5.1 → DG5.2 → DG5.3 → DG5.4 → DG5.5

9.1.1.3 Drainage Group 4

As the highest-ranking drainage group in the prioritization scoring (tied with Drainage Group 5), the CIPs proposed under Drainage Group 4 are recommended as the third set of projects in the Near-Term Phase. As stated previously, the CIPs in Drainage Group 5 are recommended for sequencing first because the projects provide of the benefits it provides for Drainage Group 4 in addition to Drainage Group 5. The improvements proposed under CIP DG 4.1A, DG4.1B, and DG4.2 would significantly reduce the remaining flooding in the downtown core and improve accessibility to and from the City's municipal facilities such as the fire station, police department, and public works during major storm events. The reduction of flooding as much as possible in Drainage Group 4 is high priority because many arterials connecting the City to Highway 101 run through the drainage group. To ensure downstream capacity is sufficient for the proposed upstream improvements, the "start downstream, then work upstream" best practice is recommended for CIP sequencing. The recommended sequencing of CIP construction in Drainage Group 4 is:

DG4.1A → DG4.1B → DG4.2 → DG4.3

9.1.2 Mid-Term – Phase B

9.1.2.1 Drainage Group 2

As the second highest-ranking drainage group in the prioritization scoring, the CIPs proposed under Drainage Group 2 are recommended as the first set of projects in the Mid-Term Phase. As stated previously, the CIPs in Drainage Group 5 are recommended for sequencing first because the projects provide of the benefits it provides for Drainage Group 2 in addition to Drainage Group 5. The reduction of flooding as much as possible in Drainage Group 2 is high priority because many arterials connecting the City to Highway 101 run through the drainage group. Furthermore, the improvements proposed under CIP DG2.1B, DG2.2, and DG2.2B would significantly reduce the risk of flooding to private property the residential areas in Drainage Group 2. Following the best practices discussed for the sequencing of the CIPs in other drainage groups, the recommended sequencing of CIP construction in Drainage Group 2 is:

DG2.2 → DG2.1B → DG2.2B

9.1.2.2 Drainage Group 3

As the third highest-ranking drainage group in the prioritization scoring, the CIPs proposed under Drainage Group 3 are recommended as the second set of projects in the Mid-Term Phase. The CIPs proposed in Drainage Group 3 are of high priority because they would significantly reduce the flooding risk on Highway 101, which serves as a major route to the County's primary medical facilities and for evacuation. The CIPs would also reduce flooding in residential and commercial areas along Hoover Ave and Harding Ave in the northern jurisdiction of the City and key grocery stores/pharmacies like Safeway and Rite Aid in the downtown area. The recommended sequence of CIPs in each drainage group is primarily based on the "start downstream, then work upstream" best practice to ensure downstream capacity is sufficient for the proposed upstream improvements. However, to provide immediate flood relieve benefits to Drainage Group 3, some upstream CIPs are prioritized in the sequence. The best practice approach is less critical due to interconnected natural storage areas in between sections of the drainage group (i.e. Elk Creek and its tributaries) that detain stormwater. In addition, given that the proposed CIPs could increase the quantity of stormwater contributions to these natural storage areas during a storm event and intersect with a FEMA Special Flood Hazard Area, the environmental and hydraulic permitting process is expected to be more complex and require a longer timeline. Following the best practices discussed for the sequencing of the CIPs in other drainage groups, the recommended sequencing of CIP construction in Drainage Group 3 is:

DG3.1A → DG3.1B → DG3.2A → DG3.2B → DG3.2C → DG3.3A → DG3.3B

9.1.3 Long-Term – Phase C

The CIPs in the Long-Term Phase are generally lower priority projects with significantly smaller footprints than those in the Near-Term Phase. As many of these projects can happen in parallel and are not hydraulically interdependent, the recommended sequencing of CIPs in the Long-Term Phase is:

DG1.1, DG8.1, & DG9.1 → DG6.1 → DG7.1

9.1.3.1 Drainage Group 1

CIP DG1.1 is recommended to be the first project in the Long-Term Phase. Although Drainage Group 1 was assessed to be the lowest of the medium priority drainage groups in the prioritization scoring criteria, the flood relief benefits of the proposed CIP DG1.1 would significantly reduce flooding along Highway 101, which serves as a major route to the County's primary medical facilities and for evacuation. Given that the existing stormwater infrastructure in Drainage Group 1 is within Caltrans right-of-way, any improvements or modifications to the stormwater infrastructure falls under the jurisdiction of Caltrans. Coordination with Caltrans to advance this CIP to design and construction is recommended to occur in parallel with other projects in the Mid-Term Phase.

9.1.3.2 Drainage Group 8 and 9

Tied for the highest-ranking medium priority drainage groups, the CIP DG8.1 and CIP DG9.1 proposed under Drainage Group 8 and Drainage Group 9, respectively, are recommended to be implemented in parallel in the Long-Term Phase due their small extent and proximity to one another. Both drainage groups have existing stormwater infrastructure in poor condition and minor flooding of residential areas is observed in both drainage groups under existing conditions. However, these drainage groups ranked lower primarily due to their small catchment area, their location on the western edge of the City bordering the Pacific Ocean, and their lack of major arterials connecting residential areas to Highway 101 and the downtown core.

9.1.3.3 Drainage Group 6 and 7

As the lowest priority drainage groups, the CIPs proposed under Drainage Group 6 and Drainage Group 7 are recommended to be implemented last due to their small extent and lack of significant flooding. Although Drainage Group 7 scored 1 point higher than Drainage Group 6, the implementation of CIP DG6.1 is recommended for implementation before CIP DG7.1 because it would reduce minor flooding to residential areas. Though CIP DG7.1 would provide some minor flood relief to Drainage Group 2, the modelling results showed no flooding in Drainage Group 7 in existing conditions under a 10-year, 24-hour during storm event.

9.1.4 Summary of Recommended CIP Phasing and Sequencing

The recommended phasing of CIP implementation by drainage group is summarized in **Figure 9.1**. The recommended sequence of CIP implementation by drainage group for Phase A is summarized in Figure 9.2. The recommended sequence of CIP implementation for Phase B is summarized in **Figure 9.3**. The recommended sequence of CIP implementation for Phase C is summarized in **Figure 9.4**.

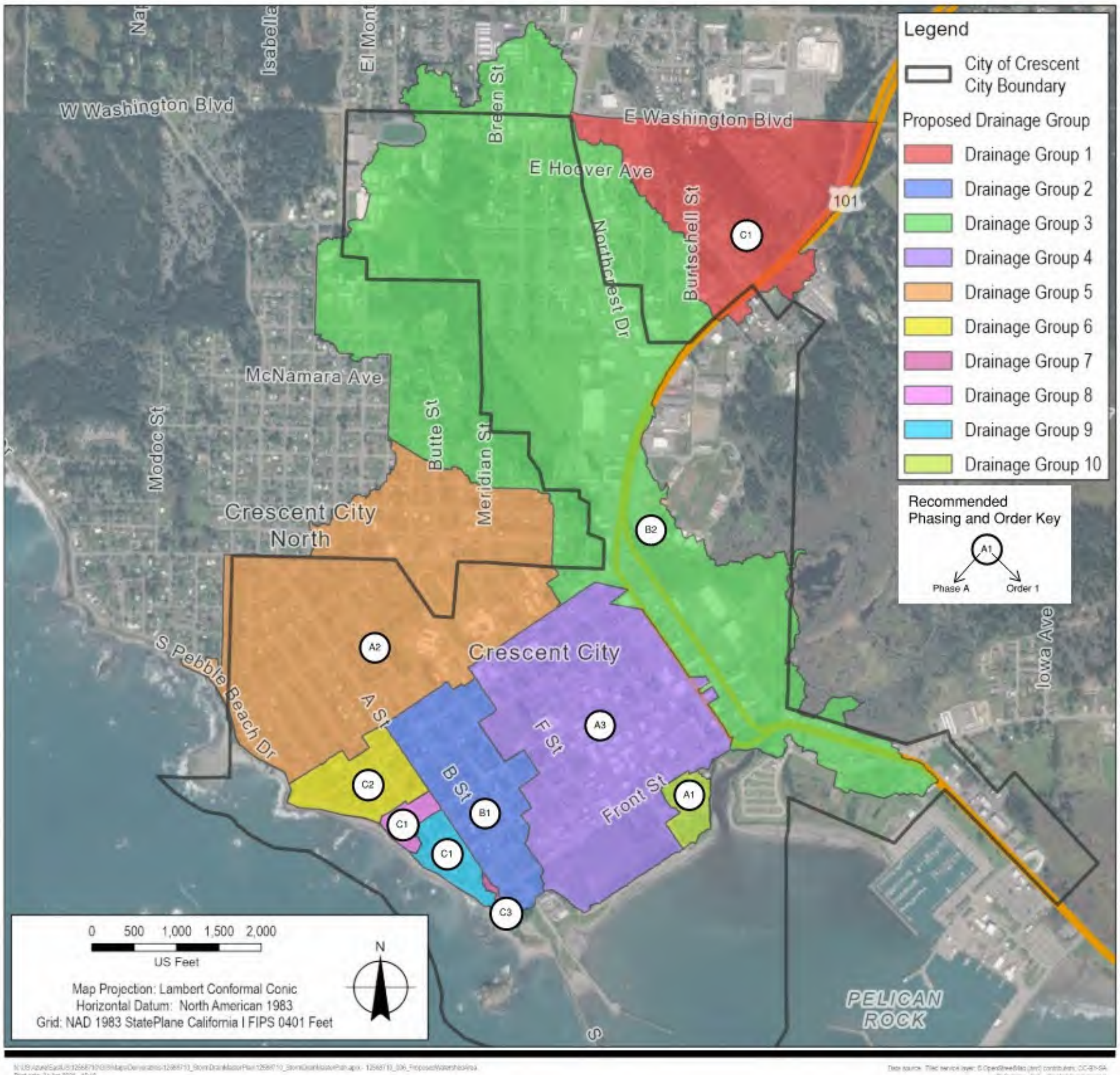

Figure 9.1 Recommended Phasing of CIP Implementation by Drainage Group

Near-Term Projects - Phase A

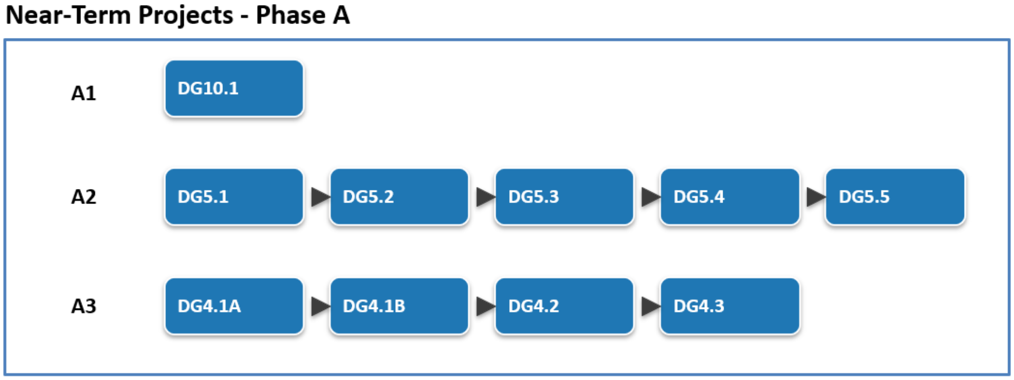

Figure 9.2 Phase A – Recommended Sequence of CIP Implementation

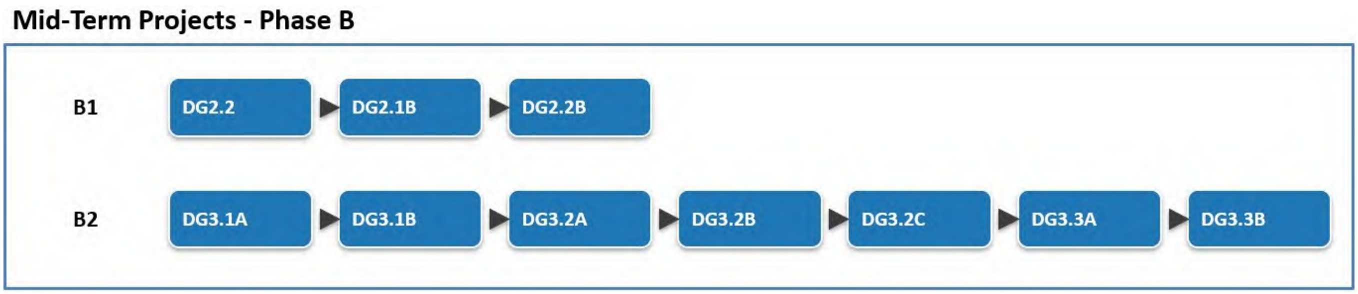

Figure 9.3 Phase B – Recommended Sequence of CIP Implementation

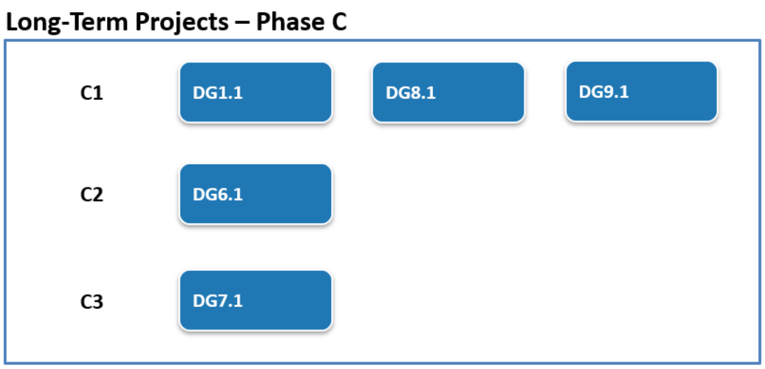

Figure 9.4 Phase C – Recommended Sequence of CIP Implementation

9.2 Conclusion and Recommendations

This Storm Drain Master Plan provides Crescent City with a robust framework for understanding existing stormwater system performance, identifying drainage deficiencies, and guiding long-term capital investment decisions. Through extensive field data collection, development of a citywide hydrologic and hydraulic model, and evaluation of existing and future climate-informed design storms, the study documents the locations, causes, and consequences of flooding across the City's drainage system.

The analyses confirm that flooding in Crescent City is driven by a combination of flat coastal topography, tidally influenced outfalls, undersized and aging infrastructure, and increasing precipitation intensity. Flooding impacts are most pronounced along critical transportation corridors, including Highway 101 and major arterials, as well as within older residential and commercial areas where limited hydraulic capacity and degraded infrastructure reduce system performance. The modeling results demonstrate that these vulnerabilities are expected to become more severe under mid- and late-century climate conditions if no improvements are implemented.

To address these challenges, the Master Plan identifies a set of CIPs developed through a deficiency analysis and refined through iterative modeling. The proposed projects collectively provide substantial reductions in flood extent, depth, and duration under present-day design storms and meaningfully improve system resilience under projected future conditions. The prioritization framework established in this plan integrates flooding impacts, public safety, infrastructure condition, regulatory considerations, feasibility, and equity to ensure that the most critical needs are addressed first.

Based on the prioritization results and hydraulic interdependencies, the recommended phasing strategy organizes implementation into near-term, mid-term, and long-term phases. This sequencing emphasizes early construction of projects that unlock downstream capacity, provide systemwide benefits, and reduce flooding along critical access routes and in high-risk neighborhoods. The accompanying planning-level cost estimates establish a realistic capital investment outlook and provide a foundation for budgeting, grant applications, and coordination with partnering agencies.

Overall, this Master Plan equips Crescent City with a clear, flexible roadmap to incrementally improve stormwater system performance, reduce flood risk to people and property, support regulatory compliance, and enhance long-term climate resilience. As projects advance to design and construction, continued model refinement, coordination with regulatory agencies, and periodic updates to the Master Plan are recommended to incorporate new data, completed improvements, and evolving climate and funding conditions.

Based on the work conducted to prepare this Master Plan, the City should consider these additional planning documents in the future:

CIP Implementation & Funding Strategy

A focused implementation plan would refine the prioritized CIP list by identifying near-term funding opportunities (e.g., grants, loans, cost-sharing), project delivery approaches, and permitting pathways. This would help the City move efficiently from planning to design and construction.

Climate Adaptation & Flood Resilience Plan

A standalone resilience plan could expand on the climate change analysis by integrating sea level rise, compound flooding (rainfall & tides), emergency access, and community vulnerability. This document would also strengthen eligibility for state and federal resilience funding.

Storm Drainage Inventory Asset Management Plan

Use the drainage inventory database from this CIP to create an asset management plan that proactively rehabilitates and replaces infrastructure, preventing emergency failures. The plan should detail documentation, assessment, and maintenance of stormwater systems (pipes, culverts, catch basins) for long-term function and financial stability.

Periodic Master Plan Update (5–10 Years)

Finally, the City should plan for periodic updates to the Storm Drain System Master Plan to incorporate completed CIPs, refined cost estimates, updated climate projections, new development, and additional field data.

Appendices

Appendix A

Assumptions

Assumptions made to prepare the Hydrology and Hydraulics (H&H) analysis to develop the CIPs include outfall conditions and reliance on the accuracy of the GPS equipment used in field data collection. Outfall boundary conditions and assumptions are further described below in Section D-3.

The accuracy of the model results is dependent on the accuracy of the provided data for the planned and in construction elements. The preliminary existing storm drainage infrastructure data was utilized to locate the existing storm drainage infrastructure during field data collection and was expanded upon. See Table 9.1 below for the received data utilized in the development of the H&H analysis.

Table 9.1 Flow routing metadata

Name	Description	File Type	Source
2006-02 Drain Basin 500 Study	List of drainage inlet locations and depths for the K-Street Outfall (Outfall 2)	.xls	City of Crescent City
2013-06 Drainage Study	Drainage study near C St memorandum, volumes, and location maps.	.dwg; .pdf	By Mike Young, provided by City of Crescent City
2014-06-18 Drainage Survey for Augustine Meeting	Further assessment of drainage study on C St.	.xls; .dwg; .pdf	By Mike Young, provided by City of Crescent City
Historic 'as-builts' of Storm Drain Infrastructure	Piecewise hand-drawn as-builts of storm drain infrastructure from 1965 – 2013	.pdf	City of Crescent City
MS4 Permit	Most recent MS4 Permit	.pdf	City of Crescent City
As-builts and plans of Front St., C St., D St., and F St.	Planned and partially in-construction drainage improvement projects to take place on Front St., C St., D St., and F St.	.pdf	City of Crescent City
As-builts of Harding St. Culvert	As-builts of Harding Ave Culvert Repair Project	.pdf	City of Crescent City
Storm Drain Capacity Analysis 3rd St Drainage from J to K St.	Rational Method analysis assessing the existing storm drainage capacity on 3rd St. from J to K St.	.xls	City of Crescent City
2024.02.23 Front Street Play to L Plans	Plans for storm drain infrastructure projects on Front Street.	.pdf	City of Crescent City
City Priority Criteria	A ranked list of criteria the City wants considered in project development and prioritization.	.docx	City of Crescent City
Critical Facilities	A shape file delineating buildings of high importance to the City.	.shp	City of Crescent City

Appendix B

Equity Analysis

Technical Memorandum

May 01, 2026

To	James Queen, City of Crescent City	**Contact No.**	707-267-2202
Copy to	n/a	**Email**	Amber.shows@ghd.com
From	Amber Shows, GHD	**Project No.**	12588710
Project Name	Crescent City Storm Drain Master Plan		
Subject	Equity Analysis		

1. Introduction

Understanding the locations of and impacts to disadvantaged populations and communities with equity concerns is an important aspect of city planning in general and is necessary to be in alignment with the ultimate goal of supporting communities to not only survive, but to thrive.

This Equity Analysis applied data analysis and geospatial mapping tools to public data to provide a contextual presentation of disadvantaged[1] populations and communities with equity concerns, including physical and socioeconomic vulnerabilities (see Section 4). Opportunities for further analysis include the refined hydraulic and hydrologic model outputs of existing flood risk and the proportional population density of block groups that were used in this analysis. Population density across block groups can be obtained for a fee from the Del Norte County Assessor's office.

1.1 Purpose of this Memorandum

This Equity Analysis report is designed to fulfill the agreed-upon deliverable requirement set forth in the Storm Drain Master Plan It is designed to provide an input for decision-making as deemed appropriate by the City and provide an additional level of refinement to the understanding of social equity in Crescent City, which meets state and federal definitions of disadvantaged at the city- and census block-group- levels. The results of this analysis will be referenced during storm drain improvement project prioritization to ensure equitable distribution of project benefits.

[1] Disadvantaged as defined in accordance with Final Designation of Disadvantaged Communities Pursuant to Senate Bill 535. May 2022. ***Final Designation of Disadvantaged Communities Pursuant to SB535, 2022 (ca.gov)**. Accessed 3/26/2024. More information: **Low-Income or Disadvantaged Communities Designated by California - Dataset - California Natural Resources Agency Open Data**. Accessed 3/26/2024.

2. Assumptions

The assumptions for this deliverable are listed below.

- Population distribution is assumed to be uniform through the block group.
- Prioritization based on equity analytics was done before the hydraulic model was developed and hence does not consider the findings of the existing conditions hydraulic model.
- American Community Survey demographic data comes from surveys which have some inherent measuring error built in due to it not being a full census of all households. For example, estimates of low-income percentage for a particular block group could be inaccurate.

3. Background

The Federal government has made it a goal that 40 percent of the overall benefits of certain Federal climate, clean energy, affordable and sustainable housing, and other investments flow to disadvantaged communities that are marginalized by underinvestment and overburdened by pollution. This commitment was made through Executive Order (EO) 14008, "*Tackling the Climate Crisis at Home and Abroad"* and EO 14096, "*Revitalizing Our Nation's Commitment to Environmental Justice for All"*. These goals are expressed through the "Justice40 Initiative". EO 14008 references the term "disadvantaged communities," which has been used in existing federal and California state programs to prioritize funding for environmental justice.[2] Similarly, through grants, programs, and funding, the Inflation Reduction Act (IRA) makes investments in climate action that are designed to reduce U.S. greenhouse gas emissions approximately 40% by 2030 with a focus on tackling climate pollution, advancing environmental justice, and delivering clean air.[3,4]

Justice40 defines overburdened and underserved communities as disadvantaged at the census tract-level. Communities are considered disadvantaged if they are:

- in census tracts that meet the thresholds for at least one category of burden, or
- on land within the boundaries of Federally Recognized Tribes.

This designation is based on an analysis of burdens at thresholds using percentiles in comparison to the US population. The Justice40 initiative supplies a geospatial tool which provides the determination based on census tract data. The Climate and Economic Justice Screening Tool (CEJST) uses datasets as indicators of burdens. The burdens are organized into categories. A community is highlighted as disadvantaged on the CEJST map if it is in a census tract that is (1) at or above the threshold for one or more environmental, climate, or other burdens, and (2) at or above the threshold for an associated socioeconomic burden[5]. In addition, a census tract that is completely surrounded by disadvantaged communities and is at or above the 50% percentile for low income is also considered disadvantaged.

The Environmental and Climate Justice Program (ECJ Program), created by the IRA, provides funding for financial and technical assistance to carry out environmental and climate justice activities to benefit disadvantaged communities. The US Environmental Protection Agency (EPA) has created the EPA IRA Disadvantaged Communities map layer to assist potential applicants seeking to identify whether a community

[2] **Disadvantaged Communities Nomenclature Within the State of California: Findings and Conclusions — A Recommendation Document**. Accessed on 4/9/2024.
[3] **Inflation Reduction Act | US EPA**. Accessed 4/9/2024.
[4] **Inflation Reduction Act Overview (epa.gov)**. Accessed 4/9/2024.
[5] **Methodology & data - Climate & Economic Justice Screening Tool (geoplatform.gov)**. This link provides definitions for categories of burdens and percentile thresholds under Justice40 criteria depicted in CEJST.

is disadvantaged for the purposes of implementing programs under the IRA. The EPA IRA Disadvantaged Communities map combines multiple datasets that individually can be used to determine whether a community is disadvantaged for the purposes of implementing programs under the IRA. All data sets are assigned values at the Census block group level. The criteria and associated datasets used in the map are:[6]

- Any census tract that is included as disadvantaged in the CEJST.
- Any census block group at or above the 90th percentile for any of US EPA's Environmental Justice Screening Tool (EJScreen) Supplemental Indexes when compared to the nation or state,
- and/or any of the following geographic areas within the Tribal lands category in EJScreen:
    - Alaska Native Allotments
    - Alaska Native Villages
    - American Indian Reservations
    - American Indian Off-reservation Trust Lands
    - Oklahoma Tribal Statistical Areas

The supplemental indexes are a combination of EJScreen's socioeconomic and environmental indicators calculated at the census block group-level and provide flexibility and additional functionality to the EJScreen tool for use in specific situations, including obtaining grant funding.

The state of California set forth indicators, thresholds, and definitions for the determination of disadvantaged populations and disadvantaged communities (DACs) through Assembly Bill (AB) 1550 and Senate Bill (SB) 535.[7] AB 1550 defines "low-income" as 80% of the California median income. Under California water code 79505.5 a Small Disadvantaged Community refers to a Disadvantaged Community that has a year-long population of no more than 10,000 persons and a combined median household income (MHI) of less than 80% of the state MHI and a Severely Disadvantaged Community (SDAC) has a population under 10,000 and a combined MHI under 60% of the statewide MHI [8].

DAC definitions and thresholds are as follows:

- **Low-Income or Disadvantaged Communities**:
    - These are census tracts with median household incomes at or below **80 percent** of the statewide median income.
    - They can also include areas with incomes below the threshold designated as low income by the **Department of Housing and Community Development**.
    - Additionally, census tracts receiving the **highest 25 percent** of overall scores in **CalEnviroScreen 4.0** fall into this category.
    - Even census tracts lacking overall scores in CalEnviroScreen 4.0 due to data gaps but receiving the **highest 5 percent** of cumulative population burden scores are considered disadvantaged.
    - Lands under the control of federally recognized Tribes are also part of this designation.[9]
- **Income Thresholds**:
    - A **(DAC)** in California is defined as a community with an annual median household income less than **80%** of the statewide annual median household income.
    - A Severely Disadvantaged Community has a median household income below 60% of the statewide average.[10]

[6] **Inflation Reduction Act Disadvantaged Communities Map | US EPA**. Accessed 4/9/2024.
[7] **SB 535 Disadvantaged Communities | OEHHA (ca.gov)**. Accessed 4/9/2024.
[8] **Disadvantaged Communities in Northern California (norcalwater.org)**. Accessed 4/9/2024.
[9] **Low-Income or Disadvantaged Communities Designated by California - Dataset - California Open Data**. Accessed 4/9/2024.
[10] **California Disadvantaged Communities Mapping Tool | Adaptation Clearinghouse**. Accessed 4/9/2024.

Crescent city has 3 zip codes and 5 main block groups, most of which lie partially within the city boundary, as illustrated in Figure 1 (below).

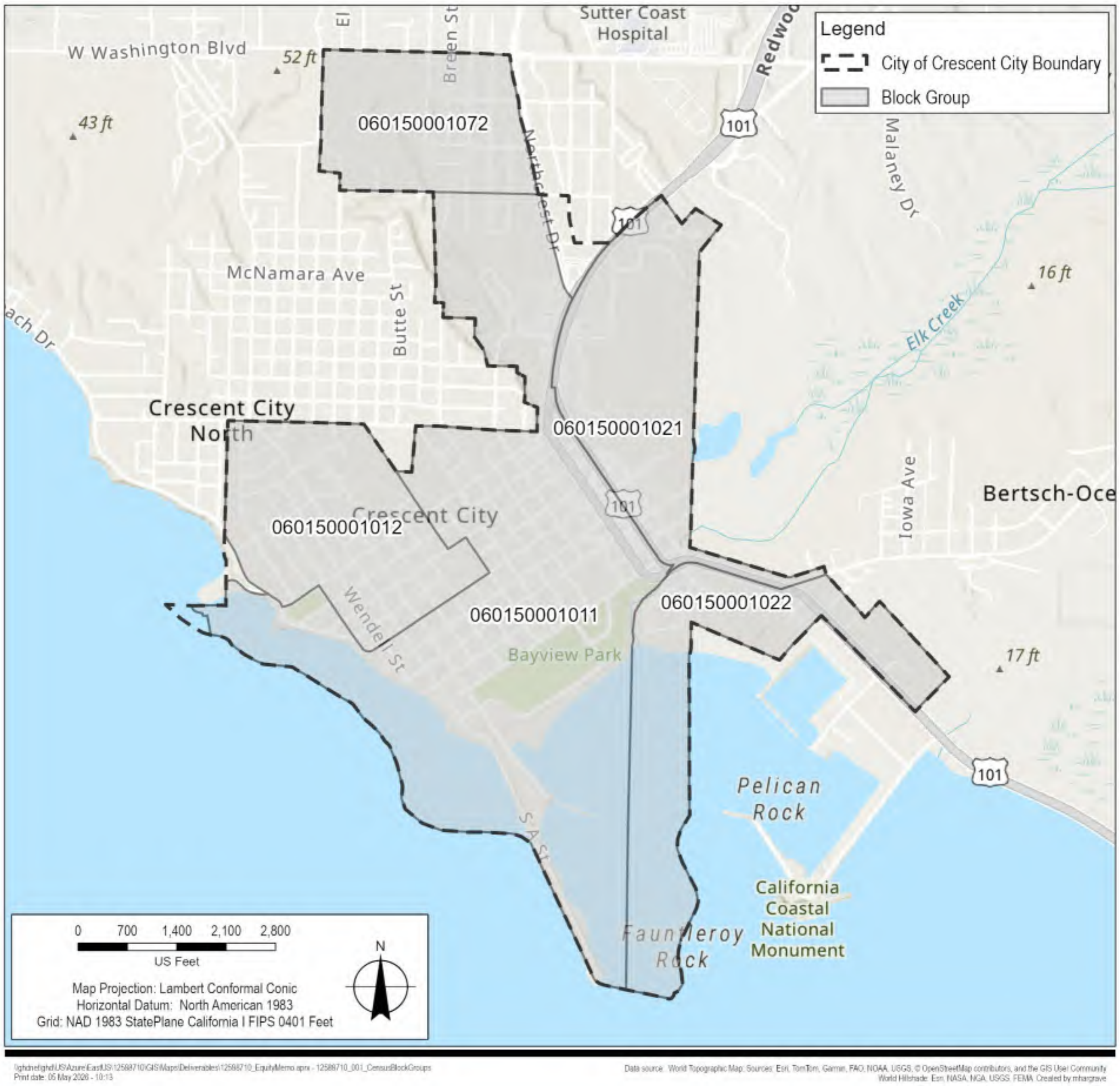

Figure 1 ***Crescent City Boundary and Census Block Groups***

This Technical Memorandum is provided as an interim output under our agreement with City Of Crescent City. It is provided to foster discussion in relation to technical matters associated with the project and should not be relied upon in any way.

Crescent City meets the California definition of a small, disadvantaged community as defined under California water code 79505.5[11] and is considered low-income in accordance with state definitions as defined by AB 1550[12] as well as qualifying as disadvantaged under the Justice40 and IRA Disadvantaged Communities definitions at the census block group-level (for all block groups that intersect with the city boundaries), as depicted in the table below[13] (see also Attachment 1).

Table 1 Justice40 and IRA Designations by Block Group

Block Group	Justice40	IRA
060150001011	Disadvantaged	Disadvantaged
060150001022	Disadvantaged	Disadvantaged
060150001072	Disadvantaged	Disadvantaged
060150001012	Disadvantaged	Disadvantaged
060150001021	Disadvantaged	Disadvantaged

The “disadvantaged” designations are important for determinations of eligibility for grant funding through Justice40 and IRA Federal agency administered programs as well as through state agencies. However, additional detailed analysis was conducted to provide a higher level of refinement to the understanding of social equity in Crescent City so that the findings may be used to support project-specific decision-making. The results of this analysis will be referenced during storm drain improvement project prioritization to ensure equitable distribution of project benefits.

4. Definitions and References

For the purposes of this analysis, California state and US federal data sources and references were used. Analyses were performed at the US census block group-level. Statistical analysis and subsequent scoring were performed for an entire block group, even if that block group only partially resides within the City boundary (see Figure 1, Section 6).

A demographic index was calculated for block groups applying socioeconomic indicators to determine the location and concentration of populations with equity concerns in comparison to the California state mean. The indicators comprising the demographic index are in alignment with the socioeconomic indicators recognized by the US EPA[14] for environmental, economic, and climate justice screening (see Table 1). Additional selected and relevant potential environmental release and exposure indicators and social and economic vulnerability indicators were then considered to further refine the context and help identify the vulnerabilities of the communities with equity concerns identified at the block group level in Crescent City. Potential flood-related climate hazards were also briefly reviewed and qualitative information was provided.

The following table provides the definitions, reference areas, and data sources applied and used for indicator comparison and index calculation and climate hazard review.

[11] California Small Disadvantaged Community is a community with no more than 10,000 persons with a combined mean household income (MHI) of less than 80% of the state MHI. **Low-Income or Disadvantaged Communities Designated by California - Dataset - California Natural Resources Agency Open Data**. Accessed 3/27/2024
[12] **Priority Populations 2023 (ca.gov)**
[13] **Explore the map - Climate & Economic Justice Screening Tool (geoplatform.gov)**
[14] Based on the US EPA’s Screening and Mapping Tool **EJScreen (epa.gov)** demographic and supplemental indexes as defined in EJScreen Technical Documentation, October 2022. **https://www.epa.gov/sites/default/files/2021-04/documents/ejscreen_technical_document.pdf** Accessed 3/26/2024

Table 2 Demographic Index Scoring and External Vulnerabilities and Hazards Considered

Indicator/Index/Hazard	Definition	Reference Area	Data Source
Demographic Index Scoring			
People of color	Individuals who listed their racial status as a race other than white alone and/or as Latino or Hispanic. The word "alone" in this case indicates that the person is of a single race, not multiracial.	Percentage of people of color in the block group	The United States (US) Environmental Protection Agency (EPA) Screening and Mapping Tool[15] (from American Community Survey[16])
Low-income	Households with income levels less than 200% of the Federal Poverty Level (FPL)	Percentage of households in the block group with incomes less than 200% of the FPL (by household) in the block group	EJScreen[15]
Over age 64	Percentage of the population over age 64	Percentage people over age 64 in the block group	EJScreen[15]
Under age 5	Percentage of the population under age 5	Percentage people under age 5 in the block group	EJScreen[15]
Less than high school education	Percentage of the population age 25 or older with less than a high school education	Percent of people age 25 or older in a block group whose education is short of a high school diploma in the block group	EJScreen[15]
Low Life Expectancy	Low Life Expectancy—Life Expectancy at Birth from Centers for Disease Control and Prevention (CDC), National Center for Health Statistics (NCHS): % Low Life Expectancy is defined as “1 – (Life Expectancy / Max Life Expectancy	Percent of people in the block group with a life expectancy at or below the 30th percentile of the US	EJScreen (from National Vital Statistics System[17])
Demographic Index	Calculated index score of the demographic indicators above	Calculated for each block group	Indicator inputs
Environmental Release and Exposure Indicators			
Underground storage tank (UST) locations	Underground Storage Tank system is a tank and any underground piping connected to the tank that has at least 10 percent of its combined volume underground. The federal UST regulations apply only to UST systems storing either petroleum or	Count applied at the block group level	EJScreen (Calculated from EPA UST Finder[18])

[15] **EJScreen (epa.gov)**
[16] The data can be downloaded from the **US Census Bureau’s FTP Server.**
[17] **NVSS - National Vital Statistics System Homepage (cdc.gov)**. Accessed on 4/9/2024.
[18] Calculated from EPA UST Finder, retrieved 2/2/2023

Indicator/Index/Hazard	Definition	Reference Area	Data Source
	certain hazardous substances.		
Traffic proximity and volume	Count of vehicles (“AADT”, avg. annual daily traffic) at major roads within 500 meters, divided by distance in meters (not km). Indicator for potential safety and air quality exposures.	Count applied at the block group level	EJScreen (Department of Transportation traffic data[19])
Social and Economic Indicators			
Renter-occupancy	Count of renter-occupied households. Functions as an indicator of housing burden and economic burden	Count applied at the block group level	American Community Survey[20]
Physical Climate Hazards			
Flood Zone Boundaries	Shows boundary lines of flood zones	This category is comprised of 100-year annual chance flood event hazard boundaries	FEMA[21]
Sea Level Rise	Sea level rise risk signifies the overall risk of inundation from projected sea level rise between one to six feet over the next ~90 years. The indicator represents the possibility of inundation based upon the combined projections at each stage of sea level rise and could vary depending upon future circumstances. A high rank indicates a community more vulnerable to sea level rise.	Reviewed at the City-level	NOAA Fisheries Community Social Vulnerability Index (CSVI)[22]
Commercial activity	Count of unemployed adults and the total number of low-income individuals	A combined indicator consisting of unemployed people in the block group plus the total number of low-income individuals in the block group	EJScreen[15]

[19] **Data Inventory | US Department of Transportation**, Accessed on 4/9/2024
[20] The data can be downloaded from the **US Census Bureau's FTP Server.**
[21] **Hazus | FEMA.gov**. Accessed 4/9/2024.
[22] Social Indicators Tool (noaa.gov), accessed 3/27/2024.

5. Methodologies

5.1 Demographic Index Statistical Methodology

The demographic index is the scoring mechanism used to identify communities with equity concerns within the City. Scores are typically calculated at the US census block group level using the following approach.

Each demographic variable (indicator value) is normalized using the z-score formula for each variable in the block group:

$$(x-\mu)/\sigma$$

Where,

X is the variable value in the block group

μ is the mean of that variable across all block groups in the region (for the Crescent City analysis the state of California was used)

σ is the standard deviation

Normalized demographic variable values are then added together to calculate the demographic index (consisting of the normalized demographic indicator values).

5.2 Scoring Methodology

Demographic index scores are provided to reflect the socioeconomic characteristics of the population in a particular block group. The index also anonymizes the data to support protection of individual privacy. This score provides a relative measure against the California mean for each indicator comprising the demographic index (see Table 2) and are descriptively ranked relative to one another. The demographic index scoring scale is presented in Table 3.

Table 3 Demographic Index Scoring Scale

Score Range*	Definition	Rank
2.97 – 3.31	Higher Level of Potential Social Vulnerability	1
2.39 – 2.96		2
1.30 – 2.39		3
0.56 – 1.29		4
0 – 0.55	Lower Level of Potential Social Vulnerability	5

* – where a score of 0 is the California mean and the range is based on the distribution of the scores

When interpreting the demographic index score, a score above zero indicates that the block group exhibits a higher level of social vulnerability - as it is represented by the calculated demographic index - than the average in California. As scores increase, the level of relative social vulnerability - as it is represented by the indicators comprising the demographic index - increases.[23]

[23] The intent of this ranking is to provide more stratification and granularity to the available data for the purposes of descriptive clarity.

To provide additional descriptive analyses, the following environmental and socioeconomic indicators were reviewed:

- Underground storage tank locations – potential environmental release exposure events, legacy pollution
- Traffic proximity and volume – potential air quality exposure and public safety concerns, legacy pollution, displacement
- Renter-occupancy – potential economic and social vulnerability, housing burden
- Commercial activity – potential economic vulnerability

Underground storage tank locations were reviewed due to the potential for environmental release, and traffic proximity and volume were reviewed as an indicator of pollution burden and public safety. Renter occupancy and commercial activity provide additional information about socioeconomic conditions and potential vulnerabilities. Supplemental indicator selection is based on standard indicators for environmental and economic justice screening[24] and as indicative of issues which are potentially relevant to the activity of storm drain planning and management. In addition, the following climate-related hazards were reviewed based on available public data:

- Flod risk areas – potential climate hazard, property damage, and public safety hazard
- Flood zone boundaries – potential climate and public safety hazard
- Sea level rise (SLR) – potential climate hazard, property damage, economic burden

Flood hazards and risks along with SLR were briefly reviewed based on public data sets due to the coastal location of Crescent City and the riverine flood risk of Del Norte County.[25] Because flood risk and hazard determinations may require hydrologic model inputs for planning applications, a brief overview of findings was provided for informational purposes but is not inclusive of site-specific hydrologic model data or historical data.[26]

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[25] **National Risk Index | FEMA.gov**. Accessed 3/26/2024.
[26] Climate-related hazards were not included in the cumulative scores provided in Section 7 but a map of SFHA zones with demographic scores was provided.

The figure below provides the results of the demographic index scoring by block group. Block group 060150001012 received the highest demographic index score, indicating the highest levels of potential socioeconomic vulnerability, as it is represented in the demographic index, to populations residing in the block group. Block groups 060150001021, 060150001011, 060150001072, 060150001022 are partially within the City boundaries. These block groups have lower scores, which means they are closer to the California mean and descriptively have progressively lower levels of potential social vulnerability relative to one another, as social vulnerability is represented in the combination of indicators described above (see Table 2).

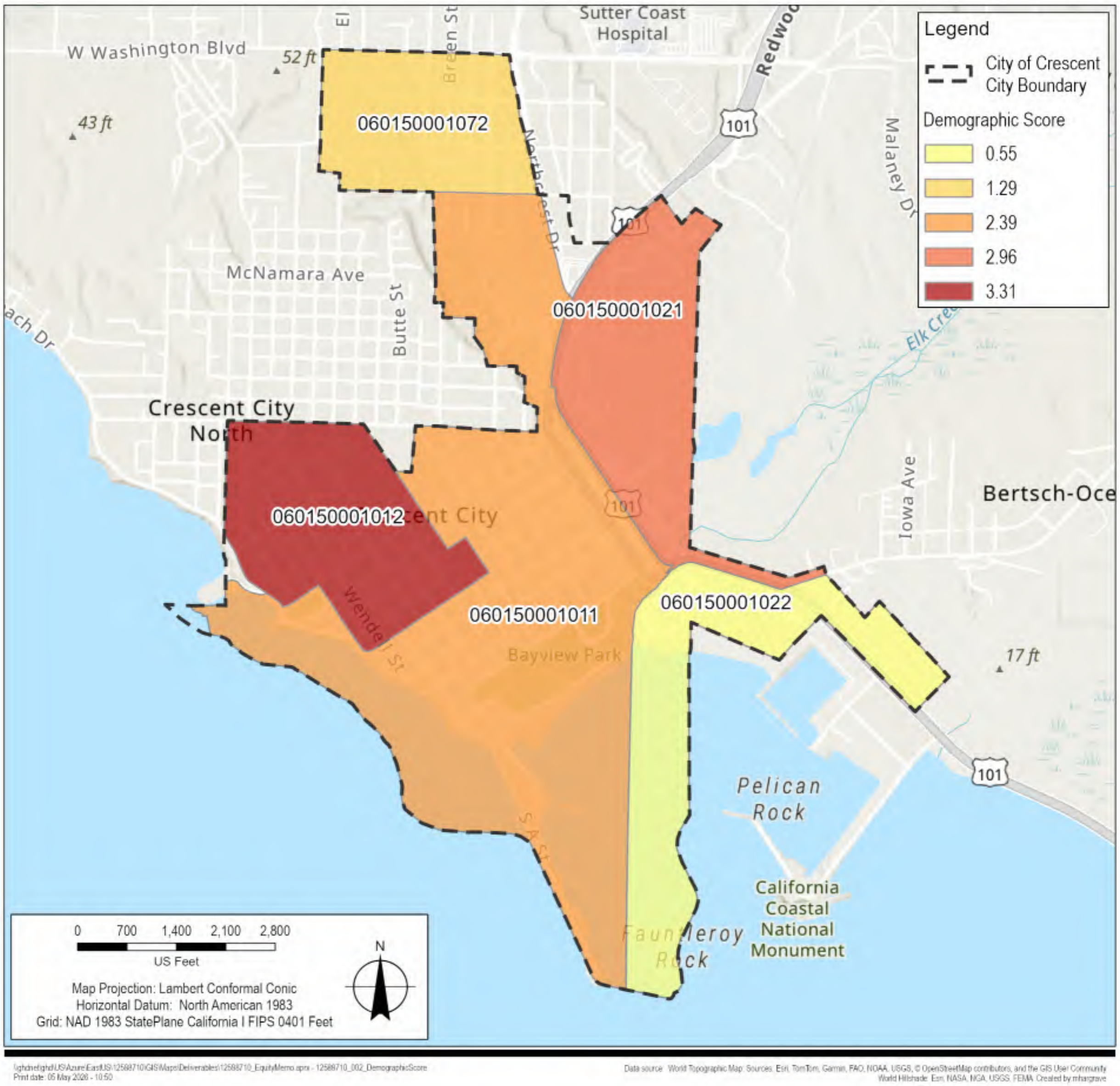

Figure 2 *Demographic Index Score by Block Group*

6. Crescent City Community Information

As part of the equity analysis, socioeconomic and environmental characteristics were reviewed and documented to support a contextual understanding of the conditions relevant to social equity in the City. A brief summary of findings is presented in this section.

6.1 Social and Economic Indicators

Table 4 presents socioeconomic data for Cresent City, including relevant population data, age, rates of owner-occupied housing units, and income levels in comparison to Del Norte County and California state statistics.

Table 4 Socioeconomic Statistics Summary

Socioeconomic Statistic[27, 28, 29]	Crescent City	Del Norte County	California State
People and Population			
Population Estimates, July 1, 2022	5,983	27,112	39,040,616
Persons less than age 5	2.90%	4.90%	5.50%
Persons less than age 18	12.30%	20.90%	21.80%
Persons over age 64	14%	19.4%	15.8%
Race and Ethnicity[30]			
People of Color	46%	40%	61% (average)
Housing			
Owner-occupied housing unit rate, 2018-2022	36.50%	68.10%	55.60%
Households, 2018-2022	2,029	9,530	13,315,822
Income and Poverty			
Median household income (in 2022 dollars), 2018-2022	$ 39,812	$ 61,149	$ 91,905
Persons in poverty, percent, 2022	22.70%	16.50%	12.20%
Health			
Persons with disabilities, 2022	22.2%	19.3%	11.7%
Employment and Labor Force			
Employment Rate, 2022	29.7%	44.6%	60%

The NOAA Fisheries Social Indicators for Coastal Communities were also reviewed for Crescent City, to gain context and understanding of potential areas of socioeconomic social vulnerability in the City. Indicators for poverty, personal disruption, and labor force structure scored high in vulnerability, while indicators for retiree migration and housing characteristics scored medium-high[31] on the community social vulnerability index (CSVI) scale. These indicators reflect the comparison statistics presented in Table 4, indicating higher than average levels of poverty and unemployment along with housing burden, which cn contribute to migration and personal disruption.[32,33]

6.2 Environmental Release and Exposure Indicators

The table below provides the values for environmental release and exposure sources at the city-level for Crescent City in comparison to California state and national percentiles.

[27] https://www.census.gov/quickfacts/fact/table/CA,delnortecountycalifornia,crescentcitycitycalifornia/PST045223
[28] **Del Norte County, California - Census Bureau Profile**. Accessed 3/26/2024.
[29] **Crescent City city, California - Census Bureau Profile**. Accessed 3/26/2024
[30] See attachment 1 to this memo: EJScreen Community Reports for Del Norte County and Crescent City.
[31] NOAA Fisheries CSVI scoring scale: High, Medium-High, Medium, Low; NA – does not apply

Environmental Release and Exposure Sources	Value	State Average	Percentile in State	US Average	Percentile in US
Particulate Matter (µg/m3)	5.85	8.65	6	8.08	7
Ozone (ppb)	44.5	65.9	0	61.6	0
Diesel Particulate Matter (µg/m3)	0.03	0.26	1	0.26	1
Air Toxics Cancer Risk (lifetime risk per million)	20	27	1	25	1
Air Toxics Respiratory Hazard Index	0.20	0.34	2	0.31	4
Toxic Releases to Air	0.36	780	6	4,600	3
Traffic Proximity (daily traffic count/distance to road)	41	510	16	210	36
Lead Paint (% pre-1960 housing)	0.28	0.31	54	0.3	56
Superfund Proximity (site count/km distance)	0.01	0.17	1	0.13	6
RMP Facility Proximity (facility count/km distance)	0.011	0.57	0	0.43	0
Hazardous Waste Proximity (facility count/km distance)	0.19	5.9	6	1.9	34
Underground Storage Tanks (count/km^2)	2.2	1.5	78	3.9	60

The values and percentiles for pollution and sources indicators may vary substantially at the block group level, so environmental indicators selected for the equity analysis were examined at the block group level.

6.3 Key Takeaways

Crescent city, as a whole and at the block group level, is considered disadvantaged in accordance with AB 1550 and California water code 79505.5 state definitions and Justice40 and IRA federal definitions (see also Attachment 1).[34,35] In addition, the City exhibits higher levels of social vulnerability when compared to the state, based on the indicators reviewed. Poverty and unemployment exceed state and county levels, and the NOAA Fisheries CSVI identifies the City at a high level of vulnerability for personal disruption, labor force structure, and housing characteristics.

[32] **Social Indicators Tool (noaa.gov)**. Accessed 3/26/2024
[33] Definitions for NOAA Fisheries indicators may be found here: **Social Indicators for Coastal Communities | NOAA Fisheries**
[34] California Small Disadvantaged Community is a community with no more than 10,000 persons with a combined mean household income (MHI) of less than 80% of the state MHI. **Low-Income or Disadvantaged Communities Designated by California - Dataset - California Natural Resources Agency Open Data**. Accessed 3/27/2024
[35] **Explore the map - Climate & Economic Justice Screening Tool (geoplatform.gov).** Accessed 3/27/2024

7. Demographic Index Scoring

The demographic index described in the previous sections was calculated at the block group level and the scores are provided in the table below. Because the analysis was performed by census block group, the calculated land area that lies within the City boundaries was provided for each block group. However, population clustering and distribution data was not integrated into the analysis so straight ratios of population to land area may not accurately reflect population and household distribution.

Table 5 Calculated and Ranked Demographic Index per Block Group with Population

Rank	Block Group Number	Score*	Population	Number of Households	Population Density+	Land area within the City Boundary (%)
3	060150001011	2.39	1,987	893	2.2	34%
1	060150001012	3.31	2,241	995	2.3	98%
2	060150001021	2.96	2,074	543	3.8	38%
5	060150001022	0.55	1,747	663	2.6	5%
4	060150001072	1.29	1,907	685	2.8	7%

* = where 0 is the California mean
+ = population (count)/number of households

All the block groups which comprise the City meet the Justice40 and US EPA Inflation Reduction Act (IRA) Disadvantaged Communities definition (see Attachment 1), therefore, differentiating based on the additional indicators included in the calculated demographic index provides clarification on relative scores of each block group compared to one another. Block group 060150001012 received the highest demographic index score, indicating the highest levels of potential socioeconomic vulnerability, as it is represented in the demographic index, to populations residing in the block group. Ninety-eight percent (98%) of the geographic area of block group 060150001012 is located within the City boundaries.

The data analyses were performed at the block group level (due to availability) and population is not necessarily equally distributed throughout the block group area, therefore, the percentage of the geographic area of the block group residing within the City boundaries was calculated for reference and is presented on Figure 3 (below) (see also Table 5).

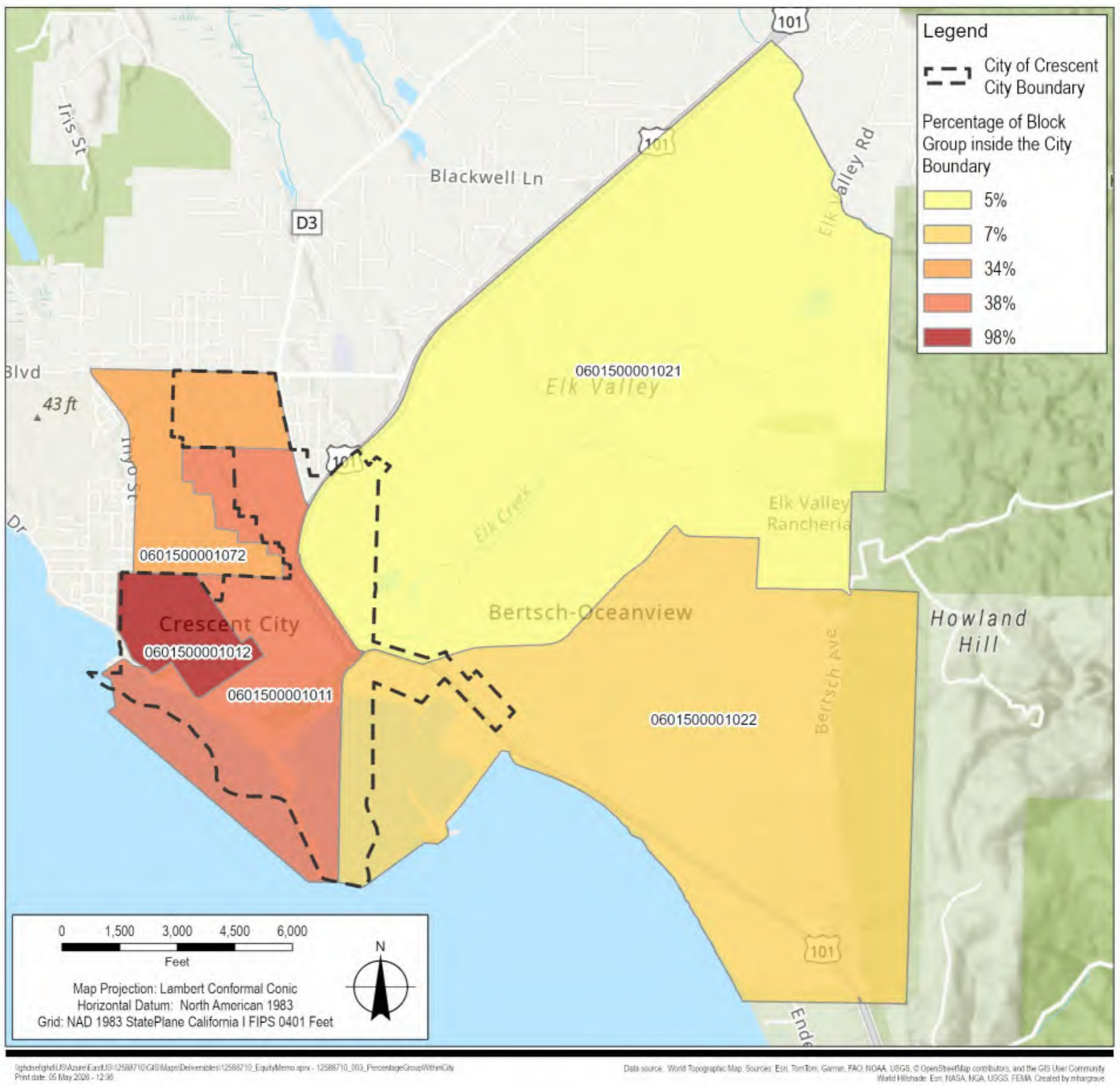

Figure 3 *Percentage of Census Block Group Land Area within City Boundaries*

Population density for each block group is a relevant consideration for planning and prioritization; however, areas of low population density and household count may be disadvantaged due to historical legacies of co-location of under-resourced communities with industrial zoning. The figures below provide population density information in the form of household density for each block group within the city boundaries (full and partial) (Figure 4) and the mean number of residents per household by block group (Figure 5).

