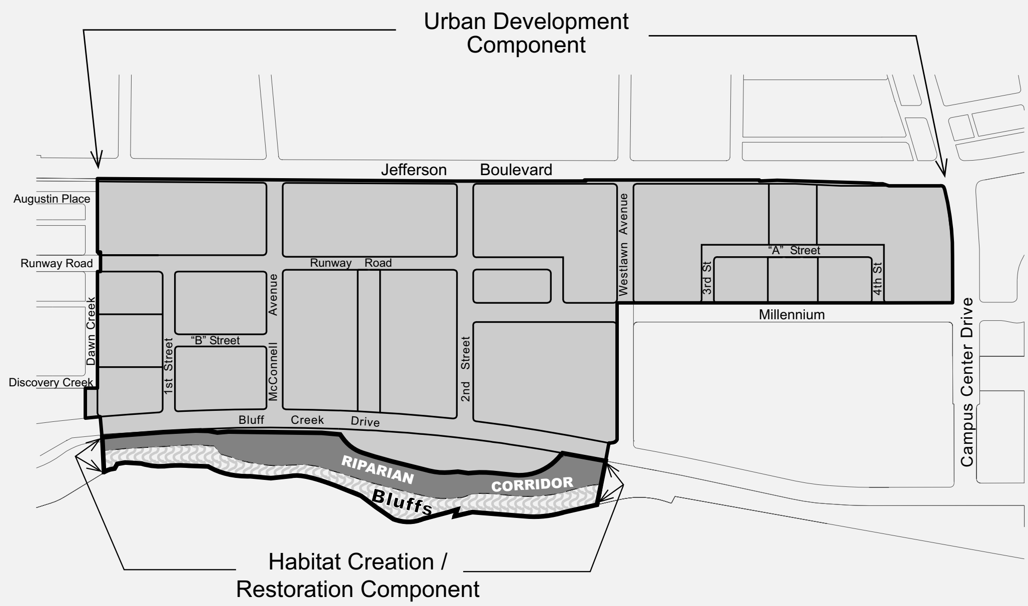
DRAFT ENVIRONMENTAL IMPACT REPORT

(DEIR)

VILLAGE AT PLAYA VISTA



VOLUME VIII

TECHNICAL APPENDIX F

F. WATER RESOURCES

City of Los Angeles/EIR No. ENV-2002-6129-EIR

2003

STATE CLEARINGHOUSE NO. 2002111065

DRAFT

ENVIRONMENTAL IMPACT REPORT (EIR)

VILLAGE AT PLAYA VISTA

TECHNICAL APPENDICES

VOLUME VIII

APPENDIX F:

WATER RESOURCES TECHNICAL APPENDIX

City of Los Angeles
EIR No. ENV-2002-6129-EIR

State Clearinghouse
No. 2002111065

2003

TABLE OF CONTENTS

Appendix Number	Title

VOLUME VIII

F **Water Resources Technical Appendix**

F-1 Camp Dresser & McKee, Psomas, and GeoSyntec Consultants, Water Resources Technical Report for The Village at Playa Vista, Volumes I–III, August 2003.

<u>Other Water Resources Appendices</u>:

SEE VOLUME IX for:

F-1 (Continued) *Camp Dresser & McKee, Psomas, and GeoSyntec Consultants, Water Resources Technical Report for The Village at Playa Vista, Volumes I–III, August 2003. (Continued)*

F-2 *Surface Water Resources, Inc., "The Ballona Freshwater Wetland System: Operations, Maintenance and Monitoring Manual," October 2001 (as amended)*

SEE VOLUME X for:

F-2 (Continued) *Surface Water Resources, Inc., "The Ballona Freshwater Wetland System: Operations, Maintenance and Monitoring Manual," October 2001, as amended. (Continued)*

APPENDIX F:

WATER RESOURCES TECHNICAL APPENDIX

APPENDIX F-1:

CAMP DRESSER & MCKEE, PSOMAS, AND GEOSYNTEC CONSULTANTS, WATER RESOURCES TECHNICAL REPORT FOR THE VILLAGE AT PLAYA VISTA, VOLUMES I–III, AUGUST 2003

Water Resources Technical Report

The Village at Playa Vista Project Summary

August 2003

Volume I of III

Prepared for:

Playa Capital Company
12555 West Jefferson Boulevard, Suite 300
Los Angeles, California 90066

Prepared by:

CDM
Psomas
URS Greiner Woodward Clyde
GeoSyntec Consultants

CDM Project No. 10610-37605.RT.DEIR

Contents

Section 1 Introduction and Summary 1-1
1.1 Introduction 1-1
1.2 Overview of the Playa Vista First Phase Project and the Proposed Project 1-2
1.2.1 Location 1-2
1.2.2 Land Use History 1-2
1.2.3 Existing General Setting 1-3
1.2.4 Characteristics of the Playa Vista Development Area 1-4
1.2.5 Planned Development of Playa Vista First Phase Project and the Proposed Project 1-4
1.2.6 The Freshwater Wetlands System as an Integral Part of Both the Playa Vista First Phase Project and the Proposed Project 1-5
1.2.6.1 Design and Permitting History of the Freshwater Wetlands System 1-5
1.2.6.2 Prior CEQA Review of the Freshwater Wetlands System 1-8
1.3 Summary 1-9
1.3.1 Surface Hydrology 1-9
1.3.2 Groundwater Hydrology 1-9
1.3.3 Surface Water Quality 1-10
1.3.4 Groundwater Quality 1-10
1.4 List of Acronyms and Abbreviations 1-11
Section 2 Hydrology 2-1
2.1 Introduction 2-1
2.2 Surface Water Hydrology 2-2
2.2.1 Regulatory Framework 2-2
2.2.1.1 Federal Level 2-2
2.2.1.2 Local Level 2-2
2.2.2 Affected Environment/Existing Conditions 2-3
2.2.2.1 Santa Monica Bay 2-3
2.2.2.2 Ballona Creek Watershed 2-3
2.2.2.3 Playa Vista First Phase Project and the Proposed Project 2-4
2.2.2.3.1 Local Watersheds and Drainage Areas 2-4
2.2.2.3.2 Drainage Facilities 2-5
2.2.3 Project Design Features 2-11
2.2.4 Surface Water Hydrology Impact Analysis 2-14
2.2.4.1 Significance Thresholds 2-14
2.2.4.2 Methodology 2-15
2.2.4.3 General Project Effects 2-19
2.2.4.4 Urban Development Component 2-19
2.2.4.4.1 Potential For Flooding 2-19

2.2.4.4.2 Potential to Reduce or Increase the Amount of Surface Water in a Waterbody 2-23
2.2.4.4.3 Potential for Permanent Adverse Change to the Movement of Surface Water 2-25
2.2.4.5 Habitat Creation/Restoration Component 2-26
2.2.4.5.1 Potential for Flooding 2-26
2.2.4.5.2 Potential to Reduce or Increase the Amount of Surface Water in a Waterbody 2-27
2.2.4.5.3 Potential for Permanent Adverse Change to the Movement of Surface Water 2-27
2.2.4.6 Summary of Potential Surface Water Hydrology Impacts 2-27
2.3 Groundwater Hydrology 2-28
2.3.1 Regulatory Framework 2-29
2.3.2 Affected Environment/Existing Conditions 2-29
2.3.2.1 Regional Deep Groundwater System 2-29
2.3.2.2 Local Shallow Groundwater System 2-31
2.3.2.2.1 Hydrogeology/Stratigraphy 2-31
2.3.2.2.2 Site-Wide Groundwater Flow 2-33
2.3.3 Project Design Features 2-34
2.3.4 Groundwater Hydrology Impact Analysis 2-34
2.3.4.1 Significance Thresholds 2-34
2.3.4.2 Methodology 2-34
2.3.4.3 General Project Effects 2-35
2.3.4.4 Urban Development Component 2-36
2.3.4.4.1 Potential for Change in Potable Water Level 2-36
2.3.4.4.2 Potential to Reduce Groundwater Recharge Capacity 2-37
2.3.4.5 Summary of Potential Groundwater Hydrology Impacts 2-38
2.4 Cumulative Impacts 2-39
Section 3 Water Quality 3-1
3.1 Introduction 3-1
3.1.1 Purpose and Scope 3-1
3.1.2 Sources of Information 3-1
3.2 Surface Water Quality 3-1
3.2.1 Regulatory Framework 3-2
3.2.1.1 Federal Level 3-2
3.2.1.1.1 Clean Water Act - National Pollutant Discharge Elimination System (NPDES) 3-2
3.2.1.1.2 Nutrient Guidelines 3-3

3.2.1.1.3 Federal Antidegradation Policy 3-4
3.2.1.2 State Level 3-4
3.2.1.2.1 Basin Plan 3-4
3.2.1.2.2 California Ocean Plan 3-6
3.2.1.2.3 California Toxic Rule 3-6
3.2.1.2.4 NPDES Statewide General Construction Storm Water Permit 3-7
3.2.1.2.5 California Identified Impaired Water Bodies 3-7
3.2.1.2.6 California Non-Point Source Pollution Control Program 3-10
3.2.1.2.7 State's Antidegradation Policy 3-11
3.2.1.3 Local Level 3-12
3.2.1.3.1 Los Angeles County Municipal Stormwater NPDES Program 3-12
3.2.1.3.2 Freshwater Wetlands System Performance Criteria 3-16
3.2.2 Affected Environment/Existing Conditions 3-17
3.2.2.1 Santa Monica Bay 3-18
3.2.2.1.1 Water Quality 3-19
3.2.2.1.2 Sediment Quality 3-20
3.2.2.2 Ballona Channel 3-21
3.2.2.2.1 Water Quality 3-21
3.2.2.2.2 Sediment Quality 3-22
3.2.2.3 Ballona Wetlands 3-23
3.2.2.3.1 Water Quality 3-23
3.2.2.3.2 Sediment Quality 3-24
3.2.2.3.3 Sediment/Upland Soil Quality 3-25
3.2.2.4 Centinela Ditch 3-25
3.2.2.4.1 Water Quality 3-26
3.2.2.4.2 Sediment Quality 3-26
3.2.2.5 Freshwater Marsh 3-26
3.2.2.5.1 Water Quality 3-26
3.2.2.5.2 Sediment Quality 3-27
3.2.2.6 Point Source Pollutant Loadings 3-28
3.2.3 Project Design Features 3-29
3.2.3.1 Freshwater Wetlands System 3-30
3.2.3.2 Other Measures to Reduce Pollutant Loadings 3-32
3.2.4 Surface Water Quality Impact Analysis 3-34
3.2.4.1 Significance Thresholds 3-36
3.2.4.1.1 Numerical (Quantitative) Water Quality Benchmarks 3-37
3.2.4.1.2 Narrative (Qualitative) Water Quality Benchmarks 3-38

3.2.4.2 Methodologies for Assessing Potential Impacts 3-38
3.2.4.2.1 Local Design Requirements (MS4 Permit) 3-39
3.2.4.2.2 Antidegradation Policy 3-41
3.2.4.2.3 Comparison of Predicted Effluent Quality to Water Quality Benchmarks 3-45
3.2.4.2.3.1 California Toxics Rule 3-45
3.2.4.2.3.2 California Ocean Plan 3-48
3.2.4.2.3.3 Ecoregion 6 – Nutrient Guidelines 3-49
3.2.4.2.4 Assessment of Impaired Water Body Identified Parameters 3-50
3.2.4.2.5 Dry-Weather Water Quality 3-52
3.2.4.2.6 Erosion, Sedimentation, and Channel Stability 3-52
3.2.4.3 Pollutant Loading Methodology and Analysis 3-53
3.2.4.3.1 Model Methodology 3-53
3.2.4.3.1.1 Rainfall Analysis 3-55
3.2.4.3.1.2 Runoff Estimation 3-56
3.2.4.3.1.3 Loadings and Concentrations Estimation 3-56
3.2.4.1.2.4 Metals Partitioning 3-57
3.2.4.1.2.5 Pollutant Removal Approximations 3-58
3.2.4.3.2 Input Parameters 3-60
3.2.4.3.2.1 Land Use Areas 3-60
3.2.4.3.2.2 Imperviousness Factors and Runoff Coefficients 3-62
3.2.4.3.2.3 Annual Rainfall Data 3-63
3.2.4.3.2.4 Constituents of Concern 3-63
3.2.4.3.2.5 Los Angeles County Land Use-Based Pollutant Data 3-64
3.2.4.3.2.6 Pollutant Removal Estimates 3-65
3.2.4.4 General Project Effects 3-65
3.2.4.5 Impact: Short-Term Surface/Uplands Construction Impacts on Receiving Waterbodies 3-66
3.2.4.5.1 Sources of Pollutants 3-66
3.2.4.5.2 Impacts of Construction-Related Activities 3-68
3.2.4.6 Impact: Long-Term Project Buildout Impacts on Receiving Waterbodies 3-69
3.2.4.6.1 Numerical Significant Impact Assessment 3-70

3.2.4.6.1.1 Freshwater Wetlands System ... 3-70
3.2.4.6.1.2 Ballona Wetlands ... 3-75
3.2.4.6.1.3 Ballona Channel ... 3-77
3.2.4.6.2 Narrative Significant Impact Assessment ... 3-80
3.2.4.6.2.1 Santa Monica Bay ... 3-80
3.2.4.6.2.2 Municipal Stormwater NPDES Permit (MS4 Permit) ... 3-82
3.2.4.6.2.3 Comparison to Basin Plan Narrative Water Quality Objectives ... 3-85
3.2.4.6.2.4 Comparison to 303(d) Listed Parameters ... 3-90
3.2.4.6.2.5 Channel Stability Evaluation ... 3-101
3.2.4.6.2.6 Assessment of Dry Weather Data ... 3-103
3.2.4.7 Impact: Potential Impacts of Proposed Project Development on the Adjacent Playa Vista First Phase Water Features ... 3-108
3.2.4.8 Cumulative Impacts ... 3-109
3.2.4.9 Summary of Surface Water Impacts ... 3-111
3.3 Groundwater Quality ... 3-115
3.3.1 Regulatory Framework ... 3-115
3.3.1.1 Federal Level ... 3-115
3.3.1.2 State Level ... 3-115
3.3.1.3 Local Level ... 3-116
3.3.2 Affected Environment/Existing Conditions ... 3-116
3.3.2.1 Salinity ... 3-116
3.3.2.2 Other Constituents in Groundwater ... 3-117
3.3.3 Project Design Features ... 3-120
3.3.4 Groundwater Quality Impacts ... 3-121
3.3.4.1 Significance Thresholds ... 3-121
3.3.4.2 Methodology ... 3-122
3.3.4.3 General Project Effects ... 3-122
3.3.4.4 Impact: Short-Term Impacts from Construction Activities ... 3-122
3.3.4.5 Impact: Long-Term Impacts from Changes in Overlying Land Uses ... 3-125
3.3.4.6 Summary of Groundwater Quality Impacts ... 3-127
3.3.4.7 Cumulative Effects ... 3-127

Appendices

Appendix A	Proposed Project Flood Hydrology (Psomas)
Appendix B	Playa Vista Water Sediment Quality Existing Data Review Report (CDM)
Appendix C	Water Quality Control Plan - Los Angeles Region Section 2
Appendix D	Stormwater Rainfall Analysis (URSGWC)
Appendix E	Stormwater EMC Analysis (GeoSyntec Consultants)
Appendix F	Pollutant Loading Model Spreadsheet Results (GeoSyntec Consultants)
Appendix G	Estimating the Variance of Modeled Metals (GeoSyntec Consultants)

List of Figures

Figure 1-1	Regional Location Map	1-15
Figure 1-2	Site Vicinity Map	1-16
Figure 1-3	Playa Vista Development Area	1-17
Figure 2-1	Flood Insurance Rate Map Flood Zones	2-42
Figure 2-2	Regional Hydrological Setting	2-43
Figure 2-3	Ballona Creek Watershed	2-44
Figure 2-4	Pre-First Phase Drainage System and Hydrology	2-45
Figure 2-5	Drainage System and Associated Hydrology with Adjacent Playa Vista First Phase Project and Proposed Project	2-46
Figure 2-6	Regional Groundwater Hydrologic Basins	2-47
Figure 2-7	General Aquifer Cross-Section	2-48
Figure 2-8	General Stratigraphic Column of Alluvium Typical of Proposed Project Site	2-49
Figure 3-1	Playa Vista Existing Data Approximate Water, Sediment, and Soil Sampling Locations	3-129
Figure 3-2	Examples of Project BMPs	3-130

List of Tables

Table 2-1 Pre-First Phase Drainage System Capacity
Table 2-2 Stormwater Flows to the Freshwater Marsh and Ballona Wetlands
Table 2-3 50-Year Peak Runoff
Table 2-4 Total Peak 50-year Runoff Rates and Volumes of Total Flows to the Ballona Wetlands
Table 2-5 Total Stormwater Runoff and Percentage of Total Flows to the Ballona Channel
Table 2-6 Total Stormwater Runoff and Percentage of Total Flows to the Freshwater Marsh and Ballona Wetland
Table 2-7 Total Stormwater Runoff and Percentage of Total Flows to the Riparian Corridor
Table 2-8 Estimated Groundwater Recharge from Precipitation[a]
Table 3-1 Proposed Beneficial Uses of Project Drainages
Table 3-2 Listed Water Quality Parameters for Ballona Creek Estuary, Ballona Wetland, and Santa Monica Bay
Table 3-3 Selected* Water Quality Constituents in Santa Monica Bay During Dry-Weather
Table 3-4 Selected* Water Quality Constituents in Santa Monica Bay During Wet-Weather
Table 3-5 Selected* Sediment Quality Constituents in Santa Monica Bay
Table 3-6 Selected* Water Quality Constituents in Ballona Channel During Dry-Weather
Table 3-7 Selected* Water Quality Constituents in Ballona Channel During Wet-Weather
Table 3-8 Selected* Sediment Quality Constituents in Ballona Channel
Table 3-9 Selected* Water Quality Constituents in Ballona Wetlands During Dry-Weather
Table 3-10 Selected* Water Quality Constituents in Ballona Wetlands During Wet-Weather
Table 3-11 Selected* Sediment Quality Constituents in Ballona Wetlands
Table 3-12 Selected* Sediment/Upland Soil Quality Constituents in Ballona Wetlands
Table 3-13 Selected* Water Quality Constituents in Centinela Ditch During Dry-Weather
Table 3-14 Selected* Sediment Quality Constituents in Centinela Ditch
Table 3-15 Selected* Water Quality Constituents in Freshwater Marsh During Dry-Weather
Table 3-16 Groundwater Remediation Facility Discharge Water Quality and Construction Dewatering Discharge Water Quality
Table 3-17 Pollutant Removal Approximations for Water Quality Inlets Used in Pollutant Loading Model
Table 3-18 Effluent Quality Approximations for the Freshwater Marsh and Ballona Wetlands Used in Pollutant Loading Model

Table 3-19 Pollutant Removal Approximations for Riparian Corridor and Centinela Ditch Used in Pollutant Loading Model
Table 3-20 Pollutant Removal Approximations for Bioswales Used in Pollutant Loading Model
Table 3-21 Numerical Water Quality Benchmarks of the Modeled Parameters
Table 3-22 Summary of SUSMP Requirements and Corresponding Playa Vista Measures
Table 3-23 Equation 3-1 Parameters to Be Used to Estimate Receiving Water Hardness
Table 3-24 Ratio of Wet Weather to Dry Weather Hardness in Freshwater Marsh Tributaries
Table 3-25 Nutrient Data from Rivers and Streams in Ecoregion 6 of Aggregate Ecoregion III
Table 3-26 National Climatic Data Center Weather Station Information
Table 3-27 Fractionation Values Used to Estimate Dissolved Metals Loads and Concentrations
Table 3-28 Land Use by Drainage System Pre-First Phase
Table 3-29 Land Use by Drainage System with Playa Vista First Phase
Table 3-30 Land Use by Drainage System with Playa Vista First Phase and Proposed Project
Table 3-31 Comparison of Hydrology Land Uses and Pollutant Loading Model Land Use
Table 3-32 Summary of Land Use Imperviousness Factors
Table 3-33 Event Mean Concentrations for Stormwater Runoff By Land Use
Table 3-34a Representative Stormwater Loads to the Freshwater Wetlands System Prior to the First Phase Project
Table 3-34b Representative Stormwater Concentrations to the Freshwater Wetlands System Prior to the First Phase Project
Table 3-35a Representative Stormwater Loads to the Freshwater Wetlands System with Playa Vista First Phase Project
Table 3-35b Representative Stormwater Concentrations to the Freshwater Wetlands System with Playa Vista First Phase and Proposed Project
Table 3-36a Representative Stormwater Loads to the Freshwater Wetlands System with Playa Vista First Phase and Proposed Project
Table 3-36b Representative Stormwater Concentrations to the Freshwater Wetlands System with Playa Vista First Phase and Proposed Project
Table 3-37 Representative Stormwater Loads and Concentrations in the Riparian Corridor/Centinela Ditch at West Boundary of Proposed Project Predicted Average Loads*
Table 3-38 Representative Stormwater Loads and Concentrations in the Riparian Corridor/Centinela Ditch at Lincoln Boulevard
Table 3-39 Representative Stormwater Loads and Concentrations to the Riparian Corridor/Lincoln Storm Drain South Primary Management Area
Table 3-40 Representative Stormwater Loads and Concentrations to the Central Storm Drain Primary Management Area

Table 3-41 Representative Stormwater Loads and Concentrations to the Jefferson Storm Drain Primary Management Area
Table 3-42 Representative Stormwater Loads and Concentrations to the Main Body of the Freshwater Marsh Near the Primary Management Areas
Table 3-43 Representative Stormwater Dissolved Metals Concentrations in the Freshwater Marsh Primary Management Areas Compared to CTR Criteria after Proposed Project
Table 3-44 Representative Stormwater Concentrations in the Primary Management Areas and the Main Body of the Freshwater Marsh Compared to Nutrient Water Quality Benchmarks After Proposed Project
Table 3-45 Representative Stormwater Concentrations in the Primary Management Areas and the Main Body of the Freshwater Marsh Compared to Water Quality Benchmarks After Proposed Project
Table 3-46a Representative Stormwater Loads to the Ballona Wetlands Prior to the First Phase Project
Table 3-46b Representative Stormwater Concentrations to the Ballona Wetlands Prior to the First Phase Project
Table 3-47a Representative Stormwater Loads to the Ballona Wetlands with Playa Vista First Phase Project
Table 3-47b Representative Stormwater Concentrations to the Ballona Wetlands with Playa Vista First Phase Project
Table 3-48a Representative Stormwater Loads to the Ballona Wetlands with Playa Vista First Phase and Proposed Project
Table 3-48b Representative Stormwater Concentrations to the Ballona Wetlands with Playa Vista First Phase and Proposed Project
Table 3-49 Predicted Influent Loads and Concentrations to the Ballona Wetlands from the Freshwater Wetlands System
Table 3-51 Comparison of Water Quality Benchmarks in the Influent to the Ballona Wetlands From the Freshwater Marsh After Proposed Project
Table 3-52a Representative Stormwater Loads to the Ballona Channel Prior to the First Phase Project
Table 3-52b Representative Stormwater Concentrations to the Ballona Channel Prior to the First Phase Project
Table 3-53a Representative Stormwater Loads to the Ballona Channel with Playa Vista First Phase Project
Table 3-53b Representative Stormwater Concentrations to the Ballona Channel with the Playa Vista First Phase Project Summary Concentrations
Table 3-54a Representative Stormwater Loads to the Ballona Channel with Playa Vista First Phase and Proposed Project
Table 3-54b Representative Stormwater Concentrations to the Ballona Channel with Playa Vista First Phase and Proposed Project

Table 3-55 Predicted Influent Loads and Concentrations to the Ballona Channel From the Combined Effluent of the Freshwater Marsh and the Ballona Wetlands
Table 3-56 Representative Stormwater Dissolved Metals Concentrations of Discharges to the Ballona Channel from the Freshwater Marsh Compared to Saltwater CTR Criteria *
Table 3-57 Comparison of Water Quality Benchmarks in the Influent to the Ballona Channel From the Freshwater Marsh After Proposed Project
Table 3-58 Comparison of Proposed Project to Basin Plan Narrative Objectives
Table 3-59 Recommended Permissible Velocities
Table 3-60 Dry Weather Water Quality Data for Freshwater Marsh Inlets and Outlet
Table 3-61 Chronic CTR Criteria Compared to Dry Weather Data

Section 1
Introduction and Summary

1.1 Introduction

This report presents a technically based analysis of the potential hydrologic and water quality impacts associated with implementation of The Village at Playa Vista (Proposed Project). For the purpose of analyzing the impacts of the Proposed Project, this report considers as a whole the pre-First Phase condition against the Proposed Project condition. The analysis also indicates the change between the adjacent Playa Vista First Phase Project conditions and Proposed Project conditions. The adjacent Playa Vista First Phase Project and the Proposed Project encompass approximately 474 acres located at the western edge of the Los Angeles metropolitan area just north of Los Angeles International Airport (LAX). Land use plans for the adjacent Playa Vista First Phase Project, which encompasses approximately 363 acres of the Playa Vista Property, were approved in 1993 and modified in 1995, and development is currently under way. The adjacent Playa Vista First Phase Project includes Vesting Tentative Tract Map (VTTM) No. 49104 and Tentative Tract Map (TTM) No. 52092. Land use and development plans for the remainder of the property are currently proposed as the Proposed Project. A Draft Environmental Impact Report (EIR) evaluating the potential impacts of the Proposed Project is currently being prepared. The following analysis of hydrology and water quality provides technical data and analysis for use in the Proposed Project's Draft EIR. The analysis addresses the Proposed Project for the California Environmental Quality Act (CEQA) evaluation. CEQA requires detailed consideration of the Proposed Project and a general comparative evaluation of alternatives.

A comprehensive description of the Proposed Project, as addressed in this technical report, is provided in Section II – Project Description of the Proposed Project's Draft EIR. The contents of this technical report are as follows:

- Section 1 - Introduction and Summary provides a description of the purpose and content of the report, as well as an overview of the history and characteristics of the adjacent Playa Vista First Phase Project and the Proposed Project. This section also summarizes the key findings of the water resources analyses.

- Section 2 - Hydrology provides an evaluation of surface water hydrology, as related to potential flooding and flood control systems, and groundwater hydrology. This section includes a description of the applicable regulatory framework, a description of the existing regional and local hydrology setting for surface water and for groundwater, and an analysis of potential flooding-related hydrology and groundwater hydrology impacts to, and from, the proposed development of the adjacent Playa Vista First Phase Project and the Proposed Project.

- Section 3 - Water Quality provides an evaluation of surface water and groundwater quality, as well as water quantity (hydrology), as it relates to receiving waters. This section includes: a description of the applicable regulatory framework, a description of existing water quality in the Proposed Project area based on past and recent sampling, and an analysis of potential water quality impacts upon completion of the Proposed Project based on the estimated amounts of stormwater system pollutant loading and other water quality-related project characteristics.

As mentioned above, although this report provides technical data and analyses to be used in the Proposed Project's Draft EIR, several aspects of the water resources issues addressed herein should be considered with respect to both the adjacent Playa Vista First Phase Project and the Proposed Project. Specifically, some of the major drainage improvements and water quality treatment features of the adjacent Playa Vista First Phase Project are designed to accommodate both the adjacent Playa Vista First Phase Project and the Proposed Project; hence, the major features of the adjacent First Phase Project were designed to also serve Proposed Project development. To evaluate the impacts of the Proposed Project, it is therefore appropriate to consider the impacts to water quality with the complete buildout of the adjacent Playa Vista First Phase Project and the Proposed Project as compared to conditions both prior to and after completion of the adjacent Playa Vista First Phase Project.

1.2 Overview of the Playa Vista First Phase Project and the Proposed Project

1.2.1 Location

The adjacent Playa Vista First Phase Project and the Proposed Project are located at the western edge of the Los Angeles metropolitan area generally between the communities of Marina del Rey and Westchester. The adjacent Playa Vista First Phase Project and the Proposed Project are bounded by the Westchester Bluffs to the south, the Ballona Wetlands to the west, and the Ballona Channel and Jefferson Boulevard to the north. **Figure 1-1, Regional Location Map,** depicts the general location of Playa Vista in the region; **Figure 1-2, Site Vicinity Map,** illustrates the Proposed Projects local setting; and **Figure 1-3, Playa Vista Development Area,** shows the boundaries of the adjacent Playa Vista First Phase Project and Proposed Project. The Playa Vista First Phase Project and the Proposed Project are within the jurisdictional boundaries of the City of Los Angeles.

1.2.2 Land Use History

Up until approximately the 1920s-1930s, the adjacent Playa Vista First Phase Project and the Proposed Project were primarily undeveloped upland although portions of the property had been used periodically for farming and ranching. In the mid-1920s, the nearby areas were crossed by Culver Boulevard (called Speedway at that time), Jefferson Boulevard, and the Pacific Electric Railroad line, and contained recreational gun clubs and truck farms. In the 1920s and 1930s, Ballona Channel was channelized which cut off the tidal and stormwater flows to much of the Ballona Wetlands. In the 1930s and 1940s, improvements occurring in and near the adjacent Playa Vista First Phase Project and the Proposed Project included the development of numerous oil and gas wells, and associated roads, tanks, sumps and pipelines, primarily north and west of the adjacent Playa Vista First Phase Project and the Proposed Project, and the construction of homes on the dunes of Playa del Rey. Agricultural operations increased as well during that time. From the late 1930s through the early 1960s, Hughes Tools (later changed to Hughes Aircraft Corporation [HAC]) constructed numerous aircraft-related buildings and a runway in the adjacent Playa Vista First Phase Project and the Proposed Project sites. In the 1950s, the majority of the oil wells on-site were taken out of service and the oil extraction operations were converted to natural gas storage operations, which included injection and extraction. Agricultural activities continued in much of the property up through the late 1980s. Industrial activities continued in the adjacent Playa Vista First Phase Project and the Proposed Project sites through the mid-1990s including the manufacturing, testing, and repair of airplanes, helicopters, and defense electronics. On-site manufacturing and industrial activities ceased in 1994 with the relocation of McDonnell Douglas Helicopters Company (MDHC) to Arizona. Since that time, many of the buildings at the former HAC/MDHC Plant Site ("Plant Site") have been demolished or are being reused. Some of the larger remaining structures are used on occasion as indoor studios for filming. In summary, the adjacent Playa Vista First Phase Project and the Proposed Project sites and surrounding areas have undergone numerous modifications and improvements over the past several decades, with almost all of the adjacent Playa Vista First Phase Project and the Proposed Project sites being disturbed either directly or indirectly. For a more detailed discussion of the land use history, refer to Section IV-C, Land Use, in the Proposed Project's Draft EIR.

1.2.3 Existing General Setting

The adjacent Playa Vista First Phase Project and the Proposed Project are set within a very urbanized area and is largely surrounded by a mix of development uses. The adjacent Playa Vista First Phase Project and the Proposed Project sites are currently a mix of vacant and developed land, including areas that are currently being developed as part of the approved Playa Vista First Phase Project.

In terms of physiographic setting, the adjacent Playa Vista First Phase Project and the Proposed Project sites are relatively flat, located in the southern portion of the Ballona Gap, the historic alluvial flood plain of the Los Angeles River. Several portions of the property have been artificially elevated through the placement of fill, some of which occurred recently in conjunction with existing and proposed development on-site. The past landform alterations on and adjacent to the Playa Vista First Phase Project and the Proposed Project, including the channelization of Ballona Channel in the 1920s and 1930s, substantially changed the character and surface hydrology of the site by rerouting some surface flows directly to Santa Monica Bay instead of through the Ballona Wetlands. This rerouting has not affected most on-site flows such as the Jefferson and Centinela Drains or on-site surface flows.

1.2.4 Characteristics of the Playa Vista Development Area

The adjacent Playa Vista First Phase Project and the Proposed Project include approximately 474 acres and are characterized by a combination of previously developed areas, areas under construction as part of the First Phase Project, and vacant areas. The eastern portion of the adjacent Playa Vista First Phase Project includes much of the former aircraft-manufacturing complex that was previously operated on-site, referred to as the former Plant Site. Several large structures exist within the area, including former aircraft hangers that are now used periodically as movie production studios. This area has been approved for development with new and redeveloped office and studio-related uses as part of the adjacent Playa Vista First Phase Project. The western portion of the adjacent Playa Vista First Phase Project is under development as part of the First Phase Project for residential uses, with some supporting commercial, community serving, and office uses. The Proposed Project, which encompasses approximately 111 acres and is located between the two components of the adjacent Playa Vista First Phase Project, is vacant except for remnants of the former aircraft manufacturing complex, including two buildings, storage sheds, roads, and paved parking areas and the footprint of the former runway.

Existing vegetation in the Playa Vista First Phase Project and the Proposed Project is generally limited to the undeveloped southern portions of the site and includes mostly scrub, non-native grasslands, and weedy species. Riparian vegetation exists along some portions of a drainage channel (Centinela Ditch) at the southern edge of the site. Existing uses around the Playa Vista First Phase Project and the Proposed Project include Ballona Channel and residential, office, commercial, and light industrial uses to the north and east; residential uses, Loyola Marymount University, and former HAC headquarters building located atop the Ballona Escarpment to the south; and Lincoln Boulevard to the west.

1.2.5 Planned Development of Playa Vista First Phase Project and the Proposed Project

The currently Proposed Project encompasses approximately 111 acres. The Proposed Project involves potential development of 2,600 residential units, 175,000 square feet of office uses, 150,000 square feet of retail space, and 40,000 square feet of community services uses.

The adjacent Playa Vista First Phase Project encompasses approximately 363 acres, including the western and eastern portions of the adjacent Playa Vista First Phase Project and the Proposed Project and the southeastern portion of the Ballona Wetlands. The Playa Vista First Phase Project includes, within VTTM No. 49104, 3,246 residential units, 3,206,950square feet of office and/or studio related uses, 35,000 square feet of retail uses, and 120,000 square feet of community serving uses. In addition, the adjacent Playa Vista First Phase Project included 28.6 acres of active open space and 26.1 acre Freshwater Marsh (within a 35 acre footprint).

Combined, the development program proposed for the adjacent Playa Vista First Phase Project and the Proposed Project envisions an integrated, mixed-use community composed of residential, commercial, recreational, hotel and civic uses, as well as significant natural areas. Buildout of the Playa Vista First Phase Project and the Proposed Project would include approximately 5,846 residential units, 3,381,950 square feet of new/replacement office and/or studio related uses, 185,000 square feet of retail space and 160,000 square feet of community-serving uses. Completion of the project includes a Freshwater Wetlands System, which includes a 26.1-acre Freshwater Marsh, an approximately 25-acre Riparian Corridor area, and bordering native upland habitats.

1.2.6 The Freshwater Wetlands System as an Integral Part of Both the Playa Vista First Phase Project and the Proposed Project

The Freshwater Wetlands System (comprised of the Freshwater Marsh and the Riparian Corridor) is a Project Design Feature serving as a water quality enhancement and flood control measure for the previously approved Playa Vista First Phase Project, as well as the Proposed Project. The Freshwater Wetlands System was designed and subsequently permitted (with the exception of the middle portion of the Riparian Corridor) by the relevant governing agencies as a comprehensive system that was intended to manage the dry weather and stormwater hydrology flows and water quality requirements for the adjacent Playa Vista First Phase Project as approved, as well as buildout under the previously proposed Master Plan. The Proposed Project as currently proposed has been substantially reduced from the previous proposal (see Section II – Project Description of the Proposed Project's Draft EIR, regarding the history of the Proposed Project) that was assumed for the design of the Freshwater Wetlands System. Since a large portion of the Freshwater Wetlands System has already been constructed as part of the adjacent Playa Vista First Phase Project, the Playa Vista First Phase Project has, in effect, provided "excess mitigation" from a hydrology and water quality perspective, which should be taken into account when assessing potential impacts of the Proposed Project. Moreover, it is important that the overall operation and performance of the Freshwater Wetlands System should be considered as a whole, inclusive of both the adjacent Playa Vista First Phase Project and the Proposed Project, because the system was designed to address Playa Vista's hydrology and water quality impacts, at buildout.

The following section provides an overview of the design and permitting history of the Freshwater Wetlands System and its function as an integral part of the stormwater management system for both the adjacent Playa Vista First Phase Project and the Proposed Project.

1.2.6.1 Design and Permitting History of the Freshwater Wetlands System

The initial proposal for the Freshwater Wetlands System emerged from the landowner's efforts in the late 1980's and early 1990's to bring about the settlement of a litigation challenging the California Coastal Commission's 1984 certification of a

Coastal Land Use Plan for the coastal zone portions of Playa Vista (the "Settlement Agreement"). Among the issues addressed in the Settlement Agreement was the use of approximately 60-acres of land previously proposed for residential development, located west of Lincoln Boulevard and south of Jefferson Boulevard. The Settlement Agreement contemplated the expansion of the Ballona Wetlands restoration to encompass this 60-acre area. The Settlement Agreement set forth "Wetlands Guidelines and Policies" to implement the portions of the Settlement Agreement.[1] The Wetlands Guidelines and Policies call for, among numerous other biological objectives, the creation of the Freshwater Wetlands System as now approved and substantially constructed.

The Freshwater Wetlands System was designed to collect stormwater runoff from the adjacent Playa Vista First Phase Project and the Proposed Project, as well as 611 acres of off-site areas surrounding the project. The system was designed to provide necessary flood control protection, while also cleansing dry weather and stormwater runoff prior to discharge into the Ballona Channel or into the Ballona Wetlands. The water quality goals called for a net improvement in water quality after buildout of both the adjacent Playa Vista First Phase Project and the Proposed Project. This net improvement in water quality was possible because of the opportunity to treat runoff on a regional basis from significant off-site areas, including the Westchester Bluffs and drainage from existing storm drains located in both Lincoln and Jefferson Boulevards. The effect of the Freshwater Wetlands System was to better manage (i.e., reduce) the amount of freshwater flowing to the Ballona Wetlands salt marsh, and to enhance the quality of dry weather and stormwater runoff into the Ballona Channel and Santa Monica Bay such that pollutant loadings discharged to the Ballona Wetlands, Ballona Channel and ultimately the Santa Monica Bay are reduced after full buildout of the adjacent Playa Vista First Phase Project and the Proposed Project when compared to pre-First Phase conditions without the Freshwater Wetlands System. These water quality benefits to the Ballona Wetlands, Ballona Channel, and Santa Monica Bay were specifically contemplated and intended in the design of the overall Playa Vista Development. In addition, the System is also designed to provide significant freshwater wetland and riparian habitat values.

The Freshwater Wetlands System consists of the Freshwater Marsh and the Riparian Corridor. The Freshwater Marsh was, and is, designed as a multifunctional best management practice (BMP) that collects dry weather and stormwater runoff from four primary drainage facilities:

1. The *Jefferson Boulevard Storm Drain*, which primarily collects runoff from Jefferson Boulevard and approximately 221 acres of development located outside of Playa Vista north of Jefferson Boulevard, and also provides drainage for approximately 35 acres located within the adjacent Playa

[1] *Friends of Ballona Wetlands v. the California Coastal Commission, Los Angeles County Superior Court, Case No. C525 826, Exhibit J.*

Vista First Phase Project and the Proposed Project sites immediately adjacent to Jefferson Boulevard.

2. The *Lincoln Drain South*, which collects runoff from approximately 91 acres atop the Westchester Bluffs located outside of Playa Vista east of Lincoln Boulevard and south of the adjacent adjacent Playa Vista First Phase Project and the Proposed Project sites.

3. The *Central Drain*, which is the primary storm drain collecting runoff from 175 acres within the adjacent Playa Vista First Phase Project and the Proposed Project sites (109 acres within the adjacent Playa Vista First Phase Project, and 66 acres within the Proposed Project site).

4. The *Riparian Corridor*, which collects runoff from approximately 291 acres of development located outside of Playa Vista atop and on the Westchester Bluffs south of the adjacent Playa Vista First Phase Project and the Proposed Project sites, as well as runoff from approximately 199 acres within the adjacent Playa Vista First Phase Project and the Proposed Project sites (156 acres within the adjacent Playa Vista First Phase Project and 43 acres within the Proposed Project).

The Freshwater Marsh was also designed to receive direct runoff from Lincoln Boulevard via the Jefferson, Lincoln and Central Storm Drains and the Riparian Corridor.

Dry weather and stormwater flows from each of these drainage facilities was designed to discharge into the Freshwater Marsh, first through primary management areas designed to remove trash and provide treatment of the runoff before entering and flowing through the main portions of the Freshwater Marsh. Additional treatment is provided in the Riparian Corridor. The Freshwater Marsh was designed to contain up to a 1-year design storm event for discharge into the Ballona Channel, with incremental runoff from larger storm events discharging into the Ballona Wetlands through an overflow weir. This design for the Freshwater Wetlands System was the result of extensive collaboration among Playa Capital Company's predecessor in interest (Maguire Thomas Partners), the Friends of Ballona Wetlands, City and State representatives, and numerous wetland restoration experts. Design of the Freshwater Marsh allows the flexibility to release additional freshwater to the Ballona Wetlands through a gated valve should it be necessary in conjunction with the future design of the salt marsh.

Following completion of the design of the Freshwater Wetlands System and in conjunction with the processing of the adjacent Playa Vista First Phase Project entitlements, the project applicant (then Maguire Thomas Partners) initiated permit actions (includes applications and subsequent determinations) with the California Coastal Commission (CCC) and the U.S. Army Corps of Engineers (USACE) to construct the System. Each of these permit actions clearly describes the multifunctional goals and purposes of the Freshwater Wetlands System.[2] The purposes articulated in the permit documents that are relevant to this Proposed Project's Draft EIR include:

1. Cleansing urban runoff from the adjacent Playa Vista First Phase Project and the Proposed Project as well as hundreds of acres outside of the Playa Vista First Phase Project and the Proposed Project areas, and

2. Providing flood control protection for future buildout of the portion of the portion of the adjacent Playa Vista First Phase Project and the Proposed Project located south of Ballona Channel.

Further details regarding the design and function of the Riparian Corridor and Freshwater Marsh can be found in the documents pertaining to these permit applications. [3]

The CCC imposed conditions on its approval of the Freshwater Wetlands System requiring ongoing water quality monitoring within the Riparian Corridor, the Freshwater Marsh and primary management areas to assure that the water quality within the Freshwater Marsh would be maintained at levels suitable for the proposed habitat uses. In making its findings, the CCC also made note of Environmental Protection Agency (EPA) policy guidance regarding the use of wetlands and riparian areas as a mechanism to control non-point source pollution. The CCC concurred with EPA's guidance in its written findings on the Freshwater Wetlands System permit, and found that the water quality benefits of the Freshwater Marsh were consistent with the Coastal Act's water quality policies and with the Coastal Zone Management Act (CZM's) requirements for managing non-point source pollution. [4]

Subsequent to the CCC's approval of the Coastal Development Permit for the Freshwater Wetlands System in September 1991, the USACE issued its permit under Section 404 of the Clean Water Act in July 1992, and the City of Los Angeles issued its Coastal Development Permit in November 1994. All of these permit actions were based upon analysis of the Freshwater Wetlands System as a Project Design Feature serving both the Playa Vista First Phase Project and the Proposed Project.

1.2.6.2 Prior CEQA Review of the Freshwater Wetlands System

Prior CEQA analysis of the Freshwater Marsh and portions of the Riparian Corridor was conducted as part of the adjacent Playa Vista First Phase Project EIR. Approval of the adjacent Playa Vista First Phase Project included the Freshwater Marsh and the

[2] *"US Army Corps of Engineers Section 404 Permit Application dated August 14, 1990, pages 7 and 8", and "Application to the California Coastal Commission for a Coastal Development Permit" dated June 13, 1991, pages 17-19.*

[3] *"US Army Corps of Engineers Section 404 Permit Application dated August 14, 1990, pages 7 and 8", and "Application to the California Coastal Commission for a Coastal Development Permit" dated June 13, 1991, pages 17-19.*

[4] *Coastal Commission Adopted Findings, Application No. 5-91-463, dated February 20, 1992.*

portions of the Riparian Corridor that are located within the boundaries of, or adjacent to, the Playa Vista First Phase tract maps. Concurrent with the completion of the Draft EIR for the adjacent Playa Vista First Phase Project, the City of Los Angeles also prepared and circulated a separate Draft EIR addressing the cumulative impacts that would result from the development of the remaining portions of the Playa Vista Development Area. Both of these documents included analysis of the Freshwater Wetlands System as a Project Design Feature intended to serve flood control and water quality functions for the adjacent Playa Vista First Phase Project, the Proposed Project and, on a regional basis, to improve the management of runoff from off-site land uses. The methodology presented in this EIR analysis is consistent with prior agency actions and analyses that considered the role and function of the Freshwater Wetlands System from a hydrologic and water quality standpoint in the context of the entirety of the watershed area prior to development of Playa Vista and its ultimate buildout (with construction of the Playa Vista First Phase Project and Proposed Project).

1.3 Summary

The following sections summarize the key findings of the water resources report.

1.3.1 Surface Hydrology

As the majority of the Proposed Project site is currently vacant undeveloped land, implementation of the Proposed Project would substantially increase the amount of impervious surface area on-site, thereby changing the volume, velocity and routing of stormwater runoff. The Proposed Project incorporates several design features to accommodate the increased runoff and provide an appropriate level of on-site flood protection, detention, and drainage. Flood protection measures would include additions and improvements to the existing storm drain system and the provision of stormwater retention facilities within the adjacent Playa Vista First Phase Project and the Proposed Project , including use of the Freshwater Wetlands System. The storm drain system is designed to accommodate a 50-year design storm, in accordance with City requirements. No significant impacts related to flooding or flood control are anticipated from development of the Proposed Project.

1.3.2 Groundwater Hydrology

The increase in impervious surfaces poses the potential to reduce groundwater recharge. However, landscape irrigation and introduction of surface water features (i.e., Freshwater Marsh and Riparian Corridor) would offset the decrease in groundwater recharge due to the increased impervious surfaces. Construction-related dewatering for subsurface excavation would be temporary and is not expected to have any long-term effects. No significant impacts to groundwater recharge and hydrology are expected to occur.

1.3.3 Surface Water Quality

The surface water quality in the vicinity of the Proposed Project could potentially be impacted both temporarily by construction activities and long-term by activities associated with the proposed land uses. With appropriate updates and amendments to the Playa Vista Stormwater Pollution Prevention Plan (SWPPP) and appropriate BMPs during construction, the impacts to water quality would be reduced to less than significant.

With regard to potential surface water quality impacts associated with the long-term operation of the proposed land uses, the pollutant loadings model used in the Playa Vista First Phase Project EIR was refined and updated to evaluate the Proposed Project. The model was used to calculate the pollutant loadings and concentrations from the various developed land uses of the Proposed Project and provide the basis to compare them to the pollutant loadings and concentrations generated from the existing land use. The effectiveness and design of water quality features proposed within the adjacent Playa Vista First Phase Project and the Proposed Project such as the Freshwater Wetlands System and water quality inlets, were accounted for in the model. Pollutant removal capabilities of the Freshwater Wetlands System and water quality inlets were derived from relevant literature.

The results of the model indicate that predicted annual pollutant loads and concentrations to the receiving waters (Ballona Creek Estuary and Ballona Wetlands) from the adjacent Playa Vista First Phase Project and the Proposed Project will decrease for all modeled constituents (total suspended solids (TSS), total phosphorus (TP), total Kjeldahl nitrogen (TKN), copper, lead, zinc, and oil and grease) with the completion of the Proposed Project as compared to pre-First Phase conditions. Also, with the additional on-site BMPs, such as roof-drain planter boxes and vegetated swales, planned as part of the Proposed Project, the average stormwater runoff concentrations to the Freshwater Marsh are predicted to be equal to or less than the predicted concentrations after the buildout of the adjacent Playa Vista First Phase Project.

It should be noted that the new water quality features, such as the Freshwater Marsh and Riparian Corridor, were designed with adequate capacity to provide the intended water quality functions for both the adjacent Playa Vista First Phase Project and the Proposed Project.

1.3.4 Groundwater Quality

Groundwater quality is not expected to be significantly impacted by the development of the Proposed Project. Groundwater resources could potentially be impacted by short-term construction activities and long-term changes in land use and recharge patterns. Short-term effects would be minimized due to the implementation of a SWPPP, the associated BMPs included in the plan, and compliance with NPDES requirements for dewatering. No long-term effects are anticipated because no industrial development is planned for the project; any uses that involve storage of fuel or other hazardous material would be regulated under local, state, and federal laws.

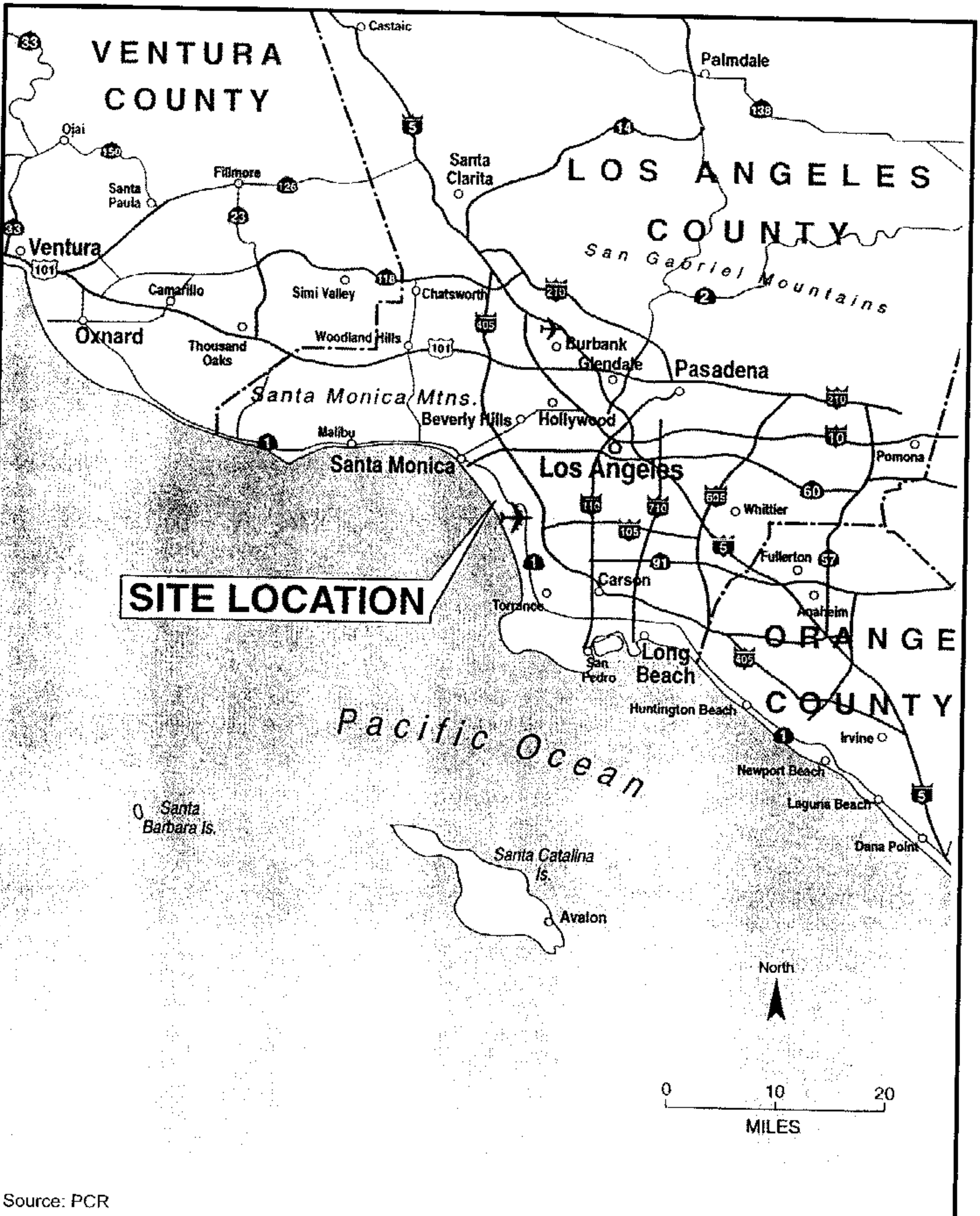
1.4 List of Acronyms and Abbreviations

1,2-DCE	1,2-Dichloroethylene
ABCL	Aquatic Bioassay Consulting Laboratory
ABT	Advanced Biological Testing
ac-ft	acre-feet
Basin Plan	Water Quality Control Plan
BMP	Best Management Practice
CalEPA	California Environmental Protection Agency
CAM	California Assessment Manual
CCC	California Coastal Commission
CDFG	California Department of Fish and Game
CDM	Camp Dresser & McKee
CEQA	California Environmental Quality Act
CFR	Code of Federal Regulations
cfs	cubic feet per second
COP	California Ocean Plan
CTR	California Toxics Rule
CWA	Clean Water Act
CWC	California Water Code (Porter-Cologne Water Quality Control Act of 1969)
CZM	Coastal Zone Management Act
DHS	California Department of Health Services

EIR	Environmental Impact Report
EMCs	Event Mean Concentrations
EPA	nited States Environmental Protection Agency
EST	Estuary Beneficial Use
FEMA	Federal Emergency Management Agency
FHWA	Federal Highway Administration
FIRM	Flood Insurance Rate Map
ft^3	cubic feet
GWTF	Groundwater Treatment Facility
HAC	Hughes Aircraft Corporation
LACDPW	Los Angeles County Department of Public Works
LAX	Los Angeles International Airport
LNAPL	Light Non-Aqueous Phase Liquid
MCL	Maximum Contaminant Level
MDHC	McDonnell Douglas Helicopters Company
mg/L	milligrams per liter
µg/L	micrograms per liter
mm	millimeter
MS4	Municipal Separate Storm Sewer System
MSL	Mean Sea Level
MUN	Municipal and Domestic Water Beneficial Use
NFIP	National Flood Insurance Program
NOI	Notice of Intent

NPDES	National Pollutant Discharge Elimination System
NURP	Nationwide Urban Runoff Program
PCBs	Polychlorinated Biphenyls
PCE	Tetrachloroethene
PEL	Probable Effects Level
ppm	parts per million
RWQCB	Regional Water Quality Control Board – Los Angeles Region
SCGC	Southern California Gas Company
SIP	State Implementation Plan
SUSMP	Standard Urban Stormwater Mitigation Plan
SVOCs	Semi-Volatile Organic Compounds
SWMM	Storm Water Management Model
SWMPR	Storm Water Management Program Requirements
SWPPP	Storm Water Pollution Prevention Plan
SWRCB	State Water Resources Control Board
SYNOP	Synoptic Rainfall Analysis Program
TBT	Tributyl Tin
TCE	Trichloroethene
TDS	Total Dissolved Solids
TKN	Total Kjeldahl Nitrogen
TMDL	Total Maximum Daily Load
TP	Total Phoshorus
TPH	Total Petroleum Hydrocarbons

TRPH	Total Recoverable Petroleum Hydrocarbons
TSS	Total Suspended Solids
URSGWC	URS Greiner Woodward Clyde (formerly Woodward Clyde Consultants)
USACE	United States Army Corps of Engineers
VOCs	Volatile Organic Compounds
WBMWD	West Basin Municipal Water District
WBWRP	West Basin Water Recycling Plant
WCBBP	West Coast Basin Barrier Project



Source: PCR

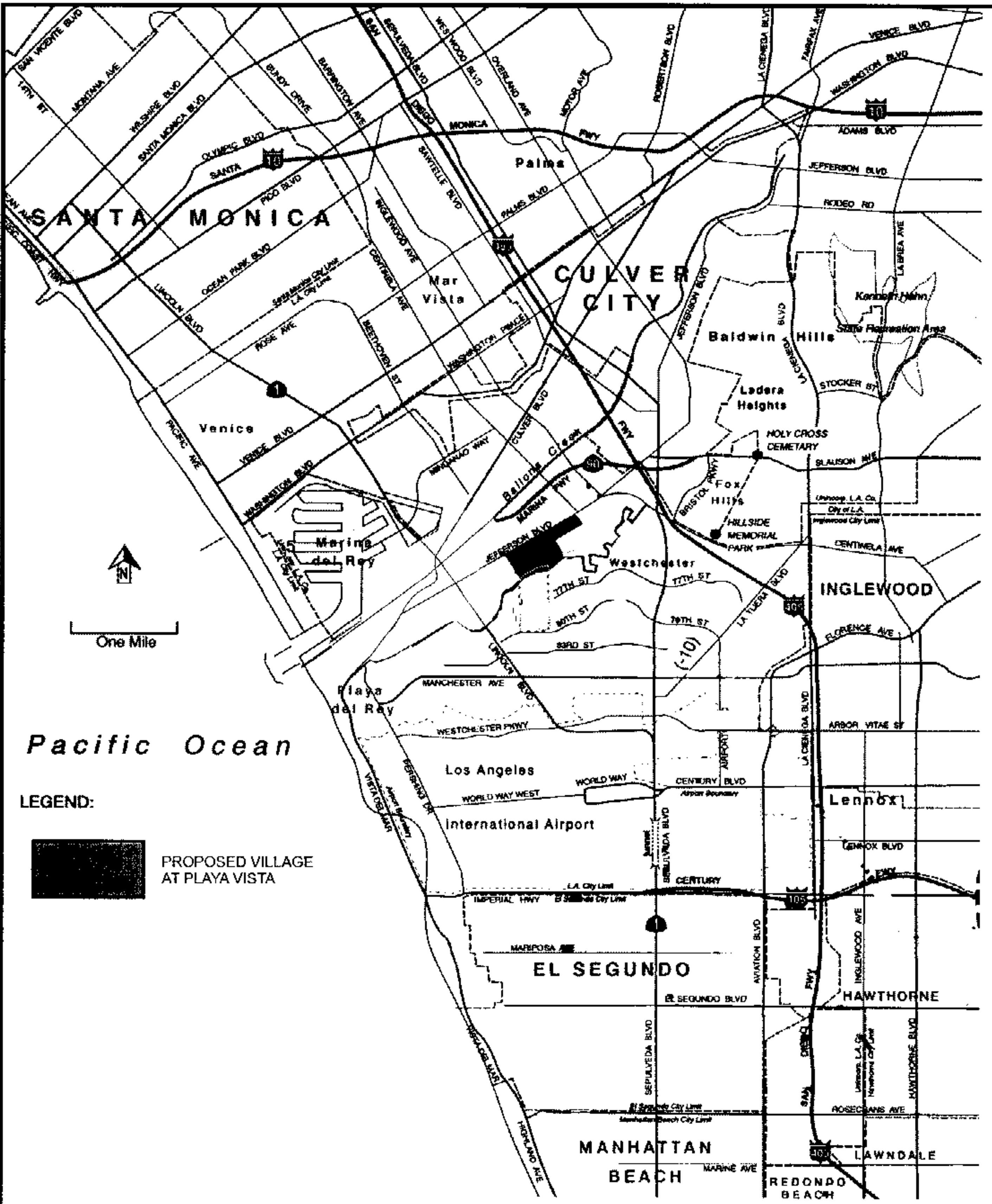
THE VILLAGE AT PLAYA VISTA
WATER RESOURCES TECHNICAL REPORT

Regional Location Map

CDM

Figure 1-1

N:\10610\3760510\cad\TechRpt\RegLocMap.cdr - Negretegd - 07/15/2003



SOURCE: PCR

THE VILLAGE AT PLAYA VISTA
WATER RESOURCES TECHNICAL REPORT

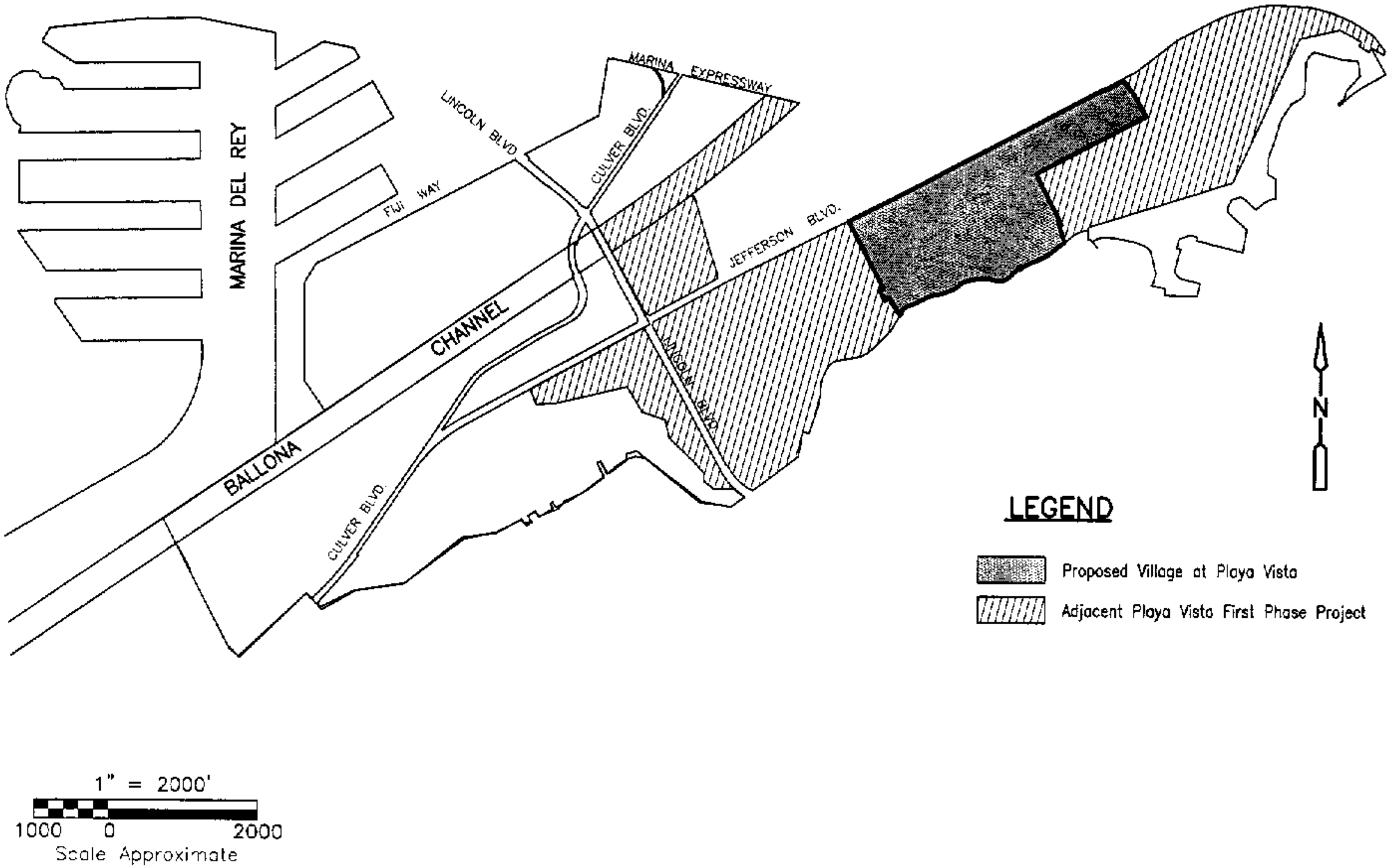
Site Vicinity Map

CDM

Figure 1-2

N:\1661\37605\0cad\TechRpt\SiteVicMap - Negretegc - 7/18/2003

DATE: Aug 15, 2003 9:06am XREFS:
DWG: N:\10610\37605\0cad\TechRpt\PVista-Fig01-03.dwg USER: negretegd



THE VILLAGE AT PLAYA VISTA
WATER RESOURCES TECHNICAL REPORT

Playa Vista Development Area

CDM

Figure 1-3

Section 2 Hydrology

2.1 Introduction

This section of the Water Resources Technical Report addresses issues related to surface water hydrology and groundwater hydrology. The surface water hydrology analysis identifies surface water runoff, drainage characteristics, and drainage and flood control improvements for pre-First Phase, with Playa Vista First Phase, and with Playa Vista First Phase Project and Proposed Project conditions. The groundwater hydrology analysis identifies subsurface stratigraphy, groundwater depth, and direction of flow. Included within each of the respective discussions of surface water hydrology and groundwater hydrology are: (1) an overview of federal and local regulations and regulatory programs that relate to the hydrology aspects of the adjacent Playa Vista First Phase Project and the Proposed Project; (2) a description of the existing hydrologic conditions of, and setting for, the adjacent Playa Vista First Phase Project and the Proposed Project as may be affected by implementation of the Proposed Project; and (3) an analysis of the potential impacts to hydrology resulting from the Proposed Project, discussed in terms of key issues.

Hydrological impact analyses in this report have been considered with both the adjacent Playa Vista First Phase Project and the Proposed Project, rather than considering existing conditions as being conditions after completion of the adjacent Playa Vista First Phase Project. This was considered to be an appropriate approach for assessing the impacts of the Proposed Project for the following reason: most of the major components of the stormwater systems designed for the adjacent Playa Vista First Phase Project were designed to manage the hydrology (and water quality) from both the adjacent Playa Vista First Phase and the Proposed Project (e.g., they were designed for ultimate buildout of the Playa Vista First Phase Project and the Proposed Project). Therefore, attempting to separate the projects for the hydrology analysis would make it difficult to understand this document, primarily because of the overlapping and common elements of the systems. It was determined that the analysis would be easier to understand and evaluate if it consisted of an analysis of existing conditions prior to construction of adjacent Playa Vista First Phase Project (pre-First Phase), as compared to ultimate buildout (with Playa Vista First Phase Project and the Proposed Project). Conducting the analysis in this manner would more clearly illustrate the ultimate changes and impacts associated with the overall water resources of the adjacent Playa Vista First Phase Project and the Proposed Project areas, as well as show what the adjacent Playa Vista First Phase Project and the Proposed Project would accomplish to protect and enhance these resources. To only evaluate the changes from the completion of the adjacent Playa Vista First Phase Project to completion of the Proposed Project would introduce confusing explanations of how overbuilt systems would be utilized to manage the changes that would occur with the Proposed Project.

2.2 Surface Water Hydrology

2.2.1 Regulatory Framework

2.2.1.1 Federal Level

National Flood Insurance Act

The National Flood Insurance Act of 1968 established the National Flood Insurance Program (NFIP), which is based on the minimal requirements for flood plain management in the Code of Federal Regulations 44, Sections 59 - 77 and is designed to minimize flood damage within Special Flood Hazard Areas. According to the Flood Insurance Rate Map (FIRM) from the Federal Emergency Management Agency (FEMA), the Project Site falls into two different floodzones.[5] The bluff of the Habitat Creation/Restoration Component is classified as Zone C – areas of minimal flooding. The remaining portions of the Proposed Project (Urban Development Component and the Riparian Corridor portion of the Habitat Creation/Restoration Component) are in Zone B - areas between the limits of the 100-year flood and 500-year flood; or certain areas subject to 100-year flooding with an average depth of less than one foot; or where the contributing drainage area is less than one square mile; or areas protected by levees from the base flood. No areas of the proposed development portions of the Proposed Project is located within Zone A (a 100-year flood zone) as determined by FEMA. The FIRM flood zones for the Proposed Project are shown on **Figure 2-1, Flood Insurance Rate Map Flood Zones.**

2.2.1.2 Local Level

Drainage and flood control structures and improvements in the City of Los Angeles are subject to review and approval by the City of Los Angeles, Bureau of Engineering. The City utilizes a 50-year design storm for flood control design purposes, which is a predicted storm event estimated using the City's methodology and assumptions, which are considered to be conservative; hence, the analysis presented herein of impacts to, and adequacy of, the storm drain and flood control system for the Proposed Project is based on such a 50-year design storm event. Based on the conservative nature of calculating such storm events, they are likely to occur less often than every 50 years. Section 2.2.3.1 provides a further description of the 50-year design storm event predicted using the City's methodology.

The County of Los Angeles and the City of Los Angeles are co-permittees under the municipal stormwater National Pollution Discharge Elimination System (NPDES) permit for Los Angeles County. As part of the NPDES program, the Standard Urban Stormwater Mitigation Plan (SUSMP) was developed to address stormwater pollution from new construction and redevelopment projects. Although most of the BMPs identified in the SUSMP are focused on water quality issues such as the infiltration or treatment of stormwater runoff and reduction of the post-project discharge of

[5] *Federal Emergency Management Agency, Flood Insurance Rate Map, Los Angeles County, California (unincorporated areas), Panel 905 of 1275 (Community Panel Number 065043 0905 C), November 15, 1985. Updated with online data from Environmental Systems Research Institute (ESRI) and FEMA, http://www.esri.com/data/download/fema/index.html#datainfo. September 9, 2002.*

pollutants from stormwater conveyance systems (addressed in Section 3, Water Quality, of this volume), one structural BMP requires that a project control peak flow discharge to provide stream channel and over bank flood protection. The Proposed Project is required to incorporate appropriate SUSMP requirements into project plans as part of the development plan approval process for building and grading permits.

2.2.2 Affected Environment/Existing Conditions

The existing surface water hydrology characteristics associated with the Proposed Project consist of, and are influenced by, a variety of watershed areas, drainage systems, and land uses. The most notable features related to the Proposed Project include: Santa Monica Bay, which receives much of the surface runoff from metropolitan Los Angeles; the Ballona Creek Watershed including the Ballona Channel into which the adjacent Playa Vista First Phase Project and the Proposed Project drain; and the local watersheds and drainage facilities. **Figure 2-2, Regional Hydrological Setting**, depicts the regional relationship between Santa Monica Bay, the Ballona Creek Watershed, and the Proposed Project. The following sections describe the relevant characteristics of each.

2.2.2.1 Santa Monica Bay

Santa Monica Bay is an open embayment with a designated surface area of approximately 266 square miles. It is bordered by Point Dume to the northwest, the Palos Verdes Peninsula to the south, and the deep Santa Monica Basin off-shore. Uses of Santa Monica Bay include recreational, commercial, and industrial uses. Activities include boating, swimming, fishing, power generation and runoff, and stormwater, wastewater and waste discharge. Relative to the Proposed Project, Santa Monica Bay lies approximately 2 miles west. The Proposed Project site has no direct connection to Santa Monica Bay, although all of its surface runoff drains eventually into Santa Monica Bay via the Ballona Channel.

2.2.2.2 Ballona Creek Watershed

The Ballona Channel is the major drainage channel in the vicinity of the Proposed Project site, and the majority of the runoff from the Proposed Project eventually reaches the Ballona Channel. The overall Ballona Creek Watershed, as shown in **Figure 2-3, Ballona Creek Watershed**, drains approximately 78,000 acres. The adjacent Playa Vista First Phase Project and the Proposed Project comprise approximately 0.5 percent of this watershed. The watershed includes portions of the Santa Monica Mountains to the north, an area west of Beverly Hills and the higher elevations of Culver City, an area extending easterly to within approximately two blocks of the Los Angeles Coliseum, and the Ballona Escarpment (Westchester and Playa del Rey Bluffs) to the south. Approximately 76 percent of the Ballona Creek Watershed consists of highly urbanized land.[6] Elevations within the watershed range from approximately sea level to 400 feet above mean sea level (MSL) in the coastal

[6] *U.S. Army Corps of Engineers-Los Angeles District, "Hydrology for Feasibility Report, Ballona Channel and Sawtelle-Westwood Channel, California-Los Angeles County Drainage Area", February 1979.*

plain and 400 feet to 1,800 feet above MSL in the mountainous areas. None of the watercourses within the watershed flow perennially from natural sources.[7] Other than urban runoff and industrial discharges, runoff into the Ballona Channel occurs only during and immediately following precipitation events.

Based on ocean tide elevations, the downstream portion of the Ballona Channel is tidally influenced, to a point approximately 3,000 feet east of Lincoln Boulevard (near the confluence with Centinela Channel). However, the saltwater portion of the Ballona Channel has been determined to be approximately downstream of the channel's intersection with Culver Boulevard. The portion of the Ballona Channel between these two points is referred to as the saltwater wedge.[8] The geometry of Ballona Channel through the Playa Vista First Phase Project and the Proposed Project site, including channel inverts, widths, side slopes, and lengths, can be found in Volume II, Appendix A of this Technical Report.

2.2.2.3 Playa Vista First Phase Project and the Proposed Project

2.2.2.3.1 *Local Watersheds and Drainage Areas*

The total tributary area of the adjacent Playa Vista First Phase Project and the Proposed Project, which includes the upstream areas that drain to the property, encompasses approximately 1,056 acres. **Figure 2-4, Pre-First Phase Drainage System and Hydrology**, shows the tributary watersheds and drainage areas associated with the adjacent Playa Vista First Phase Project and the Proposed Project. Off-site stormwater that flows onto the adjacent Playa Vista First Phase Project and the Proposed Project originates from storm drains, highways, natural drainage ways, and overland flow. The off-site tributary area north of the adjacent Playa Vista First Phase Project and the Proposed Project is highly urbanized with relatively little pervious surface area. The off-site tributary area south of the adjacent Playa Vista First Phase Project and the Proposed Project includes a portion of the Ballona Escarpment (Westchester Bluffs), Loyola Marymount University, and commercial uses along Lincoln Boulevard. Due to the existing urban nature of lands to the north, and the permanent open space (bluffs) and institutional use to the south (Loyola Marymount University), no notable changes in hydrology are expected to occur for baseline conditions in those areas upstream/upgradient of the adjacent Playa Vista First Phase Project and the Proposed Project. Within the adjacent Playa Vista First Phase Project and the Proposed Project sites, the existing undeveloped areas provide substantial surface detention for runoff generated by most storms. However, during

---

[7] *Ibid.*

[8] *The tidal prism is the intersection of freshwater and saltwater near where the Ballona Channel empties into Santa Monica Bay. It is created in the channel by the daily tidal fluctuations in the Bay as the saltwater from the Bay advances and retreats in the Channel. The water column of the tidal prism is a mixture primarily of Santa Monica Bay and, to limited extent, Marina del Rey saltwater, with freshwater from upstream flows in the Ballona Channel. Typically, the denser saltwater intruding from the Bay will become overlain by less dense freshwater flowing down Ballona Channel with some mixing and diffusion. This phenomenon is also referred to as a saltwater wedge. (Camp Dresser & McKee Inc. Ballona Creek Salinity Monitoring and Water Quality Sampling Results. August 14, 1996.)*

exceptionally wet weather, such as multiple-day storms, the soil becomes saturated, surface depressions are filled, and a relatively high volume of runoff occurs (see additional discussion below regarding drainage facilities), causing wide areas of temporary ponding.

The drainage area studied is located south of the Ballona Channel and encompasses approximately 1,555 acres. Of this, approximately 614 acres are upstream of the adjacent Playa Vista First Phase Project (not including the Freshwater Marsh) and Proposed Project sites; approximately 442 acres are associated with the adjacent Playa Vista First Phase Project and Proposed Project; and, approximately 499 acres (including the Freshwater Marsh) are downstream of the adjacent Playa Vista First Phase Project and the Proposed Project sites. The general drainage pattern in areas south of Ballona Channel is south-to-north, and east-to-west. The majority of runoff is discharged to Ballona Channel through the Freshwater Marsh outlet constructed as part of the adjacent Playa Vista First Phase Project, and to the Ballona Wetlands (during storm events larger than the 1-year storm only) and existing flap-gated culverts within the wetlands, located approximately 1.25 miles west of the Proposed Project.

The drainage system that serves the Project site was designed to serve both the adjacent Playa Vista First Phase Project and the Proposed Project, as well as adjacent upstream areas; therefore, to accurately describe the drainage setting for the Proposed Project, it is important to present the conditions of the hydrologic study area prior to the development of the adjacent Playa Vista First Phase Project (pre-First Phase Project). Figure 2-4, illustrates the pre-First Phase hydrology in terms of tributary areas, and related storm drains. The following describes the drainage facilities related to the pre-First Phase hydrology of the site.

2.2.2.3.2 *Drainage Facilities*

Ballona Channel

In the vicinity of the adjacent Playa Vista First Phase Project and the Proposed Project, the Ballona Channel is trapezoidal, with bottom widths varying from 80 to 200 feet and depths varying from 19 to 23 feet from the top of the levee. The side slopes are lined with concrete, paving stones, and riprap (i.e., rocks with boulders); the channel bottom is unpaved. The maximum flood capacity (with no freeboard[9]) of Ballona Channel in the vicinity of the adjacent Playa Vista First Phase Project and the Proposed Project is estimated to be about 72,000 cubic feet per second (cfs).[10] The Ballona Channel falls within the jurisdiction of the County of Los Angeles, and USACE. The County utilizes a hypothetical 50-year storm for flood control design purposes. This design storm is substantially larger than the USACE design storms. As a comparison, for the Ballona Creek Watershed, the USACE 100-year flood has a peak flow of 56,000 cfs and the USACE Standard Project Flood has a peak flow of 68,000

[9] *Freeboard is the distance between the waterline and the upper edge of a structure.*
[10] *U.S. Army Corps of Engineers, Op cit., February, 1979.*

cfs. Both the USACE 100-year flood and the Standard Project Flood are less than the County's 50-year design flood of 69,800 cfs. Additionally, the County and USACE standards are less than the maximum capacity (with no freeboard) of the Channel.

The design storm data for Ballona Channel has been compared against actual stream gauge data taken at the nearest stream gauge with historical data, F38C-R, located on Ballona Channel just above Sawtelle Boulevard (upstream of the Centinela Channel). Based upon the stream gauge data from the 1940's to 1990's, 10 floods above 18,000 cfs (equivalent to approximately 24,000 cfs at the site) have occurred. The largest storm on record during this period was recorded at 32,500 cfs (estimated 40,000 cfs at the site) on November 21, 1967. The largest recent storm occurred on March 10, 1995 – a peak flow 24,000 cfs was measured (estimated 30,000 cfs at the site). Maximum stage was 5.3 feet mean sea level (MSL) at the Playa Vista site, and remained above 5 feet MSL for an hour. By comparison, the design storm (a hypothetical 50-year storm assumed for the sizing and design of flood control facilities, as described above) stays above 5 feet MSL for 4 hours. Accounting for peak and duration, the storm gage data is well within the parameters of the design storm.

Due to the highly urbanized nature of the Ballona Creek Watershed, and debris control structures in undeveloped upstream areas, bedload (coarse natural materials including gravel and rocks) in the Ballona Channel is negligible. During large storms, manmade debris is often present in the runoff, collecting at bridge piers. Under pre-First Phase conditions, runoff from the site collected in low lying areas adjacent to the Ballona Channel, where sediment in the runoff settled. Since no changes are proposed to the Ballona Channel, and the proposed on-site drainage systems also collect in low lying areas prior to discharge into Ballona Channel, no change in bedload is anticipated.

<u>Pre-First Phase Drainage Facilities</u>

Table 2-1, Pre-First Phase Drainage System Capacity, compares the pre-First Phase drainage system capacities with the 50-year storm event runoff. The major drainage facilities for the pre-First Phase Project conditions are described below.

Centinela Ditch - During pre-First Phase conditions, Centinela Ditch ran east-to-west along the Teale Street (subsequently realigned and renamed Bluff Creek Drive). The upstream end of the ditch was near the east end of the former Howard Hughes Plant Site (Plant Site). It was an unlined, earthen, trapezoidal open channel from near the west end of the Plant Site to Lincoln Boulevard, and a variable-sized closed-conduit storm drain through most of the Plant Site. The ditch collected stormwater from existing developments on the Westchester Bluffs through several major and minor storm drain systems. It also drained the south portion of the adjacent Playa Vista First Phase Project and the Proposed Project sites and discharged into the East Wetland portion of the Ballona Wetlands.

This culvert had a capacity of 210 cfs and was the only culvert, excluding the Jefferson Boulevard Storm Drain, that crossed Lincoln Boulevard. Lincoln Boulevard has had occurrences of flooding in this area because the Centinela box culvert does not have sufficient capacity (i.e., 50-year design storm flows for Centinela Ditch are 630 cfs).

Jefferson Boulevard Storm Drain - During pre-First Phase conditions, the Jefferson Boulevard Storm Drain ran along the centerline of Jefferson Boulevard from Randall Street to the East Wetland portion of the Ballona Wetlands. The upstream end of the drain is at the intersection of Centinela Avenue and Major Street. The storm drain was a variable-sized reinforced concrete box that is 8.5 feet wide by 5.75 feet high at Randall Street and 12 feet wide by 7.25 feet high at the outlet. During pre-First Phase conditions, the capacity of the Jefferson Boulevard storm drain at the pre-First Phase outlet to Ballona Wetlands was estimated at 380 cfs. It is estimated that 50-year storm events would generate 457 cfs in the drain, which is greater than the capacity of the drain. Historically, this drain has been observed to flood in the vicinity of the intersection of Jefferson Boulevard and Centinela Avenue.

During pre-First Phase conditions, the Jefferson Boulevard Storm Drain collected stormwater from existing off-site developments north of Jefferson Boulevard, portions of the adjacent Playa Vista First Phase Project and the Proposed Project immediately adjacent to Jefferson Boulevard, and the area between Culver and Jefferson Boulevards, west of Lincoln Boulevard.

Lincoln Drain South – Under pre-First Phase conditions, the outlet of the Lincoln Drain South discharged into the area where the Freshwater Marsh has been constructed, on the west side of Lincoln Boulevard near Teale Street. The drain carried off-site flows from developments south of the adjacent Playa Vista First Phase Project and the Proposed Project, and to the east and west of Lincoln Boulevard.

Ballona Wetlands - Under pre-First Phase conditions, runoff originating from within the wetland and upland areas located south of Ballona Channel and west of Lincoln Boulevard, portions of the Playa del Rey Bluffs, and the Playa del Rey, area was conveyed to the degraded Ballona Wetlands system. Once runoff reached the Ballona Wetlands, the runoff flowed through earthen drainage routes to two channels that discharged into the Ballona Channel through flap-gate systems.

Within the Ballona Wetlands, limited-capacity (i.e., relatively shallow and/or narrow) channels carried low-flows through the three existing cells of the Ballona Wetlands. The three cells include the East Wetland, the South Wetland, and the North Wetland (see Figure 2-4). Low flows pass through the cells of the Ballona Wetlands in an east-to-west direction through the East Wetland to the flap-gated outlets to Ballona Channel in the North Wetland. The capacity of existing culverts under a bermed Southern California Gas Company (SCGC) access road, which is the boundary between the East and South Wetlands, and under Culver Boulevard, which is the boundary between the South and North Wetlands, was limited. As such, the wetland cells acted like detention/filtration basins and the linear drainage pattern associated with the existing channels became undefined during flood events.

In addition, during the 50-year storm event, existing development along the west end of Culver Boulevard and the SCGC facilities at the toe of the Playa del Rey Bluffs were susceptible to flooding. Culver Boulevard was below the flood level of Ballona Channel. During high water stages in Ballona Channel, all stormwater runoff from the subject study area flowed into the Ballona Wetlands. Under the 50-year storm, portions of Culver Boulevard and possibly areas in adjacent Playa del Rey would be flooded because of their low elevation and insufficient stormwater detention capacity in the Ballona Wetlands. Similarly, Lincoln Boulevard at the Centinela Ditch was subject to flooding during major storm events when there was insufficient stormwater detention capacity in the Centinela Ditch culvert and area east of Lincoln Boulevard.

Existing Drainage Facilities

Since the adjacent Playa Vista First Phase Project has not been completed, the existing conditions represent an intermediate phase. Implementation of the adjacent Playa Vista First Phase Project, which includes completion of the Freshwater Marsh and the first phase of the Riparian Corridor, is altering the baseline conditions for land uses to the east and west of the Proposed Project site and the related drainage system. This subsection provides a comparison of the existing drainage facilities and pre-First Phase conditions. Portions of the adjacent Playa Vista First Phase Project remaining to be constructed are also described.

Centinela Ditch – All of the Centinela Ditch within the adjacent Playa Vista First Phase Project has been removed as a result of site preparation and construction activities in compliance with construction plans and permits approved by the USACE, California Department of Fish and Game (CDFG) and City of Los Angeles. These permits include USACE Permit No. 90-426-EV, CDFG 1603 Streambed Alteration Agreement No. 5-693-93, and applicable grading/stockpiling permits within the adjacent Playa Vista First Phase Project area. In addition, within the Proposed Project site, most of the ditch have been removed as part of the Erosion Control Plan approved for the adjacent Playa Vista First Phase project. As under pre-First Phase conditions, the remainder of the ditch collects stormwater from existing developments on the Westchester Bluffs through several major and minor storm drain systems. Under existing conditions, it also drains the south portion of the site and discharges through a temporary detention basin (discussed below) into the Central Storm Drain (approved and constructed as part of the adjacent Playa Vista First Phase Project) under Lincoln Boulevard and into the Freshwater Marsh. At completion of the adjacent Playa Vista First Phase Project, the eastern and western portion of the Riparian Corridor will have been constructed to replace the Centinela Ditch.

As part of the adjacent Playa Vista First Phase Project's Stormwater Pollution Prevention Plan (SWPPP) and Erosion Control Plan, the City of Los Angeles Department of Public Works has approved the excavation and maintenance of temporary detention basins within the Proposed Project site (located south of Runway Road and generally west of Building 45). The detention basins provide temporary storm drainage and control sediments for the adjacent Playa Vista First Phase areas currently under construction, west of the Proposed Project site, that will ultimately drain into the Riparian Corridor, as well as portions of the eastern portion of the adjacent Playa Vista First Phase Project site, which will ultimately drain to the Central Storm Drain or the Riparian Corridor. It is expected that the temporary drainage facilities will remain on the Proposed Project site pursuant to the SWPPP as may be modified from time to time.

Central Storm Drain (approved as a part of the adjacent Playa Vista First Phase Project) – The entire tributary area of the Central Storm Drain is within the boundaries of the adjacent Playa Vista First Phase Project and the Proposed Project. The upstream terminus of the drain is at the intersection of Artisans Way and Waterfront Drive in the eastern portion of the adjacent Playa Vista First Phase Project site. It drains east to west, extending along Waterfront Drive, Millennium Street, Runway Road, Pacific Promenade, and Playa Vista Drive and discharges into the Freshwater Marsh. The circular pipe ranges in diameter from 42 inches to 96 inches, with equivalent hydraulic capacity rectangular boxes used in some sections to provide utility clearances as necessary. The Central Storm Drain is in operation in the western portion of the adjacent Playa Vista First Phase Project area and is largely completed within both the eastern and western portions of the adjacent Playa Vista First Phase Project site. The remaining (central) portion of the Central Storm Drain (under Runway Road), as approved as part of the adjacent Playa Vista First Phase Project, will be constructed as necessary for stormwater management.

Jefferson Boulevard Storm Drain –As part of the adjacent Playa Vista First Phase Project, the Jefferson Boulevard Storm Drain west of Lincoln Boulevard was abandoned and a new section was built to divert the Jefferson Boulevard Storm Drain runoff into the Freshwater Marsh (instead of the Ballona Wetlands). The northeast corner of the Lincoln and Jefferson Boulevard intersection constructed with the adjacent Playa Vista First Phase Project also drains into the Jefferson Boulevard Storm Drain. These changes will not result in any increased flows (i.e., additional backup of water) in the Jefferson Boulevard Storm Drain. It is estimated that 50-year storm events with the adjacent Playa Vista First Phase Project and the Proposed Project would generate 404 cfs in the drain, which is less than the estimated 457 cfs generated under a 50-year storm event with the pre-First Phase Project. With these modifications, all runoff from new development within the adjacent Playa Vista First Phase Project and the Proposed Project will be routed through the Freshwater Marsh. All approved modifications to the Jefferson Boulevard Storm Drain have been completed.

Lincoln Drain South – The Lincoln Drain South is the same under existing conditions as it was under pre-First Phase conditions, except a concrete swale[11] drains the flow northerly along Lincoln Boulevard and outlets into the Freshwater Marsh. Once the western portion of the Riparian Corridor has been completed, as approved for the adjacent Playa Vista First Phase Project, the Lincoln Drain South will be rerouted to drain into the Riparian Corridor/Lincoln Boulevard culvert, thus completing the approved modifications.

Freshwater Marsh (approved as part of the adjacent Playa Vista First Phase Project) – Prior to construction of the Freshwater Marsh, 100 percent of untreated runoff flows from the 1,555-acre tributary watershed drained directly into the Ballona Wetlands and then into the Ballona Channel. The Freshwater Marsh is one of the two major components of the overall Freshwater Wetlands System that was designed and subsequently permitted by the relevant governing agencies as a comprehensive system to enable the adjacent Playa Vista First Phase Project and the Proposed Project, at buildout, to 1) control the amount of freshwater flowing to the Ballona Wetlands and Ballona Channel; 2) substantially reduce the amount of surface water pollutant loads to the Ballona Wetlands; and, 3) achieve a no net increase in pollutant loads to the Ballona Channel and Santa Monica Bay (see Section 3,Water Quality of this Volume, for a discussion of the last two points). The Freshwater Marsh has been designed to receive stormwater and dry weather runoff from the Jefferson Boulevard Storm Drain, the Central Storm Drain, the Riparian Corridor, and the Lincoln Drain South. These drainage systems outlet into the Freshwater Marsh at primary management area.

The Freshwater Marsh serves as a means to divert freshwater flows from existing and new development away from the existing Ballona Wetlands salt marsh. During most runoff events, the Freshwater Marsh will discharge into Ballona Channel directly through flap-gated culverts; however, an overflow spillway is provided into the Ballona Wetlands to divert major storm flows (over 1-year storm levels). The Freshwater Marsh is divided from the Ballona Wetlands by a berm. The slopes of the berm vary from 10:1 to 5:1 horizontal-to-vertical in order to promote the establishment of wetland vegetation and provide biological protection against erosion of the berm. A design feature of the Freshwater Marsh allows flexibility to release freshwater to the Ballona Wetlands through a gated valve should it be necessary in conjunction with the design or maintenance of the salt marsh. Under normal conditions, storm flows greater than a 1-year storm will flow over the overflow spillway into the existing Ballona Wetlands. The storm overflow drains through the East, South, and North Wetland portions of the Ballona Wetlands and outlets into Ballona Channel. Only the southern portion of the Freshwater Marsh currently remains to be constructed. Completion of the Freshwater Marsh (approximately 8 acres), as approved for the adjacent Playa Vista First Phase Project, is expected in 2004.

---

[11] *A concrete swale is a shallow trough-like depression that carries water.*

Area Northwest of Lincoln/Jefferson Intersection – The area between Culver and Jefferson Boulevards, west of Lincoln Boulevard, which use to drain into the Jefferson Boulevard Storm Drain, now drains directly into the Freshwater Marsh outlet when the flapgates at Ballona Channel are open. The flapgates remain open as long as the Freshwater Marsh is hydraulically higher than the Ballona Channel. When the flapgates close (normally this would occur during major storm events) temporary ponding in the area would occur until the flapgates reopen. All modifications to this area have been completed.

Ballona Wetlands – The Ballona Wetlands are very similar under existing conditions compared to pre-First Phase conditions except that the Freshwater Marsh regulates upstream flows entering the wetlands. The capacities of existing culverts under a bermed SCGC access road, which is the boundary between the East and South Wetlands, and under Culver Boulevard, which is the boundary between the South and North Wetlands, are limited. As a result, the wetlands act like detention/filtration basins and the linear drainage pattern associated with the existing channels becomes undefined during flood events. A USACE Section 1135 Project was recently constructed to modify the existing flap-gated culverts between Ballona Channel and the North Wetlands to allow increased tidal exchange within the existing tidal channels of the Ballona Wetlands. Tidal flow is maintained within the existing tidal channels, and the Section 1135 Project does not substantially affect the flood hydrology.[12]

2.2.3 Project Design Features

Development of the adjacent Playa Vista First Phase Project and the Proposed Project includes numerous improvements to the existing storm drain system and other design features (i.e., Freshwater Wetlands System) intended to address potential hydrology impacts. The Freshwater Wetlands System (the majority of which was approved and permitted in conjunction with the adjacent Playa Vista First Phase Project) is a Project Design Feature that was intended as a comprehensive system to manage the stormwater flows and water quality requirements for both the adjacent Playa Vista First Phase Project and the Proposed Project. Some of the existing off-site drainage facilities, such as the Lincoln Drain South and connecting systems, have been designed to standards that are larger than the 50-year storm. To assure new improvements do not adversely impact existing facilities, the proposed drainage facilities improvements have been designed to handle the expected future on- and off-

[12] *The USACE recently completed construction of a project within the northernly area of the Ballona Wetlands known as "The Ballona Wetlands Section 1135 Ecosystem Restoration Project" (Section 1135 Project). The Section 1135 Project included the retrofitting of two of three existing 60-inch corrugated metal pipe culverts located on the south levee of the Ballona Creek Flood Control Channel (Ballona Channel). The culvert retrofit consisted of the attachment of two self-regulating tide-gates (mechanical devices that automatically open and close based on tidal water levels) to the existing culverts at the eastern drainage channel from the Ballona Wetlands (North Wetlands). The water surface elevation in the tidal channels will range from 0.8 feet MSL to 1.2 feet MSL. During flood conditions, the tidal gates will close, preventing storm flows from entering the Ballona Wetlands from Ballona Channel.*

site stormwater flows and avoid adverse impacts to existing facilities. The following describes the most notable improvements that occur as Project Design Features. An overview of the proposed hydrology for the adjacent Playa Vista First Phase Project and the Proposed Project is shown on **Figure 2-5, Drainage System and Associated Hydrology with Adjacent Playa Vista First Phase Project and Proposed Project.**

The current hydraulic capacity of the Jefferson Boulevard Storm Drain is not considered to meet the City of Los Angeles' current design standards. The proposed grading, including that which has already been completed as part of the adjacent Playa Vista First Phase Project, has been designed to minimize on-site drainage to the adjacent vegetated slope areas of Jefferson Boulevard, thereby reducing stormwater runoff towards the limited-capacity Jefferson Boulevard Storm Drain. Additional storm drain capacity would be provided on-site. In addition to the existing Jefferson Boulevard Storm Drain, two new major stormwater management facilities (both approved as part of the adjacent Playa Vista First Phase Project) – the Riparian Corridor and the Central Storm Drain – would provide drainage for the adjacent Playa Vista First Phase Project and the Proposed Project. The middle portion of the Riparian Corridor, within the Proposed Project, would be constructed as a part of the Proposed Project. All three major storm drains would discharge into the Freshwater Marsh located at the easterly boundary of the Ballona Wetlands. The following describes more specifically the drainage system improvements that would serve as Project Design Features for the Proposed Project:

Lincoln Drain South (approved as a part of the adjacent Playa Vista First Phase Project) – As a part of the adjacent Playa Vista First Phase Project, the outlet of the existing Lincoln Drain South will be relocated to the Freshwater Marsh. The drain will intercept off-site flow from the existing developments south of the adjacent Playa Vista First Phase Project and the Proposed Project, and to the east and west of Lincoln Boulevard.

Freshwater Marsh (approved as part of the adjacent Playa Vista First Phase Project) – The Freshwater Wetlands System associated with the previously approved Playa Vista First Phase Project was designed, sized, permitted, and constructed to serve both the adjacent Playa Vista First Phase Project and the Proposed Project. A key component of the Freshwater Wetlands System is the Freshwater Marsh located southwest of the intersection of Lincoln and Jefferson Boulevards. As such, it is included as a Project Design Feature related to the Proposed Project. The Freshwater Marsh has been designed to receive stormwater runoff from the Jefferson Boulevard Storm Drain, the Central Storm Drain, the Lincoln Drain South, and Riparian Corridor. These drains outlet into the Freshwater Marsh at primary management areas. Normally the Freshwater Marsh discharges into Ballona Channel through flap-gated culverts; however, an overflow spillway is provided into the Ballona Wetlands to divert portions of storm flows greater than the 1-year storm. Maximum water level during a 50-year return-frequency storm in the Freshwater Marsh is limited to about 8 feet above MSL in order to eliminate adverse backwater effects in the existing Jefferson Boulevard Storm Drain. The Freshwater Marsh is divided from the Ballona Wetlands by a berm. The slopes of the berm vary from 10:1 to 5:1 horizontal-to-vertical in order to promote the establishment of wetland vegetation and provide biological protection against erosion of the berm. The Freshwater Marsh is designed to contain and convey to the Ballona Channel all storms up to approximately a one-year storm[13] and has the flexibility to release freshwater to the Ballona Wetlands through a gated valve should it be necessary in conjunction with any future salt marsh restoration. This aspect of the Freshwater Marsh serves as a means to divert uncontrolled freshwater flows away from the adjacent salt marsh area, preventing the continued degradation of the salt marsh habitat that resulted from the uncontrolled freshwater inflows, and enabling future restoration of the salt marsh area.

Riparian Corridor (east and west portions approved as a part of the adjacent Playa Vista First Phase Project - central portion proposed as part of the Proposed Project) - The approximately 25-acre Riparian Corridor, including the 18.3 acres approved as part of the adjacent Playa Vista First Phase Project, will drain east to west and collect water from the south part of the adjacent Playa Vista First Phase Project and the Proposed Project sites and from existing developments on the Westchester Bluffs east of Lincoln Boulevard. In essence, the Riparian Corridor will be a relocated and greatly enhanced replacement of the Centinela Ditch. It is planned to be a wide, open channel in a naturalized setting between the toe of the Westchester Bluffs and proposed Bluff Creek Drive. The design of the typical section of the channel is trapezoidal, with 3:1 horizontal-to-vertical side slopes up to the 50-year design water level, and 2:1 slopes above. The bottom width varies from approximately 5 to 90 feet, while maximum water depth varies from approximately 3 to 7 feet. Cattails or other suitable vegetation will be established in the bottom of the channel and willow shrub will be planted on the side slopes. The eastern and western portions of the Riparian Corridor were approved, and will be constructed, as part of the adjacent Playa Vista First Phase Project.

Although the Riparian Corridor will be vegetated as described above, the Corridor has been designed to provide sufficient hydraulic capacity to accommodate the runoff from the adjacent Playa Vista First Phase Project and Proposed Project. A program will be implemented in order to maintain the required hydraulic capacity of the channel (e.g., limit large trees from establishing within the channel and removing vegetation selectively).

Central Storm Drain (approved as a part of the adjacent Playa Vista First Phase Project) - The entire tributary area of the Central Storm Drain is within the boundaries of the adjacent Playa Vista First Phase Project and the Proposed Project development. The upstream terminus of the drain will be at the intersection of Artisans Way and Waterfront Drive in the eastern portion of the adjacent Playa Vista First Phase Project. The Central Storm Drain will drain east to west, extending along Waterfront Drive, Millennium Street, Runway Road, Pacific Promenade, and Playa Vista Drive and will discharge into the Freshwater Marsh. The planned circular pipe conduit will range in

[13] *The one-year storm is estimated to be 723 cfs and the 50-year storm is approximately 1,690 cfs.*

diameter from 42 inches to 96 inches, with equivalent hydraulic capacity rectangular boxes used in some sections to provide utility clearances as necessary. Portions of the Central Storm Drain are currently being constructed as part of the adjacent Playa Vista First Phase Project.

Jefferson Boulevard Storm Drain - The Jefferson Boulevard Storm Drain is an existing system as it was modified as part of the Playa Vista First Phase Project and will not be modified east of Lincoln Boulevard. West of Lincoln Boulevard, as part of the adjacent Playa Vista First Phase Project, the existing Jefferson Boulevard Storm Drain has been abandoned and a new section built to divert the Jefferson Boulevard Storm Drain runoff into the Freshwater Marsh. The northeast corner of the Lincoln and Jefferson Boulevard intersection (Tract 49104-03) constructed with the adjacent Playa Vista First Phase Project also drains into the Jefferson Boulevard Storm Drain. These changes would not result in any increased flows (i.e. additional backup of water) in the Jefferson Boulevard Storm Drain (see **Table 2-1, Pre-First Phase Drainage System Capacity**). With these modifications, all runoff from new development within the adjacent Playa Vista First Phase Project and the Proposed Project will be routed through the Freshwater Marsh.

Area Northwest of Lincoln/Jefferson Intersection - The area located between Culver and Jefferson Boulevards, west of Lincoln Boulevard, that previously drained into the Jefferson Boulevard Storm Drain was modified as part of the Playa Vista First Phase Project to drain into the Freshwater Marsh outlet through flap-gated culverts, thereby relieving the existing Jefferson Boulevard Storm Drain. During periods of high flow within Ballona Channel, the flap gates at Ballona Channel will close, causing flow to pond within the Freshwater Marsh and its outlet. Separate flap gates within the Freshwater Marsh outlet prevent flow from the Freshwater Marsh from discharging in the adjacent wetlands area. For short periods, runoff will pond in the area located between Culver and Jefferson Boulevards, west of Lincoln Boulevard, as with pre-First Phase and existing conditions.

2.2.4 Surface Water Hydrology Impact Analysis

2.2.4.1 Significance Thresholds

The Draft Los Angeles CEQA Thresholds Guide (p. D.1-3) states that a project would normally have a significant impact on surface water hydrology if it would:

- Cause flooding during the projected 50-year developed storm event, which would have the potential to harm people or damage property or sensitive biological resources;

- Substantially reduce or increase the amount of surface water in a waterbody; or

- Result in a permanent, adverse change to the movement of surface water sufficient to produce a substantial change in the current or direction of water flow.

These thresholds are applicable to the Proposed Project and as such are used to determine if the Project would have significant surface water hydrology impacts.

2.2.4.2 Methodology

The City of Los Angeles Standard Peak Rate Method is the conservative prediction methodology used for the computation of stormwater runoff from the Proposed Project Site and from areas that are tributary to the site. The Peak Rate Method is a derivative of the classic Rational Method and was developed in the late 1930s by the City of Los Angeles for applications in the Los Angeles Basin. The basis of the design is the "pattern storm," which is a 50-year return-frequency 24-hour rainfall producing 6.8 inches of rain. This storm is preceded by three days of rainfall producing 10 percent, 40 percent, and 35 percent of the rain of the pattern storm.

For the purpose of this technical report, the impacts analysis considers as a whole the pre-First Phase condition against the Proposed Project condition. The analysis also indicates the incremental changes between the adjacent Playa Vista First Phase Project conditions and Proposed Project conditions. As a part of the stormwater system designed and approved as part of the adjacent Playa Vista First Phase Project, the Freshwater Wetlands System was designed to convey and detain the flow from both the adjacent Playa Vista First Phase Project and the Proposed Project without adversely impacting existing facilities upstream and downstream. Hence, for the overall Proposed Project impacts analysis, the Freshwater Wetlands System is utilized as a Project Design Feature for the adjacent Playa Vista First Phase Project and the Proposed Project.

Linked spreadsheet programs have been developed by Psomas and are used in this study for Initial Time of Concentration (t_c), Area Conversions (A_e), and Runoff (Q_{50}) computations, and for the presentation of the computations in a form that is required by the City of Los Angeles, Bureau of Engineering. To define the drainage patterns, delineate the tributary boundaries and identify the drainage subareas, reference maps and field inspections were used. The reference maps utilized were topographic maps of various scale, City of Los Angeles drainage maps, and record plans of existing storm drain facilities and streets. The gathered information has been compiled in a computer database, field-checked and presented on a 1'=800' scale Off-site Hydrology Map and 1"=400' scale On-Site Existing Hydrology Map (see Volume, Appendix A, of this Technical Report). The hydrology schematic, showing direction of on-site runoff and storm flow, is shown on Figure 2-4.

On-site areas also include all street rights-of-way within the hydrologic boundaries of the site.

Estimated runoff from the 50-year design storm from the off-site areas have been presented in The Village at Playa Vista Proposed Project Flood Hydrology Technical Appendix prepared by Psomas, dated July 17, 2003 (Volume II, Appendix A of this Technical Report).

The results of these computations are a time of concentration (tc) and a 50-year peak flow (Q50) value at key points of the storm drain system. These values have been used to size the storm drains. In order to compare runoff rates from different storm events, a storm frequency factor was applied to the peak 50-year runoff rate to approximate the higher frequency events (i.e., 1, 2, 5, 10, 20, and 25-year events).

The Storm Water Management Model (SWMM-XP) computer program, originally developed by the United States Environmental Protection Agency (EPA), is a rainfall runoff model that can determine the quantity and quality of runoff due to a specific rainfall event. The SWMM-XP was used to model flood and tidal flow in the Ballona Channel and Ballona Wetlands, as well as storm flow in the Freshwater Marsh. Key assumptions and design criteria used in the analysis are summarized as follows:

Design Criteria

Runoff Computations:	Peak Rate Method (a deviation of the Rational Method) as described in the City of Los Angeles, Bureau of Engineering Manual Part G, Storm Drain Design
Design Storm:	50-year return-frequency pattern storm as defined in the above manual
Isohyetal:	ISO = 1.33 inches per hour, maximum
	one-hour rainfall uniform throughout the site
Soil Types:	Type 1 - Clay - entire Project Site, except bluffs
	Type 2 - Loam - off-site areas and bluffs
Development Classification:	As shown on current City of Los Angeles Zoning maps for existing developments, and proposed zoning for the site.
Imperviousness:	Definition of imperviousness by land use (I_d) is based on development classifications as indicated in Figure G 241.3 of the Storm Drain Design Manual for each land use described.

Project-Specific Id Values:	$I_d = 35\%$	Undeveloped bluff areas, proposed parks along Riparian Corridor, and parks on-site
	$I_d = 50\%$	Engineered slopes on bluffs with concrete benches and drains
	$I_d = 60\%$	R2 residential developments
	$I_d = 70\%$	R3 residential developments and R1 single-family developments within designated hillside areas (Westchester and Playa del Rey)
	$I_d = 100\%$	R4 and R5 residential, all commercial developments, schools, and wetland areas where inundation of the land is expected for an extended period of time

Initial Time of Concentration: Figures G 242.2 A through D for developed areas from the Storm Drain Design Manual and Figure G 262 (Kirpich Nomogram) for undeveloped hillside areas

Flow Routing: Travel-time computations based on normal depth flow in streets, open channels, and closed conduits when backwater effects may not result in sealed flow conditions. Full pipe flow was assumed in existing storm drains when the design runoff rate was larger than the capacity of the conduit. Flow velocity is calculated assuming a pipe flow equal to the capacity of the conduit.

$$V = Q_c/A$$

Excess runoff was assumed to flow or pond in the street above the conduit,

Conduit Capacity:

$Q_c = K\, S_f 0.5$, where

$S_f = S_{invert}$, if street slope is not continuous (sumps, e.g., Jefferson Boulevard)

$S_f = S_{street}$, if street slope is continuous (no sumps, e.g., Pershing Drive)

and

$$K = \frac{1.486\ A^{*}R^{2/3}}{n}$$

A = cross-sectional area of flow

R = wetted perimeter

Manning's Roughness:

Based upon the Storm Drain Design Manual:

n = 0.013 for streets and all concrete storm drains

n = 0.050 for existing trapezoid earthen channels with natural vegetation

Composite roughness value was calculated for the trapezoid channel of the Riparian Corridor based on preliminary restoration plans assuming cattail planting on the bottom and willow planting on the side slopes of the channel, assuming:

n = 0.050 for bottom of the channel

n = 0.125 for side slopes of trapezoid section

n = 0.030 for vertical sides of rectangular sections

$S_f = 0.9\ S_{invert}$ for proposed storm drains in order to provide allowance for minor losses in the system

Hydrograph Development:

Peak Rate Method was used for the entire project until development of hydrographs was needed for detention computations or input data was needed for the hydrodynamic computer model of the wetlands. Then hydrographs were developed as described below.

Hydrograph development is based on Figure G 252F of the Storm Drain Design manual.

Hydrodynamic Model: EXTRAN flow routing module of the SWMM by the EPA.

2.2.4.3 General Project Effects

Both the Urban Development and Habitat Creation/Restoration Components of the Proposed Project include activities that would affect surface water hydrology. As such the following discussion pertains to the potential impacts of each component. Though each component is addressed separately, both were considered when designing the drainage facilities for the adjacent Playa Vista First Phase Project and Proposed Project. Implementation of the Habitat Creation/Restoration Component would involve the construction of a major flood control facility, the Riparian Corridor, which was designed to serve the Proposed Project by conveying increases in peak runoff rates or volumes caused by the Urban Development Component.

2.2.4.4 Urban Development Component

2.2.4.4.1 Potential For Flooding

Development within the Urban Development area would increase the amount of impervious surface area on-site, consequently increasing total peak runoff rates and volumes. The following subsections describe the potential of the Urban Development Component of the Proposed Project to cause flooding during a projected 50-year storm event post-development, which would have the potential to harm people or damage property. The impacts on sensitive biological resources are discussed in Section IV-D, Biotic Resources of the Proposed Project's Draft EIR.

Drainage facilities constructed as part of the adjacent Playa Vista First Phase Project have been sized for the full buildout of the adjacent Playa Vista First Phase Project and the Proposed Project. Since the drainage facilities have been designed based upon the installation of paved and impervious surfaces, portions of the site which are pervious during construction of the Urban Development Component would not increase stormwater runoff flows above the ultimate design flows. The construction of new drainage structures would be required in a manner and sequence, which would preclude flooding. During construction of the Proposed Project, the existing Stormwater Pollution Prevention Plan and Erosion Control Plan would be modified to incorporate the Proposed Project and implemented to provide for temporary Stormwater management. These plans would prevent construction from adversely affecting the amount of surface water in a waterbody. Therefore, construction activities for the Urban Development Component would not cause flooding during a projected 50-year developed storm event, which would have the potential to harm people or damage property.

Impacts to the existing storm drain systems (e.g., Jefferson Storm Drain) will be minimized by maintaining and improving the existing drainage system controls.

Downstream hydraulic controls (outlet water surface elevations) will be maintained at or below existing levels. Peak runoff to the systems will be maintained at or below existing levels by detention or reduction of the area tributary to the drain. **Table 2-2, Stormwater Flows to the Freshwater Marsh and Ballona Wetlands**, Stormwater Flows to the Freshwater Marsh and Ballona Wetlands, provides a comparison of 1-, 2-, 5-, 10-, 25-, and 50-year stormwater runoff volumes for existing (pre-First Phase), Playa Vista First Phase conditions, and future conditions with completion of the Proposed Project (i.e., with buildout of the Playa Vista First Phase Project and the Proposed Project). As shown in the table, the future runoff to existing drainage systems, such as the Centinela Ditch, which is replaced by the Riparian Corridor and Central Storm Drain, would be reduced from that of pre-First Phase Project conditions. Such reductions to existing drainage systems are enabled through the rerouting of existing flows and the addition of new drainage systems (i.e., Central Storm Drain) as part of the adjacent Playa Vista First Phase Project and the Proposed Project. **Table 2-3, 50-Year Peak Runoff**, provides a comparison of the 50-year storm peak runoff rates for pre-First Phase, with Playa Vista First Phase Project conditions and with adjacent Playa Vista First Phase Project and Proposed Project. With the completion of storm drains and facilities designed and built to accommodate the adjacent Playa Vista First Phase Project and Proposed Project, the existing local storm drains would not be significantly impacted by changes in surface runoff flows due to implementation of the Urban Development Component because the Proposed Project would not cause flooding of the existing local storm drains during the projected 50-year developed storm event, which would have the potential to harm people or damage property. Therefore, no adverse impacts to the existing storm drain systems (e.g., Jefferson Storm Drain) would occur because existing drainage system controls would be maintained or improved to be equal to or better than pre-First Phase conditions. For example, because the Freshwater Marsh will be maintained below 8 feet above MSL, it will also serve as detention. Downstream hydraulic controls (outlet water surface elevations) would be maintained at or below existing levels. Peak runoff to the systems would be maintained at or below existing levels by detention or reduction of the area tributary to the drain.

As described above, no development portion of the Proposed Project is within the FEMA 100-Year Floodplain. The proposed drainage system for the Urban Development Component has been designed to convey increases in total peak runoff rates and volumes caused by the Proposed Project and provide an appropriate level of on-site flood protection, detention, and drainage. The major flood control facilities that would serve the Urban Development Component include the Freshwater Wetlands System (Freshwater Marsh and Riparian Corridor), Central Storm Drain, and local drainage systems. As such, the Urban Development Component partially depends on the Riparian Corridor constructed as part of the Habitat Creation/Restoration Component to provide adequate drainage. Therefore, construction of the proposed drainage system would be phased to adequately receive any increase in peak runoff rates or volumes that could adversely affect any existing or planned development. During final design and engineering, the proposed drainage system for the Proposed Project will be sized to provide adequate flow capacity, as determined by the City. The proposed drainage system would be designed and sized such that the Project-generated runoff would not exceed the maximum capacity of the existing system. With the construction and operation of the proposed drainage systems, the Urban Development Component would not cause flooding on-site during the projected 50-year developed storm event, which would have the potential to harm people or damage property, and therefore, no significant impacts are expected to occur relative to flooding of new or existing development.

The Urban Development Component would also not cause flooding during the projected 50-year developed storm event to the off-site existing tributary area. As discussed above, the proposed drainage system for the Urban Development Component has been designed to convey increases in total peak runoff rates and volumes caused by the Proposed Project. As also generally seen in Tables 2-2, 2-3 and 2-4, the Proposed Project would add a minimal amount of total peak runoff and volumes above that of the adjacent Playa Vista First Phase Project. Although during major storm events there is some overflow from the Freshwater Marsh into the Ballona Wetlands, the total runoff actually reaching the Ballona Wetlands decreases from the pre-First Phase condition as shown in **Table 2-4, Total Peak 50-year Runoff Rates and Volumes of Total Flows to the Ballona Wetlands**. For a discussion on the potential impacts due to this decrease in runoff to the Ballona Wetlands, see Section IV-D, Biotic Resources of the Proposed Project's Draft EIR.

One SUSMP structural BMP requirement requires that a project "control peak flow discharge to provide stream channel and over bank flood protection, based on flow design criteria selected by the local agency." The City of Los Angeles' storm drain design criteria require any storm drain in a natural drainage course to be designed to control the 50-year storm event. This structural BMP requirement refers to the Proposed Project's potential to flood or cause erosion to the Riparian Corridor or the Ballona Channel. As part of the adjacent Playa Vista First Phase Project, the Riparian Corridor is a new channel designed to convey the 50-year storm event and the 50-year flow rate is predicted to remain at 549 cfs after completion of the Proposed Project (see Table 2-3). Therefore, the Riparian Corridor would meet the SUSMP requirement of no increase in peak stormwater discharge rate after development. Runoff from the Proposed Project is detained in the Freshwater Marsh prior to draining to the Ballona Channel or being diverted to the wetlands during peak storm events, thus providing flood protection to the Ballona Channel. The Ballona Channel invert is below mean sea level and the channel banks are approximately 16 feet above MSL at the lowest level at Playa del Rey and 20 feet above MSL at the Freshwater Marsh outlet. The maximum water surface elevation in the Freshwater Marsh is 8 above MSL. Therefore, flow from the Proposed Project does not cause the Ballona Channel to overtop its banks. In addition, the Ballona Channel is an improved and lined channel; therefore, erosion is not a major concern. In fact, the hydraulic cross-section of Ballona Channel is dependent upon the high storm flows removing the sediment and silt that settle above the channel invert due to interaction with Santa Monica Bay. All other SUSMP requirements primarily refer to water quality issues and are discussed in Section 3, Water Quality of this Volume.

Although the development of the Urban Development Component would result in an increase in peak runoff rates and volumes on-site, no observable increase in peak flood flows in Ballona Channel during the projected 50-year developed storm event would occur due to detention facilities and rerouting of flows within the adjacent Playa Vista First Phase Project and the Proposed Project. The Freshwater Wetlands System (Freshwater Marsh and Riparian Corridor) would serve as the primary detention facility for the adjacent Playa Vista First Phase Project and the Proposed Project. During storms greater than a 1-year design storm event, the eastern portion of the Ballona Wetlands would serve as an overflow area for the Freshwater Marsh. As part of the adjacent Playa Vista First Phase Project, flap-gated culverts at the Freshwater Marsh outlet would prevent flows from the Ballona Channel from backflowing into the Freshwater Wetlands System. Increased runoff from the Proposed Project during peak storm events would be discharged to the Freshwater Wetlands System and would not be discharged to the Ballona Channel until such time as the water elevation within the Ballona Channel drops to a level where on-site runoff can be discharged with no adverse impact to channel flows. Portions of the runoff from peak storm events greater than 1-year would flow over the adjustable weir, which manages the overflow spilling into the existing Ballona Wetlands. This adjustable weir was included in the design of the Freshwater Marsh to enable the overflow from the Freshwater Marsh to the Ballona Wetlands to be managed based on actual observed hydrology, i.e., increasing or lessening flows into the Ballona Wetlands as necessary. The proposed stormwater management facilities (e.g., flap-gates, on-site detention or other City approved methods of flood control) are expected to keep the adjacent Playa Vista First Phase Project and the Proposed Project peak flows at pre-First Phase levels. Because the Proposed Project peak flows would be retained within the Freshwater Wetlands System and Ballona Wetlands, peak flood flows in the Ballona Channel during the 50-year design storm event would not be increased; hence, the Urban Development Component would not cause flooding off-site during the projected 50-year developed storm event, which would have the potential to harm people or damage property, and a less than significant impact would occur.In addition to the proposed stormwater management facilities, during pre-First Phase, most of the adjacent Playa Vista First Phase Project and the Urban Development Component areas were at elevations lower than the maximum predicted flood flow heights in the Ballona Channel. Upon completion of the adjacent Playa Vista First Phase Project and the Urban Development Component, the building pads within the proposed development areas would all be at elevations higher than the maximum surface water elevation in the Ballona Channel. Therefore, during the projected 50-year developed storm event, there would not be any increased risk of flooding to harm people or damage property.

Lincoln Boulevard adjacent to the Proposed Project site has historically been subject to flooding under storms smaller than the City's 50-year design storm. Construction of the Freshwater Marsh as part of the adjacent Playa Vista First Phase Project has reduced flooding at Lincoln Boulevard. Also, as part of Caltrans' Lincoln Boulevard widening project, the proposed raising of Lincoln Boulevard (from Jefferson Boulevard south to the toe of the bluffs) to 11 to 14 feet above MSL (current elevation of this section of Lincoln Boulevard is about 6 to 11 feet above MSL) would eliminate such localized flooding. In addition, the maximum water surface elevation in the Freshwater Marsh would be 8 feet above MSL. All other existing streets would be maintained at current levels of protection by maintaining existing peak runoff rates at current levels. New streets would be protected per current City requirements by new storm drain systems. Therefore, the projected 50-year developed storm event would not increase risk of flooding to harm people or damage property, and no significant impacts are expected.

2.2.4.4.2 *Potential to Reduce or Increase the Amount of Surface Water in a Waterbody*

The Urban Development Component of the Proposed Project has the potential to affect the amount of surface water in waterbodies adjacent to the Project site. The waterbodies of concern are the Ballona Channel, Ballona Wetlands, Freshwater Marsh, and Riparian Corridor.

During construction of the Urban Development Component, the existing Stormwater Pollution Prevention Plan and Erosion Control Plan would be modified to incorporate the Proposed Project and implemented to provide temporary stormwater management for areas under construction to prevent the stormwater from adversely affecting waterbodies adjacent to the Project site. These stormwater management measures would be kept in place until the on-site stormwater drainage facilities designed to accommodate these flows were constructed. Therefore, the construction of the Urban Development Component would not substantially reduce or increase the amount of surface water in a waterbody and a less than significant impact would occur.

Although the development of the Urban Development Component would result in increased amounts of impervious surface consequently increasing the volume and velocity of stormwater runoff, it would not significantly change the amount of peak storm surface runoff flowing into the existing Ballona Channel. As indicated in **Table 2-5, Total Stormwater Runoff and Percentage of Total Flows to the Ballona Channel** the increase in amount of runoff flowing to the Ballona Channel due to development of the Proposed Project (compared to with Playa Vista First Phase Project conditions) is estimated to be approximately 0.3 percent. This increase is not considered to be significant. Increased runoff from the Proposed Project would be detained in the Riparian Corridor and Freshwater Marsh (and during major storms, the Ballona Wetlands), which were designed to accommodate these flows, prior to discharging to the Ballona Channel. Therefore, the Urban Development Component would not substantially reduce or increase the amount of surface water in the Ballona Channel and a less than significant impact would occur.

Development of the Urban Development Component would result in increased amounts of impervious surface consequently increasing the volume and velocity of stormwater runoff. However, it would not significantly change the amount of peak storm surface runoff flowing into the existing Ballona Wetlands. During the majority of storm events (i.e., storms of magnitude less than the 1-year design storm, which constitute approximately 92 percent of the estimated average annual flows), runoff from the adjacent Playa Vista First Phase Project, the Proposed Project, and other tributary drainage would flow through the Freshwater Marsh prior to discharge into the Ballona Channel. The Freshwater Marsh, which was designed to accommodate the total Playa Vista First Phase Project and the Proposed Project, thereby reduces the amount of freshwater flowing to the Ballona Wetlands (**Table 2-4**). For a discussion on the potential impacts related to freshwater inflows to the Ballona Wetlands, see Section IV-D, Biotic Resources, of the Proposed Project's Draft EIR.

The only runoff tributary to the Ballona Wetlands would be generated from precipitation falling directly on the wetlands and adjacent bluff areas and any overflow from the Freshwater Marsh over the Marsh's eastern berm and weir gate during storms of magnitude greater than a 1-year storm, which constitutes approximately 8 percent of the estimated average annual flows. The Freshwater Marsh was designed with an adjustable weir and low-flow diversion sluice and culvert that can be adjusted to allow more or less low-flow into the Ballona Wetlands if/as desired. See the Section IV-D, Biotic Resources of the Proposed Project's Draft EIR, for a discussion of impacts on biological resources as they relate to the adjustable weir overflow. The increased runoff due to development of the Proposed Project (as compared to the First Phase Project) would represent a very minor portion of the total flows into the existing Ballona Wetlands. **Table 2-6, Total Stormwater Runoff and Percentage of Total Flows to the Freshwater Marsh and Ballona Wetlands,** provides a breakdown of stormwater flows to the Ballona Wetlands calculated for various size storm events.

As indicated in Table 2-6, the increase in amount of runoff flowing to the Ballona Wetlands due to development of the Proposed Project compared to with Playa Vista First Phase is estimated to range from 0 percent to 3.6 percent, depending on the size of the storm event. Due to the low magnitude of this increase and considering that the amount of runoff flowing to the Ballona Wetlands due to development of the adjacent Playa Vista First Phase and Proposed Project decreases when compared to pre-First Phase conditions by 54 percent to 63 percent, the 0 percent to 3.6 percent marginal increase from First Phase to Proposed Project is not considered to be significant. Also, the additional amount of runoff to the Ballona Wetlands would only be a short-term temporary condition that dissipates as the stormwater within the Ballona Wetlands drains to the Ballona Channel. Therefore, the Urban Development Component would not substantially reduce or increase the amount of surface water in either the Ballona Wetlands or the Freshwater Marsh and a less than significant impact would occur.

Beyond not having a significant hydrological impact on the existing Ballona Wetlands, implementation of the Proposed Project would not preclude, limit, or otherwise prejudice the range of potential options for any future restoration of the Ballona Wetlands. The relationship of the adjacent Playa Vista First Phase Project and the Proposed Project to the Ballona Wetlands is controlled primarily through the operation of the Freshwater Marsh. The operational flexibility designed into the Freshwater Marsh through the adjustable weir and low-flow diversion sluice and culvert can adapt to a wide range of restoration options. The role of the Freshwater Marsh to divert flows from the Ballona Wetlands can be minimized, if desired, by keeping the adjustable weir at a lower spillover height.

As discussed above, the increased amounts of impervious surface due to the Urban Development Component would increase the volume and velocity of stormwater runoff into the Riparian Corridor. However, the Riparian Corridor, partially constructed as part of the adjacent Playa Vista First Phase Project, was designed to accommodate this increase in flows. **Table 2-7, Total Stormwater Runoff and Percentage of Total Flows to the Riparian Corridor**, provides a breakdown of stormwater flows to the Riparian Corridor for various size storm events at two locations. The amount of runoff flowing to the Riparian Corridor at the two locations due to development of the Proposed Project would decrease by 2.6 percent to 10.6 percent compared to Playa Vista First Phase conditions and by 3.3 percent to 9.8 percent when Project buildout is compared to pre-First Phase conditions, depending on the location and size of the storm event. The decrease would be caused by the grading of the Proposed Project area that would direct surface water runoff from the Riparian Corridor to the Central Storm Drain. The Riparian Corridor, with completion of the adjacent Playa Vista First Phase, is currently in its interim condition; and it was planned in its initial design that a portion of the runoff would be directed to the Central Storm Drain once the construction of the Riparian Corridor was completed as part of the Proposed Project. As such, this decrease is not considered to be significant. Therefore, the Urban Development Component would not substantially reduce or increase the amount of surface water in the Riparian Corridor and a less than significant impact would occur.

2.2.4.4.3 *Potential for Permanent Adverse Change to the Movement of Surface Water*

During construction of the Urban Development Component, the existing Stormwater Pollution Prevention Plan and Erosion Control Plan would be modified to include the Proposed Project and implemented to provide temporary stormwater management for areas under construction to prevent the stormwater from adversely affecting waterbodies adjacent to the Proposed Project site. These stormwater management measures would be kept in place until the permanent on-site stormwater drainage facilities designed to accommodate these flows were constructed. Therefore, the construction of the Urban Development Component would not result in permanent adverse change to the movement of surface water sufficient to produce a substantial change in the current or direction of water flow and a less than significant impact would occur.

As described in the Project Design Features, the Urban Development Component of the Proposed Project would result in regrading of the Project site, which would, by design, modify the surface runoff patterns and redirect flows from the Jefferson Storm Drain into the Central Storm Drain (constructed under the adjacent Playa Vista First Phase Project) and the Riparian Corridor. This redirection of stormwater runoff away from the Jefferson Storm Drain is considered beneficial since the hydraulic capacity of the Jefferson Storm Drain does not currently meet City of Los Angeles design standards (i.e., the change to the movement of surface water would, by intent, enable surface flows to be directed to a new storm drain that is designed to current City standards). The Urban Development Component would not result in a permanent, adverse change to the movement of surface water sufficient to produce a substantial change in the current or direction of water flow and a less than significant impact would occur.

2.2.4.5 Habitat Creation/Restoration Component

2.2.4.5.1 *Potential for Flooding*

Development of the Proposed Project's Habitat Creation/Restoration Component would not create additional impervious surface area on-site; therefore, it would not increase peak runoff rates or volumes during its construction or operation. Therefore, the construction and operation of the Habitat Creation/Restoration Component would not cause flooding (which would have the potential to harm people or damage property) during the projected 50-year developed storm event and a less than significant impact would occur.

Implementation of the Habitat Creation/Restoration Component would involve the construction of a major stormwater management facility, the Riparian Corridor, which (with the Central Drain) would serve as a replacement of the Centinela Ditch. The Riparian Corridor has been designed to serve the Proposed Project by conveying increases in peak runoff rates or volumes caused by the construction of the Urban Development Component and provide an appropriate level of on-site flood protection, detention, and drainage. Construction of the Riparian Corridor would be timed to adequately receive any increase in peak runoff rates or volumes that could adversely affect any existing or planned development. As shown in Table 2-2, the future runoff to the Centinela Ditch replaced by the Riparian Corridor and Central Storm Drain would be reduced from that of pre-First Phase and with Playa Vista First Phase Project conditions. Such reductions to existing drainage systems are enabled through the rerouting of existing flows and the addition of new drainage systems (i.e., Central Storm Drain) as part of the adjacent Playa Vista First Phase Project and the Proposed Project. During final engineering design, calculations will be provided to substantiate that no flooding would occur under the City's 50-year design storm.

As discussed in Subsection 2.2.3, the Freshwater Marsh would serve as the primary detention facility for the adjacent Playa Vista First Phase Project and the Proposed Project. Runoff from the Habitat Creation/Restoration Component during peak storm events would be discharged to the Freshwater Marsh and Ballona Wetlands[14], where it would remain until such time as the water elevation within the Ballona Channel drops to a level where on-site runoff can be discharged with no adverse impact to channel flows. Therefore, the construction and operation of the Habitat Creation/Restoration Component would not cause flooding (which would have the potential to harm people or damage property) during the projected 50-year developed storm event and a less than significant impact would occur.

2.2.4.5.2 *Potential to Reduce or Increase the Amount of Surface Water in a Waterbody*

The construction and operation of the Project's Habitat Creation/Restoration Component would not create additional impervious surface area on-site; therefore, it would not increase peak runoff rates or total volumes of flow. However, the Habitat Creation/Restoration Component would receive stormwater runoff from the Urban Development Component, which would increase stormwater runoff compared to what was formerly received by the Centinela Ditch in this location. Potential impacts of the Urban Development Component are discussed in Subsection 2.2.4.4.2. Because the Habitat Creation/Restoration Component was designed to receive and convey this increased stormwater flow, this increase is not considered to be significant. Therefore, the construction and operation of the Habitat Creation/Restoration Component would not significantly reduce or increase the amount of surface water in the Ballona Channel, Ballona Wetlands, Freshwater Marsh, and Riparian Corridor and a less than significant impact would occur.

2.2.4.5.3 *Potential for Permanent Adverse Change to the Movement of Surface Water*

The construction and operation of the Habitat Creation/Restoration Component of the Proposed Project would not, in general, change the direction of surface water flow. Although the Habitat Creation/Restoration Component would receive increased stormwater runoff from the Urban Development Component, the Habitat Creation/Restoration Component was designed to receive and convey this increased stormwater flow, and this increase is not considered to be adverse. Therefore, the construction and operation of the Habitat Creation/Restoration Component would not result in a permanent, adverse change to the movement of surface water sufficient to produce a substantial change in the current or direction of water flow and a less than significant impact would occur.

2.2.4.6 Summary of Potential Surface Water Hydrology Impacts

No development portion of the Proposed Project site (i.e., the Urban Development Component) is within the FEMA 100-Year Floodplain. The proposed drainage system

[14] *Only during storms greater than a 1-year design storm.*

for the Proposed Project (inclusive of the Urban Development drainage system, and the Riparian Corridor as part of the Habitat Creation/Restoration Component) has been designed to convey increases in total peak runoff rates and volumes and provide an appropriate level of on-site flood protection, detention and drainage. Therefore, the Project would not cause flooding of the existing local storm drains during the projected 50-year developed storm event, which would have the potential to harm people or damage property.

During construction of the Proposed Project, the existing Stormwater Pollution Prevention Plan and Erosion Control Plan would be modified to incorporate the Proposed Project and implemented to provide for temporary stormwater management. These plans would prevent construction from adversely affecting the amount of surface water in a waterbody. Additionally, these stormwater management measures would be temporary; hence, the construction of the Proposed Project would not result in a permanent adverse change to the movement of surface water.

Although the development of the Urban Development area would result in increased amounts of impervious surface that consequently would increase stormwater runoff flowing into adjacent waterbodies, the increase is not significant because the runoff would be detained in the Freshwater Wetlands System (the Riparian Corridor, a portion of which would be constructed as part of the Habitat Creation/Restoration Component, and the Freshwater Marsh), which would be designed specifically for stormwater management. Therefore, the Proposed Project (inclusive of both Components) would not significantly reduce or increase the amount of surface water in a waterbody.

As a Project Design Feature, the Proposed Project would result in grading of the Project area, which would, by design, modify the surface runoff patterns during Proposed Project construction and operation. Stormwater runoff during Proposed Project operation would also be redirected from the Jefferson Storm Drain into the Central Storm Drain and Riparian Corridor (a portion of which would be constructed as part of the Habitat Creation/Restoration Component). This redirection of runoff from the Jefferson Storm Drain is considered beneficial since it would result in a decrease of runoff in the Jefferson Boulevard Storm Drain, which does not meet City design standards for hydraulic capacity. Because the Proposed Project would result in a beneficial impact on the constrained Jefferson Boulevard Storm Drain and would not adversely impact any other stormwater drainage facilities, operation of the Proposed Project would not result in a permanent adverse change in the movement of surface water.

2.3 Groundwater Hydrology

The following discussion of groundwater hydrology includes terms, which characterize the water bearing aspects of, and interrelationships between, certain types of geologic units. Such terms include *aquifer, aquitard,* and *aquiclude.* An *aquifer* is a geological formation, group of formations, or part of a formation that contains sufficient saturated permeable material to potentially yield economical quantities of water to wells and springs. *Aquifers* are generally comprised of sands and gravels. An *aquitard* is a less permeable geological formation, part of a group of formations, or part of a formation that stores but does not readily transmit water. For example, an area comprised of silty clay or clay with layers of silt and sand may function as an *aquitard*. An *aquiclude* allows virtually no water to move through it, as might occur with a continuous layer of fine grained sediments and clay. Since the location, nature, and movement of groundwater is largely influenced by soil and geologic characteristics, it is recommended that the Earth Section of the Proposed Project's Draft EIR (Section IV-A) be reviewed in conjunction with the following discussion of groundwater characteristics in order to provide a more complete understanding of the Playa Vista First Phase Project and the Proposed Project. From a hydrologic perspective, the aquifer systems within the vicinity of the Project Site are considered part of the Santa Monica Hydrologic Basin.

2.3.1 Regulatory Framework

Pumping of percolating groundwater in California is governed by California water law. Landowners' overlying a groundwater basin can pump their share of groundwater utilizing their overlying rights so long as these rights have not been legally severed from the land and the groundwater pumping is limited to the landowners correlative share, which represents the portion of the water they can pump without adversely impacting other overlying right holders. Usage of groundwater can also be controlled through a judicial adjudication, wherein water rights are partitioned out to the full potential of the basin. The Proposed Project lies within the Santa Monica Hydrologic Basin, which has not been adjudicated. There is no basin-wide groundwater management program within the Santa Monica Basin.

2.3.2 Affected Environment/Existing Conditions

2.3.2.1 Regional Deep Groundwater System

The Proposed Project is located on the Ballona Gap, a subunit at the southern edge of the Santa Monica Hydrologic Basin of the Coastal Plain of Los Angeles (see **Figure 2-6, Regional Hydrologic Basins**). The Ballona Gap is a younger alluvial plain that was initially formed by headward erosion from the ocean, capturing drainage from the Sawtelle Plain and the Hollywood Piedmont Slope.[15]

Resultant deposits within the Ballona Gap form the Ballona Aquifer and include coarse sand, gravel, and cobbles. The Ballona Aquifer varies in thickness from less than 10 feet at the coast to 40 feet near Beverly Hills, and generally occurs at the Proposed Project site at a depth of approximately 50 feet below native grade.[16] Relative to the adjacent Playa Vista First Phase Project and the Proposed Project, the

[15] *California Department of Water Resources, Planned Utilization of the Groundwater Basins of the Coastal Plain of Los Angeles County," Bulletin 104, 1961, page 35.*
[16] *California Department of Water Resources, Planned Utilization of the Groundwater Basins of the Coastal Plain of Los Angeles County, Bulletin 104, 1961, page 52.*

San Pedro Formation underlies the alluvial deposits. The Silverado Aquifer occurs as a member of the San Pedro Formation. **Figure 2-7, Generalized Aquifer Cross-Section,** presents an general cross-section through the aquifer system under the adjacent Playa Vista First Phase Project and the Proposed Project, which roughly follows the alignment of the Ballona Channel, indicating the approximate elevations and relationships of the Bellflower, Ballona and Silverado Aquifers.

At the eastern edge of the adjacent Playa Vista First Phase Project and the Proposed Project Property, east of the Charnock Fault, the Ballona Aquifer is hydraulically connected with sandy gravel and silt layers of the upper San Pedro Aquiclude and with sandy gravels of the Gage/Gardena Aquifer (in a lateral manner). The Charnock Fault is believed to be a partial barrier to east-west flow in the Silverado Aquifer near the Proposed Project Site.[17] This is supported by both water level measurements from wells in the Silverado Aquifer and water quality data.[18] Water quality (total dissolved solids [TDS] - salinity) improves east of the fault.[19]

The Silverado Aquifer extends throughout most of the Coastal Plain of Los Angeles County and into Orange County.[20] The thickness of the Silverado Aquifer varies throughout the Coastal Plain and reaches a maximum thickness of approximately 500 feet near Lakewood. The maximum depth of the aquifer is approximately 1,200 feet below sea level at a location about three miles southeast of Norwalk.[21] Beneath and near the adjacent Playa Vista First Phase Project and the Proposed Project, the Silverado Aquifer occurs within the San Pedro formation, which is composed of sand, gravel and a small amount of clay.[22] The Silverado Aquifer is estimated to range in depth from about 100 to 200 feet beneath the adjacent Playa Vista First Phase Project and the Proposed Project.[23] Several distinct sand/gravel zones exist in the Silverado, which are separated by finer-grained units. The uppermost coarse-grained unit appears to be in contact with the Ballona Aquifer.[24] Regional water level contours suggest that groundwater in the Silverado Aquifer flows in an east to northeast direction.[25]

An artificial recharge area, the West Coast Basin Barrier Project (WCBBP), is located about 5.5 miles south of the site. The WCBBP is an injection project to prevent sea water intrusion in the area. Groundwater flows out radially from this area for a few

---

[17] *California Department of Water Resources, Op cit., page 110.*

[18] *McLaren Environmental Engineering, Site Investigation and Evaluation of Remedial Measures Report, Howard Hughes Property Plan Site, May 8, 1987, pages 16-17.*

[19] *McLaren Environmental Engineering, Op cit., May 8, 1987, Figure VI-4.*

[20] *California Department of Water Resources, 1961, Op cit., page 73.*

[21] *Ibid., page 75.*

[22] *Converse Consultants, Comprehensive Geotechnical Report, May 29, 1981, page 10.*

[23] *Law/Crandall, Inc., "Report of Phase II Environmental Site Assessment, Former Celery Dump Site, Playa Vista Project – Parcel A", April 7, 1992, page 11.*

[24] *Hargis and Associates, "Summary of Hydrogeologic Conditions, Summa Corporation Facility, Culver City," December 8, 1986, pages 3 and 7.*

[25] *County of Los Angeles Department of Public Works, Coastal Plain Deep Aquifer Groundwater Contour Map for Fall, 1994.*

miles, but the general trend is away from this recharge area in an east to northeast flow.[26] Both the WCBBP and groundwater extraction in the Inglewood/Hawthorne area influence the regional groundwater flow direction.

2.3.2.2 Local Shallow Groundwater System

2.3.2.2.1 Hydrogeology/Stratigraphy

Recent (Holocene) deposits underlying the adjacent Playa Vista First Phase Project and the Proposed Project extend to depths ranging from approximately 40 to 120 feet.[27] The Bellflower Aquitard, which consists of clay, silty and sandy clay, clayey silt, and fine sand, is found at depths near the surface to about 35 feet below the surface at the site.[28] The Basal unit (or lowermost unit) of the recent sediments consists of medium to coarse sand and gravel, which ranges from a few feet to 40 feet thick and is known as the Ballona Aquifer. Between the Bellflower Aquitard and Ballona Aquifer are transitional deposits (see **Figure 2-8, General Stratigraphic Column of Alluvium Typical of Proposed Project Site**). Regionally, the Ballona Aquifer occurs at a depth of 35 to 50 feet and readily transmits water.[29] Locally, these recent sediments appear to terminate at the south end of the adjacent Playa Vista First Phase Project and the Proposed Project sites, at an erosional nonconformity along the Ballona Escarpment.

Beneath some areas of Playa Vista, the lower, more permeable portion of the Bellflower Aquitard and the Ballona Aquifer together compose a single, hydraulically connected hydrogeologic unit, which is referred to as the Merged Bellflower/Ballona Aquifer, or simply, the Bellflower/Ballona Aquifer.[30,31] The lower sand and silty sand sediments of the Bellflower Aquitard are in direct contact with the underlying Ballona Aquifer sands and gravel and readily transmit to and from the underlying Ballona Aquifer. Although these two units are indicated to be distinctly different hydrogeologic units in some areas, beneath some areas of the Playa Vista First Phase and Proposed Project, the lower, more permeable portion of the Bellflower Aquitard and the Ballona Aquifer together compose a single hydraulically connected hydrogeologic unit, which is referred to as the Merged Bellflower/Ballona Aquifer, or simply the Bellflower/Ballona Aquifer.[32,33] However, the extent of hydraulic

---

26 *Ibid.*

27 *LeRoy Crandall and Associates, "Groundwater Monitoring Well Installation and Sampling, Water Quality Study, Playa Vista Project", August 21, 1990, page 3.*

28 *McLaren Environmental Engineering, Op cit., May 8, 1987, page II 5 and Figure II-2.*

29 *Hargis & Associates, Op cit., December 8, 1986, page 6.*

30 *Ibid., page 6.*

31 *McLaren Environmental Engineering, Op cit., May 8, 1987, page III-7.*

32 *California Department of Water Resources, 1961, Op cit., pages 47, 48, 51, and 52.*

33 *Hargis and Associates, Op cit., page 6*

connection between the Bellflower and Ballona units is uncertain.[34] Groundwater flow within the shallow groundwater units is generally to the north.[35]

Groundwater levels are relatively shallow beneath the site. While there is an overall trend of lower water levels on the eastern end of the Proposed Project site, reflecting the regional inland gradients in the main Aquifer units, local differences in shallow water levels and gradients are observed within different areas of the site. Such differences can result from several factors such as: varying stratigraphy (e.g., discontinuous levels of varying permeability); localized topographic differences; variable sources of shallow recharge including surface flow and subsurface recharge from the bluffs to the south; seepage from the ocean and possibly Ballona Channel, which is tidally influenced; uneven surface recharge from runoff infiltration due to varying soil conditions; and seasonal variations in precipitation. Groundwater flow beneath the site within the deep aquifer system (Silverado) is generally to the northeast.[36]

The Silverado is used for beneficial uses off-site, including municipal and domestic drinking water supply, industrial process and service supply, and agricultural supply. Currently, there is no groundwater extraction in the vicinity of the Proposed Project for beneficial uses.[37] However, groundwater extraction for remedial purposes previously occurred at the groundwater treatment facility (GWTF) located in the eastern portion of adjacent Playa Vista First Phase Project. This system included two groundwater extraction wells in the Proposed Project site and eight other extraction wells in the adjacent Playa Vista First Phase Project site. In June 2000, operation of the groundwater extraction system was temporarily suspended with Regional Water Quality Control Board – Los Angeles Region (RWQCB) approval due to grading and construction of the adjacent Playa Vista First Phase Project and the GWTF was decommissioned. Since September 2000, a new and more efficient groundwater treatment system, designed to treat a wider range of contaminants, was installed for remediation-related activities and construction dewatering in conjunction with the adjacent Playa Vista First Phase Project construction. This facility is located on the north side of Building 2 within the adjacent Playa Vista First Phase Project, east of the Proposed Project site, and operates under NPDES Permit #CAG914001. Currently, one other temporary portable groundwater treatment facility serves the adjacent Playa Vista First Phase Project and the Proposed Project. The facility is currently located within the western portion of the adjacent Playa Vista First Phase Project site,

---

[34] *Mr. Steve McArdle, Project Geologist, Law/Crandall, Inc., Telephone Communication, March 7, 1996.*

[35] *Camp Dresser & McKee, Inc. "Third Quarter 2002 Groundwater Monitoring and Progress Report". October 15, 2002.*

[36] *Camp Dresser & McKee, Inc. "Third Quarter 2002 Groundwater Monitoring and Progress Report". October 15, 2002.*

[37] *The nearest public water supply well is located at Venice Polytechnic High School, approximately 2 miles northwest of the Proposed Project. The subject well was capped in 1960 and is not active. The next closest public supply wells are located approximately 3.5 miles northwest of the Proposed Project in the City of Santa Monica. The nearest irrigation well is located approximately 2 miles southeast of the Proposed Project at the Hillside Memorial Park Cemetery.*

east of Lincoln Boulevard and south of Jefferson Boulevard, near Runway Road. This facility is presently in operation for treatment of construction dewatering effluent and operates under NPDES Permit #CAG994002. As construction of the adjacent Playa Vista First Phase Project progresses, additional treatment facilities will be added as deemed necessary, and with the approval of the RWQCB for specific construction dewatering and remediation efforts. A permanent groundwater treatment program for the adjacent Playa Vista First Phase Project and the Proposed Project will be implemented, as necessary, in accordance with RWQCB requirements and Cleanup and Abatement Order (CAO) No. 98-125. As an alternative to treatment on-site and discharge of construction dewatering under an existing NPDES permit, an Industrial Waste Discharge Permit (W-502105) has been obtained from the City of Los Angeles, Bureau of Sanitation, which allows construction dewatering to be discharged to the sanitary sewer. The existing extraction wells will be abandoned or relocated in accordance with RWQCB requirements. For a discussion of this remediation program, refer to Section IV-I, Safety/Risk of Upset of the Proposed Project's Draft EIR.

2.3.2.2.2 *Site-Wide Groundwater Flow*

The direction of groundwater flow varies throughout the adjacent Playa Vista First Phase Project and the Proposed Project sites but under the Proposed Project the groundwater flow is generally to the north or northeast, away from the ocean. Throughout the site, several factors control groundwater elevation and gradient. Seasonal variations in climatic conditions, daily tidal fluctuations and subsurface stratigraphy all influence local groundwater conditions.[38]

Based on the groundwater elevations, a substantial amount of recharge is being introduced to the aquifer located south of the adjacent Playa Vista First Phase Project and the Proposed Project. The recharge flows into the adjacent Playa Vista First Phase Project and the Proposed Project from the Ballona Escarpment through the alluvial fan located at the base of Westchester Bluffs.[39] Deposition occurs when streamflow or runoff velocity decreases due to a leveling of the surrounding topography. Alluvial fans are generally areas of groundwater recharge due to the porous, sandy subsurface layers of the fan.[40]

Dewatering activities associated with the current development of the adjacent Playa Vista First Phase Project (including dewatering of excavations, code-required foundation dewatering, etc.) have the potential to cause minor changes in local groundwater flow direction and depth. These changes, should they occur, are expected to be localized and are not expected to adversely affect regional groundwater.

---

[38] *Law/Crandall, Inc., Op cit., March 14, 1996, page 4.*

[39] *An alluvial fan is a cone-shaped, outspread, gently sloping mass of alluvium deposited by a stream or runoff.]*

[40] *American Geological Institute, Dictionary of Geologic Terms, Third Edition, 1984.*

2.3.3 Project Design Features

There are no Project Design Features related to groundwater hydrology, although the irrigation of landscaped areas and introduction or expansion of water surface area within the site through the implementation of the Freshwater Wetlands System will help offset reductions in groundwater recharge due to increased impervious area (see impacts discussion below).

2.3.4 Groundwater Hydrology Impact Analysis

2.3.4.1 Significance Thresholds

The Draft Los Angeles CEQA Thresholds Guide (p. D.3-4) states that a project would normally have a significant impact on groundwater level if it would:

- Change potable water level sufficiently to:
  - Reduce the ability of the water utility to use the groundwater basin for public water supplies, conjunctive use purposes, storage of imported water, summer/winter peaking, or respond to emergencies and drought;
  - Reduce yields of adjacent wells or wellfields (public or private); or
  - Adversely change the rate or direction of flow of groundwater; or
- Result in demonstrable and sustained reductions of groundwater recharge capacity.

These thresholds are applicable to the Proposed Project and as such are used to determine if the Project would have significant groundwater hydrology impacts.

2.3.4.2 Methodology

Short-term (construction) impacts could result from subsurface dewatering activities. Because the amount of dewatering required would be based on conditions encountered during construction and would not be determined until actual construction, these potential impacts are qualitatively assessed.

Long-term (operational) groundwater hydrology impacts resulting from changes in groundwater recharge due to development were estimated by evaluating changes in recharge based on the proposed land use changes, hydrology, and infiltration capacity of the underlying soil; and comparing the change in recharge to existing groundwater conditions. To estimate changes in recharge, the following methodologies were used:

1. The decrease in recharge resulting from rainfall was estimated for post-development conditions compared to existing conditions by calculating the increase in average annual stormwater runoff due to larger post-development areas of impervious surface. A portion of rainfall that does

not result in runoff on pervious surfaces assumed to infiltrate into the soil. A portion of the infiltrated water is retained as soil moisture and is lost to transpiration of vegetative cover and bare soil evaporation, while the remainder will percolate downward, eventually reaching the water table. The fraction that percolates depends on many factors including soil type, vegetation type, and climate. The assumption of 30 percent percolation is based in part on the fact that during the months of December through March, when most precipitation occurs, average evapotranspiration is slightly less than half of average precipitation. The actual fraction of infiltrated water that becomes deep percolation (groundwater recharge) can vary significantly from year to year depending upon rainfall patters, soil types, vegetative cover and landscape irrigation practices. A range of 30 to 50 percent could be expected. Therefore, a conservative 30 percent percolation factor was assumed for the analysis.

2. The increase in recharge resulting from applied water for landscape irrigation and the creation of the Riparian Corridor and Freshwater Marsh was estimated for post-development conditions compared to existing conditions by determining the non-potable water demand after development from the Section IV-N(1),Water Consumption, of the Proposed Project's Draft EIR. Thirty percent (30 percent) of the applied water was then assumed to percolate and become groundwater recharge, similar to the assumptions noted above.

Other potential sources of long-term impacts to groundwater hydrology could include:

1. Impacts resulting from dewatering during construction and remediation;
2. Long-term (following project completion) impacts resulting from continuing permanent dewatering systems (if required by the RWQCB).

Such impacts were evaluated based on anticipated site/structure design concepts and anticipated remediation activities.

The potential for the Proposed Project to result in the movement or expansion of existing contaminated groundwater is analyzed in Section IV-I, Safety/Risk of Upset of the Proposed Project's Draft EIR.

2.3.4.3 General Project Effects

Construction and operation of the Project's Habitat Creation/Restoration Component would complete the Riparian Corridor portion of the Freshwater Wetlands System. Since existing pervious surfaces would remain as pervious surfaces after the habitat creation/restoration and no groundwater wells would be installed as part of the Habitat Creation/Restoration Component, groundwater recharge and thus potable water levels from groundwater sources would not be affected. As such, the Proposed

Project's impacts result primarily from the implementation of the Urban Development Component, as discussed below.

2.3.4.4 Urban Development Component

2.3.4.4.1 Potential for Change in Potable Water Level

Groundwater in the area of the Project's Urban Development Component is not currently pumped for beneficial uses (i.e., drinking water, industrial or agricultural supply). The nearest public water supply well located at Venice Polytechnic High School, approximately 2 miles northwest of the Proposed Project site, was capped in 1960 and is not active. The next closest public supply wells are located approximately 3.5 miles northwest of the Proposed Project in the City of Santa Monica. The nearest irrigation well is located approximately 2 miles southeast of the Proposed Project at the Hillside Memorial Park Cemetery.

Due to the distance to these wells, and the fact that drinking water, industrial or agricultural supply wells would not be constructed as part of the Urban Development Component, construction of the Urban Development Component is not expected to change potable water levels that reduce yields of adjacent wells or wellfields (public or private). Construction and operation of the Urban Development Component also is not expected to change potable water levels that reduce the ability of the water utility to use the groundwater basin for public water supplies, conjunctive use purposes, storage of imported water, summer/winter peaking, or respond to emergencies and drought.

However, the Urban Development Component does include plans for construction of temporary and permanent dewatering wells. Temporary dewatering is likely to be required in certain areas of the Urban Development Component requiring remediation (in connection to the RWQCB's CAO No. 98-125) and subsurface excavation (which is dependent upon the actual construction techniques). This may cause short-term localized changes in the flow direction of shallow groundwater towards the areas of dewatering. Due to the short-term duration of the dewatering and the fact that no wells being used for beneficial purposes would be affected, no significant short-term impacts to groundwater hydrology due to remediation and/or construction-related dewatering for the Proposed Project is indicated. Additional potential impacts to groundwater due to remediation are discussed further in Section IV-C.(2), Water Quality and Section IV-I, Safety/Risk of Upset of the Proposed Project's Draft EIR.

Permanent dewatering systems may be required, for the methane safety system and dewatering of subterranean two-level parking garages in the Urban Development Component (it would not be necessary for one-level subterranean parking garage). This dewatering system would be a "contingent" system and would operate only if/as groundwater elevations occur at the level of the dewater pipes. In case groundwater is present or in the future rises to an elevation above the elevation of the groundwater pipes, the water is conveyed to a sump where it is removed by automatic pumps. The dewatering system does not include dewatering by pumping from deep wells or any specific well points.[41] Adverse impacts are not anticipated relative to the rate or change in the direction or movement of shallow groundwater because the maximum flow of the dewatering pipes is very low and their radius of influence on groundwater is limited. Therefore, the dewatering system is not anticipated to draw water across any substantial distance; hence, impacts are considered negligible from a local and regional basin perspective. Since no wells being used for beneficial purposes would be affected, no significant impacts to groundwater hydrology due to permanent dewatering related to the subsurface parking garages is indicated. Construction of the Urban Development Component is not expected to change potable water levels that adversely change the rate or direction of flow of groundwater.

2.3.4.4.2 *Potential to Reduce Groundwater Recharge Capacity*

Implementation of the Project's Urban Development Component would include the addition of impervious surfaces throughout much of the site. During construction grading, the existing pervious surfaces would still be pervious and would not reduce groundwater recharge. However, as construction progresses and during operation of the Urban Development Component, the conversion of existing pervious surfaces to impervious surfaces poses the potential to reduce groundwater recharge. The operation of the Urban Development Component also includes, however, the introduction of additional landscape irrigation, which could minimally increase groundwater recharge.

Percolation of precipitation occurs when rain falls on pervious surfaces. Depending upon the conditions, some rain will run off, and some will infiltrate the soil. The pollutant loading model (discussed in Section 3, Water Quality, of this Volume) evaluates the runoff using varying runoff coefficients for the pervious and impervious surfaces. Overall, the model estimates that 30 percent of the average annual rainfall infiltrates the soil while the remaining 70 percent becomes runoff with the full development (buildout) of the adjacent Playa Vista First Phase Project and Proposed Project. Of the 30 percent of average annual rainfall that infiltrates into the soil, some will be either taken up in evapotranspiration or result in deep percolation and recharge of the groundwater. The fraction that percolates is highly dependent upon soil types and conditions, vegetative cover and other factors. It is assumed that 30 percent of the water that infiltrates (equivalent to 9 percent of the average annual rainfall) would result in deep percolation across the site. **Table 2-8, Estimated Groundwater Recharge from Precipitation**, provides an estimate of the reduction in recharge resulting from reduced percolation of rainfall as a result of development. As shown in Table 2-8, there could be a reduction in groundwater recharge of approximately 12 acre-ft/year due to the incremental amount of development of the Proposed Project. The Urban Development Component (i.e., impervious area) is set back away from the base of the Ballona Escarpment (Westchester Bluffs). This would

[41] *Group Delta Consultants, "Evaluation of Subsidence Due to Lowering of Groundwater in Village at Playa Vista, Playa Vista Development, Los Angeles, California", April 15, 2003.*

allow for runoff flowing directly off the Escarpment to continue to recharge the underlying aquifer.

The Proposed Project would include landscaped area and open space, which would be irrigated, thereby offsetting the reduction in recharge area. While the majority of the applied water would be used to satisfy evapotranspiration, a fraction would typically percolate. The irrigation demand for the Urban Development Component is estimated to be approximately 61 acre-ft/year as described in Section IV-N.(1), Water Consumption of the Proposed Project's Draft EIR. Assuming that 30 percent of the applied water results in deep percolation, the estimated increase in groundwater recharge from applied water would be approximately 18 acre-ft per year.

The combination of reduced discharge from impervious surfaces and increased recharge from irrigation return flow results in a net increase of approximately 6 acre-ft/year. This increase is considered positive, but negligible from a regional basin perspective, and is not expected to result in any measurable increase in local groundwater levels.

Thus, from a hydrologic perspective, the small loss in groundwater recharge resulting from the increase in impervious surfaces as a result of development would be more than offset by potential increase in recharge from returns from irrigation application. The construction and operation of the Urban Development Component would not result in demonstrable and sustained reductions of groundwater recharge capacity. A less than significant hydrologic impact to groundwater recharge would occur.

2.3.4.5 Summary of Potential Groundwater Hydrology Impacts

Because construction and operation of the Project's Habitat Creation/Restoration Component is expected to allow that portion of the Project site to remain as pervious surfaces, it is not expected to change potable water level sufficiently or result in demonstrable and sustained reductions of groundwater recharge capacity. As such, a less than significant impact would occur. Construction of the Project's Urban Development Component includes construction of temporary and permanent dewatering systems. Furthermore, groundwater in the area of the Proposed Project site is not pumped for potable water. Although dewatering may cause local changes in the flow direction of shallow groundwater, this change in flow would be localized and, therefore, considered negligible from a regional basin perspective. Therefore, the Proposed Project is not anticipated to change potable water level to sufficiently reduce the ability of the water utility to use groundwater for public water supplies, conjunctive uses purposes, storage of imported water, summer/winter peaking, or to respond to emergencies and drought, reduce yield of adjacent wells/well fields, or adversely change the rate or direction of flow of groundwater. Accordingly, a less than significant impact would occur. Implementation of the Project's Urban Development Component would include the addition of impervious surfaces. The conversion of surfaces from pervious to impervious due to development of the Proposed Project has the potential to reduce groundwater recharge by approximately

12 acre-ft/year. The introduction of additional landscape irrigation is estimated to produce approximately 18 acre-ft/year of groundwater recharge. Therefore, the net increase of approximately 6 acre-ft/year of increased recharge due the Proposed Project is considered positive, but negligible from a regional basin perspective; hence, the Project would not result in a demonstrable and sustained reduction of groundwater recharge capacity, and no significant impact would occur.

2.4 Cumulative Impacts

The majority of the off-site areas tributary to the adjacent Playa Vista First Phase Project and the Proposed Project consist of highly urbanized development. As a result, substantial additional changes in off-site hydrologic factors affecting runoff rates (i.e., increases in impervious surface area, changes in drainage routes, etc.) are unlikely to occur. Changes in topography and developed acreage should be minimal within the entire developed watershed. While land uses may change, the total impervious area, and therefore runoff rates, should remain relatively constant. For instance, a 38-acre residential development, Tentative Tract 51122 (West Bluff Project),[42] located south of the Freshwater Marsh (see Figure 2-4) has been approved since the adjacent Playa Vista First Phase Project was approved. The hydrology for Tentative Tract 51122 includes the diversion of 27 acres of area currently draining south to Manchester Boulevard and eventually to the Freshwater Marsh. Based upon the hydrology prepared by Robert Bein, William Frost and Associates, the total 50-year peak runoff generated by the 38 acres of residential tributary area (on-site and off-site to Tract 51122) is 124 cfs with a total storm volume of 49 acre-feet, and the total 50-year peak flow rate generated by the 27 acres of diverted area is 88 cfs with a total storm volume of 35 acre-feet.[43] Per City of Los Angeles requirements, the analysis of future conditions with the addition of Proposed Project assumes that all off-site areas within the local watershed have been built out to the current zoning designations. It is not anticipated that the cumulative flows with the Tentative Tract 51122 diversion would affect the Freshwater Marsh's ability to contain the 1-year storm event. The adjustable weir that manages the overflow into the salt marsh (Ballona Wetlands) could be raised, if necessary, to contain the desired storm flows. This was envisioned at the time of design of the Freshwater Marsh and is the reason why the adjustable weir was included in the design of the Marsh. Cumulative flows during storm events greater than the 1-year storm would incrementally add to the Stormwater overflow going into the Ballona Wetlands. However, the increase is not considered significant since it represents such a small amount of the total Stormwater flowing into the wetland area (less than 1 percent associated with the diversion, between 1.3 percent and 3.6 percent for the Proposed Project, depending on the size of the storm) and the total storm flow compared to conditions before the Marsh was built is reduced by over 50 percent for all storm events. Therefore, the potential for cumulative impacts,

[42] *West Bluffs Project (Tract 51122), City of Los Angeles EIR No 91-0675, State Clearinghouse No. 92041046*

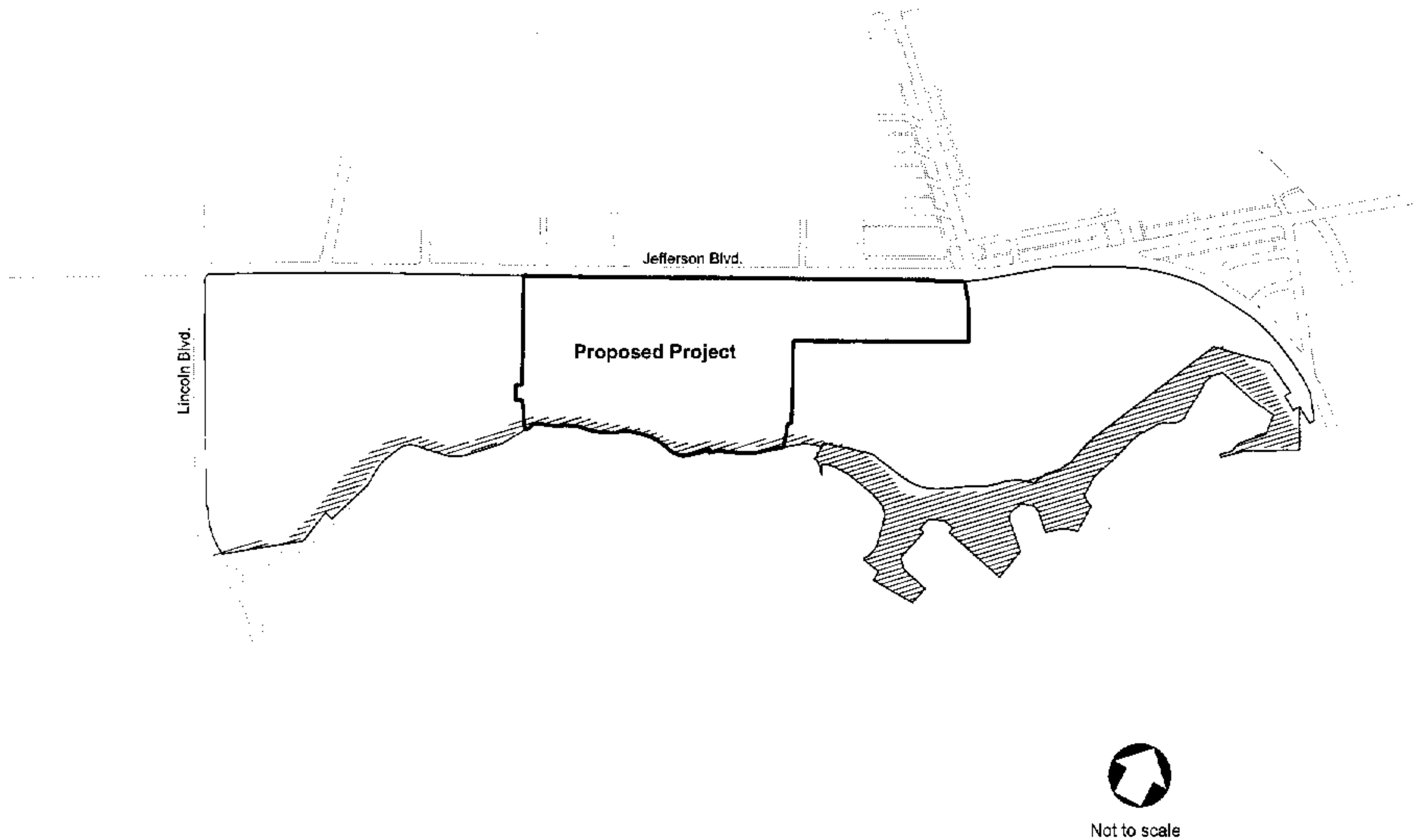
[43] *The storm volume was estimated by Psomas based upon the prorated drainage area, time of concentration, and peak runoff rate in the Robert Bein, William Frost and Associates report.*

including Tentative Tract 51122, has already been accounted for in the Project Design Features for the Proposed Project. In addition to the two off-site projects discussed above, there are seven roadway widenings that are planned to mitigate traffic congestion caused by the Proposed Project. The Centinela Corridor improvements will add approximately 0.6 acres of impervious surfaces. The other intersection improvements which include Culver Boulevard and Inglewood Boulevard, Sawtelle Avenue and Culver Boulevard, La Tijera Boulevard and Centinela Avenue, Centinela Avenue and Washington Place, Overland Avenue and Culver Boulevard and Centinela Avenue and Culver Boulevard, will add approximately 0.3 acres of impervious surfaces. All of these improvements would eventually drain to the Ballona Channel. The combined imperviousness of the roadway improvements projects is expected to increase the average annual runoff volume to the Ballona Channel by approximately 0.5 acre-feet per year, which is only about 0.2 percent of the average annual runoff from the adjacent Playa Vista First Phase and the Proposed Projects combined. All of these widening projects will be required to meet SUSMP requirements. Given the SUSMP requirements that will apply to these projects and their small size, it is anticipated that the impact associated with these off-site construction projects will be less than significant.

As such, cumulative impacts to surface water hydrology from implementation of the Proposed Project, related projects, and other background growth would be less than significant, as the Proposed Project and related growth is not anticipated to cause flooding during the projected 50-year developed storm event, which would have the potential to harm people or damage property; substantially reduce or increase the amount of surface water in a waterbody; or result in a permanent, adverse change to the movement of surface water sufficient to produce a substantial change in the current or direction of water flow.

Cumulative groundwater hydrology impacts could result from the overall utilization of respective groundwater basins located in proximity to the Proposed Project and related project sites. To the extent that it is possible that public supply wells are located within or near the related project sites, and the related projects could extract water from local basins, such cumulative utilization of groundwater in the region could adversely affect local and regional groundwater hydrology. However, the extent to which the related projects would extract or otherwise directly utilize groundwater is not possible to assess. However, the potential for impacts to groundwater hydrology from the related projects in conjunction with the Proposed Project is not anticipated to be adverse inasmuch as the related projects would be expected to utilize water supplies from the respective public water suppliers (e.g., Los Angeles Department of Water and Power), including possible use of groundwater as a supply source. Such groundwater consumption would be regulated by the respective public water supply agencies, for which groundwater utilization is limited by entitlements to maintain the integrity and productivity of groundwater basins. Consequently, no significant cumulative impacts to groundwater hydrology are expected, as the Proposed Project and related growth is not anticipated to change potable water level sufficiently to reduce the ability of the water utility to use the groundwater basin for public water supplies, conjunctive use purposes, storage of imported water, summer/winter peaking, or respond to emergencies and drought; reduce yields of adjacent wells or wellfields (public or private); or adversely change the rate or direction of flow of groundwater; or result in demonstrable and sustained reductions of groundwater recharge capacity. As such, no significant cumulative impacts are anticipated.

N:\10610\37605\Ccad\TechRpt\FloodInsRateMap.cdr - Negretegd - 07/16/2003



FLOOD ZONE B : Areas between the limits of 100-year and 500-year flood

FLOOD ZONE C : Areas of minimal flooding not requiring flood insurance.

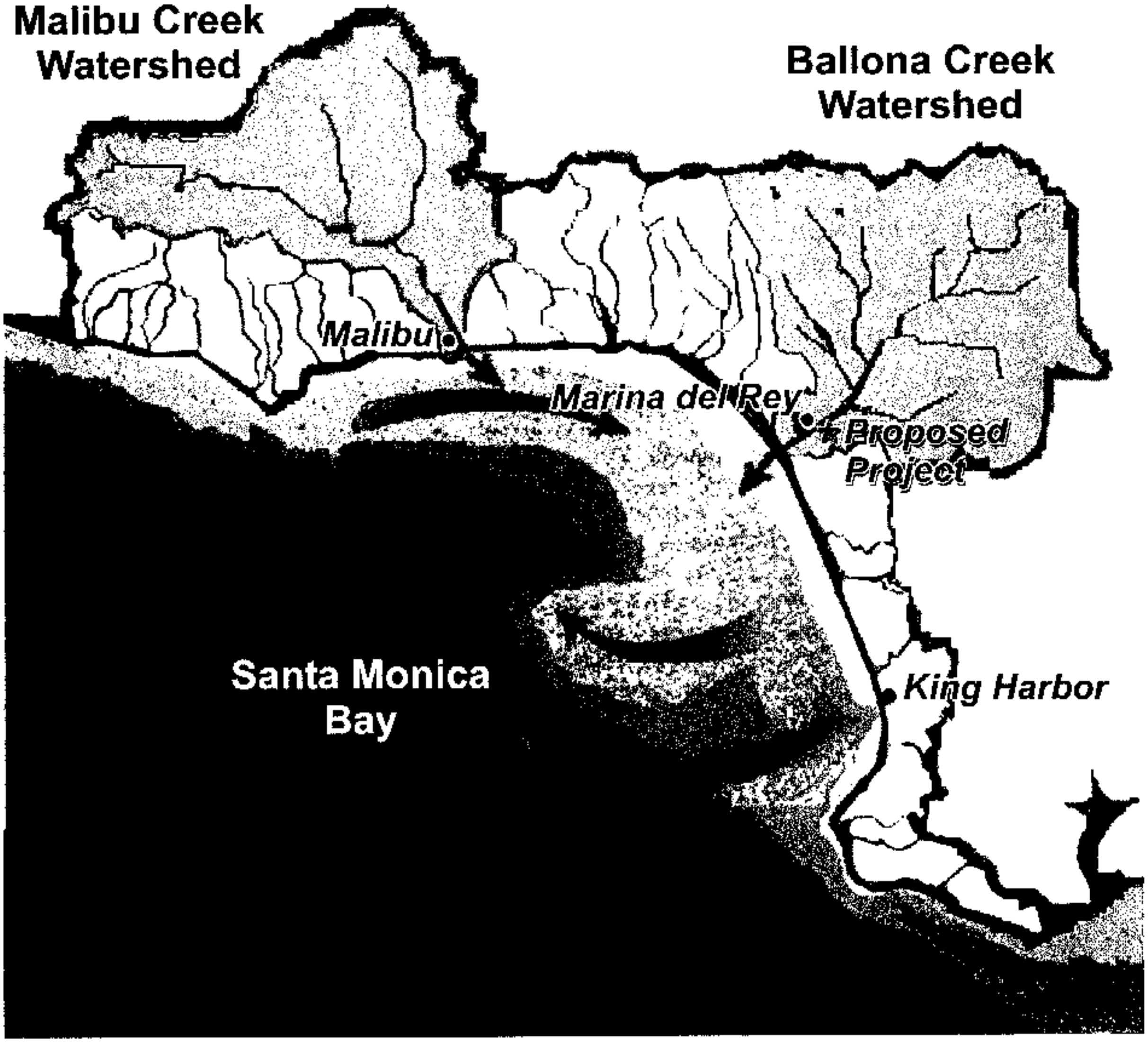
SOURCE: PSOMAS

THE VILLAGE AT PLAYA VISTA
WATER RESOURCES TECHNICAL REPORT

Flood Insurance Rate Map Flood Zones

CDM

Figure 2-1



Scale: NTS

SOURCE: PSOMAS AND ASSOCIATES

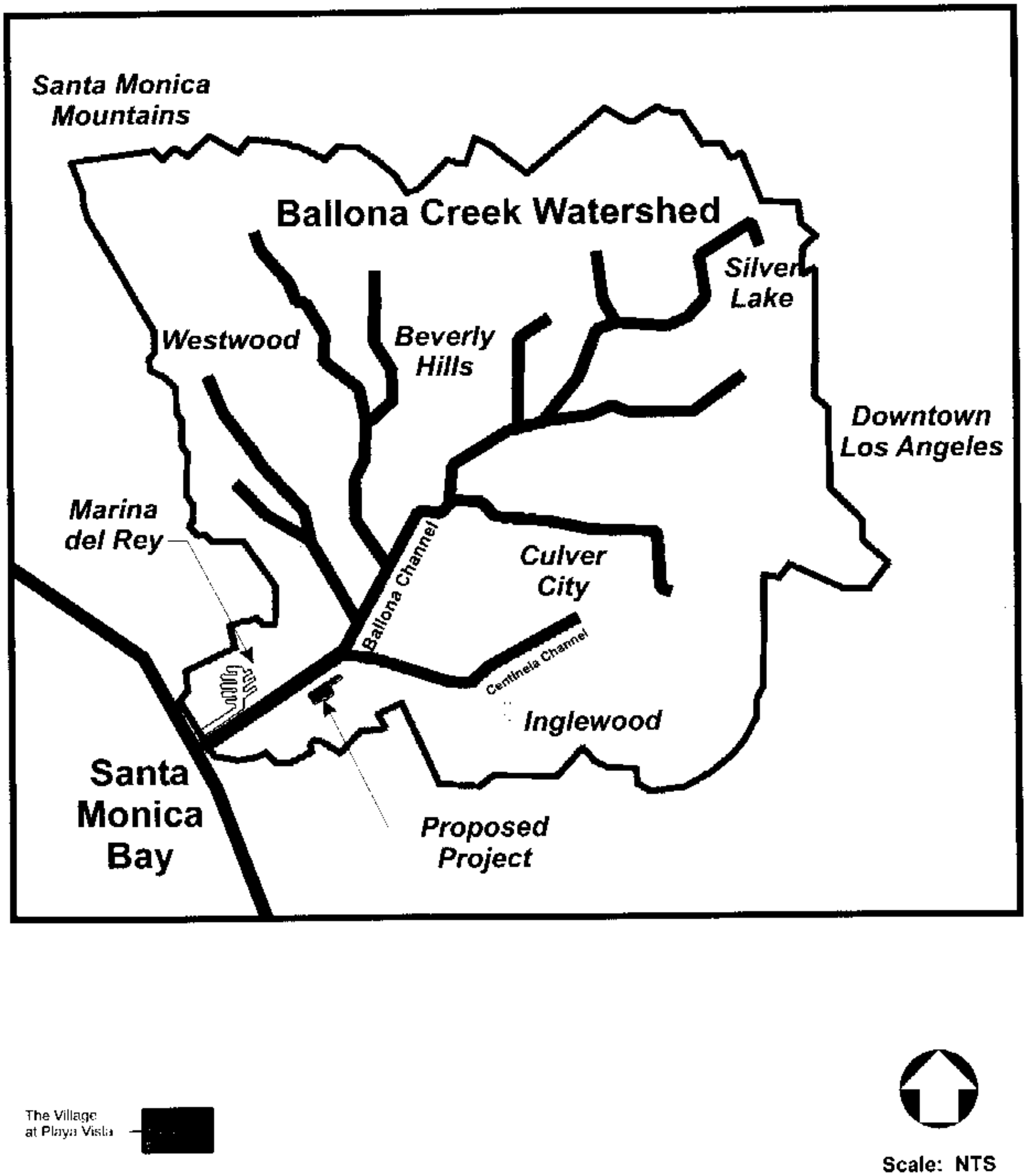
THE VILLAGE AT PLAYA VISTA
WATER RESOURCES TECHNICAL REPORT

Regional Hydrological Setting

CDM

Figure 2-2

V:\0610\37605\0ced\TechRpt\reg_hydro_setting.cdr - Negretego - 07/15/2003



SOURCE: PSOMAS AND ASSOCIATES

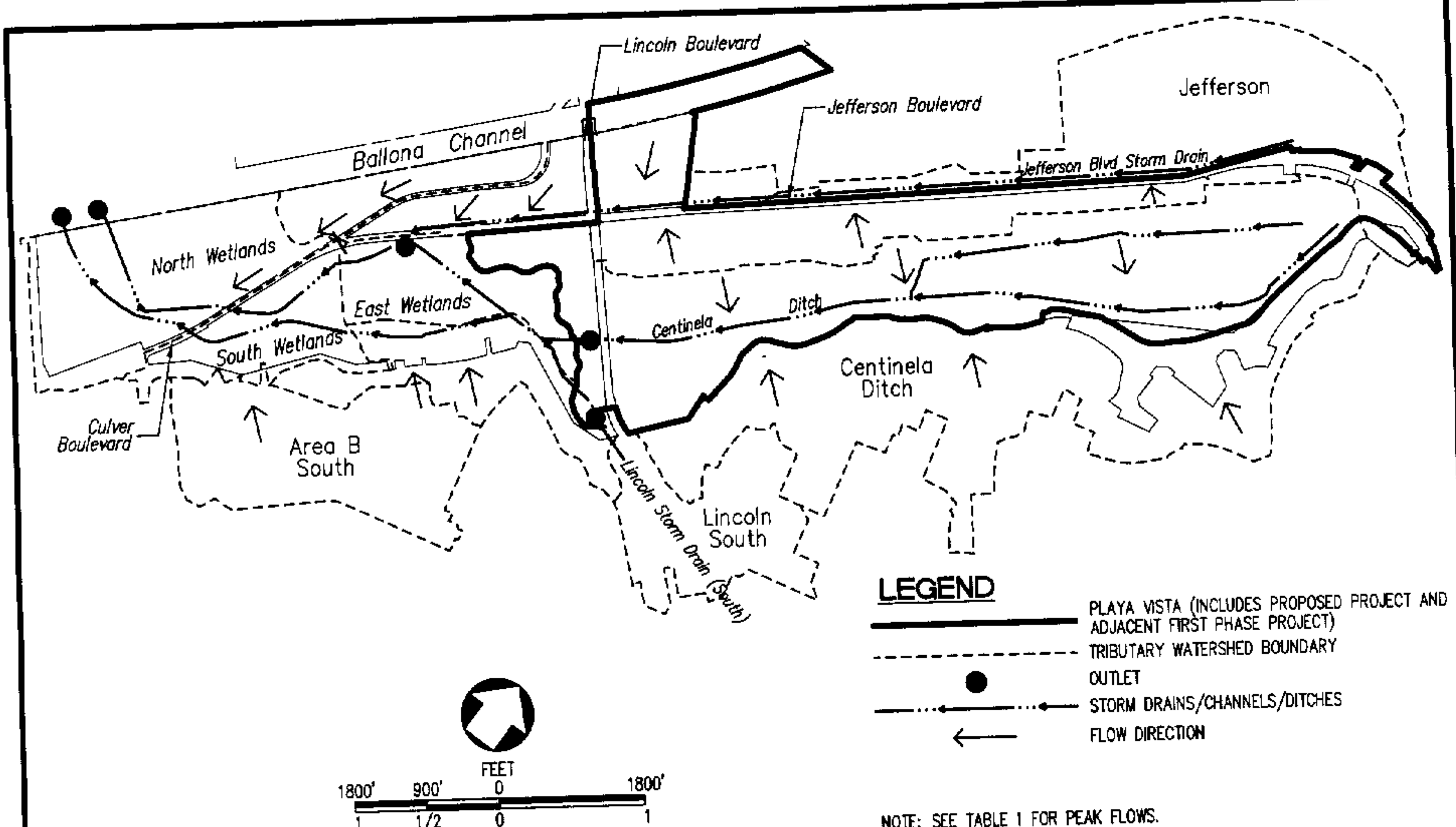
THE VILLAGE AT PLAYA VISTA
WATER RESOURCES TECHNICAL REPORT

Ballona Creek Watershed

CDM

Figure 2-3

N:\1061\0376050\cad\TechRpt\BallonaCrkWrshd.cdr - Negretecd - 07/15/2003



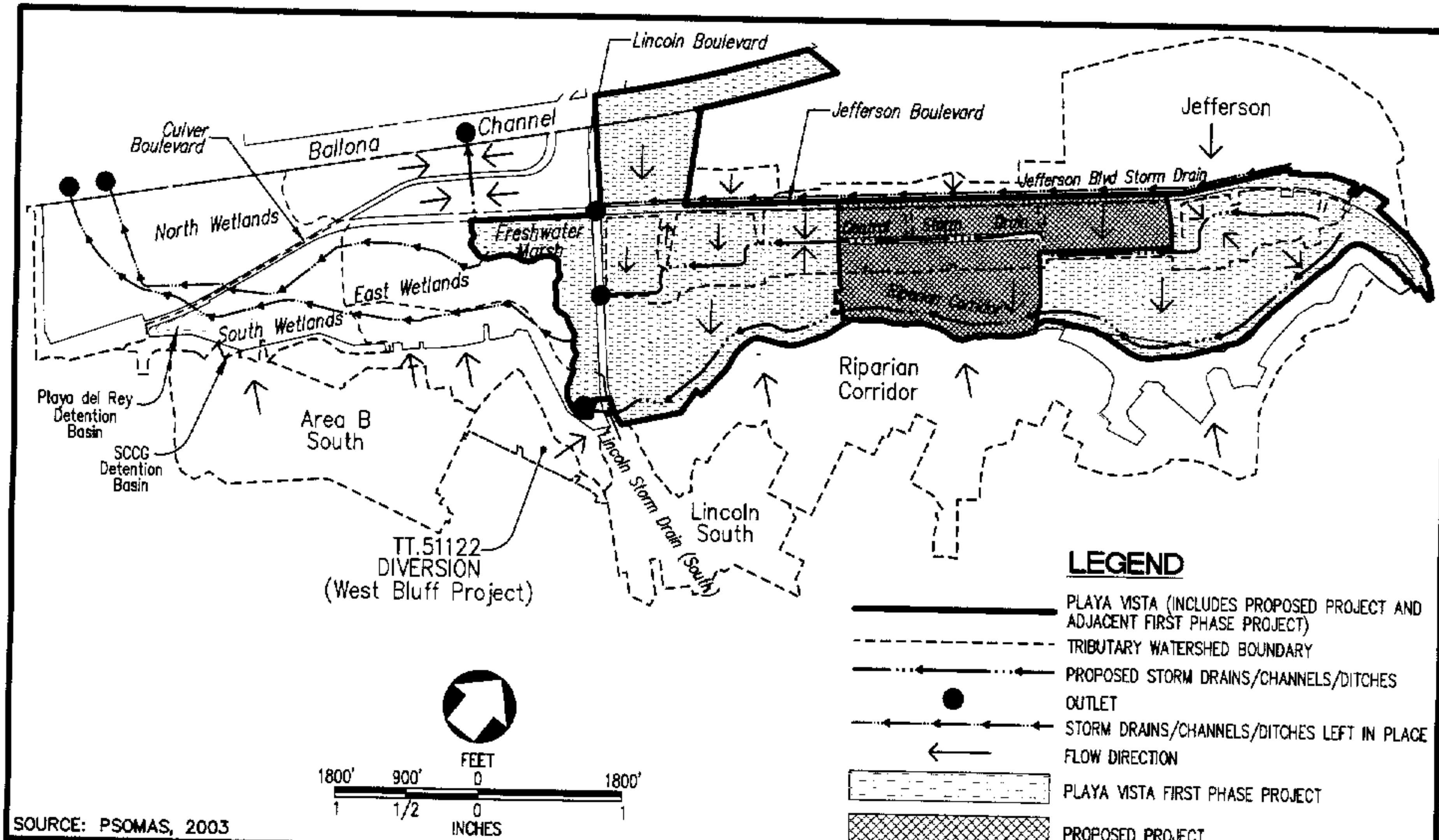
SOURCE: PSOMAS, 2003

The Village at Playa Vista Water Resources Technical Report

CDM

Pre-First Phase
Drainage System and Hydrology

Figure 2-4

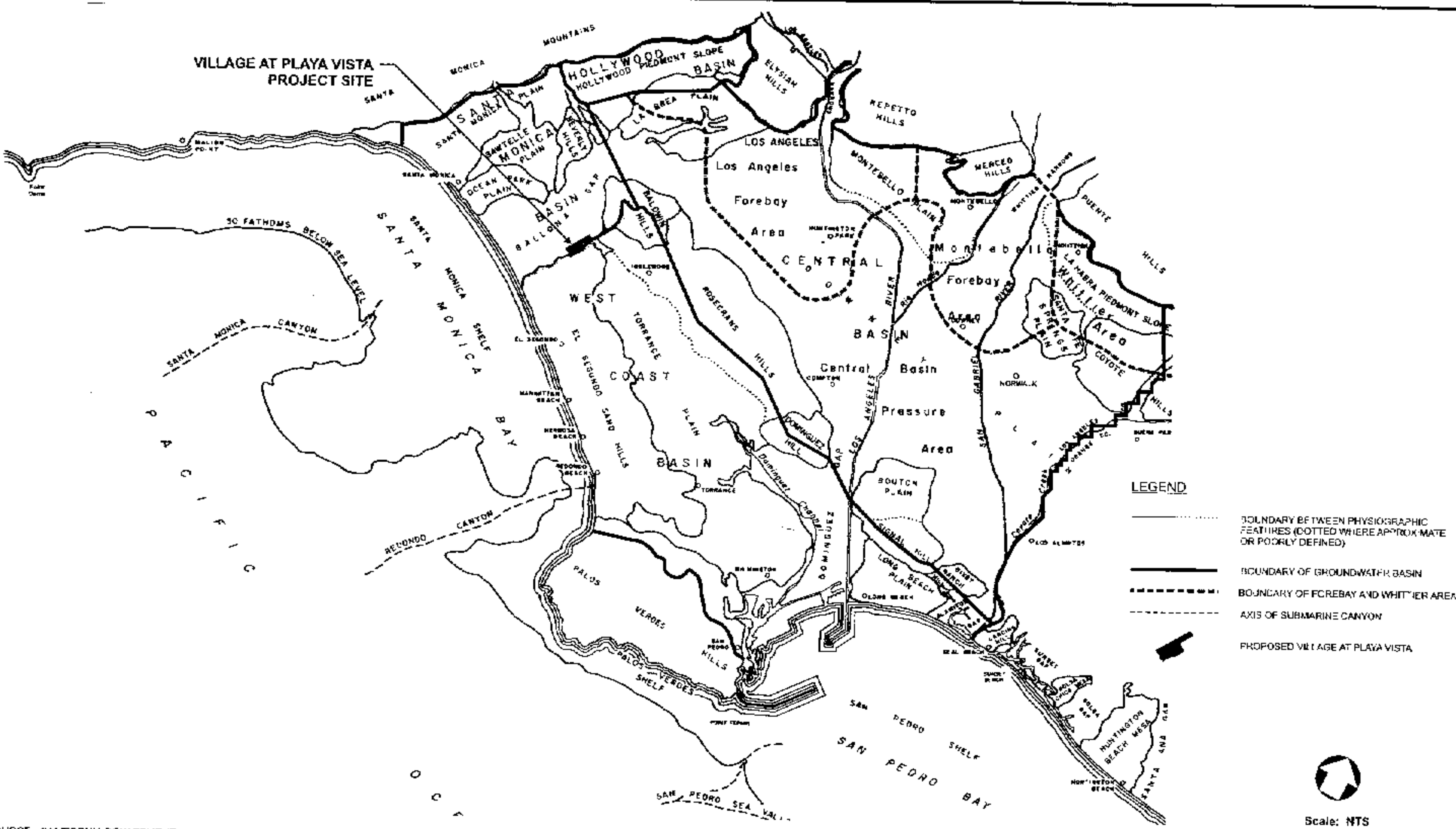


The Village at Playa Vista Water Resources Technical Report

CDM

Drainage System and
Associated Hydrology
With Adjacent Playa Vista
First Phase Project and Proposed Project

Figure 2–5



SOURCE: CALIFORNIA DEPARTMENT OF WATER RESOURCES, GROUNDWATER GEOLOGY OF THE COASTAL PLAIN OF LOS ANGELES COUNTY, PHYSIOGRAPIC FEATURES AND GROUNDWATER BASINS.

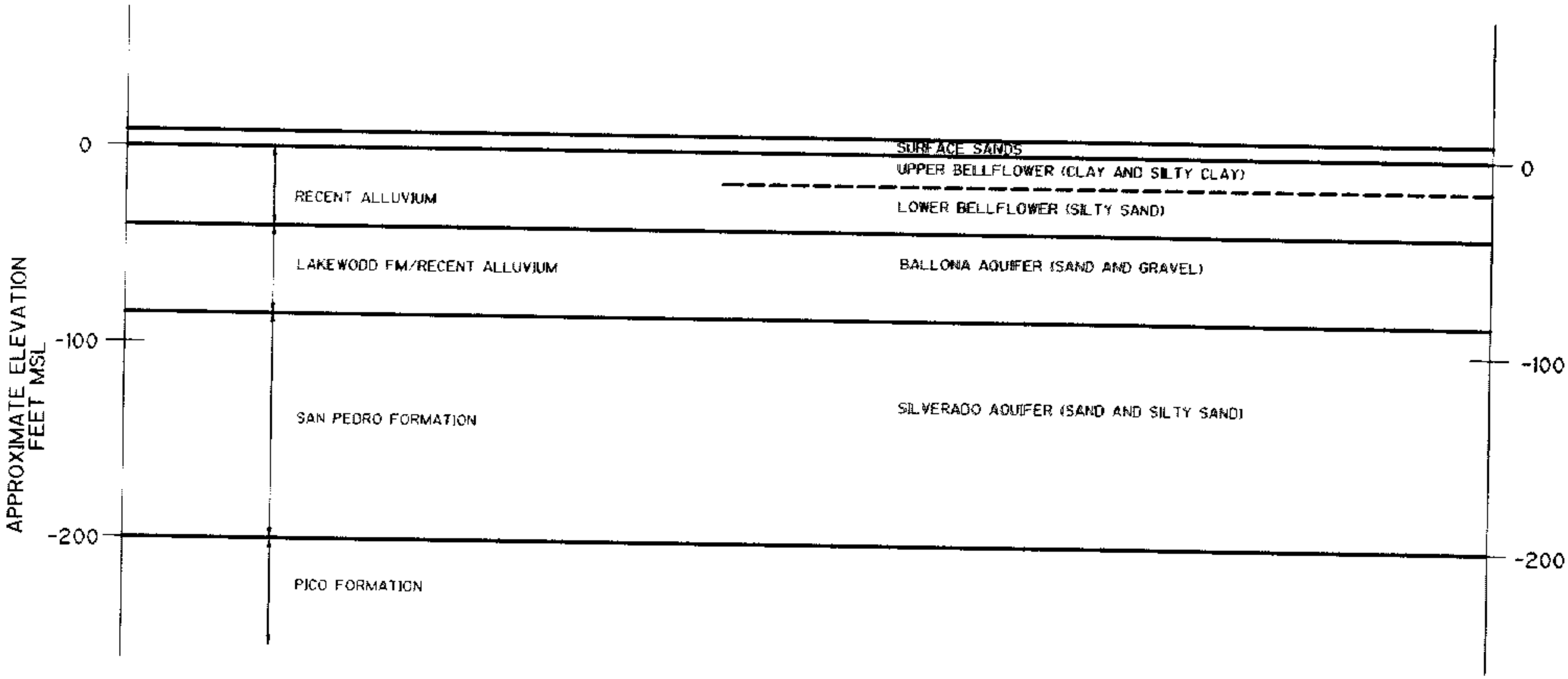
CDM

THE VILLAGE AT PLAYA VISTA
WATER RESOURCES TECHNICAL REPORT

Regional Geologic Features

Figure 2-6

DATE: Aug 13, 2003 2:34pm XREFS:
DWG: N:\10610\37605\0cad\TechRpt\PVista-Fig02-7.dwg USER: negretegd

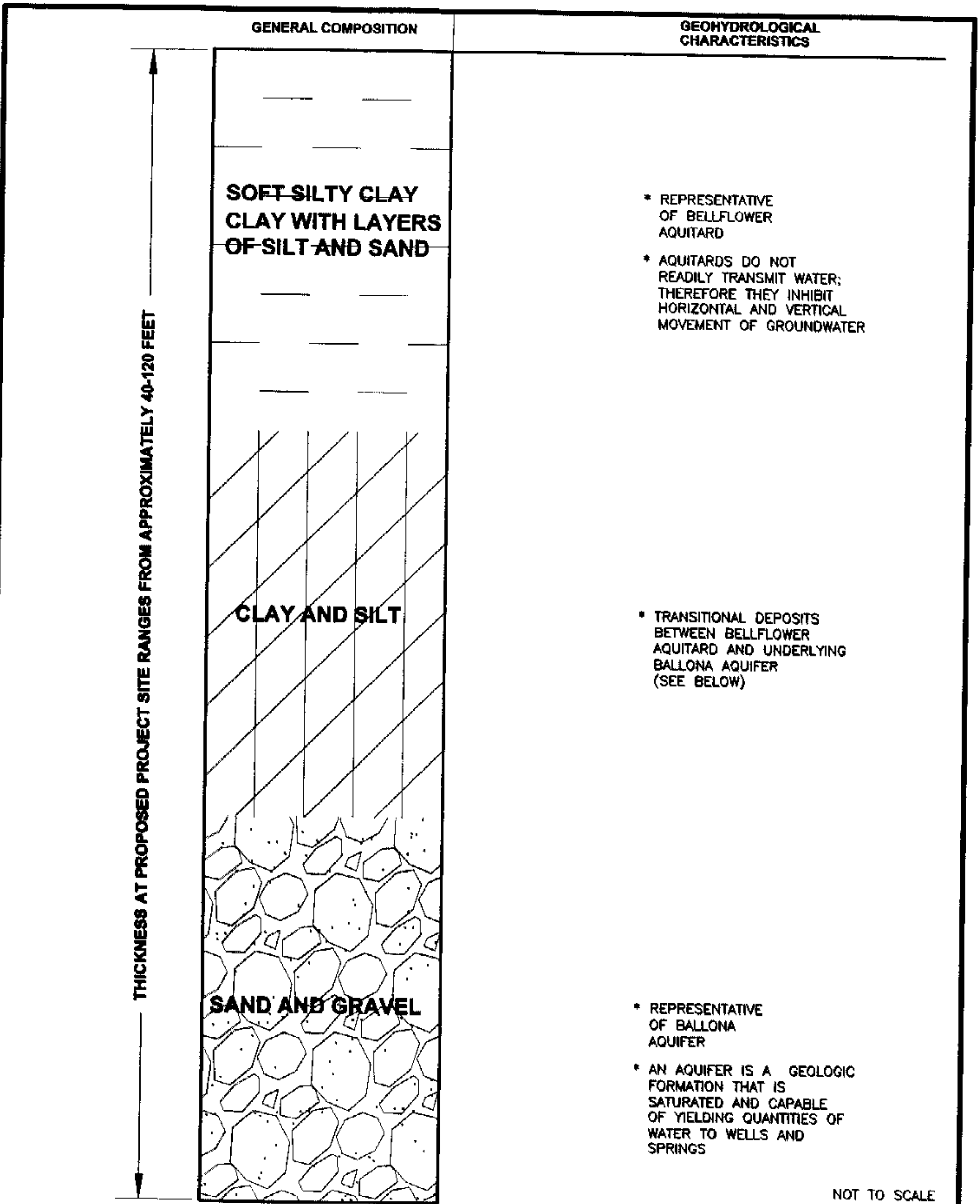


CDM

THE VILLAGE AT PLAYA VISTA
WATER RESOURCES TECHNICAL REPORT

Generalized Aquifer Cross-Section

Figure 2-7



THE VILLAGE AT PLAYA VISTA
WATER RESOURCE TECHNICAL REPORT

General Stratigraphic Column of Alluvium Typical of the Proposed Project Site

CDM

Figure 2-8

Table 2-1
Pre-First Phase Drainage System Capacity

Drainage System	Pre-First Phase Capacity (cfs)	Total Tributary Area (acre)	50-Year Storm Event Runoff (cfs)
Centinela Ditch	210	570	629
Jefferson Storm Drain	380[a]	395[b]	457
Lincoln Storm Drain South	210	91	209
Playa Vista Tributary Total	NA	1056	1,295
Ballona Wetlands Tributary Total	NA	499	914
Total		1,555	2,209

NA – Not Applicable
cfs – cubic feet per second
[a] *This is the estimated capacity of Jefferson Storm Drain at the pre-First Phase outlet to the Ballona Wetlands. Runoff flows indicated in this table and in Table 2-2 refer to flows through Jefferson Storm Drain at the outlet.*
[b] *Acreage is totaled at the former outlet west of the Freshwater Marsh and includes the area between Culver and Jefferson Boulevards, west of Lincoln Boulevard.*

Source: Psomas

Table 2-2
Stormwater Flows to the Freshwater Marsh and Ballona Wetlands

	Amount of Total Runoff Flow (in acre-feet)					
	50-Year Storm	25-Year Storm	10-Year Storm	5-Year Storm	2-Year Storm	1-Year Storm
Pre-First Phase[a]						
Jefferson Storm Drain[b,c]	399	358	304	263	195	171
Centinela Ditch at Boundary of Proposed Project[d]	461	414	351	304	225	197
Centinela Ditch at Lincoln Boulevard	550	494	419	362	268	235
Lincoln Drain South[b]	90	81	69	59	44	39
Total of Above Drains/Ditch Flowing to Ballona Wetlands	1039	933	792	685	507	445
Total Other Tributary to Ballona Wetlands[e,i]	636	571	485	419	310	272
Total to Ballona Channel	1,675	1,504	1,276	1,104	817	717
With Playa Vista First Phase Project						
Jefferson Storm Drain[b]	293	263	223	193	143	125
Central Storm Drain[g]	201	180	153	132	98	86
Riparian Corridor at Boundary of Proposed Project[d,g]	464	417	354	306	226	199
Riparian Corridor at Lincoln Boulevard[g]	546	490	416	360	266	234
Lincoln Drain South[b]	90	81	69	59	44	39
Freshwater Marsh Direct Flow[g]	41	37	31	27	20	18
Total Tributary Flowing into Freshwater Marsh to Ballona Channel[f]	1,171 (139)	1,051 (104)	892 (61)	771 (32)	571 (5)	502 (0)
Total Tributary to Ballona Wetlands[e,i]	618	555	471	407	302	265
Total to Ballona Channel	1,789	1,606	1,363	1,178	873	767
With Playa Vista First Phase Project and Proposed Project						
Jefferson Storm Drain[b]	293	263	223	193	143	125
Central Storm Drain[g]	221	198	168	146	108	95
Riparian Corridor at West Boundary of Proposed Project[d,g]	417	374	318	275	203	178
Riparian Corridor at Lincoln Boulevard[g]	531	477	405	350	259	227
Lincoln Drain South[b]	90	81	69	59	44	39
Freshwater Marsh Direct Flow[g]	41	37	31	27	20	18
Total Tributary Flowing into Freshwater Marsh to Ballona Channel[f]	1,176 (149)	1,056 (122)	896 (77)	775 (48)	574 (11)	504 (0)
Total Tributary to Ballona Wetlands[e,i]	618	555	471	407	302	265
Total to Ballona Channel	1,794	1,611	1,367	1,182	876	769

[a] *Pre-First Phase conditions represent runoff characteristics prior to construction of the stormwater system that is designed to serve both the First and the Proposed Projects.*

[b] *Existing storm drain to remain.*

[c] *Outlet is located in the area near the intersection of Culver and Jefferson Boulevards, west of Lincoln Boulevard. The area located between Culver and Jefferson Boulevards, west of Lincoln Boulevard, drains into the Jefferson Storm Drain.*

[d] *Drain not included in tributary total because runoff flow indicates flow at an intermediate point. These flows are cumulative with the flows at the Centinela Ditch/Riparian Corridor at Lincoln Boulevard.*

[e] *Not including Freshwater Marsh flows over weir to Ballona Wetlands.*

[f] *Includes the Freshwater Marsh area.*

[g] *Storm drain facility to be improved, modified, or constructed as part of the adjacent Playa Vista First Phase Project and the Proposed Project.*

[h] *Portion of the peak runoff from the all storm events over 1-year in the Freshwater Marsh flows over weir to Ballona Wetlands then out to Ballona Channel are shown in parenthesis. These numbers represent the "Overflow from the Freshwater Marsh to Ballona Wetlands" portion of the calculations in Table 2-4.*

[i] *This includes the area located between Culver and Jefferson Boulevards, west of Lincoln Boulevard, which drains directly to the Freshwater Marsh outlet to Ballona Channel.*

Source: Psomas

Table 2-3
50-Year Peak Runoff

Drainage System	Design Capacity (cfs)[a]			50-year Storm Event Peak Runoff (cfs)		
	Pre-First Phase*	With Play Vista First Phase Project	With Playa Vista First Phase and Proposed Project	Pre-First Phase*	With Playa Vista First Phase Project	With Playa Vista First Phase Project and Proposed Project
Jefferson Storm Drain [b,c]	380	380	380	457	403.6	403.6
Centinela Ditch	210	NA	NA	629	—	—
Centinela Ditch at Lincoln Boulevard	210	NA	NA	528	—	—
Lincoln Storm Drain South b	210	210	210	209	209	209
Central Storm Drain [d]	NA	328	328	—	237	312
Riparian Corridor at West Boundary of Proposed Project [d]	NA	625	625	—	625	608
Riparian Corridor at Lincoln Boulevard d	NA	625	625	—	549	549
Freshwater Marsh [d]	NA[e]	NA[e]	NA[e]	—	103.7	103.7
Overflow from Freshwater Marsh to Ballona Wetlands [f]				—	1036	1066
Ballona Wetlands [g]				914	916.9	916.9
Total Peak Runoff to the Ballona Wetlands				**2209**	**1953**	**1983**

cfs cubic feet per second
NA – Not Applicable

* *Pre-First Phase conditions represent runoff characteristics prior to construction of the stormwater system that is designed to serve both the adjacent Playa Vista First Phase and the Proposed Project development projects.*

a *The design capacity is based on the total peak runoff generated by the adjacent Playa Vista First Phase Project or with the Playa Vista First Phase and Proposed Project, whichever is greater. Should additional capacity by necessary, during final design and engineering, the design capacity of the drainage system, as determined and approved by the City, may vary from that shown in this table.*

b *Existing storm drain to remain*

c *During pre-First Phase, the outlet to the Jefferson Storm Drain is located near the intersection of Culver and Jefferson Boulevards, but will drain at Lincoln/Jefferson Boulevards into the Freshwater Marsh (as part of the adjacent Playa Vista First Phase Project). The area located between Culver and Jefferson Boulevards, west of Lincoln Boulevard, drains into Jefferson Storm Drain during pre-First Phase.*

d *New storm drains or facilities that were designed and built to accommodate runoff from the adjacent Playa Vista First Phase Project and Proposed Project.*

e *The Freshwater Marsh is an open waterbody that has a volume capacity, not a design capacity.*

f *Portion of the peak runoff that flows from the Freshwater Marsh over weir to the Ballona Wetlands.*

g *Portion of the peak runoff from the 50-year storm event in the Freshwater Marsh overflows over weir to Ballona Wetlands then out to Ballona Channel (not included in this number, but separately under footnote "d").*

Source: Psomas

Table 2-4
Total Peak 50-year Runoff Rates and Volumes of Total Flows to the Ballona Wetlands

Phase	Peak 50-year Peak Runoff Rates to the Ballona Wetlands (cfs)[a]	Peak 50-Year Peak Runoff Volumes to the Ballona Wetlands (acre-feet)[b]
Pre-First Phase	2,209	1,675
With Playa Vista First Phase	1,953	757
With Playa Vista First Phase and Proposed Project	1,983	767

cfs – cubic feet per second
[a] *Ballona Wetlands + Overflow from Freshwater Marsh to Ballona Wetlands (see Table 2-3)*
[b] *Total Tributary to Ballona Wetlands + Overflow from Freshwater Marsh to Ballona Wetlands (see Table 2-2, footnote "h")*

Source: Psomas

Table 2-5
Total Stormwater Runoff and Percentage of Total Flows to the Ballona Channel

	50-Year Storm	25-Year Storm	10-Year Storm	5 Year Storm	2-Year Storm	1-Year Storm
	Amount of Total Runoff to Ballona Channel (in acre-feet)					
Pre-First Phase Project						
Flow to Ballona Channel	1,675	1,504	1,276	1,104	817	717
With Playa Vista First Phase Project						
Flow to Ballona Channel	1,789	1,606	1,363	1,178	873	767
With Playa Vista First Phase Project and Proposed Project						
Flow to Ballona Channel	1,794	1,611	1,367	1,182	876	769
Percent of Total Flow to Ballona Channel Due to Project Buildout Compared to Pre-First Phase	7.1%	7.1%	7.1%	7.1%	7.2%	7.3%
Percent of Total Flow to Ballona Channel Due to Proposed Project (Compared to Playa Vista First Phase Project)	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%

Source: Psomas.

Table 2-6
Total Stormwater Runoff and Percentage of Total Flows to the Freshwater Marsh and Ballona Wetlands

	50-Year Storm	25-Year Storm	10-Year Storm	5 Year Storm	2-Year Storm	1-Year Storm
	Amount of Total Runoff to Freshwater Marsh (in acre-feet) a					
With Playa Vista First Phase Project						
Flow to Freshwater Marsh	1,171	1,051	892	771	571	502
With Playa Vista First Phase Project and Proposed Project						
Flow to Freshwater Marsh	1,176	1,056	896	775	574	504
Percent of Total Flow to Freshwater Marsh Due to Proposed Project	**0.4%**	**0.5%**	**0.5%**	**0.5%**	**0.4%**	**0.4%**
	Amount of Total Runoff to Ballona Wetlands (in acre-feet)					
Pre-First Phase Project						
Flow from Drains	1,039	933	792	685	507	445
Flow from Other Sources[b]	636	571	485	419	310	272
With Playa Vista First Phase Project						
Flow from Freshwater Marsh over Weir	139	104	61	32	5	0
Flow from Other Sources[b]	618	555	471	407	302	265
With Playa Vista First Phase Project and Proposed Project						
Flow from Freshwater Marsh over Weir	149	122	77	48	11	0
Flow from Other Sources[b]	618	555	471	407	302	265
Percent of Total Flow to Ballona Wetlands Due to Project Buildout Compared to Pre-First Phase	-54%	-55%	-57%	-59%	-62%	-63%
Percent of Total Flow to Ballona Wetlands Due to Proposed Project (Compared to Playa Vista First Phase Project)	1.3%	2.7%	3.0%	3.6%	2.0%	0.0%

[a] *Freshwater Marsh did not exist during pre-First Phase conditions.*
[b] *Flows in this table summarize flows to the Ballona Wetlands which are not the same as flows from other sources indicated in*
Table 2-2 because modeled peak flows over the weir do not necessarily occur at the same time as the peak flows to the Freshwater Marsh and the Ballona Wetlands. Variances may be caused by storm intensities and time of concentrations in the SWMM model.

Source: Psomas

Table 2-7
Total Stormwater Runoff and Percentage of Total Flows to the Riparian Corridor

	50-Year Storm	25-Year Storm	10-Year Storm	5 Year Storm	2-Year Storm	1-Year Storm
	Amount of Total Runoff to Riparian Corridor (in acre-feet)					
Pre-First Phase Project						
Flow to Centinela Ditch at Boundary of Proposed Project	461	414	351	304	225	197
Flow to Centinela Ditch at Lincoln Boulevard	550	494	419	362	268	235
With Playa Vista First Phase Project						
Flow to Riparian Corridor at Boundary of Proposed Project	464	417	354	306	226	199
Flow to Riparian Corridor at Lincoln Boulevard	546	490	416	360	266	234
With Playa Vista First Phase Project and Proposed Project						
Flow to Riparian Corridor at Boundary of Proposed Project	417	374	318	275	203	178
Flow to Riparian Corridor at Lincoln Boulevard	531	477	405	350	259	227
Percent of Total Flow to Riparian Corridor at Boundary of Proposed Project Due to Project Buildout Compared to Pre-First Phase Project	-9.5%	-9.7%	-9.4%	-9.5%	-9.8%	-9.6%
Percent of Total Flow to Riparian Corridor at Lincoln Boulevard Due to Project Buildout Compared to Pre-First Phase Project	-3.5%	-3.4%	-3.3%	-3.3%	-3.4%	-3.4%
Percent of Total Flow to Riparian Corridor at Boundary of Proposed Project Due to Proposed Project (Compared to Playa Vista First Phase Project)	-10.1%	-10.3%	-10.2%	-10.1%	-10.2%	-10.6%
Percent of Total Flow to Riparian Corridor at Lincoln Boulevard Due to Proposed Project (Compared to Playa Vista First Phase Project)	-2.8%	-2.7%	-2.6%	-2.8%	-2.6%	-3.0%

Source: Psomas.

Table 2-8
Estimated Groundwater Recharge from Precipitation[a]

	Pre-First Phase Project[a]	With Playa Vista First Phase Project[a]	With Playa Vista First Phase Project and Proposed Project[a]
Total Runoff (ft3/yr) [b]	6,928,209	11,265,504	13,042,729
Total Runoff (ac-ft/yr)	159	259	299
Total Rainfall (ac-ft/yr) [c]	429	429	429
Total Infiltration (ac-ft/yr) [d]	270	171	130
Groundwater Recharge [e]	135	51	39
Loss in Recharge (ac-ft/yr) [f]			12

Notes:

Average Annual Rainfall Depth: *11.66 in/yr*
Total Rainfall Volume per Year: *429 ac-ft/yr*
Total Project Area: *442 ac (The acreage's used for the recharge calculations do not include the acreage of the Ballona Channel.)*

[a] *Values include adjacent Playa Vista First Phase Project and Proposed Project areas. Off-site runoff is not included.*
[b] *From runoff estimates in pollutant loading model (Section 3, Water Quality of this volume)*
[c] *Based on average rainfall depth of 11.66 in/yr, and total project area of 442 acres.*
[d] *(Total rainfall) - (Total runoff)*
[e] *Assumes 50 percent infiltration becomes deep perchloration prior to development (i.e., pre-First Phase) and 30 percent of infiltration becomes deep percolation after development (i.e., with Playa Vista First Phase and with Playa Vista First Phase and Proposed Project)*
[f] *(Pre-First Phase recharge) - (Playa Vista First Phase and Proposed Project recharge)*

Source: Camp Dresser & McKee Inc.

Section 3
Water Quality

3.1 Introduction

3.1.1 Purpose and Scope

This section identifies the federal, state, and local regulatory framework governing surface water and groundwater quality. It also describes recent water quality measurements and physical characteristics of the surface water and the groundwater resources on, and in the vicinity of, the Proposed Project site. Finally, this section provides an assessment of potential impacts from the Proposed Project, on the water quality of the receiving water resources.

Relevant off-site surface water bodies discussed in this section include: Santa Monica Bay; Ballona Wetlands; the Ballona Channel within the vicinity of the Project Site, and the Freshwater Wetlands System. The on-site surface water resources included in this discussion is the central portion of the Riparian Corridor which is part of the Freshwater Wetlands System that was previously CEQA-certified Playa Vista First Phase Project. Groundwater resources underlying the Proposed Project Site include the Ballona Aquifer system and the Silverado Aquifer.

3.1.2 Sources of Information

The primary sources of information for on- and off-site surface water for this section include surface water runoff analysis and water quality monitoring studies performed by Aquatic Bioassay Consulting Laboratory (ABCL), Advanced Biological Testing (ABT), Camp Dresser & McKee, Inc. (CDM), Chambers Group, Los Angeles County Department of Public Works (LACDPW), Woodward-Clyde Consultants (then URS Greiner Woodward Clyde [URSGWC] and now URS), and GeoSyntec Consultants (GeoSyntec). A detailed discussion of the data collected and the criteria used to evaluate the data is included in Volume III, Appendix B of this Technical Report.

The primary sources of groundwater information for this section include the EIR and relevant technical appendices completed for the adjacent Playa Vista First Phase Project, groundwater sampling reports completed as part of a due diligence investigation completed by the environmental engineering consulting firm of ENSR, and groundwater monitoring reports completed by the hydrogeology firm of McLaren Hart Environmental Engineering Corporation.

3.2 Surface Water Quality

This section describes the surface water quality attributes of the Proposed Project and the pre-First Phase conditions of the site. It should be noted that most of the major components of the stormwater systems designed for the adjacent Playa Vista First Phase Project were designed to manage the hydrology and water quality from both the adjacent Playa Vista First Phase Project and the Proposed Project; they were designed for ultimate buildout of the project. Therefore, the analysis consists of an analysis of pre-First Phase conditions, with Playa Vista First Phase Project conditions, and with Playa Vista First Phase Project and Proposed Project conditions. The rest of this section includes a description of the regulatory framework, affected environment/existing conditions, and the surface water quality impact analysis.

3.2.1 Regulatory Framework

The Proposed Project is subject to regulation of surface water quality by the United States Environmental Protection Agency (EPA), the California State Water Resources Control Board (SWRCB), the California Regional Water Quality Control Board – Los Angeles Region (RWQCB), and the County and City of Los Angeles. These regulations include both requirements for direct and indirect permits that regulate surface water discharges as well as other water quality program requirements and plans. It should be noted that many of the programs are overlapping. For example, the state is responsible for overseeing many of the Clean Water Act permit programs and the County and City of Los Angeles under their permit with the state are responsible for implementing their permits, which in turn also affect the Proposed Project. Included below is a brief synopsis of the regulatory framework affecting water quality, including federal, state, and local programs.

3.2.1.1 Federal Level

The primary regulatory programs that affect the water quality aspects of the Proposed Project arise from the Clean Water Act, including permit requirements for stormwater runoff as well as wetlands dredging and filling as described below.

3.2.1.1.1 Clean Water Act - National Pollutant Discharge Elimination System (NPDES)

The EPA regulates water quality under the Clean Water Act (CWA). The CWA requires that the discharge of pollutants to waters of the United States from any point source be effectively prohibited, unless the discharge is in compliance with a National Pollutant Discharge Elimination System (NPDES) permit. In 1987, the CWA was amended to require that the EPA establish regulations for permitting of stormwater discharges (as a point source) by municipal and industrial facilities and construction activities under the NPDES permit program. The EPA published final regulations regarding stormwater discharges on November 16, 1990. The regulations require that municipal separate storm sewer system (MS4) discharges to surface waters be regulated by a NPDES permit. The municipal stormwater NPDES program generally applied to urban areas with a population greater than 100,000. In addition to regulating certain industrial uses, the program requires a NPDES permit for construction activities that disturb an area more than one acre. The City and County of Los Angeles are currently regulated under the Phase I municipal program, under permits issued and implemented through the Los Angeles Regional Water Quality Control Board (RWQCB). Because the Proposed Project disturbs an area of more than one acre, it requires an NPDES permit for construction activities. The requirements applicable to the Proposed Project arising from the City and County permit are discussed below in Section 3.2.1.3 Local Regulations. As part of the requirements of the Los Angeles County municipal stormwater NPDES program, the Proposed Project is also subject to Section 402(p) of the CWA that requires municipal separate storm sewer system (MS4) discharges to surface waters be regulated by a NPDES permit. This MS4 permit must require controls to reduce discharge of pollutants to the "maximum extent practicable."[44]

According to federal regulation, permit coverage for stormwater discharges associated with construction activity can be obtained through an individual or general permit. NPDES coverage under a general permit involves the submittal of a notice by the regulated construction project of intent to comply with a general permit developed by the EPA, or a state with general permit authority. In California, the State Water Resources Control Board (SWRCB) has issued a general permit for stormwater discharges associated with construction activities (General Construction Permit), with the permit implemented through the RWQCB. The requirements for this general permit are discussed below in the section on state regulations.

Section 303(d) of the CWA requires identification and listing of water-quality limited or "impaired" waterbodies where water quality standards and/or receiving water beneficial uses are not met. Once a waterbody is listed as "impaired," total maximum daily loads (TMDLs) must be established for the pollutants or flows causing the impairment (33 U.S.C. §1313(d)(c)). Both the SWRCB and the EPA have approved a Trash TMDL for the Ballona Creek Watershed, where the Proposed Project is located. Ballona Creek is listed as being impaired for other pollutants, but TMDLs have not yet been established for these pollutants.

It is anticipated that implementation of, and compliance with, the Trash TMDL requirements will be administered through the County's and the City's municipal stormwater NPDES permit programs, as well as individual NPDES permits and general industrial stormwater permits (including construction site permits administered by the RWQCB). The TMDL is discussed in more detail in Section 3.2.1.2.5, State of California Identified Impaired Waterbodies.

3.2.1.1.2 *Nutrient Guidelines*

The EPA has established nutrient water quality guidelines for various waterbodies based on ambient water quality conditions within defined ecoregions. The Proposed Project is located within Ecoregion 6 of Aggregate Ecoregion III, which is most prominently distinguished by its Mediterranean climate and associated vegetation. The guidelines are not enforceable laws or regulations; they are federal guidelines for establishing State water quality criteria for nutrients. These criteria will be referenced later in this document to assess potential impacts of nutrients on receiving waters.

[44] *The SWRCB interpret the meaning of "maximum extent practicable" to include technical feasibility, cost, and benefit derived with the burden being on the municipality to demonstrate compliance. See also Letter from Francine Diamond, Chair, Los Angeles Regional Water Quality Control Board, to General Public (January 30, 2002) with enclosure.*

3.2.1.1.3 *Federal Antidegradation Policy*

The Federal Antidegradation Policy (40 Code of Federal Regulations [CFR] §131.12) requires states to develop statewide antidegradation policies and identify methods for implementing them. Pursuant to the CFR, state antidegradation policies and implementation methods shall, at a minimum, protect and maintain: (1) existing instream water uses; (2) existing water quality where the quality of the waters exceed levels necessary to support existing beneficial uses unless the state finds that allowing lower water quality is necessary to accommodate economic and social development in the area, and water quality in waters of national and state parks and wildlife refuges and waters of exceptional recreational and ecological significance.

