CITY OF ANAHEIM

Master Plan of Storm Drainage for Fullerton Creek Channel Tributary Area

SEPTEMBER 2010
VOLUME 1
MASTER PLAN OF STORM DRAINAGE FOR
FULLERTON CREEK CHANNEL TRIBUTARY AREA

SEPTEMBER 2010

Prepared for

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Revisions

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VOLUME 2 (Bound Separately)

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1. Executive Summary

1.1 General

The City of Anaheim Master Plan of Storm Drainage for Fullerton Creek Channel Tributary Area (FCTA) covers that portion of the City of Anaheim ultimately tributary to Orange County Flood Control District (OCFCD) regional facility Fullerton Creek Channel (A03). The purpose of the Master Plan is to provide comprehensive long-range planning for the implementation and development of drainage facility improvements in the area, determine the cost of implementing the facilities, and discuss funding priorities of the improvements. This Master Plan is based on the criteria outlined in the City’s Drainage Manual for Public and Private Drainage Facilities, dated August, 2005.

In 1973, the City published a Master Plan of Drainage for the City of Anaheim. That report divided the City into 42 Drainage Districts based generally on local storm drainage facilities and the City limits at that time. In 1983, two additional Drainage Districts were added for a total of 44 Drainage Districts. Since that time the City limits have changed to include more tributary area and the City has changed its drainage classification system to watersheds which are tributary to the County of Orange’s regional drainage facilities. The City of Anaheim is divided into seven major watershed tributary areas; Santa Ana River, Carbon Creek Channel, East Garden Grove-Wintersburg Channel, Anaheim Barber City Channel, Fullerton Creek Channel, Stanton Channel, and Moody Creek Channel. Each of these watersheds include several of the Districts from the 1973 Master Plan.

The FCTA includes Drainage District’s 5, 10, 11, 13, and 15 from the 1973 Master Plan. These areas are identified as Drainage Basins instead of Districts for this Master Plan and are shown on Figure 1. The boundaries of some of the basins have been modified from the 1973 Master Plan boundaries. Figure 1 shows the new boundaries, and all references to areas in this Master Plan are based on the new boundaries. Each Drainage Basin is further divided into one or more Drainage Areas as shown in Figure 2.

1.2 Drainage Basin 5

Drainage Basin 5 drains approximately 360 acres, and is generally bounded by the 91 freeway on the north, the I-5 freeway on the east, a few hundred feet south of La Palma Avenue to the south, and Dale Avenue on the west. Generally, water flows over land to streets and then through pipes from the southeast to the northwest, and ties into Caltrans facilities at the City limits with the City of Buena Park. As shown in Figure 2, Drainage Basin 5 consists of 1 Drainage Area.

There are two storm drains in area 5-1. The main storm drain system in Magnolia Avenue and La Palma Avenue can convey 70 percent of the 10-year flow. The second storm drain in Knollwood Circle which ties in to the first storm drain is adequate to convey the 10-year storm event. However, the City’s flooded width criteria during a 10, 25 and 100-year storm event are not satisfied in most locations. An extension to the existing facilities in La Palma Avenue, and parallel relief storm drains in La Palma Avenue and Magnolia Avenue are recommended to satisfy both the City’s requirement of conveying the 10-year storm event...
and the flooded width criteria. The estimated cost for constructing the improvements is $13,774,000 (2010 dollars).

1.3 Drainage Basin 10

Drainage Basin 10 drains approximately 175 acres, and is generally bounded by the 91 freeway on the north, Brookhurst Street on the east, La Palma Avenue on the south, and the I-5 freeway on the west. Generally, water flows in streets from east to west before entering a catch basin which ties into the Houston Channel Lateral at the City Limits. The Houston Channel Lateral drains into Houston Channel, which is tributary to Fullerton Creek Channel. As shown in Figure 2, Drainage Basin 10 consists of 4 Drainage Areas.

There are no existing storm drain facilities within Drainage Basin 10. The City’s flooded width criteria during a 10, 25 and 100-year storm event are met for streets in Areas 10-3 and 10-4. However, they are not satisfied in several locations in Areas 10-1 and 10-2. Construction of new facilities in Houston Avenue, Coronet Avenue, and Falmouth Avenue are recommended to satisfy both the City’s requirement of conveying the 10-year storm event and the flooded width criteria. The estimated cost for constructing the improvements is $8,191,000 (2010 dollars).