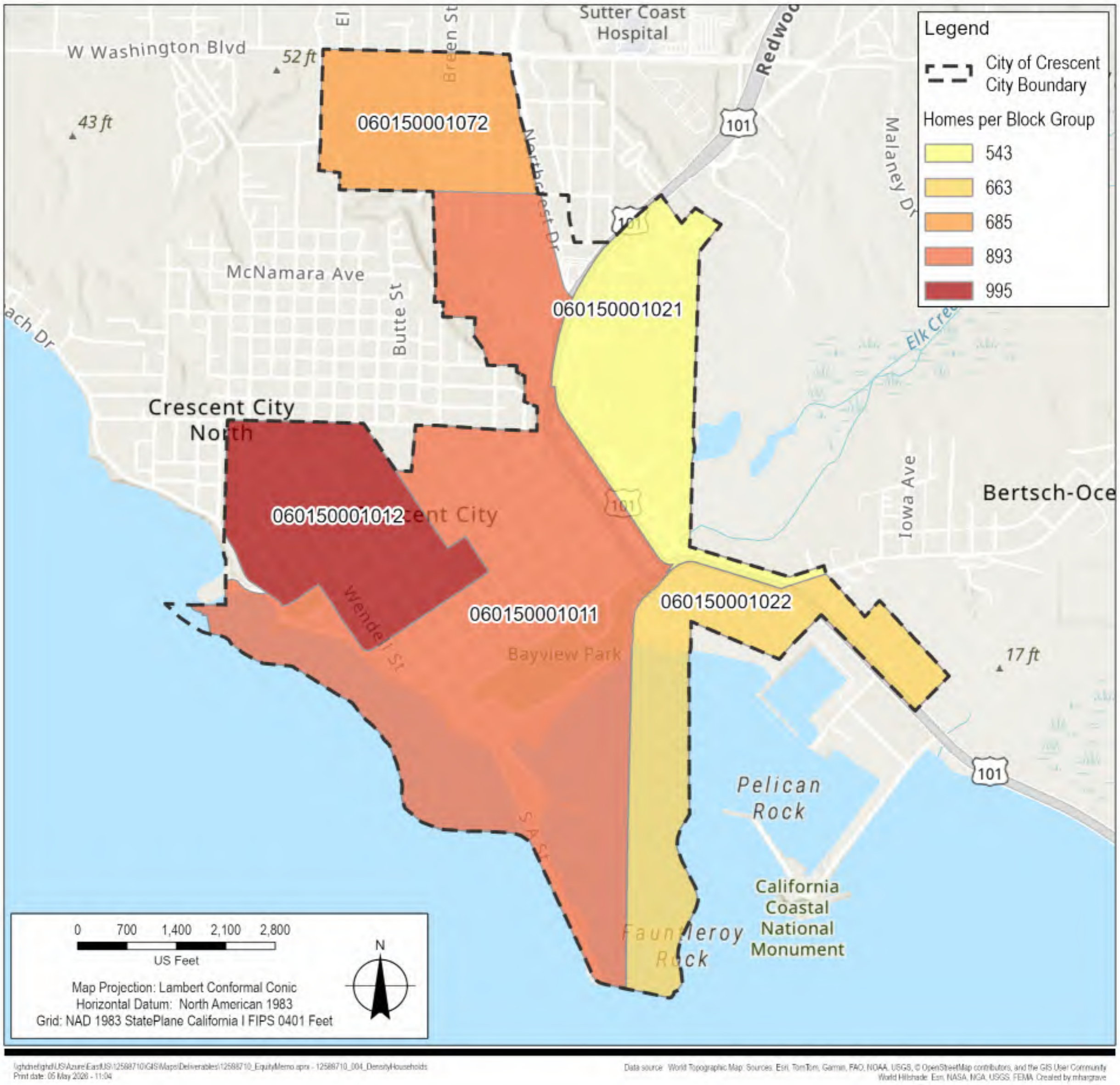

Figure 4 *Density of Households by Block Group*

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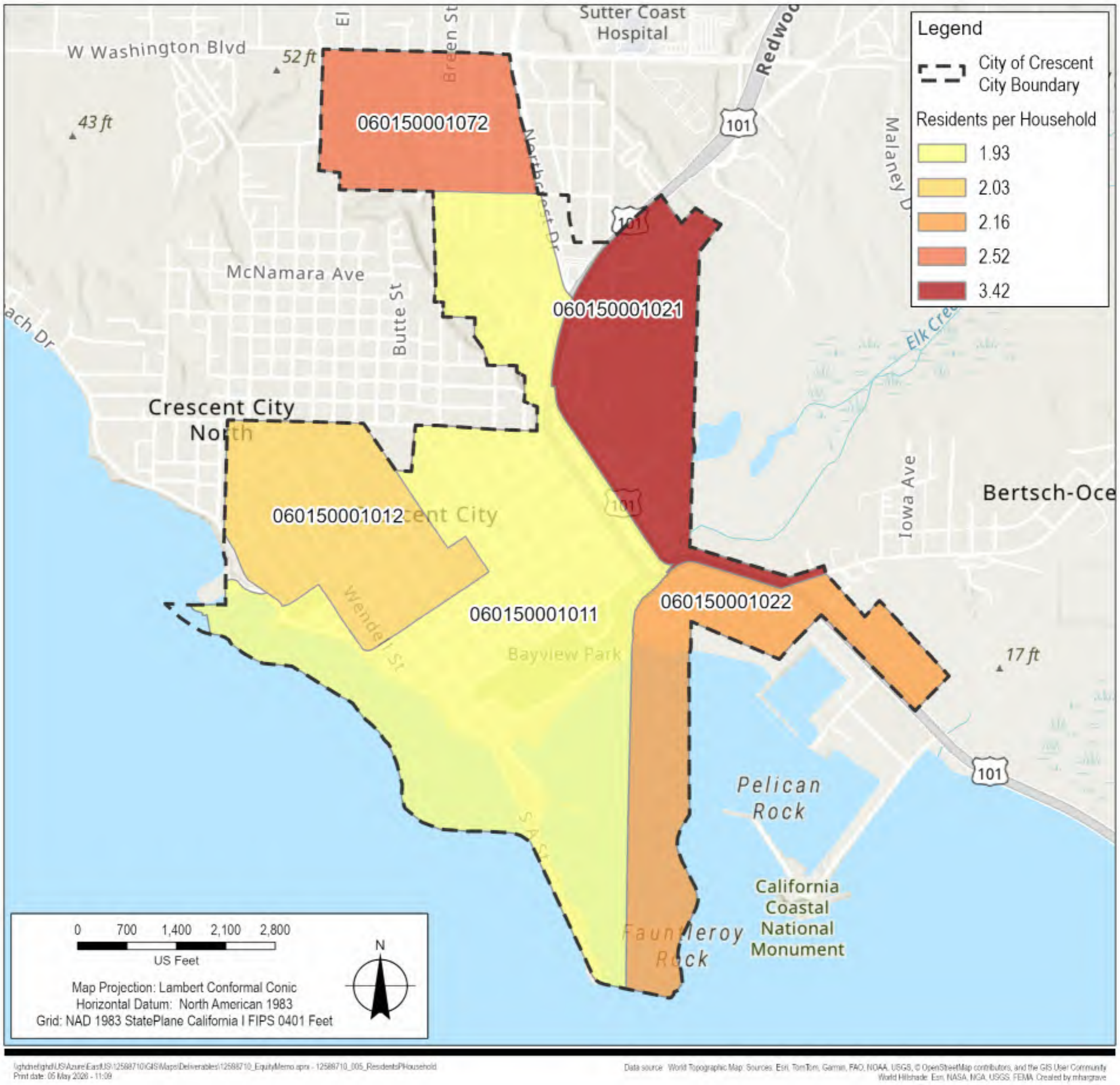

Figure 5 ***Residents per Household by Block Group***

Renter occupancy may be an indicator of economic and social vulnerability and housing burden, where lower levels of residential homeownership may indicate higher levels of vulnerability and burden. The renter occupancy percentages by block group are presented in Table 6 (below). The renter occupancy percentages in Table 6 represent the statistic for entire geographic area that comprises the associated census block group.

Table 6 Renter Occupancy by Block Group

Block Group	Percentage of Renter Occupancy
60150001011	74.89%
60150001012	58.05%
60150001021	27.37%

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Block Group	Percentage of Renter Occupancy
60150001022	22.13%
60150001072	38.99%

Flood risk and hazards are specific considerations which may require site-specific modelling and historical data for planning applications. As such, the flood hazard zone data from FEMA was used to provide a map depicting the special flood hazard area (SFHA) as it intersects with the block groups. However, outputs from hydrologic modelling and historical data would provide more specific information for use in determining flood risk and hazards to vulnerable populations. The SFHA flood zone boundaries by block group along with the demographic index score is provided in Figure 6 (below).

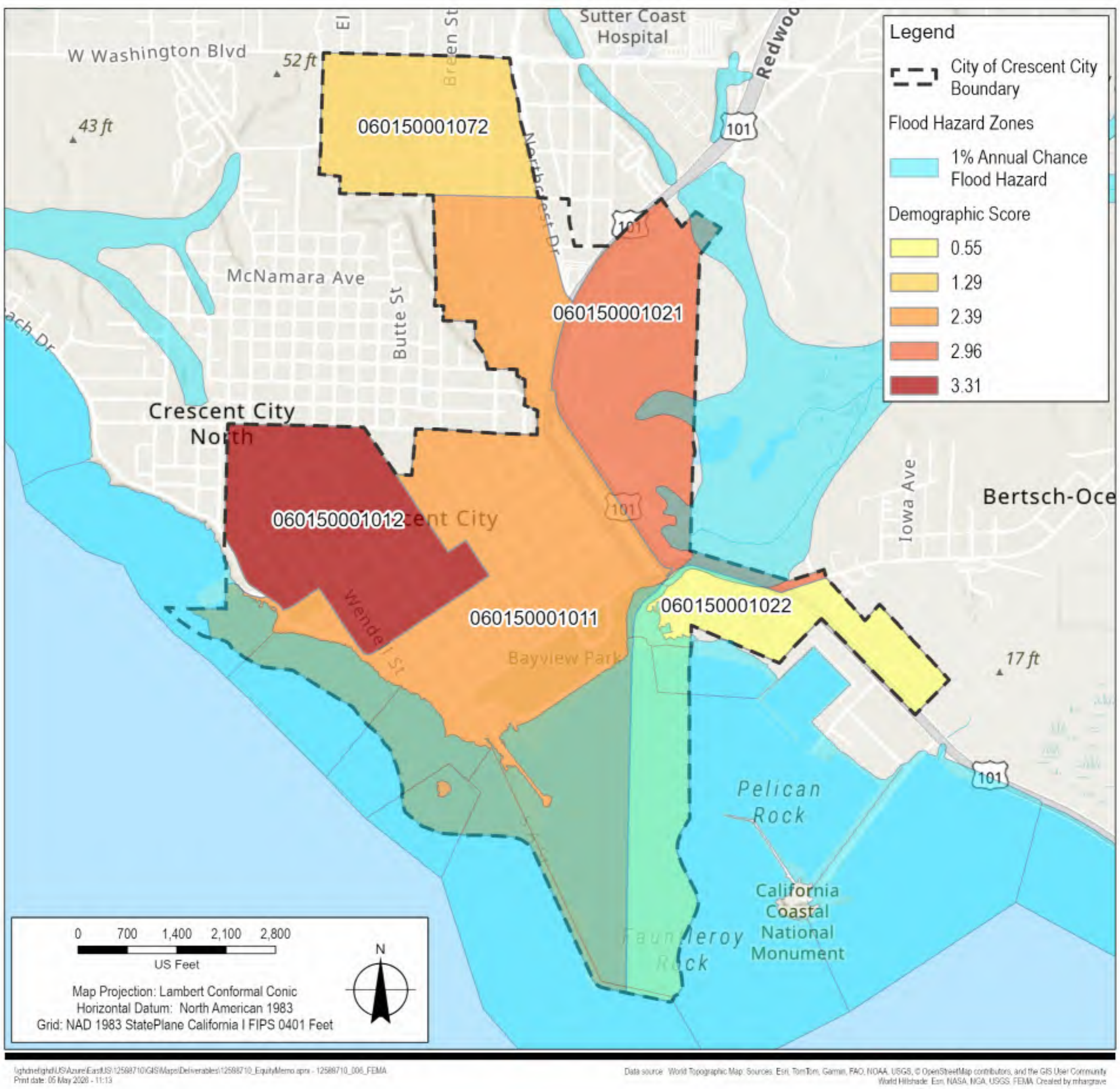


Figure 6 ***SFHA Flood Zone Boundaries by Block Group***

Climate-related hazards including flood risk and hazard and SLR were reviewed using FEMA data, EJScreen community analysis, and NOAA Fisheries sources. The risk of SLR was determined to be low by the NOAA Fisheries CSVI report for the city as a whole. Because flood risk and hazard may require technical inputs from hydrologic models and historical data when used for planning, the SFHA figure (above) was provided for informational purposes but is limited by the use of publicly available data.

Supplemental indicators were integrated into the analytical approach based on relevance to place and activity and based on standard socioeconomic indicators used for environmental, economic, and climate justice screening and assessment (see Table 2). Supplemental indicators included in the analytical evidence base are representative of the potential for pollution and public safety burdens (UST location - environmental release; traffic proximity and volume– air quality and safety) and social and economic vulnerability in the form of housing burden and economic vulnerability (renter-occupied residences; commercial activity). Table 7 (below) provides a statistical ranking of each block group per supplemental indicator along with block group level population counts by individual and household. Indicator definitions are provided in Table 2.

Table 7

Indicator	Block Group	Rank*
Supplemental Indicators		
Renter-occupancy	060150001011	1
	060150001012	2
	060150001021	4
	060150001022	5
	060150001072	3
Commercial activity	060150001011	5
	060150001012	4
	060150001021	3
	060150001022	2
	060150001072	1
Traffic proximity and volume	060150001011	5
	060150001012	1
	060150001021	4
	060150001022	2
	060150001072	3
UST	060150001011	3
	060150001012	1
	060150001021	2
	060150001022	5
	060150001072	4
Population Density/Counts		
Population	60150001011	3
	60150001012	5
	60150001021	4
	60150001022	1
	60150001072	2
Number of households	60150001011	4
	60150001012	5
	60150001021	1
	60150001022	2
	60150001072	3

* where 5 = Least or fewest and 1 = Most or highest

The demographic index score was combined with the scores for the supplemental indicators and population density to provide a cumulative score for each block group. This score provides an input for understanding the level of potential social vulnerability, as it is described by the indicators selected for this evidence base, and opportunities to positively impact social equity outcomes for communities with equity concerns at the census block group level. Based on these cumulative findings, an Equity Priority score was assigned for use in project prioritization. Table 8 (below) provides the cumulative scores and equity priorities, and Figure 7 (below) provides a visual depiction of the cumulative score and equity priority by block group.

Table 8 Cumulative Scores by Block Group

Block Group	Cumulative Score	Meaning*	Equity Priority
060150001012	12	Higher level of potential combined vulnerability	1
060150001011	18		2
060150001021	22		3
060150001072	23		4
060150001022	35	Lower level of potential combined vulnerability	5

* = indicators comprising the cumulative score include those that are used to determine whether a community is considered disadvantaged by state and federal definitions (see Section 3). The score is comprehensive of the demographic index score combined with the supplemental indicator scores.

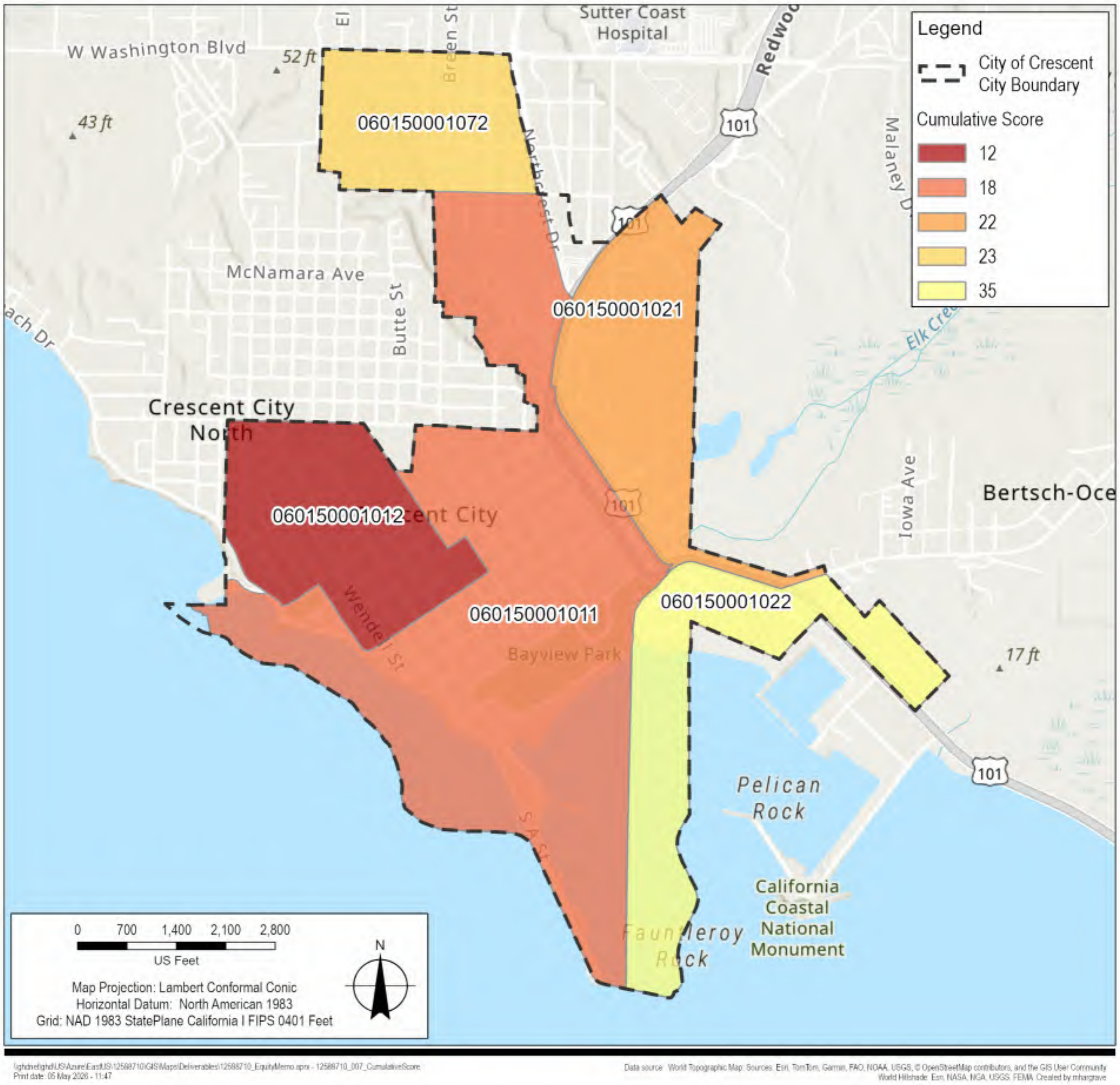


Figure 7 *Cumulative Scores and Equity Priorities*

8. Demographic and Cumulative Score Use Notes

The demographic index calculated during this analysis provides a comparative measure of social vulnerability at the census block group level. The cumulative score is the calculated demographic index combined with the supplemental indicator scores. The demographic index includes core socioeconomic indicators and the cumulative score includes both those core socioeconomic indicators along with the selected supplemental indicators that provide more refined information to reflect pollution burden, public safety, and economic vulnerability.

Both the demographic index and the cumulative score are designed to provide inputs for the evidence base needed to select opportunities and priorities to advance social equity in infrastructure planning and development.

The equity analysis was performed with currently available existing public data sets and did not include hydrologic modelled or historical data. Analyses were performed at the census block group level, so statistics reflect conditions in those geographies and are not limited to land area included in the City boundary.

Regards

Amber Shows
Project Manager

Appendix C

Data Collection Field Surveys

C-1 Purpose

The purpose of the data collection analysis was to provide an inventory of the storm drain infrastructure for the City and use that data to inform the H&H analysis. Data collected during the field survey efforts are described in the sections below.

C-2 Required Data

Data collected included watershed and sub-watershed boundary verification, surface flow routing, and existing drainage infrastructure. Data was collected through a site investigation visit with efforts between GHD and the City of Crescent City staff members and is described below.

C-2-1 Digital Elevation Model (DEM)

The existing Coastal Lidar supplied digital elevation model (DEM) was determined to have high enough resolution for the purposes of this H&H analysis. However, an expanded DEM capturing the topographic details of areas contributing to the storm water drainage system is required. These areas were determined through a preliminary watershed delineation through PCSWMM with the “Watershed Delineation Tool.” The expanded areas of the DEM do not contain drainage infrastructure elements and only contribute surface runoff to the system. Therefore, a lower resolution DEM layer to capture the expanded areas would be acceptable. The outcome of this step is a conformed DEM with the highest resolution in the lower reaches, and the lowest resolution in the higher reaches, shown in Figure 9.5 below.

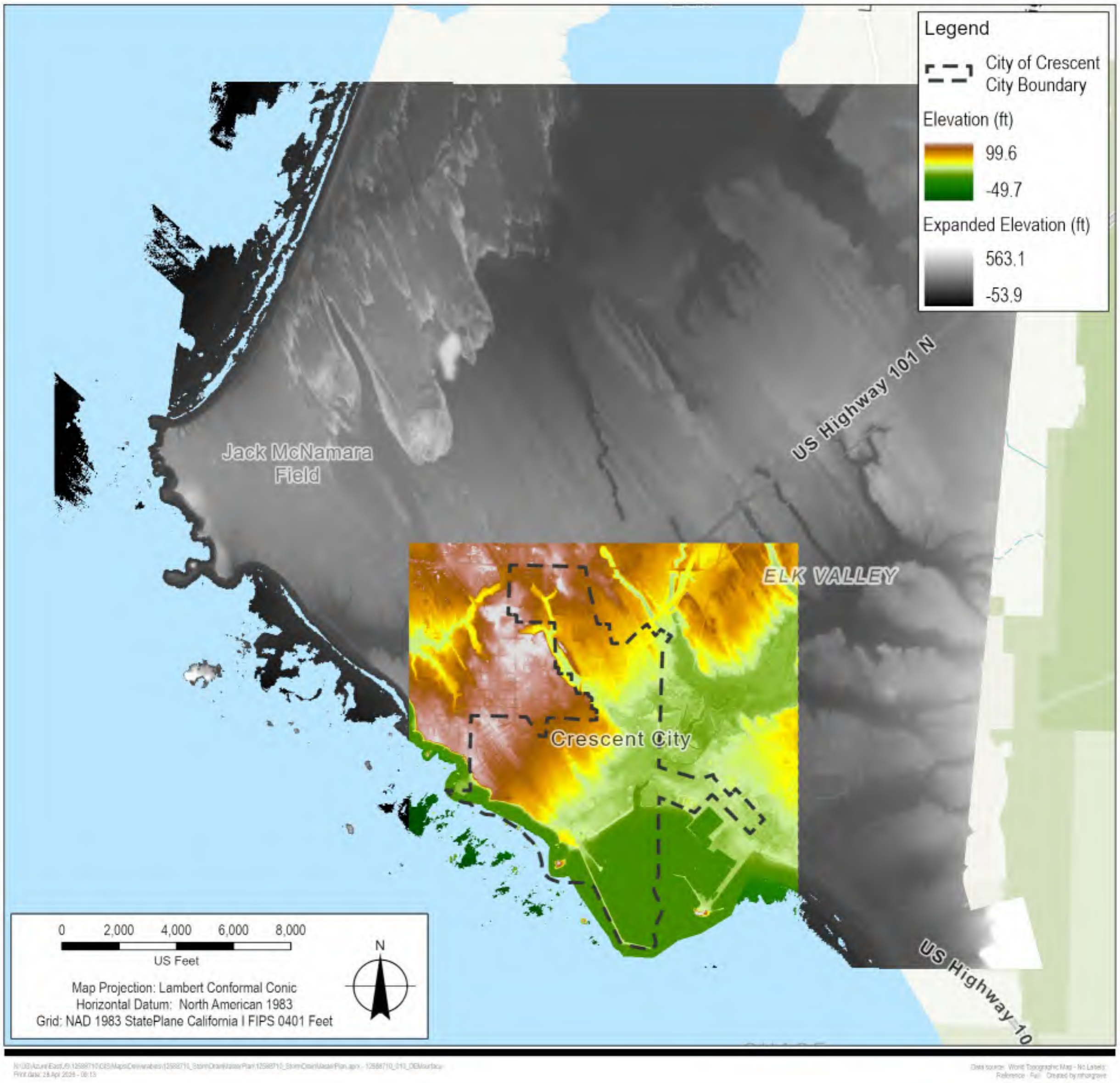


Figure 9.5 ***Conformed DEM.***

After this step, the watershed delineation tool is run to provide a preliminary delineation of the watershed and sub watersheds. The watershed and sub watersheds delineated inform the creation of the watershed map book.

C-2-2 Watershed Boundaries and Surface Flow Routing

Using DEM and using watershed delineation tool with existing model, the GIS output from PCSWMM is utilized to create the map book. Hydrologists then field verify flow boundaries and directions for each sub watershed. As the first element of field data collection; watershed and surface flow routing are verified through a field investigation by verifying watershed boundaries delineated within the watershed map book.

The model is most sensitive to areas in lower elevation within higher energy segments (greater changes in elevation for flow sections), and accordingly, data collection will be prioritized for these regions. Higher elevations and lower energy segments (flatter surface flow sections) of the watershed are of lower priority but are still recommended to collect to ensure a thorough and accurate model.

The watershed delineation tool delineates watersheds and surface flow route off connections to all existing DI junctions to provide a preliminary watershed boundary. The preliminary watershed boundary will be utilized to create a watershed map book, delineating where each watershed outfall or drainage point is located. Watershed and sub-watershed boundaries to be verified and modified based on surface flow routing affected by topography and hard barriers (i.e. roads, buildings, etc..). Areas with permittable flooding such as parks or fields considered 'greenspaces' are to also be identified and delineated. Watershed and sub-watershed boundaries and other collected field data is to be recorded in the GIS team provided watershed map book. This field work is to be conducted by the hydrologist on site and can be conducted concurrently with data collection needs described below in Section C-2-3.

Outcome of this objective is a revised watershed boundary map to incorporate into the model as a GIS file. Attributes for the GIS watershed boundary map are consistent with the attributes for the PCSWMM model.

C-2-3 Existing Drainage Infrastructure

Data collection for the existing drainage infrastructure was collected concurrently with watershed boundary and surface flow routing data collection. This section describes the data collected, and the methodology of how the data was collected.

Conditions Assessment

The conditions assessment for junctions and conduits were rated on a scale of 1-3 with 1-"Good", 2-"Emerging Issue" and 3-"Critical Issue". Condition was visually determined based on the infrastructures ability to convey storm water. Infrastructure unable to convey storm water were given a "Critical Issue" rating; some examples include drainage inlets full of sediment and debris or pipes fully crushed. "Emerging Issue" infrastructure were infrastructure able to pass a constricted volume of stormwater; some examples were partially crushed pipes or drainage inlets partially full of sediment/debris. Infrastructure rated "Good" were visually determined to be able to pass stormwater without constriction.

Junctions

Junctions include drainage inlets, manholes, detention basins, and outfalls. For the given pipe and junctions as provided in the City of Crescent Cities GIS, rim elevations were assigned based on the DEM provided elevations, rim and invert elevations need to be verified through GIS field data collection to the cm. A field form was utilized to input junction elevation data that includes junction ID, GPS location, surface area (if applicable), elevation data to the cm and a conditions assessment. This form must be able to accommodate junctions that may be found in the field that were not represented in the City of Crescent Cities GIS data files.

Table 9.2 Field Data to be Collected for H&H Deficiency Analysis – Junctions

Data Item No.	Data Item	Data Description	Units	Data Collection Method	Priority (High, Medium, Low)
1J	Drainage inlet (DI) and manhole (MH) invert elevations	- Invert elevations to bottom of DI's and MH's.	[ft]	Utilize Eos Positioning Systems #19094354 that captures junction GPS location and measured elevation to the nearest cm.	High
2J	Sediment elevation in drainage inlets and manholes	- Sediment and other debris (e.g. driftwood) build up in DI's and MH's.	[ft]	Visual inspection of difference of pipe invert elevation and approximate elevation of debris. To confirm with tape measure.	High
3J	Pipe inlet and outlet offsets elevation	- The offset is the conduit invert - junction invert	[ft]	Grab conduit invert elevation and grab junction invert elevation. Take difference in office analysis.	High

Data Item No.	Data Item	Data Description	Units	Data Collection Method	Priority (High, Medium, Low)
4J	Extraneous drainage infrastructure	- Any other drainage infrastructure that exists in system that is not represented by the existing pipe network, drainage inlets, or manholes. - Extraneous drainage infrastructure could include, but is not limited to; drainage detention basins, trash capture devices, tide gates, screens, etc.	n/a	1. Delineate on watershed map book. 2. Grab GPS location with Eos Positioning Systems #19094354. 3. Collect GIS data needs (i.e. type of infrastructure, surface area, invert elevation, rim elevation, visual inspection of condition, percent debris blockage, etc.)	High
5J	Outfalls	- Outfall rim elevation, invert elevation, outfall type, location verification	[ft]	- GIS and GPS (Eos Positioning Systems #19094354) field data collection.	High
6J	Drainage inlet rim elevations	- Drainage inlets are typically below DEM scanned surface. Difference in curb elevation and drainage inlet elevation.	[ft]	- GIS and GPS (Eos Positioning Systems #19094354) field collection of rim elevations	Medium
7J	Manhole rim elevations	- Surface elevation of manhole	[ft]	- GIS and GPS (Eos Positioning Systems #19094354) field collection of rim elevations	Low

Conduits

Conduits include closed pipes, ditches, open channel swales, streams, and estuaries. Data needs for drainage system conduits include size, material type, percent full of sediment and debris, and elevation. Conduits identified in the field as critically poor quality should be flagged as ‘critical’ with photo documentation. See the below list for the required input conduit data for the field form:

- Geometry
- Pipe material
- Size
- Percent Full
- Pipe inlet offset elevation
- Pipe outlet offset elevation

The necessary data to be collected was ranked by high, medium, and low priority based on the ability to make model assumptions without the data. It is recommended that all the data requested be collected to ensure model accuracy and validity, however, to accommodate for project schedule and budget, data that could be reasonably assumed without significant impact to the model was ranked as low priority.

Additionally, efforts to collect data should be conducted starting from the known downstream boundaries and work methodically upstream through the watershed. The H&H model is typically less sensitive to differences in drainage infrastructure elevations in more upstream and hilly areas. However, to ensure model validity and that the model captures the existing storm drainage system, it is recommended that all the requested field data is collected at all locations within the project area. See Table 2 below for the conduit field data to be collected for the H&H deficiency analysis.

Table 9.3 Field Data to be Collected for H&H Deficiency Analysis – Conduits

Data Item Number	Data Item	Data Description	Units	Data Collection Method	Priority (High, Medium, Low)
1C	Pipe inlet and outlet offsets elevation	- The offset is the conduit invert - junction invert	[ft]	Utilize tool that captures junction GPS location and measured elevation to the nearest cm.	High
2C	Extraneous drainage infrastructure	- Any other drainage infrastructure that exists in system that is not represented by the existing pipe network, drainage inlets, or manholes. - Extraneous drainage infrastructure could include, but is not limited to; drainage detention basins, trash capture devices, tide gates, screens, etc.	na	1. Delineate on watershed map book 2. Grab GPS location. 3. Collect GIS data needs.	High
3C	Pipe diameter	- Diameter of existing pipes	[ft]	- Visual Inspection, Input on form - Form to include size options from 6” to 48” diameter	High
4C	Pipe material	- Some materials of pipes are known (majority RCP). This will be marked prior to field investigations on GIS map.	na	- Visual inspection, input on form. - Pipe materials to include: HDPE, CMP, ACP, PVC, and Concrete.	Medium
5C	Collecting “other” existing drainage infrastructure	- Location of all drainage ditches, swales, or other drainage open channels	na	- Field collection of invert and rim geometry and roughness (material, debris blockage approximation).	Medium
6C	Pipe condition assessment	- Pipe condition assessment to include any sediment build up in the pipe.	[%]	- Sediment buildup to be estimated as a percentage of pipe.	Low

C-3 Background Information Review

Background information received from the City was incorporated into H&H model and CIP development. Below in Table 9.4. is a summary of the utilized background data and how it was incorporated into H&H model and CIP development.

Table 9.4 City of Crescent City SDMP Meta Data and incorporation into the project development - summary

Name	File Description	Project Development Incorporation Description
2006-02 Drain Basin 500 Study	List of drainage inlet locations and depths for the K-Street Outfall (Outfall 2)	Field Data collection data validation
2013-06 Drainage Study	Drainage study near C St memorandum, volumes, and location maps.	Field Data collection data validation
2014-06-18 Drainage Survey for Augustine Meeting	Further assessment of drainage study on C St.	Field Data collection data validation
Historic 'as-builts' of Storm Drain Infrastructure	Piecewise hand-drawn as-builts of storm drain infrastructure from 1965 – 2013	Field Data collection data validation
MS4 Permit	Most recent MS4 Permit	SDMP development
As-builts and plans of Front St., C St., D St., and F St.	Planned and partially in-construction drainage improvement projects to take place on Front St., C St., D St., and F St.	Field Data collection data validation
As-builts of Harding St. Culvert	As-builts of Harding Ave Culvert Repair Project	Field Data collection data validation
Storm Drain Capacity Analysis 3rd St Drainage from J to K St.	Rational Method analysis assessing the existing storm drainage capacity on 3rd St. from J to K St.	Field Data collection data validation; H&H Model validation
2024.02.23 Front Street Play to L Plans	Plans for storm drain infrastructure projects on Front Street.	H&H Model incorporation
City Priority Criteria	A ranked list of criteria the City wants considered in project development and prioritization.	CIP development and prioritization
Critical Facilities	A shape file delineating buildings of high importance to the City.	CIP development and prioritization; Risk Analysis

C-4 Flood History and Observations

Data on historic floods is limited to testimonial data and significant historical events. The City was able to provide a list of known historic flooding locations and dates. Flooding events observed by the City staff that drainage inlets were observed to overflow are described below in Table 9.5.

Table 9.5 List of rainstorm events that drainage inlets and manholes were observed to overflow

Date	Location
4/25/2006	Super 8 Motel 685 US 101
10/27/2008	3rd St between K St. and L St.
2/11/2009	2nd St. and B St. to 3rd St. and C St.
12/29/2011	3rd St. and J St.
11/29/2012	C St. between 4th St. and 5th St.

Date	Location
5/19/2015	3rd St. and M St.
12/9/015	3rd St. and I St.
12/13/2015	5th St. and C St.
1/19/2016	C St.
4/27/2018	4th St. and C St.
12/20/2018	5th St. and C St.

C-5 Field Investigations Results and Data Processing

Through field data collection, data was collected for 67 manholes, 405 drainage inlets, 10 outfalls, and approximately 67,300 linear feet of pipe. Additionally, the watershed and sub watershed (subcatchments) boundaries were defined and confirmed. The field data was processed and organized through Microsoft Excel before being imported directly into the PCSWMM H&H model. After the data was imported into the model, further data processing was required to input the material through the Mannings' roughness coefficient for the conduits, routing the subcatchments to their concentrated flow outlet, interconnecting the drainage system with topographically identified drainage swales and street flow. See Figure 2.1 for the existing inventory of the City's storm drainage infrastructure.

Appendix D

Computation Model Development

Computational Model Development

This section provides the approach and information required to develop the PCSWMM model to simulate and evaluate a series of design storm events. The “base conditions” model is to represent the City as accurately as possible with the existing infrastructure and infrastructure condition.

D-1 Model Approach Overview

The approach of developing the base conditions model is to first incorporate the data collected in field investigations. The data incorporated into the model from field collection is summarized in in Appendix C of the Crescent City Strom Drain Master Plan. After the existing infrastructure data are incorporated, representative design storms, watershed boundaries and characteristics, and outfall conditions are incorporated into the PCSWMM computational model.

The purpose of the H&H analysis approach is to evaluate the existing and proposed conditions for relevant design storm events, then to assess the changes in the amount of storm water runoff and any resulting surface flooding to inform drainage enhancement project development. This analysis approach includes the following tasks:

1. **Integrate Data Collected from Field Surveys.** Use inventory of the existing drainage infrastructure collected from field surveys to model drainage network including conduits, junctions, storages, and outfalls.
2. **Design Storms.** The design storms evaluated in the analysis include the 2-year, 10-year and 50-year return period, 24-hour duration storm events. Forecasted changes to precipitation in the given return frequencies as a result of climate change were also included in the analysis.
3. **Outfall Boundary Conditions**. Determine flood zone from FEMA Flood Hazard Mapping. For ocean outfalls, apply applicable Sea Level Rise (SLR) assumptions to develop downstream boundary condition.
4. **Subcatchment Delineation.** Delineate subcatchment areas and determine flow routing. During this task the hydrology parameters used to calculate the stormwater runoff flow rate such as area, flow length, slope, and curve number are developed.
5. **1D Computational Base Condition Model Simulation.** Simulate design storm events and evaluate stormwater runoff quantities and flooding under existing conditions. This step is a 1-dimensional link-node analysis that estimates the stormwater routing and runoff from the Project area using a computational model, PCSWMM 2024 (Version 7.7.3895). The model uses the Natural Resources Conservation Service (NRCS) Time of Concentration Method, Watershed Lag Method to calculate the runoff volume and flow rates from each subcatchment to each junction. The model then calculates the flow rate and volume of stormwater routed to the modeled junctions and flooding out of the modeled junctions.
6. **2D Computational Existing Condition Model Simulation.** Develop a 2-dimensional base-conditions model to assess the flooding location, extent duration, and volume within the City boundaries.
7. **Drainage Deficiency Analysis.** Identify and prioritize drainage deficiencies within the City boundaries based on flood locations simulated in Step 6. Prioritization will be aligned with City feedback and objectives.
8. **1D Computational Proposed Condition Model Simulation.** After developing a prioritized list of project alternatives to address drainage deficiencies, simulate design storm event to evaluate the level of service provided by the drainage improvement alternatives.

D-2 Design Storms

The design storms used for the analysis is the hypothetical depth of rainfall that would occur for a specified return frequency (once every 2, 10, and 50 years), duration (24-hours) and timing of distribution. All values are based on the historic rainfall records for the area.

D-2-1 Design Storms Type

An SCS Type IA design storm type was selected based on the location of the Project and using the Army Corp of Engineers HEC-HMS Technical Reference Manual. The reference map of the approximate geographic boundaries is shown below in Figure 9.6.

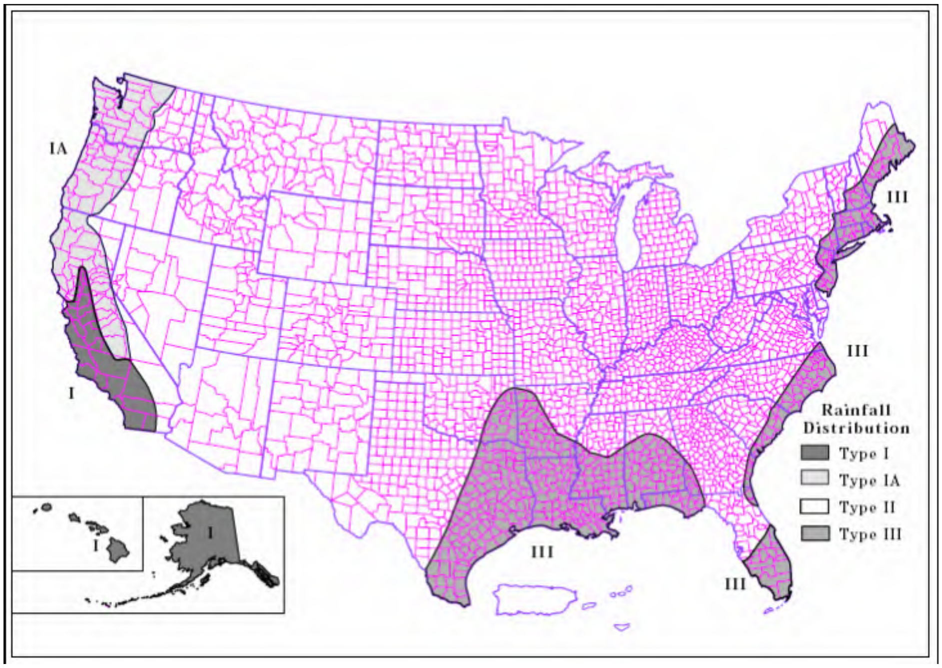


Figure 9.6 Approximate Geographic Boundaries for SCS Storm Distributions. (From HEC-HMS Technical Reference Manual, ACOE).

D-2-2 NOAA-14 Precipitation Frequency Estimates

The values for the precipitation amounts were obtained from National Weather Service NOAA Hydrometeorological Design Studies Center Atlas 14 for point precipitation frequency estimates. The Atlas provides a site-specific intensity-duration-frequency curve for precipitation, as shown in Figure 9.7. A table of values for multiple recurrence intervals and duration is presented in **Attachment 2**. The analysis evaluates the 24-hour storm duration for the 2-year (4.35 inches), 10-year (6.32 inches), and 50-year (8.25 inches) return. A graphical representation of the rainfall intensities is shown in Figure 9.7.

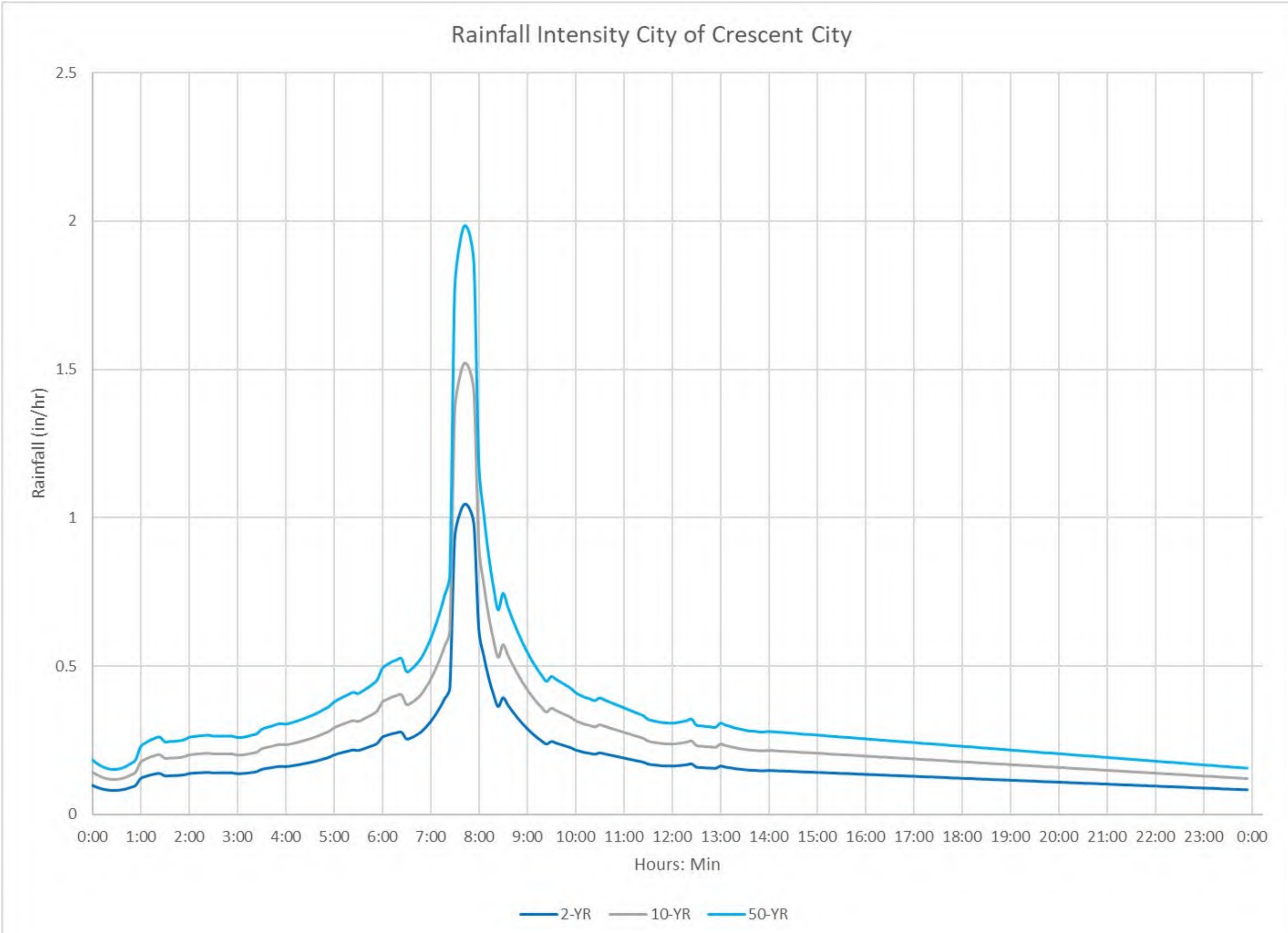


Figure 9.7 Rainfall Intensity Curves for Multiple Return Periods (SCS Type IA).

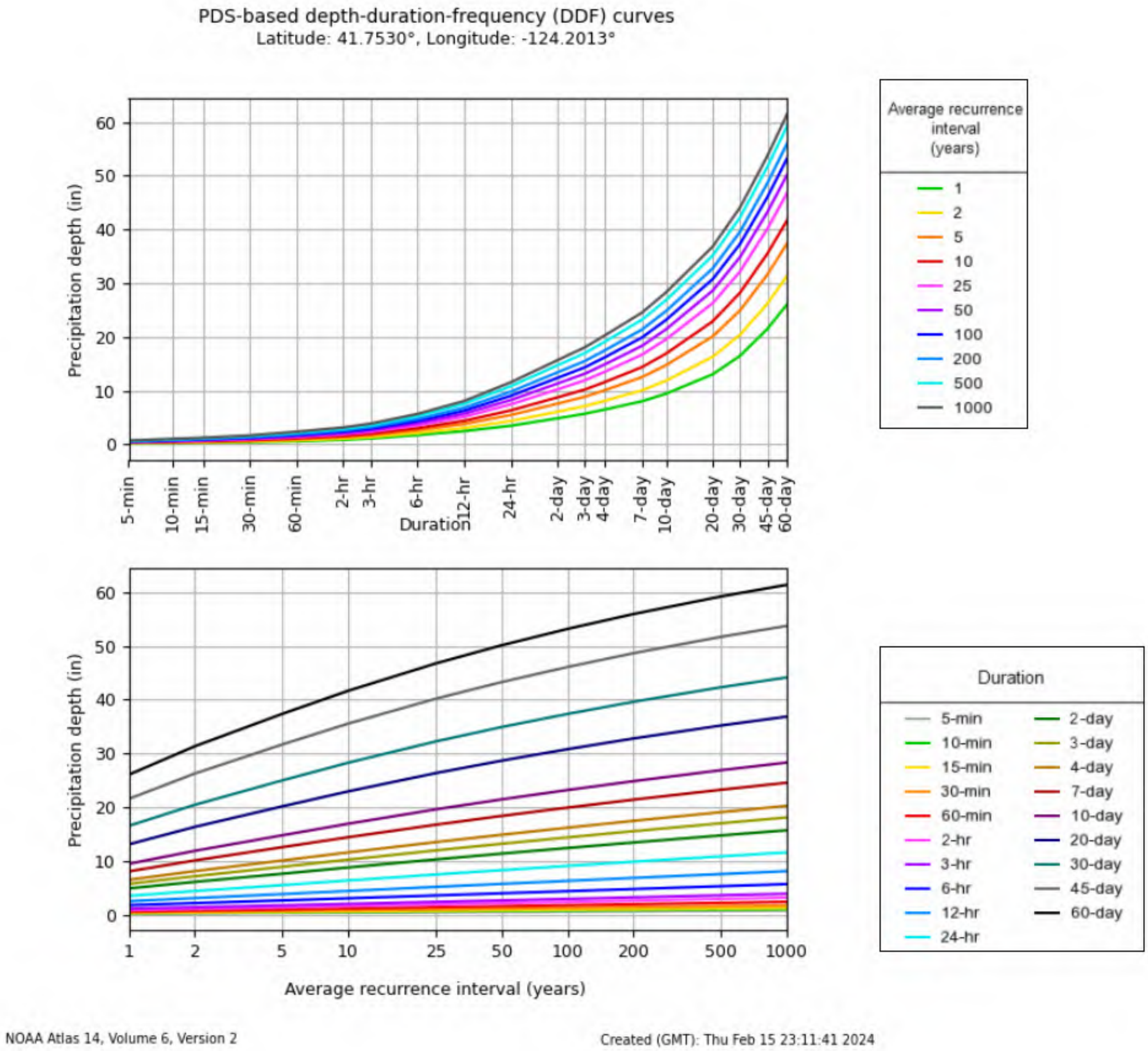


Figure 9.8 ***Intensity Duration Frequency Curve for Precipitation at Project Site.***

D-2-3 Cal-Adapt Climate Forecast and Design Considerations

The California Department of Water Resources' Climate Change Technical Advisory Group produced a set of climate change simulation forecasts that project future climate conditions by region. These simulations are general circulation models that incorporate changes in the Earth's atmosphere, oceans, lands, and ice cover (California Energy Commission, 2024). Over a 30-year historical period from 1961 – 1990, the maximum 1-day precipitation depths were measured and recorded, shown below in the brown shaded region in Figure 9.9 under "Modelled Historical." The black line within the Modelled Historical shaded region represents the actual measured precipitation maximum intensities in in/hr over a 24-hour period. The brown line within the Modelled Historical shaded region represents the modelled average precipitation intensity over that period. The base line historical precipitation projections were modelled under two scenarios: Medium Emissions and High Emissions. The Medium Emissions (RCP 4.5) is a climate projection that assumes that global greenhouse gas concentrations will continue to increase based on historical projections, peak around mid-century (~2050), then decline (Pierce, D. W., J. F. Kalansky, and D. R. Cayan (Scripps Institution of Oceanography), 2018). This projection would result in an increase in localized energy of 4.5 Watts per square meter by the year 2100, aka a representative concentration pathway (RCP) of 4.5. The RCP 4.5 scenario has an accompanying projected temperature increase, change in annual and maximum precipitation frequencies, and other climate related consequences. Alternatively, the High Emissions (RCP 8.5) scenario is a climate emissions model that assumes a continuous increase of global greenhouse gas concentrations based on historical rates (Pierce, D. W., J. F. Kalansky, and D. R. Cayan (Scripps Institution of Oceanography), 2018). The projected 30-year average change and respective ranges of change for each simulation are summarized below in Table 9.6. Based on these modelled expected changes to rainfall intensities, the NOAA-14 projected rainfall intensities are subject to change, these changes are summarized below in Table 9.7.

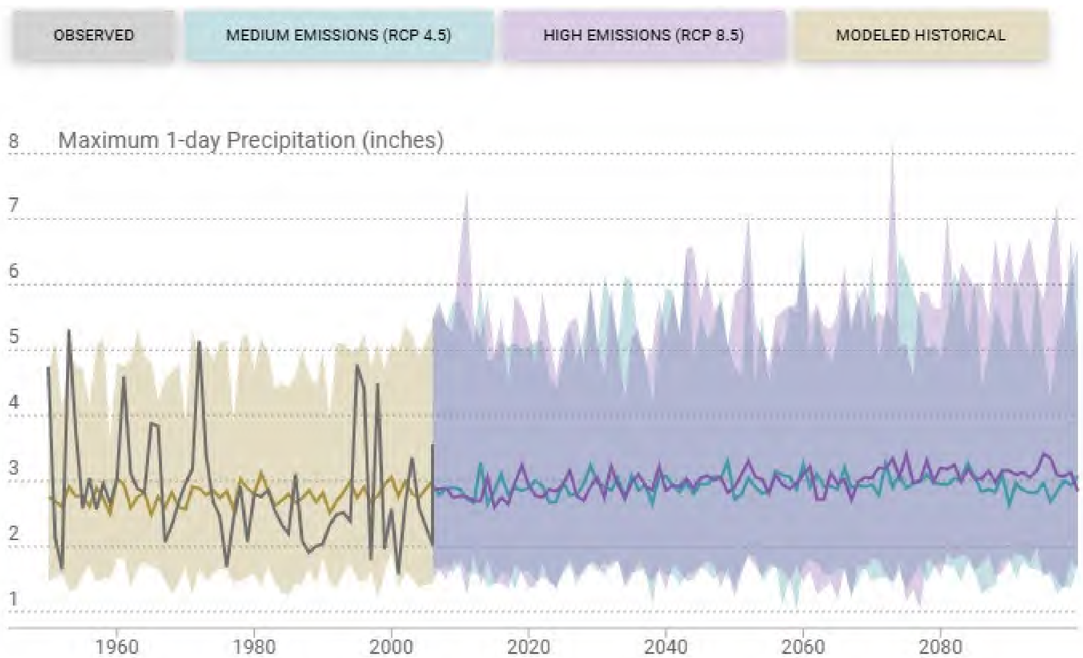


Figure 9.9 ***Maximum 1-day Precipitation for three 30-year time periods (Livneh, 2015).***

Table 9.6 ***Maximum 1-day Precipitation for three 30-year time periods (Livneh, 2015)***

Simulation	Time Period (years)	Change from baseline (in)	30-year average (in)	30-year range (in)
Baseline (Modelled Historical)	1961 – 1990	0	2.771	2.516 – 2.990
Mid-Century (Medium Emissions (RCP 4.5)	2035 – 2064	+0.194	2.964	2.533 – 3.275
Mid Century (High Emissions RCP 8.5)	2035 – 2064	+0.219	2.990	2.588 – 3.370
End Century (Medium Emissions RCP 4.5)	2070 – 2099	+0.175	2.946	2.558 – 3.487
End Century (High Emissions RCP 8.5)	2070 – 2099	+0.374	3.145	2.663 – 3.691

Table 9.7 RCP 4.5 and RCP 8.5 projected changes in 30-year periods to the NOAA-14 Rainfall Intensity for the 2-yr 24-hour, 10-yr 24-hour, and 50-yr 24-hour rainfall events

Return Period	NOAA-Atlas 14 Intensity Projections	Historic (October 1960 - Sept 1990)	Mid Century (October 2034 - Sept 2065)		End Century (October 2069 - Sept 2099)	
(years)	*(in)*	*(+0 in)*	*RCP 4.5 (+0.194 in)*	*RCP 8.5 (+0.291 in)*	*RCP 4.5 (+0.175 in)*	*RCP 8.5 (+ 0.374 in)*
2-year, 24-hour storm	4.35	4.35	4.54	4.64	4.53	4.72
10-year, 24-hour storm	6.32	6.32	6.51	6.61	6.50	6.69
50-year, 24-hour storm	8.25	8.25	8.44	8.54	8.43	8.62

Due to the variability in projected maximum 1-day precipitation events, it is recommended that for the preliminary assessment of drainage performance, the 50-year 24-hour NOAA-14 simulation be utilized for design purposes. Utilizing the 50-year 24-hour rainfall event provides a conservative and flexible assessment of expected rainfall intensity patterns and allows the City a longer period to secure funding and develop proposed projects.

D-3 Downstream Boundary Conditions

The downstream boundary conditions were determined based on location, elevation, and receiving water body characteristics. For the City, eight (8) tidal and one (1) normal outfall were determined. See Sections D-3-1 and D-3-2 for details of these analyses. Outfall 1 (OF1) is the normal conditions outfall and Outfalls 2 – 9 (OF2 – OF9) are tidal outfalls. See Figure 9.10 below for the outfall locations with respective drainage groups contributing to the outfall.

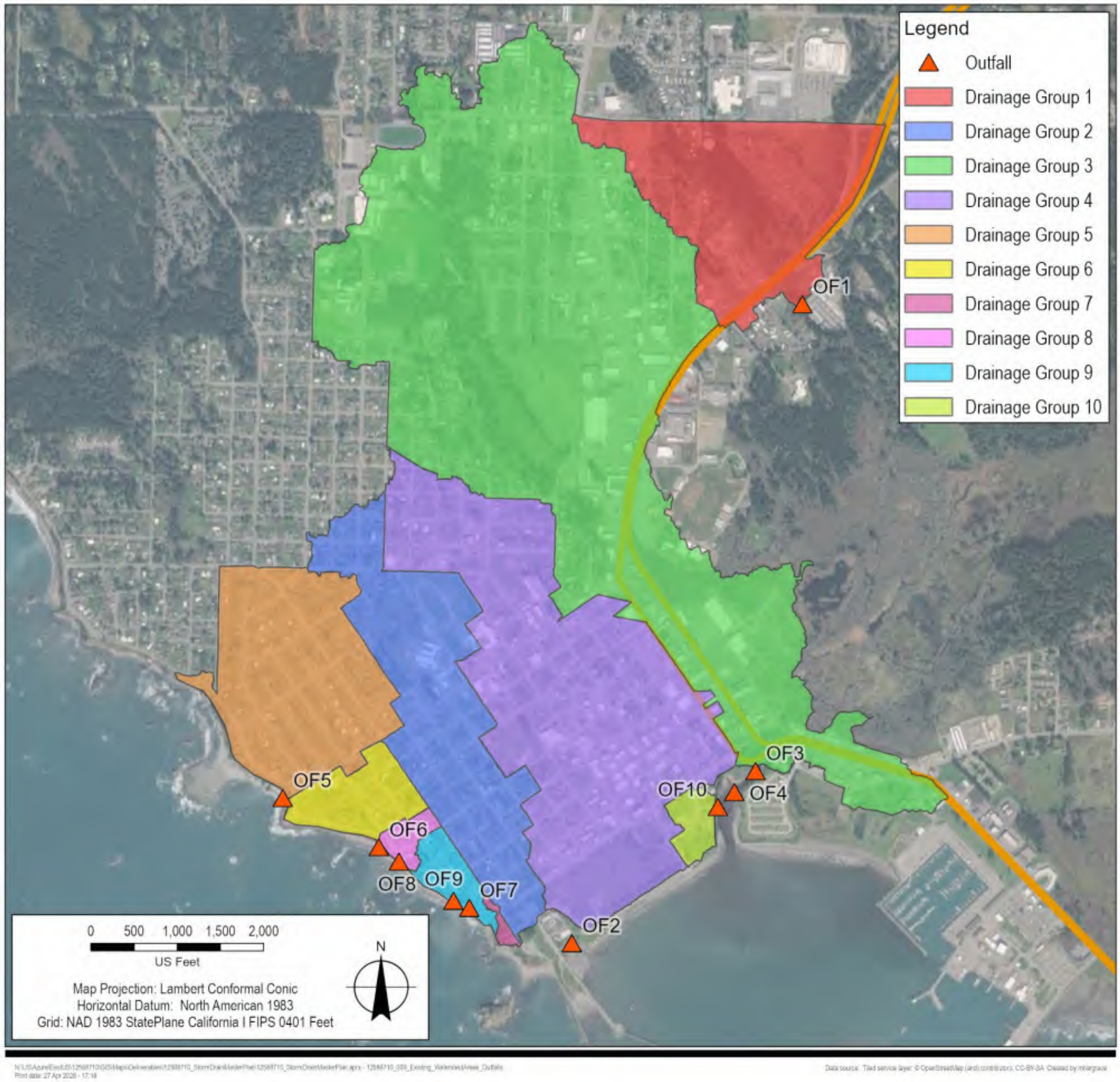


Figure 9.10 Outfall locations with respective drainage groups.

