

TABLE OF CONTENTS

STEVENSON CREEK WATERSHED MANAGEMENT PLAN

FINAL REPORT

| SECTION | Page |
|--|--------------|
| <u>SECTION 1.0 INTRODUCTION</u> | 1.1-1 |
| 1.1 What is a Watershed Management Plan? | 1.1-1 |
| 1.2 The Benefits of a Watershed Management Approach..... | 1.1-2 |
| 1.3 The Stevenson Creek Watershed..... | 1.1-2 |
| 1.3.1 Watershed Location and Description | 1.1-2 |
| 1.3.2 Basin History | 1.1-4 |
| 1.4 Project Objectives..... | 1.1-6 |
| SECTION 2.0 EXISTING CONDITIONS ANALYSIS AND PROBLEM IDENTIFICATION | 2.1-1 |
| <u>2.1 Flooding Conditions Assessment and Problem Identification</u> | 2.1-1 |
| 2.1.1 Watershed Model Selection | 2.1-1 |
| 2.1.2 Hydrologic Model Development..... | 2.1-2 |
| 2.1.2.1 Subbasin Delineations | 2.1-3 |
| 2.1.2.2 Land Use | 2.1-5 |
| 2.1.2.3 Impervious Areas | 2.1-9 |
| 2.1.2.4 Runoff Curve Number | 2.1-9 |
| 2.1.2.5 Time of Concentration..... | 2.1-15 |
| 2.1.3 Hydraulic Model Development | 2.1-15 |
| 2.1.3.1 Drainage Facility Inventory | 2.1-16 |
| 2.1.3.2 Channel Cross-Section and Floodplain Definition..... | 2.1-20 |
| 2.1.3.3 Storage Node Stage-Area Relationships..... | 2.1-21 |
| 2.1.3.4 Model Schematic | 2.1-22 |
| 2.1.3.5 Boundary Conditions | 2.1-24 |
| 2.1.4 Model Calibration and Verification | 2.1-25 |
| 2.1.4.1 Introduction..... | 2.1-25 |
| 2.1.4.2 Streamflow and Precipitation Gaging Data | 2.1-25 |
| 2.1.4.3 Selection of Calibration/Verification Storm Events..... | 2.1-27 |
| 2.1.4.4 Calibration Parameters and Results | 2.1-29 |



TABLE OF CONTENTS (CONTINUED)

| SECTION | Page |
|-------------|---|
| 2.1.5 | Flooding Conditions Assessment 2.1-37 |
| 2.1.5.1 | Design Storm Events..... 2.1-39 |
| 2.1.5.2 | Existing Flooding Conditions 2.1-39 |
| 2.1.5.3 | Flooding Level of Service Criteria 2.1-41 |
| 2.1.5.4 | Flooding Problem Identification..... 2.1-43 |
| <u>2.2</u> | <u>Natural Resources Assessment and Problem Identification</u> 2.2-1 |
| 2.2.1 | Introduction 2.2-1 |
| 2.2.2 | Existing Conditions 2.2-2 |
| 2.2.3 | Wildlife..... 2.2-12 |
| 2.2.4 | Endangered and Threatened Species..... 2.2-12 |
| <u>2.3</u> | <u>Water Quality Assessment and Problem Identification</u> 2.3-1 |
| 2.3.1 | Existing Data 2.3-2 |
| 2.3.1.1 | Existing Monitoring Programs..... 2.3-4 |
| 2.3.1.2 | Other Existing Data 2.3-6 |
| 2.3.2 | Monitoring Program 2.3-9 |
| 2.3.2.1 | Monitored Basins..... 2.3-9 |
| 2.3.2.2 | Hydrologic Monitoring 2.3-10 |
| 2.3.2.2.1 | Water Quality 2.3-17 |
| 2.3.3 | Water Quality Characteristics 2.3-17 |
| 2.3.3.1 | Petroleum Hydrocarbons 2.3-24 |
| 2.3.3.2 | Oxygen Demand 2.3-25 |
| 2.3.3.3 | Solids 2.3-28 |
| 2.3.3.4 | Metals 2.3-28 |
| 2.3.3.5 | Nutrients 2.3-33 |
| 2.3.3.6 | Bacteria..... 2.3-34 |
| 2.3.4 | Nonpoint Source Loading..... 2.3-34 |
| 2.3.4.1 | Runoff Coefficients..... 2.3-37 |
| 2.3.4.2 | Event Mean Concentrations 2.3-40 |
| 2.3.4.2.1 | In-Stream EMCs..... 2.3-40 |
| 2.3.4.2.2 | Existing Stormwater Runoff Treatment 2.3-41 |
| 2.3.4.2.3 | Landuse-Based EMCs 2.3-43 |
| 2.3.4.3 | Results..... 2.3-46 |
| SECTION 3.0 | RECOMMENDED MASTER PLAN IMPROVEMENTS 3.1-1 |
| <u>3.1</u> | <u>Flood Protection, Water Quality, Habitat, Erosion and Sedimentation Improvements</u> 3.1-1 |
| 3.1.1 | Subwatershed 1: Spring Branch 3.1-5 |



TABLE OF CONTENTS (CONTINUED)

| SECTION | Page |
|------------|--|
| 3.1.2 | Subwatershed 2: Lower Stevenson Creek 3.1-22 |
| 3.1.3 | Subwatershed 3: Middle Stevenson Creek..... 3.1-30 |
| 3.1.4 | Subwatershed 4: Upper Stevenson Creek..... 3.1-35 |
| 3.1.5 | Subwatershed 5: Hammond Branch 3.1-43 |
| 3.1.6 | Subwatershed 6: Lake Bellevue Branch..... 3.1-52 |
| 3.1.7 | Subwatershed 7: Jeffords Street Branch..... 3.1-58 |
| <u>3.2</u> | <u>Human-Sourced Fecal Contamination Study</u> 3.2-1 |
| 3.2.1 | Purpose of Further Study..... 3.2-1 |
| 3.2.2 | Plan of Study 3.2-2 |
| 3.2.3 | Dissemination of Results to End Users 3.2-3 |
| <u>3.3</u> | <u>Recommended Watershed Maintenance Plan</u> 3.3-1 |
| <u>3.4</u> | <u>Public Awareness and Involvement Programs</u> 3.4-1 |
| 3.4.1 | Adopt-a-Creek Program for Stevenson Creek 3.4-1 |
| 3.4.2 | Proper Use of Pesticides and Fertilizers..... 3.4-2 |
| 3.4.2.1 | Pesticide Use..... 3.4-2 |
| 3.4.2.2 | Fertilizers 3.4-3 |
| 3.4.3 | “Green” Thumb Landscaping Practices 3.4-3 |
| 3.4.4 | Florida Yards and Neighborhoods Program..... 3.4-4 |
| 3.4.5 | Storm Drain Marking Program..... 3.4-5 |
| <u>3.5</u> | <u>Exotic Plant Eradication Program</u> 3.5-1 |
| 3.5.1 | Brazilian Pepper 3.5-2 |
| 3.5.2 | Australian pine 3.5-3 |
| 3.5.3 | Melaleuca 3.5-3 |
| 3.5.4 | Other Exotics 3.5-4 |
| 3.5.5 | Estuary Restoration Plan 3.5-4 |
| 3.5.6 | Summary and Recommendations 3.5-5 |
| <u>3.6</u> | <u>Legal and Regulatory Framework</u> 3.6-1 |
| 3.6.1 | U.S. Army Corps of Engineers 3.6-1 |
| 3.6.2 | U.S. Environmental Protection Agency 3.6-2 |
| 3.6.3 | Federal Emergency Management Agency 3.6-2 |
| 3.6.4 | Southwest Florida Water Management District Florida Department of Environmental Protection..... 3.6-4 |
| 3.6.5 | City of Clearwater..... 3.6-4 |
| <u>3.7</u> | <u>Capital Improvement Cost Estimates</u> 3.7-1 |



TABLE OF CONTENTS (CONTINUED)

| SECTION | Page |
|---|-------|
| <u>SECTION 4.0 WATERSHED MANAGEMENT PLAN PROJECT</u> <u>PRIORITIZATION</u> | 4.1-1 |
| <u>SECTION 5.0 REFERENCES AND BIBLIOGRAPHY</u> | 5.1-1 |
| 5.1 Drainage, Hydrology, and Flood Protection..... | 5.1-1 |
| 5.2 Water and Sediment Quality..... | 5.1-3 |
| 5.3 Natural Resources..... | 5.1-4 |



LIST OF TABLES

| | |
|-----------------------------|--|
| Table 2.1-1 | Node and Subbasin Numbering Scheme |
| Table 2.1-2 | Basin Land Use Percentages |
| Table 2.1-3 | Hydrologic Soil Group Acreages and Percentages |
| Table 2.1-4 | Runoff Curve Number Computation Matrix |
| Table 2.1-5 | Comparison of Measured and Simulated High Water Elevations |
| Table 2.1.6 | Comparison of Simulated 100-Year Peak Flows and Flood Stages |
| Table 2.1-7 | Proposed Flood Control Level of Service Criteria for Stevenson Creek |
| Table 2.1-8 | Summary of Structure Flood Protection Level of Service Deficiencies |
| Table 2.2-1 | Land Use Classification by Major Subbasin |
| Table 2.2-2 | Wildlife Observed or Expected Within the Stevenson Creek Watershed |
| Table 2.2-3 | Endangered, Threatened, or Special Concern Species Present or Potentially Present in the Stevenson Creek Watershed |
| Table 2.3-1 | Loads During Monitoring Period |
| Table 2.3-2 | Water Quality Sampling Parameters |
| Table 2.3-3 | Overall Hydrologic Conditions at Monitoring Stations |
| Table 2.3-4 | Laboratory Results |
| Table 2.3-5 | Water Quality Indices |
| Table 2.3-6 | Base Flow Oxygen Demand |
| Table 2.3-7 | Storm Event Oxygen Demand |
| Table 2.3-8 | Base Flow Solids |
| Table 2.3-9 | Storm Event Solids |
| Table 2.3-10 | Metals |
| Table 2.3-11 | Base Flow Nutrients |
| Table 2.3-12 | Storm Event Nutrients |
| Table 2.3-13 | Runoff Coefficients |
| Table 2.3-14 | In-Stream EMCs |
| Table 2.3-15 | BMP Maximum Efficiencies |
| Table 2.3-16 | Landuse-Based EMCs |
| Table 2.3-17 | Landuse-Based EMCs – Selected Literature Value |
| Table 2.3-18 | Major Basin Loads |
| Table 3.1-1 | Maximum BMP Removal Efficiencies |
| Table 3.1-2 | Alternative Projects Water Quality Improvement Benefits |
| Table 3.1-3 | Vegetation Recommended for Planting in Varying Water Depths |
| Table 3.3-1 | Recommended Channel Maintenance Plan |
| Table 3.5-1 | Exotic Plant Species Within the Stevenson Creek Watershed |
| Table 3.6-1 | Proposed Flood Protection Level of Service (FPLOS) Criteria |
| Table 3.7-1 | Capital Improvement Project Cost Estimates |
| Table 4-1 | Stevenson Creek Watershed Management Plan Improvement Project Ranking Matrix |
| Table 4-2 | Project Precedence |



LIST OF FIGURES

- [Figure 1.3-1 Stevenson Creek Watershed Location Map](#)
Figure 1.3.2 Stevenson Creek Bridge Near Clearwater, Fla, 1890
- [Figure 2.1-1 Stevenson Creek Watershed Drainage Map and Model Schematic](#)
[Figure 2.1-2 Stevenson Creek Watershed Land Use Map](#)
[Figure 2.1-3 Stevenson Creek Watershed Hydrologic Soil Group Classification Map](#)
[Figure 2.1-4 AdICPR Node-Reach Schematic Existing Conditions](#)
[Figure 2.1-5 Locations of Monitoring Stations](#)
[Figure 2.1-6 July 15, 2000 Storm Event](#)
Figure 2.1-7 Box Culverts Downstream of Kings Highway Monitoring Station
Figure 2.1-8 Vegetation in Channel Downstream of Drew Street Monitoring Station
[Figure 2.1-9 Rating Curve for Stevenson Creek at Drew Street](#)
[Figure 2.1-10 Rating Curve for Spring Branch at Kings Highway](#)
[Figure 2.1-11 Stevenson Creek July 15, 2000 Calibration Storm Comparison](#)
[Figure 2.1-12 Spring Branch July 15, 2000 Calibration Storm Comparison](#)
[Figure 2.1-13 Stevenson Creek June 12, 2000 Verification Storm Comparison](#)
[Figure 2.1-14 Spring Branch June 12, 2000 Verification Storm Comparison](#)
[Figure 2.1-15 Stevenson Creek Watershed Existing Conditions 100-and 500-Year Floodplain Map](#)
[Figure 2.1-16 Existing Conditions Flood Profiles Key Map](#)
[Figure 2.1-17 Stevenson Creek Flood Profile, Existing Conditions](#)
[Figure 2.1-18 Stevenson Creek Flood Profile, Existing Conditions](#)
[Figure 2.1-19 Stevenson Creek Flood Profile, Existing Conditions](#)
[Figure 2.1-20 Stevenson Creek Flood Profile, Existing Conditions](#)
[Figure 2.1-21 Stevenson Creek Flood Profile, Existing Conditions](#)
[Figure 2.1-22 Stevenson Creek Flood Profile, Existing Conditions](#)
[Figure 2.1-23 Spring Branch Flood Profile, Existing Conditions](#)
[Figure 2.1-24 Spring Branch Flood Profile, Existing Conditions](#)
Figure 2.1-25 Flooding on Hillcrest Avenue, South of Lakeview Road
- [Figure 2.3-1 Water Quality Monitoring Stations](#)
Figure 2.3-2 Marshall Street WWTP Location
[Figure 2.3-3 Septic Tank Densities](#)
[Figure 2.3-4 Monitoring Stations Location and Coverage](#)
Figure 2.3-5 Land Use by Monitoring Station
Figure 2.3-6 Rainfall Conditions
Figure 2.3-7 Stevenson Creek Hydrologic Record
Figure 2.3-8 Stevenson Creek Hydrologic Record – Low Flow Detail
Figure 2.3-9 Spring Branch Hydrologic Record
Figure 2.3-10 Spring Branch Hydrologic Record – Low Flow Detail
[Figure 2.3-11 Existing Stormwater Treatment Areas](#)
[Figure 2.3-12 Existing Stormwater Treatment Coverage](#)



LIST OF FIGURES (CONTINUED)

- [Figure 2.3-13 BOD Loading Rates by Subwatershed](#)
- [Figure 2.3-14 TSS Loading Rates by Subwatershed](#)
- [Figure 2.3-15 Nitrogen Loading Rates by Subwatershed](#)
- [Figure 2.3-16 Phosphorus Loading Rates by Subwatershed](#)

- [Figure 3.1-1 Improvement Projects Location Map](#)
- Figure 3.1-2 Private Crossing of Spring Branch Near Betty Lane, to be Removed
- [Figure 3.1-3 Conceptual Plan of Project 1A.1](#)
- [Figure 3.1-4 Conceptual Plan of Project 1A.2](#)
- [Figure 3.1-5 Conceptual Plan of Project 1B](#)
- [Figure 3.1-6 Conceptual Plan of Project 1C](#)
- Figure 3.1-7 Photograph of site of Project 1C
- [Figure 3.1-8 Conceptual Plan of Project 1D](#)
- [Figure 3.1-9 Conceptual Plan of Project 1E](#)
- [Figure 3.1-10 Conceptual Plan of Project 1F](#)
- [Figure 3.1-11 Conceptual Plan of Project 1G](#)
- [Figure 3.1-12 Conceptual Plan of Project 1H](#)
- [Figure 3.1-13 Conceptual Plan of Project 2A](#)
- [Figure 3.1-14 Conceptual Plan of Project 2B](#)
- [Figure 3.1-15 Conceptual Plan of Project 2D](#)
- Figure 3.1-16 Photograph of site adjacent to Project 2D
- [Figure 3.1-17 Conceptual Plan of Project 3A](#)
- [Figure 3.1-18 Project 3A, Conceptual Plan Detail](#)
- Figure 3.1-19 Stevenson Creek Channel and Trees to Remain Along Hillcrest Avenue, Between Jeffords Street and Browning Street (Project 4A)
- Figure 3.1-20 Failing Retaining Wall Upstream of Browning Street to be Replaced and Vegetation to be Removed (Project 4A)
- [Figure 3.1-21 Conceptual Plan of Project 4A](#)
- [Figure 3.1-22 Conceptual Plan of Project 4B](#)
- [Figure 3.1-23 Conceptual Plan of Project 4C](#)
- [Figure 3.1-24 Conceptual Plan of Project 5A](#)
- [Figure 3.1-25 Conceptual Plan of Project 5B](#)
- [Figure 3.1-26 Conceptual Plan of Project 5C](#)
- [Figure 3.1-27 Conceptual Plan of Project 5D](#)
- [Figure 3.1-28 Conceptual Plan of Project 5E](#)
- Figure 3.1-29 Wetland Planting Illustration
- [Figure 3.1-30 Conceptual Plan of Project 6A.1](#)
- [Figure 3.1-31 Conceptual Plan of Project 6A.2](#)
- [Figure 3.1-32 Conceptual Plan of Project 6B](#)
- [Figure 3.1-33 Conceptual Plan of Project 7A](#)
- [Figure 3.1-34 Conceptual Plan of Project 7B](#)
- [Figure 3.1-35 Conceptual Plan of Project 7C](#)



LIST OF FIGURES (CONTINUED)

- [Figure 3.1-36 Project Conditions Flood Profiles Key Map](#)
[Figure 3.1-37 Stevenson Creek Flood Profile, Project Conditions](#)
[Figure 3.1-38 Stevenson Creek Flood Profile, Project Conditions](#)
[Figure 3.1-39 Stevenson Creek Flood Profile, Project Conditions](#)
[Figure 3.1-40 Stevenson Creek Flood Profile, Project Conditions](#)
[Figure 3.1-41 Stevenson Creek Flood Profile, Project Conditions](#)
[Figure 3.1-42 Stevenson Creek Flood Profile, Project Conditions](#)
[Figure 3.1-43 Spring Branch Flood Profile, Project Conditions](#)
[Figure 3.1-44 Spring Branch Flood Profile, Project Conditions](#)
[Figure 3.1-45 Project Conditions 100-Year Floodplain Comparison](#)
- Figure 3.6-1 Yard Waste on the Banks of Upper Stevenson Creek



TECHNICAL APPENDICES

VOLUME I

- APPENDIX A ADICPR HYDROLOGIC INPUT DATA SUMMARY
- APPENDIX B ADICPR HYDROLOGIC AND HYDRAULIC MODEL INPUT AND OUTPUT DATA FILES, CALIBRATION STORM EVENTS
- APPENDIX C ADICPR HYDROLOGIC AND HYDRAULIC MODEL INPUT AND OUTPUT DATA FILES, EXISTING CONDITIONS

VOLUME II

APPENDIX D EXISTING CONDITIONS LEVEL OF SERVICE EVALUATION

- APPENDIX E ADICPR HYDROLOGIC AND HYDRAULIC MODEL INPUT AND OUTPUT DATA FILES, PROPOSED CONDITIONS

APPENDIX F PROPOSED CONDITIONS LEVEL OF SERVICE EVALUATION

VOLUME III

- APPENDIX G URBAN HYDROLOGY FOR SMALL WATERSHEDS (TR-55) CHAPTERS 1-3

APPENDIX H CAPITAL COST ESTIMATES

- APPENDIX I WATER QUALITY MONITORING DATA

APPENDIX J BACTERIAL SOURCE TRACKING STUDY

APPENDIX K POLLUTANT LOADING MODEL INPUT AND OUTPUT DATA

Subbasin Loading – BOD

Subbasin Loading – Nitrogen

Subbasin Loading – TSS

Subbasin Loading - Phosporus



APPENDIX L PUBLIC MEETING QUESTIONNAIRES



SECTION 1.0 INTRODUCTION

1.1 WHAT IS A WATERSHED MANAGEMENT PLAN?

Significant improvements in the protection and restoration of the physical, chemical, and biological integrity of the nation's waters have been made in the last 25 years. The passage of the Clean Water Act and Safe Drinking Water Act has resulted in the control of pollution from "point sources" such as industrial waste and sewage treatment plants. However, until recently the federal laws have tended to focus on particular sources, pollutants, or water uses, and have not resulted in an integrated environmental management approach. Problems resulting from nonpoint pollution sources, habitat degradation, flooding, and wastewater overflows have not been resolved. These problems necessitate a comprehensive understanding of a complex system, and solutions that integrate disciplines and overlap political boundaries. This holistic, comprehensive approach is called a watershed management plan. The watershed management plan approach to improving the physical, chemical, and biological integrity of surface water is a three-part process. These three components include identifying the watershed's natural boundaries, applying the latest scientific methods to identify problems, and coordinating the improvements within social, political, and economic constraints.

- A watershed boundary incorporates all the land area that contributes stormwater runoff to a particular surface water body.
- In order to identify, characterize, and evaluate the problems within a watershed, the latest scientific tools, techniques, and theory must be utilized. The proposed solutions must include the latest and most cost-effective methods of watershed rehabilitation, integrating various scientific disciplines and expertise.
- Watersheds are seldom contained within a single political boundary. This necessitates a team approach, incorporating local, state, and federal agencies, as



Stevenson Creek Watershed Management Plan Final Report

well as the concerned public. Team members form a partnership and work together toward a common goal based on shared information, and an understanding of the priorities and responsibilities of all parties.

1.2 THE BENEFITS OF A WATERSHED MANAGEMENT APPROACH

Coordination of a watershed management plan is beneficial for environmental, financial, social, and administrative reasons. Managers from all levels of government will be better able to understand and reduce the cumulative effects of human activities in a watershed on pollution control, increased surface water runoff, fish and wildlife protection, drinking water protection, and other water resource programs when allowed to view the “big picture,” rather than just their portion of the watershed. The most critical problems are identified, and priorities can then be set to allocate the available financial and human resources.

The watershed management approach also can result in significant savings by improving communication and coordination, which will in turn reduce costly duplication of efforts and conflicting actions. This cooperation gives an active voice in resource management to the people who depend on the area resources for their recreation, health, and overall quality of life.

1.3 THE STEVENSON CREEK WATERSHED

1.3.1 Watershed Location And Description

The Stevenson Creek Watershed, the largest and most urbanized watershed within the City of Clearwater, drains 6,286 acres in west central Pinellas County (refer to [Figure 1.3-1](#)). Of this area, 4,057 acres (65 percent) are within the Clearwater city limits. The remaining 35 percent of the basin is within the City of Dunedin (1,287 acres or 20%), unincorporated Pinellas County (859 acres or 14%) and the City of Largo (83 acres or about 1%).



*Stevenson Creek Watershed Management Plan
Final Report*

[\(FIGURE 1.3-1\)](#)



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Final Report***

Stevenson Creek discharges to Clearwater Harbor. The majority of the creek has been channelized or otherwise altered, and little of the historic floodplain remains intact. Land uses within the basin are predominantly medium- and high-density residential, commercial, and open space. Approximately 90 percent of the watershed has been developed, and the vast majority of the development occurred prior to the implementation of regulatory requirements for floodplain preservation, environmental protection, stormwater treatment and attenuation. Several developments have been constructed within the creek's floodplain and have experienced severe flooding. In addition, the creek and its tributaries experience moderate to severe erosion problems due to steep embankments, improper maintenance, highly erodible soils, and inadequate right-of-way.

1.3.2 Basin History

Land use changes within the Stevenson Creek Watershed over the last 100 years have been significant. A cursory history of the changes within the basin can be determined from a review of historic archives and aerial photography. Aerial photography dated



Figure 1.3-2 Stevenson Creek Bridge, near Clearwater, Fla., 1890.

(Photo courtesy of City of Clearwater Public Library)

***Stevenson Creek Watershed Management Plan
Final Report***

1926 shows the Stevenson Creek Estuary to be much wider than it is now, approximately 1,000' wide at the mouth, compared to only 700' today. Prior to 1926, the original 19th Century wooden bridge connecting Clearwater to Dunedin, which spanned the entire estuary (Figure 1.3.2), was replaced with an earthen causway with a much narrower open span for Edgewater drive. The 1926 photography depicts a relatively intact floodplain and associated wetlands, with adjacent land uses predominantly agricultural, under development, or undeveloped. Some channelization had occurred within Spring Branch, and within Stevenson Creek between Drew Street and Druid Road. The east-west railroad that bisects the basin as well as the coastal railroad that borders the basin to the east had already been constructed. Most of the population at the time was concentrated within a ½-mile strip of land bordering Clearwater Harbor. Effects of the 1920's land boom are evidenced by the numerous subdivision streets with sidewalks constructed throughout the interior portions of the watershed. However, by 1942, only a few homes had been built within these interior subdivisions. During the post-war boom of the 1950's and 1960's, the majority of the watershed was built out within these medium density residential subdivisions and commercial developments. Also during this period, portions of the Stevenson Creek estuary were filled in along its southern banks.

By 1974, over 95% of the developable area in the watershed had been developed or set aside as parks and golf courses, and the full length of Stevenson Creek and its tributaries had been channelized. Very little of the creek's floodplain and associated wetlands remained intact. With the exception of the two golf courses bordering the creek, almost the entire floodplain of Stevenson Creek had been developed.

The majority of the land use changes within the watershed have been detrimental to water quality, flood protection, and wildlife habitat. Urban development has resulted in greater stormwater runoff volumes and peak flow rates, as well as the transport of sediments and pollutants into the creek. The effects of land use changes within the watershed on wildlife habitat are described in Section 2.2.



Stevenson Creek Watershed Management Plan Final Report

In response to severe flooding experienced within the watershed as a result of a storm event in July of 1987, a flood control study was commissioned by the City of Clearwater in April of 1988. In the study, a three-phase flood control project was developed for the main channel of Stevenson Creek. To date, two of the three phases of the project have been constructed, consisting of the main channel segments between Betty Lane and Jeffords Streets. The third phase, which included segments upstream of Jeffords Street, has not been constructed, primarily because of environmental concerns. Because the objective of the original study was focused on flood control on the main stem of Stevenson Creek, water quality and environmental enhancement/ protection needs and problems were not addressed. The tributaries and secondary drainage systems were not analyzed in detail, and the Spring Branch portion of the watershed was excluded from the original study.

1.4 PROJECT OBJECTIVES

The Stevenson Creek Watershed Management Plan has been initiated as the result of a cooperative agreement between the City of Clearwater and the Southwest Florida Water Management District (SWFWMD). Drainage improvements for enhanced stormwater quality and quantity are identified within the City of Clearwater Comprehensive Plan as areas of service deficiencies which must be addressed. Section 16.2 of the Plan states:

Objective – The City of Clearwater shall continue to develop watershed management plans which should seek to identify, evaluate, and implement the most cost effective and cost efficient programs for stormwater management, including stormwater quantity and quality...

In addition to the municipal and regulatory involvement, the residents within the watershed have had an active role in the shaping of the watershed plan. Numerous suggestions and comments concerning management actions have been received from residents and other property owners in the area through documented reports and through the public meeting process. Public involvement is a very important component of this



Stevenson Creek Watershed Management Plan Final Report

plan; watershed improvements cannot be realized without the willingness and cooperation of residents within the watershed boundaries.

The basic purpose of the management plan is to identify the causes and sources of problems such as flooding, water quality degradation, excessive channel erosion, and loss of riparian habitat. Once these problems were identified, recommendations were made to solve or alleviate the problems. Recommendations include capital improvement projects (i.e. stormwater infrastructure improvements), creation and restoration of habitat, maintenance strategies, pollution reduction programs, and public involvement and awareness. This management plan will be used as a tool in the planning, regulation, and management of natural resources and future development, and as a basis for determining and prioritizing capital improvements by the City of Clearwater and SWFWMD. The initial phase to meet this objective included a comprehensive analysis of the watershed in order to identify the problems to be addressed.

The first task in the analysis process was to collect, record, and organize all potentially useful existing information relevant to the watershed. Once the data were collected and analyzed, any data deficiencies were noted and the missing data were gathered. The information-gathering process included such activities as a literature search and review of existing data, field reconnaissance and ground-truthing of aerial photography, ground surveying, streamflow monitoring, surface water sampling and testing, habitat assessment, interviews with City operations personnel, and input from residents of the watershed.

The second task included a comprehensive stormwater quantity and quality modeling analysis of the watershed. The model was used to develop a comprehensive watershed management plan with recommendations for site-specific physical improvements for flood protection, habitat improvement, and water quality improvement. This planning phase included a conceptual design sufficient to determine permit and construction feasibility, cost effectiveness, and property acquisition requirements. At the end of the



***Stevenson Creek Watershed Management Plan
Final Report***

planning phase, meetings of the Management Plan participants will be held to discuss a course of action for proceeding to the implementation phase.

The following sections describe the methods used to gather the necessary data, how the data were applied in the development of the watershed plan, and the recommended improvements produced through the cooperative efforts of the project team.



SECTION 2.0

WATERSHED ASSESSMENT AND PROBLEM IDENTIFICATION

This section of the Watershed Management Plan describes the existing flooding, natural resources, and water quality conditions within the Stevenson Creek Watershed, and the watershed assessment methods used. The first portion of the section addresses the primary concern of those living within the watershed; the periodic flooding of roads and buildings. The second portion describes the natural resources available within the watershed, such as the location and quality of wildlife habitat. The third portion details the water quality assessment, including the results of the water quality sampling program and pollutant loading modeling.

2.1 FLOODING CONDITIONS ASSESSMENT

2.1.1 Watershed Model Selection

This section details the methods and procedures used to perform the assessments of watershed hydrologic and hydraulic conditions. An important component of this Watershed Management Plan for Stevenson Creek is an assessment of the current flood protection level of service provided throughout the watershed. A thorough understanding of basinwide hydrologic and hydraulic processes is necessary to determine the most effective means of alleviating the identified flooding problems. The watershed model prepared for this Management Plan was used as a planning tool to assess the existing flooding problems and subsequently, to optimize the flood protection benefits of the proposed improvements.

The Advanced Interconnected Channel and Pond Routing Model, Version 2.2 (AdICPR) was chosen for the hydrologic and hydraulic modeling analysis, in part because of its ability to mathematically represent the time-dependent processes that govern flow and stage in low-relief coastal watersheds such as Stevenson Creek. Furthermore, it was



***Stevenson Creek Watershed Management Plan
Final Report***

necessary to select a model which has been accepted by the Federal Emergency Management Agency (FEMA) for flood insurance studies, since the results of the analysis will be used to support a request for revision of the applicable FEMA flood insurance rate maps.

2.1.2 Hydrologic Model Development

The hydrologic model used for this study is the SCS Runoff Curve Number (CN) and Unit Hydrograph Method contained within AdICPR. This method computes a runoff (flow) versus time relationship (hydrograph) for each subbasin, given a set of hydrologic input parameters.

Hydrologic parameters required for the SCS Runoff CN and Unit Hydrograph Method include the following:

- Subbasin drainage area
- Subbasin time of concentration (TC)
- Subbasin percent directly connected impervious area (DCIA)
- Subbasin weighted runoff curve number (CN) for areas outside of DCIA
- Unit hydrograph shape factor
- Rainfall data

A description of the methodologies used to derive each of these hydrologic parameters follows in the remainder of this section.



Stevenson Creek Watershed Management Plan Final Report

2.1.2.1 Subbasin Delineations

The Stevenson Creek watershed drainage area consists of approximately 9.82 square miles (6,286 acres) of moderately sloping terrain in west central Pinellas County that discharges to Clearwater Harbor. To provide the level of detail that was deemed necessary to analyze the primary drainage facilities within the heavily urbanized Stevenson Creek watershed, the basin was divided into a total of 307 discrete subbasins that range in size from 1 to 197 acres. The average subbasin size is 20.5 acres. The delineation of individual subbasins was dictated to a large extent by the complexity of the drainage network itself and the need to define the contributing drainage area to modeled elements of the conveyance system.

Approximately 20% and 14% of the watershed area lies within the City of Dunedin and unincorporated Pinellas County, respectively. Although these governmental bodies are not official participants in the Management Plan, approximately the same level of hydrologic and hydraulic model detail was applied in these areas. This was deemed necessary in order to accurately quantify the volumes and peak rates of runoff contributed to Stevenson Creek and its tributaries by these areas.

[Figure 2.1-1](#) in the attached map pocket shows the delineation of the Stevenson Creek watershed into its 307 individual subbasins. Subbasin ID numbers consist of the letter “B” followed by a four-digit number. The four-digit number generally coincides with the ID number of the node at the outlet of the subbasin. In cases where two subbasins drain to the same node, the second subbasin has an ID number equal to the node number plus one. Nodes and subbasins were generally numbered in order increasing in the upstream direction. For convenience, the 307 individual subbasins were aggregated into eight major subbasins, or “subwatersheds”. Subbasin and node numbers are grouped according to the subwatershed in which they lie, as follows:



Table 2.1-1 Node / Subbasin Numbering Scheme

| Subwatershed | Node / Subbasin ID Range |
|------------------------|---------------------------------|
| Lower Stevenson Creek | 0000 – 0499 |
| Lower Spring Branch | 0500 – 0999 |
| Upper Spring Branch | 1000 – 1999 |
| Hammond Branch | 2000 – 2999 |
| Middle Stevenson Creek | 3000 – 3499 |
| Lake Belleview Branch | 3500 – 3999 |
| Upper Stevenson Creek | 4000 – 4139 |
| Jeffords Street Branch | 4140 – 4999 |

The means of defining subbasin boundaries employed a number of sources of information and methods. The principle source was 1”=200’ topographic aerial photographic mapping of the watershed provided by SWFWMD. This mapping shows overland topography, thus indicating direction of overland flow. However, because much of the watershed is developed, with a variety of residential, commercial, industrial, and institutional developments, man-made secondary drainage systems comprising swales, gutters, storm sewer systems, ditches, and detention ponds have interrupted the natural overland flow patterns within the basin and, in many cases, diverted storm runoff in directions that are not readily apparent from inspection of the topographic mapping. It is also important to note that the SWFWMD mapping within the basin is, for the most part, over 20 years old. Therefore, new development that has occurred within the watershed since that time does not appear on these maps, and drainage patterns and grades in certain areas have been altered since that time due to this new development.

The City of Clearwater drainage atlas maps provided detailed layouts of the secondary drainage systems within the incorporated city portions of the watershed and proved to be of immense value for assisting in the delineation of the subbasins. In addition, record drawings of permitted stormwater management facilities within the basin on file with the SWFWMD were reviewed and referenced in the subbasin delineation



Stevenson Creek Watershed Management Plan Final Report

process as a means of defining the drainage systems and drainage areas for newer developments that did not show up on any of the previously listed information sources.

The final check of subbasin delineations was field reconnaissance of the watershed to confirm the initial boundaries and to inspect the drainage facilities and conditions in the basin firsthand, to investigate areas where there was no information available from the previously listed sources, and to resolve discrepancies where there was a conflict between different sources of information regarding drainage facilities.

2.1.2.2 Land Use

Existing land use conditions within the Stevenson Creek watershed were defined with the aid of a Geographic Information System (GIS) land use coverage data file provided by SWFWMD. For convenience, the 26 different land use classifications that were defined in the SWFWMD land use coverage of the basin were consolidated into the following 13 categories:

- Commercial
- Cropland and Pastureland
- Forest
- Low Density Residential
- Medium Density Residential
- High Density Residential
- Industrial
- Institutional
- Open Land and Range Land
- Specialty Farms
- Transportation, Communications and Utilities
- Water
- Wetlands

For the purposes of this study, the medium density residential classification was redefined to include residential areas containing between 2 and 5 dwelling units per acre. In the SWFWMD classification system, this was considered to be high density. It was deemed necessary to reclassify these areas, because the actual (measured) impervious area



*Stevenson Creek Watershed Management Plan
Final Report*

percentages in these areas are more consistent with literature values cited for medium density residential. The significance and determination of impervious area is described in the next section. This change increased the percentage of the basin classified as medium density residential from none to the majority of the basin. Areas of multi-family developments (i.e., apartment and condominium complexes) remained classified as high density residential.

These land use coverages were then field-truthed by examination of recent aerial photography of the basin and comparing to the map to confirm that both the classifications and the areal extent are properly represented. Many adjustments were required. The majority involved the delineation of the developed portions of areas that were designated as institutional or transportation/utilities in the SWFWMD land use coverage to separate them from open land areas that occurred within these parcels to various degrees. The institutional land use classification includes parcels such as nursing homes, schools, churches, hospitals, auditoriums, and cemeteries, which can vary over a wide range in their degree of imperviousness. For the same reasons, significant open land areas within industrial and commercial tracts were delineated to segregate them from the actual developed portions of the parcels. Other changes were required in order to update the mapping to account for recent development. The resultant hydrologic land use classification map of the Stevenson Creek watershed that was used for model development purposes is shown in [Figure 2.1-2](#). Table 2.1-2 presents a composite breakdown of land use acreages and percentages in the Stevenson Creek Watershed.



Table 2.1-2 Basin Land Use Percentages

| Land Use Classification | Total Area (acres) | Percentage of Basin (%) |
|---|-------------------------------|------------------------------------|
| Commercial | 610 | 9.7 |
| Cropland and Pastureland | 5 | 0.1 |
| Forest | 50 | 0.8 |
| Low Density Residential | 56 | 0.9 |
| Medium Density Residential | 3861 | 61.4 |
| High Density Residential | 459 | 7.3 |
| Industrial | 42 | 0.7 |
| Institutional | 182 | 2.9 |
| Open Land and Range Land | 573 | 9.1 |
| Specialty Farms | 10 | 0.2 |
| Transportation, Communications, and Utilities | 170 | 2.7 |
| Water | 205 | 3.3 |
| Wetlands | 63 | 1.0 |
| Total | 6286 | 100.0 |

*Stevenson Creek Watershed Management Plan
Final Report*

[\(Figure 2.1-2\)](#)



2.1.2.3 Impervious Areas

Impervious areas are those surfaces such as rooftops and pavement, which impede the infiltration of runoff into the soil. Directly connected impervious area (DCIA) is defined as those impervious areas that are connected directly to the subbasin outfall (i.e., node) without flow occurring over a pervious surface. In the AdICPR model, DCIA is an optional parameter which, if used, is treated as a separate subarea within each subbasin. A separate hydrograph is computed for the DCIA, which is not subject to any initial abstraction (i.e., infiltration). Any impervious area which is not directly connected to the subbasin outfall is then used in computing a weighted curve number (CN) as described in the next section.

For the Stevenson Creek watershed model, literature values of total percent imperviousness for the different land use classifications were utilized. Measurements of impervious coverage within representative samples of each land use classification were conducted using aerial photography, in order to confirm the literature values. The split between DCIA and non-directly connected impervious areas was determined through the model calibration process, as discussed in subsequent sections.

2.1.2.4 Runoff Curve Number

By superposition, the hydrograph computed using the DCIA is added by AdICPR to the hydrograph computed using a weighted runoff curve number (CN). This results in a single composite hydrograph, which is then input into the corresponding node of the hydraulic model.

In the SCS method, the CN is a function of S , the potential maximum infiltration after runoff begins (in inches):

$$CN = \frac{1000}{S+10}$$

The standard SCS method uses the following empirical relationship:

$$I_a = 0.2S$$



*Stevenson Creek Watershed Management Plan
Final Report*

Where I_a is the initial abstraction, which includes all losses before runoff begins. It includes water intercepted by vegetation, shallow depression storage, evaporation, and infiltration. For design storm conditions in watersheds containing sandy soils, experience and literature on the subject indicate that infiltration losses comprise the majority of the initial abstraction.

The weighted CN is therefore primarily a function of the non-directly connected impervious coverages (based on land use), and the infiltration capacity of the soils. For this study, a land use/ hydrologic soils group intersection analysis was performed using the ArcView/ArcInfo Geographic Information Systems (GIS) software.

The Soil Conservation Service (SCS) (now the Natural Resources Conservation Service) of the U.S. Department of Agriculture has mapped soils in Pinellas County in its publication “Soil Survey of Pinellas County, Florida” (1972). This soil survey also provides generalized information on the hydrologic properties of the soil classifications.

A standard method of soils classification is the hydrologic soils group. Soils are grouped into four hydrologic soil groups A through D. These groups are commonly used in hydrologic analyses to estimate infiltration rates and soil moisture capacities. Descriptions of these soil groups are:

Hydrologic Soil Group A (low runoff potential): Soils that have high infiltration rates even when thoroughly wetted and a high rate of water transmission. Typical maximum infiltration rate of 10 inches per hour when dry and 0.5 in/hr when saturated.

Hydrologic Soil Group B (moderately low runoff potential): Soils that have moderate infiltration rates when thoroughly wetted and a moderate rate of water transmission. Typical maximum infiltration rate of 8 in/hr when dry and 0.4 in/hr when saturated.



***Stevenson Creek Watershed Management Plan
Final Report***

Hydrologic Soil Group C (moderately high runoff potential): Soils that have a slow infiltration rate when thoroughly wetted and a slow rate of water transmission. Typical maximum infiltration rate of 5 in/hr when dry and 0.25 in/hr when saturated.

Hydrologic Soil Group D (high runoff potential): Soils having very slow infiltration rates when thoroughly wetted and a very slow rate of water transmission. Typical infiltration rate of 3 in/hr when dry and 0.10 in/hr when saturated.

In many cases in Florida, dual hydrologic soil group classifications (A/D or B/D) are assigned to soils that, during the wet season, are saturated throughout much of the soil column due to a high surficial water table. Thus, during this time of year, infiltration is impeded and the soil acts as a D soil. However, during the rest of the year, when the water table is lower, the soil acts as an A or B soil.

[Figure 2.1-3](#) presents a composite hydrologic soil group classification map of the Stevenson Creek watershed. It can be seen from the map that soils within the basin are predominantly classified as A and B/D. Group A soils occur on upland sand ridges and group B/D soils occur on low lying areas and flat areas with poor natural drainage around natural waterbodies and wetlands. A composite breakdown of the hydrologic soil group acreage and percentages for the basin is as follows:

Table 2.1-3 Hydrologic Soil Group Acreages and Percentages

| Hydrologic Soil Group | Total Area (acres) | Percentage of Basin (%) |
|------------------------------|-------------------------------|------------------------------------|
| A | 2424 | 38.6 |
| B | 21 | 0.3 |
| B/D | 2158 | 34.3 |
| C | 1114 | 17.7 |
| D | 370 | 5.9 |
| Water | 199 | 3.2 |
| Total | 6286 | 100.0 |



*Stevenson Creek Watershed Management Plan
Final Report*

[\(Figure 2.1-3\)](#)



***Stevenson Creek Watershed Management Plan
Final Report***

The following table presents the Runoff Curve Number Computation Matrix used by the ArcView/ArcInfo Geographic Information Systems (GIS) software to compute the overall area-weighted curve number for each subbasin. In this method, a unique curve number is assigned to each possible combination of hydrologic soil group and land use category. The computer program then computes an area-weighted value based on the percentages of these soil/land use combinations found within the particular subbasin.

Table 2.1-4 Runoff Curve Number Computation Matrix

| Land Use Classification | Hydrologic Soil Group | Runoff Curve Number |
|--------------------------------|------------------------------|----------------------------|
| Commercial | A | 89 |
| Commercial | B | 92 |
| Commercial | C | 94 |
| Commercial | D | 95 |
| Commercial | B/D | 94 |
| Cropland and Pastureland | A | 49 |
| Cropland and Pastureland | B | 69 |
| Cropland and Pastureland | C | 79 |
| Cropland and Pastureland | D | 84 |
| Cropland and Pastureland | B/D | 79 |
| Forest | A | 36 |
| Forest | B | 60 |
| Forest | C | 73 |
| Forest | D | 79 |
| Forest | B/D | 73 |
| High Density Residential | A | 77 |
| High Density Residential | B | 85 |
| High Density Residential | C | 90 |
| High Density Residential | D | 92 |
| High Density Residential | B/D | 90 |
| Industrial | A | 81 |
| Industrial | B | 88 |
| Industrial | C | 91 |
| Industrial | D | 93 |
| Industrial | B/D | 91 |
| Institutional | A | 81 |
| Institutional | B | 87 |
| Institutional | C | 91 |



Table 2.1-4 (Continued) Runoff Curve Number Computation Matrix

| Land Use Classification | Hydrologic Soil Group | Runoff Curve Number |
|---|------------------------------|----------------------------|
| Institutional | D | 93 |
| Institutional | B/D | 91 |
| Low Density Residential | A | 50 |
| Low Density Residential | B | 65 |
| Low Density Residential | C | 76 |
| Low Density Residential | D | 87 |
| Low Density Residential | B/D | 76 |
| Medium Density Residential | A | 61 |
| Medium Density Residential | B | 75 |
| Medium Density Residential | C | 83 |
| Medium Density Residential | D | 86 |
| Medium Density Residential | B/D | 83 |
| Open Land and Rangeland | A | 39 |
| Open Land and Rangeland | B | 61 |
| Open Land and Rangeland | C | 74 |
| Open Land and Rangeland | D | 80 |
| Open Land and Rangeland | B/D | 74 |
| Specialty Farms | A | 59 |
| Specialty Farms | B | 74 |
| Specialty Farms | C | 82 |
| Specialty Farms | D | 86 |
| Specialty Farms | B/D | 82 |
| Transportation, Communications, and Utilities | A | 78 |
| Transportation, Communications, and Utilities | B | 83 |
| Transportation, Communications, and Utilities | C | 88 |
| Transportation, Communications, and Utilities | D | 90 |
| Transportation, Communications, and Utilities | B/D | 88 |
| Water | W | 100 |
| Wetland | A-D | 98 |
| Wetland | W | 100 |

Overall CN values were calculated for each subbasin using the above matrix and GIS intersection analysis. In order to derive the percent impervious area for each subbasin, a “pervious area” CN was created for each subbasin based only on its soil type and its pervious area land use. For example, medium density residential was shown as open land and range land to represent the lawns and open space. By comparing the overall CN to



***Stevenson Creek Watershed Management Plan
Final Report***

the pervious area CN, a total percent impervious area for each subbasin was back-calculated using using an excel spreadsheet. Then, based on the percent of total impervious as DCIA (derived through the calibration process), the curve numbers were recomputed using only the unconnected impervious area. The excel spreadsheet used for this analysis is included in Appendix A.

2.1.2.5 Time of Concentration

The time of concentration (TC) is a measure of the time scale of the runoff hydrograph and is a function of subbasin slope and surface roughness. Conceptually, it is the time required for the hydrologically most distant point in the subbasin to begin contributing flow to the subbasin outlet, following the commencement of rainfall. The time of concentration for each subbasin within the Stevenson Creek watershed was computed using the Kinematic Wave approach as outlined in SCS Technical Release 55. In this method, the TC is computed as the sum of travel times for sheet flow, shallow concentrated flow, and open channel flow. The reader is referred to chapter 3 of SCS Technical Release 55 in Appendix E for further details on this method.

2.1.3 Hydraulic Model Development

The hydraulic model used for this study was AdICPR, which contains a one-dimensional unsteady flow hydraulic routing model. This model uses a node-reach representation of the drainage system. AdICPR receives hydrograph input at specific nodes by file transfer from the hydrologic model. The model performs dynamic routing of stormwater flows through the defined storm drainage system to the points of outfall in the receiving waterbody. The program will simulate branched or looped networks; backwater due to tidal or non-tidal conditions; free-surface flow; pressure flow or surcharge; flow reversals; flow transfer by weirs, orifices, and pumping facilities; and storage. Types of reaches that can be simulated include pipes, weirs, open channels of regular or irregular cross section, bridges, and drop structures (weir and pipe in series).



Stevenson Creek Watershed Management Plan Final Report

Simulation output takes the form of water surface elevations and discharges at each node and reach within the model network, reported at user-specified time intervals.

2.1.3.1 Drainage Facility Inventory

The initial and most important step in the development of the hydraulic model of the Stevenson Creek watershed was the inventory of the drainage structures along the primary drainage system. This information provides the foundation for the model representation of the hydraulic system. The drainage facility inventory of the study area was compiled from an array of sources and methods. Hydraulic data for culverts, storm sewers, bridges, control structures, and watercourse cross sections were obtained from city drainage atlas mapping, development plans, roadway plans, previous studies, and field surveys. Data collected included elevations, lengths, dimensions, construction materials, channel vegetation, structure entrance and exit conditions, and other pertinent features. The following is a discussion of the sources and methods used to collect this information:

Existing Maps, Plans and As-Builts

The City of Clearwater maintains 1"=100' scale drainage atlas maps that include considerable detail of locations, dimensions, and invert elevations of drainage facilities located within the incorporated city limits. These maps are periodically updated as new development occurs or new information is obtained, and provide a great deal of detail within the areas they cover, including secondary storm sewer systems. Invert elevations are not always indicated, however, and there is no information shown for the unincorporated areas within the basin. The City of Dunedin storm atlas provides a similar degree of mapping of drainage facilities.

It was previously noted that the SWFWMD stormwater management facility permit files were researched to collect information on facilities constructed within the Stevenson Creek watershed since the inception of the permit regulations in 1984. The City of Clearwater, Pinellas County, and the City of Dunedin also provided record drawings of



***Stevenson Creek Watershed Management Plan
Final Report***

drainage and flood control works that have been constructed within the basin. In addition, the Stevenson Creek Sediment Evaluation with Cross Sections completed by the City of Clearwater in August 1999 provided many of the irregular cross sections used in the model. The following list contains the most noteworthy plans, maps and as-builts used as sources of existing hydraulic model input data used in the development of the Stevenson Creek hydraulic model:

- Pinellas-Anclote Basin Aerial Photography with Contours. March 1977, May 1979, and December 1985, Southwest Florida Water Management District.
- City of Clearwater Stormwater Atlas. 1996-1999, City of Clearwater Public Works Administration, Engineering.
- City of Dunedin Stormwater Atlas. 1999, City of Dunedin Engineering Section
- Stevenson Creek Sediment Evaluation with Cross Sections. August 1999, City of Clearwater Public Works Administration, Engineering.
- Spring Branch of Stevenson's Creek Drainage Basin Field Survey Notes. March 1979, Pinellas County Engineering Department.
- Stevenson's Creek Watershed Channel Improvements, Phase 1 As-Built Plans. February 1993, W.K. Daughtery Consulting Engineers, Inc.
- Stevenson Creek – Channel Improvements – Phase II Plans. March 1995, Camp, Dresser and McKee.
- Highland Avenue Stormwater Improvements As-Built Plans. November 1998, HDR Engineering, Inc.
- The Mall From Union Street to the South Terminus Record Drawings. July 1994, Seminole Engineering.
- 3rd Avenue Drainage Improvements Record Drawings. March 2000, City of Dunedin Department of Public Works and Utilities.
- Villas at Renaissance Square (Old Sunshine Mall) Construction Plans. January 1999. Florida Design Consultants, Inc.
- Various MSSW and ERP permit information on file with the Southwest Florida Water Management District.



Stevenson Creek Watershed Management Plan Final Report

Previous Studies

The Stevenson Creek watershed has been the subject of several stormwater management studies in the last 20 years that served as valuable sources of information on the existing structures and channels along the primary drainage system of the basin. These sources were used to varying degrees to supplement and/or confirm other sources to provide the required AdICPR model input data to describe the primary drainage system and facilities in the watershed.

The first of these studies was a storm drainage basin study conducted in 1981 by Henningson, Durham, and Richardson, Inc. (HDR) for Pinellas County. This study was a part of the countywide comprehensive stormwater drainage master plan, which has since been adopted within the Pinellas County Comprehensive Plan in its Drainage Element (1989). To conduct its study of the Stevenson Creek basin, HDR used the SCS TR-20 computer model for hydrologic analysis. Runoff hydrographs were developed for each subbasin in the watershed, using existing and comprehensive future land use, with the 25-year, 6-hour duration storm event of 5.5 inches total precipitation used as the basis for design. The U.S. Army Corps of Engineers HEC-2 model was used to perform backwater analyses to determine flood profiles for each of the design storm events. The Pinellas County Study also served as the basis for a Master Drainage Plan for the Spring Branch Watershed, prepared in 1983 by the City of Dunedin Public Works Department. For this study, Parsons ES used selected information from the original Pinellas County field survey notes as needed to augment the structure and cross section information within the City of Dunedin portion of Spring Branch.

In 1988, a Preliminary Master Plan for Stevenson Creek was prepared by W.K. Daughtery, Inc. for the City of Clearwater. In the 1988 study, a three-phase channel improvement project was recommended for the main channel of Stevenson Creek. The modeling methodology employed TR-20 to generate runoff hydrographs for the 5-, 10-, 25-, 50-, and 100-year, 24 hour duration storm events. The hydrographs were then input to a one-dimensional, steady-flow water surface profile model (WSP-2) to calculate the



Stevenson Creek Watershed Management Plan Final Report

flood elevations. In 1990-1991, Camp, Dresser, and McKee, Inc. (CDM) prepared a limited re-study of Stevenson Creek under which the TR-20/WSP-2 model was converted to AdICPR, Version 1.4. The AdICPR model was then used to support the detailed design of portions of the preliminary master plan project, as well as a FEMA Letter of Map Revision (LOMR). This re-study by CDM also included analysis of alternatives for floodplain enhancements within the Glen Oaks Golf Course. To date, two of the three phases of the original project have been constructed, consisting of the channel segments between Betty Lane and Jeffords Streets. The previously referenced as-built plans for these channel improvements were relied upon extensively in the development of the model.

The following list summarizes the previous and on-going studies of the Stevenson Creek Watershed which were consulted in the development of this watershed management plan:

- Summary Report for Stevenson's Creek Preliminary Master Plan. August, 1988, W.K. Daughtery Consulting Engineers, Inc.
- City of Clearwater 1997 Watershed Management Plan, Volume II. Post, Buckley, Schuh & Jernigan
- Stevenson Creek Channel Improvements, Phase 2 – Joint Dredge and Fill Permit Application. April 1992, Camp, Dresser, and McKee
- Technical information submitted to FEMA in support of request for Stevenson Creek Letter of Map Revision. May 1998, Camp, Dresser and McKee.
- Pinellas County Storm Drainage Basin Study Technical Appendix – Spring Branch of Stevenson Creek Basin and Coastal Zone 4 Basin. October 1981, Henningson, Durham & Richardson, Inc.
- Repetitive Loss Report – City of Clearwater, FL. October 1998, FEMA
- Master Drainage Plan: Spring Branch Watershed. September, 1983, City of Dunedin Public Works Department, Water Resources.
- Stevenson Creek Sediment Characterization and Removal Feasibility Study - Final Report. August 1998, BCI, Inc.



***Stevenson Creek Watershed Management Plan
Final Report***

- Stevenson Creek Estuary – Preliminary Restoration Plan. October 2000, U.S. Army Corps of Engineers, Jacksonville District

Field Reconnaissance and Field Survey

Field reconnaissance of the Stevenson Creek watershed was conducted by driving and walking the basin to determine drainage patterns, map drainage facilities, measure facility dimensions inspect the condition of the drainage facilities in the field, assemble a photographic log of drainage facilities, and to confirm information collected from the previously discussed sources and/or resolve differences between different sources.

Following completion of the field reconnaissance, Parsons ES developed a field survey plan to establish the size, location, dimensions and inverts of drainage structures, and to define current stream channel and floodplain cross sections within the Stevenson Creek watershed based on the specific needs of the hydraulic model. The emphasis of this survey was placed on areas within the basin where there were no available sources of as-built record drawings and surveys. The survey program was conducted by Harry Marlow, Inc., under the direction of Parsons ES. In addition, the City of Dunedin conducted limited surveys of selected structures and cross sections for use in the portion of the model that lies within the limits of the City of Dunedin.

2.1.3.2 Channel Cross Section and Floodplain Definition

A variety of sources of channel cross section and drainage structure data were utilized in the formulation of the AdICPR model. Parsons ES used what was judged to be the most current, detailed, and representative source of information available for any particular reach of the open channel system. In addition, the extension of channel cross-sections into the floodplain regions of the Stevenson Creek floodway was necessary for many of the surveyed cross-sections obtained from the various sources. In these instances, the SWFWMD one-foot contour topographic maps were used to scale off the floodplain extensions.



Stevenson Creek Watershed Management Plan Final Report

One of the most important requirements of the hydraulic model representation of open channel reaches is the selection of an appropriate channel roughness coefficient, or Manning's n, value. This is an index of the resistance to flow, primarily due to friction, that is dependent upon factors such as the extent and type of channel vegetation, channel bottom material, channel irregularity, channel alignment, obstructions, and depth of flow. Selection of an appropriate Manning's n value for a particular channel reach is a subjective procedure that is facilitated by past experience. As a first step in this procedure, Parsons ES personnel took color photographs of all open channel reaches within the model. Published guides and past modeling experience were then applied in the selection of channel and floodplain Manning's n values. These values were either confirmed or adjusted during the model calibration process using the rating curves of the streamflow gaging stations and the measured high water elevations.

2.1.3.3 Storage Node Stage-Area Relationships

In order to represent the attenuating effects of storage on the hydrographs computed by the hydrologic model, it is important that all significant stormwater storage areas and their hydraulic controls features be well defined within the model. This is especially important in the Stevenson Creek watershed where much of the drainage throughout the basin is controlled by lakes (man-made and natural) and natural depression areas. The AdICPR model allows the user to specify a variable stage-area relationship at any model node that defines the storage properties at that point, be it a pond, lake, wetland, or other water body.

In the development of the Stevenson Creek watershed hydraulic model, Parsons ES used, where available, record drawings and permits as a means of establishing stage-area relationships of constructed stormwater management facilities. For all others, including the natural lakes, ponds, and wetlands within the watershed, the stage-area relationships were determined by direct measurement of SWFWMD one-foot topographic maps with a planimeter.



*Stevenson Creek Watershed Management Plan
Final Report*

2.1.3.4 Model Schematic

The hydraulic model (AdICPR) of the Stevenson Creek watershed consists of a network of open channel segments, culverts, bridges, storm sewers, weirs, lakes, ponds, and wetlands that compose the primary drainage system within the basin. AdICPR uses a link-node concept to idealize the “real world” drainage system. A node is a discrete location in the drainage system where conservation of mass (continuity) is maintained. Links, or “reaches” are the connections between nodes and are used to convey water through the system. The entire network of nodes and reaches forms the hydraulic model network and serves as the computational framework for AdICPR.

The first step in development of a model schematic was to identify the primary drainage system and all drainage facilities within it. This task was accomplished through the research and review of all available sources of information that have been previously described, and through field reconnaissance of the entire watershed. All such information was compiled and a watershed drainage map developed which depicts the primary drainage system. [Figure 2.1-1](#), included in the attached map pocket, presents the drainage map of the Stevenson Creek watershed and the model node locations which were used to define the primary conveyance network of the basin. General guidelines which were followed in development of the model schematic are:

- Nodes are required at the upstream and downstream ends of any structure (e.g. culvert, bridge, weir, etc.).
- Storage elements (ponds, lakes, wetlands, etc.) are specified as nodes.
- Nodes are located at tributary confluence locations.
- Nodes are placed at locations where there is a major surface water inflow to the conveyance system.
- Points of change in channel geometry and/or slope are specified as node locations.



***Stevenson Creek Watershed Management Plan
Final Report***

- Nodes are added at locations within the network to define the hydraulic gradeline in greater detail.

When constructing a model network, unique identifiers must be assigned to all nodes and reaches. The node-numbering scheme is the same as the subbasin numbering scheme previously described, except that node identifiers begin with the letter “N”. By convention, the identification of a reach between two nodes is the same as the name of the upstream node. Reach identifiers begin with a letter prefix pertaining to the type of reach as follows:

| Reach Type | Prefix |
|-----------------------|---------------|
| Channel | C |
| Pipe | P |
| Weir | W |
| Drop Structure | DS |
| Bridge | BR |
| Overland Flow Channel | COF |
| Overland Flow Weir | WOF |

A node-reach schematic of the AdICPR model of the Stevenson Creek watershed is provided in [Figure 2.1-4](#), contained within the attached map pocket. This schematic represents the hydraulic network as it is modeled. Storage nodes and type of reaches are indicated as they are represented within the AdICPR model. The schematic includes “overflow” reaches which model the overland flow paths that floodwaters can follow when flow rates exceed the capacities of the primary drainage system. In all, the model includes 383 nodes, 252 pipe reaches, 176 open channel reaches, 171 irregular cross sections, 98 weir reaches, 39 drop structure reaches, and 6 bridge reaches.



*Stevenson Creek Watershed Management Plan
Final Report*

2.1.3.5 Boundary Conditions

The AdICPR model requires specification of hydraulic boundary conditions at all outfall points of the model schematic. In the Stevenson Creek watershed application, the primary basin outlet is located at the downstream face of the most downstream bridge at Edgewater Drive (Alt. US 19). A constant tailwater boundary condition representing the water elevation of Clearwater Harbor, a tidal waterbody, was specified at elevation 2.5 feet above mean sea level, 1929 National Geodetic Vertical Datum (NGVD) for all model simulations. This elevation was intended to approximate a “spring tide” condition within the harbor. It should be noted that for flow rates above approximately 3,000 cfs (which applies to the peak rates of flow for all design storms), the existing conditions stages within the Stevenson Creek estuary were not found to be sensitive to changes in the tidal boundary condition over a range of 0 to 3 feet NGVD.

An “overflow” boundary node exists at the northern end of the Jeffords Street Branch where floodwaters can “pop off” to the Allens Creek Basin when the flows exceed the capacity of the storm sewers. A third boundary node exists at the Clearwater Executive Airport, where a 36” diameter CMP culvert under the runways diverts a portion of the flow from the headwaters of Hammond Branch east into the Alligator Creek Basin. The tailwater elevations at these overflow boundary nodes are allowed to fluctuate with normal depth in the boundary link. Modeling results from the completed Allens Creek and Alligator Creek Watershed Plans were consulted to determine whether flooding was predicted in those watersheds which would influence stages in the corresponding Stevenson Creek boundary nodes. These model results indicated that the design flood elevations are well below the Stevenson Creek “pop-off” elevations, therefore it was not necessary to code in the time/stage boundary conditions based on these other models.



2.1.4 Model Calibration and Verification

2.1.4.1 Introduction

Model calibration refers to the adjustment of model parameters within reasonable limitations so that the model results (i.e., streamflows and water elevations) are in reasonable agreement with a set of measured data. A reasonable range of values for the adjustment of model parameters is established through the review of literature references, and adjustments outside of those ranges are made only if some unusual hydrologic or hydraulic condition exists. Ideally, the model is calibrated to more than one different storm event in order to represent a variety of volumes, intensities, and distributions. It is also desirable to calibrate to recorded flow and stage information at different locations within the watershed.

The two primary data requirements for model calibration and verification are gaged rainfall and streamflow for the study area. When selecting a calibration storm event, the rainfall and streamflow data must be sufficiently documented in appropriate time intervals so that variations in rainfall intensity and the associated runoff can be accurately simulated. Data should be recently acquired so that the current land use and hydraulic conditions existing in the study area are accurately represented. Additionally, because of the non-uniform spatial distribution inherent in Florida rainfall patterns, it is desirable that precipitation data be collected at more than one location within a large study area.

2.1.4.2 Streamflow and Precipitation Gaging Data

Prior to the initiation of this watershed management plan, no known measured streamflow data existed for Stevenson Creek. Therefore, it was necessary to collect streamflow data for calibration of the hydrologic/hydraulic computer model. This was accomplished by establishing two streamflow gaging stations within the Watershed. Continuous rainfall, stage, and streamflow data were collected under the direction of Parsons ES by Hydrogage, Inc. at Stevenson Creek near Drew Street and at Spring Branch near King's Highway. The locations of the stations are shown on [Figure 2.1.5](#).



*Stevenson Creek Watershed Management Plan
Final Report*

[\(Figure 2.1-5\)](#)



Stevenson Creek Watershed Management Plan Final Report

The streamflow data was collected in digital format from May 12, 2000 to October 12, 2000. Stream stage (water level) was recorded at 15-minute intervals using a calibrated pressure transducer. Rainfall amounts were recorded at 15-minute intervals using a standard tipping-bucket rain gage. The rainfall data recorder utilized a telemetry system to alert Hydrogage of storm events in progress. Streamflow measurements were made over a wide range of flow conditions using standard USGS stream gaging procedures. These measurements were then correlated to recorded stage elevations to establish a flow versus stage rating curve at each location.

In addition to the precipitation and streamflow data, storm event flow-weighted composite water samples were collected with the aid of automatic samplers at each station. The water quality monitoring program is described in detail in Section 2.3.2.

2.1.4.3 Selection of Calibration/Verification Storm Events

July 15, 2000

Due to the relatively short period of record, only a handful of storm events was available for calibration of the model. Fortunately for this analysis, the period of record captured a large storm that occurred on July 15, 2000. This storm produced 7.60” and 5.21” of total rainfall within a ten-hour period at the Drew Street and King’s Highway sites, respectively. As evident from [Figure 2.1-6](#), this storm consisted of two separate rainfall events occurring approximately 6 to 7 hours apart. The first event occurred from about 7:00 AM to 10:00 AM and produced 3.23” at the Drew Street site and 1.69” at the King’s Highway site. At 2:00 PM, the second event occurred, producing 4.37” at the Drew Street site and 3.52” at the King’s Highway site. All of the rainfall in the afternoon event fell within a 2-hour period from 2:00 PM to 4:00 PM. The peak 15-minute intensity occurred at about 2:30, averaging 7.44 and 4.04 inches per hour at the Drew Street and King’s Highway sites, respectively. This storm produced widespread flooding throughout Stevenson Creek and the City of Clearwater. Following this event, staff from



*Stevenson Creek Watershed Management Plan
Final Report*

[\(Figure 2.1-6\)](#)



Stevenson Creek Watershed Management Plan Final Report

Parsons ES and the City marked visible high water elevations at 21 locations throughout the basin, which City survey personnel later surveyed (three of the elevations marked in the field as “questionable” were later discarded).

Because the hydrologic model chosen for the analysis is intended to be used strictly as a single-event model, the larger, afternoon rainfall event was chosen as a calibration event. By inspection of [Figure 2.1-6](#), it is evident that both Stevenson Creek and Spring Branch responded to the two storms as separate and distinct events. It should be noted, however, that the first event served to substantially increase the soil moisture leading into the second event. Prior to the morning of July 15, hydrologic conditions within the watershed were still extremely dry due to the several months of drought during the spring of 2000.

June 12, 2000

In order to compliment and verify the large storm event of July 15, a smaller storm was chosen in order to verify the calibration parameters, and to “fine-tune” the DCIA percentages. For these purposes, the storm of June 12, 2000 was chosen, which produced 0.85 and 0.54 inches of rainfall at the Drew Street and King’s Highway stations, respectively. The antecedent moisture conditions preceding this event were extremely dry. The total rainfall amounts were therefore small enough to make the assumption that all runoff due to this storm was contributed by the DCIA, and thus all rainfall in areas outside the DCIA was lost to infiltration.

2.1.4.4 Calibration Parameters and Results

When calibrating a computer model, certain model input parameters are held constant while others are adjusted in attempt to produce reasonable agreement with measured data. Those parameters that are adjusted are referred to as calibration parameters. Since it is desirable to limit the number of calibration parameters to the fewest possible, those parameters that can be easily measured or calculated normally are not adjusted. Calibration parameters are typically those coefficients and or indexes that



Stevenson Creek Watershed Management Plan Final Report

are not easily determined from known quantities and/or established procedures. The two primary calibration parameters chosen for the Stevenson Creek model are runoff peak rate factor for the hydrologic component, and channel Manning's roughness for the hydraulic component of the model.

When calibrating a model which uses the SCS unit hydrograph and runoff curve number method, it is often necessary to adjust the runoff curve number (CN) in order for the model to match the measured runoff volume. This is primarily due to the fact that the selected calibration storm events may have antecedent moisture conditions which differ significantly from typical design values found in the literature, which are conventionally based on either average, or average wet season, conditions. Runoff volumes can be very sensitive to CN, especially in southwest Florida where the sandy soils and seasonally high water table can result in a wide range of CN values depending on the time of year (i.e., wet season versus dry season). However, no CN adjustment was necessary for the Stevenson Creek calibration since the runoff volumes predicted for the July 15th storm using CN's corresponding to average antecedent moisture conditions matched the observed volumes fairly well. This is due to the likelihood that the first of the two rainfall events on July 15th served to increase the soil moisture conditions from dry conditions to something closer to typical design conditions.

Channel Mannings Roughness

The primary means of calibrating the AdICPR hydraulic model was through adjustment of the Mannings Roughness Coefficient, or Mannings "n". This is an index of the resistance to flow through a channel, primarily due to friction, that is dependent upon factors such as the extent and type of channel vegetation, channel bottom material, channel irregularity, channel alignment, obstructions, and depth of flow. Adjustments to the channel Mannings "n" were made to the cross sections in the vicinity of the streamflow gages until the simulated flow versus stage rating curve provided a reasonable match with streamflow measurements made during a number of different storm events



***Stevenson Creek Watershed Management Plan
Final Report***

and flow conditions. No adjustments were made to the Manning's roughness in the vicinity of the Spring Branch at King's Highway station however, since within the range of the measurements, the flow appears to be controlled by the box culverts under King's Highway (refer to Figure 2.1-7). The simulated rating curve at this location provided a reasonable fit to the measured data without any adjustment to the Mannings "n" values.



Figure 2.1-7 Box Culverts Downstream of King's Highway Monitoring Station

At the Drew Street gage in Stevenson Creek, it was necessary to increase the in-bank Mannings "n" from the initial estimate of 0.07, to 0.09 for the cross section immediately downstream of the gage in order to match the measured data. In a field visit in March of 2000, this section was observed to be heavily vegetated (refer to Figure 2.1-8), although the degree of vegetation in the channel generally decreased in the sections further downstream through the golf course. Of course, the degree of vegetation varies not only with location, but also with time of year and point in the maintenance cycle.



**Figure 2.1-8 Vegetation in Channel Downstream of Drew Street
Monitoring Station**

[Figures 2.1-9 and 2.1-10](#) illustrate the simulated flow versus stage rating curves at Drew Street and King’s Highway, respectively. Note that the dependant variable (flow) is plotted on the X-axis. The measured values are plotted for comparison.

Following calibration of the Peak Rate Factor (described below), the channel Mannings “n” values were adjusted at several other locations in the watershed in order to match the surveyed high water elevations of the July 15th flood event.

Peak Rate Factor

In the SCS Unit Hydrograph Method, a composite unit hydrograph is constructed of several incremental triangular unit hydrographs that adhere to the basic SCS triangular unit hydrograph equation:

$$q_p = \frac{K'AQ}{T_p}$$

*Stevenson Creek Watershed Management Plan
Final Report*

[\(Figure 2.1-9 and 2.1-10\)](#)



***Stevenson Creek Watershed Management Plan
Final Report***

Where q_p = peak runoff rate in cfs,
A = area in square miles,
Q = rainfall excess depth in inches,
K' = runoff peak rate factor

The runoff peak rate factor, K', includes a unit conversion and a hydrograph shape factor which determines the respective fractions of the runoff volume occurring under the rising and falling limbs of the hydrograph. The value of K' has been shown to vary widely, from 100 in extremely flat basins in South Florida, up to 600 in steep, mountainous terrain. It has been suggested that K' varies with watershed surface storage and/or average watershed slope. However, since no definitive relationship between subbasin slope and K' has been proposed, it is often used as a calibration parameter. In the absence of gage data, the SCS recommends using a value of 256 for Florida, and 484 for most of the rest of the country. It can be shown that a K' of 484 corresponds to 3/8 and 5/8 of the runoff volume occurring on the rising and falling limbs of the hydrograph, respectively. A K' of 256 corresponds to 1/5 and 4/5 of the runoff volume occurring on the rising and falling limbs, respectively. The lower peak rate factors produce longer recession limbs with a smaller peak discharge rate for the same unit volume of runoff. It should be noted that these empirical values were derived from regional studies of small groups of similar watersheds, and are not necessarily applicable when applied outside their experimental ranges.

For the Stevenson Creek watershed, a value of 256 was used as the initial estimate of K' for all subbasins, in accordance with the SCS recommendation for Florida. However, this value tended to produce simulated hydrograph shapes that suggested that the K' value was too low. The K' was increased to 484 for several of the steeper subbasins throughout the watershed, including several along the main channel of Stevenson creek which had average slopes exceeding 3%. Those subbasins with average slopes of less than about 1% were left with their original K' of 256. This adjustment produced better agreement with the observed hydrograph shapes. [Figures 2.1-11 and 2.1-12](#) provide a comparison between the simulated and measured hydrographs for the storm of July 15, 2000.



*Stevenson Creek Watershed Management Plan
Final Report*

[\(Figure 2.1-11 and 2.1-12\)](#)



***Stevenson Creek Watershed Management Plan
Final Report***

Once the model was calibrated to match the observed hydrograph shape, the Mannings “n” was adjusted for the remaining cross sections throughout the watershed, in order to provide a closer match to the surveyed high water elevations. The following table compares the simulated and the measured high water elevations of the flood of July 15, 2000:

**Table 2.1-5 Comparison of Measured and Simulated High Water Elevations
Storm of July 15, 2000**

| Node ID | Node Location | Peak Stage (ft NGVD '29) | | Difference (ft) |
|---------|--|--------------------------|-----------|-----------------|
| | | Measured | Simulated | |
| 1000 | Spring Branch at King’s Highway gage | 12.51 | 12.48 | -0.03 |
| 1040 | Spring Branch at Union Street (u/s) | 16.45 | 16.36 | -0.09 |
| 2030 | Hammond Branch Pond at King’s Highway | 13.16 | 13.47 | 0.31 |
| 2130 | Flagler Ditch at Saturn Avenue | 61.10 | 61.11 | 0.01 |
| 2300 | Smallwood Circle and Rosewood Road | 45.98 | 46.08 | 0.10 |
| 3000 | Stevenson Creek at Drew Street gage | 14.12 | 14.14 | 0.02 |
| 3040 | Stevenson Creek at Cleveland Street (u/s) | 18.04 | 17.81 | -0.23 |
| 3090 | Stevenson Creek at Court Street (d/s) | 18.61 | 18.83 | 0.22 |
| 3100 | Stevenson Creek at Court Street (u/s) | 18.97 | 18.88 | -0.09 |
| 3120 | Stevenson Creek at Druid Road (d/s) | 20.76 | 20.60 | -0.16 |
| 3125 | Stevenson Creek at Druid Road (u/s) | 20.67 | 20.82 | 0.15 |
| 3700 | Lake Belleview outfall structure at Lakeview | 40.22 | 40.13 | -0.09 |
| 4020 | Stevenson Creek at Browning Street (u/s) | 30.05 | 30.21 | 0.16 |
| 4040 | Stevenson Creek at Lakeview Road (u/s) | 31.16 | 31.14 | -0.02 |
| 4080 | Stevenson Creek at St. Thomas Drive (u/s) | 39.53 | 39.52 | -0.01 |
| 4090 | Stevenson Creek at Belleair Road (d/s) | 39.80 | 39.58 | -0.22 |
| 4100 | Stevenson Creek at Belleair Road (u/s) | 40.08 | 40.12 | 0.04 |
| 4140 | Jeffords Street Branch at Highland Avenue | 28.73 | 28.73 | 0.00 |
| 4160 | Jeffords St Branch at Skyview and Jeffords | 31.14 | 30.70 | -0.44 |
| 4190 | Jeffords Street Branch at Barry and Tuscola | 30.80 | 30.67 | -0.13 |



Stevenson Creek Watershed Management Plan Final Report

All of the simulated high water elevations were within 0.50 feet of the measured values, which is within the accuracy of computation for this type of analysis, and exceeds FEMA's minimum requirements for flood insurance studies. All except two of the values were within 0.25 feet of the measurements.

Model Verification and DCIA

The storm of June 12, 2000 was simulated in order to verify the calibration parameters and to fine-tune estimates of DCIA as a percentage of total impervious area. As mentioned in previous sections, total impervious area within each subbasin was estimated based on land use and aerial photography. A 50/50 split between directly and non-directly connected impervious areas was initially assumed. Since runoff volumes resulting from high intensity, large volume storm events normally are not sensitive to the percentage of total impervious as DCIA, a small, less intense storm event was chosen for DCIA determination. Since the storm of June 12 was a low volume, low intensity storm that had extremely dry antecedent moisture conditions, all runoff from this storm can reasonably be attributed to DCIA. The initial model simulation slightly under predicted the volume from this storm. The percentage of total impervious as DCIA was then raised from 50% to 65%, which resulted in a better fit with the measured hydrographs (refer to [Figures 2.1-13 and 2.1-14](#)). The 15% impervious area that was transferred into DCIA was subtracted from the calculations of weighted CN, resulting in slightly lower CN values. Then, the calibration storm of July 15 was simulated with the new CN and DCIA values. As expected, the results from the larger storm event did not change significantly.

2.1.5 Flooding Conditions Assessment

Upon the successful completion of the development and calibration of the detailed hydrologic and hydraulic model, the next step of the watershed management planning process was to apply the model to assess the performance of the basin drainage network for a given set of design storm events. Results of these simulations were then analyzed with respect to the flooding level of service criteria, in order to identify the locations and the severity of potential flooding problems.



*Stevenson Creek Watershed Management Plan
Final Report*

[\(Figure 2.1-13 and 2.1-14\)](#)



***Stevenson Creek Watershed Management Plan
Final Report***

2.1.5.1 Design Storm Events

The basis for the evaluation of flooding conditions in the watershed were the 10, 25, 50, and 100-year return period, 24-hour duration design storm events. The total rainfall for these events are 7.5, 9.0, 10.5, and 12.0 inches, respectively, as determined from the SWFWMD Environmental Resource Permitting (ERP) Information Manual (February 1996). The 500-year, 24-hour storm was also simulated in order to be consistent with FEMA mapping guidelines. The rainfall of 14.8 inches for the 500-year storm was determined through a probability analysis of the more frequent design storm events. The SCS Type II Florida-Modified rainfall distribution was used to develop the design storm hyetographs for the all return periods.

2.1.5.2 Existing Flooding Conditions

Using the described design storm events as the basis for simulations, the AdICPR model was run to generate predictions of basinwide flooding conditions for the existing conditions throughout the Stevenson Creek watershed. The results of these model simulations are summarized in Appendix D, Table D.1. This table lists the model nodes in sequence starting from the downstream end and the corresponding model predictions of 10-, 25-, and 100-year flood elevation at those locations. Also listed are the locations and descriptions of the adjacent roadways and the low road elevation at each structure. Note that the low road elevation does not necessarily occur at the exact location of the structure itself, since sags along the road profile, as determined from SWFWMD topographic mapping and/or roadway construction drawings, may occur several hundred feet away in certain instances. When a peak flood elevation exceeds the low road elevation, it indicates that the roadway will be inundated at that location by a depth corresponding to the difference in elevations.



***Stevenson Creek Watershed Management Plan
Final Report***

Comparison with Previous Studies

The following table compares the simulated 100-year flood elevations and peak discharge rates at five key locations within Stevenson Creek to the previous analyses of the watershed:

Table 2.1-6 Comparison of 100-year Peak Discharge Rates and Flood Stages

| Location | W.K. Daugherty 1988 Preliminary Master Plan, Future Conditions | | CDM 1997 FEMA Submittal | | Parsons ES Existing Conditions | |
|--------------------|--|----------------------------|----------------------------|----------------------------|-----------------------------------|----------------------------|
| | 100-yr Flow (cfs) | 100-yr Stage (ft, NGVD) | 100-yr Flow (cfs) | 100-yr Stage (ft, NGVD) | 100-yr Flow (cfs) | 100-yr Stage (ft, NGVD) |
| Douglass Avenue | 5,859 | 4.6 | n/a | n/a | 4,697 | 7.73 |
| Palmetto Street | 4,603 | 11.0 | 2,190 | 8.67 | 3,300 | 10.14 |
| Drew Street Gage | 3,718 | 15.5 | 2,030 | 12.75 | 2,848 | 15.70 |
| S. of Court Street | 3,075 | 22.8 | 1,280 | 19.58 | 2,588 | 22.89 |
| Jeffords Street | 2,574 | 28.0 | 1,724 | 25.00 | 1,998 | 28.24 |

Because the modeling completed for this study was calibrated to measured stage and flow data, and the level of detail in the model network is an order of magnitude higher than the modeling completed for the previous studies, differences in the results are to be expected. Comparison of the peak discharge rates shows that those predicted by the Watershed Management Plan model consistently fall between those predicted by the other two studies. Upstream of Palmetto Street, the flood elevations predicted by the Parsons ES model generally compare closely with the W.K. Daugherty future conditions model, which includes the phase 1, 2, and 3 improvements (of which only phases 1 and 2 were constructed). In these same locations, the flood elevations predicted both in this study and in the W. K. Daugherty study are approximately three feet higher than those reported



***Stevenson Creek Watershed Management Plan
Final Report***

in the 1997 CDM study. While the reason for this large difference was not readily discernable, it should be mentioned that the 100-year project conditions flood levels reported in the 1997 CDM FEMA submittal are 0.5' to 2.5' lower than the 25-year project conditions flood levels reported in the 1992 CDM dredge and fill permit application (not shown). In addition, when comparing flood elevations at Douglass Avenue and Palmetto Street, it should be noted that neither of the two previous studies included the modeling of bridges at Edgewater Drive and the Pinellas Trail. In addition, the CDM study did not include the bridge at Douglass Avenue.

2.1.5.3 Flooding Level of Service Criteria

For the development of the comprehensive watershed management plan for the Stevenson Creek watershed, it was necessary to establish flood protection level of service (FPLOS) criteria by which flooding problems can be identified and alternatives for flood control can be evaluated. Determination of appropriate FPLOS criteria is therefore a very important part of the watershed planning process. Once the design storm flood elevations have been determined through the comprehensive modeling procedures, the FPLOS criteria then become the primary factor in determining the cost taxpayers must bear in order to remedy the existing flooding problems. Thus, the FPLOS criteria become the point at which the cost of infrastructure improvements is balanced against the public's desire to further reduce the flooding in the watershed.

The primary FPLOS criterion is that there is to be no structural flooding (i.e., homes and businesses) for events up to and including the 100-year flood. This criterion refers to the low floor slab elevation (lowest inhabited floor) as the point of structural flooding. This is consistent with FEMA guidelines, and has been widely adopted by counties and municipalities across the state and the country.

The secondary set of FPLOS criteria specifies allowable thresholds for street flooding. The criteria is based upon residential, collector, and arterial roadways being passable for the 10, 25, and 100-year flood events, respectively. For the purposes of this



***Stevenson Creek Watershed Management Plan
Final Report***

study, “passable” is defined as 6” of flooding or less at the lowest edge of pavement in a travel lane. No flooding is allowable on hurricane evacuation routes for events up to and including the 100-year flood. The following table summarizes the proposed FPLOS criteria for Stevenson Creek:

Table 2.1-7 -- Proposed Flood Protection Level of Service (FPLOS) Criteria for the Stevenson Creek Basin

| FPLOS Category | Allowable Flooding Depths |
|------------------------------------|-------------------------------------|
| 1. Residential Streets, 2 lanes | Up to 6” Allowed for 10-year flood |
| 2. Collector Roads, 2-4 lanes | Up to 6” Allowed for 25-year flood |
| 3. Arterial Roads, 4 or more lanes | Up to 6” Allowed for 100-year flood |
| 4. Hurricane Evacuation Routes | No flooding up to 100-year flood |
| 5. Habitable Structures | No flooding up to 100-year flood |

In the next section, the above FPLOS criteria is used to identify and develop potential projects to reduce the design flood elevations to within the allowable flooding depths. However, experience shows that improving infrastructure to reduce flood depths to meet a desired level of service is not always cost effective. For this reason, project costs must be weighed against the relative benefits. Of course, multiple-use facilities provide benefits in addition to flood control which must also be considered, as will be discussed in subsequent sections. Projects which do not provide benefits commensurate with the costs will not be recommended for funding.

Furthermore, it is not always technically feasible to reduce flood depths to meet a desired level of service. For example, many structures in low-lying areas near the coast in Clearwater were erected prior to the community’s participation in the National Flood Insurance Program, which first began in 1968. Many of these structures are subject to



Stevenson Creek Watershed Management Plan Final Report

saltwater inundation from the 100-year storm (hurricane) surge from the Gulf of Mexico. Although beyond the scope of this Watershed Management Plan, it is highly unlikely that an infrastructure project designed to protect against the 100-year storm surge in this area would be technically feasible.

In instances such as these where it is not cost effective or technically feasible to lower the floodplain, alternatives to flood level reduction should be considered. One such alternative would be a program which allows the city, in cooperation with FEMA, to assist willing property owners in the floodproofing, elevating, or purchase of flood prone structures.

2.1.5.4 Flooding Problem Identification

The limits of the 100-year floodplain were generated by delineating the predicted flood elevations on SWFWMD 1"=200' one foot contour aerial maps. Within the lower tidal portions of Stevenson Creek, the mapped floodplain limits are governed by FEMA's computed storm surge elevations, as they are higher than those predicted to occur from riverine (freshwater) flooding due to rainfall and runoff. The storm surge floodplain intersects with the riverine floodplain near the Palmetto Street crossing of Stevenson Creek.

The floodplain limits were digitized for incorporation into the GIS, as illustrated in [Figure 2.1-15](#) in the rear map pocket. The 500-year floodplain was mapped per FEMA requirements and is shown for informational purposes only. Although the hydrologic and hydraulic modeling necessarily included the entire watershed, including areas outside the corporate limits of the City of Clearwater, floodplain limits within the City of Dunedin were not mapped. Riverine flood profiles were plotted for the 10, 25, 50, 100, and 500-year design storm events for Stevenson Creek and Spring Branch, as shown on [Figures 2.1-16](#) through 2.1-24 at the end of this section.

Flood protection level of service deficiencies were identified in the watershed area within the corporate limits of the City of Clearwater. The street flooding level of service



***Stevenson Creek Watershed Management Plan
Final Report***

deficiencies for the basin are tabulated in Appendix D, Table D.1. Shaded cells indicate locations that currently do not meet the proposed FPLOS criteria. The locations of the street FPLOS deficiencies are shown graphically on [Figure 2.1-15](#).

In order to determine the number and location of structure FPLOS deficiencies, habitable structures within the limits of the 100-year floodplain were identified. A determination was then made as to which homes and businesses were likely to be susceptible to flooding for the 100-year event. This determination was based on the assumption that the floor elevations for slab-on-grade type structures are at least 6 inches above adjacent ground as shown on the SWFWMD aerials. Using this procedure, 470 structures were identified as potentially flood susceptible. In order to more accurately approximate the actual number of structure FPLOS deficiencies, surveyed finished floor information was compiled for the majority of these structures. Surveyed elevations for approximately 75 of the structures were obtained as part of the 1988 W.K. Daugherty study. An additional 272 structures were surveyed by Harry Marlow, Inc., as part of this study. The remaining 123 structure elevations were estimated from the SWFWMD topography and the surveyed elevations of nearby structures.

Of the 470 structures entered into the database, 263 structures were found to have finished floor elevations below the 100-year flood level. This is, by definition, a structure flooding level of service deficiency. As indicated on [Figure 2.1-15](#), the majority of these structures are located within the primary floodplains of the Stevenson Creek and Spring Branch main channels. However, many of the identified FPLOS deficiencies result from inadequate secondary drainage systems that feed into the main channels.

Table D.2 in Appendix D provides a complete listing of the structure flooding level of service evaluation for the Stevenson Creek Watershed. A summary of the identified structure FPLOS deficiencies in terms of both structures and total dwelling units is provided below as Table 2.1-8. Because many of the structures are multi-family



***Stevenson Creek Watershed Management Plan
Final Report***

buildings (duplexes, apartment buildings, etc), the number of flood-susceptible dwelling units is larger than the number of flood susceptible structures.

Table 2.1-8 Summary of Structure Flooding Level of Service Deficiencies

| Subwatershed | Identified 100-year Flood-Susceptible Structures | Identified 100-year Flood-Susceptible Dwelling Units |
|------------------------|---|---|
| Spring Branch | 32 | 32 |
| Lower Stevenson Creek | 32 | 32 |
| Middle Stevenson Creek | 49 | 105 |
| Upper Stevenson Creek | 85 | 85 |
| Hammond Branch | 6 | 6 |
| Lake Bellevue Branch | 14 | 23 |
| Jeffords Street Branch | 45 | 51 |
| Total | 263 | 334 |

Subwatershed 1: Spring Branch

The Spring Branch Subwatershed was found to contain 32 structure FPLOS deficiencies. The majority of these (27) are in the area of Byram Drive and Flora Drive between King’s Highway and Highland Avenue, and along Huntington Lane, east of King’s Highway. These FPLOS deficiencies are located in a depressional area bordering the historical Spring Branch channel. At Woodlawn Terrace, east of Douglass Avenue, an additional four structure FPLOS deficiencies were identified in an isolated depressional area drained by an inadequate secondary storm sewer system. These two areas were identified in the 1997 City of Clearwater Watershed Management Plan, through interviews with City staff in the Engineering Department, as “areas of concern for flooding”. Sunset Point Baptist Church was also identified as a level of service



Stevenson Creek Watershed Management Plan Final Report

deficiency. Four residential street FPLOS deficiencies and eight collector road FPLOS deficiencies were identified, including Douglass Avenue, King's Highway, Sunset Point Road (two locations) and Highland Avenue. Although not FPLOS deficiencies of the City of Clearwater, there are estimated to be 10-15 flood-susceptible homes along Betty Lane and Macomber Avenue, north of Sunset Point Road within unincorporated Pinellas County. The locations of the City of Clearwater FPLOS deficiencies are shown on [Figure 2.1-15](#).

Subwatershed 2: Lower Stevenson Creek

In the Lower Stevenson Creek Subwatershed, 32 structure FPLOS deficiencies were identified. The majority of these (27) are located along the main channel of Stevenson Creek between Douglass Avenue and Palmetto Street. These homes and businesses all have floor elevations below 9.5 feet NGVD, and are susceptible to flooding from both riverine flooding (rainfall and runoff) and storm (hurricane) surge. The 100-year storm surge elevation, as determined from the FEMA Flood Insurance Rate Maps, is elevation 11.0, NGVD. In addition to the structures susceptible to both flooding sources, there are several additional structures between Edgewater Drive and Palmetto Street which are susceptible to storm surge flooding only, which were not included. Other structure FPLOS deficiencies in Lower Stevenson Creek include two utility buildings adjacent to the Creek in the Clearwater Country Club. Also identified were two relatively isolated structure FPLOS deficiencies in the North Greenwood area and one near the intersection of Palmetto Street and King's Highway. The latter three FPLOS deficiencies are far removed from the creek, and are the result of inadequate secondary drainage systems. Residential street FPLOS deficiencies were identified at seven locations, and collector road FPLOS deficiencies were identified at six locations, including Douglass Avenue, Fairmont Avenue (two locations), Palmetto Street (two locations), and North Greenwood Avenue (refer to [Figure 2.1-15](#)).



Subwatershed 3: Middle Stevenson Creek

In terms of the concentration of flood-susceptible dwelling units, the most severe flooding problems in the watershed occur within the Middle Stevenson Creek subwatershed. Approximately 49 structures consisting of 105 ground-floor dwelling units along the banks of Middle Stevenson Creek were identified that are subject to inundation from the 100-year design flood. Many of the structures are multi-family buildings. All of the FPLOS deficiencies identified in this subwatershed are adjacent to the main channel of the Creek between Drew Street and Jeffords Street. The majority (60) of these structure FPLOS deficiencies occur in the area immediately to the west of Glen Oaks Golf Course. To provide an idea of the magnitude of the flood problem in this area, 24 dwelling units were also found to be vulnerable to the 25-year flood. In addition, three homes were found susceptible to the 10-year flood, including two homes in the 600 block of Betty Lane, which have been the subject of documented structure flooding. The most notable street FPLOS deficiency occurs at Cleveland Street, a hurricane evacuation route, at its crossing of Stevenson Creek. The predicted flood depths are more than two feet above the roadway for the 100-year flood. The roadway would also be impassable for a 25-year flood, and minor flooding is predicted for a 10-year flood. Residential street FPLOS deficiencies were identified at five locations, including Pierce Street, Franklin Street, Betty Lane (2 locations), and Mark Drive.

Although the construction of the Phase 1 and Phase 2 improvements in the 1990's significantly improved the conveyance capacity of Stevenson Creek from Drew Street to Court Street, floodplain enhancements within the Glen Oaks Golf Course were never constructed to the level originally envisioned in the 1990-1991 re-study of Stevenson Creek by CDM. In addition, the effectiveness of the constructed conveyance improvements has been greatly diminished due to a lack of adequate maintenance. Layers of sediment, and at times dense vegetation, have occupied portions of the improved channel. This problem was observed to be most severe between Drew Street and Cleveland Street.



*Stevenson Creek Watershed Management Plan
Final Report*

Subwatershed 4: Upper Stevenson Creek

Upper Stevenson Creek encompasses the portion of the Creek targeted for conveyance improvements in Phase 3 of the 1988 W.K. Daugherty study. This phase was never constructed, primarily due to environmental concerns over the proposed improvement method of hardlining (paving) the channel with concrete. In the current analysis, the Upper Stevenson Creek subwatershed was found to contain 85 structure FPLOS deficiencies. All of these lie within the floodplain of the main channel of Stevenson Creek, with the largest concentration of them occurring on both sides of the Creek between Jeffords Street and Lakeview Avenue, and along Hillcrest Avenue south of Lakeview Road (see Figure 2.1-25).



**Figure 2.1-25 Flooding on Hillcrest Avenue, South of Lakeview Road
Storm of July 15 , 2000**

However, the most severe and frequent flooding in the subwatershed occurs along Evergreen Avenue between Bellevue Boulevard and St. Thomas Drive, where seven

***Stevenson Creek Watershed Management Plan
Final Report***

homes were found susceptible to the 10-year flood. According to the City's complaint logs, at least two of these structures flooded during the recent storm of July 15, 2000. The flooding problem at this location is due to a 54" CMP culvert placed within the Stevenson Creek Channel that lacks the capacity to convey even the mean annual storm event. Residential street FPLOS deficiencies were identified at seven locations, and collector road FPLOS deficiencies were identified on Belleair Rd and Highlands Avenue.

Subwatershed 5: Hammond Branch

Hammond Branch was found to contain six structure FPLOS deficiencies, the fewest of all the subwatersheds. All of the FPLOS deficiencies are a result of inadequate secondary drainage systems. A single structure FPLOS deficiency on Hibiscus Street near King's Highway occurs when the storage capacity of the Hibiscus Pond is exceeded due to inflows from a 54" RCP culvert from the Highland Avenue drainage system. The existing outfall of Hibiscus Pond, consisting of a gunited 30" CMP, is not adequate to handle the inflows from the Highland's Avenue culvert. An unrelated problem occurs on Smallwood Circle (southeast of Highland and Palmetto), where two structure FPLOS deficiencies were identified. These homes were built in a depressional area surrounding a small city park, which floods frequently during moderate to heavy rains. The depression is drained by an undersized, failing 24" CMP culvert which runs under existing homes on Elmwood Street and Smallwood Circle. In addition, three FPLOS deficiencies were identified on Linwood Drive near Sharondale Drive, on the north side of the CSX railroad that runs parallel to Flagler Drive. This problem area is the result of floodwaters from the Flagler Drive ditch backing up through twin 48" RCP culverts under the CSX railroad. The 48" culverts were intended to convey runoff from the subbasin to the north into the Flagler ditch. During flood events, however, the culverts flow in the opposite direction, directing floodwaters from the south side of the railroad, across the flood susceptible properties bordering Linwood Drive. The problem is exacerbated by the fact that the floor elevations of the homes are only two to three feet above the invert of the Flagler Drive Ditch.



*Stevenson Creek Watershed Management Plan
Final Report*

Residential street FPLOS deficiencies were identified at twelve locations in the Hammond Branch Subwatershed. Collector road FPLOS deficiencies were identified at nine locations, including three locations on King's Highway, four locations on Highland Avenue, and two locations on Palmetto Street.

Subwatershed 6: Lake Bellevue Branch

Incrementally over past several decades, the Lake Bellevue Branch has been almost completely enclosed in storm sewer. Unfortunately, little of the storm piping was designed to adequately handle major a storm event. In the Lake Bellevue Branch Subwatershed, 14 structures consisting of 23 ground-floor dwelling units were found susceptible to inundation from the 100-year design flood. Of this total, five are businesses located on Missouri Avenue immediately south of Turner Street. Missouri Avenue itself constitutes an arterial road FPLOS deficiency at this location. This flooding problem is due to the fact that upstream of Missouri Avenue, the Lake Bellevue Branch flows into a 54" diameter culvert which lacks the capacity to convey the flow resulting from even a mean-annual storm event. Further upstream in the subwatershed, four structure FPLOS deficiencies occur at Pinellas Street, east of Greenwood Avenue, and one on Tuskawilla Street, west of Greenwood Avenue. These FPLOS deficiencies are also the result of undersized culverts placed within the historic channel of the Lake Bellevue Branch. Upstream of Lake Bellevue, four flood-susceptible structures containing a total of 13 dwelling units were identified on Wildwood Way, west of the CSX railroad. These structures were built in a low area southwest of the Lake. The drainage for this area is towards Lake Bellevue, but flows are restricted by undersized culverts beneath the CSX railroad tracks. In addition to the single arterial road FPLOS deficiency on Missouri Avenue, the Lake Bellevue Branch contains five collector road FPLOS deficiencies on Druid Road, South Greenwood Avenue (two locations), Lakeview Road, and Belleair Road, and six residential street FPLOS deficiencies.



Subwatershed 7: Jeffords Street Branch

Within the Jeffords Street Branch Subwatershed, 45 structures containing 51 dwelling units were found susceptible to the 100-year flood. The majority of these structures (35 of 45) are located within a contiguous floodplain area that encompasses the Jeffords Street ditch and the three interconnected lakes in the vicinity of Duncan Avenue and Jeffords Street. Historical 1926 aerial photography shows a wetland existed where these structures and lakes are today. It is likely that material dredged to form the three lakes was used as fill to form the building lots and roadways in the former wetland. However, the area is still extremely floodprone, as evidenced by the numerous documented complaints of flooding, and the mapped extent of the 100-year floodplain. The remaining structure FPLOS deficiencies (10 structures/16 dwelling units) were also constructed in a former wetland, in the area now bounded by Spencer Avenue, Turner Street, Duncan Avenue, and Druid Road. These structures flood on a very frequent basis, as seven are below the 10-year flood level and nine of the ten are below the 25-year flood level. According to the City's complaint logs, at least two of these structures flooded during the recent storm of July 15, 2000. Collector road FPLOS deficiencies were identified on Highland Avenue, Lake Avenue (two locations), and Cleveland Street at Duncan Avenue. In addition, seven residential street FPLOS deficiencies were identified, most of which lie within the large contiguous floodplain area that encompasses the Jeffords Street Ditch.

- [Figure 2.1-17 Stevenson Creek Flood Profile, Existing Conditions](#)
- [Figure 2.1-18 Stevenson Creek Flood Profile, Existing Conditions](#)
- [Figure 2.1-19 Stevenson Creek Flood Profile, Existing Conditions](#)
- [Figure 2.1-20 Stevenson Creek Flood Profile, Existing Conditions](#)
- [Figure 2.1-21 Stevenson Creek Flood Profile, Existing Conditions](#)
- [Figure 2.1-22 Stevenson Creek Flood Profile, Existing Conditions](#)
- [Figure 2.1-23 Spring Branch Flood Profile, Existing Conditions](#)



*Stevenson Creek Watershed Management Plan
Final Report*

- [Figure 2.1-24 Spring Branch Flood Profile, Existing Conditions](#)



2.2 NATURAL RESOURCES ASSESSMENT AND PROBLEM IDENTIFICATION

2.2.1 Introduction

In order to prepare the Watershed Management Plan for the Stevenson Creek Watershed, the entire watershed was investigated for undeveloped land, wetlands, natural areas, and potential restoration or preservation areas. The boundaries of the natural areas were identified and mapped on aerial photography (scale: 1" = 200'). These areas were characterized using the Florida Land Use Cover and Forms Classification System (FLUCCS) (FDOT, 1985).

The Stevenson Creek Watershed is a highly urbanized, densely populated area with little to offer in the way of natural systems. With one exception, the only undeveloped areas are golf courses and city parks. Wetlands are predominantly small isolated stormwater retention ponds or natural lakes that have been altered to such a degree that their origin can only be determined from historic aerial photography. The waterways are predominantly channelized with little riparian habitat. The intense development has also altered the estuarine system so that little habitat is provided at the mouth of Stevenson Creek.

Despite the intense urbanization of the watershed, improvements that do not require large expanses of open land and large expenditures of public funds can be made to increase the wildlife habitat and improve water quality. Studies have shown that golf courses can be managed to improve the water quality and wildlife habitat provided by the expanses of open space without negatively impacting the recreational function. For the purposes of this watershed management plan, a discussion of the existing natural conditions is provided in this section, while improvements that can be accomplished by public entities, private non-profit organizations, and by concerned private citizens are discussed in Section 3.



2.2.2 Existing Conditions

As can be seen in the land use map (Figure 2.1-2) and Table 2.2-1, the predominant land use within the watershed is residential, comprising approximately 70% of the total land area. Other developed areas such as commercial, industrial, institutional, open land, and transportation/utility land uses combined make up another 19% of the watershed. This leaves only 11% of the watershed in potential natural resource land uses, which includes undeveloped upland areas, recreational areas, open water bodies, or wetlands.

Most of the individual subwatersheds are similar in distribution of land uses. The Upper Spring Subwatershed has more wetlands than any other subwatershed, with 40 acres compared to less than 7 acres for each of the other subwatersheds. This is due to two large forested wetland areas near the intersection of Keene Road and Virginia Street. A 36-acre upland forested area in the Lower Spring Branch Subwatershed is by far the largest available habitat area in the watershed. The other subwatersheds have 0 to 7 acres of undeveloped uplands that may provide habitat. The open water bodies land use, which includes ponds, lakes, and other open water areas, is divided among three subwatersheds that have only 7 acres and four subwatersheds that have between 22 and 56 acres. The following paragraphs provide a subwatershed-by-subwatershed description of the land uses and available habitat.

Upper Spring Branch Subwatershed

The Upper Spring Subwatershed is located in the northernmost portion of the watershed and is the largest in total land area. There are several forested wetland areas within the watershed, as well as a freshwater marsh.

The freshwater marsh (approximately 4 acres) is located west of the forested wetland areas near the intersection of Virginia and Keene. The marsh is highly disturbed and dominated by nuisance vegetation such as primrose willow, cattail, and others. Some open water is present in the center of the marsh, indicating a depth that may be associated

Table 2.2-1

| LAND USE TYPES PER BASIN IN THE STEVENSON CREEK WATERSHED (Approximate acreages) | | | | | | | | | |
|---|---------------------------|----------------------------|--------------------------|-------------------------|----------------------------|-----------------------------|-------------------------|----------------------------|--------------|
| Land Use | Hammond Branch | Jeffords Street | Lake Bellevue | Lower Spring | Lower Stevenson | Middle Stevenson | Upper Spring | Upper Stevenson | TOTAL |
| Residential (1000- 1300) | 649 | 529 | 340 | 338 | 516 | 287 | 1226 | 491 | 4376 |
| Commercial (1400) | 34 | 31 | 178 | 11 | 56 | 145 | 115 | 41 | 610 |
| Industrial (1500) | 5 | 4 | 13 | 0 | 20 | 00 | 0 | 0 | 42 |
| Institutional (1700) | 21 | 14 | 16 | 23 | 31 | 11 | 53 | 15 | 182 |
| Recreational (1800) | 96 | 40 | 24 | 0 | 116 | 45 | 18 | 0 | 339 |
| Open Land (1900) | 41 | 2 | 13 | 37 | 11 | 11 | 105 | 14 | 234 |
| Agriculture (2000) | 10 | 0 | 0 | 0 | 0 | 0 | 5. | 0 | 15 |
| Upland Forests (4000) | 2 | 0 | 5 | 36 | 0 | 0 | 7 | 0 | 50 |
| Water Bodies (5000) | 27 | 22 | 37 | 8 | 40 | 7 | 56 | 7 | 205 |
| Wetlands (6000) | 1 | 1 | 7 | 7 | 5 | 2 | 40 | 0 | 63 |
| Trans./Utilities Communication (8000) | 27 | 8 | 22 | 5 | 27 | 27 | 47 | 7 | 170 |
| Total per Basin | 914 | 651 | 655 | 465 | 821 | 535 | 1673 | 575 | 6286 |



Stevenson Creek Watershed Management Plan Final Report

with historic activities such as peat mining or excavation to increase retention and/or to reduce the ground water levels in adjacent properties. Development is encroaching upon the marsh, with new housing constructed on the east side. In its current state, this marsh still can provide wildlife habitat, although the isolated, fragmented condition of the marsh has greatly reduced the potential.

The 30 acres of forested wetlands appear to be the former headwaters of Spring Branch, which flows from this area south and west to the confluence with Stevenson Creek. These forested wetlands have been substantially altered with dredging, draining, filling, and channelizing. The canopy consists of a mixture of hardwoods and cypress, with slash pine in the drier transitional areas. The vegetation in these wetlands has been impacted by the hydrologic alterations, and nuisance species are now dominant in some areas.

Lower Spring Branch Subwatershed

The Lower Spring Branch Subwatershed is located north and east of the confluence of Stevenson Creek and Clearwater Harbor. This is the smallest of the subwatersheds, at only 465 acres. Although this subwatershed is 80% developed, there are two areas within this subwatershed that offer habitat to wildlife. In addition, portions of the Spring Branch channel still maintain a remnant of riparian habitat in the form of trees and a somewhat natural streambed.

The forested upland area within this watershed is located near the intersection of Sunset Point Road and Betty Lane. This approximately 25-acre parcel has been impacted in the past with clear-cutting and grading. Historic aerial photography (1926) shows that this parcel was cleared and a pond was excavated on the west side, potentially in preparation for development. The southern portion of the parcel supports a stand of second-growth oak and pine with an open understory. Spring Branch borders the east side of this portion of the parcel. The northern, more mesic portion of the parcel supports more nuisance vegetation, especially around the pond and the outer edges of the site. However, there are mature trees in the canopy and native species in the understory and



*Stevenson Creek Watershed Management Plan
Final Report*

shrub layer. The vegetation in the pond is dominated by Carolina willow, and appears to be intermittently inundated.



This photo was taken facing north from the ditch that drains the small excavated pond within the forested area at Betty Lane and Sunset Point Drive.



This photo was taken in the mesic forested area, in the southern part near State Street. The vegetation in this area includes slash pine, laurel oak, saw palmetto, and cabbage palm.

Despite the impacted condition of the parcel, it currently provides the only wildlife habitat of any substantial size within the watershed. Recent survey lines cut through the parcel indicate that it may be too late to preserve it, but it has the potential to become locally significant wildlife habitat, as well as a neighborhood recreational area.

Stevenson Creek Watershed Management Plan Final Report

Lower Stevenson Creek Subwatershed

This subwatershed is 80% developed in residential, industrial, commercial, and utility/transportation land uses. Fourteen percent of the watershed is identified as recreational, but this includes a ballpark and the Clearwater Country Club. There are no large tracts of undeveloped upland areas that may provide habitat for wildlife, and few areas that would provide wetland habitat. There is a small (approximately 9-acre) parcel of land east of the Douglas Avenue Bridge on the north side of Stevenson Creek that provides the best potential habitat in the subwatershed. The parcel appears to have been a dumping ground for construction material, fill, household waste, and landscape trimmings. The majority of the site is vegetated with nuisance exotic species such as ear tree (*Enterolobium contortisiliquum*), lead tree (*Leucaena leucocephala*), Caesar weed (*Urena lobata*), castor bean (*Ricinus communis*), beggar's tick (*Bidens pilosa*), Australian pine (*Casuarina equisetifolia*), Brazilian pepper (*Schinus terebinthifolius*), and other noxious weeds. Some remnants of native upland vegetation are present on the eastern boundary, adjacent to the auto-salvage yard along the eastern boundary of the undeveloped parcel. Species present in this area include laurel oak (*Quercus laurifolia*), saw palmetto (*Serenoa repens*), cat briar (*Smilax bona-nox*), and wild grape (*Vitis* sp.).

The shoreline of the parcel along Stevenson Creek is vegetated in mangroves, including black (*Avicennia germinans*) and red (*Laguncularia racemosa*). A small mangrove swamp is located on the western side of the property. This swamp is predominantly black mangrove with an open water area in the center. The City is currently in negotiations with the owner to purchase the property containing this parcel.



*Stevenson Creek Watershed Management Plan
Final Report*



The photo to the left was taken on the north bank of Stevenson Creek west of the Douglas Avenue Bridge. The view is to the southeast

Stevenson Creek meanders through the Clearwater Country Club golf course on a semi-natural streambed. There have been previous attempts to create marsh habitat on-line with the creek that have been somewhat successful. On-line wetlands are always difficult to create because of the need to accommodate the occasional heavy volumes of water flowing through the stream and the potential for erosion. In addition, maintenance is difficult due to the nuisance exotic vegetation that can be washed in from problem areas upstream. In spite of the drawbacks, the golf course provides one of the best potential areas for habitat improvement, depending upon the available area.



This photo shows the mitigation area within the golf course. The low gabion wall was installed to protect the mitigation area from erosion and the influx of exotic vegetation.

***Stevenson Creek Watershed Management Plan
Final Report***

Middle Stevenson Creek Subwatershed

The Middle Stevenson Creek Subwatershed is 90% developed, with golf courses and a few stormwater ponds comprising the remaining ten percent. This subwatershed has the second highest area devoted to commercial enterprises, but no industrial land uses. There are no potential habitat areas with the exception of the golf courses, which provide marginal habitat at best. The creek is armored and channelized through this portion of the watershed, and although these types of improvements may be essential for flood abatement, they do little to enhance water quality and wildlife habitat.



The photo to the left shows a typical section of the creek (Lynn Lake) through the Middle Stevenson Creek Subwatershed. The algal mats on the water surface usually indicate poor water quality.

Hammond Branch Subwatershed

This second largest subwatershed is located on the east side of the watershed, with the majority of the subwatershed lying north of Drew Street. This subwatershed is 87% developed, with a golf course and ball fields again comprising the majority of the undeveloped land. There are three fairly large water bodies in the subwatershed totaling 27 acres. These managed water bodies and two very small freshwater marshes provide the best habitat options in the subwatershed.

*Stevenson Creek Watershed Management Plan
Final Report*



The photo to the left shows a view of Lake Hobart facing south. This lake is one of the larger water bodies.

Jeffords Street Subwatershed

The Jeffords Street Subwatershed is located in the eastern portion of the watershed, south of the Hammond Branch Subwatershed. This watershed is 91% developed with several water bodies and a golf course making up the remaining land uses. Crest Lake, the 20+-acre lake in the northern portion of the subwatershed, is located within a city park. This lake and the surrounding shoreline could potentially be enhanced to increase the habitat potential without impacting the park significantly. A discussion of these improvements and Best Management Practices for golf courses is provided in Section 3.

There are several small water bodies in the subwatershed ranging in size from 0.5 to 4.0 acres. These ponds are located within dense residential neighborhoods and likely do not provide more than the most minimal habitat for wildlife. Even small ponds can be improved to enhance the wildlife habitat availability by planting the shoreline with native species and improving water quality by reducing the pollutants in stormwater runoff.

*Stevenson Creek Watershed Management Plan
Final Report*



This photograph is a view of Crest Lake from the northeastern corner. The sparseness of the understory vegetation can contribute to erosion and sedimentation in the lake due to stormwater runoff.

Lake Bellevue Branch Subwatershed

The Lake Bellevue Subwatershed is located in the southwestern portion of the Stevenson Creek Watershed, with Missouri Road roughly forming the eastern boundary. The subwatershed is 89% developed, with the 33-acre Lake Bellevue comprising another 5% and the adjacent park and playgrounds adding another 5%.

This recreational area (Ed Wright Park) is the only potential wildlife habitat in the Subwatershed, but the habitat is marginal at best. The lake is maintained to keep aquatic weeds from overtaking, however on the west side of the lake, the banks are covered with Brazilian pepper and other noxious invasive plants. These weeds do provide some function acting as a buffer from the heavy traffic on Myrtle Avenue. The northeast corner of the park supports a heavy canopy of mature oaks, but the understory is predominantly a parking area.

There are six small water bodies in the subwatershed, excluding Lake Bellevue. As with the majority of the other small water bodies in the watershed, these are highly maintained, isolated, and located within dense residential neighborhoods. These areas provide marginal habitat at best.



*Stevenson Creek Watershed Management Plan
Final Report*



This photograph of Lake Bellview shows the bare shorelines and lack of significant littoral vegetation. The littoral vegetation would provide habitat and water quality benefits.



This photograph was taken on the southwestern corner of the lake and shows the nuisance vegetation infestation. Cleaning up this area would enhance the wildlife habitat provided by this area.

Upper Stevenson Creek Subwatershed

The Upper Stevenson Creek Subwatershed is located in the southeastern portion of the watershed with Missouri Avenue forming the western boundary. This subwatershed is completely built out, with the exception of four small water bodies totaling 7 acres. The creek is completely lined with houses, leaving no options for habitat improvements without purchasing expensive residential property.





This is an example of one of the culverts within the Upper Stevenson Creek Subwatershed. This culvert is near the intersection of Hillcrest and Browning.

2.2.3 Wildlife

This highly urbanized area does not provide much habitat for wildlife, other than for generalist species that have adapted to urban environments. Table 2.2-2 provides a list of common faunal species that were observed or are expected to occur in the watershed.

The Backyard Habitat program promoted by the National Wildlife Federation educates citizens on building habitat within their own backyards, which increases the available habitat in urban environments. Details on this program are available on the National Wildlife Federation website.

2.2.4 Endangered and Threatened Species

Endangered and threatened species are those that have been categorized in some way by the respective jurisdictional agencies as meriting special protection or consideration. The state lists of animals are maintained by the Florida Fish and Wildlife Conservation Commission and categorized as endangered, threatened or of special concern. The lists constitute Rules 39-27.003, 39-27.004, and 39-27.005, respectively, Florida Administrative Code.

**Stevenson Creek Watershed Management Plan
Final Report**

Table 2.2-2

| Wildlife Observed (*) or Expected Within the Stevenson Creek Watershed | |
|---|-----------------------|
| Scientific Name | Common Name |
| <u>Birds</u> | |
| <i>Accipiter cooperii</i> | Cooper's hawk |
| <i>Agelaius phoeniceus</i> * | Red-winged blackbird |
| <i>Ajaia ajaja</i> * | Roseate spoonbill. |
| <i>Anas fulvigula</i> * | Mottled duck |
| <i>Anhinga anhinga</i> * | Anhinga |
| <i>Ardea herodias</i> * | Great blue heron |
| <i>Aramus guarana</i> | Limpkin |
| <i>Bombycilla cedrorum</i> * | Cedar waxwing |
| <i>Botaurus lentiginosus</i> | American bittern |
| <i>Bubulcus ibis</i> * | Cattle egret |
| <i>Buteo lineatus</i> * | Red-shouldered hawk |
| <i>Butorides virescens</i> * | Green heron |
| <i>Cardinalis cardinalis</i> * | Cardinal |
| <i>Casmerodius albus</i> * | Great egret |
| <i>Cathartes aura</i> * | Turkey vulture |
| <i>Ceryle alcyon</i> * | Belted kingfisher |
| <i>Chadradrius vociferous</i> * | Killdeer |
| <i>Colaptes auratus</i> * | Northern flicker |
| <i>Columba livia</i> * | Rock dove |
| <i>Coragyps atratus</i> * | Black vulture |
| <i>Corvus brachyrhynchos</i> * | American crow |
| <i>Corvus ossifragus</i> * | Fish crow |
| <i>Cyanocitta cristata</i> * | Blue jay |
| <i>Dendroica coronata</i> * | Yellow-rumped warbler |
| <i>Dendroica palmarum</i> | Palm warbler |
| <i>Dryocopus pileatus</i> * | Pileated woodpecker |
| <i>Dumetella carolinensis</i> * | Catbird |
| <i>Egretta caerulea</i> * | Little blue heron |
| <i>Egretta thula</i> * | Snowy egret |
| <i>Egretta tri-color</i> * | Tricolor heron |
| <i>Elanoides forficatus</i> * | Swallow-tailed kite |
| <i>Eudocimus albus</i> * | White ibis |
| <i>Falco sparverius</i> * | American kestrel |
| <i>Falco peregrinus</i> | Peregrine falcon |



*Stevenson Creek Watershed Management Plan
Final Report*

| | |
|--------------------------|---------------|
| <i>Fulica americana*</i> | American coot |
|--------------------------|---------------|



**Stevenson Creek Watershed Management Plan
Final Report**

Table 2.2-2 (cont.)

| Wildlife Observed (*) or Expected Within the Stevenson Creek Watershed | |
|---|----------------------------|
| Scientific Name | Common Name |
| <u>Birds (cont.)</u> | |
| <i>Gallinula chloropus</i> * | Common moorhen |
| <i>Geothlypis trichas</i> * | Common yellowthroat |
| <i>Ixobrychus exilis</i> * | Least bittern |
| <i>Lanius ludovicianus</i> * | Loggerhead shrike |
| <i>Larus argentatus</i> * | Herring gull |
| <i>Larus atricilla</i> * | Laughing gull |
| <i>Larus delawarensis</i> * | Ring-billed gull |
| <i>Larus philadelphia</i> | Bonapart's gull |
| <i>Melanerpes carolinus</i> * | Red-bellied woodpecker |
| <i>Mimus polyglottus</i> * | Mocking bird |
| <i>Mycteria Americana</i> * | Wood stork |
| <i>Nycticorax nycticorax</i> * | Black-crowned night heron |
| <i>Nyctanassa violacea</i> * | Yellow-crowned night heron |
| <i>Otus asio</i> * | Belted kingfisher |
| <i>Pandion haliaetus</i> * | Osprey |
| <i>Passer domesticus</i> * | House sparrow |
| <i>Parus bicolor</i> * | Tufted titmouse |
| <i>Pelecanus occidentalis</i> * | Brown pelican |
| <i>Phalacrocorax auritus</i>* | Double-crested cormorant |
| <i>Picoides pubescens</i>* | Downy woodpecker |
| <i>Plegadis falcinellus</i> | Glossy ibis |
| <i>Podilymbus podiceps</i> * | Pied-billed grebe |
| <i>Quiscalus major</i> * | Boat-tailed grackle |
| <i>Quiscalus quiscula</i> * | Common grackle |
| <i>Rallus elegans</i> | King rail |
| <i>Rallus limicola</i> | Virginia rail |
| <i>Sterna forsteri</i> * | Forster's tern |
| <i>Streptopelia decaocto</i> * | Eastern screech owl |
| <i>Strix varia</i> | Barred owl |
| <i>Sturnus vulgarus</i> * | European starling |
| <i>Tachycineta bicolor</i> * | Tree swallow |
| <i>Toxostoma rufum</i> * | Brown thrasher |
| <i>Turdus migratorius</i> * | American robin |
| <i>Thryothorus ludovicianus</i> | Carolina wren |



*Stevenson Creek Watershed Management Plan
Final Report*

| | |
|---------------------------|---------------|
| <i>Zenaida macroura</i> * | Mourning dove |
|---------------------------|---------------|



**Stevenson Creek Watershed Management Plan
Final Report**

Table 2.2-2 (cont.)

| Wildlife Observed (*) or Expected Within the Stevenson Creek Watershed | |
|---|-------------------------|
| Scientific Name | Common Name |
| <u>Mammals</u> | |
| <i>Dasyopus novemcinctus*</i> | Armadillo |
| <i>Didelphis virginiana*</i> | Opossum |
| <i>Lasiurus intermedius</i> | Northern yellow bat |
| <i>Lontra canadensis</i> | River otter |
| <i>Peromyscus gossypinus</i> | Cotton mouse |
| <i>Peromyscus polionotus</i> | Oldfield mouse |
| <i>Procyon lotor*</i> | Raccoon |
| <i>Nycticeius humeralis</i> | Evening bat |
| <i>Sciurus carolinensis*</i> | Eastern gray squirrel |
| <i>Sciurus niger shermanii</i> | Sherman's fox squirrel |
| <i>Sigmodon hispidus</i> | Hispid cotton rat |
| <i>Sylvilagus floridanus</i> | Eastern cottontail |
| <i>Sylvilagus palustris</i> | Marsh rabbit |
| <i>Tadarida brasiliensis</i> | Brazilian free-tail bat |
| <u>Reptiles And Amphibians</u> | |
| <i>Anolis carolinensis</i> | Green anole |
| <i>Anolis sagrei sagrei</i> | Brown anole |
| <i>Acris gryllus</i> | Southern cricket frog |
| <i>Rana sphenoccephala</i> | Southern leopard frog |
| <i>Bufo terrestris</i> | Southern toad |
| <i>Coluber constrictor</i> | Black racer |
| <i>Diadophis punctatus</i> | Ring necked snake |
| <i>Hyla cinerea</i> | Green tree frog |
| <i>Hyla gratiosa</i> | Barking tree frog |
| <i>Hyla squirella</i> | Squirrel tree frog |
| <i>Osteopilus septentrionalis</i> | Cuban tree frog |
| <i>Pseudemys floridana floridana</i> | Florida cooter |
| <i>Rana sphenoccephala</i> | Southern leopard frog |
| <i>Sternotherus sp.</i> | Common musk turtle |
| <i>Thamnophis sirtalis</i> | Common garter snake |
| <i>Trachemys scripta elegans</i> | Red-eared turtle |
| <i>Trachemys scripta scripta</i> | Yellow bellied turtle |



*Stevenson Creek Watershed Management Plan
Final Report*

Table 2.2-2 (cont.)

| Wildlife Observed (*) or Expected Within the Stevenson Creek Watershed | |
|---|--------------------------|
| Common Name | Common Name |
| <u>Fish and Shellfish</u> | |
| Lane Snapper | Spotted Sea trout |
| Mojarra | Silver Sea trout |
| Grunt | Red Snapper |
| Weakfish | Yellowtail Snapper |
| Gray Snapper | Scad |
| Atlantic Bumper | Silver Perch |
| Mutton Snapper | Spot |
| Lookdown | Atlantic Croaker |
| Leatherjack | Silver Porgy |
| Mahogany Snapper | Sand Perch |
| Permit | Gag Grouper |
| Black Drum | Stone Crab |
| Red Drum | Tunicate |
| Sheepshead | Burrfish |
| Pinfish | Puffer |
| Blue Crab | Flounder |
| Toadfish | Hogfish |
| Cowfish | Wrasse |
| Filefish | Spadefish |
| Sole | Black Seabass |
| Mullet | Glass Slipper |
| Parrotfish | Squid Egg Mass |
| Sergeant Major | Comb Jelly |
| Snook | Sea Urchin |
| Gulf Shrimp | Bivalve (U.N.I.D) |
| Grass Shrimp | Sea Snail (Banded Tulip) |
| Ghost Shrimp | Sea Hare |
| Mud Crab | Sea Pork |
| Hermit Crab | Trunkfish |
| Arrow Crab | Sea Horse |
| Pipefish | Spade Crab |
| Sand Dollar | Feather Bleeny |
| Lizardfish | Scallop |
| Spider Crab | Sponge |



Table 2.2-2 (cont.)

| Wildlife Observed (*) or Expected Within the Stevenson Creek Watershed | |
|---|--------------------------|
| Common Name | Common Name |
| Seabream | Octopus |
| Shade Crab | Polychete Worms |
| Scaled Sardine | Sea Snail (Moon Snail) |
| Wort Jelly | Juv. Flying Gunnard |
| Horshoe Crab | Squid |
| Lentil Spider | Calico Crab |
| Sea Cucumber | Mangrove Snapper |
| Silverside | Whelk Egg |
| Brittle Star | Sea Snail (Banded Tulip) |

Source: Clearwater Audubon Society (Ms. Jane Williams), and Clearwater Marine Aquarium (Mr. Geoff Lane), field observations (Parsons ES, May 2000), and Florida Natural Areas Inventory, 1996

The state lists of plants are categorized into endangered and threatened and commercially exploited and are administered and maintained by the Florida Department of Agriculture and Consumer Services via Chapter 5B-40, F.A.C. The federal list of animals and plants is administered by the U.S. Fish and Wildlife Service and are published in 50 CFR 17 (animals) and 50 CFR 23 (plants).

Even the most urban environments can support some endangered species. For instance, during the field reviews for this project, white ibis and little blue heron were observed on one of the golf courses within the watershed. Bald eagles have nested in other watersheds within the City of Clearwater, and could nest in the Stevenson Creek watershed if the appropriate habitat were available. Table 2.2-3 lists the endangered, threatened, or species of special concern that occur or potentially occur in the watershed.

**Table 2.2-3
Endangered, Threatened, or Special Concern Species Observed (*)
or Potentially Present in the
Stevenson Creek Watershed**

| | | |
|----------------------|-------------------------|------------------------|
| Gopher Tortoise | Sherman’s fox squirrel* | Florida sandhill crane |
| Gopher frog | Little blue heron* | Peregrine falcon* |
| American alligator* | Wood stork* | SE American kestrel |
| Florida mouse | Tri-colored heron* | Bald eagle* |
| Eastern indigo snake | Snowy egret* | Burrowing owl |
| Limpkin* | Roseate spoonbill* | White ibis* |

The species identified with an asterisk (*) in the table above have been observed in the watershed by members of the Clearwater Audubon Society. It is highly unlikely that any of these species are successfully breeding in or if viable populations of these species exist within the Stevenson Creek Watershed due to the lack of suitable habitat.

2.3 WATER QUALITY ASSESSMENT

The Stevenson Creek Watershed is the largest watershed in the City of Clearwater. Residential land uses are dominant in this urban watershed, which provides drainage for the western portion of Clearwater as well as portions of Dunedin and unincorporated Pinellas County. The main stem of the creek originates near Belleair Road and flows northward to Clearwater Harbor.

The largest tributary is Spring Branch which flows from Dunedin and southward entering Stevenson Creek just upstream of Clearwater Harbor. Other major tributaries include two highly altered streams draining the eastern portion of the watershed. One of these streams drains into Stevenson Creek near Palmetto Street and the other empties into the creek near Jeffords Street. Another major tributary is a remnant stream that drains Lake Bellevue and enters the main channel near Glenn Oaks Golf Course.

Numerous small, natural water storage areas are located throughout the basin as well as several lakes. Most notable in size is Lake Bellevue which is around 25 acres. The two other largest lakes in the basin are Crest Lake and Lake Hobart which are about half the size of Lake Bellevue.

These storage areas and lakes provide stormwater runoff treatment. Best management practices (BMPs) for new (post-1982) development are also present; however, stormwater runoff treatment is lacking in many areas. New BMPs can help to improve water quality in the watershed; however, anthropogenic sources other than stormwater runoff appear to influence water quality in the Stevenson Creek Watershed to a significant degree.

Low dissolved oxygen levels, fecal contamination, and excessive nutrient concentrations are the primary water quality issues that have been identified in the watershed, and as such, water quality in Stevenson Creek is rated as “poor” by the state. The state’s rating is based on sampling conducted by the Pinellas County Department of

Stevenson Creek Watershed Management Plan Final Report

Environmental Management (PDEM). The city's ambient monitoring program as well as monitoring conducted for this study affirms these water quality issues.

Stevenson Creek is included on Florida's impaired waters list {303(d) List} due to concerns over dissolved oxygen, coliforms, and nutrients. The FDEP has given Stevenson Creek a priority rating of "High". Stevenson Creek is located in the "Crystal River to St. Petersburg Beach Basin" which is in Group 5 of the basin rotation cycle. TMDL development activity is expected to begin in 2004.

Water quality assessments conducted for this study included a

- Review of Existing Data (Section 2.3.1, *Existing Data*),
- Base flow and storm event monitoring program (Section 2.3.2, *Monitoring Program*),
- Water quality data interpretation (Section 2.3.3, *Water Quality Characteristics*), and
- Nonpoint source loading assessment (Section 2.3.4, *Nonpoint Source Loads*).

Each of these four elements is described separately in the following subsections.

2.3.1 Existing Data

During the last decade, Pinellas County and the city have conducted and documented water quality monitoring programs within the Stevenson Creek Watershed ([Figure 2.3-1](#)); likewise, the Marshall Street Wastewater Treatment plant (MWWTP) maintains operating records, and the Pinellas County Health Department maintains records concerning individual septic tanks. These monitoring programs and records were reviewed and are more specifically described as follows:

- **Pinellas County ambient surface water monitoring program**-- active Pinellas County monitoring program containing two stations within the Stevenson Creek Watershed (Refer to *Existing Water Quality Monitoring Programs*, Section 2.3.1.1)



Figure 2.3-1
Water Quality Monitoring Stations



- **City of Clearwater ambient surface water monitoring program** -- ambient surface water quality monitoring program from 1992 through 1995 containing ten stations within the Stevenson Creek Watershed (Refer to *Existing Water Quality Monitoring Programs*, Section 2.3.1.1)
- **Southwest Florida Water Management District, Lake Bellevue monitoring program**-- short-term program from 1996-1997 (Refer to *Existing Water Quality Monitoring Programs*, Section 2.3.1.1)
- **Marshall Street Wastewater Treatment Plant operating reports** -- ten-year record (Refer to *Other Existing Data*, Section 2.3.1.2)
- **Pinellas County Health Department septic tank records**-
- Recent septic tank construction and repair applications (Refer to *Other Existing Data*, Section 2.3.1.2)

2.3.1.1 Existing Monitoring Programs

Pinellas County, the Southwest Florida Water Management District (SWFWMD), and the City of Clearwater have conducted monitoring programs within the Stevenson Creek Watershed. Summary results from each of these monitoring programs are provided in Appendix I.

Pinellas County Department of Environmental Management (PDEM) maintains two stations in Stevenson Creek as part of its countywide ambient water quality monitoring program. The data from these two stations is the basis for the state's inclusion of Stevenson Creek on the impaired waters list, and the county has used these data to implicate Stevenson Creek as having some of the poorest water quality in the county (Myers et al. 2000).

PDEM provided the following description of these two stations to EPA's STORET database:

- "Stevenson's Creek off the southeast side of the Douglass Ave bridge just north of the Clearwater WWTP from mid span sampled monthly"



Stevenson Creek Watershed Management Plan Final Report

- “collected from Spring Branch of Stevenson’s Creek off the west side of the Overbrook bridge just west of Douglass Ave at mid span sampled monthly”

Most prominent in each of these data sets are average fecal coliforms counts and ammonia nitrogen levels, which often exceed state standards. Phosphorous is high at the Spring Branch station, and nitrate + nitrite is high at both stations, particularly at the Stevenson Creek Station. The state reports a trophic state index of 65 for the Stevenson Creek estuary indicating that water quality is poor. A review of the nitrogen/phosphorus ratios shows that the estuary is nitrogen-limited.

A short-term monitoring program was conducted by SWFWMD on Lake Belleview (1996-1997). This program consisted of two sampling events- one in each year. The results showed low phosphorous levels for both measurements and high nitrogen levels for the 1996-measurement followed by low nitrogen levels during the 1997-measurement. Accordingly, a sharp drop in lake productivity was observed during the second year. Nitrogen forms were almost entirely organic.

The city conducted an ambient surface water quality monitoring program from years 1992 through 1995. The program included 10 stations in the Stevenson Creek Watershed. The monitoring program included grab samples analyzed for nutrients, oil and grease, suspended solids, coliforms and fecal streptococcus, biochemical oxygen demand (BOD₅), chlorides, and field parameters (dissolved oxygen, pH, etc.). Dissolved oxygen and fecal contamination were the most significant concerns identified for the Stevenson Creek Watershed during the city’s monitoring program. Nutrient levels were also often elevated during the monitoring period.

2.3.1.2 Other Existing Data

Operating reports for Marshall Street Wastewater Treatment plant (MWWTP) were reviewed along with limited septic tank information made available by the Pinellas County Health Department. These records show that MWWTP (Figure 2.3-2) contributes significant quantities of nutrients, solids, and oxygen-demanding substances to the Stevenson Creek estuary, and, the septic tank information, considered in



**Stevenson Creek Watershed Management Plan
Final Report**

conjunction with coliforms sampling results, provides information concerning potential sources of fecal contamination in the basin.

The MWWTP discharges nutrients, solids, and oxygen-demanding substances to Stevenson Creek. While concentrations for these constituents in the plant effluents are within appropriate standards,

the average 5.55 MGD-flow (6.8 MGD average daily flow minus 1.25 MGD flow to the reclaimed water system) results in masses that make up a significant percentage of total loads to the estuary originating from the Stevenson Creek Watershed. Information from the monthly operating reports for the year 1999 were averaged to produce the table below which compares loads from the treatment plant with loads measured during the 186-day monitoring period, of this study, at the two monitoring stations (Drew Street and Kings Highway). Stevenson Creek at the location of the MWWTP discharge has a much higher

Figure 2.3-2

Marshall Street Wastewater Treatment Plant



**Table 2.3-1
Loads During Monitoring Period**

| Input Source | Volume Discharged (ac-ft) | BOD₅ (Pounds) | TSS (Pounds) | TN (Pounds) | TP (Pounds) |
|-------------------------|----------------------------------|---------------------------------|---------------------|--------------------|--------------------|
| Base and Storm Flow (1) | 3,170 | 101,199 | 157,406 | 11,542 | 3,084 |
| MWWTP | 2,587 | 82,596 | 128,471 | 9,420 | 2,517 |

Note: Loads measured (based on mean concentration of all samples, this study, and the overall flow) at the Spring Branch (King's Highway) and Stevenson Creek (Drew Street) Station, May 2000 – November 2000

capacity to assimilate pollution than do the upper, freshwater reaches of the creek, and



***Stevenson Creek Watershed Management Plan
Final Report***

these mass loading calculations are provided only to add perspective to overall watershed load estimates presented elsewhere in this report.

Indirect evidence suggests that both the sanitary sewer system (i.e., cross-connections or inflow) and septic tanks may contribute to bacteria and nutrient levels in the Stevenson Creek Watershed. The MWWTP appears to receive a moderate increase in flow during the wet season. In addition, the locations and density of septic tank repair permits seem to coincide with the highest percent of human isolates found in the results of the fecal coliform sampling.

A fourteen-year flow record (January 1985- January 2000) was reviewed for the MWWTP. During this time period the average daily flow during the wet season (June-September) was 7.06 MGD as compared to 6.65 MGD during the remaining eight months of the year. If this variation is due to increased rainfall during the wet season, then possible explanations for the increase are infiltration, inflow, or cross connections between the sanitary and storm systems. Anecdotal evidence of one possible infiltration or cross connection problem is provided by a resident who reported that a lift station on Sunset Point Road (just west of Stevenson Avenue) overflows during heavy rains “causing the creek to stink like sewage”.

Pinellas County recently began keeping records of applications for septic tanks repairs. The locations of the septic tanks contained in this database were plotted ([Figure 2.3-3](#)), and seem to suggest that septic tanks within the city are concentrated between Union Street and Palmetto Street. These locations are near City of Clearwater monitoring Station STC1 and STC2, which happen to be the two stations with the highest percent of human isolates in fecal coliform samples (refer to [Appendix J](#) and [Figure 2.3-1](#)). While this seems to implicate septic tanks as a source of fecal contamination, a direct “cause and effect” statement concerning the use of septic tanks in the Stevenson Creek Watershed cannot be made. Other factors, such as the downstream position of STC1 and STC2, may be the cause of the higher human-source fecal contamination that was observed - in other words, the origin of the human-sourced fecal contamination measured at STC1 and STC2 could potentially be located upstream of the septic tanks.



Figure 2.3-3

Septic Tank Densities



2.3.2 Monitoring Program

A hydrologic and water quality monitoring program was implemented for the Stevenson Creek Watershed project. Two monitoring stations were installed – one station in Stevenson Creek (*Stevenson Creek Station*) just downstream of Drew Street and one station in Spring Branch (*Spring Branch Station*) just downstream of Kings Highway ([Figure 2.3-4](#)).

Each station logged rainfall depth and channel stage at 15-minute intervals from May 21, 2001 through November 23, 2000. Flow-weighted composite samples were collected for seven (7) separate storm events and grab samples were taken for six (6) base flow events at each station. Savannah Laboratories in Tampa analyzed the samples in accordance with their FDEP-approved quality assurance plan. One equipment blank for each station was collected and analyzed prior to the first storm-sampling event.

Laboratory parameter included solids, oxygen demand, nutrients, metals and petroleum hydrocarbons. These parameters are more specifically described in Table 2.3-2 along with their corresponding minimum detection limits.

2.3.2.1 Monitored Basins

The majority (65%) of the watershed was monitored. [Figure 2.3-4](#) shows the areas that drain to each of the monitoring stations. These areas include a 2400-acre area draining to the Stevenson Creek Station and a 1700-acre area draining to the Spring Branch Station. The unmonitored portion of the basin is approximately 2200 acres.

Both the Stevenson Creek and Spring Branch Stations are similar with respect to land use. The dominant land use is residential. The primary distinguishing factor is the presence of a larger amount of commercial land use in the Stevenson Creek Basin and a larger amount of high-density residential land use in the Spring Branch Basin. The Land uses in the unmonitored portion of the basin are similar to the monitored basins as shown in Figure 2.3-5 – shown as a doughnut graph to emphasize similarity.



**Table 2.3-2
Water Quality Sampling Parameters**

| Parameter | MDL¹ (mg/l) |
|--|-----------------------------------|
| Hardness as CaCO ₃ | 3.3 |
| Petroleum Hydrocarbons | |
| Oil and Grease | 5.0 |
| Total Recoverable Petroleum Hydrocarbons, TRPH | 0.30 |
| Oxygen Demand | |
| Biochemical Oxygen Demand (5 Day), BOD ₅ | 2.0 |
| Chemical Oxygen Demand, COD | 20 |
| Total Organic Carbon, TOC | 1.0 |
| Solids | |
| Total Suspended Solids, TSS | 5.0 |
| Total Dissolved Solids, TDS | 5.0 |
| Metals | |
| Aluminum, Al | 0.20 |
| Arsenic, As | 0.010 |
| Cadmium, Cd | 0.0050 |
| Chromium, Cr | 0.010 |
| Copper, Cu | 0.020 |
| Lead, Pb | 0.0050 |
| Nickel, Ni | 0.040 |
| Zinc, Zn | 0.020 |
| Nutrients | |
| Ortho Phosphate, P | 0.050 |
| Total Phosphorus, TP | 0.10 |
| Ammonia, NH ₃ | 0.03 |
| Total Kjeldahl Nitrogen, TKN | 0.20 |
| Nitrate + Nitrite, NO ₃ , NO ₂ | 0.05 |

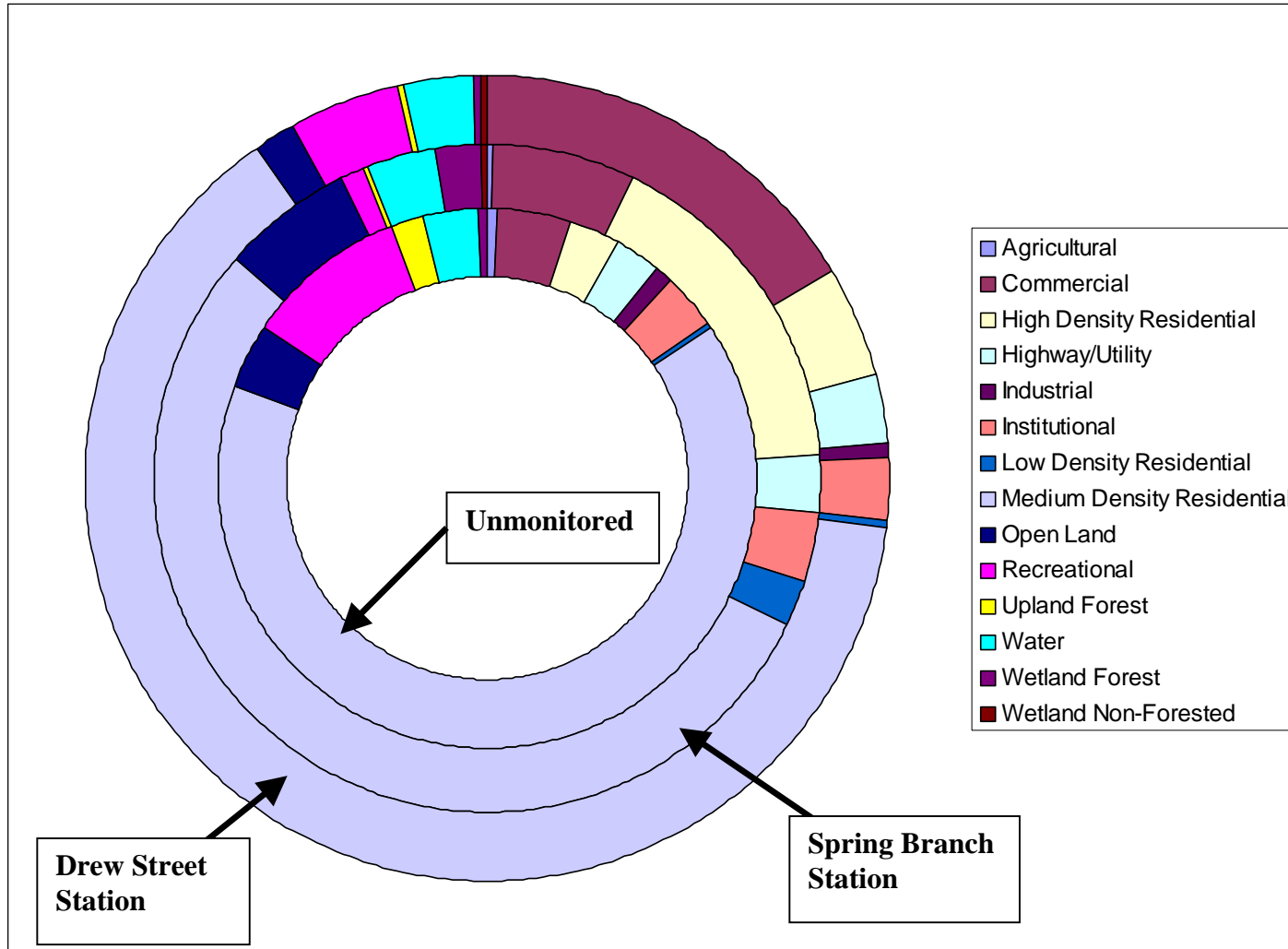
¹ Minimum Detection Limit

Figure 2.3-4

Monitoring Stations Location and Coverage



Figure 2.3-5
Land Use by Monitoring Station



2.3.2.2 Hydrologic Monitoring

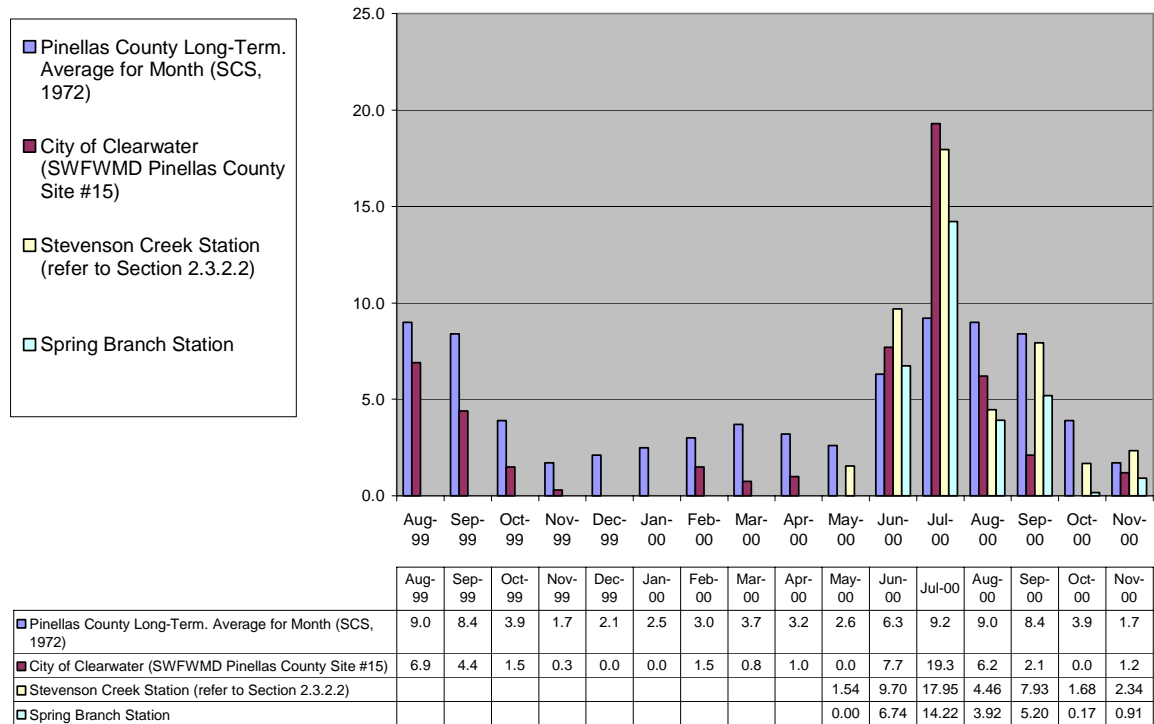
Hydrologic monitoring was conducted from May 21, 2000 through November 23, 2000. Rainfall conditions preceding and during the monitoring period were, in general, drier than normal. Rainfall conditions leading up to and including the monitoring period as compared to normal conditions are shown on Figure 2.3-6. The monitoring period followed an extremely dry “dry season” (5.1 inches of rainfall were received October 1999 to May 2000 at SWFWMD’s Site #15 rain gauge) with monthly rainfall conditions recovering to normal during the second month (June 2000) of monitoring. July 2000 was wetter than normal due chiefly to a large storm event that occurred on July 15 dropping 7.7 inches at the Stevenson Creek Station and 5.7 inches at the Spring Branch Station. Drier-than-normal conditions returned after July.

Towards the end of May 1999 it was discovered that the Stevenson Creek rain gauge was receiving inputs from the Clearwater Country Club’s sprinkler system. The rain gauge was moved away from the influence of the sprinklers as far as possible; however, minor inputs were still received from the sprinklers.

Translating the total measured flow during the monitoring period to a depth (flow volume divided by basin area), at the Stevenson Creek station 11.0 inches of rainfall appeared as flow the creek; likewise, 31.16 inches of rainfall at the Spring Branch Station resulted in 6.9 inches of flow. The remaining rainfall was lost to initial abstraction and evapotranspiration or became groundwater - later to appear as base flow of aquifer recharge. A simplified technique of base flow separation was applied to determine the relative magnitude of base flow. This technique uses the minimum daily flow during dry periods together with professional judgment to separate the flow into two components- base flow and storm event runoff. Overall hydrologic conditions for the monitoring period are listed in Table 2.3-3. Daily flow along with rainfall for the two monitoring stations is shown on Figures 2.3-7 and 2.3-9. Figures 2.3-8 and 2.3-10 provide a more detailed view for low flow conditions.

*Stevenson Creek Watershed Management Plan
Final Report*

**Figure 2.3-6
Rainfall Conditions**



**Table 2.3-3
Overall Hydrologic Conditions at Monitoring Stations**

| Watershed | Item | Quantity | Percent of Rainfall |
|------------------------|-------------------------------------|-----------------|----------------------------|
| Spring Branch | Area (AC) | 1,673.50 | -- |
| | Rainfall Depth (in.) | 31.16 | 100% |
| | Volume of Rain (AC-Ft.) | 4,345.52 | 100% |
| | Total Flow (AC-Ft.) | 960 | 22% |
| | Base Flow (AC-Ft.) | 184 | 4% |
| | Storm Flow (AC-Ft.) | 776 | 18% |
| Stevenson Creek | Area (AC) | 2,415.50 | |
| | Rainfall Depth (in.) ⁽¹⁾ | 45.61 | 100% |
| | Volume of Rain (AC-Ft.) | 9,181.91 | 100% |
| | Total Flow (AC-Ft.) | 2210 | 24% |
| | Base Flow (AC-Ft.) | 376 | 4% |
| | Storm Flow (AC-Ft.) | 1834 | 20% |

Note 1 : Rainfall depth reflects inputs from Clearwater Country Club sprinkler system- refer to Section 2.3.2.2.

Figure 2.3-7
Stevenson Creek Hydrologic Record

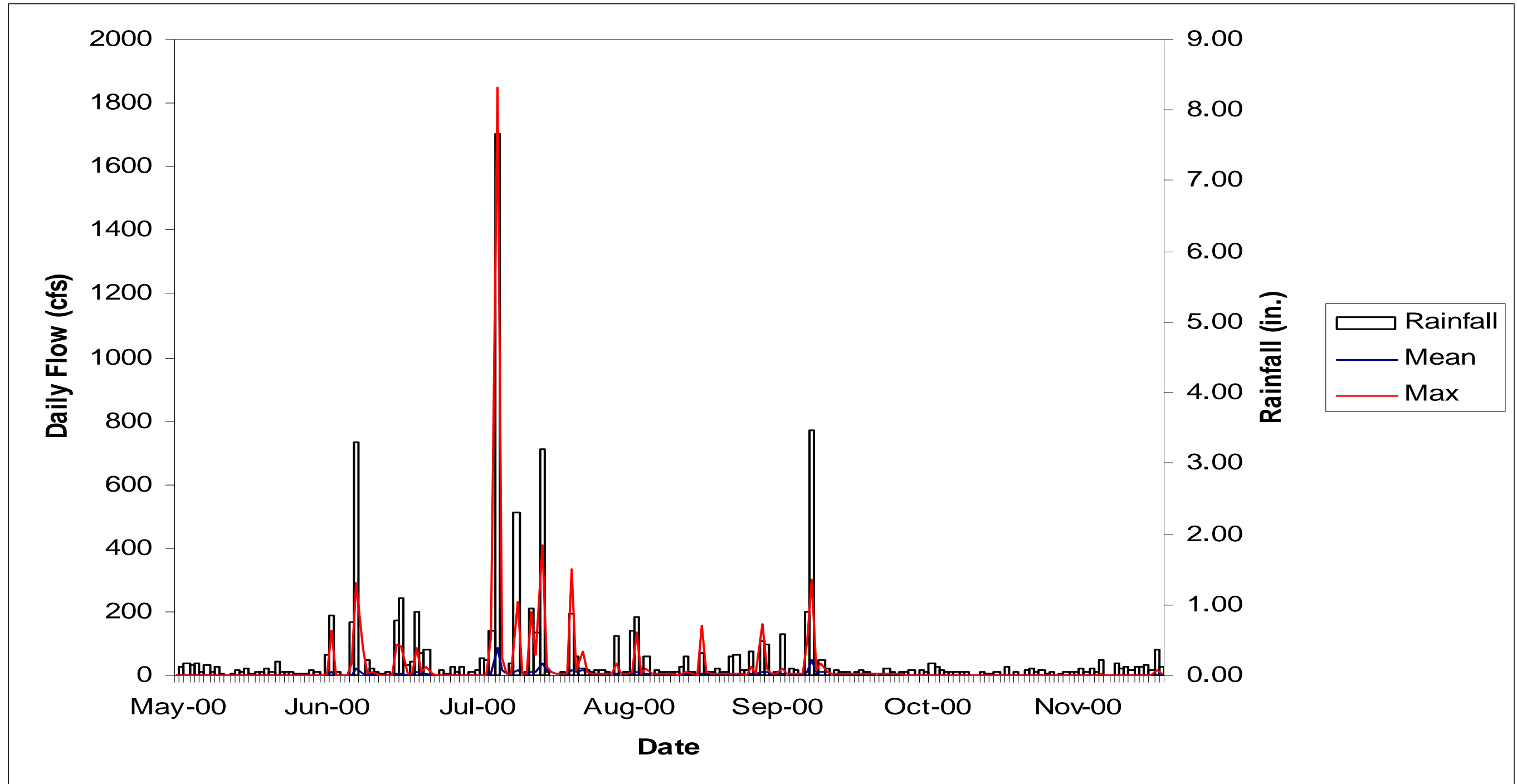


Figure 2.3-8
Stevenson Creek Hydrologic Record
Low Flow Detail

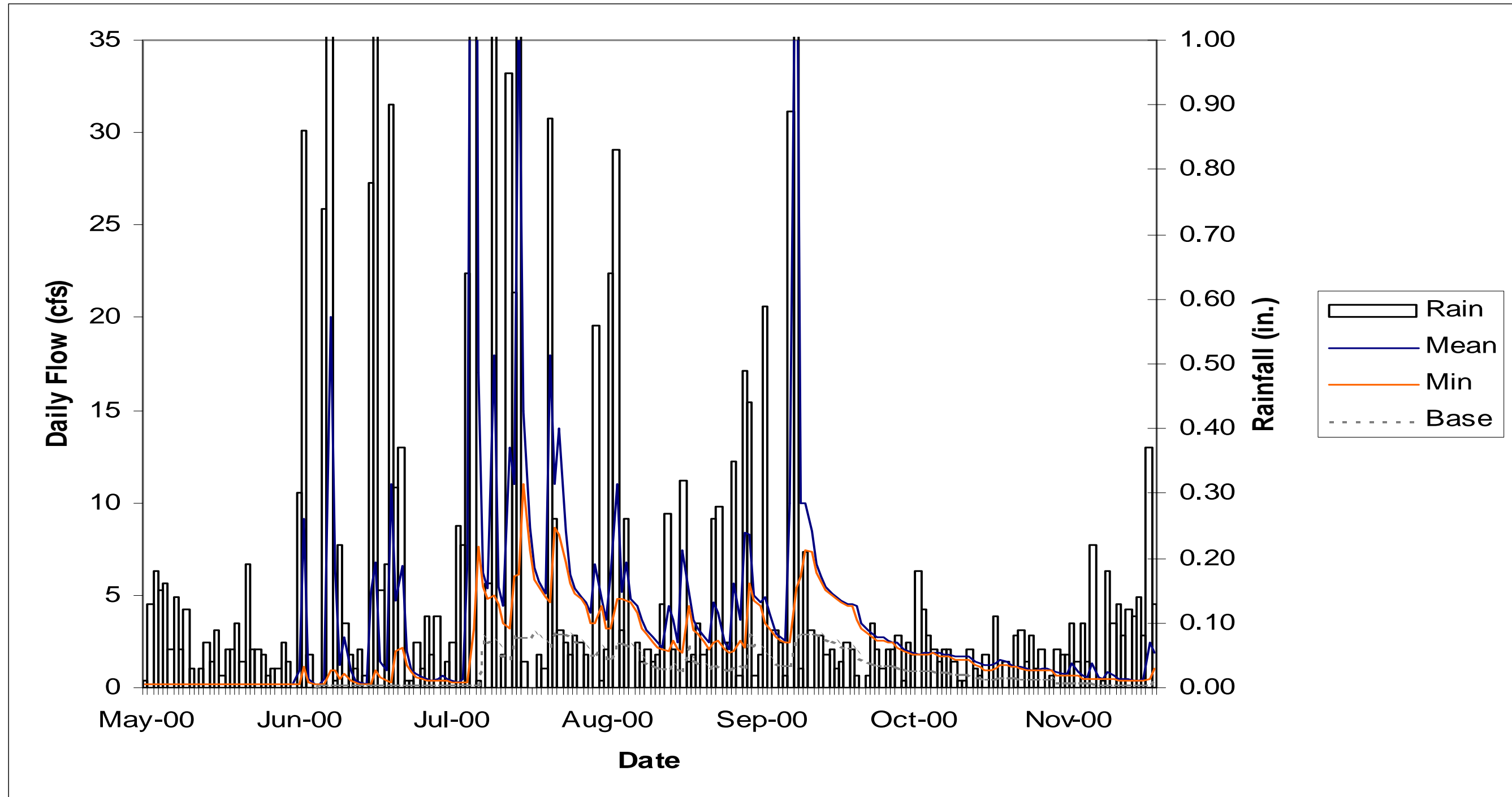


Figure 2.3-9
Spring Branch Hydrologic Record

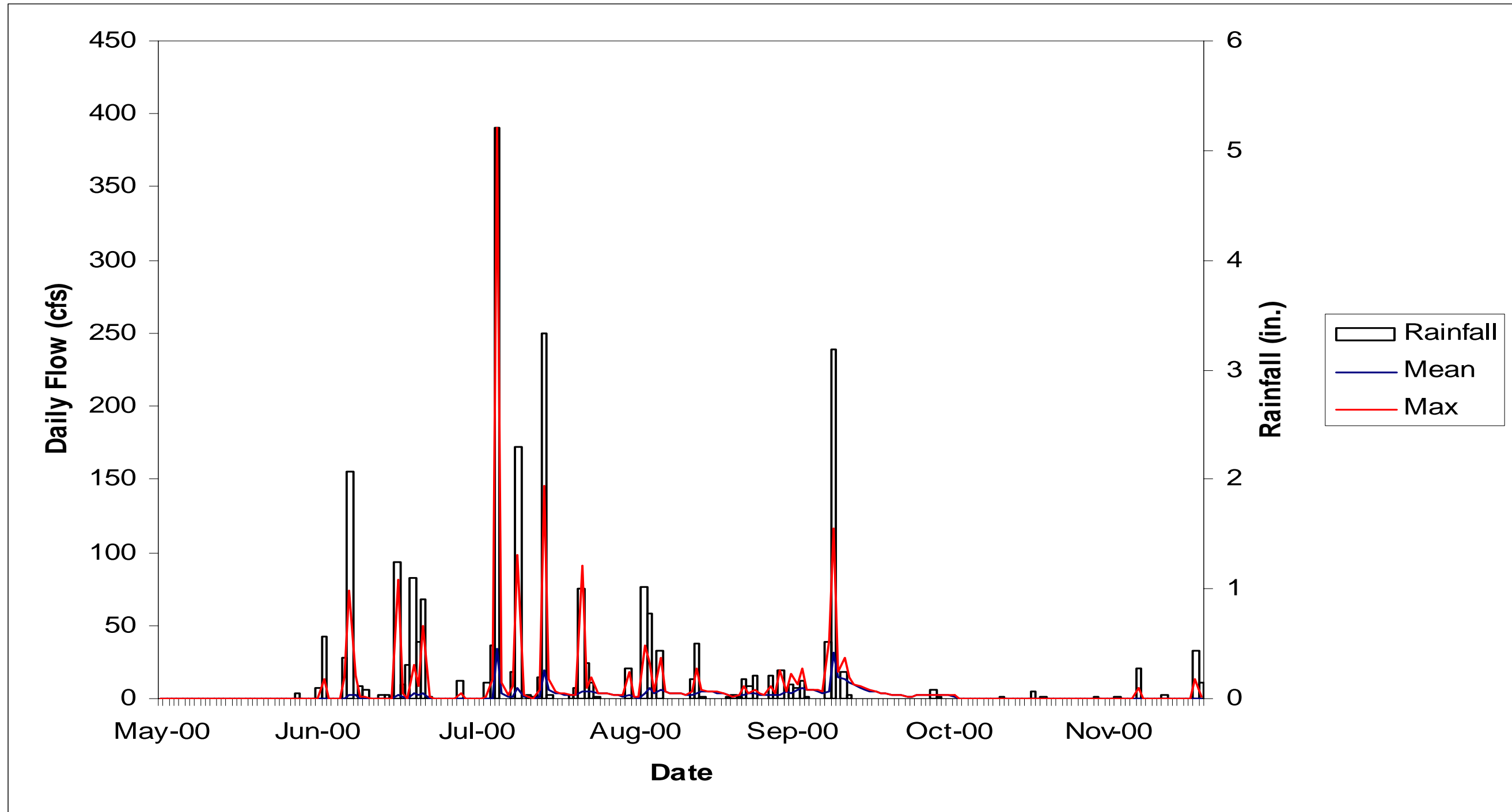
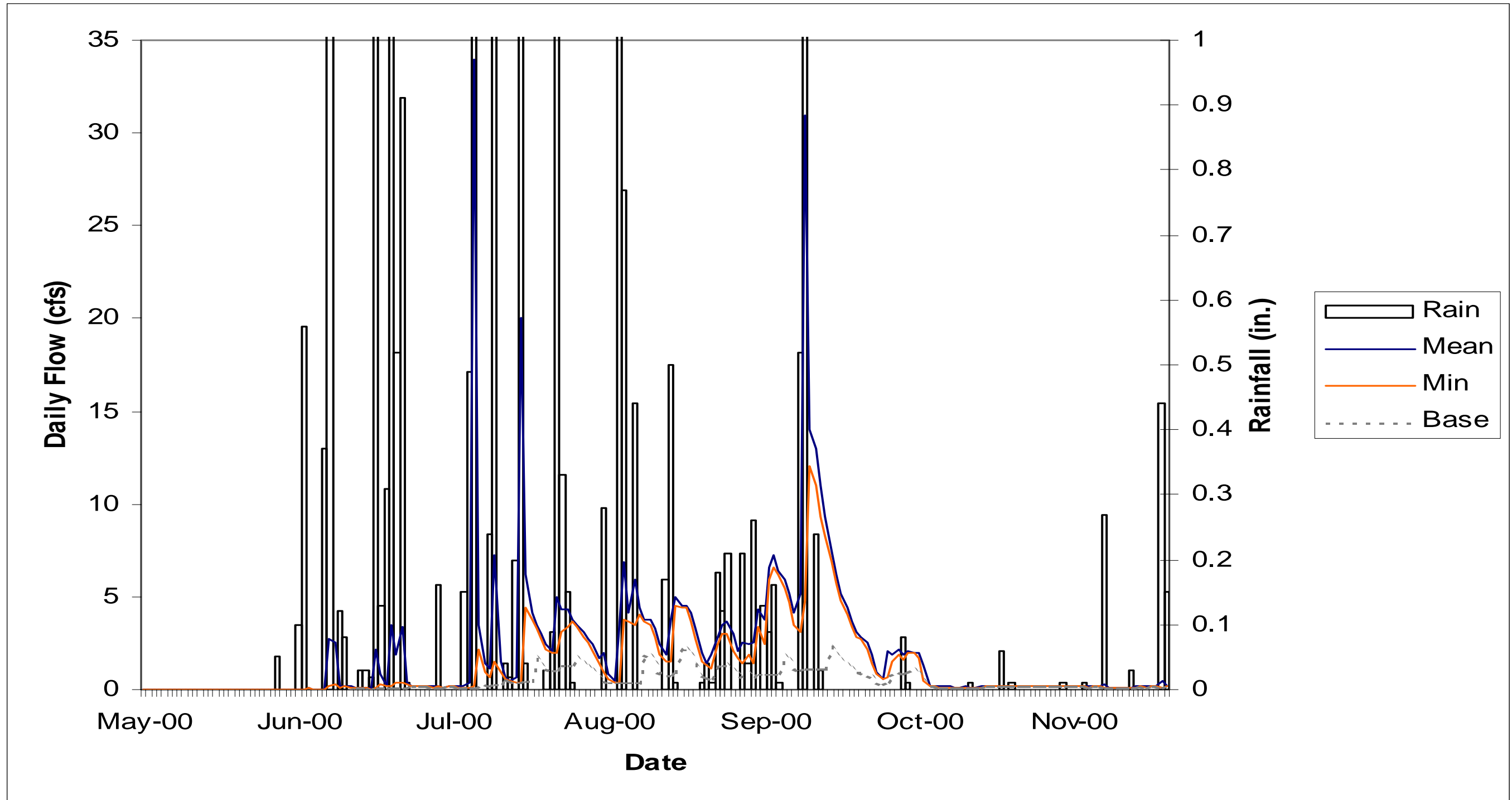


Figure 2.3-10
Spring Branch Hydrologic Record
Low Flow Detail



2.3.2.3 Water Quality

Seven (7) storm event samples and six (6) base flow samples were collected at each monitoring station. The laboratory results are provided in Table 2.3-4. Violations of Class III water quality criteria occurred in a number of instances. Details concerning these exceedences as well as other information concerning the findings of the sampling program are described in the following section.