1.4 Drainage Basin 11

Drainage Basin 11 drains approximately 430 acres, and is generally bounded by the 91 freeway on the north, Euclid Street on the east, Catalpa Avenue to the south, and Brookhurst Street on the west. Generally, water flows over land to streets and then through pipes from south to north and from east to west. The east to west flow ties into Caltrans facilities along the I-5 freeway at Brookhurst Street. The south to north flow drains into a Caltrans facility along the 91 freeway. The Caltrans facilities drain into Houston Channel (A03S02), which is tributary to Fullerton Creek Channel. As shown in Figure 2, Drainage Basin 11 consists of 8 Drainage Areas.

There is only one existing storm drain system in Basin 11. This system drains Area 11-3 in Coronet Avenue and has a capacity of 70 percent of the 10-year flow. The City’s flooded width criteria during a 10, 25 and 100-year storm event are met for streets in Areas 11-4 through 11-8. However, the City’s flooded width criteria during a 10, 25 and 100-year storm event are not satisfied in many locations in Areas 11-1, 11-2 and 11-3. New storm drain facilities along La Palma Avenue in Area 11-1 and Brookhurst Street in Area 11-2 and a parallel storm drain along Coronet Avenue in Area 11-3 are recommended to satisfy the City’s requirement of conveying the 10-year storm event as well as the City’s flooded width criteria. The estimated cost for the improvements is $17,424,000 (2010 dollars).

1.5 Drainage Basin 13

Drainage Basin 13 drains approximately 125 acres, and is generally bounded by the 91 freeway on the north, Harbor Boulevard on the east, La Palma Avenue on the south, and Euclid Street on the west. Generally, water flows over land to streets from east to west and then from south to north through an existing storm drain system along Euclid Avenue that ties into a Caltrans facility along the 91 freeway. The Caltrans facility drains into Houston Channel, which is tributary to Fullerton Creek Channel. As shown in Figure 2, Drainage Basin 13 consists of 1 Drainage Area.
The existing storm drain system in Area 13-1 can convey the 10-year storm event except for the double 10.5-foot by 2-foot reinforced concrete box (RCB) along Euclid Street. The RCB has a capacity of 80 percent of the 10-year flow. The City’s flooded width criteria during a 10, 25 and 100-year storm event are not satisfied in Chevy Chase Drive and Romneya Avenue. Extensions to the existing facilities are recommended to satisfy the City’s flooded width criteria in these locations and a parallel storm drain in Euclid Street is also recommended. The estimated cost for constructing the improvements is $4,602,000 (2010 dollars).

1.6 Drainage Basin 15

Drainage Basin 15 drains approximately 225 acres, and is generally bounded by Fullerton Creek Channel and the city limits to the north, Raymond Avenue on the east, the 91 freeway on the south, and Lemon Street on the west. The majority of flow drains to a storm drain in Orangethorpe Avenue and Lemon Street which outlets to Fullerton Creek Channel to the north. A few small areas drain north to A03S05 which outlets to Fullerton Creek Channel. As shown in Figure 2, Drainage Basin 15 consists of 6 Drainage Areas.

The existing storm drains analyzed in Basin 15 are adequately sized to carry the 10-year storm event except for the storm drain in Area 15-1. This system can convey 90 percent of the 10-year flow. The storm drains in Area 15-4 and 15-6 can convey the 100-year flow and 10-year flows, respectively. Runoff from Areas 15-2, 15-3 and 15-5 flow over land and in streets directly into either Fullerton Creek Channel or A03S05, which is tributary to Fullerton Creek Channel. The City’s flooded width criteria during a 10, 25 and 100-year storm event are not satisfied in some locations. Extensions to the existing facilities, and parallel storm drains along Orangethorpe Avenue and Lemon Street are recommended to satisfy both the City’s requirement of conveying the 10-year storm event as well as the flooded width criteria. The estimated cost for constructing these improvements is $4,938,000 (2010 dollars).

1.7 Capital Improvement Plan

The goal of the Capital Improvement Plan is to identify an organized system for implementing the proposed improvements as financing becomes available. A total of 20 projects totaling $48.9 million (2010 dollars) have been identified as part of this Master Plan. These projects range from small extensions of existing storm drains to large storm drain systems in arterial highways.

A priority ranking was developed to identify the most important projects that should be constructed first. This ranking was based on the level to which the existing system meets the City’s flood protection goals. Three categories of improvements were identified as outlined below.

Priority 1 - Proposed new storm drain in an arterial highway or local street to achieve 10, 25, and 100-year flood protection levels.

Priority 2 - Proposed parallel or replacement storm drain in an arterial highway or local street to achieve 10, 25, and 100-year flood protection levels.