D-3-1 Tidal Outfall Boundary Conditions

Tidal conditions were inputted into the model with guidance from Chapter 820 – Cross Drainage of the Federal Highway Design Manual (Highway Design Manual, 2020). The City of Crescent City falls within Province 1 of the California Open Coast and Bayfront Water Level, shown below in Figure 9.11. The controlling Gage Station is Buoy 9419750, located off the coast of Crescent City. When developing the tidal outfall boundary conditions for each respective 24-hour design storm simulation (2-year, 10-year, and 50-year), the respective tailwater elevation (ft) is a function of a one-percent compound frequency curve, made for each respective Province. The Province 1 One-Percent Compound Frequency Curve was developed by the Federal Highway Design Manual in accordance with Buoy #9419750 data obtained from NOAA and is shown below in Figure 9.12.

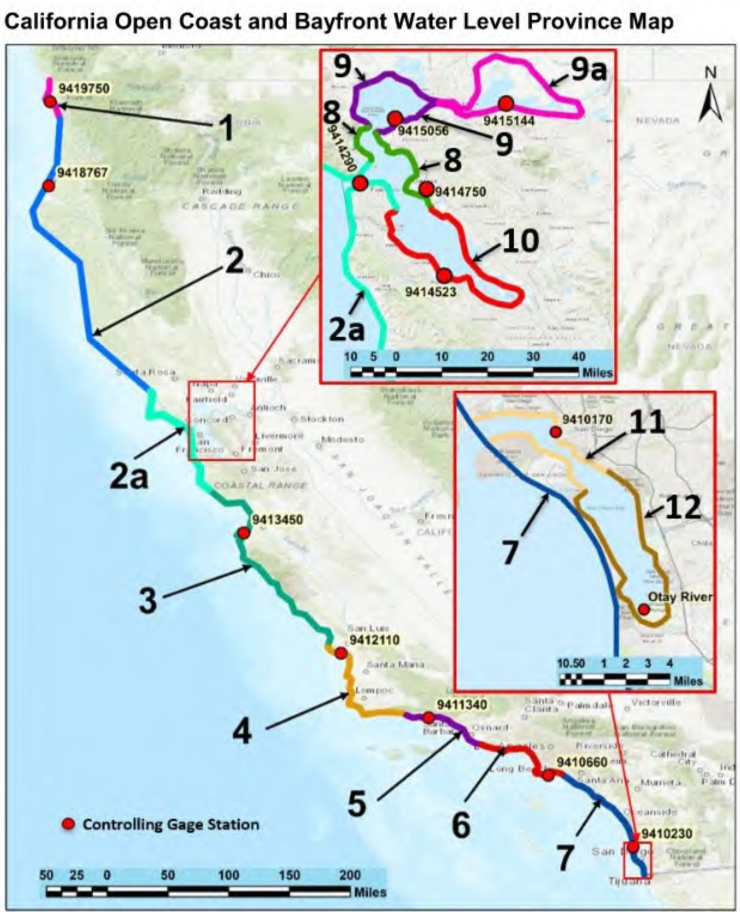


Figure 9.11 California Open Coast Province Map (Highway Design Manual, 2020).

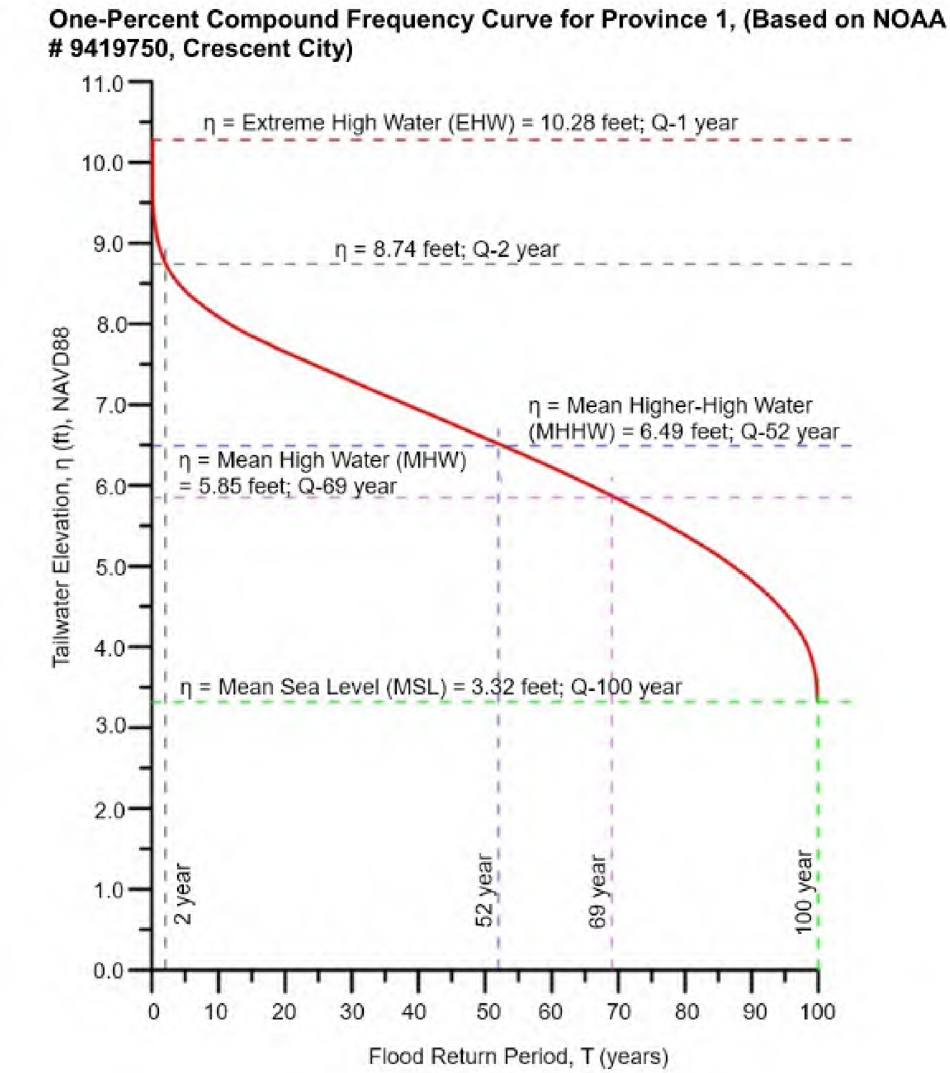


Figure 9.12 ***One Percent Compound Frequency Curve for Province 1 (Highway Design Manual, 2020).***

Utilizing the MHH tailwater elevation in feet from the One-Percent Compound Frequency curve, historic tidal data was obtained through the NOAA tidal data base. The tidal data was analyzed to find corresponding tidal events with the respective MHH water tidal levels for the 2-yr, 10-yr, and 50-yr events based on the one-percent compound frequency curve for Province 1. The MHHW level for the 2-yr event was identified to be 8.75-ft, for the 10-yr event was 8.1-ft, and 6.6-ft for the 50-year event. The tidal events were selected for a 24-hour event and aligned with the rainfall hydrographs for the 2-yr, 10-yr, and 50-yr rainfall events. The peak of the rainfall event was aligned with the peak tidal elevation. See Figure 9.13, Figure 9.14, and Figure 9.15 below for the aligned 2-yr, 10-yr, and 50-yr 24-hour design storm and tidal events, respectively. See Section D-2-2 for further details of the development of the design storm rainfall hydrographs.

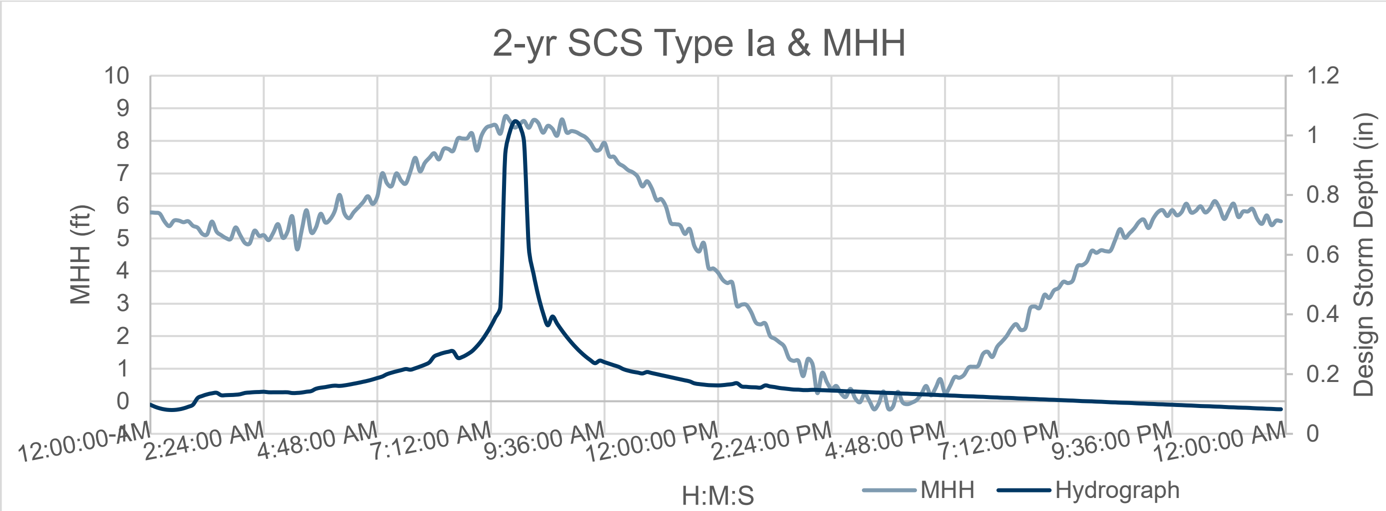


Figure 9.13 ***2-yr SCS Type 1a 24-hour design storm hydrograph with peak rainfall aligned with peak MHH for 2-yr compound frequency tidal event.***

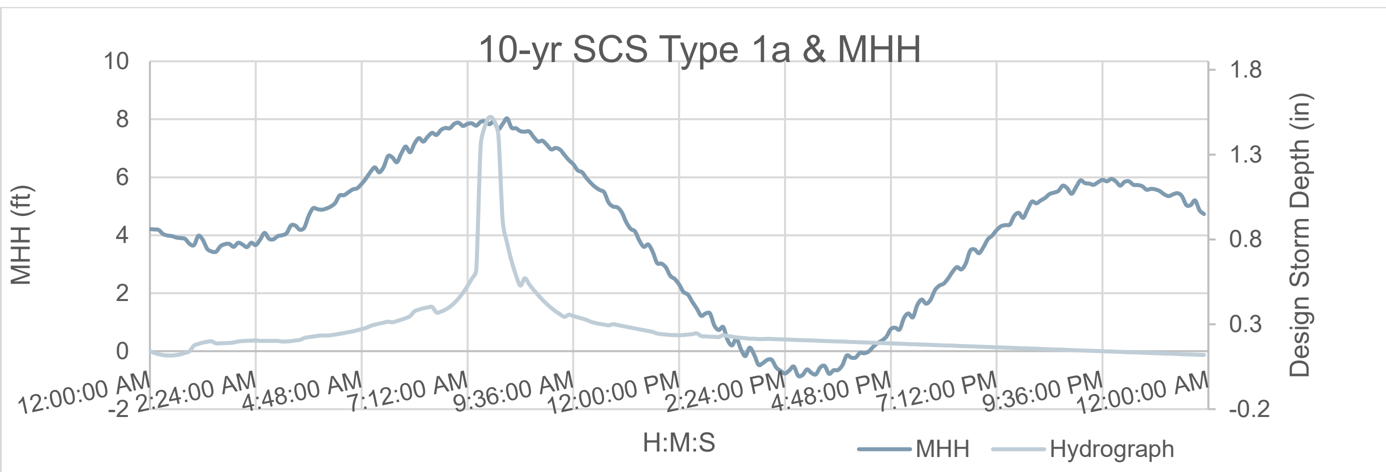


Figure 9.14 ***10-yr SCS Type 1a 24-hour design storm hydrograph with peak rainfall aligned with peak MHH for 10-yr compound frequency tidal event.***

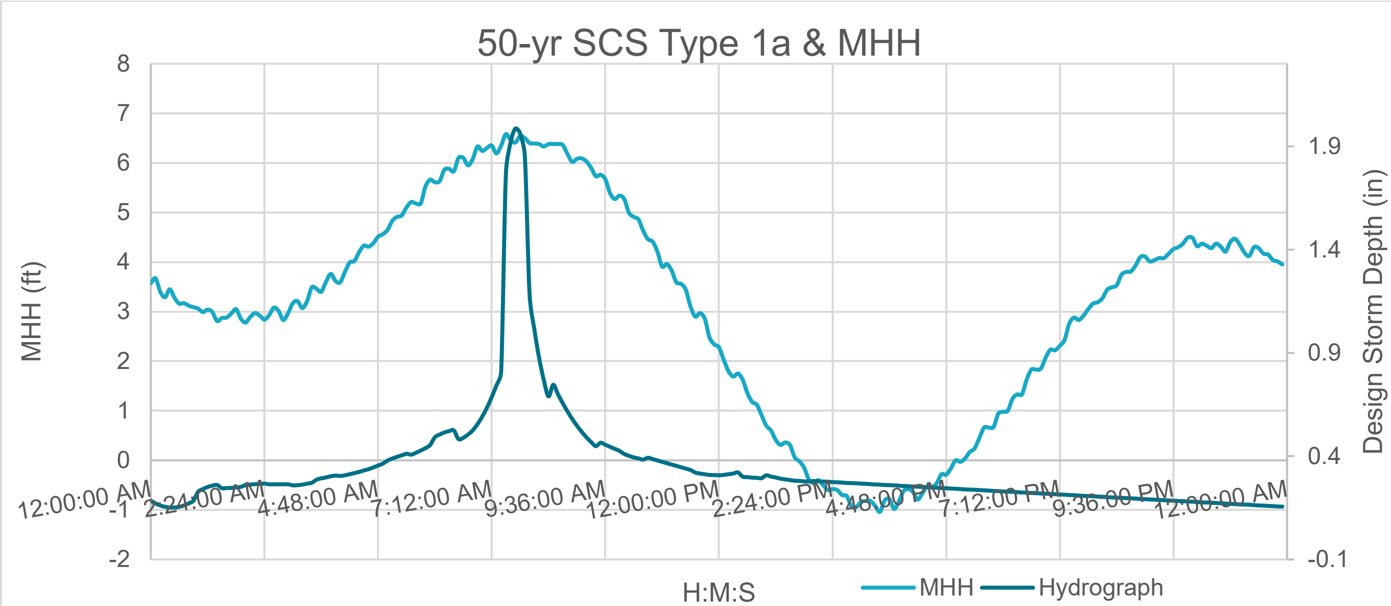


Figure 9.15 ***50-yr SCS Type 1a 24-hour design storm hydrograph with peak rainfall aligned with peak MHH for 50-yr compound frequency tidal event.***

D-3-2 Normal Outfall Boundary Conditions

The Project site is located within the Elk Creek FEMA floodplain Zones A and X. Of the ten (10) drainage outfalls, Outfall 1 is the only non-tidally influenced outfall, located within FEMA floodplain Zone A. Figure 9.16 below provides the National Flood Hazard Layer FIRMette illustrating the location of Outfall 1 with respect to the site floodplains. Detailed hydraulic analyses are not performed for Zone A floodplains, therefore no base flood elevations exist (Federal Emergency Management Agency, 2024). Additionally, Zone X floodplains are characterized as areas of minimal flood hazard. Outfall 1 is located at an elevation of approximately 14-ft (NAVD88), and the highest water level of Elk Creek in the surrounding drainage site was determined to be approximately 10ft (NAVD88) at maximum capacity. Because the outfall is significantly higher than the maximum elevation of the receiving waterbody, it is assumed that the outfall will not receive backflow and is under normal conditions.

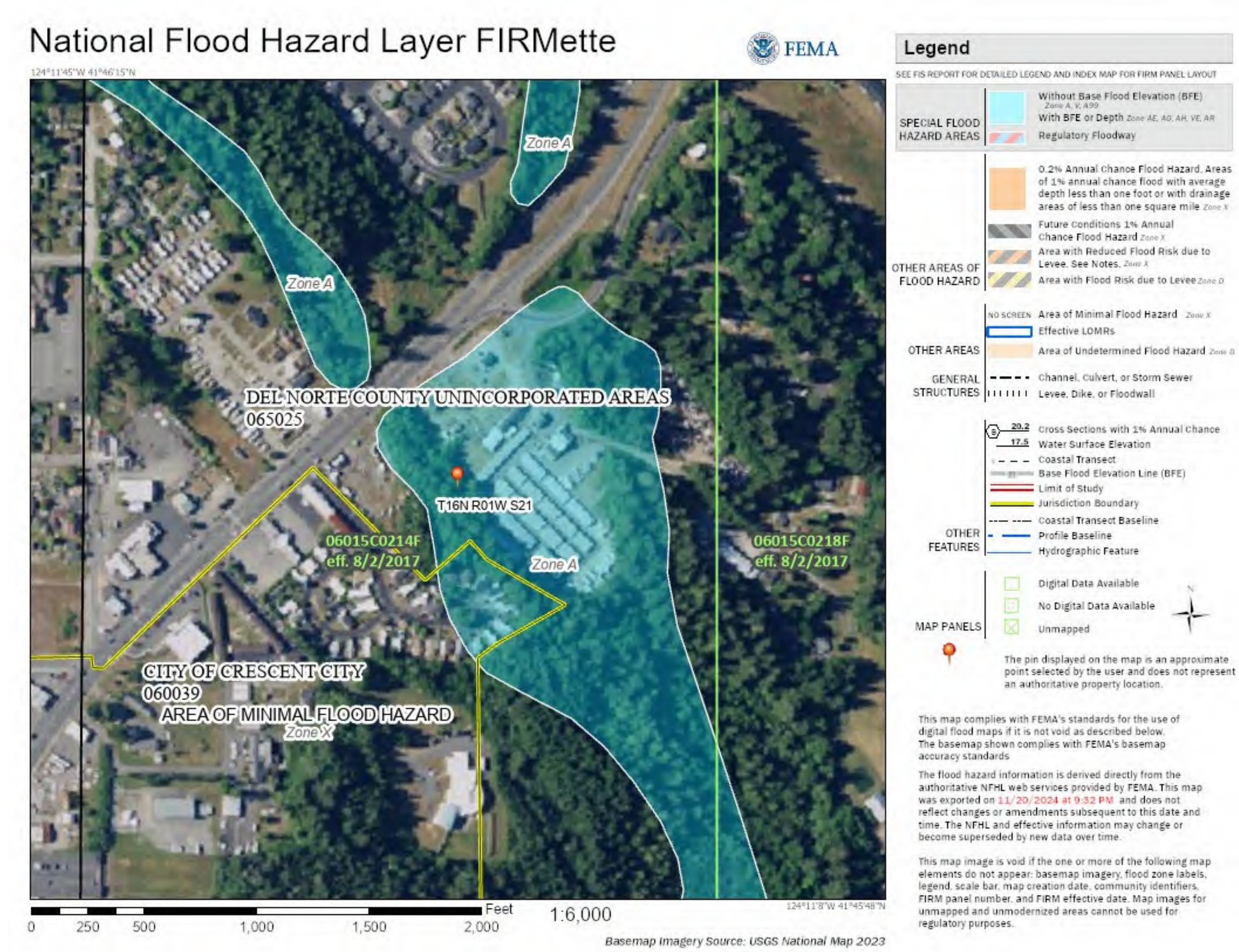


Figure 9.16 FEMA National Flood Hazard Layer FIRMette illustrating location of Outfall 1 (Federal Emergency Management Agency, 2024).

D-4 Watershed Delineation and Characterization

D-4-1 Subcatchment Delineation

The subcatchments were initially defined using the watershed delineation tool based on a high-resolution digital elevation model, and subcatchments were then refined using survey data on other infrastructure in PCSWMM modeling software. Site topography was used to refine subcatchments and routing points within the drainage network and hard structures such as roads, buildings, and parking lots. Subcatchments were sized depending on how water was routed, in cases that the surface flow runoff routed to the same point within the drainage network, a larger subcatchment was delineated. There is a total of 403 subcatchments within the larger watershed, illustrated below in Figure 9.17.

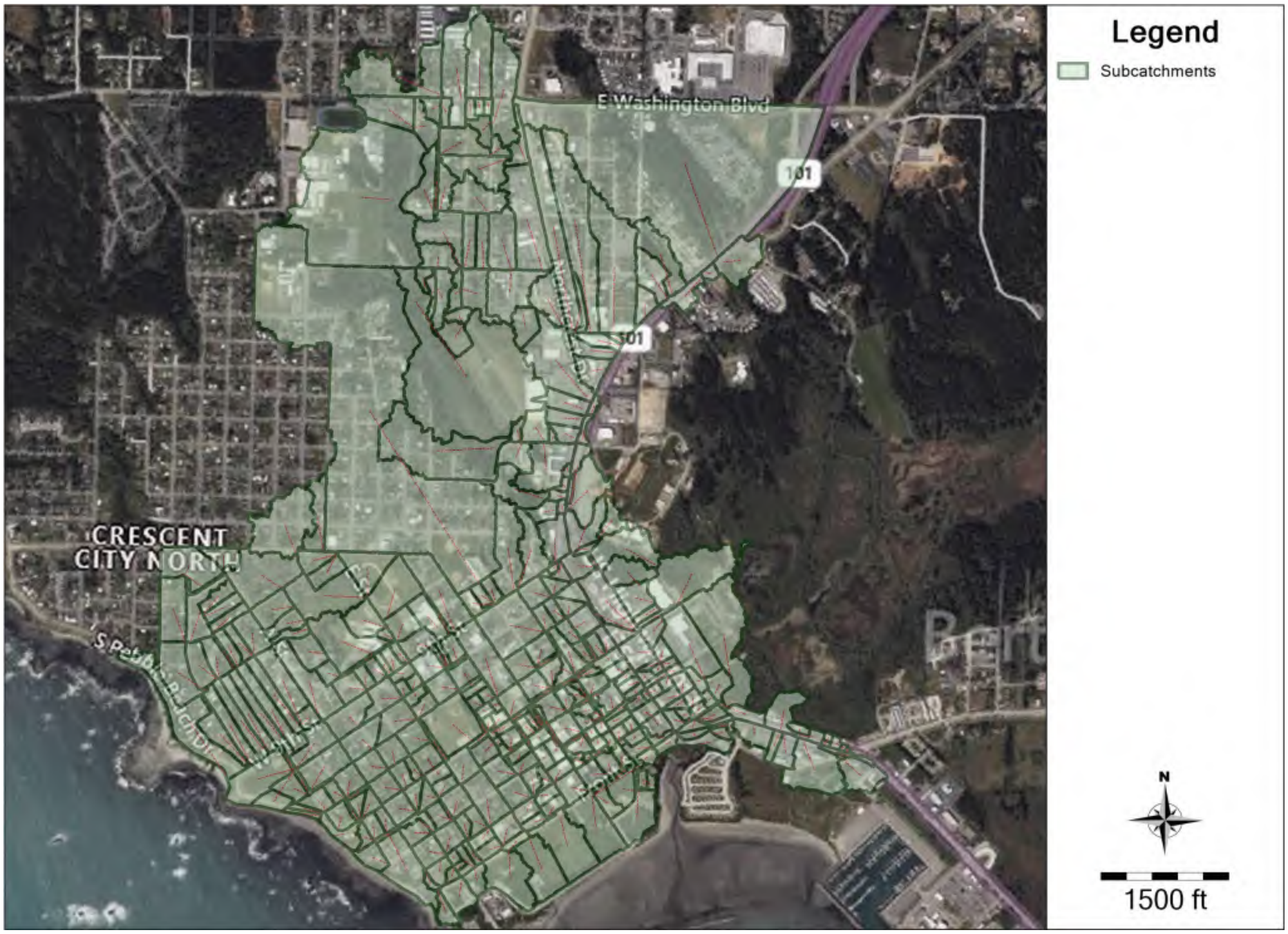


Figure 9.17 Watershed delineated subcatchments. Dark green represent subcatchment boundaries, red perforated lines illustrate point of concentrated flow.

D-4-2 Subcatchment Parameters

To characterize the hydrologic properties of each subcatchment, hydrologic parameters were calculated and assigned to their corresponding subcatchment including percent impervious area vs. pervious area, SCS curve numbers, average slope, and flow lengths. Calculations were performed in excel and imported to PCSWMM through the import function that assigns each parameter to its respective subcatchment. (**Attachment 3**).

Flow Length and Slope

Flow length and slope for the subcatchments were determined through developing a flow path layer in the PCSWMM model, which represents the average maximum length of overland sheet flow and shallow concentrated flow. These flow lengths are then used to calculate subcatchment width by dividing the subcatchment area by its subsequent flow length. Flow paths were then manually determined within the model using site topography for each subcatchment as its determining characteristic.

Subcatchment Curve Number and Pervious Area

The SCS Curve Number for each subcatchment was calculated in excel as a function of area percentage of hydrologic soil group (A, B, C, and D) and land use description. The area percentage of subcatchment land use with respect to proportion of pervious to impervious area was determined by using aerial imagery to assess soil composition, soil quality, and land use (i.e. locations of buildings, roads, fields, forests, etc.). Data from the USDA Web Soil Survey was used to determine the site soil composition, then percent land use was applied based off aerial imagery via PCSWMM and Google Earth Pro. These parameters were then used to calculate Curve Numbers to be assigned to each subcatchment. (**Attachment 4**).

Subcatchment Time of Concentration

Time of Concentration is critical to calculate the runoff flow for each subcatchment into the drainage network with respect to the design storm. The average slope for the subcatchments was determined by calculating the average slope in each subcatchment based on defined area and topography. The process was done by using the "Set DEM Slope" tool in PCSWMM for each subcatchment, Slopes, flow paths, and curve numbers are then utilized by the PCSWMM SCS Type II processor to calculate the time of concentration. The areas for each subcatchment were automatically calculated based on its geometry and populated into the subcatchment attribute table in the model. The time of concentration was determined using the SCS Method Type II (Equation 1 & 2), a function of flow length/width, slope, and curve number.

$$t_c = \frac{L^{0.8}(S+1)^{0.7}}{1140Y^{0.5}}$$ *(Equation 1)*

Where:

$t_c = time\ of\ concentration\ (hrs)$

$L = flow\ length\ (ft)$

$S = maximum\ potential\ retention\ (see\ Equation\ 2)$

$Y = average\ watershed\ land\ slope$

$$S = \frac{1000}{CN} - 10$$ *(Equation 2)*

D-5 Surface Flow Routing Methodology

The flow routing through the system incorporated the existing, planned and in-construction drainage system infrastructure and open channel flow with the larger water flow network through the system to the identified outfall locations (OF 1 – OF 10). The utilized flow routing methods are detailed below as existing drainage infrastructure flow routes, street flow, and concentrated surface flow, respectively. The planned and in construction drainage elements system flow routing were included per the information provided by City staff.

D-5-1 Existing Drainage Infrastructure Flow Routes

The first step to delineate the existing drainage infrastructure flow routes was to load in the data of all identified existing conduits (pipe networks and open channels), junctions (grate inlets, pipe connections, stormwater vaults, etc.), and stormwater depression basins. Existing system infrastructure with appropriate defining parameters were uploaded into the H&H model with field data collected. See **Appendix C** above for more details on field data collection assumptions and methodology. Existing condition conduit diameter, percent blockage, material type, invert and rim elevations were loaded into the model. Existing condition junction type, invert elevation, rim elevation, were also loaded into the model. For junctions and/or conduits that were inaccessible for field collection, their specs were assumed based on the upstream and downstream conditions. See **Attachment 5** for the existing "base" conditions model data for junctions, conduits, and outfalls. See Figure 9.18 below for the plan view of the project's existing drainage infrastructure network.

Drainage runoff basins and open channel flow were identified within the City drainage system boundaries. Drainage runoff basin surface areas and depth, and open channel lengths and cross-sectional areas were assigned based on the site Digital Elevation Model (DEM) and utilizing the Storage Creator tool in PCSWMM to delineate the dimensions of each drainage basin. These drainage basins were assigned respective storage curves based on these delineated dimensions. Drainage infrastructure and contributing surface runoff were categorized by their connected outfall. Drainage infrastructure contributing to a common outfall can impact infrastructure upstream and/or downstream and therefore should be considered together for project development. For example, if an upstream pipe was upsized with no consideration for the downstream impacts, there is potential the additional flow passing through the upsized upstream conduit could lead to unexpected flooding within the downstream network.

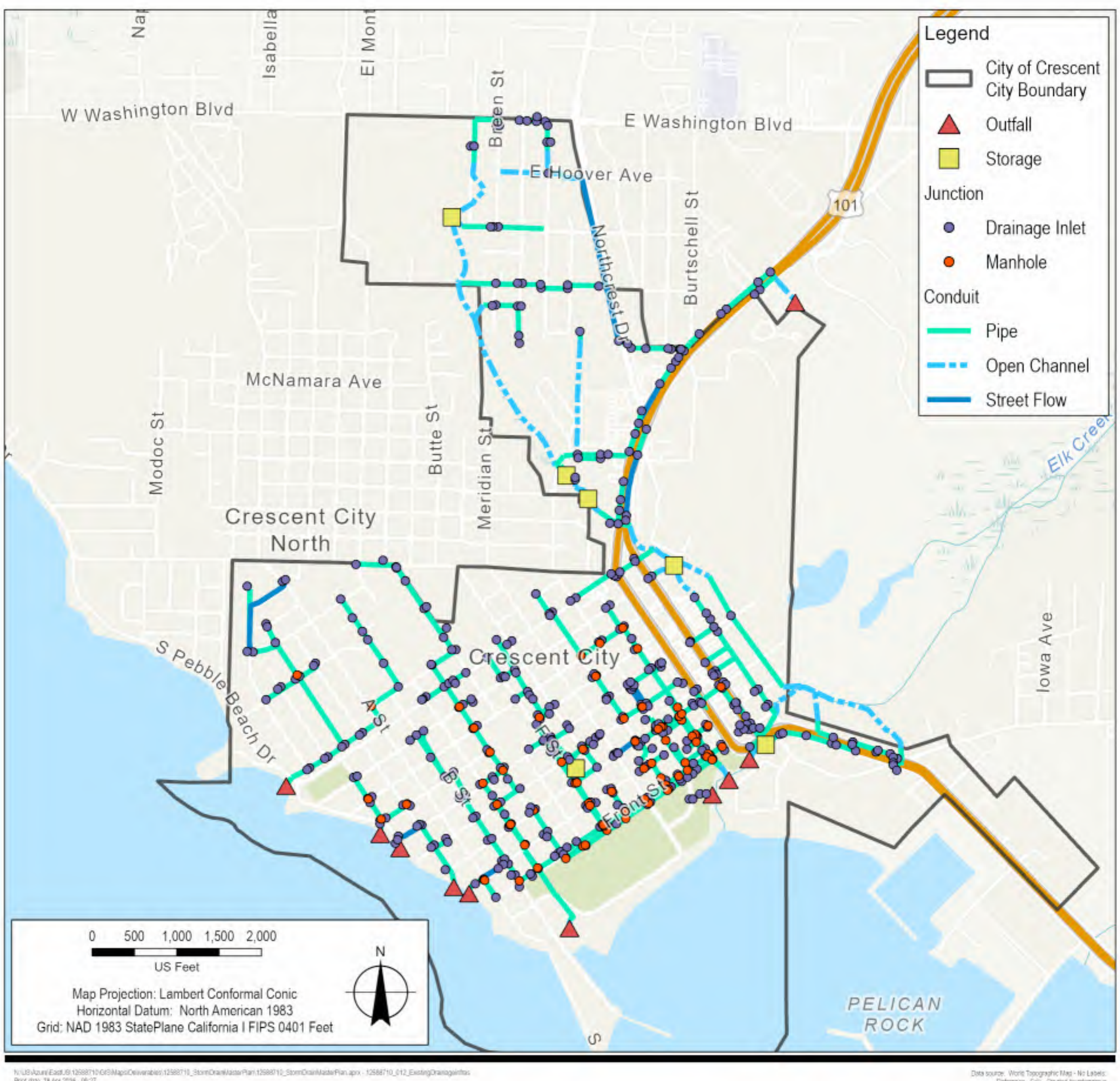


Figure 9.18 Existing Drainage Infrastructure Flow Route Plan View.

D-5-2 Dual Drainage Flow Routing

Dual drainage flow routing was considered with this drainage system analysis. Dual drainage flow routing considers a major and minor drainage system. Major drainage systems are defined as drainage systems designed to capture water conveyance on the surface, for example drainage swales or ditches, road gutter flow, or storage detention ponds. Minor drainage systems are characterized as underground drainage conveyance, typically through circular pipe connections. Open channel and street flow connections shown above in Figure 9.18 are considered major drainage system components as the blue underground pipes are minor drainage system components. See Figure 9.19 below for a further description of dual drainage system components.

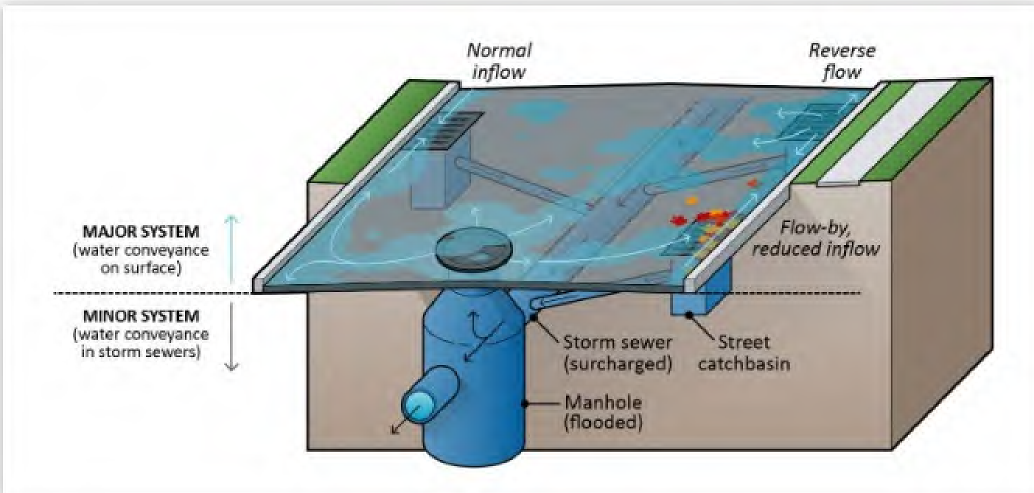


Figure 9.19 Dual drainage system components (CHI PWSWMM, 2024).

D-5-3 Model Parameters

Junctions

Junctions within the drainage system include manholes, drainage inlets, and blind junctions. This section describes the existing junctions within the project area and how they contribute to the dual drainage flow routing.

Manholes

Manholes are defined as locations where conduits join that are accessible for maintenance through a manhole. Throughout the project site, a total of 66 manholes were identified, with a wide range of depth and general condition of the manhole. See Figure 9.20 below for an example of a manhole near Front St. Manholes were identified throughout the City boundary on roads, sidewalks, and sometimes in grassy areas, like in Figure 9.20. It is assumed that all flow routing to manholes in the drainage system occurs through connected closed-pipe conduits. In drainage flow routing, no surface land flow was linked directly to manholes. Manholes serve as maintenance access points of the minor drainage system.

Figure 9.20 Manhole investigated during data collection near Front St.

Drainage Inlets

For the purposes of this analysis, drainage inlets were defined as any junction designed to receive surface flow runoff. Drainage inlets identified in the drainage system include curb inlets, grate inlets, and drop inlets. Throughout the project site, a total of 404 drainage inlets were identified. These drainage inlets had a wide range of depth, condition, apparent age, and percent blockage. See Figure 9.21, Figure 9.22, and Figure 9.23 below for a few of the found drainage inlets of varying types and conditions. Subcatchment concentrated surface flow runoff was linked directly to drainage inlets, shown by the red perforated lines in Figure 9.18. Drainage inlets serve to connect the major drainage system with the minor drainage system.

Figure 9.21 Curb inlet found in field data collection.

Figure 9.22 Grate inlet found in field data collection.

Figure 9.23 Grate inlet found in field data collection.

The Federal Highway Administration recommendation for inlet design considers the following four (4) typical inlet types: grate inlets, curb-opening inlets, combination inlets, and slotted inlets. See Figure 9.24 below for a summary of the storm drain inlet types. Through field investigations, these four inlets were found throughout the City's boundaries, with the highest proportion being grate inlets and combination inlets. The Hydraulic Engineering Circular No. 22 (HEC-22) provides an interception capacity of inlets on grates that estimates the amount of flow efficiency a grate can intake under a given set of conditions. For the purposes of this analysis, the drainage inlets assigned to the junctions were given an assumed value representative of Grate A shown in Figure 9.24. However, in further project development, it is recommended that a more detailed drainage inlet capacity analysis be conducted with recommendations from the Federal Highway Design Manual.

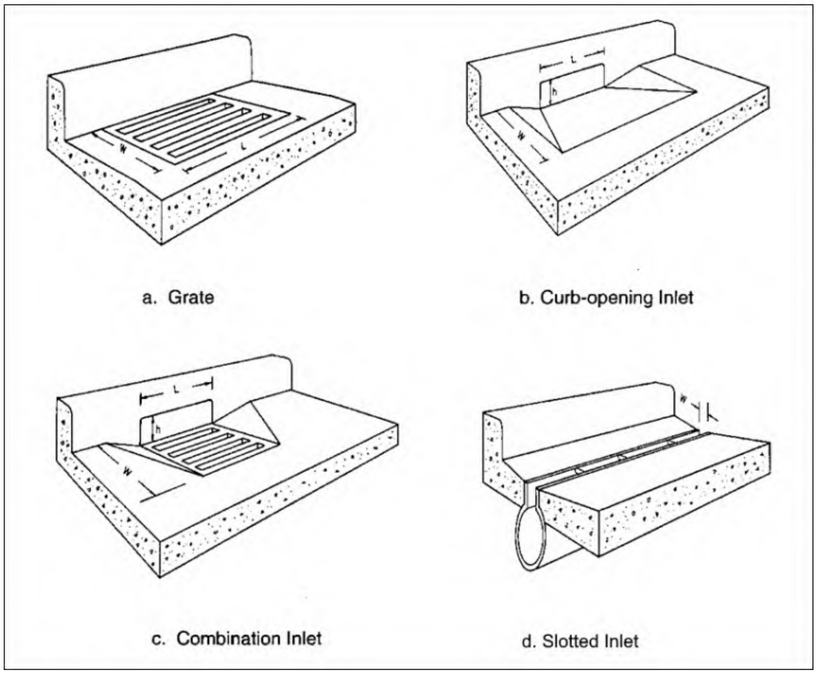


Figure 9.24 Storm drain inlet types summary (Federal Highway Administration, 2024).

Blind Junctions

Blind junctions include conduit connections without an accompanying drainage inlet or manhole. These junctions were not linked to the surface flow runoff of the system and are majorly underground pipe connections. Blind junctions had rim elevations assumed by upstream pipe outlet offset elevation and invert elevations assumed by downstream pipe offset elevation. Blind junctions represent a large proportion of the minor drainage network but have no direct connection to the major drainage network.

Closed and Open Channel Conduit Analysis

The closed and open channel conduits in the system represent all flow networks that interconnect the junctions. Underground pipe networks are within the minor drainage system as surface exposed open channel flow and street flow are part of the major drainage system. See Section D-5-2 for more details on the major and minor drainage systems.

Pipes

There are approximately 67,000 linear feet of underground storm drainpipes that convey the City's drainage. This linear footage of drainage pipe was summarized based on diameter, shown below in Table 9.8. See Section 5 for further details of existing pipe networks by diameter, length and material by Drainage Group.

Table 9.8 Linear feet of drainage pipe in Crescent City drainage system by diameter

Diameter (ft)	Linear feet of pipe (ft)
0.5	145
0.67	936
0.75	327
0.8	199
1	24,331

Diameter (ft)	Linear feet of pipe (ft)
1.2	45
1.25	4,084
1.3	109
1.4	95
1.4	14,304
1.6	29
2	11,822
2.25	195
2.5	2,915
2.67	193
2.75	226
3	6,117
4	1,181

Open Channel Flow

Open channel flow within the drainage network consisted of vegetated swales, creek flow, canals, and other miscellaneous channels that convey stormwater between nodes in the system. The open channel flow networks are part of the major drainage system, illustrating how concentrated runoff contributes and enters the minor drainage network. There is approximately 87,000 linear feet of open channel flow conveying stormwater through the drainage system. A major contributor to open channel flow in the drainage network is the channel “Elk Creek Channel” that runs parallel to Cemetery Rd. and drains to the Elk Creek marshland to the southeast. Access to survey the Elk Creek Channel was limited due to a lack of safe access points. The high-resolution DEM was utilized to estimate the geography of the contributing creek. See Section Appendix C, Section 2-1 for more details of the DEM formulation and resolution. It is recommended that for further analysis, a more detailed survey be conducted to assess the storage capacity of the Elk Creek Channel.

Street Flow

Street flow was utilized in this analysis to model a proportion of the major drainage system that is solely supported by surface road flow. It is important to note that not all projected street flow is included in this analysis, only in the cases that street flow was the only drainage route to interconnect junctions to outfalls, for instance, a bubbler. Bubbler drainage systems are designed as typically two (2) drainage inlets connected by a pipe and not connected to any outfall source. The only surface flow route for the water to flow if a drainage inlet is to overflow in a bubbler is the over the adjacent land, which in this drainage system were roadways and gutters. Street flow was modeled into the system under the Street Editor tool in PCSWMM. The Street Editor tool takes input from the user to define the roadway considering the full or half street flow, the street width, the cross slope, the curb height and the Manning’s roughness value of the roadway. Each street flow in the H&H model was defined based on-site investigation, topography, and standard values for roadways defined in the Urban Drainage Design HEC-22 reference manual (Federal Highway Administration, 2024).

Storages

Storages were included in the base-conditions model to model natural or intentional drainage basins that would hold a significant amount of stormwater in a storm event. Storage basin volume was approximated using the site topography

DEM layer. Storage volumes are estimated using the embedded “Storage Creator” tool in PC, that approximates the depth to surface area ratio based on the applied DEM layer. The Storage Creator then assigns a “Storage Curve” for each storage unit. The “Storage Curve” is a graphical and tabular relationship between depth to surface area of the storage. See **Attachment 6** below for the storages and respective curves within the base conditions model.

D-6 Two-Dimensional Hydrologic and Hydraulic Analysis

The one-dimensional base conditions H&H analysis was able to determine the volume, duration and point location of flooding within the drainage network, however, the surface flow impacts of the point flooding cannot be determined without a two-dimensional H&H analysis. The two-dimensional H&H analysis was able to locate the extent, duration and depth of flooding throughout the project boundary. Three versions of the base-conditions two-dimensional model were generated, the 2-year, 24-hour storm and tidal conditions, 10-year, 24-hour storm and tidal conditions, and the 50-year, 24-hour storm and tidal conditions. This section details the steps of the two-dimensional H&H approach.

D-6-1 Bounding

The creation of the bounding layer is the first step in generating the 2-dimensional model. The bounding layer defines the extent of the two-dimensional model, where the mesh layer will be generated. The bounding layer is illustrated below in Figure 9.25. The bounding layer is a hexagonal style with a 30-ft resolution, which allows the mesh network to have hexagonal formation with triangular connections with a maximum water depth measured of 30-feet. See Section D-6-2 for further details of the mesh formation.

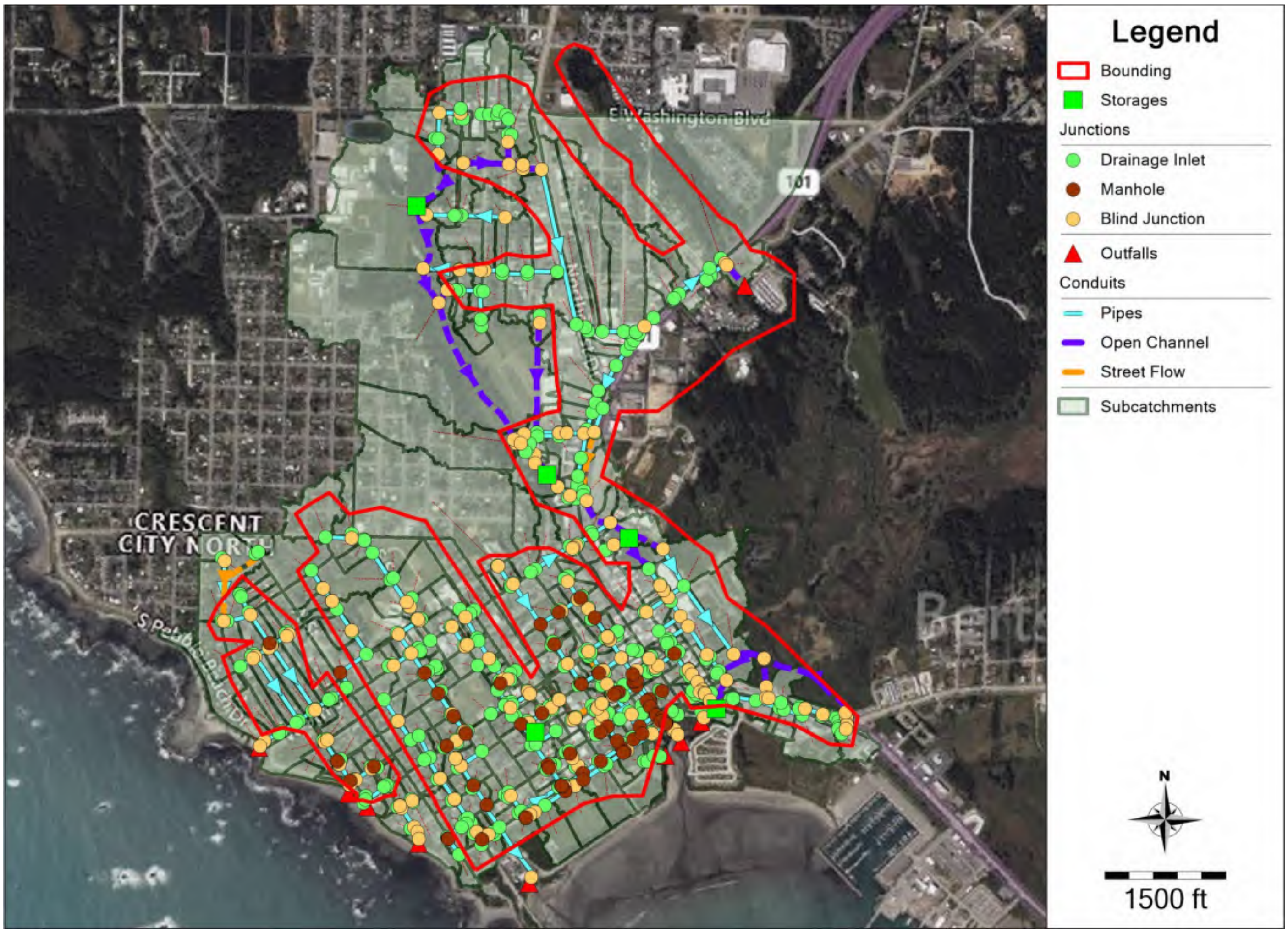


Figure 9.25 Plan view of drainage network with bounding layer boundaries.

D-6-2 2D Mesh Layer

Within the bounding layer, a two-dimensional mesh layer was generated to connect the systems drainage inlets, manholes, and storages to the mesh. PCSWMM utilizes the mesh layer to conduct a Triangular Gaussian quadrature to simulate the water flow through the drainage network with respect to the site's topography through the DEM layer. See Figure 9.26 for an example of how the mesh layer connects to the existing drainage network through a drainage inlet. The connecting storm drain infrastructure node is then connected to both the existing drainage network and the mesh layer – water simulation. This connection allows the model to better approximate the flow inflow from the upstream connected pipe(s) and the topographically defined surface flow routed into the system.

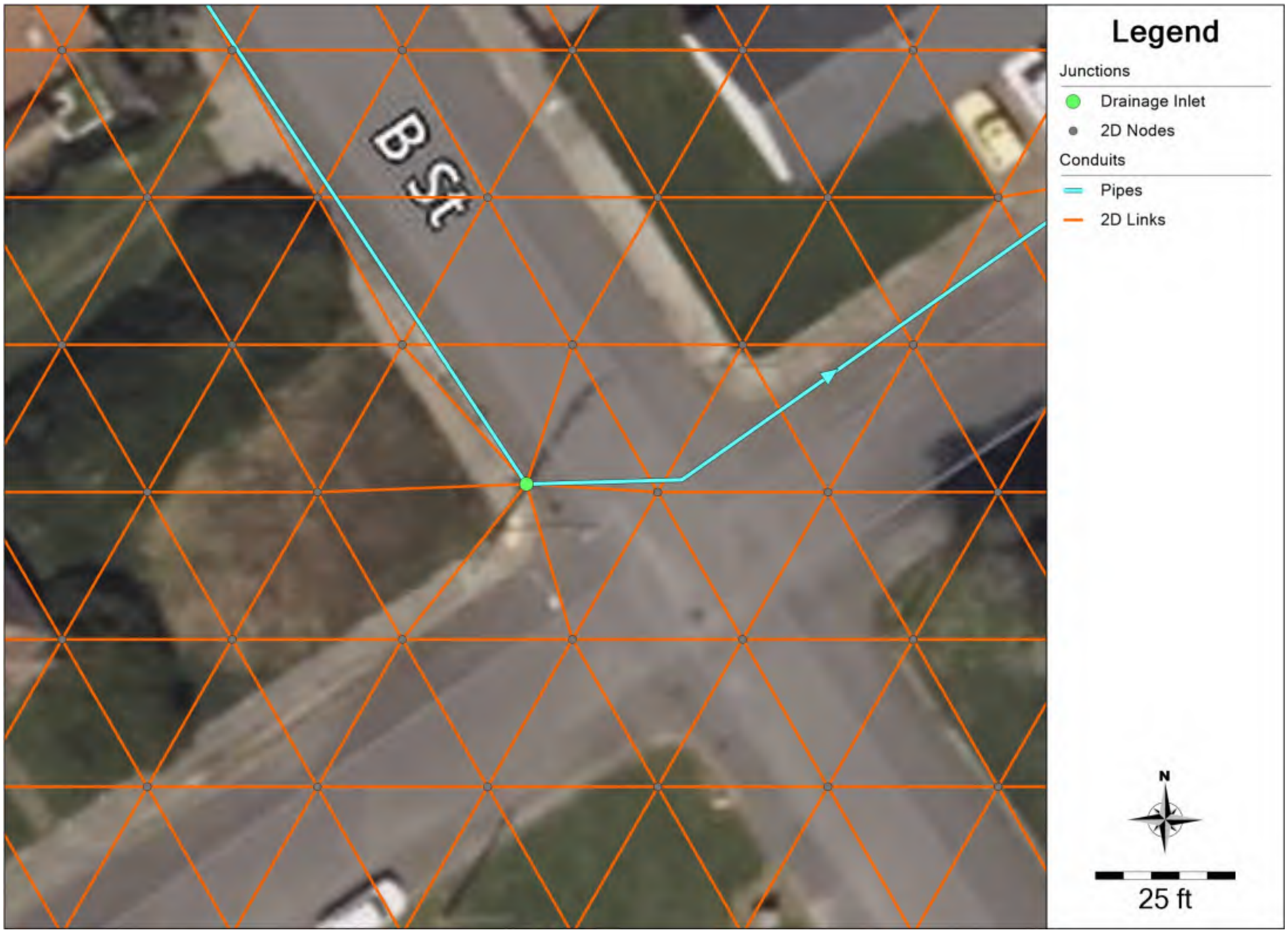


Figure 9.26 Mesh layer connection with sample drainage inlet.

D-6-3 Downstream Boundary Condition

The downstream boundary conditions are defined by areas in the models where water is anticipated to leave the system outside of the pre-defined outfalls, described previously in Section D-3. Modelling the downstream boundary condition is useful in estimating how the water exits the system across the existing terrain. When water exits the modelled system, there is a potential for backwater effects to not be properly captured within the model. Including the downstream boundary condition better represents potential backwater into the system and how backwater might influence upstream flow.