2.3.3 Water Quality Characteristics

Water quality in the Stevenson Creek Watershed is described in the following subsections. These descriptions include assessments of base flow and storm flow and identify probable sources of pollution. Water quality parameters measured during this project are compared to Florida water quality criteria (*Chapter 62-302, Florida Administrative Code*- referred to as water quality standards in this report), STORET database values (as published in the 2000 state Section 305(b) report), and comparable literature values, as appropriate. More specifically, comparisons are made with state water quality standard where numeric standards exists; otherwise, comparison is made with Florida averages as published in the 305(b) report (for base flow samples) or literature values (for stormwater runoff samples). Water quality indices are calculated for the base flow samples.

The Florida Department of Environmental Protection (FDEP) recommends the use of a Water Quality Index (WQI) to summarize water quality conditions in rivers and streams (Hand et al. 1996). The WQI is based on six categories of water quality indicators (water clarity, dissolved oxygen, oxygen-demanding substances, bacteria, nutrients, and biological diversity). Several categories contain multiple constituents (e.g., total organic carbon and BOD₅, within the category of oxygen-demanding substances). In such cases, data availability determines constituent(s) used in calculating the WQI. For each measured constituent, the raw data (e.g., monthly or quarterly observations) are converted to annual averages. The annual averages are then converted to percentiles,

Table 2.3-4 – Laboratory Results

| Date | Log # | Time | Type | Oil and Grease | Hardness as CaCO ₃ | Metals | | | | | | | Oxygen Demand | | | Solids | | | Nutrients | | | | | | |
|--------------------------------------|---------|-------|----------------|----------------|-------------------------------|--------|--------|---------|--------|--------|---------|---------|---------------|------|-----|---------------|-----------------|-----------------|-----------------|------------------|---------|----------------|-------------------|-----------|----------------|
| | | | | | | Al | As | Cd | Cr | Cu | Pb | Ni | Zn | BOD5 | COD | Total Organic | Total Suspended | Total Dissolved | Ortho Phosphate | Total Phosphorus | Ammonia | Total Kjeldahl | Nitrate + Nitrite | Organic-N | Total Nitrogen |
| Stevenson Creek (Drew Street) | | | | | | | | | | | | | | | | | | | | | | | | | |
| "June 20, 2000" | 61864-2 | 10:19 | Base Flow #1 | <5.0 | 140 | <0.20 | <0.010 | <0.0050 | <0.010 | <0.020 | <0.0050 | <0.040 | <0.020 | 5.9 | 30 | 15.0 | 6.8 | 200 | 0.450 | 0.56 | 0.088 | 1.10 | <0.050 | 1.01 | 1.10 |
| "June 30, 2000" | 61983-1 | 14:15 | Storm Event #1 | <5.0 | 76 | <0.20 | <0.010 | <0.0050 | <0.010 | <0.020 | <0.0050 | <0.040 | <0.020 | 2.1 | 30 | 9.3 | <5.0 | 130 | 0.170 | 0.22 | 0.059 | 0.66 | <0.050 | 0.60 | 0.66 |
| "July 12, 2000" | 62071-2 | 12:08 | Base Flow #2 | <5.0 | 210 | <0.20 | <0.010 | <0.0050 | <0.010 | <0.020 | <0.0050 | <0.040 | <0.020 | <2.0 | 37 | 12.0 | <5.0 | 350 | 0.370 | 0.36 | 0.140 | 1.80 | <0.050 | 1.66 | 1.80 |
| "July 20, 2000" | 62194-1 | 12:30 | Storm Event #2 | <5.0 | 68 | <.20 | <0.01 | <0.005 | <0.01 | <0.02 | <0.005 | <0.04 | 0.029 | 24 | 54 | 15 | 15.0 | 110 | 0.10 | 0.17 | 0.12 | 0.78 | <0.050 | 0.66 | 0.78 |
| "July 24, 2000" | 62218-1 | 11:35 | Storm Event #3 | <5.0 | 71 | <0.20 | <0.010 | <0.0050 | <0.010 | 0.02 | <0.0050 | <0.040 | <0.020 | 7.2 | 26 | 8.2 | 6.0 | 94 | 0.110 | 0.16 | 0.290 | 0.88 | <0.050 | 0.59 | 0.88 |
| "July 31, 2000" | 62290-1 | 17:30 | Storm Event #4 | <5.0 | 59 | 0.69 | <0.010 | <0.0050 | <0.010 | <0.020 | 0.0071 | <0.040 | 0.038 | 8.9 | 29 | 7.4 | 30.0 | 86 | 0.140 | 0.30 | 0.058 | 0.65 | 0.51 | 0.59 | 1.16 |
| "August 3, 2000" | 62336-2 | 14:34 | Base Flow #3 | <5.0 | 140 | <0.20 | <0.010 | <0.0050 | <0.010 | <0.020 | <0.0050 | <0.040 | <0.020 | 2.0 | 45 | 11.0 | 8.4 | 210 | 0.200 | 0.27 | 0.091 | 0.81 | 0.18 | 0.72 | 0.99 |
| "August 23, 2000" | 62526-1 | 10:27 | Base Flow #4 | <5.0 | 210 | <0.20 | <0.010 | <0.0050 | <0.010 | <0.020 | <0.0050 | <0.0040 | 0.200 | <2.0 | <20 | 11.0 | <5.0 | 300 | 0.17 | 0.21 | 0.088 | 0.82 | 0.27 | 0.73 | 1.09 |
| "September 13, 2000" | 62731-1 | 13:45 | Base Flow #5 | <5.0 | 180 | <0.20 | <0.010 | <0.0050 | <0.010 | <0.020 | <0.0050 | <0.040 | <0.020 | 19.0 | 58 | 24.0 | <5.0 | 240 | 0.12 | 0.21 | 0.150 | 0.89 | 0.44 | 0.74 | 1.33 |
| "September 13, 2000" | 62737-3 | 13:30 | Storm Event #5 | <5.0 | 140 | <0.20 | <0.010 | <0.0050 | <0.010 | <0.020 | <0.0050 | <0.040 | <0.020 | <2.0 | 58 | 11.0 | 6.0 | 220 | 0.20 | 0.26 | 0.037 | 0.87 | 0.55 | 0.83 | 1.42 |
| "September 17, 2000" | 62758-2 | 12:45 | Storm Event #6 | <5.0 | 89 | 0.62 | <0.010 | <0.0050 | <0.010 | <0.020 | <0.0050 | <0.040 | 0.036 | 60 | 38 | 30.0 | 26 | 140 | 0.24 | 0.49 | 0.054 | 1.20 | 0.23 | 1.15 | 1.43 |
| "October 12, 2000" | 62999-2 | 14:50 | Base Flow #6 | <5.0 | 190 | 0.33 | <0.010 | <0.0050 | <0.010 | <0.020 | <0.0050 | <0.040 | 0.022 | <2.0 | 22 | 10.0 | 18 | 300 | 0.18 | 0.38 | 0.038 | 1.10 | 0.27 | 1.06 | 1.37 |
| "November 15, 2000" | 63376-2 | 13:30 | Storm Event #7 | <5.0 | 140 | 0.27 | <0.010 | <0.0050 | <0.010 | <0.020 | 0.0054 | <0.040 | 0.066 | 14 | 93 | 27.0 | 26 | 240 | 0.34 | 0.57 | 0.031 | 1.60 | 0.34 | 1.57 | 1.94 |
| Spring Branch (Kings Highway) | | | | | | | | | | | | | | | | | | | | | | | | | |
| "June 20, 2000" | 61864-1 | 9:10 | Base Flow #1 | <5.0 | 150 | 0.25 | <0.010 | <0.0050 | <0.010 | <0.020 | <0.0050 | <0.040 | <0.020 | 7.8 | 43 | 19.0 | 16.0 | 270 | 0.560 | 0.76 | 0.110 | 1.90 | <0.050 | 1.79 | 1.90 |
| "June 30, 2000" | 61983-2 | 15:00 | Storm Event #1 | <5.0 | 64 | <0.20 | <0.010 | <0.0050 | <0.010 | <0.020 | <0.0050 | <0.040 | <0.020 | 3.3 | <20 | 10.0 | 8.8 | 100 | 0.290 | 0.33 | 0.079 | 0.80 | 0.06 | 0.72 | 0.86 |
| "July 12, 2000" | 62071-1 | 11:17 | Base Flow #2 | <5.0 | 130 | <0.20 | <0.010 | <0.0050 | <0.010 | <0.020 | <0.0050 | <0.040 | <0.020 | 6.1 | 62 | 20.0 | 15.0 | 240 | 0.640 | 0.73 | <0.030 | 2.10 | <0.050 | 2.10 | 2.10 |
| "July 17, 2000" | 62131-1 | 15:30 | Storm Event #2 | <5.0 | 34 | 0.44 | <0.010 | <0.0050 | <0.010 | <0.020 | 0.0130 | <0.040 | 0.049 | 2.2 | <20 | 4.6 | 39.0 | 41 | 0.210 | 0.45 | 0.150 | 1.40 | <0.050 | 1.25 | 1.40 |
| "July 20, 2000" | 62194-2 | 13:25 | Storm Event #3 | <5.0 | 58 | 0.32 | <0.01 | <0.005 | <0.01 | <0.02 | <0.005 | <0.04 | <0.020 | 14 | 43 | 12 | 14.0 | 120 | 0.20 | 0.27 | 0.110 | 0.93 | <0.050 | 0.82 | 0.93 |
| "July 31, 2000" | 62290-2 | 18:45 | Storm Event #4 | <5.0 | 56 | 0.70 | <0.010 | <0.0050 | <0.010 | <0.020 | 0.0078 | <0.040 | 0.037 | 25.0 | 58 | 23.0 | 23.0 | 200 | 0.220 | 0.35 | 0.160 | 0.95 | 0.18 | 0.79 | 1.13 |
| "August 3, 2000" | 62336-1 | 13:45 | Base Flow #3 | <5.0 | 130 | 0.65 | <0.010 | <0.0050 | <0.010 | <0.020 | <0.0050 | <0.040 | 0.024 | <2.0 | 26 | 13.0 | 19.0 | 240 | 0.260 | 0.46 | 0.067 | 0.94 | 0.36 | 0.87 | 1.30 |
| "August 23, 2000" | 62526-2 | 12:05 | Base Flow #4 | <5.0 | 160 | 0.21 | <0.010 | <0.0050 | <0.010 | <0.020 | <0.0050 | <0.0040 | 0.200 | 98.0 | 38 | 21.0 | 7.2 | 220 | 0.230 | 0.30 | 0.097 | 1.10 | 0.068 | 1.00 | 1.17 |
| "August 23, 2000" | 62526-3 | 11:45 | Storm Event #5 | <5.0 | 120 | 0.28 | <0.010 | <0.0050 | <0.010 | <0.020 | <0.0050 | <0.0040 | 0.250 | 52.0 | <20 | 15.0 | 21.0 | 170 | 0.190 | 0.36 | 0.084 | 1.40 | 0.32 | 1.32 | 1.72 |
| "September 13, 2000" | 62731-2 | 15:00 | Base Flow #5 | <5.0 | 120 | 0.22 | <0.010 | <0.0050 | <0.010 | <0.020 | <0.0050 | <0.040 | <0.020 | 12.0 | 54 | 18.0 | 9.2 | 220 | 0.17 | 0.27 | 0.046 | 1.20 | <0.050 | 1.15 | 1.20 |
| "September 17, 2000" | 62758-1 | 11:00 | Storm Event #6 | <5.0 | 92 | 0.41 | <0.10 | <0.0050 | <0.010 | <0.020 | 0.0063 | <0.040 | 0.037 | 12 | 36 | 10.0 | 21 | 120 | 0.14 | 0.41 | 0.110 | 0.81 | 0.25 | 0.70 | 1.06 |
| "October 12, 2000" | 62999-1 | 13:30 | Base Flow #6 | <5.0 | 220 | 0.39 | <0.010 | <0.0050 | <0.010 | <0.020 | <0.0050 | <0.040 | <0.020 | 2.1 | 35 | 11.0 | 10 | 330 | 0.067 | 0.15 | 0.120 | 0.89 | 0.05 | 0.77 | 0.94 |
| "November 15, 2000" | 63376-1 | 12:00 | Storm Event #7 | <5.0 | 140 | 0.52 | <0.010 | <0.0050 | <0.010 | <0.020 | 0.0087 | <0.040 | 0.100 | 21 | 110 | 37.0 | 44 | 370 | 0.60 | 1.00 | 0.078 | 2.80 | <0.050 | 2.72 | 2.80 |



**Stevenson Creek Watershed Management Plan
Final Report**

using a database constructed by FDEP staff (Hand et al. 1990, 1996) using data from 2,000 Florida stream monitoring locations. These percentile values, which range from 0 (best quality) to 100 (poorest quality), are then averaged to generate the WQI. The final averaging process ignores water quality categories for which no data are available. The WQI calculated for a given stream-monitoring site can therefore represent the average of from 1 to 6 categories. Although the index can be calculated based on a single category, the use of additional categories provides greater reliability (Hand et al. 1990, 1996).

FDEP recommends the following interpretation of WQI values, based on an analysis of Florida stream data and the US EPA National Profiles Water-Quality Index (Hand et al. 1996):

- 0 < WQI < 45 = “good” water quality
- 45 < WQI < 60 = “fair” water quality
- WQI > 60 = “poor” water quality.

Data for four of the six possible water quality index categories was collected at the two sampling stations. Overall water quality at both stations is rated “poor” based on

**Table 2.3-5
Water Quality Indices**

| Category | Subcategory | Drew Street | Spring Branch |
|----------------|-------------------|-------------|---------------|
| Water Clarity | TSS | 50.9 | 70.9 |
| | Overall | 57.1 | 64.9 |
| Oxygen Demand | BOD | 89.3 | 90 |
| | COD | 32.8 | 46.2 |
| | TOC | 49.2 | 58.6 |
| | Overall | 66.1 | 62.9 |
| Nutrients | Total Nitrogen | 54 | 61.8 |
| | Nitrate + Nitrite | 70.2 | 47.7 |
| | Total Phosphorous | 74.2 | 79.3 |
| | Overall | 66.0 | 72.2 |
| Bacteria | Fecal Coliform | 90 | 90 |
| Overall | | 66.0 | 72.2 |



the average of base flow samples taken during this monitoring program with quality at the Spring Branch station rated moderately poorer than at the Drew Street station Table (2.3-5).

2.3.3.1 Petroleum Hydrocarbons

Petroleum hydrocarbons include oil and grease; the “BTEX” compounds: benzene, toluene, ethyl benzene, and xylene; as well as other polynuclear aromatic hydrocarbons (PAHs). The most common sources of petroleum hydrocarbons are associated with vehicle usage. These sources include parking lots and roads, leaking storage tanks, automobile emissions, and improper or careless handling or disposal of oil; therefore, petroleum hydrocarbons are typically concentrated along transportation routes. Petroleum hydrocarbons are acutely toxic at relatively low concentrations.

For this study, oil and grease was used as an “indicator” pollutant for petroleum hydrocarbons. The sampling plan specified that if oil and grease concentrations above 5.0 mg/l were detected, then tests would also be conducted for petroleum hydrocarbons. Oil and grease was not detected; therefore, tests for petroleum hydrocarbons were not conducted. While petroleum hydrocarbons are certainly present in any urban area, they do not appear to be a significant concern in the portion of the Stevenson Creek Watershed that was monitored.

2.3.3.2 Oxygen Demand

Oxygen-demanding substances were measured by testing for Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), and Total Organic Carbon (TOC). Maintaining appropriate levels of dissolved oxygen is one of the most important considerations for the protection of fish and aquatic life. The state standard for dissolved oxygen in Class III waters is 5.0 mg/l or greater.

The direct impact of storm water runoff on dissolved oxygen conditions in receiving waters is normally not as important as the secondary impacts. Secondary impacts of low dissolved oxygen conditions include nutrient enrichment, eutrophication, and increased sediment oxygen demand.



**Stevenson Creek Watershed Management Plan
Final Report**

Base flow sampling results values (Table 2.3-6) in comparison to Florida averages), and storm event sampling results (Table 2.3-7) in comparison with Nationwide Urban Runoff Program (NURP) data from the Tampa Bay Sampling sites are provided.

Three laboratory measurements appear to be in error and, therefore, were not used. The laboratory is unable to specifically identify the source of the error; however, the error may have been caused by a standard solution that was more concentrated than specified by the test. These erroneous measurements include the base flow sample taken on August 23, 2000 at the Kings Highway Station, the storm event sample that was composited on the same day and location, and the September 17, 2000 storm event sample taken at Drew Street. These readings are suspect due to the much lower COD measurements taken on the same sample. COD should normally be higher than BOD₅, and no case should BOD₅ be significantly greater than COD. This is because BOD measures the actual oxygen consumption of microorganisms, and COD measures the amount of oxidant required to oxidize the available organic matter; therefore, a BOD that is higher than a COD implies that more organic material was consumed than was available for consumption.

Table 2.3-6, Base Flow Oxygen Demand

| Date | BOD₅ (mg/l) | COD (mg/l) | TOC (mg/l) |
|---|-----------------------------------|-----------------------|-----------------------|
| Stevenson Creek - Drew Street | | | |
| June 20, 2000 | 5.9 | 30 | 15 |
| July 12, 2000 | <2.0 | 37 | 12 |
| August 3, 2000 | 2 | 45 | 11 |
| August 23, 2000 | <2.0 | <20 | 11 |
| September 13, 2000 | 19 | 58 | 24 |
| October 12, 2000 | <2.0 | 22 | 10 |
| Mean | 5.0 | 34 | 14 |
| WQI | 89.3 | 32.8 | 49.2 |
| Spring Branch - Kings Highway | | | |
| June 20, 2000 | 7.8 | 43 | 19 |
| July 12, 2000 | 6.1 | 62 | 20 |
| August 3, 2000 | <2.0 | 26 | 13 |
| August 23, 2000 | 98 | 38 | 21 |
| September 13, 2000 | 12 | 54 | 18 |
| October 12, 2000 | 2.1 | 35 | 11 |
| Mean | 5.8 | 43 | 17 |
| WQI | 90 | 46.2 | 58.6 |
| Frequency of Exceedance in Florida Streams | | | |
| STORET-10% | 0.8 | 16 | 5 |
| Median | 1.5 | 46 | 14 |
| STORET-90% | 5.1 | 146 | 37 |

BOD was still high relative to typical Florida streams even without considering the erroneous measurements. Moderately higher BOD concentrations were present at the



**Table 2.3-7
Storm Event Oxygen Demand**

| Date | BOD₅ (mg/l) | COD (mg/l) | TOC (mg/l) |
|-----------------------|-----------------------------------|-----------------------|-----------------------|
| Drew Street | | | |
| June 30, 2000 | 2.1 | 30 | 9.3 |
| July 20, 2000 | 24 | 54 | 15 |
| July 24, 2000 | 7.2 | 26 | 8.2 |
| July 31, 2000 | 8.9 | 29 | 7.4 |
| September 13, 2000 | <2.0 | 58 | 11 |
| September 17, 2000 | 60 ⁱ | 38 | 30 |
| November 15, 2000 | 14 | 93 | 27 |
| EMC | 12.19 | 47.3 | 15.7 |
| Kings Highway | | | |
| June 30, 2000 | 3.3 | <20 | 10 |
| July 17, 2000 | 2.2 | <20 | 4.6 |
| July 20, 2000 | 14 | 43 | 12 |
| July 31, 2000 | 25 | 58 | 23 |
| August 23, 2000 | 52 ⁱ | <20 | 15 |
| September 17, 2000 | 12 | 36 | 10 |
| November 15, 2000 | 21 | 110 | 37 |
| EMC | 15.35 | 43.5 | 16.5 |
| Tampa Bay NURP | | | |
| Minimum | 0.7 | 5 | 0 |
| Mean | 5.4 | 58 | 14 |
| maximum | 28 | 210 | 88 |

ⁱ Erroneous measurement – not used

Spring Branch station than were observed at the Stevenson Creek station. COD and BOD were near the state average.

2.3.2.3 Solids

Solids are one of the most common contaminants found in urban storm water. Solids originate from many sources including the erosion of pervious surfaces and dust, litter and other particles deposited on land surfaces from human activities and the atmosphere. Stream bank and streambed erosion also appears to be a major source of solids in the Stevenson Creek Watershed.

Solids contribute to water quality, habitat and maintenance problems in Stevenson Creek Watershed. Elevated levels of solids increase turbidity, reduce the depth of light penetration within the water column, and limit the growth of desirable aquatic plants. Solids that settle out as bottom deposits and can alter habitat for fish and bottom-dwelling organisms. Solids also provide a medium for the accumulation, transport and storage of other pollutants including nutrients and metals. Sediment- bound pollutants interact with the water column through cycles of deposition, re-suspension, and re-deposition.

Suspended solids (TSS) concentrations in base flow were high at the Spring Branch station and near the Florida average at the Drew Street station. As expected, suspended solids concentrations increased substantially during storm events with the Spring Branch station experiencing higher concentrations than the Drew Street station. Results are provided on Tables 2.3-8 and 2.3-9.

2.3.2.4 Metals

Metals detected in the Stevenson Creek Watershed include aluminum, lead, and zinc. This finding is typical. Aluminum is the second most abundant naturally occurring metal and lead and zinc are the most commonly detected metals in stormwater runoff¹. Likely sources of the lead and zinc present in the Stevenson Creek Watershed include vehicle usage, atmospheric deposition, and erosion. A major finding of the NURP study is as follows:

¹ Lead and zinc were detected in 94% of NURP samples.



**Table 2.3-8
Base Flow Solids**

| Date | Total Suspended Solids (TSS, mg/l) | Total Dissolved Solids (TDS, mg/l) |
|---|---|---|
| Stevenson Creek | | |
| June 20, 2000 | 6.8 | 200 |
| July 12, 2000 | <5.0 | 350 |
| August 3, 2000 | 8.4 | 210 |
| August 23, 2000 | <5.0 | 300 |
| September 13, 2000 | <5.0 | 240 |
| October 12, 2000 | 18 | 300 |
| Mean | 6.78 | 267 |
| WQI | 50.9 | - |
| Spring Branch | | |
| June 20, 2000 | 16 | 270 |
| July 12, 2000 | 15 | 240 |
| August 3, 2000 | 19 | 240 |
| August 23, 2000 | 7.2 | 220 |
| September 13, 2000 | 9.2 | 220 |
| October 12, 2000 | 10 | 330 |
| Mean | 12.73 | 253 |
| WQI | 70.9 | - |
| Frequency of Exceedance in Florida Streams | | |
| STORET-10% | 2 | - |
| Median | 6.5 | - |
| STORET-90% | 26.5 | - |

**Table 2.3-9
Storm Event Solids**

| Date | Total Suspended Solids (TSS, mg/l) | Total Dissolved Solids (TDS, mg/l) |
|----------------------------|---|---|
| Stevenson Creek | | |
| June 30, 2000 | <5.0 | 130 |
| July 20, 2000 | 15 | 110 |
| July 24, 2000 | 6 | 94 |
| July 31, 2000 | 30 | 86 |
| September 13, 2000 | 6 | 220 |
| September 17, 2000 | 26 | 140 |
| November 15, 2000 | 26 | 240 |
| EMC | 18.3 | 147 |
| Spring Branch | | |
| June 30, 2000 | 8.8 | 100 |
| July 17, 2000 | 39 | 41 |
| July 20, 2000 | 14 | 120 |
| July 31, 2000 | 23 | 200 |
| August 23, 2000 | 21 | 170 |
| September 17, 2000 | 21 | 120 |
| November 15, 2000 | 44 | 370 |
| EMC | 25.13 | 168 |
| NURP Mixed Urban - Mean | 67 | - |

Heavy metals (especially copper, lead and zinc) are by far the most prevalent priority pollutant constituents found in urban runoff. End-of-pipe concentrations exceed EPA ambient water quality criteria and drinking water standards in many instances. Some of the metals are present often enough and in high enough concentrations to be potential threats to beneficial uses.

Metals can be toxic to aquatic life, and lead and zinc concentrations exceeding state standards were often measured during the monitoring program- more often in storm flow and more often at Spring Branch. Metals concentration for both of the monitoring stations are shown on Table 2.3-10 along with comparison to state water quality criteria and NURP data. The standards for lead and zinc are hardness-dependant, and the standard for lead was often less than the detection limit.

2.3.3.5 Nutrients

Nitrogen and phosphorus are the principal nutrients of concern in urban storm water. The major sources of nitrogen and phosphorus in the Stevenson Creek Watershed are likely associated with landscape runoff (fertilizers and organic debris) and atmospheric deposition. Improperly functioning septic tank systems and animal waste may also be an important source.

There are a number of parameters used to measure the various forms of nitrogen. Ammonia (NH₃) nitrogen is the nitrogen form that is usually the most readily toxic to aquatic life. Nitrate (NO₃) and nitrite (NO₂) are the inorganic fractions of nitrogen. Very little nitrite is usually found in storm water. Total Kjeldahl nitrogen (TKN) measures the organic and ammonia nitrogen forms. The organic fraction is determined by subtracting the NH₃ from the TKN.

Total phosphorus measures the total amount of phosphorus in both the organic and inorganic forms. Ortho-phosphate measures phosphorus that is most immediately biologically available. Most of the soluble phosphorus in storm water is usually present in the ortho-phosphate form.

*Stevenson Creek Watershed Management Plan
Final Report*

**Table 2.3-10
Metals**

| Date | Type of Flow | Aluminum ¹ | Lead | | Zinc | |
|------------------------------|----------------|-----------------------|-------------|--------------------------|-------------|--------------------------|
| | | Measurement (1) | Measurement | Class III-Fresh Standard | Measurement | Class III-Fresh Standard |
| Stevenson Creek | | | | | | |
| June 20, 2000 | Base Flow #1 | <0.20 | <0.0050 | 0.00488 | <0.020 | 0.14096 |
| July 12, 2000 | Base Flow #2 | <0.20 | <0.0050 | 0.00818 | <0.020 | 0.19874 |
| August 3, 2000 | Base Flow #3 | <0.20 | <0.0050 | 0.00488 | <0.020 | 0.14096 |
| August 23, 2000 | Base Flow #4 | <0.20 | <0.0050 | 0.00818 | 0.200 | 0.19874 |
| September 13, 2000 | Base Flow #5 | <0.20 | <0.0050 | 0.00672 | <0.020 | 0.17441 |
| October 12, 2000 | Base Flow #6 | 0.33 | <0.0050 | 0.00720 | 0.022 | 0.18258 |
| | | | | | | |
| June 30, 2000 | Storm Event #1 | <0.20 | <0.0050 | 0.00224 | <0.020 | 0.08400 |
| July 20, 2000 | Storm Event #2 | <.20 | <0.0050 | 0.00195 | 0.029 | 0.07645 |
| July 24, 2000 | Storm Event #3 | <0.20 | <0.0050 | 0.00206 | <0.020 | 0.07929 |
| July 31, 2000 | Storm Event #4 | 0.69 | 0.0071 | 0.00163 | 0.038 | 0.06778 |
| September 13, 2000 | Storm Event #5 | <0.20 | <0.0050 | 0.00488 | <0.020 | 0.14096 |
| September 17, 2000 | Storm Event #6 | 0.62 | <0.0050 | 0.00274 | 0.036 | 0.09603 |
| November 15, 2000 | Storm Event #7 | 0.27 | 0.0054 | 0.00488 | 0.066 | 0.14096 |
| Spring Branch | | | | | | |
| June 20, 2000 | Base Flow #1 | 0.25 | <0.0050 | 0.00533 | <0.020 | 0.14944 |
| July 12, 2000 | Base Flow #2 | <0.20 | <0.0050 | 0.00444 | <0.020 | 0.13238 |
| August 3, 2000 | Base Flow #3 | 0.65 | <0.0050 | 0.00444 | 0.024 | 0.13238 |
| August 23, 2000 | Base Flow #4 | 0.21 | <0.0050 | 0.00579 | 0.200 | 0.15784 |
| September 13, 2000 | Base Flow #5 | 0.22 | <0.0050 | 0.00401 | <0.020 | 0.12370 |
| October 12, 2000 | Base Flow #6 | 0.39 | <0.0050 | 0.00868 | <0.020 | 0.20673 |
| | | | | | | |
| June 30, 2000 | Storm Event #1 | <0.20 | <0.0050 | 0.00180 | <0.020 | 0.07262 |
| July 17, 2000 | Storm Event #2 | 0.44 | 0.0130 | 0.00081 | 0.049 | 0.04249 |
| July 20, 2000 | Storm Event #3 | 0.32 | <0.005 | 0.00159 | <0.020 | 0.06681 |
| July 31, 2000 | Storm Event #4 | 0.70 | 0.0078 | 0.00152 | 0.037 | 0.06485 |
| August 23, 2000 | Storm Event #5 | 0.28 | <0.0050 | 0.00401 | 0.250 | 0.12370 |
| September 17, 2000 | Storm Event #6 | 0.41 | 0.0063 | 0.00286 | 0.037 | 0.09876 |
| November 15, 2000 | Storm Event #7 | 0.52 | 0.0087 | 0.00488 | 0.100 | 0.14096 |
| NURP -Nationwide Mean | | | | | | |
| Residential | | | 0.144 | | 0.135 | |
| Mixed Urban | | | 0.114 | | 0.154 | |
| Commercial | | | 0.104 | | 0.226 | |
| Tampa Bay NURP | | | | | | |
| Minimum | | | 0.012 | | 0.020 | |
| Mean | | | 0.058 | | 0.097 | |
| Maximum | | | 0.320 | | 0.300 | |

¹ There is no aluminum standard for freshwater. The aluminum standard for Class III marine waters is 1.5 mg/l.



Stevenson Creek Watershed Management Plan Final Report

The degree to which nitrogen and phosphorus are present can determine the trophic status and amount of algal biomass produced. Excess nutrients increase biological productivity. The major impact associated with nutrient over-enrichment is excessive growth of algae that leads to nuisance algal blooms and eutrophic conditions. A secondary impact is the residual negative effect of decomposing algae in the form of sediment oxygen demand that depletes dissolved oxygen concentrations, particularly in bottom waters.

Nutrient concentrations measured during the monitoring period are presented on Tables 2.3-11 and 2.3-12 in comparison with STORET and NURP data. Nutrient concentrations do not appear to increase with storm event flow; however, since storms produce high flows the resulting increases in masses are significant.

With respect to nutrients, the Spring Branch station had slightly worse water quality than did the Drew Street station with the primary difference being nitrogen forms at each of the station. Higher-than-average levels of inorganic nitrogen levels were recorded at the Drew Street station and higher-than-average organic nitrogen levels were recorded at the Spring Branch station. Ammonia nitrogen often exceeded the state standard during the monitoring period at both stations.

2.3.3.6 Bacteria

Fecal contamination is one of the most severe water quality issues in Stevenson Creek. The magnitude and frequency of fecal counts reported in past monitoring (City of Clearwater 1992-1995)) as well as this current program are very high. The state threshold for ranking a stream in the top ten percent of Florida's worst water quality with respect to fecal coliforms is 960 colony-forming units (CFU) per 100ml. The highest count during this study was 20,000 and previous studies have recorded similarly high counts. The state standard for fecal coliforms in Class III waters is 800 counts per 100 ml.

The University of South Florida Department of Biology accomplished sampling for fecal contamination under a separate monitoring program. A bacterial source tracking



**Table 2.3-11
Base Flow Nutrients**

| Date | Ortho Phosphate (mg/l) | Total Phosphorus (mg/l) | Total Kjeldahl Nitrogen (mg/l) | Nitrate + Nitrite (mg/l) | Organic-N (mg/l) | Ammonia (mg/l) | Total Nitrogen (mg/l) |
|---|------------------------|-------------------------|--------------------------------|--------------------------|------------------|----------------|-----------------------|
| Stevenson Creek - Drew Street Station | | | | | | | |
| June 20, 2000 | 0.45 | 0.56 | 1.1 | <0.050 | 1.012 | <u>0.088</u> | 1.1 |
| July 12, 2000 | 0.37 | 0.36 | 1.8 | <0.050 | 1.66 | <u>0.14</u> | 1.8 |
| August 3, 2000 | 0.2 | 0.27 | 0.81 | 0.18 | 0.719 | <u>0.091</u> | 0.99 |
| August 23, 2000 | 0.17 | 0.21 | 0.82 | 0.27 | 0.732 | <u>0.088</u> | 1.09 |
| September 13, 2000 | 0.12 | 0.21 | 0.89 | 0.44 | 0.74 | <u>0.15</u> | 1.33 |
| October 12, 2000 | 0.18 | 0.38 | 1.1 | 0.27 | 1.062 | <u>0.038</u> | 1.37 |
| Mean | 0.25 | 0.33 | 1.09 | 0.20 | 0.988 | <u>0.10</u> | 1.28 |
| WQI | - | 74.2 | - | 70.2 | - | - | 54.0 |
| Spring Branch - Kings Highway Station | | | | | | | |
| June 20, 2000 | 0.56 | 0.76 | 1.9 | <0.050 | 1.79 | <u>0.11</u> | 1.9 |
| July 12, 2000 | 0.64 | 0.73 | 2.1 | <0.050 | 2.1 | <0.030 | 2.1 |
| August 3, 2000 | 0.26 | 0.46 | 0.94 | 0.36 | 0.873 | <u>0.067</u> | 1.3 |
| August 23, 2000 | 0.23 | 0.3 | 1.1 | 0.068 | 1.003 | <u>0.097</u> | 1.168 |
| September 13, 2000 | 0.17 | 0.27 | 1.2 | <0.050 | 1.154 | <u>0.046</u> | 1.2 |
| October 12, 2000 | 0.067 | 0.15 | 0.89 | 0.052 | 0.77 | <u>0.12</u> | 0.942 |
| Mean | 0.32 | 0.45 | 1.36 | 0.093 | 1.28 | <u>0.088</u> | 1.44 |
| WQI | - | 79.3 | - | 47.7 | - | - | 61.8 |
| Frequency of Exceedence in Florida Streams | | | | | | | |
| STORET-10% | 0.02 | - | - | 0.01 | - | - | 0.5 |
| Median | 0.09 | -- | - | 0.1 | - | - | 1.2 |
| STORET-90% | 0.89 | - | - | 0.64 | - | - | 2.7 |
| State Class III Standard | | - | - | - | - | <0.02 | |

**Table 2.3-12
Storm Event Nutrients**

| Date | Ortho Phosphate (mg/l) | Total Phosphorus (mg/l) | Total Kjeldahl Nitrogen (mg/l) | Nitrate + Nitrite (mg/l) | Organic-N (mg/l) | Ammonia (mg/l) | Total Nitrogen (mg/l) |
|--|------------------------|-------------------------|--------------------------------|--------------------------|------------------|----------------|-----------------------|
| Stevenson Creek - Drew Street Station | | | | | | | |
| June 30, 2000 | 0.17 | 0.22 | 0.66 | <0.050 | 0.601 | 0.059 | 0.66 |
| July 20, 2000 | 0.1 | 0.17 | 0.78 | <0.050 | 0.66 | 0.12 | 0.78 |
| July 24, 2000 | 0.11 | 0.16 | 0.88 | <0.050 | 0.59 | 0.29 | 0.88 |
| July 31, 2000 | 0.14 | 0.3 | 0.65 | 0.51 | 0.592 | 0.058 | 1.16 |
| September 13, 2000 | 0.2 | 0.26 | 0.87 | 0.55 | 0.833 | 0.037 | 1.42 |
| September 17, 2000 | 0.24 | 0.49 | 1.2 | 0.23 | 1.146 | 0.054 | 1.43 |
| November 15, 2000 | 0.34 | 0.57 | 1.6 | 0.34 | 1.569 | 0.031 | 1.94 |
| EMC | 0.19 | 0.31 | 0.95 | 0.36 | 0.86 | 0.09 | 1.31 |
| Spring Branch - Kings Highway Station | | | | | | | |
| June 30, 2000 | 0.29 | 0.33 | 0.8 | 0.055 | 0.721 | 0.079 | 0.855 |
| July 17, 2000 | 0.21 | 0.45 | 1.4 | <0.050 | 1.25 | 0.15 | 1.4 |
| July 20, 2000 | 0.2 | 0.27 | 0.93 | <0.050 | 0.82 | 0.11 | 0.93 |
| July 31, 2000 | 0.22 | 0.35 | 0.95 | 0.18 | 0.79 | 0.16 | 1.13 |
| August 23, 2000 | 0.19 | 0.36 | 1.4 | 0.32 | 1.316 | 0.084 | 1.72 |
| September 17, 2000 | 0.14 | 0.41 | 0.81 | 0.25 | 0.7 | 0.11 | 1.06 |
| November 15, 2000 | 0.6 | 1 | 2.8 | <0.050 | 2.722 | 0.078 | 2.8 |
| EMC | 0.26 | 0.45 | 1.30 | 0.14 | 1.19 | 0.11 | 1.41 |
| State Class III Standard | | - | - | - | - | <0.02 | - |
| NURP - Nationwide Mean | | | | | | | |
| Residential | 0.143 | 0.383 | 1.9 | 0.736 | | | 2.636 |
| Mixed Urban | 0.056 | 0.263 | 1.288 | 0.558 | | | 1.846 |
| Commercial | 0.08 | 0.201 | 1.179 | 0.572 | | | 1.751 |
| Tampa Bay NURP | | | | | | | |
| Minimum | 0.02 | 0.02 | | 0.01 | 0.18 | 0.04 | 0.52 |
| Mean | 0.09 | 0.23 | | 0.34 | 1.1 | 0.4 | 2.0 |
| Maximum | 0.22 | 1.1 | | 0.81 | 2.7 | 1.5 | 3.2 |

***Stevenson Creek Watershed Management Plan
Final Report***

(BST) method was applied to classify the source of fecal matter into three categories – human, dog, and wild animal. The report, which documents the results and findings, is provided in [Appendix J](#).

The source of most of the fecal contamination was identified as wild animal; however, significant human-sourced contamination was also discovered. The presence of fecal coliform bacteria from human sources was particularly evident at sample site STC1 (near the confluence of Spring Branch with the main branch), a site that is surrounded by onsite wastewater treatment and disposal systems (OSTDS). STC2, on Hammond Branch, was also impacted frequently by indicator bacteria from human sources, and is downstream from another cluster of residences serviced by OSTDS.

Some percent of isolates from other sources will misclassify as human isolates—this is true of all BST methodologies. The rate of misclassification of isolates into the human category can be used to develop a cut-off point for significant levels of human isolates. In this database, about 20% of wild animal isolates are misclassified as human, and wild animal isolates have the highest rate of misclassification as human of all sources. The conservative rate of 25% is used as the cut-off point for identification of a significant percentage of isolates from human sources in any sample.

Valerie J. Harwood, a professor at the University of South Florida who conducted the BST study for this project, provided the following description of the significance of fecal coliform in surface waters.

The goal of bacteriological water quality testing is, in large part, to identify water that contains human pathogens in order to protect public health. Ideally, water quality testing would reliably identify public health threats, while allowing full use of waters that do not constitute a health threat. This goal has been elusive, in part because of the limitations of the methods we use. It is difficult, time-consuming and expensive to directly quantify disease-causing bacteria and viruses, and virtually impossible to test for all possible pathogens in a water sample. Thus, we quantify indicator bacteria, whose presence more-or-less reflects the probability that there are pathogens in the water. A major problem with the fecal coliform indicator is that it is a poor predictor of some human pathogens, particularly enteric viruses, but can also be present in waters where there are few or no viral, bacterial or protozoan pathogens. The same problem exists when E. coli, a member of the fecal coliform group, or Enterococcus, a different bacterial group, are used as indicator organisms for water quality.



One of the major reasons that fecal coliforms are inadequate indicators is that they are present in the gastrointestinal tract of all warm-blooded animals and some cold-blooded animals. Some animal feces, i.e. those of humans, cattle, and swine, have a higher probability of containing human pathogens than the feces of most other species, therefore many water quality experts would place contamination from these animals in a “high risk” group. Human feces are considered particularly dangerous because of the human-specific viruses transmitted exclusively by human sources. Very low levels of fecal indicator bacteria from a high-risk animal group indicate a greater potential health hazard than higher levels of indicator bacteria from a low risk animal group. There is, however, no testing method approved by regulatory agencies such as the EPA that can be used to determine the source (i.e. cow, human, dog) of fecal indicator bacteria. Such a method would allow much more accurate risk assessment than we can achieve with standard testing methods. It would also allow regulatory agencies to more effectively identify and eliminate the source of bacterial contamination to natural waters, and would contribute greatly to the accuracy of total maximum daily load (TMDL) models.

Due to the history of high fecal coliform numbers in the urban Stevenson Creek watershed in Clearwater, Florida, the City of Clearwater funded a cutting-edge study of the sources of bacteria in this area. Based on land use patterns in the waters studied, one could predict significant fecal inputs from wild animals, particularly birds and raccoons, and from dogs. Other major candidates for fecal coliform contamination in this watershed include onsite wastewater treatment and disposal systems (OSTDS) whose drainfields are not functioning properly, or which have been bypassed. While limited steps can be taken to reduce the amount of dog wastes that enter surface waters, runoff from yards and other surfaces inevitably transports such waste to waters. Contributions from wild animal feces to the watershed are, if anything, more difficult to control than contributions from dogs. It is, however, possible to control the impact of human waste on water quality. Improvements in central sewer systems and OSTDS installations have greatly improved water quality overall in the U.S. since the implementation of the Clean Water Act in 1970. However, continued degradation of water quality in many surface waters, combined with heightened awareness of the dangers of waterborne pathogens, has led to renewed efforts to understand and mitigate the sources of microbial pollution in natural waters.

2.3.4 Nonpoint Source Loading Model

A nonpoint source loading model was prepared to estimate pollutant loads from Stevenson Creek Watershed. This model uses the EPA Simple Method, which is an event mean concentration (EMC) approach. In this approach, mass loads are calculated as the product of the EMC and the stormwater runoff volume. The stormwater runoff volume is estimated as the fraction of rainfall appearing as runoff multiplied by the basin area. The EMC is constant; thus, this method is also referred to as the “constant concentration” method.



Stevenson Creek Watershed Management Plan Final Report

This loading model is intended to serve as an estimate. The water quality estimating procedures used for this project are very simple, yet water quality estimations by any means are not precise. Dr. Wayne Huber in the EPA SWMM User's Manual expressed this fact very well.

Simulation of urban runoff quality is a very inexact science if it can even be called such. Very large uncertainties arise both in the representation of the physical, chemical and biological processes and in the acquisition of data and parameters for model algorithms

Nevertheless, the loading estimates for the Stevenson Creek Watershed presented herein represent a reasonable estimate that can be used to guide management actions.

The flow and water quality data collected for this project (Section 2.3.2) were used along with soils and land use coverage information to develop the runoff coefficients (Section 2.3.4.1) and EMCs (2.3.4.2); subsequently, this information was used in combination with an existing stormwater treatment evaluation to determine mass loads and loading rates. Additional details concerning the individual elements of the analysis are contained in the following subsections.

2.3.4.1 Runoff Coefficients

Runoff coefficients are based on soils and landuse and represent the fraction of rainfall appearing as runoff. The relationship between rainfall and runoff is, however, not truly linear; thus, each unique rainfall event will have a different runoff coefficient for a given basin. During the dry season less runoff occurs because more water is required to wet the ground surface, and infiltration occurs at a faster rate. This is because there is less soil moisture. Runoff will occur on a pervious surface only if the rainfall rate exceeds the soil infiltration rate. Infiltration rates are lower when the ground is wet and become equal to zero when the ground is saturated.

The runoff coefficients developed for the Stevenson Creek Watershed are intended to represent the fraction of rainfall appearing as runoff for an average year. The vast majority of published runoff coefficients are intended for use in the Rational Formula for peak discharge rate estimation as opposed to runoff volume estimation.



Stevenson Creek Watershed Management Plan Final Report

While, by definition, there is no difference between these two types of runoff coefficients (peak rate or flow volume), runoff coefficients used in the Rational formula generally have factors of safety built in. For this reason the runoff coefficients developed for the Stevenson Creek Watershed are generally lower than published runoff coefficients.

The overall runoff coefficients for the monitored basin are 0.29 for the Stevenson Creek Station and 0.27 for the Spring Branch Station. These overall coefficients were calculated using the overall storm event runoff coefficients (Table 2.3-3) for the monitoring period and the overall runoff coefficient for a September 17, 2000 event. Assuming that, in an average year, 60% of the total rainfall depth occurs during the four wet months (June, July, August, and September), the overall coefficients were weighted 60-40 between the “typical wet season event” (September 17, 2000) and the overall monitoring period coefficients. Runoff coefficients developed for this project are shown in Table 2.3-13.

Runoff coefficients for each unique soil-landuse combination were then developed. The weighted average of these coefficients match the calculated overall runoff coefficients which, in turn, are based on the monitoring data; thus, the runoff coefficients are, in a sense, calibrated. Obviously, runoff coefficients for soils/landuse combinations that are well represented in the monitored basins will be more accurate than combinations that are not well represented.

2.3.4.2 Event Mean Concentrations

An EMC is the concentration that has a 50% probability of being exceeded during a storm event; thus, over the course of time, half of the storms will produce concentrations higher than the EMC and half of the storms will produce concentrations lower than the EMC.

Landuse-based EMCs were developed based on a two-step process. In the first step, in-stream EMCs and runoff coefficients were developed using the monitoring data;



**Table 2.3-13
Stevenson Creek Watershed Runoff Coefficients**

| Landuse | Soil | RC |
|----------------------------|-------|-------|
| Agricultural | A | 0.075 |
| | B/D | 0.104 |
| | C | 0.133 |
| | D | 0.154 |
| | UND | 0.098 |
| Commercial | A | 0.421 |
| | B/D | 0.439 |
| | C | 0.457 |
| | D | 0.469 |
| | W | 1.000 |
| High Density Residential | A | 0.421 |
| | B | 0.439 |
| | B/D | 0.448 |
| | C | 0.457 |
| | D | 0.469 |
| Highway/Utility | A | 0.347 |
| | B/D | 0.367 |
| | C | 0.387 |
| | D | 0.402 |
| | UND | 0.363 |
| Industrial | A | 0.347 |
| | B/D | 0.367 |
| | C | 0.387 |
| | D | 0.402 |
| | W | 1.000 |
| Institutional | A | 0.298 |
| | B/D | 0.319 |
| | C | 0.341 |
| | D | 0.357 |
| | W | 1.000 |
| Low Density Residential | A | 0.100 |
| | B/D | 0.128 |
| | C | 0.156 |
| | D | 0.177 |
| | W | 1.000 |
| Medium Density Residential | A | 0.149 |
| | B | 0.176 |
| | B/D | 0.189 |
| | C | 0.202 |
| | D | 0.222 |
| | UND | 0.170 |
| W | 1.000 | |

| Landuse | Soil | RC |
|----------------------|------|-------|
| Open Land | A | 0.075 |
| | B | 0.104 |
| | B/D | 0.119 |
| | C | 0.133 |
| | D | 0.154 |
| | W | 1.000 |
| Recreational | A | 0.124 |
| | B/D | 0.152 |
| | C | 0.179 |
| | D | 0.199 |
| | UND | 0.146 |
| Upland Forest | W | 1.000 |
| | A | 0.050 |
| | B/D | 0.080 |
| Water | C | 0.110 |
| | D | 0.132 |
| | W | 1.000 |
| | A | 1.000 |
| | B | 1.000 |
| Wetland Forest | B/D | 1.000 |
| | C | 1.000 |
| | D | 1.000 |
| | W | 1.000 |
| | B/D | 0.046 |
| Wetland Non-Forested | C | 0.110 |
| | D | 0.132 |
| | W | 1.000 |
| | W | 1.000 |



subsequently, the in-stream EMCs were used to develop landuse-based EMCs. The process used to develop EMCs for this project is described in the following three subsections.

2.3.4.2.1 In-stream EMCs

Statistical analyses were conducted using the storm event monitoring data to develop the in-stream EMCs. EMCs are commonly assumed to follow a lognormal distribution. A normal distribution is the familiar bell-shaped curve. The lognormal distribution is similarly shaped; however, it is the natural log of the data that is distributed symmetrically about the mean rather than the data itself. Studies¹ have shown that a lognormal distribution best represents EMCs. Lognormal distributions are used for many applications when the sample size is relatively small and variations between individual measurements are extreme. As the sample size increases the mean calculated using a lognormal distribution will approach the arithmetic mean.

**Table 2.3-14
In-Stream EMCs**

| Parameter | Spring Branch EMC (mg/l) | Stevenson Creek EMC (mg/l) |
|------------------|---------------------------------|-----------------------------------|
| Pb | 0.006 | 0.004 |
| Zn | 0.079 | 0.030 |
| BOD5 | 15.350 | 12.190 |
| TSS | 25.129 | 18.260 |
| TP | 0.452 | 0.310 |
| TN | 1.412 | 1.310 |

In-stream EMCs for the Stevenson Creek and Spring Branch Stations are shown in Table 2.3-14.

2.3.4.2.2 Existing Stormwater Runoff Treatment

Existing stormwater treatment areas are present in the Stevenson Creek Watershed. These treatment areas consist of permitted dry retention and wet detention pond as well as natural lakes and man-made depressional storage areas. The general locations of these treatment areas are shown on [Figure 2.3-11](#) inside the subbasin in which they are contained. Assumptions used in this evaluation of existing treatment are as follows:

Figure 2.3-11

Existing Stormwater Treatment Areas



- **Treatment depth.** Permitted stormwater treatment areas are assumed to provide one inch of treatment for wet detention areas and one-half inch of treatment for dry retention areas. This is consistent with SWFWMD and City of Clearwater design criteria for stormwater treatment areas. Lakes and other “natural” BMPs are assumed to provide a maximum treatment depth of one inch adjusted downward based on the ratio of the BMP area to the tributary basin. This results in a treatment depth range of 0.01 to 1 inch. BMP efficiencies equal to one-half those for wet detention were applied and adjusted by the estimated treatment depth.
- **Treatment Coverage.** Water is treated only once. In other words water from a BMP (BMP A) which drains to a downstream basin that also contains a BMP (BMP B) is not treated again in BMP B. This assumption simplified the analysis and is rational for a number of reasons. First, most permitted BMPs do not receive runoff from offsite basins and, instead, drain directly to the primary storm sewer system. Second, BMPs in-line to the main storm sewer system will fill with water from the nearest areas first. Subsequent flows will either bypass treatment or reduce the treatment efficiency; therefore, it is reasonable to assume that these flows will not be treated. Treatment coverage is illustrated on [Figure 2.3-12](#).

BMP efficiencies (Table 2.3-15) are based on literature values and adjusted for agreement with measurements taken during the monitoring program.

**Table 2.3-15
BMP Maximum Efficiencies**

| Parameter | Wet Detention | Dry Retention | Natural Treatment |
|-----------|---------------|---------------|-------------------|
| Pb | 75% | 80% | 0.38 |
| Zn | 60% | 80% | 0.3 |
| BOD5 | 50% | 80% | 0.25 |
| TSS | 75% | 80% | 0.38 |
| TP | 60% | 80% | 0.3 |
| TN | 30% | 80% | 0.15 |

Figure 2.3-12
Treatment Coverage



2.3.4.2.3 Landuse-Based EMCs

Landuse-based EMCs were developed based on the measured in-stream EMCs. The process used to develop EMCs was to vary estimates of landuse-based EMCs until agreement with recorded data as well as agreement between the two monitoring stations was achieved. This process was performed mindful of literature values of EMCs so that individual EMC values were not assigned outside of a reasonable range.

The results agree well with the recorded data at the Stevenson Creek Station; however, lead, zinc, BOD and TSS estimates agree less well with measured values at the Spring Branch Station. Obviously, land use variation alone cannot precisely account for variations in water quality from one location to the next; nevertheless, landuse-based EMCs can provide good wash-off quality estimates- both the strengths and the shortcomings of landuse-based EMCs are apparent in the Stevenson Creek Watershed water quality monitoring data.

EMC combinations that “made the numbers work” were found for lead, zinc, BOD, and TSS; however, these EMC combinations produced EMC values that were not reasonable for the land uses. The “true EMC” may not have been measured because of the limited number of samples that were collected. Another possible explanation for the difference is sediment re-suspension in Byrum Sump. The Spring Branch Station is located just downstream of Byrum Sump and it is likely that re-suspended sediments made up significant portions of the samples at this location. This would explain the elevated TSS levels as well as lead and zinc levels. There is normally a correlation between TSS and metals concentrations in stormwater runoff; furthermore, since lead and zinc tend to accumulate in sediments, higher levels could be expected in storm flow as well as base flow.

The landuse-based EMCs are presented in Table 2.3-16 along with the percent variation from measured values at each station. Table 2.3-17 provides a listing of some of the literature values used for reference in this study.

**Table 2.3-16
Landuse-Based EMCs for Stevenson Creek Watershed¹**

| LAND USE | Pb | Zn | BOD₅ | TSS | TP | TN |
|----------------------------|-----------|-----------|------------------------|------------|-----------|-----------|
| Agricultural | 0.004 | 0.029 | 15.36 | 27.64 | 0.96 | 1.27 |
| Commercial | 0.006 | 0.044 | 14.68 | 38.36 | 0.40 | 1.37 |
| High Density Residential | 0.013 | 0.147 | 20.49 | 51.41 | 1.14 | 2.35 |
| Highway/Utility | 0.029 | 0.138 | 20.49 | 40.80 | 0.32 | 1.35 |
| Institutional | 0.006 | 0.044 | 6.83 | 35.91 | 0.43 | 0.97 |
| Industrial | 0.004 | 0.081 | 12.29 | 51.14 | 0.43 | 1.16 |
| Low Density Residential | 0.001 | 0.009 | 11.52 | 7.75 | 0.25 | 1.14 |
| Medium Density Residential | 0.001 | 0.011 | 14.72 | 11.02 | 0.28 | 1.48 |
| Open Land | 0.001 | 0.010 | 10.67 | 5.98 | 0.10 | 0.81 |
| Recreational | 0.001 | 0.007 | 1.71 | 5.98 | 0.10 | 0.81 |
| Natural Areas | 0.001 | 0.002 | 7.68 | 2.72 | 0.18 | 1.03 |
| Water | 0.001 | 0.002 | 2.73 | 0.82 | 0.10 | 0.81 |

| Agreement with Monitoring Data² | | | | | | |
|---|-----------|-----------|------------------------|------------|-----------|-----------|
| Monitoring Station | Pb | Zn | BOD₅ | TSS | TP | TN |
| Stevenson Creek | 0% | 0% | 0% | 0% | 0% | 0% |
| Spring Branch | 32% | 43% | 21% | 24% | 11% | 1% |

¹All concentrations in mg/l

²Percent difference between measured loads and calculated loads using landuse-based EMCs.



**Table 2.3-17
Landuse-Based EMCs – Selected Literature Values¹**

| NURP Median | | | | | | |
|--------------------|--------|--------|------------------|-----|-------|-------|
| LAND USE | Pb | Zn | BOD ₅ | TSS | TP | TN |
| Residential | 0.1440 | 0.1350 | 10 | 101 | 0.383 | 2.636 |
| Mixed Urban | 0.1140 | 0.1540 | 7.8 | 67 | 0.263 | 1.846 |
| Commercial | 0.1040 | 0.2260 | 9.3 | 70 | 0.201 | 1.751 |

| Stormwater Loading Rate Parameters for Central and South Florida | | | | | | |
|---|--------|--------|------------------|-------|-------|------|
| LAND-USE | Pb | Zn | BOD ₅ | TSS | TP | TN |
| General Agricultural | - | - | 3.80 | 55.30 | 0.344 | 2.32 |
| Commercial-High Intensity | 0.2140 | 0.1700 | 17.20 | 94.00 | 0.430 | 2.83 |
| Multi-Family | 0.0870 | 0.0550 | 11.00 | 71.70 | 0.490 | 2.42 |
| Highway | 0.1890 | 0.1340 | 5.60 | 50.30 | 0.340 | 2.08 |
| Industrial | 0.2020 | 0.1220 | 9.60 | 93.90 | 0.310 | 1.79 |
| Low Density Residential | 0.0370 | 0.0320 | 4.40 | 19.10 | 0.177 | 1.77 |
| Single Family | 0.0480 | 0.0570 | 7.40 | 27.00 | 0.300 | 2.29 |
| Open Land/Recreational | 0.0250 | 0.0060 | 1.45 | 11.10 | 0.053 | 1.25 |
| Water | 0.0250 | 0.0280 | 1.60 | 3.10 | 0.110 | 1.25 |
| Wetland | 0.0250 | 0.0060 | 4.63 | 10.20 | 0.190 | 1.6 |

| Hillsborough County | | | | | | |
|--------------------------------|-------|-------|------------------|--------|-------|-------|
| LAND-USE | PB | ZN | BOD ₅ | TSS | TP | TN |
| Agricultural | 0.003 | 0.017 | 18.30 | 12.70 | 2.349 | 2.97 |
| Commercial | 0.004 | 0.026 | 2.67 | 22.92 | 0.279 | 2.032 |
| High Density Residential | 0.006 | 0.058 | 2.60 | 29.00 | 1.337 | 2.047 |
| Highway/Utility | 0.960 | 0.410 | 24.00 | 261.00 | 0.120 | 4.13 |
| Institutional | 0.004 | 0.026 | 2.67 | 22.92 | 0.279 | 2.032 |
| Light Industrial | 0.006 | 0.096 | 2.87 | 18.20 | 0.332 | 2.275 |
| Low/Medium Density Residential | 0.008 | 0.022 | 1.00 | 19.00 | 0.401 | 1.363 |
| Open Land | 0.001 | 0.006 | 3.80 | 11.10 | 0.050 | 2.598 |
| Recreational | 0.006 | 0.004 | 3.80 | 11.10 | 0.050 | 2.598 |
| Upland Forest | 0.000 | 0.000 | 0.00 | 0.00 | 0.000 | 0 |
| Water | 0.000 | 0.000 | 0.00 | 0.00 | 0.000 | 0 |
| Wetland Forest | 0.000 | 0.000 | 0.00 | 0.00 | 0.000 | 0 |
| Wetland Non-Forested | 0.000 | 0.000 | 0.00 | 0.00 | 0.000 | 0 |

¹ All concentrations in mg/l



2.3.4.3 Results

Mass loads are divided into three parts: Gross load, removed load, and net load. These three types of loads are described as follows:

- Gross Load - The mass washed off, or mass generated.
- Removed Load - The mass removed by BMPS.
- Net Load - Gross load minus removed load.

Load totals are provided on Table 2.3-18 and presented visually in terms of loading rate (lb./ac) on [Figures 2.3-13](#) through [2.3-16](#). Additional details concerning the results of the nonpoint source loading analysis are provided in [Appendix K](#).

These loading estimates are intended to represent an average year. The annual rainfall used for these calculations was 55.6 inches – this is based on the average annual rainfall depth reported by the SCS in the Pinellas County Soil Survey. According to the “constant concentration” method which was used (refer to Table 2.3.4.2), load estimates for other years (or time periods) could be made by multiplying the loads presented here by the ratio of rainfall, for the period of interest, to 55.6.

The highest load totals were calculated for the Upper Spring basin. Upper Spring basin is also the largest in terms of area; therefore, this result can be misleading. A better indicator of “hot spots” is loading rate, or pound per acre (refer to Figures 2.3-13 to 2.3-16). Reviewing the results from a loading rate perspective shows the Middle Stevenson basin to have the worst stormwater runoff quality. For example, the net load of TSS originating from Upper Spring Branch is 108,743 pounds per year, and the net TSS loading rate is 65 pounds per acre per year. For Middle Stevenson Creek the net annual load of TSS is estimated at 59,604 pounds and the net TSS loading rate is 111 pounds per acre per year – a smaller load than Upper Spring Branch but a higher loading rate. The Middle Stevenson basin has an abundance of the three factors that cause high loads – soils with low infiltration rates, intense developed land use, and lack of treatment.

**Table 2.3-18
Major Basin Loads**

| Watershed | Pb | Zn | BOD₅ | COD | TSS | TP | TN |
|---------------------------------------|------------|------------|------------------------|----------------|--------------|---------------|------------|
| Gross Load (pounds per year) | | | | | | | |
| Hammond Branch | 10 | 80 | 36,441 | 46,777 | 903 | 3,861 | 10 |
| Jeffords Street | 5 | 38 | 26,273 | 29,436 | 574 | 2,790 | 5 |
| Lake Belleview | 15 | 118 | 37,515 | 73,482 | 1,080 | 3,903 | 15 |
| Lower Spring | 4 | 36 | 17,527 | 22,031 | 451 | 1,831 | 4 |
| Lower Stevenson | 11 | 75 | 33,941 | 49,546 | 817 | 3,715 | 11 |
| Middle Stevenson | 13 | 104 | 31,534 | 61,338 | 903 | 3,172 | 13 |
| Upper Spring | 36 | 325 | 84,074 | 147,929 | 2,907 | 9,021 | 36 |
| Upper Stevenson | 6 | 49 | 26,642 | 33,141 | 633 | 2,704 | 6 |
| Total | 100 | 826 | 293,948 | 463,680 | 8,269 | 30,997 | 100 |
| Load Removed (pounds per year) | | | | | | | |
| Hammond Branch | 1 | 9 | 3,049 | 6,362 | 104 | 236 | 1 |
| Jeffords Street | 1 | 5 | 2,889 | 4,090 | 74 | 208 | 1 |
| Lake Belleview | 5 | 27 | 8,861 | 24,454 | 274 | 554 | 5 |
| Lower Spring | 1 | 8 | 2,250 | 4,379 | 78 | 188 | 1 |
| Lower Stevenson | - | - | - | - | - | - | - |
| Middle Stevenson | 0 | 2 | 678 | 1,734 | 19 | 68 | 0 |
| Upper Spring | 10 | 71 | 15,068 | 39,186 | 607 | 1,048 | 10 |
| Upper Stevenson | 1 | 6 | 1,781 | 4,936 | 48 | 101 | 1 |
| Total | 20 | 128 | 34,576 | 85,142 | 1,205 | 2,403 | 20 |
| Net Load (pounds per year) | | | | | | | |
| Hammond Branch | 9 | 71 | 33,393 | 40,415 | 799 | 3,625 | 9 |
| Jeffords Street | 4 | 34 | 23,384 | 25,345 | 500 | 2,582 | 4 |
| Lake Belleview | 10 | 90 | 28,654 | 49,028 | 807 | 3,349 | 10 |
| Lower Spring | 3 | 29 | 15,277 | 17,651 | 373 | 1,644 | 3 |
| Lower Stevenson | 11 | 75 | 33,941 | 49,546 | 817 | 3,715 | 11 |
| Middle Stevenson | 13 | 102 | 30,856 | 59,604 | 884 | 3,104 | 13 |
| Upper Spring | 25 | 254 | 69,006 | 108,743 | 2,300 | 7,974 | 25 |
| Upper Stevenson | 4 | 43 | 24,861 | 28,205 | 585 | 2,603 | 4 |
| Total | 80 | 697 | 259,372 | 378,538 | 7,064 | 28,594 | 80 |

SECTION 3.0

RECOMMENDED MASTER PLAN IMPROVEMENTS

This section of the watershed management plan describes the improvements that are recommended to address the problems identified in the previous section. The first portion of this section describes the projects recommended to address the flood protection, water quality, and erosion/sedimentation problems. Several of these projects also incorporate features to enhance the quality of wildlife habitat, and to provide the potential for recreational and educational facilities. The second portion of this section provides recommendations for maintenance of the existing and proposed stormwater infrastructure throughout the watershed. The third and fourth subsections present recommendations for public awareness/involvement and exotic plant eradication programs; and the fifth section outlines the regulatory framework governing actions related to stormwater management within City of Clearwater. The sixth and final section summarizes the capital improvement cost estimates for the recommended projects.

3.1 FLOOD PROTECTION, WATER QUALITY, NATIVE HABITAT, EROSION AND SEDIMENTATION IMPROVEMENTS

In accordance with Sections 16.3.2, 17.1.2, and 23.1.2 of the City of Clearwater Comprehensive Plan, conservation of natural drainage systems, use of natural alternatives such as natural and man-made wetlands, and the protection and improvement of the quality of receiving waters are goals of the Stevenson Creek Watershed Management Plan. These goals, together with the flood protection level of service goals identified in Section 2.1.5.3, are reflected in the recommended improvement projects as illustrated on [Figure 3.1-1](#) (located in the rear map pockets) and described in the following subsections.

Computer modeling of each project was conducted using the AdICPR model and the pollutant loading spreadsheet model developed for the existing conditions, as described in Sections 2.1 and 2.3. Various alternatives were analyzed by modifying the models to reflect an array of infrastructure improvement scenarios. In this manner, the modeling



***Stevenson Creek Watershed Management Plan
Final Report***

was used as a planning tool to optimize the flood protection and water quality benefits of the projects, while working within the constraints of cost, available right-of-way, and existing facilities and infrastructure. The relative scarcity of publicly-owned and vacant land within the watershed limited the range of available alternatives and posed a unique challenge in meeting all the goals of the Watershed Management Plan in a cost effective manner. For this reason, acquisition of private property, including 33 flood-prone or flood-susceptible single-family residential homes, is recommended in order to provide the necessary land for various infrastructure improvement projects that will benefit the watershed as a whole.

In most, but not all cases, it was considered feasible and cost-effective to achieve the adopted flood protection level of service goals. If all recommended projects are implemented, 243 of the identified 334 structure FPLOS deficiencies (73%) will be remedied. Many (28) of the remaining FPLOS deficiencies are located within the coastal high hazard area of Lower Stevenson Creek and are susceptible to flooding from storm surge. Reductions in the riverine floodplain (flooding due to rainfall and runoff) will therefore not remedy these FPLOS deficiencies. The combined projects would remove FPLOS deficiencies at 33 locations on residential streets, 16 locations on collector roads, and on one arterial road. Proposed conditions AdICPR model input and output are provided in Appendix E. Proposed conditions flood elevations and levels of service for the 10-, 25-, and 100-year design storm events are provided in Appendix F, along with a node-by-node comparison of existing and proposed 100-year flood elevations. AdICPR results are provided for Spring Branch Alternative 1 (Project 1B); results are similar for Alternative 2 (Project 1C) with identical level of service for proposed conditions. Proposed conditions flood profiles are included as [Figures 3.1-36](#) through 3.1-44 at the [end of this section](#). A comparison of the existing and project conditions 100-year floodplain limits is provided as [Figure 3.1-45](#) in the rear map pockets.

Water quality, habitat, erosion and sedimentation projects were developed individually and in conjunction with the recommended flood protection projects wherever feasible. Alternative projects were evaluated with respect to water quality improvement



***Stevenson Creek Watershed Management Plan
Final Report***

benefits. The net loads (refer to Section 2.3.4) present at each project location were calculated and BMP removal efficiencies were applied to calculate the load removed by each project.

Wet detention, percolation, and sedimentation were considered for stormwater treatment methods. These treatment methods, or BMP's, are described more specifically in Table 3.1-1, along with the maximum removal efficiencies. These efficiencies were adjusted downward based on the percentage to which the project achieved ideal conditions. For example, if a wet detention pond providing 1-inch of treatment is assumed to remove 60% of phosphorus, then a wet detention pond providing one-half-inch of treatment is assumed to remove 30% of phosphorus.

**Table 3.1-1
Maximum BMP Removal Efficiencies**

| BMP Type | Pb | Zn | BOD ₅ | TSS | TP | TN |
|--------------------------|------|------|------------------|------|------|------|
| CDS Unit | 0.5 | 0.35 | 0.3 | 0.5 | 0.25 | 0 |
| Channel Improvements | 0.2 | 0.15 | 0.1 | 0.2 | 0.15 | 0.1 |
| Percolation | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 |
| Sediment Sump | 0.7 | 0.55 | 0.1 | 0.7 | 0.25 | 0 |
| Water Quality Inlet | 0.15 | 0.05 | 0.05 | 0.35 | 0.1 | 0 |
| Wet Detention (1-inch) | 0.75 | 0.6 | 0.5 | 0.75 | 0.6 | 0.3 |
| Wet Detention (2-inches) | 0.24 | 0.8 | 0.6 | 0.9 | 0.75 | 0.45 |

The alternative projects are listed along with the type of BMP proposed, loads present at BMP site, and the estimated load removed, in [Table 3.1-2](#).

Descriptions and conceptual schematic plans of these improvements are provided in the following subsections.



*Stevenson Creek Watershed Management Plan
Final Report*

[\(TABLE 3.1-2\)](#)



*Stevenson Creek Watershed Management Plan
Final Report*

3.1.1 Subwatershed 1: Spring Branch

Project 1A. Spring Branch Conveyance Enhancements. In order to address the 27 structure FPLOS deficiencies in the area of Byram Drive and Flora Drive between King's Highway and Highland Avenue, and along Huntington Lane, east of King's Highway, various enhancements to the conveyance capacity of the existing Spring Branch system are proposed. These enhancements include widening approximately 700 linear feet of the Spring Branch Channel downstream of King's Highway. This section of channel was constructed with high, steep, and unstable banks that are now nearly vertical in places due to soil erosion. The recommended project is to reshape the banks to a 4:1 (horizontal to vertical) side slope, providing additional cross sectional area for conveyance of flood flows, and providing a more stable bank configuration that would support vegetation. The bottom width and bottom elevations of the channel would remain essentially unchanged, with the exception that low, sloping walls (2.5'-3' high) constructed of gabion baskets or a cellular confinement system such as Geoweb (or equivalent) would be constructed to reduce bank erosion. The project would also include a maintenance travelway that would normally be dry but would be submerged for brief periods during major flood events. To accommodate the widened cross section, approximately 50' of additional easement width would be required adjacent to the existing 50' easement for Spring Branch extending from King's Highway downstream to the City Limits (refer to Figure 3.1-3).

Some planting of native vegetation will be undertaken for this project. Where possible, trees will be planted along the banks of the channel to eventually provide shade and reduce erosion. The shade will reduce maintenance requirements significantly because most nuisance exotic species require full sun for exponential growth. Trees recommended for the upper banks in this area are dahoon holly, southern magnolia, and eastern red cedar. These evergreen trees will not contribute as much litter to the channel as deciduous trees.



***Stevenson Creek Watershed Management Plan
Final Report***

The understory on the banks and on the slopes above the normal water elevation may be planted with Florida coontie and Virginia chain fern. Both species will tolerate full sun but can adapt to full shade as the trees mature. Another species recommended for the upper banks is cord grass. This grass forms dense clumps that will prevent bank erosion and filter runoff from the adjacent residential areas. The area around the planted vegetation may be sodded with bahia grass for temporary stabilization.

Planting in the channel at and below the normal water elevation may occur in areas where lining the channel with gabions or other bank armaments is not required. For these areas sturdy species that will withstand occasional floodwaters are recommended. Such species include bulrush, pickerelweed, and soft rush. These plants will not only provide erosion protection, they will also improve water quality during periods of low flow. The scientific names and planting depths of the recommended plants are provided in [Table 3.1-3](#).

In addition to the channel improvements, the project includes removal of a private driveway crossing of Spring Branch between Sunset Point Road and Betty Lane, within unincorporated Pinellas County (See Figure 3.1-2). This crossing consists of a 92" x 152" CMP arch culvert, which severely restricts the flow for major storm events. As evidenced in the Spring Branch flood profile ([Figure 2.1-22](#)), this structure causes 3.4 feet of head loss for the 100-year storm. Although the culvert under Betty Lane is the same size, Betty Lane itself is much lower than the private crossing, so floodwaters are allowed to overtop the road during major events. The purpose of this private driveway is unclear, as the property served by it has access from Macomber Avenue. This culvert would have to be removed prior to implementing the channel improvements described above. Removal of this culvert would also reduce flooding for the estimated 10-15 flood-susceptible homes along Betty Lane and Macomber Avenue within unincorporated Pinellas County.



*Stevenson Creek Watershed Management Plan
Final Report*

[\(TABLE 3.1-3\)](#)





**Figure 3.1-2. Private Crossing of Spring Branch Near Betty Lane
(to be Removed)**

In order to provide flood relief for the areas east of Highland Avenue, Project 1A also includes the upsizing of approximately 3,300 feet of storm sewer near Highland Avenue and Byram Drive. The Project 1A.1 and 1A.2 conveyance improvements would work together to remove the 100-year flood risk from 21 homes east of King’s Highway. This total does not include the estimated 10-15 homes in unincorporated Pinellas County. Because Project 1A would increase the discharge rates to downstream areas, this project will require construction of either Project 1B (alternative 1) or Project 1C (alternative 2) in order to offset potential downstream flooding impacts. Projects 1A.1 and 1A.2 are illustrated on [Figures 3.1-3](#) and [3.1-4](#), respectively.

Project 1B. Springtime Avenue and Douglas Avenue Bridges. In order to offset the potential downstream flooding impacts of Project 1A, the bridges at Springtime Avenue and Douglas Avenue over Spring Branch could be enlarged (refer to [Figure 3.1-5](#)). This alternative would allow the excess food flows to be safely conveyed to the Stevenson Creek estuary. The existing crossings consist of a 6’ x 15’ concrete arch at Springtime

***Stevenson Creek Watershed Management Plan
Final Report***

Avenue, and twin 7' x 8' box culverts at Douglas Avenue. The recommended pipe sizes are twin 9' x 12' box culverts (or equivalent) at both locations. This alternative would rely on the planned dredging of sediment from Edgewater Drive Bridge, as part of the Stevenson Creek Estuary Restoration Project, in order to avoid increases in flood elevations within the estuary.

Project 1C. Spring Branch Flood Detention Basin. As an alternative to Project 1B, a stormwater detention basin could be constructed downstream of the proposed channel improvements. This detention basin would provide storage and attenuation of the excess floodwaters, which could then be safely conveyed by the existing downstream system. This new facility would provide over 0.1-inches of treatment for the Spring Branch subwatershed removing an estimated 9,950 pounds of suspended solids and 290 pounds of nitrogen on an annual average basis. As illustrated on [Figure 3.1-6](#), the recommended improvements consist of a three-acre expansion of the existing Pinellas County mitigation area and construction of an eight-acre flood detention facility on vacant property owned by the Pinellas County School Board.

A discharge control weir would be constructed upstream of Betty Lane at elevation 5.5' NGVD, and a diversion weir would be constructed near the downstream end of Project 1A, at elevation 6.5', to divert a portion of the flow from Spring Branch into the facility where it would be treated and attenuated. The total area of the facility would be approximately 11 acres, and would require acquisition of a 4-acre parcel from Sunset Point Baptist Church, and acquisition of approximately 8-10 acres of property from the School Board. The project provides a significant opportunity for wetland habitat creation and water quality improvements.

The existing mitigation area on the north side of Sunset Point Road could be graded on the east side to extend the wetland into the existing church recreation area. This wetland would be connected via a culvert to another created wetland on the School Board property on the southern side of Sunset Point Road.



*Stevenson Creek Watershed Management Plan
Final Report*

[\(FIGURE 3.1-3\)](#)



*Stevenson Creek Watershed Management Plan
Final Report*

[\(FIGURE 3.1-4\)](#)



*Stevenson Creek Watershed Management Plan
Final Report*

[\(FIGURE 3.1-5\)](#)



*Stevenson Creek Watershed Management Plan
Final Report*

[\(FIGURE 3.1-6\)](#)



*Stevenson Creek Watershed Management Plan
Final Report*



Figure 3.1-7. This photograph shows the area on the south side of Sunset Point Road that could be excavated to create the stormwater detention facility.

The majority of the created wetland will consist of a shallow littoral shelf that would be planted with pickerelweed, soft rush, arrowhead, water lily, and other wetland species. [Table 3.1-3](#) provides a list of suitable wetland species and their planting depths. A shallow channel would meander through the center of the wetland, as shown in [Figure 3.1-6](#). It is recommended that trees be planted around the perimeter of the wetlands to screen the area from adjacent land uses. Recommended trees are pond cypress, red maple, and pop ash in the wetland and laurel and live oak at the top of bank. The wetland vegetation would provide water quality treatment and wildlife habitat in a very depauperate area.

Project 1D. Woodland Terrace Storm Sewer Replacement. As illustrated on [Figure 3.1-8](#), this project involves upsizing approximately 1,300' of 24" diameter storm sewer along Woodland Terrace, from Oakdale Way to Shore Drive, with 42" RCP storm sewer.



***Stevenson Creek Watershed Management Plan
Final Report***

The project will eliminate the four structure FPLOS deficiencies near Woodlawn Terrace and Oakdale Way, and may incorporate water quality inlets and / or CDS units for stormwater treatment.

Project 1E. Byram Pond Dredging and Expansion. Byram Pond is located in-line with Spring Branch immediately east of King's Highway. Since the small pond is in-line with the channel, it is a natural place for sediments to settle out of the water column and accumulate. The City desires to have the ability to regularly dredge the accumulated sediments from the pond. However, concerns over access and possible impacts to surface water quality have prevented the dredging from taking place. In order to provide an equipment access and staging area, removal of three (3) flood-susceptible homes adjacent to Byram Pond is proposed. The location of the proposed expansion and/or staging and de-watering area is illustrated on [Figure 3.1-9](#).

Project 1F. Spring Branch Stabilization, Union Street to Byram Pond. Extremely steep banks and lack of access for equipment create difficulties in maintaining the portion of the main Spring Branch channel that extends from Union Street, south to the Byram Pond. As illustrated on [Figure 3.1-10](#), the proposed improvements consist of reshaping the banks to a stable configuration and constructing a maintenance travelway within the existing 65' drainage easement. The improvements would require the construction of 4' high retaining walls on either side of a 10' wide earth-bottom channel which would convey the majority of storm events. Flood events would be allowed to occupy the upper portions of the cross section including the maintenance travelway. As an alternative, an 11' x 7' box culvert could be constructed within the existing ditch at approximately the same cost and hydraulic efficiency. However, the box culvert alternative could be expected to result in much lower long-term maintenance costs. Although this would require wetland mitigation, Project 1C could potentially be used for that purpose.



***Stevenson Creek Watershed Management Plan
Final Report***

Project 1G. Clearview Lake. As illustrated on [Figure 3.1-11](#), this project includes construction of approximately 3,000' of 18" to 66" storm sewer with inlets in order to provide drainage for, and divert runoff from, approximately 20 acres into Clearview Lake. In addition to providing stormwater treatment for the currently untreated runoff from the 20 acres, this diversion will decrease the load on the downstream storm sewer system by utilizing excess storage capacity within Clearview Lake. In addition, an outfall control structure would be constructed on the lake in order to increase residence time for small storm events, providing additional water quality benefits for the runoff that currently enters the lake. This project will remedy a collector road flooding level of service deficiency at Highland Avenue and Sunset Point, while providing wet detention stormwater treatment for a total of 52 acres.

Project 1H. Betty Lane Forested Habitat Preservation Site. Approximately 1200 feet of Spring Branch maintains a remnant of riparian habitat and a somewhat natural profile. Adjacent to the north side of the stream is a forested area that although disturbed by draining and some clearing, has not yet been developed. This forested upland area is approximately 25 acres and is located in the northeast quadrant of the intersection of Sunset Point Road and Betty Lane (refer to [Figure 3.1-12](#)).

Despite the impacted condition of the parcel, it currently provides the only existing wildlife habitat of any substantial size within the watershed. Discussions with City staff indicate that residential development may be pending on portions of the site, despite the fact that the majority of the property lies within the 100-year floodplain of Spring Branch (refer to [Figure 2.1-15](#)). Approximately six acres of this property is under City ownership and will be used as a park site. If, however, more of the site could be preserved in a natural state through purchase of additional privately owned property, it would have the potential to become locally significant wildlife habitat, floodplain preservation, and neighborhood recreational area. The site would need to be cleaned up, and all nuisance vegetation and trash removed. If the site were to become a passive park, fencing the site would be essential.



*Stevenson Creek Watershed Management Plan
Final Report*

[\(FIGURE 3.1-8\)](#)



*Stevenson Creek Watershed Management Plan
Final Report*

[\(FIGURE 3.1-9\)](#)



*Stevenson Creek Watershed Management Plan
Final Report*

[\(FIGURE 3.1-10\)](#)



*Stevenson Creek Watershed Management Plan
Final Report*

(FIGURE 3.1-11)



*Stevenson Creek Watershed Management Plan
Final Report*

[\(FIGURE 3.1-12\)](#)



***Stevenson Creek Watershed Management Plan
Final Report***

3.1.2 Subwatershed 2: Lower Stevenson Creek

Project 2A. Palmetto Street Sediment Sump. As part of the Stevenson Creek Phase 1 improvements, a small sediment sump was created south of Palmetto Street, within the Clearwater Country Club Golf Course. Since its completion, the sump has rapidly filled with sediment resulting in, on at least one occasion, the migration of sediment downstream of the low control weir. Although the City routinely removes sediment from the sump, this operation requires closing of a portion of the golf course.

Creation of an expanded sedimentation basin north of Palmetto Street on Stevenson Creek would provide improved equipment access and staging areas, and a less frequent maintenance interval than the existing sump. The proposed 60' x 350' sump, as illustrated on [Figure 3.1-13](#), is designed to have an average maintained bottom elevation of -4.5' NGVD. A low weir would be constructed at elevation 1.5' NGVD at the downstream end of the project in order to trap the sediment. Dredging would be required when the average bottom elevation reaches -3.5' NGVD, at which point an average of 2' of sediment over the bottom would be removed (allowing one foot of overdredging). The capacity of the sump with two feet of sedimentation between elevations -5.5 and -3.5 is approximately 1,550 cubic yards (bank measure). Maintenance dredging of the sump would be recommended annually, or as needed based on actual rates of accumulation. Construction of the sump would require the acquisition of an existing residential property on Palmetto Street to create an access drive from the Street. The property to be acquired is currently a structure FPLoS deficiency. Acquisition of additional drainage/access easements would be required from three properties on Betty Lane that front the Creek.

As the City of Clearwater continues to search for ways to improve water quality, wildlife habitat, and aesthetics in the community, they have been receptive to comments and suggestions from the experts at state and local environmental agencies, as well as from the Pinellas County Department of Environmental Management. It has been suggested by some of these experts that this proposed sump be planted with wetland species to the greatest extent possible. This will be a challenge due to the spatial



***Stevenson Creek Watershed Management Plan
Final Report***

requirements needed for the maintenance equipment, but the proposed conceptual design would allow some plantings of wetland species in the area near the outfall. Plants proposed for this area will include species tolerant of a wide range in salinity, such as bulrush, black rush, red and black mangrove, and leather fern. Also proposed are trees such as cypress and red maple at the toe of slope in areas that will not interfere with the maintenance equipment. [Table 3.1-3](#) lists the scientific names of the recommended plants and planting depths.

Project 2B. North Missouri Avenue and Palmetto Street Drainage Improvements. In order to remedy street FPLOS deficiencies at North Missouri Avenue and Seminole Street, upsizing of approximately 1,450 feet of existing 42” and 54” storm drain to 60” RCP is proposed (refer to [Figure 3.1-14](#)). As an alternative to constructing a portion of the 60” culvert, approximately 860 feet of 36” RCP culvert could be installed parallel to the existing 54” pipe on the opposite side of Palmetto Street.

This project will incorporate water quality improvements as part of the City’s North Greenwood Demonstration Project, in which CDS units will be installed within the storm piping systems near North Missouri Avenue and Palmetto Street, and near Pennsylvania Avenue and Grant Street. CDS units are devices that can be installed underground within new or existing storm sewer systems to remove sediment and floatable debris from the stormwater runoff stream. Together, these two units are expected to remove an estimated 2,320 pounds of suspended solids on an annual average basis. As part of the North Greenwood Demonstration Project currently underway, the stormwater quality of the inflow and outflow streams will be monitored and evaluated to assess the efficiency of the CDS units. In addition, 192 feet of the proposed 60” RCP will be installed as part of the North Greenwood Project.

Project 2C. Installation of Additional CDS Units. In addition to the CDS units installed as part of the North Greenwood Demonstration Project, other CDS units could be installed at strategic outfall locations within the Lower Stevenson Creek



***Stevenson Creek Watershed Management Plan
Final Report***

Subwatershed. This project would reduce the loading of sediments, floatable debris, and other pollutants from stormwater runoff prior to entering the Stevenson Creek Estuary. Potential locations for these additional units are located on [Figure 3.1-1](#).

Project 2D. Overbrook Avenue Detention Pond. In order to remedy street FPLOS deficiencies on Rollen Road at Parkwood Street and Terrace Road, and to provide stormwater treatment and attenuation for currently untreated runoff from 78 acres, creation of a four-acre stormwater detention pond is proposed. This new facility would provide over 0.8-inches of treatment removing an estimated 3,320 pounds of suspended solids on an annual average basis. As illustrated on [Figure 3.1-15](#), the pond would be constructed at the site of an existing auto-salvage facility southwest of Betty Lane and Overbrook Road, which has also been identified as a possible dredge material de-watering area for the Stevenson Creek Estuary Restoration Project. The detention pond would be constructed following completion of the dredging, spoil de-watering, and spoil material final disposal. In addition to the flood protection and water quality benefits, this project will remove a potential source of pollution and incompatible riparian land use adjacent to Stevenson Creek. However, prior to final determination of the feasibility of this project, testing and evaluation of the soil underneath the existing auto salvage facility is recommended.

The vacant site adjacent to the west side of the salvage yard could be incorporated into the stormwater facility created on the salvage yard, or could be converted into riparian habitat. The mangrove areas along the shoreline and in the western portion of the site should be cleaned up by removing trash and Brazilian pepper. The upland areas could be dredged and turned into additional mangrove and salt marsh habitat. This area could be developed into a passive use park with a canoe launch area and a boardwalk through the mangroves with an observation deck overlooking the creek.



*Stevenson Creek Watershed Management Plan
Final Report*



Figure 3.1-16. This photograph shows the nuisance vegetation and trash on the 9-acre vacant land parcel adjacent to the west side of the auto salvage.

Plantings in the proposed stormwater treatment facility may include pickerelweed, bulrush, soft rush, arrowhead, alligator flag, cord grass, saw grass, and other freshwater species listed in [Table 3.1-3](#). If the vacant land is developed into a salt marsh/mangrove combination habitat area, species planted should include black mangrove, red mangrove, buttonwood, black rush, and other species tolerant of brackish water. [Figure 3.1-15](#) depicts the conceptual design for the proposed stormwater facility and estuarine habitat.

Stevenson Creek Estuary Restoration Plan. The sedimentation of the Stevenson Creek Estuary has been identified as a primary concern for the City of Clearwater. The deposition of sediments over the years has reduced flow, impacted water quality, and degraded wildlife habitat. In addition, the residents in the area have reported foul odors when the sediments are exposed to the air.

The Stevenson Creek Estuary is located within an area of the City that has been designated as a “Brownfield”. Brownfield areas, as defined by the Environmental

***Stevenson Creek Watershed Management Plan
Final Report***

Protection Agency (EPA), are abandoned, idled, or underused industrial and commercial areas where expansion or redevelopment is complicated by real or perceived environmental contamination. The EPA's Brownfield Initiative is intended to empower states, municipalities, and other stakeholders to work together to determine the optimal way to assess, safely cleanup, and develop brownfields for sustainable uses that would improve the community. The Stevenson Creek Estuary area was chosen as a pilot project for the Brownfields Assessment Program, and the City of Clearwater is working with the U.S. Army Corps of Engineers (USACE) to develop a preliminary plan and feasibility study for the restoration project. If the project is deemed feasible by the USACE, the project could qualify for federal funding of up to 65% of the total cost of project implementation. The City is also working with the FDEP, the SWFWMD, Pinellas County, and local residents to promote awareness and solicit input regarding the project.

The proposed project includes a plan to dredge the estuary between the Douglas Avenue Bridge and the North Fort Harrison Bridge. As previously stated, dredging under the North Fort Harrison Bridge is a necessary precursor to Project 1B, and will improve both tidal circulation and flood flows in the estuary. The dredging will remove approximately 80,000 cubic yards of sediment and deposit it on an undeveloped parcel adjacent to the auto salvage yard, and potentially on the salvage yard site as well. The spoil will be allowed to de-water in this location and then will either be used as cover at a local landfill, or deposited on a nearby vacant parcel. The City intends to use the dredge material disposal site as a public park eventually, with a canoe launch, boardwalk, and other amenities. During the dredging, nuisance vegetation such as Brazilian pepper and cattail will be removed. Upon completion of the dredging, the banks of the creek will be planted with native vegetation such as mangroves, black rush, giant leather leaf ferns, and other species tolerant of salt or brackish water.

Although analysis of the Estuary Restoration Plan is the beyond the scope of this report, it is being developed in conjunction with this Watershed Management Plan and is considered to be a key component of the Plan. Many of the projects recommended herein



*Stevenson Creek Watershed Management Plan
Final Report*

would reduce sediment and pollutant loading to the estuary, with the intent of ensuring the future environmental and physical integrity of the estuary once it has been restored.

[\(FIGURE 3.1-13\)](#)



*Stevenson Creek Watershed Management Plan
Final Report*

[\(FIGURE 3.1-14\)](#)



*Stevenson Creek Watershed Management Plan
Final Report*

[\(FIGURE 3.1-15\)](#)



***Stevenson Creek Watershed Management Plan
Final Report***

3.1.3 Subwatershed 3: Middle Stevenson Creek

Project 3A. Glen Oaks Stormwater Detention Facility. A major stormwater infrastructure project is needed in the Middle Stevenson Creek Subwatershed in order to address the severe flooding and water quality level of service deficiencies documented within the Lower and Middle Stevenson Creek Subwatersheds. As discussed in Section 2.1.5.4, a total of 49 structures consisting of 105 ground-floor dwelling units along the banks of Middle Stevenson Creek are identified to be subject to inundation from the 100-year design flood. In addition, there have been numerous documented water quality and sedimentation problems in the downstream creek and estuary, due in large part to the contribution of untreated runoff from areas upstream of Glen Oaks. The parcel of land containing Glen Oaks Golf Club was chosen as a potential capital improvement project site due to the following factors:

- The parcel is strategically located on Stevenson Creek immediately adjacent to the most severe flooding problem area in the subwatershed,
- There are no vacant properties in the area that are large enough to provide benefits on a scale commensurate with the scale of the problems, and
- The parcel is currently under City ownership.

The recommended project would entail conversion of almost the entire parcel into a multi-purpose flood detention, stormwater treatment, wildlife habitat and recreational facility. Alternatives to this plan were considered that would provide some flood protection and water quality benefits, while allowing the existing golf course to remain in service. However, these alternatives would provide only a fraction of the benefits needed to alleviate the majority of the level of service deficiencies in the area, and would likely have a negative impact the functioning of the golf course due to poor drainage and increased frequency of flooding.

As shown conceptually in [Figures 3.1-17](#) and [3.1-18](#), the facility would consist of two separate ponds. The western portion of the site would be converted into a 13-acre wet pond on-line with Stevenson Creek. A weir structure with a bleed-down orifice located just south of the Court Street box culverts would control the normal water level at



***Stevenson Creek Watershed Management Plan
Final Report***

elevation 14.0 ft NGVD, or four feet above the existing channel bottom. A wide concrete overflow weir would be constructed at the same location at elevation 15.25, allowing the water level to fluctuate between elevations 14.0 and 15.25 during the wet season. This pond would provide improved conveyance of flood flows through the area, while at the same time attenuating peak discharge rates in the Creek. A net increase of 78 acre-feet of available floodplain storage would be created at the proposed 100-year flood elevation. The pond could be designed with both shallow and deep zones for maximum water quality benefits. Wetland plantings would be introduced into the shallow zones, with the deep zones acting as sediment sumps.

In the northeast portion of the property, a 4-acre pond would be constructed which would capture, treat, and attenuate the currently untreated runoff from approximately 50 acres of residential and commercial land uses. The 100-year peak discharge rate from the contributing area would be reduced from over 300 cfs to approximately 20 cfs. The pond could be designed as a dry pond with a bottom elevation of 25.0 ft NGVD, although additional investigation is needed in order to determine whether this site would support a dry pond. The alternative would be a wet pond with a control orifice at elevation 25.0.

The flood protection benefits of this project would be to remove the risk of flooding from 33 out of the 49 identified flood-susceptible structures (78 out of 104 dwelling units) from floods up to and including the 100-year design event. For 14 of the remaining flood susceptible structures in the Middle Stevenson Subwatershed, the frequency of flooding would be reduced from every 5 to 25 years to every 50 to 100 years. In addition, four out of the five residential street FPLOS deficiencies in the subwatershed would be eliminated. These streets are Pierce Street, Franklin Street, Betty Lane, and Mark Drive. Also, 100-year flood depths would be reduced by more than 1.7' on Cleveland Street (S.R. 60), currently a hurricane evacuation route.

The water quality benefits of this plan would include 100% treatment (retention) of runoff from the 50 acres draining to the northeastern pond, and partial, yet substantial treatment of runoff from the remaining 1,193 acres which drain directly to Stevenson



***Stevenson Creek Watershed Management Plan
Final Report***

Creek at the Glen Oaks parcel. Based on the pond surface area available, and assuming a maximum fluctuation depth of 15 inches, the on-line pond could provide wet detention for ½” of runoff from the directly connected impervious surfaces contained within the 1,193 acres. This is approximately equivalent to the runoff generated from a 0.6” rainfall over the entire contributing area. The project is expected to remove an estimated 16,500 pounds of suspended solids and 560 pounds of nitrogen on an annual average basis. The Glen Oaks treatment pond would be designed to function, in conjunction with the modified Lake Belleview system and the modified lakes upstream of Jeffords street ditch, as a “cascading pond” treatment system (refer to Sections 3.1.6 and 3.1.7). The upstream lake outfall structures would be designed to create substantially longer residence times than would exist in the Glen Oaks pond, to ensure that the residence time in the downstream pond would not be compromised by the contribution of treated discharge from the upstream ponds.

In addition to the flood protection and water quality benefits, the Glen Oaks facility would provide up to seven acres of new wetland habitat. The wetland would be planted with species such as pickerelweed, arrowhead, alligator flag, soft rush, cord grass, yellow canna, saw grass, string lily, prairie iris, water lily, spatterdock, cypress, red maple, dahoon holly, water hickory, buttonbush, and Virginia willow (refer to Table 3.1-3). This site could therefore serve as a mitigation bank to provide compensation for wetland impacts for this and other City of Clearwater capital improvement projects.

Due to variations in topography, approximately six acres of upland area is unusable as part of the stormwater facility. This remaining property would be suitable for use as either a passive or an active recreational facility. Active recreational facilities could include soccer fields, which are currently in short supply throughout the City. Alternatively, creation of upland habitat in this area would enhance the value of the wetland habitat and provide a buffer against the adjacent residential areas. If this area is converted to passive recreation and wildlife habitat, some landscaping will be required. Trees planted should include holly, southern magnolia, live oak, laurel oak, and cabbage palm. Understory plantings may include saw palmetto, wax myrtle, and gallberry.



*Stevenson Creek Watershed Management Plan
Final Report*

[\(FIGURE 3.1-17\)](#)



*Stevenson Creek Watershed Management Plan
Final Report*

[\(FIGURE 3.1-18\)](#)



*Stevenson Creek Watershed Management Plan
Final Report*

3.1.4 Subwatershed 4: Upper Stevenson Creek

Upper Stevenson Creek encompasses the portion of the Creek targeted for conveyance improvements in Phase 3 of the 1988 W.K. Daugherty study. This phase was never constructed, primarily due to environmental concerns raised over the proposed improvement method of hardlining (paving) the channel with concrete. Because of this project history, hardlining this section of the creek was eliminated as an alternative without further study in the Stevenson Creek Watershed Management Plan. Instead, various alternatives are proposed to solve the flood control and erosion problems within Upper Stevenson Creek.

Project 4A. Hillcrest Avenue Overflow Bypass Culvert. In order to remove the 100-year flood risk from 47 homes adjacent to the Creek between Jeffords Street and Bellevue Boulevard, installation of 1,900' of 7' x 11' box culvert from Browning Street to the upstream end of Linn Lake at the Evergreen Avenue footbridge is recommended. The culvert would be constructed primarily under the southbound lane of Hillcrest Avenue, and within the Jeffords Street right-of-way. Initially, alternatives were considered that would have involved channel widening or installing a box culvert in the existing channel with a swale over the top of the culvert. Both of these alternatives would have required the removal of the existing Sweetgum trees on the banks of the Creek, shown on Figure 3.1-19. Several residents spoke out at the public meetings opposing any plan that would require removal of the trees or otherwise permanently impact the nature of the existing Creek. In the recommended plan, however, the box culvert would be installed under the street, allowing the existing channel and sweetgum trees along Hillcrest Avenue to remain mostly undisturbed. This alternative received favorable comments at the second public meeting. Construction of high-flow diversion weir will allow low flows to remain within the existing channel. In addition to the bypass, the crossing of Stevenson Creek at Browning Street is proposed to be replaced with a 5' x 12' concrete box culvert.



*Stevenson Creek Watershed Management Plan
Final Report*



Figure 3.1-19. Stevenson Creek Channel and Trees Along Hillcrest Avenue, Between Jeffords Street and Browning Street (to remain)

This project also includes replacement of a failing retaining wall upstream of Browning Street, and removal of excess vegetation from the Creek downstream of the Lakeview Road Bridge. As can be seen in Figure 3.1-20, the majority of the vegetation to be removed is nuisance vegetation such as primrose willow (*Ludwigia peruviana*), melaleuca (*Melaleuca quinquenervia*), and Brazilian pepper (*Schinus terebinthifolius*). The City of Clearwater spends many precious man-hours and a significant part of the annual budget removing these noxious species from their waterways. The conceptual layout of Project 4A is depicted in [Figure 3.1-21](#).

*Stevenson Creek Watershed Management Plan
Final Report*



Figure 3.1-20. Failing Retaining Wall Upstream of Browning Street, to be Replaced and Exotic Vegetation to be Removed

Project 4B. Upper Stevenson Creek Stabilization. Channel bank erosion is a major problem within Upper Stevenson Creek, in particular the section between Lakeview Road and Bellevue Boulevard, and to a lesser extent between Jeffords Street and Lakeview Road. As a partial remedy, various site-specific erosion repair measures could be implemented. These would consist of “spot” repairs of severely eroded areas using various methods such as gabion walls and geotextiles. These minor projects would target only those repairs necessary to protect public safety and private property from stream bank failures. However, this alternative would not stop the erosion from occurring, it would only repair the existing eroded areas. Additional repairs would have to be made periodically as problems occur. Another, more permanent alternative would be to re-shape the channel cross section and install erosion control measures along entire lengths of channel, in particular between Lakeview Road and Bellevue Boulevard. Examples of erosion control measures would be low retaining walls along the toe of the channel banks, constructed of gabion baskets or “geoweb”-type retaining walls. These walls

***Stevenson Creek Watershed Management Plan
Final Report***

would support a gradually sloping backfill that could support vegetation, as illustrated on [Figure 3.1-22](#). The recommended cross section would also include a maintenance travelway to facilitate access to the creek by City maintenance crews. This alternative would create a temporary impact to the creek that would require removal of some of the existing trees and other vegetation. Many of the trees within the easement could be preserved, however, and those that are removed would be replanted with 12'-15' shade trees such as Live Oak.

The project could also incorporate low rock weirs that create shallow pools, providing habitat for small fish, turtles, and beneficial invertebrates. The weirs would have the additional benefit of slowing bed erosion and oxygenating the water as it ripples over the rocks. The weirs would be low enough as to not cause a restriction to flood flows.

Project 4C. St Thomas Drive / Bellevue Boulevard Creek Restoration. The most severe and frequent flooding in the subwatershed occurs along Evergreen Avenue between Bellevue Boulevard and St. Thomas Drive, where seven homes were found susceptible to the 10-year flood. The flooding problem at this location is due to a 54" CMP culvert placed within the Stevenson Creek Channel that lacks the capacity to convey even the mean annual storm event. As illustrated on [Figure 3.1-23](#), the recommended alternative project for Stevenson Creek between St. Thomas Drive and Bellevue Boulevard includes removal of 950 feet of 54" CMP, restoration of the historical, meandering stream channel, and replacement of the Rice Lake control structure.

The Rice Lake control structure is designed as a 20-foot wide fixed concrete weir crest at elevation 36.0' NGVD, with a 24" wide low-flow notch at elevation 35.0', attached to a proposed 58" x 91" elliptical RCP culvert under St. Thomas Drive. It is recommended that the proposed Rice Lake control structure include an operable sluice gate at elevation 30.0' NGVD that would allow the lake to be temporarily drained for periodic maintenance dredging with the City's Menzi-Muck excavator. The



***Stevenson Creek Watershed Management Plan
Final Report***

recommended maintained bottom elevation of Rice Lake is 30.0' NGVD. The culvert under Bellevue Boulevard is proposed to be replaced with a 58" x 91" elliptical RCP as well.

The project will require purchase of ten (10) flood prone homes on Evergreen Avenue between Belleview Boulevard and St. Thomas Drive. Including the ten homes to be removed, the project will remove 19 structure FPLOS deficiencies adjacent to the Creek between Bellevue Boulevard and Belleair Road.

The creation of a meandering stream in this area will greatly enhance the aesthetics of the neighborhood and provide significant water quality benefits. The meanders will include natural rock riffles at intervals in the stream. The riffles will provide protection against erosion in strategic areas but will also perform water quality functions. These riffles will oxygenate the water and provide habitat for beneficial invertebrates on the rock surfaces and in the interstitial spaces. The stream will be planted with trees and understory species that will mimic a natural hardwood hammock. Tree species proposed include laurel oak, Virginia live oak, red maple, cabbage palm, and American elm. Understory species may include such native shrub species Virginia willow, saw palmetto, and fetterbush, while the ground cover will likely be ferns such as royal fern, cinnamon fern, and Virginia chain fern. The master list of plants and the recommended planting depths are provided in [Table 3.1-3](#).

As an alternative to this project, the 54" CMP could be replaced with 950' of double 8' x 14' box culvert within the existing easement. The culvert would safely convey and contain the 100-year discharge, alleviating the flooding and allowing all of the existing homes to remain for approximately the same capital cost, and substantially lower maintenance costs. However, this alternative would not create the secondary benefits associated with water quality, habitat, and aesthetics provided by the recommended alternative.



*Stevenson Creek Watershed Management Plan
Final Report*

(FIGURE 3.1-21)



*Stevenson Creek Watershed Management Plan
Final Report*

(FIGURE 3.1-22)



*Stevenson Creek Watershed Management Plan
Final Report*

[\(FIGURE 3.1-23\)](#)



*Stevenson Creek Watershed Management Plan
Final Report*

3.1.5 Subwatershed 5: Hammond Branch

Project 5A. Flagler Drive / CSX Railroad North Swale Improvements. As illustrated on [Figure 3.1-24](#), this project includes construction of approximately 2,120 linear feet of minor ditch improvements along north side of the CSX Railroad from Linwood Drive and Sharondale Drive, west and southwest along the railroad, to Highland Avenue. The project will remedy the three FPLOS deficiencies identified on Linwood Drive near Sharondale Drive, on the north side of the CSX railroad that runs parallel to Flagler Drive. This problem area is the result of floodwaters from the Flagler Drive ditch backing up through twin 48" RCP culverts under the CSX railroad. The 48" culverts were intended to convey runoff from the subbasin to the north into the Flagler ditch. During flood events, however, the culverts flow in the opposite direction, directing floodwaters from the south side of the railroad, across the flood susceptible properties bordering Linwood Drive. The problem is exacerbated by the fact that the floor elevations of the homes are only 2-3 feet above the invert of the Flagler Drive Ditch.

The project alignment currently contains a poorly defined drainage swale. The proposed typical cross section has a 5-foot bottom width, and 3:1 (horizontal to vertical) side slopes on the side adjacent to the residential properties and 1:1 side slopes on the railroad side. The railroad side will need to be armored with riprap, and the project will require permission to perform work in railroad-owned Right-of-Way.

Downstream of the swale improvements, several upgrades to the Hammond Branch conveyance system will be required in order to remedy existing FPLOS deficiencies on Highland Avenue and Overlea Street, to replace a failed control structure between the two ponds between King's Highway and Highland Avenue, and to safely convey the additional discharge due to the swale improvements. The improvements include replacing the twin 48" culverts under King's Highway with a double 7' x 5' box culvert, replacement of both control structures on the two ponds between King's Highway and Highland Avenue, and replacement of the 38" x 60" ERCP culvert from the CSX railroad to the Highland Avenue pond with a combination of 10' x 6' box culvert and twin 60"



***Stevenson Creek Watershed Management Plan
Final Report***

RCP's. In addition, construction of a 350'-long berm adjacent to the proposed swale would be required in order to divert drainage from a partially blocked ditch to Highland Avenue and into the proposed twin 60" RCP's (refer to [Figure 3.1-24](#)).

Project 5B. Palmetto Street Drainage Improvements. As illustrated on [Figure 3.1-25](#), construction of approximately 1,900' of 54" RCP along Palmetto Street is recommended to divert treated stormwater from the Highland Avenue drainage system directly into Stevenson Creek. This project will provide flood relief for streets and homes in the area of the Hibiscus Street Pond, where a single structure FPLOS deficiency occurs on Hibiscus Street near King's Highway, when the storage capacity of the Hibiscus Pond is exceeded due to inflows from a 54" RCP culvert from the Highland Avenue drainage system. The existing outfall of Hibiscus Pond, consisting of a gunited 30" CMP, is not adequate to handle the inflows from the Highland Avenue culvert. A diversion weir near the outfall of the Highland Avenue detention pond will divert flood flows into the proposed 54" culvert. By installation of a small orifice, low flows could be allowed to continue to flow into the Hibiscus pond in order to promote flushing. The project will remedy a second structure FPLOS deficiency at the corner of Palmetto Street and King's Highway, and a collector road FPLOS deficiency at the same location. These FPLOS deficiencies technically lie within the Lower Stevenson Creek Subwatershed.

In order to provide additional water quality benefits, two existing small ponds on the Clearwater Country Club Golf Course near King's Highway and Palmetto Street could potentially be converted into an offline treatment system.

Project 5C. Saturn Avenue Drainage Improvements. This project includes the upsizing of 1,200' of existing 24" CMP and 14" x 23 arch CMP storm sewer along Saturn Avenue from Sherwood Street to Flagler Drive, in order to remedy street FPLOS deficiencies on Saturn Avenue at Sherwood Street and Leo Lane. The proposed pipe sizes are 36" RCP and 38" x 60" ERCP, as illustrated on [Figure 3.1-26](#). The project could incorporate water quality features such as water quality inlets and/or CDS units.



***Stevenson Creek Watershed Management Plan
Final Report***

Project 5D. Smallwood Circle Drainage Improvements. In the area of Smallwood Circle and Rosemere Road (southeast of Highland and Palmetto), homes were built in a depression area surrounding a small city park, which floods frequently during moderate to heavy rains. As illustrated on [Figure 3.1-27](#), the depression is drained by an undersized, failing 24” CMP culvert that runs under existing homes on Elmwood Street and Smallwood Circle. The recommended project is to abandon and fill the existing 24” CMP storm drain and construct approximately 1,000 feet of 24” x 38” and 36” storm sewer in a new alignment. The new alignment will tie into the Highland Avenue drainage system at Elmwood Street. Although the majority of the pipe will be constructed in public property or right-of-way, acquisition of drainage easements will be necessary along the rear lot lines of four properties on Smallwood Circle. The project will remove 100-year flood risk from two homes, and it will reduce the risk of house foundation failures due to the failing metal pipes. In addition, the project could incorporate water quality features such as water quality inlets and/or CDS units.

Project 5E. Lake Hobart Outfall Control Structure. The decrepit metal and wood outfall structure on this lake is proposed to be replaced with a new concrete structure, located on [Figure 3.1-28](#). The new structure will be designed to increase hydraulic residence time of runoff from small storm events, which will increase the level of stormwater treatment this lake provides. This will be accomplished by incorporating a bleed-down notch at the existing control water elevation of approximately 63.7 feet, NGVD. In order to avoid increasing the flood elevations in the lake, a 6’-wide overflow weir will be constructed at elevation 64.5, allowing unrestricted discharge of flood flows. An oil and grease skimmers will be included to prevent discharge of these contaminants to the downstream system. In addition, homeowners around the lake could be encouraged to plant the shoreline with native aquatic species that will provide biological treatment and wildlife habitat. Figure 3.1-29 provides an example of the plants that can be used and the depths at which they should be planted.



*Stevenson Creek Watershed Management Plan
Final Report*

[\(FIGURE 3.1-24\)](#)



*Stevenson Creek Watershed Management Plan
Final Report*

[\(FIGURE 3.1-25\)](#)



*Stevenson Creek Watershed Management Plan
Final Report*

[\(FIGURE 3.1-26\)](#)



*Stevenson Creek Watershed Management Plan
Final Report*

[\(FIGURE 3.1-27\)](#)



*Stevenson Creek Watershed Management Plan
Final Report*

[\(FIGURE 3.1-28\)](#)



Figure 3.1-29
Wetland Planting Illustration



*Stevenson Creek Watershed Management Plan
Final Report*

3.1.6 Subwatershed 6: Lake Bellevue Branch

Project 6A. Expansion of Lake Bellevue. In order to provide additional flood storage and littoral/wetland vegetation for water quality improvements, up to an eight-acre expansion of Lake Bellevue is proposed. The expansion would be accomplished by excavating the unutilized areas of Ed Wright Park and Ross Norton Park to provide additional lake area. The expansion is shown conceptually on [Figure 3.1-30](#), however the actual limits of excavation must be coordinated with the City of Clearwater Parks and Recreation Department due to the plans for construction of a new recreation center in Ross Norton Park. A location for the recreation center has not been determined at the time of this writing.

This expansion would further increase the level of treatment provided by the lake and should improve overall lake water quality. Additional mass reductions of approximately 13,300 pounds of suspended solids and 550 pounds of nitrogen are expected on an annual average basis. These improvements will also enhance the ability of this lake to cope with current loadings and may reduce the frequency and severity of seasonal algal blooms that have been observed.

The project includes reconfiguration of Lake Bellevue outfall structure with addition of a bleed down notch and 30' wide overflow weir to control the 100-year flood discharge. Control of the 100-year flood discharge would also require elevating the eastern 400' of Dempsey Street approximately 12", and construction of a low berm (1'-2' high) through a portion of the park

The proposed expansion would remove an area of overgrown vegetation on the west side of the lake, as well as some areas on the east side. The vegetation on the west side of the lake includes some native trees such as laurel oak and live oak, as well as a number of exotic tree species such as ear tree (*Enterolobium contortisiliquum*) and Brazilian pepper. Several dead pine trees are also present on the site and the entire area is overgrown with wild grape. Native trees in good health could be preserved by creative grading, and some of the dense vegetation adjacent to the railroad tracks could be preserved as a buffer. The



***Stevenson Creek Watershed Management Plan
Final Report***

inflow could be redirected to meander through this area for treatment prior to discharging into the lake. The excavated areas will be planted with pickerelweed, soft rush, arrowhead, yellow canna, cordgrass, and other herbaceous plant species suitable for this shallow littoral habitat. Trees will be planted to replace those removed, and the species planted will include cypress, red maple, and pop ash at the lake shoreline, and laurel oak, live oak, and dahoon holly in the upland portions of the site.

On Wildwood Way, west of the CSX railroad, several structures were built in a low area southwest of the Lake. The drainage for this area is towards Lake Bellevue, but flows are restricted by undersized culverts beneath the CSX railroad tracks. As illustrated on [Figure 3.1-31](#), addition of three (3) 36" culverts by jack-and-bore under the railroad tracks is proposed at this location. Replacement of the culverts within the CSX railroad ditch at Woodlawn Ave. and Howard Street are proposed in order to remedy street FPLOS deficiencies at those locations. Projects 6A.1 and 6A.2 combined will remove the 100-year flood risk from eight structures corresponding to a total of 17 dwelling units, and will remedy street FPLOS deficiencies on one collector road and three residential streets.

Project 6B. Turner Street Box Culvert This project is to alleviate structure FPLOS deficiencies in five businesses on Missouri Avenue immediately south of Turner Street, and on Missouri Avenue itself, which constitutes an arterial road FPLOS deficiency at this location. This flooding problem is due to the fact that upstream of Missouri Avenue, the Lake Bellevue Branch flows into a 54" diameter culvert which lacks the capacity to convey the discharge resulting from even a mean-annual storm event. As illustrated on [Figure 3.1-32](#), the recommended project includes construction of a 25-foot wide concrete control weir on the existing pond west of Missouri Avenue and north of Druid. The weir would have a lower notch at elevation 17.5 and an overflow weir at elevation 18.5. A portion of the 54" culvert would be replaced by approximately 180 feet of 5' x 9' concrete box culvert from the weir to Missouri Avenue, and construction of 1,530' of 6' x 11' concrete box culvert along Turner Street from Missouri Avenue to Glen Oaks



***Stevenson Creek Watershed Management Plan
Final Report***

stormwater detention facility. A portion of the existing 60” and 66” culvert that runs along the south lot lines of properties on the south side of Turner Street could remain in service, running parallel to the proposed box culvert. In addition to the structure FPLOS deficiencies, the project will remedy street FPLOS deficiencies on one arterial road, one collector road, and two residential streets.



*Stevenson Creek Watershed Management Plan
Final Report*

[\(FIGURE 3.1-30\)](#)



*Stevenson Creek Watershed Management Plan
Final Report*

[\(FIGURE 3.1-31\)](#)



*Stevenson Creek Watershed Management Plan
Final Report*

[\(FIGURE 3.1-32\)](#)



*Stevenson Creek Watershed Management Plan
Final Report*

3.1.7 Subwatershed 7: Jeffords Street Branch

Due to the severe flooding problems identified at the confluence of the Jeffords Street Branch and Stevenson Creek, improvements to the conveyance system of the Jeffords Street Branch that would increase flood elevations downstream were not considered. The projects in this subwatershed consist primarily of creation or expansion of lakes, ponds, and wetlands in order to temporarily detain the floodwaters and control their discharge at a rate more effectively conveyed by the existing downstream system. These projects will also reduce pollutant loadings to Stevenson Creek. Collectively these three projects are estimated to remove approximately 6,960 pounds of suspended solids and 390 pounds of nitrogen on an annual average basis.

Project 7A. Crest Lake Expansion. The primary objective of this project is to reduce 100-year flood elevations in downstream areas of Jeffords Street Branch, and to provide water quality treatment of currently untreated runoff from 43 acres of residential land use. This would be accomplished by diverting runoff from subbasins 4424 and 4426 (refer to [Figures 2.1-1](#) and [3.1-33](#)) into Crest Lake via a proposed 1,370' long 36" RCP culvert from the intersection of Duncan Avenue and Rainbow Drive, along Rainbow Drive to Crest Lake. The existing 24" storm sewer along Duncan Avenue between Rainbow Drive and Marion Street would be abandoned. In order to provide an acceptable design tailwater elevation for the proposed diversion pipe, an expansion of Crest Lake of approximately six acres will be required. The expansion is shown conceptually on [Figure 3.1-33](#), however the exact limits of excavation will need to be coordinated with the City Parks Department. In order to preserve the relatively good water quality in Crest Lake, the lake expansion could be designed as a shallow littoral shelf that will enhance the assimilative capacity of the lake.

Creating the 6-acre littoral shelf will require creative grading and sensitive design to preserve as many of the trees as possible. Several upland tree islands may be preserved in the created wetland for wildlife habitat. However, the expansion of the lake will



***Stevenson Creek Watershed Management Plan
Final Report***

require the removal of numerous oaks, pines, and cabbage palms. These trees and other valuable plants will be replaced by installing new trees in all available upland areas. The littoral area will be planted with pickerelweed, arrowhead, soft rush, cord grass, alligator flag, bulrush, yellow canna, spatterdock, saw grass, and other beneficial aquatic species. Trees planted will include cypress, red maple, and pop ash at the lake shoreline, and laurel oak, live oak, and dahoon holly in the upland portions of the site.

The water quality improvements that will be realized by the creation of this wetland will be significant, and the wetland will be of sufficient size and quality to become breeding habitat for some wading birds, small mammals, and reptiles and amphibians.

The project is designed to work in tandem with Projects 7B and 7C to reduce FPLOS deficiencies within the Jeffords Street Branch Subwatershed.

Project 7B. Duncan Avenue/Turner Street Detention Pond. In the area bounded by Spencer Avenue, Turner Street, Duncan Avenue, and Druid Road, ten structure FPLOS deficiencies were identified, as described in Section 2.1.5.4. These structures were built in what was once a wetland, and they now flood on a very frequent basis, as seven are below the 10-year flood level and nine of the ten are below the 25-year flood level. The recommended solution to this problem is acquisition and removal of the ten flood-prone structures at this location and construction of a 2.5-acre wet pond, as shown on [Figure 3.1-34](#). Since two of the structures have recently been purchased by the City, the project will require purchase of the remaining eight structures, two of which are on the same building lot and would likely be sold as a single property. The project includes construction of a control structure for the proposed pond that will control the normal water level at elevation 56.0 NGVD, and will tie into the existing 30" storm sewer along Duncan Avenue, south of Marion Street. The project will work in tandem with Projects 7A and 7C to reduce 100-year flood elevations in downstream areas of Jeffords Street Branch. In addition, the project will provide water quality treatment of currently untreated runoff from 27 acres of residential land use.



***Stevenson Creek Watershed Management Plan
Final Report***

Project 7C. Jeffords Street/Barry Road Detention Pond. The primary component of this project is the construction of a 2.5-acre pond with wetland plantings east of Lake Avenue, incorporating 500 linear feet of the existing Jeffords/Barry ditch and requiring the purchase of nine (9) flood prone residential structures on south side of the existing ditch (refer to [Figure 3.1-35](#)). The pond will include construction of control structure with bleed down orifice near Lake Avenue, and new storm sewers to equalize the proposed pond with three existing lakes at the headwaters of the Jeffords Street Branch. The orifice at Lake Avenue will control the normal water level of the four equalized lakes at elevation 25.0 NGVD. A 30-foot wide overflow weir would be constructed at elevation 26.0 for flood control. The four lakes will be equalized by three segments of new storm sewer constructed below the proposed control water elevation, totaling approximately 930 feet in length, and ranging in size from 30” to 66”. These culverts will allow the elevations within the four lakes to fluctuate together, thus behaving as a single lake for flood control and stormwater treatment purposes.

If constructed as part of projects 7A and 7B, the project will remove 100-year flood risk from 28 out of 45 structures (34 of 51 dwelling units). In addition, the four equalized lakes will provide wet detention stormwater treatment for runoff from 362 acres. The bleed down orifices will create a longer residence time in the lake system compared to the downstream Glen Oaks pond (Project 3A), so that the two projects would work together as a cascading wet detention system. The proposed 2.5-acre pond will serve as the littoral zone for the interconnected system of lakes. Plants recommended for this area include pickerelweed, arrowhead, soft rush, cord grass, alligator flag, bulrush, yellow canna, spatterdock, saw grass, and other beneficial aquatic species. Trees may be planted on the perimeter of the pond to act as a buffer from the residential areas. Trees recommended for planting in this vicinity are laurel oak, live oak, and dahoon holly. The planting depth zones for these species are found in Table 3.1-3.



***Stevenson Creek Watershed Management Plan
Final Report***

In order to resolve problems of bank erosion and nuisance vegetation, and to reduce annual maintenance costs, the remaining 600 feet of the Jeffords/Barry Street ditch west of Lake Avenue is proposed to be piped in with twin 60" HDPE storm sewer. This portion of the project will nearly eliminate the \$45,000 per year in maintenance costs to maintain existing ditch, based on man-hour and equipment cost estimates provided by the City's Road and Drainage Division to periodically remove the nuisance vegetation. If a project life span of 50 years is assumed with an annual interest rate of 7.0%, the present value of the savings in maintenance costs would be over \$620,000 per year. Mitigation for this project would be provided in the proposed 2.5-acre pond on the east side of Lake Avenue.



*Stevenson Creek Watershed Management Plan
Final Report*

[\(FIGURE 3.1-33\)](#)



*Stevenson Creek Watershed Management Plan
Final Report*

[\(FIGURE 3.1-34\)](#)



*Stevenson Creek Watershed Management Plan
Final Report*

(FIGURE 3.1-35)

- [Figure 3.1-37 Stevenson Creek Flood Profile, Project Conditions](#)
- [Figure 3.1-38 Stevenson Creek Flood Profile, Project Conditions](#)
- [Figure 3.1-39 Stevenson Creek Flood Profile, Project Conditions](#)
- [Figure 3.1-40 Stevenson Creek Flood Profile, Project Conditions](#)
- [Figure 3.1-41 Stevenson Creek Flood Profile, Project Conditions](#)
- [Figure 3.1-42 Stevenson Creek Flood Profile, Project Conditions](#)
- [Figure 3.1-43 Spring Branch Flood Profile, Project Conditions](#)
- [Figure 3.1-44 Spring Branch Flood Profile, Project Conditions](#)



Table 3.1-2 Alternative Projects-Water Quality Improvement Benefits

| Project Name | BMP Type | Percent of Ideal Coverage | Tributary Area (ac) | Pollutant Loading Present (lb/year) | | | | | | Pollutant Loading Removed (lb/year) | | | | | |
|--|------------------------|---------------------------|---------------------|-------------------------------------|------|---------|---------|-------|--------|-------------------------------------|------|-------|--------|------|------|
| | | | | Pb | Zn | BOD5 | TSS | TP | TN | Pb | Zn | BOD5 | TSS | TP | TN |
| Project 1A.1 Spring Branch Conveyance Enhancements Lower Portion | Channel Improvements | 10.7% | 1,687 | 25.4 | 257 | 69,500 | 109,798 | 2,327 | 8,033 | 0.54 | 4.1 | 742 | 2,343 | 37.2 | 85.7 |
| Project 1A.2 Spring Branch Conveyance Enhancements Upper Portion | Water Quality Inlets | 100.0% | 28.6 | 0.66 | 7.3 | 2,684 | 3,448 | 81 | 284 | 0.10 | 0.37 | 134 | 1,207 | 8.1 | - |
| Project 1C. Spring Branch Flood Detention Basin | Wet Detention (1-inch) | 11.7% | 1,772 | 26.3 | 263 | 71,652 | 113,598 | 2,380 | 8,248 | 2.3 | 18.4 | 4,184 | 9,951 | 167 | 289 |
| Project 1D. Woodland Terrace Storm Sewer Replacement. | | | | | | | | | | | | | | | |
| Water Quality Improvement Option 1 | Water Quality Inlets | 100.0% | 42.1 | 0.15 | 1.48 | 1,232 | 1,012 | 27 | 132 | 0.02 | 0.07 | 62 | 354 | 2.7 | - |
| Water Quality Improvement Option 2 | CDS Unit | 100.0% | 42.1 | 0.15 | 1.48 | 1,232 | 1,012 | 27 | 132 | 0.07 | 0.52 | 370 | 506 | 6.8 | - |
| Project 1E. Byram Pond Dredging and Expansion | Sediment Sump | 2.7% | 1,668 | 25.0 | 253 | 68,740 | 107,940 | 2,292 | 7,947 | 0.47 | 3.8 | 185 | 2,038 | 15.4 | - |
| Project 1G. Clearview Lake. | Wet Detention (1-inch) | 100.0% | 52.6 | 0.24 | 1.8 | 1,732 | 1,581 | 35.8 | 213 | 0.18 | 1.06 | 866 | 1,186 | 21.5 | 63.8 |
| Project 2A. Palmetto Street Sediment Sump. | Sediment Sump | 0.4% | 2,630 | 33.5 | 280 | 114,310 | 169,790 | 2,915 | 12,400 | 0.10 | 0.68 | 50 | 523 | 3.2 | - |
| Project 2B. North Missouri Ave and Palmetto St Drainage Improvements | CDS Unit | 100.0% | 44 | 0.86 | 8.2 | 1,903 | 4,631 | 49 | 189 | 0.43 | 2.9 | 571 | 2,316 | 12.2 | - |
| Project 2C. Installation of Additional CDS Units | | | | | | | | | | | | | | | |
| Project 2C.1. Douglas Avenue BMP | CDS Unit | 100.0% | 86.5 | 0.60 | 4.0 | 3,653 | 3,317 | 77 | 411 | 0.30 | 1.39 | 1,096 | 1,659 | 19.3 | - |
| Project 2C.2. Martin Luther King Avenue BMP | CDS Unit | 100.0% | 142 | 2.1 | 19.6 | 7,097 | 12,354 | 210 | 739 | 1.07 | 6.9 | 2,129 | 6,177 | 52.6 | - |
| Project 2C.3. Holt Avenue BMP | CDS Unit | 100.0% | 39.8 | 0.56 | 4.8 | 1,398 | 3,389 | 43 | 161 | 0.28 | 1.70 | 419 | 1,695 | 10.8 | - |
| Project 2C.4. Pennsylvania CDS Unit | CDS Unit | 100.0% | 10.1 | 0.06 | 0.55 | 429 | 511 | 9.6 | 44 | 0.03 | 0.19 | 129 | 256 | 2.4 | - |
| Project 2D. Overbrook Avenue Detention Pond. | Wet Detention (1-inch) | 82.2% | 76.7 | 2.1 | 11.3 | 3,562 | 5,398 | 73 | 331 | 1.29 | 5.6 | 1,463 | 3,326 | 35.9 | 81.6 |
| Project 3A. Glen Oaks Stormwater Detention Facility | | | | | | | | | | | | | | | |
| Project 3A.1 Wet Detention Facility | Wet Detention (1-inch) | 11.0% | 2,133 | 22.8 | 204 | 89,610 | 123,370 | 2,264 | 9,874 | 1.87 | 13.4 | 4,916 | 10,152 | 149 | 325 |
| Project 3A.2 Percolation Pond | Percolation | 100.0% | 50.4 | 1.00 | 6.2 | 2,539 | 3,941 | 55 | 245 | 0.80 | 4.9 | 2,031 | 3,152 | 44 | 196 |
| Project 3A.1 Wet Detention Facility with Group (2) | Wet Detention (1-inch) | 19.4% | 1,193 | 17.6 | 156 | 59,370 | 91,620 | 1,625 | 6,198 | 2.6 | 18.2 | 5,768 | 13,350 | 189 | 361 |
| Project 4C. St Thomas Drive / Bellevue Boulevard Creek Restoration. | Channel Improvements | 21.1% | 297 | 1.63 | 14.5 | 12,094 | 13,014 | 253 | 1,253 | 0.07 | 0.46 | 255 | 549 | 8.0 | 26.5 |
| Project 5C. Saturn Avenue Drainage Improvements. | | | | | | | | | | | | | | | |
| Water Quality Improvement Option 1 | Water Quality Inlets | 100.0% | 18.3 | 0.16 | 1.3 | 843 | 1,153 | 18.1 | 82.6 | 0.02 | 0.06 | 42.2 | 404 | 1.8 | - |
| Water Quality Improvement Option 2 | CDS Unit | 100.0% | 18.3 | 0.16 | 1.3 | 843 | 1,153 | 18.1 | 82.6 | 0.08 | 0.45 | 253 | 576 | 4.5 | - |
| Project 5D. Smallwood Circle Drainage Improvements. | | | | | | | | | | | | | | | |
| Water Quality Improvement Option 1 | Water Quality Inlets | 100.0% | 25.4 | 0.07 | 0.70 | 937 | 683 | 17.2 | 94.2 | 0.01 | 0.04 | 46.9 | 239 | 1.7 | - |
| Water Quality Improvement Option 2 | CDS Unit | 100.0% | 25.4 | 0.07 | 0.70 | 937 | 683 | 17.2 | 94.2 | 0.04 | 0.25 | 281 | 341 | 4.3 | - |
| Project 5E. Lake Hobart Outfall Control Structure. | Wet Detention (1-inch) | 100.0% | 63.8 | 0.25 | 1.5 | 1,763 | 1,108 | 35.4 | 256 | 0.19 | 0.90 | 882 | 831 | 21 | 77 |
| Project 6A. Expansion of Lake Bellevue | Wet Detention (1-inch) | 100.0% | 439 | 3.1 | 30.0 | 14,167 | 17,740 | 324 | 1,845 | 2.3 | 18 | 7,084 | 13,300 | 195 | 553 |
| Project 6B. Turner Street Box Culvert | Wet Detention (1-inch) | 6.8% | 605 | 7.3 | 71.3 | 24,478 | 39,580 | 690 | 2,974 | 0.37 | 2.9 | 837 | 2,030 | 28 | 61 |
| Project 7A. Crest Lake Expansion. | Wet Detention (2-inch) | 100.0% | 102 | 0.28 | 2.3 | 2,412 | 1,969 | 48.4 | 339 | 0.25 | 1.86 | 1,447 | 1,772 | 36 | 153 |
| Project 7B. Duncan Avenue/Turner Street Detention Pond. | Wet Detention (1-inch) | 100.0% | 26.6 | 0.25 | 2.1 | 1,216 | 1,843 | 27.1 | 122 | 0.19 | 1.24 | 608 | 1,382 | 16 | 36.5 |
| Project 7C. Jeffords Street/Barry Road Detention Pond. | Wet Detention (1-inch) | 49.8% | 362 | 1.50 | 13.3 | 12,439 | 10,200 | 239 | 1,371 | 0.56 | 4.0 | 3,096 | 3,810 | 72 | 205 |

**Stevenson Creek Watershed Management Plan
Final Report**

Table 3.1-3 Vegetation Recommended for Planting in Varying Water Depths

| COMMON NAME | BOTANICAL NAME | PLANTING ELEVATION (IN FEET TO NWL) | | | | |
|---------------------|----------------------------------|-------------------------------------|-------------|--------------|--------------|--------|
| | | <0.0 | 0.0 to -0.5 | -0.5 to -1.0 | -1.0 to -2.5 | > -2.5 |
| TREES | | | | | | |
| Red maple | <i>Acer rubrum</i> | X | X | | | |
| Black mangrove** | <i>Avicennia germinans</i> | | | X | | |
| Water hickory | <i>Carya aquatica</i> | | X | | | |
| Pop ash | <i>Fraxinus caroliniana</i> | | | X | | |
| Dahoon holly | <i>Ilex cassine</i> | X | X | | | |
| Eastern red cedar | <i>Juniperus silicicola</i> | X | | | | |
| Sweet gum | <i>Liquidambar styraciflua</i> | X | | | | |
| Southern magnolia | <i>Magnolia grandiflora</i> | X | | | | |
| Laurel oak | <i>Quercus laurifolia</i> | X | | | | |
| Live oak | <i>Quercus virginiana</i> | X | | | | |
| Red mangrove** | <i>Rhizophora mangle</i> | | | X | | |
| Cypress* | <i>Taxodium spp.</i> | | X | X | | |
| American elm | <i>Ulmus americana</i> | X | X | | | |
| SHRUBS | | | | | | |
| Beauty berry | <i>Callicarpa americana</i> | X | | | | |
| Button bush | <i>Cephalanthus occidentalis</i> | | X | X | | |
| Gallberry | <i>Ilex glabra</i> | X | | | | |
| Virginia willow | <i>Itea virginica</i> | | X | X | | |
| Wax myrtle | <i>Myrica cerifera</i> | X | | | | |
| Saw palmetto | <i>Serenoa repens</i> | X | | | | |
| FORBS | | | | | | |
| Leather fern* | <i>Acrostichum aureum</i> | | X | | | |
| Swamp fern | <i>Blechnum serrulatum</i> | | X | | | |
| Yellow canna | <i>Canna flaccida</i> | | X | X | | |
| Saw grass* | <i>Cladium jamaicense</i> | | X | X | | |
| String lily | <i>Crinum americanum</i> | | X | | | |
| Prairie iris | <i>Iris hexagona</i> | | X | | | |
| Soft rush | <i>Juncus effusus</i> | | X | X | | |
| Black rush* | <i>Juncus roemerianus</i> | | X | | | |
| Spatterdock | <i>Nuphar lutea</i> | | | | X | X |
| Water lily | <i>Nymphaea odorata</i> | | | | X | X |
| Pickerelweed | <i>Pontederia cordata</i> | | X | X | X | |
| Arrowhead | <i>Sagittaria lancifolia</i> | | | X | X | |
| Bulrush* | <i>Scirpus validus</i> | | | X | X | X |
| Alligator flag | <i>Thalia geniculata</i> | | | X | X | |
| Virginia chain fern | <i>Woodwardia virginica</i> | | X | | | |
| Florida coontie | <i>Zamia pumila</i> | X | | | | |

* Indicates tolerance of brackish water.

** Indicates tolerance of salt water.



3.2 HUMAN-SOURCED FECAL CONTAMINATION STUDY

The sampling and subsequent analysis of fecal coliforms (refer to [Section 2.3.3.6](#)) that was conducted last year (July 2000 – December 2000) confirmed that fecal coliforms from human sources are present in the watershed. While human input does not appear to be the dominant source of fecal coliform in the watershed, the levels of human-sourced fecal contamination measured during this study (refer to [Appendix J](#)) are cause for concern. Human feces are considered particularly dangerous because of the human-specific viruses transmitted exclusively by human sources. This significant finding underscores the need for accurate information concerning the sources of fecal contamination within the watershed.

Further study is needed to better define the origins, magnitude, and spatial extent of fecal contamination from human sources in the Stevenson Creek Watershed. This study will provide information needed to plan and prioritize improvements directed at reducing fecal contamination within the watershed.

3.2.1 Purpose of Further Study

While circumstantial evidence implicates improperly functioning onsite wastewater treatment and disposal systems (OSTDS) in contamination of the Stevenson Creek Watershed, direct evidence is not available. The possible contribution of illicit sewage connections, sewage overflows, and the sub-drain system underlying the streets may also be contributing to the bacterial loading, and while there is a high likelihood that the source is OSTDS, information is not available concerning which OSTDS areas are contributing to the problem.



3.2.2 Plan of Study

Some of these issues can be addressed through further study, and a four-step approach is recommended. First, better information regarding the locations and other basic attributes of existing OSTDS and the sanitary sewer system is needed (Step 1). Secondly, additional sampling and field investigations are needed to direct attention to areas that are problematic with respect to fecal contamination (Step 2). Next, focused microbiological sampling can provide direct proof that OSTDS are contributing to water quality impairments (Step 3). Finally, the results of Steps 1 – 3 can be used to reach conclusions concerning the origins, magnitude, and extent of human-sourced fecal contamination within the Stevenson Creek Watershed as well as to provide information needed to plan improvements.

These four steps (Existing Data Compilation and Review, Data Collection and Conventional Sampling, Focused Microbiological Sampling, and Data Evaluation) are more specifically described below.

Existing Data Compilation and Review (Step 1)

Existing information concerning the OSTDS and sanitary sewer system should be compiled. In regards to OSTDS, this information should include locations, approximate age, general topography, soil type, and material type, as appropriate. In regards to the sanitary sewer system, this information should include interviews with city staff, results from smoke tests, video logs, rainfall, and flow monitoring as well as population and overall plant flow and capacity data. These sewer system data can be used to provide evaluations concerning the overall soundness of the sanitary sewer system as well as the feasibility of connecting OSTDS areas to the central sewer system.

One of the main purposes of the sanitary sewer evaluation is to assess the likelihood of sewage releases to the environment through overflows, cross-connections, or pipe structural problems. Loose pipe joints and cracks would not be expected to cause



***Stevenson Creek Watershed Management Plan
Final Report***

measurable exfiltration due to high groundwater; however, the possibility of capacity problems due to wet weather inflows should be investigated, as should the possibility of significant cracks or cross-connections with the storm sewer system.

The locations of septic tanks is generally not available (refer to Section 2.3.1.2) but can likely be inferred by cross-referencing sewer service bills and property tax data or other city and county databases. Approximate age can be estimated based on the age of the dwelling or structure, and recent repair permits. The septic tank points can be intersected with available soil data to assign soil type and seasonal high water elevation.

These OSTDS and sewer system characteristics will be used to plan the sampling program and to seek relationships between these characteristics and fecal contamination. The Healthy Beaches Tampa Bay study, an extensive, multi-agency study of Pinellas and Hillsborough County waters, can also be used to identify other areas of interest for the study if desired.

Data Collection and Conventional Sampling (Step 2).

The data from Step 1 can be used to develop a field investigation and sampling program designed to “zero-in” on problem areas. Field investigations can be used to collect evidence of illicit sewage connections to the storm sewer system and other problems (i.e. soggy drainfields, etc.). Water quality samples would be collected in channels and storm sewer pipes. The recommended sampling program would consist of a large number of samples from a minimum of two events. The large number of samples is for purposes of better and more refined delineation of problem areas. The sampling frequency will be selected based on costs with a minimum of one sample representative of dry conditions and one sample representative of wet conditions. Stormwater runoff samples are desirable, but introduce cost and logistic problems that should be carefully considered before they are included in this study. All samples will be analyzed for fecal coliforms; in addition, limited bacterial source tracking using antibiotic resistance analysis may be employed.



Stevenson Creek Watershed Management Plan Final Report

The sampling program will draw attention to problem areas, and together with the information collected in Step 1, will be used to design a microbiological sampling program that is focused on identifying areas where OSTDS usage is problematic.

Focused Microbiological Sampling (Step 3)

A detailed microbiological study should be undertaken that explores the prevalence of human pathogens (enteric viruses) and *E. coli* from human sources at various Stevenson Creek sites. Antibiotic resistance analysis for the source of fecal bacteria will indicate whether the contamination is dominated by human or animal sources. “Tracer” studies, in which a specific bacteriophage (bacterial virus) that cannot infect humans is flushed down the toilets of volunteer homes, can provide evidence of the rate of viral transport from OSTDS to surface water. Bacteriophage studies are superior to dye tracer studies because the bacteriophage particles are similar in size and soil adsorption properties to human viruses, therefore their transport rate is a better approximation for that of viral pathogens than dye particles, which often predict an overly rapid transport rate. Piezometer wells can be used to trace the direction and magnitude of a contamination plume.

If sufficient funds are available, a countywide study could be conducted in which the experiments mentioned above are conducted in OSTDS drainfields situated in various types of soil with different separation distances from the water table, and of various ages. Because they are time-consuming and require a great deal of expertise, such studies are rarely conducted and would contribute a great deal to our understanding of the processes governing transport of human pathogens from OSTDS drainfields.

Data Evaluation (Step 4)

The data collected in Steps 1 – 3 will be used to develop and prioritize improvement plans. In addition, correlations and other relationships will be sought so that the results of this study may provide useful information to other areas of Pinellas County that experience fecal contamination problems.



*Stevenson Creek Watershed Management Plan
Final Report*

3.2.3 Dissemination of Results to End Users

A multi-county task force should be formed with representatives from entities such as city public works, the Pinellas County Department of Health, the University of South Florida, the Southwest Florida Water Management District, Tampa Bay Water, and the Florida Department of Environmental Protection. The purpose of the task force would be to foster communication and facilitate problem solving on water quality issues and studies. The synergistic potential of such a group could serve as a model for similar groups across the state and the nation.



3.3 RECOMMENDED WATERSHED MAINTENANCE PLAN

Comprehensive, regular maintenance of stormwater management systems is essential to ensure the systems, once constructed, continue to function within their original design parameters for many years. Maintenance is also often required for aesthetics and safety reasons. This section outlines recommended maintenance practices and schedules for the Stevenson Creek Watershed.

Open Channels. Excessive vegetation and sediment accumulation can create new flooding problems, and worsen those problems which already exist. In some instances, excessive exotic invasive vegetation and sedimentation can inhibit the growth of beneficial flora and fauna. Excessive vegetation in open channels, particularly exotic or invasive species and plants with stiff, woody stems, can greatly increase the resistance to flow, thereby reducing the capacity of the channel to convey floodwaters and ultimately resulting in higher flood levels. Excessive sediment accumulation reduces the cross sectional area and hydraulic radius of the channel, creating a similar effect. In addition, sedimentation within concrete-lined channels can allow the growth of nuisance vegetation where none was assumed to exist in the roughness coefficients used original design calculations; as has occurred within the channel segment between Court Street and Pierce Street.

Proposed Watershed Management Plan Projects 1A, 1E, 1F, 2A, 4B, and 4C are improvements to the main channels that incorporate features that will allow improved access for maintenance, including approximately 4,000 linear feet of new maintenance access roads adjacent to Stevenson Creek and Spring Branch. These maintenance access ways typically consist of earthen roads that will facilitate equipment access for slope mowers, small dump trucks, and excavators. The width of the proposed access ways varies from 12' to 25' depending on the nature of the anticipated maintenance activities, whether access will be from one side or both sides of the drainage course, and the availability of land.



***Stevenson Creek Watershed Management Plan
Final Report***

The recommended maintenance practice for open channels is mowing, and if necessary, hand removal of invasive vegetation. Spraying of herbicide should be used only in rare cases where lack of access and/or manpower prohibits the alternative methods. Any herbicide spraying should be conducted in compliance with the City of Clearwater National Pollutant Discharge Elimination System (NPDES) permit, which requires the implementation of a spray reduction program. The recommended maintenance type and frequency for each major open channel segment within the Stevenson Creek Watershed is presented Table 3.3-1.

Table 3.3-1 Recommended Channel Maintenance Plan

| Channel Segment | Applicable Improvement Project | Recommended Maintenance Type(s) | Recommended Frequency |
|---|---|---|------------------------------------|
| Stevenson Creek | | | |
| Stevenson Creek - US Alt. 19 to Douglas Avenue | Stevenson Creek Estuary Restoration Plan (U.S.A.C.O.E.) | Periodic removal of exotic and invasive plant species | Once every 2-5 years, or as needed |
| Douglas Avenue to Betty Lane | N/A | Periodic removal of exotic and invasive plant species | Once every 2-5 years, or as needed |
| Betty Lane to Proposed Sediment Sump Control Weir | Stevenson Creek Phase 1 (W.K. Daugherty Plans) | Initial dredging of accumulated sediment, periodic removal of exotic and invasive plant species | Once every 2-5 years, or as needed |
| Palmetto Street Sediment Sump | WMP Project 2A | Dredging | Annually |
| Palmetto Street to Drew Street | N/A | Periodic removal of exotic and invasive plant species | Once Every 2 years, or as needed |
| Drew Street to Pierce Street | Stevenson Creek Phase 1 (W.K. Daugherty Plans) | Periodic removal of accumulated sediment | Once every 5 years, or as needed |
| Pierce Street to Court Street | Stevenson Creek Phase 2 (CDM Plans) | Mowing | Semi-annually |



*Stevenson Creek Watershed Management Plan
Final Report*

Table 3.3-1 (Continued) Recommended Channel Maintenance Plan

| Channel Segment | Applicable Improvement Project | Recommended Maintenance Type(s) | Recommended Frequency |
|--|---------------------------------------|--|---|
| Court Street to Druid Road | WMP Project 3A (Glen Oaks) | Mowing of embankment slopes and grassed areas | Monthly during the growing season |
| | | Initial monitoring and maintenance of created wetland areas | Quarterly for the first year, Semi-annually thereafter, until beneficial vegetation is well established |
| Druid Road to Jeffords Street | Stevenson Creek Phase 2 (CDM Plans) | Repair vandalism damage to gabion walls | As needed |
| | | Dredge sediment from Jeffords Street sediment sump | Semi-annually, or as needed |
| Jeffords Street to Lakeview Road | WMP Project 4A | Mowing | Semi-annually |
| Lakeview Road to Bellevue Boulevard | WMP Project 4B | Mowing | Semi-annually |
| | | Removal of sediment from behind rock weirs | Annually, or as needed |
| Bellevue Boulevard to St. Thomas Drive | WMP Project 4C | Mowing of embankment slopes and grassed areas | Monthly during the growing season until tree canopy is established, semi-annually thereafter |
| | | Removal of sediment from upstream of proposed Bellevue Blvd control weir | Annually, or as needed |
| St. Thomas Drive to Belleair Boulevard | N/A | None | N/A |
| Belleair Boulevard to South Ridge | N/A | Mowing | Semi-annually |



*Stevenson Creek Watershed Management Plan
Final Report*

Table 3.3-1 (Continued) Recommended Channel Maintenance Plan

| Channel Segment | Applicable Improvement Project | Recommended Maintenance Type(s) | Recommended Frequency |
|---|---------------------------------------|---|---|
| Spring Branch | | | |
| Stevenson Creek to Douglas Avenue | N/A | Periodic removal of exotic and invasive plant species | Once every 2-5 years, or as needed |
| Douglas Avenue to Sunset Point Church | N/A | Jurisdiction of Pinellas County | N/A |
| Sunset Point Church to King's Highway | WMP Project 1A.1 | Mowing | Semi-annually |
| Byram Pond | WMP Project 1E | Dredging | Annually |
| Byram Pond to Union Street | WMP Project 1F | Mowing | Semi-annually |
| Hammond Branch | | | |
| Stevenson Creek to King's Highway | N/A | Periodic removal of exotic and invasive plant species | Once every 2-5 years, or as needed |
| Flagler Drive Ditch, Highland Avenue to Keene Road | N/A | Mowing | Semi-annually |
| CSX Railroad north swale, Highland Ave. to Sharondale Drive | WMP Project 5A | Mowing | Semi-annually |
| Jeffords Street Branch | | | |
| 600' west of Lake Ave to Lake Avenue. | WMP Project 7C | Mowing | Semi-annually |
| Proposed Pond at Barry Road and Tuscola | WMP Project 7C | Mowing of embankment slopes and grassed areas | Semi-annually |
| | | Initial monitoring and maintenance of created wetland areas | Quarterly for the first year, Semi-annually thereafter, until beneficial vegetation is well established |

In addition to the main channel segments listed in the above table, maintenance of the CSX railroad ditch that runs parallel to Maple Street, from Betty Lane to North



***Stevenson Creek Watershed Management Plan
Final Report***

Greenwood Avenue is recommended. The City currently owns a narrow tract of land adjacent to the south side of the ditch that could be used for maintenance access. Regular maintenance of this ditch would alleviate a structure FPLOS deficiency at 512 Washington Avenue.

Created Wetlands and Littoral Shelves. Proposed Projects 1C, 2D, 3A, 6A, 7A, 7B, and 7C are improvements that incorporate created wetland and/or littoral shelf areas. Monitoring and maintenance of created wetland areas is recommended to ensure the success of the wetland plantings. Maintenance should be conducted quarterly for the first year, and semi-annually thereafter, until beneficial vegetation is well established.

Inlets and Control Structures. Curb and ditch-bottom inlets should be inspected at least annually for blockages due to vegetation, sediment, trash, etc, and for structural integrity and safety. Cleaning of existing and proposed catch basins, or water quality inlets, and CDS units should be conducted based on an established schedule. The City of Clearwater currently has two (2) vacuum trucks for this purpose, and is in the process of purchasing a third one. Periodic inspection of all existing and new water level control structures for structural integrity, safety, accumulated sediment, vegetation, and blockages should be conducted by qualified engineering staff. Vegetation and accumulated sediment should be removed as needed from around water level control structures to ensure their proper functioning.

Culverts and Storm Sewers. The Stevenson Creek Watershed contains many existing culverts and storm sewers that are several decades old. Most of these culverts are still in serviceable condition and do not require regular maintenance. Those that were identified to be in an obvious state of deterioration are recommended for replacement in one of the 28 recommended projects described in Section 3.1. However, all infrastructure is continually deteriorating, and culverts, storm sewers, and inlets should be inspected periodically (approximately every 3 to 5 years) to identify those in need of replacement. When culverts and storm sewers are identified for replacement, the design should be



***Stevenson Creek Watershed Management Plan
Final Report***

evaluated to determine the appropriate size for the culvert to meet current design criteria for flood protection level of service.

Golf Course Best Management Practices. There are currently three golf courses within the Stevenson Creek Watershed. The two largest courses include the Clearwater Country Club Course and the Clearwater Executive Course. The third course is the Glen Oaks Golf Club, a small course that under this plan is proposed to be converted into a stormwater detention facility. Golf courses are some of the most highly maintained developed areas in the state. The expanses of turf grass, manicured landscaping, and sparkling blue water traps lead some people to think that because these areas are not paved, that they are beneficial to the environment. What most people don't realize is that a considerable amount of physical and chemical manipulation of the natural environment must be undertaken to create this illusion of perfection. The physical alterations include site grading and changing historic drainage patterns, removing native vegetation, and planting exotic, typically high-maintenance vegetation. The chemical manipulations include applications of:

- Fertilizers to help the exotic vegetation survive in the foreign environment,
- Insecticides to protect the exotic vegetation against predators for which they have no natural defense,
- Herbicides to reduce competition from other exotic species, and
- Fungicides to counteract the effects of the excessive amounts of water the exotic turf grasses require.

When these chemicals are used, the excess typically is found in surface and ground water, where they can be extremely detrimental to the environment. The effects of pesticides and fertilizers on surface and groundwater quality should motivate golf course operators to opt for application methodologies and the selection of substances with the least potential to cause water quality problems.

A comprehensive program of best management practices specifically for golf courses was developed by the University of Florida Institute of Food and Agriculture Sciences (IFAS). This program discusses ways to reduce or eliminate the need for



*Stevenson Creek Watershed Management Plan
Final Report*

fertilizers and pesticides, and recommends more environmentally friendly substances to use when needed. Some of the recommendations include:

- Use native plants in the landscape. Native plants have adapted to the environment and require less water to survive. They also have natural defenses against many predators, which will reduce the need for pesticides. Native plants will also provide habitat for wildlife.
- There are turf grasses that have been developed for use on golf courses that are hardier and require less water and fertilizer. The Pinellas County Agricultural Extension Office has information on these newly developed grasses.
- Before using a pesticide, identify the target pest. This is essential for the selection of the proper pesticide to be used. Once the pest is identified, check with the IFAS to determine the recommended pesticides for that species. These recommendations will consider soil properties such as runoff potential, leaching potential, and the relative toxicity of the pesticide.
- The application methodology is an important factor to consider when using pesticides and fertilizers. Applications directly on the soil or incorporated into the soil will likely make more product available for leaching or runoff loss. Applications to foliage may lose some product to evaporation, absorption into the foliage, or decomposition in sunlight and thereby would reduce the amount available for wash-off and transport to water bodies.
- Create littoral shelves within the water traps and plant them with emergent aquatic vegetation. The vegetation will improve water quality and reduce the occurrence of algal blooms. Fewer chemicals will be needed to keep the water features clear.
- Use organic pesticides and fertilizers when possible. Many products have been developed especially for use on golf courses and have been tested successfully by the IFAS. Information on these products is available from the county extension service.