Priority 3 - Proposed new storm drain in a local street where 100-year protection levels are met without the storm drain, however, the storm drain is required to achieve flood protection levels for the 10-year storm.
Figure 3 outlines the proposed improvements by priority. Table ES-1 outlines those projects designated as Priority 1. There are a total of 7 projects totaling $20.9 million (2010 dollars).

**Table ES-1 – Priority 1 Cost Estimate**

<table>
<thead>
<tr>
<th>Area</th>
<th>Storm Drain ID</th>
<th>Street</th>
<th>Type of Facility</th>
<th>Length (feet)</th>
<th>Estimated Cost (2010 Dollars)</th>
<th>Area Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>10-1</td>
<td>SD 10-1_01 (P)</td>
<td>Houston Avenue</td>
<td>New 60-inch RCP</td>
<td>2,320</td>
<td>$4,335,000</td>
<td>$5,879,000</td>
</tr>
<tr>
<td>10-1</td>
<td>SD 10-1_02 (P)</td>
<td>Coronet Avenue</td>
<td>New 48-inch RCP</td>
<td>1,080</td>
<td>$1,544,000</td>
<td></td>
</tr>
<tr>
<td>11-1</td>
<td>SD 11-1_01 (P)</td>
<td>La Palma Avenue</td>
<td>Replacement 60-inch RCP /54-inch /60-inch RCP/ New 42-inch RCP</td>
<td>4,155</td>
<td>$6,588,000</td>
<td>$8,235,000</td>
</tr>
<tr>
<td>11-1</td>
<td>SD 11-1_02 (P)</td>
<td>Dogwood Avenue</td>
<td>New 48-inch RCP</td>
<td>1,155</td>
<td>$1,647,000</td>
<td></td>
</tr>
<tr>
<td>11-2</td>
<td>SD 11-2_01 (P)</td>
<td>Brookhurst Street</td>
<td>New 54-inch/60-inch RCP</td>
<td>2,385</td>
<td>$3,817,000</td>
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<tr>
<td>15-1</td>
<td>SD 15-1_01 (P)</td>
<td>Orangethorpe Avenue</td>
<td>Extension 42-inch RCP</td>
<td>625</td>
<td>$782,000</td>
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</tr>
<tr>
<td>15-4</td>
<td>SD 15-4_01 (P)</td>
<td>Orangethorpe Park/Orangethorpe Avenue</td>
<td>Extension 42-inch RCP</td>
<td>1,740</td>
<td>$2,168,000</td>
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<tr>
<td><strong>TOTAL</strong></td>
<td></td>
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<td></td>
<td></td>
<td>$20,881,000</td>
<td>$20,881,000</td>
</tr>
</tbody>
</table>

Table ES-2 below outlines those projects designated as Priority 2. There are a total of 7 projects totaling $19.8 million (2010 dollars).

**Table ES-2 – Priority 2 Cost Estimate**

<table>
<thead>
<tr>
<th>Area</th>
<th>Storm Drain ID</th>
<th>Street</th>
<th>Type of Facility</th>
<th>Length (feet)</th>
<th>Estimated Cost (2010 Dollars)</th>
<th>Area Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>5-1</td>
<td>SD 5-1_03 (P)</td>
<td>La Palma Avenue</td>
<td>Parallel Relief Drain 42-inch/48-inch/54-inch RCP</td>
<td>2,990</td>
<td>$4,423,000</td>
<td>$13,227,000</td>
</tr>
<tr>
<td>5-1</td>
<td>SD 5-1_02 (P)</td>
<td>Magnolia Avenue</td>
<td>Parallel Relief Drain 54-inch RCP</td>
<td>2,770</td>
<td>$4,577,000</td>
<td></td>
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<tr>
<td>5-1</td>
<td>SD 5-1_01 (P)</td>
<td>Magnolia Avenue to Dale Avenue</td>
<td>Parallel Relief Drain 54-inch RCP</td>
<td>2,550</td>
<td>$4,227,000</td>
<td></td>
</tr>
<tr>
<td>11-3</td>
<td>SD 11-3_01 (P)</td>
<td>Coronet Avenue</td>
<td>Parallel 72-inch RCP/60-inch RCP</td>
<td>2,265</td>
<td>$4,307,000</td>
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<tr>
<td>13-1</td>
<td>SD 13-1_01 (P)</td>
<td>Euclid Street</td>
<td>Parallel 36-inch RCP</td>
<td>315</td>
<td>$325,000</td>
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<tr>
<td>15-1</td>
<td>SD 15-1_02 (P)</td>
<td>Orangethorpe Avenue</td>
<td>Parallel 36-inch RCP</td>
<td>585</td>
<td>$633,000</td>
<td></td>
</tr>
<tr>
<td>15-1</td>
<td>SD 15-1_03 (P)</td>
<td>Lemon Street</td>
<td>Parallel 36-inch RCP</td>
<td>1,250</td>
<td>$1,355,000</td>
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<tr>
<td><strong>TOTAL</strong></td>
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<td></td>
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<td></td>
<td>$19,847,000</td>
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Table ES-3 below outlines those projects designated as Priority 3. There are a total of 6 projects totaling $8.2 million (2010 dollars).
### Table ES-3 – Priority 3 Cost Estimate