Appendix E

Preliminary Assessment of Anticipated Environmental Review and Permitting Requirements

Drainage Group	CIP ID	Description / Proposed Improvements	Within Caltrans ROW?	Receiving Water (existing outfall)	Within Coastal Zone? (per City LCP)	Intersects Natural / Undisturbed Area?	Mapped Floodplain Status (FIRM 060039C eff. 08/02/2017)	Coastal Jurisdiction	Existing Environment/Setting	Environmental Permits / Approvals	Permitting Narrative	Class V Environmental Permitting Cost	Tier	Key Assumptions / Notes
1	DG1.1	Upsize ~80 LF to 3-ft HDPE; upsize ~700 LF to 2-ft HDPE on Hwy 101; install 4 new DIs. Entirely within Caltrans ROW.	Yes - entirely Caltrans ROW	Elk Creek tributary (existing outfall, no work proposed at outfall)	Within County of Del Norte LCP, but at very edge. Possible that some work would occur within City General Plan jurisdiction.	Entirely within paved area of Hwy 101.	Very close to Zone A but may stay out it appears	County-issued CDP (LCP). In coastal zone segment	Caltrans-managed Hwy 101 ROW; proximity to Elk Creek tributary; riparian vegetation close but assume it can be avoided.	County CDP under LCP for portion in coastal zone; Caltrans, County or City lead CEQA Agency, likely a Categorical Exemption.	Caltrans is construction lead; County CDP, CEQA Categorical Exemption. Outfall protected in place.	$10,000	Tier 1	
2	DG2.1B	Upsize ~1,500 LF (9th-5th St) to 2.5-ft HDPE; upsize ~200 LF (5th & D) to 2-ft HDPE; ~150 LF lateral; 11 new DIs, 4 new MHs. Outfall at B St Pier.	No	Crescent Harbor at B Street Pier (existing outfall, no work proposed at outfall)	Partially - downstream portion between Front St and harbor is in coastal zone; upstream portion (9th St area) likely outside	No	No	Outside coastal zone (no CDP)	Developed urban ROW	Minimal due to urban ROW	Outside coastal zone; existing outfall protected in place. Minimum environmental permitting expected.	$5,000	Tier 1	Project entirely within urban ROW, with minimal environmental impact.
2	DG2.2	Upsize ~200 LF to 1.5-ft HDPE; upsize ~600 LF to 3-ft HDPE; ~200 LF lateral; 9 new DIs, 3 new MHs.	No	Crescent Harbor (via Group 2 system)	Yes, partially	No	No	Western edge of CIP falls within likely city issued LCP	Developed urban ROW	CEQA documentation (likely categorical exemption); City CDP only if portion within coastal zone	ROW pipe upsizing in developed area; if outside coastal zone, environmental scope limited to CEQA documentation; minimal environmental permitting effort.	$25,000	Tier 1-2	If any portion is within coastal zone, escalates to Tier 2 (~$25K).
2	DG2.2B	Upsize ~750 LF to 2-ft HDPE along B St (6th-2nd); ~100 LF lateral; 6 new DIs, 3 new MHs. Routes under private property.	No	Crescent Harbor (via Group 2 system)	No	No	No	No, outside coastal zone	Developed urban ROW	CEQA documentation (CatEx)	Routes under private property; minimal environmental scope; CEQA cat. exemption likely	$5,000	Tier 1	Easement acquisition is out of environmental scope.
3	DG3.1A	Upsize ~350 LF to 2.5-ft HDPE; upsize ~2,350 LF to 2-ft HDPE; ~25 LF lateral; 8 new DIs. Tidally influenced area east of Hwy 101.	No (adjacent)	Elk Creek (existing outfall, no work proposed at outfall)	No - east of Highway 101, outside the LCP-defined coastal zone	Yes, semi-natural/undisturbed area within and adjacent to freshwater marsh area east of Crescent City	Yes, Zone A	Outside coastal zone (no CDP needed)	Crosses portion of freshwater marsh east of town.	CEQA documentation; possible RWQCB 401/CDFW 1602 if alignment crosses jurisdictional drainage; FEMA Floodplain Development Permit	Intersects freshwater marsh area; outside coastal zone; verify wetland/jurisdictional waters along alignment; FEMA floodplain permit likely; no CDP required.	$60,000	Tier 3	Wetlands + Elk Creek proximity drives floodplain permit and possible 1602/401. Verify wetland delineation needs - jurisdictional waters likely present.
3	DG3.1B	Upsize ~1,600 LF to 2-ft HDPE; ~150 LF lateral; 11 new DIs.	No	Elk Creek (via Group 3 system)	No - east of Highway 101, outside coastal zone	Yes, crosses freshwater forested/shrub wetland	No	Outside coastal zone (no CDP needed)	Mostly developed urban ROW, eastern portion crosses a wetland and natural area	CEQA documentation; possible RWQCB 401/CDFW 1602 if alignment crosses jurisdictional drainage; FEMA Floodplain Development Permit	ROW pipe upsizing in developed area outside coastal zone; eastern portion intersects with wetlands and potential stream channel (other waters).	$45,000	Tier 2-3	Wetlands proximity drives 1602/404/401 permits. Verify wetland delineation needs - jurisdictional waters likely present.
3	DG3.2A	Upsize ~550 LF to 2.5-ft HDPE; upsize ~350 LF to 2-ft HDPE; ~200 LF lateral; 11 new DIs, 2 new MHs.	No	Elk Creek (via Group 3 system)	No - east of Highway 101	No	No	Outside coastal zone (no CDP needed)	Developed urban ROW	CEQA documentation (likely categorical exemption)	Standard ROW pipe upsizing outside coastal zone; minimal environmental scope; CEQA cat. exemption likely.	$3,000	Tier 1	Pure ROW work outside coastal zone.
3	DG3.2B	Add ~950 LF 3-ft HDPE; add ~300 LF 2.5-ft HDPE; add ~450 LF 1-ft HDPE; upsize ~650 LF to 3-ft; upsize ~400 LF to 2.5-ft; ~400 LF lateral; 21 new DIs, 6 new MHs.	No	Elk Creek (via Group 3 system)	No - east of Highway 101	Potentially the far western portion, but seems unlikely	No	Outside coastal zone (no CDP needed)	Developed urban ROW and riparian; outside LCP coastal zone	CEQA documentation; possible CDFW 1602 / CWA 404/401, CEQA Initial Study / Negative Declaration. if any tie-in to creek/drainage; difficult to tell	Largest CIP in Group 3; flow redirection in developed ROW outside coastal zone; CEQA cat. exemption likely unless tie-in to jurisdictional drainage feature.	$50,000	Tier 3	Assume doesn't impact creek at west end. Scale doesn't drive environmental cost as much as resource impact does. If any tie-in to jurisdictional drainage, escalates to Tier 2-3.
3	DG3.2C	Upsize ~800 LF to 2-ft HDPE on E. Washington Blvd (Amador-Breen); ~50 LF lateral; 2 new DIs. Directs flow to greenway/creek.	No	Greenway/creek (per project description)	Yes, very small portion overlaps along western edge of CIP on Washington Blvd	Yes, southern portion at end of Amador Street intersects with undisturbed/natural area	No	City-issued CDP (LCP) likely. In coastal zone segment	Discharge to greenway/creek (described in project); jurisdictional drainage potential; possible riparian vegetation	RWQCB 401 WQC; CDFW 1602 LSAA; possibly USACE 404 NWP; CEQA documentation (potential IS/MND given resource impact)	Discharge to greenway/creek triggers waters-of-State permits; CDFW 1602 likely for outfall connection;coastal zone CDP; biological survey needed.	$80,000	Tier 3-4	Highest-resource-risk CIP among Group 3 due to direct greenway/creek discharge. Verify whether greenway is jurisdictional waters of US. CDFW 1602 essentially certain.
3	DG3.3A	Upsize ~350 LF to 1.5-ft HDPE; upsize ~50 LF to 1-ft HDPE; 3 new DIs.	No (adjacent to Hwy 101 and Elk Valley Rd)	Elk Creek (via Group 3 system)	Yes, a portion	Yes, northern extent	Yes, northern extent	Small portion in City issued LCP	Developed ROW at south end of city near Hwy 101 and Elk Valley Rd; northern portion extends into potential jurisdictional freshwater forested/scrub wetland	CEQA documentation; potential RWQCB 401 WQC; CDFW 1602 LSAA; possibly USACE 404 NWP	Pipe upsizing addressing south-end flooding; routine environmental scope; CEQA cat. exemption likely; no CDP if outside coastal zone.	$60,000	Tier 3-4	Potential FEMA, LCP, RWQCB, USACE. Depends upon extent of construction at northern extent of CIP.
3	DG3.3B	Upsize ~1,300 LF to 2.5-ft HDPE; 7 new DIs. Intersects Caltrans ROW.	Yes - intersects Caltrans ROW	Elk Creek (via Group 3 system)	Yes	No	Yes	City-issued CDP	Caltrans ROW at Hwy 101 N/S split area	City CDP under LCP ; CEQA documentation (Caltrans typically lead)	Hwy 101 N/S split work; environmental scope contingent on coastal zone status; Caltrans may be CEQA lead; City CDP for coastal zone segment; FEMA floodplain.	$50,000	Tier 2-3	Caltrans typically lead for NEPA/CEQA on its ROW.
4	DG4.1A	Upsize ~900 LF to 3-ft HDPE; upsize ~400 LF to 2.5-ft HDPE; upsize ~350 LF to 1.5-ft HDPE; ~250 LF lateral; 11 new DIs, 10 new MHs. Resolves flooding at 5th & J and 4th & J.	No	Elk Creek (via Group 4 outfall)	No	No - fully developed downtown grid	No	Outside coastal zone	Fully developed downtown street grid; no natural features anticipated	CEQA documentation (likely categorical exemption)	ROW pipe upsizing in fully developed downtown grid; minimal environmental scope; bundle with DG4.1B for permitting efficiency.	$5,000	Tier 1	Bundle permitting with DG4.1B. Fully developed grid - lowest resource risk.
4	DG4.1B	Upsize ~1,200 LF to 2.5-ft HDPE; upsize ~300 LF to 2-ft HDPE; upsize ~100 LF to 1.5-ft HDPE; ~250 LF lateral; 11 new DIs, 5 new MHs. Hydraulically dependent on DG4.1A.	No	Elk Creek (via Group 4 outfall)	No	No - fully developed grid	No	Outside coastal zone	Fully developed downtown street grid; no natural features anticipated	CEQA documentation (bundled with DG4.1A)	ROW pipe upsizing in downtown grid upstream of DG4.1A; bundle with DG4.1A under single environmental submittal; minimal scope.	$2,000	Tier 1	Bundle with DG4.1A.
4	DG4.2	Upsize ~600 LF to 4-ft HDPE; upsize ~350 LF to 2-ft HDPE; ~150 LF lateral; 3 new DIs, 4 new MHs. Hydraulically dependent on DG10.1.	No	Elk Creek (via Outfall 10 / DG10.1 system)	Yes, small portion at southern end overlaps coastal zone	Urban ROW expected	No	City-issued CDP for southern portion	Developed urban ROW; hydraulically tied to DG10.1	CEQA documentation (likely categorical exemption); City CDP if portion within coastal zone	ROW pipe upsizing dependent on DG10.1; minimal environmental scope; verify coastal zone status.	$10,000	Tier 1	High tier 1 due to coastal zone.

Drainage Group	CIP ID	Description / Proposed Improvements	Within Caltrans ROW?	Receiving Water (existing outfall)	Within Coastal Zone? (per City LCP)	Intersects Natural / Undisturbed Area?	Mapped Floodplain Status (FIRM 060039C eff. 08/02/2017)	Coastal Jurisdiction	Existing Environment/Setting	Environmental Permits / Approvals	Permitting Narrative	Class V Environmental Permitting Cost	Tier	Key Assumptions / Notes
4	DG4.3	Upsize ~100 LF to 3-ft HDPE; upsize ~700 LF to 2-ft HDPE; upsize ~600 LF to 1-ft HDPE; ~350 LF lateral; 9 new DIs, 4 new MHs. Hydraulically dependent on DG10.1.	No	Elk Creek (via Outfall 10 / DG10.1 system)	No	No	No	Outside coastal zone	Developed urban ROW; hydraulically tied to DG10.1 system	CEQA documentation minimal	ROW pipe upsizing dependent on DG10.1; minimal environmental scope; bundle with DG4.2.	$3,000	Tier 1	Bundle with DG4.2 if alignment permits.
5	DG5.1	Cross-town interceptor: add ~2,200 LF 4.5-ft HDPE down 9th St (D St to Outfall 5); add ~600 LF 4-ft HDPE; add/upsize ~1,300 LF to 3-ft; upsize ~200 LF to 2.5-ft; ~100 LF lateral; 8 new DIs, 5 new MHs. Outfall 5 to Pacific Ocean south of Preston Island.	No	Pacific Ocean at Outfall 5, south of Preston Island (existing outfall, no work proposed at outfall)	Yes - City LCP	Assumed all work is within paved (road) area.	No	City-issued CDP (LCP).	9th Street alignment terminates at Pacific Ocean Outfall 5; downstream portion within coastal zone strip; possible coastal bluff/ESHA at existing outfall vicinity	City CDP under LCP; CEQA Categorical Exemption	Largest CIP in master plan; appealable City CDP for downstream coastal portion; close proximity of natural habitat (ESHA) may require bio surveys and consideration in permitting.	$100,000	Tier 3	
5	DG5.2	Upsize ~900 LF to 3-ft HDPE; upsize ~1,000 LF to 2.5-ft HDPE; upsize ~600 LF to 2-ft HDPE; ~550 LF lateral; 14 new DIs, 3 new MHs. Pacific Ave; dependent on DG5.1.	No	Pacific Ocean at Outfall 5 (via DG5.1)	No	No	No	Outside coastal zone	Developed urban ROW on Pacific Avenue; hydraulically tied to DG5.1	Bundle under DG5.1 CDP and CEQA; minimal incremental environmental scope	ROW pipe upsizing on Pacific Ave dependent on DG5.1; bundle CDP and CEQA with DG5.1; marginal incremental scope.	$5,000	Tier 1	Bundle permitting with other Group 5 CIPs.
5	DG5.3	Upsize ~1,000 LF to 2.5-ft HDPE; upsize ~450 LF to 2-ft HDPE; ~50 LF lateral; 6 new DIs, 1 new MH. Gary St neighborhood; dependent on DG5.1.	No	Pacific Ocean at Outfall 5 (via DG5.1)	No	No	No	Outside coastal zone	Developed residential ROW; hydraulically tied to DG5.1	Bundle under DG5.1 CDP and CEQA if applicable; otherwise CEQA cat. exemption	ROW pipe upsizing in Gart St neighborhood dependent on DG5.1; bundle environmental permitting with Group 5; minimal scope.	$5,000	Tier 1	Bundle permitting with other Group 5 CIPs.
5	DG5.4	Upsize ~1,400 LF to 3-ft HDPE; upsize ~850 LF to 2.5-ft HDPE; upsize ~700 LF to 2-ft HDPE; ~350 LF lateral; 15 new DIs, 5 new MHs.	No	Pacific Ocean at Outfall 5 (via DG5.1) - verify	No	No	No	Outside coastal zone	Developed urban ROW; substantial scale (~3,300 LF)	Bundle under DG5.1 CDP and CEQA if applicable; otherwise CEQA documentation	Substantial ROW pipe upsizing; bundle environmental permitting with Group 5; minimal incremental scope.	$8,000	Tier 1-2	Bundle with other Group 5 CIPs.
5	DG5.5	Upsize ~450 LF to 1.5-ft HDPE; ~100 LF lateral; 3 new DIs, 1 new MH. Dependent on DG5.1.	No	Pacific Ocean at Outfall 5 (via DG5.1)	No	No	No	Outside coastal zone	Small-scale developed residential ROW	Bundle under DG5.1 CDP and CEQA if applicable	Small-scale ROW pipe upsizing; lowest environmental scope in Group 5; bundle with other Group 5 CIPs.	$2,000	Tier 1	Bundle permitting with other Group 5 CIPs.
6	DG6.1	Upsize ~50 LF to 2-ft HDPE; upsize ~450 LF to 1.5-ft HDPE; ~150 LF lateral; 8 new DIs, 3 new MHs. Outfall to Pacific Ocean south of Brother Jonathan Cemetery.	No	Pacific Ocean south of Brother Jonathan Cemetery (existing outfall, no work proposed at outfall)	Yes - within one block of Pacific along Pebble Beach Drive area	No	No	City-issued CDP (LCP); potential appealable to CCC for western most portion near to the beach	Mostly urban ROW	City CDP under LCP (likely appealable);	Coastal zone CDP with appeal jurisdiction likely. Minimal other requirements expected.	$10,000	Tier 2	Brother Jonathan Cemetery is a documented historic resource - cultural review and Tolowa Dee-ni' Nation consultation may be needed.
7	DG7.1	Replace ~400 LF of pipe with 1-ft HDPE; 2 new DIs, 1 new MH. Repairs failed pipe sections leading to Outfall 7 (Pacific Ocean). Outfall protected in place.	No	Pacific Ocean at Outfall 7 (existing outfall not modified)	Yes - within one block of Pacific along A Street/Lighthouse Way area	Yes, coastal bluff and potential ESHA	Yes, at western end outfall area	City-issued CDP (LCP); likely appealable to CCC (within 300 ft of beach)	Within coastal zone strip near Pacific Ocean; possible coastal bluff/ESHA; small project footprint	City CDP under LCP (likely appealable); biological survey for coastal portion; CEQA documentation may be Initial Study / Negative Declaration. May be within US Army Corps jurisdiction which would require CWA 404 and 401 approvals (USACE and Water Board).	Pipe repair leading to existing Outfall 7; appealable City CDP under LCP given coastal zone location; bluff biological survey; outfall protected in place.	$60,000	Tier 3	Sediment/debris cleanout at outfall (separate from pipe repair) may need additional authorization if performed seaward of MHTL.
8	DG8.1	Add ~300 LF 1-ft HDPE (W 5th St & Wendell St to Outfall 8); upsize ~100 LF to 2-ft HDPE; ~150 LF lateral; 7 new DIs, 2 new MHs. New connection to existing Outfall 8.	No	Pacific Ocean at Outfall 8 (existing outfall, no modification proposed)	Yes - within one block of Pacific along Wendell Street	Potentially the far western portion, but seems unlikley	Potentially the far western portion, but seems unlikley	City-issued CDP (LCP); likely appealable to CCC (within 300 ft of beach)	Within coastal zone along Wendell Street; possible coastal bluff/ESHA at outfall vicinity	City CDP under LCP (likely appealable); biological survey for coastal portion; CEQA documentation may be Initial Study / Negative Declaration. May be within US Army Corps jurisdiction which would require CWA 404 and 401 approvals (USACE and Water Board).	New 300 LF connection to existing Outfall 8 within coastal zone strip; appealable City CDP; ESHA verification needed; outfall protected in place.	$60,000	Tier 3	New pipe connecting to existing outfall (not new outfall). If connection point seaward of MHTL, escalates to Tier 4. Verify exact terminus.
9	DG9.1	Upsize ~600 LF to 2-ft HDPE; ~150 LF lateral; 5 new DIs, 2 new MHs. Discharges to Pacific Ocean near south end of Wendell St.	No	Pacific Ocean near south end of Wendell Street (existing outfall, no work proposed at outfall)	Yes - within one block of Pacific along Wendell Street and A Street	Yes at western terminus intersects with native vegetation (potential ESHA)	No; near outfall Zone VE	City-issued CDP (LCP); likely appealable to CCC	Within coastal zone along Wendell/A Street; possible coastal bluff/ESHA	City CDP under LCP (likely appealable); biological survey for coastal portion; CEQA documentation	ROW pipe upsizing within coastal zone strip; appealable City CDP under LCP; bluff biological survey; outfall protected in place.	$40,000	Tier 2-3	Standard coastal zone CDP profile.
10	DG10.1	Add ~300 LF 4-ft HDPE (Front St to Outfall 10); upsize ~250 LF to 4-ft HDPE; ~50 LF lateral; 5 new DIs, 1 new MH. Outfall to Elk Creek; existing outfall protected in place.	No	Elk Creek at Outfall 10 in Beachfront Park area (existing outfall protected in place per design)	Yes - between Front Street and Crescent City Harbor, within coastal zone	Yes - Beachfront Park / Elk Creek mouth corridor; possible riparian, ESHA, tidewater goby habitat	Yes, Zone AE at eastern terminus	City-issued CDP (LCP); likely appealable to CCC	Beachfront Park / Elk Creek mouth corridor; high-resource area; ESA - possible tidewater goby habitat; riparian/ESHA verification needed; cultural resources potential	City CDP under LCP (likely appealable); biological assessment (tidewater goby focus, possible ESA Section 7); possible CDFW 1602 if any work in Elk Creek streambed; cultural Phase I; FEMA Floodplain Development Permit; CEQA (IS/MND likely); possibly CWA 404/401;	Outfall protected in place per design - favorable; new pipe in Beachfront Park/Elk Creek mouth corridor requires appealable CDP, biological assessment, possible 1602; high-resource area.	$80,000	Tier 3-4	Protect in place' favorable for permitting. Beachfront Park / Elk Creek mouth is high-resource (tidewater goby, salmonid, riparian, possibly cultural). DG4.2 and DG4.3 downstream-dependent. Permitting cost dependent upon design ability to avoid habitat.
											TOTAL :	$783,000		

Drainage Group	CIP ID	Description / Proposed Improvements	Within Caltrans ROW?	Receiving Water (existing outfall)	Within Coastal Zone? (per City LCP)	Intersects Natural / Undisturbed Area?	Mapped Floodplain Status (FIRM 060039C eff. 08/02/2017)	Coastal Jurisdiction	Existing Environment/Setting	Environmental Permits / Approvals	Permitting Narrative	Class V Environmental Permitting Cost	Tier	Key Assumptions / Notes

ENVIRONMENTAL PERMITTING COST BY DRAINAGE GROUP (BUNDLED)

Assumes the City permits each Drainage Group as a single application (CDP, CEQA, biological surveys bundled). Lead CIP carries full regulatory effort; ride-along CIPs add only marginal description scope.

Drainage Group	CIPs Included	Lead CIP / Driver	Bundled Cost (ROM, $)	Notes
DG 1	DG1.1	DG1.1 (Caltrans-led)	$10,000	Caltrans-led single project; environmental scope contingent on coastal zone status.
DG 2	DG2.1B, DG2.2, DG2.2B	DG2.1B (CDP for harbor-adjacent segment)	$35,000	Lead is DG2.1B with possible coastal zone CDP; DG2.2 and DG2.2B ride along under bundled CEQA. Modest savings vs. per-CIP sum.
DG 3	DG3.1A, DG3.1B, DG3.2A, DG3.2B, DG3.2C, DG3.3A, DG3.3B	DG3.2C (greenway/creek 1602/401 driver) + DG3.3B (Caltrans	$348,000	Coastal zone. DG3.2C carries 1602/401 burden. DG3.1A floodplain drives FEMA permit. Other CIPs ride along under bundled
DG 4	DG4.1A, DG4.1B, DG4.2, DG4.3	DG4.1A (downtown grid CEQA)	$20,000	All Group 4 CIPs are in fully developed downtown grid, likely outside coastal zone. Single bundled CEQA categorical exemption
DG 5	DG5.1, DG5.2, DG5.3, DG5.4, DG5.5	DG5.1 (cross-town interceptor with appealable coastal zone CDP)	$120,000	DG5.1 carries full appealable CDP, ESHA biological survey, cultural Phase I, and FEMA permit. DG5.2-5.5 ride along under same CDP and
DG 6	DG6.1	DG6.1 (cemetery + bluff)	$10,000	Single project with appealable CDP, ESHA biological survey, cultural Phase I (cemetery), and tribal consultation potential.
DG 7	DG7.1	DG7.1 (coastal pipe repair)	$60,000	Single project with appealable CDP and bluff biological survey. Outfall protected in place.
DG 8	DG8.1	DG8.1 (new connection to existing outfall)	$60,000	Single project with appealable CDP and bluff biological survey. New connection (not new outfall) keeps in Tier 3.
DG 9	DG9.1	DG9.1 (coastal pipe upsize)	$40,000	Single project with appealable CDP and bluff biological survey.
DG 10	DG10.1	DG10.1 (Elk Creek mouth corridor)	$80,000	Single project; high-resource area (tidewater goby, salmonid, riparian); appealable CDP, ESA-level biological assessment, possible
		TOTAL (bundled, ROM):	**$783,000**	

Class V Cost Estimate - Methodology & Assumptions

Scope: ENVIRONMENTAL permitting only

AACE Class:	Class V (Concept Screening)
Project Definition:	0% to 2% complete
Expected Accuracy Range:	-50% / +100%
End Use:	Long-range capital planning, master plan budgeting
Estimating Method:	Stochastic / parametric, based on permit-tier assumptions
Scope Definition	
IN scope:	Coastal Development Permit (CDP); USACE 404; RWQCB 401; CDFW 1602; ESA/CESA; Cultural Resources/SHPO/Tribal consultation; CEQA documentation; Biological surveys/ESHA verification; FEMA Floodplain Development Permit
OUT of scope:	SWPPP/Construction General Permit; Caltrans encroachment permits; City encroachment permits; building/grading permits; easement acquisition; construction contracting
Cost Tier Definitions (environmental permitting only)	
Tier 1 - No environmental triggers	**$2K - $10K**
Description	Fully developed ROW outside coastal zone with no surface water/wetland/floodplain impact. Limited to CEQA categorical exemption and confirmation memo. No CDP, no resource agency permits.
Tier 2 - Single environmental trigger	**$15K - $40K**
Description	City-issued CDP (not appealable) under LCP, OR a single resource agency permit (FEMA floodplain, CDFW 1602, etc.). Routine biological/cultural memo. CEQA cat. exemption or short-form.
Tier 3 - Appealable CDP or multiple resource permits	**$50K - $120K**
Description	Appealable CDP (within 300 ft of beach or between sea and first public road); biological assessment for ESHA; possible 1602 + 401; cultural Phase I; CEQA IS/MND.
Tier 4 - Multi-Agency / Resource Impact	**$120K - $300K**
Description	CCC retained jurisdiction OR USACE 404 + 401 + 1602 + ESA Section 7 nexus; full CEQA MND. NOT triggered by current CIP scopes as described.
Tier 5 - Major Impact	**$300K+**
Description	Individual 404 permit; CCC hearing; ESA formal consultation; full EIR. NOT triggered by current CIP scopes as described.

Excluded from these estimates:

- Construction permits (SWPPP, encroachment, building, grading)
- Mitigation construction costs (in-lieu fees, restoration, monitoring beyond 1 yr)
- Agency filing fees (varies; add separately)
- Easement acquisition costs
- Construction monitoring / biological monitor field time
- Post-construction performance monitoring

Key Citywide Assumptions	
LCP status:	City of Crescent City has a certified LCP (originally 1984, amended 2010-2011 via CRC-MAJ-1-03). City issues CDPs except in CCC retained jurisdiction.
Coastal zone extent:	Approximately 1/10 of city. Most CIPs are OUTSIDE coastal zone.
CCC retained jurisdiction:	Tidelands, submerged lands, public trust lands, seaward of MHTL. NO CURRENT CIP triggers this per descriptions provided.
CCC appeal jurisdiction:	Between sea and first public road, within 300 ft of beach. Several CIPs trigger this (DG5.1, DG6.1, DG7.1, DG8.1, DG9.1, DG10.1).
Outfall scope assumption:	All existing outfalls protected in place per CIP descriptions. No new outfalls or outfall modifications proposed. THIS IS THE SINGLE BIGGEST COST DRIVER - if outfall work added to scope, costs escalate substantially.
Receiving waters:	Pacific Ocean (Outfalls 5, 6, 7, 8, 9), Crescent Harbor (Outfall 2), Elk Creek and tributaries (Outfalls 1, 3, 4, 10)
Listed species potentially in vicinity:	Tidewater goby (Elk Creek mouth), coho salmon (Elk Creek), western snowy plover (beaches), marbled murrelet (verify USFWS list)
Permitting bundling assumption:	Per PM, CIPs are intended to be permitted by Drainage Group rather than individually. Bundled section at bottom of CIP Permitting Matrix reflects this assumption.
FIRM reference:	FEMA FIRM Community ID 060039C, current effective date 08/02/2017

Environmental Permit / Approval Quick Reference

Scope: ENVIRONMENTAL permits only. Construction permits (SWPPP/CGP, encroachment, building, grading) are NOT in environmental scope and not included.

Permit / Approval	Trigger	Lead Agency	Typical Cost & Timeline (ROM, Class V)
Coastal Development Permit (CDP) - City-issued, not appealable	Development within Crescent City coastal zone but not in appealable area	City of Crescent City	$5K-$15K consultant + City fees; 3-6 mo
Coastal Development Permit (CDP) - City-issued, appealable to CCC	Project between sea and first public road, OR within 300 ft of beach	City issues; CCC has appeal jurisdiction	$10K-$30K consultant; 4-9 mo (longer if appealed)
Coastal Development Permit (CDP) - CCC retained jurisdiction	Tidelands, submerged lands, public trust lands, seaward of MHTL	California Coastal Commission	$20K-$60K+ consultant + CCC filing fees; 9-18 mo (NOT triggered by current CIPs as described)
Categorical Exemption (CEQA)	Routine in-kind infrastructure replacement with no resource impact	City of Crescent City	$2K-$5K consultant; 1-2 mo
Initial Study / Mitigated Negative Declaration (CEQA)	Project with potential significant impacts that can be mitigated	City of Crescent City	$20K-$60K consultant; 4-9 mo
USACE Section 404 Permit (NWP or Individual)	Discharge of dredged/fill material to waters of the U.S. (post-Sackett)	U.S. Army Corps of Engineers	NWP: $8K-$20K, 4-6 mo; IP: $40K-$120K+, 12-24 mo
RWQCB Section 401 Water Quality Certification	Federal permit (404) for discharge to waters of the State	North Coast RWQCB	$5K-$15K consultant + RWQCB fees; concurrent with 404
CDFW Section 1602 Lake & Streambed Alteration Agreement	Work in/under/across bed, bank, or channel of any river, stream, or lake	CA Dept. of Fish and Wildlife	$5K-$20K consultant + CDFW fees; 3-6 mo
FEMA Floodplain Development Permit	Work in mapped SFHA per FIRM 060039C eff. 08/02/2017	City Floodplain Administrator	$3K-$8K basic FPDP; 2-4 mo
Cultural Resources Survey / SHPO / Tribal Consultation	Project near historic resource (e.g., cemetery), federal nexus, or CEQA cultural finding	City / SHPO / Tolowa Dee-ni' Nation	$5K-$25K Phase I; Phase II/III if resources found
Biological Survey / ESHA Verification	Project in coastal zone with potential ESHA (coastal bluff, riparian, wetland)	Consultant; review by City and CCC	$5K-$20K survey; included in CDP package
ESA Section 7 Consultation	Federal nexus + listed species (e.g., tidewater goby, coho, marbled murrelet)	USFWS / NMFS via federal lead	BA prep $15K-$50K; consultation 6-18 mo (not anticipated for current CIPs absent federal nexus)

Attachments

Attachment 1

Crescent City Priority Land Uses

City of Crescent City General Plan Land Use Diagram

May 21, 2001

Crescent City Land Use Designations

Residential
- Single Family (0-2)
- Single Family (2-6)
- Multi-Family (6-15)
- Multi-Family (15-30)
- Mobilehome Park

Commercial
- Business-Professional
- Visitor and Local Commercial
- General Commercial

Industrial
- Light Industrial
- General Industrial

Public
- Public Facilities and Tribal Lands

Harbor
- Harbor Related
- Harbor Dependent
- Harbor Dependent Recreation
- Harbor Dependent Commercial

Conservation and Open Space
- Open Space
- Natural Resources

Overlays
- Urban Reserve Overlay

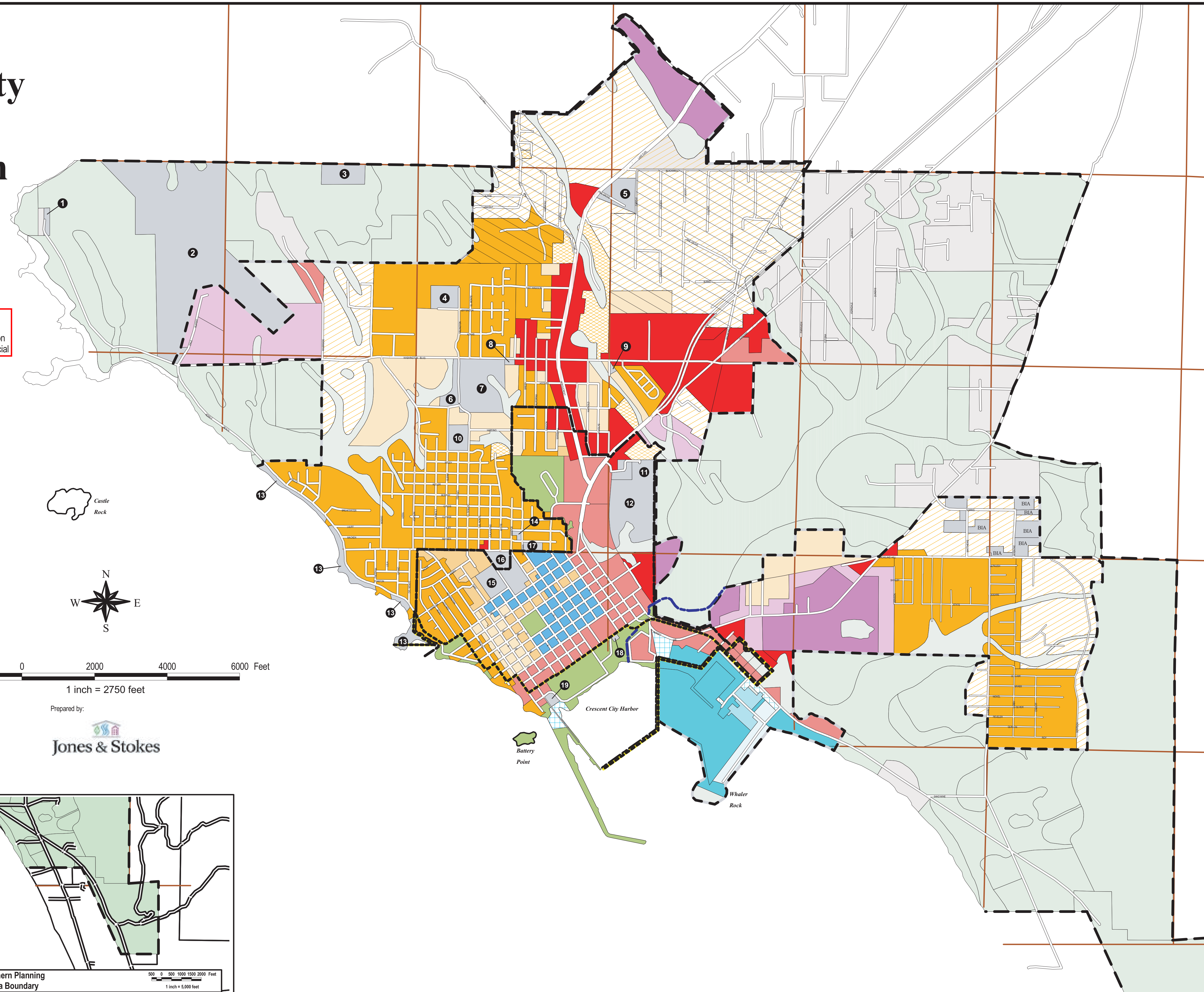
Countywide Designation
- County Rural Development
- County Resources

- Crescent City City Limit
- Planning Area Boundary
- Urban Boundary
- Coastal Zone Boundary

Public Facilities Index

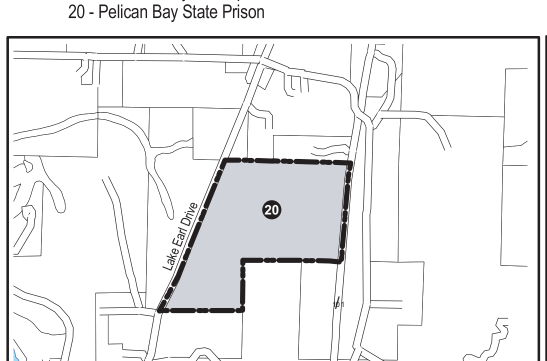
1 - County Park (Point St. George Access)
2 - County Airport (McNamara Field)
3 - County Landfill (Crescent City Landfill)
4 - Mary Peacock School
5 - Pine Grove School
6 - Community College (College of the Redwoods)
7 - Del Norte High School
8 - Crescent Fire/Emergency Services Center
9 - City Water Storage Tank
10 - Bess Maxwell School
11 - Juvenile Detention Facility
12 - Del Norte County Fairgrounds
13 - County Park (Pebble Beach Access)
14 - Public Utility Center
15 - Joe Hamilton School
16 - Crescent Elk School
17 - County Park (Macken Ballfields)
18 - Convention Center
19 - Crescent City Municipal Wastewater Treatment Plant
20 - Pelican Bay State Prison

1 inch = 2750 feet



Prepared by:

Jones & Stokes



Pelican Bay State Prison

Southern Planning Area Boundary

Attachment 2

NOAA-14 Precipitation Frequency Estimates

NOAA Atlas 14, Volume 6, Version 2
Location name: Crescent City, California, USA*
Latitude: 41.753°, Longitude: -124.2013°
Elevation: m/ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sarah Dietz, Sarah Heim, Lillian Hiner, Kazungu Maitaria, Deborah Martin, Sandra Pavlovic, Ishani Roy, Carl Trypaluk, Dale Unruh, Fenglin Yan, Michael Yekta, Tan Zhao, Geoffrey Bonnin, Daniel Brewer, Li-Chuan Chen, Tye Parzybok, John Yarchoan

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**0.170** (0.148-0.197)	**0.220** (0.192-0.256)	**0.286** (0.248-0.333)	**0.338** (0.291-0.398)	**0.410** (0.339-0.500)	**0.464** (0.375-0.580)	**0.519** (0.408-0.667)	**0.575** (0.439-0.762)	**0.651** (0.474-0.902)	**0.709** (0.497-1.02)
10-min	**0.244** (0.212-0.283)	**0.316** (0.275-0.367)	**0.409** (0.355-0.477)	**0.485** (0.417-0.570)	**0.587** (0.486-0.717)	**0.665** (0.538-0.831)	**0.744** (0.585-0.955)	**0.825** (0.629-1.09)	**0.933** (0.679-1.29)	**1.02** (0.712-1.46)
15-min	**0.295** (0.257-0.342)	**0.382** (0.332-0.443)	**0.495** (0.429-0.577)	**0.587** (0.504-0.690)	**0.710** (0.588-0.867)	**0.805** (0.650-1.00)	**0.900** (0.708-1.16)	**0.997** (0.761-1.32)	**1.13** (0.822-1.56)	**1.23** (0.861-1.77)
30-min	**0.400** (0.349-0.464)	**0.518** (0.451-0.602)	**0.672** (0.583-0.783)	**0.796** (0.684-0.936)	**0.964** (0.798-1.18)	**1.09** (0.883-1.36)	**1.22** (0.961-1.57)	**1.35** (1.03-1.79)	**1.53** (1.12-2.12)	**1.67** (1.17-2.40)
60-min	**0.564** (0.491-0.655)	**0.731** (0.635-0.849)	**0.947** (0.821-1.10)	**1.12** (0.964-1.32)	**1.36** (1.12-1.66)	**1.54** (1.24-1.92)	**1.72** (1.36-2.21)	**1.91** (1.46-2.53)	**2.16** (1.57-2.99)	**2.35** (1.65-3.39)
2-hr	**0.838** (0.730-0.972)	**1.06** (0.918-1.23)	**1.34** (1.16-1.56)	**1.57** (1.34-1.84)	**1.87** (1.55-2.28)	**2.10** (1.70-2.63)	**2.34** (1.84-3.00)	**2.58** (1.97-3.42)	**2.90** (2.11-4.02)	**3.14** (2.20-4.53)
3-hr	**1.09** (0.948-1.26)	**1.35** (1.18-1.57)	**1.70** (1.47-1.98)	**1.97** (1.69-2.32)	**2.34** (1.94-2.86)	**2.62** (2.12-3.27)	**2.90** (2.28-3.72)	**3.19** (2.43-4.22)	**3.57** (2.60-4.95)	**3.86** (2.70-5.56)
6-hr	**1.73** (1.50-2.00)	**2.12** (1.84-2.46)	**2.62** (2.27-3.05)	**3.01** (2.59-3.54)	**3.54** (2.93-4.32)	**3.94** (3.18-4.92)	**4.33** (3.41-5.56)	**4.73** (3.61-6.27)	**5.26** (3.83-7.29)	**5.66** (3.97-8.15)
12-hr	**2.47** (2.15-2.86)	**3.05** (2.65-3.54)	**3.79** (3.29-4.42)	**4.37** (3.76-5.14)	**5.13** (4.25-6.26)	**5.70** (4.60-7.12)	**6.25** (4.92-8.02)	**6.80** (5.19-9.01)	**7.52** (5.48-10.4)	**8.06** (5.65-11.6)
24-hr	**3.46** (3.09-3.96)	**4.35** (3.88-4.98)	**5.46** (4.86-6.27)	**6.32** (5.58-7.30)	**7.44** (6.38-8.84)	**8.25** (6.95-9.98)	**9.04** (7.46-11.2)	**9.81** (7.91-12.4)	**10.8** (8.40-14.2)	**11.6** (8.71-15.6)
2-day	**4.85** (4.33-5.54)	**6.07** (5.41-6.95)	**7.58** (6.74-8.70)	**8.75** (7.72-10.1)	**10.2** (8.79-12.2)	**11.3** (9.55-13.7)	**12.4** (10.2-15.3)	**13.4** (10.8-17.0)	**14.7** (11.4-19.3)	**15.7** (11.8-21.2)
3-day	**5.70** (5.09-6.52)	**7.12** (6.34-8.15)	**8.86** (7.88-10.2)	**10.2** (9.01-11.8)	**11.9** (10.2-14.2)	**13.2** (11.1-15.9)	**14.3** (11.8-17.7)	**15.5** (12.5-19.6)	**17.0** (13.2-22.3)	**18.1** (13.6-24.4)
4-day	**6.46** (5.77-7.39)	**8.07** (7.19-9.24)	**10.0** (8.93-11.5)	**11.6** (10.2-13.3)	**13.5** (11.6-16.0)	**14.8** (12.5-18.0)	**16.2** (13.3-20.0)	**17.4** (14.0-22.1)	**19.0** (14.8-25.0)	**20.2** (15.2-27.4)
7-day	**8.02** (7.15-9.17)	**10.1** (8.96-11.5)	**12.5** (11.1-14.4)	**14.4** (12.7-16.6)	**16.7** (14.3-19.9)	**18.3** (15.5-22.2)	**19.9** (16.4-24.6)	**21.4** (17.2-27.1)	**23.2** (18.0-30.5)	**24.5** (18.5-33.2)
10-day	**9.43** (8.41-10.8)	**11.8** (10.6-13.6)	**14.7** (13.1-16.9)	**16.9** (14.9-19.5)	**19.6** (16.8-23.3)	**21.4** (18.1-25.9)	**23.2** (19.1-28.6)	**24.8** (20.0-31.4)	**26.9** (20.9-35.3)	**28.3** (21.3-38.3)
20-day	**13.0** (11.6-14.9)	**16.3** (14.5-18.7)	**20.1** (17.9-23.1)	**22.9** (20.2-26.5)	**26.3** (22.6-31.3)	**28.6** (24.1-34.7)	**30.8** (25.4-38.0)	**32.8** (26.4-41.5)	**35.2** (27.3-46.2)	**36.8** (27.8-49.9)
30-day	**16.5** (14.7-18.9)	**20.4** (18.2-23.4)	**24.9** (22.2-28.6)	**28.2** (24.9-32.6)	**32.2** (27.6-38.3)	**34.9** (29.4-42.2)	**37.3** (30.8-46.2)	**39.6** (31.9-50.2)	**42.3** (32.9-55.5)	**44.1** (33.3-59.7)
45-day	**21.5** (19.2-24.6)	**26.2** (23.4-30.0)	**31.6** (28.1-36.3)	**35.5** (31.4-41.0)	**40.2** (34.5-47.7)	**43.3** (36.5-52.4)	**46.1** (38.0-57.0)	**48.6** (39.2-61.6)	**51.7** (40.2-67.9)	**53.7** (40.5-72.7)
60-day	**26.0** (23.2-29.7)	**31.3** (27.9-35.8)	**37.3** (33.2-42.8)	**41.6** (36.8-48.1)	**46.7** (40.1-55.5)	**50.1** (42.2-60.7)	**53.2** (43.9-65.7)	**55.9** (45.1-70.9)	**59.2** (46.0-77.7)	**61.4** (46.3-83.1)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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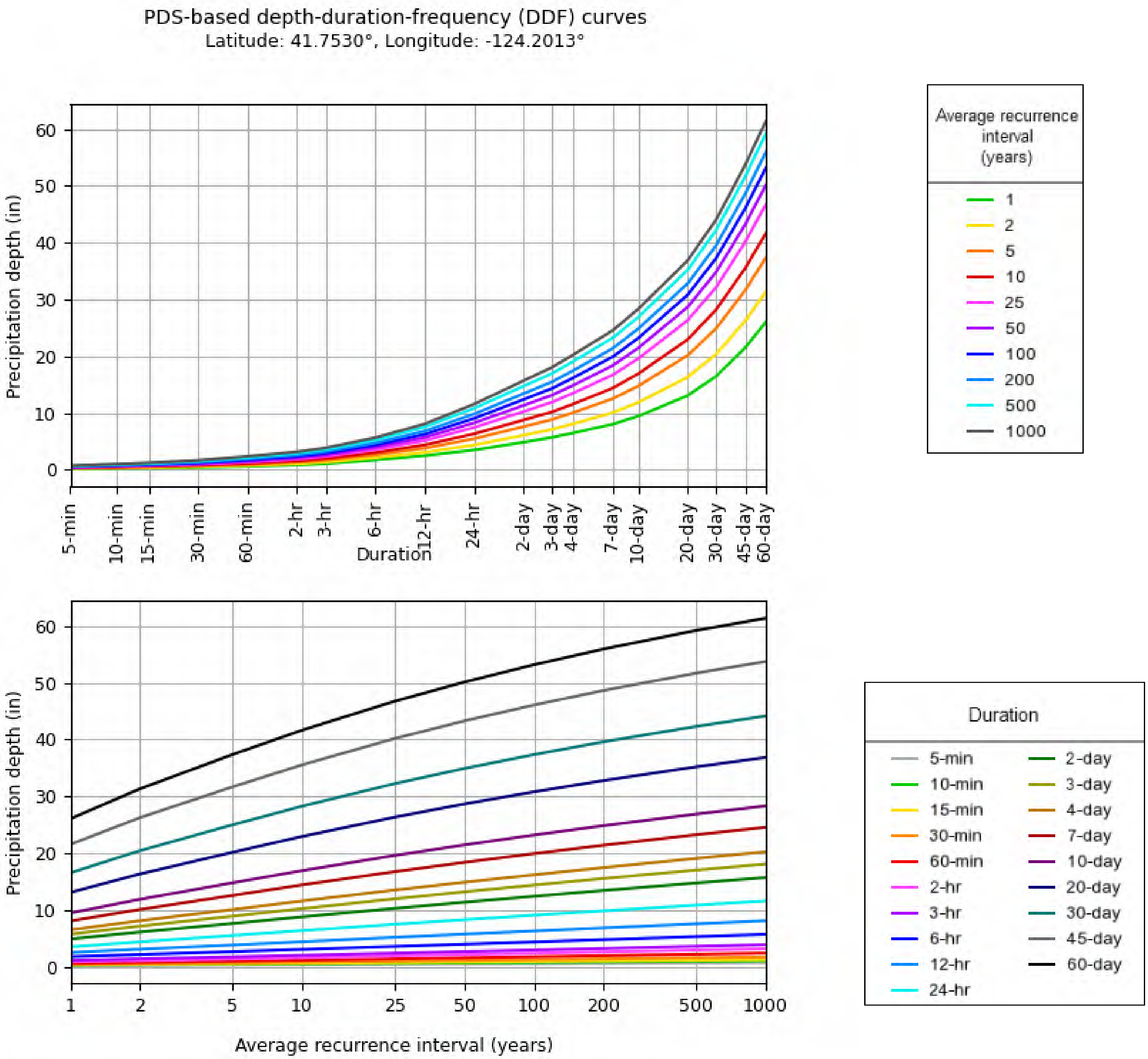
PF graphical



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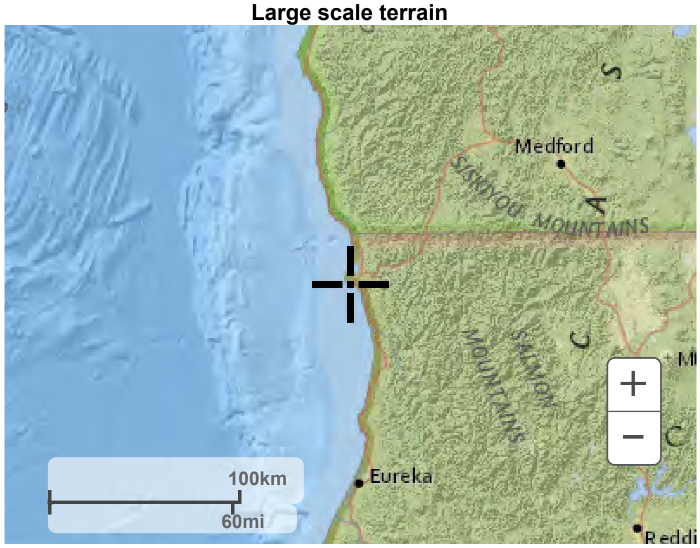
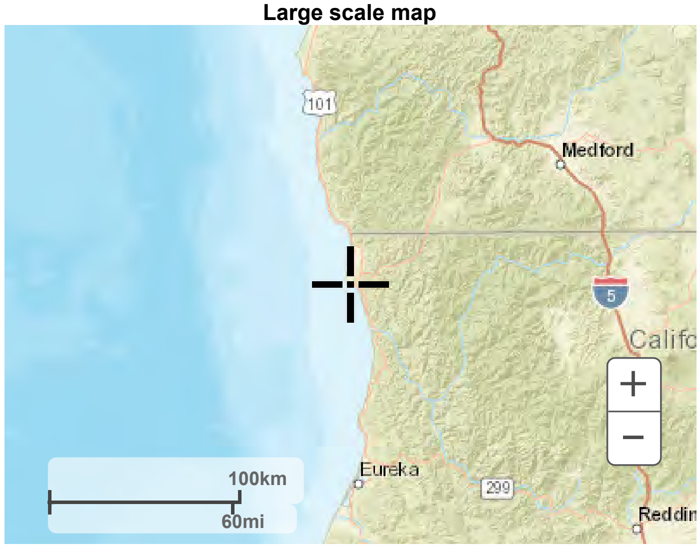
Maps & aerials

Small scale terrain

Large scale terrain



Large scale map



Large scale aerial

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Attachment 3

Subcatchment Parameters

Table 1 Subcatchment Parameters – Base Conditions

Name	Outlet	Area (ac)	Width (ft)	Flow Length (ft)	Slope (%)	Imperv. (%)	Curve Number
S1	DI182	5.2523	463.338	493.787	3.08	85	95.147
S10	DI056	1.8406	509.906	157.238	3.719	80	93.2
S11	I185	96.9426	412.874	10227.87	8.414	23.262	77.074
S11_1	DI215	94.0113	412.004	9939.545	6.677	33	80.865
S12	DI042	2.9905	471.716	276.154	1.566	63	89.109
S12_2	I192	9.8782	472.676	910.337	1.554	74	91.332
S13	I095	25.3853	503.295	2197.089	8.201	32.404	80.295
S14_1	DI050	0.7994	457.118	76.177	5.333	28	80.72
S14_2	DI064	0.9996	457.121	95.254	5.333	83	94.77
S14_3	DI062	1.3034	457.12	124.204	5.333	19	78.56
S14_4	DI066	1.8724	457.121	178.425	5.333	87	94.88
S14_5	DI063	4.2255	457.121	402.657	5.333	72	91.28
S14_6	DI065	1.0799	457.121	102.906	5.333	54	86.96
S14_8	DI067	0.7473	457.119	71.212	5.333	100	98
S14_9	DI068	6.2202	298.396	908.028	7.274	30	80.426
S15	DI069	5.8785	271.843	941.968	3.324	11	76.19
S16	DI052	3.4716	487.995	309.886	1.36	86	94.64
S16_1	DI209	0.8024	380.225	91.926	3.647	53	86.72
S16_3	DI200	1.2476	380.224	142.93	3.647	56	88.159
S17_1	DI516	1.8152	335.93	235.377	3.124	41	90.174
S17_2	DI214	3.5402	335.929	459.059	3.124	41	90.174
S18	DI071	7.6242	360.823	920.424	3.355	8	72.918
S19	DI072	6.3708	314.379	882.731	3.638	17	72.798
S2	I070	5.7114	438.889	566.86	6.688	19	77.596
S20	DI081	0.8733	370.78	102.597	4.067	48	85.97
S21_1	J42	0.1797	84.1	93.076	4.595	86	93.046
S21_2	DI075	0.6697	313.419	93.077	4.595	86	93.046
S22	DI142	11.047	372.523	1291.752	7.289	28	78.59
S22_1	DI105	2.3718	497.214	207.789	4.439	82	93.05
S22_3	DI107	1.9008	497.213	166.526	4.439	97	97.102
S22_5	DI106	0.8619	497.21	75.51	4.439	76	90.878
S23	DI120	0.1086	341.511	13.852	4.396	0	73.125
S24_1	DI082	1.1043	333.324	144.314	4.963	11	76.85

Name	Outlet	Area (ac)	Width (ft)	Flow Length (ft)	Slope (%)	Imperv. (%)	Curve Number
S24_2	J11	0.1747	52.732	144.313	4.963	11	76.85
S25_1	DI296	1	268.773	162.07	4.64	68	90.32
S25_2	DI299	0.9556	268.773	154.874	4.64	100	98
S25_4	DI165	51.2051	406.791	5483.145	6.078	39	82.884
S27	DI287	0.1103	378.052	12.709	3.983	100	98
S279_1	I113	1.9385	479.534	176.09	3.772	56	87.53
S279_3	DI500	9.9361	479.533	902.579	3.772	98	97.58
S279_4	DI499	4.9057	479.533	445.626	3.772	81	93.638
S28	DI313	0.3045	353.82	37.488	3.801	77	92.48
S28_1	DI251	9.7993	514.924	828.972	4.259	69	90.56
S29_2	J3	1.3823	104.466	576.388	5.27	59	88.16
S29_3	J4	1.0898	82.361	576.386	5.27	59	88.16
S29_4	DI367	1.02	77.086	576.385	5.27	59	88.16
S3	I092	4.0683	263.487	672.576	11.791	9	70.96
S3_10	DI189	1.3153	514.078	111.451	3.563	95	96.8
S3_11	DI208	2.6233	514.079	222.283	3.563	44	84.379
S3_2	DI237	4.7344	351.959	585.95	6.942	58	88.25
S3_5	DI238	2.4558	351.959	303.941	6.942	46	85.332
S3_6	CreekStorage	48.4091	351.959	5991.324	6.942	22	76.702
S3_7	DI191	1.6999	514.077	144.04	3.563	99	97.79
S3_8	DI193	2.4955	514.079	211.454	3.563	100	98
S3_9	DI194	9.6167	514.078	814.864	3.563	86	96.54
S30_1	DI361	1.9612	453.517	188.372	4.072	68	90.32
S30_2	DI530	0.2751	488.18	24.547	1.347	42	84.08
S30_3	DI051	1.3821	499.575	120.511	0.53	44	84.56
S30_5	DI531	1.3514	488.182	120.584	1.347	42	84.08
S30_6	DI044	1.3087	488.182	116.774	1.347	42	84.08
S31	DI054	5.6314	487.995	502.677	1.36	67	89.981
S31_1	DI043	2.8892	487.996	257.899	1.36	38	83.12
S31_3	DI053	5.2826	487.995	471.542	1.36	47	85.015
S31_4	DI045	2.2527	487.996	201.083	1.36	34	82.34
S31_5	DI046	2.7888	487.995	248.937	1.36	32	81.68
S31_8	DI047	5.4637	487.995	487.707	1.36	38	83.047
S31_9	DI054	0.4095	487.999	36.553	1.36	100	98
S32	DI037	4.0058	467.981	372.863	1.614	53	86.84
S33_1	J5	1.121	95.511	511.258	5.459	71	91.07
S33_2	DI030	2.0854	177.68	511.256	5.459	71	91.07

Name	Outlet	Area (ac)	Width (ft)	Flow Length (ft)	Slope (%)	Imperv. (%)	Curve Number
S338	I114	4.8968	383.045	556.866	4.835	40	83.66
S34	DI328	0.3436	378.084	39.587	5.135	100	98
S344_1	DI234	2.0572	364.173	246.069	9.894	41	82.983
S35	DI330	0.3459	376.046	40.068	5.044	99	97.79
S35_1	DI258	0.4024	490.295	35.751	5.665	66	89.218
S35_10	DI153	0.5448	490.29	48.403	5.665	100	98
S35_11	DI293	7.1321	490.294	633.649	5.665	14	77.033
S35_12	DI265	0.715	490.293	63.524	5.665	54	85.52
S35_14	DI070	2.034	490.294	180.71	5.665	78	92.72
S35_15	J29	1.0106	490.296	89.786	5.665	55	87.53
S35_16	DI263	0.3305	490.297	29.363	5.665	100	98
S35_17	DI099	2.4241	490.295	215.368	5.665	46	84.527
S35_18	DI488	0.3662	490.293	32.535	5.665	89	94.975
S35_19	DI276	0.1711	490.304	15.201	5.665	100	98
S35_2	DI256	2.0842	490.294	185.17	5.665	100	98
S35_20	DI267	0.5921	490.293	52.605	5.665	46	83.15
S35_21	DI268	0.5905	490.292	52.463	5.665	75	91.125
S35_22	DI283	1.6234	490.295	144.23	5.665	57	87.217
S35_23	DI273	0.3938	490.294	34.987	5.665	100	98
S35_24	DI275	0.3639	490.287	32.331	5.665	100	98
S35_25	DI270	0.5436	490.294	48.296	5.665	100	98
S35_26	DI274	0.7056	490.292	62.689	5.665	99	97.773
S35_27	DI277	0.5055	490.294	44.911	5.665	72	90.738
S35_28	DI284	0.9985	490.296	88.711	5.665	81	93.366
S35_29	DI301	1.9692	490.294	174.953	5.665	80	93.2
S35_3	DI259	1.375	490.296	122.161	5.665	53	86.21
S35_30	DI278	0.221	490.286	19.635	5.665	70	90.8
S35_31	DI282	0.1997	490.302	17.742	5.665	44	84.56
S35_32	DI285	0.4954	490.29	44.014	5.665	82	93.68
S35_33	DI300	1.1567	490.292	102.767	5.665	88	95.12
S35_34	DI302	1.1478	490.293	101.976	5.665	14	77.36
S35_35	DI159	0.5527	143.447	167.836	5.665	43	83.888
S35_36	DI297	2.2682	490.295	201.517	5.665	48	86.17
S35_37	J22	0.1729	102.344	73.59	5.665	95	76.88
S35_38	DI294	0.9065	490.292	80.538	5.665	84	94.16
S35_39	SP4	0.6554	387.95	73.59	5.665	12	76.88
S35_4	DI257	0.3167	490.296	28.137	5.665	92	95.95

Name	Outlet	Area (ac)	Width (ft)	Flow Length (ft)	Slope (%)	Imperv. (%)	Curve Number
S35_40	DI298	1.3581	490.294	120.66	5.665	77	92.48
S35_41	J25	0.5226	240.726	94.566	5.665	73	92.87
S35_42	DI122	0.979	254.089	167.836	5.665	43	83.888
S35_43	DI136	0.5419	249.616	94.566	5.665	73	92.87
S35_5	DI261	1.7953	490.293	159.503	5.665	33	81.403
S35_6	DI260	0.2506	490.304	22.264	5.665	100	98
S35_7	DI262	2.0398	490.295	181.225	5.665	80	92.883
S35_8	DI178	2.0936	490.294	186.005	5.665	38	83.1
S35_9	DI522	0.3574	92.759	167.836	5.665	43	83.888
S356_2	I111	4.8611	438.668	482.71	4.268	27	79.772
S356_3	DI229	2.1535	438.668	213.844	4.268	55	86.683
S356_4	DI230	2.3207	438.668	230.447	4.268	55	86.787
S36	DI306	0.4365	350.597	54.233	3.55	100	98
S37	DI032	1.1784	292.358	175.576	3.844	97	97.28
S37_1	DI248	1.0455	419.912	108.456	3.768	48	84.32
S37_2	DI264	0.9503	419.913	98.58	3.768	41	83.84
S38_1	DI288	0.9219	397.285	101.081	3.699	84	94.16
S38_11	DI505	0.7506	421.174	77.631	4.558	97	97.31
S38_12	I034	0.1502	421.159	15.535	4.558	96	97.04
S38_13	I536	3.7502	298.985	546.378	4.865	39	85.76
S38_14	DI101	0.5481	410.566	58.152	5.768	100	98
S38_15	DI166	0.1773	410.568	18.811	5.768	100	98
S38_16	DI173	3.3855	410.567	359.192	5.768	81	92.19
S38_17	DI169	0.4691	410.569	49.77	5.768	51	82.545
S38_18	DI168	3.6166	410.567	383.711	5.768	67	88.158
S38_19	DI172	0.2731	410.569	28.975	5.768	95	97.5
S38_2	DI295	0.5965	397.284	65.403	3.699	100	98
S38_20	DI161	2.0464	410.568	217.117	5.768	71	91.04
S38_21	DI160	0.979	410.568	103.869	5.768	84	93.948
S38_22	DI135	1.4376	410.568	152.525	5.768	96	96.95
S38_23	DI171	0.8286	410.568	87.912	5.768	70	91.406
S38_24	DI167	1.9404	410.567	205.871	5.768	8	78.22
S38_25	DI156	0.9018	410.569	95.678	5.768	69	90.2
S38_26	DI084	0.5324	410.568	56.486	5.768	100	98
S38_27	DI157	1.0765	410.566	114.214	5.768	81	93.44
S38_28	DI155	1.1017	410.568	116.887	5.768	95	96.799
S38_29	DI139	2.6435	410.567	280.468	5.768	99	97.738