3.2.1.2 State Level

The Porter-Cologne Water Quality Control Act of 1969 (herein referred to as the California Water Code, (CWC)) established the principal California program for water quality control. The CWC authorizes the SWRCB to implement the provisions of the federal CWA. The CWC divided the State of California into nine regional boards, which are under the guidance and review of the SWRCB, and implement and enforce provisions of the CWC and the CWA. The Proposed Project is located in Region 4 (Los Angeles), hereafter referred to as the RWQCB. Section 13050 of the CWC defines what is considered pollution, contamination, or nuisance. Briefly defined, pollution means an alteration of the water quality such that it unreasonably affects the water's beneficial use; contamination means an impairment of the water quality to the degree that it creates a hazard to public health; and nuisance means anything that is injurious to health, is offensive to the senses, or is an obstruction to property use, and which affects a considerable number of people. Below is a summary of state regulations that affect water quality aspects of the Proposed Project.

3.2.1.2.1 *Basin Plan*

The RWQCB maintains a Water Quality Control Plan called a "Basin Plan," that specifies beneficial uses, water quality objectives and various water quality control policies and practices for the Los Angeles region. The Basin Plan for the Los Angeles Region developed in 1975 has been subsequently updated a number of times. The most recent amendment to the Basin Plan was approved by the RWQCB in October 2001. Currently, an amendment is pending approval by the SWRCB, California Office of Administrative Law, and EPA. The Basin Plan guides conservation and enhancement of water resources and designates beneficial uses of inland surface waters, tidal prisms, harbors, and groundwater basins within Region 4. The beneficial uses identified by the RWQCB include:

- Municipal and domestic supply
- Agricultural supply
- Industrial process supply
- Industrial service supply
- Ground water recharge
- Freshwater replenishment
- Navigation
- Hydropower generation

- Water contact recreation
- Non-contact water recreation
- Commercial and sport fishing
- Aquaculture
- Warm freshwater habitat
- Cold freshwater habitat
- Inland saline water habitat
- Estuarine habitat
- Wetland habitat
- Marine habitat
- Wildlife habitat
- Preservation of biological habitats
- Rare, threatened, or endangered species
- Migration of aquatic organisms
- Spawning, reproduction, and/or early development
- Shellfish harvesting

The special beneficial uses that have been designated in the Basin Plan for the Ballona Creek Estuary and Ballona Wetlands, into which the adjacent Playa Vista First Phase Project and the Proposed Project drain, are provided in **Table 3-1, Proposed Beneficial Uses of Project Drainages**. The definitions for the beneficial uses are provided in Volume II, Appendix C of this Technical Report.

In addition to identifying beneficial uses for waterbodies, the Basin Plan also includes numerical (quantitative) and narrative (qualitative) water quality objectives. The numerical objectives apply to inland surface waters and enclosed bays and estuaries (including wetlands) in the Los Angeles Region, such as the Ballona Creek Estuary and Ballona Wetlands for the constituents and parameters listed below:

- ammonia
- radioactive substances
- nitrogen (nitrate, nitrite)
- color
- coliform bacteria
- solid, suspended, or settleable
- oil and grease
- materials
- bioaccumulation
- exotic vegetation
- dissolved oxygen
- taste and odor
- 5-day biochemical oxygen demand
- floating material
- pesticides
- temperature
- biostimulatory substances
- methylene blue activated substances

- pH
- toxicity
- chemical constituents
- mineral quality
- polychlorinated biphenyls
- turbidity
- chlorine

Besides the narrative and numerical objectives for the constituents and parameters listed above, the RWQCB has also established narrative water quality objectives that specifically apply to wetlands in the Region, such as the Ballona Wetlands. These objectives limit modifications to hydrology and habitat in order to minimize impacts to wetlands flora and fauna.

Almost all of the water quality objectives (narrative or numerical) for the constituents and parameters listed above have been established according to the designated beneficial use of the waterbodies. The Basin Plan should be referred to in determining the individual objectives. However, for mineral quality, site-specific objectives have not been determined for the inland surface waters of the Ballona Creek Watershed. These areas are often naturally impaired (by high levels of minerals) and there are not sufficient historical data to designate objectives based on natural background conditions.

3.2.1.2.2 *California Ocean Plan*

The Basin Plan also incorporates SWRCB statewide Water Quality Control Plans, such as the California Ocean Plan (COP), which is implemented by the SWRCB and the RWQCB. The COP was establishes water quality objectives for California's ocean waters and provides a basis for regulation of wastes discharged to coastal waters by point and non-point source discharges. The COP describes beneficial uses and water quality objectives for the open ocean waters - not forebays and estuaries such as those found adjacent to and directly downstream of the adjacent Playa Vista First Phase Project and the Proposed Project. Although the COP does not apply to the receiving waters immediately downstream of the adjacent Playa Vista First Phase Project and the Proposed Project, the COP numerical objectives have been used for the Santa Monica Bay for comparative purposes.

3.2.1.2.3 *California Toxic Rule*

In March of 2000, the EPA established water quality criteria for receiving waters with the California Toxics Rule (CTR). To implement the CTR, the SWRCB adopted the State Implementation Plan (SIP) in April of 2000. The SIP established policies for incorporating the CTR into NPDES permits. The CTR, enforced by the SWRCB, establishes acute and chronic surface water quality standards for waterbodies such as inland surface waters and enclosed bays and estuaries with certain designated beneficial uses in order to protect aquatic life and human health. Surface water runoff from the Proposed Project site discharges directly and indirectly to waters of the state, to which the CTR applies[45], including Santa Monica Bay, Ballona Channel, and the Ballona Wetlands. The CTR are used herein to evaluate potential impacts to these waters and for comparative purposes to assess water quality in the Freshwater Wetlands System.

3.2.1.2.4 *NPDES Statewide General Construction Storm Water Permit*

In July 1999, the SWRCB re-issued the statewide NPDES general permit for stormwater discharges associated with construction activities (General Construction Permit), in accordance with federal stormwater regulations. This permit was modified by SWRCB Resolution 2001-046, which requires monitoring for sediment and non-visible pollutants under specified circumstances. Development such as the Proposed Project that disturbs an area greater than one acre is required to file a Notice of Intent (NOI) to discharge under the General Construction Permit. After a NOI has been submitted, the discharger is authorized by the SWRCB to discharge stormwater under the terms and conditions of the General Construction Permit in effect at the time of application. The major provisions of the General Construction Permit are listed below.

- Eliminate or reduce, if appropriate, non-stormwater discharges to storm sewer systems and other waters of the nation.
- Develop a SWPPP describing best management practices (BMPs) to control stormwater and dry weather flows.
- Implement the BMPs to reduce pollutants in construction site discharges to appropriate technological and water-quality based standards.
- Inspect and maintain BMPs
- Select and implement BMPs for post-construction stormwater management.

The General Construction Permit contains receiving water limitations, which state that stormwater discharges shall not cause or contribute to a violation of any applicable water quality standards. The General Construction Permit does not preempt or supersede the authority of local stormwater management agencies to prohibit, restrict, or control stormwater discharges to separate storm sewer systems or other watercourses within their jurisdiction, as allowed by state and federal law. It is anticipated that the Proposed Project would be covered under the statewide NPDES General Construction Permit, although the RWQCB could require an individual permit.

3.2.1.2.5 *California Identified Impaired Water Bodies*

Under Section 303(d) of the CWA, the State of California identifies the Ballona Creek (in the vicinity of the adjacent Playa Vista First Phase Project and the Proposed Project, the Ballona Creek is referred to as the Ballona Channel), Ballona Creek

[45] *"Waters of the State" include any surface water or groundwater, including saline waters, within the boundaries of the State.*

Estuary, portions of the Ballona Wetlands, and the Santa Monica Bay as water quality limited. Water-quality limited or "impaired" waterbodies are those with designated uses, as listed in the Basin Plan (see Table 3-1), which have been determined to be threatened under water quality assessments conducted by the RWQCB. The "Ballona Creek Estuary" extends from the mouth of Ballona Creek to Centinela Avenue. The "Ballona Creek to Ballona Creek Estuary" reach extends from Rodeo Road at Jefferson Boulevard to Centinela Avenue. The outlets that drain from the Freshwater Marsh and the Ballona Wetlands into the Ballona Channel are located within the Ballona Creek Estuary; therefore, their discharges do not affect the upstream portions of the Ballona Channel. In February 2003, SWRCB approved the expansion of the Ballona Wetlands listing to include 315 acres.[46] In order to provide a conservative analysis of the water quality of the runoff from the Proposed Project site for the purposes of the Proposed Project's Draft EIR, it has been assumed that the runoff from the Proposed Project would flow through the Freshwater Wetlands System to the area of the Ballona Wetlands that is the focus of the 303(d) listing. This approach is conservative because the Freshwater Marsh is designed to discharge to the Ballona Wetlands only during storms greater than a one-year design storm. Santa Monica Bay and the freshwater portion of the Ballona Creek to Ballona Creek Estuary reach would not receive any runoff directly from the Proposed Project. As such, the analysis focuses primarily on the Ballona Creek Estuary and Ballona Wetlands as 303(d)-affected areas that may receive runoff from the Proposed Project. Santa Monica Bay information is included in the analysis for informational purposes.

Table 3-2, Listed Water Quality Parameters for Ballona Creek Estuary, Ballona Wetland, and Santa Monica Bay, provides the current list, as of February 2003, of parameters identified by the State as causing impairments of beneficial uses for Ballona Creek Estuary, Ballona Wetlands, and Santa Monica Bay. As a result of the 2002 305(b) water quality assessment, the 303(d) list has been revised. The 2002 303(d) list was approved by the SWRCB on February 4, 2003 and was submitted to the EPA for approval on February 28, 2003.[47] EPA's proposed revisions of the February 4 list were provided to the SWRCB by letter from EPA dated June 5, 2003.[48] None of these proposed revisions related to the subject waterbodies.[49]

In the proposed modifications to the 303(d) list, arsenic is proposed to be delisted in tissue because there is no longer a Maximum Tissue Residue Level (MTRL) for this

[46] *State Water Resources Control Board, Res. 2003-0009, Approval of the 2002 Federal Clean Water Act Section 303(d) List of Water Quality Limited Segments [online] http://www.swrcb.ca.gov/tmdl/docs. See also Nancy Richard, State Water Resources Control Board, Map of Ballona Wetlands for 303(d) List (July 24, 2003); Pre K. Saint el. al., Waterbodies, Wetlands, and their Beneficial Uses in the Los Angeles Region (4), Vol. 2. p. 58-60 (July 1993).*

[47] *State Water Resources Control Board, 2003. Letter to Catherine Kuhlman of the USEPA Region 9 Water Division : Transmittal of the 2002 Clean Water Act Section 303(d) List of Water Quality Limited Segments. February 28, 2003 [Online] http://www.swrcb.ca.gov/tmdl/docs/ usepa2002list_trasmittal.pdf*

[48] *State Water Resources Control Board, 2003. Consideration of a Resolution to Approve 2002 Federal Clean Water Act Section 303(d) List of Water Quality Limited Segments, February 4, 2003.*

[49] *EPA, 2003. Federal Register 68 FR 33693, Clean Water Act Section 303(d): Availability of List Decision, June 5, 2003.*

compound, and elevated tissue concentrations were the only reported cause of concern. Copper, lead, and silver are proposed to be delisted in tissue because the listing was based on Elevated Data Levels (EDLs) which no longer represent valid assessment guidelines. However, this proposed delisting will not remove these three metals from the 303(d) list because they are also listed for elevated levels in sediment. Tributyltin is proposed to be delisted in sediment because there is no valid assessment guideline for this compound. Delisting of tributyltin will remove this compound from the 303(d) list for Ballona Creek because elevated sediment concentrations is the only reported cause of concern for the water body. The newly proposed 303(d) listings include dissolved copper, dissolved lead, dissolved zinc, pH, and total selenium. All of these proposed new listings are due to greater than 10 percent exceedance of water quality criteria during the last monitoring effort. [50]

Under Section 303(d), TMDLs for impaired waterbodies must be established for the pollutants causing the impairment (33 U.S.C. § 1313(d)(c)). A "pollution budget" or pollutant load allocation must be established for point and non-point sources that are contributing to the water quality impairment. Once a pollution budget has been set, waste load allocations for point sources are implemented through NPDES permits for individual dischargers. The Trash TMDL for the Ballona Creek Watershed was approved by the SWRCB in February 2002 and by the EPA's Office of Administrative Law in August 2002. The Trash TMDL is the only TMDL for this waterbody that has been proposed or adopted at this time[51]. According to the TMDL, NPDES permittees will be required to submit a baseline monitoring plan to the RWQCB within thirty days after receipt of the Executive Officer's request as authorized by Section 13267 of the Porter-Cologne Water Quality Control Act. Upon final approval of the monitoring plan, monitoring of existing trash levels in the watershed will be required for at least the first two years (the permittees have the option of extending the baseline monitoring for an additional two years) to establish baseline trash loads. In the third year following implementation of the TMDL, the TMDL requires a 10 percent reduction in the baseline trash loads and 10 percent yearly reductions thereafter over a total of ten years. The numeric target of the TMDL is to have zero trash in the waterbodies by the twelfth year following implementation of the TMDL. It is anticipated that implementation of, and compliance with, the TMDL requirements will be administered through the County's and the City's MS4 Permit program.

---

[50] *State Water Resources Control Board, 2002. Letter to All Interested Parties: 2002 Clean Water Act Section 303(d) List. October 3, 2002 [Online] http://www.swrcb.ca.gov/tmdl/docs/document_availability100302.pdf*

[51] *The Trash TMDL for the Ballona Creek Watershed is currently under legal challenge by both the City and County of Los Angeles. Two lawsuits were filed in the Los Angeles County Superior Court in 2002, one on behalf of the City of Los Angeles, Bureau of Sanitation (Case No. BC 270452 filed March 21, 2003), and one on behalf of the County of Los Angeles and the Los Angeles County Flood Control District (Case No. BC 279597 – filed August 13, 2002). Both lawsuits have been transferred out of Los Angeles County Superior Court. The City of Los Angeles, Bureau of Sanitation lawsuit has been transferred to Ventura County Superior Court and the County of Los Angeles and the Los Angeles County Flood Control District lawsuit is now in San Diego County Superior Court.*

Eventually all of the 303(d)-listed waterbodies and pollutants will have TMDLs established. The Santa Monica Bay beaches have draft Dry-weather and Wet-weather TMDLs for indicator bacteria that was considered effective by the RWQCB on July 15, 2003 when a Notice of Decision was submitted to the California Resources Agency.[52] A coliform TMDL for the Ballona Creek Estuary, which may also apply to dry-weather flows, is planned for completion during the 2003/2004 fiscal year. By 2005, all of the 303(d)-listed parameters for the Ballona Creek Estuary should have TMDLs established. By 2010, all Ballona Wetlands TMDLs should be completed.[53]

3.2.1.2.6 California Non-Point Source Pollution Control Program

SWRCB and the CCC developed California's Non-Point Source Pollution Control Program, which contains management measures for six (6) specific categories of land use/development. Categories that are potentially relevant to the Proposed Project include the following: Urban Areas; Hydromodification and Wetlands/Riparian Areas/Vegetated Treatment Systems.[54] These are described in more detail below.

- Urban Management Measures - The control of urban non-point source pollution[55] requires the use of two primary strategies: the prevention of pollutant loadings and the treatment of unavoidable loadings. The urban management measures are organized to parallel the land use development process in order to address strategies to prevent and treat non-point source pollution during all phases of urbanization. The strategy relies primarily on the watershed approach, which focuses on pollution prevention and/or source reduction. Urban management measures address: runoff from developing areas (e.g., watershed protection and site development); runoff from construction sites (e.g. erosion, sediment, and chemical control); runoff from existing development; on-site disposal systems (new and operating); transportation development (planning, siting, development, operation, and maintenance of roads, highways, and bridges); and public education/outreach.

- Hydromodification Activities - Hydromodification includes the modification of streams and river channels, dams and water impoundments, and streambank/shoreline erosion. These activities can affect water temperature, change the natural supply of fresh water to waterbodies, and alter rates and paths of sediment erosion, transport, and deposition. The hydromodification management measures include: channelization/channel modification

[52] *Los Angeles Regional Water Quality Control Board, 2002. Amendment to the Water Quality Control Plan (Basin Plan) for the Los Angeles Region to Incorporate Implementation Provisions for the Region's Bacteria Objectives and to Incorporate a Wet Weather TMDL for Bacteria at Santa Monica Bay Beaches. Resolution No. 2002-022, December 12, 2002. [on-line] http://www.swrcb.ca.gov/rwqcb4/html/meetings/tmdl/tmdl_ws_santa_*

[53] *Los Angeles Regional Water Quality Control Board, 2002. Table 7A. Summary Schedule for TMDL Development. [Online] http://www.swrcb.ca.gov/rwqcb4/docs/table7_wmi_appdx.pdf*

[54] *http:\\ceres.ca.gov\coastalcomm\nps\npsndx.html*

[55] *Non-point source pollution is pollution that is attributable to many possible sources (i.e., entire watershed or urbanized area). In contrast, point source pollution is pollution that can be traced to a single source (e.g., drain pipe factors).*

(e.g., physical and chemical characteristics of surface water and instream and riparian habitat restoration); dams for erosion, sediment, chemical and pollutant control, as well as the protection of surface water quality and instream/riparian habitat; streambank and shoreline erosion; and public pollution prevention education/outreach.

- Wetlands and Riparian Areas - The intent of these measures is to promote the protection and restoration of wetlands and riparian areas and the use of vegetated treatment systems as a means to control non-point sources of pollution. These management measures include: protecting the existing water quality improvement function of wetlands and riparian areas; restoration of wetlands and riparian areas by reestablishing hydrology and vegetation; installation of vegetated treatment systems; and public education/outreach.

Under the Non-Point Source Program Strategy and Implementation Plan 1998-2013 (NPS Plan), a 3-tier system of BMPs is used as a means of implementing non-point source water quality management measures and strategies. Relevant to the Proposed Project, the NPS Plan also contains two Management Measures to address non-point source pollution, 6B (Restoration of Wetlands/Riparian Areas) and 6C (Vegetated Treatment Systems), which place an emphasis on the use of natural treatment systems, including marshes and wetlands. Management Measures 6B and 6C are as follows:

> 6B: Restoration of Wetlands/Riparian Areas - Restoration of wetlands and riparian areas refers to the recovery of a range of functions that existed previously by re-establishing hydrology, vegetation, and structure characteristics. Damaged or destroyed wetland and riparian areas should be restored where restoration of such systems will significantly abate polluted runoff.
>
> 6C: Vegetated Treatment Systems - This measure promotes the installation of vegetated treatment systems (e.g., artificial or constructed wetlands) in areas where these systems will serve a polluted runoff – abatement function. Vegetated filter strips and engineered wetlands remove sediment and other pollutants from entering adjacent waterbodies. Pollutant removals typically occur through filtration, deposition, infiltration, absorption, decomposition, and voliatilization.

3.2.1.2.7 *State's Antidegradation Policy*

In accordance to the Federal Antidegradation Policy discussed in Section 3.2.1.1.3, the SWRCB adopted Resolution No. 68-16, Statement of Policy with Respect to Maintaining High Quality Waters in California (more commonly referred to as the State's Antidegradation Policy), which restricts the degradation of surface waters of the State and protects waterbodies where the existing water quality is higher than necessary for the protection of present and anticipated designated beneficial uses. The State Antidegradation Policy is implemented by the RWQCB.

3.2.1.3 Local Level

3.2.1.3.1 Los Angeles County Municipal Stormwater NPDES Program

In accordance with the CWA, a NPDES permit is required for certain municipal separate storm sewer discharges to surface waters. The County and City of Los Angeles are co-permittees under the municipal stormwater NPDES permit for Los Angeles County (MS4 Permit described in Section 3.2.1.1.1 above). The permit is a joint permit, with the Los Angeles County Flood Control District as the principal permittee and 85 incorporated cities within the County of Los Angeles, including the City of Los Angeles, as permittees. The Proposed Project is within the region covered by NPDES Permit No. CAS004001, issued by the RWQCB on December 13, 2001.[56] Under the permit, the County and City are required to implement development planning guidance and control measures that control and mitigate the stormwater quality and quantity impacts to receiving waters as a result of development and redevelopment. They are also required to implement other municipal source detection and elimination programs as well as maintenance measures. The permit contains the following seven provisions for implementation of the Stormwater Quality Management Program (SQMP):

- General Requirements – Each permittee is required to implement the SQMP to comply with applicable storm water program requirements at a minimum and implement additional controls where necessary to reduce the discharge of pollutants in stormwater to the maximum extent practicable (MEP).

- BMP Implementation – Permittees are required to implement the most effective combination of BMPs for stormwater/urban runoff pollution control.

- SQMP Revision – Permittees are required to revise the SQMP to comply with regional, watershed specific requirements, and or waste load allocations for implementation of TMDLs for impaired waterbodies.

- Responsibilities of the Principal Permittee – The Los Angles County Flood Control District's (as the Principal Permittee) responsibilities include, but are not limited to, coordinating activities necessary to comply with the NPDES permit, provide personnel and fiscal resources for SQMP updates and annual reports and summaries of reports required under the SQMP, and implementing a County-wide Monitoring Program and evaluating results of the monitoring program.

- Responsibilities of Permittees – Each permittee is required to comply with the requirements of the SQMP applicable to the discharges within its boundaries.

---

[56] *NPDES Permit No. CAS004001 is currently under litigation (Los Angeles County Economic Development Corporation v. California State Water Resources, Case No. BS080792). However, the permit remains in effect and has not been stayed or in any way rendered ineffective by the current legal action.*

- Watershed Management Committees (WMCs) – WMCs are comprised of a voting representative from each Permittee with the Watershed Management Areas (WMAs). WMCs are required to facilitate efforts and exchange of information between Permittees, establish additional goals for WMAs, prioritize pollution control efforts, monitor implementation of tasks designated for the WMA, and assess the effectiveness of and recommend revisions to the SQMP.

- Legal Authority – Permittees are granted the necessary legal authority to prohibit non-storm water discharges to the storm drain system.

The objective of the SQMP is to reduce pollutants in urban stormwater discharges to the "maximum extent practicable" in order to attain water quality objectives and to protect the beneficial uses of receiving waters in Los Angeles County. Special provisions are provided in the NPDES permit to facilitate implementation of the SQMP. These provisions include:

- BMP substitution – Substitution of site-specific BMPs are allowed provided the alternative BMP will meet or exceed pollutant reduction of the original BMP, the fiscal burden of the original BMP is substantially greater than the proposed alternative, and the alternative BMP will be implemented within a similar time period.

- Public Information and Participation Program (PIPP)– This requires the permittee to identify how public education needs were determined, who is responsible for developing and implementing the program, and the method used to determine its effectiveness.

- Industrial/Commercial Facilities Control Program -- This requires the permittee to develop a plan for managing stormwater runoff from industrial and commercial facilities. This program will track, inspect, and ensure compliance at industrial and commercial facilities that are sources of pollutants in storm water.

- Development Planning Program – This requires the permittee to implement a development-planning program that requires development and re-development projects to minimize impacts from storm water and urban runoff.

- Development Construction Program – This requires the permittee to implement a program to control runoff from construction activity to minimize erosion and transportation of sediment and prevent non-storm water runoff from equipment and vehicle washing.

- Public Agency Activities Program – This requires municipalities to evaluate existing public agency activities that have an impact on stormwater quality (such as vehicle maintenance, landscape maintenance and weed control, and construction and maintenance of streets, roads, and flood control systems) and develop a program to reduce stormwater impacts with a schedule for implementation.

- Illicit Connections and Illicit Discharges Elimination Program – This requires each permittee to have a plan for finding and preventing illegal connections and discharges and a mechanism for enforcing against illegal connections and discharges.

In conjunction with implementation of SQMP programs and related provisions, it is required by Order No. 01-182 of the RWQCB that a monitoring and reporting program be created to assess compliance with the NPDES permit requirements.

- Monitoring Program – The permittee will perform the baseline characterization of the stormwater discharged and evaluate the effectiveness of implemented control measures and identify and implement improvements to the SQMP. Under this program, the permittee will also identify future monitoring objectives including what information will be collected, the purpose of the information, how it will be collected and used, and how the information will be analyzed, reported, and stored.

- Program Reporting and Evaluation – This program requires the permittee to have a schedule for evaluating the stormwater program, the methodology used to evaluate the program, a discussion of who performs the evaluation, and what will be evaluated.

On March 8, 2000, the Standard Urban Stormwater Mitigation Plan (SUSMP) was approved by the RWQCB as part of the NPDES program to address stormwater pollution from new construction and redevelopment projects.[57] The SUSMP contains a list of minimum BMPs that must be employed to infiltrate or treat stormwater runoff, control peak flow discharge, and reduce the post-project discharge of pollutants from stormwater conveyance systems. The SUSMP defines, based upon land use type, the types of practices that must be included and issues that must be addressed as appropriate to the development type and size.

Finalized in May 2000, the County of Los Angeles' "Manual for the Standard Urban Stormwater Mitigation Plan (SUSMP)" details the requirements for new development and significant redevelopment BMPs. The SUSMP is a model guidance document for use by Permittees and individual project owners to select post-construction BMPs. It addresses water quality and drainage issues by specifying design standards for structural or treatment control BMPs that infiltrate or treat storm water runoff and control peak flow discharge. BMPs are defined in the SUSMP as any program, technology, process, siting criteria, operational methods or measures, or engineered systems, which, when implemented, prevent, control, remove or reduce pollution.

One of the most important requirements within the SUSMP is the specific design sizing criteria for stormwater treatment/management for new development and significant redevelopment projects. The SUSMP requires developers to mitigate

[57] *California Regional Water Quality Control Board, Los Angeles Region, Resolution No. R-00-02 [January 26, 2000] and Final SUSMP [March 8, 2000].*

(infiltrate or treat) the stormwater runoff (volume or flow rate) generated from 0.75 inches of rainfall over 24 hours (determined to represent the 85th percentile of storms in Los Angeles County). The SUSMP also requires that all stormwater treatment/management facilities be designed to "control the peak flow discharge to provide stream channel and over bank flood protection" based on the requirements of the City of Los Angeles' storm drain design criteria. These criteria require that any storm drain in a natural drainage course be designed to control the 50-year storm event.[58] In addition to the sizing requirements, the SUSMP includes eight general requirements as follows:

- Maintain pre-development peak stormwater runoff discharge rates where increases will result in increased potential for downstream erosion
- Conserve natural areas (e.g. Ballona Wetlands)
- Minimize storm water pollutants of concern (e.g. Freshwater Wetlands System, water quality basins, water quality inlets, parking lot filter strips, and porous pavement)
- Protect slopes and channels
- Provide storm drain stenciling and signage
- Properly design outdoor material storage areas
- Properly design trash storage areas
- Provide proof of ongoing BMP maintenance

Also, the SUSMP includes general design specifications for individual priority project categories . These include:

- 100,000 square foot commercial developments
- Automotive repair shops
- Retail gasoline outlets
- Restaurants
- Home subdivisions with 10 to 99 housing units
- Home subdivisions with 100 or more housing units

[58] *City of Los Angeles, Department of Public Works, Bureau of Engineering, 1986. Storm Drain Design Manual Part G. [Online] http://eng.lacity.org/techdocs/stormdr/Index.htm*

For example, commercial developments must have properly designed loading and unloading dock areas, repair and maintenance bays, and vehicle equipment wash areas. Restaurants need to have properly designed equipment and accessory wash areas. Parking lots have to be properly designed to limit oil contamination and have regular maintenance of parking lot stormwater treatment systems (e.g., storm drain filters and biofilters).

The Proposed Project is required to incorporate appropriate SUSMP requirements into project plans as part of the development plan approval process for building and grading permits. Project Design Features are compared to sizing requirements in the paragraphs below, followed by brief discussions of the Proposed Project with respect to selected general SUSMP requirements. All other general SUSMP requirements are addressed in the waterbody-specific impacts subsections.

3.2.1.3.2 Freshwater Wetlands System Performance Criteria

The initial proposal for the Freshwater Wetlands System emerged from the landowner's efforts in the late 1980's and early 1990's to bring about the settlement of a litigation challenging the California Coastal Commission's 1984 certification of a Coastal Land Use Plan for the coastal zone portions of Playa Vista (the "Settlement Agreement").[59] The Settlement Agreement required the creation of the Freshwater Wetlands System. In order to construct the Freshwater Wetlands System, the landowners of the adjacent Playa Vista First Phase Project and the Proposed Project were obligated to obtain a permit under Section 404 of the CWA (404 Permit)[60] in order to dredge and fill certain waters within the project site considered jurisdictional by the U.S. Army Corps of Engineers (USACE). In order to obtain the 404 Permit, the USACE required certifications be obtained from the SWRCB (with input from the RWQCB) regarding compliance with Section 401 of the CWA (401 Certification)[61], and the CCC regarding compliance with the Coastal Zone Management Act's (CZM) requirements for managing non-point source pollution and the California Coastal Act's water quality policies (CCC Certification)[62]. The 401 Certification and CCC Certification were obtained, and a 404 Permit was issued governing both the adjacent Playa Vista First Phase Project and the Proposed Project. Also, the landowner obtained a Coastal Development Permit (CDP)[63] from the CCC that, among its requirements, contained provisions related to water quality monitoring of the

---

[59] *Friends of Ballona Wetlands v. the California Coastal Commission, Los Angeles County Superior Court, Case No. C525 826.*

[60] *U.S. Army Corps of Engineers (USACE), Clean Water Act Section 404 Permit No. 90-326-EV (March 14, 1996).*

[61] *State Water Resources Control Board (SWRCB), Conditional Water Quality Certification Under Clean Water Act Section 401 (July 3, 1995) (incorporating Memorandum from Regional Water Quality Control Board (RWQCB) to SWRCB (June 15, 1995) and Memorandum from RWQCB to SWRCB (November 30, 1993).*

[62] *California Coastal Commission, Consistency Certification for wetland fill activities as described in the application for Corps of Engineers Permit pursuant to Section 404 of the Clean Water Act, Application No. 90-426-EV, Ballona Wetalnds, Los Angles County, CC-66-91 (October 25, 1991).*

[63] *California Coastal Commission, Coastal Development Permit for Maguire Thomas Partners - Playa Vista, Permit No. 5-91-463 (August 7, 1992).*

Freshwater Wetlands System to assure the water quality within the system would be maintained at levels suitable for the proposed habitat uses. As a requirement of the 404 Permit, the landowner prepared and submitted to the USACE the Habitat Mitigation and Monitoring Plan (HMMP)[64] that described and elaborated on requirements in the 404 Permit relevant primarily to habitat goals and water-related issues necessary to establishing and maintaining the habitat.

The 404 Permit recognizes the Freshwater Wetlands System as having multiple purposes and states that those purposes are: (1) to improve the quality of urban runoff entering the Ballona Wetlands and Santa Monica Bay, reducing existing water quality impacts to the area and aiding in the national program for improvement of water quality from urban runoff; (2) provide ecologically-sound flood control facilities for the Playa Vista First Phase Project, the Proposed Project, and surrounding roads and communities; and (3) provide wildlife habitat enhancement in an area where severe habitat degradation had occurred.[65] The 404 Permit, the 401 Certification, the CCC Certification, the CDP, and the HMMP established Performance Criteria that are designed to take into account the specific conditions of the adjacent Playa Vista First Phase Project and the Proposed Project and allow the Freshwater Wetlands System to function in its water quality, flood control, and habitat enhancement capacities (Performance Criteria).[66] These Performance Criteria are conditions and requirements of the 404 Permit, the 401 Certification, and the CCC Certification and, as such, are "regulatory standards" as that term is used in the Draft Los Angeles CEQA Thresholds Guide.

3.2.2 Affected Environment/Existing Conditions

The existing conditions of the Santa Monica Bay, the Ballona Channel, and the Ballona Wetlands are included in this discussion, as well as the Freshwater Wetlands System, which is under construction pursuant to the adjacent Playa Vista First Phase Project approvals to provide treatment for the off-site areas and the builtout areas of the adjacent Playa Vista First Phase Project and the Proposed Project. The existing surface water systems at the Project site are wetted primarily by urban dry weather and stormwater weather runoff originating from the site itself and from off-site areas draining through the site. This surface water runoff is conveyed through storm drains or as unchanneled (overland) flow. Prior to its temporary decommissioning in June 2000, the groundwater treatment facility (GWTF), was the only continuous point

---

[64] *Playa Capital Co., Habitat Mitigation and Monitoring Plan, (November 1995).*

[65] *Los Angeles District Corps of Engineers, Environmental Assessment 404(b)(1) Evaluation Public Interest Review, Permit Application Number: 90-426-EV, at 5-6 (July 1, 1992) (prepared in conjunction with the 404 Permit).*

[66] *As an example of the performance criteria: 1) regarding habitat, the 404 Permit requires establishment, within the Freshwater Marsh, of 9.7 acres of open water, 7.2 acres of marsh habitat, 5.5 acres of willow woodlands, and 3.7 acres of mixed riparian habitat; 2) regarding flood control, the 404 Permit states that at buildout, the Freshwater Wetlands System will contain a 1-year frequency storm event (based on city of LA Peak Rate Hydrology Method); and 3) regarding water quality, the 401 Certification requires the Storm Water Pollution Prevention Plan prepared during construction of the project include procedures to reduce gully and rill erosion.*

source discharge within the Playa Vista Development area The treated groundwater was discharged to Centinela Creek under a RWQCB NPDES permit.

3.2.2.1 Santa Monica Bay

Santa Monica Bay generally receives surface water drainage from storm drains, overland flow, treated process waters from industrial sites, industrial and commercial discharges of non-process wastewater,[67] and discharges from power plant and wastewater treatment plant outfalls, all of which contribute to pollutant loading in the Bay. Pollutants are transported into the Bay through flushing of adjacent marina and estuary areas due to daily tidal fluctuations. The Bay receives urban runoff indirectly from the adjacent Playa Vista First Phase Project and the Proposed Project sites via the Freshwater Marsh, which flows directly to the Ballona Channel, which flows to the Bay. In addition, some runoff from larger storms (i.e., larger than a 1-year design storm) would overflow from the Freshwater Marsh (by design) and flow through the Ballona Wetlands prior to discharge to the Ballona Channel. A recent study conducted in 2001 by the Santa Monica Bay Restoration Project, University of California Los Angeles (UCLA), and Southern California Water Resources Program also noted that aerial deposition to the Bay was a potential source of mass loading for zinc, copper, and lead.[68]

Based on the SWRCB's 1994 Water Body Fact Sheet and the RWQCB, the waters of Santa Monica Bay have been assigned a Class C (impaired rating). A Class C rating for the Santa Monica Bay means that the water in the Bay is suitable for fish and aquatic habitat as well as secondary contact recreation (water related activity, such as boating, marine life study, beachcombing, sunbathing, and fishing). The Santa Monica Bay's biological community has been identified as being imbalanced, severely stressed, or known to contain toxic substances in concentrations that are hazardous to human health.[69] The contaminants of greatest concern in the Bay are chlorinated and polyaromatic hydrocarbons, organometalloids, viral pathogens, and trace metals (copper and zinc). Certain of these contaminants tend to bioaccumulate and/or are not degraded by natural biological processes; therefore, they can present risks to biota and human health at elevated concentrations. The Bay is generally considered to be nutrient poor.

The water and sediment in Santa Monica Bay have been monitored extensively by state and federal resource management agencies (such as RWQCB and SWRCB), by local agencies, by citizen volunteer monitoring groups sponsored by local environmental organizations (such as Heal the Bay and Santa Monica Bay Keeper), as well as by consulting firms as part of environmental studies of adjacent water resources. Summaries of the sampling data from some of these environmental studies are provided in this section. It should be noted that the data included in this summary

---

[67] *Santa Monica Bay Restoration Commission. http://www.santamonicabay.org/site/problems/Layout/water.jsp*

[68] *Stolzenback, Keith D., et al. Measuring and Modeling of Atmospheric Deposition on Santa Monica Bay and the Santa Monica Bay Watershed, September 2001.*

[69] *State Water Resources Control Board, Water Body Fact Sheet, May 18, 1994.*

represent only a small subset of the data available on the Bay and this summary is not intended to be comprehensive but only to provide a general description of the water and sediment quality of the Bay.

In 1993, the Santa Monica Bay Restoration Project published an assessment of the storm drain sources of contaminants to Santa Monica Bay by UCLA Department of Civil and Environmental Engineering and Woodward-Clyde Consultants. [70] The study and following update, summarized in four volumes, concluded that significant pollution enters the Bay from urban runoff originating from existing residential, industrial, and commercial land use areas surrounding Santa Monica Bay.

3.2.2.1.1 *Water Quality*

Water quality in Santa Monica Bay in the vicinity of Ballona Channel was sampled during dry weather by ABCL in 1996/1997[71] and Chambers Group in 1992,[72] and during wet weather by ABCL in 1997.[73] As shown in **Figure 3-1, Playa Vista Existing Data Approximate Water, Sediment, and Soil Sampling Locations**, samples were taken primarily near the breakwater at the entrance to Marina del Rey harbor and the mouth of Ballona Channel. **Table 3-3, Selected Water Quality Constituents in Santa Monica Bay During Dry Weather** and **Table 3-4, Selected Water Quality Constituents in Santa Monica Bay During Wet Weather** summarize the chemical constituents sampled in Santa Monica Bay for dry and wet weather conditions, respectively. The tables identify the number of samples where the chemical constituent exceeded the COP objectives[74] and the maximum observed concentrations. The existing data indicate that salinity, pH, and dissolved oxygen in the Santa Monica Bay were within the expected ranges for the ocean waters in Southern California. No volatile organic compounds and pesticides were reported above the detection levels utilized for samples taken in the bay.

However, some compounds reported in the existing data were not within typical ranges. Ammonia and phosphorus were above the typical open ocean ranges of 0.002 to 0.009 milligrams per liter (mg/L) and 0.02 to 0.03 mg/L, respectively. However, the ammonia concentrations were below the COP objectives, and phosphorus concentrations were consistent with previous samplings reported by Woodward-Clyde in 1990. Dissolved nickel and zinc exceeded CTR and chronic COP criteria, respectively.

---

[70] *Stenstrom and Strecker, UCLA Department of Civil and Environmental Engineering, and Woodward-Clyde Consultants, Assessment of the Storm Drain Sources of Contamination to Santa Monica Bay, 1993.*
[71] *Aquatic Bioassay and Consulting Laboratories, Inc.(ABCL), The Marine Environment of Marina del Rey Harbor July 1996 - June 1997, September 15, 1997.*
[72] *Chambers Group, Inc., 1993. Comparison of the Re-Establishment of Tidal Flow in the Ballona Wetlands Through the Ballona Channel or Through the Marina del Rey Entrance Channel, March, 1993.*
[73] *ABCL, Op cit., 1997.*
[74] *The California Ocean Plan (COP) includes numerical limits for a variety of constituents. The COP applies to ocean waters and not to inland bays and estuaries, such as the Ballona Estuary. The COP numerical objectives have been used here only for comparative purposes as a potential gage of the state of these water bodies. A measure of the Project's impacts on such parameters is how it affects Clean Water Act Section the 303(d) listed pollutants.*

Coliform bacteria (a human pathogen indicator) water quality objectives have exceeded state standards in Santa Monica Bay under existing conditions.[75] The State of California uses this type of data to assess water quality impairment and develop subsequent regulatory efforts (listing of water quality limited waterbodies, i.e., 303(d) listings) as well as to investigate known sources. The exceedance of these water quality objectives indicates an increased risk that human pathogens are present, but does not confirm the presence of specific human pathogens. There are many sources of coliform bacteria.

Using qualitative and/or quantitative assessment techniques, as appropriate, existing water quality conditions in Santa Monica Bay, which does not receive direct runoff from the Proposed Project, was assessed in terms of the potential for the Proposed Project to exacerbate existing potential water quality problems, and in terms of the Project Design Features included to control potential sources.

The RWQCB has prepared a Dry-Weather Total Maximum Daily Load for Bacteria at Santa Monica Bay Beaches.[76] A source analysis of the elevated densities of bacterial indicators showed that at many of the Santa Monica Bay beaches dry-weather urban runoff conveyed by storm drains and creeks (which includes Ballona Creek and Estuary) are the cause of water quality impairment in terms of the water contact recreation (REC-1) beneficial use.

3.2.2.1.2 *Sediment Quality*

Sediment in Santa Monica Bay in the vicinity of Ballona Channel was sampled by ABCL in 1996,[77] ABT in 1995,[78] and Chambers Group in 1991/1992.[79] **Table 3-5, Selected Sediment Quality Constituents in Santa Monica Bay,** summarizes the sediment sampling results for Santa Monica Bay. Several constituents were detected at levels higher than the guidance values including semi-volatile organic compound (SVOCs), metals, and pesticides. Of the metals, barium, cobalt, and lead were detected at concentrations exceeding the Probable Effects Level (PEL) guidance values. PEL is a non-regulatory guidance value, a benchmark for descriptive purposes that represents the concentration of a compound above which adverse effects in organisms are frequently expected. These PELs were obtained from the National Oceanic & Atmospheric Administration (NOAA) Screening Quick Reference Tables (SQuiRTs).[80] The SQuiRTs include multiple screening values for both saltwater and freshwater sediment to reflect the range of possible adverse biological effects. In the absence of California-established guidance criteria for sediments, these guidance values have been utilized as benchmarks for comparative purposes.

---

[75] *Santa Monica Bay Restoration Commission. http://www.santamonicabay.org/site/problems/Layout/water.jsp*
[76] *California Regional Water Quality Control Board, Los Angeles Region, Resolution 2002-022, December 12, 2002. This TMDL was considered effective as of July 15, 2003, when the RWQCB filed its Notice of Decision with the California Resources Agency.*
[77] *ABCL, Op cit., 1997.*
[78] *Advanced Biological Testing (ABT), 1995. Results of Chemical and Physical Testing of Sediments from Marina del Rey South Entrance-Draft. October 17, 1995.*
[79] *Chambers Group, Op cit., 1993.*
[80] *Buchman, M.F., 1999. NOAA Screening Quick Reference Tables, NOAA HAZMAT Report 99-1. Seattle, WA, Coastal Protection and Restoration Division, National Oceanic and Atmospheric Administration, 12 pages.*

Several pesticides and PCBs were detected in the sediments that were not found in the water column samples reported previously. Several pesticides and polychlorinated biphenyls (PCBs) were detected in the sediment were not found in the water column samples reported previously. Alpha-chlordane, gamma-chlordane, chlordane, heptachlor epoxide, p,p'-DDT; p,p'-DDD; p,p'-DDE; PCB-1248; and PCB-1254 were reported in the sediment samples from Santa Monica Bay with chlordane and DDT at levels higher than PEL guidance values.

For most of the constituents, the guidance values were exceeded in less than 15 percent of the samples. The exceptions are barium and lead where 33 percent and 24 percent exceeded, respectively.

A compound of concern in the sediments in area is tributyl tin (TBT). TBT has been introduced into the Bay from antifouling agents applied to boats. Although its use has been banned for several years, TBT levels in Santa Monica Bay have not decreased. However, since the Project does not include a marina or other boating activity areas that might be a source of TBT, TBT will not be generated by the Proposed Project.

3.2.2.2 Ballona Channel

The Ballona Channel runs just north of the adjacent Playa Vista First Phase Project and the Proposed Project sites and discharges directly into Santa Monica Bay. It serves as the major outlet for a 78,000-acre watershed upstream of the Ballona Wetlands, which includes the highly urbanized West Central Los Angeles Metropolitan Area and a portion of the Santa Monica Mountains.

3.2.2.2.1 Water Quality

Due to the saltwater wedge and the varying conditions in the channel, the evalutaion of the existing data for Ballona Channel can be divided into the freshwater portion and the saltwater portion of the channel. Because the drainage from the adjacent Playa Vista First Phase Project and the Proposed Project outlets into the Ballona Channel, downstream of the channel's intersection with Culver Boulevard, which for the purposes of this document has been treated as being within the Ballona Creek Estuary, only the saltwater portion of the Ballona Channel is discussed. As mentioned previously, the portion of the Ballona Channel between the channel's intersection with Culver Boulevard and the extent of the channel's tidally influenced point approximately 3,000 feet east of Lincoln Boulevard (near the confluence with Centinela Channel) is referred to as the saltwater wedge. ABCL, CDM, Chambers Group, and URSGQC sampled the saltwater portion of the Ballona Channel at discrete periods. **Table 3-6, Selected Water Quality Constituents in Ballona Channel During Dry Weather** and **Table 3-7, Selected Water Quality Constituents in Ballona Channel During Wet Weather** summarize the constituents that have been analyzed under dry and wet weather conditions, respectively, for saltwater samples from Ballona Channel.

Saltwater in the Ballona Channel was sampled during dry weather by URSGWC in 1990,[81] Chambers Group/Soule in 1992,[82] ABCL in 1996/1997,[83] and CDM in 1996/1998,[84] and during wet weather by Chambers Group/Soule in 1992,[85] CDM in 1995/1996,[86] and ABCL in 1996/1997.[87] Constituent levels in the saltwater portion of the Ballona Channel were comparable to concentrations in Santa Monica Bay and typical open ocean concentrations for Southern California. During dry weather sampling, dissolved oxygen and oil and grease concentrations were high (13 mg/L for dissolved oxygen and 57 mg/L for oil and grease) during February and March of 1997 and October of 1992, respectively. However, overall average is within the typical ocean range. Similar to the Santa Monica Bay sample results, ammonia and phosphorus in the saltwater portion of the channel were above the typical open ocean ranges for these compounds. Pesticides and PCBs were not detected above laboratory detection limits.

Dissolved copper, zinc, and selenium were detected above water quality criteria in the dry weather sampling period. Five out of 10 samples exceeded the chronic CTR criteria for copper; 4 out of 10 exceeded the zinc criteria; and 2 out of 4 exceeded the selenium criteria. Dissolved copper and zinc were also detected at concentrations exceeding the acute CTR criteria in wet weather. In general, heavy metals concentrations in the water column were higher during the more recent 1996-1998 sampling than the previous 1990 and 1991 sampling.

3.2.2.2.2 *Sediment Quality*

Table 3-8, Selected Sediment Quality Constituents in Ballona Channel, lists the constituents analyzed, and the constituents exceeding guidance values for sediment samples taken from the saltwater portion of the Ballona Channel.

Sediment in the saltwater portion of the Ballona Channel was sampled by URSGWC in 1990,[88] Chambers/Soule in 1992,[89] ABCL in 1996/1997,[90] and CDM in 1996-1998.[91] Lead, manganese, and nickel were detected at concentrations above the PEL sediment guidance values in 1 out of 11 samples for nickel, in 1 out of 7 samples for manganese, and in 3 out of 11 samples for lead. Other detected metals were either below sediment guidance values or do not have sediment guidance values. Detected pesticides included chlordane, p,p'-DDE, p,p'-DDT, p,p'-DDD, alpha-chlordane, gamma chlordane, and PCB-1254. DDD and DDT were detected above sediment guidance values. Total xylenes were also detected above PEL guidance values.

[81] *Woodward-Clyde Consultants, Op cit., 1990.*
[82] *Chambers Group, Inc., Op cit., 1993.*
[83] *ABCL, Op cit., 1997.*
[84] *CDM, Op cit., August 14, 1996 and Op cit., October 27, 1998.*
[85] *Chambers Group, Inc., Op cit., 1993.*
[86] *CDM, Op cit., August 14, 1996.*
[87] *ABCL, Op cit., 1997.*
[88] *Woodward-Clyde Consultants, Op cit., 1990.*
[89] *Chambers Group, Inc., Op cit., 1993.*
[90] *ABCL, Op cit., 1997.*
[91] *CDM, Op cit., August 14, 1996 and Op cit., October 27, 1998.*

Suggested sediment guidance values or benchmarks do not exist for nutrients, and oil and grease. Phosphorus concentrations were higher in the recent 1996-1998 sampling events than they were in the 1992 sampling. Oil and grease analytical results indicate highly variable levels of these constituents ranging from non-detect to 27,800 parts per million (ppm). Total petroleum hydrocarbons (TPH)-diesel and total recoverable petroleum hydrocarbons (TRPH) were detected during the most recent sampling at concentrations up to 2,300 ppm. TPH-gasoline was not detected above laboratory detection limits.

3.2.2.3 Ballona Wetlands

3.2.2.3.1 Water Quality

Freshwater surface waters reach the Ballona Wetlands directly through precipitation and point source discharges, and indirectly from non-point discharges associated with land uses surrounding the wetlands, including developments on the Westchester and Playa del Rey Bluffs, the Southern California Gas Company (SCGC) facility, runoff from Playa del Rey in the vicinity of Culver Boulevard, Culver Boulevard as it transverses the wetlands and occasional overflows from the Pershing Drive Storm Drain. The other source of surface water in the wetlands is limited, but now increased, tidal exchange from Ballona Channel to the Ballona Wetlands. During and following storm events, water in the wetlands is primarily dominated by wet weather runoff, which is temporarily detained within the wetlands, depending on heights of storm flows within Ballona Channel. In smaller storm events (less than a 1-year design storm) the detention times could be quite low depending on tide levels.

Dry weather freshwater runoff into the Ballona Wetlands, originates from off-site areas and results from such activities as excess and misapplied landscape irrigation, onto pavement, car washing, and street, driveway, and sidewalk cleaning and emerging shallow groundwater (e.g., leakage of shallow groundwater into storm drain pipes). Other potential sources include accidental sewer overflows and illegal industrial and commercial off-site discharges. Limited tidal exchange between the Ballona Channel and the Ballona Wetlands could bring these sources into the Ballona Wetlands from the Ballona Channel.

This limited tidal exchange also provides another source of surface water to the wetlands. During and following storm events, water in the wetlands is primarily dominated by wet weather runoff, which is temporarily detained within the wetlands, depending on heights of storm flows within Ballona Channel. In smaller storm events the detention times could be quite low depending on tide levels.

Runoff pollutants are removed by naturally occurring processes (wetland function) as runoff passes through the existing Ballona Wetlands. Due to its location, the Ballona Wetlands function as a runoff detention basin that supports plant and animal life. In natural wetland systems, processes such as sedimentation, filtration, biodegradation, and plant uptake typically remove particulate and organic matter. However, the flow pathways in much of the wetland are channelized and therefore for many smaller storms, the detention times and resulting treatment rates in the Ballona Wetlands are likely not as large as would be expected in wetlands constructed or managed to maximized detention times. Under dry weather conditions, detention times of dry weather flows are likely more significant, although difficult to estimate.

Table 3-9, Selected Water Quality Consituents in Ballona Wetlands During Dry Weather and **Table 3-10, Selected Water Quality Constituents in Ballona Wetlands During Wet Weather** summarize the water quality data for the Ballona Wetlands under dry and wet weather, respectively. The Ballona Wetlands was sampled in dry weather by URSGWC in 1990,[92] GeoSyntec in 2000,[93] and CDM in 1998 and 2002.[94] The Ballona Wetlands was sampled during wet weather by GeoSyntec in 2000.[95] The water quality in the Ballona Wetlands had salinity concentrations similar to the Ballona Channel. Comparing wet- and dry-weather average concentrations in the dry-weather Ballona Wetlands to those of the dry-weather Ballona Channel, the Ballona Wetlands concentrations were higher for total and dissolved arsenic and nickel, and the Ballona Channel concentrations were higher for total and dissolved copper and zinc. Concentrations of total lead and selenium were higher in the Ballona Channel during dry-weather, but were higher in Ballona Wetlands during wet-weather. All other metals concentrations were similar in magnitude or were not detected. Wet-weather concentrations of dissolved copper exceeded acute CTR criteria in the sample from the effluent of the Ballona Wetlands to the Ballona Channel. During dry-weather, dissolved arsenic, copper, nickel, selenium, and alpha-BHC were higher than chronic CTR criteria. The dry-weather exceedances were in various locations throughout the Ballona Wetlands and were not specific to a particular sampling location or period.

3.2.2.3.2 Sediment Quality

Table 3-11, Selected Sediment Quality Constituents in Ballona Wetlands, summarizes the sediment quality data for the Ballona Wetlands. Sediment quality in the drainage channels of the Ballona Wetlands was sampled in 1990 by URSGWC[99], 1998 by CDM[100], and 2000 by GeoSyntec[101]. Of the pesticides and PCBs, only DDT, PCB-1260, and chlordane were detected above laboratory detection limits and only DDT and chlordane were higher than the PEL guidance values. Of the VOCs and SVOCs, total phenols were detected only during the 1998 sampling and benzene and toluene were detected during the 2000 sampling. Nitrogen was found only in the organic-nitrogen form. Oil and grease results indicate that these constituents were lower in 1998 (62 mg/kg mean) than in 1990 (1,095 mg/kg mean). Total recoverable

---

[92] *Woodward-Clyde Consultants, Op. cit., 1990.*
[93] *GeoSyntec, 2000. Ballona Wetlands Sampling Data.*
[94] *CDM, Op. cit., October 1998. Ballona Wetlands Water Quality Sampling on August 2, 2002 Dry Weather; and Ballona Wetlands Water Quality Sampling on April 2, 2003 Dry Weather.*
[95] *GeoSyntec, 2000. Ballona Wetlands Sampling Data.*
[99] *Woodward-Clyde Consultants, Op. cit., 1990.*
[100] *CDM, Op. cit., October 1998. Ballona Wetlands Water Quality Sampling on August 2, 2002 Dry Weather; and Ballona Wetlands Water Quality Sampling on April 2, 2003 Dry Weather.*
[101] *GeoSyntec, 2000. Ballona Wetlands Sampling Data.*

petroleum hydrocarbons (TRPH) were detected during the 1998 sampling at concentrations of 50 mg/kg. TRPH was not analyzed during the other sampling events. In general, heavy metals concentrations were within the same range for all three sampling events. Barium, lead, and zinc were detected above PEL guidance values. Mercury was detected in sediment but not in surface water samples. In addition, selenium was detected in surface water samples but not in sediment samples.

3.2.2.3.3 *Sediment/Upland Soil Quality*

During the 1998 sampling event, a couple of samples were collected from upland locations in the Ballona Wetlands from areas that are not regularly flushed by the water in the wetlands. However, since these areas are occasionally covered with water during the wet winter season, it was determined that categorizing these samples as soil samples would not be accurate. Therefore, in this report, these samples are referred to as sediment/upland soil samples. These results are summarized in **Table 3-12, Selected Sediment/Upland Soil Quality Constituents in Ballona Wetlands.**

Samples taken from sediment/upland soil in the Ballona Wetlands were analyzed for nutrients including ammonia, TKN, total inorganic nitrogen, phosphorus, nitrite, and nitrate. One sample was analyzed for pesticides and PCBs, oil and grease, TRPH, TPH-gasoline, and TPH-diesel. No pesticides or polychlorinated biphenyls (PCBs) were detected in this sample above laboratory detection limits. TPH-gasoline was also not detected above laboratory detection limits during this sampling event.

Overall, the existing water and sediment quality data in the Ballona Wetlands are relatively free of contamination from potentially toxic organic contaminants (pesticides, PCBs, VOCs, SVOC's), and show only limited metals detected at levels above benchmark values in either the water or sediments. Exceedances were not consistent for all samples, and the majority of exceedances were not substantially higher than the benchmark values. The sampling suggests past and current influence of urban runoff, particularly with the detection of lead, and zinc levels, which exceeded sediment criteria at up to three out of nine sampling locations in the Ballona Wetlands sediment. These levels are typical of those in areas receiving urban runoff.

3.2.2.4 Centinela Ditch

Centinela Ditch was an unlined, earthen, trapezoidal open channel between the west end of the Plant Site and Lincoln Boulevard, and a variable-sized closed-conduit storm drain through the Plant Site. The ditch collected stormwater from existing developments on the Westchester Bluffs through several major and minor storm drain systems. Prior to completion of the adjacent Playa Vista First Phase Project, it drained the south portion of the First Phase Project and the Proposed Project sites and discharged into the East Wetland portion of the Ballona Wetlands. Currently, all of the Centinela Ditch within the adjacent Playa Vista First Phase Project site has been removed as a result of site preparation and construction activities. The remainder of the ditch collects stormwater from existing developments on the Westchester Bluffs through several storm drains. Under existing conditions, it also drains the south portion of the site and discharges through a temporary detention basin into the Central Storm Drain (approved and constructed as part of the adjacent Playa Vista First Phase Project) under Lincoln Boulevard and into the Freshwater Marsh.

The upstream portion of the Centinela Ditch primarily receives water from storm drains and can be considered to be freshwater. However, the downstream portion of the Centinela Ditch near the Ballona Wetlands becomes more brackish and can be considered to be saltwater. Because the drainage from the adjacent Playa Vista First Phase Project and the Proposed Project will outlet into the downstream portion of the Centinela Ditch, only the saltwater portion of the Centinela Ditch is discussed in this report. It is anticipated that the Riparian Corridor that replaces this section of the Centinela Ditch will receive storm drain runoff and irrigation runoff from the adjacent Playa Vista First Phase Project and the Proposed Project and be considered freshwater habitat.

3.2.2.4.1 *Water Quality*

Only one water sample was collected in the saltwater portion of the Centinela Ditch by URSGWC in 1990.[102] The results are summarized in **Table 3-13, Selected Water Quality Constituents in Centinela Ditch During Dry Weather**. VOCs were not detected in the sample. Arsenic, cadmium, chromium, copper, lead, nickel, and zinc were detected above laboratory detection limits. Only copper and lead were detected above chronic CTR criteria.

3.2.2.4.2 *Sediment Quality*

Only one sediment sample was collected in the saltwater portion of the Centinela Ditch by URSGWC in 1990.[103] The results are summarized in **Table 3-14, Selected Sediment Quality Constituents in Centinela Ditch**. VOCs, SVOCs, pesticides and PCBs were not detected above laboratory detection limits in the sample. Arsenic, cadmium, chromium, copper, lead, nickel, silver, and zinc were detected; however, none were detected above the PEL criteria.

3.2.2.5 Freshwater Marsh

3.2.2.5.1 *Water Quality*

The Freshwater Marsh is a Project Design Feature of the Playa Vista First Phase Project and the Proposed Project, and receives urban runoff directly from the adjacent Playa Vista First Phase Project and the Proposed Project sites in addition to off-site properties (e.g., bluff and light industrial/residential areas north of Jefferson Boulevard). It is designed to have the capacity to process runoff from low flows up to a 1-year design storm event (at buildout) and has the flexibility to release freshwater to the Ballona Wetlands through a gated valve should it be necessary in conjunction with any future restoration of the salt marsh or during high volume storm events (greater than 1-year events). Substantial portions of the Freshwater Marsh were

---

[102] *Woodward-Clyde Consultants, Op. cit., 1990.*
[103] *Woodward-Clyde Consultants, Op. cit., 1990.*

constructed in 2001-2002 as part of the adjacent Playa Vista First Phase Project. Only the southern portion of the Freshwater Marsh (approximately 8 acres) currently remains to be constructed (completion is scheduled for 2004).

Existing dry weather flows within the adjacent Playa Vista First Phase Project and the Proposed Project sites are minimal due to the largely undeveloped nature of the site and the erosion control plans and BMPs implemented as part of the adjacent Playa Vista First Phase Project. There is also a minimal amount of dry-weather flow from treatment groundwater dewatering from the adjacent Playa Vista First Phase Project. Due to the low volume and velocity of dry weather flows, the quality of dry weather runoff is largely a function of the source of water rather than the pollutants the flow picks up as it is conveyed through the drainage system. Runoff in urban areas may contain pesticides, garden fertilizers, oil/grease, street litter, and waste.[104] Like the Ballona Wetlands, runoff pollutants in the Freshwater Marsh are removed by naturally occurring processes (such as sedimentation, filtration, biodegradation, and plant uptake typically remove particulate and organic matter) as runoff passes through the Freshwater Marsh. The Freshwater Marsh, with its longer detention times, is expected to perform this function better than the Ballona Wetlands.

Water in the Freshwater Marsh was sampled near its inlets and outlets during its construction. Three sampling events occurred during dry weather conditions (April 2002[105], June 2002[106], and April 2003[107]). As shown in **Table 3-15, Selected Water Quality Constituents in Freshwater Marsh During Dry Weather,** none of the detected constituents in the dry weather samples exceeded chronic (or acute) CTR criteria.[108] In Table 3-15 freshwater chronic CTR criteria were used for comparison because the Freshwater Marsh is a freshwater habitat, the biology of the waterbody is dominated by freshwater aquatic life[109] and because there is a distinct separation between the Freshwater Marsh physically separated from the downstream saltwater marsh (i.e., Ballona Wetlands) by a berm with hydrologic controls mediating the exchange between them. Therefore, freshwater criteria are appropriate.

3.2.2.5.2 *Sediment Quality*

The quality of sediment in the Freshwater Marsh has not yet been assessed since its construction. By design (see Project Design Features below), the Freshwater Marsh is intended to protect the Ballona Wetlands by sequestering pollutants in sediment and

---

[104] Santa Monica Bay Project and Southern California Association of Governments, State of the Bay, Scientific Assessment, November 1988, page 3-35.
[105] CDM, 2002. Tables reporting sampling results from April 25, 2002.
[106] CDM, 2002. Tables reporting sampling results from June 28, 2002.
[107] CDM, 2003. Tables reporting sampling results from April 2, 2003.
[108] The CTR Criteria are water quality standards legally applicable to selected waters with human health or aquatic life, designations, such as the Ballona Channel and the Ballona Wetlands; however, in reference to the Freshwater Wetlands System components, the CTR Criteria are used as numerical water quality reference levels for comparative purposes only. Chronic criteria are appropriate for comparison to dry weather flows, because such flows typically occur for periods of greater than 4 days, which is the CTR averaging period for chronic criteria.
[109] The observed salinity was detected as high as 1.8 parts per thousand and according to the CTR if the salinity is between 1 and 10 part per thousand 95% or more of the time, the more stringent of the freshwater and saltwater criteria apply, unless it can be demonstrated that the biology of the water body is dominated by either freshwater or saltwater aquatic life; deeming it appropriate to use the corresponding freshwater or saltwater aquatic life criteria.

vegetation, primarily in the primary management areas of the Freshwater Marsh. Therefore over time the sediment quality of the Ballona Wetlands will improve and the sediment quality of the primary management of the Freshwater Marsh may degrade. Monitoring of the sediment in the primary management areas will be conducted to determine when or if sediment removal is necessary to ensure prolonged treatment and protection of wildlife and habitat in the Marsh, as well as, downstream waters.

3.2.2.6 Point Source Pollutant Loadings

The only continuous point source discharge within the adjacent Playa Vista First Phase Project and the Proposed Project was from the GWTF operating at the former Plant Site in the eastern portion of the adjacent Playa Vista First Phase Project. The groundwater beneath adjacent Playa Vista First Phase Project and the Proposed Project and vicinity has been contaminated from previous industrial use in the area and surrounding off-site locations (see Section 3.3, Groundwater Quality). Following a 60-day start-up period, groundwater remediation began on a continuous basis in August 1994.[110] The system extracted contaminated groundwater from beneath adjacent Playa Vista First Phase Project and the Proposed Project and vicinity and removed volatile organic compounds using air stripping. Treated water, which was monitored weekly to monthly for quality, was discharged to the existing Centinela Creek under a RWQCB NPDES permit that included limits on discharge concentrations. Actual discharge concentrations are shown in **Table 3-16, Groundwater Remediation Facility Discharge Water Quality and Construction Dewatering Discharge Water Quality**. Maximum estimated effluent concentrations of pollutants after treatment are also provided in the table.

In June 2000, operation of the groundwater extraction system was suspended with RWQCB approval due to grading and construction of the adjacent Playa Vista First Phase Project and the GWTF was temporarily decommissioned. Since September 2000, a new and more efficient groundwater treatment system, designed to treat a wider range of contaminants, was installed for remediation-related activities and for construction dewatering for construction of the adjacent Playa Vista First Phase Project. This facility is located on the north side of Building 2 within the adjacent Playa Vista First Phase Project, east of the Proposed Project site, and operates under NPDES Permit# CAG914001. Currently, one other temporary portable GWTF serves the adjacent Playa Vista First Phase Project and the Proposed Project. The facility is located within the western portion of the adjacent Playa Vista First Phase Project site, east of Lincoln Boulevard, and south of Jefferson Boulevard, near Runway Road. This facility is presently in operation for treatment of construction dewatering and operates under NPDES Permit #CAG994002. As construction of the adjacent Playa Vista First Phase Project progresses, additional treatment facilities will be added as deemed necessary by the RWQCB for specific construction dewatering and remediation efforts. A groundwater treatment program for the adjacent Playa Vista First Phase Project and the Proposed Project will be implemented, as necessary, in

[110] *Mr. Scott Broten, Project Manager, SECOR International Inc., Telephone Communication, March 4, 1996.*

accordance with RWQCB requirements, in conjunction with ongoing implementation of Cleanup Abatement Order No. 98-125. As an alternative to treatment on-site and discharge of construction dewatering under an existing NPDES permit, an Industrial Waste Discharge Permit (W-502105) has been obtained from the City of Los Angeles, Bureau of Sanitation which allows construction dewatering water to be discharged to the Sanitary Sewer. The existing extraction wells will be abandoned or relocated evaluation in accordance with RWQCB requirements. For a discussion of this remediation program, refer to Section IV-I, of the Proposed Project's Draft EIR, Safety/Risk of Upset. The discharge of treated groundwater is one of the potential water sources for the Riparian Corridor and Freshwater Marsh.

3.2.3 Project Design Features

The design of the Proposed Project incorporates a number of pollutant source control and water quality features. Source controls include such features as underground parking (approximately 75 percent of the buildings within the Proposed Project would be designed with subterranean/underground parking), covered or underground trash and recycling facilities, a street and catch basin cleaning program, xeriscape and native landscaping to reduce water use, a fertilizer and pesticide management program, prohibition of certain building materials such as roofing/gutter materials that are high in copper and/or zinc, and a tenant/resident education program. Additionally, the Proposed Project will include the use of roof drain biofiltration systems for all buildings, additional water quality inlets (BMP catch basins) for catch basins on the Central Storm Drain, and a bioswale within a park to receive and filter stormwater runoff from the Proposed Project prior to entering the Riparian Corridor. Major water quality features within the adjacent Playa Vista First Phase Project and the Proposed Project that contribute to pollutant removal through treatment of collected storm runoff include the biofiltration aspects of the Freshwater Wetlands System (including the Marsh and the Riparian Corridor), water quality inlets (BMP catch basins), and other measures described in more detail below. The water quality management features have been designed to achieve specific water quality goals and benefits at buildout of Playa Vista, including the adjacent Playa Vista First Phase Project and the Proposed Project, as compared to pre-Playa Vista conditions. The Proposed Project has been designed to achieve, in conjunction with the adjacent Playa Vista First Phase Project, no net increase in pollution to receiving waters at Project buildout, compared to pre-First Phase conditions, as well as to meet or exceed water quality design standards for BMPs. **Figure 3-2, Examples of Project BMPs**, provides an overview of the primary types of BMPs proposed for the Proposed Project. Volume III, Appendix F of this Technical Report provides a detailed discussion of the methodology and assumptions used to incorporate treatment in structural BMPS in the pollutant loading model. Flowcharts detailing the percent of flows to each BMP and the effluent concentrations or removal rates assumed for these BMPs in the pollutant loading model are shown in Figures F-1, F-2 and F-3 of Volume III, Appendix F of this Technical Report.

3.2.3.1 Freshwater Wetlands System

The Freshwater Wetlands System (which includes the Riparian Corridor and Freshwater Marsh), the majority of which was approved under the adjacent Playa Vista First Phase Project (the central portion of the Riparian Corridor is proposed for approval under the Proposed Project's Draft EIR), was designed as a comprehensive system intended to manage and accommodate the hydrology (stormwater flows) and water quality requirements of the adjacent Playa Vista First Phase Project and the Proposed Project, as well as off-site tributary areas, while providing habitat enhancement in the area. When granting their approvals for the Freshwater Wetlands System, the USACE, SWRCB, RWQCB, and CCC acknowledged the primary functions of the Freshwater Wetlands System as:

- Cleansing urban runoff from the adjacent Playa Vista First Phase Project and the Proposed Project as well as hundreds of acres outside of the adjacent Playa Vista First Phase Project and the Proposed Project areas,
- Providing flood control protection for future buildout of that portion of the adjacent Playa Vista First Phase Project and the Proposed Project located south of Ballona Channel, and
- Providing new and enhanced freshwater habitat.[111]

The agencies' approvals (404 Permit, 401 Certification, CCC Certification, and CDP) recognized the degraded nature of the pre-existing habitat in the area and the fact that urban runoff from existing development has been a contributor to that degradation, and also recognized the potential of the Freshwater Wetlands System to treat the urban runoff and increase habitat values while providing necessary flood control facilities for the adjacent Playa Vista First Phase Project and the Proposed Project. The effect of the Freshwater Wetlands System was to better manage (i.e., reduce) the amount of freshwater flowing to the Ballona Wetlands salt marsh, and to enhance the quality of dry-weather and stormwater runoff into the Ballona Channel and Santa Monica Bay such that pollutant loadings discharged to the Wetlands, Channel and ultimately the Bay are reduced after full buildout of the adjacent Playa Vista First Phase Project and the Proposed Project when compared to pre-First Phase conditions without the Freshwater Wetlands System. These water quality benefits to the Ballona Wetlands, Ballona Channel, and Santa Monica Bay were specifically contemplated and intended in the design of the Freshwater Wetlands System and the overall Playa Vista Project. In addition, the Freshwater Wetlands System is also designed to provide significant freshwater wetland and riparian habitat values, with the water supply and water quality aspects of the System ensuring that the system is supplied with enough water of sufficient quality to sustain the habitat.

[111] *US Army Corps of Engineers Environmental Assessment 404(b)(1) Evaluation Public Interest Review, Permit Application No. 90-426-EV, at 5-6 (1992). See also Letter from Dennis Dickerson, Executive Officer, Los Angeles Regional Water Quality Control Board, to Paul N. Singarella, Esq., Latham & Watkins (January 16, 2003); Letter from David J. Castanon, Acting Chief, Regulatory Branch, US Army Corps of Engineers, to Marc Huffman, Playa Vista Corporation (July 18, 2003).*

Since large portions of the Freshwater Wetlands System have already been constructed or are under construction as part of the adjacent Playa Vista First Phase Project, the First Phase provided "excess mitigation" from a hydrology and water quality perspective. With the subsequent phased construction of the Proposed Project, the Freshwater Wetlands System would still provide "over-treatment" of the runoff from the adjacent Playa Vista First Phase Project and the Proposed Project (i.e., the nature and extent of surface water quality treatment offered by the Freshwater Wetlands System would exceed the amount necessary to adequately serve the adjacent Playa Vista First Phase Project and the Proposed Project within their drainage systems) due to its volume of runoff capture vs. SUSMP requirements, as well as the fact that it treats significant off-site surface water to both the adjacent Playa Vista First Phase Project and the Proposed Project areas. In order to provide a more complete and meaningful analysis of water quality impacts associated with the Proposed Project and to evaluate the adequacy of the Freshwater Wetlands System to accommodate both adjacent Playa Vista First Phase Project and the Proposed Project flows, the pollutant loads from the pre-First Phase conditions have been compared to the pollutant loads estimated to occur at the completion of the adjacent Playa Vista First Phase Project and at the completion of the Proposed Project (buildout) through the use of the pollutant loading model discussed above.

The full Freshwater Wetlands System will consist of a Riparian Corridor and three primary management (enhanced natural treatment) areas at the openings of three outlet areas (Riparian Corridor/Lincoln Storm Drain South, Jefferson Storm Drain, and Central Storm Drain), as well as the larger Freshwater Marsh itself. Runoff quality would be passively improved as runoff flows through the Riparian Corridor, the primary management areas, and then the Freshwater Marsh by a number of natural physical and bio-chemical processes. The size of the system would allow dry-weather and most stormwater runoff to flow through at low velocities, thereby permitting the sedimentation and other removal processes of particulate matter and dissolved constituents through adsorption occurring mostly in the primary management areas and then in the rest of the Marsh. The natural systems in the wetland, including plantings of native vegetation, would slow velocities and facilitate the natural processes of adsorption, filtration, plant uptake, and biological degradation of dissolved constituents.

The natural functions of the Freshwater Wetlands System and the related hydrologic controls it provides, will decrease significantly pollutant loading to the adjacent Ballona Wetlands. The system manages freshwater input to the Ballona Wetlands by allowing the runoff from the adjacent Playa Vista First Phase Project and the Proposed Project and off-site areas, which flow through the adjacent Playa Vista First Phase Project and the Proposed Project sites under low-flow and up to approximately one-year design storm conditions (approximately 92 percent of the total flows anticipated to occur annually), to be diverted directly to the Ballona Channel.[112, 113] Freshwater flows greater than one-year-storm conditions (approximately 8 percent of the total annual flows) would experience similar or smaller (depending on the magnitude of the storm) contaminant removals in the Freshwater Wetlands System prior to being introduced to the Ballona Wetlands. Therefore, pollutant loads to the Ballona Wetlands will be reduced substantially by both actual redirection of stormwater away from the Ballona Wetlands, as well as by improved water quality of those flows that do reach the Wetlands from the Freshwater Marsh.

3.2.3.2 Other Measures to Reduce Pollutant Loadings

Similar to the provisions of the adjacent Playa Vista First Phase Project, the Proposed Project includes the installation of water quality inlets, enhanced street/catch basin cleaning, a tenant/resident education program, household hazardous waste collection, storm drain signage, landscape irrigation controls, covered trash and recycling facilities, underground parking (in most areas) and vehicle use impact reduction measures, to reduce pollutant loadings. In addition, the Proposed Project includes the use of roof drain biofiltration systems to receive and filter runoff from all buildings within the Project site. Another pollutant reduction measure to be implemented as part of the Proposed Project is a vegetated swale within a park adjacent to the Riparian Corridor. This vegetated swale will receive and filter stormwater runoff from the Proposed Project prior to entering the Riparian Corridor.

While all of these design, operational, and source control features will enhance pollutant reduction in runoff from the development, it is difficult to specifically quantify the extent of reduction for many of them, particularly for nonstructural source controls. Therefore pollutant removals only in catch basin inserts, roof-drain planter boxes, and vegetated swales were incorporated into the model (in addition to the removals modeled for the Freshwater Wetlands System). Therefore, pollutant loadings from the developed areas of adjacent Playa Vista First Phase Project and the Proposed Project are likely overestimated. Water quality inlets were assigned percent removals,[114] while all other modeled BMPs were assigned effluent qualities[115, 116](see

[112] *Woodward-Clyde, Playa Vista Stormwater Rainfall Analysis, Memorandum, November 3, 1998.*
[113] *The Freshwater Marsh is designed to accommodate/divert approximately 92 percent of the total annual flows; however, through the use of adjustable weirs and other design features, it can be operated in a manner that diverts a lesser amount of flows should there be a desire to route more water to the Ballona Wetlands.*
[114] *These studies are further described in the following two studies: Psomas and Woodward-Clyde, Playa Vista First Phase Development Interim Flood Control Solutions for VTTM 49104 and TTM 52092, October 15, 1998, and Woodward-Clyde, Santa Monica Catchbasin Retrofit Study, 1998.*
[115] *Effluent quality is determined a better indicator of BMP performance than percent removals, particularly for detention type BMPs because the effluent may not even be from the same storm event as the influent.*

Section 3.2.4.1.2.5 Pollutant Removal Approximations and Volume III, Appendix F of this Technical Report for details.) The pollutant loading model estimates that approximately 25 percent of all of the flows through the adjacent Playa Vista First Phase Project runoff and 100 percent of the Proposed Project runoff tributary to the Central Drain and 25 percent of all other Proposed Project runoff are treated by water quality inlets prior to discharge to the Freshwater Marsh. Also, all runoff from buildings in the Proposed Project tributary to the Central Drain will also be treated by roof-drain planter boxes and all runoff from the Proposed Project tributary to Riparian Corridor will be pre-treated by vegetated swales. Estimated removals for all modeled BMPs are shown in **Table 3-17, Pollutant Removal Approximation for Water Quality Inlets Used in Pollutant Loading Model, Table 3-18, Effluent Quality Approximations for the Freshwater Marsh and Ballona Wetlands Used in Pollutant Loading Model, Table 3-19, Pollutant Removal Approximations for Riparian Corridor and Centinela Ditch Used in Pollutant Loading Model,** and **Table 3-20, Pollutant Removal Approximations for Riparian Corridor and Centinela Ditch Used in Pollutant Loading Model.**

The Proposed Project will incorporate all appropriate SUSMP requirements (Section 3.2.1.3.1) into the project plans to minimize the pollutants of concern as part of the development plan approval process many of which are addressed by the key project features. The design of structural or treatment control BMPs will be consistent with the SUSMP design standards. Specific design requirements for any facilities will be incorporated as appropriate.

Overall, the key features listed above will meet or exceed the requirements of the Municipal Permit, and all other applicable structural and treatment control BMPs needed to comply with the SUSMPs to treat runoff water quality from the development will be incorporated.

The water quality control measures contained within the Playa Vista Storm Water Management Plan are consistent with the types of water quality management measures recommended in the plan for California's Non-Point Source Pollution Control Program developed by the SWRCB and the CCC. Of the six (6) management measure categories, the following are relevant to the Proposed Project: Urban; Hydromodification Activities; and Wetlands and Riparian Areas. Consistent with the recommended Urban Management Measures, the Proposed Project incorporates water quality control measures that include watershed protection and site development design features (i.e., BMPs and source controls, etc.). The Proposed Project also includes construction-related water quality control measures, treatment of runoff from existing development (off-site catch basins), and public education measures.

---

[116] *GeoSyntec Consultants, Urban Drainage and Flood Control District, and Urban Water Resources Research Council of ASCE. "Urban Drainage and Flood Control District, and Urban Water Resources Research Council of ASCE, "Urban Stormwater BMP Performance Monitoring: A Guidance for Meeting the National Stormwater BMP Database Requirements." Prepared for ASCE and USEPA. April 2002.*

Hydromodification Management Measures

Relative to the recommended Hydromodification Management Measures, which pertain to channelization/channel modification and protection of surface water and instream and riparian habitat restoration, the construction of the Riparian Corridor includes erosion control measures to be incorporated into the grading that are consistent with the recommended management measures for hydromodification. In addition the Freshwater Marsh reduces the hydromodification impacts on the Ballona Wetlands due to past urbanization via diversion of most all storm flows to the Ballona Channel.

The Riparian Corridor in the adjacent Playa Vista First Phase Project and the Proposed Project is consistent with the recommended wetlands/riparian protection and restoration management measures for Wetlands and Riparian Areas. Also, the proposed use of vegetated treatment systems such as vegetated drainage swales and strip-type biofilters is consistent with the vegetated treatment systems management measures.

The Proposed Project will be responsive to the Ballona Creek and Wetlands trash TMDLs, through the implementation of Project Design Features and BMPs, such as parking lot filter strips, enhanced street/catch basin cleaning, public education, storm drain signage, vegetated buffers, trash racks and controls within the Freshwater Wetland System. These Project Design Features and BMPs, which in several cases also include treatment of off-site runoff, are designed to prevent trash from being discharged into the Ballona Channel and Ballona Wetlands. The full-capture treatment system criteria would include systems that capture all particles retained by a 5 millimeter (mm) mesh screen from all runoff from a one-year storm and that will not clog. The Freshwater Marsh is designed to capture in excess of the 1-year storm event. In addition, with the catch basin inserts and the three primary management areas of the marsh, the Freshwater Wetlands System as a whole is designed to remove particles much smaller than 5 mm without clogging with regular maintenance.

3.2.4 Surface Water Quality Impact Analysis

Impacts to the surface water quality of the primary waterbodies of concern in the vicinity of the Proposed Project are discussed below. The assessment of the Freshwater Marsh has considered that the Marsh includes several distinct components, including the primary management areas (PMAs) and the main body of the Freshwater Marsh. The PMAs were specifically designed to serve as the primary treatment areas of the Freshwater Marsh and to be limited in habitat value. The primary waterbodies of concern for this project include those that receive direct runoff from the project areas. The Freshwater Wetlands System (Riparian Corridor and Freshwater Marsh), the Ballona Wetlands, and the Ballona Channel. Potential impacts to these waterbodies will be quantitatively assessed using the results of the pollutant loading model briefly described above. A pollutant loading model of the interim condition, after the adjacent Playa Vista First Phase Project, stormwater runoff will also be provided for comparison of the incremental change between the two phases of development. Qualitative impact assessments of the primary waterbodies of concern and of the final receiving waters, the Santa Monica Bay, will also be included in this subsection. In the next subsection the numerical and narrative water quality benchmarks that will be used to assess surface water impacts of the Proposed Project will be identified followed by the methodology used to evaluate water quality impacts relevant to those benchmarks.

For the purposes of this analysis, the following regulatory standards are considered, as appropriate:

- NPDES Stormwater Permit Requirements including:
  - The control and management of discharges from storm drains of pollutants to surface water, as required by Section 402(p) of the CWA. This is accomplished through SUSMP requirements (in the MS4 Permit) for new development projects, including structural or treatment control BMP maintenance agreements.
  - Construction Permit
  - Dewatering Permit
- Basin Plan including:
  - Water quality objectives
  - Provisions relating to beneficial uses
  - Other policies as appropriate
- Current and proposed future TMDLs of 303(d)-listed pollutants
- Water quality criteria in the California Toxics Rule (CTR)
- Water quality standards in the California Ocean Plan (COP) [used as a benchmark]
- The state and federal Antidegradation Policies
- The state Nonpoint Source Program Strategy and Implementation Plan (NPS Plan)
- Performance Criteria made applicable to the Proposed Project through the USACE 404 Permit Process.

The Performance Criteria represent site-specific "regulatory standards" (as that term is used in the Draft Los Angeles CEQA Thresholds Guide) that, if met, indicate that the Proposed Project will not cause a significant adverse impact in light of what was recognized and authorized by the regulatory agencies to be the functions of the

Freshwater Wetlands System. All of the applicable standards specifically outlined or included by reference in the applicable NPDES Permit (MS4 Permit) and the Basin Plan (including pollution, contamination, and nuisance as defined in Section 13050 of the CWC) provide a comprehensive regulatory system designed to address the current and potential future water quality issues in the County of Los Angeles. If the performance of the Proposed Project satisfies the above-cited plans, policies and procedures, both of the significance thresholds as defined in the Draft Los Angeles CEQA Thresholds Guide will be met.

3.2.4.1 Significance Thresholds

The City of Los Angeles' "Draft L.A. CEQA Thresholds Guide" indicates that a significant impact on surface water quality would occur if any discharges associated with the Proposed Project would result in any of the following:

- Create pollution, contamination or nuisance as defined in Section 13050 of the California Water Code. These definitions are:
  - Pollution means an alteration of the quality of the waters of the state to a degree which unreasonable affects either of the following: 1) the waters for beneficial uses of 2) facilities which serve these beneficial uses. "Pollution" may include "Contamination."
  - Contamination means an impairment of the quality of the waters of the state by waste to a degree which creates a hazard to the public health through poisoning or through the spread of disease. "Contamination" includes any equivalent effect resulting from the disposal of waste, whether or not waters of the state are affected.
  - Nuisance means anything which meets all of the following requirements: 1) is injurious to health, or is indecent or offensive to the senses or an obstruction to the free use of property, so as to interfere with the comfortable enjoyment of life or property; 2) affects at the same time an entire community of neighborhood, or any considerable number of persons, although the extent of the annoyance or damage inflicted upon individuals may be unequal; and 3) occurs during, or as a result of, the treatment or disposal of wastes.
- Cause regulatory standards to be violated, as defined in the applicable NPDES stormwater permit or Water Quality Control Plan (Basin Plan) for the receiving waterbody.

In evaluating the surface water quality impacts of the Proposed Project, a combination of quantitative (numerical) and qualitative (narrative) water quality benchmarks were used. The term "benchmark" is used as a catchall phrase to represent the applicable regulatory water quality standards and objectives, as well as non-regulatory water quality objectives and guidelines. In some cases, water quality standards for a waterbody are used as water quality benchmarks for a different waterbody because water quality standards are not available. For example, the COP water quality standard for TSS, which is only a regulatory standard for ocean water discharges, may be used as a water quality benchmark for water in the Ballona Wetlands because there is no specific water quality standard for TSS in wetlands. In general, quantitative water quality benchmarks were used when sufficient water quality data were available to allow water quality modeling to occur. For example, if the Proposed Project can demonstrate that no increase in pollutant loadings for 303(d) listed parameters would occur at buildout of the adjacent Playa Vista First Phase Project and Proposed Project compared to pre-First Phase conditions, the Proposed Project would not have a significant impact for those parameters. However, there is not sufficient water quality data to adequately characterize some of the 303(d) listed parameters in a land use-based pollutant loading model. Therefore, to adequately assess the potential impacts of the proposed development with respect to the unmodeled 303(d) listed parameters, narrative water quality benchmarks that directly or indirectly pertain to the unmodeled 303(d) listed parameters must be interpreted, or other water quality parameters that affect the concentrations, toxicity, or characteristics of the 303(d) listed parameters must be used to quantify the Proposed Project's impacts to surface water quality. The following further describes when and how quantitative and qualitative water quality benchmarks were used in the application of the above significance thresholds.

3.2.4.1.1 Numerical (Quantitative) Water Quality Benchmarks

To assess potential significant impacts of the modeled water quality parameters, numerical water quality benchmarks will be used. Water quality predictions developed for the Proposed Project were based on the results of a pollutant loading model (described in Section 3.2.4.3) using land use-based event mean concentrations data from Los Angeles County's 1997-2001 monitoring efforts and BMP performance data in the ASCE/EPA National Stormwater BMP Database[117] (hereafter NSW BMP Database). Two approaches were used to assess water quality impacts of the Proposed Project using the pollutant loading model. In the first approach, adjacent Playa Vista First Phase Project and Proposed Project pollutant loads and concentrations were calculated and compared to pre-First Phase pollutant loads and concentrations in the effluent to assess whether the overall adjacent Playa Vista First Phase Project and Proposed Project meet the project goal of no net increase in pollutants of concern. The water quality benchmark for these parameters will be based on any significant increase in loads or concentrations after the adjacent Playa Vista First Phase and Proposed Projects as compared to pre-First Phase conditions. In the second approach, estimated pollutant concentrations at buildout conditions were compared to water quality criteria and objectives applicable to the receiving waterbodies as well as selected benchmarks from non-legally based objectives and criteria, including the COP and the EPA's Ecoregion 6 Nutrient Guidelines (both described in Section 3.2.4.2.3 Comparison of Predicted Effluent Quality to Water Quality Criteria and Objectives).

[117] *http://www.bmpdatabase.org*

The CTR criteria were used as the water quality benchmarks for dissolved copper, lead and zinc. The effluent limitations for suspended solids and oil and grease from the COP will be used as the water quality benchmark for these parameters for the main body of the Freshwater Marsh and discharges to the Ballona Wetlands and Ballona Channel, even though they are not legally binding requirements. The significance thresholds for TP and TKN will be based on the water quality benchmarks derived from the EPA's Nutrient Guidelines. **Table 3-21, Numerical Water Quality Benchmarks of the Modeled Parameters,** summarizes the numerical water quality benchmarks of the modeled parameters to be used to assess water quality impacts to the primary receiving waters.

3.2.4.1.2 Narrative (Qualitative) Water Quality Benchmarks

The narrative water quality benchmarks described in detail in the following section are based on the qualitative water quality standards and requirements contained in the Basin Plan, the General NPDES Permit for Construction Activities, the Los Angeles SQMP, and the Los Angeles SUSMP. These narrative benchmarks were selected to address potential impacts associated with unmodeled water quality parameters, as well as other factors that cannot be addressed numerically. Potential impacts to the Santa Monica Bay are qualitatively discussed, followed by comparisons of project mitigation measures to the Los Angeles County Standard Urban Stormwater Mitigation Plan (SUSMP) requirements. Narrative assessments of the potential impacts with respect to the 303(d) listed water quality parameters, the narrative objectives in the Basin Plan, channel stability, and dry weather flows are also included in the impact analysis.

3.2.4.2 Methodologies for Assessing Potential Impacts

Impacts to the surface water quality of the primary waterbodies of concern in the vicinity of the Proposed Project are discussed below. The assessment of the Freshwater Marsh has considered that the Marsh includes several distinct components, including the primary management areas with enhanced natural treatment capacity and the main body. The primary management areas were specifically designed to serve as the primary natural treatment areas of the Freshwater Marsh. The analyses of potential effects of the Proposed Project have focused on the quality of the water that would enter the main body of the Marsh after the primary management area. The primary waterbodies of concern for this project include those that receive direct runoff from the project areas, the Freshwater Wetlands System (Riparian Corridor/Freshwater Marsh), the Ballona Wetlands, and the Ballona Channel. Potential impacts to these waterbodies will be quantitatively assessed using the results of a pollutant loading model. The modeled parameters include: TSS, TP, TKN, oil and grease, and total and dissolved copper, lead, and zinc. These parameters were chosen for two primary reasons: 1) the parameters represent typical pollutants found in urban runoff (and would thus be representative of the water quality from the Proposed Project), and 2) sufficient data were available for these parameters to facilitate land use-based modeling of stormwater runoff and effluent quality predictions from stormwater BMPs; thus the modeled pollutants are expected to be a reliable indicator of water quality. Certain metals were not selected for the model as they are not likely to be present in urban runoff at levels of concern. In order to provide a more complete and meaningful analysis of water quality impacts associated with the Proposed Project and to evaluate the adequacy of the Freshwater Wetlands System to accommodate both adjacent Playa Vista First Phase Project and the Proposed Project flows, the pollutant loads from the pre-First Phase conditions have been compared to the pollutant loads estimated to occur at the completion of the adjacent Playa Vista First Phase Project and at the completion of the Proposed Project (buildout) through the use of a pollutant loading model. Qualitative impact assessments of the primary waterbodies of concern and of the final receiving waters, the Santa Monica Bay, will also be included in this subsection. Key elements of the water quality impacts analysis include:

- assessing how the Proposed Project design meets or exceeds applicable local stormwater treatment system and source control requirements;
- providing a detailed analysis of the project goal to achieve a no net-increase, compared to pre-First Phase conditions, in pollution from parameters of concern;
- comparing predicted effluent quality of Proposed Project stormwater discharges to numerical water quality benchmarks and narrative water quality criteria and objectives;
- assessing how the project addresses parameters that are considered water quality limited in the receiving waters (i.e., impaired waterbodies);
- evaluating dry-weather (nuisance) water quality; and
- estimating whether substantial erosion, sedimentation, or channel instability would result from the Proposed Project.

By the nature of these elements of analysis, some are quantitative (numerical) and some are qualitative (narrative). Numerically-based impacts have been assessed primarily using the pollutant loading model. Narratively-based impacts have been assessed by qualitatively discussing Project Design Features, and the properties of the water quality parameters and pollutants of concern.

3.2.4.2.1 Local Design Requirements (MS4 Permit)

In March of 2000, the Regional Water Quality Control Board finalized and approved the SUSMP for Los Angeles County and Cities in Los Angeles County, which addresses stormwater pollution from new development or significant redevelopment by requiring BMPs that must be used for a designated project.

As discussed in Section 3.2.1.3.1, in May of 2000, the County of Los Angeles finalized its "Manual for the Standard Urban Stormwater Mitigation Plan (SUSMP)" which details the requirements for new development and significant re-development post-construction BMPs. The County of Los Angeles' Department of Public Works coordinates the SUSMP for the entire County; therefore, the City of Los Angeles is subject to this plan. The final SUSMP requires that new developments employ a variety of measures, including, as applicable, treatment and source controls to reduce the discharge of pollutants from stormwater conveyance systems. The SUSMP defines, based upon land use type, the types of measures that must be included and other source and treatment controls that must be considered and included as appropriate to the development type. For purposes of this impact analysis, the appropriate elements of the Proposed Project are compared to the SUSUMP requirements as well as the overall treatment achieved for the entire tributary area (watershed).

One of the methods for assessing the adequacy of the proposed Playa Vista Stormwater Management Program is to compare the sizing of water quality facilities to the SUSMP standards, which details the emerging local standards for stormwater quality BMP design in Los Angeles County. **Table 3-22, Summary of SUSMP Requirements and Corresponding Playa Vista Measures,** outlines the requirements of the SUSMP and lists how the adjacent Playa Vista First Phase Project and the Proposed Project would comply with the requirements if required to do so.

The SUSMP requirements include specific design sizing criteria for stormwater treatment for projects the size of Playa Vista. The standards require that stormwater management facilities be designed such that 0.75 inches of rainfall over 24 hours (determined to represent the 85th percentile of storms in Los Angeles) would be captured and treated. This criterion applies to BMPs that are designed based on volume (e.g. detention/filtration basins). The County of Los Angeles has developed a procedure for the sizing of facilities that are "flow-through" based (e.g. catch basin inserts, swales, etc.) in terms of design flow rates rather than volume (e.g., 0.75 inches of rainfall over some area for detention/ storage facilities).

The Los Angeles County Guidance for the Standard Stormwater Mitigation Plan specifies that the volume of stormwater runoff to be mitigated from a new development can be calculated using the following equation:

$$V_M = \left(2{,}722.5\ ft^3/acre\right)\times\left[\left(A_I\right)\left(0.9\right)+\left(A_P+A_U\right)\left(C_U\right)\right] \qquad \text{Eqn. 3-3}$$

Where: V_m = mitigation volume

A_I = impervious area

A_P = pervious area

A_U = undeveloped area

C_U = undeveloped runoff coefficient

Catch basin water quality inserts will be designed to treat a storm equal to 0.75 inches based on the Los Angeles County Guidance for the area draining each catch basin. The design of each water quality inlet will be based on a theoretical maximum flow rate expected from the 0.75-inch, 24-hour, storm event as calculated via the SUSMP procedure. The design for water quality inlets will be standardized based on catchment size. Where capacities are close to the sizing of the insert, the next largest standard size insert will be selected. This will result in some over-design relative to requirements.

The other larger planned BMPs, including the Freshwater Marsh System and the planned water quality detection features (basins) with Areas A and C would all be designed to treat storms larger than the 0.75-inch requirement. In addition to the treatment size is the fact that these systems are almost always more effective than catch basin inserts with regards to pollution control. Finally, the development includes a treatment train approach, where there are multiple BMPs for each area, including treatment and source control BMPs.

The results of comparison of the Playa Vista Stormwater Management Plan with the SUSMP, as shown in Table 3-22 is that adjacent Playa Vista First Phase Project and the Proposed Project meet or exceed all requirements developed by the County of Los Angeles and approved by the Los Angeles Regional Water Quality Control Board as being protective of receiving water quality and meeting the overall NPDES permit requirement to reduce the discharge of pollutants from the stormwater system to the maximum extent practicable. Therefore, with the implementation of the SUSMP requirements, no significant operational impacts to water quality are anticipated.

3.2.4.2.2 Antidegradation Policy

A key policy of California's water quality program is the State's Antidegradation Policy. This policy, formally known as the Statement of Policy with Respect to Maintaining High Quality Waters in California (SWRCB Resolution No. 68-16), restricts degradation of surface and ground waters. In particular, this policy protects waterbodies where existing quality is higher than necessary for the protection of beneficial uses. Under the Antidegradation Policy, any actions that can adversely affect water quality in surface or ground waters must: (1) be consistent with maximum benefit to the people of the State; (2) not unreasonably affect present and anticipated beneficial uses of the water; and (3) not result in water quality less than that prescribed in water quality plans and policies. Furthermore, any actions that can adversely affect surface waters are also subject to the Federal Antidegradation Policy (40 CFR, § 131.12) developed under the CWA. This anti-degradation policy does not state that pollutant concentrations and/or loading cannot be increased, just that they cannot result in any adverse impacts described above. Therefore, if a project can demonstrate there will be no increase in pollutant concentrations or loadings, it will have met the requirements of the Antidegradation Policy.

The degradation of the Ballona Creek Watershed by various pollutants found in urban runoff was recognized in early pre-First Phase planning efforts, well before Ballona Creek (Channel) was officially listed in 1996 by the SWRCB as an impaired waterbody. Master planning for the adjacent Playa Vista First Phase Project and the Proposed Project included water quality features that were designed to comply with the State's Antidegradation Policy by maintaining no-net increase in loads or concentrations of major pollutants of concern. The design of the flood control and surface water quality system proposed as part of the adjacent Playa Vista First Phase Project in the early 1990's was specifically intended to provide for a "no net increase" in loads and concentrations of pollutants of concern to the Ballona Channel and Santa Monica Bay for the adjacent Playa Vista First Phase Project and to contribute significantly to meeting this goal for the ultimate completion of both the adjacent Playa Vista First Phase Project and the Proposed Project. The adjacent Playa Vista First Phase Project also included water quality features (design features) that also were intended to provide water quality enhancement for runoff from Proposed Project areas tributary to them. The goals and design for the Proposed Project include the same overall goal of meeting the no-net increase in pollutant loads for pollutants of concern. As stated above, the adjacent Playa Vista First Phase Project features were designed, sized, permitted, and constructed to address both adjacent Playa Vista First Phase Project and Proposed Project development runoff control and treatment; these features were included in the Freshwater Wetlands System (Riparian Corridor and Freshwater Marsh) that was sized to provide water quality enhancements for tributary adjacent Playa Vista First Phase and Proposed Project areas as well as for upstream tributary off-site areas. Therefore, the analysis of impacts to water resources considers both Phases together as these systems would be integrated.

The commitment to no-net increase was deemed feasible in part because the adjacent Playa Vista First Phase Project and the Proposed Project had the opportunity to treat drainage from the project site as well as a significant amount of flow from off-site drainages that received very little treatment during pre-First Phase. In most projects the goal of no-net increase in pollutants is not feasible utilizing on-site measures alone; this is true particularly for loadings even with state-of-the-art BMPs because runoff volumes and typically pollutant concentrations increase when land is developed from open areas. In general, BMPs reduce pollutant loads, but this reduction is generally less than the increase resulting from urban development. The net effect is typically some increase in pollutant loads even with BMP treatment. Usually the only opportunity to actually improve water quality is during re-development of areas that had little treatment or source controls in place prior to re-development.

If a project can achieve no-net increase in pollutant concentrations and loads, to receiving waterbodies, it is expected that the project will cause no additional impacts with regard to that pollutant. In addition, if there is no increase in total pollutant loads while at the same time, runoff volumes increase, as is typical with urbanization, average concentrations will decrease, thereby reducing potential water quality impacts to downstream waterbodies as well as the potential for sediment contamination. Average lower runoff concentrations are typically important in improving the water quality of water bodies where residence times are short (e.g., smaller creeks, smaller ponds, and well-mixed estuary areas). This effect can help reduce or eliminate the periods when a particular water quality constituent could become elevated above water quality standards in a receiving waterbody.

Sediment concentrations of pollutants would also be reduced, thereby reducing downstream levels of sediment concentration. By meeting the goal of no net increase of identified and representative pollutants, the project would be expected to result in either no additional impact or reduced impacts due to decreases in pollutant concentrations in stormwater discharges.

Under the current NPDES permit requirements (NPDES Permit# CAS004001), the City and County are not required to specifically retrofit with structural BMPs the watersheds potentially affected by a development project, nor would the Applicant be responsible for treating runoff from the Jefferson and Lincoln Storm Drains and from the Westchester Bluffs that is treated in the Freshwater Marsh. In addition, the Applicant is committing to providing more comprehensive public education programs (i.e., pollution prevention information provided directly to businesses and residents of the adjacent Playa Vista First Phase Project and Proposed Project as well as reaching beyond Project boundaries through the community intranet and through local schools) than the City and County have required in their permit program for these watersheds. It is possible that the City and/or County or the RWQCB may require such measures/programs at some future date, but by the Applicant proceeding with these measures in the near-term the downstream watersheds will benefit much more rapidly.

The pollutant loading model previously used to quantitatively assess the water quality impacts of the adjacent Playa Vista First Phase Project has been adapted and updated to determine the annual pollutant loads and average concentrations for the Proposed Project together with the adjacent Playa Vista First Phase Project. The updated model was utilized to predict pollutant loads and concentrations in stormwater runoff for existing conditions (pre-First Phase development) and future conditions following completion of the Proposed Project (i.e., buildout, which includes completion of adjacent Playa Vista First Phase and Proposed Project).

The Freshwater Wetlands System, which includes all of the Freshwater Marsh and the Riparian Corridor (most of which was approved as part of the adjacent Playa Vista First Phase Project), was sized in the initial design to accommodate flows and pollutants from the completion of the adjacent Playa Vista First Phase Project and the Proposed Project and off-site tributary areas. Because the Freshwater Wetlands System is designed to accommodate the additional development of the Proposed Project, after its construction in the adjacent Playa Vista First Phase, the Freshwater Wetlands System would provide "over-treatment"[118] of the runoff from the adjacent Playa Vista First Phase Project and the off-site tributary areas. In order to provide a more complete and meaningful analysis of water quality impacts associated with the development of the Proposed Project and to evaluate the adequacy of the Freshwater Wetlands System to accommodate both adjacent Playa Vista First Phase Project and

[118] *The term "over-treatment" is used to express the design and function of the Freshwater Wetland System to provide 1) capacity and treatment of surface water from the adjacent Playa Vista First Phase Project and Proposed Project, 2) treatment of off-site runoff, and 3) management up to a one -inch rainfall (which is above the SUSMP requirement of 0.75-inches).*

Proposed Project flows, pollutant loads and concentrations from the pre-First Phase conditions have been compared to pollutant loads and concentrations estimated to occur at the completion of the adjacent Playa Vista First Phase Project and at completion of the Proposed Project (project buildout) through the use of the pollutant loading model.

Prior to the recent construction of the Freshwater Marsh as part of the adjacent Playa Vista First Phase Project, stormwater runoff drained into the existing degraded Ballona Wetlands, the Ballona Channel, and ultimately Santa Monica Bay. The pollutant loading model predicts the average annual mass (load) and annual average concentration of pollutants that will be washed downstream from the tributary area in stormwater runoff and discharged into these waters. The model also estimates the runoff and associated pollutants that are routed through roof-drain planter boxes, vegetated swales, catch basin inserts/retrofits, and to the Freshwater Wetlands System (Riparian Corridor and Freshwater Marsh) for treatment as part of the adjacent Playa Vista First Phase Project and the Proposed Project stormwater system. It does not estimate concentration and loading reductions that would likely be achieved by the other design features and source control measures (BMPs) of the project due to the lack of good data on effectiveness of these other measures. Therefore, the model is likely conservative relative to the performance of the overall stormwater management system and in particular with what the intermediate concentrations may be within the system. Pollutant loads are estimated by combining a typical pollutant event mean concentration[119] for each land use with the average annual stormwater runoff.

The input parameters for, and methodology of, the adapted pollutant loading model used to quantify the estimated amounts of pollutants of concern within stormwater are discussed in detail in Section 3.2.4.3 Pollutant Loading Methodology and Analysis. Input parameters include: rainfall data; land use assumptions; surface imperviousness factors; typical event mean concentrations of pollutants; predicted BMP performance; and dissolved fractions of particulate bound metals. The model methodology includes calculating pollutant loads by estimating runoff coefficients for each type of land use to convert rainfall data into runoff volume, then using the runoff volumes and typical event mean concentrations to estimate pollutant loads. To compare pre-First Phase and after the adjacent Playa Vista First Phase to Proposed Project pollutant loadings, land use runoff coefficients, pollutant concentrations, and BMP factors are adjusted accordingly. The model outputs are then used to predict how the resulting water quality compares to water quality benchmarks (see next section).

[119] *An event mean concentration (EMC) is a flow-weighted average concentration taken over the entire course of a storm event.*

3.2.4.2.3 *Comparison of Predicted Effluent Quality to Water Quality Benchmarks*

The parameters that were modeled based on the available data include: TSS, TP, total and dissolved copper, total and dissolved lead, total and dissolved zinc, oil and grease, and TKN. Of these constituents, only the metals (copper, lead, and zinc) are listed on the 303(d) list of parameters (Table 3-2). The CTR includes acute and chronic water quality criteria (based on hardness and salinity) and the California Ocean Plan (COP) includes water quality objectives for protection of marine aquatic life for these metals. The Basin Plan does not contain numerical water quality objectives for the modeled metals, but does contain narrative water quality objectives for the other modeled parameters. These other parameters were modeled to address the water quality objectives (narrative or numerical) listed in the COP and Basin Plan. To assess the potential water quality impacts of the Proposed Project with respect to the modeled parameters, numerical "benchmarks"[120] were derived from available water quality criteria or objectives, some of which are legally applicable to the Proposed Project's receiving waters and some that are not, but provide reference for assessment. The numerical benchmarks that are not legally applicable to project's receiving waters are used because applicable criteria or objectives are not available for those parameters that were modeled. They are used only as another measure of the potential impacts other than pre-Project versus post-Project loads and concentrations. There are currently no numerical regulatory standards that apply directly to the Project's stormwater runoff prior to mixing with the receiving waters. The following paragraphs describe how the numerical water quality benchmarks were derived and the methodology used to assess the water quality impacts with respect to those benchmark.

Some pollutants of concern were not modeled due to the lack of substantial data sets on their land use characteristics, sources, and removal capacities of the modeled BMPs. These pollutants are discussed and addressed below in Section 3.2.4.3.2 Input Parameters.

<u>3.2.4.2.3.1 California Toxics Rule</u>

CTR criteria are legally applicable water quality criteria for the receiving waters of project runoff to which beneficial uses for aquatic life and/or human health apply. The modeled parameters for which CTR criteria exist are dissolved copper, lead, and zinc. These three metals were selected for modeling due to the available datasets for accurately characterizing their land use associations and also the fact that these three metals are typically found in urban runoff.

The CTR provides water quality criteria for the protection of both freshwater and saltwater aquatic life, as well as human health. However, of the three metals modeled, only copper has a human health criterion established and this criterion is much less stringent than the aquatic life criterion. Therefore, by meeting the aquatic life criterion[121], [122], the human health criterion is also met. In addition, acute (short-term

[120] *The term "benchmark" is used as a catchall phrase to represent the regulatory water quality standards and objectives, as well as non-regulatory water quality objectives and guidelines.*
[121] *Acute criterion apply to flows less than four days in duration.*

exposure) criteria were considered to be more appropriate criteria for comparison to modeled concentrations because storm events in the geographical area of the Proposed Project do not generally last more than 12 hours, and in fact the longest recorded storm event from 1949-1997 was 4.2 days.[123] The pollutant loading model only predicts wet weather concentrations. The CTR metals criteria are also defined as a function of water hardness and salinity.

The CTR metals criteria for aquatic life apply only to the dissolved forms of copper, lead, and zinc. Freshwater acute CTR criteria were used as the numerical benchmarks for flows within the Freshwater Wetlands System. The more stringent of the freshwater acute and saltwater acute CTR criteria were used as benchmarks for discharges to the Ballona Channel and Ballona Wetlands. Since the CTR criteria are based on hardness and salinity, the metals water quality benchmarks for the receiving waters vary. The following paragraphs explain the assumptions made to arrive at the CTR-based water quality benchmarks.

Hardness Estimation

Wet weather hardness has been measured in the creeks and storm drains tributary to Ballona Channel. After the completion of the adjacent Playa Vista First Phase Project, these tributaries now discharge to the Freshwater Marsh before entering the Ballona Channel. Dry weather hardness has also been measured in the creeks and storm drains tributary to Ballona Channel prior to the completion of the adjacent Playa Vista First Phase Project; after the Freshwater Marsh was constructed, dry weather samples were taken within the marsh at the inlets and outlet. As discussed earlier, Table 3-15 contains dry weather data, for the Freshwater Marsh. (The raw data can be found in Volume III, Appendix B of this Technical Report.) Since hardness has not been measured in the Freshwater Marsh during wet weather conditions, it must be estimated. The wet weather hardness of the tributaries to the Freshwater Marsh is represented in **Table 3-23, Equation 3-1 Parameters to Be Used to Estimate Receiving Water Hardness,** except the Central Drain, as it had not yet been constructed, and direct rainfall and runoff from adjacent areas. To estimate the wet weather hardness of the Central Drain inflows to the Freshwater Marsh, the average ratio of wet weather to dry weather hardness for all the other drains will be used and are shown in **Table 3-24, Ratio of Wet Weather to Dry Weather Hardness in Freshwater Marsh Tributaries.**

Based on the average ratio of the wet weather to dry weather hardness data shown in Table 3-24, the estimated wet weather hardness of the Central Drain (using the dry weather value of 680 mg/L as $CaCO_3$) is 231 mg/L as $CaCO_3$. This value will be used to estimate the average hardness in the main body of the Freshwater Marsh immediately after an average size storm event. The hardness of rainfall directly onto

[122] *The CTR criteria are water quality standards legally applicable to selected waters with human health or aquatic life designations, such as the Ballona Channel and the Ballona Wetlands; however, in reference to the Freshwater Wetlands System components, the CTR criteria are used as numerical water quality reference levels for comparative purposes only.*

[123] *Woodward-Clyde, 1998. Playa Vista Stormwater Rainfall Analysis. Memorandum, November 3, 1998.*

the marsh and runoff from adjacent areas will be assigned a conservative value equal to that of the Lincoln Drain (35 mg/L as $CaCO_3$).

Using runoff volume estimates based on the rational formula[124], the hardness concentration within the Freshwater Marsh can be approximated using a mass balance approach. The following assumptions were made in this approach:

- The marsh contains a permanent pool volume prior to a storm event (~21 acre-ft [125]),
- Complete mixing of the permanent pool and the influent storm water occurs during the storm event, and
- The reaction of $CaCO_3$ within the marsh system can be neglected during the time frame of a typical storm event.

The mass balance equation for the Freshwater Marsh for a single storm event can be expressed as:

$$[C_{sys} \cdot V_{sys}]_2 = [\sum(C_{in} \cdot V_{in}) - \sum(C_{out} \cdot V_{out})]_{1-2} + [C_{sys} \cdot V_{sys}]_1$$

Where C is the concentration and V is the volume. The subscripts are as follows: *sys* is the entire Freshwater Marsh, *in* is the inflow, *out* is the outflow, and *1, 2* are the time subscripts for before and after the storm event respectively.

Solving for the concentration in the Marsh after the storm, $[C_{sys}]_2$ yields,

$$[C_{sys}]_2 = \frac{[\sum(C_{in} \cdot V_{in}) - \sum(C_{out} \cdot V_{out})]_{1-2} + [C_{sys} \cdot V_{sys}]_1}{[V_{sys}]_2} \qquad \text{Eqn. 3-1}$$

Given the storm volumes and event mean hardness concentrations of the inflows and outflow, Equation 3-1 can be used to estimate the hardness in the Freshwater Marsh immediately after a storm event. Two different size rainfall events were used to estimate the wet weather hardness inside the Marsh: the average annual rainfall depth, 0.67 inches,[126] and the treatment depth required by the SUSMP, 0.75-inches. Since the marsh is designed to treat over a 1" storm event, it is assumed that the entire runoff volumes from the 0.67-inch and 0.75-inch storms are completely captured and, consequently, the outflow volume during a storm event is negligible. Therefore, $[V_{sys}]_2$ is equal to the $[V_{sys}]_1$ (21.0 ac-ft) plus the sum of the inflow volumes. The hardness concentration inside the marsh is assumed to be the average of the dry weather

---

[124] *Chow, T.V., D.R. Maidment, and L.W. Mays, 1988. Applied Hydrology. McGraw-Hill, Inc. New York, NY*

[125] *Psomas, 2002. Personal communication. Memorandum dated May 30, 2002 reporting area-volume relationship of the Freshwater Marsh.*

[126] *Woodward-Clyde, 1998. Playa Vista Stormwater Rainfall Analysis. Memorandum, November 3. 1998.*

concentrations measured in the primary management areas and in the effluent of the Freshwater Marsh on June 28, 2002 and April 4, 2003 shown in Table 3-15. The runoff volumes as well as the hardness concentrations used in Equation 1 are shown in Table 3-23.

By plugging the values in Table 3-23 into Equation 3-1 the hardness concentrations within the Freshwater Marsh are estimated as:

After a 0.75" storm event, C_{sys} = 310 mg/L as CaCO3

After a 0.67" storm event, C_{sys} = 316 mg/L as CaCO3

Therefore, a conservative hardness estimate that will be used in the CTR criteria calculation is 300 mg/L as $CaCO_3$ for the main body of the Freshwater Marsh. To account for the fact that the hardness will not instantaneously reach this concentration in the Freshwater Marsh, a hardness of 200 mg/L as $CaCO_3$ will be used as the hardness for the primary management areas. Hardness in estuaries is typically high due to the high concentrations of dissolved minerals, which is indicated by the wet weather hardness of 1980 mg/L as $CaCO_3$ measured in the effluent of the Ballona Wetlands on April 17, 2000. However, the saltwater criteria are not hardness dependent, so the dissolved copper, lead, and zinc criteria values tabulated in Column C1 of § 131.38, paragraph (b)(1) of the CTR are used to compare the predicted "effective" influent concentrations to the Ballona Channel and Ballona Wetlands.[127] Table 3-21 lists the CTR criteria values used as benchmarks for dissolved metals of the Proposed Project.

3.2.4.2.3.2 California Ocean Plan

The 2001 COP, which applies to direct discharges to open ocean waters and not inland waters, includes numerical water quality objectives for metals and effluent limitations for suspended solids and oil and grease. The water quality objectives and effluent limitations contained in the COP do not apply to the waters on, or discharged from, the adjacent Playa Vista First Phase Project and the Proposed Project. The COP water quality objectives are relevant to discharges to ocean waters; the COP effluent limitations are relevant to discharges from wastewater treatment plants and industrial discharges that are direct to ocean waters. Neither the Freshwater Marsh, Ballona Wetland, nor the Ballona Channel are ocean waters; therefore, there are no ocean waters within the adjacent Playa Vista First Phase Project and the Proposed Project, nor are there direct discharges from either adjacent Playa Vista First Phase Project or the Proposed Project to ocean waters. Nevertheless, as a measure of the potential

[127] *Since the pollutant loadings model does not account for speciation changes of the modeled metals as they enter receiving waters, the concentrations in the effluent of the Freshwater Marsh were adjusted to account for the process of metal complexion with organic matter during the initial mixing of freshwater with estuarine waters. The "effective" influent concentrations are these adjusted concentrations. Refer to Volume III, Appendix G of this Technical Report for details on the assumptions, methods, and reference used in estimating the effective influent concentrations to the Ballona Channel and the Ballona Wetlands.*

impact of the Proposed Project, the COP limitations for suspended solids and oil and grease will be used as numerical water quality benchmarks for the purposes of assessing the impacts of estimated wet weather effluent concentrations. The COP 30-day average for oil and grease (25 mg/L) was used for the benchmarks for the effluent to Ballona Channel, and within the Freshwater Marsh. The average suspended sediment concentration in Ballona Channel is approximately 191 mg/L during storm events [128], and the suspended solids in publicly owned wastewater treatment plants and non-regulated industrial discharges must reduce their TSS concentrations by 75 percent with a lower limit of 60 mg/L prior to discharging to the ocean as required by the COP. Therefore, a conservative significance criterion for the discharge of suspended solids to the Ballona Channel is 60 mg/L. Because of the tendency for many water quality pollutants to adsorb to suspended particulates, this value will also be used as the benchmark for the Freshwater Marsh and discharges to the Ballona Wetlands. The numerical water quality benchmark for suspended solids and oil and grease are shown in Table 3-21 with the other benchmarks.

3.2.4.2.3.3 Ecoregion 6 – Nutrient Guidelines

The EPA has established nutrient water quality objectives for various waterbodies based on ambient water quality conditions within defined ecoregions. Ecoregions are regions of relative ecological homogeneity. They are geographic areas with similar soils, vegetation, climate, geology, land cover, physiology, and other ecosystem components.[129] The adjacent Playa Vista First Phase Project and the Proposed Project sites are located within Ecoregion 6 of Aggregate Ecoregion III, which is most prominently distinguished by its Mediterranean climate and associated vegetation. The nutrient water quality objectives are empirically derived from water quality data collected from rivers and streams within Ecoregion 6 that have been minimally impacted by human activities and are protective of aquatic life and recreational uses. The objectives are not enforceable laws or regulations; they are federal guidelines for establishing State and Tribal water quality criteria for nutrients. Based on an evaluation of these guidelines, nutrient benchmarks were chosen for the water quality of the Freshwater Marsh, as well as for discharges to Ballona Channel and the Ballona Wetlands. The summarized water quality data (**Table 3-25, Nutrient Data from Rivers and Streams in Ecoregion 6 of Aggregate Ecoregion III**) from minimally impacted streams in Ecoregion 6 were used to analytically select numerical water quality benchmarks for TKN and TP. The guidelines recommend using the median of the 25th percentiles of all seasons' data when establishing water quality criteria for a creek. Since the impact assessment is for water quality in the Freshwater Marsh and discharges to the Ballona Channel and Ballona Wetlands during storm events (wet weather), summer data were excluded and higher percentiles were selected for the thresholds. The higher values (75th percentile) were selected based upon the fact that

---

[128] *Los Angeles County Department of Public Works (LACDPW), 2000. Los Angeles County 1994-2000 Integrated Receiving Water Impacts Report. Prepared for the Los Angeles Regional Water Quality Control Board.*

[129] *USEPA, 2000. Ambient Water Quality Criteria Recommendations: Information Supporting the Development of State and Tribal Nutrient Criteria for Rivers and Streams in Nutrient Ecoregion III. EPA 822-B-00-016*

the data the analyses are based upon are likely not all storm event data, but rather are likely composed of routine low-flow sampling events that were utilized to develop the percentile values. The medians of the 75th percentiles of the fall, spring, and summer data for TKN and TP were selected as the numerical water quality thresholds for discharges to the Ballona Channel and the Ballona Wetlands. The medians of the 95th percentiles of the fall, spring, and summer data for TKN and TP were selected as the significance criteria for the Freshwater Marsh. The higher values (95th percentiles) were selected for the Marsh due to the fact that it is a wetland that typically can process higher nutrient loads and in fact can benefit from such nutrients, and nutrient criteria guidelines have not yet been established for wetlands in Aggregate Ecoregion III. Furthermore, both the 75th and 95th percentile values fall within the range of those found in typical non-impacted rivers and streams in the ecological region of the adjacent Playa Vista First Phase Project and the Proposed Project. The numerical water quality benchmarks for nutrients are summarized with the other benchmarks in Table 3-21. Similar to the COP benchmarks, these nutrient benchmarks are not legally binding criteria on the Project.

These benchmarks discussed above will help assess how the nutrient levels discharged from the Proposed Project compares to the nutrient levels of streams that have not been significantly impacted by human activities and are protective of aquatic life and recreational uses.

3.2.4.2.4 Assessment of Impaired Water Body Identified Parameters

Of the State of California identified impaired waterbodies, the Ballona Wetlands, and Ballona Creek Estuary are waterbodies potentially affected by the Proposed Project. These waterbodies have been identified as water quality limited. Table 3-2 lists parameters that were identified by the RWQCB as causing impairments of beneficial uses for each of the listed water bodies, including the Ballona Creek Estuary, Ballona Wetland, and the Santa Monica Bay.

Several approaches are appropriate to assess the impacts of the Proposed Project related to pollutants identified as limiting water quality. First, it is important to identify which constituents are associated with new urban development. This includes assessing (1) whether the parameter represents a constituent that either is due to the development and related activities, (2) is associated with wet and dry deposition, or (3) is a constituent that is either due to other causes or is historical in nature (e.g., the substance has been banned and residuals remain in the environment). For those parameters that are associated with new development, some are appropriate for quantitative assessments while others, due to a lack of sufficient data, are more appropriately addressed through a qualitative analysis.

As mentioned above in Section 3.2.1.2.5 State of California Identified Impaired Water Bodies, the Trash TMDL for the Ballona Creek Watershed was approved by EPA's Office of Administrative Law on August 1, 2002. Prior to current litigation, implementation of the trash TMDL was to begin in October 2003. Upon final approval of the monitoring plan, permittees will be required to begin reducing their trash loads by 10 percent of the baseline load each year for the next 10 years. The first compliance point was scheduled for September 2006, at which time permittees would be required to demonstrate their annual load is no more than 80 percent of the baseline load calculated as a three-year average from the time of implementation. Compliance in subsequent years will be determined with rolling three-year averages. The final waste load allocation for trash is zero, which requires a full-capture device or system to be in compliance in 2015. A trash removal device or system is considered to be full-capture if it will capture particles retained by a 5 mm mesh screen from all runoff generated from one-year or smaller storm event and it is designed to prevent plugging or blockage of the screening module. Although the local implementation requirements have not yet been finalized, it is anticipated that the extent of surface water control measures included as Project Design Features (see Section 3.2.3) would meet, or exceed, requirements for trash control.

Also discussed in Section 3.2.1.2.5 was the development of draft Dry-weather and Wet-weather TMDLs for indicator bacteria for the Santa Monica Bay beaches. The beneficial use of water contact recreation (REC-1) has been impaired by elevated bacterial indicator densities at many Santa Monica Bay (SMB) beaches. The primary source of elevated bacterial indicator densities to SMB beaches during both wet and dry weather has been determined to be urban runoff conveyed by storm drains and creeks.[130] Both of the wet and dry weather TMDLs place numeric targets on indicator bacteria levels and are included as amendments to the Basin Plan. The numeric water quality objectives for indicator bacteria are as follows:

1. Rolling 30-day Geometric Mean Limits
   a. Total coliform density shall not exceed 1,000 MPN/100 mL
   b. Fecal coliform density shall not exceed 200 MPN/100 mL
   c. Enterococcus density shall not exceed 35 MPN/100 mL
2. Single Sample Limits
   a. Total coliform density shall not exceed 10,000 MPN/100 mL
   b. Fecal coliform density shall not exceed 400 MPN/100 mL
   c. Enterocossus density shall not exceed 104 MPN/100 mL
   d. Total coliform density shall not exceed 1,000 MPN/100 mL, if the ratio of fecal-to-total coliform exceeds 0.1.

[130] *Los Angeles Regional Water Quality Control Board. 2002. Amendment to the Water Quality Control Plan (Basin Plan) for the Los Angeles Region to Incorporate Implementation Provisions for the Region's Bacteria Objectives and to Incorporate a Wet-Weather Total Maximum Daily Load for Bacteria at Santa Monica Bay Beaches. Resolution No. 2002-022, December 12, 2002. [Online] http://www.swrcb.ca.gov/rwqcb4/html/meetings/tmdl/tmdl_ws_santa_monica.html*

The dry-weather TMDL has an implementation timeframe of 6-years, which requires summer dry-weather allowable exceedance days (April 1 through October 31) and the rolling 30-day geometric means targets to be achieved within the 3 years of the effective date, and the winter dry-weather allowable exceedance days (November 1 through March 31) and the rolling 30-day geometric mean targets must be achieved within 6 years of the effective date. Fifty yards south of the Ballona Creek entrance to the Santa Monica Bay the summer dry-weather allowable exceedance frequency is zero days and the winter dry-weather allowable exceedance frequency is 3-days for daily sampling and 1 day for weekly sampling.

The wet-weather TMDL has an implementation timeframe of 10-years unless an integrated water resources approach[131] is pursued, which would allow up to 18-years for implementation. The final allowable number of exceedance days at a location fifty yards south of the Ballona Creek entrance to the Bay is 15 days, or a cumulative exceedance-day reductions of 13 days. Within the first 6-years of implementation, 25 percent of cumulative reduction from the total exceedance-day reductions is required, and a 50 percent reduction is required within 8 years.

3.2.4.2.5 Dry-Weather Water Quality

Stormwater drainage systems in Southern California have received increasing attention in terms of the impacts of dry-weather discharges and several jurisdictions have chosen to divert portions of their dry-weather flows to sanitary systems for treatment. Dry-weather flows are generally regarded as nuisance flows due to their potential effect on human health. This analysis qualitatively assesses the potential effects of these dry-weather flows from the Proposed Project based upon data collected to date and potential options for their management. This analysis will address the nuisance portion of Section 13050 of the CWC with respect to dry-weather period, and the receiving water limitations in the MS4 Permit (which states that non-stormwater discharges from the MS4 shall not cause or contribute to a condition of nuisance), as well as the proposed and potential future dry-weather TMDLs for bacteria at the Santa Monica Bay beaches and the Ballona Creek Estuary, respectively. In addition, the CTR water quality criteria will be discussed with respect to potential dry-weather flows from the Proposed Project site.[132]

3.2.4.2.6 Erosion, Sedimentation, and Channel Stability

An assessment of channel stability for receiving waters is included in this impact analysis. The amount of fresh water flows reaching the Ballona Wetlands is directly impacted by the significant diversion of runoff to the Ballona Channel, as well as the extended detention that will be provided by the Freshwater Wetlands System. Urban development is considered a hydromodification activity as it is a potential cause of instream channel erosion and resulting habitat destruction. As the Freshwater

[131] *An integrated water resources approach is one that takes a holistic view of regional water resources management by integrating planning for future wastewater, stormwater, recycled water, and potable water needs and systems.*

[132] *Chronic CTR criteria are appropriate for dry weather analysis as such flows typically last longer than four days, the time period applicable to chronic criteria.*

Wetlands System was designed to actually reduce urban runoff flows to the Ballona Wetlands, the two channels that could be the most impacted by discharge of stormwater is the Centinela Ditch, a man-made and partially unlined facility that only exists under pre-First Phase conditions, and the estuary portion of the Ballona Channel, which is composed of grouted rip-rap side slopes and an earth bottom downstream of Centinela Boulevard. Impacts to these channels are assessed quantitatively by analyzing estimated changes to runoff velocities and qualitatively by discussing the various mitigation measures included as Project Design Features of the Proposed Project.

3.2.4.3 Pollutant Loading Methodology and Analysis

The pollutant loading model previously used to quantitatively assess the water quality impacts of the adjacent Playa Vista First Phase Project was adapted and updated to determine the pollutant loads for the Proposed Project together with the adjacent Playa Vista First Phase Project. The updated model was run for existing December 1998 conditions (prior to adjacent Playa Vista First Phase development) and future conditions following completion of the Proposed Project (buildout including adjacent Playa Vista First Phase Project and the Proposed Project).

The Freshwater Marsh, approved under the adjacent Playa Vista First Phase Project, was sized in the initial design to accommodate flows and pollutants from the completion of the adjacent Playa Vista First Phase Project and the Proposed Project. As mentioned above in Section 3.2.3 Project Design Features, the Freshwater Marsh was designed to provide "over-treatment" of the runoff from the adjacent Playa Vista First Phase Project and the Proposed Project by treating a substantial quantity of off-site runoff. In order to provide a more complete and meaningful analysis of water quality impacts associated with the Proposed Project and to evaluate the adequacy of the Freshwater Marsh to accommodate both adjacent Playa Vista First Phase Project and the Proposed Project flows, pollutant loads from the existing December 1998 conditions have been compared to the pollutant loads estimated to occur at the completion of Proposed development (e.g., buildout including both adjacent Playa Vista First Phase Project and Proposed Project) through the use of the pollutant loading model.

Stormwater runoff from the project site drains into the newly constructed Freshwater Marsh, the existing Ballona Wetlands, the Ballona Channel, and ultimately Santa Monica Bay. The pollutant loading model predicts the annual mass of pollutants that will be picked up from the project tributary areas in stormwater runoff and discharged into the receiving waters. Pollutant loads are estimated by combining a typical pollutant concentration for each land use with the average annual stormwater runoff. The model methodology is described in detail in the following section.

3.2.4.3.1 Model Methodology

The pollutant loading model used for analysis of the Proposed Project was adapted from the adjacent Playa Vista First Phase EIR. In general, pollutant loads are calculated by estimating runoff coefficients to convert rainfall data into runoff volumes, then using the runoff volumes and event mean concentrations (EMCs) to estimate pollutant loads. The pollutant loading model is based on three main equations - determining the runoff coefficient, the annual runoff, and the annual pollutant loading.

The model methodology has been adapted from an empirical method that has been referred to by others as the Simple Method[133]. The Simple Method is an empirical approach developed for estimating pollutant export from urban development sites. The model was developed to provide a simple yet effective method for predicting runoff volumes, pollutant loads, and resulting pollutant concentrations from proposed project areas.

The model was developed in spreadsheet format and utilizes available stormwater monitoring and rainfall data, as well as a relationship for the prediction of runoff volumes. The model is capable of estimating changes in runoff volumes, pollutant loads, and resulting pollutant concentrations that may occur as a result of property development. The model does not incorporate the hydraulics or hydrology of the site, which would be more appropriate for design stages and requires additional data and more sophisticated modeling. This type of model generally includes structural BMPs and not source control BMPs, as data is generally not available or inconclusive for the latter. Model calculations are deterministic in that only a single value is obtained from a set of inputs without an estimation of the potential variation in stormwater loads or concentrations.

For purposes of this model the term pollutant (or pollution) refers to any physical or chemical constituent that exists naturally or is anthropogenically deposited within a watershed that can be mobilized by rainfall and transported by runoff, and that has the potential for causing deleterious effects on the receiving water environment because of concentrations in the water or as result of physical or biological accumulation.

This type of loadings model is very useful in the planning and evaluation stages of a project. If reliable estimates of the effluent quality resulting from installation of BMPs are available, the model can be used to evaluate the effectiveness of the proposed BMPs on improving water quality.

As with all environmental modeling, the precision of results is heavily dependent on how well the hydrologic, water quality, and BMP effectiveness data describe the actual site characteristics. Local and regional data used to the fullest extent possible helps to minimize errors in predictions. It is important to remember that the predictions of relative differences are also of importance rather than just precision. The ability of errors to propagate and magnify is inherent with this type of model and must be considered when viewing results. Each model step is dependent on the previous, so it is crucial that sensitive parameters are identified and the data used to

[133] *Schueler, T., 1987, Controlling Urban Runoff, A Practical Manual for Planning and Designing Urban BMPs, Metropolitan Washington Council of Governments.*

estimate those parameters are scrutinized. An extensive sensitivity analysis is beyond the scope of this document and therefore errors will only be discussed qualitatively. However, it is important to point out that one of the most variable parameters is the runoff coefficient, which is a function of the percent imperviousness. Novotny and Olem[134], when discussing the Rational Formula, state "...the runoff coefficient is the most important task of the entire calculation." Obtaining accurate percent imperviousness values are difficult, especially when the project is still in the planning phase.

3.2.4.3.1.1 Rainfall Analysis

In order to determine the average annual rainfall experienced in the vicinity of the Project site, historical (1948-1997) rainfall data were obtained[135] from the National Weather Service for the closest representative rain gauge station, No. 45114, located at the Los Angeles International Airport (LAX). The rainfall statistics were analyzed using EPA's Synoptic Rainfall Analysis Program (SYNOP) statistical rainfall program to aggregate the hourly data into individual storm events and develop storm statistics. The SYNOP program calculates the storm duration, volume, and intensity for individual storms as well as the mean and coefficient of variation. Inputs to the program include selecting the inter-event time to be used to separate individual rainfall hours into storm events as well as a minimum event size to analyze for the summary statistics. For this analysis an inter-event time of 6 hours and a minimum storm size of 0.10 inches were used[136]. This results in rainfall hours separated by less than 6 hours being aggregated into a single storm event. Storm events equal to and less than 0.10" on average are not expected to contribute significantly to runoff.

The LAX weather station is approximately 3 miles south of and about 50 feet above the project area. With this close proximity, the spatial variability of rainfall that probably exists during individual storm events is likely to be much less pronounced in annual averages. Therefore, it is reasonable to believe the storm statistics from this single rain gage are representative of the storms observed at the project site. Station information of the LAX weather station is provided in **Table 3-26, National Climatic Data Center Weather Station Information.**

---

[134] *Novotny, Vladimir, and H. Olem, 1994. Water Quality Prevention, Identification, and Management of Diffuse Pollution, Van Nostrand Reinhold, New York.*

[135] *Woodward Clyde, 1998. Playa Vista Stormwater Rainfall Analysis. Memorandum, November 3, 1998.*

[136] *U.S. Environmental Protection Agency, 1989. Analysis of Storm Event Characteristics for Selected Gages throughout the United States.*

3.2.4.3.1.2 Runoff Estimation

The pollutant loadings model estimates annual average runoff volumes based on the rational method. The rational method is probably the most widely used method for design of storm sewers.[137] It can be used to estimate runoff volumes as well as flow rates. However, for purposes of annual averages, only the simpler estimation of runoff volumes is used in the model. The model uses the rational equation as follows:

$$Q_i = (R_i)\times(I)\times(A_i)\times(CF_1) \qquad \text{Eqn. 3-2}$$

Where:

Q_i = *annual runoff volume (ft^3) from land use area i*
I = *total annual rainfall depth (in) of storms greater than 0.1"*
A_i = *land use area i (acres)*
R_i = *runoff coefficient of land use area i*
CF_1 = *conversion factor to convert from in-acres to ft^3*

The runoff coefficient, R_i, is a unit-less value that is a function of the imperviousness of land use area, *i*, and is approximated in the model by the following equation[138]:

$$R_i = 0.007 \times (\% \text{ imperviousness of } A_i) + 0.1 \qquad \text{Eqn. 3-3}$$

Runoff volumes were estimated from the runoff coefficient estimated from the percent imperviousness, the mean annual rainfall depth, and the area of each type of land use within the proposed project area and contributing offsite areas. The total runoff volumes influent to receiving waters were calculated by simply summing the runoff volumes from each individual land use area within the entire drainage.

3.2.4.3.1.3 Loadings and Concentrations Estimation

Land use-based pollutant loads and concentrations were estimated in the model using the Los Angeles County's 1997-2001 monitoring data (see Volume III, Appendix E, of this Technical Report for details). The water quality parameters selected for modeling were based on the typical pollutants found in urban stormwater, the pollutants listed on the 303(d) list for receiving water bodies, and the extent of L.A. County's data. These modeled parameters include TSS, TKN, TP, oil and grease, total copper, total lead, and total zinc. The land use EMC for each pollutant was used in conjunction with the runoff volumes from each land use area to estimate the average annual load to receiving water bodies from the project area. The following equation was utilized in the model.

---

[137] *Chow, T.V., D.R. Maidment, and L.W. Mays, 1988. Applied Hydrology. McGraw-Hill, Inc. New York, NY.*
[138] *Federal Highway Administration, 1990. Pollutant Loadings and Impacts from Stormwater Runoff, Volume III: Analytical Investigations and Research Report. Prepared by Woodward-Clyde Consultants: E.D. Driscoll, P.E. Shelley, and E.W. Strecker. FHWA-RD-88-008.*

$$L_{Dj} = \sum_{i=1}^{n_{LU}} L_i = \sum_{i=1}^{n_{LU}} (EMC_i) \times (Q_i) \times (CF_2) \qquad \text{Eqn.3-4}$$

Where: L_{Dj} = *total average annual load (lbs) from drainage area j*
L_i = *load (lbs) from land use area i*
EMC_i = *event mean concentration (mg/L) from land use area i*
Q_i = *runoff volume (ft^3) from land use area i*
CF_2 = *conversion factor to convert mg/L to lbs/ft^3*
n_{LU} = *total number of different land use areas in drainage area j*

To estimate the annual average storm event pollutant concentrations to receiving waters the total annual load calculated above is simply divided by the total runoff volume, or symbolically as:

$$C_{Dj} = \frac{L_{Dj}}{\left(\sum_{i=1}^{n_{LU}} Q_i\right) \times CF_2} \qquad \text{Eqn.3-5}$$

Where: C_{Dj} = *total annual average concentration (mg/L) from drainage area j*
L_{Dj} = *total average annual load (lbs) from drainage area j*
Q_i = *total annual runoff volume (ft^3) from land use area i*
n_{LU} = *total number of different land use areas in drainage area j*
CF_2 = *conversion factor to convert mg/L to lbs/ft^3*

The pollutant loadings model simultaneously calculates loads and concentrations for each of the constituents of concern identified below in Section 3.2.4.3.2.4.

3.2.4.1.2.4 Metals Partitioning

The L.A. County stormwater monitoring data does not contain statistically significant dissolved metals data for all of the modeled land uses. Therefore, in order to estimate the dissolved metals loads and concentrations in receiving waters, metals fractionation values were used. These values were estimated from both the L.A. County 1994-2000 land use data[139] for which valid data were available and the NSW BMP Database.[140] Commercial and high-density single-family residential land use-based EMCs for total and dissolved copper and zinc were available in the L.A. County 1994-2000 data. The average percent dissolved copper and zinc from these two land uses were used in the model. For lead, the NSW BMP database average influent and effluent dissolved fractions for wetponds were used. These fractionation values were applied to estimate dissolved metals concentrations and loads after treatment in the water quality inlets (discussed in next section). Therefore, treatment of dissolved metals in the on-site BMPs and the water quality inlets is only accounted for through treatment of total metals. The metals fractionation values are shown in **Table 3-27, Fractionation Values Used to Estimate Dissolved Metals Loads and Concentrations.**

[139] *http://Ladpw.org/wmd/npdes/9400_wq_summaries.zip*
[140] *http://Ladpw.org/wmd/npdes/9400_wq_summaries.zip*

3.2.4.1.2.5 Pollutant Removal Approximations

As mentioned above, the pollutant loading model incorporates water quality treatment in structural stormwater BMPs. There is not sufficient data available to model source control BMPs, so they were not included in the modeling effort. However, it should be noted that source control BMPs, such as public education and street sweeping are expected to provide an additional level of treatment, which are not specifically included in the pollutant loading estimates. The planned BMPs that were modeled include roof-drain planter boxes, catch basin inserts, vegetated swales, the Riparian Corridor, and the Freshwater Marsh (see Volume III, Appendix F, of this Technical Report for details). The roof-drain planter boxes are planned to treat all roof runoff that would ultimately be tributary to the Central Drain. The catch basin inserts are estimated to capture and treat 100 percent of the Proposed Project runoff entering the Central Storm Drain and 25 percent of the remaining runoff from all First Phase and Proposed Project areas. The Riparian Corridor would receive runoff from nearly 50 percent of the First Phase areas and nearly 40 percent of the Proposed Project areas, as well as off-site areas. All runoff generated from both the adjacent Playa Vista First Phase Project and Proposed Project would be routed to the Freshwater Marsh. Also, minimal treatment in the Centinela Ditch for pre-First Phase conditions and the Ballona Wetlands are included in the model to account for the existing pollutant removal capacity of this degraded channel and wetland system. Catch basin inserts were modeled using percent removals and all other BMPs, including the roof-drain planter boxes, bioswales, Riparian Corridor, Centinela Ditch (pre-First Phase only), Freshwater Marsh, and Ballona Wetlands were modeled using statistical estimates of effluent quality estimates for BMPs in the NSW BMP Database. The reason for the difference in approach is, (1) BMP monitoring studies for some BMP types only have percent removals reported rather than the effluent quality, and (2) evaluation of data in the NSW BMP Database has revealed that using percent removals to predict treatment capacity, particularly for detention facilities, has some serious short-comings, such as predicting "good" treatment when influent quality is poor and predicting "poor" treatment when the influent quality is good. The paragraphs below describe how stormwater treatment was handled in the pollutant loading model.

Catch Basin Inserts Percent Removal

As discussed in Section 3.2.3 Project Design Features, water quality inlets (primarily catch basin inserts) have been incorporated into the adjacent Playa Vista First Phase Project and the Proposed Project designs. As compared to other types of BMPs, performance studies of water quality inlets is limited, particularly considering the many types of possible configurations and types of treatment media that can be used. Of the studies reported in the literature, most of them only report percent removals rather than the influent and effluent concentrations individually. Consequently, the performance of the water quality inlets is accounted for in the model using percent removals. The ranges of pollutant removal rates found in the literature are as follows:

Total Suspended Solids: 24 – 99%[141]
Total Phosphorus: 5 – 21%[142]
Total Kjeldhal Nitrogen: 0 – 41%[120, 121]
Oil and Grease: 9 – 91%[120, 121]
Total Copper: 0 – 65%[120, 121]
Total Lead: 0 – 82%[120, 121]
Total Zinc: 0 – 90%[120, 121]

Resultant pollutant loadings to the receiving waters after flow through these water quality features are calculated as follows:

$$L_{RW} = \sum_{j=1}^{n_{RW}} L_{Dj} \; x \, (1 - \frac{R}{100}) \qquad \text{Eqn. 3-6}$$

Where: L_{RW} = *pollutant load (lbs/yr) to the receiving waters*
L_{Dj} = *total average annual load (lbs) from drainage area j*
n_{RW} = *total number of different drainage areas tributary to receiving waters*
R = *removal rate (percent)*

Effluent Quality

As mentioned earlier, the modeled treatment within the Freshwater Marsh and the Ballona Wetlands is based on the effluent quality of BMPs found in the NSW BMP Database. Effluent quality is also used to model the treatment expected to occur in the Centinela Ditch before the completion of the adjacent Playa Vista First Phase Project and the Riparian Corridor after completion, as well as roof-drain planter boxes and bioswales at various locations within the Proposed Project boundaries. Due to limited data available for roof-drain planter boxes, it was assumed that they would perform similar to bioswales. This is a conservative assumption because the quality of roof runoff is likely much cleaner than the runoff concentrations assumed in the model for the various land uses in the LA County EMC data and the effluent quality of bioswales in the NSW BMP database is based on treatment of ground-level surface runoff. Only data that have been reviewed, validated, and statistically summarized were used, which resulted in a much smaller set of studies than currently appears in the database.[143] The data used in the model to estimate treatment rates in BMPs and

---

[141] *Larry Walker Associates, Inc., 1999. Investigation of Structural Control Measures for New Development. Prepared for Sacramento Stormwater Management Program*
[142] *Interagency Catch Basin Insert Committee, 1995. Evaluation of Commercially-Available Catch Basin Inserts for the Treatment of Stormwater Runoff from Development Sites. King County Surface Water Management Division, King County Department of Metropolitan Services, Snohomish County Surface Water Management Division, Seattle Drainage and Wastewater Utility, and Port of Seattle.*
[143] *ASCE 2002. Internal Draft Analysis of the ASCE/EPA NSW BMP Database, 9/9/02. Prepared by GeoSyntec Consultants, Inc.*

existing drainage facilities (i.e., Ballona Wetlands and Centinela Ditch) are included in Volume III, Appendix F of this Technical Report. Median values of the average effluent concentration of individual biofilters and wetland channels reported in the NSW BMP Database were used to estimate the treatment in the roof-drain planter boxes and bioswales, and the Riparian Corridor, respectively. Fortieth percentiles (lower than the median) of the effluent data for wet ponds and wetlands were used to represent the effluent of the Freshwater Marsh, as it was estimated that the Marsh would achieve a higher level of performance than typically designed wetlands and wet ponds due to the large capacity of the system as compared to the average size storm event (about 1.1 inches to about 0.6 inches). Ninetieth percentiles (higher than the median) of the wetland channels and wet ponds were used to estimate the treatment in the degraded Centinela Ditch and Ballona Wetlands, respectively. This lower level of performance was assumed based upon the degraded condition and the channelization of the system that would reduce ponding times. Average annual effluent loads were calculated by multiplying the assigned (NSW BMP Database-derived) effluent concentrations by the predicted annual flow volume. The mass removed by the system (i.e., Freshwater Marsh or Ballona Wetlands) is equal to the difference between the influent and effluent loads. If the influent loads of a modeled parameter were predicted to be less than the assigned effluent loads, the mass removed would be zero and the effluent loads would be set equal to the influent loads for that parameter. This assumes the BMPs will not be source of pollution during average size storm events, which should be the case if properly maintained.

3.2.4.3.2 *Input Parameters*

Based on the model methodology described above, the input parameters necessary to estimate the runoff volumes, loads, and concentrations include: land use areas, annual average rainfall depth, percent imperviousness values for each land use, land use-based event mean concentrations, and pollutant removal estimates for the stormwater BMPs. The values used for each of these input parameters are described below.

<u>3.2.4.3.2.1 Land Use Areas</u>

The adjacent Playa Vista First Phase Project and the Proposed Project property watershed, for analytical purposes, consists of three major categories of drainage areas: adjacent Playa Vista First Phase Project, Proposed Project, and off-site areas (i.e., tributary areas outside of the adjacent Playa Vista First Phase Project and the Proposed Project). For adjacent Playa Vista First Phase acres, land uses were delineated based on pre-First Phase land use conditions and the assumed buildout in accordance with the previously approved adjacent Playa Vista First Phase project. Land uses for Proposed Project areas were delineated based on existing land use conditions and Proposed Project or alternative development. Land uses for off-site areas were delineated based on actual developed land uses and buildout of vacant parcels in accordance with existing City and/or County zoning, as appropriate. All major existing roadway rights-of-way within the Project site boundary were considered off-site including Culver, Jefferson and Lincoln Boulevards. In some cases, land use categories used by the flood assessment hydrology analysis were condensed into the land use categories defined in the pollutant loading model. **Table 3-28, Land Use by Drainage System Pre-First Phase, Table 3-29, Land Use by Drainage System with Playa Vista First Phase,** and **Table 3-30, Land Use by Drainage System with Playa Vista First Phase and Proposed Project** respectively summarize the land use acreages used in the pollutant loading model for the Proposed Project, adjacent Playa Vista First Phase Project, and off-site tributary areas under pre-First Phase, with Playa Vista First Phase, and with Playa Vista First Phase and Proposed Project conditions. Note that land use designations shown in these tables are different from the land use designations used for the hydrological assessment. Table 3-33 compares the hydrology land use designation with the designation used in the pollutant loading model.

Residential

Residential areas were separated into high, medium, low/medium, and low density residential areas. For Proposed Project land uses, high density residential was defined as those areas planned for greater than 55 dwelling units per acre. Medium density was defined as areas to be developed to less than 55 dwelling units per acre. For the Proposed Project only high-density and low-density residential designations were used. For adjacent Playa Vista First Phase development, the lots were categorized as high, medium, or low/medium according to the Proposed Development Criteria.[144] High and medium density residential areas had the same definitions as for the Proposed Project with the exception that low/medium density was defined as 40 dwelling units per acre. The adjacent Playa Vista First Phase Project did not have any low density residential areas. Residential breakdown of the off-site areas remained the same as used in the adjacent Playa Vista First Phase EIR. Although these residential designations may not match the City of Los Angeles' residential designations, they are appropriate for the adjacent Playa Vista First Phase Project and the Proposed Project from a hydrological standpoint.

Transportation/Major Roadways

Automobiles, trucks, and other vehicles can contribute significantly to pollutants in runoff from streets, highways, and parking areas, and monitoring data from highways and other transportation land uses suggests that pollutant concentrations in these locations may be higher than other urban uses. However, for the purposes of the pollutant loading model, not all streets in the project area were considered to be transportation (major roadways) land use. Local streets with lower trip volumes were considered to have similar pollutant concentrations as the adjacent land uses. For example, a local street next to a commercial lot would be counted as commercial acreage. Exceptions were made for local streets that were next to open space areas or water areas. These areas were counted as residential acreage to be conservative since by being paved, these streets clearly do not represent open space or water acreage. Only heavily traveled streets were assumed to be transportation (major roadways)

[144] *Psomas, Vesting Tentative Tract Map No. 49104, Playa Vista Phase I Subdivision, Proposed Development Criteria, October 13, 1995.*

land use. Culver Boulevard, Jefferson Boulevard, Centinela Avenue, and Lincoln Boulevard were considered to be major roadways.

Industrial and Commercial

On-site industrial land uses were also recategorized for the model. The industrial land use category as defined in the Los Angeles County Stormwater Monitoring Data typically refers to a manufacturing plant that would use a wide variety of chemicals in the production of goods and support a large number of trucks for shipping and receiving. The Proposed Project and the adjacent Playa Vista First Phase Project areas on-site that have been identified as industrial land use are more commercial in nature in that they do not involve the production and shipping of goods and generally support offices. Therefore, Proposed Project and the adjacent Playa Vista First Phase Project areas on-site that have been identified as industrial land use have been recategorized for the model as commercial land use. Off-site industrial land use areas remained categorized as industrial land use for the model.

Open Water and Open Space

Another land use distinction in the model is the difference between open water and open space. Open water was considered as an area where water is present almost year-round. For the Ballona Wetlands and the Riparian Corridor, only the acreage for the channels was considered to be open water. The remaining acreage in the Ballona Wetlands and the Riparian Corridor was considered to be open space. Similarly, in the Freshwater Marsh, only the acreage with ponded water for most of the year was categorized as open water. This acreage was estimated from the hydrology calculations performed for the design of the Freshwater Marsh.

3.2.4.3.2.2 Imperviousness Factors and Runoff Coefficients

Values used in the pollutant loading model for tributary areas, imperviousness factors for each land use, and general hydrology runoff patterns were made to be consistent with the flood assessment hydrology analysis discussed in Section 2 of this Volume, with the exception of the open space imperviousness factor. The City of Los Angeles's Flood Control Design methodologies requires that an impervious factor of 35 percent be applied to open space. This level of imperviousness is meant to represent that these areas may include compacted soils and if saturated would contribute to runoff. It is a conservative assumption with the purpose of increasing peak flows for design and safety purposes. The original EIR for the Playa Vista First Phase Project utilized the same impervious factors for land uses in the flood analysis and the water quality modeling of stormwater pollutant loads for purposes of being consistent. However, for purposes of water quality modeling, the assumption of 35 percent imperviousness would result in runoff coefficients (the amount of rainfall that results in runoff) that are probably too high for the smaller day-to-day storms. For purposes of the water quality modeling, the percent imperviousness has been reduced to 20 percent for open areas. Twenty percent imperviousness will recognize the fact that the open areas are not undisturbed (soils compacted, etc.) and the fact that they include some roadway surfaces in them. In terms of imperviousness, water bodies, such as the

Riparian Corridor, Freshwater Marsh, and the Ballona Channel, were considered to be 100 percent impervious to account for the volume of rain falling directly on surface waterbodies. In addition, existing Ballona Wetlands acres were considered to be 100 percent impervious (i.e., a conservative assumption) because the ground is saturated with water and therefore any water falling on the Ballona Wetlands would pool and eventually drain off. A summary of the imperviousness factors used for the different land uses is summarized in Table 3-32. In reality, actual imperviousness values are lower than those used in the analysis, resulting in a conservative pollutant loading assessment.

3.2.4.3.2.3 Annual Rainfall Data

The SNYOP analysis described above determined that the total average annual rainfall depth for storms of 0.10 inches (storms of less than 0.10 were assumed to not contribute significantly to runoff) or higher is 11.66 inches and the average number of storm events greater than 0.1" in depth is 17. A more in-depth description of the rainfall analysis is described in Volume III, Appendix D of this Technical Report.

3.2.4.3.2.4 Constituents of Concern

Seven constituents were selected to evaluate the effects of the proposed development on the receiving waters - TSS, TP, TKN, copper, lead, zinc, and oil and grease. These constituents are representative of those most commonly found in urban runoff with the potential for significant water quality impacts. Other significant pollutants in urban runoff, such as trash, debris, and pathogens (e.g., coliform and bacteria), and pesticides cannot be accurately quantified in a load analysis.

TSS is a measure of the organic and inorganic particulate matter that is suspended in the water. Suspended solids can block light from the waters, restricting aquatic plant growth, clog the gills of fish, and cover spawning habitats. Heavy metals and other contaminants can adsorb onto suspended solids and sediments further degrading water quality.

Nutrient content in the surface water is gauged by the pollutant loading of phosphorus and TKN. TKN represents the total concentration of ammonia and organic nitrogen. Although nutrients are required for the growth of biota, excessive amounts can be detrimental to a water body. Sources of nitrogen and phosphorus include fertilizers, animal and human wastes, and automobile exhausts.

Heavy metal pollutant loads are represented in the model by copper, lead, and zinc. These metals are most often present in urban runoff at concentrations of concern, as evidenced in the existing water quality sampling results described in Section 3.2.2, and exhibit transport and treatment properties representative of other heavy metals. At high concentrations, these compounds can be toxic to biota in their soluble form. Sources of heavy metals include weathering of soils, atmospheric deposition, automobile emissions and residuals (brake pad and tire wear), applied chemicals (weed killers, etc.), and industrial and other sources.

Oil and grease are often found in urban runoff from roadways, parking lots, and industrial and commercial properties. These constituents are aesthetically unpleasant in natural water bodies and can restrict many beneficial uses of a water body. In some instances, oil and grease can kill birds and aquatic organisms.

3.2.4.3.2.5 Los Angeles County Land Use-Based Pollutant Data

Event mean concentrations (EMCs) are used in the pollutant loading model to represent typical concentrations of contaminants in stormwater runoff. The concentrations in stormwater runoff vary depending on the land use from which the stormwater originates. For example, typical runoff from roads or parking lots are expected to contain more petroleum derivatives than runoff from a grassy park. In order to characterize the stormwater runoff, it is desirable to have site-specific or local data. Although several limited sampling events have occurred in the adjacent Playa Vista First Phase Project and the Proposed Project area, the number of samples taken per each land use are not statistically sufficient to represent the area.

As there are no historical, site-specific, pollutant concentration data available, pollutant concentrations were estimated based upon the results of government-sponsored runoff studies and from data obtained during local watershed monitoring studies. For the purpose of this analysis, the results of these studies were compared in order to estimate pollutant concentrations that would result from adjacent Playa Vista First Phase Project, Proposed Project, and off-site land uses.

In order to determine the best representative EMCs for the project site, URSGWC compared mean concentrations from the Nationwide Urban Runoff Program (NURP), the Federal Highway Administration (FHWA), and Los Angeles County Stormwater Monitoring Data and also compared these values to the mean concentrations observed in Ballona Channel under wet weather. NURP values represent analytical results of over 2,000 storm events at 85 urban sites across the United States taken from 1969 to 1983.[145] A similar FHWA study completed in 1990 reviewed analytical data from over 1,000 storm events from 31 highway sites across the United States including an I-405 interchange area in Los Angeles.[146] The EMCs from the Los Angeles County Stormwater Monitoring Data used for the comparison represent data from 1996 to 2001. A comparison of the Los Angeles County data and the NURP means suggests that the Los Angeles County data is similar to the NURP means. Upon review of the EMCs, it was determined that the Los Angeles County Stormwater Monitoring Data provides representative concentrations for the adjacent Playa Vista First Phase Project and the Proposed Project (Table 3-33) because it is more recent and represents local conditions. The Los Angeles County stormwater EMCs used in the model have been updated to include the most recent stormwater monitoring data and have been reanalyzed to account for the shape of the data distribution, as well as censored data (data reported only to be below the analytical detection limits), in calculation of the

[145] *Woodward-Clyde Consultants, United States Environmental Protection Agency, Water Planning Division, Final Report on the National Urban Runoff Program, December 1983.*
[146] *Woodward-Clyde Consultants, Federal Highway Administration, Methodology for Analysis of Pollutant Loadings from Highway Stormwater Runoff, SHWA/RD-87/086, June, 1987.*

average EMC for each land use. A more detailed comparison of EMCs is included in Volume III, Appendix E of this Technical Report.

__3.2.4.3.2.6 Pollutant Removal Estimates__

As mentioned above, the model uses percent removals to estimate treatment in the water quality inlets and uses effluent quality to estimate treatment in the Freshwater Marsh and the Ballona Wetlands. The percent removals are based on studies that have evaluated the performance of catch basin inserts and other proprietary treatment devices. The values chosen for use in the model are all conservative with respect to the range of values found in the literature (shown above in Section 3.2.4.1.2.5). These lower-end values were chosen to account for the variability observed in the available data. Ultimate performance of water quality inlets primarily depends on maintenance practices. Effluent quality is based on the average effluent concentrations of BMPs found in the NSW BMP Database. The percent removals and the effluent quality values that were used to estimate treatment in the pollutant loading model are shown in Tables 3-17 through 3-20.

3.2.4.4 General Project Effects

Because the Habitat Creation/Restoration Component would not involve the construction of impervious surfaces, the land use of the area for the Habitat Creation/Restoration Component would not change, and minimal amounts of surface water runoff would be generated compared with existing conditions. In addition, implementation of the Habitat Creation/Restoration Component would involve the construction of a major stormwater management facility, the completion of the Riparian Corridor, which was designed to serve the Proposed Project by conveying increases in peak runoff rates or volumes caused by the construction of portions of the Urban Development Component as well as provide water quality benefits through natural processes (e.g., sedimentation, biofiltration, bacterial reduction and decomposition, and plant uptake) for such runoff from the Urban Development Component. Because the Habitat Creation/Restoration Component will not have adverse impacts on surface water quality, the impacts discussion for the Proposed Project in this section focuses on surface water quality impacts of the Urban Development Component.

The quality of the existing surface water resources in the vicinity of the Proposed Project could potentially be impacted both temporarily by construction activities and long-term by operations and site attributes associated with the proposed land uses. The potential water quality effects for which impact analyses follow include:

- Short-term discharge of pollutants from construction activities including surface and upland based activities (Section 3.2.4.5).

- Potential for increased long-term stormwater pollutant loadings to receiving waters as a result of increased runoff from greater impervious surface area, and changes in land uses from undeveloped to developed uses following completion and occupation of the project (Section 3.2.4.6).

- Potential for long-term impacts of Proposed Project development on adjacent Playa Vista First Phase surface water quality features (Section 3.2.4.7).
- Cumulative water quality impacts from this project and other activities in the Santa Monica Bay watersheds (Section 3.2.4.8).

3.2.4.5 Impact: Short-Term Surface/Uplands Construction Impacts on Receiving Waterbodies

Activities associated with construction of the Proposed Project would generate pollutants which, if not controlled, could be discharged to receiving waters at levels which result in potentially adverse water quality impacts. This section describes the potential impacts and measures to control the impacts for all surface and upland construction activities which will occur throughout the Proposed Project site and those systems that are part of the adjacent Playa Vista First Phase Project designated to reduce and/or eliminate impacts from the Proposed Project.

3.2.4.5.1 Sources of Pollutants

Erosion-induced sediment is the pollutant most frequently associated with construction activities. Other pollutants of concern during construction include nutrients, trace metals, toxic chemicals, and miscellaneous wastes. These pollutants originate from a variety of construction activities and are described below.

Sediment

Soil erosion is defined as the removal and loss of soil by the actions of water, gravity, and/or wind. Rainfall and resulting runoff can loosen, pick up, and carry soil particles to receiving waters. As rainfall and runoff increases, more soil particles can become detached, rills and gullies can cut into the soil surface and the quantity of soil transported to receiving waters can be increased. Erosion and sedimentation caused by construction activities can adversely impact receiving waterbodies relative to recreational uses, fisheries, and aesthetic qualities of waterways. Excessive sediment can be detrimental to aquatic life (primary producers, benthic invertebrates, and fish) by interfering with photosynthesis, respiration, growth, and reproduction. In addition, the sediment can transport other pollutants that are attached to it including nutrients, trace metals, and hydrocarbons. Erosion control and secondary sediment control practices are required by the General Construction issued by the SWRCB (in accordance with the NPDES permit) to be employed to reduce the amount of sediment leaving the construction site. As compliance with the General Construction Permit requires that runoff not cause or contribute to exceedances of applicable water quality standards (including those from the Basin Plan), compliance with the General Construction Permit would amount to compliance with Basin Plan objectives as well.

Nutrients

Products containing nitrogen, phosphorus, and potassium are the major plant nutrients used for the fertilizing of new landscape at construction sites. Rainfall can transport these potential pollutants to receiving waters. Heavy use of commercial fertilizers can result in the discharge of nutrients to water bodies resulting in excessive algae growth. In addition, some soils are naturally high in phosphorus, which when eroded can contribute to the levels in receiving waters. The erosion and sediment control measures described above will minimize the discharge of nutrients. Also, only slow-release fertilizers applied directly to the soil will be used to establish vegetation and they will not be applied during or within 72 hours of a forecasted rain event. Also, only slow-release fertilizers applied directly to the soil would be used to establish vegetation and they would not be applied during or within 72 hours of a forecasted rain event. The Freshwater Marsh will be monitored per the Ballona Freshwater Wetland System Operations, Maintenance and Monitoring Manual (O&M Manual)[147] for signs of eutrophication, such as low dissolved oxygen and excessive nutrient concentrations, to ensure the Marsh retains its designed level of habitat quality in accordance with the Performance Criteria.

Potential Contaminants Associated with Construction Materials

Galvanized metal, painted surfaces, and preserved wood comprise many of the surfaces exposed to stormwater as a result of construction activities. These coatings and treatments may contain metals, as well as other potential contaminants such as creosote and other substances containing organic chemicals. These potential contaminants may enter receiving waters as surfaces corrode, flake, dissolve, decay, or leach metals through contact with rainfall. Acidic constituents within rain can accelerate these processes. Soils also contain natural levels of trace metals such as copper and zinc and metalloids such as selenium and arsenic.

Pesticides

Herbicides, insecticides, and rodenticides are commonly used at construction sites. The unnecessary or improper application of these pesticides may result in direct receiving water contamination and indirect pollution through drift or transport of soil particles by wind and rainfall. Also, pesticides may inadvertently be released to the environment if not properly labeled, handled, or stored.

Toxic Chemicals Associated with Spills and Illegal Dumping of Construction Materials

As with pesticides, the storage, handling, and use of chemicals, such as fuels, paints, solvents, and petroleum products, associated with construction activities could pose water quality impacts if spilled or otherwise released into or near surface waters.

Miscellaneous Wastes

Miscellaneous wastes include wash from concrete mixers, solid wastes resulting from trees and shrubs removed during land clearing, wood and paper materials derived from packaging of building products, food containers such as paper, aluminum and metal cans, and sanitary wastes. The discharge of these wastes can lead to unsightly and polluted waterways. Concrete wash water can be toxic and requires proper control.

---

[147] *Surface Water Resources, Inc., The Ballona Freshwater Wetland System Operations, Maintenance and Monitoring Manual (October 2001) (as amended).*

Non-Stormwater Discharges

Non-stormwater discharges from construction sites are typically prohibited. However, some non-stormwater discharges are allowable provided the discharges are addressed in SWPPPs and do not result in adverse water quality conditions. Non-stormwater discharges associated with construction activities that are allowable (with appropriate safeguards) include the following general items:

- Uncontaminated discharges from fire fighting activities
- Fire hydrant and potable waterline flushing
- Uncontaminated groundwater (including dewatering groundwater infiltration)
- Uncontaminated foundation and footing drain flows
- Flows associated with springs, riparian habitats, and wetlands
- Irrigation water
- Air-conditioning condensate

Site-specific non-stormwater discharges expected to be encountered during Proposed Project construction activities include the following items:

- Excavation dewatering
- Vehicle and equipment cleaning
- Irrigation runoff associated with seeding and planting activities and soil stabilization

Volumes associated with the discharges listed above are unknown. Non-stormwater discharges associated with excavation dewatering, vehicle and equipment cleaning, and irrigation runoff will be directed to appropriate measures including sedimentation basins or traps, or for concrete wash a designated area where flows can be contained and dried. These activities will be addressed specifically by the SWPPP.

3.2.4.5.2 *Impacts of Construction-Related Activities*

Construction on-site would be subject to the SWRCB General Construction Permit. In conjunction with the adjacent Playa Vista First Phase Project, a SWPPP[148] was formulated to provide a comprehensive program for adjacent Playa Vista First Phase Project construction activities to comply with the requirements of the General

[148] *SWRCB, Consolidated Storm Water Pollution Prevention Plan (SWPPP) Playa Vista Project, July 30, 2001 (as amended).*

Construction Permit. As part of the Proposed Project, the existing SWPPP will be modified and updated to address Proposed Project construction. The SWPPP defines temporary BMPs to be implemented in accordance with the General Construction Permit. BMPs deployed during construction include all of the following categories:

- Drainage Control
- Waste Management Practices
- Sediments Control
- Soil Stabilization (erosion control)
- Management of Pesticides and Fertilizers
- Tracking Controls (from vehicles)
- Vehicles and Equipment Cleaning, Fueling, and Maintenance Controls
- Spill Prevention and Control Procedures
- Contaminated Soil Management
- Measures to Comply with Waste Disposal, Sanitary Sewer, and Septic Regulations
- Material Delivery and Storage Controls
- Paving Operations Controls
- Training
- Concrete and Construction Materials Management
- Wind Erosion Control
- Ponded Water Management

The Proposed Project construction activities are generally similar to those of the adjacent Playa Vista First Phase Project, for which the SWPPP has served effectively in addressing potential short-term water impacts. Implementation of the existing SWPPP, as amended for the Proposed Project, would adequately address potential water quality impacts associated with general construction activities. Therefore, implementation of construction BMPs required as part of the SWPPP, would control the potential pollution of stormwater such that construction activities would not create pollution, contamination or nuisance as defined in Section 13050 of the CWC or cause regulatory standards to be violated as defined in the applicable NPDES Permit (MS4 Permit) or Basin Plan for the receiving waterbody. Therefore, a less than significant impact would occur from construction activities.

3.2.4.6 Impact: Long-Term Project Buildout Impacts on Receiving Waterbodies

Completion and operation of the proposed land uses will increase the amount of impervious surface area within the Proposed Project area and increase the amount of urban pollutants that are entrained in the surface runoff. If any such increases in runoff and/or pollutant sources are not adequately addressed, the waterbodies that receive the runoff could be subject to water quality impacts. Therefore, in the following assessment of the impacts of the Proposed Project with respect to the significance thresholds, an assessment of the project-specific potential for flow and pollutant load and concentration impacts to the receiving waterbodies is described in greater detail below as the expected results of the design of the project are compared to the numerical and narrative water quality benchmarks.

3.2.4.6.1 Numerical Significant Impact Assessment

This section presents an analysis of pollutant loadings and concentrations expected with the Proposed Project. An overview of the results of the pollutant loadings model is presented in the following subsections, which are organized into the Freshwater Wetlands System (i.e., Freshwater Marsh and Riparian Corridor), the Ballona Wetlands, and the Ballona Channel. For the purposes of assessing environmental impacts with respect to the modeled pollutants, the analysis considers 1) whether or not the pollutant concentrations discharged from the adjacent Playa Vista First Phase Project and the Proposed Project are greater than pre-First Phase conditions, and 2) whether or not discharges from the Project exceed numerical water quality benchmarks, which include both regulatory and non-regulatory water quality criteria and objectives. The runoff quality from off-site areas has been included in the model to estimate the total pollutant concentrations entering downstream waterbodies, which allows for an assessment of the relative impact the Project has with respect to other pollutant sources.

3.2.4.6.1.1 Freshwater Wetlands System

The Freshwater Wetlands System includes a constructed wetland and riparian corridor designed to treat stormwater from the adjacent Playa Vista First Phase Project and the Proposed Project, as well as significant off-site areas. The Freshwater Wetlands System also serves as habitat mitigation for some existing degraded wetlands that were filled as part of the adjacent Playa Vista First Phase Project, including areas within the Freshwater Marsh. Water quality impacts to the Freshwater Marsh and the Riparian Corridor were assessed by comparing the predicted annual average pollutant concentrations to significance thresholds, as well as comparing pre-First Phase versus after Proposed Project pollutant loads and concentrations.

As mentioned above in Section 3.2.3 Project Design Features, in addition to the Riparian Corridor there are three storm drains directly tributary to the Freshwater Marsh: the Jefferson Storm Drain, the Central Storm Drain, and the South Lincoln Storm Drain. Each of these storm drains and the Riparian Corridor enter shallow and wide, PMAs of the Freshwater Marsh, which effectively divide the marsh into a multi-celled wetland-pond system. The wide areas serve to slow flows, allow settling, and maximize contact with vegetation and wetland soils. The Riparian Corridor and the South Lincoln Storm Drain share one of these PMAs, so there are a total of three in the Freshwater Marsh. The Playa Vista First Phase Project EIR model has been adapted to estimate the effects of the PMAs on water quality prior to flows reaching the main parts of the Freshwater Marsh. This was done in order to better assess the potential impacts to water quality within the marsh itself. It is estimated that about 50 percent of the water quality improvements would occur in these areas. This is probably a conservative assumption in that wetland studies have shown that large portions of the pollutant removals in a marsh occurs within a short distance from the point of inflow.[149] To estimate the concentrations within the PMAs for comparison to water quality benchmarks, a conservative estimate of 3 parts inflow to 1 part effluent (Main Body concentration estimate) was used.

Table 3-34a, Representative Stormwater Loads to the Freshwater Wetlands System Prior to the First Phase Project and **Table 3-34b, Representative Stormwater Loads to the Freshwater Wetlands System Prior to the First Phase Project** are the pre-First Phase Project predicted loads and concentrations, respectively, based on existing on- and off-site land uses. **Table 3-35a, Representative Stormwater Loads to the Freshwater Wetlands System with Playa Vista First Phase Project** and **Table 3-35b, Representative Stormwater Concentrations to the Freshwater Wetlands System with Playa Vista First Phase and Proposed Project** are the predicted loads and concentrations, respectively, after implementation of the adjacent First Phase Project. **Table 3-36a, Representative Stormwater Loads to the Freshwater Wetlands System with Playa Vista First Phase and Proposed Project** and **Table 3-36b, Representative Stormwater Concentrations to the Freshwater Wetlands System with Playa Vista First Phase and Proposed Project** are the predicted loads and concentrations, respectively, after implementation of the Proposed Project. The next section explicitly compares the changes in loads and concentrations with implementation of the Proposed Project.

Pre-First Phase versus After Proposed Project Influent Loads and Concentrations

The pollutant loading model predicts both average annual stormwater loads and annual average stormwater concentrations to the Freshwater Wetlands System, as well as the cumulative average annual stormwater flow volume.

Discharges to the Riparian Corridor occur at several locations along its length and includes runoff from off-site areas, as well as the adjacent Playa Vista First Phase Project, and the Proposed Project. Prior to the adjacent Playa Vista First Phase Project, the Centinela Ditch, a degraded drainage channel at the toe of Westchester Bluffs, received runoff from the same off-site areas and many of the same Playa Vista First Phase Project areas as the Riparian Corridor. With the implementation of the Proposed Project the runoff area tributary to the Riparian Corridor would decrease by nearly 30 acres as compared with the adjacent Playa Vista First Phase Project due to routing of Project area runoff to the Central Storm Drain. To assess changes in loads and concentrations upstream of the Freshwater Marsh, loads and concentrations predicted in the Centinela Ditch during pre-First Phase were compared to loads and concentrations in the Riparian Corridor after the Playa Vista First Phase and Proposed Projects. **Table 3-37, Representative Stormwater Loads and Concentrations in the Riparian Corridor/Centinela Ditch at West Boundary of Proposed Project** and **Table 3-38, Representative Stormwater Loads and Concentration in the Riparian**

[149] *Horner, R.R. 1991. The Puget Sound Wetlands and Stormwater Management Research Program: Program Overview and Hydrology and Water Quality Studies. In Development of Guidance for Managing Urban Wetland and Stormwater. Final Report. May 1991. Report to Washington State Department of Ecology, Coastal Zone Management Program, by King County Resources Planning Section, Seattle, Washington.*

Corridor/Centinela Ditch at Lincoln Boulevard respectively, compare the loads and concentrations in the Riparian Corridor/Centinela Ditch at the downstream Proposed Project boundary and at Lincoln Boulevard prior to mixing with the Lincoln Storm Drain. Notice that in both tables all of the loads and concentrations with the Proposed Project are predicted to decrease compared to pre-First Phase conditions, and are predicted to either decrease slightly or remain unchanged compared to with the Playa Vista First Phase Project.

Table 3-39, Representative Stormwater Loads and Concentrations to the Riparian Corridor/Lincoln Storm Drain South Primary Management Area, Table 3-40, Representative Stormwater Load and Concentrations to the Central Storm Drain Primary Management Area and **Table 3-41, Preventative Stormwater Loads and Concentrations to the Jefferson Storm Drain Primary Management Area** provide comparisons of pre-First Phase, First Phase, and Proposed Project loads and concentrations of inflows to each of the PMAs (Riparian Corridor/Lincoln, Central, and Jefferson, respectively). Note that since the Riparian Corridor and the Freshwater Marsh did not exist prior to First Phase, the sum of the pre-First Phase influent loads and concentrations from the Centinela Ditch and the Lincoln Drain are used to compare influent loads and concentrations of the Riparian Corridor/Lincoln Drain PMAs with the Playa Vista First Phase Project. The Central Drain also did not exist prior to the Playa Vista First Phase Project. However there is not an appropriate pre-First Phase storm drain to compare to post-development, so only a comparison between the Playa Vista First Phase Project and Proposed Project is presented for the inflows to the Central Drain PMA (Table 3-40).

The predicted loads and concentrations to the main body of the Freshwater Marsh near the PMAs for the pre-First Phase, adjacent Playa Vista First Phase Project, and Proposed Project are presented in **Table 3-42, Representative Stormwater Loads and Concentration to the Main Body of the Freshwater Marsh Near the Primary Management Areas.** For pre-First Phase conditions the sum of the future contributing drainages to the Freshwater Marsh were used to compare to conditions with the Playa Vista First Phase and Proposed Projects. The predicted loads and concentrations of all modeled pollutants in the main body of the Freshwater Marsh are expected to decrease as compared to pre-First Phase. This decrease is due to the substantial portion of off-site runoff being treated by the Freshwater Wetlands System, as well as the on-site stormwater BMPs, such as roof-drain planter boxes, vegetated swales, and catch basin inserts planned with the Proposed Project. The slight increase in dissolved lead loads is not a concern because both the total load of lead and the average concentration of dissolved lead are predicted to decrease after completion of the adjacent Playa Vista First Phase Project, so the overall water quality impacts associated with lead are actually predicted to be lessened with implementation of the Proposed Project.

The area occupied by the current Freshwater Marsh prior to its construction received both on- and off-site runoff and associated pollutants. With the implementation of the Proposed Project, a larger amount of paved area will increase runoff that will be routed to the Freshwater Marsh, contributing to the larger annual total runoff volume. The conversion of open space to commercial and residential land uses tends to decrease the amount of suspended solids associated with upland erosion, and tends to increase the amount of heavy metals associated with urban activities. However, the water quality inlets proposed as part of the adjacent Playa Vista First Phase Project, as well as the additional on-site BMPs proposed as part of the Proposed Project provide enough treatment to minimize the expected increase of metals concentrations caused by land use conversions.

<u>Comparison to the Water Quality Benchmarks</u>

Numerical water quality benchmarks for all of the modeled parameters are shown in Table 3-21. The metals benchmarks were based on the CTR acute criteria for the protection of aquatic life. The nutrient benchmarks were based on the EPA recommended ambient water quality criteria for nutrients in rivers and streams that are minimally impacted by human activities and are protective of aquatic life and recreational uses. Note that these nutrient benchmarks also address the Basin Plan narrative water quality objective for biostimulatory substances. The suspended sediment and oil and grease significance benchmarks were derived from the water quality objectives in the California Ocean Plan. These objectives do not specifically apply to the runoff quality from the Project areas, as these objectives only apply to flows discharged directly to the ocean from publicly owned wastewater treatment plants and industrial discharge for which effluent guidelines have not been established. However they serve as an indicator of the desired water quality of discharge to the ocean waters of the State.

To assess the potential impacts of heavy metals entering the receiving waterbodies, the CTR benchmarks were compared with the model predictions as mentioned above. The CTR benchmarks do not apply directly to stormwater; they apply to the receiving waters to which the stormwater discharges. However, the CTR benchmarks are compared to the predicted dissolved metals concentrations at various locations within the Freshwater Wetlands System for an assessment of the potential impact to the system itself. A comparison of the CTR to the stormwater flows is conservative because it does not account for assimilation that may occur once the stormwater enters the receiving water.

A comparison of the dissolved metals concentrations in each of the PMAs and the main body of the Freshwater Marsh to the CTR benchmark is shown in **Table 3-43, Representative Stormwater Dissolved Metal Concentrations in the Freshwater Marsh Primary Management Areas Compared to CTR Criteria after Proposed Project**. This table shows that the predicted dissolved metals concentrations in the PMAs and the main body of the Freshwater Marsh are well below the acute CTR water quality criteria for dissolved copper, lead or zinc during an average size storm event. This indicates that the potential impacts to the Freshwater Marsh with respect to the toxicity of copper, lead, and zinc are less than significant.

Table 3-44, Representative Stormwater Concentrations in the Primary Management Areas and the Main Body of the Freshwater Marsh Compared to Nutrient Water Quality Benchmarks After Proposed Project, provides a comparison of the nutrient benchmarks and **Table 3-45, Representative Stormwater Concentrations in the Primary Management Areas and the Main Body of the Freshwater Marsh Compared to Water Quality Benchmarks After Proposed Project,** provides a comparison of the suspended sediment and oil and grease benchmarks. Both tables show that, on average, the benchmarks will generally not be exceeded in the PMAs or the main body of the Freshwater Marsh. The TSS benchmark is predicted to be exceeded slightly in the Jefferson Storm Drain PMA (79 mg/L versus 60 mg/L). However, the PMAs are specifically designed as vegetated, shallow water areas to slow flow velocities and capture particulates. Also, the TSS benchmark is only legally applicable to publicly owned treatment works and industrial dischargers, in each case, that discharge directly to the ocean; it is used here for reference due to the lack of applicable numerical water quality standards for TSS; there are numerical turbidity standards in the Basin Plan, but not for TSS.[150] The higher TSS concentration predicted for the Jefferson Storm Drain PMA is indicative of the amount of off-site areas not receiving treatment in biofilters and catch basin inserts, such as those included in the adjacent Playa Vista First Phase Project and Proposed Project. The Jefferson Storm Drain receives less than 1 percent of its runoff from the Proposed Project and less than 17 percent of its runoff from the adjacent Playa Vista First Phase Project. The remaining 83 percent of runoff is primarily from off-site residential, industrial, and transportation land uses. The annual average TP concentration discharged from the Freshwater Marsh is predicted to be slightly below the water quality benchmark. This criterion is very conservative, particularly for discharges to the Ballona Wetlands, which could actually benefit from nutrient loading by promoting aquatic plant growth and benthic community activities.[151]

The Basin Plan contains narrative water quality objectives for biostimulatory substances. Nutrients such as phosphorus and nitrogen are required by aquatic organisms for growth, however in excess these nutrients can "overstimulate" aquatic growth leading to degradation of water quality. Since the nutrient thresholds are based on streams that have not been heavily impacted and are protective of beneficial uses, meeting these thresholds also complies with the Basin Plan water quality objectives for biostimulatory substances. More discussion of the narrative water quality objectives contained in the Basin Plan is provided in Section 3.2.4.6.2 Narrative Significant Impact Assessment.

Based on the above comparisons of predicted concentrations to the significance thresholds, no significant water quality impacts from project stormwater runoff are expected in the Freshwater Wetlands System.

---

[150] *Turbidity was not modeled due to a lack of available statistically defensible data to estimate runoff levels and BMP performance. Also, turbidity cannot be directly correlated with TSS because it is a measure of the amount of light passing through the water column, which may be affected by both dissolved and suspended constituents.*

[151] *Kadlec, R.H. and R.L. Knight. (1996). Treatment Wetlands. CRC Press LLC, Boca Raton, FL.*

3.2.4.6.1.2 Ballona Wetlands

Prior to the construction of the Freshwater Marsh all of the stormwater runoff from the adjacent Playa Vista First Phase Project and Proposed Project area and adjacent off-site areas entered the Ballona Wetlands prior to draining to the Ballona Channel. This input of urban stormwater over the years has substantially contributed to the current degraded state of the Ballona Wetlands.

After the completion of the Proposed Project, the Ballona Wetlands will receive only a fraction of the original pre-First Phase Project stormwater runoff from the project area. On average, an estimated 8 percent, of the annual flows that enter the Freshwater Marsh will overflow into the Ballona Wetlands. This will constitute approximately 15 percent of the total annual runoff volume that enters the wetlands. Therefore, a vast majority (85 percent) of the runoff that will enter the Ballona Wetlands after Proposed Project completion (buildout) will be from other off-site areas directly tributary to the Ballona Wetlands (not tributary to the Freshwater Marsh). **Table 3-46a, Representative Stormwater Loads to the Ballona Wetlands Prior to the First Phase Project,** and **Table 3-46b, Representative Stormwater Concentrations to the Ballona Wetlands Prior to the First Phase Project,** are the pre-First Phase predicted loads and concentrations, respectively, to the Ballona Wetlands from each of the primary contributing sources, including the Freshwater Marsh effluent and off-site runoff. **Table 3-47a, Representative Stormwater Loads to the Ballona Wetlands with Playa Vista First Phase Project,** and **Table 3-47b,Representative Stormwater Concentrations to the Ballona Wetlands with Playa Vista First Phase Project,** are the predicted loads and concentrations, respectively, after implementation of the adjacent First Phase Project. **Table 3-48a, Representative Stormwater Loads to the Ballona Wetlands with Playa Vista First Phase and Proposed Project,** and **Table 3-48b,Representative Stormwater Concentrations to the Ballona Wetlands with Playa Vista First Phase and Proposed Project,** are the predicted loads and concentrations, respectively, after implementation of the Proposed Project. Note that "effective" Freshwater Marsh Ballona Wetlands influent concentrations are predicted for the effluent from the Freshwater Marsh to account for repartitioning of metals in the saline and organically rich receiving waters of the Ballona Wetlands. Effective dissolved metals concentrations were estimated using the observed dissolved and particulate fractionation values from the County of Los Angeles' mass-emissions data for Ballona Creek.[152] These effective concentrations more accurately represent the likely contribution of dissolved metals to the saline receiving waters of the Proposed Project because metals tend to bind more readily with organic complexes in saltwater

[152] *Los Angeles County Department of Public Works, 1994-2000 Integrated Receiving Waters Impact Report. http://ladpw.org/wmd/npdes/9400_wq_summaries.zip. The use of the Los Angeles County data for estimating changes to dissolved metals fractionation is considered a conservative use of site-specific data, as water quality monitoring in the San Francisco Bay Estuary indicates that dissolved copper, lead, and zinc are rarely measured at concentrations greater that 50 percent of the total metals concentrations (San Francisco Estuary Institute, SFEI, 1997. Regional Monitoring Program for Trace Substances, 1997 Annual Report.)*

systems than in freshwater systems.[153,154] Refer to Volume III, Appendix G of this Technical Report for information and additional supporting references for the behavior of metals in saline waters. As indicated in the tables, the loads and concentrations entering the Ballona Wetlands from the Freshwater Marsh (which are the only contributions from the adjacent Playa Vista First Phase Project and the Proposed Project) is less than the concentrations from off-site areas. The predicted total influent concentrations show a substantial improvement in water quality due to the initial mixing that would be caused by Freshwater Marsh overflow. There is also an improvement due to the fact that there will be less freshwater entering the Ballona Wetlands, which has historically been a brackish marsh that supports a variety of saltwater tolerant species of flora and fauna. It is important to note that the model does not take into account treatment of off-site runoff in vegetative buffer zones and shallow water areas around the wetland perimeter prior to reaching the main bodies of the Ballona Wetlands; hence, the concentrations associated with off-site runoff are likely to be less than shown in the tables, but not likely as low as effluent quality of the Freshwater Marsh, which was specifically designed to treat stormwater and urban runoff.

To estimate the water quality impacts of the Proposed Project on Ballona Wetlands the predicted average annual pollutant loads and annual average pollutant concentrations for pre-First Phase Project, after First Phase Project and after Proposed Project are explicitly compared below, followed by a comparison of after Proposed Project concentrations to the water quality benchmarks presented in Table 3-21.

<u>Pre-First Phase versus After Proposed Project Influent Loads and Concentrations</u>

The loads and concentrations of several of the pollutants entering the Ballona Wetlands are likely to increase slightly with the implementation of the Proposed Project as compared to post-first phase conditions (which also includes flows from the adjacent Playa Vista First Phase Project) as compared to the adjacent Playa Vista First Phase Project alone. However, these incremental increases were anticipated in the design of the Freshwater Wetlands System. The total reductions in loads and concentrations after the completion of both project phases from pre-project levels meets the goal of no net increase in constituents of concern. Most of the runoff entering the Ballona Wetlands after project completion will be from untreated off-site areas that are not tributary to the adjacent Playa Vista First Phase Project or Proposed Project areas or the Freshwater Marsh. A comparison of the pre-First Phase project loads and concentrations from the Freshwater Marsh to the Ballona Wetlands to the after adjacent Playa Vista First Phase Project and after Proposed Project loads and concentrations is shown in **Table 3-49, Predicted Influent Loads and Concentrations to the Ballona Wetlands from the Freshwater Wetlands System**. The predicted pre-First Phase loads and concentrations are shown to be much larger than the after

---

[153] *Bruland, K.W., Donat, J.R. and D.A. Hutchins, "Interactive Influences of Bioactive Trace Metals on Biological Production in Oceanic Waters," Limnological Oceanography, 36:1555-1577, 1991.*
[154] *Lores, E.M. and J.R. Pennock, "The Effect of Salinity on Binding of Cd, Cr, Cu, and Zn to Dissolved Organic Matter," Chemosphere, 39(5), 861-874, 1998.*

adjacent Playa Vista First Phase Project and after Proposed Project loads and concentrations. As indicated on the table, the loads and concentrations after adjacent Playa Vista First Phase Project and after the Proposed Project would achieve a no net increase from pre-First Phase conditions and in fact significant decreases. This is due to the large amount of urban runoff (approximately 19,000,000 cubic feet per year) that used to be discharged to the Ballona Wetlands prior to construction of the Freshwater Marsh, but is now primarily discharged to the Ballona Channel after treatment in the Marsh. This diverted runoff (92 percent of the Freshwater Marsh inflows, including the Jefferson Storm Drain) accounts for nearly 60 percent of the total runoff volume that once flowed untreated to the Ballona Wetlands. Furthermore, the Freshwater Marsh overflow (i.e., that portion of larger storm flows that is not discharged from the Freshwater Marsh to the Ballona Channel) will be treated prior to discharge to the Ballona Wetlands thereby contributing to additional reduction in the pollutant loads and concentrations.

<u>Comparison to the Water Quality Benchmarks</u>

As shown in **Table 3-50, Total Influent to Ballona Wetlands from the Freshwater Wetlands System After Adjacent Playa Vista First Phase Project and Proposed Project,** and **Table 3-51, Comparison of Water Quality Benchmarks in the Influent to the Ballona Wetlands from the Freshwater Marsh After Proposed Project,** the effluent from the Freshwater Marsh is predicted to meet the water quality benchmarks for dissolved metals, nutrients, total suspended sediment, and oil and grease. For comparison to the saltwater metals CTR criteria (Table 3-50), "effective" influent concentrations from the Freshwater Wetlands System are predicted for dissolved copper, lead, and zinc as discussed above. The effective influent concentrations are believed to more accurately represent the contribution of Proposed Project runoff to the Ballona Wetlands than the unadjusted predicted effluent because the existing model does not take into account the tendency for metals to bind with organic matter in saline and organically rich receiving waters. See Volume III, Appendix G of this Technical Report for details and supporting references for repartitioning the modeled metals in the influent to the Ballona Wetlands.

Based on the fact that none of the water quality benchmarks are predicted to be exceeded in the effluent from the Freshwater Marsh, no significant water quality impacts to the Ballona Wetlands with respect to the modeled parameters are expected as a result of the Proposed Project.

3.2.4.6.1.3 Ballona Channel

Ballona Creek is the largest tributary stream in the Santa Monica Bay watershed with approximately 176 of its 212-square-mile area developed. The major tributaries to the Ballona Creek include Centinela Creek, Sepulveda Canyon Channel, Benedict Canyon Channel, and numerous storm drains that extend well into Beverly Hills. At the outfall of the Freshwater Marsh and the Ballona Wetlands, Ballona Creek is a grouted riprap-sided, earth bottom channel, so it is more appropriately referred to as Ballona Channel in the vicinity of the adjacent Playa Vista First Phase Project and the Proposed Project. On average, 92 percent of the discharges from the Freshwater

Marsh will drain directly to the Ballona Channel with the remaining 8 percent flowing through the Ballona Wetlands prior to draining to the Channel. The Ballona Channel discharges directly to the Santa Monica Bay.

Tables 3-52a, Representative Stormwater Loads to the Ballona Channel Prior to the First Phase Project, and **Table 3-52b, Representative Stormwater Concentrations to the Ballona Channel Prior to the First Phase Project,** are the pre-First Phase predicted loads and concentrations, respectively, to the Ballona Channel from the two primary contributing sources receiving runoff from Proposed Project areas, the Freshwater Marsh and the Ballona Wetlands (which also includes First Phase area and off-site area runoff). **Table 3-53a, Representative Stormwater Loads to the Ballona Channel with Playa Vista First Phase Project,** and **Table 3-53b, Representative Stormwater Concentrations to the Ballona Channel with the Playa Vista First Phase Project,** are the predicted loads and concentrations, respectively, after implementation of the adjacent First Phase Project. **Table 3-54a, Representative Stormwater Loads to the Ballona Channel with Playa Vista First Phase and Proposed Project,** and **Table 3-54b, Representative Stormwater Concentrations to the Ballona Channel with Playa Vista First Phase and Proposed Project,** are the predicted loads and concentrations, respectively, after implementation of the Proposed Project. Note that the values shown in these tables do not take into account the ambient water quality of the Ballona Channel or the substantial amount of stormwater runoff that occurs upstream of the channel segment adjacent to the First Phase and Proposed Projects (e.g., the Project area is about 1 percent of Ballona Creeks total watershed). As with the Ballona Wetlands, to account for repartitioning of metals in the saline receiving waters of the Ballona Channel, the predicted effluent concentrations from the Freshwater Marsh have been adjusted using observed dissolved and particulate metals fractionation values.[155] Refer to Volume III, Appendix G in this Technical Report for details and supporting references for the effective concentration adjustment. As shown in Table 3-54b, the concentrations of the influent from the Ballona Wetlands after Project buildout have higher concentrations of TSS, TP, TKN, total and dissolved copper (TCu and DCu, respectively) and total and dissolved zinc (TZn and DZn, respectively) than the influent from the Freshwater Marsh. These higher concentrations are due to the fact that the Ballona Wetlands primarily receive stormwater runoff from off-site tributary areas that do not receive treatment, as well as the lower treatment levels projected for the Ballona Wetlands. The slightly higher concentrations for total and dissolved lead (TPb and DPb, respectively) in the Freshwater Marsh effluent compared to the Ballona Wetlands effluent is due to the predominant land use types being open space and low-density residential with corresponding lower lead concentrations for the off-site Ballona Wetlands directly

[155] *Los Angeles County Department of Public Works, 1994-2000 Integrated Receiving Waters Impact Report. http://ladpw.org/wmd/npdes/9400_wq_summaries.zip. The use of the Los Angeles County data for estimating changes to dissolved metals fractionation is considered a conservative use of site-specific data, as water quality monitoring in the San Francisco Bay Estuary indicates that dissolved copper, lead, and zinc are rarely measured at concentrations greater that 50 percent of the total metals concentrations (San Francisco Estuary Institute, SFEI, 1997. Regional Monitoring Program for Trace Substances, 1997 Annual Report.)*

tributary areas and the concentration limits applied in the model to the effluent of the Freshwater Marsh.

Pre-First Phase versus After Proposed Project Influent Loads and Concentrations

The changes to predicted annual loads and concentrations to the Ballona Channel from the adjacent Playa Vista First Phase Project and Proposed Project areas, as well as upstream tributary areas are shown in **Table 3-55, Predicted Influent Loads and Concentrations to the Ballona Channel from the Combined Effluent of the Freshwater Marsh and the Ballona Wetlands.** As indicated in the table, the loads and concentrations to the Ballona Channel from the Project areas after project buildout would achieve a no net increase from pre-First Phase conditions. All pollutant concentrations are expected to decrease with the completion of the Proposed Project as compared to the pre-First Phase. Slight increases in loads are expected after project buildout as compared to after the adjacent Playa Vista First Phase Project due to a larger annual runoff volume associated with the Proposed Project. However, these increases in loads are not significant considering the substantial decreases from the pre-First Phase conditions and the fact that concentrations are expected to decrease for all modeled constituents with the completion of the Proposed Project as compared to the adjacent Playa Vista First Phase Project.

The primary reason for these large decreases in concentrations from pre-First Phase to after Proposed Project is the diversion of runoff through the Freshwater Wetland System. The substantial decrease in TSS is attributable to the pollutant removal achieved through the natural wetlands cleansing processes of the Freshwater Marsh, which was specifically intended and designed as part of the adjacent Playa Vista First Phase Project and the Proposed Project stormwater treatment system. In the modeling analysis, it was conservatively assumed that the Ballona Wetlands would only provide minimal treatment by using the 90th percentile of the wet pond effluent data from the NSW BMP Database (see Volume III, Appendix F of this Technical Report for more information). As with the Ballona Wetlands water quality analysis, the differences in the predicted loads and concentrations between after the adjacent Playa Vista First Phase Project and after the Proposed Project are predicted to be minimal.

Comparison to the Water Quality Benchmarks

The Ballona Channel directly receives on average about 92 percent of the annual flows that enter the Freshwater Marsh and nearly 100 percent of the annual stormwater flows that enter the Ballona Wetlands or the Freshwater Marsh. As shown in **Table 3-56, Representative Stormwater Dissolved Metals Concentrations of Discharges to the Ballona Channel from the Freshwater Marsh Compared to Saltwater CTR Criteria,** and **Table 3-57, Comparison of Water Quality Benchmarks in the Influent to the Ballona Channel from the Freshwater Marsh After Proposed Project,** the effective[156] influent concentrations from the Freshwater Marsh meets the

[156] *The effective influent concentrations from the Freshwater Marsh represent the predicted concentrations after being adjusted to account for observed dissolved and particulate metals*

water quality benchmarks for all of the modeled pollutants. Therefore, any future exceedance of the water quality benchmarks for these pollutants in the Ballona Channel would likely be due to off-site runoff that either does not flow through the project areas or does not combine with project runoff prior to reaching the Channel (not modeled).

As shown in Table 3-56, the acute CTR criteria are predicted to be met. Comparison of chronic CTR criteria, which is based on a 4-day averaging period rather than an instantaneous maximum, to predicted metals concentrations is not considered appropriate for assessing potential impacts of stormwater runoff at the Proposed Project due to the short storm durations usually encountered in Southern California (i.e., average storm duration is less than 12 hours) and the small watershed size of the Proposed Project. Nevertheless, the metals concentrations are still predicted to meet the chronic CTR criteria (DCu: 25 μg/L, DPb: 11 μg/L, DZn: 367 μg/L).

Table 3-57 compares the total predicted influent to the Ballona Channel from the Freshwater Marsh to the water quality benchmarks for TKN, TP, TSS, and oil and grease. All of the predicted concentrations are below the benchmarks; therefore, no significant water quality impacts with respect to the modeled parameters are expected in the influent to the Ballona Channel.

Based on the above analysis, the water quality impacts associated with the Proposed Project on the Ballona Channel are considered less than significant with respect to the modeled pollutants.

3.2.4.6.2 *Narrative Significant Impact Assessment*

The potential significant impact with respect to the narrative water quality benchmarks described in Section 3.2.4.1 is assessed in this section. The narrative benchmarks were selected to address potential impacts associated with unmodeled water quality parameters, as well as other factors that cannot be addressed numerically. Potential impacts to the Santa Monica Bay are qualitatively discussed, followed by comparisons of project mitigation measures to the Los Angeles County Standard Urban Stormwater Mitigation Plan (SUSMP) requirements. Narrative assessments of the potential impacts with respect to the 303(d) listed water quality parameters, the narrative objectives in the Basin Plan, channel stability, and dry weather flows are also included in the discussion below.

3.2.4.6.2.1 Santa Monica Bay

Santa Monica Bay receives urban runoff directly from the Ballona Channel. Development of the Proposed Project could potentially increase the total annual pollutant loads to the Bay. To avoid this potential impact, the Proposed Project will incorporate a number of both source control and treatment control BMPs as previously described. A substantial proportion of stormwater pollutants that

---

fractionation in estuarine waters. For a more detailed explanation see Volume III, Appendix G of this Technical Report.

otherwise would be generated and conveyed from the Proposed Project site as well as from the adjacent Playa Vista First Phase Project would be reduced by on-site source, design, and treatment control stormwater BMPs. Pollutants that cannot be further reduced at the source or retained on-site, and pollutants originating from off-site land uses tributary to the site, would be managed to acceptable levels by the natural processes of pollutant removal in the planned Freshwater Wetland System and the Ballona Wetlands.[157]

As shown in Table 3-2, the Santa Monica Bay has 16 water quality parameters listed on the 303(d) list. Among these are the proposed to be delisted modeled metals, copper, lead, and zinc, all of which, as discussed above, are predicted to be well below the CTR criteria with implementation of the Proposed Project. The other metals listed include cadmium, mercury, nickel, and silver, which are also proposed by the SWRCB for delisting. These metals are usually associated with specific industrial and commercial processes, vehicular pollutants, or improper disposal of items containing them (refer to the Section 3.2.4.5.2.4 Comparison to 303(d) Listed Parameters for more detailed information on potential sources of these metals). Other toxic chemicals included on the 303(d) list for Santa Monica Bay include pesticides, polychlorinated biphenyls (PCBs), and polycyclic aromatic hydrocarbons (PAHs). These chemicals as well as the metals mentioned above may contribute to the fish consumption advisory and sediment toxicity parameters included on Santa Monica Bay's 303(d) list. Businesses utilizing materials and/or generating wastes containing any of these 303(d)-listed pollutants would be subject to strict materials handling and disposal requirements. Education and outreach efforts would focus on informing the public and businesses of consumer products containing these pollutants, how to properly dispose of them, and where to find, and why they should use, less toxic alternatives. Roadside BMPs and the Freshwater Wetlands System are expected to control motor vehicle-related pollutants. As discussed below in the general discussion of dry-weather flows (Section 3.2.4.6.2.6 Assessment of Dry Weather Flows), the Proposed Project is unlikely to contribute to high coliform counts (a 303(d) listed parameter for the Santa Monica Bay Beaches with Dry-weather and Wet-weather TMDLs) in the Santa Monica Bay because a new sewer system, which would be unlikely to have leaks, would be installed on-site. The public would be encouraged through public outreach to pick up after their pets and to minimize dry-weather runoff from their properties, as dry-weather runoff is often associated with higher levels of bacteria.

With the planned source control and treatment control BMPs as well as the fact that the stormwater runoff from the Proposed Project would only contribute a very minor fraction of the total runoff to the Santa Monica Bay (less than 0.2 percent), the Proposed Project is not expected to cause or contribute to exceedances of regulatory standards applicable to Santa Monica Bay (such as CTR criteria) and would not create pollution, contamination, or nuisance conditions as defined in Section 13050 of the

---

[157] *The Ballona Wetlands, in its existing condition, naturally serves to remove pollutants, any future salt marsh restoration will, in reality, enhance the water quality treatment ability of the Ballona Wetlands.*

CWC in Santa Monica Bay. Hence, the Proposed Project impacts on the Santa Monica Bay would be less than significant.

The SUSMP outlines additional requirements based on the specific land use category types. These include:

- 100,000 square foot or larger commercial developments
- Automotive repair shops
- Retail gasoline outlets
- Restaurants
- Home subdivisions with 10 to 99 housing units
- Home subdivisions with 100 or more housing units

Specific design requirements for any facilities in the above categories will be incorporated as appropriate. A detailed discussion of SUSMP requirements and corresponding Playa Vista management measures are provided in the following section.

The model results presented in Section 3.2.4.6.1, Numerical Significant Impact Assessment, indicate that following completion of the adjacent Playa Vista First Phase Project and the Proposed Project and the incorporation of the proposed water quality features (i.e., Riparian Corridor and Freshwater Marsh), the predicted annual pollutant concentrations and loads to Santa Monica Bay via the Ballona Channel from project runoff and upland areas that flow through the Project site decrease for all modeled constituents. Therefore, no significant adverse impact to the water quality of Santa Monica Bay is expected to occur from surface water runoff associated with completion of the Proposed Project (i.e., buildout).

3.2.4.6.2.2 Municipal Stormwater NPDES Permit (MS4 Permit)

In order to assess whether the Proposed Project would meet or violate MS4 Permit requirements, the nature, design, and features of the proposed Storm Water Management Program were compared to the requirements of the SUSMP program. This comparison includes the sizing of water quality facilities to the SUSMP Standards, which details the local standards for stormwater quality BMP design sizing as well as required source controls.

Treatment Sizing Requirements

The planned BMPs (e.g., Freshwater Wetlands System, water quality inlets) have been designed to treat storms larger than the 0.75-inch requirement for both the adjacent Playa Vista First Phase Project and Proposed Project on-site areas and for the existing development (off-site areas). The Freshwater Wetlands System has been designed to treat about one inch of runoff (volume and flow rate) from its contributing watershed of over 1,000 acres. In addition, the Freshwater Marsh has been designed to prevent flooding and stream channel erosion caused by storm events equal to or less than the 50-year return interval. Also, some features of the Proposed Project (such as the adjustable weir and low-flow diversion outlet structures in the Freshwater Marsh, which will control peak runoff rates while providing substantial control of stormwater pollutants of concern during dry-weather and average-size storm events) were planned and designed in response to the general SUSMP requirements. During the planning phase of the Proposed Project, natural areas and areas with significant slope were not considered for development; instead these areas have been designated as the Habitat Creation/Restoration Component. Commitments to a Public Education Program (including storm drain stenciling and signage, and ongoing BMP maintenance) were conceived during the early planning stages of the Proposed Project, as these are specific requirements of the City of Los Angeles' MS4 Permit and the SUSMP. All other SUSMP design requirements, including those for individual priority project categories have been included in the development plan for the Proposed Project.

Peak Runoff Discharge Rates and Channel Stability

In addition to the BMP sizing requirements, the SUSMP addresses peak stormwater runoff discharge rates and protection of slopes. As discussed in Section 2 of this Volume, the Proposed Project is not expected to increase peak runoff discharge rates to the Riparian Corridor or the Ballona Channel to an extent that would cause increased potential for downstream erosion. In fact the Freshwater Wetlands System was designed and built to handle the Proposed Project flow rates. However, a brief discussion is provided here to further emphasize that the Proposed Project would not contribute to channel instability, and as such would not create a nuisance as defined in Section 13050 of the CWC or cause a regulatory standard to be violated as defined in the applicable NPDES Permit (MS4 Permit).

Increased impervious areas associated with urban development can cause changes in stream morphology (e.g., changes in the form and structure of biological organisms). While uncontrolled urbanization typically does increase the energy in receiving waters, the status and attributes of the receiving water must be taken into account when assessing the nature, extent, and significance of such an increase.

All runoff from the adjacent Playa Vista First Phase and Proposed Project site eventually is discharged to the estuary portion of the Ballona Channel, which is composed of grouted riprap-side slopes and an earthen bottom. The earthen bottom is subject to potential scour if discharge velocities increase substantially with project implementation. However, impacts are unlikely considering that runoff from larger events would overflow into the Ballona Wetlands. During smaller events, the runoff that enters the Freshwater Marsh would be detained for up to 72 hours before discharging, reducing the energy in the Ballona Channel during stress times when flows and velocities in the Channel generally are near maximum values. The existing Ballona Wetlands do not discharge to the Channel when the Channel is full due to the one-way flap gates. The potential impact of peak runoff to the Ballona Channel would not cause a regulatory standard to be violated as defined in the applicable NPDES stormwater permit or create pollution, contamination and nuisance, as defined in Section 13050 of the CWC; therefore, a less than significant impact to the Channel would occur.

The other channels that would receive runoff include the Riparian Corridor, a man-made vegetated channel, and the existing channels that are presently located in the Ballona Wetlands. All of these channels have, or will have very low slopes and, therefore, relatively low velocities, even during flood events. The Proposed Project includes additional diversion of stormwater to the Ballona Channel, which historically flowed directly to the Ballona Wetlands. Runoff volumes to the Ballona Wetlands from project areas would be reduced by nearly 90 percent as compared to pre-First Phase with the completion of the Proposed Project (i.e., including the adjacent Playa Vista First Phase Project and the Proposed Project and associated Freshwater Wetlands System that diverts freshwater flows from discharge into the Ballona Wetlands).

This reduction of runoff volumes, which offsets some portion of the increases that have occurred over the last approximately 50 years due to other development, would reduce runoff energy in the channels within the Ballona Wetlands over pre-First Phase conditions. Spillover from the Freshwater Marsh to the Ballona Wetlands during larger storm events (i.e., greater than a 1-year design storm) is not expected to erode the receiving area of the Wetlands. The spillover weir for the Freshwater Marsh is constructed of articulate block (i.e., "armor-lock") and includes a spilling basin for energy dissipation of the overflow before entering the Ballona Wetlands. During large storms, water would accumulate in the Wetlands and velocities are expected to be low within the Wetlands channels. The potential impact to the stability of the Ballona Wetlands would not cause a regulatory standard to be violated as defined in the applicable NPDES stormwater permit or create pollution, contamination and nuisance, as defined in Section 13050 of the CWC; therefore, a less than significant impact would occur.

<u>BMP Maintenance</u>

The SUSMP, as well as the MS4 Permit, requires proof that permanent structural BMPs will be maintained, including a signed statement from the developer accepting responsibility for BMP maintenance until the time of property transfer. At that time, a signed agreement from a public entity, or property recipient who would assume responsibility for the maintenance would be required. The "Ballona Freshwater Wetlands System Operations, Maintenance, and Monitoring Manual" provides a detailed maintenance and monitoring schedule for the Freshwater Wetlands System including a declaration of the entities responsible for funding and conducting the maintenance and monitoring.[158] In addition, the Proposed Project includes on-site operation and maintenance programs designed to minimize environmental impacts

---

[158] *Surface Water Resources, Inc., 2001. The Ballona Freshwater Wetlands System Operations, Maintenance and Monitoring Manual. Prepared for Playa Capital Company, 2001.*

including: a tenant/resident education program, a street and catch basin cleaning program, a fertilizer and pesticide management system, and an internal shuttle system.

The results of a comparison of the Storm Water Management Plan with the SUSMP, as shown in Table 3-22 demonstrates that the Proposed Project as described meets or exceeds all requirements developed by the County of Los Angeles and approved by the RWQCB as being protective of receiving water quality and meeting the waste discharge requirements of the MS4 Permit to reduce the discharge of pollutants from the stormwater system to the "maximum extent practicable". As such, implementation of the Proposed Project would not cause regulatory standards to be violated, as defined in the applicable NPDES Permit (MS4 Permit) for the receiving waterbody; hence, the Proposed Project impacts would be less than significant.

3.2.4.6.2.3 Comparison to Basin Plan Narrative Water Quality Objectives

The narrative water quality objectives in the Basin Plan attempt to address a wide variety of pollutants, including those listed on the 303(d) list of the project receiving waters as discussed above. While the potential impacts caused by some pollutants of concern were addressed in the numerical significant impacts section there are several pollutants that, individually or in combination, have the potential to degrade water quality that cannot be addressed numerically. While the potential impacts caused by some pollutants of concern listed in the Basin Plan will be addressed in the waterbody-specific impacts subsections below, there are additional parameters that are not waterbody-specific and are qualitatively discussed to adequately assess potential impacts of the Proposed Project. Dry-weather flows are often considered nuisance flows and several of the water quality parameters listed in the Basin Plan, such as biostimulatory substances, floatable materials (including oil and grease), color, taste and odor, can contribute to or can be associated with nuisance conditions. The following paragraphs discuss how the Proposed Project would meet the water quality objectives of the Basin Plan. For a detailed assessment of Basin Plan water quality objectives in comparison to Project Design Features, refer to **Table 3-58, Comparison of Proposed Project to Basin Plan Narrative Objectives**. An assessment of dry-weather flows, which is also addressed in the Basin Plan, can be found below in Subsection 3.2.4.6.2.6.

In general, increased runoff velocities could potentially cause bank erosion and channel scouring resulting in an increase in suspended or settleable solids in the receiving waters, which could lead to a condition of nuisance as defined in the Basin Plan. However, since no substantial increases in runoff velocities are expected as a result of the Proposed Project (see Section 2 of this Volume), the Proposed Project will not cause suspended or settleable materials in the receiving waters to be in concentrations that would constitute a nuisance or adversely affect beneficial uses. Therefore, the Proposed Project would not cause regulatory standards to be violated as defined in the Basin Plan for the receiving waterbody; hence, the Proposed Project would have a less than significant impact.

Bioaccumulation, Chemical Constituents, Pesticides, and Toxicity

The 303(d)-listed water quality parameters for the receiving waters of Project runoff that have a tendency to bioaccumulate include arsenic, cadmium, silver, lead, PCBs, PAHs, DDT, and chlordane. Most of these metals and chemicals are likely due to historical sources, as several of them bind tightly to soils and sediment and either do not degrade (e.g, metals) or degrade slowly (e.g., DDT, PCBs, etc.). Some of these chemicals have been banned by federal law (i.e., DDT, PCB) and are no longer in common use. However, others (e.g., PAHs) may reflect more recent impacts associated with urban activities (e.g., vehicle use and maintenance). Public education efforts would focus on informing residents and businesses of some of the potential toxic and bioaccumulative pollutants that they may have in their possession and how to properly store, use, and dispose of these materials to minimize environmental impacts. Also, the proposed treatment control BMPs, with regular maintenance, should minimize the transport of any unknown sources of contaminated soils and sediment to receiving waterbodies.

Selenium, another potentially toxic and bioaccumulative pollutant that may be present in discharges to receiving waters, is proposed to be listed in the 2002 303(d) list as causing impairment to the Ballona Creek upstream of the Proposed Project. Selenium is a naturally occurring metalloid that is an essential element for vertebrates at low concentrations and toxic at elevated concentrations. The tendency of selenium to bioaccumulate in living organisms has led to adverse impacts on fish and birds in several wetlands in the western United States.159 The CTR criteria for total selenium in freshwater is 20 µg/L for acute exposure and 5 µg/L for chronic exposure. While selenium is not listed or proposed to be listed for Project receiving waters, it may pose a risk to biota in the Freshwater Wetlands System if persistent selenium loadings occur. However urban runoff (dry- or wet-weather) is not considered a significant source of selenium,[160] and only 3 out of 25 samples collected by the Los Angeles County Department of Public Works (1997-1999)[161] in the Ballona Creek just upstream of the estuary exceeded the chronic CTR criteria (no acute criteria exceedances), and these three samples only occurred during stormwater runoff events. Potential dry-weather issues associated with selenium are discussed in Section 3.2.4.6.2.6. During wet-weather, possible low levels of selenium are not expected to cause impairment to receiving waters because the anaerobic wetland soils of the Riparian Corridor and the Freshwater Marsh are expected to reduce soluble selenium to immobile forms, permanently setting apart stormwater selenium in the bottom sediments. Due to the relatively low levels of selenium expected to reach the Freshwater Wetlands System,

---

[159] *United States Department of the Interior, 1998. National Irrigation Water Quality Program Information Report No. 3: Guidelines for Interpretation of the Biological Effects of Selected Constituents in Biota, Water, and Sediment: Selenium. Participating agencies include Bureau of Reclamation, U.S. Fish and Wildlife Service, U.S. Geological Survey, and Bureau of Indian Affairs.*
[160] *RWQCB, Santa Ana Region, 2002. Total Maximum Daily Load for Toxic Pollutants for San Diego Creek and Newport Bay, California, June 14, 2002 (Technical Support Documents, Part D-Selenium, Section III, Page 13)*
[161] *RWQCB, Los Angeles Region, 2002. Ballona Creek 303d Fact Sheet. March 29, 2002. [Online] http://www.swrcb.ca.gov/tmdl/docs/segments/region4/ballona303d_factsheet_nomun.doc*

the selenium in the soils are not expected to reach levels of concern in the near or distant future. However as a precaution and as part of the HMMP, the soils and vegetation in the Freshwater Wetlands System will be periodically analyzed for bioaccumulation of toxicants, including selenium. If concentrations of toxicants approach levels of concern in soils or biota, remedial actions such as dredging and vegetation removal will be performed. The frequency of these activities will be dictated by observed sediment accumulation rates, as well as periodic sediment quality analyses.

Although pesticides can be highly persistent in the environment (because many bind tightly to soils and sediment), the monitoring of Los Angeles County's stormwater has resulted in the determination that most pesticides are at undetectable levels and, when they are detectable, the concentrations minimally exceed detection levels. Notable concentrations of pesticides have not been detected in soils or surface water at the Proposed Project site. The Proposed Project has committed to minimizing the use of pesticides and herbicides through the use of both source and structural controls. Pesticides would only be applied when needed in public landscaped areas (the vast majority of on-site landscaping) by qualified landscape professionals and these chemicals would be carefully stored in appropriate facilities when not in use. Paving and landscaping would serve to contain potential historical sources of pesticides. Public education efforts would focus on: 1) informing the public of the dangers of poor sediment control on their properties, 2) methods to minimize off-site runoff and reduce erosion, and 3) encouraging proper disposal of banned pesticides, if in existence.

The anaerobic conditions and associated bacterial populations that are expected in the wetland soils of the Riparian Corridor and the Freshwater Marsh will reduce many metals to insoluble forms that are less toxic and less bioavailable. Also, trace metals will be sampled several times per year in the water and annually in the sediment of the Freshwater Wetlands System to ensure trace metals concentrations do not exceed levels of concern (e.g., CTR criteria or probable effects levels [PELs] for water and sediment respectively).

The Freshwater Wetlands System O&M Manual specifies bioaccumulation/toxicity analysis on vegetation and sediment removed during maintenance and monitoring operations, which will occur as needed, at least every 10 to 20 years in the Freshwater Marsh and Riparian Corridor and possibly annually in the primary management areas. Vegetation and sediment removal frequencies will depend on sediment accumulation rates and results of annual sediment quality analyses conducted as part of the USACEs Five-Year Monitoring Program and the SWRCB Water Quality Certification Program. Samples of sediment and plant materials for bioaccumulation analysis will be submitted to a state certified laboratory for soluble Threshold Limit Concentration and Total Threshold Limit Concentration analyses. Results of the bioaccumulation tests, as well as the other sediment quality monitoring results, will be used to determine proper disposal methods of the removed materials and any further measures required in the Freshwater Wetlands System to retain habitat quality objectives. Calculations based upon estimated TSS removals indicate that the frequency of maintenance might be as low as once every 100 years in the primary management areas, however, a 10 to 20 year frequency was conservatively estimated to account for unanticipated sediment loadings caused by infrequently large storm events or other unpredictable causes.

As discussed above, through extensive source and treatment control BMPs, as well as frequent monitoring and maintenance planned for the Freshwater Wetlands System, the potential bioaccumulatory and toxicity impacts associated with metals, pesticides, and other toxic chemicals are not expected to create pollution, contamination, or nuisance as defined in Section 13050 of the CWC. As such, implementation of the Proposed Project would not cause regulatory standards to be violated; hence, the Proposed Project impacts would be less than significant with respect to bioaccumulation and toxicity.

Biochemical Oxygen Demand and Biostimulatory Substances

Biodegradable organic materials, such as human and animal waste and vegetative matter, are the primary substances that could cause increases in biochemical oxygen demand (BOD) and potential decreases in dissolved oxygen in the receiving waters. Public education efforts and enforcement of City ordinances would encourage picking up and properly disposing of pet wastes. Catch basin inserts and trash racks would be the primary treatment controls for removing organic debris from stormwater runoff. The Freshwater Marsh is expected to have the ability to decrease BOD through phytoassimilation (plant uptake) of organic materials. Biostimulatory substances may increase BOD, so some measures presented above (e.g., education programs, careful landscape maintenance, structural BMPs) apply to this category as well. Biostimulatory substances include fertilizers and other sources of nutrients, which stimulate growth of aquatic organisms such as algae. The modeling of nitrogen and phosphorus indicated that there would not be any significant impact to receiving waters with respect to these nutrients. In addition, only slow-release fertilizers that are applied directly to the soil would be used to establish vegetation and they would not be applied during or within 72 hours of a forecasted rain event. Erosion and sediment control measures that are implemented with the project would minimize the export of nutrients from the Proposed Project site.

As discussed above, through the use of on-site BMPs, the Freshwater Wetlands System, and public education, BOD and biostimulatory substances are not expected to create pollution, contamination, or nuisance as defined in Section 13050 of the CWC. As discussed below under the separate receiving waterbodies, nitrogen and phosphorus were not predicted by the pollutant loading model to exceed water quality benchmarks, and therefore are not expected to cause narrative regulatory standards to be violated as defined in the Basin Plan for the receiving waterbody; hence, the Proposed Project impacts would be less than significant with regard to BOD and biostimulatory substances.