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<tr>
<th>Area</th>
<th>Storm Drain ID</th>
<th>Street</th>
<th>Type of Facility</th>
<th>Length (feet)</th>
<th>Estimated Cost (2010 Dollars)</th>
<th>Area Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>5-1</td>
<td>SD 5-1_04 (P)</td>
<td>Sequoia Avenue</td>
<td>Extension 33-inch RCP</td>
<td>540</td>
<td>$547,000</td>
<td>$547,000</td>
</tr>
<tr>
<td>10-1</td>
<td>SD 10-1_03 (P)</td>
<td>Coronet Avenue</td>
<td>New 42-inch RCP</td>
<td>1,015</td>
<td>$1,279,000</td>
<td>$1,279,000</td>
</tr>
<tr>
<td>10-2</td>
<td>SD 10-2_01 (P)</td>
<td>Falmouth Avenue</td>
<td>New 36-inch RCP</td>
<td>980</td>
<td>$1,033,000</td>
<td>$1,033,000</td>
</tr>
<tr>
<td>11-1</td>
<td>SD 11-1_03 (P)</td>
<td>Dogwood &amp; Mohican Avenue</td>
<td>New 42-inch RCP</td>
<td>875</td>
<td>$1,065,000</td>
<td>$1,065,000</td>
</tr>
<tr>
<td>13-1</td>
<td>SD 13-1_02 (P)</td>
<td>Chevy Chase Drive</td>
<td>Replacement 42-inch RCP</td>
<td>2,245</td>
<td>$2,820,000</td>
<td></td>
</tr>
<tr>
<td>13-1</td>
<td>SD 13-1_03 (P)</td>
<td>Romneya Drive</td>
<td>Extension 36-inch RCP</td>
<td>1,355</td>
<td>$1,457,000</td>
<td>4,277,000</td>
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<tr>
<td></td>
<td>TOTAL</td>
<td></td>
<td></td>
<td></td>
<td>$8,201,000</td>
<td>$8,201,000</td>
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</table>

### 1.8 Storm Drain Impact and Improvement Fee

To finance storm drain improvements and to mitigate the flooding and storm drainage impacts caused by new development and/or by additions and expansions to existing development the City of Anaheim City Council previously adopted an ordinance and storm drain impact fees for certain areas with the City. None of these fees are applicable to the Fullerton Creek Tributary Area. A future study will be conducted to identify financing mechanisms for constructing the improvements. These could include such options as Impact Fees, Assessment Districts or other financing mechanisms.

### 1.9 Potential Locations for Detention/Infiltration Basins in City Parks

An analysis of potential locations for detention and infiltration basins in City parks was made. These detention/infiltration basins could potentially reduce the size or need for downstream storm drain facilities. The analysis was made by looking at the location of each park within the study area and determining if an existing or proposed storm drain facility was located nearby. If a storm drain facility was located nearby, then the potential to reduce downstream storm drain facilities was made. If the basin could reduce downstream facilities, then the location was identified as a potential location for a detention or infiltration basin. The results of the analysis are summarized in Table ES-4. Detailed analysis will need to be performed to determine the size and effectiveness of basins at these potential locations.

#### Table ES-4 Potential Locations for Detention/Infiltration Basins within City Parks

<table>
<thead>
<tr>
<th>Park Name</th>
<th>Street by Park</th>
<th>MP - Basin</th>
<th>SD Nearby</th>
<th>Is SD Deficient</th>
<th>Possible Location for Basin</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 - MANZANITA PARK</td>
<td>Canary St.</td>
<td>FC – 13-1</td>
<td>Proposed</td>
<td>Yes</td>
<td>Yes¹</td>
</tr>
<tr>
<td>10 - JOHN MARSHALL</td>
<td>La Palma Ave</td>
<td>11-2</td>
<td>Proposed</td>
<td>Yes</td>
<td>Yes¹</td>
</tr>
</tbody>
</table>

Notes: ¹Could reduce proposed storm drain for street flooding
Figure 1
Study Area
Master Plan of Storm Drainage for Fullerton Creek Channel Tributary Area
2. Introduction

2.1 Purpose

The City of Anaheim Master Plan of Storm Drainage for Fullerton Creek Channel Tributary Area (FCTA) covers that portion of the City of Anaheim ultimately tributary to Orange County Flood Control District (OCFCD) regional facility Fullerton Creek Channel (A03). The purpose of the Master Plan is to provide comprehensive long-range planning for the implementation and development of drainage facility improvements in the area, determine the cost of implementing the facilities, and discuss funding priorities of the improvements. This Master Plan is based on the criteria outlined in the City’s Drainage Manual for Public and Private Drainage Facilities, dated August, 2005.