3.4 PUBLIC AWARENESS AND INVOLVEMENT PROGRAMS

An essential component of any restoration plan is a focused and integrated public education and involvement program. Many agencies, both public and private, have information for the homeowner regarding practices that can be implemented at the individual home level for the benefit of the local environment. Most residents, when educated regarding their immediate environment and their potential impact upon it, become more interested in acting more responsibly.

3.4.1 Adopt-a-Creek Program for Stevenson Creek

One of the most successful methods of encouraging public involvement/awareness in the Tampa Bay area is to establish a citizen's group that "adopts" a piece of property or natural feature. Adopt-a-Pond, Adopt-a-Highway, and Adopt-a-Shoreline are examples of such programs in which a group of citizens accepts the responsibility of maintaining a section of the property on a regular basis. The Adopt-a-Pond program in Hillsborough County has been very successful in the past years, and a similar program for Stevenson Creek could be implemented. The program would encourage residents along the creek to take interest in keeping the creek clean and to help prevent water quality problems.

No regularly scheduled program of adoption and maintenance is currently offered for Stevenson Creek, despite the obvious interest and concern of the local residents. It is recommended that a program of this nature be implemented within the watershed, to accomplish the maintenance and enhancement as needed. The greatest benefit to the watershed would be the regular removal of trash and exotic vegetation within and adjacent to the creek. The creek can be segmented and the responsibilities distributed among the various civic groups and homeowner associations. A group leader will be trained in plant identification and the proper methods of eradication. Pam Leasure with the Pinellas County Department of Environmental Resources (telephone: 727-464-4793) can be contacted if there is an interest in implementing an Adopt-a-Creek program for the Stevenson Creek Watershed.



3.4.2 Proper Use of Pesticides and Fertilizers

3.4.2.1 Pesticide Use

Pesticides are applied to control a pest species, usually by reducing the population to an acceptable level. This objective can sometimes be achieved without damage to non-target species. However, when pesticides are broadcast sprayed over lawns and fields, a variety of onsite non-target organisms is impacted. In addition, much of the sprayed pesticide invariably drifts away from the intended site and deposits in non-target organisms and ecosystems. Many pesticides are not thoroughly tested prior to distribution and long term effects are not determined until too late. The pesticide DDT is a well-known example. Although the use of DDT was banned in the United States over twenty-five years ago, there are several sites within Tampa Bay where sediment concentrations exceed the No Observable Effects Level (NOEL) (TBNEP 1996).

A preferable alternative to pesticide use is integrated pest management (IPM). Within the context of IPM, acceptable pest control is achieved by employing an array of complementary approaches. The can include:

- use of natural predators, parasites, and other biological controls
- Use of pest resistant varieties of turf grass and landscape plants. Native plant species are frequently more resistant to pests and pathogens than non-native species.
- Modification of environmental conditions so as to reduce the optimality of the pest habitat. This would entail not planting monocultures of specific plants.
- Careful monitoring of pest abundance, and using pest-specific, less toxic pesticides such as *Bacillus thuringensis*.
- Use of pesticides only when they are required as a specific component of the IPM.

Information regarding insect pests, the proper use of pesticides and IPM is available at the Pinellas County Cooperative Extension Service or visit the web site at <http://gnv.ifas.ufl.edu/~FAIRSWEB/IPM/IPMFL/IPMFL.HTM>.



3.4.2.2 Fertilizers

Most homeowners use too much fertilizer in their landscapes. Over-fertilizing actually encourages the growth and proliferation of certain insects and diseases and increases maintenance needs. When choosing fertilizers, homeowners should request products that contain nutrients in water-insoluble or controlled-release form. These fertilizers dissolve slowly into the soil, reducing amount of nutrients lost in stormwater runoff. The PCCES has free information regarding the most environmentally friendly fertilizers to purchase, and how they should be applied. This information can be obtained at the extension office or at the web site listed above.

3.4.3 “Green” Thumb Landscaping Practices

The University of Florida Cooperative Extension Service, in partnership with the Tampa Bay National Estuary Program, the Florida Sea Grant College Program and numerous other environmental agencies, has prepared a Landscaping Guide for the Florida Yards and Neighborhoods Program. This informative guide describes the benefits of using native plants in the landscape and how to recreate the habitat that was lost when development occurred. The guide explains such practices as composting, mulching, fertilizing, and watering, and how these common practices can be undertaken without comprising the environment. The program also touches on such issues as maintaining waterfront property in a non-invasive manner, how to maintain a septic system, and how to attract wildlife to your backyard. This information is free from the PCCES or visit the web site at <http://coop.co.pinellas.fl.us/>.

A valuable source of information for creating an environmental landscape is the National Wildlife Federation (NWF). This organization has prepared a program that educates homeowners in the benefits of landscaping to attract wildlife and provides the basic information needed to develop wildlife habitat in a residential setting. This program is called the Backyard Habitat program, and participating residents can have their houses certified as habitat by the NWF. This and other useful topics are discussed on their web site at <http://www.nwf.org/>.



Stevenson Creek Watershed Management Plan Final Report

Another successful program is the *Naturescape* Urban Wildlife Enhancement Program, developed by the Pinellas County Department of Environmental Management (PCDEM). The booklet was produced for the residents within the Allen's Creek watershed, but the principles are applicable to all watersheds in central Florida. The booklet provides ideas on how to reduce water loss when irrigating the landscape, how to use less pesticides and fertilizers, how to create wildlife habitat, and what plants to put in the landscape, as well as what plants to avoid. This booklet is free and can be obtained from the PCDEM.

The Southwest Florida Water Management District has produced a significant amount of information on Xeriscaping. This method of landscaping reduces the amount of water that is needed by planting native and non-native plants that require little water, reducing the square-footage of water-dependent turf-grass, and by planting species that do require water in zones that can be irrigated more efficiently. Other aspects of Xeriscaping include the use of mulch to reduce moisture loss from the soil, and the use of mulch made from exotic species such as melaleuca and eucalyptus or from recycled wood products. Information can be obtained from SWFWMD free or for a nominal fee. The SWFWMD Tampa Field Office can be contacted at (813)-985-7481 or on the world wide web at <http://www.swfwmd.state.fl.us/watercon/xeris/swfxeris.html>. Information about native plants can be obtained at the Florida Native Plant Society web site at <http://www.fnps.org/index.html>. Additional information regarding xeriscaping can be obtained from the PCCES on their web site at <http://coop.co.pinellas.fl.us/Toughcom.htm>.

3.4.4 Florida Yards and Neighborhoods Program

The Pinellas County branch of the Florida Yards and Neighborhoods Program was developed by the National Estuary Program and is managed by the Pinellas County Cooperative Extension Service. This program utilizes the educational elements by helping neighborhoods work together to treat area-specific problems such as nutrient- and



Stevenson Creek Watershed Management Plan Final Report

chemical-rich stormwater runoff, yard waste disposal, misuse of chemical biocides, and improper shoreline maintenance.

The first step in participation with this program is a preliminary meeting with FYNP staff and homeowners associations requesting participation in the program. Each of the homeowners is given a detailed questionnaire to determine their specific yard maintenance activities. If a neighborhood meets the requirements for investigation by the FYNP, a team of environmental specialists performs inspections, targeting problems associated with landscape practices and stormwater runoff. Results of these inspections are analyzed and presented to the homeowners association along with suggestions on ways to remedy current environmental problems through sustainable yard maintenance practices.

3.4.5 Storm Drain Marking Program

An important component of public education for watershed management is the storm drain-marking program. This program enlightens citizens about the potential adverse effects of stormwater runoff entering surface water bodies. Many people allow paint, petroleum products and yard wastes to wash into gutters and into storm drains without consideration of the potential effects on surface waters. The storm drain marking program involves simply painting legible messages on the drains to remind the public where the drains lead. Within the Stevenson Creek Watershed, the messages may read “NO DUMPING - DRAINS TO CLEARWATER HARBOR,” or “DUMPING HERE POLLUTES STEVENSON CREEK AND CLEARWATER HARBOR”. Some of the messages may include illustrations of fish, manatees, wading birds, or dolphins.

The storm drain marking program has been successfully implemented within other areas of the City of Clearwater, and could be implemented within the Stevenson Creek Watershed without significant expense. Volunteers from local schools and civic groups could be organized to conduct the marking under the supervision of officials from various Tampa Bay agencies such as Tampa Baywatch, Tampa Bay National Estuarine Program, and city and county government. Items needed for the drain marking include traffic



***Stevenson Creek Watershed Management Plan
Final Report***

cones, a broom, paint, safety vests, instruction sheets, and stencils. These items can be purchased or fabricated from materials costing less than \$220.00.



3.5 EXOTIC PLANT ERADICATION PROGRAM

Native plant communities evolve with a complex relationship of natural controls that keep them in balance. These natural controls may include environmental requirements, competing plant species, herbivores including insects, and pathogens. When exotic plants are introduced to areas, they often have a competitive advantage over native plants because natural controls of the exotic plants are not present. Removal of exotic plant species and restoration of native communities includes supplemental control methods to replace natural controls. These supplemental controls may include manual and/or mechanical removal, physical control such as fire or water level manipulation, chemical control including application of herbicides, and biological controls such as natural insect or pathogenic controls. The ultimate exotic plant control objective is to remove exotic species and re-establish natural conditions that will restore normal competitive processes, reducing the potential for re-invasion and the requirement for continual maintenance.

Exotic plant species commonly found in the Stevenson Creek Watershed are listed in Table 3.5-1:

Table 3.5-1 Exotic Plant Species Found in the Stevenson Creek Watershed

| Scientific Name | Common Name | Scientific Name | Common Name |
|--|--------------------------------|---------------------------------------|-------------------------------|
| <i>Casuarina equisetifolia</i> | Australian pine | <i>Melaleuca quinquenervia</i> | Melaleuca |
| <i>Colocasia esculenta</i> | Wild taro | <i>Melia azedarach</i> | Chinaberry |
| <i>Dioscorea bulbifera</i> | Air-potato | <i>Panicum repens</i> | Torpedo grass |
| <i>Eichhornia crassipes</i> | Water-hyacinth | <i>Ricinus communis</i> | Castor bean |
| <i>Enterolobium contortisiliquum</i> | Ear-pod tree | <i>Sapium sebiferum</i> | Chinese tallow tree |
| <i>Hibiscus tiliaceus</i> | Mahoe | <i>Schinus terebinthifolius</i> | Brazilian pepper |
| <i>Hydrilla verticillata</i> | Hydrilla | <i>Typha sp.</i> | Cattail |
| <i>Leucaena leucocephala</i> | Lead tree | <i>Urena lobata</i> | Caesar's weed |
| <i>Ludwigia peruviana</i> | Primrose willow | <i>Wedelia trilobata</i> | Wedelia |

Citation: Florida Exotic Pest Plant Council. FLEPPC 1999 List of Florida's Most Invasive Species. Internet: <http://www.fleppc.org/99list.htm>



***Stevenson Creek Watershed Management Plan
Final Report***

Current exotic plant control techniques used by City of Clearwater employees for non-aquatic vegetation include manual removal, herbicide application, and burning. Mechanical removal is not effective for control of Australian pine, Brazilian pepper, or melaleuca when used alone because the disturbance of soil creates conditions for regrowth from seeds and root fragments, and allows further invasion by pioneering exotic plants. Intense follow up with other control methods, preferably herbicide, is also required. Burning and water level manipulation are not applicable within this watershed due to the high density of the residential and commercial areas.

Aquatic nuisance vegetation is removed from lakes and ponds via herbicide application, manual removal, and the installation of native species. Private contractors do the majority of the exotic plant maintenance. The maintenance activity in the watershed is concentrated on the removal and treatment of emergent nuisance species such as *Ludwigia peruviana*, *Typha* sp., and *Eichhornia crassipes*. These plants can choke waterways and cause flooding.

3.5.1 Brazilian Pepper

Brazilian pepper is the most aggressive exotic in the watershed, and has been found in every terrestrial plant community. This exotic forms dense monocultures in previously disturbed areas and along roadside ditches. Brazilian pepper seeds are commonly dispersed by birds and small mammals.

Removal techniques for Brazilian pepper currently used in the City of Clearwater include manual removal and herbicide application. Herbicide application involves basal bark application of a Garlon 4/diesel solution in a minimum 4-inch band approximately 6 to 12 inches above ground. The Garlon 4/diesel solution consists of two ounces of Garlon 4, Ortho X-77 spreader, and one quart diesel mixed into three quarts of water. Diesel is added to the herbicide to increase adherence to the stem, and decrease the potential for wash-off during rainfall. Retreatment may be required for larger stems. Dead stems are left standing to decay, or are removed to a landfill or mulch site. Mist application of a Garlon 4/diesel solution using one part Garlon 4 in 50 parts water is also required for treatment of seedlings under mature trees. Garlon 4 should also be applied to



***Stevenson Creek Watershed Management Plan
Final Report***

roots to eliminate regrowth. Safety equipment required during application includes a respirator, safety face shield, rubber gloves, and protective clothing. Eyewash should be carried to flush eyes in case of accidental splash or spray.

3.5.2 Australian pine

Australian pine also spreads through dispersion of seeds deposited along shorelines. Australian pine grows rapidly, forms dense monocultures, and tolerates saline conditions and a wide range of soil moisture. The dense shade and thick litter layer produced by stands of Australian pine prevent germination and growth of native species that provide food for birds and small mammals. Australian pine boles do not decay readily after being killed by girdling and tend to dry without decaying (“petrify”).

Australian pine removal techniques currently used in the City of Clearwater include cutting of the stem with a chainsaw, and spraying the stump with the Garlon 4/diesel solution described for Brazilian pepper. The cut stem is left to dry (“petrify”) for later disposal or use as fuel source. The effects of herbicide application will be noticeable within 3 to 7 days of application. Although trees can be treated throughout the year, herbicide application in April and May is most effective, followed by applications in June or July. Retreatment is performed after one month if required for larger trees. Small stems can be hand-pulled, bagged, and burned. The Garlon 4/diesel solution is also applied to roots to eliminate regrowth. Safety equipment required during application is the same as described for Brazilian pepper.

3.5.3 Melaleuca

Development activities, water level alterations, and climatic conditions make all areas in south and central Florida vulnerable to invasion by this exotic. Melaleuca grows very rapidly with trees as young as two years producing seeds. Melaleuca bark is thick and fire resistant; consequently, this exotic cannot be controlled by fire. Viable seeds formed on trees cannot be killed with herbicide or by cutting of the stem because any interference with water flow through the xylem to the seed capsules triggers immediate seed release.



***Stevenson Creek Watershed Management Plan
Final Report***

Melaleuca removal techniques currently utilized in the City of Clearwater include removal as encountered including manual cutting of the trunk, followed by stump treatment with herbicide Garlon 4. Seed capsules are put in plastic garbage bags within 20 minutes of stem cutting for disposal at the Pinellas County landfill. Landfill disposal includes burial at a depth sufficient to allow decay of the seed capsules, eliminating the potential for future sprouting. Stems are cut up and left to decay. Small seedlings are hand pulled, bagged, and burned; saplings too large to be pulled are sprayed with Garlon 4. Garlon 4 is also applied to the ground within an approximately 10-foot radius of the trunk to prevent growth of seedlings. Retreatment is provided as necessary at approximately six-month intervals.

3.5.4 Other Exotics

Other exotics currently present in areas within the watershed include ear-tree, chinaberry, Caesar weed, and air potato. These exotics are more easily controlled than those listed above. Removal techniques currently used for ear-tree include girdle and application of the Garlon 4/diesel solution described for Brazilian pepper. Chinaberry and air potato are controlled through manual removal and application of Garlon 4. These exotics are removed as encountered.

3.5.5 Estuary Restoration Plan

The U.S. Army Corps of Engineers is currently reviewing an application from the City of Clearwater to participate in a Brownfields demonstration project using the Stevenson Creek Estuary. The proposed Section 206 project will involve the removal of approximately 80,000 cubic yards of muck sediments from the creek between the Douglas Avenue Bridge and the North Fort Harrison Bridge. In addition to the muck removal, the project will involve the removal of nuisance species that currently grow on some of the sediment deltas and on the shoreline of the creek. Species to be removed include cattail, torpedo grass, Brazilian pepper, melaleuca, and mahoe. Once the nuisance vegetation accumulated sediments are removed, the shorelines of the creek will be planted with native vegetation, such as mangroves, cord grass and giant leather leaf fern.



3.5.6 Summary and Recommendations

The proposed watershed improvements are expected to effect exotic control activities in areas currently being maintained, and to facilitate removal and maintenance activities in additional exotic species affected areas by increasing accessibility. Some exotic species removal may be proposed as mitigation for impacts to wetlands during watershed improvements.

Precautions must be taken during all grading and filling activities associated with the watershed improvements, as well as removal of large-stem exotics, to minimize the enhancement of seedbed conditions. Enhancement may arise from scraping of existing seedbeds or deposition of materials that provide a seed source for exotics.

Damage to non-target vegetation and potential water contamination are potential concerns for exotics control. Herbicides effective for Australian pine and Brazilian pepper control are not selective and many native species are highly sensitive to these herbicides. Over spray and heavy rainfall following application can wash the herbicide off the trunk and damage non-target vegetation and/or enter surface water. For these reasons, the use of injection techniques instead of basal bark or girdle applications is preferred for exotics control in wetlands. In addition, while the current practice of leaving stems to decay or “petrify” provides some habitat value as bird perches and small mammal cover, stems and debris generated from larger scale exotics removal activities must be removed from wetland areas.

Exotic plant species control methods and recommendations discussed above are primarily applicable to the undeveloped public lands within the watershed. Development of a detailed plan for exotics removal and maintenance is recommended.



3.6 LEGAL AND REGULATORY FRAMEWORK

This section summarizes the existing legal and regulatory framework governing stormwater and environmental management within the City of Clearwater and the Stevenson Creek Watershed. The first four subsections outline the regulatory authority of federal and state agencies over watershed management issues. Implementation of the Watershed Management Plan will require close coordination with these agencies. The fifth and final subsection concerns the City of Clearwater and its stormwater and environmental legal framework governing items such as funding of capital improvement projects, stormwater levels of service, and municipal codes and ordinances regulating stormwater discharges, erosion control, etc.

3.6.1 U.S. Army Corps of Engineers

The U.S. Army Corps of Engineers (USACE) regulates dredge and fill activities within existing wetlands and other surface waters of the United States, including both natural and man-made lakes and ponds. Federal permitting of the recommended projects of the Stevenson Creek Watershed Management Plan will require close coordination with the USACE. The Environmental Resource Permit (ERP) program, implemented jointly in 1995 with the state water management districts, was designed to streamline the permitting process. Although the ERP application is described as a joint state and federal permit vehicle, the USACE application process can be lengthy and complicated even for relatively simple projects. The USACE issues four types of permits depending upon the type of activity proposed. The categories of permits include the 1) Letter of Permission, 2) Individual Permit, 3) Nationwide Permit, and 4) Regional or General Permit.

The permitting process for improvements proposed in this management plan will be a complex process. Because significant drainage improvements are proposed, a conceptual permit approach is recommended to facilitate the process. Once conceptual approval is achieved, the projects within the management plan can be permitted individually and expeditiously. More information regarding federal permitting can be obtained by calling Stuart Santos at (904)-232-2018 or by visiting the USACE web site at http://www.saj.usace.army.mil/permit/types_of_permits.htm.



3.6.2 U.S. Environmental Protection Agency

The National Pollution Discharge Elimination System (NPDES) is a federal program implemented as a result of the Clean Water Act. This program, in conjunction with the stormwater pollution prevention plan (U.S. EPA 833-R-92-001, October 1992) requires permit approval and compliance with water quality standards for stormwater discharges from municipal and industrial stormwater treatment facilities and construction sites. In 1998, the EPA issued the Municipal Separate Stormwater Sewer System Permit (MS4 Permit) for Region IV, that includes several municipalities including the City of Clearwater. The 1997 Stormwater Management Plan for the City of Clearwater addressed many of the requirements for compliance with the MS4 Permit, and made recommendations for current and future needs. The implementation of the capital improvements recommended in the Stevenson Creek Watershed management plan, along with the maintenance of standard best management practices during and after construction, will help ensure compliance with the MS4 Permit.

3.6.3 Federal Emergency Management Agency

In 1968, the Federal Emergency Management Agency (FEMA) began the national flood insurance program (NFIP), a cooperative program between FEMA and local governments, of which the City of Clearwater is a participant. The purpose of the NFIP is to identify and map areas of special flood hazards (SFHA), to regulate building construction and related activities within SFHA's, and to make affordable flood insurance available to owners of homes and businesses.

The maps of SFHA's are known as flood insurance rate (FIRM) maps. Once adopted, FIRM maps can be amended by the local community through a formal FEMA/NFIP application process known as a letter of map revision (LOMR). As part of this Watershed Management Plan, the FIRM maps for the City of Clearwater, last updated in 1983, will be amended based on the existing conditions hydrologic and hydraulic modeling of the Stevenson Creek Watershed, and the corresponding 100- and 500-year floodplain maps and flood profiles illustrated on Figures 2.1-15 through 2.1-23.



*Stevenson Creek Watershed Management Plan
Final Report*

The basis for the revision will be better technical information, and a more detailed analysis than was conducted for the original flood insurance study.

Since 1990, the City of Clearwater has participated in the NFIP's community rating system, which gives flood insurance premium reductions to policyholders in communities that take additional measures to reduce flood damages, beyond the minimum standards necessary to participate in the NFIP. Under the system, communities earn "credit points" for floodplain management activities within the four categories of public information, mapping and regulation, flood damage reduction, and flood preparedness. Communities are assigned a rating between 1 and 10, with class 1 requiring the most credit points and giving the greatest premium reductions, and class 10 providing no reduction in premiums. Currently, the City of Clearwater enjoys a "class 7" status in the CRS, which puts Clearwater in the top 16% of participating communities, and translates directly into a 15% premium reduction for policyholders within an identified SFHA.

Implementation of the Stevenson Creek Watershed Management Plan will qualify the City for additional credit points in the CRS through flood damage reduction. As indicated in Section 3.1, implementation of the flood protection capital improvements of the Plan will eliminate 73% of the identified structure flood protection level of service (FPLOS) deficiencies within the watershed. Under the CRS, additional credit points are also provided to communities that institute programs to relocate or floodproof structures within the 100-year floodplain. It is recommended that concurrent to implementation of the flood protection capital improvement (CIP) projects, the City work with FEMA, the NFIP/CRS, and the owners of the remaining FPLOS deficiencies to relocate or floodproof those remaining FPLOS deficient structures that cannot be cost-effectively remedied by the recommended CIP projects. FEMA provides technical assistance and in many cases, grant money to help fund the flood proofing or relocation of flood-susceptible structures. Additional information regarding the National Flood Insurance Program is available at <http://www.fema.gov/nfip>.



3.6.4 Southwest Florida Water Management District / Florida Department of Environmental Protection

The Environmental Resource Permit (ERP) Program that became effective on October 3, 1995 governs watershed management activities in Florida including design of new development and stormwater management facilities with respect to allowable rates of runoff, stormwater treatment, and impacts to floodplains and wetlands. The program represents the merging of the former wetland resource permit program from Chapter 403, Florida Statutes (F.S.), with the management and storage of surface water (MSSW) permit program in Part IV of Chapter 373, F.S. The ERP Program applies statewide, except within the Northwest Florida Water Management District, where the former wetland resource permitting program remains in effect.

To allow an applicant to deal with only one agency when seeking an ERP, the review and approval or denial of the ERP permit application will be performed by either the Department of Environmental Protection (DEP), or the Southwest Florida Water Management District (SWFWMD), depending upon the type of activity involved. Operating agreements have been signed by the agencies to specify the responsibilities between them. Information regarding the type of activity that would require coordination with the DEP is available at their web site at <http://www.dep.state.fl.us/>.

Any projects within the watershed that are funded fully or partially by the SWIM program will also require permit review by the DEP, to avoid the potential for charges of a conflict of interest. The majority of the permit applications for capital improvements within the Stevenson Creek watershed will likely be made through SWFWMD. Additional information on State Environmental Resource Permitting is available at <http://www.swfwmd.state.fl.us/osp/permits.htm>.

3.6.5 City of Clearwater

Comprehensive Plan.

The City of Clearwater Comprehensive Plan, as adopted in May of 2000, includes nine major elements. Among the goals stated within these nine elements are the conservation, protection, and restoration of the quality of surface waters within the City,



*Stevenson Creek Watershed Management Plan
Final Report*

the conservation and protection of wildlife habitat, and the management of the quantity and quality of stormwater runoff. The comprehensive plan identifies the need to “continue to prepare stormwater management plans which will identify and prioritize the implementation of programs to improve and enhance stormwater quality and quantity.” Other specific goals, needs, and policies related to watershed management stated within the comprehensive plan are highlighted below:

Future Land Use Element

- No new development or redevelopment will be permitted which causes the level of City services (traffic circulation, recreation and open space, water, sewage treatment, garbage collection, and drainage) to fall below minimum acceptable levels.

Utilities Element – Sanitary Sewer

- New septic tanks should not be permitted. Residents located in nearby unincorporated areas using septic tanks should connect to the City sewage system, as sewer lines become available.

Utilities Element – Stormwater Management

- The City of Clearwater needs to continue to monitor the stormwater management utility fee rate structure and amend it as required to remain competitive and maintain an adequate funding source to provide revenue for flood control, maintenance, retrofitting, and treatment of stormwater.
- The City of Clearwater needs to take advantage of any alternative funding opportunities that may become available from any State Agency with regard to watershed management and/or general stormwater improvements.
- The City of Clearwater needs to continue to reduce flooding problems and strive for abatement of flood damage to houses and streets.
- The City of Clearwater needs to continue to maintain, correct deficiencies and improve, where necessary, current levels of service. Maintenance and



*Stevenson Creek Watershed Management Plan
Final Report*

improvement of the City Stormwater management system must be recognized as a service provided by the City on a regular and continuous basis.

- Natural and man-made wetlands need to be utilized for stormwater storage and protected as natural resources. Wetlands provide a natural wildlife habitat and groundwater recharge functions which are pivotal characteristics of the natural and urbanized environment.
- The City of Clearwater needs to research and develop new methods that are technically, environmentally, and economically viable of treating stormwater runoff before final discharge to improve and enhance local surface waters.

Conservation Element

- The City shall continue to protect floodplains, drainage ways, and all other natural areas having functional hydrological characteristics.

Recommendations.

With regards to level of service goals for drainage and flood protection, it is recommended that Policy 16.1.1 in the Comprehensive Plan be amended to coincide with the flood protection level of service (FPLOS) criteria adopted for the Stevenson Creek Watershed Management Plan. The primary FPLOS criterion is that there is to be no structural flooding (i.e., homes and businesses) for events up to and including the 100-year flood. This criterion refers to the low floor slab elevation (lowest inhabited floor) as the point of structural flooding. This is consistent with FEMA/NFIP guidelines, and has been widely adopted by counties and municipalities across the state and the country.

The secondary set of FPLOS criteria specifies allowable thresholds for street flooding. The criteria is based upon residential, collector, and arterial roadways being passable for the 10, 25, and 100-year flood events, respectively. “Passable” is defined herein as 6” of flooding or less at the lowest edge of pavement in a travel lane. No flooding is allowable on hurricane evacuation routes for events up to and including the 100-year flood. The following table summarizes the FPLOS criteria adopted for the Stevenson Creek Watershed Management Plan and the City of Clearwater:



Proposed Flood Protection Level of Service (FPLOS) Criteria

| FPLOS Category | Allowable Flooding Depths |
|------------------------------------|-------------------------------------|
| 1. Residential Streets, 2 lanes | Up to 6” Allowed for 10-year flood |
| 2. Collector Roads, 2-4 lanes | Up to 6” Allowed for 25-year flood |
| 3. Arterial Roads, 4 or more lanes | Up to 6” Allowed for 100-year flood |
| 4. Hurricane Evacuation Routes | No flooding up to 100-year flood |
| 5. Habitable Structures | No flooding up to 100-year flood |

The above criteria is recommended for retrofit of existing City facilities that currently fall below the minimum levels of service. Due to varying levels of maintenance and the inevitable deterioration of public infrastructure over time, it is recommended that a safety factor be applied to all new stormwater management facilities serving new development within the City. The “safety factor” would help ensure these systems continue to function in the future at the minimum level of service, and could take the form of an additional 6” to 12” of freeboard applied to the minimum criteria stated above.

With regards to reducing damages and losses due to flooding, it is recommended that Policy 16.3 be amended to include a provision that would allow the City, in cooperation with FEMA and/or SWFWMD, to consider the purchase, relocation, or floodproofing of flood-susceptible private properties in cases where it is not technically feasible or cost-effective to reduce flood levels through infrastructure improvements. The purchases, relocations, and/or floodproofing should be done in cooperation with willing owners of flood-susceptible homes and businesses, and only after infrastructure improvement alternatives have been explored within an adopted watershed management plan.

Community Development Code.

The community development code for the City of Clearwater governs the design and construction of new development and re-development. The applicable divisions of this code include Division 7 – Erosion and Siltation Control, and Division 9 – General Applicability Standards. Within Division 9, the City of Clearwater Subdivision Design



***Stevenson Creek Watershed Management Plan
Final Report***

Standards and Stormwater Drainage Criteria Manual is incorporated by reference. The Stormwater Drainage Criteria Manual specifies the methods to be used for calculating peak rates of runoff. This document includes a requirement for redevelopment of land upon which no stormwater treatment or attenuation facilities exist, whereby the redeveloper is required to provide “treatment of ½” of rainfall as applied to the entire area of a development project, and ½ inch as applied over the portion of the site plan undergoing alteration in the case of redevelopment.” The manual also specifies the use of a pre-redevelopment weighted runoff coefficient of 0.2 for a site that drains to an area of known flooding problems, and a coefficient of ½ of the actual calculated coefficient for a site that does not drain to an area of known flooding problems. This requirement results in a reduction in peak rates of runoff from sites undergoing redevelopment. These provisions exceed the requirements of the SWFWMD, which in many cases of redevelopment do not require any treatment or attenuation.

Recommendations

To ensure compliance with the recommended drainage and flood protection level of service goals stated at the beginning of this section, the City of Clearwater Subdivision Design Standards and Stormwater Drainage Criteria Manual should be amended to include the proposed FPLOS criteria, with an appropriate safety factor to be applied to new development. It is also recommended that possible changes to the Stormwater Drainage Criteria Manual be considered that would allow some flexibility in the methods used to calculate peak rates of runoff, such as allowing the SCS method in place of the rational method. This change would reduce any potential liability the City may be taking on by specifying the hydrologic methods to be used for private development, as these methods may not be the most applicable in all situations.

Municipal Code of Ordinances.

The applicable portions of the City’s Code of Ordinances related to watershed management include the following chapters:

Chapter 32. Utilities. Article VI. of this chapter governs Stormwater Management. This article establishes the legal framework for the City’s Stormwater Utility in



***Stevenson Creek Watershed Management Plan
Final Report***

accordance with Florida Statute 403.0893, and establishes the stormwater utility fee structure. Additional articles in this chapter govern Sanitary Sewers, Water Supply, and Solid Waste.

Chapter 33. Waterways and Vessels. Section 33.003 of Article I prohibits the placing, discharging, or depositing of sewage, trash, garbage, etc., into navigable waters. This includes the banks and shores of any tributaries where this material “is reasonably likely to be washed into such navigable waters, either by ordinary tidal actions or by the action of rain, floods or otherwise.”

Chapter 47. Buildings and Building Regulations. Article I of this chapter specifies the methods and sources used to set the minimum floor elevations for new buildings or additions to existing buildings.

Chapter 51. Flood Damage Prevention. This Chapter governs management of the floodplain within the City of Clearwater including adoption of floodplain mapping, and requirements for new development and building construction, including encroachments into designated floodplains and floodways. Adoption and enforcement of this ordinance is required for participation in FEMA’s National Flood Insurance Program (refer to Section 3.5-3).

Recommendations

Dumping of yard waste into creeks, ditches, swales and even storm sewers is a fairly common practice throughout the Stevenson Creek Watershed (see Figure 3.5-1). This practice increases the workload of City maintenance crews, and degrades the quality of the stormwater by introducing nutrient-rich organic material to the system. When water levels and velocities rise due to heavy rainfalls, the material is washed into the Creek, and downstream where it ultimately deposits in the Stevenson Creek Estuary. The estuary has, in recent decades, become choked with highly organic sediments. Illegal dumping of yard waste has undoubtedly contributed to the accumulation of these sediments.

Section 32.274 of the Code of Ordinances prohibit the placement of solid waste into any creeks, watercourses, storm sewers, and ditches, within the City and prohibits the placement of “waste materials of any kind...which impairs the proper operation of the



*Stevenson Creek Watershed Management Plan
Final Report*

city’s sewer or drainage system”. Although these ordinances are interpreted to include lawn clippings, leaves, and fallen limbs, etc., such yard waste is not specifically mentioned in this portion of the Code. In order to facilitate the understanding and enforcement of this facet of the Code, it is recommended that “yard waste” be specifically included as a prohibited item.



Figure 3.6-1 Yard waste (Oak leaves) dumped by a resident on the banks of Upper Stevenson Creek.

The City Should actively seek to educate its residents on the negative effects of the dumping of yard waste into its creeks, ditches, and storm sewers. If necessary, these education efforts should be followed by active enforcement of the applicable ordinances.

3.7 CAPITAL IMPROVEMENT COST ESTIMATES

For purposes of budgetary planning, cost estimates were made, in 2001 dollars, of each recommended capital improvement project. The cost estimates are based on the conceptual design and are subject to change pending completion of a more detailed design process. Costs for most items were estimated based on past or current similar Parsons ES projects, and by consulting the FDOT 1- and 3-year cost history listings dated February 2001. Mobilization and demobilization costs were typically estimated to comprise approximately 9% of the total construction cost.

[Table 3.7-1](#) summarizes the total cost estimates for the individual projects, detailed estimates of which are included as [Appendix H](#). The estimates include land acquisition, engineering and related services (surveying, environmental permitting, etc.), construction, and contingency.

Cost estimates for acquisition of private property were based on the most recent assessed value as reported by the Pinellas County Property Appraiser's Office, multiplied by a factor of 1.5 to include fair market value of the property plus legal fees.

The magnitude and scope of the recommended improvements, coupled with budgetary constraints, will require phased implementation of the plan over a number of years. The capital costs listed in Table 3.7-1 will need to be adjusted annually for inflation, up to the year of actual construction, based on the construction price indices for the applicable year(s). In the next section, the recommended prioritization rankings are presented which will facilitate the development of an implementation schedule.



*Stevenson Creek Watershed Management Plan
Final Report*

Table 3.7-1. Stevenson Creek Watershed Management Plan Capital Cost Estimates

| Project No. | Project Description | Estimated Capital Cost (2001 dollars) |
|--|---|--|
| <u>Spring Branch</u> | | |
| 1A.1 | Spring Branch Conveyance Enhancements (Lower Portion) | \$526,115 |
| 1A.2 | Spring Branch Conveyance Enhancements (Upper Portion) | \$960,703 |
| 1B | Springtime Avenue and Douglas Avenue Bridges | \$830,830 |
| 1C | Spring Branch Flood Detention Basin | \$2,634,542 |
| 1D | Woodland Terrace Storm Sewer Replacement | \$446,783 |
| 1E | Byram Pond Dredging and Expansion | \$831,636 |
| 1F | Spring Branch Stabilization, Union Street to Byram Pond | \$933,969 |
| 1G | Clearview Lake | \$620,212 |
| 1H | Betty Lane Forested Habitat Preservation Site | \$1,100,000 |
| Subtotal (for alternative 2 - excluding project 1B) | | \$8,053,960 |
| <u>Lower Stevenson</u> | | |
| 2A | Palmetto Street Sediment Sump | \$544,546 |
| 2B | N. Missouri Ave. and Palmetto St. Drainage Improvements | \$486,615 |
| 2C | Installation of Additional CDS Units | \$526,500 |
| 2D | Overbrook Avenue Detention Pond | \$1,755,860 |
| Subtotal | | \$3,313,520 |
| <u>Middle Stevenson</u> | | |
| 3A | Glen Oaks Stormwater Detention Facility | \$2,203,240 |
| Subtotal | | \$2,203,240 |
| <u>Upper Stevenson</u> | | |
| 4A | Hillcrest Avenue Overflow Bypass Culvert | \$2,299,109 |
| 4B | Upper Stevenson Creek Stabilization | \$1,415,843 |
| 4C | St Thomas Drive / Bellevue Boulevard Creek Restoration | \$1,801,913 |
| Subtotal | | \$5,516,865 |
| <u>Hammond Branch</u> | | |
| 5A | Flagler Drive / CSX Railroad North Swale Improvements | \$737,241 |
| 5B | Palmetto Street Drainage Improvements | \$735,643 |
| 5C | Saturn Avenue Drainage Improvements | \$303,382 |
| 5D | Smallwood Circle Drainage Improvements | \$161,283 |
| 5E | Lake Hobart Outfall Control Structure | \$14,300 |
| Subtotal | | \$1,951,848 |
| <u>Lk Bellevue Branch</u> | | |
| 6A | Expansion of Lake Bellevue | \$1,337,884 |
| 6B | Turner Street Box Culverts | \$1,554,761 |
| Subtotal | | \$2,892,645 |
| <u>Jeffords St Branch</u> | | |
| 7A | Crest Lake Expansion | \$881,466 |
| 7B | Duncan Avenue/Turner Street Detention Pond | \$1,494,952 |
| 7C | Jeffords Street/Barry Road Detention Pond | \$1,690,634 |
| Subtotal | | \$4,067,053 |
| Grand Total | | \$27,999,132 |



*Stevenson Creek Watershed Management Plan
Final Report*

Table 3.7-1. Stevenson Creek Watershed Management Plan Capital Cost Estimates

| Project No. | Project Description | Estimated Capital Cost (2001 dollars) |
|--|---|--|
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| 1A.2 | Spring Branch Conveyance Enhancements (Upper Portion) | \$960,703 |
| 1B | Springtime Avenue and Douglas Avenue Bridges | \$830,830 |
| 1C | Spring Branch Flood Detention Basin | \$2,634,542 |
| 1D | Woodland Terrace Storm Sewer Replacement | \$446,783 |
| 1E | Byram Pond Dredging and Expansion | \$831,636 |
| 1F | Spring Branch Stabilization, Union Street to Byram Pond | \$933,969 |
| 1G | Clearview Lake | \$620,212 |
| 1H | Betty Lane Forested Habitat Preservation Site | \$1,100,000 |
| Subtotal (for alternative 2 - excluding project 1B) | | \$8,053,960 |
| <u>Lower Stevenson</u> | | |
| 2A | Palmetto Street Sediment Sump | \$544,546 |
| 2B | N. Missouri Ave. and Palmetto St. Drainage Improvements | \$486,615 |
| 2C | Installation of Additional CDS Units | \$526,500 |
| 2D | Overbrook Avenue Detention Pond | \$1,755,860 |
| Subtotal | | \$3,313,520 |
| <u>Middle Stevenson</u> | | |
| 3A | Glen Oaks Stormwater Detention Facility | \$2,203,240 |
| Subtotal | | \$2,203,240 |
| <u>Upper Stevenson</u> | | |
| 4A | Hillcrest Avenue Overflow Bypass Culvert | \$2,299,109 |
| 4B | Upper Stevenson Creek Stabilization | \$1,415,843 |
| 4C | St Thomas Drive / Bellevue Boulevard Creek Restoration | \$1,801,913 |
| Subtotal | | \$5,516,865 |
| <u>Hammond Branch</u> | | |
| 5A | Flagler Drive / CSX Railroad North Swale Improvements | \$737,241 |
| 5B | Palmetto Street Drainage Improvements | \$735,643 |
| 5C | Saturn Avenue Drainage Improvements | \$303,382 |
| 5D | Smallwood Circle Drainage Improvements | \$161,283 |
| 5E | Lake Hobart Outfall Control Structure | \$14,300 |
| Subtotal | | \$1,951,848 |
| <u>Lk Bellevue Branch</u> | | |
| 6A | Expansion of Lake Bellevue | \$1,337,884 |
| 6B | Turner Street Box Culverts | \$1,554,761 |
| Subtotal | | \$2,892,645 |
| <u>Jeffords St Branch</u> | | |
| 7A | Crest Lake Expansion | \$881,466 |
| 7B | Duncan Avenue/Turner Street Detention Pond | \$1,494,952 |
| 7C | Jeffords Street/Barry Road Detention Pond | \$1,690,634 |
| Subtotal | | \$4,067,053 |
| Grand Total | | \$27,999,132 |



SECTION 4.0 WATERSHED MANAGEMENT PLAN PROJECT PRIORITIZATION

As stated in the introduction, the objectives of this Watershed Management Plan are to identify the causes of the problems of flooding, surface water quality degradation, excessive channel erosion, and loss of riparian habitat; and to identify, evaluate and recommend solutions to these problems. The problems and the causes of these problems were identified in Section 2.0. Recommendations for solutions to the problems were made in Section 3.0. This section serves to prioritize the improvements on the basis of benefits provided, cost effectiveness, and logical precedence.

The projects recommended in this document, whether considered singly or as a whole, are economically justifiable, and clearly in the interest of public safety, health, and welfare. The management plan is consistent with the laws of the federal, state and local government, and follows the policies outlined in State, regional, and local comprehensive plans.

In this section, projects that can be expected to provide the greatest overall benefit in the most cost effective manner are identified using a project ranking procedure. This management tool is a convenient and effective method of recommending priorities for the allocation of available funding. To help identify the priority projects in the Stevenson Creek Watershed Management Plan, a set of comparative evaluation criteria were identified, and a project ranking matrix was developed. The evaluation criteria selected as a means of grading the relative merits of the recommended master plan projects are discussed below. Within each category, individual projects were graded on a scale from 0 to 10, with the lowest score indicating no real benefit and the highest indicating a high beneficial value.

Flood Control Benefits. The relative flood control benefit of an individual project is a function of the number and type of Flood Protection Level of Service (FPLOS) deficiencies remedied by that project. The projects that rank the highest in this category



***Stevenson Creek Watershed Management Plan
Final Report***

will either alleviate flooding over a large geographic area, or reduce flooding within a geographically concentrated large group of flood-susceptible homes and businesses. A score of one-half point was earned for each structure FPLOS deficiency and each residential street FPLOS deficiency remedied by the project. Remediation of each collector, arterial, and evacuation route FPLOS deficiencies earned scores of 1.0, 1.5, and 2.0 points, respectively. The scores were summed for each individual project. Two projects, (3A) Glen Oaks, and (4A) Hillcrest Avenue Bypass, initially exceeded the maximum score of 10, and thus were assigned a score of 10.

Water Quality Benefits. The relative water quality benefits of an individual project reflect the ability of the project to capture and remove pollutant loads from the stormwater runoff prior to discharge into downstream waterbodies. Those projects with little or no real water quality benefits receive a score of 0, while a project specifically designed to provide a high level of treatment of currently untreated stormwater runoff from a large drainage basin would receive a high score. In assigning scores in this category, the total suspended solids (TSS) and total nitrogen (TN) loads expected to be removed (lb./year) by each project were determined from the proposed conditions pollutant loading model. These removal rates were used as comparative indicators of relative water quality benefits. The project with the largest rate of pollutant removal (Glen Oaks), was assigned a score of 10, and the scores for the other projects are based on their individual pollutant removal rates, expressed as a fraction of the removal rates of the Glen Oaks Project.

Ecological Benefits. The potential ecological benefits of individual projects are ranked based on evaluations of the anticipated improvements to wildlife habitat that will be realized after project construction. Factors such as the size of the affected area, current quality and ecological conditions, and proximity to other habitat areas are considered in the evaluation of benefits and the relative ranking. Areas that currently provide no habitat, but will provide significant habitat upon project completion, will rank



*Stevenson Creek Watershed Management Plan
Final Report*

the highest in the matrix. Conversely, those projects which will have no habitat impacts, such as the replacement of culverts for flood control, will rank the lowest.

Channel Erosion and Sedimentation Control Benefits. Projects which will have little or no effect in the remediation of channel erosion problems and sedimentation in the watershed are assigned a score of 0. Secondary benefits of projects that attenuate downstream peak discharge rates tend to reduce the potential for channel erosion, and therefore would earn the project a score of up to 5, depending on the magnitude of the attenuation and the proximity and severity of downstream erosion problems. Projects designed to permanently remedy severe channel erosion problems along a substantial length of channel would receive the highest ranking of 10. Projects that involve creation or expansion of maintainable sediment sumps on Stevenson Creek and Spring Branch would also receive a high score.

Recreational and Educational Benefits. The recreational and educational benefits associated with a project are those that provide new opportunities for the general public by accommodating the placement of features such as picnic areas and shelters, trails and boardwalks, nature parks, fishing, boating, and/or interpretive exhibits. Projects that provide no new opportunities for recreational and educational benefits receive a score of 0, and those that can provide a high level of recreational and educational opportunity would be assigned a score of 10.

Implementability. Implementability as a ranking criterion is an assessment of the relative severity of obstacles that must be overcome in order to construct the project. It is a cumulative assessment of factors such as property and easement acquisition requirements, permitting requirements, temporary impacts to nearby residences and businesses during construction, long-term maintenance and operation requirements, and relative ease of construction. A low ranking would be assigned to projects which would have a high degree of difficulty related to any or all of these issues. A high ranking would be assigned to a project with no foreseeable implementation concerns.



*Stevenson Creek Watershed Management Plan
Final Report*

Relative Benefits to Cost. As stated previously, all of the recommended projects of the Stevenson Creek Watershed Management Plan can be justified economically. However, because funding for public infrastructure improvements is not unlimited, it is useful to identify those projects that provide the most benefit for the least cost. In order to assign a score for this criterion, a total weighted benefits score was assigned to each project based on the sum of the weighted scores of the project in the five categories of flood control, water quality, ecological benefits, erosion control benefits, and recreational/educational benefits. The total benefit score was then divided by the preliminary cost estimate of the project in thousands of dollars. A multiplier was applied to the result to force an average score of 5.0, on a scale of 1 to 10, with 0 being the least cost effective and 10 being the most cost effective. A few projects earned scores greater than 10; these were subsequently reduced to 10. It should be noted that the result is not an actual benefit to cost ratio, but rather a relative measure of each project's cost effectiveness compared to the other projects the plan.

While each of the listed ranking criteria is an important factor when evaluating the individual watershed management projects, it is not essential that each should have an equal weighting in the evaluation matrix. For that reason, weighting factors were assigned to each, ranging from 1 to 5, to establish the relative importance of individual ranking criteria. The following is a list of the weighting factors used:

| Ranking Criterion | Weighting Factor |
|--|-------------------------|
| Flood Control Benefits | 5 |
| Water Quality Benefits | 4 |
| Ecological Benefits | 4 |
| Channel Erosion and Sedimentation Control Benefits | 3 |
| Recreational and Educational Benefits | 2 |
| Implementability | 2 |
| Relative Benefits versus Cost | 5 |



*Stevenson Creek Watershed Management Plan
Final Report*

Table 4-1. Stevenson Creek Watershed Management Plan Project Ranking Matrix

| Project No. | Project Description | Flood Control Benefits 5 | Water Quality Benefits 4 | Ecological Benefits 4 | Erosion Control Benefits 3 | Recreational/Educational Benefits 2 | Ability to Implement 2 | Relative Benefits vs. Cost 5 | Weighted Score | Rank |
|---------------------------|---|-----------------------------|-----------------------------|--------------------------|-------------------------------|--|---------------------------|---------------------------------|----------------|------|
| <u>Spring Branch</u> | | | | | | | | | | |
| 1A.1 | Spring Branch Conveyance Enhancements (Lower Portion) | 10 | 1.5 | 0 | 10 | 0 | 6 | 10.0 | 5.7 | 3 |
| 1A.2 | Spring Branch Conveyance Enhancements (Upper Portion) | 6.5 | 0.5 | 0 | 0 | 0 | 8 | 4.2 | 2.8 | 14 |
| 1B | Springtime Avenue and Douglas Avenue Bridges | 1 | 0 | 0 | 0 | 0 | 7 | 0.7 | 0.9 | 28 |
| 1C | Spring Branch Flood Detention Basin | 1 | 5.7 | 10 | 5 | 2 | 4 | 3.9 | 4.4 | 6 |
| 1D | Woodland Terrace Storm Sewer Replacement | 2.5 | 0.1 | 0 | 0 | 0 | 9 | 3.4 | 1.8 | 22 |
| 1E | Byram Pond Dredging and Expansion | 1.5 | 0.8 | 0 | 5 | 0 | 4 | 3.6 | 2.0 | 21 |
| 1F | Spring Branch Stabilization, Union Street to Byram Pond | 0 | 0 | 0 | 10 | 0 | 10 | 3.8 | 2.6 | 16 |
| 1G | Clearview Lake | 0.5 | 0.9 | 0 | 1 | 0 | 8 | 1.7 | 1.3 | 27 |
| 1H | Betty Lane Forested Habitat Preservation Site | 0 | 0 | 10 | 0 | 6 | 3 | 5.5 | 3.3 | 12 |
| <u>Lower Stevenson</u> | | | | | | | | | | |
| 2A | Palmetto Street Sediment Sump | 0.5 | 0.2 | 2 | 9 | 0 | 4 | 10.0 | 3.7 | 9 |
| 2B | N. Missouri Ave. and Palmetto St. Drainage Improvements | 1 | 0.9 | 0 | 0 | 0 | 9 | 2.1 | 1.4 | 24 |
| 2C | Installation of Additional CDS Units | 0 | 4 | 1 | 0 | 0 | 10 | 4.4 | 2.4 | 18 |
| 2D | Overbrook Avenue Detention Pond | 2 | 1.8 | 6 | 0 | 4 | 6 | 3.3 | 3.0 | 13 |
| <u>Middle Stevenson</u> | | | | | | | | | | |
| 3A | Glen Oaks Stormwater Detention Facility | 10 | 10 | 10 | 5 | 10 | 6 | 8.8 | 8.5 | 1 |
| <u>Upper Stevenson</u> | | | | | | | | | | |
| 4A | Hillcrest Avenue Overflow Bypass Culvert | 10 | 0 | 0 | 3 | 0 | 6 | 3.0 | 3.3 | 10 |
| 4B | Upper Stevenson Creek Stabilization | 0 | 0 | 0 | 10 | 0 | 8 | 2.5 | 2.2 | 19 |
| 4C | St Thomas Drive / Bellevue Boulevard Creek Restoration | 9.5 | 0.4 | 6 | 2 | 2 | 3 | 5.4 | 4.5 | 5 |
| <u>Hammond Branch</u> | | | | | | | | | | |
| 5A | Flagler Drive / CSX Railroad North Swale Improvements | 5.5 | 0 | 0 | 2 | 0 | 4 | 5.3 | 2.6 | 17 |
| 5B | Palmetto Street Drainage Improvements | 2 | 0 | 0 | 2 | 0 | 8 | 2.5 | 1.7 | 23 |
| 5C | Saturn Avenue Drainage Improvements | 1 | 0.2 | 0 | 0 | 0 | 9 | 2.2 | 1.3 | 26 |
| 5D | Smallwood Circle Drainage Improvements | 1 | 0.1 | 0 | 0 | 0 | 6 | 3.9 | 1.4 | 25 |
| 5E | Lake Hobart Outfall Control Structure | 0 | 0.8 | 0 | 0 | 0 | 10 | 10.0 | 2.8 | 15 |
| <u>Lk Bellevue Branch</u> | | | | | | | | | | |
| 6A.1 | Expansion of Lake Bellevue | 4.5 | 8.7 | 7 | 1 | 3 | 8 | 9.7 | 6.1 | 2 |
| 6A.2 | Upper Lake Bellevue Culverts | 7.5 | 0 | 0 | 0 | 0 | 10 | 10.0 | 4.1 | 8 |
| 6B | Turner Street Box Culverts | 4.5 | 1.2 | 0 | 0 | 0 | 7 | 2.1 | 2.0 | 20 |
| <u>Jeffords St Branch</u> | | | | | | | | | | |
| 7A | Crest Lake Expansion | 2 | 1.6 | 6 | 1 | 4 | 10 | 6.8 | 4.1 | 7 |
| 7B | Duncan Avenue/Turner Street Detention Pond | 7 | 0.8 | 4 | 0 | 0 | 5 | 4.2 | 3.3 | 11 |
| 7C | Jeffords Street/Barry Road Detention Pond | 8 | 2.8 | 5 | 10 | 0 | 3 | 7.0 | 5.5 | 4 |

***Stevenson Creek Watershed Management Plan
Final Report***

The project prioritization ranking matrix for the Stevenson Creek Watershed Management Plan is presented in Table 4-1. It is noted that this ranking matrix evolved over time, with input from all the participating entities and the general public.

It should be stressed that the ranking process is, to a certain degree, a subjective process that is oriented towards personal values. It is, however, a valuable tool for screening projects and grouping them into relative priority classes. It is apparent through examination of Table 4-1 that those projects which serve multiple purposes rank the highest when compared to those with singular objectives. Also apparent is the observation that the projects that rank the highest generally have the highest scores in the relative benefits to cost category.

Logical Precedence. Although not included as a ranking criterion per se, the successful implementation of the Stevenson Creek Watershed Management Plan will require consideration of the logical precedence, or order of construction of the individual projects. Many of the projects will rely on the prior completion of downstream improvements, in order to avoid creating unintended flooding impacts. Or, a project might not function at its intended full capacity unless constructed in conjunction with another nearby project. Within the Stevenson Creek Watershed Management Plan, four groups of projects were identified that require ordering by logical precedence. The four groups could be constructed in any order, however the projects within each group must follow the specified sequences. For comparison, the project rank is provided for each project in the sequence, within Table 4-2 below:



Table 4-2. Project Precedence

| Project Precedence Grouping | Required Sequence of Construction | Project Rank (Independent of Sequence) |
|------------------------------------|--|---|
| Spring Branch Group | 1. 1B <u>or</u> 1C | 28 (1B), 6 (1C) |
| | 2. 1A.1 | 3 |
| | 3. 1A.2 | 14 |
| | 4. 1G | 27 |
| Glen Oaks Group | 1. 3A | 1 |
| | 2. 4A, 6B | 10 (4A), 20 (6B) |
| Hammond Branch Group | 1. 5A | 17 |
| | 2. 5C | 26 |
| Lake Bellevue Group | 1. 6A.1 | 2 |
| | 2. 6A.2 | 8 |

By examination of the Spring Branch Group in Table 4-2, it is apparent that construction of third-ranked project (1A.1) Spring Branch Improvements, Lower Portion, will require the prior construction of a lower-ranked project, either (1B) or (1C), in order to avoid downstream flooding impacts associated with the channel improvements. The preferred alternative, Project (1C) Spring Branch Detention Basin, is close in rank to project (1A.1) at a rank of 6. However, if Project (1C) cannot be implemented, for any reason, 28th-ranked Project (1B) Springtime Avenue and Douglas Avenue Bridges must be built instead. This raises the question of how to assign priorities to two projects with widely different ranks that must be built together. This could be resolved by re-assigning some of the flood control benefits from Project (1A.1) to (1B), until the scores of the two projects in Table 4-1 are equal. The resulting weighted score would be 3.8, which would result in an overall rank of 8 for the combined projects (1A.1 and 1B). The relative benefits to cost scores for projects (1A.1) and (1B) would change to 9.1 and 7.0, respectively.

In the remaining project precedence groups, the project precedence follows the order of the project rankings. Projects not specifically listed in the above table are

*Stevenson Creek Watershed Management Plan
Final Report*

considered “stand alone” projects that could logically be constructed at any point during plan implementation.

Public Acceptance. Public acceptance is a qualitative measure of the support for a particular project among the City’s taxpaying residents. In the early planning stages of a future public works project, public acceptance of the project can be difficult, if not impossible to gauge with any certainty. For this reason, it was not included herein as a ranking criterion. However, public involvement is a very important component of this plan; watershed improvements cannot be realized without the willingness and cooperation of residents within the watershed boundaries. For this reason, three (3) public meetings, or workshops, are being held to provide information and to receive comments and suggestions from the public. These comments and suggestions have helped to determine improvement projects and priorities. The first meeting was held in November of 1999, prior to the commencement of the project, to receive input from the public on known problems. A total of 68 questionnaires were received, containing descriptions by the residents of problems of sedimentation/erosion, water quality, and flood control. These questionnaires, along with the City’s complaint logs, were used to create a GIS map of the known problem areas, which was compared with the results of the computer modeling analyses by overlaying it on the 100-year floodplain map and the pollutant loading map. This information was then used in identifying areas to be targeted for watershed improvements.

The second meeting was held in January of 2001, where the results of the existing conditions analysis were presented along with the preliminary identified solutions for flood control, water quality, erosion and sedimentation. The residents were asked to comment in writing on the potential improvement projects. Approximately 70 residents attended, and 28 questionnaires were filled out. Most of the project-related comments received were positive, and many additional suggestions were made regarding specific components of the projects. These comments and suggestions were thoroughly reviewed and considered during the final completion of the Stevenson Creek Watershed Management Plan. Public meeting questionnaires from the first two public meetings are



***Stevenson Creek Watershed Management Plan
Final Report***

included as Appendix L of this report. A third public meeting is scheduled to be held later this year to present the completed Plan during a City Commission workshop, which will be televised city-wide.

Through the public meetings, workshops, and meetings among members of the project team, five projects were identified as potentially controversial projects. Project 3A (Glen Oaks), although on City-owned property, will eliminate the existing golf course at that location, currently operated through a lease agreement by the non-profit Chi-Chi Rodriguez Foundation. Projects 4C (St. Thomas Drive to Bellevue Boulevard), and 7C (Jeffords/Barry Road Pond) were identified as potentially controversial projects due to the proposed acquisition of several residential properties. Projects 6A (Expansion of Lake Bellevue) and 7A (Crest Lake Expansion) were identified by the City Parks and Recreation Department as potentially controversial due to the proposed conversion of existing upland park areas to wetland habitat.

Winning public support for these projects through the City's public information initiatives will be crucial to successful implementation of these projects. The final design and implementation of these projects must be sensitive to resident's potential concerns regarding alternative recreational opportunities, the environment, safety, aesthetics, and property values.



*Stevenson Creek Watershed Management Plan
Final Report*

Table 4-1. Stevenson Creek Watershed Management Plan Project Ranking Matrix

| Project No. | Project Description | Flood Control Benefits 5 | Water Quality Benefits 4 | Ecological Benefits 4 | Erosion Control Benefits 3 | Recreational/Educational Benefits 2 | Ability to Implement 2 | Relative Benefits vs. Cost 5 | Weighted Score | Rank |
|---------------------------|---|-----------------------------|-----------------------------|--------------------------|-------------------------------|--|---------------------------|---------------------------------|----------------|-----------|
| <u>Spring Branch</u> | | | | | | | | | | |
| 1A.1 | Spring Branch Conveyance Enhancements (Lower Portion) | 10 | 1.5 | 0 | 10 | 0 | 6 | 10.0 | 5.7 | 3 |
| 1A.2 | Spring Branch Conveyance Enhancements (Upper Portion) | 6.5 | 0.5 | 0 | 0 | 0 | 8 | 4.2 | 2.8 | 14 |
| 1B | Springtime Avenue and Douglas Avenue Bridges | 1 | 0 | 0 | 0 | 0 | 7 | 0.7 | 0.9 | 28 |
| 1C | Spring Branch Flood Detention Basin | 1 | 5.7 | 10 | 5 | 2 | 4 | 3.9 | 4.4 | 6 |
| 1D | Woodland Terrace Storm Sewer Replacement | 2.5 | 0.1 | 0 | 0 | 0 | 9 | 3.4 | 1.8 | 22 |
| 1E | Byram Pond Dredging and Expansion | 1.5 | 0.8 | 0 | 5 | 0 | 4 | 3.6 | 2.0 | 21 |
| 1F | Spring Branch Stabilization, Union Street to Byram Pond | 0 | 0 | 0 | 10 | 0 | 10 | 3.8 | 2.6 | 16 |
| 1G | Clearview Lake | 0.5 | 0.9 | 0 | 1 | 0 | 8 | 1.7 | 1.3 | 27 |
| 1H | Betty Lane Forested Habitat Preservation Site | 0 | 0 | 10 | 0 | 6 | 3 | 5.5 | 3.3 | 12 |
| <u>Lower Stevenson</u> | | | | | | | | | | |
| 2A | Palmetto Street Sediment Sump | 0.5 | 0.2 | 2 | 9 | 0 | 4 | 10.0 | 3.7 | 9 |
| 2B | N. Missouri Ave. and Palmetto St. Drainage Improvements | 1 | 0.9 | 0 | 0 | 0 | 9 | 2.1 | 1.4 | 24 |
| 2C | Installation of Additional CDS Units | 0 | 4 | 1 | 0 | 0 | 10 | 4.4 | 2.4 | 18 |
| 2D | Overbrook Avenue Detention Pond | 2 | 1.8 | 6 | 0 | 4 | 6 | 3.3 | 3.0 | 13 |
| <u>Middle Stevenson</u> | | | | | | | | | | |
| 3A | Glen Oaks Stormwater Detention Facility | 10 | 10 | 10 | 5 | 10 | 6 | 8.8 | 8.5 | 1 |
| <u>Upper Stevenson</u> | | | | | | | | | | |
| 4A | Hillcrest Avenue Overflow Bypass Culvert | 10 | 0 | 0 | 3 | 0 | 6 | 3.0 | 3.3 | 10 |
| 4B | Upper Stevenson Creek Stabilization | 0 | 0 | 0 | 10 | 0 | 8 | 2.5 | 2.2 | 19 |
| 4C | St Thomas Drive / Bellevue Boulevard Creek Restoration | 9.5 | 0.4 | 6 | 2 | 2 | 3 | 5.4 | 4.5 | 5 |
| <u>Hammond Branch</u> | | | | | | | | | | |
| 5A | Flagler Drive / CSX Railroad North Swale Improvements | 5.5 | 0 | 0 | 2 | 0 | 4 | 5.3 | 2.6 | 17 |
| 5B | Palmetto Street Drainage Improvements | 2 | 0 | 0 | 2 | 0 | 8 | 2.5 | 1.7 | 23 |
| 5C | Saturn Avenue Drainage Improvements | 1 | 0.2 | 0 | 0 | 0 | 9 | 2.2 | 1.3 | 26 |
| 5D | Smallwood Circle Drainage Improvements | 1 | 0.1 | 0 | 0 | 0 | 6 | 3.9 | 1.4 | 25 |
| 5E | Lake Hobart Outfall Control Structure | 0 | 0.8 | 0 | 0 | 0 | 10 | 10.0 | 2.8 | 15 |
| <u>Lk Bellevue Branch</u> | | | | | | | | | | |
| 6A.1 | Expansion of Lake Bellevue | 4.5 | 8.7 | 7 | 1 | 3 | 8 | 9.7 | 6.1 | 2 |
| 6A.2 | Upper Lake Bellevue Culverts | 7.5 | 0 | 0 | 0 | 0 | 10 | 10.0 | 4.1 | 8 |
| 6B | Turner Street Box Culverts | 4.5 | 1.2 | 0 | 0 | 0 | 7 | 2.1 | 2.0 | 20 |
| <u>Jeffords St Branch</u> | | | | | | | | | | |
| 7A | Crest Lake Expansion | 2 | 1.6 | 6 | 1 | 4 | 10 | 6.8 | 4.1 | 7 |
| 7B | Duncan Avenue/Turner Street Detention Pond | 7 | 0.8 | 4 | 0 | 0 | 5 | 4.2 | 3.3 | 11 |
| 7C | Jeffords Street/Barry Road Detention Pond | 8 | 2.8 | 5 | 10 | 0 | 3 | 7.0 | 5.5 | 4 |

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Final Report***

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***Stevenson Creek Watershed Management Plan
Final Report***

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Final Report***

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EXECUTIVE SUMMARY

Watershed Description

The Stevenson Creek Watershed, the largest and most urbanized watershed within the City of Clearwater, drains 6,286 acres in west central Pinellas County. Of this area, 4,057 acres (65 percent) are within the Clearwater city limits. The remaining 35 percent of the basin is within the City of Dunedin (1,287 acres or 20%), unincorporated Pinellas County (859 acres or 14%) and the City of Largo (83 acres or about 1%).

Stevenson Creek discharges to Clearwater Harbor. The majority of the creek has been channelized or otherwise altered, and little of the historic floodplain remains intact. Land uses within the basin are predominantly medium- and high-density residential, commercial, and open space. Approximately 90 percent of the watershed has been developed, and the vast majority of the development occurred prior to the implementation of regulatory requirements for floodplain preservation, environmental protection, stormwater treatment and attenuation. Several developments have been constructed within the creek's floodplain and have experienced severe flooding. In addition, the creek and its tributaries experience moderate to severe erosion problems due to steep embankments, improper maintenance, highly erodible soils, and inadequate right-of-way.

The majority of the land use changes within the watershed have been detrimental to water quality, flood protection, and wildlife habitat. Urban development has resulted in greater stormwater runoff volumes and peak flow rates, as well as the transport of sediments and pollutants into the creek.

Purpose and Objectives

The Stevenson Creek Watershed Management Plan has been initiated as the result of a cooperative agreement between the City of Clearwater and the Southwest Florida Water Management District (SWFWMD). Stormwater quality and quantity are identified within the City of Clearwater Comprehensive Plan as areas of service deficiencies which must be addressed.



Stevenson Creek Watershed Management Plan Final Report

The basic purpose of the management plan is to identify the causes and sources of problems such as flooding, water quality degradation, excessive channel erosion, and loss of riparian habitat. Once these problems were identified, recommendations were made to solve or alleviate the problems. Recommendations include capital improvement projects (i.e. stormwater infrastructure improvements), creation and restoration of habitat, maintenance strategies, pollution reduction programs, and public involvement and awareness. This management plan will be used as a tool in the planning, regulation, and management of natural resources and future development, and as a basis for determining and prioritizing capital improvements by the City of Clearwater and SWFWMD.

Data Collection

The information-gathering process included such activities as a literature search and review of existing data, field reconnaissance and ground-truthing of aerial photography, ground surveying, streamflow monitoring, surface water sampling and testing, habitat assessment, interviews with City operations personnel, and input from residents of the watershed.

Flood Protection Level of Service

In order to assess the current flood protection level of service and to determine the most effective means of alleviating the identified flooding problems, a hydrologic and hydraulic model of the watershed was prepared.

The Advanced Interconnected Channel and Pond Routing Model, Version 2.2 (AdICPR) was chosen for the hydrologic and hydraulic modeling analysis. To provide the necessary level of detail, the basin was divided into a total of 307 discrete subbasins averaging 20.5 acres in size. The delineation of subbasins was dictated to a large extent by the complexity of the drainage network itself and the need to define the contributing drainage area to modeled elements of the conveyance system.

The AdICPR model was calibrated to measured rainfall and streamflow data collected for this project. The large storm of July 15, 2000 was used as the calibration event. Once calibrated, the model was used to simulate the 5, 10, 25, 50, 100, and 500-year design flood events. Floodplain mapping and flood profiles were prepared in order



Stevenson Creek Watershed Management Plan Final Report

to identify flooding problem areas. This information will be used to support a request for revision of the applicable FEMA flood insurance rate maps.

Design 100 year flood elevations were compared with surveyed finished floor elevations of homes and businesses within the 100-year floodplain. Of the 470 structures entered into the database, 263 structures were found to have finished floor elevations below the 100-year flood level. This is, by definition, a structure flooding level of service deficiency. The majority of these structures are located within the primary floodplains of the Stevenson Creek and Spring Branch main channels. However, many of the identified FPLOS deficiencies result from inadequate secondary drainage systems that feed into the main channels.

Natural Systems

The entire watershed was investigated for undeveloped land, wetlands, natural areas, and potential restoration or preservation areas. The boundaries of the natural areas were identified and mapped on aerial photography. These areas were characterized using the Florida Land Use Cover and Forms Classification System (FLUCCS) (FDOT, 1985).

The Stevenson Creek Watershed is a highly urbanized, densely populated area with little to offer in the way of natural systems. With one exception, the only undeveloped areas are golf courses and city parks. Wetlands are predominantly small isolated stormwater retention ponds or natural lakes that have been altered to such a degree that their origin can only be determined from historic aerial photography. The waterways are predominantly channelized with little riparian habitat. The intense development has also altered the estuarine system so that little habitat is provided at the mouth of Stevenson Creek.

Water Quality Assessment

Low dissolved oxygen levels, fecal contamination, and excessive nutrient concentrations are the primary water quality issues that have been identified in the watershed, and as such, water quality in Stevenson Creek is rated as “poor” by the state. The state’s rating is based on sampling conducted by the Pinellas County Department of



Stevenson Creek Watershed Management Plan Final Report

Environmental Management (PDEM). The city's ambient monitoring program as well as monitoring conducted for this study affirms these water quality issues.

Stevenson Creek is included on Florida's impaired waters list {303(d) List} due to concerns over dissolved oxygen, fecal coliform bacteria, and nutrients. The FDEP has given Stevenson Creek a priority rating of "High". Stevenson Creek is located in the "Crystal River to St. Petersburg Beach Basin" which is in Group 5 of the basin rotation cycle. TMDL development activity is expected to begin in 2004.

Water quality assessments conducted for this study included the following elements:

- Review of Existing Data,
- Base flow and storm event monitoring program,
- Water quality data interpretation,
- Nonpoint source loading assessment, and
- Fecal contamination source tracking study.

Capital Improvement Projects

The relative scarcity of publicly-owned and vacant land within the watershed limited the range of available alternatives and posed a unique challenge in meeting all the goals of the Watershed Management Plan in a cost effective manner. For this reason, acquisition of private property, including 33 flood-prone or flood-susceptible single-family residential homes, is recommended in order to provide the necessary land for various infrastructure improvement projects that will benefit the watershed as a whole.

In most, but not all cases, it was considered feasible and cost-effective to achieve the adopted flood protection level of service goals. A total of 26 individual capital projects are recommended, consisting of a combination new stormwater management facilities and retrofits to existing facilities and infrastructure. If all recommended projects are implemented, 243 of the identified 334 structure FPLOS deficiencies (73%) will be remedied. Many (28) of the remaining FPLOS deficiencies are located within the coastal high hazard area of Lower Stevenson Creek and are susceptible to flooding from storm surge. Reductions in the riverine floodplain (flooding due to rainfall and runoff) will therefore not remedy these FPLOS deficiencies. The combined projects would remove



Stevenson Creek Watershed Management Plan Final Report

FPLOS deficiencies at 33 locations on residential streets, 16 locations on collector roads, and on one arterial road.

Water quality, habitat, erosion and sedimentation projects were developed individually and in conjunction with the recommended flood protection projects wherever feasible. Alternative projects were evaluated with respect to water quality improvement benefits.

Other Improvements/Recommendations

In addition to the capital improvement projects, the WMP includes recommendations for watershed maintenance activities, exotic plant eradication, public education and involvement, and legal and regulatory framework. A more detailed and comprehensive study to pinpoint the source(s) of the fecal coliform bacteria is also recommended. The study would serve as the basis for developing an effective strategy to address the fecal contamination problem.

Capital Costs

For purposes of budgetary planning, cost estimates were made of each recommended capital improvement project. The cost estimates are based on the conceptual design and are subject to change pending completion of a more detailed design process. The total estimated cost of the recommended projects is approximately \$27 million, in 2001 dollars, including property acquisition design, and permitting. The magnitude and scope of the recommended improvements, coupled with budgetary constraints, will require phased implementation of the plan over a number of years.

Project Prioritization

Capital projects that can be expected to provide the greatest overall benefit in the most cost effective manner were identified using a project ranking procedure. This management tool is a convenient and effective method of recommending priorities for the allocation of available funding. To help identify the priority projects in the Stevenson Creek Watershed Management Plan, a set of comparative evaluation criteria were identified, and a project ranking matrix was developed. Within each category, individual projects were graded on a scale from 0 to 10, with the lowest score indicating no real



*Stevenson Creek Watershed Management Plan
Final Report*

benefit and the highest indicating a high beneficial value. The categories considered in the ranking analysis included the following:

- flood control benefits,
- water quality benefits,
- ecological benefits,
- channel erosion and sedimentation control benefits,
- Recreational and Educational Benefits,
- Implementability, and
- Relative Benefits to Cost.

Those projects which serve multiple purposes rank the highest when compared to those with singular objectives. Also apparent is the observation that the projects that rank the highest generally have the highest scores in the relative benefits to cost category.

Through the public meetings, workshops, and meetings among members of the project team, five projects were identified as potentially controversial. These include the highest-ranked project, the Glen Oaks stormwater detention facility. Winning public support for these projects through the City's public information initiatives will be crucial to successful implementation of these projects. The final design and implementation of these projects must be sensitive to resident's potential concerns regarding alternative recreational opportunities, the environment, safety, aesthetics, and property values.



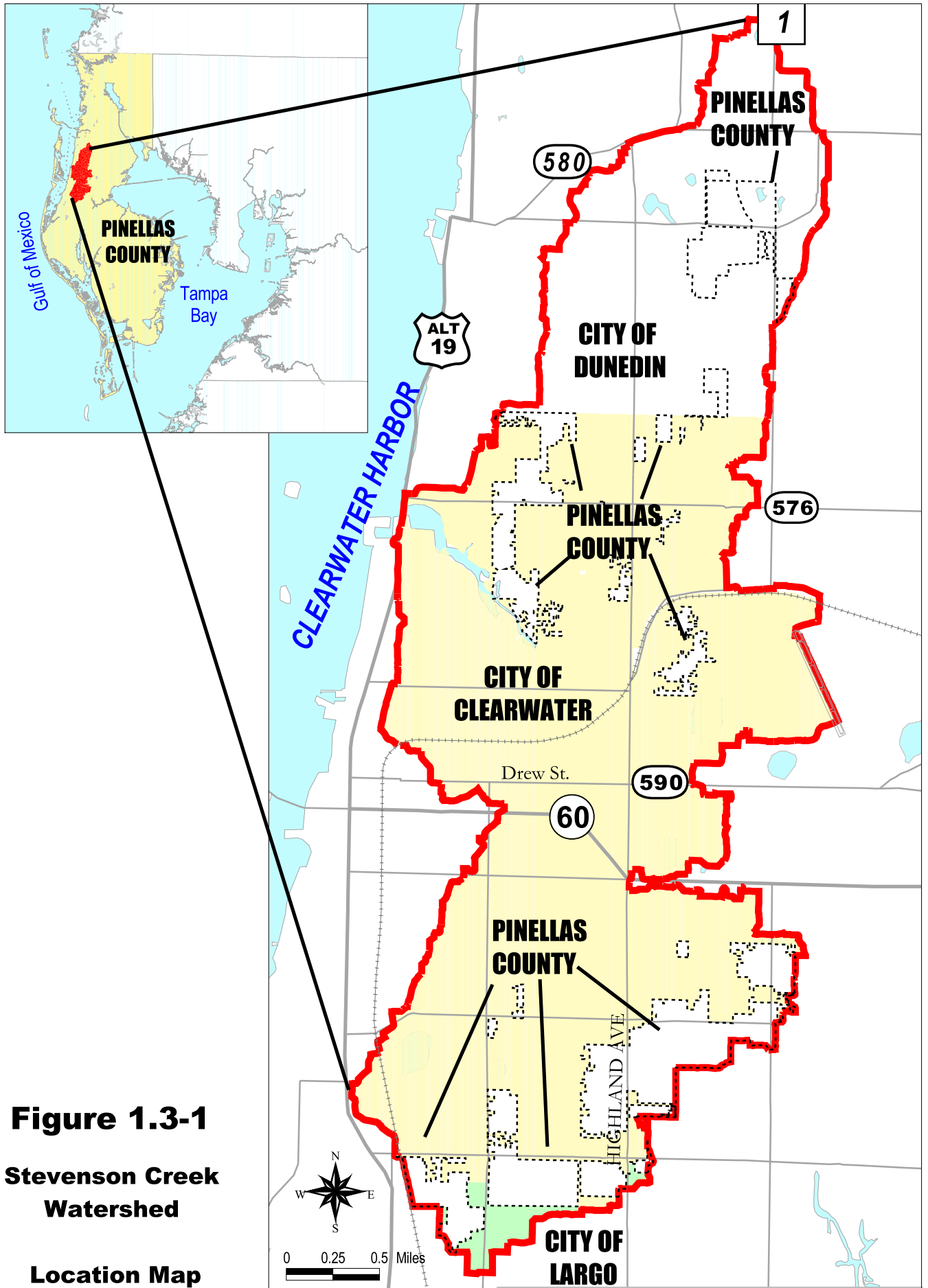








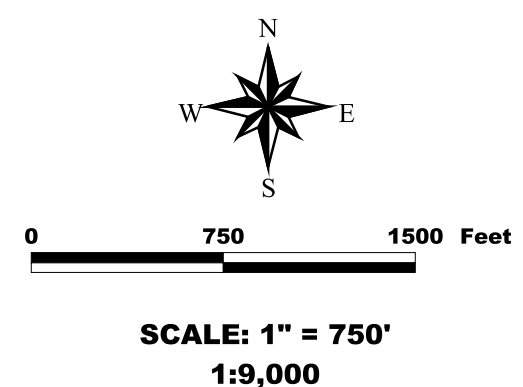
Figure 1.3-1
Stevenson Creek
Watershed
Location Map

Figure 2.1-1
Stevenson Creek
Watershed Management Plan

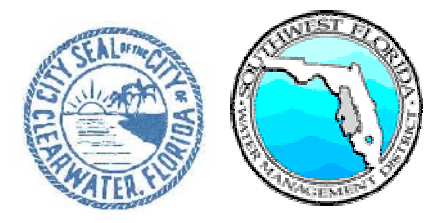
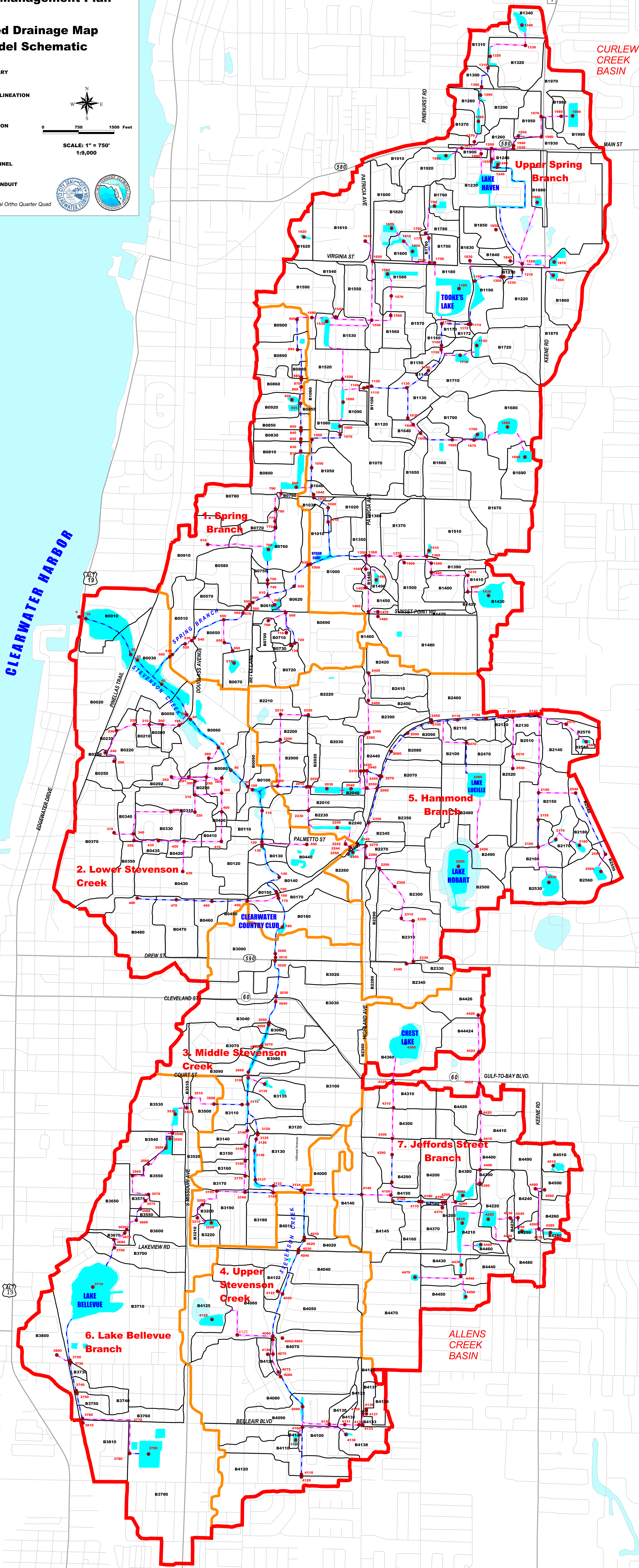
Watershed Drainage Map
and Model Schematic

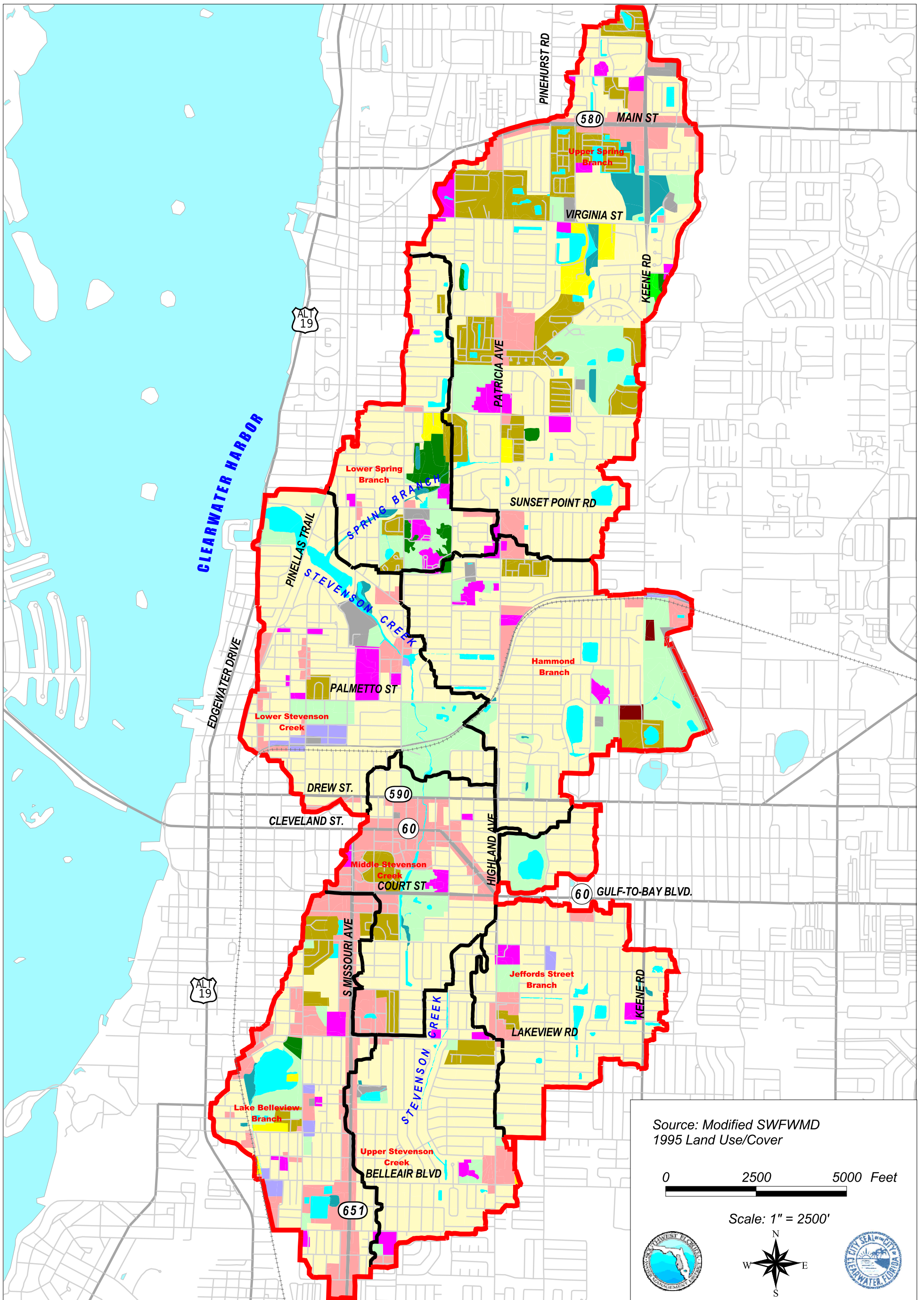
 WATERSHED BOUNDARY
 MAJOR SUBBASIN DELINEATION
 SUBBASIN DELINEATION
 DRAINAGE NODE
 MODELED OPEN CHANNEL
 MODELED CLOSED CONDUIT

SOURCE:
 1964 Aerial Photo from USGS Digital Ortho Quarter Quad



SCALE: 1" = 750'
 1:9,000



Source: Modified SWFWMD
1995 Land Use/Cover

0 2500 5000 Feet

Scale: 1" = 2500'



Figure 2.1-2

**Stevenson Creek Watershed
Land Use Classification Map**

- | | | |
|----------------------------|--------------------------|---|
| Low Density Residential | Institutional | Wetland |
| Medium Density Residential | Open Land/Recreation | Transportation, Communications, and Utilities |
| High Density Residential | Cropland and Pastureland | Water |
| Commercial | Specialty Farms | Major Subbasin Delineation |
| Industrial | Forest | Watershed Boundary |

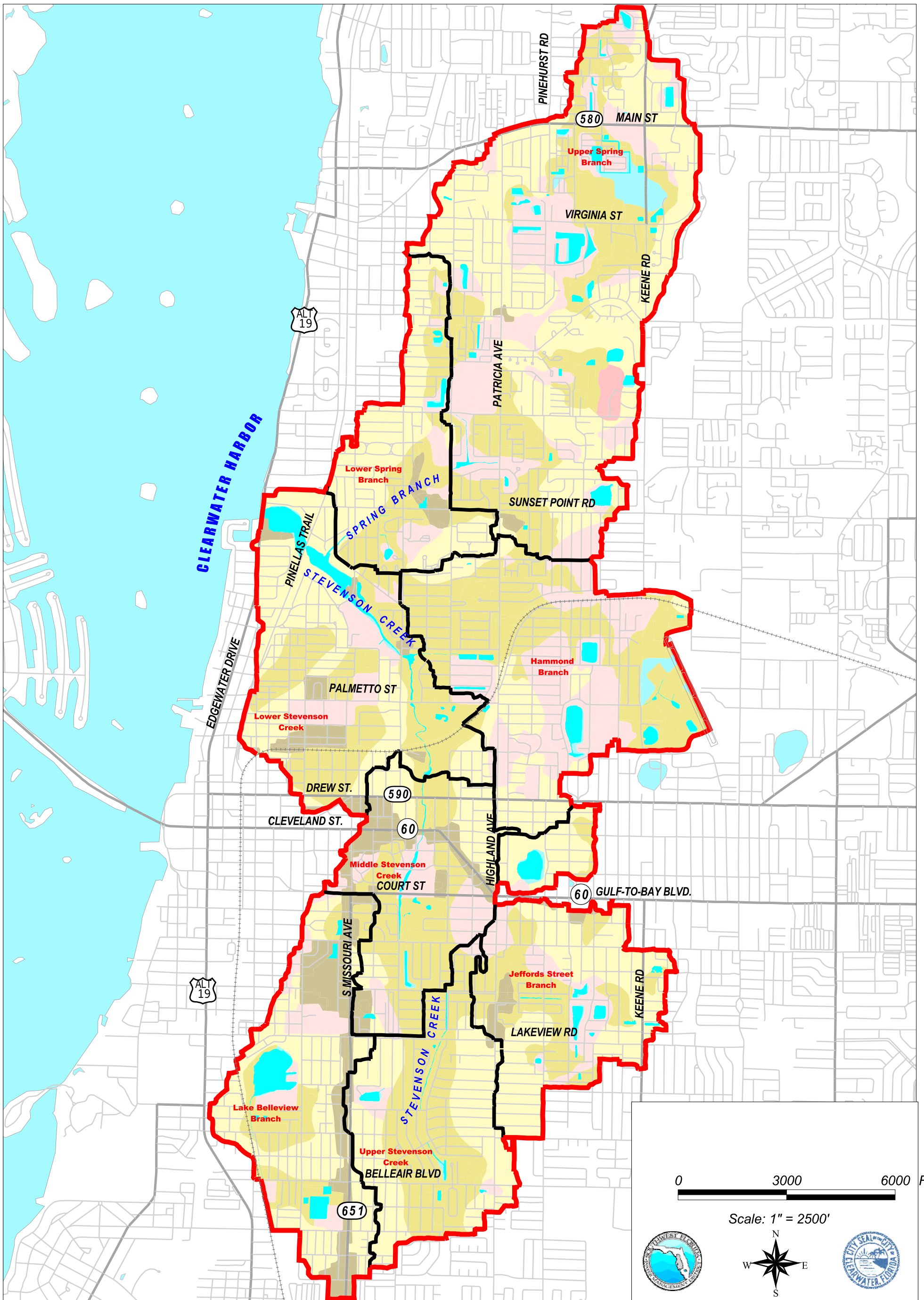


Figure 2.1-3

**Stevenson Creek Watershed
Hydrologic Soils Classification**

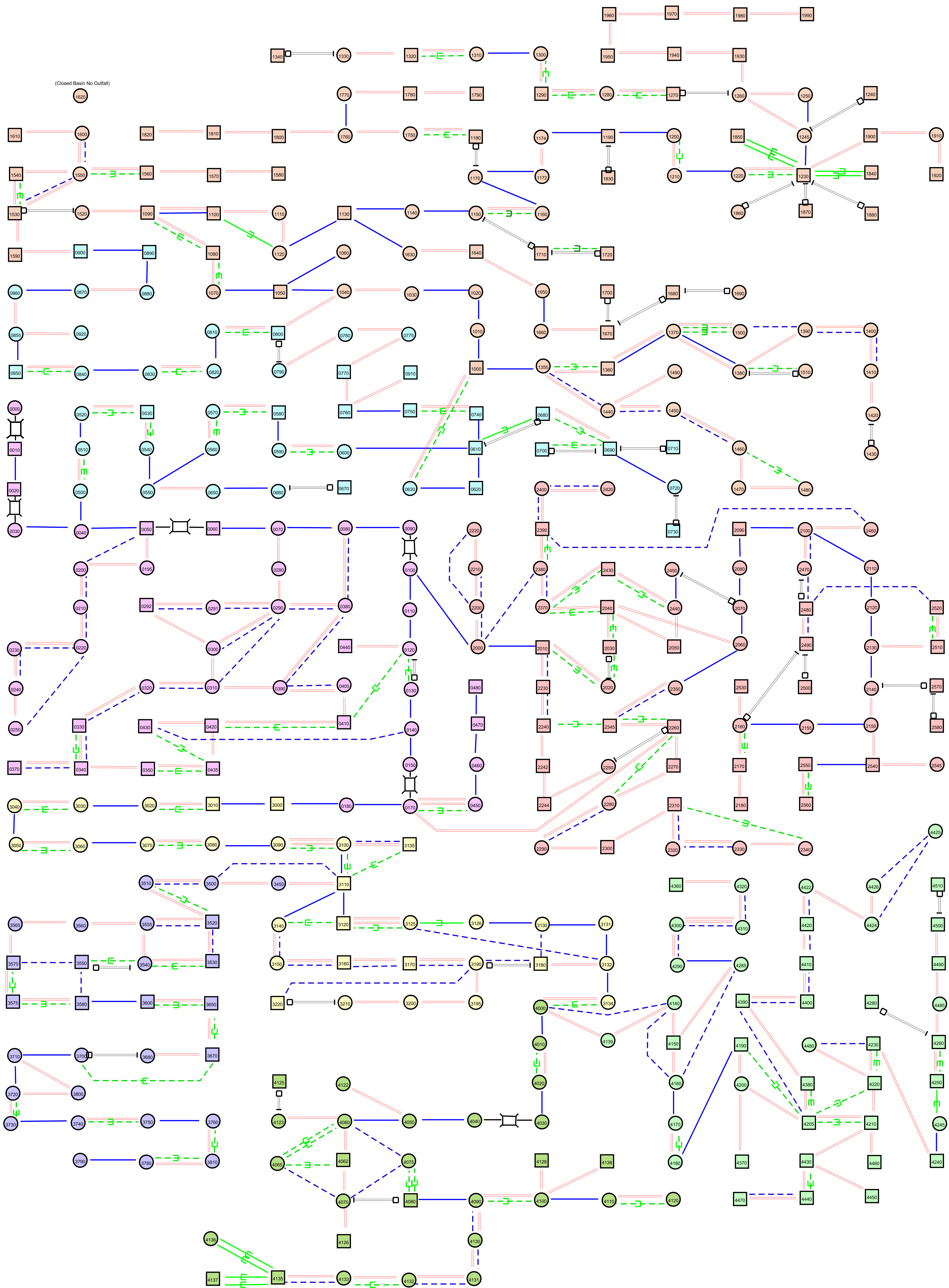
| | | | |
|---|-----|---|-------|
|  | A |  | C |
|  | B |  | D |
|  | B/D |  | Water |



**Major Subbasin Delineation
Watershed Boundary**

Figure 2.1.-4

Stevenson Creek Watershed
AdICPR Node-Reach Schematic
Existing Conditions



LEGEND

STORAGE NODE

- Hammond Branch
- Jeffords Street
- Lake Belleview
- Lower Spring Branch
- Lower Stevenson
- Middle Stevenson
- Upper Spring Branch
- Upper Stevenson

NON-STORAGE NODE

- Hammond Branch
- Jeffords Street
- Lake Belleview
- Lower Spring Branch
- Lower Stevenson
- Middle Stevenson
- Upper Spring Branch
- Upper Stevenson

- CHANNEL
- CULVERT
- WEIR
- DROP STRUCTURE
- OVERLAND FLOW WEIR
- OVERLAND FLOW CHANNEL
- BRIDGE



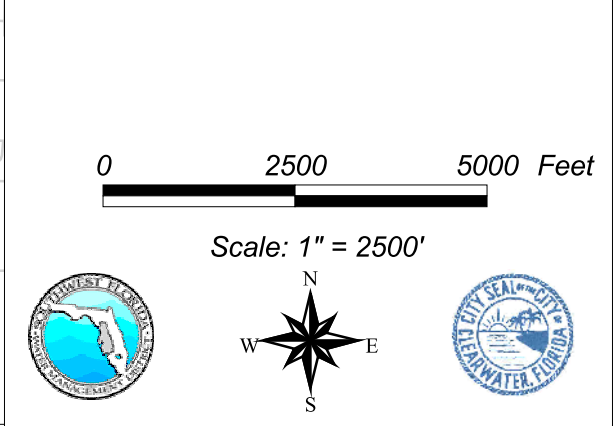
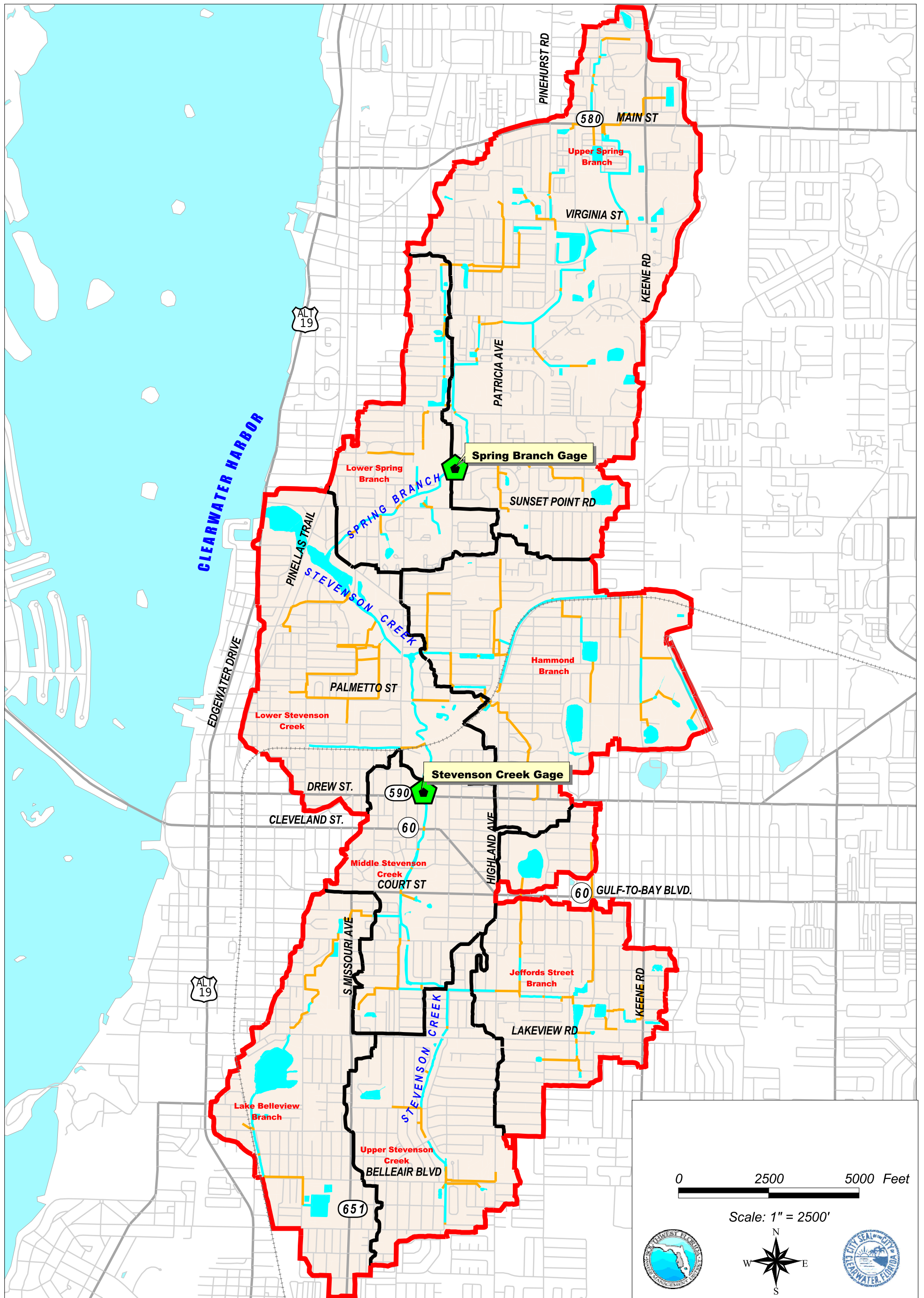


Figure 2.1-5

Location of Monitoring Stations for the Stevenson Creek Basin

-  **Parsons ES Gage Station**
-  **Open Channel**
-  **Closed Conduit**
-  **Major Subbasin Delineation**
-  **Watershed Boundary**

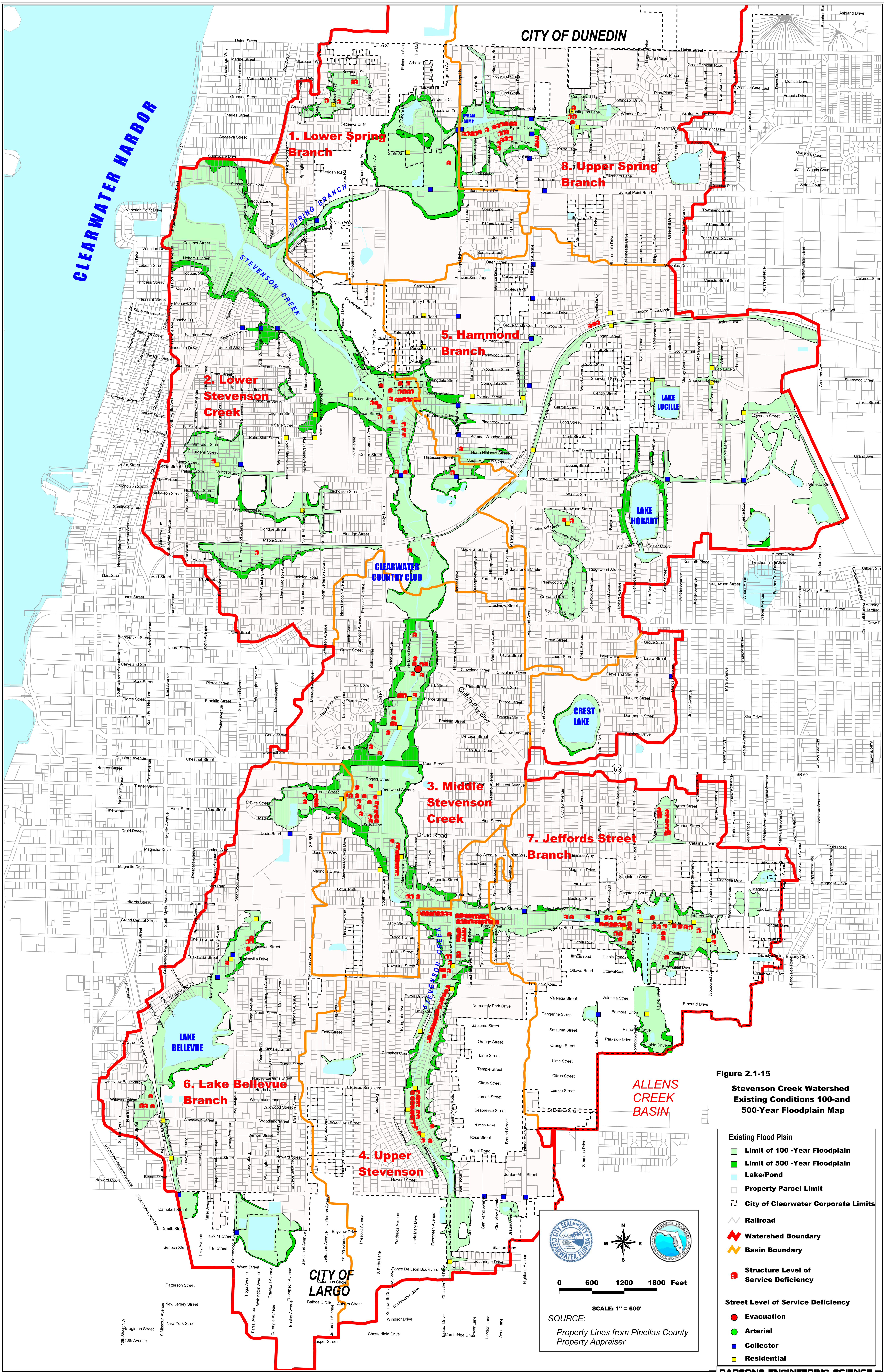


Figure 2.1-15
Stevenson Creek Watershed
Existing Conditions 100- and
500-Year Floodplain Map

- Existing Flood Plain**
- Limit of 100-Year Floodplain
 - Limit of 500-Year Floodplain
 - Lake/Pond
 - Property Parcel Limit
 - City of Clearwater Corporate Limits
 - Railroad
 - Watershed Boundary
 - Basin Boundary
 - Structure Level of Service Deficiency
- Street Level of Service Deficiency**
- Evacuation
 - Arterial
 - Collector
 - Residential
- PARSONS ENGINEERING SCIENCE**

0 600 1200 1800 Feet

SCALE: 1" = 600'

SOURCE:
 Property Lines from Pinellas County
 Property Appraiser

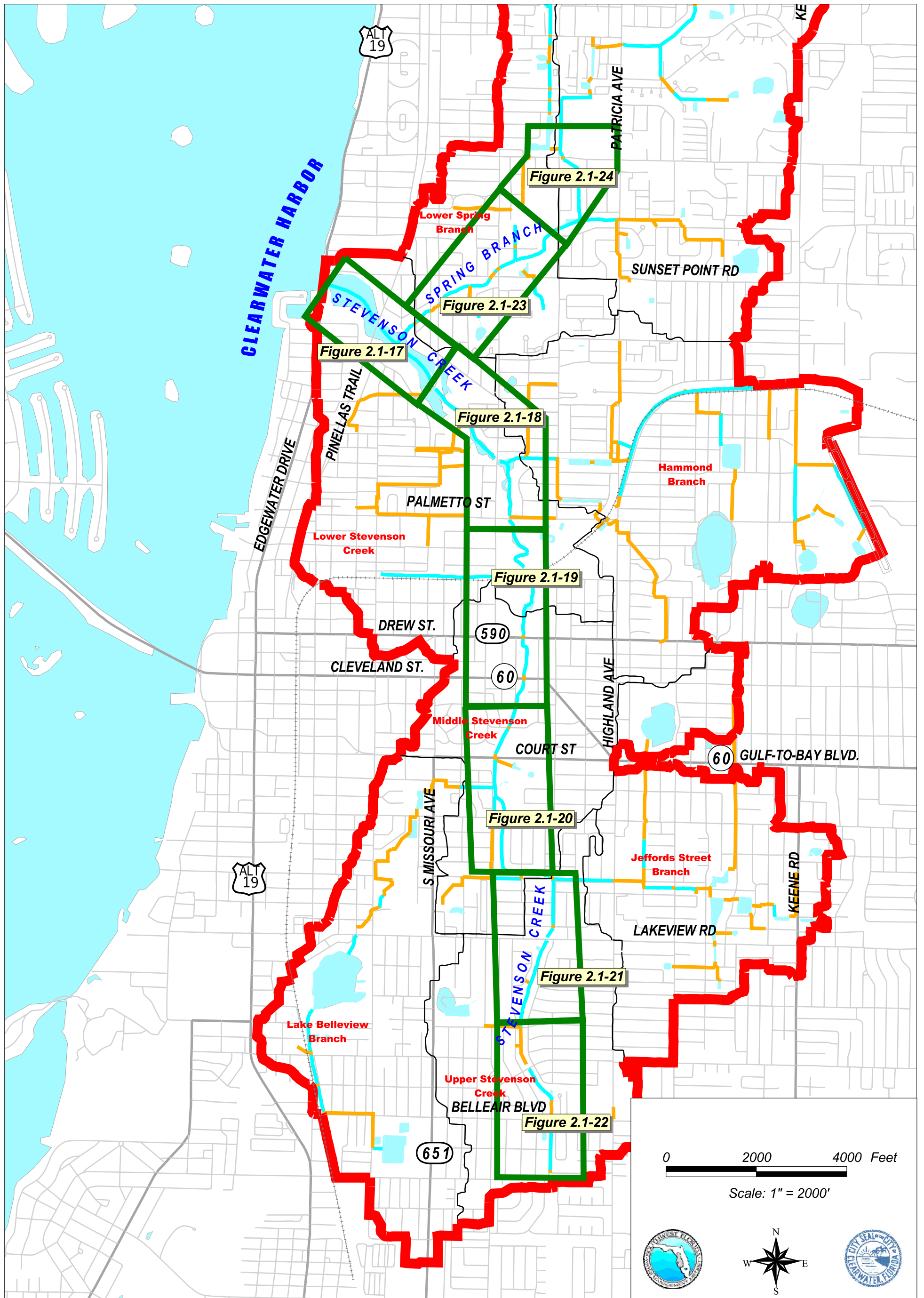
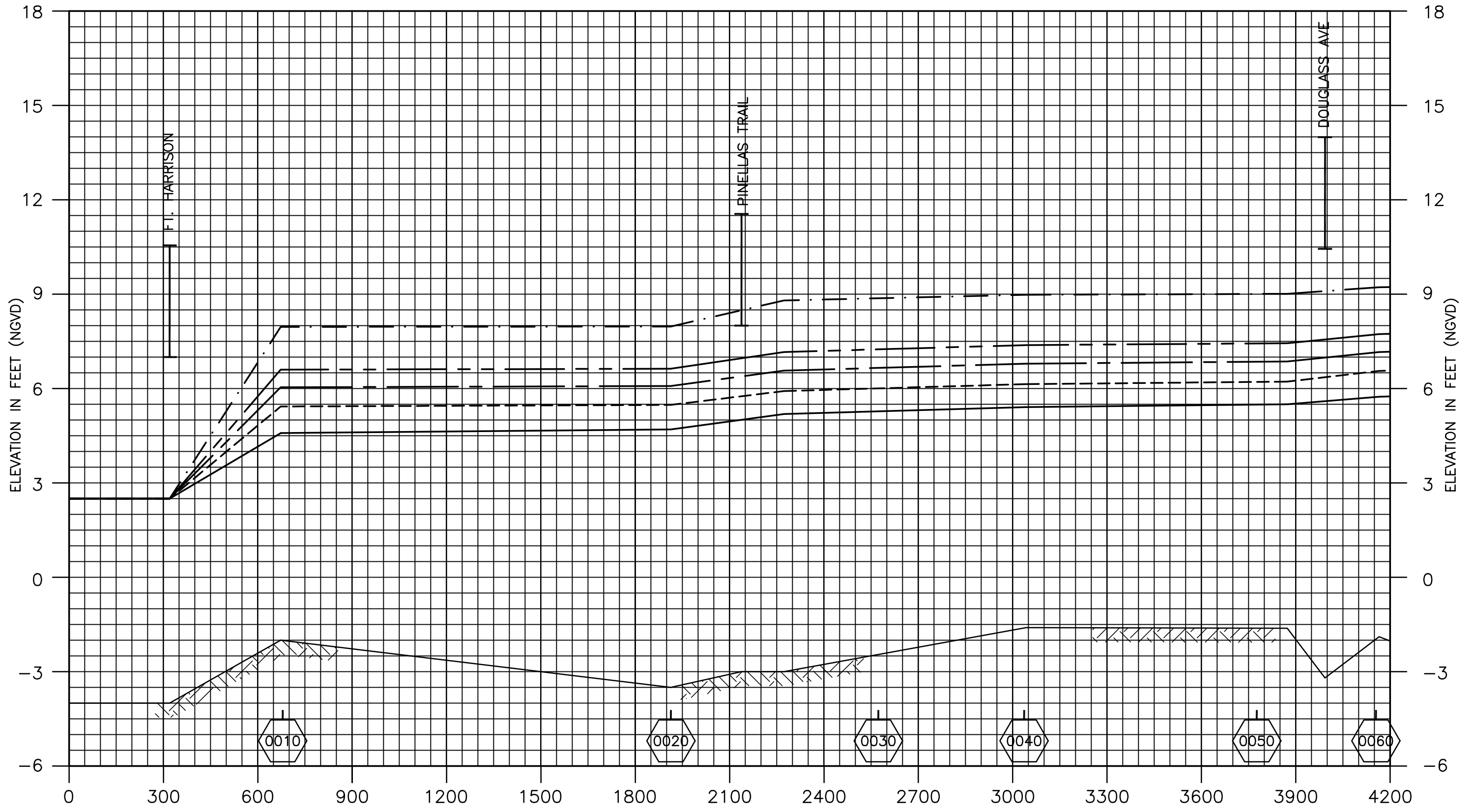


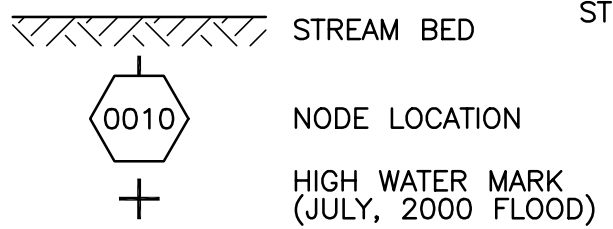
Figure 2.1-16
Stevenson Creek Watershed
Existing Conditions
Flood Profiles Key Map

- Figure Extent
- Water
- Modeled Closed Conduit
- Modeled Open Channel
- Major Subbasin Delineation
- Watershed Boundary



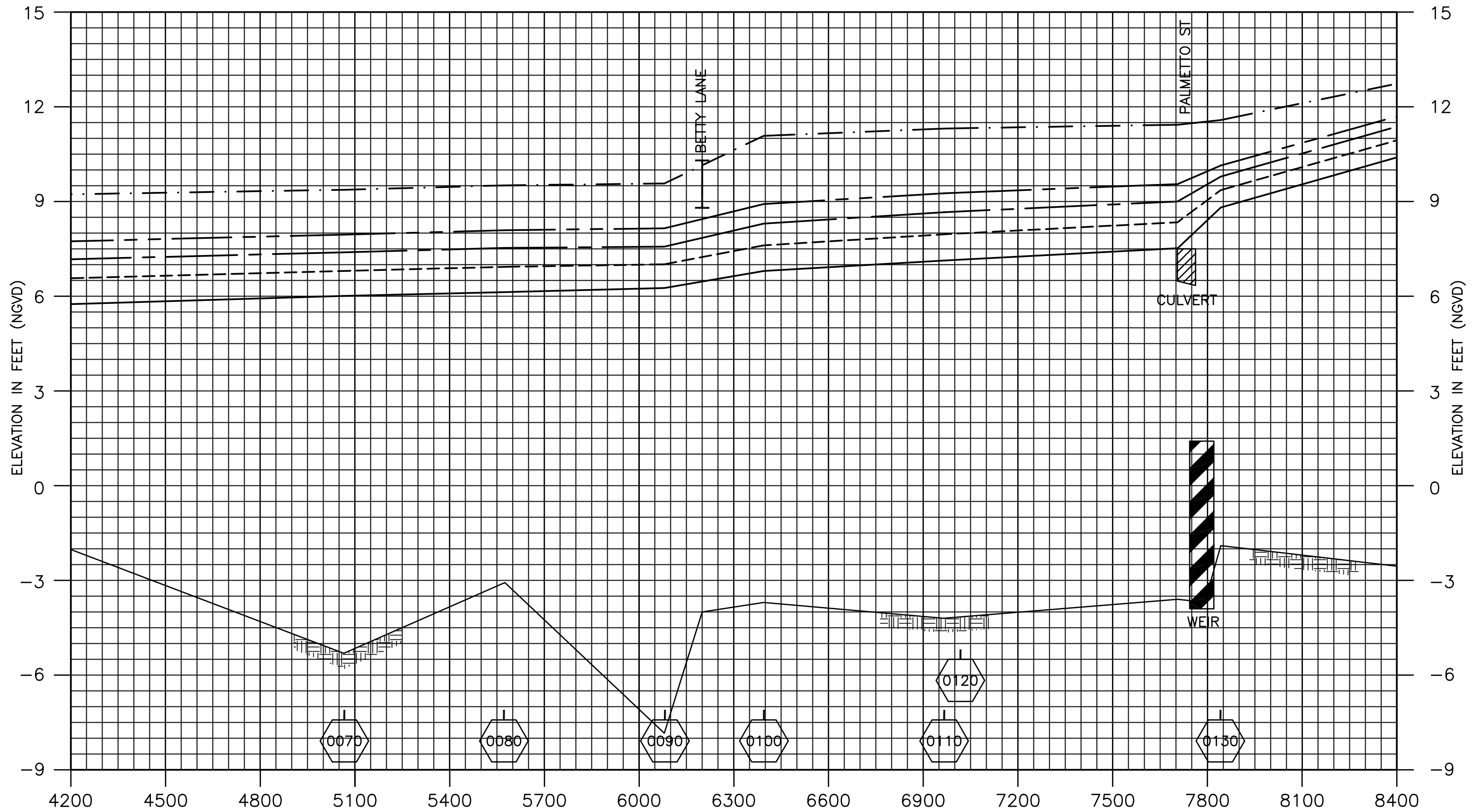
LEGEND:

- . - . - . - . - . - . 500 YEAR FLOOD
- 100 YEAR FLOOD
- 50 YEAR FLOOD
- - - - - 25 YEAR FLOOD
- 10 YEAR FLOOD






STREAM DISTANCE IN FEET

FIGURE 2.1-17
FLOOD PROFILE
EXISTING CONDITIONS
STEVENSON CREEK
CITY OF CLEARWATER, FL
PARSONS ENGINEERING SCIENCE, INC.



LEGEND:

- · — · — · — · — 500 YEAR FLOOD
- — — — — 100 YEAR FLOOD
- 50 YEAR FLOOD
- - - - - 25 YEAR FLOOD
- 10 YEAR FLOOD

-  STREAM BED
-  0010 NODE LOCATION
-  HIGH WATER MARK (JULY, 2000 FLOOD)

STREAM DISTANCE IN FEET

FIGURE 2.1-18
FLOOD PROFILE
EXISTING CONDITIONS
STEVENSON CREEK
CITY OF CLEARWATER, FL
PARSONS ENGINEERING SCIENCE, INC.

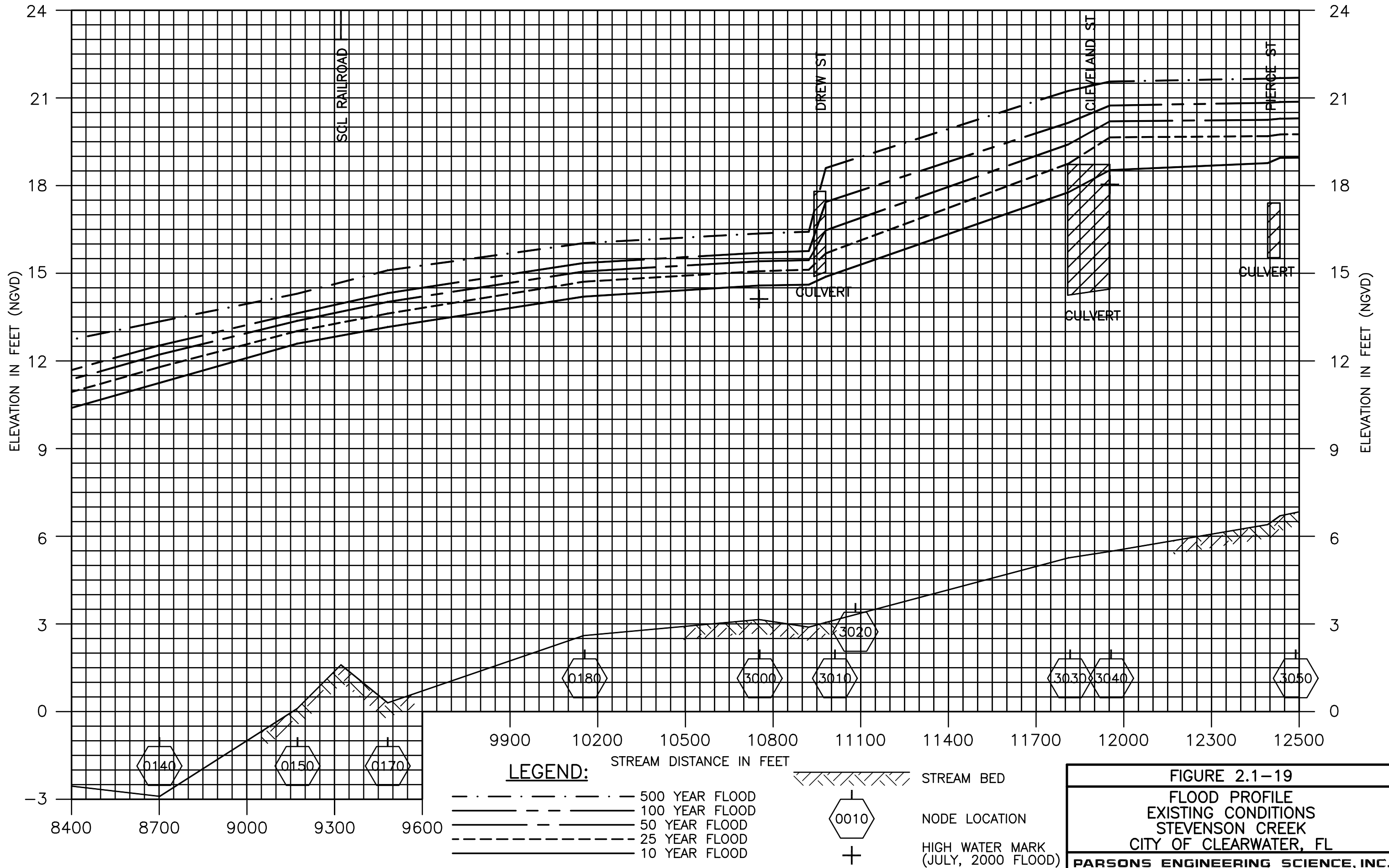
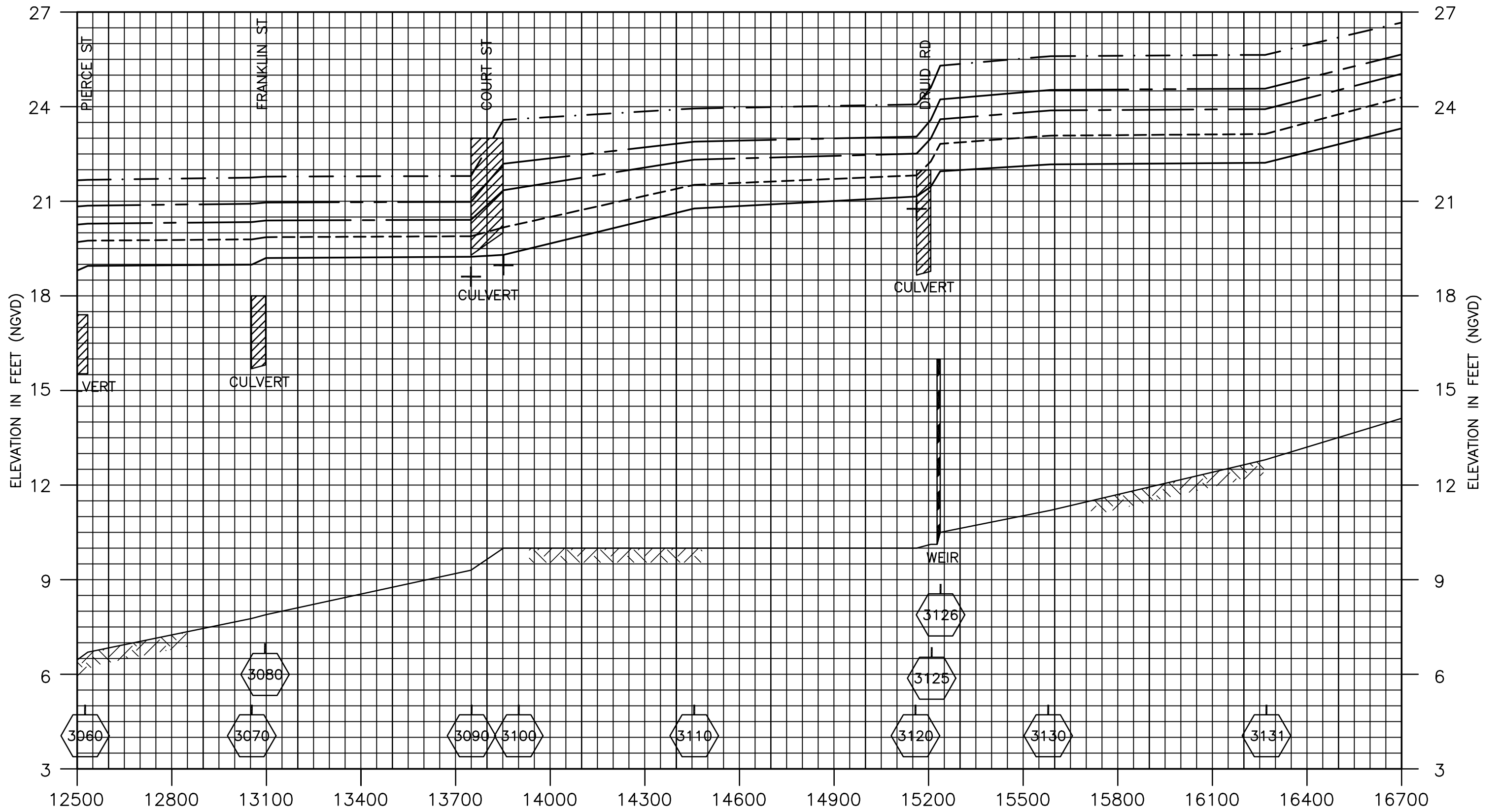


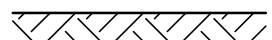
FIGURE 2.1-19
 FLOOD PROFILE
 EXISTING CONDITIONS
 STEVENSON CREEK
 CITY OF CLEARWATER, FL
PARSONS ENGINEERING SCIENCE, INC.

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 J:\CADD\737626\STEVENSON\7626FIG3.dwg, 08/15/2001 at 22:18, NJM, 1

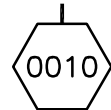


LEGEND:

- · — · — · — 500 YEAR FLOOD
- — — — — 100 YEAR FLOOD
- — — — — 50 YEAR FLOOD
- - - - - 25 YEAR FLOOD
- — — — — 10 YEAR FLOOD



STREAM BED



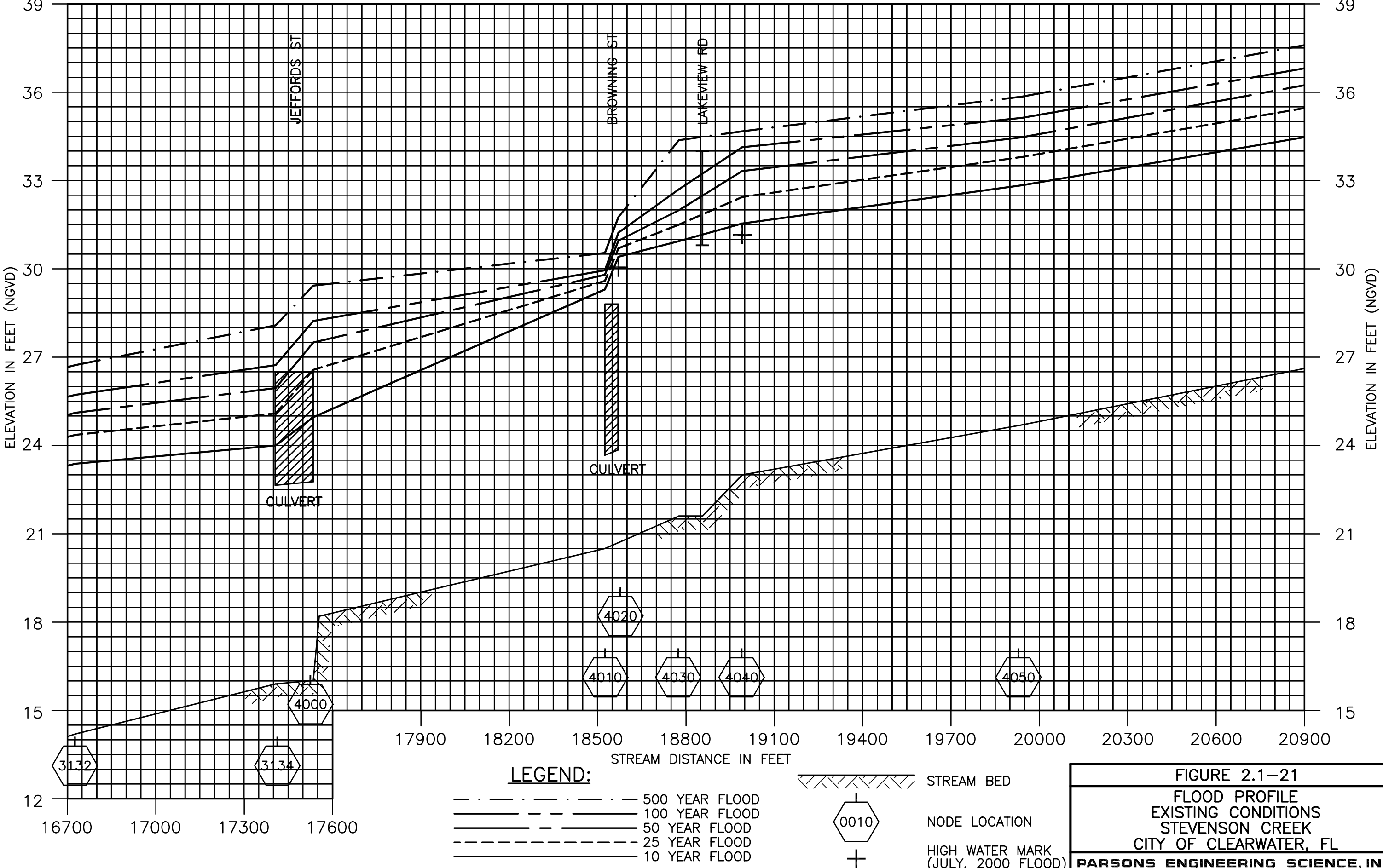
NODE LOCATION



HIGH WATER MARK
(JULY, 2000 FLOOD)

STREAM DISTANCE IN FEET

FIGURE 2.1-20
FLOOD PROFILE
EXISTING CONDITIONS
STEVENSON CREEK
CITY OF CLEARWATER, FL
PARSONS ENGINEERING SCIENCE, INC.

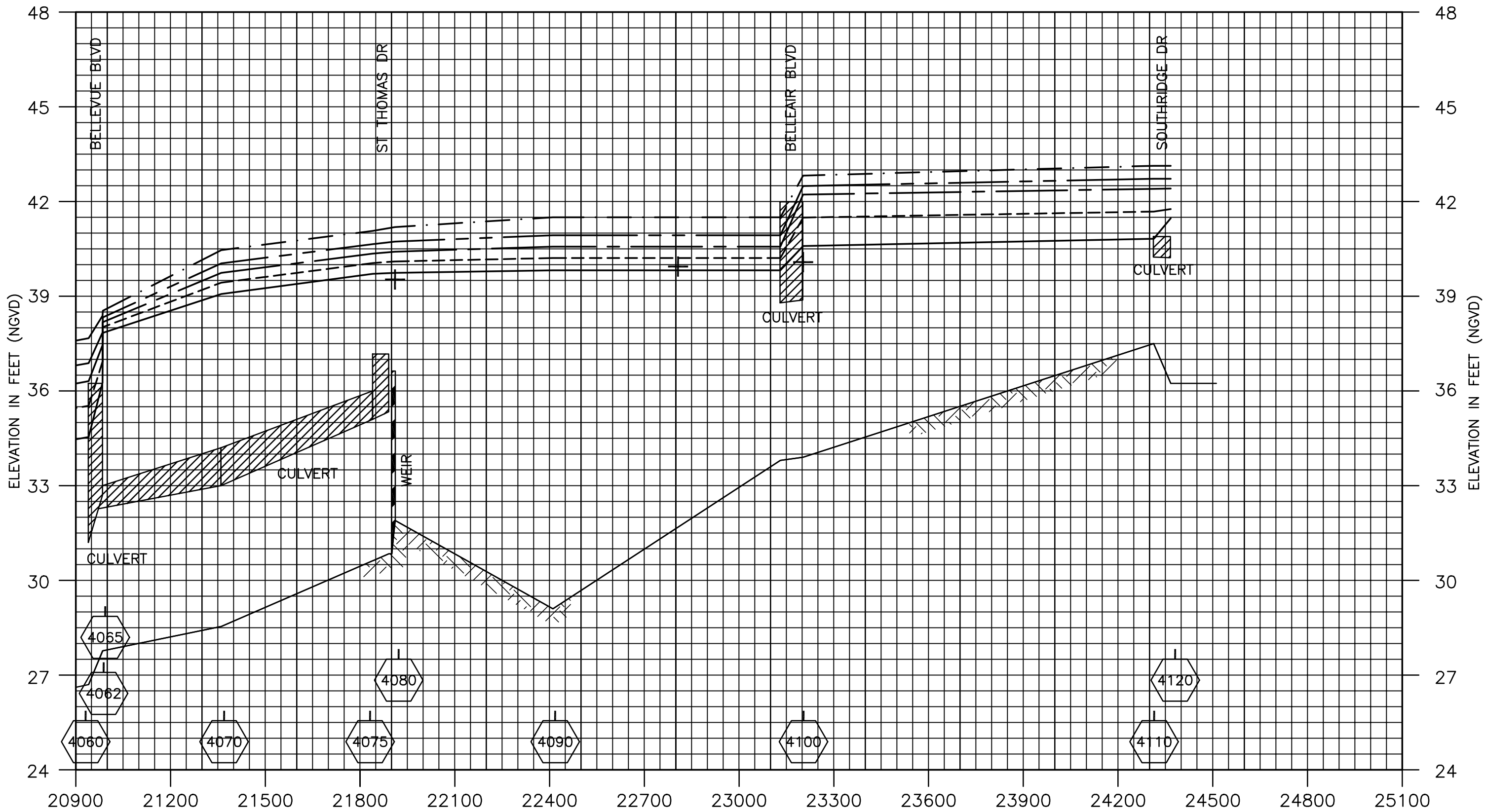


LEGEND:

- · - · - · 500 YEAR FLOOD
- · — · — 100 YEAR FLOOD
- · — — — 50 YEAR FLOOD
- - - - - 25 YEAR FLOOD
- 10 YEAR FLOOD

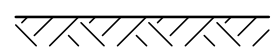
- STREAM BED
- NODE LOCATION
- HIGH WATER MARK (JULY, 2000 FLOOD)

FIGURE 2.1-21
FLOOD PROFILE
EXISTING CONDITIONS
STEVENSON CREEK
CITY OF CLEARWATER, FL
PARSONS ENGINEERING SCIENCE, INC.

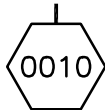


LEGEND:

- 500 YEAR FLOOD
- 100 YEAR FLOOD
- 50 YEAR FLOOD
- 25 YEAR FLOOD
- 10 YEAR FLOOD



STREAM BED



NODE LOCATION



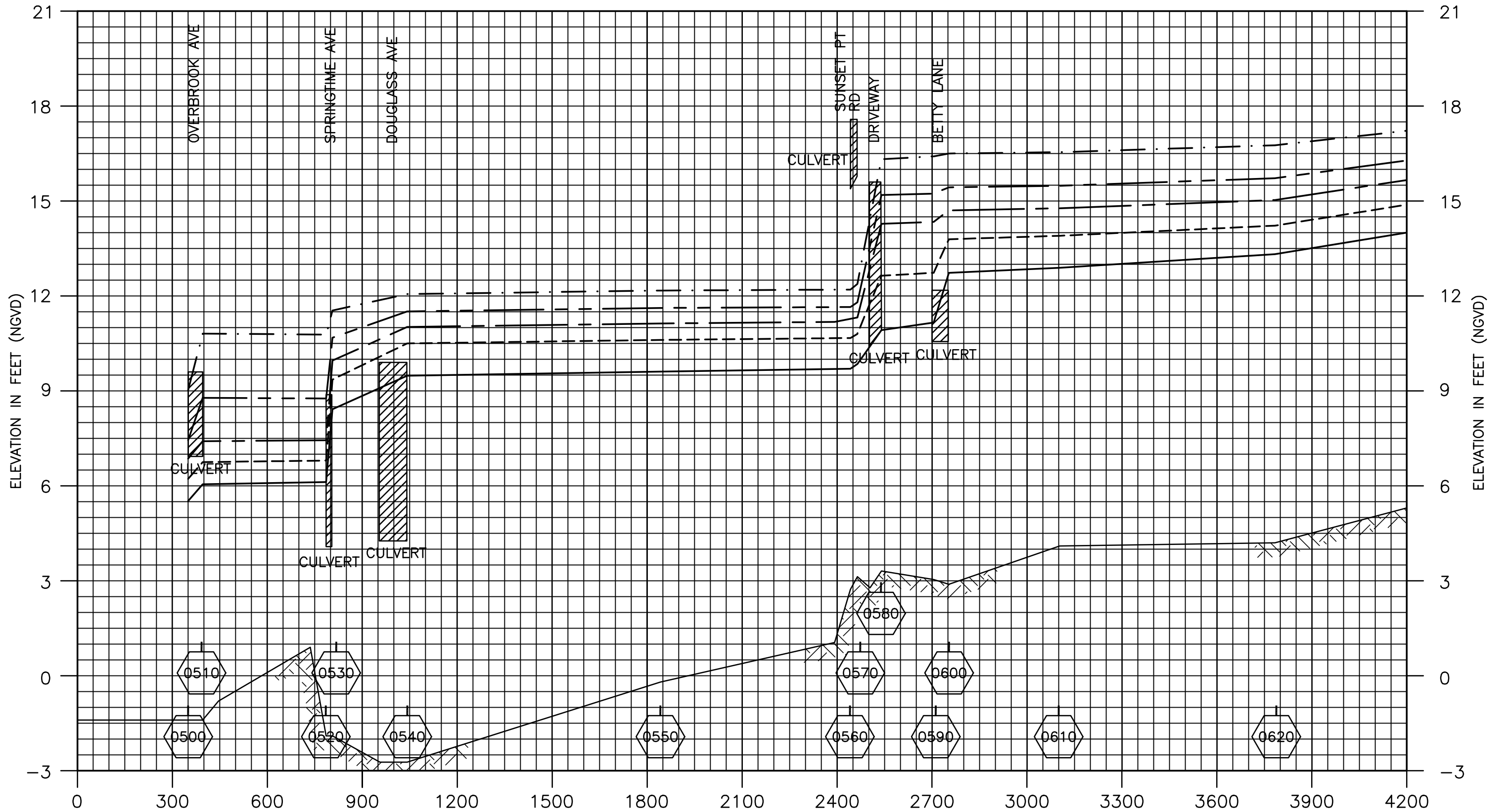
HIGH WATER MARK
(JULY, 2000 FLOOD)

STREAM DISTANCE IN FEET

FIGURE 2-1.22

FLOOD PROFILE
EXISTING CONDITIONS
STEVENSON CREEK
CITY OF CLEARWATER, FL

PARSONS ENGINEERING SCIENCE, INC.



LEGEND:

- · — · — · — · — 500 YEAR FLOOD
- — — — — 100 YEAR FLOOD
- · — · — · — 50 YEAR FLOOD
- - - - - 25 YEAR FLOOD
- 10 YEAR FLOOD

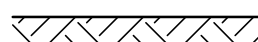
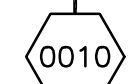

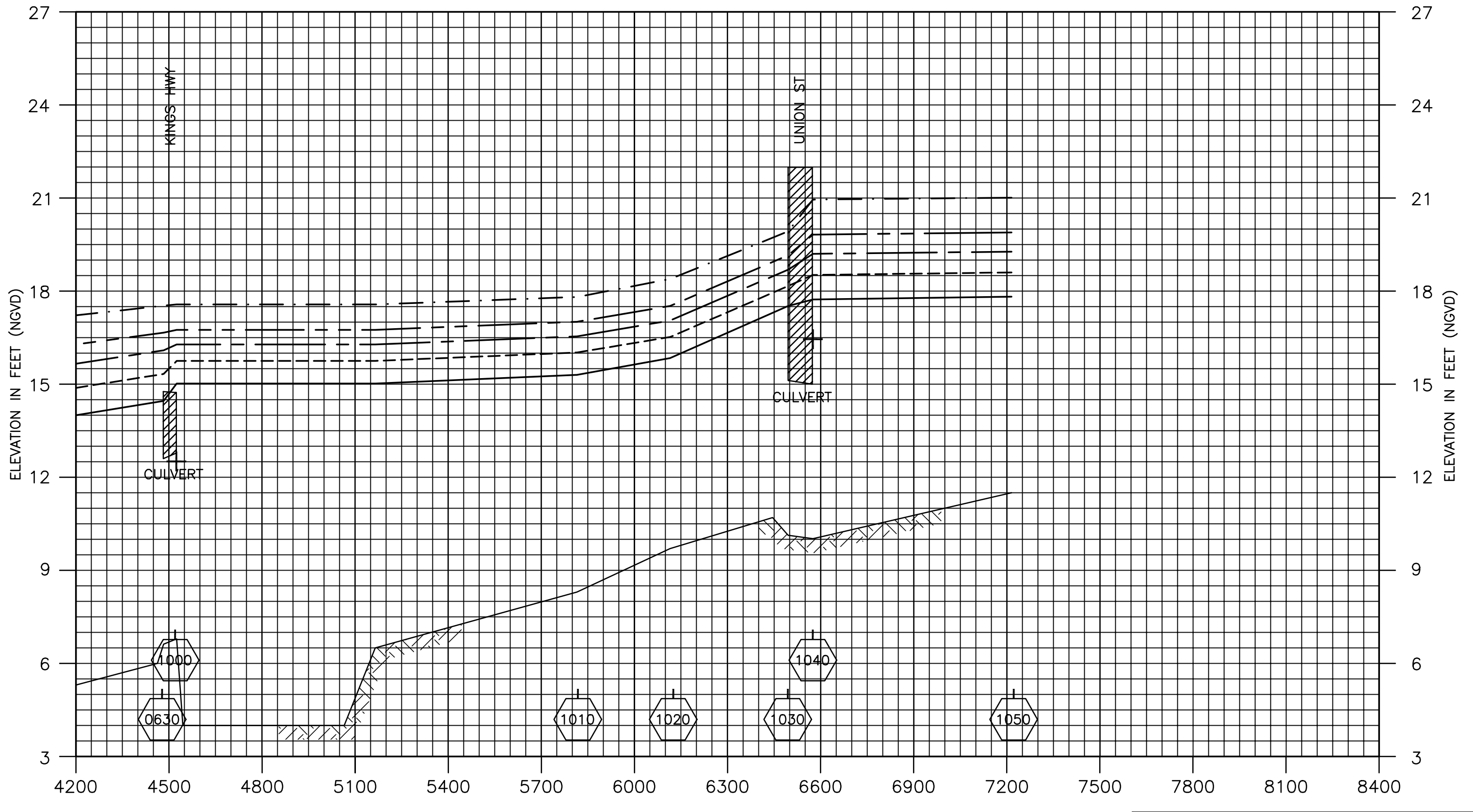
-  STREAM BED
-  NODE LOCATION
-  HIGH WATER MARK (JULY, 2000 FLOOD)

FIGURE 2.1-23
FLOOD PROFILE
EXISTING CONDITIONS
SPRING BRANCH
CITY OF CLEARWATER, FL
PARSONS ENGINEERING SCIENCE, INC.



LEGEND:

- . - . - . - . - . 500 YEAR FLOOD
- — — — — 100 YEAR FLOOD
- — — — — 50 YEAR FLOOD
- — — — — 25 YEAR FLOOD
- 10 YEAR FLOOD

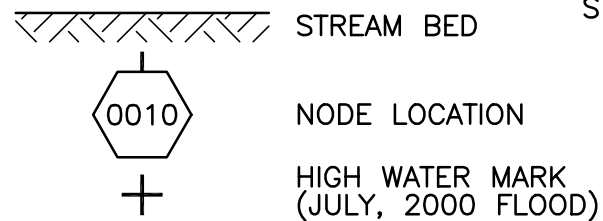


FIGURE 2-1.24
FLOOD PROFILE
EXISTING CONDITIONS
SPRING BRANCH
CITY OF CLEARWATER, FL
PARSONS ENGINEERING SCIENCE, INC.