Name	Outlet	Area (ac)	Width (ft)	Flow Length (ft)	Slope (%)	Imperv. (%)	Curve Number
S38_3	DI281	0.9353	397.286	102.55	3.699	88	95.12
S38_30	DI083	1.4611	410.566	155.019	5.768	67	90.666
S38_31	DI141	2.8793	410.566	305.486	5.768	87	94.425
S38_32	DI149	0.9173	410.567	97.323	5.768	93	96.31
S38_33	DI079	0.1442	88.032	71.353	4.558	66	91.157
S38_34	DI146	1.0602	410.568	112.484	5.768	99	97.779
S38_35	DI144	0.6915	410.568	73.366	5.768	100	98
S38_36	DI145	0.5402	410.565	57.314	5.768	100	98
S38_37	DI147	1.1594	410.567	123.009	5.768	98	97.488
S38_38	DI154	1.9496	410.567	206.847	5.768	96	97.011
S38_39	DI148	0.879	410.569	93.259	5.768	100	98
S38_4	DI218	0.5672	397.286	62.19	3.699	15	77.6
S38_40	DI140	0.6892	410.568	73.122	5.768	82	94.154
S38_41	DI150	0.3359	410.567	35.638	5.768	100	98
S38_42	DI138	5.0878	410.567	539.801	5.768	92	95.88
S38_43	DI092	1.0454	410.567	110.914	5.768	100	98
S38_44	DI137	0.5424	410.568	57.547	5.768	95	96.838
S38_45	DI134	2.5499	410.567	270.537	5.768	100	98
S38_46	DI089	0.4207	410.568	44.635	5.768	100	98
S38_47	DI132	0.3673	410.572	38.969	5.768	100	98
S38_48	DI143	0.5091	410.568	54.014	5.768	98	97.58
S38_49	DI133	0.3173	410.563	33.665	5.768	100	98
S38_5	DI504	0.5462	421.173	56.491	4.558	100	98
S38_50	DI091	0.4918	410.564	52.179	5.768	100	98
S38_51	J10	0.5344	410.569	56.698	5.768	100	98
S38_52	DI128	7.2386	410.567	767.995	5.768	76	91.64
S38_53	DI103	0.2024	410.568	21.474	5.768	100	98
S38_54	DI095	0.5654	410.569	59.987	5.768	100	98
S38_55	DI123	0.8139	410.569	86.352	5.768	100	98
S38_56	DI100	0.7427	410.569	78.798	5.768	22	76.55
S38_57	DI503	0.6559	410.568	69.589	5.768	6	72.15
S38_58	DI125	0.4436	410.564	47.065	5.768	100	98
S38_59	DI124	0.0637	410.591	6.758	5.768	90	95.25
S38_6	DI227	0.5629	397.283	61.719	3.699	10	76.4
S38_60	DI098	0.1104	410.572	11.713	5.768	100	98
S38_61	DI104	0.2156	410.559	22.875	5.768	60	87
S38_62	I049	1.8853	410.567	200.025	5.768	38	73.729

Name	Outlet	Area (ac)	Width (ft)	Flow Length (ft)	Slope (%)	Imperv. (%)	Curve Number
S38_63	DI501	3.3371	483.461	300.674	4.65	51	82.68
S38_64	DI130	0.9467	410.568	100.442	5.768	95	96.646
S38_65	DI102	0.8996	410.567	95.445	5.768	0	70.5
S38_66	DI131	0.4092	410.567	43.415	5.768	96	96.9
S38_67	DI096	0.758	410.565	80.422	5.768	100	98
S38_68	DI093	1.0422	410.569	110.574	5.768	97	97.175
S38_69	DI090	0.4629	410.57	49.112	5.768	86	94.47
S38_7	MH053	0.8637	360.987	104.222	4.558	97	97.37
S38_70	I063	13.3646	410.567	1417.946	5.768	10	73.37
S38_71	DI097	0.4956	410.565	52.582	5.768	100	98
S38_72	DI129	0.8784	410.566	93.196	5.768	97	97.175
S38_73	DI126	1.6033	410.566	170.106	5.768	30	80.19
S38_74	DI127	0.5453	410.566	57.855	5.768	100	98
S38_75	I707	0.5349	410.57	56.751	5.768	38	73.729
S38_76	I060	1.6068	483.462	144.773	4.65	51	82.68
S38_77	DI086	0.0612	112.271	23.745	5.768	100	98
S38_78	DI088	0.1627	298.472	23.745	5.768	100	98
S38_79	J39	0.5457	333.142	71.353	4.558	66	91.157
S38_8	DI537	0.8917	298.986	129.914	4.865	0	75.8
S38_80	DI078	0.144	60.185	104.223	4.558	97	97.37
S38_9	DI489	0.5723	421.176	59.19	4.558	100	98
S39	DI207	3.7809	388.993	423.391	3.739	100	98
S39_1	DI312	7.3804	336.71	954.799	3.62	33	82.86
S39_10	DI205	1.1276	388.994	126.27	3.739	91	95.71
S39_11	DI203	15.4854	388.993	1734.078	3.739	54	86.698
S39_3	DI206	11.2608	388.993	1261.001	3.739	89	95.354
S39_4	DI204	15.2926	388.993	1712.488	3.739	63	88.918
S39_5	DI195	2.5264	388.993	282.91	3.739	100	98
S39_6	DI199	0.1583	388.986	17.727	3.739	100	98
S39_7	DI198	0.3359	388.989	37.615	3.739	100	98
S39_8	DI197	1.5265	388.992	170.94	3.739	98	97.52
S39_9	DI196	1.8745	388.993	209.909	3.739	97	97.28
S398	DI231	4.7467	407.779	507.055	3.845	59	87.33
S4	DI244	6.2693	315.424	865.789	3.772	38	83.12
S40	DI109	7.2392	480.918	655.703	8.482	48	75.844
S407_1	DI213	4.7348	333.967	617.57	4.399	28	81.655
S41	DI031	6.1612	467.98	573.49	1.614	21	77.63

Name	Outlet	Area (ac)	Width (ft)	Flow Length (ft)	Slope (%)	Imperv. (%)	Curve Number
S41_1	DI235	0.6468	407.743	69.099	10.224	98	97.465
S41_2	DI236	4.4102	407.74	471.154	10.224	19	76.319
S42	DI158	8.2121	381.275	938.218	4.605	58	87.92
S43	DI003	0.4504	504.68	38.875	5.596	89	95.358
S430	DI232	2.7773	317.659	380.846	6.861	75	91.848
S433_1	DI217	2.0129	336.083	260.894	5.662	96	96.9
S433_3	DI216	0.6034	336.084	78.207	5.662	49	87.035
S433_4	I103	4.7217	336.083	611.984	5.662	13	74.66
S44	DI335	4.7355	362.926	568.376	4.416	35.704	61.432
S45	DI359	7.7188	440.303	763.635	4.081	5.299	75.934
S456	I105	0.8379	130.39	279.921	14.847	22	73.535
S461_1	DI222	0.9753	279.462	152.021	4.58	59	87.765
S461_3	DI224	3.7447	279.462	583.69	4.58	68	89.752
S461_4	DI223	1.3558	279.462	211.33	4.58	74	91.039
S462	DI498	6.4382	517.619	541.804	3.543	72	91.443
S484_1	DI226	0.9227	231.381	173.708	5.741	40	83.06
S484_2	DI225	2.6646	231.382	501.638	5.741	71	90.042
S5	DI536	10.0792	344.749	1273.535	4.506	42	85.48
S5_1	DI242	0.6639	311.73	92.771	3.818	83	96.13
S5_2	DI249	7.9316	311.729	1108.336	3.818	40	83.78
S5_3	DI245	0.4244	311.73	59.304	3.818	84	94.94
S5_4	DI241	7.6675	350.819	952.047	3.327	69	90.56
S5_5	DI243	0.4917	311.727	68.709	3.818	89	96.79
S5_6	DI247	1.5721	311.729	219.68	3.818	0	82.6
S5_7	DI240	0.8227	261.89	136.839	3.303	100	98
S5_8	DI239	1.2114	261.891	201.491	3.303	36	83.27
S517	DI221	2.5175	388.647	282.164	9.216	9	73.685
S597_1	DI190	0.6415	499.969	55.891	5.072	89	95.36
S597_2	DI181	1.4558	499.966	126.838	5.072	84	94.033
S597_3	DI374	0.4553	499.971	39.668	5.072	79	92.96
S6	DI021	0.8988	504.962	77.534	5.597	9	76.16
S6_1	DI525	1.3546	504.962	116.853	5.597	50	86
S6_10	DI254	2.8169	364.381	336.747	3.151	82	93.68
S6_13	DI035	2.9427	467.98	273.909	1.614	69	90.56
S6_14	DI039	2.8417	467.98	264.508	1.614	71	91.04
S6_16	DI040	2.8737	467.979	267.487	1.614	69	90.56
S6_17	DI031	0.2541	467.977	23.652	1.614	100	98

Name	Outlet	Area (ac)	Width (ft)	Flow Length (ft)	Slope (%)	Imperv. (%)	Curve Number
S6_18	DI041	3.2801	467.979	305.315	1.614	71	91.039
S6_2	DI057	8.4862	358.617	1030.79	4.892	54	86.96
S6_20	DI372	0.3057	467.977	28.455	1.614	100	98
S6_23	DI360	4.3802	364.381	523.632	3.151	11	77.03
S6_24	DI371	4.1458	467.98	385.895	1.614	38	82.194
S6_25	I004	1.6487	467.981	153.462	1.614	53	85.075
S6_26	DI029	0.3089	467.975	28.753	1.614	62	88.622
S6_27	DI368	0.45	467.985	41.886	1.614	26	77.65
S6_28	DI370	2.011	467.979	187.186	1.614	31	79.025
S6_29	DI369	0.5595	467.978	52.079	1.614	50	84.25
S6_3	DI491	1.8815	449.091	182.498	4.11	59	88.16
S6_30	DI365	0.9296	467.98	86.528	1.614	54	85.35
S6_31	DI001	0.8977	449.211	87.05	3.806	78	92.72
S6_32	DI366	1.6488	467.979	153.472	1.614	57	86.175
S6_33	DI023	1.9811	467.979	184.403	1.614	39	80.73
S6_34	DI022	1.665	467.979	154.98	1.614	64	88.567
S6_35	DI018	2.6848	421.833	277.242	7.488	50	86.92
S6_36	DI025	1.1269	449.209	109.276	3.806	46	83.84
S6_37	DI002	0.2694	449.206	26.124	3.806	100	98
S6_38	DI024	1.8562	449.21	179.996	3.806	57	87.856
S6_39	DI002	6.6302	449.211	642.931	3.806	48	85.053
S6_4	DI524	0.5043	504.961	43.503	5.597	50	86
S6_40	DI116	0.7343	275.031	116.3	5.62	36	80.405
S6_42	DI020	1.5163	421.832	156.579	7.488	13	76.675
S6_43	DI016	2.0582	275.032	325.981	5.62	29	79.836
S6_44	DI017	1.9938	275.032	315.781	5.62	49	85.403
S6_45	DI353	5.9646	364.381	713.039	3.151	0	75.17
S6_46	DI014	1.2837	275.033	203.314	5.62	53	85.081
S6_47	DI007	2.1521	504.964	185.648	5.597	42	84.08
S6_48	DI019	0.2413	504.974	20.815	5.597	19	78.56
S6_5	DI034	1.1897	467.981	110.738	1.614	51	86.24
S6_50	DI009	1.941	504.963	167.438	5.597	67	90.34
S6_52	DI036	0.5684	504.966	49.032	5.597	9	76.16
S6_53	DI034	4.1795	467.98	389.032	1.614	62	88.88
S6_54	DI008	0.457	504.957	39.423	5.597	15	77.6
S6_55	DI373	3.2072	467.98	298.529	1.614	63	88.876
S6_6	DI033	5.9881	467.98	557.378	1.614	72	91.28

Name	Outlet	Area (ac)	Width (ft)	Flow Length (ft)	Slope (%)	Imperv. (%)	Curve Number
S6_7	DI322	2.4704	364.382	295.324	3.151	29	83.17
S6_8	DI253	0.3042	364.377	36.366	3.151	100	98
S6_9	DI255	2.2449	364.381	268.367	3.151	79	92.96
S613_1	DI188	0.3118	345.493	39.312	4.411	100	98
S613_2	DI187	2.419	345.492	304.99	4.411	91	95.798
S626	DI183	0.7148	176.868	176.045	8.903	12	79.276
S650_1	J2	2.2491	214.581	456.568	6.663	82	94.1
S650_2	DI184	0.3382	214.58	68.655	6.663	82	94.1
S653	DI186	6.1661	496.34	541.152	7.765	64	90.159
S692	DI363	3.3823	222.995	660.701	3.939	61	88.64
S7	DI085	0.629	375.553	72.957	4.618	0	77.9
S7_6	DI119	0.7056	497.208	61.817	4.451	100	98
S712	I087	1.7953	242.664	322.27	4.37	74	91.493
S714_2	DI179	0.5739	275.172	90.849	9.801	100	98
S714_3	DI177	1.4771	275.172	233.826	9.801	80	92.5
S714_4	DI176	0.3764	275.174	59.584	9.801	100	98
S714_5	DI180	0.4174	275.171	66.075	9.801	98	97.453
S714_6	DI511	0.3073	275.171	48.646	9.801	98	97.453
S741_3	DI163	0.8852	600.678	64.193	3.336	100	98
S741_4	DI162	0.9569	600.674	69.393	3.336	21	79.04
S741_5	DI164	1.2751	600.677	92.468	3.336	71	91.04
S750	DI174	4.446	292.579	661.933	4.434	72	90.602
S771	DI252	6.9228	475.579	634.084	4.605	58	88.19
S776	DI515	3.4601	274.764	548.551	10.047	0	67.305
S797_2	DI060	0.9738	366.219	115.829	4.111	54	86.96
S797_4	DI058	2.9662	366.218	352.816	4.111	56	87.44
S797_5	DI059	1.791	366.219	213.031	4.111	35	82.4
S8	DI038	3.0966	467.981	288.234	1.614	56	87.437
S8_1	DI344	3.1517	374.299	366.787	3.43	53	88.93
S8_11	DI233	2.7734	226.081	534.363	4.5	72	91.28
S8_13	DI250	0.5304	419.916	55.021	3.768	100	98
S8_16	DI333	0.4784	374.299	55.675	3.43	89	95.36
S8_5	DI272	2.0186	292.358	300.762	3.844	76	92.24
S8_8	DI185	2.97	226.081	572.243	4.5	44	84.56
S821_1	DI351	1.9802	256.286	336.567	6.035	81	93.081
S821_2	DI350	1.1485	256.286	195.206	6.035	87	94.523
S821_4	DI152	1.0733	256.286	182.425	6.035	73	91.479

Name	Outlet	Area (ac)	Width (ft)	Flow Length (ft)	Slope (%)	Imperv. (%)	Curve Number
S821_5	DI151	0.744	256.286	126.455	6.035	19	77.624
S824	DI316	0.135	378.052	15.555	3.983	100	98
S824_1	DI266	6.1558	378.061	709.268	3.983	70	90.753
S824_10	DI280	0.3167	378.061	36.49	3.983	96	96.9
S824_11	DI286	0.1972	378.066	22.721	3.983	100	98
S824_12	DI291	0.2612	378.065	30.095	3.983	94	96.414
S824_13	DI290	0.3765	378.062	43.38	3.983	91	95.649
S824_14	DI496	0.9248	378.061	106.555	3.983	100	98
S824_2	DI305	0.7034	378.063	81.045	3.983	38	83.12
S824_3	DI307	1.1215	378.06	129.219	3.983	100	98
S824_4	DI289	0.7194	378.061	82.889	3.983	100	98
S824_6	DI303	0.9836	378.061	113.33	3.983	100	98
S824_7	DI292	0.1602	378.064	18.458	3.983	100	98
S824_8	DI317	0.9126	378.062	105.149	3.983	100	98
S824_9	DI279	2.0547	378.06	236.742	3.983	46	88.225
S832_3	DI061	2.7619	461.909	260.459	3.956	28	81.64
S838_1	DI357	1.9944	379.594	228.866	5.324	34	85.46
S838_3	DI356	0.2684	379.594	30.8	5.324	100	98
S838_4	DI358	1.9088	379.594	219.043	5.324	44	83.511
S853_2	DI352	1.3046	190.018	299.068	4.529	82	93.143
S853_3	DI355	0.2502	190.019	57.356	4.529	100	98
S853_4	DI354	1.6898	190.018	387.372	4.529	87	94.693
S856_1	DI345	0.2469	402.205	26.74	6.204	100	98
S856_10	DI339	0.8451	402.209	91.526	6.204	94	96.558
S856_11	DI341	0.6823	402.206	73.895	6.204	35	82.97
S856_12	DI340	0.3646	402.208	39.487	6.204	52	86.75
S856_13	DI348	0.4612	402.208	49.949	6.204	71	91.04
S856_2	DI329	0.7456	402.208	80.75	6.204	67	90.08
S856_3	DI346	0.2308	402.21	24.996	6.204	100	98
S856_4	DI347	0.0633	402.18	6.856	6.204	50	86
S856_5	DI342	0.1074	402.196	11.632	6.204	100	98
S856_6	DI338	1.7024	402.207	184.374	6.204	72	93.698
S856_8	DI349	0.1614	402.207	17.48	6.204	100	98
S856_9	DI343	1.3759	402.208	149.013	6.204	51	86.48
S864_1	DI321	0.2069	351.381	25.649	3.824	100	98
S864_10	DI326	0.4762	351.384	59.033	3.824	100	98
S864_11	DI494	0.6229	291.098	93.211	3.824	100	98

Name	Outlet	Area (ac)	Width (ft)	Flow Length (ft)	Slope (%)	Imperv. (%)	Curve Number
S864_12	DI332	0.5224	351.38	64.761	3.824	100	98
S864_13	J16	0.1289	60.238	93.212	3.824	100	98
S864_2	DI535	0.5059	351.383	62.715	3.824	95	96.8
S864_3	DI495	0.2207	351.378	27.36	3.824	92	96.08
S864_4	DI324	0.9958	351.382	123.447	3.824	100	98
S864_5	J9	0.6557	140.902	202.71	3.824	95	96.95
S864_6	DI323	0.1112	351.387	13.785	3.824	100	98
S864_7	DI315	0.534	351.381	66.199	3.824	100	98
S864_8	DI331	0.9795	210.482	202.711	3.824	95	96.95
S864_9	DI325	0.3999	351.38	49.575	3.824	100	98
S868	DI110	0.5761	479.579	52.327	5.9	89	94.975
S868_10	DI111	0.7281	479.572	66.134	5.9	100	98
S868_2	DI114	0.3976	479.577	36.114	5.9	100	98
S868_4	DI115	0.0637	479.567	5.786	5.9	100	98
S868_5	DI112	0.1405	479.563	12.762	5.9	100	98
S868_6	DI117	0.1249	479.563	11.345	5.9	100	98
S868_8	DI113	0.2034	479.573	18.475	5.9	100	98
S869	DI318	0.4382	365.593	52.211	4.581	100	98
S869_3	DI327	0.7028	365.592	83.738	4.581	77	92.48
S869_4	DI320	2.0024	365.594	238.583	4.581	92	96.08
S872_4	DI077	0.8335	561.649	64.644	5.133	55	85.399
S880_1	J36	1.7899	356.184	218.898	3.779	83	94.07
S880_2	DI314	0.1928	356.18	23.579	3.779	91	95.84
S880_3	DI538	0.4886	356.184	59.754	3.779	91	95.84
S880_4	J33	2.128	356.185	260.246	3.779	97	97.28
S880_8	DI311	1.315	356.186	160.819	3.779	79	92.96
S886_3	DI121	3.5221	310.811	493.62	2.929	59	83.71
S890	DI336	0.4765	545.616	38.042	3.814	10	50.212
S890_1	J46	0.201	142.761	61.33	3.814	82	89.29
S890_2	DI334	2.4155	545.618	192.844	3.814	0	73.255
S890_3	DI337	0.5672	402.857	61.33	3.814	82	89.29
S890_4	J44	0.2306	545.624	18.41	3.814	100	98
S890_5	DI073	1.4347	545.617	114.541	3.814	40	83.587
S890_7	DI073	0.3101	545.622	24.757	3.814	100	98
S890_9	J45	0.1587	545.617	12.67	3.814	50	86
S892_1	DI364	2.0336	424.558	208.649	5.411	55	86.021
S892_2	DI028	0.7737	424.559	79.382	5.411	43	83.304

Name	Outlet	Area (ac)	Width (ft)	Flow Length (ft)	Slope (%)	Imperv. (%)	Curve Number
S892_4	DI490	0.3192	424.56	32.75	5.411	70	89.75
S892_6	DI027	1.0503	424.561	107.761	5.411	60	87.832
S892_7	DI026	0.8165	424.561	83.773	5.411	38	83.148
S893	DI076	0.1604	404.459	17.275	6.091	100	98
S893_1	DI015	1.9871	404.469	214.004	6.091	61	87.428
S893_3	DI013	2.0627	404.469	222.146	6.091	67	90.08
S893_4	DI094	1.1656	404.47	125.531	6.091	53	86.72
S893_5	DI080	1.2799	404.469	137.841	6.091	60	88.4
S893_6	DI012	1.0968	404.468	118.122	6.091	65	89.56
S893_7	DI011	0.9321	404.47	100.384	6.091	85	94.4
S9	DI175	6.9755	321.846	944.094	4.201	32	83.052
S908_1	DI006	1.6164	379.923	185.328	8.226	52	86.48
S927_2	DI005	1.3621	229.55	258.476	4.748	35	81.305
S995	DI049	1.5188	499.999	132.318	0.5	67	90.08
S995_3	DI048	1.5715	500	136.909	0.5	73	91.62

Attachment 4

SCS Curve Numbers

Figure 1 Soils Data Boundary

SCS curve numbers

	Hydrologic Soil Group1			
Land Use Description	**A**	**B**	**C**	**D**
Cultivated land				
Without conservation treatment	72	81	88	91
With conservation treatment	62	71	78	81
Pasture or range land				
Poor condition	68	79	86	89
Good condition	39	61	74	80
Meadow				
Good condition	30	58	71	78
Wood or forest land				
Thin stand, poor cover, no mulch	45	66	77	83
Good cover[2]	25	55	70	77
Open spaces, lawns, parks, golf courses, cemeteries, etc.				
Good condition: grass cover on 75% or more of the area	39	61	74	80
Fair condition: grass cover on 50 - 75% of the area	49	69	79	84
Commercial and business areas (85% impervious)	89	92	94	95
Industrial districts (72% impervious)	81	88	91	93
Residential[3] Average lot size (% Impervious[4])				
1/8 ac or less (65)	77	85	90	92
1/4 ac (38)	61	75	83	87
1/3 ac (30)	57	72	81	86
1/2 ac (25)	54	70	80	85
1 ac (20)	51	68	79	84
Paved parking lots, roofs, driveways, etc.[5]	98	98	98	98
Streets and roads				
Paved with curbs and storm sewers[5]	98	98	98	98
Gravel	76	85	89	91
Dirt	72	82	87	89

1. Antecedent moisture condition II; Source: SCS Urban Hydrology for Small Watersheds, 2nd Ed., (TR-55), June 1986.

2. Good cover is protected from grazing and litter and brush cover soil.

3. Curve numbers are computed assuming that the runoff from the house and driveway is directed toward the street with a minimum of roof water directed to lawns where additional infiltration could occur.

4. The remaining pervious areas (lawn) are considered to be in good pasture condition for these curve numbers.

5. In some warmer climates of the country a curve number of 95 may be used.

Disclaimer

The values listed here were transcribed from the original reference(s) cited; CHI does not guarantee their accuracy, completeness or suitability for any purpose. The reader should read the source document(s) to understand the limitations and appropriateness of the information. The modeler is obligated to verify the applicability of these and all attributes/parameters used in their models. Professional engineering judgement must be used throughout the modeling exercise.

Land Use Description	A	B	C	D
1 ac (20)	51	68	79	84
1/2 ac (25)	54	70	80	85
1/3 ac (30)	57	72	81	86
1/4 ac (38)	61	75	83	87
1/8 ac or less (65)	77	85	90	92
Commercial and business areas (85% impervious)	89	92	94	95
Dirt	72	82	87	89
Fair condition: grass cover on 50 - 75% of the area	49	69	79	84
Good condition	39	61	74	80
Good condition	30	58	71	78
Good condition: grass cover on 75% or more of the area	39	61	74	80
Good cover[2]	25	55	70	77
Gravel	76	85	89	91
Industrial districts (72% impervious)	81	88	91	93
Paved parking lots, roofs, driveways, etc.[5]	98	98	98	98
Paved with curbs and storm sewers[5]	98	98	98	98
Poor condition	68	79	86	89
Thin stand, poor cover, no mulch	45	66	77	83
With conservation treatment	62	71	78	81
Without conservation treatment	72	81	88	91

NRCS hydrologic soil group definitions

Group	Meaning	Saturated Hydraulic Conductivity (in/hr)	Saturated Hydraulic Conductivity (mm/hr)
A	Low runoff potential. Soils having high infiltration rates even when thoroughly wetted and consisting chiefly of deep, well to excessively drained sands or gravels.	≥ 0.45	≥ 11.43
B	Soils having moderate infiltration rates when thoroughly wetted and consisting chiefly of moderately deep to deep, moderately well to well-drained soils with moderately fine to moderately coarse textures. E.g., shallow loess, sandy loam.	0.30 - 0.15	7.62-3.81
C	Soils having slow infiltration rates when thoroughly wetted and consisting chiefly of soils with a layer that impedes downward movement of water, or soils with moderately fine to fine textures. E.g., clay loams, shallow sandy loam.	0.15 - 0.05	3.81-1.27
D	High runoff potential. Soils having very slow infiltration rates when thoroughly wetted and consisting chiefly of clay soils with a high swelling potential, soils with a permanent high water table, soils with a clay-pan or clay layer at or near the surface, and shallow soils over nearly impervious material.	0.05 - 0.00	1.27-0.00

Source: Hydrology National Engineering Handbook, Chapter 7, Natural Resources Conservation Service, U.S. Department of Agriculture, January 2009.

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Attachment 5

Base Condition Model Data

Base Conditions Conduit Summary

Name	Tag	Inlet Node	Outlet Node	Length (ft)	Roughness	Inlet Offset (ft)	Outlet Offset (ft)	Entry Loss Coeff.	Exit Loss Coeff.	Cross-Section	Geom1 (ft)	Geom2 (ft)	Barrels	Slope (ft/ft)	Street	Transect	Left Bank Roughness	Right Bank Roughness	Channel Roughness
C534_1	Overland	I536	DI537	560.294	0.06	0	0	0.1	0.1	IRREGULAR	0	0	1	2.31%		Ehoover	0.35	0.35	0.32
C534_2	Overland	DI537	I115	175.039	0.06	0	0	0.1	0.1	IRREGULAR	0	0	1	0.00%		Ehoover	0.35	0.35	0.32
C536	Overland	I114	I113	226.487	0.06	0	0	0.1	0.1	IRREGULAR	0	0	1	0.37%		Ehoover2	0.35	0.35	0.32
C33	Overland	I009	I060	665.603	0.06	0	0	0.1	0.1	IRREGULAR	0	0	1	-0.35%		ElkCreek	0.25	0.25	0.2
C50	Overland	I189	I009	1287.5	0.06	0	0	0.1	0.1	IRREGULAR	0	0	1	0.34%		ElkCreek	0.25	0.25	0.2
C54	Overland	I707	SP7	40.038	0.06	0	0	0.1	0.1	IRREGULAR	0	0	1	0.45%		S101-c54	0.15	0.15	0.15
C55	Overland	SP7	I049	190.502	0.06	0	0	0.1	0.1	IRREGULAR	0	0	1	3.04%		S101-c55	0.15	0.15	0.15
C11	Overland	I185	I183	1956.473	0.06	0	0	0.1	0.1	IRREGULAR	0	0	1	-0.26%		T-C11	0.4	0.4	0.6
C29	Overland	I183	I095	55.109	0.06	0	0	0.1	0.1	IRREGULAR	0	0	1	3.63%		T-C11	0.4	0.4	0.6
C15	Overland	I101	DI183	1358.822	0.06	0	0	0.1	0.1	IRREGULAR	0	0	1	1.20%		T-C15	0.15	0.15	0.15
C17	Street	DI514	DI199	59.924	0.017	0	0	0.1	0.1	IRREGULAR	0	0	1	-0.35%		T-C1-7Wilson-rd	0.011	0.011	0.011
C19	Overland	I002	I087	458.282	0.06	0	0	0.1	0.1	IRREGULAR	0	0	1	0.22%		T-C19-2	0.4	0.4	0.6
C614	Overland	I029	I190	69.259	0.06	0	0	0.1	0.1	IRREGULAR	0	0	1	-1.44%		T-C20	0.13	0.13	0.13
C615	Overland	I030	I190	72.374	0.06	0	0	0.1	0.1	IRREGULAR	0	0	1	-1.38%		T-C20	0.13	0.13	0.13
C20	Overland	I190	OF4	107.936	0.06	0	0	0.1	0.1	IRREGULAR	0	0	1	0.37%		T-C20-2	0.13	0.13	0.13
C33_1	Overland	DI512	I188	84.016	0.06	0	0	0.1	0.1	IRREGULAR	0	0	1	0.00%		T-C33_1	0.35	0.35	0.32
C33_4	Overland	SP1	I092	197.746	0.06	0	0	0.1	0.1	IRREGULAR	0	0	1	0.00%		T-C33_2	0.35	0.35	0.32
C33_5	Overland	I188	SP1	225.722	0.06	0	0	0	0.1	IRREGULAR	0	0	1	0.00%		T-C33_2	0.35	0.35	0.32
C37	Overland	I186	DI515	461.409	0.06	0	0	0.1	0.1	IRREGULAR	0	0	1	-0.98%		T-C37	0.4	0.4	0.6
C56	Overland	I186	I070	450.069	0.06	0	0	0	0	IRREGULAR	0	0	1	-1.11%		T-C37	0.4	0.4	0.6
C9	Overland	I086	I186	215.742	0.06	0	0	0.1	0.1	IRREGULAR	0	0	1	3.30%		T-C37	0.4	0.4	0.6
C3	Overland	I123	DI537	275.57	0.06	0	0	0.1	0.1	IRREGULAR	0	0	1	-0.36%		T-C3swale	0.05	0.04	0.05
C5_1	Overland	I103	OF1	344.337	0.06	0	0	0.1	0.1	IRREGULAR	0	0	1	1.10%		T-C5_1	0.4	0.4	0.6
C507	Overland	I102	I103	31.137	0.06	0	0	0.1	0.1	IRREGULAR	0	0	1	29.27%		T-C507	0.04	0.04	0.06
C6	Overland	I063	I009	389.49	0.06	0	0	0.1	0.1	IRREGULAR	0	0	1	1.26%		T-C6	0.04	0.04	0.06
C6_2	Overland	I057	I009	350.038	0.06	0	0	0.1	0.1	IRREGULAR	0	0	1	0.82%		T-C6_2	0.04	0.04	0.06
C624	Overland	I112	CreekStorage	159.206	0.06	0	0	0.1	0.1	IRREGULAR	0	0	1	8.58%		T-C624	0.04	0.04	0.06
C622	Overland	I116	CreekStorage	881.373	0.06	0	0	0.1	0.1	IRREGULAR	0	0	1	2.40%		T-C626	0.04	0.04	0.06
C626	Overland	CreekStorage	I110	820.339	0.06	0	0	0.1	0.1	IRREGULAR	0	0	1	0.00%		T-C626	0.04	0.04	0.06
C627	Overland	I110	I185	472.66	0.06	0	0	0.1	0.1	IRREGULAR	0	0	1	1.66%		T-C627	0.04	0.04	0.06
C707_1	Overland	I105	I185	187.228	0.06	0	0	0.1	0.1	IRREGULAR	0	0	1	4.69%		T-C707_1	0.04	0.04	0.06
C9_1	Overland	I087	I186	310.92	0.06	0	0	0.1	0.1	IRREGULAR	0	0	1	1.33%		T-C9_1	0.04	0.04	0.06
C5	Overland	I049	OF3	72.879	0.06	0	0	0.1	0.1	IRREGULAR	0	0	1	2.20%		Transect1	0.04	0.04	0.06
C51	Overland	I191	OF9	68.176	0.06	0	0	0.1	0.1	IRREGULAR	0	0	1	22.21%		Transect4	0.04	0.04	0.06
C52	Overland	I192	OF5	24.053	0.06	0	0	0.1	0.1	IRREGULAR	0	0	1	16.87%		Transect5	0.04	0.04	0.06
C53	Overland	I193	OF2	87.235	0.06	0	0	0.1	0.1	IRREGULAR	0	0	1	0.57%		Transect6	0.04	0.04	0.06
C001	Closed-Conduit	DI018	I038	74.026	0.012	1.7	0	0.1	0.1	CIRCULAR	1	0	1	5.21%					
C002	Closed-Conduit	DI019	MH015	85.566	0.013	0	0	0.1	0.1	CIRCULAR	2	0	1	1.10%					
C003	Closed-Conduit	DI038	DI039	205.587	0.014	0	0	0.1	0.1	CIRCULAR	3	0	1	0.04%					
C004	Closed-Conduit	I010	DI038	23.358	0.014	0	0	0.1	0.1	CIRCULAR	3	0	1	0.01%					
C005	Closed-Conduit	DI037	I010	19	0.013	0	0	0.1	0.1	CIRCULAR	2	0	1	0.11%					
C006	Closed-Conduit	DI034	DI035	39.953	0.014	1	0	0.1	0.1	CIRCULAR	2	0	1	0.71%					
C007	Closed-Conduit	DI035	DI037	207.844	0.014	0.6	0	0.1	0.1	CIRCULAR	2	0	1	0.86%					
C009	Closed-Conduit	DI033	DI034	219.879	0.013	0	0	0.1	0.1	CIRCULAR	2	0	1	1.05%					
C011	Closed-Conduit	DI032	MH070	391.139	0.013	0	0	0.1	0.1	CIRCULAR	2	0	1	0.04%					
C014	Closed-Conduit	I021	DI032	361.201	0.014	0	0	0.1	0.1	CIRCULAR	2	0	1	0.16%					
C015	Closed-Conduit	DI060	I021	318.661	0.014	0.5	0	0.1	0.1	CIRCULAR	2	0	1	0.56%					
C016	Closed-Conduit	I020	DI060	115.488	0.014	0	0	0.1	0.1	CIRCULAR	2	0	1	0.34%					
C017	Closed-Conduit	DI058	I019	12.38	0.014	3.1	0	0.1	0.1	CIRCULAR	1	0	1	31.92%					
C018	Closed-Conduit	I019	I020	195.576	0.014	0	0	0.1	0.1	CIRCULAR	1	0	1	0.36%					
C019	Closed-Conduit	DI059	I020	5.957	0.014	2.1	2.1	0.1	0.1	CIRCULAR	2	0	1	-0.07%					
C020	Closed-Conduit	DI057	I019	265.46	0.014	0	0	0.1	0.1	CIRCULAR	1	0	1	0.66%					
C021	Closed-Conduit	DI043	I011	37.922	0.014	0.65	0.2	0.1	0.1	CIRCULAR	1.5	0	1	0.69%					
C022	Closed-Conduit	DI044	I012	33.244	0.014	0	0	0.1	0.1	CIRCULAR	1.5	0	1	1.29%					
C023	Closed-Conduit	I011	I012	37.222	0.013	0	0	0.1	0.1	CIRCULAR	1.5	0	1	0.19%					
C024_1	Closed-Conduit	DI008	I003	134.896	0.013	0	0	0.1	0.1	CIRCULAR	2	0	1	0.07%					
C024_2	Closed-Conduit	I003	DI019	25.508	0.013	0	0	0.1	0.1	CIRCULAR	2	0	1	0.26%					
C025	Closed-Conduit	I012	I013	219.981	0.013	0	0	0.1	0.1	CIRCULAR	1.5	0	1	2.89%					
C026	Closed-Conduit	DI047	I015	187.338	0.014	2.5	0	0.1	0.1	CIRCULAR	1	0	1	2.98%					
C027	Closed-Conduit	DI046	I015	31.947	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	3.29%					
C028	Closed-Conduit	DI045	I014	35.751	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	6.95%					

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C029	Closed-Conduit	I015	I014	37.019	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	2.93%					
C030_1	Closed-Conduit	I014	I022	195.726	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	1.06%					
C030_2	Closed-Conduit	I022	I013	46.968	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	2.22%					
C031	Closed-Conduit	I013	I010	953.261	0.013	0	0	0.1	0.1	CIRCULAR	1.5	0	1	0.22%					
C032	Closed-Conduit	DI048	DI049	38.189	0.014	0.3	0.88	0.1	0.1	CIRCULAR	0.67	0	1	1.81%					
C033	Closed-Conduit	DI049	DI051	211.228	0.022	0	0	0.1	0.1	CIRCULAR	1.5	0	1	0.04%					
C034	Closed-Conduit	DI051	I016	42.251	0.014	0	0	0.1	0.1	CIRCULAR	1.5	0	1	3.95%					
C035	Closed-Conduit	DI010	DI008	54.852	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	0.04%					
C036	Closed-Conduit	DI052	I016	298.02	0.014	0	0	0.1	0.1	CIRCULAR	1.5	0	1	0.40%					
C037	Closed-Conduit	DI053	I017	24.445	0.014	0.75	0.4	0.1	0.1	CIRCULAR	1.5	0	1	5.49%					
C038	Closed-Conduit	I017	DI052	46.019	0.014	0.6	0.4	0.1	0.1	CIRCULAR	1.5	0	1	0.65%					
C039_1	Closed-Conduit	I016	MH069	419.999	0.013	0	0	0.1	0.1	CIRCULAR	2	0	1	1.17%					
C039_2	Closed-Conduit	MH069	I013	42.28	0.013	0	0	0.1	0.1	CIRCULAR	2	0	1	1.82%					
C040	Closed-Conduit	DI054	I018	51.383	0.014	2.2	0.1	0.1	0.1	CIRCULAR	1	0	1	0.66%					
C041	Closed-Conduit	I018	I017	742.775	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	0.04%					
C042	Closed-Conduit	DI056	DI055	39.723	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	0.51%					
C043	Closed-Conduit	DI251	I170	324.893	0.014	1	0	0.1	0.1	CIRCULAR	1	0	1	0.41%					
C044	Closed-Conduit	DI363	I170	54.998	0.012	0.6	0	0.1	0.1	CIRCULAR	1.5	0	1	0.13%					
C045	Closed-Conduit	DI061	I021	18.609	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	2.24%					
C046	Closed-Conduit	I170	DI491	155.538	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	0.09%					
C048	Closed-Conduit	DI009	DI008	69.7	0.014	0	0	0.1	0.1	CIRCULAR	2	0	1	0.46%					
C049	Closed-Conduit	DI361	DI492	3.266	0.012	0.7	0	0.1	0.1	CIRCULAR	1.5	0	1	4.11%					
C050	Closed-Conduit	DI491	DI492	13.522	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	1.85%					
C051_1	Closed-Conduit	DI492	DI362	184.59	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	1.12%					
C051_2	Closed-Conduit	DI362	DI359	399.051	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	1.43%					
C052	Closed-Conduit	DI360	DI359	39.487	0.014	0	1.2	0.1	0.1	CIRCULAR	1	0	1	3.34%					
C053	Closed-Conduit	DI359	I168	339.231	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	0.19%					
C054	Closed-Conduit	DI353	I168	82.895	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	2.77%					
C055	Closed-Conduit	I168	I163	71.998	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	0.69%					
C056	Closed-Conduit	DI344	I163	6.906	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	7.46%					
C057	Closed-Conduit	I163	I160	182.334	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	0.27%					
C059	Closed-Conduit	DI333	I160	9.642	0.014	1.8	0	0.1	0.1	CIRCULAR	1	0	1	31.82%					
C060	Closed-Conduit	DI322	I151	32.065	0.014	1.8	0	0.1	0.1	CIRCULAR	1	0	1	9.51%					
C063	Closed-Conduit	DI312	DI306	10.754	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	12.66%					
C065	Closed-Conduit	DI295	DI281	174.621	0.012	0	0	0.1	0.1	CIRCULAR	1	0	1	2.12%					
C066	Closed-Conduit	I143	I120	286.311	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	0.72%					
C067	Closed-Conduit	DI288	DI281	39.056	0.012	0	0.8	0.1	0.1	CIRCULAR	1.3	0	1	2.28%					
C068	Closed-Conduit	DI281	DI250	61.675	0.012	3.2	0.33	0.1	0.1	CIRCULAR	1	0	1	3.44%					
C069	Closed-Conduit	I104	DI009	279.165	0.014	0	0	0.1	0.1	CIRCULAR	2	0	1	2.01%					
C070	Closed-Conduit	DI250	I120	47.65	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	2.13%					
C071	Closed-Conduit	DI248	I120	17.082	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	0.93%					
C072	Closed-Conduit	DI272	DI264	39.254	0.012	0.1	0	0.1	0.1	CIRCULAR	1	0	1	0.08%					
C073	Closed-Conduit	I127	DI248	250.8	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	0.73%					
C074	Closed-Conduit	DI264	I127	29.958	0.012	2.3	0.1	0.1	0.1	CIRCULAR	1	0	1	9.92%					
C075	Closed-Conduit	I120	MH010	295.769	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	0.41%					
C076	Closed-Conduit	DI233	MH010	13.597	0.014	1.6	0	0.1	0.1	CIRCULAR	0.5	0	1	19.27%					
C077	Closed-Conduit	DI209	DI218	39.524	0.014	0.4	0	0.1	0.1	CIRCULAR	1	0	1	0.34%					
C078	Closed-Conduit	DI218	DI227	113.102	0.014	1.3	0	0.1	0.1	CIRCULAR	1	0	1	2.07%					
C079	Closed-Conduit	DI227	MH010	49.277	0.014	2.5	0.2	0.1	0.1	CIRCULAR	1	0	1	2.85%					
C080	Closed-Conduit	DI011	I104	15.71	0.014	1	0	0.1	0.1	CIRCULAR	0.67	0	1	10.58%					
C081	Closed-Conduit	DI255	I125	18.013	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	2.43%					
C082	Closed-Conduit	I125	I126	290.419	0.012	0	1	0.1	0.1	CIRCULAR	1.25	0	1	1.27%					
C083	Closed-Conduit	DI256	I126	19.254	0.013	0.9	0	0.1	0.1	CIRCULAR	1.25	0	1	11.65%					
C084	Closed-Conduit	DI257	I128	16.334	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	16.87%					
C085	Closed-Conduit	I126	I128	33.836	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	2.51%					
C086	Closed-Conduit	I128	DI258	12.601	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	3.48%					
C087	Closed-Conduit	DI258	DI259	135.205	0.014	0	0	0.1	0.1	CIRCULAR	1	0	1	5.14%					
C088	Closed-Conduit	DI254	I124	120.866	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	4.51%					
C089	Closed-Conduit	DI252	DI253	69.78	0.012	1.1	0	0.1	0.1	CIRCULAR	1.33	0	1	1.47%					
C090	Closed-Conduit	DI253	I124	72.312	0.012	3.1	0.25	0.1	0.1	CIRCULAR	1.5	0	1	7.49%					
C091	Closed-Conduit	I134	I104	11.346	0.013	0	0	0.1	0.1	CIRCULAR	2	0	1	3.20%					

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C092	Closed-Conduit	I124	DI259	293.727	0.014	0	0	0.1	0.1	CIRCULAR	2	0	1	2.17%					
C093	Closed-Conduit	DI259	DI260	39.707	0.014	5.9	0	0.1	0.1	CIRCULAR	1.5	0	1	0.99%					
C094	Closed-Conduit	DI260	I129	253.797	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	0.98%					
C095	Closed-Conduit	DI262	I129	169.226	0.014	0	0.75	0.1	0.1	CIRCULAR	1	0	1	1.94%					
C096	Closed-Conduit	DI261	DI263	44.846	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	0.56%					
C097	Closed-Conduit	I129	DI261	6.328	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	1.58%					
C098	Closed-Conduit	DI263	DI265	65.031	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	7.83%					
C099	Closed-Conduit	DI265	I130	197.19	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	2.53%					
C1	Street	DI347	DI340	210.389	0.017	0.8	1.5	0.1	0.1	STREET	0	0	1	3.09%	JStreet				
C10	Closed-Conduit	DI531	I013	20.512	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	25.07%					
C100	Closed-Conduit	DI266	DI267	70.734	0.012	0	0.35	0.1	0.1	CIRCULAR	1.4	0	1	3.12%					
C101	Closed-Conduit	DI267	I130	116.97	0.011	0	1.6	0.1	0.1	CIRCULAR	1	0	1	5.45%					
C102	Closed-Conduit	DI006	I134	37.199	0.013	0.7	0	0.1	0.1	CIRCULAR	1.5	0	1	3.06%					
C103	Closed-Conduit	I130	DI268	49.895	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	4.71%					
C104	Closed-Conduit	J50	DI063	301.817	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	0.66%					
C104_1	Closed-Conduit	DI268	MH042	37.117	0.013	2.6	0	0.1	0.1	CIRCULAR	2	0	1	2.32%					
C104_2	Closed-Conduit	MH042	DI269	12.435	0.014	0	0	0.1	0.1	CIRCULAR	2	0	1	0.54%					
C105	Closed-Conduit	DI488	I131	26.276	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	5.98%					
C106	Closed-Conduit	I131	DI269	100.687	0.012	0	0	0.1	0.1	CIRCULAR	1	0	1	3.95%					
C107	Closed-Conduit	DI270	DI269	14.834	0.014	0	0	0.1	0.1	CIRCULAR	2	0	1	19.96%					
C108	Closed-Conduit	DI271	DI273	193.304	0.014	0	0	0.1	0.1	CIRCULAR	2.67	0	1	-1.41%					
C109	Closed-Conduit	DI269	DI271	89.421	0.012	0	0	0.1	0.1	CIRCULAR	2	0	1	3.34%					
C110	Closed-Conduit	DI275	DI273	40.354	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	1.17%					
C111	Closed-Conduit	DI276	DI275	7.394	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	2.88%					
C112	Closed-Conduit	DI293	DI276	198.801	0.012	0	0	0.1	0.1	CIRCULAR	0.8	0	1	5.65%					
C113	Closed-Conduit	MH014	MH013	6.053	0.013	0	0	0.1	0.1	CIRCULAR	1.5	0	1	1.31%					
C114	Closed-Conduit	I169	I134	310.519	0.013	0	0	0.1	0.1	CIRCULAR	2	0	1	0.33%					
C115	Closed-Conduit	DI273	DI274	58.112	0.014	0	0	0.1	0.1	FILLED_CIRCULAR	2	1.9	1	1.82%					
C116	Closed-Conduit	DI274	DI277	38.947	0.013	0	1	0.1	0.1	FILLED_CIRCULAR	2	1.9	1	1.75%					
C117	Closed-Conduit	DI279	I132	11.929	0.014	2.5	0	0.1	0.1	CIRCULAR	1.5	0	1	28.30%					
C118	Closed-Conduit	DI280	I133	5.473	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	40.08%					
C119	Closed-Conduit	I132	I133	38.596	0.014	0	0	0.1	0.1	CIRCULAR	1.5	0	1	1.30%					
C12	Closed-Conduit	DI525	DI010	77.823	0.013	2.2	0	0.1	0.1	CIRCULAR	1	0	1	0.31%					
C120	Closed-Conduit	I133	DI277	250.235	0.011	0	1	0.1	0.1	CIRCULAR	1.5	0	1	2.39%					
C121	Closed-Conduit	J54	J53	3.439	0.014	0	0	0.1	0.1	CIRCULAR	1	0	1	2.65%					
C121_1	Closed-Conduit	DI277	DI508	42.748	0.013	1	0	0.1	0.1	CIRCULAR	2	0	1	0.41%					
C121_2	Closed-Conduit	DI508	DI284	226.99	0.013	0	0	0.1	0.1	CIRCULAR	2	0	1	1.57%					
C122	Closed-Conduit	DI284	I136	30.277	0.014	0.67	0	0.1	0.1	CIRCULAR	2	0	1	3.21%					
C123	Closed-Conduit	DI292	I139	9.304	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	4.41%					
C124	Closed-Conduit	I139	DI291	16.581	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	0.05%					
C125	Closed-Conduit	DI012	I169	6.829	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	72.02%					
C126	Closed-Conduit	DI291	DI290	45.657	0.014	0	0.1	0.1	0.1	FILLED_CIRCULAR	1	0.4	1	1.38%					
C127	Closed-Conduit	DI290	DI289	85.124	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	0.38%					
C128	Closed-Conduit	DI289	I137	114.908	0.014	0	0	0.1	0.1	CIRCULAR	1	0	1	1.54%					
C129	Closed-Conduit	DI286	I137	17.69	0.014	0.8	0.8	0.1	0.1	CIRCULAR	1	0	1	3.16%					
C13	Closed-Conduit	DI524	I003	40.699	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	2.74%					
C130	Closed-Conduit	DI496	I138	19.89	0.013	0	0	0.1	0.1	CIRCULAR	0.83	0	1	2.89%					
C131	Closed-Conduit	I138	MH034	134.952	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	0.14%					
C132	Closed-Conduit	I137	MH034	21.737	0.014	0.8	0	0.1	0.1	CIRCULAR	1	0	1	7.33%					
C133	Closed-Conduit	DI287	MH034	26.165	0.014	1	0	0.1	0.1	CIRCULAR	1	0	1	4.91%					
C134	Closed-Conduit	J56	J55	12.95	0.013	0	0	0.1	0.1	CIRCULAR	2	0	1	-15.31%					
C134_1	Closed-Conduit	MH034	J23	126.255	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	4.07%					
C134_2	Closed-Conduit	J23	I136	75.718	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	4.07%					
C134_3	Closed-Conduit	J31	J55	58.201	0.013	0	0	0.1	0.1	CIRCULAR	3	0	1	1.02%					
C134_4	Closed-Conduit	J58	J59	86.541	0.013	0	0	0.1	0.1	CIRCULAR	3	0	1	1.02%					
C134_5	Closed-Conduit	J55	J58	212.475	0.013	0	0	0.1	0.1	CIRCULAR	3	0	1	1.02%					
C134_7	Closed-Conduit	J59	J68	263.752	0.013	0	0	0.1	0.1	CIRCULAR	3	0	1	1.07%					
C135	Closed-Conduit	I136	DI285	8.47	0.013	0	0	0.1	0.1	CIRCULAR	2	0	1	3.15%					
C136	Closed-Conduit	DI013	I169	38.49	0.014	4	0	0.1	0.1	CIRCULAR	2	0	1	13.33%					
C137	Closed-Conduit	DI285	SP4	133.849	0.014	0	0	0.1	0.1	CIRCULAR	2.5	0	1	-0.20%					
C138	Closed-Conduit	J57	J58	8.938	0.013	0	0	0.1	0.1	CIRCULAR	2	0	1	-19.98%					

Base Conditions Conduit Summary

Name	Tag	Inlet Node	Outlet Node	Length (ft)	Roughness	Inlet Offset (ft)	Outlet Offset (ft)	Entry Loss Coeff.	Exit Loss Coeff.	Cross-Section	Geom1 (ft)	Geom2 (ft)	Barrels	Slope (ft/ft)	Street	Transect	Left Bank Roughness	Right Bank Roughness	Channel Roughness
C139	Closed-Conduit	SP4	DI302	150.625	0.013	0	0	0.1	0.1	CIRCULAR	2.5	0	1	-0.76%					
C14	Closed-Conduit	DI516	I100	157.505	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	0.40%					
C140	Closed-Conduit	DI303	DI302	300.6	0.014	0	1.75	0.1	0.1	CIRCULAR	1	0	1	0.62%					
C141	Closed-Conduit	J60	J59	8.267	0.012	0	0	0.1	0.1	CIRCULAR	2	0	1	-17.11%					
C142	Closed-Conduit	DI278	I135	40.96	0.014	1.7	0	0.1	0.1	CIRCULAR	2	0	1	2.21%					
C143	Closed-Conduit	I135	DI282	117.011	0.013	0	0	0.1	0.1	FILLED_CIRCULAR	2	1.9	1	0.17%					
C144	Closed-Conduit	DI283	J6	22.718	0.014	0.75	0	0.1	0.1	CIRCULAR	1.5	0	1	18.35%					
C145	Closed-Conduit	J63	J64	27.897	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	5.14%					
C145_1	Closed-Conduit	DI282	MH067	150.263	0.013	0	0	0.1	0.1	FILLED_CIRCULAR	2.5	1.9	1	0.20%					
C145_2	Closed-Conduit	MH067	DI302	281.936	0.013	0	0	0.1	0.1	CIRCULAR	2	0	1	0.12%					
C146	Closed-Conduit	J68	DI036	10.618	0.012	0	0	0.1	0.1	CIRCULAR	4	0	1	-0.94%					
C147	Closed-Conduit	DI014	I169	290.843	0.014	4.9	0	0.1	0.1	CIRCULAR	2	0	1	3.73%					
C148	Closed-Conduit	J40	J69	9.067	0.012	0	0	0.1	0.1	CIRCULAR	4.5	0	1	0.00%					
C149	Closed-Conduit	DI300	MH032	24.13	0.012	0.75	0.05	0.1	0.1	CIRCULAR	1.4	0	1	7.20%					
C151	Closed-Conduit	MH032	I142	47.14	0.012	2	0	0.1	0.1	CIRCULAR	3	0	1	3.23%					
C152	Closed-Conduit	DI299	I142	67.615	0.014	1.1	0	0.1	0.1	CIRCULAR	1	0	1	3.44%					
C153	Closed-Conduit	DI297	MH032	44.732	0.014	1.45	0.1	0.1	0.1	CIRCULAR	1	0	1	7.38%					
C154	Closed-Conduit	DI298	MH033	35.832	0.012	0	0	0.1	0.1	CIRCULAR	1	0	1	0.53%					
C155_1	Closed-Conduit	MH033	J32	13.686	0.012	0.25	0	0.1	0.1	CIRCULAR	3	0	1	1.30%					
C155_2	Closed-Conduit	J32	MH011	255.051	0.012	0	0	0.1	0.1	CIRCULAR	3	0	1	1.30%					
C156_1	Closed-Conduit	MH011	MH068	9.423	0.013	0.5	0.2	0.1	0.1	CIRCULAR	3	0	1	1.20%					
C156_2	Closed-Conduit	MH068	MH012	15.065	0.014	0.4	0.1	0.1	0.1	CIRCULAR	3	0	1	0.08%					
C157	Closed-Conduit	I142	I140	288.059	0.012	0	0	0.1	0.1	CIRCULAR	3	0	1	0.83%					
C158	Closed-Conduit	DI296	I141	30.145	0.022	2.55	0	0.1	0.1	CIRCULAR	1.25	0	1	15.80%					
C159	Closed-Conduit	DI015	DI014	75.418	0.014	2.05	4.65	0.1	0.1	CIRCULAR	0.75	0	1	2.68%					
C16	Street	DI195	DI193	525.863	0.017	2.8	4.6	0.1	0.1	STREET	0	0	1	0.11%	101S				
C160	Closed-Conduit	DI294	MH012	43.679	0.014	0	0	0.1	0.1	CIRCULAR	3	0	1	5.40%					
C161	Closed-Conduit	MH012	I140	13.058	0.014	0	0	0.1	0.1	CIRCULAR	3	0	1	0.23%					
C162	Closed-Conduit	I140	I141	14.716	0.013	0	0	0.1	0.1	CIRCULAR	3	0	1	1.36%					
C163	Closed-Conduit	MH030	I141	282.987	0.012	0	0	0.1	0.1	CIRCULAR	3	0	1	-0.02%					
C164	Closed-Conduit	DI305	MH031	57.999	0.014	0	0	0.1	0.1	CIRCULAR	1	0	1	3.39%					
C165	Closed-Conduit	DI307	MH031	35.845	0.014	0.2	0	0.1	0.1	CIRCULAR	1	0	1	3.44%					
C166	Closed-Conduit	MH031	I144	60.524	0.014	1.75	0.5	0.1	0.1	CIRCULAR	1.25	0	1	2.09%					
C167	Closed-Conduit	DI308	I144	42.99	0.014	1.1	0	0.1	0.1	CIRCULAR	1	0	1	6.38%					
C168_2	Closed-Conduit	DI527	MH030	51.038	0.012	0	3	0.1	0.1	CIRCULAR	2	0	1	1.73%					
C168_3	Closed-Conduit	I144	I033	118.703	0.012	0	0	0.1	0.1	CIRCULAR	2	0	1	0.18%					
C168_4	Closed-Conduit	I033	DI527	57.694	0.012	0	0	0.1	0.1	CIRCULAR	2	0	1	0.09%					
C170	Closed-Conduit	DI017	DI014	302.476	0.014	0	0.4	0.1	0.1	CIRCULAR	2	0	1	1.90%					
C172	Closed-Conduit	DI310	MH028	45.202	0.013	0	0	0.1	0.1	CIRCULAR	2	0	1	8.87%					
C174_1	Closed-Conduit	DI528	MH012	16.738	0.013	1.5	0.5	0.1	0.1	CIRCULAR	1.5	0	1	22.15%					
C174_2	Closed-Conduit	MH004	DI528	45.184	0.013	1.5	1.2	0.1	0.1	CIRCULAR	1.5	0	1	0.24%					
C175	Closed-Conduit	MH004	MH005	5.163	0.014	0	0	0.1	0.1	CIRCULAR	4	0	1	60.02%					
C176	Closed-Conduit	DI071	I026	18.075	0.014	0.95	1.95	0.1	0.1	CIRCULAR	1.25	0	1	2.98%					
C177	Closed-Conduit	MH005	I026	133.866	0.014	1.7	0	0.1	0.1	CIRCULAR	4	0	1	0.67%					
C178	Closed-Conduit	DI069	MH005	311.654	0.014	0	0	0.1	0.1	CIRCULAR	4	0	1	0.25%					
C179	Closed-Conduit	MH003	DI069	282.164	0.014	2.75	0	0.1	0.1	FILLED_CIRCULAR	3	2.75	1	0.17%					
C18	Closed-Conduit	I060	I049	547.498	0.014	0	0	0.1	0.1	RECT_CLOSED	6	12	1	0.98%					
C180	Closed-Conduit	DI068	MH003	5.85	0.014	0.15	0	0.1	0.1	FILLED_CIRCULAR	1.25	1.15	1	92.40%					
C181	Closed-Conduit	DI016	DI017	119.273	0.014	0	0.2	0.1	0.1	CIRCULAR	1.25	0	1	2.66%					
C183_1	Closed-Conduit	MH004	MH065	312.128	0.014	1	0	0.1	0.1	CIRCULAR	1.5	0	1	0.56%					
C183_2	Closed-Conduit	MH065	MH009	30.023	0.014	0	0	0.1	0.1	CIRCULAR	1.5	0	1	0.36%					
C184_1	Closed-Conduit	MH009	I997	246.497	0.013	0	0	0.1	0.1	CIRCULAR	1.5	0	1	0.04%					
C184_2	Closed-Conduit	I997	MH003	3.762	0.013	0	2	0.1	0.1	FILLED_CIRCULAR	1.5	1.25	1	33.91%					
C185	Closed-Conduit	DI067	I997	3.671	0.013	0	0	0.1	0.1	FILLED_CIRCULAR	1.5	1.25	1	19.60%					
C186_1	Closed-Conduit	DI066	J1	27.392	0.012	1.18	0	0.1	0.1	CIRCULAR	1.5	0	1	1.37%					
C186_3	Closed-Conduit	J1	J65	18.219	0.012	0	0	0.1	0.1	CIRCULAR	1.5	0	1	1.37%					
C186_4	Closed-Conduit	J65	DI067	47.309	0.012	0	0	0.1	0.1	CIRCULAR	1.5	0	1	1.37%					
C187	Closed-Conduit	DI065	DI066	40.055	0.012	0	0.3	0.1	0.1	CIRCULAR	1	0	1	2.18%					
C188	Closed-Conduit	I023	DI066	228.918	0.014	0	0	0.1	0.1	CIRCULAR	1.25	0	1	1.36%					
C189	Closed-Conduit	DI064	I023	39.332	0.014	1.65	0	0.1	0.1	CIRCULAR	1	0	1	5.82%					
C190	Closed-Conduit	DI062	DI063	56.961	0.014	0	0.9	0.1	0.1	CIRCULAR	1	0	1	0.13%					