Color and Odor

Color and odor associated with water can result from decomposition of organic matter or the reduction of inorganic compounds, such as sulfate. Color in water from man-made sources typically results from commercial or industrial discharges. The Proposed Project site would consist primarily of high-density residential development with some commercial areas. Industrial sources of pollutants would not be present on the Proposed Project site. Commercial areas would consist primarily of retail outlets, which are not expected to be a significant source of water quality constituents that would impart color or odor to dry or wet-weather flows originating from the Proposed Project site. Source controls such as street sweeping and waste management services are expected to reduce the amount of plant material, which during decomposition could cause coloration from the release of dissolved or colloidal substances, from reaching the stormwater management system. The structural BMPs of the Proposed Project are designed to remove and/or assimilate suspended and dissolved organic matter, reducing the potential for discoloration in discharges to receiving waters.

The production of hydrogen sulfide, an offensive smelling gas caused by the reduction of sulfates by anaerobic bacteria, is likely to occur or continue to occur in the reduced sediments of the Riparian Corridor, the Freshwater Marsh, and the Ballona Wetlands. However, hydrogen sulfide production is not expected to increase beyond current production rates because there will not be a significant source of sulfates from the Proposed Project. The movement of air due to the close proximity to the ocean will dissipate any hydrogen sulfide gas produced.

Therefore, substances that cause odor or discoloration of water are not expected to create pollution or nuisance as defined in Section 13050 of the CWC or to cause regulatory standards to be violated as defined in the Basin Plan for the receiving waterbody. Hence, the Proposed Project impacts would be less than significant with regard to color and odor of receiving waters.

Sediments and Turbidity

Erosion and sediment controls will be the primary source control measures to limit the export of suspended or settleable material (e.g., sediment) from the Proposed Project site. All construction activities occurring after Project buildout (with the adjacent Playa Vista First Phase Project and Proposed Project) will be closely monitored to ensure effective erosion and sediment control BMPs are used. Other source controls include the use of native vegetation in much of the landscaping in order to minimize the potential for erosion. By reducing the amount of exposed soils (erosional surfaces), the development of the Proposed Project will reduce erosion. Structural BMPs specifically designed to achieve high levels of particulate removal (and associated pollutants) will be implemented to provide treatment of stormwater and dry-weather flows. The combination of source and structural controls targeted at reducing the entrainment and transport of suspended or settleable material is expected to maintain concentrations of these constituents well below Basin Plan water quality objectives.

The entire Freshwater Wetlands System, particularly the primary management areas of the Freshwater Marsh, is specifically designed to capture sediments. Sedimentation rates will be annually monitored in the Marsh and the Riparian Corridor as part of the O&M Manual. If accumulated sediments begin significantly reducing the storage volume in these areas or, as noted above, begin excessively segregating pollutants, sediment removal activities will be performed. Based on estimates of total suspended sediment loads to the Freshwater Marsh after completion of the adjacent Playa Vista First Phase Project and Proposed Project, the rate of sedimentation in the primary management areas should be reduced by approximately 6 percent on average. The reduction in sedimentation is due to on-site treatment controls (i.e., vegetated swales, roof-drain planter boxes, additional catch basin inserts, etc.) included in the Proposed Project. Therefore with regard to captured sediment, the Proposed Project is expected to reduce sedimentation rates in the Riparian Corridor and the Freshwater Marsh as compared to the adjacent Playa Vista First Phase Project.

Through control of suspended and settleable materials such as sediment, as well as the control of biostimulatory substances, as discussed above, the Proposed Project will not contribute to biological growth and increased turbidity. The Proposed Project impacts would be less than significant with regard to turbidity, erosion, or suspended or settleable material.

To address the narrative water quality objectives of the Basin Plan, comparisons of these objectives to the mitigation measures were made (see Table 3-58).

3.2.4.6.2.4 Comparison to 303(d) Listed Parameters

The Santa Monica Bay, the Ballona Wetlands, and the Ballona Creek Estuary, as well as the Ballona Channel upstream of the Proposed Project have been listed on the RWQCB's 303(d) list of impaired water bodies (see Table 3-2). This section presents, by each water quality constituent (including recently proposed-to-be-listed pollutants), how the Proposed Project has either (1) addressed the listed pollutant with regards to BMPs or (2) explained why the Proposed Project would not contribute to pollutant loads of the constituent. The data collected by Los Angeles County at multiple urban land use catchments has been used to assess the likelihood that the Proposed Project may contribute to some of these listed pollutants. The 303(d) listed parameters have been divided according to six groups: metals, pesticides, other toxic chemicals, trash and debris, biological, physical, and general toxicity. A discussion of the chemical and physical properties and/or characteristics of each 303(d) parameter is included, followed by a discussion of the potential impacts of each parameter.

Metals

This group of 303(d) parameters includes arsenic, cadmium, copper, lead, mercury, nickel, selenium, silver, and zinc. Since all of these metals have a tendency to adsorb to soil and sediment, erosion and sediment controls will be the primary source control measures for historic sources. The effectiveness of erosion and sediment control measures will be monitored during all construction activities where soils may be exposed to rain and/or wind. Public education and outreach will be the primary source control measures for potential future sources. Effort will be made to minimize the use of construction materials that will potentially release dissolved metals when exposed to rain. The stormwater BMPs, when maintained properly, are expected to remove significant amounts of metals. Following brief discussions of the properties and likely sources of the individual metals, pollutant-specific mitigation measures are discussed below.

Arsenic. Arsenic is a naturally occurring element in soils and minerals. Mining and coal-fired power plants contribute to the release of arsenic to water and air. The wood preservative chromated copper arsenate (CCA) is currently the most used (90 percent) form of arsenic in the U.S. However, the greatest use of arsenic in metal alloys is in lead-acid batteries used in automobiles. Many common forms of arsenic can dissolve in water, however most arsenic ends up in the soil or sediment. The State of Santa Monica Bay report states that municipal wastewater accounts for the majority of arsenic to the Bay from point sources. Non-point sources contribute significantly lower amounts of this constituent as evidenced by the low levels of arsenic found in stormwater runoff from monitoring conducted by Los Angeles County.[162] Nonetheless, contractors and the general public will be encouraged not to use CCA preserved wood products, particularly in areas whose runoff flows directly to the storm drain system. The public will be encouraged and informed how to properly dispose of lead-acid batteries.

Cadmium. Cadmium is most often present in the environment as complex oxides, sulfides, and carbonates in zinc, lead, and copper ores. It is not usually present as a pure metal in nature. Cadmium compounds are often found in or attached to small particles in air and water. Cadmium is released into the environment from mining operations and burning of fossil fuels, as well as improper disposal of items containing cadmium such as fertilizers, batteries, pigments, metal coatings, plastics, fungicides, insecticides, tires, ceramic and glass glazes, cigarettes, and some metal alloys. Cadmium has been detected in Los Angeles County urban stormwater from commercial and transportation land uses, but in concentrations that were well below criteria values. Fertilizers, insecticides, and fungicides containing cadmium will not be used. Strip-type biofilters and swales near roadsides are likely to capture a significant portion of cadmium from tire wear or other roadway sources.

Copper. Copper is naturally present in rock, soil, water, and air. Metallic copper can be found in alloys, wire, pipe, and sheet metal. The most common copper compound is copper sulfate. Copper compounds are used as fungicides, bactericides, algaecides, and as preservatives for wood, leather, and fabric. Copper is an essential nutrient for plants and animals, however it is toxic at high concentrations or long exposure durations. Most copper compounds will tightly bind to sediment particles. Contractors will be encouraged not to use copper roofing materials and chromated-copper arsenate (CCA) treated wood in areas that directly drain to the stormwater

---

[162] *The State of Santa Monica Bay Part One: Assessment of Conditions and Pollution Impacts, Southern California Association of Governments, by MBC Applied Environmental Sciences, October 1998.*

system. Because copper is a common highway runoff pollutant the strip-type biofilters and vegetated swales should provide substantial pre-treatment before stormwater reaches the storm drain system. These BMPs were not considered in the pollutant loads model, so the copper concentrations discharged to receiving waters may actually be less than predicted by the model.

Lead. Lead is naturally occurring in small amounts, but most of the lead in the environment is due to human activities. The primary uses of metallic lead today are in batteries, ammunition, and various metal products. Lead compounds have been historically used in gasoline, tires, paint, ceramics, caulking, water pipes, and solder. Before lead in gasoline was banned most of the lead released to the environment came from car exhaust. Lead has a strong affinity to bind to soil particles. Since the First Phase and Proposed Projects are new developments there should be very few, if any, new sources of lead. Although elevated levels of lead have been detected in soils near the Former Firing Range (see Section IV-I Safety Risk of Upset of the Proposed Project's Draft EIR), any concentrations exceeding regulatory standards will be remediated as part of the CAO No. 98-125. As with copper and cadmium, lead is also a common highway runoff pollutant that will be treated with the roadside BMPs.

Mercury. Mercury can be found in several forms in the environment: elemental, inorganic, or organic. Metallic mercury is used in the production of chlorine gas and caustic soda and in the extraction of gold from ore. It is also used in thermometers, barometers, fluorescent light bulbs, batteries, electrical switches, and dental fillings. Inorganic mercury compounds can be found in paint, topical antiseptics, disinfectants, and fungicides. The most common organic mercury compound is methylmercury, which is converted from other forms of mercury by microorganisms. Methylmercury is of particular concern because it is known to bioaccumulate and persist in the environment for long periods of time. The primary potential sources of mercury releases from the project area are the burning of fossil fuels and improper disposal of consumer products that contain mercury. Source control measures will include public education and an internal electric vehicle transit system.

Nickel. Nickel is primarily found in the environment combined with oxygen or sulfur. In industry, nickel is used in alloys of iron, copper, chromium, and zinc. These alloys are often used to make jewelry, coins, valves, and heat exchangers. The most common use of nickel is to make stainless steel. Nickel also exists as compounds with chlorine, sulfur, and oxygen, which are used in nickel plating, ceramics, and some batteries. Nickel is released to the environment during nickel mining, combustion of oil and coal, and from industrial discharges. Nickel will strongly attach to soil or sediment containing iron or manganese. It has not been shown to bioaccumulate in plants or animals. Currently there are no industries planned for the project area that use nickel in any significant quantities. Therefore, nickel is not a pollutant of concern for the Proposed Project.

Selenium. Selenium is a naturally occurring element in the environment. It is an essential element at low-levels but becomes toxic a high concentrations. In natural waters, selenium can exist in four primary oxidation states and as a variety of different inorganic and organic compounds. The most common oxidation state in oxygenated surface water is selenate. Besides natural occurrence, selenium can be found in anti-dandruff shampoos, gun blueing (a liquid solution used to clean the metal parts of a gun), and industrial discharges. In anaerobic conditions, selenium will be reduced by microorganisms to elemental selenium or hydrogen selenide, which are not as bioavailable and therefore less toxic than the dissolved forms of selenium. Many plants will accumulate selenium in their tissues. Since there are not any planned industries that will be discharging selenium, natural sources are expected to contribute the majority of selenium to receiving waters from the project area. Urban runoff is not a significant source of selenium. Wetland vegetation and anaerobic soils in the Riparian Corridor and the primary management areas of the marsh are expected to remove any selenium that may potentially be discharged from the project areas. Sediment and vegetation will be monitored

Silver. Silver occurs naturally both in its pure form and combined in the environment. It is used in jewelry, silverware, electronic equipment, and dental fillings. The major unnatural sources of silver in the environment include photographic materials and mining. Many silver compounds dissolve in water and do not readily evaporate, so transport to groundwater is common. Silver is not considered a pollutant of concern for the Proposed Project as it is usually associated with specific industrial and commercial sources and it is expected that there will be few, if any, of the types of businesses within the Proposed Project that utilize silver (photo processing or electronics manufacturers). Newer businesses of these types would be subject to requirements to control the escape of such material.

Zinc. Zinc is one of the most common elements in the earth's crust. Both elemental and combined zinc occur naturally in the environment. Zinc sulfide is the most common zinc ore. Metallic zinc is used to coat iron or other metals so they do not rust or corrode. It is also mixed with other metals to form alloys such as brass and bronze. Metallic zinc is also used in dry cell batteries. Zinc compounds are used to make white paints, ceramics, rubber, wood preservatives, and fabric dyes. Zinc compounds are also used in sun blocks, diaper rash ointments, deodorants, athlete's foot preparations, acne and poison ivy preparations, antidandruff shampoos, and vitamin and mineral supplements. Zinc is an essential element, however exposure to elevated concentrations may pose health risks. Virtually all of the planned mitigation measures will contribute to the reduction in zinc concentrations to the receiving waters. Roadside BMPs will pretreat roadway sources of zinc prior to discharging to the stormwater system.

<u>Pesticides</u>

There are several pesticides listed on the 303(d) list for the receiving waters of project runoff. Most of them have been banned for use in the U.S., while others are still actively used. Chlordane and DDT are listed for Ballona Creek Estuary, Ballona

Creek, and the Santa Monica Bay. Dieldrin and the Chem A pesticides (aldrin, dieldrin, chlordane, endrin, heptachlor, heptachlor epoxide, hexachlorocyclohexane (including lindane), endosulfan, and toxaphene) are listed only for Ballona Creek.

Historical Pesticides. The pesticides DDT and most of the Chem A pesticides including aldrin, chlordane, dieldrin, endrin, heptachlor, heptachlor epoxide, and toxaphene, have all been banned for use in the U.S. DDT has been banned since 1972. The EPA banned all uses of aldrin and dieldrin in 1987, heptachlor and chlordane in 1988, and toxaphene in 1990. Heptachlor epoxide is a breakdown product of heptachlor. Endrin has not been produced or sold for general use in the United States since 1986. Although these pesticides are highly persistent in the environment (due to the fact that they all bind tightly to soils and sediment), in Los Angeles County's stormwater monitoring they have been mostly undetected and when they are, the concentrations minimally exceed detection levels. Because of the lack of data for predicting the concentrations of these constituents, they were not included in the modeling. Notable levels of these pesticides have not been detected at the Project site. Notwithstanding, erosion and sediment controls, as well as public education, will limit the unintended movement of soils during construction. All construction activities will be closely monitored to ensure effective erosion and sediment control BMPs are used. Also, paving and landscaping will serve to contain historical sources of these pesticides. Public education efforts will focus on: 1) informing the public of the dangers of poor sediment control on their properties, 2) methods to minimize offsite runoff and reduce erosion, and 3) encouraging proper disposal of banned pesticides that some people may still possess.

Currently Used Pesticides. Of the 303(d) listed pesticides, endosulfan and lindane are still in use in Los Angeles County. Endosulfan is a restricted use pesticide that can only be obtained and used by licensed professionals. It is used as an insecticide on grains, tea, fruits, vegetables, tobacco, coffee, and cotton, and also as a wood preservative. It is moderately persistent in soils where its half-life is about 50 days. In water it does not dissolve well however it has a half-life of only about 7 days in water. In 2000, greater than 95 percent of the reported endosulfan used in Los Angeles County was for the treatment of peach and nectarine crops[163]. Commercial farming is not included in the First Phase Project or the Proposed Project, so use of this compound as an insecticide will not be an issue. Contractors will be restricted from using endolsulfan-treated wood products.

Lindane is also a restricted use pesticide that is no longer produced in the U.S., however it is still imported. The general public can obtain lindane-containing shampoos and lotions for the treatment of ticks and head lice with a prescription. The use of lindane as a fungicide on seeds is the most widespread use in the U.S., however it is also used as an insecticide and fumigant on a wide range of soil-dwelling and

[163] *Department of Pesticide Regulation, 2000. Annual Pesticide Use Report Preliminary Data: Los Angeles County Indexed by Chemical. [Available Online] http://www.cdpr.ca.gov/docs/pur/pur00rep/chemcnty/Losang00.pdf*

plant-eating insects on fruits, vegetables, and forest crops. In 2000, 98 percent of the reported lindane used in Los Angeles County was applied to outdoor plants and for landscape maintenance. In soil, sediments, and water, lindane is broken down to less toxic substances by algae, fungi, and bacteria. It has a low affinity for soil binding and its half-life in most soils is approximately 15 months. The primary source control measure that will be employed to mitigate potential lindane contamination is public education and conservative pesticide application practices. The public will be informed of the dangers of using lindane-containing products, the importance of closely following product directions, and how to avoid contaminating soils and water resources when using lindane. They will also be encouraged to use alternative means to control ticks and lice. A public education effort for lindane is already underway in Los Angeles[164]. The Proposed Project has committed to minimizing the use of pesticides and herbicides through the use of native vegetation in much of the landscaping, and through careful and minimal applications and storage of any such materials. Almost all of the landscaping on-site (other than private balconies) will have professional landscaping rather than individual homeowners. This should improve the reliability of the BMPs.

Other Toxic Chemicals

The 303(d) listing includes polycholrinated biphenyls (PCBs), polycyclic aromatic hydrocarbons (PAHs), and Arochlor (PCB product trade name). All of these are toxic chemicals that have been shown to impair the 303(d) list of waterbodies related to the Proposed Project. PCBs are listed for Ballona Creek Estuary and Santa Monica Bay. PAHs are listed for Ballona Creek Estuary and Santa Monica Bay. Arochlor is listed only for Ballona Creek Estuary.

PCBs. PCBs (polychlorinated biphenyls) are a group of toxic chemicals (includes Arochlor products) that have been used as insulators and heat-dissipaters in capacitors and transformers, hydraulic fluids, paint additives, plasticizers; inks and dyes, as ingredients in pesticides, in adhesives, in protective wood coatings, and in carbonless-copy paper. The natural gas industry has reportedly used PCBs as an "oil fog" into underground gas pipes to retard rust and as a dust retardant. Production of PCBs in the U.S. was stopped in 1977 and open disposal was banned in 1979. Today, PCBs can be released into the environment from poorly maintained hazardous waste sites, illegal or improper disposal of PCB wastes, leaks or releases from electrical transformers containing PCBs, and the disposal of PCB-containing consumer products. To date in Los Angeles County's urban stormwater monitoring, PCBs have been primarily below detection levels. In few instances where they have been detected, they are below criteria levels. Landscaping and paving of the site would substantially control any surface sources of PCBs. The public will be informed of the dangers of PCBs in and around their home, where to properly dispose of old fluorescent light fixtures or other electrical devices that may contain PCBs, and the importance of using natural gas filters in their homes. In addition, since they typically

[164] *www.lacsd.org/Lindane/*

adsorb strongly to particulates, the BMPs would be effective at reducing the minor concentrations that might be present.

PAHs. PAHs (polycyclic aromatic hydrocarbons) are a group of over 100 different chemicals that are formed during the incomplete combustion of coal, oil, gas, wood, garbage, or other organic substances, such as tobacco and charbroiled meat. PAHs can be found in asphalt, crude oil, coal, coal tar pitch, creosote, used motor oil, gasoline, and roofing tar. The primary sources of PAHs in the air are volcanoes, forest fires, residential wood burning, and exhaust from automobiles and trucks. Some PAHs evaporate into the atmosphere, but most of them stick strongly to soil particles. Several mitigation measures exist to minimize potential PAH contamination in the receiving waters of the project site. Source control efforts will focus on educating the public on the proper disposal of used motor oil and other petroleum products and the importance of not burning trash and debris. Swales and strip-type biofilters will be installed to minimize the migration of PAHs released from asphalt roadways, rooftops, parking lots, and creosote-treated telephone poles.

Trash and Debris. All urban developments can be expected to generate trash and debris. From 1999 to 2001, the City of Los Angeles, Department of Public Works, Stormwater Management Division monitored trash-generation rates according to land use types in the Santa Monica Bay and Los Angeles River watersheds[165]. The land uses outside of downtown Los Angeles that had the highest percentage of full catch basin inserts when inspected were residential (42 percent), commercial (31 percent), and industrial (18 percent). The Santa Monica Catch Basin Retrofit Study (1999) did estimate trash generation by land use, but only as a screening level tool. The input data was based on monitoring conducted in Sydney, Australia. The Proposed Project includes significant BMPs that would be expected to result in a near zero release of any trash through the storm drain system. Residents and visitors will be educated through the use of signage and other programs regarding proper trash disposal. Frequent street sweeping would effectively remove trash from street surfaces. The water quality catch basins would capture nearly all trash that would enter them, as would the detention systems (water quality basin and the water quality portion of the flood control basin) and the Freshwater Wetlands System (Freshwater Marsh/Riparian Corridor). In addition the Proposed Project includes installation of trash racks at inlets to the Riparian Corridor and the Freshwater Marsh, and to other water bodies that will meet the definitions of trash sizing in the TMDL. The Proposed Project also includes either catch basin inserts/retrofits and/or a continuous deflective separation (CDS) unit, either of which will significantly reduce or eliminate trash generation. The Proposed Project includes managed in-door trash collection and storage areas for residents. Commercial businesses will also have managed trash collection areas. Off-site, the retrofitting of catch basins (Jefferson and Lincoln Storm Drains and Westchester Bluffs tributary) would be expected to reduce trash and debris being discharged to the Ballona Wetlands and ultimately Ballona Channel.

[165] *City of Los Angeles, 2001. High Trash-Generation Areas and Control Measures. Department of Public Works, Bureau of Sanitation, Stormwater Management Division.*

Overall, the Proposed Project should result in a large net reduction in trash and debris conveyed in storm drains to Ballona Channel from the project area. Trash was not modeled due to the scarcity of data and because the system is expected to be nearly 100 percent effective in removing trash and debris from the Proposed Project stormwater as well as removing trash from existing systems.

Biological Parameters

The biological 303(d) parameters include enteric viruses (Ballona Creek), high coliform count (Ballona Creek Estuary, Ballona Creek), exotic vegetation (Ballona Wetlands), fish consumption advisory (Santa Monica Bay), and shellfish harvesting advisory (Ballona Creek Estuary). Many of these parameters are associated with one another. For example, fecal coliform is often used as an indicator organism for enteric viruses and shellfish harvesting is often regulated according to coliform concentrations. The bacterial parameters are discussed below.

Enteric Viruses and High Coliform Counts. Enteric viruses and fecal coliform are commonly introduced into stormwater runoff through exposure to animal and human wastes. Animal waste deposited on streets or within drainage channels can be washed into storm drains. Human waste can be introduced into the storm drain system through illegal wastewater connections or through leaks from existing wastewater pipelines. Since the Proposed Project will be new development, the wastewater system will be new, thus making leaks to the storm drain unlikely and minimizing the opportunity for illegal cross-connections between the wastewater and storm drain systems. In addition, many of the source control methods that the Proposed Project is planning on implementing (e.g., street sweeping, water quality detention basins, media filtration) would also significantly reduce enteric viruses in stormwater. Levels of coliform bacteria can be reduced by over 50 percent in water quality basins, although performance varies widely. Media filters afford an opportunity for further removal of bacteria and pathogens. Public education encouraging compliance with leash laws "pick-up after your pet" could also reduce animal waste washed into the storm drains as well as the fact that there will not be outdoor boarding of animals. All of these measures will be applied in the Proposed Project and therefore given the off-site treatment as well as effective on-site measures should result in a reduction of pathogens over existing conditions. Fecal Coliform levels were not modeled due to the scarcity and extreme variabilities of data on new urban areas and the fact that the data in general is single grab sample data (due to holding times) and is therefore not reliable for predictions of average runoff characteristics.

Coliform bacteria can be found in animal waste as well as in the soil. Fecal coliform bacteria, which originates in the intestines of all warm-blooded animals, often indicates the presence of human or animal feces. One particular type of fecal coliform, Eschrichia coli O157:H7 (E. coli), has been associated with many outbreaks of foodborne and waterborne illness in the Los Angeles area[166]. The presence of E. coli in

[166] *Los Angeles County Department of Health Services Public Health Letter "Escherichia Coli 0157:H7 Infection" March 1993 Vol. 15, No. 2*

water is a strong indication of recent sewage or animal waste contamination. Besides the source control measures mentioned above, the Riparian Corridor and the shallow primary management areas of the Freshwater Marsh are expected to provide some level of treatment, as exposure to sunlight has been shown to greatly reduce coliform densities[167].

Enteric viruses, or gastrointestinal viruses, are the most common disease-causing viruses found in water. Viruses consist of a single strand of genetic material within a protein coat. Unlike many forms of bacteria, all viruses require a host to reproduce and each virus can attack only one species of organism. Viruses are much smaller than bacteria, and therefore much more difficult to detect and treat. Many of these viruses have been eradicated in the waters of the United States through the use of vaccines, however a few are still prevalent. Some of the common viruses that still pose a human health threat in the U.S. include the Hepatitis A virus, the Rotavirus, and the Norwalk virus. Due to the small size and the host specificity of viruses, as compared to other pollutants in the water, determining the effectiveness of treatment is both difficult and costly. Consequently, the source control measures mentioned above would be the primary method used to reduce enteric viruses. The long detention times expected in the Riparian Corridor and the Freshwater Marsh should effectively minimize viral contact with specific hosts. Also, the solar radiation expected in these BMPs should reduce viral activity, as sunlight and temperature has been shown to reduce densities of male-specific bacteriophage (MSB), a potential indicator of enteric viruses[168].

Exotic Vegetation. The Ballona Wetlands have been identified as being impaired by exotic vegetation. The Proposed Project will only use native vegetation in the Riparian Corridor and around the Freshwater Marsh. Landscaping in the residential and commercial areas will use mostly native vegetation. Any non-native vegetation selected for landscaping will not be invasive to native plants. The public will be encouraged not to plant exotic grasses or other plants whose seeds may potentially migrate off their properties via wind, rain, or animals.

Fish Consumption and Shellfish Harvesting Advisories. Fish consumption advisory is in effect in the Santa Monica Bay and shellfish harvesting advisory is in effect in the Ballona Creek Estuary. The Office of Environmental Health Hazard Assessment of the California Environmental Protection Agency has primary responsibility for protecting California residents from the health risks of consuming contaminated fish and shellfish. They do this by issuing consumption advisories for the general population as well as for specific vulnerable subpopulations. These advisories tell the public when high concentrations of chemical contaminants have been found in local fish and shellfish. They also include recommendations to limit or avoid eating certain fish species from specific waterbodies or waterbody types. Elevated levels of arsenic,

[167] *Burkhardt III, W., K.R. Calci, W.D. Watkins, S.R. Rippy, and S.J. Chirtel, 2000. Inactivation of Indicator Microorganisms in Estuarine Waters. Wat. Res. Vol. 34, No. 8, pp.2207-2214*
[168] *Burkhardt III, W., K.R. Calci, W.D. Watkins, S.R. Rippy, and S.J. Chirtel, 2000. Inactivation of Indicator Microorganisms in Estuarine Waters. Wat. Res. Vol. 34, No. 8, pp.2207-2214*

copper, DDT, lead, PCBs, silver, and Chem A pesticides in the tissues of aquatic organisms contribute to the fish consumption advisory in the Santa Monica Bay and the shellfish harvesting advisory in the Ballona Creek Estuary. Shellfish harvesting advisories are also released if during any 30-day period water densities of total coliform exceed 70/100 ml, or 230/100 ml for a five-tube decimal dilution test or 330/100 ml when a three-tube decimal dilution test is used. The Proposed Project includes several source controls and treatment controls (as discussed above) to reduce concentrations and loads of these chemical and biological constituents from project area as well as some off-site area discharges.

Physical Parameters

Physical Parameters include habitat alterations, reduced tidal flushing, and hydromodification. For hydromodification impacts, the Ballona Wetlands have been receiving increased urban runoff as its tributary areas have been developed over the years. The Proposed Project with the Freshwater Wetlands System will actually reduce past increases in flows to the Ballona Wetlands and the resulting impacts. With decreased flows, habitat alteration due to urban runoff impacts should be reduced.

Operation of the Freshwater Marsh is an integral part of the stormwater management system for the adjacent Playa Vista First Phase Project and the Proposed Project, and is also designed to reduce the amount of pollutants flowing into the Ballona Wetlands. The Freshwater Marsh would divert the vast majority (approximately 92 percent) of the average annual flows from the adjacent Playa Vista First Phase Project and the Proposed Project away from the Ballona Wetlands and, instead, provide for water quality treatment before discharging flows to the Ballona Channel. As such, potential water quality and flow impacts to the Ballona Wetlands are reduced. During larger storm events when the capacity of the Freshwater Marsh is exceeded, runoff from the adjacent Playa Vista First Phase Project and the Proposed Project would flow from the Freshwater Marsh to the Ballona Wetlands through the overflow spillway. As discussed in Section 2, Hydrology, of this Volume, the increase of runoff to the Ballona Wetlands during such storm events that is attributable to the Proposed Project would be minor (i.e., approximately 5 percent or less depending on the size of the storm event). As such, the associated amount of urban runoff pollutants to the Ballona Wetlands would also be minor. Additionally, potential water quality impacts to the Ballona Wetlands would be reduced by the substantial amount of initial mixing that would occur during such events and by the short-term temporary nature of stormwater accumulation within the Ballona Wetlands (i.e., stormwater would drain from the Ballona Wetlands – within about 12 hours or a few tidal cycles depending on the storm and tidal conditions - into the Ballona Channel). As such, no significant water quality impacts to the Ballona Wetlands are expected to occur from implementation of the Proposed Project.

The Ballona Channel is a grouted riprap sided, earth bottom channel in the tidal zone in the vicinity of the discharges from the project area (the Freshwater Marsh and Ballona Wetlands discharge points). Therefore the small increases in flow expected with the Proposed Project as compared to the upstream areas would not have an effect on channel stability of the Ballona Channel tidal prism area.

General Toxicity

General toxicity parameters that impair project runoff to receiving waters include water column toxicity (Ballona Creek) and sediment toxicity (Ballona Creek and Ballona Creek Estuary). In both cases, the net reduction in pollution from the Proposed Project should reduce water column and/or sediment toxicity in these water bodies. The primary toxic chemicals have been individually addressed above. However, the combined affect of low levels (even below the analytical detection limits) of these toxic chemicals could be potentially harmful to aquatic organisms. Also, there are potentially several chemical constituents that are not routinely monitored due to technical or economic limitations and/or lack of water quality criteria. On the other hand, if the toxic chemicals are not in forms that are bioavailable the presence of these chemicals may not necessarily be harmful to aquatic life. Therefore, toxicity identification evaluations (TIEs) are used to evaluate the toxicity of chemical constituents combined.

Water Column Toxicity. The RWQCB has identified Ballona Creek as being water quality limited for water column toxicity. The Basin Plan objective of no less than 70 percent survival in a single toxicity test and no less than a mean of 90 percent survival in any three consecutive toxicity tests was used to determine that the water body was impaired with toxicity. The project design features and the source control measures identified to treat the primary toxic chemicals described above are expected to remove a variety of other pollutants as well. Also, pollutants that are lipophilic (oil soluble) tend to bioaccumulate, but also tend to adsorb to soil and sediment particles. These types of pollutants can significantly contribute to chronic toxicity, which is primarily a dry weather issue due to the infrequent nature of rain events in the Southern California area. Dry weather flows in the project area will be detained for much longer than wet weather flows in the Freshwater Wetlands System and therefore greater treatment would be expected.

Sediment Toxicity. The RWQCB has used the sediment toxicity data generated through the Bay Protection & Toxic Cleanup Program (BPTCP) to evaluate sediment toxicity impairment in the Ballona Creek Estuary and the Santa Monica Bay. Sediment toxicity was evaluated using the amphipod (a crustacean) survival test where less than 60 percent survival was considered toxic sediment. BPTCP work has revealed that generally metals are not bioavailable (they tend to bind with the usually generous amounts of sulfides in the sediments) and don't contribute to sediment toxicity. Sediments contaminated with even high levels of metals, but not with organic chemicals, will usually not result in adverse effects[169]. The primary organic chemicals that are listed as impairing the sediment quality of the Ballona Creek Estuary are DDT, PCBs, chlordane, lead, zinc, and PAHs. In the Santa Monica Bay, the primary

[169] *Regional Water Quality Control Board, Los Angeles Region, 1996 California Water Quality Assessment - 305(b) Report Supporting Documentation for Los Angeles Region*

organic chemicals that are listed as impairing the sediment quality are DDT, PCBs, chlordane, lead, zinc, cadmium, copper, mercury, and PAHs. Discharge of these chemicals are expected to be decreased with the Project because they are either no longer in use or will be removed in the stormwater BMPs.

3.2.4.6.2.5 Channel Stability Evaluation

Increased impervious areas associated with urban development can cause streams to degrade. While it is true that urbanization typically does increase the energy in receiving waters, the status and attributes of the receiving water must be taken into account when assessing the nature, extent, and significance of such an increase.

All runoff from the site eventually is discharged to the estuary portion of the Ballona Channel, which is composed grouted riprap-side, earth bottom slopes. The earth bottom is subject to potential scour if discharge velocities increase substantially with project implementation. However, impacts are unlikely given that runoff will be detained until the channel is able to handle the discharge during larger events. The runoff that enters the Central Storm Drain will be detained for up to 72 hours before discharging, thereby reducing the energy in the Ballona Channel during maximum stress times. Furthermore, the Ballona Wetlands do not discharge to the channel when the channel is full due to the one-way flap gates. Therefore the impact of increased discharge to the stability of the Ballona Channel is negligible.

The other channels that will receive runoff include the Riparian Corridor, a man-made water feature, and the existing channels that are presently located in the Ballona Wetlands. These channels all have very low slopes and, therefore, relatively low velocities, even during flood events. The Project includes diversion of stormwater to the Ballona Channel, which historically flowed directly to the Ballona Wetlands. Flow volumes to the Ballona Wetlands will be reduced by approximately 66 percent with the completion of the Proposed Project (i.e., buildout of Playa Vista including the adjacent Playa Vista First Phase Project and the Proposed Project and associated Freshwater Wetlands System that diverts freshwater flows from discharge into the Ballona Wetlands). This reduction of runoff volumes, that partially makes up for some portion of the increases that have occurred due to other upstream development, will reduce runoff energy in the channels within the Ballona Wetlands over existing conditions. Spillover from the Freshwater Marsh to the Ballona Wetlands during larger storm events (i.e., greater than a 1-year design storm) is not expected to erode the receiving area of the wetlands. The spillover weir for the Freshwater Marsh is constructed of articulate block (i.e., "armor-lock") and includes a spilling basin for energy dissipation of the overflow before entering the Ballona Wetlands. Therefore, the potential impact to the stability of the Ballona Wetlands is negligible

Increases in downstream peak flow rates are of primary concern when designing upstream water quality control measures for development. Significant increases in flow can, and in some cases do, cause downstream erosion in unlined open channels. Typically, channel erosion occurs where peak velocities have increased significantly due to changes in flow rate, or where a disturbance of soils has taken place. A check of downstream erosion potential is an essential part of conveyance and best management practice design. Although the Riparian Corridor is a Project Design Feature of the Proposed Project, this section examines the erosion potential of the Riparian Corridor under proposed conditions and determines if expected flow velocities indicate potential erosion problems.

The Riparian Corridor receives effluent from the adjacent Playa Vista First Phase Project and the Proposed development areas and off-site runoff as described previously.

Flow rates in the corridor will be the greatest in the downstream reach. The Centinela Ditch at this location has the following characteristics when flowing at a peak flood control flow rate of 537 cfs (Los Angeles City Methodology):

Bottom Slope:	0.00085
Roughness Coefficient:	0.045
Flow Area:	289.1 ft2
Wetted Perimeter:	107.66 ft
Top Width:	100.95 ft
Maximum Depth:	8.25 ft
Mean Velocity:	1.86 ft/s

These conditions were used to evaluate the potential for channel erosion. Two primary methods are used from basic literature on the design of open channels for determining the potential for erosion:

- Recommended permissible velocity
- Incipient motion

The permissible velocity method is an empirical approach and provides a permissible velocity for a variety of channel materials given assumptions about the basic design of the channel. A table of permissible velocities is shown in **Table 3-59, Recommended Permissible Velocities.**

The assumptions for using the values shown in Table 3-59 include:

- the side slopes are stable under all conditions
- the channel is relatively straight
- the depth of flow is approximately one meter

- the channel is trapezoidal in cross-section

Although not all of the assumptions for the permissible velocity method are directly applicable to the Riparian Corridor, the results of using the permissible velocity approach are conservative. The permissible velocity for a channel lined with fine sand is 2.0 ft/s. The calculated mean velocity in the Riparian Corridor using Manning's equation applied to an irregular channel cross-section is 1.86 ft/s. The Corridor will be vegetated with native grasses growing on a sandy silt soil. The presence of vegetation and cohesive soils significantly increases the permissible velocity for the Corridor in excess of 2.0 ft/s. It is estimated that a flow with a mean velocity in excess of 3.0 ft/s could be conveyed through the Corridor without significant erosion.

The Corridor will have side slopes of under 2:1. This is the slope recommended by Fortier and Scobey[170] for loose sandy soils. The Corridor will be vegetated with native shrubs, trees, and grasses, which help to prevent side slope erosion. The Corridor should be stable under a variety of potential conditions.

The second method mentioned above (i.e., incipient motion) is typically used for soils that are not vegetated and are not cohesive. Calculations based on the incipient motion approach were inappropriate for estimating conditions in the Corridor.

The Corridor is the only open conveyance with potential for erosion (however unlikely as discussed above) due to increased flows from the adjacent Playa Vista First Phase Project and Proposed Project. By the time runoff reaches Lincoln Boulevard and into the existing Ballona Wetlands, the energy will have been reduced. This, in conjunction with the expected decrease in runoff volumes and rates flowing to the Ballona Wetlands, is expected to cause little or no impact from the Proposed Project on stability or existing habitat in the channels of the Ballona Wetlands.

3.2.4.6.2.6 Assessment of Dry Weather Data

The relatively low quality and high quantity of runoff from developed areas compared to the runoff from natural areas are well-know factors influencing receiving water impairment in urban areas. Due to the relative quantity (i.e., loads) of pollutants of concern associated with stormwater flows, receiving waters impact assessments generally focus on wet-weather runoff. An equally important issue when assessing potential impacts to receiving waters, especially in arid climates such as the Proposed Project is dry-weather flows associated with urban activities. Sources of dry-weather flows, potentially associated with the Proposed Project, include flows from on-site urban activities (e.g. irrigation runoff, car washing, pavement washing, air conditioning condensate, etc.) and perennial flows within the Riparian Corridor, both of which may transport sediment, nutrients, vehicular pollutants, and/or animal waste products from the Proposed Project areas to receiving waters. Dry-weather flows will also enter the Proposed Project area from off-site land uses, including the Westchester Bluffs. The quantity of runoff associated with dry-weather flows from the

[170] *Fortier, Samuel and Fred C. Scobey, 1926. Permissible Canal Velocities Transactions. American Society of Civil Engineers, Vol 89, Paper No. 1588, pp. 940-984.*

Proposed Project area is expected to be negligible as the Proposed Project includes the use of vegetation with low water requirements in approximately 50 percent of the community landscaped areas, a careful irrigation program that emphasizes no excess irrigation, and a public education program to inform residents of the potential receiving waters impacts of excessive dry-weather runoff. Perennial flows within the Riparian Corridor are part of the intent and design of the Corridor and will include off-site generated dry-weather flows as well as other sources to maintain the vegetation in the system. Other sources of dry-weather flows may include illicit sewer connections to the storm drain system, which could contribute to the input of human pathogens to receiving waters. However, since the Proposed Project will be a new development with a new storm and sewer system, illicit sewer connections are unlikely. The dry-weather input of human pathogens associated with animal waste are expected to be reduced by encouraging residents to pick up after their pets and to not feed wild birds. Therefore, the potential for the Proposed Project to violate future dry-weather TMDLs for fecal coliform or other human pathogens in the Ballona Creek Estuary and/or Santa Monica Bay would be less than significant.

Limited dry-weather monitoring data are available for assessing ambient dry-weather concentrations and loads to receiving waters after buildout of the Proposed Project. As indicated in **Table 3-60, Dry Weather Water Quality Data for Freshwater Marsh Inlets and Outlet,** dry-weather water quality samples were collected on April 25 and June 28, 2002 and on April 2, 2003 in the Lincoln and Jefferson Storm Drains immediately upstream of the Freshwater Marsh. The analyses of the April 2002 samples included an extensive list of parameters, including conventional parameters such as pH, total suspended and settleable solids, and turbidity, as well as total metals, total petroleum hydrocarbons, and volatile organics. The June 2002 sampling event was intended to fill data gaps of the April sampling event. During this event, samples were analyzed for total and dissolved metals, salinity, and hardness so that a comparison to CTR benchmarks could be made.171 (Note the CTR criteria for metals are both hardness and salinity dependent). The analysis of the April 2003 sample included an even more extensive list of parameters than the other two sampling events, including bacteria, general minerals, hydrocarbons, metals, nutrients, PCBs, pesticides, semi-volatile organic carbon, toxicity, and volatile organic carbon. Out of all of the trace elements analyzed during the three dry-weather sampling events, only a handful of metals were detected above analytical detection limits, and as shown in **Table 3-61, Chronic CTR Criteria Compared to Dry Weather Data,** none of the detected values exceeded the chronic freshwater CTR criteria. Also, the samples analyzed for coliform bacteria (fecal and total) were well below the Basin Plan water quality objectives. While these data are not completely representative of the dry-weather runoff from the First Phase and Proposed Project areas, they do represent at least a portion of the ambient perennial flows that will be supplying the Freshwater

[171] *The CTR criteria (benchmarks) are water quality standards legally applicable to receiving waters with human health or aquatic life designated uses, such as the Ballona Channel and Ballona Wetlands. However, in reference to the Freshwater Wetlands System, the use of the CTR criteria (benchmarks) are used as numerical water quality benchmarks for the purposes of assessing potential water quality impacts.*

Marsh with a continual source of fresh water; the primary sources of which will be from off-site urban runoff and groundwater-supplemented flows.

For purposes of assessing the potential for metals contained in dry weather flows to impact downstream receiving waters, the available water quality data from the downstream end of the Freshwater Marsh were compared with the chronic saltwater criteria from the CTR. The following is a comparison of the CTR criteria[172] (in µg/L) with the observed dry-weather dissolved metals concentrations of discharges to the Ballona Channel from the Freshwater Marsh:

Constituent	Chronic CTR Criteria[173]	Outlet From Freshwater Marsh (µg/L)[174]
Arsenic	36	6
Cadmium	9.3	Not Detected
Copper	3.1	3.2
Lead	8.1	Not Detected
Mercury	0.04	Not Detected
Nickel	8.2	1.9
Silver	1.9	Not Detected
Zinc	81	1.2

This comparison presents a conservative case because: 1) there are 8 acres of the Freshwater Marsh yet to be constructed which will add significant treatment volume to the existing Marsh, 2) construction of the Riparian Corridor has not yet begun and when completed will add significant treatment areas, and 3) the existing vegetation in the Freshwater Marsh is emergent and will continue to mature with time, increasing biological activities, enhancing flow distributions, etc. that should improve performance over time. These factors indicate that the removal efficiency of metals will be greater in the future than it is today. In addition, it is expected that the dissolved metals concentrations will diminish as dry weather flows enter the Ballona Channel and/or the Ballona Wetlands, as the brackish and organically rich environment at those locations will have a tendency to drive metals from a dissolved state into the fraction associated with particulates and organic matter in the water. Thus, the fact that the copper concentration is 0.1 part per billion above the chronic CTR criterion is not considered significant.

[172] *The CTR criteria apply to receiving waters – not directly to discharges to those receiving waters. Thus, the CTR is not directly applicable to the influent to the Ballona Channel from the Freshater Marsh. A comparison of the CTR to influent concentrations is conservative because it does not account for assimilation that may occur once the influent actually enters the receiving water.*
[173] *Final Saltwater CTR Criteria – May 18, 2000. Federal Register Volume 65, No. 97, 40 CFR Part 131, Water Quality Standards.*
[174] *Camp Dresser & McKee Inc., April 2, 2003. Freshwater Marsh Water Quality Sampling, Dry Weather, Playa Vista, California. Based on actual sampling. The April 2003 sampling did not include the 8 acres of the Freshwater Marsh yet to be constructed.*

As discussed above in Section 3.2.4.6.2.3, Basin Plan Water Quality Objectives, the potential toxic properties of selenium are increasingly raising concern in California, particularly in wetlands. Existing dry-weather monitoring data indicate that dry-weather runoff, particularly from urban areas, is not a significant source of selenium. Therefore since urban runoff in general and dry-weather runoff in particular are not likely sources of selenium, the primary potential sources of selenium near the Proposed Project include groundwater-supplemented flows, upland weathering of minerals, and atmospheric deposition. As shown in Table 3-16, the maximum selenium concentration in groundwater near the project site is 5.6 µg/L and dry-weather water quality samples in the inlets to the Freshwater Marsh (Table 3-15) have not contained detectable concentrations of selenium. As such, during dry-weather selenium is not expected to be a significant biological concern in the Freshwater Marsh or its receiving waters as a result of the Proposed Project. Therefore the potential biological impacts of selenium associated with dry-weather flows are anticipated to be less than significant as a result of the Proposed Project.

According to the Basin Plan, receiving waters designated with warm freshwater habitats (WARM) should not be altered by more than 5 degrees F above the natural temperature and at no time should the waters exceed 80 degrees F as a result of urban runoff. Currently, none of the water bodies receiving discharges from the Proposed Project are designated WARM. However, the narrative temperature objective for wetlands in the Basin Plan applies to the Ballona Wetlands and the Thermal Plan applies to the Ballona Creek Estuary. The Basin Plan narrative objectives for wetlands states that wetlands shall be protected to prevent significant adverse effects on natural temperature and according to the Thermal Plan, discharges to estuaries must not exceed 20 degrees F above the natural receiving water temperature or cause the receiving waters to increase by more than 4 degrees F above the natural temperature. The Ballona Wetlands will only receive discharges from the Freshwater Marsh during storm events greater than or equal to the 1-year storm; during such events there would likely be significant cloud cover. Therefore, the Ballona Creek Estuary is the only receiving water that would be potentially impacted by elevated runoff temperatures. Runoff from the Proposed Project caused by excessive irrigation, car washing, pavement washing, and air conditioning condensate may absorb heat during sheet flow across hot pavement and deliver heated effluent to receiving waters. Also, shallow summer time flows in the Riparian Corridor and the primary management areas of the Freshwater Marsh may be heated by solar radiation before discharging to receiving waters. Due to the relative size of the Proposed Project compared to the Ballona Creek Watershed (only about 1 percent of the watershed area), and the fact that the estuary portion of the Ballona Creek has diurnal tidal exchange, the runoff from the Proposed Project is not anticipated to cause increases in receiving water temperatures. Also, on-site BMPs are designed to reduce runoff volumes, as well as minimize the contact time of dry-weather sheet flow with impervious surfaces by quickly routing such flows to vegetated areas (e.g., roof-drain planter boxes and bioswales) and the subsurface storm drain system. With the establishment of riparian trees and vegetation in the Riparian Corridor and the primary management areas of the Freshwater Marsh, as required by the HMMP, temperature increases caused by solar radiation are expected to be lessened. In addition the mixing of deeper, cooler water in the main body of the Freshwater Marsh is expected to reduce water temperatures prior to discharging to the Ballona Creek Estuary. Therefore, the potential increase in receiving water temperatures is expected to be negligible as a result of the Proposed Project.

Based on a conservative assumption that the Proposed Project includes development typical of the existing urbanized areas in the Ballona Creek Watershed (i.e., highly connected impervious areas and few stormwater source controls), the estimated dry-weather runoff to the Freshwater Marsh would be approximately 0.5 to 1 cubic feet per second. Low flows such as this would be detained in the Freshwater Marsh between 26 to 53 days in the summer and between 11 and 22 days in the winter before they would be slowly released to the Ballona Wetlands and Ballona Channel. With this extended detention time, substantial water quality improvements are expected, but this extended detention may contribute to increases in the production of mosquito larvae in the Freshwater Wetlands System. As part of the Operations, Maintenance and Monitoring Plan , the Freshwater Marsh will be monitored frequently (i.e., weekly inspections; monthly sampling) during the mosquito breeding season (May-October) for signs of increased mosquito populations or habitat, such as sightings of living larvae or adult mosquitoes, impedances to flow, high nutrient concentrations, or low dissolved oxygen. If during inspections, signs of increased mosquito habitat are noted, immediate remedial activities will be coordinated with the Los Angeles County West Vector Control District and/or USACE. These remedial activities include: 1) removing vegetation, algal mats, or other objects that may be impeding flow and reducing access of predatory fish, 2) draining, filling, or treating isolated depressions containing stagnant water, 3) applying Bacillus thuringiensis bacterium (Bti) or alternative pesticide approved by the California Department of Health Services, and 3) introducing mosquito fish (Gambusia affinis) or other predatory species approved by the Los Angeles County West Vector Control District and the California Department of Fish and Game.

The dry weather flows on and adjacent to the Proposed Project site during several sampling and analysis programs have been found to have water quality that is relatively good (below receiving water criteria). [175] Dry weather flows include dry weather flows from the site and perennial flows within the Riparian Corridor. Nuisance flows are expected to be negligible as the Proposed Project (and the adjacent Playa Vista First Phase Project) includes the use of vegetation with low water requirements and a careful irrigation program that emphasizes no excess irrigation. Perennial flows within the Riparian Corridor are part of the intent and design of the Corridor. As such, no significant impact is anticipated.

Dry-weather flows in this area have been found to be relatively good as mentioned above. In addition, these dry weather flows will receive significant treatment within the Freshwater Wetlands System prior to discharge. As mentioned in Section 3.2.2.5,

---

[175] *First Phase Playa Vista Project, EIR, 1993.*

the fecal coliform counts within the marsh have been found to be low during dry weather sampling conducted to date and the expectation is that these levels would not increase with the addition of new urban areas that do not have sanitary sewer connections for dry weather flows. Finally, these dry weather flows are necessary for sustaining the Freshwater Wetlands System.

Water quality at the inlets and outlets to the Freshwater Marsh has been monitored during three dry weather sampling events. On April 13-14 2000, sampling took place in the tributary channels before entering the marsh. On April 25, 2002 and June 28, 2002, sampling took place inside the primary management areas of the Freshwater Marsh near the Central Drain inlet, the Jefferson inlet, and the Freshwater Marsh outlet. The dry weather data from these three events are summarized in Table 3-60.

The two sampling dates where hardness data were collected show hardness concentrations ranging between 350 and 800 mg/L as $CaCO_3$. The measured dissolved metals concentrations from these two sampling dates are compared in Table 3-61 to the chronic CTR criteria using the measured hardness concentrations from Table 3-60.

The dry weather dissolved metals concentrations do not exceed the chronic CTR criteria at the measured hardness in the channels tributary to the Freshwater Marsh or near the inlets or outlet within the Freshwater Marsh.

Based on minimal dry-weather runoff anticipated from the Proposed Project, the absence of exceedances of water quality criteria for trace elements including selenium in the existing dry-weather runoff, negligible expected increases in receiving water temperatures, extended residence time in the Freshwater Marsh (see Subsection 3.1.4.2.4), and the mosquito abatement procedures approved the Los Angeles County West Vector Control District, USACE, and the California Department of Fish and Game, the Proposed Project would not create pollution, contamination, or nuisance as defined in Section 13050 of the CWC. As such, implementation of the Proposed Project would not cause regulatory standards to be violated as defined in the Basin Plan for the receiving waterbody; hence, the Proposed Project impacts would be less than significant with regard to dry-weather flows.

3.2.4.7 Impact: Potential Impacts of Proposed Project Development on the Adjacent Playa Vista First Phase Water Features

As described above in Section 3.2.3.1, the adjacent Playa Vista First Phase Project includes construction of the Riparian Corridor and the Freshwater Marsh as part of the stormwater management system. These waterbodies are proposed to be supplied with fresh water during dry weather primarily by a groundwater treatment system located at the eastern end of the adjacent Playa Vista First Phase Project and the Proposed Project. These features were designed with the intention of being configured to provide these same functions for the remaining development areas that will drain to them as in the adjacent Playa Vista First Phase Project, including flow regulation to the saltwater marsh, water quality enhancement, and habitat. The Riparian Corridor was sized such that it has adequate capacity to provide the intended water quality functions. It will receive runoff from the developed area associated with the buildout of the adjacent Playa Vista First Phase Project and the Proposed Project. The Freshwater Marsh was also designed to provide adequate capacity to provide water quality treatment of urban stormwater from the additional areas of development with completion of Playa Vista. In addition, it was also sized to provide adequate capacity to manage freshwater inflows to the Ballona Wetlands so that the freshwater inflows to the saltwater wetlands occur on average once a year or less (with flexibility to alter freshening as it is needed).

As these facilities were designed to manage stormwater from all tributary areas upon completion of development at Playa Vista, they were "over-designed" in terms of their water quality and flow management performance for adjacent Playa Vista First Phase. That is, upon completion of the adjacent Playa Vista First Phase Project and the Proposed Project, the amount of pollutants entering these systems will increase as well as the discharge of pollutants. However, the adjacent Playa Vista First Phase Project and the Proposed Project have been designed such that the overall goal to not increase pollutant loads with the entire project as compared to pre-project loads is achieved for key constituents (e.g., TSS, nutrients, and heavy metals). In addition, the Freshwater Marsh will divert freshwater inflows from the Ballona Wetlands (although saltwater wetlands managers will have the ability to regulate this to meet Ballona Wetlands restoration goals), thereby reducing the biological impacts to the Ballona Wetlands that currently occur due to periodic freshening of the saline conditions in the wetlands.

These waterbodies (Riparian Corridor and Freshwater Marsh) were designed specifically for performing water quality functions and volume control of freshwater inflows to the Ballona Wetlands for the entire buildout of the adjacent Playa Vista First Phase Project and the Proposed Project. Therefore, they are not considered to be negatively impacted by the completion of the Proposed Project as compared to adjacent Playa Vista First Phase.

3.2.4.8 Cumulative Impacts

The majority of the off-site areas tributary to the adjacent Playa Vista First Phase Project and the Proposed Project consist of highly urbanized development; hence, substantial changes in off-site hydrology (i.e., increases in impervious surface area, changes in drainage routes, etc.) are unlikely. Similarly, it is unlikely that there would be substantial additions or changes to the types of urban uses that currently contribute to the surface water quality characteristics of the Playa Vista watershed. Two future off-site development projects currently planned or under construction are the West Bluff project (Tentative Tract 51122[176]) and the Loyola Marymount University expansion. Both of these development projects are able to be accomodated by the Freshwater Marsh, and are therefore not expected to substantially affect the

[176] *West Bluffs Project (Tract 51122), City of Los Angeles EIR No 91-0675, State Clearinghouse No. 92041046.*

water quality or hydrology of the Freshwater Marsh, the Ballona Wetlands, or the Ballona Channel. The Loyola Marymount University expansion is not expected to cause any cumulative impacts in the Freshwater Marsh or it receiving waters because the overall land use and drainage areas are not changing significantly. The West Bluff Project includes 27 acres of area that will be diverted to the Freshwater Marsh via the Lincoln Storm Drain. This diverted runoff increases the average annual runoff volume to the Freshwater Marsh by approximately 3.4 percent, which is insignificant considering the Marsh has approximately a 50 percent excess capacity (i.e. the SUSMP requires that a 0.75-inch storm must be captured and treated and the Freshwater Marsh has a capacity for about an 1.1-inch storm). This small increase in runoff will likely add to the current annual pollutant loadings to the Marsh and the Ballona Channel (an estimated 2-4 percent increase in modeled pollutant loadings). With this small loading increase, overall pollutant loads to the Ballona Channel and Wetlands would still be below pre-First Phase. In addition, the concentrations of all modeled pollutants are still expected to either decrease or remain the same in the main body and the effluent from the Marsh due to the increase in runoff volume combined with increased pollutant removals expected in the CDS unit to be installed by Caltrans that will treat Lincoln Boulevard runoff prior to discharging to the Freshwater Marsh. Finally, the Freshwater Marsh was designed with an adjustable outlet weir to accomodate runoff from potential future developement and other watershed management changes. Therefore, the addition of the West Bluff Project runoff is not anticipated to cumulatively impact the Freshwater Marsh or its receiving waters.

In addition to the two off-site projects discussed above, there are seven roadway widenings that are planned to mitigate traffic congestion caused by the Proposed Project. The Centinela Corridor improvements will add approximately 0.6 acres of impervious surfaces. The other intersection improvements which include Culver Boulevard and Inglewood Boulevard, Sawtelle Avenue and Culver Boulevard, La Tijera Boulevard and Centinela Avenue, Centinela Avenue and Washington Place, Overland Avenue and Culver Boulevard and Centinela Avenue and Culver Boulevard, will add approximately 0.3 acres of impervious surfaces. All of these improvements would eventually drain to the Ballona Channel. The combined imperviousness of the roadway improvements projects is expected to increase the average annual runoff volume to the Ballona Channel by approximately 0.5 acre-feet per year, which is only about 0.2 percent of the average annual runoff from the adjacent Playa Vista First Phase and the Proposed Projects combined. All of these widening projects will be required to meet SUSMP requirements. Given the SUSMP requirements that will apply to these projects and their small size, it is anticipated that the impact associated with these off-site construction projects will be less than significant.

In considering the potential for cumulative water quality impacts within the surrounding Ballona Channel Watershed, it is likely that future urbanization within the 78,000-acre watershed area will contribute to water quality impacts to the Santa Monica Bay. However, since the Ballona Channel Watershed is already highly urbanized, other changes or development are not likely to cause substantial changes in regional surface water quality. In fact, with redevelopment projects (with application of the SUSMP requirements as appropriate) and increases in system-wide soure and treatment controls associated with other elements of the MS4 Permit, it is anticipated over time, regional water quality will likely be improved rather than degraded with future development and redevelopment projects. The proposed development of the adjacent Playa Vista First Phase Project and the Proposed Project would not result in a cumulatively considerable contribution to such future water quality impacts. The adjacent Playa Vista First Phase Project and the Proposed Project represents less than 1 percent of the Ballona Channel Watershed, but, more importantly, the estimated amounts of pollutant loadings associated with the buildout of the adjacent Playa Vista First Phase Project and the Proposed Project are comparable to, or less than, the loadings for pre-First Phase conditions.

3.2.4.9 Summary of Surface Water Impacts

Potential significant impacts of the Proposed Project were assessed both numerically and narratively. Numerical significant impacts were assessed using a pollutant loadings model, developed specifically for the planned development, to evaluate potential changes in concentrations in stormwater runoff from pre-First Phase, adjacent Playa Vista First Phase, and the Proposed Project areas. The model was also used to compare significant pollutant thresholds (derived in Section 3.2.4.2) to the model-predicted pollutants (i.e. TSS, TP, TKN, oil and grease, and dissolved and total copper, lead and zinc). The numerical impact assessment found no significant increases in pollutant loadings and concentrations and no exceedances of significant thresholds with implementation of the Proposed Project.

The numerical significance thresholds were derived from water quality criteria and objectives and guidelines, all of which are not directly applicable to stormwater discharges but provide a basis for comparisons. The California Toxics Rule is applicable to inland surface waters and enclosed bays and estuaries. In this assessment, potential impacts were assessed for the Freshwater Wetlands System (Riparian Corridor and Freshwater Marsh), the Ballona Channel, and the Ballona Wetlands. All of the other significance thresholds are considered conservative, in that they were derived from water quality criteria or objectives that are not directly applicable to stormwater discharges or the receiving waters of project runoff. The total suspended sediment and oil and grease significance thresholds were derived from the COP effluent limitations for publicly owned wastewater treatment facilities and non-regulated industrial discharges to the ocean waters of the State. These thresholds were chosen as guidelines of the desired water quality of ocean water discharges. The nutrients thresholds (TKN and TP) were derived from federal guidelines for establishing State and Tribal water quality criteria for nutrients in rivers and streams. These guidelines are not enforceable, however, they are values obtained from monitoring data from streams of the region that are minimally impacted by human activities and are protective of aquatic life and recreational uses. By meeting the thresholds derived from the COP and the EPA nutrient guidance document (Nutrient Ecoregion), the potential water quality impacts of the project with respect to these parameters is considered less than significant. The pollutant loading model, due to lack of specific source control performance data, does not take into account all of the on-site source control BMPs planned in the Proposed Project (see Figure 3-2). Therefore, the actual quality of runoff from the Proposed Project is expected to be better than predicted in the model.

In addition to the Freshwater Wetlands System, the treatment control BMPs that were included in the model consist of:

- Roof downspout planter boxes for all buildings planned for the Proposed Project in the Central Drain catchment,
- A vegetated swale for all runoff entering the Riparian Corridor from the Proposed Project area,
- Catch basin inserts for 100 percent of the runoff entering the Central Drain from the Proposed Project area and additional catch basin inserts for 25 percent of the runoff from other adjacent Playa Vista First Phase and Proposed Project areas,
- A vegetated swale treating Lincoln Boulevard runoff prior to discharging to the Central Drain, and
- A hydrodynamic solids separation device treating Lincoln Boulevard runoff prior to discharging to the Freshwater Marsh.

Some of the planned BMPs that are expected to reduce pollutant loads and concentrations in the runoff of the Proposed Project but were not included in the model include street sweeping, public education, catch basin cleaning, trash racks, underground parking, an internal transit system, and a pesticide and fertilizer management program. Street sweeping, public education, catch basin cleaning, and trash racks are anticipated to reduce trash and sediment loadings, as well as contaminants associated with these bulk pollutants. Underground parking and the internal transit system are anticipated to reduce vehicular pollutants including metals. The pesticide and fertilizer management program is anticipated to reduce the amount of nutrients and toxic pollutants generated from landscaping activities.

In addition to using the pollutant loadings model for assessing numerical significance impacts, narrative significance impacts were assessed by qualitatively discussing the Project Design Features with respect to the following:

- The potential impacts to the Santa Monica Bay,
- The requirements in the Los Angeles County SUSMP,
- The characteristics and potential sources of the 303(d) listed parameters,
- The narrative water quality objectives of the Basin Plan,

- The stability of channels receiving stormwater runoff from project areas,
- The potential impacts of dry weather (nuisance) flows from the project areas, and
- Potential deviation from the Performance Criteria.

Considering all of the inputs to Santa Monica Bay, the quantity of stormwater runoff from the Proposed Project site is less than significant in comparison. In fact the adjacent Playa Vista First Phase Project together with the Proposed Project results in net benefits to receiving waters listed in the Basin Plan, including the Ballona Wetlands, Ballona Estuary, and Santa Monica Bay. Consequently, the potential water quality impacts to Santa Monica Bay have been qualitatively discussed and determined to be less than significant, via comparisons of Project runoff quality to pre-First Phase loads and concentrations and numerical water quality benchmarks, as well as discussions of 303(d) listed pollutants.

The stormwater treatment system and source control measures for both the adjacent Playa Vista First Phase Project and Proposed Project were designed specifically with consideration of the local design and treatment requirements and therefore are consistent with requirements for stormwater management. Furthermore, the Project Design Features were designed to specifically exceed the requirements of the Los Angeles County SUSMP, as shown in the comparison table (Table 3-22). This exceedance is not only based upon the size of the treatment system, but also the treatment of off-site areas and the increased effectiveness of wetland treatment systems over other less effective BMP types that have been allowed under the SUSMP program.

Based on an analysis of the individual 303(d) water quality parameters listed both in the original 1998 list and the newly proposed 2002 list, the Proposed Project is not expected to increase loads or concentrations of any of these constituents in the listed waterbodies, as most of the listed pollutants are from historical sources, such as contaminated soil, or are removed by on-site BMPs and the Freshwater Wetlands System. The source control measures and the structural BMPs are expected to be effective at reducing the current loading of the 303(d) listed pollutants; resulting in an expected improvement to the water quality of stormwater runoff from the Project area and contributing off-site areas.

Several of 303(d) listed parameters for receiving waters of Project runoff affect or directly relate to the narrative objectives in the Basin Plan. These narrative objectives were qualitatively assessed and are expected to be met with the implementation of the Proposed Project.

Peak stormwater runoff discharge rates and channel stability are not considered to be a significant issue with the development of the Proposed Project. The increased runoff due to increased impervious areas would be completely contained within the stormwater treatment system, which includes energy dissipaters (e.g., water quality inserts/catch basin inserts and riprap at outlets) and extended detention in the

Freshwater Wetlands System. No detrimental increases in channel velocities are expected and the Proposed Project is not expected to cause regulatory standards to be violated, as defined in the applicable NPDES Permit (MS4 Permit; per SUSMP Standards) or the Basin Plan. By not causing a condition of nuisance as defined in the Basin Plan, a nuisance is also not anticipated to be created as defined in Section 13050 of the CWC. The Ballona Wetlands will receive reduced erosive flows because of the routing of flows away from the salt marsh from all but large storm events and the flow retardation in the Freshwater Marsh. The Ballona Channel is a grouted riprap sided channel that would not be impacted by the small increase in flows caused by this Project. The small increase in flows relative to those originating upstream is not expected to create pollution, contamination or nuisance as defined in Section 13050 of the CWC.

Potential dry-weather flows from the developed areas and off-site areas would be detained longer than wet-weather flows, resulting in even greater treatment. They are being employed to help sustain the Freshwater Wetlands System and, in fact, are considered a benefit to the system. Also, conservative irrigation practices and newer sewer systems are expected to minimize dry-weather flows from the Proposed Project areas.

Compliance with the Performance Criteria is an ongoing process as construction of the Freshwater Wetlands System is completed, and as habitat is established and maintained. The O&M Manual serves as the primary vehicle, in accordance with which compliance with the Performance Criteria is taking place. The analyses presented herein above demonstrate that water quality of the Proposed Project will support the required habitat of the Freshwater Wetlands System and protect downstream receiving waters, thus satisfying the water quality aspects of the Performance Criteria and the associated permits and approvals. Verification of the water quality-related Performance Criteria will be documented through the annual reports submitted to the USACE, RWQCB, CCC, and other agencies responsible for enforcement of the Performance Criteria.

Based on the numerical and narrative impact assessment, the Proposed Project is not expected to create pollution, contamination, or nuisance, as defined in Section 13050 of the CWC, or cause regulatory standards to be violated, as defined in the applicable NPDES Permit (MS4 Permit) or the Basin Plan, for the receiving waterbodies, and is expected to comply with the project-specific Performance Criteria resulting from the USACE 404 Permit and related agency actions. Mitigation measures are proposed below to require implementation of the Project Design Features which serve to eliminate potential significant impacts discussed above. Therefore, the impacts to surface waters are anticipated to be less than significant with the implementation of the Proposed Project.

3.3 Groundwater Quality

3.3.1 Regulatory Framework

The Proposed Project is subject to groundwater quality regulations at the federal, state and local level by the EPA, California EPA (CalEPA), and RWQCB. Furthermore, the RWQCB, acting as the lead regulatory agency for the state, may solicit input from other state and local agencies as appropriate. The following describes existing regulations and regulatory programs pertaining to groundwater quality.

3.3.1.1 Federal Level

Under the Safe Drinking Water Act, the EPA sets drinking water standards referred to as the National Primary Drinking Water Regulations, 40 CFR Part 141, and the National Secondary Drinking Water Regulations, 40 CFR Part 143. These regulations set maximum contamination levels (MCL)[177] for substances in drinking water and apply to groundwater if the groundwater is a source of potable water or otherwise subject to MUN designated use.[178] Groundwater in the area of the adjacent Playa Vista First Phase Project and the Proposed Project is not currently pumped for beneficial uses (i.e., drinking water, industrial or agricultural supply). A comparison of groundwater concentrations to MCL standards is provided in the Proposed Project's Draft EIR, Section IV-I, Safety/Risk of Upset.

The nearest public supply well is located at Venice Polytechnic High School, approximately 2 miles northwest of the Proposed Project. The subject well was capped in 1960 and is not active. The next closest public supply wells are located approximately 3.5 miles northwest of the Proposed Project in the City of Santa Monica. The nearest irrigation well is located approximately 2 miles southeast of the Proposed Project at the Hillside Memorial Park Cemetery.

3.3.1.2 State Level

RWQCB was appointed lead agency by Cal EPA to regulate activities and factors that affect or may affect groundwater quality at the Proposed Project site. As discussed in Section 3.2.1.2.1, Basin Plan, the Basin Plan specifies beneficial uses for the Santa Monica Basin, where the Proposed Project is located. A determination of whether the subject groundwater concentrations exceed any applicable regulatory standards or otherwise require remediation actions will be made by the RWQCB in conjunction with the ongoing implementation of the CAO No. 98-125, as discussed in detail in the Proposed Project's Draft EIR, Section IV-I, Safety/Risk of Upset. The Basin Plan sets forth a number of general objectives for all groundwater, and specific mineral objectives for most basins. Mineral objectives (maximum limits) for the Santa Monica Basin include:

---

[177] *Maximum Contamination Levels (MCLs) are referenced as a basis for comparisons. However cleanup levels for on-site contamination would be determined by the RWQCB in accordance with the requirements of the Cleanup and Abatement Order No. 98-125.*

[178] *"MUN" is defined in the Basin Plan as "Municipal and Domestic Supply (MUN) uses of water for community, military, or individual water supply systems including, but not limited to, drinking water supply." Los Angeles Basin Plan, page 2-1.*

- Total Dissolved Solids (TDS) - 1,000 mg/L
- Sulfate - 250 mg/L
- Chloride - 200 mg/L
- Boron - 0.5 mg/L

It is the responsibility of the RWQCB to regulate the activities and factors which affect or may affect the quality of the groundwater, and the Basin Plan has a Strategic Plan and Implementation section which defines the RWQCB's regulatory programs and planning activities to accomplish its responsibilities. These include issuing and enforcing waste discharge requirements for discharges to land and groundwater; controlling non-point source pollutants as they may affect groundwater quality; and implementing and enforcing regulatory and strategic programs for remediation of existing groundwater pollution. On-site groundwater remediation for the adjacent Playa Vista First Phase Project and the Proposed Project is under the regulatory control of the RWQCB.

In addition, Title 22, Division 4, Chapter 15 of the California Code of Regulations establishes primary and secondary drinking water standards for public water systems that have been based upon the national standards. Groundwater in the area of the adjacent Playa Vista First Phase Project and the Proposed Project is not currently used for drinking water. See the Proposed Project's Draft EIR, Section IV-I, Safety/Risk of Upset for further discussion.

3.3.1.3 Local Level

The RWQCB enforces the NPDES General Construction Permit to control pollutant discharges through a SWPPP. While the BMPs included in the SWPPP primarily are aimed at minimizing the discharge of pollutants to receiving surface waters, the BMPs also would serve to minimize any short-term impacts on groundwater quality from construction activities.

3.3.2 Affected Environment/Existing Conditions

The following describes the existing groundwater quality beneath the adjacent Playa Vista First Phase Project and the Proposed Project and vicinity, including salinity levels and pollutant concentrations in the groundwater.

3.3.2.1 Salinity

Monitoring wells for the Silverado Aquifer (deeper aquifer) have indicated high chloride and total dissolved solids (TDS) concentrations. TDS is a general measure of salinity. These wells indicate a high level of TDS ranging from 800 to 2,000 mg/L, well above the recommended level of 1,000 mg/L for drinking water. These concentrations are indicative of the degradation of groundwater from sea water intrusion which likely occurred during a period from 1920 to 1950 when it has been thought that overpumping of this aquifer occurred and/or may be indicative of earlier deeper inland penetration of saltwater in estuaries like the historical Ballona Wetlands. It is possible, however, that such saltwater infiltration from the historical Ballona Wetlands was subsequently reduced with the channelization of Ballona Creek.

Groundwater quality within the shallower Ballona Aquifer system is also considered degraded as a consequence of past overproduction of shallow groundwater and/or seawater inland penetration. Currently, no wells extract groundwater from the Ballona Aquifer for domestic uses or irrigation on or near the adjacent Playa Vista First Phase Project and the Proposed Project.

Based on groundwater sampling in three wells during the Third Quarter of 1999, TDS concentrations within the Ballona Aquifer system underlying the adjacent Playa Vista First Phase Project and the Proposed Project ranged from 500 mg/L to 4,200 mg/L.[179] [180] These values are a range higher than the Basin Plan standards, but are likely due to the proximity to the ocean. [181] Currently, no wells on or near the sites of the adjacent Playa Vista First Phase Project and the Proposed Project extract groundwater from the Ballona Aquifer for domestic uses or irrigation.

3.3.2.2 Other Constituents in Groundwater

Contamination within the adjacent Playa Vista First Phase Project and Proposed Project sites is a result of past industrial activities. A reduction in the levels of contamination within the area is a result of the ongoing soil and groundwater remediation activities. The ongoing remediation is another factor affecting groundwater quality.

The Bellflower Aquitard and Ballona and Silverado Aquifers were sampled for priority pollutants[182], metals, volatile and extractable organic compounds, pesticides, and PCBs on several occasions between 1988 and 2000 and are currently monitored on a quarterly basis (for more information see the Proposed Project's Draft EIR, Section IV-I, Safety/Risk of Upset). During these events, numerous wells were sampled in the Proposed Project site. No pesticides or PCBs were detected in any samples.[183,184] Solvent and gasoline contamination was identified during the 1987 through 2000 groundwater sampling in the adjacent Playa Vista First Phase Project and the Proposed Project. As discussed in Section IV-I, Safety/Risk of Upset, in the Proposed Project EIR, there are six study areas within the Proposed Project site and three areas in the western portion of the adjacent Playa Vista First Phase Project that

---

[179] *Camp Dresser & McKee Inc., "Third Quarter 1999 Groundwater Monitoring and Progress Report," November 12, 1999.*

[180] *Camp Dresser & McKee Inc., "Third Quarter 1999 Groundwater Monitoring and Progress Report," November 12, 1999.*

[181] *The Ballona Creek watershed does not have a site-specific TDS standard listed in the Basin Plan. However, the Ballona Creek is designated as having a potential municipal water supply beneficial use.*

[182] *Priority pollutants are toxic compounds for which CalEPA establishes numeric criteria in order to define thresholds for pollutant levels in waterbodies.*

[183] *LeRoy Crandall and Associates, Op cit., August 21, 1990, page 10.*

[184] *CDM, Op cit., July 17, 2000, Section 5.*

were identified as potential sources of impacted groundwater that could potentially affect the Proposed Project site. Two of the six areas of concern are within the Proposed Project site, the former Temporary Drum Storage Area and former Salvage Yard (see the Proposed Project's Draft EIR, Section IV-I, Safety/Risk of Upset, for a map of these areas of potential environmental concern). Monitoring wells are part of the quarterly groundwater sampling network for the Proposed Project area.[185] A discussion of the findings with respect to groundwater quality can be found in the Proposed Project's Draft EIR, Safety/Risk of Upset.

Groundwater under the former Salvage Yard has been sampled quarterly since the first quarter of 1999 in accordance with the Final Groundwater Sampling and Analysis Plan. During the initial sampling, groundwater was analyzed for priority pollutants including PCBs, pesticides, VOCs, TPH, and CAM 17 metals. Because PCBs and pesticides were not detected, subsequent groundwater samples collected during the second and third quarters of 1999 were analyzed for VOCs, CAM 17 metals and TPH. Starting with the fourth quarter of 1999, groundwater samples have been collected quarterly and analyzed for VOCs and TPH. Between the first quarter of 1999 and second quarter of 2002, groundwater samples had detectable concentrations[186] of PCE (0.8 to 3.1 μg/L), TCE (2.0 to 42 μg/L), 1,1,1-TCA (0.6 to 3.2 μg/L), 1,1-DCE (0.6 to 1.5 μg/L), 1,1-DCA (0.5 to 10 μg/L), cis-1,2-DCE (0.8 to 21 μg/L), trans-1,2-DCE (0.5 to 3.0 μg/L), vinyl chloride (2.4 to 33 μg/L), and TPH-cc (339 μg/L)[187]. It should be noted, however, that TPH-cc has not been detected since the second quarter of 2000. The highest concentrations of total metals were for barium (0.11 mg/L) and zinc (29 mg/L). The highest concentrations of dissolved metals were also for barium (7 mg/L) and zinc (2 mg/L). Toluene and TPH-cc were detected at concentrations of 2.1 and 690 μg/L, respectively, in groundwater samples collected from the deep monitoring well (Silverado Aquifer) during the fourth quarter 1999. Neither compound has been detected since that time.

Groundwater beneath the former Temporary Drum Storage Area was sampled in the first quarter of 1999 through the second quarter of 2002 for VOCs. Groundwater in this area was also sampled for PCBs and pesticides in the first quarter of 1999; for TPH between the first quarter of 1999 and the third quarter of 2001; and for total/dissolved CAM 17 metals during the second and third quarters of 1999. PCBs and pesticides were not detected during the initial sampling event. The highest concentrations of total metals were for barium (0.1 mg/L) and zinc (0.01 mg/L). The highest concentrations of dissolved metals were also for barium (0.33 mg/L) and zinc (0.04 mg/L). Some sampling events only included the analysis of dissolved metals. TPH was not detected. With respect to VOCs, groundwater samples collected between March 1999 and the third quarter of 2002 had detectable concentrations of TCE (0.51 to 4.3 μg/L), 1,1-DCE (one time detection of 0.6 μg/L in the third quarter of

[185] *CDM 1999 – Final Groundwater Sampling and Analysis Plan, Playa Vista Site, June 30, 1999.*
[186] *In accordance with the Cleanup and Abatement Order No.98-125, Playa Vista will investigate and if necessary, will remediate the groundwater to RWQCB approved clean-up levels.*
[187] *Camp Dresser & McKee Inc. Second Quarter 2002 Groundwater Monitoring and Progress Report. Section 10, Tables 9,10 and 11, July 15, 2002.*

1999), 1,1,1-TCA (one time detection of 0.65 µg/L in the fourth quarter of 1999), and cis-1,2-DCE (0.64 to 7.8 µg/L).[188]

Although monitoring wells located in the other areas of potential environmental concern within the Proposed Project site (former Remote Test Site, former Firing Range Area, former Aircraft Service Area and former Purged Fuel Storage Area) are not included in the quarterly groundwater monitoring network, groundwater beneath each of these areas was investigated during a soil and groundwater investigation performed by CDM in early 2002 (see Section IV-I, Safety/Risk of Upset, of the Proposed Project's Draft EIR for results)[189].

During the soil and groundwater investigation, groundwater samples were analyzed primarily for VOCs and metals, although other constituents (i.e., PCBs and TPH-cc) were analyzed in a few selected samples. VOCs detected most frequently and at the highest concentration in the groundwater samples were cis-1,2-DCE, 1,1-DCA and vinyl chloride. Cis-1,2-DCE concentrations were detected as high as 99 µg/L in the upper Bellflower Aquitard; 1,1-DCA was observed at concentrations up to 19 µg/L; and vinyl chloride at concentrations up to 6 µg/L. In the lower Bellflower Aquitard and Ballona Aquifer, cis-1,2-DCE was detected at concentrations up to 930 µg/L; 1,1-DCA at concentrations of 70 µg/L; and vinyl chloride was detected at up to 66 µg/L. The highest cis-1,2-DCE and 1,1-DCA concentrations were detected in the Ballona Aquifer sample collected down gradient of former Firing Range Area and the eastern portion of the former Salvage Yard Area. The highest vinyl chloride concentration was detected in the sample collected from the well located in the former Firing Range Area.

Except for one sample, all metals concentrations in the groundwater samples were below California's drinking water standard, which demonstrates that groundwater within the Proposed Project site has not been impacted by metals. Arsenic was detected in one sample, located in the former Salvage Yard Area, at a concentration of 52 µg/L, which is just slightly higher than the drinking water standard of 50 µg/L. As previously noted, groundwater in the vicinity of the Proposed Project is not pumped for use as drinking water or any other beneficial use.

Since March 1999, wells located near Building 11 (within the adjacent Playa Vista First Phase Project area) have been gauged and purged of light non-aqueous phase liquid (LNAPL – a fuel hydrocarbon). At most, 2 feet of LNAPL was observed in the wells, which was manually removed from the wells on a monthly basis until July 1999, when no measurable LNAPL thickness was observed in the wells.[190] A LNAPL sheen

---

[188] *In accordance with the Cleanup and Abatement Order No. 98-125, Playa Vista will investigate and if necessary, will remediate the groundwater to RWQCB approved clean-up levels.*

[189] *Camp Dresser & McKee Inc., Soil and Groundwater Investigation Report, Phase 2 Portion of the Area D Project Area, Playa Vista Site, May 15, 2002.*

[190] *Camp Dresser & McKee Inc., First Quarter 2000 Groundwater Monitoring and Progress Report, April 14, 2000, Section 5.*

has been observed in a few wells since November 1999, however, during the first two quarters of 2002, no sheen was observed in the monitored wells.[191]

Prior to its decommissioning in June 2000, the GWTF discharged treated water to Centinela Creek under a RWQCB NPDES permit. The NPDES permit placed strict limits on the concentrations of pollutants that were acceptable for discharge and required the treated water to be monitored weekly to monthly for quality. **Table 3-17, Pollutant Removal Approximations for Water Quality Inlets Used in Pollutant Loading Model**, summarizes the permitted and detected effluent concentrations from remediation activities and construction dewatering. As of March 2000, the total volume of groundwater treated and discharged was approximately 94 million gallons.[192] Prior to discharge, the treated groundwater was sampled and analyzed to ensure it met the effluent limit concentrations specified in the permit. Whenever treated groundwater contained pollutants at concentrations exceeding the permit requirements, the water was not discharged until the source of the exceedance was identified and corrective action implemented.

See Section IV-I, Safety/Risk of Upset, of the Proposed Project's Draft EIR for a discussion of the assessment and remediation of soil and groundwater contamination associated with the former Howard Hughes Company Plant activity areas within the Proposed Project site.

3.3.3 Project Design Features

A number of surface water quality Project Design Features have been designed to reduce the potential for pollutants associated with both construction (such as construction BMPs) and operation (such as the Freshwater Wetlands System). To the extent that there is any incidental groundwater recharge from runoff flowing over or detained in pervious surfaces on the Proposed Project, the potential for groundwater quality impacts would be reduced as a result of the measures designed to reduce pollutants in surface runoff. There is the potential to concentrate sediment in the bottom of the Freshwater Wetlands System, which could be transmitted through infiltration into the groundwater. However, the Freshwater Wetlands System has been designed to reduce pollutants, and thus sediments, in surface water. The anaerobic conditions and associated bacterial populations that are expected in the wetland soils of the Riparian Corridor and the Freshwater Marsh will reduce many metals to insoluble forms that are less toxic and less bioavailable. As part of the Freshwater Wetlands System's O&M Manual, monitoring and maintenance (e.g., vegetation and sediment removal) would be performed as prescribed in the O&M Manual to ensure that quality of the sediment accumulated remains below levels of concerns associated with metals, pesticides, and other toxic chemical as they relate to potential bioaccumulatory and toxicity impacts. In addition, the aquifers

---

[191] *Camp Dresser & McKee Inc., Second Quarter 2002 Groundwater Monitoring and Progress Report, July 15, 2002.*
[192] *Camp Dresser & McKee Inc., First Quarter 2000 Groundwater Monitoring and Progress Report, April 14, 2000, Section 5.*

(Ballona and Silverado) underlying the site are separated from the surface with an aquitard (Bellflower). The Bellflower Aquitard acts like a barrier, slowing the hydraulic communication between the surface and the Ballona and Silverado Aquifers, thus limiting the impact of these deeper water producing units. To further limit migration of pollutant through infiltration, the Riparian Corridor portion of the Freshwater Wetlands System has been designed with a clay liner to limit flow from the surface water to the groundwater.

No land uses (e.g., industrial land uses) are planned that could legally contribute to groundwater contamination within the Proposed Project site. The design, construction and operation of any land uses that might include storage of fuel in underground tanks (such as retail gas stations), would be regulated by current state law that provides for methods which monitor and minimize the potential for leakage.

Not all structures within the Proposed Project site would be above the groundwater table. Some structures may extend into the groundwater table (e.g., two-level subterranean parking garages), and those structures would require permanent dewatering systems. The proposed permanent dewatering systems, which include dewatering for the methane safety system and dewatering of structures below the groundwater table, is a "contingent" system that would operate only if/as groundwater elevations occur at the level of the dewatering pipes. In case groundwater is present or in future rises to an elevation above the elevation of the groundwater pipes, the system is designed to convey the water to a sump where it is removed by automatic pumps. Generally, the dewatering system does not include dewatering by pumping from deep wells or any specific well points.[193] However, some dewatering may be necessary in connection with periodic methane system maintenance. Any necessary groundwater dewatering would be conducted in accordance with the NPDES or other applicable regulatory requirements.

3.3.4 Groundwater Quality Impacts

3.3.4.1 Significance Thresholds

The Draft Los Angeles CEQA Thresholds Guide (p. D.4-4) states that a project would normally result in a significant impact on groundwater quality if it would:

- Affect the rate or change the direction of movement of existing contaminants;
- Expand the area affected by contaminants;
- Result in an increased level of groundwater contamination (including that from direct percolation, injection or salt water intrusion); or
- Cause regulatory water quality standards at an existing production well to be violated, as defined in the California Code of Regulations, Title 22, Division 4, Chapter 15 and the Safe Drinking Water Act.

These thresholds are applicable to the Proposed Project and as such are used to determine if the Project would have significant groundwater quality impacts.

3.3.4.2 Methodology

Short-term groundwater quality impacts could potentially occur during construction of the Proposed Project as a result of soil or shallow groundwater being exposed to construction materials, wastes, and spilled materials or as a result of construction dewatering. These potential impacts are qualitatively assessed.

Long-term (operational) groundwater quality impacts associated with the Proposed Project could potentially occur due to permanent dewatering of underground parking structures and/or groundwater remediation activities. These potential impacts are qualitatively assessed.

The potential for the Proposed Project to result in groundwater contamination, modification of existing contaminant movement, or expansion of the contaminated area is analyzed in Section IV-I, Safety/Risk of Upset of the Proposed Project's Draft EIR.

3.3.4.3 General Project Effects

The quality of the existing groundwater resources in the vicinity of the Proposed Project could potentially be impacted both temporarily by construction activities and long-term by operations associated with the proposed land uses. The potential water quality effects for which impact analyses follow include:

- Short-term changes in groundwater quality due to construction activities (Section 3.3.4.4)
- Long-term impacts on the underlying groundwater as a result in changes in overlying land uses and groundwater recharge patterns (Section 3.3.4.5)
- Cumulative water quality impacts (Section 3.3.4.6)

3.3.4.4 Impact: Short-Term Impacts from Construction Activities

As discussed in Section 3.2.3.6.2, the existing SWPPP will be updated and amended as appropriate to include Proposed Project construction activities and will be implemented throughout the duration of construction activities on the Proposed Project. The RWQCB is the primary enforcing agency for the SWPPP and can inspect the Proposed Project at any time after construction begins. The RWQCB also has the authority to review the SWPPP at the site, declare the SWPPP and/or BMPs to be inadequate, and to initiate enforcement actions, if necessary. While the BMPs that would be included in the SWPPP are primarily aimed at minimizing the discharge of pollutants to surface receiving waters, the BMPs will also serve to minimize any short-term impacts on groundwater quality from construction activities. Specific BMPs that would address possible discharges of pollutants most likely to affect groundwater include:

- Waste Management Practices
- Vehicle and Equipment Cleaning, Fueling, and Maintenance Controls
- Material Delivery and Storage Controls
- Spill Prevention and Control Procedures
- Measures to Comply with Waste Disposal, Sanitary Sewer, and Septic Regulations
- Contaminated Soil Management

Any discharge of groundwater in conjunction with construction dewatering or operational dewatering for structures placed below grade for the Proposed Project would require compliance with the Project's General Construction Permit, an individual NPDES permit, or an appropriate industrial users discharge permit issued by the City of Los Angeles Department of Public Works, Bureau of Sanitation. Although construction of the Urban Development Component would reduce open space and increase the impervious areas of the site, resulting in reduced infiltration (see Section 2 of this Volume), additional irrigation of added landscaped areas would offset the decrease, resulting in a net increase of approximately 6 acre-ft/year. This increase is considered positive, but negligible from a regional basin perspective, and is not expected to result in any measurable increase in local groundwater levels.

It is anticipated that construction dewatering will occur in conjunction with the Proposed Project. Any discharge of groundwater will require compliance with the NPDES General Permit for Construction Dewatering from the RWQCB.

Given the relatively shallow depth to groundwater in the area of the Proposed Project, below-grade construction activities for the Urban Development Component could potentially encounter groundwater, thereby requiring dewatering during construction. Due to the short-term nature of construction and dewatering activities, and through implementation of applicable construction BMPs and compliance with NPDES requirements for dewatering discharges, no significant adverse short-term impacts to groundwater quality are indicated.

As described in Section IV-I, Safety & Risk of Upset of the Proposed Project's Draft EIR, groundwater contamination has been observed both beneath the Urban Development Component as well as under adjacent areas – former Test Site 2 and former industrial areas east of the Proposed Project site and within the adjacent Playa Vista First Phase Project. A detailed discussion of contaminated groundwater within the boundaries of the Proposed Project and adjacent areas is found in Section IV-I, Safety & Risk of Upset. Two potential impacts could occur from short or long-term dewatering. The dewatering could: (1) affect the rate or change the direction of the movement of existing contaminants, or (2) expand the area affected by contaminants.

Short or long-term dewatering also has the potential to draw groundwater contamination from areas adjacent to the Proposed Project. To the west of the Urban Development Component, a former industrial area known as former Test Site 2 within the adjacent Playa Vista First Phase Project site is currently undergoing active groundwater remediation. The groundwater remediation at former Test Site 2 includes both in-situ biodegradation of contaminants, as well as groundwater extraction and treatment. Groundwater extraction at former Test Site 2 will create an inward hydraulic gradient toward the treatment zone, i.e., away from the Proposed Project. Therefore, although the adjacent former Test Site 2 area is, under natural conditions, cross-gradient and slightly upgradient of the Proposed Project, the implemented remediation of former Test Site 2 makes it unlikely that groundwater extraction within the Proposed Project would draw contamination from the adjacent areas to the west.

Groundwater beneath the former industrial areas east of the Proposed Project site and within the adjacent Playa Vista First Phase Project is downgradient to slightly cross-gradient from the Proposed Project area. Under current natural conditions, it is unlikely that contamination in these former industrial areas could migrate westward into the Proposed Project. The Remediation Plan for these former industrial areas, approved by the RWQCB in November 2002, is expected to commence implementation by Fall 2003. This Plan specifies active extraction and treatment of groundwater at a number of contaminant source areas in the former industrial areas east of the Proposed Project site and within the adjacent Playa Vista First Phase Project. The extraction will create greater inward hydraulic gradients, away from the Proposed Project and toward the treatment zones, further decreasing the potential for migration of contaminants toward the Proposed Project.

Although remedial planning and design for the Proposed Project area are expected to be completed by 2004, remediation of the groundwater is expected to take several years. Therefore, depending on the timing of the construction of the Urban Development Component, dewatering activities could potentially result in the extraction of contaminated groundwater. However, any required remedial action with respect to groundwater is expected to be initiated prior to construction of the Urban Development Component. Therefore, it is likely that the extent and magnitude of contamination at the time of construction will be less than current conditions. In addition, remediation would be conducted under the direction of the RWQCB, and the RWQCB would require that construction and/or long-term dewatering be conducted in a manner that does not negatively impact ongoing remediation or exacerbate the extent of contamination. If necessary, the remedial systems would be modified to preclude or minimize the potential for dewatering activities to spread contamination. Remedial systems, if any, and dewatering activities, therefore, are expected to be fully compatible.

Due to the short-term nature of construction and dewatering activities, implementation of applicable construction BMPs, compliance with NPDES requirements for dewatering discharges, and compliance with State Title 22 standards for recycled water quality, development of the Urban Development Component would not result in an increased level of groundwater contamination (including that from direct percolation, injection or salt water intrusion). Therefore, a less than significant impact to groundwater quality would occur.

3.3.4.5 Impact: Long-Term Impacts from Changes in Overlying Land Uses

Long-term dewatering during operation of the Urban Development Component may be required for structures that would be constructed below the groundwater table surface, such as subterranean (underground) parking garages. The proposed permanent dewatering systems, which includes dewatering for the methane safety system and dewatering of subterranean parking lots, is a "contingent" system that would operate only if/as groundwater elevations occur at the level of the dewatering pipes. In case groundwater is present or in future rises to an elevation above the elevation of the groundwater pipes, the water is conveyed to a sump where it is removed by automatic pumps. The dewatering system does not include dewatering by pumping from deep wells or any specific well points.[194] Adverse impacts are not anticipated relative to the rate or change in the direction or movement of existing contaminates in groundwater from dewatering associated with operation of the permanent dewatering systems. This is because the maximum flow of the dewatering pipes is very low and their radius of influence on the groundwater unit is limited. Therefore, the dewatering pipes are not anticipated to draw water across any substantial distance, and impacts would be less than significant. To date, no effect on plume movement has been observed in relation to the operation of permanent dewatering systems anywhere within the adjacent Playa Vista First Phase Project site, and similar results are anticipated for such systems installed within the Proposed Project. See Section IV-A, Earth and Section IV-I, Safety/Risk of Upset, of the Proposed Project's Draft EIR for further discussion of the potential impacts of dewatering on subsidence and groundwater contamination, respectively.

Given the relatively shallow depth to groundwater in the area of the Proposed Project, it is reasonable to expect that any below-grade construction activities for the Habitat Creation/Restoration Component may encounter groundwater thereby requiring dewatering during construction. As described above, groundwater remediation at the Proposed Project site is expected to be initiated prior to construction of the Habitat Creation/Restoration Component, thereby reducing the extent and magnitude of contamination to less than current conditions. In addition, remediation would be conducted under the direction of the RWQCB, and the RWQCB would require that construction dewatering be conducted in a manner that does not negatively impact ongoing remediation nor exacerbate the extent of contamination. Remediation at the nearby areas of Test Site 2 and the former industrial areas east of the Proposed Project site and within the adjacent Playa Vista First Phase Project would create an inward hydraulic gradient toward the treatment zone, i.e., away from the Proposed Project, and would also be conducted under the direction of the RWQCB. Due to the short-

---

[194] *Group Delta Consultants, "Evaluation of Subsidence Due to Lowering of Groundwater in Village at Playa Vista, Playa Vista Development, Los Angeles, California", April 15, 2003.*

term nature of construction and dewatering activities, dewatering for the Habitat Creation/Restoration Component is not expected to significantly affect the rate or change the direction of movement of existing contaminants or expand the area affected by contaminants for the known contaminant areas beneath the Proposed Project Site, the former Test Site 2, and the former industrial sites east of the Project Site and within the adjacent Playa Vista First Phase Project.

The Habitat Creation/Restoration Component does not involve the construction of any industrial development that would contribute to groundwater contamination within the Proposed Project site. The Riparian Corridor portion of the Habitat Creation/Restoration Component would collect stormwater runoff from the Proposed Project and off-site tributaries, which could contain pollutants typical of urban development. The Riparian Corridor could detain the stormwater resulting in percolation of the stormwater runoff into the groundwater. However, the upper portion of the Riparian Corridor would have a clay liner limiting percolation of surface runoff to the groundwater. In addition, the depth to Silverado Aquifer, which is the only aquifer at the site with beneficial uses, is 100 to 200 feet below ground surface. Therefore, development of the Habitat Creation/Restoration Component is not expected to result in an increased level of groundwater contamination (including that from direct percolation, injection or salt water intrusion).

The Proposed Project would utilize recycled (reclaimed) water for irrigation and office toilet/cooling tower use, which may percolate to local groundwater units. Recycled water for on-site landscape irrigation, provided by the West Basin Municipal Water District (WBMWD)'s West Basin Water Recycling Plant (WBWRP), is regulated by the Regional Water Quality Control Board (RWQCB), using health standards established by the California Department of Health Services (DHS). Such irrigation water must meet or exceed the State Title 22 standards for water quality. As a permit condition to procure Title 22 recycled water, the RWQCB requires ongoing monitoring of product water, as well as annual reporting of water quality analysis results. Any recycled water that would percolate into local groundwater units would be filtered through varying layers of earth, further enhancing its purity. Furthermore, the only groundwater unit beneath the Proposed Project site with current beneficial uses is the Silverado Aquifer, which is also the deepest aquifer (100 to 200 feet) at the site. Therefore, in order for recycled irrigation water to reach an aquifer that is pumped for beneficial uses, the water would have to pass through several hundred feet of earth and rock. Consequently, given the initial quality of the Title 22 water to be applied as irrigation supply, as well as the depth to groundwater units with beneficial uses, no impacts to groundwater quality from the use of recycled water are expected to occur, and no mitigation is required.

With respect to other operational (long-term) groundwater quality impacts, no land uses (e.g., industrial development) would be permitted or are presently planned that could legally contribute to groundwater contamination within the Proposed Project site. Current state law would regulate the design, construction and operation of any land uses that might include storage of fuel in underground tanks.

3.3.4.6 Summary of Groundwater Quality Impacts

Groundwater in the area of the Urban Development Component of the Proposed Project is not currently pumped for beneficial uses (i.e., drinking water, industrial or agricultural supply). The nearest public water supply well located at Venice Polytechnic High School, approximately 2 miles northwest of the Proposed Project, was capped in 1960 and is not active. The next closest public supply wells are located approximately 3.5 miles northwest of the Proposed Project in the City of Santa Monica. The nearest irrigation well is located approximately 2 miles southeast of the Proposed Project at the Hillside Memorial Park Cemetery. Due to the distance to these wells, the fact that drinking water, industrial or agricultural supply wells would not be constructed as part of the Urban Development Component, and compliance with State Title 22 standards for recycled water quality, construction and operation of the Urban Development Component are not expected to cause regulatory water quality standards at an existing production well to be violated, as defined in the California Code of Regulations, Title 22, Division 4, Chapter 15 and the Safe Drinking Water Act. Hence, a less than significant impact to groundwater quality would occur.

Construction and operation dewatering for the development of the Urban Development Component are not expected to affect the rate or change the direction of movement of existing contaminants or expand the area affected by contaminants for the known contaminant areas beneath the Proposed Project Site, the former Test Site 2, and the former industrial sites east of the Project Site and within the adjacent Playa Vista First Phase Project. Therefore, impacts to groundwater due to dewatering are anticipated to be less than significant with the implementation of the Urban Development Component.

In summary, neither construction nor operation of the Proposed Project is expected to result in a substantial increase in pollutant loadings to, or contamination of, groundwater aquifers over existing levels, and therefore no significant adverse impact to groundwater quality is indicated.

3.3.4.7 Cumulative Effects

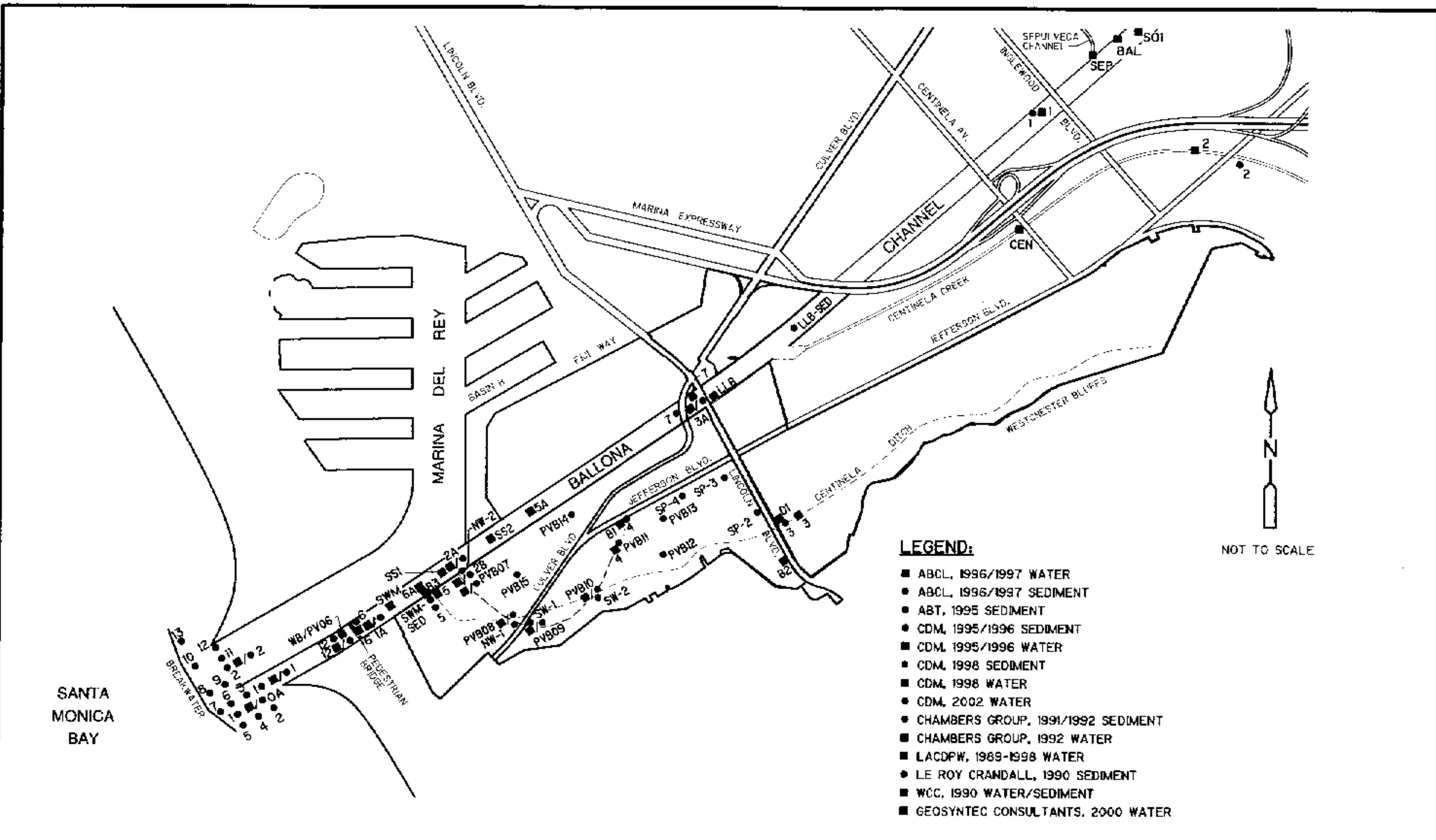
For the cumulative impacts analysis relative to the Proposed Project, land use in the immediate vicinity of the Proposed Project site was identified, and the impacts of any changes that might affect groundwater quality were evaluated. The tributary area analyzed includes the Proposed Project and the subset of related projects within the tributary area, which includes the adjacent Playa Vista First Phase Project, West Bluff project (Tentative Tract 51122), and the Loyola Marymount University expansion. Since these areas are already highly urbanized, other changes or development are not likely to cause substantial changes in regional surface water or groundwater quality. Predicted loads and concentrations in this analysis were based on the total tributary drainage area generating runoff using designated zoning/land uses. In fact, with redevelopment projects (with application of the SUSMP requirements as appropriate) and increases in system-wide controls associated with other elements of the MS4 Permit, it is anticipated over time, regional water quality may improve.

Additionally, related projects are unlikely to cause or increase groundwater contamination because existing statutes prohibit contamination of groundwater by existing and future land uses and also require remediation of existing contamination. The Proposed Project occupies less than 1 percent of the coastal plain hydrologic groundwater basin. As such and in light of the limited contribution from other projects and Proposed Project's control measures, the Proposed Project's contribution to surface water or groundwater quality impacts is not cumulatively considerable and, therefore, less than significant.

In addition to the two off-site projects discussed above, there are seven roadway widenings that are planned to mitigate traffic congestion caused by the Proposed Project. The Centinela Corridor improvements will add approximately 0.6 acres of impervious surfaces. The other intersection improvements which include Culver Boulevard and Inglewood Boulevard, Sawtelle Avenue and Culver Boulevard, La Tijera Boulevard and Centinela Avenue, Centinela Avenue and Washington Place, Overland Avenue and Culver Boulevard and Centinela Avenue and Culver Boulevard, will add approximately 0.3 acres of impervious surfaces which is a nominal loss of pervious surface; therefore, it is anticipated that the impact associated with these off-site construction projects will be less than significant.

Cumulative impacts to surface water quality would be less than significant, as the Proposed Project is not anticipated to create pollution, contamination or nuisance as defined in Section 13050 of the CWC or cause regulatory standards to be violated, as defined in the applicable NPDES stormwater permit or Water Quality Control Plan (Basin Plan) for the receiving waterbodies.

Cumulative impacts to groundwater quality would be less than significant, as the Proposed Project is not anticipated to affect the rate or direction of movement of existing contaminants; expand the areas affected by contaminants; increase the level of groundwater contamination (including that from direct percolation, injection or saltwater intrusion); or cause regulatory water quality standards of existing production wells to be violated as defined in the California Code of Regulations, Title 22, Division 4, Chapter 15 and the Safe Drinking Water Act.



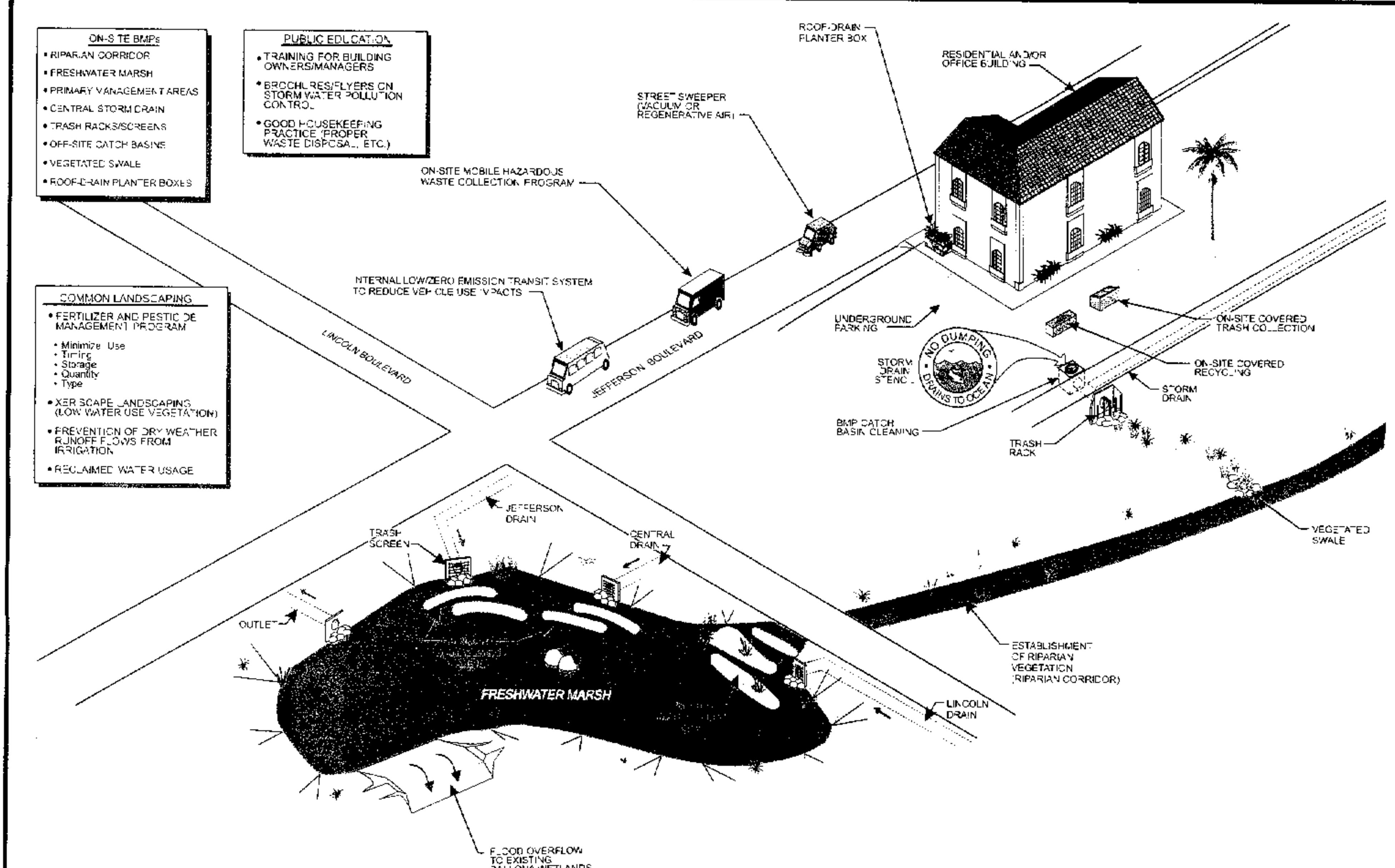
CDM

THE VILLAGE AT PLAYA VISTA
WATER RESOURCES TECHNICAL REPORT

Playa Vista Existing Data - Approximate Water, Sediment, and Soil Sampling Locations

Figure 3-1

N:\1061\037605\0cad\TechRpt\BestMgtPract.cdr - Negretegd - 07/15/2003



SOURCE: URS (Modified by CDM)

Note: For discussion purposes only. Actual development and placement details may vary.

THE VILLAGE AT PLAYA VISTA
WATER RESOURCES TECHNICAL REPORT

Examples of
Best Management Practices (BMPs)

CDM

Figure 3-2

Table 3-1
Proposed Beneficial Uses of Project Drainages

	Beneficial Use																
	MUN	IND	PROC	AGR	NAV	REC1	REC2	COMM	WARM	EST	MAR	WILD	RARE	MIGR	SPWN	SHELL	WET[a]
Surface Water																	
Ballona Creek Estuary[b]	--	--	--	--	E	E	E	E	--	E	E	E	E[c]	E[d]	E[c]	E	--
Ballona Wetlands[g]	--	--	--	--	--	E	E	--	--	E	--	E	E[c]	E[d]	E[c]	--	E
Ballona Creek to Estuary[b]	P[e]	--	--	--	--	P[f]	E	--	P	--	--	P	--	--	--	--	--
Ballona Creek	P[e]	--	--	--	--	P[f]	E	--	P	--	--	E	--	--	--	--	--
Groundwater																	
Santa Monica Basin	E	E	E	E	--	--	--	--	--	--	--	--	--	--	--	--	--
Coastal Feature																	
Ballona Creek Estuary[b]	--	--	--	--	E	E	E	E	--	E	E	E	E[c]	E[d]	E[d]	E	--
Ballona Wetlands[g]	--	--	--	--	--	E	E	--	--	E	--	E	E[c]	E[d]	E[d]	--	E
Coastal Wetland																	
Ballona Wetlands	--	--	--	--	--	E	E	--	--	E	--	E	E[c]	E[d]	E[d]	--	E

Notes:

P = Potential E = Existing

Beneficial Use Designations: MUN = Municipal and Domestic Supply; IND = Industrial Service Supply; PROC = Industrial Process Supply; AGR = Agricultural Supply, NAV = Navigation; REC1 = Water Contact Recreation; REC2 = Non-contact Water Recreation; COMM = Commercial and Sport Fishing; WARM = Warm Freshwater Habitat; EST = Estuarine Habitat; MAR = Marine Habitat; WILD = Wildlife Habitat; RARE = Rare, Threatened, or Endangered Species; MIGR = Migration of Aquatic Organisms; SPWN = Spawning, Reproduction, and/or Early Development: SHELL = Shellfish Harvesting; WET = Wetland Habitat

a = Waterbodies designated as WET may have wetlands habitat associated with only a portion of the waterbody. Any regulatory action would require a detailed analysis of the area.

b = These areas refer to geographical reaches of the Ballona Channel. All references to Tidal Prisms in Regional Board Documents are functionally equivalent to estuaries. In the Water Quality Control Plan, Los Angeles Region (RWQCB, 1994), the Ballona Estuary is defined as beginning just below Lincoln Boulevard Bridge and extends down to Dockweiler Beach, near the mouth of the Ballona Channel. The reach Ballona Creek to Estuary extends from Bridge up to McManus Park. From there upstream to the intersection of Cochran Street and Venice Boulevard is the Ballona Creek reach.

c = One or more rare species utilize all ocean, bays, estuaries, and coastal wetlands for foraging and/or nesting.

d = Aquatic organisms utilize all bays, estuaries, lagoons and coastal wetlands, to a certain extent, for spawning and early development. This may include migration into areas that are heavily influenced by freshwater inputs.

e = MUN designations are designated under State Board Resolution No. 88-63 (Sources of Drinking Water) and Regional Board Resolution No. 89-03 (Incorporation of Sources of Drinking Water Policy into the Water Quality Control Plans (Basin Plans)). Some designations may be considered for exemptions at a later date.

f = Access prohibited by Los Angeles County DPW.

g = Existing Ballona Wetland

Source: Los Angeles Regional Water Quality Control Board, June 1994, Water Quality Control Plan, Los Angeles Region

Table 3-2
Listed Water Quality Parameters for Ballona Creek Estuary, Ballona Wetland, and Santa Monica Bay

Parameter	Ballona Creek Estuary	Ballona Wetland	Santa Monica Bay [a]
Arochlor (PCB product trade name)	✓ [b]		
Arsenic, tissue		✓ [b]	
Cadmium, sediment			✓ [b]
Chlordane, tissue (pesticide)	✓		
Chlordane, sediment (pesticide)	✓		✓
Copper, sediment			✓ [b]
DDT, tissue (pesticide)			✓
DDT, sediment (pesticide)	✓		✓
Debris			✓
Exotic Vegetation		✓	
Fish Consumption Advisory			✓
Habitat Alterations		✓	
High Coliform Count	✓		
Hydromodification		✓	
Lead, tissue			✓ [b]
Lead, sediment	✓		✓ [b]
Mercury, sediment			✓ [b]
Nickel, sediment			✓ [b]
PAHs, sediment (polycyclic aromatic hydrocarbons)	✓		✓
PCBs, sediment and tissue (polychlorinated biphenyls)	✓		✓
Reduced Tidal Flushing		✓	
Sediment Toxicity	✓		✓
Shellfish Harvesting Advisory	✓		
Silver, tissue			✓ [b]
Trash		✓	
Zinc, sediment	✓		✓ [b]

a *Listing for Santa Monica Bay offshore and near shore.*
b *Proposed to be delisted in the 2002 303(d).*
Source: *Parameters included in 1998 and 2002 California 303(d) List.*

Table 3-3
Selected* Water Quality Constituents in Santa Monica Bay During Dry-Weather

Constituent	Units	Chronic[a,b] CTR Criteria	COP Objectives	COP Chronic Toxicity	Total Number of Samples	Number of Samples Exceeding Criteria	Observed Concentrations Min.	Max.	Mean
Oil and Grease	mg/L	—	25	—	1		8	8	8
Total Coliform	MPN/100ml	—	1,000	—	22	6	ND	16,000	1,330
Fecal Coliform	MPN/100ml	—	200	—	22	6	ND	1,300	273
Entero Coccus	Col's/100ml	—	—	—	22	—	ND	1.8	28
Salinity	0/00	—	—	—	64		25	33.57	33
pH	su		—	—	64	—	7.84	8.3	8.1
Dissolved Oxygen	mg/L	—	—	—	64	—	5.54	9.54	7.8
Total Phosphorus	mg/L		—	—	1	—	0.17	0.17	0.17
Dissolved Arsenic	µg/L	36	32	19	1	0	ND	2	1
Dissolved Cadmium	µg/L	9.3	4	8	1	0	ND	ND	ND
Dissolved Copper	µg/L	3.1	12	5	1	0	ND	ND	ND
Dissolved Lead	µg/L	8.1	8	22	1	0	ND	ND	ND
Dissolved Mercury	µg/L	—	0.16	0.4	1	0	ND	ND	ND
Dissolved Nickel	µg/L	8.2	20	48	1	1	10	10	10
Dissolved Zinc	µg/L	81	80	51	1	1	60	60	60
Aldrin[b]	µg/L	1.3	0.000022	—	1	0	ND	ND	ND
Chlordane	µg/L	0.004	0.000023	—	1	0	ND	ND	ND
Dieldrin[b]	µg/L	0.0019	0.00004	-	1	0	ND	ND	ND
Endrin[b]	µg/L	0.0023	0.004	—	1	0	ND	ND	ND
Toxaphene	µg/L	0.0002	0.0021	—	1	0	ND	ND	ND
Heptachlor	µg/L	0.0036	0.00072	—	1	0	ND	ND	ND
Heptachlor Epoxide[b]	µg/L	0.0036	—	—	1	0	ND	ND	ND
O,P'-DDT	µg/L	—	0.00017	—	1	—	ND	ND	ND
P,P'-DDT	µg/L	0.001	0.00017	—	1	0	ND	ND	ND
PCB-1016	µg/L	0.03	0.000019	—	1	0	ND	ND	ND
PCB-1221	µg/L	0.03	0.000019	—	1	0	ND	ND	ND
PCB-1232	µg/L	0.03	0.000019	—	1	0	ND	ND	ND
PCB-1242	µg/L	0.03	0.000019	—	1	0	ND	ND	ND
PCB-1248	µg/L	0.03	0.000019	—	1	0	ND	ND	ND
PCB-1260	µg/L	0.03	0.000019	—	1	0	ND	ND	ND
PCB-1254	µg/L	0.03	0.000019	—	1	0	ND	ND	ND

Notes:

— = No Criteria CTR = California Toxics Rule COP = California Ocean Plan
NA = Not Analyzed µg/L = micrograms per liter ppt = parts per thousand
ND = Not Detected mg/L = milligrams per liter
MPN/100 ml = Most Probable Number per 100 milliliters

Final CTR Criteria = 2000, May 18. Federal Register Volume 65, No. 97, 40 CFR Part 131, Water Quality Standards, Establishment of Numeric Criteria for Priority Toxic Pollutants for the State of California.

COP Objectives = 1997. California State Water Resources Control Board. California Ocean Plan. Table B Water Quality Objectives. Daily Maximums for aquatic life and 30 day Averages for human health.

COP Chronic Toxicity = 1997. California State Water Resources Control Board. California Ocean Plan. Table D Conservative Estimates of Chronic Toxicity.

**"Selected" water quality constituents represent those water quality constituents most relevant to the analysis and discussion presented in this section. The data for all constituents sampled is contained in Volume III, Appendix B.*

[a] For waters in which salinity is equal to or greater than 10 ppt and 95% or more of the time, the applicable criteria are the saltwater criteria.

[b] CTR criteria are for the protection of human health due to the consumption of aquatic organisms living in waters with carcinogenic compounds.

1993, March. Chambers Group, Inc. Comparison of the Re-establishment of Tidal Flow in the Ballona Wetlands Through the Ballona Channel or Through the Marina Del Rey Entrance Channel.

1997, September 15. Aquatic Bioassay Consulting Laboratory. The Marine Environment of Marina del Rey Harbor, July 1996 – June 1997.

Table 3-4
Selected* Water Quality Constituents
in Santa Monica Bay During Wet-Weather

Constituent	Units	*Acute*[a,b] CTR Criteria	COP Objectives	Total Number of Samples	Number of Samples Exceeding Criteria	Observed Concentrations Min.	Max.	Mean
Total Coliform	MPN/100ml		1000	2	0	ND	20	10
Fecal Coliform	MPN/100ml	—	200	2	0	ND	20	10
Entero Coccus	Col's/100ml		—	2	—	ND	ND	ND

Notes:
— = No Criteria
ND – Not Detected
MPN/100 ml = Most Probable Number per 100 milliliters
CTR = California Toxics Rule
COP = California Ocean Plan
Final CTR Criteria – 2000, May 18. Federal Register Volume 65, No. 97, 40 CFR Part 131, Water Quality Standards, Establishment of Numeric Criteria for Priority Toxic Pollutants for the State of California.
COP Objectives – 1997. California State Water Resources Control Board. California Ocean Plan. Table B Water Quality Objectives. Daily Maximums for aquatic life and 30-day Averages for human health.
*"Selected" water quality constituents represent those water quality constituents most relevant to the analysis and discussion presented in this section. The data for all constituents sampled is contained in Volume III, Appendix B of this Technical Report.
[a] *For waters in which salinity is equal to or greater than 10 ppt and 95% or more of the time, the applicable criteria are the saltwater criteria.*
[b] *CTR criteria are for the protection of human health due to the consumption of aquatic organisms living in waters with carcinogenic compounds.*
1997, September 15. Aquatic Bioassay Consulting Laboratory. The Marine Environment of Marina del Rey Harbor, July 1996 - June 1997.

Table 3-5
Selected* Sediment Quality Constituents in Santa Monica Bay

Constituent	Units	NOAA Screening Quick Reference Table (SquiRT) Marine Sediment PELs	Total Number of Samples	Number of Samples Above Guidance Values	Observed Concentrations		
					Minimum	Maximum	Mean
Oil and Grease	mg/kg	—	4	—	120	1,510	620
Hardness as $CaCO_3$	mg/kg	—	2	—	2,500	3,300	2,900
Total Phosphorus	mg/kg	—	1	—	2.1	2.1	2.1
Butylbenzylphthalate [a]	µg/kg	63	13	6	ND	2,500	292
Dimethylphthalate [a]	µg/kg	6	13	1	ND	1,390	107
Napthalene	µg/kg	390.64	13	0	ND	ND	ND
Acenaphthylene	µg/kg	127.87	13	0	ND	ND	ND
Acenaphthene	µg/kg	88.9	13	0	ND	ND	ND
Fluorene	µg/kg	144.35	13	0	ND	ND	ND
Phenanthrene	µg/kg	543.53	13	1	ND	933	131
Anthracene	µg/kg	245	13	1	ND	1,430	128
Fluoranthene	µg/kg	1493.54	13	0	ND	1,310	282
Pyrene	µg/kg	1397.6	13	1	ND	2,030	420
Benzo(a)anthracene	µg/kg	692.53	13	1	ND	1,900	228
Chrysene	µg/kg	845.98	13	0	ND	726	176
Benzo(b)anthracene	µg/kg	—	13	—	ND	1,030	152
Benzo(k)fluoranthene [a]	µg/kg	1,800	13	0	ND	695	161
Benzo(a)pyrene	µg/kg	763.22	13	1	ND	792	139
Dibenzo(a,h)anthracene	µg/kg	134.61	13	1	ND	843	65
Indeno(1,2,3-c,d)pyrene [a]	µg/kg	600	13	0	ND	ND	ND
Benzo(g,h,i)perylene	µg/kg	670	13	0	ND	ND	ND
Arsenic	mg/kg	41.6	17	0	1.2	5.6	2.5
Barium [a]	mg/kg	48	15	5	14.5	76.3	39
Cadmium	mg/kg	4.21	17	0	ND	0.794	0.44
Cobalt [a]	mg/kg	10	13	1	2.51	13.6	4.7
Copper	mg/kg	108.2	17	0	5.3	41.5	19
Lead	mg/kg	112.18	17	4	22.6	298	88
Manganese [a]	mg/kg	260	16	0	ND	207	26
Mercury	mg/kg	0.696	17	0	ND	0.22	0.10
Nickel	mg/kg	42.8	17	0	4.82	20.5	11
Selenium [a]	mg/kg	1	7	0	ND	0.6	0.13
Silver	mg/kg	1.77	11	0	ND	1.69	0.37
Zinc	mg/kg	271	17	0	31.2	243	104
Aldrin [a]	µg/kg	9.5	14	0	ND	ND	ND
Alpha-Chlordane	µg/kg	—	2	—	ND	6	3.0
Gamma Chlordane	µg/kg	-	2	—	2.7	6	4.4
Chlordane	µg/kg	4.79	15	2	ND	56.7	52

Table 3-5
Selected* Sediment Quality Constituents in Santa Monica Bay

Constituent	Units	NOAA Screening Quick Reference Table (SquiRT) Marine Sediment PELs	Total Number of Samples	Number of Samples Above Guidance Values	Observed Concentrations		
					Minimum	Maximum	Mean
Dieldrin	µg/kg	4.3	14	0	ND	ND	ND
Endrin	µg/kg	—	14	—	ND	ND	ND
Toxaphene	µg/kg	—	14	—	ND	ND	ND
Heptachlor[a]	µg/kg	0.3	14	0	ND	ND	ND
Heptachlor Epoxide	µg/kg	—	16	—	ND	2.5	0.18
O,P'-DDT	µg/kg	—	14	—	ND	ND	ND
P,P'-DDT	µg/kg	4.77	17	2	ND	30	2.4
Total DDT	µg/kg	51.7	2	0	6	27.3	17
P,P'-DDD	µg/kg	7.81	17	0	ND	5.3	0.7
P,P'-DDE	µg/kg	374.17	17	0	ND	17.7	5.2
PCB-1016	µg/kg	188.79	14	0	ND	ND	ND
PCB-1221	µg/kg	188.79	14	0	ND	ND	ND
PCB-1232	µg/kg	188.79	14	0	ND	ND	ND
PCB-1242	µg/kg	188.79	14	0	ND	ND	ND
PCB-1248	µg/kg	188.79	14	0	ND	103	55
PCB-1254	µg/kg	188.79	16	0	ND	57.9	43
PCB-1260	µg/kg	188.79	14	0	ND	ND	ND

Notes:
— = No Guidance Value · *µg/kg = micrograms per kilogram* · *PEL = Probable Effects Level*
NA = Not Analyzed · *mg/kg = milligrams per kilogram*
ND = Not Detected · *SW = Saltwater*
NOAA SQuiRT = National Oceanic and Atmospheric Administration Screening Quick Reference Tables
"Selected" water quality constituents represent those water quality constituents most relevant to the analysis and discussion presented in this section. The data for all constituents sampled is contained in Volume III, Appendix B.
[a] *Apparent Effects Threshold (AET) is used instead because PEL is not listed*

March 1993. Chambers Group, Inc. Comparison of the Re-establishment of Tidal Flow in the Ballona Wetlands Through the Ballona Channel or Through the Marina Del Rey Entrance Channel.
October 17, 1995. Advanced Biological Testing. Draft Report of Results of Chemical and Physical Testing of Sediments from Marina Del Rey South Entrance.
September 15, 1997. Aquatic Bioassay Consulting Laboratory. The Marine Environment of Marina del Rey Harbor July 1996 - June 1997.
Buchman, M.F., 1999. NOAA Screening Quick Reference Tables, NOAA HAZMAT Report 99 1, Seattle, WA, Coastal Protection and Restoration Division, National Oceanic and Atmospheric Administration, 12 pages.

Source: Camp Dresser & McKee Inc.

Table 3-6
Selected* Water Quality Constituents in Ballona Channel During Dry-Weather

Constituent	Units	*Chronic* [a,b] CTR Criteria	Total Number of Samples	Number of Samples Exceeding Criteria	Observed Concentrations Minimum	Maximum	Mean
Oil and Grease	mg/L	-	15	—	ND	57	8
Total Coliform	MPN/100ml		13	—	ND	16,000	3,567
Fecal Coliform	MPN/100ml	—	13	—	ND	1,300	216
Hardness	mg/L	—	6		2,600	6,300	4,253
TKN	mg/L	—	10	—	ND	1.8	0.7
Ammonia	mg/L	—	6	—	ND	0.94	0.16
Dissolved Oxygen	mg/L	—	22	—	5.5	13.9	8.3
Total Phosphorus	mg/L	—	16	—	ND	0.53	0.16
Total Suspended Solids	mg/L	—	6	—	27	110	59
Salinity	ppt	—	24	—	21.09	33.5	30
Dissolved Arsenic	μg/L	36	10	0	ND	2	0.2
Total Arsenic	μg/L	—	8	—	ND	ND	ND
Dissolved Cadmium	μg/L	9.3	10	0	ND	ND	ND
Total Cadmium	μg/L		8	—	ND	1.7	0.2
Dissolved Copper	μg/L	3.1	10	5	ND	120	32
Total Copper	μg/L	—	8		ND	120	19
Dissolved Lead	μg/L	8.1	10	0	ND	ND	ND
Total Lead	μg/L	—	8	..	ND	55	16
Dissolved Mercury	μg/L	—	10	—	ND	ND	ND
Total Mercury	μg/L	—	8	--	ND	0.35	0.05
Dissolved Nickel	μg/L	8.2	10	0	ND	ND	ND
Total Nickel	μg/L	—	8	—	ND	ND	ND
Dissolved Selenium	μg/L	71	4	2	ND	440	208
Total Selenium	μg/L	-	8	-	ND	460	102
Dissolved Silver	μg/L	—	4	—	ND	1.7	0.4
Total Silver	μg/L	—	8	—	ND	ND	ND
Dissolved Zinc	μg/L	81	10	4	ND	210	97
Total Zinc	μg/L	—	8	—	ND	170	46
PAHs	μg/L	—	2	—	ND	ND	ND
Naphthalene	μg/L	—	6	--	ND	3.1	1
PCB-1016	μg/L	0.03	8	0	ND	ND	ND
PCB-1221	μg/L	0.03	8	0	ND	ND	ND
PCB-1232	μg/L	0.03	8	0	ND	ND	ND
PCB-1242	μg/L	0.03	8	0	ND	ND	ND
PCB-1248	μg/L	0.03	8	0	ND	ND	ND
PCB-1260	μg/L	0.03	8	0	ND	ND	ND
PCB-1254	μg/L	0.03	9	0	ND	ND	ND
Aldrin [b]	μg/L	0.00014	8	0	ND	ND	ND
Chlordane	μg/L	0.004	8	0	ND	ND	ND
Dieldrin [b]	μg/L	0.0019	8	0	ND	ND	ND
Endrin [b]	μg/L	0.0023	8	0	ND	ND	ND
Toxaphene	μg/L	0.0002	8	0	ND	ND	ND
Heptachlor	μg/L	0.0036	8	0	ND	ND	ND

Table 3-6
Selected* Water Quality Constituents in Ballona Channel During Dry-Weather

Constituent	Units	*Chronic*[a, b] CTR Criteria	Total Number of Samples	Number of Samples Exceeding Criteria	Observed Concentrations Minimum	Maximum	Mean
Heptachlor Epoxide[b]	μg/L	0.0036	8	0	ND	ND	ND
O,P'-DDT	μg/L	-	6	--	ND	ND	ND
P,P'-DDT	μg/L	0.001	8	0	ND	ND	ND

Notes:

— = No Criteria | *CTR = California Toxics Rule* | *ppt = parts per thousand*

NA = Not Analyzed | *μg/l = micrograms per liter*

ND = Not Detected | *mg/L = milligrams per liter*

MPN/100 ml = Most Probable Number per 100 milliliters

Final CTR Criteria = 2000, May 18. Federal Register Volume 65, No. 97, 40 CFR Part 131, Water Quality Standards, Establishment of Numeric Criteria for Priority Toxic Pollutants for the State of California.

"Selected" water quality constituents represent those water quality constituents most relevant to the analysis and discussion presented in this section. The data for all constituents sampled is contained in Volume I, Section 3, Water Resources Technical Report.

[a] *For waters in which salinity is equal to or greater than 10 ppt and 95% or more of the time, the applicable criteria are the saltwater criteria.*

[b] *CTR criteria are for the protection of human health due to the consumption of aquatic organisms living in waters with carcinogenic compounds.*

November 1990. Woodward-Clyde Consultants, Final Technical Appendix to the Master EIR. Table 5.7.

March 1993. Chambers Group, Inc. Comparison of the Re-establishment of Tidal Flow in the Ballona Wetlands Through the Ballona Channel or Through the Marina Del Rey Entrance Channel.

August 14, 1996. Camp Dresser & McKee Inc. Ballona Creek Water and Sediment Quality Sediment Quality Report, 1995/1996, Wet Weather Season, Playa Vista, California.

September 15, 1997. Aquatic Bioassay Consulting Laboratory. The Marine Environment of Marina del Rey Harbor, July 1996 - June 1997.

October 1998. Camp Dresser & McKee Inc. Playa Vista Area A and Area B Wetlands Surface Water and Sediment Monitoring Report.

Source: Camp Dresser & McKee Inc

Table 3-7
Selected* Water Quality Constituents
in Ballona Channel During Wet-Weather

Constituent	Units	Acute [a] CTR Criteria	Total Number of Samples	Number of Samples Exceeding Criteria	Observed Concentrations Minimum	Maximum	Mean
Oil and Grease	mg/L	—	13	—	ND	16	5.4
Total Coliform	MPN/100ml	—	1	—	ND	ND	ND
Fecal Coliform	MPN/100ml	—	1	—	ND	ND	ND
Hardness	mg/L	—	6	—	54	1,800	487
Salinity	ppt	—	2	—	26.5	33.5	30
Total Suspended Solids	mg/L	—	2	—	89	120	105
Total Phosphorus	mg/L	—	13	—	0.18	2.9	1.0
TKN	mg/L	—	8	—	0.18	6.4	2.3
Total Arsenic	µg/L	—	7	—	ND	ND	ND
Dissolved Arsenic	µg/L	69	5	0	ND	ND	ND
Total Cadmium	µg/L		7	—	ND	ND	ND
Dissolved Cadmium	µg/L	42	5	0	ND	ND	ND
Total Copper	µg/L	—	7	—	ND	30	10
Dissolved Copper	µg/L	4.8	5	4	ND	13	10
Total Lead	µg/L	—	7		ND	ND	ND
Dissolved Lead	µg/L	210	5	0	ND	ND	ND
Total Mercury	µg/L	—	7	—	ND	ND	ND
Dissolved Mercury	µg/L	—	5	—	ND	ND	ND
Total Nickel	µg/L	—	7	—	ND	13	1.9
Dissolved Nickel	µg/L	74	5	0	ND	ND	ND
Total Selenium	µg/L	-	7	-	ND	ND	ND
Total Silver	µg/L	—	7	—	ND	ND	ND
Total Zinc	µg/L	—	8	—	0.015	123	49
Dissolved Zinc	µg/L	90	5	4	ND	13	10
Naphthalene [b]	µg/L	—	6		ND	ND	ND
Aldrin	µg/L	1.3	5	0	ND	ND	ND
Chlordane	µg/L	0.09	5	0	ND	ND	ND
Dieldrin	µg/L	0.71	5	0	ND	ND	ND
Endrin	µg/L	0.037	5	0	ND	ND	ND
Toxaphene	µg/L	0.21	5	0	ND	ND	ND
Heptachlor	µg/L	0.053	5	0	ND	ND	ND
Heptachlor Epoxide	µg/L	0.053	5	0	ND	ND	ND
O,P'-DDT	µg/L	—	5	—	ND	ND	ND
P,P'-DDT	µg/L	0.13	5	0	ND	ND	ND
PCB-1016 [c]	µg/L	0.03	5	0	ND	ND	ND
PCB-1221 [c]	µg/L	0.03	5	0	ND	ND	ND
PCB-1232 [c]	µg/L	0.03	5	0	ND	ND	ND
PCB-1242 [c]	µg/L	0.03	5	0	ND	ND	ND
PCB-1248 [c]	µg/L	0.03	5	0	ND	ND	ND

Table 3-7
Selected* Water Quality Constituents
In Ballona Channel During Wet-Weather

Constituent	Units	Acute [a] CTR Criteria	Total Number of Samples	Number of Samples Exceeding Criteria	Observed Concentrations		
					Minimum	Maximum	Mean
PCB-1254 [c]	µg/L	0.03	5	0	ND	ND	ND
PCB-1260 [c]	µg/L	0.03	5	0	ND	ND	ND

Notes:

— = No Criteria *CTR – California Toxics Rule* *ppt = parts per thousand*

NA – Not Analyzed *µg/l = micrograms per liter*

ND – Not Detected *mg/l = milligrams per liter*

MPN/100 ml – Most Probable Number per 100 milliliters

Final CTR Criteria = May 18, 2000. Federal Register Volume 65, No. 97, 40 CFR Part 131, Water Quality Standards, Establishment of Numeric Criteria for Priority Toxic Pollutants for the State of California.

*"Selected" water quality constituents represent those water quality constituents most relevant to the analysis and discussion presented in this section. The data for all constituents sampled is contained in Volume III, Appendix B of this Technical Report.

[a] *For waters in which salinity is equal to or greater than 10 ppt and 95% or more of the time, the applicable criteria are the saltwater criteria.*

[b] *CTR criteria are for the protection of human health due to the consumption of aquatic organisms living in waters with carcinogenic compounds.*

[c] *CTR criteria are the chronic saltwater criteria or the protection of aquatic life. The CTR does not designate specific saltwater acute criteria for these constituents.*

November 1990. Woodward-Clyde Consultants, Final Technical Appendix to the Master EIR. Table 5-7.

March 1993. Chambers Group, Inc. Comparison of the Re-establishment of Tidal Flow in the Ballona Wetlands Through the Ballona Channel or Through the Marina Del Rey Entrance Channel

August 14, 1996. Camp Dresser & McKee Inc. Ballona Creek Water and Sediment Quality Sediment Quality Report, 1995/1996, Wet Weather Season, Playa Vista, California.

September 15, 1997. Aquatic Bioassay Consulting Laboratory. The Marine Environment of Marina del Rey Harbor, July 1996 - June 1997.

October 1998. Camp Dresser & McKee Inc. Playa Vista Area A and Area B Wetlands Surface Water and Sediment Monitoring Report.

Table 3-8
Selected* Sediment Quality Constituents in Ballona Channel

Constituent	Units	NOAA Screening Quick Reference Table (SquiRT) Marine Sediment PELs	Total Number of Samples	Number of Samples Above Guidance Values	Observed Concentrations		
					Minimum	Maximum	Mean
TRPH	mg/kg	—	2	—	53	2,300	1,177
TPH-gasoline	mg/kg	—	3	—	ND	ND	ND
TPH-diesel	mg/kg	—	3	—	ND	ND	ND
Nitrogen	mg/kg	—	1	—	190	190	190
Oil and Grease	mg/kg	—	11	—	ND	27,800	3,609
Tributyltin	mg/kg	—	7	—	ND	0.63	0.24
Hardness as CaCO3	mg/kg	-	1	—	2,200	2,200	2,200
Total Hardness	mg/kg	—	1	—	33,000	33,000	33,000
Total Phosphorus	mg/kg	—	6	—	1.5	400	96
TKN	mg/kg	—	3	—	160	1,100	504
Salinity	mg/kg	—	2	—	8,800	15,500	12,150
Total Xylenes	µg/kg	4	6	2	ND	33	9
Arsenic	mg/kg	41.6	11	0	ND	6.95	3.4
Cadmium	mg/kg	4.21	11	0	ND	1.58	0.55
Copper	mg/kg	108.2	11	0	8.1	42.3	25
Lead	mg/kg	112.18	11	3	ND	161	56
Manganese	mg/kg	260	7	1	ND	433	178
Mercury	mg/kg	0.696	11	0	ND	0.17	0.06
Nickel	mg/kg	42.8	11	1	ND	66.9	18
Selenium	mg/kg	1	6	0	ND	0.33	0.1
Silver	mg/kg	1.77	6	0	ND	0.663	0.11
Zinc	mg/kg	271	11	0	13	202	107
Aldrin	µg/kg	9.5	6	0	ND	ND	ND
Alpha-Chlordane	µg/kg	—	1	—	6.6	6.6	6.6
Gamma-Chlordane	µg/kg	—	1	—	7.7	7.7	7.7
Chlordane	µg/kg	4.76	7	4	ND	210	73
Dieldrin	µg/kg	4.3	6	0	ND	ND	ND
Endrin	µg/kg	—	6	—	ND	ND	ND
Endrin Aldehyde	µg/kg	—	1	—	ND	ND	ND
Toxaphene	µg/kg	—	6	—	ND	ND	ND
Heptachlor	µg/kg	0.3	6	0	ND	ND	ND
Heptachlor Epoxide	µg/kg	-	7	—	ND	ND	ND
O,P'-DDT	µg/kg	—	4	0	ND	ND	ND
P,P'-DDT	µg/kg	4.77	8	4	ND	160	39
P,P'-DDD	µg/kg	7.81	11	3	ND	190	34
P,P'DDE	µg/kg	374.17	11	0	ND	190	34
Total DDT	µg/kg	51.7	1	0	17.8	17.8	18

Table 3-8
Selected* Sediment Quality Constituents In Ballona Channel

Constituent	Units	NOAA Screening Quick Reference Table (SquiRT) Marine Sediment PELs	Total Number of Samples	Number of Samples Above Guidance Values	Observed Concentrations		
					Minimum	Maximum	Mean
PCB-1016	µg/kg	188.79	6	0	ND	ND	ND
PCB-1221	µg/kg	188.79	6	0	ND	ND	ND
PCB-1232	µg/kg	188.79	6	0	ND	ND	ND
PCB-1242	µg/kg	188.79	6	0	ND	ND	ND
PCB-1248	µg/kg	188.79	6	0	ND	ND	ND
PCB-1254	µg/kg	188.79	10	0	ND	20	2
PCB-1260	µg/kg	188.79	6	0	ND	ND	ND

Notes:
— = No Guidance Value *µg/kg = micrograms per kilogram* *PEL = Probable Effects Level*
NA = Not Analyzed *mg/kg = milligrams per kilogram*
ND = Not Detected *SW = Saltwater*
NOAA SQuiRT = National Oceanic and Atmospheric Administration Screening Quick Reference Tables
"Selected" water quality constituents represent those water quality constituents most relevant to the analysis and discussion presented in this section. The data for all constituents sampled is contained in Volume I, Section 3, Water Resources Technical Report.

November 1990. Woodward-Clyde Consultants, Final Technical Appendix to the Master EIR. Table 5-7.
March 1993. Chambers Group, Inc. Comparison of the Re-establishment of Tidal Flow in the Ballona Wetlands Through the Ballona Channel or Through the Marina Del Rey Entrance Channel.
August 14, 1996. Camp Dresser & McKee Inc. Ballona Creek Water and Sediment Quality Sediment Quality Report, 1995/1996, Wet Weather Season, Playa Vista, California and October 1998. Camp Dresser & McKee Inc. Playa Vista Area A and Area B Wetlands Surface Water and Sediment Monitoring Report.
September 15, 1997. Aquatic Bioassay Consulting Laboratory. The Marine Environment of Marina del Rey Harbor July 1996 - June 1997.
Buchman, M.F., 1999. NOAA Screening Quick Reference Tables, NOAA HAZMAT Report 99-1, Seattle, WA, Coastal Protection and Restoration Division, National Oceanic and Atmospheric Administration, 12 pages.

Source: Camp Dresser & McKee Inc

Table 3-9
Selected* Water Quality Constituents in Ballona Wetlands During Dry-Weather

Constituent	Units	Chronic CTR Criteria [a]	Total Number of Samples	Number of Samples Exceeding Criteria	Observed Concentrations		
					Minimum	Maximum	Mean
Oil & Grease	mg/L	—	5	—	ND	0.62	0.35
Total Coliform	MPN/100ml	—	5	—	ND	ND	ND
Fecal Coliform	MPN/100ml	—	5	—	ND	ND	ND
Hardness	mg/L	—	7	—	140	14,000	5,187
TKN	mg/L	—	6	—	1.1	3.4	2.53
Total Phosphorus	mg/L	—	6	—	0.044	1.6	0.53
Total Suspended Solids	mg/L	—	1	—	16	16	16
Salinity	ppt	—	5	—	31	79	42.8
Dissolved Arsenic	µg/L	36	8	1	ND	66	15.72
Total Arsenic	µg/L	—	7	—	2.1	59	15.18
Dissolved Cadmium	µg/L	9.3	8	0	0.1	0.11	0.04
Total Cadmium	µg/L	—	7	—	ND	0.49	0.11
Dissolved Copper	µg/L	3.1	8	7	5	20	9.02
Total Copper	µg/L	—	7	—	22.3	50.6	18.2
Dissolved Lead	µg/L	8.1	8	0	ND	2.91	0.57
Total Lead	µg/L		7	—	2.01	12	3.51
Dissolved Mercury	µg/L		8		ND	ND	ND
Total Mercury	µg/L	—	7		ND	ND	ND
Dissolved Nickel	µg/L	8.2	8	2	2.27	9	4.0
Total Nickel	µg/L	—	7	—	3.69	13	4.43
Dissolved Selenium	µg/L	71	8	1	ND	270	48.64
Total Selenium	µg/L	-	7	—	6.59	260	58.01
Dissolved Silver	µg/L	-	8	-	ND	0.12	0.02
Total Silver	µg/L	-	7		ND	0.31	0.04
Dissolved Zinc	µg/L	81	8	0	14	54	29.51
Total Zinc	µg/L	—	7	—	11	72.9	28.66
Acenaphthene [b]	µg/L	2,700	4	0	ND	ND	ND
Acenaphthylene [b]	µg/L	—	4	—	ND	ND	ND
Anthracene [b]	µg/L	110,000	4	0	ND	ND	ND
Benzo(a)anthracene [b]	µg/L	0.049	4	0	ND	ND	ND
Benzo(a)pyrene [b]	µg/L	0.049	4	0	ND	ND	ND
Benzo(b)fluoranthene [b]	µg/L	0.049	4	0	ND	ND	ND
Benzo(g,h,i)perylene [b]	µg/L	—	4	—	ND	ND	ND
Benzo(k)fluoranthene [b]	µg/L	0.049	4	0	ND	ND	ND
Chrysene [b]	µg/L	0.049	4	0	ND	ND	ND
Dibenzo(a,h)anthracene [b]	µg/L	0.049	4	0	ND	ND	ND
Fluoranthene [b]	µg/L	370	4	0	ND	ND	ND
Fluorene [b]	µg/L	14,000	4	0	ND	ND	ND
Naphthalene [b]	µg/L	—	4	—	ND	ND	ND
Phenanthrene [b]	µg/L	—	4	—	ND	ND	ND
Pyrene [b]	µg/L	11,000	4	0	ND	ND	ND
4,4'-DDT	µg/L	0.001	4	0	ND	ND	ND
Aldrin [c]	µg/L	1.3	4	0	ND	ND	ND
alpha-BHC [b]	µg/L	0.013	4	2	ND	0.045	0.02
Chlordane	µg/L	0.004	4	0	ND	ND	ND
Dieldrin	µg/L	0.0019	4	0	ND	ND	ND
Endosulfan I	µg/L	—	4	—	ND	ND	ND
Endosulfan II	µg/L	—	4	—	ND	ND	ND
Endrin	µg/L	0.0023	4	0	ND	ND	ND
Heptachlor Epoxide	µg/L	0.0036	4	0	ND	ND	ND
Heptachlor	µg/L	0.0036	4	0	ND	ND	ND
Aroclor-1016	µg/L	0.03	4	0	ND	ND	ND

Table 3-9
Selected* Water Quality Constituents in Ballona Wetlands During Dry-Weather

Constituent	Units	Chronic CTR Criteria [a]	Total Number of Samples	Number of Samples Exceeding Criteria	Observed Concentrations		
					Minimum	Maximum	Mean
Aroclor-1221	µg/L	0.03	4	0	ND	ND	ND
Aroclor-1232	µg/L	0.03	4	0	ND	ND	ND
Aroclor-1242	µg/L	0.03	4	0	ND	ND	ND
Aroclor-1248	µg/L	0.03	4	0	ND	ND	ND
Aroclor-1254	µg/L	0.03	4	0	ND	ND	ND
Aroclor-1260	µg/L	0.03	4	0	ND	ND	ND
Chloropyrifos	µg/L	--	4	---	ND	ND	ND

Notes:

--- = No Criteria | *CTR = California Toxics Rule* | *N/A – Not Applicable*
NA = Not Analyzed | *µg/L = micrograms per liter* | *ppt = parts per thousand*
ND = Not Detected | *mg/L = milligrams per liter*

MPN/100 ml = Most Probable Number per 100 milliliters

Final CTR Criteria = May 18, 2000. Federal Register Volume 65, No. 97, 40 CFR Part 131, Water Quality Standards, Establishment of Numeric Criteria for Priority Toxic Pollutants for the State of California.

"Selected" water quality constituents represent those water quality constituents most relevant to the analysis and discussion presented in this section. The data for all constituents sampled is contained in Volume III, Appendix B of this Technical Report.

[a] *For waters in which salinity is equal to or greater than 10 ppt and 95% or more of the time, the applicable criteria are the saltwater criteria.*

[b] *CTR Criteria are from human health organisms only criteria.*

[c] *CTR does not designate specific saltwater chronic criteria for these constituents.*

November 1990. Woodward-Clyde Consultants, Final Technical Appendix to the Master EIR. Table 5-2.
October 1998. Camp Dresser & McKee Inc. Playa Vista Area A and Area B Wetlands Surface Water and Sediment Monitoring Report.
2000 Data. GeoSyntec Consultants
August 2, 2002. Camp Dresser & McKee Inc. Ballona Wetlands Water Quality Sampling, Dry Weather, Playa Vista, California.
Source: Camp Dresser & McKee Inc.

Table 3-10
Selected* Water Quality Constituents in Ballona Wetlands During Wet-Weather

Constituent	Units	CTR Acute Criteria [a]	Total Number of Samples	Number of Samples Exceeding Criteria	Observed Concentrations		
					Minimum	Maximum	Mean
Total Hardness	mg/L	—	2	—	346	1,980	1,163
Total Suspended Solids	mg/L	—	2	—	73	187	130
Dissolved Arsenic	µg/L	69	2	0	3.02	6.79	4.91
Total Arsenic	µg/L	—	2	—	4.73	7.06	5.90
Dissolved Copper	µg/L	4.8	2	1	3.25	7.19	5.22
Total Copper	µg/L	—	2	—	13.5	24.6	19.05
Total Lead	µg/L	—	2	—	12.9	17.6	15.25
Dissolved Nickel	µg/L	74	2	0	2.23	2.74	2.49
Total Nickel	µg/L		2	—	4.27	9.94	7.11
Dissolved Selenium	µg/L	290	2	0	4.78	23.3	14.04
Total Selenium	µg/L	—	2	—	2.43	21	11.72
Dissolved Zinc	µg/L	90	2	0	14.6	19.9	17.25
Total Zinc	µg/L	—	2	—	29.2	131	80.1

Notes:
-- = No Criteria
NA = Not Analyzed
ND = Not Detected
CTR = California Toxics Rule
µg/L = micrograms per liter
mg/L = milligrams per liter
ppt = parts per thousand
MPN/100 ml = Most Probable Number per 100 milliliters
"Selected" water quality constituents represent those water quality constituents most relevant to the analysis and discussion presented in this section. The data for all constituents sampled is contained in Volume III, Appendix B of this Technical Report.
[a] *For waters in which salinity is equal to or greater than 10 ppt and 95% or more of the time, the applicable criteria are the saltwater criteria.*

Final CTR Criteria = May 18, 2000. Federal Register Volume 65, No. 97, 40 CFR Part 131, Water Quality Standards, Establishment of Numeric Criteria for Priority Toxic Pollutants for the State of California.
2000 Data. GeoSyntec Consultants.
Source: Camp Dresser & McKee Inc

Table 3-11
Selected* Sediment Quality Constituents in Ballona Wetlands

Constituent	Units	NOAA SQuiRT Marine Sediment PELs	Total Number of Samples	Number of Samples Above Guidance Values	Observed Concentrations		
					Minimum	Maximum	Mean
Total Phenols	µg/kg	—	1	—	4.5	4.5	4.5
Benzene	µg/kg	—	3	—	ND	15	5.0
Toluene	µg/kg	—	3	—	ND	7.9	2.6
TRPH	mg/kg	—	1	—	50	50	50
Oil and Grease	mg/kg	—	3	—	62	2,100	1,081
Salinity	mg/kg	—	5	—	ND	17,000	8,960
Ammonia-N	mg/kg	—	5	—	ND	ND	ND
Nitrite-N	mg/kg	—	5	—	ND	ND	ND
Nitrate-N	mg/kg	—	5	—	ND	ND	ND
Total Inorganic Nitrogen	mg/kg	—	5	—	ND	ND	ND
TKN	mg/kg	—	5	—	190	680	520
Total Phosphorus	mg/kg	—	5	—	240	380	280
Acenaphthene	µg/kg	88.9	2	0	ND	ND	ND
Acenaphthylene	µg/kg	127.87	2	0	ND	ND	ND
Anthracene	µg/kg	245	2	0	ND	ND	ND
Benz(a)anthracene	µg/kg	692.53	2	0	ND	ND	ND
Benzo(a)pyrene	µg/kg	763.22	2	0	ND	ND	ND
Benzo(b)fluoranthene [a]	µg/kg	1,800	2	0	ND	ND	ND
Benzo(g,h,i)perylene	µg/kg	670	2	0	ND	ND	ND
Benzo(k)fluoranthene [a]	µg/kg	1,800	2	0	ND	ND	ND
Chrysene	µg/kg	845.98	2	0	ND	ND	ND
Dibenz(a,h)anthracene	µg/kg	134.61	2	0	ND	ND	ND
Fluoranthene	µg/kg	1,493.54	2	0	ND	ND	ND
Fluorene	µg/kg	144.35	2	0	ND	ND	ND
Indeno(1,2,3-c,d)pyrene [a]	µg/kg	600	2	0	ND	ND	ND
Naphthalene	µg/kg	390.64	2	0	ND	ND	ND
Phenanthrene	µg/kg	543.53	2	0	ND	ND	ND
Pyrene	µg/kg	1,397.6	2	0	ND	ND	ND
Arsenic	mg/kg	8.2	10	0	ND	4.21	2.9
Barium [a]	mg/kg	48	3	2	47.3	147	112.4
Cadmium	mg/kg	1.2	10	0	ND	2.24	1.0
Copper	mg/kg	34	10	0	14.1	63	29.4
Lead	mg/kg	46.7	10	2	3.2	258	68
Mercury	mg/kg	0.15	10	0	ND	0.184	0.06
Nickel	mg/kg	20.9	10	0	7	29	18.3
Selenium [a]	mg/kg	—	10	—	ND	ND	ND
Silver	mg/kg	1	10	0	ND	1.21	0.28
Zinc	mg/kg	150	10	2	40	359	145
Aldrin [a]	µg/kg	9.5	2	0	ND	ND	ND

Table 3-11
Selected* Sediment Quality Constituents in Ballona Wetlands

Constituent	Units	NOAA SQuiRT Marine Sediment PELs	Total Number of Samples	Number of Samples Above Guidance Values	Observed Concentrations		
					Minimum	Maximum	Mean
Dieldrin	µg/kg	4.3	2	0	ND	ND	ND
Endosulfan I	µg/kg	—	2	-	ND	ND	ND
Endosulfan II	µg/kg	—	2	-	ND	ND	ND
Endrin	µg/kg	—	2	—	ND	ND	ND
Heptachlor Epoxide	µg/kg	—	2	-	ND	ND	ND
Heptachlor ª	µg/kg	0.3	2	0	ND	ND	ND
PCB-1016	µg/kg	188.79	2	0	ND	ND	ND
PCB-1221	µg/kg	188.79	2	0	ND	ND	ND
PCB-1232	µg/kg	188.79	2	0	ND	ND	ND
PCB-1242	µg/kg	188.79	2	0	ND	ND	ND
PCB-1248	µg/kg	188.79	2	0	ND	ND	ND
PCB-1262	µg/kg	188.79	2	0	ND	ND	ND
Toxaphene	µg/kg	—	2	-	ND	ND	ND
P,P'-DDT	µg/kg	4.77	3	1	ND	6.9	2.3
PCB-1254	µg/kg	188.79	3	0	ND	ND	ND
PCB-1260	µg/kg	188.79	3	0	ND	92	31
Chlordane	µg/kg	4.79	3	1	ND	84	28

Notes:
= No Guidance Value — *µg/kg – micrograms per kilogram* — *NA – Not Analyzed*
mg/kg – milligrams per kilogram — *ND = Not Detected* — *SW – Saltwater*
PEL - Probable Effects Level
NOAA SQuiRT – National Oceanic and Atmospheric Administration Screening Quick Reference Tables.
"Selected" water quality constituents represent those water quality constituents most relevant to the analysis and discussion presented in this section. The data for all constituents sampled is contained in Volume I, Section 3, Water Resources Technical Report.
ª *Apparent Effects Threshold (AET) is listed instead of PEL because PEL is not listed for this constituent.*

Buchman, M.F., 1999. NOAA Screening Quick Reference Tables, NOAA HAZMAT Report 99-1, Seattle, WA, Coastal Protection and Restoration Division, National Oceanic and Atmospheric Administration, 12 pages. 1990, November. Woodward-Clyde Consultants, Final Technical Appendix to the Master EIR. Table 5-2.
November 1990. Woodward-Clyde Consultants. Final Technical Appendix to the Master EIR.
October 1998. Camp Dresser & McKee Inc. Playa Vista Area A and Area B Wetlands Surface Water and Sediment Monitoring Report.
2000 Data. GeoSyntec Consultants.

Source: Camp Dresser & McKee Inc

Table 3-12
Selected* Sediment/Upland Soil Quality Constituents in Ballona Wetlands

Constituent	Units	NOAA Screening Quick Reference Table (SquiRT) Marine Sediment PELs	Total Number of Samples	Number of Samples Above Guidance Values	Observed Concentrations		
					Minimum	Maximum	Mean
Ammonia	mg/kg		4	—	ND	ND	ND
Total Inorganic Nitrogen	mg/kg	—	4	—	ND	ND	ND
Nitrite	mg/kg	—	4	—	ND	ND	ND
Nitrate	mg/kg	—	4	—	ND	ND	ND
TRPH	mg/kg	—	1	—	40	40	40
TPH-gasoline	mg/kg	—	1	—	ND	ND	ND
TPH-diesel	mg/kg	—	1	—	6.8	6.8	6.8
Oil and Grease	mg/kg		1	0	43	43	43
Total Hardness	mg/kg	—	0	0	ND	ND	ND
Salinity	g/kg	—	4	0	7.7	57	22.83
TKN	mg/kg	—	4	0	110	520	300
Total Phosphorus	mg/kg	—	4	0	200	440	310
Aluminum	mg/kg	—	2	0	12,000	13,000	12,500
Antimony	mg/kg		3	0	ND	ND	ND
Arsenic	mg/kg	41.6	2	0	ND	5.4	2.7
Cadmium	mg/kg	4.21	2	0	ND	ND	ND
Copper	mg/kg	108.2	2	0	23	28	25.5
Lead	mg/kg	112.18	2	0	4.3	24	14.15
Manganese	mg/kg	—	2	0	360	440	400
Mercury	mg/kg	0.696	2	0	0.05	0.094	0.07
Nickel	mg/kg	42.8	2	0	30	35	32.5
Selenium[a]	mg/kg	1	2	0	ND	ND	ND
Silver	mg/kg	1.77	2	0	ND	ND	ND
Thallium	mg/kg	—	2	0	ND	ND	ND
Zinc	mg/kg	271	2	0	59	83	71
O,P'-DDD	µg/kg		1	0	ND	ND	ND
P,P'-DDD	µg/kg	7.81	1	0	ND	ND	ND
O,P'-DDE	µg/kg	—	1	0	ND	ND	ND
P,P'-DDE	µg/kg	374.17	1	0	ND	ND	ND
PCB-1254	µg/kg	188.79	1	0	ND	ND	ND

Notes:
— = No Guidance Value *µg/kg = micrograms per kilogram* *PEL = Probable Effects Level*
NA = Not Analyzed *mg/kg = milligrams per kilogram*
ND = Not Detected *SW = Saltwater*
NOAA SQuiRT = National Oceanic and Atmospheric Administration Screening Quick Reference Tables
**"Selected" water quality constituents represent those water quality constituents most relevant to the analysis and discussion presented in this section. The data for all constituents sampled is contained in Volume I, Section 3, Water Resources Technical Report.*
[a] Apparent Effects Threshold (AET) is used instead because PEL is not listed

October 1998. Camp Dresser & McKee. Playa Vista Area A and Area B Wetlands Surface Water and Sediment Monitoring Report.
Buchman, M.F., 1999. NOAA Screening Quick Reference Tables, NOAA HAZMAT Report 99-1, Seattle, WA, Coastal Protection and Restoration Division, National Oceanic and Atmospheric Administration, 12 pages.

Source: Camp Dresser & McKee Inc

Table 3-13
Selected* Water Quality Constituents in Centinela Ditch During Dry-Weather

Constituent	Units	Chronic CTR Criteria	Total Number of Samples	Number of Samples Exceeding Criteria	Observed Concentrations Minimum	Maximum	Mean
Total Hardness	mg/L	—	1	—	720	720	720
Total Suspended Solids [a]	mg/L	—	1	—	140	140	140
TKN[a]	mg/L	—	1	—	1.5	1.5	1.50
Total Phosphorus	mg/L	—	1	—	0.76	0.76	0.76
PAHs	µg/L	—	1	—	ND	ND	ND
Oil & Grease	mg/L	—	1	-	ND	ND	ND
Pesticides and PCBs	µg/L	—	1	—	ND	ND	ND
Dissolved Arsenic	µg/L	36	1	0	7	7	7.0
Dissolved Cadmium	µg/L	9.3	1	0	2	2	2.00
Dissolved Chromium	µg/L	50	1	0	9	9	9
Dissolved Copper	µg/L	3.1	1	1	5	5	5
Dissolved Lead	µg/L	8.1	1	1	19	19	19.0
Dissolved Mercury	µg/L	—	1	—	ND	ND	ND
Dissolved Nickel	µg/L	8.2	1	0	7	7	7
Dissolved Selenium	µg/L	71	1	0	ND	ND	ND
Dissolved Silver	µg/L	—	1	—	ND	ND	ND
Dissolved Zinc	µg/L	81	1	0	54	54	54

Notes:
— – No Criteria *CTR – California Toxics Rule*
NA – Not Analyzed *µg/L = micrograms per liter*
ND – Not Detected *mg/L – milligrams per liter*
"Selected" water quality constituents represent those water quality constituents most relevant to the analysis and discussion presented in this section. The data for all constituents sampled is contained in Volume I, Section 3, Water Resources Technical Report (Appendix F-1).
[a] *Results for Total Suspended Solids and Total Kjeldahl Nitrogen from: July 1990. Woodward-Clyde Consultants, Dry Weather Sampling Results Report. Table 4.*

November 1990. Woodward-Clyde Consultants. Final Technical Appendix to the Master EIR.
Final CTR Criteria = May 18, 2000. Federal Register Volume 65, No. 97, 40 CFR Part 131, Water Quality Standards, Establishment of Numeric Criteria for Priority Toxic Pollutants for the State of California.
Source: Camp Dresser & McKee Inc

Table 3-14
Selected[a] Sediment Quality Constituents in Centinela Ditch

Constituent	Units	NOAA Screening Quick Reference Table (SquiRT) Marine Sediment PELs	Total Number of Samples	Number of Samples Above Guidance Values	Observed Concentrations		
					Minimum	Maximum	Mean
Oil & Grease	mg/kg	—	1	—	89	89	89
Acenaphthene	µg/kg	88.9	1	0	ND	ND	ND
Acenaphthylene	µg/kg	127.87	1	0	ND	ND	ND
Anthracene	µg/kg	245	1	0	ND	ND	ND
Benzo(a)anthracene	µg/kg	692.53	1	0	ND	ND	ND
Benzo(a)pyrene	µg/kg	763.22	1	0	ND	ND	ND
Benzo(b)fluoranthene[a]	µg/kg	1800	1	0	ND	ND	ND
Benzo(g,h,i)perylene	µg/kg	670	1	0	ND	ND	ND
Benzo(k)fluoranthene[a]	µg/kg	1800	1	0	ND	ND	ND
Butylbenzylphthalate[a]	µg/kg	63	1	0	ND	ND	ND
Chrysene	µg/kg	845.98	1	0	ND	ND	ND
Dibenz(a,h)anthracene	µg/kg	134.61	1	0	ND	ND	ND
Fluoranthene	µg/kg	1,493.54	1	0	ND	ND	ND
Fluorene	µg/kg	144.35	1	0	ND	ND	ND
Indeno(1,2,3-c,d)pyrene[a]	µg/kg	600	1	0	ND	ND	ND
Naphthalene	µg/kg	390.64	1	0	ND	ND	ND
Phenanthrene	µg/kg	543.53	1	0	ND	ND	ND
Pyrene	µg/kg	1,397.6	1	0	ND	ND	ND
Arsenic	mg/kg	41.6	1	0	2.85	2.85	2.85
Cadmium	mg/kg	4.21	1	0	2	2	2
Chromium	mg/kg	160.4	1	0	27.5	27.5	27.5
Copper	mg/kg	108.2	1	0	29.5	29.5	29.5
Lead	mg/kg	112.18	1	0	58	58	58
Mercury	mg/kg	0.696	1	0	ND	ND	ND
Nickel	mg/kg	42.8	1	0	9.5	9.5	9.5
Selenium[a]	mg/kg	1	1	0	ND	ND	ND
Silver	mg/kg	1.77	1	0	0.7	0.7	0.7
Zinc	mg/kg	271	1	0	160	160	160
Aldrin[a]	µg/kg	9.5	1	0	ND	ND	ND
Chlordane	µg/kg	4.79	1	0	ND	ND	ND
p,p'-DDD	µg/kg	7.81	1	0	ND	ND	ND
p,p'-DDE	µg/kg	374.17	1	0	ND	ND	ND
p,p'-DDT	µg/kg	4.77	1	0	ND	ND	ND
Dieldrin	µg/kg	4.3	1	0	ND	ND	ND
Endrin	µg/kg	—	1	-	ND	ND	ND
Heptachlor Epoxide	µg/kg	-	1	—	ND	ND	ND
Heptachlor[a]	µg/kg	0.3	1	0	ND	ND	ND

Table 3-14
Selected* Sediment Quality Constituents in Centinela Ditch

Constituent	Units	NOAA Screening Quick Reference Table (SquiRT) Marine Sediment PELs	Total Number of Samples	Number of Samples Above Guidance Values	Observed Concentrations		
					Minimum	Maximum	Mean
Methoxychlor	µg/kg	—	1	—	ND	ND	ND
Aroclor-1016	µg/kg	188.79	1	0	ND	ND	ND
Aroclor-1221	µg/kg	188.79	1	0	ND	ND	ND
Aroclor-1232	µg/kg	188.79	1	0	ND	ND	ND
Aroclor-1242	µg/kg	188.79	1	0	ND	ND	ND
Aroclor-1248	µg/kg	188.79	1	0	ND	ND	ND
Aroclor-1254	µg/kg	188.79	1	0	ND	ND	ND
Aroclor-1260	µg/kg	188.79	1	0	ND	ND	ND
Aroclor-1262	µg/kg	188.79	1	0	ND	ND	ND
Toxaphene	µg/kg	—	1	—	ND	ND	ND

Notes:
= No Guidance Value *µg/kg – micrograms per kilogram* *PEL=- Probable Effects Level*
NA = Not Analyzed *mg/kg – milligrams per kilogram*
ND = Not Detected *SW – Saltwater*
NOAA SQuiRT – National Oceanic and Atmospheric Administration Screening Quick Reference Tables
"Selected" water quality constituents represent those water quality constituents most relevant to the analysis and discussion presented in this section. The data for all constituents sampled is contained in Volume I, Section 3, Water Resources Technical Report.
^ Apparent Effects Threshold (AET) is used instead because PEL is not listed

November 1990. Woodward-Clyde Consultants. Final Technical Appendix to the Master EIR.
Buchman, M.F., 1999. NOAA Screening Quick Reference Tables, NOAA HAZMAT Report 99-1, Seattle, WA. Coastal Protection and Restoration Division, National Oceanic and Atmospheric Administration, 12 pages.

Source: Camp Dresser & McKee Inc

Table 3-15
Selected* Water Quality Constituents in Freshwater Marsh During Dry-Weather

Constituent	Units	Chronic CTR Criteria [a]	Total Number of Samples	Number of Samples Exceeding Criteria	Observed Concentrations Minimum	Maximum	Mean
Fecal Coliforms	MPN/100 ml	—	3	—	2	8	4.67
Total Coliforms	MPN/100 ml	—	3	-	13	23	17
Total Suspended Solids	mg/l	—	6	—	ND	39	21.33
Salinity	g/l	—	6	—	ND	2	0.92
Oil and Grease	mg/l	—	6	—	ND	0.44	0.19
TKN	mg/l	—	3	—	0.37	0.72	0.59
Total Phosphorus	mg/l	—	3	—	0.15	0.64	0.41
Hardness	mg/l	—	6	—	156	800	453
Acenaphthene [b]	µg/l	2,700	3	0	ND	ND	ND
Acenaphthylene	µg/l	—	3	—	ND	ND	ND
Anthracene [b]	µg/l	110,000	3	0	ND	ND	ND
Benzo(a)anthracene [b]	µg/l	0.049	3	0	ND	ND	ND
Benzo(a)pyrene [b]	µg/l	0.049	3	0	ND	ND	ND
Benzo(b)fluoranthene [b]	µg/l	0.049	3	0	ND	ND	ND
Benzo(g,h,i)perylene [b]	µg/l	—	3	—	ND	ND	ND
Benzo(k)fluoranthene [b]	µg/l	0.049	3	0	ND	ND	ND
Chrysene [b]	µg/l	0.049	3	0	ND	ND	ND
Dibenzo(a,h)anthracene [b]	µg/l	0.049	3	0	ND	ND	ND
Fluoranthene [b]	µg/l	370	3	0	ND	ND	ND
Fluorene [b]	µg/l	14,000	3	0	ND	ND	ND
Indeno(1,2,3-c.d) pyrene	µg/l	0.049	1	0	ND	ND	ND
Naphthalene	µg/l	—	1	—	ND	ND	ND
Phenanthrene	µg/l	—	3	—	ND	ND	ND
Pyrene [b]	µg/l	11,000	3	0	ND	ND	ND
Dissolved Arsenic	µg/l	150	6	0	6	8.4	7.07
Total Arsenic	µg/l	—	9		6.1	11	8.5
Dissolved Cadmium	µg/l	6.2	6	0	ND	0.2	0.09
Total Cadmium	µg/l	—	9	—	ND	0.2	0.13
Dissolved Copper	µg/l	29	6	0	3.2	6.7	5.03
Total Copper	µg/l	—	9	—	3.5	16	9.37
Dissolved Lead	µg/l	11	6	0	ND	2.9	0.70
Total Lead	µg/l	—	9	—	ND	1.8	0.56
Dissolved Mercury	µg/l	—	6	—	ND	ND	ND
Total Mercury	µg/l	—	9	—	ND	ND	ND
Dissolved Nickel	µg/l	170	6	0	1.9	3.8	2.88
Total Nickel	µg/l	—	9	—	2.0	5.6	3.76
Dissolved Selenium	µg/l	—	6	—	ND	ND	ND
Total Selenium	µg/l	5	9	0	ND	ND	ND
Dissolved Silver	µg/l	—	6	—	ND	ND	ND
Total Silver	µg/l	—	9	—	ND	0.2	0.02
Dissolved Zinc	µg/l	380	6	0	1.2	28	12.25
Total Zinc	µg/l	—	9		1.7	16	9.78
P,P'-DDT	µg/l	0.001	3	0	ND	ND	ND
Aldrin [c]	µg/l	3	3	0	ND	ND	ND

Table 3-15
Selected* Water Quality Constituents in Freshwater Marsh During Dry-Weather

Constituent	Units	Chronic CTR Criteria [a]	Total Number of Samples	Number of Samples Exceeding Criteria	Observed Concentrations Minimum	Maximum	Mean
Dieldrin	µg/l	0.056	3	0	ND	ND	ND
Endosulfan I	µg/l	0.056	3	0	ND	ND	ND
Endosulfan II	µg/l	0.056	3	0	ND	ND	ND
Endrin	µg/l	0.036	3	0	ND	ND	ND
Heptachlor Epoxide	µg/l	0.52	3	0	ND	ND	ND
Heptachlor	µg/l	0.52	3	0	ND	ND	ND
PCB-1016	µg/l	0.014	3	0	ND	ND	ND
PCB-1221	µg/l	0.014	3	0	ND	ND	ND
PCB-1232	µg/l	0.014	3	0	ND	ND	ND
PCB-1242	µg/l	0.014	3	0	ND	ND	ND
PCB-1248	µg/l	0.014	3	0	ND	ND	ND
PCB-1254	µg/l	0.014	3	0	ND	ND	ND
PCB-1260	µg/l	0.014	3	0	ND	ND	ND

Notes:
= No Criteria *CTR = California Toxics Rule*
MPN/100 ml – Most Probable Number per 100 milliliters
NA = Not Analyzed *µg/l = micrograms per liter*
ND = Not Detected *mg/l = milligrams per liter*
Final CTR Criteria – May 18, 2000. Federal Register Volume 65, No. 97, 40 CFR Part 131, Water Quality Standards, Establishment of Numeric Criteria for Priority Toxic Pollutants for the State of California.
"Selected" water quality constituents represent those water quality constituents most relevant to the analysis and discussion presented in this section. The data for all constituents sampled is contained in Volume III, Appendix B of this Technical Report.
[a] *CTR Criteria was calculated using the mean hardness for all freshwater dry weather samples collected in the Freshwater Marsh. Since the mean hardness was 453 mg/l (greater than the maximum set by the CTR), a hardness of 400 mg/l was used.*
[b] *CTR criteria are for the protection of human health due to the consumption of aquatic organisms living in waters with carcinogenic compounds. CTR does not designate specific freshwater chronic criteria for these constituents.*
[c] *CTR criteria shown are the freshwater acute criteria for the protection of aquatic life. CTR does not designate specific freshwater chronic criteria for these constituents.*

April 25, 2002 and June 28, 2002. Camp Dresser & McKee Inc. Freshwater Marsh Water Quality Sampling, Dry Weather, Playa Vista, California.
April 2, 2003. Camp Dresser & McKee Inc. Freshwater Marsh Water Quality Sampling, Dry Weather, Playa Vista, California.
Source: Camp Dresser & McKee Inc

Table 3-16
Groundwater Remediation Facility Discharge Water Quality and Construction Dewatering Discharge Water Quality

			Remediation		Construction Dewatering	
Parameter	Units	EPA Method	NPDES Permit Limitation Monthly/Daily [a]	System Effluent Concentration [b]	NPDES Permit Limitation Monthly/Daily [c]	System Effluent Concentration [d]
pH	PH	150.1	6.0 – 9.0	7.05 - 7.68	6.0 – 9.0	7.37 – 8.24
Oil and Grease	mg/L	413.2	NA	ND<2.0	10/15	ND<1.0
Temperature	oF	Field	<100	73.8	<100	NA
Turbidity	NTU	180.1	50/150	ND<1.0	50/150	ND<1.0-3.5
Total Suspended Solids	mg/L	160.2	50/150	ND<10	50/150	ND<10 - 11
BOD5 20oC	mg/L	405.1	20/30	ND<2.0	20/30	ND<2.0
Sulfides (Total)	mg/L	376.2	1.0	ND< 0.1	1.0	ND<0.1
MBAS	mg/L	425.1	0.5	ND<0.10 - 0.22	0.5	0.27 – 1.1*
Settleable Solids	mL/L	160.5	0.1/0.3	ND<0.1	0.1/0.3	ND<0.1
Residual Chlorine	mg/L	330.5	NA	NA	0.1	ND<0.1
Benzene	ug/L	8020	1.0	ND<0.5	1.0	ND<0.5
Toluene	ug/L	8020	150	ND<0.5	150	ND<0.5 – 0.77
Ethylbenzene	ug/L	8020	700	ND<0.5	700	ND<0.5
Total Xylenes	ug/L	8020	1,750	ND<2.0	1,750	ND<2.0 - 3.5
Ethylene Dibromide	ug/L	504	0.05	ND<0.02	0.05	ND<0.02
Carbon Tetrachloride	ug/L	8260B	NA	ND<0.5	0.5	ND<0.05
Antimony	ug/L	6020	NA	ND<2.0	NA	ND<2.0 - 3.5
Arsenic	ug/L	6020	NA	4.8	50	ND<1.0 - 52*
Cadmium	ug/L	6020	NA	ND<1.0	10	ND<1.0
Chromium	ug/L	6020	NA	ND<1.0	50	ND<1.0 – 5.0
Chromium +6	ug/L	7196	NA	NA	NA	ND<8
Copper	ug/L	6020	NA	3.3	1000	ND<1.0 – 7.3
Lead	ug/L	7421	50	ND<1.0	50	ND<2.0
Mercury	ug/L	6020	NA	ND<0.2	2.0	ND<0.2
Nickel	ug/L	6020	NA	5.7	NA	ND<1.0 – 12
Selenium	ug/L	6020	NA	5.6	10	ND<1.0 – 3.5
Silver	ug/L	6020	NA	ND<1.0	50	ND<2.0
Zinc	ug/L	6020	NA	12	NA	ND<10 - 26
TPH as Gasoline	ug/L	8015M	100	ND<50	100	ND<50
1,4-Dichlorobenzene	ug/L	8260B	NA	ND<0.5	5.0	ND<0.5
1,1-Dichloroethane	ug/L	8260B	NA	ND<0.5	5.0	ND<0.5
1,2-Dichloroethane	ug/L	8260B	NA	ND<0.5	0.5	ND< 0.5
1,1-Dichloroethene	ug/L	8260B	NA	ND< 0.5	6.0	ND<0.5
1,1,1-Trichloroethane	ug/L	8260B	NA	NA	NA	ND<0.5 - 0.69
Chloroform	ug/L	8260B	NA	NA	NA	ND<0.5 – 1.1
Dichloromethane	ug/L	8260B	NA	NA	NA	ND<2
Trichloroethylene	ug/L	8260B	NA	ND<0.5	5	ND<0.5

Table 3-16
Groundwater Remediation Facility Discharge Water Quality and Construction Dewatering Discharge Water Quality

Parameter	Units	EPA Method	Remediation: NPDES Permit Limitation Monthly/Daily [a]	Remediation: System Effluent Concentration [b]	Construction Dewatering: NPDES Permit Limitation Monthly/Daily [c]	Construction Dewatering: System Effluent Concentration [d]
Tetrachloroethylene	ug/L	8260B	NA	ND<0.5	5	ND<0.5
Vinyl Chloride	ug/L	8260B	NA	ND<0.5	0.5	ND<0.5
Methyl-tert-butyl-ether	ug/L	8260	35	ND<0.5	35	ND<0.5 – 4.0
Phenols	mg/L	420.1	1.0	ND<0.1	1.0	ND<0.1
Chlorinated Phenols	ug/L	8270	NA	NA	1.0	ND **

Notes:

mg/L = milligrams per liter
ug/L = micrograms per liter
NPDES = National Pollutant Discharge Elimination System
** One time exceedance; water was re-treated and tested three times for compliance prior to discharge*
*** Laboratory reporting limits vary by compound*
[a] RWQCB NPDES Permit #CAG834001
[b] Based on monitoring results from 2002 Annual Report, February 2003
[c] RWQCB NPDES Permit #CAG994002
[d] Based on monitoring results from 2002 Annual Report, February 2003
J – Estimated concentrations – detected at a concentration below laboratory reporting limit.
ND< – not detected at method detection limits
NA – not applicable
EPA Method – United States Environmental Protection Agency specifications for sampling and laboratory testing

Source: Camp Dresser & McKee Inc.

Table 3-17
Pollutant Removal Approximations for Water Quality Inlets Used in Pollutant Loading Model

Modeled Constituent	% Removals for Water Quality Inlets [1]
Total Suspended Solids	30%
Total Phosphorus	10%
Total Kjeldhal Nitrogen	0%
Oil and Grease	20%
Total Copper	10%
Total Lead	15%
Total Zinc	10%
Dissolved Copper	10%
Dissolved Lead	15%
Dissolved Zinc	10%

[1] *Conservative estimates based on ranges found in literature: Larry Walker Associates, Inc., 1999.* Investigation of Structural Control Measures for New Development. *Prepared for Sacramento Stormwater Management Program; Interagency Catch Basin Insert Committee, 1995.* Evaluation of Commercially-Available Catch Basin Inserts for the Treatment of Stormwater Runoff from Development Sites. *King County Surface Water Management Division, King County Department of Metropolitan Services, Snohomish County Surface Water Management Division, Seattle Drainage and Wastewater Utility, and Port of Seattle. Since dissolved metals estimates are based on fractionation values, percent removals for dissolved metals were equal to percent removals for total metals.*

Table 3-18
Effluent Quality Approximations for the Freshwater Marsh and Ballona Wetlands Used in Pollutant Loading Model

Parameter	No. of Studies	Freshwater Marsh[1]	Ballona Wetlands[2]	Units
Total Suspended Solids	18	11.3	39.5	mg/L
Total Phosphorus	18	0.13	0.23	mg/L
Total Kjeldahl Nitrogen	12	0.84	1.35	mg/L
Oil and Grease	1	0.90	1.51	mg/L
Total Copper	11	6.0	14.8	ug/L
Dissolved Copper	3	4.7	6.2	ug/L
Total Lead	13	4.6	44.4	ug/L
Dissolved Lead	3	2.7	7.8	ug/L
Total Zinc	13	20.9	36.9	ug/L
Dissolved Zinc	18	7.5	15.2	ug/L

[1] Calculated from the National Stormwater Best Management Practices Database wet pond outflow concentration data. Fortieth percentile values of outflow data from statistically summarized studies are shown. Studies with less than 3 events or data with effluent concentrations larger than influent concentrations were omitted. The oil and grease estimate is taken from only one study (DUST Debris Marsh) contained in the database that was chosen based on the order of magnitude of influent oil and grease predicted. The 75th percentile of the oil and grease data was used in this conservative estimate.
[2] Same as 1 above, except the 90th percentile values of outflow data from statistically summarized wet pond studies are shown.

Table 3-19
Pollutant Removal Approximations for Riparian Corridor and Centinela Ditch Used in Pollutant Loading Model

Parameter	No. of Studies	Riparian Corridor	Units
Total Suspended Solids[1]	5	24.9	mg/L
Total Phosphorus	21	0.3	mg/L
Total Kjeldahl Nitrogen	11	1.5	mg/L
Oil and Grease[2]	1	1.3	mg/L
Total Copper	11	11.4	ug/L
Dissolved Copper	8	9.9	ug/L
Total Lead	15	9.6	ug/L
Dissolved Lead	5	4.4	ug/L
Total Zinc[1]	11	140.6	ug/L
Dissolved Zinc[1]	5	35.2	ug/L

Calculated from the National Stormwater Best Management Practices Database bioswales, wetland channel, and wet pond outflow concentration data. Unless noted, median outflow concentrations are used for the Riparian Corridor and 75th percentiles are used for the Centinela Ditch. Only studies with average EMC influent concentrations within 70% of the predicted influent concentrations were used. Studies with less than 3 events or with effluent concentrations larger than influent concentrations were omitted.

[1] *The 75th and 90th percentiles were used instead of the median and the 75th percentiles, respectively, to account for the relatively high influent concentrations expected for these parameters in comparison to the effluent data.*

[2] *The oil and grease estimate for the Riparian Corridor is taken from only one study (NW Wetland Channel) contained in the database that was chosen based on the order of magnitude of influent oil and grease predicted. The oil and grease estimate for the Centinela Ditch is taken as the median of two studies contained in the database, a biofilter and a bioretention area.*

Table 3-20
Pollutant Removal Approximations for Bioswales Used in Pollutant Loading Model

Parameter	No. of Studies	Bioswales	Units
Total Suspended Solids	4	27.1	mg/L
Total Phosphorus	18	0.46	mg/L
Total Kjeldahl Nitrogen	12	1.74	mg/L
Oil and Grease	2	2.7	mg/L
Total Copper	14	9.4	ug/L
Dissolved Copper	11	8.2	ug/L
Total Lead	17	11.2	ug/L
Dissolved Lead	11	4.4	ug/L
Total Zinc	17	41.0	ug/L
Dissolved Zinc	11	36.3	ug/L

Calculated from the National Stormwater Best Management Practices Database bioswales outflow concentration data. Only studies with average EMC influent concentrations within 70% of the predicted influent concentrations were used. Studies with less than 3 events or with effluent concentrations larger than influent concentrations were omitted.

Table 3-21
Numerical Water Quality Benchmarks of the Modeled Parameters

	Primary Management Areas of the Freshwater Marsh	Main Body of the Freshwater Marsh	Influent to the Ballona Channel and Ballona Wetlands
Dissolved Copper (µg/L) [a]	26	38	4.8
Dissolved Lead (µg/L) [a]	136	208	210
Dissolved Zinc (µg/L) [a]	210	297	90
Total Phosphorus (mg/L) [b]	2.8	2.8	0.2
Total Suspended Sediment (mg/L) [c]	60	60	60
Total Kjeldahl Nitrogen (mg/L) [b]	3.3	3.3	1.5
Oil and Grease (mg/L) [c]	25	25	25

[a] *Final CTR Criteria 2000, May 18. Federal Register Volume 65, No. 97, 40 CFR Part 131, Water Quality Standards. Establishment of Numeric Criteria for Priority Toxic Pollutants for the State of California. The acute freshwater criteria were used as water quality benchmarks for dissolved metals within the Freshwater Marsh. Hardness concentrations of 200 mg/l and 300 mg/l were assumed for the primary management areas of the Freshwater Marsh and the main body and effluent from the Freshwater Marsh, respectively. The acute saltwater criteria were used for influent to the Ballona Channel and Ballona Wetlands. See Section 3.2.4.2.3.1, California Toxics Rule for details.*

[b] *USEPA, 2000. Ambient Water Quality Criteria Recommendations: Information Supporting the Development of State and Tribal Nutrient Criteria for Rivers and Streams in Nutrient Ecoregion III. EPA 822-B-00-016*

[c] *SWRCB, 2001. California Ocean Plan: Water Quality Control Plan Ocean Waters of California.*

mg/L = milligrams per liter

µg/L = micrograms per liter

Source: GeoSyntec Consultants

Table 3-22
Summary of SUSMP Requirements and Corresponding Playa Vista Measures

Requirement	Type of Requirement	Criteria/ Description	Corresponding Playa Vista Measures
Submit a Drainage Concept and Stormwater Quality Plan and Include Details of Facilities and Measures to Mitigate Impacts on Improvement Plans	General	• SUSMP Project Type: Part A in Table 2-1 of SUSMP Manual. Development is a 100,000 ft^2 or greater commercial development.	• Design drawings will be submitted to the City and/or County as appropriate.
Peak Stormwater Discharge Rates	General	• Not to exceed the pre-development discharge rate where the increased peak stormwater discharge will result in increased potential for downstream erosion.	• Peak flows will not be problematic as flows to the Ballona Channel will only occur after passing through the Freshwater Marsh and thus after peak flow has subsided; additionally the Ballona Channel is a concrete sided channel making erosion of the channel less of a concern. • The overflow weir to the Ballona Wetlands has been designed such that flows will not cause erosion problems. • On-site conveyance systems are designed to handle expected flows.
Conservation of Natural Areas	General	• Concentrate or cluster development on portions of a site while leaving the remaining land in a natural undisturbed condition. • Limit clearing and grading of native vegetation at a site to the minimum amount needed to build lots, allow access, and provide fire protection. • Maximize trees and other vegetation at each site, planting additional vegetation, clustering tree areas, and promoting the use of native and/or drought tolerant plants. • Promote natural vegetation by using parking lot islands and other landscaped areas. • Preserve riparian areas and wetlands.	• Out of a total of approximately 162 acres in the Proposed Project, approximately 60 acres will be restored and protected as natural areas. • The final project stormwater system includes the establishment of natural areas in the Riparian Corridor and Bluffs and a Freshwater Marsh. • Natural and low-impact vegetation is being utilized within the development.

Table 3-22
Summary of SUSMP Requirements and Corresponding Playa Vista Measures

Requirement	Type of Requirement	Criteria/ Description	Corresponding Playa Vista Measures
Minimize Stormwater Pollutants of Concern	General	• Minimize to the maximum extent practicable, the introduction of pollutants of concern that may result in significant impacts, generated from site runoff of directly connected impervious areas (DCIA), to the stormwater conveyance system as approved by the building official. Pollutants of concern consist of any pollutants that exhibit one or more of the following characteristics: current loadings or historic deposits of the pollutant are impacting the beneficial uses of a receiving water, elevated levels of the pollutant are found in sediments of a receiving water and/or have the potential to bioaccumulate in organisms therein, or the detectable inputs of the pollutant are at concentrations or loads considered potentially toxic to humans and/or flora and fauna.	• Playa Vista's BMPs include numerous source controls, including education programs, street sweeping, catch basin cleaning, use of low-impact vegetation, and parking underground. Structural source controls (i.e., swales) are also included.
Protect Slopes and Channels	General	Project plans must include BMPs consistent with local codes and ordinances and the SUSMP to decrease the potential of slopes and/or channels from eroding and impacting stormwater runoff: • Convey runoff safely from the tops of slopes and stabilize disturbed slopes. • Utilize natural drainage systems to the maximum extent practicable. • Control or reduce or eliminate flow to natural drainage systems to the maximum extent practicable. • Stabilize permanent channel crossings. • Vegetate slopes with native or drought tolerant vegetation. • Install energy dissipaters, such as riprap, at the outlets of new storm drains, culverts, conduits, or channels that enter unlined channels in accordance with applicable specifications to minimize erosion with the approval of all agencies with jurisdiction, e.g., the U.S. Army Corps of Engineers and the California Department of Fish and Game.	• Project does not include development areas with substantial slopes. • The Riparian Corridor will be an improved channel replacing the existing Centinela Ditch. • Riparian Corridor will handle the expected flow regime with little or no erosion and will be planted with native vegetation. The inlets to the Riparian Corridor will include energy dissipaters. • The bluffs will be revegetated with native species and graded for stability, as necessary.

Table 3-22
Summary of SUSMP Requirements and Corresponding Playa Vista Measures

Requirement	Type of Requirement	Criteria/ Description	Corresponding Playa Vista Measures
Provide Storm Drain System Stenciling and Signage	General	• All storm drain inlets and catch basins within the project area must be stenciled with prohibitive language and/or graphical icons to discourage illegal dumping. • Signs and prohibitive language and/or graphical icons, which prohibit illegal dumping, must be posted at public access points along channels and creeks within the project area. • Legibility of stencils and signs must be maintained.	• All storm drain inlets and water quality inlets will be stenciled or signed. • Signs will be posted in any areas where dumping could likely occur. • The Playa Vista Management Association will maintain stencils and signs.
Properly Design Outdoor Material Storage Areas	General	• Where proposed project plans include outdoor areas for storage of materials that may contribute pollutants to the storm water conveyance system, measures to mitigate impacts must be included.	• Post-construction, there are no planned outdoor material storage areas. • All businesses opting to have such a facility will be required to meet this requirement
Properly Design Trash Storage Areas	General	All trash containers must meet the following structural or treatment control BMP requirements: • Trash container areas must have drainage from adjoining roofs and pavement diverte around the areas. • Trash container areas must be screened or walled to prevent off-site transport of trash.	• All trash facilities are planned to be located below ground. • All businesses opting to have such a facility, will be required to meet this requirement.
Provide Proof of Ongoing BMP Maintenance	General	• Applicant required to provide verification of maintenance provisions through such means as may be appropriate, including, but not limited to legal agreements, covenants, CEQA mitigation requirements and/or Conditional Use Permits.	• A responsible entity, such as a Storm Drainage Maintenance District or Property Owners Association, shall be responsible for maintenance.

Table 3-22
Summary of SUSMP Requirements and Corresponding Playa Vista Measures

Requirement	Type of Requirement	Criteria/ Description	Corresponding Playa Vista Measures
Design Standards for Structural or Treatment Control BMPs	General	Post-construction Structural or Treatment Control BMPs shall be designed to:mitigate (infiltrate or treat) stormwater runoff from either: 1. the 85th percentile 24-hour runoff event determined as the maximized capture stormwater volume for the area, from the formula recommended in Urban Runoff Quality Management WEF Manual of Practice No. 23/ASCE Manual of Practice No. 87, (1998), or 2. the volume of annual runoff based on unit basin storage water quality volume, to achieve 80 percent or more volume treatment by the method recommended in California Stormwater Best Management Practices Handbook – Industrial Commercial (1993), or 3. the volume of runoff produced from a 0.75 inch storm event, prior to its discharge to a storm water conveyance system, or 4. the volume of runoff produced from an historical-record based reference 24-hour rainfall criterion for "treatment" (0.75 inch average for the Los Angeles County area) that achieves approximately the same reduction in pollutant loads achieved by the 85th percentile 24-hour runoff event. AND Control peak flow discharge to provide stream channel and over bank flood protection, based on flow design criteria selected by the local agency.	• The Playa Vista Project substantially exceeds this standard by treating events that are up to 50 percent larger than the required 0.75 inch treatment volume. • Although it would only require 39 acre-feet of volume to treat the entire tributary area, Playa Vista treatment control BMPs treat about 61 acre-ft of runoff volume. • Peak flow control has been provided in compliance with the City of Los Angeles requirements.
Properly Design Loading/Unloading Dock Areas	100,000 ft^2 Commercial Developments	• Cover loading dock areas or design drainage to minimize run-on and runoff of stormwater. • Direct connections to storm drains from depressed loading docks (truck wells) are prohibited.	• All commercial areas will be required to comply with these requirements through legal agreements. • All depressed loading docks will drain to a sump that can only be drained via pumping to the sanitation system.

Table 3-22
Summary of SUSMP Requirements and Corresponding Playa Vista Measures

Requirement	Type of Requirement	Criteria/ Description	Corresponding Playa Vista Measures
Properly Design Repair/ Maintenance Bays	100,000 ft^2 Commercial Developments	• Repair/ maintenance bays must be indoors or designed in such a way that does not allow stormwater run-on or contact with stormwater runoff. • Design a repair/ maintenance bay drainage system to capture all washwater, leaks, and spills. Connect drains to a sump for collection and disposal. Direct connection of the repair/ maintenance bays to the storm drain system is prohibited. If required by local jurisdiction, obtain an Industrial Waste Discharge Permit.	• All commercial businesses that have such facilities will be required via legal agreement to comply with these provisions.
Properly Design Vehicle/ Equipment Wash Areas	100,000 ft^2 Commercial Developments	• Self contained and /or covered, equipped with a clarifier, or other pre-treatment facility, and properly connected to a sanitary sewer.	• All commercial businesses that have such facilities will be required via legal agreement to comply with these provisions.
Properly design equipment/accessory wash areas	Restaurants	Outdoor equipment/accessory washing/steam cleaning areas must be designed as follows: • Self-contained, equipped with a grease trap, and properly connected to a sanitary sewer. • If the wash area is to be located outdoors, it must be covered, paved, have secondary containment, and be connected to the sanitary sewer.	• All commercial builders/businesses having such facilities must comply with these provisions through direct approvals from the City of Los Angeles.
Properly Design Parking Area	Parking Lots	• Reduce impervious land coverage of parking areas. • Infiltrate runoff before it reaches the storm drain system. • Treat runoff before it reaches storm drain system.	• Almost all parking lots will be below ground. • Surface parking lots will be designed to include biofiltration or runoff wil be routed to downstream BMPs for treatment.
Properly Design to Limit Oil Contamination and Perform Maintenance	Parking Lots	• Treat to remove oil and petroleum hydrocarbons at parking lots that are heavily used. • Ensure adequate operation and maintenance of treatment systems, particularly sludge and oil removal.	• See above. • Biofiltration will address oil and petroleum hydrocarbons as will the water quality catch basins. • Maintenance will be performed by the Property Owners Association.
Limitation of Use of Infiltration BMPs	General	• Infiltration is limited based on design of BMP, pollutant characteristics, land use, soil conditions, and traffic.	• Infiltration BMPs will not be used due to poor soil and high groundwater conditions. However, some of the BMPs (vegetated areas, grasscrete, porous pavement, biofiltration basins) will promote some level of Infiltration.

Table 3-23
Equation 3-1 Parameters to Be Used to Estimate Receiving Water Hardness

Eqn. 1 Variables	Description	0.75" Storm Volume (ac-ft)	0.67" Storm Volume (ac-ft)	Hardness (mg/L as $CaCO_3$)
Inflows, C_{in} and V_{in}	Riparian Corridor/Centinella Ditch[1]	17.3	15.5	210.0
	Central Storm Drain[2]	8.6	7.6	231.2
	Jefferson Storm Drain[1]	10.3	9.2	346.0
	Lincoln Storm Drain – South[1]	2.6	2.3	35.0
	Direct to Freshwater Marsh[3]	0.8	0.7	35.0
$[V_{sys}]_1$, $[C_{sys}]_1$	Freshwater Marsh Before Storm[4]	21.0	21.0	453.3
$[V_{sys}]_2$, $[C_{sys}]_2$	Freshwater Marsh After Storm	60.7	56.4	Eqn. 3-1

[1] *GeoSyntec, 2000. Unpublished wet weather sampling data in tributaries to Freshwater Marsh from 4/17/00 sampling event.*

[2] *Estimated using average ratio of wet weather hardness to dry weather hardness in the other storm drains. See Table 3-24.*

[3] *The hardness of rainfall directly onto the marsh and runoff from adjacent areas will be assigned a conservative value equal to that of the Lincoln Drain*

[4] *The hardness before storm is based on the average dry weather hardness concentration observed in the primary management areas and the effluent of the Freshwater Marsh. Playa Vista, Freshwater Marsh Sampling: Summary of Laboratory Analytical Results from 06/28/02 and 04/02/03.*

Table 3-24
Ratio of Wet Weather to Dry Weather Hardness in Freshwater Marsh Tributaries

Location	Ratio
Centinela Ditch	0.36
Lincoln Drain	0.10
Jefferson Drain	0.56
Average Ratio	***0.34***

GeoSyntec, 2000. Unpublished wet weather sampling data in tributaries to Freshwater Marsh from 04/17/00 sampling event
GeoSyntec, 2000. Unpublished dry weather sampling data in tributaries to Freshwater Marsh from 04/13/00 to 04/14/00 sampling event.

Table 3-25
Nutrient Data from Rivers and Streams in Ecoregion 6 of Aggregate Ecoregion III

TKN (mg/L)										
SEASON	N	MEAN	MIN	MAX	CV	P5	P25	MEDIAN	P75	P95
FALL	35	1.3	0.05	3.5	78	0.05	0.6	1.01	2.05	3.5
SPRING	44	1.12	0.05	3.5	87	0.1	0.35	0.87	1.45	3.3
WINTER	47	1.26	0.05	8.45	109	0.05	0.33	1.05	1.45	3.3
Total Phosphorus (mg/L)										
SEASON	N	MEAN	MIN	MAX	CV	P5	P25	MEDIAN	P75	P95
FALL	17	0.42	0.003	2.83	1.76	0.003	0.02	0.14	0.21	2.83
SPRING	27	0.27	0.003	2.20	1.80	0.008	0.04	0.11	0.19	1.28
WINTER	24	0.58	0.01	4.30	1.92	0.01	0.04	0.15	0.26	3.00

USEPA, 2000. Ambient Water Quality Criteria Recommendations: Information Supporting the Development of State and Tribal Nutrient Criteria for Rivers and Streams in Nutrient Ecoregion III. EPA 822-B-00-016

Table 3-26
National Climatic Data Center Weather Station Information

Name	NCDC ID	Latitude	Longitude	Elevation	Rainfall Record
Los Angeles International Airport	45114	33:56:00	118:24:00	97.1	1948-present

Table 3-27
Fractionation Values Used to Estimate Dissolved Metals Loads and Concentrations

Metal	ASCE/EPA BMP Database (%)	LA County 1994-2000 Data		Fraction Used (%)
		Commercial (%)	Residential (%)	
Copper	54.3%	36.0%	57.0%	46.5%
Lead	44.0%	NA	NA	44.0%
Zinc	47.5%	63.0%	56.0%	59.5%

NA - data not available due to statistically insignificant number of data points above the detection limit

Table 3-28
Land Use by Drainage System Pre-First Phase

(acres)

Drainage System	Industrial	Commercial/ Residential	Commercial[1]	Major Roadways[2]	Open Water[3]	High Density Residential	Low Density Residential	Open Space	Total[4]
Playa Vista Tributary									
Centinela Ditch									
Proposed Project			16		1			55	72
First Phase			81		5			120	206
Off-site			88	2			154	48	292
Jefferson Storm Drain[5]									
Proposed Project								38	38
First Phase								94	94
Off-site	65		12	37		9	93	47	263
Lincoln Storm Drain South									
First Phase									
Off-site			4	5		7	74	1	91
Freshwater Marsh[6] (First Phase)								32	32
Total[4]	**65**	**0**	**201**	**44**	**6**	**16**	**321**	**435**	**1088**
Ballona Wetlands Tributary									
Ballona Wetlands			10	16	6	11	160	264	467
Total[4]	**0**	**0**	**10**	**16**	**6**	**11**	**160**	**264**	**467**
Total Acreage of Tributary Areas	**65**	**0**	**211**	**60**	**12**	**27**	**481**	**699**	**1555**

Notes:

[1] *The 16 and 81 acres within the Proposed Project and First Phase Project areas, respectively, that are tributary to the Centinela Ditch Drainage System are the former Hughes Aircraft Company plant buildings used for commercial purposes.*

[2] *Major Roadways include Jefferson Blvd, Lincoln Blvd., Culver Blvd., and Centinela Ave.*

[3] *Open Water acreages represent the Centinela Ditch.*

[4] *Acreages are adjusted to account for rounding.*

[5] *In pre-First Phase, the Jefferson Storm Drain outlet is located near the Culver/Jefferson intersection and receives a portion of the runoff from the area near the Culver/Jefferson Boulevard intersection, west of Lincoln Boulevard, and then discharges directly to the Ballona Wetlands.*

[6] *In pre-First Phase, the Freshwater Marsh has not been constructed.*

Source: *Camp Dresser & McKee Inc.*

Table 3-29
Land Use by Drainage System with Playa Vista First Phase

(acres)

Drainage System	Industrial	Commercial/ Residential	Commercial[1]	Major Roadways[2]	Open Water[3]	High Density Residential	Low Density Residential	Open Space	Total[4]
Playa Vista Tributary									
Riparian Corridor									
Proposed Project			16		1			55	72
First Phase			87		14	30		26	157
Off-site			87				154	47	289
Central Storm Drain									
Proposed Project								37	37
First Phase			38			58		13	109
Off-site				8					8
Jefferson Storm Drain									
Proposed Project								1	1
First Phase			15			18		2	35
Off-site	65		12	41		9	93	1	221
Lincoln Storm Drain South									
First Phase									
Off-site			4	6		7	74		91
Freshwater Marsh									
First Phase					10			22	32
Total[4]	**65**	**0**	**259**	**56**	**25**	**122**	**321**	**204**	**1052**
Ballona Wetlands Tributary									
Ballona Wetlands[6]			10	20[5]	5	11	161	296[6]	503
Total[4]	**0**	**0**	**10**	**20**[5]	**5**	**11**	**161**	**296**	**503**
Total Acreage of Tributary Areas	**65**	**0**	**269**	**76**	**30**	**133**	**482**	**500**	**1555**

Notes:

[1] *The 16 acres within the Proposed Project area and 81 of the 87 acres within the First Phase Project are the former Hughes Aircraft Company plant buildings used for commerical purposes.*

[2] *Major Roadways include Jefferson Blvd, Lincoln Blvd., Culver Blvd., and Centinela Ave.*

[3] *Open Water acreages represent the Centinela Ditch.*

[4] *Acreages are adjusted to account for rounding.*

[5] *Increase in acreage from Table 3-28 is due to the widening of Lincoln Boulevard.*

[6] *Increase in acreage from Table 3-28 is due to a portion of the runoff from the area near the Culver/Jefferson Boulevard intersection, west of Lincoln Boulevard, which discharges to the Jefferson Storm Drain prior to discharging to the Ballona Wetlands in pre-First Phase.*

Source: *Camp Dresser & McKee Inc.*

Table 3-30
Land Use by Drainage System with Playa Vista First Phase and Proposed Project

(acres)

Drainage System	Industrial	Commercial/ Residential	Commercial	Major Roadways[1]	Open Water	High Density Residential	Low Density Residential	Open Space	Total[2]
Playa Vista Tributary									
Riparian Corridor									
Proposed Project		8			4	17		14	43
First Phase			87		14	30		26	157
Off-site			87	1			154	47	289
Central Storm Drain									
Proposed Project		15				47		4	66
First Phase			38			58		13	109
Off-site				8					8
Jefferson Storm Drain									
Proposed Project						1			1
First Phase			15			18		2	35
Off-site	65		12	41		9	93	1	221
Lincoln Storm Drain South									
First Phase									
Off-site			4	6		7	74		91
Freshwater Marsh									
First Phase					10			22	32
Total[2]	**65**	**23**	**243**	**56**	**28**	**187**	**321**	**129**	**1052**
Ballona Wetlands Tributary									
Ballona Wetlands[4]			10	20[3]	5	11	161	296[4]	503
Total[2]	**0**	**0**	**10**	**20[3]**	**5**	**11**	**161**	**296**	**503**
Total Acreage of Tributary Areas	65	23	253	76	33	198	482	425	1555

Notes:
[1] Major Roadways include Jefferson Blvd, Lincoln Blvd., Culver Blvd., and Centinela Ave.
[2] Acreages are adjusted to account for rounding.
[3] Increase in acreage from Table 3-28 is due to the widening of Lincoln Boulevard.
[4] Increase in acreage from Table 3-28 is due a portion of the runoff from the area near the Culver/Jefferson Boulevard intersection, west of Lincoln Boulevard, which discharges to the Jefferson Storm Drain prior to discharging to the Ballona Wetlands in pre-First Phase.

Source: Camp Dresser & McKee Inc.

Table 3-31
Comparison of Hydrology Land Uses and Pollutant Loading Model Land Use

Hydrology Land Use	Pollutant Loading Model Land Use
Hotel Office/Commercial Community Serving	Commercial
Mixed Use	Commercial/Residential
Studio SCGC Facilities	Industrial
Open Space Gas Company Field Tidal Habitat Habitat Creation Plant Nursery Riparian Corridor Bluffs	Open Space
Freshwater Marsh Ballona Wetlands Boat Marina Water	Water
High Density Residential Medium Density Residential Low/Medium Density Residential Low Density Residential	High Density Residential Medium Density Residential Low/Medium Density Residential Low Density Residential

Source: Camp Dresser & McKee Inc.

Table 3-32
Summary of Land Use Imperviousness Factors

Model Land Use	Imperviousness (%)
Industrial Residential/Commercial Commercial Transportation (Major Roadways) Open Water High Density Residential	100
Medium Density Residential	70
Low/Medium Residential	60
Low Density Residential	40
Open Space	20

Note: Open space value was adjusted. See text.
Source: City of Los Angeles Storm Drain Design Manual, Figure G241.3

Table 3-33

Event Mean Concentrations for Stormwater Runoff By Land Use

Los Angeles County Event Mean Concentrations (mg/L)								
Pollutant	**Industrial**	**Commercial/ Residential**	**Commercial**	**Transportation/ Major Roadways**	**Open Water[a]**	**High Density Res.[b]**	**Low Density Res.**	**Open Space**
Total Suspended Solids	177.8	54.0	67.6	39.4	0.0	40.3	40.3	223.6
Total Phosphorus	0.308	0.318	0.399	0.295	0.0	0.236	0.236	0.124
Total Copper	0.028	0.023	0.035	0.034	0.0	0.011	0.011	0.009
Total Lead	0.018	0.012	0.021	0.004	0.0	0.003	0.003	0.003
Total Zinc	0.335	0.168	0.239	0.173	0.0	0.097	0.097	0.022
Oil & Grease	1.70	2.29	3.28	3.10	0.00	1.30	1.30	0.00
Total Kjeldahl Nitrogen	2.28	2.46	3.11	1.05	0.00	1.81	1.81	0.98

mg/L = milligrams per liter

[a] Water areas were assumed not to add any pollutant loadings.

[b] The values for the high density land use category were used for the high, medium, and low/medium density residential and other/unknown land use categories in the model.

Source: URSGWC, 1999. Memorandum to CDM dated March 12, 1999. LA County EMC values updated with 1997-2001 data provided from LA County website.

Table 3-34a
Representative Stormwater Loads to the Freshwater Wetlands System Prior to the First Phase Project

	Predicted Average Annual Loads[a] (lbs/year)										Runoff Volume (ft^3/yr)
	TSS	TP	TKN	O&G	TCu	DCu	TPb	DPb	TZn	DZn	
Runoff Tributary to the Upper Centinela Ditch (Upstream of West Boundary of Proposed Project)	47,639	178	1,384	1,293	14.1	6.6	7.9	3.6	96.3	57.3	9,095,264
Mass Removed in Upper Riparian Centinela Ditch	*0*	*0*	*-383*	*0*	*-2.6*	*0.0*	*0.0*	*0.0*	*0.0*	*-27.5*	
Centinela Ditch at Proposed Project Boundary	47,639	178	1,000	1,293	11.5	6.6	7.9	3.6	96.3	29.8	9,095,264
Runoff Tributary to the Lower Centinela Ditch (Downstream of West Boundary of Proposed Project)	16,794	33	254	200	2.5	1.2	1.2	0.6	15.6	7.3	2,165,473
Mass Removed in Lower Centinela Ditch	*-1,715*	*0*	*-16*	*0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*-0.2*	
Centinela Ditch at Lincoln	62,718	211	1,239	1,494	14.1	7.8	9.1	4.2	111.9	36.9	11,260,737
Lincoln Storm Drain - South	4,666	28	200	177	1.6	0.8	0.5	0.2	12.5	7.5	1,744,991
Centinela Ditch and Lincoln	67,384	239	1,439	1,671	15.7	8.5	9.6	4.4	124.4	44.4	13,005,728
Runoff Directly Tributary to Future Freshwater Marsh	4,499	3	20	0	0.2	0.1	0.1	0.0	0.5	0.3	323,623
Total Influent to Future Freshwater Marsh	71,883	241	1,459	1,671	15.9	8.6	9.7	4.4	124.9	44.7	13,329,351
Runoff Tributary to the Jefferson Storm Drain (currently tributary to Ballona Wetlands; included here for comparison purposes)	59,399	117	794	706	9.6	4.5	4.1	1.9	79.3	47.2	7,500,115

[a] Totals calculated prior to rounding.

lbs = pounds
TKN = Total Kjedahl Nitrogen
TPb = Total Lead
ft^3/yr = cubic feet per year
O&G = Oil and Grease
DPb = Dissolved Lead
TSS = Total Suspended Solids
TCu = Total Copper
TZn = Total Zinc
TP = Total Phosphorus
DCu = Dissolved Copper
DZn = Dissolved Zinc

Source: GeoSyntec Consultants

Table 3-34b
Representative Stormwater Concentrations to the Freshwater Wetlands System Prior to the First Phase Project

	Summary Concentrations									
	(mg/L)				(µg/L)					
	TSS	TP	TKN	O&G	TCu	DCu	TPb	DPb	TZn	DZn
Runoff Tributary to the Upper Centinela Ditch (Upstream of West Boundary of Proposed Project)	83.9	0.3	2.4	2.3	24.9	11.6	13.9	6.3	169.5	100.9
Percent Removed in Upper Riparian Centinela Ditch	*0%*	*0%*	*28%*	*0%*	*18%*	*0%*	*0%*	*0%*	*0%*	*48%*
Centinela Ditch at Proposed Project Boundary	**83.9**	**0.3**	**1.8**	**2.3**	**20.3**	**11.6**	**13.9**	**6.3**	**169.5**	**52.5**
Runoff Tributary to the Lower Centinela Ditch (Downstream of West Boundary of Proposed Project)	124.2	0.2	1.9	1.5	18.8	8.7	9.1	4.2	115.6	53.8
Percent Removed in Lower Centinela Ditch	*10%*	*0%*	*6%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*2%*
Centinela Ditch at Lincoln	**89.2**	**0.3**	**1.8**	**2.1**	**20.0**	**11.0**	**12.9**	**5.9**	**159.2**	**52.5**
Lincoln Storm Drain - South	42.8	0.3	1.8	1.6	15.1	7.0	4.7	2.1	115.0	68.4
Centinela Ditch and Lincoln	**83.0**	**0.3**	**1.8**	**2.1**	**19.4**	**10.5**	**11.8**	**5.4**	**153.3**	**54.7**
Runoff Directly Tributary to Future Freshwater Marsh	222.7	0.1	1.0	0.0	8.9	4.1	3.2	1.5	22.3	13.3
Total Influent to Future Freshwater Marsh	**86.4**	**0.3**	**1.8**	**2.0**	**19.1**	**10.3**	**11.6**	**5.3**	**150.1**	**53.7**
Runoff Tributary to the Jefferson Storm Drain (currently tributary to Ballona Wetlands; included here for comparison purposes)	126.9	0.2	1.7	1.5	20.6	9.6	8.7	4.0	169.3	100.8

mg/L = milligrams per liter *µg/L = micrograms per liter* *ft^3/yr = cubic feet per year*
TSS = Total Suspended Solids *TP = Total Phosphorus*
TKN = Total Kjedahl Nitrogen *O&G = Oil and Grease* *TCu = Total Copper* *DCu = Dissolved Copper*
TPb = Total Lead *DPb = Dissolved Lead* *TZn = Total Zinc* *DZn = Dissolved Zinc*

Source: GeoSyntec Consultants

Table 3-35a
Representative Stormwater Loads to the Freshwater Wetlands System with Playa Vista First Phase Project

	Predicted Average Annual Loads[a] (lbs/year)										Runoff Volume (ft^3/yr)
	TSS	TP	TKN	O&G	TCu	DCu	TPb	DPb	TZn	DZn	
Runoff Tributary to the Upper Riparian Corridor (Upstream of West Boundary of Proposed Project)	43,144	171	1,326	1,252	13.6	6.3	7.5	3.4	92.9	55.2	8,611,192
Mass Removed Through Riparian Corridor WQ Inlets (25% of First Phase Project Area)	*-849*	*-2*	*0*	*-25*	*-0.1*	*-0.1*	*-0.1*	*-0.1*	*-0.9*	*-0.5*	
Mass Removed in Upper Riparian Corridor	*-28,923*	*-20*	*-526*	*-528*	*-7.3*	*-0.9*	*-2.3*	*-1.0*	*-16.4*	*-35.8*	
Riparian Corridor at Proposed Project Boundary	13,372	150	800	699	6.1	5.3	5.1	2.4	75.6	18.9	8,611,192
Runoff Tributary to the Lower Riparian Corridor (Downstream of West Boundary of Proposed Project)	11,055	52	399	351	3.6	1.7	1.8	0.8	26.0	15.5	3,144,959
Mass Removed Through Riparian Corridor WQ Inlets (25% of First Phase Project Area)	*-541*	*-1*	*0.0*	*-9*	*0.0*	*0.0*	*0.0*	*0.0*	*-0.3*	*-0.2*	
Mass Removed in Lower Riparian Corridor	*-5,631*	*0*	*-107*	*-87*	*-1.3*	*0.0*	*0.0*	*0.0*	*0.0*	*-8.4*	
Riparian Corridor at Lincoln	18,256	200	1,092	954	8.4	7.0	6.9	3.2	101.2	25.9	11,756,152
Lincoln Storm Drain - South	4,709	28.3	201.4	183.6	1.7	0.8	0.5	0.23	12.9	7.7	1,777,700
Mass Removed by Caltrans CDS Unit on Lincoln	*0.00*	*0.00*	*-6.9*	*0.00*	*-0.4*	*-0.2*	*-0.06*	*-0.03*	*-2.45*	*-1.5*	
Influent to Riparian Corridor and Lincoln Primary Management Area	22,965	229	1,287	1,138	9.7	7.6	7.3	3.4	111.8	32.1	13,533,852
Mass Removed in Riparian Corridor and Lincoln Primary Management Area	*-9,324*	*-59*	*-331*	*-244*	*-3.0*	*-1.9*	*-1.8*	*-0.6*	*-48.1*	*-14.2*	
Effluent from Riparian Corridor and Lincoln Primary Management Area	13,641	170	956	894	6.7	5.7	5.6	2.8	63.6	17.8	13,533,852
Runoff Tributary to the Central Storm Drain	18,162	70	520	475	5.0	2.3	2.2	1.0	34.6	20.6	4,018,581
Mass Removed by Off-site Vegetated Swale on Lincoln Blvd	*-212*	*0*	*0*	*-7*	*-0.4*	*-0.2*	*0.0*	*0.0*	*-2.3*	*-1.4*	
Mass Removed Through Central Drain WQ Inlets (25% of First Phase Project Area)	*-1,311*	*-2*	*0*	*-21*	*-0.1*	*-0.1*	*-0.1*	*0.0*	*-0.8*	*0*	
Influent to Central Storm Drain Primary Management Area	16,639	68	520	447	4.5	2.1	2.2	1.0	31.6	18.8	
Mass Removed in Central Drain Primary Management Area	*-6,756*	*-17*	*-134*	*-96*	*-1.4*	*-0.5*	*-0.5*	*-0.2*	*-13.6*	*-8.3*	
Effluent from Central Storm Drain Primary Management Area	9,883	51	386	351	3.1	1.6	1.6	0.8	18.0	10.4	4,018,581

Table 3-35a
Representative Stormwater Loads to the Freshwater Wetlands System with Playa Vista First Phase Project

	Predicted Average Annual Loads[a] (lbs/year)										Runoff Volume (ft^3/yr)
	TSS	TP	TKN	O&G	TCu	DCu	TPb	DPb	TZn	DZn	
Runoff Tributary to the Jefferson Storm Drain	38,361	127	863	888	10.5	4.9	4.5	2.1	89.6	53.3	6,987,025
Mass Removed Through Jefferson Drain WQ Inlets (25% of First Phase Project Area)	*-299*	*-1*	*0*	*-8*	*0.0*	*0.0*	*0.0*	*0.0*	*-0.3*	*0*	
Influent to Jefferson Storm Drain Primary Management Area	38,062	127	863	880	10.4	4.8	4.5	2.0	89.4	53.2	
Mass Removed in Jefferson Drain Primary Management Area	*-15,454*	*-32*	*-222*	*-189*	*-3.2*	*-1.2*	*-1.1*	*-0.4*	*-38.5*	*-23.6*	
Effluent from Jefferson Storm Drain Primary Management Area	22,608	94	641	691	7.2	3.6	3.4	1.7	50.9	29.5	6,987,025
Totals from Primary Management Areas to Main Body of Freshwater Marsh	48,133	315	1,982	1,937	16.9	10.9	10.6	5.3	132.4	57.8	24,539,458
Runoff directly tributary to the Freshwater Marsh	3,107	2	14	2	0.1	0.1	0.0	0.0	0.4	0.2	560,173
Mass Removed in Main Body of Freshwater Marsh	*-31,533*	*-108*	*-687*	*-528*	*-7.6*	*-3.6*	*-3.4*	*-1.1*	*-100.1*	*-46.2*	
Effluent from Freshwater Marsh	17,707	209	1,309	1,410	9.4	7.3	7.2	4.2	32.7	11.8	25,099,631

[a] Totals calculated prior to rounding.