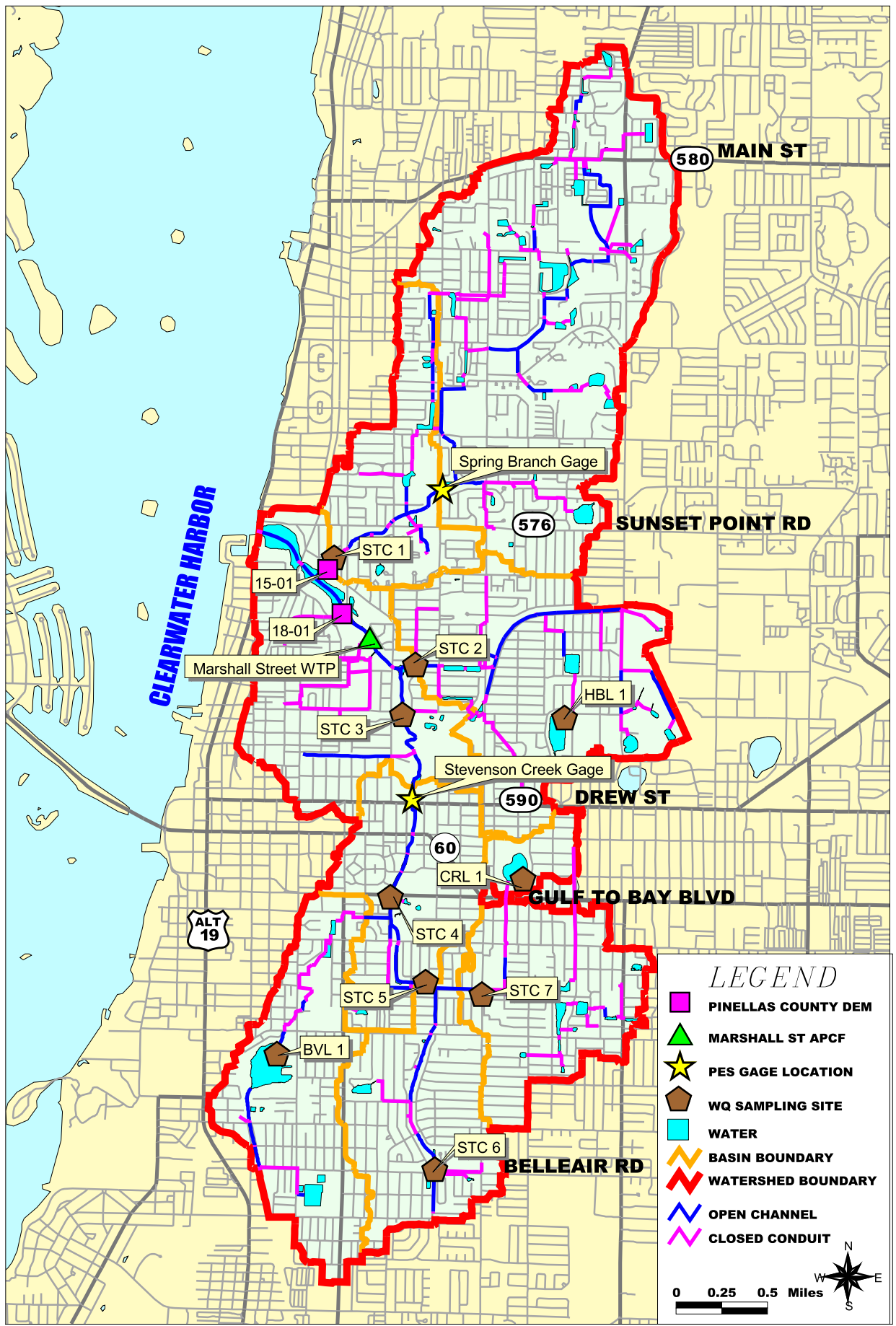


Figure 2.3-1 - Water Quality Monitoring Stations

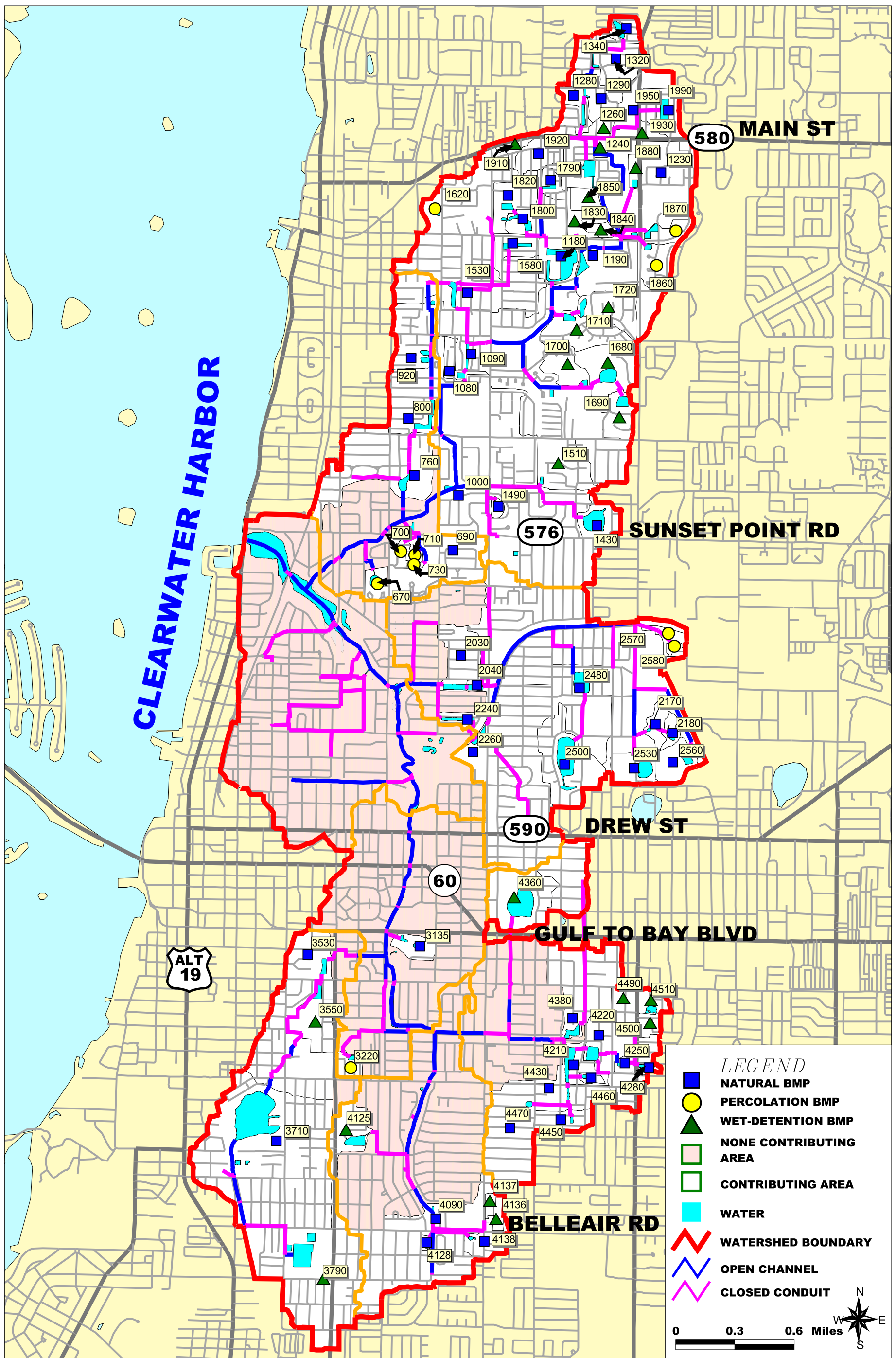


Figure 2.3-11 - Existing Treatment Locations

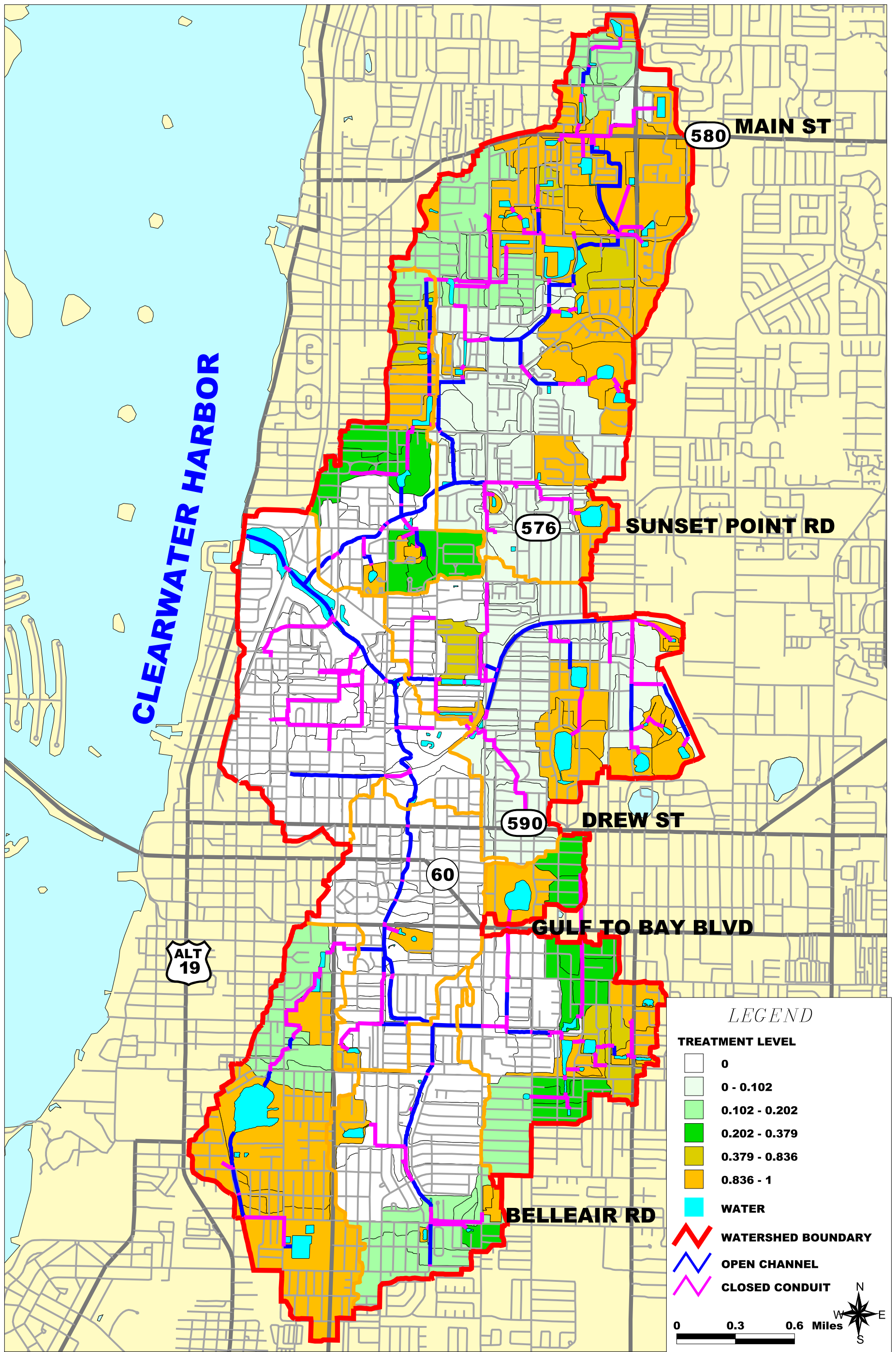


Figure 2.3-12 - Existing Treatment Coverage

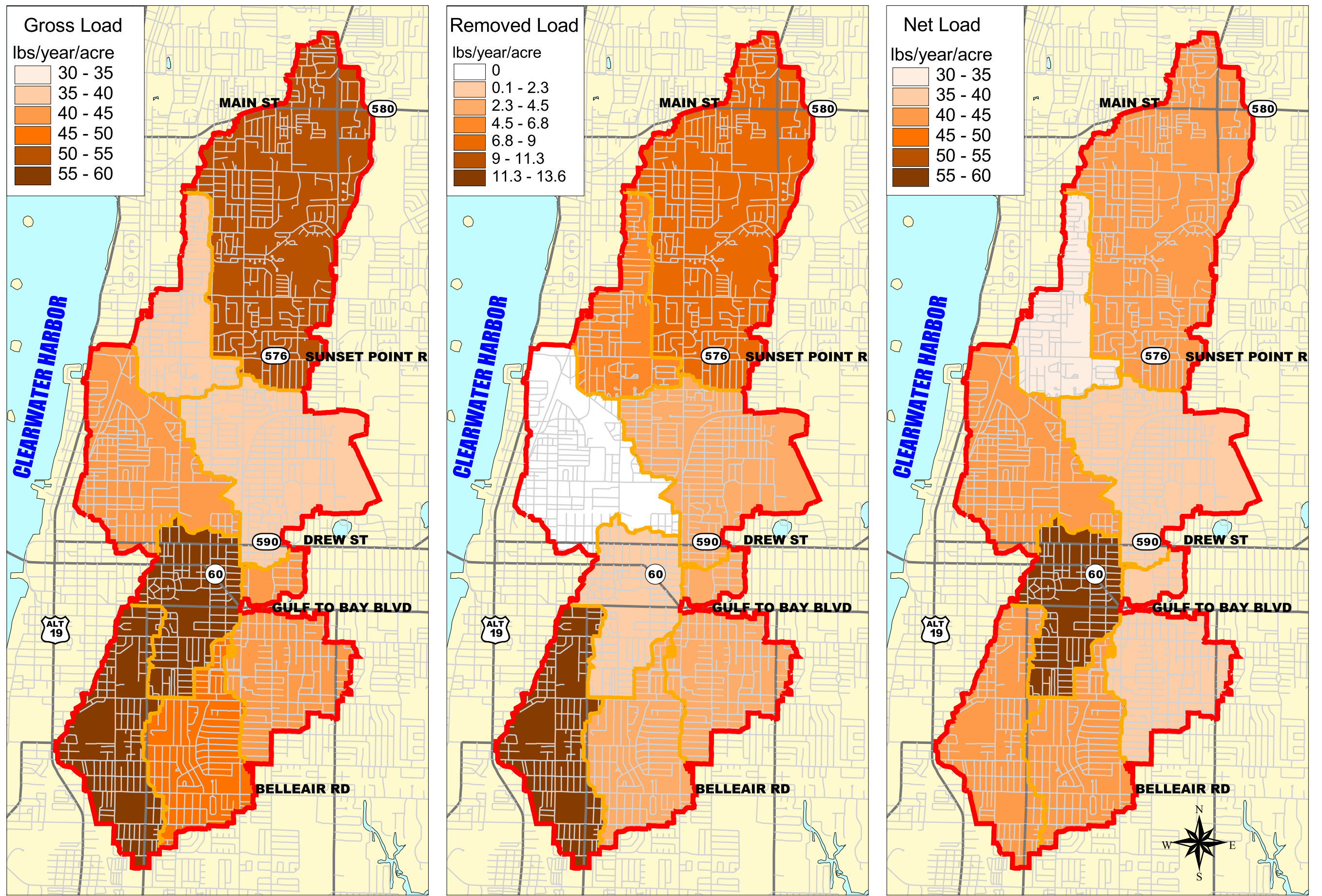


Figure 2.3-13 Major Basin Loading - BOD

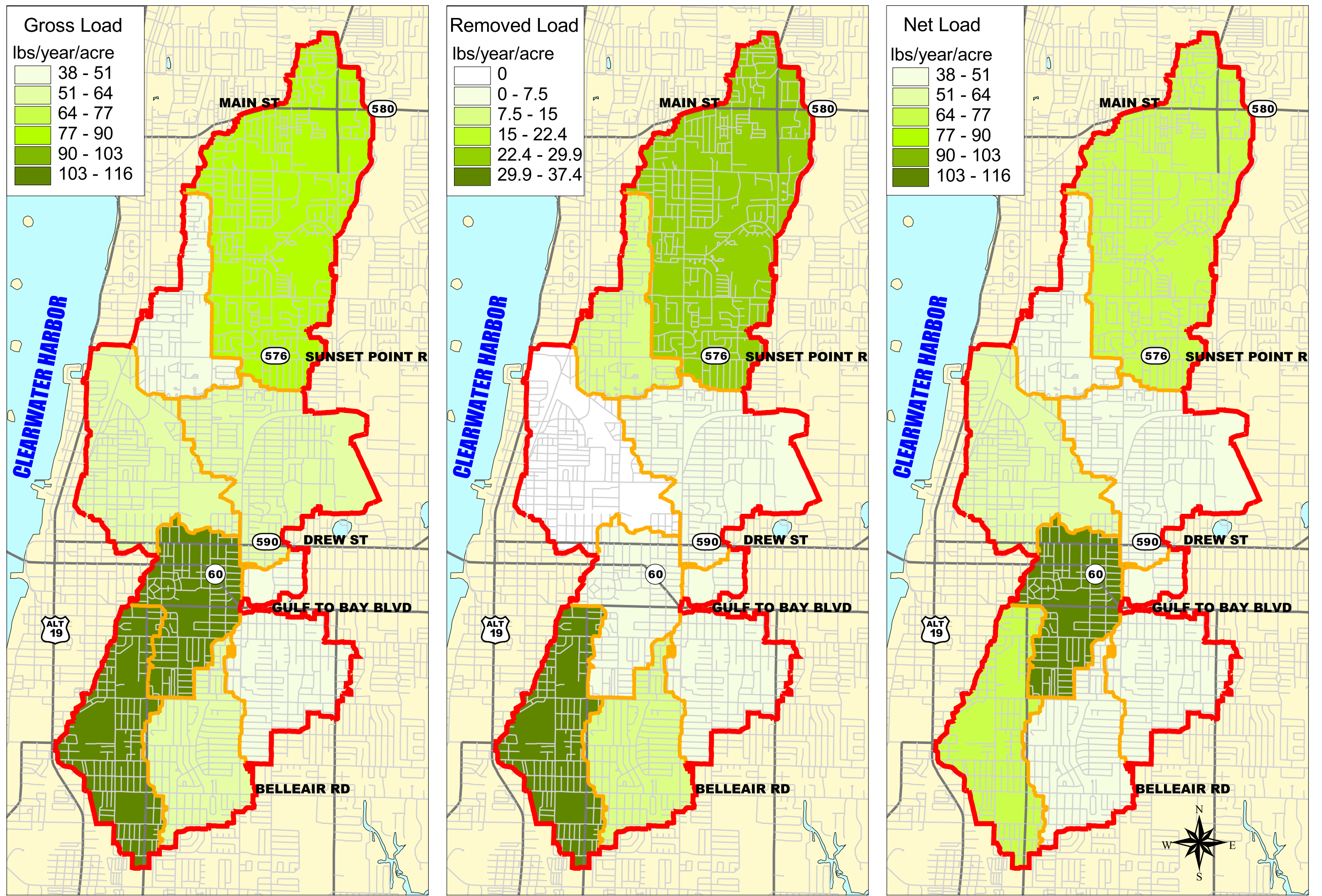


Figure 2.3-14 Major Basin Loading - TSS

0 2000 4000 6000 Feet



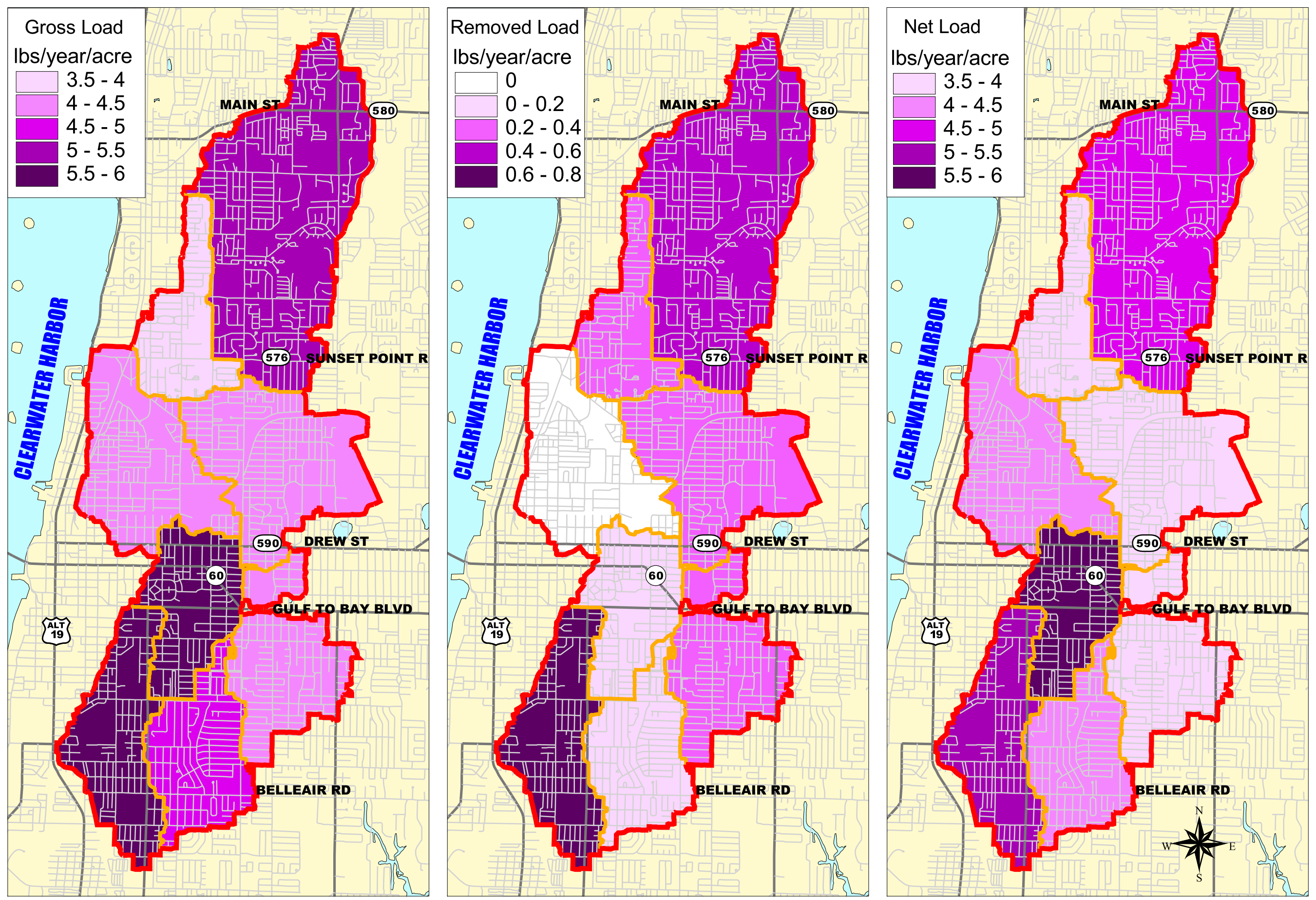


Figure 2.3-15 Major Basin Loading - Nitrogen

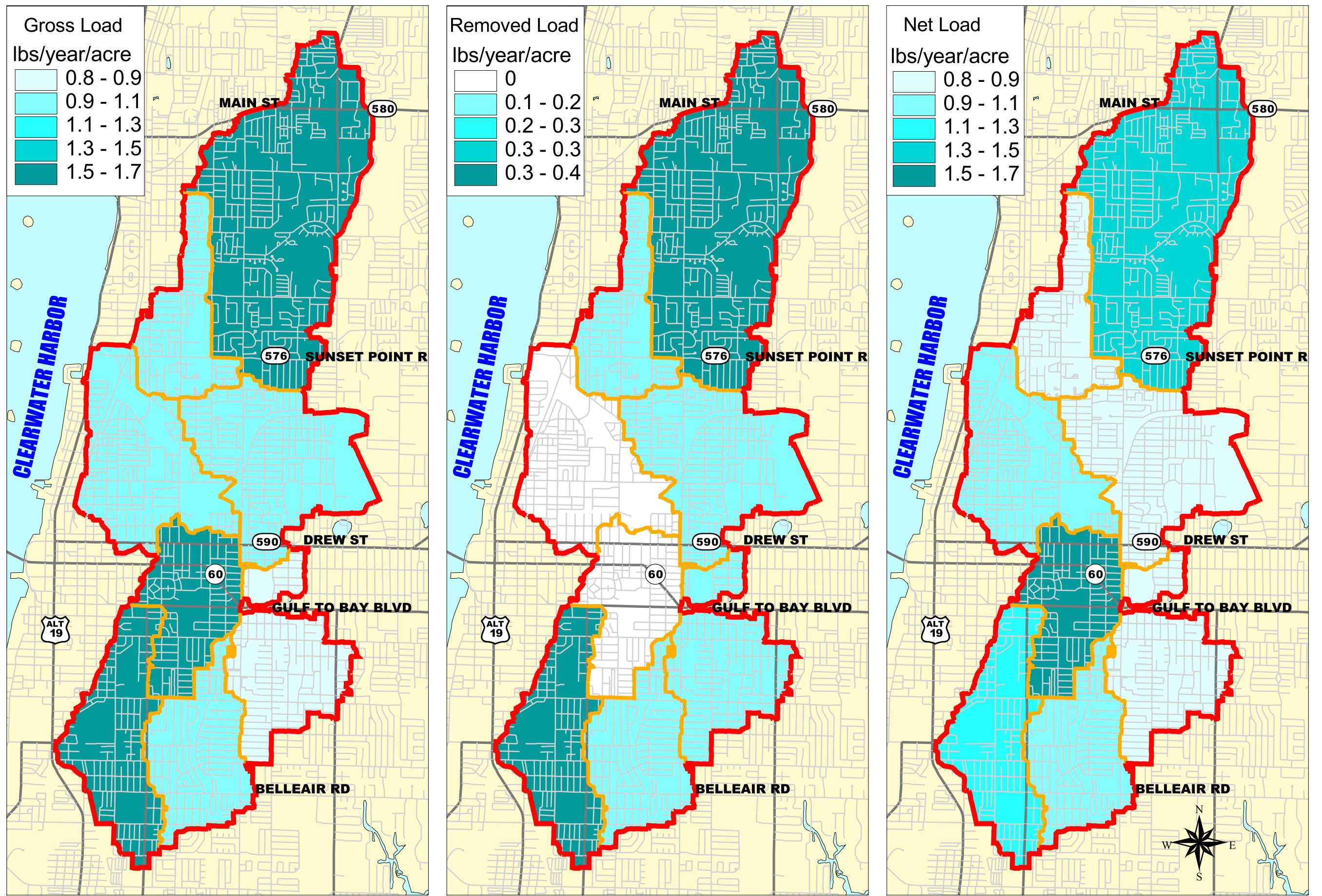


Figure 2.3-16 Major Basin Loading - Phosphorus

0 2000 4000 6000 Feet

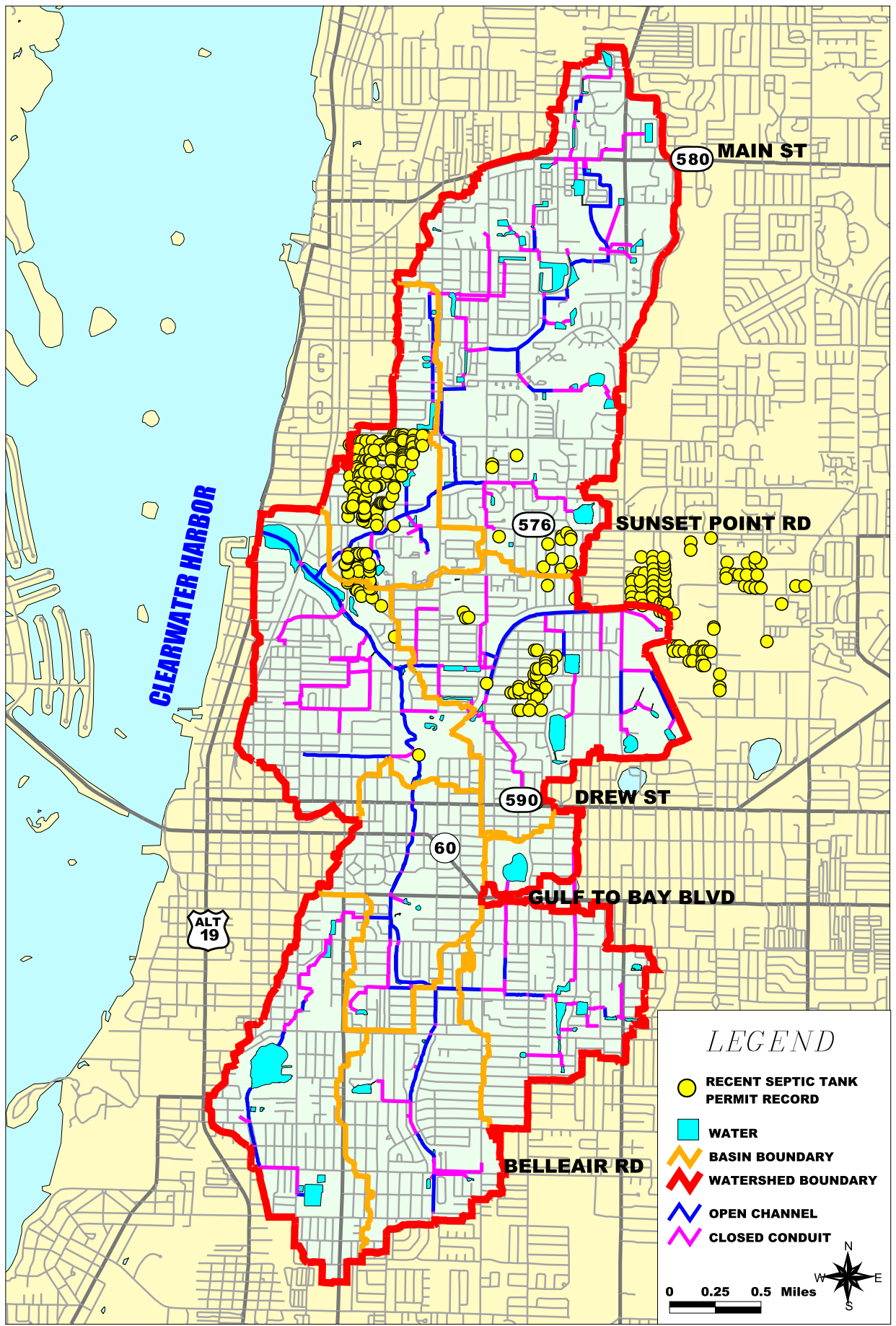


Figure 2.3-3 - Septic Tank Densities

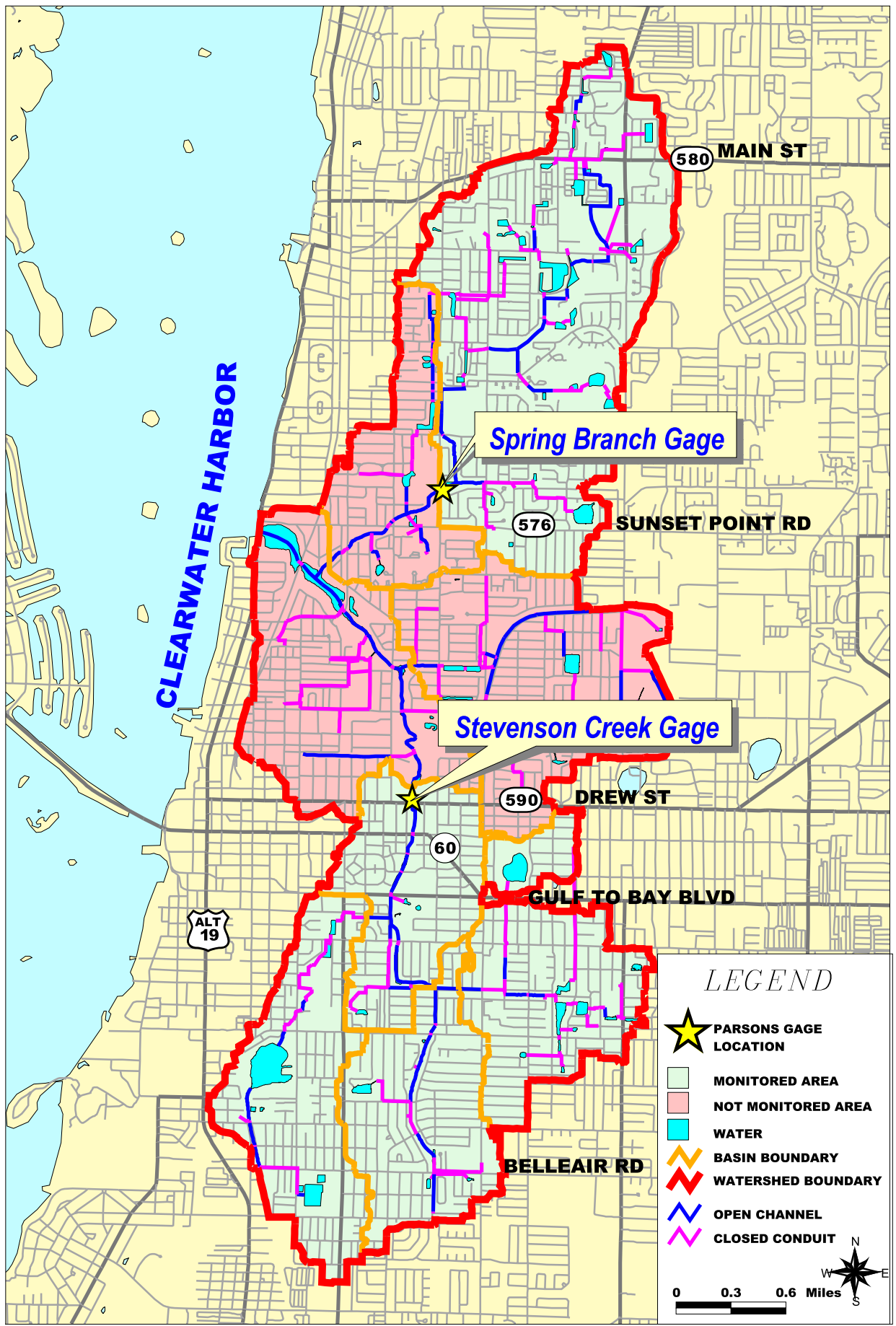
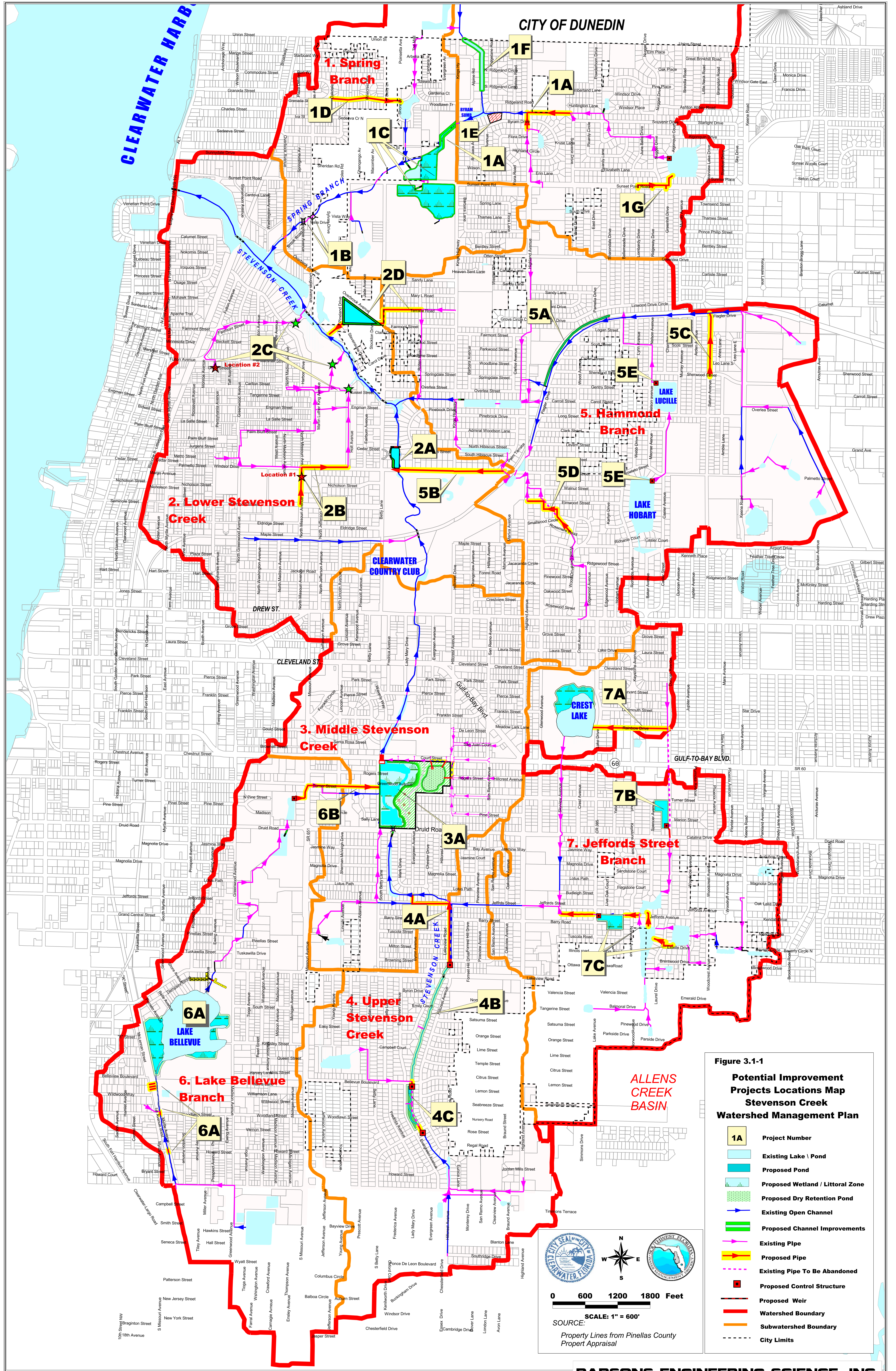


Figure 2.3-4 - Monitoring Station Coverage



CITY OF DUNEDIN

1. Spring Branch

2. Lower Stevenson Creek

3. Middle Stevenson Creek

4. Upper Stevenson Creek

5. Hammond Branch

6. Lake Bellevue Branch

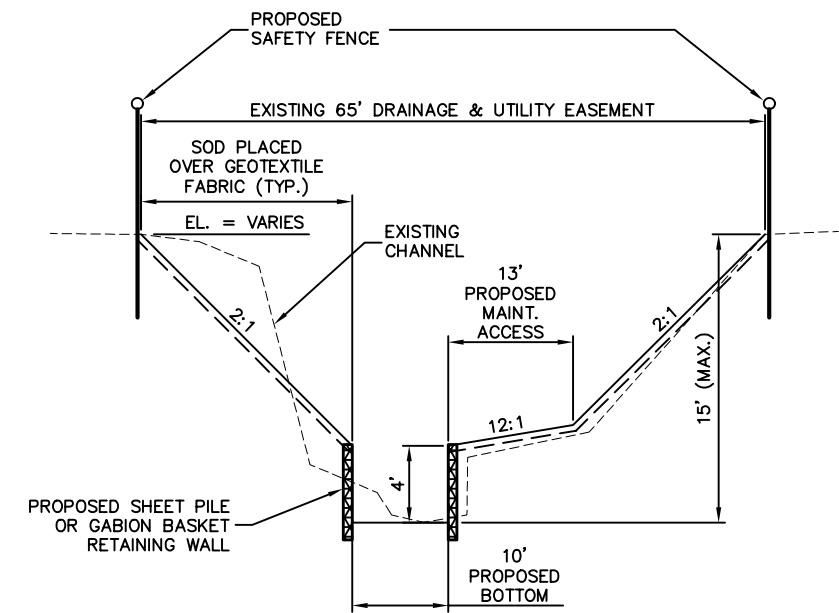
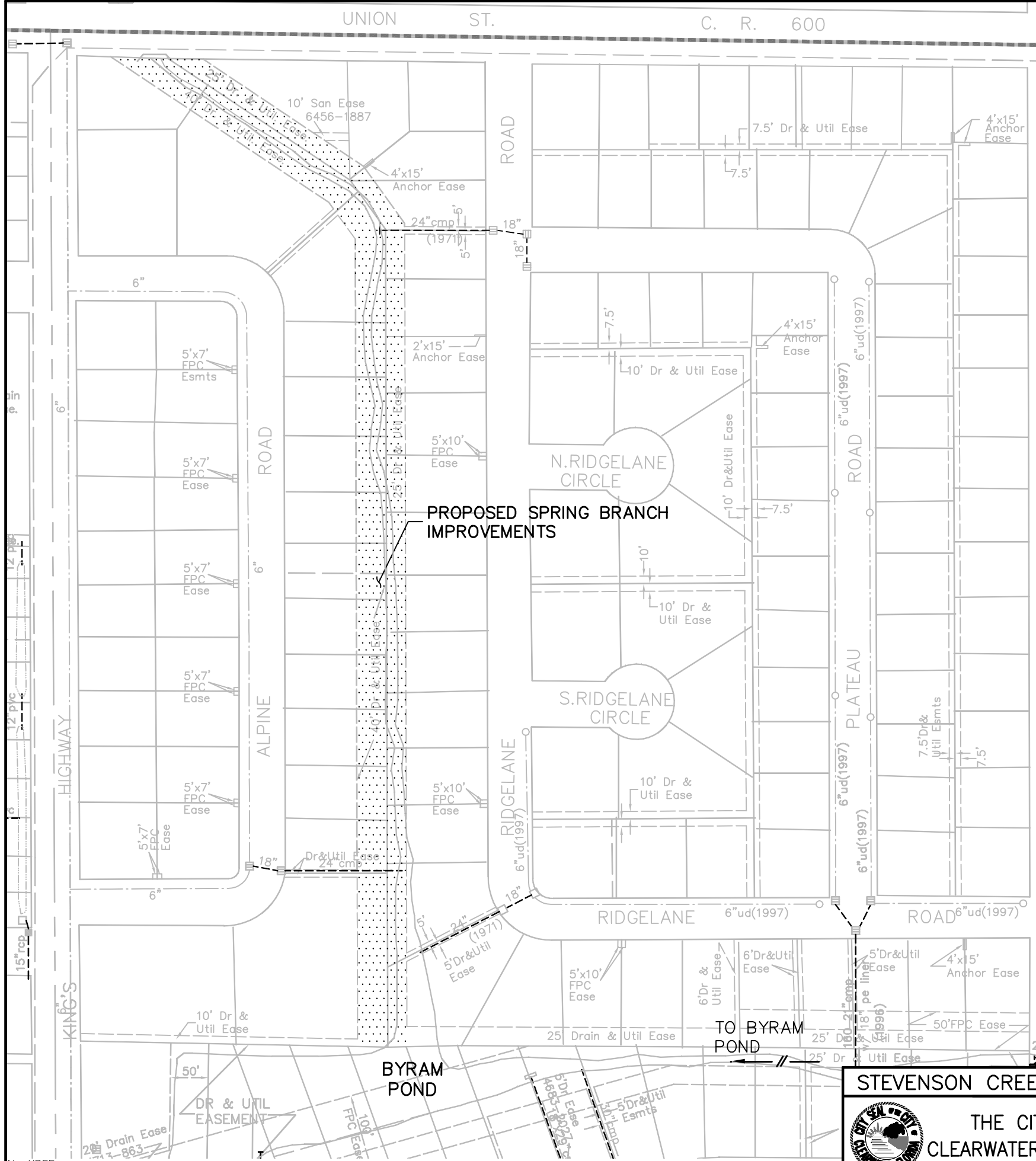
7. Jeffords Street Branch

ALLENS CREEK BASIN

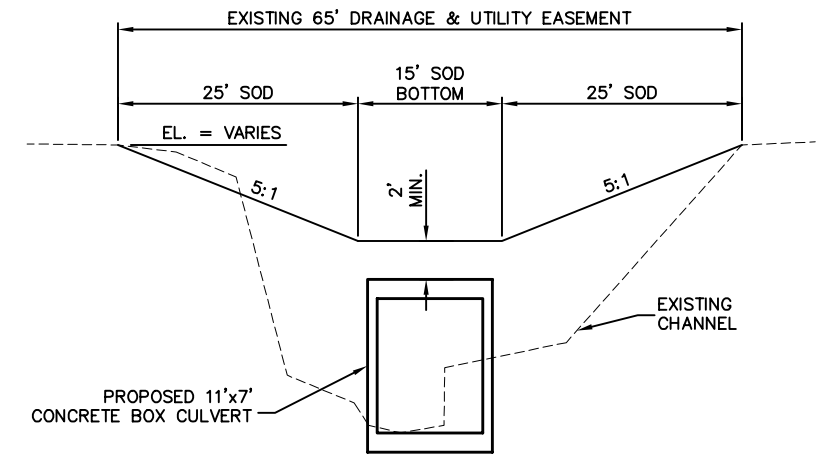
Figure 3.1-1
Potential Improvement
Projects Locations Map
Stevenson Creek
Watershed Management Plan

- 1A Project Number
- Existing Lake / Pond
- Proposed Pond
- Proposed Wetland / Littoral Zone
- Proposed Dry Retention Pond
- Existing Open Channel
- Proposed Channel Improvements
- Existing Pipe
- Proposed Pipe
- Existing Pipe To Be Abandoned
- Proposed Control Structure
- Proposed Weir
- Watershed Boundary
- Subwatershed Boundary
- City Limits

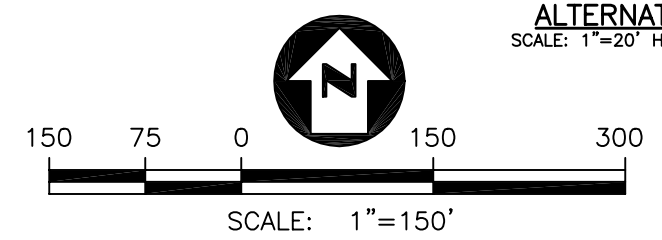
0 600 1200 1800 Feet
SCALE: 1" = 600'
 SOURCE: Property Lines from Pinellas County
 Property Appraisal

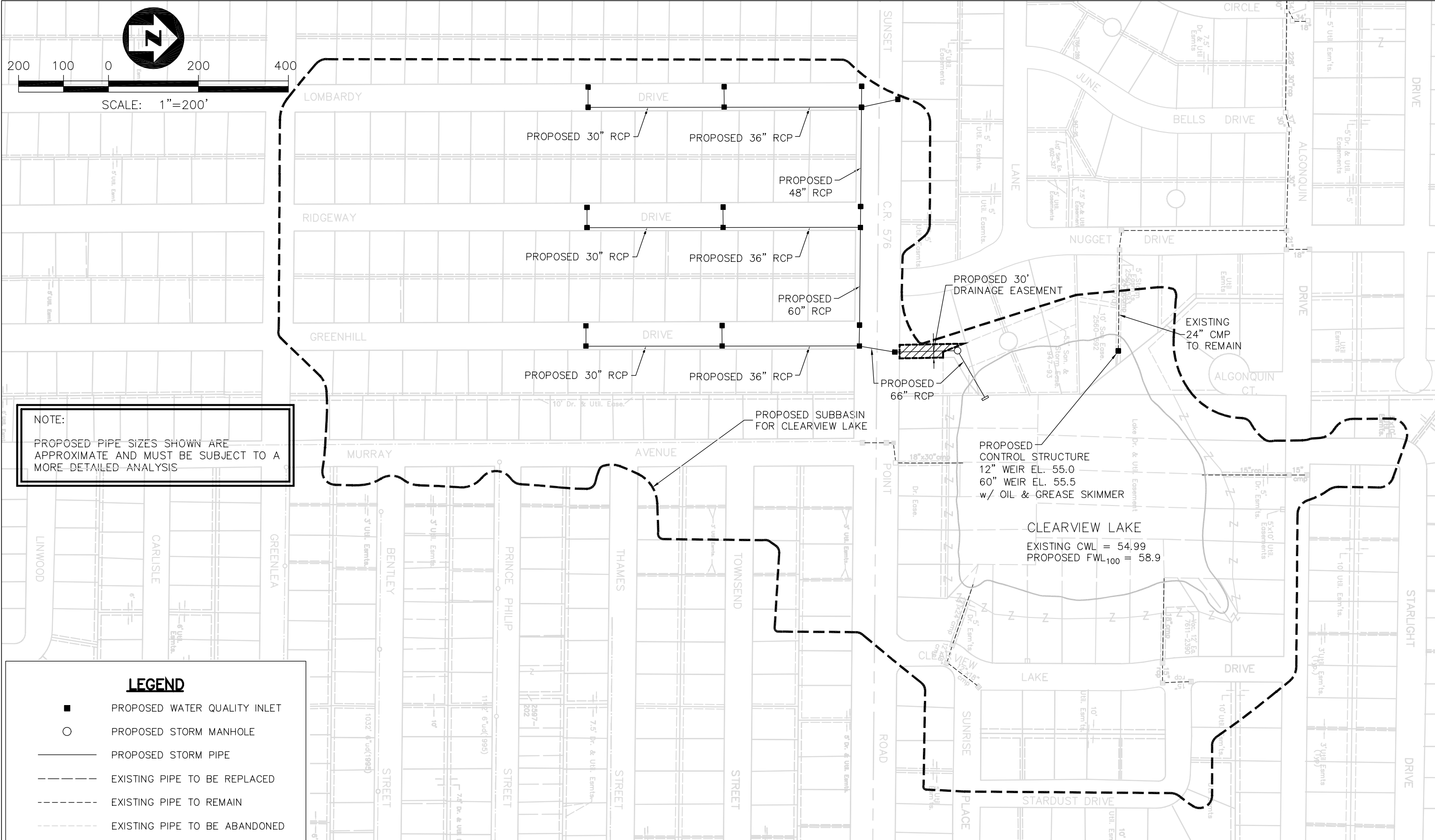


TYPICAL CROSS SECTION
ALTERNATE 'A'
SCALE: 1"=20' H, 1"=10' V



TYPICAL CROSS SECTION
ALTERNATE 'B'
SCALE: 1"=20' H, 1"=10' V





NOTE:
 PROPOSED PIPE SIZES SHOWN ARE APPROXIMATE AND MUST BE SUBJECT TO A MORE DETAILED ANALYSIS

LEGEND

- PROPOSED WATER QUALITY INLET
- PROPOSED STORM MANHOLE
- PROPOSED STORM PIPE
- - - EXISTING PIPE TO BE REPLACED
- - - EXISTING PIPE TO REMAIN
- - - EXISTING PIPE TO BE ABANDONED
- ▭ (with arrows) PROPOSED LITTORAL SHELF
- - - DRAINAGE SUBBASIN

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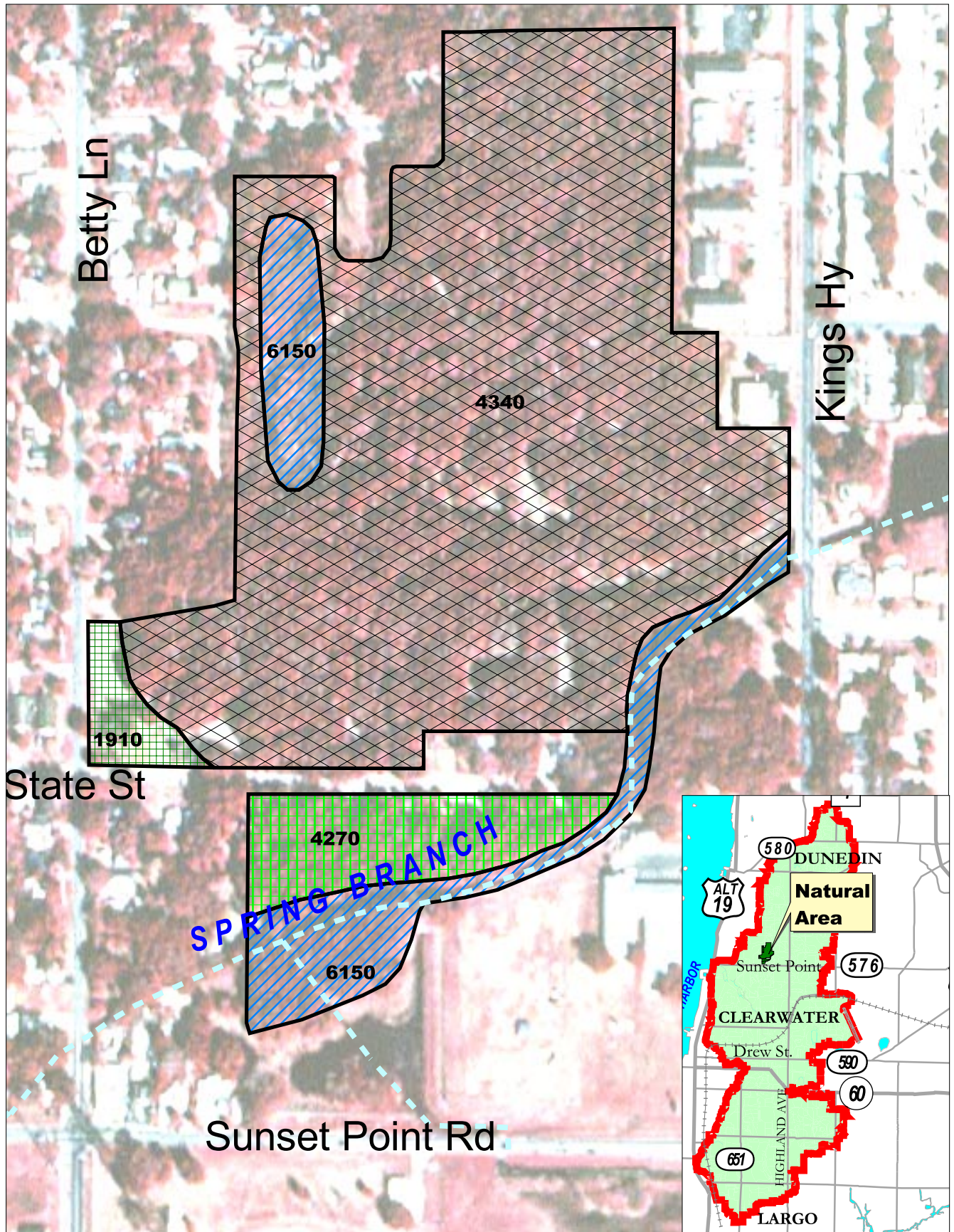
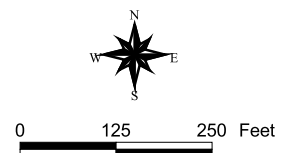
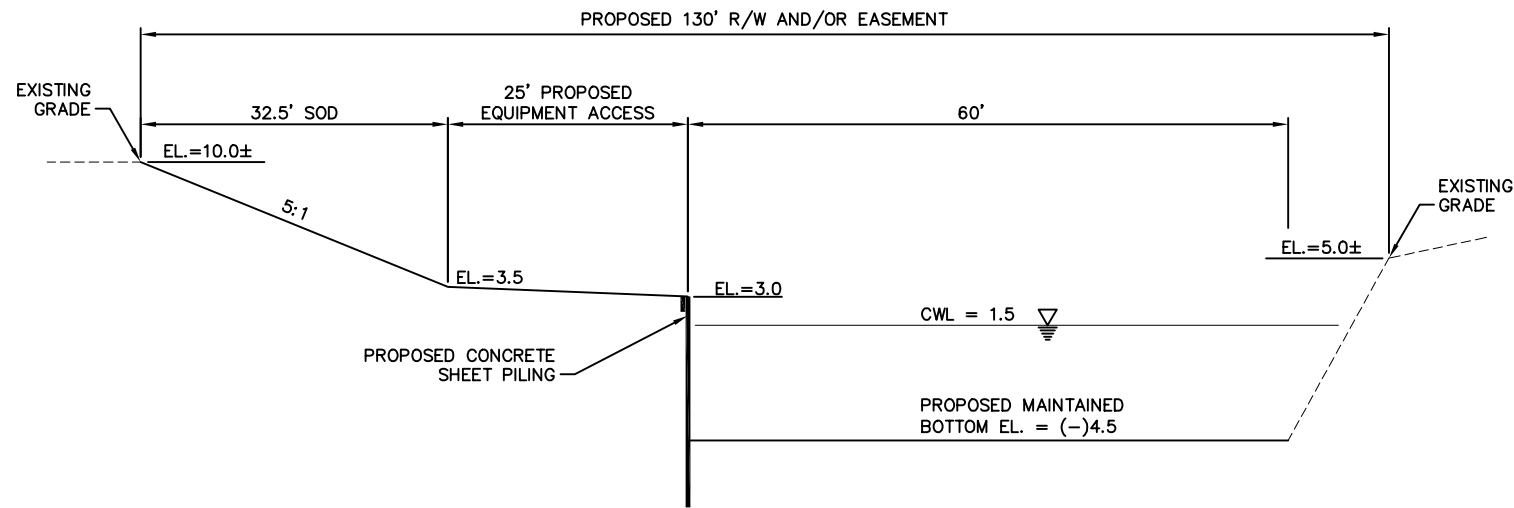


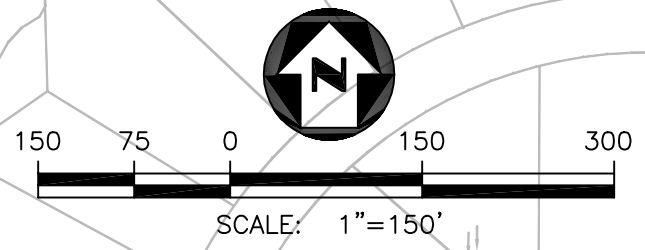
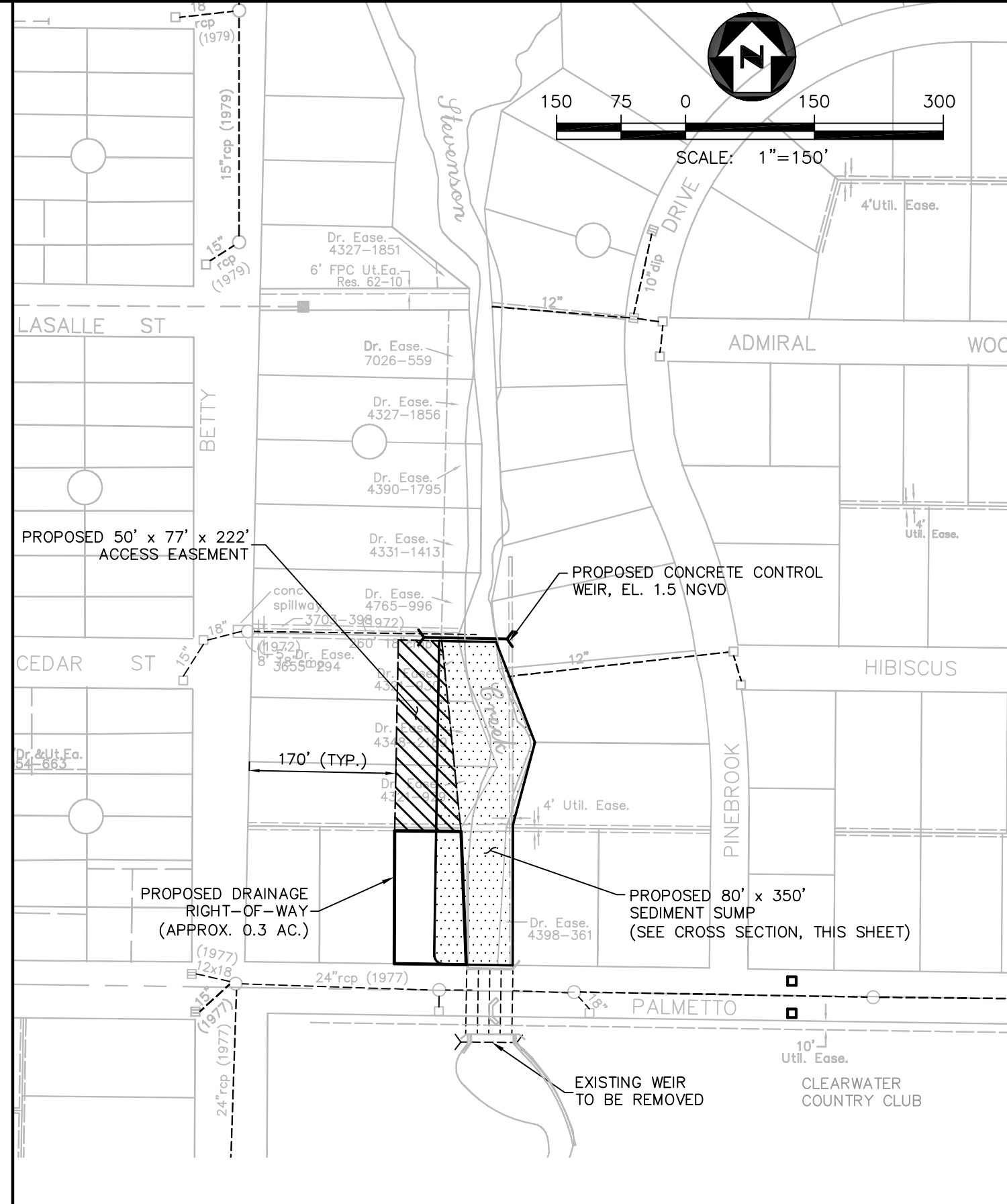
Figure 3.1-12
Stevenson Creek Watershed
Potential Natural Resource
Improvement Area



-  1910 - OPEN LAND (W/IN URBAN AREAS)
-  4270 - LIVE OAK
-  6150 - WETLANDS - BOTTOMLANDS
-  4340 - HARDWOOD - CONIFER MIXED

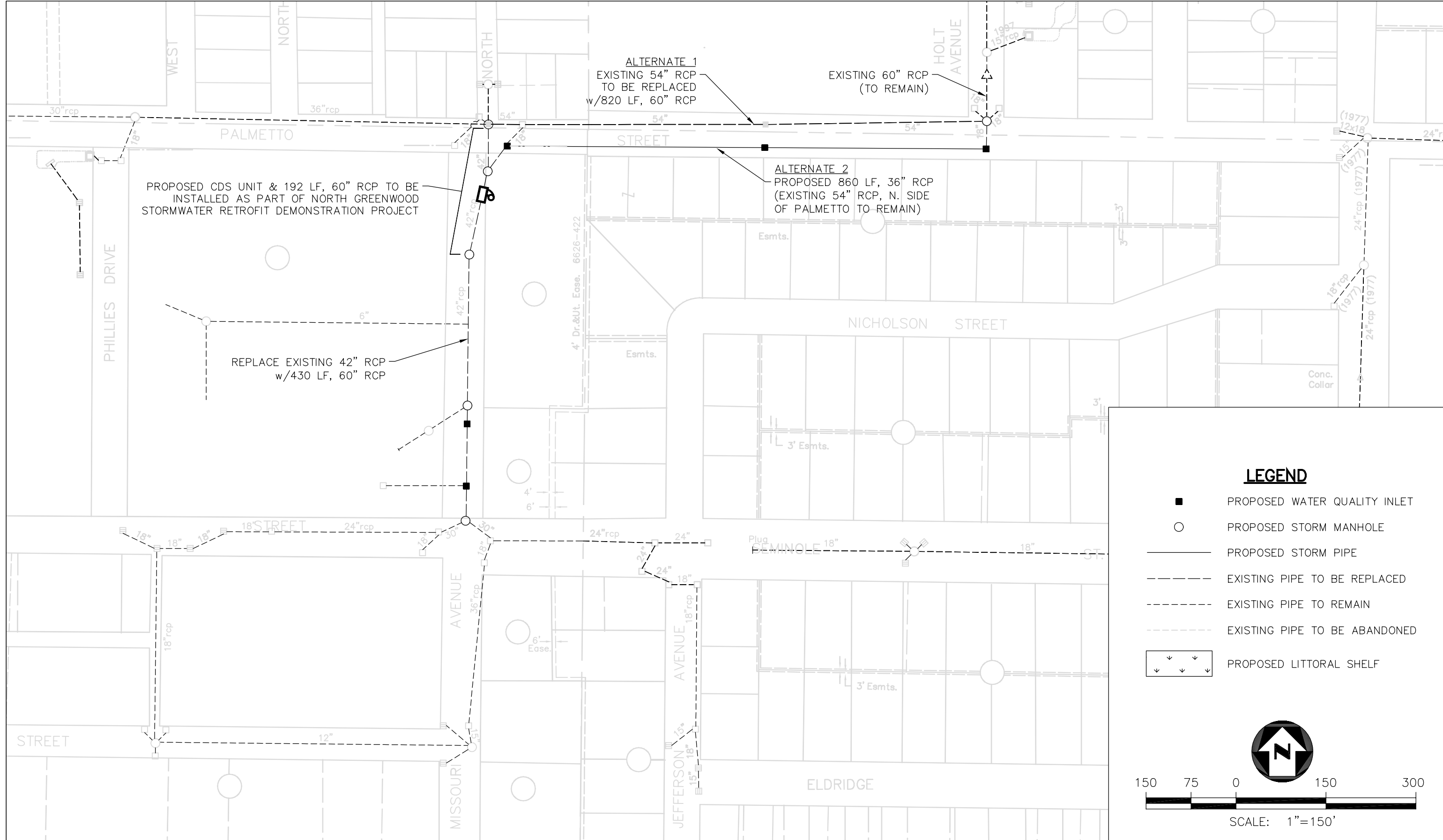




SEDIMENT SUMP
TYPICAL CROSS SECTION
PROJECT 2A
SCALE: 1"=20' H, 1"= 10' V



| | | |
|--|--|---|
| STEVENSON CREEK WATERSHED MANAGEMENT PLAN | | FIGURE 3.1-13 |
|  THE CITY OF CLEARWATER, FLORIDA |  PARSONS ENGINEERING SCIENCE, INC. Tampa, Florida (813) 933-4650 | PROJECT 2A PALMETTO STREET SEDIMENT SUMP |



LEGEND

- PROPOSED WATER QUALITY INLET
- PROPOSED STORM MANHOLE
- PROPOSED STORM PIPE
- - - EXISTING PIPE TO BE REPLACED
- · · EXISTING PIPE TO REMAIN
- · · EXISTING PIPE TO BE ABANDONED
- ⌵⌵⌵ PROPOSED LITTORAL SHELF



SCALE: 1"=150'

STEVENSON CREEK WATERSHED MANAGEMENT PLAN



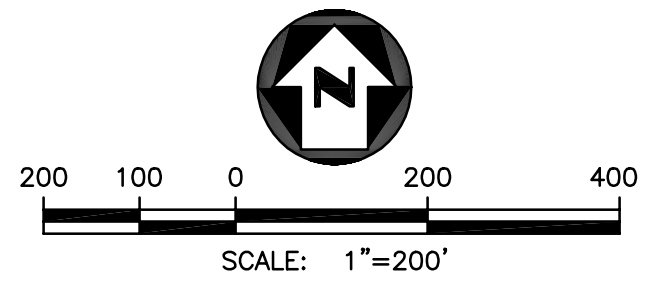
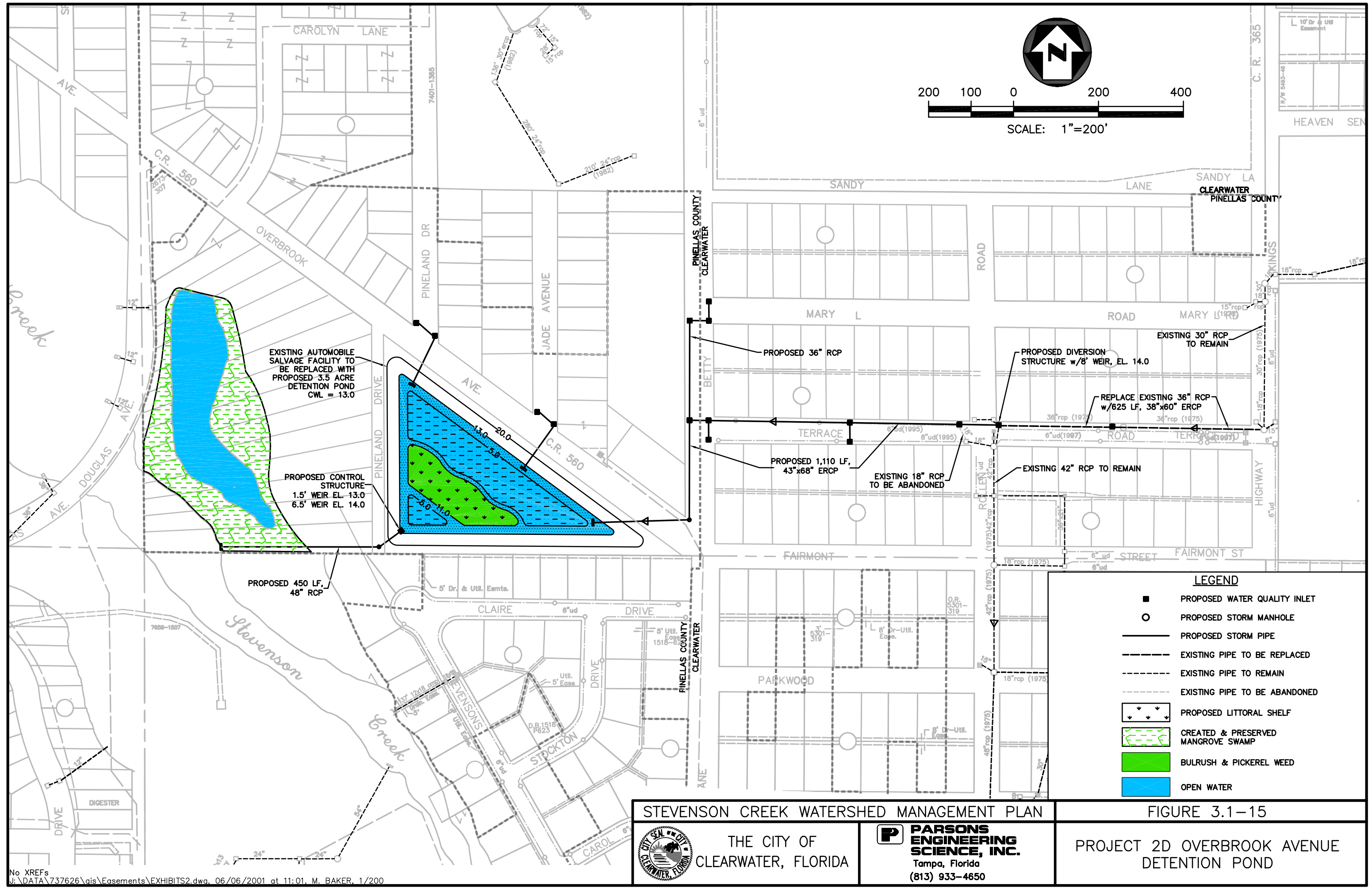
**THE CITY OF
CLEARWATER, FLORIDA**



**PARSONS
ENGINEERING
SCIENCE, INC.**
Tampa, Florida
(813) 933-4650

FIGURE 3.1-14

**PROJECT 2B NORTH MISSOURI AVENUE
& PALMETTO STREET
DRAINAGE IMPROVEMENTS**



| LEGEND | |
|-------------------------|------------------------------------|
| ■ | PROPOSED WATER QUALITY INLET |
| ○ | PROPOSED STORM MANHOLE |
| — | PROPOSED STORM PIPE |
| - - - | EXISTING PIPE TO BE REPLACED |
| - - - | EXISTING PIPE TO REMAIN |
| - - - | EXISTING PIPE TO BE ABANDONED |
| ▭ (with arrows) | PROPOSED LITTORAL SHELF |
| ▭ (with wavy lines) | CREATED & PRESERVED MANGROVE SWAMP |
| ▭ (with green hatching) | BULRUSH & PICKEREL WEED |
| ▭ (with blue hatching) | OPEN WATER |

STEVENSON CREEK WATERSHED MANAGEMENT PLAN

FIGURE 3.1-15

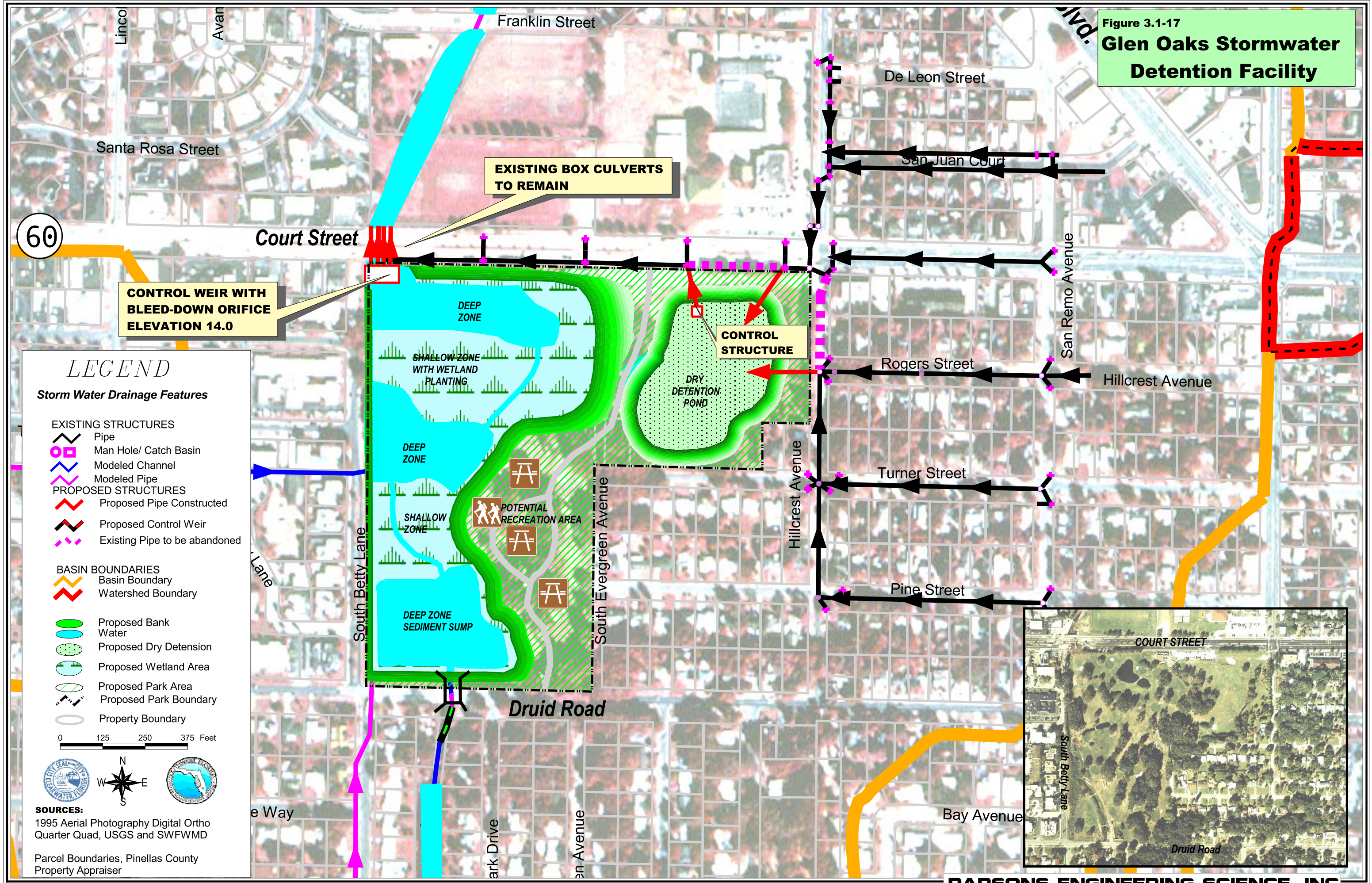
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PROJECT 2D OVERBROOK AVENUE
DETENTION POND

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Figure 3.1-17
Glen Oaks Stormwater Detention Facility



CONTROL WEIR WITH BLEED-DOWN ORIFICE ELEVATION 14.0

EXISTING BOX CULVERTS TO REMAIN

CONTROL STRUCTURE

LEGEND

Storm Water Drainage Features

- EXISTING STRUCTURES**
 - Pipe
 - Man Hole/ Catch Basin
 - Modeled Channel
 - Modeled Pipe
- PROPOSED STRUCTURES**
 - Proposed Pipe Constructed
 - Proposed Control Weir
 - Existing Pipe to be abandoned
- BASIN BOUNDARIES**
 - Basin Boundary
 - Watershed Boundary
- Water Features**
 - Proposed Bank Water
 - Proposed Dry Detention
 - Proposed Wetland Area
 - Proposed Park Area
 - Proposed Park Boundary
 - Property Boundary

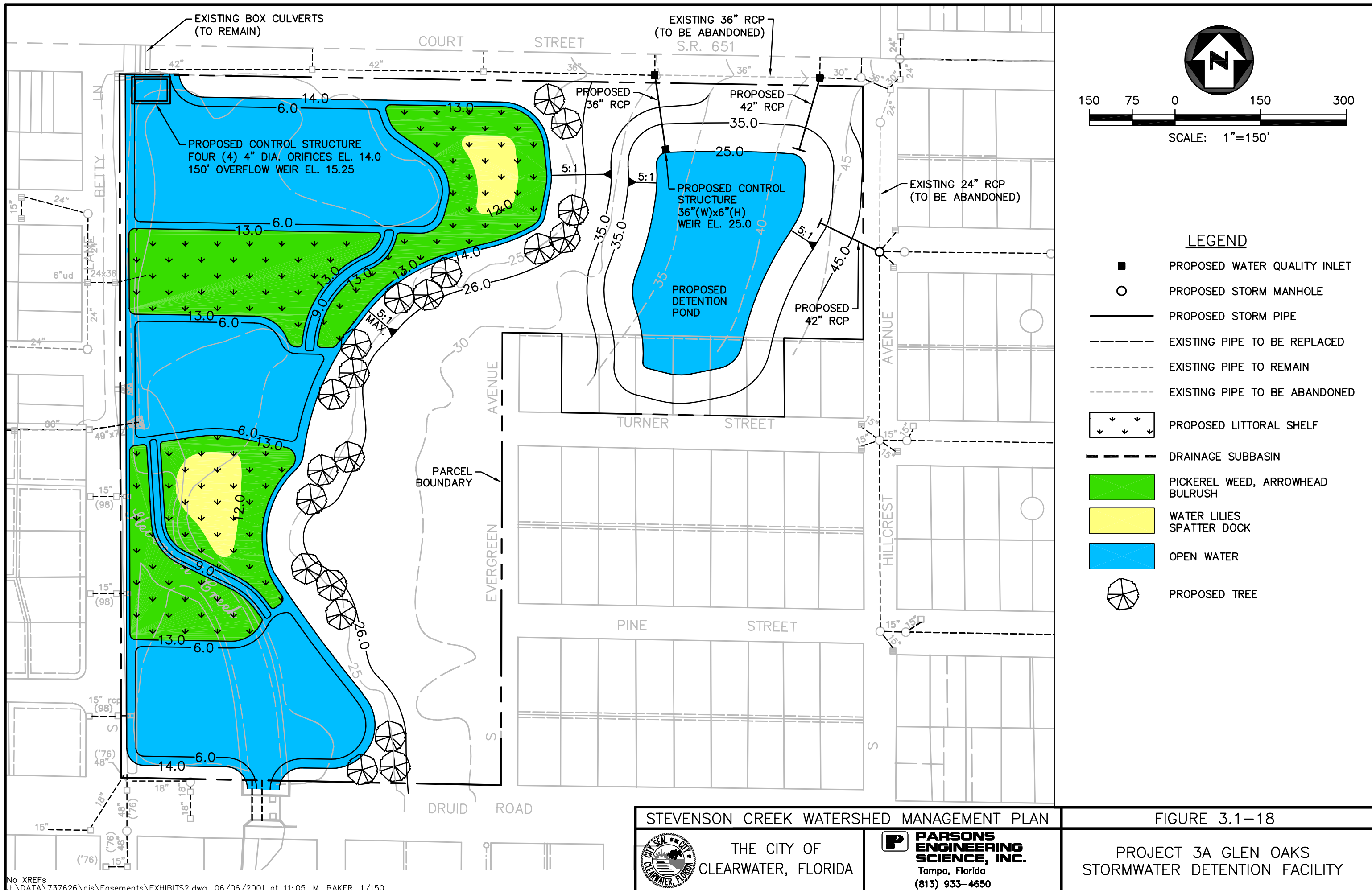
0 125 250 375 Feet



SOURCES:
 1995 Aerial Photography Digital Ortho Quarter Quad, USGS and SWFWMD

Parcel Boundaries, Pinellas County Property Appraiser





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STEVENSON CREEK WATERSHED MANAGEMENT PLAN

THE CITY OF CLEARWATER, FLORIDA



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 (813) 933-4850

FIGURE 3.1-18

PROJECT 3A GLEN OAKS STORMWATER DETENTION FACILITY



200 100 0 200 400

SCALE: 1"=200'

LEGEND

- PROPOSED WATER QUALITY INLET
- PROPOSED STORM MANHOLE
- PROPOSED STORM PIPE
- - - EXISTING PIPE TO BE REPLACED
- - - EXISTING PIPE TO REMAIN
- - - EXISTING PIPE TO BE ABANDONED
- ▭ (with arrows) PROPOSED LITTORAL SHELF
- - - DRAINAGE SUBBASIN

STEVENSON CREEK WATERSHED MANAGEMENT PLAN

FIGURE 3.1-21

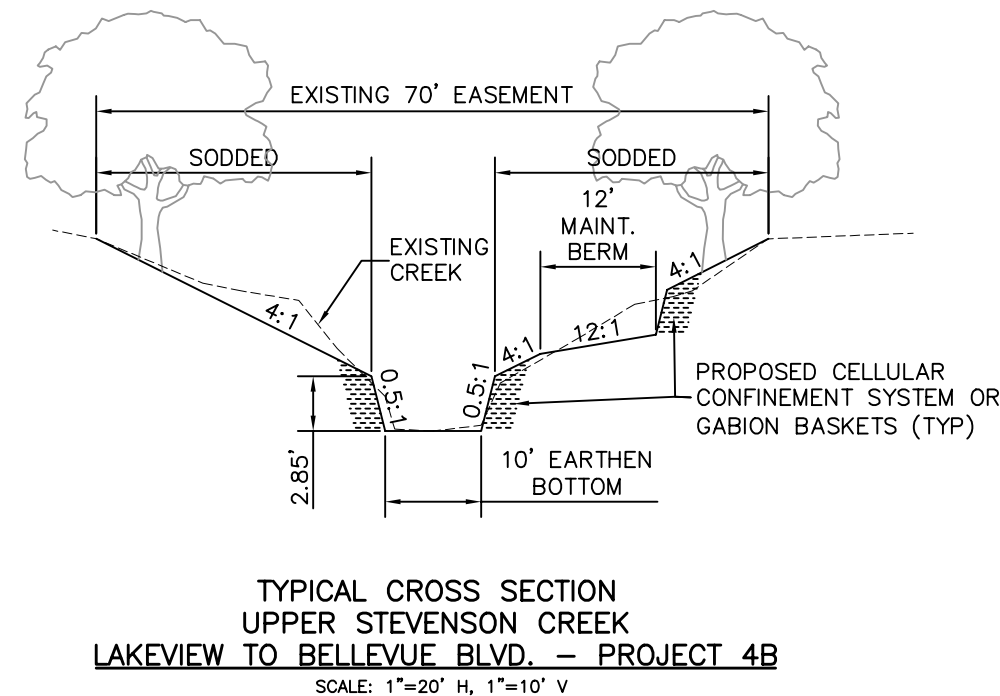
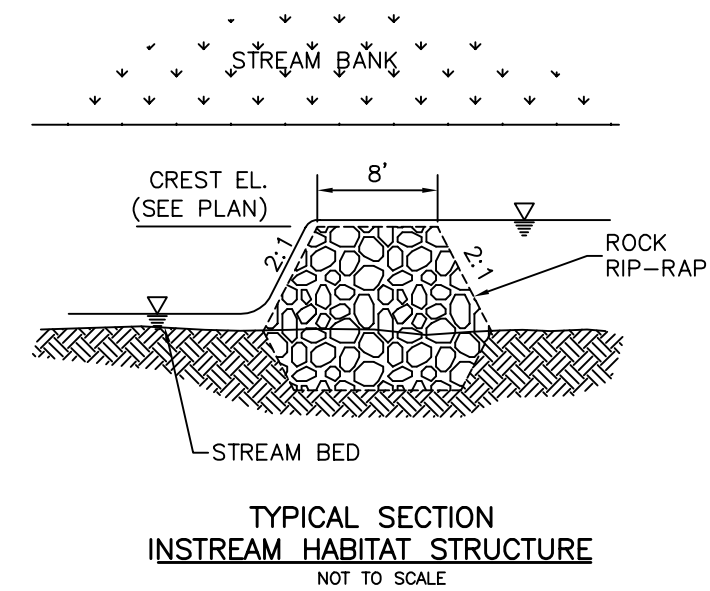
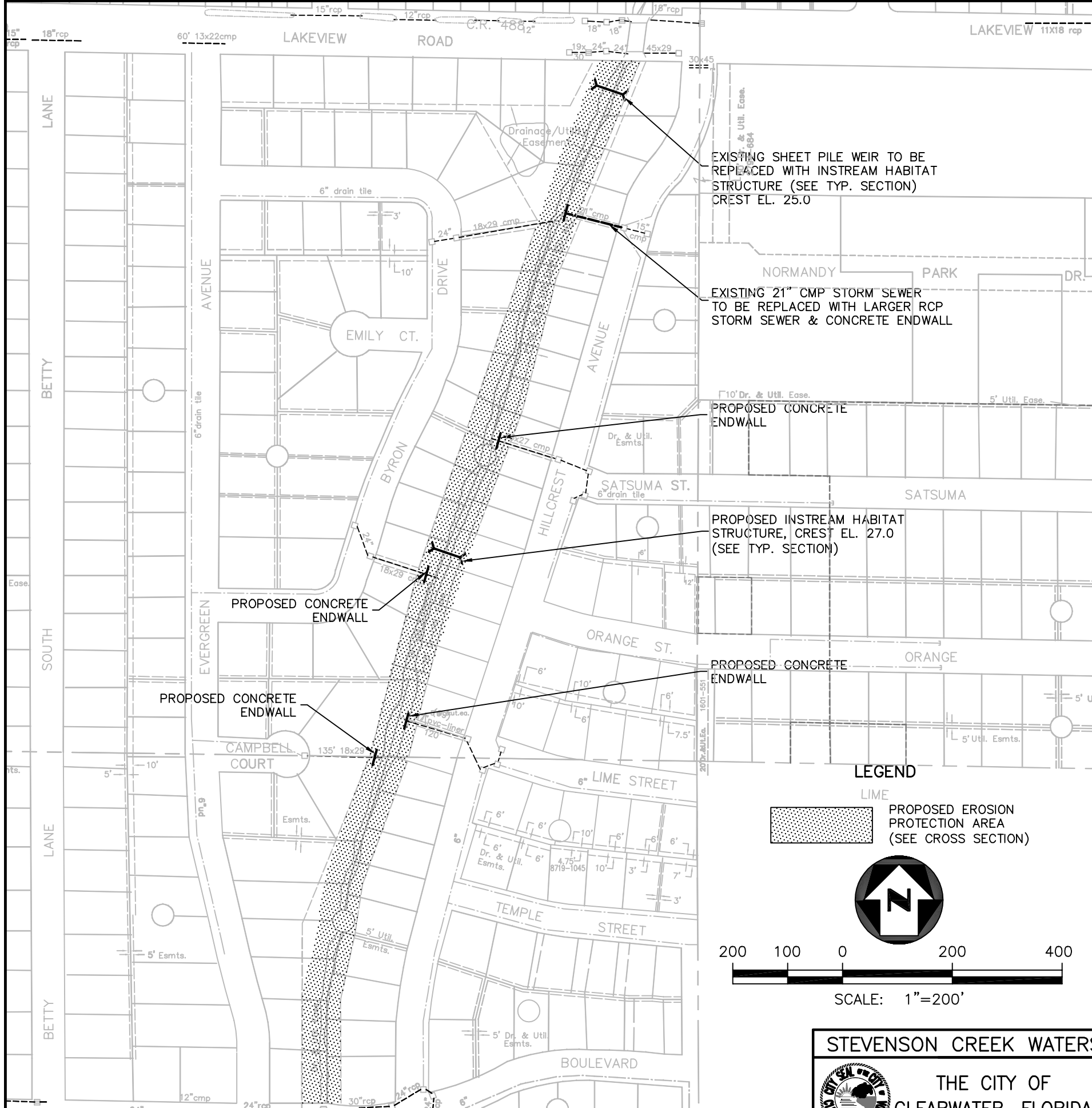


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**PROJECT 4A HILLCREST AVENUE
OVERFLOW BY-PASS CULVERT**



STEVENSON CREEK WATERSHED MANAGEMENT PLAN

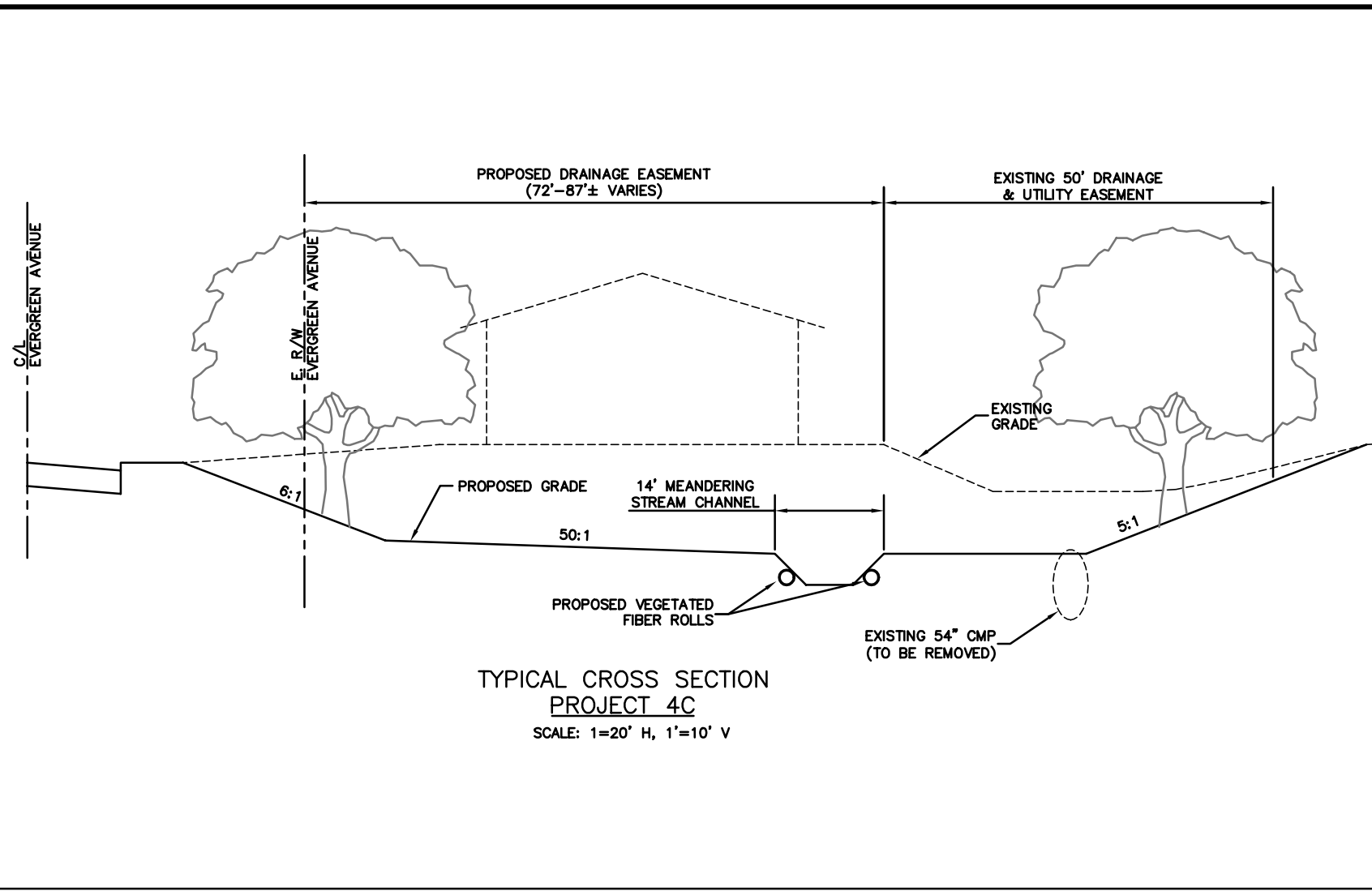
FIGURE 3.1-22

THE CITY OF
CLEARWATER, FLORIDA

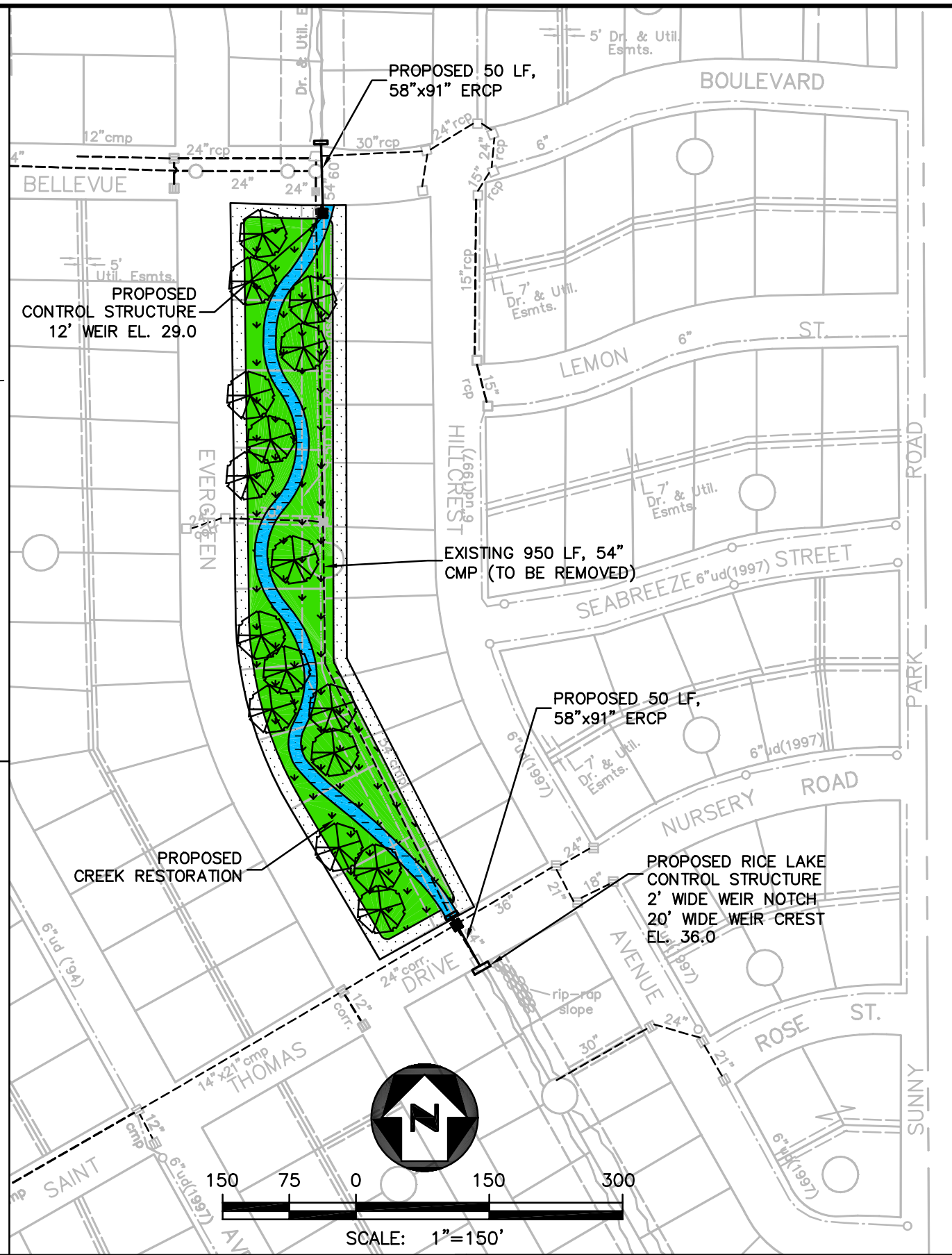
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PROJECT 4B UPPER STEVENSON
CREEK EROSION PROTECTION
MEASURES

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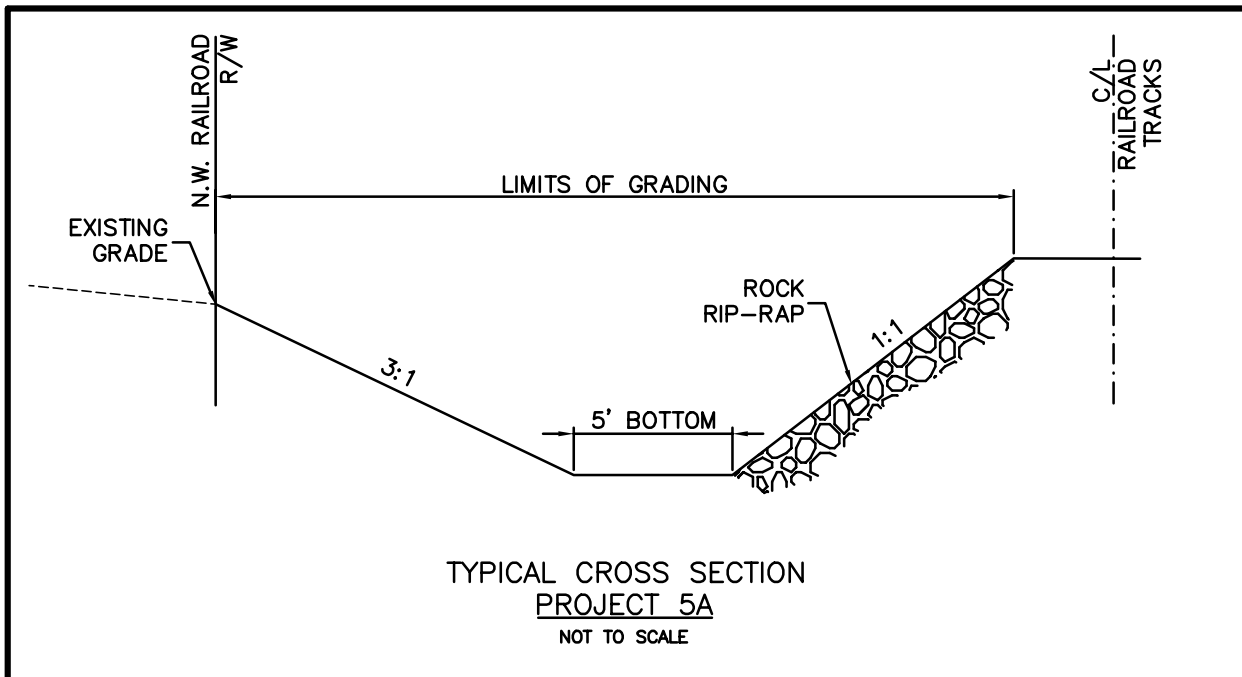


- LEGEND**
- PROPOSED WATER QUALITY INLET
 - PROPOSED STORM MANHOLE
 - PROPOSED STORM PIPE
 - - - EXISTING PIPE TO BE REPLACED
 - - - EXISTING PIPE TO REMAIN
 - - - EXISTING PIPE TO BE ABANDONED
 - - - DRAINAGE SUBBASIN
 - UNDERSTORY PLANTINGS
 - OPEN WATER CHANNEL
 - PROPOSED TREE



| | | |
|---|--|---|
| STEVENSON CREEK WATERSHED MANAGEMENT PLAN | | FIGURE 3.1-23 |
| THE CITY OF CLEARWATER, FLORIDA | PARSONS ENGINEERING SCIENCE, INC. Tampa, Florida (813) 933-4650 | PROJECT 4C ST. THOMAS DRIVE TO BELLEVUE BOULEVARD CREEK RESTORATION PROJECT |

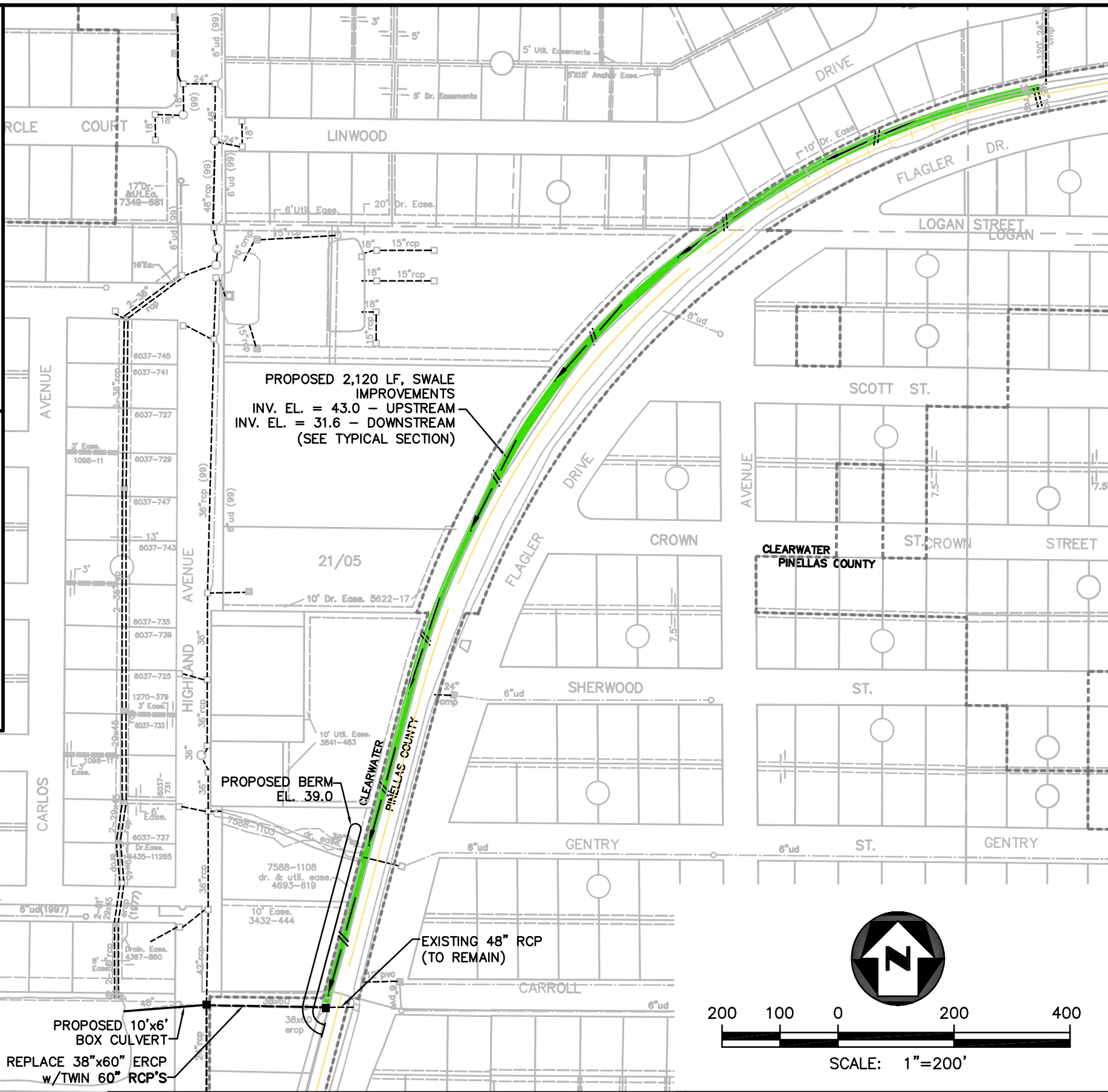
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TYPICAL CROSS SECTION
PROJECT 5A
NOT TO SCALE

LEGEND

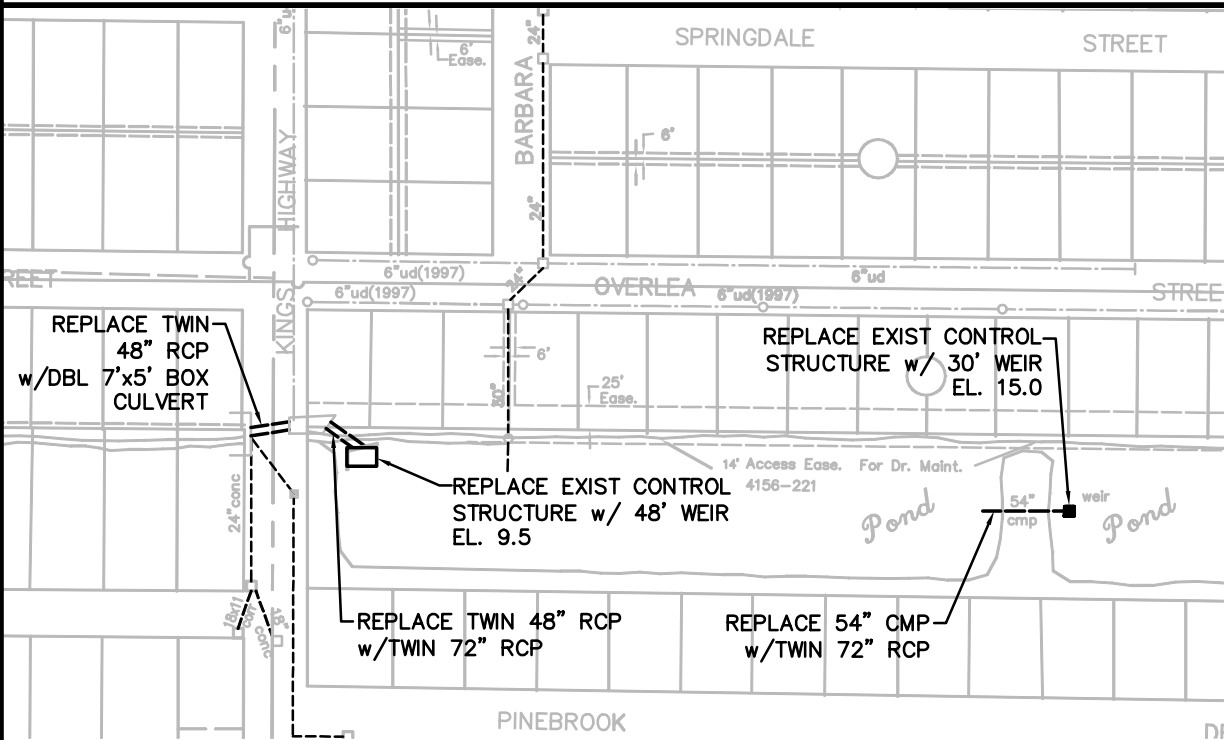
- PROPOSED WATER QUALITY INLET
- PROPOSED STORM MANHOLE
- PROPOSED STORM PIPE
- - - EXISTING PIPE TO BE REPLACED
- - - EXISTING PIPE TO REMAIN
- - - EXISTING PIPE TO BE ABANDONED
- ▭ (with arrows) PROPOSED LITTORAL SHELF
- - - DRAINAGE SUBBASIN



PROPOSED 2,120 LF, SWALE IMPROVEMENTS
INV. EL. = 43.0 - UPSTREAM
INV. EL. = 31.6 - DOWNSTREAM
(SEE TYPICAL SECTION)

PROPOSED BERM
EL. 39.0

EXISTING 48" RCP
(TO REMAIN)



STEVENSON CREEK WATERSHED MANAGEMENT PLAN

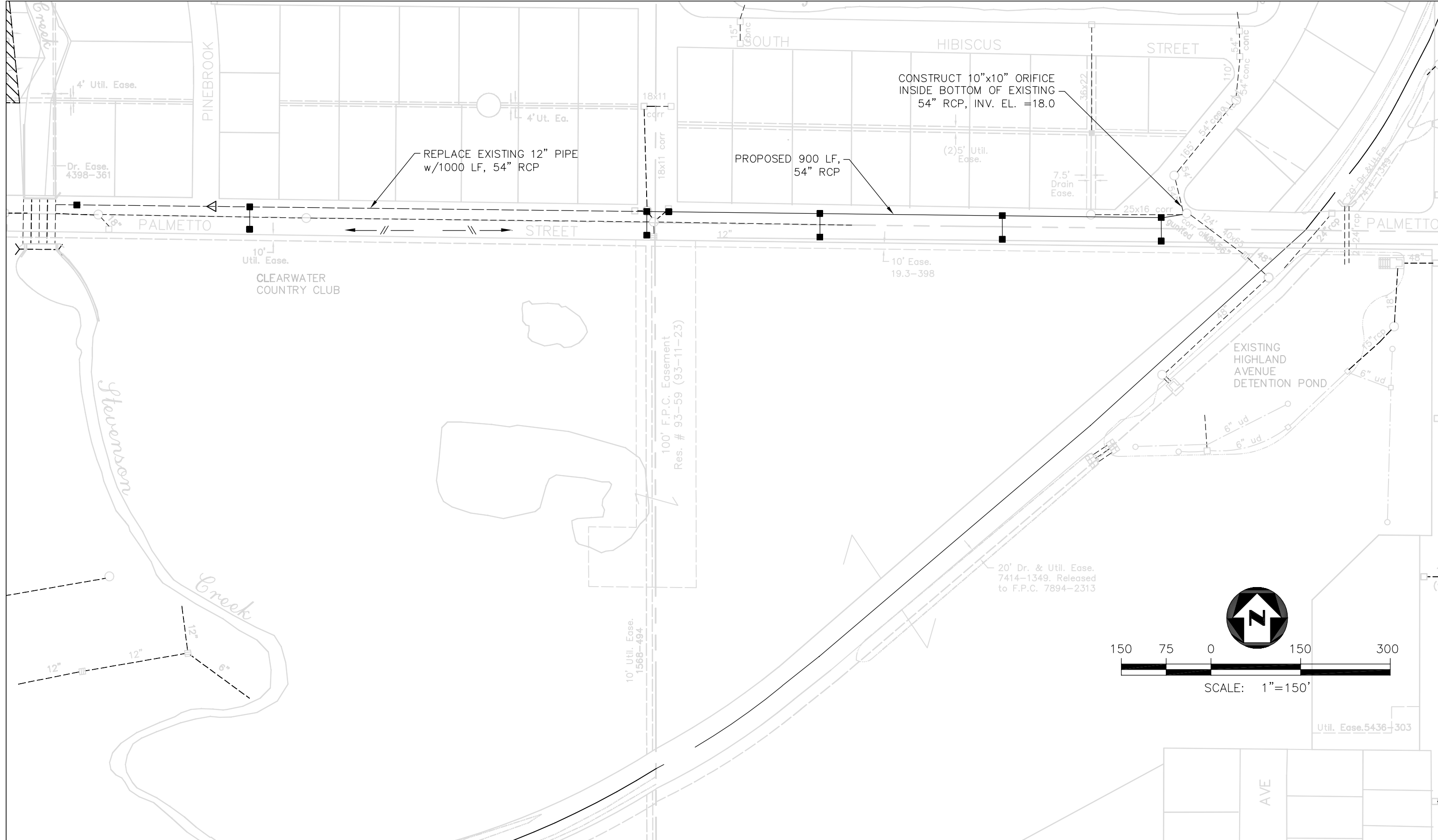
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(813) 933-4850

FIGURE 3.1-24


PROJECT 5A FLAGLER DRIVE / CSX RAILROAD
NORTH SWALE IMPROVEMENTS

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STEVENSON CREEK WATERSHED MANAGEMENT PLAN

FIGURE 3.1-25



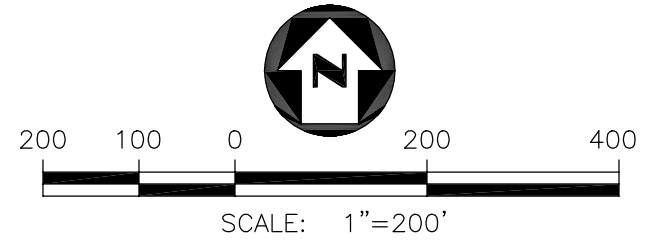
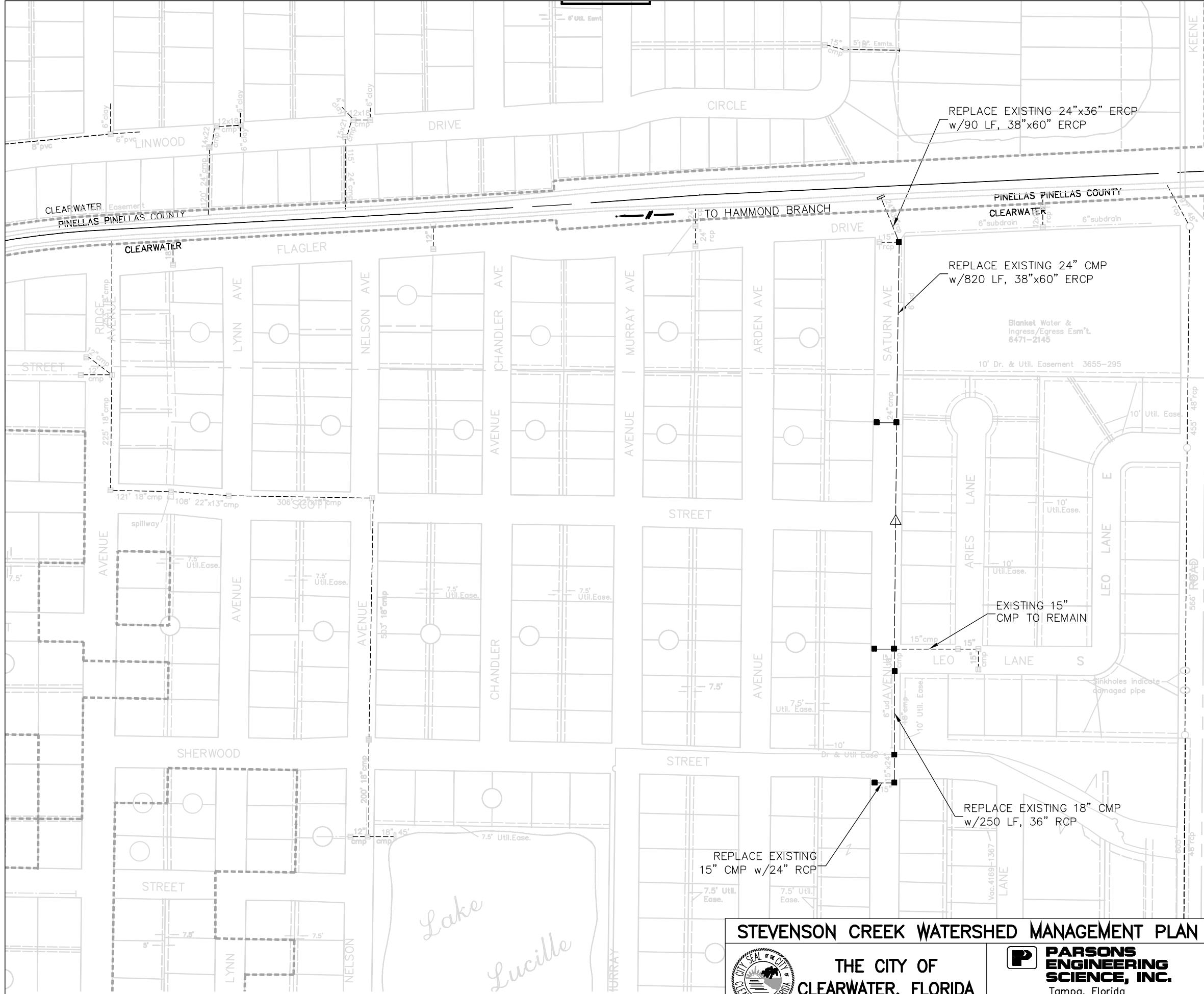
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PROJECT 5B PALMETTO STREET
DRAINAGE IMPROVEMENTS

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- LEGEND**
- PROPOSED WATER QUALITY INLET
 - PROPOSED STORM MANHOLE
 - PROPOSED STORM PIPE
 - - - EXISTING PIPE TO BE REPLACED
 - EXISTING PIPE TO REMAIN
 - EXISTING PIPE TO BE ABANDONED

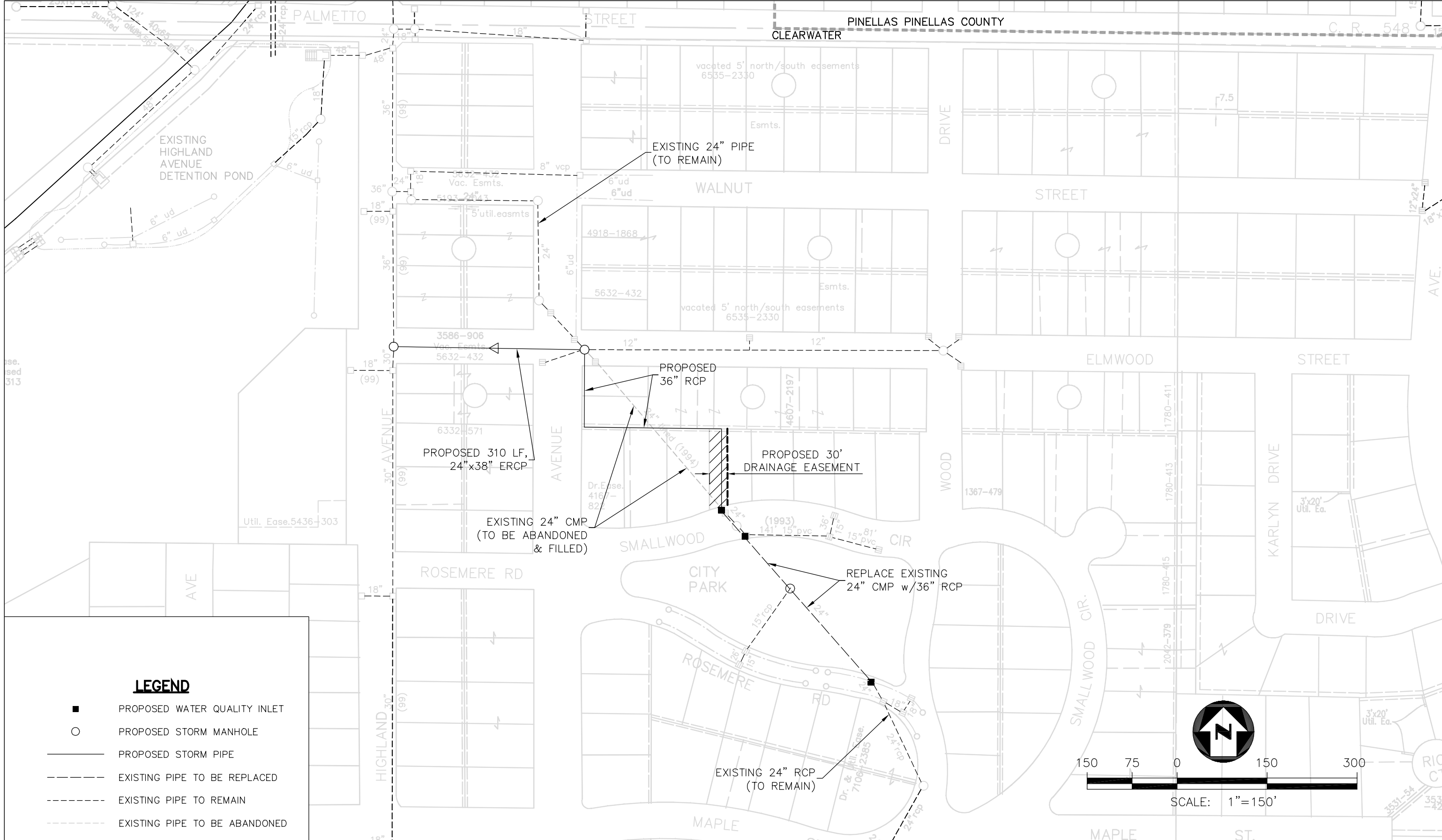
STEVENSON CREEK WATERSHED MANAGEMENT PLAN



FIGURE 3.1-26

PROJECT 5C SATURN AVENUE DRAINAGE IMPROVEMENTS

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LEGEND

- PROPOSED WATER QUALITY INLET
- PROPOSED STORM MANHOLE
- PROPOSED STORM PIPE
- - - EXISTING PIPE TO BE REPLACED
- - - EXISTING PIPE TO REMAIN
- - - EXISTING PIPE TO BE ABANDONED
- ▭ (with arrows) PROPOSED LITTORAL SHELF
- - - DRAINAGE SUBBASIN

STEVENSON CREEK WATERSHED MANAGEMENT PLAN

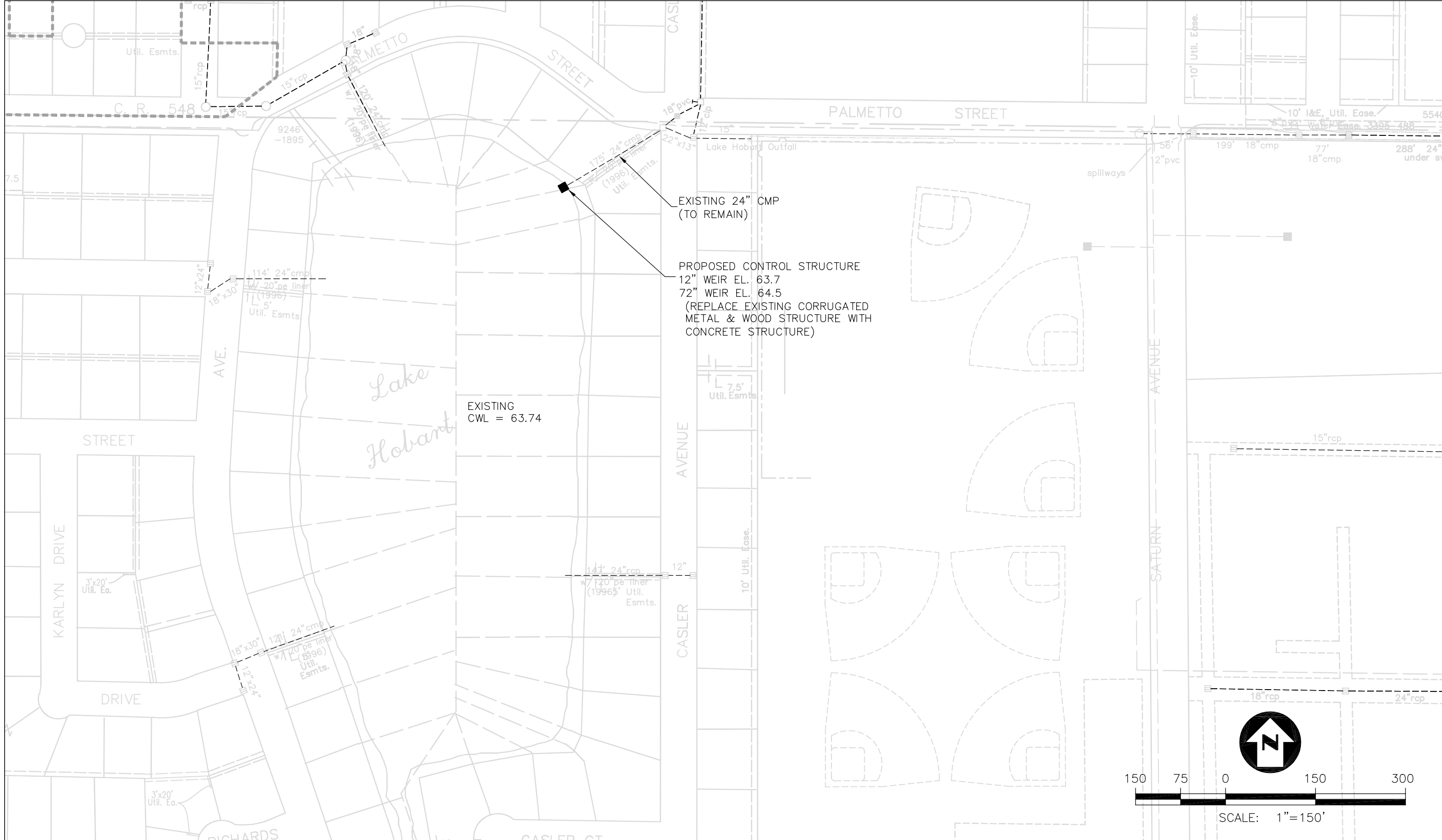
FIGURE 3.1-27


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PROJECT 5D SMALLWOOD CIRCLE DRAINAGE IMPROVEMENTS

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STEVENSON CREEK WATERSHED MANAGEMENT PLAN

FIGURE 3.1-28

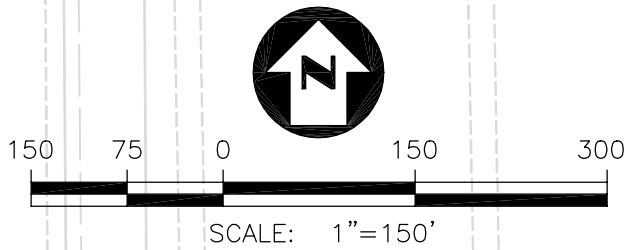


THE CITY OF
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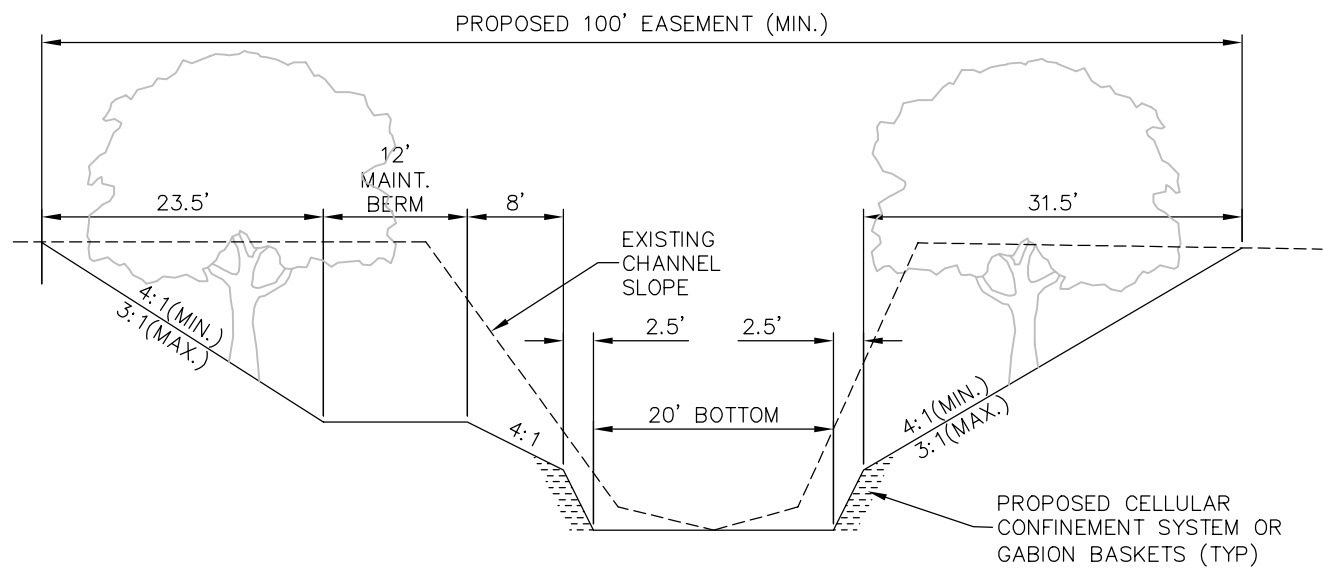


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PROJECT 5E LAKE HOBART
CONTROL STRUCTURE

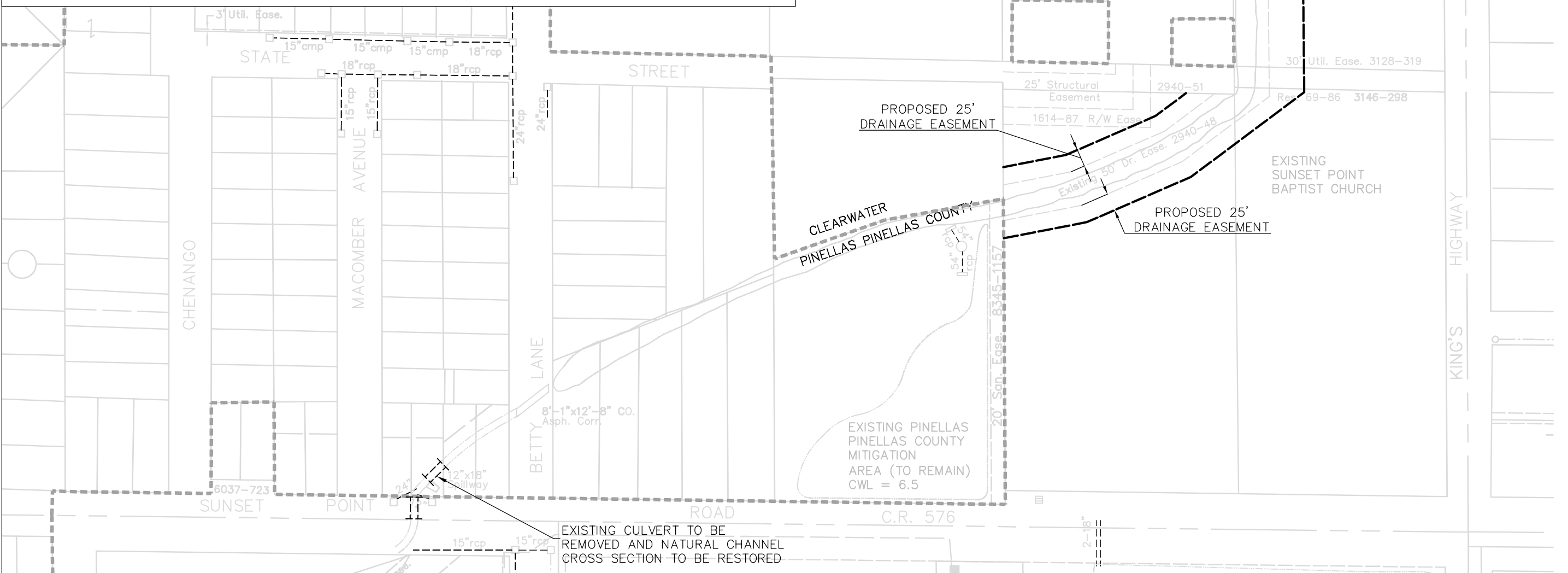
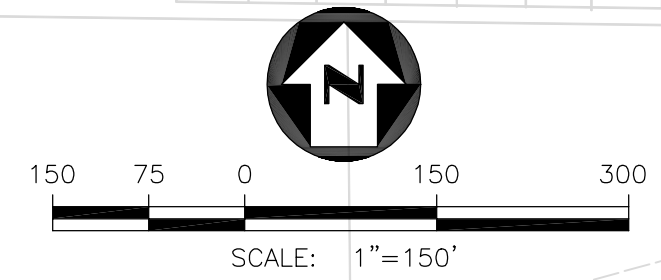


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**TYPICAL CHANNEL CROSS SECTION
SPRING BRANCH - PROJECT 1A**

SCALE: 1/16" = 1' H, 1/8" = 1'-0" V





SCALE: 1"=250'

LEGEND

- PROPOSED WATER QUALITY INLET
- PROPOSED STORM MANHOLE
- PROPOSED STORM PIPE
- - - EXISTING PIPE TO BE REPLACED
- - - EXISTING PIPE TO REMAIN
- - - EXISTING PIPE TO BE ABANDONED
- ▭ (with arrows) PROPOSED LITTORAL SHELF
- ▭ (orange) POND CYPRESS, BUTTON BUSH SAWGRASS
- ▭ (green) PICKEREL WEED, ARROWHEAD ALLIGATOR FLAG, BULRUSH
- ▭ (blue) OPEN WATER

STEVENSON CREEK WATERSHED MANAGEMENT PLAN

FIGURE 3.1-30

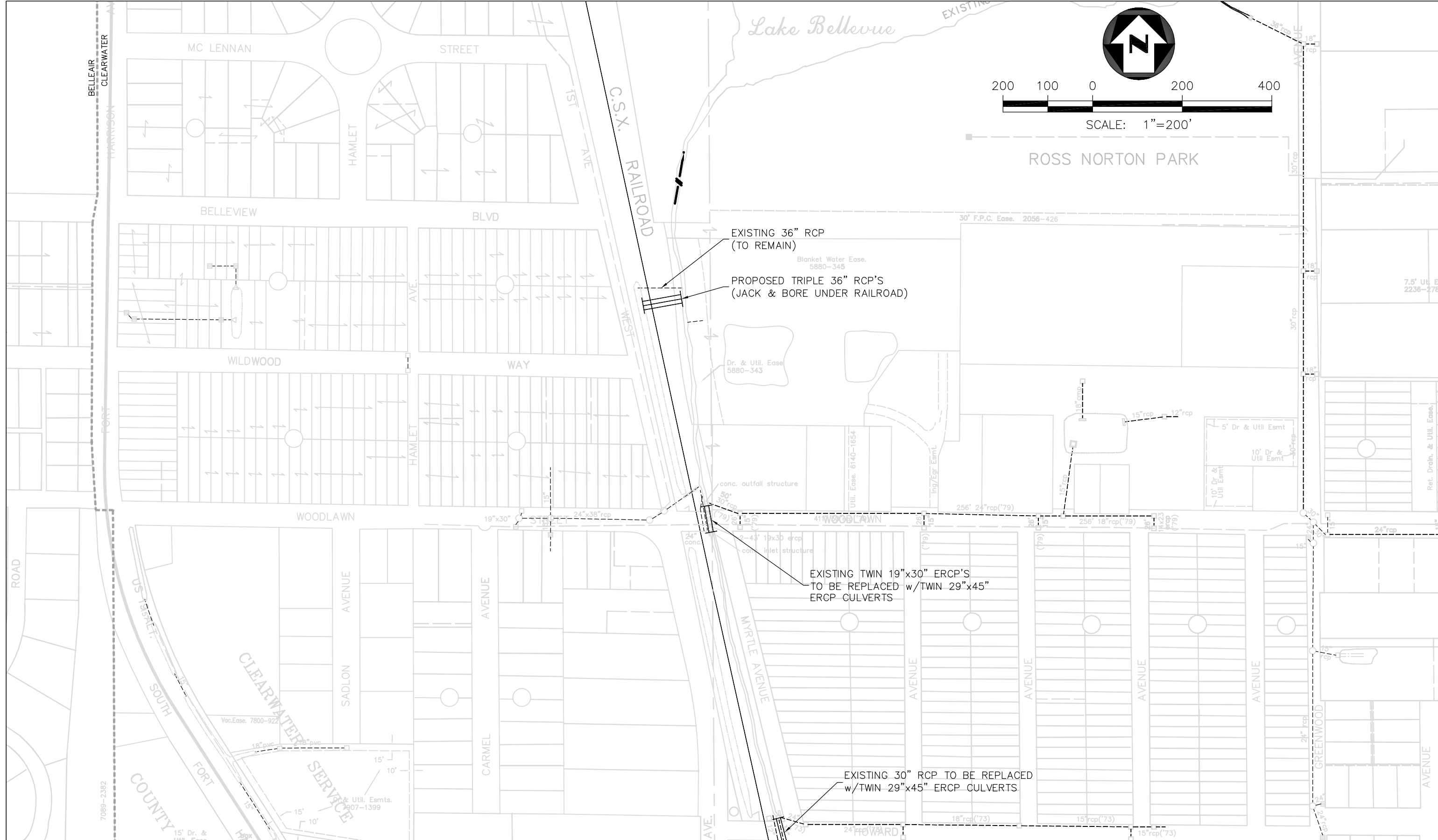


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PROJECT 6A.1 LAKE BELLEVUE
EXPANSION



200 100 0 200 400

SCALE: 1"=200'

ROSS NORTON PARK

STEVENSON CREEK WATERSHED MANAGEMENT PLAN

FIGURE 3.1-31



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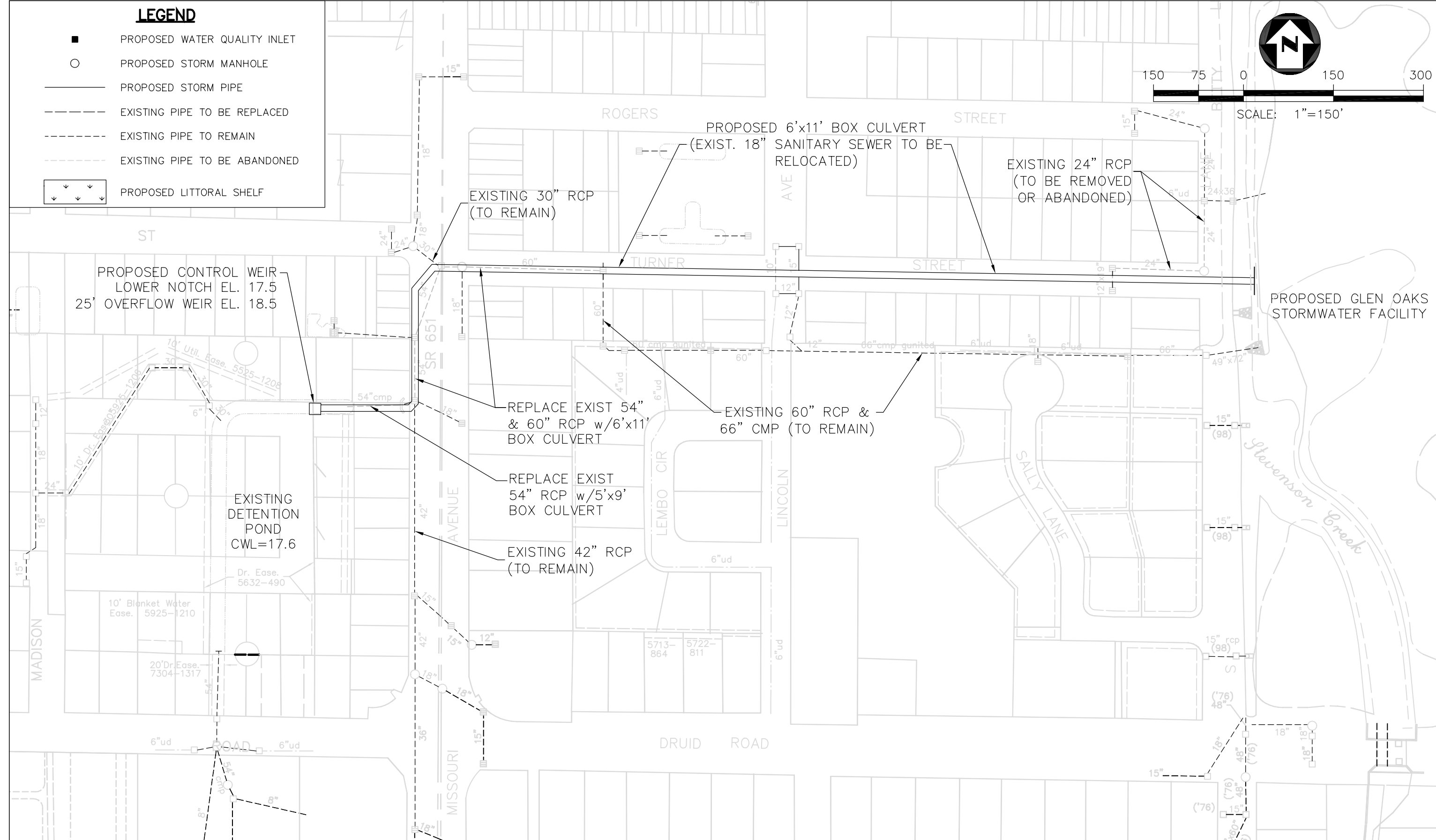
PROJECT 6A.2 UPPER LAKE
BELLEVUE CULVERTS

LEGEND

- PROPOSED WATER QUALITY INLET
- PROPOSED STORM MANHOLE
- PROPOSED STORM PIPE
- - - EXISTING PIPE TO BE REPLACED
- - - EXISTING PIPE TO REMAIN
- - - EXISTING PIPE TO BE ABANDONED
- ▭ (with arrows) PROPOSED LITTORAL SHELF



SCALE: 1"=150'



STEVENSON CREEK WATERSHED MANAGEMENT PLAN

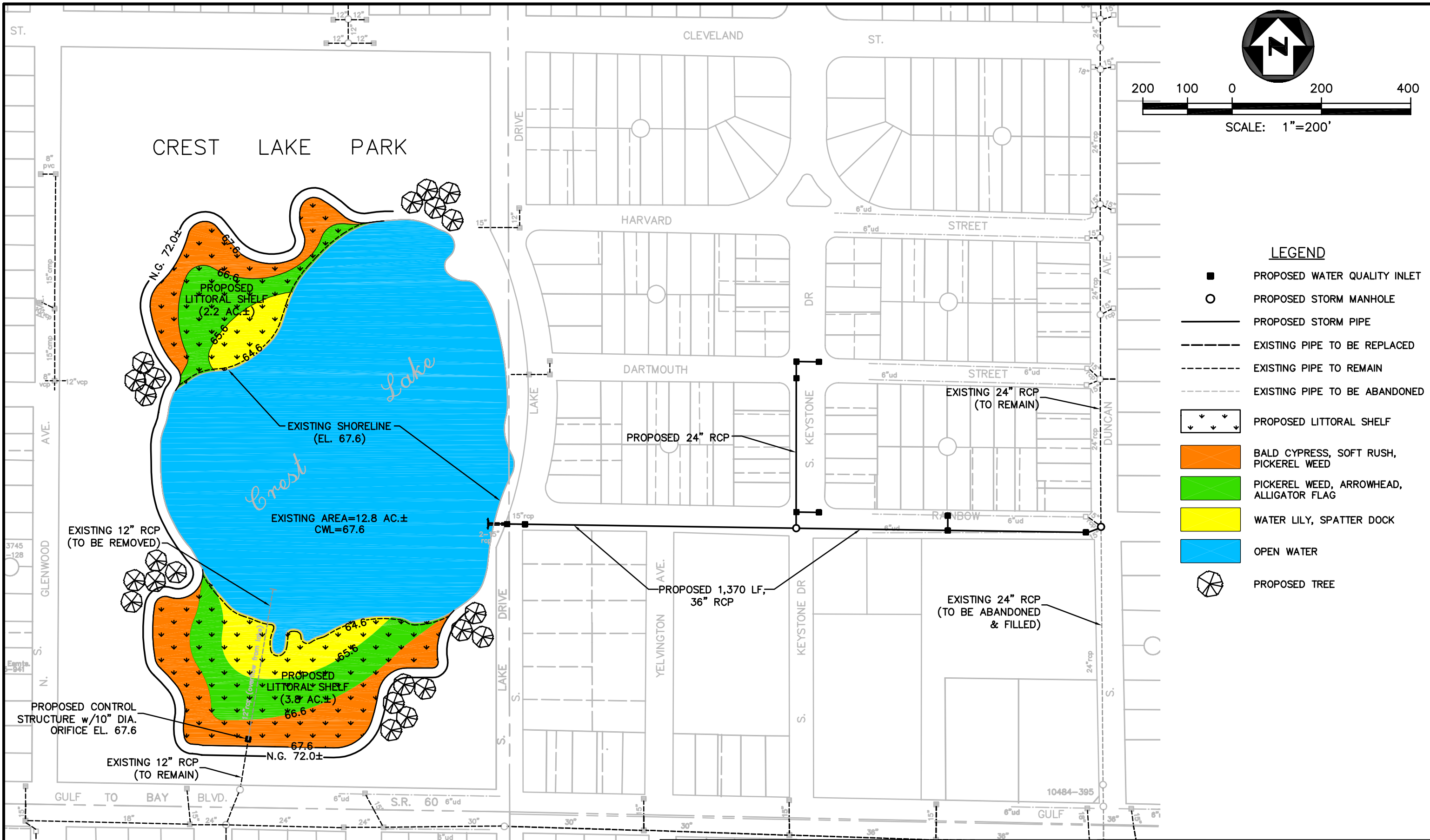
FIGURE 3.1-32


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PROJECT 6B TURNER STREET BOX CULVERT

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LEGEND

- PROPOSED WATER QUALITY INLET
- PROPOSED STORM MANHOLE
- PROPOSED STORM PIPE
- - - EXISTING PIPE TO BE REPLACED
- - - EXISTING PIPE TO REMAIN
- - - EXISTING PIPE TO BE ABANDONED
- ▾ ▾ ▾ PROPOSED LITTORAL SHELF
- Orange Box BALD CYPRESS, SOFT RUSH, PICKEREL WEED
- Green Box PICKEREL WEED, ARROWHEAD, ALLIGATOR FLAG
- Yellow Box WATER LILY, SPATTER DOCK
- Blue Box OPEN WATER
- Tree Symbol PROPOSED TREE

STEVENS ON CREEK WATERSHED MANAGEMENT PLAN

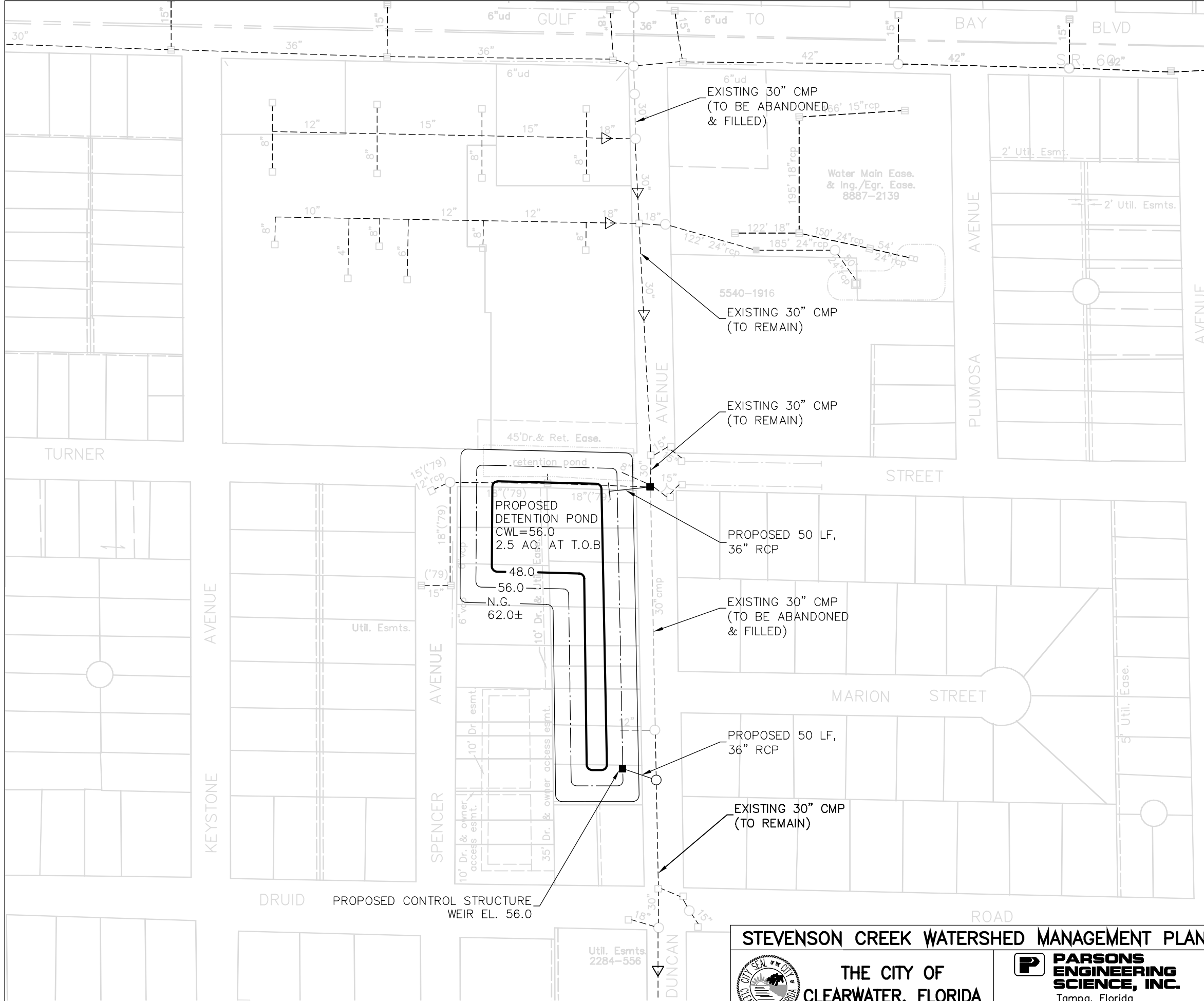
FIGURE 3.1-33

THE CITY OF
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PROJECT 7A CREST LAKE
EXPANSION

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SCALE: 1"=150'

LEGEND

- PROPOSED WATER QUALITY INLET
- PROPOSED STORM MANHOLE
- PROPOSED STORM PIPE
- - - EXISTING PIPE TO BE REPLACED
- - - EXISTING PIPE TO REMAIN
- - - EXISTING PIPE TO BE ABANDONED
- ▭ (with arrows) PROPOSED LITTORAL SHELF
- - - DRAINAGE SUBBASIN

No XREFs
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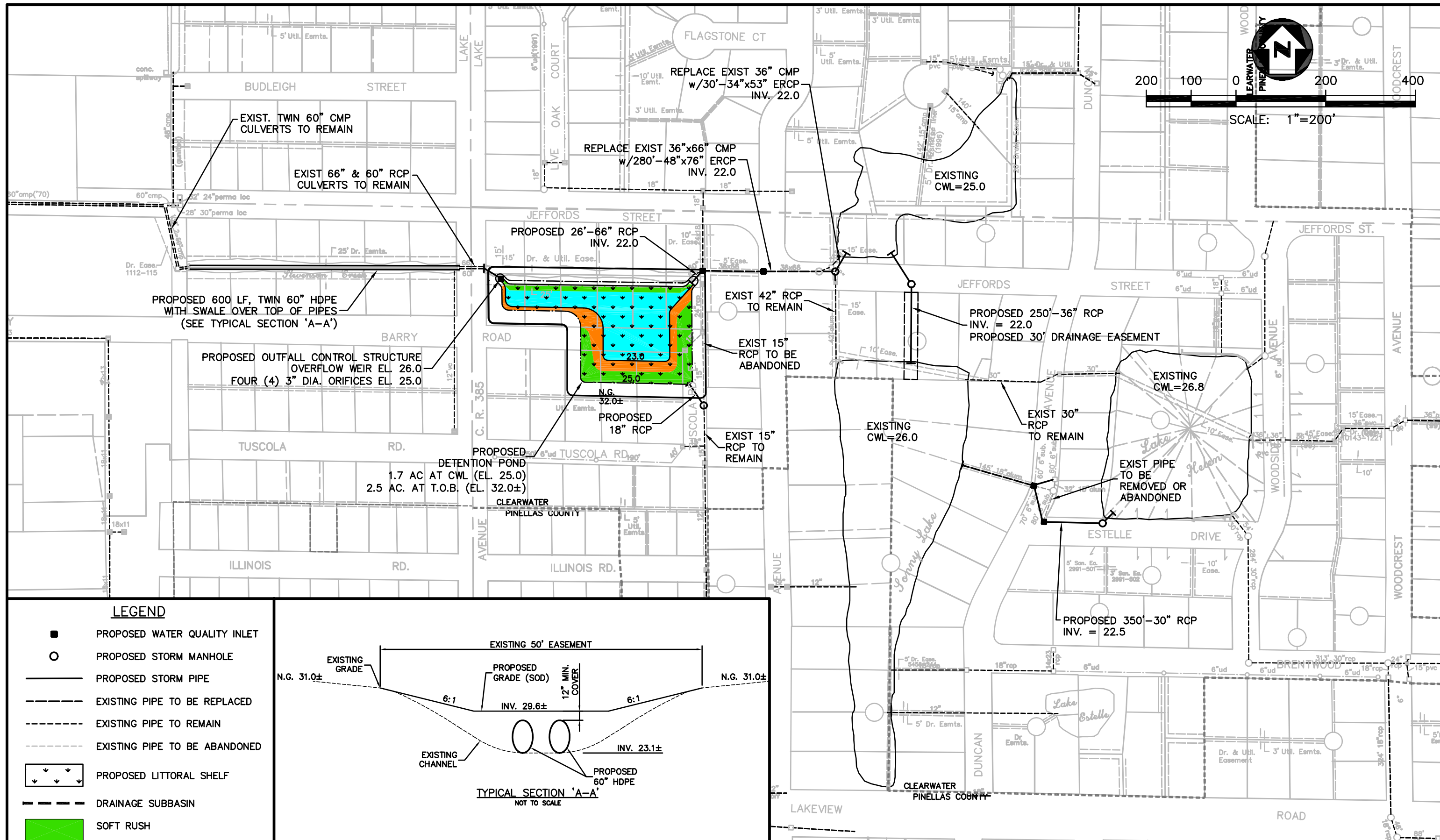
STEVENSON CREEK WATERSHED MANAGEMENT PLAN

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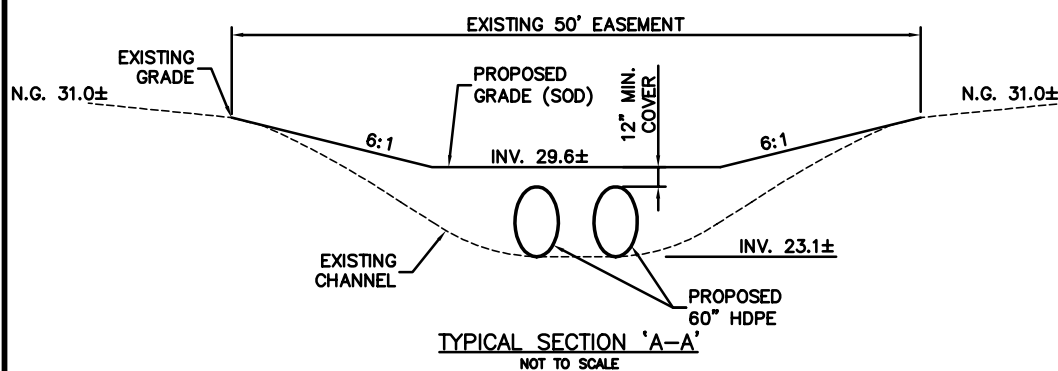
FIGURE 3.1-34

PROJECT 7B
DUNCAN AVENUE/TURNER STREET
DETENTION POND



LEGEND

- PROPOSED WATER QUALITY INLET
- PROPOSED STORM MANHOLE
- PROPOSED STORM PIPE
- - - EXISTING PIPE TO BE REPLACED
- - - EXISTING PIPE TO REMAIN
- - - EXISTING PIPE TO BE ABANDONED
- ▭ (with arrows) PROPOSED LITTORAL SHELF
- - - DRAINAGE SUBBASIN
- (Green) SOFT RUSH
- (Orange) BULRUSH
- (Blue) PICKEREL WEED



STEVENSON CREEK WATERSHED MANAGEMENT PLAN

FIGURE 3.1-35

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PROJECT 7C JEFFORDS STREET/BARRY ROAD POND

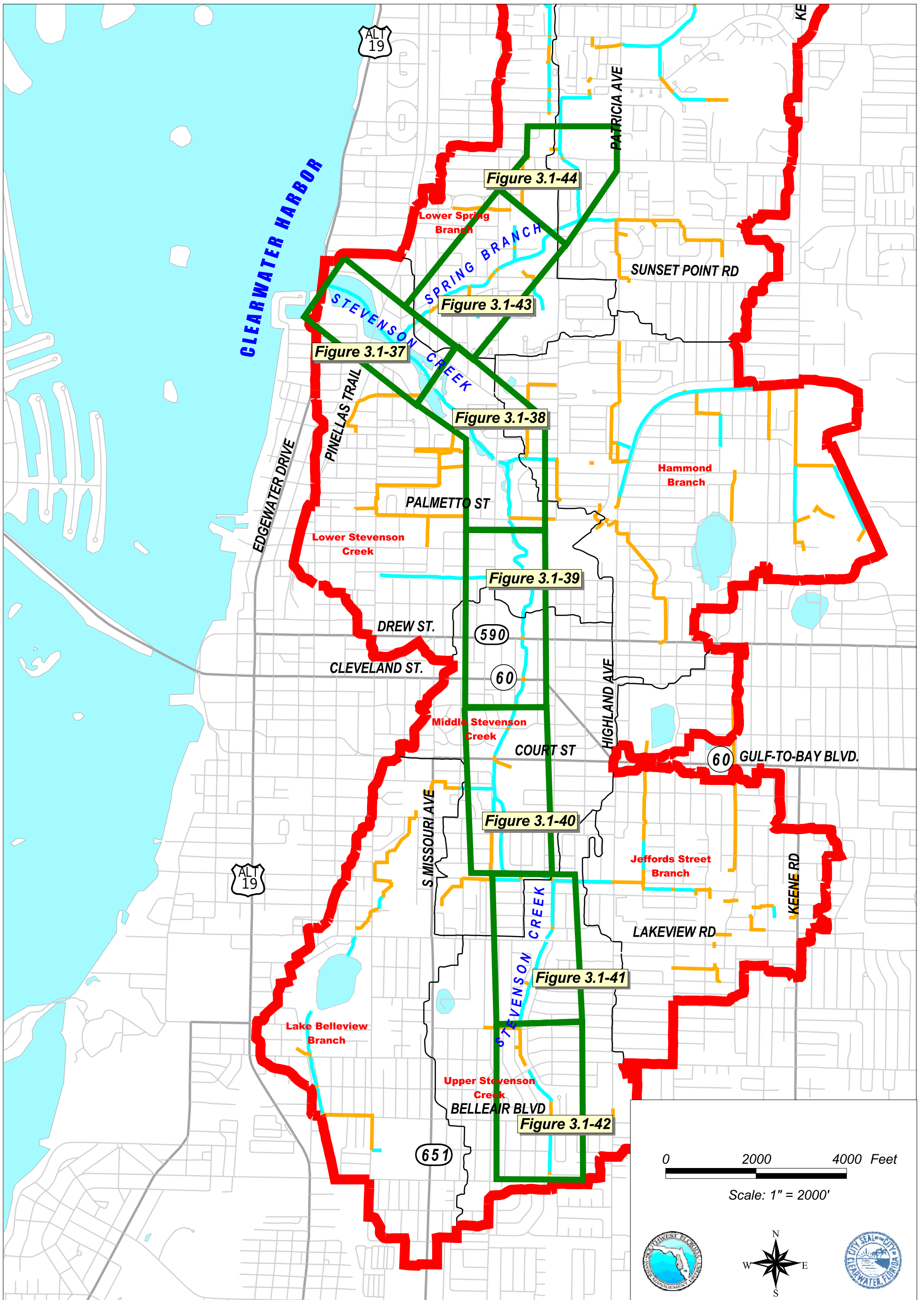
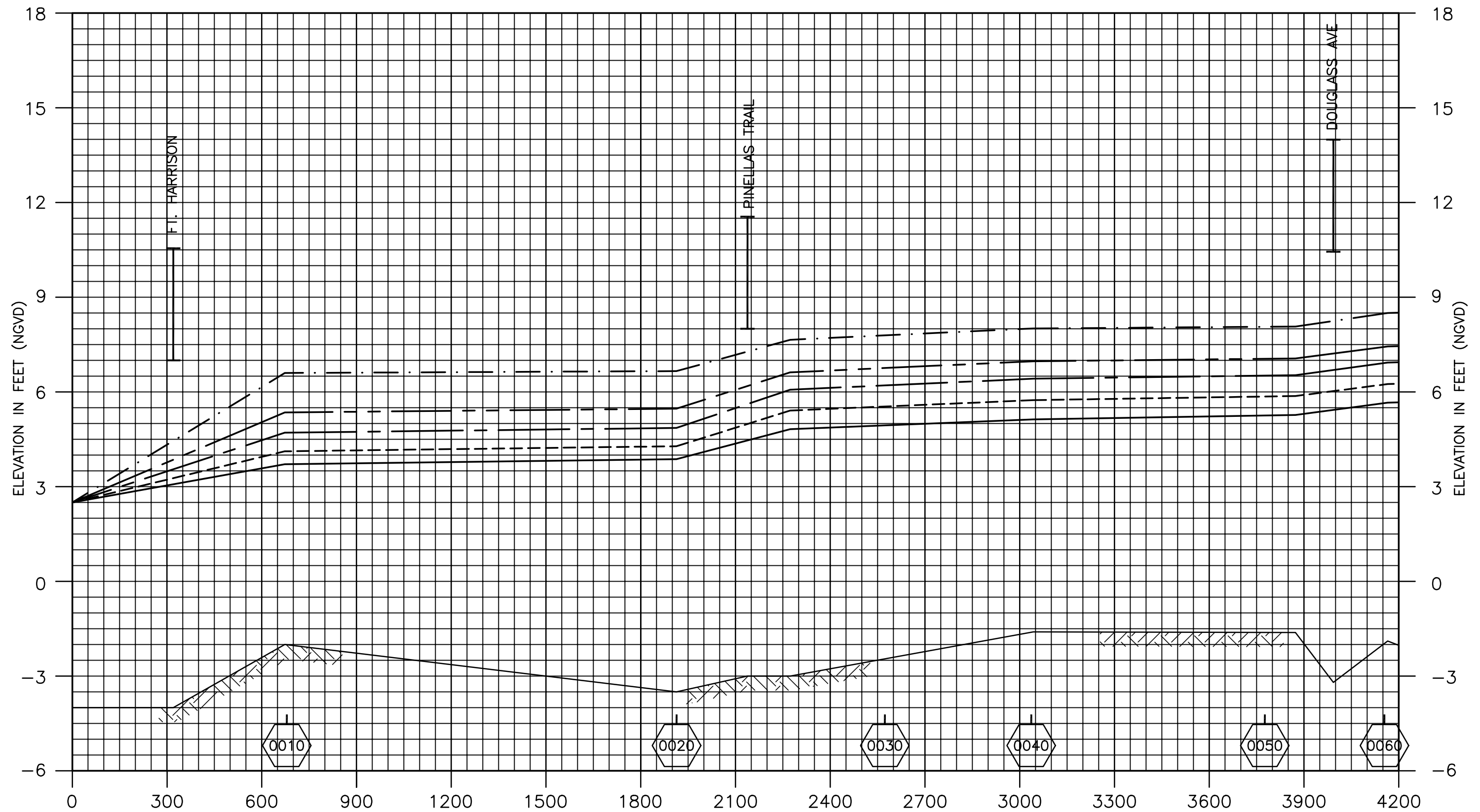


Figure 3.1-36

**Stevenson Creek Watershed
Project Conditions
Flood Profiles Key Map**

□ Figure Extent
□ Water

— Modeled Closed Conduit
— Modeled Open Channel
— Major Subbasin Delineation
— Watershed Boundary

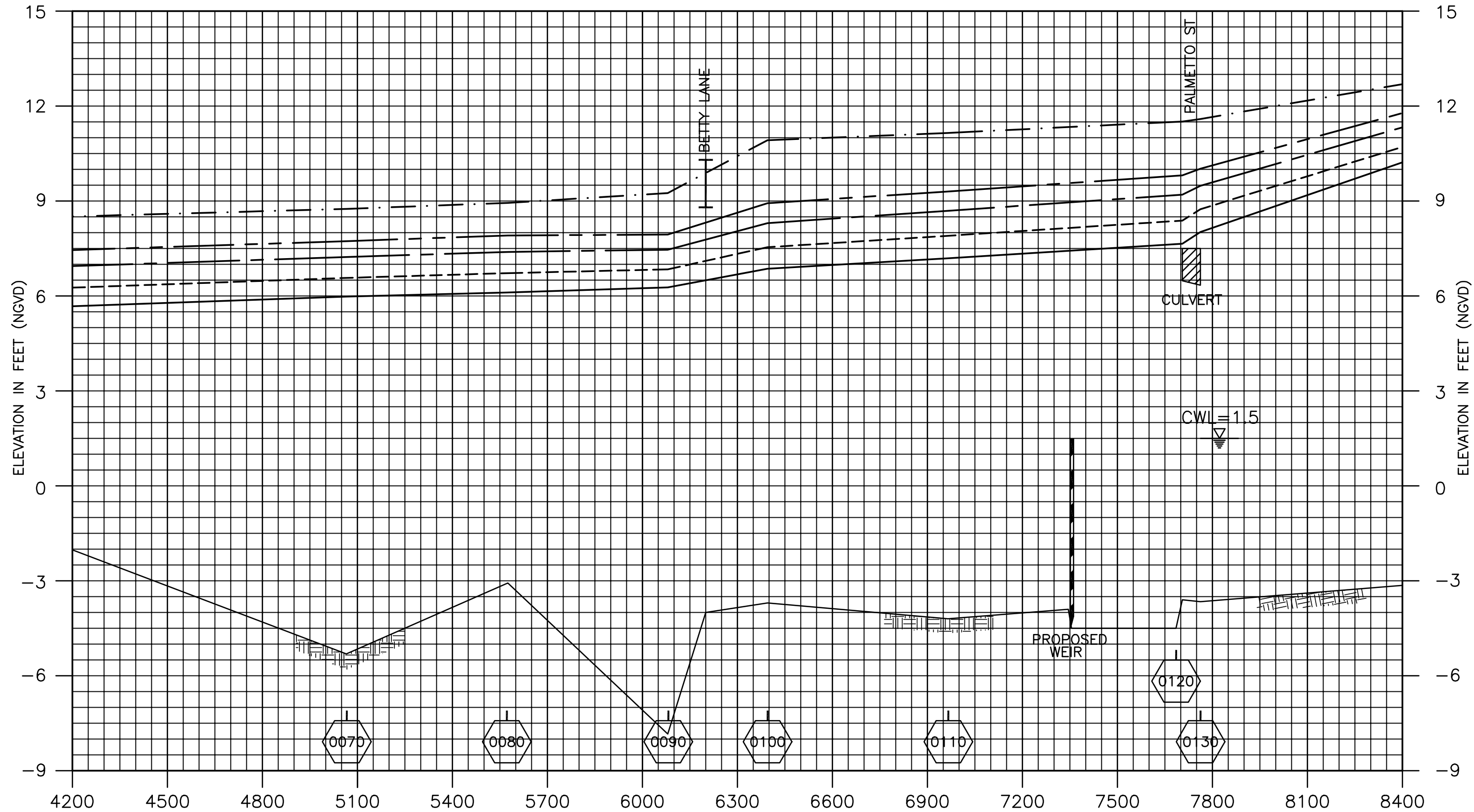


LEGEND:

- . - . - . - . - . 500 YEAR FLOOD
- — — — — 100 YEAR FLOOD
- 50 YEAR FLOOD
- - - - - 25 YEAR FLOOD
- 10 YEAR FLOOD

- STREAM BED
- NODE LOCATION
- HIGH WATER MARK (JULY, 2000 FLOOD)

FIGURE 3.1-37
FLOOD PROFILE
PROJECT CONDITIONS
STEVENSON CREEK
CITY OF CLEARWATER, FL
PARSONS ENGINEERING SCIENCE, INC.



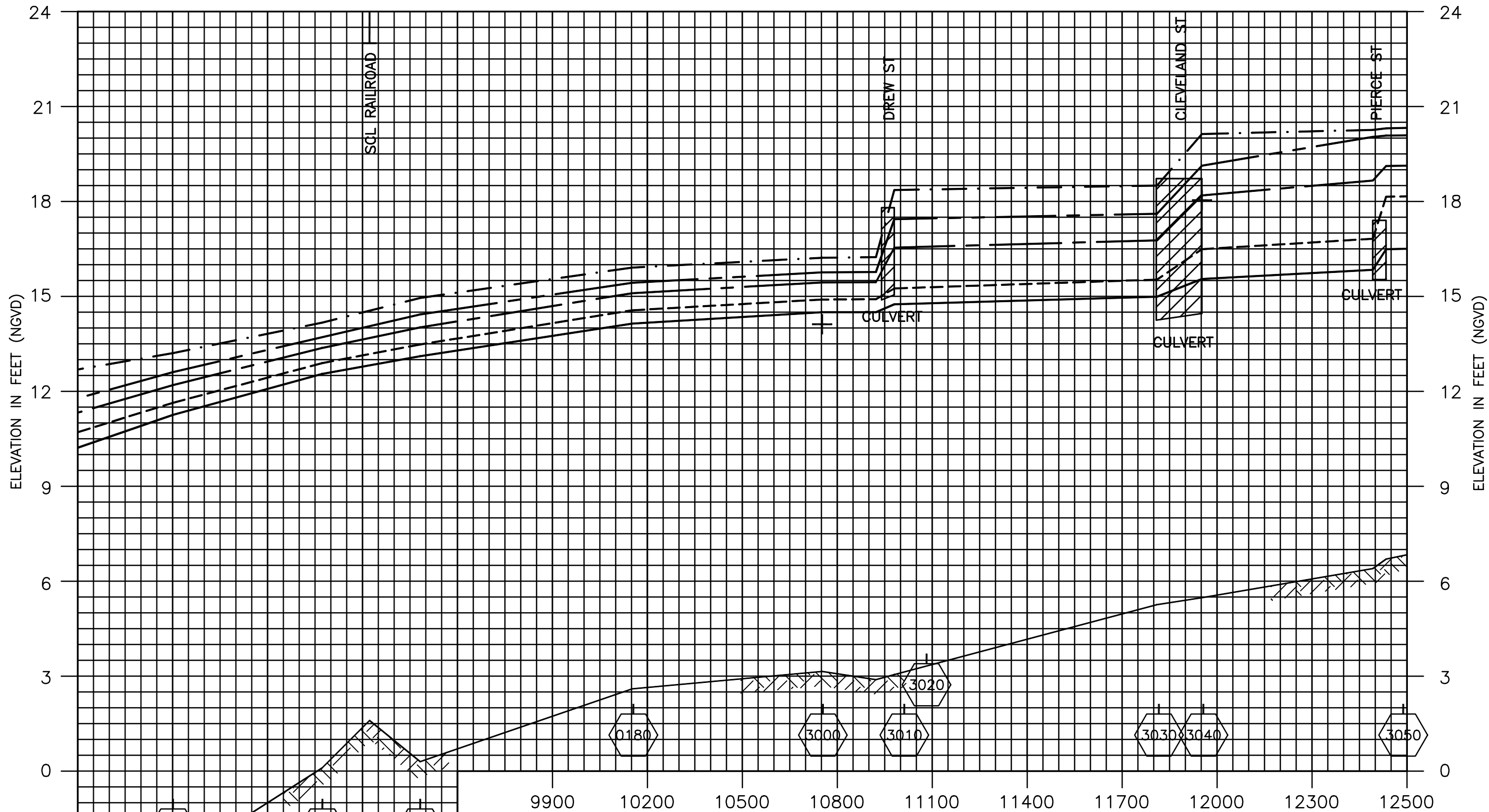
LEGEND:

- . - . - . - . - . - . 500 YEAR FLOOD
- — — — — 100 YEAR FLOOD
- 50 YEAR FLOOD
- - - - - 25 YEAR FLOOD
- 10 YEAR FLOOD

- STREAM BED
- NODE LOCATION
- HIGH WATER MARK (JULY, 2000 FLOOD)

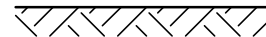
STREAM DISTANCE IN FEET

FIGURE 3.1-38
FLOOD PROFILE
PROJECT CONDITIONS
STEVENSON CREEK
CITY OF CLEARWATER, FL
PARSONS ENGINEERING SCIENCE, INC.