Base Conditions Conduit Summary

Name	Tag	Inlet Node	Outlet Node	Length (ft)	Roughness	Inlet Offset (ft)	Outlet Offset (ft)	Entry Loss Coeff.	Exit Loss Coeff.	Cross-Section	Geom1 (ft)	Geom2 (ft)	Barrels	Slope (ft/ft)	Street	Transect	Left Bank Roughness	Right Bank Roughness	Channel Roughness
C191	Closed-Conduit	DI063	I023	57.065	0.014	0	0	0.1	0.1	CIRCULAR	1	0	1	0.35%					
C193	Closed-Conduit	I175	DI016	282.491	0.014	0	0	0.1	0.1	CIRCULAR	1.25	0	1	1.24%					
C194	Closed-Conduit	DI334	DI335	39.723	0.012	0.4	0	0.1	0.1	CIRCULAR	1.5	0	1	1.78%					
C195	Closed-Conduit	DI336	DI337	78.541	0.014	0.6	0	0.1	0.1	CIRCULAR	2	0	1	0.36%					
C196	Closed-Conduit	DI335	DI336	103.989	0.014	0	0.2	0.1	0.1	CIRCULAR	1.75	0	1	0.12%					
C197	Closed-Conduit	DI337	OF10	72.352	0.013	0	0	0.1	0.1	CIRCULAR	2	0	1	8.88%					
C199	Closed-Conduit	DI311	DI310	41.71	0.012	1.25	0	0.1	0.1	CIRCULAR	2	0	1	3.06%					
C2	Street	DI348	DI343	254.079	0.017	0.9	13.3	0.1	0.1	STREET	0	0	1	-1.91%	JStreet				
C200_1	Closed-Conduit	DI538	MH040	61.632	0.014	0	0	0.1	0.1	CIRCULAR	1	0	1	2.68%					
C200_2	Closed-Conduit	MH040	I147	38.704	0.014	0	0	0.1	0.1	CIRCULAR	1.25	0	1	1.73%					
C201	Closed-Conduit	DI314	I147	9.173	0.014	1	0	0.1	0.1	CIRCULAR	1	0	1	4.76%					
C202	Closed-Conduit	I147	I146	39.837	0.014	0	0	0.1	0.1	CIRCULAR	1.25	0	1	0.03%					
C203	Closed-Conduit	DI313	I146	6.707	0.014	0	0	0.1	0.1	CIRCULAR	1	0	1	9.09%					
C204	Closed-Conduit	DI367	I175	315.384	0.013	0	0.75	0.1	0.1	CIRCULAR	1.25	0	1	1.12%					
C205_1	Closed-Conduit	MH027	MH041	208.223	0.014	0	0	0.1	0.1	CIRCULAR	1.5	0	1	0.25%					
C205_2	Closed-Conduit	MH041	MH028	99.489	0.014	0	0	0.1	0.1	CIRCULAR	2	0	1	6.94%					
C206	Closed-Conduit	DI535	MH027	177.123	0.014	0	0	0.1	0.1	CIRCULAR	1	0	1	0.17%					
C207	Closed-Conduit	I146	MH027	35.402	0.013	0	0	0.1	0.1	CIRCULAR	1.25	0	1	0.40%					
C208	Closed-Conduit	DI081	MH055	26.002	0.014	1.6	0	0.1	0.1	CIRCULAR	1	0	1	19.54%					
C209	Closed-Conduit	MH055	MH057	125.219	0.014	1.25	0	0.1	0.1	CIRCULAR	4	0	1	0.19%					
C21	Closed-Conduit	DI521	I180	3.889	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	32.83%					
C210	Closed-Conduit	MH028	MH055	183.041	0.014	0.8	0	0.1	0.1	CIRCULAR	4	0	1	0.13%					
C211	Closed-Conduit	DI489	I034	45.218	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	1.85%					
C212	Closed-Conduit	I034	MH054	177.178	0.013	0	0	0.1	0.1	CIRCULAR	1.25	0	1	2.14%					
C213	Closed-Conduit	MH054	MH053	248.374	0.014	0	0	0.1	0.1	CIRCULAR	1.5	0	1	0.02%					
C214	Closed-Conduit	DI505	MH052	138.714	0.014	0	0	0.1	0.1	CIRCULAR	0.75	0	1	3.68%					
C215	Closed-Conduit	DI030	I175	15.549	0.014	1.35	0	0.1	0.1	CIRCULAR	1.25	0	1	5.84%					
C216	Closed-Conduit	DI504	MH051	87.834	0.013	0	0	0.1	0.1	CIRCULAR	0.833	0	1	7.71%					
C217	Closed-Conduit	DI078	MH059	25.788	0.012	2.1	0	0.1	0.1	CIRCULAR	2.5	0	1	10.39%					
C218_1	Closed-Conduit	MH057	J41	103.508	0.013	0	0	0.1	0.1	CIRCULAR	4	0	1	0.03%					
C218_2	Closed-Conduit	J41	MH059	172.004	0.013	0	0	0.1	0.1	CIRCULAR	4	0	1	0.03%					
C22	Closed-Conduit	DI522	I025	11.44	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	6.14%					
C220_1	Closed-Conduit	MH051	J21	9.88	0.013	0	0	0.1	0.1	CIRCULAR	2	0	1	1.15%					
C220_2	Closed-Conduit	J21	MH052	72.095	0.013	0	0	0.1	0.1	CIRCULAR	2	0	1	1.16%					
C221	Closed-Conduit	MH052	MH053	122.922	0.014	0.5	0.5	0.1	0.1	CIRCULAR	2	0	1	-2.35%					
C222	Closed-Conduit	MH053	MH059	95.3	0.014	0.2	0	0.1	0.1	CIRCULAR	2	0	1	1.80%					
C223	Closed-Conduit	MH059	MH062	72.769	0.014	0	0	0.1	0.1	CIRCULAR	3	0	1	4.03%					
C224	Closed-Conduit	MH062	I029	128.951	0.014	0.1	0	0.1	0.1	CIRCULAR	3	0	1	0.27%					
C225	Closed-Conduit	MH061	I030	126.083	0.014	0	0	0.1	0.1	CIRCULAR	3	0	1	1.16%					
C226	Closed-Conduit	MH013	DI003	14.955	0.022	0	0	0.1	0.1	CIRCULAR	1.5	0	1	0.18%					
C227	Closed-Conduit	DI036	I193	783.523	0.013	0	0	0.1	0.1	CIRCULAR	4	0	1	0.80%					
C228	Closed-Conduit	MH062	MH061	8.948	0.014	0	0	0.1	0.1	CIRCULAR	6	0	1	-13.65%					
C23	Closed-Conduit	DI523	DI272	16.654	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	0.36%					
C230	Closed-Conduit	I031	MH061	8.997	0.014	0	0	0.1	0.1	CIRCULAR	2	0	1	10.51%					
C231_1	Closed-Conduit	J39	J69	95.029	0.013	0	0	0.1	0.1	CIRCULAR	2	0	2	1.10%					
C231_2	Closed-Conduit	J69	MH061	62.703	0.011	0	0	0.1	0.1	CIRCULAR	4	0	1	0.78%					
C233_1	Closed-Conduit	J19	J20	43.412	0.022	0	0	0.1	0.1	CIRCULAR	2	0	1	0.44%					
C233_2	Closed-Conduit	J20	J39	161.951	0.014	0	0	0.1	0.1	CIRCULAR	2	0	1	0.62%					
C234	Closed-Conduit	DI082	MH050	35.025	0.014	0.25	0	0.1	0.1	CIRCULAR	1.5	0	1	3.95%					
C235_1	Closed-Conduit	MH050	J19	171.219	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	0.16%					
C235_2	Closed-Conduit	J19	MH049	12.547	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	0.17%					
C236	Closed-Conduit	DI083	MH050	17.913	0.014	0.35	0.4	0.1	0.1	CIRCULAR	1	0	1	6.12%					
C237_1	Closed-Conduit	MH048	MH044	89.199	0.022	0	0	0.1	0.1	HORIZ_ELLIPSE	1.83	3	2	0.34%					
C237_2	Closed-Conduit	MH044	MH049	286.53	0.022	1.9	0	0.1	0.1	HORIZ_ELLIPSE	1.83	3	2	0.13%					
C238	Closed-Conduit	I075	DI036	161.659	0.013	0	0	0.1	0.1	CIRCULAR	2	0	1	0.13%					
C239	Closed-Conduit	DI495	I149	84.939	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	1.49%					
C24	Closed-Conduit	DI529	I141	10.92	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	33.16%					
C240	Closed-Conduit	I149	I150	68.147	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	0.38%					
C241	Closed-Conduit	DI315	I150	81.716	0.011	1.08	0	0.1	0.1	CIRCULAR	0.67	0	1	0.09%					
C242_1	Closed-Conduit	DI320	J37	11.316	0.013	0.75	0	0.1	0.1	CIRCULAR	1.5	0	1	2.37%					
C242_2	Closed-Conduit	J37	DI321	43.039	0.013	0	0	0.1	0.1	CIRCULAR	1.5	0	1	2.37%					

Base Conditions Conduit Summary

Name	Tag	Inlet Node	Outlet Node	Length (ft)	Roughness	Inlet Offset (ft)	Outlet Offset (ft)	Entry Loss Coeff.	Exit Loss Coeff.	Cross-Section	Geom1 (ft)	Geom2 (ft)	Barrels	Slope (ft/ft)	Street	Transect	Left Bank Roughness	Right Bank Roughness	Channel Roughness
C243	Closed-Conduit	DI321	I155	61.322	0.014	1.75	0.25	0.1	0.1	CIRCULAR	1.25	0	1	2.64%					
C244	Closed-Conduit	I150	I156	111.044	0.022	0	0	0.1	0.1	CIRCULAR	1	0	1	0.23%					
C245	Closed-Conduit	DI324	I156	37.451	0.012	0.25	0	0.1	0.1	CIRCULAR	1	0	1	1.42%					
C246	Closed-Conduit	I156	DI323	13.848	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	0.00%					
C247	Closed-Conduit	DI323	J17	257.982	0.011	0	0	0.1	0.1	CIRCULAR	1	0	1	0.58%					
C248	Closed-Conduit	I155	I157	63.162	0.013	0	0	0.1	0.1	CIRCULAR	1.5	0	1	0.08%					
C249_1	Closed-Conduit	MH001	J60	66.083	0.013	0	0	0.1	0.1	CIRCULAR	3	0	1	0.51%					
C249_2	Closed-Conduit	J60	J68	251.708	0.014	0	0	0.1	0.1	CIRCULAR	3	0	1	0.57%					
C25	Closed-Conduit	DI526	I033	36.342	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	0.17%					
C250	Closed-Conduit	DI325	I157	2.954	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	43.40%					
C251_1	Closed-Conduit	I157	DI326	158.214	0.013	0	0	0.1	0.1	CIRCULAR	1.5	0	1	0.65%					
C251_2	Closed-Conduit	DI326	I158	13.381	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	1.66%					
C252	Closed-Conduit	DI326	I158	13.381	0.013	0	0	0.1	0.1	CIRCULAR	1.5	0	1	1.66%					
C253	Closed-Conduit	I158	MH026	16.865	0.022	0	0.5	0.1	0.1	CIRCULAR	1.5	0	1	3.69%					
C254	Closed-Conduit	DI327	I159	13.882	0.014	0.43	0	0.1	0.1	CIRCULAR	1.25	0	1	10.48%					
C255_1	Closed-Conduit	MH026	J17	8.035	0.022	0.9	0	0.1	0.1	CIRCULAR	1.5	0	1	0.32%					
C255_3	Closed-Conduit	J17	J18	154.525	0.022	0	0	0.1	0.1	CIRCULAR	1.25	0	1	0.32%					
C255_4	Closed-Conduit	J18	MH057	434.805	0.022	0	0.1	0.1	0.1	CIRCULAR	1.25	0	1	0.32%					
C256	Closed-Conduit	DI329	I161	68.211	0.012	1.1	0	0.1	0.1	CIRCULAR	1	0	1	2.42%					
C257	Closed-Conduit	I161	DI328	111.062	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	0.31%					
C258	Closed-Conduit	DI328	I159	20.583	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	1.51%					
C259	Closed-Conduit	I159	MH026	24.947	0.014	0	0	0.1	0.1	CIRCULAR	1.25	0	1	-0.52%					
C26	Closed-Conduit	DI007	DI009	39.557	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	0.38%					
C260	Closed-Conduit	DI050	MH001	10.448	0.012	1.6	0.1	0.1	0.1	CIRCULAR	1	0	1	33.27%					
C261-	Closed-Conduit	DI331	DI330	126.379	0.014	0.25	0.5	0.1	0.1	CIRCULAR	1	0	1	0.10%					
C262	Closed-Conduit	MH023	I162	9.475	0.022	0	0	0.1	0.1	CIRCULAR	1.5	0	1	8.22%					
C263	Closed-Conduit	DI332	I162	3.353	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	231.93%					
C264	Closed-Conduit	I162	MH024	220.223	0.022	0	0	0.1	0.1	CIRCULAR	1.5	0	1	0.34%					
C265	Closed-Conduit	MH024	MH025	26.95	0.022	0	0.1	0.1	0.1	CIRCULAR	1.5	0	1	-3.09%					
C266	Closed-Conduit	MH025	MH026	40.521	0.022	0	0	0.1	0.1	CIRCULAR	1.5	0	1	-1.71%					
C267	Closed-Conduit	DI330	MH025	42.881	0.022	0.05	0	0.1	0.1	CIRCULAR	1.5	0	1	1.29%					
C268	Closed-Conduit	MH023	MH022	58.783	0.022	0.7	0.5	0.1	0.1	CIRCULAR	1.5	0	1	2.83%					
C269	Closed-Conduit	MH022	DI494	204.721	0.014	3.2	0	0.1	0.1	CIRCULAR	2	0	1	0.22%					
C27	Closed-Conduit	DI509	I041	5.348	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	8.67%					
C270	Closed-Conduit	DI494	MH026	117.423	0.014	0	0.8	0.1	0.1	CIRCULAR	1.5	0	1	0.49%					
C271_1	Closed-Conduit	MH002	J56	58.88	0.013	0	0	0.1	0.1	CIRCULAR	2	0	1	0.92%					
C271_3	Closed-Conduit	J56	J57	212.498	0.014	0	0	0.1	0.1	CIRCULAR	2	0	1	0.92%					
C271_4	Closed-Conduit	J57	MH001	20.417	0.014	0	0	0.1	0.1	CIRCULAR	2	0	1	0.92%					
C272_1	Closed-Conduit	MH022	J15	80.751	0.013	0	0	0.1	0.1	CIRCULAR	1.5	0	1	0.12%					
C272_2	Closed-Conduit	J15	MH051	143.803	0.013	0	0	0.1	0.1	CIRCULAR	2	0	1	0.12%					
C273	Closed-Conduit	DI316	I153	16.268	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	2.98%					
C274	Closed-Conduit	DI318	I154	15.686	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	1.65%					
C275	Closed-Conduit	I154	DI319	12.023	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	-3.02%					
C276	Closed-Conduit	DI317	I153	15.493	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	0.59%					
C277	Closed-Conduit	I153	I154	36.431	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	0.31%					
C278	Closed-Conduit	DI090	DI519	40.693	0.012	0.5	0	0.1	0.1	CIRCULAR	1.5	0	1	3.07%					
C279	Closed-Conduit	DI519	MH046	57.437	0.014	0.8	0	0.1	0.1	CIRCULAR	1.5	0	1	2.49%					
C28	Closed-Conduit	DI511	DI180	223.098	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	1.22%					
C280	Closed-Conduit	DI089	MH046	34.167	0.014	1.1	0	0.1	0.1	CIRCULAR	1	0	1	5.32%					
C281	Closed-Conduit	MH046	I040	245.909	0.014	1	0	0.1	0.1	CIRCULAR	2	0	1	0.43%					
C282	Closed-Conduit	DI070	MH002	10.051	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	18.53%					
C283	Closed-Conduit	MH046	DI091	20.979	0.014	1.1	0	0.1	0.1	CIRCULAR	1	0	1	7.30%					
C284	Closed-Conduit	I040	I039	44.8	0.014	0	0	0.1	0.1	CIRCULAR	2	0	1	0.00%					
C285	Closed-Conduit	DI143	I071	36.393	0.022	0	0	0.1	0.1	CIRCULAR	1.5	0	1	3.89%					
C286	Closed-Conduit	DI144	I071	11.316	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	5.55%					
C287	Closed-Conduit	I071	I039	136.335	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	0.07%					
C288	Closed-Conduit	I039	DI086	24.158	0.022	0	0	0.1	0.1	CIRCULAR	1.2	0	1	0.08%					
C290	Closed-Conduit	DI088	I040	59.675	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	2.91%					
C291	Closed-Conduit	DI091	DI092	239.4	0.013	2.1	0	0.1	0.1	CIRCULAR	1	0	1	-0.05%					
C292	Closed-Conduit	DI092	I041	35.404	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	0.09%					
C293	Closed-Conduit	DI080	DI076	19.342	0.012	0	0	0.1	0.1	CIRCULAR	1.25	0	1	6.55%					

Base Conditions Conduit Summary

Name	Tag	Inlet Node	Outlet Node	Length (ft)	Roughness	Inlet Offset (ft)	Outlet Offset (ft)	Entry Loss Coeff.	Exit Loss Coeff.	Cross-Section	Geom1 (ft)	Geom2 (ft)	Barrels	Slope (ft/ft)	Street	Transect	Left Bank Roughness	Right Bank Roughness	Channel Roughness
C294	Closed-Conduit	DI093	I041	4.154	0.014	0	0	0.1	0.1	CIRCULAR	1	0	1	8.21%					
C295	Closed-Conduit	I041	I042	70.377	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	0.00%					
C296	Closed-Conduit	DI095	I042	35.15	0.022	1.8	0	0.1	0.1	CIRCULAR	1.5	0	1	-1.31%					
C297	Closed-Conduit	I042	I043	119.074	0.013	0	0	0.1	0.1	CIRCULAR	1.5	0	1	0.78%					
C298	Closed-Conduit	DI096	I043	2.819	0.014	2.2	0	0.1	0.1	CIRCULAR	1.5	0	1	10.16%					
C299	Closed-Conduit	I043	I044	107.259	0.013	0	0	0.1	0.1	CIRCULAR	1.5	0	1	0.09%					
C30	Closed-Conduit	I095	I184	58.528	0.013	0	0	0.1	0.1	CIRCULAR	3	0	1	1.71%					
C300	Closed-Conduit	DI097	I044	8.059	0.014	0	0	0.1	0.1	CIRCULAR	1.25	0	1	13.74%					
C301	Closed-Conduit	DI098	I044	42.034	0.014	0	0	0.1	0.1	CIRCULAR	1.5	0	1	-2.14%					
C302	Closed-Conduit	I045	DI098	29.329	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	0.03%					
C303	Closed-Conduit	I044	I046	53.579	0.013	0	0	0.1	0.1	CIRCULAR	1.5	0	1	0.06%					
C304_1	Closed-Conduit	DI076	J31	18.577	0.012	0.05	0	0.1	0.1	CIRCULAR	1.25	0	1	4.33%					
C304_2	Closed-Conduit	J31	MH002	14.09	0.012	0	1.4	0.1	0.1	CIRCULAR	1.25	0	1	4.33%					
C306	Closed-Conduit	DI100	I046	53.035	0.014	1.5	0	0.1	0.1	CIRCULAR	1.5	0	1	2.22%					
C307	Closed-Conduit	I046	I047	14.261	0.013	0	0	0.1	0.1	CIRCULAR	1.5	0	1	0.14%					
C308	Closed-Conduit	DI102	DI101	75.641	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	1.31%					
C309	Closed-Conduit	DI101	I047	7.69	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	0.98%					
C31	Closed-Conduit	I184	DI513	226.333	0.013	0	0	0.1	0.1	CIRCULAR	3	0	1	0.09%					
C310_1	Closed-Conduit	I047	I999	101.681	0.013	0	0	0.1	0.1	CIRCULAR	2	0	1	0.03%					
C310_2	Closed-Conduit	I999	I048	58.13	0.013	0	0	0.1	0.1	CIRCULAR	2	0	1	0.84%					
C311	Closed-Conduit	DI503	I049	82.119	0.013	0	0	0.1	0.1	CIRCULAR	4	0	1	5.47%					
C312	Closed-Conduit	DI123	DI124	71.873	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	3.66%					
C313	Closed-Conduit	DI125	DI124	69.504	0.022	1	1.05	0.1	0.1	CIRCULAR	1.5	0	1	0.11%					
C314	Closed-Conduit	DI124	I045	58.844	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	0.06%					
C315_1	Closed-Conduit	I035	J53	144.233	0.012	0	0	0.1	0.1	CIRCULAR	2	0	1	1.80%					
C315_2	Closed-Conduit	J53	MH002	138.779	0.012	0	2.75	0.1	0.1	CIRCULAR	2	0	1	1.80%					
C316	Closed-Conduit	DI103	I707	165.106	0.014	0	0	0.1	0.1	CIRCULAR	2.5	0	1	0.00%					
C317	Closed-Conduit	DI104	DI103	41.273	0.014	0.9	0.5	0.1	0.1	CIRCULAR	2.5	0	1	0.09%					
C318	Closed-Conduit	DI105	DI104	279.893	0.014	1.25	0	0.1	0.1	CIRCULAR	2.5	0	1	0.27%					
C319	Closed-Conduit	DI106	DI105	307.904	0.014	0.5	0	0.1	0.1	CIRCULAR	2.5	0	1	0.25%					
C320	Closed-Conduit	DI107	DI106	58.9	0.014	0.2	0.1	0.1	0.1	CIRCULAR	2	0	1	0.60%					
C321	Closed-Conduit	DI111	DI110	28.75	0.014	0	0	0.1	0.1	CIRCULAR	1	0	1	0.85%					
C322	Closed-Conduit	DI110	I051	70.266	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	0.35%					
C323	Closed-Conduit	DI109	DI107	239.611	0.014	0.1	0	0.1	0.1	CIRCULAR	2	0	1	0.73%					
C324	Closed-Conduit	I051	DI109	90.815	0.014	0	0	0.1	0.1	CIRCULAR	2	0	1	0.03%					
C325	Closed-Conduit	I052	I051	232.604	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	-0.01%					
C326	Closed-Conduit	DI087	I035	2.471	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	43.10%					
C327	Closed-Conduit	DI112	I052	22.346	0.011	1	0	0.1	0.1	CIRCULAR	1	0	1	7.70%					
C328	Closed-Conduit	DI113	I052	15.667	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	6.00E-05					
C329	Closed-Conduit	DI114	DI113	152.74	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	0.42%					
C331	Closed-Conduit	I053	I189	65.651	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	0.76%					
C333	Closed-Conduit	DI117	DI115	52.314	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	0.21%					
C334	Closed-Conduit	I054	I053	72.278	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	0.14%					
C335	Closed-Conduit	DI115	I054	55.553	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	0.18%					
C336	Closed-Conduit	I055	I054	17.927	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	2.34%					
C338_1	Closed-Conduit	DI099	J24	51.995	0.012	1	0	0.1	0.1	CIRCULAR	1	0	1	2.50%					
C338_3	Closed-Conduit	J24	J29	225.552	0.012	0	0	0.1	0.1	CIRCULAR	2	0	1	0.57%					
C338_4	Closed-Conduit	J29	I035	37.108	0.012	0	0	0.1	0.1	CIRCULAR	2	0	1	0.57%					
C339	Closed-Conduit	I056	I055	48.653	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	0.06%					
C34	Closed-Conduit	DI201	DI514	13.359	0.013	0	0	0.1	0.1	CIRCULAR	1.5	0	1	0.65%					
C340	Closed-Conduit	DI119	I056	92.201	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	0.05%					
C341	Closed-Conduit	DI121	DI120	73.045	0.011	0	0.45	0.1	0.1	CIRCULAR	0.67	0	1	0.40%					
C342	Closed-Conduit	DI120	DI119	27.477	0.014	0.47	0.03	0.1	0.1	CIRCULAR	1	0	1	1.82%					
C343	Closed-Conduit	I058	I057	134.498	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	0.22%					
C344	Closed-Conduit	I059	I058	27.613	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	0.36%					
C345	Closed-Conduit	DI501	I059	165.181	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	0.61%					
C346	Closed-Conduit	DI126	I060	147.268	0.013	0	0	0.1	0.1	CIRCULAR	1.5	0	1	0.12%					
C347	Closed-Conduit	DI127	DI126	40.753	0.022	0.7	0.5	0.1	0.1	CIRCULAR	0.75	0	1	2.16%					
C348	Closed-Conduit	DI128	DI126	209.096	0.014	0	0	0.1	0.1	FILLED_CIRCULAR	1.5	1	1	0.08%					
C349_1	Closed-Conduit	DI094	J30	34.846	0.013	1	0	0.1	0.1	CIRCULAR	1	0	1	1.91%					
C349_2	Closed-Conduit	J30	DI087	14.118	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	1.91%					

Name	Tag	Inlet Node	Outlet Node	Length (ft)	Roughness	Inlet Offset (ft)	Outlet Offset (ft)	Entry Loss Coeff.	Exit Loss Coeff.	Cross-Section	Geom1 (ft)	Geom2 (ft)	Barrels	Slope (ft/ft)	Street	Transect	Left Bank Roughness	Right Bank Roughness	Channel Roughness
C35	Overland	I029	I030	14.258	0.022	0	0	0	0	RECT_OPEN	8	40	1	0.00%					
C350	Closed-Conduit	DI129	DI128	54.591	0.012	0	0.77	0.1	0.1	CIRCULAR	1.25	0	1	2.21%					
C351	Closed-Conduit	I061	DI128	39.798	0.014	0	0	0.1	0.1	CIRCULAR	1.5	0	1	0.01%					
C352	Closed-Conduit	DI142	I063	1047.828	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	0.07%					
C353	Closed-Conduit	I070	DI142	525.758	0.011	1.9	0.83	0.1	0.1	CIRCULAR	0.67	0	1	0.51%					
C354	Closed-Conduit	I065	I061	423.02	0.013	0	0	0.1	0.1	CIRCULAR	1.5	0	1	0.02%					
C355	Closed-Conduit	DI133	DI132	32.086	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	6.11%					
C356	Closed-Conduit	DI131	DI130	47.494	0.012	1	0	0.1	0.1	CIRCULAR	1.5	0	1	1.94%					
C357	Closed-Conduit	DI132	DI130	39.749	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	0.25%					
C358	Closed-Conduit	DI130	I065	288.601	0.013	1.1	1.1	0.1	0.1	CIRCULAR	1.5	0	1	0.57%					
C359	Closed-Conduit	I064	I065	153.361	0.013	0	0	0.1	0.1	CIRCULAR	1.5	0	1	0.07%					
C36	Street	I113	DI207	1965.266	0.017	0.8	0.8	0.1	0.1	STREET	0	0	1	0.37%	Northcrest				
C360_1	Closed-Conduit	MH006	I180	185.293	0.013	0	0	0.1	0.1	CIRCULAR	2	0	1	0.55%					
C360_2	Closed-Conduit	I180	DI087	116.036	0.013	0	0	0.1	0.1	CIRCULAR	2	0	1	1.63%					
C361	Closed-Conduit	DI134	I064	324.077	0.013	0	0.75	0.1	0.1	CIRCULAR	1.5	0	1	0.68%					
C362	Closed-Conduit	DI135	I064	225.928	0.013	0	0	0.1	0.1	CIRCULAR	1.5	0	1	0.44%					
C363	Closed-Conduit	I066	DI135	57.135	0.014	1.7	0	0.1	0.1	CIRCULAR	1.5	0	1	2.98%					
C364	Closed-Conduit	DI137	I066	9.434	0.013	2	1.7	0.1	0.1	CIRCULAR	1	0	1	0.87%					
C365	Closed-Conduit	DI139	I067	21.423	0.014	0.7	0	0.1	0.1	CIRCULAR	1.25	0	1	2.37%					
C366	Closed-Conduit	DI138	I067	22.426	0.014	0	0	0.1	0.1	CIRCULAR	1.5	0	1	0.38%					
C367	Closed-Conduit	I067	I066	325.589	0.013	0	1.7	0.1	0.1	CIRCULAR	1.5	0	1	0.84%					
C368	Closed-Conduit	I068	DI137	98.081	0.014	0	2	0.1	0.1	CIRCULAR	1	0	1	0.02%					
C369	Closed-Conduit	DI140	I068	10.991	0.011	0.75	0	0.1	0.1	CIRCULAR	0.75	0	1	9.84%					
C370	Closed-Conduit	I069	I068	71.248	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	0.38%					
C371	Closed-Conduit	I050	MH006	6.793	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	71.53%					
C372	Closed-Conduit	DI141	I069	15.809	0.011	1.75	0	0.1	0.1	CIRCULAR	0.75	0	1	6.18%					
C373	Closed-Conduit	DI515	I069	249.785	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	0.33%					
C374	Closed-Conduit	DI165	I085	8.035	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	13.59%					
C375	Closed-Conduit	I085	DI163	276.611	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	0.80%					
C376	Closed-Conduit	DI164	DI163	21.897	0.014	0	0.85	0.1	0.1	CIRCULAR	1.25	0	1	0.43%					
C377	Closed-Conduit	DI163	DI162	39.693	0.014	1.1	0.4	0.1	0.1	CIRCULAR	1	0	1	3.75%					
C378	Closed-Conduit	DI162	I084	12.777	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	3.03%					
C379	Closed-Conduit	I084	MH036	604.4	0.014	0	0	0.1	0.1	CIRCULAR	1.5	0	1	1.18%					
C38	Overland	J2	DI513	106.035	0.014	0	0	0	0	RECT_OPEN	1	50	1	-2.33%					
C380	Closed-Conduit	MH036	MH037	267.631	0.014	0.4	1.15	0.1	0.1	CIRCULAR	1.5	0	1	0.14%					
C381	Closed-Conduit	DI158	MH037	19.249	0.014	0.17	0.4	0.1	0.1	CIRCULAR	1	0	1	5.59%					
C382	Closed-Conduit	DI116	MH006	38.156	0.014	0.1	1	0.1	0.1	CIRCULAR	1	0	1	6.64%					
C383	Closed-Conduit	DI157	I082	23.548	0.014	1	0.1	0.1	0.1	CIRCULAR	1	0	1	11.55%					
C384	Closed-Conduit	MH037	I082	40.548	0.014	1	0	0.1	0.1	CIRCULAR	2	0	1	4.26%					
C385	Closed-Conduit	I082	I081	246.514	0.013	0	0	0.1	0.1	CIRCULAR	2	0	1	0.16%					
C386	Closed-Conduit	DI156	I081	11.465	0.014	1	0.3	0.1	0.1	CIRCULAR	1	0	1	15.64%					
C387	Closed-Conduit	I081	I080	16.119	0.013	0	0	0.1	0.1	CIRCULAR	2	0	1	6.84%					
C388	Closed-Conduit	DI155	MH038	24.242	0.014	0	0.05	0.1	0.1	CIRCULAR	1	0	1	8.15%					
C389	Closed-Conduit	I080	MH038	22.316	0.014	0	0	0.1	0.1	CIRCULAR	2	0	1	1.51%					
C39	Street	DI003	DI525	224.66	0.017	2.1	3.1	0.1	0.1	STREET	0	0	1	1.50%	2ndStreet				
C390	Closed-Conduit	DI160	DI161	61.074	0.014	0.43	0.03	0.1	0.1	CIRCULAR	1	0	1	1.64%					
C391	Closed-Conduit	DI161	I083	54.668	0.014	0.8	0.45	0.1	0.1	CIRCULAR	1	0	1	2.29%					
C392	Closed-Conduit	I083	I080	258.499	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	1.74%					
C393	Closed-Conduit	I062	MH006	136.486	0.013	0	0	0.1	0.1	CIRCULAR	2	0	1	0.44%					
C394	Closed-Conduit	MH038	I079	163.306	0.014	3	0	0.1	0.1	CIRCULAR	2	0	1	3.78%					
C395	Closed-Conduit	DI154	I079	9.273	0.012	2.2	0	0.1	0.1	CIRCULAR	2	0	1	35.96%					
C396	Closed-Conduit	I079	MH039	137.535	0.014	0	0	0.1	0.1	CIRCULAR	2	0	1	1.64%					
C397	Closed-Conduit	DI152	MH039	40.601	0.014	0	0.75	0.1	0.1	CIRCULAR	1	0	1	8.72%					
C398	Closed-Conduit	MH039	I078	285.244	0.014	3.8	0.5	0.1	0.1	CIRCULAR	2	0	1	2.47%					
C399	Closed-Conduit	DI151	I078	32.789	0.014	0.5	0	0.1	0.1	CIRCULAR	1	0	1	8.69%					
C4	Street	DI055	DI052	1093.064	0.017	0.4	3.9	0.1	0.1	STREET	0	0	1	0.15%	Street				
C40	Closed-Conduit	DI028	DI029	39.45	0.013	1.2	0	0.1	0.1	CIRCULAR	1	0	1	1.23%					
C400	Closed-Conduit	DI150	I078	9.841	0.011	0.75	0	0.1	0.1	CIRCULAR	0.5	0	1	27.54%					
C401	Closed-Conduit	I078	I077	15.568	0.013	0	0	0.1	0.1	CIRCULAR	2	0	1	9.68%					
C402	Closed-Conduit	DI149	DI148	36.34	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	3.09%					
C403	Closed-Conduit	DI148	DI147	39.689	0.014	0	0.08	0.1	0.1	CIRCULAR	1	0	1	2.70%					

Base Conditions Conduit Summary

Name	Tag	Inlet Node	Outlet Node	Length (ft)	Roughness	Inlet Offset (ft)	Outlet Offset (ft)	Entry Loss Coeff.	Exit Loss Coeff.	Cross-Section	Geom1 (ft)	Geom2 (ft)	Barrels	Slope (ft/ft)	Street	Transect	Left Bank Roughness	Right Bank Roughness	Channel Roughness
C404	Closed-Conduit	DI122	I062	12.785	0.014	2	0	0.1	0.1	CIRCULAR	1.25	0	1	5.46%					
C405	Closed-Conduit	DI147	I074	107.386	0.014	0.8	0	0.1	0.1	CIRCULAR	1	0	1	1.77%					
C406	Closed-Conduit	I077	I074	33.528	0.013	0	0	0.1	0.1	CIRCULAR	2	0	1	5.38%					
C407	Closed-Conduit	DI350	I166	44.077	0.012	1.25	0	0.1	0.1	CIRCULAR	1	0	1	4.18%					
C408	Closed-Conduit	DI351	I166	23.12	0.012	2.53	0.12	0.1	0.1	CIRCULAR	0.67	0	1	7.75%					
C409	Closed-Conduit	I166	I077	295.134	0.013	0	0	0.1	0.1	CIRCULAR	1.25	0	1	0.51%					
C41	Street	DI029	DI022	286.126	0.017	2.1	2.85	0.1	0.1	STREET	0	0	1	0.22%	5thStreet				
C410	Closed-Conduit	I074	I072	266.001	0.013	0	0	0.1	0.1	CIRCULAR	2	0	1	1.77%					
C411	Closed-Conduit	DI145	DI146	62.126	0.014	0	0	0.1	0.1	CIRCULAR	2	0	1	2.25%					
C412	Closed-Conduit	DI146	I072	165.491	0.014	0	0	0.1	0.1	CIRCULAR	1.5	0	1	0.14%					
C413	Closed-Conduit	I073	I072	9.541	0.013	0	0	0.1	0.1	CIRCULAR	2.5	0	1	6.30%					
C414	Closed-Conduit	I072	MH048	241.246	0.013	0	0	0.1	0.1	HORIZ_ELLIPSE	1.83	3	2	1.27%					
C415	Closed-Conduit	DI136	I062	26.791	0.014	2.1	0	0.1	0.1	CIRCULAR	1	0	1	2.98%					
C416	Closed-Conduit	DI086	DI085	79.003	0.014	0	0	0.1	0.1	CIRCULAR	1.25	0	1	0.08%					
C417	Closed-Conduit	DI085	DI084	40.341	0.013	0.5	0	0.1	0.1	CIRCULAR	1	0	1	1.08%					
C418	Closed-Conduit	DI085	MH044	177.398	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	0.78%					
C419	Closed-Conduit	I036	MH048	65.356	0.013	0.2	0	0.1	0.1	CIRCULAR	1	0	1	1.92%					
C42	Closed-Conduit	MH070	DI033	246.292	0.013	0	0	0.1	0.1	CIRCULAR	2	0	1	0.34%					
C420_1	Closed-Conduit	MH045	MH058	253.762	0.014	0	0	0.1	0.1	CIRCULAR	3	0	2	0.55%					
C420_2	Closed-Conduit	MH058	J40	23.91	0.014	0	0	0.1	0.1	CIRCULAR	3	0	2	2.54%					
C420_4	Closed-Conduit	J40	MH062	62.896	0.011	0	0.1	0.1	0.1	CIRCULAR	4	0	1	2.54%					
C421	Closed-Conduit	I028	MH062	213.223	0.022	0	0	0.1	0.1	CIRCULAR	3	0	1	1.31%					
C422	Closed-Conduit	DI075	I028	19.608	0.014	0.9	0	0.1	0.1	CIRCULAR	1	0	1	12.63%					
C423_1	Closed-Conduit	I027	J43	131.328	0.013	0	0	0.1	0.1	CIRCULAR	3	0	1	0.01%					
C423_2	Closed-Conduit	J43	J46	87.236	0.013	0	0	0.1	0.1	CIRCULAR	3	0	1	0.01%					
C423_4	Closed-Conduit	J45	I028	71.787	0.013	0	0	0.1	0.1	CIRCULAR	3	0	1	0.01%					
C423_5	Closed-Conduit	J46	J45	74.29	0.013	0	0	0.1	0.1	CIRCULAR	3	0	1	0.01%					
C424	Closed-Conduit	DI074	I027	17.919	0.014	1.2	0	0.1	0.1	CIRCULAR	1	0	1	17.73%					
C425_2	Closed-Conduit	J47	MH064	272.842	0.022	0	0	0.1	0.1	FILLED_CIRCULAR	3	0.25	1	0.54%					
C425_3	Closed-Conduit	MH063	I027	42.614	0.013	0	0	0.1	0.1	CIRCULAR	3	0	1	0.12%					
C425_4	Closed-Conduit	MH064	MH063	16.387	0.022	2.5	2	0.1	0.1	FILLED_CIRCULAR	3	0.25	1	1.04%					
C426	Closed-Conduit	MH007	I062	146.935	0.013	0	0	0.1	0.1	CIRCULAR	2	0	1	0.27%					
C427_1	Closed-Conduit	DI072	J48	18.635	0.013	0	0	0.1	0.1	CIRCULAR	2	0	1	0.92%					
C427_2	Closed-Conduit	DI073	J48	21.97	0.013	0	0	0.1	0.1	CIRCULAR	2	0	1	-1.88%					
C428_1	Closed-Conduit	MH066	J47	325.913	0.022	1.5	0	0.1	0.1	FILLED_CIRCULAR	3	0.25	1	0.18%					
C428_2	Closed-Conduit	I026	MH066	127.986	0.022	0	0	0.1	0.1	FILLED_CIRCULAR	3	0.25	1	0.49%					
C429	Closed-Conduit	DI338	I164	37.454	0.014	2.25	0	0.1	0.1	CIRCULAR	1	0	1	11.76%					
C43	Closed-Conduit	DI301	J8	33.302	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	5.54%					
C430	Closed-Conduit	DI339	I164	15.827	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	0.82%					
C431	Closed-Conduit	I164	MH021	7.907	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	2.15%					
C432	Closed-Conduit	DI355	DI354	19.178	0.014	0.33	1	0.1	0.1	CIRCULAR	0.25	0	1	13.09%					
C433	Closed-Conduit	DI354	I167	37.556	0.014	0.12	0.45	0.1	0.1	CIRCULAR	1.25	0	1	3.96%					
C434	Closed-Conduit	DI352	I167	5.411	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	12.40%					
C435	Closed-Conduit	I167	I164	301.163	0.014	3.75	0	0.1	0.1	CIRCULAR	1.5	0	1	2.74%					
C436	Closed-Conduit	MH021	MH020	254.895	0.013	0	0	0.1	0.1	CIRCULAR	2	0	1	0.65%					
C437	Closed-Conduit	I076	MH007	12.845	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	1.57%					
C438	Closed-Conduit	DI341	MH020	8.296	0.014	1.5	0	0.1	0.1	CIRCULAR	1	0	1	24.62%					
C439	Closed-Conduit	DI342	MH020	33.404	0.014	1.23	0	0.1	0.1	CIRCULAR	0.67	0	1	6.50%					
C44	Street	DI302	DI300	318.924	0.017	4.1	3.6	0.1	0.1	STREET	0	0	1	1.03%	FStreet				
C440	Closed-Conduit	DI340	MH020	29.091	0.014	0	0	0.1	0.1	CIRCULAR	1.6	0	1	4.79%					
C441	Closed-Conduit	MH020	I165	64.54	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	0.02%					
C442	Closed-Conduit	DI343	I165	10.166	0.014	1.65	0	0.1	0.1	CIRCULAR	1.25	0	1	12.81%					
C443	Closed-Conduit	DI345	I165	30.413	0.014	0.4	0	0.1	0.1	CIRCULAR	1	0	1	4.10%					
C444	Closed-Conduit	I165	I073	267.599	0.013	0	0	0.1	0.1	CIRCULAR	2.5	0	1	0.02%					
C445	Closed-Conduit	DI346	DI347	27.225	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	2.65%					
C446	Closed-Conduit	DI349	DI348	22.351	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	2.07%					
C447	Closed-Conduit	DI357	MH019	39.073	0.012	1.8	0	0.1	0.1	CIRCULAR	1	0	1	7.18%					
C449	Closed-Conduit	DI153	I076	29.554	0.014	0.45	0	0.1	0.1	CIRCULAR	1.5	0	1	3.23%					
C45	Closed-Conduit	DI306	I143	11.334	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	10.29%					
C450	Closed-Conduit	DI358	MH019	30.481	0.014	1.45	0	0.1	0.1	CIRCULAR	1	0	1	5.33%					
C451	Closed-Conduit	DI356	MH019	13.07	0.014	1.25	0	0.1	0.1	CIRCULAR	1	0	1	12.87%					

Name	Tag	Inlet Node	Outlet Node	Length (ft)	Roughness	Inlet Offset (ft)	Outlet Offset (ft)	Entry Loss Coeff.	Exit Loss Coeff.	Cross-Section	Geom1 (ft)	Geom2 (ft)	Barrels	Slope (ft/ft)	Street	Transect	Left Bank Roughness	Right Bank Roughness	Channel Roughness
C452	Closed-Conduit	MH019	I167	292.042	0.014	0	0	0.1	0.1	CIRCULAR	1	0	1	2.44%					
C453	Closed-Conduit	DI175	DI174	69.925	0.012	1.5	0	0.1	0.1	CIRCULAR	1.25	0	1	2.24%					
C454	Closed-Conduit	DI174	DI173	510.054	0.013	0	0	0.1	0.1	CIRCULAR	1.25	0	1	0.75%					
C455	Closed-Conduit	DI173	I091	43.228	0.014	0	0	0.1	0.1	CIRCULAR	1.5	0	1	0.80%					
C456	Closed-Conduit	I091	I090	17.02	0.014	1.1	0	0.1	0.1	CIRCULAR	1.5	0	1	8.85%					
C457	Closed-Conduit	DI172	I091	2.75	0.014	1.1	1.1	0.1	0.1	CIRCULAR	1.5	0	1	27.49%					
C458	Closed-Conduit	DI171	I088	12.724	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	20.88%					
C459	Closed-Conduit	I090	I088	40.329	0.013	0	0	0.1	0.1	CIRCULAR	1.5	0	1	0.74%					
C46	Closed-Conduit	I160	I151	21.558	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	2.32%					
C460_1	Closed-Conduit	MH008	I025	234.378	0.013	0	0	0.1	0.1	CIRCULAR	2	0	1	0.08%					
C460_2	Closed-Conduit	I025	I076	25.814	0.013	0	0	0.1	0.1	CIRCULAR	2	0	1	1.55%					
C461	Closed-Conduit	DI170	I090	20.77	0.012	1.5	0.5	0.1	0.1	CIRCULAR	1.2	0	1	12.70%					
C462_1	Closed-Conduit	I088	DI520	23.798	0.013	0	0	0.1	0.1	CIRCULAR	1.5	0	1	0.20%					
C462_2	Closed-Conduit	DI520	DI169	221.26	0.013	0	0	0.1	0.1	CIRCULAR	1.5	0	1	5.38%					
C463	Closed-Conduit	DI168	DI169	36.08	0.014	0.1	0	0.1	0.1	CIRCULAR	1	0	1	2.09%					
C464	Closed-Conduit	DI169	I087	267.567	0.014	0	0	0.1	0.1	CIRCULAR	1.5	0	1	3.57%					
C465	Closed-Conduit	DI167	DI166	45.034	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	0.16%					
C466	Closed-Conduit	DI166	I086	88.983	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	6.81%					
C467	Closed-Conduit	I092	I093	187.227	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	-1.60%					
C468	Closed-Conduit	DI177	DI176	95.544	0.011	0	0	0.1	0.1	CIRCULAR	0.5	0	1	2.88%					
C469	Closed-Conduit	I093	DI176	80.044	0.014	0	0	0.1	0.1	CIRCULAR	1	0	1	0.63%					
C47	Closed-Conduit	I151	I143	305.688	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	0.31%					
C470	Closed-Conduit	DI176	I002	139.464	0.014	0.25	0.25	0.1	0.1	CIRCULAR	1	0	1	3.95%					
C471	Closed-Conduit	DI159	MH008	12.107	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	4.95%					
C472	Closed-Conduit	DI182	I002	75.992	0.022	0	0.35	0.1	0.1	CIRCULAR	1.5	0	1	8.42%					
C473	Closed-Conduit	DI181	DI182	54.05	0.014	0	0.05	0.1	0.1	CIRCULAR	1.5	0	1	1.31%					
C474	Closed-Conduit	DI180	DI179	120.681	0.014	0.1	0.4	0.1	0.1	CIRCULAR	1.5	0	1	0.32%					
C475	Closed-Conduit	DI179	DI176	161.281	0.014	1.5	0	0.1	0.1	CIRCULAR	1.5	0	1	1.86%					
C476	Closed-Conduit	I094	I095	152.541	0.013	0	0	0.1	0.1	CIRCULAR	3	0	1	0.33%					
C478	Closed-Conduit	I096	DI183	273.777	0.014	0.15	0	0.1	0.1	CIRCULAR	3	0	1	-0.20%					
C479	Closed-Conduit	DI184	DI186	266.755	0.014	0	0	0.1	0.1	CIRCULAR	1.5	0	1	0.56%					
C48	Closed-Conduit	DI187	I096	6.807	0.013	1.65	1.65	0.1	0.1	CIRCULAR	1.5	0	1	0.00%					
C480	Closed-Conduit	DI186	I096	44.866	0.013	0	0	0.1	0.1	CIRCULAR	1.5	0	1	3.81%					
C481	Closed-Conduit	DI188	I097	4.403	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	22.05%					
C482	Closed-Conduit	I089	MH008	34.752	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	2.90%					
C483	Closed-Conduit	I097	I096	91.412	0.014	0	0	0.1	0.1	CIRCULAR	3	0	1	3.29%					
C484	Closed-Conduit	I098	I097	213.305	0.013	0	0	0.1	0.1	CIRCULAR	3	0	1	0.75%					
C485	Closed-Conduit	DI189	I098	58.446	0.014	2.25	0	0.1	0.1	CIRCULAR	2.5	0	1	4.14%					
C486	Closed-Conduit	DI191	DI189	223.569	0.014	0.05	0	0.1	0.1	CIRCULAR	2	0	1	1.15%					
C487	Closed-Conduit	I099	DI190	9.92	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	1.32%					
C488	Closed-Conduit	DI374	I099	311.469	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	0.97%					
C489	Closed-Conduit	DI193	DI191	130.13	0.014	0	0	0.1	0.1	CIRCULAR	2	0	1	0.74%					
C49	Closed-Conduit	DI183	I094	160.4	0.013	0	0	0.1	0.1	CIRCULAR	3	0	1	0.74%					
C490	Closed-Conduit	DI194	DI193	148.512	0.014	2.05	0.45	0.1	0.1	CIRCULAR	2.75	0	1	2.37%					
C491	Closed-Conduit	DI196	DI195	229.209	0.013	1.5	0.4	0.1	0.1	CIRCULAR	1.5	0	1	0.47%					
C492	Closed-Conduit	DI197	DI196	99.188	0.013	0.1	0	0.1	0.1	CIRCULAR	1.5	0	1	0.70%					
C493	Closed-Conduit	DI178	I089	15.577	0.014	1.8	0	0.1	0.1	CIRCULAR	1	0	1	10.44%					
C494	Closed-Conduit	DI198	DI197	56.367	0.014	0.25	0	0.1	0.1	CIRCULAR	1.5	0	1	0.41%					
C495	Closed-Conduit	DI199	DI198	97.875	0.014	0	0	0.1	0.1	CIRCULAR	1.5	0	1	0.15%					
C496	Closed-Conduit	I100	DI199	113.963	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	0.16%					
C497	Closed-Conduit	DI202	DI201	102.006	0.013	0	0	0.1	0.1	CIRCULAR	1.5	0	1	0.25%					
C498	Closed-Conduit	DI203	DI202	37.185	0.014	0	0	0.1	0.1	CIRCULAR	1.5	0	1	0.54%					
C499	Closed-Conduit	DI204	DI203	263.017	0.014	0.4	0	0.1	0.1	CIRCULAR	1.5	0	1	1.24%					
C500	Closed-Conduit	DI205	DI204	175.663	0.014	0.77	0.17	0.1	0.1	CIRCULAR	1.5	0	1	0.93%					
C501	Closed-Conduit	DI206	DI205	61.447	0.014	0	0.75	0.1	0.1	CIRCULAR	1.25	0	1	2.58%					
C502	Closed-Conduit	DI207	DI206	113.079	0.014	0	0	0.1	0.1	CIRCULAR	1.25	0	1	1.55%					
C503	Closed-Conduit	DI214	DI213	81.507	0.012	1.5	0.5	0.1	0.1	CIRCULAR	1.5	0	1	2.72%					
C504	Closed-Conduit	MH035	I089	304.52	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	1.34%					
C505_1	Closed-Conduit	DI213	DI518	494.982	0.013	0	1	0.1	0.1	CIRCULAR	1	0	1	0.17%					
C505_2	Closed-Conduit	DI518	DI215	186.533	0.013	1	0	0.1	0.1	CIRCULAR	1	0	1	0.10%					
C506	Closed-Conduit	DI215	I102	79.766	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	1.71%					