WQ = Water Quality

lbs = pounds — *ft^3/yr = cubic feet per year* — *TSS = Total Suspended Solids* — *TP = Total Phosphorus*
TKN = Total Kjedahl Nitrogen — *O&G = Oil and Grease* — *TCu = Total Copper* — *DCu = Dissolved Copper*
TPb = Total Lead — *DPb = Dissolved Lead* — *TZn = Total Zinc* — *DZn = Dissolved Zinc*

Source: GeoSyntec Consultants

Table 3-35b
Representative Stormwater Concentrations to the Freshwater Wetlands System with Playa Vista First Phase and Proposed Project

	Summary Concentrations									
	(mg/L)				(μg/L)					
	TSS	TP	TKN	O&G	TCu	DCu	TPb	DPb	TZn	DZn
Runoff Tributary to the Upper Riparian Corridor After On-Site Treatment (Upstream of West Boundary of Proposed Project)	78.7	0.31	2.5	2.3	25.0	11.6	13.8	6.3	171.0	101.8
Percent Removed in Upper Riparian Corridor	*68%*	*12%*	*40%*	*43%*	*54%*	*14%*	*31%*	*30%*	*18%*	*65%*
Riparian Corridor at Proposed Project Boundary	24.9	0.3	1.5	1.3	11.4	9.9	9.6	4.4	140.6	35.2
Runoff Tributary to the Lower Riparian Corridor After On-site Treatment (Downstream of West Boundary of Proposed Project)	53.6	0.26	2.0	1.7	18.0	8.3	9.0	4.1	130.7	77.8
Percent Removed in Lower Riparian Corridor	*54%*	*0%*	*27%*	*25%*	*37%*	*0%*	*0%*	*0%*	*0%*	*55%*
Riparian Corridor at Lincoln	24.9	0.3	1.5	1.3	11.4	9.5	9.4	4.3	137.9	35.2
Lincoln Storm Drain – South After Treatment in Caltrans' CDS Unit	42.4	0.26	1.8	1.7	11.6	5.4	4.0	1.8	93.8	55.8
Influent to Riparian Corridor and Lincoln Primary Management Area	27.2	0.27	1.5	1.3	11.4	9.0	8.7	4.0	132.1	37.9
Percent Removed in Riparian Corridor and Lincoln Primary Management Area	*41%*	*26%*	*26%*	*21%*	*31%*	*25%*	*24%*	*17%*	*43%*	*44%*
Within Riparian Corridor and Lincoln Primary Management Area (assuming 3:1 influent and effluent mixing ratio)	24.4	0.25	1.4	1.3	10.5	8.4	8.2	3.8	117.9	33.7
Effluent from Riparian Corridor and Lincoln Primary Management Area	16.1	0.20	1.1	1.1	7.9	6.7	6.6	3.3	75.3	21.1
Influent to Central Storm Drain Primary Management Area After On-Site Treatment	66.3	0.27	2.1	1.8	17.9	8.3	8.6	3.9	125.9	74.9
Percent Removed in Central Drain Primary Management Area	*41%*	*26%*	*26%*	*21%*	*31%*	*25%*	*24%*	*17%*	*43%*	*44%*
Within Central Storm Drain Primary Management Area (assuming 3:1 influent to effluent mixing ratio)	59.6	0.25	1.9	1.7	16.5	7.8	8.1	3.8	112.3	66.6
Effluent from Central Storm Drain Primary Management Area	39.4	0.20	1.5	1.4	12.3	6.2	6.5	3.2	71.7	41.6

Table 3-35b
Representative Stormwater Concentrations to the Freshwater Wetlands System with Playa Vista First Phase and Proposed Project

	Summary Concentrations									
	(mg/L)				(µg/L)					
	TSS	TP	TKN	O&G	TCu	DCu	TPb	DPb	TZn	DZn
Influent to Jefferson Storm Drain Primary Management Area After On-Site Treatment	**87.3**	**0.29**	**2.0**	**2.0**	**23.9**	**11.1**	**10.3**	**4.7**	**204.9**	**121.9**
Percent Removed in Jefferson Drain Primary Management Area	*41%*	*26%*	*26%*	*21%*	*31%*	*25%*	*24%*	*17%*	*43%*	*44%*
Within Jefferson Storm Drain Primary Management Area (assuming 3:1 influent to effluent mixing ratio)	**78.4**	**0.27**	**1.9**	**1.9**	**22.0**	**10.4**	**9.6**	**4.5**	**182.8**	**108.4**
Effluent from Jefferson Storm Drain Primary Management Area	**51.8**	**0.22**	**1.5**	**1.6**	**16.5**	**8.3**	**7.7**	**3.9**	**116.7**	**67.7**
Totals from Primary Management Areas to Main Body of Freshwater Marsh	30.1	0.2	1.3	1.3	11.1	7.1	6.9	3.5	86.5	37.7
Runoff directly tributary to the Freshwater Marsh	88.9	0.05	0.4	0.1	4.1	1.9	1.3	0.6	11.9	7.1
Percent Removed in Main Body of Freshwater Marsh	*64%*	*34%*	*34%*	*27%*	*45%*	*33%*	*32%*	*21%*	*75%*	*80%*
Effluent from Freshwater Marsh	**11.3**	**0.13**	**0.8**	**0.9**	**6.0**	**4.7**	**4.6**	**2.7**	**20.9**	**7.5**

mg/L = milligrams per liter *µg/L = micrograms per liter* *ft^3/yr = cubic feet per year*
TSS = Total Suspended Solids *TP = Total Phosphorus*
TKN = Total Kjedahl Nitrogen *O&G = Oil and Grease* *TCu = Total Copper* *DCu = Dissolved Copper*
TPb = Total Lead *DPb = Dissolved Lead* *TZn = Total Zinc* *DZn = Dissolved Zinc*

Source: GeoSyntec Consultants

Table 3-36a
Representative Stormwater Loads to the Freshwater Wetlands System with Playa Vista First Phase and Proposed Project

	Predicted Average Annual Loads[a] (lbs/year)										Runoff Volume (ft^3/yr)
	TSS	TP	TKN	O&G	TCu	DCu	TPb	DPb	TZn	DZn	
Runoff Tributary to the Upper Riparian Corridor (Upstream of West Boundary of Proposed Project)	37,463	168	1,304	1,228	13.0	6.0	7.1	3.2	90.7	54.0	8,595,931
Mass Removed Through Riparian Corridor WQ Inlets (25% of First Phase and 25% Proposed Project Areas)	-1,113	-2	0	-29	-0.1	-0.1	-0.1	-0.1	-1.0	-0.6	
Mass Removed by Biofiltration Swale	-859	0.0	-13.5	0.0	-0.27	-0.13	-0.01	-0.01	-3.8	-2.3	
Mass Removed in Upper Riparian Corridor	-22,142	-17	-492	-502	-6.4	-0.5	-1.8	-0.8	-10.4	-32.2	
Riparian Corridor at Proposed Project Boundary	13,349	149	799	698	6.1	5.3	5.1	2.4	75.4	18.9	
Runoff Tributary to the Lower Riparian Corridor (Downstream of West Boundary of Proposed Project)	11,055	52	399	351	3.6	1.7	1.8	0.8	26.0	15.5	3,144,959
Mass Removed Through Riparian Corridor WQ Inlets (25% of First Phase and 25% of Proposed Project Areas)	-541	-1	0.0	-9	0.0	0.0	0.0	0.0	-0.3	-0.2	
Mass Removed in Lower Riparian Corridor	-5,631	0	-107	-87	-1.3	0.0	0.0	0.0	0.0	-8.4	
Riparian Corridor at Lincoln	18,232	200	1,091	953	8.4	7.0	6.9	3.2	101.1	25.8	11,740,891
Lincoln Storm Drain - South	4,709	28.3	201.4	183.6	1.7	0.8	0.5	0.23	12.9	7.7	1,777,700
Mass Removed by Caltrans CDS Unit on Lincoln	0.0	0.0	-6.9	0.0	-0.4	-0.2	-0.06	-0.03	-2.5	-1.5	
Influent to RC and Lincoln Primary Management Area	22,941	229	1,292	1,136	10.1	7.8	7.4	3.4	114.0	33.5	
Mass Removed in Riparian Corridor and Lincoln Primary Management Area	-9,093	-58	-337	-242	-3.1	-1.9	-1.8	-0.6	-48.9	-14.9	
Effluent from Riparian Corridor and Lincoln Primary Management Area	13,848	170	955	894	7.0	5.9	5.6	2.8	65.1	18.6	13,518,591
Runoff Tributary to the Central Storm Drain	19,175	101	759	679	6.7	3.1	2.9	1.3	49.2	29.3	5,797,724
Mass Removed by Roof-Drain Planter Boxes	-1,021	0.0	-13.9	0.0	-0.3	-0.13	-0.01	-0.01	-4.5	-2.7	
Mass Removed by Off-site Vegetated Swale on Lincoln Blvd	-212	0.0	0.0	-7.2	-0.4	-0.20	0.00	0.00	-2.3	-1.4	
Mass Removed Through Central Drain WQ Inlets (25% of First Phase and 100% of Proposed Project Areas)	-2,497	-5	0.0	-62	-0.3	-0.1	-0.2	-0.1	-1.8	-1.1	
Influent to Central Storm Drain Primary Management Area	15,444	96	745	610	5.7	2.7	2.7	1.2	40.6	24.1	
Mass Removed in Central Drain Primary Management Area	-6,122	-24	-194	-130	-1.8	-0.7	-0.6	-0.2	-17.4	-10.7	
Effluent from Central Storm Drain Pretreatment Area	9,323	72	551	480	3.9	2.0	2.0	1.0	23.2	13.4	5,797,724

Table 3-36a
Representative Stormwater Loads to the Freshwater Wetlands System with Playa Vista First Phase and Proposed Project

	Predicted Average Annual Loads[a] (lbs/year)										Runoff Volume (ft^3/yr)
	TSS	TP	TKN	O&G	TCu	DCu	TPb	DPb	TZn	DZn	
Runoff Tributary to the Jefferson Storm Drain	**38,361**	**127**	**862**	**888**	**10.5**	**4.9**	**4.5**	**2.1**	**89.6**	**53.3**	**6,987,025**
Mass Removed Through Jefferson Drain WQ Inlets (25% of First Phase and 25% of Proposed Project Areas)	*-303*	*-1*	*0*	*-8*	*0.0*	*0.0*	*0.0*	*0.0*	*-0.3*	*0*	
Influent to Jefferson Storm Drain Primary Management Area	**38,058**	**127**	**863**	**880**	**10.4**	**4.8**	**4.5**	**2.0**	**89.4**	**53.2**	
Mass Removed in Jefferson Drain Primary Management Area	*-15,085*	*-32*	*-225*	*-187*	*-3.2*	*-1.2*	*-1.1*	*-0.3*	*-38.3*	*-23.6*	
Effluent from Jefferson Storm Drain Primary Management Area	**22,973**	**94**	**638**	**693**	**7.2**	**3.7**	**3.4**	**1.7**	**51.0**	**29.6**	**6,987,025**
Totals from Primary Management Areas to Main Body of Freshwater Marsh	46,144	336	2,144	2,067	18.1	11.5	11.1	5.6	139.3	61.6	**26,303,340**
Runoff directly tributary to the Freshwater Marsh	3,107	2	14	2	0.1	0.1	0.0	0.0	0.4	0.2	560,173
Mass Removed in Main Body of Freshwater Marsh	*-30,300*	*-115*	*-756*	*-559*	*-8.1*	*-3.76*	*-3.5*	*-1.1*	*-104.6*	*-49.2*	
Effluent from Freshwater Marsh	**18,951**	**223**	**1,401**	**1,509**	**10.1**	**7.8**	**7.7**	**4.5**	**35.0**	**12.6**	**26,863,513**

[a] Totals calculated prior to rounding.

WQ = Water Quality
lbs = pounds
ft^3/yr = cubic feet per year
TSS = Total Suspended Solids
TP = Total Phosphorus
TKN = Total Kjedahl Nitrogen
O&G = Oil and Grease
TCu = Total Copper
DCu = Dissolved Copper
TPb = Total Lead
DPb = Dissolved Lead
TZn = Total Zinc
DZn = Dissolved Zinc

Source: GeoSyntec Consultants

Table 3-36b
Representative Stormwater Concentrations to the Freshwater Wetlands System with Playa Vista First Phase and Proposed Project

	Summary Concentrations									
	(mg/L)				(µg/L)					
	TSS	**TP**	**TKN**	**O&G**	**TCu**	**DCu**	**TPb**	**DPb**	**TZn**	**DZn**
Runoff Tributary to the Upper Riparian Corridor After On-Site Treatment (Upstream of West Boundary of Proposed Project)	66.1	0.31	2.4	2.2	23.4	10.9	12.9	5.9	160.0	95.2
Percent Removed in Upper Riparian Corridor	*62%*	*10%*	*38%*	*42%*	*51%*	*9%*	*26%*	*26%*	*12%*	*63%*
Riparian Corridor at Proposed Project Boundary	**24.9**	**0.3**	**1.5**	**1.3**	**11.4**	**9.9**	**9.6**	**4.4**	**140.6**	**35.2**
Runoff Tributary to the Lower Riparian Corridor After On-site Treatment (Downstream of West Boundary of Proposed Project)	53.6	0.26	2.0	1.7	18.0	8.3	9.0	4.1	130.7	77.8
Percent Removed in Lower Riparian Corridor	*54%*	*0%*	*27%*	*25%*	*37%*	*0%*	*0%*	*0%*	*0%*	*55%*
Riparian Corridor at Lincoln	**24.9**	**0.3**	**1.5**	**1.3**	**11.4**	**9.5**	**9.4**	**4.3**	**137.9**	**35.2**
Lincoln Storm Drain - South	42.4	0.26	1.8	1.7	15.5	7.2	4.6	2.1	115.9	69.0
Influent to Riparian Corridor and Lincoln Primary Management Area	**27.2**	**0.27**	1.5	1.3	**11.9**	**9.2**	**8.8**	**4.0**	**135.0**	**39.7**
Percent Removed in Riparian Corridor and Lincoln Primary Management Area	*40%*	*25%*	*26%*	*21%*	*31%*	*25%*	*24%*	*16%*	*43%*	*44%*
Within Riparian Corridor and Lincoln Primary Management Area (assuming 3:1 influent and effluent mixing ratio)	24.5	0.25	1.4	1.3	11.0	8.6	8.2	3.9	120.6	35.3
Effluent from Riparian Corridor and Lincoln Primary Management Area	**16.4**	**0.20**	**1.1**	1.1	**8.2**	**6.9**	**6.7**	**3.4**	**77.1**	**22.1**
Influent to Central Storm Drain Primary Management Area After On-Site Treatment	**42.7**	**0.27**	**2.1**	**1.7**	**15.8**	**7.3**	**7.4**	**3.4**	**112.1**	**66.7**
Percent Removed in Central Drain Primary Management Area	*40%*	*25%*	*26%*	*21%*	*31%*	*25%*	*24%*	*16%*	*43%*	*44%*
Within Central Storm Drain Primary Management Area (assuming 3:1 influent to effluent mixing ratio)	38.4	0.25	1.9	1.6	14.5	6.9	7.0	3.2	100.1	59.3
Effluent from Central Storm Drain Primary Management Area	**25.8**	**0.20**	**1.5**	**1.3**	**10.9**	**5.5**	**5.7**	**2.8**	**64.0**	**37.1**

Table 3-36b
Representative Stormwater Concentrations to the Freshwater Wetlands System with Playa Vista First Phase and Proposed Project

	Summary Concentrations									
	(mg/L)				(μg/L)					
	TSS	TP	TKN	O&G	TCu	DCu	TPb	DPb	TZn	DZn
Influent to Jefferson Storm Drain Primary Management Area After On-Site Treatment	**87.3**	**0.29**	**2.0**	**2.0**	**23.9**	**11.1**	**10.3**	**4.7**	**204.9**	**121.9**
Percent Removed in Jefferson Drain Primary Management Area	*40%*	*25%*	*26%*	*21%*	*31%*	*25%*	*24%*	*16%*	*43%*	*44%*
Within Jefferson Storm Drain Primary Management Area (assuming 3:1 influent to effluent mixing ratio)	78.6	0.27	1.8	1.9	22.0	10.4	9.6	4.5	182.9	108.4
Effluent from Jefferson Storm Drain Primary Management Area	**52.7**	**0.22**	**1.5**	**1.6**	**16.5**	**8.4**	**7.8**	**3.9**	**117.0**	**67.8**
Totals from Primary Management Areas to Main Body of Freshwater Marsh	28.1	0.2	1.3	1.3	11.0	7.0	6.8	3.4	84.8	37.5
Runoff directly tributary to the Freshwater Marsh	88.9	0.05	0.4	0.1	4.1	1.9	1.3	0.6	11.9	7.1
Percent Removed in Main Body of Freshwater Marsh	*62%*	*34%*	*35%*	*27%*	*45%*	*32%*	*31%*	*20%*	*75%*	*80%*
Effluent from Freshwater Marsh	**11.3**	**0.13**	**0.8**	**0.9**	**6.02**	**4.66**	**4.59**	**2.68**	**20.89**	**7.53**

mg/L = milligrams per liter *μg/L = micrograms per liter* *ft^3/yr = cubic feet per year*
TSS = Total Suspended Solids *TP = Total Phosphorus*
TKN = Total Kjedahl Nitrogen *O&G = Oil and Grease* *TCu = Total Copper* *DCu = Dissolved Copper*
TPb = Total Lead *DPb = Dissolved Lead* *TZn = Total Zinc* *DZn = Dissolved Zinc*

Source: GeoSyntec Consultants

Table 3-37
Representative Stormwater Loads and Concentrations in the Riparian Corridor/Centinela Ditch at West Boundary of Proposed Project

	Predicted Average Loads*										Volume
	(lbs/yr)				(lbs/yr)						(10^3 ft^3/year)
	TSS	TP	TKN	O&G	TCu	DCu	TPb	DPb	TZn	DZn	
Pre-First Phase **	47,639	178	1,000	1,293	11.5	6.6	7.9	3.6	96.3	29.8	9,095
With Playa Vista First Phase Project	13,372	150	800	699	6.1	5.3	5.1	2.4	75.6	18.9	8,611
With Proposed Project***	13,349	149	799	698	6.1	5.3	5.1	2.4	75.4	18.9	8,596

	Predicted Average Concentrations*										Volume
	(mg/L)				(µg/L)						(10^3 ft^3/year)
	TSS	TP	TKN	O&G	TCu	DCu	TPb	DPb	TZn	DZn	
Pre-First Phase **	83.9	0.3	1.8	2.3	20.3	11.6	13.9	6.3	169.5	52.5	9,095
With Playa Vista First Phase Project	24.9	0.3	1.5	1.3	11.4	9.9	9.6	4.4	140.6	35.2	8,611
With Proposed Project***	24.9	0.3	1.5	1.3	11.4	9.9	9.6	4.4	140.6	35.2	8,596

lbs/yr = pounds per year — *10^3 ft^3/yr = one thousand cubic feet per year* — *mg/L = milligrams per liter* — *µg/L = micrograms per liter*
TSS = Total Suspended Solids — *TP = Total Phosphorus* — *TKN = Total Kjeldahl Nitrogen* — *O&G = Oil and Grease*
TCu = Total Copper — *DCu = Dissolved Copper* — *TPb = Total Lead* — *DPb = Dissolved Lead*
TZn = Total Zinc — *DZn = Dissolved Zinc*

* *Subtotals and totals were calculated prior to rounding*
** *Total pollutant loads for pre-First Phase conditions are included in table, to provide a basis for comparison of project impacts.*
****Which also includes the adjacent Playa Vista First Phase Project (i.e., Playa Vista Project Buildout).*

Source: Camp Dresser and McKee Inc. and GeoSyntec Consultants

Table 3-38
Representative Stormwater Loads and Concentrations in the Riparian Corridor/Centinela Ditch at Lincoln Boulevard

	Predicted Average Loads*										Volume
	(lbs/yr)				(lbs/yr)						(10^3 ft^3/year)
	TSS	TP	TKN	O&G	TCu	DCu	TPb	DPb	TZn	DZn	
Pre-First Phase **	62,718	211	1,239	1,494	14.1	7.8	9.1	4.2	111.9	36.9	11,261
With Playa Vista First Phase Project	18,256	200	1,092	954	8.4	7.0	6.9	3.2	101.2	25.9	11,756
With Proposed Project***	18,232	200	1,091	953	8.4	7.0	6.9	3.2	101.1	25.8	11,741

	Predicted Average Concentrations*										Volume
	(mg/L)				(µg/L)						(10^3 ft^3/year)
	TSS	TP	TKN	O&G	TCu	DCu	TPb	DPb	TZn	DZn	
Pre-First Phase **	89.2	0.3	1.8	2.1	20.0	11.0	12.9	5.9	159.2	52.5	11,261
With Playa Vista First Phase Project	24.9	0.3	1.5	1.3	11.4	9.5	9.4	4.3	137.9	35.2	11,756
With Proposed Project***	24.9	0.3	1.5	1.3	11.4	9.5	9.4	4.3	137.9	35.2	11,741

lbs/yr = pounds per year
TSS = Total Suspended Solids
TCu = Total Copper
TZn = Total Zinc
10^3 ft^3/yr = one thousand cubic feet per year
TP = Total Phosphorus
DCu = Dissolved Copper
DZn = Dissolved Zinc
mg/L = milligrams per liter
TKN = Total Kjeldahl Nitrogen
TPb = Total Lead
µg/L = micrograms per liter
O&G = Oil and Grease
DPb = Dissolved Lead

* *Subtotals and totals were calculated prior to rounding*
** *Total pollutant loads for pre-First Phase conditions are included in table to provide a basis for comparison of project impacts.*
*** *Which also includes the adjacent Playa Vista First Phase Project (i.e., Playa Vista Project Buildout).*

Source: Camp Dresser and McKee Inc. and GeoSyntec Consultants.

Table 3-39
Representative Stormwater Loads and Concentrations to the Riparian Corridor/Lincoln Storm Drain South Primary Management Area

	Predicted Average Loads*										Volume
	(lbs/yr)				(lbs/yr)						(10^3 ft^3/year)
	TSS	TP	TKN	O&G	TCu	DCu	TPb	DPb	TZn	DZn	
Pre-First Phase (sum of Centinela Ditch and Lincoln Drain)**	67,384	239	1,439	1,671	15.7	8.5	9.6	4.4	124.4	44.4	13,006
With Playa Vista First Phase Project	22,965	229	1,294	1,138	10.1	7.8	7.4	3.4	114.1	33.5	13,534
With Proposed Project***	22,941	229	1,292	1,136	10.1	7.8	7.4	3.4	114.0	33.5	13,519

	Predicted Average Concentrations*										Volume
	(mg/L)				(µg/L)						(10^3 ft^3/year)
	TSS	TP	TKN	O&G	TCu	DCu	TPb	DPb	TZn	DZn	
Pre-First Phase (sum of Centinela Ditch and Lincoln Drain)**	83.0	0.29	1.77	2.06	19.4	10.5	11.8	5.4	153.3	54.7	13,006
With Playa Vista First Phase Project	27.2	0.27	1.53	1.35	11.9	9.2	8.8	4.0	135.0	39.7	13,534
With Proposed Project***	27.2	0.27	1.53	1.35	11.9	9.2	8.8	4.0	135.0	39.7	13,519

lbs/yr = pounds per year | *10^3 ft^3/yr = one thousand cubic feet per year* | *mg/L = milligrams per liter* | *µg/L = micrograms per liter*
TSS = Total Suspended Solids | *TP = Total Phosphorus* | *TKN = Total Kjeldahl Nitrogen* | *O&G = Oil and Grease*
TCu = Total Copper | *DCu = Dissolved Copper* | *TPb = Total Lead* | *DPb = Dissolved Lead*
TZn = Total Zinc | *DZn = Dissolved Zinc*

* *Subtotals and totals were calculated prior to rounding*
** *Total pollutant loads for pre-First Phase conditions are included in table, to provide a basis for comparison of project impacts.*
*** *Which also includes the adjacent Playa Vista First Phase Project (i.e., Playa Vista Project Buildout).*

Source: Camp Dresser and McKee Inc. and GeoSyntec Consultants

Table 3-40
Representative Stormwater Loads and Concentrations to the Central Storm Drain Primary Management Area

	Predicted Average Loads* (lbs/yr)				Predicted Average Loads* (lbs/yr)						Volume (10^3 ft^3/year)
	TSS	TP	TKN	O&G	TCu	DCu	TPb	DPb	TZn	DZn	
Pre-First Phase (Central Drain nonexistent)**	0	0	0	0	0	0	0	0	0	0	0
With Playa Vista First Phase Project	16,639	68	520	447	4.5	2.1	2.2	1.0	31.6	18.8	4,019
With Proposed Project***	15,444	96	745	610	5.7	2.7	2.7	1.2	40.6	24.1	5,798

	Predicted Average Concentrations* (mg/L)				Predicted Average Concentrations* (µg/L)						Volume (10^3 ft^3/year)
	TSS	TP	TKN	O&G	TCu	DCu	TPb	DPb	TZn	DZn	
Pre-First Phase (Central Drain nonexistent)**	0.0	0.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
With Playa Vista First Phase Project	66.3	0.27	2.07	1.78	17.9	8.3	8.6	3.9	125.9	74.9	4,019
With Proposed Project***	42.7	0.27	2.06	1.68	15.8	7.3	7.4	3.4	112.1	66.7	5,798

lbs/yr – pounds per year
TSS = Total Suspended Solids
TCu – Total Copper
TZn = Total Zinc
10^3 ft^3/yr =one thousand cubic feet per year
TP – Total Phosphorus
DCu = Dissolved Copper
DZn = Dissolved Zinc
mg/L – milligrams per liter
TKN = Total Kjeldahl Nitrogen
TPb – Total Lead
µg/L = micrograms per liter
O&G = Oil and Grease
DPb = Dissolved Lead

* *Subtotals and totals were calculated prior to rounding*
** *Total pollutant loads for pre-First Phase conditions are included in table, to provide a basis for comparison of project impacts. Breakdown of existing pollutant loading for each area is provided in Section 3 of the Water Resources Technical Report.*
*** *Which also includes the adjacent Playa Vista First Phase Project (i.e., Playa Vista Project Buildout).*

Source: Camp Dresser and McKee Inc. and GeoSyntec Consultants

Table 3-41
Representative Stormwater Loads and Concentrations to the Jefferson Storm Drain Primary Management Area

	Predicted Average Loads*										Volume
	(lbs/yr)				(lbs/yr)						(10³ ft³/year)
	TSS	TP	TKN	O&G	TCu	DCu	TPb	DPb	TZn	DZn	
Pre-First Phase **	59,399	117	794	706	9.6	4.5	4.1	1.9	79.3	47.2	7,500
With Playa Vista First Phase Project	38,062	127	863	880	10.4	4.8	4.5	2.0	89.4	53.2	6,987
With Proposed Project***	38,058	127	862	880	10.4	4.8	4.5	2.0	89.4	53.2	6,987

	Predicted Average Concentrations*										Volume
	(mg/L)				(µg/L)						(10³ ft³/year)
	TSS	TP	TKN	O&G	TCu	DCu	TPb	DPb	TZn	DZn	
Pre-First Phase **	126.9	0.25	1.70	1.51	20.6	9.6	8.7	4.0	169.3	100.8	7,500
With Playa Vista First Phase Project	87.3	0.29	1.98	2.02	23.9	11.1	10.3	4.7	204.9	121.9	6,987
With Proposed Project***	87.3	0.29	1.98	2.02	23.9	11.1	10.3	4.7	204.9	121.9	6,987

lbs/yr = pounds per year *10³ ft³/yr = one thousand cubic feet per year* *mg/L = milligrams per liter* *µg/L = micrograms per liter*
TSS = Total Suspended Solids *TP = Total Phosphorus* *TKN = Total Kjeldahl Nitrogen* *O&G = Oil and Grease*
TCu = Total Copper *DCu = Dissolved Copper* *TPb = Total Lead* *DPb = Dissolved Lead*
TZn = Total Zinc *DZn = Dissolved Zinc*
* *Subtotals and totals were calculated prior to rounding*
** *Total pollutant loads for pre-First Phase conditions are included in table, to provide a basis for comparison of project impacts*
*** *Which also includes the adjacent Playa Vista First Phase Project (i.e., Playa Vista Project Buildout).*

Source. Camp Dresser and McKee Inc. and GeoSyntec Consultants

Table 3-42
Representative Stormwater Loads and Concentrations to the Main Body of the Freshwater Marsh Near the Primary Management Areas

	Predicted Average Loads*										Volume
	(lbs/yr)				(lbs/yr)						(10^3 ft^3/year)
	TSS	TP	TKN	O&G	TCu	DCu	TPb	DPb	TZn	DZn	
Pre-First Phase (sum of future contributing drainages)**	131,283	358	2,253	2,377	25.5	13.1	13.7	6.3	204.2	91.8	20,829
With Playa Vista First Phase Project	49,240	317	1,996	1,939	17.1	10.9	10.6	5.3	132.9	58.0	25,100
With Proposed Project***	49,251	338	2,158	2,069	18.2	11.6	11.1	5.6	139.7	61.8	26,863

	Predicted Average Concentrations*										Volume
	(mg/L)				(µg/L)						(10^3 ft^3/year)
	TSS	TP	TKN	O&G	TCu	DCu	TPb	DPb	TZn	DZn	
Pre-First Phase (sum of future contributing drainages)**	101.0	0.28	1.73	1.83	19.6	10.1	10.6	4.8	157.0	70.6	20,829
With Playa Vista First Phase Project	31.4	0.20	1.27	1.24	10.9	7.0	6.8	3.4	84.8	37.0	25,100
With Proposed Project***	29.4	0.20	1.29	1.23	10.9	6.9	6.6	3.3	83.3	36.9	26,863

lbs/yr = pounds per year
TSS = Total Suspended Solids
TCu = Total Copper
TZn = Total Zinc
10^3 ft^3/yr = one thousand cubic feet per year
TP = Total Phosphorus
DCu = Dissolved Copper
DZn = Dissolved Zinc
mg/L = milligrams per liter
TKN = Total Kjeldahl Nitrogen
TPb = Total Lead
µg/L = micrograms per liter
O&G = Oil and Grease
DPb = Dissolved Lead

* *Subtotals and totals were calculated prior to rounding*
** *Total pollutant loads for pre-First Phase conditions are included in table, to provide a basis for comparison of project impacts.*
*** *Which also includes the adjacent Playa Vista First Phase Project (i.e., Playa Vista Project Buildout).*

Source: Camp Dresser and McKee Inc. and GeoSyntec Consultants

Table 3-43
Representative Stormwater Dissolved Metals Concentrations in the Freshwater Marsh Primary Management Areas Compared to CTR Criteria after Proposed Project

Jefferson Storm Drain Primary Management Area (Hardness = 200 mg/L)

Parameter	Acute CTR (µg/L)[b]	Predicted Concentration (µg/L)
Dissolved Copper, DCu	26	10.4
Dissolved Lead, DPb	136	4.5
Dissolved Zinc, DZn	210	108.4

Central Storm Drain Primary Management Area (Hardness = 200 mg/L)

Parameter	Acute CTR (µg/L)[b]	Predicted Concentration (µg/L)
Dissolved Copper, DCu	26	6.9
Dissolved Lead, DPb	136	3.2
Dissolved Zinc, DZn	210	59.3

Riparian Corridor/Lincoln Storm Drain South Primary Management Area (Hardness = 200 mg/L)

Parameter	Acute CTR (µg/L)[b]	Predicted Concentration (µg/L)
Dissolved Copper, DCu	26	8.6
Dissolved Lead, DPb	136	3.9
Dissolved Zinc, DZn	210	35.3

Main Body of Marsh (Hardness = 300 mg/L)

Parameter	Acute CTR (µg/L)[b]	Predicted Concentration (µg/L)
Dissolved Copper, Dcu	38	6.9
Dissolved Lead, DPb	208	3.3
Dissolved Zinc, DZn	297	36.9

[a] The CTR does not apply directly to stormwater but, rather, to the receiving waters to which the stormwater discharges. A comparison of the CTR to the stormwater flows is conservative because it does not account for assimilation that may occur once the stormwater enters the receiving water.

[b] Final CTR Criteria – 2000, May 18. Federal Register Volume 65, No. 97, 40 CFR Part 131, Water Quality Standards. Establishment of Numeric Criteria for Priority Toxic Pollutants for the State of California.
mg/L = milligrams per liter
µg/L = micrograms per liter
CTR = California Toxics Rule

Source: GeoSyntec Consultants

Table 3-44
Representative Stormwater Concentrations in the Primary Management Areas and the Main Body of the Freshwater Marsh Compared to Nutrient Water Quality Benchmarks After Proposed Project

Jefferson Storm Drain Primary Management Area

Parameter	Water Quality Benchmark[a]	Predicted Concentration
Total Phosphorus, TP (mg/L)	2.8	0.22
Total Kjeldahl Nitrogen, TKN (mg/L)	3.3	1.5

Central Storm Drain Primary Management Area

Parameter	Water Quality Benchmark[a]	Predicted Concentration
Total Phosphorus, TP (mg/L)	2.8	0.25
Total Kjeldahl Nitrogen, TKN (mg/L)	3.3	1.9

Riparian Corridor/Lincoln Storm Drain South Primary Management Area

Parameter	Water Quality Benchmark[a]	Predicted Concentration
Total Phosphorus (mg/L)	2.8	0.25
Total Kjeldahl Nitrogen, TKN (mg/L)	3.3	2.1

Main Body of Marsh

Parameter	Water Quality Benchmark[a]	Predicted Concentration
Total Phosphorus, TP (mg/L)	2.8	0.20
Total Kjeldahl Nitrogen, TKN (mg/L)	3.3	1.3

a U.S. EPA, 2000. Ambient Water Quality Criteria Recommendations: Information Supporting the Development of State and Tribal Nutrient Criteria for Rivers and Streams in Nutrient Ecoregion III. EPA 822-B-00-016
mg/L = milligrams per liter

Source: GeoSyntec Consultants

Table 3-45
Representative Stormwater Concentrations in the Primary Management Areas and the Main Body of the Freshwater Marsh Compared to Water Quality Benchmarks After Proposed Project

Jefferson Storm Drain Primary Management Area

Parameter	Water Quality Benchmark[a]	Predicted Concentration
Total Suspended Solids, TSS (mg/L)	60	79
Oil and Grease, O&G (mg/L)	25	1.9

Central Storm Drain Primary Management Area

Parameter	Water Quality Benchmark[a]	Predicted Concentration
Total Suspended Solids, TSS (mg/L)	60	38
Oil and Grease, O&G (mg/L)	25	1.6

Riparian Corridor/Lincoln Storm Drain South Primary Management Area

Parameter	Water Quality Benchmark[a]	Predicted Concentration
Total Suspended Solids, TSS (mg/L)	60	25
Oil and Grease, O&G (mg/L)	25	1.3

Main Body of Marsh

Parameter	Water Quality Benchmark[a]	Predicted Concentration
Total Suspended Solids, TSS (mg/L)	60	29
Oil and Grease, O&G (mg/L)	25	1.2

Table 3-46a
Representative Stormwater Loads to the Ballona Wetlands Prior to the First Phase Project

	Predicted Average Annual Loads[a] (lbs/year)										Runoff Volume (ft^3/yr)
	TSS	TP	TKN	O&G	TCu	DCu	TPb	DPb	TZn	DZn	
Jefferson Storm Drain Effluent	59,399	117	794	706	9.6	4.5	4.1	1.9	79.3	47.2	7,500,115
Freshwater Marsh Effluent (Not in Operation)	71,883	241	1,459	1,671	15.9	8.6	9.7	4.4	124.9	44.7	13,329,351
Off-site Stormwater Runoff Direct to Wetlands	47,632	82	595	404	5.3	2.5	1.7	0.8	31.8	18.9	6,667,439
Total Ballona Wetlands Tributary	**178,915**	**440**	**2,847**	**2,781**	**30.9**	**15.6**	**15.4**	**7.1**	**236.0**	**110.8**	**27,496,905**
Mass Removed in Wetlands	*-111,028*	*-45*	*-526*	*-189*	*-5.4*	*-5.0*	*0.0*	*0.0*	*-172.7*	*-84.7*	
Ballona Wetlands Effluent	**67,887**	**395**	**2,321**	**2,592**	**25.5**	**10.6**	**15.4**	**7.1**	**63.3**	**26.1**	**27,496,905**

[a] Totals calculated prior to rounding.

lbs = pounds
TKN = Total Kjedahl Nitrogen
TPb = Total Lead
Source: GeoSyntec Consultants
ft^3/yr = cubic feet per year
O&G = Oil and Grease
DPb = Dissolved Lead
TSS = Total Suspended Solids
TCu = Total Copper
TZn = Total Zinc
TP = Total Phosphorus
DCu = Dissolved Copper
DZn = Dissolved Zinc

Table 3-46b
Representative Stormwater Concentrations to the Ballona Wetlands Prior to the First Phase Project

	Summary Concentrations									
	(mg/L)				(µg/L)					
	TSS	TP	TKN	O&G	TCu	DCu	TPb	DPb	TZn	DZn
Jefferson Storm Drain Effluent	126.9	0.2	1.7	1.5	20.6	9.6	8.7	4.0	169.3	100.8
Freshwater Marsh Effluent (Not in Operation)	86.4	0.3	1.8	2.0	19.1	10.3	11.6	5.3	150.1	53.7
Off-site Stormwater Runoff Direct to Wetlands	114.4	0.2	1.4	1.0	12.8	5.9	4.0	1.9	76.5	45.5
Total Area - Ballona Wetlands Tributary	104.2	0.3	1.7	1.6	18.0	9.1	9.0	4.1	137.5	64.5
Percent Removed in Ballona Wetlands	*62%*	*10%*	*18%*	*7%*	*17%*	*32%*	*0%*	*0%*	*73%*	*76%*
Ballona Wetlands Effluent	**39.5**	**0.2**	**1.4**	**1.5**	**14.8**	**6.2**	**9.0**	**4.1**	**36.9**	**15.2**

Table 3-46b
Representative Stormwater Concentrations to the Ballona Wetlands Prior to the First Phase Project

	Summary Concentrations									
	(mg/L)				(µg/L)					
	TSS	TP	TKN	O&G	TCu	DCu	TPb	DPb	TZn	DZn

mg/L = milligrams per liter
TSS = Total Suspended Solids
TKN = Total Kjedahl Nitrogen
TPb = Total Lead

µg/L = micrograms per liter
TP = Total Phosphorus
O&G = Oil and Grease
DPb = Dissolved Lead

ft^3/yr = cubic feet per year
TCu = Total Copper
TZn = Total Zinc

DCu = Dissolved Copper
DZn = Dissolved Zinc

Source: GeoSyntec Consultants

Table 3-47a
Representative Stormwater Loads to the Ballona Wetlands with Playa Vista First Phase Project

	Predicted Average Annual Loads[a] (lbs/year)										Runoff Volume (ft^3/yr)
	TSS	TP	TKN	O&G	TCu	DCu	TPb	DPb	TZn	DZn	
Freshwater Marsh Effluent (8% Overflow)	1,417	17	105	113	0.8	0.6	0.6	0.3	2.6	0.9	2,007,970
Off-site Stormwater Runoff Direct to Wetlands	44,624	78	576	383	5.0	2.3	1.6	0.7	30.4	18.1	6,347,820
Total Ballona Wetlands Tributary	46,040	95	680	496	5.7	2.9	2.2	1.1	33.0	19.0	**8,355,791**
Mass Removed in Wetlands	*-25,411*	*0*	*0*	*0*	*0.0*	*0.0*	*0.0*	*0.0*	*-13.8*	*-11.1*	
Ballona Wetlands Effluent	**20,630**	**95**	**680**	**496**	**5.7**	**2.9**	**2.2**	**1.1**	**19.2**	**7.9**	**8,355,791**

[a] Totals calculated prior to rounding.

lbs = pounds
TKN = Total Kjedahl Nitrogen
TPb = Total Lead
Source: GeoSyntec Consultants

ft^3/yr = cubic feet per year
O&G = Oil and Grease
DPb = Dissolved Lead

TSS = Total Suspended Solids
TCu = Total Copper
TZn = Total Zinc

TP = Total Phosphorus
DCu = Dissolved Copper
DZn = Dissolved Zinc

Table 3-47b
Representative Stormwater Concentrations to the Ballona Wetlands with Playa Vista First Phase Project

	Summary Concentrations									
	(mg/L)				(µg/L)					
	TSS	TP	TKN	O&G	TCu	DCu	TPb	DPb	TZn	DZn
Effective Freshwater Marsh Influent to Ballona Wetlands (8% Overflow)*	11.3	0.1	0.8	0.9	6.0	4.7	4.6	2.7	20.9	7.5
Off-site Stormwater Runoff Direct to Wetlands	112.6	0.20	1.5	1.0	12.6	5.8	4.1	1.9	76.7	45.7
Total Ballona Wetlands Tributary	88.3	0.18	1.3	1.0	11.0	5.6	4.2	2.1	63.3	36.5
Percent Removed in Wetlands	*55%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*42%*	*58%*
Ballona Wetlands Effluent	**39.5**	**0.18**	**1.3**	**1.0**	**11.0**	**5.6**	**4.2**	**2.1**	**36.9**	**15.2**

* *The effective influent concentrations from the Freshwater Marsh represent the predicted concentrations after being adjusted to account forobserved dissolved and particulate metals fractionation in estuarine waters. For a more detailed explanation see Volume III, Appendix G of this Technical Report.*

mg/L = milligrams per liter
TSS = Total Suspended Solids
TKN = Total Kjedahl Nitrogen
TPb = Total Lead
Source: GeoSyntec Consultants

µg/L = micrograms per liter
TP = Total Phosphorus
O&G = Oil and Grease
DPb = Dissolved Lead

ft³/yr = cubic feet per year
TCu = Total Copper
TZn = Total Zinc

DCu = Dissolved Copper
DZn = Dissolved Zinc

Table 3-48a
Representative Stormwater Loads to the Ballona Wetlands with Playa Vista First Phase and Proposed Project

	Predicted Average Annual Loadsa										Runoff Volume
	(lbs/year)										
	TSS	TP	TKN	O&G	TCu	DCu	TPb	DPb	TZn	DZn	(ft3/yr)
Freshwater Marsh Effluent (8% Overflow)	1,516	18	112	121	0.8	0.6	0.6	0.4	2.8	1.0	2,149,081
Off-site Stormwater Runoff Direct to Wetlands	44,624	78	576	383	5.0	2.3	1.6	0.7	30.4	18.1	6,347,820
Total Ballona Wetlands Tributary	46,140	96	688	504	5.8	2.94	2.2	1.1	33.2	19.1	**8,496,901**
Mass Removed in Wetlands	*-25,162*	*0*	*0*	*0*	*0.0*	*0.0*	*0.0*	*0.0*	*-13.7*	*-11.0*	
Ballona Wetlands Effluent	**20,978**	**96**	**688**	**504**	**5.8**	**2.9**	**2.2**	**1.1**	**19.6**	**8.1**	**8,496,901**

Table 3-48a
Representative Stormwater Loads to the Ballona Wetlands with Playa Vista First Phase and Proposed Project

	Predicted Average Annual Loadsa (lbs/year)										Runoff Volume (ft3/yr)
	TSS	TP	TKN	O&G	TCu	DCu	TPb	DPb	TZn	DZn	

[a] Totals calculated prior to rounding.

lbs = pounds
TKN = Total Kjedahl Nitrogen
TPb = Total Lead
ft^3/yr = cubic feet per year
O&G = Oil and Grease
DPb = Dissolved Lead
TSS = Total Suspended Solids
TCu = Total Copper
TZn = Total Zinc
TP = Total Phosphorus
DCu = Dissolved Copper
DZn = Dissolved Zinc

Source: GeoSyntec Consultants

Table 3-48b
Representative Stormwater Concentrations to the Ballona Wetlands with Playa Vista First Phase and Proposed Project

	Summary Concentrations (mg/L)				(µg/L)					
	TSS	TP	TKN	O&G	TCu	DCu	TPb	DPb	TZn	DZn
Effective Freshwater Marsh Influent to Ballona Wetlands (8% Overflow)*	11.3	0.13	0.84	0.9	6.0	2.9	4.6	2.7	20.9	6.9
Off-site Stormwater Runoff Direct to Wetlands	112.6	0.20	1.5	1.0	12.6	5.8	4.1	1.9	76.7	45.7
Total Ballona Wetlands Tributary	87.0	0.18	1.3	1.0	10.9	5.5	4.2	2.1	62.6	36.0
Percent Removed in Wetlands	*55%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*41%*	*58%*
Ballona Wetlands Effluent	**39.5**	**0.18**	**1.3**	**1.0**	**10.9**	**5.5**	**4.2**	**2.1**	**36.9**	**15.2**

* *The effective influent concentrations from the Freshwater Marsh represent the predicted concentrations after being adjusted to account forobserved dissolved and particulate metals fractionation in estuarine waters. For a more detailed explanation see Volume III, Appendix G of this Technical Report*

mg/L = milligrams per liter
TSS = Total Suspended Solids
TKN = Total Kjedahl Nitrogen
TPb = Total Lead
µg/L = micrograms per liter
TP = Total Phosphorus
O&G = Oil and Grease
DPb = Dissolved Lead
ft^3/yr = cubic feet per year
TCu = Total Copper
TZn = Total Zinc
DCu = Dissolved Copper
DZn = Dissolved Zinc

Source: GeoSyntec Consultants

Table 3-49
Predicted Influent Loads and Concentrations to the Ballona Wetlands from the Freshwater Wetlands System

Predicted Average Annual Loads* (lbs/year)

	TSS	TP	TKN	O&G	TCu	DCu	TPb	DPb	TZn	DZn	Volume (10^3 ft^3/year)
Pre-First Phase**	71,883	241	1,459	1,671	15.9	8.6	9.7	4.4	124.9	44.7	13,329
After First Phase Project	1,417	17	105	113	0.8	0.6	0.6	0.3	2.6	0.9	2,008
After Proposed Project***	1,516	18	112	121	0.8	0.6	0.6	0.4	2.8	1.0	2,149
Percent Reduction from Pre-First Phase to Proposed Project	*-98%*	*-93%*	*-92%*	*-93%*	*-95%*	*-93%*	*-94%*	*-92%*	*-98%*	*-98%*	*-84%*

Predicted Annual Average Concentrations*

	(mg/L)				(µg/L)						Runoff Volume
	TSS	TP	TKN	O&G	TCu	DCu	TPb	DPb	TZn	DZn	(10^3 ft^3/year)
Pre-First Phase**	86.4	0.29	1.75	2.01	19.1	10.3	11.6	5.3	150.1	53.7	13,329
After First Phase Project	11.3	0.13	0.84	0.90	6.0	4.7	4.6	2.7	20.9	7.5	2,008
After Proposed Project***	11.3	0.13	0.84	0.90	6.0	4.7	4.6	2.7	20.9	7.5	2,149
Percent Reduction from Pre-First Phase to Proposed Project	*-87%*	*-54%*	*-52%*	*-55%*	*-69%*	*-55%*	*-60%*	*-50%*	*-86%*	*-86%*	*-84%*

lbs/yr – pounds per year; 10^3 ft^3/yr = one thousand cubic feet per year; mg/L – milligrams per liter; µg/L = micrograms per liter
TSS = Total Suspended Solids; TP = Total Phosphorus; TKN = Total Kjedahl Nitrogen; O&G – Oil and Grease
TCu – Total Copper; DCu = Dissolved Copper; TPb – Total Lead; DPb = Dissolved Lead
TZn = Total Zinc; DZn – Dissolved Zinc
** Subtotals and totals were calculated prior to rounding*
*** Total pollutant loads for existing conditions are included in table, to provide a basis for comparison of project impacts.*
**** Which also includes First Phase Project (i.e., Playa Vista Project Buildout).*

Source: Camp Dresser and McKee, Inc. and GeoSyntec Consultants

Table 3-50

Total Influent to Ballona Wetlands From the Freshwater Wetlands System After Adjacent Playa Vista First Phase Project and Proposed Project

Parameter	Acute CTR (µg/L)[a]	Predicted Effective Concentration (µg/L)[b]
Copper, Dissolved	4.8	2.9
Lead, Dissolved	210	2.7
Zinc, Dissolved	90	6.9

[a] Final CTR Criteria - 2000, May 18. Federal Register Volume 65, No. 97, 40 CFR Part 131, Water Quality Standards.

[b] *The effective influent concentrations from the Freshwater Marsh represent the predicted concentrations after being adjusted to account for observed dissolved and particulate metals fractionation in estuarine waters. For a more detailed explanation see Volume III, Appendix G of this Technical Report.*

µg/L = micrograms per liter
CTR = California Toxics Rule
N.E. = Not Expected to exceed once in any 100-year period.

Source: GeoSyntec Consultants

Table 3-51
Comparison of Water Quality Benchmarks in the Influent to the Ballona Wetlands From the Freshwater Marsh After Proposed Project

Freshwater Marsh Effluent

Parameter	Water Quality Benchmark	Predicted Concentration
Total Phosphorus (mg/L)[a]	0.2	0.13
TKN (mg/L)[a]	1.5	0.84
Total Suspended Solids (mg/L)[b]	60	11.3
Oil and Grease (mg/L)[b]	25	0.90

[a] USEPA, 2000. Ambient Water Quality Criteria Recommendations: Information Supporting the Development of State and Tribal Nutrient Criteria for Rivers and Streams in Nutrient Ecoregion III. EPA 822-B-00-016

[b] SWRCB, 2001. California Ocean Plan: Water Quality Control Plan Ocean Waters of California.

mg/L = milligrams per liter
TKN = Total Kjedahl Nitrogen

Source: GeoSyntec Consultants

Table 3-52a
Representative Stormwater Loads to the Ballona Channel Prior to the First Phase Project

	Predicted Average Annual Loadsa (lbs/year)										Runoff Volume (ft3/yr)
	TSS	TP	TKN	O&G	TCu	DCu	TPb	DPb	TZn	DZn	
Freshwater Marsh Effluent (Not in operation; all runoff from Project area discharged directly to the Ballona Wetlands)	0	0	0	0	0	0	0	0	0	0	0
Ballona Wetlands Effluent	67,887	395	2,321	2,592	25.5	10.6	15.4	7.1	63.3	26.1	27,496,905
Total Ballona Channel Influent	**67,887**	**395**	**2,321**	**2,592**	**25.5**	**10.6**	**15.4**	**7.1**	**63.3**	**26.1**	**27,496,905**

[a] Totals calculated prior to rounding.

lbs = pounds
TKN = Total Kjedahl Nitrogen
TPb = Total Lead
ft^3/yr = cubic feet per year
O&G = Oil and Grease
DPb = Dissolved Lead
TSS = Total Suspended Solids
TCu = Total Copper
TZn = Total Zinc
TP = Total Phosphorus
DCu = Dissolved Copper
DZn = Dissolved Zinc

Source: GeoSyntec Consultants

Table 3-52b
Representative Stormwater Concentrations to the Ballona Channel Prior to the First Phase Project

	Summary Concentrations									
	(mg/L)				(µg/L)					
	TSS	TP	TKN	O&G	TCu	DCu	TPb	DPb	TZn	DZn
Freshwater Marsh Effluent (Not in operation; all runoff from Project area discharged directly to the Ballona Wetlands)	0	0	0	0	0	0	0	0	0	0
Ballona Wetlands Effluent	39.5	0.2	1.4	1.5	14.8	6.2	9.0	4.1	36.9	15.2
Total Ballona Channel Influent	**39.5**	**0.2**	**1.4**	**1.5**	**14.8**	**6.2**	**9.0**	**4.1**	**36.9**	**15.2**

mg/L = milligrams per liter
TSS = Total Suspended Solids
TKN = Total Kjedahl Nitrogen
TPb = Total Lead
µg/L = micrograms per liter
TP = Total Phosphorus
O&G = Oil and Grease
DPb = Dissolved Lead
ft^3/yr = cubic feet per year
TCu = Total Copper
TZn = Total Zinc
DCu = Dissolved Copper
DZn = Dissolved Zinc

Source: GeoSyntec Consultants

Table 3-53a
Representative Stormwater Loads to the Ballona Channel with Playa Vista First Phase Project

	Predicted Average Annual Loadsa (lbs/year)										Runoff Volume (ft3/yr)
	TSS	TP	TKN	O&G	TCu	DCu	TPb	DPb	TZn	DZn	
Freshwater Marsh Effluent (92% of FWM Influent)	16,290	192	1,205	1,297	8.7	6.7	6.6	3.9	30.1	10.9	23,091,661
Ballona Wetlands Effluent	20,630	95	680	496	5.7	2.9	2.2	1.1	19.2	7.9	8,355,791
Total Ballona Channel Influent	**36,920**	**287**	**1,885**	**1,794**	**14.4**	**9.62**	**8.8**	**4.9**	**49.3**	**18.8**	**31,447,451**

[a] *Totals calculated prior to rounding.*

lbs = pounds
TKN = Total Kjedahl Nitrogen
TPb = Total Lead
ft^3/yr = cubic feet per year
O&G = Oil and Grease
DPb = Dissolved Lead
TSS = Total Suspended Solids
TCu = Total Copper
TZn = Total Zinc
TP = Total Phosphorus
DCu = Dissolved Copper
DZn = Dissolved Zinc

Source: GeoSyntec Consultants

Table 3-53b
Representative Stormwater Concentrations to the Ballona Channel with the Playa Vista First Phase Project

	Summary Concentrations (mg/L)				Summary Concentrations (µg/L)					
	TSS	TP	TKN	O&G	TCu	DCu	TPb	DPb	TZn	DZn
Effective Freshwater Marsh Influent to Ballona Channel (92% of FWM Influent)[a]	11.3	0.1	0.8	0.9	6.0	2.9	4.6	2.7	20.9	6.9
Ballona Wetlands Effluent	39.5	0.18	1.30	0.95	10.9	5.5	4.2	2.1	36.9	15.2
Total Ballona Channel Influent	**18.5**	**0.15**	**0.95**	**0.9**	**7.3**	**4.9**	**4.5**	**2.5**	**25.0**	**9.5**

[a] *The effective influent concentrations from the Freshwater Marsh represent the predicted concentrations after being adjusted to account for observed dissolved and particulate metals fractionation in estuarine waters. For a more detailed explanation see Volume III, Appendix G of this Technical Report.*

mg/L = milligrams per liter
TSS = Total Suspended Solids
TKN = Total Kjedahl Nitrogen
TPb = Total Lead
µg/L = micrograms per liter
TP = Total Phosphorus
O&G = Oil and Grease
DPb = Dissolved Lead
ft^3/yr = cubic feet per year
TCu = Total Copper
TZn = Total Zinc
DCu = Dissolved Copper
DZn = Dissolved Zinc

Source: GeoSyntec Consultants

Table 3-54a
Representative Stormwater Loads to the Ballona Channel with Playa Vista First Phase and Proposed Project

	Predicted Average Annual Loadsa (lbs/year)										Runoff Volume (ft3/yr)
	TSS	TP	TKN	O&G	TCu	DCu	TPb	DPb	TZn	DZn	
Freshwater Marsh Effluent (92% of FWM Influent)	17,435	205	1,289	1,389	9.3	7.2	7.1	4.1	32.2	11.6	24,714,432
Ballona Wetlands Effluent	20,978	96	688	504	5.8	2.7	2.2	1.1	19.6	8.1	8,496,901
Total Ballona Channel Influent	**38,413**	**302**	**1,977**	**1,893**	**15.1**	**9.90**	**9.3**	**5.2**	**51.8**	**19.7**	**33,211,333**

[a] Totals calculated prior to rounding.

lbs = pounds
TKN = Total Kjedahl Nitrogen
TPb = Total Lead
ft^3/yr = cubic feet per year
O&G = Oil and Grease
DPb = Dissolved Lead
TSS = Total Suspended Solids
TCu = Total Copper
TZn = Total Zinc
TP = Total Phosphorus
DCu = Dissolved Copper
DZn = Dissolved Zinc

Source: GeoSyntec Consultants

Table 3-54b
Representative Stormwater Concentrations to the Ballona Channel with Playa Vista First Phase and Proposed Project

	Summary Concentrations									
	(mg/L)				(µg/L)					
	TSS	TP	TKN	O&G	TCu	DCu	TPb	DPb	TZn	DZn
Effective Freshwater Marsh Influent to Ballona Channel (92% of FWM Influent)[a]	11.3	0.13	0.84	0.90	6.0	2.9	4.6	2.7	20.9	6.9
Ballona Wetlands Effluent	39.5	0.18	1.30	0.95	10.9	5.1	4.2	2.1	36.9	15.2
Total Ballona Channel Influent	**18.5**	**0.15**	**0.95**	**0.9**	**7.3**	**4.8**	**4.5**	**2.5**	**25.0**	**9.5**

[a] *The effective influent concentrations from the Freshwater Marsh represent the predicted concentrations after being adjusted to account for observed dissolved and particulate metals fractionation in estuarine waters. For a more detailed explanation see Volume III, Appendix G of this TechnicalReport.*

mg/L = milligrams per liter
TSS = Total Suspended Solids
TKN = Total Kjedahl Nitrogen
TPb = Total Lead
µg/L = micrograms per liter
TP = Total Phosphorus
O&G = Oil and Grease
DPb = Dissolved Lead
ft^3/yr = cubic feet per year
TCu = Total Copper
TZn = Total Zinc
DCu = Dissolved Copper
DZn = Dissolved Zinc

Source: GeoSyntec Consultants

Table 3-55
Predicted Influent Loads and Concentrations to the Ballona Channel From the Combined Effluent of the Freshwater Marsh and the Ballona Wetlands

	Predicted Average Annual Loads* (lbs/year)										Volume
	TSS	TP	TKN	O&G	TCu	DCu	TPb	DPb	TZn	DZn	(ft³/year)
Pre-First Phase**	67,887	395	2,321	2,592	25.5	10.6	15.4	7.1	63.3	26.1	27,496,905
After First Phase Project	36,920	287	1,885	1,794	14.4	9.6	8.8	4.9	49.3	18.8	31,447,451
After Proposed Project***	38,413	302	1,977	1,893	15.1	9.9	9.3	5.2	51.8	19.7	33,211,333
Percent Reduction from Pre-First Phase to Proposed Project	-43%	-24%	-15%	-27%	-41%	-6%	-40%	-26%	-18%	-25%	21%

	Predicted Annual Average Concentrations* (mg/L)				(µg/L)						Runoff Volume
	TSS	TP	TKN	O&G	TCu	DCu	TPb	DPb	TZn	DZn	(ft³/year)
Pre-First Phase**	39.5	0.230	1.4	1.5	14.8	6.2	9.0	4.1	36.9	15.2	27,496,905
After First Phase Project	18.8	0.146	0.96	0.91	7.3	4.9	4.5	2.5	25.1	9.6	31,447,451
After Proposed Project***	18.5	0.146	0.954	0.91	7.3	4.8	4.5	2.5	25.0	9.5	33,211,333
Percent Reduction from Pre-First Phase to Proposed Project	-53%	-37%	-29%	-40%	-51%	-23%	-50%	-39%	-32%	-38%	21%

lbs/yr = pounds per year *ft³/yr =one thousand cubic feet per year* *mg/L = milligrams per liter* *µg/L = micrograms per liter*
TSS = Total Suspended Solids *TP = Total Phosphorus* *TKN = Total Kjedahl Nitrogen* *O&G = Oil and Grease*
TCu = Total Copper *DCu = Dissolved Copper* *TPb = Total Lead* *DPb = Dissolved Lead*
TZn = Total Zinc *DZn = Dissolved Zinc*

* *Subtotals and totals were calculated prior to rounding*
** *Total pollutant loads for existing conditions are included in table, to provide a basis for comparison of project impacts.*
*** *Which also includes First Phase Project (i.e., Playa Vista Project Buildout).*

Source: Camp Dresser and McKee, Inc. and GeoSyntec Consultants

Table 3-56

Representative Stormwater Dissolved Metals Concentrations of Discharges to the Ballona Channel from the Freshwater Marsh Compared to Saltwater CTR Criteria *

Freshwater Marsh Effluent

Parameter	Acute CTR (µg/L)[a]	Predicted Effective Concentration (µg/L)[b]
Copper, Dissolved	4.8	2.9
Lead, Dissolved	210	2.7
Zinc, Dissolved	90	6.9

[a] Final CTR Criteria – 2000, May 18. Federal Register Volume 65, No. 97, 40 CFR Part 131, Water Quality Standards.
[b] *The effective influent concentrations from the Freshwater Marsh represent the predicted concentrations after being adjusted to account for observed dissolved and particulate metals fractionation in estuarine waters. For a more detailed explanation see Volume III, Appendix G of this Technical Report*

Establishment of Numeric Criteria for Priority Toxic Pollutants for the State of California.
µg/L = micrograms per liter
CTR = California Toxics Rule

* *The CTR criteria apply to receiving waters – not directly to discharges to those receiving waters. Thus, the CTR is not directly applicable to the influent to the Channel. A comparison of the CTR to influent concentrations is conservative because it does not account for assimilation that may occur once the influent actually enters the receiving waters.*

Source: GeoSyntec Consultants

Table 3-57
Comparison of Water Quality Benchmarks in the Influent to the Ballona Channel From the Freshwater Marsh After Proposed Project

Freshwater Marsh Effluent

Parameter	Water Quality Benchmark	Predicted Concentration
Total Phosphorus (mg/L)[a]	0.2	0.13
TKN (mg/L)[a]	3.3	0.84
Total Suspended Solids (mg/L)[b]	60	11.3
Oil and Grease (mg/L)[b]	25	0.9

[a] USEPA, 2000. Ambient Water Quality Criteria Recommendations: Information Supporting the Development of State and Tribal Nutrient Criteria for Rivers and Streams in Nutrient Ecoregion III. EPA 822-B-00-016

[b] SWRCB, 2001. California Ocean Plan: Water Quality Control Plan Ocean Waters of California.

mg/L = milligrams per liter
TKN = Total Kjedahl Nitrogen

Source: GeoSyntec Consultants

Table 3-58
Comparison of Proposed Project to Basin Plan Narrative Objectives

Basin Plan – Regional Objectives for Inland Surface Waters and Enclosed Bays and Estuaries (including wetlands)	Proposed Project (including design features of both the First Phase and Proposed Projects and intended and designed to address water quality of Playa Vista at buildout)
Bioaccumulation: *Toxic pollutants shall not be present at levels that will bioaccumulate in aquatic life to levels which are harmful to aquatic life or human health*	The primary bioaccumulative pollutants that have been identified as impairing the receiving waters of project runoff (Table 2) are arsenic, DDT, lead, PCBs, PAHs, and the Chem A compounds aldrin, chlordane, dieldrin, endosulfan, heptachlor, heptachlor epoxide, lindane, and toxaphene. The pesticides DDT, aldrin, chlordane, dieldrin, endrin, heptachlor, heptachlor epoxide, and toxaphene have all been banned for use in the U.S, however they persist in the environment because they all bind tightly to soils and sediment.Notable levels of these pesticides have not been detected at the Project Site. Notwithstanding erosion and sediment controls will limit the unintended movement of soils during construction. All construction activities will be closely monitored to ensure effective erosion and sediment control BMPs are used. Public education efforts will focus on: 1) informing the public of the dangers of poor sediment control on their properties, 2) methods to minimize offsite runoff and reduce erosion, and 3) encouraging proper disposal of banned pesticides that some people may still possess. Most arsenic is found in the wood preservative chromated copper arsenate (CCA), while the greatest use in metal alloys is lead-acid batteries for automobiles. The use of arsenic treated wood will be strongly discouraged to limit or prevent this metal from entering stormwater runoff. In addition the public will be educated on the reasons and method for proper disposal of lead-acid batteries. Lead naturally occurs in small amounts, however most lead in the environment is from human activities. The project consists of new development so there should not be any new sources of lead. Although elevated levels of lead have been detected in soils near the Former Firing Range (see section IV-I Safety Risk of Upset), any concentrations exceeding regulatory standards will be remediated as part of Cleanup and Abatement Order No. 98-125. The primary sources of lead in the project area will be contaminated soils. Development of the project will prevent erosion from impervious (i.e. paved) areas and erosion and sediment controls will limit the export of this metal from the project site. Sources from roads and highways will be treated with the roadside BMPs. PAHs consist of over 100 different chemicals that are formed during the incomplete combustion of coal, oil, gas, wood, garbage, or other organic substances. Educational materials will be provided to the public on the proper disposal of used motor oil and other petroleum products and the importance of not burning trash and debris. Swales and strip-type biofilters will be installed to minimize the migration of PAHs released from asphalt roadways, rooftops, parking lots, and creosote-treated telephone poles. Based on PCBs having been banned for over 20 years, it is not expected that development of the Proposed Project would result in any notable use or presence of PCBs at the site.

Table 3-58
Comparison of Proposed Project to Basin Plan Narrative Objectives

Basin Plan – Regional Objectives for Inland Surface Waters and Enclosed Bays and Estuaries (including wetlands)	Proposed Project (including design features of both the First Phase and Proposed Projects and intended and designed to address water quality of Playa Vista at buildout)
Biochemical Oxygen Demand (BOD_5): *Waters shall be free of substances that result in increases in the BOD which adversely affect beneficial uses*	Biodegradable organic materials, such as human and animal waste and yard debris, are the primary substances that could cause increases in BOD and eventual decreases in dissolved oxygen in the receiving waters. Yard debris collection service will be provided to homeowners to minimize improper disposal of yard wastes in storm drains and channels. Public education efforts and enforcement of City ordinances will encourage picking up and properly disposing of pet wastes. Catch basin inserts and trash racks will be the primary treatment control for removing organic debris from stormwater runoff. The Freshwater Marsh is expected to have the ability to decrease BOD through phytoassimilation of organic materials.
Biostimulatory Substances: *Waters shall not contain biostimulatory substances in concentrations that promote aquatic growth to the extent that such growth causes nuisance or adversely affects beneficial uses*	Biostimulatory substances may increase BOD, so some mitigation measures presented above (e.g. yard debris collection, education programs, structural BMPs) apply to this category as well. Biostimulatory substances include fertilizers and other sources of nutrients, which stimulate growth of aquatic organisms such as algae. Dissolved nutrients are generally not removable through standard stormwater BMPs however the Freshwater Marsh will provide the opportunity for nutrient uptake . This should greatly reduce the amount of biostimulatory (i.e. nutrients) discharged waters receiving dry and wet-weather flows from the project site. In addition to treatment of these substances in the Freshwater Marsh system, source controls will be implemented to minimize the amount of fertilizers and other biostimulatory substances used on the project site. This will be accomplished through education of landscaping contractors regarding proper types of fertilizers and methods of application. For example only slow-release fertilizers that are applied directly to the soil will be used to establish vegetation and they will not be applied during or within 72 hours of forecasted rain events. In addition erosion and sediment control measures that are implemented with the project will minimize the export of nutrients from the project site.
Chemical Constituents: *Surface waters shall not contain concentrations of chemical constituents in amounts that adversely affect any designated beneficial use*	Many types of chemical constituents are addressed in sections of this table, for example, toxic chemicals, oil and grease, PCBs, and suspended and settleable solids. The source controls and structural BMPs target various types of compounds (e.g. pesticides, oil and grease, nutrients) with similar chemical and physical properties, therefore effective removal can be expected for compounds with similar properties to the compounds specifically addressed in this documents. All the types of chemical compounds addressed are expected to be controlled through the effective implementation of source controls and with treatment in structural BMPs specifically design to achieve high levels of particulate removal, removal of pollutants associated with particulates, and the removal of oil and grease. This combination of source and structural controls is expected to result in the effective prevention and reduction of chemical concentrations to below levels of concern.

Table 3-58
Comparison of Proposed Project to Basin Plan Narrative Objectives

Basin Plan – Regional Objectives for Inland Surface Waters and Enclosed Bays and Estuaries (including wetlands)	Proposed Project (including design features of both the First Phase and Proposed Projects and Intended and designed to address water quality of Playa Vista at buildout)
Color: *Waters shall be free of coloration that causes nuisance or adversely affects beneficial uses*	Color can be a natural condition resulting from plant material or mineral sources. Anthropogenic sources of color in water typically results from commercial or industrial discharges. The Project Site will consist primarily of residential development with some commercial areas. Industrial sources of pollutants will not be present on the project site. Commercial areas will consist primarily of retail outlets, which are not expected to be a source of water quality constituents that will impact the color of dry or wet-weather flows originating on the project site. Any potentially hazardous chemicals used in commercial areas of the Project will not be exposed to rainfall and will not reach stormwater flows. Proper disposal of any and all chemicals will prevent impacts to dry-weather flows as well.
Exotic Vegetation: *Exotic vegetation shall not be introduced around stream courses to the extent that such growth causes nuisance or adversely affects beneficial uses*	The majority of on-site landscaping (other than private balconies) will be created and maintained by landscaping professionals rather than individual homeowners. Persons responsible for landscaping of the project will be instructed to use only non-exotic and non-invasive plants for this purpose. The use of invasive and/or exotic plants will be prohibited in public landscaped areas and in particular near any waterbodies. Landscape professionals will be educated in the identification of potentially invasive species in order to eradicate stands of undesirable plants while they are at manageable levels.
Floating Material: *Waters shall not contain floating materials, including solids, liquids, foams, and scum, in concentrations that cause nuisance or adversely affect beneficial uses*	Floating material typically consists of trash and debris, as well as oil and grease. The Proposed Project includes BMPs expected to nearly eliminate the export of trash from the project site through the storm drain system. Structural BMPs include water quality catch basins, the detention system, CDS units, and Freshwater Marsh. Removal of floatables by these BMPs is described in more detail in Section 3.1.4.1.2.3.3 Comparison to 303(d) Listed Parameters. Source controls for trash and debris implemented during the Proposed Project include frequent street sweeping, managed in-door trash collection and storage areas for residents, and the distribution of educational materials on proper disposal of waste generated by residents of the Project. The concentrations of oil and grease in surface runoff from the Project areas are predicted to be insignificant, especially after treatment in the structural BMPs (see Section 3.1.4.1.2.2 Numerical Significant Impacts).

Table 3-58
Comparison of Proposed Project to Basin Plan Narrative Objectives

Basin Plan – Regional Objectives for Inland Surface Waters and Enclosed Bays and Estuaries (including wetlands)	Proposed Project (including design features of both the First Phase and Proposed Projects and intended and designed to address water quality of Playa Vista at buildout)
Oil and Grease: *Waters shall not contain oils, greases, waxes or other materials in concentrations that result in a visible film or coating on the surface of the water or on objects in the water, that cause nuisance, or that otherwise adversely affect beneficial uses*	Sources of oil and grease from the project site will consist primarily of parking areas and roads and highways. In order to minimize the entrainment of oil and grease in wet or dry-weather flows the majority of parking areas will be below ground. Impervious land coverage of parking areas will be reduced by minimizing paved areas and the use of porous pavement and "grasscrete". Any runoff generated from parking areas will be treated in biofiltration facilities or routed to downstream BMPs for treatment prior to reaching the storm drain system. Sources from roads and highways will be treated with the roadside BMPs that are effective at reducing pollutants found in the highway environment like oil and grease prior to this runoff reaching the storm drain system. The use of BMPs designed to remove oil and grease to treat runoff from parking lots and roadways is expected to reduce concentrations of these chemicals to well below water quality objectives.
Pesticides: *No individual pesticide or combination of pesticides shall be present in concentrations that adversely affect beneficial uses*	Several pesticides are listed on the 303(d) list for the receiving waters of project runoff. The pesticides DDT, aldrin, chlordane, dieldrin, endrin, heptachlor, heptachlor epoxide, and toxaphene have all been banned for use in the U.S. Hexachlorocyclohexane (including lindane) and endosulfan are the only listed pesticides that could still potentially be used during project operations. Endosulfan is a restricted use pesticide that can only be obtained and used by licensed professionals and is used for agricultural purposes. Commercial farming is not included in the First Phase Project or the Proposed Project, so this pesticide will not be used at the project site and contractors will be restricted from using endolsulfan-treated wood products. Lindane is also a restricted use pesticide, however the general public can obtain lindane-containing shampoos and lotions for the treatment of ticks and head lice with a prescription. In 2000, 98 percent of the reported lindane used in Los Angeles County was applied to outdoor plants and for landscape maintenance. The primary source control measure that will be employed to mitigate potential lindane contamination is public education and conservative pesticide application practices. The public will be informed of the dangers of using lindane-containing products, the importance of closely following product directions, and how to avoid contaminating soils and water resources when using lindane. They will also be encouraged to use alternative means to control ticks and lice. A public education effort for lindane is already underway in Los Angeles (www.lacsd.org/Lindane/). The Proposed Project has committed to minimizing the use of pesticides and herbicides through the use of both source and structural controls. Erosion and sediment controls and public education will be the primary source control measures for these compounds. All construction activities will be closely monitored to ensure effective erosion and sediment control BMPs are used. Other source controls include the use of native vegetation in much of the landscaping in order to minimize the amount of

Table 3-58
Comparison of Proposed Project to Basin Plan Narrative Objectives

Basin Plan – Regional Objectives for Inland Surface Waters and Enclosed Bays and Estuaries (including wetlands)	Proposed Project (including design features of both the First Phase and Proposed Projects and intended and designed to address water quality of Playa Vista at buildout)
	pesticide required to achieve pest control and education efforts. Pesticides will only be applied to public landscaped areas (the majority of on-site landscaping) by qualified landscape professionals and these chemicals will be carefully stored in appropriate facilities when not in use. Paving and landscaping will serve to contain historical sources of these pesticides. Public education efforts will focus on: 1) informing the public of the dangers of poor sediment control on their properties, 2) methods to minimize offsite runoff and reduce erosion, and 3) encouraging proper disposal of banned pesticides that some people may still possess. Although pesticides can be highly persistent in the environment because they all bind tightly to soils and sediment, in Los Angeles County's stormwater monitoring they have been mostly undetected and when they are, the concentrations minimally exceed detection levels. Moreover, notable concentrations of pesticides have not been detected in soils or surface water at the Project Site. The use of the aforementioned source controls in conjunction with structural BMPs that will remove sediments and associated pesticides, if any, from dry and wet-weather flows are expected to prevent the concentration of any pesticide from reaching levels of concern.
Polychlorinated Biphenyls (PCBs): *The purposeful discharge of PCBs (the sum of chlorinated biphenyls whose analytical characteristics resemble those of Aroclor-1016,-1221,-1232,-1242,-1248,-1254, and –1260) to waters of the Region, or at locations where the waste can subsequently reach waters of the Region, is prohibited.*	PCBs are a group of toxic chemicals that have been widely used in industrial processes and applications. Production of PCBs in the U.S. was stopped in 1977 and open disposal was banned in 1979. To date in Los Angeles County's urban stormwater monitoring, PCBs have been primarily below detection levels and the few instances of detects have been below criteria levels. Landscaping and paving of the site should prevent or greatly reduce any export from surface sources at the project site. Stormwater BMPs should be effective at reducing any minor concentrations because PCBs adsorb strongly to particulates. The public will be informed of the dangers and potential sources of PCBs in and around their home and how to properly dispose of potential sources of this contaminant.
Radioactive Substances: *Radionuclides shall not be present in concentrations that are deleterious to human, plant, animal, or aquatic life or that result in the accumulation of radionuclides in the food web to an extent that presents a hazard to human, plant, animal, or aquatic life*	The project site will not contain any industrial or commercial uses that generate radioactive substances. As such the site will not be a source of this class of constituents and will not contribute to the violation of water quality criteria relating to radioactive substances.

Table 3-58
Comparison of Proposed Project to Basin Plan Narrative Objectives

Basin Plan – Regional Objectives for Inland Surface Waters and Enclosed Bays and Estuaries (including wetlands)	Proposed Project (including design features of both the First Phase and Proposed Projects and intended and designed to address water quality of Playa Vista at buildout)
Solid, Suspended, or Settleable Materials: *Waters shall not contain suspended or settleable material in concentrations that cause nuisance or adversely affect beneficial uses*	Erosion and sediment controls will be the primary source control measures to limit the export of suspended or settleable material (e.g. sediment) from the project site. All construction activities will be closely monitored to ensure effective erosion and sediment control BMPs are used. Other source controls include the use of native vegetation in much of the landscaping in order to minimize the potential for erosion. Development of the Project will prevent erosion from impervious (i.e. paved) areas. Structural BMPs specifically designed to achieve high levels of particulate removal (and associated pollutants) will be implemented to provide treatment of stormwater and dry-weather flows. The combination of source and structural controls targeted at reducing the entrainment and transport of suspended or settleable material is expected to maintain concentrations of these constituents well below water quality criteria.
Taste and Odor: *Waters shall not contain taste or odor-producing substances in concentrations that impart undesirable tastes or odors to fish flesh or other edible aquatic resources, cause nuisance, or adversely affect beneficial uses*	Erosion and sediment source controls will be implemented with the Project to limit the generation of water quality constituents such as sediments and pesticides associated with sediments. Other source controls such as street sweeping and public education will minimize the entrainment of ubiquitous stormwater pollutants such as metals, nutrients, and household chemicals. Structural BMPs will treat both stormwater and dry-weather flow removing sediments and associated pollutants. Source controls are expected to prevent compounds that could potentially cause taste and odor problems from reaching the storm drain system, while structural BMPs should minimize the potential of any such compounds to cause water quality concerns in the receiving waters through reduction to concentrations below levels of concern.
Toxicity: *All waters shall be maintained free of toxic substances in concentrations that are toxic to, or that produce detrimental physiological responses in, human, plant, animal, or aquatic life.*	Toxic pollutants with a tendency to bio-accumulate are discussed in the relation to the Basin Plan regional objectives in the first row of this table. Other pollutants that tend to be a concern in regards to toxicity are generally heavy metals and anthropogenic chemicals such as pesticides or organic chemicals used in commercial or industrial processes. Industrial sources of pollutants will not be present on the Project Site and commercial areas will consist primarily of retail outlets, which are not expected to be a notable source of water pollutants. Any potentially hazardous chemicals used in commercial areas of the project will not be exposed to rainfall and will not reach stormwater flows. Proper disposal of any and all chemicals will prevent impacts to dry-weather flows as well. Structural BMPs will be implemented to achieve high levels of removal of particulates and associated pollutants such as metals originating from automobiles, rooftops, and wear and tear on roadways and guardrails, which could cause toxic effects. Source controls for parking lots and roadways are expected to result in dissolved metal concentrations that are not of concern in stormwater runoff from the project site. Sediment removal rates will markedly reduce the load total metal load through removal of metals in particulate form; this in conjunction with source controls to limit the dissolved metal concentrations should prevent the toxic effects from these elements.

Table 3-58
Comparison of Proposed Project to Basin Plan Narrative Objectives

Basin Plan – Regional Objectives for Inland Surface Waters and Enclosed Bays and Estuaries (including wetlands)	Proposed Project (including design features of both the First Phase and Proposed Projects and intended and designed to address water quality of Playa Vista at buildout)
Turbidity: *Waters shall be free of changes in turbidity that cause nuisance or adversely affect beneficial uses.*	The Project will not contribute to changes (i.e. increases) in turbidity through control of suspended and settleable materials such as sediment. This will be achieved through a combination of source and structural controls as discussed above in the section on Solid, Suspended, or Settleable Materials.
Basin Plan – Regional Objectives Specific to Wetlands	
Hydrology: *Natural hydrological conditions necessary to support the physical, chemical, and biological characteristics present in wetlands shall be protected to prevent significant adverse effects on:* *natural temperature, pH, dissolved oxygen, and other natural physical/chemical conditions* *movement of aquatic fauna* *survival and reproduction of aquatic flora and fauna, and* *water levels*	The constructed Freshwater Marsh will receive and treat runoff from the First Phase Project and the Proposed Project, which previously was routed to the Ballona Wetlands. Prior to urban development around the Ballona Wetlands dry-weather flows did not reach the marsh area, routing of these flows for treatment in the Freshwater Marsh will replicate the pre-development conditions. Due to urban development and increased stormwater runoff volumes the overflow of stormwater runoff from the Freshwater Marsh (which will process and treat the majority of runoff) will still likely exceed stormwater volumes reaching the Ballona Wetlands prior to the urban development of the area. It is expected that implementation of the Freshwater Marsh will more closely replicate the historical hydrology of the wetlands. It is expected that estuarine waters will inundate substantial areas of the Ballona Wetlands at high tide helping to maintain beneficial water levels in the wetlands. Routing of stormwater flows to the Freshwater Marsh for treatment will substantially reduce the load of pollutants discharge to the Ballona Wetlands thereby improving the water quality of this ecosystem. Other than these changes to hydrology and a reduction in flows from urban areas routed to the wetlands, the wetlands will be protected from development and remain essentially unchanged. This will permit the movement of aquatic fauna throughout the wetlands. Negative impacts to the reproduction of flora and fauna are not expected.
Habitat: *Existing habitats and associated populations of wetlands fauna and flora shall be maintained by: maintaining substrate characteristics necessary to support flora and fauna which would be present naturally, protecting food supplies for fish and wildlife, protecting reproductive and nursery areas, and protecting wildlife corridors*	Due to the use of the Freshwater Marsh to treat runoff from the First Phase Project and the Proposed Project some changes to the hydrology of the Ballona Wetlands is expected to occur. It is believed that the changes will more closely mimic the hydrologic conditions prior to urban development in the area. This reflects the only anticipated changes to the wetlands. Other impacts to substrae characteristics, food supplies, reproductive and nursery areas, and wildlife corridors are not expected to occur.

Table 3-59
Recommended Permissible Velocities

Material	Velocity	
	(m/s)	(ft/s)
Fine Sand	0.6	2.0
Coarse Sand	1.2	3.9
Earth		
Sand Silt	0.6	2.0
Silt Clay	1.1	3.6
Clay	1.8	5.9
Grass Lined Earth (slope <5%)		
Bermuda Grass		
Sandy Silt	1.8	5.9
Silt Clay	2.4	7.9
Kentucky Blue Grass		
Sandy Silt	1.5	4.9
Silt Clay	2.1	6.9
Poor Rock (sedimentary)		
Soft Sandstone	2.4	7.9
Soft Shale	1.1	3.6
Good Rock (igneous or metamorphic)	6.1	20.0

Source: U.S. Army Corps of Engineers. 1970. Hydraulic Design of Flood Control Channels, Report EM1110-2-1601

Table 3-60
Dry Weather Water Quality Data for Freshwater Marsh Inlets and Outlet

Date of Data Collection	Location	Parameters							
		TSS	Hardness	TCu	DCu	TPb	DPb	TZn	DZn
		mg/L	mg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
04/14/00[a]	Centinela Ditch	NA.	580	2.1	4.6	ND<1	4.8	24.9	23.2
	Lincoln Drain	NA	350	3.8	743	3.1	23.2	54.3	583.0
04/13/00[a]	Jefferson Drain	NA	620	5.1	50.6	1.2	2.0	38.7	72.9
04/25/02[b]	Central Drain Inlet	29	NA	NA	13	NA	0.29 J	NA	7.3 J
	Jefferson Inlet	26	NA	NA	14	NA	0.68 J	NA	11
	Freshwater Marsh Outlet	14	NA	NA	16	NA	0.34 J	NA	9.3 J
06/28/02[b]	Central Drain Inlet	NA	680	5.3	9.7	0.83 J	ND<1	28	7.6 J
	Jefferson Inlet	NA	740	6.7	8.3	2.9	0.32 J	21	16
	Freshwater Marsh Outlet	NA	800	6.4	7.8	0.46 J	0.23 J	14	7.1 J
04/02/03[c]	Central Drain Inlet	20	186	6.1	4.0	1.4	ND	13	5.9
	Jefferson Inlet	39	156	5.9	4.6	1.8	ND	15	3.4
	Freshwater Marsh Outlet	ND	158	3.5	3.2	ND	ND	1.7	1.2

mg/L = milligrams per liter *µg/L = micrograms per liter* *TSS = Total Suspended Solids*
TCu Total Copper *DCu = Dissolved Copper* *TPb - Total Lead*
DPb = Dissolved Lead *TZn - Total Zinc* *DZn = Dissolved Zinc*
NA = not analyzed
J = estimated concentration (between method detection and laboratory reporting limit)
ND = not detected at a concentration greater than the reporting limit shown

[a] *GeoSyntec Consultants, 2000. Draft Playa Vista Summary Table From Sampling Dates 04/13/00 and 04/14/00.*
[b] *Playa Vista, 2002. Freshwater Marsh Sampling: Summary of Laboratory Analytical Results from 04/25/02 and 06/28/02.*
[c] *Playa Vista, 2003. Freshwater Marsh Sampling: Summary of Laboratory Analytical Results from 04/02/03.*
Source: GeoSyntec Consultants, 2003.

Table 3-61
Chronic CTR Criteria Compared to Dry Weather Data

Date of Data Collection	Freshwater Marsh Location	Chronic CTR Criteria at Measured Hardness[a]			Measured Data		
		DCu (µg/L)	DPb (µg/L)	DZn (µg/L)	DCu (µg/L)	DPb (µg/L)	DZn (µg/L)
04/14/00	Centinela Ditch	29.3	10.9	382	2.1	ND<1	24.9
	Lincoln Drain	26.1	9.5	341	3.8	3.1	54.3
04/13/00	Jefferson Drain	29.3	10.9	382	5.1	1.2	38.7
06/28/02	Central Drain Inlet	29.3	10.9	382	5.3	0.83 J	28
	Jefferson Inlet	29.3	10.9	382	6.7	2.9	21
	Freshwater Marsh Outlet	29.3	10.9	382	6.4	0.46 J	14
04/02/03	Central Drain Inlet	15.2	4.9	200	4.0	ND<0.5	5.9
	Jefferson Inlet	13.1	4.1	172	4.6	ND<0.5	3.4
	Freshwater Marsh Outlet	13.2	4.1	174	3.2	ND<0.5	1.2

[a] Final CTR Criteria – 2000, May 18. Federal Register Volume 65, No. 97, 40 CFR Part 131, Water Quality Standards. Establishment of Numeric Criteria for Priority Toxic Pollutants for the State of California. The maximum hardness to use in the CTR calculation is 400 mg/L as $CaCO_3$.

µg/L = micrograms per liter
DCu = Dissolved Copper
DPb = Dissolved Lead
DZn = Dissolved Zinc
J - estimated concentration (between method detection and laboratory reporting limit)
ND = not detected at a concentration greater than the reporting limit shown
CTR = California Toxics Rule
Source: GeoSyntec Consultants

CDM

WATER RESOURCES TECHNICAL REPORT

The Village at Playa Vista Project

Appendix A

August 2003

Volume II of III

Prepared for:

Playa Capital Company
12555 West Jefferson Boulevard, Suite 300
Los Angeles, California 90066

Prepared by:

CDM
Psomas
URS Greiner Woodward Clyde
GeoSyntec Consultants

CDM Project No. 10610-37605 RT.DEIR

Appendix A
Proposed Project Flood Hydrology (Psomas)

The Village at Playa Vista Proposed Project Flood Hydrology Technical Appendix

July 14, 2003

Prepared by:

PSOMAS
11444 West Olympic Boulevard
Suite 750
West Los Angeles, CA 90064
(310) 954 3700
(310) 954-3777 Fax

Prepared for:

PLAYA CAPITAL COMPANY, LLC
12555 West Jefferson Boulevard
Los Angeles, CA 90066
(310) 822-0074
(310) 827-1073 Fax

The Village at Playa Vista
Proposed Project Flood Hydrology
Technical Appendix Volume 2

July 14, 2003

Prepared for:

PLAYA CAPITAL COMPANY, LLC
12555 West Jefferson Boulevard
Los Angeles, CA 90066
(310) 822-0074
(310) 827-1073 Fax

Prepared by:

PSOMAS
11444 West Olympic Boulevard
Suite 750
West Los Angeles, CA 90064
(310) 954-3700
(310) 954-3777 Fax

REGISTERED PROFESSIONAL ENGINEER
JASON H. FUKUMITSU
No. 40695
Exp. 3-31-07
CIVIL
STATE OF CALIFORNIA

Jason H. Fukumitsu, RCE 40695

7-14-03
Date

TABLE OF CONTENTS

1.0 Introduction

1.1 Setting

1.1.1 Regulatory Framework

1.1.1.1 Federal Level

National Flood Insurance Act
Clean Water Act – Section 404

1.1.1.2 Local Level

1.1.2 Existing Conditions/Surface Water

1.1.2.1 Santa Monica Bay

1.1.2.2 Ballona Creek Watershed

1.1.2.3 First Phase Project and Proposed Projects

1.1.2.3.1 Local Watersheds and Drainage Areas

1.1.2.3.2 Drainage Facilities

Ballona Channel
Pre-First Phase Drainage Facilities
Existing Drainage Facilities

1.2 Impact Analysis

1.2.1 Surface Water Hydrology

1.2.1.1 Methodology

1.2.1.2 Significance Thresholds

1.2.1.3 Project Design Features

1.2.1.4 Project Impacts – Surface Water Hydrology

1.2.1.4.1 Urban Development Component
1.2.1.4.1.1 Potential for Flooding

1.2.1.4.1.2 Potential to Reduce or Increase the Amount of Surface Water in a Waterbody

1.2.1.4.1.3 Potential For Adverse Change to the Movement of Surface Water

1.2.1.4.2 Habitat Creation /Restoration Component

1.2.1.4.2.1 Potential for Flooding
1.2.1.4.2.2 Potential to Reduce or Increase the Amount of Surface Water in a Waterbody
1.2.1.4.2.3 Potential for Adverse Change to the Movement of Surface Water
1.2.1.4.3 Summary of Potential Surface Water Hydrology Impacts

1.2.2 Mitigation Measures

1.2.3 Unavoidable Adverse Impacts

1.2.4 Cumulative Impacts

2.0 Existing On-Site Hydrology

2.1 – Ballona Wetlands (Previously Area B) Existing Hydrology
2.1-a Runoff Table – Wetlands

2.2 – Area D Existing Hydrology
2.2-a Runoff Table – Line D1E – Centinela Ditch
2.2-b Area Conversion Table – Line D1E – Centinela Ditch
2.2-c Initial Time of Concentration Table – Line D1E – Centinela Ditch
2.2-d Runoff Table – Line D2E – Jefferson Drain
2.2-e Area Conversion Table – Line D2E – Jefferson Drain
2.2-f Initial Time of Concentration Table – Line D2E – Jefferson Drain

2.3 – Onsite Hydrology Pre-First Phase Map

3.0 - Existing and Proposed Off-Site Hydrology (unchanged)

3.1 – Tract 43416
3.1-a Off-Site Area and Runoff Summary Table
3.1-b Runoff Table
3.1-c Area Conversion Table
3.1-d Initial Time of Concentration Table

3.2 – Off-Site Area C.4.2
- 3.2-a Runoff Table
- 3.2-b Area Conversion Table
- 3.2-c Initial Time of Concentration Table

3.3 – Tract 43415
- 3.3-a Runoff Table – C.6.2 & C.6.3
- 3.3-b Area Conversion Table – C.6.2 & C.6.3
- 3.3-c Initial Time of Concentration Table – C.6.2 & C.6.3

3.4 – Off-Site Area C.8.1
- 3.4-a Runoff Table
- 3.4-b Area Conversion Table
- 3.4-c Initial Time of Concentration

3.5 – Hughes Aircraft Center Storm Drain
- 3.5-a Runoff Table – C.19.0
- 3.5-b Area Conversion Table – C.19.0
- 3.5-c Initial Time of Concentration Table – C.19.0

3.6 – Pershing Overflow to Wetlands
- 3.6-a Runoff Table
- 3.6-b Area Conversion Table
- 3.6-c Initial Time of Concentration
- 3.6-d Pershing Storm Drain Overflow Hydrograph

3.7–Off-Site Hydrology Map – Reduced Copy

4.0 - Proposed On-Site Hydrology

4.1 – Playa Vista Hydrology Summary Tables

4.2 – Ballona Wetlands (Area B) and D Proposed Hydrology – Phase I

4.2.1 Ballona Wetlands
- 4.2.1-a Runoff Table
- 4.2.1-b Area Conversion Table
- 4.2.1-c Initial Time of Concentration Table

4.2.2 Jefferson Storm Drain
- 4.2.2-a Runoff Table
- 4.2.2-b Area Conversion Table
- 4.2.2-c Initial Time of Concentration Table

4.2.3 Central Storm Drain
4.2.3-a Runoff Table
4.2.3-b Area Conversion Table
4.2.3-c Initial Time of Concentration Table

4.2.4 Riparian Corridor
4.2.4-a Runoff Table
4.2.4-b Area Conversion Table
4.2.4-c Initial Time of Concentration Table

4.2.5 Playa Vista Phase I Hydrology Map – Reduced Copy

4.3 – The Village at Playa Vista (Proposed Project) Proposed Hydrology

4.3.1 Ballona Wetlands
4.3.1-a Runoff Table
4.3.1-b Area Conversion Table
4.3.1-c Initial Time of Concentration Table

4.3.2 Jefferson Storm Drain
4.3.2-a Runoff Table
4.3.2-b Area Conversion Table
4.3.2-c Initial Time of Concentration Table

4.3.3 Central Storm Drain
4.3.3-a Runoff Table
4.3.3-b Area Conversion Table
4.3.3-c Initial Time of Concentration Table

4.3.4 Riparian Corridor
4.3.4-a Runoff Table
4.3.4-b Area Conversion Table
4.3.4-c Initial Time of Concentration Table

4.3.5 Proposed Project Hydrology Map – Reduced Copy

4.4 – Ballona Wetlands Hydraulics

4.5 – Reference Tables and Graphs

5.0 - Full-Size Hydrology Maps

5.1 – Playa Vista Existing On-Site Hydrology

5.2 – Playa Vista Off-Site Hydrology

5.3 – Playa Vista Proposed On-Site Hydrology

5.4 – Flood Insurance Rate Map

THE VILLAGE AT PLAYA VISTA
PROPOSED PROJECT FLOOD HYDROLOGY

1.0 INTRODUCTION

This section describes the affected environment and existing conditions, and sets forth an impact analysis related to surface water and groundwater hydrology. Surface water hydrology issues addressed in this section primarily include surface water runoff, drainage characteristics, and drainage and flood control improvements for pre-First Phase, existing, and The Village at Playa Vista (hereafter "Proposed Project") Proposed Project conditions.

This section summarizes information derived from the project calculations and data found in Sections 2 through 4. To define the existing drainage patterns, delineate the tributary boundaries and identify the drainage subareas, Psomas reviewed reference maps and conducted field inspections. The reference maps utilized were topographic maps of various scale, City of Los Angeles drainage maps, and record plans of existing and proposed storm drain facilities and streets. The gathered information has been compiled in a computer database, field-checked and mapped (see Section 5 for Hydrology Maps). Stream gauge data taken at the Sawtelle Avenue crossing was used as base data for Ballona Channel.

1.1 SETTING

1.1.1 Regulatory Framework

1.1.1.1 Federal Level

National Flood Insurance Act

The National Flood Insurance Act of 1968 established the National Flood Insurance Program (NFIP), which is based on the minimal requirements for flood plain management in the Code of Federal Regulations 44, Sections 59-77. The Federal Regulations are designed to minimize flood damage within Special Flood Hazard Areas. Based on the Flood Insurance Rate Map (FIRM) from the Federal Emergency Management Agency (FEMA), portions of the Project site are within three separate flood classifications.[1] These are defined as follows:

[1] *Federal Emergency Management Agency, Flood Insurance Rate Map, Los Angeles County, California (unincorporated areas), Panel 905 of 1275 (Community Panel Number 065043 0905 C), November 15,*

Zone A. Areas of 100-year flood; base flood elevations and flood hazard factors are not determined.

Zone B. Areas between the limits of the 100-year flood and 500-year flood; or certain areas subject to 100-year flooding with average depth of less than one foot; or where the contributing drainage area is less than one square mile; or areas protected by levees from the base flood.

Zone C. Areas of minimal flooding, not requiring flood insurance.

Based on the FIRM, portions of the Proposed Project fall into two different flood zones. The bluff is classified as Zone C. The remaining portions of the Proposed Project (and portions of the First Phase immediately to the east and west of the Second Phase) are in Zone B (except the Riparian Corridor which is a waterbody). None of the proposed development portion of Proposed Project is located within a 100-year flood zone as determined by FEMA. The FIRM flood zones for the Proposed Project are can be found on the FIRM map in Section 5.

1.1.1.2 Local Level

Drainage and flood control structures and improvements in the City of Los Angeles are subject to review and approval by the City of Los Angeles, Bureau of Engineering. The City utilizes a 50-year design storm for flood control design purposes; hence, the analysis presented herein of impacts to, and adequacy of, the storm drain and flood control system for the Proposed Project is based on such a 50-year design storm event. The 50-year design storm event used for design and analysis purposes is a predicted storm event estimated using the City's methodology and assumptions, which, in comparison to USACE design storms, are considered to be conservative. Based on the conservative nature of calculating such storm events, they are likely to occur less often than every 50 years

1.1.2 Existing Conditions - Surface Water

The existing surface water hydrology characteristics associated with the Proposed Project consist of, and are influenced by, a variety of watershed areas, drainage systems, and land uses. The most notable features related to the Proposed Project include: Santa Monica Bay, which receives much of the surface runoff from metropolitan Los Angeles; the Ballona Creek Watershed, including the Ballona Channel, into which the First Phase Project and Proposed Projects drains; and the local watersheds and drainage facilities. The following sections describe the relevant characteristics of each.

1985. Updated with online data from Environmental Systems Research Institute (ESRI) and FEMA, http://www.esri.com/data/download/fema/index.html#datainfo. September 9, 2002.

1.1.2.1 Santa Monica Bay

Santa Monica Bay is an open embayment with a designated surface area of approximately 266 square miles. It is bordered by Point Dume to the northwest, the Palos Verdes Peninsula to the south, and the deep Santa Monica Basin offshore. Uses of Santa Monica Bay include recreational, commercial, and industrial uses. Activities include boating, swimming, fishing, power generation and runoff, and wastewater and waste discharge. Relative to the Proposed Project, Santa Monica Bay lies approximately 2 miles west. Playa Vista has no direct connection to Santa Monica Bay, although a majority of the surface runoff from the property drains eventually into Santa Monica Bay via the Ballona Channel.

1.1.2.2 Ballona Creek Watershed

The Ballona Channel is the major drainage channel in the vicinity of the Proposed Project site, and all of the runoff from the Proposed Project eventually reaches the Ballona channel. The overall Ballona Creek Watershed drains approximately 78,000 acres, of which the First Phase Project and The Village at Playa Vista (Proposed Project), comprises 0.5 % of this watershed. The watershed includes portions of the Santa Monica Mountains to the north, an area west of Beverly Hills and the higher elevations of Culver City, an area extending easterly to within approximately two blocks of the Los Angeles Coliseum, and the Ballona Escarpment to the south. Approximately 76 % of the Ballona Creek Watershed consists of highly urbanized land.[2] Elevations within the watershed range from approximately sea level to 400 feet above mean sea level (MSL) in the coastal plain and 400 feet to 1,800 feet above MSL in the mountainous areas. None of the watercourses within the watershed flow perennially from natural sources.[3] Other than urban runoff and industrial discharges, runoff into the Ballona Channel occurs only during and immediately following precipitation events.

Based on ocean tide elevations, the downstream portion of the Ballona Channel is tidally influenced up to and past Lincoln Boulevard. The saltwater portion of the Ballona Channel has been determined to be approximately downstream of the channel's intersection with Culver Boulevard, although the channel is tidally influenced to a point approximately 3,000 feet east of Lincoln Boulevard (near the confluence with Centinela Channel).

---

[2] *U.S. Army Corps of Engineers - Los Angeles District, "Hydrology for Feasibility Report, Ballona Channel and Sawtelle-Westwood Channel, California Los Angeles Drainage Area," February 1979.*

[3] *U.S. Army Corps of Engineers - Los Angeles District, "Hydrology for Feasibility Report, Ballona Channel and Sawtelle-Westwood Channel, California Los Angeles Drainage Area," February 1979.*

1.1.2.3 First Phase Project and Proposed Projects

1.1.2.3.1 Local Watersheds and Drainage Areas

The total tributary area of the adjacent Playa Vista First Phase Project and the Proposed Project, which includes the upstream areas that drain to the Property, encompasses approximately 1,056 acres. Figure 4 on page 8 shows the tributary watersheds and drainage areas associated with the adjacent Playa Vista First Phase Project and the Proposed Project sites. Off-site stormwater that flows onto the adjacent Playa Vista First Phase Project and the Proposed Project sites originates from storm drains, highways, natural drainage ways, and overland flow. The off-site tributary area north of the adjacent Playa Vista First Phase Project and the Proposed Project sites is highly urbanized with relatively little pervious surface area. The off-site tributary area south of the adjacent Playa Vista First Phase Project and the Proposed Project sites includes a portion of the Ballona Escarpment (Westchester Bluffs), Loyola Marymount University, and commercial uses along Lincoln Boulevard. Due to the existing urban nature of lands to the north, and the permanent open space (bluffs) and institutional use to the south (Loyola Marymount University), no notable changes in hydrology are expected to occur for baseline conditions in those areas upstream/upgradient of the adjacent Playa Vista First Phase Project and the Proposed Project. Within the adjacent Playa Vista First Phase Project and the Proposed Project sites, the existing undeveloped areas provide substantial surface detention for runoff generated by most storms. However, during exceptionally wet weather, such as multiple-day storms, the soil becomes saturated, surface depressions are filled, and a relatively high volume of runoff occurs (see additional discussion below regarding drainage facilities), causing wide areas of temporary ponding.

The drainage area studied is located south of the Ballona Channel and encompasses approximately 1,555 acres. Of this, approximately 614 acres are upstream of the adjacent Playa Vista First Phase Project (not including the Freshwater Marsh) and Proposed Project sites; approximately 442 acres are associated with the adjacent Playa Vista First Phase Project and Proposed Project sites; and, approximately 499 acres (including the Freshwater Marsh) are downstream of the adjacent Playa Vista First Phase Project and the Proposed Project sites. The general drainage pattern in areas south of Ballona Channel is south-to-north, and east-to-west. The majority of runoff is discharged to Ballona Channel through the Freshwater Marsh outlet constructed as part of the adjacent Playa Vista First Phase Project, and to the Ballona Wetlands (during storm events larger than the 1-year storm only) and existing flap-gated culverts within the wetlands, located approximately 1.25 miles west of the Proposed Project.

The drainage system that serves the Project site was designed to serve both the adjacent Playa Vista First Phase Project and the Proposed Project, as well as adjacent upstream areas; therefore, to accurately describe the drainage setting for the Proposed Project, it is important to present the conditions of the hydrologic study area prior to the development of the adjacent Playa Vista First Phase Project ("pre-First Phase Project). The Pre First Phase Hydrology Map in Section 5 illustrates the pre-First Phase hydrology in terms of tributary areas and related storm drains. As described above in Section 1.1, the drainage system designed for Playa Vista was designed and developed to serve both the First Phase Project and Proposed Projects; therefore, to accurately describe the drainage setting for the Proposed Project, it is important to present the pre-First Phase Project conditions of the hydrologic study area. The following describes the drainage facilities related to the pre-First Phase Project hydrology of the site.

1.1.2.3.2 Drainage Facilities

Ballona Channel

In the vicinity of the First Phase Project and Proposed Projects, the Ballona Channel is trapezoidal, with bottom widths varying from 80 to 200 feet and depths varying from 19 to 23 feet from the top of the levee. The side slopes are lined with concrete, paving stones, and riprap (i.e., rocks with boulders); the channel bottom is unpaved. The maximum flood capacity of Ballona Channel in the vicinity of the First Phase Project and Proposed Projects is estimated to be about 72,000 cubic feet per second (cfs).[4] The Ballona Channel falls within the jurisdictions of the County of Los Angeles and U.S. Army Corps of Engineers (USACE).The County utilizes a hypothetical 50-year storm for flood control design purposes. This design storm is substantially larger than the USACE design storms. As a comparison, for the Ballona Creek Watershed, the USACE 100-year flood has a peak flow of 56,000 cubic feet per second (cfs) and the USACE Standard Project Flood has a peak flow of 68,000 cfs. Both the USACE 100-year flood and the Standard Project Flood are less than the County's 50-year design flood of 69,800 cfs.

The design storm data for Ballona Channel has been compared against actual stream gauge data taken at the nearest stream gauge, F38C-R, located on Ballona Channel just above Sawtelle Boulevard (upstream of the Centinela Channel). Based upon the stream gauge data from the 1940's to 1990's, 10 floods above 18,000 cfs (translates to approximately 24,000 cfs at the site) have occurred. The largest storm on record of 32,500 cfs (estimated 40,000 cfs at the site) occurred on November 21, 1967. The largest recent storm occurred on March 10, 1995 – a peak flow 24,000 cfs was measured (estimated 30,000 cfs at the site). Maximum stage was 5.3 feet MSL at the site, and remained above 5 feet MSL for an hour. By comparison, the design storm (a hypothetical 50-year storm assumed for the sizing and design of flood control facilities, as described above) stays above 5 feet MSL for 4 hours. Accounting for peak and duration, the storm gauge data is well within the parameters of the design storm.

[4] *U.S. Army Corps of Engineers – Los Angeles District, "Hydrology for Feasibility Report, Ballona Channel and Sawtelle-Westwood Channel, California – Los Angeles Drainage Area," February 1979.*

Due to the highly urbanized nature of the Ballona Channel watershed, and debris control structures in undeveloped upstream areas, bedload (coarse natural materials including gravel and rocks) in the Ballona Channel is negligible. During large storms, manmade debris is often present in the runoff, collecting at bridge piers. Under pre-First Phase conditions, runoff from the site collected in low lying areas adjacent to the Ballona Channel, where sediment in the runoff settles.

Pre-First Phase Drainage Facilities

The major drainage facilities for the pre-First Phase Project conditions are described below and in Table 1 following.

Centinela Ditch – During pre-First Phase conditions, Centinela Ditch ran east-to-west along Teale Street (subsequently realigned and renamed Bluff Creek Drive). The upstream end of the ditch was near the east end of the former Howard Hughes Plant Site (Plant Site). It was an unlined, earthen, trapezoidal open channel from near the west end of the Plant Site to Lincoln Boulevard, and a variable-sized closed-conduit storm drain through the most of Plant Site. The ditch collected stormwater from existing developments on the Westchester Bluffs through several major and minor storm drain systems. It also drained the south portion of the adjacent Playa Vista First Phase Project and the Proposed Project sites and discharged into the East Wetland portion of the Ballona Wetlands. See Pre-First Phase Hydrology Map in Section 5.

Jefferson Boulevard Storm Drain – During pre-First Phase conditions, the Jefferson Boulevard Storm Drain ran along the centerline of Jefferson Boulevard from Randall Street to the East Wetland portion of the Ballona Wetlands. The upstream end of the drain was at the intersection of Centinela Avenue and Major Street. The storm drain was a variable-sized reinforced concrete box that was 8.5 feet wide by 5.75 feet high at Randall Street and 12 feet wide by 7.25 feet high at the outlet. During pre-First Phase conditions, the capacity of the Jefferson Boulevard storm drain at the pre-First Phase outlet to the Ballona Wetlands was estimated at 380 cfs. It is estimated that 50-year storm events would generate 457 cfs in the drain, which is greater than the capacity of the drain. Historically, this drain has been observed to flood in the vicinity of the intersection of Jefferson Boulevard and Centinela Avenue.

During pre-First Phase conditions, the Jefferson Boulevard Storm Drain collected stormwater from off-site developments north of Jefferson Boulevard, portions of the adjacent Playa Vista First Phase Project and the Proposed Project immediately adjacent to Jefferson Boulevard, and the area between Culver and Jefferson Boulevards, west of Lincoln Boulevard.

Table 1

PRE-FIRST PHASE DRAINAGE SYSTEM

Drainage System	Pre-First Phase Capacity (cfs)*	Tributary Area: Outside Playa Vista*	Within Playa Vista*	Total	50-Year Storm Event Runoff (cfs)
Centinela Ditch	210	250.9 ac	318.4 ac	569.3 ac	629
Jefferson Storm Drain	380	256.7 ac**	138.8 ac	395.5 ac	457
Lincoln Storm Drain South	210	91.8 ac	0 ac	91.8 ac	209
Playa Vista Tributary Total		599.4 ac	457.2 ac	1056.6 ac	1,295**
Ballona Wetlands – East		116.9 ac	31.8 ac	148.7 ac	245
Ballona Wetlands – North		162.1 ac***	0 ac	162.1 ac	322
Ballona Wetlands – South		188.1 ac	0 ac	188.1 ac	347
Ballona Wetlands Tributary Total		467.1 ac	31.8 ac	498.9 ac	914
Total		**1,066.5 ac**	**489 ac**	**1,555.5 ac**	**2,209****

* *Playa Vista defined as south of Ballona Channel inclusive of previously approved First Phase Project area and currently proposed Proposed Project area*

** *Due to confluence, the peak flow is not the sum of the peak runoff from the subareas. Acreage is totaled at outlet west of the Freshwater Marsh and includes 35.6 acres within the former residential planning area between Culver and Jefferson Boulevards, west of Lincoln Boulevard.*

*** *Includes 23.8 acres within the former residential planning area between Culver and Jefferson Boulevards, west of Lincoln Boulevard, that drains to the Freshwater Marsh outlet after construction of the First Phase Project*

Lincoln Drain South – Under pre-First Phase conditions, the outlet of the Lincoln Drain South discharged into the area where the Freshwater Marsh has been constructed on the west side of Lincoln Boulevard near Teale Street. The drain carried off-site flows from developments south of the adjacent Playa Vista First Phase Project and the Proposed Project and to the east and west of Lincoln Boulevard.

Ballona Wetlands – Under pre-First Phase conditions, runoff originating from within the wetland and upland areas located south of Ballona Channel and west of Lincoln Boulevard, portions of the Playa del Rey Bluffs, and the Playa del Rey area, was conveyed to the degraded Ballona Wetlands system. Once runoff reached the Ballona Wetlands, the runoff flowed to two channels that discharged into the Ballona Channel through flap-gate systems.

Within the Ballona Wetlands, limited-capacity (i.e., relatively shallow and/or narrow) channels carried low-flows through the three areas of the Ballona Wetlands. The three areas included the East Wetland, the South Wetland, and the North Wetland. During pre-First Phase conditions, the East Wetlands was primarily a freshwater system with ponding due to low points, while the North and South Wetlands were saltwater wetlands with well-defined channels. Low-flows passed through the areas of the Ballona Wetlands in an east-to-west direction through the East Wetland to the flap-gated outlets to Ballona Channel in the North Wetland. The capacity of existing culverts under a bermed Southern California Gas Company (SCGC) access road, which is the boundary between the East and South Wetlands, and under Culver Boulevard, which is the boundary between the South and North Wetlands, was limited. As such, under pre-First Phase conditions, the wetland areas acted like detention/filtration basins and the linear drainage pattern associated with the existing channels became undefined during flood events.

In addition, during the 50-year storm event, development along the west end of Culver Boulevard and the SCGC facilities at the toe of the Playa del Rey Bluffs were susceptible to flooding. Culver Boulevard was below the flood level of Ballona Channel. During high water stages in Ballona Channel, all stormwater runoff from the subject study area flowed into the Ballona Wetlands. Under the 50-year storm, portions of Culver Boulevard and possibly areas in adjacent Playa del Rey would be flooded because of their low elevation and insufficient stormwater detention capacity in the Ballona Wetlands. Similarly, Lincoln Boulevard at the Centinela Ditch was subject to flooding during major storm events when there was insufficient stormwater detention capacity in the Centinela Ditch culvert and area east of Lincoln Boulevard.

Existing Drainage Facilities

Since the adjacent Playa Vista First Phase Project has not been completed, the existing conditions represent an intermediate phase. Implementation of the adjacent Playa Vista First Phase Project, which includes completion of the Freshwater Marsh and the first phase of the Riparian Corridor, is altering the baseline conditions for land uses to the east and west of the Proposed Project site and the related drainage system. This subsection provides a comparison of the existing drainage facilities and pre-First Phase conditions. Portions of the adjacent Playa Vista First Phase Project remaining to be constructed are also described.

Centinela Ditch – All of the Centinela Ditch within the adjacent Playa Vista First Phase Project has been removed as a result of site preparation and construction activities in compliance with construction plans and permits approved by the USACE, California Department of Fish and Game (CDFG) and City of Los Angeles. Examples of these permits include USACE Permit No. 90-426-EV, CDFG 1603 Streambed Alteration Agreement No. 5-693-93, and applicable grading/stockpiling permits within the adjacent Playa Vista First Phase Project area. In addition, within the Proposed Project site, most of the ditch have been removed as part of the Erosion Control Plan approved by the City of Los Angeles, Department of Public Works, for the adjacent Playa Vista First Phase project. As under pre-First Phase conditions, the remainder of the ditch collects stormwater from existing developments on the Westchester Bluffs through several major and minor storm drain systems. Under existing conditions, it also drains the south portion of the site and discharges through a temporary detention basin (discussed below) into the Central Drain (approved and constructed as part of the adjacent Playa Vista First Phase Project) under Lincoln Boulevard and into the Freshwater Marsh. At completion of the adjacent Playa Vista First Phase Project, the eastern and western portion of the Riparian Corridor will have been constructed to replace the Centinela Ditch.

As part of the adjacent Playa Vista First Phase Project's Stormwater Pollution Prevention Plan (SWPPP) and Erosion Control Plan, the City of Los Angeles Department of Public Works has been approved the excavation and maintenance of temporary detention basins that have been created in the Proposed Project site (located south of Runway Road and generally west of Building 45). Temporary detention basins provide temporary storm drainage and control sediments for the adjacent Playa Vista First Phase areas currently under construction, west of the Proposed Project site, that will ultimately drain into the Riparian Corridor, as well as portions of the eastern portion of the adjacent Playa Vista First Phase Project site, which will ultimately drain to the Central Storm Drain or the Riparian Corridor. It is expected that the temporary drainage facilities will remain on the Proposed Project site pursuant to the SWPPP as may be modified from time to time.

Central Storm Drain (approved as a part of the adjacent Playa Vista First Phase Project) – The entire tributary area of the Central Storm Drain is within the boundaries of the adjacent Playa Vista First Phase Project and the Proposed Project. The upstream terminus of the drain is at the intersection of Artisans Way and Waterfront Drive in the eastern portion of the adjacent Playa Vista First Phase Project site. It drains east to west, extending along Waterfront Drive, Millennium Street, Runway Road, Pacific Promenade, and Playa Vista Drive and discharges into the Freshwater Marsh. The circular pipe ranges in diameter from 42 inches to 96 inches, with equivalent hydraulic capacity rectangular boxes used in some sections to provide utility clearances as necessary. The Central Storm Drain is in operation in the western portion of the adjacent Playa Vista First Phase Project area and is largely completed within the eastern portion of the adjacent Playa Vista First Phase Project site. The remaining (central) portion of the Central Storm Drain (under Runway Road), as approved as part of the adjacent Playa Vista First Phase Project, will be constructed as necessary for stormwater management.

Jefferson Boulevard Storm Drain –As part of the adjacent Playa Vista First Phase Project, the Jefferson Boulevard Storm Drain west of Lincoln Boulevard was abandoned and a new section was built to divert the Jefferson Boulevard Storm Drain runoff into the Freshwater Marsh (instead of the Ballona Wetlands). The northeast corner of the Lincoln and Jefferson Boulevard intersection constructed with the adjacent Playa Vista First Phase Project also drains into the Jefferson Boulevard Storm Drain. These changes will not result in any increased flows (i.e., additional backup of water) in the Jefferson Boulevard Storm

Drain. It is estimated that 50-year storm events with the adjacent Playa Vista First Phase Project and the Proposed Project would generate 404 cfs in the drain, which is less than the estimated 457 cfs generated under a 50-year storm event with the pre-First Phase Project. With these modifications, all runoff from new development within the adjacent Playa Vista First Phase Project and the Proposed Project will be routed through the Freshwater Marsh. All approved modifications to the Jefferson Boulevard Storm Drain have been completed.

Lincoln Drain South – The Lincoln Drain South is the same under existing conditions as it was under pre-First Phase conditions, except a concrete swale[5] drains the flow northerly along Lincoln Boulevard and outlets into the Freshwater Marsh. Once the western portion of the Riparian Corridor has been completed, as approved for the adjacent Playa Vista First Phase Project, the Lincoln Drain South will be rerouted to drain into the Freshwater Marsh via the Riparian Corridor culvert under Lincoln Boulevard, thus completing the approved modifications.

Freshwater Marsh (approved as part of the adjacent Playa Vista First Phase Project) – Prior to construction of the Freshwater Marsh, 100% of untreated runoff flows from the 1,555-acre tributary watershed drained directly into the Ballona Wetlands and then into the Ballona Channel. The Freshwater Marsh is one of the two major components of the overall Freshwater Wetlands System that was designed and subsequently permitted by the relevant governing agencies as a comprehensive system to enable the adjacent Playa Vista First Phase Project and the Proposed Project, at buildout, to 1) control the amount of freshwater flowing to the Ballona Wetlands and Ballona Channel; 2) substantially reduce the amount of surface water pollutant loads to the Ballona Wetlands; and, 3) achieve a no net increase in pollutant loads to the Ballona Channel and Santa Monica Bay (see Volume I, Section 3,Water Quality, for a discussion of the last two points). The Freshwater Marsh has been designed to receive stormwater and dry weather runoff from the Jefferson Boulevard Storm Drain, the Central Storm Drain, the Riparian Corridor, and the Lincoln Drain South. These drainage systems outlet into the Freshwater Marsh at pre-treatment catchment areas.

The Freshwater Marsh serves as a mean to divert freshwater flows from exiting and new development away from the existing Ballona Wetlands salt marsh. During most runoff events, the Freshwater Marsh will discharge into Ballona Channel directly through flap-gated culverts; however, an overflow spillway is provided into the Ballona Wetlands to divert major storm flows (over 1-year storm levels). The Freshwater Marsh is divided from the Ballona Wetlands by a berm. The slopes of the berm vary from 10:1 to 5:1 horizontal-to-vertical in order to promote the establishment of wetland vegetation and provide biological protection against erosion of the berm. A design feature of the Freshwater Marsh allows flexibility to release freshwater to the Ballona Wetlands through a gated valve should it be necessary in conjunction with the design or maintenance of the salt marsh. Under

[5] *A concrete swale is a shallow trough-like depression that carries water.*

it be necessary in conjunction with the design or maintenance of the salt marsh. Under normal conditions, storm flows greater than a 1-year storm will flow over the overflow spillway into the existing Ballona Wetlands. The storm overflow drains through the East, South, and North Wetland portions of the Ballona Wetlands and outlets into Ballona Channel. Only the southern portion of the Freshwater Marsh (approximately 8 acres) currently remains to be constructed. Completion of the Freshwater Marsh, as approved for the adjacent Playa Vista First Phase Project, is expected in 2004.

Area Northwest of Lincoln/Jefferson Intersection – The area between Culver and Jefferson Boulevards, west of Lincoln Boulevard, which used to drain into the Jefferson Boulevard Storm Drain, now drains directly into the Freshwater Marsh outlet when the flapgates at Ballona Channel are open. The flapgates remain open as long as the Freshwater Marsh is hydraulically higher than the Ballona Channel. When the flapgates close (normally this would occur during major storm events) temporary ponding in the area would occur until the flapgates reopen. All modifications to this area have been completed.

Ballona Wetlands – The Ballona Wetlands are very similar under existing conditions compared to pre-First Phase conditions except that the Freshwater Marsh regulates upstream flows entering the wetlands. The capacities of existing culverts under a bermed SCGC access road, which is the boundary between the East and South Wetlands, and under Culver Boulevard, which is the boundary between the South and North Wetlands, are limited. As a result, the wetlands act like detention/filtration basins and the linear drainage pattern associated with the existing channels becomes undefined during flood events. The East Wetlands are primarily a freshwater system, subject to long-term ponding due to low points within the wetland areas. The North and South Wetlands are saltwater wetlands, with well-defined channels. A USACE Section 1135 Project was recently constructed to modify the existing flap-gated culverts between Ballona Channel and the North Wetlands to allow increased tidal exchange within the existing tidal channels of the Ballona Wetlands. Tidal flow is maintained within the existing tidal channels, and the Section 1135 Project does not substantially affect the flood hydrology.[6]

[6] *The USACE recently completed construction of a project within the northerly area of the Ballona Wetlands known as "The Ballona Wetlands Section 1135 Ecosystem Restoration Project" (Section 1135 Project). The Section 1135 Project included the retrofitting of two of three existing 60-inch corrugated metal pipe culverts located on the south levee of the Ballona Creek Flood Control Channel (Ballona Channel). The culvert retrofit consisted of the attachment of two self-regulating tide-gates (mechanical devices that automatically open and close based on tidal water levels) to the existing culverts at the eastern drainage channel from the Ballona Wetlands (North Wetlands). The water surface elevation in the tidal channels will range from 0.8 feet MSL to 1.2 feet MSL. During flood conditions, the tidal gates will close, preventing storm flows from entering the Ballona Wetlands from Ballona Channel.*

1.2 IMPACT ANALYSIS

1.2.1 Surface Water Hydrology

1.2.1.1 Methodology

The City of Los Angeles Standard Peak Rate Method is used for the computation of stormwater runoff from the Proposed Project site and from areas that are tributary to the site as its potential prediction methodology is the most conservative of the jurisdictional agencies. The Peak Rate Method is a derivative of the classic Rational Method and was developed in the late 1930s by the City of Los Angeles for applications in the Los Angeles Basin.

The basis of the design is the "pattern storm," which is a 50-year return-frequency 24-hour rainfall producing 6.8 inches of rain. This storm is preceded by three days of rainfall producing 10 %, 40 %, and 35 % of the rain of the pattern storm.

Calculations for sizing the storm drains were performed as required by the City of Los Angeles, Bureau of Engineering. The peak 50-year runoff rate was used to approximate higher frequency events (i.e., 1, 2, 5, 10, 20, and 25-year events) for comparison. The SWMM-XP (Storm Water Management Model) computer program, originally developed by the EPA, was used to model flood and tidal flow in the Ballona Channel and Ballona Wetlands, as well as storm flow in the Freshwater Marsh.

For the purpose of this EIR, the impacts analysis considers as a whole the pre-First Phase condition against the Second Phase condition. The analysis also indicates the incremental changes between First Phase Project conditions and Proposed Project conditions. As a part of the stormwater system designed and approved as part of the First Phase Project, the Freshwater Wetlands System was designed to convey and detain the flow from both the First Phase Project and Proposed Projects without adversely impacting existing facilities upstream and downstream. Hence, for the overall Proposed Project impacts analysis, the Freshwater Wetlands System is utilized as a Project Design Feature for the First Phase Project and Proposed Projects.

Linked spreadsheet programs were developed for Initial Time of Concentration (t_c), Area Conversions (A_c), and Runoff (Q_{50}) computations, and for the presentation of the computations in a form that is required by the City of Los Angeles, Bureau of Engineering. The results of these computations are a time of concentration (t_c) and a 50-year peak flow (Q_{50}) value at key points of the storm drain system. These values have been used to size the storm drains. In order to compare runoff rates from different storm events, a storm frequency factor was applied to the peak 50-year runoff rate to approximate the higher frequency events (i.e., 1, 2, 5, 10, 20, and 25-year events). These runoff rates are theoretical and will differ from runoff rates developed by a statistical analysis of local rainfall records.

The theoretical runoff rates are based upon fully saturated conditions, and are typically conservative. Additionally, hydrographs were calculated at key concentration points to determine the total storm runoff volume generated by the various storm events.

The existing, offsite, and Phase I calculations were based upon calculations previously prepared by Psomas and included in other reference documents. In order to maintain consistency, the documents are included in their original form. For the Proposed Project, a Geographic Information System (GIS) data base was developed for the hydrological boundaries and land uses. The total watershed acreage has remained the same, however, some change in distribution between the watershed have occurred. Since the changes were minimal, and did not affect the modeling, the runoff rates were adjusted by prorating the unit runoff rate over the change in acreage.

The SWMM-XP (Storm Water Management Model) computer program, originally developed by the EPA, is a rainfall runoff model that can determine the quantity and quality of runoff due to a specific rainfall event. The SWMM-XP was used to model flood and tidal flow in the Ballona Channel and Ballona wetlands, as well as storm flow in the Freshwater Marsh.

The flow over the Freshwater Marsh Weir was determined from the Storm Water Management Model (SWMM) models developed for the Playa Vista Project and Ballona Wetlands. The models used the Extran module of SWMM to model the hydraulic features of the wetlands. A large body of literature on the theory and case studies is available, partly documented in a bibliography of SWMM-related publications and elsewhere. The model has been used for very complex hydraulic analysis for many stormwater management planning studies and pollution-abatement projects. There are many instances of successful calibration and verification of the model. Extran was chosen for the wetlands modeling because it contains a wide range of hydraulic options that are not available in most other modeling software packages. The specific features of Extran include the capability to route unsteady flow through a network of open and closed conduits; to model flow over weirs, through orifices, flapgated outlets and pumps; and to utilize tidal influences and backwater curves.

To construct each model, the flow of water in Ballona Creek and throughout the wetlands was represented by a series of links and nodes. The channels in the wetlands were represented by links, with the nodes defining the upstream and downstream ends of the channels. The links and nodes information for the existing model was generated from existing topography, record drawings and field investigations. The links and nodes information for the models of the proposed projects were generated from a combination of the information obtained for the existing information, along with the proposed grading and drainage plans for the proposed development.

The Flow over the FWM weir was determined from SWMM model runs for each of the Phase II storms (1, 2, 5, 10, 25, and 50-year. The resulting hydrographs for flow over the FWM weir into the East Wetlands gave the peak flow, and the area under the hydrograph gave the volume of the flow into the wetlands. Since Phase I models were not available, the Phase I values were determined by scaling the Phase II hydrographs by the ratio of the Phase I and Phase II peak water surface elevations.

Key assumptions and design criteria used in the analysis are summarized as follows:

Design Criteria

Runoff Computations:	Peak Rate Method (a derivation of the Rational Method) as described in the City of Los Angeles, Bureau of Engineering Manual Part G, Storm Drain Design.
Design Storm:	50-year return-frequency pattern storm as defined in the above manual
Isohyetal:	ISO = 1.33 inches per hour, maximum one-hour rainfall uniform throughout the site
Soil Types:	Type 1 - Clay - entire project site, except bluffs Type 2 - Loam - off-site areas and bluffs
Development Classification:	As shown on current City of Los Angeles Zoning maps for existing developments, and proposed zoning for the project site.
Imperviousness:	Definition of imperviousness by land use (I_d) is based on development classifications as indicated in Figure G 241.3 of the Storm Drain Design Manual for each land use on described.

Project-Specific I_d Values:		I_d = 35% Undeveloped bluff areas, proposed parks along Riparian Corridor, and parks on-site
	I_d = 50%	Engineered slopes on bluffs with concrete benches and drains
	I_d – 60%	R2 residential developments
	I_d = 70%	R3 residential developments and R1 single-family developments within designated hillside areas (Westchester and Playa del Rey)
	I_d = 100%	R4 and R5 residential, all commercial developments, schools, and wetland areas where inundation of the land is expected for an extended period of time

Initial Time of Concentration: Figures G 242.2 A through D for developed areas from the Storm Drain Design Manual and Figure G 262 (Kirpich Nomogram) for undeveloped hillside areas

Flow Routing: Travel-time computations based on normal depth flow in streets, open channels, and closed conduits when backwater effects may not result in sealed flow conditions. Full pipe flow was assumed in existing storm drains when the design runoff rate was larger than the capacity of the conduit. Flow velocity is calculated assuming a pipe flow equal to the capacity of the conduit.

$V - Q_c/A$

Excess runoff was assumed to flow or pond in the street above the conduit

Conduit Capacity:

$Qc = K\ Sf^{0.5}$, where

Sf = 0.9* Sinvert, if street slope is not continuous (sumps, e.g., Jefferson Boulevard)

Sf = 0.9* Sstreet, if street slope is continuous (e.g. no sumps)

and $$K = \frac{1.486\ A*R^{2/3}}{n}$$

A = cross-sectional area of flow

R = wetted perimeter

Manning's Roughness:

Based upon the City of Los Angeles Storm Drain Design Manual:

n = 0.013 for streets and all concrete storm drains

n = 0.050 for existing trapezoid earthen channels with natural vegetation

Composite roughness value was calculated for the trapezoidal channel of the Riparian Corridor based on preliminary restoration plans assuming cattail planting on the bottom and willow planting on the side slopes of the channel, assuming:

n = 0.050 for bottom of the channel

n = 0.125 for side slopes of trapezoid section

n = 0.030 for vertical sides of rectangular sections

Hydrograph Development: Peak Rate Method is used for the entire project except for detention computations or input data for the hydrodynamic computer model of the wetlands. Where needed, hydrographs were developed as described below.

Hydrograph development is based on Figure G 252F of the Storm Drain Design manual.

Hydrodynamic Model: EXTRAN SWMM developed by the USEPA

1.2.1.2 Significance Thresholds

The Draft Los Angeles CEQA Thresholds Guide (p. D.1-3) states that a project would normally have a significant impact on surface water hydrology if it would:

- Cause flooding during the projected 50-year developed storm event, which would have the potential to harm people or damage property or sensitive biological resources;
- Substantially reduce or increase the amount of surface water in a waterbody; or
- Result in a permanent, adverse change to the movement of surface water sufficient to produce a substantial change in the current or direction of water flow.

These thresholds are applicable to the Proposed Project and as such are used to determine if the Project would have significant surface water hydrology impacts.

1.2.1.3 Project Design Features

Development of the adjacent Playa Vista First Phase Project and the Proposed Project includes numerous improvements to the existing storm drain system and other design features (i.e., Freshwater Wetlands System) intended to address potential hydrology impacts. The Freshwater Wetlands System (the majority of which was approved and permitted in conjunction with the adjacent Playa Vista First Phase Project) is a Project Design Feature that was intended as a comprehensive system to manage the stormwater flows and water quality requirements for both the adjacent Playa Vista First Phase Project and the Proposed Project. Some of the existing off-site drainage facilities, such as the Lincoln Drain South and connecting systems, have been designed to standards that are larger than the 50-year storm. To assure new improvements do not adversely impact existing facilities, the proposed drainage facilities improvements have been designed to handle the expected future on- and off-site stormwater flows and avoid adverse impacts to existing facilities. The following describes the most notable improvements that occur as Project Design Features.

The hydraulic capacity of the Jefferson Boulevard Storm Drain is not considered to meet the City of Los Angeles' current design standards. The proposed grading, including that which has already been completed as part of the adjacent Playa Vista First Phase Project, has been designed to minimize on-site drainage to the adjacent vegetated slope areas of Jefferson Boulevard, thereby reducing stormwater runoff towards the limited-capacity Jefferson Boulevard Storm Drain. Additional storm drain capacity would be provided on-site. In addition to the existing Jefferson Boulevard Storm Drain, two new major stormwater management facilities (both approved as part of the adjacent Playa Vista First Phase Project) – the Riparian Corridor and the Central Storm Drain – would provide drainage for the adjacent Playa Vista First Phase Project and the Proposed Project. A portion of the Riparian Corridor within the Proposed Project would be constructed as a part of the Proposed Project. All three major storm drains would discharge into the Freshwater Marsh located at the easterly boundary of the Ballona Wetlands. The following describes more specifically the drainage system improvements that would serve as Project Design Features for the Proposed Project:

Lincoln Drain South (approved as a part of the adjacent Playa Vista First Phase) – As a part of the adjacent Playa Vista First Phase Project, the outlet of the existing Lincoln Drain South will be relocated to the Freshwater Marsh. The drain will intercept off-site flow from the existing developments south of the adjacent Playa Vista First Phase Project and the Proposed Project, and to the east and west of Lincoln Boulevard.

Freshwater Marsh (approved as part of the adjacent Playa Vista First Phase) –The stormwater system associated with the previously approved Playa Vista First Phase Project was designed, sized, permitted, and constructed to serve both the adjacent Playa Vista First Phase Project and the Proposed Project. A key component of the stormwater system is the Freshwater Marsh located southwest of the intersection of Lincoln and Jefferson Boulevards. As such, it is included as a Project Design Feature related to the Proposed Project. The Freshwater Marsh has been designed to receive stormwater runoff from the Jefferson Boulevard Storm Drain, the Central Storm Drain, the Lincoln Drain South, and Riparian Corridor. These drains outlet into the Freshwater Marsh at primary management areas. Normally the Freshwater Marsh discharges into Ballona Channel through flap-gated culverts. however, an overflow spillway is provided into the Ballona Wetlands to divert portions of storm flows greater than the 1-year storm. Maximum water level during a 50-year return-frequency storm in the Freshwater Marsh is limited to about 8 feet above MSL in order to eliminate adverse backwater effects in the existing Jefferson Boulevard Storm Drain. The Freshwater Marsh is divided from the Ballona Wetlands by a berm. The slopes of the berm vary from 10:1 to 5:1 horizontal-to-vertical in order to promote the establishment of wetland vegetation and provide biological protection against erosion of the berm. The Freshwater Marsh is designed to contain and convey to the Ballona Channel all storms up to approximately a one-year storm[7] and has the flexibility to release freshwater to the Ballona Wetlands through a gated valve should it be necessary in conjunction with any future salt marsh restoration. This aspect of the Freshwater Marsh serves as a means to divert uncontrolled freshwater flows away from the adjacent salt marsh area, preventing the continued degradation of the salt marsh habitat that resulted from the uncontrolled freshwater inflows, and enabling future restoration of the salt marsh area.

Riparian Corridor (east and west portions approved as a part of the adjacent Playa Vista First Phase Project - central portion proposed as part of the Proposed Project) The approximately 25-acre Riparian Corridor, including the 18.3 acres approved as part of the adjacent Playa Vista First Phase Project, will drain east to west and collect water from the south part of the adjacent Playa Vista First Phase Project and the Proposed Project sites and from existing developments on the Westchester Bluffs east of Lincoln Boulevard. In essence, the Riparian Corridor will be a relocated and greatly enhanced replacement of the Centinela Ditch. It is planned to be a wide, open channel in a naturalized setting between the toe of the Westchester Bluffs and proposed Bluff Creek Drive. The design of the typical section of the channel is trapezoidal, with 3:1 horizontal-to-vertical side slopes up to the 50-year design water level, and 2:1 slopes above. The bottom width varies from approximately 5 to 90 feet, while maximum water depth varies from approximately 3 to 7 feet. Cattails or other suitable vegetation will be established in the bottom of the channel and willow shrub will be planted on the side slopes. The eastern and western portions of the Riparian Corridor were approved, and will be constructed, as part of the adjacent Playa Vista First Phase Project.

Although the Riparian Corridor will be vegetated as described above, the Corridor has been designed to provide sufficient hydraulic capacity to accommodate the runoff from the adjacent Playa Vista First Phase Project and Proposed Project. A program will be implemented in order to maintain the required hydraulic capacity of the channel (e.g., limit large trees from establishing within the channel and removing vegetation selectively).

Central Storm Drain (approved as a part of the adjacent Playa Vista First Phase Project) The entire tributary area of the Central Storm Drain is within the boundaries of the adjacent Playa Vista First Phase Project and the Proposed Project development. The

[7] *The one-year storm is estimated to be 723 cfs and the 50 year storm is approximately 1,690 cfs.*

upstream terminus of the drain will be at the intersection of Artisans Way and Waterfront Drive in the eastern portion of the adjacent Playa Vista First Phase Project. The Central Storm Drain will drain east to west, extending along Waterfront Drive, Millennium Street, Runway Road, Pacific Promenade, and Playa Vista Drive and will discharge into the Freshwater Marsh. The planned circular pipe conduit will range in diameter from 42 inches to 96 inches, with equivalent hydraulic capacity rectangular boxes used in some sections to provide utility clearances as necessary. Portions of the Central Storm Drain are currently being constructed as part of the adjacent Playa Vista First Phase Project.

Jefferson Boulevard Storm Drain – The Jefferson Boulevard Storm Drain is an existing system as it was modified as part of the adjacent Playa Vista First Phase Project and will not be modified east of Lincoln Boulevard under the Proposed Project.

Area Northwest of Lincoln/Jefferson Intersection - The area located between Culver and Jefferson Boulevards, west of Lincoln Boulevard, that previously drained into the Jefferson Boulevard Storm Drain was modified as part of the Playa Vista First Phase Project to drain into the Freshwater Marsh outlet through flap-gated culverts, thereby relieving the existing Jefferson Boulevard Storm Drain. During periods of high flow within Ballona Channel, the flap gates at Ballona Channel will close, causing flow to pond within the Freshwater Marsh and its outlet. Separate flap gates within the Freshwater Marsh outlet prevent flow from the Freshwater Marsh from discharging in the adjacent wetlands area. For short periods, runoff will pond in the area located between Culver and Jefferson Boulevards, west of Lincoln Boulevard, as with pre-First Phase and existing conditions.

1.2.1.4 Project Impacts – Surface Water Hydrology

1.2.1.4.1 Urban Development Component

1.2.1.4.1.1 Potential for Flooding

Development within the Urban Development area would increase the amount of impervious surface area on-site, consequently increasing total peak runoff rates and volumes. The following subsections describe the potential of the Urban Development Component of the Proposed Project to cause flooding during a projected 50-year storm event, which would have the potential to harm people or damage property.

Drainage facilities constructed as part of the adjacent Playa Vista First Phase Project have been sized for the full buildout of the adjacent Playa Vista First Phase Project and the Proposed Project. Since the drainage facilities have been designed based upon the installation of paved and impervious surfaces, portions of the site which are pervious during construction of the Urban Development Component would not increase stormwater runoff flows above the ultimate design flows. The construction of new drainage structures would be required in a manner and sequence, which would preclude flooding. During construction of the Proposed Project, a Stormwater Pollution Prevention Plan and Erosion Control Plan would be implemented to provide for temporary Stormwater management. These plans would prevent construction from adversely affecting the amount of surface water in a waterbody. Therefore, construction activities for the Urban Development Component would not cause flooding during a projected 50-year developed storm event, which would have the potential to harm people or damage property.

Table 2 provides a comparison of 1-, 2-, 5-, 10-, 25-, and 50-year stormwater runoff volumes for pre-First Phase conditions, Playa Vista First Phase conditions, and future conditions with completion of the Proposed Project (i.e., with buildout of the adjacent Playa Vista First Phase Project and the Proposed Project). As shown in the table, the future runoff to existing drainage systems, such as the Centinela Ditch, which is replaced by the Riparian Corridor and Central Storm Drain, would be reduced from that of pre-First Phase Project conditions. Such reductions to existing drainage systems are enabled through the rerouting of existing flows and the addition of new drainage systems (i.e., Central Storm Drain) as part of the adjacent Playa Vista First Phase Project and the Proposed Project. Table 3 on page 33 provides a comparison of the 50-year storm peak runoff rates for pre-First Phase, with Playa Vista First Phase Project conditions and with Playa Vista First Phase Project and Proposed Project. With the completion of storm drains and facilities designed and built to accommodate the adjacent Playa Vista First Phase Project and Proposed Project, the existing local storm drains would not be significantly impacted by changes in surface runoff flows due to implementation of the Urban Development Component because the Proposed Project would not cause flooding of the existing local storm drains during the projected 50-year developed storm event, which would have the potential to harm people or damage property. Therefore, no adverse impacts to the existing storm drain systems (e.g., Jefferson Storm Drain) would occur because the existing drainage system controls would be maintained or improved to be at or better than pre-First Phase conditions. For example, because the Freshwater Marsh will be maintained below 8 feet above MSL, it will also serve as detention. Downstream hydraulic controls (outlet water surface elevations) would be maintained at or below existing levels. Peak runoff to the systems would be maintained at or below existing levels by detention or reduction of the area tributary to the drain.

Table 2
Stormwater Flows to the Freshwater Marsh and Ballona Wetlands

	Amount of Total Runoff Flow (in acre-feet)					
	50-Year Storm	25-Year Storm	10-Year Storm	5 Year Storm	2-Year Storm	1-Year Storm
Pre-First Phase[a]						
Jefferson Storm Drain [b,c]	399	358	304	263	195	171
Centinela Ditch at Boundary of Proposed Project [d]	461	414	351	304	225	197
Centinela Ditch at Lincoln Boulevard	550	494	419	362	268	235
Lincoln Drain South [b]	90	81	69	59	44	39
Total of Above Drains/Ditch Flowing to Ballona Wetlands	1039	933	792	685	507	445
Total Other Tributary to Ballona Wetlands [e,f]	636	571	485	419	310	272
Total to Ballona Channel	1,675	1,504	1,276	1,104	817	717
With Playa Vista First Phase Project						
Jefferson Storm Drain [b]	293	263	223	193	143	125
Central Storm Drain [g]	201	180	153	132	98	86
Riparian Corridor at Boundary of Proposed Project [d,g]	464	417	354	306	226	199
Riparian Corridor at Lincoln Boulevard [g]	546	490	416	360	266	234
Lincoln Drain South [b]	90	81	69	59	44	39
Freshwater Marsh Direct Flow [g]	41	37	31	27	20	18
Total Tributary Flowing into Freshwater Marsh to Ballona Channel[h]	1,171 (139)	1,051 (104)	892 (61)	771 (32)	571 (5)	502 (0)
Total Tributary to Ballona Wetlands [e,i]	618	555	471	407	302	265
Total to Ballona Channel	1,789	1,606	1,363	1,178	873	767
With Playa Vista First Phase Project and Proposed Project						
Jefferson Storm Drain [b]	293	263	223	193	143	125
Central Storm Drain [g]	221	198	168	146	108	95
Riparian Corridor at West Boundary of Proposed Project [d,g]	417	374	318	275	203	178
Riparian Corridor at Lincoln Boulevard [g]	531	477	405	350	259	227
Lincoln Drain South [b]	90	81	69	59	44	39
Freshwater Marsh Direct Flow [g]	41	37	31	27	20	18
Total Tributary Flowing into Freshwater Marsh to Ballona Channel[h]	1,176 (149)	1,056 (122)	896 (77)	775 (48)	574 (11)	504 (0)
Total Tributary to Ballona Wetlands [e,i]	618	555	471	407	302	265
Total to Ballona Channel	1,794	1,611	1,367	1,182	876	769

[a] *Pre First Phase conditions represent runoff characteristics prior to construction of the stormwater system that is designed to serve both the First and the Proposed Projects*

[b] *Existing storm drain to remain.*

[c] *Outlet is located in the area near the intersection of Culver and Jefferson Boulevards, west of Lincoln Boulevard. The area located between Culver and Jefferson Boulevards, west of Lincoln Boulevard, drains into the Jefferson Storm Drain.*

[d] *Drain not included in tributary total because runoff flow indicates flow at an intermediate point. These flows are cumulative with the flows at the Centinela Ditch/Riparian Corridor at Lincoln Boulevard.*

[e] *Not including Freshwater Marsh flows over weir to Ballona Wetlands*

[f] *Includes the Freshwater Marsh area.*

[g] *Storm drain facility to be improved, modified, or constructed as part of the adjacent Playa Vista First Phase Project and the Proposed Project.*

[h] *Portion of the peak runoff from the all storm events over 1-year in the Freshwater Marsh flows over weir to Ballona Wetlands then out to Ballona Channel are shown in parenthesis. These numbers represent the "Overflow from the Freshwater Marsh to Ballona Wetlands" portion of the calculations in Table 4.*

[i] *This includes the area located between Culver and Jefferson Boulevards, west of Lincoln Boulevard, which drains directly to the Freshwater Marsh outlet to Ballona Channel.*

Table 3

50-YEAR PEAK RUNOFF RATES

	Design Capacity (cfs)			50-year Storm Event Peak Runoff (cfs)		
Drainage System	**Pre-First Phase***	**With Playa Vista First Phase Project**	**With Playa Vista First Phase & Proposed Project**	**Pre-First Phase ***	**With Playa Vista First Phase Project**	**With PlayaVista First Phase & Proposed Project**
Jefferson Storm Drain [b,c]	380	380	380	457		
Centinela Ditch	210	N/A	N/A	629	403.6	403.6
Centinela Ditch at Lincoln Boulevard	210	N/A	N/A	528		
Lincoln Storm Drain South [b]	210	210	210	209	209	209
Central Storm Drain [d]	N/A	328	328		237	312
Riparian Corridor at West Boundary of Proposed project [d]	N/a	625	625		625	608
Riparian Corridor at Lincoln Boulevard [d]	N/a	625	625		549	549
Freshwater Marsh [d]	N/A[e]	N/A[e]	N/A[e]		103.7	103.7
Overflow from Freshwater Marsh to Ballona Wetlands [f]					1036	1066
Ballona Wetlands [g]				914	916.9	916.9
Total Peak Runoff to the Ballona Wetlands				**2209**	**1953**	**1983**

cfs – cubic feet per second
N/A – Not Applicable

* *Pre-First Phase conditions represent runoff characteristics prior to construction of stormwater system that is designed to serve both the adjacent PlayaVista First Phase and the Proposed Project development project*

a *The design capacity is based on the total peak runoff generated by the adjacent Playa Vista First Phase Project or with the Playa Vista First Phase and Proposed Project, whichever is greater. Should additional capacity be necessary during final design and engineering, the design capacity of the drainage system, as determined and approved by the City, may vary from that shown in this table.*

b *Existing storm drain to remain*

c *During pre-First Phase, the outlet to the Jefferson Storm Drain is located near the intersection of Culver and Jefferson Boulevards, but will drain at Lincoln/Jefferson Boulevards into the Freshwater Marsh (as part of the adjacent Playa Vista First Phase Project). The area located between Culver and Jefferson Boulevards, west of Lincoln Boulevard, drains in Jefferson Storm Drain during pre-First Phase*

d *New storm drains or facilities that were designed and built to accommodate runoff from the adjacent Playa Vista First Phase Project and Proposed Project.*

e The Freshwater Marsh is an open water body that has a volume capacity, not a design capacity.

f Portion of the peak runoff that flows from the Freshwater Marsh over weir to the Ballona Wetlands.

g Portion of the peak runoff from the 50-year storm event in the Freshwater Marsh overflows over weir to Ballona Wetlands then out to Ballona Channel (not included in this number, but separately under footnote "f").

As described above, no development portion of the Proposed Project is within the FEMA 100-Year Floodplain. The proposed drainage system for the Urban Development Component has been designed to convey increases in total peak runoff rates and volumes caused by the Proposed Project and provide an appropriate level of on-site flood protection, detention, and drainage. The major flood control facilities that would serve the Urban Development Component include the Freshwater Wetlands System (Freshwater Marsh and Riparian Corridor), Central Storm Drain, and local drainage systems. As such, the Urban Development Component partially depends on the Riparian Corridor constructed as part of the Habitat Creation/Restoration Component to provide adequate drainage. Therefore, construction of the proposed drainage system would be phased to adequately receive any increase in peak runoff rates or volumes that could adversely affect any existing or planned development. During final design and engineering, the proposed drainage system for the Proposed Project will be sized to provide adequate flow capacity, as determined by the City. The proposed drainage system would be designed and sized such that the Project-generated runoff would not exceed the maximum capacity of the existing system. With the construction and operation of the proposed drainage systems, the Urban Development Component would not cause flooding on-site during the projected 50-year developed storm event, which would have the potential to harm people or damage property, and no therefore, no significant impacts are expected to occur relative to flooding of new or existing development.

The Urban Development Component would also not cause flooding during the projected 50-year developed storm event to the off-site existing tributary area. As discussed above, the proposed drainage system for the Urban Development Component has been designed to convey increases in total peak runoff rates and volumes caused by the Proposed Project. As also generally seen in Tables 2, 3 and 4 respectively, the Proposed Project would add a minimal amount of total peak runoff and volumes above that of the adjacent Playa Vista First Phase Project. Although during major storm events there is some overflow from the Freshwater Marsh into the Ballona Wetlands, the total runoff actually reaching the Ballona Wetlands decreases from the pre-First Phase condition as shown in Table 4.

One SUSMP structural BMP requirement requires that a project "control peak flow discharge to provide stream channel and over bank flood protection, based on flow design criteria selected by the local agency." The City of Los Angeles' storm drain design criteria require any storm drain in a natural drainage course to be designed to control the 50-year storm event. This structural BMP requirement refers to the Proposed Project's potential to flood or cause erosion to the Riparian Corridor or the Ballona Channel. As part of the adjacent Playa Vista First Phase Project, the Riparian Corridor is a new channel designed to convey the 50-year storm event and the 50-year flow rate is predicted to remain at 549 cfs after completion of the Proposed Project (see Table 3). Therefore, the Riparian Corridor would meet the SUSMP requirement of no increase in peak stormwater discharge rate after development. Runoff from the Proposed Project is detained in the Freshwater Marsh prior to draining to the Ballona Channel or being diverted to the wetlands during peak storm events, thus providing flood protection to the Ballona Channel. The Ballona Channel invert is below mean sea level and the channel banks are approximately 16 feet above MSL at the lowest level at Playa del Rey and 20 feet above MSL at the Freshwater Marsh outlet. The maximum water surface elevation in the Freshwater Marsh is 8 above MSL. Therefore, flow from the Proposed Project does not cause the Ballona Channel to overtop its banks. In addition, the Ballona Channel is an improved and lined channel; therefore, erosion is not a major concern. In fact, the hydraulic cross-section of Ballona Channel is dependent upon the high storm flows removing the sediment and silt that settle above the channel invert due to interaction with Santa Monica Bay.

Table 4
Total Peak 50-year Runoff Rates and Volumes of Total Flows to the Ballona Wetlands

Phase	Peak 50-year Peak Runoff Rates to the Ballona Wetlands (cfs)[a]	Peak 50-Year Peak Runoff Volumes to the Ballona Wetlands (acre-feet)[b]
Pre-First Phase	2,209	1,675
With Playa Vista First Phase	1,953	757
With Playa Vista First Phase and Proposed Project	1,983	767

cfs – cubic feet per second
[a] *Ballona Wetlands + Overflow from Freshwater Marsh to Ballona Wetlands (see Table 3)*
[b] *Total Tributary to Ballona Wetlands + Overflow from Freshwater Marsh to Ballona Wetlands (see Table 2, footnote "h")*

Although the development of the Urban Development Component would result in an increase in peak runoff rates and volumes on-site, no observable increase in peak flood flows in Ballona Channel during the projected 50-year developed storm event would occur due to detention facilities and rerouting of flows within the adjacent Playa Vista First Phase Project and the Proposed Project. The Freshwater Wetlands System (Freshwater Marsh and Riparian Corridor) would serve as the primary detention facility for the adjacent Playa Vista First Phase Project and the Proposed Project. During storms greater than a 1-year design storm event, the eastern portion of the Ballona Wetlands would serve as an overflow area for the Freshwater Marsh. As part of the adjacent Playa Vista First Phase Project, flap-gated culverts at the Freshwater Marsh outlet would prevent flows from the Ballona Channel from backflowing into the Freshwater Wetlands System. Increased runoff from the Proposed Project during peak storm events would be discharged to the Freshwater Wetlands System and would not be discharged to the Ballona Channel until such time as the water elevation within the Ballona Channel drops to a level where on-site runoff can be discharged with no adverse impact to channel flows. Portions of the runoff from peak storm events greater than 1-year would flow over the overflow spillway into the existing Ballona Wetlands. However, the Proposed Project would not significantly change the amount of peak stormwater runoff flowing into the Ballona Wetlands. The proposed stormwater management facilities (e.g., flap-gates, on-site detention or other City approved methods of flood control) are expected to keep the adjacent Playa Vista First Phase Project and the Proposed Project peak flows at pre-First Phase levels. Because the Proposed Project peak flows would be retained within the Freshwater Wetlands System and Ballona Wetlands, peak flood flows in the Ballona Channel during the 50-year design storm event would not be increased; hence, the Urban Development Component would not cause flooding off-site during the projected 50-year developed storm event, which would have the potential to harm people or damage property, and a less than significant impact would occur.

In addition to the proposed stormwater management facilities, during pre-First Phase, most of the adjacent Playa Vista First Phase Project and the Urban Development Component areas were at elevations lower than the maximum predicted flood flow heights in the Ballona Channel. Upon completion of the adjacent Playa Vista First Phase Project and the Urban Development Component, the building pads within the proposed development areas would all be at elevations higher than the maximum surface water elevation in the Ballona Channel. Therefore, during the projected 50-year developed storm event, there would not be any increased risk of flooding to harm people or damage property.

Lincoln Boulevard adjacent to the Proposed Project site has historically been subject to flooding under storms smaller than the City's 50-year design storm. Construction of the Freshwater Marsh as part of the adjacent Playa Vista First Phase Project has reduced flooding at Lincoln Boulevard. Also, as part of Caltrans' Lincoln Boulevard widening project, the proposed raising of Lincoln Boulevard (from Jefferson Boulevard south to the toe of the bluffs) to 11 to 14 feet above MSL (current elevation of this section of Lincoln Boulevard is about 6 to 11 feet above MSL) would eliminate such localized flooding. In addition, the maximum water surface elevation in the Freshwater Marsh would be 8 feet above MSL. All other existing streets would be maintained at current levels of protection by maintaining existing peak runoff rates at current levels. New streets would be protected per current City requirements by new storm drain systems. Therefore, the projected 50-year developed storm event would not increase risk of flooding to harm people or damage property, and no significant impacts are expected.

1.2.1.4.1.2 Potential to Reduce or Increase the Amount of Surface Water in a Waterbody

The Urban Development Component of the Proposed Project has the potential to affect the amount of surface water in waterbodies adjacent to the Project site. The waterbodies of concern are the Ballona Channel, Ballona Wetlands, Freshwater Marsh, and Riparian Corridor.

During construction of the Urban Development Component, a Stormwater Pollution Prevention Plan and Erosion Control Plan would be implemented to provide temporary stormwater management for areas under construction to prevent the stormwater from adversely affecting waterbodies adjacent to the Project site. These stormwater management measures would be kept in place until the on-site stormwater drainage facilities designed to accommodate these flows were constructed. Therefore, the construction of the Urban

Development Component would not substantially reduce or increase the amount of surface water in a waterbody and a less than significant impact would occur.

Although the development of the Urban Development Component would result in increased amounts of impervious surface consequently increasing the volume and velocity of stormwater runoff, it would not significantly change the amount of peak storm surface runoff flowing into the existing Ballona Channel. As indicated in Table 5 on page 37, the increase in amount of runoff flowing to the Ballona Channel due to development of the Proposed Project (compared to with Playa Vista First Phase Project conditions) is estimated to be approximately 0.3%. This increase is not considered to be significant. Increased runoff from the Proposed Project would be detained in the Riparian Corridor and Freshwater Marsh, which were designed to accommodate these flows, prior to discharging to the Ballona Channel. Therefore, the Urban Development Component would not substantially reduce or increase the amount of surface water in the Ballona Channel and a less than significant impact would occur.

Table 5
Total Stormwater Runoff and Percentage of Total Flows to the Ballona Channel

	50-Year Storm	25-Year Storm	10-Year Storm	5 Year Storm	2 Year Storm	1-Year Storm
	Amount of Total Runoff to Ballona Channel (in acre-feet)					
Pre-First Phase Project						
Flow to Ballona Channel	1,675	1,504	1,276	1,104	817	717
With Playa Vista First Phase Project						
Flow to Ballona Channel	1,789	1,606	1,363	1,178	873	767
With Playa Vista First Phase Project and Proposed Project						
Flow to Ballona Channel	1,794	1,611	1,367	1,182	876	769
Percent of Total Flow to Ballona Channel Due to Project Buildout Compared to Pre-First Phase	7.1%	7.1%	7.1%	7.1%	7.2%	7.3%
Percent of Total Flow to Ballona Channel Due to Proposed Project (Compared to Playa Vista First Phase Project)	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%

Development of the Urban Development Component would result in increased amounts of impervious surface consequently increasing the volume and velocity of stormwater runoff. However, it would not significantly change the amount of peak storm surface runoff flowing into the existing Ballona Wetlands. During the majority of storm events (i.e., storms of magnitude less than the 1-year design storm, which constitute approximately 92% of the estimated average annual flows), runoff from the adjacent Playa

Vista First Phase Project, the Proposed Project, and other tributary drainage would flow through the Freshwater Marsh prior to discharge into the Ballona Channel. The Freshwater Marsh, which was designed to accommodate the total Playa Vista First Phase Project and the Proposed Project, thereby reduces the amount of freshwater flowing to the Ballona Wetlands (Table 4)

The only runoff tributary to the Ballona Wetlands would be generated from precipitation falling directly on the wetlands and adjacent bluff areas and any overflow from the Freshwater Marsh over the Marsh's eastern berm and weir gate during storms of magnitude greater than a 1-year storm, which constitutes approximately 8% of the estimated average annual flows. The Freshwater Marsh was designed with an adjustable weir and low-flow diversion sluice and culvert that can be adjusted to allow more or less low-flow into the Ballona Wetlands if/as desired. See the Section IV-D, Biotic Resources, for a discussion of impacts on biological resources as they relate to the adjustable weir overflow. The increased runoff due to development of the Proposed Project would represent a very minor portion of the total flows into the existing Ballona Wetlands. Table 6 on page 39 provides a breakdown of stormwater flows to the Ballona Wetlands calculated for various size storm events.

As indicated in Table 6 on page 39, the increase in amount of runoff flowing to the Ballona Wetlands due to development of the Proposed Project compared to with Playa Vista First Phase is estimated to range from 0% to 3.6%, depending on the size of the storm event. Due to the low magnitude of this increase and considering that the amount of runoff flowing to the Ballona Wetlands due to development of the adjacent Playa Vista First Phase and Proposed Project decreases when compared to pre-First Phase conditions by 54% to 63%, the 0% to 3.6% increase is not considered to be significant. Also, the additional amount of runoff to the Ballona Wetlands would only be a short-term temporary condition that dissipates as the stormwater within the Ballona Wetlands drains to the Ballona Channel. Therefore, the Urban Development Component would not substantially reduce or increase the amount of surface water in either the Ballona Wetlands or the Freshwater Marsh and a less than significant impact would occur.

Beyond not having a significant hydrological impact on the existing Ballona Wetlands, implementation of the Proposed Project would not preclude, limit, or otherwise prejudice the range of potential options for any future restoration of the Ballona Wetlands. The relationship of the adjacent Playa Vista First Phase Project and the Proposed Project to the Ballona Wetlands is controlled primarily through the operation of the Freshwater Marsh. The operational flexibility designed into the Freshwater Marsh through the adjustable weir and low-flow diversion sluice and culvert can adapt to a wide range of restoration options. The role of the Freshwater Marsh to divert flows from the Ballona Wetlands can be minimized, if desired, by keeping the adjustable weir at a lower spillover height.

Table 6
Total Stormwater Runoff and Percentage of Total Flows to the Freshwater Marsh and Ballona Wetlands

	50-Year Storm	25-Year Storm	10-Year Storm	5 Year Storm	2-Year Storm	1-Year Storm
	Amount of Total Runoff to Freshwater Marsh (in acre-feet) [a]					
With Playa Vista First Phase Project						
Flow to Freshwater Marsh	1,171	1,051	892	771	571	502
With Playa Vista First Phase Project and Proposed Project						
Flow to Freshwater Marsh	1,176	1,056	896	775	574	504
Percent of Total Flow to Freshwater Marsh Due to Proposed Project	0.4%	0.5%	0.5%	0.5%	0.4%	0.4%
	Amount of Total Runoff to Ballona Wetlands (in acre-feet)					
Pre-First Phase Project						
Flow from Drains	1,039	933	792	685	507	445
Flow from Other Sources[b]	636	571	485	419	310	272
With Playa Vista First Phase Project						
Flow from Freshwater Marsh over Weir	139	104	61	32	5	0
Flow from Other Sources[b]	618	555	471	407	302	265
With Playa Vista First Phase Project and Proposed Project						
Flow from Freshwater Marsh over Weir	149	122	77	48	11	0
Flow from Other Sources[b]	618	555	471	407	302	265
Percent of Total Flow to Ballona Wetlands Due to Project Buildout Compared to Pre-First Phase	-54%	-55%	-57%	-59%	-62%	-63%
Percent of Total Flow to Ballona Wetlands Due to Proposed Project (Compared to Playa Vista First Phase Project)	1.3%	2.7%	3.0%	3.6%	2.0%	0.0%

[a] *Freshwater Marsh did not exist during pre-First Phase conditions.*
[b] *Flows in this table summarize flows to the Ballona Wetlands which are not the same as flows from other sources indicated in*
Table 2 because modeled peak flows over the weir do not necessarily occur at the same time as the peak flows to the Freshwater Marsh and the Ballona Wetlands. Variances may be caused by storm intensities and time of concentrations in the SWMM model.

As discussed above, the increased amounts of impervious surface due to the Urban Development Component would increase the volume and velocity of stormwater runoff into the Riparian Corridor. However, the Riparian Corridor, partially constructed as part of the adjacent Playa Vista First Phase Project, was designed to accommodate this increase in flows. Table 7 provides a breakdown of stormwater flows to the Riparian Corridor for various size storm events at two locations. The amount of runoff flowing to the Riparian Corridor at the two locations due to development of the Proposed Project would decrease by 2.6% to 10.6% compared to Playa Vista First Phase conditions and by 3.3% to 9.8% when Project buildout is compared to pre-First Phase conditions, depending on the location and size of the storm event. The decrease would be caused by the grading of the Proposed Project area that would direct surface water runoff from the Riparian Corridor to the Central Storm Drain. The Riparian Corridor, with completion of the adjacent Playa Vista First Phase, is currently in its interim condition; and it was planned in its initial design that a portion of the runoff would be directed to the Central Storm Drain once the construction of the Riparian Corridor was completed as part of the Proposed Project. As such, this decrease is not considered to be significant. Therefore, the Urban Development Component would not substantially reduce or increase the amount of surface water in the Riparian Corridor and a less than significant impact would occur.

1.2.1.4.1.3 Potential For Adverse Change to the Movement of Surface Water

During construction of the Urban Development Component, a Stormwater Pollution Prevention Plan and Erosion Control Plan would be implemented to provide temporary stormwater management for areas under construction to prevent the stormwater from adversely affecting waterbodies adjacent to the Project site. These stormwater management measures would be kept in place until the permanent on-site stormwater drainage facilities designed to accommodate these flows were constructed. Therefore, the construction of the Urban Development Component would not result in permanent adverse change to the movement of surface water sufficient to produce a substantial change in the current or direction of water flow and a less than significant impact would occur.

As described in the Project Design Features, the Urban Development Component of the Proposed Project would result in regrading of the Project site, which would, by design, modify the surface runoff patterns and redirect flows from the Jefferson Storm Drain into the Central Storm Drain (constructed under the adjacent Playa Vista First Phase Project) and the Riparian Corridor. This redirection of stormwater runoff away from the Jefferson Storm Drain is considered beneficial since the hydraulic capacity of the Jefferson Storm Drain does not meet City of Los Angeles design standards (i.e., the change to the movement of surface water would, by intent, enable surface flows to be directed to a new storm drain that is designed to current City standards). The Urban Development Component would not result in a permanent, adverse change to the movement of surface water sufficient to produce a substantial change in the current or direction of water flow and a less than significant impact would occur.

Table 7
Total Stormwater Runoff and Percentage of Total Flows to the Riparian Corridor

	50-Year Storm	25-Year Storm	10-Year Storm	5 Year Storm	2-Year Storm	1-Year Storm
	Amount of Total Runoff to Riparian Corridor (in acre-feet)					
Pre-First Phase Project						
Flow to Centinela Ditch at Boundary of Proposed Project	461	414	351	304	225	197
Flow to Centinela Ditch at Lincoln Boulevard	550	494	419	362	268	235
With Playa Vista First Phase Project						
Flow to Riparian Corridor at Boundary of Proposed Project	464	417	354	306	226	199
Flow to Riparian Corridor at Lincoln Boulevard	546	490	416	360	266	234
With Playa Vista First Phase Project and Proposed Project						
Flow to Riparian Corridor at Boundary of Proposed Project	417	374	318	275	203	178
Flow to Riparian Corridor at Lincoln Boulevard	531	477	405	350	259	227
Percent of Total Flow to Riparian Corridor at Boundary of Proposed Project Due to Project Buildout Compared to Pre-First Phase Project	-9.5%	-9.7%	-9.4%	-9.5%	-9.8%	-9.6%
Percent of Total Flow to Riparian Corridor at Lincoln Boulevard Due to Project Buildout Compared to Pre-First Phase Project	-3.5%	-3.4%	-3.3%	-3.3%	-3.4%	-3.4%
Percent of Total Flow to Riparian Corridor at Boundary of Proposed Project Due to Proposed Project (Compared to Playa Vista First Phase Project)	-10.1%	-10.3%	-10.2%	-10.1%	-10.2%	-10.6%
Percent of Total Flow to Riparian Corridor at Lincoln Boulevard Due to Proposed Project (Compared to Playa Vista First Phase Project)	-2.8%	-2.7%	-2.6%	-2.8%	-2.6%	-3.0%

1.2.1.4.2 Habitat Creation/Restoration Component

1.2.1.4.2.1 Potential for Flooding

Development of the Project's Habitat Creation/Restoration Component would not create additional impervious surface area on-site; therefore, it would not increase peak runoff rates or volumes during its construction or operation. Therefore, the construction and operation of the Habitat Creation/Restoration Component would not cause flooding (which would have the potential to harm people or damage property) during the projected 50-year developed storm event and a less than significant impact would occur.

Implementation of the Habitat Creation/Restoration Component would involve the construction of a major stormwater management facility, the Riparian Corridor, which (with the Central Drain) would serve as a replacement of the Centinela Ditch. The Riparian Corridor has been designed to serve the Proposed Project by conveying increases in peak runoff rates or volumes caused by the construction of the Urban Development Component and provide an appropriate level of on-site flood protection, detention, and drainage. Construction of the Riparian Corridor would be timed to adequately receive any increase in peak runoff rates or volumes that could adversely affect any existing or planned development. As shown in Table 2, the future runoff to the Centinela Ditch replaced by the Riparian Corridor and Central Storm Drain would be reduced from that of pre-First Phase and with Playa Vista First Phase Project conditions. Such reductions to existing drainage systems are enabled through the rerouting of existing flows and the addition of new drainage systems (i.e., Central Storm Drain) as part of the adjacent Playa Vista First Phase Project and the Proposed Project. During final engineering design, calculations will be provided to substantiate that no flooding would occur under the City's 50-year design storm.

As previously discussed, the Freshwater Marsh would serve as the primary detention facility for the adjacent Playa Vista First Phase Project and the Proposed Project. Runoff from the Habitat Creation/Restoration Component during peak storm events would be discharged to the Freshwater Marsh and Ballona Wetlands[8], where it would remain until such time as the water elevation within the Ballona Channel drops to a level where on-site runoff can be discharged with no adverse impact to channel flows. Therefore, the construction and operation of the Habitat Creation/Restoration Component would not cause flooding (which would have the potential to harm people or damage property) during the projected 50-year developed storm event and a less than significant impact would occur.

1.2.1.4.2.2 Potential to Reduce or Increase the Amount of Surface Water in a Waterbody

The construction and operation of the Project's Habitat Creation/Restoration Component would not create additional impervious surface area on-site; therefore, it would

[8] *Only during storms greater than a 1-year design storm.*

not increase peak runoff rates or total volumes of flow. However, the Habitat Creation/Restoration Component would receive stormwater runoff from the Urban Development Component, which would increase stormwater runoff compared to what was formerly received by the Centinela Ditch in this location. Because the Habitat Creation/Restoration Component was designed to receive and convey this increased stormwater flow, this increase is not considered to be significant. Therefore, the construction and operation of the Habitat Creation/Restoration Component would not significantly reduce or increase the amount of surface water in the Ballona Channel, Ballona Wetlands, Freshwater Marsh, and Riparian Corridor and a less than significant impact would occur.

1.2.1.4.2.3 Potential for Adverse Change to the Movement of Surface Water

The construction and operation of the Habitat Creation/Restoration Component of the Proposed Project would not, in general, change the direction of surface water flow. Although the Habitat Creation/Restoration Component would receive increased stormwater runoff from the Urban Development Component, the Habitat Creation/Restoration Component was designed to receive and convey this increased stormwater flow, and this increase is not considered to be adverse. Therefore, the construction and operation of the Habitat Creation/Restoration Component would not result in a permanent, adverse change to the movement of surface water sufficient to produce a substantial change in the current or direction of water flow and a less than significant impact would occur.

1.2.1.4.3 Summary of Potential Surface Water Hydrology Impacts

No development portion of the Proposed Project site (i.e., the Urban Development Component) is within the FEMA 100-Year Floodplain. The proposed drainage system for the Proposed Project (inclusive of the Urban Development drainage system, and the Riparian Corridor as part of the Habitat Creation/Restoration Component) has been designed to convey increases in total peak runoff rates and volumes and provide an appropriate level of on-site flood protection, detention and drainage. Therefore, the Project would not cause flooding of the existing local storm drains during the projected 50-year developed storm event, which would have the potential to harm people or damage property.

During construction of the Proposed Project, a Stormwater Pollution Prevention Plan and Erosion Control Plan would be implemented to provide for temporary stormwater management. These plans would prevent construction from adversely affecting the amount of surface water in a waterbody. Additionally, these stormwater management measures would be temporary; hence, the construction of the Proposed Project would not result in a permanent adverse change to the movement of surface water.

Although the development of the Urban Development area would result in increased amounts of impervious surface that consequently would increase stormwater runoff flowing into adjacent waterbodies, the increase is not significant because the runoff would be detained in the Freshwater Wetlands System (the Riparian Corridor, a portion of which would be constructed as part of the Habitat Creation/Restoration Component, and the Freshwater Marsh), which would be designed specifically for stormwater management. Therefore, the Proposed Project (inclusive of both Components) would not significantly reduce or increase the amount of surface water in a waterbody.

As a Project Design Feature, the Proposed Project would result in grading of the Project area, which would, by design, modify the surface runoff patterns during Proposed Project construction and operation. Stormwater runoff during Proposed Project operation would also be redirected from the Jefferson Storm Drain into the Central Storm Drain and Riparian Corridor (a portion of which would be constructed as part of the Habitat Creation/Restoration Component). This redirection of runoff from the Jefferson Storm Drain is considered beneficial since it would result in a decrease of runoff in the Jefferson Storm Drain, which does not meet City design standards for hydraulic capacity. Because the Proposed Project would result in a beneficial impact on the constrained Jefferson Storm Drain, and would not adversely impact any other stormwater drainage facilities, operation of the Proposed Project would not result in a permanent adverse change in the movement of surface water.

1.2.2 MITIGATION MEASURES

- Prior to issuance of any building permit, the Applicant shall be required to complete or otherwise guarantee completion of the Freshwater Marsh, Riparian Corridor and other structural/treatment control BMPs (e.g., Best Management Practice catchbasins, etc.), satisfactory to the City's Department of Public Works and/or other responsible agencies (e.g., U.S. Army Corps of Engineers in conformance with Permit No. 90-426-EV).

- Prior to recordation of the tentative tract map, a covenant and agreement shall be prepared and recorded satisfactory to the Department of Public Works, Bureau of Sanitation, Stormwater Management Division and the City Attorney, as appropriate, which shall include the following:

    - Properties within the Proposed Project shall be encumbered with an obligation to perpetually fund the operation and maintenance of the appropriate structural/treatment control BMPs, such as the Freshwater Marsh and Riparian Corridor and Best Management Practices catchbasins satisfactory to the Department of Public Works. Properties dedicated to a public entity or owned by the property owners' association (i.e., parks, community – serving parcels, etc.) shall not be subject to this obligation.

- The Proposed Project shall be implement and perform the requirements set forth in the Operations, Maintenance and Monitoring Manual for the Freshwater Wetlands System, in accordance with all permit requirements to monitor and evaluate the hydrologic and water quality performance of the Freshwater Marsh and Riparian Corridor. Information obtained from the monitoring program shall be translated into corrective action and system modifications if necessary, in accordance with the U.S. Army Corps of Engineers (USACE) requirements and satisfactory to the City of Los Angeles Department of Public Works.

- A monitoring report shall be prepared as required by applicable permits[9] which addresses water sampling locations, frequency of sampling, pollutants of concern to be tested, testing methods, corrective measures if necessary, etc. for the Freshwater Marsh and Riparian Corridor. The report shall be submitted to the USACE, RWQCB, and the City of Los Angeles Department of Public Works, Bureau of Sanitation.

- Maintenance records for the structural/treatment control BMPs shall be maintained and submitted to the City of Los Angeles Department of Public Works, Bureau of Sanitation.

• Prior to issuance of any building permit, the Applicant shall encumber the parcel for which the permit is sought with a covenant to fund the Playa Vista Community Service Organization or other funding mechanism, satisfactory to the Advisory Agency and the City Engineer, for the purpose of funding the operation and maintenance of the Freshwater Marsh and Riparian Corridor and other structural/treatment control BMPs. The covenant shall obligate future owners within the parcel to fund the Community Service Organization or other funding mechanism, and shall contain provisions detailing the timing and mechanism for such funding satisfactory to the Department of Public Works. Properties dedicated to a public entity or owned by the property owners' association (i.e., parks, community-parcels, etc.) shall not be subject to this funding obligation.

---

[9] *Applicable permits include Corps Permit No. 90-426-EV and corresponding Section 401 certification, California Department of Fish and Game 1603 Streambed Alteration Agreement No. 5-639-93, and Coastal Development Permit No. 5-91-463.*

- Prior to issuance of any building permit, the Applicant or the Playa Vista Community Service Organization shall enter into an agreement with the Ballona Wetlands Conservancy or other responsible entity, which shall address the responsibility for funding, coordination, and oversight of all operations and maintenance procedures for the Freshwater Marsh and Riparian Corridor. Maintenance shall be conducted, and maintenance reports submitted periodically and after each storm event to prevent trash, debris, and sediments from clogging the system, in accordance with the U.S. Army Corps of Engineers (USACE) requirements and satisfactory to the City of Los Angeles Department of Public Works.

1.2.3 UNAVOIDABLE ADVERSE IMPACTS

Impacts to surface water hydrology would be less than significant, as the Proposed Project is not anticipated to cause flooding during the projected 50-year developed storm event, which would have the potential to harm people or damage property; substantially reduce or increase the amount of surface water in a waterbody; or result in a permanent, adverse change to the movement of surface water sufficient to produce a substantial change in the current or direction of water flow.

1.2.4 CUMULATIVE IMPACTS

The majority of the off-site areas tributary to the adjacent Playa Vista First Phase Project and the Proposed Project consist of highly urbanized development. As a result, substantial additional changes in off-site hydrologic factors affecting runoff rates (i.e., increases in impervious surface area, changes in drainage routes, etc.) are unlikely to occur. Changes in topography and developed acreage should be minimal within the entire developed watershed. While land uses may change, the total impervious area, and therefore runoff rates, should remain relatively constant. For instance, a 38-acre residential development, Tentative Tract 51122,[10] located south of the Freshwater Marsh (see Figure 4) has been approved since the adjacent Playa Vista First Phase Project was approved. The hydrology for Tentative Tract 51122 includes the diversion of 27 acres of area currently draining south to Manchester Boulevard and eventually to the Freshwater Marsh. Based upon the hydrology prepared by Robert Bein, William Frost and Associates, the total 50-year peak runoff generated by the 38 acres of residential tributary area (on-site and off-site to Tract 51122) is 124 cfs with a total storm volume of 49 acre-feet, and the total 50-year peak flow rate generated by the 27 acres of diverted area is 88 cfs with a total storm volume of 35 acre-feet.[11] Per City of Los Angeles requirements, the analysis of

---

[10] *West Bluffs Project (Tract 51122), City of Los Angeles EIR No 91-0675, State Clearinghouse No. 92041046*

[11] *The storm volume was estimated by Psomas based upon the prorated drainage area, time of concentration, and peak runoff rate in the Robert Bein, William Frost and Associates report.*

future conditions with the addition of Proposed Project assumes that all off-site areas within the local watershed have been built out to the current zoning designations. It is not anticipated that the cumulative flows with the Tentative Tract 51122 diversion would affect the Freshwater Marsh's ability to contain the 1-year storm event. The adjustable weir that manages the overflow into the salt marsh could be raised, if necessary, to contain the desired storm flows. This was envisioned at the time of design of the Freshwater Marsh and is the reason why the adjustable weir was included in the design of the Marsh. Cumulative flows during storm events greater than the 1-year storm would incrementally add to the stormwater overflow going into the salt marsh. However, the increase is not considered significant since it represents such as small amount of the total stormwater flowing into the wetland area (less than 1% associated with the diversion, between 1.3% and 3.6% for the Proposed Project, depending on the size of the storm) and the total storm flow compared to conditions before the marsh was built is reduced by over 50% for all storm events. Therefore, the potential for cumulative impacts, including Tentative Tract 51122, has already been accounted for in the Project Design Features for the Proposed Project. As such, cumulative impacts to surface water hydrology from implementation of the Proposed Project, related projects, and other background growth would be less than significant, as the Proposed Project and related growth is not anticipated to cause flooding during the projected 50-year developed storm event, which would have the potential to harm people or damage property; substantially reduce or increase the amount of surface water in a waterbody; or result in a permanent, adverse change to the movement of surface water sufficient to produce a substantial change in the current or direction of water flow.

PLAYA VISTA EXISTING HYDROLOGY

TABLED BY VAT CHECKED BY GMV SUPERVISED BY	CITY OF LOS ANGELES Department of Public Works Bureau of Engineering	STORM DRAIN DESIGN RUNOFF TABLING SHEET Frequency 50 Year	Project: 1MTP0104.10 - PLAYA VISTA ON-SITE HYDROLOGY - EXISTING QUAD "B" - WETLANDS	Date: Aug-12-1992 Sheet:

Drainage Map Area No	Drainage Map Area Acres	Runoff	Runoff 100% Ae	Flow Routing Surface Flow N	S	E	W	Storm Drain	ISO	Freq. Fact.	Dist. Fact.	Amen 1hr RFR	Fro	BPRR	Frict. Slope (S)	K= Q / S^.5	Size	Area (sf)	Vel. (ft/s)	L (ft)	Tc or tcx (min)	Storm Drain Station	Location	Remarks	
NODE B - EAST WETLAND																									1
	7.0	ΣA	6.2																						2
B.1		q	4.42						1.33	1.00	1.00	1.33	1.30	3.40			B=	8'					<- C.21.0		
		Q	27.4														z=	2	n=	.050	3.8		Off-Site Hydrology		3
	6.3	A	5.3				27.4										d=	2.08							
	13.3	ΣA	11.5												0.0008	968.74	Trap	25.3	1.08	275	4.2		<- C.22.0 & C.0.22		4
B.2		q	3.60						1.33	1.00	1.00	1.33	1.30	2.77			B=	9'							
		Q	41.4														z=	2	n=	.050	8.0				5
	4.7	A	3.9				41.4										d=	2.47							
	18	ΣA	15.4												0.0008	1463.7	Trap	34.4	1.20	570	7.9		<- C.23.0 & C.0.23		6
B.3		q	2.67						1.33	1.00	1.00	1.33	1.30	2.05			B=	9'							
		Q	41.1														z=	2	n=	.050	15.9				7
	3.2	A	2.6				41.1										d=	2.46							
	21.2	ΣA	16												0.0008	1453.1	Trap	34.2	1.20	640	8.9		<- C.24.0 & C.0.24		8
B.4		q	2.20						1.33	1.00	1.00	1.33	1.30	1.69			B=	9'							
		Q	39.6														z=	2	n=	.050	24.8				9
	15.2	A	13.2				39.6										d=	2.41							
	36.4	ΣA	31.2												0.0008	1400.1	Trap	33.3	1.19	560	7.8		<- C.25.0 & C.0.25		10
B.5		q	1.95						1.33	1.00	1.00	1.33	1.30	1.50			B=	15'							
		Q	60.8														z=	2	n=	.050	32.6				11
	5.5	A	4.4				60.8										d=	2.42							
	41.9	ΣA	35.6												0.0008	2149.6	Trap	47.9	1.27	740	9.7		<- C.26.0 & C.0.26		12
B.6		q	1.74						1.33	1.00	1.00	1.33	1.30	1.34			B=	15'							
		Q	61.9														z=	2	n=	.050	42.3				13
	3.5	A	2.9				61.9										d=	2.44							
	45.4	ΣA	38.5												0.0008	2188.5	Trap	48.5	1.28	400	5.2		<- C.27.0 & C.0.27		14
B.7		q	1.65						1.33	1.00	1.00	1.33	1.30	1.27			B=	15'							
		Q	63.5														z=	2	n=	.050	47.5				15
	118.4	A	118.4				63.5										d=	2.48							
	163.8	ΣA	156.9												0.0008	2245.1	Trap	49.5	1.28	520	6.8		<- East Wetland		16
B.8		q	1.56						1.33	1.00	1.00	1.33	1.30	1.20									@ Gas Company Road		
		Q	245																		54.3				17
							245																		
																									18
																									19

PLAYA VISTA EXISTING HYDROLOGY

TABLED BY VAT CHECKED BY GMV SUPERVISED BY				CITY OF LOS ANGELES Department of Public Works Bureau of Engineering					STORM DRAIN DESIGN RUNOFF TABLING SHEET Frequency 50 Year						Project: 1MTP0104.10 - PLAYA VISTA ON-SITE HYDROLOGY - EXISTING QUAD "B" - WETLANDS								Date: Aug-12-1992 Sheet:		
Drainage Map		Runoff		Flow Routing																					
Area No	Area Acres		100% Ae	Surface Flow N	S	E	W	Storm Drain	ISO	Freq. Fact.	Dist. Fact.	Amen 1hr RFR	Fro	BPRR	Frict. Slope (S)	K= Q / S^.5	Size	Area [sf]	Vel. [ft/s]	L [ft]	tc or tcx [min]	Storm Drain Station	Location	Remarks	1
NODE D - SOUTH WETLAND																									
D.1	6.6	ΣA	5.5														B=	8'							20
		q	4.42						1.33	1.00	1.00	1.33	1.30	3.40			z=	2	n=	.050	3.3		<- C.28.0 & C.0.28		
		Q	24.3														d=	1.95							21
	8.0	A	6.7				24.3								0.0008	859.13	Trap	23.2	1.05	550	8.8		<- C.29.0 & C.0.29		22
D.2	14.6	ΣA	12.2														B=	14'							
		q	3.00						1.33	1.00	1.00	1.33	1.30	2.31			z=	2	n=	.050	12.1				
		Q	36.6														d=	2.42							23
	108.6	A	95.7				36.6								0.0008	1294	Trap	31.2	1.17	800	11.3		<- C.30.0 & C.0.30		24
D.3	123.2	ΣA	107.9														B=	65'							
		q	2.25						1.33	1.00	1.00	1.33	1.30	1.73			z=	2	n=	.050	23.4				
		Q	243														d=	2.42							25
	20.7	A	17.7				243								0.0008	8591.3	Trap	169	1.44	580	6.7		<- C.31.0 & C.0.31		26
D.4	143.9	ΣA	125.6																						
		q	2.02						1.33	1.00	1.00	1.33	1.30	1.55											
		Q	254																		30.1				27
	40.6	A	40.6				254														0.0		<- South Wetland		28
ΣD.4	184.5	ΣA	166.2																						
		q	2.02						1.33	1.00	1.00	1.33	1.30	1.55									@ Culver Boulevard		
		Q	336																		30.1				29
							336																		
																									30
																									31

PLAYA VISTA EXISTING HYDROLOGY

TABLED BY VAT CHECKED BY GMV SUPERVISED BY				CITY OF LOS ANGELES Department of Public Works Bureau of Engineering					STORM DRAIN DESIGN RUNOFF TABLING SHEET Frequency 50 Year						Project: 1MTP0104.10 - PLAYA VISTA ON-SITE HYDROLOGY - EXISTING QUAD "B" - WETLANDS								Date: Aug-12-1992 Sheet:		
Drainage Map		Runoff		Flow Routing																					
				Surface Flow				Storm																	
Area No	Area Acres		100% Ae	N	S	E	W	Drain	ISO	Freq. Fact.	Dist. Fact.	Amen 1hr RFR	Fro	BPRR	Frict. Slope (S)	K= Q / S^.5	Size	Area [sf]	Vel. [ft/s]	L [ft]	Ic or Icx [min]	Storm Drain Station	Location	Remarks	
NODE F - NORTH WETLAND																									1
F.1	14.6	ΣA	12.9														B=	12'							32
		q	3.94						1.33	1.00	1.00	1.33	1.30	3.03			z=	2	n=	.050	6.5		<- C.32.0 & C.0.32		
		Q	50.8														d=	2.43							33
	147.9	A	147.9				50.8																		
F.2	162.5	ΣA	160.8												0.0008	1796.1	Trap	40.9	1.24	1800	24.2		<- North Wetland		34
		q	2.00						1.33	1.00	1.00	1.33	1.30	1.54									@ Ballona Channel Levee		
		Q	322																		30.7				
				322																					35
																									36
																									37

PLAYA VISTA EXISTING HYDROLOGY

TABLED BY PMP CHECKED BY GMV SUPERVISED BY				CITY OF LOS ANGELES Department of Public Works Bureau of Engineering					STORM DRAIN DESIGN RUNOFF TABLING SHEET Frequency 50 Year						Project: 1MTP0102.25 - PLAYA VISTA ON-SITE HYDROLOGY - EXISTING QUAD "D" - CENTINELA DITCH								Date: Oct-16-1990 Sheet:		
Drainage Map Area No.	Drainage Map Area Acres	Runoff	Runoff 100% Ae	Flow Routing Surface Flow N	S	E	W	Storm Drain	ISO	Freq. Fact.	Dist. Fact.	Amer 1hr BFR	Fro	BFRR	Frict. Slope (S)	K=Q/S^.5	Size	Area (sf)	Vel. (ft/s)	L (ft)	Tc or tcx (min)	Storm Drain Station	Location	Remarks	
LINE D1E																									1
101	13.4	ΣA q Q	11.7 3.6 42.1						1.33	1.00	1.000	1.33	1.30	2.75			D= d=	42 ø 2.67	n=	.013	8.1		Area 101.1, 101.2, & C.1.0 Tc(C.1.0) = Q(C.1.0) =	 8.1 min 34 cfs	2
	13.2	A	10.3					42.1							0.002	941	PIPE	7.89	5.34	1140	3.6	<- Area 102.1, 102.2, & C.2.0 (Onsite)			3
102	26.6	ΣA q Q	22.0 3.1 68.2						1.33	1.00	1.000	1.33	1.30	2.35			D= d=	45 ø 2.63	n=	.013	11.7				4
	11.4	A	11.4					68.2							0.004	1028	PIPE	8.27	8.25	420	0.8	<- Area 104 (PARKING LOT)			5
104	36.0	ΣA q Q	33.4 3.0 100						1.33	1.00	1.000	1.33	1.30	2.28			D= d=	54 ø 2.92	n=	.013	12.5				6
	10.3	A	8.1					100							0.004	1508	PIPE	10.93	9.15	280	0.5	<- Area 105.1, 105.2, & C.3.0			7
105	46.3	ΣA q Q	41.5 2.9 120						1.33	1.00	1.000	1.33	1.30	2.24			D= d=	54 ø 3.4	n=	.013	13.0				8
	17.0	A	16.8					120							0.004	1809	PIPE	12.90	9.3	500	0.9	<- Area 106.1, 106.2			9
106	65.3	ΣA q Q	58.3 2.8 163						1.33	1.00	1.000	1.33	1.30	2.16							13.9				10
	39.5	A	33.2					163														<- Line D1E-106 from:		90	11
Σ 106	104.8	ΣA q Q	91.5 2.8 256						1.33	1.00	1.000	1.33	1.30	2.17		(2 pipes)	D= d=	66 ø 3.64	n=	.013	14.0	···· tc1/Q1= tc2/Q2= tcx=	13.8 min 14.1 min 14.0 min	163 cfs 93.3 cfs	12
	6.6	A	5.9					163							0.004	3859	PIPE	27.60	9.28	520	0.9	<- Area 107.1, 107.2, & C.5.0			13
107	111.4	ΣA q Q	97.4 2.7 263						1.33	1.00	1.000	1.33	1.30	2.11							14.9				14
	30.5	A	24.9					263														<- Line D1E-107 from:		106	15
Σ 107	141.9	ΣA q Q	122.3 2.9 355						1.33	1.00	1.000	1.33	1.30	2.25		(2 pipes)	D= d=	66 ø 3.71	n=	.013	12.9	···· tc1/Q1= tc2/Q2= tcx=	14.9 min 7.4 min 12.9 min	263 cfs 92.6 cfs	16
	16.7	A	16.1					355							0.004	5352	PIPE	35.00	10.1	320	0.5	<- Area 108.1, 108.2, & C.7.0			17
108	158.6	ΣA q Q	138.4 2.9 401						1.33	1.00	1.000	1.33	1.30	2.21	n = W1 = W2 =	0.050 34.00' 354.00'	B = d1 = d2 =	10' 4.00' 1.60'	Z1 = Z2 = d =	3 100 5.5	13.4				18
	9.5	A	9.3					401							0.002	8967	Trap	398.4	1.01	560	9.3	<- Area 110.1 & 110.2			19
110	168.2	ΣA q Q	147.7 2.3 340						1.33	1.00	0.991	1.33	1.29	1.76	n = W1 = W2 =	0.050 34.00' 324.00'	B = d1 = d2 =	10' 4.00' 1.45'	Z1 = Z2 = d =	3 100 5.45	22.7				20
	7.6	A	6.5					340							0.001	10752	Trap	347.6	0.98	810	13.8	<- Area 112.1, 112.2, Revised C.8.1			21
112	175.8	ΣA q Q	154.2 1.8 278						1.33	1.00	0.993	1.33	1.29	1.40	n = W1 = W2 =	0.050 34.00' 288.00'	B = d1 = d2 =	10' 4.00' 1.27'	Z1 = Z2 = d =	3 100 5.27	36.5				22

Runoff Table
Line D.1.E - Centinela Ditch

TABLED BY	PMP			CITY OF LOS ANGELES Department of Public Works Bureau of Engineering					STORM DRAIN DESIGN RUNOFF TABLING SHEET Frequency 50 Year						Project: 1MTP0102.25 - PLAYA VISTA ON-SITE HYDROLOGY - EXISTING QUAD "D" - CENTINELA DITCH								Date: Oct-16-1990		
CHECKED BY	GMV																						Sheet:		
SUPERVISED BY																									
Drainage Map		Runoff		Flow Routing																					
				Surface Flow																					
Area No	Area Acres		100% Ae	N	S	E	W	Storm Drain	ISO	Freq. Fact.	Dist. Fact.	Amen 1hr RFB	Fro	BPRR	Frict. Slope (S)	K = Q/S^.5	Size	Area (sf)	Vol. (ft/s)	L (ft)	Tc or Tcx (min)	Storm Drain Station	Location	Remarks	
	6.4	A	5.6					278							0.001	8791	Trap	292.5	0.95	510	8.9	<- Area	13.1, 113.2 & C.9.0		23
	182.2	ΣA	159.8																						
113		q	1.7						1.33	1.00	0.994	1.33	1.29	1.30											
		Q	272																		45.4				24
	124.5	A	117.2					278																	
	306.7	ΣA	277.0												n =	0.050	B =	10'	Z1 =	3	....	<- S.D. from LMU (C.10.0)			25
Σ113		q	2.1						1.33	1.00	0.979	1.33	1.27	1.59	W1 =	34.00'	d1 =	4.00'	Z2 =	100	24.9	Ic1/Q1 =	45.4 min	272 cfs	
		Q	582												W2 =	424.00'	d2 =	1.95'	d =	5.95		Ic2/Q2 =	10.2 min	377.9 cfs	26
																						Icx =	24.9 min		
	5.9	A	5.4					582							0.001	18404	Trap	534.6	1.09	670	10.3	<- Area	14.1, 114.2 & C.11.0		27
	312.6	ΣA	282.4																						
114		q	1.9						1.33	1.00	0.984	1.33	1.20	1.45											
		Q	537																		35.2				28
	91.3	A	76.4					537																	
	403.9	ΣA	358.8												n =	0.050	B =	10'	Z1 =	3	....	< Onsite Line D2E from		70	29
Σ 114		q	1.7						1.33	1.00	0.960	1.33	1.27	1.01	W1 =	34.00'	d1 =	4.00'	Z2 =	100	44.7	Ic1/Q1 =	35.2 min	537 cfs	
		Q	610												W2 =	434.00'	d2 =	2.00'	d =	6		Ic2/Q2 =	100.1 min	91.7 cfs	30
																						Icx =	44.7 min		
	2.9	A	2.3					610							0.001	19290	Trap	556	1.1	200	3.0	<- Area	15.1, 115.2 & C.12.0		31
	406.6	ΣA	361.1												n =	0.050	B =	10'	Z1 =	3					
115		q	1.6						1.33	1.00	0.981	1.33	1.28	1.27	W1 =	34.00'	d1 =	4.00'	Z2 =	100	47.7				
		Q	578												W2 =	424.00'	d2 =	1.95'	d =	5.95					32
	21.4	A	15.7					610							0.001	18278	Trap	534.8	1.08	1270	19.6	<- Area	116.1, 116.2, 116.3 & C.13.0		33
	428.2	ΣA	376.8												n =	0.050	B =	10'	Z1 =	3					
116		q	1.4						1.33	1.00	0.985	1.33	1.28	1.09	W1 =	34.00'	d1 =	4.00'	Z2 =	100	87.3				
		Q	528												W2 =	406.00'	d2 =	1.86'	d =	5.86					34
	21.4	A	15.4					528							0.002	11806	Trap	497.2	1.06	710	11.1	<- Area	118.1, 118.2, 118.3, 118.4, C.14.0, C.15.0, C.16.0, C.17.0 & C.18.0		35
	449.6	ΣA	392.2												n =	0.050	B =	10'	Z1 =	3					
118		q	1.3						1.33	1.00	0.987	1.33	1.28	1.02	W1 =	34.00'	d1 =	4.00'	Z2 =	100	76.4				
		Q	510												W2 =	398.00'	d2 =	1.82'	d =	5.82					36
	12.0	A	9.0					510							6E-04	20621	Trap	481.1	1.06	470	7.4	<- Area	120.1		37
	461.6	ΣA	401.2																						
120		q	1.3						1.33	1.00	0.988	1.33	1.28	0.98							85.8				
		Q	522																						38
	41.2	A	40.9					522																	
	502.6	ΣA	442.1												n =	0.050	B =	10'	Z1 =	3	....	<-HAC SD (C.19.0) from Offsite			39
Σ 120		q	1.4						1.33	1.00	0.988	1.33	1.28	1.09	W1 =	34.00'	d1 =	4.00'	Z2 =	100	67.8	Ic1/Q1 =	85.8 min	522 cfs	
		Q	619												W2 =	436.00'	d2 =	2.01'	d =	6.01		Ic2/Q2 =	7.1 min	155 cfs	40
																						Icx =	67.8 min		
	10.5	A	7.9					619							1E-04	61900	Trap	560.4	1.1	290	4.4	<- Area	122.1 & 122.2		41
	513.3	ΣA	450.0												n =	0.050	B =	10'	Z1 =	3					
122		q	1.4						1.33	1.00	0.989	1.33	1.29	1.06	W1 =	34.00'	d1 =	4.00'	Z2 =	100	72.2				
		Q	630												W2 =	440.00'	d2 =	2.03'	d =	6.03					42
	6.8	A	5.1					630							1E-04	63000	Trap	569.1	1.11	420	6.3	<- Area	124.1		43
	520.1	ΣA	455.1												n =	0.050	B =	10'	Z1 =	3					
124		q	1.3						1.33	1.00	0.990	1.33	1.29	1.02	W1 =	34.00'	d1 =	4.00'	Z2 =	100	78.5				
		Q	592												W2 =	428.00'	d2 =	1.97'	d =	5.97					44

Runoff Table
Line D.1.E - Centinela Ditch

PLAYA VISTA L ;TING HYDROLOGY

TABLED BY PMP CHECKED BY GMV SUPERVISED BY				CITY OF LOS ANGELES Department of Public Works Bureau of Engineering					STORM DRAIN DESIGN RUNOFF TABLING SHEET Frequency 50 Year						Project: 1MTP0102.25 - PLAYA VISTA ON-SITE HYDROLOGY - EXISTING QUAD "D" - CENTINELA DITCH								Date: Oct-16-1990 Sheet:		
Drainage Map		Runoff		Flow Routing																					
				Surface Flow																					
Area No	Area Acres		100% Ae	N	S	E	W	Storm Drain	ISO	Freq. Fact.	Dist. Fact.	Amen 1hr BFR	Fra	BPRR	Frict. Slope (S)	K= Q/S^.5	Size	Area (sf)	Vel. (ft/s)	L (ft)	tc or tcx (min)	Storm Drain Station	Location	Remarks	
	34.9	A	26.1					592																	
126	565.0	ΣA	481.2												1E-04	59200	Trap	543.1	1.09	500	7.6	<- Area	126.1, 126.2,	126.3 & 126.4	45
		q	1.3						1.33	1.00	0.992	1.33	1.29	0.98		n =	0.013								
		Q	626													R =	1.2	W=	6.00'		96				46
	2.9	A	2.9				595	31								Kf =	3098	H=	4.00'						
128	557.9	ΣA	484.1												.0001	62600	RCB	24	1.29	100	1.3	<- Area	124.1		47
		q	1.3						1.33	1.00	0.992	1.33	1.29	0.98											
		Q	629																		07				48
								629														->Fresh	water Wetland		47

TABLED BY	PMP	CITY OF LOS ANGELES	STORM DRAIN DESIGN	Project: IMTP0102.25 - PLAYA VISTA	Date: Oct-16-1990
CHECKED BY	GMV	Department of Public Works	RUNOFF TABLING SHEET	ON-SITE HYDROLOGY - EXISTING	Sheet:
SUPERVISED BY		Bureau of Engineering	Frequency 50 Year	QUAD "D" - CENTINELA DITCH	

LINE D2E - 114

Drainage Map Area No.	Drainage Map Area Acres	Runoff	100% Aa	Surface Flow N	Surface Flow S	Surface Flow E	Surface Flow W	Flow Routing Storm Drain	ISO	Freq. Fact.	Dist. Fact.	Amen 1hr BFR	Fro	BPRR	Frict. Slope (S)	K= Q/S^.5	Size	Area (sf)	Vel. (ft/s)	L (ft)	tc or tcx (min)	Storm Drain Station	Location	Remarks	
																									48
	3.5	ΣA	3.0														b=	1'				<- Area 201			
201		q	3.1						1.33	1.00	1.000	1.33	1.30	2.35			z=	100	n=	0.03	11.6				
		Q	9.3														d=	0.33'							49
	4.5	A	3.9					9.3							0.003	170	Trap	11.27	0.83	680	13.7	<- Area 202			50
	8.0	ΣA	6.9														b=	1'							
202		q	2.2						1.33	1.00	1.000	1.33	1.30	1.67			z=	100	n=	0.03	25.3				51
		Q	15.2														d=	0.41'							
	9.8	A	7.7					15.2							0.003	304	Trap	17.44	0.87	1000	19.1	<- Area 204			52
	16.8	ΣA	14.6														b=	1'							
204		q	1.7						1.33	1.00	1.000	1.33	1.30	1.31			z=	100	n=	0.03	44.4				53
		Q	24.8														d=	0.53'							
	6.5	A	5.7					24.8							0.002	601	Trap	29.09	0.85	750	14.7	<- Area 206			54
	23.3	ΣA	20.3														b=	1'							
206		q	1.5						1.33	1.00	1.000	1.33	1.30	1.16			z=	100	n=	0.03	59.1				55
		Q	30.5														d=	0.60'							
	6.1	A	5.3					30.5							0.001	815	Trap	36.54	0.83	650	13.0	<- Area 208			56
	29.4	ΣA	25.6														b=	1'							
208		q	1.4						1.33	1.00	1.000	1.33	1.30	1.06			z=	100	n=	0.03	72.1				57
		Q	35.0														d=	0.85'							
	5.4	A	5.4					35.8							0.001	893	Trap	42.36	0.85	160	3.2	<- Area 210			58
	34.8	ΣA	31.0																						
210		q	1.4						1.33	1.00	1.000	1.33	1.30	1.04							75.3				59
		Q	43.4																						
	28.7	A	21.4					43.4																	
	63.5	ΣA	52.4														b=	1'			....	<- Line D2E from:		62	60
Σ 210		q	1.3						1.33	1.00	1.000	1.33	1.30	1.02			z=	40	n=	0.03	78.2	tc1/Q1=	75.3 min	40.4 cfs	
																						tc2/Q2=	82.8 min	27.8 cfs	61
		Q	68.1														d=	1.14'				tcx=	78.2 min		
	9.3	A	8.2					68.1							0.001	1820	Trap	63.09	1.28	700	9.1				62
	72.8	ΣA	60.6														b=	1'							
212		q	1.3						1.33	1.00	1.000	1.33	1.30	0.97			z=	40	n=	0.03	87.3				63
		Q	78.8														d=	1.17'							
	8.0	A	7.0					78.8							0.002	1970	Trap	56.3	1.4	630	7.5	<- Area 214.1			64
	80.8	ΣA	67.6														b=	1'							
214		q	1.2						1.33	1.00	1.000	1.33	1.30	0.94			z=	40	n=	0.03	94.8				65
		Q	81.1														d=	1.98'							
	4.1	A	3.1					81.1							15-04	8110	Trap	159.3	0.51	30	1.0	<- Area 215.1			66
	84.9	ΣA	70.7														b=	1'							
216		q	1.2						1.33	1.00	1.000	1.33	1.30	0.94			z=	10	n=	0.03	95.8				67
		Q	84.8														d=	1.88'							
	10.5	A	6.8					81.1							0.004	1299	Trap	29.94	2.71	700	4.3				68
	91.3	ΣA	76.4																						
114		q	1.2						1.33	1.00	1.000	1.33	1.30	0.92							100.1				69
		Q	91.7																						
								91.7														-> to Node 114 @ line:		29	70
																									71

Runoff Table
Line D.1.E - Centinela Ditch

TABLED BY PMP CHECKED BY GMV SUPERVISED BY	CITY OF LOS ANGELES Department of Public Works Bureau of Engineering	STORM DRAIN DESIGN RUNOFF TABLING SHEET Frequency 50 Year	Project: 1MTP0102.25 - PLAYA VISTA ON-SITE HYDROLOGY - EXISTING QUAD "D" - CENTINELA DITCH	Date: Oct-16-1990 Sheet:

Drainage Map Area No.	Drainage Map Area Acres	Runoff	Runoff 100% Ap	Flow Routing Surface Flow N	S	E	W	Storm Drain	ISO	Freq. Fact.	Dist. Fact.	Amen 1hr BFD	Fro	BPRR	Frict. Slope (S)	K=Q/S^.5	Size	Area (sf)	Vel. (ft/s)	L (ft)	tc or tcx (min)	Storm Drain Station	Location	Remarks	
LINE 3 - 210																									
	2.8	ΣA	2.1														b=	1'							72
301		q	3.3						1.33	1.00	1.000	1.33	1.30	2.51			z=	50	n=	0.03	10.0	<- Area 201-INITIAL AREA			
		Q	6.9														d=	0.40'							73
	3.0	A	2.2					6.9							0.002	147	Trap	8.51	0.81	320	6.6	<- Area 302			
	5.8	ΣA	4.3														b=	1'							74
302		q	2.6						1.33	1.00	1.000	1.33	1.30	2.01			z=	100	n=	0.03	16.6				
		Q	11.2														d=	0.35'							75
	10.1	A	7.5					11.2							0.003	204	Trap	12.95	0.86	1060	20.4	<- Area 304			
	15.9	ΣA	11.8														b=	1'							76
304		q	1.8						1.33	1.00	1.000	1.33	1.30	1.42			z=	100'	n=	0.03	37.0				
		Q	21.2														d=	0.48							77
	5.6	A	4.2					21.2							0.002	452	Trap	23.48	0.9	1180	21.8	<- Area 306			
	21.5	ΣA	16.0														b=	1'							78
306		q	1.5						1.33	1.00	1.000	1.33	1.30	1.16			z=	100'	n=	0.03	58.8				
		Q	24.0														d=	0.56							79
	7.2	A	5.4					24							0.001	665	Trap	31.39	0.76	1100	24.0				
	28.7	ΣA	21.4																						80
210		q	1.3						1.33	1.00	1.000	1.33	1.30	1.00							82.8				
		Q	27.8																						81
								27.8														-> to Node 210 @ line:		60	82
																									83

TABLED BY PMP
CHECKED BY GMV
SUPERVISED BY

CITY OF LOS ANGELES
Department of Public Works
Bureau of Engineering

STORM DRAIN DESIGN
RUNOFF TABLING SHEET
Frequency 50 Year

Project: 1MTP0102.25 - PLAYA VISTA
ON-SITE HYDROLOGY - EXISTING
QUAD "D" - CENTINELA DITCH

Date: Oct-16-1990
Sheet:

Drainage Map Area No	Drainage Map Area Acres	Runoff	Runoff 100% Ap	Flow Routing Surface Flow N	S	E	W	Storm Drain	ISO	Freq Fact.	Dist. Fact.	Amen 1hr BFR	Fro	BFRR	Frict. Slope (S)	K= Q/S^.5	Size	Area (sf)	Vel. (ft/s)	L (ft)	Tc or Tcx (min)	Storm Drain Station	Location	Remarks	
Line D1E-106 - Revised Area C-4.0																									
C.4.2	32.1	ΣA	28.1																						84
		q	2.86						1.33	1.00	1.000	1.33	1.30	2.20			D=	30 in			13.5	<- Area C.4.2 (Offsite)	Offsite Boundary		
		Q	80.4														d=	1.83							85
	7.4	A	5.1					80.4							0.168	196	Pipe	3.65	20.9	660	0.5				86
C.4.1	39.5	ΣA	33.2																						
		q	2.82						1.33	1.00	1.000	1.33	1.30	2.17			H=	4.00'			14.0		Bluffside		87
		Q	93.6														d=	8.00'							
	0.0	A	0.0					93.6							0.091	310	RCB	4.62	20.3	111	0.1				88
C.4.0	39.5	ΣA	33.2																						
		q	2.81						1.33	1.00	1.000	1.33	1.30	2.16							14.1		Riparian Corridor		89
		Q	93.3																						
		A						93.3														>To Node	Σ106 at line:	11	90
		ΣA																							
		q																							
		Q																							91
Line D1E-107 - Revised Area C.8.1.1 (Existing channel - Line 1)																									92
1.2	11.1	ΣA	10.3														B=	3.0							
		q	3.02						1.33	1.00	1.000	1.33	1.30	2.94			z=	1.00			7.0	<- Area C.8.3 (Offsite)	Offsite Boundary		93
		Q	39.3														d=	0.69							
	1.9	A	1.1					39.3							0.058	183	Trap	2.56	15.4	5	0.0				94
1.3	12.9	ΣA	11.4														B=	3.0							
		q	3.82						1.33	1.00	1.000	1.33	1.30	2.94			z=	1.00			7.0		Bluffs East		95
		Q	43.5														d=	0.73							
	2.1	A	1.3					43.5							0.058	181	Trap	2.74	15.9	6	0.0				96
1.4	15.0	ΣA	12.7														B=	3.0							
		q	3.82						1.33	1.00	1.000	1.33	1.30	2.94			z=	1.00			7.0		Bluffs East		97
		Q	48.5														d=	0.76							
	1.7	A	1.0					48.5							0.058	201	Trap	2.97	16.3	275	0.3			20	98
1.5	16.7	ΣA	13.7														B=	3.0							
		q	3.74						1.33	1.00	1.000	1.33	1.30	2.88			z=	1.00			7.3		Bluffs East		99
		Q	51.2														d=	0.81							
	1.6	A	1.0					51.2							0.058	213	Trap	3.07	16.7	220	0.2				100
1.6	18.3	ΣA	14.7														B=	3.0							
		q	3.71						1.33	1.00	1.000	1.33	1.30	2.85			z=	1.00			7.5		Bluffs East		101
		Q	54.5														d=	0.84							
	0.9	A	0.6					54.5							0.058	226	Trap	3.21	17	111	0.1				102
1.7	19.2	ΣA	15.3														B=	3.0							
		q	3.68						1.33	1.00	1.000	1.33	1.30	2.83			z=	1.00			7.6		Bluffs East		103
		Q	56.3														d=	0.69							
	11.3	A	9.6					56.3							0.091	167	Trap	2.56	22	111		<- From	Σ2.5 at line:	119	104
Σ1.7	30.5	ΣA	24.9																		* * * *	Ic1/Q1=	7.6 min	56.3 cfs	
		q	3.72						1.33	1.00	1.000	1.33	1.30	2.06							7.4	Ic2/Q2=	7.0 min	36.7 cfs	105
		Q	92.6																			Icx=	7.4 min		
		A						92.6														-> To Node	107 @ line	15	106

Runoff Table
Line D.1.E - Centinela Ditch

TABLED BY PMP CHECKED BY GMV SUPERVISED BY				CITY OF LOS ANGELES Department of Public Works Bureau of Engineering					STORM DRAIN DESIGN RUNOFF TABLING SHEET Frequency 50 Year						Project: 1MTP0102.25 - PLAYA VISTA ON-SITE HYDROLOGY - EXISTING QUAD "D" - CENTINELA DITCH								Date: Oct-16-1990 Sheet:		
Drainage Map		Runoff		Flow Routing																					
Area No	Area Acres		100% Ae	Surface Flow N	S	E	W	Storm Drain	ISO	Freq. Fact.	Dist. Fact.	Amen 1hr RFR	Fro	BPRR	Frict. Slope (S)	K= Q/S^.5	Size	Area (sf)	Vel. (ft/s)	L (ft)	Tc or tcx (min)	Storm Drain Station	Location	Remarks	
Line D1E-107 - Revised Onsite Area C.6.1.2 (Access road - Line 2)																									
2.1	0.2	ΣA	0.2																						107
		q	4.42						1.33	1.00	1.000	1.33	1.30	3.40			n=	.013							
		Q	0.9														z=	25			4.0		North Graded	Slopes	108
	0.5	A	0.3					0.9									d=	0.09							
	0.7	ΣA	0.5												0.121	2.587	V-chan	0.22	4.09	140	0.6				109
2.2		q	4.42						1.33	1.00	1.000	1.33	1.30	3.40			n=	.013							
		Q	2.2														z=	25			4.6		North Graded	Slopes	110
	0.3	A	0.2					2.2									d=	0.13							
	1.0	ΣA	0.7												0.114	6.516	V-chan	0.44	5.00	105	0.4				111
2.3		q	4.42						1.33	1.00	1.000	1.33	1.30	3.40			n=	.013							
		Q	3.1														z=	25			5.0		North Graded	Slopes	112
	1.0	A	0.7					3.1									d=	0.09							
	2.0	ΣA	1.4												0.114	9.181	V-chan	0.57	5.44	255	0.8				113
2.4		q	4.15						1.33	1.00	1.000	1.33	1.30	3.19			n=	.013							
		Q	5.8														z=	25			6.8		North Graded	Slopes	114
	0.3	A	0.2					5.8									d=	0.09							
	2.3	ΣA	1.8												0.076	21.039	V-chan	1.06	5.47	120	0.4				115
2.5		q	4.03						1.33	1.00	1.000	1.33	1.30	3.10											
		Q	6.4																		6.2		North Graded	Slopes	116
	9.0	A	8.0					6.4							0.091										
	11.3	ΣA	9.6																			<- Area C-6.2 (Offsite)			117
Σ2.5		q	3.62						1.33	1.00	1.000	1.33	1.30	2.84							....	tc1/Q1=	6.2 min	6.4 cfs	
		Q	36.7																		7.0	tc2/Q2=	7.2 min	30.2 cfs	118
		A						36.7														tcx=	7 min		
																						-> To Σ1.7 at line		104	119

Runoff Table
Line D.1.E - Centinela Ditch

PLAYA VISTA E[illegible]ING HYDROLOGY

Design Storm Frequency				50	year											
Node #	Area #	ISO	Soil Type		IMPERVIOUSNESS 100%	70%	60%	50%	40%	35%	15%	SUB AREA	EQUIV AREA	TOTAL AREA	TOTAL Ae	COMMENTS
LINE D1E : CENTINELA DITCH																
	101.1	1.33	1	dA:	1.50											
	101.2	1.33	2	dA:				1.05				1.5	1.5			
	C.1.0											1.1	0.7			
101												10.8	9.5			<- Bluff Area Above 101
												13.4	11.7	13.4	11.7	<- C.1.0 - Offsite from Tr. 43416
	102.1	1.33	1	dA:	3.99											
	102.2	1.33	2	dA:				7.06				4.0	4.0			
	C.2.0	1.33	2	dA:				2.10				7.1	4.9			
102												2.1	1.4			<- Bluff Area Above 102
												13.2	10.3	26.6	22.0	<- C.2.0 - Onsite Bluff Area
	104.1	1.33	1	dA:	11.36											
104												11.4	11.4			
												11.4	11.4	38.0	33.4	
	105.1	1.33	1	dA:	3.24											
	105.2	1.33	2	dA:				0.83				3.2	3.2			
	C.3.0	1.33	2	dA:				6.30				0.8	0.6			
105												6.3	4.3			<- Bluff Area Above 105
												10.3	8.1	48.3	41.5	<- C.3.0 - Onsite Bluff Area
	106.1	1.33	1	dA:	16.23											
	106.2	1.33	2	dA:				0.81				16.2	16.2			
106												0.8	0.6			
												17.0	16.8	65.3	58.3	<- Onsite Bluff Above 106
	C.4.1	1.33	2	dA:												
	C.4.2	1.33	2	dA:								7.4	5.1			
Σ106												32.1	28.1			<- C.4.1 - Onsite Bluff Area
												39.5	33.2	104.8	91.5	<- C.4.2 - From Offsite Hydrology
	107.1	1.33	1	dA:	4.32											
	107.2	1.33	2	dA:				0.67				4.3	4.3			
	C.5.0											0.7	0.5			
107												1.6	1.1			<- Bluff Area Above 107
												6.6	5.9	111.4	97.4	<- C.5.0 Onsite Bluff Area
	C.6.3															
	1.3	1.33	2	dA:				1.70				11.1	10.3			<- SD from Tr 43415 (School)
	1.4	1.33	2	dA:				2.07				1.8	1.1			
	1.5	1.33	2	dA:				1.66				2.1	1.3			
	1.6	1.33	2	dA:				1.63				1.7	1.0			
	1.7	1.33	2	dA:				0.91				1.6	1.0			
	ΣC.6.1.1											0.9	0.6			
												19.2	15.3			-> To Σ107 (See Below)
	C.6.2															
	2.1	1.33	2	dA:				0.24				9.0	8.0			<- SD from Tr 43415 (Tract)
	2.2	1.33	2	dA:				0.45				0.2	0.2			
	2.3	1.33	2	dA:				0.26				0.5	0.3			
	2.4	1.33	2	dA:				0.98				0.3	0.2			
	2.5	1.33	2	dA:				0.98				1.0	0.7			
	ΣC.6.1.2											0.3	0.2			
												11.3	9.6			-> To Σ107 (See Below)
Σ107	C.6.1															
												30.5	24.9	141.9	122.3	