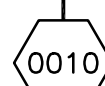


LEGEND:

- · — · — · — · — 500 YEAR FLOOD
- - - - - 100 YEAR FLOOD
- · — — — — 50 YEAR FLOOD
- - - - - 25 YEAR FLOOD
- - - - - 10 YEAR FLOOD



STREAM BED

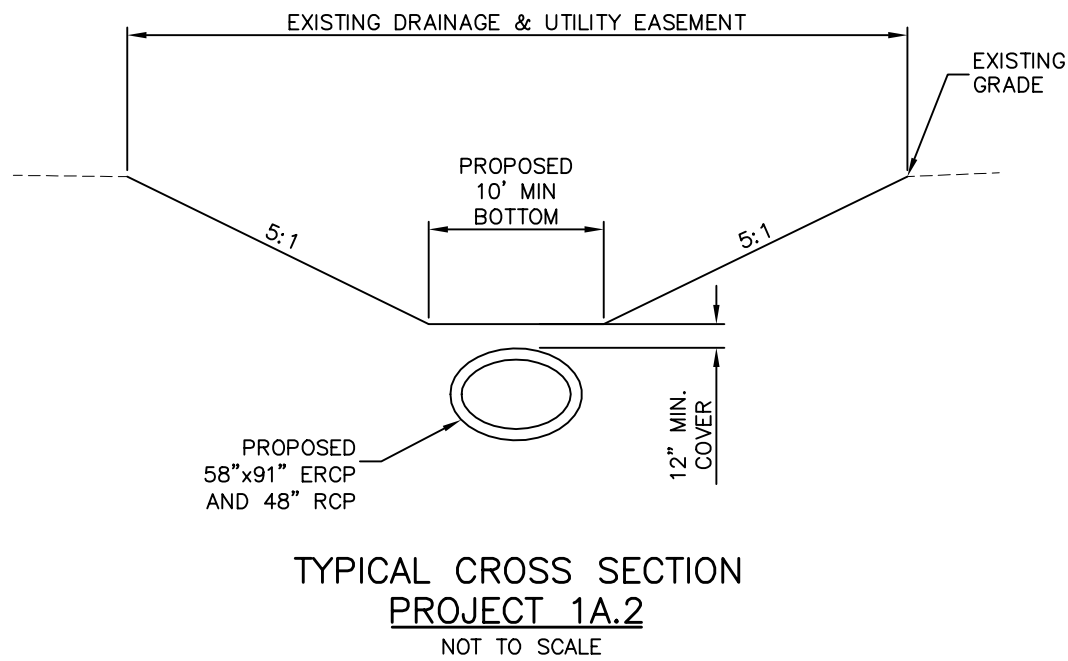


NODE LOCATION

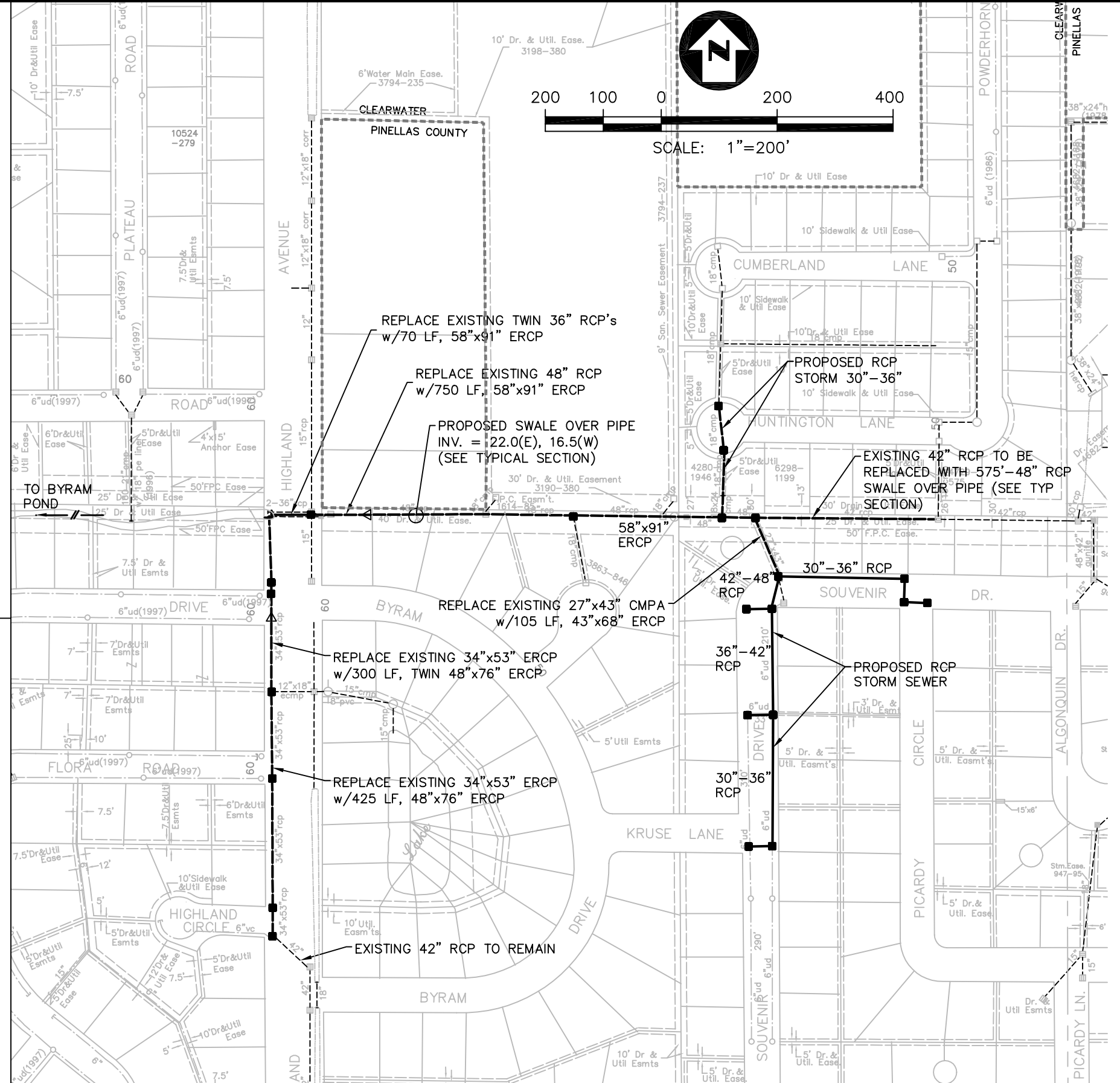


HIGH WATER MARK
(JULY, 2000 FLOOD)

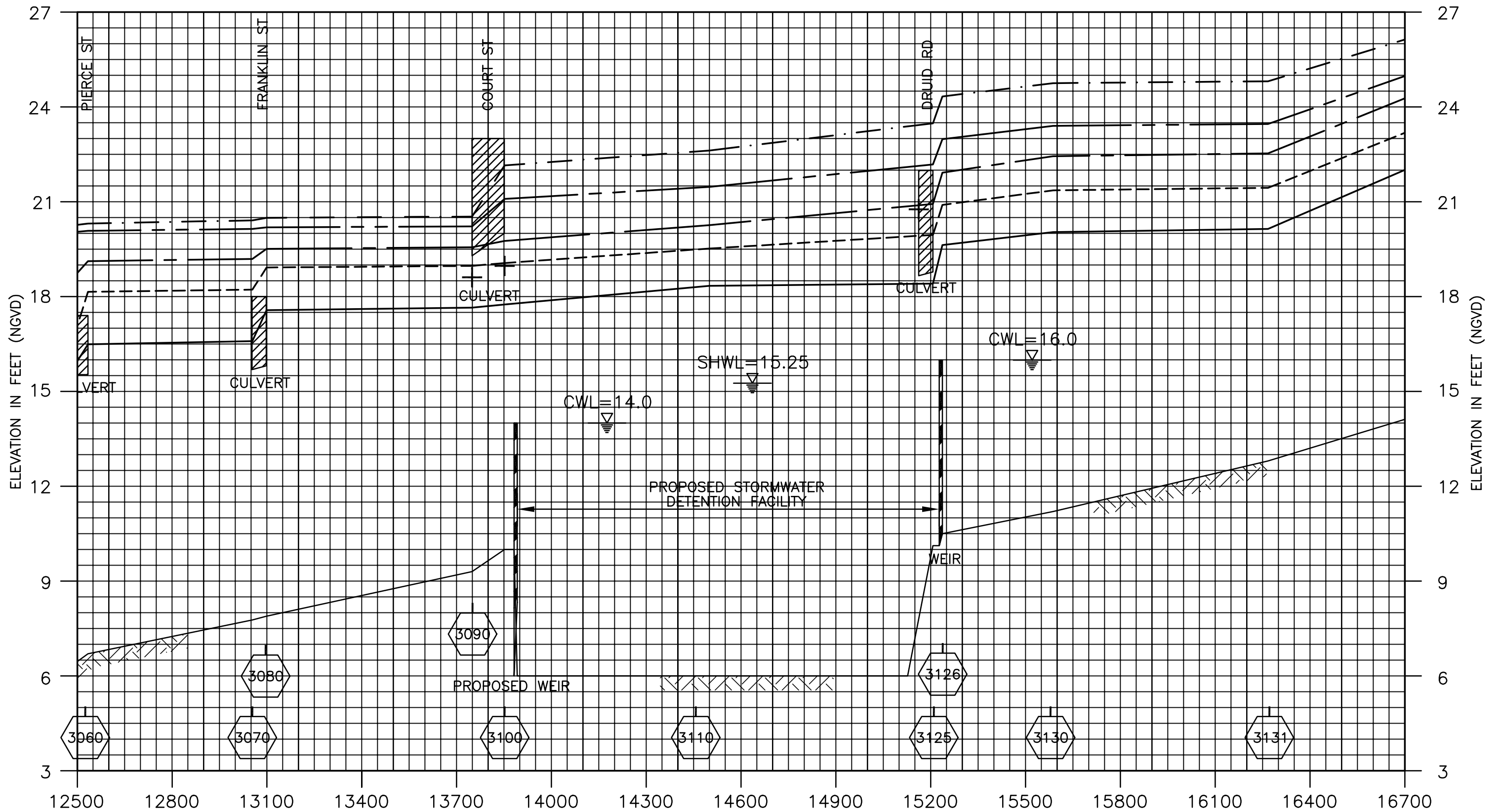
FIGURE 3.1-39
FLOOD PROFILE
PROJECT CONDITIONS
STEVENSON CREEK
CITY OF CLEARWATER, FL
PARSONS ENGINEERING SCIENCE, INC.



- LEGEND**
- PROPOSED WATER QUALITY INLET
 - PROPOSED STORM MANHOLE
 - PROPOSED STORM PIPE
 - - - EXISTING PIPE TO BE REPLACED
 - - - EXISTING PIPE TO REMAIN
 - - - EXISTING PIPE TO BE ABANDONED
 - ▾ PROPOSED LITTORAL SHELF



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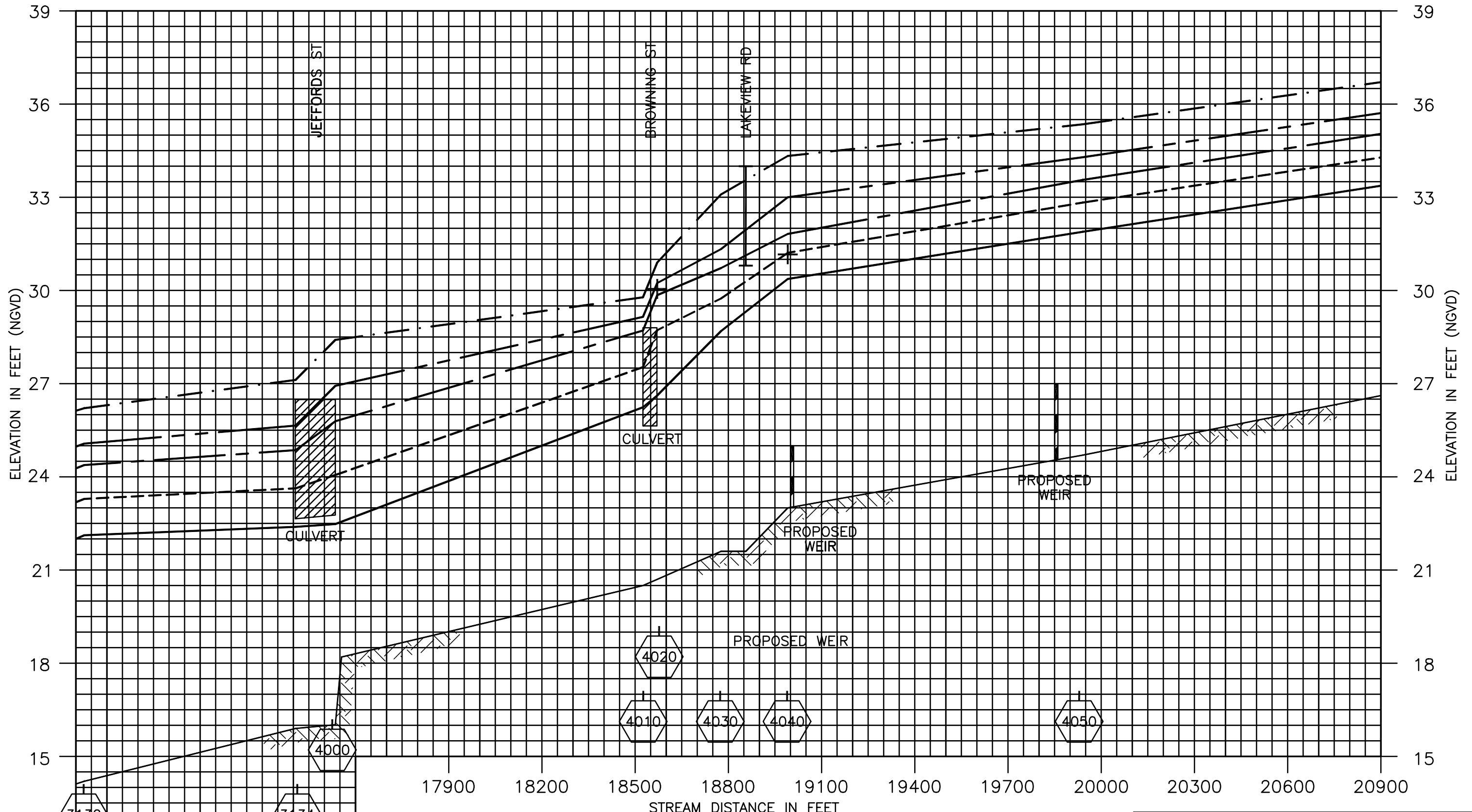


LEGEND:

- . - . - . - . - . - . 500 YEAR FLOOD
- — — — — 100 YEAR FLOOD
- 50 YEAR FLOOD
- - - - - 25 YEAR FLOOD
- 10 YEAR FLOOD

- STREAM BED
- 0010 NODE LOCATION
- HIGH WATER MARK (JULY, 2000 FLOOD)

FIGURE 3.1-40
FLOOD PROFILE
PROJECT CONDITIONS
STEVENSON CREEK
CITY OF CLEARWATER, FL
PARSONS ENGINEERING SCIENCE, INC.

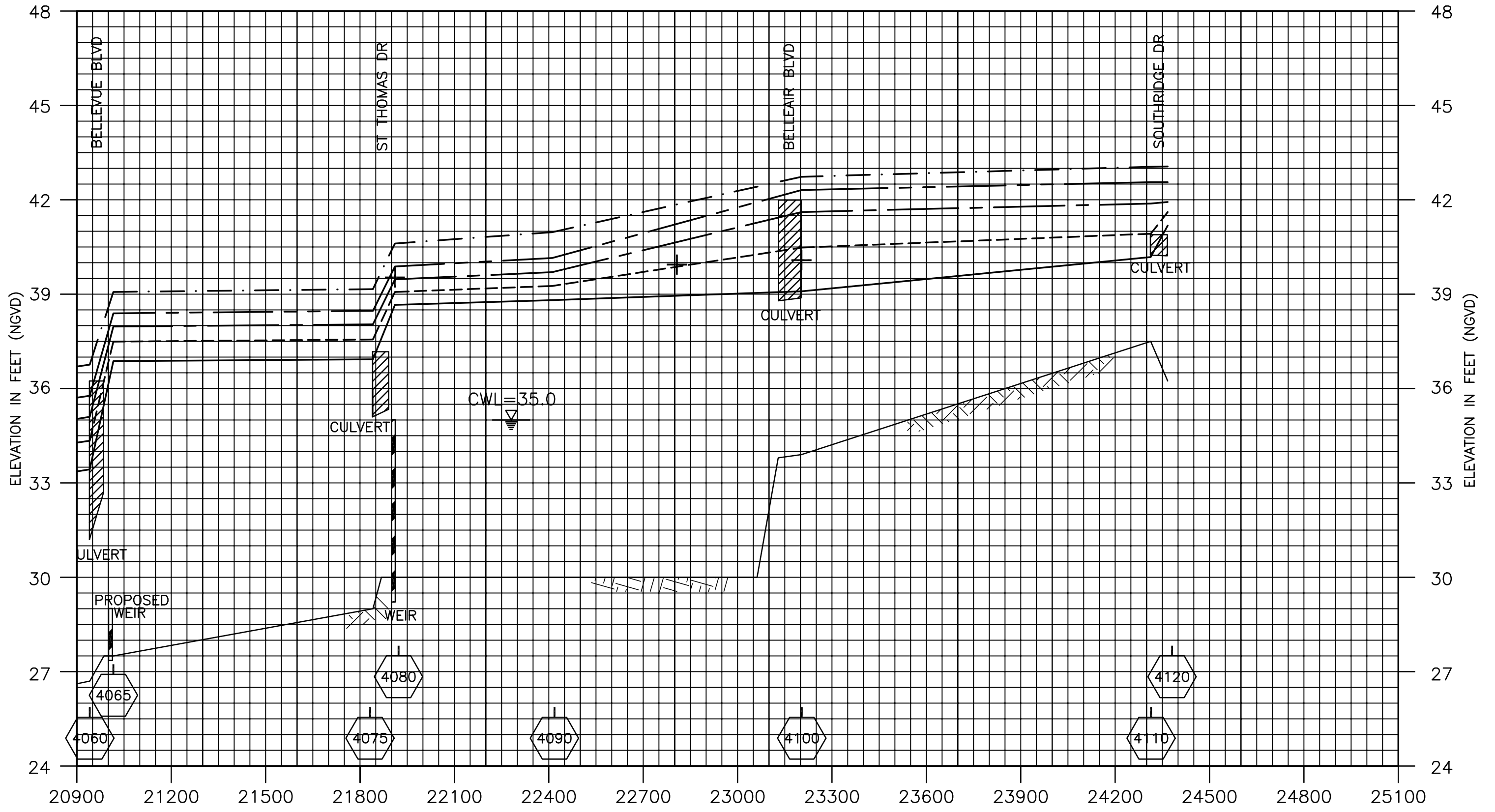


LEGEND:

- . - . - . - . - . 500 YEAR FLOOD
- 100 YEAR FLOOD
- _____ 50 YEAR FLOOD
- - - - - 25 YEAR FLOOD
- _____ 10 YEAR FLOOD

- STREAM BED
- NODE LOCATION
- HIGH WATER MARK (JULY, 2000 FLOOD)

FIGURE 3.1-41
FLOOD PROFILE
PROJECT CONDITIONS
STEVENSON CREEK
CITY OF CLEARWATER, FL
PARSONS ENGINEERING SCIENCE, INC.



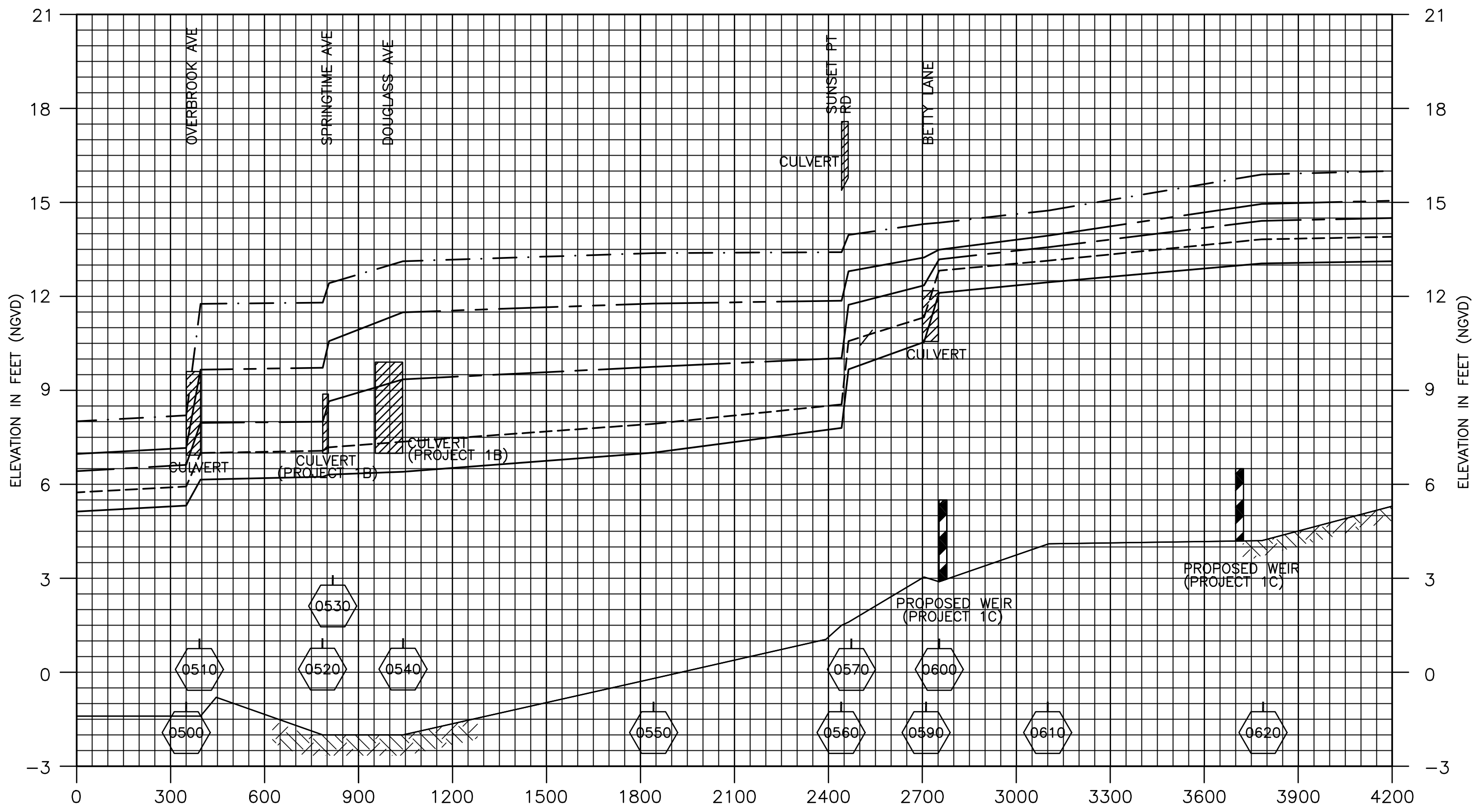
LEGEND:

- · — · — · — · — · — 500 YEAR FLOOD
- — — — — — — — — — 100 YEAR FLOOD
- 50 YEAR FLOOD
- - - - - 25 YEAR FLOOD
- 10 YEAR FLOOD

- STREAM BED
- NODE LOCATION
- HIGH WATER MARK (JULY, 2000 FLOOD)

FIGURE 3.1-42
FLOOD PROFILE
PROJECT CONDITIONS
STEVENSON CREEK
CITY OF CLEARWATER, FL
PARSONS ENGINEERING SCIENCE, INC.

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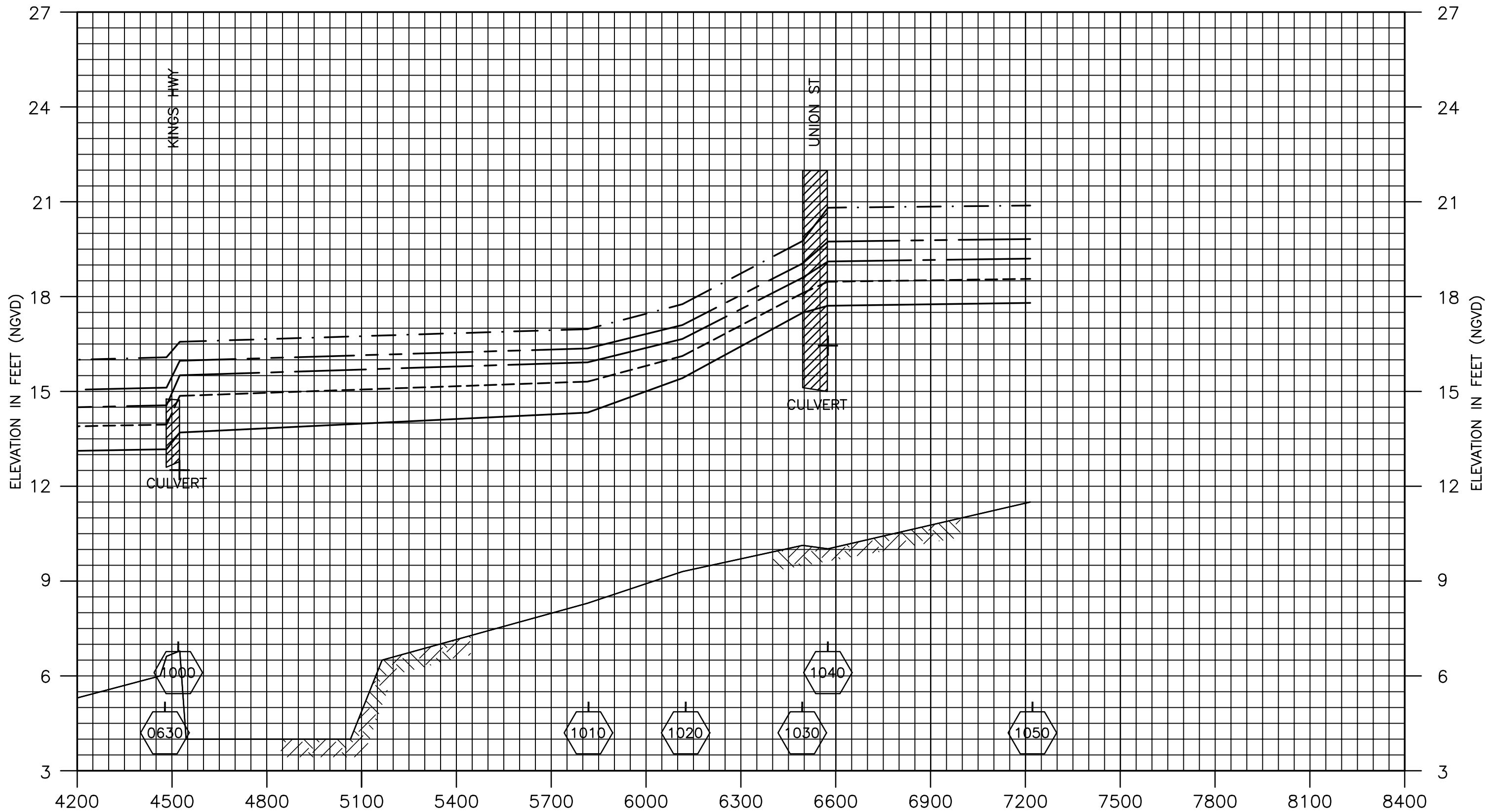


LEGEND:

- · — · — · — · — 500 YEAR FLOOD
- — — — — 100 YEAR FLOOD
- 50 YEAR FLOOD
- - - - - 25 YEAR FLOOD
- 10 YEAR FLOOD

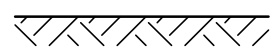
- STREAM BED
- NODE LOCATION
- HIGH WATER MARK (JULY, 2000 FLOOD)

FIGURE 3.1-43
FLOOD PROFILE
PROJECT CONDITIONS
SPRING BRANCH
CITY OF CLEARWATER, FL
PARSONS ENGINEERING SCIENCE, INC.

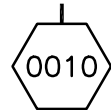


LEGEND:

- 500 YEAR FLOOD
- 100 YEAR FLOOD
- 50 YEAR FLOOD
- 25 YEAR FLOOD
- 10 YEAR FLOOD



STREAM BED



NODE LOCATION



HIGH WATER MARK
(JULY, 2000 FLOOD)

STREAM DISTANCE IN FEET

FIGURE 3.1-44
FLOOD PROFILE
PROJECT CONDITIONS
SPRING BRANCH
CITY OF CLEARWATER, FL
PARSONS ENGINEERING SCIENCE, INC.

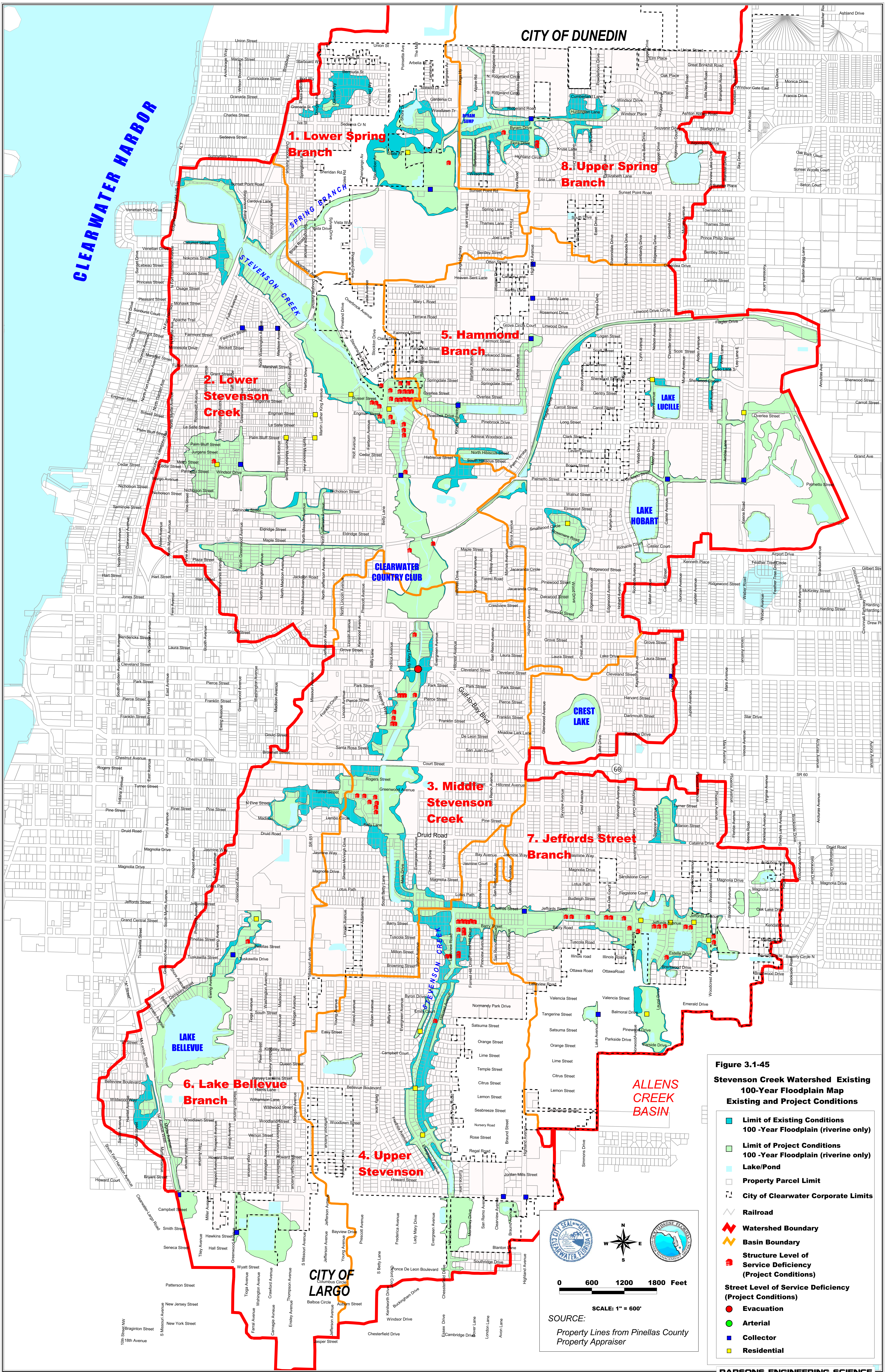


Figure 3.1-45
Stevenson Creek Watershed Existing
100-Year Floodplain Map
Existing and Project Conditions

- Limit of Existing Conditions 100-Year Floodplain (riverine only)
- Limit of Project Conditions 100-Year Floodplain (riverine only)
- Lake/Pond
- Property Parcel Limit
- City of Clearwater Corporate Limits
- Railroad
- ◆ Watershed Boundary
- ◆ Basin Boundary
- Structure Level of Service Deficiency (Project Conditions)
- Street Level of Service Deficiency (Project Conditions)
- Arterial
- Collector
- Residential

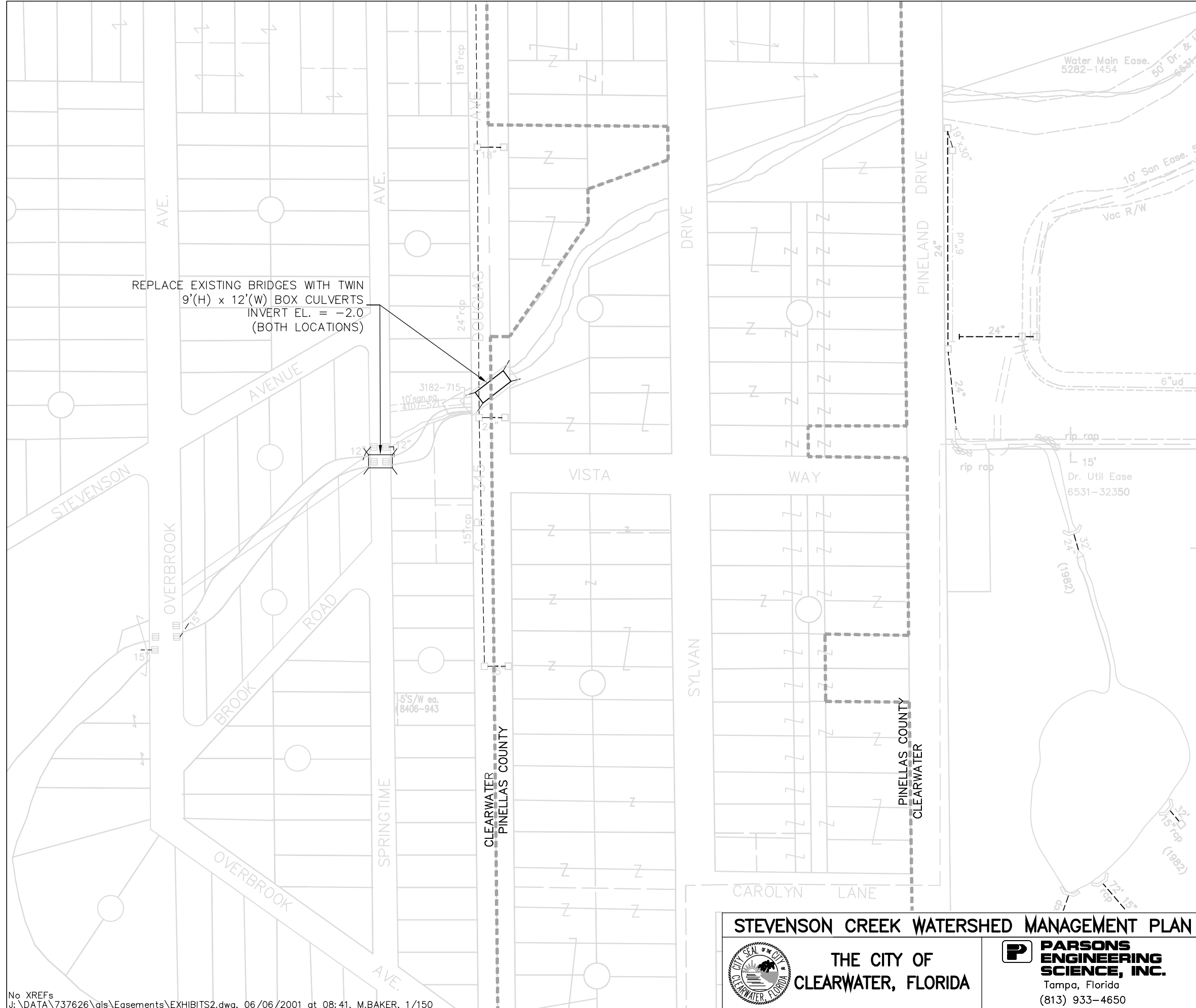
0 600 1200 1800 Feet

SCALE: 1" = 600'

SOURCE:
 Property Lines from Pinellas County
 Property Appraiser



SCALE: 1"=150'



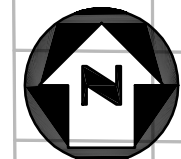
REPLACE EXISTING BRIDGES WITH TWIN 9'(H) x 12'(W) BOX CULVERTS INVERT EL. = -2.0 (BOTH LOCATIONS)

STEVENSON CREEK WATERSHED MANAGEMENT PLAN

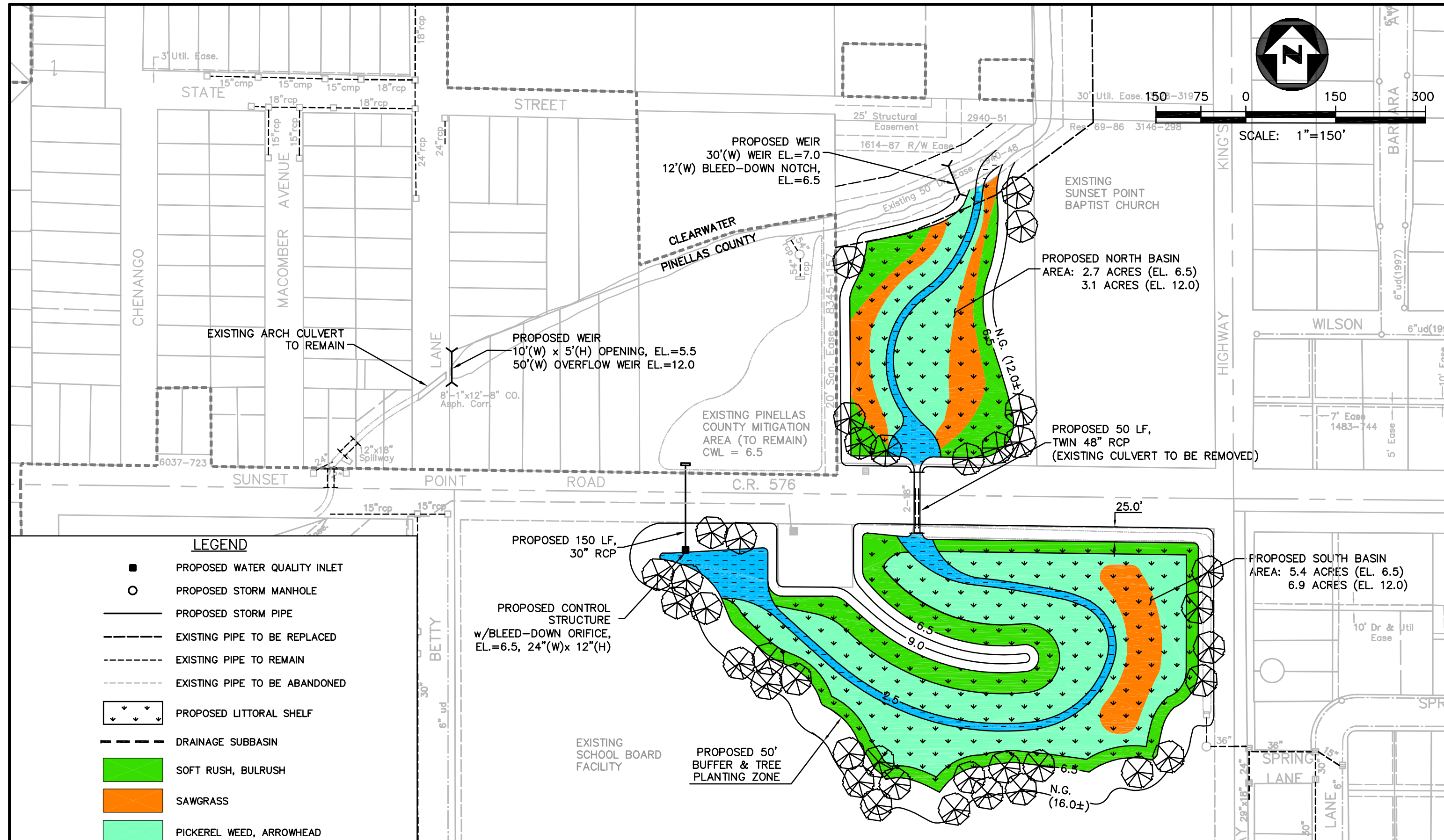


FIGURE 3.1-5

PROJECT 1B REPLACEMENT OF BRIDGES AT SPRINGTIME AVE & DOUGLAS AVE OVER SPRING BRANCH



SCALE: 1"=150'



LEGEND

- PROPOSED WATER QUALITY INLET
- PROPOSED STORM MANHOLE
- PROPOSED STORM PIPE
- - - EXISTING PIPE TO BE REPLACED
- - - EXISTING PIPE TO REMAIN
- - - EXISTING PIPE TO BE ABANDONED
- ▾ ▾ ▾ PROPOSED LITTORAL SHELF
- - - DRAINAGE SUBBASIN
- SOFT RUSH, BULRUSH
- SAWGRASS
- PICKEREL WEED, ARROWHEAD
- OPEN WATER
- PROPOSED TREE

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STEVENSON CREEK WATERSHED MANAGEMENT PLAN

THE CITY OF CLEARWATER, FLORIDA

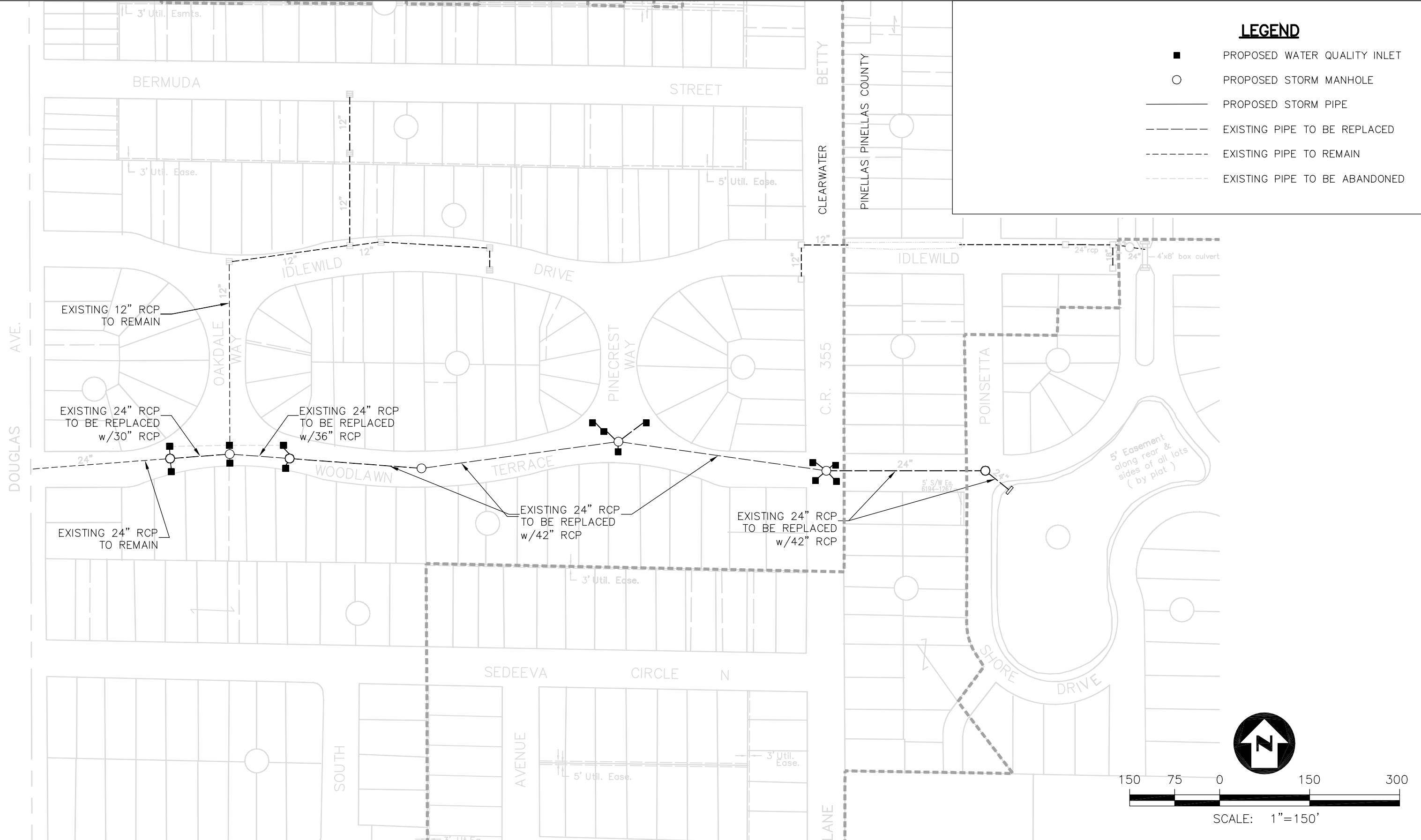
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Tampa, Florida
(813) 933-4650

FIGURE 3.1-6

PROJECT 1C SPRING BRANCH STORMWATER DETENTION BASIN

LEGEND

- PROPOSED WATER QUALITY INLET
- PROPOSED STORM MANHOLE
- PROPOSED STORM PIPE
- - - EXISTING PIPE TO BE REPLACED
- - - EXISTING PIPE TO REMAIN
- - - EXISTING PIPE TO BE ABANDONED



SCALE: 1"=150'

STEVENSON CREEK WATERSHED MANAGEMENT PLAN

FIGURE 3.1-8



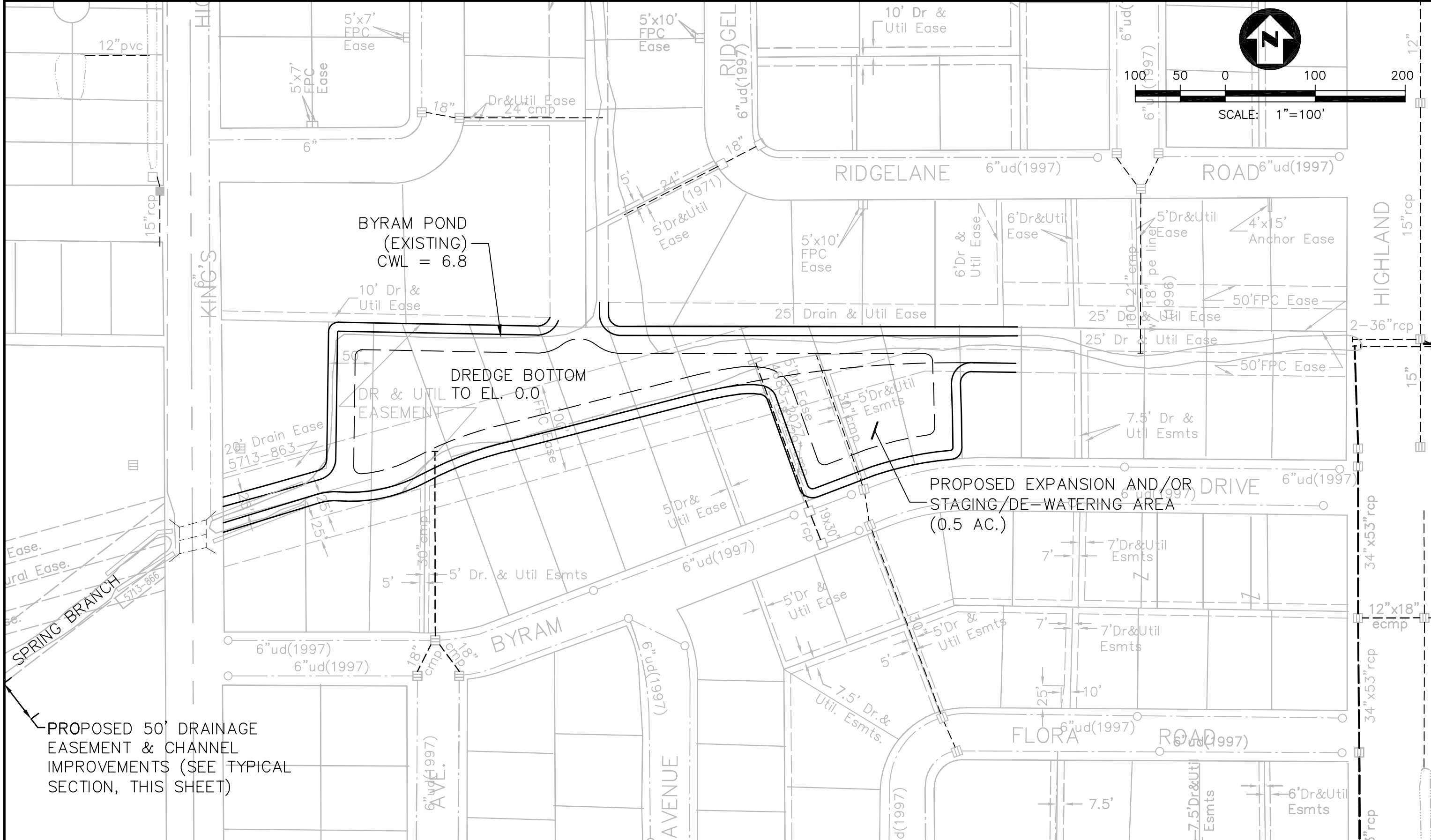
**THE CITY OF
CLEARWATER, FLORIDA**





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ENGINEERING
SCIENCE, INC.**
Tampa, Florida
(813) 933-4650

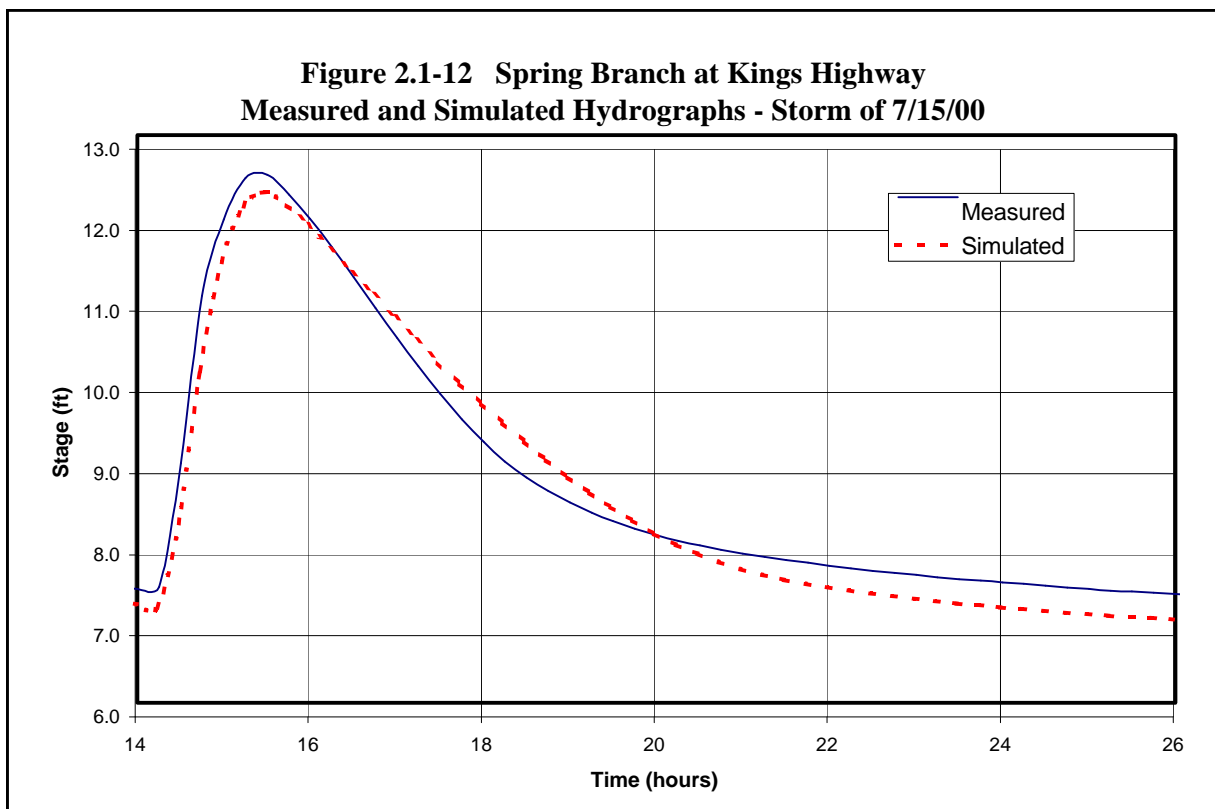
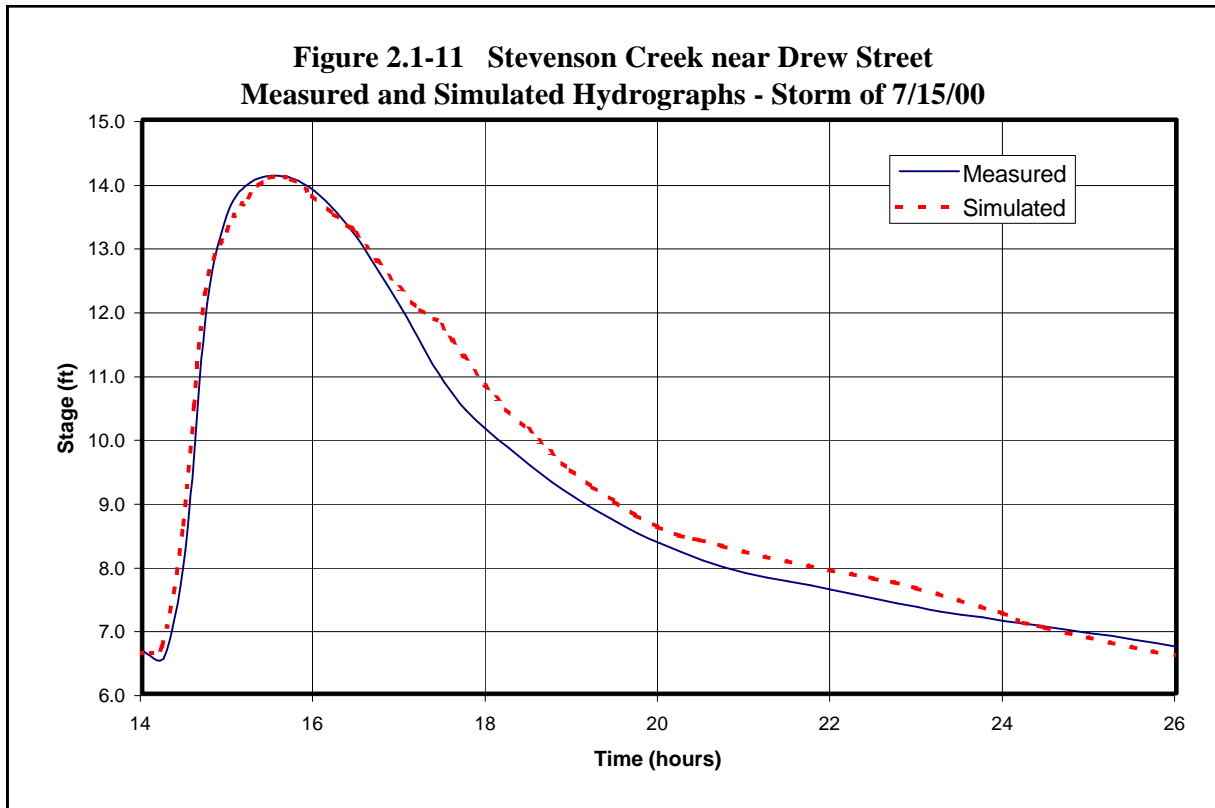
**PROJECT 1D WOODLAND TERRACE
STORM SEWER REPLACEMENT**

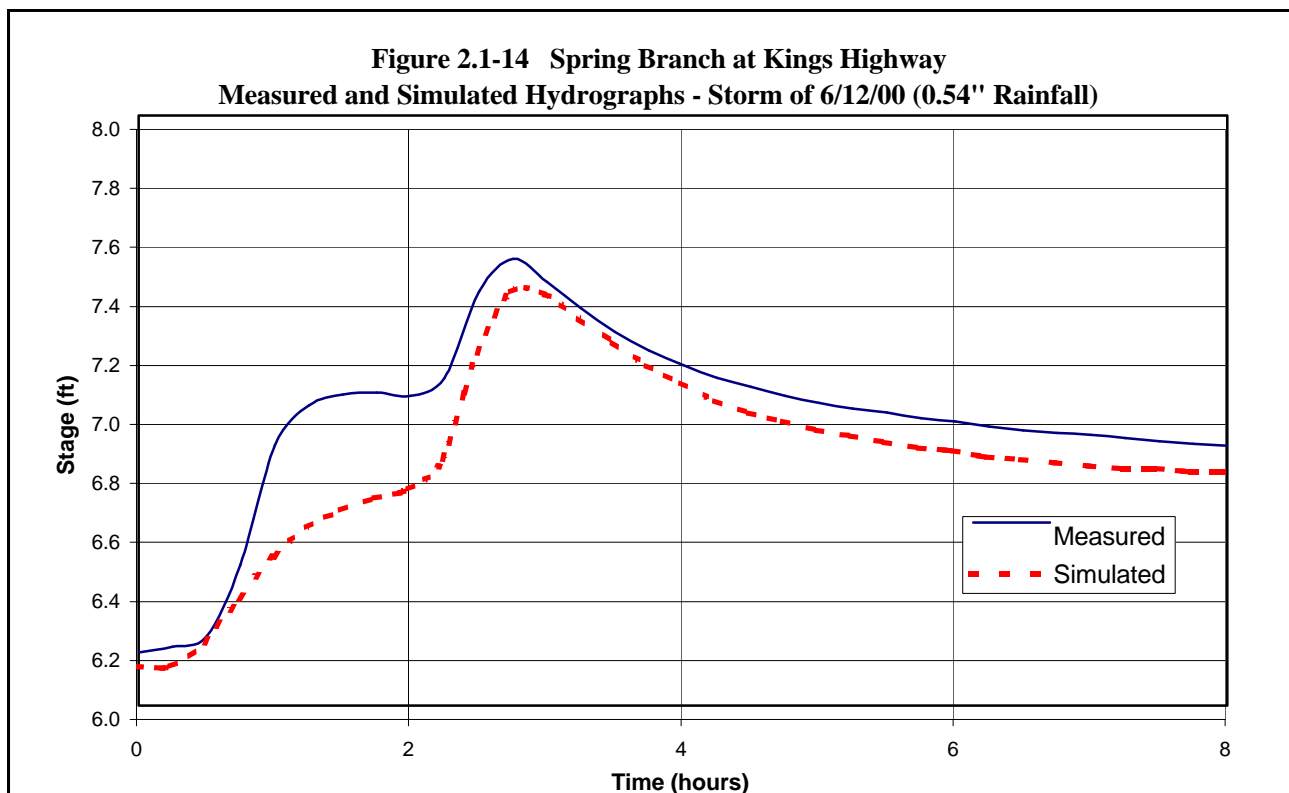
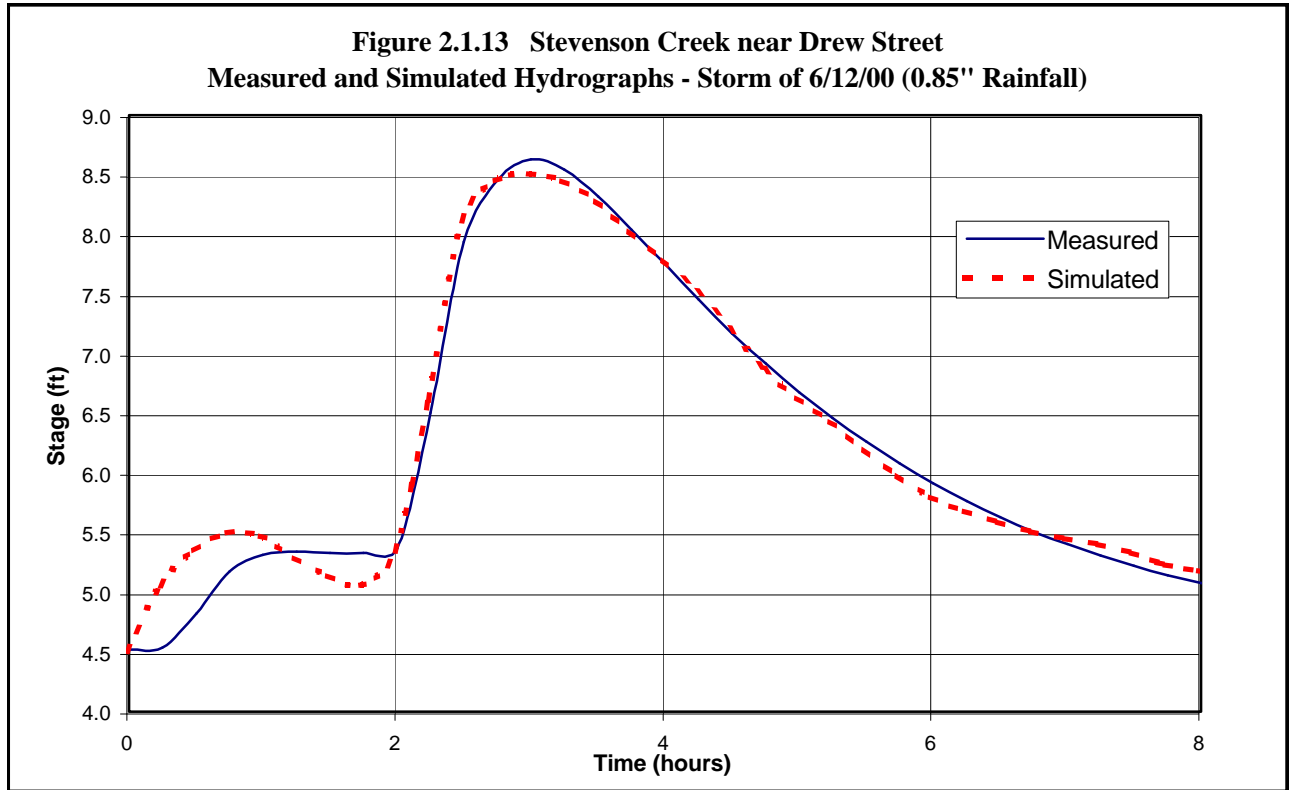
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PROPOSED 50' DRAINAGE EASEMENT & CHANNEL IMPROVEMENTS (SEE TYPICAL SECTION, THIS SHEET)

| | | |
|--|---|---|
| <p>STEVENSON CREEK WATERSHED MANAGEMENT PLAN</p> | | <p>FIGURE 3.1-9</p> |
|  <p>THE CITY OF CLEARWATER, FLORIDA</p> |  <p>PARSONS ENGINEERING SCIENCE, INC. Tampa, Florida (813) 933-4650</p> | <p>PROJECT 1E BYRAM POND DREDGING & EXPANSION</p> |





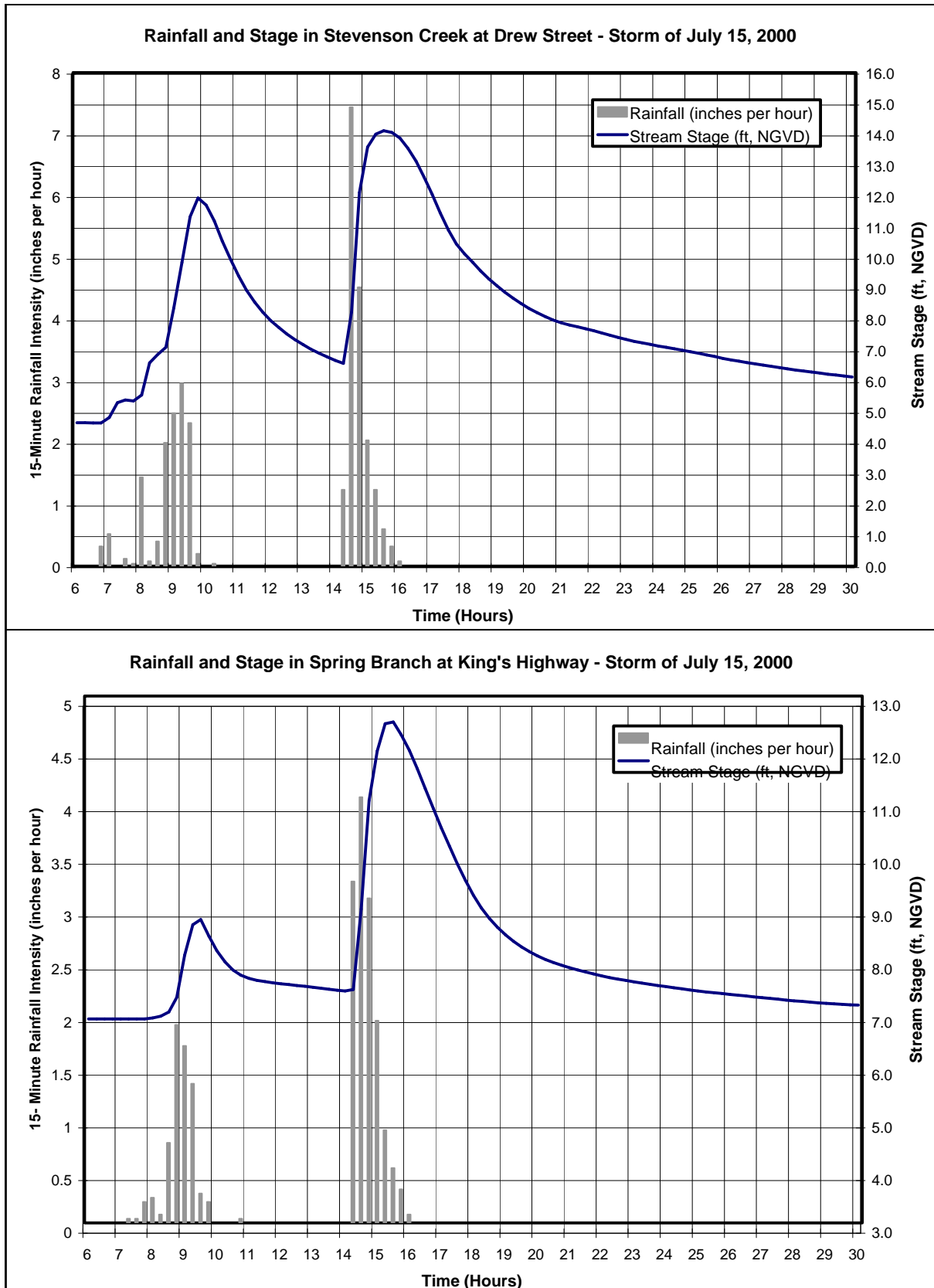


Figure 2.1-6 July 15, 2000 Storm Events

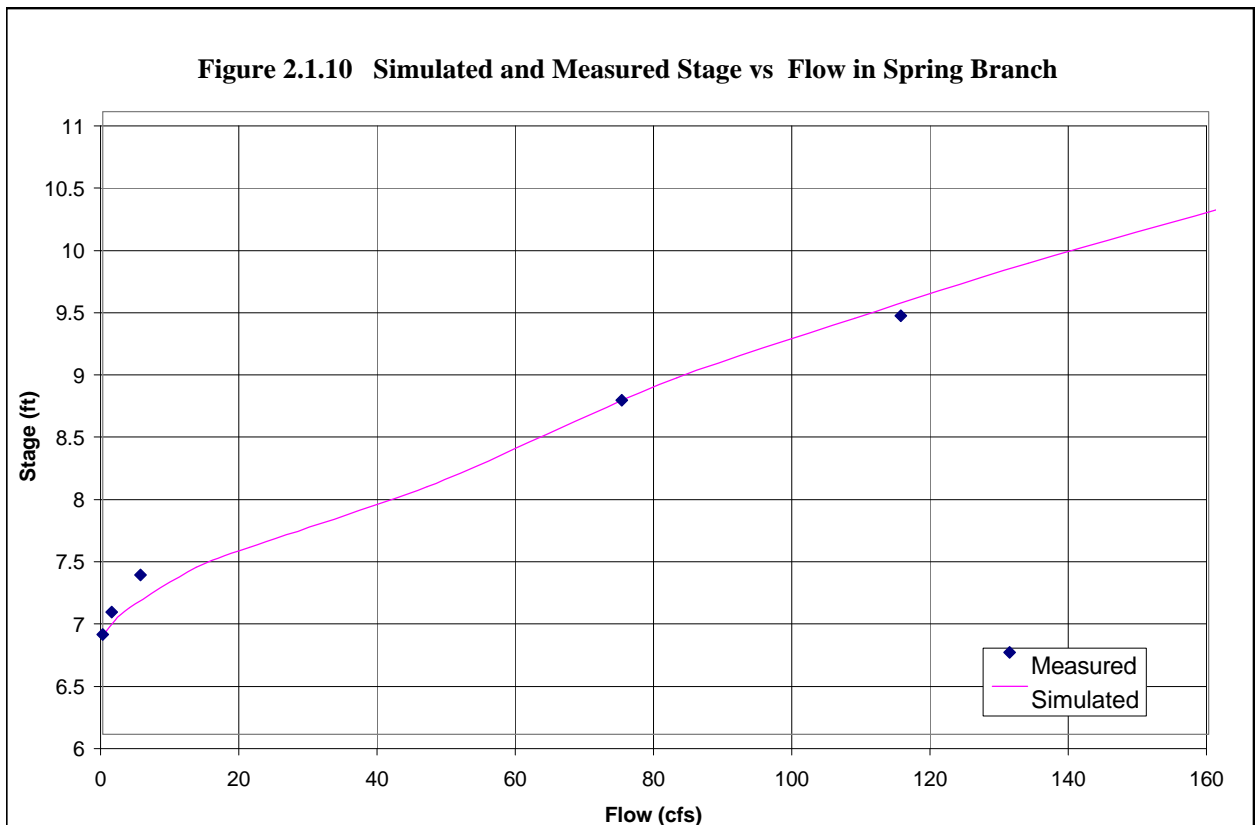
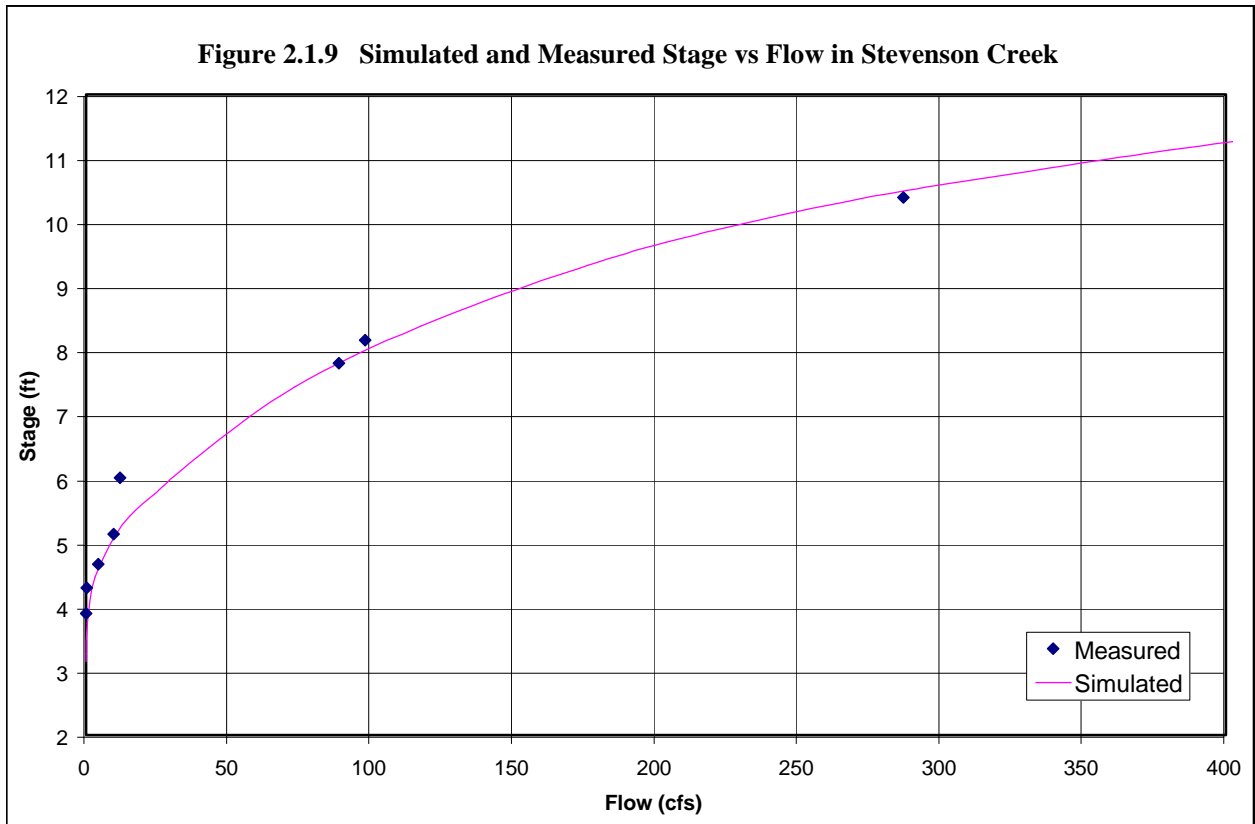


Table D.1 Existing Conditions Street Flooding Level of Service Evaluation

0.51 = FPLOS Deficiency

| Node ID | Node Location | Roadway Classification | Lowest Road Elev. | Flood Elev. 10-yr, 24-hr | Depth of Flooding (ft) | Flood Elev. 25-yr, 24-hr | Depth of Flooding (ft) | Flood Elev. 100-yr,24-hr | Depth of Flooding (ft) |
|---------|--|------------------------|-------------------|--------------------------|------------------------|--------------------------|------------------------|--------------------------|------------------------|
| N0000 | Clearwater Harbor | Collector | 7.5 | 2.50 | (0.00) | 2.50 | (0.00) | 2.50 | (0.00) |
| N0010 | Stevenson Creek, 320' E. of Alt. 19 | Collector | 7.5 | 4.63 | (0.00) | 5.43 | (0.00) | 6.60 | (0.00) |
| N0020 | Stevenson Creek, 225' NW of Pinellas Trail | Residential | 6.3 | 4.70 | (0.00) | 5.48 | (0.00) | 6.63 | 0.33 |
| N0030 | Stevenson Creek, 120' SE of Pinellas Trail | Residential | 9.3 | 5.19 | (0.00) | 5.92 | (0.00) | 7.16 | (0.00) |
| N0040 | Stevenson Creek, 890' SE of Pinellas Trail | Residential | 9.3 | 5.41 | (0.00) | 6.14 | (0.00) | 7.38 | (0.00) |
| N0050 | Stevenson Creek, 120' NW of Douglass Ave | Collector | 9.0 | 5.50 | (0.00) | 6.22 | (0.00) | 7.44 | (0.00) |
| N0060 | Stevenson Creek, 120' SE of Douglass Ave | Residential | 10.5 | 5.74 | (0.00) | 6.56 | (0.00) | 7.73 | (0.00) |
| N0070 | Stevenson Creek, 1,020 SE of Douglass Ave | Residential | 10.5 | 6.01 | (0.00) | 6.80 | (0.00) | 7.95 | (0.00) |
| N0080 | Stevenson Creek, 1,530' SE of Douglass Ave | Residential | 9.0 | 6.13 | (0.00) | 6.93 | (0.00) | 8.09 | (0.00) |
| N0090 | Stevenson Creek, 120' NW of Betty Lane | Collector | 10.1 | 6.26 | (0.00) | 7.01 | (0.00) | 8.15 | (0.00) |
| N0100 | Stevenson Creek, 120' E of Betty Lane | Residential | 6.1 | 6.80 | 0.70 | 7.61 | 1.51 | 8.92 | 2.82 |
| N0110 | Stevenson Creek, 690' SE of Betty Lane | Residential | 10.0 | 7.13 | (0.00) | 7.96 | (0.00) | 9.26 | (0.00) |
| N0120 | Stevenson Creek at Palmetto Street | Collector | 7.0 | 7.52 | 0.52 | 8.34 | 1.34 | 9.55 | 2.55 |
| N0130 | Stevenson Creek at Palmetto Street | Collector | 7.0 | 8.81 | 1.81 | 9.36 | 2.36 | 10.14 | 3.14 |
| N0140 | Stevenson Creek, 860' S of Palmetto Street | Collector | 16.5 | 11.25 | (0.00) | 11.79 | (0.00) | 12.53 | (0.00) |
| N0150 | Stevenson Creek, 150' NW of SCL Railroad | Collector | 25.7 | 12.59 | (0.00) | 13.02 | (0.00) | 13.63 | (0.00) |
| N0170 | Stevenson Creek, 150' S of SCL Railroad | Collector | 25.0 | 13.16 | (0.00) | 13.62 | (0.00) | 14.32 | (0.00) |
| N0180 | Stevenson Creek, 820' S of SCL Railroad | Residential | 21.0 | 14.20 | (0.00) | 14.71 | (0.00) | 15.35 | (0.00) |
| N0195 | Douglass Avenue, 200' E of Harbor Drive | Collector | 9.0 | 6.65 | (0.00) | 7.27 | (0.00) | 8.24 | (0.00) |
| N0200 | Douglass Avenue, 150' W of Harbor Drive | Collector | 10.3 | 10.83 | 0.53 | 10.96 | 0.66 | 11.19 | 0.89 |
| N0210 | Fairmont Street and Washington Avenue | Collector | 12.0 | 12.67 | 0.67 | 12.81 | 0.81 | 13.07 | 1.07 |
| N0220 | Fairmont Steet and N. Greenwood Avenue | Collector | 14.0 | 14.65 | 0.65 | 14.79 | 0.79 | 15.04 | 1.04 |
| N0230 | Fairmont Street and Fulton Avenue | Collector | 21.5 | 17.06 | (0.00) | 17.06 | (0.00) | 17.06 | (0.00) |
| N0240 | Marshall Street and Fulton Avenue | Residential | 26.5 | 20.89 | (0.00) | 21.08 | (0.00) | 21.29 | (0.00) |
| N0250 | Pennsylvania Street and Grant Street | Residential | 22.4 | 22.50 | 0.10 | 22.67 | 0.27 | 22.77 | 0.37 |
| N0280 | Marshall Street AWTP | Residential | 7.5 | 7.40 | (0.00) | 7.95 | 0.45 | 8.74 | 1.24 |
| N0290 | Russel Street 350' W of Holt Avenue | Residential | 9.0 | 9.32 | 0.32 | 9.62 | 0.62 | 9.92 | 0.92 |
| N0291 | Russel Street and Martin Luther King Ave | Residential | 16.0 | 9.71 | (0.00) | 10.22 | (0.00) | 10.95 | (0.00) |
| N0292 | Russel Street and N Madison Ave | Residential | 16.0 | 13.39 | (0.00) | 14.98 | (0.00) | 16.76 | 0.76 |
| N0300 | Martin Luther King Ave S of Russel Street | Residential | 13.0 | 11.02 | (0.00) | 11.43 | (0.00) | 11.91 | (0.00) |
| N0310 | Martin Luther King Ave and Engman Street | Residential | 12.0 | 12.76 | 0.76 | 12.97 | 0.97 | 13.28 | 1.28 |
| N0320 | Martin Luther King Ave and Palm Bluff St | Residential | 15.0 | 15.67 | 0.67 | 15.75 | 0.75 | 15.88 | 0.88 |

Table D.1 Existing Conditions Street Flooding Level of Service Evaluation

0.51 = FPLOS Deficiency

| Node ID | Node Location | Roadway Classification | Lowest Road Elev. | Flood Elev. 10-yr, 24-hr | Depth of Flooding (ft) | Flood Elev. 25-yr, 24-hr | Depth of Flooding (ft) | Flood Elev. 100-yr,24-hr | Depth of Flooding (ft) |
|---------|--|------------------------|-------------------|--------------------------|------------------------|--------------------------|------------------------|--------------------------|------------------------|
| N0330 | Palm Bluff Street and N Madison Avenue | Residential | 14.8 | 16.21 | 1.41 | 16.32 | 1.52 | 16.50 | 1.70 |
| N0340 | N Greenwood Avenue and Metto Street | Collector | 19.2 | 20.18 | 0.98 | 20.43 | 1.23 | 21.00 | 1.80 |
| N0350 | N Greenwood Avenue and Palmetto Street | Collector | 21.7 | 20.90 | (0.00) | 21.26 | (0.00) | 21.55 | (0.00) |
| N0370 | Pennsylvania Avenue and Metto Street | Residential | 20.8 | 21.41 | 0.61 | 21.66 | 0.86 | 21.96 | 1.16 |
| N0380 | Holt Avenue and Russel Street | Residential | 5.9 | 6.79 | 0.89 | 7.24 | 1.34 | 8.21 | 2.31 |
| N0390 | Holt Avenue and Engman Street | Residential | 16.5 | 9.83 | (0.00) | 10.34 | (0.00) | 11.18 | (0.00) |
| N0400 | Holt Avenue 420' S of Engman Street | Residential | 20.2 | 11.55 | (0.00) | 12.29 | (0.00) | 13.32 | (0.00) |
| N0410 | Palmetto Street and Holt Avenue | Collector | 20.1 | 13.71 | (0.00) | 14.63 | (0.00) | 15.78 | (0.00) |
| N0420 | Palmetto Street and N Missouri Avenue | Collector | 20.2 | 16.77 | (0.00) | 17.86 | (0.00) | 18.88 | (0.00) |
| N0430 | N Missouri Avenue and Seminole Street | Residential | 19.2 | 20.30 | 1.10 | 20.73 | 1.53 | 21.33 | 2.13 |
| N0435 | Palmetto Street and Phillies Stadium Drive | Collector | 20.2 | 18.67 | (0.00) | 20.63 | 0.43 | 21.33 | 1.13 |
| N0440 | Palmetto Street and Kings Highway | Collector | 19.4 | 19.69 | 0.29 | 20.12 | 0.72 | 20.68 | 1.28 |
| N0450 | Betty Lane and SCL Railroad Ditch | Collector | 23.8 | 21.26 | (0.00) | 22.77 | (0.00) | 24.11 | 0.31 |
| N0460 | N. Lincoln Avenue and SCL Railroad Ditch | Residential | 26.0 | 22.16 | (0.00) | 23.14 | (0.00) | 24.30 | (0.00) |
| N0470 | N. Missouri Avenue and SCL Railroad Ditch | Residential | 24.0 | 23.20 | (0.00) | 23.71 | (0.00) | 24.58 | 0.58 |
| N0480 | N. Greenwood Avenue and Maple Street | Collector | 23.6 | 23.52 | (0.00) | 23.93 | 0.33 | 24.69 | 1.09 |
| N0500 | Spring Branch at Overbrook Avenue | Residential | 9.4 | 5.52 | (0.00) | 6.22 | (0.00) | 7.44 | (0.00) |
| N0510 | Spring Branch at Overbrook Avenue | Residential | 9.4 | 6.05 | (0.00) | 6.75 | (0.00) | 8.78 | (0.00) |
| N0520 | Spring Branch at Springtime Avenue | Residential | 8.9 | 6.12 | (0.00) | 6.80 | (0.00) | 8.76 | (0.00) |
| N0530 | Spring Branch at Douglass Avenue | Collector | 9.5 | 8.42 | (0.00) | 9.36 | (0.00) | 10.68 | 1.18 |
| N0540 | Spring Branch at Douglass Avenue | Collector | 9.5 | 9.48 | (0.00) | 10.50 | 1.00 | 11.51 | 2.01 |
| N0550 | (Pinellas County - FPLOS not determined) | | | 9.61 | | 10.61 | | 11.62 | |
| N0560 | Spring Branch at Sunset Point Drive | Collector | 17.4 | 9.70 | (0.00) | 10.67 | (0.00) | 11.65 | (0.00) |
| N0570 | (Pinellas County - FPLOS not determined) | | | 9.85 | | 10.80 | | 11.80 | |
| N0580 | (Pinellas County - FPLOS not determined) | | | 10.92 | | 12.64 | | 15.19 | |
| N0590 | (Pinellas County - FPLOS not determined) | | | 11.16 | | 12.73 | | 15.23 | |
| N0600 | (Pinellas County - FPLOS not determined) | | | 12.73 | | 13.79 | | 15.43 | |
| N0610 | (Pinellas County - FPLOS not determined) | | | 12.89 | | 13.90 | | 15.48 | |
| N0620 | Spring Branch, 700' SW of Kings Highway | Collector | 16.0 | 13.32 | (0.00) | 14.22 | (0.00) | 15.72 | (0.00) |
| N0630 | Spring Branch at Kings Highway (west side) | Collector | 14.5 | 14.46 | (0.00) | 15.33 | 0.83 | 16.66 | 2.16 |
| N0650 | Pineland Avenue and Vista Way | Residential | 19.0 | 16.45 | (0.00) | 16.89 | (0.00) | 17.61 | (0.00) |
| N0660 | Retention pond outfall SE of Pineland, Vista | Residential | 20.0 | 17.19 | (0.00) | 17.39 | (0.00) | 17.90 | (0.00) |

Table D.1 Existing Conditions Street Flooding Level of Service Evaluation

0.51 = FPLOS Deficiency

| Node ID | Node Location | Roadway Classification | Lowest Road Elev. | Flood Elev. 10-yr, 24-hr | Depth of Flooding (ft) | Flood Elev. 25-yr, 24-hr | Depth of Flooding (ft) | Flood Elev. 100-yr,24-hr | Depth of Flooding (ft) |
|---------|--|------------------------|-------------------|--------------------------|------------------------|--------------------------|------------------------|--------------------------|------------------------|
| N0670 | Retention pond SE of Pineland and Vista | Residential | 22.0 | 19.38 | (0.00) | 19.65 | (0.00) | 20.17 | (0.00) |
| N0680 | (Pinellas County - FPLOS not determined) | | | 12.91 | | 13.91 | | 15.49 | |
| N0690 | Sunset Point Drive, 750' E of Betty Lane | Collector | 11.9 | 12.91 | 1.01 | 13.91 | 2.01 | 15.49 | 3.59 |
| N0700 | School Board Retention Pond | Residential | 17.0 | 16.68 | (0.00) | 16.71 | (0.00) | 16.77 | (0.00) |
| N0710 | School Board Retention Pond | Residential | 17.0 | 16.21 | (0.00) | 16.39 | (0.00) | 16.78 | (0.00) |
| N0720 | School Board Ditch | Residential | 19.0 | 18.64 | (0.00) | 18.82 | (0.00) | 19.05 | 0.05 |
| N0730 | School Board Retention Pond | Residential | 20.0 | 19.39 | (0.00) | 19.61 | (0.00) | 20.05 | 0.05 |
| N0740 | State Street Ditch, 320' E of Betty Lane | Residential | 12.3 | 12.97 | 0.67 | 13.92 | 1.62 | 15.53 | 3.23 |
| N0750 | State Street Ditch, 320' E of Betty Lane | Residential | 12.3 | 13.02 | 0.72 | 13.92 | 1.62 | 15.50 | 3.20 |
| N0760 | Pond E of Betty Lane and Woodlawn Terr. | Residential | 15.0 | 13.32 | (0.00) | 13.96 | (0.00) | 15.51 | 0.51 |
| N0770 | (Pinellas County - FPLOS not determined) | | | 13.36 | | 14.01 | | 15.58 | |
| N0775 | (Pinellas County - FPLOS not determined) | | | 13.82 | | 15.08 | | 17.08 | |
| N0780 | (Pinellas County - FPLOS not determined) | | | 13.95 | | 15.32 | | 17.48 | |
| N0790 | (City of Dunedin - FPLOS not determined) | | | 14.14 | | 15.49 | | 17.64 | |
| N0800 | (City of Dunedin - FPLOS not determined) | | | 17.76 | | 18.58 | | 19.83 | |
| N0810 | (City of Dunedin - FPLOS not determined) | | | 17.84 | | 18.59 | | 19.85 | |
| N0820 | (City of Dunedin - FPLOS not determined) | | | 17.84 | | 18.59 | | 19.80 | |
| N0830 | (City of Dunedin - FPLOS not determined) | | | 17.92 | | 18.60 | | 19.85 | |
| N0840 | (City of Dunedin - FPLOS not determined) | | | 17.94 | | 18.61 | | 19.83 | |
| N0850 | (City of Dunedin - FPLOS not determined) | | | 18.15 | | 18.68 | | 19.85 | |
| N0855 | (City of Dunedin - FPLOS not determined) | | | 18.17 | | 18.70 | | 19.85 | |
| N0860 | (City of Dunedin - FPLOS not determined) | | | 18.48 | | 19.07 | | 20.13 | |
| N0870 | (City of Dunedin - FPLOS not determined) | | | 18.54 | | 19.10 | | 20.14 | |
| N0880 | (City of Dunedin - FPLOS not determined) | | | 18.71 | | 19.28 | | 20.28 | |
| N0890 | (City of Dunedin - FPLOS not determined) | | | 18.77 | | 19.31 | | 20.29 | |
| N0900 | (City of Dunedin - FPLOS not determined) | | | 18.79 | | 19.33 | | 20.29 | |
| N0910 | Woodlawn Terrace and Oakdale Way | Residential | 19.0 | 20.79 | 1.79 | 21.32 | 2.32 | 21.88 | 2.88 |
| N0920 | (City of Dunedin - FPLOS not determined) | | | 18.18 | | 18.70 | | 19.82 | |
| N1000 | Spring Branch at Kings Highway (east side) | Collector | 14.5 | 15.02 | 0.52 | 15.75 | 1.25 | 16.75 | 2.25 |
| N1010 | Spring Branch, 680' S of Union Street | Residential | 21.0 | 15.30 | (0.00) | 16.02 | (0.00) | 17.01 | (0.00) |
| N1020 | Spring Branch, 380' S of Union Street | Residential | 20.8 | 15.84 | (0.00) | 16.52 | (0.00) | 17.52 | (0.00) |
| N1030 | Spring Branch at Union Street | Collector | 20.0 | 17.52 | (0.00) | 18.16 | (0.00) | 19.15 | (0.00) |

Table D.1 Existing Conditions Street Flooding Level of Service Evaluation

0.51 = FPLOS Deficiency

| Node ID | Node Location | Roadway Classification | Lowest Road Elev. | Flood Elev. 10-yr, 24-hr | Depth of Flooding (ft) | Flood Elev. 25-yr, 24-hr | Depth of Flooding (ft) | Flood Elev. 100-yr,24-hr | Depth of Flooding (ft) |
|---------|--|------------------------|-------------------|--------------------------|------------------------|--------------------------|------------------------|--------------------------|------------------------|
| N1040 | (City of Dunedin - FPLOS not determined) | | | 17.73 | | 18.52 | | 19.82 | |
| N1050 | (City of Dunedin - FPLOS not determined) | | | 17.82 | | 18.60 | | 19.89 | |
| N1060 | (City of Dunedin - FPLOS not determined) | | | 17.82 | | 18.60 | | 19.89 | |
| N1070 | (City of Dunedin - FPLOS not determined) | | | 17.95 | | 18.71 | | 19.97 | |
| N1080 | (City of Dunedin - FPLOS not determined) | | | 18.05 | | 18.77 | | 20.01 | |
| N1090 | (City of Dunedin - FPLOS not determined) | | | 18.37 | | 18.90 | | 20.07 | |
| N1100 | (City of Dunedin - FPLOS not determined) | | | 22.32 | | 22.89 | | 23.85 | |
| N1110 | (City of Dunedin - FPLOS not determined) | | | 23.04 | | 23.47 | | 24.21 | |
| N1120 | (City of Dunedin - FPLOS not determined) | | | 23.99 | | 24.22 | | 24.67 | |
| N1130 | (City of Dunedin - FPLOS not determined) | | | 24.39 | | 24.77 | | 25.62 | |
| N1140 | (City of Dunedin - FPLOS not determined) | | | 24.49 | | 24.90 | | 25.84 | |
| N1150 | (City of Dunedin - FPLOS not determined) | | | 24.54 | | 24.95 | | 25.95 | |
| N1160 | (City of Dunedin - FPLOS not determined) | | | 24.61 | | 25.06 | | 26.26 | |
| N1170 | (City of Dunedin - FPLOS not determined) | | | 24.61 | | 25.06 | | 26.27 | |
| N1172 | (City of Dunedin - FPLOS not determined) | | | 24.64 | | 25.09 | | 26.33 | |
| N1174 | (City of Dunedin - FPLOS not determined) | | | 24.65 | | 25.10 | | 26.36 | |
| N1180 | (City of Dunedin - FPLOS not determined) | | | 24.62 | | 25.08 | | 26.28 | |
| N1190 | (City of Dunedin - FPLOS not determined) | | | 24.67 | | 25.12 | | 26.40 | |
| N1200 | (City of Dunedin - FPLOS not determined) | | | 24.74 | | 25.18 | | 26.48 | |
| N1210 | (City of Dunedin - FPLOS not determined) | | | 27.61 | | 28.49 | | 29.20 | |
| N1220 | (City of Dunedin - FPLOS not determined) | | | 27.63 | | 28.50 | | 29.23 | |
| N1230 | (City of Dunedin - FPLOS not determined) | | | 28.01 | | 28.64 | | 29.24 | |
| N1240 | (City of Dunedin - FPLOS not determined) | | | 28.02 | | 28.65 | | 29.27 | |
| N1245 | (City of Dunedin - FPLOS not determined) | | | 28.02 | | 28.65 | | 29.26 | |
| N1250 | (City of Dunedin - FPLOS not determined) | | | 28.02 | | 28.65 | | 29.27 | |
| N1260 | (City of Dunedin - FPLOS not determined) | | | 28.23 | | 28.78 | | 29.82 | |
| N1270 | (City of Dunedin - FPLOS not determined) | | | 30.34 | | 30.98 | | 32.08 | |
| N1280 | (City of Dunedin - FPLOS not determined) | | | 30.35 | | 30.99 | | 32.08 | |
| N1290 | (City of Dunedin - FPLOS not determined) | | | 30.60 | | 30.99 | | 32.08 | |
| N1300 | (City of Dunedin - FPLOS not determined) | | | 33.12 | | 33.35 | | 33.71 | |
| N1310 | (City of Dunedin - FPLOS not determined) | | | 33.38 | | 33.72 | | 34.31 | |
| N1320 | (City of Dunedin - FPLOS not determined) | | | 33.74 | | 33.89 | | 34.36 | |

Table D.1 Existing Conditions Street Flooding Level of Service Evaluation

0.51 = FPLOS Deficiency

| Node ID | Node Location | Roadway Classification | Lowest Road Elev. | Flood Elev. 10-yr, 24-hr | Depth of Flooding (ft) | Flood Elev. 25-yr, 24-hr | Depth of Flooding (ft) | Flood Elev. 100-yr,24-hr | Depth of Flooding (ft) |
|---------|--|------------------------|-------------------|--------------------------|------------------------|--------------------------|------------------------|--------------------------|------------------------|
| N1330 | (City of Dunedin - FPLOS not determined) | | | 42.18 | | 42.56 | | 43.19 | |
| N1340 | (City of Dunedin - FPLOS not determined) | | | 42.36 | | 42.75 | | 43.40 | |
| N1350 | Byram East Ditch at Highland Avenue | Collector | 17.2 | 15.37 | (0.00) | 16.16 | (0.00) | 17.27 | 0.07 |
| N1360 | Byram East Ditch at Highland Avenue | Collector | 17.2 | 18.64 | 1.44 | 19.08 | 1.88 | 19.93 | 2.73 |
| N1370 | Byram East Ditch, 730' E of Highland Ave | Residential | 23.7 | 25.27 | 1.57 | 25.68 | 1.98 | 26.52 | 2.82 |
| N1380 | Byram East Ditch, 1,350' E of Highland Ave | Residential | 28.5 | 27.81 | (0.00) | 28.22 | (0.00) | 28.62 | 0.12 |
| N1390 | Souvenir Drive near Algonquin Drive | Residential | 29.0 | 28.47 | (0.00) | 29.28 | 0.28 | 29.66 | 0.66 |
| N1400 | Algonquin Drive, 340' W of Picardy Circle | Residential | 34.5 | 29.14 | (0.00) | 30.74 | (0.00) | 33.66 | (0.00) |
| N1410 | Algonquin Drive and Nugget Drive | Residential | 56.5 | 50.48 | (0.00) | 50.77 | (0.00) | 50.88 | (0.00) |
| N1420 | Nugget Drive, 400' S of Algonquin Drive | Residential | 58.5 | 53.89 | (0.00) | 53.90 | (0.00) | 54.73 | (0.00) |
| N1430 | Clearview Lake | Residential | 59.0 | 56.19 | (0.00) | 56.54 | (0.00) | 57.36 | (0.00) |
| N1440 | Highland Avenue, 130' S of Byram Drive | Collector | 16.0 | 17.57 | 1.57 | 17.94 | 1.94 | 18.43 | 2.43 |
| N1450 | Highland Avenue at Highland Circle | Collector | 20.0 | 20.67 | 0.67 | 20.85 | 0.85 | 21.11 | 1.11 |
| N1460 | Highland Avenue at Sunset Point Road | Collector | 32.5 | 32.72 | 0.22 | 32.91 | 0.41 | 33.14 | 0.64 |
| N1470 | Sunset Point Road, 250' E of Highland Ave | Collector | 33.3 | 33.62 | 0.32 | 33.79 | 0.49 | 33.96 | 0.66 |
| N1480 | Sunset Point Road, 250' E of Highland Ave | Collector | 33.3 | 33.81 | 0.51 | 33.86 | 0.56 | 33.96 | 0.66 |
| N1490 | Pond NE of Highland Avenue and Byram Dr | Residential | 16.8 | 15.48 | (0.00) | 15.98 | (0.00) | 16.69 | (0.00) |
| N1500 | Souvenir Drive, 250' W of Picardy Circle | Residential | 24.6 | 26.64 | 2.04 | 27.22 | 2.62 | 27.87 | 3.27 |
| N1510 | Retention Pond in Windsor Woods Sub. | Residential | 28.0 | 28.08 | 0.08 | 28.28 | 0.28 | 28.68 | 0.68 |
| N1520 | (City of Dunedin - FPLOS not determined) | | | 19.03 | | 19.58 | | 20.61 | |
| N1530 | (City of Dunedin - FPLOS not determined) | | | 19.26 | | 19.82 | | 20.80 | |
| N1540 | (City of Dunedin - FPLOS not determined) | | | 19.83 | | 20.03 | | 20.80 | |
| N1550 | (City of Dunedin - FPLOS not determined) | | | 22.47 | | 24.03 | | 24.54 | |
| N1560 | (City of Dunedin - FPLOS not determined) | | | 23.79 | | 24.54 | | 24.84 | |
| N1570 | (City of Dunedin - FPLOS not determined) | | | 23.97 | | 24.44 | | 24.96 | |
| N1580 | (City of Dunedin - FPLOS not determined) | | | 23.81 | | 24.30 | | 24.87 | |
| N1590 | (City of Dunedin - FPLOS not determined) | | | 19.21 | | 19.75 | | 20.73 | |
| N1600 | (City of Dunedin - FPLOS not determined) | | | 26.88 | | 26.99 | | 27.12 | |
| N1610 | (City of Dunedin - FPLOS not determined) | | | 27.87 | | 28.23 | | 28.87 | |
| N1620 | (City of Dunedin - FPLOS not determined) | | | 31.14 | | 31.43 | | 32.02 | |
| N1630 | (City of Dunedin - FPLOS not determined) | | | 26.18 | | 26.47 | | 26.83 | |
| N1640 | (City of Dunedin - FPLOS not determined) | | | 30.11 | | 30.77 | | 31.89 | |

Table D.1 Existing Conditions Street Flooding Level of Service Evaluation

0.51 = FPLOS Deficiency

| Node ID | Node Location | Roadway Classification | Lowest Road Elev. | Flood Elev. 10-yr, 24-hr | Depth of Flooding (ft) | Flood Elev. 25-yr, 24-hr | Depth of Flooding (ft) | Flood Elev. 100-yr,24-hr | Depth of Flooding (ft) |
|---------|--|------------------------|-------------------|--------------------------|------------------------|--------------------------|------------------------|--------------------------|------------------------|
| N1650 | (City of Dunedin - FPLOS not determined) | | | 30.96 | | 31.53 | | 32.80 | |
| N1660 | (City of Dunedin - FPLOS not determined) | | | 31.34 | | 31.81 | | 32.91 | |
| N1670 | (City of Dunedin - FPLOS not determined) | | | 32.22 | | 32.58 | | 33.29 | |
| N1680 | (City of Dunedin - FPLOS not determined) | | | 35.81 | | 36.67 | | 38.54 | |
| N1690 | (City of Dunedin - FPLOS not determined) | | | 39.53 | | 39.80 | | 40.59 | |
| N1700 | (City of Dunedin - FPLOS not determined) | | | 36.31 | | 36.69 | | 37.49 | |
| N1710 | (City of Dunedin - FPLOS not determined) | | | 27.35 | | 28.17 | | 30.34 | |
| N1720 | (City of Dunedin - FPLOS not determined) | | | 44.60 | | 44.74 | | 44.88 | |
| N1750 | (City of Dunedin - FPLOS not determined) | | | 24.62 | | 25.08 | | 26.28 | |
| N1760 | (City of Dunedin - FPLOS not determined) | | | 24.63 | | 25.10 | | 26.29 | |
| N1770 | (City of Dunedin - FPLOS not determined) | | | 25.19 | | 25.31 | | 26.30 | |
| N1780 | (City of Dunedin - FPLOS not determined) | | | 27.09 | | 27.39 | | 27.95 | |
| N1790 | (City of Dunedin - FPLOS not determined) | | | 28.64 | | 29.01 | | 29.52 | |
| N1800 | (City of Dunedin - FPLOS not determined) | | | 24.64 | | 25.06 | | 26.09 | |
| N1810 | (City of Dunedin - FPLOS not determined) | | | 24.64 | | 25.06 | | 26.10 | |
| N1820 | (City of Dunedin - FPLOS not determined) | | | 24.87 | | 25.41 | | 26.30 | |
| N1830 | (City of Dunedin - FPLOS not determined) | | | 26.96 | | 27.24 | | 27.97 | |
| N1840 | (City of Dunedin - FPLOS not determined) | | | 28.02 | | 28.64 | | 29.24 | |
| N1850 | (City of Dunedin - FPLOS not determined) | | | 28.02 | | 28.64 | | 29.25 | |
| N1860 | (City of Dunedin - FPLOS not determined) | | | 30.84 | | 31.60 | | 33.17 | |
| N1870 | (City of Dunedin - FPLOS not determined) | | | 31.62 | | 32.40 | | 34.09 | |
| N1880 | (City of Dunedin - FPLOS not determined) | | | 29.71 | | 30.14 | | 30.93 | |
| N1900 | (City of Dunedin - FPLOS not determined) | | | 28.03 | | 28.65 | | 29.33 | |
| N1910 | (City of Dunedin - FPLOS not determined) | | | 28.10 | | 28.73 | | 29.91 | |
| N1920 | (City of Dunedin - FPLOS not determined) | | | 30.71 | | 31.09 | | 31.72 | |
| N1930 | (City of Dunedin - FPLOS not determined) | | | 31.34 | | 32.81 | | 35.58 | |
| N1940 | (City of Dunedin - FPLOS not determined) | | | 33.14 | | 35.17 | | 38.45 | |
| N1950 | (City of Dunedin - FPLOS not determined) | | | 37.03 | | 39.57 | | 43.93 | |
| N1960 | (City of Dunedin - FPLOS not determined) | | | 50.58 | | 50.77 | | 50.77 | |
| N1970 | (City of Dunedin - FPLOS not determined) | | | 52.94 | | 53.52 | | 54.89 | |
| N1980 | (City of Dunedin - FPLOS not determined) | | | 52.81 | | 53.12 | | 54.16 | |
| N1990 | (City of Dunedin - FPLOS not determined) | | | 51.70 | | 52.20 | | 53.42 | |

Table D.1 Existing Conditions Street Flooding Level of Service Evaluation

0.51 = FPLOS Deficiency

| Node ID | Node Location | Roadway Classification | Lowest Road Elev. | Flood Elev. 10-yr, 24-hr | Depth of Flooding (ft) | Flood Elev. 25-yr, 24-hr | Depth of Flooding (ft) | Flood Elev. 100-yr,24-hr | Depth of Flooding (ft) |
|---------|--|------------------------|-------------------|--------------------------|------------------------|--------------------------|------------------------|--------------------------|------------------------|
| N2000 | Hammond Branch, 625' W of Kings Highway | Residential | 6.5 | 6.83 | 0.33 | 7.64 | 1.14 | 8.95 | 2.45 |
| N2010 | Hammond Branch at Kings Highway | Collector | 9.8 | 9.26 | (0.00) | 10.55 | 0.75 | 12.26 | 2.46 |
| N2020 | Hammond Branch at Kings Highway | Collector | 9.8 | 10.58 | 0.78 | 10.94 | 1.14 | 12.27 | 2.47 |
| N2030 | Hammond Branch Pond E of Kings Highway | Residential | 15.1 | 16.22 | 1.12 | 16.72 | 1.62 | 16.94 | 1.84 |
| N2040 | Hammond Branch Pond W of Highland Ave | Residential | 19.0 | 18.92 | (0.00) | 19.18 | 0.18 | 19.66 | 0.66 |
| N2050 | Hammond Branch at Highland Avenue | Residential | 27.5 | 22.39 | (0.00) | 22.49 | (0.00) | 24.19 | (0.00) |
| N2060 | RR ditch at Flagler Drive and Carroll Street | Residential | 43.3 | 42.56 | (0.00) | 43.05 | (0.00) | 43.63 | 0.33 |
| N2070 | RR ditch at Flagler Drive and Gentry Street | Residential | 44.2 | 43.97 | (0.00) | 44.46 | 0.26 | 44.98 | 0.78 |
| N2080 | RR ditch at Flagler Drive and Crown Street | Residential | 46.7 | 46.78 | 0.08 | 47.11 | 0.41 | 47.42 | 0.72 |
| N2090 | RR ditch at Flagler Drive 200' N of Scott St | Residential | 48.4 | 48.85 | 0.45 | 49.07 | 0.67 | 49.33 | 0.93 |
| N2100 | RR ditch at Flagler Dr 250' W of Ridge Ave | Residential | 50.3 | 51.12 | 0.82 | 51.25 | 0.95 | 51.50 | 1.20 |
| N2110 | RR ditch at Flagler Dr 100' E of Lynn Ave | Residential | 55.3 | 53.45 | (0.00) | 53.60 | (0.00) | 53.90 | (0.00) |
| N2120 | RR ditch at Flagler Dr 80' W of Murry Ave | Residential | 60.1 | 58.04 | (0.00) | 58.27 | (0.00) | 58.72 | (0.00) |
| N2130 | RR ditch at Flagler Dr and Saturn Avenue | Residential | 63.3 | 61.22 | (0.00) | 61.45 | (0.00) | 61.87 | (0.00) |
| N2140 | RR ditch at Flagler Drive and Keene Road | Collector | 62.9 | 62.75 | (0.00) | 62.95 | 0.05 | 63.24 | 0.34 |
| N2150 | Keene Road ditch 200' N of Long Street | Residential | 65.3 | 67.41 | 2.11 | 68.09 | 2.79 | 69.16 | 3.86 |
| N2155 | Keene Road ditch 440' S of Long Street | Residential | 69.0 | 67.43 | (0.00) | 68.10 | (0.00) | 69.17 | 0.17 |
| N2160 | Keene Road ditch at Palmetto Street | Collector | 67.0 | 67.47 | 0.47 | 68.10 | 1.10 | 69.18 | 2.18 |
| N2170 | West pond in Clearwater Golf Park | (no street) | | 68.45 | | 68.62 | | 69.18 | |
| N2180 | Center pond in Clearwater Golf Park | (no street) | | 68.87 | | 69.18 | | 69.63 | |
| N2200 | Rollen Road and Parkwood Street | Residential | 13.8 | 14.71 | 0.91 | 15.61 | 1.81 | 16.00 | 2.20 |
| N2210 | Rollen Road and Terrace Road | Residential | 17.0 | 17.51 | 0.51 | 17.70 | 0.70 | 17.94 | 0.94 |
| N2220 | Kings Highway and Terrace Road | Collector | 19.9 | 20.38 | 0.48 | 20.52 | 0.62 | 20.74 | 0.84 |
| N2230 | Kings Highway and Admiral Woodson Lane | Collector | 15.5 | 16.23 | 0.73 | 16.48 | 0.98 | 16.88 | 1.38 |
| N2240 | Pond at Kings Highway and Hibiscus Street | Residential | 23.0 | 19.86 | (0.00) | 20.07 | (0.00) | 20.42 | (0.00) |
| N2242 | Palmetto Street and Palm Terrace Drive | Collector | 25.0 | 22.06 | (0.00) | 22.07 | (0.00) | 22.93 | (0.00) |
| N2244 | Palmetto Street and SCL Railroad | Collector | 30.0 | 26.41 | (0.00) | 26.41 | (0.00) | 26.43 | (0.00) |
| N2250 | Palmetto Street and SCL Railroad | Collector | 36.0 | 30.71 | (0.00) | 31.14 | (0.00) | 32.05 | (0.00) |
| N2260 | Detention Pond SW of Highland & Palmetto | Collector | 37.0 | 33.31 | (0.00) | 34.38 | (0.00) | 36.85 | (0.00) |
| N2270 | Highland Avenue and Palmetto Street | Collector | 37.5 | 33.73 | (0.00) | 34.92 | (0.00) | 37.25 | (0.00) |
| N2280 | Highland Avenue and Walnut Street | Collector | 42.0 | 41.86 | (0.00) | 42.46 | 0.46 | 43.24 | 1.24 |
| N2290 | Glenwood Avenue and Elmwood Street | Residential | 49.0 | 49.11 | 0.11 | 49.29 | 0.29 | 49.46 | 0.46 |

Table D.1 Existing Conditions Street Flooding Level of Service Evaluation

0.51 = FPLOS Deficiency

| Node ID | Node Location | Roadway Classification | Lowest Road Elev. | Flood Elev. 10-yr, 24-hr | Depth of Flooding (ft) | Flood Elev. 25-yr, 24-hr | Depth of Flooding (ft) | Flood Elev. 100-yr,24-hr | Depth of Flooding (ft) |
|---------|---|------------------------|-------------------|--------------------------|------------------------|--------------------------|------------------------|--------------------------|------------------------|
| N2300 | Park at Smallwood Circle and Rosemere Rd | Residential | 44.5 | 46.30 | 1.80 | 46.65 | 2.15 | 49.39 | 4.89 |
| N2310 | Park at Ridgewood Street and Wood Ave | Residential | 53.0 | 53.06 | 0.06 | 53.77 | 0.77 | 55.12 | 2.12 |
| N2320 | Ridgewood Street and Edgewood Avenue | Residential | 58.0 | 55.60 | (0.00) | 56.40 | (0.00) | 57.33 | (0.00) |
| N2330 | Drew Street at Edgewood Avenue | Collector | 66.0 | 58.86 | (0.00) | 59.44 | (0.00) | 60.59 | (0.00) |
| N2340 | Drew Street at Crest Avenue | Collector | 62.7 | 62.61 | (0.00) | 63.10 | 0.40 | 63.22 | 0.52 |
| N2345 | Highland Avenue and Palmetto Street | Collector | 36.6 | 36.81 | 0.21 | 36.93 | 0.33 | 37.13 | 0.53 |
| N2350 | Flagler Drive and Lavern Street | Residential | 39.0 | 39.78 | 0.78 | 40.03 | 1.03 | 40.43 | 1.43 |
| N2370 | Overlea Street, E of Carlos Avenue | Residential | 23.5 | 24.25 | 0.75 | 24.49 | 0.99 | 24.89 | 1.39 |
| N2380 | Highland Avenue and Fairmont Street | Collector | 27.3 | 27.83 | 0.53 | 28.05 | 0.75 | 28.33 | 1.03 |
| N2390 | Highland Avenue and Fairmont Street | Collector | 27.3 | 28.37 | 1.07 | 28.53 | 1.23 | 28.76 | 1.46 |
| N2400 | Highland Avenue and Sandy Lane | Collector | 32.5 | 33.35 | 0.85 | 33.47 | 0.97 | 33.68 | 1.18 |
| N2420 | Highland Avenue and Greenlea Drive | Collector | 34.9 | 35.36 | 0.46 | 35.44 | 0.54 | 35.55 | 0.65 |
| N2430 | Highland Avenue 200' N of Overlea Street | Collector | 26.8 | 27.38 | 0.58 | 27.51 | 0.71 | 27.64 | 0.84 |
| N2440 | Highland Avenue 200' N of Overlea Street | Collector | 26.8 | 27.40 | 0.60 | 27.53 | 0.73 | 27.66 | 0.86 |
| N2450 | SCL RR W of Gentry Street and Flagler Drive | Residential | 44.2 | 36.49 | (0.00) | 36.54 | (0.00) | 36.60 | (0.00) |
| N2460 | Linwood Drive and Sharondale Drive | Residential | 51.0 | 51.27 | 0.27 | 51.39 | 0.39 | 51.60 | 0.60 |
| N2470 | Nelson Avenue and Scott Street | Residential | 58.4 | 58.79 | 0.39 | 58.86 | 0.46 | 59.33 | 0.93 |
| N2480 | Lake Lucille | Residential | 59.0 | 60.37 | 1.37 | 60.55 | 1.55 | 61.09 | 2.09 |
| N2490 | Palmetto Street and Casloer Avenue | Collector | 66.4 | 66.49 | 0.09 | 66.94 | 0.54 | 67.12 | 0.72 |
| N2500 | Lake Hobart | Collector | 67.3 | 65.74 | (0.00) | 66.35 | (0.00) | 67.42 | 0.12 |
| N2510 | Saturn Avenue and Leo Lane | Residential | 63.4 | 64.67 | 1.27 | 64.75 | 1.35 | 64.89 | 1.49 |
| N2520 | Saturn Avenue and Sherwood Street | Residential | 63.2 | 64.67 | 1.47 | 64.75 | 1.55 | 64.88 | 1.68 |
| N2530 | Lake at St Andrews Cove Apartments | Residential | 69.4 | 67.22 | (0.00) | 67.78 | (0.00) | 68.92 | (0.00) |
| N2540 | Clearwater Air Park | Evacuation | 68.0 | 67.15 | (0.00) | 67.59 | (0.00) | 68.61 | 0.61 |
| N2545 | Clearwater Air Park | Evacuation | 68.0 | 61.40 | (0.00) | 61.40 | (0.00) | 61.40 | (0.00) |
| N2550 | Clearwater Air Park | Evacuation | 70.5 | 68.44 | (0.00) | 68.59 | (0.00) | 68.87 | (0.00) |
| N2560 | SE Pond in Clearwater Golf Park | (no street) | | 69.64 | | 69.72 | | 69.83 | |
| N2570 | City of Clearwater Public Service Complex | Residential | 64.3 | 63.76 | (0.00) | 64.03 | (0.00) | 64.47 | 0.17 |
| N2580 | City of Clearwater Public Service Complex | Residential | 66.0 | 66.07 | (0.00) | 66.24 | (0.00) | 66.71 | (0.00) |
| N3000 | Stevenson Creek gage, 170' N of Drew Street | Collector | 21.0 | 14.58 | (0.00) | 15.07 | (0.00) | 15.70 | (0.00) |
| N3010 | Stevenson Creek at Drew Street | Collector | 17.6 | 14.61 | (0.00) | 15.12 | (0.00) | 15.76 | (0.00) |
| N3020 | Stevenson Creek at Drew Street | Collector | 17.6 | 14.88 | (0.00) | 15.68 | (0.00) | 17.44 | (0.00) |

Table D.1 Existing Conditions Street Flooding Level of Service Evaluation

0.51 = FPLOS Deficiency

| Node ID | Node Location | Roadway Classification | Lowest Road Elev. | Flood Elev. 10-yr, 24-hr | Depth of Flooding (ft) | Flood Elev. 25-yr, 24-hr | Depth of Flooding (ft) | Flood Elev. 100-yr,24-hr | Depth of Flooding (ft) |
|---------|---|------------------------|-------------------|--------------------------|------------------------|--------------------------|------------------------|--------------------------|------------------------|
| N3030 | Stevenson Creek at Cleveland Street (SR 60) | Evacuation | 18.0 | 17.77 | (0.00) | 18.75 | 0.74 | 20.15 | 2.14 |
| N3040 | Stevenson Creek at Cleveland Street (SR 60) | Evacuation | 18.0 | 18.53 | 0.52 | 19.65 | 1.64 | 20.74 | 2.73 |
| N3050 | Stevenson Creek at Pierce Street | Residential | 17.2 | 18.77 | 1.57 | 19.69 | 2.49 | 20.83 | 3.63 |
| N3060 | Stevenson Creek at Pierce Street | Residential | 17.2 | 18.95 | 1.75 | 19.75 | 2.55 | 20.86 | 3.66 |
| N3070 | Stevenson Creek at Franklin Street | Residential | 17.8 | 18.99 | 1.19 | 19.79 | 1.99 | 20.92 | 3.12 |
| N3080 | Stevenson Creek at Franklin Street | Residential | 17.8 | 19.20 | 1.40 | 19.86 | 2.06 | 20.96 | 3.16 |
| N3090 | Stevenson Creek at Court Street (SR 595A) | Arterial | 22.0 | 19.24 | (0.00) | 19.89 | (0.00) | 20.98 | (0.00) |
| N3100 | Stevenson Creek at Court Street (SR 595A) | Arterial | 22.0 | 19.30 | (0.00) | 20.17 | (0.00) | 22.19 | 0.19 |
| N3110 | Stevenson Creek 605' S of Court Street | Residential | 19.0 | 20.77 | 1.77 | 21.52 | 2.52 | 22.89 | 3.89 |
| N3120 | Stevenson Creek at Druid Road | Collector | 21.8 | 21.15 | (0.00) | 21.82 | 0.02 | 23.05 | 1.25 |
| N3125 | Stevenson Creek at Druid Road | Collector | 21.8 | 21.46 | (0.00) | 22.26 | 0.46 | 23.58 | 1.78 |
| N3126 | Stevenson Creek Weir S of Druid Road | Residential | 21.5 | 21.95 | 0.45 | 22.82 | 1.32 | 24.23 | 2.73 |
| N3130 | Stevenson Creek 350' S of Druid (Linn Lake) | Residential | 21.5 | 22.17 | 0.67 | 23.08 | 1.58 | 24.53 | 3.03 |
| N3131 | Stevenson Creek 1030' S of Druid(Linn Lake) | Residential | 23.0 | 22.22 | (0.00) | 23.13 | 0.13 | 24.57 | 1.57 |
| N3132 | Stevenson Creek at Evergreen Avenue | Residential | 24.0 | 23.38 | (0.00) | 24.36 | 0.36 | 25.72 | 1.72 |
| N3134 | Stevenson Creek at Hillcrest N of Jeffords | Residential | 26.5 | 24.00 | (0.00) | 25.09 | (0.00) | 26.73 | 0.23 |
| N3135 | Pond in Golf Course S of Druid | Residential | 33.0 | 20.70 | (0.00) | 20.89 | (0.00) | 22.77 | (0.00) |
| N3140 | Druid Road and S. Betty Lane | Collector | 22.2 | 20.77 | (0.00) | 21.52 | (0.00) | 22.91 | 0.71 |
| N3150 | S. Betty Lane and Jasmine Way | Residential | 24.0 | 24.42 | 0.42 | 24.72 | 0.72 | 25.06 | 1.06 |
| N3160 | S. Betty Lane and Magnolia Drive | Residential | 26.0 | 26.55 | 0.55 | 26.74 | 0.74 | 26.99 | 0.99 |
| N3170 | S. Betty Lane and Lotus Path | Residential | 28.5 | 28.94 | 0.44 | 29.11 | 0.61 | 29.30 | 0.80 |
| N3180 | Jeffords Street and Byron Avenue | Residential | 25.5 | 25.61 | 0.11 | 25.88 | 0.38 | 26.10 | 0.60 |
| N3190 | Jeffords Street and S. Betty Lane | Residential | 33.0 | 33.14 | (0.00) | 33.34 | 0.34 | 33.52 | 0.52 |
| N3195 | Jeffords Street and Lincoln Avenue | Residential | 53.0 | 49.95 | (0.00) | 50.21 | (0.00) | 50.22 | (0.00) |
| N3200 | Plaza Pines Shopping Center | Residential | 57.0 | 52.21 | (0.00) | 52.23 | (0.00) | 52.85 | (0.00) |
| N3210 | Plaza Pines Shopping Center | Residential | 58.5 | 54.32 | (0.00) | 54.71 | (0.00) | 55.14 | (0.00) |
| N3220 | Plaza Pines Shopping Center Pond | Residential | 60.8 | 61.22 | 0.42 | 61.27 | 0.47 | 61.34 | 0.54 |
| N3450 | Lake Bellevue Branch at S. Betty Lane | Residential | 19.0 | 21.01 | 2.01 | 21.64 | 2.64 | 22.91 | 3.91 |
| N3500 | Lake Bellevue Branch at S. Lincoln Drive | Residential | 20.3 | 22.23 | 1.93 | 22.62 | 2.32 | 23.27 | 2.97 |
| N3510 | Lake Bellevue Branch at Missouri Avenue | Arterial | 23.0 | 24.36 | 1.36 | 24.64 | 1.64 | 25.68 | 2.68 |
| N3520 | Lake Bellevue Branch at Missouri Avenue | Arterial | 23.0 | 24.37 | 1.37 | 24.65 | 1.65 | 25.67 | 2.67 |
| N3530 | Lake Bellevue Branch Pond W of Missouri | Residential | 25.0 | 25.37 | 0.37 | 25.75 | 0.75 | 26.56 | 1.56 |

Table D.1 Existing Conditions Street Flooding Level of Service Evaluation

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|---------|---|------------------------|-------------------|--------------------------|------------------------|--------------------------|------------------------|--------------------------|------------------------|
| N3540 | Lake Bellevue Branch at Druid Road | Collector | 27.8 | 28.15 | 0.35 | 28.35 | 0.55 | 29.04 | 1.24 |
| N3550 | Stormwater Pond at Renaissance Sq. Villas | Residential | 31.0 | 30.09 | (0.00) | 31.21 | 0.21 | 32.02 | 1.02 |
| N3555 | Lake Bellevue Branch 400' S of Druid | Residential | 32.5 | 28.82 | (0.00) | 29.56 | (0.00) | 30.51 | (0.00) |
| N3560 | Lake Bellevue Branch W of Renaissance Sq | Residential | 36.0 | 30.23 | (0.00) | 32.93 | (0.00) | 34.03 | (0.00) |
| N3565 | Lk Bellevue Brnch at Lotus Path/ S Greenwd | Collector | 45.6 | 32.10 | (0.00) | 36.27 | (0.00) | 37.45 | (0.00) |
| N3570 | Lake Bellevue Branch S of Renaissance Sq | Residential | 37.5 | 33.90 | (0.00) | 38.77 | 1.27 | 39.81 | 2.31 |
| N3575 | Lk Bellevue Branch 150' S of Renaissance Sq | Residential | 36.0 | 36.54 | 0.54 | 38.77 | 2.77 | 39.81 | 3.81 |
| N3580 | Lake Bellevue Branch 250' N of Pinellas St | Residential | 38.0 | 38.44 | 0.44 | 39.01 | 1.01 | 39.88 | 1.88 |
| N3600 | Lake Bellevue Branch at Pinellas Street | Residential | 38.5 | 38.57 | 0.07 | 39.42 | 0.92 | 40.74 | 2.24 |
| N3650 | Lk Bellevue Brnch at Tuskawilla/ S Greenwd | Collector | 39.8 | 40.35 | 0.55 | 40.71 | 0.91 | 41.28 | 1.48 |
| N3670 | Lake Bellevue Branch at Tuskawilla Ave | Residential | 39.8 | 40.43 | 0.63 | 40.79 | 0.99 | 41.39 | 1.59 |
| N3680 | Lake Bellevue Branch 160' N of Lakeview | Residential | 42.5 | 41.85 | (0.00) | 42.11 | (0.00) | 42.57 | 0.07 |
| N3700 | Lake Bellevue Branch at Lakeview Road | Collector | 41.8 | 42.34 | 0.54 | 42.69 | 0.89 | 43.24 | 1.44 |
| N3710 | Lake Bellevue | Collector | 44.5 | 42.36 | (0.00) | 42.76 | (0.00) | 43.48 | (0.00) |
| N3720 | Lake Bellevue Branch at Woodlawn Ave | Residential | 48.8 | 44.80 | (0.00) | 46.03 | (0.00) | 47.90 | (0.00) |
| N3730 | Lake Bellevue Branch at Woodlawn Ave | Residential | 48.8 | 49.31 | 0.51 | 49.85 | 1.05 | 50.65 | 1.85 |
| N3740 | Lake Bellevue Branch at Howard Street | Residential | 51.8 | 50.90 | (0.00) | 50.90 | (0.00) | 52.27 | 0.47 |
| N3750 | Lake Bellevue Branch at Howard Street | Residential | 51.8 | 52.58 | 0.78 | 52.99 | 1.19 | 53.67 | 1.87 |
| N3760 | Lake Bellevue Branch at Belleair Road | Collector | 56.3 | 55.12 | (0.00) | 55.80 | (0.00) | 56.82 | 0.52 |
| N3780 | S. Greenwood Avenue at Hawkins Street | Collector | 61.5 | 61.95 | 0.45 | 62.19 | 0.69 | 62.55 | 1.05 |
| N3790 | Missouri Avenue FDOT Detention Pond | Arterial | 64.5 | 61.98 | (0.00) | 62.28 | (0.00) | 62.78 | (0.00) |
| N3800 | Wildwood Way and SCL Railroad | Residential | 44.0 | 44.35 | 0.35 | 44.96 | 0.96 | 45.74 | 1.74 |
| N3810 | Belleair Road and SCL Railroad | Collector | 56.3 | 56.86 | 0.56 | 57.34 | 1.04 | 58.02 | 1.72 |
| N4000 | Stevenson Creek at Jeffords Street | Residential | 24.5 | 24.96 | 0.46 | 26.57 | 2.07 | 28.24 | 3.74 |
| N4010 | Stevenson Creek at Browning Street | Residential | 28.6 | 29.30 | 0.70 | 29.59 | 0.99 | 29.94 | 1.34 |
| N4020 | Stevenson Creek at Browning Street | Residential | 28.6 | 30.41 | 1.81 | 30.70 | 2.10 | 31.24 | 2.64 |
| N4030 | Stevenson Creek at Lakeview Road | Collector | 33.8 | 30.94 | (0.00) | 31.50 | (0.00) | 32.72 | (0.00) |
| N4040 | Hillcrest Avenue S. of Lakeview Road | Residential | 31.0 | 31.54 | 0.54 | 32.44 | (0.00) | 34.13 | 3.13 |
| N4050 | Stevenson Creek 950' S of Lakeview Road | Residential | 33.5 | 32.84 | (0.00) | 33.80 | 0.30 | 35.13 | 1.63 |
| N4060 | Stevenson Creek at Bellevue Boulevard | Residential | 36.0 | 34.54 | (0.00) | 35.53 | (0.00) | 36.88 | 0.88 |
| N4062 | Stevenson Creek at Bellevue Boulevard | Residential | 36.0 | 36.26 | 0.26 | 36.93 | 0.93 | 37.85 | 1.85 |
| N4065 | Stevenson Creek at Bellevue Boulevard | Residential | 36.0 | 37.84 | 1.84 | 38.02 | 2.02 | 38.34 | 2.34 |

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|---------|--|------------------------|-------------------|--------------------------|------------------------|--------------------------|------------------------|--------------------------|------------------------|
| N4070 | Stevenson Creek 380' S of Bellevue Blvd. | (no street) | | 39.07 | | 39.43 | | 40.05 | |
| N4075 | Stevenson Creek at St Thomas Drive | Residential | 36.8 | 39.71 | 2.91 | 40.05 | 3.25 | 40.65 | 3.85 |
| N4080 | Stevenson Creek at St Thomas Drive | Residential | 36.8 | 39.74 | 2.94 | 40.10 | 3.30 | 40.73 | 3.93 |
| N4090 | Rice Lake | Collector | 41.8 | 39.82 | (0.00) | 40.21 | (0.00) | 40.94 | (0.00) |
| N4100 | Stevenson Creek at Belleair Boulevard | Collector | 41.8 | 40.59 | (0.00) | 41.49 | (0.00) | 42.49 | 0.69 |
| N4110 | Stevenson Creek at Southridge Drive | Residential | 40.9 | 40.82 | (0.00) | 41.68 | 0.78 | 42.72 | 1.82 |
| N4120 | Stevenson Creek at Southridge Drive | Residential | 40.9 | 41.47 | 0.57 | 41.76 | 0.86 | 42.72 | 1.82 |
| N4122 | Byron Drive 400' S of Emily Court | Residential | 34.3 | 35.50 | 1.20 | 35.94 | 1.64 | 36.65 | 2.35 |
| N4123 | Bellevue Boulevard at Boylan Avenue | Residential | 55.0 | 53.49 | (0.00) | 53.60 | (0.00) | 53.83 | (0.00) |
| N4125 | Missouri Avenue FDOT Detention Pond | Arterial | 65.0 | 59.83 | (0.00) | 60.46 | (0.00) | 61.64 | (0.00) |
| N4126 | Evergreen Avenue 400' S of Bellevue Blvd | Residential | 35.2 | 38.47 | 3.27 | 38.76 | 3.56 | 39.27 | 4.07 |
| N4128 | Pond adj. to Stevenson Creek S of Belleair | Residential | 47.7 | 39.04 | (0.00) | 39.40 | (0.00) | 40.00 | (0.00) |
| N4130 | Belleair Road 700' W of Highland Avenue | Collector | 44.5 | 44.88 | 0.38 | 45.01 | 0.51 | 45.17 | 0.67 |
| N4131 | Belleair Road 350' W of Highland Avenue | Collector | 44.9 | 45.57 | 0.67 | 45.69 | 0.79 | 45.87 | 0.97 |
| N4132 | Belleair Road and Highland Avenue | Collector | 46.6 | 46.83 | 0.23 | 46.90 | 0.30 | 47.03 | 0.43 |
| N4133 | Belleair Road and Highland Avenue | Collector | 46.6 | 47.05 | 0.45 | 47.11 | 0.51 | 47.32 | 0.72 |
| N4135 | Highland Avenue 280' N of Belleair Road | Collector | 53.3 | 47.65 | (0.00) | 48.24 | (0.00) | 53.43 | 0.13 |
| N4136 | Labelle Plaza South Detention Pond | Residential | 56.0 | 52.63 | (0.00) | 53.72 | (0.00) | 54.69 | (0.00) |
| N4137 | Labelle Plaza North Detention Pond | Residential | 60.0 | 54.62 | (0.00) | 55.20 | (0.00) | 56.45 | (0.00) |
| N4138 | Pond SE of Belleair Road and Clearview Ave | Residential | 45.5 | 45.76 | 0.26 | 46.58 | 1.08 | 47.66 | 2.16 |
| N4139 | Jeffords Street Branch at Hillcrest Avenue | Residential | 26.0 | 25.16 | (0.00) | 26.72 | 0.72 | 28.33 | 2.33 |
| N4140 | Jeffords Street Branch at Highland Avenue | Collector | 28.5 | 29.15 | 0.65 | 29.64 | 1.14 | 30.28 | 1.78 |
| N4150 | Jeffords Street Branch 650' E of Highland | Residential | 31.0 | 31.42 | 0.42 | 31.86 | 0.86 | 32.43 | 1.43 |
| N4160 | Jeffords Street Branch 600' W of Lake Ave | Residential | 31.0 | 31.42 | 0.42 | 31.84 | 0.84 | 32.42 | 1.42 |
| N4170 | Jeffords Street Branch at Lake Avenue | Collector | 31.3 | 31.41 | 0.11 | 31.82 | 0.52 | 32.52 | 1.22 |
| N4180 | Jeffords Street Branch at Lake Avenue | Collector | 31.3 | 31.35 | 0.05 | 31.88 | 0.58 | 32.57 | 1.27 |
| N4190 | Jeffords Street Branch 460' E of Lake Ave | (no street) | | 31.34 | | 31.89 | | 32.59 | |
| N4200 | Jeffords Street Branch 486' E of Lake Ave | Residential | 30.4 | 31.23 | 0.83 | 32.06 | 1.66 | 32.79 | 2.39 |
| N4205 | Jeffords Street 100' E of Tuscola Road | Residential | 30.0 | 31.60 | 1.60 | 32.28 | 2.28 | 32.97 | 2.97 |
| N4210 | Sonny Lake | Residential | 30.3 | 31.85 | 1.55 | 32.29 | 1.99 | 32.98 | 2.68 |
| N4220 | Lake Helen | Residential | 30.2 | 31.60 | 1.40 | 32.29 | 2.09 | 32.97 | 2.77 |
| N4230 | Woodcrest Avenue 450' S of Jeffords Street | Residential | 31.2 | 32.21 | 1.01 | 32.36 | 1.16 | 32.97 | 1.77 |

Table D.1 Existing Conditions Street Flooding Level of Service Evaluation

0.51 = FPLOS Deficiency

| Node ID | Node Location | Roadway Classification | Lowest Road Elev. | Flood Elev. 10-yr, 24-hr | Depth of Flooding (ft) | Flood Elev. 25-yr, 24-hr | Depth of Flooding (ft) | Flood Elev. 100-yr,24-hr | Depth of Flooding (ft) |
|---------|---|------------------------|-------------------|--------------------------|------------------------|--------------------------|------------------------|--------------------------|------------------------|
| N4240 | Ditch Terminus 220' E of Woodcrest Avenue | Residential | 44.0 | 33.68 | (0.00) | 34.04 | (0.00) | 34.74 | (0.00) |
| N4245 | Beginning of Lake Alpine Outfall Ditch | Residential | 36.0 | 33.68 | (0.00) | 34.04 | (0.00) | 34.74 | (0.00) |
| N4250 | Lake Alpine | Residential | 36.0 | 33.73 | (0.00) | 34.08 | (0.00) | 34.77 | (0.00) |
| N4260 | Keene Road and Beverly Circle | Arterial | 36.6 | 34.93 | (0.00) | 36.13 | (0.00) | 37.12 | 0.52 |
| N4280 | Pond SE of Keene Road and Beverly Circle | Residential | 36.7 | 34.66 | (0.00) | 35.08 | (0.00) | 35.80 | (0.00) |
| N4285 | West End of Budleigh Street at N-S Ditch | Residential | 34.5 | 34.92 | 0.42 | 35.07 | 0.57 | 35.48 | 0.98 |
| N4290 | West End of Magnolia Drive at N-S Ditch | Residential | 50.0 | 47.20 | (0.00) | 47.50 | (0.00) | 47.90 | (0.00) |
| N4300 | Druid Road and Skyview Avenue | Collector | 56.0 | 56.31 | 0.31 | 56.31 | 0.31 | 56.52 | 0.52 |
| N4310 | Turner Street and Skyview Avenue | Residential | 68.5 | 68.60 | 0.10 | 68.75 | 0.25 | 68.84 | 0.34 |
| N4320 | Gulf to Bay Boulevard and Skyview Avenue | Evacuation | 72.2 | 68.58 | (0.00) | 68.73 | (0.00) | 68.83 | (0.00) |
| N4360 | Crest Lake | Collector | 71.2 | 68.73 | (0.00) | 69.11 | (0.00) | 69.90 | (0.00) |
| N4370 | Tuscola Road and Barry Road | Residential | 28.0 | 31.32 | 3.32 | 32.10 | 4.10 | 32.86 | 4.86 |
| N4380 | Lake NE of Jeffords St and Keystone Ave | Residential | 31.3 | 31.60 | 0.30 | 32.29 | 0.99 | 32.97 | 1.67 |
| N4390 | Duncan Avenue 470' N of Jeffords Street | Residential | 32.5 | 32.66 | 0.16 | 32.96 | 0.46 | 33.60 | 1.10 |
| N4400 | Duncan Avenue at Magnolia Drive | Residential | 40.5 | 37.43 | (0.00) | 37.43 | (0.00) | 40.83 | 0.33 |
| N4410 | Duncan Avenue and Druid Road | Collector | 59.9 | 56.13 | (0.00) | 57.11 | (0.00) | 56.65 | (0.00) |
| N4420 | Duncan Avenue and Turner Street | Residential | 61.5 | 61.78 | 0.28 | 61.99 | 0.49 | 62.20 | 0.70 |
| N4422 | Duncan Avenue and Gulf-to-Bay Boulevard | Evacuation | 67.5 | 65.04 | (0.00) | 65.53 | (0.00) | 65.90 | (0.00) |
| N4424 | Duncan Avenue and Rainbow Drive | Residential | 70.0 | 70.19 | 0.19 | 70.31 | 0.31 | 70.47 | 0.47 |
| N4425 | Allens Creek Boundary Node | Residential | 68.0 | 68.00 | 0.00 | 68.00 | 0.00 | 68.00 | 0.00 |
| N4426 | Duncan Avenue and Cleveland Street | Collector | 69.0 | 69.61 | 0.61 | 69.69 | 0.69 | 69.83 | 0.83 |
| N4430 | Pond SW of Lakeview Rd and Duncan Ave | Collector | 35.4 | 32.24 | (0.00) | 33.60 | (0.00) | 36.03 | 0.63 |
| N4440 | Balmora Drive near Norwood Avenue | Residential | 34.0 | 34.87 | 0.87 | 35.55 | 1.55 | 36.09 | 2.09 |
| N4450 | Pond SE of Pinewood Dr and Norwood Ave | Residential | 34.0 | 32.91 | (0.00) | 33.78 | (0.00) | 35.44 | 1.44 |
| N4460 | Pond SE of Duncan Ave and Brentwood Dr | Residential | 33.0 | 31.85 | (0.00) | 32.30 | (0.00) | 32.98 | (0.00) |
| N4470 | Pond at Lake Avenue and Bamora Drive | Collector | 46.5 | 47.10 | 0.60 | 47.25 | 0.75 | 47.49 | 0.99 |
| N4480 | Brentwood Drive and Woodcrest Avenue | Residential | 36.0 | 34.30 | (0.00) | 36.31 | 0.31 | 36.54 | 0.54 |
| N4485 | Keene Road 540' N of Beverly Circle | Arterial | 42.7 | 35.86 | (0.00) | 37.21 | (0.00) | 38.21 | (0.00) |
| N4490 | Pond SW of Keene Rd and Magnolia Drive | Arterial | 42.7 | 40.95 | (0.00) | 41.57 | (0.00) | 42.66 | (0.00) |
| N4500 | Pond SE of Keene Road and Magnolia Drive | Arterial | 42.7 | 41.38 | (0.00) | 42.09 | (0.00) | 43.17 | 0.47 |
| N4510 | Pond NE of Keene Road and Magnolia Drive | Residential | 49.5 | 44.99 | (0.00) | 45.42 | (0.00) | 46.35 | (0.00) |

Table D.2 Existing Conditions Structure Flooding Level of Service Evaluation

0.51 = FPLOS Deficiency

| Map # | Address | # Grnd Flr Dwelling Units | Node ID | Finished Floor Elev. (ft,NGVD) | Flood Elev.(ft) 10-year | Depth of Flooding (feet) | Flood Elev.(ft) 25-year | Depth of Flooding (feet) | Flood Elev.(ft) 100-year | Depth of Flooding (feet) | Node Total Flood-prone Structures |
|-------|---|---------------------------|---------|--------------------------------|-------------------------|--------------------------|-------------------------|--------------------------|--------------------------|--------------------------|-----------------------------------|
| 1 | 1508 Stevenson Dr. | 1 | N0080 | 9.75 | 6.13 | -3.62 | 6.93 | -2.82 | 8.09 | -1.66 | 0 Structures |
| 2 | 1300 Betty Lane (Business) | 1 | N0090 | 7.26 | 6.26 | -1.00 | 7.01 | -0.25 | 8.15 | 0.89 | 5 Structures 5 Units |
| 2A | 1300 Block Betty Ln (FF estimated) | 1 | N0090 | 7.5 | 6.26 | -1.24 | 7.01 | -0.49 | 8.15 | 0.65 | |
| 2B | 1300 Block Betty Ln (FF estimated) | 1 | N0090 | 7.5 | 6.26 | -1.24 | 7.01 | -0.49 | 8.15 | 0.65 | |
| 2C | 1300 Block Betty Ln (FF estimated) | 1 | N0090 | 7.5 | 6.26 | -1.24 | 7.01 | -0.49 | 8.15 | 0.65 | |
| 2D | 1200 Block Betty Ln (FF estimated) | 1 | N0090 | 7.5 | 6.26 | -1.24 | 7.01 | -0.49 | 8.15 | 0.65 | |
| 3 | 1211 Betty Lane | 1 | N0100 | 8.33 | 6.80 | -1.53 | 7.61 | -0.72 | 8.92 | 0.59 | 17 Structures 17 Units |
| 3A | 1200 Block Betty Ln (FF estimated) | 1 | N0100 | 8.0 | 6.80 | -1.20 | 7.61 | -0.39 | 8.92 | 0.92 | |
| 3B | 1300 Block Betty Ln (FF estimated) | 1 | N0100 | 8.0 | 6.80 | -1.20 | 7.61 | -0.39 | 8.92 | 0.92 | |
| 3C | 1300 Block Overlea (FF estimated) | 1 | N0100 | 7.8 | 6.80 | -1.00 | 7.61 | -0.19 | 8.92 | 1.12 | |
| 3D | 1300 Block Overlea (FF estimated) | 1 | N0100 | 7.8 | 6.80 | -1.00 | 7.61 | -0.19 | 8.92 | 1.12 | |
| 3E | 1300 Block Overlea (FF estimated) | 1 | N0100 | 7.8 | 6.80 | -1.00 | 7.61 | -0.19 | 8.92 | 1.12 | |
| 3F | 1300 Block Overlea (FF estimated) | 1 | N0100 | 7.8 | 6.80 | -1.00 | 7.61 | -0.19 | 8.92 | 1.12 | |
| 3G | 1300 Block Overlea (FF estimated) | 1 | N0100 | 7.8 | 6.80 | -1.00 | 7.61 | -0.19 | 8.92 | 1.12 | |
| 3H | 1300 Block Overlea (FF estimated) | 1 | N0100 | 7.8 | 6.80 | -1.00 | 7.61 | -0.19 | 8.92 | 1.12 | |
| 3I | 1300 Block Overlea (FF estimated) | 1 | N0100 | 8.0 | 6.80 | -1.20 | 7.61 | -0.39 | 8.92 | 0.92 | |
| 3J | 1300 Block Overlea (FF estimated) | 1 | N0100 | 8.0 | 6.80 | -1.20 | 7.61 | -0.39 | 8.92 | 0.92 | |
| 3K | 1300 Block Overlea (FF estimated) | 1 | N0100 | 8.0 | 6.80 | -1.20 | 7.61 | -0.39 | 8.92 | 0.92 | |
| 3L | 1300 Block Springdale Str. (FF estimated) | 1 | N0100 | 8.7 | 6.80 | -1.90 | 7.61 | -1.09 | 8.92 | 0.22 | |
| 3M | Bethany C.M.E. Church on Sprindale (est.) | 1 | N0100 | 9.0 | 6.80 | -2.20 | 7.61 | -1.39 | 8.92 | -0.08 | |
| 3N | 1300 Block Overlea (FF estimated) | 1 | N0100 | 8.7 | 6.80 | -1.90 | 7.61 | -1.09 | 8.92 | 0.22 | |
| 3O | 1300 Block Overlea (FF estimated) | 1 | N0100 | 9 | 6.80 | -2.20 | 7.61 | -1.39 | 8.92 | -0.08 | |
| 3P | 1300 Block Overlea (FF estimated) | 1 | N0100 | 9 | 6.80 | -2.20 | 7.61 | -1.39 | 8.92 | -0.08 | |
| 3Q | 1300 Block Overlea (FF estimated) | 1 | N0100 | 9 | 6.80 | -2.20 | 7.61 | -1.39 | 8.92 | -0.08 | |
| 272 | 1321 Springdale St. | 1 | N0100 | 8.73 | 6.80 | -1.93 | 7.61 | -1.12 | 8.92 | 0.19 | |
| 273 | 1315 Betty Lane | 1 | N0100 | 7.12 | 6.80 | -0.32 | 7.61 | 0.49 | 8.92 | 1.80 | |
| 274 | 1317 Overea St. | 1 | N0100 | 7.80 | 6.80 | -1.00 | 7.61 | -0.19 | 8.92 | 1.12 | |
| 4 | 1020 Pine Brook Dr. | 1 | N0110 | 12.14 | 7.13 | -5.01 | 7.96 | -4.18 | 9.26 | -2.88 | |

Table D.2 Existing Conditions Structure Flooding Level of Service Evaluation

0.51 = FPLOS Deficiency

| Map # | Address | # Grnd Flr Dwelling Units | Node ID | Finished Floor Elev. (ft,NGVD) | Flood Elev.(ft) 10-year | Depth of Flooding (feet) | Flood Elev.(ft) 25-year | Depth of Flooding (feet) | Flood Elev.(ft) 100-year | Depth of Flooding (feet) | Node Total Flood-prone Structures |
|-------|---------------------------------------|---------------------------|---------|--------------------------------|-------------------------|--------------------------|-------------------------|--------------------------|--------------------------|--------------------------|-----------------------------------|
| 5 | 1201 Betty Lane | 1 | N0110 | 12.14 | 7.13 | -5.01 | 7.96 | -4.18 | 9.26 | -2.88 | 3 Structures |
| 4A | 1000 Block Pinebrook Dr. (Estimated) | 1 | N0110 | 9.6 | 7.13 | -2.47 | 7.96 | -1.64 | 9.26 | -0.34 | |
| 4B | 1000 Block Pinebrook Dr. (Estimated) | 1 | N0110 | 9.1 | 7.13 | -1.97 | 7.96 | -1.14 | 9.26 | 0.16 | |
| 4C | 1000 Block Pinebrook Dr. (Estimated) | 1 | N0110 | 9.1 | 7.13 | -1.97 | 7.96 | -1.14 | 9.26 | 0.16 | |
| 4D | 1000 Block Pinebrook Dr. (Estimated) | 1 | N0110 | 9.1 | 7.13 | -1.97 | 7.96 | -1.14 | 9.26 | 0.16 | |
| 275 | 1012 PineBrook Dr. | 1 | N0110 | 10.08 | 7.13 | -2.95 | 7.96 | -2.12 | 9.26 | -0.82 | 3 Units |
| 6 | 1324 Palmetto Street | 1 | N0120 | 9.41 | 7.52 | -1.89 | 8.34 | -1.07 | 9.55 | 0.14 | 2 Structures |
| 7 | 1312 Palmetto Street | 1 | N0120 | 9.24 | 7.52 | -1.72 | 8.34 | -0.90 | 9.55 | 0.31 | 2 Units |
| 8 | Clearwater C.C. utility bldg -W. bank | 1 | N0170 | 12.60 | 13.16 | 0.56 | 13.62 | 1.02 | 14.32 | 1.72 | 2 Structures |
| 9 | Clearwater C.C. utility bldg -E. bank | 1 | N0170 | 12.34 | 13.16 | 0.82 | 13.62 | 1.28 | 14.32 | 1.98 | 2 Units |
| 158 | 902 Palm Bluff St. | 1 | N0370 | 24.34 | 21.41 | -2.93 | 21.66 | -2.68 | 21.96 | -2.38 | 1 Structure 1 Unit |
| 159 | 904 Palm Bluff St. | 1 | N0370 | 23.52 | 21.41 | -2.11 | 21.66 | -1.86 | 21.96 | -1.56 | |
| 160 | 908 Palm Bluff St. | 1 | N0370 | 22.62 | 21.41 | -1.21 | 21.66 | -0.96 | 21.96 | -0.66 | |
| 161 | 1012 Pennsylvania Ave.Church | 1 | N0370 | 22.19 | 21.41 | -0.78 | 21.66 | -0.53 | 21.96 | -0.23 | |
| 162 | 910 Jurgens St. | 1 | N0370 | 24.30 | 21.41 | -2.89 | 21.66 | -2.64 | 21.96 | -2.34 | |
| 163 | 912 Jurgens St. | 1 | N0370 | 22.98 | 21.41 | -1.57 | 21.66 | -1.32 | 21.96 | -1.02 | |
| 164 | 913 Jurgens St. | 1 | N0370 | 23.47 | 21.41 | -2.06 | 21.66 | -1.81 | 21.96 | -1.51 | |
| 165 | 1010 Pennsylvania Ave. | 1 | N0370 | 22.93 | 21.41 | -1.52 | 21.66 | -1.27 | 21.96 | -0.97 | |
| 166 | 1008 Pennsylvania Ave. | 1 | N0370 | 21.85 | 21.41 | -0.44 | 21.66 | -0.19 | 21.96 | 0.11 | |
| 170 | 912 Palmetto St. | 1 | N0370 | 21.96 | 21.41 | -0.55 | 21.66 | -0.30 | 21.96 | 0.00 | |
| 172 | 920 Pennsylvania Ave. | 1 | N0370 | 22.38 | 21.41 | -0.97 | 21.66 | -0.72 | 21.96 | -0.42 | |
| 175 | 1396 Palmetto St. | 1 | N0440 | 19.94 | 19.69 | -0.25 | 20.12 | 0.18 | 20.68 | 0.74 | 1 Structure |
| 187 | 511 Washington Ave. | 1 | N0470 | 25.47 | 23.20 | -2.27 | 23.71 | -1.76 | 24.58 | -0.89 | 0 Structures |
| 179 | 506 N. Greenwood Ave. | 1 | N0480 | 24.85 | 23.52 | -1.33 | 23.93 | -0.92 | 24.69 | -0.16 | |
| 180 | 1003 Lee St. | 1 | N0480 | 25.55 | 23.52 | -2.03 | 23.93 | -1.62 | 24.69 | -0.86 | |
| 181 | 1027 Lee St. | 1 | N0480 | 25.74 | 23.52 | -2.22 | 23.93 | -1.81 | 24.69 | -1.05 | |
| 182 | 1004 Plaza St. | 1 | N0480 | 25.95 | 23.52 | -2.43 | 23.93 | -2.02 | 24.69 | -1.26 | |
| 183 | 1008 Plaza St. | 1 | N0480 | 26.13 | 23.52 | -2.61 | 23.93 | -2.20 | 24.69 | -1.44 | |

Table D.2 Existing Conditions Structure Flooding Level of Service Evaluation

0.51 = FPLOS Deficiency

| Map # | Address | # Grnd Flr Dwelling Units | Node ID | Finished Floor Elev. (ft,NGVD) | Flood Elev.(ft) 10-year | Depth of Flooding (feet) | Flood Elev.(ft) 25-year | Depth of Flooding (feet) | Flood Elev.(ft) 100-year | Depth of Flooding (feet) | Node Total Flood-prone Structures |
|-------|---------------------------|---------------------------|---------|--------------------------------|-------------------------|--------------------------|-------------------------|--------------------------|--------------------------|--------------------------|-----------------------------------|
| 184 | 1010 Plaza St. | 1 | N0480 | 26.22 | 23.52 | -2.70 | 23.93 | -2.29 | 24.69 | -1.53 | 1 Structure 1 Unit |
| 185 | 500 N. Greenwood Ave. | 1 | N0480 | 25.96 | 23.52 | -2.44 | 23.93 | -2.03 | 24.69 | -1.27 | |
| 186 | 512 N. Washington Ave. | 1 | N0480 | 24.64 | 23.52 | -1.12 | 23.93 | -0.71 | 24.69 | 0.05 | |
| 117 | Sunset Pt. Baptist Church | 1 | N0620 | 14.40 | 13.32 | -1.08 | 14.22 | -0.18 | 15.72 | 1.32 | 1 Structure |
| 101 | 1226 Idlewild Drive | 1 | N0910 | 23.10 | 20.79 | -2.31 | 21.32 | -1.78 | 21.88 | -1.22 | 4 Structures 4 Units |
| 102 | 1242 Idlewild Drive | 1 | N0910 | 22.38 | 20.79 | -1.59 | 21.32 | -1.06 | 21.88 | -0.50 | |
| 103 | 1246 Idlewild Drive | 1 | N0910 | 21.92 | 20.79 | -1.13 | 21.32 | -0.60 | 21.88 | -0.04 | |
| 104 | 1250 Idlewild Drive | 1 | N0910 | 21.54 | 20.79 | -0.75 | 21.32 | -0.22 | 21.88 | 0.34 | |
| 105 | 1254 Idlewild Drive | 1 | N0910 | 21.45 | 20.79 | -0.66 | 21.32 | -0.13 | 21.88 | 0.43 | |
| 106 | 1260 Idlewild Drive | 1 | N0910 | 22.63 | 20.79 | -1.84 | 21.32 | -1.31 | 21.88 | -0.75 | |
| 107 | 1266 Idlewild Drive | 1 | N0910 | 22.88 | 20.79 | -2.09 | 21.32 | -1.56 | 21.88 | -1.00 | |
| 108 | 1243 Idlewild Drive | 1 | N0910 | 22.94 | 20.79 | -2.15 | 21.32 | -1.62 | 21.88 | -1.06 | |
| 109 | 1245 Idlewild Drive | 1 | N0910 | 22.17 | 20.79 | -1.38 | 21.32 | -0.85 | 21.88 | -0.29 | |
| 110 | 1212 Woodlawn Terr. | 1 | N0910 | 20.23 | 20.79 | 0.56 | 21.32 | 1.09 | 21.88 | 1.65 | |
| 111 | 1232 Woodlawn Terr. | 1 | N0910 | 21.87 | 20.79 | -1.08 | 21.32 | -0.55 | 21.88 | 0.01 | |
| 112 | 1234 Woodlawn Terr. | 1 | N0910 | 22.58 | 20.79 | -1.79 | 21.32 | -1.26 | 21.88 | -0.70 | |
| 113 | 2000 Douglas Ave. | 1 | N0910 | 22.48 | 20.79 | -1.69 | 21.32 | -1.16 | 21.88 | -0.60 | |
| 114 | 1209 Woodlawn Terr. | 1 | N0910 | 22.26 | 20.79 | -1.47 | 21.32 | -0.94 | 21.88 | -0.38 | |
| 115 | 1213 Woodlawn Terr. | 1 | N0910 | 22.43 | 20.79 | -1.64 | 21.32 | -1.11 | 21.88 | -0.55 | |
| 116 | 1225 Woodlawn Terr. | 1 | N0910 | 22.01 | 20.79 | -1.22 | 21.32 | -0.69 | 21.88 | -0.13 | |
| 118 | 1400 Byram Drive | 1 | N1000 | 16.61 | 15.02 | -1.59 | 15.75 | -0.86 | 16.75 | 0.14 | |
| 119 | 1408 Byram Drive | 1 | N1000 | 16.72 | 15.02 | -1.70 | 15.75 | -0.97 | 16.75 | 0.03 | |
| 120 | 1422 Byram Drive | 1 | N1000 | 16.62 | 15.02 | -1.60 | 15.75 | -0.87 | 16.75 | 0.13 | |
| 121 | 1430 Byram Drive | 1 | N1000 | 16.66 | 15.02 | -1.64 | 15.75 | -0.91 | 16.75 | 0.09 | |
| 122 | 1436 Byram Drive | 1 | N1000 | 16.71 | 15.02 | -1.69 | 15.75 | -0.96 | 16.75 | 0.04 | |
| 123 | 1446 Byram Drive | 1 | N1000 | 16.82 | 15.02 | -1.80 | 15.75 | -1.07 | 16.75 | -0.07 | |
| 124 | 1450 Byram Drive | 1 | N1000 | 16.47 | 15.02 | -1.45 | 15.75 | -0.72 | 16.75 | 0.28 | |
| 125 | 1456 Byram Drive | 1 | N1000 | 16.85 | 15.02 | -1.83 | 15.75 | -1.10 | 16.75 | -0.10 | |