Base Conditions Conduit Summary

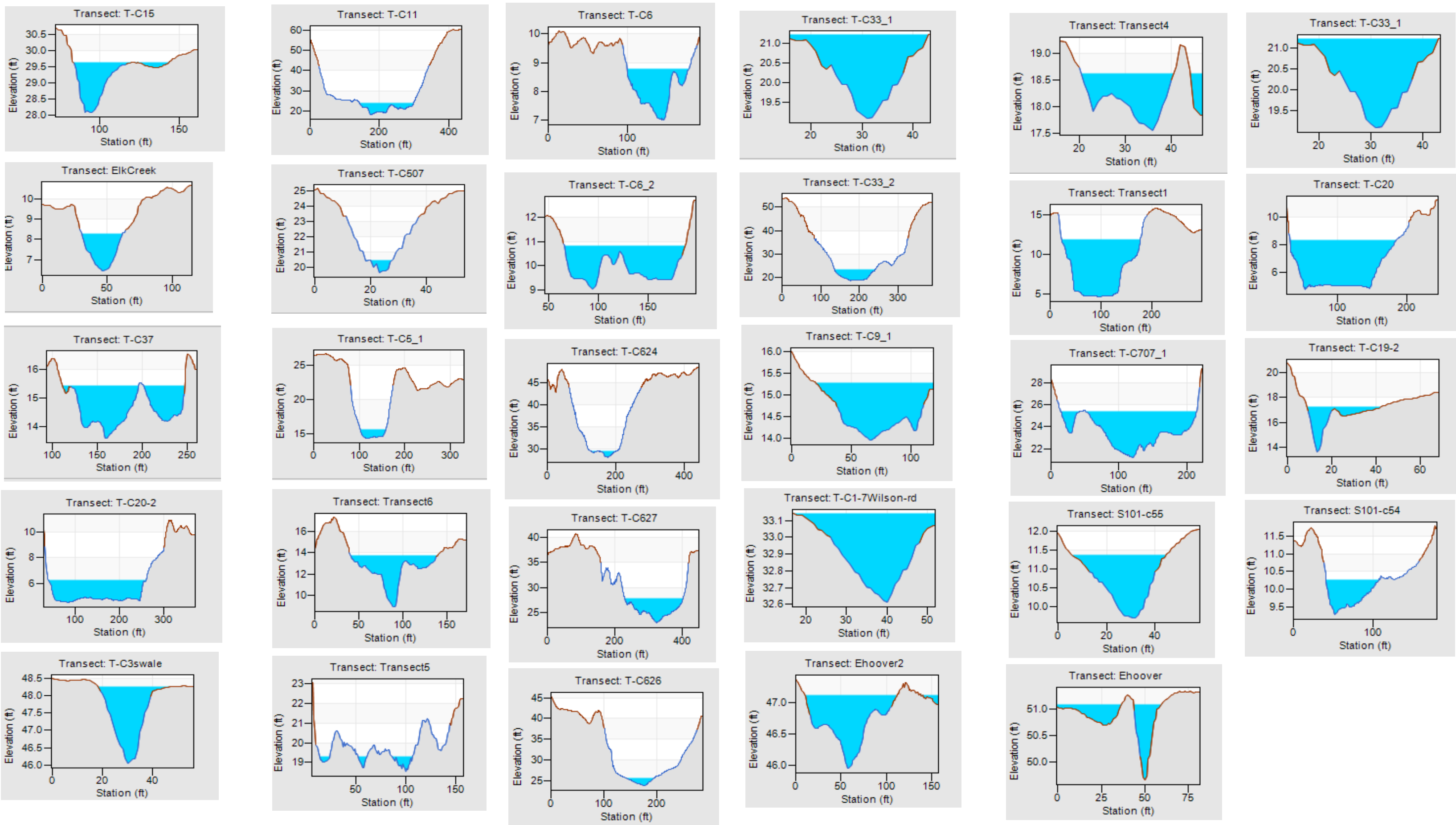
Name	Tag	Inlet Node	Outlet Node	Length (ft)	Roughness	Inlet Offset (ft)	Outlet Offset (ft)	Entry Loss Coeff.	Exit Loss Coeff.	Cross-Section	Geom1 (ft)	Geom2 (ft)	Barrels	Slope (ft/ft)	Street	Transect	Left Bank Roughness	Right Bank Roughness	Channel Roughness
C508	Closed-Conduit	DI217	DI216	82.465	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	3.91%					
C509	Closed-Conduit	DI216	I102	230.035	0.014	2.1	0	0.1	0.1	CIRCULAR	1.5	0	1	1.00%					
C510	Closed-Conduit	DI500	DI499	366.6	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	0.32%					
C511	Closed-Conduit	DI499	DI498	38.771	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	1.22%					
C512	Closed-Conduit	DI498	DI228	313.961	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	0.73%					
C513	Closed-Conduit	DI228	DI229	41.674	0.012	0.6	0.5	0.1	0.1	CIRCULAR	1.5	0	1	0.71%					
C514	Closed-Conduit	DI229	I107	213.752	0.014	0.12	0	0.1	0.1	CIRCULAR	2	0	1	0.46%					
C515	Closed-Conduit	DI185	MH035	13.763	0.014	1	0	0.1	0.1	CIRCULAR	1.5	0	1	9.15%					
C516	Closed-Conduit	DI230	I107	12.52	0.013	2.17	0	0.1	0.1	CIRCULAR	2.5	0	1	1.76%					
C517	Closed-Conduit	DI231	I108	16.088	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	9.76%					
C518	Closed-Conduit	I107	I108	55.491	0.014	0	0	0.1	0.1	CIRCULAR	2.5	0	1	7.01%					
C519	Closed-Conduit	I108	I109	256.982	0.014	0	0	0.1	0.1	CIRCULAR	2.5	0	1	1.17%					
C520	Closed-Conduit	DI232	I109	9.667	0.012	1.25	0	0.1	0.1	CIRCULAR	1.5	0	1	87.90%					
C521	Closed-Conduit	I109	I110	453.491	0.013	0	0	0.1	0.1	CIRCULAR	2.5	0	1	1.58%					
C522	Closed-Conduit	DI226	I105	107.987	0.014	4.2	0	0.1	0.1	CIRCULAR	2	0	1	6.58%					
C523	Closed-Conduit	DI225	DI226	39.681	0.014	0.2	0	0.1	0.1	CIRCULAR	2	0	1	1.05%					
C524	Closed-Conduit	DI223	DI225	260.44	0.014	0.6	0	0.1	0.1	CIRCULAR	2	0	1	1.20%					
C525	Closed-Conduit	DI224	DI223	39.472	0.014	0.85	0	0.1	0.1	CIRCULAR	1.5	0	1	3.87%					
C526	Closed-Conduit	DI200	MH035	47.6	0.014	3.6	0	0.1	0.1	CIRCULAR	1	0	1	2.83%					
C527	Closed-Conduit	DI222	DI223	349.25	0.014	1.15	0	0.1	0.1	CIRCULAR	1.25	0	1	0.92%					
C528	Closed-Conduit	DI221	DI222	89.396	0.014	0	0	0.1	0.1	CIRCULAR	1.5	0	1	3.92%					
C529	Closed-Conduit	DI208	I101	96.141	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	3.09%					
C530	Closed-Conduit	DI236	I112	346.329	0.014	0	5.2	0.1	0.1	CIRCULAR	1.5	0	1	0.06%					
C531	Closed-Conduit	DI235	DI236	26.562	0.014	0	0.27	0.1	0.1	CIRCULAR	1.5	0	1	11.08%					
C532	Closed-Conduit	DI234	DI235	63.346	0.014	0	0.15	0.1	0.1	CIRCULAR	1.5	0	1	1.02%					
C533	Closed-Conduit	I111	DI234	537.472	0.014	0	0	0.1	0.1	CIRCULAR	1.25	0	1	0.45%					
C535	Closed-Conduit	I115	I114	46.31	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	0.67%					
C537	Closed-Conduit	MH010	MH035	301.176	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	1.66%					
C539	Closed-Conduit	DI237	DI238	41.663	0.014	0	0	0.1	0.1	CIRCULAR	1	0	1	8.15%					
C540	Closed-Conduit	DI238	I116	194.174	0.014	2.1	0	0.1	0.1	CIRCULAR	1.5	0	1	2.87%					
C541	Closed-Conduit	I117	DI238	320.929	0.014	0	0	0.1	0.1	CIRCULAR	1.5	0	1	9.00E-05					
C542	Closed-Conduit	I118	I117	260.059	0.013	0	0	0.1	0.1	CIRCULAR	1.5	0	1	0.19%					
C544	Closed-Conduit	DI240	DI239	40.241	0.014	0.15	0	0.1	0.1	CIRCULAR	1	0	1	0.27%					
C545	Closed-Conduit	DI239	I118	68.779	0.014	0	0	0.1	0.1	CIRCULAR	1.5	0	1	6.80%					
C546	Closed-Conduit	DI536	I118	63.343	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	8.26%					
C547	Closed-Conduit	DI241	DI242	92.78	0.014	0.7	0	0.1	0.1	CIRCULAR	1.5	0	1	1.32%					
C548	Closed-Conduit	I172	I191	87.318	0.013	0	0	0.1	0.1	CIRCULAR	1.5	0	1	1.26%					
C549	Closed-Conduit	DI242	DI243	106.14	0.014	0	0.15	0.1	0.1	CIRCULAR	2	0	1	0.28%					
C550	Closed-Conduit	DI243	DI245	104.718	0.014	0.75	0	0.1	0.1	CIRCULAR	2	0	1	0.98%					
C551	Closed-Conduit	DI245	DI246	77.129	0.014	0.1	0	0.1	0.1	CIRCULAR	2.75	0	1	0.36%					
C552	Closed-Conduit	DI244	DI243	51.765	0.014	0	0.4	0.1	0.1	CIRCULAR	1.25	0	1	1.15%					
C553	Closed-Conduit	DI246	I122	195.49	0.014	0.1	0.1	0.1	0.1	CIRCULAR	2.25	0	1	0.65%					
C554	Closed-Conduit	DI249	DI247	39.445	0.014	0	0.8	0.1	0.1	CIRCULAR	1	0	1	1.12%					
C555	Closed-Conduit	I122	DI247	4.65	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	2.11%					
C556	Closed-Conduit	DI247	I123	91.645	0.014	0.7	0	0.1	0.1	CIRCULAR	2.5	0	1	1.31%					
C557	Closed-Conduit	I174	I173	163.014	0.013	0	0	0.1	0.1	CIRCULAR	1.5	0	1	0.31%					
C558	Closed-Conduit	DI021	DI020	39.368	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	1.63%					
C559	Closed-Conduit	I171	I172	75.413	0.013	0	0	0.1	0.1	CIRCULAR	1.5	0	1	3.70%					
C560	Closed-Conduit	DI024	I171	46.515	0.014	0	0	0.1	0.1	CIRCULAR	1	0	1	4.96%					
C561	Closed-Conduit	I173	I171	284.503	0.013	0	0	0.1	0.1	CIRCULAR	1.5	0	1	0.43%					
C562	Closed-Conduit	DI001	I174	24.039	0.012	0.8	0	0.1	0.1	CIRCULAR	1.5	0	1	5.62%					
C563	Closed-Conduit	DI002	I174	17.436	0.014	0.9	0.2	0.1	0.1	CIRCULAR	1	0	1	3.43%					
C564	Closed-Conduit	I176	I173	30.042	0.013	0	0	0.1	0.1	CIRCULAR	1.5	0	1	5.50%					
C565	Closed-Conduit	DI025	I176	7.778	0.014	0	0	0.1	0.1	CIRCULAR	1.5	0	1	0.85%					
C566	Closed-Conduit	DI026	I176	34.921	0.014	1	0	0.1	0.1	CIRCULAR	1.5	0	1	9.49%					
C568	Closed-Conduit	DI027	DI028	26.25	0.014	0	0	0.1	0.1	CIRCULAR	1	0	1	7.39%					
C569	Closed-Conduit	DI020	I075	68.93	0.013	1.5	0	0.1	0.1	CIRCULAR	1	0	1	0.53%					
C57	Closed-Conduit	DI003	DI533	111.003	0.013	0	0	0.1	0.1	FILLED_CIRCULAR	2	1.99	1	0.88%					
C572_1	Closed-Conduit	DI022	DI532	40.73	0.013	0	0	0.1	0.1	FILLED_CIRCULAR	1.5	1.25	1	4.49%					
C572_2	Closed-Conduit	DI532	DI023	48.498	0.013	0	0	0.1	0.1	FILLED_CIRCULAR	1.5	1.25	1	1.27%					
C573	Closed-Conduit	DI023	OF8	74.548	0.013	0	0	0.1	0.1	CIRCULAR	2	0	1	22.08%					

Name	Tag	Inlet Node	Outlet Node	Length (ft)	Roughness	Inlet Offset (ft)	Outlet Offset (ft)	Entry Loss Coeff.	Exit Loss Coeff.	Cross-Section	Geom1 (ft)	Geom2 (ft)	Barrels	Slope (ft/ft)	Street	Transect	Left Bank Roughness	Right Bank Roughness	Channel Roughness
C575_1	Closed-Conduit	I181	OF6	111.001	0.013	0	0	0.1	0.1	CIRCULAR	4	0	1	12.94%					
C576	Closed-Conduit	DI369	I181	14.617	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	109.60%					
C577	Closed-Conduit	I179	I181	37.803	0.013	0	0	0.1	0.1	CIRCULAR	3	0	1	18.16%					
C578	Closed-Conduit	DI368	I179	20.919	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	23.56%					
C579	Closed-Conduit	MH017	I179	16.31	0.013	0	0	0.1	0.1	CIRCULAR	2.5	0	1	6.54%					
C58	Closed-Conduit	DI533	J107	89.414	0.013	0	0	0.1	0.1	FILLED_CIRCULAR	2	1.99	1	3.06%					
C580	Closed-Conduit	I038	I075	87.015	0.013	0	0	0.1	0.1	CIRCULAR	2	0	1	0.22%					
C581	Closed-Conduit	I178	MH017	70.858	0.014	0	0	0.1	0.1	CIRCULAR	1	0	1	2.73%					
C582	Closed-Conduit	DI366	I178	15.931	0.014	1.1	0	0.1	0.1	CIRCULAR	1	0	1	18.59%					
C583	Closed-Conduit	I177	I178	239.068	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	0.63%					
C584	Closed-Conduit	DI365	I177	26.259	0.014	0.05	0.8	0.1	0.1	CIRCULAR	0.5	0	1	7.91%					
C585	Closed-Conduit	MH018	I177	39.437	0.012	0	0	0.1	0.1	CIRCULAR	0.75	0	1	1.48%					
C586	Closed-Conduit	DI364	MH018	13.735	0.012	0	0	0.1	0.1	CIRCULAR	0.75	0	1	10.08%					
C587	Closed-Conduit	DI490	MH018	42.726	0.014	0	0	0.1	0.1	CIRCULAR	0.75	0	1	5.10%					
C588	Closed-Conduit	DI370	I182	7.956	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	32.91%					
C589	Closed-Conduit	I182	MH017	238.918	0.014	0	0	0.1	0.1	CIRCULAR	2	0	1	2.26%					
C59	Closed-Conduit	J107	OF7	58.398	0.013	0	0	0.1	0.1	FILLED_CIRCULAR	2	1.99	1	1.25%					
C590	Closed-Conduit	DI371	MH016	47.898	0.012	0	0.85	0.1	0.1	CIRCULAR	1.25	0	1	4.20%					
C591	Closed-Conduit	MH015	I038	17.619	0.013	0	0	0.1	0.1	CIRCULAR	2	0	1	2.17%					
C592	Closed-Conduit	MH016	I182	46.668	0.014	2.7	0	0.1	0.1	CIRCULAR	2.5	0	1	2.82%					
C593	Closed-Conduit	DI372	MH016	11.508	0.014	0.5	2.7	0.1	0.1	CIRCULAR	1.5	0	1	1.60%					
C594	Closed-Conduit	DI031	I004	20.412	0.014	0.5	0	0.1	0.1	CIRCULAR	1	0	1	3.80%					
C595	Closed-Conduit	DI373	I005	9.875	0.014	0.2	0	0.1	0.1	CIRCULAR	1	0	1	7.25%					
C596	Closed-Conduit	I005	I004	45.95	0.014	0	0	0.1	0.1	CIRCULAR	1	0	1	0.42%					
C597	Closed-Conduit	I004	DI372	277.929	0.014	0	1.5	0.1	0.1	CIRCULAR	1	0	1	1.06%					
C598	Closed-Conduit	DI041	DI042	40.005	0.014	0.2	0	0.1	0.1	CIRCULAR	4	0	1	0.92%					
C599_2	Closed-Conduit	DI042	I001	201.498	0.013	0	0	0.1	0.1	CIRCULAR	4	0	1	8.11%					
C599_3	Closed-Conduit	I001	I192	84.417	0.013	0	0	0.1	0.1	RECT_OPEN	4	4	1	6.53%					
C60	Closed-Conduit	J61	J62	26.15	0.013	0	0	0.1	0.1	CIRCULAR	2	0	1	-38.44%					
C60_2	Closed-Conduit	J62	MH012	373.507	0.011	0	0	0.1	0.1	CIRCULAR	3	0	1	0.52%					
C60_3	Closed-Conduit	J1	J64	83.299	0.011	0	0	0.1	0.1	CIRCULAR	3.5	0	1	0.52%					
C60_4	Closed-Conduit	J64	J62	131.044	0.011	0	0	0.1	0.1	CIRCULAR	3.5	0	1	0.52%					
C600	Closed-Conduit	DI039	DI040	40.234	0.014	0.85	0	0.1	0.1	FILLED_CIRCULAR	3	1	1	4.31%					
C601	Closed-Conduit	DI040	DI041	210.825	0.013	0.4	0	0.1	0.1	CIRCULAR	3.5	0	1	0.90%					
C602	Closed-Conduit	DI005	MH014	239.216	0.012	1.8	0	0.1	0.1	CIRCULAR	1.5	0	1	2.75%					
C61	Closed-Conduit	J66	J67	19.173	0.013	0	0	0.1	0.1	CIRCULAR	2	0	1	3.61%					
C61_1	Closed-Conduit	DI036	J67	244.816	0.011	0	0	0.1	0.1	CIRCULAR	3.5	0	1	-0.21%					
C61_2	Closed-Conduit	J67	J1	93.345	0.011	0	0	0.1	0.1	CIRCULAR	3.5	0	1	-0.21%					
C62	Closed-Conduit	J28	J27	21.2	0.013	0	0	0.1	0.1	CIRCULAR	3	0	1	2.97%					
C62_1	Closed-Conduit	DI302	J28	15.247	0.011	0	0	0.1	0.1	CIRCULAR	3	0	1	1.30%					
C62_2	Closed-Conduit	J28	MH032	279.077	0.011	0	0	0.1	0.1	CIRCULAR	2	0	2	1.30%					
C63	Closed-Conduit	I136	MH067	93.248	0.011	0	0	0.1	0.1	CIRCULAR	1.5	0	1	-1.61%					
C630	Street	DI319	DI320	250.525	0.017	0.2	2.6	0.1	0.1	STREET	0	0	1	1.64%	3rdStreet				
C64	Closed-Conduit	J3	J4	187.591	0.014	0	0	0.1	0.1	CIRCULAR	1	0	1	0.66%					
C65	Closed-Conduit	J4	J5	108.194	0.014	0	0	0.1	0.1	CIRCULAR	0.83	0	1	1.00%					
C653	Closed-Conduit	I048	DI503	165.758	0.013	0	0	0.1	0.1	CIRCULAR	2	0	1	1.35%					
C66	Closed-Conduit	J5	DI016	499.385	0.014	0	0	0.1	0.1	CIRCULAR	2	0	1	1.06%					
C67	Closed-Conduit	DI277	J6	172.388	0.013	0	0	0.1	0.1	CIRCULAR	3	0	1	0.31%					
C68	Closed-Conduit	J6	J7	176.086	0.013	0	0	0.1	0.1	CIRCULAR	3	0	1	0.57%					
C69	Closed-Conduit	J7	J8	278.021	0.013	0	0	0.1	0.1	CIRCULAR	3	0	1	0.36%					
C7	Street	DI190	DI181	738.784	0.017	0.8	2.6	0.1	0.1	STREET	0	0	1	0.95%	101N				
C70	Closed-Conduit	J30	J31	286.455	0.013	0	0	0.1	0.1	CIRCULAR	3	0	1	2.47%					
C70_1	Closed-Conduit	J8	J27	16.782	0.013	0	0	0.1	0.1	CIRCULAR	3	0	1	1.07%					
C70_2	Closed-Conduit	J27	MH032	281.306	0.013	0	0	0.1	0.1	CIRCULAR	3	0	1	1.07%					
C71	Closed-Conduit	MH067	J7	13.721	0.013	0	0	0.1	0.1	CIRCULAR	1.5	0	1	0.00%					
C72	Closed-Conduit	I138	DI289	35.112	0.014	0	0	0.1	0.1	CIRCULAR	0.75	0	1	-6.76%					
C73_1	Closed-Conduit	J13	MH049	13.942	0.013	0	0	0.1	0.1	CIRCULAR	2	0	1	-3.70%					
C73_2	Closed-Conduit	MH051	J13	24.326	0.013	0	0	0.1	0.1	CIRCULAR	2	0	1	-3.69%					
C74_1	Closed-Conduit	MH044	MH023	37.603	0.013	0	0	0.1	0.1	CIRCULAR	1.25	0	1	-4.89%					
C75	Closed-Conduit	J9	MH023	210.178	0.013	0	0	0.1	0.1	CIRCULAR	1.33	0	1	0.89%					
C76	Closed-Conduit	J10	J11	33.71	0.013	0	0	0.1	0.1	CIRCULAR	2.5	0	1	0.30%					

Base Conditions Conduit Summary

Name	Tag	Inlet Node	Outlet Node	Length (ft)	Roughness	Inlet Offset (ft)	Outlet Offset (ft)	Entry Loss Coeff.	Exit Loss Coeff.	Cross-Section	Geom1 (ft)	Geom2 (ft)	Barrels	Slope (ft/ft)	Street	Transect	Left Bank Roughness	Right Bank Roughness	Channel Roughness
C77	Closed-Conduit	J11	I039	99.359	0.013	0	0	0.1	0.1	CIRCULAR	2.5	0	1	0.40%					
C78	Closed-Conduit	J16	DI494	63.706	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	0.38%					
C79	Closed-Conduit	MH049	MH045	23.368	0.013	0	0	0.1	0.1	CIRCULAR	3	0	2	0.93%					
C8	Closed-Conduit	DI530	I022	15.849	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	27.37%					
C80	Closed-Conduit	MH047	MH045	5.69	0.013	0	0	0.1	0.1	CIRCULAR	5	0	1	-4.29%					
C81	Closed-Conduit	DI287	DI303	247.856	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	1.51%					
C82	Closed-Conduit	J22	J23	44.217	0.013	0	0	0.1	0.1	CIRCULAR	1.25	0	1	2.08%					
C83	Closed-Conduit	J25	J26	6.962	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	1.95%					
C83_1	Closed-Conduit	MH007	J26	117.924	0.013	0	0	0.1	0.1	CIRCULAR	2	0	1	0.88%					
C83_2	Closed-Conduit	J26	J24	173.942	0.013	0	0	0.1	0.1	CIRCULAR	2	0	1	1.36%					
C84	Closed-Conduit	I142	J32	14.244	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	-3.32%					
C85	Closed-Conduit	MH030	J34	215.857	0.013	0	0	0.1	0.1	CIRCULAR	3	0	2	0.07%					
C86	Closed-Conduit	J34	MH029	52.573	0.013	0	0	0.1	0.1	CIRCULAR	3	0	2	0.29%					
C87	Closed-Conduit	MH029	J36	44.695	0.013	0	0	0.1	0.1	CIRCULAR	4	0	1	0.34%					
C88	Closed-Conduit	J36	MH028	260.754	0.013	0	0	0.1	0.1	CIRCULAR	4	0	1	0.39%					
C89	Closed-Conduit	DI495	MH040	111.805	0.013	0	0	0.1	0.1	CIRCULAR	1.25	0	1	-1.25%					
C89_1	Closed-Conduit	DI077	J38	52.945	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	1.25%					
C89_2	Closed-Conduit	DI079	J38	29.456	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	7.90%					
C89_3	Closed-Conduit	J38	J69	177.256	0.013	0	0	0.1	0.1	CIRCULAR	1.5	0	1	1.16%					
C89_4	Closed-Conduit	MH059	J40	33.793	0.013	0	0	0.1	0.1	CIRCULAR	4.5	0	1	3.65%					
C90	Closed-Conduit	J42	J41	29.962	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	5.91%					
C91	Closed-Conduit	DI075	J41	52.846	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	2.60%					
C92	Closed-Conduit	MH028	MH063	65.893	0.013	0	0	0.1	0.1	CIRCULAR	2	0	1	-2.21%					
C92_1	Closed-Conduit	DI081	J44	62.303	0.013	0	0	0.1	0.1	CIRCULAR	2	0	1	2.65%					
C92_2	Closed-Conduit	J44	J43	34.258	0.013	0	0	0.1	0.1	CIRCULAR	2	0	1	2.65%					
C93	Closed-Conduit	J48	J47	11.545	0.013	0	0	0.1	0.1	CIRCULAR	2	0	1	0.94%					
C94	Closed-Conduit	J47	MH029	61.436	0.013	0	0	0.1	0.1	CIRCULAR	2	0	1	2.35%					
C95	Closed-Conduit	J33	J34	7.498	0.013	0	0	0.1	0.1	CIRCULAR	2	0	1	34.61%					
C96	Closed-Conduit	DI028	DI025	301.292	0.022	0	0	0.1	0.1	CIRCULAR	1	0	1	1.54%					
C97	Closed-Conduit	J52	J50	57.568	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	5.22%					
C98	Closed-Conduit	J49	J50	25.253	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	11.97%					
C99	Closed-Conduit	J51	J50	46.987	0.013	0	0	0.1	0.1	CIRCULAR	1	0	1	8.54%					

Base Conditions Conduit Summary



Base Conditions Junction Summary

Name	Description	Invert Elev. (ft)	Rim Elev. (ft)	Depth (ft)	Tag	X-Coordinate	Y-Coordinate
DI001	DI	27.048	29.348	2.3	DG9	5959961.516	2528186.888
DI002	DI	26.398	28.298	1.9	DG9	5959980.726	2528150.171
DI003	DI	14.109	16.309	2.2	DG7	5960407.528	2527713.454
DI005	DI	18.996	22.346	3.35	DG7	5960551.715	2527496.886
DI006	DI	18.421	20.621	2.2	DG2	5960458.576	2528170.644
DI007	DI	12.15	14.25	2.1	DG2	5960624.07	2527925.166
DI008	DI	11.681	15.181	3.5	DG2	5960696.845	2527891.75
DI009	DI	12	14.2	2.2	DG2	5960656.138	2527948.33
DI010	DI	11.7	13.4	1.7	DG2	5960643.592	2527882.469
DI011	DI	18.275	19.975	1.7	DG2	5960506.613	2528191.524
DI012	DI	22.991	25.991	3	DG2	5960316.093	2528451.92
DI013	DI	20.085	26.085	6	DG2	5960283.027	2528430.268
DI014	DI	24.932	31.832	6.9	DG2	5960189.443	2528702.05
DI015	DI	29.553	32.353	2.8	DG2	5960120.503	2528671.468
DI016	DI	34.443	36.743	2.3	DG2	5959952.208	2528919.066
DI017	DI	31.07	35.57	4.5	DG2	5960054.657	2528972.841
DI018	DI	12.353	15.053	2.7	DG2	5960829.558	2527621.412
DI019	DI	11.523	14.523	3	DG2	5960785.855	2527758.305
DI020	DI	8.876	12.376	3.5	DG2	5960985.727	2527743.424
DI021	DI	9.518	12.218	2.7	DG2	5960963.789	2527776.112
DI022	DI	31.684	34.584	2.9	DG8	5959399.214	2528217.952
DI023	DI	29.243	32.843	3.6	DG8	5959365.998	2528137.005
DI024	DI	27.091	29.691	2.6	DG9	5959954.875	2527819.183
DI025	DI	27.716	32.116	4.4	DG9	5959822.701	2528109.8
DI026	DI	29.948	32.448	2.5	DG9	5959790.613	2528085.17
DI027	DI	34.28	35.28	1	DG8	5959678.591	2528350.494
DI028	DI	32.345	35.145	2.8	DG8	5959653.867	2528359.32
DI029	DI	33.06	35.26	2.2	DG8	5959621.582	2528336.644
DI030	DI	37.507	40.107	2.6	DG2	5959780.757	2529149.89
DI031	DI	41.18	42.68	1.5	DG6	5958872.218	2528910.772
DI032	DI	46.238	48.938	2.7	DG5	5959402.297	2529979.343
DI033	DI	45.242	50.442	5.2	DG5	5959155.316	2529564.229
DI034	DI	42.926	47.476	4.55	DG5	5958976.141	2529436.774
DI035	DI	43.643	47.943	4.3	DG5	5958942.801	2529414.755
DI036	DI	9.8	12.8	3	DG2	5961050.144	2527836.602
DI037	DI	42.45	47.35	4.9	DG5	5958769.615	2529299.834
DI038	DI	42.427	47.677	5.25	DG5	5958736.044	2529274.245
DI039	DI	42.342	47.142	4.8	DG5	5958568.633	2529154.91
DI040	DI	41.459	47.359	5.9	DG5	5958535.428	2529132.19
DI041	DI	39.953	50.253	10.3	DG5	5958355.253	2529022.711
DI042	DI	39.784	50.484	10.7	DG5	5958322.281	2529000.055
DI043	DI	50.743	52.893	2.15	DG5	5958423.94	2530255.745
DI044	DI	51.291	52.791	1.5	DG5	5958398.383	2530232.922
DI045	DI	50.103	51.953	1.85	DG5	5958010.971	2529980.403
DI046	DI	49.756	52.006	2.25	DG5	5957979.912	2529954.99
DI047	DI	51.791	55.291	3.5	DG5	5957841.47	2529830.405
DI048	DI	53.214	54.764	1.55	DG5	5957839.236	2530724.796
DI049	DI	51.944	54.744	2.8	DG5	5957854.596	2530689.831
DI050	DI	13.274	15.874	2.6	DG2	5960903.887	2528117.352

Base Conditions Junction Summary

Name	Description	Invert Elev. (ft)	Rim Elev. (ft)	Depth (ft)	Tag	X-Coordinate	Y-Coordinate
DI051	DI	51.868	53.868	2	DG5	5957948.357	2530500.549
DI052	DI	51.4	55.4	4	DG5	5957684.947	2530391.184
DI053	DI	52.49	55.49	3	DG5	5957615.149	2530397.072
DI054	DI	50.07	53.27	3.2	DG5	5957615.301	2531170.966
DI055	DI	56.522	57.022	0.5	DG5	5958033.111	2531222.857
DI056	DI	56.726	57.226	0.5	DG5	5958065.931	2531245.236
DI057	DI	50.938	55.838	4.9	DG5	5958722.97	2531017.372
DI058	DI	49.865	53.965	4.1	DG5	5958857.676	2530795.664
DI059	DI	48.496	52.596	4.1	DG5	5958974.257	2530635.806
DI060	DI	48.109	51.709	3.6	DG5	5959041.506	2530536.885
DI061	DI	47.247	50.547	3.3	DG5	5959225.068	2530256.029
DI062	DI	13.973	16.323	2.35	DG4	5961116.566	2528241.127
DI063	DI	13	15.908	2.908	DG4	5961163.077	2528274.012
DI064	DI	13.435	16.085	2.65	DG4	5961156.343	2528209.074
DI065	DI	10.871	12.971	2.1	DG4	5961287.148	2528016.233
DI066	DI	9.697	12.977	3.28	DG4	5961321.842	2528036.251
DI067	DI	9.606	11.706	2.1	DG4	5961376.564	2527961.151
DI068	DI	9.512	12.512	3	DG4	5961382.661	2527950.927
DI069	DI	7.97	12.97	5	DG4	5961614.968	2528107.252
DI070	DI	15.996	18.646	2.65	DG2	5960737.11	2528365.088
DI071	DI	9.539	11.739	2.2	DG4	5961973.499	2528364.39
DI072	DI	8.571	11.571	3	DG4	5962344.805	2528594.899
DI073	DI	7.988	11.988	4	DG4	5962378.73	2528617.093
DI074	DI	9.029	11.229	2.2	DG4	5962624.043	2528803.559
DI075	DI	8.606	10.506	1.9	DG4	5962929.316	2529010.215
DI076	DI	16.929	19.579	2.65	DG2	5960703.573	2528338.787
DI077	DI	8.659	10.459	1.8	DG4	5963256.832	2529232.406
DI078	DI	7.748	12.448	4.7	DG4	5963022.88	2529167.445
DI079	DI	10.321	11.821	1.5	DG4	5963210.382	2529300.467
DI080	DI	18.193	19.193	1	DG2	5960708.68	2528320.131
DI081	DI	9.64	12.54	2.9	DG4	5962696.187	2528946.521
DI082	DI	9.603	11.353	1.75	DG4	5963029.735	2529534.683
DI083	DI	9.615	11.015	1.4	DG4	5963054.808	2529503.967
DI084	DI	8.086	11.086	3	DG4	5962869.883	2529788.593
DI085	DI	8.021	10.921	2.9	DG4	5962894.311	2529756.487
DI086	DI	8.081	10.831	2.75	DG4	5962959.714	2529800.805
DI087	DI	22.978	24.478	1.5	DG2	5960577.475	2528599.269
DI088	DI	9.837	10.837	1	DG4	5962985.735	2529788.813
DI089	DI	8.882	10.982	2.1	DG3	5963187.227	2530002.329
DI090	DI	9.543	11.543	2	DG3	5963239.678	2530039.652
DI091	DI	7.74	10.84	3.1	DG3	5963228.012	2529966.648
DI092	DI	9.963	11.463	1.5	DG3	5963363.185	2529769.056
DI093	DI	10.27	11.27	1	DG3	5963396.485	2529790.378
DI094	DI	22.914	24.917	2.003	DG2	5960535.951	2528573.332
DI095	DI	7.668	10.986	3.318	DG3	5963404.037	2529710.063
DI096	DI	7.085	10.785	3.7	DG3	5963502.583	2529633.204
DI097	DI	9.997	11.497	1.5	DG3	5963562.159	2529550.533
DI098	DI	8	11	3	DG3	5963519.064	2529534.104
DI099	DI	23.801	25.801	2	DG2	5960837.216	2528777.033

Base Conditions Junction Summary

Name	Description	Invert Elev. (ft)	Rim Elev. (ft)	Depth (ft)	Tag	X-Coordinate	Y-Coordinate
DI100	DI	8.548	11.548	3	DG3	5963544.937	2529472.81
DI101	DI	8.925	11.525	2.6	DG3	5963598.413	2529494.846
DI102	DI	9.915	10.915	1	DG3	5963673.994	2529497.878
DI103	DI	7.58	10.98	3.4	DG3	5963904.847	2529420.513
DI104	DI	7.219	10.819	3.6	DG3	5963944.831	2529430.748
DI105	DI	6.727	11.027	4.3	DG3	5964221.595	2529406.134
DI106	DI	7.007	10.507	3.5	DG3	5964515.142	2529313.194
DI107	DI	7.259	10.459	3.2	DG3	5964571.424	2529295.826
DI109	DI	8.9	11	2.1	DG3	5964799.911	2529223.652
DI110	DI	9.175	10.375	1.2	DG3	5964765.989	2529331.511
DI111	DI	9.418	10.668	1.25	DG3	5964758.443	2529303.767
DI112	DI	9.616	11.616	2	DG3	5965044.056	2529213.655
DI113	DI	8.902	11.802	2.9	DG3	5965068.163	2529231.114
DI114	DI	9.538	11.868	2.33	DG3	5965214.122	2529186.104
DI115	DI	9.7	12.957	3.257	DG3	5965296.262	2529134.267
DI116	DI	29.328	31.328	2	DG2	5960364.117	2528826.604
DI117	DI	9.812	12.812	3	DG3	5965246.452	2529150.259
DI119	DI	10.1	12.7	2.6	DG3	5965247.934	2529083.179
DI120	DI	10.16	12.49	2.33	DG3	5965247.731	2529055.702
DI121	DI	10.901	12.651	1.75	DG3	5965286.331	2528993.688
DI122	DI	25.197	28.537	3.34	DG2	5960509.794	2528918.127
DI123	DI	10.672	11.672	1	DG3	5963419.136	2529448.709
DI124	DI	8.045	11.045	3	DG3	5963483.87	2529479.938
DI125	DI	8.173	10.973	2.8	DG3	5963436.427	2529530.733
DI126	DI	7.134	10.134	3	DG3	5963765.969	2529774.415
DI127	DI	7.812	10.142	2.33	DG3	5963740.76	2529742.395
DI128	DI	7.296	10.296	3	DG3	5963653.667	2529950.798
DI129	DI	9.272	10.572	1.3	DG3	5963606.163	2529923.895
DI130	DI	9.04	11.64	2.6	DG3	5963141.261	2530165.525
DI131	DI	8.959	11.459	2.5	DG3	5963166.786	2530125.472
DI132	DI	9.14	11.89	2.75	DG3	5963108.556	2530142.934
DI133	DI	11.098	11.098	0	DG3	5963126.603	2530116.403
DI134	DI	10.437	12.937	2.5	DG3	5963024.32	2530267.327
DI135	DI	8.5	12.8	4.3	DG3	5963169.917	2530637.156
DI136	DI	25.197	28.297	3.1	DG2	5960531.936	2528885.497
DI137	DI	8.282	11.482	3.2	DG3	5963128.174	2530686.817
DI138	DI	13.029	14.529	1.5	DG3	5962852.181	2530518.99
DI139	DI	12.752	14.952	2.2	DG3	5962845.626	2530502.537
DI140	DI	10.626	12.126	1.5	DG3	5963087.57	2530778.416
DI141	DI	9.793	12.293	2.5	DG3	5963039.305	2530847.089
DI142	DI	10.277	12.177	1.9	DG3	5963332.506	2530824.898
DI143	DI	9.613	11.113	1.5	DG4	5962929.546	2529953.274
DI144	DI	8.827	10.827	2	DG4	5962892.193	2529927.98
DI145	DI	11.635	13.635	2	DG4	5962759.728	2530024.204
DI146	DI	10.239	13.239	3	DG4	5962698.501	2530034.74
DI147	DI	15.803	17.603	1.8	DG4	5962503.336	2530217.117
DI148	DI	16.954	18.704	1.75	DG4	5962480.523	2530249.596
DI149	DI	18.076	19.076	1	DG4	5962512.71	2530266.466
DI150	DI	19.863	21.113	1.25	DG4	5962389.383	2530205.765

Base Conditions Junction Summary

Name	Description	Invert Elev. (ft)	Rim Elev. (ft)	Depth (ft)	Tag	X-Coordinate	Y-Coordinate
DI151	DI	20.337	21.837	1.5	DG4	5962359.105	2530180.122
DI152	DI	26.025	27.775	1.75	DG4	5962190.194	2530415.9
DI153	DI	27.605	29.905	2.3	DG2	5960650.464	2529028.658
DI154	DI	24.938	29.138	4.2	DG4	5962155.6	2530552.695
DI155	DI	29.183	31.633	2.45	DG4	5962070.417	2530696.87
DI156	DI	29.672	31.672	2	DG4	5962017.203	2530660.959
DI157	DI	30.802	32.802	2	DG4	5961806.743	2530533.261
DI158	DI	31.029	32.529	1.5	DG4	5961771.982	2530509.268
DI159	DI	28.291	31.491	3.2	DG2	5960470.626	2529205.646
DI160	DI	33.499	35.829	2.33	DG4	5961903.692	2530945.376
DI161	DI	32.899	35.199	2.3	DG4	5961852.944	2530911.393
DI162	DI	38.387	40.887	2.5	DG4	5961222.713	2530860.722
DI163	DI	39.176	41.276	2.1	DG4	5961187.985	2530841.496
DI164	DI	40.121	41.371	1.25	DG4	5961190.689	2530819.767
DI165	DI	42.482	44.152	1.67	DG4	5961029.013	2531076.088
DI166	DI	20.049	21.049	1	DG3	5962390.374	2531284.317
DI167	DI	20.12	21.12	1	DG3	5962352.105	2531261.806
DI168	DI	21.211	23.611	2.4	DG3	5962183.393	2531491.654
DI169	DI	20.558	23.858	3.3	DG3	5962201.861	2531460.657
DI170	DI	34.417	37.117	2.7	DG3	5961975.816	2531282.129
DI171	DI	35.101	37.301	2.2	DG3	5962003.843	2531311.198
DI172	DI	33.929	36.529	2.6	DG3	5961949.157	2531291.423
DI173	DI	33.547	36.947	3.4	DG3	5961917.378	2531316.945
DI174	DI	37.391	39.291	1.9	DG3	5961494.734	2531031.399
DI175	DI	37.459	40.209	2.75	DG3	5961436.929	2530992.05
DI176	DI	17.5	19	1.5	DG3	5961994.749	2531906.499
DI177	DI	20.253	21.253	1	DG3	5961899.6	2531915.19
DI178	DI	28.517	31.317	2.8	DG2	5960449.067	2529235.504
DI179	DI	18.993	22.493	3.5	DG3	5962013.034	2532066.744
DI180	DI	19.676	23.576	3.9	DG3	5962027.487	2532186.559
DI181	DI	19.485	22.235	2.75	DG3	5962092.595	2531998.65
DI182	DI	18.729	21.629	2.9	DG3	5962090.586	2531944.635
DI183	DI	19.688	25.688	6	DG3	5961517.036	2532722.622
DI184	DI	22.198	23.698	1.5	DG3	5961523.156	2532679.279
DI185	DI	33.039	35.539	2.5	DG2	5960281.326	2529487.552
DI186	DI	20.698	23.698	3	DG3	5961789.896	2532676.025
DI187	DI	18.992	23.992	5	DG3	5961789.036	2532727.445
DI188	DI	22.948	24.448	1.5	DG3	5961881.901	2532722.355
DI189	DI	23.766	28.516	4.75	DG3	5962130.134	2532758.349
DI190	DI	28.264	29.264	1	DG3	5962229.239	2532719.174
DI191	DI	26.285	31.085	4.8	DG3	5962200.947	2532970.412
DI193	DI	27.246	32.046	4.8	DG3	5962239.362	2533094.746
DI194	DI	29.16	34.41	5.25	DG3	5962274.985	2533238.926
DI195	DI	29.618	32.618	3	DG3	5962493.326	2533554.522
DI196	DI	29.601	32.601	3	DG3	5962623.638	2533743.09
DI197	DI	30.197	32.697	2.5	DG3	5962680.75	2533824.187
DI198	DI	30.178	32.928	2.75	DG3	5962714.845	2533869.074
DI199	DI	30.323	32.523	2.2	DG3	5962777.792	2533944.025
DI200	DI	30.529	35.129	4.6	DG2	5960332.102	2529521.892

Base Conditions Junction Summary

Name	Description	Invert Elev. (ft)	Rim Elev. (ft)	Depth (ft)	Tag	X-Coordinate	Y-Coordinate
DI201	DI	30.2	33.012	2.812	DG3	5962727.405	2533965.889
DI202	DI	30.455	33.888	3.433	DG3	5962625.465	2533969.613
DI203	DI	30.655	34.155	3.5	DG3	5962588.408	2533972.704
DI204	DI	33.525	36.625	3.1	DG3	5962325.418	2533976.76
DI205	DI	34.552	38.222	3.67	DG3	5962149.802	2533980.972
DI206	DI	36.885	38.885	2	DG3	5962112.172	2534029.551
DI207	DI	38.641	39.641	1	DG3	5962004.5	2534064.108
DI208	DI	38.971	39.971	1	DG3	5961549.753	2534175.226
DI209	DI	37.667	39.567	1.9	DG2	5960282.286	2529802.766
DI213	DI	26.88	30.38	3.5	DG1	5963274.884	2534436.058
DI214	DI	28.095	31.095	3	DG1	5963210.944	2534385.508
DI215	DI	25.886	27.886	2	DG1	5963793.149	2534878.617
DI216	DI	24.715	28.315	3.6	DG1	5963670.14	2534669.965
DI217	DI	27.936	28.936	1	DG1	5963611.952	2534611.527
DI218	DI	37.931	40.231	2.3	DG2	5960259.124	2529834.79
DI221	DI	34.962	36.462	1.5	DG3	5960828.408	2534037.958
DI222	DI	31.459	35.659	4.2	DG3	5960821.295	2534127.073
DI223	DI	29.407	36.007	6.6	DG3	5960812.413	2534476.218
DI224	DI	30.085	35.835	5.75	DG3	5960851.869	2534475.061
DI225	DI	26.875	32.875	6	DG3	5960552.189	2534486.928
DI226	DI	26.659	32.859	6.2	DG3	5960512.581	2534484.498
DI227	DI	36.891	40.391	3.5	DG2	5960165.269	2529771.673
DI228	DI	37.942	40.442	2.5	DG3	5961085.721	2534689.589
DI229	DI	37.746	40.296	2.55	DG3	5961083.805	2534731.22
DI230	DI	34.93	39.6	4.67	DG3	5960868.467	2534743.588
DI231	DI	34.563	41	6.437	DG3	5960811.247	2534747.386
DI232	DI	35.132	37.882	2.75	DG3	5960552.62	2534743.462
DI233	DI	38.76	40.86	2.1	DG2	5960113.796	2529735.573
DI234	DI	45.812	48.262	2.45	DG3	5960583.864	2535410.081
DI235	DI	45.017	47.617	2.6	DG3	5960520.529	2535408.893
DI236	DI	41.822	47.022	5.2	DG3	5960493.997	2535410.147
DI237	DI	50.858	51.858	1	DG3	5960256.207	2536365.07
DI238	DI	47.472	51.472	4	DG3	5960297.803	2536362.711
DI239	DI	52.666	56.566	3.9	DG3	5960557.152	2536608.036
DI240	DI	52.625	56.625	4	DG3	5960597.391	2536607.638
DI241	DI	49.288	52.888	3.6	DG3	5960830.555	2536665.681
DI242	DI	48.765	51.665	2.9	DG3	5960923.199	2536660.625
DI243	DI	48.314	51.064	2.75	DG3	5961029.3	2536657.646
DI244	DI	49.308	51.108	1.8	DG3	5961041.413	2536707.975
DI245	DI	48.043	51.543	3.5	DG3	5961133.942	2536653.594
DI246	DI	47.864	51.164	3.3	DG3	5961162.791	2536604.627
DI247	DI	46.496	49.696	3.2	DG3	5961158.601	2536411.926
DI248	DI	39.148	44.248	5.1	DG2	5959944.875	2529983.379
DI249	DI	47.738	49.738	2	DG3	5961197.982	2536409.644
DI250	DI	40.005	43.905	3.9	DG2	5959997.744	2530019.764
DI251	DI	52.667	54.967	2.3	DG2	5958897.817	2531428.814
DI252	DI	34.934	40.334	5.4	DG4	5960743.428	2530523.195
DI253	DI	35.006	39.606	4.6	DG4	5960685.629	2530484.095
DI254	DI	37.901	38.901	1	DG4	5960561.71	2530538.058

Base Conditions Junction Summary

Name	Description	Invert Elev. (ft)	Rim Elev. (ft)	Depth (ft)	Tag	X-Coordinate	Y-Coordinate
DI255	DI	39.437	41.767	2.33	DG4	5960449.492	2530325.039
DI256	DI	35.646	37.796	2.15	DG4	5960611.502	2530088.082
DI257	DI	36.185	37.185	1	DG4	5960644.981	2530108.676
DI258	DI	33.03	36.43	3.4	DG4	5960664.713	2530102.248
DI259	DI	26.088	33.488	7.4	DG4	5960773.776	2530182.162
DI260	DI	31.597	33.747	2.15	DG4	5960790.57	2530146.18
DI261	DI	29	35	6	DG4	5960926.073	2529924.126
DI262	DI	33.13	34.88	1.75	DG4	5960780.276	2529837.821
DI263	DI	28.75	31	2.25	DG4	5960949.516	2529885.894
DI264	DI	41.727	45.027	3.3	DG2	5959724.79	2529863.031
DI265	DI	23.677	27.877	4.2	DG4	5960987.659	2529833.222
DI266	DI	29.214	30.714	1.5	DG4	5961250.439	2529773.031
DI267	DI	26.662	29.262	2.6	DG4	5961186.681	2529742.398
DI268	DI	16.354	22.454	6.1	DG4	5961049.195	2529651.263
DI269	DI	18.026	22.226	4.2	DG4	5961074.815	2529611.147
DI270	DI	20.929	22.429	1.5	DG4	5961071.477	2529596.69
DI271	DI	15.041	22.941	7.9	DG4	5961029.505	2529534.053
DI272	DI	41.657	44.807	3.15	DG2	5959694.487	2529838.076
DI273	DI	17.767	19.767	2	DG4	5961140.697	2529375.955
DI274	DI	16.711	18.711	2	DG4	5961197.553	2529387.979
DI275	DI	18.24	20.24	2	DG4	5961117.843	2529342.694
DI276	DI	18.453	20.453	2	DG4	5961113.15	2529348.407
DI277	DI	15.029	18.929	3.9	DG4	5961214.507	2529352.915
DI278	DI	13.203	18.953	5.75	DG4	5961210.302	2529349.613
DI279	DI	23.248	27.248	4	DG4	5961396.76	2529526.698
DI280	DI	24.036	27.036	3	DG4	5961421.876	2529489.102
DI281	DI	39.256	43.456	4.2	DG2	5960048.735	2530054.461
DI282	DI	13.8	19.081	5.281	DG4	5961249.315	2529214.409
DI283	DI	17.851	20.101	2.25	DG4	5961201.458	2529215.031
DI284	DI	12.301	16.631	4.33	DG4	5961398.664	2529156.107
DI285	DI	11.733	16.883	5.15	DG4	5961419.246	2529123.365
DI286	DI	21.558	23.358	1.8	DG4	5961564.985	2529282.612
DI287	DI	20.494	22.494	2	DG4	5961600.815	2529229.489
DI288	DI	40.945	43.445	2.5	DG2	5960072.4	2530023.391
DI289	DI	22.767	24.427	1.66	DG4	5961664.968	2529336.345
DI290	DI	23.093	24.893	1.8	DG4	5961735.426	2529384.116
DI291	DI	23.821	25.221	1.4	DG4	5961773.289	2529409.633
DI292	DI	24.24	25.24	1	DG4	5961784.18	2529423.342
DI293	DI	29.663	30.913	1.25	DG4	5960944.896	2529242.511
DI294	DI	9.787	13.587	3.8	DG4	5961785.651	2528331.873
DI295	DI	42.951	43.951	1	DG2	5960195.782	2530148.644
DI296	DI	9.354	13.154	3.8	DG4	5961844.961	2528371.809
DI297	DI	11.262	14.712	3.45	DG4	5961615.528	2528579.199
DI298	DI	10.389	14.389	4	DG4	5961639.353	2528547.281
DI299	DI	11.021	13.121	2.1	DG4	5961735.796	2528611.802
DI300	DI	10.352	14.102	3.75	DG4	5961671.666	2528617.189
DI301	DI	14.341	18.341	4	DG4	5961446.99	2528851.885
DI302	DI	13.149	17.399	4.25	DG4	5961501.02	2528863.253
DI303	DI	16.751	19.499	2.748	DG4	5961750.049	2529031.62

Base Conditions Junction Summary

Name	Description	Invert Elev. (ft)	Rim Elev. (ft)	Depth (ft)	Tag	X-Coordinate	Y-Coordinate
DI305	DI	13.282	14.982	1.7	DG4	5961867.846	2528763.961
DI306	DI	42.207	45.607	3.4	DG2	5959793.774	2530236.175
DI307	DI	12.348	14.898	2.55	DG4	5961916.248	2528781.748
DI308	DI	12.939	15.039	2.1	DG4	5961936.293	2528734.036
DI310	DI	9.687	13.087	3.4	DG4	5962528.651	2528855.5
DI311	DI	9.711	13.211	3.5	DG4	5962562.618	2528879.709
DI312	DI	43.558	46.558	3	DG2	5959787.539	2530244.943
DI313	DI	13.845	14.845	1	DG4	5962361.638	2529063.795
DI314	DI	12.687	14.687	2	DG4	5962322.741	2529037.461
DI315	DI	9.993	11.743	1.75	DG4	5962401.966	2529251.272
DI316	DI	18.187	19.517	1.33	DG4	5961948.801	2529179.276
DI317	DI	17.794	19.544	1.75	DG4	5961944.952	2529162.923
DI318	DI	17.849	19.459	1.61	DG4	5961981.17	2529200.677
DI319	DI	17.953	19.283	1.33	DG4	5961996.767	2529197.648
DI320	DI	11.456	14.206	2.75	DG4	5962197.783	2529347.172
DI321	DI	10.919	14.419	3.5	DG4	5962217.33	2529296.455
DI322	DI	43.235	46.235	3	DG2	5960081.424	2530415.283
DI323	DI	10.75	13.047	2.297	DG4	5962265.668	2529325.083
DI324	DI	11.033	14.033	3	DG4	5962242.639	2529281.276
DI325	DI	11.926	12.926	1	DG4	5962315.72	2529369.583
DI326	DI	9.722	11.87	2.148	DG4	5962444.28	2529464.04
DI327	DI	9.267	10.937	1.67	DG4	5962443.213	2529499.484
DI328	DI	8.56	10.66	2.1	DG4	5962445.657	2529521.568
DI329	DI	9.45	11.55	2.1	DG4	5962316.263	2529595.447
DI330	DI	8.188	10.938	2.75	DG4	5962477.319	2529541.256
DI331	DI	8.56	10.81	2.25	DG4	5962589.767	2529598.941
DI332	DI	10.779	12.779	2	DG4	5962713.547	2529629.152
DI333	DI	43.624	46.424	2.8	DG2	5960033.201	2530416.628
DI334	DI	9.205	11.105	1.9	DG10	5962840.183	2528652.954
DI335	DI	8.898	11.325	2.427	DG10	5962879.895	2528653.906
DI336	DI	8.578	12.2	3.622	DG10	5962961.594	2528718.243
DI337	DI	8.895	12	3.105	DG10	5963040.105	2528715.996
DI338	DI	14.626	17.876	3.25	DG4	5962030.592	2529594.77
DI339	DI	12.629	16.879	4.25	DG4	5962055.737	2529628.369
DI340	DI	12.068	13.668	1.6	DG4	5962271.268	2529771.782
DI341	DI	11.158	13.658	2.5	DG4	5962274.675	2529747.663
DI342	DI	11.611	13.511	1.9	DG4	5962296.613	2529714.67
DI343	DI	10.302	13.202	2.9	DG4	5962329.582	2529784.8
DI344	DI	43.514	47.314	3.8	DG2	5959933.913	2530564.464
DI345	DI	11.507	12.907	1.4	DG4	5962352.792	2529752.209
DI346	DI	19.995	20.995	1	DG4	5962134.432	2529964.137
DI347	DI	19.275	20.275	1	DG4	5962156.398	2529948.049
DI348	DI	17.861	19.861	2	DG4	5962181.458	2529978.987
DI349	DI	18.324	20.324	2	DG4	5962183.314	2530001.261
DI350	DI	18.592	20.842	2.25	DG4	5962109.193	2530011.495
DI351	DI	17.376	20.576	3.2	DG4	5962142.482	2530037.012
DI352	DI	17.666	22.766	5.1	DG4	5961893.373	2529868.926
DI353	DI	45.797	46.797	1	DG2	5959968.552	2530672.557
DI354	DI	18.814	23.264	4.45	DG4	5961860.077	2529847.098

Base Conditions Junction Summary

Name	Description	Invert Elev. (ft)	Rim Elev. (ft)	Depth (ft)	Tag	X-Coordinate	Y-Coordinate
DI355	DI	21.974	23.304	1.33	DG4	5961856.03	2529828.349
DI356	DI	24.531	26.781	2.25	DG4	5961742.811	2530112.56
DI357	DI	25.111	27.911	2.8	DG4	5961695	2530091.968
DI358	DI	24.286	26.736	2.45	DG4	5961715.066	2530131.976
DI359	DI	44.156	49.156	5	DG2	5959704.278	2530902.715
DI360	DI	46.672	49.472	2.8	DG2	5959736.242	2530925.9
DI361	DI	51.384	53.884	2.5	DG2	5959378.709	2531385.55
DI362	DI	49.875	52.675	2.8	DG2	5959480.908	2531233.402
DI363	DI	51.811	53.911	2.1	DG2	5959220.412	2531472.609
DI364	DI	35.459	37.639	2.18	DG6	5959505.345	2528601.861
DI365	DI	36.32	37.62	1.3	DG6	5959454.494	2528583.817
DI366	DI	33.811	35.911	2.1	DG6	5959257.27	2528434.116
DI367	DI	42.216	44.216	2	DG2	5959617.698	2529414.602
DI368	DI	33.797	34.797	1	DG6	5959183.944	2528404.034
DI369	DI	33.042	34.042	1	DG6	5959185.822	2528364.584
DI370	DI	37.946	38.946	1	DG6	5959064.005	2528611.259
DI371	DI	36.936	39.336	2.4	DG6	5959086.692	2528680.75
DI372	DI	36.46	39.26	2.8	DG6	5959038.607	2528663.44
DI373	DI	41.614	42.814	1.2	DG6	5958917.137	2528928.239
DI374	DI	31.417	32.417	1	DG3	5962328.656	2533023.33
DI488	DI	23.569	24.569	1	DG4	5961184.459	2529664.177
DI489	DI	13.368	14.868	1.5	DG4	5962655.805	2529263.554
DI490	DI	36.256	37.256	1	DG6	5959539.674	2528576.707
DI491	DI	52.2	53.45	1.25	DG2	5959373.37	2531399.789
DI492	DI	51.95	53.2	1.25	DG2	5959380.491	2531388.293
DI494	DI	9.759	12.759	3	DG4	5962584.534	2529464.31
DI495	DI	12.526	15.526	3	DG4	5962237.548	2529106.116
DI496	DI	20.974	23.974	3	DG4	5961706.562	2529302.267
DI498	DI	40.222	41.722	1.5	DG3	5961399.604	2534682.313
DI499	DI	40.695	41.695	1	DG3	5961399.527	2534721.145
DI500	DI	41.86	42.86	1	DG3	5961766.044	2534713.026
DI501	DI	8.908	9.908	1	DG3	5964537.478	2529381.565
DI503	DI	6.091	10.691	4.6	DG3	5963551.526	2529272.164
DI504	DI	13.506	14.506	1	DG4	5962808.483	2529343.118
DI505	DI	10.904	11.904	1	DG4	5962813.214	2529241.619
DI508	DI	15.855	18.355	2.5	DG4	5961240.743	2529319.163
DI509	DI	10.392	11.392	1	DG3	5963389.468	2529791.801
DI511	DI	22.404	25.204	2.8	DG3	5962060.215	2532407.248
DI512	DI	15	21	6	DG3	5961490.817	2532424.913
DI513	DI	16.791	21	4.209	DG3	5961494.216	2532451.252
DI514	DI	30.113	33.013	2.9	DG3	5962740.757	2533965.502
DI515	DI	11.397	13.397	2	DG3	5962900.87	2531038.772
DI516	DI	31.129	32.229	1.1	DG3	5962958.06	2534145.128
DI518	DI	25.063	28.763	3.7	DG1	5963649.858	2534759.186
DI519	DI	8.795	11.095	2.3	DG3	5963267.21	2530009.687
DI520	DI	32.453	35.853	3.4	DG3	5962017.173	2531338.804
DI521	DI	26.087	27.087	1	DG2	5960511.861	2528695.085
DI522	DI	28.201	30.201	2	DG2	5960607.698	2529020.791
DI523	DI	41.717	45.417	3.7	DG2	5959679.4	2529831.017