Area Conversion Table
Line D.1.E - Centinela Ditch

PLAYA VISTA EXISTING HYDROLOGY

Design Storm Frequency				50	year											
Node #	Area #	ISO	Soil Type		IMPERVIOUSNESS 100%	70%	60%	50%	40%	35%	15%	SUB AREA	EQUIV AREA	TOTAL AREA	TOTAL Ae	COMMENTS
	108.1	1.33	1	dA:	14.74											
	108.2	1.33	2	dA:				0.97				14.7	14.7			
	C.7.0	1.33	2	dA:				1.03				1.0	0.7			<- Bluff Area Above 108
108												1.0	0.7			<- C.7.0 Onsite Bluff Area
												16.7	16.1	158.6	139.4	
	110.1	1.33	1	dA:	8.61											
	110.2	1.33	2	dA:				0.97				8.6	8.6			
110												1.0	0.7			<- Bluff Area Above 110
												9.6	9.3	168.2	147.7	
	112.1	1.33	1	dA:	3.99											
	112.2	1.33	2	dA:				1.13				4.0	4.0			
	C.8.1											1.1	0.8			<- Bluff Area Above 112
	C.8.2	1.33	2	dA:				0.90				1.6	1.1			<- C.8.1 from Offsite Hydrology
112												0.9	0.6			
												7.6	6.5	175.8	154.2	
	113.1	1.33	1	dA:	3.90											
	113.2	1.33	2	dA:				1.00				3.9	3.9			
	C.9.0											1.0	0.7			<- Bluff Area Above 113
113												1.5	1.0			<- C.9.0 from Offsite Hydrology
												6.4	5.6	182.2	159.8	
	C.10.0															
Σ113												124.5	117.2			<- LMU SD from Off-site Hydrology
												124.5	117.2	306.7	277.0	
	114.1	1.33	1	dA:	4.01											
	114.2	1.33	2	dA:				1.13				4.0	4.0			
	C.11.0											1.1	0.8			<- Bluff Area Above 114
114												0.8	0.6			<- C.11.0 from Offsite Hydrology
												5.9	5.4	312.5	282.4	
	Line D2E															
Σ114												91.3	76.4			<-From Line D2E
												91.3	76.4	403.9	358.8	
	115.1	1.33	1	dA:	0.98											
	115.2	1.33	2	dA:				0.42				1.0	1.0			
	C.12.0											0.4	0.3			<- Bluff Area Above 115
115												1.5	1.0			<- C.12.0 from Offsite Hydrology
												2.9	2.3	406.8	361.1	
	116.1	1.33	1	dA:						12.33						
	116.2	1.33	1	dA:						5.46		12.3	9.2			
	116.3	1.33	2	dA:				1.77				5.5	4.1			
	C.13.0											1.8	1.2			<- Bluff Area Above 116
116												1.8	1.2			<- C.13.0 from Offsite Hydrology
												21.4	15.7	428.2	376.8	

Area Conversion Table
Line D.1.E - Centinela Ditch

PLAYA VISTA EXISTING HYDROLOGY

Design Storm Frequency				50	year											
Node #	Area #	ISO	Soil Type		IMPERVIOUSNESS 100%	70%	60%	50%	40%	35%	15%	SUB AREA	EQUIV AREA	TOTAL AREA	TOTAL Ae	COMMENTS
	118.1	1.33	1	dA:						5.60		5.6	4.2			
	118.2	1.33	1	dA:						5.74		5.7	4.3			
	118.3	1.33	2	dA:				3.13				3.1	2.2			<- Bluff Area Above 118
	118.4	1.33	2	dA:				0.36				0.4	0.2			<- Bluff Area Above 118
	C.14.0											0.8	0.6			<- C.14.0 from Offsite Hydrology
	C.15.0											0.9	0.6			<- C.15.0 from Offsite Hydrology
	C.16.0											1.6	1.1			<- C.16.0 from Offsite Hydrology
	C.17.0											2.4	1.6			<- C.17.0 from Offsite Hydrology
	C.18.0											0.9	0.6			<- C.18.0 from Offsite Hydrology
118												*21.4*	*15.4*	449.6	392.2	
	120.1	1.33	1	dA:						11.96		12.0	9.0			
120												*12.0*	*9.0*	461.6	401.2	
	C.19.0											41.2	40.9			<- C.19.0 from Offsite Hydrology
Σ120												*41.2*	*40.9*	502.8	442.1	
	122.1	1.33	1	dA:						5.07		5.1	3.8			
	122.2	1.33	1	dA:						5.41		5.4	4.1			
122												*10.5*	*7.9*	513.3	450.0	
	124.1	1.33	1	dA:						6.81		6.8	5.1			
124												*6.8*	*5.1*	520.1	455.1	
	126.1	1.33	1	dA:						11.04		11.0	8.3			
	126.2	1.33	1	dA:						12.41		12.4	9.3			
	126.3	1.33	1	dA:						8.57		8.6	6.4			
	126.4	1.33	1	dA:						2.86		2.9	2.1			
126												*34.9*	*26.1*	555.0	461.2	
	128.1	1.33	1	dA:	2.88							2.9	2.9			
128												*2.9*	*2.9*	557.9	484.1	

PLAYA VISTA EXISTING HYDROLOGY

Design Storm Frequency				50	year											
Node #	Area #	ISO	Soil Type		IMPERVIOUSNESS 100%	70%	60%	50%	40%	35%	15%	SUB AREA	EQUIV AREA	TOTAL AREA	TOTAL Aa	COMMENTS
LINE D2E : TRIBUTARY TO CENTINELA DITCH																
	201.1	1.33	1	dA:	1.74					1.74		3.5	3.0			
201												3.5	3.0	3.5	3.0	
	202.2	1.33	1	dA:	2.25					2.25		4.5	3.9			
202												4.5	3.9	8.0	6.9	
	204.1	1.33	1	dA:	4.42					4.42		8.8	7.7			
204												8.8	7.7	16.8	14.6	
	206.1	1.33	1	dA:	3.23					3.23		6.5	5.7			
206												6.5	5.7	23.3	20.3	
	208.1	1.33	1	dA:	3.05					3.05		6.1	5.3			
208												6.1	5.3	29.4	25.6	
	210.1	1.33	1	dA:	5.42							5.4	5.4			
210												5.4	5.4	34.8	31.0	
	Line D3E											28.7	21.4			<- From Line D3E
Σ210												28.7	21.4	63.5	52.4	
	212.1	1.33	1	dA:	4.67					4.67		9.3	8.2			
212												9.3	8.2	72.8	60.6	
	214.1	1.33	1	dA:	4.01					4.01		8.0	7.0			
214												8.0	7.0	80.8	67.6	
	215.1	1.33	1	dA:						4.09		4.1	3.1			
215												4.1	3.1	84.9	70.7	
	216.1	1.33	1	dA:	3.50					7.01		10.5	8.8			
216												10.5	8.8	95.4	79.6	-> To Line D1E - Node Σ114

Area Conversion Table
Line D.1.E - Centinela Ditch

PLAYA VISTA EXISTING HYDROLOGY

Design Storm Frequency				50	year											
Node #	Area #	ISO	Soil Type		IMPERVIOUSNESS 100%	70%	60%	50%	40%	35%	15%	SUB AREA	EQUIV AREA	TOTAL AREA	TOTAL Ae	COMMENTS
LINE D3E : TRIBUTARY TO CENTINELA DITCH THROUGH LINE D2E																
	301.1	1.33	1	dA:						2.77		2.8	2.1			
301												2.8	2.1	2.8	2.1	
	302.1	1.33	1	dA:						2.96		3.0	2.2			
302												3.0	2.2	5.8	4.3	
	304.1	1.33	1	dA:						10.06		10.1	7.5			
304												10.1	7.5	15.9	11.8	
	306.1	1.33	1	dA:						5.62		5.6	4.2			
306												5.6	4.2	21.5	16.0	
	308.1	1.33	1	dA:						7.16		7.2	5.4			
308												7.2	5.4	28.7	21.4	- > To Line D2E - Node ∑210

Project Name:	PLAYA VISTA - ON-SITE HYDROLOGY - AREA "D" EXISTING								Date:	10/16/90
Project Number:	1MTP0102.25				Tabled By:	PMP			Checked By:	GMV
Area Number:	201.1	301.1	C.6.1.2							
Node Number:	201	301	2.1							
Runoff Tabling Sheet:										
Conveyor:	Overland	Overland	Gutter							
Development Type:	A1	A1	Undeveloped							
Development Class:	35 -1	35 -1	35 - 2							
Elevation Difference:	3 ft	2.3 ft	29 ft							
Length of Reach:	450 ft	370 ft	250 ft							
Average Slope:	0.67%	0.62%	11.60%							
Method of Computation:	Kirpich Fig. G 262	Kirpich Fig. G 262	Figure G242.2c							
ISO:	1.33	1.33	1.33							
Fro:	0.98	0.98	0.79							
tc:	5.8 min	5.0 min	tc(700)= 6.70							
For overland flow: (2)tc:	11.6 min	10.0 min								
TIME OF CONCENTRATION (tc):	11.6 min	10.0 min	4.0 min							

Initial Time of Concentration Table
Line D.1.E - Centinela Ditch

PLAYA VISTA EXISTING HYDROLOGY

TABLED BY / CHECKED BY / SUPERVISED BY	PMP / GMV	CITY OF LOS ANGELES Department of Public Works Bureau of Engineering	STORM DRAIN DESIGN RUNOFF TABLING SHEET Frequency 50 Year	Project: 1MTP0104.10 - PLAYA VISTA ON-SITE HYDROLOGY - EXISTING QUAD "D" - JEFFERSON DRAIN	Date: Aug-12-1992 Sheet:

Drainage Map Area No	Drainage Map Area Acres	Runoff	Runoff 100% Ae	Flow Routing Surface Flow N	S	E	W	Storm Drain	ISO	Freq. Fact.	Dist. Fact.	Amen thi RFR	Fra	BFRR	Frict. Slope (S)	K= Q/S^.5	Size	Area [sf]	Vel. [ft/s]	L [ft]	Ic or tcx [min]	Storm Drain Station	Location	Remarks	
LINE D2E - JEFFERSON STORM DRAIN																									
201	3.4	ΣA	3.4																						1
		q	3.7						1.33	1.00	1.000	1.33	1.30	2.88		n =	0.019					< - Area 201			
		Q	12.6													R =	0.75	d=	1.68'		7.3		MAJOR AVE.	J.1.0; Ic =7.3 min. A = 3.4 Ac.	2
	20.5	A	19.2				0	13								Kf =	291.6								
202	23.9	ΣA	22.6												0.002	281.74	38ø	3.09	4.21	360	1.4	< - Area 202			3
		q	3.5						1.33	1.00	1.000	1.33	1.30	2.67		n =	0.013								
		Q	79.1													R =	0.813				8.7		TEALE ST.	(J.2.0)	4
	5.8	A	5.1				42	37								Kf =	825.7								
204	29.7	ΣA	27.7												0.002	1768.7	39ø	8.296	4.46	663	2.5	< - Area 204			5
		q	3.1						1.33	1.00	1.000	1.33	1.30	2.39		n =	0.013								
		Q	85.9													R =	0.938				11.2				6
	50.9	A	40.4				32	54								Kf =	1209								
206	80.6	ΣA	68.1												0.002	1920.8	45ø	11.04	4.89	170	0.6	< - Area 206			7
		q	3.0						1.33	1.00	1.000	1.33	1.30	2.34		n =	0.013								
		Q	204.0													R =	1.375				11.8		INGLEWOOD BLVD.	(J.4.0)	8
	7.4	A	6.5				78	126								Kf =	3358								
208	88.0	ΣA	74.6												.0014	5452.1	66ø	23.76	5.3	774	2.4	< - Area 208			9
		q	2.00						1.33	1.00	1.000	1.33	1.30	2.15		n =	0.013								
		Q	209													R =	1.375				14.2		310' EAST OF RANDALL	(J.5.0)	10
	46.3	A	35.1				83	126								Kf =	3358								
210	134.3	ΣA	109.7												.0014	5585.8	66ø	23.76	5.3	349	1.1	< - Area 210			11
		q	2.7						1.33	1.00	0.999	1.33	1.30	2.09		n =	0.013								
		Q	296													R =	1.715	W=	8.50'		15.3		RANDALL ST. (Street Flow after RCB is full)	(J.6.0)	12
	23.4	A	21.5				100	198								Kf =	8004	H=	5.75'						
212	157.7	ΣA	131.2												.0006	12084	RCB	48.88	4.01	456	1.9	< - Area 212			13
		q	2.6						1.33	1.00	0.994	1.33	1.29	1.98		n =	0.013								
		Q	341													R =	1.715	W=	8.50'		17.2		CENTINELA AVE.	(J.7.0)	14
	38.8	A	29.8				145	196								Kf =	8004	H=	5.75'						
214	198.5	ΣA	161.0												.0006	13921	RCB	48.88	4.01	1040	4.3	< - Area 214			15
		q	2.3						1.33	1.00	0.991	1.33	1.29	1.80		n =	0.013								
		Q	370													R =	1.825	W=	10.0'		21.5		GROSVERNOR ST.	(J.8.0)	16
	4.2	A	3.5				130	240								Kf =	9817	H=	5.75'						
216	200.7	ΣA	164.5												.0006	15105	RCB	57.50	4.17	535	2.1	< - Area 216			17
		q	2.2						1.33	1.00	0.991	1.33	1.29	1.73		n =	0.013								
		Q	362													R =	1.825	W=	10.0'		23.6		WESTLAWN AVE.	(J.9.0)	18
	4.2	A	4.0				142	220								Kf =	9817	H=	5.75'						
218	204.9	ΣA	168.5												.0005	16189	RCB	57.50	3.83	622	2.7	< - Area 218			19
		q	2.1						1.33	1.00	0.882	1.33	1.29	1.65		n =	0.013								
		Q	354													R =	2.055	W=	12.0'		26.3		680' WEST OF WESTLAWN	(J.10.0)	20
	3.4	A	3.4				44	310								Kf =	13856	H=	6.25'						
220	208.3	ΣA	171.8												.0005	15831	RCB	75.00	4.13	425	1.7	< - Area 220			21
		q	2.1						1.33	1.00	0.992	1.33	1.29	1.60		n =	0.013								
		Q	361													R =	2.055	W=	12.0'		28.0		580' EAST OF McCONNELL	(J.11.0)	22
																Kf =	13856	H=	6.25'						

Runoff Table
Line D.2.E - Jefferson Drain

TABLED BY	RMP	CITY OF LOS ANGELES Department of Public Works Bureau of Engineering	STORM DRAIN DESIGN RUNOFF TABLING SHEET Frequency 50 Year	Project: 1MTP0104.10 - PLAYA VISTA ON-SITE HYDROLOGY - EXISTING QUAD "D" - JEFFERSON DRAIN	Date: Aug-12-1992
CHECKED BY	GMV				Sheet:
SUPERVISED BY					

Drainage Map Area No	Area Acres	Runoff	100% Ag	Surface Flow N	S	E	W	Storm Drain	ISO	Freq. Fact.	Dist. Fact.	Amen 1hr RFR	Fro	BPRR	Frict. Slope (S)	K= Q / $S^{.5}$	Size	Area [sf]	Vel. [ft/s]	L [ft]	to or tcx [min]	Storm Drain Station	Location	Remarks	
	7.7	A	7.7				51	310																	
	218.0	ΣA	179.6												.0005	16144	RCB	75.00	4.13	748	3.0	< - Area 222			
222		q	2.0						1.33	1.00	0.993	1.33	1.29	1.53		n =	0.013								23
		Q	359													R =	2.108	W=	12.0		31.0		120' WEST OF McCONNELL		24
	3.8	A	3.8				31	328								Kl =	14659	H=	6.50					(J.12.0)	
	219.8	ΣA	183.4												.0005	16055	RCB	78.00	4.21	305	1.2	< - Area 224			
224		q	1.9						1.33	1.00	0.992	1.33	1.29	1.51		n =	0.013								25
		Q	348													R =	2.108	W=	12.0		32.2		300' EAST OF BEETHOVEN		26
	1.4	A	1.4				20	328								Kl =	14659	H=	6.50					(J.13.0)	
	221.2	ΣA	184.8												.0005	15583	RCB	78.00	4.21	700	2.8	< - Area 226			
226		q	1.9						1.33	1.00	0.993	1.33	1.29	1.45		n =	0.013								27
		Q	351													R =	2.16	W=	12.0		35.0		400' WEST OF BEETHOVEN		28
	4.4	A	4.4				5	346								Kl =	15471	H=	6.75					(J.14.0)	
	225.6	ΣA	189.2												.0005	15697	RCB	81	4.27	590	2.3	< - Area 228			
228		q	1.8						1.33	1.00	0.993	1.33	1.29	1.41		n =	0.013	d=	5.51						29
		Q	341													R =	2.16	W=	12.0		37.3		100' EAST OF ALLA RD.		30
	9.3	A	9.3				0	341								Kl =	15471	H=	6.75					(J.15.0)	
	234.9	ΣA	198.5												.0005	15250	RCB	66.12	5.16	405	1.3	< - Area 230			
230		q	1.8						1.33	1.00	0.992	1.33	1.29	1.39		n =	0.013	d=	5.70						31
		Q	357													R =	2.211	W=	12.0		38.6		ALLA ROAD		32
	4.2	A	4.2				0	357								Kl =	16294	H=	7.00					(J.16.0)	
	239.1	ΣA	202.7												.0005	15965	RCB	68.4	5.22	590	1.9	< - Area 232			
232		q	1.8						1.33	1.00	0.992	1.33	1.29	1.36		n =	0.013	d=	5.79						33
		Q	365													R =	2.26	W=	12.0		40.5		BAY STREET		34
	34.3	A	25.9				0	365								Kl =	17125	H=	7.25					(J.17.0)	
	273.4	ΣA	228.6												.0005	16323	RCB	69.48	5.25	935	3.0	< - Area 234			
234		q	1.7						1.33	1.00	0.991	1.33	1.29	1.32		n =	0.013						QUAD "D" - NORTH OF		35
		Q	389													R =	2.28	W=	12.0		43.5		JEFFERSON BLVD.		36
	0.0	A	0.0				6	383								Kl =	17125	H=	7.25					(J.18.0)	
	273.4	ΣA	228.6												.0005	17397	RCB	87	4.4	50	0.2	< - Travel Time to Node 236			
236		q	1.7						1.33	1.00	0.988	1.33	1.28	1.32									QUAD "D" - SOUTH OF		37
		Q	389																		43.7		JEFFERSON BLVD.		38
	86.8	A	65.1				6	383																(J.19.0)	
	360.2	ΣA	293.7																			< - Line C2P - 236 Fro		72	
Σ 236		q	1.5						1.33	1.00	0.988	1.33	1.28	1.20		n =	0.013				. . .	tc1/Q1=	43.7 min	389 cfs	39
		Q	441													R =	2.28	W=	12.0		54.3	tc2/Q2=	107.0 min	76 cfs	40
	3.0	A	3.0				58	383								Kl =	17125	H=	7.25			tcx=	54.3 min		
	363.2	ΣA	295.7												.0005	18722	RCB	87	4.4	75	0.3	< - Area 238			
238		q	1.5						1.33	1.00	0.988	1.33	1.28	1.20		n =	0.013								41
		Q	445													R =	2.28	W=	12.0		54.6		LINCOLN BLVD.		42
	3.3	A	3.3				62	383								Kl =	17125	H=	7.25						
	368.5	ΣA	300.0												.0005	19901	RCB	87	4.4	1500	5.7	< - Area 240			
240		q	1.5						1.33	1.00	0.989	1.33	1.29	1.15		n =	0.013								43
		Q	450													R =	2.26	W=	12.0		60.3		JEFFERSON BLVD		44
																Kl =	17125	H=	7.25						

Runoff Table
Line D.2.E - Jefferson Drain

PLAYA VISTA EXISTING HYDROLOGY

TABLED BY	PMP	CHECKED BY	GMV	SUPERVISED BY

CITY OF LOS ANGELES
Department of Public Works
Bureau of Engineering

STORM DRAIN DESIGN
RUNOFF TABLING SHEET
Frequency 50 Year

Project: 1MTP0104.10 - PLAYA VISTA
ON-SITE HYDROLOGY - EXISTING
QUAD "D" - JEFFERSON DRAIN

Date: Aug-12-1992
Sheet:

Drainage Map Area No	Area Acres	Runoff	100% Ae	Surface Flow N	S	E	W	Storm Drain	ISO	Freq. Fact.	Dist. Fact.	Amen 1hr RFR	Fro	RFRR	Frict. Slope (S)	K= Q/S^.5	Size	Area [sf]	Vel. [ft/s]	L [ft]	tc or tcx [min]	Storm Drain Station	Location	Remarks	
	35.6	A	28.7				67	383							.0005	20125	RCB	87	4.4	105	0.4	<- Area 242			
	402.1	ΣA	328.7																						45
242		q	1.5						1.33	1.00	0.888	1.33	1.28	1.14		n =	0.013								
		Q	490													R =	2.26	W=	12.0'		60.7		QUAD "B" - NORTH OF		46
	0.0	A	0.0				107	383								Kl =	17125	H=	7.25'				JEFF., SOUTH OF CULVER		
	402.1	ΣA	328.7												.0005	21913	RCB	87	4.4	880	3.3				47
244		q	1.4						1.33	1.00	0.988	1.33	1.28	1.12											
		Q	457																		64.0				48
		A					74	383																	
		ΣA																			64.0	-> TO WETLANDS			49
		q																							
		Q																							50

PLAYA VISTA EXISTING HYDROLOGY

TABLED BY PMP CHECKED BY GMV SUPERVISED BY				CITY OF LOS ANGELES Department of Public Works Bureau of Engineering					STORM DRAIN DESIGN RUNOFF TABLING SHEET Frequency 50 Year						Project: 1MTP0104.10 - PLAYA VISTA ON-SITE HYDROLOGY - EXISTING QUAD "D" - JEFFERSON DRAIN								Date: Aug-12-1992 Sheet:		
Drainage Map		Runoff		Flow Routing																					
Area No	Area Acres		100% Ae	Surface Flow N	S	E	W	Storm Drain	ISO	Freq. Fact.	Dist. Fact.	Amen 1hr RFR	Frp	BPRR	Frict. Slope (S)	K= Q S½	Size	Area [sf]	Vol. [ft/s]	L [ft]	tc or tcx [min]	Storm Drain Station	Location	Remarks	
LINE C2P - 236																									
	3.5	ΣA	2.6																						51
501		q	2.4						1.33	1.00	1.000	1.33	1.30	1.86			b=	1'				<- Area 501			
		Q	8.2														z=	100	n=	0.03	20.0				
																	d=	0.38'							52
	2.8	A	2.1					8.2																	
	6.3	ΣA	4.7												.0008	253	Trap	15.19	0.41	650	20.5	<- Area 502			53
502		q	1.7						1.33	1.00	1.000	1.33	1.30	1.28			b=	1'							
		Q	8.0														z=	100	n=	0.03	46.5				
																	d=	0.44'							54
	3.6	A	2.7					8																	
	9.9	ΣA	7.4												.0005	358	Trap	19.70	0.41	750	30.8	<- Area 504			55
504		q	1.3						1.33	1.00	1.000	1.33	1.30	1.03			b=	1'							
		Q	9.8														z=	100	n=	0.03	77.3				
																	d=	0.45'							56
	3.6	A	2.7					9.6																	
	13.5	ΣA	10.1												.0006	392	Trap	21.08	0.46	310	11.3	<- Area 506			57
506		q	1.3						1.33	1.00	1.000	1.33	1.30	0.97			b=	10'							
		Q	13.1														z=	10	n=	0.03	88.6				
																	d=	0.62'							58
	3.9	A	2.9					13.1																	
	17.4	ΣA	13.0												.0020	293	Trap	10.09	1.3	1400	18.0	<- Area 508			59
508		q	1.2						1.33	1.00	1.000	1.33	1.30	0.89			b=	10'							
		Q	15.6														z=	3	n=	0.03	107				
																	d=	0.54'							60
	4.5	A	3.3					15.6																	
	21.9	ΣA	16.3												.0070	186	Trap	6.28	2.49	1100	7.4	<- Area 510			61
510		q	1.1						1.33	1.00	1.000	1.33	1.30	0.87			b=	10'							
		Q	17.9														z=	3			114				
																	d=	1.41'							62
	8.3	A	6.2					17.9																	
	30.2	ΣA	22.5												.0003	1033	Trap	20.06	0.89	1350	25.2	<- Area 512			63
512		q	1.0						1.33	1.00	1.000	1.33	1.30	0.80			b=	10'							
		Q	22.5														z=	3	n=	0.03	139				
																	d=	1.09'							64
	11.5	A	8.6					22.5																	
	41.7	ΣA	31.1												.0012	550	Trap	14.52	1.55	1450	15.6	<- Area 514			65
514		q	1.0						1.33	1.00	1.000	1.33	1.30	0.76											
		Q	31.1																n=	0.03	155				66
	39.7		29.9																						
	5.4	A	4.1					31.1														<- LINE 6 from line :		82	67
	86.8	ΣA	65.1																			<- LINE 7 from line :		94	68
Σ 514		q	1.2						1.33	1.00	1.000	1.33	1.30	0.80		n =	0.013				.....	tc1/Q1=	155 min	31 cfs	
		Q	78.1													R =	0.813				105	tc2/Q2=	69 min	42 cfs	69
																Kf =	825.7					tc3/Q3=	104 min	5 cfs	
																						tcx=	105.4 min		
	0.0	A	0.0	51				27.4							0.001	2354.8	39ø	8.298	3.3	360	1.8				
	86.8	ΣA	65.1																						70
236		q	1.2						1.33	1.00	1.000	1.33	1.30	0.89											
		Q	78.1																		107				71
		A						78.1																	
		ΣA																			107	-> To Node 236 at thi		39	72
		q							1.33	1.00	1.000	1.33	1.30	3.40								(To Jefferson SD)			
		Q																							73

PLAYA VISTA EXISTING HYDROLOGY

TABLED BY PMP CHECKED BY GMV SUPERVISED BY	CITY OF LOS ANGELES Department of Public Works Bureau of Engineering	STORM DRAIN DESIGN RUNOFF TABLING SHEET Frequency 50 Year	Project: 1MTP0104.10 - PLAYA VISTA ON-SITE HYDROLOGY - EXISTING QUAD "D" - JEFFERSON DRAIN	Date: Aug-12-1992 Sheet:

LINE 5 - 514

Drainage Map Area No	Drainage Map Area Acres	Runoff	Runoff 100% Ae	Flow Routing Surface Flow N	S	E	W	Storm Drain	ISO	Freq. Fact.	Dist. Fact.	Amen 1hr AFR	Fro	BFRR	Frict. Slope (S)	K= Q / S^.5	Size	Area [sf]	Vel. [ft/s]	L [ft]	tc or tcx [min]	Storm Drain Station	Location	Remarks	74
601	8 8	ΣA	6.6														b=	10'				<- Area 601			
		q	2.4						1.33	1.00	1.000	1.33	1.30	1.86			z=	2	n=	0.05	20.0				75
		Q	15.8														d=	0.06'							
	9.0	A	6.8					0							.0014	422	Trap	10.81	1.46	1050	12.0	<- Area 602			76
602	17.8	ΣA	13.4														b=	10'							
		q	2.0						1.33	1.00	1.000	1.33	1.30	1.51			z=	10	n=	0.03	32.0				77
		Q	28.8														d=	1.20'							
	10.6	A	8.0					6.8							.0008	1094	Trap	26.26	1.02	1100	18.0	<- Area 604			78
604	26.4	ΣA	21.4														b=	10'							
		q	1.6						1.39	1.00	1.000	1.33	1.30	1.24			z=	10	n=	0.03	50.0				79
		Q	34.2														d=	1.28'							
	11.3	A	8.5					8.0							.0009	1140	Trap	27.06	1.26	1400	16.5	<- Area 606			80
514	39.7	ΣA	29.9																						
		q	1.4						1.33	1.00	1.000	1.39	1.30	1.08							68.5				81
		Q	41.9																						
		A						8.5													68.5	-> to Node 514 @line		87	82
		ΣA																							
		q																							83
		Q																							

PLAYA VISTA EXISTING HYDROLOGY

TABLED BY PMP CHECKED BY GMV SUPERVISED BY	CITY OF LOS ANGELES Department of Public Works Bureau of Engineering	STORM DRAIN DESIGN RUNOFF TABLING SHEET Frequency 50 Year	Project: 1MTP0104.10 - PLAYA VISTA ON-SITE HYDROLOGY - EXISTING QUAD "D" - JEFFERSON DRAIN	Date: Aug-12-1992 Sheet:

LINE 7 - 514

Drainage Map Area No	Drainage Map Area Acres	Runoff	Runoff 100% Ae	Surface Flow N	Surface Flow S	Surface Flow E	Surface Flow W	Storm Drain	ISO	Freq. Fact.	Dist. Fact.	Amen 1hr RFR	Fro	BPRR	Frict. Slope (S)	K= Q/S½	Size	Area (sf)	Vel. (ft/s)	L (ft)	Tc or tcx (min)	Storm Drain Station	Location	Remarks	
	0.9	ΣA	0.7														b=	10'							84
701		q	2.4						1.33	1.00	1.000	1.33	1.30	1.82			z=	3'	n=	0.03	21.0	<- Area 701			
		Q	1.7														d=	0.27							85
	2.4	A	1.8					1.7							.0009	57	Trap	2.80	0.59	1010	28.7	<- Area 702			
	3.3	ΣA	2.5														b=	10'							86
702		q	1.0						1.33	1.00	1.000	1.33	1.30	1.25			z=	3'	n=	0.03	49.7				
		Q	4.0														d=	0.46							87
	1.4	A	1.1					4							.0008	141	Trap	5.22	0.77	720	15.7	<- Area 704			
	4.7	ΣA	3.6														b=	10'							88
704		q	1.4						1.33	1.00	1.000	1.33	1.30	1.11			z=	3'	n=	0.03	65.4				
		Q	5.0														d=	0.95							89
	0.7	A	0.5					5							.0001	500	Trap	5.22	0.96	650	11.9	<- Area 706			
	5.4	ΣA	4.1														b=	10'							90
706		q	1.3						1.33	1.00	1.000	1.33	1.30	1.03			z=	3'	n=	0.03	77				
		Q	5.3														d=	0.37							91
	0.0	A	0.0					5.3							.0030	97	Trap	4.05	1.31	2100	26.7				
	5.4	ΣA	4.1																						92
514		q	1.2						1.33	1.00	1.000	1.33	1.30	0.90							104				
		Q	4.9																						93
		A						4.9																	
		ΣA																			104	-> to Node 514 @ Line		68	94
		q																							
		Q																							95

Design Storm Frequency				50	year											
					IMPERVIOUSNESS											
Node #	Area #	ISO	Soil Type		100%	70%	60%	50%	40%	35%	15%	SUB AREA	EQUIV AREA	TOTAL AREA	TOTAL Ae	COMMENTS
LINE D2E: JEFFERSON STORM DRAIN																
	J.1.0															
201												3.4	3.4			< - Offsite J.1.0 (Major Ave at Cent.)
												3.4	3.4	3.4	3.4	
	202.1	1.33	1	dA:	11.89											
	202.2	1.33	2	dA:				4.24				11.9	11.9			
	J.2.0											4.2	2.9			< - Bluff Area Above 202
202												4.4	4.4			< - Offsite J.2.0 (Teale Street at
												20.5	19.2	23.9	22.6	Centinela Avenue)
	204.1	1.33	1	dA:	2.92					2.92						
204												5.8	5.1			
												5.8	5.1	29.7	27.7	
	J.4.0															
206												50.9	40.4			< - Offsite J.4.0 (Inglewood Blvd. at
												50.9	40.4	80.6	68.1	Jefferson Blvd.)
	208.1	1.33	1	dA:	1.91					3.81		5.7	4.8			
	J.5.0															
208												1.7	1.7			< - Offsite J.5.0 (310' E. of Randall S
												7.4	6.5	88.0	74.6	at Jefferson Blvd.)
	210.1	1.33	1	dA:	0.56					1.16		1.7	1.5			
	J.6.0															
210												44.6	33.6			< - Offsite J.6.0 (Randall St. at
												46.3	35.1	134.3	109.7	Jefferson Blvd.)
	212.1	1.33	1	dA:	1.21					2.42		3.6	3.0			
	J.7.0															
212												19.8	18.5			< - Offsite J.7.0 (Centinela Avenue
												23.4	21.5	157.7	131.2	at Jefferson Blvd.)
	214.1	1.33	1	dA:	1.43					2.86		4.3	3.6			
	J.8.0															
214												34.5	26.2			< - Offsite J.8.0 (Grosvernor St.
												38.8	29.8	196.6	161.0	at Jefferson Blvd.)
	J.9.0	1.33	1	dA:												
216												4.2	3.5			< - Offsite J.9.0 (Westlawn Avenue
												4.2	3.5	200.7	164.5	at Jefferson Blvd.)
	416.1	1.33	1	dA:	0.86					0.86		1.7	1.5			
	J.10.0															
218												2.5	2.5			< - Offsite J.10.0 (680' West of
												4.2	4.0	204.9	168.5	Westlawn Ave. at Jefferson Blvd.)
	220.1	1.33	1	dA:	0.5							0.5	0.5			
	J.11.0															
220												2.9	2.9			< - Offsite J.11.0 (580' East of
												3.4	3.4	208.3	171.9	McConnell Ave. at Jefferson Blvd.)

Area Conversion Table
Line D.2.E - Jefferson Drain

PLAYA VISTA EXISTING HYDROLOGY

Design Storm Frequency				50	year											
Node #	Area #	ISO	Soil Type		IMPERVIOUSNESS 100%	70%	60%	50%	40%	35%	15%	SUB AREA	EQUIV AREA	TOTAL AREA	TOTAL Ae	COMMENTS
	222.1	1.33	1	dA:	1.16											
	J.12.0											1.2	1.2			
222												6.5	6.5			< - Offsite J.12.0 (120' West of
												7.7	7.7	216.0	179.6	McConnell Ave. at Jefferson Blvd.)
	224.1	1.33	1	dA:	0.82											
	J.13.0	1.33	1	dA:								0.8	0.8			
224												3.0	3.0			< - Offsite J.13.0 (300' East of
												3.8	3.8	219.8	183.4	Beethoven St. at Jefferson Blvd.)
	J.14.0	1.33	1	dA:												
226												1.4	1.4			< - Offsite J.14.0 (400' West of
												1.4	1.4	221.2	184.8	Beethoven St. at Jefferson Blvd)
	228.1	1.33	1	dA:	1.29											
	J.15.0	1.33	1	dA:								1.3	1.3			
228												3.1	3.1			< - Offsite J.15.0 (100' East of
												4.4	4.4	225.6	189.2	Alla Road at Jefferson Blvd.)
	228.1	1.33	1	dA:	0.65											
	J.16.0	1.33	1	dA:								0.7	0.7			
230												8.6	8.6			< - Offsite J.16.0 (Alla Road at
												9.3	9.3	234.9	198.5	Jefferson Blvd.)
	J.17.0	1.33	1	dA:								4.2	4.2			
232												4.2	4.2	239.1	202.7	< - Offsite J.17.0 (Bay St. at Jefferson Blvd.)
	234.1	1.33	1	dA:	0.65					33.6		34.3	25.9			
234												34.3	25.9	273.4	228.6	< - Quad "D" north of Jefferson
												86.8	65.1			
Σ236												86.8	65.1	360.2	293.7	< - Line D2E - 236 (Quad "D" south of Jefferson)
	238.1	1.33	1	dA:	3.01							3.0	3.0			
238												3.0	3.0	363.2	296.7	< - Area 238 (Lincoln Blvd. at Jefferson)
	240.1	1.33	1	dA:	3.32							3.3	3.3			
240												3.3	3.3	366.5	300.0	< - Area 240 (Jefferson Blvd.)
	242.1	1.33	1	dA:						35.63		35.6	26.7			< - Area 242 (Area East of Lincoln,
242												35.6	26.7	402.1	326.7	South of Culver, North of Jefferson)

Area Conversion Table
Line D.2.E - Jefferson Drain

PLAYA VISTA EXISTING HYDROLOGY

Design Storm Frequency				50	year											
Node #	Area #	ISO	Soil Type		IMPERVIOUSNESS 100%	70%	60%	50%	40%	35%	15%	SUB AREA	EQUIV AREA	TOTAL AREA	TOTAL Ae	COMMENTS
LINE D2E - 236 : TRIBUTARY TO LINE D2E - JEFFERSON STORM DRAIN																
	501.1	1.33	1	dA:						3.48		3.5	2.6			
501												*3.5*	*2.6*	3.5	2.6	
	502.1	1.33	1	dA:						2.76		2.8	2.1			
502												*2.8*	*2.1*	6.3	4.7	
	504.1	1.33	1	dA:						3.59		3.6	2.7			
504												*3.6*	*2.7*	9.9	7.4	
	506.1	1.33	1	dA:						3.56		3.6	2.7			
506												*3.6*	*2.7*	13.5	10.1	
	508.1	1.33	1	dA:						3.85		3.9	2.9			
508												*3.9*	*2.9*	17.4	13.0	
	510.1	1.33	1	dA:						4.46		4.5	3.3			
510												*4.5*	*3.3*	21.9	16.3	
	512.1	1.33	1	dA:						8.32		8.3	6.2			
512												*8.3*	*6.2*	30.2	22.5	
	514.1	1.33	1	dA:						11.49		11.5	8.6			
514												*11.5*	*8.6*	41.7	31.1	
												39.7	29.9			<- Line 6 - 514
												5.4	4.1			<- Line 7 - 514
Σ514												*45.1*	*34.0*	86.8	65.1	-> to Line D2E @ Node 234

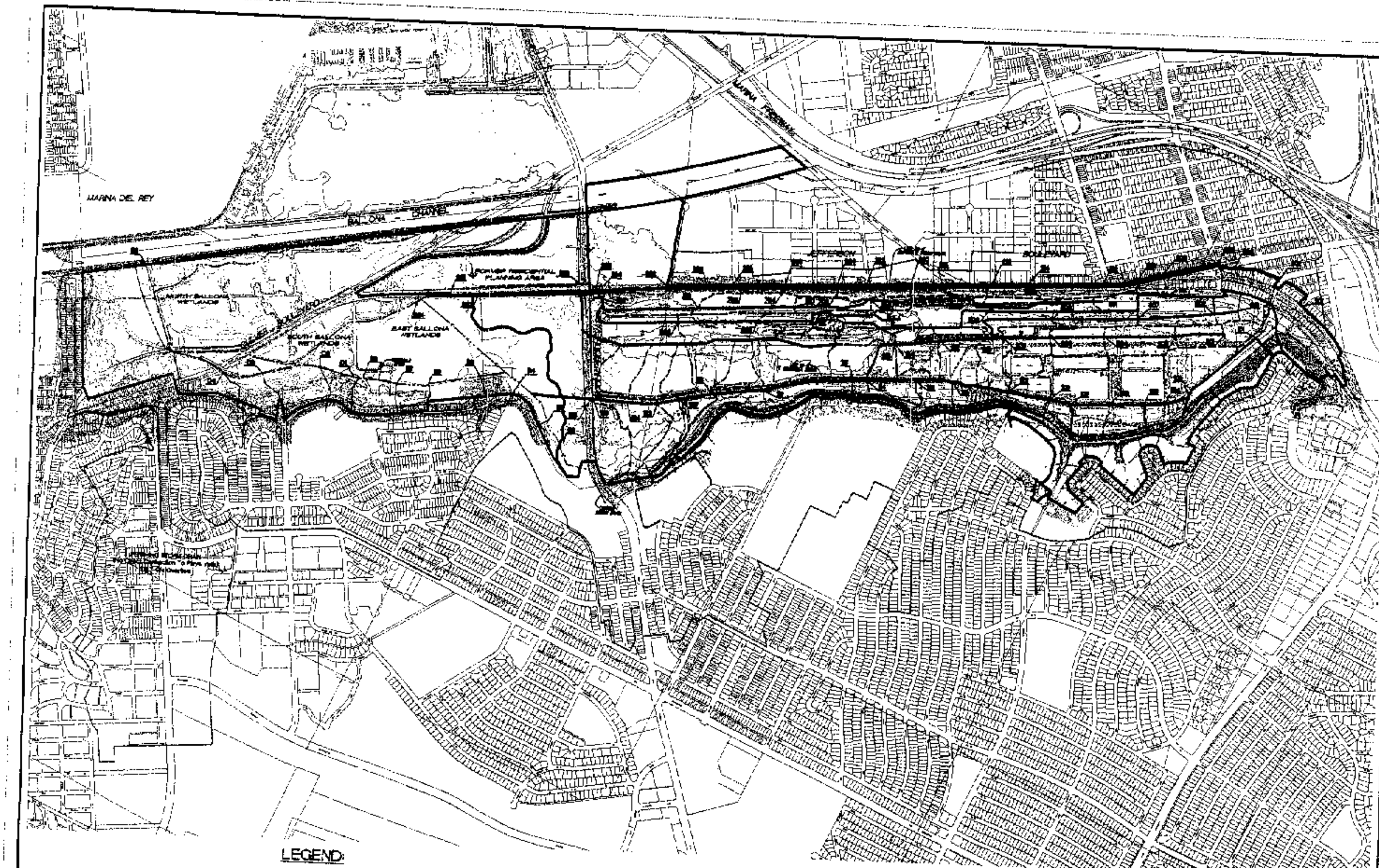
Design Storm Frequency				50	year											
Node #	Area #	ISO	Soil Type		IMPERVIOUSNESS 100%	70%	60%	50%	40%	35%	15%	SUB AREA	EQUIV AREA	TOTAL AREA	TOTAL Ae	COMMENTS
LINE 6 : TRIBUTARY TO LINE D2E - 236																
	601.1	1.33	1	dA:						8.83		8.8	6.6			
601												8.8	6.6	8.8	6.6	
	602.1	1.33	1	dA:						5.29		5.3	4.0			
	602.1	1.33	1	dA:						3.69		3.7	2.8			
602												9.0	6.8	17.8	13.4	
	604.1	1.33	1	dA:						10.63		10.6	8.0			
604												10.6	8.0	28.4	21.4	
	606.1	1.33	1	dA:						11.33		11.3	8.5			
606												11.3	8.5	39.7	29.9	-> to Line D2E-236 at NODE 514
LINE 7 : TRIBUTARY TO LINE D2E - 236																
	701.1	1.33	1	dA:						0.94		0.9	0.7			
701												0.9	0.7	0.9	0.7	
	702.1	1.33	1	dA:						2.38		2.4	1.8			
702												2.4	1.8	3.3	2.5	
	704.1	1.33	1	dA:						1.43		1.4	1.1			
704												1.4	1.1	4.7	3.6	
	706.1	1.33	1	dA:						0.66		0.7	0.5			
706												0.7	0.5	5.4	4.1	-> to Line D2E-236 at NODE 514

Project Name: PLAYA VISTA - ON-SITE HYDROLOGY - EXISTING Date: 8/12/92

Project Number: 1MTP0104.10 Tabled By: PMP Checked By: GMV

Area Number:	202.1	501.1	601.1	701.1						
Node Number:	202	501	601	701						
Runoff Tabling Sheet:										
Conveyor:	Overland	Overland	Overland	Overland						
Development Type:	Parking	Undev.	Undev.	Undev.						
Development Class:	100	35	35	35						
Elevation Difference:	7.6 ft	1.8 ft	9 ft	1 ft						
Length of Reach:	1400 ft	600 ft	1600 ft	520 ft						
Average Slope:	0.54%	0.30%	0.56%	0.19%						
Method of Computation:	Figure G.242.2A	Kirpich Fig. G 261	Kirpich Fig. G 261	Kirpich Fig. G 261						
ISO:	1.33	1.33	1.33	1.33						
Fro:	1.30	0.98	0.98	0.98						
Base tc or tc(700):	7.0 min	10.0 min	16.0 min	10.5 min						
TIME OF CONCENTRATION (tc):	9.9 min	20.0 min	32.0 min	21.0 min						

Initial Time of Concentration Table
Line D.2.E - Jefferson Drain



LEGEND:

- PROJECT BOUNDARY
- WATERSHED BOUNDARY
- SUB AREA BOUNDARY
- OFF-SITE HYDROLOGY LIMITS
- EXISTING STORM DRAIN LINE
- STORM DRAIN CHANNELS/DITCHES LINE
- MAIN LINE NODE
- LATERAL NODE

THE VILLAGE AT PLAYA VISTA
PROPOSED PROJECT
WATER RESOURCES REPORT - HYDROLOGY

ONSITE HYDROLOGY PRE-FIRST PHASE

PSOMAS

PLAYA VISTA OFF-SITE HYDROLOGY

DRAINAGE SYSTEM	Off-site Node No.	Drainage Area A [ac]	Equivalent Area Ae [ac]	Time of Conc. tc [min]	Design Runoff Q50y [cfs]	COMMENTS	Unit Runoff q [cfs/ac]
QUAD "D"							
QUAD "D" - CENTINELA DITCH/RIPARIAN CORRIDOR OFF-SITE							
Tract 43416 (Bluff Tract)	C-1.0	10.8 ac	9.5 ac	8.1 min	34.0 cfs	Revised	3.15 cfs/ac
Firebrand Street Storm Drain	C-4.2	32.1 ac	28.1 ac	13.5 min	80.4 cfs	Revised	2.50 cfs/ac
Tract 43415 (School)	C-6.2	9.0 ac	8.0 ac	7.2 min	30.2 cfs	Revised	3.36 cfs/ac
Tract 43415 (Tract)	C-6.3	11.1 ac	10.3 ac	7.0 min	39.3 cfs	Revised	3.54 cfs/ac
Bluff above North Outfall Sewer	C-8.1	1.6 ac	1.1 ac	7.7 min	6.2 cfs	Revised	3.88 cfs/ac
Bluff above North Outfall Sewer	C-9.0	1.5 ac	1.0 ac	6.4 min	4.0 cfs		2.67 cfs/ac
LMU Storm Drain	C-10.0	124.5 ac	117.2 ac	10.2 min	378 cfs		3.04 cfs/ac
Bluff above North Outfall Sewer	C-11.0	0.8 ac	0.6 ac	8.0 min	2.2 cfs		2.75 cfs/ac
Bluff above North Outfall Sewer	C-12.0	1.5 ac	1.0 ac	9.5 min	3.3 cfs		2.20 cfs/ac
Bluff above North Outfall Sewer	C-13.0	1.8 ac	1.2 ac	9.2 min	4.1 cfs		2.28 cfs/ac
Bluff above North Outfall Sewer	C-14.0	0.8 ac	0.6 ac	2.9 min	2.7 cfs		3.38 cfs/ac
Bluff above North Outfall Sewer	C-15.0	0.9 ac	0.6 ac	3.6 min	2.7 cfs		3.00 cfs/ac
Bluff above North Outfall Sewer	C-16.0	1.6 ac	1.1 ac	7.8 min	4.0 cfs		2.50 cfs/ac
Bluff above North Outfall Sewer	C-17.0	2.4 ac	1.6 ac	6.8 min	6.2 cfs		2.58 cfs/ac
Bluff above North Outfall Sewer	C-18.0	0.9 ac	0.6 ac	4.9 min	2.7 cfs		3.00 cfs/ac
HAC Storm Drain	C-19.0	41.2 ac	40.9 ac	7.1 min	155 cfs	Revised	3.76 cfs/ac
CENTINELA DITCH OFF-SITE TOTAL:		242.5 ac	223.4 ac				3.11 cfs/ac

PLAYA VISTA OFF-SITE HYDROLOGY

DRAINAGE SYSTEM	Off-site Node No.	Drainage Area A [ac]	Equivalent Area Ae [ac]	Time of Conc. tc [min]	Design Runoff Q50y [cfs]	COMMENTS	Unit Runoff q [cfs/ac]
JEFFERSON STORM DRAIN 0FF-SIT							
Major Avenue	J-1.0	3.4 ac	3.4 ac	6.6 min	15.4 cfs		4.53 cfs/ac
Teale Street	J-2.0	4.4 ac	4.4 ac	8.0 min	15.8 cfs		3.59 cfs/ac
Inglewood Boulevard	J-4.0	50.9 ac	40.4 ac	19.4 min	98.7 cfs		1.94 cfs/ac
Jefferson Blvd. east of Randall St.	J-5.0	1.7 ac	1.7 ac	10.4 min	5.4 cfs		3.18 cfs/ac
Randall Street	J-6.0	44.6 ac	33.6 ac	27.0 min	71.2 cfs		1.60 cfs/ac
Centinela Avenue	J-7.0	19.8 ac	18.5 ac	20.4 min	44.2 cfs		2.23 cfs/ac
Grosvenor Boulevard	J-8.0	34.5 ac	27.1 ac	19.5 min	66.1 cfs		1.92 cfs/ac
Westlawn Avenue	J-9.0	4.2 ac	3.5 ac	5.2 min	15.3 cfs		3.64 cfs/ac
Jefferson Blvd. West of Westlawn Ave.	J-10.0	2.5 ac	2.5 ac	8.1 min	9.0 cfs		3.60 cfs/ac
Jefferson Blvd. East of McConnell Ave.	J-11.0	2.9 ac	2.9 ac	7.7 min	10.6 cfs		3.66 cfs/ac
McConnell Avenue	J-12.0	6.5 ac	6.5 ac	9.7 min	21.5 cfs		3.31 cfs/ac
Jefferson Blvd. East of Beethoven Street.	J-13.0	3.0 ac	3.0 ac	7.8 min	10.9 cfs		3.63 cfs/ac
Jefferson Blvd. West of Beethoven Street.	J-14.0	1.4 ac	1.4 ac	6.7 min	5.4 cfs		3.86 cfs/ac
Jefferson Blvd. East of Alla Street.	J-15.0	3.1 ac	3.1 ac	11.6 min	9.5 cfs		3.06 cfs/ac
Alla Street	J-16.0	8.6 ac	8.6 ac	6.9 min	33.0 cfs		3.84 cfs/ac
Bay Street	J-17.0	4.2 ac	4.2 ac	3.8 min	18.6 cfs		4.43 cfs/ac
JEFFERSON OFF-SITE TOT:		195.7 ac	164.8 ac				2.30 cfs/ac
QUAD "D" OFF-SITE TOTAL:		438.2 ac	388.2 ac				2.75 cfs/ac

PLAYA VISTA OFF-SITE HYDROLOGY

DRAINAGE SYSTEM	Off-site Node No.	Drainage Area A [ac]	Equivalent Area Ae [ac]	Time of Conc. tc [min]	Design Runoff Q50y [cfs]	COMMENTS	Unit Runoff q [cfs/ac]
QUAD "B"							
Lincoln Boulevard Storm Drain	C-20.0	85.4 ac	70.7 ac	12.5 min	209.0 cfs		2.45 cfs/ac
80th Street North	C-21.0	7.0 ac	6.2 ac	3.8 min	27.4 cfs		3.91 cfs/ac
Bluff above North Outfall Sewer	C-22.0	4.6 ac	4.1 ac	3.5 min	18.1 cfs		3.93 cfs/ac
Bluff above North Outfall Sewer	C-23.0	3.4 ac	3.0 ac	3.7 min	13.3 cfs		3.91 cfs/ac
Bluff above North Outfall Sewer	C-24.0	2.1 ac	1.8 ac	3.5 min	8.0 cfs		3.81 cfs/ac
Hastings Avenue Storm Drain	C-25.0	14.3 ac	12.6 ac	5.3 min	54.4 cfs		3.80 cfs/ac
Bluff above North Outfall Sewer	C-26.0	2.7 ac	2.4 ac	3.1 min	10.6 cfs		3.93 cfs/ac
Bluff above North Outfall Sewer	C-27.0	2.3 ac	2.0 ac	3.0 min	8.8 cfs		3.83 cfs/ac
Bluff above North Outfall Sewer	C-28.0	4.7 ac	4.2 ac	3.3 min	18.6 cfs		3.96 cfs/ac
Bluff above North Outfall Sewer	C-29.0	6.1 ac	5.4 ac	4.0 min	23.9 cfs		3.92 cfs/ac
Falmouth Avenue Storm Drain	C-30.0	106.0 ac	93.9 ac	12.2 min	281.0 cfs		2.65 cfs/ac
Sinaloa Road Storm Drain	C-31.0	17.9 ac	15.7 ac	9.6 min	52.1 cfs		2.91 cfs/ac
Culver Boulevard/Playa del Rey	C-32.0	6.2 ac	5.4 ac	6.5 min	21.3 cfs		3.44 cfs/ac
Culver Boulevard/Playa del Rey	C-0.33	5.9 ac	5.9 ac	11.5 min	18.1 cfs		3.07 cfs/ac
WETLANDS OFF-SITE TOTAL:		268.6 ac	233.3 ac				2.85 cfs/ac
QUAD "B" OFF-SITE TOTAL:		268.6 ac	233.3 ac				2.85 cfs/ac

PLAYA VISTA OFF-SITE HYDROLOGY

TABLED BY VAT CHECKED BY GMV SUPERVISED BY	CITY OF LOS ANGELES Department of Public Works Bureau of Engineering	STORM DRAIN DESIGN RUNOFF TABLING SHEET Frequency 50 Year	Project: 1MTP0104.10 OFFSITE HYDROLOGY C-1.0 - TRACT 43416	Date: Aug-12-1992 Sheet:

Drainage Map Area No	Drainage Map Area Acres	Runoff	Runoff 100% As	Flow Routing Surface Flow N	S	E	W	Storm Drain	ISO	Freq. Fact.	Dist. Fact.	Amen 1hr RFR	Fro	BPRR	Frict. Slope (S)	K= Q / S^.5	Size	Area [sf]	Vel. [ft/s]	L [ft]	tc or tcx [min]	Storm Drain Station	Location	Remarks	
																									1
Storm Drain Line "A"																									2
6.1	3.7	ΣA q Q	3.3 4.30 14.2						1.33	1.00	1.00	1.33	1.30	3.31			R/W= W= d=	56' 36' 0.42			5.3				3
	3.5	A	3.1	14											0.013	124.54	Street	4.08	3.49	550	2.6				4
6.2	7.2	ΣA q Q	6.4 3.61 23.1						1.33	1.00	1.00	1.33	1.30	2.78			D= d=	24" 1.39			7.9				5
	2.1	A	1.8	9				14							0.006	309.69	Pipe	3.84	6.02	310	0.9				6
6.3	9.3	ΣA q Q	8.2 3.46 28.4						1.33	1.00	1.00	1.33	1.30	2.66							8.8				7
	1.5	A	1.3	0				14														<- Line "A-1" @ line:		17	8
Σ6.3	10.8	ΣA q Q	9.5 3.61 34.3						1.33	1.00	1.00	1.33	1.30	2.78			D= d=	24" 0.73			7.9	tc1/Q1= tc2/Q2= tcx=	8.8 min 3.3 min 7.9 min	28.4 cfs 5.7 cfs	9
	0.0	A	0.0	0				34							0.278	65.054	Pipe	1.05	32.8	345	0.2				10
6.5	10.8	ΣA q Q	9.5 3.58 34.0						1.33	1.00	1.00	1.33	1.30	2.75							8.1				11
								34														-> Centinela Ditch			12
Line "A-1"																									13
6.4	1.5	ΣA q Q	1.3 4.42 5.7						1.33	1.00	1.00	1.33	1.30	3.40			D= d=	24" 1			2.5				14
	0.0	A	0.0			6									0.003	114.00	Pipe	1.58	3.61	180	0.8				15
Σ6.3	1.5	ΣA q Q	1.3 4.42 5.7						1.33	1.00	1.00	1.33	1.30	3.40							3.3				16
																						-> Node 6.3 @ line:		8	17

PLAYA VISTA OFF-SITE HYDROLOGY

TABLED BY VAT CHECKED BY GMV SUPERVISED BY				CITY OF LOS ANGELES Department of Public Works Bureau of Engineering					STORM DRAIN DESIGN RUNOFF TABLING SHEET Frequency 50 Year						Project: 1MTP0104.10 OFFSITE HYDROLOGY C-1.0 - TRACT 43416								Date: Aug-12-1992 Sheet:		
Drainage Map		Runoff		Flow Routing																					
Area No	Area Acres		100% Ap	Surface Flow N	S	E	W	Storm Drain	ISO	Freq. Fact.	Dist. Fact.	Amen 1hr RFR	Fro	BPRR	Frict. Slope (S)	K= Q/S^.5	Size	Area (sf)	Vel. (ft/s)	L (ft)	tc or tcx (min)	Storm Drain Station	Location	Remarks	1
Storm Drain Line #1																									18
1.1	5.5	ΣA	4.9														R/W=	60'							
		q	3.64						1.33	1.00	1.00	1.33	1.30	2.85			W=	36'			6.9		ALVERSTONE AVE		19
		Q	18.8														d=	0.45							
	5.6	A	5.0	19											0.01	185.24	Street	5.84	3.22	900	4.7				20
1.2	11.1	ΣA	9.9																						
		q	3.06						1.33	1.00	1.00	1.33	1.30	2.35							11.6		ALVERSTONE & DUNFIELD		21
		Q	30.3																						
	12.1	A	10.6	30																					
Σ1.2	23.2	ΣA	20.5														R/W=	60'				<- from	Line #2 @ line	49	22
		q	3.13						1.33	1.00	1.00	1.33	1.30	2.41			W=	36'			11.0	tc1/Q1=	11.6 min	30.3 cfs	23
		Q	64.2														d=	0.72				tc2/Q2=	10.5 min	33.9 cfs	
																						tcx=	11 min		
	4.0	A	3.6	84											0.005	907.93	Street	18	3.57	260	1.2				24
1.3	27.2	ΣA	24.1														R/W=	60'							
		q	2.99						1.33	1.00	1.00	1.33	1.30	2.30			W=	36'			12.2		ALVERSTONE & RIGGS		25
		Q	72.1														d=	0.74							
	0.0	A	0.0				72								0.005	990.37	Street	19.2	3.76	750	3.3				26
1.4	27.2	ΣA	24.1																						
		q	2.69						1.33	1.00	1.00	1.33	1.30	2.07							15.5		RIGGS & OGELSBY		27
		Q	64.8																						
	22.8	A	20.1				65																		
Σ1.4	50.0	ΣA	44.2														R/W=	60'				<- from	Line #3 @ line	67	28
		q	2.86						1.33	1.00	1.00	1.33	1.30	2.20			W=	36'			13.5	tc1/Q1=	15.5 min	64.8 cfs	29
		Q	126														d=	0.77				tc2/Q2=	10.6 min	46.3 cfs	
																						tcx=	13.5 min		
	0.0	A	0.0	126											0.012	1140.8	Street	21.0	6	660	1.8				30
1.5	50.0	ΣA	44.2																						
		q	2.72						1.33	1.00	1.00	1.33	1.30	2.09							15.3		RIGGS & KENTWOOD		31
		Q	120.0																						
	22.9	A	20.1	120																					
Σ1.5	72.9	ΣA	64.3														R/W=	60'				<- from	Line #5 @ line	77	32
		q	2.86						1.33	1.00	1.00	1.33	1.30	2.20			W=	36'			13.6	tc1/Q1=	15.3 min	120 cfs	33
		Q	184														d=	0.79				tc2/Q2=	9.6 min	51.6 cfs	
																						tcx=	13.6 min		
	0.1	A	0.1	184											0.02	1288.3	Street	22.2	6.29	150	0.3				34
1.6	73.0	ΣA	64.4																						
		q	2.83						1.33	1.00	1.00	1.33	1.30	2.18			D=	2-48"			13.9				35
		Q	182														d=	0.94							
	0.0	A	0.0					182							0.278	345.19	Pipe	4.48	40.7	245	0.1				36
(1.7)	73.0	ΣA	64.4																						
		q	2.82						1.33	1.00	1.00	1.33	1.30	2.17			D=	2-48"			14.0				37
		Q	182														d=	1.67							

PLAYA VISTA OFF-SITE HYDROLOGY

TABLED BY VAT CHECKED BY GMV SUPERVISED BY				CITY OF LOS ANGELES Department of Public Works Bureau of Engineering					STORM DRAIN DESIGN RUNOFF TABLING SHEET Frequency 50 Year						Project: 1MTP0104.10 OFFSITE HYDROLOGY C-1.0 - TRACT 43416								Date: Aug-12-1992 Sheet:		
Drainage Map		Runoff		Flow Routing																					
Area No	Area Acres		100% Ae	Surface Flow N	S	E	W	Storm Drain	ISO	Freq. Fact.	Dist. Fact.	Amen 1hr RFR	Fro	BPRR	Frict. Slope (S)	K= Q / S^.5	Size	Area (sf)	Vel. (ft/s)	L (ft)	tc or tcx (min)	Storm Drain Station	Location	Remarks	
	6.3	A	5.1					182																	1
	79.3	ΣA	89.5												0.031	1042.1	Pipe	9.9	18.3	402		<- from Line #7 @ line		87	38
1.7		q	2.91						1.33	1.00	1.00	1.33	1.30	2.24			"V" shaape					tc1/Q1=	14 min	182 cfs	39
		Q	202														z=	4			13.0	tc2/Q2=	4.4 min	22.1 c/s	
																	d=	2.71				tcx=	13 min		
	2.2	A	1.3			202									0.017	1564.5	Chann	29.3	6.89	360	0.9				40
	81.5	ΣA	70.8																						
1.8		q	2.83						1.33	1.00	1.00	1.33	1.30	2.18							13.9				41
		Q	200																						
								200														-> Centinela Storm Drain			42

PLAYA VISTA OFF-SITE HYDROLOGY

TABLED BY VAT
CHECKED BY GMV
SUPERVISED BY

CITY OF LOS ANGELES
Department of Public Works
Bureau of Engineering

STORM DRAIN DESIGN
RUNOFF TABLING SHEET
Frequency 50 Year

Project: 1MTP0104.10
OFFSITE HYDROLOGY
C-1.0 - TRACT 43416

Date: Aug-12-1992

Sheet:

Drainage Map Area No	Drainage Map Area Acres	Runoff	Runoff 100% Ae	Flow Routing Surface Flow N	S	E	W	Storm Drain	ISO	Freq. Fact.	Dist. Fact.	Amen 1hr RFR	Fro	BPRR	Frict. Slope (S)	K= Q/S^.5	Size	Area [sf]	Vel. [ft/s]	L [ft]	tc or tcx [min]	Storm Drain Station	Location	Remarks	1
Line #2																									43
2.1	5.2	ΣA q Q	4.6 4.17 19.2						1.33	1.00	1.00	1.33	1.30	3.21			R/W= W= d=	60' 36' 0.45			5.7		DUNFIELD AVE		44
	6.9	A	6.0	19											0.012	176.75	Street	5.84	3.29	840	4.3				45
2.2	12.1	ΣA q Q	10.6 3.26 34.6						1.33	1.00	1.00	1.33	1.30	2.51			R/W= W= d=	60' 36' 0.47			10.0				46
	0.0	A	0.0	35											0.024	221.5	Street	6.56	5.27	160	0.5				47
Σ1.2	12.1	ΣA q Q	10.6 3.20 33.9						1.33	1.00	1.00	1.33	1.30	2.46							10.5				48
						34																-> Node 1.2 @ line:		22	49
																									50
Line #4																									51
4.1	5.4	ΣA q Q	4.8 4.34 20.8						1.33	1.00	1.00	1.33	1.30	3.34			R/W= W= d=	60' 36' 0.4			5.2		OGELSBY AVE		52
	0.0	A	0.0	21											0.029	121.31	Street	4.1	5.07	600	2.0				53
Σ3.3	5.4	ΣA q Q	4.8 3.77 18.1						1.33	1.00	1.00	1.33	1.30	2.90							7.2		OGELSBY & NANCY		54
				18																		-> Node 3.3 @ line:		63	55
																									56

PLAYA VISTA OFF-SITE HYDROLOGY

TABLED BY VAT CHECKED BY GMV SUPERVISED BY				CITY OF LOS ANGELES Department of Public Works Bureau of Engineering					STORM DRAIN DESIGN RUNOFF TABLING SHEET Frequency 50 Year						Project: 1MTP0104.10 OFFSITE HYDROLOGY C-1.0 - TRACT 43416								Date: Aug-12-1992 Sheet:		
Drainage Map		Runoff		Flow Routing																					
Area No	Area Acres		100% Ae	Surface Flow N	S	E	W	Storm Drain	ISO	Freq. Fact.	Dist. Fact.	Aman 1hr RFR	Fro	BPRR	Frict. Slope (S)	K= Q/S^.5	Size	Area (sf)	Vel. (ft/s)	L (ft)	tc or tcx (min)	Storm Drain Station	Location	Remarks	1
Line #3																									57
3.1	5.5	ΣA	4.8																						
		q	4.08														R/W=	60'							
		Q	19.6						1.33	1.00	1.00	1.33	1.30	3.14			W=	36'			6.0		EL MANOR AVE		58
																	d=	0.45							
	3.0	A	2.6	20											0.011	183.57	Stree	5.84	3.36	710	3.5				59
3.2	6.5	ΣA	7.4														R/W=	60'							
		q	3.34						1.33	1.00	1.00	1.33	1.30	2.57			W=	36'			9.5		EL MANOR & NANCY		60
		Q	24.7														d=	0.4							
	2.8	A	2.0	25											0.045	117.09	Street	4.1	6.02	310	0.9				61
3.3	11.1	ΣA	9.7																						
		q	3.21						1.33	1.00	1.00	1.33	1.30	2.47							10.4		OGELSBY & NANCY		62
		Q	31.1																						
	5.4	A	4.8				31															<- from	Line #4 @ line	55	63
Σ3.3	16.5	ΣA	14.5														R/W=	60'				tc1/Q1=	10.4 min	31.1 cfs	
		q	3.38						1.33	1.00	1.00	1.33	1.30	2.60			W=	36'			9.2	tc2/Q2=	7.2 min	18.1 cfs	64
		Q	49														d=	0.61				tcx=	9.2 min		
	0.0	A	0.0	49											0.008	541.11	Street	12.2	4.02	340	1.4				65
Σ1.4	16.5	ΣA	14.5																						
		q	3.19						1.33	1.00	1.00	1.33	1.30	2.45							10.6		OGELSBY & RIGGS		66
		Q	46.3																						
				46																		-> Node	1.4 @ line:	28	67
																									68

PLAYA VISTA OFF-SITE HYDROLOGY

TABLED BY VAT CHECKED BY GMV SUPERVISED BY				CITY OF LOS ANGELES Department of Public Works Bureau of Engineering					STORM DRAIN DESIGN RUNOFF TABLING SHEET Frequency 50 Year						Project: 1MTP0104.10 OFFSITE HYDROLOGY C-1.0 - TRACT 43416								Date: Aug-12-1992 Sheet:		
Drainage Map		Runoff		Flow Routing																					
				Surface Flow				Storm Drain																	
Area No	Area Acres		100% Ae	N	S	E	W		ISO	Freq. Fact.	Dist. Fact.	Amen 1hr RFR	Frp	BPRR	Frict. Slope (S)	K= Q/S^.5	Size	Area [sf]	Vel. [ft/s]	L [ft]	Ic or Icx [min]	Storm Drain Station	Location	Remarks	l
Line #5																									69
	2.7	ΣA	2.3																						
5.1		q	4.42						1.33	1.00	1.00	1.33	1.30	3.40			R/W=	60'			4.3		McCOOL AVE		70
		Q	10.2														W=	36'							
																	d=	0.31							
	12.7	A	11.2	10											0.033	55.98	Street	2.12	4.81	770	2.7				71
	15.4	ΣA	13.5														R/W=	60'							
5.2		q	3.82						1.33	1.00	1.00	1.33	1.30	2.94			W=	36'			7.0		McCOOL & NANCY		72
		Q	51.6														d=	0.64							
	0.9	A	0.8	52											0.006	645	Street	13.7	3.77	330	1.5				73
	16.3	ΣA	14.3														R/W=	60'							
5.3		q	3.51						1.33	1.00	1.00	1.33	1.30	2.70			W=	36'			8.5		KENTWOOD & NANCY		74
		Q	50.2														d=	0.52							
	1.4	A	1.2	50											0.02	351.47	Street	8.63	5.82	380	1.1				75
	17.7	ΣA	15.5																						
1.5		q	3.33						1.33	1.00	1.00	1.33	1.30	2.56							9.6		KENTWOOD & RIGGS		76
		Q	51.6																						
																						-> Node 1.5 @ line:		32	77
																									78
Line #7																									79
	1.2	ΣA	1.0																						
7.1		q	4.42						1.33	1.00	1.00	1.33	1.30	3.40			D=	18"			3.9		PROPOSED LINE "8"		80
		Q	4.4														d=	0.56							
	0.5	A	0.4					4.4							0.02	31.113	Pipe	0.6	7.32	50	0.1				81
	1.7	ΣA	1.4																						
7.2		q	4.42						1.33	1.00	1.00	1.33	1.30	3.40			D=	24"			4.0				82
		Q	6.2														d=	0.42							
	3.0	A	2.6					6.2							0.08	21.92	Pipe	0.48	12.9	160	0.2				83
	4.7	ΣA	4.0																						
7.3		q	4.42						1.33	1.00	1.00	1.33	1.30	3.40			D=	24"			4.2				84
		Q	17.7														d=	0.57							
	1.6	A	1.0					17.7							0.189	40.714	Pipe	0.75	23.7	350	0.2				85
	6.3	ΣA	5																						
1.7		q	4.42						1.33	1.00	1.00	1.33	1.30	3.40							4.4				86
		Q	22.1																						
								22.1														-> Node 1.7 @ line:		38	87

PLAYA VISTA OFF-SITE HYDROLOGY

DESIGN YEAR		50	ISO:	1.33	SOIL:	2								
NODE #	AREA #	Id:	100	70	60	50	40	35	15	SUB AREA	EQUIV AREA	TOTAL AREA	TOTAL Ae	COMMENTS
		Fro:	1.30	1.15	1.07	0.90	0.91	0.79	0.60					
		K:	1.00	0.80	0.82	0.69	0.70	0.61	0.46					
	5	dA:		5.20										
	ΔA		0.00	5.20	0.00	0.00	0.00	0.00	0.00	5.2	4.6			
2.1														
												5.2	4.6	DUNFIELD AVE
	6	dA:		6.85										
	ΔA		0.00	6.85	0.00	0.00	0.00	0.00	0.00	6.9	6.1			
2.2														
												12.1	10.7	DUNFIELD & NANCY
Σ1.2														
												12.1	10.7	-> Line 1 @ Node 1.2
	10	dA:		5.42										
	ΔA		0.00	5.42	0.00	0.00	0.00	0.00	0.00	5.4	4.8			
4.1														
												5.4	4.8	OGELSBY
3.3														
												5.4	4.8	-> Line 3 @ Node 3.3
	7	dA:		5.51										
	ΔA		0.00	5.51	0.00	0.00	0.00	0.00	0.00	5.5	4.9			
3.1														
												5.5	4.9	EL MANOR AVE
	8	dA:		2.96										
	ΔA		0.00	2.96	0.00	0.00	0.00	0.00	0.00	3.0	2.6			
3.2														
												8.5	7.5	EL MANOR & NANCY
	9	dA:		2.57										
	ΔA		0.00	2.57	0.00	0.00	0.00	0.00	0.00	2.6	2.3			
3.3														
												11.1	9.8	OGELSBY & NANCY
Σ3.3														
												16.5	14.6	-> Line 1 @ Node 1.4

PLAYA VISTA OFF-SITE HYDROLOGY

DESIGN YEAR		50	ISO:	1.33	SOIL:	2									
NODE #	AREA #	Id:	100	70	60	50	40	35	15	SUB AREA	EQUIV AREA	TOTAL AREA	TOTAL Ae	COMMENTS	
		Fro:	1.30	1.15	1.07	0.90	0.91	0.79	0.60						
		K:	1.00	0.88	0.82	0.69	0.70	0.61	0.46						
	12	dA:		2.67											
	ΔA		0.00	2.67	0.00	0.00	0.00	0.00	0.00	2.7	2.4				
5.1															
												2.7	2.4	McCOOL AVE	
	13	dA:		7.74											
	ΔA		0.00	7.74	0.00	0.00	0.00	0.00	0.00	7.7	6.8				
5.2															
												10.4	9.2	McCOOL & NANCY	
	11	dA:		4.96											
	ΔA		0.00	4.96	0.00	0.00	0.00	0.00	0.00	5.0	4.4				
5.2															
												15.4	13.6	KENTWOOD & NANCY	
	26	dA:		0.91											
	ΔA		0.00	0.91	0.00	0.00	0.00	0.00	0.00	0.9	0.8				
5.3															
												16.3	14.4	KENTWOOD & NANCY	
Σ5.3															
												16.3	14.4	-> *Line 1 @ Node 1.5*	

PLAYA VISTA OFF-SITE HYDROLOGY

DESIGN YEAR		50	ISO:	1.33	SOIL:	2								
NODE #	AREA #	Id:	100	70	60	50	40	35	15	SUB AREA	EQUIV AREA	TOTAL AREA	TOTAL Ae	COMMENTS
		Fro:	1.30	1.15	1.07	0.90	0.91	0.79	0.60					
		K:	1.00	0.88	0.82	0.69	0.70	0.61	0.46					
	19	dA:		1.19										
	ΔA		0.00	1.19	0.00	0.00	0.00	0.00	0.00	1.2	1.1			
7.1												1.2	1.1	
	25	dA:		0.51										
	ΔA		0.00	0.51	0.00	0.00	0.00	0.00	0.00	0.5	0.5			
7.2												1.7	1.6	
	26	dA:		3.01										
	ΔA		0.00	3.01	0.00	0.00	0.00	0.00	0.00	3.0	2.7			
7.3												4.7	4.3	
	20	dA:						1.62						
	ΔA		0.00	0.00	0.00	0.00	0.00	1.62	0.00	1.6	1.0			
1.7												6.3	5.3	
Σ1.7												6.3	5.3	-> Line 1 @ Node 1.7
	1	dA:		5.54										
	ΔA		0.00	5.54	0.00	0.00	0.00	0.00	0.00	5.5	4.9			
1.1												5.5	4.9	ALVERSTONE AVE
	2	dA:		5.64										
	ΔA		0.00	5.64	0.00	0.00	0.00	0.00	0.00	5.6	5.0			
1.2												11.1	9.9	ALVERSTONE & DUNFIELD AVE
Σ1.2												23.2	20.6	<- Line 2
	3	dA:		4.04										
	ΔA		0.00	4.04	0.00	0.00	0.00	0.00	0.00	4.0	3.6			
1.3												4.0	3.6	ALVERSTONE & RIGGS
Σ1.3												27.2	24.2	ALVERSTONE & RIGGS

PLAYA VISTA OFF-SITE HYDROLOGY

DESIGN YEAR		50	ISO:	1.33	SOIL:	2								
NODE #	AREA #	Id:	100	70	60	50	40	35	15	SUB AREA	EQUIV AREA	TOTAL AREA	TOTAL Ae	COMMENTS
		Fro:	1.30	1.15	1.07	0.90	0.91	0.79	0.60					
		K:	1.00	0.88	0.82	0.69	0.70	0.61	0.46					
	4	dA:		6.34										
	ΔA		0.00	6.34	0.00	0.00	0.00	0.00	0.00	6.3	5.6			
1.4												6.3	5.6	OGELSBY & RIGGS
Σ1.4												50.0	44.4	<- Line 3
	18	dA:		1.35										
	ΔA		0.00	1.35	0.00	0.00	0.00	0.00	0.00	1.4	1.2			
1.5												1.4	1.2	KENTWOOD & RIGGS
	14	dA:		5.20										
	ΔA		0.00	5.20	0.00	0.00	0.00	0.00	0.00	5.2	4.6			
1.5												6.6	5.8	KENTWOOD & RIGGS
Σ1.5												72.9	64.6	<- Line 5
	29	dA:		0.13										
	ΔA		0.00	0.13	0.00	0.00	0.00	0.00	0.00	0.1	0.1			
1.6												0.1	0.1	KENTWOOD & RIGGS
Σ1.6												73.0	64.7	KENTWOOD & RIGGS
Σ1.7												79.3	70.0	<- Line 7
	21	dA:						2.19						
	ΔA		0.00	0.00	0.00	0.00	0.00	2.19	0.00	2.2	1.3			
1.8												2.2	1.3	
Σ1.8												81.5	71.3	CENTINELA STORM DRAIN

PLAYA VISTA OFF-SITE HYDROLOGY

DESIGN YEAR		50	ISO:	1.33	SOIL:	2								
NODE #	AREA #	Id:	100	70	60	50	40	35	15	SUB AREA	EQUIV AREA	TOTAL AREA	TOTAL Ae	COMMENTS
		Fro:	1.30	1.15	1.07	0.90	0.91	0.79	0.60					
		K:	1.00	0.98	0.82	0.69	0.70	0.61	0.46					
STORM DRAIN LINE "A"														
	24	dA:		1.53										
	ΔA		0.00	1.53	0.00	0.00	0.00	0.00	0.00	1.5	1.4			
6.4												1.5	1.4	
	22	dA:		3.73										
	ΔA		0.00	3.73	0.00	0.00	0.00	0.00	0.00	3.7	3.3			
6.1												3.7	3.3	
	23	dA:		3.48										
	ΔA		0.00	3.48	0.00	0.00	0.00	0.00	0.00	3.5	3.1			
6.2												7.2	6.4	
	27	dA:		2.08										
	ΔA		0.00	2.08	0.00	0.00	0.00	0.00	0.00	2.1	1.8			
6.3												9.3	8.2	
Σ6.3												10.8	9.6	
		dA:		0.00										
	ΔA		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.0			
6.5												10.8	9.6	CENTINELA DITCH (PLAYA VISTA SITE)

PLAYA VISTA OFF-SITE HYDROLOGY

Project Name:	TRACT No. 43416	Tabled By:	VAT	Date:	8/12/92
Project Number:	1MTP0104.10	Checked By:	GMV		

Area Number:	1	5	7	10	12	22	19
Node Number:	1.1	2.1	3.1	4.1	5.1	6.1	7.1
Runoff Tabling Sheet:							
Conveyor:	Gutter	Gutter	Gutter	Gutter	Gutter	Gutter	Gutter
Development Type:	R1	R1	R1	R1	R1	R1	R1
Development Class:	70-2	70-2	70-2	70-2	70-2	70-2	70-2
Elevation Difference:	7.8 ft	8.5 ft	8.7 ft	19.8 ft	17 ft	31.3 ft	7.8 ft
Length of Reach:	775 ft	725 ft	765 ft	700 ft	500 ft	800 ft	380 ft
Average Slope:	1.01%	1.17%	1.14%	2.83%	3.40%	3.91%	2.05%
Method of Computation:	Figure G242.2A	Figure G242.2A	Figure G242.2A	Figure G242.2A	Figure G242.2A	Figure G242.2A	Figure G242.2A
ISO:	1.33	1.33	1.33	1.33	1.33	1.33	1.33
Fro:	1.15	1.15	1.15	1.15	1.15	1.15	1.15
tc(700):	6.6 min	5.6 min	5.7 min	5.2 min	5.1 min	5.0 min	5.3 min
TIME OF CONCENTRATION (tc):	6.9 min	5.7 min	6.0 min	5.2 min	4.3 min	5.3 min	3.9 min

PLAYA VISTA OFF-SITE HYDROLOGY

TABLED BY BCB CHECKED BY GMV SUPERVISED BY GMV				CITY OF LOS ANGELES Department of Public Works Bureau of Engineering					STORM DRAIN DESIGN RUNOFF TABLING SHEET Frequency 50 Year						Project: 1MTP0104.10 - C.4.2 OFFSITE HYDROLOGY								Date: Aug-12-1992 Sheet:		
Drainage Map		Runoff		Flow Routing																					
				Surface Flow																					
Area No	Area Acres		100% Ae	N	S	E	W	Storm Drain	ISO	Freq. Fact.	Dist. Fact.	Amen 1hr RFR	Fro	BPRR	Frict. Slope (S)	K= Q / S^.5	Size	Area [sf]	Vel. [ft/s]	L [ft]	Tc or Tcx [min]	Storm Drain Station	Location	Remarks	1
Area C.4.2																									
4.2.4	3.4	ΣA	2.9						1.33	1.00	1.00	1.33	1.30	2.75			R/W=	30'			8.1		Henefer Ave @ Hedding		2
		q	3.58														W=	30'							
		Q	10.4														d=	0.41							
	6.5	A	5.8		10.4										0.005	147.00	Street	4.56	2.28	370	2.7				3
4.2.3	9.9	ΣA	8.7						1.33	1.00	1.00	1.33	1.30	2.43			R/W=	30'			10.8		250' north of Henefer Ave @ Firebrand St		4
		q	3.16														W=	30'							
		Q	27.5														d=	0.56							
	11.3	A	9.9		27.5										0.004	434.81	Street	9.20	2.99	250	1.4				5
4.2.2	21.2	ΣA	18.6						1.33	1.00	1.00	1.33	1.30	2.30			R/W=	30'			12.2		Henefer Ave @ Firebrand St		6
		q	2.99														W=	30'							
		Q	55.6														d=	0.56							
	10.9	A	9.5		55.6										0.017	430.25	Street	9.19	6.05	480	1.3				7
4.2.1	32.1	ΣA	28.1						1.33	1.00	1.00	1.33	1.30	2.20							13.5		480' west of Henefer Ave along Firebrand St		8
		q	2.86																						
		Q	80.4																						
								80.4															-> to Onsite Hydrology		9

PLAYA VISTA OFF-SITE HYDROLOGY

Design Storm Frequency:				50	year											
Node #	Area #	ISO	Soil Type		IMPERVIOUSNESS 100%	70%	60%	50%	40%	35%	15%	SUB AREA	EQUIV AREA	TOTAL AREA	TOTAL Ae	COMMENTS
C-4.2 Revised Offsite Area																
	C.4.2.4	1.33	2	dA:		3.35						3.4	2.9			
	C.4.2.3	1.33	2	dA:		6.53						6.5	5.7			
	C.4.2.2	1.33	2	dA:		11.26						11.3	9.9			
	C.4.2.1	1.33	2	dA:		10.86						10.9	9.6			
C.4.2												*32.1*	*28.1*	32.1	28.1	-> to Onsite Hydrology

PLAYA VISTA OFF-SITE HYDROLOGY

Project Name:	Area C.4.2	Tabled By:	BCB	Date:	6/12/92	
Project Number:	1MTP0104.10	Checked By:	GMV			

Area Number:	C.4.2.4						
Node Number:	C.4.2						
Runoff Tabling Sheet:							
Conveyor:	Gutter						
Development Type:	R1						
Development Class:	70-2						
Elevation Difference:	2.8 ft						
Length of Reach:	680 ft						
Average Slope:	*0.41%*						
Method of Computation:	Figure G242.2A						
ISO:	1.33						
Fro:	1.15						
Ic(700):	8.2 min						
TIME OF CONCENTRATION (tc):	8.1 min						

PLAYA VISTA OFF-SITE HYDROLOGY

TABLED BY VAT CHECKED BY GMV SUPERVISED BY GMV				CITY OF LOS ANGELES Department of Public Works Bureau of Engineering					STORM DRAIN DESIGN RUNOFF TABLING SHEET Frequency 50 Year						Project: 1MTP0104.10 - C-6.2 & C-6.3 OFFSITE HYDROLOGY								Date: Aug-12-1992 Sheet:		
Drainage Map		Runoff		Flow Routing																					
				Surface Flow				Storm		Freq.	Dist.	Amen			Frict.	K=					tc or	Storm			
Area No	Area Acres		100% Ae	N	S	E	W	Drain	ISO	Fact.	Fact.	1hr RFR	Fro	BPRR	Slope (S)	Q / S^.5	Size	Area [sf]	Vel. [ft/s]	L [ft]	tcx [min]	Drain Station	Location	Remarks	1
SOUTH PORTION OF SITE																									2
3.1	0.5	ΣA q Q	0.4 4.42 1.8						1.33	1.00	1.00	1.33	1.30	3.40							2.3		South Portion of Tr 43415		3
					1.8																		> To Dunbarton Avenue		4
SITE ALONG STREET "B" (C-6.2)																									5
5.1	2.0	ΣA q Q	1.6 4.42 8.0						1.33	1.00	1.00	1.33	1.30	3.40			R/W= W= d=	60' 36' 0.29			4.2		South Portion of Tr 43415		6
	2.5	A	2.2			8.0									0.033	44,173	Street	1.78	4.49	400	1.5				7
5.2	4.5	ΣA q Q	4.0 4.17 16.7						1.33	1.00	1.00	1.33	1.30	3.21							5.7		East Portion of Tr 43415		8
				16.7																			-> to Node 4.4 Line #18		9

PLAYA VISTA OFF-SITE HYDROLOGY

TABLED BY VAT CHECKED BY GMV SUPERVISED BY GMV				CITY OF LOS ANGELES Department of Public Works Bureau of Engineering					STORM DRAIN DESIGN RUNOFF TABLING SHEET Frequency 50 Year						Project: 1MTP0104.10 - C-6.2 & C-6.3 OFFSITE HYDROLOGY								Date: Aug-12-1992 Sheet:		
Drainage Map		Runoff		Flow Routing																					
				Surface Flow				Storm Drain																	
Area No	Area Acres		100% Ae	N	S	E	W		ISO	Freq. Fact.	Dist. Fact.	Amen 1hr RFR	Fro.	BPRR	Frict. Slope (S)	K= Q / $S^{.5}$	Size	Area [sf]	Vel. [ft/s]	L [ft]	tc or tcx [min]	Storm Drain Station	Location	Remarks	1
SITE ALONG STREET "A" - (C-6.2)																									
																									10
4.1	0.9	ΣA	0.8																						
		q	4.42						1.33	1.00	1.00	1.33	1.30	3.40			R/W=	60'							
		Q	3.5														W =	36'			4.2		West Portion of Tr 43415		11
	1.2	A	1.1	3.5													d =	0.3							
4.2	2.1	ΣA	1.9												0.005	49.497	Street	1.94	1.8	210	1.9				12
		q	4.06						1.33	1.00	1.00	1.33	1.30	3.12			R/W=	60'							
		Q	7.7														W =	36'			6.1		North Portion of Tr 43415		13
	0.5	A	0.4	7.7													d =	0.39							
4.3	2.6	ΣA	2.3												0.005	108.89	Street	3.82	2.02	90	0.7				14
		q	3.86						1.33	1.00	1.00	1.33	1.30	2.97			R/W=	60'							
		Q	8.9														W =	36'			6.8		North Portion of Tr 43415		15
	1.9	A	1.7			8.9											d =	0.31							
4.4	4.5	ΣA	4.0												0.026	54.984	Street	2.12	4.2	390	1.2				16
		q	3.60						1.33	1.00	1.00	1.33	1.30	2.77											
		Q	14.4																		8.0		North Portion of Tr 43415		17
	4.5	A	4.0			14																			
Σ4.4	9.0	ΣA	8.0																			<- Line # 9, Street "B"			18
		q	3.86						1.33	1.00	1.00	1.33	1.30	2.97								tc1/Q1=	8.0 min	14.4 cfs	
		Q	30.9														D =	24"			6.8	tc2/Q2=	5.7 min	16.7 cfs	19
	0.0	A	0.0					30.9									d =	1.74				tcx=	6.8 min		
4.5	9.0	ΣA	8.0												0.017	236.99	Pipe	2.9	10.7	160	0.3				20
		q	3.80						1.33	1.00	1.00	1.33	1.30	2.92											
		Q	30.4														D =	24"			7.1				21
	0.0	A	0.0					30.4									d =	0.65							
4.6	9.0	ΣA	8.0												0.35	51.385	Street	0.88	34.5	200	0.1				22
		q	3.77						1.33	1.00	1.00	1.33	1.30	2.90											
		Q	30.2																		7.2				23
								30.2															-> to Onsite Hydrology		24

PLAYA VISTA OFF-SITE HYDROLOGY

TABLED BY VAT CHECKED BY GMV SUPERVISED BY GMV				CITY OF LOS ANGELES Department of Public Works Bureau of Engineering					STORM DRAIN DESIGN RUNOFF TABLING SHEET Frequency 50 Year						Project: 1MTP0104.10 - C-6.2 & C-6.3 OFFSITE HYDROLOGY								Date: Aug-12-1992 Sheet:		
Drainage Map		Runoff		Flow Routing																					
				Surface Flow																					
Area No	Area Acres		100% Ae	N	S	E	W	Storm Drain	ISO	Freq. Fact.	Dist. Fact.	Amen 1hr RFR	Fro	BPRR	Frict. Slope (S)	K= Q / S^.5	Size	Area (sf)	Vel. (ft/s)	L (ft)	Ic or Icx (min)	Storm Drain Station	Location	Remarks	1
EXISTING CHANNEL - (C-6.3)																									
	4.3	ΣA	4.3																						25
1.1		q	3.94														B=	3.0							
		Q	16.9						1.33	1.00	1.00	1.33	1.30	3.03			z =	1.00			6.5		School Site		26
	6.0	A	6.0					16.9									d =	0.33							
	11.1	ΣA	10.3												0.136	45.827	Trap. C	1.08	15.6	480	0.5				27
1.2		q	3.82														B=	3.0							
		Q	39.3						1.33	1.00	1.00	1.33	1.30	2.94			z =	1.00			7.0		School Site		28
								39.3									d =	0.69					-> to Onsite Hydrology		29

PLAYA VISTA OFF-SITE HYDROLOGY

Design Storm Frequency:				50	year											
Node #	Area #	ISO	Soil Type		100%	IMPERVIOUSNESS 70%	60%	50%	40%	35%	15%	SUB AREA	EQUIV AREA	TOTAL AREA	TOTAL Ae	COMMENTS
South Portion of Site																
	3.1	1.33	2	dA:		0.47										
Σ3.1												0.5	0.4			South Portion of Tr 43415
												0.5	*0.4*	0.5	0.4	-> to Dunbarton Avenue
C-6.2 Revised Offsite Area																
	5.1	1.33	2	dA:		2.01										
	5.2	1.33	2	dA:		2.54						2.0	1.8			South Portion of Tr 43415
5.2												2.5	2.2			East Portion of Tr 43415
												4.5	*4.0*	4.5	4.0	-> to C-6.2 (see below)
	4.1	1.33	2	dA:		0.94										
	4.2	1.33	2	dA:		1.24						0.9	0.8			West Portion of Tr 43415
	4.3	1.33	2	dA:		0.51						1.2	1.1			North Portion of Tr 43415
	4.4	1.33	2	dA:		1.92						0.5	0.4			North Portion of Tr 43415
4.4												1.9	1.7			North Portion of Tr 43415
												4.5	*4.0*	4.5	4.0	-> to C-6.2 (see below)
C-6.2																
												9.0	*8.0*	9.0	8.0	-> to Onsite Hydrology
C-6.3 Revised Offsite Area																
	1.1	1.33	2	dA:	4.32											
	1.2	1.33	2	dA:	4.86					1.95		4.3	4.3			School Site
C-6.3												6.8	6.0			School Site
												11.1	*10.3*	11.1	10.3	-> to Onsite Hydrology

PLAYA VISTA OFF-SITE HYDROLOGY

Project Name:	TRACT No. 43415		Tabled By:	VAT	
Project Number:	1MTP0104.10		Date:	8/12/92	
			Checked By:	GMV	
Area Number:	1	13	14	18	
Node Number:	1.1	3.1	4.1	5.1	
Runoff Tabling Sheet:					
Conveyor:	Gutter	Gutter	Gutter	Gutter	
Development Type:	School	R1	R1	R1	
Development Class:	100	70-2	70-2	70-2	
Elevation Difference:	8 ft	2.67 ft	1.62 ft	2.17 ft	
Length of Reach:	800 ft	133 ft	237.81 ft	384 ft	
Average Slope:	1.00%	2.01%	0.68%	0.57%	
Method of Computation:	Figure G242.2A	Figure G242.2A	Figure G242.2A	Figure G242.2A	
ISO:	1.33	1.33	1.33	1.33	
Fro:	1.30	1.15	1.15	1.15	
Ic(700):	6.1 min	5.3 min	7.2 min	7.6 min	
TIME OF CONCENTRATION (tc):	6.5 min	2.3 min	4.2 min	5.6 min	

PLAYA VISTA OFF-SITE HYDROLOGY

TABLED BY PMP CHECKED BY GMV SUPERVISED BY				CITY OF LOS ANGELES Department of Public Works Bureau of Engineering					STORM DRAIN DESIGN RUNOFF TABLING SHEET Frequency 50 Year						Project: 1MTP0104.10 - C-8.1 OFFSITE HYDROLOGY								Date: Aug-12-1992 Sheet:		
Drainage Map		Runoff		Flow Routing																					
				Surface Flow				Storm Drain																	
Area No	Area Acres		100% Ae	N	S	E	W		ISO	Freq. Fact.	Dist. Fact.	Amen Hr RFR	Fro	BPRR	Frict. Slope (S)	K= Q / S^.5	Size	Area (sf)	Vel. (ft/s)	L (ft)	Tc or Tcx (min)	Storm Drain Station	Location	Remarks	
OFF-SITE AREA C.8.0																									1
ΣC.8.1	2.5	ΣA	1.7																						
		q	3.67						1.33	1.00	1.00	1.33	1.30	2.82			D= 15"				7.7		<- AREA ΣC.8.1		2
		Q	6.2																						
	0.0	A	0.0	6.2													d= 0.32'								
C.8.1	2.5	ΣA	1.7												0.47	9.0436		0.24	25.8	75	0.0				3
		q	3.67						1.33	1.00	1.00	1.33	1.30	2.82							7.7				4
		Q	6.2																						
		A		6.2																					
		ΣA																					-> TO ON-SITE HYDROLOGY		5
		q																							
		Q																							6

PLAYA VISTA OFF-SITE HYDROLOGY

Design Storm Frequency:				50	year											
						IMPERVIOUSNESS										
Node #	Area #	ISO	Soil Type		100%	70%	60%	50%	40%	35%	15%	SUB AREA	EQUIV AREA	TOTAL AREA	TOTAL Ae	COMMENTS
C-8.1 Revised Offsite Area																
	C.8.2	1.33	2	dA:				0.90				0.9	0.6			Onsite bluff owned by MTP
	C.8.1	1.33	2	dA:				1.60				1.6	1.1			Offsite bluff area
ΣC.8.1												2.5	1.7	2.5	1.7	

PLAYA VISTA OFF-SITE HYDROLOGY

Project Name:	Area C-8.1	Tabled By: PMP	Date:	August 12, 1992					
Project Number:	1MTP0104.10	Checked By: GMV							
Area Number:	C.8.1								
Node Number:	C.8.1								
Runoff Tabling Sheet:									
Conveyor:	STREET								
Development Type:	BLUFF								
Development Class:	50-2								
Elevation Difference:	2.7 ft								
Length of Reach:	430 ft								
Average Slope:	0.63%								
Method of Computation:	FIGURE G 242.2 C								
ISO:	1.33								
Fro:	0.90								
tc(700):	9.8 min								
TIME OF CONCENTRATION (tc):	7.7 min								

PLAYA VISTA OFF-SITE HYDROLOGY

TABLED BY BCB CHECKED BY GMV SUPERVISED BY				CITY OF LOS ANGELES Department of Public Works Bureau of Engineering					STORM DRAIN DESIGN RUNOFF TABLING SHEET Frequency 50 Year						Project: 1MTP0104.10 - PLAYA VISTA OFF-SITE HYDROLOGY C-19.0 - HUGHES AIRCRAFT CENTER								Date: Aug-12-1992 Sheet:		
Drainage Map		Runoff		Flow Routing																					
				Surface Flow				Storm																	
Area No	Area Acres		100% Ae	N	S	E	W	Drain	ISO	Freq. Fact.	Dist. Fact.	Amen 1hr RFR	Fro	BPRR	Frict. Slope (S)	K= Q/S^.5	Size	Area [sf]	Vel. [ft/s]	L [ft]	Ic or Icx [min]	Storm Drain Station	Location	Remarks	
C-19.0 Hughes Aircraft Center Storm Drain																									1
	2.1	ΣA	1.8																						2
C-19.13		q	4.42																						
		Q	8						1.33	1.00	1.000	1.33	1.30	3.40			D=	24 ø	n=	.013	3.8		400' North of 80th Street along Campion Drive		3
	6.2	A	6.2					8									d=	0.44'							
	8.3	ΣA	8.0												0.108	24	Pipe	0.52	15.4	600	0.6	9+23.27	per plan No. D-28301-Sheet 4		4
C-19.12		q	4.68						1.33	1.00	1.000	1.33	1.30	3.60											
		Q	37.4														D=	27 ø	n=	.013	4.4				5
	4.0	A	4.0					37.4									d=	1.13'							
	12.3	ΣA	12.0												0.051	165	Pipe	2.01	18.6	600	0.5	3+23.67	per plan No. D-28301-Sheet 2		6
C-19.11		q	4.46						1.33	1.00	1.000	1.33	1.30	3.43											
		Q	53.5																		4.9				7
								53.5																	
																						-> to C-19.1 at line:		20	8
		A																							9
	13.1	ΣA	13.1																						
C-19.24		q	4.15																						10
		Q	54.4						1.33	1.00	1.000	1.33	1.30	3.19			W=	30'	n=	.013	5.8		<- Proposed LMU Campus		11
	6.7	A	6.7				54.4										d=	0.55'							
	19.8	ΣA	19.8												0.022	371	Street	8.62	6.31	650	1.7				12
C-19.23		q	3.71																						
		Q	73.5						1.33	1.00	1.000	1.33	1.30	2.65			D=	24 ø	n=	.013	7.5				13
	5.4	A	5.4					73.5									d=	2.00'							
	25.2	ΣA	25.2												0.047	339	Pipe	3.14	23.4	220			<- Area C-19.22		14
C-19.22		q	3.71						1.33	1.00	1.000	1.33	1.30	2.85											
		Q	93.5														D=	33 ø	n=	.013	7.5				15
	3.7	A	3.7					93.5									d=	1.53'							
	28.9	ΣA	28.9												0.088	315	Pipe	3.40	27.5	820	0.5				16
C-19.21		q	3.60						1.33	1.00	1.000	1.33	1.30	2.77											
		Q	104																		8.0				17
								104																	
																						-> to C-19.1 at line:		21	18
																									19

PLAYA VISTA OFF-SITE HYDROLOGY

ABLED BY		BCB	CITY OF LOS ANGELES	STORM DRAIN DESIGN	Project: 1MTP0104.10 - PLAYA VISTA	Date: Aug-12-1992
HECKED BY		GMV	Department of Public Works	RUNOFF TABLING SHEET	OFF-SITE HYDROLOGY	Sheet:
UPERVISED BY			Bureau of Engineering	Frequency 50 Year	C-19.0 - HUGHES AIRCRAFT CENTER	

Drainage Map: Area No	Area Acres	Runoff	100% Ae	Flow Routing: Surface Flow N	S	E	W	Storm Drain	ISO	Freq. Fact.	Dist. Fact.	Amen 1hr RFR	Fro	BPRR	Fricl. Slope (S)	K= Q/S^.5	Size	Area [sf]	Vel. [ft/s]	L [ft]	tc or tcx [min]	Storm Drain Station	Location	Remarks	
	12.3		12.0																						
	28.9	A	28.9																						1
C-19.1	41.2	ΣA	40.9																		<-Line C-19.11		from line:	8	20
		q	3.84																		<-Line C-19.21		from line:	18	21
		Q	157						1.33	1.00	1.000	1.33	1.30	2.95							• • • •	tc1/Q1=	4.9 min	53.5 cfs	
	0.0	A	0.0														D=	36 ø	n=	.013	6.9	tc2/Q2=	8.0 min	104 cfs	22
C-19.0	41.2	ΣA	40.9					157									d=	1.73'				tcx=	6.9 min		
		q	3.82												0.14	420	Pipe	4.23	37.1	280	0.1				
		Q	156						1.33	1.00	1.000	1.33	1.30	2.94											23
																					7.0		Sta. 209+60.75 of North Outfall Sewer per plan 7036		24
																						-> to Node 166 (Line D1P)			25
																									26

Design Storm Frequency:				50	year											
Node #	Area #	ISO	Soil Type		IMPERVIOUSNESS 100%	70%	60%	50%	40%	35%	15%	SUB AREA	EQUIV AREA	TOTAL AREA	TOTAL Ae	COMMENTS
C-19.0 Hughes Aircraft Center Storm Drain																
	C.19.13	1.83	2	dA:		2.10										
	C.19.12	1.33	2	dA:	6.18							2.1	1.8			
	C.19.11	1.33	2	dA:	3.96							6.2	6.2			
C.19.1												4.0	4.0			
												12.3	*12.0*	12.3	12.0	-> to C.19.1
	C.19.24	1.33	2	dA:	13.12											
	C.19.23	1.33	2	dA:	6.70							13.1	13.1			
	C.19.22	1.33	2	dA:	5.35							6.7	6.7			
	C.19.21	1.33	2	dA:	3.73							5.4	5.4			
C.19.1												3.7	3.7			
												28.9	*28.9*	28.9	28.9	-> to C.19.1

Project Name: PLAYA VISTA - OFF-SITE HYDROLOGY

Project Number: 1MTP0104.10 Tabled By: BCB

Date: 8/12/92 Checked By: GMV

Area Number:	C-19.13	C-19.24							
Node Number:	C-19.0	C-19.0							
Runoff Tabling Sheet:									
Conveyor:	Gutter	Gutter							
Development Type:	R1	R4							
Development Class:	70-2	100							
Elevation Difference:	15 ft	10 ft							
Length of Reach:	400 ft	750 ft							
Average Slope:	3.75%	1.33%							
Method of Computation:	Figure G242.2A	Figure G242.2A							
ISO:	1.33	1.33							
Fro:	1.30	1.30							
Ic(700):	5.0 min	5.6 min							
TIME OF CONCENTRATION (tc):	3.8 min	5.8 min							

Initial Time of Concentration

Table 3.5-c - Off-Site Area C-19.0
Hughes Aircraft Center Storm Drain

PLAYA VISTA OFF-SITE HYDROLOGY

TABLED BY GMV CHECKED BY SUPERVISED BY				CITY OF LOS ANGELES Department of Public Works Bureau of Engineering					STORM DRAIN DESIGN RUNOFF TABLING SHEET Frequency 50 Year						Project: 1MTP0104.10 - PLAYA VISTA OFF-SITE HYDROLOGY PERSHING OVERFLOW TO WETLANDS								Date: Aug-12-1992 Sheet:		
Drainage Map		Runoff		Flow Routing																					
				Surface Flow																					
Area No	Area Acres		100% Ae	N	S	E	W	Storm Drain	ISO	Freq. Fact.	Dist. Fact.	Amen 1 hr RFR	Fro	BPRR	Frict. Slope (S)	K= Q/S½	Size	Area (sf)	Vel. (ft/s)	L (ft)	Tc or tcx (min)	Storm Drain Station	Location	Remarks	
Pershing Storm Drain																									
1.0	15.6	ΣA	11																						1
		q	3.34																						
		Q	36.7						1.33	1.00	1.000	1.33	1.30	2.57		n =	0.013								
																R =	0.5								
2.0	20.6	A	15.5	18				19								Kf =	226				9.5		Sterry St.		2
	36.2	ΣA	26.5												0.007	438.65	24ø	3.14	6.05	360	1.0				3
		q	3.20													n =	0.013								
		Q	84.8						1.33	1.00	1.000	1.33	1.30	2.46		R =	0.69								
3.0	6.7	A	5.8	41				44								Kf =	529				10.5		Napoleon Street		4
	42.9	ΣA	32.1												0.007	1013.6	33ø	5.94	7.41	360	0.8				5
		q	3.09													n =	0.013								
		Q	99.2						1.33	1.00	1.000	1.33	1.30	2.38		R =	0.75								
4.0	25.9	A	18.9	43				56								Kf =	867				11.3		Waterview Street		6
	68.8	ΣA	50.9												0.007	1185.7	36ø	7.07	7.92	360	0.8				7
		q	3.00													n =	0.013								
		Q	153						1.33	1.00	1.000	1.33	1.30	2.31		R =	0.88								
5.0	16.9	A	12.8	69				84								Kf =	1006				12.1		Manitoba Street		8
	85.7	ΣA	63.7												0.007	1828.7	42ø	9.62	8.73	360	0.7				9
		q	2.93													n =	0.013								
		Q	187						1.33	1.00	1.000	1.33	1.30	2.25		R =	0.88								
6.0	9.5	A	8.6	77				110								Kf =	1006				12.8		Redlands Street		10
	95.2	ΣA	70.3												0.012	1707.1	42ø	9.62	11.4	360	0.5				11
		q	2.89													n =	0.013								
		Q	203						1.33	1.00	1.000	1.33	1.30	2.22		R =	1.44								
7.0	10.6	A	7.3	83				120								Kf =	3781				13.3		Talbert Street		12
	105.8	ΣA	77.8												0.001	6419.4	69ø	26	4.82	360	1.3				13
		q	2.77													n =	0.013								
		Q	215						1.33	1.00	1.000	1.33	1.30	2.13		R =	1.44								
8.0	22.8	A	17.5	95				120								Kf =	3781				14.6		Manchester Avenue		14
	128.6	ΣA	95.1												0.001	6798.9	69ø	26	4.62	366	1.3				15
		q	2.64													n =	0.013								
		Q	251						1.33	1.00	0.995	1.33	1.29	2.05		R =	1.38								
9.0	14.9	A	10.5	101				150								Kf =	3358				15.9		Campbell Street		16
	143.5	ΣA	105.6												0.002	5612.5	66ø	23.8	0.31	385	1.0				17
		q	2.58													n =	0.013								
		Q	272						1.33	1.00	0.993	1.33	1.29	2.00		R =	1.38								
10.0	6.8	A	5.4	122				150								Kf =	3358				16.9		Sunridge Street		18
	150.3	ΣA	111												0.002	6082.1	66ø	23.8	6.31	370	1.0				19
		q	2.52													n =	0.013								
		Q	280						1.33	1.00	0.991	1.33	1.29	1.95		R =	0.88								
																Kf =	1006				17.9		Rees Walk		20

PLAYA VISTA OFF-SITE HYDROLOGY

TABLED BY GMV
CHECKED BY
SUPERVISED BY

CITY OF LOS ANGELES
Department of Public Works
Bureau of Engineering

STORM DRAIN DESIGN
RUNOFF TABLING SHEET
Frequency 50 Year

Project: 1MTP0104.10 - PLAYA VISTA
OFF-SITE HYDROLOGY
PERSHING OVERFLOW TO WETLANDS

Date: Aug-12-1992
Sheet:

Drainage Map Area No	Area Acres	Runoff	100% Ae	Flow Routing Surface Flow N	S	E	W	Storm Drain	ISO	Freq. Fact.	Dist. Fact.	Amen 1hr RFR	Fra	BPRR	Frict. Slope (S)	K= Q/S^.5	Size	Area [sf]	Vel. [ft/s]	L [ft]	tc or tcx [min]	Storm Drain Station	Location	Remarks	
	19.4	A	14.2	108				174																	
	169.7	ΣA	126.2												0.03	1616.6	42ø	9.62	18.1	465	0.4				21
11.0		q	2.47						1.33	1.00	0.988	1.33	1.28	1.93		n =	0.013								
		Q	309													R =	0.88				18.3		Cabora Drive		22
	3.6	A	2.8	135				174								Kf =	1008								
	173.3	ΣA	128												0.03	1784	42ø	9.62	18.1	600	0.6		->Overflow to Wetlands		23
12.0		q	2.43						1.33	1.00	0.988	1.33	1.28	1.90		n =	0.013								
		Q	311													R =	0.88				18.9		Culver Boulevard		24
	5.3	A	4.2	137				174								Kf =	1006								
	178.6	ΣA	132.2												0.03	1795.6	42ø	9.62	18.1	842	0.8				25
13.0		q	2.39						1.33	1.00	0.988	1.33	1.28	1.87		n =	0.013								
		Q	316													R =	1.56				19.7		Vista Del Mar		26
	5.3	A	4.2	17				299								Kf =	4722								
															0.004	4996.4	75ø	30.7	9.75	360	0.5				27
																									28

PLAYA VISTA OFF-SITE HYDROLOGY

DESIGN YEAR		.50	ISO:	1.33	SOIL:	2								
NODE #	AREA #	Id:	100	70	60	50	40	35	15	SUB AREA	EQUIV AREA	TOTAL AREA	TOTAL Ae	COMMENTS
		Fro:	1.30	1.15	1.07	0.90	0.91	0.79	0.60					
		K:	1.00	0.88	0.82	0.69	0.70	0.61	0.46					
	1 -> 3	dA:			0.80	6.00	8.80							
1.0	ΔA		0.00	0.00	0.80	6.00	8.80	0.00	0.00	15.6	11.0			
	4 -> 7	dA:		6.20	0.80	13.60						15.6	11.0	Sterry Street
2.0	ΔA		0.00	6.20	0.80	13.60	0.00	0.00	0.00	20.6	15.5			
	8 -> 10	dA:		4.70	0.80	1.20						36.2	26.5	Napoleon Street
3.0	ΔA		0.00	4.70	0.80	1.20	0.00	0.00	0.00	6.7	5.6			
	11 -> 14	dA:		4.20	0.80	20.90						42.9	32.1	Waterview Street
4.0	ΔA		0.00	4.20	0.80	20.90	0.00	0.00	0.00	25.9	18.8			
	15 -> 19	dA:		5.40	0.80	10.70						68.8	50.9	Manitoba Street
5.0	ΔA		0.00	5.40	0.80	10.70	0.00	0.00	0.00	16.9	12.8			
	20 -> 22	dA:				9.50						85.7	63.7	Redlands Street
6.0	ΔA		0.00	0.00	0.00	9.50	0.00	0.00	0.00	9.5	6.6			
	23 -> 26	dA:				10.60						95.2	70.3	Talbert Street
7.0	ΔA		0.00	0.00	0.00	10.60	0.00	0.00	0.00	10.6	7.3			
	27 -> 32	dA:	1.60	3.90	3.80	13.50						105.8	77.6	Manchester Avenue
8.0	ΔA		1.60	3.90	3.80	13.50	0.00	0.00	0.00	22.8	17.5			
	33 -> 35	dA:	0.80			14.10						128.6	95.1	Campbell Street
9.0	ΔA		0.80	0.00	0.00	14.10	0.00	0.00	0.00	14.9	10.5			
	36 -> 39	dA:	1.30		2.40	3.10						143.5	105.6	Sunridge Street
10.0	ΔA		1.30	0.00	2.40	3.10	0.00	0.00	0.00	6.8	5.4			
	40 -> 44	dA:	1.50		2.40	15.50						150.3	111.0	Rees Walk
11.0	ΔA		1.50	0.00	2.40	15.50	0.00	0.00	0.00	19.4	14.2			
	45 - 46	dA:			2.10	1.50						169.7	125.2	Cabora Drive - Overflow to Wetland
12.0	ΔA		0.00	0.00	2.10	1.50	0.00	0.00	0.00	3.6	2.8			
	47 - 48	dA:	1.10		1.90	2.30						173.3	128.0	Culver Boulevard
13.0	ΔA		1.10	0.00	1.90	2.30	0.00	0.00	0.00	5.3	4.2			
												178.6	132.2	Vista Del Mar

Project Name: PLAYA VISTA - OFF-SITE HYDROLOGY QUAD "B" - PERSHING OVERFLOW

Project Number: 1MTP0104.10

Tabled By: GMV Date: 8/12/92

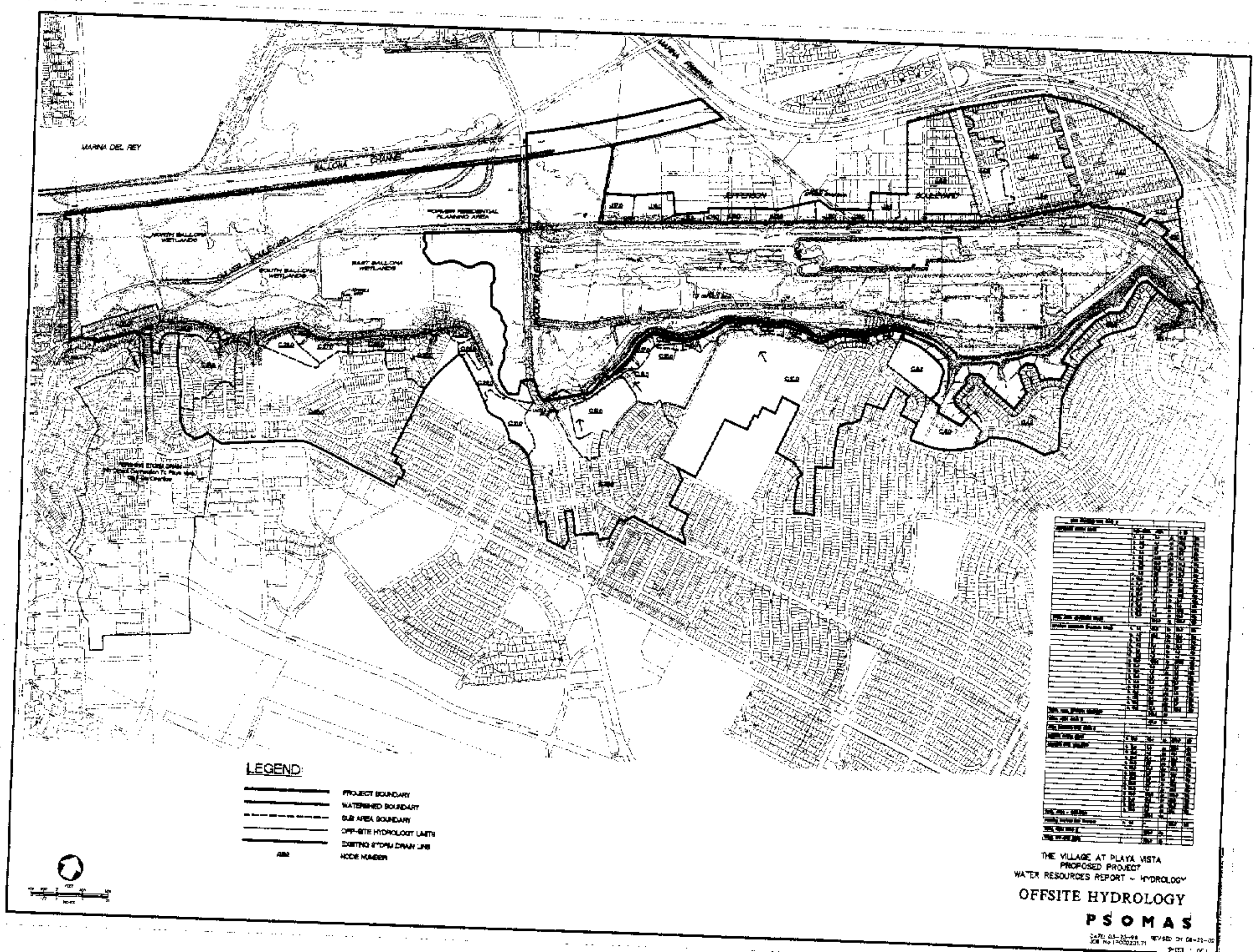
Checked By: GMV

Area Number:	1							
Node Number:	1.0							
Runoff Tabling Sheet:								
Conveyor:	Gutter							
Development Type:	R1							
Development Class:	50-2							
Elevation Difference:	23 ft							
Length of Reach:	1150 ft							
Average Slope:	*2.00%*							
Method of Computation:	Figure G242.2B							
ISO:	1.33							
Fro:	0.91							
tc(700):	7.4 min							
TIME OF CONCENTRATION (tc):	9.5 min							

A =	170 ac
tc =	18.3 min
Qp =	309 cfs
Qc =	174 cfs

PERSHING STORM DRAIN OVERFLOW TO NORTH WETLAND - 50 YEAR STORM

TIME	BPRR	CLOCK TIME	OVERFLOW HYDROGRAPH 1st Day Q50	2nd Day Q50	3rd Day Q50	4th Day Q50	OVERFLOW VOLUME 1st Day V50	2nd Day V50	3rd Day V50	4th Day V50
-1062	0.14	0	0 cfs	0 cfs	0 cfs	0 cfs				
-60	0.35	1002	0 cfs	0 cfs	0 cfs	0 cfs	0.00 af	0.00 af	0.00 af	0.00 af
0	0.37	1062	0 cfs	0 cfs	0 cfs	0 cfs	0.00 af	0.00 af	0.00 af	0.00 af
60	0.40	1122	0 cfs	0 cfs	0 cfs	0 cfs	0.00 af	0.00 af	0.00 af	0.00 af
70	0.49	1132	0 cfs	0 cfs	0 cfs	0 cfs	0.00 af	0.00 af	0.00 af	0.00 af
80	0.65	1142	0 cfs	0 cfs	0 cfs	0 cfs	0.00 af	0.00 af	0.00 af	0.00 af
85	0.79	1147	0 cfs	0 cfs	0 cfs	0 cfs	0.00 af	0.00 af	0.00 af	0.00 af
88	0.90	1150	0 cfs	0 cfs	0 cfs	0 cfs	0.00 af	0.00 af	0.00 af	0.00 af
90	1.01	1152	0 cfs	0 cfs	0 cfs	0 cfs	0.00 af	0.00 af	0.00 af	0.00 af
91	1.13	1153	0 cfs	0 cfs	0 cfs	7 cfs	0.00 af	0.00 af	0.00 af	0.00 af
92	1.28	1154	0 cfs	0 cfs	0 cfs	31 cfs	0.00 af	0.00 af	0.00 af	0.00 af
93	1.53	1155	0 cfs	0 cfs	0 cfs	72 cfs	0.00 af	0.00 af	0.00 af	0.03 af
94	1.82	1156	0 cfs	0 cfs	0 cfs	118 cfs	0.00 af	0.00 af	0.00 af	0.10 af
95	1.89	1157	0 cfs	0 cfs	0 cfs	128 cfs	0.00 af	0.00 af	0.00 af	0.23 af
96	1.92	1158	0 cfs	0 cfs	0 cfs	133 cfs	0.00 af	0.00 af	0.00 af	0.40 af
97	1.93	1159	0 cfs	0 cfs	0 cfs	135 cfs	0.00 af	0.00 af	0.00 af	0.58 af
98	1.93	1160	0 cfs	0 cfs	0 cfs	135 cfs	0.00 af	0.00 af	0.00 af	0.77 af
99	1.90	1161	0 cfs	0 cfs	0 cfs	131 cfs	0.00 af	0.00 af	0.00 af	0.95 af
100	1.87	1162	0 cfs	0 cfs	0 cfs	126 cfs	0.00 af	0.00 af	0.00 af	1.14 af
101	1.76	1163	0 cfs	0 cfs	0 cfs	108 cfs	0.00 af	0.00 af	0.00 af	1.31 af
102	1.58	1164	0 cfs	0 cfs	0 cfs	79 cfs	0.00 af	0.00 af	0.00 af	1.47 af
103	1.42	1165	0 cfs	0 cfs	0 cfs	54 cfs	0.00 af	0.00 af	0.00 af	1.60 af
104	1.28	1166	0 cfs	0 cfs	0 cfs	31 cfs	0.00 af	0.00 af	0.00 af	1.69 af
105	1.13	1167	0 cfs	0 cfs	0 cfs	7 cfs	0.00 af	0.00 af	0.00 af	1.75 af
106	1.01	1168	0 cfs	0 cfs	0 cfs	0 cfs	0.00 af	0.00 af	0.00 af	1.78 af
107	0.91	1169	0 cfs	0 cfs	0 cfs	0 cfs	0.00 af	0.00 af	0.00 af	1.78 af
108	0.83	1170	0 cfs	0 cfs	0 cfs	0 cfs	0.00 af	0.00 af	0.00 af	1.78 af
109	0.76	1171	0 cfs	0 cfs	0 cfs	0 cfs	0.00 af	0.00 af	0.00 af	1.78 af
110	0.69	1172	0 cfs	0 cfs	0 cfs	0 cfs	0.00 af	0.00 af	0.00 af	1.78 af
111	0.64	1173	0 cfs	0 cfs	0 cfs	0 cfs	0.00 af	0.00 af	0.00 af	1.78 af
112	0.59	1174	0 cfs	0 cfs	0 cfs	0 cfs	0.00 af	0.00 af	0.00 af	1.78 af
113	0.55	1175	0 cfs	0 cfs	0 cfs	0 cfs	0.00 af	0.00 af	0.00 af	1.78 af
114	0.50	1176	0 cfs	0 cfs	0 cfs	0 cfs	0.00 af	0.00 af	0.00 af	1.78 af
115	0.48	1177	0 cfs	0 cfs	0 cfs	0 cfs	0.00 af	0.00 af	0.00 af	1.78 af
116	0.44	1178	0 cfs	0 cfs	0 cfs	0 cfs	0.00 af	0.00 af	0.00 af	1.78 af
120	0.36	1182	0 cfs	0 cfs	0 cfs	0 cfs	0.00 af	0.00 af	0.00 af	1.78 af
125	0.31	1187	0 cfs	0 cfs	0 cfs	0 cfs	0.00 af	0.00 af	0.00 af	1.78 af
130	0.28	1192	0 cfs	0 cfs	0 cfs	0 cfs	0.00 af	0.00 af	0.00 af	1.78 af
135	0.24	1197	0 cfs	0 cfs	0 cfs	0 cfs	0.00 af	0.00 af	0.00 af	1.78 af
140	0.22	1202	0 cfs	0 cfs	0 cfs	0 cfs	0.00 af	0.00 af	0.00 af	1.78 af
145	0.20	1207	0 cfs	0 cfs	0 cfs	0 cfs	0.00 af	0.00 af	0.00 af	1.78 af
150	0.19	1212	0 cfs	0 cfs	0 cfs	0 cfs	0.00 af	0.00 af	0.00 af	1.78 af
155	0.17	1217	0 cfs	0 cfs	0 cfs	0 cfs	0.00 af	0.00 af	0.00 af	1.78 af
160	0.16	1222	0 cfs	0 cfs	0 cfs	0 cfs	0.00 af	0.00 af	0.00 af	1.78 af
170	0.16	1232	0 cfs	0 cfs	0 cfs	0 cfs	0.00 af	0.00 af	0.00 af	1.78 af
180	0.15	1242	0 cfs	0 cfs	0 cfs	0 cfs	0.00 af	0.00 af	0.00 af	1.78 af
190	0.15	1252	0 cfs	0 cfs	0 cfs	0 cfs	0.00 af	0.00 af	0.00 af	1.78 af
200	0.15	1262	0 cfs	0 cfs	0 cfs	0 cfs	0.00 af	0.00 af	0.00 af	1.78 af
210	0.15	1272	0 cfs	0 cfs	0 cfs	0 cfs	0.00 af	0.00 af	0.00 af	1.78 af
220	0.15	1282	0 cfs	0 cfs	0 cfs	0 cfs	0.00 af	0.00 af	0.00 af	1.78 af
230	0.15	1292	0 cfs	0 cfs	0 cfs	0 cfs	0.00 af	0.00 af	0.00 af	1.78 af
250	0.15	1312	0 cfs	0 cfs	0 cfs	0 cfs	0.00 af	0.00 af	0.00 af	1.78 af
260	0.14	1322	0 cfs	0 cfs	0 cfs	0 cfs	0.00 af	0.00 af	0.00 af	1.78 af
300	0.14	1362	0 cfs	0 cfs	0 cfs	0 cfs	0.00 af	0.00 af	0.00 af	1.78 af
378	0.14	1440	0 cfs	0 cfs	0 cfs	0 cfs	0.00 af	0.00 af	0.00 af	1.78 af


MARINA DEL REY
BALLONA CHANNEL
MARINA FREEWAY
FORMER RESIDENTIAL PLANNING AREA
NORTH BALLONA WETLANDS
SOUTH BALLONA WETLANDS
EAST BALLONA WETLANDS
JEFFERSON
BOULEVARD
LEGEND:
PROJECT BOUNDARY
WATERSHED BOUNDARY
SUB AREA BOUNDARY
OFF-SITE HYDROLOGY LIMITS
EXISTING STORM DRAIN LINE
NODE NUMBER
THE VILLAGE AT PLAYA VISTA
PROPOSED PROJECT
WATER RESOURCES REPORT - HYDROLOGY
OFFSITE HYDROLOGY
PSOMAS

Flows to the the FWM and Ballona Wetlands

	Tributary Area (ac)	Tc	50-Year Q_p (cfs)	50-Year Volume (ac-ft)	25 Year Q_p (cfs)	25 Year Volume (ac-ft)	20-Year Q_p (cfs)	20-Year Volume (ac-ft)	10-Year Q_p (cfs)	10-Year Volume (ac-ft)	5-Year Q_p (cfs)	5-Year Volume (ac-ft)	2-Year Q_p (cfs)	2-Year Volume (ac-ft)	1 Year Q_t (cfs)	1 Year Volume (ac-ft)
Pre-Playa Vista																
Jefferson Drain**	395	64	457	399	470	358	372	325	348	304	301	263	223	195	196	171
Centinela Ditch	570	87	629	550	565	494	513	448	479	419	415	362	307	268	269	235
Lincoln Storm Drain	91	12.5	209	90	188	81	170	73	159	69	138	59	102	44	89	39
TOTALS at Lincoln Blvd (FWM)	1056		1295	1039	1163	933	1055	847	987	792	853	685	532	507	554	445
East WL's & Tribs***	148.9	54.3	245	205	220	184	200	167	187	155	161	135	120	100	105	88
South WL's & Tribs	188.1	30.1	347	223	312	200	283	182	264	170	229	147	169	109	149	95
North WL's & Tribs	162.5	30.7	322	208	289	187	262	170	245	158	212	137	157	132	138	89
TOTALS BWL Direct Flow	499.5		914	636	821	571	745	518	696	485	602	419	446	310	391	272
TOTAL	1555.5		2209	1675	1984	1504	1800	1365	1683	1276	1456	1104	1078	817	945	717
Centinela Ditch at Ph 2 W'ly PL	429	67.3	628	461	474	414	430	376	402	351	348	304	258	225	226	197
Phase I																
Jefferson Drain	257	40	403.6	293	362	263	329	239	308	223	266	193	197	143	173	125
Central Drain	154	56	237	201	213	190	193	164	181	153	156	132	115	98	101	86
Riparian @ FWM	518	70	625	546	561	490	509	445	476	416	412	360	305	266	258	234
Lincoln Storm Drain	91	13	209	90	188	81	170	73	159	69	138	59	102	44	89	39
FWM Direct Flow	32	10	103.7	41	93	37	85	33	79	31	68	27	51	20	44	18
TOTALS at FWM	1052		1578.3	1171	1417	1052	1286	954	1203	892	1040	772	770	571	676	501
East WL's & Tribs	116.9	54.3	117	147	105	132	95	120	89	112	77	97	57	72	50	63
South WL's & Tribs	188.1	30.1	347	223	312	200	283	182	264	170	229	147	169	109	149	95
North WL's & Tribs	138.8	30.7	276.7	179	248	161	226	146	211	136	182	118	135	87	118	77
Northeast WL's & Tribs	59.7	10	176.2	69	158	62	144	56	134	53	116	45	86	34	75	30
TOTALS BWL Direct Flow	503.5		916.9	618	823	555	747	504	699	471	604	407	447	302	392	265
TOTAL	1555.5		2495.2	1789	2241	1607	2034	1458	1901	1363	1644	1179	1218	873	1068	766
Riparian at Ph 2 W'ly PL	396	55.5	549	464	493	417	447	378	418	354	362	306	268	226	235	199
Flow over FWM Weir			1036	139	824	104	657	93	490	51	247	32	41	5	0	0
Total BWL Direct Flow & Overflow			1952.9	757	1647	659	1404	586	1169	532	851	439	488	307	392	265
Phase II																
Jefferson Drain	257	39.8	403.6	293	362	263	329	239	308	223	265	193	197	143	173	125
Central Drain	183	37.8	312	221	280	198	254	190	238	168	206	146	152	108	134	95
Riparian	489	56	608	531	546	477	496	433	463	405	401	350	297	259	260	227
Lincoln Storm Drain	91	12.5	209	90	188	81	170	73	159	69	138	59	102	44	89	39
FWM Direct Flow	32	10	103.7	41	93	37	85	33	79	31	68	27	51	20	44	18
TOTALS at FWM	1052		1636.3	1176	1469	1056	1334	958	1247	896	1078	775	799	574	700	503
East WL's & Tribs	116.9	54.3	117	147	105	132	95	120	89	112	77	97	57	72	50	63
South WL's & Tribs	188.1	30.1	347	223	312	200	283	182	264	170	229	147	169	109	149	95
North WL's & Tribs	138.8	30.7	276.7	179	248	161	226	146	211	136	182	118	135	87	116	77
Northeast WL's & Tribs	59.7	50	176.2	69	158	62	144	56	134	53	116	45	86	34	75	30
TOTALS BWL Direct Flow	503.5		916.9	618	823	555	747	504	699	471	604	407	447	302	392	265
TOTAL	1555.5		2553.2	1794	2293	1611	2081	1462	1946	1367	1683	1182	1246	875	1093	768
Riparian at Ph 2 W'ly PL	367	43.9	546	417	493	374	447	340	418	318	362	275	269	203	235	178
Flow over FWM Weir			1066	149	928	122	773	100	617	77	377	48	112	11	0	0
Total BWL Direct Flow & Overflow			1982.9	767	1751	677	1520	603	1316	548	981	455	559	313	392	255
TRACT 51122																
Diversion	27	10	88	35	79	31	72	29	67	27	58	23	43	17	38	15
Total Tract (incls portion trib to PV)	38	10	124	49	111	44	101	40	94	37	82	32	61	24	53	21

* Note: Pre PV watersheds are not identical to the Proposed project and cannot be compared directly.

** Outlet located near Culver / Jefferson intersection. Includes NW corner of Jefferson / Lincoln

*** includes FWM area

TABLED BY MTK CHECKED BY GMV SUPERVISED BY	CITY OF LOS ANGELES Department of Public Works Bureau of Engineering	STORM DRAIN DESIGN RUNOFF TABLING SHEET Frequency 50 Year	Project: 1MTP0108.10 - PLAYA VISTA TRACT 49104 - HYDROLOGY STUDY AREA "D" - RIPARIAN COORIDOR/ CENTINELA DITCH	Date: Sep-9-1994 Sheet:

Drainage Map Area No	Area Acres	Runoff	100% Ae	Flow Routing Surface Flow N	S	E	W	Storm Drain	ISO	Freq. Fact.	Dist. Fact.	Amen 1hr R.F.R.	Fro	BPRR	Frict. Slope (S)	K= Q / S^.5	Size	Area [sf]	Vel [ft/s]	L [ft]	tc or tcx [min]	Storm Drain Station	Location	Remarks	
LINE D1PI - RIPARIAN COORIDOR/CENTINELA DITCH																									
102	10.6	ΣA	9.2																				for Riparian Corridor: n(side) = .125 n(base) = .050		1
		c	3.35																						
		Q	30.8						1.33	1.00	1.000	1.33	1.30	2.58			D=	33 ø	n=	.013	9.4		Area 102.1 & .2 Centinela & Teale Street		2
105	1.4	A	1.0					30.8									d=	1.94							
	12.0	ΣA	10.2												0.0009	1027	PIPE	4.47	6.89	126	0.3	<- Area 106.1			3
		q	3.32																						
		Q	33.9						1.33	1.00	1.000	1.33	1.30	2.55							9.7		Line D1P Node #106		4
Σ106	10.8	A	9.5																						
	22.8	ΣA	19.7					33.9																	
		q	3.43																			<- S.D. from Tract 43416 (Rev. C.1.0)			5
		Q	67.6						1.33	1.00	1.000	1.33	1.30	2.64			b=	16'			....	tc1/Q1=	9.7 min	33.9 cfs	
																	z=	3	n=	.089	8.9	tc2/Q2=	8.1 min	34 cfs	6
110	6.4	A	4.5					67.6									d =	2.74				tcx=	8.9 min		
	29.2	ΣA	24.2												0.0009	2253.33	Trap	66	1.02	452	7.4	<- Area 110.1 & .2			7
		q	2.64																						
		Q	63.9						1.33	1.00	1.000	1.33	1.30	2.03							16.3		Line D1P Node #110		8
Σ110	2.80	A	2.8					63.9																	
	32.0	ΣA	27																						
		q	2.73																			<- Area 108.1 @ Line:		81	9
		Q	73.7						1.33	1.00	1.000	1.33	1.30	2.10			b=	16'			....	tc1/Q1=	16.3 min	63.9 cfs	
																	z=	3	n=	.090	15.1	tc2/Q2=	7.8 min	10.5 cfs	10
114	4.2	A	2.9					73.7									d =	2.95				tcx=	15.1 min		
	36.2	ΣA	29.9												0.0009	2456.67	Trap	73	1.01	481	7.9	<- Area 114.1, 144.2, & 116.2			11
		q	2.3																						
		Q	68.8						1.33	1.00	1.000	1.33	1.30	1.75							23.0		Line D1P Node #114		10
Σ114	4.8	A	4.8					68.8																	
	41	ΣA	34.7																			<- Area 112.1 @ Line:		84	11
		c	2.42																			tc1/Q1=	23 min	68.8 cfs	
		Q	84						1.33	1.00	1.000	1.33	1.33	1.86			b=	16'							
																	z=	3	n=	.094	19.9	tc2/Q2=	7.7 min	17.6 cfs	12
116	3.2	A	2.5					84									d =	3.60				tcx=	19.9 min		
	44.2	ΣA	37.2												0.004	1328	Trap	96	0.88	126	2.4	<- Area 116.1, & C2.0			13
		q	2.3													n =	0.013								
		Q	85.6						1.33	1.00	1.000	1.33	1.30	1.77		R =	0.938			.013	22.3		Location of Detention Basin Capacity = 2 acre-feet		14
118	8.3	A	8.2				9.1	76.5								Kf =	1209						Line D1E Node # 116		
	52.5	ΣA	45.4												0.004	1353.5	45 ø	30.8	2.8	505	3.0	<- Area 118.1 (PARKING LOT)			15
		q	2.2																						
		Q	99.9						1.33	1.00	1.000	1.33	1.30	1.67			D=	54 ø	n=	.013	25.3		Line D1E Node # 118		16
																	d=	3.29							

Date: 9/9/94

RUNOFF TABLE
RIPARIAN COORIDOR/CENTINELA DITCH

PSOMAS

TABLED BY	MTK	CITY OF LOS ANGELES, Department of Public Works, Bureau of Engineering
CHECKED BY	GMV	STORM DRAIN DESIGN RUNOFF TABLING SHEET, Frequency 50 Year
SUPERVISED BY		Project: 1MTP0108.10 - PLAYA VISTA, TRACT 49104 - HYDROLOGY STUDY, AREA "D" - RIPARIAN COORIDOR/ CENTINELA DITCH
Date: Sep-9-1994	Sheet:	

Drainage Map Area No	Area Acres	Runoff	100% Ae	Flow Routing Surface Flow N	S	E	W	Storm Drain	ISO	Freq. Fact.	Dist. Fact.	Amen 1hr RFR	Fro	BPRR
120	9.3	A	7.1					99.9						
	61.8	ΣA	52.5											
		q	2.2						1.33	1.00	1.000	1.33	1.30	1.66
		Q	116											
122	56.1	A	49.8											
	117.9	ΣA	102.3					116						
		q	2.1						1.33	1.00	0.999	1.33	1.30	1.63
		Q	215											
124	7.5	A	6.8											
	125.4	ΣA	109.1					215						
		q	2.1						1.33	1.00	0.998	1.33	1.30	1.62
		Q	229											
Σ 124	30.6	A	24.9											
	156.0	ΣA	134.0					229						
		q	2.3						1.33	1.00	0.993	1.33	1.29	1.79
		Q	308											
126	15.7	A	15.1											
	171.7	ΣA	149.1					308						
		q	2.3						1.33	1.00	0.992	1.33	1.29	1.78
		Q	343											
128	9.3	A	9.1											
	181.0	ΣA	158.2					343						
		q	1.9						1.33	1.00	0.993	1.33	1.29	1.51
		Q	301											
130	7.6	A	6.5											
	186.6	ΣA	164.7					301						
		q	1.7						1.33	1.00	0.994	1.33	1.29	1.29
		Q	280											
132	6.6	A	5.8											
	195.2	ΣA	170.5					280						
		q	1.5						1.33	1.00	0.994	1.33	1.29	1.20
		Q	256											
Σ132	124.5	A	117.3											
	319.7	ΣA	287.8					256						
		q	2.0						1.33	1.00	0.982	1.33	1.26	1.60
		Q	576											
134	5.9	A	5.3											
	325.6	ΣA	293.1					576						
		q	1.8						1.33	1.00	0.984	1.33	1.26	1.40
		Q	528											

Frict. Slope (S)	K= Q/S^.5	Size	Area [sf]	Vel. [ft/s]	L [ft]	tc or tcx [min]	Storm Drain Station	Location	Remarks	
0.004	1580	PIPE	12.46	8.02	272	0.6	<- Area 120.1, 120.2, & C.3.0			17
		D= 54 ø, c= 3.44		n= .013		25.9		Line D1E Node # 120		18
0.004	1834	PIPE	13.06	8.88	506	0.9	<- Area 122.1, 122.2, & C.4.0			19
(2 pipes)	n= 0.013, R= 1.375, Kf= 6716				.013	26.8		Line D1E Node # 122		20
0.004	3399.4	2-66ø	24.4	8.81	310	0.6	<- Area 124.1, 124.2, & C.5.0			21
						27.4		Line D1E Node # 124		22
(2 pipes)	n= 0.013						<- S.D. from Tract 43415 (C.6.0)			23
	R= 1.375, Kf= 6716				.013	.... 21.6	tc1/Q1= tc2/Q2= tcx=	27.4 min, 7.4 min, 21.6 min	229 cfs, 92.6 cfs	24
0.004	4859.9	2-66ø	30.8	10.00	310	0.5	<- Area 126.1, 126.2, & C.7.0			25
n= , W1= , W2=	0.050, 34.00', 324.00'	B= , d1= , d2=	10', 4.00', 1.45'	Z1= , Z2= , d=	3, 100, 5.45	22.1		Line D1E Node # 126		26
0.002	7670	Trap	347.55	0.99	580	9.8	<- Area 128.1 & 128.2			27
n= , W1= , W2=	0.050, 34.00', 302.00'	B= , d1= , d2=	10', 4.00', 1.34'	Z1= , Z2= , d=	3, 100, 5.34	31.9		Line D1E Node # 128		28
0.001	9518	Trap	313.12	0.96	792	13.8	<- Area 130.1, 130.2 & C.8.0			29
n= , W1= , W2=	0.050, 34.00', 288.00'	B= , d1= , d2=	10', 4.00', 1.27'	Z1= , Z2= , d=	3, 100, 5.27	45.7		Line D1E Node # 130		30
0.001	8854	Trap	292.47	0.96	505	8.6	<- Area 132.1, 132.2 & C.9.0			31
						54.5		Line D1E Node # 132		32
							<- S.D. from LMU (C.10.0)			33
n= , W1= , W2=	0.050, 34.00', 422.00'	B= , d1= , d2=	10', 4.00', 1.94'	Z1= , Z2= , d=	3, 100, 5.94	.... 28.1	tc1/Q1= tc2/Q2= tcx=	54.5 min, 10.2 min, 28.1 min	256 cfs, 378 cfs	34
0.001	18215	Trap	530.32	1.09	667	10.2	<- Area 134.1, 134.2 & C.11.0			35
n= , W1= , W2=	0.050, 34.00', 406.00'	B= , d1= , d2=	10', 4.00', 1.86'	Z1= , Z2= , d=	3, 100, 5.86	38.3		Line D1E Node # 134		36

Date: 9/9/94

RUNOFF TABLE
RIPARIAN COORIDOR/CENTINELA DITCH

TABLED BY MTK CHECKED BY GMV SUPERVISED BY				CITY OF LOS ANGELES Department of Public Works Bureau of Engineering					STORM DRAIN DESIGN RUNOFF TABLING SHEET Frequency 50 Year						Project: 1MTP0108.10 - PLAYA VISTA TRACT 49104 - HYDROLOGY STUDY AREA "D" - RIPARIAN COORIDOR/ CENTINELA DITCH								Date: Sep-9-1994 Sheet:		
Drainage Map		Runoff		Flow Routing																					
Area No	Area Acres		100% Ae	Surface Flow N	S	E	W	Storm Drain	ISO	Freq. Fact.	Dist. Fact	Amen 1hr RFR	Fro	BPRR	Frict. Slope (S)	K= Q / S^.5	Size	Area [sf]	Vel. [ft/s]	L [ft]	tc or tcx [min]	Storm Drain Station	Location	Remarks	
140	6.1	A	4.3					528							0.001	16697	Trap	497.2	1.06	813	12.8	<- Area 140.1, 140.2, & C12.0			37
	331.7	ΣA	297.4																						
		q	1.57						1.33	1.00	0.987	1.33	1.28	1.23											
		Q	467																		51.1	38 + 10	Teale @ 9th Street Line D1P Node # 140		38
Σ140	63.9	A	55.6					467																	
	395.6	ΣA	353.0																			<- Line D2PI @ Line:		78	39
		q	1.5						1.33	1.00	0.984	1.33	1.28	1.19	n =	0.040	B =	30.00'	Z=	0		tc1/Q1=	51.1 min	467 cfs	
		Q	530												W=	30.00'	d=	6.62'			55.5	tc2/Q2=	87 min	65.8 cfs	40
															note: velocity computed from profile due to backwater							tcx=	55.5 min		
145	0.0	A	0.0					530							0.001	16760	Trap	198.86	2.67	110	0.7	Channel Transition			41
	395.6	ΣA	353.0												n =	0.087	B =	35.00'	Z=	2					
		q	1.51						1.33	1.00	0.985	1.33	1.28	1.18	W=	61.84'	d=	6.71'							
		Q	533																		56.2	37 + 00	Line D1P Node # 145		42
															note: velocity computed from profile due to backwater										
147	0.0	A	0.0					533							0.001	16855	Trap	325.1	1.64	900	9.1	Channel Transition			43
	395.6	ΣA	353.0												n =	0.040	B =	30.00'	Z=	0					
		q	1.4						1.33	1.00	0.984	1.33	1.28	1.11	W=	30.00'	d1 =	6.55'							
		Q	494																		65.3	28 + 00			44
															note: velocity computed from profile due to backwater										
148	14.2	A	9.9					494							0.001	15622	Trap	196.63	2.51	250	1.7	<- Area 148.1, 148.2, C13.0, C14.0,			45
	409.8	ΣA	362.9																						
		q	1.40						1.33	1.00	0.986	1.33	1.28	1.09									C15.0, C16.0, and C17.0		
		Q	508																		67.0	25 + 50	Line D1P Node # 148		44
Σ148	13.1	A	13.1					508																	
	422.9	ΣA	376.0																			<- Area 146 @ Line:		87	45
		q	1.40						1.33	1.00	0.986	1.33	1.28	1.09	n =	0.040	B =	30.00'	Z=	0		tc1/Q1=	67 min	508 cfs	
		Q	526												W=	30.00'	d=	6.72'			67.0	tc2/Q2=	11 min	41.4 cfs	46
															note: velocity computed from profile due to backwater							tcx=	67 min	Q2 < 0.1*Q1	
149	0.0	A	0.0					526							0.031	16534	Trap	201.15	2.61	350	2.2	Channel Transition			47
	422.9	ΣA	376.0												n =	0.081	B =	43.00'	Z=	2					
		q	1.38						1.33	1.00	0.987	1.33	1.28	1.08	W=	70.84'	d=	6.96'							
		Q	519																		69.2	19 + 20	Line D1P Node # 149		48
															note: velocity computed from profile due to backwater										
150	6.1	A	4.4					519							0.001	16412	Trap	397.7	1.31	460	5.9	<- Area 150.1, 150.2 & C18.0			49
	429.0	ΣA	380.4												n =	0.079	B =	46.00'	Z=	2					
		q	1.33						1.33	1.00	0.987	1.33	1.28	1.04	W=	74.64'	d=	7.16'							
		Q	506																		75.1	17 + 20	Line D1P Node # 150		50
															note: velocity computed from profile due to backwater										
154	5.5	A	4.1					506							0.001	16001	Trap	430.33	1.18	450	6.4	<- Area 154.1 & 154.2			51
	434.5	ΣA	384.5																						
		q	1.28						1.33	1.00	0.988	1.33	1.28	1.00											
		Q	492																		81.5	12 + 70	**Bay Street** Line D1P Node # 154		52

RUNOFF TABLE
RIPARIAN COORIDOR/CENTINELA DITCH

PSOMAS

TABLED BY MTK CHECKED BY GMV SUPERVISED BY				CITY OF LOS ANGELES Department of Public Works Bureau of Engineering					STORM DRAIN DESIGN RUNOFF TABLING SHEET Frequency 50 Year						Project: 1MTP0108.10 - PLAYA VISTA TRACT 49104 - HYDROLOGY STUDY AREA "D" - RIPARIAN COORIDOR/ CENTINELA DITCH								Date: Sep-9-1994 Sheet:		
Drainage Map		Runoff		Flow Routing																					
Area No	Area Acres		100% Ae	Surface Flow N	S	E	W	Storm Drain	ISO	Freq. Fact	Dist. Fact	Amen 1hr R.F.R.	Fro	BPRR	Frict. Slope (S)	K= Q S^.5	Size	Area [sf]	Vel. [ft/s]	L [ft]	tc or tcx [min]	Storm Drain Station	Location	Remarks	
	22.1	A	22.1					492																	
Σ154	456.6	ΣA	406.6																			<- Area 152.1 @ Line:		90	53
		q	1.36						1.33	1.00	0.986	1.33	1.28	1.06	n =	0.079	B =	49.00'	Z=	2		tc1/Q1=	81.5 min	492 cfs	
		Q	553												W=	78.40'	d=	7.35'			72.5	tc2/Q2=	11.2 min	72.5 cfs	54
															note: velocity computed from profile due to backwater							tcx=	72.5 min		
	1.2	A	0.9					553							0.001	17487	Trap	467.2	1.18	210	3.0	<- Area 156.1 & .2			55
156	457.8	ΣA	407.5																						
		q	1.33						1.33	1.00	0.985	1.33	1.28	1.04											
		Q	542																						
	41.1	A	38.5																		75.5	10 + 60	Line D1P Node # 156		56
	498.9	ΣA	446					542																	
Σ156		q	1.46																			<- Hughes SD(Rev. C.19.0) from Off-site Hy			57
		Q	651						1.33	1.00	0.980	1.33	1.27	1.15	n =	0.079	B =	50.00'	Z=	2		tc1/Q1=	75.5 min	542 cfs	
	13.5	A	10.0												W=	79.88'	d=	7.47'			60.3	tc2/Q2=	7.2 min	155 cfs	58
								651							note: velocity computed from profile due to backwater							tcx=	50.3 min		
	5'2.4	ΣA	456.0												0.001	20586	Trap	482	1.35	670	8.3	<- Area 160.1 & .2			59
160		q	1.38														W =	10.00'					East side of		
		Q	629						1.33	1.00	0.981	1.33	1.28	1.08			H =	6.50'	n=	.014	68.6	3 + 90	Lincoln Blvd.		60
	0.0	A	0.0														N =	2	d =	5.3			Line D1P Node # 160		
	512.4	ΣA	456.0					629							0.0009	20966.7	RCB	126	4.99	390	1.3				61
162		q	1.37																						
		Q	625						1.33	1.00	0.981	1.33	1.28	1.07							69.9	0 + 00	Freshwater Wetland		62
								625																	
250																							-> Freshwater Wetland		63
																									64

RUNOFF TABLE
RIPARIAN COORIDOR/CENTINELA DITCH

PSOMAS

TABLED BY MTK		CHECKED BY GMV		SUPERVISED BY
CITY OF LOS ANGELES Department of Public Works Bureau of Engineering	STORM DRAIN DESIGN RUNOFF TABLING SHEET Frequency 50 Year	Project: 1MTP0108.10 - PLAYA VISTA TRACT 49104 - HYDROLOGY STUDY AREA "D" - RIPARIAN COORIDOR/ CENTINELA DITCH	Date: Sep-9-1994	Sheet:

Drainage Map Area No	Area Acres	Runoff	100% Ae	Flow Routing Surface Flow N	S	E	W	Storm Drain	ISO	Freq. Fact.	Dist. Fact	Amen 1hr RFR	Fro	BPRR	Frict. Slope (S)	K= Q/S^1/2	Size	Area (sf)	Vel. (ft/s)	L (ft)	tc or tcx (min)	Storm Drain Station	Location	Remarks	
LINE D3PI - 140																									
300	5.5	ΣA	4.8																						
		q	3.0														b=	1'				<- Area 300.1			
		Q	14.4						1.33	1.00	1.000	1.33	1.30	2.34			z=	100	n=	0.03	11.8		Plant Site		63
	6.1	A	5.3														d=	0.43'							
302	11.6	ΣA	10.1					14.4							0.0017	349	Trap	19.34	0.74	750	16.9	<- Area 302.1	Surface Flo		64
		q	2.1														b=	1'							
		Q	21.2						1.33	1.00	1.000	1.33	1.30	1.58			z=	100	n=	0.03	28.7				65
	7.2	A	6.3														d=	0.52'							
304	18.8	ΣA	16.4					21.2							0.0014	557	Trap	27.81	0.76	650	14.3	<- Area 304.1			66
		q	1.7														b=	1'							
		Q	27.9						1.33	1.00	1.000	1.33	1.30	1.33			z=	100	n=	0.03	43.0				67
	6.7	A	6.7														d=	0.59'							
306	25.5	ΣA	23.1					27.9							0.0013	774	Trap	35.14	0.79	335	7.1	<- Area 306.1			68
		q	1.6														b=	1'							
		Q	37.0						1.33	1.00	1.000	1.33	1.30	1.24			z=	100	n=	0.03	50.1				69
	9.9	A	8.7														d=	0.66'							
308	35.4	ΣA	31.8					37							0.0014	989	Trap	44.17	0.84	630	12.5	<- Area 308.			70
		q	1.5														b=	1'							
		Q	47.7						1.33	1.00	1.000	1.33	1.30	1.13			z=	40	n=	0.03	62.6				71
	9.7	A	8.5														d=	0.97'							
310	45.1	ΣA	40.3					47.7							0.0016	1193	Trap	38.65	1.23	630	8.5	<- Area 310.1			72
		q	1.4														b=	1'							
		Q	56.4						1.33	1.00	1.000	1.33	1.30	1.07			z=	40	n=	0.03	71.1				73
	13.8	A	10.3														d=	1.78'							
312	58.9	ΣA	50.6					56.4							0.0013	1564	Trap	33.59	1.68	1520	15.1	<- Area 312.1, 144.1, &142.1			74
		q	1.3														b=	1'							
		Q	65.8						1.33	1.00	1.000	1.33	1.30	0.98			z=	10	n=	0.03	86.2				75
																	d=	1.44'							
140								65.8							0.0039	903	Trap	22.25	2.53	120	0.8				76
																					87.0				77
																						-> Node 140 @ Line:		39	78

RUNOFF TABLE
RIPARIAN COORIDOR/CENTINELA DITCH

TABLED BY MTK CHECKED BY GMV SUPERVISED BY				CITY OF LOS ANGELES Department of Public Works Bureau of Engineering					STORM DRAIN DESIGN RUNOFF TABLING SHEET Frequency 50 Year						Project: 1MTP0108.10 - PLAYA VISTA TRACT 49104 - HYDROLOGY STUDY AREA "D" - RIPARIAN COORIDOR/ CENTINELA DITCH								Date: Sep-9-1994 Sheet:		
Drainage Map		Runoff		Flow Routing																					
				Surface Flow																					
Area No	Area Acres		100% Ae	N	S	E	W	Storm Drain	ISO	Freq. Fact.	Dist. Fact.	Amen 1hr RFR	Fro	BPRR	Frict. Slope (S)	K= Q S^.5	Size	Area [sf]	Vel. [ft/s]	L [ft]	Tc or tcx [min]	Storm Drain Station	Location	Remarks	
Area 108.1																									
108.0	2.8	ΣA	2.8						1.33	1.00	1.000	1.33	1.30	2.88								<- Area 108.1			
		q	3.74																						
		Q	10.5														D=	24 ø			7.3		12th & Teale Street		79
								10.5									d=	1.41							
															0.003	192	Pipe	2.37	4.43	125	0.5				80
																					7.8	-> Node 110 @ Line:		9	81
Area 112.1																									
112.0	4.8	ΣA	4.8						1.33	1.00	1.000	1.33	1.30	2.85								<- Area 112.1			
		q	3.71																						
		Q	17.8														D=	30 ø			7.5		11th & Teale Street		82
								17.8									d=	1.68							
															0.003	325	Pipe	3.51	5.07	75	0.2				83
																					7.7	-> Node 148 @ Line:		11	84
Area 146.1																									
146.0	13.1	ΣA	13.1						1.33	1.00	1.000	1.33	1.30	2.43								<- Area 146.1			
		c	3.16																						
		Q	41.4														D=	42 ø			10.8		6th & Teale Street		85
								41.4									d=	2.26							
															0.003	756	Pipe	6.58	6.29	75	0.2				86
																					11.0	-> Node 148 @ Line:		45	87
Area 152.1																									
152.0	22.1	ΣA	22.1						1.33	1.00	1.000	1.33	1.30	2.52								<- Area 152.1			
		q	3.28																						
		Q	72.5														D=	48 ø			9.9		Bay St. & Teale St.		88
								72.5									d=	3.03							
															0.003	1324	Pipe	10.20	7.11	570	1.3				89
																					11.2	-> Node 154 @ Line:		53	90

Date: 9/9/94

RUNOFF TABLE
RIPARIAN COORIDOR/CENTINELA DITCH

PSOMAS

1MTP0108.10 - PLAYA VISTA
TRACT 49104 - HYDROLOGY STUDY

Design Storm Frequency				50 year												
Node #	Area #	ISO	Soil Type		IMPERVIOUSNESS 100%	70%	60%	50%	40%	35%	15%	SUB AREA	EQUIV AREA	TOTAL AREA	TOTAL Ae	COMMENTS
RIPARIAN COORIDOR/CENTINELA DITCH																
	102.1	1.33	1	dA:	6.23					0.00		6.2	6.2			
	102.2	1.33	2	dA:				4.42				4.4	3.0			
102												10.6	9.2	10.6	9.2	
	106.1	1.33	1	dA:						0.21		0.2	0.2			
	106.2	1.33	2	dA:				1.16				1.2	0.8			
106												1.4	1.0	12.0	10.2	
	C.1.0	1.33	2	dA:		10.82						10.8	9.5			<- SD from Tract 43416
Σ106												10.8	9.5	22.8	19.7	
	110.1	1.33	1	dA:						0.94		0.9	0.7			
	110.2	1.33	2	dA:				5.52				5.5	3.8			
		1.33	1	dA:								0.0	0.0			
110												6.4	4.5	29.2	24.2	
	108.1	1.33	1	dA:	2.79							2.8	2.8			
Σ110												2.8	2.8	32.0	27.0	
	114.1	1.33	1	dA:						0.95		1.0	0.7			
	114.2	1.33	2	dA:				0.59				0.6	0.4			
	116.2	1.33	2	dA:				2.62				2.6	1.8			<- Bluff Area Above 116
114												4.2	2.9	36.2	29.9	
	112.1	1.33	1	dA:	4.84					0.00		4.8	4.8			
Σ114												4.8	4.8	41.0	34.7	
	116.1	1.33	1	dA:	1.06							1.1	1.1			
	C.2.0	1.33	2	dA:				2.10				2.1	1.4			<- C.2.0 from Offsite Hydrology
116												3.2	2.5	44.2	37.2	
	118.1	1.33	1	dA:	8.07							8.1	8.1			
	118.2	1.33	2	dA:				0.16				0.2	0.1			
118												8.3	8.2	52.5	45.4	
	120.1	1.33	1	dA:	2.42							2.4	2.4			
	120.2	1.33	2	dA:				0.56				0.6	0.4			<- Bluff Area Above 120
	C.3.0	1.33	2	dA:				6.30				6.3	4.3			<- C.3.0 from Offsite Hydrology
120												9.3	7.1	61.8	52.5	

AREA CONVERSION TABLE
RIPARIAN CORRIDOR/CENTINELA DITCH

PSOMAS

Node #	Area #	ISO	Soil Type		100%	70%	60%	50%	40%	35%	15%	SUB AREA	EQUIV AREA	TOTAL AREA	TOTAL Ae	COMMENTS
Design Storm Frequency				50 year	IMPERVIOUSNESS											
	122.1	1.33	1	dA:	15.90							15.9	15.9			
	122.2	1.33	2	dA:				0.83				0.8	0.6			<- Bluff Area Above 122
	C.4.0	1.33	2	dA:		32.00		7.42				39.4	33.3			< - C.4.0 from Offsite Hydrology
122												56.1	49.8	117.9	102.3	
	124.1	1.33	1	dA:	5.25							5.3	5.3			
	124.2	1.33	2	dA:				0.63				0.6	0.4			<- Bluff Area Above 124
	C.5.0	1.33	2	dA:				1.61				1.6	1.1			< - C.5.0 from Offsite Hydrology
124												7.5	6.8	125.4	109.1	
	C.6.0	1.33	2	dA:	9.18	9.16		2.13		10.10		30.6	24.9			< - S.D. From Tract 43415
Σ124												30.6	24.9	156.0	134.0	
	126.1	1.33	1	dA:	13.81							13.8	13.8			
	126.2	1.33	2	dA:				0.90				0.9	0.6			<- Bluff Area Above126
	C.7.0	1.33	2	dA:				1.03				1.0	0.7			< - C.7.0 from Offsite Hydrology
126												15.7	15.1	171.7	149.1	
	128.1	1.33	1	dA:	8.56							8.6	8.6			
	128.2	1.33	2	dA:				0.74				0.7	0.5			<- Bluff Area Above 128
128												9.3	9.1	181.0	158.2	
	130.1	1.33	1	dA:	3.98							4.0	4.0			
	130.2	1.33	2	dA:				1.12				1.1	0.8			<- Bluff Area Above 130
	C.8.0	1.33	2	dA:				2.48				2.5	1.7			< - C.8.0 from Offsite Hydrology
130												7.6	6.5	188.6	164.7	
	132.1	1.33	1	dA:	4.07							4.1	4.1			
	132.2	1.33	2	dA:				0.98				1.0	0.7			<- Bluff Area Above 132
	C.9.0	1.33	2	dA:				1.47				1.5	1.0			< - C.9.0 from Offsite Hydrology
132												6.6	5.8	195.2	170.5	
	C.10.0	1.33	2	dA:	66.20	57.20		1.10				124.5	117.3			< - LMU SD from Off-site Hydrology
Σ132												124.5	117.3	319.7	287.8	
	134.1	1.33	1	dA:	3.92							3.9	3.9			
	134.2	1.33	2	dA:				1.15				1.2	0.8			<- Bluff Area Above 134
	C.11.0	1.33	2	dA:				0.84				0.8	0.6			< - C.11.0 from Offsite Hydrology
134												5.9	5.3	325.6	293.1	

Date: 9/9/94

AREA CONVERSION TABLE
RIPARIAN CORRIDOR/CENTINELA DITCH

PSOMAS

Node #	Area #	ISO	Soil Type		100%	70%	60%	50%	40%	35%	15%	SUB AREA	EQUIV AREA	TOTAL AREA	TOTAL Ae	COMMENTS
Design Storm Frequency				50 year	IMPERVIOUSNESS											
	C.12.0	1.33	2	dA:				1.47				1.5	1.0			<- C.12.0 from Offsite Hydrology
	140.1	1.33	1	dA:						3.22		3.2	2.4			
	140.2	1.33	2	dA:				1.37				1.4	0.9			
140												*6.1*	*4.3*	331.7	297.4	
	300-312											63.9	55.6			<- Line D3PI
Σ140												*63.9*	*55.6*	395.6	353.0	
	C.13.0	1.33	2	dA:				1.80				1.8	1.2			<- C.13.0 from Off-site Hydrology
	C.14.0	1.33	2	dA:				0.82				0.8	0.6			<- C.14.0 from Off-site Hydrology
	C.15.0	1.33	2	dA:				0.91				0.9	0.6			<- C.15.0 from Off-site Hydrology
	C.16.0	1.33	2	dA:				1.58				1.6	1.1			<- C.16.0 from Off-site Hydrology
	C.17.0	1.33	2	dA:				2.35				2.4	1.6			<- C.17.0 from Off-site Hydrology
	148.1	1.33	1	dA:						4.59		4.6	3.4			
	148.2	1.33	2	dA:				2.07				2.1	1.4			
148												*14.2*	*9.9*	409.8	362.9	
	146.1	1.33	1	dA:	13.05					0.00		13.1	13.1			
Σ148												*13.1*	*13.1*	422.9	376.0	
	150.1	1.33	1	dA:						3.68		3.7	2.8			
	150.2	1.33	2	dA:				1.51				1.5	1.0			
	C.18.0	1.33	2	dA:						0.93		0.9	0.6			<- C.18.0 from Off-site Hydrology
150												*6.1*	*4.4*	429.0	380.4	
	154.1	1.33	1	dA:						4.63		4.6	3.5			
	154.2	1.33	2	dA:				0.94				0.9	0.6			
154												*5.5*	*4.1*	434.5	384.5	
	152.1	1.33	1	dA:	22.08					0.00		22.1	22.1			
Σ154												*22.1*	*22.1*	456.6	406.6	
	156.1	1.33	1	dA:						1.00		1.0	0.8			
	156.2	1.33	2	dA:				0.17				0.2	0.1			
156												*1.2*	*0.9*	457.8	407.5	
	C.19.0	1.33	2	dA:	19.22	21.92						41.1	38.5			<- C.19.0 from Off-site Hydrology
Σ156												*41.1*	*38.5*	498.9	446.0	
	160.1	1.33	1	dA:						11.55		11.6	8.7			
	160.2	1.33	2	dA:				1.88				1.9	1.3			
160												*13.5*	*10.0*	512.4	456.0	-> To Freshwater Wetland

AREA CONVERSION TABLE
RIPARIAN CORRIDOR/CENTINELA DITCH

Design Storm Frequency				50 year												
Node #	Area #	ISO	Soil Type		IMPERVIOUSNESS							SUB AREA	EQUIV AREA	TOTAL AREA	TOTAL Ae	COMMENTS
					100%	70%	60%	50%	40%	35%	15%					
LINE D3PI : TRIBUTARY TO CENTINELA DITCH																
	300.1	1.33	1	dA:	2.75											
300										2.75		5.5	4.8			
												5.5	4.8	5.5	4.8	
	302.1	1.33	1	dA:	3.05											
302										3.05		6.1	5.3			
												6.1	5.3	11.6	10.1	
	304.1	1.33	1	dA:	3.62											
304										3.62		7.2	6.3			
												7.2	6.3	18.8	16.4	
	306.1	1.33	1	dA:	6.72											
306												6.7	6.7			
												6.7	6.7	25.5	23.1	
	308.1	1.33	1	dA:	4.96											
308										4.96		9.9	8.7			
												9.9	8.7	35.4	31.8	
	310.1	1.33	1	dA:	4.85											
310										4.85		9.7	8.5			
												9.7	8.5	45.1	40.3	
	312.1	1.33	1	dA:												
	144	1.33	1	dA:	2.93					13.79		13.8	10.3			
	142	1.33	1	dA:	2.06					0.00		2.9	2.9			
312										0.00		2.1	2.1			
												18.8	15.3	63.9	55.6	-> Area 140

STORM DRAIN LINE:	RIPARIAN COORIDOR/CENTINELA DITCH					
TABLED BY:	MTK					
CHECKED BY:	GMV					
Area Number:	102.1	108.1	112.1	146.1	152.1	300.1
Node Number:	102	108	112	146	152	300
Runoff Tabling Sheet:						
Conveyor:	Gutter	Gutter	Gutter	Gutter	Gutter	Gutter
Development Type:	C1	R4	R4	R4	R4	P
Development Class:	100	100	100	100	100	100
Elevation Difference:	4 ft	2.4 ft	2.5 ft	5.2 ft	5.4 ft	2.6 ft
Length of Reach:	1000 ft	600 ft	625 ft	1300 ft	1210 ft	1100 ft
Average Slope:	0.40%	0.40%	0.40%	0.40%	0.45%	0.24%
Method of Computation:	Figure G242.2A	Figure G242.2A	Figure G242.2A	Figure G242.2A	Figure G242.2A	Figure G242.2A
ISO:	1.33	1.33	1.33	1.33	1.33	1.33
Fro:	1.30	1.30	1.30	1.30	1.30	1.30
tc(700):	7.9 min	7.9 min	7.9 min	7.9 min	7.5 min	9.4 min
TIME OF CONCENTRATION (tc):	9.4 min	7.3 min	7.5 min	10.8 min	9.9 min	11.8 min

INITIAL TIME OF CONCENTRATION
RIPARIAN CORRIDOR/CENTINELA DITCH

Section 3.1-2

Design Storm Frequency				50 year												
Node #	Area #	ISO	Soil Type		IMPERVIOUSNESS							SUB AREA	EQUIV AREA	TOTAL AREA	TOTAL Ae	COMMENTS
					100%	70%	60%	50%	40%	35%	15%					
CENTRAL STORM DRAIN																
	206	1.33	1	dA:	15.97											
206												16.0	16.0			
												16.0	*16.0*	16.0	16.0	12th Street & "J" Street
	208	1.33	1	dA:	9.34											
208												9.3	9.3			
												9.3	*9.3*	25.3	25.3	11th Street & "J" Street
	210	1.33	1	dA:	2.75											
210												2.8	2.8			
												2.8	*2.8*	28.1	28.1	10th Street & "J" Street
	212	1.33	1	dA:	10.80											
212												10.8	10.8			
												10.8	*10.8*	38.9	38.9	Centinela Avenue
	218	1.33	1	dA:	1.79											
218												1.8	1.8			"E" Street Extension
												1.8	*1.8*	40.7	40.7	East of Grosvenor Blvd.
	222	1.33	1	dA:	1.41											
222												1.4	1.4			"E" Street Extension
												1.4	*1.4*	42.1	42.1	@ Westlawn Ave.
	228	1.33	1	dA:	1.40											
228												1.4	1.4			"E" Street Extension
												1.4	*1.4*	43.5	43.5	between McConnell & Westlawn
	232	1.33	1	dA:	2.01											
232												2.0	2.0			"E" Street Extension @
												2.0	*2.0*	45.5	45.5	McConnell Ave.
	238	1.33	1	dA:	8.00											
		1.33	1	dA:								8.0	6.0			9th & "E" Street
	426	1.33	1	dA:								37.0	27.8			<- Line 4DPI
238										7.27		7.3	5.5			<- South of "E" Street
												52.3	*41.3*	97.8	86.8	
	244	1.33	1	dA:	10.50											
244												10.5	10.5			
												10.5	*10.5*	108.3	97.3	Alla Rd. & "E" Street

AREA CONVERSION TABLE
CENTRAL STORM DRAIN

Design Storm Frequency				50 year												
Node #	Area #	ISO	Soil Type		IMPERVIOUSNESS 100%	70%	60%	50%	40%	35%	15%	SUB AREA	EQUIV AREA	TOTAL AREA	TOTAL Ae	COMMENTS
	246	1.33	1	dA:	12.37											
246												12.4	12.4			6th & "F" Street
												12.4	12.4	120.7	109.7	
	250	1.33	1	dA:	9.41											
250												9.4	9.4			4th & "F" Street
												9.4	9.4	130.1	119.1	
	252	1.33	1	dA:	23.79											
252												23.8	23.8			Bay St. & "F" Street
												23.8	23.8	153.9	142.9	
	258	1.33	1	dA:	11.27											
258												11.3	11.3			Lincoln Blvd.
												11.3	11.3	165.2	154.2	-> Freshwater Wetland
LINE 4DPI - STORM DRAIN NORTH OF "E" STREET																
	414	1.33	1	dA:												
414										7.29		7.3	5.5			< - AREA 414 (Existing Area)
												7.3	5.5	7.3	5.5	Diversion Channel
	416	1.33	1	dA:												
416										4.42		4.4	3.3			< - AREA 416 (Existing Area)
												4.4	3.3	11.7	8.8	Diversion Channel
	418	1.33	1	dA:												
418										6.52		6.5	4.9			< - AREA 418 (Existing Area)
												6.5	4.9	18.2	13.7	Diversion Channel
	420	1.33	1	dA:												
420										6.41		6.4	4.8			< - AREA 420 (Existing Area)
												6.4	4.8	24.6	18.5	Diversion Channel
	422	1.33	1	dA:												
422										6.17		6.2	4.6			< - AREA 422 (Existing Area)
												6.2	4.6	30.8	23.1	Diversion Channel
	424	1.33	1	dA:												
424										6.23		6.2	4.7			< -AREA 424
												6.2	4.7	37.0	27.8	-> Central SD Node 238

AREA CONVERSION TABLE
CENTRAL STORM DRAIN

STORM DRAIN LINE:	CENTRAL STORM DRAIN								
TABLED BY:	MTK								
CHECKED BY:	GMV								
Area Number:	206	414							
Node Number:	206	414							
Runoff Tabling Sheet:									
Conveyor:	Gutter	Gutter							
Development Type:	M	Undev.							
Development Class:	100	35-1							
Elevation Difference:	4.3 ft	5 ft							
Length of Reach:	818 ft	1000 ft							
Average Slope:	0.53%	0.50%							
Method of Computation:	Figure G242.2A	Figure G242.2B							
ISO:	1.33	1.33							
Fro:	1.30	0.98							
tc(700):	7.1 min	11.5 min							
TIME OF CONCENTRATION (tc):	7.7 min	13.7 min							

Date: 9/9/94

INITIAL TIME OF CONCENTRATION
CENTRAL STORM DRAIN

PSOMAS

TABLED BY MTK CHECKED BY GMV SUPERVISED BY	CITY OF LOS ANGELES Department of Public Works Bureau of Engineering	STORM DRAIN DESIGN RUNOFF TABLING SHEET Frequency 50 Year	Project: 1MTP0108.10 - PLAYA VISTA TRACT 49104 - HYDROLOGY STUDY AREA "D" - CENTRAL STORM DRAIN	Date: Sep-9-94 Sheet:

Drainage Map Area No	Drainage Map Area Acres	Runoff	Runoff 100% Ae	Flow Routing Surface Flow N	S	E	W	Storm Drain	ISO	Freq. Fact.	Dist. Fact.	Amen 1hr RFR	Fro	BPRR	Frict. Slope (S)	K= Q/S^.5	Size	Area [sf]	Vel. [ft/s]	L [ft]	tc or tcx [min]	Storm Drain Station	Location	Remarks	
CENTRAL STORM DRAIN																									
206	16.0	ΣA	16.0																						
		q	3.67																						
		Q	58.7						1.33	1.00	1.000	1.33	1.30	2.82			D =	54 in			7.7	94 + 82	12th Street / "J" Street		1
	9.3	ΣA	9.3					58.7									d =	3.67							
208	25.3	ΣA	25.3												0.0009	1957	PIPE	13.88	4.229	484	1.9	<- Area 208			2
		q	3.33																						
		Q	84.2						1.33	1.00	1.000	1.33	1.30	2.56			D =	66 in			9.6	89 + 98	11th Street / "J" Street		3
	2.8	A	2.8					84.2									d =	3.93							
210	28.1	ΣA	28.1												0.0009	2807	PIPE	18.14	4.642	484	1.7	<- Area 210			4
		q	3.09																						
		Q	66.8						1.33	1.00	1.000	1.33	1.30	2.38			D =	72 in			11.3	85 + 14	10th Street / "J" Street		5
	10.8	A	10.8					86.8									d =	4.[illegible]							
212	38.9	ΣA	38.9												0.0009	2893	PIPE	20.58	4.218	591	2.3	<- Area 212			6
		q	2.86																						
		Q	111						1.33	1.00	1.000	1.33	1.30	2.20			D =	78 in			13.6	79 + 23	Centinela Avenue		7
	1.8	A	1.8					111									d =	4.92							
218	40.7	ΣA	40.7												0.0009	3700	PIPE	26.96	4.117	929	3.8	<- Area 218			8
		q	2.56																						
		Q	104						1.33	1.00	1.000	1.33	1.30	1.97			D =	84 in			17.4	69 + 94	"E" St. Extension East of Grosvenor Blvd.		9
	1.4	A	1.4					111									d =	5.36							
222	42.1	ΣA	42.1												0.0009	3467	PIPE	31.63	3.288	767	3.9	<- Area 222			10
		q	2.34																						
		Q	98.5						1.33	1.00	1.000	1.33	1.30	1.80			D =	90 in			21.3	62 + 27	"E" St. Extension @ Westlawn Ave.		11
	1.4	A	1.4					111									d =	5.47							
228	43.5	ΣA	43.5												0.0009	3283	PIPE	34.5	2.855	762	4.4	<- Area 228			12
		q	2.16																						
		Q	94						1.33	1.00	1.000	1.33	1.30	1.66			D =	90 in			25.7	54 + 95	"E" St. Ext. between McConnell & Westlawn		13
	2.0	A	2.0					111									d =	6.02							
232	45.5	ΣA	45.5												0.0009	3133	PIPE	38.02	2.472	924	6.2	<- Area 232			14
		q	1.96																						
		Q	89.2						1.33	1.00	1.000	1.33	1.30	1.51			D =	96 in			31.9	45 + 71	"E" St. Extension @ McConnell Ave.		15
	15.3	A	13.5					111									d =	6.18							
238	60.8	ΣA	59.0												0.0009	2973	PIPE	41.67	2.141	932	7.3	<- Area 238 & 426			16
		q	1.79																						
		Q	106						1.33	1.00	1.000	1.33	1.30	1.38							39.2	36 + 39	9th Street / "E" Street		17
	37.0	A	27.8					111																	
Total 238	97.8	ΣA	86.8																			<- SD D4PI from line		47	18
		q	1.82																						
		Q	158						1.33	1.00	1.000	1.33	1.30	1.40			D = d =	102 in 6.06			38.0	tc1/Q1 tc2/Q2 tcx	39.2 min 35.5 min 38.0 min	106 cfs 52 cfs	19

Date: 9/9/94

RUNOFF TABLE
CENTRAL STORM DRAIN

TABLED BY MTK
CHECKED BY GMV
SUPERVISED BY

CITY OF LOS ANGELES
Department of Public Works
Bureau of Engineering

STORM DRAIN DESIGN
RUNOFF TABLING SHEET
Frequency 50 Year

Project: 1MTP0108.10 - PLAYA VISTA
TRACT 49104 - HYDROLOGY STUDY
AREA "D" - CENTRAL STORM DRAIN

Date: Sep-9-94

Sheet:

Drainage Map		Runoff		Flow Routing																					
Area No	Area Acres		100% Ae	Surface Flow N	S	E	W	Storm Drain	ISO	Freq. Fact.	Dist. Fact.	Amen 1hr RFR	Fro	BPRR	Frict. Slope (S)	K= Q / S^.5	Size	Area [sf]	Vel. [ft/s]	L [ft]	tc or tcx [min]	Storm Drain Station	Location	Remarks	
244	10.5	A	10.5					158																	
	108.3	ΣA	97.3												0.0009	3533	PPE	43.31	2.447	950	6.5	<- Area 244			
		q	1.68																						20
		Q	163						1.33	1.00	1.000	1.33	1.30	1.29			D =	102 in			45.7	26 + 89	Alla Road / "E" Street		21
246	12.4	A	12.4					163									d =	6.24							
	120.7	ΣA	109.7												0.0009	5433	PPE	44.66	3.65	388	'.8	<- Area 246			22
		q	1.65																						
		Q	181						1.33	1.00	0.999	1.33	1.30	1.27			D =	102 in			47.5	23 + 00	6th Street / "F" Street		23
250	9.4	A	9.4					181									d =	6.64							
	130.1	ΣA	119.1												0.0009	5033	PPE	47.58	3.804	741	3.2	<- Area 250			24
		q	1.61																						
		Q	192						1.33	1.00	0.998	1.33	1.30	1.24			D =	108 in			50.7	15 + 60	4th Street / "F" Street		25
252	23.8	A	23.8					192									d =	4.57							
	153.9	ΣA	142.9												0.0009	6400	PPE	32.4	5.926	292	0.8	<- Area 252			26
		q	1.59																						
		Q	227						1.33	1.00	0.996	1.33	1.29	1.23			D =	108 in			51.5	12 + 66	Bay Street / "F" Street		27
254	0.0	A	0.0					227									d =	5.05							
	153.9	ΣA	142.9												0.0009	7567	PPE	36.77	6.174	291	0.8				28
		c	1.57																						
		Q	224						1.33	1.00	0.996	1.33	1.29	1.22			D =	108 in			52.3	9 + 78	Bay St. between "F" Street & "G" Street		29
258	11.3	A	11.3					224									d =	5.01							
	165.2	ΣA	154.2												0.0009	7467	PPE	36.39	6.156	783	2.1	<- Lincoln Boulevard			30
		q	1.55													Double box	W=	8.50	x 2						
		Q	239						1.33	1.00	0.996	1.33	1.29	1.20			H=	5.00			54.4	1 + 95	Lincoln Blvd. C/L		31
260	0.0	A	0.0					239									d =	7.16							
	165.2	ΣA	154.2												0.0009	7967	BOX	85	2.812	195	1.2				32
		q	1.54																						
		Q	237						1.33	1.00	0.996	1.33	1.29	1.19							55.6	0 + 00	Central Drain @ Freshwater Wetland		33
240								237															-> Fresh Water Wetland		34
																									35

RUNOFF TABLE
CENTRAL STORM DRAIN

TABLED BY MTK CHECKED BY GMV SUPERVISED BY				CITY OF LOS ANGELES Department of Public Works Bureau of Engineering					STORM DRAIN DESIGN RUNOFF TABLING SHEET Frequency 50 Year						Project: 1MTP0108.10 - PLAYA VISTA TRACT 49104 - HYDROLOGY STUDY AREA "D" - CENTRAL STORM DRAIN								Date: Sep-9-94 Sheet:		
Drainage Map		Runoff		Flow Routing																					
Area No	Area Acres		100% Ae	Surface Flow N	S	E	W	Storm Drain	ISO	Freq. Fact.	Dist. Facl.	Amen 1hr RFR	Fro	BRRR	Frict. Slope (S)	K= Q / S^.5	Size	Area [sf]	Vel. [ft/s]	L [ft]	tc or tcx [min]	Storm Drain Station	Location	Remarks	
LINE D4PI - STORM DRAIN NORTH OF "E" STREET																									
414	7.3	ΣA	5.5																						
		q	2.85						1.33	1.00	1.000	1.33	1.30	2.19			b=	10'							
		Q	15.7														z=	2	n=	.050	13.7				36
	4.4	A	3.3														d =	0.61'							
416	11.7	ΣA	8.8												.00090	523.33	TRAP	6.886	2.28	503	3.7	<- Area 416			
		q	2.56						1.33	1.00	1.000	1.33	1.30	1.97			b=	10'							37
		Q	22.5														z=	2	n=	.050	17.4				
	6.5	A	4.9					22.5									c =	0.76'							38
418	18.2	ΣA	13.7												.00090	750	TRAP	8.73	2.577	784	5.1	<- Area 418			
		q	2.29						1.33	1.00	1.000	1.33	1.30	1.76			b=	10'							39
		Q	31.4														z=	2	n=	.050	22.5				40
	6.4	A	4.6					31.4									d =	0.92'							
420	24.6	ΣA	18.5												.00090	1045.7	TRAP	10.88	2.886	734	4.2	<- Area 420			
		q	2.13														b=	10'							41
		Q	39.4						1.33	1.00	1.000	1.33	1.30	1.64			z=	2	n=	0.05	26.7				42
	6.2	A	4.6					39.4									d =	1.05'							
422	30.8	ΣA	23.1												.00090	1313.3	TRAP	12.67	3.11	739	4.0	<- Area 422			
		q	2.00														b=	10'							43
		Q	46.2						1.33	1.00	1.000	1.33	1.30	1.54			z=	2	n=	.050	30.7				44
	6.2	A	4.7					46.2									c =	1.15'							
424	37	ΣA	27.8												0.0009	1540	TRAP	14.11	3.274	935	4.8	<- Area 424			45
		q	1.87						1.33	1.00	1.000	1.33	1.30	1.44			D=	42 in	n=	.013	35.5				
		Q	52														d =	2.71'							46
																	Pipe	7.98sf	6.516			-> Node 238 to line		18	47

Section 3.1-3

PSOMAS

TABLED BY MTK CHECKED BY GMV SUPERVISED BY	CITY OF LOS ANGELES Department of Public Works Bureau of Engineering	STORM DRAIN DESIGN RUNOFF TABLING SHEET Frequency 50 Year	Project: 1MTP0108.10 - PLAYA VISTA TRACT 49104 HYDROLOGY STUDY AREA "D" - JEFFERSON STORM DRAIN	Date: Sep-9-1994 Sheet:

Drainage Map Area No	Drainage Map Area Acres	Runoff	Runoff 100% Ae	Surface Flow N	S	E	W	Storm Drain	ISO	Freq. Fact.	Dist. Fact.	Amen 1hr RFR	Fro	BPRR	Frict. Slope (S)	K= Q / S^.5	Size	Area [sf]	Vel. [ft/s]	L [ft]	tc or tcx [min]	Storm Drain Station	Location	Remarks	
JEFFERSON STORM DRAIN																									
	1.8	ΣA	1.8																						
502		q	3.54						1.33	1.00	1.000	1.33	1.30	2.72							8.3	<- Area 502.1		Assume full pipe flow until box is open	1
		Q	6.4																						
	3.4	A	3.4					6																	
	5.2	ΣA	5.2																			<- J-1.0 from Off-Site Hydrology			2
Σ502		q	3.77						1.33	1.00	1.000	1.33	1.30	2.90		n =	0.013				• • • •	c1/A1 =	8.3 min	1.8 ac	
		Q	19.5													R =	0.75'				7.2	c2/A2 =	6.6 min	3.4 ac	3
	2.3	A	2.3					20								Kf=	667	Af =	7.07			tcx =	7.2 min		
	7.5	ΣA	7.5												0.002	438	36 ø	7.07	2.77	425	2.6	<- Area 504.1			4
504		c	3.29						1.33	1.00	1.000	1.33	1.30	2.53							9.8		Teale Street		5
		Q	24.7																						
	4.4	A	4.4																						
	11.9	ΣA	11.9																			<- J-2.0 from Off-Site Hydrology			6
Σ504		q	3.29						1.33	1.00	1.000	1.33	1.30	2.53		n =	0.013								
		Q	39.2													R =	0.81'				9.8				7
	3.3	A	3.3				2	37								Kf=	824	Af =	8.30						
	15.2	ΣA	15.2												0.002	877	39 ø	8.3	4.72	730	2.6	<- Area 506.1			8
506		q	2.98						1.33	1.00	1.000	1.33	1.30	2.29		n =	0.013								
		Q	45.3													R =	0.94'				12.4		Centinela & Jefferson		9
	0.4	A	0.4					45								Kf=	1211	Af =	11.04						
	15.6	ΣA	15.6												0.002	1013	45 ø	11.04	4.10	170	0.7	<- Area 508.1			10
508		q	2.90						1.33	1.00	1.000	1.33	1.30	2.23											
		Q	45.2																		13.1		Inglewood Boulevard		11
	50.9	A	40.4																						
	66.5	ΣA	56																			<- J-4.0 from Off-Site Hydrology			12
Σ508		q	2.56						1.33	1.00	1.000	1.33	1.30	1.97		n =	0.013				• • • •	c1/Q1 =	13.1 min	45.2 cfs	
		Q	143													R =	1.38'				17.4	c2/Q2 =	19.4 min	98.7 cfs	13
	2.7	A	2.7				17	126								Kf=	3366	Af =	23.76			tcx =	17.4 min		
	69.2	ΣA	58.7												0.0014	3822	66 ø	23.76	6.02	705	2.0	<- Area 510.1			14
510		q	2.44						1.33	1.00	1.000	1.33	1.30	1.88											
		Q	143																		19.4		Jefferson Boulevard		15

RUNOFF TABLE
JEFFERSON STORM DRAIN

PSOMAS

TABLED BY MTK CHECKED BY GMV SUPERVISED BY				CITY OF LOS ANGELES Department of Public Works Bureau of Engineering					STORM DRAIN DESIGN RUNOFF TABLING SHEET Frequency 50 Year						Project: 1MTP0108.10 - PLAYA VISTA TRACT 49104 HYDROLOGY STUDY AREA "D" - JEFFERSON STORM DRAIN								Date: Sep-9-1994 Sheet:		
Drainage Map		Runoff		Flow Routing																					
Area No	Area Acres		100% Ae	Surface Flow N	S	E	W	Storm Drain	ISO	Freq. Fact.	Dist. Fact.	Amen 1hr RFR	Fro	BPRR	Fricl. Slope (S)	K= Q/S^.5	Size	Area [sf]	Vel. [ft/s]	L [ft]	tc or tcx [min]	Storm Drain Station	Location	Remarks	
Σ510	1.7	A	1.7																			<- J-5.0 from Off-Site Hydrology			15
	70.9	ΣA	60.4																						
		q	2.44						1.33	1.00	1.000	1.33	1.30	1.88		n =	0.013								
		Q	147													R =	1.38'				19.4				17
512	0.9	A	0.9				21	126								Kf=	3366	Af =	23.76						
	71.8	ΣA	61.3												0.0014	3929	66 ø	23.76	6.19	395	1.1	<- Area 512.1			18
		q	2.39						1.33	1.00	1.000	1.33	1.30	1.84											
		Q	147																						
Σ512	44.6	A	33.6																		20.5		Randall Street		19
	116.4	ΣA	94.9																						
		q	2.29																			<- J-6.0 from Off-Site Hydrology			20
		Q	217						1.33	1.00	0.999	1.33	1.30	1.76		n =	0.013	dn =	5.75'		....	tc1/Q1=	20.5 min	147 cfs	
514	2.2	A	2.2													R =	1.71'	W =	8.50'		22.6	tc2/Q2=	27 min	71.2 cfs	21
							21	196								K'=	7989	H =	5.75'			tcx=	22.6 min		
	118.6	ΣA	97.1												0.0006	8859	RCB	48.88	4.44	425	1.6	<- Area 514.1			22
		q	2.22																						
		Q	216						1.33	1.00	0.998	1.33	1.30	1.71											
Σ514	19.8	A	18.5																		24.2		Centinela Avenue		23
	138.4	ΣA	115.6																						
		q	2.23																			<- J-7.0 from Off-Site Hydrology			24
		Q	258						1.33	1.00	0.995	1.33	1.29	1.73		n =	0.013	dn =	5.75'		....	tc1/Q1=	24.2 min	216 cfs	
516	1.1	A	1.1													R =	1.71'	W =	8.50'		23.6	tc2/Q2=	20.4 min	44.2 cfs	25
							62	196								Kl=	7989	H =	5.75'			tcx=	23.6 min		
	135.5	ΣA	116.7												0.0006	10533	RCB	48.88	5.28	110	3.5	<- Area 516.1			26
		q	2.09																						
		Q	244						1.33	1.00	0.995	1.33	1.29	1.62											
Σ516	34.5	A	27.1																		27.1		Grosvenor Boulevard		27
	174.0	ΣA	143.8																			<- J-8.0 from Off-Site Hydrology			28
		q	2.15						1.33	1.00	0.991	1.33	1.29	1.67		n =	0.013	dn =	5.75'		....	tc1/Q1=	27.1 min	244 cfs	
		Q	309													R =	1.83'	W =	10.00'		25.5	tc2/Q2=	19.5 min	66.1 cfs	29
518	0.2	A	0.2				68	241								K'=	9834	H =	5.75'			tcx=	25.5 min		
	174.2	ΣA	144.0												0.0006	12615	RCB	57.5	5.37	530	1.6	<- Area 518.1			30
		q	2.09																						
		Q	301						1.33	1.00	0.992	1.33	1.29	1.62											
Σ518	4.2	A	3.5																		27.1		Westlawn Avenue		31
	178.4	ΣA	147.5																			<- J-9.0 from Off-Site Hydrology			32
		q	2.09						1.33	1.00	0.992	1.33	1.29	1.62		n =	0.013	dn =	6.25'			tc1/Q1=	27.1 min	301 cfs	
		Q	308													R =	2.05'	W =	12.00'		27.1	tc2/Q2=	5.2 min	15.3 cfs	33
520	0.4	A	0.4					308								Kl=	13835	H =	6.25'			tcx=	27.1 min	Q2<0.1*Q1	
	178.8	ΣA	147.9												0.0005	13774	RCB	75	4.11	645	2.6	<- Area 520.1			34
		q	2.01						1.33	1.00	0.993	1.33	1.29	1.56											
		Q	297																		29.7		700' w/o Westlawn Ave		35

Date: 9/9/94

RUNOFF TABLE
JEFFERSON STORM DRAIN

PSOMAS

TABLED BY MTK CHECKED BY GMV SUPERVISED BY				CITY OF LOS ANGELES Department of Public Works Bureau of Engineering					STORM DRAIN DESIGN RUNOFF TABLING SHEET Frequency 50 Year						Project: 1MTP0108.10 - PLAYA VISTA TRACT 49104 HYDROLOGY STUDY AREA "D" - JEFFERSON STORM DRAIN								Date: Sep-9-1994 Sheet:		
Drainage Map		Runoff		Flow Routine																					
Area No	Area Acres		100% Ae	Surface Flow N	S	E	W	Storm Drain	ISO	Freq. Fact.	Dist. Fact.	Amen 1hr RFR	Fro	BPRR	Frict. Slope (S)	K= Q/S^.5	Size	Area [sf]	Vel. [ft/s]	L [ft]	tc or tcx [min]	Storm Drain Station	Location	Remarks	
	2.5	A	2.5																			<- J-10.0 from Off-Site Hydrology			36
Σ520	181.3	ΣA	150.4																						
		q	2.01						1.33	1.00	0.992	1.33	1.29	1.56		n =	0.013	dn =	6.25'		29.7	tc1/Q1=	29.7 min	297 cfs	37
		Q	302													R =	2.05'	W =	12.00'			tc2/Q2=	8.1 min	9 cfs	
	0.4	A	0.4					302								Kf=	13835	H =	6.25'			tcx=	29.7 min	Q2<0.1*Q1	
	181.7	ΣA	150.8												0.0005	13506	RCB	75	4.03	425	1.8	<- Area 522.1			38
522		q	1.96						1.33	1.00	0.992	1.33	1.29	1.52											
		Q	296																		31.5		12th Street		39
	2.9	A	2.9																						
	184.6	ΣA	153.7																			<- J-11.0 from Off-Site Hydrology			40
Σ522		q	1.96						1.33	1.00	0.992	1.33	1.29	1.52		n =	0.013	dn =	6.25'		31.5	tc1/Q1=	31.5 min	296 cfs	41
		Q	301													R =	2.05'	W =	12.00'			tc2/Q2=	7.7 min	10.6 cfs	
	0.8	A	0.8					301								Kf=	13835	H =	6.25'			tcx=	31.5 min	Q2<0.1*Q1	
	185.4	ΣA	154.5												0.0005	13461	RCB	75	4.01	705	2.9	<- Area 524.1 & .2			42
524		q	1.88						1.33	1.00	0.992	1.33	1.29	1.46											
		Q	290																		34.4		McConnell Avenue		43
	6.5	A	6.5																						
	191.9	ΣA	161																			<- J-12.0 from Off-Site Hydrology			44
Σ524		q	1.88						1.33	1.00	0.992	1.33	1.29	1.45		n =	0.013	dn =	6.50'		34.4	tc1/Q1=	34.4 min	290 cfs	45
		Q	303													R =	2.11'	W =	12.00'			tc2/Q2=	9.7 min	21.5 cfs	
	0.4	A	0.4					303								Kf=	14668	H =	6.50'			tcx=	34.4 min	Q2<0.1*Q1	
	192.3	ΣA	161.4												0.0005	13551	RCB	78	3.86	350	1.5	<- Area 526.1			46
526		q	1.86						1.33	1.00	0.992	1.33	1.29	1.44											
		Q	300																		35.9		Beethoven Street		47
	3.0	A	3.0																						
	195.3	ΣA	164.4																			<- J-13.0 from Off-Site Hydrology			48
Σ526		q	1.86						1.33	1.00	0.992	1.33	1.29	1.44		n =	0.013	dn =	6.50'		35.9	tc1/Q1=	35.9 min	300 cfs	49
		Q	306													R =	2.11'	W =	12.00'			tc2/Q2=	7.8 min	10.9 cfs	
	0.9	A	0.9					305								Kf=	14668	H =	6.50'			tcx=	35.9 min	Q2<0.1*Q1	
	196.2	ΣA	165.3												0.0005	13685	RCB	78	3.92	695	3.0	<- Area 528.1			50
528		q	1.79						1.33	1.00	0.992	1.33	1.29	1.39											
		Q	296																		38.9		400' w/o Beethoven St		51
	1.4	A	1.4																						
	197.6	ΣA	166.7																			<- J-14.0 from Off-Site Hydrology			52
Σ528		q	1.79						1.33	1.00	0.992	1.33	1.29	1.39		n =	0.013	dn =	6.75'		38.9	tc1/Q1=	38.9 min	296 cfs	53
		Q	298													R =	2.16'	W =	12.00'			tc2/Q2=	6.7 min	5.4 cfs	
	1.6	A	1.6					298								Kf=	15471	H =	6.75'			tcx=	38.9 min	Q2<0.1*Q1	
	199.2	ΣA	168.3												0.0005	13327	RCB	81	3.68	815	3.7	<- Area 530.1			54
530		q	1.72						1.33	1.00	0.992	1.33	1.29	1.33											
		Q	289																		42.6		Alla Street		55

RUNOFF TABLE
JEFFERSON STORM DRAIN

PSOMAS

TABLED BY MTK
CHECKED BY GMV
SUPERVISED BY

CITY OF LOS ANGELES
Department of Public Works
Bureau of Engineering

STORM DRAIN DESIGN
RUNOFF TABLING SHEET
Frequency 50 Year

Project: 1MTP0108.10 - PLAYA VISTA
TRACT 49104 HYDROLOGY STUDY
AREA "D" - JEFFERSON STORM DRAIN

Date: Sep-9-1994
Sheet:

Drainage Map Area No	Area Acres	Runoff	100% Ae	Surface Flow N	S	E	W	Storm Drain	ISO	Freq. Fact.	Dist. Fact.	Amen 1hr RFR	Fro	BFRR	Frict. Slope (S)	K= Q/S^.5	Size	Area (sf)	Vel. (ft/s)	L (ft)	tc or tcx (min)	Storm Drain Station	Location	Remarks	
Σ530	3.1	A	3.1																			<- J-15.0 from Off-Site Hydrology			56
	202.3	ΣA	171.4																						
		q	1.72						1.33	1.00	0.992	1.33	1.29	1.33		n =	0.013	dn =	6.75'			tc1/Q1=	42.6 min	289 cfs	
		Q	295													R =	2.16'	W =	12.00'		42.6	tc2/Q2=	11.5 min	9.5 cfs	57
532	0.4	A	0.4					295								Kf=	15471	H =	6.75'			tcx=	42.6 min	Q2<0.1*Q1	
	202.7	ΣA	171.8												0.0005	13193	RCB	81	3.64	280	1.3	<- Area 532.1			58
		q	1.70						1.33	1.00	0.992	1.33	1.29	1.32											
		Q	292																		43.9		400' w/o Alla Street		59
Σ532	8.6	A	8.6																						
	2'1.3	ΣA	180.4																			<- J-16.0 from Off-Site Hydrology			60
		q	1.70						1.33	1.00	0.991	1.33	1.29	1.32		n =	0.013	dn =	7.00'			tc1/Q1=	43.9 min	292 cfs	
		Q	307													R =	2.21'	W =	12.00'		43.9	tc2/Q2=	6.9 min	33 cfs	61
534	0.8	A	0.8					307								Kf=	16291	H =	7.00'			tcx=	43.9 min	Q2<0.1*Q1	
	212.1	ΣA	181.2												0.0005	13729	RCB	84	3.65	550	2.5	<- Area 534.1			62
		q	1.65						1.33	1.00	0.992	1.33	1.29	1.28											
		Q	299																		46.4		Existing Bay Street		63
Σ534	4.2	A	4.2																						
	216.3	ΣA	185.4																			<- J-17.0 from Off-Site Hydrology			64
		q	1.65						1.33	1.00	0.992	1.33	1.29	1.28		n =	0.013	dn =	7.25'			tc1/Q1=	46.4 min	299 cfs	
		Q	306													R =	2.26'	W =	12.00'		46.4	tc2/Q2=	3.8 min	18.6 cfs	65
537	31.2	A	31.2					306								Kf=	17126	H =	7.25'			tcx=	46.4 min	Q2<0.1*Q1	
	247.5	ΣA	216.6												0.0005	13685	RCB	87	3.52	715	3.4	<- Area 537.1			66
		q	1.61						1.33	1.00	0.990	1.33	1.29	1.25		n =	0.013	dn =	7.25'						
		Q	349													R =	2.26'	W =	12.00'		49.8		2nd & Jefferson		67
540	8.7	A	8.7													Kf=	17126	H =	7.25'						
	256.2	ΣA	225.3					349							0.0005	15608	RCB	87	4.01	730	3.0	<- Area 540.1			68
		q	1.56						1.33	1.00	0.990	1.33	1.29	1.21		n =	0.013	dn =	7.25'						
		Q	351													R =	2.26'	W =	12.00'		52.8	4 + 25	Lincoln Boulevard		69
544	0.0	A	0.0					351								Kf=	17126	H =	7.25'						
	256.2	ΣA	225.3												0.006	4531	RCB	87	4.03	425	1.8				70
		q	1.55						1.33	1.00	0.990	1.33	1.29	1.20											
		Q	349																		54.6	0 + 00	Freshwater Wetland		71
								349																	
230																						-> To Freshwater Wetland			72
																									73

RUNOFF TABLE
JEFFERSON STORM DRAIN

Node #	Area #	ISO	Soil Type		100%	70%	60%	50%	40%	35%	15%	SUB AREA	EQUIV AREA	TOTAL AREA	TOTAL Ae	COMMENTS
Design Storm Frequency				50 year	IMPERVIOUSNESS											
JEFFERSON STORM DRAIN																
	502.1	1.33	1	dA:	1.80											
502												1.8	1.8			
												1.8	*1.8*	1.8	1.8	Major Street
	J-1.0			dA:												
Σ502												3.4	3.4			<- J-1.0 from Offsite Hydrology
												3.4	*3.4*	5.2	5.2	
	504.1	1.33	1	dA:	2.30											
504												2.3	2.3			
												2.3	*2.3*	7.5	7.5	Teale Street
	J-2.0			dA:												
Σ504												4.4	4.4			<- J-2.0 from Offsite Hydrology
												4.4	*4.4*	11.9	11.9	
	506.1	1.33	1	dA:	3.27											
506												3.3	3.3			
												3.3	*3.3*	15.2	15.2	Centinela Ave & Jefferson Blvd
	508.1	1.33	1	dA:	0.44											
508												0.4	0.4			
												0.4	*0.4*	15.6	15.6	Inglewood Boulevard
	J-4.0			dA:												
Σ508												50.9	40.4			<- J-4.0 from Offsite Hydrology
												50.9	*40.4*	66.5	56.0	
	510.1	1.33	1	dA:	2.70											
510												2.7	2.7			
												2.7	*2.7*	69.2	58.7	Jefferson Boulevard
	J-5.0			dA:												
Σ510												1.7	1.7			<- J-5.0 from Offsite Hydrology
												1.7	*1.7*	70.9	60.4	
	512.1	1.33	1	dA:	0.94											
512												0.9	0.9			
												0.9	*0.9*	71.8	61.3	Randall Street
	J-6.0			dA:												
Σ512												44.6	33.6			<- J-6.0 from Offsite Hydrology
												44.6	*33.6*	116.4	94.9	
	514.1	1.33	1	dA:	2.23											
514												2.2	2.2			
												2.2	*2.2*	118.6	97.1	Centinela Avenue
	J-7.0			dA:												
Σ514												19.8	18.5			<- J-7.0 from Offsite Hydrology
												19.8	*18.5*	138.4	115.6	

AREA CONVERSION TABLE
JEFFERSON STORM DRAIN

PSOMAS

Design Storm Frequency				50 year												
Node #	Area #	ISO	Soil Type		IMPERVIOUSNESS 100%	70%	60%	50%	40%	35%	15%	SUB AREA	EQUIV AREA	TOTAL AREA	TOTAL Ae	COMMENTS
	516.1	1.33	1	dA:	1.10											
516												1.1	1.1			
												1.1	*1.1*	139.5	116.7	Grosvenor Boulevard
	J-8.0			dA:												
Σ516												34.5	27.1			<- J-8.0 from Offsite Hydrology
												34.5	*27.1*	174.0	143.8	
	518.1	1.33	1	dA:	0.15											
518												0.2	0.2			
												0.2	*0.2*	174.2	144.0	Westlawn Avenue
	J-9.0			dA:												
Σ518												4.2	3.5			<- J-9.0 from Offsite Hydrology
												4.2	*3.5*	178.4	147.5	
	520.1	1.33	1	dA:	0.44											
520												0.4	0.4			
												0.4	*0.4*	178.8	147.9	700' west of Westlawn Ave
	J-10.0			dA:												
Σ520												2.5	2.5			<- J-10.0 from Offsite Hydrology
												2.5	*2.5*	181.3	150.4	
	522.1	1.33	1	dA:	0.42											
522												0.4	0.4			
												0.4	*0.4*	181.7	150.8	12th Street
	J-11.0			dA:												
Σ522												2.9	2.9			<- J-11.0 from Offsite Hydrology
												2.9	*2.9*	184.6	153.7	
	524.1	1.33	1	dA:	0.76											
524												0.8	0.8			
												0.8	*0.8*	185.4	154.5	McConnell Avenue
	J-12.0			dA:												
Σ524												6.5	6.5			<- J-12.0 from Offsite Hydrology
												6.5	*6.5*	191.9	161.0	
	526.1	1.33	1	dA:	0.39											
526												0.4	0.4			
												0.4	*0.4*	192.3	161.4	Beethoven Street
	J-13.0			dA:												
Σ526												3.0	3.0			<- J-13.0 from Offsite Hydrology
												3.0	*3.0*	195.3	164.4	
	528.1	1.33	1	dA:	0.88											
528												0.9	0.9			
												0.9	*0.9*	196.2	165.3	400' west of Beethoven St

AREA CONVERSION TABLE
JEFFERSON STORM DRAIN

Design Storm Frequency				50 year												
Node #	Area #	ISO	Soil Type		IMPERVIOUSNESS							SUB AREA	EQUIV AREA	TOTAL AREA	TOTAL Ae	COMMENTS
					100%	70%	60%	50%	40%	35%	15%					
	J-14.0			dA:												
Σ528												1.4	1.4			<- J-14.0 from Offsite Hydrology
												1.4	*1.4*	197.6	166.7	
	530.1	1.33	1	dA:	1.56											
530												1.6	1.6			
												1.6	*1.6*	199.2	168.3	Alia Street
	J-15.0			dA:												
Σ530												3.1	3.1			<- J-15.0 from Offsite Hydrology
												3.1	*3.1*	202.3	171.4	
	532.1	1.33	1	dA:	0.42											
532												0.4	0.4			
												0.4	*0.4*	202.7	171.8	400' west of Alla Street
	J-16.0			dA:												
Σ532												8.6	8.6			<- J-16.0 from Offsite Hydrology
												8.6	*8.6*	211.3	180.4	
	534.1	1.33	1	dA:	0.79											
534												0.8	0.8			
												0.8	*0.8*	212.1	181.2	Existing Bay Street
	J-17.0			dA:												
Σ534												4.2	4.2			<- J-17.0 from Offsite Hydrology
												4.2	*4.2*	216.3	185.4	
	537.1	1.33	1	dA:	31.22											
537												31.2	31.2			
												31.2	*31.2*	247.5	216.6	1st Street
	540.1	1.33	1	dA:	8.67											
540												8.7	8.7			Jefferson/Lincoln runoff
												8.7	*8.7*	256.2	225.3	Lincoln Boulevard

STORM DRAIN LINE: TABLED BY: CHECKED BY:	JEFFERSON STORM DRAIN MTK GMV								
Area Number:	502.1								
Node Number:	502								
Runoff Tabling Sheet:									
Conveyor:	Gutter								
Development Type:	Highway								
Development Class:	100								
Elevation Difference:	3.06 ft								
Length of Reach:	765 ft								
Average Slope:	0.40%								
Method of Computation:	Figure G262								
ISO:	1.33								
Fro:	1.30								
tc(700):	7.9 min								
TIME OF CONCENTRATION (tc):	8.3 min								

INITIAL TIME OF CONCENTRATION
JEFFERSON STORM DRAIN

Section 3.2-1

PSOMAS

TABLED BY MTK CHECKED BY GMV SUPERVISED BY	CITY OF LOS ANGELES Department of Public Works Bureau of Engineering	STORM DRAIN DESIGN RUNOFF TABLING SHEET Frequency 50 Year	Project: 1MTP0108.10 - PLAYA VISTA TRACT 49104 - HYDROLOGY STUDY AREA "B"	Date: Sep-9-1994 Sheet:

Drainage Map Area No	Area Acres	Runoff	100% Ae	Flow Routing Surface Flow N	S	E	W	Storm Drain	ISO	Freq. Fact.	Dist. Fact.	Amen 1hr RFR	Fro	BPRR	Frict. Slope (S)	K= Q / S^.5	Size	Area [sf]	Vel. [ft/s]	L [ft]	tc or tcx [min]	Storm Drain Station	Location	Remarks	
FRESHWATER WETLAND																									
FWW	42.6	ΣA	41.3																						
		q	3.26						1.33	1.00	1.00	1.33	1.30	2.51							10.0				1
		Q	135.0																						
				135																					
240																						-> Freshwater Wetland at Node 240			2
																									3
AREA B - BETWEEN JEFFERSON BOULEVARD AND CULVER BOULEVARD																									
604	36.7	ΣA	36.7																						
		q	1.61						1.33	1.00	1.00	1.33	1.30	1.24							50.0				4
		Q	59.1																						
		A		59.1																					
212		ΣA																				-> Outlet Pipe at Node 212			5
		q																							
		Q																							6
AREA B - BETWEEN CULVER BOULEVARD AND BALLONA CREEK																									
606	5.8	ΣA	5.8																						
		q	1.61						1.33	1.00	1.00	1.33	1.30	1.24							50.0				7
		Q	9.3																						
		A		9.3																					
211		ΣA																				-> Outlet Pipe at Node 211			8
		q																							
		Q																							9

Date: 9/9/94

RUNOFF TABLE
AREA B

PSOMAS

TABLED BY MTK CHECKED BY GMV SUPERVISED BY				CITY OF LOS ANGELES Department of Public Works Bureau of Engineering					STORM DRAIN DESIGN RUNOFF TABLING SHEET Frequency 50 Year						Project: 1MTP0108.10 - PLAYA VISTA TRACT 49104 - HYDROLOGY STUDY AREA "B"								Date: Sep-9-1994 Sheet:		
Drainage Map		Runoff		Flow Routing																					
Area No.	Area Acres		100% Ae	Surface Flow N	S	E	W	Storm Drain	ISO	Freq. Fact.	Dist. Fact.	Amen 1hr RFR	Fro	BPRR	Frict. Slope (S)	K= Q / S^.5	Size	Area [sf]	Vel. [ft/s]	L [ft]	tc or tcx [min]	Storm Drain Station	Location	Remarks	
EAST WETLAND																									
800	116.0	ΣA q Q	113.0 1.56 176.0						1.33	1.00	.998	1.33	1.30	1.20							54.3		tc is from Table 4.1.2-1a Page [illegible] Line 17 of Existing Hydrology		10
							176														54.3		of Master Plan		11
																									12
SOUTH WETLAND																									
700	186.4	ΣA q Q	170.3 2.02 344.0						1.33	1.00	1.00	1.33	1.30	1.55							30.1		tc is from Table 4.1.2-1a Page 2 Line 29 of Existing Hydrology		13
							344														30.1		of Master Plan		14
																									15
NORTH WETLAND																									
600	153.5	ΣA q Q	152.8 2.00 306.0						1.33	1.00	1.00	1.33	1.30	1.54							30.7		tc is from Table 4.1.2-1a Page 3 Line 35 of Existing Hydrology		16
							306														30.7		of Master Plan		17
																									18

Date: 9/9/94

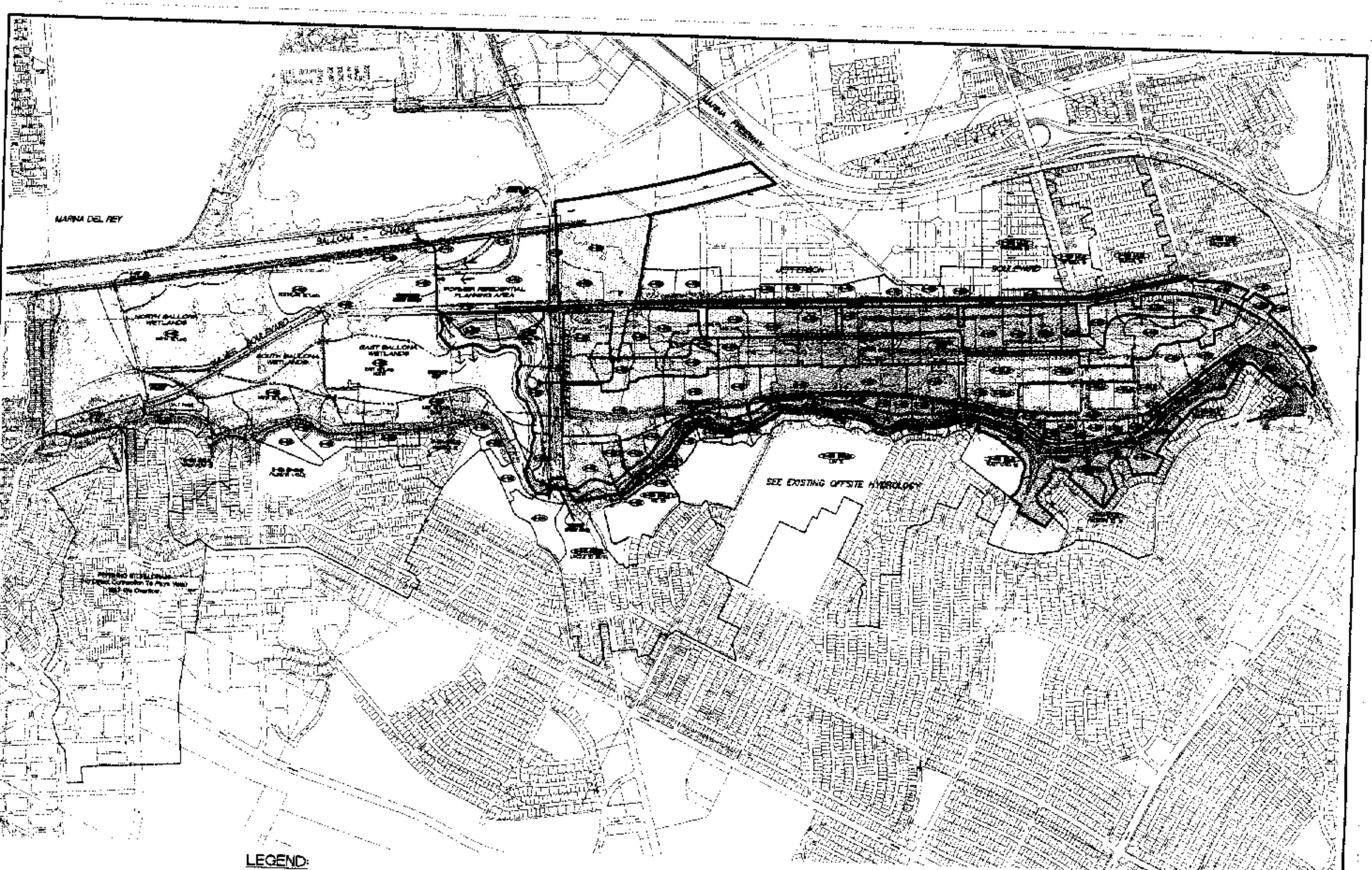
RUNOFF TABLE
AREA B

Design Storm Frequency				50 year												
Node #	Area #	ISO	Soil Type		IMPERVIOUSNESS							SUB AREA	EQUIV AREA	TOTAL AREA	TOTAL Ae	COMMENTS
					100%	70%	60%	50%	40%	35%	15%					
FRESH WATER WETLAND																
	C.21	1.33	2	dA:		7.04										
	C.22	1.33	2	dA:		4.64						7.0	6.2			<- C21.0
	FWW	1.33	1	dA:	31.00							4.6	4.1			<- C22.0
240												31.0	31.0			Fresh water Wetland Area
												42.6	41.3	42.6	41.3	
AREA "B" - NORTH OF JEFFERSON BLVD.																
	604	1.33	1	dA:	36.70											
212												36.7	36.7			Between Jefferson & Culver Blvd.
												36.7	36.7	36.7	36.7	
	606	1.33	1	dA:	5.80											
211												5.8	5.8			Between Culver Blvd & Ballona Creek
												5.8	5.8	42.5	42.5	
EAST WETLAND																
	C23.0	1.33	2	dA:		3.40										
	C24.0	1.33	2	dA:		2.10						3.4	3.0			<- C23.0
	C25.0	1.33	2	dA:		14.30						2.1	1.8			<- C24.0
	C26.0	1.33	2	dA:		2.70						14.3	12.6			<- C25.0
	C27.0	1.33	2	dA:		2.30						2.7	2.4			<- C26.0
	800.1	1.33	1	dA:	91.20							2.3	2.0			<- C27.0
800												91.2	91.2			East Wetland Area
												116.0	113.0	116.0	113.0	
SOUTH WETLAND																
	C28.0	1.33	2	dA:		4.70										
	C29.0	1.33	2	dA:		6.10						4.7	4.1			<- C28.0
	C30.0	1.33	2	dA:		106.00						6.1	5.4			<- C29.0
	C31.0	1.33	2	dA:		17.90						106.0	93.3			<- C30.0
	700.1	1.33	1	dA:	51.70							17.9	15.8			<- C31.0
700												51.7	51.7			South Wetland Area
												186.4	170.3	186.4	170.3	
NORTH WETLAND																
	C32.0	1.33	2	dA:		6.20										
	C.0.33	1.33	2	dA:	5.90							6.2	5.5			<- C32.0
	600.1	1.33	1	dA:	141.40							5.9	5.9			<- C.0.32
600												141.4	141.4			North Wetland Area
												153.5	152.8	153.5	152.8	

STORM DRAIN LINE:	FRESHWATER WETLAND OUTLET PIPE								
TABLED BY:	MTK								
CHECKED BY :	GMV								
Area Number:	604	606							
Node Number:	*212*	*211*							
Runoff Tabling Sheet:									
Conveyor:	Surface	Surface							
Development Type:	Undev.	Undev.							
Development Class:	100	100							
Elevation Difference:	1 ft	0.5 ft							
Length of Reach:	2000 ft	1000 ft							
Average Slope:	0.05%	0.05%							
Method of Computation:	Figure G262	Figure G262							
ISO:	1.33	1.33							
Fro:	1.30	1.30							
tc(700):									
TIME OF CONCENTRATION (tc):	50.0 min	50.0 min							

Date: 9/9/94

INITIAL TIME OF CONCENTRATION
AREA B



LEGEND:

- PROJECT BOUNDARY
- WATERSHED BOUNDARY
- SUB AREA BOUNDARY
- OFF-SITE HYDROLOGY LIMITS
- STORM DRAIN LINE
- STORM DRAIN CHANNEL/DITCHES LINE
- NODE NUMBER
- PREVIOUSLY APPROVED FIRST PHASE PROJECT
- PROPOSED "PROJECT"

THE VILLAGE AT PLAYA VISTA
PROPOSED PROJECT
WATER RESOURCES REPORT – HYDROLOGY

ONSITE HYDROLOGY STUDY FOR PLAYA VISTA FIRST PHASE

PSOMAS

HYDROLOGY STUDY FOR THE VILLAGE AT PLAYA VISTA (PROPOSED PROJEC T) AND BALLONA WETLANDS - RIPARIAN CORRIDOR

TABLED BY	GMV	CITY OF LOS ANGELES	STORM DRAIN DESIGN	Project: 1PCC0201.66 - PLAYA VISTA	Date: 11/07/02
CHECKED BY		Department of Public Works	RUNOFF TABLING SHEET	HYDROLOGY FOR AREAS "B" AND "D"	
SUPERVISED BY		Bureau of Engineering	Frequency 50 Year	AREA "D"- RIPARIAN CORRIDOR	Sheet:

Drainage Map Area No	Area Acres	Runoff	100% Ae	Surface Flow N	S	E	W	Storm Drain	ISO	Freq. Fact.	Dist. Fact.	Amen 1hr RFR	Fro	BPRR	Frict. Slope (S)	K= Q S^.5	Size	Area [sf]	Vel. [ft/s]	L [ft]	tc or tcx [min]	Storm Drain Station	Location	Remarks	
RIPARIAN CORRIDOR																							for Riparian Corridor:		
	4.6	SA	3.2																				n(side) =	.125	1
RC-390		q	3.28						1.33	1.00	1.000	1.33	1.30	2.52		d/D =	0.71					<- Area D-390	n(base) =	.050	
		Q	10.5													k/K =	0.853				9.9				
	1.5	A	1.1					10.5								n =	0.013								2
	6.1	ΣA	4.3												0.0009	350	30 in	3.7	2.82	400	2.4	<- Area D-380			
RC-380		q	2.99						1.33	1.00	1.000	1.33	1.30	2.30											3
		Q	12.9																		12.3				4
	10.5	A	9.2					12.9																	
Σ	16.6	ΣA	13.5																			<- Tract 43416 SD			5
RC-380		q	3.37						1.33	1.00	1.000	1.33	1.30	2.59			b=	16'			****	Riparian Corridor	12.3 min	12.9 cfs	
		Q	45.5														z=	3	n=	0.087	9.3	Tract 43416 SD	8.1 min	32.9 cfs	6
	6.4	A	4.4					45.5									d =	2.51				tcx=	9.3 min		
	23.0	ΣA	17.9												0.0009	1517	Trap	59.06	0.77	290	6.3	<- Area D-370			7
RC-370		q	2.69						1.33	1.00	1.000	1.33	1.30	2.07											
		Q	48.2																		15.6				8
	8.6	A	8.6					48.2																	
Σ	3[illegible].6	ΣA	26.5																			<- Area D-372			9
RC-370		q	2.93						1.33	1.00	1.000	1.33	1.30	2.25			b=	16'			****	Riparian Corridor	15.6 min	48.2 cfs	
		Q	77.5														z=	3	n=	0.093	12.8	Area D-372	8.4 min	30.3 cfs	10
	1.4	A	1.0					77.5									d =	3.43				tcx=	12.8 min		
	33.0	ΣA	27.5												0.0009	2583	Trap	90.17	0.86	440	8.5	<- Area D-360			11
RC-360		q	2.3						1.33	1.00	1.000	1.33	1.30	1.80											
		Q	64.4																		21.3				10
	6.6	A	6.6					64.4																	
Σ	39.6	ΣA	34.1																			<- Area D-362			11
RC-360		q	2.54						1.33	1.00	1.000	1.33	1.30	1.95			b=	16'				Riparian Corridor	21.3 min	64.4 cfs	
		Q	86.4														z=	3	n=	0.094	17.9	Area D-362	8.5 min	23.2 cfs	12
	5.1	A	3.5					86.4									d =	3.65				tcx=	17.9 min		
	44.7	ΣA	37.6												0.0009	2880	Trap	98.37	0.88	300	5.7	<- Areas D-350 & D-352			13
RC-350		q	2.2						1.33	1.00	1.000	1.33	1.30	1.73			b=	17'							
		Q	84.6														z=	3	n=	0.092	23.6				14
																	d =	3.50							

HYDROLOGY STUDY FOR THE VILLAGE AT PLAYA VISTA (PROPOSED PROJEC T) AND BALLONA WETLANDS - RIPARIAN CORRIDOR

TABLED BY	CHECKED BY	SUPERVISED BY		CITY OF LOS ANGELES	STORM DRAIN DESIGN	Project:	Date:
			GMV	Department of Public Works	RUNOFF TABLING SHEET	1PCC0201.66 - PLAYA VISTA	11/07/02
				Bureau of Engineering	Frequency 50 Year	HYDROLOGY FOR AREAS "B" AND "D"	Sheet:
						AREA "D" - RIPARIAN CORRIDOR	

Drainage Map Area No	Area Acres	Runoff	100% Ae	Flow Routing Surface Flow N	S	E	W	Storm Drain	ISO	Freq. Fact.	Dist. Fact.	Amen 1hr RFR	Fro	BPRR	Frict. Slope (S)	K= Q/S^.5	Size	Area [sf]	Vel. [ft/s]	L [ft]	tc or tcx [min]	Storm Drain Station	Location	Remarks	
	3.6	A	3.2					84.6																	
	48.3	ΣA	40.8												0.0009	2820	Trap	96.25	0.88	365	6.9	<- Areas D-340 & D-342			15
RC-340		q	2.0						1.33	1.00	1.000	1.33	1.30	1.54			b=	17'							
		Q	81.7														z=	3	n=	0.092	30.5				16
	5.0	A	3.5					81.7									d =	3.43							
	53.3	ΣA	44.3												0.0009	2723	Trap	93.60	0.87	280	5.3	<- Areas D-330 & D-332			17
RC-330		q	1.9						1.33	1.00	1.000	1.33	1.30	1.44			b=	17'							
		Q	82.9														z=	3	n=	0.092	35.8				18
	5.2	A	3.7					82.9									d =	3.45							
	58.5	ΣA	48.0												0.0009	2763	Trap	94.36	0.88	320	6.1	<- Areas D-320 & D-322			19
RC-320		q	1.7						1.33	1.00	1.000	1.33	1.30	1.34			b=	17'							
		Q	83.6														z=	3	n=	0.092	41.9				20
	2.9	A	2.1					83.6									d =	3.47							
	61.4	ΣA	50.1												0.0009	2787	Trap	95.11	0.88	330	6.3	<- Area D-310			21
RC-310		q	1.6						1.33	1.00	1.000	1.33	1.30	1.26											
		Q	82.1																		48.2				22
	38.5	A	33.4					82.1																	
Σ	99.9	ΣA	83.5																			<- Firebrand SD	from line	83	23
RC-310		q	2.0						1.33	1.00	1.000	1.33	1.30	1.56			b=	17'			****	Riparian Corridor	48.2 min	82.1 cfs	
		Q	169														z=	3	n=	0.099	29.9	Firebrand St. SD	13.9 min	94.2 cfs	24
	4.1	A	3.8					169.0									d =	5.15				tcx=	29.9 min		
	104.0	ΣA	87.3												0.0009	5633	Trap	167.12	1.01	110	1.8	<- Areas D-300 & D-302			25
RC-300		q	2.0						1.33	1.00	1.000	1.33	1.30	1.52			b=	17'							
		Q	173														z=	3	n=	0.099	31.7				26
	5.0	A	3.6					173.0									d =	5.21							
	109.0	ΣA	90.9												0.0009	5767	Trap	170.00	1.02	230	3.8	<- Areas D-290 & D-292			27
RC-290		q	1.9						1.33	1.00	1.000	1.33	1.30	1.44			b=	17'							
		Q	170														z=	3	n=	0.099	35.5				28
	2.3	A	1.7					170.0									d =	5.17							
	111.3	ΣA	92.6												0.0009	5667	Trap	168.08	1.01	230	3.8	<- Area D-280			29
RC-280		q	1.8						1.33	1.00	0.999	1.33	1.30	1.38											
		Q	166																		39.3				30

HYDROLOGY STUDY FOR THE VILLAGE AT PLAYA VISTA (PROPOSED PROJEC T) AND BALLONA WETLANDS - RIPARIAN CORRIDOR

TABLED BY	GMV	CITY OF LOS ANGELES	STORM DRAIN DESIGN
CHECKED BY		Department of Public Works	RUNOFF TABLING SHEET
SUPERVISED BY		Bureau of Engineering	Frequency 50 Year

Project: 1PCC0201.66 - PLAYA VISTA
HYDROLOGY FOR AREAS "B" AND "D"
AREA "D"- RIPARIAN CORRIDOR

Date: 11/07/02
Sheet:

Drainage Map Area No	Area Acres	Runoff	100% Ae	Flow Routing Surface Flow N	S	E	W	Storm Drain	ISO	Freq. Fact	Dist. Fact.	Amen 1hr RFR	Frq	BPRR	Frict. Slope (S)	K= Q S^.5	Size	Area [sf]	Vel. [ft/s]	L [ft]	tc or tcx [min]	Storm Drain Station	Location	Remarks	
	30.0	A	24.5					166.0																	
Σ	141.3	ΣA	117.1																			<- Tract 43415 SD			31
RC-280		q	2.1						1.33	1.00	0.996	1.33	1.29	1.60			b=	17'			****	Riparian Corridor	39.3 min	166.0 cfs	
		Q	242														z=	3	n=	0.102	28.0	Tract 43415 SD	7.4 min	91.1 cfs	32
	5.8	A	4.8					242.0									d =	6.23				tcx=	28.0 min		
	147.1	ΣA	121.9												0.0009	8067	Trap	222.35	1.09	470	7.2	<- Areas D-270, D-272 & D-274			33
RC-270		q	1.9						1.33	1.00	0.997	1.33	1.30	1.45			b=	17'							
		Q	230														z=	3	n=	0.038	35.2				34
	5.1	A	3.6					230									d =	5.30							
	152.2	ΣA	125.5												0.0009	7667	Rect.	90.10	2.55	570	3.7	<- Areas D-260 & D-262			35
RC-260		q	1.8						1.33	1.00	0.996	1.33	1.29	1.39			b=	17'							
		Q	225														z=	3	n=	0.039	38.9				36
	2.3	A	2.2					225.0									d =	5.23							
	154.5	ΣA	127.7												0.0009	7500	Rect.	88.91	2.53	130	0.9	<- Areas D-250 & D-252			37
RC-250		q	1.8						1.33	1.00	0.996	1.33	1.29	1.37			b=	17'							
		Q	226														z=	3	n=	0.102	39.8				38
	10.8	A	10.1					226									d =	6.01							
	165.3	ΣA	137.8												0.0009	7533	Trap	210.53	1.07	460	7.1	<- Areas D-240 & D-242			39
RC-240		q	1.7						1.33	1.00	0.995	1.33	1.29	1.28			b=	17'							
		Q	228														z=	3	n=	0.102	46.9				40
	5.3	A	3.8					228									d =	6.04							
	170.6	ΣA	141.6												0.0009	7600	Trap	212.12	1.07	270	4.2	<- Areas D-230 & D-232			41
RC-230		q	1.59						1.33	1.00	0.996	1.33	1.29	1.23			b=	17'							
		Q	225														z=	3	n=	0.102	51.1				42
	3.0	A	2.2					225									d =	6.00							
	173.6	ΣA	143.8												0.0009	7500	Trap	210.00	1.07	330	5.1	<- Area D-220			43
RC-220		q	1.52						1.33	1.00	0.996	1.33	1.29	1.18											
		Q	219																		56.2				44
	116.9	A	110.0					219																	
Σ	290.5	ΣA	253.8																			<- LMU SD			45
RC-220		q	2.1						1.33	1.00	0.985	1.33	1.28	1.61			b=	40'			****	Riparian Corridor	56.2 min	219.0 cfs	
		Q	523														z=	3	n=	0.087	27.8	LMU SD	10.2 min	354.8 cfs	46
	10.7	A	10.1					523									d =	6.27				tcx=	27.8 min		
	301.2	ΣA	263.9												0.0009	17433	Trap	368.74	1.42	170	2.0	<- Areas D-210 & D-212			47
RC-210		q	2.00						1.33	1.00	0.984	1.33	1.28	1.56			b=	40'							
		Q	527														z=	3	n=	0.087	29.8				48
																	d =	6.30							

HYDROLOGY STUDY FOR THE VILLAGE AT PLAYA VISTA (PROPOSED PROJEC T) AND BALLONA WETLANDS - RIPARIAN CORRIDOR

TASLED BY			GMV	CITY OF LOS ANGELES					STORM DRAIN DESIGN								Project: 1PCC0201.66 - PLAYA VISTA						Date:	11/07/02	
CHECKED BY				Department of Public Works					RUNOFF TABLING SHEET								HYDROLOGY FOR AREAS "B" AND "D"								
SUPERVISED BY				Bureau of Engineering					Frequency			50	Year				AREA "D"- RIPARIAN CORRIDOR						Sheet:		
Drainage Map		Runoff		Flow Routing																					
Area	Area		100%	Surface Flow				Storm	ISO	Freq.	Dist.	Amen			Frict.	K=	Size	Area	Vel.	L	tc or	Storm			
No	Acres		Ae	N	S	E	W	Drain		Fact.	Fact.	1hr	Fro	BPRR	Slope	Q					tcx	Drain	Location	Remarks	
												RFR			(S)	S^.5		[sf]	[ft/s]	[ft]	[min]	Station			
	8.7	A	6.2					527																	
	309.9	ΣA	270.1												0.0009	17567	Trap	371.07	1.42	740	8.7	<- Areas D-200 & D-202			49
RC-200		q	1.78						1.33	1.00	0.986	1.33	1.28	1.39			b=	30'							
		Q	481														z=	3	n=	0.042	38.5				50
																	d =	5.78							
	12.3	A	11.7					481																	
	322.2	ΣA	281.8												0.0009	16033	Rect.	173.40	2.77	310	1.9	<- Areas D-190 & D-192			51
RC-190		q	1.75						1.33	1.00	0.986	1.33	1.28	1.37			b=	30'							
		Q	494														z=	3	n=	0.042	40.3				52
																	d =	5.87							
	0.0	A	0.0					494																	
	322.2	ΣA	281.8												0.0009	16467	Rect.	176.10	2.81	450	2.7	Channel Transition			53
RC-185		q	1.70						1.33	1.00	0.986	1.33	1.28	1.33			b=	40'							
		Q	460														z=	3	n=	0.086	43.0				54
																	d =	5.95							
	15.7	A	13.1					480																	
	337.9	ΣA	294.9												0.0009	16000	Trap	344.21	1.39	350	4.2	<- Areas D-180, D-182 & D-184			55
RC-180		q	1.63						1.33	1.00	0.986	1.33	1.28	1.27											
		Q	479																		47.2				56
	40.8	A	40.8					479																	
Σ	378.7	ΣA	335.7																			<- EMT SD	from line	98	57
RC-180		q	1.7						1.33	1.00	0.983	1.33	1.28	1.32			b=	40'			****	Riparian Corridor	47.2 min	479.0 cfs	
		Q	567														z=	3	n=	0.088	43.9	EMT SD	25.8 min	88.0 cfs	58
																	d =	6.58				tcx=	43.9 min		
	4.9	A	3.5					567																	
	383.6	ΣA	339.2												0.0009	18900	Trap	393.09	1.44	430	5.0	<- Areas D-170 & D-172			59
RC-170		q	1.61						1.33	1.00	0.983	1.33	1.28	1.26			b=	40'							
		Q	547														z=	3	n=	0.088	48.9				60
																	d =	6.44							
	10.8	A	10.4					547																	
	394.4	ΣA	349.6												0.0009	18233	Trap	382.02	1.43	400	4.7	<- Areas D-160 & D-162			61
RC-160		q	1.55						1.33	1.00	0.984	1.33	1.28	1.21			b=	40'							
		Q	541														z=	3	n=	0.088	53.5				62
																	d =	6.40							
	3.7	A	2.6					541																	
	398.1	ΣA	352.2												0.0009	18033	Trap	378.88	1.43	280	3.3	<- Areas D-150 & D-152			63
RC-150		q	1.51						1.33	1.00	0.985	1.33	1.28	1.18			b=	40'							
		Q	532														z=	3	n=	0.088	56.8				64
																	d =	6.33							
	5.3	A	3.8					532																	
	403.4	ΣA	356.0												0.0009	17733	Trap	373.41	1.42	540	6.3	<- Areas D-140 & D-142			65
RC-140		q	1.43						1.33	1.00	0.987	1.33	1.28	1.12			b=	40'							
		Q	510														z=	3	n=	0.087	63.1				66
																	d =	6.17							

HYDROLOGY STUDY FOR THE VILLAGE AT PLAYA VISTA (PROPOSED PROJEC T) AND BALLONA WETLANDS - RIPARIAN CORRIDOR

TABLED BY			GMV	CITY OF LOS ANGELES					STORM DRAIN DESIGN							Project:	1PCC0201.66 - PLAYA VISTA						Date:	11/07/02	
CHECKED BY				Department of Public Works					RUNOFF TABLING SHEET								HYDROLOGY FOR AREAS "B" AND "D"								
SUPERVISED BY				Bureau of Engineering					Frequency			50	Year				AREA "D" - RIPARIAN CORRIDOR						Sheet:		
Drainage Map		Runoff		Flow Routing																					
Area	Area		100%	Surface Flow				Storm	ISO	Freq.	Dist.	Amen 1hr	Fro	BPRR	Frict.	K=	Size	Area	Vel.	L	tc or	Storm	Location	Remarks	
No	Acres		Ae	N	S	E	W	Drain		Fact.	Fact.	R F R			Slope (S)	Q S^.5		[sf]	[ft/s]	[ft]	tcx [min]	Drain Station			
	27.6	A	26.2					510																	
	431.0	ΣA	382.2												0.0009	17000	Trap	361.01	1.41	380	4.5	<- Areas D-130, D-132 & D-134			67
RC-130		q	1.40						1.33	1.00	0.986	1.33	1.28	1.09			b=	40'							
		Q	533														z=	3	n=	0.088	67.6				68
	3.8	A	2.8					533									d =	6.34							
	434.8	ΣA	385.0												0.0009	17767	Trap	374.19	1.42	240	2.8	<- Areas D-120 & D-122			69
RC-120		q	1.37						1.33	1.00	0.988	1.33	1.28	1.07											
		Q	527																		70.4				70
	40.3	A	40.0					527																	
Σ	475.1	ΣA	425.0																			<- HAC SD			71
RC-120		q	1.5						1.33	1.00	0.982	1.33	1.28	1.18			b=	40'			****	Riparian Corridor	70.4 min	527.0 cfs	
		Q	642														z=	3	n=	0.090	56.2	HAC SD	7.0 min	152.6 cfs	72
	10.0	A	7.0					642									d =	7.09				tcx=	56.2 min		
	485.1	ΣA	432.0												0.0009	21400	Trap	434.40	1.48	620	7.0	<- Area D-110			73
RC-110		q	1.43						1.33	1.00	0.984	1.33	1.28	1.12			Height =	8.00 ft							
		Q	619														Width =	10.00 ft	n=	0.014	63.2		East of Lincoln Blvd.		74
	0.0	A	0.0					619									Barrels =	3	d =	7.00 ft					
	485.1	ΣA	432.0												0.0009	20633	RC Box	210.00	2.95	500	2.8				75
FWM-140		q	1.41						1.33	1.00	0.984	1.33	1.28	1.10											
		Q	608																		66.0				76
								608														-> Freshwater Marsh	@ Node	FWM-140	77

HYDROLOGY STUDY FOR THE VILLAGE AT PLAYA VISTA (PROPOSED PROJEC T) AND BALLONA WETLANDS - RIPARIAN CORRIDOR

TABLED BY			GMV	CITY OF LOS ANGELES					STORM DRAIN DESIGN							Project:	1PCC0201.66 - PLAYA VISTA						Date:	11/07/02	
CHECKED BY				Department of Public Works					RUNOFF TABLING SHEET								HYDROLOGY FOR AREAS "B" AND "D"								
SUPERVISED BY				Bureau of Engineering					Frequency		50	Year					AREA "D"- RIPARIAN CORRIDOR						Sheet:		
Drainage Map		Runoff		Flow Routing																					
Area	Area		100%	Surface Flow				Storm	ISO	Freq.	Dist.	Amen	Fro	BPRR	Frict.	K=	Size	Area	Vel.	L	tc or	Storm	Location	Remarks	
No	Acres		Ae	N	S	E	W	Drain		Fact.	Fact.	1hr			Slope	Q					tcx	Drain			
												R F R			(S)	S^.5		[sf]	[ft/s]	[ft]	[min]	Station			
FIREBRAND STREET STORM DRAIN																									
	32.2	ΣA	28.2													d/D =	0.72					<- Area D-314			
RC-314		q	2.86						1.33	1.00	1.000	1.33	1.30	2.20		k/K =	0.871								
		Q	80.7													n =	0.013				13.5				78
	6.3	A	5.2					80.7							0.168	197	24 in	2.4	33.34	660	0.3	<- Area D-312			
	38.5	ΣA	33.4																						79
RC-312		q	2.83						1.33	1.00	1.000	1.33	1.30	2.18			Height =	4.00 ft							
		Q	94.7														Width =	8.00 ft	n=	0.014	13.8				80
	0.0		0.0					94.7									Barrels =	1	d =	0.58 ft					
	38.5	ΣA	33.4												0.091	314	RC Box	4.64	20.41	111	0.1				81
RC-310		q	2.82						1.33	1.00	1.000	1.33	1.30	2.17											
		Q	94.2																		13.9				82
								94.2														-> Riparian Corridor	@ line	23	83

HYDROLOGY STUDY FOR THE VILLAGE AT PLAYA VISTA (PROPOSED PROJEC T) AND BALLONA WETLANDS - RIPARIAN CORRIDOR

TABLED BY			GMV	CITY OF LOS ANGELES	STORM DRAIN DESIGN	Project: 1PCC0201.66 - PLAYA VISTA	Date:	11/07/02
CHECKED BY				Department of Public Works	RUNOFF TABLING SHEET	HYDROLOGY FOR AREAS "B" AND "D"		
SUPERVISED BY				Bureau of Engineering	Frequency 50 Year	AREA "D"- RIPARIAN CORRIDOR	Sheet:	

Drainage Map		Runoff		Flow Routing																					
Area	Area		100%	Surface Flow				Storm	ISO	Freq. Fact.	Dist. Fact.	Amen 1hr	Fro	BPRR	Frict. Slope	K= Q	Size	Area	Vel.	L	tc or tcx	Storm Drain	Location	Remarks	
No	Acres		Ae	N	S	E	W	Drain				R F R			(S)	S^.5		[sf]	[ft/s]	[ft]	[min]	Station			
EMT STORM DRAIN																									
	3.5	ΣA	3.5													d/D =	0.65					<- Area D-186.06			
EMT-170		q	4.38						1.33	1.00	1.000	1.33	1.30	3.37		k/K =	0.764								
		Q	15.3													n =	0.013				5.1				84
	4.4	A	4.4					15.3							0.0009	510	36 in	4.9	3.15	230	1.2				
	7.9	ΣA	7.9													d/D =	0.63					<- Area D-186.05			85
EMT-160		q	3.99						1.33	1.00	1.000	1.33	1.30	3.07		k/K =	0.731								
		Q	31.5													n =	0.013				6.3				86
	6.0	A	6.0					31.5							0.0009	1050	48 in	8.3	3.78	530	2.3				
	13.9	ΣA	13.9													d/D =	0.69					<- Area D-186.04			87
EMT-150		q	3.47						1.33	1.00	1.000	1.33	1.30	2.67		k/K =	0.817								
		Q	48.2													n =	0.013				8.7				88
	7.8	A	7.8					48.2							0.0009	1607	54 in	11.6	4.15	290	1.2				
	21.7	ΣA	21.7													d/D =	0.75					<- Area D-186.03			89
EMT-140		q	3.29						1.33	1.00	1.000	1.33	1.30	2.53		k/K =	0.914								
		Q	71.4													n =	0.013				9.8				90
	9.9	A	9.9					71.4							0.0009	2380	60 in	15.8	4.52	280	1.0				
	31.6	ΣA	31.6													d/D =	0.81					<- Area D-186.02			91
EMT-130		c	3.15						1.33	1.00	1.000	1.33	1.30	2.42		k/K =	0.987								
		Q	99.4													n =	0.013				10.9				92
	9.2	A	9.2					99.4							0.0009	3313	66 in	20.5	4.85	550	1.9				
	40.8	ΣA	40.8													d/D =	0.77					<- Area D-186.01			93
EMT-120		q	2.94						1.33	1.00	1.000	1.33	1.30	2.26		k/K =	0.945								
		Q	120													n =	0.013				12.7				94
	0.0	A	0.0					120							0.0009	4000	72 in	23.4	5.14	3700	12.0				
	40.8	ΣA	40.8													d/D =	0.62								95
EMT-110		q	2.20						1.33	1.00	1.000	1.33	1.30	1.69		k/K =	0.705								
		Q	89.6													n =	0.013				24.7				96
	0.0		0.0					89.6							0.0009	2987	72 in	18.2	4.91	300	1.0				
	40.8	ΣA	40.8																						97
RC-180		q	2.16						1.33	1.00	1.000	1.33	1.30	1.68											
		Q	88																		25.8				98
								88														-> Riparian Corridor	@ line	57	99

HYDROLOGY STUDY FOR THE VILLAGE AT PLAYA VISTA (PROPOSED PROJECT) AND BALLONA WETLANDS - RIPARIAN CORRIDOR

Design Storm Frequency:			50	year												
Node #	Area #	ISO	Soil Type		IMPERVIOUSNESS 1.00	0.70	0.60	0.50	0.40	0.35	0.15	SUB AREA	EQUIV AREA	TOTAL AREA	TOTAL Ae	COMMENTS
RIPARIAN CORRIDOR																
	D-390	1.33	2	dA:				4.56				4.6	3.2			*Bluffside*
RC-390												4.6	3.2	4.6	3.2	
	D-380	1.33	1	dA:						0.23		0.2	0.2			
	D-380	1.33	2	dA:				1.31				1.3	0.9			*Bluffside*
RC-380												1.5	1.1	6.1	4.3	
Σ	D-382	1.33	1	dA:								10.5	9.2			<- Tract 43416 SD
RC-380												10.5	9.2	16.6	13.5	Confluence
	D-370	1.33	1	dA:						0.58		0.6	0.4			
	D-370	1.33	2	dA:				5.82				5.8	4.0			*Bluffside*
RC-370												6.4	4.4	23.0	17.9	
Σ	D-372	1.33	1	dA:	8.64							8.6	8.6			
RC-370												8.6	8.6	31.6	26.5	Confluence
	D-360	1.33	1	dA:						0.88		0.9	0.7			
	D-360	1.33	2	dA:				0.46				0.5	0.3			*Bluffside*
RC-360												1.4	1.0	33.0	27.5	
Σ	D-362	1.33	1	dA:	6.59							6.6	6.6			
RC-360												6.6	6.6	39.6	34.1	Confluence
	D-352	1.33	2	dA:				3.79				3.8	2.6			
	D-350	1.33	1	dA:						0.55		0.6	0.4			
	D-350	1.33	2	dA:				0.71				0.7	0.5			*Bluffside*
RC-350												5.1	3.5	44.7	37.6	
	D-342	1.33	1	dA:	2.07							2.1	2.1			
	D-340	1.33	1	dA:						1.04		1.0	0.8			
	D-340	1.33	2	dA:				0.49				0.5	0.3			*Bluffside*

HYDROLOGY STUDY FOR THE VILLAGE AT PLAYA VISTA (PROPOSED PROJECT) AND BALLONA WETLANDS - RIPARIAN CORRIDOR

Design Storm Frequency: 50 year

Node #	Area #	ISO	Soil Type		IMPERVIOUSNESS 1.00	0.70	0.60	0.50	0.40	0.35	0.15	SUB AREA	EQUIV AREA	TOTAL AREA	TOTAL Ae	COMMENTS
RC-340												3.6	3.2	48.3	40.8	
	D-332	1.33	2	dA:				3.18				3.2	2.2			
	D-330	1.33	1	dA:						1.32		1.3	1.0			
	D-330	1.33	2	dA:				0.47				0.5	0.3			*Bluffside*
RC-330												5.0	3.5	53.3	44.3	
	D-322	1.33	2	dA:				2.83				2.8	2.0			
	D-320	1.33	1	dA:						1.94		1.9	1.5			
	D-320	1.33	2	dA:				0.47				0.5	0.3			*Bluffside*
RC-320												5.2	3.7	58.5	48.0	
	D-310	1.33	1	dA:						2.44		2.4	1.8			
	D-310	1.33	2	dA:				0.50				0.5	0.3			*Bluffside*
RC-310												2.9	2.1	61.4	50.1	
	D-314	1.33		dA:								61.4	50.1			<- Riparian @ RC-310
Σ	D-314	1.33		dA:								38.5	33.4			<- Firebrand St. SD @ RC-312
RC-310												99.9	83.5	99.9	83.5	**Confluence**
	D-302	1.33	1	dA:	3.04							3.0	3.0			
	D-300	1.33	1	dA:						0.89		0.9	0.7			
	D-300	1.33	2	dA:				0.18				0.2	0.1			*Bluffside*
RC-300												4.1	3.8	104.0	87.3	

HYDROLOGY STUDY FOR THE VILLAGE AT PLAYA VISTA (PROPOSED PROJECT) AND BALLONA WETLANDS - RIPARIAN CORRIDOR

Design Storm Frequency:				50	year											
Node	Area	ISO	Soil		I M P E R V I O U S N E S S							SUB	EQUIV	TOTAL	TOTAL	COMMENTS
#	#		Type		1.00	0.70	0.60	0.50	0.40	0.35	0.15	AREA	AREA	AREA	Ae	
	D-292	1.33	2	dA:				2.59				2.6	1.8			
	D-290	1.33	1	dA:						2.08		2.1	1.6			
	D-290	1.33	2	dA:				0.31				0.3	0.2			*Bluffside*
RC-290												5.0	3.6	**109.0**	**90.9**	
	D-280	1.33	1	dA:						1.75		1.8	1.3			
	D-280	1.33	2	dA:				0.51				0.5	0.4			*Bluffside*
RC-280												2.3	1.7	**111.3**	**92.6**	
	D-282	1.33		dA:								30.0	24.5			<- Tract 43415
Σ	D-280	1.33		dA:								111.3	92.6			<- Riparian @ RC-280
RC-280												141.3	117.1	**141.3**	**117.1**	**Confluence**
	D-274	1.33	2	dA:				0.73				0.7	0.5			
	D-272	1.33	1	dA:	2.08							2.1	2.1			
	D-270	1.33	1	dA:						1.98		2.0	1.5			
	D-270	1.33	2	dA:				0.99				1.0	0.7			*Bluffside*
RC-270												5.8	4.8	**147.1**	**121.9**	
	D-262	1.33	2	dA:				3.11				3.1	2.2			
	D-260	1.33	1	dA:						1.12		1.1	0.8			
	D-260	1.33	2	dA:				0.91				0.9	0.6			*Bluffside*
RC-260												5.1	3.6	**152.2**	**125.5**	
	D-252	1.33	1	dA:	1.94							1.9	1.9			
	D-250	1.33	1	dA:						0.18		0.2	0.1			
	D-250	1.33	2	dA:				0.18				0.2	0.1			*Bluffside*
RC-250												2.3	2.2	**154.5**	**127.7**	

HYDROLOGY STUDY FOR THE VILLAGE AT PLAYA VISTA (PROPOSED PROJECT) AND BALLONA WETLANDS - RIPARIAN CORRIDOR

Design Storm Frequency:				50	year											
Node	Area	ISO	Soil		IMPERVIOUSNESS							SUB	EQUIV	TOTAL	TOTAL	COMMENTS
#	#		Type		1.00	0.70	0.60	0.50	0.40	0.35	0.15	AREA	AREA	AREA	Ae	
	D-242	1.33	1	dA:	8.31					0.11		8.4	8.4			
	D-240	1.33	1	dA:						1.60		1.6	1.2			
	D-240	1.33	2	dA:				0.73				0.7	0.5			*Bluffside*
RC-240												10.8	10.1	**165.3**	**137.8**	
	D-232	1.33	2	dA:				3.18				3.2	2.2			
	D-230	1.33	1	dA:						1.65		1.7	1.2			
	D-230	1.33	2	dA:				0.49				0.5	0.3			*Bluffside*
RC-230												5.3	3.8	**170.6**	**141.6**	
	D-220	1.33	1	dA:						2.10		2.1	1.6			
	D-220	1.33	2	dA:				0.89				0.9	0.6			*Bluffside*
RC-220												3.0	2.2	**173.6**	**143.8**	
	D-222	1.33		dA:								116.9	110.0			<- Loyola SD
Σ	D-220	1.33		dA:								173.6	143.8			<- Riparian @ RC-220
RC-220												290.5	253.8	**290.5**	**253.8**	**Confluence**
	D-212	1.33	1	dA:	8.36					0.84		9.2	9.0			
	D-210	1.33	1	dA:						1.05		1.1	0.8			
	D-210	1.33	2	dA:				0.49				0.5	0.3			*Bluffside*
RC-210												10.7	10.1	**301.2**	**263.9**	
	D-202	1.33	2	dA:				4.07				4.1	2.8			
	D-200	1.33	1	dA:						3.29		3.3	2.5			
	D-200	1.33	2	dA:				1.32				1.3	0.9			*Bluffside*
RC-200												8.7	6.2	**309.9**	**270.1**	
	D-192	1.33	1	dA:	10.14					0.96		11.1	10.9			
	D-190	1.33	1	dA:						0.75		0.8	0.6			
	D-190	1.33	2	dA:				0.41				0.4	0.3			*Bluffside*
RC-190												12.3	11.7	**322.2**	**281.8**	
	D-184	1.33	2	dA:				5.54				5.5	3.8			
	D-182	1.33	1	dA:	6.75							6.8	6.8			

HYDROLOGY STUDY FOR THE VILLAGE AT PLAYA VISTA (PROPOSED PROJECT) AND BALLONA WETLANDS - RIPARIAN CORRIDOR

Design Storm Frequency:				50	year											
Node	Area	ISO	Soil		IMPERVIOUSNESS							SUB	EQUIV	TOTAL	TOTAL	COMMENTS
#	#		Type		1.00	0.70	0.60	0.50	0.40	0.35	0.15	AREA	AREA	AREA	Ae	
	D-180	1.33	1	dA:						2.70		2.7	2.0			
	D-180	1.33	2	dA:				0.74				0.7	0.5			*Bluffside*
RC-180												15.7	13.1	**337.9**	**294.9**	
	D-180	1.33		dA:								337.9	294.9			<- Riparian @ RC-180
Σ	D-186	1.33		dA:								40.8	40.8			<- EMT Plant Site SD
RC-180												378.7	335.7	**378.7**	**335.7**	**Confluence**
	D-172	1.33	2	dA:				1.82				1.8	1.3			
	D-170	1.33	1	dA:						2.32		2.3	1.7			
	D-170	1.33	2	dA:				0.73				0.7	0.5			*Bluffside*
RC-170												4.9	3.5	**383.6**	**339.2**	
	D-162	1.33	1	dA:	9.41							9.4	9.4			
	D-160	1.33	1	dA:						0.99		1.0	0.7			
	D-160	1.33	2	dA:				0.35				0.4	0.2			*Bluffside*
RC-160												10.8	10.4	**394.4**	**349.6**	
	D-152	1.33	2	dA:				2.58				2.6	1.8			
	D-150	1.33	1	dA:						0.77		0.8	0.6			
	D-150	1.33	2	dA:				0.34				0.3	0.2			*Bluffside*
RC-150												3.7	2.6	**398.1**	**352.2**	
	D-142	1.33	2	dA:				1.13				1.1	0.8			
	D-140	1.33	1	dA:						2.84		2.8	2.1			
	D-140	1.33	2	dA:				1.29				1.3	0.9			*Bluffside*
RC-140												5.3	3.8	**403.4**	**356.0**	

HYDROLOGY STUDY FOR THE VILLAGE AT PLAYA VISTA (PROPOSED PROJECT) AND BALLONA WETLANDS - RIPARIAN CORRIDOR

Design Storm Frequency:				50 year													
Node #	Area #	ISO	Soil Type		IMPERVIOUSNESS 1.00	0.70	0.60	0.50	0.40	0.35	0.15	SUB AREA	EQUIV AREA	TOTAL AREA	TOTAL Ae	COMMENTS
	D-134	1.33	2	dA:				1.09				1.1	0.8			
	D-132	1.33	1	dA:	22.25							22.3	22.3			
	D-130	1.33	1	dA:						3.86		3.9	2.9			
	D-130	1.33	2	dA:				0.44				0.4	0.3			*Bluffside*
RC-130												27.6	26.2	431.0	382.2	
	D-122	1.33	2	dA:				0.44				0.4	0.3			
	D-120	1.33	1	dA:						3.09		3.1	2.3			
	D-120	1.33	2	dA:				0.27				0.3	0.2			*Bluffside*
RC-120												3.8	2.8	434.8	385.0	
	D-120	1.33		dA:								434.8	385.0			<- Riparian @ RC-180
Σ	D-124	1.33		dA:								40.3	40.0			<- HAC SD
RC-120												475.1	425.0	475.1	425.0	Confluence
	D-110	1.33	2	dA:				10.04				10.0	7.0			*Bluffside*
RC-110												10.0	7.0	485.1	432.0	-> Freshwater Marsh FWM-140

HYDROLOGY STUDY FOR THE VILLAGE AT PLAYA VISTA (PROPOSED PROJECT) AND BALLONA WETLANDS - RIPARIAN CORRIDOR

Design Storm Frequency:			50	year												
Node	Area	ISO	Soil		IMPERVIOUSNESS							SUB	EQUIV	TOTAL	TOTAL	COMMENTS
#	#		Type		1.00	0.70	0.60	0.50	0.40	0.35	0.15	AREA	AREA	AREA	Ae	
FIREBRAND STREET STORM DRAIN																
	D-314	1.33	1	dA:								32.2	28.2			<- Firebrand St. SD
RC-314												32.2	28.2	32.2	28.2	
	D-312	1.33	1	dA:				6.32				6.3	5.2			
RC-312												6.3	5.2	38.5	33.4	-> Riparian Corridor @ RC-310
EMT PLANT SITE STORM DRAIN																
	D-186.06	1.33	1	dA:	3.45							3.5	3.5			
EMT-170												3.5	3.5	3.5	3.5	
	D-186.05	1.33	1	dA:	4.35							4.4	4.4			
EMT-160												4.4	4.4	7.9	7.9	
	D-186.04	1.33	1	dA:	6.00							6.0	6.0			
EMT-150												6.0	6.0	13.9	13.9	
	D-186.03	1.33	1	dA:	7.78							7.8	7.8			
EMT-140												7.8	7.8	21.7	21.7	
	D-186.02	1.33	1	dA:	9.85							9.9	9.9			
EMT-130												9.9	9.9	31.6	31.6	
	D-186.01	1.33	1	dA:	9.21							9.2	9.2			
EMT-120												9.2	9.2	40.8	40.8	-> Riparian Corridor @ RC-180

HYDROLOGY STUDY FOR THE VILLAGE AT PLAYA VISTA (PROPOSED PROJECT) AND BALLONA WETLANDS - RIPARIAN CORRIDOR

Project Name:	PLAYA VISTA HYDROLOGY FOR AREAS "B" AND "D"				
Project Number:	1PCC0201.66				
Tabled By:	GMV				
Checked By:					
Date:	11/7/2002				
Drainage System:	**Riparian Corridor**	**Riparian Corridor**	**Riparian Corridor**	**EMT Storm Drain**	**Riparian Corridor**
Area Number:	**D-390**	**D-372**	**D-362**	**D-186.06**	**152.1**
Node Number:	**RC-390**	**RC-370**	**RC-360**	**EMT-170**	**152**
Runoff Tabling Sheet:					
Conveyor:	Swale	Gutter	Gutter	Gutter	Gutter
Development Type:	OS	R4	R4	M	R4
Development Class:	35	100	100	100	100
Elevation Difference:	5 ft	3 ft	1 ft	5 ft	5.4 ft
Length of Reach:	1000 ft	800 ft	500 ft	500 ft	1210 ft
Average Slope:	0.50%	0.38%	0.20%	1.00%	0.45%
Method of Computation:	Figure G242.2A	Figure G242.2A	Figure G242.2A	Figure G242.2A	Figure G242.2A
ISO:	1.33	1.33	1.33	1.33	1.33
Fro:	1.30	1.30	1.30	1.30	1.30
tc(700):	8.3 min	7.9 min	10.0 min	6.0 min	7.5 min
TIME OF CONCENTRATION (tc):	**9.9 min**	**8.4 min**	**8.5 min**	**5.1 min**	**9.9 min**

HYDROLOGY STUDY FOR THE VILLAGE AT PLAYA VISTA (PROPOSED PROJECT) AND BALLONA WETLANDS - CENTRAL STORM DRAIN

TABLED BY GMV CHECKED BY SUPERVISED BY	CITY OF LOS ANGELES Department of Public Works Bureau of Engineering	STORM DRAIN DESIGN RUNOFF TABLING SHEET Frequency 50 Year	Project: 1PCC0201.66 - PLAYA VISTA AREAS "B" AND "D" CENTRAL STORM DRAIN	Date: Nov-7-02 Sheet:

Drainage Map Area No	Drainage Map Area Acres	Runoff	Runoff 100% Ae	Flow Routing Surface Flow N	S	E	W	Storm Drain	ISO	Freq. Fact.	Dist. Fact.	Amen 1hr RFR	Fro	BPRR	Frict. Slope (S)	K= Q/S^.5	Size	Area [sf]	Vel. [ft/s]	L [ft]	tc or tcx [min]	Storm Drain Station	Location	Remarks	1
CENTRAL STORM DRAIN																									2
	8.0	A	8.0																			<- Area D-610			3
	8.0	ΣA	8.0													d/D =	0.75								
CD-310		q	3.46						1.33	1.00	1.000	1.33	1.30	2.66		k/K =	0.918				8.8		"I" Street @ 15th Street		3
		Q	27.7													n =	0.013								
	14.0	A	14.0					27.7							0.0009	923	42 in	7.7	3.56	1005	4.7	<- Areas D-600 & D-602			4
	22.0	ΣA	22.0													d/D =	0.68								
CD-300		q	2.86						1.33	1.00	1.000	1.33	1.30	2.20		k/K =	0.805				13.5		"I" Street @ 13th Street		5
		Q	62.9													n =	0.013								
	9.4	A	9.4					62.9							0.0009	2097	60 in	14.1	4.46	700	2.6	<- Area D-590			6
	31.4	ΣA	31.4													d/D =	0.69								
CD-290		q	2.65						1.33	1.00	1.000	1.33	1.30	2.04		k/K =	0.827				16.1		"I" Street 400' e/o Centinela		7
		Q	83.3													n =	0.013								
	5.7	A	5.7					83.3							0.0009	2777	66 in	17.5	4.76	415	1.5	<- Area D-580			8
	37.1	ΣA	37.1													d/D =	0.77								
CD-280		q	2.55						1.33	1.00	1.000	1.33	1.30	1.96		k/K =	0.938				17.6		Centinela Avenue		9
		Q	94.5													n =	0.013								
	6.6	A	6.5					94.5							0.0009	3150	66 in	19.5	4.85	530	1.8	<- Area D-570			10
	43.7	ΣA	43.6													d/D =	0.70								
CD-270		q	2.44						1.33	1.00	1.000	1.33	1.30	1.88		k/K =	0.842				19.4		"J" Street @ 7th Street		11
		Q	107													n =	0.013								
	5.9	A	5.8					107							0.0009	3567	72 in	21.1	5.06	380	1.3	<- Area D-560			12
	49.6	ΣA	49.4													d/D =	0.76								
CD-260		q	2.38						1.33	1.00	1.000	1.33	1.30	1.83		k/K =	0.929				20.7		"J" Street @ 6th Street		13
		Q	118													n =	0.013								
	6.5	A	6.5					118							0.0009	3933	72 in	23.1	5.12	380	1.2	<- Area D-550			14
	56.1	ΣA	55.9													d/D =	0.69								
CD-250		q	2.31						1.33	1.00	1.000	1.33	1.30	1.78		k/K =	0.820				21.9		"J" Street @ 5th Street		15
		Q	129													n =	0.013								
	12.2	A	11.8					129							0.0009	4300	78 in	24.2	5.33	540	1.7	<- Area D-540			16
	68.3	ΣA	67.7													d/D =	0.79								
CD-240		q	2.25						1.33	1.00	1.000	1.33	1.30	1.73		k/K =	0.966				23.6		Westlawn @ Runway Rd.		17
		Q	152													n =	0.013								

HYDROLOGY STUDY FOR THE VILLAGE AT PLAYA VISTA (PROPOSED PROJECT) AND BALLONA WETLANDS - CENTRAL STORM DRAIN

TABLED BY GMV CHECKED BY SUPERVISED BY	CITY OF LOS ANGELES Department of Public Works Bureau of Engineering	STORM DRAIN DESIGN RUNOFF TABLING SHEET Frequency 50 Year	Project: 1PCC0201.66 - PLAYA VISTA AREAS "B" AND "D" CENTRAL STORM DRAIN	Date: Nov-7-02 Sheet:

Drainage Map Area No	Drainage Map Area Acres	Runoff	Runoff 100% Ae	Flow Routing Surface Flow N	S	E	W	Flow Routing Storm Drain	ISO	Freq. Fact.	Dist. Fact.	Amen 1hr RFR	Fro	BPRR	Frict. Slope (S)	K= Q/S^.5	Size	Area [sf]	Vel. [ft/s]	L [ft]	tc or tcx [min]	Storm Drain Station	Location	Remarks	1
	6.8	A	6.7					152							0.0009	5067	78 in	28.1	5.41	821	2.5	<- Area D-530			18
CD-230	75.1	ΣA	74.4						1.33	1.00	1.000	1.33	1.30	1.65		d/D =	0.70				26.1		Runway Rd. @ 3rd St.		19
		q	2.15													k/K =	0.835								
		Q	160													n =	0.013								
	8.5	A	8.4					160							0.0009	5333	84 in	28.5	5.61	380	1.1	<- Area D-520			20
CD-220	83.6	ΣA	82.8						1.33	1.00	1.000	1.33	1.30	1.62		d/D =	0.75				27.2		Runway Rd. @ 2nd St.		21
		q	2.11													k/K =	0.908								
		Q	174													n =	0.013								
	8.8	A	8.5					174							0.0009	5800	84 in	30.7	5.66	535	1.6	<- Area D-510			22
CD-210	92.4	ΣA	91.3						1.33	1.00	1.000	1.33	1.30	1.58		d/D =	0.80				28.8		Runway Rd. @ McConnell Ave.		23
		q	2.05													k/K =	0.981								
		Q	188													n =	0.013								
	5.5	A	5.5					188							0.0009	6267	84 in	33.0	5.70	553	1.6	<- Area D-500			24
CD-200	97.9	ΣA	96.8						1.33	1.00	1.000	1.33	1.30	1.55		d/D =	0.71				30.4		Runway Rd. @ 1st St.		25
		q	2.02													k/K =	0.846								
		Q	195													n =	0.013								
	13.0	A	12.7					195							0.0009	6500	90 in	33.3	5.86	380	1.1	<- Area D-490			26
CD-190	110.9	ΣA	109.5						1.33	1.00	0.999	1.33	1.30	1.52		d/D =	0.77				31.5		Runway Rd. @ Hurlt Way		27
		q	1.98													k/K =	0.938								
		Q	216													n =	0.013								
	4.5	A	4.5					216							0.0009	7200	90 in	36.3	5.96	410	1.1	<- Area D-480			28
CD-180	115.4	ΣA	114.0						1.33	1.00	0.999	1.33	1.30	1.50		d/D =	0.79				32.6		Runway Rd. @ Celedon Creek		29
		q	1.95													k/K =	0.964								
		Q	222													n =	0.013								
	2.7	A	2.7					222							0.0009	7400	90 in	37.2	5.97	320	0.9	<- Area D-470			30
CD-170	118.1	ΣA	116.7						1.33	1.00	0.999	1.33	1.30	1.48		d/D =	0.80				33.5		Runway Rd. @ Seabluff Drive		31
		q	1.92													k/K =	0.977								
		Q	225													n =	0.013								
	4.7	A	4.7					225							0.0009	7500	90 in	37.7	5.97	220	0.6	<- Area D-460			32
CD-160	122.8	ΣA	121.4						1.33	1.00	0.998	1.33	1.30	1.47		d/D =	0.71				34.1		Runway Rd. @ Alla Rd.		33
		q	1.91													k/K =	0.848								
		Q	232													n =	0.013								

HYDROLOGY STUDY FOR THE VILLAGE AT PLAYA VISTA (PROPOSED PROJECT) AND BALLONA WETLANDS - CENTRAL STORM DRAIN

TABLED BY GMV CHECKED BY SUPERVISED BY	CITY OF LOS ANGELES Department of Public Works Bureau of Engineering	STORM DRAIN DESIGN **RUNOFF TABLING SHEET** Frequency 50 Year	**Project: 1PCC0201.66 - PLAYA VISTA AREAS "B" AND "D" CENTRAL STORM DRAIN**	**Date:** Nov-7-02 **Sheet:**				

Drainage Map Area No	Area Acres	Runoff	100% Ae	Flow Routing Surface Flow N	S	E	W	Storm Drain	ISO	Freq. Fact.	Dist. Fact.	Amen 1hr RFR	Fro	BPRR	Frict. Slope (S)	K= Q/S^.5	Size	Area [sf]	Vel. [ft/s]	L [ft]	tc or tcx [min]	Storm Drain Station	Location	Remarks	1
	6.2	A	6.2					232							0.0009	7733	96 in	37.9	6.12	396	1.1	<- Area D-450			34
	129.0	ΣA	127.6													d/D =	0.73								
CD-150		q	1.89						1.33	1.00	0.998	1.33	1.30	1.45		k/K =	0.881				35.2		**Pacific Promenade @ Para Way**		35
		Q	241													n =	0.013								
	6.9	A	6.9					241							0.0009	8033	96 in	39.0	6.17	399	1.1	<- Area D-440			36
	135.9	ΣA	134.5													d/D =	0.75								
CD-140		q	1.86						1.33	1.00	0.998	1.33	1.30	1.43		k/K =	0.914				36.3		**Pacific Promenade @ Kiyot Way**		37
		Q	250													n =	0.013								
	7.3	A	7.3					250							0.0009	8333	96 in	40.4	6.18	380	1.0	<- Area D-430			38
	143.2	ΣA	141.8													d/D =	0.78								
CD-130		q	1.83						1.33	1.00	0.997	1.33	1.30	1.41		k/K =	0.950				37.3		**Pacific Promenade @ Seawalk Drive**		39
		Q	260													n =	0.013								
	6.7	A	6.7					260							0.0009	8667	96 in	41.8	6.22	318	0.9	<- Area D-420			40
	149.9	ΣA	148.5																						
CD-120		q	1.82						1.33	1.00	0.997	1.33	1.30	1.40							38.2		**Vista Drive @ Pacific Promenade**		41
		Q	270																						
	12.1	A	12.1					270														<- Line CD-1	from line	54	42
S	162.0	ΣA	160.6													d/D =	0.77				****	Central SD	38.2 min	270.0 cfs	
CD-120		q	1.9						1.33	1.00	0.995	1.33	1.29	1.46		k/K =	0.939				34.7	Line CD-1	10.4 min	38.9 cfs	43
		Q	302													n =	0.013					tcx=	34.7 min		
	10.7	A	10.7					302							0.0009	10067	102 in	46.6	6.48	1020	2.6	<- Area D-410			44
	172.7	ΣA	171.3													d/D =	0.79								
CD-110		q	1.82						1.33	1.00	0.994	1.33	1.29	1.41		k/K =	0.970				37.3		**Lincoln Boulevard**		45
		Q	312													n =	0.013								
	0.0	A	0.0					312							0.0009	10400	102 in	48.1	6.49	190	0.5				46
	172.7	ΣA	171.3																						
FWM-130		q	1.81						1.33	1.00	0.994	1.33	1.29	1.40							37.8				47
		Q	309																						
								309														-> Freshwater Marsh	@ Node	FWM-130	48
																									49

HYDROLOGY STUDY FOR THE VILLAGE AT PLAYA VISTA (PROPOSED PROJECT) AND BALLONA WETLANDS - CENTRAL STORM DRAIN

TABLED BY GMV CHECKED BY SUPERVISED BY	CITY OF LOS ANGELES Department of Public Works Bureau of Engineering	STORM DRAIN DESIGN RUNOFF TABLING SHEET Frequency 50 Year	Project: 1PCC0201.66 - PLAYA VISTA AREAS "B" AND "D" CENTRAL STORM DRAIN	Date: Nov-7-02 Sheet:

Drainage Map Area No	Area Acres	Runoff	100% Ae	Flow Routing Surface Flow N	S	E	W	Storm Drain	ISO	Freq. Fact.	Dist. Fact.	Amen 1hr RFR	Fro	BPRR	Frict. Slope (S)	K= Q / S^.5	Size	Area [sf]	Vel. [ft/s]	L [ft]	tc or tcx [min]	Storm Drain Station	Location	Remarks	1
LINE CD-1																									
	12.1	A	12.1																			<- Area D-422			50
CD-122	12.1	ΣA q Q	12.1 3.46 41.8						1.33	1.00	1.000	1.33	1.30	2.66		d/D = k/K = n =	0.79 0.970 0.013				8.8				51
	0.0	A	0.0					42							0.0009	1393	48 in	10.7	3.92	388	1.6				52
CD-120	12.1	ΣA q Q	12.1 3.21 38.9						1.33	1.00	1.000	1.33	1.30	2.47							10.4				53
								39														-> Central SD	@ line	42	54

HYDROLOGY STUDY FOR THE VILLAGE AT PLAYA VISTA (PROPOSED PROJECT) AND BALLONA WETLANDS - CENTRAL STORM DRAIN

Design Storm Frequency				50	year											
Node #	Area #	ISO	Soil Type		100%	IMPERVIOUSNESS 70%	60%	50%	40%	35%	15%	SUB AREA	EQUIV AREA	TOTAL AREA	TOTAL Ae	COMMENTS
CENTRAL STORM DRAIN																
	D-610	1.33	1	dA:	8.03							8.0	8.0			
CD-310												8.0	8.0	8.00	8.00	"I" Street @ 15th Street
	D-602	1.33	1	dA:	6.14							6.1	6.1			EMT Lake
	D-600	1.33	1	dA:	7.90							7.9	7.9			
CD-300												14.0	14.0	22.00	22.00	"I" Street @ 13th Street
	D-590	1.33	1	dA:	9.39							9.4	9.4			
CD-290												9.4	9.4	31.40	31.40	"I" Street 400' e/o Centinela
	D-580	1.33	1	dA:	5.69							5.7	5.7			
CD-280												5.7	5.7	37.10	37.10	Centinela Avenue
	D-570	1.33	1	dA:	6.42					0.17		6.6	6.5			
CD-270												6.6	6.5	43.70	43.60	"J" Street @ 7th Street
	D-560	1.33	1	dA:	5.61					0.30		5.9	5.8			
CD-260												5.9	5.8	49.60	49.40	"J" Street @ 6th Street
	D-550	1.33	1	dA:	6.35					0.17		6.5	6.5			
CD-250												6.5	6.5	56.10	55.90	"J" Street @ 5th Street
	D-540	1.33	1	dA:	10.62					1.58		12.2	11.8			
CD-240												12.2	11.8	68.30	67.70	Westlawn @ Runway Rd.
	D-530	1.33	1	dA:	6.53					0.29		6.8	6.7			
CD-230												6.8	6.7	75.10	74.40	Runway Rd. @ 3rd St.
	D-520	1.33	1	dA:	8.30					0.17		8.5	8.4			
CD-220												8.5	8.4	83.60	82.80	Runway Rd. @ 2nd St.

Design Storm Frequency				50	year											
Node #	Area #	ISO	Soil Type		IMPERVIOUSNESS 100%	70%	60%	50%	40%	35%	15%	SUB AREA	EQUIV AREA	TOTAL AREA	TOTAL Ae	COMMENTS
	D-510	1.33	1	dA:	7.78					0.98		8.8	8.5			
CD-210												8.8	8.5	92.40	91.30	Runway Rd. @ McConnell Ave.
	D-500	1.33	1	dA:	5.54							5.5	5.5			
CD-200												5.5	5.5	97.90	96.80	Runway Rd. @ 1st St.
	D-490	1.33	1	dA:	12.02					0.93		13.0	12.7			
CD-190												13.0	12.7	110.90	109.50	Runway Rd. @ Hurlt Way
	D-480	1.33	1	dA:	4.50							4.5	4.5			
CD-180												4.5	4.5	115.40	114.00	Runway Rd. @ Celedon Creek
	D-470	1.33	1	dA:	2.74							2.7	2.7			
CD-170												2.7	2.7	118.10	116.70	Runway Rd. @ Seabluff Drive
	D-460	1.33	1	dA:	4.66							4.7	4.7			
CD-160												4.7	4.7	122.80	121.40	Runway Rd. @ Alla Rd.
	D-450	1.33	1	dA:	6.22							6.2	6.2			
CD-150												6.2	6.2	129.00	127.60	Promenade @ Para Way
	D-440	1.33	1	dA:	6.88							6.9	6.9			
CD-140												6.9	6.9	135.90	134.50	
	D-430	1.33	1	dA:	7.28							7.3	7.3			
CD-130												7.3	7.3	143.20	141.80	
	D-420	1.33	1	dA:	6.74							6.7	6.7			
CD-120												6.7	6.7	149.90	148.50	

Design Storm Frequency				50	year											
Node #	Area #	ISO	Soil Type		IMPERVIOUSNESS 100%	70%	60%	50%	40%	35%	15%	SUB AREA	EQUIV AREA	TOTAL AREA	TOTAL Ae	COMMENTS
LINE CD-1																
	D-422	1.33	1	dA:	12.14							12.1	12.1			
CD-122												12.1	12.1	12.10	12.10	
RETURN TO CENTRAL STORM DRAIN																
	D-420	1.33		dA:								149.9	148.5			<- CENTRAL SD
Σ	D-422	1.33		dA:								12.1	12.1			<- LINE CD-1
RC-310												162.0	160.6	162.00	160.60	Confluence
	D-410	1.33	1	dA:	10.67							10.7	10.7			Lincoln Boulevard
CD-110												10.7	10.7	172.70	171.30	-> Freshwater Marsh @ FWM-130

Project Name:	PLAYA VISTA HYDROLOGY FOR AREAS "B" AND "D"					
Project Number:	1PCC0201.66					
Tabled By:	GMV					
Checked By:						
Date:	11/7/2002					
Drainage System:	Central S.D.	Line CD-1				
Area Number:	D-610	D-422				
Node Number:	CD-310	CD-122				
Runoff Tabling Sheet:						
Conveyor:	Gutter	Gutter				
Development Type:	M	M				
Development Class:	100	100				
Elevation Difference:	3.5 ft	3.5 ft				
Length of Reach:	700 ft	700 ft				
Average Slope:	0.50%	0.50%				
Method of Computation:	Figure G242.2A	Figure G242.2A				
ISO:	1.33	1.33				
Fro:	1.30	1.30				
tc(700):	8.8 min	8.8 min				
TIME OF CONCENTRATION (tc):	8.8 min	8.8 min				

HYDROLOGY STUDY FOR THE VILLAGE AT PLAYA VISTA (PROPOSED PROJECT) AND BALLONA WETLANDS - JEFFERSON STORM DRAIN

TABLED BY GMV CHECKED BY SUPERVISED BY	CITY OF LOS ANGELES Department of Public Works Bureau of Engineering	STORM DRAIN DESIGN RUNOFF TABLING SHEET Frequency 50 Year	Project: 1PCC0201.66 - PLAYA VISTA HYDROLOGY FOR AREAS "B" AND "D" JEFFERSON STORM DRAIN	Date: Nov-7-2002 Sheet:

Drainage Map Area No	Area Acres	Runoff	100% Ae	Flow Routing Surface Flow N	S	E	W	Storm Drain	ISO	Freq. Fact.	Dist. Fact.	Amen 1hr RFR	Fro	BPRR	Frict. Slope (S)	K= Q / S^.5	Size	Area [sf]	Vel. [ft/s]	L [ft]	tc or tcx [min]	Storm Drain Station	Location	Remarks	1
JEFFERSON STORM DRAIN																									2
	12.4	A	12.4																						
JD-350	12.4	ΣA	12.4																			<- Areas D-880, D-882 & D-884			3
		q	3.15						1.33	1.00	1.000	1.33	1.30	2.42		n =	0.013				10.9			Assume full pipe flow until box is open	4
																R =	0.75'								
		Q	39													Kf=	667	Af =	7.07						
	6.7	A	6.7				9	30							0.002	872	36 ø	7.07	5.52	425	1.3	<- Areas D-870 & D-872			5
JD-340	19.1	ΣA	19.1													n =	0.013								
		q	2.99						1.33	1.00	1.000	1.33	1.30	2.30		R =	0.81'				12.2				6
		Q	57.1													Kf=	826	Af =	8.30						
	4.1	A	4.1				20	37							0.002	1277	39 ø	8.296	6.88	730	1.8	<- Area D-860			7
JD-330	23.2	ΣA	23.2													n =	0.013								
		q	2.82						1.33	1.00	1.000	1.33	1.30	2.17		R =	0.94'				14.0		Teale Street		8
		Q	65.4													Kf=	1209	Af =	11.04						
	0.0	A	0.0				11	54							0.002	1462	45 ø	11.04	5.92	170	0.5				9
JD-320	23.2	ΣA	23.2																						
		q	2.78						1.33	1.00	1.000	1.33	1.30	2.14							14.5		Inglewood Boulevard		10
		Q	64.5																						
	51.8	A	41.1																			<- Inglewood Blvd. SD			11
Σ JD-320	75.0	ΣA	64.3													n =	0.013				****	Jefferson SD	14.5 min	64.5 cfs	
		q	2.6						1.33	1.00	1.000	1.33	1.30	1.97		R =	1.38'				17.5	Inglewood SD	19.4 min	100 4 cfs	12
		Q	165													Kf=	3358	Af =	23.76			tcx=	17.5 min		
	6.5	A	6.5				39	126							0.0014	4410	66 ø	23.76	6.94	1100	2.6	<- Area D-842			13
JD-310	81.5	ΣA	70.8																						
		q	2.41						1.33	1.00	1.000	1.33	1.30	1.85							20.1		Randall Street		14
		Q	170																						
	42.1	A	31.7																			<- Randall St. SD			15
Σ JD-310	123.6	ΣA	102.5													n =	0.013	dn =	5.75'		****	Jefferson SD	20.1 min	170.0 cfs	
		q	2.31						1.33	1.00	0.998	1.33	1.30	1.78		R =	1.71'	W =	8.50'		22.1	Randall SD	27.0 min	67 2 cfs	16
		Q	237													Kf=	8004	H =	5.75'			tcx=	22.1 min		
	4.0	A	4.0				41	196							0.0006	9675	RCB	48.88	4.85	425	1.5	<- Area D-832			17
JD-300	127.6	ΣA	106.5																						
		q	2.25						1.33	1.00	0.998	1.33	1.30	1.73							23.6		Centinela Avenue		18
		Q	240																						

HYDROLOGY STUDY FOR THE VILLAGE AT PLAYA VISTA (PROPOSED PROJECT) AND BALLONA WETLANDS - JEFFERSON STORM DRAIN

TABLED BY CHECKED BY SUPERVISED BY	GMV	CITY OF LOS ANGELES Department of Public Works Bureau of Engineering	STORM DRAIN DESIGN **RUNOFF TABLING SHEET** Frequency 50 Year	**Project: 1PCC0201.66 - PLAYA VISTA** **HYDROLOGY FOR AREAS "B" AND "D"** **JEFFERSON STORM DRAIN**	**Date:** Nov-7-2002 **Sheet:**

Drainage Map Area No	Drainage Map Area Acres	Runoff	Runoff 100% Ae	Flow Routing Surface Flow N	S	E	W	Storm Drain	ISO	Freq. Fact.	Dist. Fact.	Amen 1hr RFR	Fro	BPRR	Frict. Slope (S)	K= Q S^.5	Size	Area [sf]	Vel. [ft/s]	L [ft]	tc or tcx [min]	Storm Drain Station	Location	Remarks	
	18.2	A	17.0																						1
Σ	145.8	ΣA	123.5																			<- Centinela Ave. SD			19
JD-300		q Q	2.23 276						1.33	1.00	0.995	1.33	1.29	1.73		n = R = Kf=	0.013 1.71' 8004	dn = W = H =	5.75' 8.50' 5.75'		23.6	Jefferson SD Centinela SD tcx=	23.6 min 20.4 min 23.1 min	240.0 cfs 40.6 cfs	20
	6.1	A	6.1				80	196							0.0006	11268	RCB	48.88	5.65	1110	3.3	<- Areas D-822 & D-824			21
JD-290	151.9	ΣA q Q	129.6 2.10 273						1.33	1.00	0.995	1.33	1.29	1.63							26.9		**Grosvenor Boulevard**		22
	32.7	A	25.7																						
Σ	184.6	ΣA	155.3																			<- Grosvenor Blvd. SD			23
JD-290		q Q	2.15 335						1.33	1.00	0.993	1.33	1.29	1.67		n = R = Kf=	0.013 1.83' 9817	dn = W = H =	5.75' 10.00' 5.75'		**** 25.5	Jefferson SD Grosvenor SD tcx=	26.9 min 19.5 min 25.5 min	273.0 cfs 62.7 cfs	24
	4.5	A	3.9				95	240							0.0006	13676	RCB	57.5	5.83	530	1.5	<- Area D-810			25
JD-280	189.1	ΣA q Q	159.2 2.10 335						1.33	1.00	0.993	1.33	1.29	1.63		n = R = Kf=	0.013 2.05' 13856	dn = W = H =	6.25' 12.00' 6.25'		27.0		**Westlawn Avenue**		26
	3.0	A	3.0												0.0005	14982	RCB	75	4.47	645	2.4	<- Area D-800			27
JD-270	192.1	ΣA q Q	162.2 2.03 329						1.33	1.00	0.992	1.33	1.29	1.57		n = R = Kf=	0.013 2.05' 13856	dn = W = H =	6.25' 12.00' 6.25'		29.4		**700' w/o Westlawn Ave**		28
	3.4	A	3.4				19	310							0.0005	14713	RCB	75	4.39	425	1.6	<- Area D-790			29
JD-260	195.5	ΣA q Q	165.6 1.97 327						1.33	1.00	0.993	1.33	1.29	1.53		n = R = Kf=	0.013 2.05' 13856	dn = W = H =	6.25' 12.00' 6.25'		31.0		**McConnell Avenue**		30
	8.5	A	8.5				17	310							0.0005	14624	RCB	75	4.36	705	2.7	<- Areas D-780 & D-782			31
JD-250	204.0	ΣA q Q	174.1 1.91 332						1.33	1.00	0.992	1.33	1.29	1.48		n = R = Kf=	0.013 2.11' 14659	dn = W = H =	6.50' 12.00' 6.50'		33.7		**Beethoven Street**		32
	3.5	A	3.5				4	328							0.0005	14847	RCB	78	4.26	645	2.5	<- Areas D-770 & D-772			33
JD-230	207.5	ΣA q Q	177.6 1.84 328						1.33	1.00	0.992	1.33	1.29	1.43		n = R = Kf=	0.013 2.11' 14659	dn = W = H =	6.50' 12.00' 6.50'		36.2		**Westlawn Avenue**		34
	1.5	A	1.5				0	328							0.0005	14669	RCB	78	4.21	260	1.0	<- Area D-760			35
JD-220	209	ΣA q Q	179.1 1.82 326						1.33	1.00	0.992	1.33	1.29	1.41		n = R = Kf=	0.013 2.16' 15471	dn = W = H =	5.32' 12.00' 6.75'		37.2		**400' w/o Beethoven St**		36

TABLED BY GMV CHECKED BY SUPERVISED BY	CITY OF LOS ANGELES Department of Public Works Bureau of Engineering	STORM DRAIN DESIGN **RUNOFF TABLING SHEET** Frequency 50 Year	**Project: 1PCC0201.66 - PLAYA VISTA** **HYDROLOGY FOR AREAS "B" AND "D"** **JEFFERSON STORM DRAIN**	**Date:** Nov-7-2002 **Sheet:**

Drainage Map Area No	Area Acres	Runoff	100% Ae	Flow Routing Surface Flow N	S	E	W	Storm Drain	ISO	Freq. Fact.	Dist. Fact	Amen 1hr RFR	Fro	BPRR	Frict. Slope (S)	K= Q/S^.5	Size	Area [sf]	Vel. [ft/s]	L [ft]	tc or tcx [min]	Storm Drain Station	Location	Remarks	1
	7.8	A	7.8					326							0.0005	14579	RCB	63.84	5.11	695	2.3	<- Area D-750			37
	216.8	ΣA	186.9													n =	0.013	dn =	5.40'						
JD-210		q	1.78						1.33	1.00	0.991	1.33	1.29	1.38		R =	2.16'	W =	12.00'		39.5		**Alla Street**		38
		Q	333													Kf=	15471	H =	6.75'						
	4.5	A	4.5					333							0.0005	14892	RCB	64.8	5.14	695	2.3	<- Area D-740			39
	221.3	ΣA	191.4													n =	0.013	dn =	5.50'						
JD-200		q	1.78						1.33	1.00	0.991	1.33	1.29	1.38		R =	2.16'	W =	12.00'		39.5		**300' w/o Alla Street**		40
		Q	341													Kf=	15471	H =	6.75'						
	5.1	A	5.1					341							0.0005	15250	RCB	66	5.17	330	1.1	<- Area D-735			41
	226.4	ΣA	196.5													n =	0.013	dn =	5.61'						
JD-190		q	1.78						1.33	1.00	0.991	1.33	1.29	1.38		R =	2.26'	W =	12.00'		39.5		**Existing Bay Street**		42
		Q	350													Kf=	17125	H =	7.25'						
	26.6	A	26.6					350							0.0005	15652	RCB	67.32	5.20	460	1.5	<- Area D-730			43
	253	ΣA	223.1													n =	0.013	dn =	7.25'						
JD-180		q	1.78						1.33	1.00	0.989	1.33	1.29	1.38		R =	2.26'	W =	12.00'		39.5		**2nd street**		44
		Q	397													Kf=	17125	H =	7.25'						
	6.0	A	6.0				14	383							0.0005	17754	RCB	87	4.56	540	2.0	<- Area D-720			45
	259	ΣA	229.1													n =	0.013	dn =	7.25'						
JD-170		q	1.78						1.33	1.00	0.989	1.33	1.29	1.38		R =	2.26'	W =	12.00'		39.5		**100' e/o Lincoln Blvd.**		46
		Q	408													Kf=	17125	H =	7.25'						
	11.3	A	11.3				25	383							0.0005	18246	RCB	87	4.69	130	0.5	<- Area D-710			47
	270.3	ΣA	240.4													n =	0.013	dn =	2.66'						
JD-160		q	1.77						1.33	1.00	0.988	1.33	1.28	1.38		R =	2.26'	W =	12.00'		39.5		**Lincoln Blvd.**		48
		Q	425													Kf=	17125	H =	7.25'						
	0.0	A	0.0					425							0.006	5487	RCB	31.92	13.31	250	0.3				49
	270.3	ΣA	240.4																						
JD-155		q	1.75						1.33	1.00	0.988	1.33	1.28	1.37							39.8		**Junction with Jefferson SD West**		50
		Q	422																						
	0.9	A	0.9																			**<- Jefferson SD West**	**from line**	**64**	51
Σ	271.2	ΣA	241.3													n =	0.013	dn =	2.66'		****	Jefferson SD	39.8 min	422.0 cfs	
JD-155		q	1.77						1.33	1.00	0.988	1.33	1.28	1.38		R =	2.26'	W =	12.00'		39.6	Jefferson SD West	14.0 min	2.5 cfs	52
		Q	426													Kf=	17125	H =	7.25'			**tcx=**	39.6 min		
	0.0	A	0.0					426							0.006	5500	RCB	31.92	13.35	180	0.2				53
	271.2	ΣA	241.3																						
FWM-120		**q**	**1.75**						**1.33**	**1.00**	**0.988**	**1.33**	**1.28**	**1.37**							**39.8**				**54**
		Q	**423**																						
								423														**-> Freshwater Marsh**	**@ Node**	FWM-120	**55**

TABLED BY GMV
CHECKED BY
SUPERVISED BY

CITY OF LOS ANGELES
Department of Public Works
Bureau of Engineering

STORM DRAIN DESIGN
RUNOFF TABLING SHEET
Frequency 50 Year

Project: 1PCC0201.66 - PLAYA VISTA
HYDROLOGY FOR AREAS "B" AND "D"
JEFFERSON STORM DRAIN

Date: Nov-7-2002
Sheet:

Drainage Map Area No	Drainage Map Area Acres	Runoff	Runoff 100% Ae	Flow Routing Surface Flow N	S	E	W	Storm Drain	ISO	Freq. Fact.	Dist. Fact.	Amen 1hr RFR	Fro	BPRR	Frict. Slope (S)	K= Q/S^.5	Size	Area [sf]	Vel. [ft/s]	L [ft]	tc or tcx [min]	Storm Drain Station	Location	Remarks	1
AREA "B" DRAINAGE - JEFFERSON STORM DRAIN WEST																									
LINE B-1																									
	0.9	A	0.9																						
JD-130	0.9	ΣA	0.9																			<- Area B-120			56
		q	3.72						1.33	1.00	1.000	1.33	1.30	2.86		d/D =	0.54								
		Q	3.3													k/K =	0.573				7.4				57
																n =	0.013								
	0.0	A	0.0					3							0.003	60	18 in	1.0	3.38	630	3.1				58
JD-140	0.9	ΣA	0.9													d/D =	0.50								
		q	3.2						1.33	1.00	1.000	1.33	1.30	2.46		k/K =	0.503				10.5		New Jefferson Drain Lat.		59
		Q	2.9													n =	0.013								
	0.0	A	0.0					3							0.003	53	18 in	0.9	3.28	570	2.9				60
JD-150	0.9	ΣA	0.9													d/D =	0.09								
		q	2.9						1.33	1.00	1.000	1.33	1.30	2.21		k/K =	0.018				13.4		New Jefferson Drain Lat.		61
		Q	2.6													n =	0.013								
	0.0	A	0.0					3							0.003	47	60 in	0.9	2.97	100	0.6				62
JD-155	0.9	ΣA	0.9													d/D =	0.00								
		q	2.8						1.33	1.00	1.000	1.33	1.30	2.17		k/K =	0.000				14.0		Join Exist 60" RCP		63
		Q	2.5													n =	0.013								
								3														-> Jefferson SD	@ line	51	64

HYDROLOGY STUDY FOR THE VILLAGE AT PLAYA VISTA (PROPOSED PROJECT) AND BALLONA WETLANDS - JEFFERSON STORM DRAIN

TABLED BY GMV CHECKED BY SUPERVISED BY	CITY OF LOS ANGELES Department of Public Works Bureau of Engineering	STORM DRAIN DESIGN **RUNOFF TABLING SHEET** Frequency 50 Year	**Project: 1PCC0201.66 - PLAYA VISTA HYDROLOGY FOR AREAS "B" AND "D" JEFFERSON STORM DRAIN**	**Date:** Nov-7-2002 **Sheet:**

Drainage Map Area No	Area Acres	Runoff	100% Ae	Flow Routing Surface Flow N	S	E	W	Storm Drain	ISO	Freq. Fact.	Dist. Fact.	Amen 1hr RFR	Fro	BPRR	Frict. Slope (S)	K= Q/S^.5	Size	Area [sf]	Vel. [ft/s]	L [ft]	tc or tcx [min]	Storm Drain Station	Location	Remarks	1
Area B N/O Jefferson & E/O Culver / Jefferson																									
	33.4	A	33.4																			**<- Area B-110**			65
B-212	33.4	ΣA	33.4						1.33	1.00	1.000	1.33	1.30	2.51							10.0				66
		q	3.26																						
		Q	109																						
	20.6	A	20.6																			**<- Area B-112**			67
B-211	20.6	ΣA	20.6						1.33	1.00	1.000	1.33	1.30	2.51							10.0				68
		q	3.26																						
		Q	67.2																						

Node #	Area #	ISO	Soil Type	50	year											
					IMPERVIOUSNESS											
					100%	70%	60%	50%	40%	35%	15%	SUB AREA	EQUIV AREA	TOTAL AREA	TOTAL Ae	COMMENTS
JEFFERSON BOULEVARD STORM DRAIN EAST																
	D-884	1.33	1	dA:	6.89							6.9	6.9			
	D-882	1.33	1	dA:	3.30							3.3	3.3			
	D-880	1.33	1	dA:	2.22							2.2	2.2			
JD-350												12.4	12.4	12.4	12.4	Major Street
	D-872	1.33	1	dA:	4.03							4.0	4.0			
	D-870	1.33	1	dA:	2.68							2.7	2.7			
JD-340												6.7	6.7	19.1	19.1	Teale Street
	D-860	1.33	1	dA:	4.08							4.1	4.1			
JD-330												4.1	4.1	23.2	23.2	Centinela Ave & Jefferson Blvd
Σ	D-850	1.33	1	dA:								51.8	41.1			<- Inglewood Blvd. SD
JD-320												51.8	41.1	75.0	64.3	Inglewood & Jefferson
	D-842	1.33	1	dA:	6.49							6.5	6.5			
JD-310												6.5	6.5	81.5	70.8	Jefferson & Randall
Σ	D-840	1.33	1	dA:								42.1	31.7			<- Randall St. SD
JD-310												42.1	31.7	123.6	102.5	
	D-832	1.33	1	dA:	3.96							4.0	4.0			
JD-300												4.0	4.0	127.6	106.5	Jefferson @ Centinela Ave.
Σ	D-830	1.33	1	dA:								18.2	17.0			<- Centinela Ave. SD
JD-300												18.2	17.0	145.8	123.5	Jefferson @ Centinela Ave.
	D-824	1.33	1	dA:	4.43							4.4	4.4			
	D-822	1.33	1	dA:	1.67							1.7	1.7			
JD-290												6.1	6.1	151.9	129.6	Grosvenor Boulevard
Σ	D-820	1.33	1	dA:								32.7	25.7			<- Gosvenor Blvd. SD
JD-290												32.7	25.7	184.6	155.3	
	D-810	1.33	1	dA:	2.05				2.40			4.5	3.9			
JD-280												4.5	3.9	189.1	159.2	
	D-800	1.33	1	dA:	3.01							3.0	3.0			

			50	year												
Node #	Area #	ISO	Soil Type		IMPERVIOUSNESS 100%	70%	60%	50%	40%	35%	15%	SUB AREA	EQUIV AREA	TOTAL AREA	TOTAL Ae	COMMENTS
JD-270												3.0	3.0	192.1	162.2	700' west of Westlawn Ave
	D-790	1.33	1	dA:	3.37							3.4	3.4			
JD-260												3.4	3.4	195.5	165.6	
	D-780	1.33	1	dA:	6.28							6.3	6.3			
	D-782	1.33	1	dA:	2.24							2.2	2.2			
JD-250												8.5	8.5	204.0	174.1	McConnell Avenue
	D-770	1.33	1	dA:	2.67							2.7	2.7			
	D-772	1.33	1	dA:	0.81							0.8	0.8			
JD-230												3.5	3.5	207.5	177.6	Beethoven Street
	D-760	1.33	1	dA:	1.46							1.5	1.5			
JD-220												1.5	1.5	209.0	179.1	400' west of Beethoven St
	D-750	1.33	1	dA:	7.81							7.8	7.8			
JD-210												7.8	7.8	216.8	186.9	Alla Street

				50	year											
Node #	Area #	ISO	Soil Type		IMPERVIOUSNESS 100%	70%	60%	50%	40%	35%	15%	SUB AREA	EQUIV AREA	TOTAL AREA	TOTAL Ae	COMMENTS
	D-740	1.33	1	dA:	4.49							4.5	4.5			
JD-200												4.5	4.5	221.3	191.4	400' west of Alla Street
	D-735	1.33	1	dA:	5.06							5.1	5.1			
JD-190												5.1	5.1	226.4	196.5	
	D-730	1.33	1	dA:	26.60							26.6	26.6			Site 3
JD-180												26.6	26.6	253.0	223.1	
	D-720	1.33	1	dA:	6.00							6.0	6.0			Site 3 Southwest
JD-170												6.0	6.0	259.0	229.1	
	D-710	1.33	1	dA:	11.30							11.3	11.3			Lincoln & Jefferson
JD-160												11.3	11.3	270.3	240.4	-> Jefferson SD @ JD-155
Σ				dA:								270.3	240.4			<- Jefferson SD East
				dA:								0.9	0.9			<- Jefferson SD West
JD-155												271.2	241.3	271.2	241.3	-> Freshwater Marsh @ FWM-120

				50	year											
Node #	Area #	ISO	Soil Type		IMPERVIOUSNESS 100%	70%	60%	50%	40%	35%	15%	SUB AREA	EQUIV AREA	TOTAL AREA	TOTAL Ae	COMMENTS
AREA "B" DRAINAGE - JEF FERSON STORM DRAIN WEST																
LINE B1																
	B-112	1.33	1	dA:	20.61					0.00		20.6	20.6			
B2-112												20.6	20.6	20.6	20.6	
	B-110	1.33	1	dA:	33.37					0.00		33.4	33.4			
B1-110												33.4	33.4	33.4	33.4	
	B-120	1.33	1	dA:	0.90							0.9	0.9			Line B1
JD-130												0.9	0.9	0.9	0.9	--> Jefferson JD-140
				dA:								0.9	0.9			<- LINE B2
JD-140												0.9	0.9	0.9	0.9	--> Jefferson SD @ JD-155

Project Name:	PLAYA VISTA HYDROLOGY FOR AREAS "B" AND "D"					
Project Number:	1PCC0201.66					
Tabled By:	GMV					
Checked By:						
Date:	11/7/2002					
Drainage System:	Jefferson SD	Jefferson SD West	Jefferson SD West	Jefferson SD West		
Area Number:	D-880	B-112	B-120	B-124		
Node Number:	JD-350	B1-130	JD-130	B2-120		
Runoff Tabling Sheet:						
Conveyor:	Gutter	Gutter	Gutter	Gutter		
Development Type:	Highway	Highway	Highway	Highway		
Development Class:	100	100	100	100		
Elevation Difference:	3.14 ft	1.8 ft	0.9 ft	3.4 ft		
Length of Reach:	1100 ft	1400 ft	630 ft	850 ft		
Average Slope:	0.29%	0.13%	0.14%	0.40%		
Method of Computation:	Figure G242.2A	Figure G242.2A	Figure G242.2A	Figure G242.2A		
ISO:	1.33	1.33	1.33	1.33		
Fro:	1.30	1.30	1.30	1.30		
tc(700):	8.7 min	7.8 min	7.8 min	7.8 min		
TIME OF CONCENTRATION (tc):	10.9 min	11.0 min	7.4 min	8.6 min		

TABLED BY CHECKED BY SUPERVISED BY	GMV	CITY OF LOS ANGELES Department of Public Works Bureau of Engineering	STORM DRAIN DESIGN RUNOFF TABLING SHEET Frequency 50 Year	Project: 1PCC0201.66 - PLAYA VISTA HYDROLOGY FOR AREAS "B" AND "D" AREA "B" - WETLANDS	Date: 11/07/02 Sheet:

Drainage Map Area No	Area Acres	Runoff	100% Ae	Flow Routing Surface Flow N	S	E	W	Storm Drain	ISO	Freq. Fact.	Dist. Fact.	Amen 1hr RFR	Fro	BPRR	Frict. Slope (S)	K= Q/S^.5	Size	Area [sf]	Vel. [ft/s]	L [ft]	tc or tcx [min]	Storm Drain Station	Location	Remarks	
FRESHWATER MARSH																									1
FWM-140	18.3	A	17.0																						
	18.3	ΣA	17.0																			<- Areas B-240, B-244, B-246			2
		q	4.30																						
		Q	73.2						1.33	1.00	1.000	1.33	1.30	3.31							5.3				3
	485.1		432																						
	86.5	A	71.6																			<- Riparian Corridor			4
	589.9	ΣA	520.8																			<- Lincoln SD South			5
Σ FWM-140																					****	FWM Direct	5.3 min	73.2 cfs	
		c	1.6						1.33	1.00	0.975	1.33	1.27	1.26							48.4	Riparian Corridor	66.0 min	608.0 cfs	
		Q	833																			Lincoln SD South	12.5 min	211.7 cfs	6
																						tcx=	48.4 min		
FWM-130	7.1	A	7.:																						
	597.0	ΣA	527.7																			<- Area B-230			7
		q	1.60						1.33	1.00	0.975	·.30	1.27	1.26											
		Q	844																			48.4			8
	172.7		171.3																						
Σ FWM-130	769.7	ΣA	899.0																			<- Central SD			9
		q	1.6						1.33	1.00	0.967	1.33	1.26	1.29							**** 45.6	FWM	48.4 min	844.0 cfs	
		Q	1140																			Central SD	37.8 min	309.0 cfs	10
																						tcx=	45.6 min		
FWM-120	9.8	A	9.8																						
	779.5	ΣA	708.8																			<- Area B-220			11
		q	1.63						1.33	1.00	0.967	1.29	1.26	1.29							45.6				
		Q	1150																						12
	271.2		241.3																						
Σ FWM-120	1050.7	ΣA	950.1																			<- Jefferson SD			13
		q	1.6						1.33	1.00	0.957	1.33	1.24	1.31							**** 44.0	FWM	45.6 min	1150.0 cfs	
		Q	1540																			Jefferson SD	39.8 min	423.0 cfs	14
																						tcx=	44.0 min		
FWM-110	8.2	A	8.2																						
	1058.9	ΣA	958.3																			<- Area B-210			15
		q	1.62						1.33	1.00	0.957	1.33	1.24	1.31							44.0				
		Q	1560																						16
																						-> Ballona Creek Channel	@ Node	Ballona-140	17
																									18

HYDROLOGY STUDY FOR THE VILLAGE AT PLAYA VISTA (PROPOSED PROJECT) AND BALLONA WETLANDS - WETLANDS

TABLED BY / CHECKED BY / SUPERVISED BY	GMV	CITY OF LOS ANGELES Department of Public Works Bureau of Engineering	STORM DRAIN DESIGN RUNOFF TABLING SHEET Frequency 50 Year	Project: 1PCC0201.66 - PLAYA VISTA HYDROLOGY FOR AREAS "B" AND "D" AREA "B"- WETLANDS	Date: 11/07/02 Sheet:

Drainage Map Area No	Area Acres	Runoff	100% Ae	Flow Routing Surface Flow N	S	E	W	Storm Drain	ISO	Freq. Fact.	Dist. Fact.	Amen 1hr RFR	Fro	BPRR	Frict. Slope (S)	K= Q/S^.5	Size	Area [sf]	Vel. [ft/s]	L [ft]	tc or tcx [min]	Storm Drain Station	Location	Remarks	
EAST WETLAND NORTH AND FORMER RESIDENTIAL AREA B																									19
EW-110	60.2	A	60.2																						
	60.2	ΣA	60.2																			<- Area B-320			20
		q	3.26						1.33	1.00	1.000	1.33	1.30	2.51							10.0		East Wetland South and Bluffs		21
		Q	196																						
BB-110	20.3	A	20.3					0																	
	80.5	ΣA	80.5																			<- Areas B-310 & B-312			22
		q	3.26						1.33	1.00	1.000	1.33	1.30	2.51							10.0				23
		Q	263																						
Ballona-130		A						0																	
	80.5	ΣA	80.5																						24
		q	3.26						1.33	1.00	1.000	1.33	1.30	2.51							10.0				25
		Q	263																						
																						-> Ballona Creek Channel	@ Node	Ballona-140	26
																									27

TABLED BY GMV CHECKED BY SUPERVISED BY	**CITY OF LOS ANGELES** Department of Public Works Bureau of Engineering
STORM DRAIN DESIGN **RUNOFF TABLING SHEET** Frequency 50 Year	**Project: 1PCC0201.66 - PLAYA VISTA** **HYDROLOGY FOR AREAS "B" AND "D"** **AREA "B"- WETLANDS**
Date: 11/07/02	**Sheet:**

Drainage Map Area No	Drainage Map Area Acres	Runoff	Runoff 100% Ae	Flow Routing Surface Flow N	S	E	W	Storm Drain	ISO	Freq. Fact.	Dist. Fact.	Amen 1hr RFR	Fro	BPRR	Frict. Slope (S)	K= Q / S^.5	Size	Area [sf]	Vel. [ft/s]	L [ft]	tc or tcx [min]	Storm Drain Station	Location	Remarks	
EAST WETLAND SOUTH																									28
	36.9	A	33.8																						
	36.9	ΣA	33.8																			<- Areas B-330, B-332, B-336 & B-338			29
EW-310		q Q	3.26 110						1.33	1.00	1.000	1.33	1.30	2.51							10.0			**East Wetland South & Bluffs**	30
	13.7		12.1																						
Σ	50.6	ΣA	45.9																			**<- Hastings SD**			31
EW-310		q Q	3.5 161						1.33	1.00	1.000	1.33	1.30	2.70							**** 8.5	East Wetland South Hastings SD tcx=	10.0 min 5.3 min 8.5 min	110.0 cfs 52.2 cfs	32
		A																							
	50.6	ΣA	45.9																						33
SW-110		q Q	3.51 161						1.33	1.00	1.000	1.33	1.30	2.70							8.5				34
																						-> South Wetland	**@ Node**	**SW-110**	35
																									36

HYDROLOGY STUDY FOR THE VILLAGE AT PLAYA VISTA (PROPOSED PROJECT) AND BALLONA WETLANDS - WETLANDS

TABLED BY GMV CHECKED BY SUPERVISED BY	CITY OF LOS ANGELES Department of Public Works Bureau of Engineering	STORM DRAIN DESIGN RUNOFF TABLING SHEET Frequency 50 Year	Project: 1PCC0201.66 - PLAYA VISTA HYDROLOGY FOR AREAS "B" AND "D" AREA "B"- WETLANDS	Date: 11/07/02 Sheet:

Drainage Map Area No	Area Acres	Runoff	100% Ae	Flow Routing Surface Flow N	S	E	W	Storm Drain	ISO	Freq. Fact.	Dist. Fact.	Amen 1hr RFR	Fro	BPRR	Frict. Slope (S)	K= Q/S^.5	Size	Area [sf]	Vel. [ft/s]	L [ft]	tc or tcx [min]	Storm Drain Station	Location	Remarks	
SOUTH WETLAND																									37
	68.9	A	66.0																			<- Areas B-420, B-422, B-428, B-430 & B-432			38
SW-110	68.9	ΣA q Q	66.0 3.26 215						1.33	1.00	1.000	1.33	1.30	2.51							10.0			South Wetland & Bluffs	39
	50.6		45.9																			<- East Wetland South			40
	107.4		95.1																			<- Falmouth SD			41
	18.2		16																			<- Sinaloa SD			42
Σ SW-110	245.1	ΣA q Q	223.0 3.2 713						1.33	1.00	1.000	1.33	1.30	2.46							**** 10.5	South Wetland East Wetland South Falmouth SD Sinaloa SD tcx=	10.0 min 8.5 min 12.2 min 9.6 min 10.5 min	215.0 cfs 161.0 cfs 284.6 cfs 53.1 cfs	43
		A																							44
NW-110	245.1	ΣA q Q	223 3.20 713						1.33	1.00	1.000	1.33	1.30	2.46							10.5				45
																						-> North Wetland	@ Node	NW-110	46
																									47

HYDROLOGY STUDY FOR THE VILLAGE AT PLAYA VISTA (PROPOSED PROJECT) AND BALLONA WETLANDS - WETLANDS

TABLED BY CHECKED BY SUPERVISED BY			GMV	CITY OF LOS ANGELES Department of Public Works Bureau of Engineering					STORM DRAIN DESIGN **RUNOFF TABLING SHEET** Frequency 50 Year						Project: 1PCC0201.66 - PLAYA VISTA HYDROLOGY FOR AREAS "B" AND "D" AREA "B"- WETLANDS								Date: 11/07/02 Sheet:		
Drainage Map		Runoff		Flow Routing					ISO	Freq. Fact.	Dist. Fact.	Amen 1hr RFR	Fro	BPRR	Frict. Slope (S)	K= Q/S^.5	Size	Area [sf]	Vel. [ft/s]	L [ft]	tc or tcx [min]	Storm Drain Station	Location	Remarks	
Area No	Area Acres		100% Ae	Surface Flow N	S	E	W	Storm Drain																	
NORTH WETLAND																									48
	122.3	A	122.3																						
	122.3	ΣA	122.3																			<- Areas B-410 & B-412			49
NW-110		q	3.26						1.33	1.00	1.000	1.33	1.30	2.51							10.0		North Wetland & Playa del Rey		50
		Q	399																						
	245.1		223																			<- South Wetland			51
Σ NW-110	367.4	ΣA q Q	345.3 3.2 1110						1.33	1.00	1.000	1.33	1.30	2.48							···· 10.3	North Wetland South Wetland tcx=	10.0 min 10.5 min 10.3 min	399.0 cfs 713.0 cfs	52
		A																							53
	367.4	ΣA	345.3																						
Ballona-120		q	3.22						1.33	1.00	1.000	1.33	1.30	2.48							10.3				54
		Q	1110																						
																						-> Ballona Creek Channel	@ Node	Ballona-120	55
																									56

HYDROLOGY STUDY FOR THE VILLAGE AT PLAYA VISTA (PROPOSED PROJECT) AND BALLONA WETLANDS - WETLANDS

Design Storm Frequency:			50	year												
Node #	Area #	ISO	Soil Type		IMPERVIOUSNESS 100%	70%	60%	50%	40%	35%	15%	SUB AREA	EQUIV AREA	TOTAL AREA	TOTAL Ae	COMMENTS
FRESHWATER MARSH																
	B-244	1.33	1	dA:		8.26						8.3	7.4			Bluff
	B-246	1.33	1	dA:		3.38						3.4	3.0			Bluff
	B-240	1.33	1	dA:	6.64							6.6	6.6			Freshwater Marsh
FWM-140												18.3	17.0	18.3	17.0	
	D-110			dA:								485.1	432.0			<- Riparian Corridor
	B-242			dA:								86.5	71.6			<- Lincoln SD South
Σ	D-240			dA:								18.3	17.0			<- Freshwater Marsh
FWM-140												589.9	520.6	589.9	520.6	
	B-230	1.33	1	dA:	7.11							7.1	7.1			Freshwater Marsh
FWM-130												7.1	7.1	597.0	527.7	
	D-410			dA:								172.7	171.3			<- Central SD @ CD-110
Σ	D-230			dA:								597.0	527.7			<- Freshwater Marsh
FWM-130												769.7	699.0	769.7	699.0	
	B-220	1.33	1	dA:	9.75							9.8	9.8			Freshwater Marsh
FWM-120												9.8	9.8	779.5	708.8	
	D-710			dA:								271.2	241.3			<- Jefferson SD @ JD-155
Σ	D-220	1.33		dA:								779.5	708.8			<- Freshwater Marsh
FWM-120												1050.7	950.1	1050.7	950.1	
	B-210	1.33	1	dA:	8.23							8.2	8.2			Freshwater Marsh
FWM-110												8.2	8.2	1058.9	958.3	-> Ballona Creek Channel @ Ballona-140
EAST WETLAND NORTH AND FORMER RESIDENTIAL AREA B																
	B-320	1.33	1	dA:	60.24							60.2	60.2			East Wetland North
EW-110												60.2	60.2	60.2	60.2	
	B-312	1.33	1	dA:	4.14							4.1	4.1			Culver Boulevard
	B-310	1.33	1	dA:	16.23							16.2	16.2			Former Residential Area B
BB-110												20.3	20.3	80.5	80.5	-> Ballona Creek Channel @ Ballona-130

Design Storm Frequency:					50	year										
Node #	Area #	ISO	Soil Type		IMPERVIOUSNESS 100%	70%	60%	50%	40%	35%	15%	SUB AREA	EQUIV AREA	TOTAL AREA	TOTAL Ae	COMMENTS
EAST WETLAND SOUTH																
	B-338	1.33	1	dA:		2.28						2.3	2.0			Bluff
	B-336	1.33	1	dA:		1.62						1.8	1.4			Bluff
	B-332	1.33	1	dA:		4.37						4.4	3.9			Bluff
	B-330	1.33	1	dA:	17.60			10.95				28.6	26.5			East Wetland South
EW-310												36.9	33.8	36.9	33.8	
	B-330			dA:								36.9	33.8			<- East Wetland South & Bluffs
Σ	B-334	1.33		dA:								13.7	12.1			<- Hasting SD
EW-310												50.6	45.9	50.6	45.9	-> South Wetland

HYDROLOGY STUDY FOR THE VILLAGE AT PLAYA VISTA (PROPOSED PROJECT) AND BALLONA WETLANDS - WETLANDS

Design Storm Frequency:			50	year												
Node #	Area #	ISO	Soil Type		IMPERVIOUSNESS 100%	70%	60%	50%	40%	35%	15%	SUB AREA	EQUIV AREA	TOTAL AREA	TOTAL Ae	COMMENTS
SOUTH WETLAND																
	B-432	1.33	1	dA:		4.21						4.2	3.8			
	B-430	1.33	1	dA:		1.39						1.4	1.2			
	B-428	1.33	1	dA:		4.98						5.0	4.4			
	B-422	1.33	1	dA:		5.61						5.6	5.0			
	B-420	1.33	1	dA:	46.47	1.25		4.95				52.7	51.6			South Wetland
SW-110												68.9	66.0	68.9	66.0	
				dA:								50.6	45.9			<- East Wetland South
				dA:								68.9	66.0			<- Bluffs & South Wetland
				dA:								107.4	95.1			<- Falmouth SD
Σ				dA:								18.2	16.0			<- Sinaloa SD
SW-110												245.1	223.0	245.1	223.0	-> North Wetland
NORTH WETLAND																
	B-412	1.33	1	dA:	10.08							10.1	10.1			Playa del Rey
	B-410	1.33	1	dA:	112.23							112.2	112.2			North Wetland
NW-110												122.3	122.3	122.3	122.3	
				dA:								245.1	223.0			<- South Wetland
Σ				dA:								122.3	122.3			<- North Wetland & Playa del Rey
NW-110												367.4	345.3	367.4	345.3	-> Ballona Creek Channel @ Ballona-120

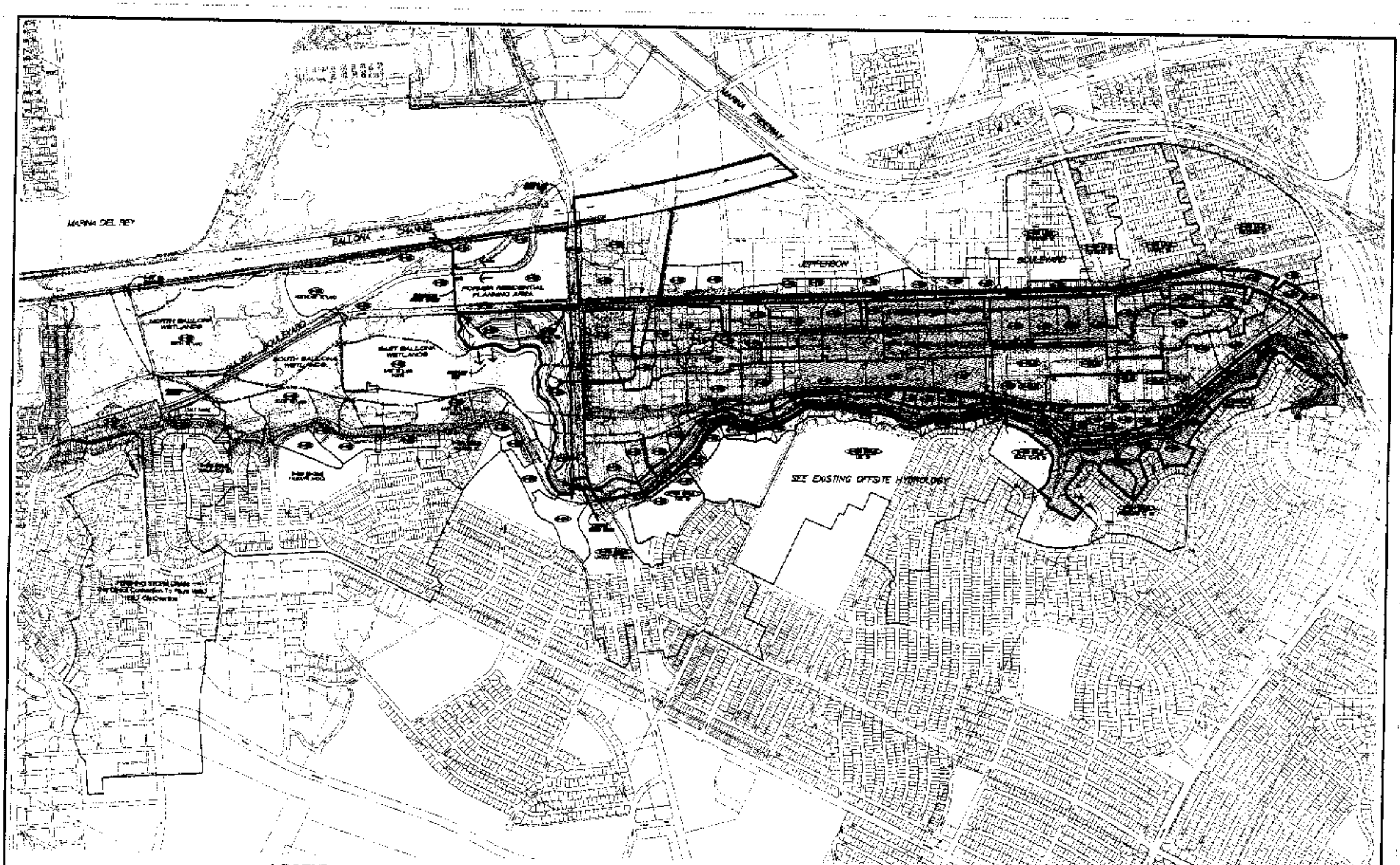
Design Storm Frequency:				50	year										
Node #	Area #	ISO	Soil Type	100%	IMPERVIOUSNESS 70%	60%	50%	40%	35%	15%	SUB AREA	EQUIV AREA	TOTAL AREA	TOTAL Ae	COMMENTS
PLAYA VISTA TRIBUTARY AREAS SOUTH OF BALLONA CREEK CHANNEL TOTAL															
	B-210		dA:								1058.9	958.3			<- Freshwater Marsh
	B-310		dA:								80.5	80.5			<- Former Residential Area B
	B-410		dA:								367.4	345.3			<- North Wetland
											1506.8	*1384.1*	1506.8	1384.1	-> Ballona Creek Channel

Project Name:	PLAYA VISTA HYDROLOGY FOR AREAS "B" AND "D"
Project Number:	1PCC0201.66
Tabled By:	GMV
Checked By:	
Date:	11/7/2002
Drainage System:	Wetlands
Area Number:	B-244
Node Number:	FWM-140
Runoff Tabling Sheet:	
Conveyor:	Gutter
Development Type:	Bluff
Development Class:	50-2
Elevation Difference:	85 ft
Length of Reach:	850 ft
Average Slope:	10.00%
Method of Computation:	Figure G242.2C
ISO:	1.33
Fro:	1.30
tc(700):	4.8 min
TIME OF CONCENTRATION (tc):	5.3 min

Reference Number	Title	Prepared By	Date	Revision Date	Psomas Job Number
[1]	Hydrology Report for Playa Vista Developments, Los Angeles, California, Supplement to the Environmental Impact Report	Psomas and Associates [Gabor M. Vasarhelyi]	August 14, 1990	August 13, 1992	1MTP0104.10
[2]	Playa Vista Hydrology Study, Volume I, Off-site Hydrology	Psomas and Associates [Gabor M. Vasarhelyi]	August 28, 1987		1HUG0618
[3]	Hydrology Report for Tract 49104 of the Playa Vista Developments, Los Angeles, California,	Psomas and Associates	Spetember 1998		

REFERENCE REPORTS

DRAINAGE SYSTEM	Off-site Area Number	Drainage Area	Equivalent Area	Time of Concent-ration	Design Runoff	Ref. No.	Reference Page	Adjusted Drainage Area	Adjusted Equivalent Area	Time of Concent-ration	Adjusted Design Runoff	On-site Node Number
		A [ac]	Ae [ac]	tc [min]	Q50-year [cfs]			A [ac]	Ae [ac]	tc [min]	Q50-year [cfs]	
Tract 43416 (UCLA Tract)	C1.0	10.8 ac	9.5 ac	8.1 min	34.0 cfs	[1]	Runoff Table - C.1.0 - Tract 43416, Table 3.1.1-1a - Page 1, Line 11	10.5 ac	9.2 ac	8.1 min	32.9 cfs	RC-380
Firebrand Street Storm Drain	C4.2	32.1 ac	28.1 ac	13.5 min	80.4 cfs	[1]	Runoff Table - C.4.2 - Offsite Area, Table 3.1.1-2a, Page 1, Line 8	32.2 ac	28.2 ac	13.5 min	80.7 cfs	RC-314
Tract 43415	C6.0	30.5 ac	24.9 ac	7.4 min	92.6 cfs	[1]	Runoff Table - Line D1P-128, Table 5.1.1-1a - Page 12, Line 217	30.0 ac	24.5 ac	7.4 min	91.1 cfs	RC-280
LMU Storm Drain	C10.0	124.5 ac	117.2 ac	10.2 min	378.0 cfs	[2]	2.1 Runoff Tabling, Page 2.1.8, Line 22	116.9 ac	110.0 ac	10.2 min	354.8 cfs	RC-220
HAC Storm drain	C19.0	41.2 ac	40.9 ac	7.0 min	156.0 cfs	[1]	Runoff Table - C-19.0, Table 3.1.1-5a - Page 2, Line 24	40.3 ac	40.0 ac	7.0 min	152.6 cfs	RC-120
Lincoln Storm Drain South	C20.0	85.4 ac	70.7 ac	12.5 min	209.0 cfs	[2]	2.1 Runoff Tabling, Page 2.1.15.1, Line 24	86.5 ac	71.6 ac	12.5 min	211.7 cfs	FWM-140
Hastings Avenue Storm Drain	C25.0	14.3 ac	12.6 ac	5.3 min	54.4 cfs	[2]	2.1 Runoff Tabling, Page 2.1.18 Line 22	13.7 ac	12.1 ac	5.3 min	52.2 cfs	EW-310
Falmouth Avenue	C30.0	106.0 ac	93.9 ac	12.2 min	281.0 cfs	[2]	2.1 Runoff Tabling, Page 2.1.22 Line 18	107.4 ac	95.1 ac	12.2 min	284.6 cfs	SW-110
Sinaloa Road Storm Drain	C31.0	17.9 ac	15.7 ac	9.6 min	52.1 cfs	[2]	2.1 Runoff Tabling, Page 2.1.23 Line 14	18.2 ac	16.0 ac	9.6 min	53.1 cfs	SW-110
Inglewood Boulevard Storm Drain	J-4.0	50.9 ac	40.4 ac	19.4 min	98.7 cfs	[2]	2.1 Runoff Tabling, Page 2.1.26, Line 16	51.8 ac	41.1 ac	19.4 min	100.4 cfs	JD-320
Randall Street Storm Drain	J-6.0	44.6 ac	33.6 ac	27.0 min	71.2 cfs	[2]	2.1 Runoff Tabling, Page 2.1.28, Line 20	42.1 ac	31.7 ac	27.0 min	67.2 cfs	JD-310
Centinela Avenue Storm Drain	J-7.0	19.8 ac	18.5 ac	20.4 min	44.2 cfs	[2]	2.1 Runoff Tabling, Page 2.1.29, Line 6	18.2 ac	17.0 ac	20.4 min	40.6 cfs	JD-300
Grosvenor Boulevard Storm Drain	J-8.0	34.5 ac	27.1 ac	19.5 min	66.1 cfs	[2]	2.1 Runoff Tabling, Page 2.1.29, Line 18	32.7 ac	25.7 ac	19.5 min	62.7 cfs	JD-290



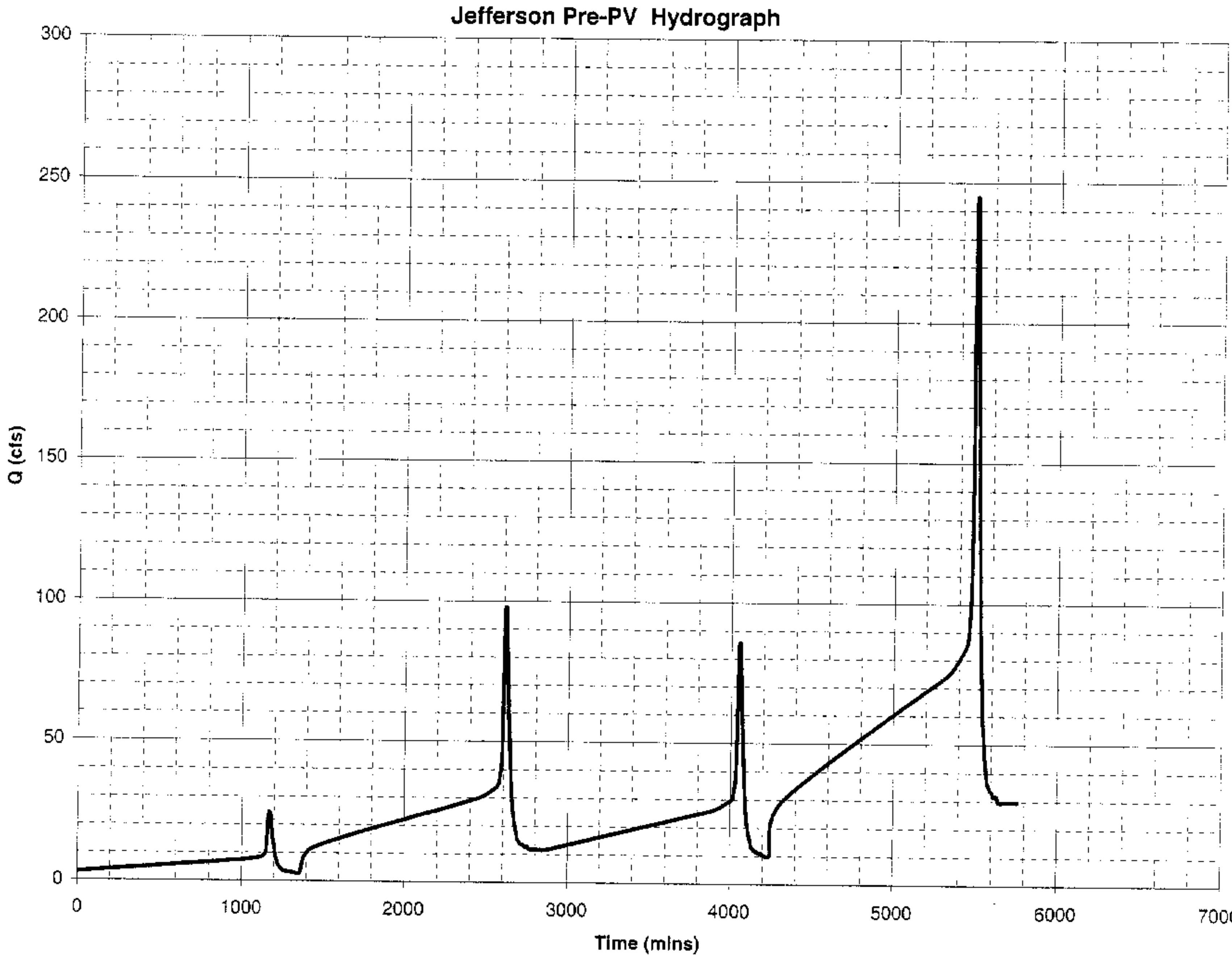
LEGEND:

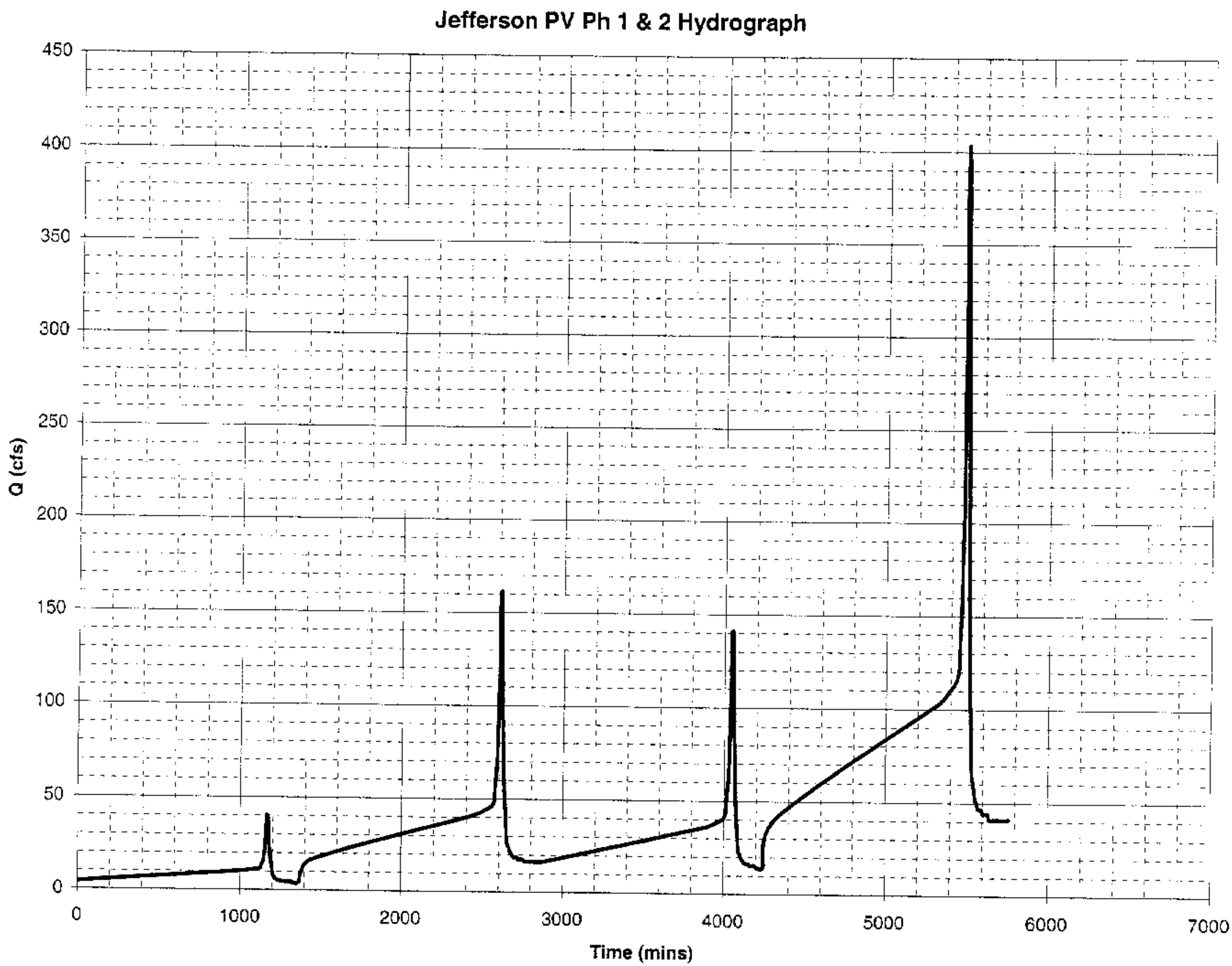
- PROJECT BOUNDARY
- WATERSHED BOUNDARY
- SUB AREA BOUNDARY
- OFF-SITE HYDROLOGY LIMITS
- STORM DRAIN LINE
- STORM DRAIN CHANNEL/DITCHES LINE
- NODE NUMBER
- PREVIOUSLY APPROVED FIRST PHASE PROJECT
- PROPOSED PROJECT

THE VILLAGE AT PLAYA VISTA
PROPOSED PROJECT
WATER RESOURCES REPORT – HYDROLOGY

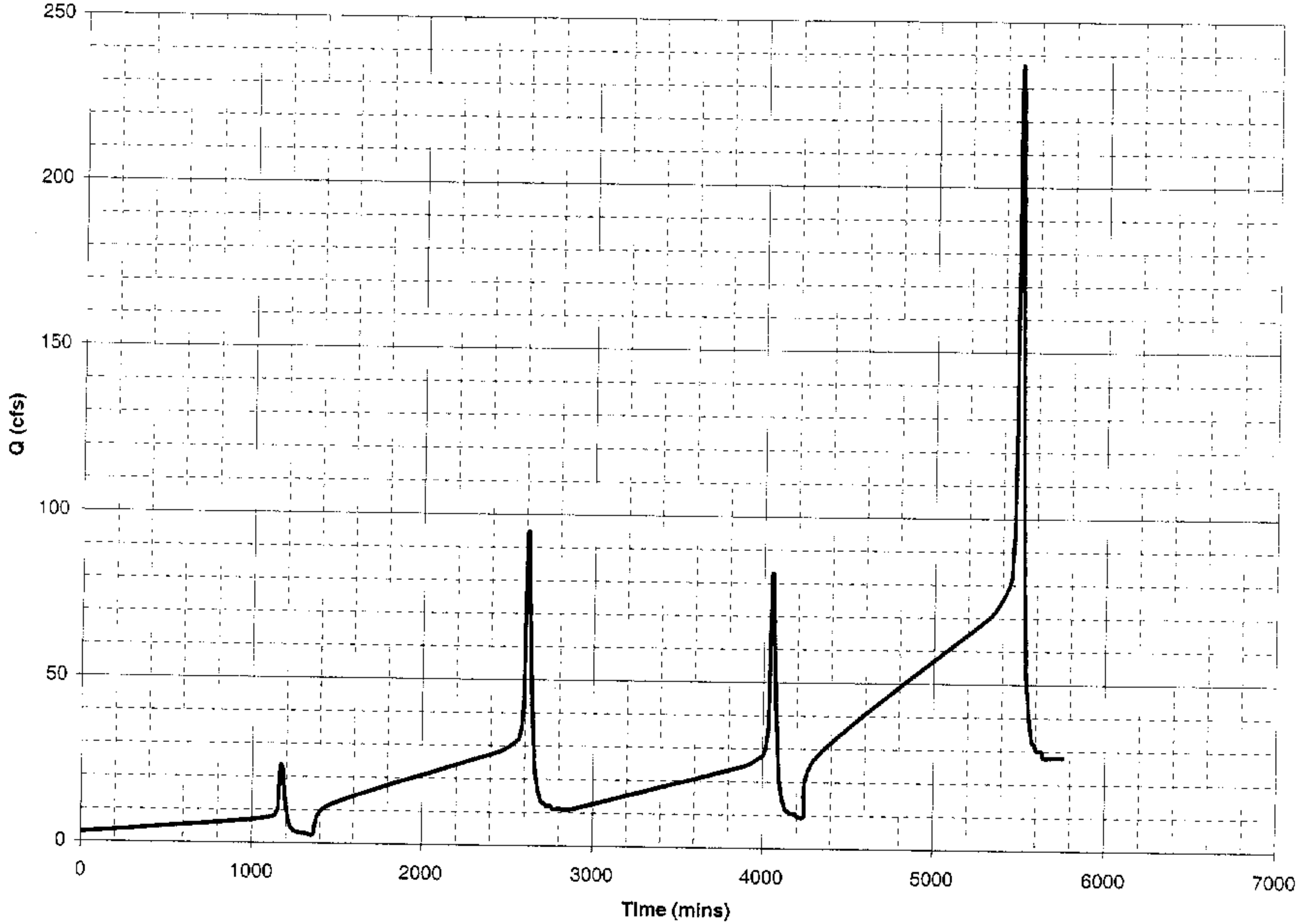
ONSITE HYDROLOGY STUDY FOR PLAYA VISTA SECOND PHASE

PSOMAS

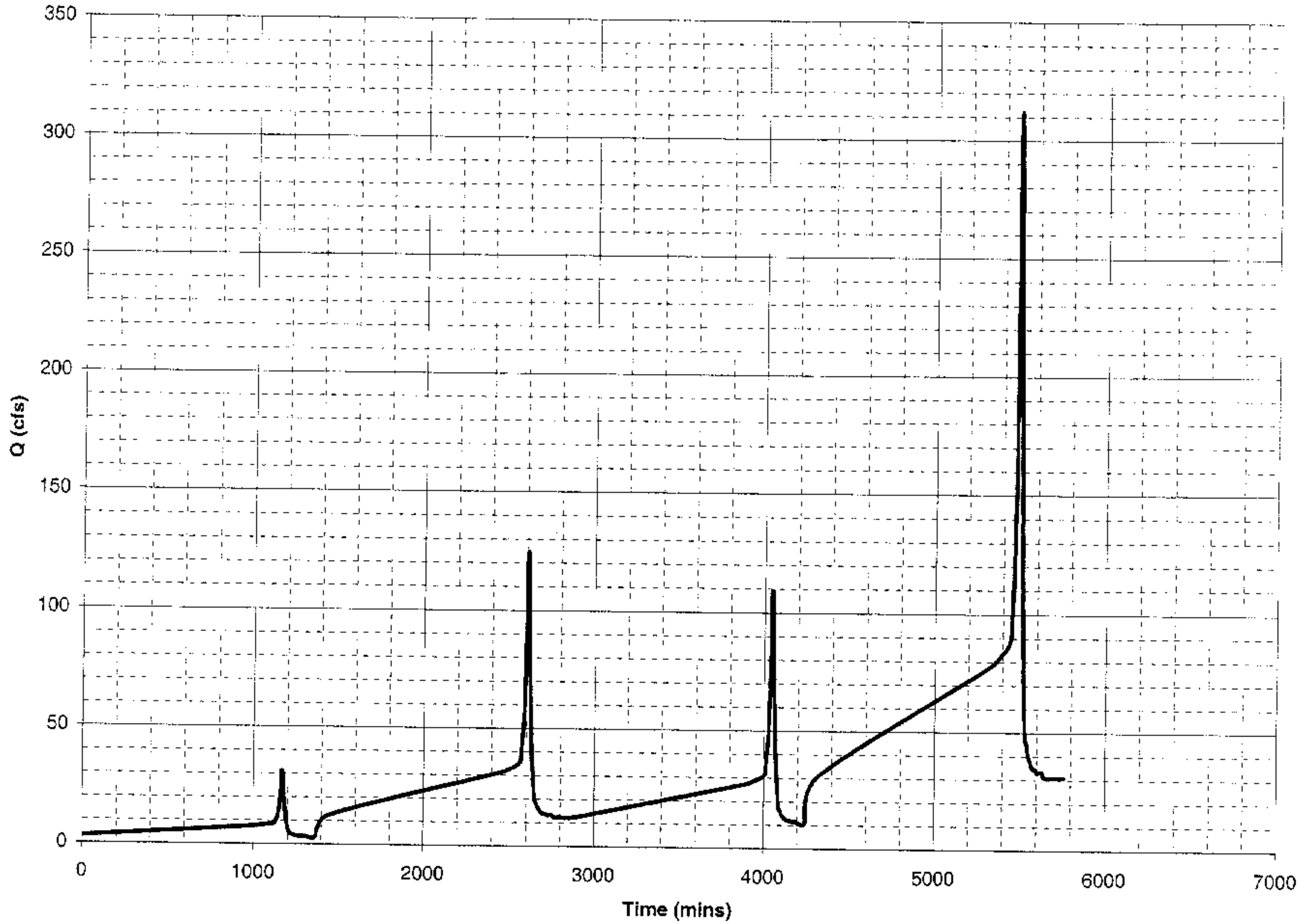

Jefferson Pre-PV Hydrograph
Q (cfs)
300
250
200
150
100
50
0
0
1000
2000
3000
4000
5000
6000
7000
Time (mins)


Jefferson PV Ph 1 & 2 Hydrograph
Q (cfs)
450
400
350
300
250
200
150
100
50
0
0
1000
2000
3000
4000
5000
6000
7000
Time (mins)

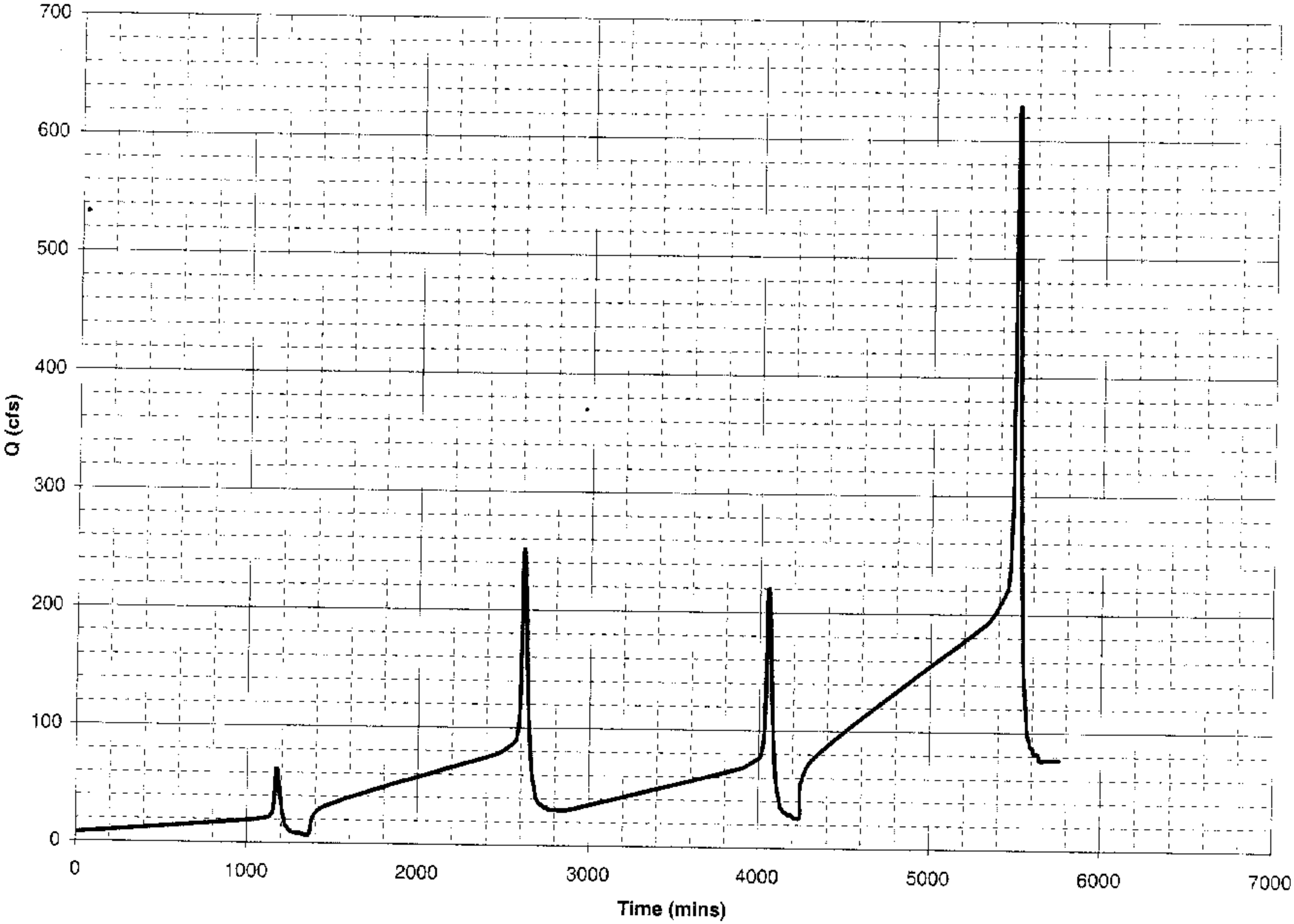
Central Drain Phase 1 Hydrograph



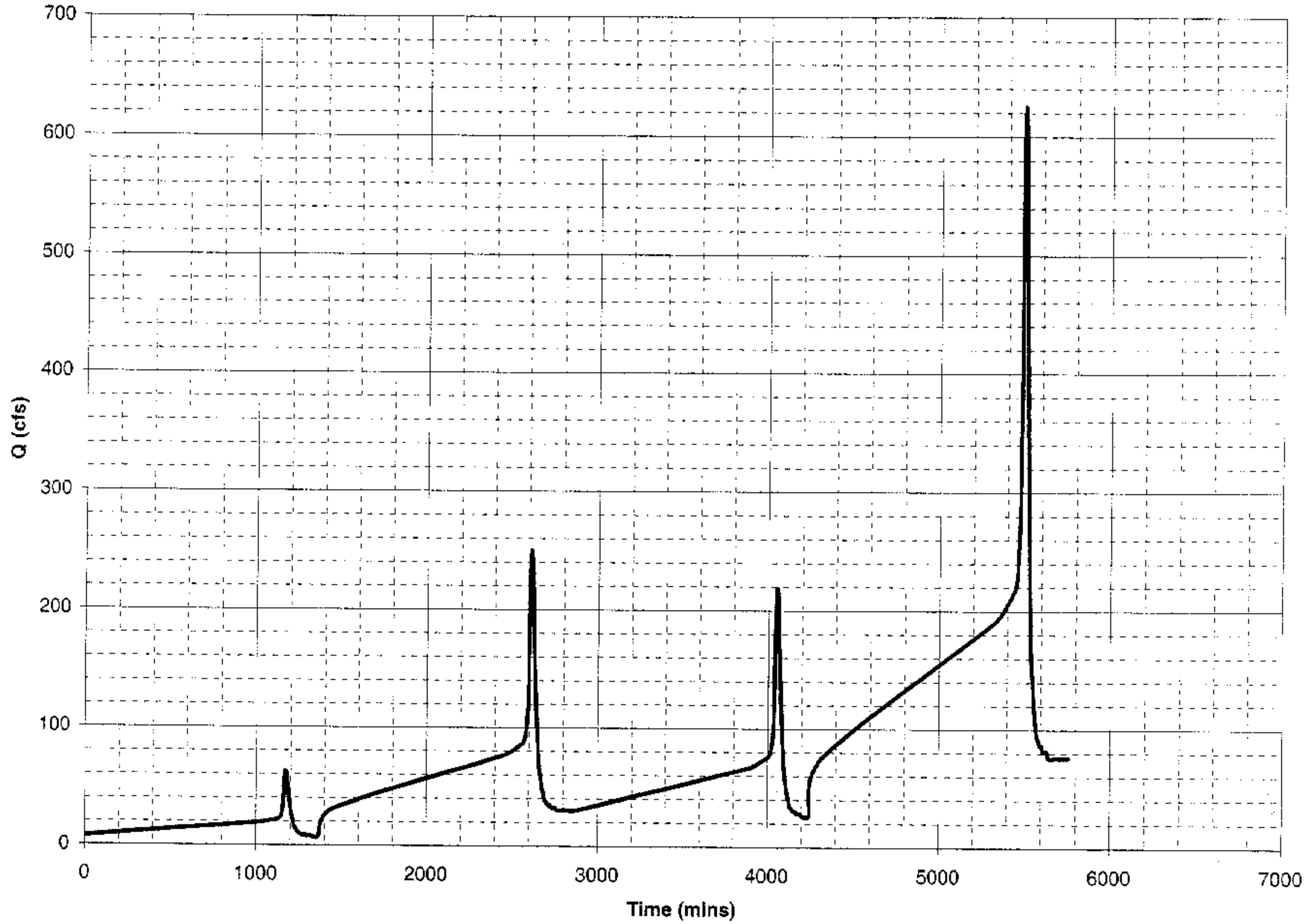
Central Drain Phase 2 Hydrograph



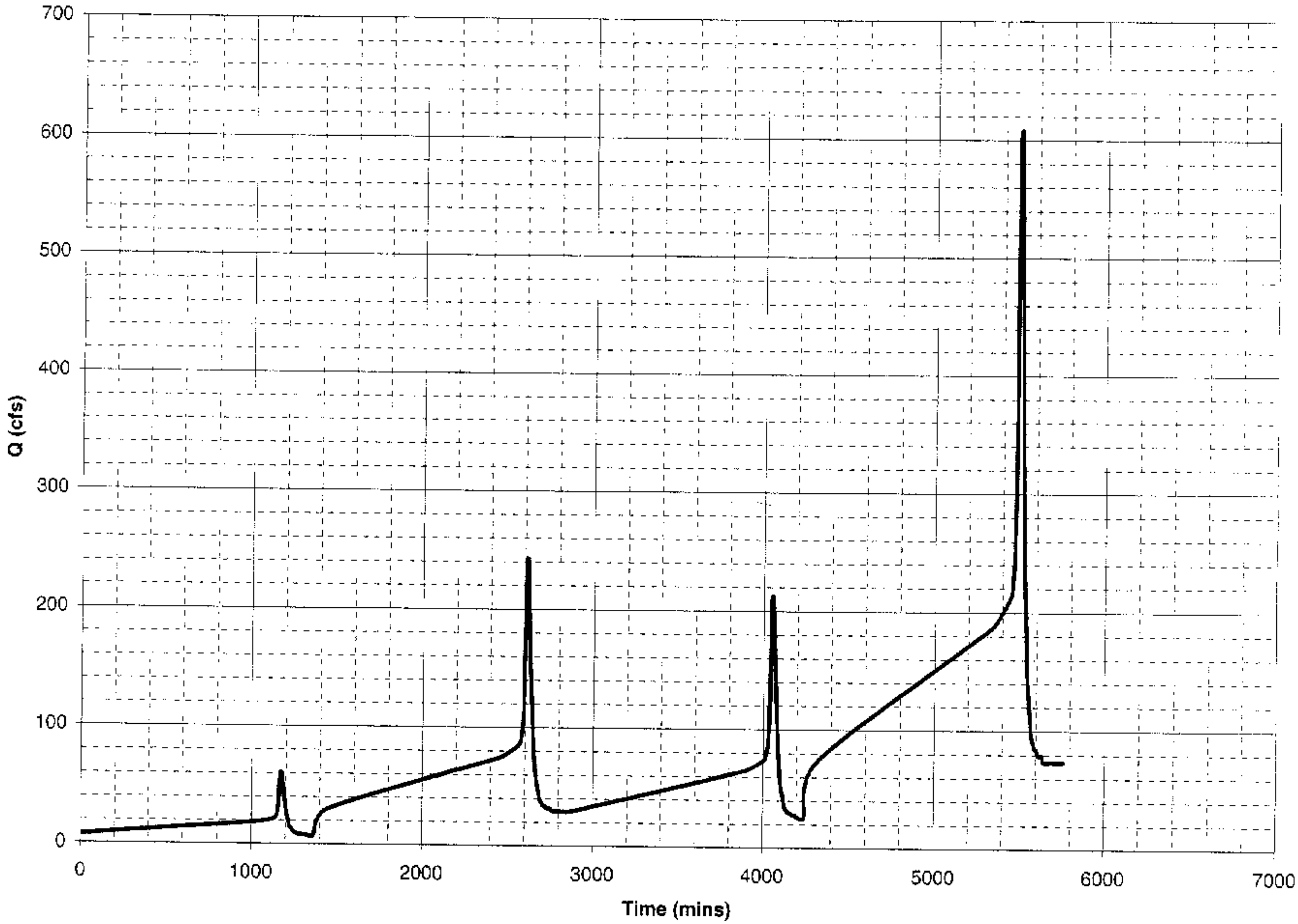
Centinela Ditch Pre-PV Hydrograph



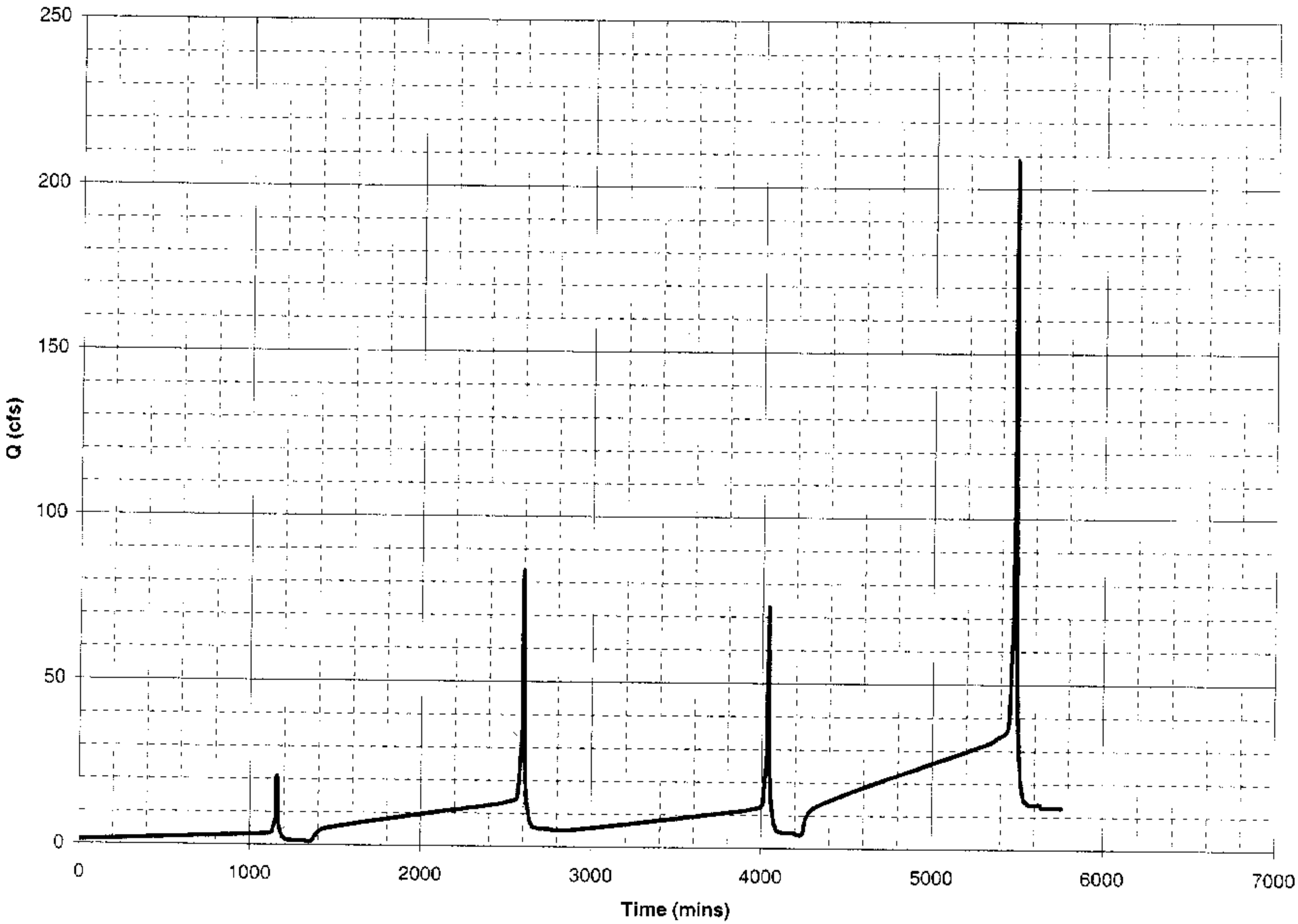
Riparian Phase 1 Hydrograph



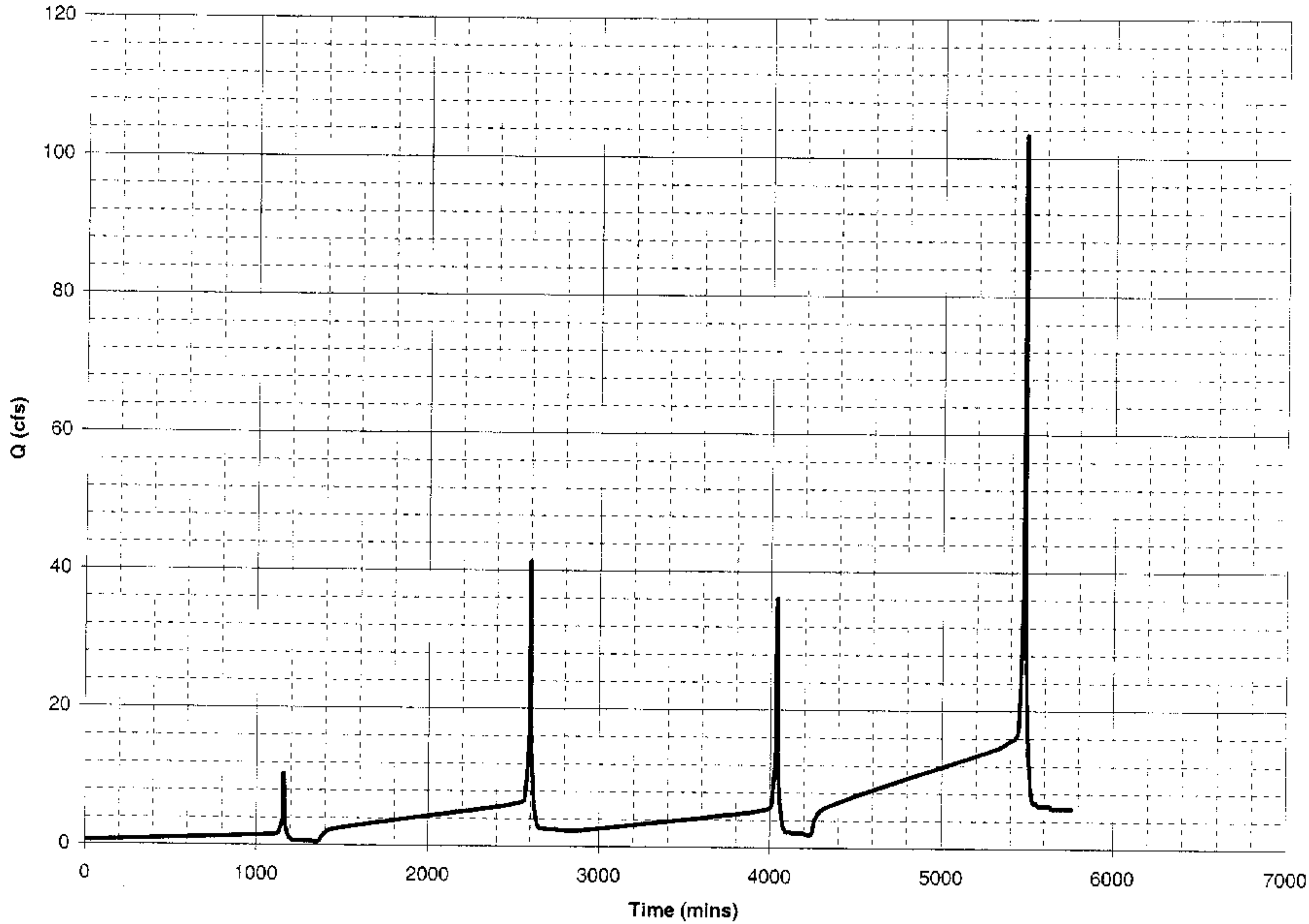
Riparian Phase 2 Hydrograph



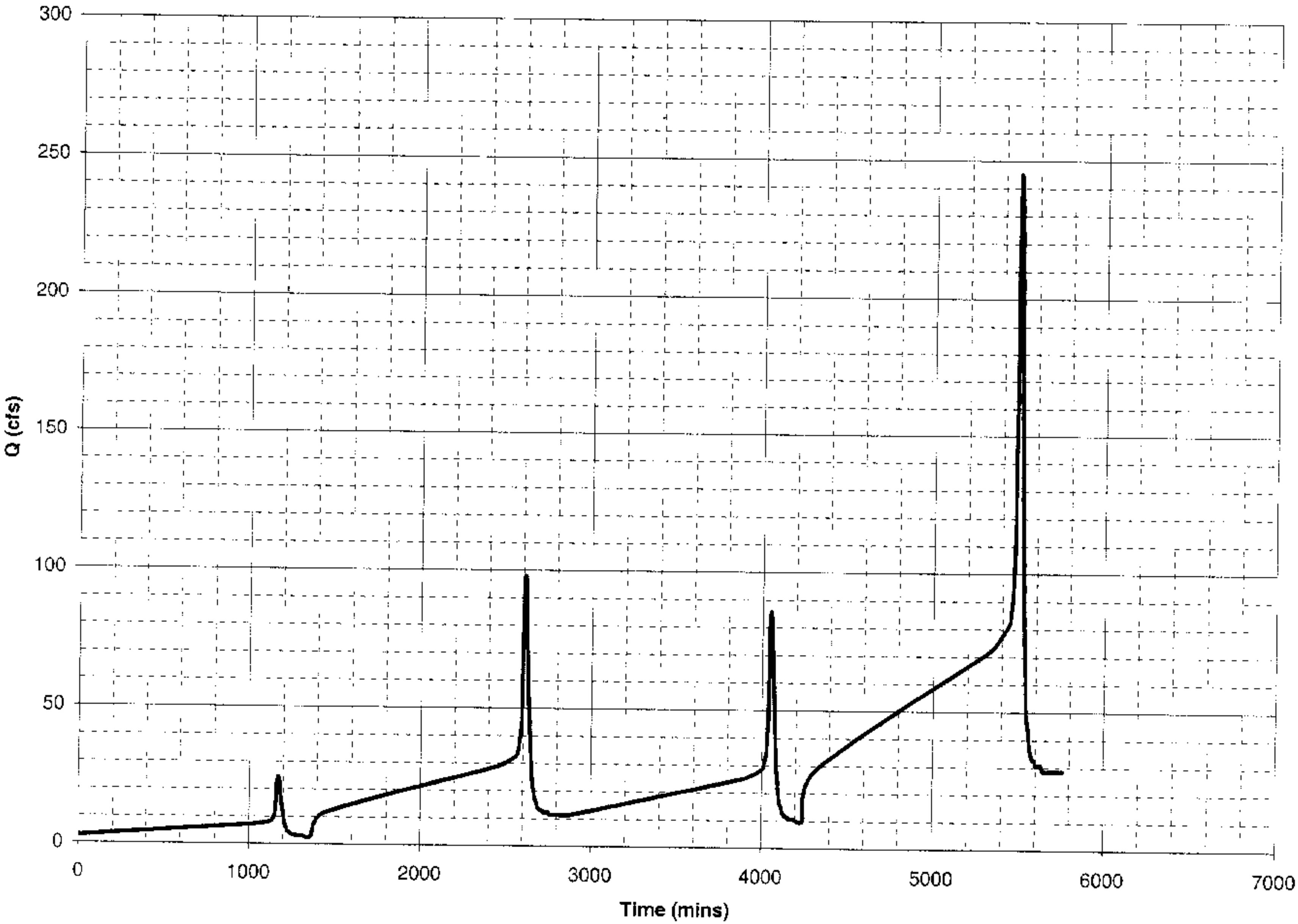
Lincoln Drain South Hydrograph



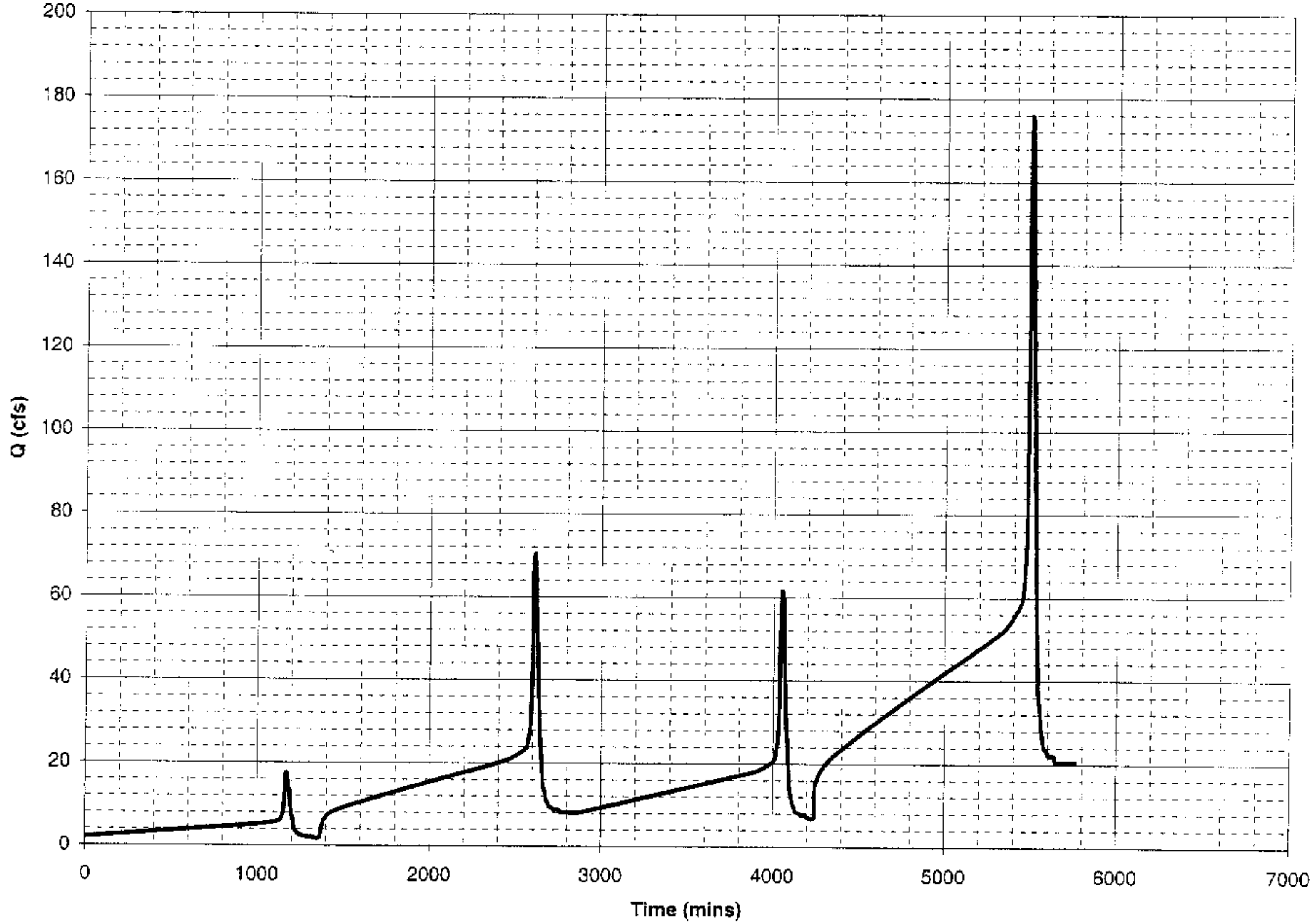
FWM Hydrograph



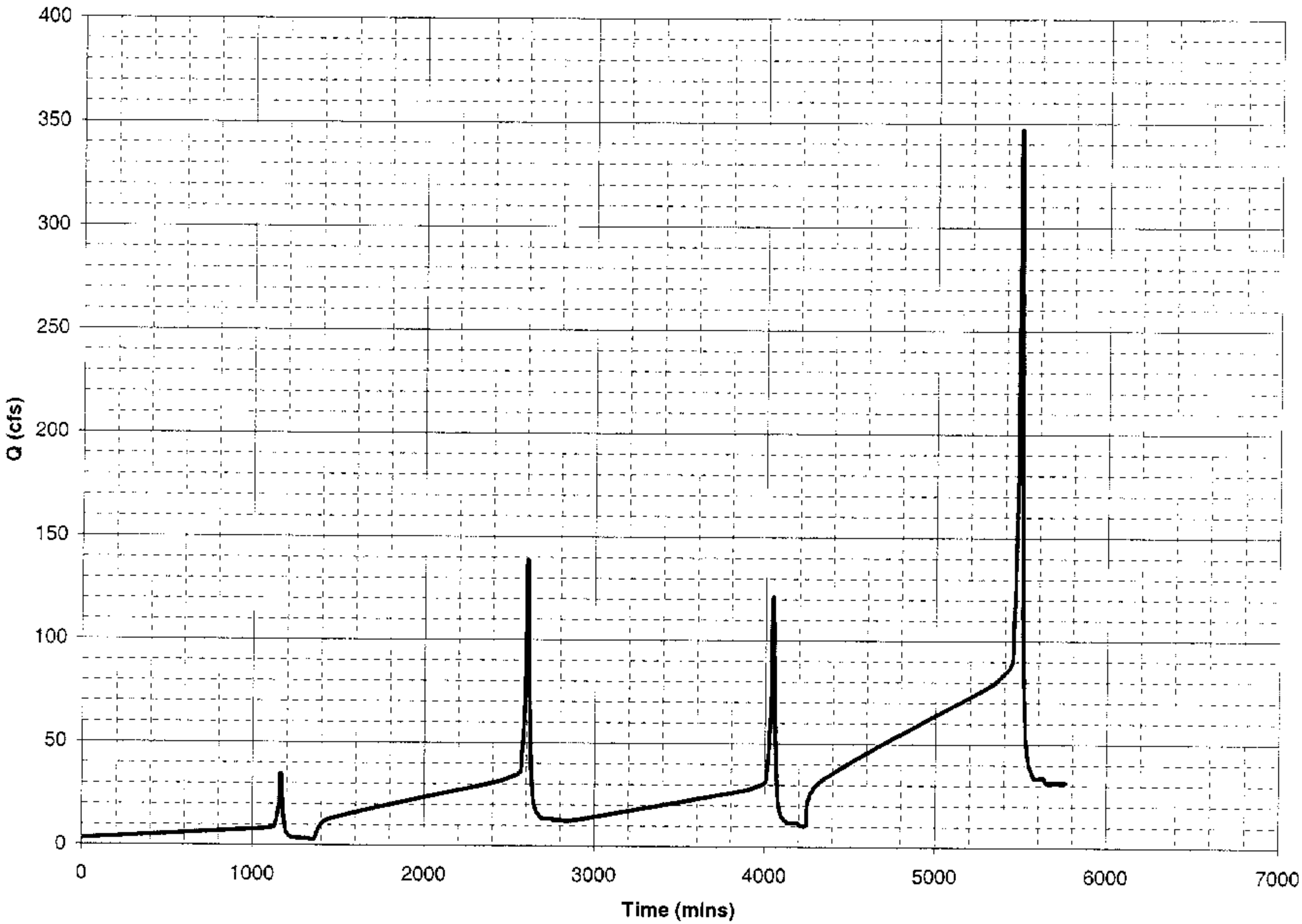
East WL Pre-PV Hydrograph



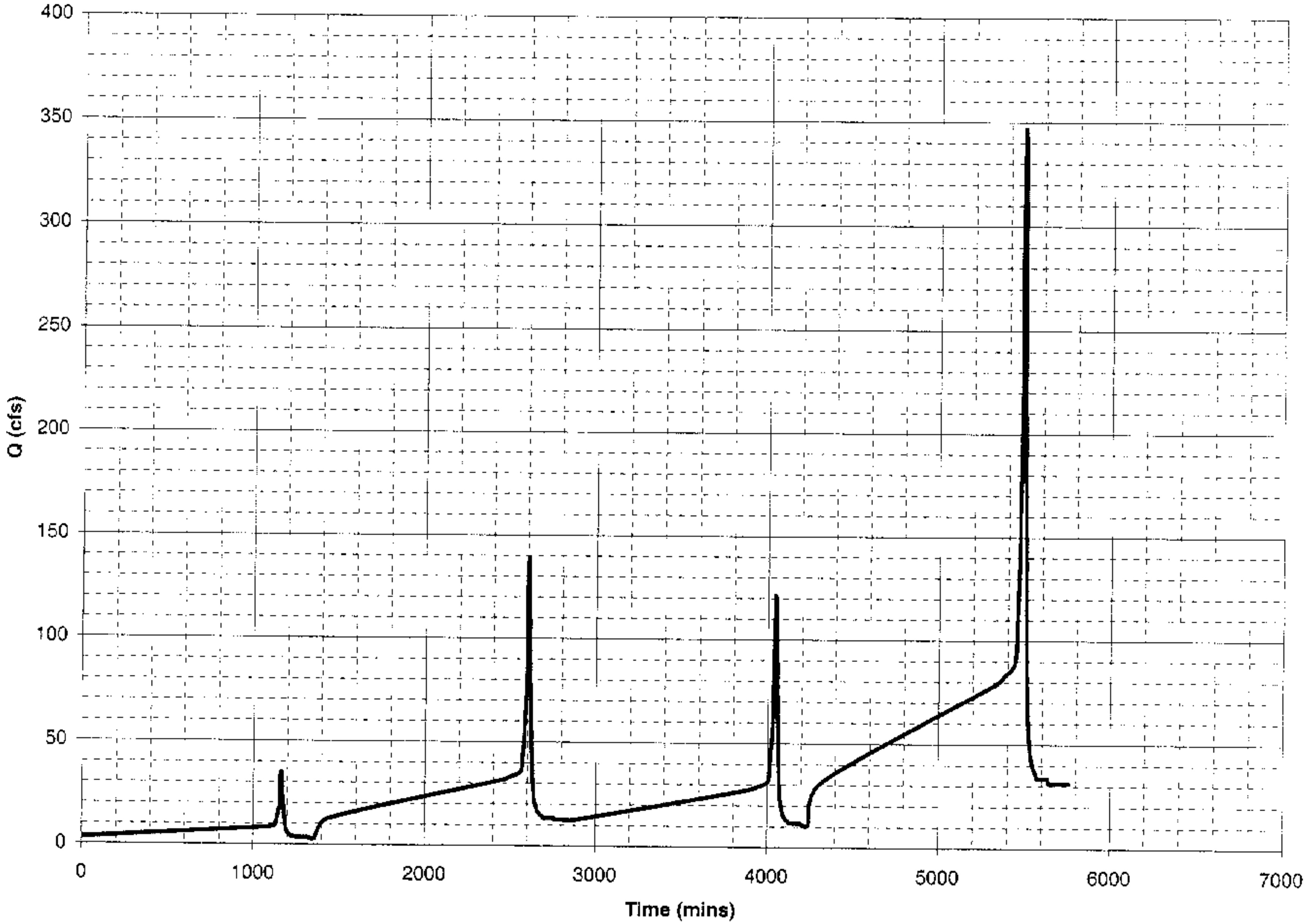
East WL Ph 1 & 2 Hydrograph



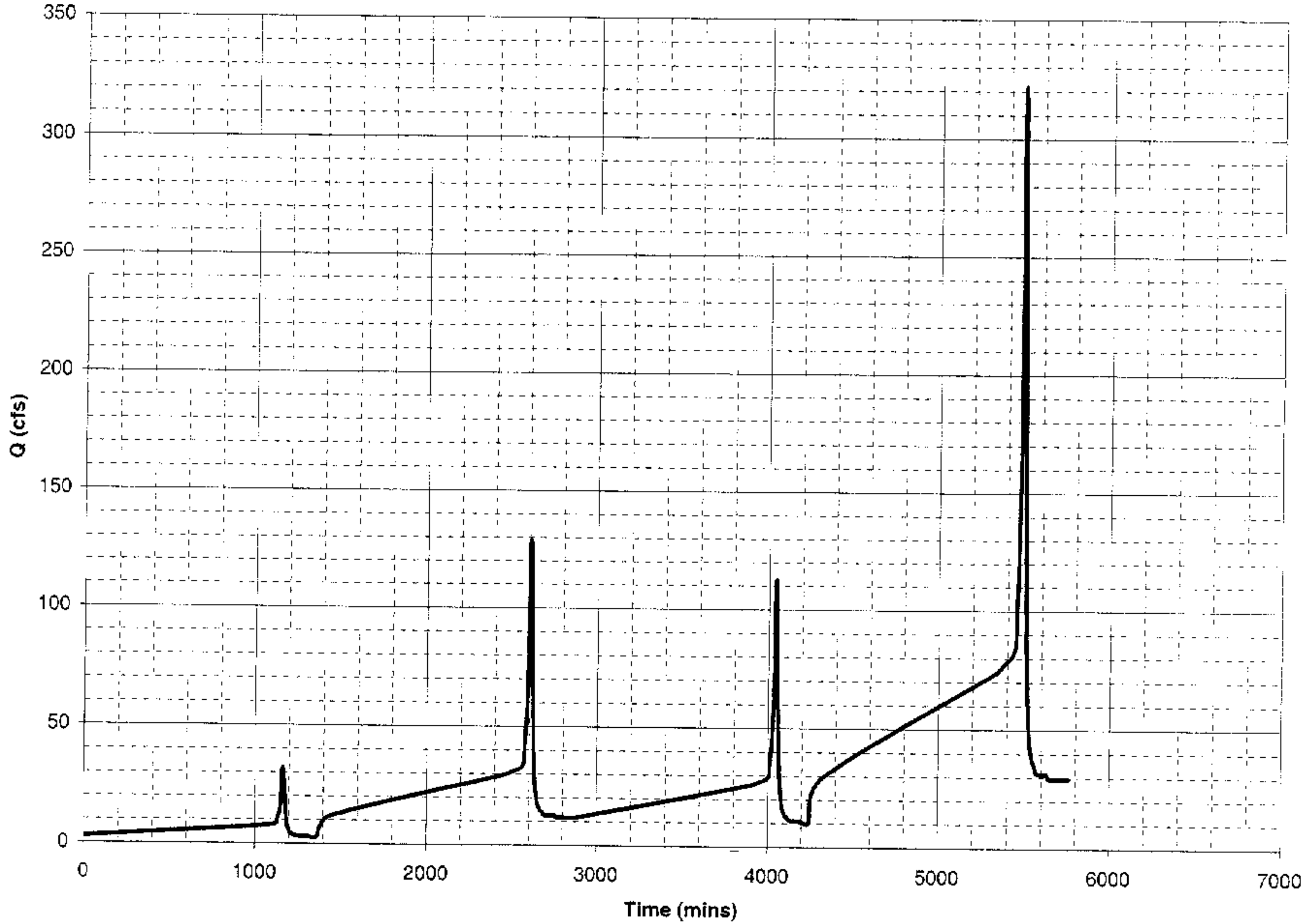
South WL Pre-PV Hydrograph



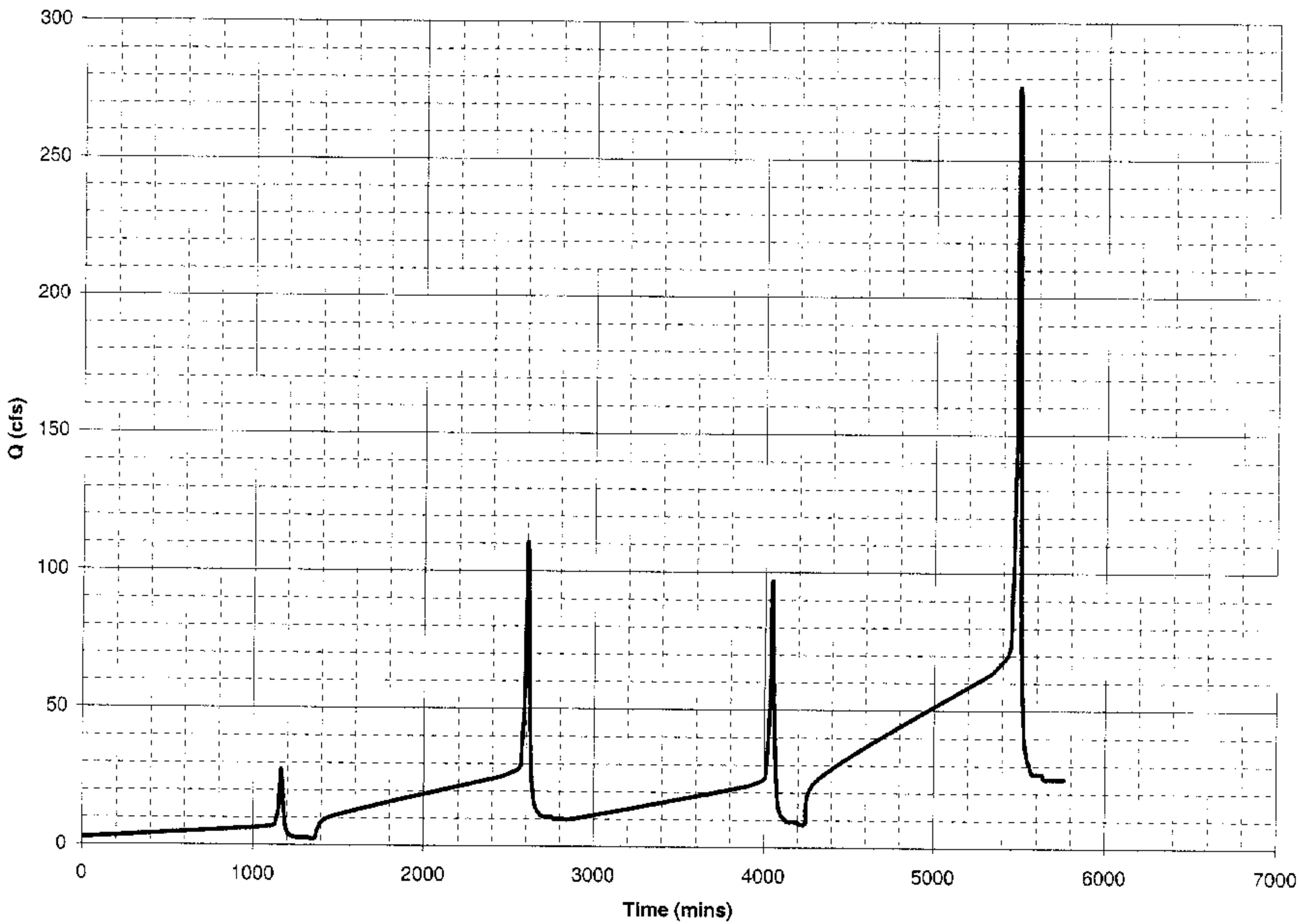
South WL Ph 1 & 2 Hydrograph



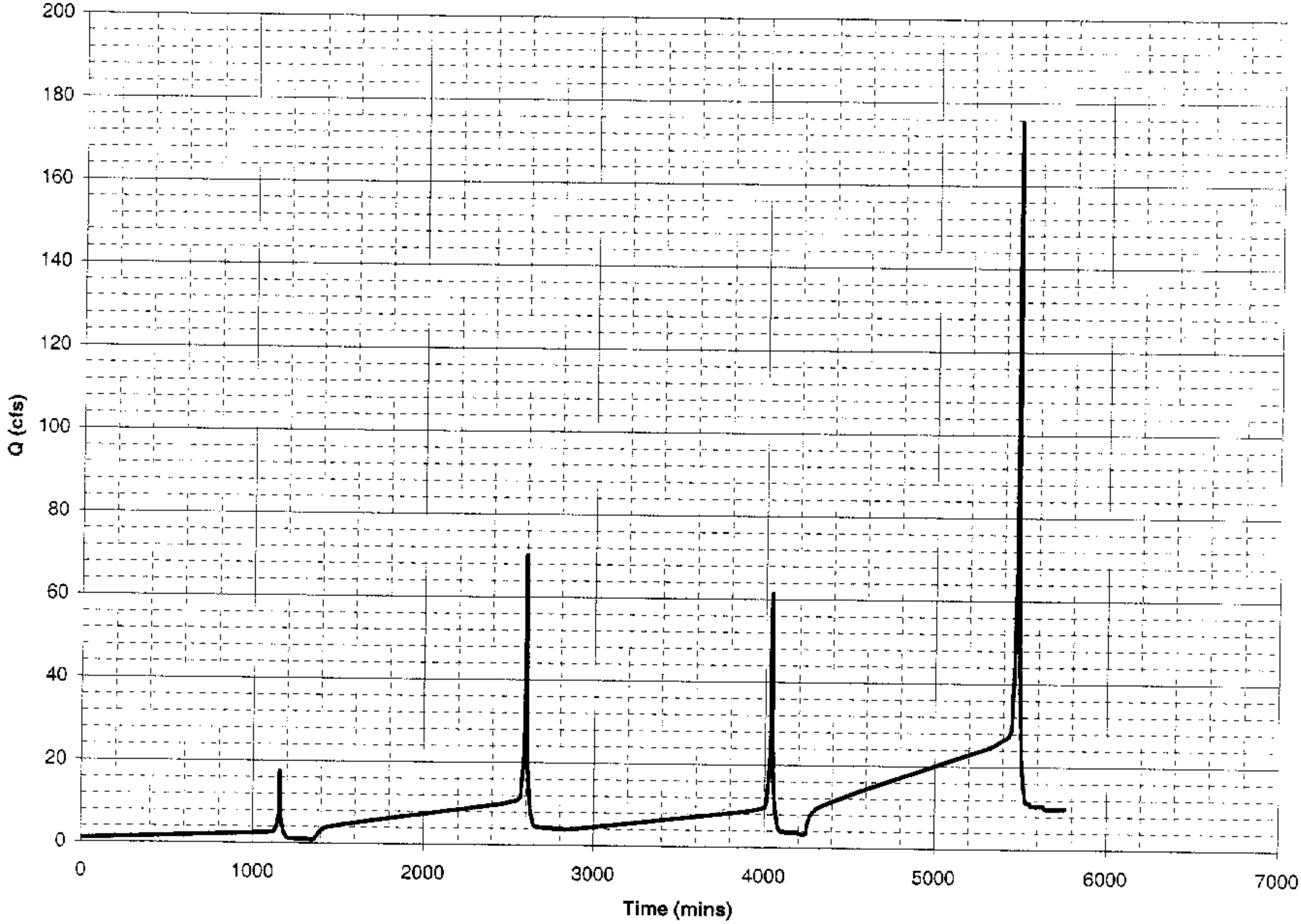
North WL Pre-PV Hydrograph



North WL Ph 1 & 2 Hydrograph



Former Res B Ph 1 & 2 WL Ph 1 & 2 Hydrograph



Jeff Dr - Pre PV @ Outlet

		A=	402.1	ac		Outlet West of Freshwater Marsh																			
		tc=	59.99	min		50 year - 4 day Storm																			
SS	SC	SPRR	1.15	1.0			Flow				Runoff					Percentage of Total Runoff									
1.19	1.15	Gp=	457	cfs	0.0cfs	CLOCK	1st Day	2nd Day	3rd Day	4th Day	1st Day	2nd Day	2nd Day	4th Day	1st Day	1st Day	2nd Day	2nd Day	2nd Day	3rd Day	3rd Day	3rd Day	4th Day	4th Day	4th Day
		TIME	BPRR	Q1	Q(by-pass)	TIME	Q (cfs)	Q (cfs)	Q (cfs)	Q (cfs)	V (af)	V (af)	V (af)	V (af)	V (af)	%	V (af)	ΣV (af)	%	V (af)	ΣV (af)	%	V (af)	ΣV (af)	%
0.14	0.14	-1062	0.14	55.6	55.6	0	5.6	22.3	22.3	55.6								22.2			107.6			196.1	
0.35	0.35	-60	0.35	139.1	139.1	1002	13.9	55.6	48.7	139.1	13.4	53.7	48.9	134.4	13.4	3.36%	53.7	75.0	19.02%	43.9	155.5	39.18%	134.4	320.5	80.23%
0.37	0.37	0	0.37	147.0	147.0	1062	14.7	58.8	51.5	147.0	14.6	58.5	53.1	146.2	14.6	3.56%	58.5	80.7	20.20%	53.1	160.7	40.22%	146.2	332.3	83.19%
0.40	0.40	60	0.40	158.9	158.9	1122	15.9	63.6	55.6	158.9	15.9	63.5	57.5	158.8	15.9	3.98%	63.5	85.8	21.47%	57.5	165.1	41.33%	158.8	344.9	86.35%
0.42	0.41	70	0.41	162.9	162.9	1132	16.3	65.2	57.0	162.9	16.1	64.4	58.3	161.0	16.1	4.03%	64.4	86.6	21.69%	58.0	165.9	41.52%	161.0	347.1	86.51%
0.46	0.44	80	0.44	174.9	174.9	1142	17.5	69.9	61.2	174.9	16.3	65.3	59.1	163.4	16.3	4.09%	65.3	87.6	21.93%	59.1	166.7	41.73%	163.4	349.5	87.49%
0.49	0.47	85	0.47	186.8	186.8	1147	18.7	74.7	65.4	186.8	16.5	65.8	59.5	164.6	16.5	4.12%	65.8	88.1	22.05%	59.5	167.1	41.83%	164.5	350.7	87.80%
0.53	0.50	88	0.50	198.7	198.7	1150	19.9	79.5	69.5	198.7	16.5	66.2	59.8	165.4	16.5	4.14%	66.2	88.4	22.13%	59.8	167.4	41.90%	165.4	351.5	88.00%
0.56	0.52	90	0.52	206.7	206.7	1152	20.7	82.7	72.3	206.7	16.6	66.4	60.0	166.0	16.6	4.16%	66.4	88.6	22.19%	60.0	167.6	41.95%	166.0	352.1	88.14%
0.59	0.53	91	0.53	210.7	210.7	1153	21.1	84.3	73.7	210.7	16.6	66.5	60.1	166.3	16.6	4.16%	66.5	88.7	22.22%	60.1	167.7	41.98%	166.3	352.4	88.21%
0.62	0.55	92	0.55	218.6	218.6	1154	21.9	87.4	76.5	218.6	16.7	66.6	60.2	166.6	16.7	4.17%	66.6	88.9	22.24%	60.2	167.9	42.00%	166.6	352.7	88.29%
0.66	0.58	93	0.58	230.5	230.5	1155	23.1	92.2	80.7	230.5	16.7	66.7	60.3	166.9	16.7	4.18%	66.7	89.0	22.29%	60.3	167.9	42.03%	166.9	353.0	88.37%
0.71	0.61	94	0.61	242.5	242.5	1156	24.2	97.0	84.9	242.5	16.7	66.9	60.4	167.2	16.7	4.19%	66.9	89.1	22.31%	60.4	168.0	42.05%	167.2	353.3	88.45%
0.76	0.65	95	0.65	258.4	258.4	1157	25.8	103.3	90.4	258.4	16.8	67.0	60.6	167.5	16.8	4.19%	67.0	89.2	22.34%	60.6	168.1	42.09%	167.5	353.6	88.52%
0.81	0.70	96	0.70	278.2	278.2	1158	27.8	111.3	97.4	278.2	16.8	67.2	60.7	167.9	16.8	4.20%	67.2	89.4	22.38%	60.7	168.3	42.12%	167.9	354.0	88.63%
0.87	0.76	97	0.76	302.1	302.1	1159	30.2	120.8	105.7	302.1	16.8	67.3	60.8	168.3	16.8	4.21%	67.3	89.6	22.42%	60.8	168.4	42.16%	168.3	354.4	88.73%
0.94	0.84	98	0.84	333.9	333.9	1160	33.4	133.5	116.9	333.9	16.9	67.5	61.0	168.7	16.9	4.22%	67.5	89.7	22.46%	61.0	168.5	42.20%	168.7	354.8	88.84%
1.02	0.92	99	0.92	365.7	365.7	1161	36.6	146.3	128.0	365.7	16.9	67.7	61.1	169.2	16.9	4.24%	67.7	89.9	22.51%	61.1	168.7	42.24%	169.2	355.3	88.96%
1.09	1.01	100	1.01	401.4	401.4	1162	40.1	160.6	140.5	401.4	17.0	67.9	61.3	169.8	17.0	4.25%	67.9	90.1	22.56%	61.3	168.9	42.28%	169.8	355.9	89.09%
1.12	1.06	101	1.06	421.3	421.3	1163	42.1	168.5	147.4	421.3	17.0	68.1	61.5	170.3	17.0	4.26%	68.1	90.4	22.62%	61.5	169.1	42.33%	170.3	356.4	89.23%
1.15	1.09	102	1.09	430.7	433.2	1164	43.3	173.3	151.6	433.2	17.1	68.4	61.7	170.9	17.1	4.28%	68.4	90.6	22.68%	61.7	169.3	42.39%	170.9	357.0	89.38%
1.16	1.11	103	1.11	441.1	441.1	1165	44.1	176.4	154.4	441.1	17.2	68.6	61.9	171.5	17.2	4.29%	68.6	90.8	22.74%	61.9	169.5	42.44%	171.5	357.6	89.53%
1.18	1.13	104	1.13	449.1	449.1	1166	44.9	179.6	157.2	449.1	17.2	68.8	62.2	172.1	17.2	4.31%	68.8	91.1	22.80%	62.2	169.7	42.49%	172.1	358.2	89.68%
1.19	1.14	105	1.14	453.0	453.0	1167	45.3	181.2	158.6	453.0	17.3	69.1	62.4	172.7	17.3	4.32%	69.1	91.3	22.86%	62.4	169.9	42.55%	172.7	358.8	89.84%
1.19	1.14	106	1.14	453.0	453.0	1168	45.3	181.2	158.6	453.0	17.3	69.3	62.6	173.4	17.3	4.34%	69.3	91.6	22.93%	62.6	170.2	42.60%	173.4	359.5	89.99%
1.19	1.15	107	1.15	457.0	457.0	1169	45.7	182.8	160.0	457.0	17.4	69.6	62.8	174.0	17.4	4.36%	69.6	91.8	22.99%	62.8	170.4	42.66%	174.0	360.1	90.15%
1.19	1.15	108	1.15	457.0	457.0	1170	45.7	182.8	160.0	457.0	17.5	69.9	63.0	174.6	17.5	4.37%	69.9	92.1	23.05%	63.0	170.6	42.71%	174.6	360.7	90.31%
1.19	1.15	109	1.15	457.0	457.0	1171	45.7	182.8	160.0	457.0	17.5	70.1	63.3	175.3	17.5	4.39%	70.1	92.3	23.12%	63.3	170.8	42.77%	175.3	361.4	90.47%
1.18	1.15	110	1.15	457.0	457.0	1172	45.7	182.9	159.9	457.0	17.6	70.4	63.5	175.9	17.6	4.40%	70.4	92.6	23.18%	63.5	171.0	42.82%	175.9	362.0	90.62%
1.17	1.14	111	1.14	453.0	453.0	1173	45.3	181.2	158.6	453.0	17.7	70.6	63.7	176.5	17.7	4.42%	70.6	92.8	23.24%	63.7	171.2	42.88%	176.5	362.6	90.78%
1.16	1.14	112	1.14	453.0	453.0	1174	45.3	181.2	158.6	453.0	17.7	70.9	63.9	177.1	17.7	4.43%	70.9	93.1	23.30%	63.9	171.5	42.93%	177.1	363.2	90.94%
1.15	1.13	113	1.13	449.0	449.0	1175	44.9	179.6	157.2	449.0	17.8	71.1	64.1	177.8	17.8	4.45%	71.1	93.3	23.37%	64.1	171.7	42.99%	177.8	363.9	91.09%
1.13	1.12	114	1.12	445.1	445.1	1176	44.5	178.0	155.8	445.1	17.8	71.3	64.3	178.4	17.8	4.47%	71.3	93.6	23.43%	64.3	171.9	43.04%	178.4	364.5	91.25%
1.11	1.11	115	1.11	441.1	441.1	1177	44.1	176.4	154.4	441.1	17.9	71.6	64.6	179.0	17.9	4.48%	71.6	93.8	23.49%	64.6	172.1	43.09%	179.0	365.1	91.40%
1.05	1.09	116	1.09	433.1	433.1	1178	43.3	173.3	151.6	433.1	18.0	71.8	64.8	179.6	18.0	4.50%	71.8	94.1	23.55%	64.8	172.3	43.15%	179.6	365.7	91.55%
0.96	1.00	120	1.00	397.3	397.3	1182	39.7	158.9	139.1	397.3	18.2	72.7	65.6	181.9	18.2	4.55%	72.7	95.0	23.78%	65.6	173.1	43.35%	181.9	368.0	92.12%
0.83	0.86	125	0.86	341.7	341.7	1187	34.2	136.7	119.6	341.7	18.4	73.8	66.5	184.4	18.4	4.62%	73.8	96.0	24.03%	66.5	174.0	43.57%	184.4	370.5	92.76%
0.69	0.73	130	0.73	290.0	290.0	1192	29.0	116.0	101.5	290.0	18.7	74.6	67.2	186.6	18.7	4.67%	74.6	96.9	24.25%	67.2	174.8	43.76%	186.6	372.7	93.30%
0.58	0.63	135	0.63	250.3	250.3	1197	25.0	100.1	87.6	250.3	18.8	75.4	67.9	188.5	18.8	4.72%	75.4	97.6	24.44%	67.9	175.4	43.92%	188.5	374.5	93.77%
0.49	0.54	140	0.54	214.5	214.5	1202	21.5	85.8	75.1	214.5	19.0	76.0	68.4	190.1	19.0	4.76%	76.0	98.3	24.60%	68.4	176.0	44.06%	190.1	376.2	94.17%
0.41	0.46	145	0.46	182.7	182.7	1207	18.3	73.1	64.0	182.7	19.1	76.6	68.9	191.4	19.1	4.79%	76.6	98.8	24.73%	68.9	176.5	44.18%	191.4	377.5	94.51%
0.35	0.40	150	0.40	158.9	158.9	1212	15.9	63.6	55.6	158.9	19.3	77.0	69.3	192.6	19.3	4.82%	77.0	99.3	24.85%	69.3	176.9	44.29%	192.6	378.7	94.81%
0.29	0.34	155	0.34	135.1	135.1	1217	13.5	54.0	47.3	135.1	19.4	77.4	69.7	193.6	19.4	4.85%	77.4	99.7	24.95%	69.7	177.2	44.38%	193.6	379.7	95.06%
0.25	0.29	160	0.29	115.2	115.2	1222	11.5	46.1	40.3	115.2	19.4	77.8	70.0	194.5	19.4	4.87%	77.8	100.0	25.04%	70.0	177.6	44.45%	194.5	380.5	95.28%
0.22	0.25	170	0.25	99.3	99.3	1232	9.9	39.7	34.8	99.3	19.6	78.4	70.5	196.0	19.6	4.91%	78.4	100.6	25.19%	70.5	178.1	44.58%	196.0	382.0	95.65%
0.19	0.21	180	0.21	83.4	83.4	1242	8.3	33.4	29.2	83.4	19.7	78.9	70.9	197.2	19.7	4.94%	78.9	101.1	25.31%	70.9	178.5	44.69%	197.2	383.3	95.96%
0.17	0.18	190	0.19	71.5	71.5	1252	7.2	28.6	25.0	71.5	19.8	79.3	71.3	198.3	19.8	4.96%	79.3	101.5	25.42%	71.3	178.9	44.78%	198.3	384.4	96.23%
0.16	0.17	200	0.17	67.5	67.5	1262	6.8	27.0	23.6	67.5	19.9	79.7	71.7	199.2	19.9	4.99%	79.7	101.9	25.52%	71.7	179.2	44.87%	199.3	385.3	96.47%
0.16	0.16	210	0.16	63.6	63.6	1272	6.4	25.4	22.3	63.6	20.0	80.1	72.0	200.1	20.0	5.01%	80.1	102.3	25.61%	72.0	179.5	44.95%	200.1	386.2	96.69%
0.15	0.16	220	0.16	63.6	63.6	1282	6.4	25.4	22.2	63.6	20.1	80.4	72.3	201.0	20.1	5.03%	80.4	102.6	25.70%	72.3	179.8	45.02%	201.0	387.1	96.91%
0.15	0.15	230	0.15	59.6	59.6	1292	6.0	23.8	20.9	59.6	20.2	80.7	72.6	201.9	20.2	5.05%	80.7	103.0	25.79%	72.6	180.1	45.10%	201.9	388.0	97.13%
0.15	0.15	250	0.15	59.6	59.6	1312	6.0	23.8	20.9	59.6	20.4	81.4	73.1	203.5	20.4	5.09%	81.4	103.6	25.94%	73.1	180.7	45.24%	203.5	389.6	97.54%
0.14	0.14	260	0.14	55.6	55.6	1322	5.6	22.3	19.5	55.6	20.4	81.7	73.4	204.3	20.4	5.11%	81.7	103.9	26.02%	73.4	181.0	45.31%	204.3	390.4	97.74%
0.14	0.14	300	0.14	55.6	55.6	1362	5.6	22.3	19.5	55.6	20.7	82.9	74.5	207.4	20.7	5.19%	82.9	105.2	26.33%	74.5	182.1	45.59%	207.4	393.5	98.50%
0.14	0.14	378	0.14	55.6	55.6	1440	22.3	22.3	55.6	55.6	22.2	85.3	78.5	213.3	22.2	5.57%	85.3	107.6	26.95%	78.5	180.1	43.53%	213.3	395.4	100.00%
					Daily Peak Flow (cfs) =		46	183	160	457		V(af)		399											
					Daily Average Flow (cfs) =		11	43	40	108			20.3												

Jeff Dr - Pre PV @ Lincoln

		A=	383.2	ac		Outlet West of Freshwater Marsh																			
		tc1:	54.6	min		50 year - 4 day Storm																			
50	55	BPRR:	1.19	0.9			Flow				Runoff					Percentage of Total Runoff									
1.24	1.19	Qp1:	445	cfs	0.0cfs	CLOCK	1st Day	2nd Day	3rd Day	4th Day	1st Day	2nd Day	3rd Day	4th Day	1st Day	1st Day	2nd Day	2nd Day	2nd Day	3rd Day	3rd Day	3rd Day	4th Day	4th Day	4th Day
		TIME	BPRR	Q1	Q(by-pass)	TIME	Q [cfs]	Q [cfs]	Q [cfs]	Q [cfs]	V [af]	V [af]	V [af]	V [af]	V [af]	%	V [af]	Σ V [af]	%	V [af]	Σ V [af]	%	V [af]	Σ V [af]	%
0.14	0.14	-1062	0.14	52.2	52.2	0	5.2	20.9	20.9	52.2								20.8			100.6			174.1	
0.35	0.35	-60	0.35	130.4	130.4	1002	13.0	52.2	45.7	130.4	12.6	50.4	45.9	120.0	12.5	3.37%	50.4	71.2	19.06%	45.9	146.5	39.22%	120.0	300.1	80.32%
0.37	0.37	0	0.37	137.9	137.9	1062	13.8	55.2	48.3	137.9	13.7	54.9	49.8	137.1	13.7	3.67%	54.8	75.6	20.24%	49.8	150.4	40.25%	137.1	311.2	83.29%
0.40	0.40	60	0.40	149.1	149.1	1122	14.9	59.6	52.2	149.1	14.9	59.5	53.9	149.0	14.9	3.99%	59.6	80.4	21.51%	53.9	154.5	41.36%	149.0	323.1	86.46%
0.43	0.42	70	0.42	156.8	156.8	1132	15.7	62.7	54.9	156.8	15.1	60.4	54.7	151.1	15.1	4.04%	60.4	81.2	21.74%	54.7	155.3	41.56%	151.1	325.2	87.02%
0.48	0.46	80	0.46	172.0	172.0	1142	17.2	68.8	60.2	172.0	15.3	61.3	55.5	153.3	15.3	4.10%	61.3	82.1	21.98%	55.5	156.1	41.77%	153.3	327.4	87.63%
0.52	0.49	85	0.49	183.5	183.5	1147	18.4	73.4	64.2	183.5	15.5	61.6	55.9	154.6	15.5	4.14%	61.8	82.6	22.11%	55.9	156.5	41.88%	154.6	328.7	87.96%
0.56	0.53	88	0.53	198.4	198.4	1150	19.8	79.4	69.4	198.4	15.5	62.1	56.2	155.4	15.5	4.16%	62.1	82.9	22.18%	56.2	156.8	41.96%	155.4	329.5	88.17%
0.61	0.56	90	0.56	210.2	210.2	1152	21.0	84.1	73.6	210.2	15.6	62.4	56.4	155.9	15.6	4.17%	62.4	83.2	22.26%	56.4	157.0	42.02%	155.9	330.0	88.32%
0.65	0.59	91	0.59	221.7	221.7	1153	22.2	88.7	77.6	221.7	15.6	62.5	56.5	156.2	15.6	4.18%	62.5	83.3	22.29%	56.5	157.1	42.04%	156.2	330.3	88.40%
0.69	0.62	92	0.63	233.2	233.2	1154	23.3	93.3	81.6	233.2	15.7	62.6	56.6	156.5	15.7	4.19%	62.6	83.4	22.32%	56.6	157.2	42.07%	156.5	330.6	88.48%
0.74	0.66	93	0.67	248.4	248.4	1155	24.8	99.3	86.9	248.4	15.7	62.7	56.7	156.9	15.7	4.20%	62.7	83.5	22.35%	56.7	157.3	42.10%	156.9	331.0	88.57%
0.78	0.71	94	0.72	266.7	266.7	1156	26.7	106.7	93.3	266.7	15.7	62.9	56.8	157.2	15.7	4.21%	62.9	83.7	22.40%	56.8	157.5	42.14%	157.2	331.3	88.67%
0.84	0.76	95	0.77	285.6	285.6	1157	28.6	114.3	100.0	285.6	15.8	63.0	57.0	157.6	15.8	4.22%	63.0	83.8	22.44%	57.0	157.6	42.17%	157.6	331.7	88.77%
0.90	0.81	96	0.82	304.6	304.6	1158	30.5	121.8	106.6	304.6	15.8	63.2	57.1	158.0	15.8	4.23%	63.2	84.0	22.48%	57.1	157.7	42.21%	158.0	332.1	88.88%
0.97	0.87	97	0.88	327.2	327.2	1159	32.7	130.9	114.5	327.2	15.8	63.4	57.3	158.4	15.8	4.24%	63.4	84.2	22.53%	57.3	157.9	42.25%	158.4	332.5	88.98%
1.05	0.94	98	0.95	353.6	353.6	1160	35.4	141.4	123.8	353.6	15.9	63.6	57.4	158.9	15.9	4.25%	63.6	84.4	22.58%	57.4	158.0	42.30%	158.9	333.0	89.12%
1.14	1.02	99	1.03	383.7	383.7	1161	38.4	153.5	134.3	383.7	15.9	63.8	57.6	159.4	15.9	4.27%	63.8	84.6	22.63%	57.6	158.2	42.34%	159.4	333.5	89.25%
1.17	1.09	100	1.10	408.6	408.6	1162	40.9	163.4	143.0	408.6	16.0	64.0	57.8	160.0	16.0	4.28%	64.0	84.8	22.69%	57.8	158.4	42.39%	160.0	334.1	89.40%
1.19	1.12	101	1.13	419.5	419.5	1163	42.0	167.8	146.8	419.5	16.1	64.2	58.0	160.5	16.1	4.30%	64.2	85.0	22.75%	58.0	158.6	42.45%	160.5	334.6	89.55%
1.22	1.15	102	1.16	430.7	430.7	1164	43.1	172.3	150.7	430.7	16.1	64.4	58.2	161.1	16.1	4.31%	64.4	85.2	22.81%	58.2	158.8	42.50%	161.1	335.2	89.71%
1.23	1.16	103	1.17	434.4	434.4	1165	43.4	173.8	152.0	434.4	16.2	64.7	58.4	161.7	16.2	4.33%	64.7	85.5	22.88%	58.4	159.0	42.56%	161.7	335.8	89.87%
1.24	1.18	104	1.18	441.6	441.6	1166	44.2	176.6	154.5	441.6	16.2	64.9	58.6	162.3	16.2	4.34%	64.9	85.7	22.94%	58.6	159.2	42.61%	162.3	336.4	90.03%
1.24	1.18	105	1.18	441.6	441.6	1167	44.2	176.6	154.5	441.6	16.3	65.2	58.8	162.9	16.3	4.36%	65.2	86.0	23.01%	58.8	159.4	42.67%	162.9	337.0	90.19%
1.24	1.19	106	1.19	445.0	445.0	1168	44.5	178.0	155.8	445.0	16.4	65.4	59.0	163.5	16.4	4.38%	65.4	86.2	23.07%	59.0	159.7	42.73%	163.5	337.6	90.36%
1.24	1.19	107	1.19	445.0	445.0	1169	44.5	178.0	155.8	445.0	16.4	65.7	59.3	164.1	16.4	4.39%	65.7	86.5	23.14%	59.3	159.9	42.79%	164.1	338.2	90.52%
1.23	1.19	108	1.19	444.7	444.7	1170	44.5	177.9	155.6	444.7	16.5	65.9	59.5	164.8	16.5	4.41%	65.9	86.7	23.20%	59.5	160.1	42.84%	164.8	338.9	90.68%
1.22	1.19	109	1.19	444.4	444.4	1171	44.4	177.8	155.5	444.4	16.5	66.1	59.7	165.4	16.5	4.43%	66.1	86.9	23.27%	59.7	160.3	42.90%	165.4	339.5	90.85%
1.21	1.18	110	1.18	440.7	440.7	1172	44.1	176.3	154.2	440.7	16.6	66.4	59.9	166.0	16.6	4.44%	66.4	87.2	23.33%	59.9	160.5	42.96%	166.0	340.1	91.01%
1.20	1.17	111	1.17	436.9	436.9	1173	43.7	174.8	152.9	436.9	16.7	66.6	60.1	166.6	16.7	4.46%	66.6	87.4	23.40%	60.1	160.7	43.01%	166.6	340.7	91.17%
1.18	1.16	112	1.16	432.9	432.9	1174	43.3	173.2	151.5	432.9	16.7	66.9	60.3	167.2	16.7	4.47%	66.9	87.7	23.46%	60.3	160.9	43.07%	167.2	341.3	91.33%
1.16	1.15	113	1.15	428.9	428.9	1175	42.9	171.6	150.1	428.9	16.8	67.1	60.5	167.8	16.8	4.49%	67.1	87.9	23.53%	60.5	161.1	43.13%	167.8	341.9	91.49%
1.14	1.13	114	1.13	421.4	421.4	1176	42.1	168.5	147.5	421.4	16.8	67.3	60.7	168.4	16.8	4.51%	67.3	88.1	23.58%	60.7	161.4	43.19%	168.4	342.5	91.65%
1.10	1.11	115	1.11	413.4	413.4	1177	41.3	165.4	144.7	413.4	16.9	67.6	60.9	168.9	16.9	4.52%	67.6	88.4	23.65%	60.9	161.6	43.24%	168.9	343.0	91.80%
1.06	1.09	116	1.09	405.3	405.3	1178	40.5	162.1	141.9	405.3	17.0	67.8	61.1	169.5	17.0	4.54%	67.8	88.6	23.71%	61.1	161.8	43.29%	169.5	343.6	91.95%
0.91	0.96	120	0.96	356.3	356.3	1182	35.6	142.5	124.7	356.3	17.2	68.6	61.9	171.6	17.2	4.59%	68.6	89.4	23.94%	61.9	162.5	43.49%	171.6	345.7	92.52%
0.76	0.83	125	0.82	307.3	307.3	1187	30.7	122.9	107.5	307.3	17.4	69.5	62.7	173.9	17.4	4.65%	69.6	90.4	24.19%	62.7	163.3	43.70%	173.9	348.0	93.13%
0.63	0.69	130	0.69	255.4	255.4	1192	25.5	102.1	89.4	255.4	17.6	70.3	63.3	175.8	17.6	4.71%	70.3	91.1	24.39%	63.3	164.0	43.88%	175.8	349.9	93.63%
0.53	0.58	135	0.58	214.7	214.7	1197	21.5	85.9	75.1	214.7	17.7	71.0	63.9	177.4	17.7	4.75%	71.0	91.8	24.56%	63.9	164.5	44.03%	177.4	351.5	94.06%
0.44	0.49	140	0.49	181.1	181.1	1202	18.1	72.5	63.4	181.1	17.9	71.5	64.4	178.8	17.9	4.79%	71.5	92.3	24.71%	64.4	165.0	44.16%	178.8	352.9	94.44%
0.36	0.41	145	0.41	151.3	151.3	1207	15.1	60.5	53.0	151.3	18.0	72.0	64.8	180.0	18.0	4.82%	72.0	92.8	24.83%	64.8	165.4	44.27%	180.0	354.0	94.75%
0.30	0.35	150	0.35	129.0	129.0	1212	12.9	51.6	45.1	129.0	18.1	72.4	65.1	180.9	18.1	4.84%	72.4	93.2	24.93%	65.1	165.7	44.36%	180.9	355.0	95.01%
0.26	0.29	155	0.29	107.2	107.2	1217	10.7	42.9	37.5	107.2	18.2	72.7	65.4	181.7	18.2	4.86%	72.7	93.5	25.02%	65.4	166.0	44.43%	181.7	355.8	95.23%
0.22	0.25	160	0.25	92.3	92.3	1222	9.2	36.9	32.3	92.3	18.2	73.0	65.6	182.4	18.2	4.88%	73.0	93.8	25.09%	65.6	166.3	44.50%	182.4	356.5	95.41%
0.19	0.22	170	0.22	81.1	81.1	1232	8.1	32.4	28.4	81.1	18.4	73.4	66.1	183.6	18.4	4.91%	73.4	94.2	25.22%	66.1	166.7	44.61%	183.6	357.7	95.73%
0.17	0.19	180	0.19	70.2	70.2	1242	7.0	28.1	24.6	70.2	18.5	73.9	66.4	184.7	18.5	4.94%	73.9	94.7	25.33%	66.4	167.1	44.71%	184.7	358.7	96.01%
0.16	0.17	190	0.17	63.1	63.1	1252	6.3	25.2	22.1	63.1	18.6	74.2	66.7	185.6	18.6	4.97%	74.2	95.0	25.43%	66.7	167.4	44.79%	185.6	359.7	96.25%
0.16	0.16	200	0.16	59.6	59.6	1262	6.0	23.9	20.9	59.6	18.6	74.6	67.0	186.4	18.6	4.99%	74.6	95.4	25.52%	67.0	167.7	44.87%	186.4	360.5	96.48%
0.16	0.16	210	0.16	59.6	59.6	1272	6.0	23.9	20.9	59.6	18.7	74.9	67.3	187.2	18.7	5.01%	74.9	95.7	25.61%	67.3	168.0	44.95%	187.2	361.3	96.70%
0.15	0.15	220	0.15	55.9	55.9	1282	5.6	22.4	19.6	55.9	18.8	75.2	67.6	188.0	18.8	5.03%	75.2	96.0	25.69%	67.6	168.2	45.02%	188.0	362.1	96.91%
0.15	0.15	230	0.15	55.9	55.9	1292	5.6	22.4	19.6	55.9	18.9	75.5	67.9	188.9	18.9	5.05%	75.5	96.3	25.78%	67.9	168.5	45.10%	188.9	362.9	97.12%
0.15	0.15	250	0.15	55.9	55.9	1312	5.6	22.4	19.6	55.9	19.0	76.1	68.4	190.3	19.0	5.09%	76.1	96.9	25.94%	68.4	169.0	45.24%	190.3	364.4	97.53%
0.14	0.14	260	0.14	52.2	52.2	1322	5.2	20.9	18.3	52.2	19.1	76.4	68.7	191.1	19.1	5.11%	76.4	97.2	26.02%	68.7	169.3	45.31%	191.1	365.2	97.73%
0.14	0.14	300	0.14	52.2	52.2	1362	5.2	20.9	18.5	52.2	19.4	77.6	69.7	194.0	19.4	5.19%	77.6	98.4	26.33%	69.7	170.3	45.58%	194.0	368.1	98.50%
0.14	0.14	378	0.14	52.2	52.2	1440	20.9	20.9	52.2	52.2	20.8	79.8	73.5	199.6	20.8	5.57%	79.6	100.6	26.93%	73.5	174.1	46.59%	199.5	373.7	100.00%
				Daily Peak Flow [cfs] =			45	178	156	445			sff (af) =	374											
				Daily Average Flow [cfs] =			10	40	37	101				471											

Jefferson Drain - PV Ph 1 & 2

		A=	257.1	ac																					
		tc1:	39.8	min		50 year - 4 day Storm																			
35	40	BPRR	1.37	1.0			Flow				Runoff					Percentage of Total Runoff									
1.45	1.37	Qp1:	403.6	cfs	0.0cfs	CLOCK	1st Day	2nd Day	3rd Day	4th Day	1st Day	2nd Day	3rd Day	4th Day	1st Day	1st Day	2nd Day	2nd Day	2nd Day	3rd Day	3rd Day	3rd Day	4th Day	4th Day	4th Day
		TIME	BPRR	Q1	Q(by-pass)	TIME	Q [cfs]	Q [cfs]	Q [cfs]	Q [cfs]	V [af]	V [af]	V [af]	V [af]	V [af]	%	V [af]	ΣV [af]	%	V [af]	ΣV [af]	%	V [af]	ΣV [af]	%
0.14	0.14	-1062	0.14	41.1	41.1	0	4.1	16.5	16.5	41.1								10.3			79.9			136.5	
0.35	0.35	-60	0.35	102.8	102.8	1002	10.3	41.1	36.0	102.8	9.9	39.7	36.2	99.4	9.9	3.39%	39.7	55.0	19.13%	36.2	116.1	39.29%	99.4	235.8	80.52%
0.37	0.37	0	0.37	108.7	108.7	1062	10.9	43.5	38.1	108.7	10.9	43.2	39.3	108.1	10.8	3.69%	43.2	59.5	20.33%	39.3	118.1	40.33%	108.1	244.6	83.50%
0.40	0.40	60	0.40	117.5	117.5	1122	11.8	47.0	41.1	117.5	11.7	47.0	42.5	117.4	11.7	4.01%	47.0	63.3	21.61%	42.5	121.4	41.45%	117.4	253.9	86.69%
0.46	0.45	70	0.45	132.3	132.3	1132	13.2	52.9	46.3	132.3	11.9	47.7	43.1	119.2	11.9	4.07%	47.7	64.0	21.84%	43.1	122.0	41.65%	119.2	255.6	87.28%
0.58	0.54	80	0.54	159.1	159.1	1142	15.9	63.7	55.7	159.1	12.1	48.5	43.8	121.2	12.1	4.14%	48.5	64.8	22.11%	43.9	122.7	41.89%	121.2	257.7	87.90%
0.66	0.61	85	0.61	179.8	179.8	1147	18.0	71.9	62.9	179.8	12.2	48.9	44.2	122.3	12.2	4.18%	48.9	65.2	22.27%	44.2	123.1	42.03%	122.3	258.6	88.36%
0.72	0.67	88	0.67	197.5	197.5	1150	19.7	79.0	69.1	197.5	12.3	49.2	44.5	123.1	12.3	4.20%	49.2	65.6	22.38%	44.5	123.4	42.13%	123.1	259.6	88.63%
0.79	0.72	90	0.72	212.4	212.4	1152	21.2	85.0	74.3	212.4	12.4	49.5	44.7	123.7	12.4	4.22%	49.5	65.8	22.46%	44.7	123.6	42.19%	123.7	260.2	88.82%
0.83	0.76	91	0.76	224.1	224.1	1153	22.4	89.7	78.4	224.1	12.4	49.6	44.8	124.0	12.4	4.23%	49.6	65.9	22.50%	44.8	123.7	42.23%	124.0	260.5	88.92%
0.89	0.81	92	0.81	238.9	238.9	1154	23.9	95.6	83.8	238.9	12.4	49.7	44.9	124.3	12.4	4.24%	49.7	66.0	22.54%	44.9	123.8	42.27%	124.3	260.8	89.03%
0.96	0.86	93	0.86	253.9	253.9	1155	25.4	101.5	88.9	253.9	12.5	49.9	45.0	124.5	12.5	4.25%	49.9	66.2	22.59%	45.0	123.5	42.31%	124.6	261.1	89.15%
1.05	0.90	94	0.93	274.7	274.7	1156	27.5	108.9	96.1	274.7	12.5	50.0	45.2	125.0	12.5	4.27%	50.0	66.3	22.64%	45.2	124.0	42.35%	125.0	261.5	89.27%
1.15	1.00	95	1.01	295.6	295.6	1157	29.6	118.2	103.5	295.6	12.5	50.2	45.3	125.4	12.5	4.28%	50.2	66.5	22.69%	45.3	124.2	42.40%	125.4	261.9	89.41%
1.29	1.10	96	1.11	325.4	325.4	1158	32.5	130.2	113.9	325.4	12.6	50.3	45.5	125.8	12.6	4.30%	50.5	66.6	22.75%	45.5	124.3	42.45%	125.8	262.3	89.55%
1.38	1.24	97	1.25	366.0	366.0	1159	36.6	146.4	128.1	366.0	12.6	50.5	45.6	126.2	12.6	4.31%	50.5	66.8	22.82%	45.6	124.5	42.51%	126.3	262.8	89.72%
1.42	1.28	98	1.29	377.7	377.7	1160	37.8	151.1	132.2	377.7	12.7	50.7	45.8	126.5	12.7	4.33%	50.7	67.0	22.89%	45.8	124.7	42.57%	126.8	263.3	89.89%
1.44	1.32	99	1.32	389.3	389.3	1161	38.9	155.7	136.2	389.3	12.7	50.9	46.0	127.3	12.7	4.35%	50.9	67.2	22.96%	46.0	124.9	42.63%	127.3	263.8	90.07%
1.45	1.34	100	1.34	395.0	395.0	1162	39.5	158.0	138.3	395.0	12.8	51.2	46.2	127.5	12.8	4.37%	51.2	67.5	23.03%	46.2	125.1	42.69%	127.9	264.4	90.26%
1.45	1.36	101	1.36	400.8	400.8	1163	40.1	160.3	140.3	400.6	12.8	51.4	46.4	128.4	12.8	4.38%	51.4	67.7	23.11%	46.4	125.2	42.76%	128.4	264.9	90.44%
1.46	1.37	102	1.37	403.6	403.6	1164	40.4	161.4	141.3	403.6	12.9	51.6	46.6	129.0	12.9	4.40%	51.6	67.9	23.18%	46.6	125.4	42.83%	129.0	265.5	90.63%
1.46	1.37	103	1.37	403.6	403.6	1165	40.4	161.4	141.3	403.6	13.0	51.8	46.8	129.5	13.0	4.42%	51.8	68.1	23.26%	46.9	125.6	42.89%	129.5	266.0	90.82%
1.45	1.37	104	1.37	403.5	403.5	1166	40.3	161.4	141.2	403.5	13.0	52.0	47.0	130.1	13.0	4.44%	52.0	68.3	23.33%	47.0	125.8	42.96%	130.1	266.5	91.01%
1.44	1.36	105	1.36	400.5	400.5	1167	40.1	160.2	140.2	400.5	13.1	52.3	47.1	130.7	13.1	4.46%	52.3	68.6	23.41%	47.1	126.0	43.03%	130.7	267.1	91.20%
1.42	1.35	106	1.35	397.5	397.5	1168	39.7	159.0	139.1	397.5	13.1	52.5	47.2	131.2	13.1	4.48%	52.5	68.8	23.48%	47.3	126.2	43.09%	131.2	267.7	91.39%
1.40	1.34	107	1.34	394.4	394.4	1169	39.4	157.8	138.1	394.4	13.2	52.7	47.5	131.7	13.2	4.50%	52.7	69.0	23.56%	47.5	126.4	43.15%	131.7	268.2	91.57%
1.36	1.32	108	1.32	388.3	388.3	1170	38.8	155.3	135.9	388.3	13.2	52.9	47.7	132.3	13.2	4.52%	52.9	69.2	23.63%	47.7	126.6	43.22%	132.3	268.8	91.76%
1.28	1.29	109	1.29	378.9	378.9	1171	37.9	151.6	132.6	378.9	13.3	53.1	47.5	132.8	13.3	4.53%	53.1	69.4	23.70%	47.5	126.6	43.28%	132.8	269.3	91.94%
1.22	1.26	110	1.26	369.8	369.8	1172	37.0	147.9	129.4	369.8	13.3	53.3	48.1	133.3	13.3	4.55%	53.3	69.6	23.77%	48.1	127.0	43.35%	133.3	269.8	92.12%
1.16	1.21	111	1.21	354.9	354.9	1173	35.5	142.0	124.2	354.9	13.4	53.5	48.3	133.8	13.4	4.57%	53.5	69.8	23.84%	48.3	127.1	43.40%	133.8	270.3	92.29%
1.10	1.15	112	1.15	337.3	337.3	1174	33.7	134.9	118.1	337.3	13.4	53.7	48.4	134.3	13.4	4.59%	53.7	70.0	23.91%	48.4	127.3	43.46%	134.3	270.8	92.45%
1.04	1.09	113	1.09	319.7	319.7	1175	32.0	127.9	111.9	319.7	13.5	53.9	48.6	134.8	13.5	4.60%	53.9	70.2	23.97%	48.6	127.5	43.52%	134.8	271.2	92.60%
0.99	1.04	114	1.04	305.0	305.0	1176	30.5	122.0	106.7	305.0	13.5	54.1	48.7	135.2	13.5	4.62%	54.1	70.4	24.03%	48.7	127.6	43.57%	135.2	271.7	92.75%
0.94	0.99	115	0.99	290.3	290.3	1177	29.0	116.1	101.6	290.3	13.6	54.2	48.9	135.5	13.6	4.63%	54.2	70.5	24.08%	48.9	127.8	43.62%	135.5	272.1	92.89%
0.89	0.94	116	0.94	275.6	275.6	1178	27.6	110.2	96.5	275.6	13.6	54.4	49.0	136.0	13.6	4.64%	54.4	70.7	24.14%	49.0	127.9	43.66%	136.0	272.5	93.02%
0.72	0.76	120	0.75	222.8	222.8	1182	22.3	89.1	78.0	222.8	13.7	54.6	49.5	137.4	13.7	4.69%	54.6	71.3	24.33%	49.5	128.4	43.83%	137.4	273.8	93.49%
0.55	0.60	125	0.60	175.7	175.7	1187	17.6	70.3	61.5	175.7	13.9	55.5	50.0	138.7	13.9	4.74%	55.5	71.8	24.51%	50.0	128.9	43.99%	138.7	275.2	93.96%
0.42	0.48	130	0.48	140.3	140.3	1192	14.0	56.1	49.1	140.3	14.0	55.9	50.4	139.8	14.0	4.77%	55.9	72.2	24.66%	50.4	129.2	44.12%	139.8	276.3	94.33%
0.32	0.38	135	0.38	110.9	110.9	1197	11.1	44.4	38.8	110.9	14.1	56.3	50.7	140.7	14.1	4.80%	56.3	72.6	24.78%	50.7	129.5	44.22%	140.7	277.2	94.63%
0.27	0.31	140	0.31	90.6	90.6	1202	9.1	36.2	31.7	90.6	14.1	56.6	50.9	141.4	14.1	4.83%	56.6	72.9	24.87%	50.9	129.8	44.31%	141.4	277.8	94.86%
0.23	0.25	145	0.25	73.2	73.2	1207	7.3	29.3	25.6	73.2	14.2	56.8	51.1	141.5	14.2	4.85%	56.8	73.1	24.95%	51.1	130.0	44.37%	141.9	278.4	95.05%
0.21	0.22	150	0.22	64.5	64.5	1212	6.5	25.8	22.6	64.5	14.2	57.0	51.3	142.4	14.2	4.86%	57.0	73.3	25.02%	51.3	130.1	44.43%	142.4	278.9	95.22%
0.20	0.21	155	0.21	61.6	61.6	1217	6.2	24.6	21.6	61.6	14.3	57.1	51.4	142.5	14.3	4.88%	57.1	73.4	25.08%	51.4	130.3	44.48%	142.9	279.3	95.37%
0.19	0.20	160	0.20	58.6	58.6	1222	5.9	23.5	20.5	58.6	14.3	57.3	51.6	143.3	14.3	4.89%	57.3	73.6	25.13%	51.6	130.4	44.53%	143.3	279.8	95.51%
0.18	0.18	170	0.18	52.9	52.9	1232	5.3	21.2	18.5	52.9	14.4	57.6	51.8	144.0	14.4	4.92%	57.6	73.9	25.24%	51.8	130.7	44.62%	144.0	280.5	95.77%
0.17	0.17	180	0.17	50.0	50.0	1242	5.0	20.0	17.5	50.0	14.5	57.9	52.1	144.7	14.5	4.94%	57.9	74.2	25.33%	52.1	131.0	44.71%	144.7	281.2	96.01%
0.15	0.16	190	0.16	47.0	47.0	1252	4.7	18.8	16.5	47.0	14.5	58.2	52.3	145.4	14.5	4.96%	58.2	74.5	25.42%	52.3	131.2	44.79%	145.4	281.9	96.24%
0.15	0.16	200	0.16	46.9	46.9	1262	4.7	18.8	16.4	46.9	14.6	58.4	52.5	146.1	14.5	4.99%	58.4	74.7	25.51%	52.5	131.4	44.87%	146.1	282.5	96.46%
0.15	0.16	210	0.16	46.9	46.9	1272	4.7	18.8	16.4	46.9	14.7	58.7	52.6	146.7	14.7	5.01%	58.7	75.0	25.60%	52.8	131.6	44.94%	146.7	283.2	96.68%
0.15	0.15	220	0.15	44.1	44.1	1282	4.4	17.6	15.4	44.1	14.7	58.9	53.0	147.3	14.7	5.03%	58.9	75.2	25.69%	53.0	131.9	45.02%	147.3	283.8	96.90%
0.15	0.15	230	0.15	44.1	44.1	1292	4.4	17.6	15.4	44.1	14.8	59.2	53.2	147.9	14.8	5.05%	59.2	75.5	25.77%	53.2	132.1	45.09%	147.9	284.4	97.10%
0.15	0.15	250	0.15	44.1	44.1	1312	4.4	17.6	15.4	44.1	14.9	59.7	53.6	148.2	14.9	5.09%	59.7	76.0	25.94%	53.6	132.5	45.24%	149.2	285.6	97.52%
0.14	0.14	360	0.14	41.1	41.1	1322	4.1	16.5	14.4	41.1	15.0	59.9	53.8	149.7	15.0	5.11%	59.9	76.2	26.02%	53.8	132.7	45.31%	149.7	286.2	97.72%
0.14	0.14	300	0.14	41.1	41.1	1362	4.1	16.5	14.4	41.1	15.2	60.9	54.6	152.0	15.2	5.19%	60.9	77.1	26.33%	54.6	133.5	45.58%	152.0	288.5	98.49%
0.14	0.14	375	0.14	41.1	41.1	1440	16.5	16.5	41.1	41.1	16.3	62.5	57.6	156.4	16.3	5.57%	62.6	78.9	26.03%	57.6	138.5	46.60%	156.4	292.9	100.00%
					Daily Peak Flow [cfs] =		40	161	141	404			ff [af] =	293											
					Daily Average Flow [cfs] =		8	32	29	79				36.3											