Table D.2 Existing Conditions Structure Flooding Level of Service Evaluation

0.51 = FPLOS Deficiency

| Map # | Address | # Grnd Flr Dwelling Units | Node ID | Finished Floor Elev. (ft,NGVD) | Flood Elev.(ft) 10-year | Depth of Flooding (feet) | Flood Elev.(ft) 25-year | Depth of Flooding (feet) | Flood Elev.(ft) 100-year | Depth of Flooding (feet) | Node Total Flood-prone Structures |
|-------|----------------------|---------------------------|---------|--------------------------------|-------------------------|--------------------------|-------------------------|--------------------------|--------------------------|--------------------------|-----------------------------------|
| 126 | 1458 Byram Drive | 1 | N1000 | 14.91 | 15.02 | 0.11 | 15.75 | 0.84 | 16.75 | 1.84 | |
| 127 | 1460 Byram Drive | 1 | N1000 | 13.99 | 15.02 | 1.03 | 15.75 | 1.76 | 16.75 | 2.76 | |
| 128 | 1462 Byram Drive | 1 | N1000 | 15.73 | 15.02 | -0.71 | 15.75 | 0.02 | 16.75 | 1.02 | |
| 129 | 1466 Byram Drive | 1 | N1000 | 16.10 | 15.02 | -1.08 | 15.75 | -0.35 | 16.75 | 0.65 | |
| 130 | 1468 Byram Drive | 1 | N1000 | 16.04 | 15.02 | -1.02 | 15.75 | -0.29 | 16.75 | 0.71 | |
| 131 | 1472 Byram Drive | 1 | N1000 | 16.30 | 15.02 | -1.28 | 15.75 | -0.55 | 16.75 | 0.45 | |
| 132 | 1476 Byram Drive | 1 | N1000 | 17.01 | 15.02 | -1.99 | 15.75 | -1.26 | 16.75 | -0.26 | |
| 133 | 1482 Byram Drive | 1 | N1000 | 18.13 | 15.02 | -3.11 | 15.75 | -2.38 | 16.75 | -1.38 | |
| 134 | 1492 Byram Drive | 1 | N1000 | 18.04 | 15.02 | -3.02 | 15.75 | -2.29 | 16.75 | -1.29 | |
| 135 | 1447 Byram Drive | 1 | N1000 | 17.08 | 15.02 | -2.06 | 15.75 | -1.33 | 16.75 | -0.33 | |
| 136 | 1457 Byram Drive | 1 | N1000 | 17.01 | 15.02 | -1.99 | 15.75 | -1.26 | 16.75 | -0.26 | |
| 137 | 1461 Byram Drive | 1 | N1000 | 16.28 | 15.02 | -1.26 | 15.75 | -0.53 | 16.75 | 0.47 | |
| 138 | 1463 Byram Drive | 1 | N1000 | 15.91 | 15.02 | -0.89 | 15.75 | -0.16 | 16.75 | 0.84 | |
| 139 | 1465 Byram Drive | 1 | N1000 | 16.07 | 15.02 | -1.05 | 15.75 | -0.32 | 16.75 | 0.68 | |
| 140 | 1467 Byram Drive | 1 | N1000 | 17.06 | 15.02 | -2.04 | 15.75 | -1.31 | 16.75 | -0.31 | |
| 141 | 1471 Byram Drive | 1 | N1000 | 17.43 | 15.02 | -2.41 | 15.75 | -1.68 | 16.75 | -0.68 | |
| 142 | 1944 Flora Rd. | 1 | N1000 | 16.58 | 15.02 | -1.56 | 15.75 | -0.83 | 16.75 | 0.17 | |
| 143 | 1950 Flora Rd. | 1 | N1000 | 16.68 | 15.02 | -1.66 | 15.75 | -0.93 | 16.75 | 0.07 | |
| 144 | 1464 Flora Rd. | 1 | N1000 | 16.52 | 15.02 | -1.50 | 15.75 | -0.77 | 16.75 | 0.23 | |
| 145 | 1466 Flora Rd. | 1 | N1000 | 16.20 | 15.02 | -1.18 | 15.75 | -0.45 | 16.75 | 0.55 | |
| 146 | 1468 Flora Rd. | 1 | N1000 | 16.38 | 15.02 | -1.36 | 15.75 | -0.63 | 16.75 | 0.37 | 20 Structures |
| 147 | 1467 Flora Rd. | 1 | N1000 | 16.91 | 15.02 | -1.89 | 15.75 | -1.16 | 16.75 | -0.16 | 20 Units |
| 151 | 1556 Huntington Lane | 1 | N1370 | 25.19 | 25.27 | 0.08 | 25.68 | 0.49 | 26.52 | 1.33 | |
| 152 | 1549 Huntington Lane | 1 | N1370 | 24.64 | 25.27 | 0.63 | 25.68 | 1.04 | 26.52 | 1.88 | 3 Structures |
| 153 | 1555 Huntington Lane | 1 | N1370 | 25.08 | 25.27 | 0.19 | 25.68 | 0.60 | 26.52 | 1.44 | 3 Units |
| 148 | 1949 Highland Ave. | 1 | N1440 | 17.60 | 17.57 | -0.03 | 17.94 | 0.34 | 18.43 | 0.83 | |
| 149 | 1943 Highland Ave. | 1 | N1440 | 17.39 | 17.57 | 0.18 | 17.94 | 0.55 | 18.43 | 1.04 | 3 Structures |
| 150 | 1937 Highland Ave. | 1 | N1440 | 16.39 | 17.57 | 1.18 | 17.94 | 1.55 | 18.43 | 2.04 | 3 Units |

Table D.2 Existing Conditions Structure Flooding Level of Service Evaluation

0.51 = FPLOS Deficiency

| Map # | Address | # Grnd Flr Dwelling Units | Node ID | Finished Floor Elev. (ft,NGVD) | Flood Elev.(ft) 10-year | Depth of Flooding (feet) | Flood Elev.(ft) 25-year | Depth of Flooding (feet) | Flood Elev.(ft) 100-year | Depth of Flooding (feet) | Node Total Flood-prone Structures |
|-------|--------------------------------------|---------------------------|---------|--------------------------------|-------------------------|--------------------------|-------------------------|--------------------------|--------------------------|--------------------------|-----------------------------------|
| 154 | 1550 Souvenir Drive | 1 | N1500 | 26.59 | 26.64 | 0.05 | 27.22 | 0.63 | 27.87 | 1.28 | 1 Structure |
| 173 | 1402 N. Hibiscus St. | 1 | N2240 | 19.95 | 19.86 | -0.09 | 20.07 | 0.12 | 20.42 | 0.47 | 1 Structure |
| 174 | 1410 N. Hibiscus St. | 1 | N2240 | 20.84 | 19.86 | -0.98 | 20.07 | -0.77 | 20.42 | -0.42 | 1 Unit |
| 176 | 1536 Smallwood Circle | 1 | N2300 | 48.43 | 46.30 | -2.13 | 46.65 | -1.78 | 49.39 | 0.96 | 2 Structures |
| 177 | 1544 Smallwood Circle | 1 | N2300 | 48.99 | 46.30 | -2.69 | 46.65 | -2.34 | 49.39 | 0.40 | 2 Units |
| 178 | 1550 Ridgewood St. | 1 | N2310 | 55.72 | 53.06 | -2.66 | 53.77 | -1.95 | 55.12 | -0.60 | 0 Structures |
| 155 | 1585 Linwood Drive | 1 | N2460 | 48.69 | 51.27 | 2.58 | 51.39 | 2.70 | 51.60 | 2.91 | 3 Structures 3 Units |
| 156 | 1591 Linwood Drive | 1 | N2460 | 48.28 | 51.27 | 2.99 | 51.39 | 3.11 | 51.60 | 3.32 | |
| 157 | 1593 Linwood Drive | 1 | N2460 | 49.02 | 51.27 | 2.25 | 51.39 | 2.37 | 51.60 | 2.58 | |
| 10 | 1329 Drew Street | 1 | N3020 | 19.59 | 14.88 | -4.71 | 15.68 | -3.91 | 17.44 | -2.15 | 1 Structure 1 Unit |
| 11 | 1345 Drew Street | 1 | N3020 | 18.11 | 14.88 | -3.23 | 15.68 | -2.43 | 17.44 | -0.67 | |
| 12 | 111 Lady Mary Drive | 1 | N3020 | 17.12 | 14.88 | -2.24 | 15.68 | -1.44 | 17.44 | 0.32 | |
| 13 | 106A Evergreen Avenue | 1 | N3020 | 18.08 | 14.88 | -3.20 | 15.68 | -2.40 | 17.44 | -0.64 | |
| 14 | 105&107 Lady Mary Drive | 2 | N3020 | 18.44 | 14.88 | -3.56 | 15.68 | -2.76 | 17.44 | -1.00 | |
| 15 | 1330 Cleveland St (Office Building) | 2 | N3030 | 19.72 | 17.77 | -1.95 | 18.75 | -0.97 | 20.15 | 0.43 | 4 Structures 6 Units |
| 15A | 11 Lady Mary Dr (Office Building) | 2 | N3030 | 19.72 | 17.77 | -1.95 | 18.75 | -0.97 | 20.15 | 0.43 | |
| 15B | 1300 Blk Cleveland St (Map #19?) | 1 | N3030 | 18.31 | 17.77 | -0.54 | 18.75 | 0.44 | 20.15 | 1.84 | |
| 15C | 1300 Blk Cleveland St (FF estimated) | 1 | N3030 | 19.5 | 17.77 | -1.73 | 18.75 | -0.75 | 20.15 | 0.65 | |
| 16 | 1343 Cleveland Street | 1 | N3040 | 20.04 | 18.53 | -1.51 | 19.65 | -0.39 | 20.74 | 0.70 | 2 Structures |
| 17 | 1331 Cleveland Street | 1 | N3040 | 20.01 | 18.53 | -1.48 | 19.65 | -0.36 | 20.74 | 0.73 | 2 Units |
| 18 | 1345 Park Street | 1 | N3050 | 21.93 | 18.77 | -3.16 | 19.69 | -2.24 | 20.83 | -1.10 | 4 Structures 6 Units |
| 20 | 1338 Pierce Street (Business) | 3 | N3050 | 19.16 | 18.77 | -0.39 | 19.69 | 0.53 | 20.83 | 1.67 | |
| 188 | 1318 Pierce St. | 1 | N3050 | 20.00 | 18.77 | -1.23 | 19.69 | -0.31 | 20.83 | 0.83 | |
| 189 | 1320 Pierce St. | 1 | N3050 | 18.87 | 18.77 | -0.10 | 19.69 | 0.82 | 20.83 | 1.96 | |
| 190 | 1326 Pierce St. | 1 | N3050 | 18.57 | 18.77 | 0.20 | 19.69 | 1.12 | 20.83 | 2.26 | |
| 191 | 1313 Pierce St. | 1 | N3060 | 21.00 | 18.95 | -2.05 | 19.75 | -1.25 | 20.86 | -0.14 | 0 Structures |
| 21 | 215 Waverly Way | 2 | N3070 | 19.95 | 18.99 | -0.96 | 19.79 | -0.16 | 20.92 | 0.97 | 0.51 = FPLOS Deficiency |
| 22 | 221 Waverly Way | 2 | N3070 | 19.28 | 18.99 | -0.29 | 19.79 | 0.51 | 20.92 | 1.64 | |

Table D.2 Existing Conditions Structure Flooding Level of Service Evaluation

0.51 = FPLOS Deficiency

| Map # | Address | # Grnd Flr Dwelling Units | Node ID | Finished Floor Elev. (ft,NGVD) | Flood Elev.(ft) 10-year | Depth of Flooding (feet) | Flood Elev.(ft) 25-year | Depth of Flooding (feet) | Flood Elev.(ft) 100-year | Depth of Flooding (feet) | Node Total Flood-prone Structures |
|-------|---------------------------------------|---------------------------|---------|--------------------------------|-------------------------|--------------------------|-------------------------|--------------------------|--------------------------|--------------------------|-----------------------------------|
| 23 | 227 Waverly Way | 1 | N3070 | 19.5 | 18.99 | -0.51 | 19.79 | 0.29 | 20.92 | 1.42 | 4 Structures |
| 24 | 229 Waverly Way | 1 | N3070 | 19.5 | 18.99 | -0.51 | 19.79 | 0.29 | 20.92 | 1.42 | |
| 276 | 1305 Franklin St. (Office Bldg.) | 1 | N3080 | 20.72 | 19.20 | -1.52 | 19.86 | -0.86 | 20.96 | 0.24 | 1 Unit |
| 25 | 311 S. Betty Lane (Bldg. 1) | 4 | N3090 | 21.03 | 19.20 | -1.83 | 19.86 | -1.17 | 20.96 | -0.07 | 2 Structures 10 Units |
| 26 | 1290 Court Street (Business) | 1 | N3090 | 22.43 | 19.24 | -3.19 | 19.89 | -2.54 | 20.98 | -1.45 | |
| 277 | 311 S. Betty Lane (Bldg. 2) | 15 | N3090 | 21.32 | 19.24 | -2.08 | 19.89 | -1.43 | 20.98 | -0.34 | |
| 278 | 1295 Santa Rosa Dr. Apt.# 1-5 | 5 | N3090 | 20.51 | 19.24 | -1.27 | 19.89 | -0.62 | 20.98 | 0.47 | |
| 279 | 1295 Santa Rosa Dr. Apt.# 11-15 | 5 | N3090 | 20.51 | 19.24 | -1.27 | 19.89 | -0.62 | 20.98 | 0.47 | |
| 27 | 514 Betty Lane | 1 | N3100 | 22.19 | 19.30 | -2.89 | 20.17 | -2.02 | 22.19 | 0.00 | |
| 30 | 600 Betty Lane | 1 | N3110 | 20.49 | 20.77 | 0.28 | 21.52 | 1.03 | 22.89 | 2.40 | 18 Structures |
| 31 | 606 Betty Lane | 1 | N3110 | 20.35 | 20.77 | 0.42 | 21.52 | 1.17 | 22.89 | 2.54 | |
| 32 | 610 Betty Lane | 1 | N3110 | 21.33 | 20.77 | -0.56 | 21.52 | 0.19 | 22.89 | 1.56 | |
| 33 | 616 Betty Lane | 1 | N3110 | 21.25 | 20.77 | -0.48 | 21.52 | 0.27 | 22.89 | 1.64 | |
| 34 | 620 Betty Lane | 1 | N3110 | 21.83 | 20.77 | -1.06 | 21.52 | -0.31 | 22.89 | 1.06 | |
| 35 | 622 Betty Lane | 1 | N3110 | 21.82 | 20.77 | -1.05 | 21.52 | -0.30 | 22.89 | 1.07 | |
| 192 | 1245 Rogers St. (Office Building) | 2 | N3110 | 23.44 | 20.77 | -2.67 | 21.52 | -1.92 | 22.89 | -0.55 | |
| 193 | 1266 Turner St. (Office Building) | 3 | N3110 | 21.60 | 20.77 | -0.83 | 21.52 | -0.08 | 22.89 | 1.29 | |
| 194 | 1270 Turner St. (Nursing Home) | 20 | N3110 | 21.58 | 20.77 | -0.81 | 21.52 | -0.06 | 22.89 | 1.31 | |
| 201 | 601 S. Lincoln Ave. (Office Building) | 1 | N3110 | 21.87 | 20.77 | -1.10 | 21.52 | -0.35 | 22.89 | 1.02 | |
| 202 | 1241 Turner St. | 1 | N3110 | 21.61 | 20.77 | -0.84 | 21.52 | -0.09 | 22.89 | 1.28 | |
| 203 | 1253 Turner St. | 5 | N3110 | 21.17 | 20.77 | -0.40 | 21.52 | 0.35 | 22.89 | 1.72 | |
| 204 | 1265 Turner St. | 3 | N3110 | 21.01 | 20.77 | -0.24 | 21.52 | 0.51 | 22.89 | 1.88 | |
| 205 | 610 Sally Lane | 6 | N3110 | 22.60 | 20.77 | -1.83 | 21.52 | -1.08 | 22.89 | 0.29 | |
| 206 | 612 Sally Lane - Apt. Building | 3 | N3110 | 22.44 | 20.77 | -1.67 | 21.52 | -0.92 | 22.89 | 0.45 | |
| 207 | same as above | 3 | N3110 | 22.44 | 20.77 | -1.67 | 21.52 | -0.92 | 22.89 | 0.45 | |
| 208 | 622 Sally Lane | 2 | N3110 | 23.04 | 20.77 | -2.27 | 21.52 | -1.52 | 22.89 | -0.15 | |
| 209 | 605 Sally Lane | 2 | N3110 | 21.38 | 20.77 | -0.61 | 21.52 | 0.14 | 22.89 | 1.51 | |
| 211 | 619 Sally Lane | 3 | N3110 | 21.73 | 20.77 | -0.96 | 21.52 | -0.21 | 22.89 | 1.16 | |

Table D.2 Existing Conditions Structure Flooding Level of Service Evaluation

0.51 = FPLOS Deficiency

| Map # | Address | # Grnd Flr Dwelling Units | Node ID | Finished Floor Elev. (ft,NGVD) | Flood Elev.(ft) 10-year | Depth of Flooding (feet) | Flood Elev.(ft) 25-year | Depth of Flooding (feet) | Flood Elev.(ft) 100-year | Depth of Flooding (feet) | Node Total Flood-prone Structures | |
|-------|------------------------------------|---------------------------|---------|--------------------------------|-------------------------|--------------------------|-------------------------|--------------------------|--------------------------|--------------------------|-----------------------------------|--|
| 212 | 621 Sally Lane | 4 | N3110 | 22.17 | 20.77 | -1.40 | 21.52 | -0.65 | 22.89 | 0.72 | 60 Units | |
| 38A | 1301 Druid Rd (FF estimated) | 1 | N3126 | 24.50 | 21.95 | -2.55 | 22.82 | -1.68 | 24.23 | -0.27 | 2 Structures 2 Units | |
| 38B | 1311 Druid Rd (FF estimated) | 1 | N3126 | 23.50 | 21.95 | -1.55 | 22.82 | -0.68 | 24.23 | 0.73 | | |
| 38C | 800 Blk S Betty Ln (FF estimated) | 1 | N3126 | 25.50 | 21.95 | -3.55 | 22.82 | -2.68 | 24.23 | -1.27 | | |
| 38D | 800 Blk Mark Drive (FF estimated) | 1 | N3126 | 23.80 | 21.95 | -1.85 | 22.82 | -0.98 | 24.23 | 0.43 | | |
| 38 | 813 Betty Lane | 1 | N3130 | 26.42 | 22.17 | -4.25 | 23.08 | -3.34 | 24.53 | -1.89 | 8 Structures 8 Units | |
| 39 | 910 Mark Drive | 1 | N3130 | 23.78 | 22.17 | -1.61 | 23.08 | -0.70 | 24.53 | 0.75 | | |
| 40 | 913 S Betty Lane | 1 | N3130 | 27.34 | 22.17 | -5.17 | 23.08 | -4.26 | 24.53 | -2.81 | | |
| 38E | 800 Blk S Betty Ln (FF estimated) | 1 | N3130 | 25.80 | 22.17 | -3.63 | 23.08 | -2.72 | 24.53 | -1.27 | | |
| 38F | 800 Blk Mark Drive (FF estimated) | 1 | N3130 | 23.80 | 22.17 | -1.63 | 23.08 | -0.72 | 24.53 | 0.73 | | |
| 38G | 800 Blk S Betty Ln (FF estimated) | 1 | N3130 | 26.70 | 22.17 | -4.53 | 23.08 | -3.62 | 24.53 | -2.17 | | |
| 38H | 800 Blk S Betty Ln (FF estimated) | 1 | N3130 | 26.90 | 22.17 | -4.73 | 23.08 | -3.82 | 24.53 | -2.37 | | |
| 38I | 900 Blk S Betty Ln (FF estimated) | 1 | N3130 | 27.10 | 22.17 | -4.93 | 23.08 | -4.02 | 24.53 | -2.57 | | |
| 38J | 900 Blk S Betty Ln (FF estimated) | 1 | N3130 | 27.25 | 22.17 | -5.08 | 23.08 | -4.17 | 24.53 | -2.72 | | |
| 39A | 800 Blk Mark Drive (FF estimated) | 1 | N3130 | 23.80 | 22.17 | -1.63 | 23.08 | -0.72 | 24.53 | 0.73 | | |
| 39B | 800 Blk Mark Drive (FF estimated) | 1 | N3130 | 23.80 | 22.17 | -1.63 | 23.08 | -0.72 | 24.53 | 0.73 | | |
| 39C | 800 Blk Mark Drive (FF estimated) | 1 | N3130 | 23.80 | 22.17 | -1.63 | 23.08 | -0.72 | 24.53 | 0.73 | | |
| 39D | 900 Blk Mark Drive (FF estimated) | 1 | N3130 | 23.80 | 22.17 | -1.63 | 23.08 | -0.72 | 24.53 | 0.73 | | |
| 39E | 900 Blk Mark Drive (FF estimated) | 1 | N3130 | 23.90 | 22.17 | -1.73 | 23.08 | -0.82 | 24.53 | 0.63 | | |
| 39F | 900 Blk Mark Drive (FF estimated) | 1 | N3130 | 24.10 | 22.17 | -1.93 | 23.08 | -1.02 | 24.53 | 0.43 | | |
| 39G | 900 Blk Mark Drive (FF estimated) | 1 | N3130 | 24.60 | 22.17 | -2.43 | 23.08 | -1.52 | 24.53 | -0.07 | | |
| 39H | 900 Blk Mark Drive (FF estimated) | 1 | N3130 | 24.60 | 22.17 | -2.43 | 23.08 | -1.52 | 24.53 | -0.07 | | |
| 39I | 900 Blk Mark Drive (FF estimated) | 1 | N3130 | 24.60 | 22.17 | -2.43 | 23.08 | -1.52 | 24.53 | -0.07 | | |
| 41 | 1101 S Betty Lane | 1 | N3131 | 30.91 | 22.22 | -8.69 | 23.13 | -7.78 | 24.57 | -6.34 | | |
| 42 | 1020 Mark Drive | 1 | N3131 | 25.54 | 22.22 | -3.32 | 23.13 | -2.41 | 24.57 | -0.97 | | |
| 42A | 1000 Blk Mark Drive (FF estimated) | 1 | N3131 | 24.60 | 22.22 | -2.38 | 23.13 | -1.47 | 24.57 | -0.03 | | |
| 42B | 1000 Blk Mark Drive (FF estimated) | 1 | N3131 | 25.00 | 22.22 | -2.78 | 23.13 | -1.87 | 24.57 | -0.43 | | |
| 42C | 1000 Blk Mark Drive (FF estimated) | 1 | N3131 | 25.20 | 22.22 | -2.98 | 23.13 | -2.07 | 24.57 | -0.63 | | |

Table D.2 Existing Conditions Structure Flooding Level of Service Evaluation

0.51 = FPLOS Deficiency

| Map # | Address | # Grnd Flr Dwelling Units | Node ID | Finished Floor Elev. (ft,NGVD) | Flood Elev.(ft) 10-year | Depth of Flooding (feet) | Flood Elev.(ft) 25-year | Depth of Flooding (feet) | Flood Elev.(ft) 100-year | Depth of Flooding (feet) | Node Total Flood-prone Structures |
|-------|------------------------------------|---------------------------|---------|--------------------------------|-------------------------|--------------------------|-------------------------|--------------------------|--------------------------|--------------------------|-----------------------------------|
| 42D | 1000 Blk Mark Drive (FF estimated) | 1 | N3131 | 25.40 | 22.22 | -3.18 | 23.13 | -2.27 | 24.57 | -0.83 | 0 Structures 0 Units |
| 42E | 1000 Blk Mark Drive (FF estimated) | 1 | N3131 | 25.60 | 22.22 | -3.38 | 23.13 | -2.47 | 24.57 | -1.03 | |
| 42F | 1000 Blk Mark Drive (FF estimated) | 1 | N3131 | 25.60 | 22.22 | -3.38 | 23.13 | -2.47 | 24.57 | -1.03 | |
| 42G | 1000 Blk Mark Drive (FF estimated) | 1 | N3131 | 25.60 | 22.22 | -3.38 | 23.13 | -2.47 | 24.57 | -1.03 | |
| 42H | 1000 Blk Mark Drive (FF estimated) | 1 | N3131 | 25.60 | 22.22 | -3.38 | 23.13 | -2.47 | 24.57 | -1.03 | |
| 42I | 1000 Blk Mark Drive (FF estimated) | 1 | N3131 | 25.60 | 22.22 | -3.38 | 23.13 | -2.47 | 24.57 | -1.03 | |
| 42J | 1000 Blk Mark Drive (FF estimated) | 1 | N3132 | 25.60 | 23.38 | -2.22 | 24.36 | -1.24 | 25.72 | 0.12 | 3 Structures 3 Units |
| 42K | 1000 Blk Mark Drive (FF estimated) | 1 | N3132 | 25.60 | 23.38 | -2.22 | 24.36 | -1.24 | 25.72 | 0.12 | |
| 42L | 1000 Blk Mark Drive (FF estimated) | 1 | N3132 | 25.60 | 23.38 | -2.22 | 24.36 | -1.24 | 25.72 | 0.12 | |
| 198 | 603 S. Missouri Ave. | 1 | N3510 | 24.36 | 24.36 | 0.00 | 24.64 | 0.28 | 25.68 | 1.32 | 3 Structures 3 Units |
| 199 | 613 S. Missouri Ave. | 1 | N3510 | 23.87 | 24.36 | 0.49 | 24.64 | 0.77 | 25.68 | 1.81 | |
| 200 | 615 S. Missouri Ave. | 1 | N3510 | 25.21 | 24.36 | -0.85 | 24.64 | -0.57 | 25.68 | 0.47 | |
| 195 | 701 Madison Ave. S. | 1 | N3530 | 27.88 | 25.37 | -2.51 | 25.75 | -2.13 | 26.56 | -1.32 | 2 Structures 2 Units |
| 196 | 600 S. Missouri Ave. | 1 | N3530 | 26.16 | 25.37 | -0.79 | 25.75 | -0.41 | 26.56 | 0.40 | |
| 197 | 614 S. Missouri Ave. | 1 | N3530 | 25.79 | 25.37 | -0.42 | 25.75 | -0.04 | 26.56 | 0.77 | |
| 229 | 1122 Pinellas St. | 1 | N3600 | 39.65 | 38.57 | -1.08 | 39.42 | -0.23 | 40.74 | 1.09 | 4 Structures 4 Units |
| 230 | 1114 Pinellas St. | 1 | N3600 | 39.24 | 38.57 | -0.67 | 39.42 | 0.18 | 40.74 | 1.50 | |
| 231 | 1120 Pinellas St. | 1 | N3600 | 40.34 | 38.57 | -1.77 | 39.42 | -0.92 | 40.74 | 0.40 | |
| 233 | 1111 Pinellas St. | 1 | N3600 | 40.97 | 38.57 | -2.40 | 39.42 | -1.55 | 40.74 | -0.23 | |
| 234 | 1115 Pinellas St. | 1 | N3600 | 40.45 | 38.57 | -1.88 | 39.42 | -1.03 | 40.74 | 0.29 | |
| 232 | 1260 S. Greenwood Ave. | 1 | N3650 | 42.94 | 40.35 | -2.59 | 40.71 | -2.23 | 41.28 | -1.66 | |
| 235 | 1015 Tuskawilla St. | 1 | N3670 | 41.08 | 40.43 | -0.65 | 40.79 | -0.29 | 41.39 | 0.31 | 1 Structure 1 Unit |
| 236 | 1000 Lakeview Rd. | 1 | N3670 | 43.08 | 40.43 | -2.65 | 40.79 | -2.29 | 41.39 | -1.69 | |
| 237 | 1012 Lakeview Rd. | 1 | N3670 | 42.46 | 40.43 | -2.03 | 40.79 | -1.67 | 41.39 | -1.07 | |
| 238 | 1020 Lakeview Rd. | 1 | N3670 | 43.31 | 40.43 | -2.88 | 40.79 | -2.52 | 41.39 | -1.92 | |
| 239 | 931 Dempsey St. | 1 | N3710 | 45.54 | 42.36 | -3.18 | 42.76 | -2.78 | 43.48 | -2.06 | |
| 240 | 925 Dempsey St. | 1 | N3710 | 44.13 | 42.36 | -1.77 | 42.76 | -1.37 | 43.48 | -0.65 | |
| 241 | 915 Dempsey St. | 1 | N3710 | 44.37 | 42.36 | -2.01 | 42.76 | -1.61 | 43.48 | -0.89 | |

Table D.2 Existing Conditions Structure Flooding Level of Service Evaluation

0.51 = FPLOS Deficiency

| Map # | Address | # Grnd Flr Dwelling Units | Node ID | Finished Floor Elev. (ft,NGVD) | Flood Elev.(ft) 10-year | Depth of Flooding (feet) | Flood Elev.(ft) 25-year | Depth of Flooding (feet) | Flood Elev.(ft) 100-year | Depth of Flooding (feet) | Node Total Flood-prone Structures |
|-------|---------------------------------------|---------------------------|---------|--------------------------------|-------------------------|--------------------------|-------------------------|--------------------------|--------------------------|--------------------------|-----------------------------------|
| 242 | 909 Dempsey St. | 1 | N3710 | 44.05 | 42.36 | -1.69 | 42.76 | -1.29 | 43.48 | -0.57 | 0 Structures |
| 243 | 901 Dempsey St. | 1 | N3710 | 44.83 | 42.36 | -2.47 | 42.76 | -2.07 | 43.48 | -1.35 | 0 Units |
| 244 | 629 Belleview Blvd. | 1 | N3800 | 45.99 | 44.35 | -1.64 | 44.96 | -1.03 | 45.74 | -0.25 | 4 Structures 13 Units |
| 245 | 630 A, B, C, D Wildwood Way | 4 | N3800 | 44.92 | 44.35 | -0.57 | 44.96 | 0.04 | 45.74 | 0.82 | |
| 246 | 633-635 Wildwood Way | 3 | N3800 | 44.66 | 44.35 | -0.31 | 44.96 | 0.30 | 45.74 | 1.08 | |
| 247 | 629/627/625 Wildwood Way | 3 | N3800 | 44.01 | 44.35 | 0.34 | 44.96 | 0.95 | 45.74 | 1.73 | |
| 248 | 619-621 Wildwood Way | 3 | N3800 | 45.13 | 44.35 | -0.78 | 44.96 | -0.17 | 45.74 | 0.61 | |
| 249 | 616 Woodlawn St. | 1 | N3800 | 46.89 | 44.35 | -2.54 | 44.96 | -1.93 | 45.74 | -1.15 | |
| 250 | 618-620 Woodlawn St. | 3 | N3800 | 46.63 | 44.35 | -2.28 | 44.96 | -1.67 | 45.74 | -0.89 | |
| 251 | 622-624 Woodlawn St. | 3 | N3800 | 46.90 | 44.35 | -2.55 | 44.96 | -1.94 | 45.74 | -1.16 | |
| 252 | 626-628 Woodlawn St. | 3 | N3800 | 46.84 | 44.35 | -2.49 | 44.96 | -1.88 | 45.74 | -1.10 | |
| 253 | 638 Woodlawn St. | 1 | N3800 | 47.57 | 44.35 | -3.22 | 44.96 | -2.61 | 45.74 | -1.83 | |
| 45 | 1400 Jeffords Street | 1 | N4000 | 28.52 | 24.96 | -3.56 | 26.57 | -1.95 | 28.24 | -0.28 | |
| 46 | 1201 Hillcrest Avenue | 1 | N4000 | 27.12 | 24.96 | -2.16 | 26.57 | -0.55 | 28.24 | 1.12 | |
| 46A | 1400 Blk Jeffords St. (FF Estimated) | 1 | N4000 | 27.17 | 24.96 | -2.21 | 26.57 | -0.60 | 28.24 | 1.07 | |
| 46B | 1400 Blk Jeffords St. (FF Estimated) | 1 | N4000 | 27.22 | 24.96 | -2.26 | 26.57 | -0.65 | 28.24 | 1.02 | |
| 46C | 1400 Blk Jeffords St. (FF Estimated) | 1 | N4000 | 27.27 | 24.96 | -2.31 | 26.57 | -0.70 | 28.24 | 0.97 | |
| 46D | 1400 Blk Jeffords St. (FF Estimated) | 1 | N4000 | 27.32 | 24.96 | -2.36 | 26.57 | -0.75 | 28.24 | 0.92 | |
| 47A | 1370 Barry Ave. | 1 | N4000 | 28.4 | 24.96 | -3.44 | 26.57 | -1.83 | 28.24 | -0.16 | |
| 47B | 1371 Barry Ave. | 1 | N4000 | 28.57 | 24.96 | -3.61 | 26.57 | -2.00 | 28.24 | -0.33 | |
| 254 | NE Cor. S. Evergreen & Jeffords St. | 1 | N4000 | 27.32 | 24.96 | -2.36 | 26.57 | -0.75 | 28.24 | 0.92 | |
| 255 | 1351 Jeffords St. | 1 | N4000 | 27.07 | 24.96 | -2.11 | 26.57 | -0.50 | 28.24 | 1.17 | |
| 256 | 1355 Jeffords St. | 1 | N4000 | 27.24 | 24.96 | -2.28 | 26.57 | -0.67 | 28.24 | 1.00 | |
| 257 | 1359 Jeffords St. | 1 | N4000 | 26.93 | 24.96 | -1.97 | 26.57 | -0.36 | 28.24 | 1.31 | |
| 258 | 1363 Jeffords St. | 1 | N4000 | 27.30 | 24.96 | -2.34 | 26.57 | -0.73 | 28.24 | 0.94 | |
| 259 | 1367 Jeffords St. | 1 | N4000 | 27.35 | 24.96 | -2.39 | 26.57 | -0.78 | 28.24 | 0.89 | |
| 260 | 1371 Jeffords St. | 1 | N4000 | 27.68 | 24.96 | -2.72 | 26.57 | -1.11 | 28.24 | 0.56 | |
| 261 | 1375 Jeffords St. | 1 | N4000 | 27.61 | 24.96 | -2.65 | 26.57 | -1.04 | 28.24 | 0.63 | |

Table D.2 Existing Conditions Structure Flooding Level of Service Evaluation

0.51 = FPLOS Deficiency

| Map # | Address | # Grnd Flr Dwelling Units | Node ID | Finished Floor Elev. (ft,NGVD) | Flood Elev.(ft) 10-year | Depth of Flooding (feet) | Flood Elev.(ft) 25-year | Depth of Flooding (feet) | Flood Elev.(ft) 100-year | Depth of Flooding (feet) | Node Total Flood-prone Structures |
|-------|--|---------------------------|---------|--------------------------------|-------------------------|--------------------------|-------------------------|--------------------------|--------------------------|--------------------------|-----------------------------------|
| 262 | 1200 S. Hillcrest Ave. | 1 | N4000 | 27.86 | 24.96 | -2.90 | 26.57 | -1.29 | 28.24 | 0.38 | |
| 263 | 1374 Barry St. | 1 | N4000 | 28.60 | 24.96 | -3.64 | 26.57 | -2.03 | 28.24 | -0.36 | |
| 264 | 1210 S. Hillcrest Ave. | 1 | N4000 | 28.27 | 24.96 | -3.31 | 26.57 | -1.70 | 28.24 | -0.03 | |
| 265 | 1375 Barry St. | 1 | N4000 | 28.51 | 24.96 | -3.55 | 26.57 | -1.94 | 28.24 | -0.27 | |
| 266 | 1220 S. Hillcrest Ave. | 1 | N4000 | 28.58 | 24.96 | -3.62 | 26.57 | -2.01 | 28.24 | -0.34 | |
| 267 | 1374 Tuscola St. | 1 | N4000 | 28.59 | 24.96 | -3.63 | 26.57 | -2.02 | 28.24 | -0.35 | |
| 268 | 1230 S. Hillcrest Ave. | 1 | N4000 | 28.22 | 24.96 | -3.26 | 26.57 | -1.65 | 28.24 | 0.02 | |
| 269 | 1375 Tuscola St. | 1 | N4000 | 28.79 | 24.96 | -3.83 | 26.57 | -2.22 | 28.24 | -0.55 | |
| 270 | 1240 S. Hillcrest Ave. | 1 | N4000 | 28.55 | 24.96 | -3.59 | 26.57 | -1.98 | 28.24 | -0.31 | |
| 271 | 1392 Milton St. | 1 | N4000 | 28.85 | 24.96 | -3.89 | 26.57 | -2.28 | 28.24 | -0.61 | |
| 280 | 1246 S. Hillcrest Ave. | 1 | N4000 | 28.25 | 24.96 | -3.29 | 26.57 | -1.68 | 28.24 | -0.01 | |
| 286 | 1227 S. Hillcrest Ave. | 1 | N4000 | 27.20 | 24.96 | -2.24 | 26.57 | -0.63 | 28.24 | 1.04 | |
| 286A | 1200 Blk Hillcrest Ave (FF Estimated) | 1 | N4000 | 26.90 | 24.96 | -1.94 | 26.57 | -0.33 | 28.24 | 1.34 | |
| 286B | 1200 Blk Barry Ave. (FF Estimated) | 1 | N4000 | 26.20 | 24.96 | -1.24 | 26.57 | 0.37 | 28.24 | 2.04 | |
| 286C | 1200 Blk Forrest Hill Dr. (FF Estimated) | 1 | N4000 | 26.50 | 24.96 | -1.54 | 26.57 | 0.07 | 28.24 | 1.74 | |
| 286D | 1200 Blk Forrest Hill Dr. (FF Estimated) | 1 | N4000 | 27.10 | 24.96 | -2.14 | 26.57 | -0.53 | 28.24 | 1.14 | |
| 286E | 1200 Blk Forrest Hill Dr. (FF Estimated) | 1 | N4000 | 27.70 | 24.96 | -2.74 | 26.57 | -1.13 | 28.24 | 0.54 | |
| 286F | 1200 Blk Forrest Hill Dr. (FF Estimated) | 1 | N4000 | 28.30 | 24.96 | -3.34 | 26.57 | -1.73 | 28.24 | -0.06 | |
| 286G | 1200 Blk Forrest Hill Dr. (FF Estimated) | 1 | N4000 | 28.50 | 24.96 | -3.54 | 26.57 | -1.93 | 28.24 | -0.26 | |
| 286H | 1200 Blk Forrest Hill Dr. (FF Estimated) | 1 | N4000 | 28.70 | 24.96 | -3.74 | 26.57 | -2.13 | 28.24 | -0.46 | |
| 286I | 1200 Blk Forrest Hill Dr. (FF Estimated) | 1 | N4000 | 28.90 | 24.96 | -3.94 | 26.57 | -2.33 | 28.24 | -0.66 | |
| 286J | 1200 Blk Forrest Hill Dr. (FF Estimated) | 1 | N4000 | 29.10 | 24.96 | -4.14 | 26.57 | -2.53 | 28.24 | -0.86 | |
| 286K | 1000 Blk Hillcrest Ave (FF Estimated) | 1 | N4000 | 27.60 | 24.96 | -2.64 | 26.57 | -1.03 | 28.24 | 0.64 | |
| 287 | 1239 S. Hillcrest Ave. | 1 | N4000 | 28.49 | 24.96 | -3.53 | 26.57 | -1.92 | 28.24 | -0.25 | |
| 287A | 1200 Blk Hillcrest Ave (FF Estimated) | 1 | N4000 | 28.21 | 24.96 | -3.25 | 26.57 | -1.64 | 28.24 | 0.03 | |
| 287B | 1200 Blk Hillcrest Ave (FF Estimated) | 1 | N4000 | 28.60 | 24.96 | -3.64 | 26.57 | -2.03 | 28.24 | -0.36 | |
| 287C | 1200 Blk Hillcrest Ave (FF Estimated) | 1 | N4000 | 28.80 | 24.96 | -3.84 | 26.57 | -2.23 | 28.24 | -0.56 | |
| 289 | 1425 Jeffords St. | 1 | N4000 | 27.38 | 24.96 | -2.42 | 26.57 | -0.81 | 28.24 | 0.86 | |

Table D.2 Existing Conditions Structure Flooding Level of Service Evaluation

0.51 = FPLOS Deficiency

| Map # | Address | # Grnd Flr Dwelling Units | Node ID | Finished Floor Elev. (ft,NGVD) | Flood Elev.(ft) 10-year | Depth of Flooding (feet) | Flood Elev.(ft) 25-year | Depth of Flooding (feet) | Flood Elev.(ft) 100-year | Depth of Flooding (feet) | Node Total Flood-prone Structures |
|-------|---|---------------------------|---------|--------------------------------|-------------------------|--------------------------|-------------------------|--------------------------|--------------------------|--------------------------|-----------------------------------|
| 289A | 1400 Blk Jeffords St. (FF Estimated) | 1 | N4000 | 27.58 | 24.96 | -2.62 | 26.57 | -1.01 | 28.24 | 0.66 | |
| 289B | 1400 Blk Jeffords St. (FF Estimated) | 1 | N4000 | 27.78 | 24.96 | -2.82 | 26.57 | -1.21 | 28.24 | 0.46 | |
| 289C | 1400 Blk Jeffords St. (FF Estimated) | 1 | N4000 | 27.98 | 24.96 | -3.02 | 26.57 | -1.41 | 28.24 | 0.26 | |
| 289D | 1400 Blk Jeffords St. (FF Estimated) | 1 | N4000 | 28.18 | 24.96 | -3.22 | 26.57 | -1.61 | 28.24 | 0.06 | |
| 289E | 1400 Blk Jeffords St. (FF Estimated) | 1 | N4000 | 28.38 | 24.96 | -3.42 | 26.57 | -1.81 | 28.24 | -0.14 | |
| 290 | 1418 Barry St. | 1 | N4000 | 26.61 | 24.96 | -1.65 | 26.57 | -0.04 | 28.24 | 1.63 | |
| 290A | 1400 Blk Barry St. (FF Estimated) | 1 | N4000 | 26.60 | 24.96 | -1.64 | 26.57 | -0.03 | 28.24 | 1.64 | |
| 290B | 1400 Blk Barry St. (FF Estimated) | 1 | N4000 | 26.60 | 24.96 | -1.64 | 26.57 | -0.03 | 28.24 | 1.64 | |
| 290C | 1400 Blk Barry St. (FF Estimated) | 1 | N4000 | 26.60 | 24.96 | -1.64 | 26.57 | -0.03 | 28.24 | 1.64 | |
| 290D | 1400 Blk Barry St. (FF Estimated) | 1 | N4000 | 26.60 | 24.96 | -1.64 | 26.57 | -0.03 | 28.24 | 1.64 | |
| 291 | 1451 Jeffords St. | 1 | N4000 | 28.57 | 24.96 | -3.61 | 26.57 | -2.00 | 28.24 | -0.33 | |
| 291A | 1400 Blk Jeffords St. (FF Estimated) | 1 | N4000 | 28.53 | 24.96 | -3.57 | 26.57 | -1.96 | 28.24 | -0.29 | |
| 291B | 1400 Blk Jeffords St. (FF Estimated) | 1 | N4000 | 28.55 | 24.96 | -3.59 | 26.57 | -1.98 | 28.24 | -0.31 | |
| 291C | 1400 Blk Jeffords St. (FF Estimated) | 1 | N4000 | 28.57 | 24.96 | -3.61 | 26.57 | -2.00 | 28.24 | -0.33 | |
| 291D | 1400 Blk Jeffords St. (FF Estimated) | 1 | N4000 | 28.54 | 24.96 | -3.58 | 26.57 | -1.97 | 28.24 | -0.30 | |
| 292 | 1442 Barry St. | 1 | N4000 | 27.59 | 24.96 | -2.63 | 26.57 | -1.02 | 28.24 | 0.65 | |
| 292A | 1400 Blk Barry St. (FF Estimated) | 1 | N4000 | 27.90 | 24.96 | -2.94 | 26.57 | -1.33 | 28.24 | 0.34 | |
| 292B | 1400 Blk Barry St. (FF Estimated) | 1 | N4000 | 27.80 | 24.96 | -2.84 | 26.57 | -1.23 | 28.24 | 0.44 | |
| 292C | 1400 Blk Barry St. (FF Estimated) | 1 | N4000 | 27.39 | 24.96 | -2.43 | 26.57 | -0.82 | 28.24 | 0.85 | |
| 292D | 1400 Blk Barry St. (FF Estimated) | 1 | N4000 | 27.19 | 24.96 | -2.23 | 26.57 | -0.62 | 28.24 | 1.05 | |
| 292E | 1400 Blk Barry St. (FF Estimated) | 1 | N4000 | 27.01 | 24.96 | -2.05 | 26.57 | -0.44 | 28.24 | 1.23 | |
| 292F | 1400 Blk Barry St. (FF Estimated) | 1 | N4000 | 26.81 | 24.96 | -1.85 | 26.57 | -0.24 | 28.24 | 1.43 | |
| 293 | 1481 Jeffords St. | 1 | N4000 | 28.50 | 24.96 | -3.54 | 26.57 | -1.93 | 28.24 | -0.26 | |
| 293A | 1400 Blk Jeffords St. (FF Estimated) | 1 | N4000 | 28.58 | 24.96 | -3.62 | 26.57 | -2.01 | 28.24 | -0.34 | |
| 293B | 1200 Blk S. Highland Ave (FF Estimated) | 1 | N4000 | 28.64 | 24.96 | -3.68 | 26.57 | -2.07 | 28.24 | -0.40 | |
| 294 | 1468 Barry St. | 1 | N4000 | 28.64 | 24.96 | -3.68 | 26.57 | -2.07 | 28.24 | -0.40 | |
| 294A | 1400 Blk Barry St. (FF Estimated) | 1 | N4000 | 28.44 | 24.96 | -3.48 | 26.57 | -1.87 | 28.24 | -0.20 | |
| 294B | 1400 Blk Barry St. (FF Estimated) | 1 | N4000 | 28.24 | 24.96 | -3.28 | 26.57 | -1.67 | 28.24 | 0.00 | |

Table D.2 Existing Conditions Structure Flooding Level of Service Evaluation

0.51 = FPLOS Deficiency

| Map # | Address | # Grnd Flr Dwelling Units | Node ID | Finished Floor Elev. (ft,NGVD) | Flood Elev.(ft) 10-year | Depth of Flooding (feet) | Flood Elev.(ft) 25-year | Depth of Flooding (feet) | Flood Elev.(ft) 100-year | Depth of Flooding (feet) | Node Total Flood-prone Structures |
|-------|--|---------------------------|---------|--------------------------------|-------------------------|--------------------------|-------------------------|--------------------------|--------------------------|--------------------------|-----------------------------------|
| 294C | 1400 Blk Barry St. (FF Estimated) | 1 | N4000 | 28.04 | 24.96 | -3.08 | 26.57 | -1.47 | 28.24 | 0.20 | 41 Structures 41 Units |
| 295 | 1212 S. Highland Ave. | 1 | N4000 | 28.72 | 24.96 | -3.76 | 26.57 | -2.15 | 28.24 | -0.48 | |
| 295A | 1400 Blk Barry St. (FF Estimated) | 1 | N4000 | 28.70 | 24.96 | -3.74 | 26.57 | -2.13 | 28.24 | -0.46 | |
| 295B | 1400 Blk Barry St. (FF Estimated) | 1 | N4000 | 28.69 | 24.96 | -3.73 | 26.57 | -2.12 | 28.24 | -0.45 | |
| 295C | 1400 Blk Barry St. (FF Estimated) | 1 | N4000 | 28.67 | 24.96 | -3.71 | 26.57 | -2.10 | 28.24 | -0.43 | |
| 281 | 1393 Milton St. | 1 | N4010 | 28.86 | 29.30 | 0.44 | 29.59 | 0.73 | 29.94 | 1.08 | 5 Structures 5 Units |
| 282 | 1250 Hillcrest Ave. | 1 | N4010 | 28.70 | 29.30 | 0.60 | 29.59 | 0.89 | 29.94 | 1.24 | |
| 283 | 1260 Hillcrest Ave. | 1 | N4010 | 29.85 | 29.30 | -0.55 | 29.59 | -0.26 | 29.94 | 0.09 | |
| 288 | 1251 S. Hillcrest Ave. | 1 | N4010 | 28.94 | 29.30 | 0.36 | 29.59 | 0.65 | 29.94 | 1.00 | |
| 288A | 1200 Blk Hillcrest Ave (FF Estimated) | 1 | N4010 | 28.94 | 29.30 | 0.36 | 29.59 | 0.65 | 29.94 | 1.00 | |
| 284 | 1395 Browning St. | 1 | N4020 | 30.48 | 30.41 | -0.07 | 30.70 | 0.22 | 31.24 | 0.76 | 3 Structures 3 Units |
| 285 | 1397 Browning St. | 1 | N4020 | 30.37 | 30.41 | 0.04 | 30.70 | 0.33 | 31.24 | 0.87 | |
| 48 | 1397 Browning St. | 1 | N4020 | 30.51 | 30.41 | -0.10 | 30.70 | 0.19 | 31.24 | 0.73 | |
| 49 | 1388 Lakeview Rd. | 1 | N4030 | 31.74 | 30.94 | -0.8 | 31.50 | -0.24 | 32.72 | 0.98 | 1 Structure |
| 50 | 1322 Hillcrest Ave. | 1 | N4040 | 33.50 | 31.54 | -1.96 | 32.44 | -1.06 | 34.13 | 0.63 | 9 Structures 9 Units |
| 50A | 1300 Blk Hillcrest Ave. (FF estimated) | 1 | N4040 | 33.7 | 31.54 | -2.16 | 32.44 | -1.26 | 34.13 | 0.43 | |
| 50B | 1300 Blk Hillcrest Ave. (FF estimated) | 1 | N4040 | 33.6 | 31.54 | -2.06 | 32.44 | -1.16 | 34.13 | 0.53 | |
| 50C | 1300 Blk Hillcrest Ave. (FF estimated) | 1 | N4040 | 33.5 | 31.54 | -1.96 | 32.44 | -1.06 | 34.13 | 0.63 | |
| 50D | 1300 Blk Hillcrest Ave. (FF estimated) | 1 | N4040 | 33.6 | 31.54 | -2.06 | 32.44 | -1.16 | 34.13 | 0.53 | |
| 50E | 1300 Blk Hillcrest Ave. (FF estimated) | 1 | N4040 | 33.7 | 31.54 | -2.16 | 32.44 | -1.26 | 34.13 | 0.43 | |
| 373 | 1346 Hillcrest Ave. S. | 1 | N4040 | 34.11 | 31.54 | -2.57 | 32.44 | -1.67 | 34.13 | 0.02 | |
| 373A | 1300 Blk Hillcrest Ave. (FF estimated) | 1 | N4040 | 34.0 | 31.54 | -2.46 | 32.44 | -1.56 | 34.13 | 0.13 | |
| 373B | 1300 Blk Hillcrest Ave. (FF estimated) | 1 | N4040 | 33.8 | 31.54 | -2.26 | 32.44 | -1.36 | 34.13 | 0.33 | |
| 51 | 1357 Byron Dr. | 1 | N4050 | 36.88 | 32.84 | -4.04 | 33.80 | -3.08 | 35.13 | -1.75 | |
| 374 | 1380 Hillcrest Ave. S. | 1 | N4050 | 34.81 | 32.84 | -1.97 | 33.80 | -1.01 | 35.13 | 0.32 | |
| 374A | 1300 Blk Hillcrest Ave. (FF estimated) | 1 | N4050 | 34.7 | 32.84 | -1.86 | 33.80 | -0.90 | 35.13 | 0.43 | |
| 374B | 1300 Blk Hillcrest Ave. (FF estimated) | 1 | N4050 | 34.5 | 32.84 | -1.66 | 33.80 | -0.70 | 35.13 | 0.63 | |
| 374C | 1300 Blk Hillcrest Ave. (FF estimated) | 1 | N4050 | 34.4 | 32.84 | -1.56 | 33.80 | -0.60 | 35.13 | 0.73 | |

Table D.2 Existing Conditions Structure Flooding Level of Service Evaluation

0.51 = FPLOS Deficiency

| Map # | Address | # Grnd Flr Dwelling Units | Node ID | Finished Floor Elev. (ft,NGVD) | Flood Elev.(ft) 10-year | Depth of Flooding (feet) | Flood Elev.(ft) 25-year | Depth of Flooding (feet) | Flood Elev.(ft) 100-year | Depth of Flooding (feet) | Node Total Flood-prone Structures |
|-------|--|---------------------------|---------|--------------------------------|-------------------------|--------------------------|-------------------------|--------------------------|--------------------------|--------------------------|-----------------------------------|
| 374D | 1300 Blk Hillcrest Ave. (FF estimated) | 1 | N4050 | 34.3 | 32.84 | -1.46 | 33.80 | -0.50 | 35.13 | 0.83 | 7 Structures 7 Units |
| 374E | 1300 Blk Hillcrest Ave. (FF estimated) | 1 | N4050 | 34.2 | 32.84 | -1.36 | 33.80 | -0.40 | 35.13 | 0.93 | |
| 375 | 1400 Hillcrest Ave. S. | 1 | N4050 | 36.49 | 32.84 | -3.65 | 33.80 | -2.69 | 35.13 | -1.36 | |
| 375A | 1400 Blk Hillcrest Ave. (FF estimated) | 1 | N4050 | 36.2 | 32.84 | -3.36 | 33.80 | -2.40 | 35.13 | -1.07 | |
| 375B | 1400 Blk Hillcrest Ave. (FF estimated) | 1 | N4050 | 35.9 | 32.84 | -3.06 | 33.80 | -2.10 | 35.13 | -0.77 | |
| 375C | 1400 Blk Hillcrest Ave. (FF estimated) | 1 | N4050 | 35.6 | 32.84 | -2.76 | 33.80 | -1.80 | 35.13 | -0.47 | |
| 375D | 1400 Blk Hillcrest Ave. (FF estimated) | 1 | N4050 | 35.3 | 32.84 | -2.46 | 33.80 | -1.50 | 35.13 | -0.17 | |
| 375E | 1400 Blk Hillcrest Ave. (FF estimated) | 1 | N4050 | 35.0 | 32.84 | -2.16 | 33.80 | -1.20 | 35.13 | 0.13 | |
| 52 | 1375 Campbell Ct. | 1 | N4060 | 38.82 | 34.54 | -4.28 | 35.53 | -3.29 | 36.88 | -1.94 | 0 Structures 0 Units |
| 376 | 1424 Hillcrest Ave. S. | 1 | N4060 | 37.75 | 34.54 | -3.21 | 35.53 | -2.22 | 36.88 | -0.87 | |
| 376A | 1400 Blk Hillcrest Ave. (FF estimated) | 1 | N4060 | 38.0 | 34.54 | -3.46 | 35.53 | -2.47 | 36.88 | -1.12 | |
| 376B | 1400 Blk Hillcrest Ave. (FF estimated) | 1 | N4060 | 37.6 | 34.54 | -3.06 | 35.53 | -2.07 | 36.88 | -0.72 | |
| 376C | 1400 Blk Hillcrest Ave. (FF estimated) | 1 | N4060 | 37.4 | 34.54 | -2.86 | 35.53 | -1.87 | 36.88 | -0.52 | |
| 376D | 1400 Blk Hillcrest Ave. (FF estimated) | 1 | N4060 | 37.2 | 34.54 | -2.66 | 35.53 | -1.67 | 36.88 | -0.32 | |
| 376E | 1400 Blk Hillcrest Ave. (FF estimated) | 1 | N4060 | 37.0 | 34.54 | -2.46 | 35.53 | -1.47 | 36.88 | -0.12 | |
| 376F | 1400 Blk Hillcrest Ave. (FF estimated) | 1 | N4060 | 36.9 | 34.54 | -2.36 | 35.53 | -1.37 | 36.88 | -0.02 | |
| 53 | 1453 Evergreen Ave. | 1 | N4070 | 40.04 | 39.07 | -0.97 | 39.43 | -0.61 | 40.05 | 0.01 | |
| 54 | 1430 Hillcrest Ave. | 1 | N4070 | 38.72 | 39.07 | 0.35 | 39.43 | 0.71 | 40.05 | 1.33 | |
| 55 | 1434 Hillcrest Ave. | 1 | N4070 | 39.12 | 39.07 | -0.05 | 39.43 | 0.31 | 40.05 | 0.93 | |
| 56 | 1457 Evergreen Ave. | 1 | N4070 | 38.66 | 39.07 | 0.41 | 39.43 | 0.77 | 40.05 | 1.39 | |
| 57 | 1438 Hillcrest Ave. | 1 | N4070 | 39.58 | 39.07 | -0.51 | 39.43 | -0.15 | 40.05 | 0.47 | |
| 58 | 1461 Evergreen Ave. | 1 | N4070 | 37.97 | 39.07 | 1.10 | 39.43 | 1.46 | 40.05 | 2.08 | |
| 59 | 1465 Evergreen Ave. | 1 | N4070 | 37.69 | 39.07 | 1.38 | 39.43 | 1.74 | 40.05 | 2.36 | |
| 60 | 1442 Hillcrest Ave. | 1 | N4070 | 39.66 | 39.07 | -0.59 | 39.43 | -0.23 | 40.05 | 0.39 | |
| 61 | 1466 Hillcrest Ave. | 1 | N4070 | 39.76 | 39.07 | -0.69 | 39.43 | -0.33 | 40.05 | 0.29 | |
| 62 | 1469 Evergreen Ave. | 1 | N4070 | 38.65 | 39.07 | 0.42 | 39.43 | 0.78 | 40.05 | 1.40 | |
| 63 | 1450 Hillcrest Ave. | 1 | N4070 | 39.83 | 39.07 | -0.76 | 39.43 | -0.40 | 40.05 | 0.22 | |
| 64 | 1473 Evergreen Ave. | 1 | N4070 | 39.09 | 39.07 | -0.02 | 39.43 | 0.34 | 40.05 | 0.96 | |

Table D.2 Existing Conditions Structure Flooding Level of Service Evaluation

0.51 = FPLOS Deficiency

| Map # | Address | # Grnd Flr Dwelling Units | Node ID | Finished Floor Elev. (ft,NGVD) | Flood Elev.(ft) 10-year | Depth of Flooding (feet) | Flood Elev.(ft) 25-year | Depth of Flooding (feet) | Flood Elev.(ft) 100-year | Depth of Flooding (feet) | Node Total Flood-prone Structures |
|-------|---------------------|---------------------------|---------|--------------------------------|-------------------------|--------------------------|-------------------------|--------------------------|--------------------------|--------------------------|-----------------------------------|
| 65 | 1454 Hillcrest Ave. | 1 | N4070 | 39.92 | 39.07 | -0.85 | 39.43 | -0.49 | 40.05 | 0.13 | 17 Structures 17 Units |
| 66 | 1479 Evergreen Ave. | 1 | N4070 | 38.73 | 39.07 | 0.34 | 39.43 | 0.70 | 40.05 | 1.32 | |
| 67 | 1458 Hillcrest Ave. | 1 | N4070 | 40.46 | 39.07 | -1.39 | 39.43 | -1.03 | 40.05 | -0.41 | |
| 68 | 1501 Evergreen Ave. | 1 | N4070 | 38.97 | 39.07 | 0.1 | 39.43 | 0.46 | 40.05 | 1.08 | |
| 69 | 1462 Hillcrest Ave. | 1 | N4070 | 40.48 | 39.07 | -1.41 | 39.43 | -1.05 | 40.05 | -0.43 | |
| 70 | 1509 Evergreen Ave. | 1 | N4070 | 39.7 | 39.07 | -0.63 | 39.43 | -0.27 | 40.05 | 0.35 | |
| 71 | 1466 Hillcrest Ave. | 1 | N4070 | 40.35 | 39.07 | -1.28 | 39.43 | -0.92 | 40.05 | -0.3 | |
| 72 | 1517 Evergreen Ave. | 1 | N4070 | 39.62 | 39.07 | -0.55 | 39.43 | -0.19 | 40.05 | 0.43 | |
| 73 | 1470 Hillcrest Ave. | 1 | N4070 | 40.38 | 39.07 | -1.31 | 39.43 | -0.95 | 40.05 | -0.33 | |
| 74 | 1506 Hillcrest Ave. | 1 | N4080 | 40.03 | 39.74 | -0.29 | 40.10 | 0.07 | 40.73 | 0.7 | 2 Structures |
| 75 | 1521 Evergreen Ave. | 1 | N4080 | 40.65 | 39.74 | -0.91 | 40.10 | -0.55 | 40.73 | 0.08 | 2 Units |
| 296 | 1551 Jeffords St. | 1 | N4160 | 31.30 | 31.42 | 0.12 | 31.84 | 0.54 | 32.42 | 1.12 | 3 Structures 3 Units |
| 297 | 1557 Jeffords St. | 1 | N4160 | 31.79 | 31.42 | -0.37 | 31.84 | 0.05 | 32.42 | 0.63 | |
| 298 | 1563 Jeffords St. | 1 | N4160 | 33.11 | 31.42 | -1.69 | 31.84 | -1.27 | 32.42 | -0.69 | |
| 299 | 1571 Jeffords St. | 1 | N4160 | 32.99 | 31.42 | -1.57 | 31.84 | -1.15 | 32.42 | -0.57 | |
| 300 | 1579 Jeffords St. | 1 | N4160 | 31.97 | 31.42 | -0.55 | 31.84 | -0.13 | 32.42 | 0.45 | |
| 301 | 1585 Jeffords St. | 1 | N4160 | 32.44 | 31.42 | -1.02 | 31.84 | -0.60 | 32.42 | -0.02 | |
| 302 | 1601 Jeffords St. | 1 | N4180 | 32.83 | 31.35 | -1.48 | 31.88 | -0.95 | 32.57 | -0.26 | 10 Structures |
| 303 | 1607 Jeffords St. | 1 | N4180 | 32.42 | 31.35 | -1.07 | 31.88 | -0.54 | 32.57 | 0.15 | |
| 304 | 1613 Jeffords St. | 1 | N4180 | 32.48 | 31.35 | -1.13 | 31.88 | -0.60 | 32.57 | 0.09 | |
| 305 | 1619 Jeffords St. | 1 | N4180 | 32.58 | 31.35 | -1.23 | 31.88 | -0.70 | 32.57 | -0.01 | |
| 306 | 1625 Jeffords St. | 1 | N4180 | 32.53 | 31.35 | -1.18 | 31.88 | -0.65 | 32.57 | 0.04 | |
| 307 | 1631 Jeffords St. | 1 | N4180 | 32.33 | 31.35 | -0.98 | 31.88 | -0.45 | 32.57 | 0.24 | |
| 308 | 1211 Lake Dr. | 1 | N4180 | 32.12 | 31.35 | -0.77 | 31.88 | -0.24 | 32.57 | 0.45 | |
| 309 | 1606 Barry Rd. | 1 | N4180 | 31.26 | 31.35 | 0.09 | 31.88 | 0.62 | 32.57 | 1.31 | |
| 310 | 1612 Barry Rd. | 1 | N4180 | 31.37 | 31.35 | -0.02 | 31.88 | 0.51 | 32.57 | 1.20 | |
| 311 | 1618 Barry Rd. | 1 | N4180 | 31.18 | 31.35 | 0.17 | 31.88 | 0.70 | 32.57 | 1.39 | |
| 312 | 1624 Barry Rd. | 1 | N4180 | 31.41 | 31.35 | -0.06 | 31.88 | 0.47 | 32.57 | 1.16 | |

Table D.2 Existing Conditions Structure Flooding Level of Service Evaluation

0.51 = FPLOS Deficiency

| Map # | Address | # Grnd Flr Dwelling Units | Node ID | Finished Floor Elev. (ft,NGVD) | Flood Elev.(ft) 10-year | Depth of Flooding (feet) | Flood Elev.(ft) 25-year | Depth of Flooding (feet) | Flood Elev.(ft) 100-year | Depth of Flooding (feet) | Node Total Flood-prone Structures |
|-------|-----------------------|---------------------------|---------|--------------------------------|-------------------------|--------------------------|-------------------------|--------------------------|--------------------------|--------------------------|-----------------------------------|
| 313 | 1630 Barry Rd. | 1 | N4180 | 31.57 | 31.35 | -0.22 | 31.88 | 0.31 | 32.57 | 1.00 | 10 Units |
| 316 | 1172 S. Keystone Ave. | 1 | N4205 | 33.11 | 31.60 | -1.51 | 32.28 | -0.83 | 32.97 | -0.14 | 4 Structures 4 Units |
| 317 | 1176 S. Keystone Ave. | 1 | N4205 | 32.91 | 31.60 | -1.31 | 32.28 | -0.63 | 32.97 | 0.06 | |
| 318 | 1180 S. Keystone Ave. | 1 | N4205 | 32.59 | 31.60 | -0.99 | 32.28 | -0.31 | 32.97 | 0.38 | |
| 319 | 1182 S. Keystone Ave. | 1 | N4205 | 34.26 | 31.60 | -2.66 | 32.28 | -1.98 | 32.97 | -1.29 | |
| 320 | 1184 S. Keystone Ave. | 1 | N4205 | 33.28 | 31.60 | -1.68 | 32.28 | -1.00 | 32.97 | -0.31 | |
| 321 | 1188 S. Keystone Ave. | 1 | N4205 | 32.81 | 31.60 | -1.21 | 32.28 | -0.53 | 32.97 | 0.16 | |
| 324 | 1641 Jeffords St. | 1 | N4205 | 32.99 | 31.60 | -1.39 | 32.28 | -0.71 | 32.97 | -0.02 | |
| 326 | 1658 Jeffords St. | 1 | N4205 | 32.79 | 31.60 | -1.19 | 32.28 | -0.51 | 32.97 | 0.18 | |
| 327 | 1664 Jeffords St. | 1 | N4205 | 33.05 | 31.60 | -1.45 | 32.28 | -0.77 | 32.97 | -0.08 | |
| 328 | 1668 Jeffords St. | 1 | N4205 | 33.57 | 31.60 | -1.97 | 32.28 | -1.29 | 32.97 | -0.60 | |
| 329 | 1670 Jeffords St. | 1 | N4205 | 33.45 | 31.60 | -1.85 | 32.28 | -1.17 | 32.97 | -0.48 | |
| 330 | 1030 S. Duncan Ave. | 1 | N4205 | 33.28 | 31.60 | -1.68 | 32.28 | -1.00 | 32.97 | -0.31 | |
| 331 | 1028 S. Duncan Ave. | 1 | N4205 | 33.57 | 31.60 | -1.97 | 32.28 | -1.29 | 32.97 | -0.60 | |
| 332 | 1024 S. Duncan Ave. | 1 | N4205 | 33.50 | 31.60 | -1.90 | 32.28 | -1.22 | 32.97 | -0.53 | |
| 325 | 1183 S. Keystone Ave. | 1 | N4210 | 32.68 | 31.85 | -0.83 | 32.29 | -0.39 | 32.98 | 0.30 | 7 Structures 7 Units |
| 333 | 1647 Jeffords St. | 1 | N4210 | 33.65 | 31.85 | -1.80 | 32.29 | -1.36 | 32.98 | -0.67 | |
| 334 | 1659 Jeffords St. | 1 | N4210 | 32.32 | 31.85 | -0.47 | 32.29 | -0.03 | 32.98 | 0.66 | |
| 335 | 1665 Jeffords St. | 1 | N4210 | 32.15 | 31.85 | -0.30 | 32.29 | 0.14 | 32.98 | 0.83 | |
| 336 | 1671 Jeffords St. | 1 | N4210 | 32.49 | 31.85 | -0.64 | 32.29 | -0.20 | 32.98 | 0.49 | |
| 337 | 1104 Duncan Ave. | 1 | N4210 | 32.81 | 31.85 | -0.96 | 32.29 | -0.52 | 32.98 | 0.17 | |
| 338 | 1184 Duncan Ave. | 1 | N4210 | 32.97 | 31.85 | -1.12 | 32.29 | -0.68 | 32.98 | 0.01 | |
| 339 | 1188 Duncan Ave. | 1 | N4210 | 33.87 | 31.85 | -2.02 | 32.29 | -1.58 | 32.98 | -0.89 | |
| 340 | 1192 Duncan Ave. | 1 | N4210 | 34.53 | 31.85 | -2.68 | 32.29 | -2.24 | 32.98 | -1.55 | |
| 341 | 1196 Duncan Ave. | 1 | N4210 | 34.34 | 31.85 | -2.49 | 32.29 | -2.05 | 32.98 | -1.36 | |
| 342 | 1200 Duncan Ave. | 1 | N4210 | 34.07 | 31.85 | -2.22 | 32.29 | -1.78 | 32.98 | -1.09 | |
| 356 | 1201 Duncan Ave. | 1 | N4210 | 32.41 | 31.85 | -0.56 | 32.29 | -0.12 | 32.98 | 0.57 | |
| 357 | 1707 Estelle Dr. | 1 | N4210 | 33.00 | 31.85 | -1.15 | 32.29 | -0.71 | 32.98 | -0.02 | |

Table D.2 Existing Conditions Structure Flooding Level of Service Evaluation

0.51 = FPLOS Deficiency

| Map # | Address | # Grnd Flr Dwelling Units | Node ID | Finished Floor Elev. (ft,NGVD) | Flood Elev.(ft) 10-year | Depth of Flooding (feet) | Flood Elev.(ft) 25-year | Depth of Flooding (feet) | Flood Elev.(ft) 100-year | Depth of Flooding (feet) | Node Total Flood-prone Structures |
|-------|---------------------|---------------------------|---------|--------------------------------|-------------------------|--------------------------|-------------------------|--------------------------|--------------------------|--------------------------|-----------------------------------|
| 343 | 1035 S. Duncan Ave. | 1 | N4220 | 33.03 | 31.60 | -1.43 | 32.29 | -0.74 | 32.97 | -0.06 | 5 Structures 5 Units |
| 344 | 1706 Jeffords St. | 1 | N4220 | 33.23 | 31.60 | -1.63 | 32.29 | -0.94 | 32.97 | -0.26 | |
| 345 | 1714 Jeffords St. | 1 | N4220 | 33.01 | 31.60 | -1.41 | 32.29 | -0.72 | 32.97 | -0.04 | |
| 346 | 1718 Jeffords St. | 1 | N4220 | 33.09 | 31.60 | -1.49 | 32.29 | -0.80 | 32.97 | -0.12 | |
| 347 | 1701 Jeffords St. | 1 | N4220 | 32.76 | 31.60 | -1.16 | 32.29 | -0.47 | 32.97 | 0.21 | |
| 348 | 1707 Jeffords St. | 1 | N4220 | 32.89 | 31.60 | -1.29 | 32.29 | -0.60 | 32.97 | 0.08 | |
| 349 | 1717 Jeffords St. | 1 | N4220 | 32.30 | 31.60 | -0.70 | 32.29 | -0.01 | 32.97 | 0.67 | |
| 350 | 1733 Jeffords St. | 1 | N4220 | 32.40 | 31.60 | -0.80 | 32.29 | -0.11 | 32.97 | 0.57 | |
| 351 | 1105 Duncan Ave. | 1 | N4220 | 33.24 | 31.60 | -1.64 | 32.29 | -0.95 | 32.97 | -0.27 | |
| 352 | 1109 Duncan Ave. | 1 | N4220 | 33.19 | 31.60 | -1.59 | 32.29 | -0.90 | 32.97 | -0.22 | |
| 353 | 1113 Duncan Ave. | 1 | N4220 | 33.60 | 31.60 | -2.00 | 32.29 | -1.31 | 32.97 | -0.63 | |
| 354 | 1117 Duncan Ave. | 1 | N4220 | 33.59 | 31.60 | -1.99 | 32.29 | -1.30 | 32.97 | -0.62 | |
| 355 | 1121 Duncan Ave. | 1 | N4220 | 33.61 | 31.60 | -2.01 | 31.60 | -2.01 | 32.97 | -0.64 | |
| 358 | 1101 Woodside Ave. | 1 | N4220 | 33.43 | 31.60 | -1.83 | 31.60 | -1.83 | 32.97 | -0.46 | |
| 359 | 1105 Woodside Ave. | 1 | N4220 | 33.19 | 31.60 | -1.59 | 31.60 | -1.59 | 32.97 | -0.22 | |
| 360 | 1109 Woodside Ave. | 1 | N4220 | 32.81 | 31.60 | -1.21 | 31.60 | -1.21 | 32.97 | 0.16 | |
| 361 | 1115 Woodside Ave. | 1 | N4220 | 33.12 | 31.60 | -1.52 | 31.60 | -1.52 | 32.97 | -0.15 | |
| 362 | 1117 Woodside Ave. | 1 | N4220 | 33.28 | 31.60 | -1.68 | 31.60 | -1.68 | 32.97 | -0.31 | |
| 363 | 1121 Woodside Ave. | 1 | N4220 | 33.05 | 31.60 | -1.45 | 31.60 | -1.45 | 32.97 | -0.08 | |
| 364 | 1135 Jeffords St. | 1 | N4230 | 33.77 | 32.21 | -1.56 | 32.36 | -1.41 | 32.97 | -0.80 | |
| 365 | 1106 Woodcrest Ave. | 1 | N4230 | 33.66 | 32.21 | -1.45 | 32.36 | -1.30 | 32.97 | -0.69 | |
| 366 | 1110 Woodcrest Ave. | 1 | N4230 | 33.49 | 32.21 | -1.28 | 32.36 | -1.13 | 32.97 | -0.52 | |
| 367 | 1114 Woodcrest Ave. | 1 | N4230 | 33.23 | 32.21 | -1.02 | 32.36 | -0.87 | 32.97 | -0.26 | |
| 368 | 1118 Woodcrest Ave. | 1 | N4230 | 33.12 | 32.21 | -0.91 | 32.36 | -0.76 | 32.97 | -0.15 | |
| 369 | 1120 Woodcrest Ave. | 1 | N4230 | 34.24 | 32.21 | -2.03 | 32.36 | -1.88 | 32.97 | -1.27 | |
| 370 | 1126 Woodcrest Ave. | 1 | N4230 | 33.12 | 32.21 | -0.91 | 32.36 | -0.76 | 32.97 | -0.15 | |
| 371 | 1115 Woodcrest Ave. | 1 | N4240 | 33.93 | 33.68 | -0.25 | 34.04 | 0.11 | 34.74 | 0.81 | |
| 372 | 1121 Woodcrest Ave. | 1 | N4240 | 33.19 | 33.68 | 0.49 | 34.04 | 0.85 | 34.74 | 1.55 | |

Table D.2 Existing Conditions Structure Flooding Level of Service Evaluation

0.51 = FPLOS Deficiency

| Map # | Address | # Grnd Flr Dwelling Units | Node ID | Finished Floor Elev. (ft,NGVD) | Flood Elev.(ft) 10-year | Depth of Flooding (feet) | Flood Elev.(ft) 25-year | Depth of Flooding (feet) | Flood Elev.(ft) 100-year | Depth of Flooding (feet) | Node Total Flood-prone Structures |
|-------|---------------------------------|---------------------------|---------|--------------------------------|-------------------------|--------------------------|-------------------------|--------------------------|--------------------------|--------------------------|-----------------------------------|
| 314 | 1619 Barry Rd. | 1 | N4370 | 31.36 | 31.32 | -0.04 | 32.10 | 0.74 | 32.86 | 1.50 | 3 Structures 3 Units |
| 314A | 1613 Barry Rd (FF estimated) | 1 | N4370 | 32.40 | 31.32 | -1.08 | 32.10 | -0.30 | 32.86 | 0.46 | |
| 315 | 1625 Barry Rd. | 1 | N4370 | 32.37 | 31.32 | -1.05 | 32.10 | -0.27 | 32.86 | 0.49 | |
| 322 | 1131 S. Keystone Ave. | 1 | N4380 | 32.75 | 31.60 | -1.15 | 32.29 | -0.46 | 32.97 | 0.22 | 1 Structure |
| 323 | 1640 Jeffords St. | 1 | N4380 | 33.00 | 31.60 | -1.40 | 32.29 | -0.71 | 32.97 | -0.03 | 1 Unit |
| 213 | 601,603 Spencer Ave. | 2 | N4420 | 61.62 | 61.78 | 0.16 | 61.99 | 0.37 | 62.20 | 0.58 | 10 Structures 16 Units |
| 214 | 605,607 Spencer Ave. | 2 | N4420 | 61.14 | 61.78 | 0.64 | 61.99 | 0.85 | 62.20 | 1.06 | |
| 215 | 609,611 Spencer Ave. | 2 | N4420 | 61.81 | 61.78 | -0.03 | 61.99 | 0.18 | 62.20 | 0.39 | |
| 216 | 613,615 Spencer Ave. | 2 | N4420 | 62.55 | 61.78 | -0.77 | 61.99 | -0.56 | 62.20 | -0.35 | |
| 217 | 617,619 Spencer Ave. | 2 | N4420 | 62.81 | 61.78 | -1.03 | 61.99 | -0.82 | 62.20 | -0.61 | |
| 218 | 701, 707, 713, 719 Spencer Ave. | 2 | N4420 | 63.05 | 61.78 | -1.27 | 61.99 | -1.06 | 62.20 | -0.85 | |
| 219 | same as # 118 above | 2 | N4420 | 63.05 | 61.78 | -1.27 | 61.99 | -1.06 | 62.20 | -0.85 | |
| 220 | 725, 731, 737 Spencer Ave. | 3 | N4420 | 63.25 | 61.78 | -1.47 | 61.99 | -1.26 | 62.20 | -1.05 | |
| 221 | 602, 600 S. Duncan Ave. | 2 | N4420 | 61.97 | 61.78 | -0.19 | 61.99 | 0.02 | 62.20 | 0.23 | |
| 222 | 610, 608 S. Duncan Ave. | 2 | N4420 | 61.45 | 61.78 | 0.33 | 61.99 | 0.54 | 62.20 | 0.75 | |
| 223 | 612 S. Duncan Ave. | 1 | N4420 | 61.44 | 61.78 | 0.34 | 61.99 | 0.55 | 62.20 | 0.76 | |
| 224 | 618 S. Duncan Ave. | 1 | N4420 | 61.31 | 61.78 | 0.47 | 61.99 | 0.68 | 62.20 | 0.89 | |
| 225 | 704, 706 S. Duncan Ave. | 2 | N4420 | 61.13 | 61.78 | 0.65 | 61.99 | 0.86 | 62.20 | 1.07 | |
| 226 | 710 S. Duncan Ave. | 1 | N4420 | 61.33 | 61.78 | 0.45 | 61.99 | 0.66 | 62.20 | 0.87 | |
| 226A | 708 S. Duncan Ave | 1 | N4420 | 62.07 | 61.78 | -0.29 | 61.99 | -0.08 | 62.20 | 0.13 | |
| 227 | 1672 Druid Rd. | 1 | N4420 | 63.79 | 61.78 | -2.01 | 61.99 | -1.80 | 62.20 | -1.59 | |
| 228 | 1676 Druid Rd. | 1 | N4420 | 63.23 | 61.78 | -1.45 | 61.99 | -1.24 | 62.20 | -1.03 | |

Table F.1 Proposed Conditions Street Flooding Level of Service Evaluation

0.51 = FPLOS Deficiency

| Node ID | Node Location | Roadway Classification | Lowest Road Elev. | Flood Elev. 10-yr, 24-hr | Depth of Flooding (ft) | Flood Elev. 25-yr, 24-hr | Depth of Flooding (ft) | Flood Elev. 100-yr,24-hr | Depth of Flooding (ft) |
|---------|--|------------------------|-------------------|--------------------------|------------------------|--------------------------|------------------------|--------------------------|------------------------|
| N0000 | Clearwater Harbor | Collector | 7.5 | 2.50 | (0.00) | 2.50 | (0.00) | 2.50 | (0.00) |
| N0010 | Stevenson Creek, 320' E. of Alt. 19 | Collector | 7.5 | 3.71 | (0.00) | 4.12 | (0.00) | 5.35 | (0.00) |
| N0020 | Stevenson Creek, 225' NW of Pinellas Trail | Residential | 6.3 | 3.87 | (0.00) | 4.28 | (0.00) | 5.47 | (0.00) |
| N0030 | Stevenson Creek, 120' SE of Pinellas Trail | Residential | 9.3 | 4.82 | (0.00) | 5.41 | (0.00) | 6.62 | (0.00) |
| N0040 | Stevenson Creek, 890' SE of Pinellas Trail | Residential | 9.3 | 5.13 | (0.00) | 5.74 | (0.00) | 6.97 | (0.00) |
| N0050 | Stevenson Creek, 120' NW of Douglass Ave | Collector | 9.0 | 5.27 | (0.00) | 5.87 | (0.00) | 7.06 | (0.00) |
| N0060 | Stevenson Creek, 120' SE of Douglass Ave | Residential | 10.5 | 5.66 | (0.00) | 6.25 | (0.00) | 7.44 | (0.00) |
| N0070 | Stevenson Creek, 1,020 SE of Douglass Ave | Residential | 10.5 | 5.98 | (0.00) | 6.57 | (0.00) | 7.73 | (0.00) |
| N0080 | Stevenson Creek, 1,530' SE of Douglass Ave | Residential | 9.0 | 6.11 | (0.00) | 6.72 | (0.00) | 7.91 | (0.00) |
| N0090 | Stevenson Creek, 120' NW of Betty Lane | Collector | 10.1 | 6.27 | (0.00) | 6.84 | (0.00) | 7.94 | (0.00) |
| N0100 | Stevenson Creek, 120' E of Betty Lane | Residential | 6.1 | 6.86 | 0.76 | 7.54 | 1.44 | 8.93 | 2.83 |
| N0110 | Stevenson Creek, 690' SE of Betty Lane | Residential | 10.0 | 7.19 | (0.00) | 7.90 | (0.00) | 9.30 | (0.00) |
| N0120 | Stevenson Creek at Palmetto Street | Collector | 7.0 | 7.65 | 0.65 | 8.38 | 1.38 | 9.81 | 2.81 |
| N0130 | Stevenson Creek at Palmetto Street | Collector | 7.0 | 8.02 | 1.02 | 8.74 | 1.74 | 10.02 | 3.02 |
| N0140 | Stevenson Creek, 860' S of Palmetto Street | Collector | 16.5 | 11.26 | (0.00) | 11.64 | (0.00) | 12.61 | (0.00) |
| N0150 | Stevenson Creek, 150' NW of SCL Railroad | Collector | 25.7 | 12.55 | (0.00) | 12.89 | (0.00) | 13.71 | (0.00) |
| N0170 | Stevenson Creek, 150' S of SCL Railroad | Collector | 25.0 | 13.11 | (0.00) | 13.48 | (0.00) | 14.43 | (0.00) |
| N0180 | Stevenson Creek, 820' S of SCL Railroad | Residential | 21.0 | 14.14 | (0.00) | 14.56 | (0.00) | 15.43 | (0.00) |
| N0195 | Douglass Avenue, 200' E of Harbor Drive | Collector | 9.0 | 6.53 | (0.00) | 7.01 | (0.00) | 7.99 | (0.00) |
| N0200 | Douglass Avenue, 150' W of Harbor Drive | Collector | 10.3 | 10.83 | 0.53 | 10.96 | 0.66 | 11.19 | 0.89 |
| N0210 | Fairmont Street and Washington Avenue | Collector | 12.0 | 12.67 | 0.67 | 12.81 | 0.81 | 13.07 | 1.07 |
| N0220 | Fairmont Steet and N. Greenwood Avenue | Collector | 14.0 | 14.65 | 0.65 | 14.79 | 0.79 | 15.04 | 1.04 |
| N0230 | Fairmont Street and Fulton Avenue | Collector | 21.5 | 17.06 | (0.00) | 17.06 | (0.00) | 17.06 | (0.00) |
| N0240 | Marshall Street and Fulton Avenue | Residential | 26.5 | 20.89 | (0.00) | 21.08 | (0.00) | 21.29 | (0.00) |
| N0250 | Pennsylvania Street and Grant Street | Residential | 22.4 | 22.50 | 0.10 | 22.67 | 0.27 | 22.77 | 0.37 |
| N0280 | Marshall Street AWTP | Residential | 7.5 | 7.44 | (0.00) | 7.87 | 0.37 | 8.65 | 1.15 |
| N0290 | Russel Street 350' W of Holt Avenue | Residential | 9.0 | 9.38 | 0.38 | 9.65 | 0.65 | 9.93 | 0.93 |
| N0291 | Russel Street and Martin Luther King Ave | Residential | 16.0 | 9.71 | (0.00) | 10.24 | (0.00) | 10.95 | (0.00) |
| N0292 | Russel Street and N Madison Ave | Residential | 16.0 | 13.39 | (0.00) | 15.01 | (0.00) | 16.77 | 0.77 |
| N0300 | Martin Luther King Ave S of Russel Street | Residential | 13.0 | 11.07 | (0.00) | 11.46 | (0.00) | 11.92 | (0.00) |
| N0310 | Martin Luther King Ave and Engman Street | Residential | 12.0 | 12.77 | 0.77 | 12.99 | 0.99 | 13.29 | 1.29 |

Table F.1 Proposed Conditions Street Flooding Level of Service Evaluation

0.51 = FPLOS Deficiency

| Node ID | Node Location | Roadway Classification | Lowest Road Elev. | Flood Elev. 10-yr, 24-hr | Depth of Flooding (ft) | Flood Elev. 25-yr, 24-hr | Depth of Flooding (ft) | Flood Elev. 100-yr,24-hr | Depth of Flooding (ft) |
|---------|---|------------------------|-------------------|--------------------------|------------------------|--------------------------|------------------------|--------------------------|------------------------|
| N0320 | Martin Luther King Ave and Palm Bluff St | Residential | 15.0 | 15.67 | 0.67 | 15.75 | 0.75 | 15.88 | 0.88 |
| N0330 | Palm Bluff Street and N Madison Avenue | Residential | 14.8 | 16.21 | 1.41 | 16.31 | 1.51 | 16.50 | 1.70 |
| N0340 | N Greenwood Avenue and Metto Street | Collector | 19.2 | 20.18 | 0.98 | 20.43 | 1.23 | 21.00 | 1.80 |
| N0350 | N Greenwood Avenue and Palmetto Street | Collector | 21.7 | 20.97 | (0.00) | 21.27 | (0.00) | 21.55 | (0.00) |
| N0370 | Pennsylvania Avenue and Metto Street | Residential | 20.8 | 21.41 | 0.61 | 21.66 | 0.86 | 21.96 | 1.16 |
| N0380 | Holt Avenue and Russel Street | Residential | 5.9 | 6.88 | 0.98 | 7.22 | 1.32 | 8.11 | 2.21 |
| N0390 | Holt Avenue and Engman Street | Residential | 16.5 | 10.29 | (0.00) | 10.80 | (0.00) | 11.55 | (0.00) |
| N0400 | Holt Avenue 420' S of Engman Street | Residential | 20.2 | 12.58 | (0.00) | 13.34 | (0.00) | 14.27 | (0.00) |
| N0410 | Palmetto Street and Holt Avenue | Collector | 20.1 | 15.32 | (0.00) | 16.23 | (0.00) | 17.26 | (0.00) |
| N0420 | Palmetto Street and N Missouri Avenue | Collector | 20.2 | 17.63 | (0.00) | 18.61 | (0.00) | 19.51 | (0.00) |
| N0425 | Palmetto Street and N Missouri Avenue | Collector | 20.2 | 18.73 | (0.00) | 19.65 | (0.00) | 20.45 | 0.25 |
| N0430 | N Missouri Avenue and Seminole Street | Residential | 19.2 | 19.59 | 0.39 | 20.52 | 1.32 | 21.23 | 2.03 |
| N0435 | Palmetto Street and Phillis Stadium Drive | Collector | 20.2 | 19.34 | (0.00) | 20.58 | 0.38 | 21.23 | 1.03 |
| N0440 | Palmetto Street and Kings Highway | Collector | 19.4 | 15.66 | (0.00) | 15.60 | (0.00) | 19.59 | 0.19 |
| N0450 | Betty Lane and SCL Railroad Ditch | Collector | 23.8 | 21.53 | (0.00) | 22.94 | (0.00) | 24.19 | 0.39 |
| N0460 | N. Lincoln Avenue and SCL Railroad Ditch | Residential | 26.0 | 22.00 | (0.00) | 23.15 | (0.00) | 24.31 | (0.00) |
| N0470 | N. Missouri Avenue and SCL Railroad Ditch | Residential | 24.0 | 22.98 | (0.00) | 23.59 | (0.00) | 24.52 | 0.52 |
| N0480 | N. Greenwood Avenue and Maple Street | Collector | 23.6 | 23.39 | (0.00) | 23.82 | 0.22 | 24.64 | 1.04 |
| N0490 | Overbrook Avenue Detention Pond | Residential | 20.0 | 15.91 | (0.00) | 16.28 | (0.00) | 16.76 | (0.00) |
| N0500 | Spring Branch at Overbrook Avenue | Residential | 9.4 | 5.32 | (0.00) | 5.93 | (0.00) | 7.16 | (0.00) |
| N0510 | Spring Branch at Overbrook Avenue | Residential | 9.4 | 6.15 | (0.00) | 7.00 | (0.00) | 9.66 | 0.26 |
| N0520 | Spring Branch at Springtime Avenue | Residential | 8.9 | 6.24 | (0.00) | 7.07 | (0.00) | 9.72 | 0.82 |
| N0530 | Spring Branch at Douglass Avenue | Collector | 9.5 | 6.31 | (0.00) | 7.18 | (0.00) | 10.57 | 1.07 |
| N0540 | Spring Branch at Douglass Avenue | Collector | 9.5 | 6.40 | (0.00) | 7.36 | (0.00) | 11.49 | 1.99 |
| N0550 | (Pinellas County - FPLOS not determined) | | | 7.01 | | 7.93 | | 11.77 | |
| N0560 | Spring Branch at Sunset Point Drive | Collector | 17.4 | 7.80 | (0.00) | 8.55 | (0.00) | 11.86 | (0.00) |
| N0570 | (Pinellas County - FPLOS not determined) | | | 9.67 | | 10.57 | | 12.80 | |
| N0590 | (Pinellas County - FPLOS not determined) | | | 10.54 | | 11.33 | | 13.24 | |
| N0600 | (Pinellas County - FPLOS not determined) | | | 12.11 | | 12.82 | | 13.49 | |
| N0610 | (Pinellas County - FPLOS not determined) | | | 12.45 | | 13.14 | | 13.94 | |
| N0620 | Spring Branch, 700' SW of Kings Highway | Collector | 16.0 | 13.05 | (0.00) | 13.82 | (0.00) | 14.95 | (0.00) |

Table F.1 Proposed Conditions Street Flooding Level of Service Evaluation

0.51 = FPLOS Deficiency

| Node ID | Node Location | Roadway Classification | Lowest Road Elev. | Flood Elev. 10-yr, 24-hr | Depth of Flooding (ft) | Flood Elev. 25-yr, 24-hr | Depth of Flooding (ft) | Flood Elev. 100-yr,24-hr | Depth of Flooding (ft) |
|---------|--|------------------------|-------------------|--------------------------|------------------------|--------------------------|------------------------|--------------------------|------------------------|
| N0630 | Spring Branch at Kings Highway (west side) | Collector | 14.5 | 13.17 | (0.00) | 13.95 | (0.00) | 15.12 | 0.62 |
| N0650 | Pineland Avenue and Vista Way | Residential | 19.0 | 16.45 | (0.00) | 16.61 | (0.00) | 17.65 | (0.00) |
| N0660 | Retention pond outfall SE of Pineland, Vista | Residential | 20.0 | 17.19 | (0.00) | 17.38 | (0.00) | 17.90 | (0.00) |
| N0670 | Retention pond SE of Pineland and Vista | Residential | 22.0 | 19.38 | (0.00) | 19.65 | (0.00) | 20.17 | (0.00) |
| N0680 | (Pinellas County - FPLOS not determined) | | | 12.50 | | 13.17 | | 13.98 | |
| N0690 | Sunset Point Drive, 750' E of Betty Lane | Collector | 11.9 | 12.75 | 0.85 | 13.17 | 1.27 | 13.98 | 2.08 |
| N0700 | School Board Retention Pond | Residential | 17.0 | 16.68 | (0.00) | 16.71 | (0.00) | 16.77 | (0.00) |
| N0710 | School Board Retention Pond | Residential | 17.0 | 16.21 | (0.00) | 16.39 | (0.00) | 16.78 | (0.00) |
| N0720 | School Board Ditch | Residential | 19.0 | 18.64 | (0.00) | 18.82 | (0.00) | 19.05 | 0.05 |
| N0730 | School Board Retention Pond | Residential | 20.0 | 19.39 | (0.00) | 19.61 | (0.00) | 20.05 | 0.05 |
| N0740 | State Street Ditch, 320' E of Betty Lane | Residential | 12.3 | 12.64 | 0.34 | 13.28 | 0.98 | 14.06 | 1.76 |
| N0750 | State Street Ditch, 320' E of Betty Lane | Residential | 12.3 | 13.03 | 0.73 | 13.29 | 0.99 | 14.06 | 1.76 |
| N0760 | Pond E of Betty Lane and Woodlawn Terr. | Residential | 15.0 | 13.38 | (0.00) | 13.62 | (0.00) | 14.20 | (0.00) |
| N0770 | (Pinellas County - FPLOS not determined) | | | 13.42 | | 13.66 | | 14.38 | |
| N0775 | (Pinellas County - FPLOS not determined) | | | 14.09 | | 15.16 | | 16.91 | |
| N0780 | (Pinellas County - FPLOS not determined) | | | 14.24 | | 15.44 | | 17.36 | |
| N0790 | (City of Dunedin - FPLOS not determined) | | | 14.40 | | 15.56 | | 17.48 | |
| N0800 | (City of Dunedin - FPLOS not determined) | | | 17.73 | | 18.51 | | 19.74 | |
| N0810 | (City of Dunedin - FPLOS not determined) | | | 17.82 | | 18.51 | | 19.73 | |
| N0820 | (City of Dunedin - FPLOS not determined) | | | 17.83 | | 18.52 | | 19.76 | |
| N0830 | (City of Dunedin - FPLOS not determined) | | | 17.91 | | 18.52 | | 19.73 | |
| N0840 | (City of Dunedin - FPLOS not determined) | | | 17.94 | | 18.54 | | 19.77 | |
| N0850 | (City of Dunedin - FPLOS not determined) | | | 18.14 | | 18.65 | | 19.76 | |
| N0855 | (City of Dunedin - FPLOS not determined) | | | 18.17 | | 18.67 | | 19.77 | |
| N0860 | (City of Dunedin - FPLOS not determined) | | | 18.47 | | 19.06 | | 20.08 | |
| N0870 | (City of Dunedin - FPLOS not determined) | | | 18.53 | | 19.09 | | 20.08 | |
| N0880 | (City of Dunedin - FPLOS not determined) | | | 18.71 | | 19.27 | | 20.24 | |
| N0890 | (City of Dunedin - FPLOS not determined) | | | 18.77 | | 19.31 | | 20.25 | |
| N0900 | (City of Dunedin - FPLOS not determined) | | | 18.79 | | 19.32 | | 20.25 | |
| N0910 | Woodlawn Terrace and Oakdale Way | Residential | 19.0 | 16.13 | (0.00) | 16.47 | (0.00) | 20.13 | 1.13 |
| N0920 | (City of Dunedin - FPLOS not determined) | | | 18.17 | | 18.68 | | 19.72 | |

Table F.1 Proposed Conditions Street Flooding Level of Service Evaluation

0.51 = FPLOS Deficiency

| Node ID | Node Location | Roadway Classification | Lowest Road Elev. | Flood Elev. 10-yr, 24-hr | Depth of Flooding (ft) | Flood Elev. 25-yr, 24-hr | Depth of Flooding (ft) | Flood Elev. 100-yr,24-hr | Depth of Flooding (ft) |
|---------|--|------------------------|-------------------|--------------------------|------------------------|--------------------------|------------------------|--------------------------|------------------------|
| N1000 | Spring Branch at Kings Highway (east side) | Collector | 14.5 | 13.70 | (0.00) | 14.86 | 0.36 | 15.97 | 1.47 |
| N1010 | Spring Branch, 680' S of Union Street | Residential | 21.0 | 14.33 | (0.00) | 15.31 | (0.00) | 16.36 | (0.00) |
| N1020 | Spring Branch, 380' S of Union Street | Residential | 20.8 | 15.42 | (0.00) | 16.12 | (0.00) | 17.10 | (0.00) |
| N1030 | Spring Branch at Union Street | Collector | 20.0 | 17.49 | (0.00) | 18.11 | (0.00) | 19.05 | (0.00) |
| N1040 | (City of Dunedin - FPLOS not determined) | | | 17.71 | | 18.47 | | 19.74 | |
| N1050 | (City of Dunedin - FPLOS not determined) | | | 17.80 | | 18.56 | | 19.82 | |
| N1060 | (City of Dunedin - FPLOS not determined) | | | 17.80 | | 18.56 | | 19.82 | |
| N1070 | (City of Dunedin - FPLOS not determined) | | | 17.93 | | 18.68 | | 19.90 | |
| N1080 | (City of Dunedin - FPLOS not determined) | | | 18.04 | | 18.74 | | 19.95 | |
| N1090 | (City of Dunedin - FPLOS not determined) | | | 18.37 | | 18.87 | | 20.02 | |
| N1100 | (City of Dunedin - FPLOS not determined) | | | 22.32 | | 22.89 | | 23.84 | |
| N1110 | (City of Dunedin - FPLOS not determined) | | | 23.04 | | 23.47 | | 24.21 | |
| N1120 | (City of Dunedin - FPLOS not determined) | | | 24.00 | | 24.23 | | 24.67 | |
| N1130 | (City of Dunedin - FPLOS not determined) | | | 24.40 | | 24.78 | | 25.62 | |
| N1140 | (City of Dunedin - FPLOS not determined) | | | 24.50 | | 24.90 | | 25.84 | |
| N1150 | (City of Dunedin - FPLOS not determined) | | | 24.54 | | 24.96 | | 25.94 | |
| N1160 | (City of Dunedin - FPLOS not determined) | | | 24.61 | | 25.06 | | 26.25 | |
| N1170 | (City of Dunedin - FPLOS not determined) | | | 24.62 | | 25.07 | | 26.27 | |
| N1172 | (City of Dunedin - FPLOS not determined) | | | 24.64 | | 25.09 | | 26.32 | |
| N1174 | (City of Dunedin - FPLOS not determined) | | | 24.65 | | 25.10 | | 26.35 | |
| N1180 | (City of Dunedin - FPLOS not determined) | | | 24.63 | | 25.08 | | 26.28 | |
| N1190 | (City of Dunedin - FPLOS not determined) | | | 24.67 | | 25.12 | | 26.40 | |
| N1200 | (City of Dunedin - FPLOS not determined) | | | 24.74 | | 25.18 | | 26.47 | |
| N1210 | (City of Dunedin - FPLOS not determined) | | | 27.60 | | 28.47 | | 29.19 | |
| N1220 | (City of Dunedin - FPLOS not determined) | | | 27.62 | | 28.48 | | 29.22 | |
| N1230 | (City of Dunedin - FPLOS not determined) | | | 28.01 | | 28.63 | | 29.23 | |
| N1240 | (City of Dunedin - FPLOS not determined) | | | 28.01 | | 28.64 | | 29.25 | |
| N1245 | (City of Dunedin - FPLOS not determined) | | | 28.01 | | 28.64 | | 29.25 | |
| N1250 | (City of Dunedin - FPLOS not determined) | | | 28.01 | | 28.64 | | 29.26 | |
| N1260 | (City of Dunedin - FPLOS not determined) | | | 28.22 | | 28.77 | | 29.80 | |
| N1270 | (City of Dunedin - FPLOS not determined) | | | 30.34 | | 30.98 | | 32.07 | |

Table F.1 Proposed Conditions Street Flooding Level of Service Evaluation

0.51 = FPLOS Deficiency

| Node ID | Node Location | Roadway Classification | Lowest Road Elev. | Flood Elev. 10-yr, 24-hr | Depth of Flooding (ft) | Flood Elev. 25-yr, 24-hr | Depth of Flooding (ft) | Flood Elev. 100-yr,24-hr | Depth of Flooding (ft) |
|---------|--|------------------------|-------------------|--------------------------|------------------------|--------------------------|------------------------|--------------------------|------------------------|
| N1280 | (City of Dunedin - FPLOS not determined) | | | 30.35 | | 30.99 | | 32.08 | |
| N1290 | (City of Dunedin - FPLOS not determined) | | | 30.60 | | 30.99 | | 32.08 | |
| N1300 | (City of Dunedin - FPLOS not determined) | | | 33.12 | | 33.35 | | 33.71 | |
| N1310 | (City of Dunedin - FPLOS not determined) | | | 33.38 | | 33.72 | | 34.31 | |
| N1320 | (City of Dunedin - FPLOS not determined) | | | 33.74 | | 33.89 | | 34.36 | |
| N1330 | (City of Dunedin - FPLOS not determined) | | | 42.18 | | 42.56 | | 43.19 | |
| N1340 | (City of Dunedin - FPLOS not determined) | | | 42.36 | | 42.75 | | 43.40 | |
| N1350 | Byram East Ditch at Highland Avenue | Collector | 17.2 | 14.74 | (0.00) | 15.40 | (0.00) | 16.71 | (0.00) |
| N1360 | Byram East Ditch at Highland Avenue | Collector | 17.2 | 17.98 | 0.78 | 18.33 | 1.13 | 19.35 | 2.15 |
| N1370 | Byram East Ditch, 730' E of Highland Ave | Residential | 23.7 | 22.53 | (0.00) | 23.50 | (0.00) | 24.60 | 0.90 |
| N1380 | Byram East Ditch, 1,350' E of Highland Ave | Residential | 28.5 | 26.83 | (0.00) | 27.63 | (0.00) | 28.02 | (0.00) |
| N1390 | Souvenir Drive near Algonquin Drive | Residential | 29.0 | 27.72 | (0.00) | 29.26 | 0.26 | 29.68 | 0.68 |
| N1400 | Algonquin Drive, 340' W of Picardy Circle | Residential | 34.5 | 28.58 | (0.00) | 31.37 | (0.00) | 34.77 | (0.00) |
| N1410 | Algonquin Drive and Nugget Drive | Residential | 56.5 | 50.86 | (0.00) | 50.98 | (0.00) | 51.20 | (0.00) |
| N1420 | Nugget Drive, 400' S of Algonquin Drive | Residential | 58.5 | 54.31 | (0.00) | 54.79 | (0.00) | 55.76 | (0.00) |
| N1430 | Clearview Lake | Residential | 59.0 | 56.97 | (0.00) | 57.60 | (0.00) | 58.90 | (0.00) |
| N1440 | Highland Avenue, 130' S of Byram Drive | Collector | 16.0 | 15.19 | (0.00) | 16.07 | 0.07 | 17.41 | 1.41 |
| N1450 | Highland Avenue at Highland Circle | Collector | 20.0 | 16.90 | (0.00) | 18.49 | (0.00) | 20.61 | 0.61 |
| N1460 | Highland Avenue at Sunset Point Road | Collector | 32.5 | 32.66 | 0.16 | 32.83 | 0.33 | 32.98 | 0.48 |
| N1470 | Sunset Point Road, 250' E of Highland Ave | Collector | 33.3 | 33.60 | 0.30 | 33.73 | 0.43 | 33.88 | 0.58 |
| N1480 | Sunset Point Road, 250' E of Highland Ave | Collector | 33.3 | 33.75 | 0.45 | 33.80 | 0.50 | 33.88 | 0.58 |
| N1490 | Pond NE of Highland Avenue and Byram Dr | Residential | 16.8 | 14.43 | (0.00) | 14.96 | (0.00) | 15.76 | (0.00) |
| N1500 | Souvenir Drive, 250' W of Picardy Circle | Residential | 24.6 | 23.38 | (0.00) | 24.81 | 0.21 | 26.43 | 1.83 |
| N1510 | Retention Pond in Windsor Woods Sub. | Residential | 28.0 | 28.06 | 0.06 | 28.20 | 0.20 | 28.43 | 0.43 |
| N1520 | (City of Dunedin - FPLOS not determined) | | | 19.03 | | 19.57 | | 20.60 | |
| N1530 | (City of Dunedin - FPLOS not determined) | | | 19.26 | | 19.81 | | 20.80 | |
| N1540 | (City of Dunedin - FPLOS not determined) | | | 19.83 | | 20.03 | | 20.80 | |
| N1550 | (City of Dunedin - FPLOS not determined) | | | 22.47 | | 24.03 | | 24.54 | |
| N1560 | (City of Dunedin - FPLOS not determined) | | | 23.79 | | 24.54 | | 24.84 | |
| N1570 | (City of Dunedin - FPLOS not determined) | | | 23.97 | | 24.44 | | 24.96 | |
| N1580 | (City of Dunedin - FPLOS not determined) | | | 23.81 | | 24.30 | | 24.87 | |

Table F.1 Proposed Conditions Street Flooding Level of Service Evaluation

0.51 = FPLOS Deficiency

| Node ID | Node Location | Roadway Classification | Lowest Road Elev. | Flood Elev. 10-yr, 24-hr | Depth of Flooding (ft) | Flood Elev. 25-yr, 24-hr | Depth of Flooding (ft) | Flood Elev. 100-yr,24-hr | Depth of Flooding (ft) |
|---------|--|------------------------|-------------------|--------------------------|------------------------|--------------------------|------------------------|--------------------------|------------------------|
| N1590 | (City of Dunedin - FPLOS not determined) | | | 19.21 | | 19.75 | | 20.72 | |
| N1600 | (City of Dunedin - FPLOS not determined) | | | 26.88 | | 26.99 | | 27.12 | |
| N1610 | (City of Dunedin - FPLOS not determined) | | | 27.87 | | 28.23 | | 28.87 | |
| N1620 | (City of Dunedin - FPLOS not determined) | | | 31.14 | | 31.43 | | 32.02 | |
| N1630 | (City of Dunedin - FPLOS not determined) | | | 26.18 | | 26.47 | | 26.84 | |
| N1640 | (City of Dunedin - FPLOS not determined) | | | 30.11 | | 30.77 | | 31.89 | |
| N1650 | (City of Dunedin - FPLOS not determined) | | | 30.96 | | 31.53 | | 32.80 | |
| N1660 | (City of Dunedin - FPLOS not determined) | | | 31.34 | | 31.81 | | 32.91 | |
| N1670 | (City of Dunedin - FPLOS not determined) | | | 32.22 | | 32.58 | | 33.29 | |
| N1680 | (City of Dunedin - FPLOS not determined) | | | 35.82 | | 36.68 | | 38.55 | |
| N1690 | (City of Dunedin - FPLOS not determined) | | | 39.53 | | 39.80 | | 40.59 | |
| N1700 | (City of Dunedin - FPLOS not determined) | | | 36.31 | | 36.69 | | 37.49 | |
| N1710 | (City of Dunedin - FPLOS not determined) | | | 27.35 | | 28.18 | | 30.35 | |
| N1720 | (City of Dunedin - FPLOS not determined) | | | 44.60 | | 44.74 | | 44.88 | |
| N1750 | (City of Dunedin - FPLOS not determined) | | | 24.63 | | 25.09 | | 26.28 | |
| N1760 | (City of Dunedin - FPLOS not determined) | | | 24.63 | | 25.11 | | 26.28 | |
| N1770 | (City of Dunedin - FPLOS not determined) | | | 25.19 | | 25.30 | | 26.30 | |
| N1780 | (City of Dunedin - FPLOS not determined) | | | 27.09 | | 27.39 | | 27.95 | |
| N1790 | (City of Dunedin - FPLOS not determined) | | | 28.64 | | 29.01 | | 29.52 | |
| N1800 | (City of Dunedin - FPLOS not determined) | | | 24.64 | | 25.06 | | 26.09 | |
| N1810 | (City of Dunedin - FPLOS not determined) | | | 24.64 | | 25.06 | | 26.09 | |
| N1820 | (City of Dunedin - FPLOS not determined) | | | 24.87 | | 25.41 | | 26.30 | |
| N1830 | (City of Dunedin - FPLOS not determined) | | | 26.96 | | 27.24 | | 27.98 | |
| N1840 | (City of Dunedin - FPLOS not determined) | | | 28.01 | | 28.63 | | 29.23 | |
| N1850 | (City of Dunedin - FPLOS not determined) | | | 28.01 | | 28.64 | | 29.23 | |
| N1860 | (City of Dunedin - FPLOS not determined) | | | 30.84 | | 31.60 | | 33.16 | |
| N1870 | (City of Dunedin - FPLOS not determined) | | | 31.62 | | 32.40 | | 34.09 | |
| N1880 | (City of Dunedin - FPLOS not determined) | | | 29.71 | | 30.14 | | 30.93 | |
| N1900 | (City of Dunedin - FPLOS not determined) | | | 28.02 | | 28.64 | | 29.30 | |
| N1910 | (City of Dunedin - FPLOS not determined) | | | 28.09 | | 28.73 | | 29.88 | |
| N1920 | (City of Dunedin - FPLOS not determined) | | | 30.71 | | 31.10 | | 31.72 | |

Table F.1 Proposed Conditions Street Flooding Level of Service Evaluation

0.51 = FPLOS Deficiency

| Node ID | Node Location | Roadway Classification | Lowest Road Elev. | Flood Elev. 10-yr, 24-hr | Depth of Flooding (ft) | Flood Elev. 25-yr, 24-hr | Depth of Flooding (ft) | Flood Elev. 100-yr,24-hr | Depth of Flooding (ft) |
|---------|--|------------------------|-------------------|--------------------------|------------------------|--------------------------|------------------------|--------------------------|------------------------|
| N1930 | (City of Dunedin - FPLOS not determined) | | | 31.33 | | 32.81 | | 35.57 | |
| N1940 | (City of Dunedin - FPLOS not determined) | | | 33.13 | | 35.16 | | 38.44 | |
| N1950 | (City of Dunedin - FPLOS not determined) | | | 37.02 | | 39.56 | | 43.92 | |
| N1960 | (City of Dunedin - FPLOS not determined) | | | 50.58 | | 50.77 | | 50.78 | |
| N1970 | (City of Dunedin - FPLOS not determined) | | | 52.94 | | 53.52 | | 54.89 | |
| N1980 | (City of Dunedin - FPLOS not determined) | | | 52.81 | | 53.12 | | 54.16 | |
| N1990 | (City of Dunedin - FPLOS not determined) | | | 51.70 | | 52.20 | | 53.42 | |
| N2000 | Hammond Branch, 625' W of Kings Highway | Residential | 6.5 | 6.90 | 0.40 | 7.59 | 1.09 | 8.98 | 2.48 |
| N2010 | Hammond Branch at Kings Highway | Collector | 9.8 | 10.31 | (0.00) | 10.68 | 0.88 | 11.26 | 1.46 |
| N2020 | Hammond Branch at Kings Highway | Collector | 9.8 | 10.75 | 0.95 | 10.94 | 1.14 | 11.36 | 1.56 |
| N2030 | Hammond Branch Pond E of Kings Highway | Residential | 15.1 | 13.27 | (0.00) | 14.50 | (0.00) | 16.62 | 1.52 |
| N2040 | Hammond Branch Pond W of Highland Ave | Residential | 19.0 | 19.28 | (0.00) | 19.58 | 0.58 | 20.34 | 1.34 |
| N2050 | Hammond Branch at Highland Avenue | Collector | 26.8 | 26.60 | (0.00) | 26.12 | (0.00) | 26.79 | (0.00) |
| N2055 | Proposed Improved Railroad Ditch | | | 38.10 | | 37.93 | | 38.03 | |
| N2060 | RR ditch at Flagler Drive and Carroll Street | Residential | 43.3 | 41.39 | (0.00) | 42.04 | (0.00) | 42.91 | (0.00) |
| N2070 | RR ditch at Flagler Drive and Gentry Street | Residential | 44.2 | 42.62 | (0.00) | 43.37 | (0.00) | 44.32 | 0.12 |
| N2080 | RR ditch at Flagler Drive and Crown Street | Residential | 46.7 | 45.45 | (0.00) | 45.94 | (0.00) | 46.72 | (0.00) |
| N2090 | RR ditch at Flagler Drive 200' N of Scott St | Residential | 48.4 | 47.66 | (0.00) | 48.01 | (0.00) | 48.66 | 0.26 |
| N2100 | RR ditch at Flagler Dr 250' W of Ridge Ave | Residential | 50.3 | 50.17 | (0.00) | 50.51 | 0.21 | 50.99 | 0.69 |
| N2110 | RR ditch at Flagler Dr 100' E of Lynn Ave | Residential | 55.3 | 54.71 | (0.00) | 55.11 | (0.00) | 55.49 | (0.00) |
| N2120 | RR ditch at Flagler Dr 80' W of Murry Ave | Residential | 60.1 | 58.21 | (0.00) | 58.61 | (0.00) | 59.06 | (0.00) |
| N2130 | RR ditch at Flagler Dr and Saturn Avenue | Residential | 63.3 | 61.90 | (0.00) | 62.22 | (0.00) | 62.54 | (0.00) |
| N2140 | RR ditch at Flagler Drive and Keene Road | Collector | 62.9 | 62.87 | (0.00) | 63.09 | 0.19 | 63.40 | 0.50 |
| N2150 | Keene Road ditch 200' N of Long Street | Residential | 65.3 | 67.47 | 2.17 | 68.14 | 2.84 | 69.18 | 3.88 |
| N2155 | Keene Road ditch 440' S of Long Street | Residential | 69.0 | 67.49 | (0.00) | 68.14 | (0.00) | 69.19 | 0.19 |
| N2160 | Keene Road ditch at Palmetto Street | Collector | 67.0 | 67.53 | 0.53 | 68.15 | 1.15 | 69.20 | 2.20 |
| N2170 | West pond in Clearwater Golf Park | (no street) | | 68.45 | | 68.62 | | 69.20 | |
| N2180 | Center pond in Clearwater Golf Park | (no street) | | 68.87 | | 69.18 | | 69.63 | |
| N2200 | Rollen Road and Parkwood Street | Residential | 13.8 | 12.12 | (0.00) | 14.92 | 1.12 | 15.88 | 2.08 |
| N2210 | Rollen Road and Terrace Road | Residential | 17.0 | 17.25 | 0.25 | 17.64 | 0.64 | 17.95 | 0.95 |
| N2220 | Kings Highway and Terrace Road | Collector | 19.9 | 19.26 | (0.00) | 20.20 | 0.30 | 20.54 | 0.64 |

Table F.1 Proposed Conditions Street Flooding Level of Service Evaluation

0.51 = FPLOS Deficiency

| Node ID | Node Location | Roadway Classification | Lowest Road Elev. | Flood Elev. 10-yr, 24-hr | Depth of Flooding (ft) | Flood Elev. 25-yr, 24-hr | Depth of Flooding (ft) | Flood Elev. 100-yr,24-hr | Depth of Flooding (ft) |
|---------|---|------------------------|-------------------|--------------------------|------------------------|--------------------------|------------------------|--------------------------|------------------------|
| N2230 | Kings Highway and Admiral Woodson Lane | Collector | 15.5 | 15.75 | 0.25 | 15.87 | 0.37 | 16.18 | 0.68 |
| N2240 | Pond at Kings Highway and Hibiscus Street | Residential | 23.0 | 17.44 | (0.00) | 18.37 | (0.00) | 19.75 | (0.00) |
| N2242 | Palmetto Street and Palm Terrace Drive | Collector | 25.0 | 21.89 | (0.00) | 22.10 | (0.00) | 22.12 | (0.00) |
| N2244 | Palmetto Street and SCL Railroad | Collector | 30.0 | 26.52 | (0.00) | 26.54 | (0.00) | 26.55 | (0.00) |
| N2250 | Palmetto Street and SCL Railroad | Collector | 36.0 | 30.39 | (0.00) | 30.73 | (0.00) | 31.34 | (0.00) |
| N2260 | Detention Pond SW of Highland & Palmetto | Collector | 37.0 | 32.54 | (0.00) | 33.33 | (0.00) | 34.86 | (0.00) |
| N2270 | Highland Avenue and Palmetto Street | Collector | 37.5 | 33.66 | (0.00) | 34.31 | (0.00) | 35.72 | (0.00) |
| N2280 | Highland Avenue and Walnut Street | Collector | 42.0 | 41.43 | (0.00) | 42.23 | 0.23 | 42.96 | 0.96 |
| N2290 | Glenwood Avenue and Elmwood Street | Residential | 49.0 | 46.63 | (0.00) | 47.17 | (0.00) | 48.72 | (0.00) |
| N2300 | Park at Smallwood Circle and Rosemere Rd | Residential | 44.5 | 46.90 | 2.40 | 47.38 | 2.88 | 48.27 | 3.77 |
| N2310 | Park at Ridgewood Street and Wood Ave | Residential | 53.0 | 53.10 | 0.10 | 53.83 | 0.83 | 55.21 | 2.21 |
| N2320 | Ridgewood Street and Edgewood Avenue | Residential | 58.0 | 55.61 | (0.00) | 56.41 | (0.00) | 57.34 | (0.00) |
| N2330 | Drew Street at Edgewood Avenue | Collector | 66.0 | 58.86 | (0.00) | 59.44 | (0.00) | 60.60 | (0.00) |
| N2340 | Drew Street at Crest Avenue | Collector | 62.7 | 62.61 | (0.00) | 63.10 | 0.40 | 63.22 | 0.52 |
| N2345 | Highland Avenue and Palmetto Street | Collector | 36.6 | 36.57 | (0.00) | 36.75 | 0.15 | 36.95 | 0.35 |
| N2350 | Flagler Drive and Levern Street | Residential | 39.0 | 38.89 | (0.00) | 39.60 | 0.60 | 40.04 | 1.04 |
| N2370 | Overlea Street, E of Carlos Avenue | Residential | 23.5 | 23.77 | 0.27 | 24.07 | 0.57 | 24.53 | 1.03 |
| N2380 | Highland Avenue and Fairmont Street | Collector | 27.3 | 27.77 | 0.47 | 27.97 | 0.67 | 28.17 | 0.87 |
| N2390 | Highland Avenue and Fairmont Street | Collector | 27.3 | 28.36 | 1.06 | 28.50 | 1.20 | 28.69 | 1.39 |
| N2400 | Highland Avenue and Sandy Lane | Collector | 32.5 | 33.35 | 0.85 | 33.47 | 0.97 | 33.68 | 1.18 |
| N2420 | Highland Avenue and Greenlea Drive | Collector | 34.9 | 35.36 | 0.46 | 35.44 | 0.54 | 35.55 | 0.65 |
| N2450 | SCL RR W of Gentry Street and Flagler Drive | Residential | 44.2 | 38.41 | (0.00) | 38.26 | (0.00) | 38.35 | (0.00) |
| N2460 | Linwood Drive and Sharondale Drive | Residential | 51.0 | 46.27 | (0.00) | 46.77 | (0.00) | 47.44 | (0.00) |
| N2470 | Nelson Avenue and Scott Street | Residential | 58.4 | 58.79 | 0.39 | 58.86 | 0.46 | 59.13 | 0.73 |
| N2480 | Lake Lucille | Residential | 59.0 | 60.34 | 1.34 | 60.41 | 1.41 | 60.84 | 1.84 |
| N2490 | Palmetto Street and Casloer Avenue | Collector | 66.4 | 66.49 | 0.09 | 66.94 | 0.54 | 67.12 | 0.72 |
| N2500 | Lake Hobart | Collector | 67.3 | 65.74 | (0.00) | 66.34 | (0.00) | 67.42 | 0.12 |
| N2510 | Saturn Avenue and Leo Lane | Residential | 63.4 | 63.23 | (0.00) | 64.10 | 0.70 | 64.54 | 1.14 |
| N2520 | Saturn Avenue and Sherwood Street | Residential | 63.2 | 63.77 | 0.57 | 64.17 | 0.97 | 64.55 | 1.35 |
| N2530 | Lake at St Andrews Cove Apartments | Residential | 69.4 | 67.23 | (0.00) | 67.79 | (0.00) | 68.93 | (0.00) |
| N2540 | Clearwater Air Park | Evacuation | 68.0 | 67.17 | (0.00) | 67.59 | (0.00) | 68.62 | 0.62 |

Table F.1 Proposed Conditions Street Flooding Level of Service Evaluation

0.51 = FPLOS Deficiency

| Node ID | Node Location | Roadway Classification | Lowest Road Elev. | Flood Elev. 10-yr, 24-hr | Depth of Flooding (ft) | Flood Elev. 25-yr, 24-hr | Depth of Flooding (ft) | Flood Elev. 100-yr,24-hr | Depth of Flooding (ft) |
|---------|---|------------------------|-------------------|--------------------------|------------------------|--------------------------|------------------------|--------------------------|------------------------|
| N2545 | Clearwater Air Park | Evacuation | 68.0 | 61.40 | (0.00) | 61.40 | (0.00) | 61.40 | (0.00) |
| N2550 | Clearwater Air Park | Evacuation | 70.5 | 68.44 | (0.00) | 68.58 | (0.00) | 68.87 | (0.00) |
| N2560 | SE Pond in Clearwater Golf Park | (no street) | | 69.64 | | 69.72 | | 69.83 | |
| N2570 | City of Clearwater Public Service Complex | Residential | 64.3 | 63.78 | (0.00) | 64.05 | (0.00) | 64.52 | 0.22 |
| N2580 | City of Clearwater Public Service Complex | Residential | 66.0 | 66.07 | (0.00) | 66.24 | (0.00) | 66.71 | 0.71 |
| N3000 | Stevenson Creek gage, 170' N of Drew Street | Collector | 21.0 | 14.50 | (0.00) | 14.90 | (0.00) | 15.76 | (0.00) |
| N3010 | Stevenson Creek at Drew Street | Collector | 17.6 | 14.50 | (0.00) | 14.91 | (0.00) | 15.77 | (0.00) |
| N3020 | Stevenson Creek at Drew Street | Collector | 17.6 | 14.75 | (0.00) | 15.25 | (0.00) | 17.44 | (0.00) |
| N3030 | Stevenson Creek at Cleveland Street (SR 60) | Evacuation | 18.0 | 14.99 | (0.00) | 15.53 | (0.00) | 17.61 | (0.00) |
| N3040 | Stevenson Creek at Cleveland Street (SR 60) | Evacuation | 18.0 | 15.55 | (0.00) | 16.49 | (0.00) | 19.13 | 1.12 |
| N3050 | Stevenson Creek at Pierce Street | Residential | 17.2 | 15.84 | (0.00) | 16.82 | (0.00) | 20.04 | 2.84 |
| N3060 | Stevenson Creek at Pierce Street | Residential | 17.2 | 16.49 | (0.00) | 18.15 | 0.95 | 20.08 | 2.88 |
| N3070 | Stevenson Creek at Franklin Street | Residential | 17.8 | 16.59 | (0.00) | 18.22 | 0.42 | 20.14 | 2.34 |
| N3080 | Stevenson Creek at Franklin Street | Residential | 17.8 | 17.57 | (0.00) | 18.92 | 1.12 | 20.19 | 2.39 |
| N3090 | Stevenson Creek at Court Street (SR 595A) | Arterial | 22.0 | 17.65 | (0.00) | 18.97 | (0.00) | 20.22 | (0.00) |
| N3100 | Stevenson Creek at Court Street (SR 595A) | Arterial | 22.0 | 17.75 | (0.00) | 19.06 | (0.00) | 21.09 | (0.00) |
| N3110 | Stevenson Creek 605' S of Court Street | Residential | 19.0 | 18.34 | (0.00) | 19.52 | 0.52 | 21.47 | 2.47 |
| N3125 | Stevenson Creek at Druid Road | Collector | 21.8 | 18.41 | (0.00) | 19.95 | (0.00) | 22.18 | 0.38 |
| N3126 | Stevenson Creek Weir S of Druid Road | Residential | 21.5 | 19.63 | (0.00) | 20.90 | (0.00) | 22.98 | 1.48 |
| N3130 | Stevenson Creek 350' S of Druid (Linn Lake) | Residential | 21.5 | 20.04 | (0.00) | 21.36 | (0.00) | 23.40 | 1.90 |
| N3131 | Stevenson Creek 1030' S of Druid(Linn Lake) | Residential | 23.0 | 20.14 | (0.00) | 21.44 | (0.00) | 23.46 | 0.46 |
| N3132 | Stevenson Creek at Evergreen Avenue | Residential | 24.0 | 22.12 | (0.00) | 23.29 | (0.00) | 25.07 | 1.07 |
| N3134 | Stevenson Creek at Hillcrest N of Jeffords | Residential | 26.5 | 22.39 | (0.00) | 23.63 | (0.00) | 25.65 | (0.00) |
| N3135 | Pond in Golf Course S of Druid | Residential | 33.0 | 29.91 | (0.00) | 31.06 | (0.00) | 33.30 | 0.30 |
| N3150 | S. Betty Lane and Jasmine Way | Residential | 24.0 | 22.57 | (0.00) | 24.54 | 0.54 | 24.95 | 0.95 |
| N3160 | S. Betty Lane and Magnolia Drive | Residential | 26.0 | 26.18 | 0.18 | 26.71 | 0.71 | 26.98 | 0.98 |
| N3170 | S. Betty Lane and Lotus Path | Residential | 28.5 | 28.84 | 0.34 | 29.11 | 0.61 | 29.30 | 0.80 |
| N3180 | Jeffords Street and Byron Avenue | Residential | 25.5 | 25.22 | (0.00) | 25.85 | 0.35 | 26.08 | 0.58 |
| N3190 | Jeffords Street and S. Betty Lane | Residential | 33.0 | 33.02 | (0.00) | 33.34 | 0.34 | 33.52 | 0.52 |
| N3195 | Jeffords Street and Lincoln Avenue | Residential | 53.0 | 49.95 | (0.00) | 50.21 | (0.00) | 50.22 | (0.00) |
| N3200 | Plaza Pines Shopping Center | Residential | 57.0 | 52.21 | (0.00) | 52.23 | (0.00) | 52.85 | (0.00) |

Table F.1 Proposed Conditions Street Flooding Level of Service Evaluation

0.51 = FPLOS Deficiency

| Node ID | Node Location | Roadway Classification | Lowest Road Elev. | Flood Elev. 10-yr, 24-hr | Depth of Flooding (ft) | Flood Elev. 25-yr, 24-hr | Depth of Flooding (ft) | Flood Elev. 100-yr,24-hr | Depth of Flooding (ft) |
|---------|---|------------------------|-------------------|--------------------------|------------------------|--------------------------|------------------------|--------------------------|------------------------|
| N3210 | Plaza Pines Shopping Center | Residential | 58.5 | 54.32 | (0.00) | 54.71 | (0.00) | 55.14 | (0.00) |
| N3220 | Plaza Pines Shopping Center Pond | Residential | 60.8 | 61.22 | 0.42 | 61.27 | 0.47 | 61.34 | 0.54 |
| N3450 | Lake Bellevue Branch at S. Betty Lane | Residential | 19.0 | 18.44 | (0.00) | 19.64 | 0.64 | 21.48 | 2.48 |
| N3500 | Lake Bellevue Branch at S. Lincoln Drive | Residential | 20.3 | 19.05 | (0.00) | 20.15 | (0.00) | 21.50 | 1.20 |
| N3510 | Lake Bellevue Branch at Missouri Avenue | Arterial | 23.0 | 19.21 | (0.00) | 20.43 | (0.00) | 22.49 | (0.00) |
| N3520 | Lake Bellevue Branch at Missouri Avenue | Arterial | 23.0 | 19.37 | (0.00) | 21.05 | (0.00) | 23.50 | 0.50 |
| N3530 | Lake Bellevue Branch Pond W of Missouri | Residential | 25.0 | 21.09 | (0.00) | 22.49 | (0.00) | 25.54 | 0.54 |
| N3540 | Lake Bellevue Branch at Druid Road | Collector | 27.8 | 27.89 | 0.09 | 28.18 | 0.38 | 28.75 | 0.95 |
| N3550 | Stormwater Pond at Renaissance Sq. Villas | Residential | 31.0 | 29.97 | (0.00) | 30.68 | (0.00) | 31.54 | 0.54 |
| N3555 | Lake Bellevue Branch 400' S of Druid | Residential | 32.5 | 28.58 | (0.00) | 28.88 | (0.00) | 30.00 | (0.00) |
| N3560 | Lake Bellevue Branch W of Renaissance Sq | Residential | 36.0 | 30.30 | (0.00) | 31.24 | (0.00) | 33.22 | (0.00) |
| N3565 | Lk Bellevue Brnch at Lotus Path/ S Greenwd | Collector | 45.6 | 33.03 | (0.00) | 34.80 | (0.00) | 36.54 | (0.00) |
| N3570 | Lake Bellevue Branch S of Renaissance Sq | Residential | 37.5 | 35.39 | (0.00) | 37.80 | 0.30 | 38.95 | 1.45 |
| N3575 | Lk Bellevue Branch 150' S of Renaissance Sq | Residential | 36.0 | 36.70 | 0.70 | 37.80 | 1.80 | 38.95 | 2.95 |
| N3580 | Lake Bellevue Branch 250' N of Pinellas St | Residential | 38.0 | 38.41 | 0.41 | 38.66 | 0.66 | 39.11 | 1.11 |
| N3600 | Lake Bellevue Branch at Pinellas Street | Residential | 38.5 | 38.53 | 0.03 | 38.85 | 0.35 | 39.59 | 1.09 |
| N3650 | Lk Bellevue Brnch at Tuskawilla/ S Greenwd | Collector | 39.8 | 40.18 | 0.38 | 40.31 | 0.51 | 40.78 | 0.98 |
| N3670 | Lake Bellevue Branch at Tuskawilla Ave | Residential | 39.8 | 40.19 | 0.39 | 40.40 | 0.60 | 40.86 | 1.06 |
| N3680 | Lake Bellevue Branch 160' N of Lakeview | Residential | 42.5 | 41.08 | (0.00) | 41.87 | (0.00) | 42.27 | (0.00) |
| N3700 | Lake Bellevue Branch at Lakeview Road | Collector | 41.8 | 41.74 | (0.00) | 42.30 | 0.50 | 42.75 | 0.95 |
| N3705 | Proposed Lake Bellevue Outfall Weir | | | 42.46 | | 43.01 | | 43.89 | |
| N3710 | Lake Bellevue | Collector | 44.5 | 42.46 | (0.00) | 43.02 | (0.00) | 43.91 | (0.00) |
| N3720 | Lake Bellevue Branch at Woodlawn Ave | Residential | 48.8 | 44.46 | (0.00) | 45.63 | (0.00) | 48.00 | (0.00) |
| N3730 | Lake Bellevue Branch at Woodlawn Ave | Residential | 48.8 | 45.90 | (0.00) | 49.16 | 0.36 | 50.34 | 1.54 |
| N3740 | Lake Bellevue Branch at Howard Street | Residential | 51.8 | 51.51 | (0.00) | 51.64 | (0.00) | 52.38 | 0.58 |
| N3750 | Lake Bellevue Branch at Howard Street | Residential | 51.8 | 52.21 | 0.41 | 52.57 | 0.77 | 53.45 | 1.65 |
| N3760 | Lake Bellevue Branch at Belleair Road | Collector | 56.3 | 55.14 | (0.00) | 55.86 | (0.00) | 56.92 | 0.62 |
| N3780 | S. Greenwood Avenue at Hawkins Street | Collector | 61.5 | 61.95 | 0.45 | 62.19 | 0.69 | 62.55 | 1.05 |
| N3790 | Missouri Avenue FDOT Detention Pond | Arterial | 64.5 | 61.98 | (0.00) | 62.28 | (0.00) | 62.78 | (0.00) |
| N3800 | Wildwood Way and SCL Railroad | Residential | 44.0 | 42.89 | (0.00) | 43.20 | (0.00) | 43.94 | (0.00) |
| N3810 | Belleair Road and SCL Railroad | Collector | 56.3 | 56.86 | 0.56 | 57.34 | 1.04 | 58.03 | 1.73 |

Table F.1 Proposed Conditions Street Flooding Level of Service Evaluation

0.51 = FPLOS Deficiency

| Node ID | Node Location | Roadway Classification | Lowest Road Elev. | Flood Elev. 10-yr, 24-hr | Depth of Flooding (ft) | Flood Elev. 25-yr, 24-hr | Depth of Flooding (ft) | Flood Elev. 100-yr,24-hr | Depth of Flooding (ft) |
|---------|--|------------------------|-------------------|--------------------------|------------------------|--------------------------|------------------------|--------------------------|------------------------|
| N4000 | Stevenson Creek at Jeffords Street | Residential | 24.5 | 22.50 | (0.00) | 24.10 | (0.00) | 26.93 | 2.43 |
| N4010 | Stevenson Creek at Browning Street | Residential | 28.6 | 26.24 | (0.00) | 27.53 | (0.00) | 29.15 | 0.55 |
| N4020 | Stevenson Creek at Browning Street | Residential | 28.6 | 26.62 | (0.00) | 28.72 | 0.12 | 30.24 | 1.64 |
| N4030 | Stevenson Creek at Lakeview Road | Collector | 33.8 | 28.69 | (0.00) | 29.74 | (0.00) | 31.33 | (0.00) |
| N4040 | Hillcrest Avenue S. of Lakeview Road | Residential | 31.0 | 30.37 | (0.00) | 31.21 | (0.00) | 33.00 | 2.00 |
| N4050 | Stevenson Creek 950' S of Lakeview Road | Residential | 33.5 | 31.89 | (0.00) | 32.83 | (0.00) | 34.29 | 0.79 |
| N4060 | Stevenson Creek at Bellevue Boulevard | Residential | 36.0 | 33.43 | (0.00) | 34.34 | (0.00) | 35.77 | (0.00) |
| N4065 | Stevenson Creek at Bellevue Boulevard | Residential | 36.0 | 36.87 | 0.87 | 37.49 | 1.49 | 38.39 | 2.39 |
| N4075 | Stevenson Creek at St Thomas Drive | Residential | 36.8 | 36.93 | 0.13 | 37.56 | 0.76 | 38.47 | 1.67 |
| N4080 | Stevenson Creek at St Thomas Drive | Residential | 36.8 | 38.66 | 1.86 | 39.07 | 2.27 | 39.88 | 3.08 |
| N4090 | Rice Lake | Collector | 41.8 | 38.81 | (0.00) | 39.26 | (0.00) | 40.15 | (0.00) |
| N4100 | Stevenson Creek at Belleair Boulevard | Collector | 41.8 | 39.09 | (0.00) | 40.48 | (0.00) | 42.31 | 0.51 |
| N4110 | Stevenson Creek at Southridge Drive | Residential | 40.9 | 40.18 | (0.00) | 40.92 | 0.02 | 42.56 | 1.66 |
| N4120 | Stevenson Creek at Southridge Drive | Residential | 40.9 | 41.18 | 0.28 | 41.61 | 0.71 | 42.56 | 1.66 |
| N4122 | Byron Drive 400' S of Emily Court | Residential | 34.3 | 35.45 | 1.15 | 35.84 | 1.54 | 36.51 | 2.21 |
| N4123 | Bellevue Boulevard at Boylan Avenue | Residential | 55.0 | 53.49 | (0.00) | 53.63 | (0.00) | 53.88 | (0.00) |
| N4125 | Missouri Avenue FDOT Detention Pond | Arterial | 65.0 | 59.85 | (0.00) | 60.47 | (0.00) | 61.64 | (0.00) |
| N4128 | Pond adj. to Stevenson Creek S of Belleair | Residential | 47.7 | 38.48 | (0.00) | 38.85 | (0.00) | 39.54 | (0.00) |
| N4130 | Belleair Road 700' W of Highland Avenue | Collector | 44.5 | 44.85 | 0.35 | 45.00 | 0.50 | 45.16 | 0.66 |
| N4131 | Belleair Road 350' W of Highland Avenue | Collector | 44.9 | 45.56 | 0.66 | 45.69 | 0.79 | 45.87 | 0.97 |
| N4132 | Belleair Road and Highland Avenue | Collector | 46.6 | 46.83 | 0.23 | 46.90 | 0.30 | 47.03 | 0.43 |
| N4133 | Belleair Road and Highland Avenue | Collector | 46.6 | 47.05 | 0.45 | 47.11 | 0.51 | 47.32 | 0.72 |
| N4135 | Highland Avenue 280' N of Belleair Road | Collector | 53.3 | 47.66 | (0.00) | 48.24 | (0.00) | 53.43 | 0.13 |
| N4136 | Labelle Plaza South Detention Pond | Residential | 56.0 | 52.63 | (0.00) | 53.72 | (0.00) | 54.69 | (0.00) |
| N4137 | Labelle Plaza North Detention Pond | Residential | 60.0 | 54.62 | (0.00) | 55.20 | (0.00) | 56.45 | (0.00) |
| N4138 | Pond SE of Belleair Road and Clearview Ave | Residential | 45.5 | 45.68 | 0.18 | 46.50 | 1.00 | 47.61 | 2.11 |
| N4139 | Jeffords Street Branch at Hillcrest Avenue | Residential | 26.0 | 22.81 | (0.00) | 24.34 | (0.00) | 27.08 | 1.08 |
| N4140 | Jeffords Street Branch at Highland Avenue | Collector | 28.5 | 28.84 | 0.34 | 29.34 | 0.84 | 30.10 | 1.60 |
| N4150 | Jeffords Street Branch 650' E of Highland | Residential | 31.0 | 30.52 | (0.00) | 31.57 | 0.57 | 32.23 | 1.23 |
| N4160 | Jeffords Street Branch 600' W of Lake Ave | Residential | 31.0 | 30.47 | (0.00) | 31.56 | 0.56 | 32.25 | 1.25 |
| N4170 | Jeffords Street Branch at Lake Avenue | Collector | 31.3 | 30.46 | (0.00) | 31.51 | 0.21 | 32.43 | 1.13 |

Table F.1 Proposed Conditions Street Flooding Level of Service Evaluation

0.51 = FPLOS Deficiency

| Node ID | Node Location | Roadway Classification | Lowest Road Elev. | Flood Elev. 10-yr, 24-hr | Depth of Flooding (ft) | Flood Elev. 25-yr, 24-hr | Depth of Flooding (ft) | Flood Elev. 100-yr,24-hr | Depth of Flooding (ft) |
|---------|--|------------------------|-------------------|--------------------------|------------------------|--------------------------|------------------------|--------------------------|------------------------|
| N4180 | Jeffords Street Branch at Lake Avenue | Collector | 31.3 | 30.46 | (0.00) | 31.54 | 0.24 | 32.49 | 1.19 |
| N4200 | Jeffords Street Branch 486' E of Lake Ave | Residential | 30.4 | 30.51 | 0.11 | 31.72 | 1.32 | 32.61 | 2.21 |
| N4205 | Jeffords Street 100' E of Tuscola Road | Residential | 30.0 | 31.11 | 1.11 | 32.18 | 2.18 | 32.74 | 2.74 |
| N4210 | Sonny Lake | Residential | 30.3 | 31.33 | 1.03 | 32.19 | 1.89 | 32.75 | 2.45 |
| N4220 | Lake Helen | Residential | 30.2 | 31.16 | 0.96 | 32.18 | 1.98 | 32.74 | 2.54 |
| N4230 | Woodcrest Avenue 450' S of Jeffords Street | Residential | 31.2 | 32.18 | 0.98 | 32.31 | 1.11 | 32.75 | 1.55 |
| N4240 | Ditch Terminus 220' E of Woodcrest Avenue | Residential | 44.0 | 33.68 | (0.00) | 34.03 | (0.00) | 34.70 | (0.00) |
| N4245 | Beginning of Lake Alpine Outfall Ditch | Residential | 36.0 | 33.68 | (0.00) | 34.03 | (0.00) | 34.70 | (0.00) |
| N4250 | Lake Alpine | Residential | 36.0 | 33.73 | (0.00) | 34.08 | (0.00) | 34.74 | (0.00) |
| N4260 | Keene Road and Beverly Circle | Arterial | 36.6 | 34.94 | (0.00) | 36.13 | (0.00) | 37.12 | 0.52 |
| N4280 | Pond SE of Keene Road and Beverly Circle | Residential | 36.7 | 34.66 | (0.00) | 35.08 | (0.00) | 35.80 | (0.00) |
| N4285 | West End of Budleigh Street at N-S Ditch | Residential | 34.5 | 34.85 | 0.35 | 35.12 | 0.62 | 35.34 | 0.84 |
| N4290 | West End of Magnolia Drive at N-S Ditch | Residential | 50.0 | 47.17 | (0.00) | 47.51 | (0.00) | 47.90 | (0.00) |
| N4300 | Druid Road and Skyview Avenue | Collector | 56.0 | 56.33 | 0.33 | 56.32 | 0.32 | 56.52 | 0.52 |
| N4310 | Turner Street and Skyview Avenue | Residential | 68.5 | 68.59 | 0.09 | 68.75 | 0.25 | 68.84 | 0.34 |
| N4320 | Gulf to Bay Boulevard and Skyview Avenue | Evacuation | 72.2 | 68.58 | (0.00) | 68.74 | (0.00) | 68.83 | (0.00) |
| N4360 | Crest Lake | Collector | 71.2 | 68.85 | (0.00) | 69.14 | (0.00) | 69.62 | (0.00) |
| N4380 | Lake NE of Jeffords St and Keystone Ave | Residential | 31.3 | 31.18 | (0.00) | 32.18 | 0.88 | 32.74 | 1.44 |
| N4390 | Duncan Avenue 470' N of Jeffords Street | Residential | 32.5 | 31.60 | (0.00) | 32.78 | 0.28 | 33.17 | 0.67 |
| N4400 | Duncan Avenue at Magnolia Drive | Residential | 40.5 | 37.41 | (0.00) | 37.42 | (0.00) | 40.78 | 0.28 |
| N4410 | Duncan Avenue and Druid Road | Collector | 59.9 | 55.51 | (0.00) | 56.08 | (0.00) | 56.70 | (0.00) |
| N4420 | Duncan Avenue and Turner Street | Residential | 61.5 | 59.23 | (0.00) | 60.01 | (0.00) | 61.55 | 0.05 |
| N4424 | Duncan Avenue and Rainbow Drive | Residential | 70.0 | 69.92 | (0.00) | 70.25 | 0.25 | 70.41 | 0.41 |
| N4425 | Allens Creek Boundary Node | Residential | 68.0 | 68.00 | 0.00 | 68.00 | 0.00 | 68.00 | 0.00 |
| N4426 | Duncan Avenue and Cleveland Street | Collector | 69.0 | 69.59 | 0.59 | 69.68 | 0.68 | 69.83 | 0.83 |
| N4430 | Pond SW of Lakeview Rd and Duncan Ave | Collector | 35.4 | 31.81 | (0.00) | 33.32 | (0.00) | 35.92 | 0.52 |
| N4440 | Balmora Drive near Norwood Avenue | Residential | 34.0 | 34.67 | 0.67 | 35.51 | 1.51 | 36.06 | 2.06 |
| N4450 | Pond SE of Pinewood Dr and Norwood Ave | Residential | 34.0 | 32.85 | (0.00) | 33.67 | (0.00) | 35.35 | 1.35 |
| N4460 | Pond SE of Duncan Ave and Brentwood Dr | Residential | 33.0 | 31.33 | (0.00) | 32.19 | (0.00) | 32.76 | (0.00) |
| N4470 | Pond at Lake Avenue and Bamora Drive | Collector | 46.5 | 47.10 | 0.60 | 47.25 | 0.75 | 47.49 | 0.99 |
| N4480 | Brentwood Drive and Woodcrest Avenue | Residential | 36.0 | 34.37 | (0.00) | 36.27 | 0.27 | 36.53 | 0.53 |

Table F.1 Proposed Conditions Street Flooding Level of Service Evaluation

0.51 = FPLOS Deficiency

| Node ID | Node Location | Roadway Classification | Lowest Road Elev. | Flood Elev. 10-yr, 24-hr | Depth of Flooding (ft) | Flood Elev. 25-yr, 24-hr | Depth of Flooding (ft) | Flood Elev. 100-yr,24-hr | Depth of Flooding (ft) |
|---------|--|------------------------|-------------------|--------------------------|------------------------|--------------------------|------------------------|--------------------------|------------------------|
| N4485 | Keene Road 540' N of Beverly Circle | Arterial | 42.7 | 35.86 | (0.00) | 37.21 | (0.00) | 38.21 | (0.00) |
| N4490 | Pond SW of Keene Rd and Magnolia Drive | Arterial | 42.7 | 40.95 | (0.00) | 41.57 | (0.00) | 42.66 | (0.00) |
| N4500 | Pond SE of Keene Road and Magnolia Drive | Arterial | 42.7 | 41.38 | (0.00) | 42.09 | (0.00) | 43.17 | 0.47 |
| N4510 | Pond NE of Keene Road and Magnolia Drive | Residential | 49.5 | 44.99 | (0.00) | 45.42 | (0.00) | 46.35 | (0.00) |

Table F.2 Proposed Conditions Structure Flooding Level of Service Evaluation

0.51 = FPLOS Deficiency

| Map # | Address | # Grnd Flr Dwelling Units | Node ID | Finished Floor Elev. (ft,NGVD) | Flood Elev.(ft) 10-year | Depth of Flooding (feet) | Flood Elev.(ft) 25-year | Depth of Flooding (feet) | Flood Elev.(ft) 100-year | Depth of Flooding (feet) | Node Total Flood-prone Structures |
|-------|---|---------------------------|---------|--------------------------------|-------------------------|--------------------------|-------------------------|--------------------------|--------------------------|--------------------------|-----------------------------------|
| 1 | 1508 Stevenson Dr. | 1 | N0080 | 9.75 | 6.11 | -3.64 | 6.72 | -3.03 | 7.91 | -1.84 | 0 Structures |
| 2 | 1300 Betty Lane (Business) | 1 | N0090 | 7.26 | 6.27 | -0.99 | 6.84 | -0.42 | 7.94 | 0.68 | 5 Structures 5 Units |
| 2A | 1300 Block Betty Ln (FF estimated) | 1 | N0090 | 7.5 | 6.27 | -1.23 | 6.84 | -0.66 | 7.94 | 0.44 | |
| 2B | 1300 Block Betty Ln (FF estimated) | 1 | N0090 | 7.5 | 6.27 | -1.23 | 6.84 | -0.66 | 7.94 | 0.44 | |
| 2C | 1300 Block Betty Ln (FF estimated) | 1 | N0090 | 7.5 | 6.27 | -1.23 | 6.84 | -0.66 | 7.94 | 0.44 | |
| 2D | 1200 Block Betty Ln (FF estimated) | 1 | N0090 | 7.5 | 6.27 | -1.23 | 6.84 | -0.66 | 7.94 | 0.44 | |
| 3 | 1211 Betty Lane | 1 | N0100 | 8.33 | 6.86 | -1.47 | 7.54 | -0.79 | 8.93 | 0.60 | 17 Structures 17 Units |
| 3A | 1200 Block Betty Ln (FF estimated) | 1 | N0100 | 8.0 | 6.86 | -1.14 | 7.54 | -0.46 | 8.93 | 0.93 | |
| 3B | 1300 Block Betty Ln (FF estimated) | 1 | N0100 | 8.0 | 6.86 | -1.14 | 7.54 | -0.46 | 8.93 | 0.93 | |
| 3C | 1300 Block Overlea (FF estimated) | 1 | N0100 | 7.8 | 6.86 | -0.94 | 7.54 | -0.26 | 8.93 | 1.13 | |
| 3D | 1300 Block Overlea (FF estimated) | 1 | N0100 | 7.8 | 6.86 | -0.94 | 7.54 | -0.26 | 8.93 | 1.13 | |
| 3E | 1300 Block Overlea (FF estimated) | 1 | N0100 | 7.8 | 6.86 | -0.94 | 7.54 | -0.26 | 8.93 | 1.13 | |
| 3F | 1300 Block Overlea (FF estimated) | 1 | N0100 | 7.8 | 6.86 | -0.94 | 7.54 | -0.26 | 8.93 | 1.13 | |
| 3G | 1300 Block Overlea (FF estimated) | 1 | N0100 | 7.8 | 6.86 | -0.94 | 7.54 | -0.26 | 8.93 | 1.13 | |
| 3H | 1300 Block Overlea (FF estimated) | 1 | N0100 | 7.8 | 6.86 | -0.94 | 7.54 | -0.26 | 8.93 | 1.13 | |
| 3I | 1300 Block Overlea (FF estimated) | 1 | N0100 | 8.0 | 6.86 | -1.14 | 7.54 | -0.46 | 8.93 | 0.93 | |
| 3J | 1300 Block Overlea (FF estimated) | 1 | N0100 | 8.0 | 6.86 | -1.14 | 7.54 | -0.46 | 8.93 | 0.93 | |
| 3K | 1300 Block Overlea (FF estimated) | 1 | N0100 | 8.0 | 6.86 | -1.14 | 7.54 | -0.46 | 8.93 | 0.93 | |
| 3L | 1300 Block Springdale Str. (FF estimated) | 1 | N0100 | 8.7 | 6.86 | -1.84 | 7.54 | -1.16 | 8.93 | 0.23 | |
| 3M | Bethany C.M.E. Church on Sprindale (est.) | 1 | N0100 | 9.0 | 6.86 | -2.14 | 7.54 | -1.46 | 8.93 | -0.07 | |
| 3N | 1300 Block Overlea (FF estimated) | 1 | N0100 | 8.7 | 6.86 | -1.84 | 7.54 | -1.16 | 8.93 | 0.23 | |
| 3O | 1300 Block Overlea (FF estimated) | 1 | N0100 | 9 | 6.86 | -2.14 | 7.54 | -1.46 | 8.93 | -0.07 | |
| 3P | 1300 Block Overlea (FF estimated) | 1 | N0100 | 9 | 6.86 | -2.14 | 7.54 | -1.46 | 8.93 | -0.07 | |
| 3Q | 1300 Block Overlea (FF estimated) | 1 | N0100 | 9 | 6.86 | -2.14 | 7.54 | -1.46 | 8.93 | -0.07 | |
| 272 | 1321 Springdale St. | 1 | N0100 | 8.73 | 6.86 | -1.87 | 7.54 | -1.19 | 8.93 | 0.20 | |
| 273 | 1315 Betty Lane | 1 | N0100 | 7.12 | 6.86 | -0.26 | 7.54 | 0.42 | 8.93 | 1.81 | |
| 274 | 1317 Overea St. | 1 | N0100 | 7.80 | 6.86 | -0.94 | 7.54 | -0.26 | 8.93 | 1.13 | |
| 4 | 1020 Pine Brook Dr. | 1 | N0110 | 12.14 | 7.19 | -4.95 | 7.90 | -4.24 | 9.30 | -2.84 | |

Table F.2 Proposed Conditions Structure Flooding Level of Service Evaluation

0.51 = FPLOS Deficiency

| Map # | Address | # Grnd Flr Dwelling Units | Node ID | Finished Floor Elev. (ft,NGVD) | Flood Elev.(ft) 10-year | Depth of Flooding (feet) | Flood Elev.(ft) 25-year | Depth of Flooding (feet) | Flood Elev.(ft) 100-year | Depth of Flooding (feet) | Node Total Flood-prone Structures | |
|-------|---------------------------------------|---------------------------|--------------------------------------|--------------------------------|-------------------------|--------------------------|-------------------------|--------------------------|--------------------------|--------------------------|-----------------------------------|---------|
| 5 | 1201 Betty Lane | 1 | N0110 | 12.14 | 7.19 | -4.95 | 7.90 | -4.24 | 9.30 | -2.84 | 3 Structures | |
| 4A | 1000 Block Pinebrook Dr. (Estimated) | 1 | N0110 | 9.6 | 7.19 | -2.41 | 7.90 | -1.70 | 9.30 | -0.30 | | |
| 4B | 1000 Block Pinebrook Dr. (Estimated) | 1 | N0110 | 9.1 | 7.19 | -1.91 | 7.90 | -1.20 | 9.30 | 0.20 | | |
| 4C | 1000 Block Pinebrook Dr. (Estimated) | 1 | N0110 | 9.1 | 7.19 | -1.91 | 7.90 | -1.20 | 9.30 | 0.20 | | |
| 4D | 1000 Block Pinebrook Dr. (Estimated) | 1 | N0110 | 9.1 | 7.19 | -1.91 | 7.90 | -1.20 | 9.30 | 0.20 | | |
| 275 | 1012 PineBrook Dr. | 1 | N0110 | 10.08 | 7.19 | -2.89 | 7.90 | -2.18 | 9.30 | -0.78 | 3 Units | |
| 6 | 1324 Palmetto Street | 1 | N0120 | 9.41 | 7.65 | -1.76 | 8.38 | -1.03 | 9.81 | 0.40 | 1 Structures | |
| 7 | 1312 Palmetto Street | 1 | To be acquired as part of project 2A | | | | | | | | | 1 Units |
| 8 | Clearwater C.C. utility bldg -W. bank | 1 | N0170 | 12.60 | 13.11 | 0.51 | 13.48 | 0.88 | 14.43 | 1.83 | 2 Structures | |
| 9 | Clearwater C.C. utility bldg -E. bank | 1 | N0170 | 12.34 | 13.11 | 0.77 | 13.48 | 1.14 | 14.43 | 2.09 | 2 Units | |
| 158 | 902 Palm Bluff St. | 1 | N0370 | 24.34 | 21.41 | -2.93 | 21.66 | -2.68 | 21.96 | -2.38 | 1 Structure 1 Unit | |
| 159 | 904 Palm Bluff St. | 1 | N0370 | 23.52 | 21.41 | -2.11 | 21.66 | -1.86 | 21.96 | -1.56 | | |
| 160 | 908 Palm Bluff St. | 1 | N0370 | 22.62 | 21.41 | -1.21 | 21.66 | -0.96 | 21.96 | -0.66 | | |
| 161 | 1012 Pennsylvania Ave.Church | 1 | N0370 | 22.19 | 21.41 | -0.78 | 21.66 | -0.53 | 21.96 | -0.23 | | |
| 162 | 910 Jurgens St. | 1 | N0370 | 24.30 | 21.41 | -2.89 | 21.66 | -2.64 | 21.96 | -2.34 | | |
| 163 | 912 Jurgens St. | 1 | N0370 | 22.98 | 21.41 | -1.57 | 21.66 | -1.32 | 21.96 | -1.02 | | |
| 164 | 913 Jurgens St. | 1 | N0370 | 23.47 | 21.41 | -2.06 | 21.66 | -1.81 | 21.96 | -1.51 | | |
| 165 | 1010 Pennsylvania Ave. | 1 | N0370 | 22.93 | 21.41 | -1.52 | 21.66 | -1.27 | 21.96 | -0.97 | | |
| 166 | 1008 Pennsylvania Ave. | 1 | N0370 | 21.85 | 21.41 | -0.44 | 21.66 | -0.19 | 21.96 | 0.11 | | |
| 170 | 912 Palmetto St. | 1 | N0370 | 21.96 | 21.41 | -0.55 | 21.66 | -0.30 | 21.96 | 0.00 | | |
| 172 | 920 Pennsylvania Ave. | 1 | N0370 | 22.38 | 21.41 | -0.97 | 21.66 | -0.72 | 21.96 | -0.42 | | |
| 175 | 1396 Palmetto St. | 1 | N0440 | 19.94 | 15.66 | -4.28 | 15.60 | -4.34 | 19.59 | -0.35 | 0 Structures | |
| 187 | 511 Washington Ave. | 1 | N0470 | 25.47 | 22.98 | -2.49 | 23.59 | -1.88 | 24.52 | -0.95 | 0 Structures | |
| 179 | 506 N. Greenwood Ave. | 1 | N0480 | 24.85 | 23.39 | -1.46 | 23.82 | -1.03 | 24.64 | -0.21 | | |
| 180 | 1003 Lee St. | 1 | N0480 | 25.55 | 23.39 | -2.16 | 23.82 | -1.73 | 24.64 | -0.91 | | |
| 181 | 1027 Lee St. | 1 | N0480 | 25.74 | 23.39 | -2.35 | 23.82 | -1.92 | 24.64 | -1.10 | | |
| 182 | 1004 Plaza St. | 1 | N0480 | 25.95 | 23.39 | -2.56 | 23.82 | -2.13 | 24.64 | -1.31 | | |
| 183 | 1008 Plaza St. | 1 | N0480 | 26.13 | 23.39 | -2.74 | 23.82 | -2.31 | 24.64 | -1.49 | | |