Base Conditions Junction Summary

Name	Description	Invert Elev. (ft)	Rim Elev. (ft)	Depth (ft)	Tag	X-Coordinate	Y-Coordinate
DI524	DI	12.705	14.105	1.4	DG2	5960737.074	2527758.134
DI525	DI	9.744	12.944	3.2	DG2	5960580.311	2527837.168
DI526	DI	11.152	14.002	2.85	DG4	5961990.713	2528581.883
DI527	DI	11.037	13.887	2.85	DG4	5962059.154	2528552.713
DI528	DI	10.049	13.749	3.7	DG4	5961839.456	2528324.294
DI529	DI	10.637	13.737	3.1	DG4	5961864.995	2528341.813
DI530	DI	49.726	52.226	2.5	DG5	5958187.139	2530072.754
DI531	DI	49.487	51.887	2.4	DG5	5958234.667	2530104.901
DI532	DI	29.857	34.357	4.5	DG8	5959392.171	2528177.835
DI533	DI	13.133	16.133	3	DG7	5960311.992	2527656.962
DI535	DI	13.394	14.394	1	DG4	5962539.89	2529177.876
DI536	DI	53.215	57.215	4	DG3	5960569.425	2536739.316
DI537	DI	47	50.164	3.164	DG3	5961168.533	2536044.846
DI538	DI	15.568	16.568	1	DG4	5962247.98	2528980.466
I001	Inter	23.5	49	25.5	DG5	5958143.768	2528906.59
I002	Inter	12	17.537	5.537	DG3	5962131.828	2531880.806
I003	Inter	11.59	15	3.41	DG2	5960771.7	2527779.526
I004	Inter	40.906	42.906	2	DG6	5958886.07	2528895.775
I005	Inter	41.1	43.445	2.345	DG6	5958924.233	2528921.37
I009	Inter	4.625	12	7.375	DG3	5964322.801	2529924.783
I010	Inter	42.43	47.413	4.983	DG5	5958755.644	2529286.952
I011	Inter	50.933	52.933	2	DG5	5958447.889	2530226.341
I012	Inter	50.861	52.861	2	DG5	5958417.087	2530205.439
I013	Inter	44.5	52.288	7.788	DG5	5958233.374	2530084.431
I014	Inter	47.624	52.506	4.882	DG5	5958030.837	2529950.71
I015	Inter	48.707	52.449	3.742	DG5	5958000.034	2529930.175
I016	Inter	50.2	53	2.8	DG5	5957972.529	2530465.894
I017	Inter	51.5	58	6.5	DG5	5957638.927	2530391.392
I018	Inter	51.83	58.23	6.4	DG5	5957651.077	2531134.083
I019	Inter	49.2	54.7	5.5	DG5	5958870.037	2530796.368
I020	Inter	48.5	55	6.5	DG5	5958980.118	2530634.709
I021	Inter	46.83	53	6.17	DG5	5959222.193	2530274.415
I022	Inter	45.542	52.33	6.788	DG5	5958194.177	2530058.552
I023	Inter	12.8	15.689	2.889	DG4	5961192.309	2528225.001
I025	Inter	27.5	30.105	2.605	DG2	5960617.655	2529026.419
I026	Inter	8	13.53	5.53	DG4	5961985.103	2528350.532
I027	Inter	7.1	12.35	5.25	DG4	5962635.794	2528790.033
I028	Inter	7.05	11.26	4.21	DG4	5962938.725	2528993.01
I029	Inter	4	11	7	DG4	5963205.281	2529034.404
I030	Inter	4	11	7	DG4	5963214.052	2529045.643
I031	Inter	6.4	10.922	4.522	DG4	5963113.023	2529134.05
I033	Inter	11.09	14.358	3.268	DG4	5962023.32	2528597.933
I034	Inter	12.533	14.133	1.6	DG4	5962689.351	2529233.233
I035	Inter	22	25	3	DG2	5960578.932	2528597.313
I036	Inter	8	14	6	DG4	5962745.743	2529780.785
I038	Inter	10.2	13.823	3.623	DG2	5960848.475	2527692.981
I039	Inter	8.1	11.476	3.376	DG4	5962979.511	2529814.652
I040	Inter	8.1	10.368	2.268	DG4	5963016.479	2529839.96
I041	Inter	9.93	13	3.07	DG3	5963393.145	2529787.919

Base Conditions Junction Summary

Name	Description	Invert Elev. (ft)	Rim Elev. (ft)	Depth (ft)	Tag	X-Coordinate	Y-Coordinate
I042	Inter	9.93	11.419	1.489	DG3	5963433.031	2529729.935
I043	Inter	9	12	3	DG3	5963500.238	2529631.638
I044	Inter	8.9	10.985	2.085	DG3	5963560.21	2529542.71
I045	Inter	8.01	12	3.99	DG3	5963534.827	2529509.368
I046	Inter	8.87	11.575	2.705	DG3	5963591.095	2529498.927
I047	Inter	8.85	12	3.15	DG3	5963599.219	2529487.204
I048	Inter	8.33	11.33	3	DG3	5963692.967	2529357.939
I049	Inter	1.604	5.604	4	DG3	5963580.048	2529195.156
I050	Inter	29.853	30.853	1	DG2	5960397.102	2528848.58
I051	Inter	8.929	12	3.071	DG3	5964832.37	2529308.469
I052	Inter	8.901	11.963	3.062	DG3	5965052.807	2529234.216
I053	Inter	9.5	13.188	3.688	DG3	5965342.747	2529192.057
I054	Inter	9.6	13.36	3.76	DG3	5965349.99	2529120.141
I055	Inter	10.02	13.679	3.659	DG3	5965352.405	2529102.377
I056	Inter	10.05	13.121	3.071	DG3	5965336.193	2529056.503
I057	Inter	7.5	12.281	4.781	DG3	5964356.11	2529576.326
I058	Inter	7.8	10.673	2.873	DG3	5964354.436	2529441.835
I059	Inter	7.9	9.819	1.919	DG3	5964381.223	2529435.138
I060	Inter	6.958	8.958	2	DG3	5963858.902	2529660.17
I061	Inter	7.3	11.187	3.887	DG3	5963621.305	2529973.963
I062	Inter	26.5	32	5.5	DG2	5960518.221	2528908.513
I063	Inter	9.514	10.514	1	DG3	5963949.013	2529977.606
I064	Inter	7.5	12.497	4.997	DG3	5963293.399	2530447.953
I065	Inter	7.4	12	4.6	DG3	5963382.865	2530323.389
I066	Inter	8.5	12.169	3.669	DG3	5963137.171	2530683.979
I067	Inter	12.944	14.444	1.5	DG3	5962867.047	2530502.196
I068	Inter	10.3	12.4	2.1	DG3	5963078.917	2530771.634
I069	Inter	10.568	12.568	2	DG3	5963039.968	2530831.295
I070	Inter	11.867	12.867	1	DG3	5963072.273	2531281.747
I071	Inter	8.2	11.352	3.152	DG4	5962903.512	2529927.842
I072	Inter	10	15.492	5.492	DG4	5962565.687	2529936.004
I073	Inter	10.6	15.499	4.899	DG4	5962557.899	2529930.506
I074	Inter	14.7	20.73	6.03	DG4	5962415.395	2530155.484
I075	Inter	10.012	12.012	2	DG2	5960916.818	2527745.177
I076	Inter	27.1	29.93	2.83	DG2	5960632.426	2529005.248
I077	Inter	16.5	21.559	5.059	DG4	5962396.505	2530183.184
I078	Inter	18	21.347	3.347	DG4	5962387.758	2530196.062
I079	Inter	24	29.472	5.472	DG4	5962149.756	2530545.495
I080	Inter	27.5	35	7.5	DG4	5962039.262	2530662.304
I081	Inter	28.6	35	6.4	DG4	5962025.824	2530653.4
I082	Inter	29	32.675	3.675	DG4	5961821.748	2530515.11
I083	Inter	32	35.288	3.288	DG4	5961895.622	2530877.227
I084	Inter	38	41.079	3.079	DG4	5961224.446	2530848.06
I085	Inter	41.4	43.897	2.497	DG4	5961036.37	2531072.861
I086	Inter	14.003	15.003	1	DG3	5962463.537	2531334.967
I087	Inter	11	15.5	4.5	DG3	5962424.142	2531609.606
I088	Inter	32.5	36.786	4.286	DG3	5961999.303	2531323.087
I089	Inter	28.7	31.798	3.098	DG2	5960463.393	2529241.62
I090	Inter	32.8	37.093	4.293	DG3	5961965.953	2531300.409

Base Conditions Junction Summary

Name	Description	Invert Elev. (ft)	Rim Elev. (ft)	Depth (ft)	Tag	X-Coordinate	Y-Coordinate
I091	Inter	33.2	36.589	3.389	DG3	5961951.859	2531290.873
I092	Inter	15	18.6	3.6	DG3	5961771.305	2532051.762
I093	Inter	18	21.757	3.757	DG3	5961923.052	2531942.09
I094	Inter	18.5	28.09	9.59	DG3	5961357.324	2532707.756
I095	Inter	18	25	7	DG3	5961257.483	2532592.424
I096	Inter	18.992	24.579	5.587	DG3	5961790.812	2532720.881
I097	Inter	22	29	7	DG3	5961882.179	2532717.966
I098	Inter	23.6	29	5.4	DG3	5962095.385	2532711.354
I099	Inter	28.395	29.395	1	DG3	5962227.132	2532728.864
I100	Inter	30.5	32.776	2.276	DG3	5962843.545	2534037.109
I101	Inter	36	40.135	4.135	DG3	5961547.962	2534079.099
I102	Inter	24.521	27.521	3	DG1	5963845.704	2534818.61
I103	Inter	15.775	16.775	1	DG1	5963866.098	2534795.078
I104	Inter	17.622	20.122	2.5	DG2	5960497.994	2528178.387
I105	Inter	23.764	27	3.236	DG3	5960404.667	2534488.532
I107	Inter	36.88	39.88	3	DG3	5960870.049	2534731.168
I108	Inter	33	39.895	6.895	DG3	5960814.559	2534731.642
I109	Inter	30	37.907	7.907	DG3	5960557.596	2534735.171
I110	Inter	22.82	40.279	17.459	DG3	5960104.406	2534751.914
I111	Inter	48.209	49.209	1	DG3	5961120.988	2535390.463
I112	Inter	36.425	37.925	1.5	DG3	5960147.714	2535416.172
I113	Inter	45.855	46.855	1	DG3	5961572.176	2535981.107
I114	Inter	46.69	47.69	1	DG3	5961345.964	2535992.356
I115	Inter	47	50	3	DG3	5961343.464	2536038.599
I116	Inter	44	46	2	DG3	5960293.638	2536168.577
I117	Inter	47.5	57.466	9.966	DG3	5960307.801	2536683.492
I118	Inter	48	56.893	8.893	DG3	5960567.757	2536675.994
I120	Inter	38.99	44.156	5.166	DG2	5959960.707	2529989.782
I122	Inter	46.594	52	5.406	DG3	5961162.327	2536409.133
I123	Inter	46	49	3	DG3	5961159.899	2536320.288
I124	Inter	32.454	39.819	7.365	DG4	5960629.769	2530438.172
I125	Inter	39	41.978	2.978	DG4	5960466.112	2530318.096
I126	Inter	34.318	39	4.682	DG4	5960626.443	2530075.938
I127	Inter	40.971	44.971	4	DG2	5959740.737	2529837.672
I128	Inter	33.468	36.868	3.4	DG4	5960654.249	2530095.222
I129	Inter	29.1	35	5.9	DG4	5960922.578	2529929.41
I130	Inter	18.7	28	9.3	DG4	5961096.028	2529668.476
I131	Inter	22	24.584	2.584	DG4	5961158.373	2529667.329
I132	Inter	22.5	27.503	5.003	DG4	5961405.199	2529518.269
I133	Inter	22	26.559	4.559	DG4	5961426.409	2529486.022
I134	Inter	17.985	19.985	2	DG2	5960491.604	2528187.76
I135	Inter	14	19.667	5.667	DG4	5961188.957	2529314.654
I136	Inter	12	17.259	5.259	DG4	5961415.586	2529131.001
I137	Inter	21	23.385	2.385	DG4	5961573.329	2529267.015
I138	Inter	20.4	23.9	3.5	DG4	5961695.304	2529318.664
I139	Inter	23.83	25.179	1.349	DG4	5961788.865	2529415.309
I140	Inter	7.4	13.77	6.37	DG4	5961841.836	2528335.031
I141	Inter	7.2	15	7.8	DG4	5961854.148	2528343.097
I142	Inter	9.8	13.803	4.003	DG4	5961680.127	2528573.424

Base Conditions Junction Summary

Name	Description	Invert Elev. (ft)	Rim Elev. (ft)	Depth (ft)	Tag	X-Coordinate	Y-Coordinate
I143	Inter	41.047	46.047	5	DG2	5959800.816	2530227.294
I144	Inter	11.3	14.69	3.39	DG4	5961956.834	2528696.272
I146	Inter	13.238	15.238	2	DG4	5962364.805	2529057.882
I147	Inter	13.251	15.251	2	DG4	5962331.73	2529035.677
I149	Inter	11.259	14.959	3.7	DG4	5962308.039	2529153.506
I150	Inter	11	14.074	3.074	DG4	5962326.894	2529218.994
I151	Inter	42	46.714	4.714	DG2	5960054.869	2530397.31
I153	Inter	17.702	19.702	2	DG4	5961959.814	2529167.303
I154	Inter	17.59	19.59	2	DG4	5961989.995	2529187.709
I155	Inter	10.8	12.816	2.016	DG4	5962262.074	2529338.39
I156	Inter	10.75	12.964	2.214	DG4	5962265.09	2529311.251
I157	Inter	10.75	12.388	1.638	DG4	5962315.237	2529372.496
I158	Inter	9.5	11.433	1.933	DG4	5962455.141	2529471.857
I159	Inter	8.25	11.433	3.183	DG4	5962456.347	2529503.98
I160	Inter	42.5	46.759	4.259	DG2	5960042.725	2530415.121
I161	Inter	8.9	11.566	2.666	DG4	5962382.244	2529612.75
I162	Inter	7.7	12.066	4.366	DG4	5962715.408	2529626.361
I163	Inter	43	47.454	4.454	DG2	5959940.607	2530566.18
I164	Inter	12.5	17.292	4.792	DG4	5962062.656	2529614.13
I165	Inter	10.66	15	4.34	DG4	5962337.614	2529778.564
I166	Inter	18	21.085	3.085	DG4	5962152.995	2530016.42
I167	Inter	17	22.639	5.639	DG4	5961893.844	2529863.539
I168	Inter	43.5	47.708	4.208	DG2	5959900.146	2530625.735
I169	Inter	19	25.83	6.83	DG2	5960318.383	2528445.48
I170	Inter	52.338	54.478	2.14	DG2	5959222.523	2531417.65
I171	Inter	24.786	27.786	3	DG9	5959996.059	2527840.806
I172	Inter	22	26.123	4.123	DG9	5960038.165	2527778.241
I173	Inter	26	31.827	5.827	DG9	5959837.061	2528076.739
I174	Inter	26.5	29.368	2.868	DG9	5959973.454	2528166.021
I175	Inter	37.95	39.95	2	DG2	5959795.687	2529154.236
I176	Inter	27.65	31.994	4.344	DG9	5959821.104	2528102.193
I177	Inter	33.5	37.859	4.359	DG6	5959470.169	2528562.747
I178	Inter	32	35.881	3.881	DG6	5959272.237	2528428.665
I179	Inter	29	35.04	6.04	DG6	5959204.4	2528399.652
I180	Inter	24.874	28	3.126	DG2	5960508.748	2528692.765
I181	Inter	22.244	34.244	12	DG6	5959200.225	2528362.08
I182	Inter	35.459	38.459	3	DG6	5959070.896	2528615.235
I183		20	25	5	DG3	5961228.73	2532639.439
I184		17	25.324	8.324	DG3	5961315.989	2532590.765
I185		15	24.602	9.602	DG3	5960301.918	2534332.012
I188		15	22.275	7.275	DG3	5961493.168	2532344.319
I189		9	17	8	DG3	5965334.986	2529257.249
I190		4.996	14	9.004	DG4	5963254.354	2528985.527
I191		20.9	22.9	2	DG9	5960052.484	2527692.104
I192		18	22	4	DG5	5958091.701	2528840.14
I193		3.5	8	4.5	DG2	5961443.576	2527216.784
I536	Inter	59.953	60.953	1	DG3	5960608.585	2536064.844
I707		7.58	10.83	3.25	DG3	5963770.789	2529324.132
I997		8.9	12.198	3.298	DG4	5961378.612	2527958.097

Base Conditions Junction Summary

Name	Description	Invert Elev. (ft)	Rim Elev. (ft)	Depth (ft)	Tag	X-Coordinate	Y-Coordinate
I999		8.82	10.928	2.108	DG3	5963656.362	2529403.096
J1		10.502	12.602	2.1	DG4	5961337.974	2528014.112
J10		8.6	11.157	2.557	DG4	5963054.437	2529745.338
J107		10.395	17.395	7	DG7	5960239.325	2527604.891
J11		8.5	11.205	2.705	DG4	5963026.19	2529726.938
J13	Inter	7.653	13.418	5.765	DG4	5962895.06	2529414.174
J15	Inter	6.922	12.869	5.947	DG4	5962794.065	2529519.745
J16	DI	10	12.236	2.236	DG4	5962527.37	2529436.189
J17		9.253	11.788	2.535	DG4	5962473.169	2529475.684
J18	MH	8.757	14.117	5.36	DG4	5962563.37	2529350.243
J19	Inter	8.189	12.987	4.798	DG4	5962917.266	2529428.641
J20	DI	8	12.855	4.855	DG4	5962936.69	2529389.846
J21	DI	6.641	13.783	7.142	DG4	5962880.091	2529392.425
J22		16	18.324	2.324	DG4	5961512.741	2529147.485
J23		15.079	17.972	2.893	DG4	5961477.646	2529174.414
J24		23.5	25.837	2.337	DG2	5960794.537	2528747.365
J25	DI	26	27.945	1.945	DG2	5960695.074	2528890.945
J26		25.864	28.075	2.211	DG2	5960701.231	2528894.227
J27	MH	12.321	17.98	5.659	DG4	5961489.692	2528840.716
J28	MH	12.951	17.696	4.745	DG4	5961508.686	2528850.106
J29	DI	22.212	25.118	2.906	DG2	5960609.393	2528618.567
J3	DI	42.029	45.029	3	DG2	5959542.544	2529349.583
J30	MH	23.248	24.67	1.422	DG2	5960565.506	2528591.822
J31	MH	16.175	19.404	3.229	DG2	5960718.603	2528349.735
J32	Inter	10.272	14.456	4.184	DG4	5961669.52	2528563.952
J33	DI	9.452	13.72	4.268	DG4	5962265.703	2528626.448
J34	Inter	7	13.764	6.764	DG4	5962268.858	2528619.646
J36	DI	6.7	13.669	6.969	DG4	5962347.712	2528675.588
J37	MH	11.938	14.299	2.361	DG4	5962201.852	2529336.646
J38	MH	8	11.773	3.773	DG4	5963226.872	2529276.06
J39	DI	6.996	12.631	5.635	DG4	5963024.421	2529253.741
J4	DI	40.799	43.799	3	DG2	5959695.947	2529457.592
J40	MH	5.949	11.844	5.895	DG4	5963072.54	2529171.658
J41	Inter	7.233	12.102	4.869	DG4	5962902.509	2529055.787
J42	DI	9	13.087	4.087	DG4	5962884.874	2529079.98
J43	DI	7.082	11.833	4.751	DG4	5962744.895	2528863.17
J44	DI	7.99	11.935	3.945	DG4	5962727.616	2528892.813
J45	DI	7.06	11.012	3.952	DG4	5962879.084	2528953.116
J46	DI	7.07	11.562	4.492	DG4	5962817.368	2528911.793
J47	MH	8.292	11.95	3.658	DG4	5962354.717	2528613.831
J48	MH	8.4	11.939	3.539	DG4	5962360.999	2528604.117
J49	DI	18	21.416	3.416	DG4	5961017.33	2528537.374
J5	Inter	39.718	42.718	3	DG2	5959698.982	2529349.468
J50	MH	15	21.134	6.134	DG4	5960995.376	2528524.926
J51	DI	19	22.114	3.114	DG4	5960964.438	2528560.264
J52	DI	18	21.228	3.228	DG4	5960947.777	2528492.513
J53	Inter	19.409	21.828	2.419	DG2	5960655.922	2528475.373
J54	DI	19.5	21.627	2.127	DG2	5960659.002	2528476.909
J55	Inter	15.582	18.73	3.148	DG2	5960752.117	2528302.239

Base Conditions Junction Summary

Name	Description	Invert Elev. (ft)	Rim Elev. (ft)	Depth (ft)	Tag	X-Coordinate	Y-Coordinate
J56	Inter	13.622	18.682	5.06	DG2	5960762.99	2528309.243
J57	Inter	11.664	16.416	4.752	DG2	5960882.048	2528133.255
J58	Inter	13.415	16.673	3.258	DG2	5960874.461	2528128.546
J59		12.532	16.054	3.522	DG2	5960892.944	2528046.912
J6		14.5	20.039	5.539	MH	5961220.666	2529227.16
J60		11.138	16.12	4.982	DG2	5960899.779	2528051.538
J61	DI	0	14.869	14.869	DG4	5961503.855	2528154.573
J62		9.382	13.926	4.544	DG4	5961517.01	2528132.002
J63	DI	11.5	14.164	2.664	DG4	5961393.302	2528083.928
J64		10.067	13.111	3.044	DG4	5961407.554	2528059.975
J65	DI	10.253	12.598	2.345	DG4	5961348.704	2527999.417
J66	DI	11	13.372	2.372	DG4	5961247.536	2527980.826
J67	Inter	10.308	13.303	2.995	DG4	5961258.523	2527965.142
J68	MH	9.7	14.26	4.56	DG2	5961044.538	2527845.616
J69	MH	5.949	11.771	5.822	DG4	5963080.072	2529176.709
J7		13.5	21.288	7.788	MH	5961320.482	2529082.095
J8		12.5	17.678	5.178	MH	5961480.188	2528854.514
J9	DI	10.352	13.352	3	DG4	5962605.284	2529814.08
MH001	MH	11.476	16.476	5	DG2	5960893.486	2528116.282
MH002	MH	14.165	19.165	5	DG2	5960730	2528357.986
MH003	MH	5.692	12.192	6.5	DG4	5961377.929	2527954.383
MH004	MH	9.857	12.857	3	DG4	5961866.187	2528287.866
MH005	MH	7.2	12.9	5.7	DG4	5961869.143	2528283.645
MH006	MH	25.901	30.901	5	DG2	5960399.001	2528842.064
MH007	MH	26.899	29.899	3	DG2	5960637.972	2528993.662
MH008	MH	27.692	31.692	4	DG2	5960481.105	2529211.717
MH009	MH	9	12.512	3.512	DG4	5961582.347	2528096.858
MH010	MH	37.787	40.787	3	DG2	5960124.731	2529743.655
MH011	MH	6.955	13.155	6.2	DG4	5961813.496	2528353.39
MH012	MH	7.43	13.63	6.2	DG4	5961828.987	2528337.354
MH013	MH	14.136	17.336	3.2	DG7	5960414.778	2527700.373
MH014	MH	14.215	17.515	3.3	DG7	5960418.433	2527695.536
MH015	MH	10.583	14.583	4	DG2	5960832.154	2527686.346
MH016	MH	34.076	39.276	5.2	DG6	5959046.349	2528654.928
MH017	MH	30.064	35.264	5.2	DG6	5959202.545	2528415.855
MH018	MH	34.082	38.082	4	DG6	5959498.968	2528589.692
MH019	MH	24.113	27.113	3	DG4	5961731.379	2530106.226
MH020	MH	10.675	13.675	3	DG4	5962282.515	2529744.952
MH021	MH	12.33	17.33	5	DG4	5962067.545	2529607.92
MH022	MH	7.015	12.315	5.3	DG4	5962748.738	2529586.577
MH023	MH	8.476	12.376	3.9	DG4	5962716.548	2529635.764
MH024	MH	6.953	11.553	4.6	DG4	5962527.873	2529510.905
MH025	MH	7.686	11.886	4.2	DG4	5962501.414	2529505.783
MH026	MH	8.379	11.779	3.4	DG4	5962468.477	2529482.18
MH027	MH	13.097	14.897	1.8	DG4	5962391.567	2529081.058
MH028	MH	5.693	13.193	7.5	DG4	5962561.687	2528824.647
MH029	MH	6.85	13.787	6.937	DG4	5962308.443	2528654.244
MH030	MH	7.154	14.054	6.9	DG4	5962084.026	2528508.144
MH031	MH	11.315	15.565	4.25	DG4	5961923.18	2528746.578

Base Conditions Junction Summary

Name	Description	Invert Elev. (ft)	Rim Elev. (ft)	Depth (ft)	Tag	X-Coordinate	Y-Coordinate
MH032	MH	9.32	14.72	5.4	DG4	5961649.024	2528608.847
MH033	MH	10.2	14.78	4.58	DG4	5961661.796	2528575.215
MH034	MH	20.212	23.212	3	DG4	5961581.124	2529246.722
MH035	MH	32.785	35.785	3	DG2	5960293.349	2529494.248
MH036	MH	30.849	34.249	3.4	DG4	5961563.29	2530347.563
MH037	MH	29.724	32.724	3	DG4	5961785.964	2530496.039
MH038	MH	27.163	32.163	5	DG4	5962054.778	2530678.345
MH039	MH	21.749	27.549	5.8	DG4	5962227.463	2530432.013
MH040	MH	13.92	15.42	1.5	DG4	5962300.05	2529013.441
MH041	MH	12.579	14.079	1.5	DG4	5962506.057	2528907.132
MH042	MH	18.093	21.993	3.9	DG4	5961063.958	2529617.209
MH044	MH	6.641	11.641	5	DG4	5962746.011	2529659.131
MH045	MH	7.95	13.066	5.116	DG4	5962914.362	2529399.838
MH046	MH	8.168	11.168	3	DG3	5963215.935	2529983.803
MH047	MH	7.706	13.006	5.3	DG4	5962919.43	2529402.407
MH048	MH	6.948	11.948	5	DG4	5962699.102	2529735.001
MH049	MH	8.168	13.168	5	DG4	5962906.68	2529421.88
MH050	MH	8.47	11.47	3	DG4	5963061.752	2529520.484
MH051	MH	6.755	13.855	7.1	DG4	5962874.785	2529400.73
MH052	MH	5.808	13.608	7.8	DG4	5962918.807	2529331.577
MH053	DI	8.7	17	8.3	DG4	5962987.863	2529229.883
MH054	MH	8.739	11.739	3	DG4	5962786.212	2529084.871
MH055	MH	6.254	12.754	6.5	DG4	5962713.413	2528927.04
MH057	MH	7.263	12.463	5.2	DG4	5962817.177	2528997.135
MH058	MH	6.557	12.557	6	DG4	5963058.499	2529190.98
MH059	MH	7.183	11.883	4.7	DG4	5963044.304	2529153.093
MH061	MH	5.46	11.46	6	DG4	5963116.793	2529125.881
MH062	MH	4.25	11.25	7	DG4	5963109.476	2529120.72
MH063	MH	7.15	12.4	5.25	DG4	5962598.257	2528769.862
MH064	MH	6.82	12.32	5.5	DG4	5962584.406	2528761.1
MH065	MH	9.109	12.609	3.5	DG4	5961607.772	2528112.825
MH066	MH	7.373	12.873	5.5	DG4	5962086.814	2528428.222
MH067	MH	13.5	18.59	5.09	DG4	5961332.272	2529089.118
MH068	MH	7.142	13.342	6.2	DG4	5961822.615	2528351.006
MH069	MH	45.268	52.268	7	DG5	5958206.627	2530117.177
MH070	MH	46.07	51.834	5.764	DG5	5959082.327	2529754.405

Base Condition Outfalls

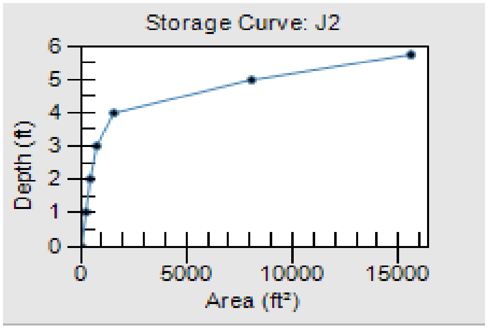
Name	Invert Elev. (ft)	Rim Elev. (ft)	Type
OF1	12.00	14.17	NORMAL
OF2	3.00	8.00	TIDAL
OF3	0.00	4.00	TIDAL
OF4	4.60	10.00	TIDAL
OF5	14.00	18.00	TIDAL
OF6	8.00	12.00	TIDAL
OF7	9.66	17.66	TIDAL
OF8	13.17	17.17	TIDAL
OF9	6.12	22.00	TIDAL
OF10	2.49	4.49	TIDAL

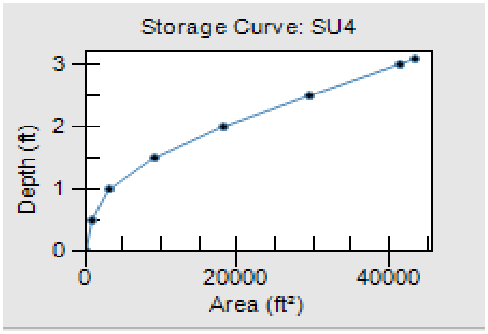
Attachment 6

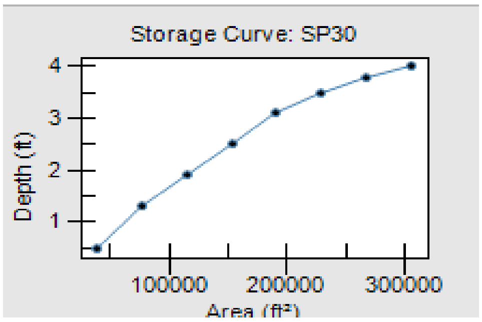
Storage Curves

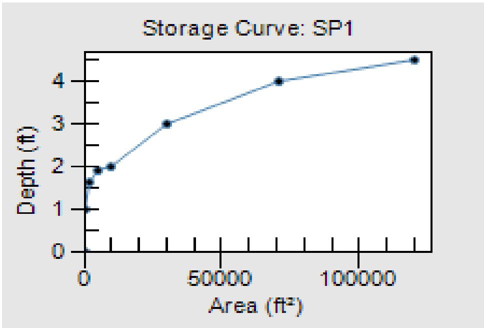
Storage Curves

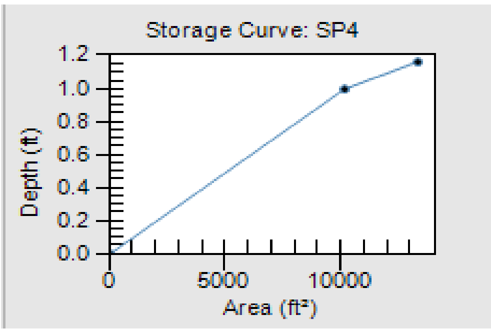
Name	Invert Elev. (ft)	Rim Elev. (ft)	Depth (ft)	Curve Name
CreekStorage	22.81	25.91	3.09	SU4
I186	6.88	17.00	10.12	SP30
J2	14.32	20.03	5.71	J2
SP1	15.00	22.00	7.00	SP1
SP4	12.00	17.53	5.53	SP4
SP7	7.40	10.29	2.89	SP7

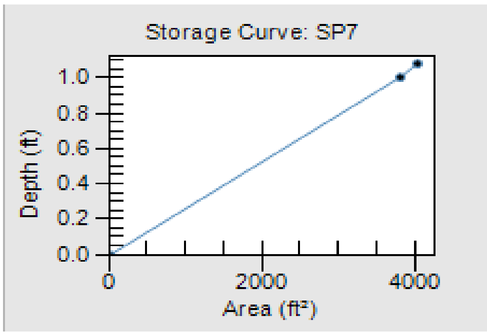












Technical Memorandum

April 28, 2026

To	Eric Wier, PE	**Contact No.**	(707)267-2238
Copy to	David Yeager	**Email**	Patrick.Sullivan@ghd.com
From	Patrick Sullivan	**Project No.**	12588710
Project Name	Crescent City Storm Drain Master Plan		
Subject	Extreme Event October 13, 2025, Analysis		

1. Introduction

On October 13th, 2025, Crescent City was impacted by an extreme weather event that tested the capacity and resilience of its storm drain infrastructure. This event highlighted vulnerabilities within the existing system and underscored the importance of ongoing assessment and planning to mitigate future risks.

1.1 Purpose of this Memorandum

The purpose of this memorandum is to evaluate the Crescent City October 13th, 2025, extreme rainfall event to determine the recurrence interval and evaluate the performance of City's storm drain system under existing, base, and proposed conditions (as outlined the City's Storm Drain Master Plan).

1.2 Scope and limitations

This technical memorandum has been prepared by GHD for City Of Crescent City. It is not prepared as, and is not represented to be, a deliverable suitable for reliance by any person for any purpose. It is not intended for circulation or incorporation into other documents. The matters discussed in this memorandum are limited to those specifically detailed in the memorandum and are subject to any limitations or assumptions specially set out.

2. Extreme Event Recurrence Interval

The Crescent City extreme rainfall event on October 13th, 2025, commenced at approximately 2:30 AM. The most severe precipitation occurred between 3:00 AM and 5:30 AM, placing considerable stress on the stormwater drainage infrastructure. Precipitation persisted at lower intensity until about 8:00 AM. This event resulted in immediate flooding throughout downtown Crescent City. Resident observations indicated that the heaviest rainfall was highly localized to the downtown area, with markedly reduced intensity just a few miles away. According to data from the National Oceanic and Atmospheric Administration (NOAA) weather station at Jack McNamara Field, located roughly two miles from downtown, 1.68 inches of rain were recorded on October 13th, 2025.

To supplement this information, the City collected additional rainfall data via Weather Underground, a commercial service providing real-time, hyper-local weather reports based on a network of personal weather stations (PWS). Data from Station KCACRESC155 at 1405 Harrold St., Crescent City, recorded rainfall at five-minute intervals, totalling 2.89 inches for the event. A graph depicting rainfall intensity and cumulative accumulation is presented in Figure 1; the blue line represents rainfall intensity while the orange line indicates total accumulation. Analysis of this plot shows that 96% of the total precipitation occurred within a three-hour window, with 100% falling within six hours.

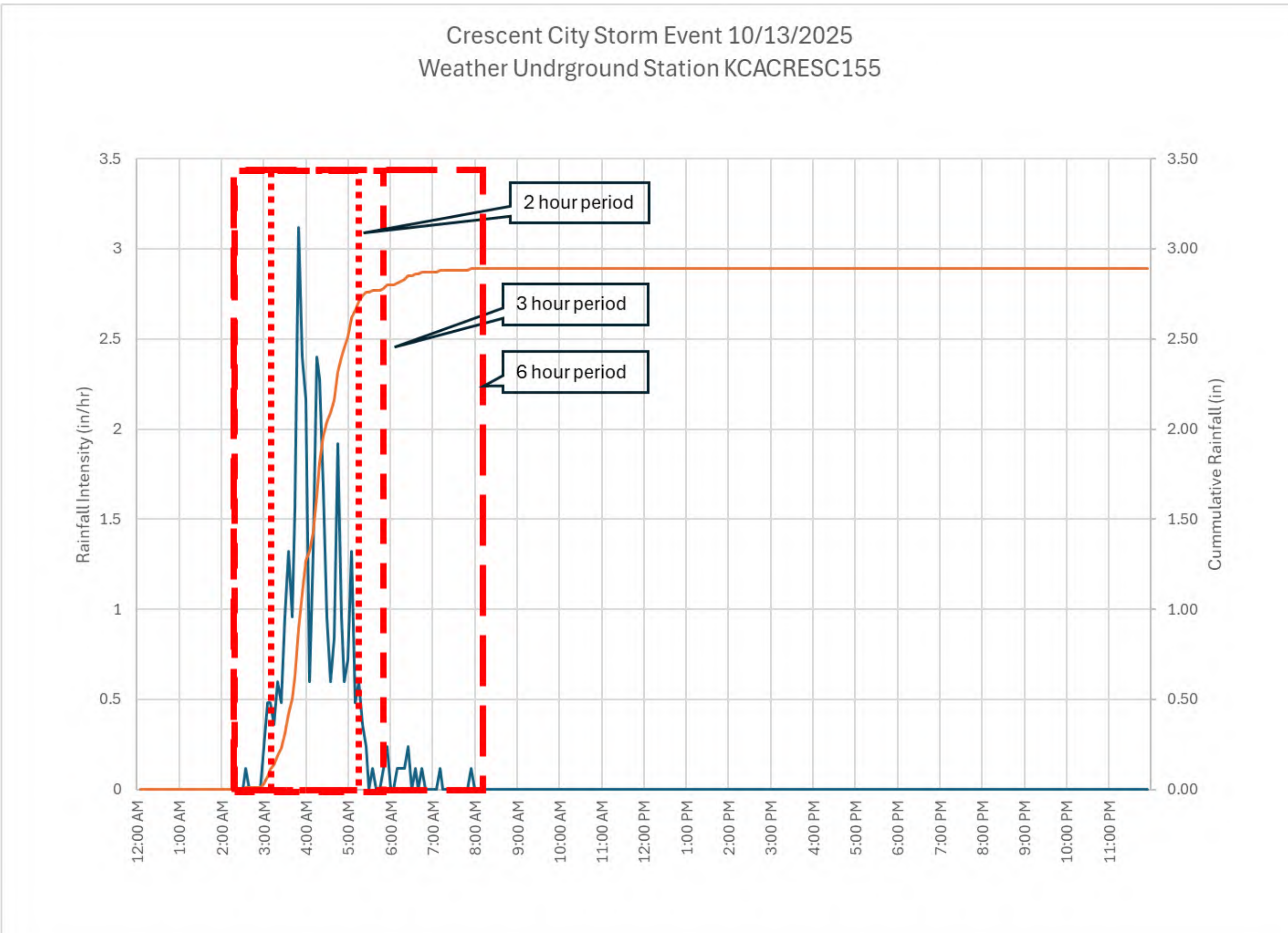


Figure 1 ***Rainfall Intensity and Cumulative Plot, Crescent City October 13, 2025***

The return period, or recurrence interval, measures how often a specific rainfall event occurs on average, calculated using historical rainfall data. NOAA's Precipitation-Frequency Atlas offers location-specific precipitation frequency estimates for different intervals and storm durations. For Crescent City, 2-hour, 3-hour and 6-hour precipitation frequency values were used to estimate the return period of a recent rain event. Precipitation frequency plots (Figure 2, Figure 3, and Figure 4) display the estimate along with 90% confidence intervals; the return period is found where the observed rainfall crosses these plots. Based on the rainfall data presented in Figure 1 and NOAA data, the estimated return period for the October 13, 2025, Crescent City storm was 210 years for the 2-hour event, 87 years for a 3-hour event, and 7 years for a 6-hour event.

Table 1 Return Period Estimates for October 13, 2025, Storm Event

Storm Duration	Precipitation (in)	Return Period (yr)	Lower 90% Confidence (yr)	Upper 90% Confidence (yr)
2-hr	2.57	210	48	--
3-hr	2.79	87	25	--
6-hr	2.89	7	4	20

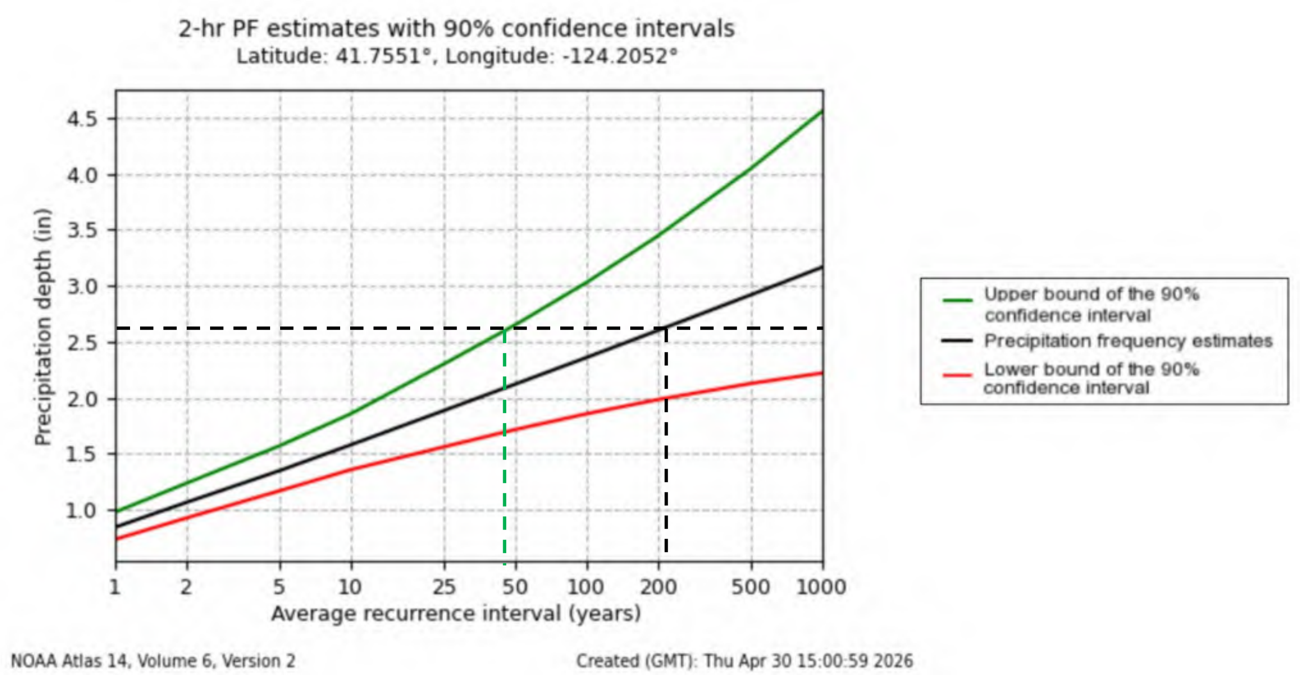


Figure 2 NOAA 2-hr Precipitation Frequency Estimate for Crescent City

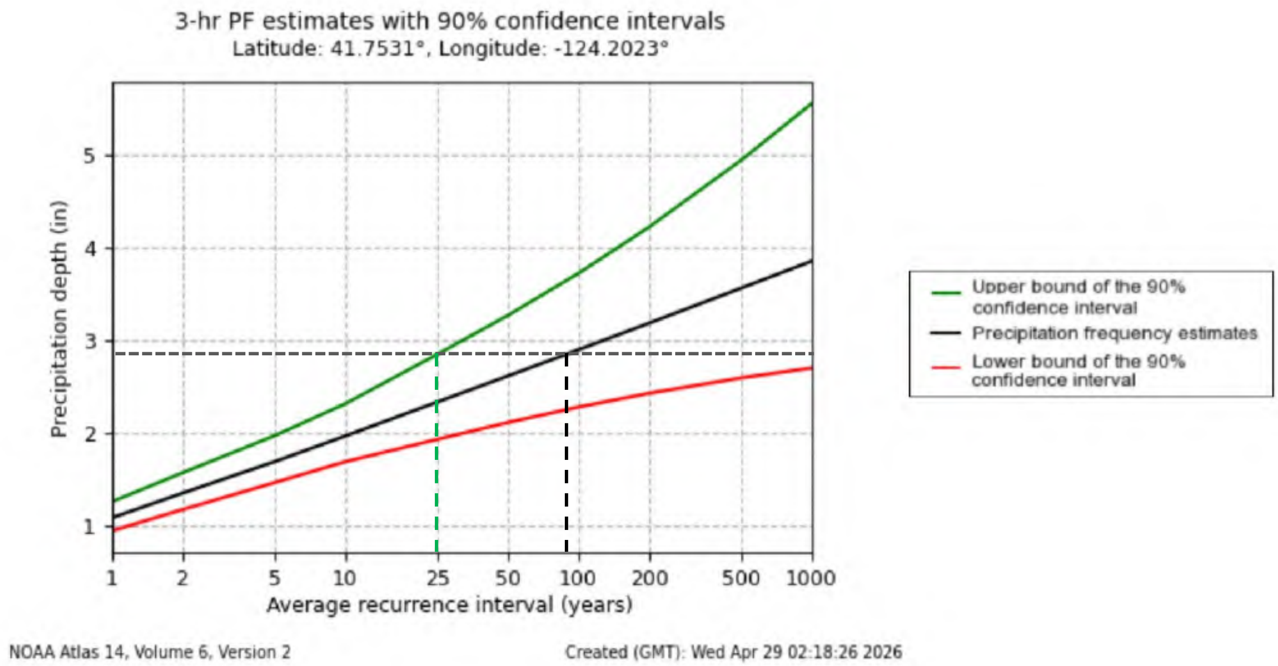


Figure 3 NOAA 3-hr Precipitation Frequency Estimate for Crescent City

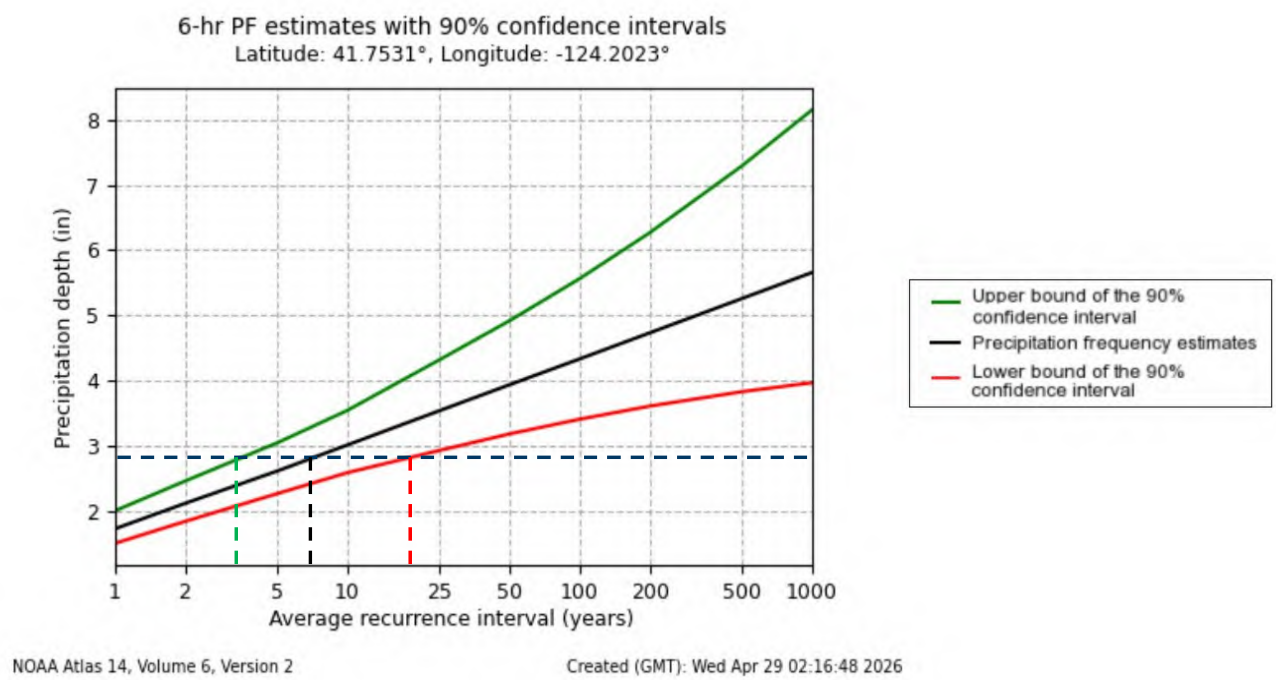


Figure 4 NOAA 6-hr Precipitation Frequency Estimate for Crescent City

3. Flooding Assessment

Crescent City is in the process of developing Storm Drain Master Plan (SDMP), which is a document that analyzes a City's existing stormwater infrastructure to identify flooding risks, assess pipe conditions, and plan for future capacity needs. It serves as a roadmap for identifying deficiencies, prioritizing repairs, upgrading systems to meet regulatory standards, and directing capital improvement projects. As part of this process a computation stormwater model, PC-SWMM, was developed. The model simulates stormwater runoff and movement through the City and the City's storm drain system. The stormwater model simulates selected rainfall events with various return periods (2-yr 24-hr, 10-yr 24-hr, and 50-yr 24-hr) and stormwater flow through drainage infrastructure (pipes, ditches, culverts) and over the ground surface. It quantifies stormwater flow, volume, velocity, and flooding/inundation extents. It is used to identify deficiencies in the existing system and assess potential improvement projects. Several different storm drain model scenarios were developed:

- Existing conditions – this model scenario represents the storm drain system at the time of the extreme rainfall event
- Base conditions – this model scenario is similar to the existing conditions model, but it includes several storm drain improvement projects that are already design and construction scheduled. This scenario was used in the SDMP as the base condition for deficiency analysis and comparison assessment of proposed projects
- Proposed conditions – this model scenario simulates the proposed drainage improvement projects that are recommended in the SDMP

The model development and parameterization process is extensively documented the City's Storm Drain Master Plan (GHD 2023) and included in Appendix A.

The assessment of the October 13th extreme event uses the model scenarios to quantify and compare the resulting flooding under each scenario. The model will use the observed rainfall pattern, shown in Figure 1, and observed tidal conditions to access each scenario. The tide data was obtained from NOAA Tides and Currents (Crescent City, CA 9419750) for October 13, 2025, and is shown graphically in Figure 5.

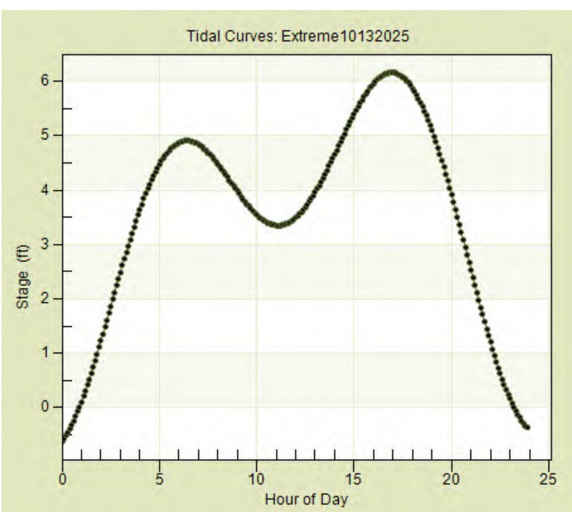


Figure 5 Crescent City (9419750) Tides October 13, 2025

The flooding impacts are evaluated by updating model scenarios to simulate rainfall and tides on October 13, 2025. The extents of flooding under existing conditions are used to identify key locations. Flooding volumes under each scenario are calculated and volumes are compared across scenarios to assess differences.

3.1 Key Flooding Locations

The city staff indicated two regions where flooding damage occurred or was documented. These regions were identified as Key flooding locations and are shown in Figure 6. The western location encompassed flooding from 4th St. to 7th St. between C St. and G St. The eastern location encompassed flooding from Front St. to 4th St. between H St. and N St.

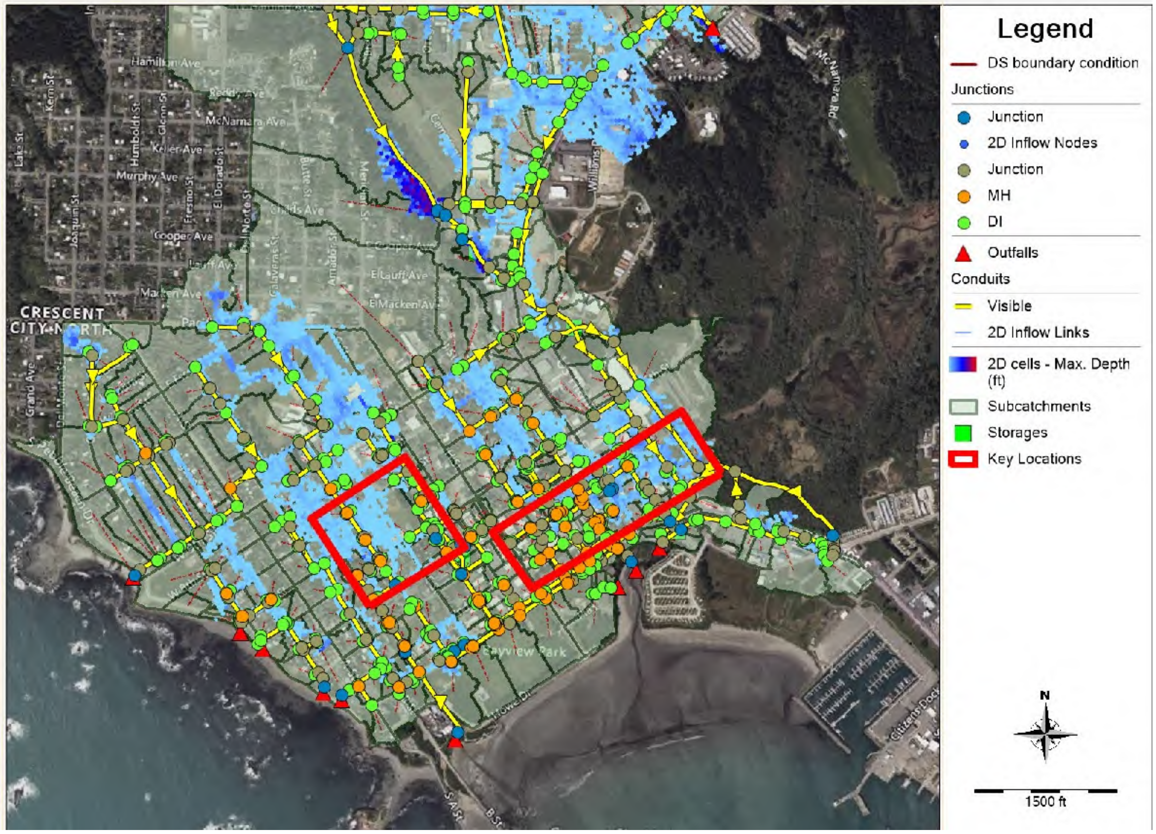


Figure 6 Key Flooding Locations, Extreme Event October 13, 2025

3.2 Flooding Volume Estimates

The three modeling scenarios were run with the rainfall and tidal conditions for October 13, 2025. The resulting flooding within the key locations was calculated and presented in Table 2. There were minimal differences between the existing and base condition models.

Table 2 Model Scenario Flooding Summary

Model Scenario	Flooding Volume West (MG)	Flooding Volume East (MG)	Flooding Volume Total (MG)	Flooding Difference (MG)
Existing Conditions	1.687	1.924	3.611	--
Base Conditions	1.687	1.929	3.616	0.005
Proposed Conditions	0.132	0.455	0.587	3.024

The proposed condition model demonstrated considerable improvement over the existing and base conditions. The proposed condition modeled flooding extents are shown in Figure 7.

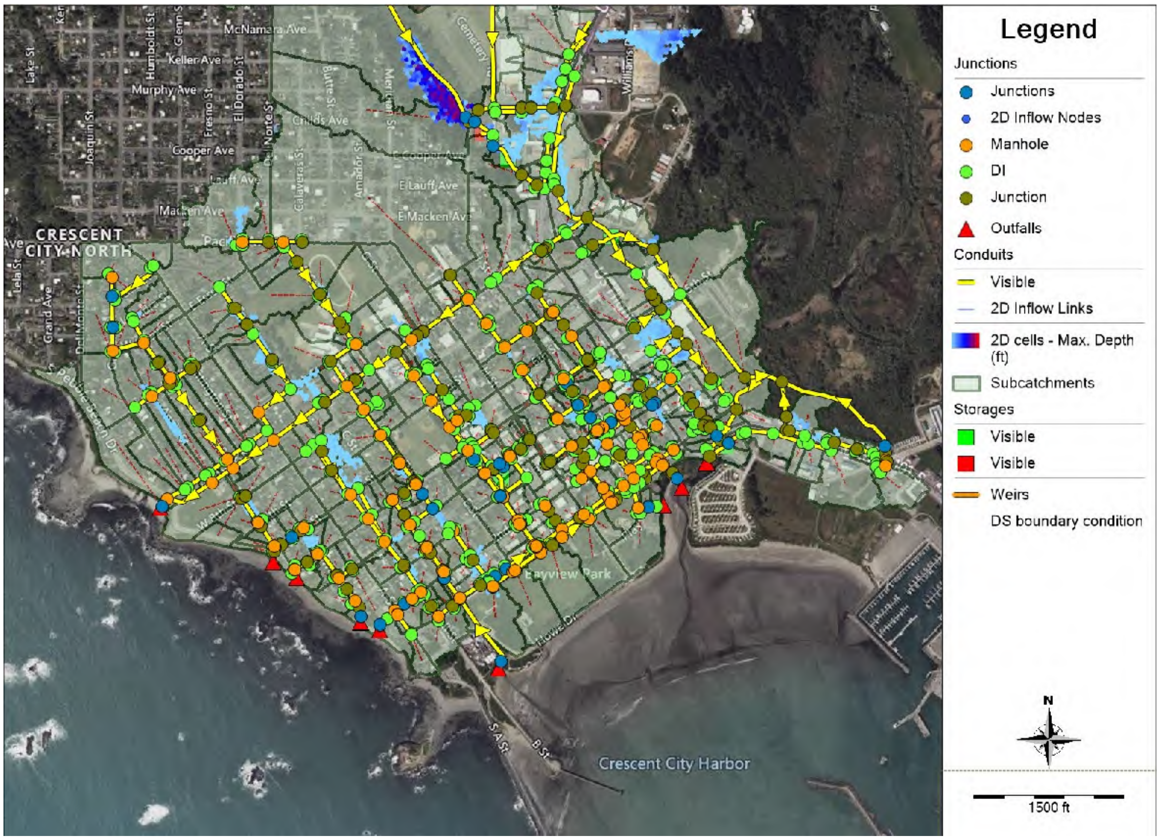


Figure 7 ***Proposed Condition Scenario Flooding with Extreme Event Rainfall and Tides***

4. Conclusion

This memorandum summarises an analysis of the Crescent City extreme rain event that occurred on 13/10/2025. An evaluation of the available precipitation data revealed a significant discrepancy in rainfall intensity across the region. Several rain gauges near Crescent City were assessed, and precipitation amounts varied considerably, which suggests that a small but intense rainstorm struck the city. A privately owned weather station recorded rainfall data at five-minute intervals, indicating that 2.89 inches of rain fell in less than six hours, with 2.7 inches occurring within three hours. This observation confirms that the storm was a three-hour event, and therefore the six-hour return period estimate is not representative of this occurrence. NOAA precipitation frequency predictions for Crescent City were used to estimate the return period, resulting in an 87-year return period. However, the upper and lower confidence intervals were inconclusive, due to the limited period of record for high intensity three-hour storm events. However, within the 3-hour period there was a higher intensity 2-hour period with 2.57 inches of rain fell. The return period for the 2-hour period was 210 years. This estimate was also inconclusive, due to the limited period of record.

Hydrologic modelling was performed using rainfall data from local gauges to simulate runoff and assess storm drain performance under both existing and proposed conditions. The effects of the high intensity rainfall event were used to evaluate flooding associated with the City’s existing storm drain system and the proposed conditions recommended in the City’s SDMP. There was minimal difference in flooding between the current storm drain system and the base conditions that include scheduled improvements. Performance under the proposed SDMP improvements indicated substantial enhancements in storm drain system effectiveness.