Central Drain Ph 1

		A=	154	ac																					
		tc1:	55.6	min		50 year - 4 day Storm																			
55	80	BPRR:	1.19	Q1			Flow				Runoff					Percentage of Total Runoff									
1.19	1.15	Qp1:	237	cfs	0.0cfs	CLOCK	1st Day	2nd Day	3rd Day	4th Day	1st Day	2nd Day	3rd Day	4th Day	1st Day	1st Day	2nd Day	2nd Day	2nd Day	3rd Day	3rd Day	3rd Day	4th Day	4th Day	4th Day
		TIME	BPRR	Q1	Q(by-pass)	TIME	Q [cfs]	Q [cfs]	Q [cfs]	Q [cfs]	V [af]	V [af]	V [af]	V [af]	V [af]	%	V [af]	ΣV [af]	%	V [af]	ΣV [af]	%	V [af]	ΣV [af]	%
0.14	0.14	-1062	0.14	28.0	28.0	0	2.8	11.2	11.2	28.0								11.2			54.0			93.5	
0.30	0.35	-60	0.35	70.0	70.0	1002	7.0	28.0	24.5	70.0	6.8	27.0	24.6	67.6	6.8	3.37%	27.0	38.2	19.05%	24.6	78.5	39.21%	67.6	161.1	80.30%
0.37	0.37	5	0.37	74.0	74.0	1062	7.4	29.6	25.9	74.0	7.4	29.4	25.7	73.6	7.4	3.67%	29.4	40.6	20.24%	25.7	80.7	40.25%	73.6	167.0	83.27%
0.46	0.40	60	0.40	80.0	80.0	1122	8.0	32.0	28.0	80.0	8.0	32.0	28.9	79.9	8.0	3.98%	32.0	43.1	21.51%	28.9	83.0	41.06%	79.9	173.4	86.44%
0.42	0.41	70	0.42	83.7	83.7	1132	8.4	33.5	29.3	83.7	8.1	32.4	29.3	81.1	8.1	4.04%	32.4	43.5	21.73%	29.3	83.4	41.55%	81.1	174.5	87.00%
0.46	0.44	80	0.46	91.5	91.5	1142	9.2	36.6	32.0	91.5	8.2	32.9	29.8	82.3	8.2	4.10%	32.9	44.1	21.97%	29.8	83.8	41.77%	82.3	175.7	87.60%
0.45	0.47	85	0.49	97.5	97.5	1147	9.8	39.0	34.1	97.5	8.3	33.2	30.0	82.9	8.3	4.13%	33.2	44.3	22.10%	30.0	84.0	41.88%	82.9	176.4	87.93%
0.53	0.50	88	0.53	105.3	105.3	1150	10.5	42.1	36.8	105.3	8.3	33.3	30.1	83.3	8.3	4.15%	33.3	44.5	22.18%	30.1	84.1	41.95%	83.3	176.8	88.14%
0.56	0.52	90	0.55	111.0	111.0	1152	11.1	44.4	38.9	111.0	8.4	33.5	30.2	83.5	8.4	4.17%	33.5	44.6	22.24%	30.2	84.3	42.00%	83.5	177.1	88.29%
0.59	0.53	91	0.58	116.5	116.5	1153	11.7	46.6	40.8	116.5	8.4	33.5	30.3	83.9	8.4	4.18%	33.5	44.7	22.27%	30.3	84.3	42.03%	83.9	177.2	88.36%
0.62	0.56	92	0.61	122.3	122.3	1154	12.2	48.9	42.8	122.3	8.4	33.6	30.3	84.0	8.4	4.19%	33.6	44.7	22.31%	30.3	84.4	42.06%	84.0	177.4	88.45%
0.66	0.58	93	0.65	130.1	130.1	1155	13.0	52.0	45.5	130.1	8.4	33.7	30.4	84.1	8.4	4.19%	33.7	44.8	22.34%	30.4	84.4	42.09%	84.1	177.6	88.53%
0.71	0.61	94	0.70	139.6	139.6	1156	14.0	55.8	48.9	139.6	8.4	33.7	30.5	84.3	8.4	4.20%	33.7	44.9	22.38%	30.5	84.5	42.12%	84.2	177.8	88.62%
0.76	0.65	95	0.75	149.3	149.3	1157	14.9	59.7	52.3	149.3	8.5	33.8	30.5	84.5	8.5	4.21%	33.8	45.0	22.42%	30.5	84.6	42.16%	84.5	178.0	88.72%
0.81	0.70	96	0.80	159.3	159.3	1158	15.9	63.7	55.8	159.3	8.5	33.9	30.6	84.7	8.5	4.22%	33.9	45.1	22.46%	30.6	84.6	42.19%	84.7	178.2	88.83%
0.87	0.78	97	0.86	171.3	171.3	1159	17.1	68.5	60.0	171.3	8.5	34.0	30.7	85.0	8.5	4.24%	34.0	45.1	22.51%	30.7	84.7	42.23%	85.0	178.4	88.94%
0.94	0.84	98	0.93	185.6	185.6	1160	18.6	74.2	64.9	185.6	8.5	34.1	30.8	85.2	8.5	4.25%	34.1	45.2	22.56%	30.8	84.9	42.28%	85.2	178.7	89.07%
1.02	0.92	99	1.01	201.6	201.6	1161	20.2	80.6	70.5	201.6	8.5	34.2	30.9	85.5	8.5	4.26%	34.2	45.3	22.61%	30.9	84.9	42.32%	85.5	178.9	89.20%
1.09	1.01	100	1.08	216.0	216.0	1162	21.6	86.4	75.6	216.0	8.6	34.3	31.0	85.8	8.6	4.28%	34.3	45.5	22.67%	31.0	85.0	42.37%	85.8	179.2	89.34%
1.12	1.06	101	1.11	222.5	222.5	1163	22.3	89.0	77.9	222.5	8.6	34.4	31.1	86.1	8.6	4.29%	34.4	45.6	22.73%	31.1	85.1	42.43%	86.1	179.5	89.49%
1.15	1.09	102	1.14	228.5	228.5	1164	22.9	91.4	80.0	228.5	8.6	34.5	31.2	86.4	8.6	4.31%	34.5	45.7	22.79%	31.2	85.2	42.46%	86.4	179.8	89.65%
1.15	1.11	103	1.15	230.8	230.8	1165	23.1	92.3	80.8	230.8	8.7	34.7	31.3	86.7	8.7	4.32%	34.7	45.9	22.85%	31.3	85.3	42.54%	86.7	180.1	89.81%
1.18	1.13	104	1.17	234.8	234.8	1166	23.5	93.9	82.2	234.8	8.7	34.8	31.4	87.0	8.7	4.34%	34.8	46.0	22.92%	31.4	85.4	42.59%	87.0	180.5	89.97%
1.16	1.14	105	1.18	235.0	235.0	1167	23.5	94.0	82.3	235.0	8.7	34.9	31.5	87.3	8.7	4.35%	34.9	46.1	22.98%	31.5	85.5	42.65%	87.3	180.8	90.13%
1.15	1.14	106	1.18	236.8	236.8	1168	23.7	94.7	82.9	236.8	8.8	35.1	31.6	87.6	8.8	4.37%	35.1	46.2	23.04%	31.6	85.7	42.71%	87.6	181.1	90.29%
1.18	1.15	107	1.19	237.0	237.0	1169	23.7	94.8	83.0	237.0	8.8	35.2	31.8	88.0	8.8	4.39%	35.2	46.4	23.11%	31.8	85.8	42.76%	88.0	181.4	90.45%
1.15	1.15	108	1.19	237.0	237.0	1170	23.7	94.8	83.0	237.0	8.8	35.3	31.9	88.3	8.8	4.40%	35.3	46.5	23.17%	31.9	85.9	42.82%	88.3	181.9	90.61%
1.19	1.15	109	1.19	237.0	237.0	1171	23.7	94.8	83.0	237.0	8.9	35.5	32.0	88.6	8.9	4.42%	35.5	46.6	23.24%	32.0	86.0	42.88%	88.6	182.1	90.78%
1.18	1.15	110	1.18	235.2	235.2	1172	23.5	94.1	82.3	235.2	8.9	35.6	32.1	89.0	8.9	4.43%	35.6	46.7	23.30%	32.1	86.1	42.93%	89.0	182.4	90.94%
1.17	1.14	111	1.17	233.2	233.2	1173	23.3	93.3	81.6	233.2	8.9	35.7	32.2	89.3	8.9	4.45%	35.7	46.9	23.37%	32.2	86.2	42.99%	89.3	182.7	91.10%
1.16	1.14	112	1.16	231.5	231.5	1174	23.1	92.6	81.0	231.5	9.0	35.8	32.3	89.6	9.0	4.47%	35.8	47.0	23.43%	32.3	86.3	43.04%	89.6	183.0	91.26%
1.15	1.13	113	1.15	229.5	229.5	1175	22.9	91.8	80.3	229.5	9.0	36.0	32.4	89.9	9.0	4.48%	36.0	47.1	23.50%	32.4	86.5	43.10%	89.8	183.4	91.42%
1.13	1.12	114	1.13	225.7	225.7	1176	22.6	90.3	79.0	225.7	9.0	36.1	32.5	90.2	9.0	4.50%	36.1	47.3	23.56%	32.5	86.6	43.15%	90.2	183.7	91.57%
1.11	1.11	115	1.11	222.0	222.0	1177	22.2	88.8	77.7	222.0	9.1	36.2	32.7	90.5	9.1	4.51%	36.2	47.4	23.62%	32.7	86.7	43.21%	90.5	184.0	91.73%
1.09	1.09	116	1.09	218.0	218.0	1178	21.8	87.2	76.3	218.0	9.1	36.3	32.8	90.8	9.1	4.53%	36.3	47.5	23.68%	32.8	86.8	43.29%	90.8	184.3	91.88%
0.96	1.00	120	0.96	192.9	192.9	1182	19.3	77.2	67.5	192.9	9.2	36.8	33.2	92.0	9.2	4.59%	36.8	48.0	23.91%	33.2	87.2	43.46%	92.0	185.4	92.44%
0.83	0.80	125	0.83	166.7	166.7	1187	16.7	66.7	58.3	166.7	9.3	37.3	33.6	93.2	9.3	4.65%	37.3	48.4	24.15%	33.6	87.6	43.65%	93.2	186.7	93.06%
0.69	0.73	130	0.69	138.9	138.9	1192	13.9	55.6	48.6	138.9	9.4	37.7	34.0	94.3	9.4	4.70%	37.7	48.9	24.36%	34.0	88.0	43.86%	94.3	187.7	93.59%
0.58	0.63	135	0.59	117.2	117.2	1197	11.7	46.9	41.0	117.2	9.5	38.1	34.3	95.1	9.5	4.74%	38.1	49.2	24.54%	34.3	88.3	44.01%	95.1	188.6	94.02%
0.49	0.54	140	0.50	99.2	99.2	1202	9.9	39.7	34.7	99.2	9.6	38.4	34.5	95.9	9.6	4.78%	38.4	49.5	24.69%	34.5	88.5	44.14%	95.9	189.3	94.40%
0.41	0.46	145	0.42	83.2	83.2	1207	8.3	33.3	29.1	83.2	9.7	38.6	34.7	96.5	9.7	4.81%	38.6	49.8	24.81%	34.7	88.8	44.25%	96.5	190.0	94.71%
0.35	0.40	150	0.36	71.2	71.2	1212	7.1	28.5	24.9	71.2	9.7	38.8	34.9	97.0	9.7	4.84%	38.8	50.0	24.92%	34.9	88.9	44.35%	97.0	190.5	94.97%
0.29	0.34	155	0.30	59.2	59.2	1217	5.9	23.7	20.7	59.2	9.7	39.0	35.1	97.5	9.7	4.85%	39.0	50.2	25.01%	35.1	89.1	44.42%	97.5	190.9	95.20%
0.25	0.29	160	0.25	51.0	51.0	1222	5.1	20.4	17.8	51.0	9.8	39.2	35.2	97.9	9.8	4.88%	39.2	50.3	25.08%	35.2	89.2	44.49%	97.9	191.3	95.39%
0.22	0.25	170	0.22	44.7	44.7	1232	4.5	17.9	15.6	44.7	9.9	39.4	35.5	98.5	9.9	4.91%	39.4	50.6	25.22%	35.5	89.5	44.60%	98.5	192.0	95.72%
0.19	0.21	180	0.19	38.5	38.5	1242	3.8	15.4	13.5	38.5	9.9	39.6	35.7	99.1	9.9	4.94%	39.6	50.8	25.33%	35.7	89.7	44.70%	99.1	192.6	96.00%
0.17	0.18	190	0.17	34.2	34.2	1252	3.4	13.7	12.0	34.2	10.0	39.8	35.8	99.5	10.0	4.97%	39.8	51.0	25.43%	35.8	89.8	44.79%	99.5	193.1	96.25%
0.16	0.17	200	0.16	32.2	32.2	1262	3.2	12.9	11.3	32.2	10.0	40.0	36.0	100.1	10.0	4.99%	40.0	51.2	25.52%	36.0	90.0	44.87%	100.1	193.6	96.49%
0.16	0.16	210	0.16	32.0	32.0	1272	3.2	12.8	11.2	32.0	10.1	40.2	36.1	100.5	10.1	5.01%	40.2	51.4	25.61%	36.1	90.2	44.95%	100.5	194.0	96.72%
0.15	0.16	220	0.15	30.2	30.2	1282	3.0	12.1	10.6	30.2	10.1	40.4	36.3	100.9	10.1	5.03%	40.4	51.5	25.69%	36.3	90.3	45.02%	100.9	194.4	96.91%
0.15	0.15	230	0.15	30.0	30.0	1292	3.0	12.0	10.5	30.0	10.1	40.5	36.4	101.4	10.1	5.05%	40.5	51.7	25.78%	36.4	90.5	45.10%	101.4	194.8	97.12%
0.15	0.15	250	0.15	30.0	30.0	1312	3.0	12.0	10.5	30.0	10.2	40.9	36.7	102.2	10.2	5.09%	40.9	52.0	25.94%	36.7	90.7	45.24%	102.2	195.6	97.53%
0.14	0.14	260	0.14	28.0	28.0	1322	2.8	11.2	9.8	28.0	10.3	41.0	36.9	102.6	10.3	5.11%	41.0	52.2	26.02%	36.9	90.9	45.31%	102.6	196.0	97.73%
0.14	0.14	300	0.14	28.0	28.0	1362	2.8	11.2	9.8	28.0	10.4	41.6	37.4	104.1	10.4	5.19%	41.6	52.8	26.30%	37.4	91.4	45.58%	104.1	197.6	98.50%
0.14	0.14	373	0.14	28.0	28.0	1440	11.2	11.2	28.0	28.0	11.2	42.9	39.4	107.1	11.2	5.57%	42.9	54.0	26.93%	39.4	93.5	46.59%	107.1	200.6	100.00%
					Daily Peak Flow [cfs] =		24	95	83	237			ΣV [af] =	201											
					Daily Average Flow [cfs] =		6	22	20	54				25.3											

Central Drain Ph 2

A= 133.1 ac; tc= 37.8 min; BPRF 1.41 0.6; Qpl 312 cfs; 0.0cfs

50 year - 4 day Storm

35	40	TIME	BPRR	Q1	Q(by-pass)	CLOCK TIME	Flow 1st Day Q [cfs]	2nd Day Q [cfs]	3rd Day Q [cfs]	4th Day Q [cfs]
1.46	1.37									
0.14	0.14	-1062	0.14	31.0	31.0	0	3.1	12.4	12.4	31.0
0.35	0.35	00	0.35	77.5	77.5	1002	7.7	31.0	27.1	77.5
0.37	0.37	0	0.37	81.9	81.9	1062	8.2	32.8	28.7	81.9
0.40	0.40	60	0.40	88.5	88.5	1122	8.9	35.4	31.0	88.5
0.46	0.45	70	0.45	100.6	100.6	1132	10.1	40.2	35.2	100.6
0.58	0.54	80	0.56	123.4	123.4	1142	12.3	49.4	43.2	123.4
0.66	0.61	85	0.63	139.9	139.9	1147	14.0	56.0	49.0	139.9
0.72	0.67	88	0.69	153.2	153.2	1150	15.3	61.3	53.6	153.2
0.79	0.72	90	0.75	166.2	166.2	1152	16.6	66.5	58.2	166.2
0.83	0.76	91	0.79	175.0	175.0	1153	17.5	70.0	61.3	175.0
0.89	0.81	92	0.85	187.1	187.1	1154	18.7	74.8	65.5	187.1
0.96	0.86	93	0.90	200.1	200.1	1155	20.0	80.0	70.0	200.1
1.05	0.93	94	0.98	217.5	217.5	1156	21.8	87.0	76.1	217.5
1.15	1.00	95	1.07	235.9	235.9	1157	23.5	94.4	82.6	235.9
1.29	1.10	96	1.18	262.0	262.0	1158	26.2	104.8	91.7	262.0
1.38	1.24	97	1.30	288.1	288.1	1159	28.8	115.2	100.8	288.1
1.42	1.28	98	1.34	296.9	296.9	1160	29.7	118.8	103.9	296.9
1.44	1.32	99	1.37	303.9	303.9	1161	30.4	121.5	106.3	303.9
1.45	1.34	100	1.39	307.3	307.3	1162	30.7	122.9	107.6	307.3
1.46	1.36	101	1.40	310.8	310.8	1163	31.1	124.3	108.8	310.8
1.46	1.37	102	1.41	312.0	312.0	1164	31.2	124.8	109.2	312.0
1.46	1.37	103	1.41	312.0	312.0	1165	31.2	124.8	109.2	312.0
1.45	1.37	104	1.41	311.0	311.0	1166	31.1	124.4	108.9	311.0
1.44	1.36	105	1.40	308.8	308.8	1167	30.9	123.5	108.1	308.8
1.42	1.35	106	1.38	305.6	305.6	1168	30.6	122.3	107.0	305.6
1.40	1.34	107	1.37	302.4	302.4	1169	30.2	121.0	105.9	302.4
1.36	1.32	108	1.34	296.1	296.1	1170	29.6	118.4	103.6	296.1
1.28	1.29	109	1.29	284.6	284.6	1171	28.5	113.8	99.6	284.6
1.22	1.26	110	1.24	275.0	275.0	1172	27.5	110.0	96.2	275.0
1.16	1.21	111	1.19	263.0	263.0	1173	26.3	105.2	92.0	263.0
1.10	1.15	112	1.13	249.7	249.7	1174	25.0	99.9	87.4	249.7
1.04	1.09	113	1.07	236.4	236.4	1175	23.6	94.6	82.7	236.4
0.99	1.04	114	1.02	225.3	225.3	1176	22.5	90.1	78.9	225.3
0.94	0.99	115	0.97	214.3	214.3	1177	21.4	85.7	75.0	214.3
0.89	0.94	116	0.92	203.2	203.2	1178	20.3	81.3	71.1	203.2
0.72	0.76	120	0.74	164.3	164.3	1182	16.4	65.7	57.5	164.3
0.55	0.60	125	0.58	127.9	127.9	1187	12.8	51.2	44.8	127.9
0.42	0.48	130	0.45	100.4	100.4	1192	10.0	40.2	35.1	100.4
0.32	0.38	135	0.35	78.3	78.3	1197	7.8	31.3	27.4	78.3
0.27	0.31	140	0.29	64.7	64.7	1202	6.5	25.9	22.7	64.7
0.23	0.25	145	0.24	53.4	53.4	1207	5.3	21.4	18.7	53.4
0.21	0.22	150	0.22	47.7	47.7	1212	4.8	19.1	16.7	47.7
0.20	0.21	155	0.21	45.5	45.5	1217	4.6	18.2	15.9	45.5
0.19	0.20	160	0.20	43.3	43.3	1222	4.3	17.3	15.2	43.3
0.18	0.18	170	0.18	39.8	39.8	1232	4.0	15.9	13.9	39.8
0.17	0.17	180	0.17	37.6	37.6	1242	3.8	15.1	13.2	37.6
0.16	0.16	190	0.16	35.4	35.4	1252	3.5	14.2	12.4	35.4
0.15	0.15	200	0.16	34.4	34.4	1262	3.4	13.8	12.1	34.4
0.15	0.16	210	0.16	34.4	34.4	1272	3.4	13.8	12.1	34.4
0.15	0.15	220	0.15	33.2	33.2	1282	3.3	13.3	11.6	33.2
0.15	0.15	230	0.15	33.2	33.2	1292	3.3	13.3	11.6	33.2
0.15	0.15	250	0.15	33.2	33.2	1312	3.3	13.3	11.6	33.2
0.14	0.14	260	0.14	31.0	31.0	1322	3.1	12.4	10.8	31.0
0.14	0.14	300	0.14	31.0	31.0	1362	3.1	12.4	10.8	31.0
0.14	0.14	378	0.14	31.0	31.0	1440	12.4	12.4	31.0	31.0
					Daily Peak Flow [cfs] =		31	125	109	312
					Daily Average Flow [cfs] =		6	24	22	59

CLOCK TIME	Runoff 1st Day V [af]	2nd Day V [af]	3rd Day V [af]	4th Day V [af]	Percentage of Total Runoff 1st Day V [af]	1st Day %	2nd Day V [af]	2nd Day ΣV [af]	2nd Day %	3rd Day V [af]	3rd Day ΣV [af]	3rd Day %	4th Day V [af]	4th Day ΣV [af]	4th Day %
0								12.3			55.4			102.9	
1002	7.5	25.9	27.3	74.8	7.5	3.39%	29.9	42.2	19.13%	27.7	86.7	39.29%	74.8	177.7	90.50%
1062	8.1	32.6	29.6	81.4	8.1	3.60%	32.6	44.9	20.32%	29.6	89.0	40.32%	81.4	184.3	83.48%
1122	8.8	35.4	32.0	88.5	8.8	4.01%	35.4	47.7	21.60%	32.0	91.5	41.44%	86.5	191.3	86.67%
1132	9.0	35.9	32.5	89.8	9.0	4.07%	35.9	48.2	21.83%	32.5	91.9	41.65%	89.8	192.6	87.26%
1142	9.1	36.5	33.0	91.3	9.1	4.14%	36.5	48.8	22.11%	33.0	92.5	41.89%	91.3	194.2	87.96%
1147	9.2	36.9	33.3	92.2	9.2	4.18%	36.9	49.2	22.28%	33.3	92.5	42.03%	92.2	195.1	88.37%
1150	9.3	37.1	33.6	92.8	9.3	4.20%	37.1	49.4	22.38%	33.6	93.0	42.13%	92.8	195.7	88.64%
1152	9.3	37.3	33.7	93.3	9.2	4.22%	37.3	49.5	22.47%	33.7	93.2	42.20%	93.3	196.1	88.84%
1153	9.4	37.4	33.8	93.5	9.4	4.24%	37.4	49.7	22.51%	33.8	93.2	42.24%	93.5	196.4	88.95%
1154	9.4	37.5	33.9	93.8	9.4	4.25%	37.5	49.8	22.55%	33.9	93.3	42.28%	93.8	196.6	89.06%
1155	9.4	37.6	34.0	94.0	9.4	4.26%	37.6	49.9	22.60%	34.0	93.4	42.32%	94.0	196.9	89.18%
1156	9.4	37.7	34.1	94.3	9.4	4.27%	37.7	50.0	22.65%	34.1	93.5	42.36%	94.3	197.2	89.31%
1157	9.5	37.8	34.2	94.6	9.5	4.29%	37.8	50.1	22.71%	34.2	93.6	42.41%	94.6	197.5	89.45%
1158	9.5	38.0	34.3	95.0	9.5	4.30%	38.0	50.3	22.77%	34.3	93.8	42.47%	95.0	197.8	89.61%
1159	9.5	38.1	34.4	95.3	9.5	4.32%	38.1	50.4	22.84%	34.4	93.9	42.53%	95.3	198.2	89.78%
1160	9.6	38.3	34.6	95.7	9.6	4.34%	38.3	50.6	22.91%	34.6	94.0	42.59%	95.7	198.6	89.96%
1161	9.6	38.5	34.7	96.2	9.6	4.36%	38.5	50.8	22.99%	34.7	94.2	42.66%	96.2	199.0	90.15%
1162	9.7	38.6	34.9	96.6	9.7	4.37%	38.6	50.9	23.07%	34.9	94.3	42.72%	96.6	199.4	90.34%
1163	9.7	38.8	35.0	97.0	9.7	4.39%	38.8	51.1	23.14%	35.0	94.5	42.79%	97.0	199.9	90.53%
1164	9.7	39.0	35.2	97.4	9.7	4.41%	39.0	51.3	23.22%	35.2	94.6	42.86%	97.4	200.3	90.73%
1165	9.8	39.1	35.3	97.9	9.8	4.43%	39.1	51.4	23.30%	35.3	94.8	42.93%	97.9	200.7	90.92%
1166	9.8	39.3	35.5	98.3	9.8	4.45%	39.3	51.6	23.38%	35.5	94.9	43.00%	98.3	201.2	91.12%
1167	9.9	39.5	35.6	98.7	9.9	4.47%	39.5	51.8	23.45%	35.6	95.1	43.06%	98.7	201.6	91.31%
1168	9.9	39.7	35.8	99.1	9.9	4.49%	39.7	51.9	23.53%	35.8	95.2	43.13%	99.1	202.0	91.50%
1169	10.0	39.8	35.9	99.6	10.0	4.51%	39.8	52.1	23.61%	35.9	95.4	43.20%	99.6	202.4	91.69%
1170	10.0	40.0	36.1	100.0	10.0	4.53%	40.0	52.3	23.68%	36.1	95.5	43.26%	100.0	202.8	91.88%
1171	10.0	40.1	36.2	100.4	10.0	4.55%	40.1	52.4	23.75%	36.2	95.6	43.33%	100.4	203.2	92.06%
1172	10.1	40.3	36.3	100.8	10.1	4.56%	40.3	52.6	23.82%	36.3	95.8	43.39%	100.8	203.6	92.24%
1173	10.1	40.5	36.5	101.1	10.1	4.58%	40.5	52.7	23.89%	36.5	95.9	43.45%	101.1	204.0	92.40%
1174	10.1	40.5	36.6	101.5	10.1	4.60%	40.6	52.9	23.95%	36.6	96.0	43.50%	101.5	204.3	92.56%
1175	10.2	40.7	36.7	101.8	10.2	4.61%	40.7	53.0	24.01%	36.7	96.2	43.55%	101.8	204.7	92.71%
1176	10.2	40.9	36.8	102.1	10.2	4.63%	40.9	53.1	24.07%	36.8	96.3	43.61%	102.1	205.0	92.86%
1177	10.2	41.0	36.9	102.4	10.2	4.64%	41.0	53.3	24.13%	36.9	96.4	43.65%	102.4	205.3	93.00%
1178	10.3	41.1	37.0	102.7	10.3	4.65%	41.1	53.4	24.18%	37.0	96.5	43.70%	102.7	205.6	93.13%
1182	10.4	41.5	37.4	103.7	10.4	4.70%	41.5	53.8	24.36%	37.4	96.8	43.86%	103.7	206.6	93.58%
1187	10.5	41.9	37.7	104.7	10.5	4.74%	41.9	54.2	24.54%	37.7	97.2	44.02%	104.7	207.6	94.04%
1192	10.6	42.2	38.0	105.5	10.6	4.78%	42.2	54.5	24.69%	38.0	97.5	44.14%	105.5	208.4	94.40%
1197	10.6	42.5	38.2	106.1	10.6	4.81%	42.5	54.7	24.80%	38.2	97.7	44.24%	106.1	209.0	94.68%
1202	10.7	42.7	38.4	106.5	10.7	4.83%	42.7	54.9	24.89%	38.4	97.8	44.32%	106.6	209.5	94.90%
1207	10.7	42.8	38.5	107.0	10.7	4.85%	42.8	55.1	24.96%	38.5	98.0	44.38%	107.0	209.9	95.08%
1212	10.7	43.0	38.7	107.4	10.7	4.86%	43.0	55.2	25.02%	38.7	98.1	44.44%	107.4	210.3	95.24%
1217	10.8	43.1	38.8	107.7	10.8	4.88%	43.1	55.4	25.08%	38.8	98.2	44.49%	107.7	210.6	95.39%
1222	10.8	43.2	38.9	108.0	10.8	4.89%	43.2	55.5	25.14%	38.9	98.3	44.54%	108.0	210.9	95.52%
1232	10.9	43.4	39.1	108.6	10.9	4.92%	43.4	55.7	25.24%	39.1	98.5	44.63%	108.6	211.5	95.78%
1242	10.9	43.7	39.3	109.1	10.9	4.94%	43.7	55.9	25.34%	39.3	98.7	44.71%	109.1	212.0	96.03%
1252	11.0	43.9	39.4	109.6	11.0	4.97%	43.9	56.1	25.43%	39.4	98.9	44.79%	109.6	212.5	96.25%
1262	11.0	44.0	39.6	110.1	11.0	4.99%	44.0	56.3	25.52%	39.6	99.1	44.87%	110.1	213.0	96.47%
1272	11.1	44.2	39.6	110.6	11.1	5.01%	44.2	56.5	25.60%	39.8	99.2	44.94%	110.6	213.5	96.69%
1282	11.1	44.4	39.9	111.1	11.1	5.03%	44.4	56.7	25.69%	39.9	99.4	45.02%	111.1	213.9	96.90%
1292	11.2	44.6	40.1	111.5	11.2	5.05%	44.6	56.9	25.77%	40.1	99.5	45.09%	111.5	214.4	97.10%
1312	11.2	45.0	40.4	112.4	11.2	5.09%	45.0	57.3	25.94%	40.4	99.9	45.24%	112.4	215.3	97.52%
1322	11.3	45.1	40.6	112.9	11.3	5.11%	45.1	57.4	26.02%	40.6	100.0	45.31%	112.9	215.7	97.72%
1362	11.5	45.8	41.2	114.6	11.5	5.19%	45.8	58.1	26.33%	41.2	100.6	45.58%	114.6	217.4	98.43%
1440	12.3	47.2	43.4	117.9	12.3	5.57%	47.2	59.4	26.93%	43.4	102.9	46.60%	117.9	220.8	100.00%
			V (af) =	221											
			27.9												

Centinela Ditch Pre- PV @ Ph 1

A= 429 ac
tc= 59.99 min
BPRR 1.15 1.0
Opt: 528 cfs 0.0cfs
50 year - 4 day Storm

55 / 1.19	60 / 1.15	TIME	BPRR	QI	Q(by-pass)	CLOCK TIME	Flow 1st Day Q [cfs]	2nd Day Q [cfs]	3rd Day Q [cfs]	4th Day Q [cfs]	Runoff Vo 1st Day V (af)	2nd Day V (af)	3rd Day V (af)	4th Day V (af)
0.14	0.14	-1052	0.14	64.3	64.3	0	6.4	25.7	25.7	64.3				
0.35	0.35	-60	0.35	160.7	160.7	1002	16.1	64.3	56.2	160.7	15.5	62.1	56.6	155.2
0.37	0.37	0	0.37	169.9	169.9	1052	17.0	67.9	59.5	169.9	16.9	67.6	61.3	168.9
0.40	0.40	50	0.40	183.6	183.6	1122	18.4	73.5	64.3	183.6	18.4	73.4	66.4	183.5
0.42	0.41	70	0.41	188.2	188.2	1132	18.8	75.3	65.9	188.2	18.6	74.4	67.3	186.1
0.46	0.44	80	0.44	202.0	202.0	1142	20.2	80.8	70.7	202.0	18.9	75.5	68.3	188.8
0.49	0.47	85	0.47	215.8	215.8	1147	21.6	86.3	75.5	215.8	19.0	75.1	68.8	190.2
0.53	0.50	88	0.50	229.6	229.6	1150	23.0	91.8	80.4	229.6	19.1	76.4	69.1	191.1
0.56	0.52	90	0.52	238.8	238.8	1152	23.9	95.5	83.6	238.8	19.2	76.7	69.3	191.8
0.59	0.53	91	0.53	243.4	243.4	1153	24.3	97.4	85.2	243.4	19.2	76.8	69.4	192.1
0.62	0.55	92	0.55	252.6	252.6	1154	25.3	101.0	88.4	252.6	19.2	77.0	69.6	192.4
0.66	0.58	93	0.58	266.4	266.4	1155	26.6	106.5	93.2	266.4	19.3	77.1	69.7	192.8
0.71	0.61	94	0.61	280.1	280.1	1156	28.0	112.1	98.0	280.1	19.3	77.3	69.8	193.2
0.76	0.65	95	0.65	298.5	298.5	1157	29.9	119.4	104.5	298.5	19.4	77.4	70.0	193.6
0.81	0.70	96	0.70	321.5	321.5	1158	32.1	128.6	112.5	321.5	19.4	77.6	70.1	194.0
0.87	0.76	97	0.76	349.0	349.0	1159	34.9	139.6	122.2	349.0	19.4	77.8	70.3	194.5
0.94	0.84	98	0.84	385.7	385.7	1160	38.6	154.3	135.0	385.7	19.5	78.0	70.5	195.0
1.02	0.92	99	0.92	422.5	422.5	1161	42.2	169.0	147.9	422.5	19.6	78.2	70.6	195.5
1.09	1.01	100	1.01	463.8	463.8	1162	46.4	185.5	162.3	463.8	19.6	78.5	70.9	196.1
1.12	1.06	101	1.06	486.7	486.7	1163	48.7	194.7	170.3	486.7	19.7	78.7	71.1	196.8
1.15	1.09	102	1.09	500.5	500.5	1164	50.0	200.2	175.2	500.5	19.7	79.0	71.3	197.5
1.15	1.11	103	1.11	509.6	509.6	1165	51.0	203.9	178.4	509.6	19.8	79.3	71.6	198.2
1.19	1.13	104	1.13	518.8	518.8	1166	51.9	207.5	181.6	518.8	19.9	79.6	71.8	198.9
1.19	1.14	105	1.14	523.4	523.4	1167	52.3	209.4	183.2	523.4	20.0	79.8	72.1	199.6
1.19	1.14	106	1.14	523.4	523.4	1168	52.3	209.4	183.2	523.4	20.0	80.1	72.3	200.3
1.19	1.16	107	1.15	528.0	528.0	1169	52.8	211.2	184.8	528.0	20.1	80.4	72.6	201.0
1.19	1.15	108	1.15	528.0	528.0	1170	52.8	211.2	184.8	528.0	20.2	80.7	72.8	201.8
1.18	1.15	109	1.15	528.0	528.0	1171	52.8	211.2	184.8	528.0	20.2	81.0	73.1	202.5
1.18	1.15	110	1.15	528.0	528.0	1172	52.8	211.2	184.8	528.0	20.3	81.3	73.3	203.2
1.17	1.14	111	1.14	523.4	523.4	1173	52.3	209.4	183.2	523.4	20.4	81.6	73.6	203.9
1.16	1.14	112	1.14	523.4	523.4	1174	52.3	209.4	183.2	523.4	20.5	81.9	73.8	204.7
1.13	1.13	113	1.13	518.8	518.8	1175	51.9	207.5	181.6	518.8	20.5	82.1	74.1	205.4
1.13	1.12	114	1.12	514.2	514.2	1176	51.4	205.7	180.0	514.2	20.6	82.4	74.3	206.1
1.11	1.11	115	1.11	509.6	509.6	1177	51.0	203.8	178.4	509.6	20.7	82.7	74.6	206.8
1.05	1.09	116	1.09	500.4	500.4	1178	50.0	200.2	175.1	500.4	20.7	83.0	74.8	207.5
0.96	1.00	120	1.00	459.1	459.1	1182	45.9	183.6	160.7	459.1	21.0	84.1	75.8	210.1
0.93	0.86	125	0.86	394.8	394.8	1187	39.5	157.9	138.2	394.8	21.3	85.2	76.8	213.1
0.59	0.73	130	0.73	335.1	335.1	1192	33.5	134.0	117.3	335.1	21.6	86.2	77.7	215.5
0.58	0.63	135	0.63	289.2	289.2	1197	28.9	115.7	101.2	289.2	21.8	87.1	78.4	217.7
0.49	0.54	140	0.54	247.9	247.9	1202	24.8	99.1	86.8	247.9	22.0	87.8	79.1	219.6
0.41	0.46	145	0.46	211.1	211.1	1207	21.1	84.5	73.9	211.1	22.1	88.5	79.6	221.2
0.35	0.40	150	0.40	183.6	183.6	1212	18.4	73.4	64.3	183.6	22.3	89.0	80.1	222.5
0.29	0.34	155	0.34	156.0	156.0	1217	15.6	62.4	54.6	156.0	22.4	89.5	80.5	223.7
0.25	0.29	160	0.29	133.1	133.1	1222	13.3	53.2	46.6	133.1	22.5	89.9	80.9	224.7
0.22	0.25	170	0.25	114.7	114.7	1232	11.5	45.9	40.2	114.7	22.6	90.6	81.5	226.4
0.19	0.21	180	0.21	96.4	96.4	1242	9.6	38.6	33.7	96.4	22.8	91.1	82.0	227.8
0.17	0.18	190	0.18	82.6	82.6	1252	8.3	33.1	28.9	82.5	22.9	91.6	82.4	229.1
0.16	0.17	200	0.17	78.0	78.0	1262	7.8	31.2	27.3	78.0	23.0	92.1	82.8	230.2
0.16	0.16	210	0.16	73.5	73.5	1272	7.3	29.4	25.7	73.5	23.1	92.5	83.1	231.2
0.15	0.16	220	0.16	73.4	73.4	1282	7.3	29.4	25.7	73.4	23.2	92.9	83.5	232.2
0.15	0.15	230	0.15	68.9	68.9	1292	6.9	27.5	24.1	68.9	23.3	93.3	83.8	233.2
0.15	0.15	250	0.15	68.9	68.9	1312	6.9	27.5	24.1	68.9	23.5	94.0	84.5	235.1
0.14	0.14	260	0.14	64.3	64.3	1322	6.4	25.7	22.5	64.3	23.5	94.4	84.8	236.0
0.14	0.14	300	0.14	64.3	64.3	1362	6.4	25.7	22.5	64.3	24.0	95.8	86.1	239.6
0.14	0.14	378	0.14	64.3	64.3	1440	25.7	25.7	64.3	64.3	25.7	98.6	90.7	246.5
						Daily Peak Flow [cfs] =	53	211	185	528		roff (af) =		461
						Daily Average Flow [cfs] -	13	50	46	124			56.2	

Percentage of Total Runoff

CLOCK TIME	1st Day V (af)	1st Day %	2nd Day V (af)	2nd Day Σ V (af)	2nd Day %	3rd Day V (af)	3rd Day Σ V (af)	3rd Day %	4th Day V (af)	4th Day Σ V (af)	4th Day %
0				25.7			124.3			215.0	
1002	15.5	3.35%	62.1	87.8	19.02%	56.6	180.8	39.18%	155.2	370.2	80.23%
1052	16.9	3.66%	67.6	93.2	20.20%	61.3	185.6	40.22%	168.9	383.9	83.19%
1122	18.4	3.99%	73.4	99.1	21.47%	66.4	190.7	41.33%	183.5	398.5	86.35%
1132	18.6	4.03%	74.4	100.1	21.69%	67.3	191.6	41.52%	186.1	401.1	86.91%
1142	18.9	4.09%	75.5	101.2	21.93%	68.3	192.6	41.73%	188.9	403.9	87.49%
1147	19.0	4.12%	76.1	101.8	22.05%	68.8	193.1	41.83%	190.2	405.2	87.80%
1150	19.1	4.14%	76.4	102.1	22.13%	69.1	193.4	41.90%	191.1	406.1	88.00%
1152	19.2	4.16%	76.7	102.4	22.19%	69.3	193.6	41.95%	191.6	406.8	88.14%
1153	19.2	4.16%	76.8	102.5	22.22%	69.4	193.7	41.98%	192.1	407.1	88.21%
1154	19.2	4.17%	77.0	102.7	22.24%	69.6	193.8	42.00%	192.4	407.4	88.29%
1155	19.3	4.18%	77.1	102.8	22.28%	69.7	194.0	42.03%	192.8	407.8	88.37%
1156	19.3	4.19%	77.3	103.0	22.31%	69.8	194.1	42.06%	193.2	408.2	88.45%
1157	19.4	4.19%	77.4	103.1	22.34%	70.0	194.2	42.09%	193.6	408.6	88.53%
1158	19.4	4.20%	77.6	103.3	22.38%	70.1	194.4	42.12%	194.0	409.0	88.63%
1159	19.4	4.21%	77.8	103.5	22.42%	70.3	194.6	42.16%	194.5	409.5	88.73%
1160	19.5	4.22%	78.0	103.7	22.46%	70.5	194.7	42.20%	195.0	410.0	88.84%
1161	19.6	4.24%	78.2	103.9	22.51%	70.6	194.9	42.24%	195.5	410.5	88.96%
1162	19.6	4.25%	78.5	104.1	22.56%	70.9	195.1	42.28%	196.1	411.1	89.09%
1163	19.7	4.26%	78.7	104.4	22.62%	71.1	195.4	42.33%	196.8	411.8	89.23%
1164	19.7	4.28%	79.0	104.7	22.69%	71.3	195.6	42.39%	197.5	412.5	89.38%
1165	19.8	4.29%	79.3	104.9	22.74%	71.6	195.9	42.44%	198.2	413.2	89.53%
1166	19.9	4.31%	79.5	105.2	22.80%	71.8	196.1	42.49%	198.9	413.9	89.68%
1167	20.0	4.32%	79.8	105.5	22.86%	72.1	196.3	42.55%	199.6	414.6	89.84%
1168	20.0	4.34%	80.1	105.8	22.92%	72.3	196.6	42.60%	200.3	415.3	89.99%
1169	20.1	4.35%	80.4	106.1	22.99%	72.6	196.9	42.66%	201.0	416.0	90.15%
1170	20.2	4.37%	80.7	106.4	23.05%	72.8	197.1	42.71%	201.8	416.8	90.31%
1171	20.2	4.39%	81.0	106.7	23.12%	73.1	197.4	42.77%	202.5	417.5	90.47%
1172	20.3	4.40%	81.3	107.0	23.18%	73.3	197.6	42.82%	203.2	418.2	90.62%
1173	20.4	4.42%	81.6	107.3	23.24%	73.6	197.9	42.88%	203.9	418.9	90.78%
1174	20.5	4.43%	81.9	107.5	23.30%	73.8	198.1	42.93%	204.7	419.7	90.94%
1175	20.5	4.45%	82.1	107.8	23.37%	74.1	198.4	42.99%	205.4	420.4	91.09%
1176	20.6	4.47%	82.4	108.1	23.43%	74.3	198.6	43.04%	206.1	421.1	91.25%
1177	20.7	4.48%	82.7	108.4	23.49%	74.6	198.9	43.09%	206.8	421.8	91.40%
1178	20.7	4.50%	83.0	108.7	23.55%	74.8	199.1	43.15%	207.5	422.5	91.55%
1182	21.0	4.55%	84.1	109.7	23.78%	75.8	200.2	43.37%	210.1	425.1	92.12%
1187	21.3	4.62%	85.2	110.9	24.03%	76.8	201.1	43.57%	213.1	428.1	92.76%
1192	21.6	4.67%	86.2	111.9	24.25%	77.7	201.9	43.75%	215.6	430.6	93.30%
1197	21.8	4.72%	87.1	112.8	24.44%	78.4	202.7	43.92%	217.7	432.7	93.77%
1202	22.0	4.76%	87.8	113.5	24.60%	79.1	203.3	44.06%	219.6	434.6	94.17%
1207	22.1	4.79%	88.5	114.1	24.73%	79.6	203.9	44.18%	221.2	436.2	94.51%
1212	22.3	4.82%	89.0	114.7	24.85%	80.1	204.4	44.29%	222.5	437.5	94.81%
1217	22.4	4.85%	89.5	115.2	24.96%	80.5	204.8	44.38%	223.7	438.7	95.06%
1222	22.5	4.87%	89.9	115.6	25.04%	80.9	205.1	44.45%	224.7	439.7	95.28%
1232	22.6	4.91%	90.6	116.2	25.18%	81.5	205.7	44.58%	226.4	441.4	95.65%
1242	22.8	4.94%	91.1	116.8	25.31%	82.0	206.2	44.69%	227.8	442.8	95.96%
1252	22.9	4.96%	91.6	117.3	25.42%	82.4	206.7	44.78%	229.1	444.1	96.23%
1262	23.0	4.99%	92.1	117.8	25.52%	82.8	207.1	44.87%	230.2	445.2	96.47%
1272	23.1	5.01%	92.5	118.2	25.61%	83.1	207.4	44.95%	231.2	446.2	96.69%
1282	23.2	5.03%	92.9	118.6	25.70%	83.5	207.8	45.02%	232.2	447.2	96.91%
1292	23.3	5.05%	93.3	119.0	25.78%	83.8	208.1	45.10%	233.2	448.2	97.13%
1312	23.5	5.09%	94.0	119.7	25.94%	84.5	208.8	45.24%	235.1	450.1	97.54%
1322	23.5	5.11%	94.4	120.1	26.02%	84.8	209.1	45.31%	236.0	451.0	97.74%
1362	24.0	5.19%	95.8	121.5	26.33%	86.1	210.3	45.58%	239.6	454.6	98.50%
1440	25.7	5.57%	98.6	124.3	26.93%	90.7	215.0	45.59%	246.5	461.5	100.00%

Centinela Ditch Pre- PV @ FWM

		t--	570	ac		50 year - 4 day Storm																			
		tc1	59.99	min			Flow				Runoff				Percentage of Total Runoff										
55	60	BPRR	1.15	1.0																					
1.19	1.15	Qp1	629	cfs	0 0cfs	CLOCK	1st Day	2nd Day	3rd Day	4th Day	1st Day	2nd Day	3rd Day	4th Day	1st Day	1st Day	2nd Day	2nd Day	2nd Day	3rd Day	3rd Day	3rd Day	4th Day	4th Day	4th Day
		TIME	BPRR	Q1	Q(by-pass)	TIME	Q [cfs]	Q [cfs]	Q [cfs]	Q [cfs]	V (af)	V (af)	V (af)	V (af)	V (af)	%	V (af)	ΣV (af)	%	V (af)	ΣV (af)	%	V (af)	ΣV (af)	%
0.14	0.14	-1062	0.14	76.6	76.6	0-	7.7	30.6	30.6	75.6								30.6			148.0			256.1	
0.35	0.35	-60	0.35	191.4	191.4	1002	19.1	76.6	67.0	191.4	18.5	74.0	67.4	184.9	18.5	3.36%	74.0	104.6	19.02%	67.4	215.4	39.18%	184.9	441.1	80.27%
0.37	0.37	0	0.37	202.4	202.4	1062	20.2	80.9	70.8	202.4	20.1	80.5	73.1	201.2	20.1	3.66%	80.5	111.1	20.20%	73.1	221.1	40.22%	201.2	457.3	83.19%
0.40	0.40	60	0.40	218.8	218.8	1122	21.9	87.5	76.6	218.8	21.9	87.4	79.2	219.6	21.9	3.98%	87.4	118.0	21.47%	79.2	227.2	41.33%	219.6	474.7	86.35%
0.42	0.41	70	0.41	224.2	224.2	1132	22.4	89.7	78.5	224.2	22.2	88.7	80.2	221.7	22.2	4.03%	88.7	119.3	21.69%	80.2	228.7	41.59%	221.7	477.8	86.91%
0.46	0.44	80	0.44	240.7	240.7	1142	24.1	96.3	84.2	240.7	22.5	89.9	81.3	224.9	22.5	4.09%	89.9	120.5	21.93%	81.3	229.4	41.73%	224.9	481.0	87.49%
0.49	0.47	85	0.47	257.1	257.1	1147	25.7	102.8	90.0	257.1	22.7	90.6	81.9	226.6	22.7	4.12%	90.6	121.2	22.05%	81.9	230.0	41.83%	226.6	482.7	87.80%
0.53	0.50	88	0.50	273.5	273.5	1150	27.3	109.4	95.7	273.5	22.8	91.1	82.3	227.7	22.8	4.14%	91.1	121.7	22.13%	82.3	230.4	41.90%	227.7	483.8	88.00%
0.56	0.52	90	0.52	284.4	284.4	1152	28.4	113.8	99.6	284.4	22.8	91.4	82.6	228.4	22.8	4.16%	91.4	122.0	22.19%	82.6	230.6	41.95%	228.4	484.6	88.14%
0.59	0.53	91	0.53	289.9	289.9	1153	29.0	116.0	101.5	289.9	22.9	91.5	82.7	228.8	22.9	4.16%	91.5	122.1	22.22%	82.7	230.8	41.98%	228.8	485.0	88.21%
0.62	0.55	92	0.55	300.9	300.9	1154	30.1	120.4	105.3	300.9	22.9	91.7	82.9	229.2	22.9	4.17%	91.7	122.5	22.24%	82.9	230.9	42.00%	229.2	485.4	88.29%
0.66	0.58	93	0.58	317.3	317.3	1155	31.7	126.9	111.1	317.3	23.0	91.9	83.0	229.7	23.0	4.18%	91.9	122.6	22.29%	83.0	231.1	42.03%	229.7	485.8	88.37%
0.71	0.61	94	0.61	333.7	333.7	1156	33.4	133.5	116.8	333.7	23.0	92.0	83.2	230.1	23.0	4.19%	92.0	122.6	22.31%	83.2	231.2	42.06%	230.1	486.3	88.45%
0.76	0.65	95	0.65	355.6	355.6	1157	35.6	142.2	124.5	355.6	23.1	92.2	83.3	230.6	23.1	4.19%	92.2	122.8	22.34%	83.3	231.4	42.09%	230.6	486.7	88.53%
0.81	0.70	96	0.70	383.0	383.0	1158	38.3	153.2	134.0	383.0	23.1	92.4	83.5	231.1	23.1	4.20%	92.4	123.0	22.38%	83.5	231.6	42.12%	231.1	487.2	88.63%
0.87	0.76	97	0.76	415.8	415.8	1159	41.6	166.3	145.5	415.8	23.2	92.7	83.7	231.7	23.2	4.21%	92.7	123.3	22.42%	83.7	231.8	42.16%	231.7	487.8	88.73%
0.94	0.84	98	0.84	459.5	459.5	1160	46.0	183.8	160.8	459.5	23.2	92.9	83.9	232.3	23.2	4.22%	92.9	123.5	22.46%	83.9	232.0	42.20%	232.3	488.4	88.84%
1.02	0.92	99	0.92	503.3	503.3	1161	50.3	201.3	176.1	503.3	23.3	93.2	84.2	232.9	23.3	4.24%	93.2	123.8	22.51%	84.2	232.2	42.24%	232.9	489.1	88.96%
1.09	1.01	100	1.01	552.5	552.5	1162	55.2	221.0	193.4	552.5	23.4	93.5	84.4	233.6	23.4	4.25%	93.5	124.1	22.56%	84.4	232.5	42.28%	233.6	489.8	89.09%
1.12	1.06	101	1.06	579.8	579.8	1163	58.0	231.9	202.9	579.8	23.4	93.8	84.7	234.4	23.4	4.26%	93.8	124.4	22.62%	84.7	232.7	42.33%	234.4	490.6	89.23%
1.15	1.09	102	1.09	596.2	596.2	1164	59.6	238.5	208.7	596.2	23.5	94.1	85.0	235.2	23.5	4.28%	94.1	124.7	22.68%	85.0	233.0	42.39%	235.2	491.4	89.38%
1.16	1.11	103	1.11	607.1	607.1	1165	60.7	242.9	212.5	607.1	23.6	94.4	85.3	236.1	23.6	4.29%	94.4	125.0	22.74%	85.3	233.3	42.44%	236.1	492.2	89.53%
1.18	1.13	104	1.13	618.1	618.1	1166	61.8	247.2	216.3	618.1	23.7	94.8	85.6	236.9	23.7	4.31%	94.8	125.4	22.80%	85.6	233.6	42.49%	236.9	493.0	89.68%
1.18	1.14	105	1.14	623.5	623.5	1167	62.4	249.4	218.2	623.5	23.8	95.1	85.9	237.9	23.8	4.32%	95.1	125.7	22.86%	85.9	233.9	42.55%	237.9	493.9	89.84%
1.19	1.14	106	1.14	623.5	623.5	1168	62.4	249.4	218.2	623.5	23.9	95.4	86.2	238.6	23.9	4.34%	95.4	126.0	22.93%	86.2	234.2	42.60%	238.6	494.8	89.99%
1.19	1.16	107	1.15	629.0	629.0	1169	62.9	251.6	220.2	629.0	23.9	95.8	86.5	239.5	23.9	4.36%	95.8	126.4	22.99%	86.5	234.5	42.65%	239.5	495.6	90.15%
1.19	1.15	108	1.15	629.0	629.0	1170	62.9	251.6	220.2	629.0	24.0	96.1	86.8	240.3	24.0	4.37%	96.1	126.7	23.05%	86.8	234.8	42.71%	240.3	496.5	90.31%
1.19	1.15	109	1.15	629.0	629.0	1171	62.9	251.6	220.2	629.0	24.1	96.5	87.1	241.2	24.1	4.39%	96.5	127.1	23.12%	87.1	235.1	42.77%	241.2	497.4	90.47%
1.18	1.15	110	1.15	629.0	629.0	1172	62.9	251.6	220.1	629.0	24.2	96.8	87.4	242.1	24.2	4.40%	96.8	127.4	23.18%	87.4	235.4	42.82%	242.1	498.2	90.62%
1.17	1.14	111	1.14	623.5	623.5	1173	62.4	249.4	218.2	623.5	24.3	97.2	87.7	242.9	24.3	4.42%	97.2	127.8	23.24%	87.7	235.7	42.88%	242.9	499.1	90.78%
1.16	1.14	112	1.14	623.5	623.5	1174	62.4	249.4	218.2	623.5	24.4	97.5	88.0	243.8	24.4	4.43%	97.5	128.1	23.30%	88.0	236.0	42.93%	243.8	499.9	90.94%
1.15	1.13	113	1.13	618.0	618.0	1175	61.8	247.2	216.3	618.0	24.5	97.9	88.3	244.7	24.5	4.45%	97.9	128.5	23.37%	88.3	236.3	42.99%	244.7	500.8	91.09%
1.13	1.12	114	1.12	612.6	612.6	1176	61.3	245.0	214.4	612.6	24.6	98.2	88.6	245.5	24.6	4.47%	98.2	128.9	23.43%	88.6	236.6	43.04%	245.5	501.6	91.25%
1.11	1.11	115	1.11	607.1	607.1	1177	60.7	242.8	212.5	607.1	24.6	98.5	88.9	246.3	24.6	4.48%	98.5	129.1	23.49%	88.9	236.9	43.09%	246.3	502.5	91.40%
1.09	1.09	116	1.09	596.1	596.1	1178	59.6	238.5	208.6	596.1	24.7	98.9	89.2	247.2	24.7	4.50%	98.9	129.5	23.56%	89.2	237.2	43.15%	247.2	503.3	91.55%
0.95	1.00	120	1.00	546.9	546.9	1182	54.7	218.7	191.4	546.9	25.0	100.1	90.3	250.3	25.0	4.55%	100.1	130.7	23.78%	90.3	238.3	43.35%	250.3	506.5	92.12%
0.83	0.86	125	0.86	470.3	470.3	1187	47.0	188.1	164.6	470.3	25.4	101.5	91.5	253.8	25.4	4.62%	101.5	132.1	24.03%	91.5	239.5	43.57%	253.8	510.0	92.76%
0.69	0.73	130	0.73	399.2	399.2	1192	39.9	159.7	139.7	399.2	25.7	102.7	92.5	256.8	25.7	4.67%	102.7	133.2	24.25%	92.5	240.6	43.76%	256.8	513.0	93.30%
0.58	0.63	135	0.63	344.5	344.5	1197	34.5	137.8	120.6	344.5	25.9	103.8	93.4	259.4	25.9	4.72%	103.8	134.3	24.44%	93.4	241.5	43.92%	259.4	515.5	93.77%
0.49	0.54	140	0.54	295.3	295.3	1202	29.5	118.1	103.3	295.3	26.2	104.6	94.2	261.6	26.2	4.76%	104.5	135.2	24.60%	94.2	242.2	44.06%	261.6	517.7	94.17%
0.41	0.46	145	0.46	251.5	251.5	1207	25.2	100.6	88.0	251.5	26.3	105.4	94.9	263.5	26.3	4.79%	105.4	136.0	24.73%	94.9	242.9	44.18%	263.5	519.6	94.51%
0.35	0.40	150	0.40	218.7	218.7	1212	21.9	87.5	76.5	218.7	26.5	106.0	95.4	265.1	26.5	4.82%	106.0	136.6	24.85%	95.4	243.5	44.29%	265.1	521.2	94.81%
0.29	0.34	155	0.34	185.9	185.9	1217	18.6	74.4	65.1	185.9	26.6	106.6	95.9	266.5	26.6	4.85%	106.6	137.2	24.95%	95.9	244.0	44.38%	266.5	522.6	95.06%
0.25	0.29	160	0.29	158.6	158.6	1222	15.9	63.4	55.5	158.6	26.8	107.1	96.3	267.7	26.8	4.87%	107.1	137.7	25.04%	96.3	244.4	44.45%	267.7	523.8	95.28%
0.22	0.25	170	0.25	136.7	136.7	1232	13.7	54.7	47.8	136.7	27.0	107.9	97.0	269.7	27.0	4.91%	107.9	138.5	25.19%	97.0	245.1	44.58%	269.7	525.8	95.65%
0.19	0.21	180	0.21	114.8	114.8	1242	11.5	45.9	40.2	114.8	27.1	108.6	97.6	271.4	27.1	4.94%	108.6	139.2	25.31%	97.6	245.7	44.69%	271.4	527.5	95.96%
0.17	0.18	190	0.18	98.4	98.4	1252	9.8	39.4	34.5	98.4	27.3	109.2	98.2	272.9	27.3	4.96%	109.2	139.8	25.43%	98.2	246.2	44.78%	272.9	529.0	96.23%
0.15	0.17	200	0.17	93.0	93.0	1262	9.3	37.2	32.5	93.0	27.4	109.7	98.6	274.2	27.4	4.99%	109.7	140.3	25.52%	98.6	246.7	44.87%	274.2	530.4	96.47%
0.15	0.16	210	0.16	87.5	87.5	1272	8.8	35.0	30.6	87.5	27.5	110.2	99.1	275.5	27.5	5.01%	110.2	140.8	25.61%	99.1	247.1	44.95%	275.5	531.6	96.69%
0.15	0.16	220	0.16	87.5	87.5	1282	8.7	35.0	30.6	87.5	27.7	110.7	99.5	276.7	27.7	5.03%	110.7	141.3	25.70%	99.5	247.5	45.02%	276.7	532.8	96.91%
0.15	0.15	230	0.15	82.0	82.0	1292	8.2	32.8	28.7	82.0	27.8	111.1	99.9	277.8	27.8	5.05%	111.1	141.7	25.78%	99.9	247.9	45.10%	277.8	534.0	97.13%
0.15	0.15	250	0.15	82.0	82.0	1312	8.2	32.8	28.7	82.0	28.0	112.0	100.7	280.1	28.0	5.09%	112.0	142.6	25.94%	100.7	248.7	45.24%	280.1	536.2	97.54%
0.14	0.14	260	0.14	76.6	76.6	1322	7.7	30.6	26.8	76.6	28.1	112.5	101.1	281.2	28.1	5.11%	112.5	143.1	26.02%	101.1	249.1	45.31%	281.2	537.3	97.74%
0.14	0.14	300	0.14	76.6	76.6	1362	7.7	30.6	26.8	76.6	28.5	114.2	102.5	285.4	28.5	5.19%	114.2	144.8	26.33%	102.5	250.6	45.58%	285.4	541.5	98.50%
0.14	0.14	378	0.14	76.6	76.6	1440	30.6	30.6	76.6	76.6	30.6	117.5	108.1	293.6	30.6	5.57%	117.5	148.0	26.93%	108.1	256.1	46.59%	293.6	549.8	100.00%
					Daily Peak Flow (cfs) =		63	252	220	629			Vt (af) =	550											
					Daily Average Flow (cfs) =		15	59	54	148			183.3												

Riparian Ph 1 @ Ph 1 PL

A= 396 ac
tc1: 55.5 min
BPRR: 1.19
Qp1: 549 cfs

50 year - 4 day Storm

55	60	TIME	BPRR	Q1	0.0cfs Q(by-pass)	CLOCK TIME	Flow 1st Day Q [cfs]	2nd Day Q [cfs]	3rd Day Q [cfs]	4th Day Q [cfs]
1.19	1.15									
0.14	0.14	-1052	0.14	64.8	64.8	0	6.5	25.9	25.9	64.8
0.35	0.35	-60	0.35	162.0	162.0	1002	16.2	64.8	56.7	162.0
0.37	0.37	0	0.37	171.3	171.3	1062	17.1	68.5	59.9	171.3
0.40	0.40	60	0.40	185.2	185.2	1122	18.5	74.1	64.8	185.2
0.42	0.41	70	0.42	194.0	194.0	1132	19.4	77.6	67.9	194.0
0.46	0.44	80	0.46	212.0	212.0	1142	21.2	84.8	74.2	212.0
0.49	0.47	85	0.49	225.9	225.9	1147	22.6	90.4	79.1	225.9
0.53	0.50	88	0.53	243.9	243.9	1150	24.4	97.6	85.4	243.9
0.56	0.52	90	0.56	257.4	257.4	1152	25.7	102.9	90.1	257.4
0.59	0.53	91	0.58	270.3	270.3	1153	27.0	108.1	94.6	270.3
0.62	0.55	92	0.61	283.8	283.8	1154	28.4	113.5	99.3	283.8
0.66	0.58	93	0.65	301.8	301.8	1155	30.2	120.7	105.6	301.8
0.71	0.61	94	0.70	324.0	324.0	1156	32.4	129.6	113.4	324.0
0.76	0.65	95	0.75	346.7	346.7	1157	34.7	138.7	121.3	346.7
0.81	0.70	96	0.80	369.9	369.9	1158	37.0	147.9	129.5	369.9
0.87	0.76	97	0.86	397.6	397.6	1159	39.8	159.1	139.2	397.6
0.94	0.84	98	0.93	430.5	430.5	1160	43.0	172.2	150.7	430.5
1.02	0.92	99	1.01	467.5	467.5	1161	46.8	187.0	163.6	467.5
1.09	1.01	100	1.08	500.9	500.9	1162	50.1	200.3	175.3	500.9
1.12	1.06	101	1.11	515.7	515.7	1163	51.6	206.3	180.5	513.7
1.15	1.09	102	1.14	529.8	529.6	1164	53.0	211.8	185.3	529.6
1.16	1.11	103	1.16	534.7	534.7	1165	53.5	213.9	187.1	534.7
1.18	1.13	104	1.18	543.9	543.9	1166	54.4	217.6	190.4	543.9
1.18	1.14	105	1.18	544.4	544.4	1167	54.4	217.7	190.5	544.4
1.19	1.14	106	1.19	548.5	548.5	1168	54.9	219.4	192.0	548.5
1.19	1.15	107	1.19	549.0	549.0	1169	54.9	219.6	192.2	549.0
1.19	1.15	108	1.19	549.0	549.0	1170	54.9	219.6	192.2	549.0
1.19	1.15	109	1.19	549.0	549.0	1171	54.9	219.6	192.2	549.0
1.18	1.15	110	1.18	544.8	544.8	1172	54.5	217.9	190.7	544.8
1.17	1.14	111	1.17	540.2	540.2	1173	54.0	216.1	189.1	540.2
1.16	1.14	112	1.16	536.0	536.0	1174	53.6	214.4	187.6	536.0
1.15	1.13	113	1.15	531.4	531.4	1175	53.1	212.6	186.0	531.4
1.13	1.12	114	1.13	522.6	522.6	1176	52.3	209.0	182.9	522.6
1.11	1.11	115	1.11	513.8	513.8	1177	51.4	205.5	179.8	513.8
1.09	1.09	116	1.09	504.6	504.6	1178	50.5	201.8	176.6	504.6
0.96	1.00	120	0.96	446.2	446.2	1182	44.6	178.5	156.2	446.2
0.83	0.86	125	0.83	385.6	385.6	1187	38.6	154.2	135.0	385.6
0.69	0.73	130	0.69	321.3	321.3	1192	32.1	128.5	112.4	321.3
0.58	0.63	135	0.58	270.8	270.8	1197	27.1	108.3	94.8	270.8
0.49	0.54	140	0.50	229.1	229.1	1202	22.9	91.7	80.2	229.1
0.41	0.46	145	0.42	192.1	192.1	1207	19.2	76.8	67.2	192.1
0.35	0.40	150	0.36	164.3	164.3	1212	16.4	65.7	57.5	164.3
0.29	0.34	155	0.30	136.6	136.6	1217	13.7	54.6	47.8	136.6
0.25	0.29	160	0.25	117.6	117.6	1222	11.8	47.0	41.2	117.6
0.22	0.25	170	0.22	103.2	103.2	1232	10.3	41.3	36.1	103.2
0.19	0.21	180	0.19	88.9	88.9	1242	8.9	35.6	31.1	88.9
0.17	0.18	190	0.17	79.2	79.2	1252	7.9	31.7	27.7	79.2
0.16	0.17	200	0.16	74.5	74.5	1262	7.5	29.8	26.1	74.5
0.16	0.16	210	0.16	74.1	74.1	1272	7.4	29.6	25.9	74.1
0.15	0.16	220	0.15	69.9	69.9	1282	7.0	28.0	24.5	69.9
0.15	0.15	230	0.15	69.4	69.4	1292	6.9	27.8	24.3	69.4
0.15	0.15	250	0.15	69.4	69.4	1312	6.9	27.8	24.3	69.4
0.14	0.14	260	0.14	64.8	64.8	1322	6.5	25.9	22.7	64.8
0.14	0.14	300	0.14	64.8	64.8	1362	6.5	25.9	22.7	64.8
0.14	0.14	378	0.14	64.8	64.8	1440	25.9	25.9	64.8	64.8
					Daily Peak Flow (cfs) =		55	220	192	549
					Daily Average Flow (cfs) =		13	50	46	125

CLOCK TIME	Runoff Vol 1st Day V (af)	2nd Day V (af)	3rd Day V (af)	4th Day V (af)	1st Day V (af)	Percentage of Total Runoff 1st Day %	2nd Day V (af)	2nd Day ΣV (af)	2nd Day %	3rd Day V (af)	3rd Day ΣV (af)	3rd Day %	4th Day V (af)	4th Day ΣV (af)	4th Day %
0								25.8			125.0			216.3	
1002	15.7	62.6	57.0	156.5	15.7	3.37%	62.6	88.5	19.05%	57.0	182.1	39.21%	156.5	372.6	80.30%
1062	17.0	68.1	61.8	170.3	17.0	3.67%	68.1	94.0	20.24%	61.8	186.9	40.25%	170.3	386.6	83.27%
1122	18.5	74.0	67.0	185.0	18.5	3.99%	74.0	99.9	21.51%	67.0	192.0	41.36%	185.0	401.4	85.44%
1132	18.8	75.1	67.9	187.6	18.8	4.04%	75.1	100.9	21.73%	67.9	192.9	41.56%	187.6	404.0	87.00%
1142	19.0	76.2	68.9	190.4	19.0	4.10%	76.2	102.0	21.97%	68.9	193.9	41.77%	190.4	406.9	87.61%
1147	19.2	76.8	69.4	191.9	19.2	4.13%	76.8	102.6	22.10%	69.4	194.4	41.88%	191.5	408.3	87.93%
1150	19.3	77.2	69.8	192.9	19.3	4.15%	77.2	103.0	22.19%	69.8	194.8	41.95%	192.9	409.2	88.14%
1152	19.4	77.4	70.0	193.6	19.4	4.17%	77.4	103.3	22.24%	70.0	195.0	42.01%	193.6	409.8	88.29%
1153	19.4	77.6	70.1	194.0	19.4	4.18%	77.5	103.4	22.28%	70.1	195.2	42.03%	194.0	410.3	88.37%
1154	19.4	77.7	70.3	194.3	19.4	4.19%	77.7	103.6	22.31%	70.2	195.3	42.06%	194.3	410.7	88.45%
1155	19.5	77.9	70.4	194.8	19.5	4.19%	77.9	103.7	22.34%	70.4	195.4	42.09%	194.8	411.1	88.54%
1156	19.5	78.1	70.5	195.2	19.5	4.20%	78.1	103.9	22.38%	70.5	195.5	42.12%	195.2	411.5	88.63%
1157	19.6	78.3	70.7	195.6	19.6	4.21%	78.3	104.1	22.42%	70.7	195.7	42.16%	195.6	412.0	88.73%
1158	19.6	78.5	70.9	196.1	19.6	4.22%	78.5	104.3	22.46%	70.9	195.9	42.20%	196.1	412.5	88.83%
1159	19.7	78.7	71.1	196.7	19.7	4.24%	78.7	104.5	22.51%	71.1	196.1	42.24%	196.7	413.0	88.95%
1160	19.7	78.9	71.3	197.2	19.7	4.25%	78.9	104.7	22.56%	71.3	196.3	42.28%	197.2	413.6	89.07%
1161	19.8	79.1	71.5	197.9	19.8	4.26%	79.1	105.0	22.61%	71.5	196.5	42.33%	197.9	414.2	89.20%
1162	19.9	79.4	71.7	198.5	19.9	4.28%	79.4	105.3	22.67%	71.7	196.8	42.38%	198.5	414.8	89.35%
1163	19.9	79.7	72.0	199.2	19.9	4.29%	79.7	105.6	22.73%	72.0	197.0	42.43%	199.2	415.5	89.50%
1164	20.0	80.0	72.2	199.9	20.0	4.31%	80.0	105.8	22.79%	72.2	197.2	42.48%	199.9	416.3	89.65%
1165	20.1	80.3	72.5	200.7	20.1	4.32%	80.3	106.1	22.85%	72.5	197.5	42.54%	200.7	417.0	89.81%
1166	20.1	80.6	72.7	201.4	20.1	4.34%	80.6	106.4	22.92%	72.7	197.8	42.59%	201.4	417.7	89.97%
1167	20.2	80.9	73.0	202.2	20.2	4.35%	80.9	106.7	22.98%	73.0	198.0	42.65%	202.2	418.5	90.13%
1168	20.3	81.2	73.3	202.9	20.3	4.37%	81.2	107.0	23.05%	73.3	198.3	42.71%	202.9	419.2	90.30%
1169	20.4	81.5	73.5	203.7	20.4	4.39%	81.5	107.3	23.11%	73.5	198.6	42.76%	203.7	420.0	90.46%
1170	20.4	81.8	73.8	204.4	20.4	4.40%	81.8	107.6	23.18%	73.8	198.8	42.82%	204.4	420.8	90.62%
1171	20.5	82.1	74.1	205.2	20.5	4.42%	82.1	107.9	23.24%	74.1	199.1	42.88%	205.2	421.5	90.78%
1172	20.6	82.4	74.3	205.9	20.6	4.44%	82.4	108.2	23.31%	74.3	199.3	42.94%	205.9	422.3	90.95%
1173	20.7	82.7	74.6	206.7	20.7	4.45%	82.7	108.5	23.37%	74.6	199.6	42.99%	206.7	423.0	91.11%
1174	20.7	83.0	74.8	207.4	20.7	4.47%	83.0	108.8	23.44%	74.8	199.9	43.05%	207.4	423.8	91.27%
1175	20.8	83.3	75.1	208.2	20.8	4.48%	83.3	109.1	23.50%	75.1	200.1	43.10%	208.2	424.5	91.43%
1176	20.9	83.6	75.3	208.9	20.9	4.50%	83.6	109.4	23.56%	75.3	200.4	43.16%	208.9	425.2	91.58%
1177	21.0	83.8	75.6	209.6	21.0	4.51%	83.8	109.7	23.62%	75.6	200.6	43.21%	209.6	425.9	91.74%
1178	21.0	84.1	75.8	210.3	21.0	4.53%	84.1	110.0	23.68%	75.8	200.9	43.26%	210.3	426.6	91.89%
1182	21.3	85.2	76.8	212.5	21.3	4.59%	85.2	111.0	23.91%	76.8	201.8	43.46%	212.9	429.2	92.45%
1187	21.6	86.3	77.8	215.8	21.6	4.65%	86.3	112.2	24.16%	77.8	202.8	43.68%	215.8	432.1	93.07%
1192	21.8	87.3	78.6	218.2	21.8	4.70%	87.3	113.1	24.37%	78.6	203.5	43.86%	218.2	434.5	93.59%
1197	22.0	88.1	79.3	220.3	22.0	4.74%	88.1	113.9	24.54%	79.3	204.4	44.01%	220.3	436.6	94.03%
1202	22.2	88.8	79.9	222.0	22.2	4.78%	88.8	114.6	24.69%	79.9	205.0	44.14%	222.0	438.3	94.40%
1207	22.3	89.4	80.4	223.4	22.3	4.81%	89.4	115.2	24.81%	80.4	205.5	44.25%	223.4	439.8	94.71%
1212	22.5	89.9	80.9	224.7	22.5	4.84%	89.9	115.7	24.92%	80.9	205.9	44.35%	224.7	441.0	94.98%
1217	22.6	90.3	81.2	225.7	22.6	4.86%	90.3	116.1	25.01%	81.2	206.3	44.42%	225.7	442.0	95.20%
1222	22.7	90.6	81.5	226.6	22.7	4.88%	90.6	116.5	25.09%	81.5	206.6	44.49%	226.6	442.9	95.39%
1232	22.8	91.2	82.1	228.1	22.8	4.91%	91.2	117.1	25.22%	82.1	207.1	44.61%	228.1	444.4	95.72%
1242	22.9	91.8	82.5	229.4	22.9	4.94%	91.8	117.6	25.33%	82.5	207.6	44.70%	229.4	445.7	96.00%
1252	23.1	92.2	82.9	230.5	23.1	4.97%	92.2	118.1	25.43%	82.9	208.0	44.79%	230.5	446.9	96.25%
1262	23.2	92.7	83.3	231.6	23.2	4.99%	92.7	118.5	25.52%	83.3	208.3	44.87%	231.6	448.0	96.48%
1272	23.3	93.1	83.7	232.7	23.3	5.01%	93.1	118.9	25.61%	83.7	208.7	44.95%	232.7	449.0	96.70%
1282	23.4	93.5	84.0	233.6	23.4	5.03%	93.5	119.3	25.69%	84.0	209.0	45.02%	233.6	450.0	96.91%
1292	23.5	93.8	84.3	234.6	23.5	5.05%	93.8	119.7	25.78%	84.3	209.4	45.10%	234.6	450.9	97.12%
1312	23.7	94.6	85.0	236.5	23.7	5.09%	94.6	120.4	25.94%	85.0	210.1	45.24%	236.5	452.8	97.53%
1322	23.7	95.0	85.3	237.4	23.7	5.11%	95.0	120.8	26.02%	85.3	210.4	45.31%	237.4	451.8	97.73%
1362	24.1	96.4	86.6	241.0	24.1	5.19%	96.4	122.2	26.33%	86.6	211.6	45.58%	241.0	457.3	98.50%
1440	25.8	99.2	91.3	248.0	25.9	5.57%	99.2	125.0	26.93%	91.3	216.3	46.59%	248.0	464.3	100.00%
			(af) =	464											
				58.5											

Riparian Ph 1

		A=	518	ac																					
		Ic1:	59.99	min		50 year - 4 day Storm																			
55	60	BPRR:	1.15	1.0			Flow				Runoff					Percentage of Total Runoff									
1.13	1.15	Qp1:	625	cfs	0 0cfs	CLOCK	1st Day	2nd Day	3rd Day	4th Day	1st Day	2nd Day	3rd Day	4th Day	1st Day	1st Day	2nd Day	2nd Day	2nd Day	3rd Day	3rd Day	3rd Day	4th Day	4th Day	4th Day
		TIME	BPRR	Q1	Q(by-pass)	TIME	Q [cfs]	Q [cfs]	Q [cfs]	Q [cfs]	V [af]	V [af]	V [af]	V [af]	V [af]	%	V [af]	ΣV [af]	%	V [af]	ΣV [af]	%	V [af]	ΣV [af]	%
0.14	0.14	-1062	0.14	76.1	76.1	0	7.6	30.4	30.4	76.1								30.4			147.1			254.5	
0.35	0.35	60	0.35	190.2	190.2	1002	19.0	76.1	66.6	190.2	18.4	73.5	66.9	183.9	18.4	3.36%	73.5	103.9	19.02%	66.9	214.0	39.18%	183.8	438.3	80.23%
0.37	0.37	0	0.37	201.1	201.1	1062	20.1	80.4	70.4	201.1	20.0	80.0	72.6	199.9	20.0	3.66%	80.0	110.4	20.20%	72.6	219.7	40.22%	199.9	454.4	83.19%
0.40	0.40	60	0.40	217.4	217.4	1122	21.7	87.0	76.1	217.4	21.7	86.9	78.7	217.2	21.7	3.98%	86.9	117.3	21.47%	78.7	225.8	41.33%	217.2	471.7	86.35%
0.42	0.41	75	0.41	222.8	222.8	1132	22.3	89.1	78.0	222.8	22.0	88.1	79.7	220.3	22.0	4.03%	88.1	118.5	21.69%	79.7	226.8	41.52%	220.3	474.8	86.91%
0.46	0.44	80	0.44	239.1	239.1	1142	23.9	95.7	83.7	239.1	22.3	89.4	80.8	227.4	22.3	4.09%	89.4	119.8	21.93%	80.8	227.9	41.73%	227.4	477.9	87.49%
0.49	0.47	85	0.47	255.4	255.4	1147	25.5	102.2	89.4	255.4	22.5	90.1	81.4	225.1	22.5	4.12%	90.1	120.5	22.05%	81.4	228.5	41.83%	225.1	479.6	87.80%
0.53	0.50	88	0.50	271.8	271.8	1150	27.2	108.7	95.1	271.8	22.6	90.5	81.8	226.2	22.6	4.14%	90.5	120.9	22.13%	81.8	228.9	41.90%	226.2	480.7	88.00%
0.56	0.52	90	0.52	282.6	282.6	1152	28.3	113.1	98.9	282.6	22.7	90.8	82.1	227.0	22.7	4.16%	90.8	121.2	22.19%	82.1	229.2	41.95%	227.0	481.5	88.14%
0.59	0.53	91	0.53	288.1	288.1	1153	28.8	115.2	100.8	288.1	22.7	91.0	82.2	227.4	22.7	4.16%	91.0	121.4	22.22%	82.2	229.3	41.98%	227.4	481.9	88.21%
0.62	0.55	92	0.55	299.0	299.0	1154	29.9	119.6	104.6	299.0	22.8	91.1	82.4	227.8	22.8	4.17%	91.1	121.5	22.24%	82.4	229.5	42.00%	227.8	482.3	88.29%
0.66	0.58	93	0.58	315.3	315.3	1155	31.5	126.1	110.3	315.3	22.8	91.3	82.5	228.2	22.8	4.18%	91.3	121.7	22.28%	82.5	229.6	42.03%	228.2	482.7	88.37%
0.71	0.61	94	0.61	331.6	331.6	1156	33.2	132.6	116.1	331.6	22.9	91.5	82.7	228.7	22.9	4.19%	91.5	121.9	22.31%	82.7	229.8	42.06%	228.7	483.2	88.45%
0.76	0.65	95	0.65	353.4	353.4	1157	35.3	141.3	123.7	353.4	22.9	91.7	82.8	229.1	22.9	4.19%	91.7	122.1	22.34%	82.8	229.9	42.09%	229.1	483.6	88.53%
0.81	0.70	96	0.70	380.5	380.5	1158	38.1	152.2	133.2	380.5	23.0	91.9	83.0	229.6	23.0	4.20%	91.9	122.3	22.39%	83.0	230.1	42.12%	229.6	484.1	88.63%
0.87	0.76	97	0.76	413.1	413.1	1159	41.3	165.3	144.6	413.1	23.0	92.1	83.2	230.2	23.0	4.21%	92.1	122.5	22.42%	83.2	230.3	42.16%	230.2	484.7	88.73%
0.94	0.84	98	0.84	456.6	456.6	1160	45.7	182.6	159.8	456.6	23.1	92.3	83.4	230.8	23.1	4.22%	92.3	122.7	22.46%	83.4	230.5	42.20%	230.8	485.3	88.84%
1.02	0.92	99	0.92	500.1	500.1	1161	50.0	200.0	175.0	500.1	23.1	92.6	83.6	231.4	23.1	4.24%	92.6	123.0	22.51%	83.6	230.7	42.24%	231.4	485.9	88.96%
1.09	1.01	100	1.01	549.0	549.0	1162	54.9	219.6	192.1	549.0	23.2	92.9	83.9	232.2	23.2	4.25%	92.9	123.3	22.56%	83.9	231.0	42.28%	232.2	486.7	89.09%
1.12	1.06	101	1.06	576.1	576.1	1163	57.6	230.4	201.6	576.1	23.3	93.2	84.2	232.9	23.3	4.26%	93.2	123.6	22.62%	84.2	231.3	42.33%	232.9	487.4	89.23%
1.15	1.09	102	1.09	592.4	592.4	1164	59.2	237.0	207.3	592.4	23.4	93.5	84.4	233.7	23.4	4.28%	93.5	123.9	22.68%	84.4	231.5	42.39%	233.7	488.2	89.38%
1.16	1.11	103	1.11	603.3	603.3	1165	60.3	241.3	211.1	603.3	23.5	93.8	84.7	234.6	23.5	4.29%	93.8	124.2	22.74%	84.7	231.8	42.44%	234.6	489.1	89.53%
1.18	1.13	104	1.13	614.1	614.1	1166	61.4	245.7	214.9	614.1	23.5	94.2	85.0	235.4	23.5	4.31%	94.2	124.6	22.80%	85.0	232.1	42.49%	235.4	489.9	89.68%
1.18	1.14	105	1.14	619.6	619.6	1167	62.0	247.8	216.8	619.6	23.6	94.5	85.3	236.2	23.6	4.32%	94.5	124.9	22.86%	85.3	232.4	42.55%	236.2	490.8	89.84%
1.19	1.14	106	1.14	619.6	619.6	1168	62.0	247.8	216.9	619.6	23.7	94.8	85.6	237.1	23.7	4.34%	94.8	125.2	22.93%	85.6	232.7	42.60%	237.1	491.6	89.99%
1.19	1.15	107	1.15	625.0	625.0	1169	62.5	250.0	218.8	625.0	23.8	95.2	85.9	238.0	23.8	4.35%	95.2	125.6	22.99%	85.9	233.0	42.66%	238.0	492.5	90.15%
1.19	1.15	108	1.15	625.0	625.0	1170	62.5	250.0	218.8	625.0	23.9	95.5	86.2	238.8	23.9	4.37%	95.5	125.9	23.05%	86.2	233.3	42.71%	238.8	493.3	90.31%
1.19	1.15	109	1.15	625.0	625.0	1171	62.5	250.0	218.8	625.0	24.0	95.9	86.5	239.7	24.0	4.39%	95.9	126.3	23.12%	86.5	233.6	42.77%	239.7	494.2	90.47%
1.18	1.15	110	1.15	625.0	625.0	1172	62.5	250.0	218.7	625.0	24.1	96.2	86.8	240.5	24.1	4.40%	96.2	126.6	23.18%	86.8	233.9	42.82%	240.5	495.1	90.62%
1.17	1.14	111	1.14	619.6	619.6	1173	62.0	247.8	216.8	619.6	24.1	96.6	87.1	241.4	24.1	4.42%	96.6	127.0	23.24%	87.1	234.2	42.88%	241.4	495.9	90.79%
1.16	1.14	112	1.14	619.5	619.5	1174	62.0	247.8	216.8	619.5	24.2	96.9	87.4	242.3	24.2	4.43%	96.9	127.3	23.30%	87.4	234.5	42.93%	242.3	496.8	90.94%
1.15	1.13	113	1.13	614.1	614.1	1175	61.4	245.6	214.9	614.1	24.3	97.2	87.7	243.1	24.3	4.45%	97.2	127.6	23.37%	87.7	234.8	42.99%	243.1	497.6	91.09%
1.13	1.12	114	1.12	608.7	608.7	1176	60.9	243.5	213.0	608.7	24.4	97.6	88.0	243.9	24.4	4.47%	97.6	128.0	23.43%	88.0	235.1	43.04%	243.9	498.5	91.25%
1.11	1.11	115	1.11	603.2	603.2	1177	60.3	241.3	211.1	603.2	24.5	97.9	88.7	244.9	24.5	4.48%	97.9	128.3	23.49%	88.3	235.4	43.09%	244.8	499.3	91.40%
1.09	1.09	116	1.09	592.4	592.4	1178	59.2	236.9	207.3	592.4	24.6	98.2	88.6	245.5	24.6	4.50%	98.2	128.6	23.55%	88.6	235.7	43.15%	245.6	500.1	91.55%
0.96	1.00	120	1.00	543.4	543.4	1182	54.3	217.4	190.2	543.4	24.9	99.5	89.7	248.7	24.9	4.55%	99.5	129.9	23.78%	89.7	236.8	43.35%	248.7	502.2	92.12%
0.83	0.86	125	0.86	467.3	467.3	1187	46.7	186.9	163.6	467.3	25.2	100.9	90.9	252.2	25.2	4.62%	100.9	131.3	24.03%	90.9	238.0	43.57%	252.2	506.7	92.76%
0.69	0.73	130	0.73	396.7	396.7	1192	39.7	158.7	138.8	396.7	25.5	102.1	91.9	255.2	25.5	4.67%	102.1	132.5	24.25%	91.9	239.0	43.75%	255.2	509.7	93.30%
0.58	0.63	135	0.63	342.3	342.3	1197	34.2	136.9	119.8	342.3	25.8	103.1	92.8	257.7	25.8	4.72%	103.1	133.5	24.44%	92.8	239.9	43.92%	257.7	512.2	93.77%
0.49	0.54	140	0.54	293.4	293.4	1202	29.3	117.4	102.7	293.4	26.0	104.0	93.6	259.9	26.0	4.76%	104.0	134.4	24.60%	93.6	240.7	44.06%	259.9	514.4	94.17%
0.41	0.46	145	0.46	249.9	249.9	1207	25.0	100.0	87.5	249.9	26.2	104.7	94.3	261.8	26.2	4.79%	104.7	135.1	24.73%	94.3	241.4	44.18%	261.8	516.3	94.51%
0.35	0.40	150	0.40	217.3	217.3	1212	21.7	86.9	76.1	217.3	26.3	105.4	94.8	263.4	26.3	4.82%	105.4	135.8	24.85%	94.8	241.9	44.28%	263.4	517.9	94.81%
0.29	0.34	155	0.34	184.7	184.7	1217	18.5	73.9	64.7	184.7	26.5	105.9	95.3	264.6	26.5	4.85%	105.9	136.3	24.95%	95.3	242.4	44.38%	264.8	519.3	95.06%
0.25	0.29	160	0.29	157.6	157.6	1222	15.8	63.0	55.1	157.6	26.6	106.4	95.7	266.0	26.6	4.87%	106.4	136.8	25.04%	95.7	242.8	44.45%	266.0	520.6	95.28%
0.22	0.25	170	0.25	135.8	135.8	1232	13.6	54.3	47.5	135.8	26.8	107.2	96.4	268.0	26.8	4.91%	107.2	137.5	25.19%	96.4	243.5	44.58%	268.0	522.5	95.65%
0.19	0.21	180	0.21	114.1	114.1	1242	11.4	45.6	39.9	114.1	27.0	107.9	97.0	269.7	27.0	4.94%	107.9	138.3	25.31%	97.0	244.1	44.69%	269.7	524.2	95.96%
0.17	0.18	190	0.18	97.8	97.8	1252	9.8	39.1	34.2	97.8	27.1	108.5	97.5	271.2	27.1	4.96%	108.5	138.9	25.42%	97.5	244.6	44.78%	271.2	525.7	96.23%
0.16	0.17	200	0.17	92.4	92.4	1262	9.2	36.9	32.3	92.4	27.2	109.0	98.0	272.5	27.2	4.99%	109.0	139.4	25.52%	98.0	245.1	44.87%	272.5	527.0	96.47%
0.16	0.16	210	0.16	87.0	87.0	1272	8.7	34.8	30.4	87.0	27.4	109.5	98.4	273.7	27.4	5.01%	109.5	139.9	25.61%	98.4	245.5	44.95%	273.7	528.2	96.69%
0.15	0.16	220	0.16	86.9	86.9	1282	8.7	34.8	30.4	86.9	27.5	110.0	98.8	274.9	27.5	5.03%	110.0	140.4	25.70%	98.8	246.0	45.02%	274.9	529.4	96.91%
0.15	0.15	230	0.15	81.5	81.5	1292	8.2	32.6	28.5	81.5	27.6	110.4	99.2	276.1	27.6	5.05%	110.4	140.8	25.78%	99.2	246.4	45.10%	276.1	530.6	97.13%
0.15	0.15	250	0.15	81.5	81.5	1312	8.2	32.6	26.5	81.5	27.8	111.2	100.0	278.3	27.8	5.09%	111.2	141.7	25.94%	100.0	247.1	45.24%	278.3	532.8	97.54%
0.14	0.14	260	0.14	76.1	76.1	1322	7.6	30.4	26.6	76.1	27.9	111.6	100.4	279.4	27.9	5.11%	111.6	142.2	26.02%	100.4	247.5	45.31%	279.4	533.9	97.74%
0.14	0.14	300	0.14	76.1	76.1	1362	7.6	30.4	26.6	76.1	28.4	113.4	101.9	283.6	28.4	5.19%	113.4	143.8	26.33%	101.9	249.0	45.58%	283.6	538.1	98.50%
0.14	0.14	378	0.14	76.1	76.1	1440	30.4	30.4	76.1	76.1	30.4	116.7	107.4	291.8	30.4	5.57%	116.7	147.1	26.93%	107.4	254.5	46.59%	291.8	546.3	100.00%
					Daily Peak Flow [cfs] =		63	250	219	625			V(af) =	546											
					Daily Average Flow [cfs] =		15	59	54	147				63.9											

Riparian Ph 2 @ Ph 1 PL

		A=	367	ac																					
		tc1:	43.9	min		50 year - 4 day Storm																			
40	45	BPRR:	1.32	0.8			Flow				Runoff Vol					Percentage of Total Runoff									
1.37	1.30	Qp1:	549	cfs	0.0cfs	CLOCK	1st Day	2nd Day	3rd Day	4th Day	1st Day	2nd Day	3rd Day	4th Day	1st Day	1st Day	2nd Day	2nd Day	2nd Day	3rd Day	3rd Day	3rd Day	4th Day	4th Day	4th Day
		TIME	BPRR	Q1	Q(by-pass)	TIME	Q [cfs]	Q [cfs]	Q [cfs]	Q [cfs]	V [af]	V [af]	V [af]	V [af]	V [af]	%	V [af]	∑V [af]	%	V [af]	∑V [af]	%	V [af]	∑V [af]	%
0.14	0.14	-1062	0.14	58.4	58.4	0	5.8	23.4	23.4	58.4								23.2			112.9			194.4	
0.35	0.35	-60	0.35	146.1	146.1	1002	14.6	58.4	51.1	146.1	14.1	56.5	51.4	141.1	14.1	3.38%	56.5	79.7	19.10%	51.4	163.7	39.25%	141.1	335.5	80.40%
0.37	0.37	0	0.37	154.4	154.4	1062	15.4	61.8	54.0	154.4	15.4	61.4	55.8	153.5	15.4	3.68%	61.4	84.6	20.20%	55.8	168.1	40.30%	153.5	347.5	83.40%
0.40	0.40	60	0.40	166.9	166.9	1122	16.7	66.8	58.4	166.9	16.7	66.7	60.4	166.8	16.7	4.00%	66.7	89.9	21.56%	60.4	172.7	41.41%	166.8	361.2	86.59%
0.45	0.44	70	0.44	184.6	184.6	1132	18.5	73.8	64.6	184.6	16.9	67.7	61.3	169.2	16.9	4.06%	67.7	90.9	21.80%	61.3	173.6	41.61%	169.2	363.6	87.17%
0.54	0.51	80	0.52	215.6	215.6	1142	21.6	86.2	75.5	215.6	17.2	68.8	62.2	172.0	17.2	4.12%	68.8	92.0	22.06%	62.2	174.5	41.84%	172.0	366.4	87.83%
0.61	0.57	85	0.58	241.6	241.6	1147	24.2	96.6	84.5	241.6	17.4	69.4	62.8	173.5	17.4	4.16%	69.4	92.6	22.21%	62.8	175.1	41.98%	173.5	367.9	88.20%
0.67	0.62	86	0.63	263.4	263.4	1150	26.3	105.3	92.2	263.4	17.5	69.8	63.1	174.6	17.5	4.19%	69.8	93.1	22.31%	63.1	175.5	42.05%	174.6	369.0	88.45%
0.72	0.68	90	0.69	287.5	287.5	1152	28.7	115.0	100.6	287.5	17.5	70.2	63.4	175.4	17.5	4.20%	70.2	93.4	22.38%	63.4	175.7	42.13%	175.4	369.7	88.54%
0.76	0.71	91	0.72	300.9	300.9	1153	30.1	120.4	105.3	300.9	17.6	70.3	63.5	175.8	17.6	4.21%	70.3	93.5	22.42%	63.5	175.9	42.18%	175.8	370.1	88.73%
0.81	0.75	92	0.76	318.5	318.5	1154	31.9	127.4	111.5	318.5	17.6	70.5	63.7	176.2	17.6	4.22%	70.5	93.7	22.46%	63.7	176.0	42.20%	176.2	370.6	88.84%
0.86	0.79	93	0.81	336.1	336.1	1155	33.6	134.5	117.7	336.1	17.7	70.7	63.8	176.7	17.7	4.24%	70.7	93.9	22.51%	63.8	176.2	42.25%	175.7	371.0	88.94%
0.93	0.84	94	0.86	358.8	358.8	1156	35.9	143.5	125.6	358.8	17.7	70.9	64.0	177.1	17.7	4.25%	70.9	94.1	22.56%	64.0	176.3	42.28%	177.1	371.5	89.06%
1.00	0.90	95	0.92	384.8	384.8	1157	38.5	153.9	134.7	384.8	17.8	71.1	64.2	177.7	17.8	4.26%	71.1	94.3	22.60%	64.2	176.5	42.32%	177.7	372.0	89.18%
1.10	0.97	96	1.00	416.8	416.8	1158	41.7	166.7	145.9	416.8	17.8	71.3	64.4	178.2	17.8	4.27%	71.3	94.5	22.65%	64.4	176.7	42.36%	178.2	372.5	89.31%
1.24	1.06	97	1.10	458.9	458.9	1159	45.9	183.6	160.6	458.9	17.9	71.5	64.6	178.8	17.9	4.29%	71.5	94.7	22.71%	64.6	176.9	42.41%	178.8	373.2	89.46%
1.28	1.19	98	1.21	504.9	504.9	1160	50.5	202.0	176.7	504.9	17.9	71.8	64.8	179.5	17.9	4.30%	71.8	95.0	22.78%	64.8	177.2	42.47%	179.5	373.8	89.62%
1.32	1.22	99	1.24	518.4	518.4	1161	51.8	207.3	181.4	518.4	18.0	72.1	65.1	180.2	18.0	4.32%	72.1	95.3	22.84%	65.1	177.4	42.53%	180.2	374.5	89.79%
1.34	1.25	100	1.27	530.0	530.0	1162	53.0	212.0	185.5	530.0	18.1	72.4	65.3	180.9	18.1	4.34%	72.4	95.6	22.91%	65.3	177.7	42.59%	180.9	375.3	89.96%
1.36	1.27	101	1.29	538.3	538.3	1163	53.8	215.3	188.4	538.3	18.2	72.7	65.6	181.6	18.2	4.35%	72.7	95.9	22.98%	65.6	177.9	42.65%	181.6	376.0	90.14%
1.37	1.28	102	1.30	542.5	542.5	1164	54.2	217.0	189.9	542.5	18.2	73.0	65.8	182.4	18.2	4.37%	73.0	96.2	23.05%	65.8	178.2	42.71%	182.4	376.7	90.31%
1.37	1.29	103	1.31	545.7	545.7	1165	54.6	218.3	191.0	545.7	18.3	73.3	66.1	183.1	18.3	4.39%	73.3	96.5	23.13%	66.1	178.4	42.78%	183.1	377.5	90.49%
1.37	1.30	104	1.32	549.0	549.0	1166	54.9	219.6	192.2	549.0	18.4	73.6	66.4	183.9	18.4	4.41%	73.6	96.8	23.20%	66.4	178.7	42.84%	183.9	378.2	90.67%
1.36	1.30	105	1.31	548.1	548.1	1167	54.8	219.2	191.8	548.1	18.5	73.9	66.6	184.6	18.5	4.43%	73.9	97.1	23.27%	66.6	179.0	42.90%	184.6	379.0	90.85%
1.35	1.30	106	1.31	547.2	547.2	1168	54.7	218.9	191.5	547.2	18.5	74.2	66.9	185.4	18.5	4.44%	74.2	97.4	23.34%	66.9	179.2	42.97%	185.4	379.8	91.04%
1.34	1.29	107	1.30	543.0	543.0	1169	54.3	217.2	190.0	543.0	18.6	74.5	67.2	186.1	18.6	4.46%	74.5	97.7	23.42%	67.2	179.5	43.03%	186.1	380.5	91.22%
1.32	1.28	108	1.29	537.9	537.9	1170	53.8	215.2	188.3	537.9	18.7	74.8	67.4	186.9	18.7	4.48%	74.8	98.0	23.49%	67.4	179.8	43.09%	186.9	381.2	91.40%
1.29	1.27	109	1.27	531.9	531.9	1171	53.2	212.8	186.2	531.9	18.8	75.0	67.7	187.6	18.8	4.50%	75.0	98.3	23.56%	67.7	180.0	43.15%	187.6	382.0	91.57%
1.26	1.26	110	1.26	525.9	525.9	1172	52.6	210.4	184.1	525.9	18.8	75.3	67.9	188.4	18.8	4.52%	75.3	98.6	23.63%	67.9	180.3	43.22%	188.4	382.7	91.75%
1.21	1.23	111	1.23	511.5	511.5	1173	51.2	204.6	179.0	511.5	18.9	75.6	68.2	189.1	18.9	4.53%	75.6	98.8	23.70%	68.2	180.5	43.28%	189.1	383.4	91.92%
1.15	1.20	112	1.19	496.2	496.2	1174	49.6	198.5	173.7	496.2	19.0	75.9	68.4	189.9	19.0	4.55%	75.9	99.1	23.76%	68.4	180.8	43.33%	189.8	384.1	92.08%
1.09	1.16	113	1.14	477.7	477.7	1175	47.8	191.1	167.2	477.7	19.0	76.2	68.7	190.4	19.0	4.57%	76.2	99.4	23.83%	68.7	181.0	43.39%	190.4	384.8	92.25%
1.04	1.11	114	1.09	456.8	456.8	1176	45.7	182.7	159.9	456.8	19.1	76.4	68.9	191.1	19.1	4.58%	76.4	99.6	23.89%	68.9	181.2	43.44%	191.1	385.4	92.40%
0.99	1.07	115	1.05	439.2	439.2	1177	43.9	175.7	153.7	439.2	19.2	76.7	69.1	191.7	19.2	4.60%	76.7	99.9	23.95%	69.1	181.4	43.50%	191.7	386.1	92.55%
0.94	1.02	116	1.00	418.4	418.4	1178	41.8	167.3	146.4	418.4	19.2	76.9	69.3	192.2	19.2	4.61%	76.9	100.1	24.00%	69.3	181.5	43.55%	192.3	386.6	92.69%
0.78	0.97	120	0.85	353.0	353.0	1182	35.3	141.2	123.6	353.0	19.4	77.8	70.1	194.4	19.4	4.66%	77.8	101.0	24.21%	70.1	182.4	43.72%	194.4	388.8	93.20%
0.60	0.71	125	0.69	286.2	286.2	1187	28.6	114.5	100.2	286.2	19.7	78.6	70.8	196.6	19.7	4.71%	78.6	101.9	24.42%	70.8	183.2	43.91%	196.6	391.0	93.73%
0.48	0.58	130	0.56	232.9	232.9	1192	23.3	93.2	81.5	232.9	19.8	79.4	71.5	198.4	19.8	4.76%	79.4	102.8	24.59%	71.5	183.6	44.06%	198.4	392.8	94.15%
0.36	0.47	135	0.45	187.9	187.9	1197	18.8	75.2	65.8	187.9	20.0	79.9	72.0	199.8	20.0	4.79%	79.9	103.2	24.73%	72.0	184.3	44.18%	199.8	394.2	94.50%
0.31	0.38	140	0.36	152.2	152.2	1202	15.2	60.9	53.3	152.2	20.1	80.4	72.4	201.0	20.1	4.82%	80.4	103.6	24.84%	72.4	184.7	44.28%	201.0	395.4	94.78%
0.25	0.31	145	0.30	123.9	123.9	1207	12.4	49.5	43.4	123.9	20.2	80.8	72.7	202.0	20.2	4.84%	80.8	104.0	24.93%	72.7	185.0	44.36%	202.0	396.3	95.01%
0.22	0.25	150	0.24	101.6	101.6	1212	10.2	40.6	35.6	101.6	20.3	81.1	73.0	202.7	20.3	4.86%	81.1	104.3	25.01%	73.0	185.3	44.42%	202.7	397.1	95.20%
0.21	0.22	155	0.22	90.9	90.9	1217	9.1	36.4	31.8	90.9	20.3	81.4	73.2	203.4	20.3	4.88%	81.4	104.6	25.07%	73.2	185.5	44.48%	203.4	397.8	95.36%
0.20	0.21	160	0.21	86.7	86.7	1222	8.7	34.7	30.4	86.7	20.4	81.6	73.4	204.0	20.4	4.89%	81.6	104.8	25.13%	73.4	185.8	44.53%	204.0	398.4	95.50%
0.18	0.19	170	0.18	78.4	78.4	1232	7.8	31.4	27.4	78.4	20.5	82.1	73.8	205.2	20.5	4.92%	82.1	105.3	25.24%	73.8	186.2	44.63%	205.2	399.5	95.77%
0.17	0.17	180	0.17	71.0	71.0	1242	7.1	28.4	24.8	71.0	20.6	82.5	74.2	206.2	20.6	4.94%	82.5	105.7	25.34%	74.2	186.5	44.71%	206.2	400.5	96.02%
0.16	0.16	190	0.16	66.8	66.8	1252	6.7	26.7	23.4	66.8	20.7	82.9	74.5	207.1	20.7	4.97%	82.9	106.1	25.43%	74.5	186.8	44.79%	207.1	401.5	96.25%
0.16	0.16	200	0.16	66.8	66.8	1262	6.7	26.7	23.4	66.8	20.8	83.2	74.8	208.1	20.8	4.99%	83.2	106.4	25.52%	74.8	187.2	44.87%	208.1	402.4	96.47%
0.16	0.16	210	0.15	66.8	66.8	1272	6.7	26.7	23.4	66.8	20.9	83.6	75.2	209.0	20.9	5.01%	83.6	106.8	25.60%	75.2	187.5	44.95%	209.0	403.3	96.69%
0.15	0.15	220	0.15	62.6	62.6	1282	6.3	25.0	21.9	62.6	21.0	83.9	75.5	209.9	21.0	5.03%	83.9	107.2	25.69%	75.5	187.8	45.02%	209.9	404.2	96.90%
0.15	0.15	230	0.15	62.6	62.6	1292	6.3	25.0	21.9	62.6	21.1	84.3	75.8	210.7	21.1	5.05%	84.3	107.5	25.77%	75.8	188.1	45.09%	210.7	405.1	97.11%
0.15	0.15	250	0.15	62.6	62.6	1312	6.3	25.0	21.9	62.6	21.2	85.0	76.4	212.4	21.2	5.09%	85.0	108.2	25.94%	76.4	188.7	45.24%	212.4	406.8	97.52%
0.14	0.14	260	0.14	58.4	58.4	1322	5.8	23.4	20.5	58.4	21.3	85.3	76.7	213.3	21.3	5.11%	85.3	108.5	26.02%	76.7	189.0	45.31%	213.3	407.6	97.72%
0.14	0.14	300	0.14	58.4	58.4	1362	5.8	23.4	20.5	58.4	21.7	86.6	77.8	216.5	21.7	5.19%	86.6	109.8	26.33%	77.8	190.1	45.58%	216.5	410.9	98.50%
0.14	0.14	378	0.14	58.4	58.4	1440	23.4	23.4	58.4	58.4	23.2	89.1	82.0	222.8	23.2	5.57%	89.1	112.3	26.93%	82.0	194.4	45.59%	222.8	417.1	100.00%
					Daily Peak Flow (cfs) =		55	220	192	549			kaf (af) =	417											
					Daily Average Flow (cfs) =		12	45	41	112			52.5												

		A=	489	ac																					
		tc1:	59.9	mn		50 year - 4 day Storm																			
55	60	BPRR:	1.15	1.0			Flow				Runoff					Percentage of Total Runoff									
1.19	1.15	Qp1:	608	cfs	0.0cfs	CLOCK	1st Day	2nd Day	3rd Day	4th Day	1st Day	2nd Day	3rd Day	4th Day	1st Day	1st Day	2nd Day	2nd Day	2nd Day	3rd Day	3rd Day	3rd Day	4th Day	4th Day	4th Day
		TIME	BPRR	Q1	Q(by-pass)	TIME	Q [cfs]	Q [cfs]	Q [cfs]	Q [cfs]	V [af]	V [af]	V [af]	V [af]	V [af]	%	V [af]	ΣV [af]	%	V [af]	ΣV [af]	%	V [af]	ΣV [af]	%
0.14	0.14	-1062	0.14	74.0	74.0	0	7.4	29.6	29.6	74.0								29.6			143.2			247.4	
0.35	0.35	-60	0.35	184.9	184.9	1002	18.5	74.0	64.7	184.9	17.9	71.5	65.1	178.6	17.9	3.36%	71.5	101.0	19.02%	65.1	208.1	39.13%	178.6	426.1	80.23%
0.37	0.37	0	0.37	195.5	195.5	1062	19.5	78.2	68.4	195.5	19.4	77.7	70.6	194.4	19.4	3.66%	77.7	107.3	20.21%	70.6	213.6	40.22%	194.4	441.9	83.19%
0.40	0.40	60	0.40	211.3	211.3	1122	21.1	84.5	74.0	211.3	21.1	84.5	76.5	211.2	21.1	3.98%	84.5	114.0	21.47%	76.5	219.5	41.33%	211.2	458.5	86.36%
0.42	0.41	70	0.41	216.7	216.7	1132	21.7	86.7	75.9	216.7	21.4	85.7	77.5	214.1	21.4	4.03%	85.7	115.2	21.59%	77.5	220.5	41.52%	214.1	461.5	86.91%
0.46	0.44	80	0.44	232.7	232.7	1142	23.3	93.1	81.4	232.7	21.7	86.9	78.6	217.2	21.7	4.09%	86.9	116.4	21.93%	78.6	221.6	41.73%	217.2	464.5	87.49%
0.49	0.47	85	0.47	248.5	248.5	1147	24.9	99.4	87.0	248.5	21.9	87.6	79.2	218.9	21.9	4.12%	87.6	117.1	22.05%	79.2	222.2	41.84%	218.9	466.3	87.81%
0.53	0.50	88	0.50	264.5	264.5	1150	26.4	105.8	92.6	264.5	22.0	88.0	79.5	219.9	22.0	4.14%	88.0	117.5	22.13%	79.5	222.5	41.91%	219.9	467.4	88.01%
0.56	0.52	90	0.52	275.2	275.2	1152	27.5	110.1	96.3	275.2	22.1	88.3	79.8	220.7	22.1	4.16%	88.3	117.8	22.19%	79.8	222.8	41.95%	220.7	468.1	88.15%
0.59	0.53	91	0.53	280.6	280.6	1153	28.1	112.2	98.2	280.6	22.1	88.4	79.9	221.1	22.1	4.16%	88.4	118.0	22.22%	79.9	222.9	41.98%	221.1	468.5	88.22%
0.62	0.55	92	0.55	291.3	291.3	1154	29.1	116.5	102.0	291.3	22.1	88.6	80.1	221.5	22.1	4.17%	88.6	118.1	22.25%	80.1	223.1	42.01%	221.5	468.9	88.29%
0.66	0.58	93	0.58	307.3	307.3	1155	30.7	122.9	107.5	307.3	22.2	88.7	80.2	221.9	22.2	4.18%	88.7	118.3	22.28%	80.2	223.2	42.03%	221.9	469.3	88.37%
0.71	0.61	94	0.61	323.3	323.3	1156	32.3	129.3	113.2	323.3	22.2	88.9	80.4	222.3	22.2	4.19%	88.9	118.5	22.31%	80.4	223.4	42.06%	222.3	469.7	88.45%
0.76	0.65	95	0.65	344.6	344.6	1157	34.5	137.8	120.6	344.6	22.3	89.1	80.5	222.8	22.3	4.19%	89.1	118.7	22.34%	80.5	223.5	42.09%	222.8	470.2	88.54%
0.81	0.70	96	0.70	371.0	371.0	1158	37.1	148.4	129.8	371.0	22.3	89.3	80.7	223.3	22.3	4.20%	89.3	118.9	22.38%	80.7	223.7	42.12%	223.3	470.7	88.63%
0.87	0.76	97	0.76	402.7	402.7	1159	40.3	161.1	140.9	402.7	22.4	89.5	80.9	223.8	22.4	4.21%	89.5	119.1	22.42%	80.9	223.9	42.16%	223.8	471.2	88.73%
0.94	0.84	98	0.84	444.9	444.9	1160	44.5	177.9	155.7	444.9	22.4	89.7	81.1	224.4	22.4	4.23%	89.7	119.3	22.47%	81.1	224.1	42.20%	224.4	471.8	88.84%
1.02	0.92	99	0.92	487.1	487.1	1161	48.7	194.8	170.5	487.1	22.5	90.0	81.3	225.0	22.5	4.24%	90.0	119.6	22.51%	81.3	224.3	42.24%	225.0	472.4	88.96%
1.09	1.01	100	1.01	534.5	534.5	1162	53.4	213.8	187.1	534.5	22.6	90.3	81.6	225.7	22.6	4.25%	90.3	119.8	22.57%	81.6	224.6	42.29%	225.7	473.1	89.09%
1.12	1.06	101	1.06	560.7	560.7	1163	56.1	224.3	196.2	560.7	22.6	90.6	81.8	226.5	22.6	4.26%	90.6	120.1	22.62%	81.8	224.8	42.34%	226.5	473.9	89.24%
1.15	1.09	102	1.09	576.5	576.5	1164	57.7	230.6	201.8	576.5	22.7	90.9	82.1	227.3	22.7	4.28%	90.9	120.5	22.68%	82.1	225.1	42.39%	227.3	474.7	89.38%
1.16	1.11	103	1.11	587.0	587.0	1165	58.7	234.8	205.4	587.0	22.8	91.2	82.4	228.1	22.8	4.29%	91.2	120.9	22.74%	82.4	225.4	42.44%	228.1	475.5	89.53%
1.18	1.13	104	1.13	597.5	597.5	1166	59.8	239.0	209.1	597.5	22.9	91.5	82.7	228.9	22.9	4.31%	91.5	121.1	22.80%	82.7	225.7	42.49%	228.9	476.3	89.69%
1.18	1.14	105	1.14	602.7	602.7	1167	60.3	241.1	211.0	602.7	23.0	91.9	82.9	229.7	23.0	4.33%	91.9	121.4	22.87%	82.9	226.0	42.55%	229.7	477.1	89.84%
1.19	1.14	106	1.14	602.8	602.8	1168	60.3	241.1	211.0	602.8	23.1	92.2	83.2	230.5	23.1	4.34%	92.2	121.8	22.93%	83.2	226.2	42.60%	230.5	478.0	90.00%
1.19	1.15	107	1.15	608.0	608.0	1169	60.8	243.2	212.8	608.0	23.1	92.5	83.5	231.4	23.1	4.36%	92.5	122.1	22.99%	83.5	226.5	42.66%	231.4	478.8	90.16%
1.19	1.15	108	1.15	608.0	608.0	1170	60.8	243.2	212.8	608.0	23.2	92.9	83.8	232.2	23.2	4.37%	92.9	122.4	23.06%	83.8	226.8	42.71%	232.2	479.6	90.31%
1.19	1.15	109	1.15	608.0	608.0	1171	60.8	243.2	212.8	608.0	23.3	93.2	84.1	233.0	23.3	4.39%	93.2	122.8	23.12%	84.1	227.1	42.77%	233.0	480.5	90.47%
1.18	1.15	110	1.15	607.9	607.9	1172	60.8	243.2	212.8	607.9	23.4	93.6	84.4	233.9	23.4	4.40%	93.6	123.1	23.19%	84.4	227.4	42.82%	233.9	481.3	90.63%
1.17	1.14	111	1.14	602.6	602.6	1173	60.3	241.0	210.9	602.6	23.5	93.9	84.7	234.7	23.5	4.42%	93.9	123.4	23.24%	84.7	227.7	42.88%	234.7	482.1	90.79%
1.16	1.14	112	1.14	602.5	602.5	1174	60.3	241.0	210.9	602.5	23.6	94.2	85.0	235.5	23.6	4.44%	94.2	123.8	23.31%	85.0	228.0	42.93%	235.5	483.0	90.94%
1.15	1.13	113	1.13	597.2	597.2	1175	59.7	238.9	209.0	597.2	23.6	94.5	85.3	236.4	23.6	4.45%	94.5	124.1	23.37%	85.3	228.3	42.99%	236.4	483.9	91.10%
1.13	1.12	114	1.12	591.8	591.8	1176	59.2	236.7	207.1	591.8	23.7	94.9	85.6	237.2	23.7	4.47%	94.9	124.4	23.43%	85.6	228.6	43.04%	237.2	484.5	91.25%
1.11	1.11	115	1.11	586.4	586.4	1177	58.6	234.6	205.3	586.4	23.8	95.2	85.9	238.0	23.8	4.48%	95.2	124.8	23.49%	85.9	228.9	43.10%	238.0	485.4	91.41%
1.09	1.09	116	1.09	575.9	575.9	1178	57.6	230.4	201.6	575.9	23.9	95.5	86.1	238.8	23.9	4.50%	95.5	125.1	23.55%	86.1	229.1	43.15%	238.8	486.2	91.56%
0.96	1.00	120	1.00	527.9	527.9	1182	52.8	211.2	184.8	527.9	24.2	96.7	87.2	241.8	24.2	4.55%	96.7	125.3	23.78%	87.2	230.2	43.35%	241.8	489.2	92.13%
0.81	0.86	125	0.86	454.0	454.0	1187	45.4	181.6	158.9	454.0	24.5	98.1	88.4	245.2	24.5	4.62%	98.1	127.6	24.04%	88.4	231.4	43.57%	245.2	492.6	92.77%
0.69	0.73	130	0.73	385.3	385.3	1192	38.5	154.1	134.8	385.3	24.8	99.2	89.4	248.1	24.8	4.67%	99.2	128.8	24.25%	89.4	232.4	43.76%	248.1	495.5	93.31%
0.58	0.63	135	0.63	332.3	332.3	1197	33.2	132.9	116.3	332.3	25.1	100.2	90.3	250.6	25.1	4.72%	100.2	129.8	24.44%	90.3	233.3	43.92%	250.6	498.0	93.79%
0.49	0.54	140	0.54	284.8	284.8	1202	28.5	113.9	99.7	284.8	25.3	101.1	91.0	252.7	25.3	4.76%	101.1	130.6	24.60%	91.0	234.0	44.06%	252.7	500.1	94.18%
0.41	0.46	145	0.46	242.5	242.5	1207	24.3	97.0	84.9	242.5	25.5	101.8	91.6	254.5	25.5	4.79%	101.8	131.4	24.74%	91.6	234.6	44.18%	254.5	501.5	94.52%
0.35	0.40	150	0.40	210.8	210.8	1212	21.1	84.3	73.8	210.8	25.6	102.4	92.2	256.1	25.6	4.82%	102.4	132.0	24.85%	92.2	235.2	44.29%	256.1	503.5	94.81%
0.29	0.34	155	0.34	179.1	179.1	1217	17.9	71.6	62.7	179.1	25.7	103.0	92.7	257.4	25.7	4.85%	103.0	132.5	24.96%	92.7	235.7	44.39%	257.4	504.8	95.06%
0.25	0.29	160	0.29	152.8	152.8	1222	15.3	61.1	53.5	152.8	25.9	103.4	93.1	258.6	25.9	4.87%	103.4	133.0	25.04%	93.1	236.1	44.45%	258.6	505.0	95.26%
0.22	0.25	170	0.25	131.8	131.8	1232	13.2	52.7	46.1	131.8	26.1	104.2	93.7	260.5	26.1	4.91%	104.2	133.8	25.19%	93.7	236.7	44.58%	260.5	507.9	95.65%
0.19	0.21	180	0.21	110.7	110.7	1242	11.1	44.3	38.8	110.7	26.2	104.9	94.3	262.2	26.2	4.94%	104.9	134.4	25.31%	94.3	237.3	44.69%	262.2	509.6	95.96%
0.17	0.19	190	0.18	95.0	95.0	1252	9.5	38.0	33.2	95.0	26.4	105.4	94.8	263.6	26.4	4.97%	105.4	135.0	25.42%	94.8	237.8	44.78%	263.6	511.0	96.23%
0.16	0.17	200	0.17	89.7	89.7	1262	9.0	35.9	31.4	89.7	26.5	106.0	95.3	264.9	26.5	4.99%	106.0	135.5	25.52%	95.3	238.3	44.87%	264.9	512.3	96.47%
0.16	0.15	210	0.16	84.5	84.5	1272	8.5	33.8	29.6	84.5	26.6	106.4	95.7	266.1	26.6	5.01%	106.4	136.0	25.61%	95.7	238.7	44.95%	266.1	513.5	96.70%
0.15	0.15	220	0.16	84.4	84.4	1282	8.4	33.8	29.5	84.4	26.7	106.9	96.1	267.3	26.7	5.03%	106.9	136.5	25.70%	96.1	239.1	45.02%	267.3	514.7	96.91%
0.15	0.15	230	0.15	79.2	79.2	1292	7.9	31.7	27.7	79.2	26.8	107.4	96.5	268.4	26.8	5.05%	107.4	136.9	25.78%	96.5	239.5	45.10%	268.4	515.8	97.13%
0.15	0.15	250	0.15	79.2	79.2	1312	7.9	31.7	27.7	79.2	27.1	108.2	97.2	270.6	27.1	5.09%	108.2	137.8	25.94%	97.2	240.3	45.24%	270.6	518.0	97.54%
0.14	0.14	260	0.14	74.0	74.0	1322	7.4	29.6	25.9	74.0	27.2	108.6	97.6	271.6	27.2	5.11%	108.6	138.2	26.02%	97.6	240.5	45.31%	271.6	519.0	97.74%
0.14	0.14	300	0.14	74.0	74.0	1362	7.4	29.6	25.9	74.0	27.6	110.3	99.0	275.7	27.6	5.19%	110.3	139.8	26.33%	99.0	242.1	45.58%	275.7	523.1	98.50%
0.14	0.14	378	0.14	74.0	74.0	1440	29.6	29.6	74.0	74.0	29.6	112.5	104.4	283.5	29.6	5.57%	113.5	140.0	26.50%	104.4	247.4	46.59%	283.6	531.1	100.00%
					Daily Peak Flow [cfs] =		61	243	213	608			ff (af) =	531											
					Daily Average Flow [cfs] =		15	57	53	143				66.3											

Lincoln Drain South

		A=	91.8	ac																					
		tc1:	12.5	min		50 year - 4 day Storm																			
12	14	BPRR	2.28	0.3			Flow				Runoff					Percentage of Total Runoff									
2.32	2.17	Qp1:	209	cfs	0.0cfs	CLOCK	1st Day	2nd Day	3rd Day	4th Day	1st Day	2nd Day	3rd Day	4th Day	1st Day	1st Day	2nd Day	2nd Day	2nd Day	3rd Day	3rd Day	3rd Day	4th Day	4th Day	4th Day
		TIME	BPRR	Q1	Q(by-pass)	TIME	Q [cfs]	Q [cfs]	Q [cfs]	Q [cfs]	V [af]	V [af]	V [af]	V [af]	V [af]	%	V [af]	∑V [af]	%	V [af]	∑V [af]	%	V [af]	∑V [af]	%
0.14	0.14	-1052	0.14	12.8	12.8	0	1.3	5.1	5.1	12.8								5.0			24.3			42.1	
0.35	0.35	-50	0.35	32.0	32.0	1002	3.2	12.8	11.2	32.0	3.1	12.4	11.3	31.6	3.1	3.43%	12.4	17.4	19.29%	11.3	35.6	39.47%	31.0	73.0	80.91%
0.37	0.37	0	0.37	33.9	33.9	1062	3.4	13.6	11.9	33.9	3.4	13.5	12.2	33.7	3.4	3.79%	13.5	18.5	20.50%	12.2	36.5	40.48%	33.7	75.7	83.93%
0.40	0.40	60	0.40	36.6	36.6	1122	3.7	14.7	12.8	36.6	3.7	14.6	13.2	36.6	3.7	4.08%	14.6	19.7	21.79%	13.3	37.6	41.61%	36.6	78.7	87.16%
0.50	0.49	70	0.50	45.6	45.6	1132	4.6	18.2	15.9	45.6	3.7	14.9	13.5	37.2	3.7	4.12%	14.9	19.9	22.04%	13.5	37.8	41.83%	37.2	79.2	87.78%
0.67	0.66	80	0.67	61.1	61.1	1142	6.1	24.4	21.4	61.1	3.8	15.2	13.7	37.9	3.8	4.20%	15.2	20.2	22.37%	13.7	38.0	42.12%	37.9	80.0	88.60%
0.80	0.79	85	0.80	73.0	73.0	1147	7.3	29.2	25.6	73.0	3.8	15.3	13.9	38.4	3.8	4.25%	15.3	20.4	22.57%	13.9	38.2	42.30%	38.4	80.4	89.11%
0.91	0.90	88	0.91	83.1	83.1	1150	8.3	33.2	29.1	83.1	3.9	15.5	14.0	38.7	3.9	4.29%	15.5	20.5	22.71%	14.0	38.3	42.42%	38.7	80.7	89.47%
1.05	1.04	90	1.05	95.9	95.9	1152	9.6	38.4	33.6	95.9	3.9	15.6	14.1	38.9	3.9	4.31%	15.6	20.6	22.82%	14.1	38.4	42.52%	38.9	81.0	89.74%
1.41	1.29	91	1.38	126.1	126.1	1153	12.6	50.5	44.1	126.1	3.9	15.6	14.1	39.1	3.9	4.33%	15.6	20.7	22.89%	14.1	38.4	42.56%	39.1	81.1	90.01%
1.80	1.60	92	1.82	166.4	166.4	1154	16.6	66.6	58.2	166.4	3.9	15.7	14.2	39.3	3.9	4.35%	15.7	20.7	22.98%	14.2	38.5	42.65%	39.3	81.3	90.13%
2.26	2.06	93	2.21	202.4	202.4	1155	20.2	80.9	70.8	202.4	4.0	15.8	14.3	39.5	4.0	4.38%	15.8	20.9	23.09%	14.3	38.6	42.76%	39.5	81.6	90.42%
2.31	2.19	94	2.27	207.4	207.4	1156	20.7	83.0	72.6	207.4	4.0	15.9	14.4	39.8	4.0	4.41%	15.9	21.0	23.22%	14.4	38.7	42.86%	39.8	81.9	90.73%
2.32	2.16	95	2.28	208.8	208.8	1157	20.9	83.5	73.1	208.8	4.0	16.0	14.5	40.1	4.0	4.44%	16.0	21.1	23.36%	14.5	38.8	42.97%	40.1	82.2	91.05%
2.31	2.17	96	2.28	208.3	208.3	1158	20.8	83.3	72.9	208.3	4.0	16.2	14.6	40.4	4.0	4.48%	16.2	21.2	23.47%	14.6	38.9	43.08%	40.4	82.5	91.36%
2.24	2.15	97	2.22	203.0	203.0	1159	20.3	81.2	71.1	203.0	4.1	16.3	14.7	40.7	4.1	4.51%	16.3	21.3	23.60%	14.7	39.0	43.19%	40.7	82.7	91.68%
1.94	2.12	98	1.99	181.8	181.8	1160	18.2	72.7	63.6	181.8	4.1	16.4	14.8	40.9	4.1	4.54%	16.4	21.4	23.72%	14.8	39.1	43.30%	40.9	83.0	91.97%
1.62	2.01	99	1.72	157.3	157.3	1161	15.7	62.9	55.0	157.3	4.1	16.5	14.9	41.2	4.1	4.56%	16.5	21.5	23.82%	14.9	39.2	43.39%	41.2	83.2	92.23%
1.42	1.69	100	1.49	136.0	136.0	1162	13.6	54.4	47.6	136.0	4.1	16.6	14.9	41.4	4.1	4.59%	16.6	21.6	23.91%	14.9	39.3	43.47%	41.4	83.4	92.45%
1.25	1.49	101	1.30	119.3	119.3	1163	11.9	47.7	41.7	119.3	4.2	16.6	15.0	41.6	4.2	4.60%	16.5	21.6	23.99%	15.0	39.3	43.53%	41.6	83.6	92.65%
1.10	1.29	102	1.15	105.1	105.1	1164	10.5	42.0	36.8	105.1	4.2	16.7	15.0	41.7	4.2	4.62%	16.7	21.7	24.05%	15.0	39.3	43.59%	41.7	83.8	92.82%
0.97	1.14	103	1.01	92.7	92.7	1165	9.3	37.1	32.4	92.7	4.2	16.7	15.1	41.8	4.2	4.64%	16.7	21.8	24.12%	15.1	39.4	43.65%	41.8	83.9	92.97%
0.87	1.00	104	0.90	82.6	82.6	1166	8.3	33.1	28.9	82.6	4.2	16.8	15.1	42.0	4.2	4.65%	16.8	21.8	24.17%	15.1	39.4	43.69%	42.0	84.0	93.10%
0.80	0.87	105	0.82	74.9	74.9	1167	7.5	29.9	26.2	74.9	4.2	16.8	15.2	42.1	4.2	4.66%	16.8	21.9	24.22%	15.2	39.5	43.74%	42.1	84.1	93.22%
0.74	0.79	106	0.75	68.9	68.9	1168	6.9	27.6	24.1	68.9	4.2	16.9	15.2	42.2	4.2	4.67%	16.9	21.9	24.26%	15.2	39.5	43.77%	42.2	84.2	93.33%
0.69	0.72	107	0.70	64.1	64.1	1169	6.4	25.6	22.4	64.1	4.2	16.9	15.2	42.3	4.2	4.68%	16.9	21.9	24.30%	15.2	39.5	43.81%	42.3	84.3	93.44%
0.65	0.66	108	0.66	60.2	60.2	1170	6.0	24.1	21.1	60.2	4.2	16.9	15.3	42.4	4.2	4.69%	16.9	22.0	24.34%	15.3	39.6	43.84%	42.4	84.4	93.53%
0.62	0.64	109	0.63	57.2	57.2	1171	5.7	22.9	20.0	57.2	4.2	17.0	15.3	42.4	4.2	4.70%	17.0	22.0	24.38%	15.3	39.6	43.87%	42.4	84.5	93.62%
0.58	0.59	110	0.58	53.3	53.3	1172	5.3	21.3	18.7	53.3	4.3	17.0	15.3	42.5	4.3	4.71%	17.0	22.0	24.41%	15.3	39.6	43.90%	42.5	84.6	93.70%
0.55	0.56	111	0.55	50.6	50.6	1173	5.1	20.2	17.7	50.6	4.3	17.0	15.3	42.6	4.3	4.72%	17.0	22.1	24.44%	15.3	39.6	43.93%	42.6	84.6	93.78%
0.52	0.53	112	0.52	47.8	47.8	1174	4.8	19.1	16.7	47.8	4.3	17.1	15.4	42.6	4.3	4.73%	17.1	22.1	24.47%	15.4	39.7	43.96%	42.6	84.7	93.86%
0.50	0.51	113	0.50	46.0	46.0	1175	4.6	18.4	16.1	46.0	4.3	17.1	15.4	42.7	4.3	4.73%	17.1	22.1	24.50%	15.4	39.7	43.98%	42.7	84.8	93.93%
0.47	0.48	114	0.47	43.3	43.3	1176	4.3	17.3	15.1	43.3	4.3	17.1	15.4	42.8	4.3	4.74%	17.1	22.1	24.53%	15.4	39.7	44.01%	42.8	84.8	94.00%
0.45	0.46	115	0.45	41.4	41.4	1177	4.1	16.6	14.5	41.4	4.3	17.1	15.4	42.8	4.3	4.75%	17.1	22.2	24.55%	15.4	39.7	44.03%	42.8	84.9	94.06%
0.43	0.43	116	0.43	39.4	39.4	1178	3.9	15.7	13.8	39.4	4.3	17.2	15.5	42.9	4.3	4.75%	17.2	22.2	24.58%	15.5	39.8	44.05%	42.9	84.9	94.13%
0.36	0.36	120	0.36	33.0	33.0	1182	3.3	13.2	11.5	33.0	4.3	17.2	15.5	43.1	4.3	4.77%	17.2	22.3	24.67%	15.5	39.8	44.12%	43.1	85.1	94.35%
0.30	0.31	125	0.30	27.7	27.7	1187	2.8	11.1	8.7	27.7	4.3	17.3	15.6	43.3	4.3	4.80%	17.3	22.3	24.76%	15.6	39.9	44.21%	43.3	85.4	94.58%
0.26	0.27	130	0.26	24.0	24.0	1192	2.4	9.6	8.4	24.0	4.3	17.4	15.7	43.5	4.3	4.82%	17.4	22.4	24.84%	15.7	40.0	44.28%	43.5	85.5	94.77%
0.22	0.23	135	0.22	20.4	20.4	1197	2.0	8.1	7.1	20.4	4.4	17.5	15.7	43.6	4.4	4.83%	17.5	22.5	24.91%	15.7	40.0	44.34%	43.6	85.7	94.94%
0.20	0.21	140	0.20	18.5	18.5	1202	1.9	7.4	6.5	18.5	4.4	17.5	15.8	43.8	4.4	4.85%	17.5	22.5	24.96%	15.8	40.1	44.39%	43.8	85.8	95.09%
0.18	0.19	145	0.18	16.7	16.7	1207	1.7	6.7	5.8	16.7	4.4	17.6	15.8	43.9	4.4	4.86%	17.6	22.6	25.02%	15.8	40.1	44.44%	43.9	85.9	95.23%
0.17	0.18	150	0.17	15.8	15.8	1212	1.6	6.3	5.5	15.8	4.4	17.6	15.8	44.0	4.4	4.87%	17.6	22.6	25.07%	15.8	40.1	44.48%	44.0	86.1	95.35%
0.16	0.17	155	0.16	14.9	14.9	1217	1.5	6.0	5.2	14.9	4.4	17.6	15.9	44.1	4.4	4.89%	17.6	22.7	25.11%	15.9	40.2	44.52%	44.1	86.2	95.47%
0.16	0.16	160	0.16	14.7	14.7	1222	1.5	5.9	5.1	14.7	4.4	17.7	15.9	44.2	4.4	4.90%	17.7	22.7	25.16%	15.9	40.2	44.56%	44.2	86.3	95.58%
0.16	0.16	170	0.16	14.7	14.7	1232	1.5	5.9	5.1	14.7	4.4	17.8	16.0	44.4	4.4	4.92%	17.8	22.8	25.25%	16.0	40.3	44.64%	44.4	86.5	95.80%
0.15	0.15	180	0.15	13.7	13.7	1242	1.4	5.5	4.8	13.7	4.5	17.8	16.1	44.6	4.5	4.94%	17.8	22.9	25.34%	16.1	40.4	44.71%	44.6	86.7	96.02%
0.15	0.15	190	0.15	13.7	13.7	1252	1.4	5.5	4.8	13.7	4.5	17.9	16.1	44.8	4.5	4.96%	17.9	22.9	25.42%	16.1	40.4	44.79%	44.8	86.9	96.23%
0.15	0.15	200	0.15	13.7	13.7	1262	1.4	5.5	4.8	13.7	4.5	18.0	16.2	45.0	4.5	4.98%	18.0	23.0	25.50%	16.2	40.5	44.86%	45.0	87.0	96.44%
0.15	0.15	210	0.15	13.7	13.7	1272	1.4	5.5	4.8	13.7	4.5	18.1	16.3	45.2	4.5	5.00%	18.1	23.1	25.59%	16.3	40.6	44.93%	45.2	87.2	96.65%
0.15	0.15	220	0.15	13.7	13.7	1282	1.4	5.5	4.8	13.7	4.5	18.1	16.3	45.4	4.5	5.03%	18.1	23.2	25.67%	16.3	40.6	45.01%	45.4	87.4	96.86%
0.15	0.15	230	0.15	13.7	13.7	1292	1.4	5.5	4.8	13.7	4.6	18.2	16.4	45.5	4.6	5.05%	18.2	23.3	25.75%	16.4	40.7	45.08%	45.5	87.6	97.07%
0.15	0.15	250	0.15	13.7	13.7	1312	1.4	5.5	4.8	13.7	4.6	18.4	16.5	45.9	4.6	5.09%	18.4	23.4	25.92%	16.5	40.8	45.23%	45.9	88.0	97.49%
0.14	0.14	260	0.14	12.8	12.8	1322	1.3	5.1	4.5	12.8	4.6	18.4	16.6	46.1	4.6	5.11%	18.4	23.5	26.00%	16.6	40.9	45.30%	46.1	88.2	97.70%
0.14	0.14	300	0.14	12.8	12.8	1362	1.3	5.1	4.5	12.8	4.7	18.7	16.8	46.8	4.7	5.19%	18.7	23.8	26.32%	16.8	41.1	45.57%	46.8	88.9	98.47%
0.14	0.14	378	0.14	12.8	12.8	1440	5.1	5.1	12.8	12.8	5.0	19.3	17.6	48.2	5.0	5.57%	19.3	24.3	26.93%	17.6	42.1	46.60%	48.2	90.2	100.00%
					Daily Peak Flow [cfs] =		21	84	73	209			bf (af) =	90											
					Daily Average Flow [cfs] =		3	10	9	24			114												

		A=	33.8	ac																					
		tc1:	10	min	50 year - 4 day Storm																				
10	12	BPRR	2.50	0.0			Flow				Runoff					Percentage of Total Runoff									
2.50	2.32	Opt1:	103.7	cfs	0.0cfs	CLOCK	1st Day	2nd Day	3rd Day	4th Day	1st Day	2nd Day	3rd Day	4th Day	1st Day	1st Day	2nd Day	2nd Day	2nd Day	3rd Day	3rd Day	3rd Day	4th Day	4th Day	4th Day
		TIME	BPRR	Q1	Q(by-pass)	TIME	Q [cfs]	Q [cfs]	Q [cfs]	Q [cfs]	V [af]	V [af]	V [af]	V [af]	V [af]	%	V [af]	∑V [af]	%	V [af]	∑V [af]	%	V [af]	∑V [af]	%
0.14	0.14	-1062	0.14	5.8	5.8	0	0.6	2.3	2.3	5.8								2.3			11.0			19.0	
0.35	0.35	-60	0.35	14.5	14.5	1002	1.5	5.8	5.1	14.5	1.4	5.6	5.1	14.0	1.4	3.44%	5.6	7.9	13.31%	5.1	16.1	35.44%	14.0	33.1	80.96%
0.37	0.37	0	0.37	15.3	15.3	1062	1.5	6.1	5.4	15.3	1.5	6.1	5.5	15.7	1.5	3.74%	6.1	8.4	20.52%	5.5	16.5	41.50%	15.7	34.3	83.98%
0.46	0.40	60	0.40	16.6	16.6	1122	1.7	6.6	5.8	16.6	1.7	6.6	6.0	16.6	1.7	4.06%	6.6	8.9	21.81%	6.0	17.0	41.63%	16.6	35.6	87.22%
0.50	0.50	70	0.50	20.7	20.7	1132	2.1	8.3	7.3	20.7	1.7	6.7	5.1	16.8	1.7	4.12%	6.7	9.0	22.07%	6.1	17.1	41.80%	16.8	35.9	87.65%
0.67	0.67	80	0.67	27.8	27.8	1142	2.8	11.1	9.7	27.8	1.7	6.9	6.2	17.2	1.7	4.21%	6.9	9.1	22.39%	6.2	17.2	42.14%	17.2	36.2	88.67%
0.80	0.80	85	0.80	33.2	33.2	1147	3.3	13.3	11.6	33.2	1.7	7.0	6.3	17.4	1.7	4.26%	7.0	9.2	22.60%	6.3	17.3	42.32%	17.4	36.4	89.18%
0.91	0.91	88	0.91	37.7	37.7	1150	3.8	15.1	13.2	37.7	1.8	7.0	6.3	17.5	1.8	4.29%	7.0	9.3	22.74%	6.3	17.3	42.45%	17.5	36.6	89.54%
1.05	1.05	90	1.05	43.6	43.6	1152	4.4	17.4	15.2	43.6	1.8	7.1	6.4	17.6	1.8	4.32%	7.1	9.3	22.85%	6.4	17.4	42.54%	17.6	36.7	89.81%
1.43	1.41	91	1.43	59.3	59.3	1153	5.9	23.7	20.8	59.3	1.8	7.1	6.4	17.7	1.8	4.34%	7.1	9.4	22.92%	6.4	17.4	42.60%	17.7	36.7	89.98%
2.32	1.69	92	2.32	96.2	96.2	1154	9.6	38.5	33.7	96.2	1.8	7.1	6.4	17.8	1.8	4.36%	7.1	9.4	23.03%	6.4	17.4	42.69%	17.8	36.9	90.25%
2.47	2.26	93	2.47	102.5	102.5	1155	10.2	41.0	35.9	102.5	1.8	7.2	6.5	18.0	1.8	4.40%	7.2	9.5	23.16%	6.5	17.5	42.81%	18.0	37.0	90.59%
2.49	2.31	94	2.49	103.3	103.3	1156	10.3	41.3	36.1	103.3	1.8	7.2	6.5	18.1	1.8	4.43%	7.2	9.5	23.30%	6.5	17.5	42.93%	18.1	37.1	90.93%
2.49	2.32	95	2.49	103.3	103.3	1157	10.3	41.3	36.1	103.3	1.8	7.3	6.6	18.2	1.9	4.47%	7.3	9.6	23.44%	6.6	17.6	43.06%	18.2	37.3	91.28%
2.44	2.31	96	2.44	101.2	101.2	1158	10.1	40.5	35.4	101.2	1.8	7.4	6.6	18.4	1.8	4.50%	7.4	9.6	23.58%	6.6	17.6	43.18%	18.4	37.4	91.63%
2.21	2.24	97	2.21	91.7	91.7	1159	9.2	36.7	32.1	91.7	1.9	7.4	6.7	18.5	1.9	4.53%	7.4	9.7	23.71%	6.7	17.7	43.29%	18.5	37.5	91.95%
1.80	1.94	98	1.80	74.7	74.7	1160	7.5	29.9	26.1	74.7	1.9	7.5	6.7	18.6	1.9	4.56%	7.5	9.7	23.82%	6.7	17.7	43.39%	18.6	37.7	92.23%
1.50	1.62	99	1.50	62.2	62.2	1161	6.2	24.9	21.8	62.2	1.9	7.5	6.8	18.7	1.9	4.59%	7.5	9.8	23.91%	6.8	17.7	43.47%	18.7	37.7	92.46%
1.25	1.42	100	1.25	51.9	51.9	1162	5.2	20.7	18.1	51.9	1.9	7.5	6.8	18.8	1.9	4.61%	7.5	9.8	23.99%	6.8	17.8	43.54%	18.8	37.8	92.65%
1.03	1.25	101	1.03	42.7	42.7	1163	4.3	17.1	15.0	42.7	1.9	7.5	6.8	18.9	1.9	4.62%	7.5	9.8	24.05%	6.8	17.8	43.59%	18.9	37.9	92.81%
0.91	1.10	102	0.91	37.7	37.7	1164	3.8	15.1	13.2	37.7	1.9	7.6	6.8	18.9	1.9	4.63%	7.6	9.8	24.11%	6.8	17.8	43.64%	18.9	37.9	92.95%
0.85	0.97	103	0.85	35.3	35.3	1165	3.5	14.1	12.3	35.3	1.9	7.6	6.8	19.0	1.9	4.65%	7.6	9.9	24.16%	6.8	17.8	43.68%	19.0	38.0	93.07%
0.78	0.87	104	0.78	32.4	32.4	1166	3.2	12.9	11.3	32.4	1.9	7.6	6.9	19.0	1.9	4.66%	7.6	9.9	24.20%	6.9	17.8	43.72%	19.0	38.0	93.19%
0.73	0.80	105	0.73	30.3	30.3	1167	3.0	12.1	10.6	30.3	1.9	7.6	6.9	19.1	1.9	4.67%	7.6	9.9	24.24%	6.9	17.9	43.76%	19.1	38.1	93.29%
0.69	0.74	106	0.69	28.6	28.6	1168	2.9	11.4	10.0	28.6	1.9	7.6	6.9	19.1	1.9	4.68%	7.6	9.9	24.28%	6.9	17.9	43.79%	19.1	38.1	93.33%
0.66	0.69	107	0.66	27.4	27.4	1169	2.7	11.0	9.6	27.4	1.9	7.7	6.9	19.1	1.9	4.69%	7.7	9.9	24.32%	6.9	17.9	43.83%	19.1	38.2	93.49%
0.63	0.65	108	0.63	26.1	26.1	1170	2.6	10.5	9.1	26.1	1.9	7.7	6.9	19.2	1.9	4.70%	7.7	9.9	24.36%	6.9	17.9	43.86%	19.2	38.2	93.58%
0.60	0.62	109	0.60	24.9	24.9	1171	2.5	10.0	8.7	24.9	1.9	7.7	6.9	19.2	1.9	4.71%	7.7	10.0	24.39%	6.9	17.9	43.89%	19.2	38.2	93.66%
0.57	0.58	110	0.57	23.6	23.6	1172	2.4	9.5	8.3	23.6	1.9	7.7	6.9	19.2	1.9	4.71%	7.7	10.0	24.43%	6.9	17.9	43.92%	19.2	38.3	93.75%
0.56	0.55	111	0.55	22.8	22.8	1173	2.3	9.1	8.0	22.8	1.9	7.7	6.9	19.3	1.9	4.72%	7.7	10.0	24.46%	6.9	17.9	43.95%	19.3	38.3	93.82%
0.52	0.52	112	0.52	21.6	21.6	1174	2.2	8.6	7.5	21.6	1.9	7.7	7.0	19.3	1.9	4.73%	7.7	10.0	24.49%	7.0	18.0	43.97%	19.3	38.3	93.90%
0.50	0.50	113	0.50	20.7	20.7	1175	2.1	8.3	7.3	20.7	1.9	7.7	7.0	19.3	1.9	4.74%	7.7	10.0	24.52%	7.0	18.0	44.00%	19.3	38.4	93.97%
0.47	0.47	114	0.47	19.5	19.5	1176	1.9	7.8	6.8	19.5	1.9	7.7	7.0	19.4	1.9	4.74%	7.7	10.0	24.54%	7.0	18.0	44.02%	19.4	38.4	94.04%
0.45	0.45	115	0.45	18.7	18.7	1177	1.9	7.5	6.5	18.7	1.9	7.8	7.0	19.4	1.9	4.75%	7.8	10.0	24.57%	7.0	18.0	44.04%	19.4	38.4	94.10%
0.43	0.43	116	0.43	17.8	17.8	1178	1.8	7.1	6.2	17.8	1.9	7.8	7.0	19.4	1.9	4.76%	7.8	10.0	24.59%	7.0	18.0	44.06%	19.4	38.4	94.16%
0.36	0.36	120	0.36	14.9	14.9	1182	1.5	6.0	5.2	14.9	2.0	7.8	7.0	19.5	2.0	4.78%	7.8	10.1	24.68%	7.0	18.0	44.14%	19.5	38.5	94.38%
0.30	0.30	125	0.30	12.4	12.4	1187	1.2	5.0	4.4	12.4	2.0	7.8	7.1	19.6	2.0	4.80%	7.8	10.1	24.77%	7.1	18.1	44.22%	19.6	38.6	94.62%
0.25	0.26	130	0.25	10.4	10.4	1192	1.0	4.1	3.6	10.4	2.0	7.9	7.1	19.7	2.0	4.83%	7.9	10.1	24.85%	7.1	18.1	44.29%	19.7	38.7	94.81%
0.21	0.22	135	0.21	8.7	8.7	1197	0.9	3.5	3.0	8.7	2.0	7.9	7.1	19.7	2.0	4.84%	7.9	10.2	24.92%	7.1	18.1	44.35%	19.7	38.8	94.97%
0.19	0.20	140	0.19	7.9	7.9	1202	0.8	3.2	2.8	7.9	2.0	7.9	7.1	19.8	2.0	4.85%	7.9	10.2	24.97%	7.1	18.1	44.40%	19.8	38.8	95.11%
0.17	0.18	145	0.17	7.1	7.1	1207	0.7	2.8	2.5	7.1	2.0	7.9	7.1	19.9	2.0	4.86%	7.9	10.2	25.02%	7.1	18.1	44.44%	19.9	38.9	95.24%
0.16	0.17	150	0.16	6.6	6.6	1212	0.7	2.7	2.3	6.6	2.0	8.0	7.2	19.9	2.0	4.87%	8.0	10.2	25.07%	7.2	18.2	44.48%	19.9	38.9	95.35%
0.16	0.16	155	0.16	6.6	6.6	1217	0.7	2.7	2.3	6.6	2.0	8.0	7.2	19.9	2.0	4.89%	8.0	10.3	25.11%	7.2	18.2	44.52%	19.9	39.0	95.46%
0.16	0.16	160	0.16	6.6	6.6	1222	0.7	2.7	2.3	6.6	2.0	8.0	7.2	20.0	2.0	4.90%	8.0	10.3	25.16%	7.2	18.2	44.56%	20.0	39.0	95.57%
0.16	0.16	170	0.16	6.6	6.6	1232	0.7	2.7	2.3	6.6	2.0	8.0	7.2	20.1	2.0	4.92%	8.0	10.3	25.25%	7.2	18.2	44.64%	20.1	39.1	95.80%
0.15	0.16	180	0.15	6.2	6.2	1242	0.6	2.5	2.2	6.2	2.0	8.1	7.3	20.2	2.0	4.94%	8.1	10.3	25.33%	7.3	18.3	44.71%	20.2	39.2	96.02%
0.15	0.15	190	0.15	6.2	6.2	1252	0.6	2.5	2.2	6.2	2.0	8.1	7.3	20.3	2.0	4.96%	8.1	10.4	25.42%	7.3	18.3	44.79%	20.3	39.3	96.23%
0.15	0.15	200	0.15	6.2	6.2	1262	0.6	2.5	2.2	6.2	2.0	8.1	7.3	20.3	2.0	4.98%	8.1	10.4	25.50%	7.3	18.3	44.86%	20.3	39.4	96.44%
0.15	0.15	210	0.15	6.2	6.2	1272	0.6	2.5	2.2	6.2	2.0	8.2	7.4	20.4	2.0	5.00%	8.2	10.4	25.59%	7.4	18.3	44.93%	20.4	39.5	96.65%
0.15	0.15	220	0.15	6.2	6.2	1282	0.6	2.5	2.2	6.2	2.1	8.2	7.4	20.5	2.1	5.03%	8.2	10.5	25.67%	7.4	18.4	45.01%	20.5	39.5	96.86%
0.15	0.15	230	0.15	6.2	6.2	1292	0.6	2.5	2.2	6.2	2.1	8.2	7.4	20.6	2.1	5.05%	8.2	10.5	25.75%	7.4	18.4	45.08%	20.6	39.6	97.07%
0.15	0.15	250	0.15	6.2	6.2	1312	0.6	2.5	2.2	6.2	2.1	8.3	7.5	20.8	2.1	5.09%	8.3	10.6	25.92%	7.5	18.5	45.23%	20.8	39.8	97.48%
0.14	0.14	260	0.14	5.8	5.8	1322	0.6	2.3	2.0	5.8	2.1	8.3	7.5	20.9	2.1	5.11%	8.3	10.6	26.00%	7.5	18.5	45.30%	20.9	39.9	97.69%
0.14	0.14	300	0.14	5.8	5.8	1362	0.6	2.3	2.0	5.8	2.1	8.5	7.6	21.2	2.1	5.19%	8.5	10.7	26.32%	7.6	18.6	45.57%	21.2	40.2	98.47%
0.14	0.14	378	0.14	5.8	5.8	1440	2.3	2.3	5.8	5.8	2.3	8.7	8.0	21.8	2.3	5.57%	8.7	11.0	26.93%	8.0	19.0	46.60%	21.8	40.8	100.00%
					Daily Peak Flow [cfs] =		10	41	36	103			ff [af] =	41											
					Daily Average Flow [cfs] =		1	4	4	11			51												

East WL's - Pre PV

50	55	A=	148.7	ac		50 year - 4 day Storm	Flow				Runoff				Percentage of Total Runoff										
1.24	1.19	tc1:	54.3	min	0.0cfs																				
		EFFR.	1.30	0.9																					
		Opt	245	cfs		CLOCK	1st Day	2nd Day	3rd Day	4th Day	1st Day	2nd Day	3rd Day	4th Day	1st Day	1st Day	2nd Day	2nd Day	2nd Day	3rd Day	3rd Day	3rd Day	4th Day	4th Day	4th Day
		TIME	BPRR	Q1	Q(by-pass)	TIME	Q [cfs]	Q [cfs]	Q [cfs]	Q [cfs]	V [af]	V [af]	V [af]	V [af]	V [af]	%	V [af]	ΣV [af]	%	V [af]	ΣV [af]	%	V [af]	ΣV [af]	%
0.14	0.14	1062	0.14	28.7	28.7	0	2.9	11.5	11.5	28.7								11.4			55.3			95.6	
0.35	0.35	-60	0.35	71.6	71.6	1002	7.2	28.7	25.1	71.6	6.9	27.7	25.2	59.2	6.9	3.37%	27.7	39.1	19.05%	25.2	60.5	39.22%	63.2	154.8	80.32%
0.37	0.37	0	0.37	75.7	75.7	1022	7.6	30.3	26.5	75.7	7.5	30.1	27.3	75.3	7.5	3.67%	30.1	41.5	20.25%	27.3	82.5	40.25%	75.3	170.9	83.29%
0.40	0.40	60	0.40	81.9	81.9	1122	8.2	32.7	28.7	61.9	8.2	32.7	29.6	51.8	8.2	3.99%	32.7	44.1	21.52%	29.6	84.3	41.07%	81.8	177.4	86.47%
0.43	0.42	70	0.42	86.3	86.3	1132	8.6	34.5	30.2	86.3	8.3	33.2	30.0	53.0	8.3	4.04%	33.2	44.5	21.74%	30.0	85.3	41.56%	83.0	178.5	87.03%
0.48	0.46	80	0.46	94.7	94.7	1142	9.5	37.9	33.2	94.7	8.4	33.7	30.5	54.2	8.4	4.10%	33.7	46.1	21.98%	30.5	85.7	41.76%	84.2	179.8	87.64%
0.52	0.49	85	0.49	101.2	101.2	1147	10.1	40.5	35.4	101.2	8.5	34.0	30.7	84.9	8.5	4.14%	34.0	45.4	22.12%	30.7	86.0	41.85%	84.9	180.5	87.97%
0.56	0.53	88	0.53	109.3	109.3	1150	10.9	43.7	38.3	109.3	8.5	34.1	30.9	85.3	8.5	4.16%	34.1	45.6	22.20%	30.9	86.1	41.97%	85.3	180.9	88.18%
0.61	0.56	90	0.57	116.1	116.1	1152	11.6	46.4	40.6	116.1	8.6	34.3	31.0	85.5	8.6	4.17%	34.3	45.7	22.26%	31.0	86.2	42.02%	85.5	181.2	88.33%
0.65	0.59	91	0.60	122.5	122.5	1153	12.2	49.0	42.9	122.5	8.6	34.3	31.0	85.9	8.6	4.18%	34.3	45.7	22.29%	31.0	86.3	42.05%	85.9	181.4	88.41%
0.69	0.62	93	0.63	128.9	128.9	1154	12.9	51.6	45.1	128.9	8.6	34.4	31.1	86.0	8.6	4.19%	34.4	45.8	22.33%	31.1	86.3	42.08%	86.0	181.6	88.49%
0.74	0.66	89	0.67	137.4	137.4	1155	13.7	55.0	48.1	137.4	8.6	34.5	31.1	86.2	8.6	4.20%	34.5	45.9	22.36%	31.1	86.4	42.11%	86.2	181.8	88.58%
0.78	0.71	94	0.72	147.3	147.3	1156	14.7	58.9	51.6	147.3	8.6	34.5	31.2	86.4	8.6	4.21%	34.5	46.0	22.40%	31.2	86.5	42.14%	86.4	181.9	88.68%
0.84	0.76	95	0.77	157.8	157.8	1157	15.8	63.1	55.2	157.8	8.7	34.6	31.3	86.6	8.7	4.22%	34.6	46.0	22.44%	31.3	86.5	42.18%	86.6	182.2	88.78%
0.90	0.81	96	0.82	168.4	168.4	1158	16.8	67.3	58.9	168.4	8.7	34.7	31.4	86.8	8.7	4.23%	34.7	46.1	22.49%	31.4	86.6	42.22%	86.8	182.4	88.89%
0.97	0.87	97	0.88	180.9	180.9	1159	18.1	72.4	63.3	180.9	8.7	34.8	31.4	87.0	8.7	4.24%	34.8	46.2	22.53%	31.4	86.7	42.26%	87.0	182.6	89.01%
1.05	0.94	98	0.96	195.5	195.5	1160	19.6	78.2	68.4	195.5	8.7	34.9	31.5	87.3	8.7	4.25%	34.9	46.3	22.58%	31.5	86.8	42.30%	87.3	182.9	89.13%
1.14	1.02	99	1.04	212.2	212.2	1161	21.2	84.9	74.3	212.2	8.8	35.0	31.6	87.6	8.8	4.27%	35.0	46.4	22.64%	31.6	86.9	42.35%	87.6	183.2	89.27%
1.17	1.09	100	1.10	225.4	225.4	1162	22.5	90.2	78.9	225.4	8.8	35.1	31.7	87.9	8.8	4.28%	35.1	46.6	22.70%	31.7	87.0	42.40%	87.9	183.5	89.42%
1.19	1.12	101	1.13	231.2	231.2	1163	23.1	92.5	80.9	231.2	8.8	35.3	31.9	88.2	8.8	4.30%	35.3	46.7	22.76%	31.9	87.1	42.45%	88.2	183.8	89.57%
1.22	1.15	102	1.15	237.4	237.4	1164	23.7	95.0	83.1	237.4	8.9	35.4	32.0	88.5	8.9	4.31%	35.4	46.8	22.82%	32.0	87.2	42.51%	88.5	184.1	89.73%
1.23	1.16	103	1.17	239.4	239.4	1165	23.9	95.8	83.8	239.4	8.9	35.5	32.1	88.8	8.9	4.33%	35.5	47.0	22.88%	32.1	87.3	42.57%	88.8	184.4	89.89%
1.24	1.19	104	1.19	243.2	243.2	1166	24.3	97.3	85.1	243.2	8.9	35.7	32.2	89.2	8.9	4.35%	35.7	47.1	22.95%	32.2	87.5	42.62%	89.2	184.8	90.05%
1.24	1.19	105	1.19	243.2	243.2	1167	24.3	97.3	85.1	243.2	9.0	35.8	32.3	89.5	9.0	4.36%	35.8	47.2	23.01%	32.3	87.6	42.68%	89.5	185.1	90.21%
1.24	1.19	106	1.20	245.0	245.0	1168	24.5	98.0	85.8	245.0	9.0	35.9	32.4	89.8	9.0	4.38%	35.9	47.4	23.08%	32.4	87.7	42.74%	89.8	185.4	90.38%
1.24	1.19	107	1.20	245.0	245.0	1169	24.5	98.0	85.8	245.0	9.0	36.1	32.6	90.2	9.0	4.40%	36.1	47.5	23.15%	32.6	87.8	42.79%	90.2	185.8	90.54%
1.23	1.19	108	1.20	244.7	244.7	1170	24.5	97.9	85.6	244.7	9.1	36.2	32.7	90.5	9.1	4.41%	36.2	47.5	23.21%	32.7	87.9	42.85%	90.5	186.1	90.71%
1.22	1.19	109	1.19	244.4	244.4	1171	24.4	97.8	85.5	244.4	9.1	36.3	32.8	90.9	9.1	4.43%	36.3	47.8	23.28%	32.8	88.0	42.91%	90.9	186.4	90.87%
1.21	1.18	110	1.18	242.4	242.4	1172	24.2	97.0	84.8	242.4	9.1	36.5	32.9	91.2	9.1	4.44%	36.5	47.9	23.34%	32.9	88.2	42.97%	91.2	186.8	91.03%
1.20	1.17	111	1.17	240.3	240.3	1173	24.0	96.1	84.1	240.3	9.2	36.6	33.0	91.5	9.2	4.46%	36.6	48.0	23.41%	33.0	88.3	43.02%	91.5	187.1	91.20%
1.18	1.15	112	1.16	238.0	238.0	1174	23.8	95.2	83.3	238.0	9.2	36.7	33.1	91.8	9.2	4.48%	36.7	48.2	23.47%	33.1	88.4	43.08%	91.8	187.4	91.36%
1.15	1.15	113	1.15	235.7	235.7	1175	23.6	94.3	82.5	235.7	9.2	36.9	33.2	92.2	9.2	4.49%	36.9	48.3	23.54%	33.2	88.5	43.13%	92.2	187.8	91.52%
1.14	1.13	114	1.13	231.6	231.6	1176	23.2	92.6	81.1	231.6	9.2	37.0	33.4	92.5	9.2	4.51%	37.0	48.4	23.60%	33.4	88.6	43.19%	92.5	188.1	91.67%
1.10	1.11	115	1.11	226.9	226.9	1177	22.7	90.8	79.4	226.9	9.3	37.1	33.5	92.8	9.3	4.52%	37.1	48.5	23.66%	33.5	88.7	43.24%	92.8	188.4	91.83%
1.05	1.09	116	1.09	222.2	222.2	1178	22.2	88.9	77.8	222.2	9.3	37.2	33.6	93.1	9.3	4.54%	37.2	48.7	23.72%	33.6	88.8	43.30%	93.1	188.7	91.98%
0.91	0.96	120	0.95	195.1	195.1	1182	19.5	78.0	68.3	195.1	9.4	37.7	34.0	94.3	9.4	4.59%	37.7	49.1	23.94%	34.0	89.2	43.49%	94.3	189.9	92.54%
0.75	0.83	125	0.82	167.9	167.9	1187	16.8	67.2	58.8	167.9	9.6	38.2	34.4	95.5	9.6	4.66%	38.2	49.6	24.15%	34.4	89.7	43.71%	95.5	191.1	93.15%
0.63	0.69	130	0.68	139.5	139.5	1192	14.0	55.8	48.8	139.5	9.7	38.6	34.8	96.6	9.7	4.71%	38.6	50.1	24.39%	34.8	90.0	43.89%	96.6	192.2	93.69%
0.53	0.56	135	0.57	117.3	117.3	1197	11.7	46.9	41.0	117.3	9.7	39.0	35.1	97.5	9.7	4.75%	39.0	50.4	24.57%	35.1	90.4	44.04%	97.5	193.1	94.09%
0.44	0.49	140	0.48	98.9	98.9	1202	9.9	39.5	34.6	98.9	9.8	39.3	35.4	98.2	9.8	4.79%	39.3	50.7	24.71%	35.4	90.6	44.16%	98.2	193.8	94.46%
0.38	0.41	145	0.40	82.5	82.5	1207	8.2	33.0	28.9	82.5	9.9	39.5	35.6	98.8	9.9	4.82%	39.5	51.0	24.83%	35.6	90.8	44.27%	98.8	194.4	94.75%
0.30	0.35	150	0.34	70.2	70.2	1212	7.0	28.1	24.6	70.2	9.9	39.7	35.8	99.4	9.9	4.84%	39.7	51.2	24.94%	35.8	91.0	44.36%	99.4	195.0	95.02%
0.26	0.29	155	0.29	58.5	58.5	1217	5.8	23.4	20.5	58.5	10.0	39.9	35.9	99.8	10.0	4.86%	39.9	51.3	25.02%	35.9	91.2	44.44%	99.8	195.4	95.23%
0.22	0.25	160	0.25	50.3	50.3	1222	5.0	20.1	17.6	50.3	10.0	40.1	36.1	100.2	10.0	4.89%	40.1	51.5	25.10%	36.1	91.3	44.50%	100.2	195.8	95.42%
0.19	0.22	170	0.22	44.2	44.2	1232	4.4	17.7	15.5	44.2	10.1	40.3	36.3	100.8	10.1	4.91%	40.3	51.8	25.22%	36.3	91.5	44.61%	100.8	196.4	95.73%
0.17	0.19	180	0.19	38.3	38.3	1242	3.8	15.3	13.4	38.3	10.1	40.6	36.5	101.4	10.1	4.94%	40.6	52.0	25.33%	36.5	91.7	44.71%	101.4	197.0	96.01%
0.16	0.17	190	0.17	34.5	34.5	1252	3.5	13.8	12.1	34.5	10.2	40.8	36.7	101.9	10.2	4.97%	40.8	52.2	25.43%	36.7	91.9	44.79%	101.9	197.5	96.26%
0.16	0.16	200	0.16	32.7	32.7	1262	3.3	13.1	11.5	32.7	10.2	40.9	36.8	102.4	10.2	4.99%	40.9	52.4	25.52%	36.8	92.1	44.87%	102.4	198.0	96.49%
0.16	0.16	210	0.16	32.7	32.7	1272	3.3	13.1	11.5	32.7	10.3	41.1	37.0	102.8	10.3	5.01%	41.1	52.5	25.61%	37.0	92.2	44.95%	102.8	198.4	96.70%
0.15	0.15	220	0.15	30.7	30.7	1282	3.1	12.3	10.7	30.7	10.3	41.3	37.1	103.2	10.3	5.03%	41.3	52.7	25.69%	37.1	92.4	45.02%	103.2	198.8	96.91%
0.15	0.15	230	0.15	30.7	30.7	1292	3.1	12.3	10.7	30.7	10.4	41.5	37.3	103.7	10.4	5.05%	41.5	52.9	25.78%	37.3	92.5	45.10%	103.7	199.3	97.12%
0.15	0.15	250	0.15	30.7	30.7	1312	3.1	12.3	10.7	30.7	10.5	41.8	37.6	104.5	10.5	5.09%	41.8	53.2	25.94%	37.6	92.8	45.24%	104.5	200.1	97.53%
0.14	0.14	260	0.14	28.7	28.7	1322	2.9	11.5	10.0	28.7	10.5	42.0	37.7	104.9	10.5	5.11%	42.0	53.4	26.02%	37.7	93.0	45.31%	104.9	200.5	97.73%
0.14	0.14	300	0.14	28.7	28.7	1362	2.9	11.5	10.0	28.7	10.7	42.6	38.3	106.5	10.7	5.19%	42.6	54.0	26.33%	38.3	93.5	45.58%	106.5	202.1	98.50%
0.14	0.14	378	0.14	28.7	28.7	1440	11.5	11.5	28.7	28.7	11.4	43.8	40.3	109.6	11.4	5.57%	45.8	55.3	26.93%	40.3	95.9	46.59%	109.6	205.2	100.00%
					Daily Peak Flow [cfs] =		25	98	86	245			ff (af) =	205											
					Daily Average Flow [cfs] =		6	22	20	55				25.9											

East WL's -PH 1 & 2

		A=	116.9	ac																					
		tc=	54.3	min		50 year - 4 day Storm																			
50	55	BPRR	1.20	0.9			Flow				Runoff					Percentage of Total Runoff									
1.24	1.19	Qp1	176	cfs	0.0cfs	CLOCK	1st Day	2nd Day	3rd Day	4th Day	1st Day	2nd Day	3rd Day	4th Day	1st Day	1st Day	2nd Day	2nd Day	2nd Day	3rd Day	3rd Day	3rd Day	4th Day	4th Day	4th Day
		TIME	BPRR	Q1	Q(by-pass)	TIME	Q [cfs]	Q [cfs]	Q [cfs]	Q [cfs]	V [af]	V [af]	V [af]	V [af]	V [af]	%	V [af]	ΣV [af]	%	V [af]	ΣV [af]	%	V [af]	ΣV [af]	%
0.14	0.14	-1062	0.14	20.6	20.6	0	2.1	8.2	8.2	20.6								8.2			39.7			56.7	
0.35	0.36	-60	0.35	51.5	51.5	1002	5.1	20.6	18.0	51.5	5.0	19.9	15.1	46.7	5.0	3.37%	19.9	28.1	19.06%	18.1	57.8	39.22%	49.7	116.4	80.32%
0.37	0.37	0	0.37	54.4	54.4	1062	5.4	21.8	19.0	54.4	5.4	21.6	18.6	54.1	5.4	3.67%	21.6	29.8	20.25%	19.6	59.3	40.29%	54.1	122.8	83.29%
0.40	0.40	60	0.40	58.8	58.8	1122	5.9	23.5	20.6	58.8	5.9	23.5	21.3	58.8	5.9	3.99%	23.5	31.7	21.52%	21.3	61.0	41.37%	58.8	127.4	86.47%
0.43	0.42	70	0.42	62.0	62.0	1132	6.2	24.8	21.7	62.0	6.0	23.8	21.6	59.6	6.0	4.04%	23.8	32.0	21.74%	21.6	61.3	41.55%	59.6	128.7	87.03%
0.48	0.46	80	0.46	68.0	68.0	1142	6.8	27.2	23.8	68.0	6.0	24.2	21.9	60.5	6.0	4.10%	24.2	32.4	21.98%	21.9	61.6	41.76%	60.5	129.2	87.64%
0.52	0.49	85	0.49	72.7	72.7	1147	7.3	29.1	25.4	72.7	6.1	24.4	22.1	61.0	6.1	4.14%	24.4	32.6	22.12%	22.1	61.7	41.85%	61.0	129.7	87.97%
0.56	0.53	88	0.53	78.5	78.5	1150	7.9	31.4	27.5	78.5	6.1	24.5	22.2	61.3	6.1	4.16%	24.5	32.7	22.20%	22.2	61.9	41.97%	61.3	130.0	88.10%
0.61	0.56	90	0.57	83.4	83.4	1152	8.3	33.3	29.2	83.4	6.2	24.6	22.2	61.5	6.2	4.17%	24.5	32.8	22.26%	22.2	61.9	42.02%	61.5	130.2	88.33%
0.65	0.59	91	0.60	88.0	88.0	1153	8.8	35.2	30.8	88.0	6.2	24.7	22.3	61.6	6.2	4.18%	24.7	32.9	22.29%	22.3	62.0	42.05%	61.6	130.3	88.41%
0.69	0.62	92	0.63	92.6	92.6	1154	9.3	37.0	32.4	92.6	6.2	24.7	22.3	61.8	6.2	4.19%	24.7	32.9	22.33%	22.3	62.0	42.08%	61.8	130.4	88.49%
0.74	0.66	93	0.67	98.7	98.7	1155	9.9	39.5	34.5	98.7	6.2	24.8	22.4	61.9	6.2	4.20%	24.8	33.0	22.36%	22.4	62.1	42.11%	61.9	130.6	88.58%
0.78	0.71	94	0.72	105.8	105.8	1156	10.6	42.3	37.0	105.8	6.2	24.8	22.4	62.0	6.2	4.21%	24.8	33.0	22.40%	22.4	62.1	42.14%	62.0	130.7	88.66%
0.84	0.75	95	0.77	113.4	113.4	1157	11.3	45.4	39.7	113.4	6.2	24.9	22.5	62.2	6.2	4.22%	24.9	33.1	22.44%	22.5	62.2	42.18%	62.2	130.9	88.76%
0.90	0.81	96	0.82	121.0	121.0	1158	12.1	48.4	42.3	121.0	6.2	24.9	22.5	62.3	6.2	4.23%	24.9	33.1	22.49%	22.5	62.2	42.22%	62.3	131.0	88.85%
0.97	0.87	97	0.88	130.0	130.0	1159	13.0	52.0	45.5	130.0	6.3	25.0	22.6	62.5	6.3	4.24%	25.0	33.2	22.53%	22.6	62.3	42.26%	62.5	131.2	89.01%
1.05	0.94	98	0.96	140.5	140.5	1160	14.0	56.2	49.2	140.5	6.3	25.1	22.7	62.7	6.3	4.25%	25.1	33.3	22.58%	22.7	62.3	42.30%	62.7	131.4	89.13%
1.14	1.02	99	1.04	152.4	152.4	1161	15.2	61.0	53.4	152.4	6.3	25.2	22.7	62.9	6.3	4.27%	25.2	33.4	22.64%	22.7	62.4	42.35%	62.9	131.6	89.27%
1.17	1.09	100	1.10	161.9	161.9	1162	16.2	64.8	56.7	161.9	6.3	25.2	22.8	63.1	6.3	4.28%	25.2	33.5	22.70%	22.8	62.5	42.40%	63.1	131.8	89.42%
1.19	1.12	101	1.13	166.1	166.1	1163	16.6	66.4	58.1	166.1	6.3	25.3	22.9	63.3	6.3	4.30%	25.3	33.5	22.76%	22.9	62.6	42.45%	63.3	132.0	89.57%
1.22	1.15	102	1.16	170.5	170.5	1164	17.1	68.2	59.7	170.5	6.4	25.4	23.0	63.6	6.4	4.31%	25.4	33.6	22.82%	23.0	62.7	42.51%	63.6	132.3	89.73%
1.23	1.16	103	1.17	172.0	172.0	1165	17.2	68.8	60.2	172.0	6.4	25.5	23.0	63.8	6.4	4.33%	25.5	33.7	22.88%	23.0	62.7	42.57%	63.8	132.5	89.89%
1.24	1.18	104	1.19	174.7	174.7	1166	17.5	69.9	61.2	174.7	6.4	25.6	23.1	64.1	6.4	4.35%	25.6	33.8	22.95%	23.1	62.8	42.62%	64.1	132.7	90.05%
1.24	1.18	105	1.19	174.7	174.7	1167	17.5	69.9	61.2	174.7	6.4	25.7	23.2	64.3	6.4	4.36%	25.7	33.9	23.01%	23.2	62.9	42.68%	64.3	133.0	90.21%
1.24	1.19	106	1.20	176.0	176.0	1168	17.6	70.4	61.6	176.0	6.5	25.8	23.3	64.5	6.5	4.38%	25.8	34.0	23.08%	23.3	63.0	42.74%	64.5	133.2	90.38%
1.24	1.19	107	1.20	176.0	176.0	1169	17.6	70.4	61.6	176.0	6.5	25.9	23.4	64.8	6.5	4.40%	25.9	34.1	23.15%	23.4	63.1	42.79%	64.8	133.5	90.54%
1.23	1.19	108	1.20	175.8	175.8	1170	17.6	70.3	61.5	175.8	6.5	26.0	23.5	65.0	6.5	4.41%	26.0	34.2	23.21%	23.5	63.2	42.85%	65.0	133.7	90.71%
1.22	1.19	109	1.19	175.6	175.6	1171	17.6	70.2	61.5	175.6	6.5	26.1	23.6	65.3	6.5	4.43%	26.1	34.3	23.28%	23.6	63.2	42.91%	65.3	133.9	90.87%
1.21	1.18	110	1.18	174.1	174.1	1172	17.4	69.6	60.9	174.1	6.6	26.2	23.6	65.5	6.6	4.44%	26.2	34.4	23.34%	23.6	63.3	42.97%	65.5	134.2	91.03%
1.20	1.17	111	1.17	172.5	172.5	1173	17.3	69.1	60.4	172.6	6.6	26.3	23.7	65.7	6.6	4.46%	26.3	34.5	23.41%	23.7	63.4	43.02%	65.7	134.4	91.20%
1.16	1.16	112	1.16	171.0	171.0	1174	17.1	68.4	59.8	171.0	6.6	26.4	23.8	66.0	6.6	4.48%	26.4	34.6	23.47%	23.8	63.5	43.08%	66.0	134.7	91.35%
1.16	1.15	113	1.15	169.3	169.3	1175	16.9	67.7	59.3	169.3	6.6	26.5	23.9	66.2	6.6	4.49%	26.5	34.7	23.54%	23.9	63.6	43.13%	66.2	134.9	91.52%
1.14	1.13	114	1.13	166.4	166.4	1176	16.6	66.5	58.2	166.4	6.6	26.6	24.0	66.4	6.6	4.51%	26.6	34.8	23.60%	24.0	63.7	43.19%	66.4	135.1	91.67%
1.10	1.11	115	1.11	163.0	163.0	1177	16.3	65.2	57.1	163.0	6.7	26.7	24.0	66.7	6.7	4.52%	26.7	34.9	23.66%	24.0	63.7	43.24%	66.7	135.3	91.83%
1.06	1.05	116	1.09	159.6	159.6	1178	16.0	63.9	55.9	159.6	6.7	26.8	24.1	66.9	6.7	4.54%	26.8	35.0	23.72%	24.1	63.8	43.30%	66.9	135.6	91.98%
0.91	0.96	120	0.95	140.1	140.1	1182	14.0	56.0	49.0	140.1	6.8	27.1	24.4	67.7	6.8	4.58%	27.1	35.3	23.94%	24.4	64.1	43.49%	67.7	136.4	92.54%
0.76	0.83	125	0.82	120.6	120.6	1187	12.1	48.2	42.2	120.6	6.9	27.4	24.7	68.5	6.9	4.66%	27.4	35.7	24.19%	24.7	64.4	43.71%	68.5	137.3	93.15%
0.63	0.69	130	0.68	100.2	100.2	1192	10.0	40.1	35.1	100.2	6.9	27.8	25.0	69.4	6.9	4.71%	27.8	36.0	24.39%	25.0	64.7	43.89%	69.4	138.1	93.56%
0.53	0.58	135	0.57	84.3	84.3	1107	8.4	33.7	29.5	84.3	7.0	28.0	25.2	70.0	7.0	4.75%	28.0	36.2	24.57%	25.2	64.9	44.04%	70.0	138.7	94.09%
0.44	0.49	140	0.48	71.0	71.0	1202	7.1	28.4	24.9	71.0	7.1	28.2	25.4	70.5	7.1	4.79%	28.2	36.4	24.71%	25.4	65.1	44.16%	70.5	139.2	94.46%
0.36	0.41	145	0.40	59.3	59.3	1207	5.9	23.7	20.7	59.3	7.1	28.4	25.6	71.0	7.1	4.82%	28.4	36.6	24.83%	25.6	65.3	44.27%	71.0	139.7	94.76%
0.30	0.35	150	0.34	50.4	50.4	1212	5.0	20.2	17.7	50.4	7.1	28.6	25.7	71.4	7.1	4.84%	28.6	36.8	24.94%	25.7	65.4	44.36%	71.4	140.0	95.02%
0.28	0.29	155	0.29	42.0	42.0	1217	4.2	16.8	14.7	42.0	7.2	28.7	25.8	71.7	7.2	4.86%	28.7	36.9	25.02%	25.8	65.5	44.44%	71.7	140.4	95.23%
0.22	0.25	160	0.25	36.1	36.1	1222	3.6	14.5	12.6	36.1	7.2	28.8	25.9	72.0	7.2	4.88%	28.8	37.0	25.10%	25.9	65.6	44.50%	72.0	140.6	95.42%
0.19	0.22	170	0.22	31.7	31.7	1232	3.2	12.7	11.1	31.7	7.2	29.0	26.1	72.4	7.2	4.91%	29.0	37.2	25.22%	26.1	65.8	44.61%	72.4	141.1	95.73%
0.17	0.19	180	0.19	27.5	27.5	1242	2.8	11.0	9.6	27.5	7.3	29.1	26.2	72.8	7.3	4.94%	29.1	37.3	25.33%	26.2	65.9	44.71%	72.8	141.5	96.01%
0.16	0.17	190	0.17	24.8	24.8	1252	2.5	9.9	8.7	24.8	7.3	29.3	26.3	73.2	7.3	4.97%	29.3	37.5	25.43%	26.3	66.0	44.79%	73.2	141.9	96.25%
0.16	0.16	200	0.16	23.5	23.5	1262	2.4	9.4	8.2	23.5	7.4	29.4	26.4	73.5	7.4	4.99%	29.4	37.6	25.52%	26.4	66.1	44.87%	73.5	142.2	96.48%
0.16	0.16	210	0.16	23.5	23.5	1272	2.4	9.4	8.2	23.5	7.4	29.5	26.6	73.9	7.4	5.01%	29.5	37.7	25.61%	26.5	66.3	44.95%	73.9	142.5	96.70%
0.15	0.15	220	0.15	22.1	22.1	1282	2.2	8.8	7.7	22.1	7.4	29.7	26.7	74.2	7.4	5.03%	29.7	37.9	25.69%	26.7	66.4	45.02%	74.2	142.8	96.91%
0.15	0.15	230	0.15	22.1	22.1	1292	2.2	8.8	7.7	22.1	7.4	29.8	26.8	74.5	7.4	5.05%	29.8	38.0	25.78%	26.8	66.5	45.10%	74.5	143.1	97.12%
0.15	0.15	250	0.15	22.1	22.1	1312	2.2	8.8	7.7	22.1	7.5	30.0	27.0	75.1	7.5	5.09%	30.0	38.2	25.94%	27.0	66.7	45.24%	75.1	143.9	97.53%
0.14	0.14	260	0.14	20.6	20.6	1322	2.1	8.2	7.2	20.6	7.5	30.1	27.1	75.4	7.5	5.11%	30.1	38.4	26.02%	27.1	66.8	45.31%	75.4	144.3	97.73%
0.14	0.14	300	0.14	20.6	20.6	1362	2.1	8.2	7.2	20.6	7.7	30.6	27.5	76.5	7.7	5.19%	30.6	38.8	26.33%	27.5	67.2	45.58%	76.5	145.2	98.50%
0.14	0.14	378	0.14	20.6	20.6	1440	8.2	8.2	20.6	20.6	8.2	31.5	29.0	78.7	8.2	5.57%	31.5	39.7	26.93%	29.0	68.7	46.59%	78.7	147.4	100.00%
					Daily Peak Flow [cfs] =		18	70	62	176			V [af] =	147											
					Daily Average Flow [cfs] =		4	16	15	40			18.6												

South WL's - Pre PV

		A=	138.1	ac																					
		tc=	30.1	min		50 year - 4 day Storm																			
30	35	BPRR	1.55	0.0			Flow				Runoff					Percentages of Total Runoff									
1.55	1.46	Qp=	347	cfs	0.0cfs	CLOCK	1st Day	2nd Day	3rd Day	4th Day	1st Day	2nd Day	3rd Day	4th Day	1st Day	1st Day	2nd Day	2nd Day	2nd Day	3rd Day	3rd Day	3rd Day	4th Day	4th Day	4th Day
		TIME	BPRR	Qt	Q(by-pass)	TIME	Q (cfs)	Q (cfs)	Q (cfs)	Q (cfs)	V (af)	V (af)	V (af)	V (af)	V (af)	%	V (af)	ΣV (af)	%	V (af)	ΣV (af)	%	V (af)	ΣV (af)	%
0.14	0.14	-1062	0.14	31.4	31.4	0	3.1	12.6	12.6	31.4								12.4			60.0			103.9	
0.35	0.35	-00	0.35	78.4	78.4	1002	7.8	31.4	27.5	78.4	7.6	30.2	27.6	75.8	7.6	3.40%	30.2	42.6	19.17%	27.6	87.6	39.31%	75.8	179.7	80.60%
0.37	0.37	0	0.37	82.9	82.9	1062	8.3	33.2	29.0	82.9	8.2	33.0	28.9	82.5	8.2	3.70%	33.0	45.4	20.36%	28.9	90.0	40.36%	82.5	186.4	83.59%
0.40	0.40	60	0.40	89.7	89.7	1122	9.0	35.9	31.4	89.7	9.0	35.8	32.4	89.6	9.0	4.02%	35.8	48.2	21.64%	32.4	92.5	41.48%	89.6	193.4	86.79%
0.46	0.46	70	0.46	107.5	107.5	1132	10.7	43.0	37.6	107.5	9.1	36.4	32.9	90.9	9.1	4.08%	36.4	48.8	21.85%	32.9	92.9	41.69%	90.9	194.8	87.40%
0.61	0.58	80	0.61	136.6	136.6	1142	13.7	54.6	47.8	136.6	9.3	37.1	33.5	92.6	9.3	4.16%	37.1	49.5	22.15%	33.5	93.5	41.96%	92.6	196.5	88.16%
0.71	0.66	85	0.71	158.9	158.9	1147	15.9	63.6	55.6	158.9	9.4	37.5	33.9	93.5	9.4	4.20%	37.5	49.9	22.37%	33.9	93.9	42.12%	93.5	197.5	88.61%
0.79	0.72	88	0.78	174.6	174.6	1150	17.5	69.8	61.1	174.6	9.4	37.7	34.1	94.3	9.4	4.23%	37.7	50.1	22.50%	34.1	94.1	42.23%	94.3	198.2	88.92%
0.84	0.79	90	0.84	188.0	188.0	1152	18.8	75.2	65.8	188.0	9.5	37.9	34.3	94.8	9.5	4.25%	37.9	50.3	22.59%	34.3	94.3	42.31%	94.8	198.7	89.14%
0.90	0.83	91	0.90	201.4	201.4	1153	20.1	80.6	70.5	201.4	9.5	38.0	34.4	95.1	9.5	4.27%	38.0	50.4	22.63%	34.4	94.4	42.35%	95.1	199.0	89.29%
0.96	0.89	92	0.96	214.9	214.9	1154	21.5	85.9	75.2	214.9	9.5	38.2	34.5	95.4	9.5	4.28%	38.2	50.6	22.69%	34.5	94.5	42.39%	95.4	199.2	89.39%
1.08	0.96	93	1.08	241.5	241.5	1155	24.2	96.6	84.5	241.5	9.5	38.3	34.6	95.7	9.6	4.29%	38.3	50.7	22.74%	34.6	94.6	42.44%	95.7	199.6	89.53%
1.20	1.05	94	1.20	268.3	268.3	1156	26.8	107.3	93.9	268.3	9.6	38.4	34.7	96.1	9.6	4.31%	38.4	50.8	22.80%	34.7	94.7	42.50%	96.1	199.9	89.69%
1.35	1.15	95	1.35	301.7	301.7	1157	30.2	120.7	105.6	301.7	9.6	38.6	34.8	96.4	9.6	4.33%	38.6	51.0	22.87%	34.8	94.9	42.56%	96.4	200.3	89.87%
1.47	1.29	96	1.47	328.7	328.7	1158	32.9	131.5	115.0	328.7	9.7	38.8	35.0	96.9	9.7	4.35%	38.8	51.2	22.95%	35.0	95.0	42.63%	96.9	200.7	90.06%
1.51	1.38	97	1.51	337.9	337.9	1159	33.8	135.1	118.2	337.9	9.7	38.9	35.2	97.3	9.7	4.37%	38.9	51.3	23.04%	35.2	95.2	42.70%	97.3	201.2	90.27%
1.53	1.42	98	1.53	342.4	342.4	1160	34.2	137.0	119.8	342.4	9.8	39.1	35.3	97.8	9.8	4.39%	39.1	51.5	23.12%	35.3	95.3	42.77%	97.8	201.7	90.48%
1.55	1.44	99	1.55	346.9	346.9	1161	34.7	138.8	121.4	346.9	9.8	39.3	35.5	98.3	9.8	4.41%	39.3	51.7	23.20%	35.5	95.5	42.85%	98.3	202.1	90.69%
1.55	1.45	100	1.55	347.0	347.0	1162	34.7	138.8	121.4	347.0	9.9	39.5	35.6	98.8	9.9	4.43%	39.5	51.9	23.29%	35.6	95.7	42.92%	98.8	202.6	90.90%
1.55	1.46	101	1.55	347.0	347.0	1163	34.7	138.8	121.5	347.0	9.9	39.7	35.8	99.2	9.9	4.45%	39.7	52.1	23.38%	35.8	95.8	43.00%	99.2	203.1	91.12%
1.54	1.46	102	1.54	344.8	344.8	1164	34.5	137.9	120.7	344.8	10.0	39.9	36.0	99.7	10.0	4.47%	39.9	52.3	23.46%	36.0	96.0	43.07%	99.7	203.6	91.33%
1.53	1.46	103	1.53	342.6	342.6	1165	34.3	137.0	119.9	342.6	10.0	40.1	36.1	100.2	10.0	4.49%	40.1	52.5	23.55%	36.1	96.2	43.15%	100.2	204.0	91.54%
1.51	1.45	104	1.51	338.2	338.2	1166	33.8	135.3	118.4	338.2	10.1	40.3	36.3	100.7	10.1	4.52%	40.3	52.7	23.63%	36.3	96.3	43.22%	100.7	204.5	91.76%
1.48	1.44	105	1.48	331.5	331.5	1167	33.2	132.6	116.0	331.5	10.1	40.4	36.5	101.1	10.1	4.54%	40.4	52.9	23.71%	36.5	96.5	43.29%	101.1	205.0	91.96%
1.43	1.42	106	1.43	320.5	320.5	1168	32.0	128.2	112.2	320.5	10.2	40.6	36.6	101.6	10.2	4.56%	40.6	53.0	23.79%	36.6	96.7	43.36%	101.6	205.4	92.16%
1.34	1.40	107	1.34	300.6	300.6	1169	30.1	120.2	105.2	300.6	10.2	40.8	36.8	102.0	10.2	4.58%	40.8	53.2	23.87%	36.8	96.8	43.43%	102.0	205.9	92.36%
1.25	1.36	109	1.25	280.7	280.7	1170	28.1	112.3	98.2	280.7	10.2	41.0	36.9	102.4	10.2	4.59%	41.0	53.4	23.94%	36.9	96.9	43.49%	102.4	206.3	92.54%
1.17	1.29	109	1.17	262.7	262.7	1171	26.3	105.1	92.0	262.7	10.3	41.1	37.1	102.8	10.3	4.61%	41.1	53.5	24.01%	37.1	97.1	43.55%	102.8	206.6	92.70%
1.09	1.22	110	1.09	244.9	244.9	1172	24.5	98.0	85.7	244.9	10.3	41.2	37.2	103.1	10.3	4.63%	41.2	53.7	24.07%	37.2	97.2	43.61%	103.1	207.0	92.86%
1.03	1.16	111	1.03	231.4	231.4	1173	23.1	92.6	81.0	231.4	10.3	41.4	37.3	103.4	10.3	4.64%	41.4	53.8	24.13%	37.3	97.3	43.66%	103.4	207.3	93.01%
0.97	1.10	112	0.97	218.0	218.0	1174	21.8	87.2	76.3	218.0	10.4	41.5	37.4	103.8	10.4	4.65%	41.5	53.9	24.19%	37.4	97.4	43.71%	103.8	207.6	93.15%
0.91	1.04	113	0.91	204.5	204.5	1175	20.5	81.8	71.6	204.5	10.4	41.6	37.5	104.0	10.4	4.67%	41.6	54.0	24.24%	37.5	97.5	43.75%	104.0	207.9	93.29%
0.85	0.99	114	0.85	191.1	191.1	1176	19.1	76.5	66.9	191.1	10.4	41.7	37.6	104.3	10.4	4.68%	41.7	54.1	24.29%	37.6	97.6	43.79%	104.3	208.2	93.40%
0.80	0.94	115	0.80	179.9	179.9	1177	18.0	72.0	63.0	179.9	10.5	41.8	37.7	104.6	10.5	4.69%	41.8	54.2	24.33%	37.7	97.7	43.83%	104.6	208.4	93.51%
0.76	0.89	116	0.76	170.9	170.9	1178	17.1	68.4	59.8	170.9	10.5	41.9	37.8	104.8	10.5	4.70%	41.9	54.3	24.38%	37.9	97.8	43.87%	104.8	208.7	93.62%
0.59	0.72	120	0.59	132.8	132.8	1182	13.3	53.1	46.5	132.8	10.6	42.3	38.1	105.7	10.6	4.74%	42.3	54.7	24.53%	38.1	98.1	44.00%	105.7	209.5	94.00%
0.43	0.56	125	0.43	96.9	96.9	1187	9.7	38.8	33.9	96.9	10.6	42.6	38.3	106.4	10.6	4.78%	42.6	55.0	24.67%	38.3	98.4	44.13%	106.4	210.3	94.35%
0.33	0.42	130	0.33	74.4	74.4	1192	7.4	29.7	26.0	74.4	10.7	42.8	38.5	107.0	10.7	4.80%	42.8	55.2	24.78%	38.5	98.6	44.22%	107.0	210.9	94.52%
0.28	0.32	135	0.28	62.9	62.9	1197	6.3	25.2	22.0	62.9	10.8	43.0	38.7	107.5	10.8	4.82%	43.0	55.4	24.86%	38.7	98.7	44.30%	107.5	211.4	94.83%
0.24	0.27	140	0.24	53.9	53.9	1202	5.4	21.6	18.9	53.9	10.8	43.2	38.9	107.9	10.8	4.84%	43.2	55.6	24.93%	38.9	98.9	44.36%	107.9	211.8	95.01%
0.22	0.23	145	0.22	49.4	49.4	1207	4.9	19.7	17.3	49.4	10.8	43.3	39.0	108.3	10.8	4.86%	43.3	55.7	25.00%	39.0	99.0	44.41%	108.3	212.1	95.17%
0.20	0.21	150	0.20	44.9	44.9	1212	4.5	17.9	15.7	44.9	10.9	43.4	39.1	108.6	10.9	4.87%	43.4	55.8	25.05%	39.1	99.1	44.47%	108.6	212.5	95.31%
0.19	0.20	155	0.19	42.6	42.6	1217	4.3	17.1	14.9	42.6	10.9	43.6	39.2	108.9	10.9	4.89%	43.6	56.0	25.11%	39.2	99.2	44.51%	108.9	212.8	95.45%
0.18	0.19	160	0.18	40.4	40.4	1222	4.0	16.2	14.1	40.4	10.9	43.7	39.3	109.2	10.9	4.90%	43.7	56.1	25.16%	39.3	99.3	44.56%	109.2	213.0	95.58%
0.17	0.18	170	0.17	38.1	38.1	1232	3.8	15.3	13.4	38.1	11.0	43.9	39.5	109.7	11.0	4.92%	43.9	56.3	25.26%	39.5	99.5	44.64%	109.7	213.6	95.82%
0.16	0.17	180	0.16	35.9	35.9	1242	3.6	14.4	12.6	35.9	11.0	44.1	39.7	110.2	11.0	4.95%	44.1	56.5	25.35%	39.7	99.7	44.72%	110.2	214.1	96.05%
0.15	0.16	190	0.15	33.7	33.7	1252	3.4	13.5	11.8	33.7	11.1	44.3	39.8	110.7	11.1	4.97%	44.3	56.7	25.43%	39.8	99.9	44.80%	110.7	214.6	96.26%
0.15	0.15	200	0.15	33.6	33.6	1262	3.4	13.4	11.8	33.6	11.1	44.5	40.0	111.2	11.1	4.99%	44.5	56.9	25.52%	40.0	100.0	44.87%	111.2	215.0	96.47%
0.15	0.15	210	0.15	33.6	33.6	1272	3.4	13.4	11.8	33.6	11.2	44.7	40.2	111.6	11.2	5.01%	44.7	57.1	25.60%	40.2	100.2	44.94%	111.6	215.5	96.68%
0.15	0.15	220	0.15	33.6	33.6	1282	3.4	13.4	11.8	33.6	11.2	44.8	40.3	112.1	11.2	5.03%	44.8	57.2	25.69%	40.3	100.3	45.02%	112.1	216.0	96.89%
0.15	0.15	230	0.15	33.6	33.6	1292	3.4	13.4	11.8	33.6	11.3	45.0	40.5	112.6	11.3	5.05%	45.0	57.4	25.77%	40.5	100.5	45.09%	112.6	216.4	97.10%
0.15	0.15	250	0.15	33.6	33.6	1312	3.4	13.4	11.8	33.6	11.3	45.4	40.8	113.5	11.3	5.09%	45.4	57.8	25.93%	40.8	100.8	45.23%	113.5	217.3	97.51%
0.14	0.14	260	0.14	31.4	31.4	1322	3.1	12.6	11.0	31.4	11.4	45.6	41.0	113.9	11.4	5.11%	45.6	58.0	26.01%	41.0	101.0	45.30%	113.9	217.8	97.71%
0.14	0.14	300	0.14	31.4	31.4	1362	3.1	12.6	11.0	31.4	11.6	46.3	41.6	115.7	11.6	5.19%	46.3	58.7	26.32%	41.6	101.6	45.58%	115.7	219.5	98.49%
0.14	0.14	378	0.14	31.4	31.4	1440	12.6	12.6	31.4	31.4	12.4	47.5	43.8	119.0	12.4	5.57%	47.5	60.0	26.93%	43.8	103.9	46.60%	119.0	222.9	100.00%
					Daily Peak Flow (cfs) =		35	139	121	347			ΣV (af) =	223											
					Daily Average Flow (cfs) =		6	24	22	60			28.1												

South WL's - Ph 1 & 2

		A= 184.1 ac																							
		tc1: 30.1 min			50 year - 4 day Storm																				
30	35	BPRR	1.56	0.0			Flow				Runoff 1					Percentage of Total Runoff									
1.55	1.46	Qp1:	347	cfs	0.0cfs	CLOCK	1st Day	2nd Day	3rd Day	4th Day	1st Day	2nd Day	3rd Day	4th Day	1st Day	1st Day	2nd Day	2nd Day	2nd Day	3rd Day	3rd Day	3rd Day	4th Day	4th Day	4th Day
		TIME	BPRR	Q1	Q(by-pass)	TIME	Q [cfs]	Q [cfs]	Q [cfs]	Q [cfs]	V [af]	V [af]	V [af]	V [af]	V [af]	%	V [af]	ΣV [af]	%	V [af]	ΣV [af]	%	V [af]	ΣV [af]	%
0.14	0.14	-1062	0.14	31.4	31.4	0	3.1	12.6	12.6	31.4								12.4			60.0			109.9	
0.35	0.35	-60	0.35	78.4	78.4	1002	7.8	31.4	27.5	78.4	7.6	30.3	27.6	75.8	7.5	3.40%	30.3	42.7	19.17%	27.6	87.6	39.31%	75.8	179.7	80.60%
0.37	0.37	0	0.37	82.9	82.9	1062	8.3	33.2	29.0	82.9	8.2	33.0	29.9	82.5	8.2	3.70%	33.0	45.4	20.36%	29.9	90.0	40.36%	82.5	186.3	83.59%
0.40	0.40	60	0.40	89.7	89.7	1122	9.0	35.9	31.4	89.7	9.0	35.8	32.4	89.5	9.0	4.02%	35.8	48.2	21.64%	32.4	92.5	41.48%	89.5	193.4	86.79%
0.48	0.46	70	0.48	107.5	107.5	1132	10.7	43.0	37.6	107.5	9.1	36.4	32.9	90.9	9.1	4.08%	36.4	48.6	21.89%	32.9	92.9	41.69%	90.9	194.8	87.40%
0.61	0.58	80	0.61	136.6	136.6	1142	13.7	54.6	47.8	136.6	9.3	37.1	33.5	92.8	9.3	4.16%	37.1	49.5	22.19%	33.5	93.5	41.96%	92.6	196.5	88.15%
0.71	0.66	85	0.71	158.9	158.9	1147	15.9	63.6	55.6	158.9	9.4	37.5	33.9	93.8	9.4	4.20%	37.5	49.9	22.37%	33.9	93.9	42.12%	93.6	197.5	88.61%
0.78	0.72	88	0.78	174.6	174.6	1150	17.5	69.8	61.1	174.6	9.4	37.7	34.1	94.3	9.4	4.23%	37.7	50.1	22.50%	34.1	94.1	42.23%	94.3	198.2	88.92%
0.84	0.79	90	0.84	188.0	188.0	1152	18.8	75.2	65.8	188.0	9.5	37.9	34.3	94.8	9.5	4.25%	37.9	50.3	22.59%	34.3	94.3	42.31%	94.8	198.7	89.14%
0.90	0.83	91	0.90	201.4	201.4	1153	20.1	80.6	70.5	201.4	9.5	38.0	34.4	95.1	9.5	4.27%	38.0	50.4	22.63%	34.4	94.4	42.36%	95.1	199.0	89.25%
0.96	0.89	92	0.96	214.9	214.9	1154	21.5	85.9	75.2	214.9	9.5	38.2	34.5	95.4	9.5	4.28%	38.2	50.6	22.69%	34.5	94.5	42.39%	95.4	199.2	89.36%
1.08	0.96	93	1.08	241.5	241.5	1155	24.2	96.6	84.5	241.5	9.6	38.3	34.6	95.7	9.6	4.29%	38.3	50.7	22.74%	34.6	94.6	42.44%	95.7	199.6	89.50%
1.20	1.05	94	1.20	268.3	268.3	1156	26.8	107.3	93.9	268.3	9.6	38.4	34.7	96.1	9.6	4.31%	38.4	50.8	22.80%	34.7	94.7	42.50%	96.1	199.9	89.69%
1.35	1.15	95	1.35	301.7	301.7	1157	30.2	120.7	105.6	301.7	9.6	38.6	34.9	96.4	9.6	4.33%	38.6	51.0	22.87%	34.9	94.9	42.56%	96.4	200.3	89.87%
1.47	1.29	96	1.47	328.7	328.7	1158	32.9	131.5	115.0	328.7	9.7	38.8	35.0	96.9	9.7	4.35%	38.8	51.2	22.95%	35.0	95.0	42.63%	96.9	200.7	90.06%
1.51	1.38	97	1.51	337.9	337.9	1159	33.8	135.1	118.2	337.9	9.7	38.9	35.2	97.3	9.7	4.37%	38.9	51.3	23.04%	35.2	95.2	42.70%	97.3	201.2	90.27%
1.53	1.42	98	1.53	342.4	342.4	1160	34.2	137.0	119.8	342.4	9.8	39.1	35.3	97.8	9.8	4.39%	39.1	51.5	23.12%	35.3	95.3	42.77%	97.8	201.7	90.48%
1.55	1.44	99	1.55	346.9	346.9	1161	34.7	138.8	121.4	346.9	9.8	39.3	35.5	98.3	9.8	4.41%	39.3	51.7	23.20%	35.5	95.5	42.85%	98.3	202.1	90.69%
1.55	1.45	100	1.55	347.0	347.0	1162	34.7	138.8	121.4	347.0	9.9	39.5	35.6	98.8	9.9	4.43%	39.5	51.9	23.29%	35.6	95.7	42.92%	98.8	202.6	90.90%
1.55	1.45	101	1.55	347.0	347.0	1163	34.7	138.8	121.5	347.0	9.9	39.7	35.8	99.2	9.9	4.45%	39.7	52.1	23.38%	35.8	95.9	43.00%	99.2	203.1	91.12%
1.54	1.46	102	1.54	344.8	344.8	1164	34.5	137.9	120.7	344.8	10.0	39.9	36.0	99.7	10.0	4.47%	39.9	52.3	23.46%	36.0	96.0	43.07%	99.7	203.6	91.33%
1.53	1.46	103	1.53	342.6	342.6	1165	34.3	137.0	119.9	342.6	10.0	40.1	36.1	100.2	10.0	4.49%	40.1	52.5	23.55%	36.1	96.2	43.15%	100.2	204.0	91.54%
1.51	1.45	104	1.51	338.2	338.2	1166	33.8	135.3	118.4	338.2	10.1	40.3	36.3	100.7	10.1	4.52%	40.3	52.7	23.63%	36.3	96.3	43.22%	100.7	204.5	91.76%
1.48	1.44	105	1.48	331.5	331.5	1167	33.2	132.6	116.0	331.5	10.1	40.4	36.5	101.1	10.1	4.54%	40.4	52.9	23.71%	36.5	96.5	43.29%	101.1	205.0	91.96%
1.43	1.42	106	1.43	320.5	320.5	1168	32.0	128.2	112.2	320.5	10.2	40.6	36.6	101.6	10.2	4.56%	40.6	53.0	23.79%	36.6	96.7	43.36%	101.6	205.4	92.16%
1.34	1.40	107	1.34	300.6	300.6	1169	30.1	120.2	105.2	300.6	10.2	40.8	36.8	102.0	10.2	4.58%	40.8	53.2	23.87%	36.8	96.8	43.43%	102.0	205.9	92.36%
1.25	1.36	108	1.25	280.7	280.7	1170	28.1	112.3	98.2	280.7	10.2	41.0	36.9	102.4	10.2	4.59%	41.0	53.4	23.94%	36.9	96.9	43.49%	102.4	206.3	92.54%
1.17	1.28	109	1.17	262.7	262.7	1171	26.3	105.1	92.0	262.7	10.3	41.1	37.1	102.8	10.3	4.61%	41.1	53.5	24.01%	37.1	97.1	43.55%	102.8	206.6	92.70%
1.09	1.22	110	1.09	244.9	244.9	1172	24.5	98.0	85.7	244.9	10.3	41.2	37.2	103.1	10.3	4.63%	41.2	53.7	24.07%	37.2	97.2	43.61%	103.1	207.0	92.86%
1.03	1.16	111	1.03	231.4	231.4	1173	23.1	92.6	81.0	231.4	10.3	41.4	37.3	103.4	10.3	4.64%	41.4	53.8	24.13%	37.3	97.3	43.66%	103.4	207.3	93.01%
0.97	1.10	112	0.97	218.0	218.0	1174	21.8	87.2	76.3	218.0	10.4	41.5	37.4	103.8	10.4	4.65%	41.5	53.9	24.19%	37.4	97.4	43.71%	103.8	207.6	93.15%
0.91	1.04	113	0.91	204.5	204.5	1175	20.5	81.8	71.6	204.5	10.4	41.5	37.5	104.0	10.4	4.67%	41.6	54.0	24.24%	37.5	97.5	43.75%	104.0	207.9	93.28%
0.85	0.99	114	0.85	191.1	191.1	1176	19.1	76.5	66.9	191.1	10.4	41.7	37.6	104.3	10.4	4.68%	41.7	54.1	24.29%	37.6	97.6	43.79%	104.3	208.2	93.40%
0.80	0.94	115	0.80	179.9	179.9	1177	18.0	72.0	63.0	179.9	10.5	41.8	37.7	104.6	10.5	4.69%	41.8	54.2	24.33%	37.7	97.7	43.83%	104.6	208.4	93.51%
0.76	0.89	116	0.76	170.9	170.9	1178	17.1	68.4	59.8	170.9	10.5	41.9	37.8	104.8	10.5	4.70%	41.9	54.3	24.38%	37.8	97.8	43.87%	104.8	208.7	93.62%
0.59	0.72	120	0.59	132.8	132.8	1182	13.3	53.1	46.5	132.8	10.6	42.3	38.1	105.7	10.6	4.74%	42.3	54.7	24.53%	38.1	98.1	44.00%	105.7	209.5	94.00%
0.43	0.55	125	0.43	96.8	96.8	1187	9.7	38.8	33.9	96.8	10.6	42.6	38.3	106.4	10.6	4.76%	42.6	55.0	24.67%	38.3	98.4	44.13%	106.4	210.3	94.35%
0.33	0.42	130	0.33	74.4	74.4	1192	7.4	29.7	26.0	74.4	10.7	42.8	38.5	107.0	10.7	4.80%	42.8	55.2	24.76%	38.5	98.6	44.22%	107.0	210.9	94.62%
0.28	0.32	135	0.28	62.9	62.9	1197	6.3	25.2	22.0	62.9	10.8	43.0	38.7	107.5	10.8	4.82%	43.0	55.4	24.86%	38.7	98.7	44.30%	107.5	211.4	94.83%
0.24	0.27	140	0.24	53.9	53.9	1202	5.4	21.6	18.9	53.9	10.8	43.2	38.9	107.9	10.8	4.84%	43.2	55.6	24.93%	38.9	98.9	44.36%	107.9	211.6	95.01%
0.22	0.23	145	0.22	49.4	49.4	1207	4.9	19.7	17.3	49.4	10.8	43.3	39.0	108.3	10.8	4.86%	43.3	55.7	25.00%	39.0	99.0	44.41%	108.3	212.1	95.17%
0.20	0.21	150	0.20	44.9	44.9	1212	4.5	17.9	15.7	44.9	10.9	43.4	39.1	108.5	10.9	4.87%	43.4	55.8	25.05%	39.1	99.1	44.47%	108.5	212.5	95.31%
0.19	0.20	155	0.19	42.6	42.6	1217	4.3	17.1	14.9	42.6	10.9	43.6	39.2	108.9	10.9	4.89%	43.6	56.0	25.11%	39.2	99.2	44.51%	108.9	212.8	95.45%
0.18	0.19	160	0.18	40.4	40.4	1222	4.0	16.2	14.1	40.4	10.9	43.7	39.3	109.2	10.9	4.90%	43.7	56.1	25.16%	39.3	99.3	44.56%	109.2	213.0	95.58%
0.17	0.18	170	0.17	38.1	38.1	1232	3.8	15.3	13.4	38.1	11.0	43.9	39.5	109.7	11.0	4.92%	43.9	56.3	25.26%	39.5	99.5	44.64%	109.7	213.6	95.82%
0.16	0.17	180	0.16	35.9	35.9	1242	3.5	14.4	12.6	35.9	11.0	44.1	39.7	110.2	11.0	4.95%	44.1	56.5	25.35%	39.7	99.7	44.72%	110.2	214.1	96.05%
0.15	0.16	190	0.15	33.7	33.7	1252	3.4	13.5	11.8	33.7	11.1	44.3	39.8	110.7	11.1	4.97%	44.3	56.7	25.43%	39.8	99.9	44.80%	110.7	214.6	96.26%
0.15	0.15	200	0.15	33.6	33.6	1262	3.4	13.4	11.8	33.6	11.1	44.5	40.0	111.2	11.1	4.99%	44.5	56.9	25.52%	40.0	100.0	44.87%	111.2	215.0	96.47%
0.15	0.15	210	0.15	33.6	33.6	1272	3.4	13.4	11.8	33.6	11.2	44.7	40.2	111.6	11.2	5.01%	44.7	57.1	25.60%	40.2	100.2	44.94%	111.6	215.5	96.68%
0.15	0.15	220	0.15	33.6	33.6	1282	3.4	13.4	11.8	33.6	11.2	44.8	40.3	112.1	11.2	5.03%	44.8	57.2	25.68%	40.3	100.3	45.02%	112.1	215.9	96.89%
0.15	0.15	230	0.15	33.6	33.6	1292	3.4	13.4	11.8	33.6	11.3	45.0	40.5	112.6	11.3	5.05%	45.0	57.4	25.77%	40.5	100.5	45.09%	112.6	216.4	97.10%
0.15	0.15	250	0.15	33.6	33.6	1312	3.4	13.4	11.8	33.6	11.3	45.4	40.8	113.5	11.3	5.09%	45.4	57.8	25.93%	40.8	100.8	45.23%	113.5	217.3	97.51%
0.14	0.14	260	0.14	31.4	31.4	1332	3.1	12.6	11.0	31.4	11.4	45.6	41.0	113.9	11.4	5.11%	45.6	58.0	26.01%	41.0	101.0	45.30%	113.9	217.8	97.71%
0.14	0.14	300	0.14	31.4	31.4	1362	3.1	12.6	11.0	31.4	11.6	46.3	41.6	115.7	11.6	5.19%	46.3	58.7	26.32%	41.6	101.6	45.59%	115.7	219.5	98.49%
0.14	0.14	372	0.14	31.4	31.4	1440	12.6	12.6	31.4	31.4	12.4	47.6	43.9	119.0	12.4	5.57%	47.6	60.0	26.93%	43.9	103.9	46.62%	119.0	222.9	100.00%
				Daily Peak Flow [cfs] =			35	139	121	347			pf [af] =	229											
				Daily Average Flow [cfs] =			6	24	22	60					29.1										

North WL's - Pre PV

		A=	162.1	ac																					
		tc1:	30.7	min		50 year - 4 day Storm																			
30	35	BPRR	1.54	0.1			Flow				Runoff 1					Percentage of Total Runoff									
1.55	1.46	Qp1:	322	cfs	0.0cfs	CLOCK	1st Day	2nd Day	3rd Day	4th Day	1st Day	2nd Day	3rd Day	4th Day	1st Day	1st Day	2nd Day	2nd Day	2nd Day	3rd Day	3rd Day	3rd Day	4th Day	4th Day	4th Day
		TIME	BPRR	Q1	Q(by-pass)	TIME	Q [cfs]	Q [cfs]	Q [cfs]	Q [cfs]	V [af]	V [af]	V [af]	V [af]	V [af]	%	V [af]	ΣV [af]	%	V [af]	ΣV [af]	%	V [af]	ΣV [af]	%
0.14	0.14	-1062	0.14	29.3	29.3	0	2.9	11.7	11.7	29.3								11.5			56.1			97.1	
0.35	0.35	60	0.35	73.3	73.3	1002	7.3	29.3	25.7	73.3	7.1	28.7	25.8	70.8	7.1	3.40%	28.7	39.9	19.19%	25.8	81.5	39.31%	70.8	167.9	80.58%
0.37	0.37	0	0.37	77.5	77.5	1062	7.7	31.0	27.1	77.5	7.7	30.9	28.0	77.1	7.7	3.70%	30.8	42.4	20.39%	29.0	84.1	40.36%	77.1	174.2	83.57%
0.40	0.40	60	0.40	83.8	83.8	1122	8.4	33.5	29.3	83.8	8.4	33.5	30.3	83.7	8.4	4.02%	33.5	45.1	21.64%	30.3	86.4	41.49%	83.7	180.8	86.77%
0.48	0.46	70	0.48	99.9	99.9	1132	10.0	40.0	35.0	99.9	8.5	34.0	30.8	85.0	8.5	4.08%	34.0	45.6	21.88%	30.8	86.9	41.69%	85.0	182.1	87.38%
0.61	0.58	80	0.61	126.9	126.9	1142	12.7	50.8	44.4	126.9	8.7	34.6	31.3	86.5	8.7	4.15%	34.6	46.2	22.16%	31.3	87.4	41.95%	86.5	183.6	88.13%
0.71	0.66	85	0.70	147.2	147.2	1147	14.7	58.9	51.5	147.2	8.7	35.0	31.6	87.5	8.7	4.20%	35.0	46.6	22.36%	31.6	87.7	42.11%	87.5	184.6	88.58%
0.78	0.72	89	0.77	161.6	161.6	1150	16.2	64.6	56.6	161.6	8.8	35.3	31.9	88.1	8.8	4.23%	35.3	46.9	22.46%	31.9	88.0	42.22%	88.1	185.2	88.89%
0.84	0.79	90	0.83	174.5	174.5	1152	17.4	69.8	61.1	174.5	8.9	35.4	32.0	88.5	8.9	4.25%	35.4	47.0	22.57%	32.0	88.1	42.29%	88.6	185.7	89.11%
0.90	0.83	91	0.89	186.4	186.4	1153	18.6	74.6	65.3	186.4	8.9	35.5	32.1	88.8	8.9	4.26%	35.5	47.1	22.62%	32.1	88.2	42.34%	88.8	185.9	89.21%
0.96	0.89	92	0.95	199.0	199.0	1154	19.9	79.6	69.7	199.0	8.9	35.6	32.2	89.1	8.9	4.28%	35.6	47.2	22.67%	32.2	88.3	42.38%	89.1	186.2	89.36%
1.08	0.96	93	1.06	222.7	222.7	1155	22.3	89.1	77.9	222.7	8.9	35.8	32.3	89.4	8.9	4.29%	35.8	47.4	22.73%	32.3	88.4	42.43%	89.4	186.5	89.50%
1.20	1.05	94	1.18	246.9	246.9	1156	24.7	98.8	86.4	246.9	9.0	35.9	32.4	89.7	9.0	4.31%	35.9	47.5	22.79%	32.4	88.5	42.48%	89.7	186.8	89.65%
1.35	1.15	95	1.32	276.9	276.9	1157	27.7	110.8	96.9	276.9	9.0	36.0	32.5	90.1	9.0	4.32%	36.0	47.6	22.86%	32.5	88.7	42.54%	90.1	187.2	89.82%
1.47	1.29	96	1.44	302.6	302.6	1158	30.3	121.0	105.9	302.6	9.0	36.2	32.7	90.5	9.0	4.34%	36.2	47.8	22.93%	32.7	88.8	42.61%	90.5	187.6	90.02%
1.51	1.38	97	1.49	312.4	312.4	1159	31.2	125.0	109.4	312.4	9.1	36.4	32.8	90.9	9.1	4.35%	36.4	48.0	23.02%	32.8	88.9	42.68%	90.9	188.0	90.22%
1.53	1.42	98	1.51	317.2	317.2	1160	31.7	126.9	111.0	317.2	9.1	36.5	33.0	91.3	9.1	4.38%	36.5	48.1	23.10%	33.0	89.1	42.75%	91.3	188.4	90.43%
1.56	1.44	99	1.53	321.4	321.4	1161	32.1	128.6	112.5	321.4	9.2	36.7	33.1	91.8	9.2	4.40%	36.7	48.3	23.18%	33.1	89.2	42.83%	91.6	188.5	90.64%
1.55	1.45	100	1.54	321.7	321.7	1162	32.2	128.7	112.6	321.7	9.2	36.9	33.3	92.2	9.2	4.43%	36.9	48.5	23.27%	33.3	89.4	42.90%	92.2	189.3	90.85%
1.55	1.46	101	1.54	322.0	322.0	1163	32.2	128.8	112.7	322.0	9.3	37.1	33.4	92.7	9.3	4.45%	37.1	48.7	23.35%	33.4	89.6	42.98%	92.7	189.8	91.06%
1.54	1.46	102	1.53	320.2	320.2	1164	32.0	128.1	112.1	320.2	9.3	37.2	33.6	93.1	9.3	4.47%	37.2	48.8	23.44%	33.6	89.7	43.05%	93.1	190.2	91.28%
1.53	1.46	103	1.52	318.4	318.4	1165	31.8	127.4	111.4	318.4	9.4	37.4	33.8	93.5	9.4	4.49%	37.4	49.0	23.52%	33.8	89.9	43.13%	93.5	190.6	91.45%
1.51	1.45	104	1.50	314.5	314.5	1166	31.5	125.8	110.1	314.5	9.4	37.6	33.9	94.0	9.4	4.51%	37.6	49.2	23.61%	33.9	90.0	43.20%	94.0	191.1	91.70%
1.48	1.44	105	1.47	306.8	306.8	1167	30.8	123.5	108.1	306.8	9.4	37.8	34.1	94.4	9.4	4.53%	37.8	49.4	23.69%	34.1	90.2	43.27%	94.4	191.5	91.90%
1.43	1.42	106	1.43	299.2	299.2	1168	29.9	119.7	104.7	299.2	9.5	37.9	34.2	94.8	9.5	4.55%	37.9	49.5	23.77%	34.2	90.3	43.34%	94.8	191.9	92.10%
1.34	1.40	107	1.35	282.4	282.4	1169	28.2	113.0	98.8	282.4	9.5	38.1	34.3	95.2	9.5	4.57%	38.1	49.7	23.85%	34.3	90.5	43.41%	95.2	192.3	92.29%
1.25	1.36	108	1.27	265.0	265.0	1170	26.5	106.0	92.8	265.0	9.6	38.2	34.5	95.6	9.6	4.59%	38.2	49.8	23.92%	34.5	90.6	43.47%	95.6	192.7	92.48%
1.17	1.28	109	1.19	248.3	248.3	1171	24.8	99.3	86.9	248.3	9.6	38.4	34.6	96.0	9.6	4.60%	38.4	50.0	23.99%	34.6	90.7	43.53%	96.0	193.1	92.65%
1.09	1.22	110	1.11	232.1	232.1	1172	23.2	92.8	81.2	232.1	9.6	38.5	34.7	96.3	9.6	4.62%	38.5	50.1	24.05%	34.7	90.8	43.59%	96.3	193.4	92.80%
1.03	1.15	111	1.05	219.5	219.5	1173	22.0	87.8	76.8	219.5	9.7	38.6	34.8	96.6	9.7	4.64%	38.6	50.2	24.11%	34.8	90.9	43.64%	96.6	193.7	92.95%
0.97	1.10	112	0.99	207.0	207.0	1174	20.7	82.8	72.4	207.0	9.7	38.8	34.9	96.9	9.7	4.65%	38.8	50.4	24.17%	34.9	91.0	43.69%	96.9	194.0	93.09%
0.91	1.04	113	0.93	194.4	194.4	1175	19.4	77.8	68.0	194.4	9.7	38.9	35.0	97.2	9.7	4.66%	38.9	50.5	24.22%	35.0	91.1	43.73%	97.2	194.3	93.23%
0.85	0.99	114	0.87	182.1	182.1	1176	18.2	72.9	63.7	182.1	9.7	39.0	35.1	97.4	9.7	4.68%	39.0	50.5	24.27%	35.1	91.2	43.78%	97.4	194.5	93.35%
0.80	0.94	115	0.82	171.7	171.7	1177	17.2	68.7	60.1	171.7	9.8	39.1	35.2	97.7	9.8	4.69%	39.1	50.7	24.32%	35.2	91.3	43.82%	97.7	194.8	93.47%
0.76	0.89	116	0.78	163.0	163.0	1178	16.3	65.2	57.0	163.0	9.8	39.2	35.3	97.9	9.8	4.70%	39.2	50.8	24.36%	35.3	91.4	43.86%	97.9	195.0	93.58%
0.59	0.72	120	0.61	127.4	127.4	1182	12.7	51.0	44.6	127.4	9.9	39.5	35.6	98.7	9.9	4.74%	39.5	51.1	24.51%	35.6	91.7	43.99%	98.7	195.8	93.96%
0.43	0.55	125	0.45	93.6	93.6	1187	9.4	37.4	32.8	93.6	9.9	39.8	35.8	99.5	9.9	4.77%	39.8	51.4	24.66%	35.8	91.9	44.12%	99.5	196.6	94.33%
0.32	0.42	130	0.34	71.8	71.8	1192	7.2	28.7	25.1	71.8	10.0	40.0	36.0	100.0	10.0	4.80%	40.0	51.6	24.77%	36.0	92.1	44.22%	100.0	197.1	94.60%
0.28	0.32	135	0.29	59.8	59.8	1197	6.0	23.9	20.9	59.8	10.0	40.2	36.2	100.5	10.0	4.82%	40.2	51.8	24.86%	36.2	92.3	44.29%	100.5	197.6	94.82%
0.24	0.27	140	0.24	51.1	51.1	1202	5.1	20.5	17.9	51.1	10.1	40.3	36.3	100.9	10.1	4.84%	40.3	51.9	24.93%	36.3	92.4	44.36%	100.9	198.0	95.00%
0.22	0.23	145	0.22	46.4	46.4	1207	4.6	18.5	16.2	46.4	10.1	40.5	36.4	101.2	10.1	4.86%	40.5	52.1	24.99%	36.4	92.5	44.41%	101.2	198.3	95.16%
0.20	0.21	150	0.20	42.2	42.2	1212	4.2	16.9	14.8	42.2	10.2	40.5	36.5	101.5	10.2	4.87%	40.6	52.2	25.05%	36.5	92.7	44.46%	101.5	198.9	95.31%
0.19	0.20	155	0.18	40.1	40.1	1217	4.0	16.0	14.0	40.1	10.2	40.7	36.6	101.8	10.2	4.88%	40.7	52.3	25.11%	36.6	92.8	44.51%	101.9	198.9	95.45%
0.18	0.19	160	0.18	36.0	36.0	1222	3.8	15.2	13.3	36.0	10.2	40.8	36.7	102.1	10.2	4.90%	40.9	52.4	25.16%	36.7	92.8	44.56%	102.1	199.2	95.57%
0.17	0.18	170	0.17	35.9	35.9	1232	3.6	14.4	12.6	35.9	10.3	41.0	36.9	102.6	10.3	4.92%	41.0	52.6	25.26%	36.9	93.0	44.64%	102.5	199.7	95.82%
0.16	0.17	180	0.16	33.8	33.8	1242	3.4	13.5	11.6	33.8	10.3	41.2	37.1	103.1	10.3	4.95%	41.2	52.8	25.35%	37.1	93.2	44.72%	103.1	200.2	96.05%
0.15	0.16	190	0.15	31.7	31.7	1252	3.2	12.7	11.1	31.7	10.4	41.4	37.2	103.5	10.4	4.97%	41.4	53.0	25.43%	37.2	93.4	44.80%	103.5	200.6	96.27%
0.15	0.15	200	0.15	31.4	31.4	1262	3.1	12.6	11.0	31.4	10.4	41.6	37.4	103.9	10.4	4.99%	41.6	53.2	25.52%	37.4	93.5	44.87%	103.9	201.0	96.47%
0.15	0.15	210	0.15	31.4	31.4	1272	3.1	12.6	11.0	31.4	10.4	41.7	37.5	104.4	10.4	5.01%	41.7	53.3	25.60%	37.5	93.7	44.94%	104.4	201.5	96.68%
0.15	0.15	220	0.15	31.4	31.4	1282	3.1	12.6	11.0	31.4	10.5	41.9	37.7	104.8	10.5	5.03%	41.9	53.5	25.68%	37.7	93.8	45.02%	104.8	201.5	96.89%
0.15	0.15	230	0.15	31.4	31.4	1292	3.1	12.6	11.0	31.4	10.5	42.1	37.8	105.2	10.5	5.05%	42.1	53.7	25.77%	37.8	94.0	45.09%	105.2	202.3	97.10%
0.15	0.15	250	0.15	31.4	31.4	1312	3.1	12.6	11.0	31.4	10.6	42.4	38.1	106.1	10.6	5.09%	42.4	54.0	25.93%	38.1	94.3	45.23%	105.1	203.2	97.51%
0.14	0.14	260	0.14	29.3	29.3	1322	2.9	11.7	10.3	29.3	10.7	42.6	38.3	106.5	10.7	5.11%	42.6	54.2	26.01%	38.3	94.4	45.30%	106.5	203.6	97.71%
0.14	0.14	300	0.14	29.3	29.3	1362	2.9	11.7	10.3	29.3	10.8	43.3	38.9	108.1	10.8	5.19%	43.3	54.9	26.32%	38.9	95.0	45.58%	108.1	205.2	98.49%
0.14	0.14	378	0.14	29.3	29.3	1440	11.7	11.7	29.3	29.3	11.6	44.5	41.0	111.3	11.6	5.57%	44.5	58.1	28.03%	41.0	97.1	46.60%	111.3	208.4	100.00%
					Daily Peak Flow [cfs] =		32	129	113	322			ΣV [af] =	208											
					Daily Average Flow [cfs] =		5	22	21	56			26.3												