Table F.2 Proposed Conditions Structure Flooding Level of Service Evaluation

0.51 = FPLOS Deficiency

| Map # | Address | # Grnd Flr Dwelling Units | Node ID | Finished Floor Elev. (ft,NGVD) | Flood Elev.(ft) 10-year | Depth of Flooding (feet) | Flood Elev.(ft) 25-year | Depth of Flooding (feet) | Flood Elev.(ft) 100-year | Depth of Flooding (feet) | Node Total Flood-prone Structures |
|-------|---------------------------|---------------------------|---------|--------------------------------|-------------------------|--------------------------|-------------------------|--------------------------|--------------------------|--------------------------|-----------------------------------|
| 184 | 1010 Plaza St. | 1 | N0480 | 26.22 | 23.39 | -2.83 | 23.82 | -2.40 | 24.64 | -1.58 | 0 Structures 0 Units |
| 185 | 500 N. Greenwood Ave. | 1 | N0480 | 25.96 | 23.39 | -2.57 | 23.82 | -2.14 | 24.64 | -1.32 | |
| 186 | 512 N. Washington Ave. | 1 | N0480 | 24.64 | 23.39 | -1.25 | 23.82 | -0.82 | 24.64 | 0.00 | |
| 117 | Sunset Pt. Baptist Church | 1 | N0620 | 14.40 | 13.05 | -1.35 | 13.82 | -0.58 | 14.95 | 0.55 | 1 Structure |
| 101 | 1226 Idlewild Drive | 1 | N0910 | 23.10 | 16.13 | -6.97 | 16.47 | -6.63 | 20.13 | -2.97 | 0 Structures 0 Units |
| 102 | 1242 Idlewild Drive | 1 | N0910 | 22.38 | 16.13 | -6.25 | 16.47 | -5.91 | 20.13 | -2.25 | |
| 103 | 1246 Idlewild Drive | 1 | N0910 | 21.92 | 16.13 | -5.79 | 16.47 | -5.45 | 20.13 | -1.79 | |
| 104 | 1250 Idlewild Drive | 1 | N0910 | 21.54 | 16.13 | -5.41 | 16.47 | -5.07 | 20.13 | -1.41 | |
| 105 | 1254 Idlewild Drive | 1 | N0910 | 21.45 | 16.13 | -5.32 | 16.47 | -4.98 | 20.13 | -1.32 | |
| 106 | 1260 Idlewild Drive | 1 | N0910 | 22.63 | 16.13 | -6.50 | 16.47 | -6.16 | 20.13 | -2.50 | |
| 107 | 1266 Idlewild Drive | 1 | N0910 | 22.88 | 16.13 | -6.75 | 16.47 | -6.41 | 20.13 | -2.75 | |
| 108 | 1243 Idlewild Drive | 1 | N0910 | 22.94 | 16.13 | -6.81 | 16.47 | -6.47 | 20.13 | -2.81 | |
| 109 | 1245 Idlewild Drive | 1 | N0910 | 22.17 | 16.13 | -6.04 | 16.47 | -5.70 | 20.13 | -2.04 | |
| 110 | 1212 Woodlawn Terr. | 1 | N0910 | 20.23 | 16.13 | -4.10 | 16.47 | -3.76 | 20.13 | -0.10 | |
| 111 | 1232 Woodlawn Terr. | 1 | N0910 | 21.87 | 16.13 | -5.74 | 16.47 | -5.40 | 20.13 | -1.74 | |
| 112 | 1234 Woodlawn Terr. | 1 | N0910 | 22.58 | 16.13 | -6.45 | 16.47 | -6.11 | 20.13 | -2.45 | |
| 113 | 2000 Douglas Ave. | 1 | N0910 | 22.48 | 16.13 | -6.35 | 16.47 | -6.01 | 20.13 | -2.35 | |
| 114 | 1209 Woodlawn Terr. | 1 | N0910 | 22.26 | 16.13 | -6.13 | 16.47 | -5.79 | 20.13 | -2.13 | |
| 115 | 1213 Woodlawn Terr. | 1 | N0910 | 22.43 | 16.13 | -6.30 | 16.47 | -5.96 | 20.13 | -2.30 | |
| 116 | 1225 Woodlawn Terr. | 1 | N0910 | 22.01 | 16.13 | -5.88 | 16.47 | -5.54 | 20.13 | -1.88 | |
| 118 | 1400 Byram Drive | 1 | N1000 | 16.61 | 13.70 | -2.91 | 14.86 | -1.75 | 15.97 | -0.64 | |
| 119 | 1408 Byram Drive | 1 | N1000 | 16.72 | 13.70 | -3.02 | 14.86 | -1.86 | 15.97 | -0.75 | |
| 120 | 1422 Byram Drive | 1 | N1000 | 16.62 | 13.70 | -2.92 | 14.86 | -1.76 | 15.97 | -0.65 | |
| 121 | 1430 Byram Drive | 1 | N1000 | 16.66 | 13.70 | -2.96 | 14.86 | -1.80 | 15.97 | -0.69 | |
| 122 | 1436 Byram Drive | 1 | N1000 | 16.71 | 13.70 | -3.01 | 14.86 | -1.85 | 15.97 | -0.74 | |
| 123 | 1446 Byram Drive | 1 | N1000 | 16.82 | 13.70 | -3.12 | 14.86 | -1.96 | 15.97 | -0.85 | |
| 124 | 1450 Byram Drive | 1 | N1000 | 16.47 | 13.70 | -2.77 | 14.86 | -1.61 | 15.97 | -0.50 | |
| 125 | 1456 Byram Drive | 1 | N1000 | 16.85 | 13.70 | -3.15 | 14.86 | -1.99 | 15.97 | -0.88 | |

Table F.2 Proposed Conditions Structure Flooding Level of Service Evaluation

0.51 = FPLOS Deficiency

| Map # | Address | # Grnd Flr Dwelling Units | Node ID | Finished Floor Elev. (ft,NGVD) | Flood Elev.(ft) 10-year | Depth of Flooding (feet) | Flood Elev.(ft) 25-year | Depth of Flooding (feet) | Flood Elev.(ft) 100-year | Depth of Flooding (feet) | Node Total Flood-prone Structures | |
|-------|----------------------|---------------------------|--------------------------------------|--------------------------------|-------------------------|--------------------------|-------------------------|--------------------------|--------------------------|--------------------------|-----------------------------------|--|
| 126 | 1458 Byram Drive | 1 | To be acquired as part of project 1E | | | | | | | | | |
| 127 | 1460 Byram Drive | 1 | To be acquired as part of project 1E | | | | | | | | | |
| 128 | 1462 Byram Drive | 1 | To be acquired as part of project 1E | | | | | | | | | |
| 129 | 1466 Byram Drive | 1 | N1000 | 16.10 | 13.70 | -2.40 | 14.86 | -1.24 | 15.97 | -0.13 | | |
| 130 | 1468 Byram Drive | 1 | N1000 | 16.04 | 13.70 | -2.34 | 14.86 | -1.18 | 15.97 | -0.07 | | |
| 131 | 1472 Byram Drive | 1 | N1000 | 16.30 | 13.70 | -2.60 | 14.86 | -1.44 | 15.97 | -0.33 | | |
| 132 | 1476 Byram Drive | 1 | N1000 | 17.01 | 13.70 | -3.31 | 14.86 | -2.15 | 15.97 | -1.04 | | |
| 133 | 1482 Byram Drive | 1 | N1000 | 18.13 | 13.70 | -4.43 | 14.86 | -3.27 | 15.97 | -2.16 | | |
| 134 | 1492 Byram Drive | 1 | N1000 | 18.04 | 13.70 | -4.34 | 14.86 | -3.18 | 15.97 | -2.07 | | |
| 135 | 1447 Byram Drive | 1 | N1000 | 17.08 | 13.70 | -3.38 | 14.86 | -2.22 | 15.97 | -1.11 | | |
| 136 | 1457 Byram Drive | 1 | N1000 | 17.01 | 13.70 | -3.31 | 14.86 | -2.15 | 15.97 | -1.04 | | |
| 137 | 1461 Byram Drive | 1 | N1000 | 16.28 | 13.70 | -2.58 | 14.86 | -1.42 | 15.97 | -0.31 | | |
| 138 | 1463 Byram Drive | 1 | N1000 | 15.91 | 13.70 | -2.21 | 14.86 | -1.05 | 15.97 | 0.06 | | |
| 139 | 1465 Byram Drive | 1 | N1000 | 16.07 | 13.70 | -2.37 | 14.86 | -1.21 | 15.97 | -0.10 | | |
| 140 | 1467 Byram Drive | 1 | N1000 | 17.06 | 13.70 | -3.36 | 14.86 | -2.20 | 15.97 | -1.09 | | |
| 141 | 1471 Byram Drive | 1 | N1000 | 17.43 | 13.70 | -3.73 | 14.86 | -2.57 | 15.97 | -1.46 | | |
| 142 | 1944 Flora Rd. | 1 | N1000 | 16.58 | 13.70 | -2.88 | 14.86 | -1.72 | 15.97 | -0.61 | | |
| 143 | 1950 Flora Rd. | 1 | N1000 | 16.68 | 13.70 | -2.98 | 14.86 | -1.82 | 15.97 | -0.71 | | |
| 144 | 1464 Flora Rd. | 1 | N1000 | 16.52 | 13.70 | -2.82 | 14.86 | -1.66 | 15.97 | -0.55 | | |
| 145 | 1466 Flora Rd. | 1 | N1000 | 16.20 | 13.70 | -2.50 | 14.86 | -1.34 | 15.97 | -0.23 | | |
| 146 | 1468 Flora Rd. | 1 | N1000 | 16.38 | 13.70 | -2.68 | 14.86 | -1.52 | 15.97 | -0.41 | 1 Structure | |
| 147 | 1467 Flora Rd. | 1 | N1000 | 16.91 | 13.70 | -3.21 | 14.86 | -2.05 | 15.97 | -0.94 | 1 Unit | |
| 151 | 1556 Huntington Lane | 1 | N1370 | 25.19 | 22.53 | -2.66 | 23.50 | -1.69 | 24.60 | -0.59 | 0 Structures | |
| 152 | 1549 Huntington Lane | 1 | N1370 | 24.64 | 22.53 | -2.11 | 23.50 | -1.14 | 24.60 | -0.04 | | |
| 153 | 1555 Huntington Lane | 1 | N1370 | 25.08 | 22.53 | -2.55 | 23.50 | -1.58 | 24.60 | -0.48 | | |
| 148 | 1949 Highland Ave. | 1 | N1440 | 17.60 | 15.19 | -2.41 | 16.07 | -1.53 | 17.41 | -0.19 | 2 Structures | |
| 149 | 1943 Highland Ave. | 1 | N1440 | 17.39 | 15.19 | -2.20 | 16.07 | -1.32 | 17.41 | 0.02 | | |
| 150 | 1937 Highland Ave. | 1 | N1440 | 16.39 | 15.19 | -1.20 | 16.07 | -0.32 | 17.41 | 1.02 | 2 Units | |

Table F.2 Proposed Conditions Structure Flooding Level of Service Evaluation

0.51 = FPLOS Deficiency

| Map # | Address | # Grnd Flr Dwelling Units | Node ID | Finished Floor Elev. (ft,NGVD) | Flood Elev.(ft) 10-year | Depth of Flooding (feet) | Flood Elev.(ft) 25-year | Depth of Flooding (feet) | Flood Elev.(ft) 100-year | Depth of Flooding (feet) | Node Total Flood-prone Structures |
|-------|--------------------------------------|---------------------------|---------|--------------------------------|-------------------------|--------------------------|-------------------------|--------------------------|--------------------------|--------------------------|-----------------------------------|
| 154 | 1550 Souvenir Drive | 1 | N1500 | 26.59 | 23.38 | -3.21 | 24.81 | -1.78 | 26.43 | -0.16 | 0 Structures |
| 173 | 1402 N. Hibiscus St. | 1 | N2240 | 19.95 | 17.44 | -2.51 | 18.37 | -1.58 | 19.75 | -0.20 | 0 Structures |
| 174 | 1410 N. Hibiscus St. | 1 | N2240 | 20.84 | 17.44 | -3.40 | 18.37 | -2.47 | 19.75 | -1.09 | 0 Units |
| 176 | 1536 Smallwood Circle | 1 | N2300 | 48.43 | 46.90 | -1.53 | 47.38 | -1.05 | 48.27 | -0.16 | 0 Structures |
| 177 | 1544 Smallwood Circle | 1 | N2300 | 48.99 | 46.90 | -2.09 | 47.38 | -1.61 | 48.27 | -0.72 | 0 Units |
| 178 | 1550 Ridgewood St. | 1 | N2310 | 55.72 | 53.10 | -2.62 | 53.83 | -1.89 | 55.21 | -0.51 | 0 Structures |
| 155 | 1585 Linwood Drive | 1 | N2460 | 48.69 | 46.27 | -2.42 | 46.77 | -1.92 | 47.44 | -1.25 | 0 Structures 0 Units |
| 156 | 1591 Linwood Drive | 1 | N2460 | 48.28 | 46.27 | -2.01 | 46.77 | -1.51 | 47.44 | -0.84 | |
| 157 | 1593 Linwood Drive | 1 | N2460 | 49.02 | 46.27 | -2.75 | 46.77 | -2.25 | 47.44 | -1.58 | |
| 10 | 1329 Drew Street | 1 | N3020 | 19.59 | 14.75 | -4.84 | 15.25 | -4.34 | 17.44 | -2.15 | 1 Structure 1 Unit |
| 11 | 1345 Drew Street | 1 | N3020 | 18.11 | 14.75 | -3.36 | 15.25 | -2.86 | 17.44 | -0.67 | |
| 12 | 111 Lady Mary Drive | 1 | N3020 | 17.12 | 14.75 | -2.37 | 15.25 | -1.87 | 17.44 | 0.32 | |
| 13 | 106A Evergreen Avenue | 1 | N3020 | 18.08 | 14.75 | -3.33 | 15.25 | -2.83 | 17.44 | -0.64 | |
| 14 | 105&107 Lady Mary Drive | 2 | N3020 | 18.44 | 14.75 | -3.69 | 15.25 | -3.19 | 17.44 | -1.00 | |
| 15 | 1330 Cleveland St (Office Building) | 2 | N3030 | 19.72 | 14.99 | -4.73 | 15.53 | -4.19 | 17.61 | -2.11 | 0 Structures 0 Units |
| 15A | 11 Lady Mary Dr (Office Building) | 2 | N3030 | 19.72 | 14.99 | -4.73 | 15.53 | -4.19 | 17.61 | -2.11 | |
| 15B | 1300 Blk Cleveland St (Map #19?) | 1 | N3030 | 18.31 | 14.99 | -3.32 | 15.53 | -2.78 | 17.61 | -0.70 | |
| 15C | 1300 Blk Cleveland St (FF estimated) | 1 | N3030 | 19.5 | 14.99 | -4.51 | 15.53 | -3.97 | 17.61 | -1.89 | |
| 16 | 1343 Cleveland Street | 1 | N3040 | 20.04 | 15.55 | -4.49 | 16.49 | -3.55 | 19.13 | -0.91 | 0 Structures |
| 17 | 1331 Cleveland Street | 1 | N3040 | 20.01 | 15.55 | -4.46 | 16.49 | -3.52 | 19.13 | -0.88 | 0 Units |
| 18 | 1345 Park Street | 1 | N3050 | 21.93 | 15.84 | -6.09 | 16.82 | -5.11 | 20.04 | -1.89 | 4 Structures 6 Units |
| 20 | 1338 Pierce Street (Business) | 3 | N3050 | 19.16 | 15.84 | -3.32 | 16.82 | -2.34 | 20.04 | 0.88 | |
| 188 | 1318 Pierce St. | 1 | N3050 | 20.00 | 15.84 | -4.16 | 16.82 | -3.18 | 20.04 | 0.04 | |
| 189 | 1320 Pierce St. | 1 | N3050 | 18.87 | 15.84 | -3.03 | 16.82 | -2.05 | 20.04 | 1.17 | |
| 190 | 1326 Pierce St. | 1 | N3050 | 18.57 | 15.84 | -2.73 | 16.82 | -1.75 | 20.04 | 1.47 | |
| 191 | 1313 Pierce St. | 1 | N3060 | 21.00 | 16.49 | -4.51 | 18.15 | -2.85 | 20.08 | -0.92 | |
| 21 | 215 Waverly Way | 2 | N3070 | 19.95 | 16.59 | -3.36 | 18.22 | -1.73 | 20.14 | 0.19 | |
| 22 | 221 Waverly Way | 2 | N3070 | 19.28 | 16.59 | -2.69 | 18.22 | -1.06 | 20.14 | 0.86 | |

Table F.2 Proposed Conditions Structure Flooding Level of Service Evaluation

0.51 = FPLOS Deficiency

| Map # | Address | # Grnd Flr Dwelling Units | Node ID | Finished Floor Elev. (ft,NGVD) | Flood Elev.(ft) 10-year | Depth of Flooding (feet) | Flood Elev.(ft) 25-year | Depth of Flooding (feet) | Flood Elev.(ft) 100-year | Depth of Flooding (feet) | Node Total Flood-prone Structures |
|-------|---------------------------------------|---------------------------|---------|--------------------------------|-------------------------|--------------------------|-------------------------|--------------------------|--------------------------|--------------------------|-----------------------------------|
| 23 | 227 Waverly Way | 1 | N3070 | 19.5 | 16.59 | -2.91 | 18.22 | -1.28 | 20.14 | 0.64 | 4 Structures 6 Units |
| 24 | 229 Waverly Way | 1 | N3070 | 19.5 | 16.59 | -2.91 | 18.22 | -1.28 | 20.14 | 0.64 | |
| 276 | 1305 Franklin St. (Office Bldg.) | 1 | N3080 | 20.72 | 17.57 | -3.15 | 18.92 | -1.80 | 20.19 | -0.53 | 0 Structures |
| 25 | 311 S. Betty Lane (Bldg. 1) | 4 | N3090 | 21.03 | 17.57 | -3.46 | 18.92 | -2.11 | 20.19 | -0.84 | 0 Structures 0 Units |
| 26 | 1290 Court Street (Business) | 1 | N3090 | 22.43 | 17.65 | -4.78 | 18.97 | -3.46 | 20.22 | -2.21 | |
| 277 | 311 S. Betty Lane (Bldg. 2) | 15 | N3090 | 21.32 | 17.65 | -3.67 | 18.97 | -2.35 | 20.22 | -1.10 | |
| 278 | 1295 Santa Rosa Dr. Apt.# 1-5 | 5 | N3090 | 20.51 | 17.65 | -2.86 | 18.97 | -1.54 | 20.22 | -0.29 | |
| 279 | 1295 Santa Rosa Dr. Apt.# 11-15 | 5 | N3090 | 20.51 | 17.65 | -2.86 | 18.97 | -1.54 | 20.22 | -0.29 | |
| 27 | 514 Betty Lane | 1 | N3100 | 22.19 | 17.75 | -4.44 | 19.06 | -3.13 | 21.09 | -1.10 | 0 Structures |
| 30 | 600 Betty Lane | 1 | N3110 | 20.49 | 18.34 | -2.15 | 19.52 | -0.97 | 21.47 | 0.98 | 7 Structures |
| 31 | 606 Betty Lane | 1 | N3110 | 20.35 | 18.34 | -2.01 | 19.52 | -0.83 | 21.47 | 1.12 | |
| 32 | 610 Betty Lane | 1 | N3110 | 21.33 | 18.34 | -2.99 | 19.52 | -1.81 | 21.47 | 0.14 | |
| 33 | 616 Betty Lane | 1 | N3110 | 21.25 | 18.34 | -2.91 | 19.52 | -1.73 | 21.47 | 0.22 | |
| 34 | 620 Betty Lane | 1 | N3110 | 21.83 | 18.34 | -3.49 | 19.52 | -2.31 | 21.47 | -0.36 | |
| 35 | 622 Betty Lane | 1 | N3110 | 21.82 | 18.34 | -3.48 | 19.52 | -2.30 | 21.47 | -0.35 | |
| 192 | 1245 Rogers St. (Office Building) | 2 | N3110 | 23.44 | 18.34 | -5.10 | 19.52 | -3.92 | 21.47 | -1.97 | |
| 193 | 1266 Turner St. (Office Building) | 3 | N3110 | 21.60 | 18.34 | -3.26 | 19.52 | -2.08 | 21.47 | -0.13 | |
| 194 | 1270 Turner St. (Nursing Home) | 20 | N3110 | 21.58 | 18.34 | -3.24 | 19.52 | -2.06 | 21.47 | -0.11 | |
| 201 | 601 S. Lincoln Ave. (Office Building) | 1 | N3110 | 21.87 | 18.34 | -3.53 | 19.52 | -2.35 | 21.47 | -0.40 | |
| 202 | 1241 Turner St. | 1 | N3110 | 21.61 | 18.34 | -3.27 | 19.52 | -2.09 | 21.47 | -0.14 | |
| 203 | 1253 Turner St. | 5 | N3110 | 21.17 | 18.34 | -2.83 | 19.52 | -1.65 | 21.47 | 0.30 | |
| 204 | 1265 Turner St. | 3 | N3110 | 21.01 | 18.34 | -2.67 | 19.52 | -1.49 | 21.47 | 0.46 | |
| 205 | 610 Sally Lane | 6 | N3110 | 22.60 | 18.34 | -4.26 | 19.52 | -3.08 | 21.47 | -1.13 | |
| 206 | 612 Sally Lane - Apt. Building | 3 | N3110 | 22.44 | 18.34 | -4.10 | 19.52 | -2.92 | 21.47 | -0.97 | |
| 207 | same as above | 3 | N3110 | 22.44 | 18.34 | -4.10 | 19.52 | -2.92 | 21.47 | -0.97 | |
| 208 | 622 Sally Lane | 2 | N3110 | 23.04 | 18.34 | -4.70 | 19.52 | -3.52 | 21.47 | -1.57 | |
| 209 | 605 Sally Lane | 2 | N3110 | 21.38 | 18.34 | -3.04 | 19.52 | -1.86 | 21.47 | 0.09 | |
| 211 | 619 Sally Lane | 3 | N3110 | 21.73 | 18.34 | -3.39 | 19.52 | -2.21 | 21.47 | -0.26 | |

Table F.2 Proposed Conditions Structure Flooding Level of Service Evaluation

0.51 = FPLOS Deficiency

| Map # | Address | # Grnd Flr Dwelling Units | Node ID | Finished Floor Elev. (ft,NGVD) | Flood Elev.(ft) 10-year | Depth of Flooding (feet) | Flood Elev.(ft) 25-year | Depth of Flooding (feet) | Flood Elev.(ft) 100-year | Depth of Flooding (feet) | Node Total Flood-prone Structures | |
|-------|------------------------------------|---------------------------|---------|--------------------------------|-------------------------|--------------------------|-------------------------|--------------------------|--------------------------|--------------------------|-----------------------------------|--|
| 212 | 621 Sally Lane | 4 | N3110 | 22.17 | 18.34 | -3.83 | 19.52 | -2.65 | 21.47 | -0.70 | 14 Units | |
| 38A | 1301 Druid Rd (FF estimated) | 1 | N3126 | 24.50 | 19.63 | -4.87 | 20.90 | -3.60 | 22.98 | -1.52 | 0 Structures 0 Units | |
| 38B | 1311 Druid Rd (FF estimated) | 1 | N3126 | 23.50 | 19.63 | -3.87 | 20.90 | -2.60 | 22.98 | -0.52 | | |
| 38C | 800 Blk S Betty Ln (FF estimated) | 1 | N3126 | 25.50 | 19.63 | -5.87 | 20.90 | -4.60 | 22.98 | -2.52 | | |
| 38D | 800 Blk Mark Drive (FF estimated) | 1 | N3126 | 23.80 | 19.63 | -4.17 | 20.90 | -2.90 | 22.98 | -0.82 | | |
| 38 | 813 Betty Lane | 1 | N3130 | 26.42 | 20.04 | -6.38 | 21.36 | -5.06 | 23.40 | -3.02 | 0 Structures 0 Units | |
| 39 | 910 Mark Drive | 1 | N3130 | 23.78 | 20.04 | -3.74 | 21.36 | -2.42 | 23.40 | -0.38 | | |
| 40 | 913 S Betty Lane | 1 | N3130 | 27.34 | 20.04 | -7.30 | 21.36 | -5.98 | 23.40 | -3.94 | | |
| 38E | 800 Blk S Betty Ln (FF estimated) | 1 | N3130 | 25.80 | 20.04 | -5.76 | 21.36 | -4.44 | 23.40 | -2.40 | | |
| 38F | 800 Blk Mark Drive (FF estimated) | 1 | N3130 | 23.80 | 20.04 | -3.76 | 21.36 | -2.44 | 23.40 | -0.40 | | |
| 38G | 800 Blk S Betty Ln (FF estimated) | 1 | N3130 | 26.70 | 20.04 | -6.66 | 21.36 | -5.34 | 23.40 | -3.30 | | |
| 38H | 800 Blk S Betty Ln (FF estimated) | 1 | N3130 | 26.90 | 20.04 | -6.86 | 21.36 | -5.54 | 23.40 | -3.50 | | |
| 38I | 900 Blk S Betty Ln (FF estimated) | 1 | N3130 | 27.10 | 20.04 | -7.06 | 21.36 | -5.74 | 23.40 | -3.70 | | |
| 38J | 900 Blk S Betty Ln (FF estimated) | 1 | N3130 | 27.25 | 20.04 | -7.21 | 21.36 | -5.89 | 23.40 | -3.85 | | |
| 39A | 800 Blk Mark Drive (FF estimated) | 1 | N3130 | 23.80 | 20.04 | -3.76 | 21.36 | -2.44 | 23.40 | -0.40 | | |
| 39B | 800 Blk Mark Drive (FF estimated) | 1 | N3130 | 23.80 | 20.04 | -3.76 | 21.36 | -2.44 | 23.40 | -0.40 | | |
| 39C | 800 Blk Mark Drive (FF estimated) | 1 | N3130 | 23.80 | 20.04 | -3.76 | 21.36 | -2.44 | 23.40 | -0.40 | | |
| 39D | 900 Blk Mark Drive (FF estimated) | 1 | N3130 | 23.80 | 20.04 | -3.76 | 21.36 | -2.44 | 23.40 | -0.40 | | |
| 39E | 900 Blk Mark Drive (FF estimated) | 1 | N3130 | 23.90 | 20.04 | -3.86 | 21.36 | -2.54 | 23.40 | -0.50 | | |
| 39F | 900 Blk Mark Drive (FF estimated) | 1 | N3130 | 24.10 | 20.04 | -4.06 | 21.36 | -2.74 | 23.40 | -0.70 | | |
| 39G | 900 Blk Mark Drive (FF estimated) | 1 | N3130 | 24.60 | 20.04 | -4.56 | 21.36 | -3.24 | 23.40 | -1.20 | | |
| 39H | 900 Blk Mark Drive (FF estimated) | 1 | N3130 | 24.60 | 20.04 | -4.56 | 21.36 | -3.24 | 23.40 | -1.20 | | |
| 39I | 900 Blk Mark Drive (FF estimated) | 1 | N3130 | 24.60 | 20.04 | -4.56 | 21.36 | -3.24 | 23.40 | -1.20 | | |
| 41 | 1101 S Betty Lane | 1 | N3131 | 30.91 | 20.14 | -10.77 | 21.44 | -9.47 | 23.46 | -7.45 | | |
| 42 | 1020 Mark Drive | 1 | N3131 | 25.54 | 20.14 | -5.40 | 21.44 | -4.10 | 23.46 | -2.08 | | |
| 42A | 1000 Blk Mark Drive (FF estimated) | 1 | N3131 | 24.60 | 20.14 | -4.46 | 21.44 | -3.16 | 23.46 | -1.14 | | |
| 42B | 1000 Blk Mark Drive (FF estimated) | 1 | N3131 | 25.00 | 20.14 | -4.86 | 21.44 | -3.56 | 23.46 | -1.54 | | |
| 42C | 1000 Blk Mark Drive (FF estimated) | 1 | N3131 | 25.20 | 20.14 | -5.06 | 21.44 | -3.76 | 23.46 | -1.74 | | |

Table F.2 Proposed Conditions Structure Flooding Level of Service Evaluation

0.51 = FPLOS Deficiency

| Map # | Address | # Grnd Flr Dwelling Units | Node ID | Finished Floor Elev. (ft,NGVD) | Flood Elev.(ft) 10-year | Depth of Flooding (feet) | Flood Elev.(ft) 25-year | Depth of Flooding (feet) | Flood Elev.(ft) 100-year | Depth of Flooding (feet) | Node Total Flood-prone Structures |
|-------|------------------------------------|---------------------------|---------|--------------------------------|-------------------------|--------------------------|-------------------------|--------------------------|--------------------------|--------------------------|-----------------------------------|
| 42D | 1000 Blk Mark Drive (FF estimated) | 1 | N3131 | 25.40 | 20.14 | -5.26 | 21.44 | -3.96 | 23.46 | -1.94 | 0 Structures 0 Units |
| 42E | 1000 Blk Mark Drive (FF estimated) | 1 | N3131 | 25.60 | 20.14 | -5.46 | 21.44 | -4.16 | 23.46 | -2.14 | |
| 42F | 1000 Blk Mark Drive (FF estimated) | 1 | N3131 | 25.60 | 20.14 | -5.46 | 21.44 | -4.16 | 23.46 | -2.14 | |
| 42G | 1000 Blk Mark Drive (FF estimated) | 1 | N3131 | 25.60 | 20.14 | -5.46 | 21.44 | -4.16 | 23.46 | -2.14 | |
| 42H | 1000 Blk Mark Drive (FF estimated) | 1 | N3131 | 25.60 | 20.14 | -5.46 | 21.44 | -4.16 | 23.46 | -2.14 | |
| 42I | 1000 Blk Mark Drive (FF estimated) | 1 | N3131 | 25.60 | 20.14 | -5.46 | 21.44 | -4.16 | 23.46 | -2.14 | |
| 42J | 1000 Blk Mark Drive (FF estimated) | 1 | N3132 | 25.60 | 22.12 | -3.48 | 23.29 | -2.31 | 25.07 | -0.53 | 0 Structures 0 Units |
| 42K | 1000 Blk Mark Drive (FF estimated) | 1 | N3132 | 25.60 | 22.12 | -3.48 | 23.29 | -2.31 | 25.07 | -0.53 | |
| 42L | 1000 Blk Mark Drive (FF estimated) | 1 | N3132 | 25.60 | 22.12 | -3.48 | 23.29 | -2.31 | 25.07 | -0.53 | |
| 198 | 603 S. Missouri Ave. | 1 | N3510 | 24.36 | 19.21 | -5.15 | 20.43 | -3.93 | 22.49 | -1.87 | 0 Structures 0 Units |
| 199 | 613 S. Missouri Ave. | 1 | N3510 | 23.87 | 19.21 | -4.66 | 20.43 | -3.44 | 22.49 | -1.38 | |
| 200 | 615 S. Missouri Ave. | 1 | N3510 | 25.21 | 19.21 | -6.00 | 20.43 | -4.78 | 22.49 | -2.72 | |
| 195 | 701 Madison Ave. S. | 1 | N3530 | 27.88 | 21.09 | -6.79 | 22.49 | -5.39 | 25.54 | -2.34 | 0 Structures 0 Units |
| 196 | 600 S. Missouri Ave. | 1 | N3530 | 26.16 | 21.09 | -5.07 | 22.49 | -3.67 | 25.54 | -0.62 | |
| 197 | 614 S. Missouri Ave. | 1 | N3530 | 25.79 | 21.09 | -4.70 | 22.49 | -3.30 | 25.54 | -0.25 | |
| 229 | 1122 Pinellas St. | 1 | N3600 | 39.65 | 38.53 | -1.12 | 38.85 | -0.80 | 39.59 | -0.06 | 1 Structure 1 Unit |
| 230 | 1114 Pinellas St. | 1 | N3600 | 39.24 | 38.53 | -0.71 | 38.85 | -0.39 | 39.59 | 0.35 | |
| 231 | 1120 Pinellas St. | 1 | N3600 | 40.34 | 38.53 | -1.81 | 38.85 | -1.49 | 39.59 | -0.75 | |
| 233 | 1111 Pinellas St. | 1 | N3600 | 40.97 | 38.53 | -2.44 | 38.85 | -2.12 | 39.59 | -1.38 | |
| 234 | 1115 Pinellas St. | 1 | N3600 | 40.45 | 38.53 | -1.92 | 38.85 | -1.60 | 39.59 | -0.86 | |
| 232 | 1260 S. Greenwood Ave. | 1 | N3650 | 42.94 | 40.18 | -2.76 | 40.31 | -2.63 | 40.78 | -2.16 | |
| 235 | 1015 Tuskawilla St. | 1 | N3670 | 41.08 | 40.19 | -0.89 | 40.40 | -0.68 | 40.86 | -0.22 | 0 Structures 0 Units |
| 236 | 1000 Lakeview Rd. | 1 | N3670 | 43.08 | 40.19 | -2.89 | 40.40 | -2.68 | 40.86 | -2.22 | |
| 237 | 1012 Lakeview Rd. | 1 | N3670 | 42.46 | 40.19 | -2.27 | 40.40 | -2.06 | 40.86 | -1.60 | |
| 238 | 1020 Lakeview Rd. | 1 | N3670 | 43.31 | 40.19 | -3.12 | 40.40 | -2.91 | 40.86 | -2.45 | |
| 239 | 931 Dempsey St. | 1 | N3710 | 45.54 | 42.46 | -3.08 | 43.02 | -2.52 | 43.91 | -1.63 | |
| 240 | 925 Dempsey St. | 1 | N3710 | 44.13 | 42.46 | -1.67 | 43.02 | -1.11 | 43.91 | -0.22 | |
| 241 | 915 Dempsey St. | 1 | N3710 | 44.37 | 42.46 | -1.91 | 43.02 | -1.35 | 43.91 | -0.46 | |

Table F.2 Proposed Conditions Structure Flooding Level of Service Evaluation

0.51 = FPLOS Deficiency

| Map # | Address | # Grnd Flr Dwelling Units | Node ID | Finished Floor Elev. (ft,NGVD) | Flood Elev.(ft) 10-year | Depth of Flooding (feet) | Flood Elev.(ft) 25-year | Depth of Flooding (feet) | Flood Elev.(ft) 100-year | Depth of Flooding (feet) | Node Total Flood-prone Structures | |
|-------|---------------------------------------|---------------------------|---------|--------------------------------|-------------------------|--------------------------|-------------------------|--------------------------|--------------------------|--------------------------|-----------------------------------|--------------|
| 242 | 909 Dempsey St. | 1 | N3710 | 44.05 | 42.46 | -1.59 | 43.02 | -1.03 | 43.91 | -0.14 | 0 Structures | |
| 243 | 901 Dempsey St. | 1 | N3710 | 44.83 | 42.46 | -2.37 | 43.02 | -1.81 | 43.91 | -0.92 | 0 Units | |
| 244 | 629 Belleview Blvd. | 1 | N3800 | 45.99 | 42.89 | -3.10 | 43.20 | -2.79 | 43.94 | -2.05 | | |
| 245 | 630 A, B, C, D Wildwood Way | 4 | N3800 | 44.92 | 42.89 | -2.03 | 43.20 | -1.72 | 43.94 | -0.98 | | |
| 246 | 633-635 Wildwood Way | 3 | N3800 | 44.66 | 42.89 | -1.77 | 43.20 | -1.46 | 43.94 | -0.72 | | |
| 247 | 629/627/625 Wildwood Way | 3 | N3800 | 44.01 | 42.89 | -1.12 | 43.20 | -0.81 | 43.94 | -0.07 | | |
| 248 | 619-621 Wildwood Way | 3 | N3800 | 45.13 | 42.89 | -2.24 | 43.20 | -1.93 | 43.94 | -1.19 | | |
| 249 | 616 Woodlawn St. | 1 | N3800 | 46.89 | 42.89 | -4.00 | 43.20 | -3.69 | 43.94 | -2.95 | | |
| 250 | 618-620 Woodlawn St. | 3 | N3800 | 46.63 | 42.89 | -3.74 | 43.20 | -3.43 | 43.94 | -2.69 | | |
| 251 | 622-624 Woodlawn St. | 3 | N3800 | 46.90 | 42.89 | -4.01 | 43.20 | -3.70 | 43.94 | -2.96 | | |
| 252 | 626-628 Woodlawn St. | 3 | N3800 | 46.84 | 42.89 | -3.95 | 43.20 | -3.64 | 43.94 | -2.90 | | 0 Structures |
| 253 | 638 Woodlawn St. | 1 | N3800 | 47.57 | 42.89 | -4.68 | 43.20 | -4.37 | 43.94 | -3.63 | | 0 Units |
| 45 | 1400 Jeffords Street | 1 | N4000 | 28.52 | 22.50 | -6.02 | 24.10 | -4.42 | 26.93 | -1.59 | | |
| 46 | 1201 Hillcrest Avenue | 1 | N4000 | 27.12 | 22.50 | -4.62 | 24.10 | -3.02 | 26.93 | -0.19 | | |
| 46A | 1400 Blk Jeffords St. (FF Estimated) | 1 | N4000 | 27.17 | 22.50 | -4.67 | 24.10 | -3.07 | 26.93 | -0.24 | | |
| 46B | 1400 Blk Jeffords St. (FF Estimated) | 1 | N4000 | 27.22 | 22.50 | -4.72 | 24.10 | -3.12 | 26.93 | -0.29 | | |
| 46C | 1400 Blk Jeffords St. (FF Estimated) | 1 | N4000 | 27.27 | 22.50 | -4.77 | 24.10 | -3.17 | 26.93 | -0.34 | | |
| 46D | 1400 Blk Jeffords St. (FF Estimated) | 1 | N4000 | 27.32 | 22.50 | -4.82 | 24.10 | -3.22 | 26.93 | -0.39 | | |
| 47A | 1370 Barry Ave. | 1 | N4000 | 28.4 | 22.50 | -5.9 | 24.10 | -4.3 | 26.93 | -1.47 | | |
| 47B | 1371 Barry Ave. | 1 | N4000 | 28.57 | 22.50 | -6.07 | 24.10 | -4.47 | 26.93 | -1.64 | | |
| 254 | NE Cor. S. Evergreen & Jeffords St. | 1 | N4000 | 27.32 | 22.50 | -4.82 | 24.10 | -3.22 | 26.93 | -0.39 | | |
| 255 | 1351 Jeffords St. | 1 | N4000 | 27.07 | 22.50 | -4.57 | 24.10 | -2.97 | 26.93 | -0.14 | | |
| 256 | 1355 Jeffords St. | 1 | N4000 | 27.24 | 22.50 | -4.74 | 24.10 | -3.14 | 26.93 | -0.31 | | |
| 257 | 1359 Jeffords St. | 1 | N4000 | 26.93 | 22.50 | -4.43 | 24.10 | -2.83 | 26.93 | 0.00 | | |
| 258 | 1363 Jeffords St. | 1 | N4000 | 27.30 | 22.50 | -4.80 | 24.10 | -3.20 | 26.93 | -0.37 | | |
| 259 | 1367 Jeffords St. | 1 | N4000 | 27.35 | 22.50 | -4.85 | 24.10 | -3.25 | 26.93 | -0.42 | | |
| 260 | 1371 Jeffords St. | 1 | N4000 | 27.68 | 22.50 | -5.18 | 24.10 | -3.58 | 26.93 | -0.75 | | |
| 261 | 1375 Jeffords St. | 1 | N4000 | 27.61 | 22.50 | -5.11 | 24.10 | -3.51 | 26.93 | -0.68 | | |

Table F.2 Proposed Conditions Structure Flooding Level of Service Evaluation

0.51 = FPLOS Deficiency

| Map # | Address | # Grnd Flr Dwelling Units | Node ID | Finished Floor Elev. (ft,NGVD) | Flood Elev.(ft) 10-year | Depth of Flooding (feet) | Flood Elev.(ft) 25-year | Depth of Flooding (feet) | Flood Elev.(ft) 100-year | Depth of Flooding (feet) | Node Total Flood-prone Structures |
|-------|--|---------------------------|---------|--------------------------------|-------------------------|--------------------------|-------------------------|--------------------------|--------------------------|--------------------------|-----------------------------------|
| 262 | 1200 S. Hillcrest Ave. | 1 | N4000 | 27.86 | 22.50 | -5.36 | 24.10 | -3.76 | 26.93 | -0.93 | |
| 263 | 1374 Barry St. | 1 | N4000 | 28.60 | 22.50 | -6.10 | 24.10 | -4.50 | 26.93 | -1.67 | |
| 264 | 1210 S. Hillcrest Ave. | 1 | N4000 | 28.27 | 22.50 | -5.77 | 24.10 | -4.17 | 26.93 | -1.34 | |
| 265 | 1375 Barry St. | 1 | N4000 | 28.51 | 22.50 | -6.01 | 24.10 | -4.41 | 26.93 | -1.58 | |
| 266 | 1220 S. Hillcrest Ave. | 1 | N4000 | 28.58 | 22.50 | -6.08 | 24.10 | -4.48 | 26.93 | -1.65 | |
| 267 | 1374 Tuscola St. | 1 | N4000 | 28.59 | 22.50 | -6.09 | 24.10 | -4.49 | 26.93 | -1.66 | |
| 268 | 1230 S. Hillcrest Ave. | 1 | N4000 | 28.22 | 22.50 | -5.72 | 24.10 | -4.12 | 26.93 | -1.29 | |
| 269 | 1375 Tuscola St. | 1 | N4000 | 28.79 | 22.50 | -6.29 | 24.10 | -4.69 | 26.93 | -1.86 | |
| 270 | 1240 S. Hillcrest Ave. | 1 | N4000 | 28.55 | 22.50 | -6.05 | 24.10 | -4.45 | 26.93 | -1.62 | |
| 271 | 1392 Milton St. | 1 | N4000 | 28.85 | 22.50 | -6.35 | 24.10 | -4.75 | 26.93 | -1.92 | |
| 280 | 1246 S. Hillcrest Ave. | 1 | N4000 | 28.25 | 22.50 | -5.75 | 24.10 | -4.15 | 26.93 | -1.32 | |
| 286 | 1227 S. Hillcrest Ave. | 1 | N4000 | 27.20 | 22.50 | -4.70 | 24.10 | -3.10 | 26.93 | -0.27 | |
| 286A | 1200 Blk Hillcrest Ave (FF Estimated) | 1 | N4000 | 26.90 | 22.50 | -4.40 | 24.10 | -2.80 | 26.93 | 0.03 | |
| 286B | 1200 Blk Barry Ave. (FF Estimated) | 1 | N4000 | 26.20 | 22.50 | -3.70 | 24.10 | -2.10 | 26.93 | 0.73 | |
| 286C | 1200 Blk Forrest Hill Dr. (FF Estimated) | 1 | N4000 | 26.50 | 22.50 | -4.00 | 24.10 | -2.40 | 26.93 | 0.43 | |
| 286D | 1200 Blk Forrest Hill Dr. (FF Estimated) | 1 | N4000 | 27.10 | 22.50 | -4.60 | 24.10 | -3.00 | 26.93 | -0.17 | |
| 286E | 1200 Blk Forrest Hill Dr. (FF Estimated) | 1 | N4000 | 27.70 | 22.50 | -5.20 | 24.10 | -3.60 | 26.93 | -0.77 | |
| 286F | 1200 Blk Forrest Hill Dr. (FF Estimated) | 1 | N4000 | 28.30 | 22.50 | -5.80 | 24.10 | -4.20 | 26.93 | -1.37 | |
| 286G | 1200 Blk Forrest Hill Dr. (FF Estimated) | 1 | N4000 | 28.50 | 22.50 | -6.00 | 24.10 | -4.40 | 26.93 | -1.57 | |
| 286H | 1200 Blk Forrest Hill Dr. (FF Estimated) | 1 | N4000 | 28.70 | 22.50 | -6.20 | 24.10 | -4.60 | 26.93 | -1.77 | |
| 286I | 1200 Blk Forrest Hill Dr. (FF Estimated) | 1 | N4000 | 28.90 | 22.50 | -6.40 | 24.10 | -4.80 | 26.93 | -1.97 | |
| 286J | 1200 Blk Forrest Hill Dr. (FF Estimated) | 1 | N4000 | 29.10 | 22.50 | -6.60 | 24.10 | -5.00 | 26.93 | -2.17 | |
| 286K | 1000 Blk Hillcrest Ave (FF Estimated) | 1 | N4000 | 27.60 | 22.50 | -5.10 | 24.10 | -3.50 | 26.93 | -0.67 | |
| 287 | 1239 S. Hillcrest Ave. | 1 | N4000 | 28.49 | 22.50 | -5.99 | 24.10 | -4.39 | 26.93 | -1.56 | |
| 287A | 1200 Blk Hillcrest Ave (FF Estimated) | 1 | N4000 | 28.21 | 22.50 | -5.71 | 24.10 | -4.11 | 26.93 | -1.28 | |
| 287B | 1200 Blk Hillcrest Ave (FF Estimated) | 1 | N4000 | 28.60 | 22.50 | -6.10 | 24.10 | -4.50 | 26.93 | -1.67 | |
| 287C | 1200 Blk Hillcrest Ave (FF Estimated) | 1 | N4000 | 28.80 | 22.50 | -6.30 | 24.10 | -4.70 | 26.93 | -1.87 | |
| 289 | 1425 Jeffords St. | 1 | N4000 | 27.38 | 22.50 | -4.88 | 24.10 | -3.28 | 26.93 | -0.45 | |

Table F.2 Proposed Conditions Structure Flooding Level of Service Evaluation

0.51 = FPLOS Deficiency

| Map # | Address | # Grnd Flr Dwelling Units | Node ID | Finished Floor Elev. (ft,NGVD) | Flood Elev.(ft) 10-year | Depth of Flooding (feet) | Flood Elev.(ft) 25-year | Depth of Flooding (feet) | Flood Elev.(ft) 100-year | Depth of Flooding (feet) | Node Total Flood-prone Structures |
|-------|---|---------------------------|---------|--------------------------------|-------------------------|--------------------------|-------------------------|--------------------------|--------------------------|--------------------------|-----------------------------------|
| 289A | 1400 Blk Jeffords St. (FF Estimated) | 1 | N4000 | 27.58 | 22.50 | -5.08 | 24.10 | -3.48 | 26.93 | -0.65 | |
| 289B | 1400 Blk Jeffords St. (FF Estimated) | 1 | N4000 | 27.78 | 22.50 | -5.28 | 24.10 | -3.68 | 26.93 | -0.85 | |
| 289C | 1400 Blk Jeffords St. (FF Estimated) | 1 | N4000 | 27.98 | 22.50 | -5.48 | 24.10 | -3.88 | 26.93 | -1.05 | |
| 289D | 1400 Blk Jeffords St. (FF Estimated) | 1 | N4000 | 28.18 | 22.50 | -5.68 | 24.10 | -4.08 | 26.93 | -1.25 | |
| 289E | 1400 Blk Jeffords St. (FF Estimated) | 1 | N4000 | 28.38 | 22.50 | -5.88 | 24.10 | -4.28 | 26.93 | -1.45 | |
| 290 | 1418 Barry St. | 1 | N4000 | 26.61 | 22.50 | -4.11 | 24.10 | -2.51 | 26.93 | 0.32 | |
| 290A | 1400 Blk Barry St. (FF Estimated) | 1 | N4000 | 26.60 | 22.50 | -4.10 | 24.10 | -2.50 | 26.93 | 0.33 | |
| 290B | 1400 Blk Barry St. (FF Estimated) | 1 | N4000 | 26.60 | 22.50 | -4.10 | 24.10 | -2.50 | 26.93 | 0.33 | |
| 290C | 1400 Blk Barry St. (FF Estimated) | 1 | N4000 | 26.60 | 22.50 | -4.10 | 24.10 | -2.50 | 26.93 | 0.33 | |
| 290D | 1400 Blk Barry St. (FF Estimated) | 1 | N4000 | 26.60 | 22.50 | -4.10 | 24.10 | -2.50 | 26.93 | 0.33 | |
| 291 | 1451 Jeffords St. | 1 | N4000 | 28.57 | 22.50 | -6.07 | 24.10 | -4.47 | 26.93 | -1.64 | |
| 291A | 1400 Blk Jeffords St. (FF Estimated) | 1 | N4000 | 28.53 | 22.50 | -6.03 | 24.10 | -4.43 | 26.93 | -1.60 | |
| 291B | 1400 Blk Jeffords St. (FF Estimated) | 1 | N4000 | 28.55 | 22.50 | -6.05 | 24.10 | -4.45 | 26.93 | -1.62 | |
| 291C | 1400 Blk Jeffords St. (FF Estimated) | 1 | N4000 | 28.57 | 22.50 | -6.07 | 24.10 | -4.47 | 26.93 | -1.64 | |
| 291D | 1400 Blk Jeffords St. (FF Estimated) | 1 | N4000 | 28.54 | 22.50 | -6.04 | 24.10 | -4.44 | 26.93 | -1.61 | |
| 292 | 1442 Barry St. | 1 | N4000 | 27.59 | 22.50 | -5.09 | 24.10 | -3.49 | 26.93 | -0.66 | |
| 292A | 1400 Blk Barry St. (FF Estimated) | 1 | N4000 | 27.90 | 22.50 | -5.40 | 24.10 | -3.80 | 26.93 | -0.97 | |
| 292B | 1400 Blk Barry St. (FF Estimated) | 1 | N4000 | 27.80 | 22.50 | -5.30 | 24.10 | -3.70 | 26.93 | -0.87 | |
| 292C | 1400 Blk Barry St. (FF Estimated) | 1 | N4000 | 27.39 | 22.50 | -4.89 | 24.10 | -3.29 | 26.93 | -0.46 | |
| 292D | 1400 Blk Barry St. (FF Estimated) | 1 | N4000 | 27.19 | 22.50 | -4.69 | 24.10 | -3.09 | 26.93 | -0.26 | |
| 292E | 1400 Blk Barry St. (FF Estimated) | 1 | N4000 | 27.01 | 22.50 | -4.51 | 24.10 | -2.91 | 26.93 | -0.08 | |
| 292F | 1400 Blk Barry St. (FF Estimated) | 1 | N4000 | 26.81 | 22.50 | -4.31 | 24.10 | -2.71 | 26.93 | 0.12 | |
| 293 | 1481 Jeffords St. | 1 | N4000 | 28.50 | 22.50 | -6.00 | 24.10 | -4.40 | 26.93 | -1.57 | |
| 293A | 1400 Blk Jeffords St. (FF Estimated) | 1 | N4000 | 28.58 | 22.50 | -6.08 | 24.10 | -4.48 | 26.93 | -1.65 | |
| 293B | 1200 Blk S. Highland Ave (FF Estimated) | 1 | N4000 | 28.64 | 22.50 | -6.14 | 24.10 | -4.54 | 26.93 | -1.71 | |
| 294 | 1468 Barry St. | 1 | N4000 | 28.64 | 22.50 | -6.14 | 24.10 | -4.54 | 26.93 | -1.71 | |
| 294A | 1400 Blk Barry St. (FF Estimated) | 1 | N4000 | 28.44 | 22.50 | -5.94 | 24.10 | -4.34 | 26.93 | -1.51 | |
| 294B | 1400 Blk Barry St. (FF Estimated) | 1 | N4000 | 28.24 | 22.50 | -5.74 | 24.10 | -4.14 | 26.93 | -1.31 | |

Table F.2 Proposed Conditions Structure Flooding Level of Service Evaluation

0.51 = FPLOS Deficiency

| Map # | Address | # Grnd Flr Dwelling Units | Node ID | Finished Floor Elev. (ft,NGVD) | Flood Elev.(ft) 10-year | Depth of Flooding (feet) | Flood Elev.(ft) 25-year | Depth of Flooding (feet) | Flood Elev.(ft) 100-year | Depth of Flooding (feet) | Node Total Flood-prone Structures |
|-------|--|---------------------------|---------|--------------------------------|-------------------------|--------------------------|-------------------------|--------------------------|--------------------------|--------------------------|-----------------------------------|
| 294C | 1400 Blk Barry St. (FF Estimated) | 1 | N4000 | 28.04 | 22.50 | -5.54 | 24.10 | -3.94 | 26.93 | -1.11 | 9 Structures 9 Units |
| 295 | 1212 S. Highland Ave. | 1 | N4000 | 28.72 | 22.50 | -6.22 | 24.10 | -4.62 | 26.93 | -1.79 | |
| 295A | 1400 Blk Barry St. (FF Estimated) | 1 | N4000 | 28.70 | 22.50 | -6.20 | 24.10 | -4.60 | 26.93 | -1.77 | |
| 295B | 1400 Blk Barry St. (FF Estimated) | 1 | N4000 | 28.69 | 22.50 | -6.19 | 24.10 | -4.59 | 26.93 | -1.76 | |
| 295C | 1400 Blk Barry St. (FF Estimated) | 1 | N4000 | 28.67 | 22.50 | -6.17 | 24.10 | -4.57 | 26.93 | -1.74 | |
| 281 | 1393 Milton St. | 1 | N4010 | 28.86 | 26.24 | -2.62 | 27.53 | -1.33 | 29.15 | 0.29 | 4 Structures 4 Units |
| 282 | 1250 Hillcrest Ave. | 1 | N4010 | 28.70 | 26.24 | -2.46 | 27.53 | -1.17 | 29.15 | 0.45 | |
| 283 | 1260 Hillcrest Ave. | 1 | N4010 | 29.85 | 26.24 | -3.61 | 27.53 | -2.32 | 29.15 | -0.70 | |
| 288 | 1251 S. Hillcrest Ave. | 1 | N4010 | 28.94 | 26.24 | -2.70 | 27.53 | -1.41 | 29.15 | 0.21 | |
| 288A | 1200 Blk Hillcrest Ave (FF Estimated) | 1 | N4010 | 28.94 | 26.24 | -2.70 | 27.53 | -1.41 | 29.15 | 0.21 | 4 Units |
| 284 | 1395 Browning St. | 1 | N4020 | 30.48 | 26.62 | -3.86 | 28.72 | -1.76 | 30.24 | -0.24 | 0 Structures 0 Units |
| 285 | 1397 Browning St. | 1 | N4020 | 30.37 | 26.62 | -3.75 | 28.72 | -1.65 | 30.24 | -0.13 | |
| 48 | 1397 Browning St. | 1 | N4020 | 30.51 | 26.62 | -3.89 | 28.72 | -1.79 | 30.24 | -0.27 | |
| 49 | 1388 Lakeview Rd. | 1 | N4030 | 31.74 | 28.69 | -3.05 | 29.74 | -2 | 31.33 | -0.41 | 0 Structures |
| 50 | 1322 Hillcrest Ave. | 1 | N4040 | 33.50 | 30.37 | -3.13 | 31.21 | -2.29 | 33.00 | -0.5 | 0 Structures 0 Units |
| 50A | 1300 Blk Hillcrest Ave. (FF estimated) | 1 | N4040 | 33.7 | 30.37 | -3.33 | 31.21 | -2.49 | 33.00 | -0.7 | |
| 50B | 1300 Blk Hillcrest Ave. (FF estimated) | 1 | N4040 | 33.6 | 30.37 | -3.23 | 31.21 | -2.39 | 33.00 | -0.6 | |
| 50C | 1300 Blk Hillcrest Ave. (FF estimated) | 1 | N4040 | 33.5 | 30.37 | -3.13 | 31.21 | -2.29 | 33.00 | -0.5 | |
| 50D | 1300 Blk Hillcrest Ave. (FF estimated) | 1 | N4040 | 33.6 | 30.37 | -3.23 | 31.21 | -2.39 | 33.00 | -0.6 | |
| 50E | 1300 Blk Hillcrest Ave. (FF estimated) | 1 | N4040 | 33.7 | 30.37 | -3.33 | 31.21 | -2.49 | 33.00 | -0.7 | |
| 373 | 1346 Hillcrest Ave. S. | 1 | N4040 | 34.11 | 30.37 | -3.74 | 31.21 | -2.9 | 33.00 | -1.11 | |
| 373A | 1300 Blk Hillcrest Ave. (FF estimated) | 1 | N4040 | 34.0 | 30.37 | -3.63 | 31.21 | -2.79 | 33.00 | -1 | |
| 373B | 1300 Blk Hillcrest Ave. (FF estimated) | 1 | N4040 | 33.8 | 30.37 | -3.43 | 31.21 | -2.59 | 33.00 | -0.8 | |
| 51 | 1357 Byron Dr. | 1 | N4050 | 36.88 | 31.89 | -4.99 | 32.83 | -4.05 | 34.29 | -2.59 | |
| 374 | 1380 Hillcrest Ave. S. | 1 | N4050 | 34.81 | 31.89 | -2.92 | 32.83 | -1.98 | 34.29 | -0.52 | |
| 374A | 1300 Blk Hillcrest Ave. (FF estimated) | 1 | N4050 | 34.7 | 31.89 | -2.81 | 32.83 | -1.87 | 34.29 | -0.41 | |
| 374B | 1300 Blk Hillcrest Ave. (FF estimated) | 1 | N4050 | 34.5 | 31.89 | -2.61 | 32.83 | -1.67 | 34.29 | -0.21 | |
| 374C | 1300 Blk Hillcrest Ave. (FF estimated) | 1 | N4050 | 34.4 | 31.89 | -2.51 | 32.83 | -1.57 | 34.29 | -0.11 | |

Table F.2 Proposed Conditions Structure Flooding Level of Service Evaluation

0.51 = FPLOS Deficiency

| Map # | Address | # Grnd Flr Dwelling Units | Node ID | Finished Floor Elev. (ft,NGVD) | Flood Elev.(ft) 10-year | Depth of Flooding (feet) | Flood Elev.(ft) 25-year | Depth of Flooding (feet) | Flood Elev.(ft) 100-year | Depth of Flooding (feet) | Node Total Flood-prone Structures | |
|-------|--|---------------------------|--------------------------------------|--------------------------------|-------------------------|--------------------------|-------------------------|--------------------------|--------------------------|--------------------------|-----------------------------------|--|
| 374D | 1300 Blk Hillcrest Ave. (FF estimated) | 1 | N4050 | 34.3 | 31.89 | -2.41 | 32.83 | -1.47 | 34.29 | -0.01 | 1 Structures 1 Units | |
| 374E | 1300 Blk Hillcrest Ave. (FF estimated) | 1 | N4050 | 34.2 | 31.89 | -2.31 | 32.83 | -1.37 | 34.29 | 0.09 | | |
| 375 | 1400 Hillcrest Ave. S. | 1 | N4050 | 36.49 | 31.89 | -4.60 | 32.83 | -3.66 | 34.29 | -2.20 | | |
| 375A | 1400 Blk Hillcrest Ave. (FF estimated) | 1 | N4050 | 36.2 | 31.89 | -4.31 | 32.83 | -3.37 | 34.29 | -1.91 | | |
| 375B | 1400 Blk Hillcrest Ave. (FF estimated) | 1 | N4050 | 35.9 | 31.89 | -4.01 | 32.83 | -3.07 | 34.29 | -1.61 | | |
| 375C | 1400 Blk Hillcrest Ave. (FF estimated) | 1 | N4050 | 35.6 | 31.89 | -3.71 | 32.83 | -2.77 | 34.29 | -1.31 | | |
| 375D | 1400 Blk Hillcrest Ave. (FF estimated) | 1 | N4050 | 35.3 | 31.89 | -3.41 | 32.83 | -2.47 | 34.29 | -1.01 | | |
| 375E | 1400 Blk Hillcrest Ave. (FF estimated) | 1 | N4050 | 35.0 | 31.89 | -3.11 | 32.83 | -2.17 | 34.29 | -0.71 | | |
| 52 | 1375 Campbell Ct. | 1 | N4060 | 38.82 | 33.43 | -5.39 | 34.34 | -4.48 | 35.77 | -3.05 | 0 Structures 0 Units | |
| 376 | 1424 Hillcrest Ave. S. | 1 | N4060 | 37.75 | 33.43 | -4.32 | 34.34 | -3.41 | 35.77 | -1.98 | | |
| 376A | 1400 Blk Hillcrest Ave. (FF estimated) | 1 | N4060 | 38.0 | 33.43 | -4.57 | 34.34 | -3.66 | 35.77 | -2.23 | | |
| 376B | 1400 Blk Hillcrest Ave. (FF estimated) | 1 | N4060 | 37.6 | 33.43 | -4.17 | 34.34 | -3.26 | 35.77 | -1.83 | | |
| 376C | 1400 Blk Hillcrest Ave. (FF estimated) | 1 | N4060 | 37.4 | 33.43 | -3.97 | 34.34 | -3.06 | 35.77 | -1.63 | | |
| 376D | 1400 Blk Hillcrest Ave. (FF estimated) | 1 | N4060 | 37.2 | 33.43 | -3.77 | 34.34 | -2.86 | 35.77 | -1.43 | | |
| 376E | 1400 Blk Hillcrest Ave. (FF estimated) | 1 | N4060 | 37.0 | 33.43 | -3.57 | 34.34 | -2.66 | 35.77 | -1.23 | | |
| 376F | 1400 Blk Hillcrest Ave. (FF estimated) | 1 | N4060 | 36.9 | 33.43 | -3.47 | 34.34 | -2.56 | 35.77 | -1.13 | | |
| 53 | 1453 Evergreen Ave. | 1 | To be acquired as part of project 4C | | | | | | | | | |
| 54 | 1430 Hillcrest Ave. | 1 | N4065 | 38.72 | 36.87 | -1.85 | 37.49 | -1.23 | 38.39 | -0.33 | | |
| 55 | 1434 Hillcrest Ave. | 1 | N4065 | 39.12 | 36.87 | -2.25 | 37.49 | -1.63 | 38.39 | -0.73 | | |
| 56 | 1457 Evergreen Ave. | 1 | To be acquired as part of project 4C | | | | | | | | | |
| 57 | 1438 Hillcrest Ave. | 1 | N4065 | 39.58 | 36.87 | -2.71 | 37.49 | -2.09 | 38.39 | -1.19 | | |
| 58 | 1461 Evergreen Ave. | 1 | To be acquired as part of project 4C | | | | | | | | | |
| 59 | 1465 Evergreen Ave. | 1 | To be acquired as part of project 4C | | | | | | | | | |
| 60 | 1442 Hillcrest Ave. | 1 | N4065 | 39.66 | 36.87 | -2.79 | 37.49 | -2.17 | 38.39 | -1.27 | | |
| 61 | 1466 Hillcrest Ave. | 1 | N4065 | 39.76 | 36.87 | -2.89 | 37.49 | -2.27 | 38.39 | -1.37 | | |
| 62 | 1469 Evergreen Ave. | 1 | To be acquired as part of project 4C | | | | | | | | | |
| 63 | 1450 Hillcrest Ave. | 1 | N4065 | 39.83 | 36.87 | -2.96 | 37.49 | -2.34 | 38.39 | -1.44 | | |
| 64 | 1473 Evergreen Ave. | 1 | To be acquired as part of project 4C | | | | | | | | | |

Table F.2 Proposed Conditions Structure Flooding Level of Service Evaluation

0.51 = FPLOS Deficiency

| Map # | Address | # Grnd Flr Dwelling Units | Node ID | Finished Floor Elev. (ft,NGVD) | Flood Elev.(ft) 10-year | Depth of Flooding (feet) | Flood Elev.(ft) 25-year | Depth of Flooding (feet) | Flood Elev.(ft) 100-year | Depth of Flooding (feet) | Node Total Flood-prone Structures |
|-------|---------------------|---------------------------|--------------------------------------|--------------------------------|-------------------------|--------------------------|-------------------------|--------------------------|--------------------------|--------------------------|-----------------------------------|
| 65 | 1454 Hillcrest Ave. | 1 | N4065 | 39.92 | 36.87 | -3.05 | 37.49 | -2.43 | 38.39 | -1.53 | 0 Structures 0 Units |
| 66 | 1479 Evergreen Ave. | 1 | To be acquired as part of project 4C | | | | | | | | |
| 67 | 1458 Hillcrest Ave. | 1 | N4065 | 40.46 | 36.87 | -3.59 | 37.49 | -2.97 | 38.39 | -2.07 | |
| 68 | 1501 Evergreen Ave. | 1 | To be acquired as part of project 4C | | | | | | | | |
| 69 | 1462 Hillcrest Ave. | 1 | N4065 | 40.48 | 36.87 | -3.61 | 37.49 | -2.99 | 38.39 | -2.09 | |
| 70 | 1509 Evergreen Ave. | 1 | To be acquired as part of project 4C | | | | | | | | |
| 71 | 1466 Hillcrest Ave. | 1 | N4065 | 40.35 | 36.87 | -3.48 | 37.49 | -2.86 | 38.39 | -1.96 | |
| 72 | 1517 Evergreen Ave. | 1 | To be acquired as part of project 4C | | | | | | | | |
| 73 | 1470 Hillcrest Ave. | 1 | N4065 | 40.38 | 36.87 | -3.51 | 37.49 | -2.89 | 38.39 | -1.99 | |
| 74 | 1506 Hillcrest Ave. | 1 | N4080 | 40.03 | 38.66 | -1.37 | 39.07 | -0.96 | 39.88 | -0.15 | 0 Structures |
| 75 | 1521 Evergreen Ave. | 1 | N4080 | 40.65 | 38.66 | -1.99 | 39.07 | -1.58 | 39.88 | -0.77 | 0 Units |
| 296 | 1551 Jeffords St. | 1 | N4160 | 31.30 | 30.47 | -0.83 | 31.56 | 0.26 | 32.25 | 0.95 | 3 Structures 3 Units |
| 297 | 1557 Jeffords St. | 1 | N4160 | 31.79 | 30.47 | -1.32 | 31.56 | -0.23 | 32.25 | 0.46 | |
| 298 | 1563 Jeffords St. | 1 | N4160 | 33.11 | 30.47 | -2.64 | 31.56 | -1.55 | 32.25 | -0.86 | |
| 299 | 1571 Jeffords St. | 1 | N4160 | 32.99 | 30.47 | -2.52 | 31.56 | -1.43 | 32.25 | -0.74 | |
| 300 | 1579 Jeffords St. | 1 | N4160 | 31.97 | 30.47 | -1.50 | 31.56 | -0.41 | 32.25 | 0.28 | |
| 301 | 1585 Jeffords St. | 1 | N4160 | 32.44 | 30.47 | -1.97 | 31.56 | -0.88 | 32.25 | -0.19 | |
| 302 | 1601 Jeffords St. | 1 | N4180 | 32.83 | 30.46 | -2.37 | 31.54 | -1.29 | 32.49 | -0.34 | 3 Structures |
| 303 | 1607 Jeffords St. | 1 | N4180 | 32.42 | 30.46 | -1.96 | 31.54 | -0.88 | 32.49 | 0.07 | |
| 304 | 1613 Jeffords St. | 1 | N4180 | 32.48 | 30.46 | -2.02 | 31.54 | -0.94 | 32.49 | 0.01 | |
| 305 | 1619 Jeffords St. | 1 | N4180 | 32.58 | 30.46 | -2.12 | 31.54 | -1.04 | 32.49 | -0.09 | |
| 306 | 1625 Jeffords St. | 1 | N4180 | 32.53 | 30.46 | -2.07 | 31.54 | -0.99 | 32.49 | -0.04 | |
| 307 | 1631 Jeffords St. | 1 | N4180 | 32.33 | 30.46 | -1.87 | 31.54 | -0.79 | 32.49 | 0.16 | |
| 308 | 1211 Lake Dr. | 1 | To be acquired as part of project 7C | | | | | | | | |
| 309 | 1606 Barry Rd. | 1 | To be acquired as part of project 7C | | | | | | | | |
| 310 | 1612 Barry Rd. | 1 | To be acquired as part of project 7C | | | | | | | | |
| 311 | 1618 Barry Rd. | 1 | To be acquired as part of project 7C | | | | | | | | |
| 312 | 1624 Barry Rd. | 1 | To be acquired as part of project 7C | | | | | | | | |

Table F.2 Proposed Conditions Structure Flooding Level of Service Evaluation

0.51 = FPLOS Deficiency

| Map # | Address | # Grnd Flr Dwelling Units | Node ID | Finished Floor Elev. (ft,NGVD) | Flood Elev.(ft) 10-year | Depth of Flooding (feet) | Flood Elev.(ft) 25-year | Depth of Flooding (feet) | Flood Elev.(ft) 100-year | Depth of Flooding (feet) | Node Total Flood-prone Structures |
|-------|-----------------------|---------------------------|--------------------------------------|--------------------------------|-------------------------|--------------------------|-------------------------|--------------------------|--------------------------|--------------------------|-----------------------------------|
| 313 | 1630 Barry Rd. | 1 | To be acquired as part of project 7C | | | | | | | | 3 Units |
| 316 | 1172 S. Keystone Ave. | 1 | N4205 | 33.11 | 31.11 | -2.00 | 32.18 | -0.93 | 32.74 | -0.37 | 1 Structure 1 Unit |
| 317 | 1176 S. Keystone Ave. | 1 | N4205 | 32.91 | 31.11 | -1.80 | 32.18 | -0.73 | 32.74 | -0.17 | |
| 318 | 1180 S. Keystone Ave. | 1 | N4205 | 32.59 | 31.11 | -1.48 | 32.18 | -0.41 | 32.74 | 0.15 | |
| 319 | 1182 S. Keystone Ave. | 1 | N4205 | 34.26 | 31.11 | -3.15 | 32.18 | -2.08 | 32.74 | -1.52 | |
| 320 | 1184 S. Keystone Ave. | 1 | N4205 | 33.28 | 31.11 | -2.17 | 32.18 | -1.10 | 32.74 | -0.54 | |
| 321 | 1188 S. Keystone Ave. | 1 | N4205 | 32.81 | 31.11 | -1.70 | 32.18 | -0.63 | 32.74 | -0.07 | |
| 324 | 1641 Jeffords St. | 1 | N4205 | 32.99 | 31.11 | -1.88 | 32.18 | -0.81 | 32.74 | -0.25 | |
| 326 | 1658 Jeffords St. | 1 | N4205 | 32.79 | 31.11 | -1.68 | 32.18 | -0.61 | 32.74 | -0.05 | |
| 327 | 1664 Jeffords St. | 1 | N4205 | 33.05 | 31.11 | -1.94 | 32.18 | -0.87 | 32.74 | -0.31 | |
| 328 | 1668 Jeffords St. | 1 | N4205 | 33.57 | 31.11 | -2.46 | 32.18 | -1.39 | 32.74 | -0.83 | |
| 329 | 1670 Jeffords St. | 1 | N4205 | 33.45 | 31.11 | -2.34 | 32.18 | -1.27 | 32.74 | -0.71 | |
| 330 | 1030 S. Duncan Ave. | 1 | N4205 | 33.28 | 31.11 | -2.17 | 32.18 | -1.10 | 32.74 | -0.54 | |
| 331 | 1028 S. Duncan Ave. | 1 | N4205 | 33.57 | 31.11 | -2.46 | 32.18 | -1.39 | 32.74 | -0.83 | |
| 332 | 1024 S. Duncan Ave. | 1 | N4205 | 33.50 | 31.11 | -2.39 | 32.18 | -1.32 | 32.74 | -0.76 | |
| 325 | 1183 S. Keystone Ave. | 1 | N4210 | 32.68 | 31.33 | -1.35 | 32.19 | -0.49 | 32.75 | 0.07 | 5 Structures 5 Units |
| 333 | 1647 Jeffords St. | 1 | N4210 | 33.65 | 31.33 | -2.32 | 32.19 | -1.46 | 32.75 | -0.90 | |
| 334 | 1659 Jeffords St. | 1 | N4210 | 32.32 | 31.33 | -0.99 | 32.19 | -0.13 | 32.75 | 0.43 | |
| 335 | 1665 Jeffords St. | 1 | N4210 | 32.15 | 31.33 | -0.82 | 32.19 | 0.04 | 32.75 | 0.60 | |
| 336 | 1671 Jeffords St. | 1 | N4210 | 32.49 | 31.33 | -1.16 | 32.19 | -0.30 | 32.75 | 0.26 | |
| 337 | 1104 Duncan Ave. | 1 | N4210 | 32.81 | 31.33 | -1.48 | 32.19 | -0.62 | 32.75 | -0.06 | |
| 338 | 1184 Duncan Ave. | 1 | N4210 | 32.97 | 31.33 | -1.64 | 32.19 | -0.78 | 32.75 | -0.22 | |
| 339 | 1188 Duncan Ave. | 1 | N4210 | 33.87 | 31.33 | -2.54 | 32.19 | -1.68 | 32.75 | -1.12 | |
| 340 | 1192 Duncan Ave. | 1 | N4210 | 34.53 | 31.33 | -3.20 | 32.19 | -2.34 | 32.75 | -1.78 | |
| 341 | 1196 Duncan Ave. | 1 | N4210 | 34.34 | 31.33 | -3.01 | 32.19 | -2.15 | 32.75 | -1.59 | |
| 342 | 1200 Duncan Ave. | 1 | N4210 | 34.07 | 31.33 | -2.74 | 32.19 | -1.88 | 32.75 | -1.32 | |
| 356 | 1201 Duncan Ave. | 1 | N4210 | 32.41 | 31.33 | -1.08 | 32.19 | -0.22 | 32.75 | 0.34 | |
| 357 | 1707 Estelle Dr. | 1 | N4210 | 33.00 | 31.33 | -1.67 | 32.19 | -0.81 | 32.75 | -0.25 | |

Table F.2 Proposed Conditions Structure Flooding Level of Service Evaluation

0.51 = FPLOS Deficiency

| Map # | Address | # Grnd Flr Dwelling Units | Node ID | Finished Floor Elev. (ft,NGVD) | Flood Elev.(ft) 10-year | Depth of Flooding (feet) | Flood Elev.(ft) 25-year | Depth of Flooding (feet) | Flood Elev.(ft) 100-year | Depth of Flooding (feet) | Node Total Flood-prone Structures |
|-------|---------------------|---------------------------|---------|--------------------------------|-------------------------|--------------------------|-------------------------|--------------------------|--------------------------|--------------------------|-----------------------------------|
| 343 | 1035 S. Duncan Ave. | 1 | N4220 | 33.03 | 31.16 | -1.87 | 32.18 | -0.85 | 32.74 | -0.29 | |
| 344 | 1706 Jeffords St. | 1 | N4220 | 33.23 | 31.16 | -2.07 | 32.18 | -1.05 | 32.74 | -0.49 | |
| 345 | 1714 Jeffords St. | 1 | N4220 | 33.01 | 31.16 | -1.85 | 32.18 | -0.83 | 32.74 | -0.27 | |
| 346 | 1718 Jeffords St. | 1 | N4220 | 33.09 | 31.16 | -1.93 | 32.18 | -0.91 | 32.74 | -0.35 | |
| 347 | 1701 Jeffords St. | 1 | N4220 | 32.76 | 31.16 | -1.60 | 32.18 | -0.58 | 32.74 | -0.02 | |
| 348 | 1707 Jeffords St. | 1 | N4220 | 32.89 | 31.16 | -1.73 | 32.18 | -0.71 | 32.74 | -0.15 | |
| 349 | 1717 Jeffords St. | 1 | N4220 | 32.30 | 31.16 | -1.14 | 32.18 | -0.12 | 32.74 | 0.44 | |
| 350 | 1733 Jeffords St. | 1 | N4220 | 32.40 | 31.16 | -1.24 | 32.18 | -0.22 | 32.74 | 0.34 | |
| 351 | 1105 Duncan Ave. | 1 | N4220 | 33.24 | 31.16 | -2.08 | 32.18 | -1.06 | 32.74 | -0.50 | |
| 352 | 1109 Duncan Ave. | 1 | N4220 | 33.19 | 31.16 | -2.03 | 32.18 | -1.01 | 32.74 | -0.45 | |
| 353 | 1113 Duncan Ave. | 1 | N4220 | 33.60 | 31.16 | -2.44 | 32.18 | -1.42 | 32.74 | -0.86 | |
| 354 | 1117 Duncan Ave. | 1 | N4220 | 33.59 | 31.16 | -2.43 | 32.18 | -1.41 | 32.74 | -0.85 | |
| 355 | 1121 Duncan Ave. | 1 | N4220 | 33.61 | 31.16 | -2.45 | 31.16 | -2.45 | 32.74 | -0.87 | |
| 358 | 1101 Woodside Ave. | 1 | N4220 | 33.43 | 31.16 | -2.27 | 31.16 | -2.27 | 32.74 | -0.69 | |
| 359 | 1105 Woodside Ave. | 1 | N4220 | 33.19 | 31.16 | -2.03 | 31.16 | -2.03 | 32.74 | -0.45 | |
| 360 | 1109 Woodside Ave. | 1 | N4220 | 32.81 | 31.16 | -1.65 | 31.16 | -1.65 | 32.74 | -0.07 | |
| 361 | 1115 Woodside Ave. | 1 | N4220 | 33.12 | 31.16 | -1.96 | 31.16 | -1.96 | 32.74 | -0.38 | |
| 362 | 1117 Woodside Ave. | 1 | N4220 | 33.28 | 31.16 | -2.12 | 31.16 | -2.12 | 32.74 | -0.54 | 2 Structures |
| 363 | 1121 Woodside Ave. | 1 | N4220 | 33.05 | 31.16 | -1.89 | 31.16 | -1.89 | 32.74 | -0.31 | 2 Units |
| 364 | 1135 Jeffords St. | 1 | N4230 | 33.77 | 32.18 | -1.59 | 32.31 | -1.46 | 32.75 | -1.02 | |
| 365 | 1106 Woodcrest Ave. | 1 | N4230 | 33.66 | 32.18 | -1.48 | 32.31 | -1.35 | 32.75 | -0.91 | |
| 366 | 1110 Woodcrest Ave. | 1 | N4230 | 33.49 | 32.18 | -1.31 | 32.31 | -1.18 | 32.75 | -0.74 | |
| 367 | 1114 Woodcrest Ave. | 1 | N4230 | 33.23 | 32.18 | -1.05 | 32.31 | -0.92 | 32.75 | -0.48 | |
| 368 | 1118 Woodcrest Ave. | 1 | N4230 | 33.12 | 32.18 | -0.94 | 32.31 | -0.81 | 32.75 | -0.37 | |
| 369 | 1120 Woodcrest Ave. | 1 | N4230 | 34.24 | 32.18 | -2.06 | 32.31 | -1.93 | 32.75 | -1.49 | |
| 370 | 1126 Woodcrest Ave. | 1 | N4230 | 33.12 | 32.18 | -0.94 | 32.31 | -0.81 | 32.75 | -0.37 | |
| 371 | 1115 Woodcrest Ave. | 1 | N4240 | 33.93 | 33.68 | -0.25 | 34.03 | 0.10 | 34.70 | 0.77 | 2 Structures |
| 372 | 1121 Woodcrest Ave. | 1 | N4240 | 33.19 | 33.68 | 0.49 | 34.03 | 0.84 | 34.70 | 1.51 | 2 Units |

Table F.2 Proposed Conditions Structure Flooding Level of Service Evaluation

0.51 = FPLOS Deficiency

| Map # | Address | # Grnd Flr Dwelling Units | Node ID | Finished Floor Elev. (ft,NGVD) | Flood Elev.(ft) 10-year | Depth of Flooding (feet) | Flood Elev.(ft) 25-year | Depth of Flooding (feet) | Flood Elev.(ft) 100-year | Depth of Flooding (feet) | Node Total Flood-prone Structures |
|-------|---------------------------------|---------------------------|--------------------------------------|--------------------------------|-------------------------|--------------------------|-------------------------|--------------------------|--------------------------|--------------------------|-----------------------------------|
| 314 | 1619 Barry Rd. | 1 | To be acquired as part of project 7C | | | | | | | | 0 Structures 0 Units |
| 314A | 1613 Barry Rd (FF estimated) | 1 | To be acquired as part of project 7C | | | | | | | | |
| 315 | 1625 Barry Rd. | 1 | To be acquired as part of project 7C | | | | | | | | |
| 322 | 1131 S. Keystone Ave. | 1 | N4380 | 32.75 | 31.18 | -1.57 | 32.18 | -0.57 | 32.74 | -0.01 | 0 Structures |
| 323 | 1640 Jeffords St. | 1 | N4380 | 33.00 | 31.18 | -1.82 | 32.18 | -0.82 | 32.74 | -0.26 | 0 Units |
| 213 | 601,603 Spencer Ave. | 2 | To be acquired as part of project 7B | | | | | | | | 0 Structures 0 Units |
| 214 | 605,607 Spencer Ave. | 2 | To be acquired as part of project 7B | | | | | | | | |
| 215 | 609,611 Spencer Ave. | 2 | To be acquired as part of project 7B | | | | | | | | |
| 216 | 613,615 Spencer Ave. | 2 | N4420 | 62.55 | 59.23 | -3.32 | 60.01 | -2.54 | 61.55 | -1.00 | |
| 217 | 617,619 Spencer Ave. | 2 | N4420 | 62.81 | 59.23 | -3.58 | 60.01 | -2.80 | 61.55 | -1.26 | |
| 218 | 701, 707, 713, 719 Spencer Ave. | 2 | N4420 | 63.05 | 59.23 | -3.82 | 60.01 | -3.04 | 61.55 | -1.50 | |
| 219 | same as # 118 above | 2 | N4420 | 63.05 | 59.23 | -3.82 | 60.01 | -3.04 | 61.55 | -1.50 | |
| 220 | 725, 731, 737 Spencer Ave. | 3 | N4420 | 63.25 | 59.23 | -4.02 | 60.01 | -3.24 | 61.55 | -1.70 | |
| 221 | 602, 600 S. Duncan Ave. | 2 | To be acquired as part of project 7B | | | | | | | | |
| 222 | 610, 608 S. Duncan Ave. | 2 | To be acquired as part of project 7B | | | | | | | | |
| 223 | 612 S. Duncan Ave. | 1 | To be acquired as part of project 7B | | | | | | | | |
| 224 | 618 S. Duncan Ave. | 1 | To be acquired as part of project 7B | | | | | | | | |
| 225 | 704, 706 S. Duncan Ave. | 2 | To be acquired as part of project 7B | | | | | | | | |
| 226 | 710 S. Duncan Ave. | 1 | To be acquired as part of project 7B | | | | | | | | |
| 226A | 708 S. Duncan Ave | 1 | To be acquired as part of project 7B | | | | | | | | |
| 227 | 1672 Druid Rd. | 1 | N4420 | 63.79 | 59.23 | -4.56 | 60.01 | -3.78 | 61.55 | -2.24 | 0 Structures |
| 228 | 1676 Druid Rd. | 1 | N4420 | 63.23 | 59.23 | -4.00 | 60.01 | -3.22 | 61.55 | -1.68 | 0 Units |

Table F.3 100-Year, 24-Hour Design Flood Elevation Comparison, Existing and Proposed Conditions

| Node ID | Node Location | 100-Year, 24-Hour Design Storm Flood Elevations in Feet (NGVD 1929) | | | Notes |
|---------|--|--|----------|------------|---------------------|
| | | Existing | Proposed | Difference | |
| N0000 | Clearwater Harbor | 2.50 | 2.50 | 0.00 | |
| N0010 | Stevenson Creek, 320' E. of Alt. 19 | 6.60 | 5.35 | -1.25 | |
| N0020 | Stevenson Creek, 225' NW of Pinellas Trail | 6.63 | 5.47 | -1.16 | |
| N0030 | Stevenson Creek, 120' SE of Pinellas Trail | 7.16 | 6.62 | -0.54 | |
| N0040 | Stevenson Creek, 890' SE of Pinellas Trail | 7.38 | 6.97 | -0.41 | |
| N0050 | Stevenson Creek, 120' NW of Douglass Ave | 7.44 | 7.06 | -0.38 | |
| N0060 | Stevenson Creek, 120' SE of Douglass Ave | 7.73 | 7.44 | -0.29 | |
| N0070 | Stevenson Creek, 1,020 SE of Douglass Ave | 7.95 | 7.73 | -0.22 | |
| N0080 | Stevenson Creek, 1,530' SE of Douglass Ave | 8.09 | 7.91 | -0.18 | |
| N0090 | Stevenson Creek, 120' NW of Betty Lane | 8.15 | 7.94 | -0.21 | |
| N0100 | Stevenson Creek, 120' E of Betty Lane | 8.92 | 8.93 | 0.01 | |
| N0110 | Stevenson Creek, 690' SE of Betty Lane | 9.26 | 9.30 | 0.04 | |
| N0120 | Stevenson Creek at Palmetto Street | 9.55 | 9.81 | 0.26 | |
| N0130 | Stevenson Creek at Palmetto Street | 10.14 | 10.02 | -0.12 | |
| N0140 | Stevenson Creek, 860' S of Palmetto Street | 12.53 | 12.61 | 0.08 | |
| N0150 | Stevenson Creek, 150' NW of SCL Railroad | 13.63 | 13.71 | 0.08 | |
| N0170 | Stevenson Creek, 150' S of SCL Railroad | 14.32 | 14.43 | 0.11 | |
| N0180 | Stevenson Creek, 820' S of SCL Railroad | 15.35 | 15.43 | 0.08 | |
| N0195 | Douglass Avenue, 200' E of Harbor Drive | 8.24 | 7.99 | -0.25 | |
| N0200 | Douglass Avenue, 150' W of Harbor Drive | 11.19 | 11.19 | 0.00 | |
| N0210 | Fairmont Street and Washington Avenue | 13.07 | 13.07 | 0.00 | |
| N0220 | Fairmont Steet and N. Greenwood Avenue | 15.04 | 15.04 | 0.00 | |
| N0230 | Fairmont Street and Fulton Avenue | 17.06 | 17.06 | 0.00 | |
| N0240 | Marshall Street and Fulton Avenue | 21.29 | 21.29 | 0.00 | |
| N0250 | Pennsylvania Street and Grant Street | 22.77 | 22.77 | 0.00 | |
| N0280 | Marshall Street AWTP | 8.74 | 8.65 | -0.09 | |
| N0290 | Russel Street 350' W of Holt Avenue | 9.92 | 9.93 | 0.01 | |
| N0291 | Russel Street and Martin Luther King Ave | 10.95 | 10.95 | 0.00 | |
| N0292 | Russel Street and N Madison Ave | 16.76 | 16.77 | 0.01 | |
| N0300 | Martin Luther King Ave S of Russel Street | 11.91 | 11.92 | 0.01 | |
| N0310 | Martin Luther King Ave and Engman Street | 13.28 | 13.29 | 0.01 | |
| N0320 | Martin Luther King Ave and Palm Bluff St | 15.88 | 15.88 | 0.00 | |
| N0330 | Palm Bluff Street and N Madison Avenue | 16.50 | 16.50 | 0.00 | |
| N0340 | N Greenwood Avenue and Metto Street | 21.00 | 21.00 | 0.00 | |
| N0350 | N Greenwood Avenue and Palmetteo Street | 21.55 | 21.55 | 0.00 | |
| N0370 | Pennsylvania Avenue and Metto Street | 21.96 | 21.96 | 0.00 | |
| N0380 | Holt Avenue and Russel Street | 8.21 | 8.11 | -0.10 | |
| N0390 | Holt Avenue and Engman Street | 11.18 | 11.55 | 0.37 | OK - Inside manhole |
| N0400 | Holt Avenue 420' S of Engman Street | 13.32 | 14.27 | 0.95 | OK - Inside manhole |
| N0410 | Palmetto Street and Holt Avenue | 15.78 | 17.26 | 1.48 | OK - Inside manhole |
| N0420 | Palmetto Street and N Missouri Avenue | 18.88 | 19.51 | 0.63 | OK - Inside manhole |
| N0425 | Palmetto Street and N Missouri Avenue | | 20.45 | | |

Table F.3 100-Year, 24-Hour Design Flood Elevation Comparison, Existing and Proposed Conditions

| Node ID | Node Location | 100-Year, 24-Hour Design Storm Flood Elevations in Feet (NGVD 1929) | | | Notes |
|---------|--|--|----------|------------|-------------------|
| | | Existing | Proposed | Difference | |
| N0430 | N Missouri Avenue and Seminole Street | 21.33 | 21.23 | -0.10 | |
| N0435 | Palmetto Street and Phillis Stadium Drive | 21.33 | 21.23 | -0.10 | |
| N0440 | Palmetto Street and Kings Highway | 20.68 | 19.59 | -1.09 | |
| N0450 | Betty Lane and SCL Railroad Ditch | 24.11 | 24.19 | 0.08 | |
| N0460 | N. Lincoln Avenue and SCL Railroad Ditch | 24.30 | 24.31 | 0.01 | |
| N0470 | N. Missouri Avenue and SCL Railroad Ditch | 24.58 | 24.52 | -0.06 | |
| N0480 | N. Greenwood Avenue and Maple Street | 24.69 | 24.64 | -0.05 | |
| N0490 | Overbrook Avenue Detention Pond | | 16.76 | | |
| N0500 | Spring Branch at Overbrook Avenue | 7.44 | 7.16 | -0.28 | |
| N0510 | Spring Branch at Overbrook Avenue | 8.78 | 9.66 | 0.88 | OK - within banks |
| N0520 | Spring Branch at Springtime Avenue | 8.76 | 9.72 | 0.96 | OK - within banks |
| N0530 | Spring Branch at Douglass Avenue | 10.68 | 10.57 | -0.11 | |
| N0540 | Spring Branch at Douglass Avenue | 11.51 | 11.49 | -0.02 | |
| N0550 | (Pinellas County - FPLOS not determined) | 11.62 | 11.77 | 0.15 | OK - within banks |
| N0560 | Spring Branch at Sunset Point Drive | 11.65 | 11.86 | 0.21 | OK - within banks |
| N0570 | (Pinellas County - FPLOS not determined) | 11.80 | 12.80 | 1.00 | OK - within banks |
| N0590 | (Pinellas County - FPLOS not determined) | 15.23 | 13.24 | -1.99 | |
| N0600 | (Pinellas County - FPLOS not determined) | 15.43 | 13.49 | -1.94 | |
| N0610 | (Pinellas County - FPLOS not determined) | 15.48 | 13.94 | -1.54 | |
| N0620 | Spring Branch, 700' SW of Kings Highway | 15.72 | 14.95 | -0.77 | |
| N0630 | Spring Branch at Kings Highway (west side) | 16.66 | 15.12 | -1.54 | |
| N0650 | Pineland Avenue and Vista Way | 17.61 | 17.65 | 0.04 | |
| N0660 | Retention pond outfall SE of Pineland, Vista | 17.90 | 17.90 | 0.00 | |
| N0670 | Retention pond SE of Pineland and Vista | 20.17 | 20.17 | 0.00 | |
| N0680 | (Pinellas County - FPLOS not determined) | 15.49 | 13.98 | -1.51 | |
| N0690 | Sunset Point Drive, 750' E of Betty Lane | 15.49 | 13.98 | -1.51 | |
| N0700 | School Board Retention Pond | 16.77 | 16.77 | 0.00 | |
| N0710 | School Board Retention Pond | 16.78 | 16.78 | 0.00 | |
| N0720 | School Board Ditch | 19.05 | 19.05 | 0.00 | |
| N0730 | School Board Retention Pond | 20.05 | 20.05 | 0.00 | |
| N0740 | State Street Ditch, 320' E of Betty Lane | 15.53 | 14.06 | -1.47 | |
| N0750 | State Street Ditch, 320' E of Betty Lane | 15.50 | 14.06 | -1.44 | |
| N0760 | Pond E of Betty Lane and Woodlawn Terr. | 15.51 | 14.20 | -1.31 | |
| N0770 | (Pinellas County - FPLOS not determined) | 15.58 | 14.38 | -1.20 | |
| N0775 | (Pinellas County - FPLOS not determined) | 17.08 | 16.91 | -0.17 | |
| N0780 | (Pinellas County - FPLOS not determined) | 17.48 | 17.36 | -0.12 | |
| N0790 | (City of Dunedin - FPLOS not determined) | 17.64 | 17.48 | -0.16 | |
| N0800 | (City of Dunedin - FPLOS not determined) | 19.83 | 19.74 | -0.09 | |
| N0810 | (City of Dunedin - FPLOS not determined) | 19.85 | 19.73 | -0.12 | |
| N0820 | (City of Dunedin - FPLOS not determined) | 19.80 | 19.76 | -0.04 | |
| N0830 | (City of Dunedin - FPLOS not determined) | 19.85 | 19.73 | -0.12 | |
| N0840 | (City of Dunedin - FPLOS not determined) | 19.83 | 19.77 | -0.06 | |

Table F.3 100-Year, 24-Hour Design Flood Elevation Comparison, Existing and Proposed Conditions

| Node ID | Node Location | 100-Year, 24-Hour Design Storm Flood Elevations in Feet (NGVD 1929) | | | Notes |
|---------|--|--|----------|------------|-------|
| | | Existing | Proposed | Difference | |
| N0850 | (City of Dunedin - FPLOS not determined) | 19.85 | 19.76 | -0.09 | |
| N0855 | (City of Dunedin - FPLOS not determined) | 19.85 | 19.77 | -0.08 | |
| N0860 | (City of Dunedin - FPLOS not determined) | 20.13 | 20.08 | -0.05 | |
| N0870 | (City of Dunedin - FPLOS not determined) | 20.14 | 20.08 | -0.06 | |
| N0880 | (City of Dunedin - FPLOS not determined) | 20.28 | 20.24 | -0.04 | |
| N0890 | (City of Dunedin - FPLOS not determined) | 20.29 | 20.25 | -0.04 | |
| N0900 | (City of Dunedin - FPLOS not determined) | 20.29 | 20.25 | -0.04 | |
| N0910 | Woodlawn Terrace and Oakdale Way | 21.88 | 20.13 | -1.75 | |
| N0920 | (City of Dunedin - FPLOS not determined) | 19.82 | 19.72 | -0.10 | |
| N1000 | Spring Branch at Kings Highway (east side) | 16.75 | 15.97 | -0.78 | |
| N1010 | Spring Branch, 680' S of Union Street | 17.01 | 16.36 | -0.65 | |
| N1020 | Spring Branch, 380' S of Union Street | 17.52 | 17.10 | -0.42 | |
| N1030 | Spring Branch at Union Street | 19.15 | 19.05 | -0.10 | |
| N1040 | (City of Dunedin - FPLOS not determined) | 19.82 | 19.74 | -0.08 | |
| N1050 | (City of Dunedin - FPLOS not determined) | 19.89 | 19.82 | -0.07 | |
| N1060 | (City of Dunedin - FPLOS not determined) | 19.89 | 19.82 | -0.07 | |
| N1070 | (City of Dunedin - FPLOS not determined) | 19.97 | 19.90 | -0.07 | |
| N1080 | (City of Dunedin - FPLOS not determined) | 20.01 | 19.95 | -0.06 | |
| N1090 | (City of Dunedin - FPLOS not determined) | 20.07 | 20.02 | -0.05 | |
| N1100 | (City of Dunedin - FPLOS not determined) | 23.85 | 23.84 | -0.01 | |
| N1110 | (City of Dunedin - FPLOS not determined) | 24.21 | 24.21 | 0.00 | |
| N1120 | (City of Dunedin - FPLOS not determined) | 24.67 | 24.67 | 0.00 | |
| N1130 | (City of Dunedin - FPLOS not determined) | 25.62 | 25.62 | 0.00 | |
| N1140 | (City of Dunedin - FPLOS not determined) | 25.84 | 25.84 | 0.00 | |
| N1150 | (City of Dunedin - FPLOS not determined) | 25.95 | 25.94 | -0.01 | |
| N1160 | (City of Dunedin - FPLOS not determined) | 26.26 | 26.25 | -0.01 | |
| N1170 | (City of Dunedin - FPLOS not determined) | 26.27 | 26.27 | 0.00 | |
| N1172 | (City of Dunedin - FPLOS not determined) | 26.33 | 26.32 | -0.01 | |
| N1174 | (City of Dunedin - FPLOS not determined) | 26.36 | 26.35 | -0.01 | |
| N1180 | (City of Dunedin - FPLOS not determined) | 26.28 | 26.28 | 0.00 | |
| N1190 | (City of Dunedin - FPLOS not determined) | 26.40 | 26.40 | 0.00 | |
| N1200 | (City of Dunedin - FPLOS not determined) | 26.48 | 26.47 | -0.01 | |
| N1210 | (City of Dunedin - FPLOS not determined) | 29.20 | 29.19 | -0.01 | |
| N1220 | (City of Dunedin - FPLOS not determined) | 29.23 | 29.22 | -0.01 | |
| N1230 | (City of Dunedin - FPLOS not determined) | 29.24 | 29.23 | -0.01 | |
| N1240 | (City of Dunedin - FPLOS not determined) | 29.27 | 29.25 | -0.02 | |
| N1245 | (City of Dunedin - FPLOS not determined) | 29.26 | 29.25 | -0.01 | |
| N1250 | (City of Dunedin - FPLOS not determined) | 29.27 | 29.26 | -0.01 | |
| N1260 | (City of Dunedin - FPLOS not determined) | 29.82 | 29.80 | -0.02 | |
| N1270 | (City of Dunedin - FPLOS not determined) | 32.08 | 32.07 | -0.01 | |
| N1280 | (City of Dunedin - FPLOS not determined) | 32.08 | 32.08 | 0.00 | |
| N1290 | (City of Dunedin - FPLOS not determined) | 32.08 | 32.08 | 0.00 | |

Table F.3 100-Year, 24-Hour Design Flood Elevation Comparison, Existing and Proposed Conditions

| Node ID | Node Location | 100-Year, 24-Hour Design Storm Flood Elevations in Feet (NGVD 1929) | | | Notes |
|---------|--|--|----------|------------|---------------------|
| | | Existing | Proposed | Difference | |
| N1300 | (City of Dunedin - FPLOS not determined) | 33.71 | 33.71 | 0.00 | |
| N1310 | (City of Dunedin - FPLOS not determined) | 34.31 | 34.31 | 0.00 | |
| N1320 | (City of Dunedin - FPLOS not determined) | 34.36 | 34.36 | 0.00 | |
| N1330 | (City of Dunedin - FPLOS not determined) | 43.19 | 43.19 | 0.00 | |
| N1340 | (City of Dunedin - FPLOS not determined) | 43.40 | 43.40 | 0.00 | |
| N1350 | Byram East Ditch at Highland Avenue | 17.27 | 16.71 | -0.56 | |
| N1360 | Byram East Ditch at Highland Avenue | 19.93 | 19.35 | -0.58 | |
| N1370 | Byram East Ditch, 730' E of Highland Ave | 26.52 | 24.60 | -1.92 | |
| N1380 | Byram East Ditch, 1,350' E of Highland Ave | 28.62 | 28.02 | -0.60 | |
| N1390 | Souvenir Drive near Algonquin Drive | 29.66 | 29.68 | 0.02 | |
| N1400 | Algonquin Drive, 340' W of Picardy Circle | 33.66 | 34.77 | 1.11 | OK - Inside manhole |
| N1410 | Algonquin Drive and Nugget Drive | 50.88 | 51.20 | 0.32 | OK - Inside manhole |
| N1420 | Nugget Drive, 400' S of Algonquin Drive | 54.73 | 55.76 | 1.03 | OK - Inside manhole |
| N1430 | Clearview Lake | 57.36 | 58.90 | 1.54 | OK - Inside manhole |
| N1440 | Highland Avenue, 130' S of Byram Drive | 18.43 | 17.41 | -1.02 | |
| N1450 | Highland Avenue at Highland Circle | 21.11 | 20.61 | -0.50 | |
| N1460 | Highland Avenue at Sunset Point Road | 33.14 | 32.98 | -0.16 | |
| N1470 | Sunset Point Road, 250' E of Highland Ave | 33.96 | 33.88 | -0.08 | |
| N1480 | Sunset Point Road, 250' E of Highland Ave | 33.96 | 33.88 | -0.08 | |
| N1490 | Pond NE of Highland Avenue and Byram Dr | 16.69 | 15.76 | -0.93 | |
| N1500 | Souvenir Drive, 250' W of Picardy Circle | 27.87 | 26.43 | -1.44 | |
| N1510 | Retention Pond in Windsor Woods Sub. | 28.68 | 28.43 | -0.25 | |
| N1520 | (City of Dunedin - FPLOS not determined) | 20.61 | 20.60 | -0.01 | |
| N1530 | (City of Dunedin - FPLOS not determined) | 20.80 | 20.80 | 0.00 | |
| N1540 | (City of Dunedin - FPLOS not determined) | 20.80 | 20.80 | 0.00 | |
| N1550 | (City of Dunedin - FPLOS not determined) | 24.54 | 24.54 | 0.00 | |
| N1560 | (City of Dunedin - FPLOS not determined) | 24.84 | 24.84 | 0.00 | |
| N1570 | (City of Dunedin - FPLOS not determined) | 24.96 | 24.96 | 0.00 | |
| N1580 | (City of Dunedin - FPLOS not determined) | 24.87 | 24.87 | 0.00 | |
| N1590 | (City of Dunedin - FPLOS not determined) | 20.73 | 20.72 | -0.01 | |
| N1600 | (City of Dunedin - FPLOS not determined) | 27.12 | 27.12 | 0.00 | |
| N1610 | (City of Dunedin - FPLOS not determined) | 28.87 | 28.87 | 0.00 | |
| N1620 | (City of Dunedin - FPLOS not determined) | 32.02 | 32.02 | 0.00 | |
| N1630 | (City of Dunedin - FPLOS not determined) | 26.83 | 26.84 | 0.01 | |
| N1640 | (City of Dunedin - FPLOS not determined) | 31.89 | 31.89 | 0.00 | |
| N1650 | (City of Dunedin - FPLOS not determined) | 32.80 | 32.80 | 0.00 | |
| N1660 | (City of Dunedin - FPLOS not determined) | 32.91 | 32.91 | 0.00 | |
| N1670 | (City of Dunedin - FPLOS not determined) | 33.29 | 33.29 | 0.00 | |
| N1680 | (City of Dunedin - FPLOS not determined) | 38.54 | 38.55 | 0.01 | |
| N1690 | (City of Dunedin - FPLOS not determined) | 40.59 | 40.59 | 0.00 | |
| N1700 | (City of Dunedin - FPLOS not determined) | 37.49 | 37.49 | 0.00 | |
| N1710 | (City of Dunedin - FPLOS not determined) | 30.34 | 30.35 | 0.01 | |

Table F.3 100-Year, 24-Hour Design Flood Elevation Comparison, Existing and Proposed Conditions

| Node ID | Node Location | 100-Year, 24-Hour Design Storm Flood Elevations in Feet (NGVD 1929) | | | Notes |
|---------|--|--|----------|------------|---------------------|
| | | Existing | Proposed | Difference | |
| N1720 | (City of Dunedin - FPLOS not determined) | 44.88 | 44.88 | 0.00 | |
| N1750 | (City of Dunedin - FPLOS not determined) | 26.28 | 26.28 | 0.00 | |
| N1760 | (City of Dunedin - FPLOS not determined) | 26.29 | 26.28 | -0.01 | |
| N1770 | (City of Dunedin - FPLOS not determined) | 26.30 | 26.30 | 0.00 | |
| N1780 | (City of Dunedin - FPLOS not determined) | 27.95 | 27.95 | 0.00 | |
| N1790 | (City of Dunedin - FPLOS not determined) | 29.52 | 29.52 | 0.00 | |
| N1800 | (City of Dunedin - FPLOS not determined) | 26.09 | 26.09 | 0.00 | |
| N1810 | (City of Dunedin - FPLOS not determined) | 26.10 | 26.09 | -0.01 | |
| N1820 | (City of Dunedin - FPLOS not determined) | 26.30 | 26.30 | 0.00 | |
| N1830 | (City of Dunedin - FPLOS not determined) | 27.97 | 27.98 | 0.01 | |
| N1840 | (City of Dunedin - FPLOS not determined) | 29.24 | 29.23 | -0.01 | |
| N1850 | (City of Dunedin - FPLOS not determined) | 29.25 | 29.23 | -0.02 | |
| N1860 | (City of Dunedin - FPLOS not determined) | 33.17 | 33.16 | -0.01 | |
| N1870 | (City of Dunedin - FPLOS not determined) | 34.09 | 34.09 | 0.00 | |
| N1880 | (City of Dunedin - FPLOS not determined) | 30.93 | 30.93 | 0.00 | |
| N1900 | (City of Dunedin - FPLOS not determined) | 29.33 | 29.30 | -0.03 | |
| N1910 | (City of Dunedin - FPLOS not determined) | 29.91 | 29.88 | -0.03 | |
| N1920 | (City of Dunedin - FPLOS not determined) | 31.72 | 31.72 | 0.00 | |
| N1930 | (City of Dunedin - FPLOS not determined) | 35.58 | 35.57 | -0.01 | |
| N1940 | (City of Dunedin - FPLOS not determined) | 38.45 | 38.44 | -0.01 | |
| N1950 | (City of Dunedin - FPLOS not determined) | 43.93 | 43.92 | -0.01 | |
| N1960 | (City of Dunedin - FPLOS not determined) | 50.77 | 50.78 | 0.01 | |
| N1970 | (City of Dunedin - FPLOS not determined) | 54.89 | 54.89 | 0.00 | |
| N1980 | (City of Dunedin - FPLOS not determined) | 54.16 | 54.16 | 0.00 | |
| N1990 | (City of Dunedin - FPLOS not determined) | 53.42 | 53.42 | 0.00 | |
| N2000 | Hammond Branch, 625' W of Kings Highway | 8.95 | 8.98 | 0.03 | |
| N2010 | Hammond Branch at Kings Highway | 12.26 | 11.26 | -1.00 | |
| N2020 | Hammond Branch at Kings Highway | 12.27 | 11.36 | -0.91 | |
| N2030 | Hammond Branch Pond E of Kings Highway | 16.94 | 16.62 | -0.32 | |
| N2040 | Hammond Branch Pond W of Highland Ave | 19.66 | 20.34 | 0.68 | OK - Within bank |
| N2050 | Hammond Branch at Highland Avenue | 24.19 | 26.79 | 2.60 | OK - Within manhole |
| N2055 | Proposed Improved Railroad Ditch | | 38.03 | | |
| N2060 | RR ditch at Flagler Drive and Carroll Street | 43.63 | 42.91 | -0.72 | |
| N2070 | RR ditch at Flagler Drive and Gentry Street | 44.98 | 44.32 | -0.66 | |
| N2080 | RR ditch at Flagler Drive and Crown Street | 47.42 | 46.72 | -0.70 | |
| N2090 | RR ditch at Flagler Drive 200' N of Scott St | 49.33 | 48.66 | -0.67 | |
| N2100 | RR ditch at Flagler Dr 250' W of Ridge Ave | 51.50 | 50.99 | -0.51 | |
| N2110 | RR ditch at Flagler Dr 100' E of Lynn Ave | 53.90 | 55.49 | 1.59 | OK - Within bank |
| N2120 | RR ditch at Flagler Dr 80' W of Murry Ave | 58.72 | 59.06 | 0.34 | OK - Within bank |
| N2130 | RR ditch at Flagler Dr and Saturn Avenue | 61.87 | 62.54 | 0.67 | OK - Within bank |
| N2140 | RR ditch at Flagler Drive and Keene Road | 63.24 | 63.40 | 0.16 | |
| N2150 | Keene Road ditch 200' N of Long Street | 69.16 | 69.18 | 0.02 | |

Table F.3 100-Year, 24-Hour Design Flood Elevation Comparison, Existing and Proposed Conditions

| Node ID | Node Location | 100-Year, 24-Hour Design Storm Flood Elevations in Feet (NGVD 1929) | | | Notes |
|---------|---|--|----------|------------|--------------------------------------|
| | | Existing | Proposed | Difference | |
| N2155 | Keene Road ditch 440' S of Long Street | 69.17 | 69.19 | 0.02 | |
| N2160 | Keene Road ditch at Palmetto Street | 69.18 | 69.20 | 0.02 | |
| N2170 | West pond in Clearwater Golf Park | 69.18 | 69.20 | 0.02 | |
| N2180 | Center pond in Clearwater Golf Park | 69.63 | 69.63 | 0.00 | |
| N2200 | Rollen Road and Parkwood Street | 16.00 | 15.88 | -0.12 | |
| N2210 | Rollen Road and Terrace Road | 17.94 | 17.95 | 0.01 | |
| N2220 | Kings Highway and Terrace Road | 20.74 | 20.54 | -0.20 | |
| N2230 | Kings Highway and Admiral Woodson Lane | 16.88 | 16.18 | -0.70 | |
| N2240 | Pond at Kings Highway and Hibiscus Street | 20.42 | 19.75 | -0.67 | |
| N2242 | Palmetto Street and Palm Terrace Drive | 22.93 | 22.12 | -0.81 | |
| N2244 | Palmetto Street and SCL Railroad | 26.43 | 26.55 | 0.12 | Ok - Within manhole |
| N2250 | Palmetto Street and SCL Railroad | 32.05 | 31.34 | -0.71 | |
| N2260 | Detention Pond SW of Highland & Palmetto | 36.85 | 34.86 | -1.99 | |
| N2270 | Highland Avenue and Palmetto Street | 37.25 | 35.72 | -1.53 | |
| N2280 | Highland Avenue and Walnut Street | 43.24 | 42.96 | -0.28 | |
| N2290 | Glenwood Avenue and Elmwood Street | 49.46 | 48.72 | -0.74 | |
| N2300 | Park at Smallwood Circle and Rosemere Rd | 49.39 | 48.27 | -1.12 | |
| N2310 | Park at Ridgewood Street and Wood Ave | 55.12 | 55.21 | 0.09 | |
| N2320 | Ridgewood Street and Edgewood Avenue | 57.33 | 57.34 | 0.01 | |
| N2330 | Drew Street at Edgewood Avenue | 60.59 | 60.60 | 0.01 | |
| N2340 | Drew Street at Crest Avenue | 63.22 | 63.22 | 0.00 | |
| N2345 | Highland Avenue and Palmetto Street | 37.13 | 36.95 | -0.18 | |
| N2350 | Flagler Drive and Levern Street | 40.43 | 40.04 | -0.39 | |
| N2370 | Overlea Street, E of Carlos Avenue | 24.89 | 24.53 | -0.36 | |
| N2380 | Highland Avenue and Fairmont Street | 28.33 | 28.17 | -0.16 | |
| N2390 | Highland Avenue and Fairmont Street | 28.76 | 28.69 | -0.07 | |
| N2400 | Highland Avenue and Sandy Lane | 33.68 | 33.68 | 0.00 | |
| N2420 | Highland Avenue and Greenlea Drive | 35.55 | 35.55 | 0.00 | |
| N2450 | SCL RR W of Gentry Street and Flagler Drive | 36.60 | 38.35 | 1.75 | OK - Within proposed berm (el. 39.0) |
| N2460 | Linwood Drive and Sharondale Drive | 51.60 | 47.44 | -4.16 | |
| N2470 | Nelson Avenue and Scott Street | 59.33 | 59.13 | -0.20 | |
| N2480 | Lake Lucille | 61.09 | 60.84 | -0.25 | |
| N2490 | Palmetto Street and Casloer Avenue | 67.12 | 67.12 | 0.00 | |
| N2500 | Lake Hobart | 67.42 | 67.42 | 0.00 | |
| N2510 | Saturn Avenue and Leo Lane | 64.89 | 64.54 | -0.35 | |
| N2520 | Saturn Avenue and Sherwood Street | 64.88 | 64.55 | -0.33 | |
| N2530 | Lake at St Andrews Cove Apartments | 68.92 | 68.93 | 0.01 | |
| N2540 | Clearwater Air Park | 68.61 | 68.62 | 0.01 | |
| N2545 | Clearwater Air Park | 61.40 | 61.40 | 0.00 | |
| N2550 | Clearwater Air Park | 68.87 | 68.87 | 0.00 | |
| N2560 | SE Pond in Clearwater Golf Park | 69.83 | 69.83 | 0.00 | |
| N2570 | City of Clearwater Public Service Complex | 64.47 | 64.52 | 0.05 | |

Table F.3 100-Year, 24-Hour Design Flood Elevation Comparison, Existing and Proposed Conditions

| Node ID | Node Location | 100-Year, 24-Hour Design Storm Flood Elevations in Feet (NGVD 1929) | | | Notes |
|---------|---|--|----------|------------|-------------|
| | | Existing | Proposed | Difference | |
| N2580 | City of Clearwater Public Service Complex | 66.71 | 66.71 | 0.00 | |
| N3000 | Stevenson Creek gage, 170' N of Drew Street | 15.70 | 15.76 | 0.06 | |
| N3010 | Stevenson Creek at Drew Street | 15.76 | 15.77 | 0.01 | |
| N3020 | Stevenson Creek at Drew Street | 17.44 | 17.44 | 0.00 | |
| N3030 | Stevenson Creek at Cleveland Street (SR 60) | 20.15 | 17.61 | -2.54 | |
| N3040 | Stevenson Creek at Cleveland Street (SR 60) | 20.74 | 19.13 | -1.61 | |
| N3050 | Stevenson Creek at Pierce Street | 20.83 | 20.04 | -0.79 | |
| N3060 | Stevenson Creek at Pierce Street | 20.86 | 20.08 | -0.78 | |
| N3070 | Stevenson Creek at Franklin Street | 20.92 | 20.14 | -0.78 | |
| N3080 | Stevenson Creek at Franklin Street | 20.96 | 20.19 | -0.77 | |
| N3090 | Stevenson Creek at Court Street (SR 595A) | 20.98 | 20.22 | -0.76 | |
| N3100 | Stevenson Creek at Court Street (SR 595A) | 22.19 | 21.09 | -1.10 | |
| N3110 | Stevenson Creek 605' S of Court Street | 22.89 | 21.47 | -1.42 | |
| N3125 | Stevenson Creek at Druid Road | 23.58 | 22.18 | -1.40 | |
| N3126 | Stevenson Creek Weir S of Druid Road | 24.23 | 22.98 | -1.25 | |
| N3130 | Stevenson Creek 350' S of Druid (Linn Lake) | 24.53 | 23.40 | -1.13 | |
| N3131 | Stevenson Creek 1030' S of Druid(Linn Lake) | 24.57 | 23.46 | -1.11 | |
| N3132 | Stevenson Creek at Evergreen Avenue | 25.72 | 25.07 | -0.65 | |
| N3134 | Stevenson Creek at Hillcrest N of Jeffords | 26.73 | 25.65 | -1.08 | |
| N3135 | Pond in Golf Course S of Druid | 22.77 | 33.30 | 10.53 | OK new pond |
| N3150 | S. Betty Lane and Jasmine Way | 25.06 | 24.95 | -0.11 | |
| N3160 | S. Betty Lane and Magnolia Drive | 26.99 | 26.98 | -0.01 | |
| N3170 | S. Betty Lane and Lotus Path | 29.30 | 29.30 | 0.00 | |
| N3180 | Jeffords Street and Byron Avenue | 26.10 | 26.08 | -0.02 | |
| N3190 | Jeffords Street and S. Betty Lane | 33.52 | 33.52 | 0.00 | |
| N3195 | Jeffords Street and Lincoln Avenue | 50.22 | 50.22 | 0.00 | |
| N3200 | Plaza Pines Shopping Center | 52.85 | 52.85 | 0.00 | |
| N3210 | Plaza Pines Shopping Center | 55.14 | 55.14 | 0.00 | |
| N3220 | Plaza Pines Shopping Center Pond | 61.34 | 61.34 | 0.00 | |
| N3450 | Lake Bellevue Branch at S. Betty Lane | 22.91 | 21.48 | -1.43 | |
| N3500 | Lake Bellevue Branch at S. Lincoln Drive | 23.27 | 21.50 | -1.77 | |
| N3510 | Lake Bellevue Branch at Missouri Avenue | 25.68 | 22.49 | -3.19 | |
| N3520 | Lake Bellevue Branch at Missouri Avenue | 25.67 | 23.55 | -2.12 | |
| N3530 | Lake Bellevue Branch Pond W of Missouri | 26.56 | 25.54 | -1.02 | |
| N3540 | Lake Bellevue Branch at Druid Road | 29.04 | 28.75 | -0.29 | |
| N3550 | Stormwater Pond at Renaissance Sq. Villas | 32.02 | 31.54 | -0.48 | |
| N3555 | Lake Bellevue Branch 400' S of Druid | 30.51 | 30.00 | -0.51 | |
| N3560 | Lake Bellevue Branch W of Renaissance Sq | 34.03 | 33.22 | -0.81 | |
| N3565 | Lk Bellevue Brnch at Lotus Path/ S Greenwd | 37.45 | 36.54 | -0.91 | |
| N3570 | Lake Bellevue Branch S of Renaissance Sq | 39.81 | 38.95 | -0.86 | |
| N3575 | Lk Bellevue Branch 150' S of Renaissance Sq | 39.81 | 38.95 | -0.86 | |
| N3580 | Lake Bellevue Branch 250' N of Pinellas St | 39.88 | 39.11 | -0.77 | |

Table F.3 100-Year, 24-Hour Design Flood Elevation Comparison, Existing and Proposed Conditions

| Node ID | Node Location | 100-Year, 24-Hour Design Storm Flood Elevations in Feet (NGVD 1929) | | | Notes |
|---------|--|--|----------|------------|-----------------------------------|
| | | Existing | Proposed | Difference | |
| N3600 | Lake Bellevue Branch at Pinellas Street | 40.74 | 39.59 | -1.15 | |
| N3650 | Lk Bellevue Brnch at Tuskawilla/ S Greenwd | 41.28 | 40.78 | -0.50 | |
| N3670 | Lake Bellevue Branch at Tuskawilla Ave | 41.39 | 40.86 | -0.53 | |
| N3680 | Lake Bellevue Branch 160' N of Lakeview | 42.57 | 42.27 | -0.30 | |
| N3700 | Lake Bellevue Branch at Lakeview Road | 43.24 | 42.75 | -0.49 | |
| N3705 | Proposed Lake Bellevue Outfall Weir | | 43.89 | | |
| N3710 | Lake Bellevue | 43.48 | 43.91 | 0.43 | OK - Lake Bellevue Low FF = 44.05 |
| N3720 | Lake Bellevue Branch at Woodlawn Ave | 47.90 | 48.00 | 0.10 | |
| N3730 | Lake Bellevue Branch at Woodlawn Ave | 50.65 | 50.34 | -0.31 | |
| N3740 | Lake Bellevue Branch at Howard Street | 52.27 | 52.38 | 0.11 | |
| N3750 | Lake Bellevue Branch at Howard Street | 53.67 | 53.45 | -0.22 | |
| N3760 | Lake Bellevue Branch at Belleair Road | 56.82 | 56.92 | 0.10 | |
| N3780 | S. Greenwood Avenue at Hawkins Street | 62.55 | 62.55 | 0.00 | |
| N3790 | Missouri Avenue FDOT Detention Pond | 62.78 | 62.78 | 0.00 | |
| N3800 | Wildwood Way and SCL Railroad | 45.74 | 43.94 | -1.80 | |
| N3810 | Belleair Road and SCL Railroad | 58.02 | 58.03 | 0.01 | |
| N4000 | Stevenson Creek at Jeffords Street | 28.24 | 26.93 | -1.31 | |
| N4010 | Stevenson Creek at Browning Street | 29.94 | 29.15 | -0.79 | |
| N4020 | Stevenson Creek at Browning Street | 31.24 | 30.24 | -1.00 | |
| N4030 | Stevenson Creek at Lakeview Road | 32.72 | 31.33 | -1.39 | |
| N4040 | Hillcrest Avenue S. of Lakeview Road | 34.13 | 33.00 | -1.13 | |
| N4050 | Stevenson Creek 950' S of Lakeview Road | 35.13 | 34.29 | -0.84 | |
| N4060 | Stevenson Creek at Bellevue Boulevard | 36.88 | 35.77 | -1.11 | |
| N4065 | Stevenson Creek at Bellevue Boulevard | 38.34 | 38.39 | 0.05 | |
| N4075 | Stevenson Creek at St Thomas Drive | 40.65 | 38.47 | -2.18 | |
| N4080 | Stevenson Creek at St Thomas Drive | 40.73 | 39.88 | -0.85 | |
| N4090 | Rice Lake | 40.94 | 40.15 | -0.79 | |
| N4100 | Stevenson Creek at Belleair Boulevard | 42.49 | 42.31 | -0.18 | |
| N4110 | Stevenson Creek at Southridge Drive | 42.72 | 42.56 | -0.16 | |
| N4120 | Stevenson Creek at Southridge Drive | 42.72 | 42.56 | -0.16 | |
| N4122 | Byron Drive 400' S of Emily Court | 36.65 | 36.51 | -0.14 | |
| N4123 | Bellevue Boulevard at Boylan Avenue | 53.83 | 53.88 | 0.05 | |
| N4125 | Missouri Avenue FDOT Detention Pond | 61.64 | 61.64 | 0.00 | |
| N4128 | Pond adj. to Stevenson Creek S of Belleair | 40.00 | 39.54 | -0.46 | |
| N4130 | Belleair Road 700' W of Highland Avenue | 45.17 | 45.16 | -0.01 | |
| N4131 | Belleair Road 350' W of Highland Avenue | 45.87 | 45.87 | 0.00 | |
| N4132 | Belleair Road and Highland Avenue | 47.03 | 47.03 | 0.00 | |
| N4133 | Belleair Road and Highland Avenue | 47.32 | 47.32 | 0.00 | |
| N4135 | Highland Avenue 280' N of Belleair Road | 53.43 | 53.43 | 0.00 | |
| N4136 | Labelle Plaza South Detention Pond | 54.69 | 54.69 | 0.00 | |
| N4137 | Labelle Plaza North Detention Pond | 56.45 | 56.45 | 0.00 | |
| N4138 | Pond SE of Belleair Road and Clearview Ave | 47.66 | 47.61 | -0.05 | |

Table F.3 100-Year, 24-Hour Design Flood Elevation Comparison, Existing and Proposed Conditions

| Node ID | Node Location | 100-Year, 24-Hour Design Storm Flood Elevations in Feet (NGVD 1929) | | | Notes |
|---------|--|--|----------|------------|-------|
| | | Existing | Proposed | Difference | |
| N4139 | Jeffords Street Branch at Hillcrest Avenue | 28.33 | 27.08 | -1.25 | |
| N4140 | Jeffords Street Branch at Highland Avenue | 30.28 | 30.10 | -0.18 | |
| N4150 | Jeffords Street Branch 650' E of Highland | 32.43 | 32.23 | -0.20 | |
| N4160 | Jeffords Street Branch 600' W of Lake Ave | 32.42 | 32.25 | -0.17 | |
| N4170 | Jeffords Street Branch at Lake Avenue | 32.52 | 32.43 | -0.09 | |
| N4180 | Jeffords Street Branch at Lake Avenue | 32.57 | 32.49 | -0.08 | |
| N4200 | Jeffords Street Branch 486' E of Lake Ave | 32.79 | 32.61 | -0.18 | |
| N4205 | Jeffords Street 100' E of Tuscola Road | 32.97 | 32.74 | -0.23 | |
| N4210 | Sonny Lake | 32.98 | 32.75 | -0.23 | |
| N4220 | Lake Helen | 32.97 | 32.74 | -0.23 | |
| N4230 | Woodcrest Avenue 450' S of Jeffords Street | 32.97 | 32.75 | -0.22 | |
| N4240 | Ditch Terminus 220' E of Woodcrest Avenue | 34.74 | 34.70 | -0.04 | |
| N4245 | Beginning of Lake Alpine Outfall Ditch | 34.74 | 34.70 | -0.04 | |
| N4250 | Lake Alpine | 34.77 | 34.74 | -0.03 | |
| N4260 | Keene Road and Beverly Circle | 37.12 | 37.12 | 0.00 | |
| N4280 | Pond SE of Keene Road and Beverly Circle | 35.80 | 35.80 | 0.00 | |
| N4285 | West End of Budleigh Street at N-S Ditch | 35.48 | 35.34 | -0.14 | |
| N4290 | West End of Magnolia Drive at N-S Ditch | 47.90 | 47.90 | 0.00 | |
| N4300 | Druid Road and Skyview Avenue | 56.52 | 56.52 | 0.00 | |
| N4310 | Turner Street and Skyview Avenue | 68.84 | 68.84 | 0.00 | |
| N4320 | Gulf to Bay Boulevard and Skyview Avenue | 68.83 | 68.83 | 0.00 | |
| N4360 | Crest Lake | 69.90 | 69.62 | -0.28 | |
| N4380 | Lake NE of Jeffords St and Keystone Ave | 32.97 | 32.74 | -0.23 | |
| N4390 | Duncan Avenue 470' N of Jeffords Street | 33.60 | 33.17 | -0.43 | |
| N4400 | Duncan Avenue at Magnolia Drive | 40.83 | 40.78 | -0.05 | |
| N4410 | Duncan Avenue and Druid Road | 56.65 | 56.70 | 0.05 | |
| N4420 | Duncan Avenue and Turner Street | 62.20 | 61.55 | -0.65 | |
| N4424 | Duncan Avenue and Rainbow Drive | 70.47 | 70.41 | -0.06 | |
| N4425 | Allens Creek Boundary Node | 68.00 | 68.00 | 0.00 | |
| N4426 | Duncan Avenue and Cleveland Street | 69.83 | 69.83 | 0.00 | |
| N4430 | Pond SW of Lakeview Rd and Duncan Ave | 36.03 | 35.92 | -0.11 | |
| N4440 | Balmora Drive near Norwood Avenue | 36.09 | 36.06 | -0.03 | |
| N4450 | Pond SE of Pinewood Dr and Norwood Ave | 35.44 | 35.35 | -0.09 | |
| N4460 | Pond SE of Duncan Ave and Brentwood Dr | 32.98 | 32.76 | -0.22 | |
| N4470 | Pond at Lake Avenue and Bamora Drive | 47.49 | 47.49 | 0.00 | |
| N4480 | Brentwood Drive and Woodcrest Avenue | 36.54 | 36.53 | -0.01 | |
| N4485 | Keene Road 540' N of Beverly Circle | 38.21 | 38.21 | 0.00 | |
| N4490 | Pond SW of Keene Rd and Magnolia Drive | 42.66 | 42.66 | 0.00 | |
| N4500 | Pond SE of Keene Road and Magnolia Drive | 43.17 | 43.17 | 0.00 | |
| N4510 | Pond NE of Keene Road and Magnolia Drive | 46.35 | 46.35 | 0.00 | |

**Stevenson Creek Watershed Management Plan
Preliminary Engineer's Opinions of
Probable Construction Cost**

1. Spring Branch

| Project | COST |
|-----------------|--------------------|
| 1A.1 | \$526,115 |
| 1A.2 | \$960,703 |
| 1B | \$830,830 |
| 1C | \$2,634,542 |
| 1D | \$446,783 |
| 1E | \$831,636 |
| 1F | \$933,969 |
| 1G | \$620,212 |
| TOTAL | |
| (Alt. 1) | \$5,150,248 |
| (Alt. 2) | \$6,953,960 |

2. Lower Stevenson Creek

| Project | COST |
|----------------|--------------------|
| 2A | \$544,546 |
| 2B | \$486,615 |
| 2C | \$526,500 |
| 2D | \$1,755,860 |
| TOTAL | \$3,313,520 |

3. Middle Stevenson Creek

| Project | COST |
|----------------|--------------------|
| 3A | \$2,203,240 |
| TOTAL | \$2,203,240 |

4. Upper Stevenson Creek

| Project | COST |
|----------------|--------------------|
| 4A | \$2,299,109 |
| 4B | \$1,415,843 |
| 4C | \$1,801,913 |
| TOTAL | \$5,516,865 |

5. Hammond Branch

| Project | COST |
|----------------|--------------------|
| 5A | \$737,241 |
| 5B | \$735,643 |
| 5C | \$303,382 |
| 5D | \$161,283 |
| 5E | \$14,300 |
| TOTAL | \$1,951,848 |

6. Lake Bellevue Branch

| Project | COST |
|----------------|--------------------|
| 6A | \$1,337,884 |
| 6B | \$1,554,761 |
| TOTAL | \$2,892,645 |

7. Jeffords Street Branch

| Project | COST |
|----------------|--------------------|
| 7A | \$881,466 |
| 7B | \$1,494,952 |
| 7C | \$1,690,634 |
| TOTAL | \$4,067,053 |

Plan 1 Total Cost = \$25,095,419
Plan 2 Total Cost = \$26,899,132

Stevenson Creek Watershed Management Plan Preliminary Engineer's Opinions of Cost

1. Spring Branch Improvements

Project 1A.1 Spring Branch Conveyance Enhancements (Lower Portion)

| Item # | Description | Unit | Quantity | Unit Cost | Total Cost |
|--------|---|------|----------|-----------|------------------|
| 110A | Channel Excavation | CY | 12,200 | \$11.00 | \$134,200 |
| | Low Retaining Wall (Gabions or Geoweb) | LF | 1,400 | \$120.00 | \$168,000 |
| 120A | Sod (bahia) | SY | 5,500 | \$1.50 | \$8,250 |
| | Remove and Dispose of Existing Pipe and Headwall | LS | 1 | \$1,500 | \$1,500 |
| | 12'-15' Trees, on 50' Centers | EA | 30 | \$190.00 | \$5,700 |
| | Mobilization | | | | \$31,765 |
| | Total Estimated Construction Cost | | | | \$349,415 |
| | Engineering and Contingency (30% of construction) | | | | \$104,825 |
| | Acquisition of Drainage Easement | SF | 62,500 | \$1.15 | \$71,875 |
| | ESTIMATED TOTAL COST | | | | \$526,115 |

Project 1A.2 Spring Branch Conveyance Enhancements (Upper Portion)

| Item # | Description | Unit | Quantity | Unit Cost | Total Cost |
|--------|---|------|----------|-----------|------------------|
| | 58" x 91" ERCP | LF | 820 | \$190 | \$155,800 |
| | 48" x 76" ERCP | LF | 725 | \$175 | \$126,875 |
| | 43" x 68" ERCP | LF | 105 | \$140 | \$14,700 |
| | 42" RCP | LF | 815 | \$85 | \$69,275 |
| | 30"-36" RCP | LF | 650 | \$65 | \$42,250 |
| | 18"-24" RCP | LF | 150 | \$40 | \$6,000 |
| | Remove and Dispose of Existing Pipe | LF | 2,430 | \$12.50 | \$30,375 |
| | Swale Replacement and Grading | LF | 750 | \$5.00 | \$3,750 |
| 120A | Sod (bahia) | SY | 3,000 | \$1.50 | \$4,500 |
| | Inlets and Junction Boxes | LS | 22 | \$3,500 | \$77,000 |
| 130A | Pavement Removal and Restoration | SY | 2,000 | \$42.00 | \$84,000 |
| | Misc Demolition and Restoration | LS | 1 | \$15,000 | \$15,000 |
| | Maintenance of Traffic | DY | 120 | \$300 | \$36,000 |
| | Utility Relocation | | | | \$6,295 |
| | Mobilization | | | | \$67,182 |
| | Total Estimated Construction Cost | | | | \$739,002 |
| | Engineering and Contingency (30% of construction) | | | | \$221,701 |
| | ESTIMATED TOTAL COST | | | | \$960,703 |

Project 1B. Replacement of bridges at Springtime Avenue and Douglass Avenue over Spring Branch. (Cost estimate does not include dredging of sediment from Edgewater Drive bridge over Stevenson Creek).

| Item # | Description | Unit | Quantity | Unit Cost | Total Cost |
|--------|--|------|----------|--------------|------------------|
| | Springtime Ave. (Two 9' x 12' Box Culverts, L=30') | LS | 1 | \$175,000.00 | \$175,000 |
| | Douglass Ave. (Two 9' x 12' Box Culverts, L=86') | LS | 1 | \$350,000.00 | \$350,000 |
| 120B | Sod (bahia) | SY | 2,000 | \$1.50 | \$3,000 |
| | Utility Relocation + Misc Demo and Restoration | LS | 1 | \$50,000 | \$50,000 |
| | BMP Measure | LS | 1 | \$500 | \$500 |
| | Maintenance of Traffic | LS | 1 | \$2,500 | \$2,500 |
| | Mobilization | | | | \$58,100 |
| | Total Estimated Construction Cost | | | | \$639,100 |
| | Engineering and Contingency (30% of construction) | | | | \$191,730 |
| | | | | | |
| | ESTIMATED TOTAL COST | | | | \$830,830 |

Project 1C. Spring Branch Stormwater Detention Basin

| Item # | Description | Unit | Quantity | Unit Cost | Total Cost |
|--------|---|------|----------|-----------|--------------------|
| 110C | Excavation | CY | 167,000 | \$5.50 | \$918,500 |
| 120C | Sod (bahia) | SY | 18,665 | \$1.50 | \$27,998 |
| | Concrete Control Weirs | EA | 2 | \$40,000 | \$80,000 |
| | Outfall Control Structure | EA | 1 | \$5,000 | \$5,000 |
| | 48" RCP | LF | 195 | \$95 | \$18,525 |
| | 30" RCP | LF | 150 | \$50 | \$7,500 |
| | Pavement Removal and Restoration | SY | 90 | \$42.00 | \$3,780 |
| | Wetland Plantings | AC | 8.0 | \$3,500 | \$28,000 |
| | Organic Mulch | CY | 6,500 | \$3.00 | \$19,500 |
| | 12'-15' Trees, on 50' Centers | EA | 44 | \$190.00 | \$8,360 |
| | Mobilization | | | | \$111,716 |
| | Total Estimated Construction Cost | | | | \$1,228,879 |
| | Engineering and Contingency (30% of construction) | | | | \$368,664 |
| | Property Acquisition | | | | \$1,037,000 |
| | | | | | |
| | ESTIMATED TOTAL COST | | | | \$2,634,542 |

Project 1D. Replacement of 1,300' of 24" storm sewer along Woodland Terrace

| Item # | Description | Unit | Quantity | Unit Cost | Total Cost |
|--------|---|------|----------|------------|------------------|
| | 42" RCP | LF | 1,300 | \$85.00 | \$110,500 |
| 130D | Pavement Removal and Restoration | SY | 1,733 | \$42.00 | \$72,786 |
| | Remove and dispose of Existing Pipe | LF | 1,300 | \$12.50 | \$16,250 |
| | Manholes and Inlets | LS | 21 | \$4,000.00 | \$84,000 |
| | Endwall | LS | 1 | \$1,400.00 | \$1,400 |
| | Erosion Control Measures | LS | 1 | \$500.00 | \$500 |
| | Maintenance of Traffic | LS | 1 | \$2,000 | \$2,000 |
| | Miscellaneous Demolition and Restoration | LS | 1 | \$25,000 | \$25,000 |
| | Mobilization | | | | \$31,244 |
| | Total Estimated Construction Cost | | | | \$343,680 |
| | Engineering and Contingency (30% of construction) | | | | \$103,104 |
| | | | | | |
| | ESTIMATED TOTAL COST | | | | \$446,783 |

Project 1E. Byram Pond Dredging and Expansion

| Item # | Description | Unit | Quantity | Unit Cost | Total Cost |
|--------|---|------|----------|-----------|------------------|
| | Dredging of Byram Sump | CY | 9,000 | \$25.00 | \$225,000 |
| | Demolition and Disposal of Existing Structures | LS | 3 | \$5,000 | \$15,000 |
| | Sod (bahia) | SY | 3,933 | \$1.50 | \$5,900 |
| | Mobilization | | | | \$24,590 |
| | Total Estimated Construction Cost | | | | \$270,489 |
| | Engineering and Contingency (30% of construction) | | | | \$81,147 |
| | Total Property Acquisition | | | | \$480,000 |
| | | | | | |
| | ESTIMATED TOTAL COST | | | | \$831,636 |

Project 1F. Spring Branch Stabilization, from Union Street to Byram Pond

| Item # | Description | Unit | Quantity | Unit Cost | Total Cost |
|--------|---|------|----------|-----------|------------------|
| 110F | Channel Excavation | CY | 11,875 | \$15.00 | \$178,125 |
| | Sheet Pile Retaining Wall | LF | 2,000 | \$220.00 | \$440,000 |
| | Sod (bahia) | SY | 10,000 | \$1.50 | \$15,000 |
| | Diversion of Flow / BMP Measure | LS | 1 | \$20,000 | \$20,000 |
| | Mobilization | | | | \$65,313 |
| | Total Estimated Construction Cost | | | | \$718,438 |
| | Engineering and Contingency (30% of construction) | | | | \$215,531 |
| | | | | | |
| | ESTIMATED TOTAL COST | | | | \$933,969 |

Project 1G. Clearview Lake

| Item # | Description | Unit | Quantity | Unit Cost | Total Cost |
|--------|---|------|----------|-----------|------------------|
| | Control Structure for Clearview Lake | LS | 1 | \$5,000 | \$5,000 |
| | 66" RCP | LF | 340 | \$180 | \$61,200 |
| | 60" RCP | LF | 260 | \$170 | \$44,200 |
| | 48" RCP | LF | 270 | \$95 | \$25,650 |
| | 36" RCP | LF | 900 | \$65 | \$58,500 |
| | 30" RCP | LF | 900 | \$52 | \$46,800 |
| | 18"-24" RCP | LF | 240 | \$40 | \$9,600 |
| 130G | Pavement Removal and Restoration | SY | 350 | \$42.00 | \$14,700 |
| | Standard Inlet Structures | EA | 20 | \$3,500 | \$70,000 |
| | Endwall | LS | 1 | \$1,400 | \$1,400 |
| | Sawcut and Replace Existing Driveways | EA | 24 | \$2,600 | \$62,400 |
| | Sidewalk | SY | 400 | \$15 | \$6,000 |
| | Sod (St. Augustine) | SY | 6,000 | \$3.50 | \$21,000 |
| | Utility Relocation | LS | 1 | \$4,265 | \$4,265 |
| | Erosion Control Measures | LS | 1 | \$500 | \$500 |
| | Maintenance of Traffic | | | | \$2,500 |
| | Mobilization | | | | \$43,371 |
| | Total Estimated Construction Cost | | | | \$477,086 |
| | Engineering and Contingency (30% of construction) | | | | \$143,126 |
| | Acquisition of Drainage Easement | SF | 3,300 | \$3.00 | \$9,900 |
| | ESTIMATED TOTAL COST | | | | \$620,212 |

Total Cost for Spring Branch Projects, Alternative 1

| Project | Cost |
|--------------|------------------|
| 1A.1 | 526,115 |
| 1A.2 | 960,703 |
| 1B | 830,830 |
| 1D | 446,783 |
| 1E | 831,636 |
| 1F | 933,969 |
| 1G | 620,212 |
| Total | 5,150,248 |

Total Cost for Spring Branch Projects, Alternative 2

| Project | Cost |
|--------------|------------------|
| 1A.1 | 526,115 |
| 1A.2 | 960,703 |
| 1C | 2,634,542 |
| 1D | 446,783 |
| 1E | 831,636 |
| 1F | 933,969 |
| 1G | 620,212 |
| Total | 6,953,960 |

2. Lower Stevenson Creek

Project 2A. Palmetto Street Sediment Sump

| Item | Description | Unit | Quantity | Unit Cost | Total Cost |
|------|---|------|----------|-----------|------------------|
| | Demolition and Disposal of Existing Structure | EA | 1 | \$5,000 | \$5,000 |
| 210A | Excavation of Sediment Sump | CY | 7,500 | \$15 | \$112,500 |
| 220A | Sod (bahia) | SY | 1,900 | \$1.50 | \$2,850 |
| | Large Control Weir | LS | 1 | \$50,000 | \$50,000 |
| | Concrete Sheet Pile Retaining Wall | LF | 350 | \$220 | \$77,000 |
| | Diversion of Flow / BMP Measure | LS | 1 | \$20,000 | \$20,000 |
| | Maintenance of Traffic | LS | 1 | \$500 | \$500 |
| | Mobilization | LS | | | \$26,785 |
| | Total Estimated Construction Cost | | | | \$294,635 |
| | Engineering and Contingency (30% of construction) | | | | \$88,391 |
| | Right-of-Way Acquisition | | | | \$117,300 |
| | Acquisition of Drainage Easement | SF | 13,400 | \$3.30 | \$44,220 |
| | ESTIMATED TOTAL COST | | | | \$544,546 |

Project 2B. North Missouri Avenue and Palmetto Street Drainage Improvements (Alt. 1)

| Item | Description | Unit | Quantity | Unit Cost | Total Cost |
|------|---|------|----------|------------|------------------|
| | 60" RCP | LF | 1,300 | \$170.00 | \$221,000 |
| 230B | Pavement Removal and Restoration | SY | 1,120 | \$42.00 | \$47,040 |
| | Junction Box | LS | 6 | \$3,500.00 | \$21,000 |
| | Remove and dispose of Existing Pipe | LF | 1,300 | \$12.50 | \$16,250 |
| | Maintenance of Traffic | | | | \$10,000 |
| | Utility Relocation and Miscellaneous Demolition and Restoration | | | | \$25,000 |
| | Mobilization | | | | \$34,029 |
| | Total Estimated Construction Cost | | | | \$374,319 |
| | Engineering and Contingency (30% of construction) | | | | \$112,296 |
| | ESTIMATED TOTAL COST | | | | \$486,615 |

Project 2B. North Missouri Avenue and Palmetto Street Drainage Improvements (Alt. 2)

| Item | Description | Unit | Quantity | Unit Cost | Total Cost |
|------|---|------|----------|------------|------------------|
| Lo | 60" RCP | LF | 435 | \$170.00 | \$73,950 |
| | 36" RCP | LF | 860 | \$65.00 | \$55,900 |
| 230B | Pavement Removal and Restoration | SY | 1,120 | \$42.00 | \$47,040 |
| | Junction Box | LS | 6 | \$3,500.00 | \$21,000 |
| | Remove and dispose of Existing Pipe | LF | 435 | \$12.50 | \$5,438 |
| | Maintenance of Traffic | | | | \$10,000 |
| | Utility Relocation and Miscellaneous Demolition and Restoration | | | | \$25,000 |
| | Mobilization | | | | \$23,833 |
| | Total Estimated Construction Cost | | | | \$262,160 |
| | Engineering and Contingency (30% of construction) | | | | \$78,648 |
| | | | | | |
| | ESTIMATED TOTAL COST | | | | \$340,808 |

Project 2C. Installation of CDS units at strategic outfall locations

| Item | Description | Unit | Quantity | Unit Cost | Total Cost |
|------|---|------|----------|-----------|------------------|
| | Install CDS Units | LS | 3 | \$135,000 | \$405,000 |
| | Total Estimated Construction Cost | | | | \$405,000 |
| | Engineering and Contingency (30% of Construction) | | | | \$121,500.00 |
| | | | | | |
| | ESTIMATED TOTAL COST | | | | \$526,500 |

Project 2D. Overbrook Avenue Detention Pond

| Item | Description | Unit | Quantity | Unit Cost | Total Cost |
|------|---|------|----------|-------------|--------------------|
| | Demolition/ Offsite Disposal of Existing Structures | LS | 1 | \$30,000 | \$30,000 |
| 210D | Excavation and Offsite Disposal (clean material) | CY | 51,000 | \$7.00 | \$357,000 |
| | 43" x 68" ERCP | LF | 1,110 | \$140 | \$155,400 |
| | 38" x 60" ERCP | LF | 625 | \$120 | \$75,000 |
| | 48" RCP | LF | 450 | \$95 | \$42,750 |
| | 36" RCP | LF | 260 | \$65 | \$16,900 |
| | 18"-24" RCP | LF | 400 | \$40 | \$16,000 |
| | Inlet Structures | EA | 16 | \$3,500 | \$56,000 |
| | Pavement Removal and Restoration | SY | 2,700 | \$42.00 | \$113,400 |
| 220D | Sod (bahia) | SY | 7,700 | \$1.50 | \$11,550 |
| | Control Structure | LS | 1 | \$10,000.00 | \$10,000 |
| | Maintenance of Traffic | DY | 60 | \$300 | \$18,000 |
| | Mobilization | | | | \$90,200 |
| | Total Estimated Construction Cost | | | | \$992,200 |
| | Engineering and Contingency (30% of construction) | | | | \$297,660 |
| | Real Property Acquisition | | | | \$466,000 |
| | | | | | |
| | ESTIMATED TOTAL COST | | | | \$1,755,860 |

Note: Cost estimate does not include any environmental remediation measures that may be necessary.

Cost for property acquisition is based on 2001 assessed value times a factor of 1.5.

Total Cost for Lower Stevenson Creek Proposed Projects

| Project | Cost |
|----------------|--------------------|
| A | \$544,546 |
| B | \$486,615 |
| C | \$526,500 |
| D | \$1,755,860 |
| TOTAL | \$3,313,520 |

3. Middle Stevenson Creek

Project 3A. Stormwater detention basins on Stevenson Creek within the Glen Oaks Golf Course

| Item | Description | Unit | Quantity | Unit Cost | Total Cost |
|------|---|------|----------|------------|------------------|
| 310A | Excavation (large pond) | CY | 225,000 | \$5.00 | 1,125,000 |
| 311A | Excavation (small pond) | CY | 81,300 | \$3.00 | 243,900 |
| 320A | Sod (bahia) | SY | 46,000 | \$1.50 | 69,000 |
| | Large Control Weir w/Bleeder | LS | 1 | \$50,000 | 50,000 |
| | Control Structure for Small Pond | LS | 1 | \$10,000 | 10,000 |
| | Construct 36" RCP | LF | 350 | \$65.00 | 22,750 |
| | Mitred Endwall | LS | 2 | \$2,500.00 | 5,000 |
| | Junction Box | LS | 3 | \$3,500.00 | 10,500 |
| | Wetland Plantings | AC | 6.5 | \$3,500 | 22,750 |
| | Organic Mulch | CY | 5,300 | \$3.00 | 15,900 |
| | Mobilization | LS | 1 | \$120,000 | 120,000 |
| | Total Estimated Construction Cost | | | | 1,694,800 |
| | Engineering and Contingency (30% of construction) | | | | 508,440 |
| | ESTIMATED TOTAL COST | | | | 2,203,240 |

Total Cost for Middle Stevenson Creek Proposed Projects

| Projects | Cost |
|--------------|------------------|
| 3A | 2,203,240 |
| Total | 2,203,240 |

4. Upper Stevenson Creek

Project 4A. High-Flow Bypass culvert from Browning Street to Linn Lake

| Item | Description | Unit | Quantity | Unit Cost | Total Cost |
|------|---|------|----------|-------------|--------------------|
| | Construct 6.5' x 11' Concrete Box Culvert | LF | 1,900 | \$650.00 | \$1,235,000 |
| | Construct 5' x 12' Concret Box Culvert | LF | 40 | \$625.00 | \$25,000 |
| | Relocate Sanitary Sewer Mains | LF | 700 | \$50.00 | \$35,000 |
| 430A | Pavement Removal and Restoration | SY | 5,300 | \$42.00 | \$222,600 |
| | High Flow diversion Weir | LS | 1 | \$10,000.00 | \$10,000 |
| | Removal of Vegetation in Creek | LS | 1 | \$7,500.00 | \$7,500 |
| | Remove and Replace retaining wall | LF | 150 | \$350.00 | \$52,500 |
| 420A | Sod (bahia) | SY | 2,500 | \$1.50 | \$3,750 |
| | Maintenance of Traffic | LS | 1 | \$500 | \$500 |
| | Utility Relocation and Miscellaneous Domolition and Restoration | | | | \$15,919 |
| | Mobilization | | | | \$160,777 |
| | Total Estimated Construction Cost | | | | \$1,768,545 |
| | Engineering and Contingency (30% of construction) | | | | \$530,564 |
| | | | | | |
| | ESTIMATED TOTAL COST | | | | \$2,299,109 |

Project 4B. Stevenson Creek Stabilization from Lakeview Avenue to Bellevue Blvd.

| Item | Description | Unit | Quantity | Unit Cost | Total Cost |
|------|---|------|----------|-----------|--------------------|
| | Clearing and Grubbing | AC | 3.2 | \$6,000 | \$19,200 |
| | Channel Excavation and Shaping | CY | 12,000 | \$12.00 | \$144,000 |
| | Low Retaining Wall (Gabions or Geoweb) | LF | 6,000 | \$120 | \$720,000 |
| | Endwalls | EA | 5 | \$2,500 | \$12,500 |
| | 42" RCP | LF | 100 | \$85 | \$8,500 |
| | 30" RCP | LF | 300 | \$50 | \$15,000 |
| | 24" RCP | LF | 60 | \$40 | \$2,400 |
| | Inlet Structures | EA | 5 | \$4,000 | \$20,000 |
| | Small Rip-Rap Weir Structures | EA | 2 | \$7,500 | \$15,000 |
| | Sod (bahia) | SY | 12,200 | \$1.50 | 18,300.00 |
| | 12'-15' Trees, on 50' Centers | EA | 80 | \$190.00 | \$15,200 |
| | Mobilization | | | | \$99,010 |
| | Total Estimated Construction Cost | | | | \$1,089,110 |
| | Engineering and Contingency (30% of construction) | | | | \$326,733 |
| | | | | | |
| | ESTIMATED TOTAL COST | | | | \$1,415,843 |

Project 4C. Stevenson Creek Restoration from Bellevue Blvd. To St. Thomas Drive

| Item | Description | Unit | Quantity | Unit Cost | Total Cost |
|------|---|------|----------|-----------|--------------------|
| | Demolition/ Offsite Disposal of Existing Structures | EA | 10 | \$5,000 | \$50,000 |
| | Remove and Dispose of 54" CMP | LF | 950 | \$12.50 | \$11,875 |
| | Excavation | CY | 23,000 | \$8.00 | \$184,000 |
| | 58" x 91" ERCP | LF | 100 | \$190 | \$19,000 |
| | Pavement Removal and Restoration | SY | 130 | \$42.00 | \$5,460 |
| | Headwall for 58" x 91" ERCP | EA | 2 | \$4,000 | \$8,000 |
| | Large Control Structures | EA | 2 | \$10,000 | \$20,000 |
| 420C | Sod (bahia) | SY | 8,170 | \$1.50 | \$12,255 |
| | Understory Plantings | AC | 1.0 | \$3,500 | \$3,500 |
| | 12'-15' Trees, on 50' Centers | EA | 40 | \$190.00 | \$7,600 |
| 440C | Organic Mulch | CY | 850 | \$3.00 | \$2,550 |
| | Maintenance of Traffic | LS | 1 | \$1,000 | \$1,000 |
| | Mobilization | | | | \$32,424 |
| | Total Estimated Construction Cost | | | | \$357,664 |
| | Engineering and Contingency (30% of construction) | | | | \$107,299 |
| | Total Property Acquisition | | | | \$1,336,950 |
| | ESTIMATED TOTAL COST | | | | \$1,801,913 |

Total Cost for Upper Stevenson Creek Proposed Projects

| Projects | Cost |
|--------------|--------------------|
| 4A | \$2,299,109 |
| 4B | \$1,415,843 |
| 4C | \$1,801,913 |
| Total | \$5,516,865 |

5. Hammond Branch

Project 5A. Improvement of ditch along north side of Flagler Railroad from Linwood Drive and Sharondale Drive to Gentry Street

| Item | Description | Unit | Quantity | Unit Cost | Total Cost |
|------|---|------|----------|-----------|------------------|
| 510A | Excavation / Embankment Fill and Compaction | CY | 8,500 | \$15.00 | \$127,500 |
| | Rip Rap | CY | 520 | \$40.00 | \$20,800 |
| | 72" RCP | LF | 292 | \$185 | \$54,020 |
| | 60" RCP | LF | 420 | \$170 | \$71,400 |
| | 6' x 10' Box Culvert | LF | 120 | \$525 | \$63,000 |
| | Double 5' x 7' Box Culvert | LF | 50 | \$650 | \$32,500 |
| | Endwall for twin 72" RCP | EA | 2 | \$4,500 | \$9,000 |
| | Pavement Removal and Restoration | SY | 1,200 | \$42 | \$50,400 |
| | Remove and Dispose of Existing Culvert | LF | 635 | \$12.50 | \$7,938 |
| | Special Inlet and Junction Structures | EA | 3 | \$4,500 | \$13,500 |
| | Special Concrete Control Structures | EA | 2 | \$15,000 | \$30,000 |
| 520A | Sod (bahia) | SY | 7,300 | \$1.50 | \$10,950 |
| | Maintenance of Traffic | DY | 90 | \$300.00 | \$27,000 |
| | Mobilization | | | | \$49,101 |
| | Total Estimated Construction Cost | | | | \$567,108 |
| | Engineering and Contingency (30% of construction) | | | | \$170,132 |
| | | | | | |
| | ESTIMATED TOTAL COST | | | | \$737,241 |

Project 5B. Drainage improvements in the area of Palmetto Street and Kings Highway

| Item | Description | Unit | Quantity | Unit Cost | Total Cost |
|------|---|------|----------|------------|------------------|
| | Construct 54" RCP | LF | 1,900 | \$130.00 | \$247,000 |
| | Junction Boxes and Inlets | LS | 35 | \$3,500.00 | \$122,500 |
| 130A | Pavement Removal and Restoration | SY | 2,533 | \$42.00 | \$106,386 |
| 520B | Sod (bahia) | SY | 1,700 | \$1.50 | \$2,550 |
| | Maintenance of Traffic | DY | 120 | \$300 | \$36,000 |
| | Mobilization | | | | \$51,444 |
| | Total Estimated Construction Cost | | | | \$565,880 |
| | Engineering and Contingency (30% of construction) | | | | \$169,764 |
| | | | | | |
| | ESTIMATED TOTAL COST | | | | \$735,643 |

C. Drainage/water quality improvements in the area of Saturn Ave. and Sherwood Street

| Item | Description | Unit | Quantity | Unit Cost | Total Cost |
|------|---|------|----------|------------|------------------|
| | 24" RCP | LF | 70 | \$40.00 | \$2,800 |
| | 36" RCP | LF | 920 | \$65.00 | \$59,800 |
| | 38" x 60" ERCP | LF | 270 | \$120.00 | \$32,400 |
| | Remove and dispose of Existing Pipe | LF | 1,190 | \$12.50 | \$14,875 |
| 530C | Pavement Removal and Restoration | SY | 1,590 | \$42.00 | \$66,780 |
| | Junction Box | EA | 2 | \$3,500.00 | \$7,000 |
| | Special Inlets | EA | 7 | \$4,000.00 | \$28,000 |
| | Maintenance of Traffic | LS | 1 | \$500 | \$500 |
| | Mobilization | | | | \$21,216 |
| | Total Estimated Construction Cost | | | | \$233,371 |
| | Engineering and Contingency (30% of construction) | | | | \$70,011 |
| | | | | | |
| | ESTIMATED TOTAL COST | | | | \$303,382 |

D. Drainage/water quality improvements in the area of Smallwood Circle and Rosemere Road

| Item | Description | Unit | Quantity | Unit Cost | Total Cost |
|------|---|------|----------|------------|------------------|
| 550D | Fill existing 24" CMP | CY | 44 | \$50.00 | \$2,200 |
| | Construct 24" x 38" Elliptical Concrete Culvert | LF | 310 | \$65.00 | \$20,150 |
| | Construct 36" RCP | LF | 690 | \$70.00 | \$48,300 |
| | Construct 30" RCP | LF | 350 | \$65.00 | \$22,750 |
| | Pavement Removal and Restoration | SY | 50 | \$42.00 | \$2,100 |
| | Junction Box | LS | 4 | \$3,500.00 | \$14,000 |
| | Utility Relocation + Misc Demo and Restoration | | | | \$3,285 |
| | Mobilization | | | | \$11,279 |
| | Total Estimated Construction Cost | | | | \$124,064 |
| | Engineering and Contingency (30% of construction) | | | | \$37,219 |
| | Drainage Easement | | | | |
| | ESTIMATED TOTAL COST | | | | \$161,283 |

Project 5E. Replace Lake Hobart Outfall Structure

| Item | Description | Unit | Quantity | Unit Cost | Total Cost |
|------|---|------|----------|-------------|-----------------|
| | Control Structure | LS | 1 | \$10,000.00 | \$10,000 |
| | Mobilization | | | | \$1,000 |
| | Total Estimated Construction Cost | | | | \$11,000 |
| | Engineering and Contingency (30% of construction) | | | | \$3,300 |
| | | | | | |
| | ESTIMATED TOTAL COST | | | | \$14,300 |

Total Cost for Hammond Branch Proposed Projects

| Projects | Cost |
|-----------------|--------------------|
| 5A | \$737,241 |
| 5B | \$735,643 |
| 5C | \$303,382 |
| 5D | \$161,283 |
| 5E | \$14,300 |
| Total | \$1,951,848 |

6. Lake Bellevue Branch

Project 6A. Expansion of Lake Bellevue

| Item | Description | Unit | Quantity | Unit Cost | Total Cost |
|------|---|------|----------|------------|--------------------|
| 610A | Excavation of the 8-acre expansion | CY | 109,520 | \$6.00 | \$657,120 |
| 630A | Pavement Removal and Restoration | SY | 1,300 | \$50.00 | \$65,000 |
| 611A | Low Berm | CY | 500 | \$10.00 | \$5,000 |
| | 36" RCP | LF | 250 | \$65.00 | \$16,250 |
| | 54" Dia. Jack and Bore Casing | LF | 150 | \$455.00 | \$68,250 |
| | 29" x 45" ERCP | LF | 200 | \$70.00 | \$14,000 |
| 620A | Sod (bahia) | SY | 21,100 | \$1.50 | \$31,650 |
| | Large Control Structure (Weir w/Bleeder) | LS | 1 | \$25,000 | \$25,000 |
| | Wetland Plantings | AC | 7.0 | \$3,500 | \$24,500 |
| 640A | Organic Mulch | CY | 5,700 | \$3.00 | \$17,100 |
| | BMP Measure | LS | 1 | \$2,000.00 | \$2,000 |
| | Miscellaneous Demolition and Restoration | LS | | | \$9,259 |
| | Maintenance of Traffic | LS | 1 | \$500 | \$500 |
| | Mobilization | | | | \$93,513 |
| | Total Estimated Construction Cost | | | | \$1,029,142 |
| | Engineering and Contingency (30% of construction) | | | | \$308,742 |
| | | | | | |
| | ESTIMATED TOTAL COST | | | | \$1,337,884 |

Project 6B. Turner Street Box Culvert

| Item | Description | Unit | Quantity | Unit Cost | Total Cost |
|------|---|------|----------|-----------|--------------------|
| | Large Control Structure (Weir) | LS | 1 | \$50,000 | \$50,000 |
| | Construct 5' x 9' Concrete Box Culvert | LF | 180 | \$361.00 | \$64,980 |
| | Construct 6' x 11' Concrete Box Culvert | LF | 1,530 | \$530.00 | \$810,900 |
| 630B | Pavement Removal and Restoration | SY | 3,400 | \$42.00 | \$142,800 |
| 620B | Sod (bahia) | SY | 1,900 | \$1.50 | \$2,850 |
| | Utility Relocation and Misc Demo and Restoration | | | | \$10,715 |
| | Maintenance of Traffic | LS | 1 | \$5,000 | \$5,000 |
| | Mobilization | | | | \$108,725 |
| | Total Estimated Construction Cost | | | | \$1,195,970 |
| | Engineering and Contingency (30% of construction) | | | | \$358,791 |
| | | | | | |
| | ESTIMATED TOTAL COST | | | | \$1,554,761 |

Total Cost for Bellevue Branch Proposed Projects

| Projects | Cost |
|--------------|--------------------|
| 7A | \$1,337,884 |
| 7B | \$1,554,761 |
| Total | \$2,892,645 |

7. Jeffords Street Branch

Project 7A. Crest Lake Expansion

| Item | Description | Unit | Quantity | Unit Cost | Total Cost |
|------|---|------|----------|-----------|------------------|
| 710A | Excavation of the 6-acre expansion | CY | 58,000 | \$6.00 | \$348,000 |
| | Wetland Plantings | AC | 6.0 | \$3,500 | \$21,000 |
| | Organic Mulch | CY | 5,700 | \$3.00 | \$17,100 |
| | 36" RCP | LF | 1,370 | \$65.00 | \$89,050 |
| | 24" RCP | LF | 400 | \$40.00 | \$16,000 |
| | Inlet Structures | EA | 9 | \$3,500 | \$31,500 |
| 730A | Pavement Removal and Restoration | SY | 1,830 | \$42.00 | \$76,860 |
| 720A | Sod (bahia) | SY | 10,000 | \$1.50 | \$15,000 |
| | Endwall | LS | 1 | \$1,400 | \$1,400 |
| | Erosion Control Measures | LS | 1 | \$500 | \$500 |
| | Mobilization | | | | \$61,641 |
| | Total Estimated Construction Cost | | | | \$678,051 |
| | Engineering and Contingency (30% of construction) | | | | \$203,415 |
| | | | | | |
| | ESTIMATED TOTAL COST | | | | \$881,466 |

Project 7B. Duncan Avenue / Turner Street Detention Pond

| Item | Description | Unit | Quantity | Unit Cost | Total Cost |
|------|---|------|----------|-----------|--------------------|
| | Demolition/ Offsite Disposal of Existing Structures | EA | 9 | \$5,000 | \$45,000 |
| 710B | Excavation of 2.5-acre Wet Pond | CY | 45,441 | \$6.00 | \$272,646 |
| | Control Structure w/Bleeder | LS | 1 | \$10,000 | \$10,000 |
| 720B | Sod (bahia) | SY | 5,300 | \$1.50 | \$7,950 |
| | Mobilization | | | | \$33,560 |
| | Total Estimated Construction Cost | | | | \$369,156 |
| | Engineering and Contingency (30% of construction) | | | | \$110,747 |
| | Total Property Acquisition | | | | \$1,015,050 |
| | | | | | |
| | ESTIMATED TOTAL COST | | | | \$1,494,952 |

Project 7C. Jeffords Street / Barry Road Detention Pond

| Item | Description | Unit | Quantity | Unit Cost | Total Cost |
|------|---|------|----------|-----------|--------------------|
| | Demolition/ Offsite Disposal of Existing Structures | EA | 9 | \$5,000 | \$45,000 |
| 710C | Excavation of 2.5-acre Wet Pond | CY | 26395 | \$6.00 | \$158,370 |
| | Control Structure w/Bleeder | LS | 1 | \$10,000 | \$10,000 |
| | Construct 60" HDPE | LS | 1200 | \$75.00 | \$90,000 |
| | Construct 48" x 76" ERCP | LS | 320 | \$175.00 | \$56,000 |
| | Construct 36" RCP | LS | 210 | \$65.00 | \$13,650 |
| | Construct 30" RCP | LS | 400 | \$52.00 | \$20,800 |
| | Wetland Plantings | AC | 2.5 | \$3,500 | \$8,750 |
| 740C | Organic Mulch | CY | 2,000 | \$3.00 | \$6,000 |
| 730C | Pavement Removal and Restoration | SY | 180 | \$42.00 | \$7,560 |
| 720C | Sod (bahia) | SY | 5,300 | 1.50 | \$7,950 |
| | Mobilization | | | | \$42,408 |
| | Total Estimated Construction Cost | | | | \$466,488 |
| | Engineering and Contingency (30% of construction) | | | | \$139,946 |
| | Total Property Acquisition | | | | \$1,084,200 |
| | | | | | |
| | ESTIMATED TOTAL COST | | | | \$1,690,634 |

Total Cost for Jeffords Street Branch Proposed Projects

| Projects | Cost |
|--------------|--------------------|
| 7A | \$881,466 |
| 7B | \$1,494,952 |
| 7C | \$1,690,634 |
| Total | \$4,067,053 |

Final Report

**Bacterial Source Tracking Using Antibiotic Resistance
Analysis of Fecal Coliforms**

Stevenson Creek, Clearwater, Florida

June – December, 2000

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March 20, 2001

Introduction

Various bacteria are found in the digestive tracts and feces of wild and domestic animals and humans. Some of these bacteria including fecal coliforms and fecal streptococci are used as indicators of fecal contamination when present in natural waters. Unfortunately, the mere presence of these indicator bacteria is not informative as to the source of fecal pollution, an important factor for risk-assessment and remediation. Consequently, several methods collectively known as bacterial source tracking (BST) methods have been developed to “fingerprint” fecal indicator bacteria in order to determine their host or source (e.g. human, dog, wild animal) and may be based on either the genetic make-up of the bacteria, or on physiological characteristics such as resistance to various antibiotics. Using antibiotic resistance analysis (ARA), it is possible to assess the source of indicator organisms based on a much larger subset of the bacterial population than is currently possible using genetic methods. ARA was used to determine the source of fecal contamination in this study essentially as described in Harwood et. al 2000.