North WL's - Ph 1 & 2

		A= 138.8 ac																							
		tc1: 30.7 min				50 year - 4 day Storm																			
30	35	BPRR 1.54	0.1				Flow				Runoff					Percentage of Total Runoff									
1.55	1.46	Qp1: 276.7	cfs	0 0cfs		CLOCK	1st Day	2nd Day	3rd Day	4th Day	1st Day	2nd Day	3rd Day	4th Day	1st Day	1st Day	2nd Day	2nd Day	2nd Day	3rd Day	3rd Day	3rd Day	4th Day	4th Day	4th Day
		TIME	BPRR	Q1	Q(by-pass)	TIME	Q [cfs]	Q [cfs]	Q [cfs]	Q [cfs]	V [af]	V [af]	V [af]	V [af]	V [af]	%	V [af]	ΣV [af]	%	V [af]	ΣV [af]	%	V [af]	ΣV [af]	%
0.14	0.14	-1062	0.14	25.2	25.2	0	2.5	10.1	10.1	25.7								10.0			48.2			93.4	
0.35	0.35	-60	0.35	63.0	63.0	1002	6.3	25.2	22.0	63.0	6.1	24.3	22.2	60.9	6.1	3.40%	24.3	34.3	19.16%	22.2	70.4	39.31%	60.9	144.3	80.58%
0.37	0.37	0	0.37	66.6	66.6	1062	6.7	26.6	23.3	66.6	6.6	26.5	24.0	66.2	6.6	3.70%	26.5	36.5	20.36%	24.0	72.3	40.36%	66.2	145.7	83.57%
0.40	0.40	60	0.40	72.0	72.0	1122	7.2	28.8	25.2	72.0	7.2	28.8	25.0	71.9	7.2	4.02%	28.8	38.7	21.64%	26.0	74.3	41.48%	71.9	155.4	86.77%
0.48	0.46	70	0.48	85.9	85.9	1132	8.6	34.4	30.1	85.9	7.3	29.2	25.4	73.0	7.3	4.08%	29.2	39.2	21.88%	26.4	74.6	41.59%	73.0	156.5	87.38%
0.61	0.58	80	0.61	109.0	109.0	1142	10.9	43.6	38.2	109.0	7.4	29.7	26.9	74.4	7.4	4.15%	29.7	39.7	22.18%	26.5	75.1	41.95%	74.4	157.8	88.13%
0.71	0.66	85	0.70	126.5	126.5	1147	12.7	50.6	44.3	126.5	7.5	30.1	27.2	75.2	7.5	4.20%	30.1	40.0	22.36%	27.2	75.4	42.11%	75.2	158.6	88.58%
0.78	0.72	88	0.77	138.9	138.9	1150	13.9	55.5	48.6	138.9	7.6	30.3	27.4	75.7	7.6	4.23%	30.3	40.3	22.48%	27.4	75.6	42.22%	75.7	159.2	88.89%
0.84	0.79	90	0.83	149.9	149.9	1152	15.0	60.0	52.5	149.9	7.6	30.5	27.5	76.1	7.6	4.25%	30.5	40.4	22.57%	27.5	75.7	42.29%	76.1	159.6	89.11%
0.90	0.83	91	0.89	160.2	160.2	1153	16.0	64.1	56.1	160.2	7.6	30.5	27.6	76.3	7.6	4.26%	30.5	40.5	22.62%	27.6	75.8	42.34%	76.3	159.8	89.23%
0.96	0.89	92	0.95	171.0	171.0	1154	17.1	68.4	59.9	171.0	7.7	30.6	27.7	76.6	7.7	4.28%	30.6	40.6	22.67%	27.7	75.9	42.38%	76.6	160.0	89.36%
1.00	0.96	93	1.06	191.4	191.4	1155	19.1	76.5	67.0	191.4	7.7	30.7	27.8	76.8	7.7	4.29%	30.7	40.7	22.73%	27.8	76.0	42.43%	76.8	160.3	89.50%
1.20	1.05	94	1.18	212.2	212.2	1156	21.2	84.9	74.3	212.2	7.7	30.8	27.9	77.1	7.7	4.31%	30.8	40.8	22.79%	27.9	76.1	42.48%	77.1	160.5	89.66%
1.35	1.15	95	1.32	237.9	237.9	1157	23.8	95.2	83.3	237.9	7.7	31.0	28.0	77.4	7.7	4.32%	31.0	40.9	22.86%	28.0	76.2	42.54%	77.4	160.9	89.82%
1.47	1.29	96	1.44	260.0	260.0	1158	26.0	104.0	91.0	260.0	7.8	31.1	28.1	77.7	7.8	4.34%	31.1	41.1	22.93%	28.1	76.3	42.61%	77.7	161.2	90.02%
1.51	1.38	97	1.49	268.5	268.5	1159	26.8	107.4	94.0	268.5	7.8	31.2	28.2	78.1	7.8	4.36%	31.2	41.2	23.02%	28.2	76.4	42.68%	78.1	161.6	90.22%
1.53	1.42	98	1.51	272.6	272.6	1160	27.3	109.0	95.4	272.6	7.8	31.4	28.3	78.5	7.8	4.38%	31.4	41.4	23.10%	28.3	76.6	42.75%	78.5	161.9	90.43%
1.55	1.44	99	1.53	276.2	276.2	1161	27.6	110.5	96.7	276.2	7.9	31.5	28.5	78.9	7.9	4.40%	31.5	41.5	23.18%	28.5	76.7	42.83%	78.9	162.3	90.64%
1.55	1.45	100	1.54	276.4	276.4	1162	27.6	110.6	96.8	276.4	7.9	31.7	28.6	79.2	7.9	4.43%	31.7	41.7	23.27%	28.6	76.8	42.90%	79.2	162.7	90.85%
1.55	1.46	101	1.54	276.7	276.7	1163	27.7	110.7	96.8	276.7	8.0	31.9	28.7	79.6	8.0	4.45%	31.9	41.8	23.35%	28.7	77.0	42.98%	79.6	163.1	91.06%
1.54	1.46	102	1.53	275.2	275.2	1164	27.5	110.1	96.3	275.2	8.0	32.0	28.9	80.0	8.0	4.47%	32.0	42.0	23.44%	28.9	77.1	43.05%	80.0	163.4	91.28%
1.53	1.46	103	1.52	273.6	273.6	1165	27.4	109.4	95.8	273.6	8.0	32.2	29.0	80.4	8.0	4.49%	32.2	42.1	23.52%	29.0	77.2	43.13%	80.4	163.8	91.49%
1.51	1.45	104	1.50	270.3	270.3	1166	27.0	108.1	94.5	270.3	8.1	32.3	29.1	80.9	8.1	4.51%	32.3	42.3	23.61%	29.1	77.4	43.20%	80.8	164.2	91.70%
1.48	1.44	105	1.47	265.4	265.4	1167	26.5	106.1	92.9	265.4	8.1	32.5	29.3	81.1	8.1	4.53%	32.5	42.4	23.69%	29.3	77.5	43.27%	81.1	164.6	91.90%
1.43	1.42	106	1.43	257.1	257.1	1168	25.7	102.8	90.0	257.1	8.1	32.6	29.4	81.5	8.1	4.55%	32.6	42.6	23.77%	29.4	77.6	43.34%	81.5	164.9	92.10%
1.34	1.40	107	1.35	242.7	242.7	1169	24.3	97.1	84.9	242.7	8.2	32.7	29.5	81.8	8.2	4.57%	32.7	42.7	23.85%	29.5	77.7	43.41%	81.8	165.3	92.29%
1.25	1.36	108	1.27	227.7	227.7	1170	22.8	91.1	79.7	227.7	8.2	32.9	29.6	82.2	8.2	4.59%	32.9	42.8	23.92%	29.6	77.8	43.47%	82.2	165.6	92.48%
1.17	1.28	109	1.19	213.3	213.3	1171	21.3	85.3	74.7	213.3	8.2	33.0	29.7	82.5	8.2	4.60%	33.0	43.0	23.99%	29.7	78.0	43.53%	82.5	165.9	92.65%
1.09	1.22	110	1.11	199.5	199.5	1172	19.9	79.8	69.8	199.5	8.3	33.1	29.8	82.7	8.3	4.62%	33.1	43.1	24.05%	29.8	78.0	43.58%	82.7	166.2	92.80%
1.03	1.16	111	1.05	188.7	188.7	1173	18.9	75.5	66.0	188.7	8.3	33.2	29.9	83.0	8.3	4.64%	33.2	43.2	24.11%	29.9	78.1	43.64%	83.0	166.4	92.95%
0.97	1.10	112	0.99	177.9	177.9	1174	17.8	71.1	62.2	177.9	8.3	33.3	30.0	83.3	8.3	4.65%	33.3	43.3	24.17%	30.0	78.2	43.69%	83.3	166.7	93.09%
0.91	1.04	113	0.93	167.1	167.1	1175	16.7	66.8	58.5	167.1	8.3	33.4	30.1	83.5	8.3	4.66%	33.4	43.4	24.22%	30.1	78.3	43.73%	83.5	166.9	93.23%
0.85	0.99	114	0.87	156.5	156.5	1176	15.7	62.6	54.8	156.5	8.4	33.5	30.2	83.7	8.4	4.68%	33.5	43.5	24.27%	30.2	78.4	43.78%	83.7	167.2	93.35%
0.80	0.94	115	0.82	147.5	147.5	1177	14.8	59.0	51.6	147.5	8.4	33.6	30.2	83.9	8.4	4.69%	33.6	43.5	24.32%	30.2	78.5	43.82%	83.9	167.4	93.47%
0.76	0.89	116	0.78	140.1	140.1	1178	14.0	56.0	49.0	140.1	8.4	33.7	30.3	84.1	8.4	4.70%	33.7	43.6	24.36%	30.3	78.5	43.85%	84.1	167.6	93.58%
0.59	0.72	120	0.61	109.5	109.5	1182	10.9	43.8	38.3	109.5	8.5	33.9	30.6	84.8	8.5	4.74%	33.9	43.9	24.51%	30.6	78.7	43.99%	84.8	168.3	93.96%
0.43	0.55	125	0.45	80.4	80.4	1187	8.0	32.2	28.1	80.4	8.5	34.2	30.8	85.5	8.5	4.77%	34.2	44.2	24.66%	30.8	79.0	44.12%	85.5	168.9	94.33%
0.33	0.42	130	0.34	61.7	61.7	1192	6.2	24.7	21.6	61.7	8.6	34.4	31.0	86.0	8.6	4.80%	34.4	44.4	24.77%	31.0	79.2	44.22%	86.0	169.4	94.60%
0.28	0.32	135	0.29	51.4	51.4	1197	5.1	20.6	18.0	51.4	8.6	34.5	31.1	86.3	8.6	4.82%	34.5	44.5	24.86%	31.1	79.3	44.29%	86.3	169.8	94.82%
0.24	0.27	140	0.24	44.0	44.0	1202	4.4	17.6	15.4	44.0	8.7	34.7	31.2	86.7	8.7	4.84%	34.7	44.6	24.93%	31.2	79.4	44.36%	86.7	170.1	95.00%
0.22	0.23	145	0.22	39.8	39.8	1207	4.0	15.9	13.9	39.8	8.7	34.8	31.3	87.0	8.7	4.86%	34.8	44.8	24.99%	31.3	79.5	44.41%	87.0	170.4	95.16%
0.20	0.21	150	0.20	36.2	36.2	1212	3.6	14.5	12.7	36.2	8.7	34.9	31.4	87.2	8.7	4.87%	34.9	44.9	25.05%	31.4	79.6	44.45%	87.2	170.7	95.31%
0.19	0.20	155	0.19	34.4	34.4	1217	3.4	13.8	12.1	34.4	8.7	35.0	31.5	87.5	8.7	4.89%	35.0	45.0	25.11%	31.5	79.7	44.51%	87.5	170.9	95.46%
0.18	0.19	160	0.18	32.6	32.6	1222	3.3	13.1	11.4	32.6	8.8	35.1	31.6	87.7	8.8	4.90%	35.1	45.1	25.16%	31.6	79.8	44.56%	87.7	171.1	95.57%
0.17	0.18	170	0.17	30.8	30.8	1232	3.1	12.3	10.8	30.8	8.8	35.3	31.7	88.1	8.8	4.92%	35.3	45.2	25.26%	31.7	79.8	44.64%	88.1	171.6	95.62%
0.16	0.17	180	0.16	29.0	29.0	1242	2.9	11.6	10.2	29.0	8.9	35.4	31.9	88.6	8.9	4.95%	35.4	45.4	25.35%	31.9	80.1	44.72%	88.6	172.0	96.05%
0.15	0.16	190	0.15	27.2	27.2	1252	2.7	10.9	9.5	27.2	8.9	35.6	32.0	88.9	8.9	4.97%	35.6	45.5	25.43%	32.0	80.2	44.80%	88.9	172.4	96.27%
0.15	0.15	200	0.15	27.0	27.0	1262	2.7	10.8	9.4	27.0	8.9	35.7	32.1	89.3	8.9	4.99%	35.7	45.7	25.52%	32.1	80.3	44.87%	89.3	172.8	96.47%
0.15	0.15	210	0.15	27.0	27.0	1272	2.7	10.8	9.4	27.0	9.0	35.9	32.3	89.7	9.0	5.01%	35.9	45.8	25.60%	32.3	80.5	44.94%	89.7	173.1	96.66%
0.15	0.15	220	0.15	27.0	27.0	1282	2.7	10.8	9.4	27.0	9.0	36.0	32.4	90.1	9.0	5.03%	36.0	46.0	25.68%	32.4	80.6	45.02%	90.1	173.5	96.89%
0.15	0.15	230	0.15	27.0	27.0	1292	2.7	10.8	9.4	27.0	9.0	36.2	32.5	90.4	9.0	5.05%	36.2	46.1	25.77%	32.5	80.7	45.05%	90.4	173.9	97.10%
0.15	0.15	250	0.15	27.0	27.0	1312	2.7	10.8	9.4	27.0	9.1	36.5	32.8	91.2	9.1	5.09%	36.5	46.4	25.93%	32.8	81.0	45.23%	91.2	174.6	97.51%
0.14	0.14	260	0.14	25.2	25.2	1322	2.5	10.1	8.8	25.2	9.2	36.6	32.9	91.5	9.2	5.11%	36.6	46.6	26.01%	32.9	81.1	45.30%	91.5	175.0	97.71%
0.14	0.14	300	0.14	25.2	25.2	1362	2.5	10.1	8.8	25.2	9.3	37.2	33.4	92.9	9.3	5.19%	37.2	47.1	26.32%	33.4	81.6	45.58%	92.9	176.4	98.49%
0.14	0.14	378	0.14	25.2	25.2	1440	10.1	10.1	25.2	25.2	10.0	38.3	35.2	95.6	10.0	5.57%	38.3	48.2	26.93%	35.2	83.4	46.60%	95.6	179.1	100.00%
				Daily Peak Flow [cfs] =			28	111	97	277			af(af) =	178											
				Daily Average Flow [cfs] =			5	19	18	48				22.6											

NE WL's - Ph 1 & 2

		A=	58.9	ac																					
		tc1	10	min		50 year - 4 day Storm																			
10	12	BPRR	2.50	0.9			Flow				Runoff					Percentage of Total Runoff									
2.50	2.32	Dp1	176.2	cfs	0 0cfs	CLOCK	1st Day	2nd Day	3rd Day	4th Day	1st Day	2nd Day	3rd Day	4th Day	1st Day	1st Day	2nd Day	2nd Day	2nd Day	3rd Day	3rd Day	3rd Day	4th Day	4th Day	4th Day
		TIME	BPRR	QI	Q(by-pass)	TIME	Q [cfs]	Q [cfs]	Q [cfs]	Q [cfs]	V [af]	V [af]	V [af]	V [af]	V [af]	%	V [af]	ΣV [af]	%	V [af]	ΣV [af]	%	V [af]	ΣV [af]	%
0.14	0.14	-1062	0.14	9.9	9.9	0	1.0	3.9	3.9	9.9								3.9			18.7			32.3	
0.35	0.35	-60	0.35	24.7	24.7	1002	2.5	9.9	8.6	24.7	2.4	9.5	8.7	22.8	2.4	3.44%	9.5	13.4	19.31%	8.7	27.4	39.44%	27.6	56.2	80.96%
0.37	0.37	0	0.37	26.1	26.1	1062	2.6	10.4	9.1	26.1	2.6	10.4	9.4	25.9	2.6	3.74%	10.4	14.2	20.52%	9.4	28.1	40.50%	25.9	58.3	83.98%
0.40	0.40	60	0.40	28.2	28.2	1122	2.8	11.3	9.9	28.2	2.8	11.3	10.2	28.2	2.8	4.06%	11.3	15.1	21.81%	10.2	28.9	41.63%	28.2	60.5	87.22%
0.50	0.50	70	0.50	35.2	35.2	1132	3.5	14.1	12.3	35.2	2.9	11.4	10.4	28.6	2.9	4.12%	11.4	15.3	22.07%	10.4	29.0	41.95%	28.6	60.9	87.85%
0.67	0.67	80	0.67	47.2	47.2	1142	4.7	18.9	16.5	47.2	2.9	11.7	10.6	29.2	2.9	4.21%	11.7	15.5	22.39%	10.6	29.2	42.14%	29.2	61.5	88.67%
0.80	0.80	85	0.80	56.4	56.4	1147	5.6	22.6	19.7	56.4	3.0	11.8	10.7	29.5	3.0	4.26%	11.8	15.7	22.60%	10.7	29.4	42.32%	29.5	61.9	89.18%
0.91	0.91	89	0.91	64.1	64.1	1150	6.4	25.7	22.4	64.1	3.0	11.9	10.8	29.8	3.0	4.29%	11.9	15.9	22.74%	10.8	29.4	42.45%	29.8	62.1	89.54%
1.05	1.05	90	1.05	74.0	74.0	1152	7.4	29.6	25.9	74.0	3.0	12.0	10.8	30.0	3.0	4.32%	12.0	15.9	22.85%	10.8	29.5	42.54%	30.0	62.3	89.81%
1.43	1.41	91	1.43	100.8	100.8	1153	10.1	40.3	35.3	100.8	3.0	12.0	10.9	30.1	3.0	4.34%	12.0	15.9	22.92%	10.9	29.6	42.60%	30.1	62.4	89.99%
2.32	1.89	92	2.32	163.5	163.5	1154	16.4	65.4	57.2	163.5	3.0	12.1	10.9	30.3	3.0	4.36%	12.1	16.0	23.03%	10.9	29.6	42.69%	30.3	62.6	90.25%
2.47	2.26	93	2.47	174.1	174.1	1155	17.4	69.6	60.9	174.1	3.1	12.2	11.0	30.5	3.1	4.40%	12.2	16.1	23.16%	11.0	29.7	42.81%	30.5	62.8	90.59%
2.49	2.31	94	2.49	175.5	175.5	1156	17.5	70.2	61.4	175.5	3.1	12.3	11.1	30.7	3.1	4.43%	12.3	16.2	23.30%	11.1	29.8	42.93%	30.7	63.1	90.93%
2.49	2.32	95	2.49	175.5	175.5	1157	17.5	70.2	61.4	175.5	3.1	12.4	11.2	31.0	3.1	4.47%	12.4	16.3	23.44%	11.2	29.9	43.06%	31.0	63.3	91.28%
2.44	2.31	96	2.44	172.0	172.0	1158	17.2	68.8	60.2	172.0	3.1	12.5	11.3	31.2	3.1	4.50%	12.5	16.4	23.58%	11.3	29.9	43.18%	31.2	63.6	91.63%
2.21	2.24	97	2.21	155.8	155.8	1159	15.6	62.3	54.5	155.8	3.1	12.6	11.3	31.5	3.1	4.53%	12.6	16.4	23.71%	11.3	30.0	43.29%	31.5	63.8	91.95%
1.80	1.94	98	1.80	126.9	126.9	1160	12.7	50.7	44.4	126.8	3.2	12.7	11.4	31.6	3.2	4.56%	12.7	16.5	23.82%	11.4	30.1	43.39%	31.6	64.0	92.23%
1.50	1.62	99	1.50	105.7	105.7	1161	10.6	42.3	37.0	105.7	3.2	12.7	11.5	31.8	3.2	4.59%	12.7	16.6	23.91%	11.5	30.2	43.47%	31.8	64.1	92.46%
1.25	1.42	100	1.25	88.1	88.1	1162	8.8	35.2	30.8	88.1	3.2	12.8	11.5	31.9	3.2	4.61%	12.8	16.6	23.99%	11.5	30.2	43.54%	31.9	64.3	92.66%
1.03	1.25	101	1.03	72.6	72.6	1163	7.3	29.0	25.4	72.6	3.2	12.8	11.6	32.1	3.2	4.62%	12.8	16.7	24.05%	11.6	30.2	43.59%	32.1	64.4	92.81%
0.91	1.10	102	0.91	64.1	64.1	1164	6.4	25.7	22.4	64.1	3.2	12.9	11.6	32.1	3.2	4.63%	12.9	16.7	24.11%	11.6	30.3	43.64%	32.1	64.5	92.95%
0.85	0.97	103	0.85	59.9	59.9	1165	6.0	24.0	21.0	59.9	3.2	12.9	11.6	32.2	3.2	4.55%	12.9	16.8	24.16%	11.6	30.3	43.68%	32.2	64.6	93.07%
0.78	0.87	104	0.78	55.0	55.0	1166	5.5	22.0	19.2	55.0	3.2	12.9	11.6	32.3	3.2	4.56%	12.9	16.8	24.20%	11.6	30.3	43.72%	32.3	64.6	93.19%
0.73	0.80	105	0.73	51.5	51.5	1167	5.1	20.6	18.0	51.5	3.2	13.0	11.7	32.4	3.2	4.57%	13.0	16.8	24.24%	11.7	30.4	43.75%	32.4	64.7	93.29%
0.69	0.74	106	0.69	48.6	48.6	1168	4.9	19.5	17.0	48.6	3.2	13.0	11.7	32.5	3.2	4.58%	13.0	16.8	24.28%	11.7	30.4	43.79%	32.5	64.8	93.39%
0.66	0.69	107	0.66	46.5	46.5	1169	4.7	18.6	16.3	46.5	3.3	13.0	11.7	32.5	3.3	4.60%	13.0	16.9	24.32%	11.7	30.4	43.83%	32.5	64.8	93.49%
0.63	0.65	108	0.63	44.4	44.4	1170	4.4	17.8	15.5	44.4	3.3	13.0	11.7	32.6	3.3	4.70%	13.0	16.9	24.36%	11.7	30.4	43.86%	32.6	64.9	93.56%
0.60	0.62	109	0.60	42.3	42.3	1171	4.2	16.9	14.8	42.3	3.3	13.1	11.8	32.6	3.3	4.71%	13.1	16.9	24.39%	11.8	30.4	43.85%	32.6	65.0	93.66%
0.57	0.58	110	0.57	40.2	40.2	1172	4.0	16.1	14.1	40.2	3.3	13.1	11.8	32.7	3.3	4.71%	13.1	16.9	24.43%	11.8	30.5	43.92%	32.7	65.0	93.75%
0.55	0.55	111	0.55	38.8	38.8	1173	3.9	15.5	13.6	38.8	3.3	13.1	11.8	32.8	3.3	4.72%	13.1	17.0	24.46%	11.8	30.5	43.95%	32.8	65.1	93.82%
0.52	0.52	112	0.52	36.6	36.6	1174	3.7	14.7	12.8	36.6	3.3	13.1	11.8	32.8	3.3	4.73%	13.1	17.0	24.49%	11.8	30.5	43.97%	32.8	65.1	93.90%
0.50	0.50	113	0.50	35.2	35.2	1175	3.5	14.1	12.3	35.2	3.3	13.1	11.8	32.9	3.3	4.74%	13.1	17.0	24.52%	11.8	30.5	44.00%	32.9	65.2	93.97%
0.47	0.47	114	0.47	33.1	33.1	1175	3.3	13.3	11.6	33.1	3.3	13.2	11.9	32.9	3.3	4.74%	13.2	17.0	24.54%	11.9	30.5	44.02%	32.9	65.2	94.04%
0.45	0.45	115	0.45	31.7	31.7	1177	3.2	12.7	11.1	31.7	3.3	13.2	11.9	32.9	3.3	4.75%	13.2	17.0	24.57%	11.9	30.5	44.04%	32.9	65.3	94.10%
0.43	0.43	116	0.43	30.3	30.3	1178	3.0	12.1	10.6	30.3	3.3	13.2	11.9	33.0	3.3	4.76%	13.2	17.1	24.59%	11.9	30.6	44.06%	33.0	65.3	94.16%
0.36	0.36	120	0.36	25.4	25.4	1182	2.5	10.1	8.9	25.4	3.3	13.3	11.9	33.1	3.3	4.78%	13.3	17.1	24.68%	11.9	30.6	44.14%	33.1	65.5	94.39%
0.30	0.30	125	0.30	21.1	21.1	1187	2.1	8.5	7.4	21.1	3.3	13.3	12.0	33.3	3.3	4.80%	13.3	17.2	24.77%	12.0	30.7	44.22%	33.3	65.6	94.62%
0.25	0.26	130	0.25	17.6	17.6	1192	1.8	7.0	6.2	17.6	3.3	13.4	12.0	33.4	3.3	4.82%	13.4	17.2	24.85%	12.0	30.7	44.29%	33.4	65.8	94.81%
0.21	0.22	135	0.21	14.8	14.8	1197	1.5	5.9	5.2	14.8	3.4	13.4	12.1	33.5	3.4	4.84%	13.4	17.3	24.92%	12.1	30.8	44.35%	33.5	65.9	94.97%
0.19	0.20	140	0.19	13.4	13.4	1202	1.3	5.4	4.7	13.4	3.4	13.5	12.1	33.6	3.4	4.85%	13.5	17.3	24.97%	12.1	30.8	44.40%	33.6	66.0	95.11%
0.17	0.18	145	0.17	12.0	12.0	1207	1.2	4.8	4.2	12.0	3.4	13.5	12.1	33.7	3.4	4.86%	13.5	17.4	25.02%	12.1	30.8	44.44%	33.7	66.1	95.24%
0.16	0.17	150	0.16	11.3	11.3	1212	1.1	4.5	3.9	11.3	3.4	13.5	12.2	33.8	3.4	4.87%	13.5	17.4	25.07%	12.2	30.9	44.48%	33.8	66.1	95.35%
0.16	0.16	155	0.16	11.3	11.3	1217	1.1	4.5	3.9	11.3	3.4	13.6	12.2	33.9	3.4	4.89%	13.6	17.4	25.11%	12.2	30.9	44.52%	33.9	66.2	95.46%
0.16	0.16	160	0.16	11.3	11.3	1222	1.1	4.5	3.9	11.3	3.4	13.6	12.2	34.0	3.4	4.90%	13.6	17.5	25.16%	12.2	30.9	44.56%	34.0	66.3	95.57%
0.16	0.16	170	0.16	11.3	11.3	1232	1.1	4.5	3.9	11.3	3.4	13.6	12.3	34.1	3.4	4.92%	13.6	17.5	25.25%	12.3	31.0	44.64%	34.1	66.4	95.80%
0.15	0.15	180	0.15	10.6	10.6	1242	1.1	4.2	3.7	10.6	3.4	13.7	12.3	34.3	3.4	4.94%	13.7	17.6	25.33%	12.3	31.0	44.71%	34.3	66.5	96.02%
0.15	0.15	190	0.15	10.6	10.6	1252	1.1	4.2	3.7	10.6	3.4	13.8	12.4	34.4	3.4	4.95%	13.8	17.6	25.42%	12.4	31.1	44.79%	34.4	66.7	96.23%
0.15	0.15	200	0.15	10.6	10.6	1262	1.1	4.2	3.7	10.6	3.5	13.8	12.4	34.6	3.5	4.98%	13.8	17.7	25.50%	12.4	31.1	44.86%	34.6	66.9	96.44%
0.15	0.15	210	0.15	10.6	10.6	1272	1.1	4.2	3.7	10.6	3.5	13.9	12.5	34.7	3.5	5.00%	13.9	17.7	25.59%	12.5	31.2	44.93%	34.7	67.0	96.65%
0.15	0.15	220	0.15	10.6	10.6	1282	1.1	4.2	3.7	10.6	3.5	13.9	12.5	34.9	3.5	5.03%	13.9	17.8	25.67%	12.5	31.2	45.01%	34.9	67.2	96.86%
0.15	0.15	230	0.15	10.6	10.6	1292	1.1	4.2	3.7	10.6	3.5	14.0	12.6	35.0	3.5	5.05%	14.0	17.9	25.75%	12.6	31.3	45.08%	35.0	67.3	97.07%
0.15	0.15	250	0.15	10.6	10.6	1312	1.1	4.2	3.7	10.6	3.5	14.1	12.7	35.3	3.5	5.09%	14.1	18.0	25.92%	12.7	31.4	45.23%	35.3	67.6	97.49%
0.14	0.14	260	0.14	9.9	9.9	1322	1.0	3.9	3.5	9.9	3.5	14.2	12.7	35.4	3.5	5.11%	14.2	18.0	26.00%	12.7	31.4	45.30%	35.4	67.6	97.69%
0.14	0.14	300	0.14	9.9	9.9	1362	1.0	3.9	3.5	9.9	3.6	14.4	12.9	36.0	3.6	5.19%	14.4	18.3	26.32%	12.9	31.8	45.57%	36.0	68.3	98.47%
0.14	0.14	372	0.14	9.9	9.9	1440	3.9	3.9	9.9	9.9	3.9	14.8	13.6	37.0	3.9	5.57%	14.8	19.7	26.93%	13.6	32.3	46.60%	37.0	69.4	100.00%
					Daily Peak Flow [cfs] =		18	70	61	175			5d V(d) =	60											
					Daily Average Flow [cfs] =		2	7	7	19				8.7											

Tr 51122 Total - post dev

10	12	A= 38 ac tc1: 10 min BPRR 2.50 0.0 Op1: 124 cfs TIME	BPRR	Q1	0.0cfs Q(by-pass)	50 year - 4 day Storm CLOCK TIME	Flow 1st Day Q [cfs]	2nd Day Q [cfs]	3rd Day Q [cfs]	4th Day Q [cfs]
2.50	2.32									
0.14	0.14	-1062	0.14	6.9	6.9	0	0.7	2.8	2.8	6.9
0.35	0.35	-60	0.35	17.4	17.4	1002	1.7	6.9	6.1	17.4
0.37	0.37	0	0.37	18.4	18.4	1062	1.8	7.3	6.4	18.4
0.40	0.40	60	0.40	19.8	19.8	1122	2.0	7.9	6.9	19.8
0.50	0.50	70	0.50	24.8	24.8	1132	2.5	9.9	8.7	24.8
0.67	0.67	80	0.67	33.2	33.2	1142	3.3	13.3	11.6	33.2
0.80	0.80	85	0.80	39.7	39.7	1147	4.0	15.9	13.9	39.7
0.91	0.91	88	0.91	45.1	45.1	1150	4.5	18.1	15.8	45.1
1.05	1.05	90	1.05	52.1	52.1	1152	5.2	20.8	18.2	52.1
1.43	1.41	91	1.43	70.9	70.9	1153	7.1	28.4	24.8	70.9
2.32	1.89	92	2.32	115.1	115.1	1154	11.5	46.0	40.3	115.1
2.47	2.26	93	2.47	122.5	122.5	1155	12.3	49.0	42.9	122.5
2.49	2.31	94	2.49	123.5	123.5	1156	12.4	49.4	43.2	123.5
2.49	2.32	95	2.49	123.5	123.5	1157	12.4	49.4	43.2	123.5
2.44	2.31	96	2.44	121.0	121.0	1158	12.1	48.4	42.4	121.0
2.21	2.24	97	2.21	109.6	109.6	1159	11.0	43.8	38.4	109.6
1.80	1.94	98	1.80	89.3	89.3	1160	8.9	35.7	31.2	89.3
1.50	1.62	99	1.50	74.4	74.4	1161	7.4	29.8	26.0	74.4
1.25	1.42	100	1.25	62.0	62.0	1162	6.2	24.8	21.7	62.0
1.03	1.25	101	1.03	51.1	51.1	1163	5.1	20.4	17.9	51.1
0.91	1.10	102	0.91	45.1	45.1	1164	4.5	18.1	15.8	45.1
0.85	0.97	103	0.85	42.2	42.2	1165	4.2	16.9	14.8	42.2
0.78	0.87	104	0.78	38.7	38.7	1166	3.9	15.5	13.5	38.7
0.73	0.80	105	0.73	36.2	36.2	1167	3.6	14.5	12.7	36.2
0.69	0.74	106	0.69	34.2	34.2	1168	3.4	13.7	12.0	34.2
0.66	0.69	107	0.66	32.7	32.7	1169	3.3	13.1	11.5	32.7
0.63	0.65	108	0.63	31.2	31.2	1170	3.1	12.5	10.9	31.2
0.60	0.62	109	0.60	29.8	29.8	1171	3.0	11.9	10.4	29.8
0.57	0.59	110	0.57	28.3	28.3	1172	2.8	11.3	9.9	28.3
0.55	0.55	111	0.55	27.3	27.3	1173	2.7	10.9	9.5	27.3
0.52	0.52	112	0.52	25.8	25.8	1174	2.6	10.3	9.0	25.8
0.50	0.50	113	0.50	24.8	24.8	1175	2.5	9.9	8.7	24.8
0.47	0.47	114	0.47	23.3	23.3	1176	2.3	9.3	8.2	23.3
0.45	0.45	115	0.45	22.3	22.3	1177	2.2	8.9	7.8	22.3
0.43	0.43	116	0.43	21.3	21.3	1178	2.1	8.5	7.5	21.3
0.36	0.36	120	0.36	17.9	17.9	1182	1.8	7.1	6.2	17.9
0.30	0.30	125	0.30	14.9	14.9	1187	1.5	6.0	5.2	14.9
0.25	0.26	130	0.25	12.4	12.4	1192	1.2	5.0	4.3	12.4
0.21	0.22	135	0.21	10.4	10.4	1197	1.0	4.2	3.6	10.4
0.19	0.20	140	0.19	9.4	9.4	1202	0.9	3.8	3.3	9.4
0.17	0.18	145	0.17	8.4	8.4	1207	0.8	3.4	3.0	8.4
0.16	0.17	150	0.16	7.9	7.9	1212	0.8	3.2	2.8	7.9
0.16	0.16	155	0.16	7.9	7.9	1217	0.8	3.2	2.8	7.9
0.16	0.16	160	0.16	7.9	7.9	1222	0.8	3.2	2.8	7.9
0.16	0.16	170	0.16	7.9	7.9	1232	0.8	3.2	2.8	7.9
0.15	0.15	180	0.15	7.4	7.4	1242	0.7	3.0	2.6	7.4
0.15	0.15	190	0.15	7.4	7.4	1252	0.7	3.0	2.6	7.4
0.15	0.15	200	0.15	7.4	7.4	1262	0.7	3.0	2.6	7.4
0.15	0.15	210	0.15	7.4	7.4	1272	0.7	3.0	2.6	7.4
0.15	0.15	220	0.15	7.4	7.4	1282	0.7	3.0	2.6	7.4
0.15	0.15	230	0.15	7.4	7.4	1292	0.7	3.0	2.6	7.4
0.15	0.15	250	0.15	7.4	7.4	1312	0.7	3.0	2.6	7.4
0.14	0.14	260	0.14	6.9	6.9	1322	0.7	2.8	2.4	6.9
0.14	0.14	300	0.14	6.9	6.9	1362	0.7	2.8	2.4	6.9
0.14	0.14	378	0.14	6.9	6.9	1440	2.8	2.8	6.9	6.9
					Daily Peak Flow [cfs] =		12	49	43	124
					Daily Average Flow [cfs] =		1	5	5	13

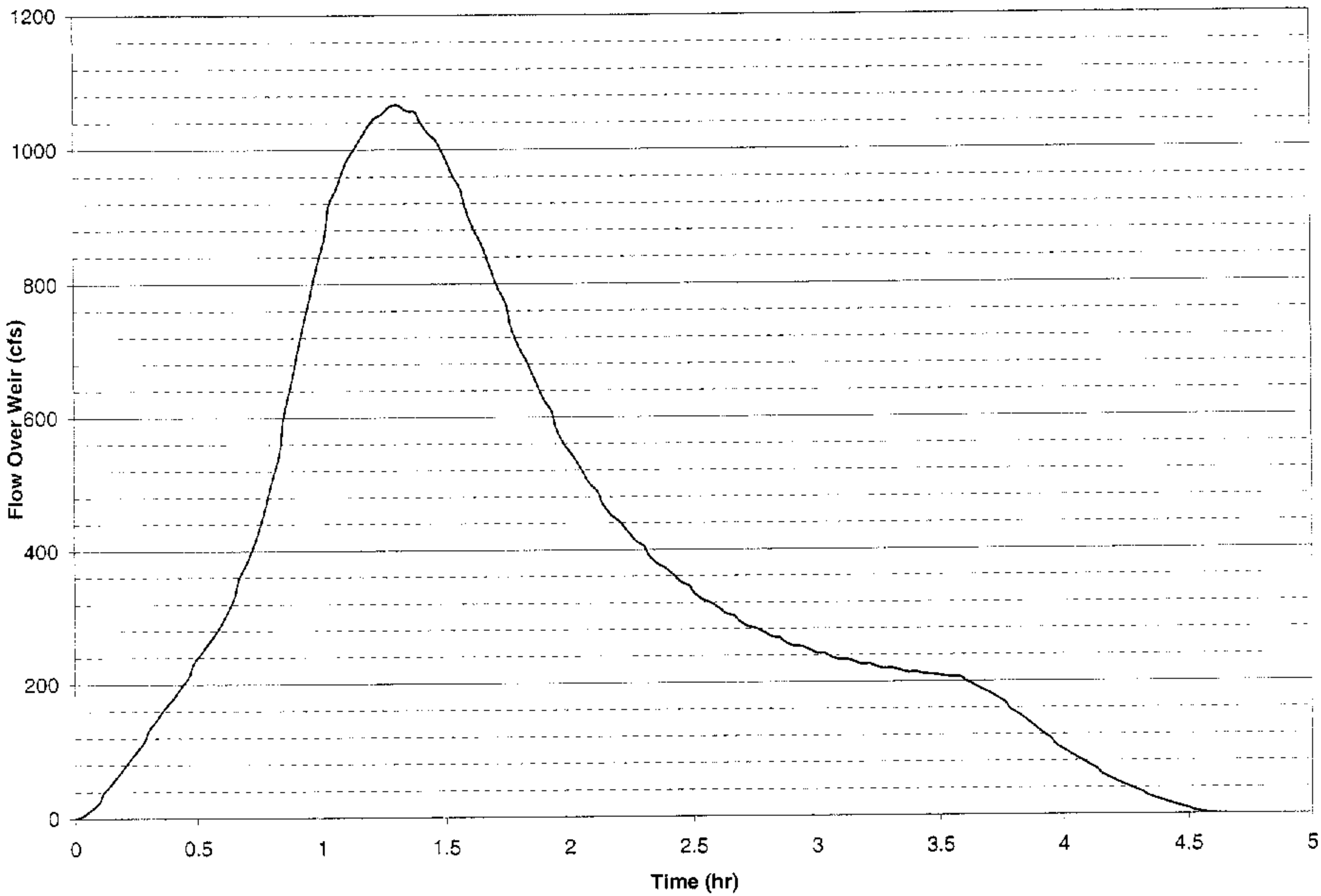
CLOCK TIME	Runoff 1st Day V [af]	2nd Day V [af]	3rd Day V [af]	4th Day V [af]	1st Day V [af]	Percentage of Total Runoff 1st Day %	2nd Day V [af]	2nd Day ΣV [af]
0								2.7
1002	1.7	6.7	6.1	16.8	1.7	3.44%	6.7	9.4
1062	1.8	7.3	6.6	18.2	1.8	3.74%	7.3	10.0
1122	2.0	7.9	7.2	19.8	2.0	4.06%	7.9	10.6
1132	2.0	8.1	7.3	20.1	2.0	4.12%	8.1	10.8
1142	2.1	8.2	7.4	20.5	2.1	4.21%	8.2	10.9
1147	2.1	8.3	7.5	20.8	2.1	4.26%	8.3	11.0
1150	2.1	8.4	7.6	21.0	2.1	4.29%	8.4	11.1
1152	2.1	8.4	7.6	21.1	2.1	4.32%	8.4	11.2
1153	2.1	8.5	7.7	21.2	2.1	4.34%	8.5	11.2
1154	2.1	8.5	7.7	21.3	2.1	4.36%	8.5	11.2
1155	2.1	8.6	7.8	21.5	2.1	4.40%	8.6	11.3
1156	2.2	8.7	7.8	21.6	2.2	4.43%	8.7	11.4
1157	2.2	8.7	7.9	21.8	2.2	4.47%	8.7	11.4
1158	2.2	8.8	7.9	22.0	2.2	4.50%	8.8	11.5
1159	2.2	8.9	8.0	22.1	2.2	4.53%	8.9	11.6
1160	2.2	8.9	8.0	22.3	2.2	4.56%	8.9	11.6
1161	2.2	9.0	8.1	22.4	2.2	4.59%	9.0	11.7
1162	2.2	9.0	8.1	22.5	2.2	4.61%	9.0	11.7
1163	2.3	9.0	8.1	22.6	2.3	4.62%	9.0	11.7
1164	2.3	9.0	8.2	22.6	2.3	4.63%	9.0	11.8
1165	2.3	9.1	8.2	22.7	2.3	4.65%	9.1	11.8
1166	2.3	9.1	8.2	22.7	2.3	4.66%	9.1	11.8
1167	2.3	9.1	8.2	22.8	2.3	4.67%	9.1	11.8
1168	2.3	9.1	8.2	22.8	2.3	4.68%	9.1	11.9
1169	2.3	9.2	8.2	22.9	2.3	4.69%	9.2	11.9
1170	2.3	9.2	8.3	22.9	2.3	4.70%	9.2	11.9
1171	2.3	9.2	8.3	23.0	2.3	4.71%	9.2	11.9
1172	2.3	9.2	8.3	23.0	2.3	4.71%	9.2	11.9
1173	2.3	9.2	8.3	23.1	2.3	4.72%	9.2	11.9
1174	2.3	9.2	8.3	23.1	2.3	4.73%	9.2	12.0
1175	2.3	9.2	8.3	23.1	2.3	4.74%	9.2	12.0
1176	2.3	9.3	8.3	23.2	2.3	4.74%	9.3	12.0
1177	2.3	9.3	8.4	23.2	2.3	4.75%	9.3	12.0
1178	2.3	9.3	8.4	23.2	2.3	4.76%	9.3	12.0
1182	2.3	9.3	8.4	23.3	2.3	4.78%	9.3	12.0
1187	2.3	9.4	8.4	23.4	2.3	4.80%	9.4	12.1
1192	2.4	9.4	8.5	23.5	2.4	4.82%	9.4	12.1
1197	2.4	9.4	8.5	23.5	2.4	4.84%	9.4	12.2
1202	2.4	9.5	8.5	23.7	2.4	4.85%	9.5	12.2
1207	2.4	9.5	8.5	23.7	2.4	4.86%	9.5	12.2
1212	2.4	9.5	8.6	23.8	2.4	4.87%	9.5	12.2
1217	2.4	9.5	8.6	23.9	2.4	4.89%	9.5	12.3
1222	2.4	9.6	8.6	23.9	2.4	4.90%	9.6	12.3
1232	2.4	9.6	8.6	24.0	2.4	4.92%	9.6	12.3
1242	2.4	9.6	8.7	24.1	2.4	4.94%	9.6	12.4
1252	2.4	9.7	8.7	24.2	2.4	4.96%	9.7	12.4
1262	2.4	9.7	8.8	24.3	2.4	4.98%	9.7	12.4
1272	2.4	9.8	8.8	24.4	2.4	5.00%	9.8	12.5
1282	2.5	9.8	8.8	24.5	2.5	5.03%	9.8	12.5
1292	2.5	9.9	8.9	24.5	2.5	5.05%	9.9	12.5
1312	2.5	9.9	8.9	24.9	2.5	5.09%	9.9	12.7
1322	2.5	10.0	9.0	24.9	2.5	5.11%	10.0	12.7
1362	2.5	10.1	9.1	25.3	2.5	5.19%	10.1	12.8
1440	2.7	10.4	9.6	26.1	2.7	5.57%	10.4	13.1
Daily Peak Flow			[illegible] (af)	49				
Daily Average Flow				0.2				

CLOCK TIME	2nd Day %	3rd Day V [af]	3rd Day ΣV [af]	3rd Day %	4th Day V [af]	4th Day ΣV [af]	4th Day %
0			13.1			22.7	
1002	19.51%	6.1	19.3	39.44%	15.8	39.5	90.96%
1062	20.52%	6.5	19.5	40.60%	19.2	41.6	93.96%
1122	21.31%	7.2	20.1	41.63%	19.8	42.6	87.22%
1132	22.07%	7.3	20.4	41.85%	20.1	42.5	87.85%
1142	22.39%	7.4	20.5	42.14%	20.5	40.3	88.67%
1147	22.60%	7.5	20.7	42.32%	20.8	43.5	89.19%
1150	22.74%	7.5	20.7	42.45%	21.0	43.7	89.54%
1152	22.85%	7.6	20.5	42.54%	21.1	43.8	89.81%
1153	22.92%	7.7	20.5	42.60%	21.2	43.9	89.99%
1154	23.03%	7.7	20.5	42.69%	21.3	44.1	90.25%
1155	23.16%	7.8	20.8	42.81%	21.5	44.2	90.50%
1156	23.30%	7.8	21.0	42.93%	21.6	44.4	90.93%
1157	23.44%	7.9	21.0	43.06%	21.8	44.6	91.26%
1158	23.58%	7.9	21.1	43.16%	22.0	44.7	91.53%
1159	23.71%	8.0	21.1	43.26%	22.1	44.9	91.85%
1160	23.82%	8.0	21.2	43.39%	22.3	45.0	92.23%
1161	23.91%	8.1	21.2	43.47%	22.4	45.1	92.46%
1162	23.99%	8.1	21.3	43.54%	22.5	45.2	92.86%
1163	24.05%	8.1	21.3	43.55%	22.6	45.3	92.91%
1164	24.11%	8.2	21.3	43.54%	22.6	45.4	92.95%
1165	24.16%	8.2	21.3	43.58%	22.7	45.4	93.07%
1166	24.20%	8.2	21.3	43.72%	22.7	45.5	93.19%
1167	24.24%	8.2	21.4	43.76%	22.8	45.5	93.29%
1168	24.28%	8.2	21.4	43.79%	22.8	45.6	93.39%
1169	24.32%	8.2	21.4	43.83%	22.9	45.6	93.49%
1170	24.36%	8.3	21.4	43.86%	22.9	45.7	93.58%
1171	24.39%	8.3	21.4	43.89%	23.0	45.7	93.66%
1172	24.43%	8.3	21.4	43.92%	23.0	45.8	93.75%
1173	24.46%	8.3	21.5	43.95%	23.1	45.8	93.82%
1174	24.49%	8.3	21.5	43.97%	23.1	45.8	93.90%
1175	24.52%	8.3	21.5	44.00%	23.1	45.9	93.97%
1176	24.54%	8.3	21.5	44.02%	23.2	45.9	94.04%
1177	24.57%	8.4	21.5	44.04%	23.2	45.9	94.10%
1178	24.59%	8.4	21.5	44.06%	23.2	46.0	94.16%
1182	24.68%	8.4	21.5	44.14%	23.3	46.1	94.38%
1187	24.77%	8.4	21.6	44.22%	23.4	46.2	94.62%
1192	24.85%	8.5	21.6	44.29%	23.5	46.3	94.81%
1197	24.92%	8.5	21.6	44.35%	23.6	46.4	94.97%
1202	24.97%	8.5	21.7	44.40%	23.7	46.4	95.11%
1207	25.02%	8.5	21.7	44.44%	23.7	46.5	95.24%
1212	25.07%	8.6	21.7	44.48%	23.8	46.5	95.35%
1217	25.11%	8.6	21.7	44.52%	23.9	46.6	95.46%
1222	25.15%	8.6	21.8	44.56%	23.9	46.7	95.57%
1232	25.25%	8.6	21.8	44.64%	24.0	46.8	95.80%
1242	25.33%	8.7	21.8	44.71%	24.1	46.9	96.02%
1252	25.42%	8.7	21.9	44.79%	24.2	47.0	96.23%
1262	25.50%	8.8	21.9	44.86%	24.3	47.1	96.44%
1272	25.59%	8.8	21.9	44.93%	24.4	47.2	96.65%
1282	25.67%	8.8	22.0	45.01%	24.5	47.3	96.86%
1292	25.75%	8.9	22.0	45.08%	24.5	47.4	97.07%
1312	25.92%	8.9	22.1	45.23%	24.8	47.6	97.48%
1322	26.00%	9.0	22.1	45.30%	24.9	47.7	97.69%
1362	26.32%	9.1	22.2	45.57%	25.3	48.1	98.47%
1440	26.93%	9.6	22.7	45.60%	26.1	48.9	100.00%

Tr 51122 Diversion - post dev

		A=	27	ac																					
		tc1:	10	min	50 year - 4 day Storm																				
10	12	BPRR	2.50	0.0			Flow				Runoff					Percentage of Total Runoff									
2.50	2.32	Qp1:	86	cfs	0.0cfs	CLOCK	1st Day	2nd Day	3rd Day	4th Day	1st Day	2nd Day	3rd Day	4th Day	1st Day	1st Day	2nd Day	2nd Day	2nd Day	3rd Day	3rd Day	3rd Day	4th Day	4th Day	4th Day
		TIME	BPRR	Q1	Q(by-pass)	TIME	Q [cfs]	Q [cfs]	Q [cfs]	Q [cfs]	V [af]	V [af]	V [af]	V [af]	V [af]	%	V [af]	∑V [af]	%	V [af]	∑V [af]	%	V [af]	∑V [af]	%
0.14	0.14	-1062	0.14	4.9	4.9	0	0.5	2.0	2.0	4.9								1.9			9.3			16.1	
0.35	0.35	60	0.35	12.3	12.3	1002	1.2	4.9	4.3	12.3	1.2	4.8	4.3	11.9	1.2	3.44%	4.9	6.7	19.31%	4.3	13.7	39.44%	11.9	28.0	80.56%
0.37	0.37	0	0.37	13.0	13.0	1062	1.3	5.2	4.5	13.0	1.3	5.2	4.7	12.9	1.3	3.74%	5.2	7.1	20.62%	4.7	14.0	40.50%	12.9	29.1	83.98%
0.40	0.40	60	0.40	14.1	14.1	1122	1.4	5.6	4.9	14.1	1.4	5.6	5.1	14.1	1.4	4.06%	5.6	7.5	21.81%	5.1	14.4	41.63%	14.1	30.2	87.22%
0.50	0.50	70	0.50	17.6	17.6	1132	1.8	7.0	6.2	17.6	1.4	5.7	5.2	14.3	1.4	4.12%	5.7	7.6	22.07%	5.2	14.5	41.85%	14.3	30.4	87.85%
0.67	0.67	80	0.67	23.6	23.6	1142	2.4	9.4	8.3	23.6	1.5	5.8	5.3	14.6	1.5	4.21%	5.8	7.8	22.39%	5.3	14.6	42.14%	14.6	30.7	88.67%
0.80	0.80	85	0.80	28.2	28.2	1147	2.8	11.3	9.9	28.2	1.5	5.9	5.3	14.7	1.5	4.26%	5.9	7.8	22.60%	5.3	14.7	42.32%	14.7	30.9	89.18%
0.91	0.91	88	0.91	32.0	32.0	1150	3.2	12.8	11.2	32.0	1.5	5.9	5.4	14.9	1.5	4.29%	5.9	7.9	22.74%	5.4	14.7	42.45%	14.9	31.0	89.54%
1.05	1.05	90	1.05	37.0	37.0	1152	3.7	14.8	12.9	37.0	1.5	6.0	5.4	15.0	1.5	4.32%	6.0	7.9	22.85%	5.4	14.7	42.54%	15.0	31.1	89.81%
1.43	1.41	91	1.43	50.3	50.3	1153	5.0	20.1	17.6	50.3	1.5	6.0	5.4	15.0	1.5	4.34%	6.0	7.9	22.92%	5.4	14.8	42.60%	15.0	31.2	89.99%
2.32	1.89	92	2.32	81.7	81.7	1154	8.2	32.7	28.6	81.7	1.5	6.0	5.5	15.1	1.5	4.36%	6.0	8.0	23.09%	5.5	14.8	42.69%	15.1	31.3	90.25%
2.47	2.25	93	2.47	86.9	86.9	1155	8.7	34.8	30.4	86.9	1.5	6.1	5.5	15.2	1.5	4.40%	6.1	8.0	23.16%	5.5	14.8	42.81%	15.2	31.4	90.59%
2.49	2.31	94	2.49	87.6	87.6	1156	8.8	35.1	30.7	87.6	1.5	6.1	5.5	15.4	1.5	4.43%	6.1	8.1	23.30%	5.5	14.9	42.93%	15.4	31.5	90.93%
2.49	2.32	95	2.49	87.6	87.6	1157	8.8	35.1	30.7	87.6	1.5	6.2	5.6	15.5	1.5	4.47%	6.2	8.1	23.44%	5.6	14.9	43.05%	15.5	31.6	91.28%
2.44	2.31	96	2.44	85.9	85.9	1158	8.6	34.4	30.1	85.9	1.6	6.2	5.6	15.6	1.6	4.50%	6.2	8.2	23.58%	5.6	15.0	43.18%	15.6	31.7	91.63%
2.21	2.24	97	2.21	77.8	77.8	1159	7.8	31.1	27.2	77.8	1.6	6.3	5.7	15.7	1.6	4.53%	6.3	8.2	23.71%	5.7	15.0	43.29%	15.7	31.9	91.95%
1.80	1.94	98	1.80	63.4	63.4	1160	6.3	25.3	22.2	63.4	1.6	6.3	5.7	15.8	1.6	4.56%	6.3	8.3	23.82%	5.7	15.0	43.39%	15.8	32.0	92.23%
1.50	1.62	99	1.50	52.8	52.8	1161	5.3	21.1	18.5	52.8	1.6	6.4	5.7	15.9	1.6	4.59%	6.4	8.3	23.91%	5.7	15.1	43.47%	15.9	32.0	92.46%
1.25	1.42	100	1.25	44.0	44.0	1162	4.4	17.6	15.4	44.0	1.6	6.4	5.8	16.0	1.6	4.61%	6.4	8.3	23.99%	5.8	15.1	43.54%	16.0	32.1	92.66%
1.03	1.25	101	1.03	36.3	36.3	1163	3.6	14.5	12.7	36.3	1.6	6.4	5.8	16.0	1.6	4.62%	6.4	8.3	24.05%	5.8	15.1	43.59%	16.0	32.2	92.81%
0.91	1.10	102	0.91	32.0	32.0	1164	3.2	12.8	11.2	32.0	1.6	6.4	5.8	16.1	1.6	4.63%	6.4	8.4	24.11%	5.8	15.1	43.64%	16.1	32.2	92.96%
0.85	0.97	103	0.85	29.9	29.9	1165	3.0	12.0	10.5	29.9	1.6	6.4	5.8	16.1	1.6	4.65%	6.4	8.4	24.16%	5.8	15.1	43.68%	16.1	32.2	93.07%
0.78	0.87	104	0.78	27.5	27.5	1166	2.7	11.0	9.6	27.5	1.6	6.5	5.8	16.1	1.6	4.65%	6.5	8.4	24.20%	5.8	15.1	43.72%	16.1	32.3	93.19%
0.73	0.80	105	0.73	25.7	25.7	1167	2.6	10.3	9.0	25.7	1.6	6.5	5.8	16.2	1.6	4.67%	6.5	8.4	24.24%	5.8	15.2	43.76%	16.2	32.3	93.29%
0.69	0.74	106	0.69	24.3	24.3	1168	2.4	9.7	8.5	24.3	1.6	6.5	5.8	16.2	1.6	4.68%	6.5	8.4	24.28%	5.8	15.2	43.79%	16.2	32.4	93.39%
0.65	0.69	107	0.66	23.2	23.2	1169	2.3	9.3	8.1	23.2	1.6	6.5	5.9	16.2	1.6	4.69%	6.5	8.4	24.32%	5.9	15.2	43.83%	16.2	32.4	93.49%
0.63	0.65	108	0.63	22.2	22.2	1170	2.2	8.9	7.8	22.2	1.6	6.5	5.9	16.3	1.6	4.70%	6.5	8.4	24.36%	5.9	15.2	43.86%	16.3	32.4	93.58%
0.60	0.62	109	0.60	21.1	21.1	1171	2.1	8.4	7.4	21.1	1.6	6.5	5.9	16.3	1.6	4.71%	6.5	8.5	24.39%	5.9	15.2	43.89%	16.3	32.4	93.66%
0.57	0.59	110	0.57	20.1	20.1	1172	2.0	8.0	7.0	20.1	1.6	6.5	5.9	16.3	1.6	4.71%	6.5	8.5	24.43%	5.9	15.2	43.92%	16.3	32.5	93.75%
0.55	0.55	111	0.55	19.4	19.4	1173	1.9	7.7	6.8	19.4	1.6	6.5	5.9	16.4	1.6	4.72%	6.5	8.5	24.46%	5.9	15.2	43.95%	16.4	32.5	93.82%
0.52	0.52	112	0.52	18.3	18.3	1174	1.8	7.3	6.4	18.3	1.6	6.6	5.9	16.4	1.6	4.73%	6.6	8.5	24.49%	5.9	15.2	43.97%	16.4	32.5	93.90%
0.50	0.50	113	0.50	17.6	17.6	1175	1.8	7.0	6.2	17.6	1.6	6.6	5.9	16.4	1.6	4.74%	6.6	8.5	24.52%	5.9	15.2	44.00%	16.4	32.6	93.97%
0.47	0.47	114	0.47	16.5	16.5	1176	1.7	6.6	5.8	16.5	1.6	6.6	5.9	16.4	1.6	4.74%	6.6	8.5	24.54%	5.9	15.2	44.02%	16.4	32.6	94.04%
0.45	0.45	115	0.45	15.8	15.8	1177	1.6	6.3	5.5	15.8	1.6	6.6	5.9	16.5	1.6	4.75%	6.6	8.5	24.57%	5.9	15.3	44.04%	16.5	32.6	94.10%
0.43	0.43	116	0.43	15.1	15.1	1178	1.5	6.1	5.3	15.1	1.6	6.6	5.9	16.5	1.6	4.76%	6.6	8.5	24.59%	5.9	15.3	44.06%	16.5	32.6	94.15%
0.36	0.35	120	0.36	12.7	12.7	1182	1.3	5.1	4.4	12.7	1.7	6.6	6.0	16.6	1.7	4.79%	6.6	8.6	24.68%	6.0	15.3	44.14%	16.6	32.7	94.38%
0.30	0.30	125	0.30	10.6	10.6	1187	1.1	4.2	3.7	10.6	1.7	6.7	6.0	16.6	1.7	4.80%	6.7	8.6	24.77%	6.0	15.3	44.22%	16.6	32.8	94.62%
0.25	0.25	130	0.25	8.8	8.8	1192	0.9	3.5	3.1	8.8	1.7	6.7	6.0	16.7	1.7	4.82%	6.7	8.6	24.85%	6.0	15.3	44.29%	16.7	32.8	94.81%
0.21	0.22	135	0.21	7.4	7.4	1197	0.7	3.0	2.6	7.4	1.7	6.7	6.0	16.9	1.7	4.84%	6.7	8.6	24.92%	6.0	15.4	44.35%	16.9	32.9	94.97%
0.19	0.20	140	0.19	6.7	6.7	1202	0.7	2.7	2.3	6.7	1.7	6.7	6.1	16.8	1.7	4.85%	6.7	8.7	24.97%	6.1	15.4	44.40%	16.8	32.9	95.11%
0.17	0.18	145	0.17	6.0	6.0	1207	0.6	2.4	2.1	6.0	1.7	6.7	6.1	16.8	1.7	4.86%	6.7	8.7	25.02%	6.1	15.4	44.44%	16.8	33.0	95.24%
0.16	0.17	150	0.16	5.6	5.6	1212	0.6	2.3	2.0	5.6	1.7	6.8	6.1	16.9	1.7	4.87%	6.8	8.7	25.07%	6.1	15.4	44.48%	16.9	33.0	95.35%
0.16	0.16	155	0.16	5.6	5.6	1217	0.6	2.3	2.0	5.6	1.7	6.8	6.1	16.9	1.7	4.89%	6.8	8.7	25.11%	6.1	15.4	44.52%	16.9	33.1	95.46%
0.16	0.16	160	0.16	5.6	5.6	1222	0.6	2.3	2.0	5.6	1.7	6.8	6.1	17.0	1.7	4.90%	6.8	8.7	25.16%	6.1	15.4	44.58%	17.0	33.1	95.57%
0.16	0.16	170	0.16	5.6	5.6	1232	0.6	2.3	2.0	5.6	1.7	6.8	6.1	17.0	1.7	4.92%	6.8	8.7	25.25%	6.1	15.5	44.64%	17.0	33.2	95.80%
0.15	0.15	180	0.15	5.3	5.3	1242	0.5	2.1	1.8	5.3	1.7	6.8	6.2	17.1	1.7	4.94%	6.8	8.8	25.33%	6.2	15.5	44.71%	17.1	33.3	96.02%
0.15	0.15	190	0.15	5.3	5.3	1252	0.5	2.1	1.8	5.3	1.7	6.9	6.2	17.2	1.7	4.96%	6.9	8.8	25.42%	6.2	15.5	44.79%	17.2	33.3	96.23%
0.15	0.15	200	0.15	5.3	5.3	1262	0.5	2.1	1.8	5.3	1.7	6.9	6.2	17.3	1.7	4.98%	6.9	8.8	25.50%	6.2	15.5	44.86%	17.3	33.4	96.44%
0.15	0.15	210	0.15	5.3	5.3	1272	0.5	2.1	1.8	5.3	1.7	6.9	6.2	17.3	1.7	5.00%	6.9	8.9	25.59%	6.2	15.5	44.93%	17.3	33.5	96.65%
0.15	0.15	220	0.15	5.3	5.3	1282	0.5	2.1	1.8	5.3	1.7	7.0	6.3	17.4	1.7	5.03%	7.0	8.9	25.67%	6.3	15.6	45.01%	17.4	33.6	96.86%
0.15	0.15	230	0.15	5.3	5.3	1292	0.5	2.1	1.8	5.3	1.7	7.0	6.3	17.5	1.7	5.05%	7.0	8.9	25.75%	6.3	15.5	45.08%	17.5	33.6	97.07%
0.15	0.15	250	0.15	5.3	5.3	1312	0.5	2.1	1.8	5.3	1.8	7.1	6.3	17.6	1.8	5.08%	7.1	9.0	25.92%	6.3	15.7	45.23%	17.6	33.8	97.46%
0.14	0.14	260	0.14	4.9	4.9	1322	0.5	2.0	1.7	4.9	1.8	7.1	6.4	17.7	1.8	5.11%	7.1	9.0	26.00%	6.4	15.7	45.30%	17.7	33.8	97.69%
0.14	0.14	300	0.14	4.9	4.9	1362	0.5	2.0	1.7	4.9	1.8	7.2	6.5	18.0	1.8	5.19%	7.2	9.1	26.32%	6.5	15.8	45.67%	18.0	34.1	98.47%
0.14	0.14	378	0.14	4.9	4.9	1440	2.0	2.0	4.9	4.9	1.9	7.4	6.8	18.5	1.9	5.57%	7.4	9.3	26.93%	6.8	16.1	46.60%	18.5	34.6	100.00%
					Daily Peak Flow (cfs) =		9	35	31	88			∑V (af) =	35											
					Daily Average Flow (cfs) =		1	4	3	9				4.4											

FreshWater Marsh Overflow Weir Flow
50 - Yr



```
ST 10.50,
SW 1, 0, 0,
MM 8, 1,2,3,10,11,12,13,14,
$ANUM
$EXTRAN
A1 'PLAYA VISTA CONCEPTUAL SALT MARSH DESIGN - WJT 12-21-01                        '
A1 'MID/FULL TIDAL DESIGN - UNDEVELOOPED AREA B - 50 YEAR STORM                   '
BB          0,       0,          ,       3,        ,         ,         ,         ,
          30,          ,          ,         ,       0,         ,         ,         /
B1 51840, 10.000, 0.000, 1, 500, 500, 0, 0, 0, 0, 0, 0, 0, 10.000,
B2 0,  10,  12.57,     ,     .05,    1E 5 ,   1000.,      0./
B3  0,  0,  0,  0,  26
C1 '1001      ','101        ','100       ',
        0.,6 ,      0.,  21.4,    200.,    1300.,   0.000,   0.000,        .037,
     3.,    3.,0,0/
CJ 203/
C1 '1011      ','110        ','101       ',
        0.,6 ,      0.,  21.41,   200.,    1320.,   0.000,   0.000,        .033,
     3.,    3.,0,0/
CJ 205/
C1 '1101      ','120        ','110       ',
        0.,6 ,      0.,  21.95,   200.,     610.,   0.000,   0.000,        .026,
     3.,    3.,0,0/
CJ 207/
C1 '1201      ','121        ','120       ',
        0.,6 ,      0.,  22.34,   200.,    1085.,   0.000,   0.000,        .024,
     3.,    3.,0,0/
CJ 209/
C1 '1211      ','130        ','121       ',
        0.,6 ,      0.,  22.73,   200.,    1085.,   0.000,   0.000,        .024,
     3.,    3.,0,0/
CJ 211/
C1 '1301      ','131        ','130       ',
        0.,6 ,      0.,  23.16,   200.,    1150.,   0.000,   0.000,        .025,
     3.,    3.,0,0/
CJ 213/
C1 '1311      ','140        ','131       '.
        0.,6 ,      0.,   23.6,   200.,    1150.,   0.000,   0.000,        .024,
     3.,    3.,0,0/
CJ 215/
C1 '1401      ','141        ','140       ',
        0.,6 ,      0.,  23.84,   200.,    1300.,   0.000,   0.000,        .024,
     3.,    3.,0,0/
CJ 217/
C1 '1411      ','142        ','141       ',
        0.,6 ,      0.,  25.31,   200.,    1500.,   0.000,   0.000,        .023,
     3.,    3.,0,0/
CJ 219/
C1 '1421      ','150        ','142       ',
        0.,6 ,      0.,  24.38,   200.,    1500.,   0.000,   0.000,        .022,
     3.,    3.,0,0/
CJ 221/
C1 '1501      ','151        ','150       ',
        0.,6 ,      0.,  24.89,  167.3,    1000.,   0.000,   0.000,        .022,
     3.,    3.,0,0/
CJ 223/
C1 '1511      ','152        ','151       ',
```

```
        0.,6 ,      0.,   25.4,   134.7,    1000.,   0.000,   0.000,      .022,
     3.,    3.,0,0/
CJ 225/
C1 '1521      ','153       ','152       ',
        0.,6 ,      0.,  25.91,    102.,    1000.,   0.000,   0.000,      .022,
     3.,    3.,0,0/
CJ 227/
C1 '1531      ','154       ','153       ',
        0.,6 ,      0.,  26.46,     80.,     900.,   0.000,   0.000,      .022,
     3.,    3.,0,0/
CJ 229/
C1 '1541      ','155       ','154       ',
        0.,6 ,      0.,  26.86,     80.,    1100.,   0.000,   0.000,      .022,
     3.,    3.,0,0/
CJ 231/
C1 '1551      ','156       ','155       ',
        0.,6 ,      0.,  27.22,     80.,    1000.,   0.000,   0.000,      .022,
     3.,    3.,0,0/
CJ 233/
C1 '1561      ','157       ','156       ',
        0.,6 ,      0.,  27.58,     80.,    1000.,   0.000,   0.000,      .022,
     3.,    3.,0,0/
CJ 235/
C1 '2101      ','211       ','210       ',
        0.,2 ,      0.,     6.,     10.,     210.,   0.000,   0.000,      .019,
        0.0,   0.0,0,0/
CJ 239/
C1 '2111      ','212       ','211       ',
        0.,2 ,      0.,     6.,     10.,     180.,   0.000,   0.000,      .019,
        0.0,   0.0,0,0/
CJ 241/
C1 '2121      ','213       ','212       ',
        0.,2 ,      0.,     6.,     10.,     610.,   0.000,   0.000,      .019,
        0.0,   0.0,0,0/
CJ 243/
C1 '2115      ','215       ','211       ',
        0.,1 ,      0.,     2.,        ,   -90.00,   0.000,   1.020,       .02,
        0.0,   0.0,0,0/
CJ 245/
C1 '2125      ','216       ','212       ',
        0.,6 ,      0.,     3.,     20.,   -88.00,   0.000,   1.340,       .02,
     0.,    0.,0,0/
CJ 247/
C1 '2201      ','221       ','220       ',
        0.,6 ,      0.,   11.3,     35.,     250.,   0.000,   0.000,      .035,
     10.,   10.,0,0/
CJ 250/
C1 '2211      ','222       ','221       ',
        0.,6 ,      0.,   11.2,     80.,     225.,   0.000,   0.000,      .035,
     5.,    5.,0,0/
CJ 252/
C1 '2221      ','226       ','222       ',
        0.,6 ,      0.,   10.9,     35.,     475.,   0.000,   0.000,      .035,
     5.,   10.,0,0/
CJ 254/
C1 '2202      ','224       ','220       ',
        0.,6 ,      0.,   11.2,     40.,     500.,   0.000,   0.000,      .035,
```

```
      10.,   10.,0,0/
CJ 256/
C1 '2241      ','226       ','224       ',
         0.,6 ,      0.,   10.9,     35.,     525.,  0.000,  0.000,      .035,
      10.,    5.,0,0/
CJ 257/
C1 '2261      ','230       ','226       ',
         0.,6 ,      0.,   10.5,     80.,     300.,  0.000,  0.000,      .035,
       5.,    5.,0,0/
CJ 259/
C1 '2263      ','240       ','226       ',
         0.,6 ,      0.,   10.7,    100.,     750.,  0.200,  0.000,      .035,
      10.,   10.,0,0/
CJ 261/
C1 '2403      ','241       ','240       ',
         0.,6 ,      0.,   10.4,     60.,     750.,  0.000,  0.000,      .035,
      10.,   10.,0,0/
CJ 263/
C1 '2411      ','250       ','241       ',
         0.,6 ,      0.,   10.1,     40.,     850.,  0.000,  0.000,      .035,
      10.,    5.,0,0/
CJ 265/
C1 '2301      ','231       ','230       ',
         0.,2 ,      0.,   7.25,     12.,     279.,  0.000,  0.550,      .029,
        0.0,   0.0,0,0/
CJ 269/
C1 '2503      ','260       ','250       ',
         0.,1 ,      0.,    4.,        ,     2440.,  0.000,  0.000,      .015,
        0.0,   0.0,0,0/
CJ 271/
C1 '2521      ','254       ','252       ',
         0.,6 ,      0.,    11.,     40.,    3920.,  0.000,  0.000,       .03,
       3.,    3.,0,0/
CJ 273/
C1 '6341      ','636       ','634       ',
         0.,1 ,      0.,    2.,        ,       85.,  0.000,  0.000,      .038,
        0.0,   0.0,0,0/
CJ 282/
C1 '5401      ','370       ','534       ',
         0.,1 ,      0.,    3.,        ,      135.,  0.000,  0.000,      .016,
        0.0,   0.0,0,0/
CJ 294/
C1 '6501      ','510       ','650       ',
         0.,2 ,      0.,    4.,      10.,     160.,  0.000,  0.000,      .018,
        0.0,   0.0,0,0/
CJ 296/
C1 '3768      ','360       ','376       ',
         0.,6 ,      0.,    8.,     100.,     120.,  6.000,  2.800,       .05,.
       0.,    0.,0,0/
CJ 322/
C1 '3748      ','340       ','374       ',
         0.,6 ,      0.,    8.,     100.,     500.,  6.700,  3.300,        .1,
       0.,    0.,0,0/
CJ 323/
C1 '3749      ','350       ','374       ',
         0.,6 ,      0.,    8.,     100.,     400.,  5.400,  3.300,        .1,
       0.,    0.,0,0/
```

```
CJ 324/
C1 '3727      ','332       ','372       ',
        0.,6 ,     0.,    8.,    100.,     270.,   4.900,   3.500,        .05,
      0.,    0.,0,0/
CJ 325/
C1 '5101      ','520       ','510       ',
        0.,6 ,     0.,   14.,     5.,      540.,   0.000,   0.000,       .035,
      5.,    5.,0,0/
CJ 326/
C1 '5103      ','512       ','510       ',
        0.,6 ,     0.,   14.,     5.,      540.,   0.000,   0.000,       .035,
      5.,    5.,0,0/
CJ 328/
C1 '5201      ','530       ','520       ',
        0.,6 ,     0.,   13.5,    5.,      490.,   0.000,   0.000,       .035,
      5.,    5.,0,0/
CJ 330/
C1 '5121      ','530       ','512       ',
        0.,6 ,     0.,   13.5,    5.,      540.,   0.000,   0.000,       .035,
      5.,    5.,0,0/
CJ 331/
C1 '5321      ','534       ','530       ',
        0.,6 ,     0.,   13.,     5.,      830.,   0.000,   0.000,       .035,
      3.,    3.,0,0/
CJ 334/
C1 '6361      ','638       ','636       ',
        0.,6 ,     0.,   11.5,   10.,      435.,   0.000,   0.000,       .035,
      3.,    3.,0,0/
CJ 351/
C1 '6601      ','662       ','660       ',
        0.,6 ,     0.,   14.5,    5.,      340.,   0.000,   0.000,        .05,
      3.,    3.,0,0/
CJ 354/
C1 '6621      ','664       ','662       ',
        0.,6 ,     0.,   14.5,    5.,      545.,   0.000,   0.000,        .05,
      3.,    3.,0,0/
CJ 356/
C1 '6641      ','640       ','664       ',
        0.,6 ,     0.,   14.5,    5.,      605.,   0.000,   0.000,        .05,
      3.,    3.,0,0/
CJ 357/
C1 '6642      ','640       ','660       ',
        0., 6,     0.,    9.,    250.,    1490.,   5.010,   5.500,         .1,
     20.,   10.,0,0/
CJ 358/
C1 '1402      ','210       ','140       ',
        0.,1 ,     0.,    5.,         ,  -179.20,  0.000,   0.000,       .021,
         0.0,    0.0,0,0/
CJ 237/
C1 '1403      ','210       ','140       ',
        0.,1 ,     0.,    5.,         ,  -187.20,  0.000,   0.000,        .02,
         0.0,    0.0,0,0/
CJ 237/
C1 '1404      ','210       ','140       ',
        0.,1 ,     0.,    5.,         ,  -195.20,  0.000,   0.000,        .02,
         0.0,    0.0,0,0/
CJ 237/
```

```
C1 '2501      ','252      ','250      ',
       0.,2 ,    0.,    7.,   10.5,    496.,  0.000,  0.000,     .02,
        0.0,  0.0,0,0/
CJ 267/
C1 '2502      ','252      ','250      ',
       0.,2 ,    0.,    7.,   10.5,    496.,  0.000,  0.000,     .02,
        0.0,  0.0,0,0/
CJ 267/
C1 '1102      ','660      ','110      ',
       0.,1 ,    0.,    5.,       ,  -90.00,  0.000,  6.410,    .025,
        0.0,  0.0,0,0/
CJ 275/
C1 '1104      ','660      ','110      ',
       0.,1 ,    0.,   1.5,       ,     90.,  0.000,  6.410,    .013,
        0.0,  0.0,0,0/
CJ 275/
C1 '1202      ','610      ','120      ',
       0.,1 ,    0.,    5.,       ,  -90.00,  0.000,  5.950,    .025,
        0.0,  0.0,0,0/
CJ 277/
C1 '1203      ','610      ','120      ',
       0.,1 ,    0.,    5.,       ,  -90.00,  0.000,  5.950,    .025,
        0.0,  0.0,0,0/
CJ 277/
C1 '1204      ','610      ','120      ',
       0.,1 ,    0.,  3.75,       ,     90.,  0.000,  5.950,    .021,
        0.0,  0.0,0,0/
CJ 277/
C1 '1205      ','610      ','120      ',
       0.,1 ,    0.,  3.75,       ,     90.,  0.000,  5.950,    .021,
        0.0,  0.0,0,0/
CJ 277/
C1 '1302      ','410      ','130      ',
       0.,1 ,    0.,    5.,       , -130.00,  0.000,  4.330,    .021,
        0.0,  0.0,0,0/
CJ 279/
C1 '1303      ','410      ','130      ',
       0.,1 ,    0.,    5.,       , -130.00,  0.000,  4.330,    .021,
        0.0,  0.0,0,0/
CJ 279/
C1 '1304      ','410      ','130      ',
       0., 2,    0.,   5.0,     9.,    130.,  0.000,  4.330,    .025,
        0.0,  0.0,0,0/
CJ 279/
C1 '1305      ','410      ','130      ',
       0., 2,    0.,   5.0,     9.,    130.,  0.000,  4.330,    .025,
        0.0,  0.0,0,0/
CJ 279/
C1 '5105      ','560      ','510      ',
       0.,2 ,    0.,    4.,     5.,  -50.00,  0.000,  0.800,    .019,
        0.0,  0.0,0,0/
CJ 285/
C1 '5106      ','560      ','510      ',
       0.,2 ,    0.,    4.,     5.,  -50.00,  0.000,  0.800,    .019,
        0.0,  0.0,0,0/
CJ 285/
C1 '5203      ','570      ','520      ',
```

```
        0.,2 ,      0.,     4.,      5.,  -45.00,  0.000,  0.800,     .019,
         0.0,   0.0,0,0/
CJ 288/
C1 '5204     ','570      ','520      ',
        0.,2 ,      0.,     4.,      5.,  -45.00,  0.000,  0.800,     .019,
         0.0,   0.0,0,0/
CJ 288/
C1 '4301     ','310      ','430      ',
        0.,2 ,      0.,     5.,     15.,    225.,  0.000,  0.000,     .024,
         0.0,   0.0,0,0/
CJ 291/
C1 '4302     ','310      ','430      ',
        0.,2 ,      0.,     5.,     15.,    225.,  0.000,  0.000,     .024,
         0.0,   0.0,0,0/
CJ 291/
C1 '3101     ','320      ','310      ',
        0.,6 ,      0.,  14.42,     30.,    480.,  0.000,  0.000,     .035,
      5.,    5.,0,0/
CJ 301/
C1 '3102     ','320      ','310      ',
        0.,6 ,      0.,    11.,     50.,    480.,  5.700,  7.500,      .05,
      0.,    0.,0,0/
CJ 301/
C1 '3201     ','322      ','320      ',
        0.,6 ,      0.,  13.25,      5.,    650.,  0.000,  0.000,     .035,
      5.,    5.,0,0/
CJ 303/
C1 '3202     ','322      ','320      ',
        0.,6 ,      0.,    11.,    100.,    650.,  4.500,  5.700,      .05,
      0.,    0.,0,0/
CJ 303/
C1 '3204     ','330      ','320      ',
        0.,6 ,      0.,  14.96,     30.,    570.,  0.000,  0.000,     .035,
      5.,    5.,0,0/
CJ 305/
CX '3204     ', , , , 0, , 0, , , , ,
C1 '3205     ','330      ','320      ',
        0.,6 ,      0.,    11.,     50.,    570.,  6.900,  5.700,      .05,
      0.,    0.,0,0/
CJ 305/
CX '3205     ', , , , 0, , 0, , , , ,
C1 '3301     ','332      ','330      ',
        0.,6 ,      0.,    13.,      5.,    650.,  0.000,  0.000,     .035,
      5.,    5.,0,0/
CJ 307/
C1 '3302     ','332      ','330      ',
        0.,6 ,      0.,    11.,    100.,    650.,  4.900,  6.900,      .05,
      0.,    0.,0,0/
CJ 307/
C1 '3304     ','334      ','330      ',
        0.,6 ,      0.,   13.2,      5.,    410.,  0.000,  0.000,     .035,
      5.,    5.,0,0/
CJ 309/
C1 '3305     ','334      ','330      ',
        0.,6 ,      0.,    11.,    100.,    410.,  5.100,  6.900,      .05,
      0.,    0.,0,0/
CJ 309/
```

```
C1 '3307      ','340      ','330      ',
     0.,6 ,      0.,  14.55,    20.,    100.,  0.000,  0.000,    .035,
   5.,    5.,0,0/
CJ 311/
C1 '3308      ','340      ','330      ',
     0.,6 ,      0.,    11.,    50.,    100.,  6.700,  6.900,    .05,
   0.,    0.,0,0/
CJ 311/
C1 '3401      ','350      ','340      ',
     0.,6 ,      0.,  13.29,    20.,    680.,  0.000,  0.000,    .035,
   5.,    5.,0,0/
CJ 313/
C1 '3402      ','350      ','340      ',
     0.,6 ,      0.,    11.,    50.,    680.,  5.400,  6.700,    .05,
   0.,    0.,0,0/
CJ 313/
C1 '3501      ','360      ','350      ',
     0.,6 ,      0.,    14.,    20.,    750.,  0.000,  0.000,    .035,
   5.,    5.,0,0/
CJ 315/
C1 '3502      ','360      ','350      ',
     0.,6 ,      0.,    11.,    50.,    750.,  6.000,  5.400,    .05,
   0.,    0.,0,0/
CJ 315/
C1 '3701      ','372      ','370      ',
     0.,6 ,      0.,  12.02,     5.,   1040.,  0.000,  0.000,    .035,
   3.,    3.,0,0/
CJ 317/
C1 '3702      ','372      ','370      ',
     0.,6 ,      0.,     8.,   100.,   1040.,  3.500,  4.800,    .1,
   0.,    0.,0,0/
CJ 317/
C1 '3721      ','374      ','372      ',
     0.,6 ,      0.,  11.39,     5.,    890.,  0.000,  0.000,    .035,
   3.,    3.,0,0/
CJ 319/
C1 '3722      ','374      ','372      ',
     0.,6 ,      0.,     8.,    60.,    890.,  3.300,  3.500,    .1,
   0.,    0.,0,0/
CJ 319/
C1 '3741      ','376      ','374      ',
     0.,6 ,      0.,  10.71,     5.,    820.,  0.000,  0.000,    .035,
   3.,    3.,0,0/
CJ 321/
C1 '3742      ','376      ','374      ',
     0.,6 ,      0.,     8.,    50.,    820.,  2.800,  3.300,    .1,
   0.,    0.,0,0/
CJ 321/
C1 '5301      ','540      ','530      ',
     0.,6 ,      0.,   14.5,     5.,    320.,  0.000,  0.000,    .035,
   5.,    5.,0,0/
CJ 333/
C1 '5302      ','540      ','530      ',
     0.,6 ,      0.,    11.,   100.,    320.,  6.500,  6.600,    .1,
   0.,    0.,0,0/
CJ 333/
C1 '6101      ','620      ','610      ',
```

```
          0.,6 ,       0.,    15.,      20.,      325.,  0.000,   0.000,      .035,
        5.,     5.,0,0/
CJ 336/
C1 '6102       ','620       ','610       ',
          0.,6 ,       0.,    9.5,      55.,      325.,  5.500,   5.500,       .1,
        0.,     0.,0,0/
CJ 336/
C1 '6201       ','622       ','620       ',
          0.,6 ,       0.,   14.5,      10.,      680.,  0.000,   0.000,      .035,
        5.,     5.,0,0/
CJ 338/
C1 '6202       ','622       ','620       ',
          0.,6 ,       0.,    9.5,     125.,      680.,  5.000,   5.500,       .1,
        0.,     0.,0,0/
CJ 338/
C1 '6203       ','630       ','620       ',
          0.,6 ,       0.,   14.5,      20.,      480.,  0.000,   0.000,      .035,
        5.,     5.,0,0/
CJ 340/
C1 '6204       ','630       ','620       ',
          0.,6 ,       0.,     9.,     100.,      480.,  5.500,   5.500,       .1,
        0.,     0.,0,0/
CJ 340/
C1 '6221       ','624       ','622       ',
          0.,6 ,       0.,   14.5,      10.,      600.,  0.000,   0.000,      .035,
        5.,     5.,0,0/
CJ 342/
C1 '6223       ','624       ','622       ',
          0.,6 ,       0.,    9.5,     125.,      600.,  5.000,   5.000,       .1,
        0.,     0.,0,0/
CJ 342/
C1 '6241       ','626       ','624       ',
          0.,6 ,       0.,    14.,      10.,      615.,  0.000,   0.000,      .035,
        5.,     5.,0,0/
CJ 344/
C1 '6242       ','626       ','624       ',
          0.,6 ,       0.,    12.,     125.,      615.,  4.000,   5.000,      .05,
        0.,     0.,0,0/
CJ 344/
C1 '6301       ','632       ','630       ',
          0.,6 ,       0.,    14.,      10.,      640.,  0.000,   0.000,      .035,
        5.,     5.,0,0/
CJ 346/
C1 '6302       ','632       ','630       ',
          0.,6 ,       0.,    12.,     200.,      640.,  5.000,   5.000,      .05,
        0.,     0.,0,0/
CJ 346/
C1 '6304       ','640       ','630       ',
          0.,6 ,       0.,   14.5,      20.,      285.,  0.000,   0.000,      .035,
        5.,     5.,0,0/
CJ 348/
C1 '6306       ','640       ','630       ',
          0.,6 ,       0.,    12.,     100.,      285.,  4.500,   4.500,      .05,
        0.,     0.,0,0/
CJ 348/
C1 '6321       ','634       ','632       ',
          0.,6 ,       0.,    14.,      10.,      815.,  0.000,   0.000,      .035,
```

```
     5.,      5.,0,0/
CJ 349/
C1 '6323       ','634        ','632        ',
        0.,6 ,      0.,     12.,     200.,       815.,   4.000,   4.000,          .05,
     0.,      0.,0,0/
CJ 349/
C1 '6401       ','650        ','640        ',
        0.,6 ,      0.,   14.5,      20.,       600.,   0.000,   0.000,         .035,
     5.,      5.,0,0/
CJ 352/
C1 '6402       ','650        ','640        ',
        0.,6 ,      0.,     11.,     100.,       600.,   4.500,   4.500,          .05,
     0.,      0.,0,0/
CJ 352/
C1 '4201       ','430        ','420        ',
        0.,6 ,      0.,     15.,      40.,       360.,   0.000,   0.000,         .035,
     5.,      5.,0,0/
CJ 365/
C1 '4202       ','430        ','420        ',
      0.0, 6,          ,     13.,     300.,       360.,   5.000,   5.000,          .05,
    10.,    10.,0,0/
CJ 365/
C1 '4101       ','420        ','410        ',
        0.,6 ,      0.,     15.,      40.,       520.,   0.000,   0.000,         .035,
     5.,      5.,0,0/
CJ 366/
C1 '4102       ','420        ','410        ',
      0.0, 6,          ,     13.,     150.,       540.,   5.000,   5.000,          .05,
    10.,    10.,0,0/
CJ 366/
D1 '101', 20., -11.4, 0., 8.63, 0, -1, -1, -1.000, 201, 0, 0, 100.000, /
D1 '100', 18., -13.32, 0., 10.55, 0, -1, -1, -1.000, 202, 0, 0, 100.000, /
D1 '110', 21., -10.41, 0., 7.64, 0, -1, -1, -1.000, 204, 0, 0, 100.000, /
D1 '120', 22., -9.95, 0., 7.18, 0, -1, -1, -1.000, 206, 0, 0, 100.000, /
D1 '121', 23.2, -9.14, 0., 6.37, 0,  1, -1, -1.000, 208, 0, 0, 100.000, /
D1 '130', 24.4, -8.33, 0., 5.56, 0, -1, -1,  1.000, 210, 0, 0, 100.000, /
D1 '131', 25.7, -7.46, 0., 4.69, 0, -1, -1, -1.000, 212, 0, 0, 100.000, /
D1 '140', 27., -6.6, 0., 3.83, 0, -1, -1, -1.000, 214, 0, 0, 100.000, /
D1 '141', 28.21, -5.63, 0., 2.86, 0, -1, -1, -1.000, 216, 0, 0, 100.000, /
D1 '142', 30.81, -4.5, 0., 1.73, 0, -1, -1, -1.000, 218, 0, 0, 100.000, /
D1 '150', 31., -3.38, 0., .61, 0, -1, -1,  1.000, 220, 0, 0, 100.000, /
D1 '151', 32.33, -2.56, 0., 0., 0, -1, -1, -1.000, 222, 0, 0, 100.000, /
D1 '152', 33.67,  1.73, 0., 0., 0, -1, -1, -1.000, 224, 0, 0, 100.000, /
D1 '153', 35., -.91, 0., 0., 0, -1, -1, -1.000, 226, 0, 0, 100.000, /
D1 '154', 36., -.46, 0., 0., 0, -1, -1, -1.000, 228, 0, 0, 100.000, /
D1 '155', 39.26, 2.4, 0., 0., 0, -1, -1, -1.000, 230, 0, 0, 100.000, /
D1 '156', 42.22, 5., 0., 0., 0, -1, -1, -1.000, 232, 0, 0, 100.000, /
D1 '157', 45.18, 7.6, 0., 0., 0, -1, -1, -1.000, 234, 0, 0, 100.000, /
D1 '210', 17., -3.85, 0., 0., 0, -1, -1,  1.000, 236, 0, 0, 100.000, /
D1 '211', 17., -3.64, 0., 0., 0, -1, -1, -1.000, 238, 0, 0, 100.000, /
D1 '212', 17., -3.46, 0., 0., 0, -1, -1, -1.000, 240, 0, 0, 100.000, /
D1 '213', 20., -2.85, 0., 0., 0, -1, -1, -1.000, 242, 0, 0, 100.000, /
D1 '215', 20., .42, 0., 0., 0, -1, -1, -1.000, 244, 0, 0, 100.000, /
D1 '216', 20., -.55, 0., 0., 0, -1, -1,  1.000, 246, 0, 0, 100.000, /
D1 '221', 20., -2.3, 0., 4.3, 0, -1, -1,  1.000, 248, 0, 0, 100.000, /
D1 '220', 20., -2.4, 0., 4.4, 0, -1, -1, -1.000, 249, 0, 0, 100.000, /
D1 '222', 20., -2.2, 0., 4.2, 0, -1, -1, -1.000, 251, 0, 0, 100.000, /
```

```
D1 '226', 20., -2.1, 0., 4.1, 0, -1, -1, -1.000, 253, 0, 0, 100.000, /
D1 '224', 20., -2.25, 0., 4.25, 0, -1, -1, -1.000, 255, 0, 0, 100.000, /
D1 '230', 20., 1.05, 0., .95, 0, -1, -1, -1.000, 258, 0, 0, 100.000, /
D1 '240', 20., -2., 0., 4., 0, -1, -1, -1.000, 260, 0, 0, 100.000, /
D1 '241', 20., -1.5, 0., 3.5, 0, -1, -1, -1.000, 262, 0, 0, 100.000, /
D1 '250', 20., -1., 0., 3., 0, -1, -1, -1.000, 264, 0, 0, 100.000, /
D1 '252', 11., -.63, 0., 2.63, 0, -1, -1, -1.000, 266, 0, 0, 100.000, /
D1 '231', 11., 2.45, 0., 0., 0, -1, -1, 1.000, 268, 0, 0, 100.000, /
D1 '260', 40., 24.5, 0., 0., 0, -1, -1, -1.000, 270, 0, 0, 100.000, /
D1 '254', 20., 8., 0., 0., 0, -1, -1, -1.000, 272, 0, 0, 100.000, /
D1 '660', 15., -3.9, 0., 1.13, 0, -1, -1, -1.000, 274, 0, 0, 100.000, /
D1 '610', 15., -3.87, 0., 1.1, 0, -1, -1, -1.000, 276, 0, 0, 100.000, /
D1 '410', 15., -3.89, 0., 1.12, 0, -1, -1, -1.000, 278, 0, 0, 100.000, /
D1 '636', 15., -1., 0., 0., 0, -1, -1, -1.000, 280, 0, 0, 100.000, /
D1 '634', 15., -3.5, 0., .73, 0, -1, -1, -1.000, 281, 0, 0, 100.000, /
D1 '560', 15.,  2., 0., 0., 0, -1, -1,  1.000, 283, 0, 0, 100.000, /
D1 '510', 15., -2.91, 0., .14, 0, -1, -1, -1.000, 284, 0, 0, 100.000, /
D1 '570', 15., -1.4, 0., 0., 0, -1, -1, -1.000, 286, 0, 0, 100.000, /
D1 '520', 15., -2.75, 0., 0., 0, -1, -1, -1.000, 287, 0, 0, 100.000, /
D1 '310', 15., -4.42, 0., 1.65, 0, -1, -1, -1.000, 289, 0, 0, 100.000, /
D1 '430', 15., -3.55, 0., .78, 0, -1, -1, -1.000, 290, 0, 0, 100.000, /
D1 '370', 15., -1.82, 0., 0., 0, -1, -1, -1.000, 292, 0, 0, 100.000, /
D1 '534', 15., -1.96, 0., 0., 0, -1, -1,  1.000, 293, 0, 0, 100.000, /
D1 '650', 15., -3., 0., .23, 0, -1, -1, -1.000, 295, 0, 0, 100.000, /
D1 '320', 15., -3.24, 0., .47, 0, -1, -1, -1.000, 300, 0, 0, 100.000, /
D1 '322', 15., -2.25, 0., 0., 0, -1, -1, -1.000, 302, 0, 0, 100.000, /
D1 '330', 20., -3.98, 0., 1.21, 0, -1, -1, -1.000, 304, 0, 0, 100.000, /
D1 '332', 15.,  2., 0., 0., 0, -1, -1,  1.000, 306, 0, 0, 100.000, /
D1 '334', 20.,  2.2, 0., 0., 0, -1, -1,  1.000, 308, 0, 0, 100.000, /
D1 '340', 20., -3.55, 0., .78, 0, -1, -1, -1.000, 310, 0, 0, 100.000, /
D1 '350', 20., -2.29, 0., 0., 0, -1, -1, -1.000, 312, 0, 0, 100.000, /
D1 '360', 15., -3., 0., .23, 0, -1, -1, -1.000, 314, 0, 0, 100.000, /
D1 '372', 15., -1.02, 0., 0., 0, -1, -1, -1.000, 316, 0, 0, 100.000, /
D1 '374', 15., -.34, 0., 0., 0, -1, -1, -1.000, 318, 0, 0, 100.000, /
D1 '376', 15., .29, 0., 0., 0, -1, -1, -1.000, 320, 0, 0, 100.000, /
D1 '512', 15., -2.76, 0., 0., 0, -1, -1,  1.000, 327, 0, 0, 100.000, /
D1 '530', 15., -3.6, 0., .83, 0, -1, -1, -1.000, 329, 0, 0, 100.000, /
D1 '540', 15., -3.5, 0., .73, 0, -1, -1, -1.000, 332, 0, 0, 100.000, /
D1 '620', 15., -3.7, 0., .93, 0, -1, -1, -1.000, 335, 0, 0, 100.000, /
D1 '622', 15., -3.27, 0., .5, 0, -1, -1, -1.000, 337, 0, 0, 100.000, /
D1 '630', 15., -3.45, 0., .68, 0, -1, -1, -1.000, 339, 0, 0, 100.000, /
D1 '624', 15., -3.89, 0., 1.12, 0, -1, -1, -1.000, 341, 0, 0, 100.000, /
D1 '626', 15.,  2.5, 0., 0., 0, -1, -1,  1.000, 343, 0, 0, 100.000, /
D1 '632', 15., -4.03, 0., 1.26, 0, -1, -1,  1.000, 345, 0, 0, 100.000, /
D1 '640', 15., -3.31, 0., .54, 0, -1, -1, -1.000, 347, 0, 0, 100.000, /
D1 '638', 15., -.5, 0., 0., 0, -1, -1, -1.000, 350, 0, 0, 100.000, /
D1 '662', 15., -3.76, 0., .99, 0, -1, -1, -1.000, 353, 0, 0, 100.000, /
D1 '664', 15., -3.55, 0., .78, 0, -1, -1, -1.000, 355, 0, 0, 100.000, /
D1 '420', 15., -3.69, 0., .92, 0, -1, -1, -1.000, 364, 0, 0, 100.000, /
E1 '213', 15.,  1.0, 8, 0,
E2 .01, 0., .08, .9, .1, 1.9, .119, 2.9, .083, 3.9
   .1, 4.9, .128, 6.9, .367, 13.9
E1 '215', 15., -1.0, 7, 0,
E2 .01, 0., .2, 3.08, 1.5, 3.58, 3.7, 4.58, 5., 5.58
   7.5, 6.58, 15.7, 7.58
E1 '216', 15., -1.0, 8, 0,
E2 .01, 0., .8, 3.65, 7.2, 4.15, 11.3, 4.55, 18.4, 5.55
```

```
   21.3, 6.55, 29.4, 7.55, 30.7, 8.55
 E1 '220', 15., -1.0, 8, 0,
 E2 .01, 0., .273, .4, .474, 1.4, 1.666, 2.4, .512, 3.4
   .797, 4.4, 1.343, 6.4, 1.772, 13.4
 E1 '520', 15., -1.0, 9, 0,
 E2 .01, 0., .231, .75, .307, 1.25, .419, 2.75, .757, 4.25
   2.244, 5.75, 4.32, 7.75, 5.578, 12.75, 5.58, 13.75
 E1 '320', 15., -1.0, 10, 0,
 E2 .01, 0., .475, 2.24, 1.898, 3.24, 2.991, 4.24, 3.244, 5.24
   3.371, 5.74, 5.581, 6.24, 7.152, 7.74, 7.594, 9.74, 8.063, 14.42
 E1 '322', 15., -1.0, 10, 0,
 E2 .01, 0., .15, 1.25, .799, 2.25, 1.684, 3.25, 1.853, 4.25
   1.914, 4.75, 4.02, 5.25, 4.109, 6.75, 4.244, 8.75, 4.55, 13.25
 E1 '332', 15., -1.0, 10, 0,
 E2 .01, 0., .15, 1., .713, 2., 1.346, 3., 1.834, 4.
   1.926, 4.5, 7.654, 5., 8.732, 6.5, 8.732, 8.5, 8.732, 13.
 E1 '334', 15., -1.0, 10, 0,
 E2 .01, 0., .064, 1.2, .306, 2.2, .615, 3.2, .741, 4.2
   .813, 4.7, 2.72, 5.2, 3.736, 6.7, 3.947, 8.7, 4.562, 13.2
 E1 '340', 20., -1.0, 10, 0,
 E2 .01, 0., .752, 2.55, 2.342, 3.55, 3.936, 4.55, 4.259, 5.55
   4.428, 6.05, 4.845, 6.55, 6.879, 8.05, 7.374, 10.05, 8.335, 14.55
 E1 '540', 15., -1.0, 10, 0,
 E2 .01, 0., .166, 1.5, .2, 2., .873, 2.5, 3.262, 3.5
   3.705, 5., 7.293, 6.5, 11.331, 8.5, 12.154, 13.5, 12.266, 14.5
 E1 '620', 15., -1.0, 8, 0,
 E2 .01, 0., .355, 1.7, .435, 2.2, .774, 3.7, 4.57, 5.2
   5.369, 6.7, 5.369, 8.7, 5.45, 14.7
 E1 '622', 15.,  1.0, 9, 0,
 E2 .01, 0., .137, .27, .375, 1.27, .494, 1.77, .985, 3.27
   5.98, 4.77, 8.123, 6.27, 8.305, 8.27, 8.544, 14.27
 E1 '632', 15., -1.0, 9, 0,
 E2 .01, 0., 1.083, 1.03, 1.344, 2.03, 1.46, 2.53, 4.837, 3.03
   11.638, 4.03, 12.332, 5.53, 13.854, 7.03, 14.135, 9.03
 E1 '640', 15.,  1.0, 8, 0,
 E2 .01, 0., .029, .31, .221, 1.81, .783, 3.31, 1.958, 4.81
   2.023, 6.31, 2.09, 8.31, 2.185, 14.31
 E1 '638', 15., -1.0, 4, 0,
 E2 .01, 0., .399, 3.5, 3.196, 5.5, 4.199, 11.5
 E1 '664', 15., -1.0, 7, 0,
 E2 .01, 0., .137, 2.05, .257, 3.55, 4.77, 5.05, 7.089, 6.55
   8.943, 8.55, 12.247, 14.55
 E1 '420', 15.,  1.0, 7, 0,
 E2 .01, 0., .534, 2.7, .765, 4.7, 5.288, 6.7, 7.989, 8.2
   10.04, 10.2, 12.577, 14.7
 G1 'WEIR#6', '220', '213', 1, 4.400, 12.400, 26., 2.8, /
 G1 'WEIR#7', '220', '213', 1, 6.400, 12.400, 2.67, 2.8, /
 G1 'WEIR#8', '220', '340', 1, 8.900, 12.400, 300., 2.8, /
 G1 'WEIR#9', '320', '540', 1, 11.240, 14.500, 20., 2.8, /
 G1 'WEIR#10', '512', '634', 1, 7.070, 10.000, 20., 2.8, /
 I1   '100        ', 1, /
 J1          4
 J2     0.0, 25.
 J3 1,     4,0,    0.016   /
 J4 0.0, 1.98, 6.05, -2.87, 11.58, 0.94, 17.65, -0.87
 * Gobal Daily Sewage flow Data
 * Global Hourly Sewage flow Data
```

```
K1   5
K2 '157        ','215        ','216        ','240        ','231        '
K2 '260        ','254        ','636        ','560        ','570        '
K2 '520        ','320        ','330        ','340        ','372        '
K2 '376        ','530        ','540        ','620        ','622        '
K2 '624        ','626        ','632        ','640        ','662        '
K2 '420        '
K3  0, 0, 0, 0, 0, 0
    0, 0, 0, 0, 0
    0, 0, 0, 0, 0
    0, 0, 0, 0, 0
    0, 0, 0, 0, 0
    0
K3  24, 0, 0, 0, 0, 0
    0, 0, 0, 0, 0
    0, 0, 0, 0, 0
    0, 0, 0, 0, 0
    0, 0, 0, 0, 0
    0
K3  25.667, 16, 0.4, 0.6, 0.8, 4.3
    0.4, 1.9, 0, 0, 0.1
    0.6, 0.1, 0.1, 0.1, 0.1
    0.1, 0, 0.1, 0.1, 0.1
    0, 0.1, 0.1, 0.1, 0.1
    0.1
K3  27.333, 63, 0.5, 0.7, 1.6, 4.3
    0.9, 3.8, 0.1, 0.1, 0.2
    1.2, 0.2, 0.2, 0.1, 0.2
    0.2, 0.1, 0.1, 0.1, 0.1
    0.1, 0.1, 0.1, 0.2, 0.2
    0.1
K3  29, 142, 0.5, 0.8, 2.4, 4.3
    1.3, 5.7, 0.1, 0.1, 0.3
    1.8, 0.3, 0.3, 0.2, 0.3
    0.3, 0.1, 0.2, 0.2, 0.2
    0.1, 0.2, 0.2, 0.2, 0.3
    0.2
K3  30.667, 253, 0.5, 0.9, 3.3, 5.3
    1.8, 7.5, 0.1, 0.2, 0.4
    2.4, 0.4, 0.4, 0.2, 0.4
    0.4, 0.1, 0.3, 0.2, 0.3
    0.2, 0.2, 0.2, 0.3, 0.5
    0.3
K3  32.333, 383, 0.8, 1.4, 4.1, 6.4
    2.2, 9.4, 0.2, 0.2, 0.5
    3, 0.5, 0.5, 0.3, 0.5
    0.5, 0.1, 0.3, 0.3, 0.3
    0.2, 0.3, 0.3, 0.4, 0.6
    0.3
K3  39, 904, 0.9, 1.5, 7.3, 7.1
    4, 17, 0.3, 0.4, 0.9
    5.4, 0.9, 1, 0.5, 0.9
    0.8, 0.2, 0.6, 0.5, 0.6
    0.4, 0.5, 0.5, 0.7, 1
    0.6
K3  40.667, 1402, 1, 1.5, 8.1, 8.8
    4.5, 18.8, 0.4, 0.5, 1
```

5.9, 1, 1.1, 0.6, 1
0.9, 0.3, 0.6, 0.6, 0.7
0.4, 0.6, 0.5, 0.8, 1.2
0.7
K3 41.167, 1551, 1, 1.6, 8.4, 10.8
4.6, 19.4, 0.4, 0.5, 1.1
6.1, 1, 1.1, 0.6, 1
1, 0.3, 0.7, 0.6, 0.7
0.4, 0.6, 0.6, 0.8, 1.2
0.7
K3 41.667, 1803, 1.1, 1.7, 8.6, 11.2
4.8, 19.9, 0.4, 0.5, 1.1
6.3, 1, 1.1, 0.6, 1
1, 0.3, 0.7, 0.6, 0.7
0.4, 0.6, 0.6, 0.8, 1.2
0.7
K3 42.667, 2306, 1.3, 2.2, 9.3, 11.4
5.1, 21.5, 0.4, 0.6, 1.2
6.8, 1.1, 1.2, 0.6, 1.1
1.1, 0.3, 0.7, 0.7, 0.8
0.5, 0.7, 0.6, 0.9, 1.3
0.8
K3 42.833, 2402, 1.8, 2.9, 11.1, 12.3
6.4, 22.1, 0.5, 0.7, 1.5
8.5, 1.4, 1.6, 0.8, 1.4
1.3, 0.4, 0.9, 0.9, 1
0.6, 0.8, 0.8, 1.1, 1.7
1
K3 43, 2498, 1.9, 3.1, 14.1, 13.9
8.6, 23.7, 0.7, 0.9, 2.1
11.4, 1.8, 2.1, 1.1, 1.9
1.8, 0.5, 1.2, 1.2, 1.3
0.8, 1.1, 1, 1.5, 2.2
1.3
K3 43.067, 2540, 2, 3.3, 16, 16.7
9.9, 25, 0.8, 1.1, 2.5
13.2, 2.1, 2.4, 1.3, 2.3
2.1, 0.6, 1.4, 1.3, 1.5
0.9, 1.3, 1.2, 1.7, 2.6
1.5
K3 43.083, 2550, 2.2, 3.5, 16.4, 17.3
10.3, 25.3, 0.8, 1.1, 2.6
13.6, 2.2, 2.5, 1.3, 2.3
2.2, 0.6, 1.5, 1.4, 1.5
0.9, 1.4, 1.2, 1.8, 2.7
1.5
K3 43.133, 2579, 2.4, 4, 18.1, 18
11.7, 26.9, 1, 1.3, 3.1
15.5, 2.5, 2.8, 1.5, 2.8
2.5, 0.7, 1.7, 1.6, 1.8
1, 1.5, 1.4, 2.1, 3.1
1.7
K3 43.167, 2602, 2.6, 4.3, 19.5, 18.8
13.5, 28, 1.1, 1.5, 3.9
17.8, 2.9, 3.3, 1.7, 3.3
3, 0.8, 1.9, 1.8, 2
1.2, 1.8, 1.6, 2.4, 3.6

2
K3 43.183, 2614, 2.8, 4.6, 20.8, 20.7
18.2, 28.5, 1.5, 2.2, 7.7
24.1, 3.9, 4.4, 2.3, 5.2
4.2, 1.1, 2.6, 2.5, 2.8
1.6, 2.4, 2.2, 3, 4.9
2.7
K3 43.2, 2624, 3.8, 6.2, 22.2, 21.5
25.7, 29.6, 2.4, 3.5, 9.3
34.7, 6.1, 7.2, 3.7, 7.6
6.8, 1.8, 4.2, 4, 4.4
2.6, 3.9, 3.6, 3.9, 7.9
4.4
K3 43.217, 2634, 6.2, 10.1, 25, 22.3
29.7, 31.2, 2.6, 3.6, 9.4
39.7, 6.7, 7.7, 4, 7.8
7, 1.9, 4.5, 4.2, 4.7
2.8, 4.2, 3.8, 4.9, 8.4
4.7
K3 43.233, 2648, 6.6, 10.8, 27.7, 23.5
30.3, 32.8, 2.6, 3.6, 9
40.3, 6.7, 7.7, 4, 7.8
7.1, 2, 4.5, 4.3, 4.8
2.8, 4.2, 3.9, 5, 8.4
4.7
K3 43.25, 2657, 6.7, 10.9, 31.2, 25
30.4, 35, 2.6, 3.6, 7.1
40.4, 6.7, 7.7, 4, 7.4
7, 2, 4.5, 4.3, 4.8
2.8, 4.2, 3.9, 5, 8.4
4.7
K3 43.267, 2671, 6.7, 10.9, 34, 26.6
30.1, 37.7, 2.6, 3.4, 5.5
40, 6.6, 7.6, 3.9, 6.1
6.6, 1.9, 4.5, 4.2, 4.7
2.8, 4.1, 3.8, 5.1, 8.1
4.6
K3 43.283, 2683, 6.6, 10.6, 34.9, 28.8
28.7, 40.9, 2.3, 2.8, 4.4
37.9, 6.1, 6.9, 3.6, 4.7
5.5, 1.7, 4, 3.8, 4.3
2.5, 3.7, 3.4, 5, 7.2
4.2
K3 43.3, 2694, 5.9, 9.6, 35.4, 31
24.5, 45.2, 1.9, 2.3, 3.8
32.1, 5, 5.6, 2.9, 3.9
4.4, 1.4, 3.3, 3.1, 3.5
2, 3.1, 2.8, 4.6, 5.8
3.4
K3 43.317, 2709, 4.8, 7.8, 35.9, 34.1
20.4, 49.5, 1.6, 1.9, 3.5
26.8, 4.2, 4.7, 2.4, 3.4
3.7, 1.2, 2.7, 2.6, 2.9
1.7, 2.5, 2.3, 4.2, 4.9
2.9
K3 43.333, 2723, 4, 6.5, 35.9, 38.4
17.7, 54.4, 1.3, 1.6, 3.2

23.1, 3.5, 3.9, 2, 3.1
3.2, 1, 2.3, 2.2, 2.5
1.4, 2.1, 1.9, 3.6, 4.1
2.4
K3 43.35, 2736, 3.4, 5.5, 35.9, 39.6
15.4, 57.1, 1.1, 1.4, 2.9
19.9, 3, 3.2, 1.7, 2.8
2.7, 0.8, 1.9, 1.8, 2
1.2, 1.7, 1.6, 3.1, 3.4
2
K3 43.367, 2748, 2.8, 4.5, 35.7, 40.8
13.5, 58.7, 1, 1.3, 2.6
17.6, 2.6, 2.8, 1.5, 2.5
2.4, 0.7, 1.7, 1.6, 1.8
1, 1.5, 1.4, 2.8, 3
1.7
K3 43.383, 2765, 2.4, 4, 35.5, 41.4
12.1, 59.7, 0.9, 1.2, 2.4
15.8, 2.4, 2.6, 1.4, 2.3
2.3, 0.7, 1.6, 1.5, 1.7
1, 1.4, 1.3, 2.4, 2.8
1.6
K3 43.4, 2782, 2.3, 3.7, 35, 42
10.9, 60.8, 0.8, 1.1, 2.3
14.3, 2.2, 2.4, 1.3, 2.1
2.1, 0.6, 1.4, 1.3, 1.5
0.9, 1.3, 1.2, 2.2, 2.6
1.5
K3 43.417, 2797, 2.1, 3.4, 34.3, 42.3
10.1, 61.4, 0.8, 1, 2.1
13.2, 2, 2.3, 1.2, 2
1.9, 0.6, 1.3, 1.3, 1.4
0.8, 1.2, 1.1, 1.9, 2.4
1.4
K3 43.433, 2813, 2, 3.2, 33.2, 42.3
9.4, 61.4, 0.7, 0.9, 1.9
12.3, 1.9, 2.1, 1.1, 1.8
1.8, 0.5, 1.3, 1.2, 1.3
0.8, 1.2, 1.1, 1.7, 2.3
1.3
K3 43.45, 2834, 1.9, 3, 31.2, 42.3
8.8, 61.9, 0.7, 0.9, 1.8
11.5, 1.8, 2, 1.1, 1.7
1.7, 0.5, 1.2, 1.1, 1.3
0.7, 1.1, 1, 1.6, 2.2
1.3
K3 43.467, 2855, 1.8, 2.9, 29.1, 42
8.3, 61.9, 0.7, 0.8, 1.7
10.9, 1.7, 2, 1, 1.6
1.6, 0.5, 1.1, 1.1, 1.2
0.7, 1.1, 1, 1.5, 2.1
1.2
K3 43.483, 2876, 1.7, 2.7, 27.3, 41.7
7.9, 61.9, 0.6, 0.8, 1.6
10.4, 1.7, 1.9, 1, 1.5
1.6, 0.5, 1.1, 1, 1.2
0.7, 1, 0.9, 1.4, 2

1.1
K3 43.5, 2897, 1.6, 2.6, 25.4, 41.3
7.4, 61.9, 0.6, 0.8, 1.5
9.8, 1.6, 1.8, 0.9, 1.4
1.5, 0.4, 1, 1, 1.1
0.6, 1, 0.9, 1.3, 1.9
1.1
K3 43.517, 2925, 1.5, 2.5, 24, 40.7
7.1, 61.4, 0.6, 0.7, 1.4
9.3, 1.5, 1.7, 0.9, 1.4
1.4, 0.4, 1, 0.9, 1.1
0.6, 0.9, 0.9, 1.3, 1.8
1
K3 43.533, 2952, 1.5, 2.4, 22.6, 39.7
6.7, 61.4, 0.5, 0.7, 1.3
8.8, 1.4, 1.6, 0.8, 1.3
1.3, 0.4, 0.9, 0.9, 1
0.6, 0.9, 0.8, 1.2, 1.7
1
K3 43.55, 2980, 1.4, 2.3, 21.2, 38.8
6.4, 60.8, 0.5, 0.7, 1.2
8.5, 1.4, 1.6, 0.8, 1.2
1.3, 0.4, 0.9, 0.9, 1
0.6, 0.8, 0.8, 1.1, 1.6
1
K3 43.567, 3008, 1.3, 2.2, 19.9, 37.2
6, 60.3, 0.5, 0.6, 1.2
8, 1.3, 1.5, 0.8, 1.2
1.2, 0.4, 0.9, 0.8, 0.9
0.5, 0.8, 0.7, 1.1, 1.5
0.9
K3 43.583, 3042, 1.3, 2, 18.7, 35.4
5.8, 59.7, 0.5, 0.6, 1.1
7.6, 1.2, 1.4, 0.7, 1.1
1.2, 0.4, 0.8, 0.8, 0.9
0.5, 0.8, 0.7, 1, 1.5
0.9
K3 43.6, 3077, 1.2, 1.9, 17.8, 33.5
5.5, 58.7, 0.5, 0.6, 1.1
7.3, 1.2, 1.3, 0.7, 1
1.1, 0.3, 0.8, 0.7, 0.8
0.5, 0.7, 0.7, 1, 1.4
0.8
K3 43.633, 3150, 1, 1.6, 15.8, 32
5.1, 56.2, 0.4, 0.5, 1
6.7, 1.1, 1.2, 0.6, 0.9
1, 0.3, 0.7, 0.7, 0.8
0.4, 0.7, 0.6, 0.9, 1.3
0.8
K3 43.667, 3240, 0.8, 1.3, 13.8, 28.9
4.6, 53.8, 0.4, 0.5, 0.8
6.1, 1, 1.1, 0.6, 0.9
0.9, 0.3, 0.7, 0.6, 0.7
0.4, 0.6, 0.6, 0.8, 1.2
0.7
K3 43.75, 3575, 0.7, 1.1, 10.1, 23.4
3.9, 46.3, 0.3, 0.4, 0.7

5.1, 0.8, 0.9, 0.5, 0.7
0.8, 0.2, 0.5, 0.5, 0.6
0.3, 0.5, 0.5, 0.7, 1
0.6
K3 43.833, 4129, 0.6, 0.9, 7.7, 18.4
3.3, 39.3, 0.3, 0.3, 0.6
4.4, 0.7, 0.8, 0.4, 0.6
0.6, 0.2, 0.5, 0.4, 0.5
0.3, 0.4, 0.4, 0.6, 0.8
0.5
K3 43.917, 4857, 0.5, 0.8, 6.5, 14.7
2.8, 33.9, 0.2, 0.3, 0.5
3.7, 0.6, 0.7, 0.3, 0.5
0.6, 0.2, 0.4, 0.4, 0.4
0.2, 0.4, 0.3, 0.5, 0.7
0.4
K3 44, 5625, 0.5, 0.7, 5.6, 11.6
2.5, 29.1, 0.2, 0.3, 0.5
3.3, 0.5, 0.6, 0.3, 0.5
0.5, 0.1, 0.3, 0.3, 0.4
0.2, 0.3, 0.3, 0.5, 0.6
0.4
K3 44.083, 6152, 0.4, 0.7, 5.1, 9.5
2.3, 24.8, 0.2, 0.2, 0.5
3, 0.5, 0.5, 0.3, 0.5
0.5, 0.1, 0.3, 0.3, 0.3
0.2, 0.3, 0.3, 0.4, 0.6
0.3
K3 44.167, 6679, 0.4, 0.7, 4.7, 7.7
2.2, 21.5, 0.2, 0.2, 0.5
2.8, 0.4, 0.5, 0.3, 0.4
0.4, 0.1, 0.3, 0.3, 0.3
0.2, 0.3, 0.2, 0.4, 0.5
0.3
K3 44.25, 6825, 0.4, 0.7, 4.4, 6.8
2.1, 18.3, 0.2, 0.2, 0.5
2.7, 0.4, 0.5, 0.3, 0.4
0.4, 0.1, 0.3, 0.3, 0.3
0.2, 0.3, 0.2, 0.4, 0.5
0.3
K3 44.333, 6972, 0.4, 0.7, 4.2, 6.5
2.1, 15.6, 0.2, 0.2, 0.5
2.7, 0.4, 0.5, 0.3, 0.4
0.4, 0.1, 0.3, 0.3, 0.3
0.2, 0.3, 0.2, 0.4, 0.5
0.3
K3 44.5, 6699, 0.4, 0.7, 4, 6.1
2.1, 13.5, 0.2, 0.2, 0.5
2.7, 0.4, 0.5, 0.3, 0.4
0.4, 0.1, 0.3, 0.3, 0.3
0.2, 0.3, 0.2, 0.4, 0.5
0.3
K3 44.667, 6097, 0.4, 0.7, 3.7, 5.5
1.9, 11.3, 0.2, 0.2, 0.4
2.5, 0.4, 0.5, 0.2, 0.4
0.4, 0.1, 0.3, 0.3, 0.3
0.2, 0.3, 0.2, 0.3, 0.5

0.3
K3 44.833, 5409, 0.4, 0.7, 3.5, 5.2
1.9, 9.7, 0.2, 0.2, 0.4
2.5, 0.4, 0.5, 0.2, 0.4
0.4, 0.1, 0.3, 0.3, 0.3
0.2, 0.3, 0.2, 0.3, 0.5
0.3
K3 45, 4721, 0.4, 0.7, 3.5, 4.9
1.9, 9.2, 0.2, 0.2, 0.4
2.5, 0.4, 0.5, 0.2, 0.4
0.4, 0.1, 0.3, 0.3, 0.3
0.2, 0.3, 0.2, 0.3, 0.5
0.3
K3 45.167, 4165, 0.4, 0.7, 3.5, 4.9
1.9, 8.6, 0.2, 0.2, 0.4
2.5, 0.4, 0.5, 0.2, 0.4
0.4, 0.1, 0.3, 0.3, 0.3
0.2, 0.3, 0.2, 0.3, 0.5
0.3
K3 45.333, 3609, 0.4, 0.7, 3.5, 4.9
1.9, 8.6, 0.2, 0.2, 0.4
2.5, 0.4, 0.5, 0.2, 0.4
0.4, 0.1, 0.3, 0.3, 0.3
0.2, 0.3, 0.2, 0.3, 0.5
0.3
K3 45.5, 3225, 0.4, 0.7, 3.5, 4.6
1.9, 8.1, 0.2, 0.2, 0.4
2.5, 0.4, 0.5, 0.2, 0.4
0.4, 0.1, 0.3, 0.3, 0.3
0.2, 0.3, 0.2, 0.3, 0.5
0.3
K3 45.667, 2840, 0.4, 0.7, 3.5, 4.6
1.9, 8.1, 0.2, 0.2, 0.4
2.5, 0.4, 0.5, 0.2, 0.4
0.4, 0.1, 0.3, 0.3, 0.3
0.2, 0.3, 0.2, 0.3, 0.5
0.3
K3 45.833, 2569, 0.4, 0.6, 3.5, 4.6
1.9, 8.1, 0.2, 0.2, 0.4
2.5, 0.4, 0.5, 0.2, 0.4
0.4, 0.1, 0.3, 0.3, 0.3
0.2, 0.3, 0.2, 0.3, 0.5
0.3
K3 46, 2298, 0.4, 0.6, 3.3, 4.6
1.8, 7.5, 0.1, 0.2, 0.4
2.4, 0.4, 0.4, 0.2, 0.4
0.4, 0.1, 0.3, 0.2, 0.3
0.2, 0.2, 0.2, 0.3, 0.5
0.3
K3 46.333, 1922, 0.4, 0.6, 3.3, 4.3
1.8, 7.5, 0.1, 0.2, 0.4
2.4, 0.4, 0.4, 0.2, 0.4
0.4, 0.1, 0.3, 0.2, 0.3
0.2, 0.2, 0.2, 0.3, 0.5
0.3
K3 46.667, 1682, 0.4, 0.6, 3.3, 4.3
1.8, 7.5, 0.1, 0.2, 0.4

2.4, 0.4, 0.4, 0.2, 0.4
0.4, 0.1, 0.3, 0.2, 0.3
0.2, 0.2, 0.2, 0.3, 0.5
0.3
K3 47, 1443, 0.4, 0.6, 3.3, 4.3
1.8, 7.5, 0.1, 0.2, 0.4
2.4, 0.4, 0.4, 0.2, 0.4
0.4, 0.1, 0.3, 0.2, 0.3
0.2, 0.2, 0.2, 0.3, 0.5
0.3
K3 48, 1048, 1.5, 2.4, 3.3, 4.3
1.8, 7.5, 0.1, 0.2, 0.4
2.4, 0.4, 0.4, 0.2, 0.4
0.4, 0.1, 0.3, 0.2, 0.3
0.2, 0.2, 0.2, 0.3, 0.5
0.3
K3 49.667, 530, 1.5, 2.4, 3.3, 17.2
1.8, 7.5, 0.1, 0.2, 0.4
2.4, 0.4, 0.4, 0.2, 0.4
0.4, 0.1, 0.3, 0.2, 0.3
0.2, 0.2, 0.2, 0.3, 0.5
0.3
K3 51.333, 253, 1.5, 2.5, 3.3, 17.2
1.8, 7.5, 0.1, 0.2, 0.4
2.4, 0.4, 0.4, 0.2, 0.4
0.4, 0.1, 0.3, 0.2, 0.3
0.2, 0.2, 0.2, 0.3, 0.5
0.3
K3 53, 569, 1.8, 2.7, 6.5, 17.2
3.6, 15.1, 0.3, 0.4, 0.8
4.8, 0.8, 0.9, 0.5, 0.8
0.8, 0.2, 0.5, 0.5, 0.5
0.3, 0.5, 0.4, 0.6, 0.9
0.5
K3 54.667, 1012, 1.9, 3.1, 9.8, 19.8
5.4, 22.6, 0.4, 0.6, 1.2
7.1, 1.2, 1.3, 0.7, 1.2
1.1, 0.3, 0.8, 0.7, 0.8
0.5, 0.7, 0.7, 1, 1.4
0.8
K3 56.333, 1532, 2, 3.5, 13, 23.4
7.2, 30.1, 0.6, 0.8, 1.6
9.5, 1.5, 1.7, 0.9, 1.5
1.5, 0.4, 1, 1, 1.1
0.6, 0.9, 0.9, 1.3, 1.9
1.1
K3 63, 3616, 3.2, 5.7, 16.3, 28.5
9, 37.7, 0.7, 1, 2.1
11.9, 1.9, 2.2, 1.1, 1.9
1.9, 0.5, 1.3, 1.2, 1.4
0.8, 1.2, 1.1, 1.6, 2.3
1.3
K3 64.667, 5606, 3.8, 6.1, 29.3, 36.5
16.2, 67.8, 1.3, 1.7, 3.7
21.4, 3.5, 3.9, 2, 3.5
3.4, 1, 2.3, 2.2, 2.4
1.4, 2.1, 2, 2.9, 4.2

2.4
K3 65.167, 6203, 3.9, 6.3, 32.5, 43.1
18, 75.4, 1.5, 1.9, 4.1
23.8, 3.8, 4.3, 2.3, 3.9
3.8, 1.1, 2.6, 2.4, 2.7
1.6, 2.4, 2.2, 3.2, 4.6
2.7
K3 65.667, 7210, 4, 6.5, 33.4, 44.3
18.5, 77.5, 1.5, 2, 4.2
24.5, 4, 4.5, 2.3, 4
3.9, 1.1, 2.6, 2.5, 2.8
1.6, 2.4, 2.2, 3.3, 4.8
2.7
K3 66.667, 9224, 4.3, 7, 34.4, 45.6
19, 79.7, 1.6, 2, 4.4
25.2, 4.1, 4.6, 2.4, 4.1
4, 1.2, 2.7, 2.5, 2.9
1.7, 2.5, 2.3, 3.4, 4.9
2.8
K3 66.833, 9608, 5.4, 8.7, 37.1, 49.3
20.6, 86.1, 1.7, 2.2, 4.7
27.2, 4.4, 5, 2.6, 4.4
4.3, 1.3, 2.9, 2.8, 3.1
1.8, 2.7, 2.5, 3.6, 5.3
3
K3 67, 9992, 7.2, 11.7, 44.5, 55.5
25.7, 88.3, 2.1, 2.8, 6.1
34, 5.5, 6.2, 3.2, 5.6
5.4, 1.6, 3.6, 3.4, 3.9
2.3, 3.4, 3.1, 4.5, 6.6
3.8
K3 67.067, 10160, 7.9, 12.4, 56.5, 66.7
34.4, 94.7, 2.8, 3.8, 8.4
45.5, 7.4, 8.3, 4.3, 7.7
7.3, 2.1, 4.9, 4.6, 5.2
3, 4.5, 4.2, 6, 8.9
5.1
K3 67.083, 10199, 8.1, 13.1, 63.9, 71.4
39.8, 99.9, 3.3, 4.4, 10
52.6, 8.5, 9.6, 5, 9
8.5, 2.4, 5.6, 5.3, 6
3.5, 5.3, 4.8, 7, 10.4
5.9
K3 67.133, 10316, 8.6, 14, 65.7, 72.8
41.1, 101.2, 3.4, 4.5, 10.4
54.4, 8.8, 9.9, 5.2, 9.4
8.8, 2.5, 5.8, 5.5, 6.2
3.6, 5.4, 5, 7.2, 10.7
6.1
K3 67.167, 10408, 9.8, 15.9, 72.2, 75.4
46.8, 107.7, 3.8, 5.2, 12.6
61.9, 10, 11.3, 5.9, 11
10.1, 2.9, 6.6, 6.3, 7
4.1, 6.2, 5.6, 8.2, 12.2
6.9
K3 67.183, 10455, 10.6, 17.1, 77.8, 82.8
54, 112, 4.4, 6.2, 15.5

71.4, 11.5, 13, 6.8, 13.3
12, 3.3, 7.7, 7.2, 8.1
4.8, 7.1, 6.5, 9.5, 14.2
8
K3 67.2, 10495, 11.3, 18.3, 83.3, 85.1
72.8, 114.1, 6, 8.6, 30.8
96.3, 15.7, 17.8, 9.2, 20.8
16.7, 4.5, 10.4, 9.8, 11
6.5, 9.7, 8.9, 12.1, 19.5
10.9
K3 67.217, 10534, 15.4, 24.9, 88.9, 89
102.7, 118.4, 9.8, 14, 37
138.7, 24.6, 28.8, 15, 30.2
27.1, 7.3, 16.9, 16, 17.6
10.5, 15.7, 14.4, 15.6, 31.6
17.7
K3 67.233, 10592, 24.9, 40.5, 99.8, 94
118.9, 124.9, 10.4, 14.5, 37.5
158.6, 26.7, 30.7, 16, 31.3
28.1, 7.7, 18, 17, 18.9
11.2, 16.8, 15.3, 19.4, 33.4
18.8
K3 67.25, 10626, 26.6, 43.1, 110.9, 100.2
121.1, 131.3, 10.5, 14.5, 35.9
161.3, 27, 30.9, 16.1, 31.2
28.2, 7.8, 18.2, 17.1, 19.1
11.3, 16.9, 15.5, 20, 33.6
19
K3 67.267, 10685, 26.8, 43.4, 124.6, 106.4
121.5, 139.9, 10.5, 14.4, 28.2
161.8, 27, 30.9, 16.1, 29.7
27.9, 7.8, 18.2, 17.1, 19.1
11.3, 16.9, 15.5, 20.2, 33.5
19
K3 67.283, 10731, 26.8, 43.4, 135.8, 115.1
120.4, 150.7, 10.3, 13.5, 21.9
160.1, 26.5, 30.3, 15.8, 24.3
26.3, 7.7, 17.8, 16.8, 18.8
11.1, 16.6, 15.1, 20.2, 32.4
18.6
K3 67.3, 10777, 26.2, 42.6, 139.7, 123.9
114.8, 163.6, 9.3, 11.3, 17.4
151.6, 24.4, 27.4, 14.3, 18.8
22, 6.9, 16.1, 15.2, 17.1
10, 15, 13.7, 19.8, 28.7
16.8
K3 67.317, 10834, 23.8, 38.5, 141.7, 136.4
97.9, 180.9, 7.6, 9.1, 15.4
128.6, 20.1, 22.3, 11.6, 15.5
17.6, 5.6, 13.1, 12.4, 14
8.2, 12.2, 11.2, 18.6, 23.3
13.7
K3 67.333, 10891, 19.4, 31.4, 143.5, 153.4
81.8, 198.1, 6.3, 7.6, 13.8
107.3, 16.7, 18.6, 9.7, 13.7
14.8, 4.7, 10.9, 10.3, 11.7
6.8, 10.2, 9.3, 16.8, 19.4

11.4

K3 67.35, 10942, 16.1, 26.2, 143.6, 158.4
70.8, 217.5, 5.3, 6.6, 12.7
92.5, 14.1, 15.5, 8.1, 12.3
12.8, 3.9, 9.1, 8.6, 9.8
5.7, 8.5, 7.8, 14.3, 16.4
9.5

K3 67.367, 10992, 13.4, 21.8, 143.6, 163.2
61.4, 228.2, 4.4, 5.6, 11.4
79.7, 11.8, 12.8, 6.7, 11
10.9, 3.2, 7.5, 7.1, 8.1
4.7, 7, 6.4, 12.5, 13.6
7.8

K3 67.383, 11060, 11.1, 18, 142.7, 165.6
54.1, 234.7, 3.8, 5, 10.5
70.3, 10.4, 11.3, 5.9, 9.9
9.8, 2.9, 6.6, 6.3, 7.2
4.1, 6.2, 5.6, 11, 12.1
6.9

K3 67.4, 11126, 9.8, 15.9, 141.8, 168
48.3, 239, 3.6, 4.7, 9.8
63.1, 9.6, 10.6, 5.5, 9.2
9.1, 2.7, 6.2, 5.8, 6.7
3.9, 5.8, 5.3, 9.7, 11.3
6.5

K3 67.417, 11190, 9.1, 14.8, 140, 169.2
43.6, 243.3, 3.3, 4.3, 9.1
57, 8.8, 9.7, 5, 8.5
8.4, 2.4, 5.7, 5.4, 6.1
3.5, 5.3, 4.8, 8.6, 10.4
5.9

K3 67.433, 11252, 8.4, 13.6, 137.3, 169.2
40.2, 245.4, 3.1, 4, 8.3
52.7, 8.2, 9.1, 4.7, 7.9
7.7, 2.3, 5.3, 5, 5.7
3.3, 5, 4.5, 7.6, 9.7
5.6

K3 67.45, 11336, 7.8, 12.7, 132.8, 169.3
37.4, 245.4, 2.9, 3.8, 7.7
49.1, 7.7, 8.6, 4.5, 7.3
7.3, 2.2, 5, 4.7, 5.4
3.1, 4.7, 4.3, 7, 9.1
5.3

K3 67.467, 11420, 7.4, 12, 124.7, 167.9
35.1, 247.6, 2.8, 3.6, 7.3
46.2, 7.3, 8.2, 4.3, 7
7, 2.1, 4.8, 4.5, 5.1
3, 4.5, 4.1, 6.5, 8.7
5

K3 67.483, 11505, 7.1, 11.5, 116.5, 166.6
33.2, 247.6, 2.7, 3.4, 6.7
43.7, 7, 7.8, 4.1, 6.4
6.5, 2, 4.6, 4.3, 4.9
2.9, 4.3, 3.9, 6.1, 8.3
4.8

K3 67.5, 11589, 6.8, 11, 109.1, 165.4
31.6, 247.6, 2.5, 3.2, 6.3

41.7, 6.6, 7.4, 3.9, 6.1
6.2, 1.9, 4.4, 4.1, 4.7
2.7, 4.1, 3.7, 5.7, 7.9
4.6
K3 67.517, 11698, 6.5, 10.5, 101.7, 162.8
29.7, 247.6, 2.4, 3, 6
39.2, 6.3, 7.1, 3.7, 5.8
5.9, 1.8, 4.2, 3.9, 4.4
2.6, 3.9, 3.5, 5.3, 7.5
4.3
K3 67.533, 11808, 6.1, 9.9, 96.1, 158.9
28.3, 245.4, 2.3, 2.9, 5.6
37.4, 6, 6.8, 3.6, 5.5
5.7, 1.7, 4, 3.8, 4.3
2.5, 3.7, 3.4, 5, 7.2
4.2
K3 67.55, 11919, 5.9, 9.6, 90.6, 155
26.7, 245.4, 2.2, 2.8, 5.3
35.4, 5.7, 6.5, 3.4, 5.2
5.4, 1.6, 3.8, 3.6, 4
2.4, 3.5, 3.2, 4.8, 6.8
4
K3 67.567, 12031, 5.6, 9.1, 85, 148.8
25.7, 243.3, 2.1, 2.7, 4.9
34, 5.5, 6.2, 3.2, 5
5.1, 1.6, 3.6, 3.4, 3.9
2.3, 3.4, 3.1, 4.6, 6.6
3.8
K3 67.583, 12170, 5.4, 8.7, 79.5, 141.4
24.2, 241.1, 2, 2.5, 4.7
32, 5.2, 5.8, 3, 4.6
4.8, 1.5, 3.4, 3.2, 3.6
2.1, 3.2, 2.9, 4.3, 6.2
3.6
K3 67.6, 12308, 5.1, 8.2, 74.8, 134
23.1, 239, 1.9, 2.4, 4.5
30.6, 4.9, 5.6, 2.9, 4.4
4.6, 1.4, 3.3, 3.1, 3.5
2, 3.1, 2.8, 4.1, 5.9
3.4
K3 67.633, 12598, 4.6, 7.5, 71.1, 127.9
22.1, 234.7, 1.8, 2.3, 4.2
29.2, 4.7, 5.3, 2.8, 4.2
4.4, 1.3, 3.1, 3, 3.3
2, 2.9, 2.7, 3.9, 5.6
3.3
K3 67.667, 12961, 3.9, 6.3, 63.2, 115.5
20.3, 225, 1.7, 2.1, 3.8
26.9, 4.3, 4.9, 2.6, 3.8
4, 1.2, 2.9, 2.7, 3.1
1.8, 2.7, 2.5, 3.6, 5.2
3
K3 67.75, 14298, 3.2, 5.2, 55.3, 93.4
18.5, 215.3, 1.5, 1.9, 3.4
24.5, 4, 4.5, 2.3, 3.4
3.6, 1.1, 2.6, 2.5, 2.8
1.6, 2.4, 2.2, 3.3, 4.7

2.7
K3 67.833, 16518, 2.7, 4.4, 40.4, 73.7
15.4, 185.2, 1.3, 1.5, 2.8
20.4, 3.3, 3.7, 1.9, 2.8
3, 0.9, 2.2, 2.1, 2.3
1.4, 2, 1.9, 2.8, 3.9
2.3
K3 67.917, 19428, 2.3, 3.7, 31, 58.8
13.2, 157.2, 1.1, 1.3, 2.3
17.4, 2.8, 3.1, 1.6, 2.4
2.5, 0.8, 1.8, 1.7, 1.9
1.1, 1.7, 1.6, 2.4, 3.2
1.9
K3 68, 22500, 2, 3.3, 26.1, 46.5
11.2, 135.6, 0.9, 1.2, 2.1
14.7, 2.3, 2.6, 1.4, 2.1
2.3, 0.7, 1.5, 1.4, 1.6
1, 1.4, 1.3, 2.1, 2.8
1.6
K3 68.083, 24608, 1.8, 3, 22.4, 38
10.2, 116.3, 0.8, 1, 2
13.4, 2.1, 2.4, 1.2, 2
2, 0.6, 1.4, 1.3, 1.5
0.9, 1.3, 1.2, 1.9, 2.5
1.4
K3 68.167, 26716, 1.7, 2.8, 20.5, 30.7
9.1, 99, 0.7, 0.9, 1.9
12, 1.9, 2.1, 1.1, 1.8
1.8, 0.5, 1.2, 1.2, 1.3
0.8, 1.2, 1.1, 1.7, 2.3
1.3
K3 68.25, 27302, 1.7, 2.8, 18.6, 27.1
8.6, 86.1, 0.7, 0.9, 1.9
11.3, 1.8, 2, 1, 1.8
1.7, 0.5, 1.2, 1.1, 1.2
0.7, 1.1, 1, 1.6, 2.1
1.2
K3 68.333, 27887, 1.7, 2.8, 17.7, 25.8
8.2, 73.2, 0.7, 0.9, 1.9
10.9, 1.8, 2, 1, 1.8
1.7, 0.5, 1.2, 1.1, 1.2
0.7, 1.1, 1, 1.5, 2.1
1.2
K3 68.5, 26794, 1.7, 2.8, 16.8, 24.6
8.2, 62.4, 0.7, 0.9, 1.9
10.9, 1.8, 2, 1, 1.8
1.7, 0.5, 1.2, 1.1, 1.2
0.7, 1.1, 1, 1.5, 2.1
1.2
K3 68.667, 24387, 1.6, 2.6, 15.8, 22.2
8.2, 53.8, 0.7, 0.9, 1.9
10.9, 1.8, 2, 1, 1.8
1.7, 0.5, 1.2, 1.1, 1.2
0.7, 1.1, 1, 1.5, 2.1
1.2
K3 68.833, 21635, 1.6, 2.6, 14.9, 20.9
7.7, 45.2, 0.6, 0.8, 1.8

```
     10.2, 1.6, 1.9, 1, 1.7
     1.6, 0.5, 1.1, 1, 1.2
     0.7, 1, 0.9, 1.4, 2
     1.1
K3   69, 18883, 1.6, 2.6, 14, 19.7
     7.7, 38.8, 0.6, 0.8, 1.8
     10.2, 1.6, 1.9, 1, 1.7
     1.6, 0.5, 1.1, 1, 1.2
     0.7, 1, 0.9, 1.4, 2
     1.1
K3   69.167, 16660, 1.6, 2.6, 13.9, 19.7
     7.7, 36.6, 0.6, 0.8, 1.8
     10.2, 1.6, 1.9, 1, 1.7
     1.6, 0.5, 1.1, 1, 1.2
     0.7, 1, 0.9, 1.4, 2
     1.1
K3   69.333, 14437, 1.6, 2.6, 13.9, 19.7
     7.7, 34.4, 0.6, 0.8, 1.8
     10.2, 1.6, 1.9, 1, 1.7
     1.6, 0.5, 1.1, 1, 1.2
     0.7, 1, 0.9, 1.4, 2
     1.1
K3   69.5, 12898, 1.6, 2.6, 13.9, 18.5
     7.7, 34.4, 0.6, 0.8, 1.8
     10.2, 1.6, 1.9, 1, 1.7
     1.6, 0.5, 1.1, 1, 1.2
     0.7, 1, 0.9, 1.4, 2
     1.1
K3   69.667, 11359, 1.6, 2.6, 13.9, 18.5
     7.7, 32.3, 0.6, 0.8, 1.8
     10.2, 1.6, 1.9, 1, 1.7
     1.6, 0.5, 1.1, 1, 1.2
     0.7, 1, 0.9, 1.4, 2
     1.1
K3   69.833, 10276, 1.6, 2.6, 13.9, 18.5
     7.7, 32.3, 0.6, 0.8, 1.8
     10.2, 1.6, 1.9, 1, 1.7
     1.6, 0.5, 1.1, 1, 1.2
     0.7, 1, 0.9, 1.4, 2
     1.1
K3   70, 9193, 1.5, 2.4, 13.9, 18.5
     7.7, 32.3, 0.6, 0.8, 1.8
     10.2, 1.6, 1.9, 1, 1.7
     1.6, 0.5, 1.1, 1, 1.2
     0.7, 1, 0.9, 1.4, 2
     1.1
K3   70.333, 7688, 1.5, 2.4, 13, 17.2
     7.2, 30.1, 0.6, 0.8, 1.6
     9.5, 1.5, 1.7, 0.9, 1.5
     1.5, 0.4, 1, 1, 1.1
     0.6, 0.9, 0.9, 1.3, 1.9
     1.1
K3   70.667, 6730, 1.5, 2.4, 13, 17.2
     7.2, 30.1, 0.6, 0.8, 1.6
     9.5, 1.5, 1.7, 0.9, 1.5
     1.5, 0.4, 1, 1, 1.1
     0.6, 0.9, 0.9, 1.3, 1.9
```

1.1
K3 71, 5771, 1.5, 2.4, 13, 17.2
7.2, 30.1, 0.6, 0.8, 1.6
9.5, 1.5, 1.7, 0.9, 1.5
1.5, 0.4, 1, 1, 1.1
0.6, 0.9, 0.9, 1.3, 1.9
1.1
K3 72, 4190, 1.5, 2.4, 13, 17.2
7.2, 30.1, 0.6, 0.8, 1.6
9.5, 1.5, 1.7, 0.9, 1.5
1.5, 0.4, 1, 1, 1.1
0.6, 0.9, 0.9, 1.3, 1.9
1.1
K3 73.667, 2118, 1.5, 2.4, 13, 17.2
7.2, 30.1, 0.6, 0.8, 1.6
9.5, 1.5, 1.7, 0.9, 1.5
1.5, 0.4, 1, 1, 1.1
0.6, 0.9, 0.9, 1.3, 1.9
1.1
K3 75.333, 746, 1.5, 2.4, 8.7, 17.2
4.8, 20.1, 0.4, 0.5, 1.1
6.3, 1, 1.2, 0.6, 1
1, 0.3, 0.7, 0.6, 0.7
0.4, 0.6, 0.6, 0.8, 1.2
0.7
K3 77, 498, 1.8, 2.6, 5.7, 17.2
3.1, 13.2, 0.3, 0.3, 0.7
4.2, 0.7, 0.8, 0.4, 0.7
0.7, 0.2, 0.4, 0.4, 0.5
0.3, 0.4, 0.4, 0.6, 0.8
0.5
K3 78.667, 886, 1.9, 3, 8.5, 19.2
4.7, 19.8, 0.4, 0.5, 1.1
6.2, 1, 1.1, 0.6, 1
1, 0.3, 0.7, 0.6, 0.7
0.4, 0.6, 0.6, 0.8, 1.2
0.7
K3 80.333, 1340, 2, 3.4, 11.4, 22.8
6.3, 26.4, 0.5, 0.7, 1.4
8.3, 1.3, 1.5, 0.8, 1.3
1.3, 0.4, 0.9, 0.8, 0.9
0.6, 0.8, 0.8, 1.1, 1.6
0.9
K3 87, 3164, 2.9, 5, 14.2, 27.7
7.9, 33, 0.6, 0.8, 1.8
10.4, 1.7, 1.9, 1, 1.7
1.6, 0.5, 1.1, 1.1, 1.2
0.7, 1, 1, 1.4, 2
1.2
K3 88.667, 4905, 3.3, 5.3, 25.6, 34.2
14.2, 59.3, 1.2, 1.5, 3.2
18.7, 3, 3.4, 1.8, 3
3, 0.9, 2, 1.9, 2.1
1.3, 1.9, 1.7, 2.5, 3.7
2.1
K3 89.167, 5427, 3.4, 5.4, 28.4, 37.7
15.7, 65.9, 1.3, 1.7, 3.6

20.8, 3.4, 3.8, 2, 3.4
3.3, 1, 2.2, 2.1, 2.4
1.4, 2.1, 1.9, 2.8, 4.1
2.3
K3 89.667, 6309, 3.5, 5.6, 29.3, 38.8
16.2, 67.8, 1.3, 1.7, 3.7
21.4, 3.5, 3.9, 2, 3.5
3.4, 1, 2.3, 2.2, 2.4
1.4, 2.1, 2, 2.9, 4.2
2.4
K3 90.667, 8071, 3.8, 6.1, 30.1, 39.9
16.6, 69.7, 1.4, 1.8, 3.8
22, 3.6, 4, 2.1, 3.6
3.5, 1, 2.4, 2.2, 2.5
1.5, 2.2, 2, 2.9, 4.3
2.5
K3 90.833, 8407, 4.7, 7.6, 32.5, 43.1
18, 75.4, 1.5, 1.9, 4.1
23.8, 3.8, 4.3, 2.3, 3.9
3.8, 1.1, 2.6, 2.4, 2.7
1.6, 2.4, 2.2, 3.2, 4.6
2.7
K3 91, 8743, 6.3, 10.2, 38.9, 48.5
22.5, 77.2, 1.8, 2.4, 5.4
29.7, 4.8, 5.4, 2.8, 4.9
4.7, 1.4, 3.2, 3, 3.4
2, 3, 2.7, 3.9, 5.8
3.3
K3 91.067, 8890, 6.8, 10.8, 49.5, 58.4
30.1, 82.9, 2.5, 3.3, 7.3
39.9, 6.4, 7.3, 3.8, 6.7
6.4, 1.8, 4.3, 4, 4.5
2.7, 4, 3.6, 5.3, 7.8
4.5
K3 91.083, 8924, 7, 11.4, 55.9, 62.6
34.8, 87.4, 2.9, 3.8, 8.8
46, 7.4, 8.4, 4.4, 7.9
7.4, 2.1, 4.9, 4.7, 5.2
3.1, 4.6, 4.2, 6.1, 9.1
5.2
K3 91.133, 9026, 7.5, 12.2, 57.5, 63.9
36, 88.5, 3, 4, 9.1
47.6, 7.7, 8.7, 4.5, 8.2
7.7, 2.2, 5.1, 4.8, 5.4
3.2, 4.7, 4.3, 6.3, 9.4
5.3
K3 91.167, 9107, 8.6, 13.9, 63.2, 66
40.9, 94.2, 3.4, 4.5, 11
54.1, 8.8, 9.9, 5.1, 9.6
8.8, 2.5, 5.8, 5.5, 6.2
3.6, 5.4, 4.9, 7.2, 10.7
6.1
K3 91.183, 9148, 9.3, 14.9, 68.1, 72.4
47.2, 98, 3.9, 5.4, 13.5
62.5, 10.1, 11.4, 5.9, 11.7
10.5, 2.9, 6.7, 6.3, 7.1
4.2, 6.2, 5.7, 8.3, 12.4

7
K3 91.2, 9183, 9.9, 16, 72.9, 74.1
63.7, 99.8, 5.3, 7.5, 26.9
84.3, 13.7, 15.5, 8.1, 18.2
14.6, 3.9, 9.1, 8.6, 9.7
5.7, 8.5, 7.8, 10.6, 17.1
9.5
K3 91.217, 9218, 13.5, 21.8, 77.8, 77.9
89.9, 103.6, 8.6, 12.2, 32.4
121.4, 21.5, 25.2, 13.1, 26.4
23.7, 6.4, 14.8, 14, 15.4
9.2, 13.8, 12.6, 13.6, 27.7
15.5
K3 91.233, 9268, 21.8, 35.4, 87.4, 82.2
104, 109.3, 9.1, 12.7, 32.8
138.8, 23.3, 26.8, 14, 27.4
24.6, 6.8, 15.8, 14.9, 16.6
9.8, 14.7, 13.4, 17, 29.2
16.5
K3 91.25, 9298, 23.2, 37.7, 97, 87.6
106, 114.9, 9.2, 12.7, 31.4
141.2, 23.6, 27.1, 14.1, 27.3
24.7, 6.8, 15.9, 15, 16.7
9.9, 14.8, 13.5, 17.5, 29.4
16.6
K3 91.267, 9350, 23.4, 38, 109, 93.1
106.3, 122.5, 9.2, 12.6, 24.7
141.5, 23.6, 27.1, 14.1, 26
24.4, 6.8, 15.9, 15, 16.7
9.9, 14.8, 13.5, 17.7, 29.3
16.6
K3 91.283, 9390, 23.4, 38, 118.9, 100.8
105.4, 131.9, 9, 11.8, 19.2
140.1, 23.2, 26.5, 13.8, 21.3
23, 6.7, 15.6, 14.7, 16.4
9.7, 14.5, 13.3, 17.7, 28.4
16.3
K3 91.3, 9430, 23, 37.2, 122.3, 108.4
100.4, 143.2, 8.2, 9.9, 15.3
132.6, 21.3, 24, 12.5, 16.4
19.2, 6.1, 14.1, 13.3, 15
8.8, 13.1, 12, 17.4, 25.1
14.7
K3 91.317, 9480, 20.8, 33.7, 124, 119.4
85.7, 158.2, 6.7, 7.9, 13.4
112.5, 17.6, 19.6, 10.2, 13.6
15.4, 4.9, 11.5, 10.8, 12.3
7.2, 10.7, 9.8, 16.3, 20.4
12
K3 91.333, 9530, 16.9, 27.5, 125.6, 134.3
71.5, 173.3, 5.5, 6.7, 12.1
93.9, 14.7, 16.3, 8.5, 12
12.9, 4.1, 9.6, 9, 10.2
6, 8.9, 8.1, 14.7, 17
10
K3 91.35, 9574, 14.1, 22.9, 125.6, 138.6
62, 190.3, 4.6, 5.7, 11.1

80.9, 12.3, 13.6, 7.1, 10.7
11.2, 3.4, 8, 7.5, 8.6
5, 7.4, 6.8, 12.5, 14.3
8.3
K3 91.367, 9618, 11.8, 19.1, 125.7, 142.8
53.8, 199.7, 3.8, 4.9, 10
69.8, 10.3, 11.2, 5.8, 9.6
9.6, 2.8, 6.6, 6.2, 7.1
4.1, 6.1, 5.6, 10.9, 11.9
6.9
K3 91.383, 9677, 9.7, 15.7, 124.9, 144.9
47.4, 205.3, 3.4, 4.4, 9.2
61.5, 9.1, 9.9, 5.1, 8.7
8.5, 2.5, 5.8, 5.5, 6.3
3.6, 5.4, 4.9, 9.6, 10.6
6.1
K3 91.4, 9736, 8.6, 13.9, 124.1, 147
42.3, 209.1, 3.1, 4.1, 8.6
55.2, 8.4, 9.2, 4.8, 8.1
8, 2.3, 5.4, 5.1, 5.8
3.4, 5, 4.6, 8.5, 9.9
5.7
K3 91.417, 9791, 8, 13, 122.5, 148.1
38.1, 212.9, 2.9, 3.8, 7.9
49.9, 7.7, 8.5, 4.4, 7.5
7.3, 2.1, 5, 4.7, 5.3
3.1, 4.6, 4.2, 7.5, 9.1
5.2
K3 91.433, 9846, 7.3, 11.9, 120.1, 148.1
35.2, 214.8, 2.7, 3.5, 7.3
46.1, 7.2, 7.9, 4.1, 6.9
6.8, 2, 4.7, 4.4, 5
2.9, 4.3, 4, 6.7, 8.4
4.9
K3 91.45, 9919, 6.9, 11.1, 116.2, 148
32.7, 214.8, 2.6, 3.3, 6.7
43, 6.7, 7.5, 3.9, 6.4
6.4, 1.9, 4.4, 4.2, 4.7
2.7, 4.1, 3.7, 6.1, 8
4.6
K3 91.467, 9993, 6.5, 10.5, 109.1, 146.9
30.7, 216.7, 2.4, 3.1, 6.4
40.4, 6.4, 7.2, 3.7, 6.1
6.1, 1.8, 4.2, 4, 4.5
2.6, 3.9, 3.6, 5.7, 7.6
4.4
K3 91.483, 10067, 6.2, 10.1, 101.9, 145.8
29, 216.7, 2.3, 2.9, 5.9
38.2, 6.1, 6.8, 3.6, 5.6
5.7, 1.7, 4, 3.8, 4.3
2.5, 3.7, 3.4, 5.3, 7.3
4.2
K3 91.5, 10141, 5.9, 9.6, 95.4, 144.7
27.7, 216.7, 2.2, 2.8, 5.5
36.5, 5.8, 6.5, 3.4, 5.3
5.4, 1.6, 3.8, 3.6, 4.1
2.4, 3.6, 3.3, 5, 6.9

4
K3 91.517, 10236, 5.6, 9.2, 89, 142.4
26, 216.7, 2.1, 2.7, 5.2
34.3, 5.5, 6.2, 3.2, 5.1
5.2, 1.6, 3.6, 3.4, 3.9
2.3, 3.4, 3.1, 4.7, 6.6
3.8
K3 91.533, 10332, 5.4, 8.7, 84.1, 139
24.7, 214.8, 2, 2.6, 4.9
32.7, 5.3, 6, 3.1, 4.8
5, 1.5, 3.5, 3.3, 3.7
2.2, 3.3, 3, 4.4, 6.3
3.7
K3 91.55, 10429, 5.2, 8.4, 79.2, 135.6
23.4, 214.8, 1.9, 2.4, 4.6
30.9, 5, 5.6, 2.9, 4.5
4.7, 1.4, 3.3, 3.1, 3.5
2.1, 3.1, 2.8, 4.2, 6
3.5
K3 91.567, 10527, 4.9, 7.9, 74.4, 130.2
22.5, 212.9, 1.8, 2.3, 4.3
29.7, 4.8, 5.4, 2.8, 4.3
4.5, 1.4, 3.2, 3, 3.4
2, 3, 2.7, 4, 5.7
3.3
K3 91.583, 10648, 4.7, 7.6, 69.5, 123.7
21.1, 211, 1.7, 2.2, 4.1
28, 4.5, 5.1, 2.7, 4
4.2, 1.3, 3, 2.8, 3.2
1.9, 2.8, 2.6, 3.8, 5.4
3.1
K3 91.6, 10770, 4.4, 7.2, 65.5, 117.3
20.2, 209.1, 1.7, 2.1, 3.9
26.8, 4.3, 4.9, 2.5, 3.9
4, 1.2, 2.9, 2.7, 3
1.8, 2.7, 2.4, 3.6, 5.2
3
K3 91.633, 11024, 4, 6.6, 62.2, 111.9
19.3, 205.3, 1.6, 2, 3.7
25.6, 4.1, 4.7, 2.4, 3.7
3.8, 1.2, 2.7, 2.6, 2.9
1.7, 2.6, 2.3, 3.4, 4.9
2.9
K3 91.667, 11341, 3.4, 5.5, 55.3, 101.1
17.8, 196.9, 1.5, 1.8, 3.3
23.5, 3.8, 4.3, 2.2, 3.3
3.5, 1.1, 2.5, 2.4, 2.7
1.6, 2.3, 2.1, 3.1, 4.5
2.6
K3 91.75, 12511, 2.8, 4.6, 48.4, 81.7
16.2, 188.4, 1.3, 1.6, 3
21.4, 3.5, 3.9, 2, 3
3.2, 1, 2.3, 2.2, 2.4
1.4, 2.1, 2, 2.9, 4.1
2.4
K3 91.833, 14453, 2.4, 3.8, 35.3, 64.5
13.5, 162, 1.1, 1.4, 2.5

17.8, 2.9, 3.3, 1.7, 2.5
2.6, 0.8, 1.9, 1.8, 2
1.2, 1.8, 1.6, 2.4, 3.4
2
K3 91.917, 16999, 2, 3.2, 27.1, 51.5
11.6, 137.5, 0.9, 1.1, 2
15.3, 2.4, 2.7, 1.4, 2.1
2.2, 0.7, 1.6, 1.5, 1.7
1, 1.5, 1.4, 2.1, 2.8
1.7
K3 92, 19688, 1.8, 2.9, 22.9, 40.7
9.8, 118.7, 0.8, 1, 1.8
12.9, 2, 2.3, 1.2, 1.9
2, 0.6, 1.3, 1.3, 1.4
0.8, 1.2, 1.1, 1.8, 2.4
1.4
K3 92.083, 21532, 1.6, 2.6, 19.6, 33.2
8.9, 101.7, 0.7, 0.9, 1.7
11.7, 1.8, 2.1, 1.1, 1.7
1.8, 0.5, 1.2, 1.1, 1.3
0.8, 1.1, 1, 1.6, 2.2
1.3
K3 92.167, 23376, 1.5, 2.4, 17.9, 26.9
8, 86.7, 0.6, 0.8, 1.6
10.5, 1.7, 1.8, 1, 1.6
1.6, 0.5, 1.1, 1, 1.2
0.7, 1, 0.9, 1.5, 2
1.1
K3 92.25, 23889, 1.5, 2.4, 16.3, 23.7
7.5, 75.4, 0.6, 0.8, 1.6
9.9, 1.6, 1.7, 0.9, 1.5
1.5, 0.4, 1, 1, 1.1
0.6, 0.9, 0.9, 1.4, 1.9
1.1
K3 92.333, 24401, 1.5, 2.4, 15.5, 22.6
7.2, 64.1, 0.6, 0.8, 1.6
9.5, 1.5, 1.7, 0.9, 1.5
1.5, 0.4, 1, 1, 1.1
0.6, 0.9, 0.9, 1.3, 1.9
1.1
K3 92.5, 23445, 1.5, 2.4, 14.7, 21.5
7.2, 54.6, 0.6, 0.8, 1.6
9.5, 1.5, 1.7, 0.9, 1.5
1.5, 0.4, 1, 1, 1.1
0.6, 0.9, 0.9, 1.3, 1.9
1.1
K3 92.667, 21338, 1.4, 2.3, 13.8, 19.4
7.2, 47.1, 0.6, 0.8, 1.6
9.5, 1.5, 1.7, 0.9, 1.5
1.5, 0.4, 1, 1, 1.1
0.6, 0.9, 0.9, 1.3, 1.9
1.1
K3 92.833, 18930, 1.4, 2.3, 13, 18.3
6.7, 39.6, 0.6, 0.7, 1.5
8.9, 1.4, 1.6, 0.8, 1.4
1.4, 0.4, 1, 0.9, 1
0.6, 0.9, 0.8, 1.2, 1.7

```
    1
K3  93, 16522, 1.4, 2.3, 12.2, 17.2
    6.7, 33.9, 0.6, 0.7, 1.5
    8.9, 1.4, 1.6, 0.8, 1.4
    1.4, 0.4, 1, 0.9, 1
    0.6, 0.9, 0.8, 1.2, 1.7
    1
K3  93.167, 14578, 1.4, 2.3, 12.2, 17.2
    6.7, 32, 0.6, 0.7, 1.5
    8.9, 1.4, 1.6, 0.8, 1.4
    1.4, 0.4, 1, 0.9, 1
    0.6, 0.9, 0.8, 1.2, 1.7
    1
K3  93.333, 12633, 1.4, 2.3, 12.2, 17.2
    6.7, 30.1, 0.6, 0.7, 1.5
    8.9, 1.4, 1.6, 0.8, 1.4
    1.4, 0.4, 1, 0.9, 1
    0.6, 0.9, 0.8, 1.2, 1.7
    1
K3  93.5, 11286, 1.4, 2.3, 12.2, 16.2
    6.7, 30.1, 0.6, 0.7, 1.5
    8.9, 1.4, 1.6, 0.8, 1.4
    1.4, 0.4, 1, 0.9, 1
    0.6, 0.9, 0.8, 1.2, 1.7
    1
K3  93.667, 9939, 1.4, 2.3, 12.2, 16.2
    6.7, 28.3, 0.6, 0.7, 1.5
    8.9, 1.4, 1.6, 0.8, 1.4
    1.4, 0.4, 1, 0.9, 1
    0.6, 0.9, 0.8, 1.2, 1.7
    1
K3  93.833, 8992, 1.4, 2.3, 12.2, 16.2
    6.7, 28.3, 0.6, 0.7, 1.5
    8.9, 1.4, 1.6, 0.8, 1.4
    1.4, 0.4, 1, 0.9, 1
    0.6, 0.9, 0.8, 1.2, 1.7
    1
K3  94, 8044, 1.3, 2.1, 12.2, 16.2
    6.7, 28.3, 0.6, 0.7, 1.5
    8.9, 1.4, 1.6, 0.8, 1.4
    1.4, 0.4, 1, 0.9, 1
    0.6, 0.9, 0.8, 1.2, 1.7
    1
K3  94.333, 6727, 1.3, 2.1, 11.4, 15.1
    6.3, 26.4, 0.5, 0.7, 1.4
    8.3, 1.3, 1.5, 0.8, 1.3
    1.3, 0.4, 0.9, 0.8, 0.9
    0.6, 0.8, 0.8, 1.1, 1.6
    0.9
K3  94.667, 5888, 1.3, 2.1, 11.4, 15.1
    6.3, 26.4, 0.5, 0.7, 1.4
    8.3, 1.3, 1.5, 0.8, 1.3
    1.3, 0.4, 0.9, 0.8, 0.9
    0.6, 0.8, 0.8, 1.1, 1.6
    0.9
K3  95, 5049, 1.3, 2.1, 11.4, 15.1
    6.3, 26.4, 0.5, 0.7, 1.4
```

8.3, 1.3, 1.5, 0.8, 1.3
1.3, 0.4, 0.9, 0.8, 0.9
0.6, 0.8, 0.8, 1.1, 1.6
0.9
K3 96, 3666, 3.8, 6.1, 11.4, 15.1
6.3, 26.4, 0.5, 0.7, 1.4
8.3, 1.3, 1.5, 0.8, 1.3
1.3, 0.4, 0.9, 0.8, 0.9
0.6, 0.8, 0.8, 1.1, 1.6
0.9
K3 97.667, 1853, 3.8, 6.1, 11.4, 43.1
6.3, 26.4, 0.5, 0.7, 1.4
8.3, 1.3, 1.5, 0.8, 1.3
1.3, 0.4, 0.9, 0.8, 0.9
0.6, 0.8, 0.8, 1.1, 1.6
0.9
K3 99.333, 653, 3.8, 6.1, 8.1, 43.1
4.5, 18.8, 0.4, 0.5, 1
5.9, 1, 1.1, 0.6, 1
0.9, 0.3, 0.6, 0.6, 0.7
0.4, 0.6, 0.5, 0.8, 1.2
0.7
K3 101, 1423, 4, 6.5, 16.3, 43.1
9, 37.7, 0.7, 1, 2.1
11.9, 1.9, 2.2, 1.1, 1.9
1.9, 0.5, 1.3, 1.2, 1.4
0.8, 1.2, 1.1, 1.6, 2.3
1.3
K3 102.667, 2530, 4.2, 7, 24.4, 43.1
13.5, 56.5, 1.1, 1.4, 3.1
17.8, 2.9, 3.3, 1.7, 2.9
2.8, 0.8, 1.9, 1.8, 2
1.2, 1.8, 1.6, 2.4, 3.5
2
K3 104.333, 3829, 4.5, 7.6, 32.5, 43.1
18, 75.4, 1.5, 1.9, 4.1
23.8, 3.8, 4.3, 2.3, 3.9
3.8, 1.1, 2.6, 2.4, 2.7
1.6, 2.4, 2.2, 3.2, 4.6
2.7
K3 111, 9040, 8.9, 14.2, 40.6, 47.2
22.5, 94.2, 1.8, 2.4, 5.2
29.7, 4.8, 5.4, 2.8, 4.8
4.7, 1.4, 3.2, 3, 3.4
2, 3, 2.7, 4, 5.8
3.3
K3 112.667, 14015, 9.4, 15.3, 73.1, 54.3
40.5, 169.6, 3.3, 4.3, 9.3
53.5, 8.7, 9.8, 5.1, 8.7
8.4, 2.5, 5.7, 5.4, 6.1
3.6, 5.3, 4.9, 7.1, 10.5
6
K3 113.167, 15507, 9.6, 15.7, 81.3, 63.9
45, 188.4, 3.7, 4.8, 10.3
59.5, 9.6, 10.9, 5.7, 9.6
9.4, 2.7, 6.4, 6, 6.8
4, 5.9, 5.4, 7.9, 11.6

6.7
K3 113.667, 18025, 9.9, 16.1, 83.6, 80.2
46.3, 193.8, 3.8, 5, 10.6
61.2, 9.9, 11.2, 5.8, 9.9
9.7, 2.8, 6.6, 6.2, 7
4.1, 6.1, 5.6, 8.2, 12
6.9
K3 114.667, 23060, 10.8, 17.4, 85.9, 107.8
47.6, 199.2, 3.9, 5.1, 10.9
62.9, 10.2, 11.5, 6, 10.2
9.9, 2.9, 6.7, 6.4, 7.2
4.2, 6.3, 5.7, 8.4, 12.3
7
K3 114.833, 24020, 13.4, 21.8, 92.9, 110.8
51.4, 215.3, 4.2, 5.5, 11.8
68, 11, 12.4, 6.5, 11
10.7, 3.1, 7.3, 6.9, 7.7
4.5, 6.8, 6.2, 9.1, 13.3
7.6
K3 115, 24979, 18, 29.2, 111.2, 113.9
64.3, 220.7, 5.3, 6.9, 15.3
85, 13.7, 15.5, 8.1, 14
13.4, 3.9, 9.1, 8.6, 9.7
5.7, 8.5, 7.8, 11.2, 16.6
9.5
K3 115.067, 25399, 19.6, 31, 141.3, 123.2
86.1, 236.8, 7.1, 9.4, 21
113.9, 18.4, 20.8, 10.8, 19.1
18.2, 5.3, 12.2, 11.5, 13
7.6, 11.4, 10.4, 15.1, 22.3
12.8
K3 115.083, 25497, 20.1, 32.1, 159.8, 138.7
99.5, 249.8, 8.2, 10.9, 25
131.5, 21.3, 24, 12.5, 22.5
21.2, 6.1, 14.1, 13.3, 15
8.8, 13.1, 12, 17.4, 25.9
14.7
K3 115.133, 25789, 21.5, 34.9, 164.4, 166.8
102.8, 253, 8.4, 11.3, 26
136, 22, 24.8, 12.9, 23.4
22, 6.3, 14.6, 13.8, 15.5
9.1, 13.6, 12.4, 18, 26.8
15.2
K3 115.167, 26021, 24.5, 39.7, 180.5, 177.3
117, 269.1, 9.6, 13, 31.5
154.7, 25, 28.2, 14.7, 27.5
25.2, 7.1, 16.6, 15.7, 17.6
10.3, 15.4, 14.1, 20.5, 30.5
17.3
K3 115.183, 26137, 26.4, 42.7, 194.5, 180.5
135, 279.9, 11.1, 15.5, 38.7
178.5, 28.8, 32.6, 17, 33.3
30, 8.2, 19.2, 18.1, 20.3
11.9, 17.8, 16.3, 23.7, 35.6
20
K3 115.2, 26237, 28.2, 45.8, 208.3, 188.5
181.9, 285.3, 15.1, 21.5, 76.9

240.8, 39.2, 44.4, 23.1, 51.9
41.8, 11.2, 26.1, 24.6, 27.6
16.2, 24.3, 22.2, 30.2, 48.8
27.2
K3 115.217, 26336, 38.4, 62.3, 222.2, 206.9
256.8, 296, 24.5, 34.9, 92.6
353.8, 61.4, 72, 37.5, 75.5
67.8, 18.2, 42.3, 39.9, 44
26.4, 39.3, 36, 38.9, 79.1
44.2
K3 115.233, 26480, 62.4, 101.2, 249.6, 214.3
297.3, 312.2, 26.1, 36.2, 93.7
427.6, 66.7, 76.7, 39.9, 78.2
70.2, 19.4, 45.1, 42.5, 47.4
28.1, 41.9, 38.3, 48.6, 83.5
47
K3 115.25, 26565, 66.4, 107.7, 277.2, 222.6
302.7, 328.3, 26.3, 36.3, 89.7
475.3, 67.4, 77.3, 40.2, 78
70.5, 19.5, 45.4, 42.8, 47.8
28.3, 42.2, 38.6, 50, 84.1
47.4
K3 115.267, 26713, 66.9, 108.6, 311.5, 234.9
303.7, 349.9, 26.3, 35.9, 70.5
522.4, 67.5, 77.3, 40.2, 74.3
69.7, 19.5, 45.4, 42.8, 47.8
28.3, 42.2, 38.6, 50.5, 83.8
47.4
K3 115.283, 26828, 66.9, 108.6, 339.6, 250.4
301.1, 376.8, 25.8, 33.8, 54.8
528.3, 66.3, 75.7, 39.4, 60.8
65.7, 19.1, 44.5, 42, 46.9
27.7, 41.4, 37.9, 50.5, 81.1
46.5
K3 115.3, 26942, 65.6, 106.4, 349.3, 266.1
287, 409.1, 23.3, 28.3, 43.6
511.9, 60.9, 68.6, 35.7, 46.9
55, 17.3, 40.3, 38, 42.8
25.1, 37.5, 34.3, 49.6, 71.8
42.1
K3 115.317, 27085, 59.4, 96.4, 354.2, 287.9
244.9, 452.1, 19, 22.6, 38.4
456.4, 50.2, 55.9, 29.1, 38.8
44, 14.1, 32.8, 31, 35.1
20.4, 30.5, 27.9, 46.5, 58.2
34.3
K3 115.333, 27228, 48.4, 78.5, 358.8, 309.8
204.4, 495.2, 15.8, 19, 34.5
403.2, 41.9, 46.6, 24.2, 34.3
37, 11.8, 27.4, 25.8, 29.2
17, 25.4, 23.3, 42.1, 48.6
28.6
K3 115.35, 27355, 40.3, 65.4, 358.9, 341.1
177.1, 543.6, 13.2, 16.4, 31.6
362.2, 35.3, 38.8, 20.2, 30.7
31.9, 9.8, 22.8, 21.5, 24.5
14.2, 21.2, 19.4, 35.8, 40.9

23.8
K3 115.367, 27481, 33.6, 54.5, 359, 383.6
153.6, 570.6, 10.9, 14.1, 28.5
325.4, 29.5, 32, 16.6, 27.5
27.3, 8.1, 18.8, 17.7, 20.3
11.7, 17.5, 16, 31.2, 34.1
19.6
K3 115.383, 27649, 27.7, 44.9, 356.8, 395.9
135.3, 586.7, 9.6, 12.6, 26.2
283.6, 26, 28.2, 14.7, 24.8
24.4, 7.1, 16.6, 15.7, 18
10.3, 15.4, 14.1, 27.5, 30.2
17.3
K3 115.4, 27816, 24.5, 39.7, 354.5, 408
120.8, 597.5, 9, 11.7, 24.5
236.7, 24, 26.4, 13.7, 23.1
22.8, 6.7, 15.5, 14.6, 16.7
9.7, 14.4, 13.2, 24.3, 28.2
16.2
K3 115.417, 27974, 22.8, 37.1, 350, 414
108.9, 608.2, 8.2, 10.8, 22.7
196.5, 21.9, 24.2, 12.6, 21.3
20.9, 6.1, 14.2, 13.4, 15.3
8.9, 13.2, 12.1, 21.5, 25.9
14.9
K3 115.433, 28131, 21, 34, 343.2, 420
100.6, 613.6, 7.7, 9.9, 20.9
162.8, 20.4, 22.7, 11.8, 19.7
19.3, 5.7, 13.3, 12.6, 14.3
8.3, 12.4, 11.3, 19.1, 24.1
13.9
K3 115.45, 28341, 19.6, 31.8, 331.9, 423
93.5, 613.6, 7.3, 9.4, 19.1
129.8, 19.2, 21.4, 11.2, 18.3
18.2, 5.4, 12.6, 11.9, 13.4
7.8, 11.7, 10.7, 17.5, 22.8
13.1
K3 115.467, 28551, 18.5, 30.1, 311.6, 423
87.7, 619, 7, 9, 18.2
115.5, 18.3, 20.5, 10.7, 17.5
17.4, 5.2, 12, 11.4, 12.8
7.5, 11.2, 10.2, 16.2, 21.8
12.6
K3 115.483, 28762, 17.7, 28.8, 291.2, 422.9
82.9, 619, 6.7, 8.4, 16.7
109.3, 17.4, 19.6, 10.2, 16.1
16.4, 4.9, 11.5, 10.8, 12.2
7.2, 10.7, 9.8, 15.2, 20.7
12
K3 115.5, 28973, 16.9, 27.5, 272.6, 419.8
79.1, 619, 6.3, 8, 15.8
104.2, 16.6, 18.6, 9.7, 15.3
15.5, 4.7, 10.9, 10.3, 11.6
6.8, 10.2, 9.3, 14.3, 19.7
11.4
K3 115.517, 29246, 16.1, 26.2, 254.3, 416.6
74.2, 619, 6, 7.6, 15

98, 15.7, 17.7, 9.2, 14.4
14.7, 4.5, 10.4, 9.8, 11
6.5, 9.7, 8.8, 13.3, 18.7
10.9

K3 115.533, 29519, 15.3, 24.9, 240.3, 413.4
70.7, 613.6, 5.8, 7.3, 14.1
93.5, 15.1, 17.1, 8.9, 13.8
14.2, 4.3, 10, 9.5, 10.6
6.2, 9.3, 8.5, 12.6, 18.1
10.5

K3 115.55, 29798, 14.8, 24, 226.4, 407
66.8, 613.6, 5.5, 6.9, 13.2
88.4, 14.3, 16.1, 8.4, 12.9
13.4, 4.1, 9.5, 8.9, 10.1
5.9, 8.8, 8.1, 11.9, 17.1
9.9

K3 115.567, 30077, 14, 22.7, 212.5, 397.1
64.3, 608.2, 5.3, 6.6, 12.3
85, 13.7, 15.5, 8.1, 12.4
12.9, 3.9, 9.1, 8.6, 9.7
5.7, 8.5, 7.8, 11.5, 16.4
9.5

K3 115.583, 30424, 13.4, 21.8, 198.6, 387.5
60.4, 602.9, 5, 6.2, 11.7
79.9, 12.9, 14.6, 7.6, 11.6
12.1, 3.7, 8.6, 8.1, 9.1
5.3, 8, 7.3, 10.8, 15.4
8.9

K3 115.6, 30770, 12.6, 20.5, 187, 372
57.8, 597.5, 4.8, 5.9, 11.1
76.5, 12.4, 14, 7.3, 11
11.5, 3.5, 8.2, 7.7, 8.7
5.1, 7.6, 7, 10.3, 14.7
8.6

K3 115.633, 31496, 11.6, 18.7, 177.6, 353.5
55.3, 586.7, 4.5, 5.7, 10.5
73.1, 11.8, 13.3, 6.9, 10.5
11, 3.4, 7.8, 7.4, 8.3
4.9, 7.3, 6.7, 9.8, 14.1
8.2

K3 115.667, 32403, 9.7, 15.7, 157.9, 335
50.8, 562.5, 4.2, 5.2, 9.5
67.1, 10.9, 12.3, 6.4, 9.5
10.1, 3.1, 7.2, 6.8, 7.6
4.5, 6.7, 6.1, 9, 12.9
7.5

K3 115.75, 35746, 8.1, 13.1, 138.2, 319.7
46.3, 538.3, 3.8, 4.7, 8.5
61.2, 9.9, 11.2, 5.8, 8.5
9.1, 2.8, 6.6, 6.2, 7
4.1, 6.1, 5.6, 8.2, 11.8
6.9

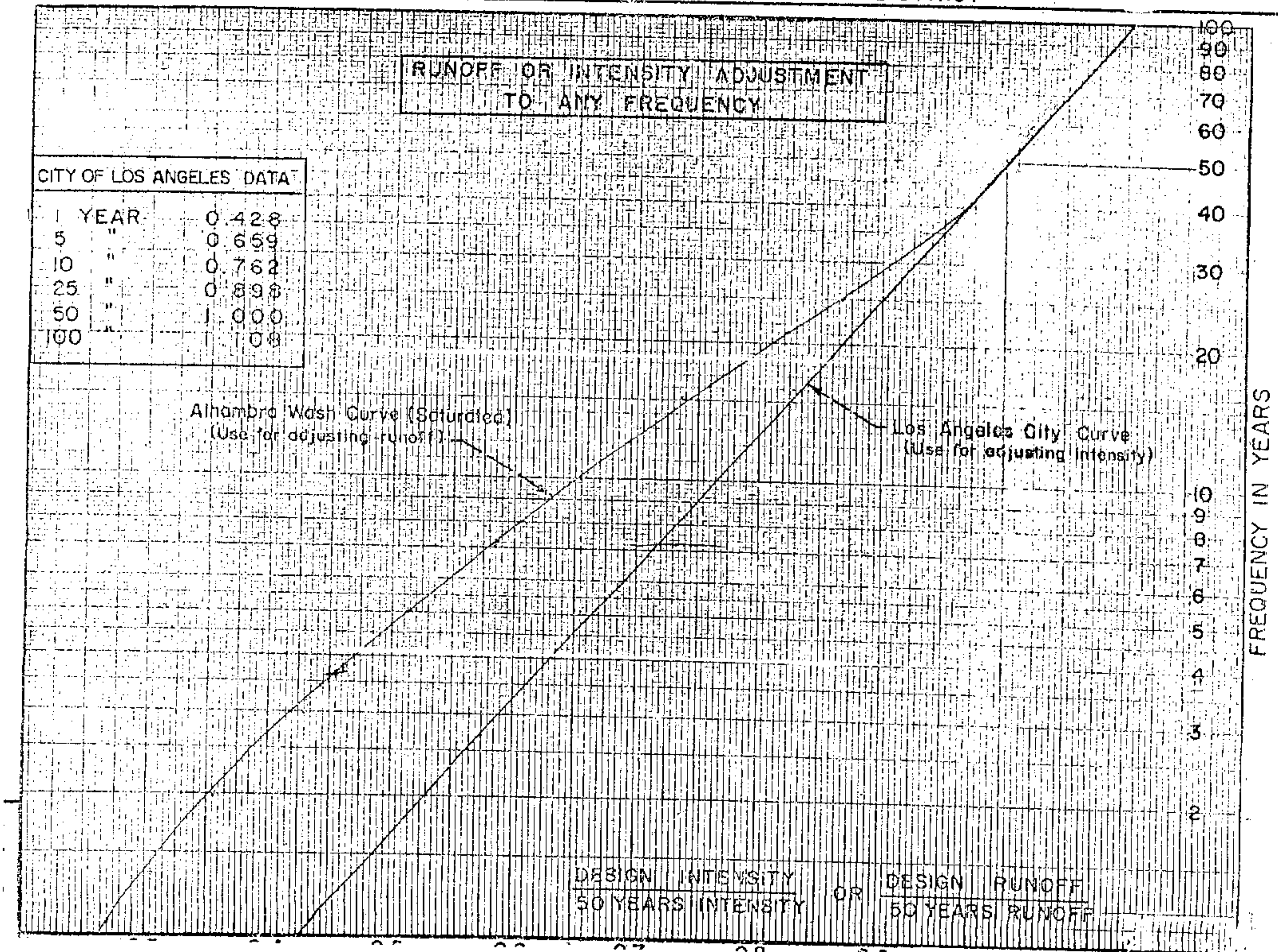
K3 115.833, 41294, 6.7, 10.9, 100.9, 288.9
38.6, 462.9, 3.2, 3.9, 7
51, 8.2, 9.3, 4.8, 7
7.5, 2.4, 5.5, 5.2, 5.8
3.4, 5.1, 4.7, 6.9, 9.8

5.7
K3 115.917, 48569, 5.6, 9.2, 77.4, 233.5
33.1, 392.9, 2.6, 3.2, 5.8
43.6, 6.9, 7.8, 4, 5.9
6.2, 2, 4.6, 4.3, 4.9
2.8, 4.2, 3.9, 6, 8.1
4.8
K3 116, 56251, 5.1, 8.3, 65.4, 184.2
28, 339.1, 2.2, 2.9, 5.2
36.8, 5.8, 6.5, 3.4, 5.4
5.6, 1.6, 3.8, 3.6, 4.1
2.4, 3.6, 3.3, 5.1, 7
4
K3 116.083, 61520, 4.6, 7.4, 56, 147.1
25.4, 290.7, 2, 2.6, 4.9
33.4, 5.3, 5.9, 3.1, 5
5.1, 1.5, 3.5, 3.3, 3.7
2.2, 3.2, 2.9, 4.7, 6.3
3.6
K3 116.167, 66789, 4.3, 7, 51.2, 116.3
22.8, 247.6, 1.8, 2.3, 4.7
30, 4.7, 5.3, 2.7, 4.5
4.6, 1.3, 3.1, 2.9, 3.3
1.9, 2.9, 2.6, 4.2, 5.6
3.2
K3 116.25, 68254, 4.3, 7, 46.5, 95
21.5, 215.3, 1.7, 2.2, 4.7
28.3, 4.5, 5, 2.6, 4.4
4.3, 1.3, 2.9, 2.8, 3.1
1.8, 2.7, 2.5, 4, 5.3
3
K3 116.333, 69718, 4.3, 7, 44.2, 76.7
20.6, 183, 1.7, 2.2, 4.7
27.2, 4.4, 5, 2.6, 4.4
4.3, 1.3, 2.9, 2.8, 3.1
1.8, 2.7, 2.5, 3.8, 5.3
3
K3 116.5, 66986, 4.3, 7, 41.9, 67.6
20.6, 156.1, 1.7, 2.2, 4.7
27.2, 4.4, 5, 2.6, 4.4
4.3, 1.3, 2.9, 2.8, 3.1
1.8, 2.7, 2.5, 3.6, 5.3
3
K3 116.667, 60967, 4, 6.5, 39.6, 64.5
20.6, 134.6, 1.7, 2.2, 4.7
27.2, 4.4, 5, 2.6, 4.4
4.3, 1.3, 2.9, 2.8, 3.1
1.8, 2.7, 2.5, 3.6, 5.3
3
K3 116.833, 54087, 4, 6.5, 37.2, 61.5
19.3, 113, 1.6, 2.1, 4.4
25.5, 4.1, 4.7, 2.4, 4.1
4, 1.2, 2.7, 2.6, 2.9
1.7, 2.5, 2.3, 3.4, 5
2.9
K3 117, 47207, 4, 6.5, 34.9, 55.4
19.3, 96.9, 1.6, 2.1, 4.4

25.5, 4.1, 4.7, 2.4, 4.1
4, 1.2, 2.7, 2.6, 2.9
1.7, 2.5, 2.3, 3.4, 5
2.9
K3 117.167, 41650, 4, 6.5, 34.8, 52.4
19.3, 91.5, 1.6, 2.1, 4.4
25.5, 4.1, 4.7, 2.4, 4.1
4, 1.2, 2.7, 2.6, 2.9
1.7, 2.5, 2.3, 3.4, 5
2.9
K3 117.333, 36093, 4, 6.5, 34.8, 49.3
19.3, 86.1, 1.6, 2.1, 4.4
25.5, 4.1, 4.7, 2.4, 4.1
4, 1.2, 2.7, 2.6, 2.9
1.7, 2.5, 2.3, 3.4, 5
2.9
K3 117.5, 32245, 4, 6.5, 34.8, 49.1
19.3, 86.1, 1.6, 2.1, 4.4
25.5, 4.1, 4.7, 2.4, 4.1
4, 1.2, 2.7, 2.6, 2.9
1.7, 2.5, 2.3, 3.4, 5
2.9
K3 117.667, 28397, 4, 6.5, 34.8, 49.1
19.3, 80.7, 1.6, 2.1, 4.4
25.5, 4.1, 4.7, 2.4, 4.1
4, 1.2, 2.7, 2.6, 2.9
1.7, 2.5, 2.3, 3.4, 5
2.9
K3 117.833, 25690, 4, 6.5, 34.8, 46.2
19.3, 80.7, 1.6, 2.1, 4.4
25.5, 4.1, 4.7, 2.4, 4.1
4, 1.2, 2.7, 2.6, 2.9
1.7, 2.5, 2.3, 3.4, 5
2.9
K3 118, 22983, 3.8, 6.1, 34.8, 46.2
19.3, 80.7, 1.6, 2.1, 4.4
25.5, 4.1, 4.7, 2.4, 4.1
4, 1.2, 2.7, 2.6, 2.9
1.7, 2.5, 2.3, 3.4, 5
2.9
K3 118.333, 19221, 3.8, 6.1, 32.5, 46.2
18, 75.4, 1.5, 1.9, 4.1
23.8, 3.8, 4.3, 2.3, 3.9
3.8, 1.1, 2.6, 2.4, 2.7
1.6, 2.4, 2.2, 3.2, 4.6
2.7
K3 118.667, 16824, 3.8, 6.1, 32.5, 46.2
18, 75.4, 1.5, 1.9, 4.1
23.8, 3.8, 4.3, 2.3, 3.9
3.8, 1.1, 2.6, 2.4, 2.7
1.6, 2.4, 2.2, 3.2, 4.6
2.7
K3 119, 14427, 3.8, 6.1, 32.5, 43.1
18, 75.4, 1.5, 1.9, 4.1
23.8, 3.8, 4.3, 2.3, 3.9
3.8, 1.1, 2.6, 2.4, 2.7
1.6, 2.4, 2.2, 3.2, 4.6

```
     2.7
K3   120, 10475, 3.8, 6.1, 32.5, 43.1
     18, 75.4, 1.5, 1.9, 4.1
     23.8, 3.8, 4.3, 2.3, 3.9
     3.8, 1.1, 2.6, 2.4, 2.7
     1.6, 2.4, 2.2, 3.2, 4.6
     2.7
K3   121.667, 5295, 2.8, 4.5, 32.5, 43.1
     18, 75.4, 1.5, 1.9, 4.1
     23.8, 3.8, 4.3, 2.3, 3.9
     3.8, 1.1, 2.6, 2.4, 2.7
     1.6, 2.4, 2.2, 3.2, 4.6
     2.7
K3   123.333, 1865, 1.5, 3, 21.7, 43.1
     12, 50.2, 1, 1.3, 2.7
     15.9, 2.6, 2.9, 1.5, 2.6
     2.5, 0.7, 1.7, 1.6, 1.8
     1.1, 1.6, 1.4, 2.1, 3.1
     1.8
K3   125, 185, 0.7, 1.2, 10.8, 43.1
     6, 25.1, 0.5, 0.6, 1.4
     7.9, 1.3, 1.4, 0.8, 1.3
     1.3, 0.4, 0.9, 0.8, 0.9
     0.5, 0.8, 0.7, 1.1, 1.5
     0.9
K3   126.667, 0, 0, 0, 0, 0
     0, 0, 0, 0, 0
     0, 0, 0, 0, 0
     0, 0, 0, 0, 0
     0, 0, 0, 0, 0
     0
K3   500, 0, 0, 0, 0, 0
     0, 0, 0, 0, 0
     0, 0, 0, 0, 0
     0, 0, 0, 0, 0
     0, 0, 0, 0, 0
     0
$ENDPROGRAM
```

LOS ANGELES COUNTY _LOOD CONTROL DISTRICT



$Q_{10} = .698\ Q_{50}$ $Q_{100} = 1.167\ Q_{50} = 1.671\ Q_{10}$

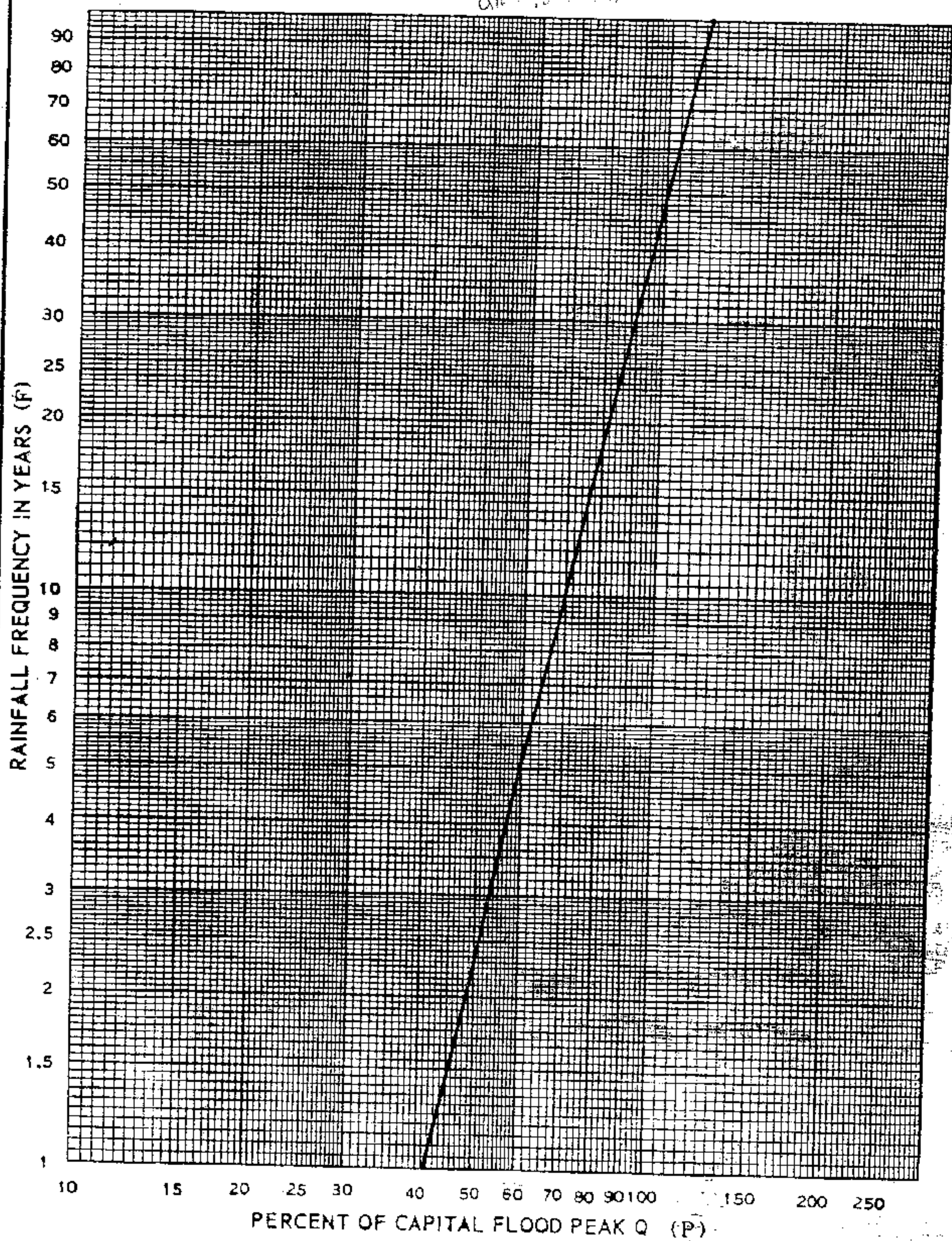
$$F = 50\left(\frac{P}{100}\right)^{4.48}$$

$$\frac{P}{100} = .417\ F^{.223}$$

$$Q_y = \left(\frac{y}{x}\right)^{.223} Q_x$$

Where: Q_x = a known Q for frequency x.

y = the frequency for the desired Q.

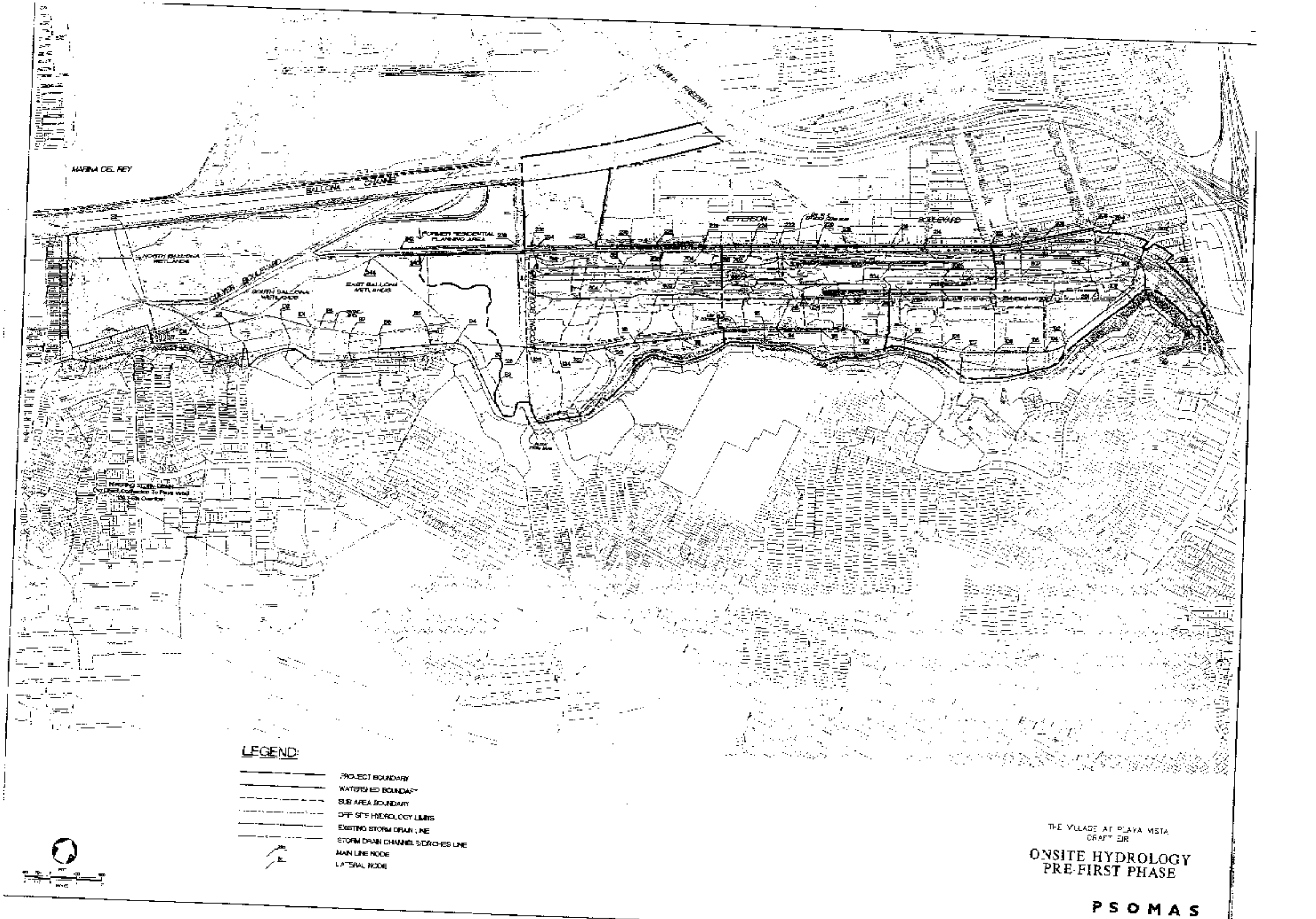


CALTRANS: $Q_{100} = 1.11 * Q_{50}$ (PER S.K.)

PREPARED BY	LOS ANGELES COUNTY FLOOD CONTROL DISTRICT
R.E. Bredehorst (signature)	
R.E. BREDEHORST	PERCENT OF CAPITAL FLOOD PEAK Q VERSUS RAINFALL FREQUENCY
DATE: 6-19-73 NO.	

Map Pocket 1

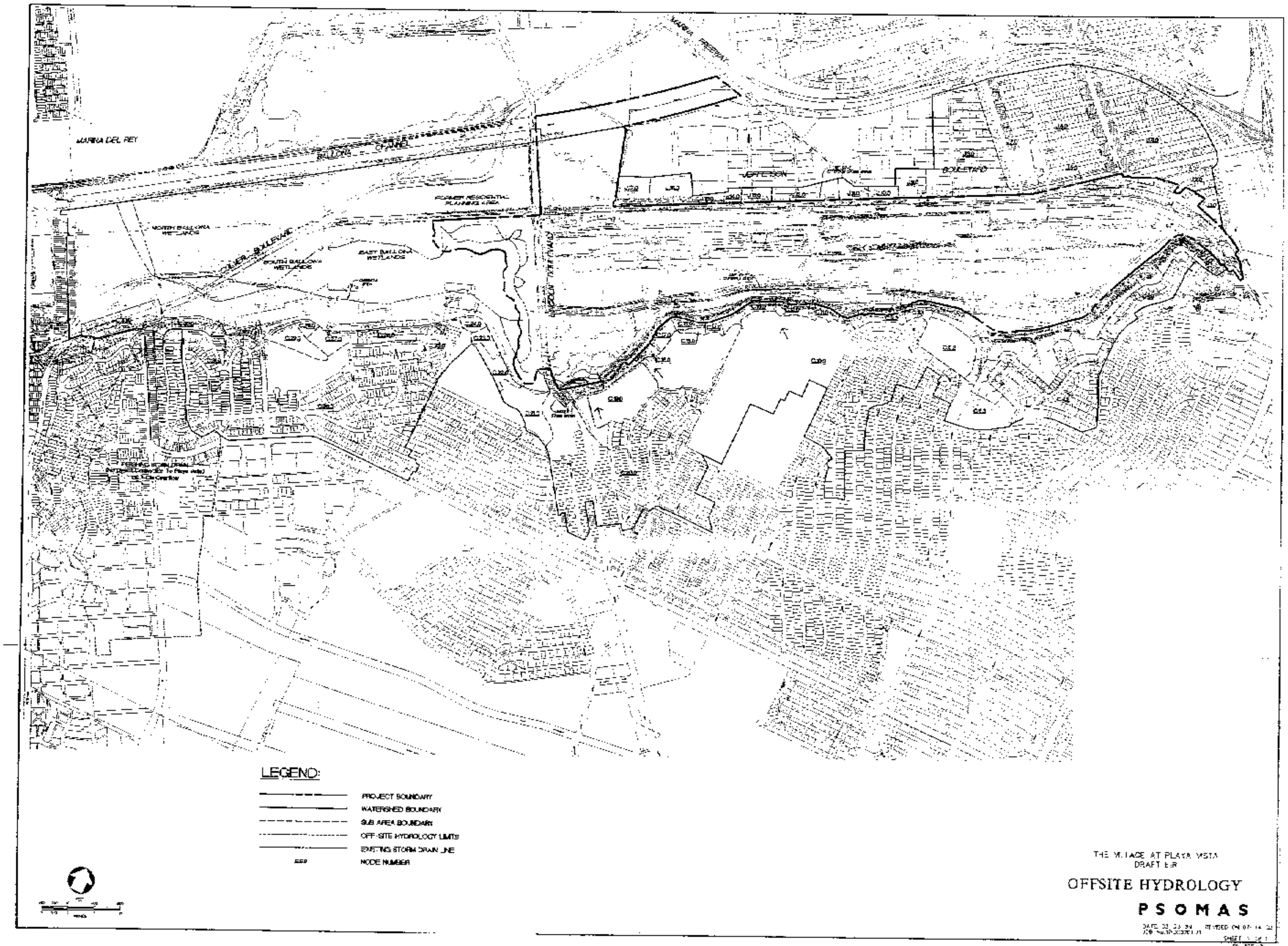
Playa Vista Existing On-Site Hydrology



This Graphic Has Been Reduced for Reproduction Purposes. Full Size Originals Are Available For Review At The Los Angeles City Planning Department – 200 N. Spring St., #720, Los Angeles, CA 90012

Map Pocket 2

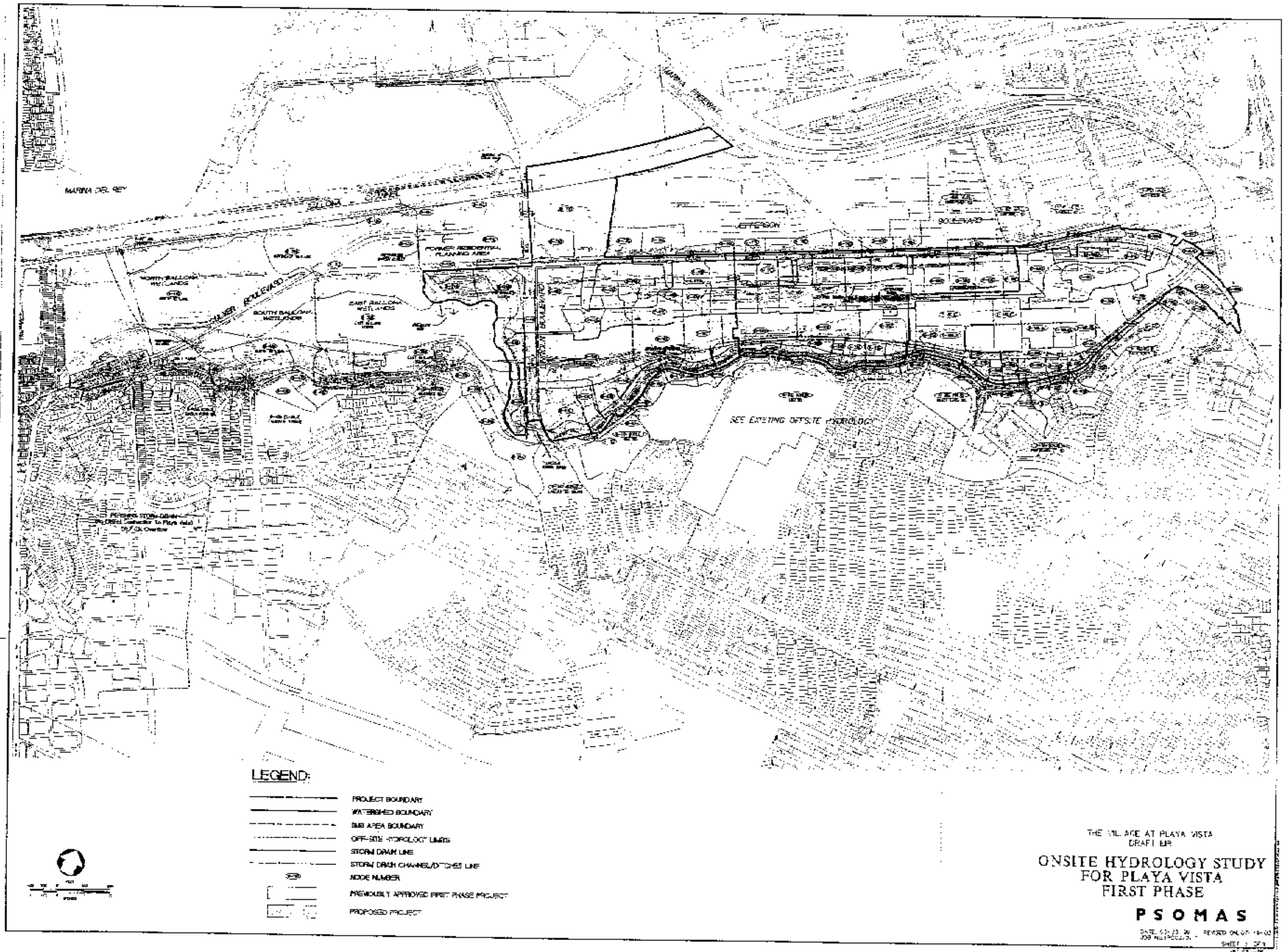
5.2 – Playa Vista Off-Site Hydrology



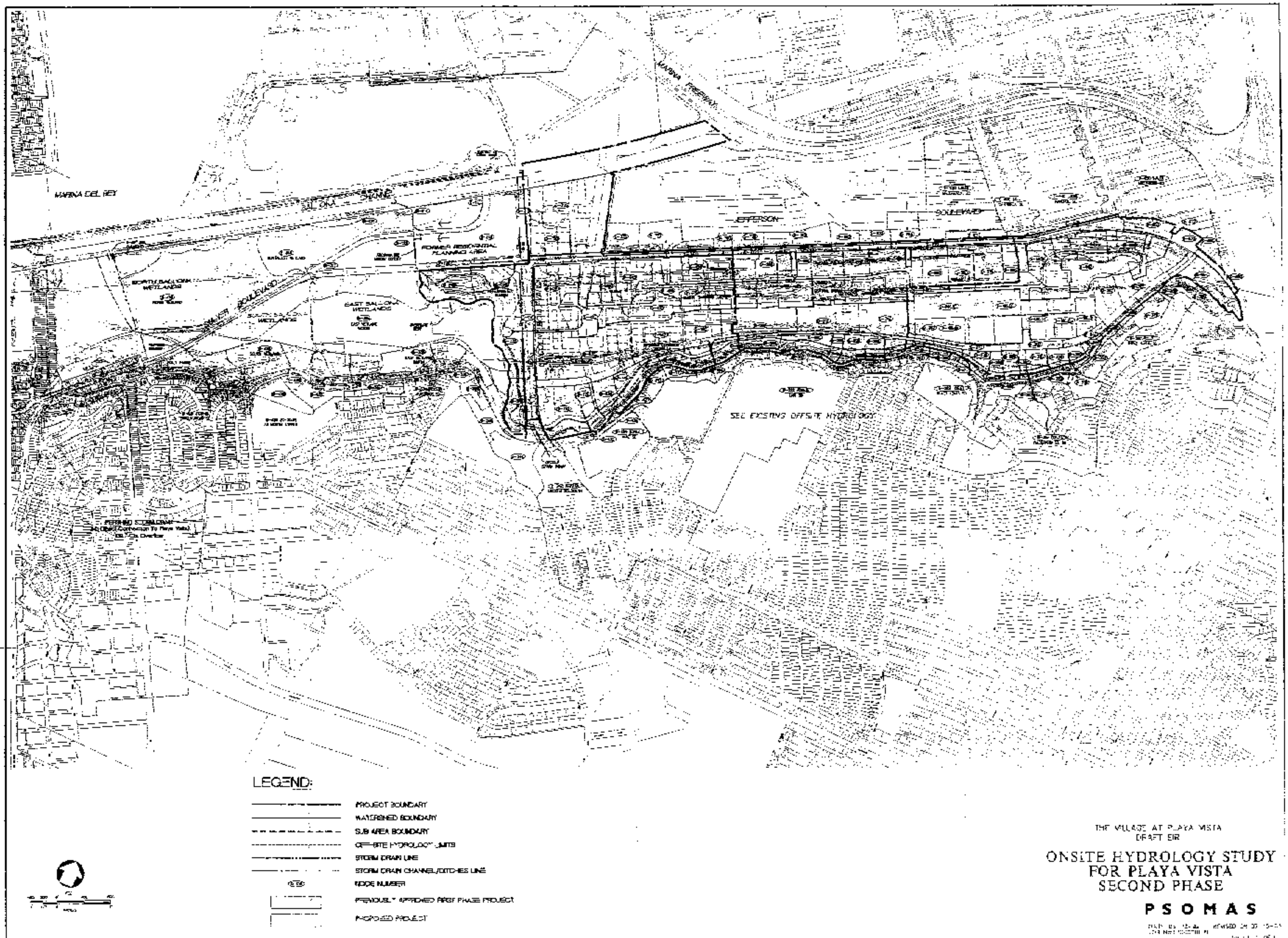
This Graphic Has Been Reduced for Reproduction Purposes. Full Size Originals Are Available For Review At The Los Angeles City Planning Department – 200 N. Spring St., #720, Los Angeles, CA 90012

Map Pocket 3

Playa Vista Proposed On-Site Hydrology

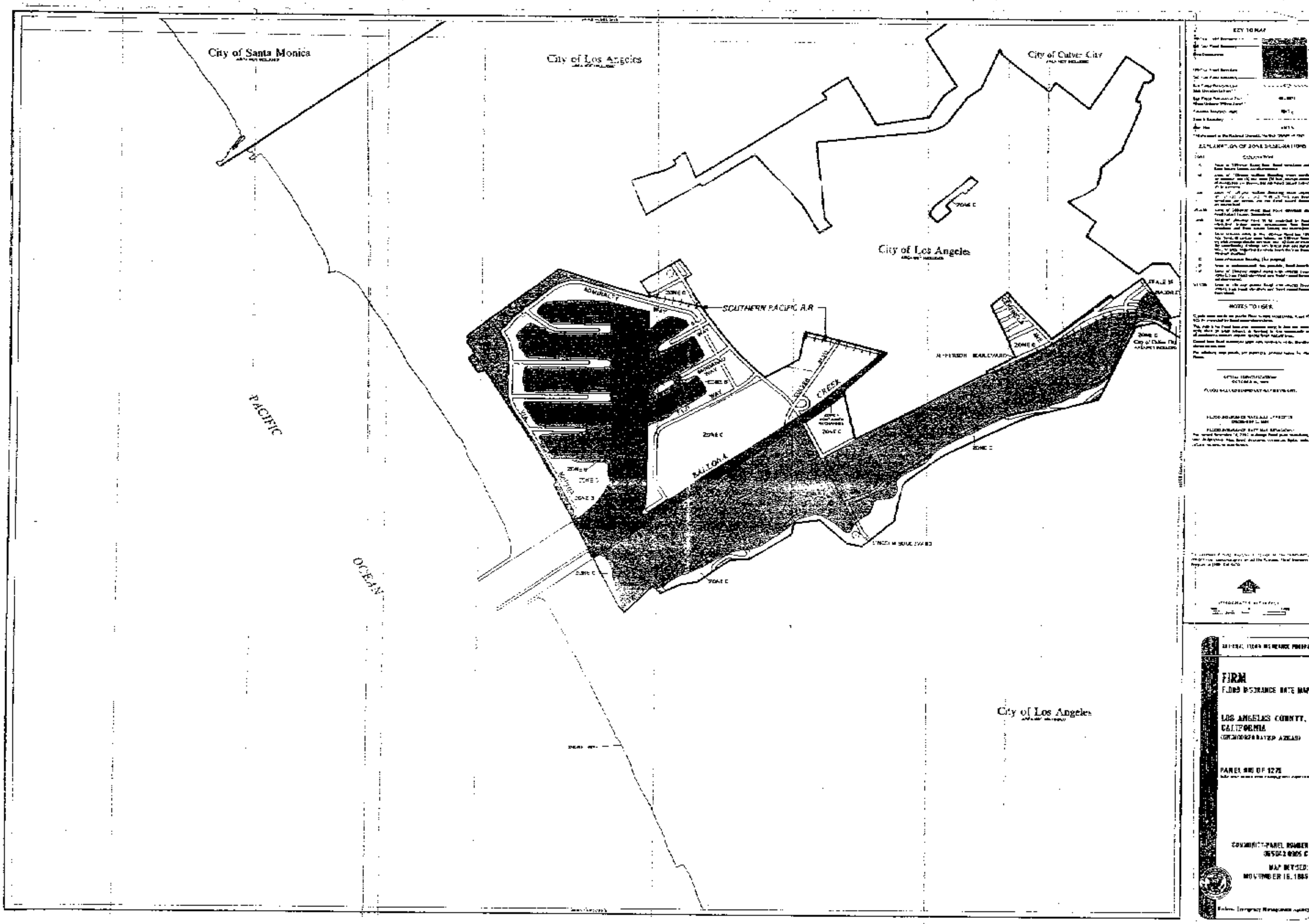


This Graphic Has Been Reduced for Reproduction Purposes. Full Size Originals Are Available For Review At The Los Angeles City Planning Department – 200 N. Spring St., #720, Los Angeles, CA 90012



This Graphic Has Been Reduced for Reproduction Purposes. Full Size Originals Are Available For Review At The Los Angeles City Planning Department – 200 N. Spring St., #720, Los Angeles, CA 90012

Map Pocket 4
Flood Insurance Rate Map



This Graphic Has Been Reduced for Reproduction Purposes. Full Size Originals Are Available For Review At The Los Angeles City Planning Department – 200 N. Spring St., #720, Los Angeles, CA 90012