In any BST method, a database of fingerprints, or patterns, of bacteria isolated from the feces of known source animals (e.g. humans, dogs, wild animals) must first be constructed and tested for its predictive accuracy. This database is called the calibration data set. Discriminant analysis, a multivariate statistical test, is used to analyze the data. The ability of the database to accurately predict the source of indicator organisms is assessed using isolates from known sources as “unknown” or test isolates. The database can also be self-crossed, that is, the database isolates are used as both the calibration data set and the test data set.

The database used in this study consists of 3309 fecal coliform isolates from six sources, humans (domestic wastewater), dogs, cattle, chickens, pigs and wild animals (mainly raccoons and birds). The average rate of correct classification (ARCC) is a measure of the predictive accuracy of the database, and is obtained by self-crossing the database, adding the number of correctly classified isolates in all source categories, and dividing by the total number of isolates. The ARCC of this data set is 57.2% when 6 source categories are used in the analysis. The chance of an isolate falling into one of 6 categories by chance if categorization were random is 16.7%, therefore the antibiotic resistance patterns of fecal coliforms have substantial predictive capacity with respect to bacterial sources (Harwood *et al.*, 2000).

In any database, some percent of isolates from other sources will misclassify as human isolates. The rate of misclassification of isolates into the human category can be used to develop a cut-off point for significant levels of human isolates. In this database, about 20% of wild animal isolates are misclassified as human, and wild animal isolates have the highest rate of misclassification as human of all sources. The conservative rate of 25% is used as the cut-off point for identification of a significant percentage of isolates from human sources in any sample.

Stevenson Creek

This study was initiated in order to identify the dominant source(s) of fecal contamination to Stevenson Creek in Clearwater, Florida. Five sites were chosen to represent areas where routine monitoring has shown high levels of fecal coliforms. Two of the sites were located at the composite samplers previously installed for the project (Comp1 and Comp2). Comp1 is located at the golf course on the main branch of Stevenson Creek; Comp 2 is located on Spring Branch off King Highway. Sites previously designated for monitoring efforts were sampled: STC1 at Spring Branch, STC2 at Hammond’s Branch and STC5 at Evergreen.

Sampling dates were June 27, July 25, August 22, September 19, October 23, November 13, and December 27, 2000. Isolation of fecal coliforms was poor from November with samples yielding only an estimate of population density and no information as to source of contamination. Consequently, additional samples were collected in December.

Results

The dominant sources of fecal coliform isolates obtained from the five sites over the course of this study were wild animal, dog and human. The overall trend was for wild animal isolates to comprise the majority of fecal coliforms obtained when colony forming units (CFU) counts exceeded the acceptable limit of 200CFU/100ml. STC1 and STC2 sampled on 6/27/00 were the only observations where exceedingly high CFU counts co-occurred with a majority of human isolates. On 8/22/00 at STC1, the majority of isolates were dog and the CFU count was 300/100ml. Samples from the month of September yielded a majority of human isolates from all sites while densities of coliforms were low, ranging from 7-26 CFU/100ml. The above results suggest that source most frequently contributing to excessive fecal coliform counts was wild animals followed by human and dog isolates.

Some statistically significant relationships were apparent between the CFU counts and classification of isolates. The percentages of isolates from specific sources were compared to CFU/100ml using a regression analysis. There was a significant, inverse relationship between the percentage human isolates and the CFU count for Comp2, i.e. as the CFU count went down over the study period, the percentage of human isolates went up, $P=0.019$, $r^2=0.87$ (Fig. 9). While this relationship was not observed for the other four sites examined individually, it was observed when data from all sites were pooled, $P=0.001$, $r^2=0.34$ (Fig 11). This indicates enough of an overall trend among the sites to maintain a significant inverse relationship between CFU and percent human. Likewise, when the percentage of wild isolates was compared to CFU counts in a similar test, a significant direct relationship was observed at STC 1, $P<0.001$, $r^2=0.96$. The CFU count decreased along with the percent of wild isolates, Fig 10. Again, a significant relationship was not observed for any of the other four sites when examined individually. However, when the five sites were pooled the regression was significant, $P<0.001$, $r^2=0.60$ (Fig. 12). These results support the notion that wild animals are the predominant contributors to fecal contamination marked by elevated fecal coliform levels.

The relative importance of specific wild animals as contributors to high fecal coliform numbers is difficult to assess with confidence but is likely related to factors such as population size and density and their utilization of the territory adjacent to the sample sites. During the course of the study, birds were the most frequently observed wild vertebrates. Great white egrets, snowy egrets, little blue herons, and anhingas were frequently present in low densities during sample collection i.e one or two individuals. Waterfowl such as gallinules, coots and ducks, were observed in slightly higher densities (three or four individuals), but not as frequently. The largest aggregates of wild animals observed during the study period were flocks of migratory birds such as European starlings and boat-tailed grackles. These birds, however, were observed during the late fall months when fecal coliform densities were low. Gulls common to the coastal areas such as the black-headed gull and herring gull were not observed frequently near the sampling sites.

While human input may not be the major cause of elevated fecal coliform levels for most of the samples analyzed for this study, the domination of small populations by human isolates suggests that human sources contribute to low-level background contamination. This occurs when FC populations are low, near the transition to dry season and perhaps few isolates are washed into surface waters from draining storm water. Lowering water tables may also draw wastewater from small, otherwise innocuous leaks. Overall, there was little evidence of acute human fecal contamination on a large scale across the five site examined. However, there may be considerable human source influencing STC1 and STC2, which is detectable despite the presence of fecal coliforms from other sources. These sites were impacted by human fecal sources with the highest frequency and magnitude of the five sites. They were more frequently over 25% human and exhibited a higher mean % human than the other sites. The most pronounced human contamination of STC1 and 2 occurred in June where 56.7% and 47.7% of isolates examined were human. The density of human isolates at STC1 and STC2 may be approximated from the fecal coliform density using the percent classified as humans. This yields 11400 'human'CFU/100ml for STC1 and 2400 'human'CFU/100ml for STC 2, both of which exceed the limit of 200CFU/ml. Consequently, unlike any other sampling event in this study, the human input for these two sites in June were high enough to cause violation considering only human isolates.

References

- V. J. Harwood**, J. Whitlock and V. H. Withington. 2000. Classification of the antibiotic resistance patterns of indicator bacteria by discriminant analysis: use in predicting the source of fecal contamination in subtropical Florida waters. *Appl. Environ Microbiol.* 66:3698-3704.

Table 1. Density of fecal coliforms from the five sites as determined by membrane filtration
Colony Forming Units/100ml

| Site | June | July | August | September | October | November | December |
|--------|-------|-------|--------|-----------|---------|----------|----------|
| STC 1 | 20000 | 13000 | 300 | 26 | 35 | 1 | 6 |
| STC 2 | 5000 | 2200 | 68 | 7 | 1 | 1 | 70 |
| STC 5 | 1600 | 6400 | 115 | 7 | 1 | 1 | 24 |
| Comp 1 | 12000 | 18000 | 110 | 9 | 6 | 30 | 17 |
| Comp 2 | 20000 | 12000 | 0 | 16 | 960 | 10 | 120 |
| Mean | 11720 | 10320 | 118.6 | 13 | 200.6 | 8.6 | 47.4 |

Table 2. Percent wild isolates at Stevenson Creek sites, June – December

| Site | June | July | August | Sept | Oct | Nov | Dec | Mean |
|-------|-------|------|--------|------|------|-----|-----|------|
| Comp1 | 100.0 | 62.7 | 76.2 | 0 | 34.1 | NA | 0 | 45.5 |
| Comp2 | 100.0 | 62.1 | 30.5 | 0 | 63.4 | NA | 0 | 42.7 |
| STC1 | 43.3 | 42.1 | 21.7 | 3.1 | 0 | NA | 0 | 18.9 |
| STC2 | 40.9 | 43.2 | 10.5 | 16.7 | NA | NA | 0 | 22.3 |
| STC5 | 80.6 | 67.7 | 46.7 | 6.3 | NA | NA | 0 | 40.3 |

Table 3. Percent human isolates at Stevenson Creek sites, June – December

| Site | June | July | August | Sept | Oct | Nov | Dec | Mean | # > 25% |
|-------|------|------|--------|------|------|-----|------|------|---------|
| Comp1 | 0 | 3.7 | 4.8 | 62.5 | 20.5 | NA | 75 | 27.8 | 2 |
| Comp2 | 0 | 6.9 | 25.4 | 93.3 | 15.9 | NA | 90.5 | 38.7 | 3 |
| STC1 | 56.7 | 31.6 | 13.3 | 90.6 | 12.5 | NA | 71.4 | 46.0 | 4 |
| STC2 | 47.7 | 16.2 | 10.5 | 83.3 | NA | NA | 75 | 46.5 | 3 |
| STC5 | 0 | 22.6 | 10 | 75 | NA | NA | 82.5 | 38.0 | 2 |

Table 4. Percent dog isolates at Stevenson Creek sites, June – December

| Site | June | July | August | Sept | Oct | Nov | Dec | Mean |
|-------|------|------|--------|------|------|-----|------|-------|
| Comp1 | 0 | 0 | 19.1 | 37.5 | 36.4 | NA | 25 | 19.6 |
| Comp2 | 0 | 0 | 42.4 | 6.7 | 2.3 | NA | 9.5 | 10.15 |
| STC1 | 0 | 18.4 | 65.0 | 3.1 | 87.5 | NA | 28.6 | 33.7 |
| STC2 | 0 | 18.9 | 79.0 | 0 | NA | NA | 25 | 24.6 |
| STC5 | 0 | 6.5 | 43.3 | 18.8 | NA | NA | 17.5 | 17.2 |

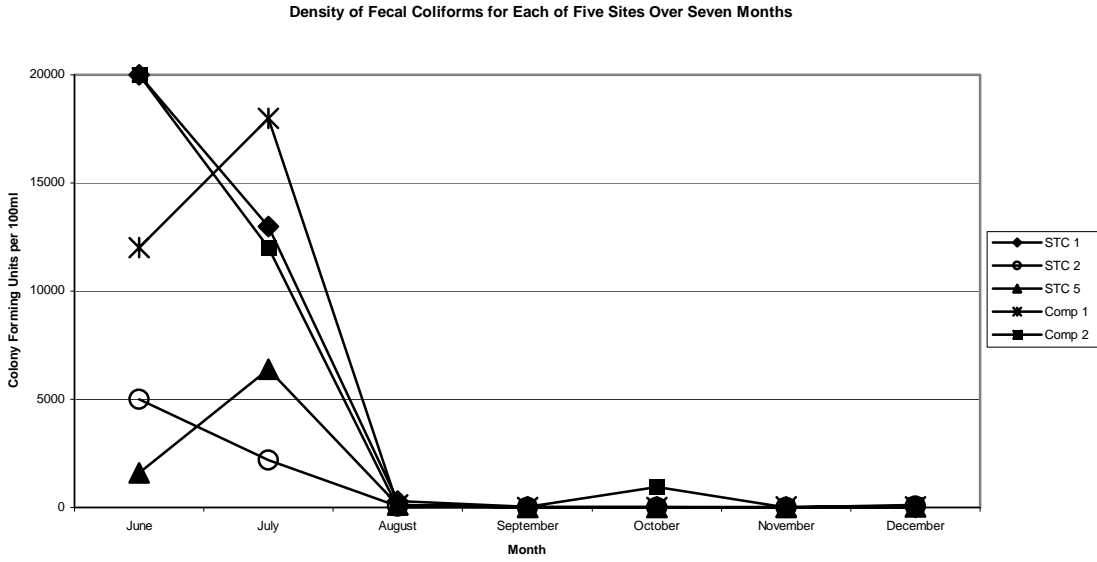


Figure 1. CFU/100ml from the five sites over seven months.

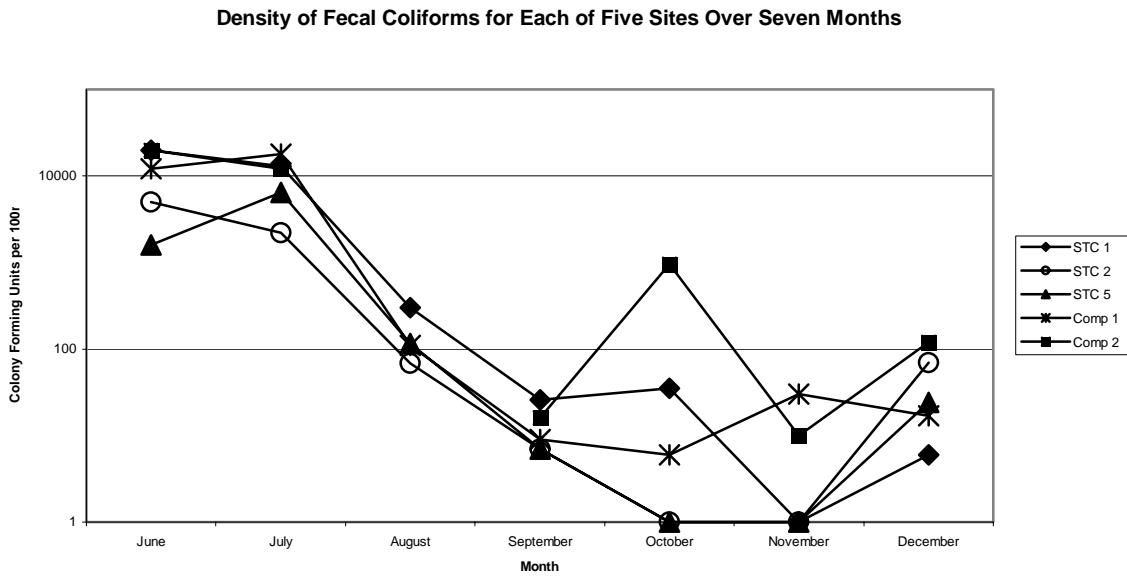


Figure 2. CFU/100ml from the five sites over seven months, graphed on a log scale.

Categorization of Isolates from Each of Five Sites on 6/27/00

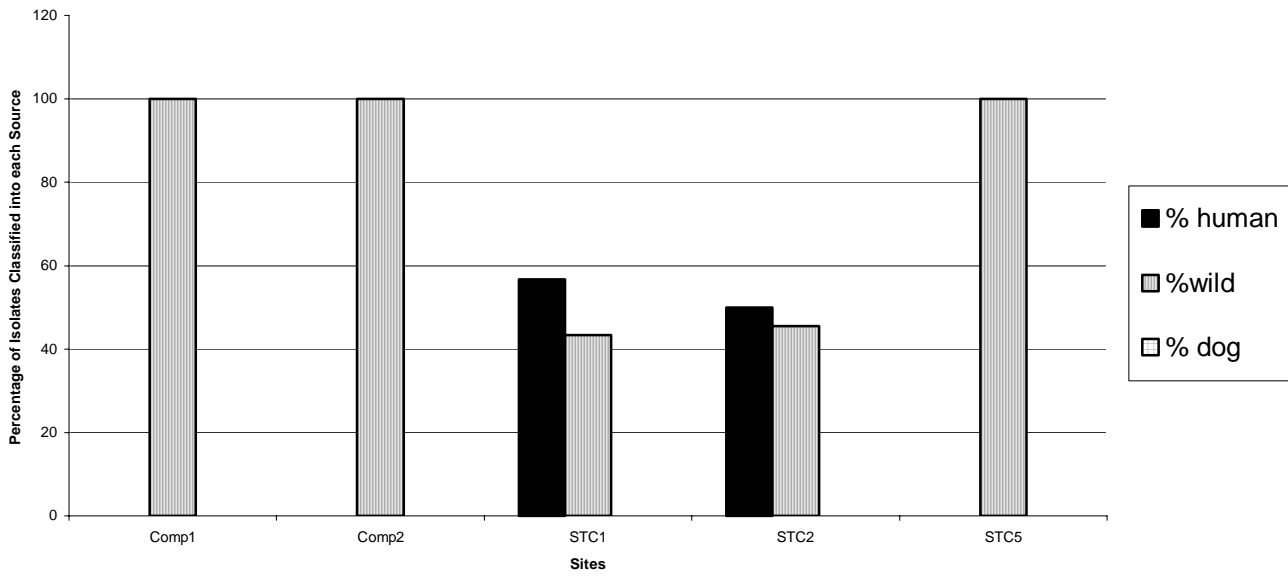


Figure 3

Categorization of Isolates from Each of Five Sites on 7/25/00

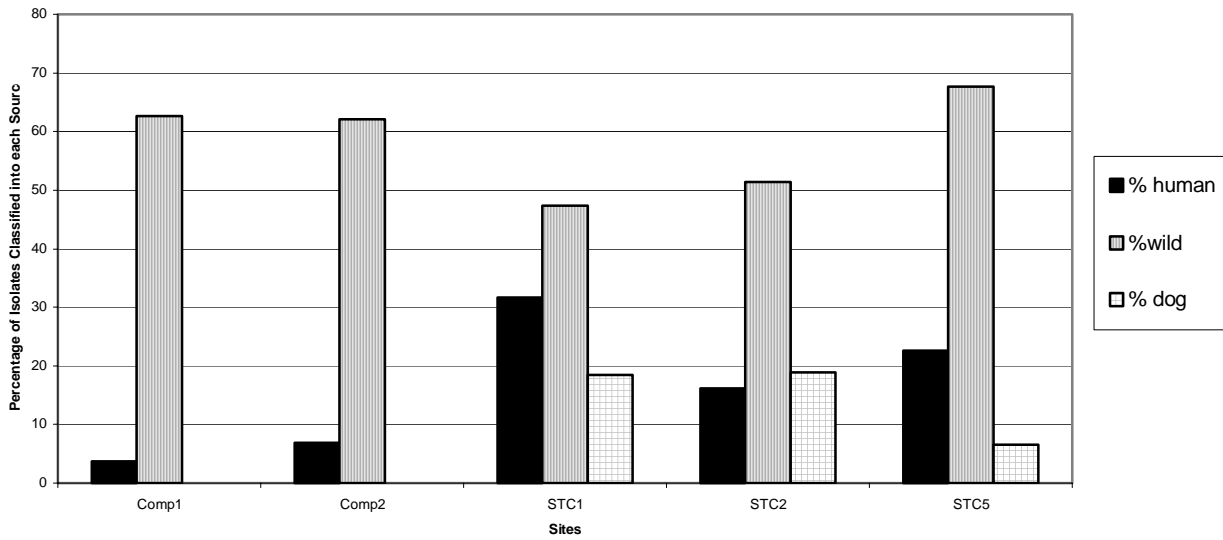


Figure 4.

Categorization of Isolates from Each of Five Sites on 8/22/00

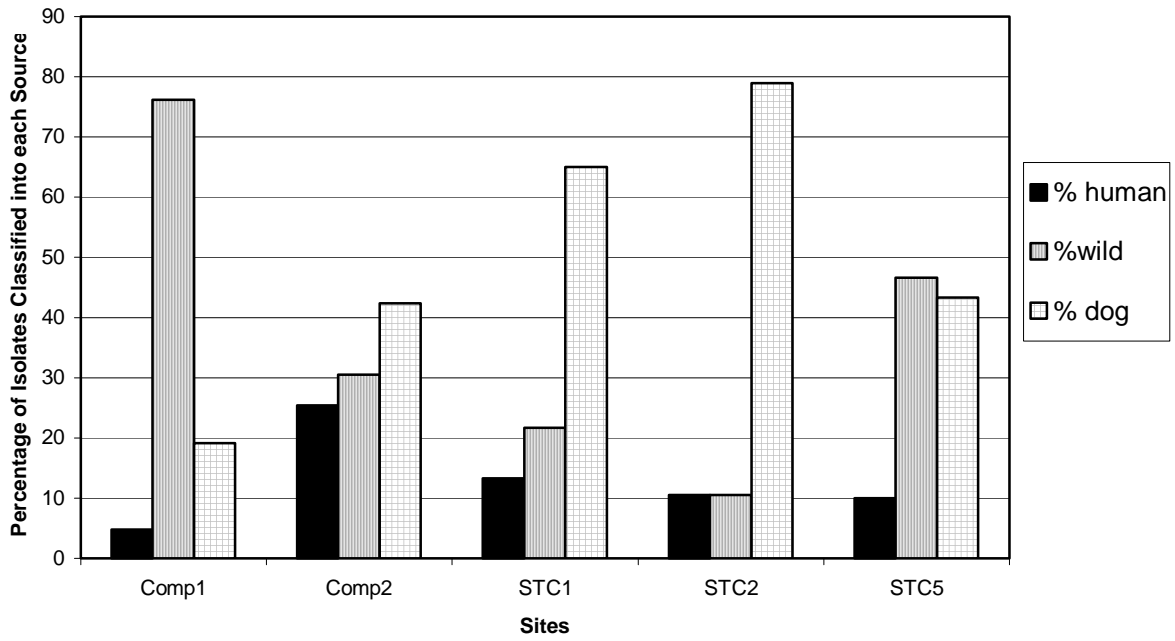


Figure 5.

Categorization of Isolates from each of Five Sites on 9/19/00

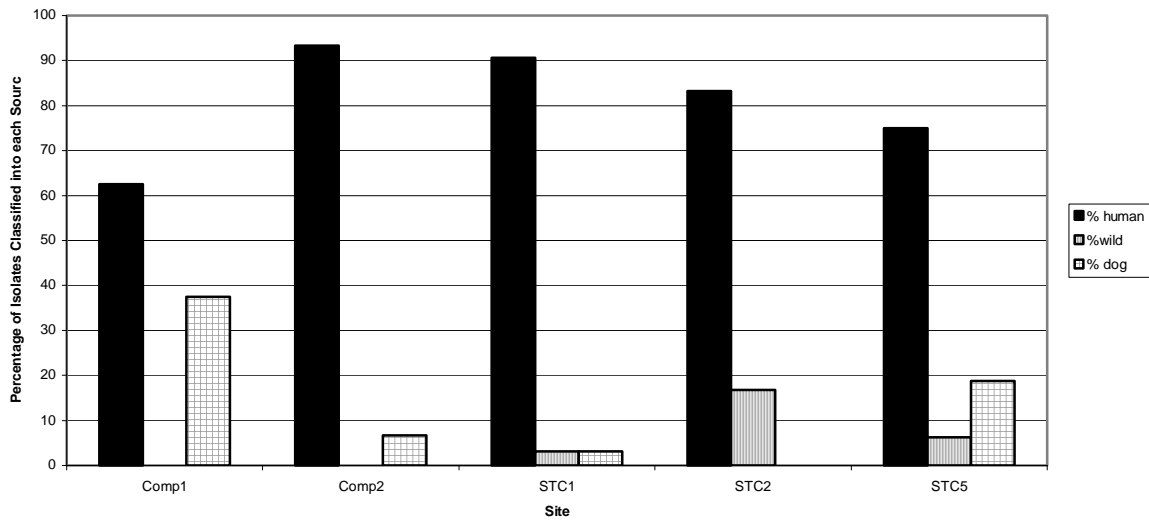


Figure 6.

Categorization of Isolates from the Three Sites from Which Fecal Coliforms were Obtained on 10/23/00

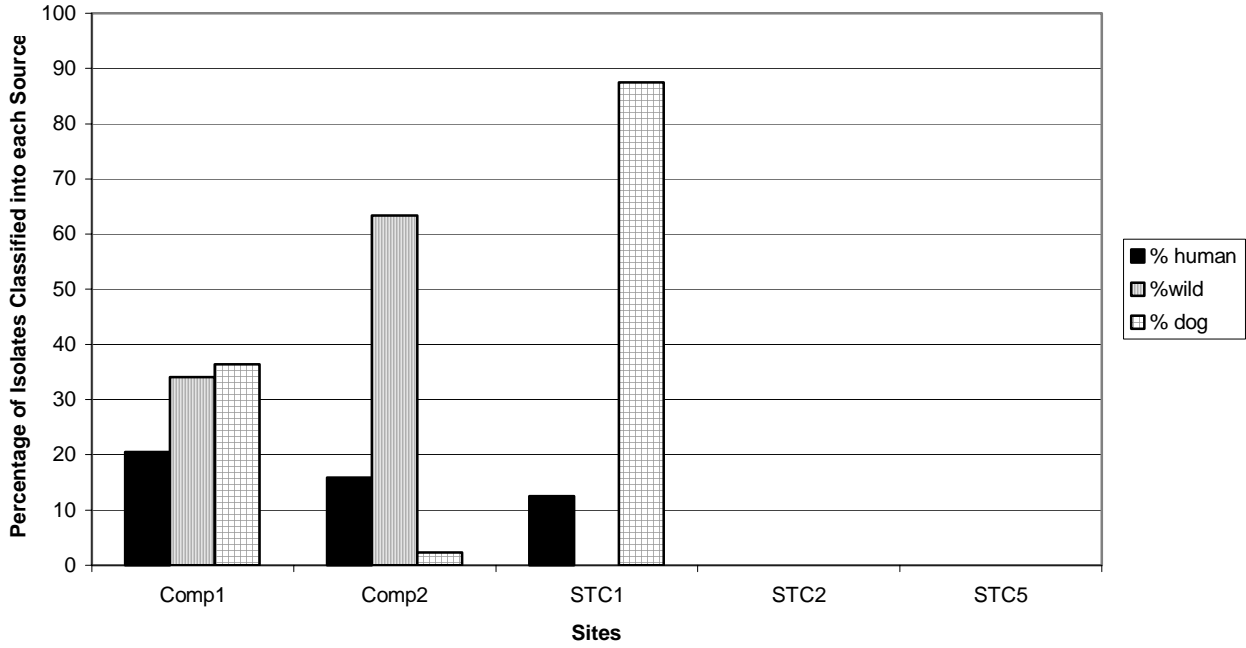


Figure 7.

Categorization of Isolates from Each of Five Sites on 12/27/00

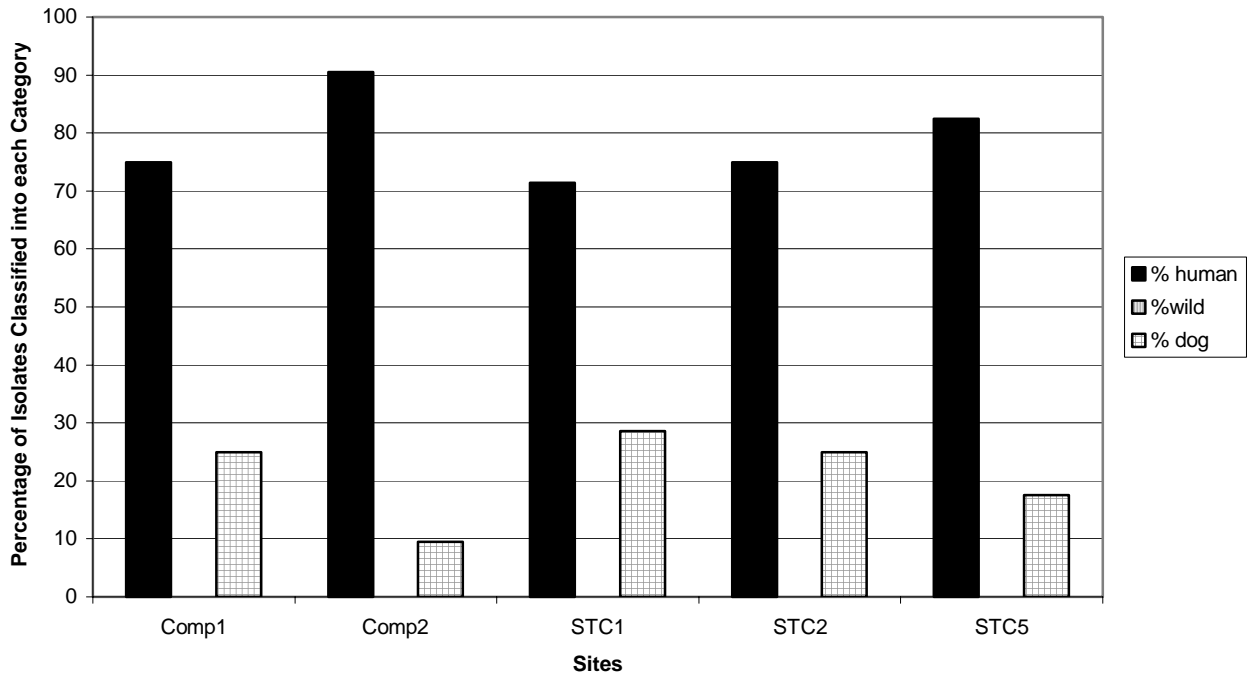


Figure 8.

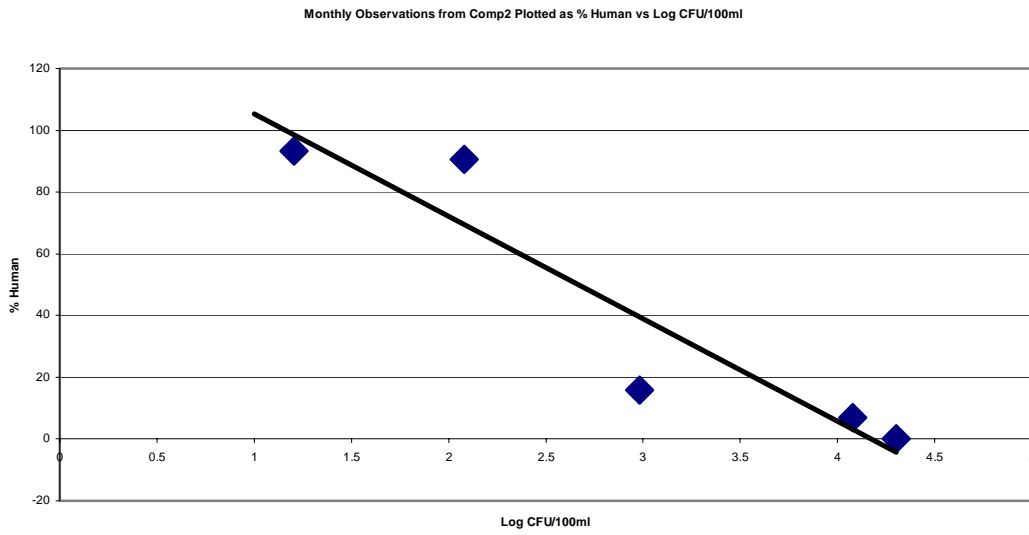


Figure 9.

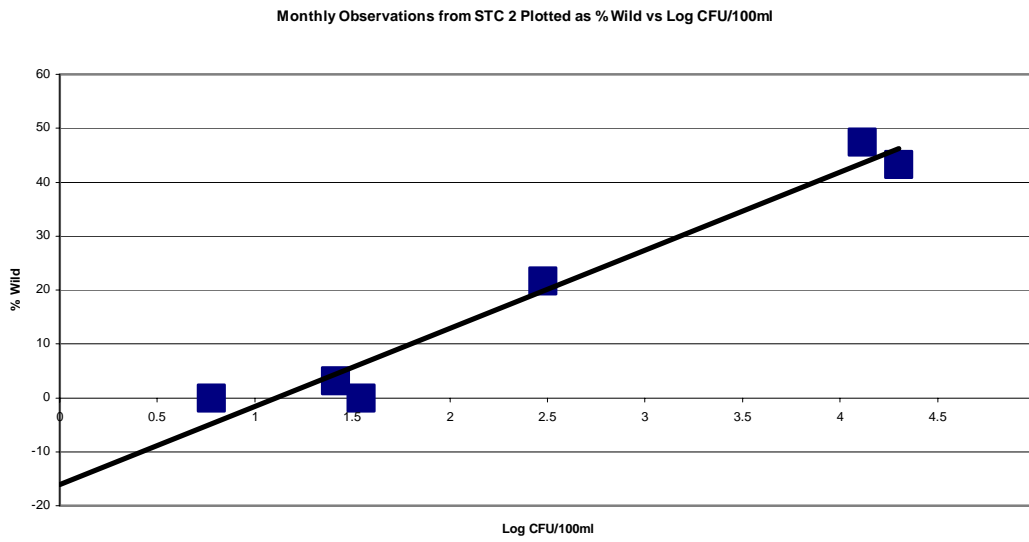


Figure 10.

| Information | | | | Average Annual Loads (pounds, G=Gross, R=Removed, N=Net) | | | | | |
|------------------|-----------|-----------------------|------------------------------|--|------|---------|---------|-------|--------|
| Name | Area (ac) | Runoff Volume (ac-ft) | Composite Runoff Coefficient | G_PB | G_ZN | G_BOD5 | G_TSS | G_TP | G_TN |
| Hammond Branch | 913.2180 | 1023 | 0.242 | 10 | 80 | 36,441 | 46,777 | 903 | 3,861 |
| Jeffords Street | 651.4446 | 754 | 0.250 | 5 | 38 | 26,273 | 29,436 | 574 | 2,790 |
| Lake Belleview | 653.7598 | 1033 | 0.341 | 15 | 118 | 37,515 | 73,482 | 1,080 | 3,903 |
| Lower Spring | 463.7520 | 471 | 0.219 | 4 | 36 | 17,527 | 22,031 | 451 | 1,831 |
| Lower Stevenson | 822.1520 | 1065 | 0.280 | 11 | 75 | 33,941 | 49,546 | 817 | 3,715 |
| Middle Stevenson | 535.3692 | 799 | 0.322 | 13 | 104 | 31,534 | 61,338 | 903 | 3,172 |
| Upper Spring | 1673.4679 | 2092 | 0.270 | 36 | 325 | 84,074 | 147,929 | 2,907 | 9,021 |
| Upper Stevenson | 574.9511 | 677 | 0.254 | 6 | 49 | 26,642 | 33,141 | 633 | 2,704 |
| | | | | 100 | 826 | 293,948 | 463,680 | 8,269 | 30,997 |

| Information | | | | Average Annual Loads (pounds, G=Gross, R=Removed, N=Net) | | | | | |
|------------------|-----------|-----------------------|------------------------------|--|------|--------|--------|-------|-------|
| Name | Area (ac) | Runoff Volume (ac-ft) | Composite Runoff Coefficient | R_PB | R_ZN | R_BOD5 | R_TSS | R_TP | R_TN |
| Hammond Branch | 913.2180 | 1023 | 0.242 | 1 | 9 | 3,049 | 6,362 | 104 | 236 |
| Jeffords Street | 651.4446 | 754 | 0.250 | 1 | 5 | 2,889 | 4,090 | 74 | 208 |
| Lake Belleview | 653.7598 | 1033 | 0.341 | 5 | 27 | 8,861 | 24,454 | 274 | 554 |
| Lower Spring | 463.7520 | 471 | 0.219 | 1 | 8 | 2,250 | 4,379 | 78 | 188 |
| Lower Stevenson | 822.1520 | 1065 | 0.280 | - | - | - | - | - | - |
| Middle Stevenson | 535.3692 | 799 | 0.322 | 0 | 2 | 678 | 1,734 | 19 | 68 |
| Upper Spring | 1673.4679 | 2092 | 0.270 | 10 | 71 | 15,068 | 39,186 | 607 | 1,048 |
| Upper Stevenson | 574.9511 | 677 | 0.254 | 1 | 6 | 1,781 | 4,936 | 48 | 101 |
| | | | | 20 | 128 | 34,576 | 85,142 | 1,205 | 2,403 |

| Information | | | | Average Annual Loads (pounds, G=Gross, R=Removed, N=Net) | | | | | |
|------------------|-----------|-----------------------|------------------------------|--|------|---------|---------|-------|--------|
| Name | Area (ac) | Runoff Volume (ac-ft) | Composite Runoff Coefficient | N_PB | N_ZN | N_BOD5 | N_TSS | N_TP | N_TN |
| Hammond Branch | 913.2180 | 1023 | 0.242 | 9 | 71 | 33,393 | 40,415 | 799 | 3,625 |
| Jeffords Street | 651.4446 | 754 | 0.250 | 4 | 34 | 23,384 | 25,345 | 500 | 2,582 |
| Lake Belleview | 653.7598 | 1033 | 0.341 | 10 | 90 | 28,654 | 49,028 | 807 | 3,349 |
| Lower Spring | 463.7520 | 471 | 0.219 | 3 | 29 | 15,277 | 17,651 | 373 | 1,644 |
| Lower Stevenson | 822.1520 | 1065 | 0.280 | 11 | 75 | 33,941 | 49,546 | 817 | 3,715 |
| Middle Stevenson | 535.3692 | 799 | 0.322 | 13 | 102 | 30,856 | 59,604 | 884 | 3,104 |
| Upper Spring | 1673.4679 | 2092 | 0.270 | 25 | 254 | 69,006 | 108,743 | 2,300 | 7,974 |
| Upper Stevenson | 574.9511 | 677 | 0.254 | 4 | 43 | 24,861 | 28,205 | 585 | 2,603 |
| | | | | 80 | 697 | 259,372 | 378,538 | 7,064 | 28,594 |

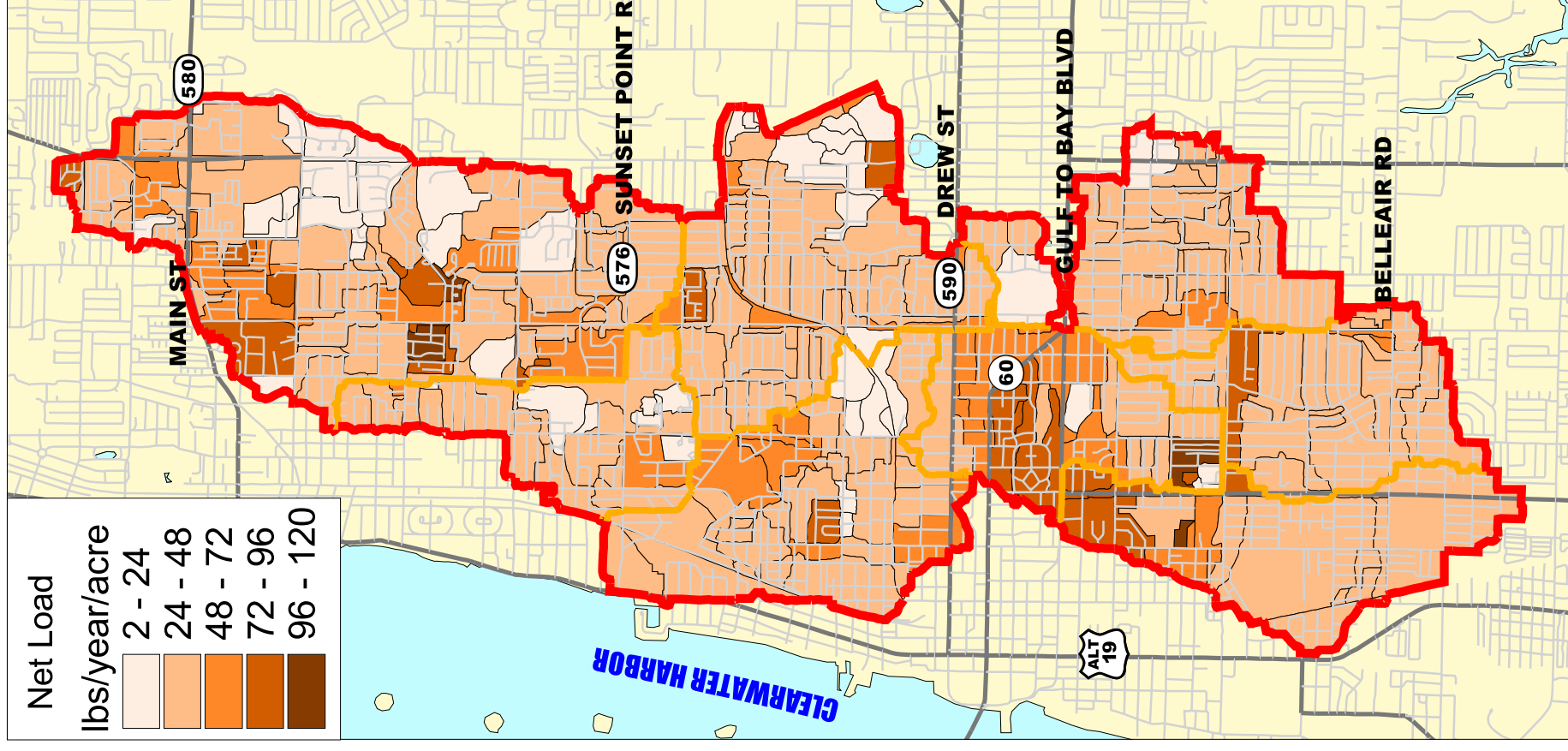
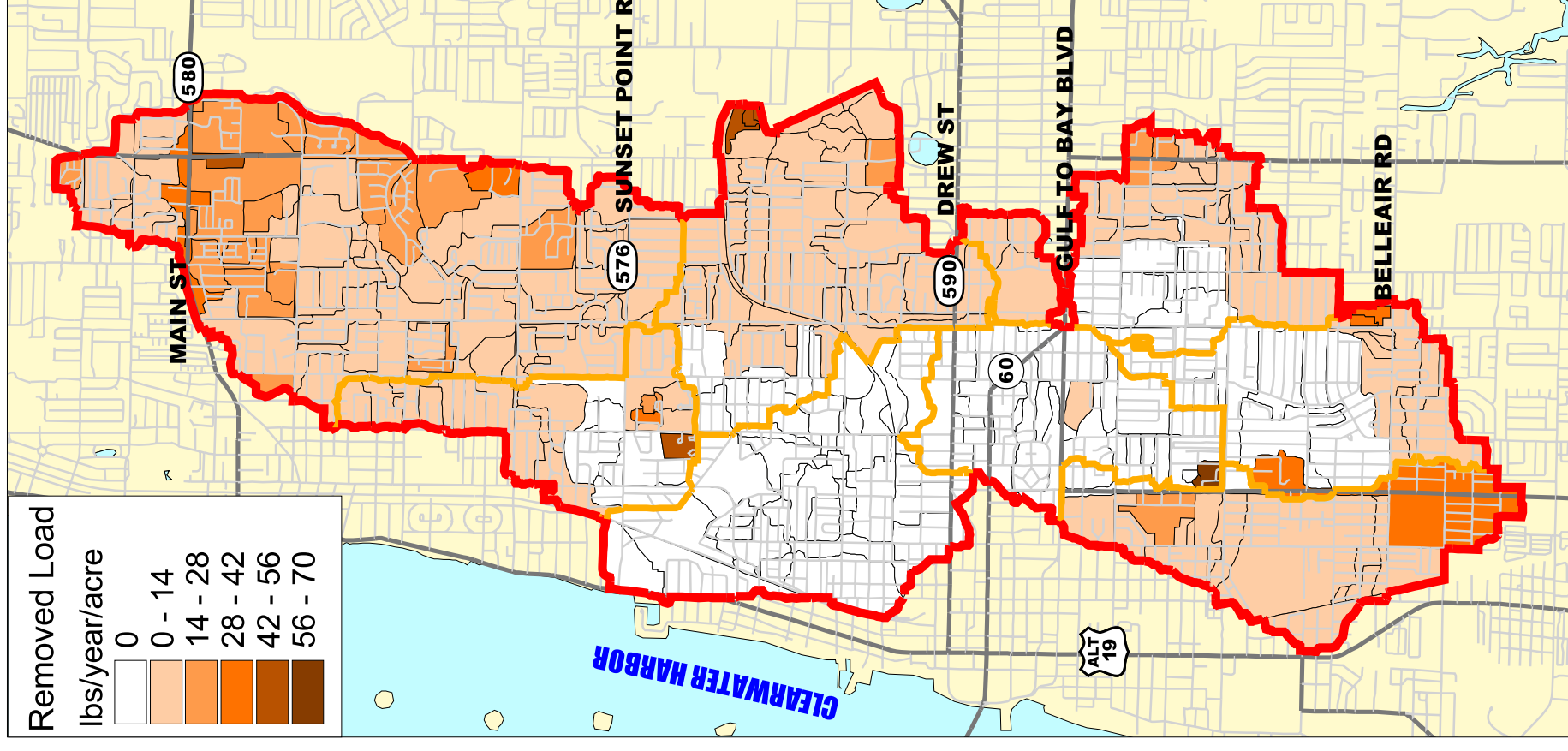
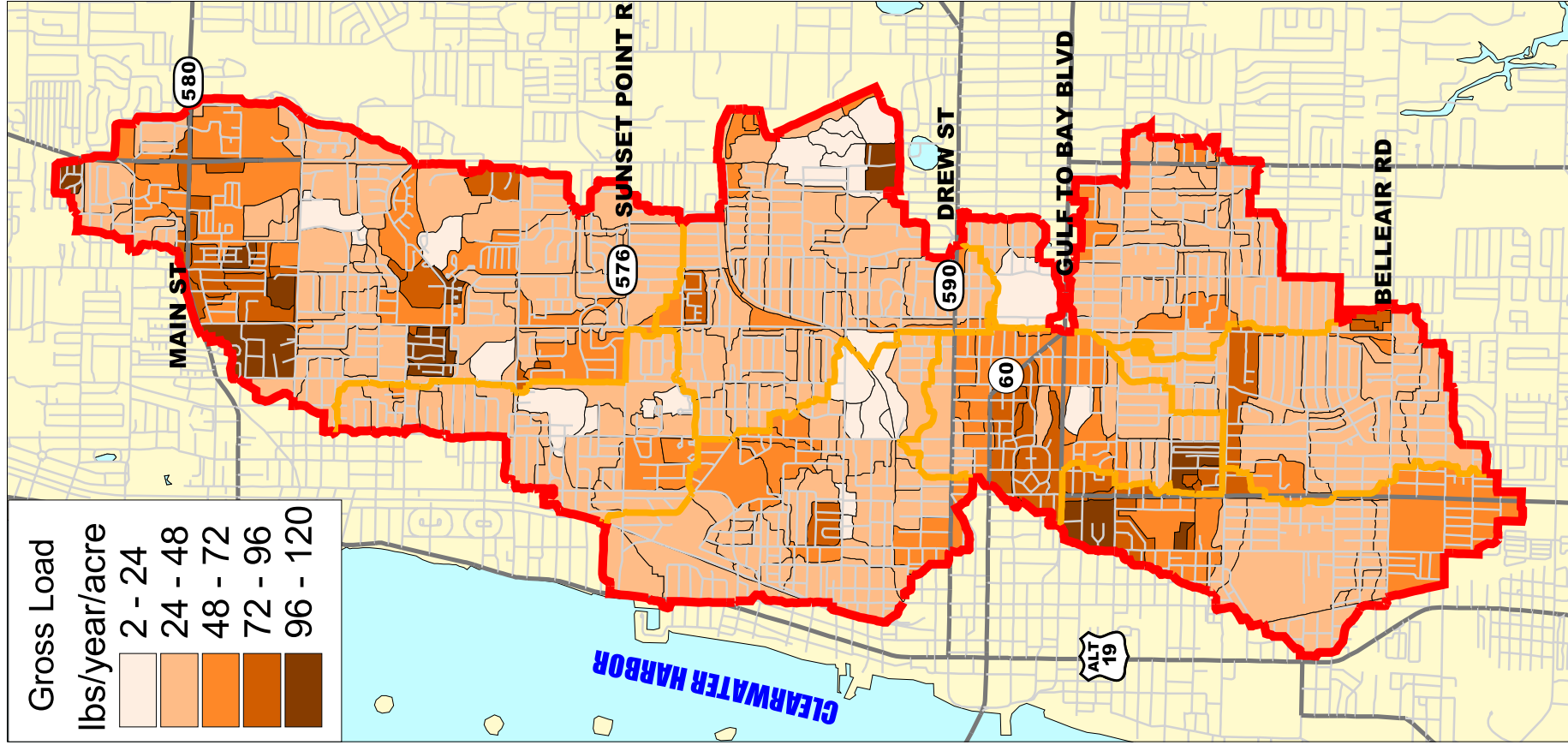
| Information | | | | Average Annual Loads (pounds, G=Gross, R=Removed, N=Net) | | | | | | | | | | | | | | | | | |
|-------------|-----------|-----------------------|------------------------------|--|-------|----------|-----------|--------|--------|------|-------|----------|-----------|--------|--------|------|-------|----------|----------|--------|--------|
| Basin ID | Area (ac) | Runoff Volume (ac-ft) | Composite Runoff Coefficient | G PB | G ZN | G BOD5 | G TSS | G TP | G TN | R PB | R ZN | R BOD5 | R TSS | R TP | R TN | N PB | N ZN | N BOD5 | N TSS | N TP | N TN |
| B4460 | 3.46 | 3.88 | 0.24 | 0.01 | 0.10 | 130.69 | 95.27 | 2.58 | 14.24 | 0.01 | 0.03 | 32.67 | 35.73 | 0.77 | 2.14 | 0.01 | 0.07 | 98.02 | 59.54 | 1.80 | 12.11 |
| B4040 | 48.71 | 75.47 | 0.33 | 1.65 | 17.98 | 3,610.76 | 7,282.53 | 154.01 | 393.31 | - | - | - | - | - | - | 1.65 | 17.98 | 3,610.76 | 7,282.53 | 154.01 | 393.31 |
| B4470 | 75.71 | 73.10 | 0.21 | 0.22 | 2.15 | 2,869.04 | 2,142.30 | 54.17 | 289.76 | 0.01 | 0.11 | 119.41 | 133.74 | 2.70 | 7.24 | 0.21 | 2.04 | 2,749.63 | 2,008.56 | 51.46 | 282.53 |
| B4430 | 8.52 | 8.87 | 0.23 | 0.03 | 0.24 | 320.24 | 236.04 | 6.20 | 33.76 | 0.00 | 0.02 | 23.90 | 26.43 | 0.56 | 1.51 | 0.03 | 0.22 | 296.34 | 209.61 | 5.65 | 32.25 |
| B4440 | 22.24 | 20.78 | 0.20 | 0.06 | 0.62 | 832.29 | 622.72 | 15.74 | 83.72 | 0.01 | 0.06 | 62.12 | 69.72 | 1.41 | 3.75 | 0.06 | 0.56 | 770.16 | 553.00 | 14.34 | 79.97 |
| B4060 | 73.88 | 77.14 | 0.23 | 0.28 | 2.59 | 3,069.89 | 2,502.54 | 58.73 | 307.60 | - | - | - | - | - | - | 0.28 | 2.59 | 3,069.89 | 2,502.54 | 58.73 | 307.60 |
| B4122 | 7.52 | 7.73 | 0.22 | 0.02 | 0.23 | 309.73 | 231.74 | 5.86 | 31.16 | - | - | - | - | - | - | 0.02 | 0.23 | 309.73 | 231.74 | 5.86 | 31.16 |
| B4050 | 48.72 | 50.76 | 0.23 | 0.15 | 1.49 | 1,998.68 | 1,491.92 | 37.95 | 202.57 | - | - | - | - | - | - | 0.15 | 1.49 | 1,998.68 | 1,491.92 | 37.95 | 202.57 |
| B4125 | 30.68 | 52.06 | 0.37 | 1.34 | 7.19 | 1,956.05 | 3,533.16 | 40.88 | 180.13 | 1.00 | 4.31 | 978.02 | 2,649.87 | 24.53 | 54.04 | 0.34 | 2.87 | 978.02 | 883.29 | 16.36 | 126.09 |
| B4450 | 19.00 | 18.24 | 0.21 | 0.05 | 0.52 | 704.14 | 524.14 | 13.43 | 72.01 | 0.01 | 0.05 | 60.07 | 67.07 | 1.38 | 3.69 | 0.05 | 0.47 | 644.07 | 457.07 | 12.06 | 68.32 |
| B3800 | 39.87 | 48.46 | 0.26 | 0.33 | 2.78 | 1,923.63 | 2,557.08 | 41.49 | 189.37 | 0.13 | 0.83 | 480.91 | 958.90 | 12.45 | 28.41 | 0.21 | 1.95 | 1,442.72 | 1,598.17 | 29.04 | 160.97 |
| B4070 | 2.69 | 2.76 | 0.22 | 0.01 | 0.08 | 110.70 | 82.83 | 2.09 | 11.14 | - | - | - | - | - | - | 0.01 | 0.08 | 110.70 | 82.83 | 2.09 | 11.14 |
| B4080 | 104.83 | 111.03 | 0.23 | 0.40 | 3.76 | 4,423.51 | 3,700.76 | 85.52 | 444.47 | - | - | - | - | - | - | 0.40 | 3.76 | 4,423.51 | 3,700.76 | 85.52 | 444.47 |
| B4126 | 5.42 | 5.58 | 0.22 | 0.02 | 0.17 | 223.29 | 167.07 | 4.22 | 22.46 | - | - | - | - | - | - | 0.02 | 0.17 | 223.29 | 167.07 | 4.22 | 22.46 |
| B4132 | 4.57 | 7.16 | 0.34 | 0.09 | 0.70 | 286.17 | 622.95 | 7.23 | 27.23 | 0.01 | 0.04 | 14.42 | 47.10 | 0.44 | 0.82 | 0.08 | 0.66 | 271.74 | 575.85 | 6.79 | 26.41 |
| B4135 | 4.23 | 3.99 | 0.20 | 0.04 | 0.29 | 153.33 | 259.37 | 3.40 | 14.46 | 0.00 | 0.02 | 7.73 | 19.61 | 0.21 | 0.44 | 0.04 | 0.28 | 145.60 | 239.76 | 3.19 | 14.02 |
| B3730 | 2.36 | 2.60 | 0.24 | 0.01 | 0.10 | 101.71 | 94.09 | 2.02 | 10.26 | 0.00 | 0.03 | 25.43 | 35.29 | 0.61 | 1.54 | 0.01 | 0.07 | 76.28 | 58.81 | 1.41 | 8.72 |
| B3790 | 137.80 | 230.99 | 0.36 | 3.59 | 23.03 | 8,340.85 | 16,511.14 | 202.10 | 823.37 | 2.69 | 13.82 | 4,170.43 | 12,383.35 | 121.25 | 247.01 | 0.90 | 9.21 | 4,170.43 | 4,127.78 | 80.84 | 576.35 |
| B4136 | 6.89 | 12.79 | 0.40 | 0.20 | 1.50 | 510.05 | 1,310.18 | 13.77 | 47.76 | 0.15 | 0.90 | 255.02 | 982.64 | 8.26 | 14.33 | 0.05 | 0.60 | 255.02 | 327.55 | 5.51 | 33.43 |
| B3740 | 10.42 | 13.42 | 0.28 | 0.11 | 0.90 | 496.90 | 809.26 | 12.18 | 50.35 | 0.04 | 0.27 | 124.22 | 303.47 | 3.66 | 7.55 | 0.07 | 0.63 | 372.67 | 505.79 | 8.53 | 42.80 |
| B4137 | 3.58 | 7.00 | 0.42 | 0.11 | 0.83 | 279.32 | 729.70 | 7.60 | 26.12 | 0.08 | 0.50 | 139.66 | 547.27 | 4.56 | 7.84 | 0.03 | 0.33 | 139.66 | 182.42 | 3.04 | 18.28 |
| B4130 | 5.94 | 7.82 | 0.28 | 0.09 | 0.71 | 257.72 | 593.46 | 6.85 | 24.63 | 0.01 | 0.04 | 12.99 | 44.87 | 0.41 | 0.74 | 0.09 | 0.66 | 244.73 | 548.59 | 6.43 | 23.88 |
| B3750 | 6.06 | 7.32 | 0.26 | 0.06 | 0.47 | 230.55 | 407.69 | 6.65 | 25.38 | 0.02 | 0.14 | 57.64 | 152.88 | 1.99 | 3.81 | 0.04 | 0.33 | 172.92 | 254.81 | 4.65 | 21.57 |
| B4090 | 25.96 | 32.21 | 0.27 | 0.16 | 1.30 | 1,057.25 | 1,176.57 | 23.92 | 113.82 | 0.01 | 0.08 | 53.29 | 88.96 | 1.45 | 3.44 | 0.15 | 1.23 | 1,003.96 | 1,087.61 | 22.48 | 110.38 |
| B4131 | 3.26 | 5.14 | 0.34 | 0.07 | 0.51 | 195.41 | 440.05 | 4.93 | 18.31 | 0.01 | 0.03 | 9.85 | 33.27 | 0.30 | 0.56 | 0.06 | 0.48 | 185.56 | 406.77 | 4.64 | 17.76 |
| B3760 | 14.88 | 18.50 | 0.27 | 0.13 | 1.42 | 716.51 | 1,131.88 | 16.33 | 70.61 | 0.05 | 0.43 | 179.13 | 424.45 | 4.90 | 10.59 | 0.08 | 1.00 | 537.38 | 707.42 | 11.43 | 60.02 |
| B4133 | 2.68 | 3.81 | 0.31 | 0.05 | 0.41 | 148.80 | 356.97 | 3.94 | 14.02 | 0.00 | 0.03 | 7.50 | 26.99 | 0.24 | 0.42 | 0.05 | 0.38 | 141.30 | 329.98 | 3.70 | 13.59 |
| B3810 | 30.03 | 41.79 | 0.30 | 0.38 | 4.34 | 1,601.98 | 3,323.76 | 40.05 | 155.16 | 0.14 | 1.30 | 400.50 | 1,246.41 | 12.01 | 23.27 | 0.24 | 3.04 | 1,201.48 | 2,077.35 | 28.03 | 131.88 |
| B4100 | 31.55 | 32.38 | 0.22 | 0.10 | 0.96 | 1,296.68 | 970.18 | 24.53 | 130.44 | 0.01 | 0.06 | 65.36 | 73.36 | 1.48 | 3.94 | 0.09 | 0.91 | 1,231.32 | 896.83 | 23.05 | 126.49 |
| B4138 | 15.68 | 14.68 | 0.20 | 0.07 | 0.62 | 563.32 | 587.97 | 11.51 | 57.10 | 0.01 | 0.07 | 53.35 | 83.53 | 1.31 | 3.25 | 0.06 | 0.55 | 509.96 | 504.43 | 10.20 | 53.85 |
| B4128 | 1.92 | 3.04 | 0.34 | 0.01 | 0.05 | 65.59 | 43.35 | 1.48 | 9.09 | 0.00 | 0.02 | 16.40 | 16.26 | 0.44 | 1.36 | 0.01 | 0.03 | 49.20 | 27.10 | 1.03 | 7.72 |
| B4110 | 27.50 | 28.28 | 0.22 | 0.08 | 0.84 | 1,132.65 | 847.45 | 21.43 | 113.94 | 0.01 | 0.05 | 57.09 | 64.08 | 1.30 | 3.45 | 0.08 | 0.79 | 1,075.56 | 783.38 | 20.13 | 110.49 |
| B4120 | 50.61 | 61.51 | 0.26 | 0.47 | 3.83 | 2,193.21 | 3,411.37 | 54.34 | 225.77 | 0.04 | 0.23 | 110.55 | 257.93 | 3.29 | 6.83 | 0.43 | 3.60 | 2,082.66 | 3,153.43 | 51.05 | 218.94 |

| Information | | Loading Rates (pounds/acre/average year, G=Gross, R=Removed, N=Net) | | | | | |
|------------------|-----------|---|-------|--------|---------|-------|-------|
| Name | Area (ac) | G_PB | G_ZN | G_BOD5 | G_TSS | G_TP | G_TN |
| Hammond Branch | 913 | 0.011 | 0.088 | 39.904 | 51.222 | 0.989 | 4.228 |
| Jeffords Street | 651 | 0.008 | 0.059 | 40.331 | 45.185 | 0.882 | 4.282 |
| Lake Belleview | 654 | 0.023 | 0.180 | 57.383 | 112.399 | 1.652 | 5.970 |
| Lower Spring | 464 | 0.009 | 0.079 | 37.795 | 47.505 | 0.973 | 3.949 |
| Lower Stevenson | 822 | 0.013 | 0.092 | 41.283 | 60.264 | 0.993 | 4.518 |
| Middle Stevenson | 535 | 0.025 | 0.194 | 58.902 | 114.571 | 1.686 | 5.924 |
| Upper Spring | 1673 | 0.021 | 0.194 | 50.239 | 88.397 | 1.737 | 5.391 |
| Upper Stevenson | 575 | 0.010 | 0.085 | 46.339 | 57.642 | 1.102 | 4.704 |

| Information | | Loading Rates (pounds/acre/average year, G=Gross, R=Removed, N=Net) | | | | | |
|------------------|-----------|---|-------|--------|--------|-------|-------|
| Name | Area (ac) | R_PB | R_ZN | R_BOD5 | R_TSS | R_TP | R_TN |
| Hammond Branch | 913 | 0.002 | 0.010 | 3.338 | 6.967 | 0.114 | 0.259 |
| Jeffords Street | 651 | 0.002 | 0.007 | 4.435 | 6.279 | 0.114 | 0.319 |
| Lake Belleview | 654 | 0.007 | 0.042 | 13.554 | 37.405 | 0.418 | 0.848 |
| Lower Spring | 464 | 0.002 | 0.016 | 4.853 | 9.443 | 0.169 | 0.405 |
| Lower Stevenson | 822 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Middle Stevenson | 535 | 0.001 | 0.004 | 1.267 | 3.239 | 0.036 | 0.127 |
| Upper Spring | 1673 | 0.006 | 0.043 | 9.004 | 23.416 | 0.363 | 0.626 |
| Upper Stevenson | 575 | 0.002 | 0.011 | 3.098 | 8.585 | 0.084 | 0.176 |

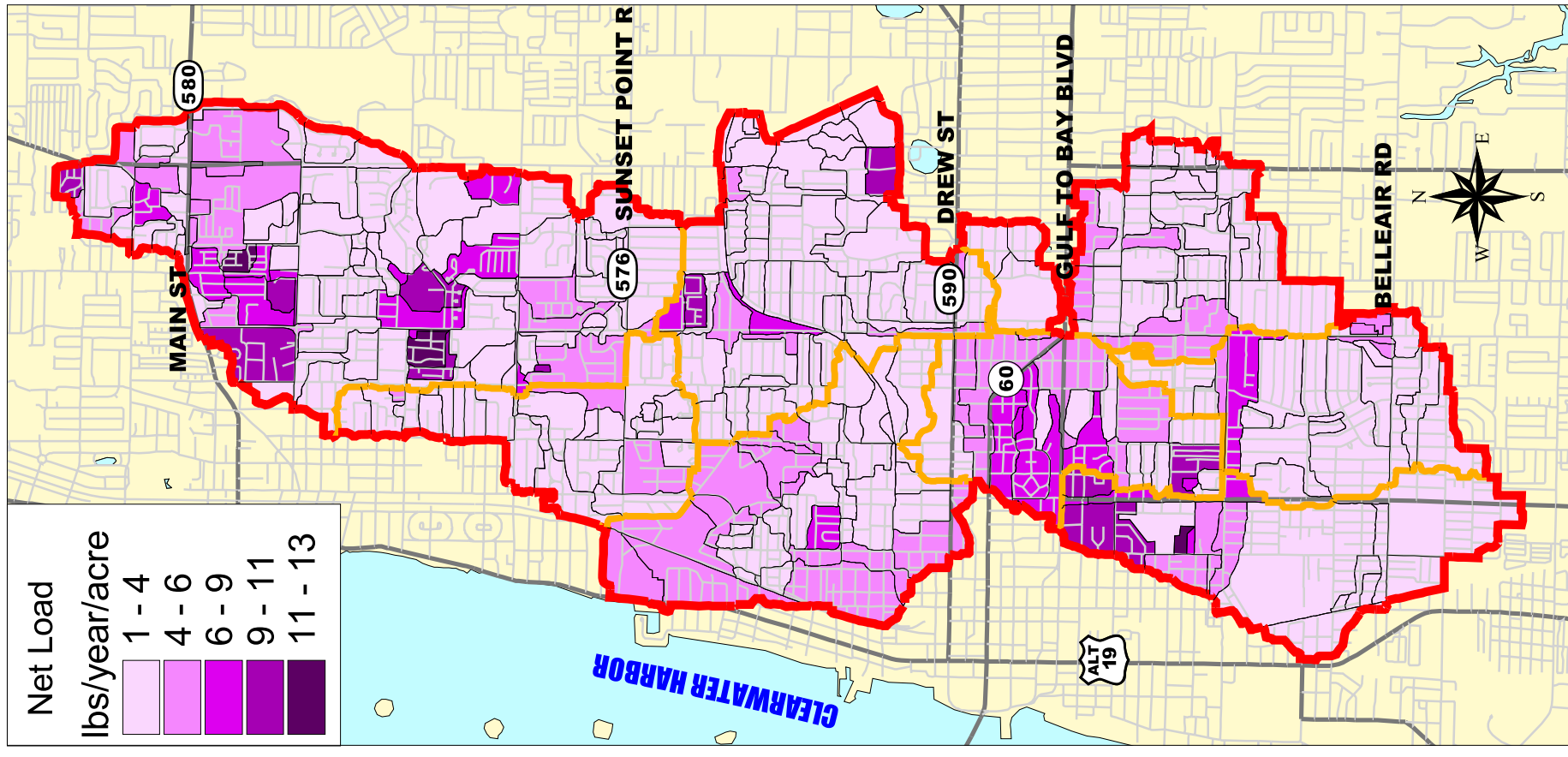
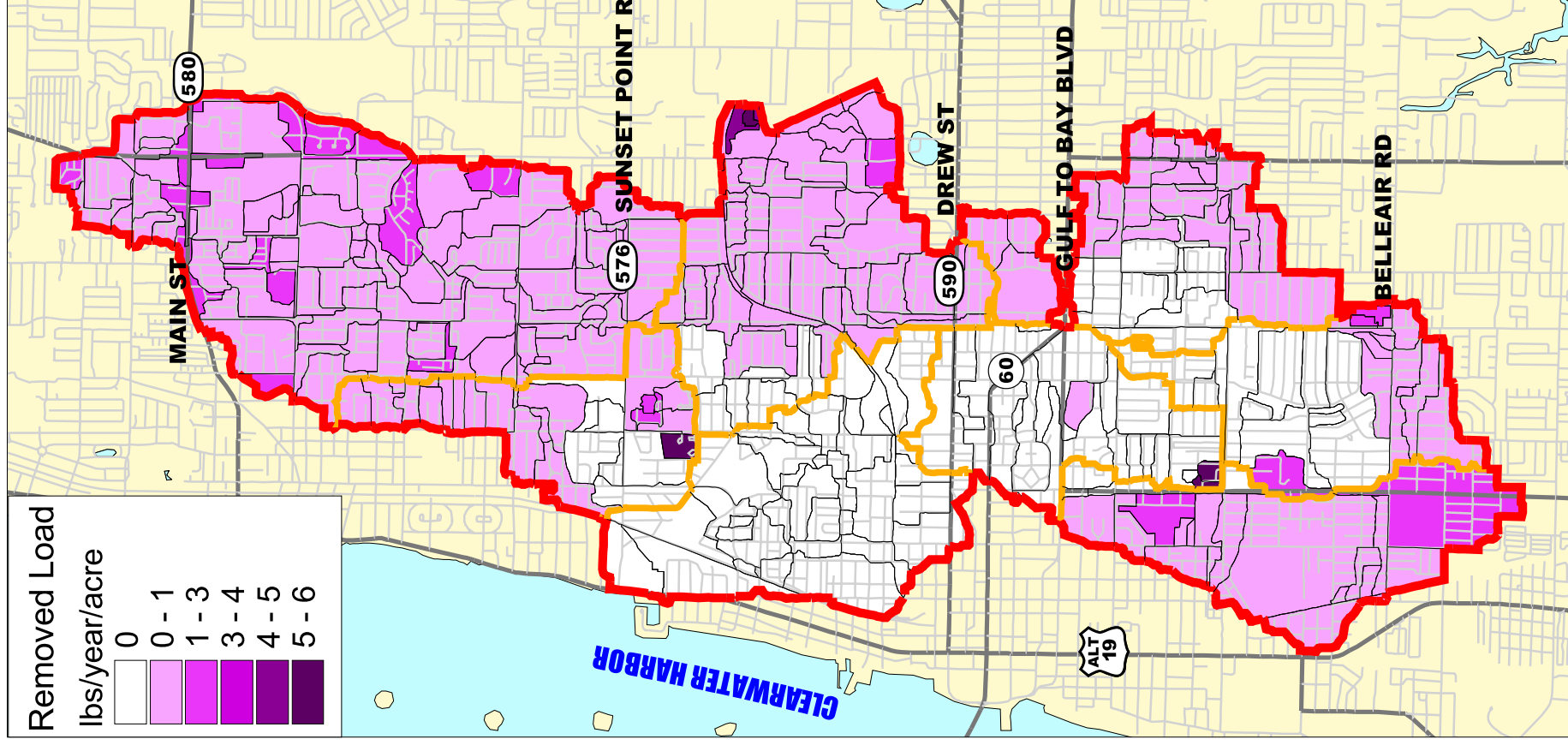
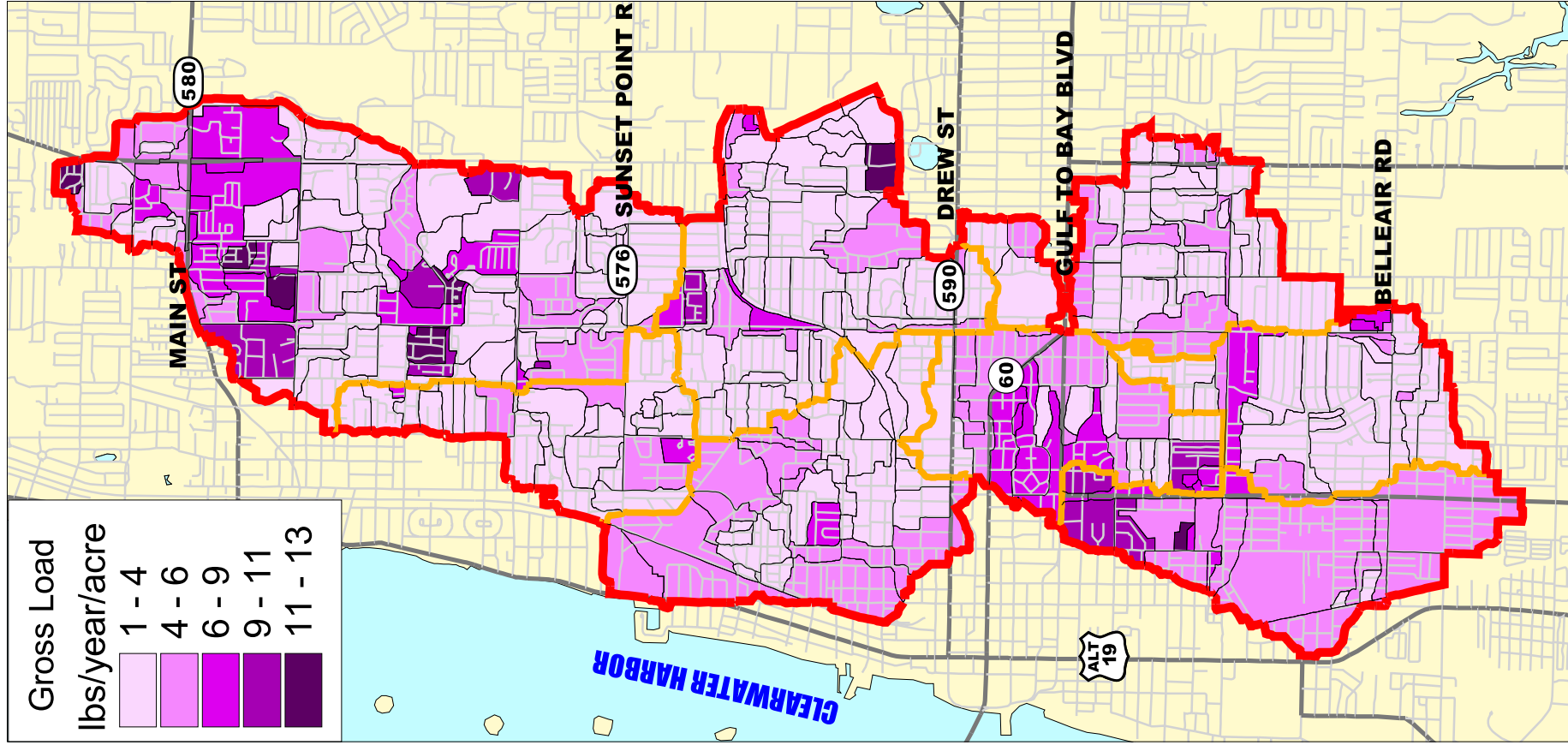
| Information | | Loading Rates (pounds/acre/average year, G=Gross, R=Removed, N=Net) | | | | | |
|------------------|-----------|---|-------|--------|---------|-------|-------|
| Name | Area (ac) | N_PB | N_ZN | N_BOD5 | N_TSS | N_TP | N_TN |
| Hammond Branch | 913 | 0.010 | 0.078 | 36.566 | 44.255 | 0.875 | 3.970 |
| Jeffords Street | 651 | 0.006 | 0.052 | 35.896 | 38.906 | 0.768 | 3.964 |
| Lake Belleview | 654 | 0.016 | 0.138 | 43.829 | 74.994 | 1.234 | 5.122 |
| Lower Spring | 464 | 0.007 | 0.062 | 32.942 | 38.062 | 0.804 | 3.544 |
| Lower Stevenson | 822 | 0.013 | 0.092 | 41.283 | 60.264 | 0.993 | 4.518 |
| Middle Stevenson | 535 | 0.025 | 0.190 | 57.634 | 111.332 | 1.650 | 5.797 |
| Upper Spring | 1673 | 0.015 | 0.152 | 41.236 | 64.981 | 1.375 | 4.765 |
| Upper Stevenson | 575 | 0.008 | 0.074 | 43.241 | 49.057 | 1.018 | 4.527 |

| Information | | Loading Rates (pounds/acre/average year, G=Gross, R=Removed, N=Net) | | | | | | | | | | | | | | | | | |
|-------------|-----------|---|-------|--------|---------|-------|-------|-------|-------|--------|---------|-------|-------|-------|-------|--------|---------|-------|-------|
| Name | Area (ac) | G_PB | G_ZN | G_BOD5 | G_TSS | G_TP | G_TN | R_PB | R_ZN | R_BOD5 | R_TSS | R_TP | R_TN | N_PB | N_ZN | N_BOD5 | N_TSS | N_TP | N_TN |
| B4125 | 30.68 | 0.044 | 0.234 | 63.751 | 115.152 | 1.333 | 5.871 | 0.033 | 0.140 | 31.876 | 86.364 | 0.800 | 1.761 | 0.011 | 0.094 | 31.876 | 28.788 | 0.533 | 4.110 |
| B4450 | 19.00 | 0.003 | 0.028 | 37.068 | 27.593 | 0.707 | 3.791 | 0.000 | 0.003 | 3.162 | 3.531 | 0.072 | 0.194 | 0.003 | 0.025 | 33.906 | 24.062 | 0.635 | 3.597 |
| B3800 | 39.87 | 0.008 | 0.070 | 48.249 | 64.137 | 1.041 | 4.750 | 0.003 | 0.021 | 12.062 | 24.051 | 0.312 | 0.713 | 0.005 | 0.049 | 36.187 | 40.086 | 0.728 | 4.037 |
| B4070 | 2.69 | 0.003 | 0.031 | 41.189 | 30.818 | 0.779 | 4.143 | - | - | - | - | - | - | 0.003 | 0.031 | 41.189 | 30.818 | 0.779 | 4.143 |
| B4080 | 104.83 | 0.004 | 0.036 | 42.196 | 35.302 | 0.816 | 4.240 | - | - | - | - | - | - | 0.004 | 0.036 | 42.196 | 35.302 | 0.816 | 4.240 |
| B4126 | 5.42 | 0.003 | 0.031 | 41.189 | 30.818 | 0.779 | 4.143 | - | - | - | - | - | - | 0.003 | 0.031 | 41.189 | 30.818 | 0.779 | 4.143 |
| B4132 | 4.57 | 0.020 | 0.154 | 62.647 | 136.375 | 1.582 | 5.962 | 0.002 | 0.009 | 3.158 | 10.311 | 0.096 | 0.180 | 0.018 | 0.145 | 59.489 | 126.064 | 1.487 | 5.781 |
| B4135 | 4.23 | 0.009 | 0.070 | 36.269 | 61.353 | 0.804 | 3.421 | 0.001 | 0.004 | 1.828 | 4.639 | 0.049 | 0.103 | 0.008 | 0.065 | 34.441 | 56.714 | 0.755 | 3.317 |
| B3730 | 2.36 | 0.005 | 0.041 | 43.061 | 39.837 | 0.853 | 4.344 | 0.002 | 0.012 | 10.765 | 14.939 | 0.256 | 0.652 | 0.003 | 0.028 | 32.296 | 24.898 | 0.597 | 3.692 |
| B3790 | 137.80 | 0.026 | 0.167 | 60.531 | 119.823 | 1.467 | 5.975 | 0.020 | 0.100 | 30.265 | 89.867 | 0.880 | 1.793 | 0.007 | 0.067 | 30.265 | 29.956 | 0.587 | 4.183 |
| B4136 | 6.89 | 0.029 | 0.217 | 73.979 | 190.033 | 1.997 | 6.927 | 0.022 | 0.130 | 36.989 | 142.525 | 1.198 | 2.078 | 0.007 | 0.087 | 36.989 | 47.508 | 0.799 | 4.849 |
| B3740 | 10.42 | 0.011 | 0.087 | 47.669 | 77.635 | 1.169 | 4.830 | 0.004 | 0.026 | 11.917 | 29.113 | 0.351 | 0.725 | 0.007 | 0.061 | 35.752 | 48.522 | 0.818 | 4.106 |
| B4137 | 3.58 | 0.031 | 0.232 | 77.937 | 203.604 | 2.120 | 7.288 | 0.023 | 0.140 | 38.968 | 152.703 | 1.272 | 2.186 | 0.008 | 0.093 | 38.968 | 50.901 | 0.848 | 5.101 |
| B4130 | 5.94 | 0.016 | 0.119 | 43.368 | 99.864 | 1.152 | 4.144 | 0.001 | 0.007 | 2.186 | 7.551 | 0.070 | 0.125 | 0.015 | 0.111 | 41.182 | 92.313 | 1.082 | 4.019 |
| B3750 | 6.06 | 0.009 | 0.078 | 38.066 | 67.312 | 1.098 | 4.190 | 0.004 | 0.023 | 9.517 | 25.242 | 0.329 | 0.628 | 0.006 | 0.055 | 28.550 | 42.070 | 0.768 | 3.562 |
| B4090 | 25.96 | 0.006 | 0.050 | 40.732 | 45.329 | 0.922 | 4.385 | 0.001 | 0.003 | 2.053 | 3.427 | 0.056 | 0.133 | 0.006 | 0.047 | 38.679 | 41.902 | 0.866 | 4.252 |
| B4131 | 3.26 | 0.020 | 0.156 | 59.950 | 135.000 | 1.513 | 5.617 | 0.002 | 0.010 | 3.022 | 10.207 | 0.092 | 0.170 | 0.019 | 0.146 | 56.929 | 124.792 | 1.422 | 5.447 |
| B3760 | 14.88 | 0.008 | 0.096 | 48.161 | 76.081 | 1.098 | 4.746 | 0.003 | 0.029 | 12.040 | 28.530 | 0.329 | 0.712 | 0.005 | 0.067 | 36.121 | 47.551 | 0.768 | 4.034 |
| B4133 | 2.68 | 0.020 | 0.152 | 55.591 | 133.368 | 1.471 | 5.237 | 0.002 | 0.009 | 2.802 | 10.084 | 0.089 | 0.158 | 0.018 | 0.143 | 52.789 | 123.284 | 1.382 | 5.078 |
| B3810 | 30.03 | 0.013 | 0.145 | 53.353 | 110.696 | 1.334 | 5.167 | 0.005 | 0.043 | 13.338 | 41.511 | 0.400 | 0.775 | 0.008 | 0.101 | 40.015 | 69.185 | 0.934 | 4.392 |
| B4100 | 31.55 | 0.003 | 0.031 | 41.100 | 30.751 | 0.778 | 4.134 | 0.000 | 0.002 | 2.072 | 2.325 | 0.047 | 0.125 | 0.003 | 0.029 | 39.029 | 28.426 | 0.731 | 4.009 |
| B4138 | 15.68 | 0.005 | 0.040 | 35.916 | 37.488 | 0.734 | 3.641 | 0.001 | 0.005 | 3.402 | 5.326 | 0.083 | 0.207 | 0.004 | 0.035 | 32.514 | 32.162 | 0.650 | 3.434 |
| B4128 | 1.92 | 0.006 | 0.025 | 34.177 | 22.589 | 0.769 | 4.735 | 0.002 | 0.008 | 8.544 | 8.471 | 0.231 | 0.711 | 0.003 | 0.018 | 25.633 | 14.118 | 0.538 | 4.025 |
| B4110 | 27.50 | 0.003 | 0.031 | 41.189 | 30.818 | 0.779 | 4.143 | 0.000 | 0.002 | 2.076 | 2.330 | 0.047 | 0.125 | 0.003 | 0.029 | 39.113 | 28.488 | 0.732 | 4.018 |
| B4120 | 50.61 | 0.009 | 0.076 | 43.338 | 67.409 | 1.074 | 4.461 | 0.001 | 0.005 | 2.185 | 5.097 | 0.065 | 0.135 | 0.009 | 0.071 | 41.153 | 62.312 | 1.009 | 4.326 |

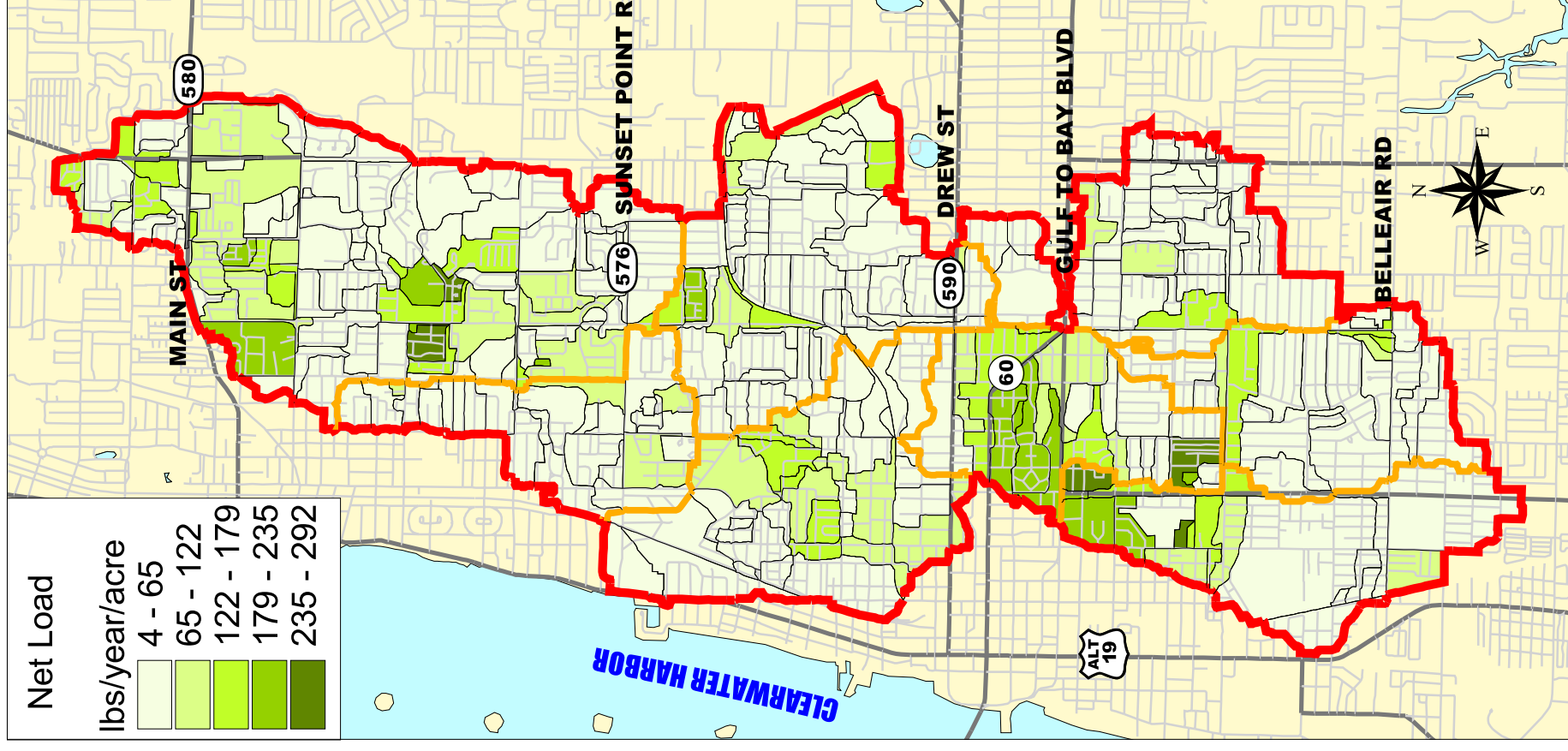
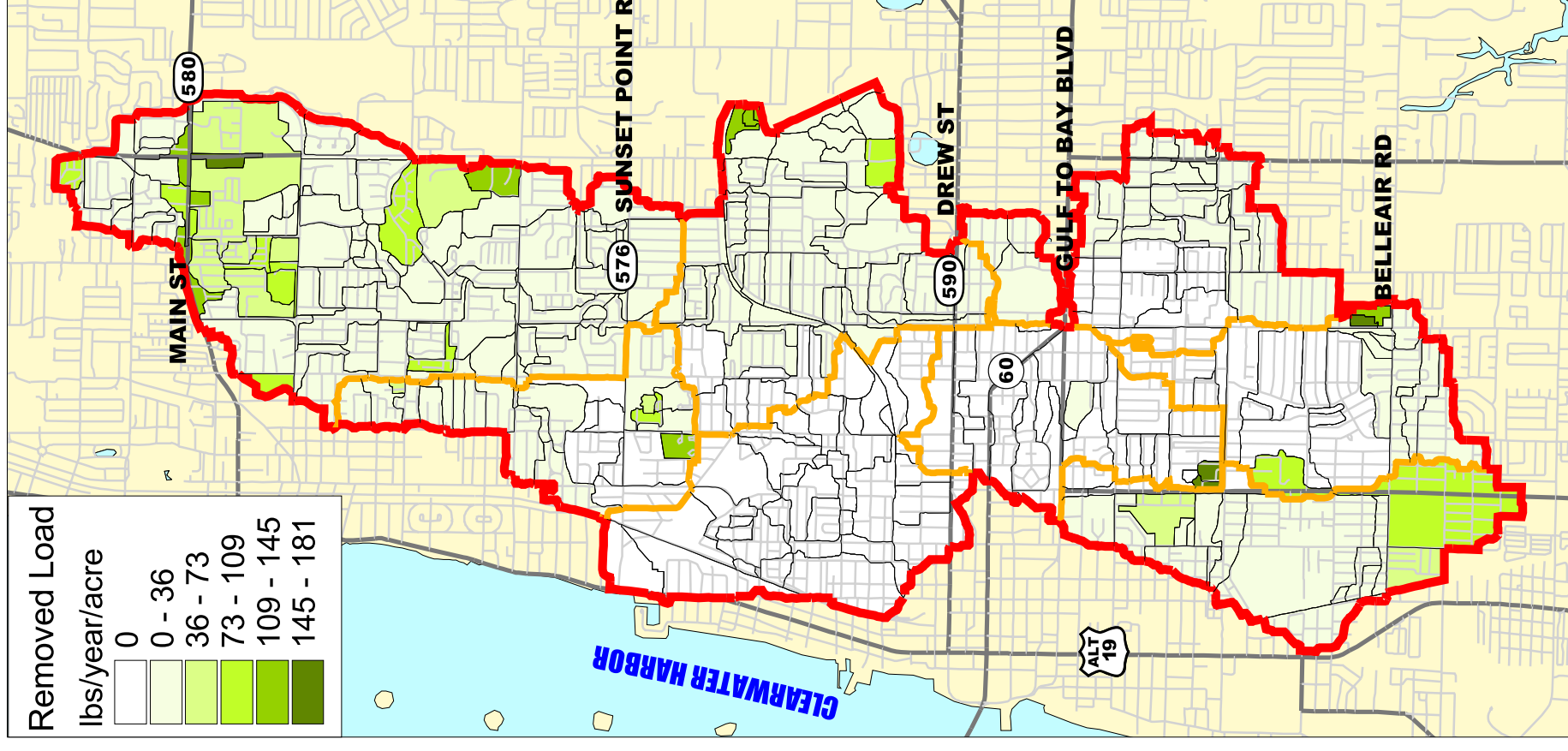
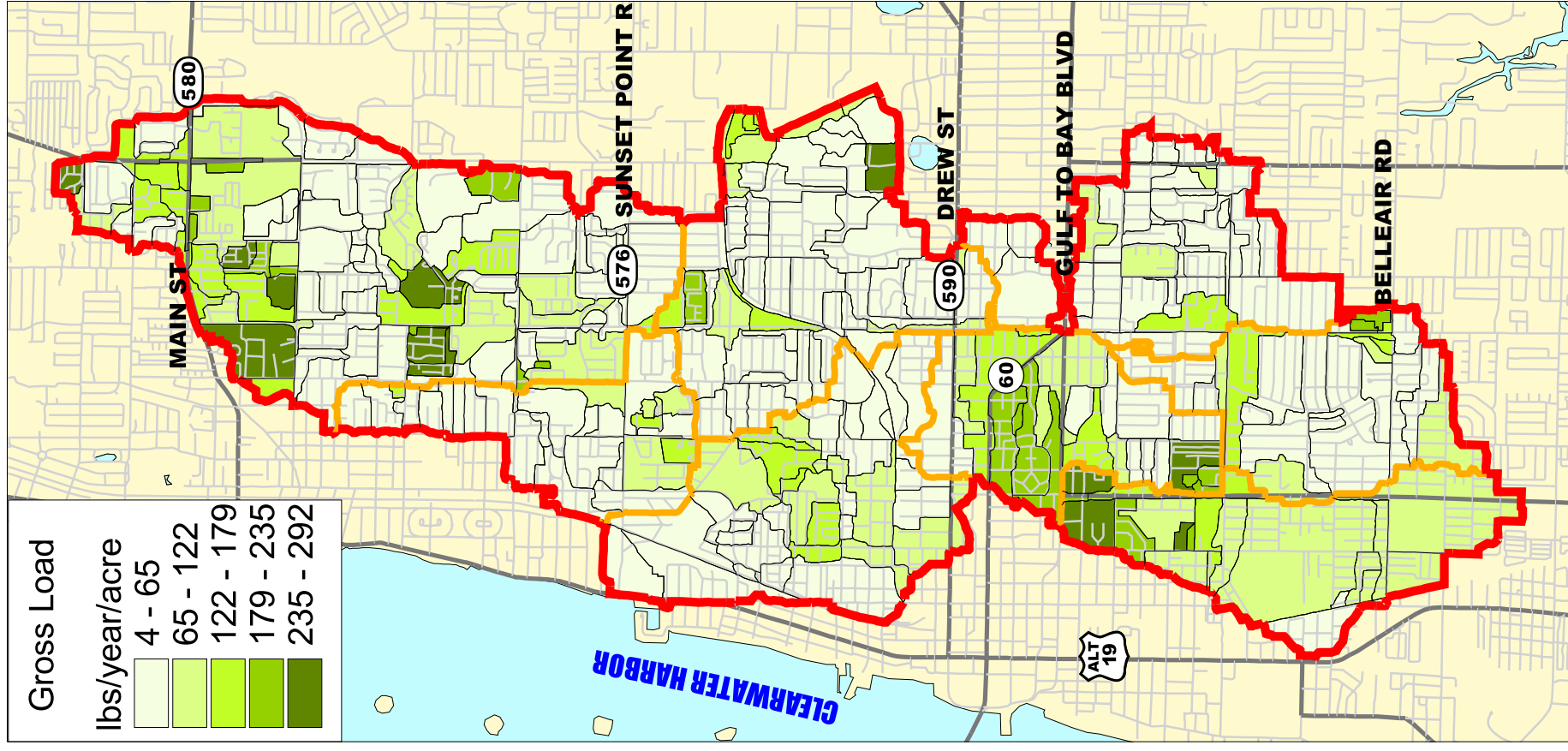


Subbasin Loading - BOD



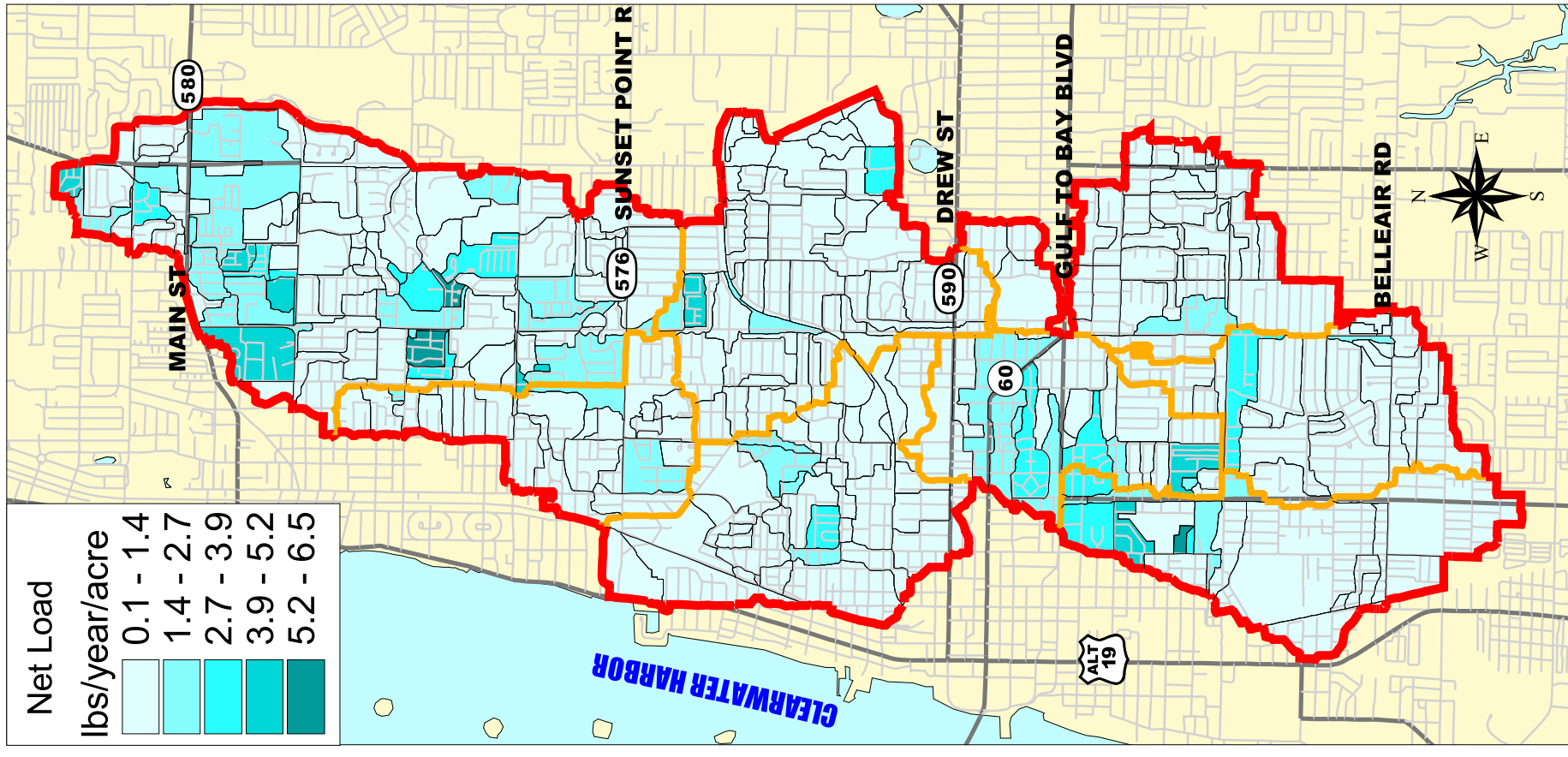
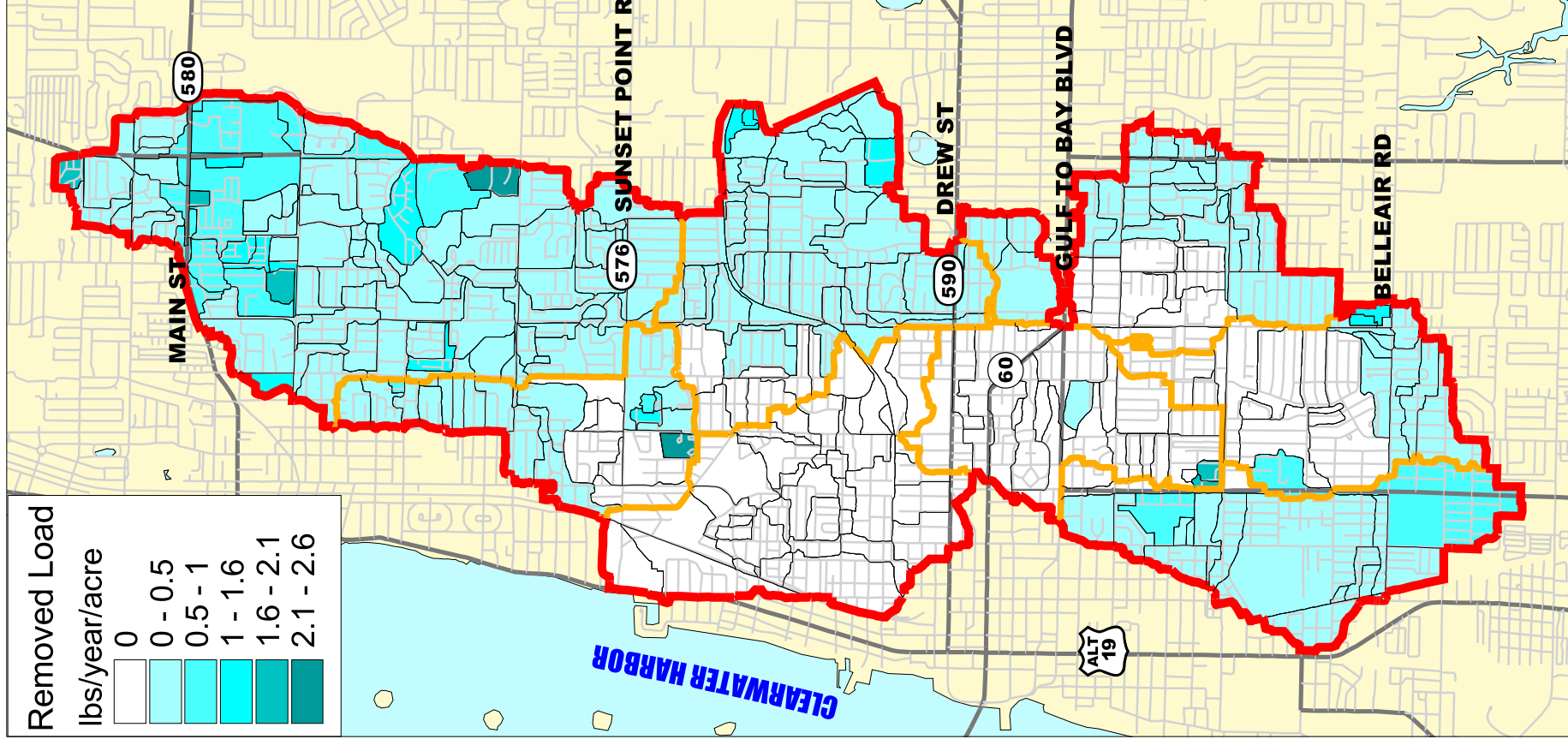
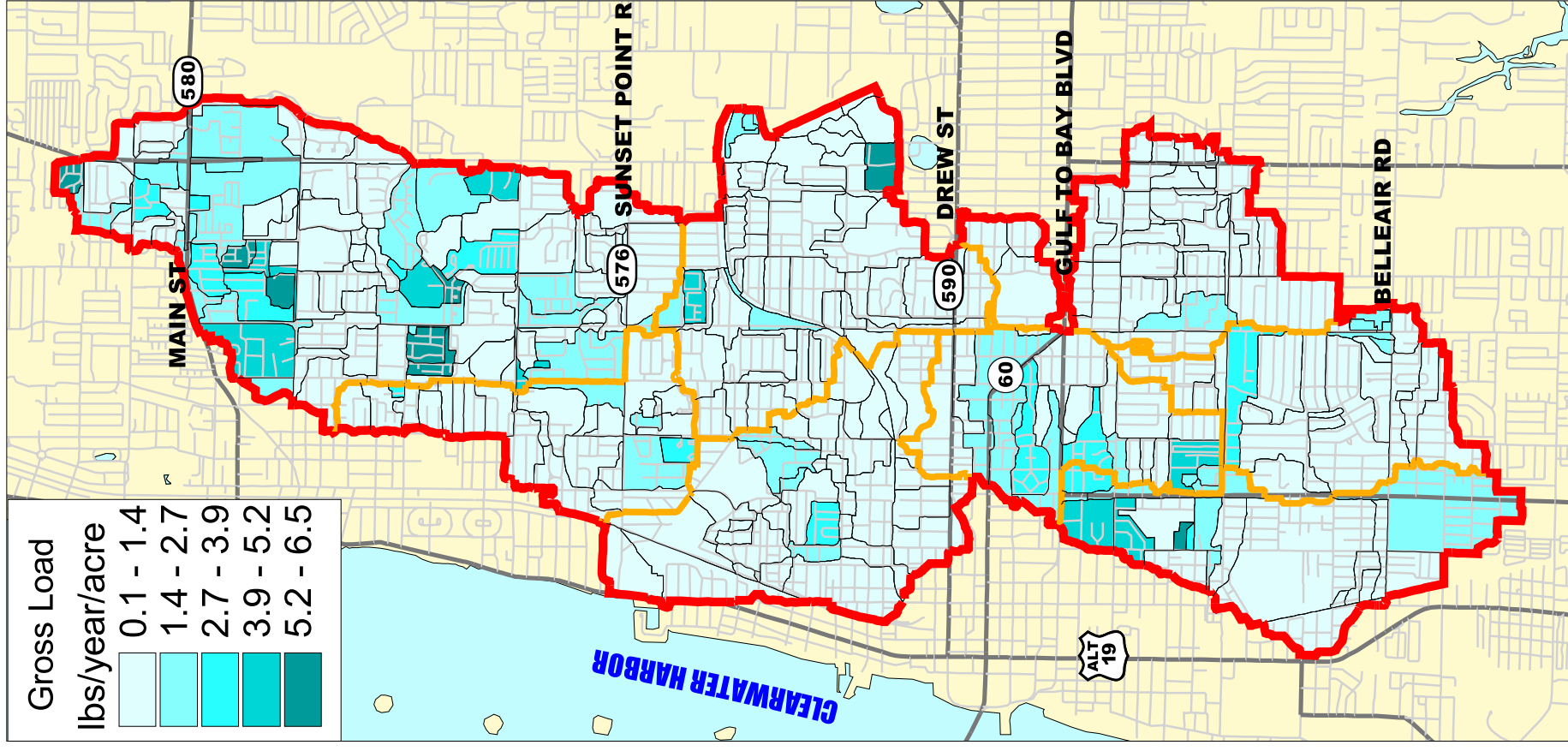


Subbasin Loading - Nitrogen

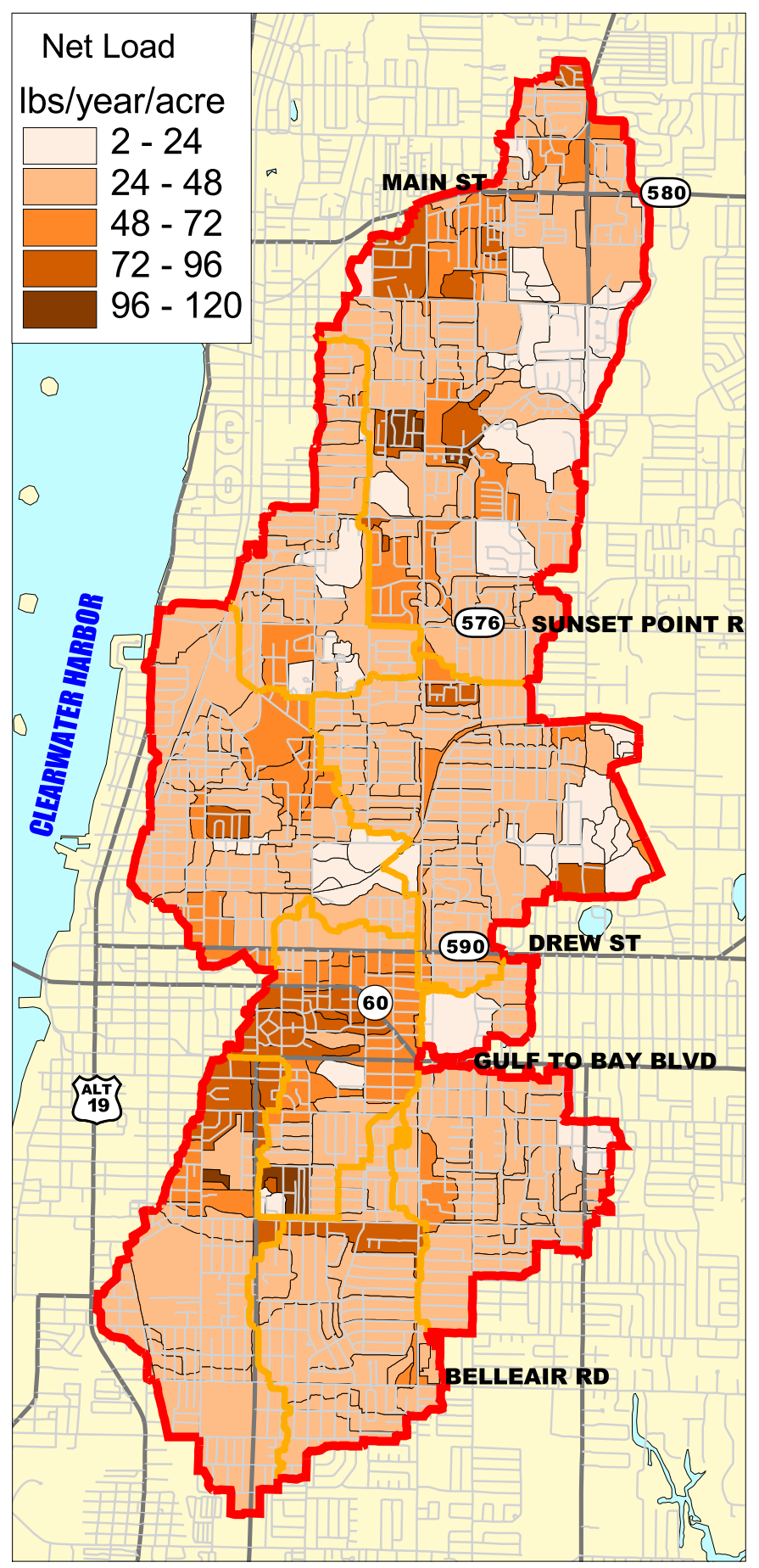
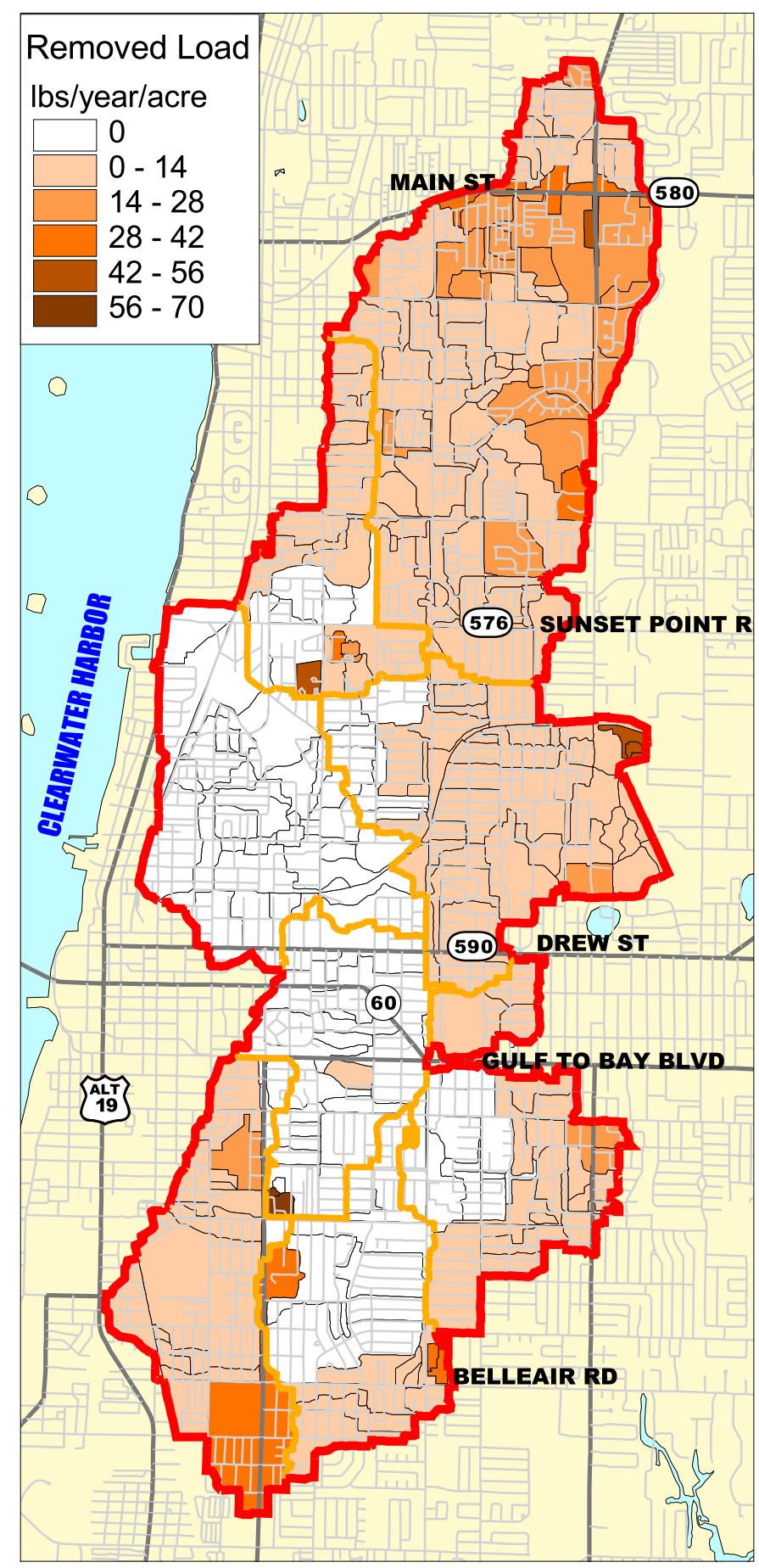
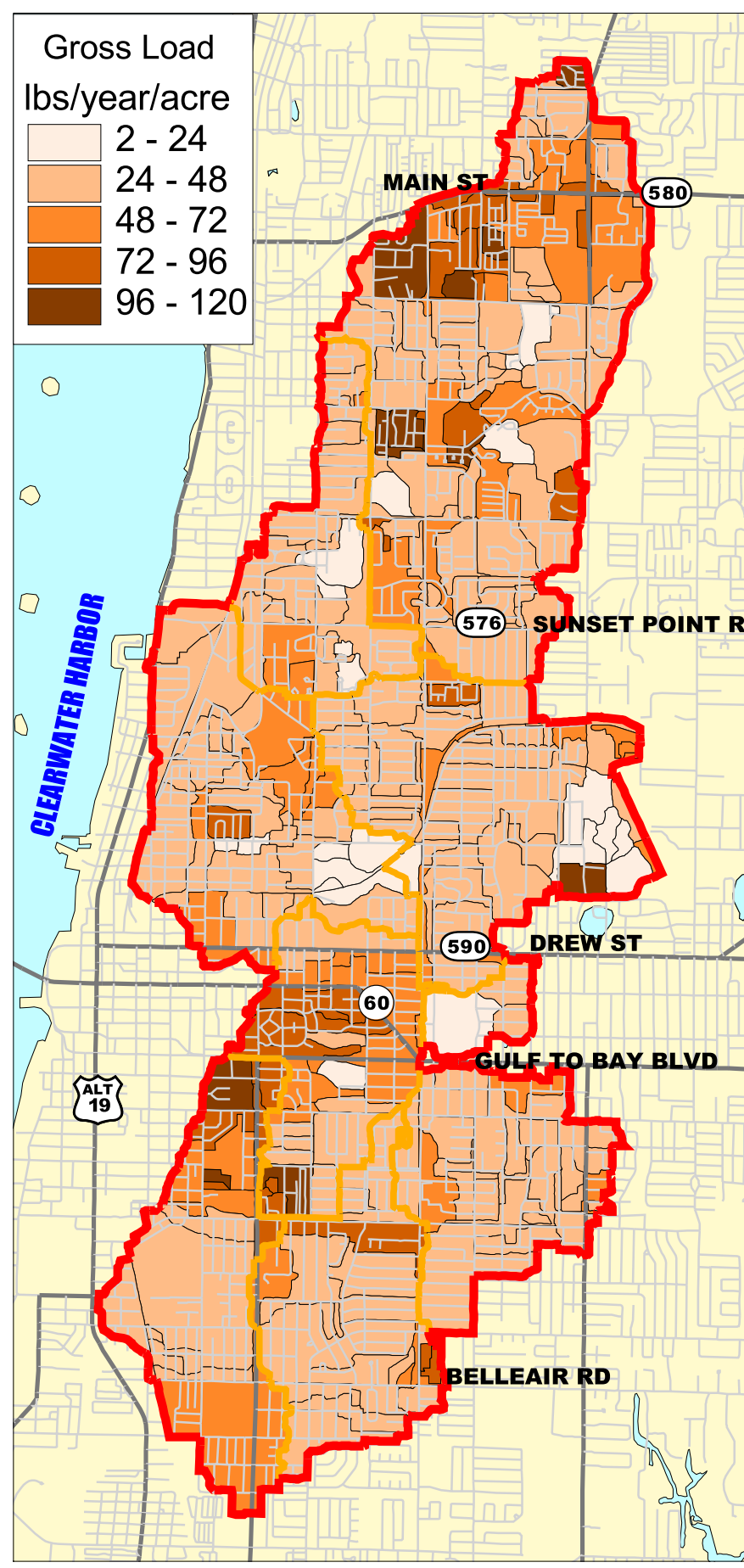


Subbasin Loading - TSS

0 2000 4000 6000 Feet

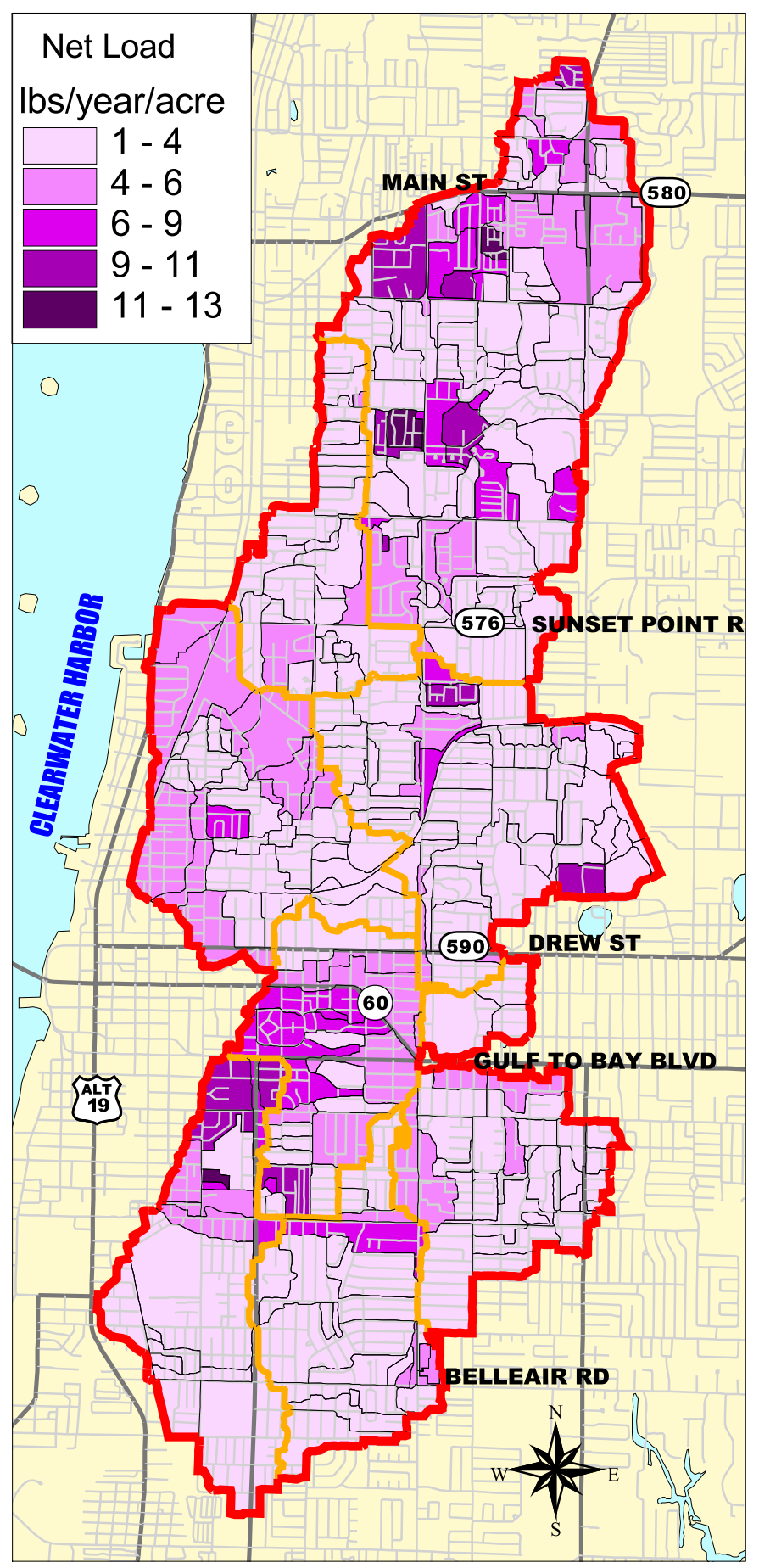
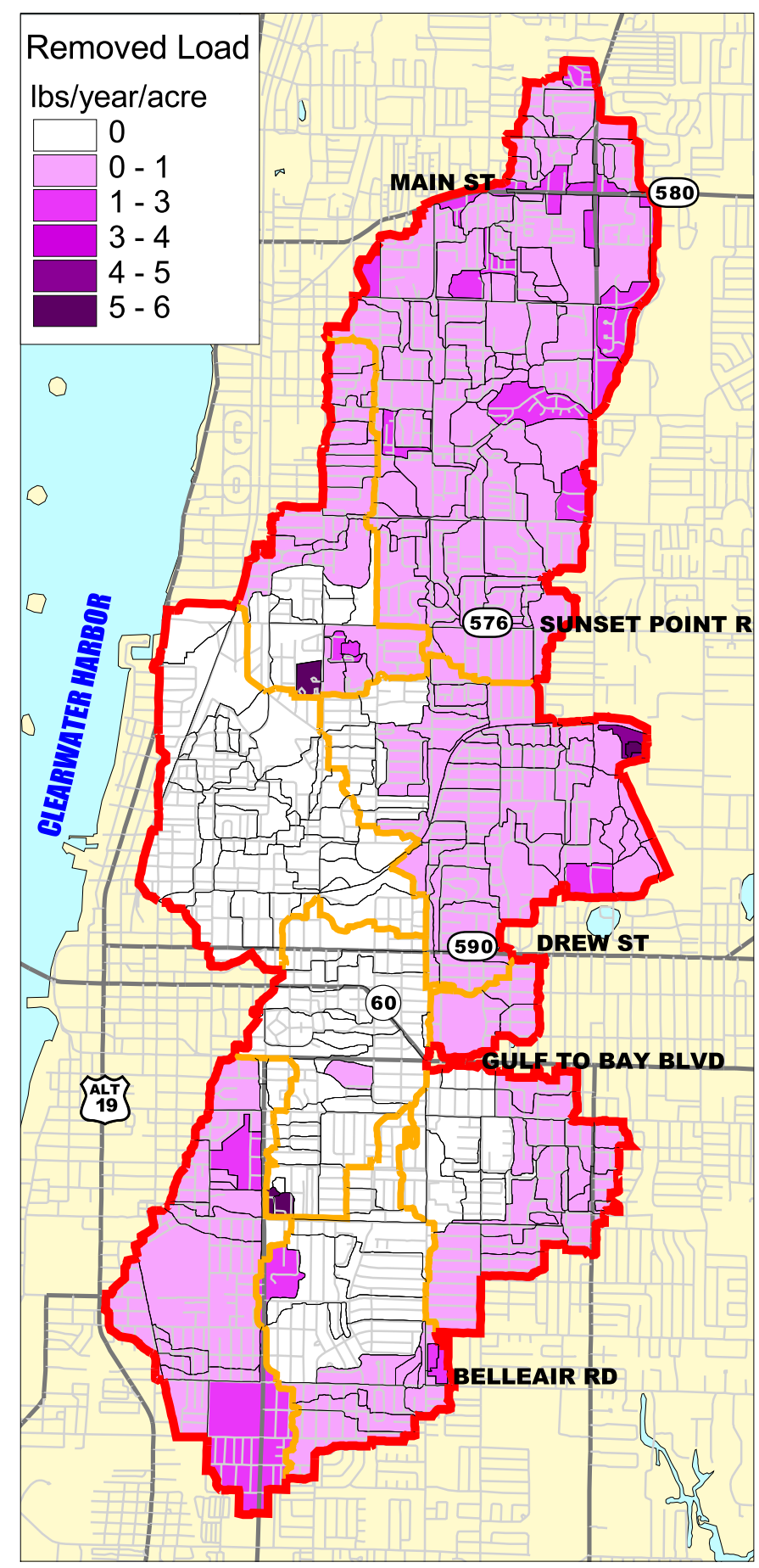
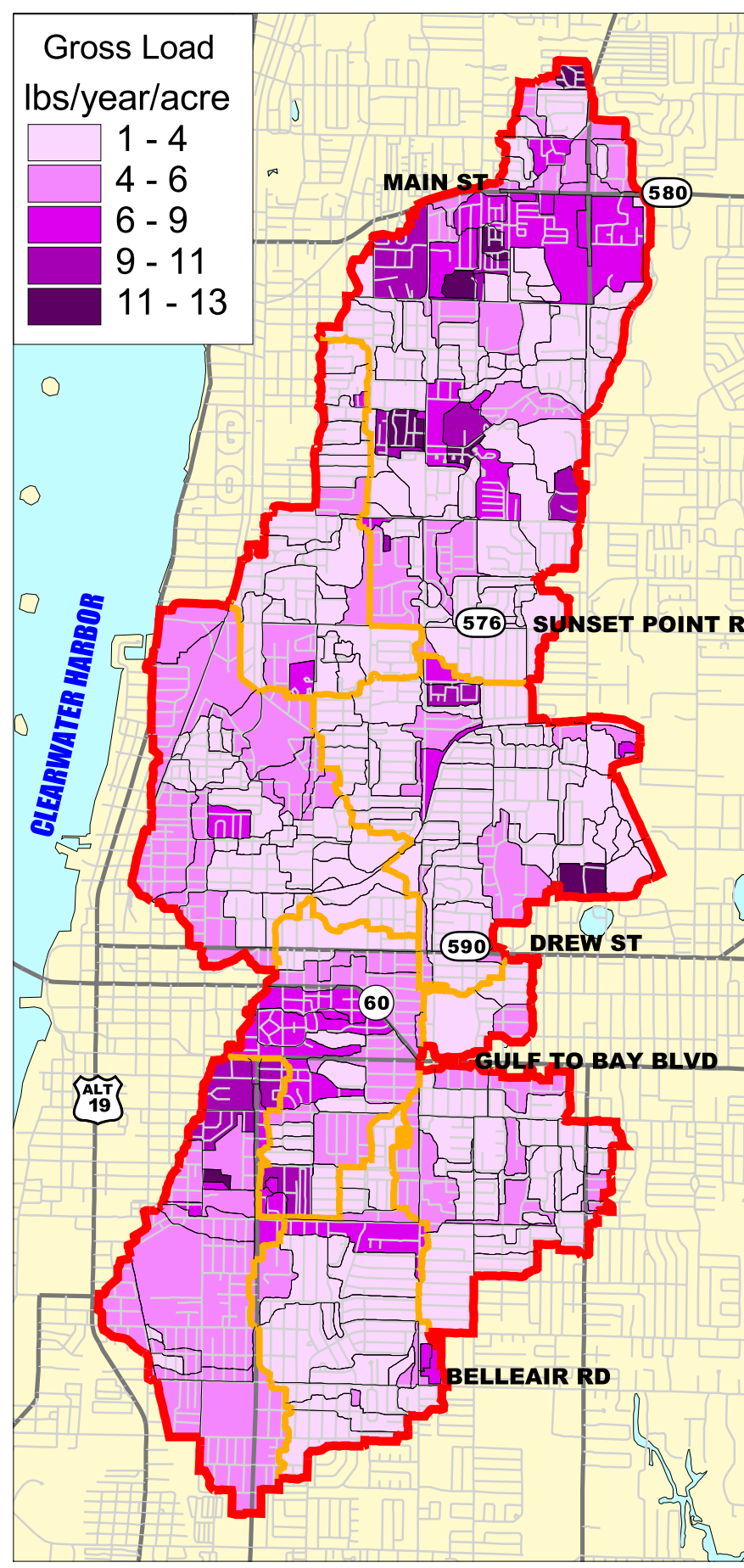


Subbasin Loading - Phosphorus



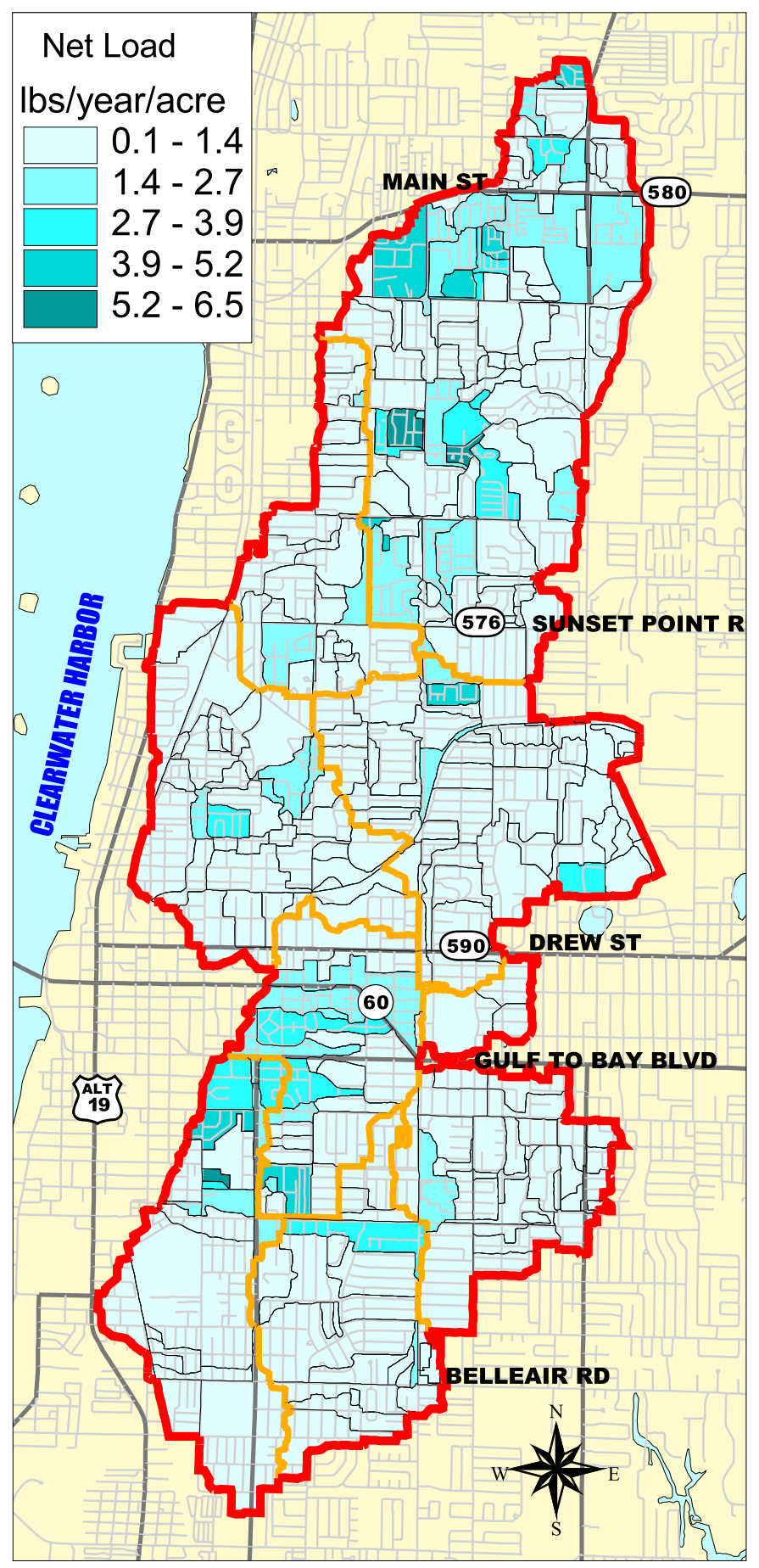
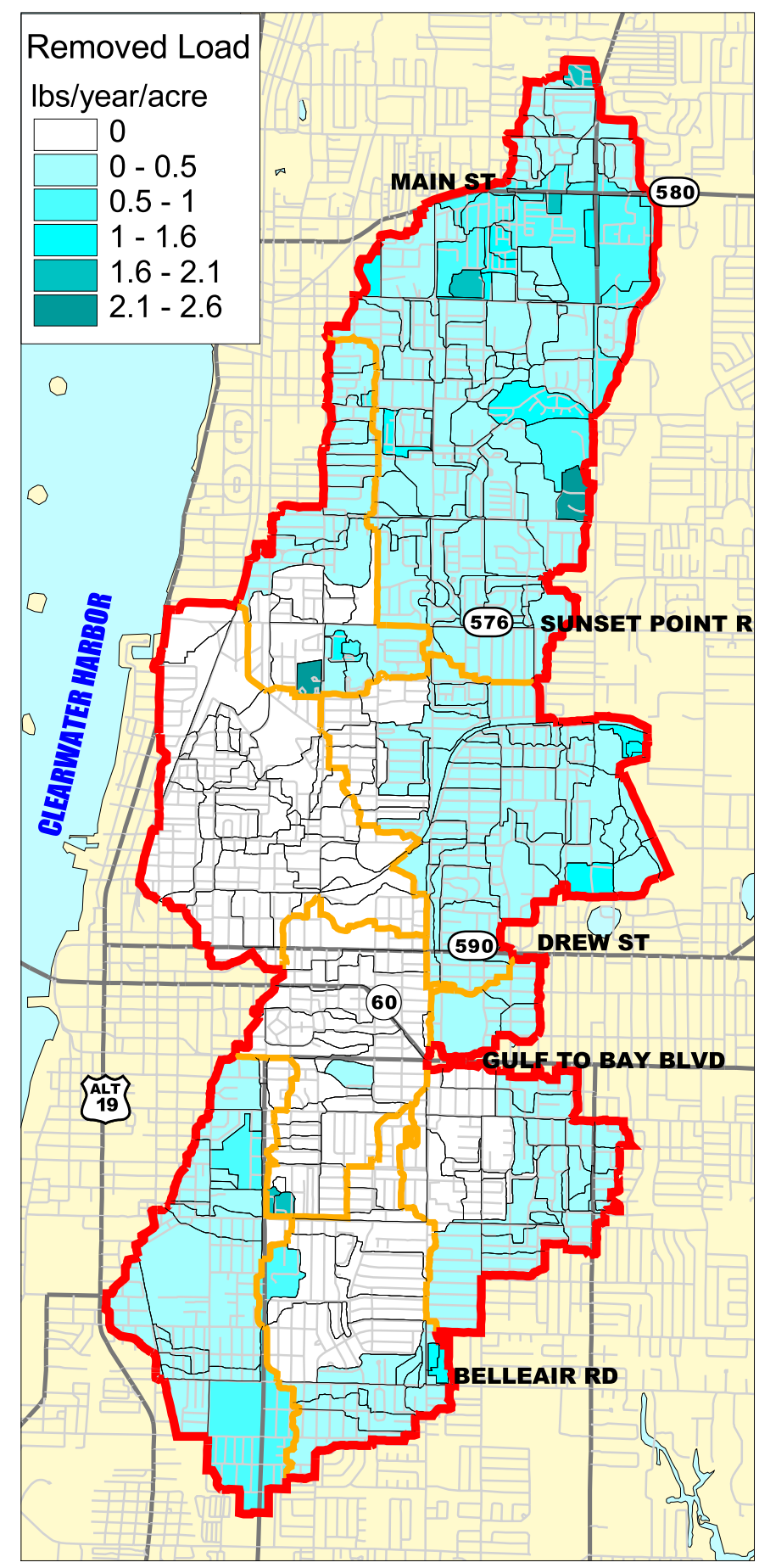
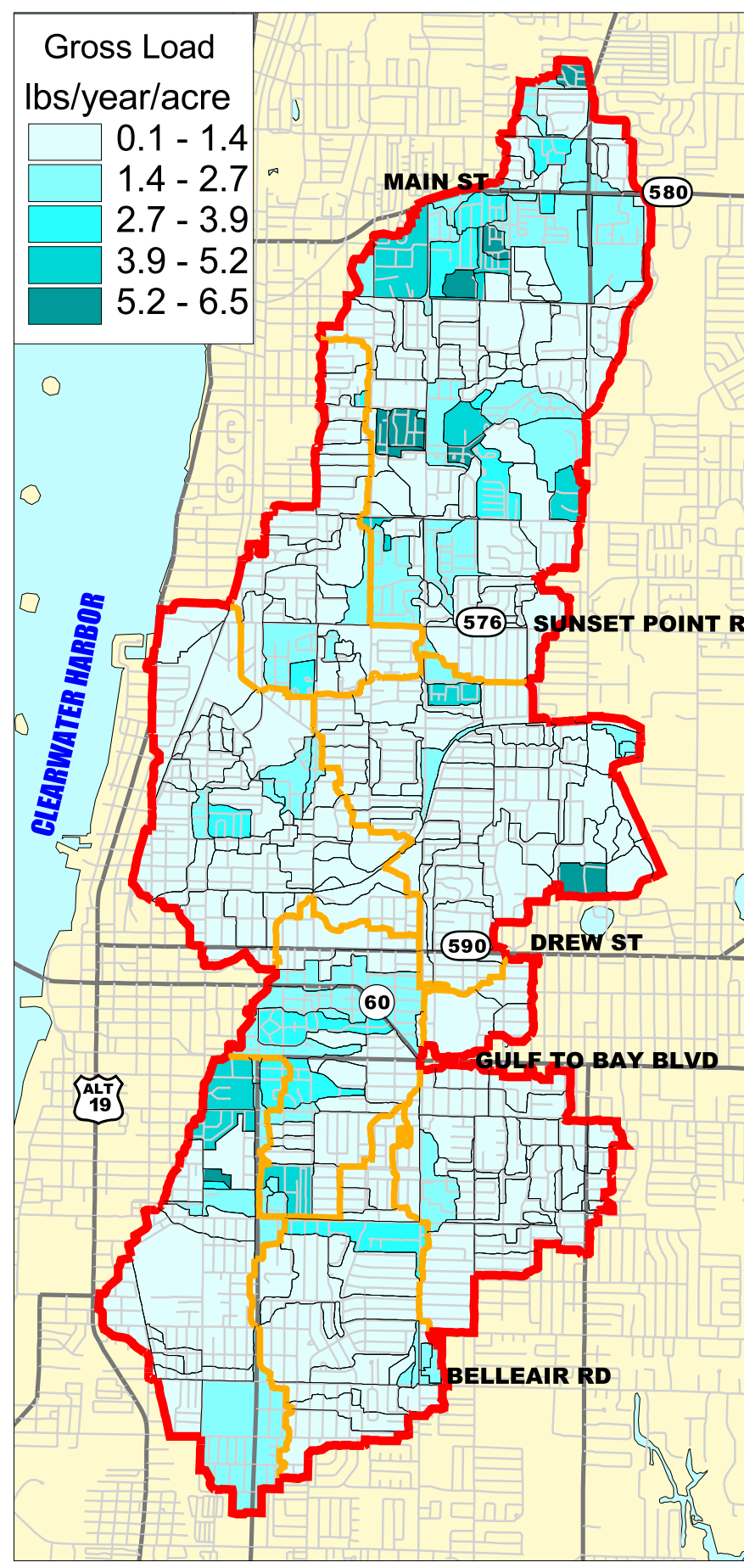
Subbasin Loading - BOD

0 2000 4000 6000 Feet

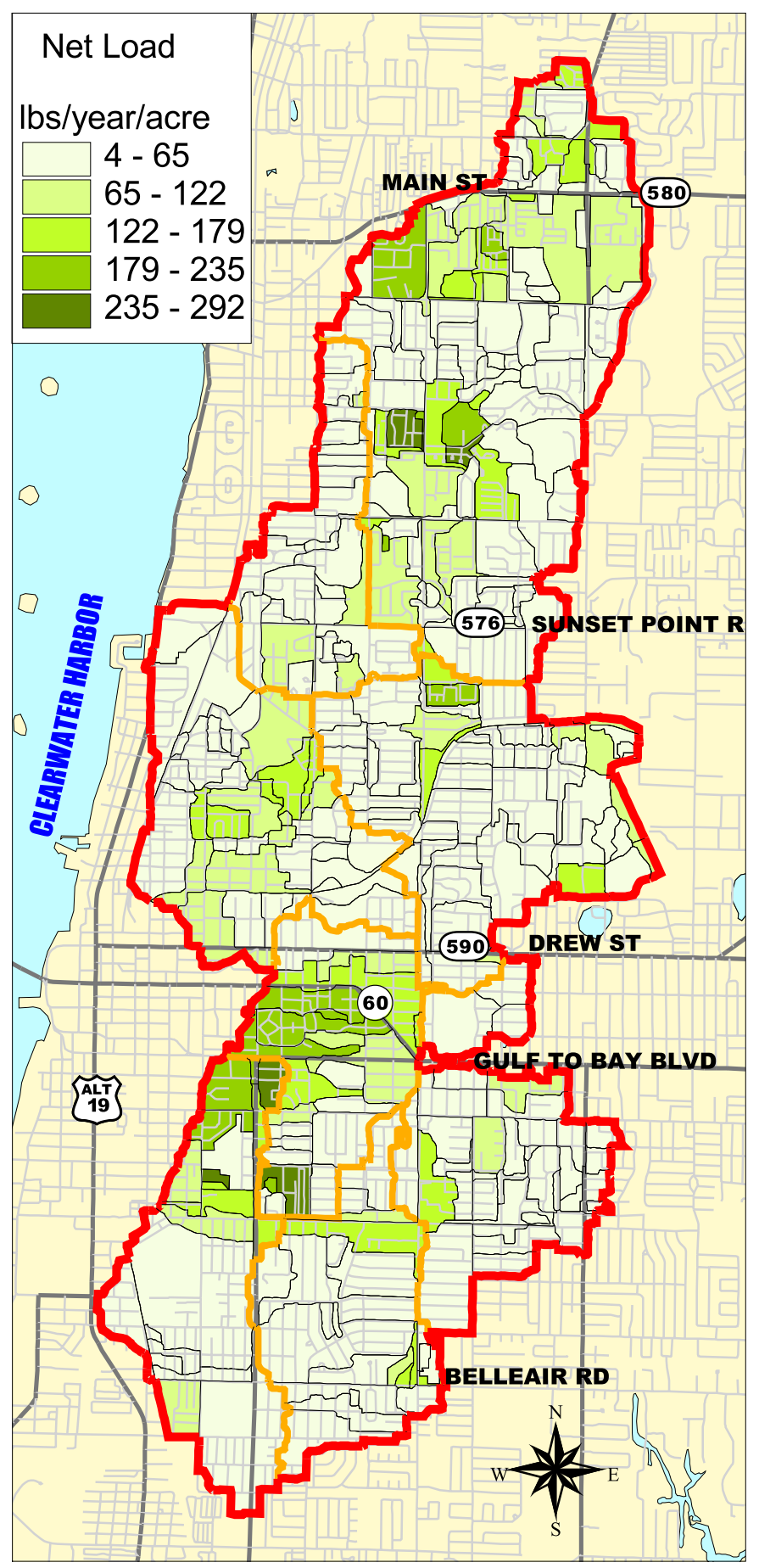
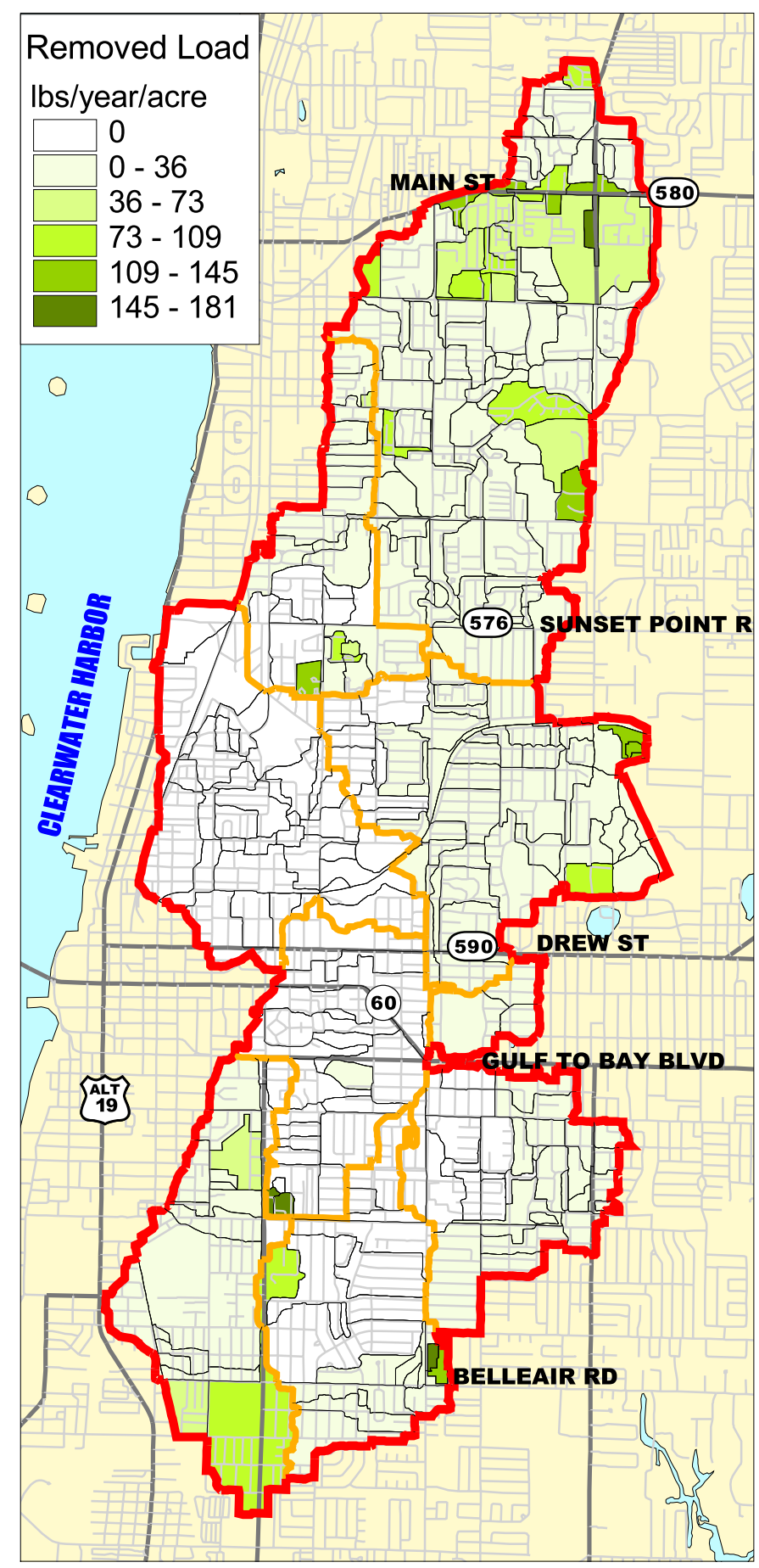
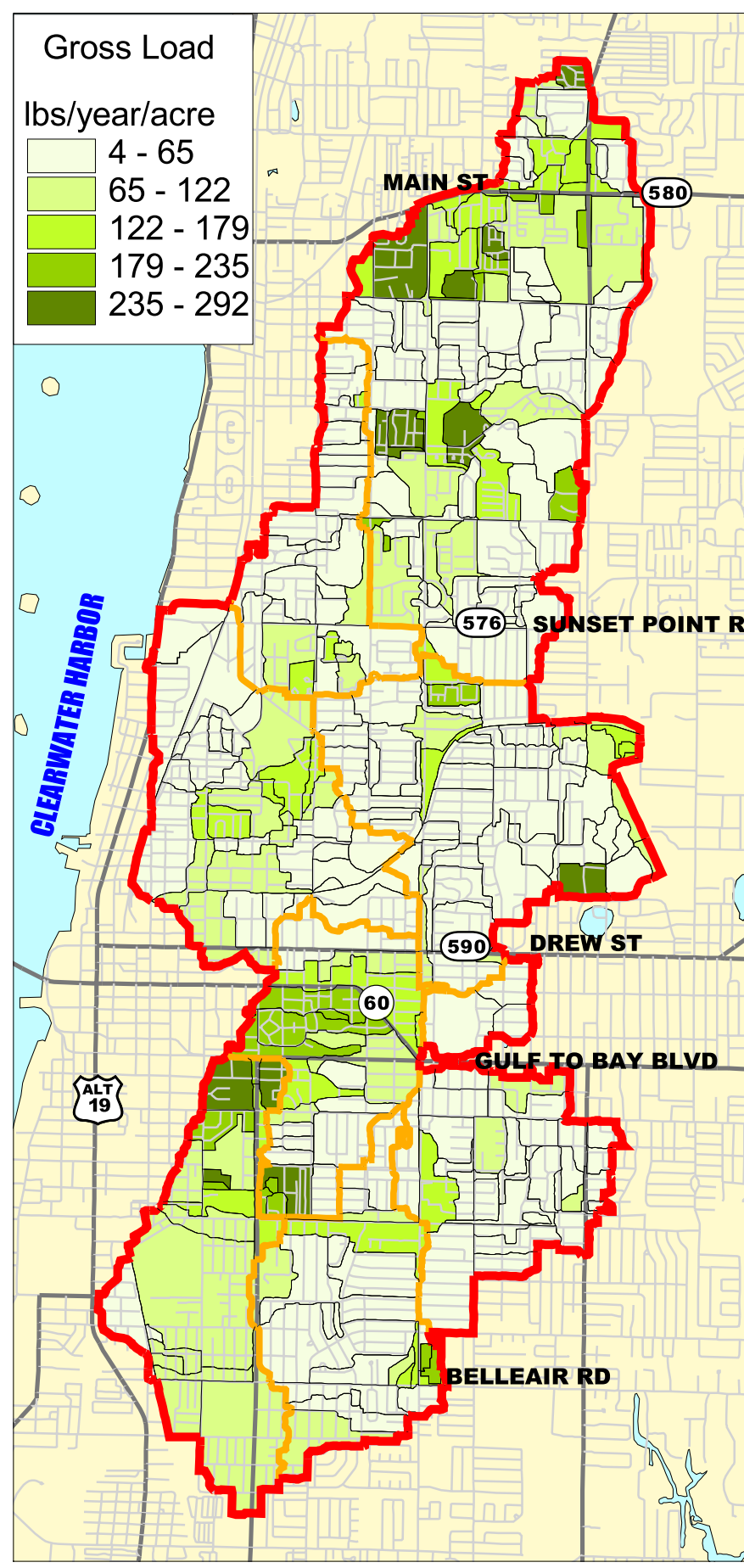


Subbasin Loading - Nitrogen

0 2000 4000 6000 Feet



Subbasin Loading - Phosphorus



Subbasin Loading - TSS