2.2 Background

In 1973, the City published a Master Plan of Drainage for the City of Anaheim. That report divided the City into 42 Drainage Districts based generally on local storm drainage facilities and the City limits at that time. In 1983, two additional Drainage Districts were added for a total of 44 Drainage Districts. Since that time the City limits have changed to include more tributary area and the City has changed its drainage classification system to watersheds which relate to the County of Orange’s regional drainage facilities. The City of Anaheim is divided into seven major watershed tributary areas; Santa Ana River, Carbon Creek Channel, East Garden Grove-Wintersburg Channel, Anaheim Barber City Channel, Fullerton Creek Channel, Stanton Channel, and Moody Creek Channel. Each of these watersheds include several of the Districts from the 1973 Master Plan.

The FCTA includes Drainage District’s 5, 10, 11, 13, and 15 from the 1973 Master Plan. These areas are identified as Drainage Basins instead of Districts for this Master Plan and are shown on Figure 1. The boundaries of some of the basins have been modified from the 1973 Master Plan boundaries. Figure 1 shows the new boundaries, and all references to areas in this Master Plan are based on the new boundaries.

As shown on Figure 1, Drainage Basins 5, 10, 11, and 13 are generally bounded by the 91 freeway to the north; West Street to the east; a few hundred feet south of La Palma Avenue to the south; and Dale Avenue to the west. Most of the flow from these Drainage Basins drain to Houston Channel which is tributary to Fullerton Creek Channel. Basin 5 drains to a Caltrans Facility tributary to Fullerton Creek Channel. Drainage Basin 15 is generally bounded by Fullerton Creek Channel and the northerly city limits to the north; Raymond Avenue to the east; the 91 freeway to the south; and Lemon Street to the west (See Figure 1). The majority of flows from Drainage Basin 15 drain to a storm drain in Orangethorpe Avenue and Lemon Street which outlets to Fullerton Creek Channel to the north. A few small areas drain to A03S05 which outlets to Fullerton Creek Channel.
3. Technical Criteria

3.1 Hydrologic Analysis

The hydrologic analysis for the City of Anaheim Master Plan of Storm Drainage for FCTA was performed in accordance with the City of Anaheim Department of Public Works Storm Drainage Manual for Public and Private Storm Drainage Facilities, dated August of 2005. The City of Anaheim has adopted the 1986 Orange County Hydrology Manual (and the subsequent Addendum No. 1 to the Hydrology Manual, issued in 1995), except for the modifications outlined in Division 1 of the City’s Manual. The modification affecting hydrology includes the requirement that the analysis of all storm events be based on the “high confidence level” storm frequency event. This criterion was used for the Master Plan. The methods, data, and criteria integrated and incorporated are consistent with accepted methods of analyzing storm water runoff throughout Orange County as outlined in the Orange County Hydrology Manual.

GIS Facility Maps and AutoCad drawings were obtained from the City, which contained streets and existing facilities for the FCTA. Drainage Basins were delineated based on the 1973 drainage maps. A field review was then conducted, and the drainage patterns were further refined. Land use data was obtained from the City of Anaheim’s October 2008 General Plan and soils information was obtained from the 1986 Orange County Hydrology Manual. Land use, soils information and subarea information was input into the Advanced Engineering Software Computer Program RATOC which is based on the 1986 Orange County Hydrology Manual.

3.2 Hydraulics Analysis

Storm drains and street flooded width analyses were performed in accordance with the City of Anaheim Department of Public Works Storm Drainage manual, dated August of 2005. The existing drainage systems were analyzed using computer analysis techniques that consisted of the storm drain analysis program, Water Surface and Pressure Gradient Hydraulic Analysis System (WSPG), originally written for use by the Los Angeles County Flood Control District. WSPG is a hydraulics program that can be used to determine the capacity of a storm drain system. The computational procedure is based on solving Bernoulli’s equation for the total energy at each section and Manning’s formula for friction loss between the sections in a reach. Confluences are analyzed using pressure and momentum theory. The program uses basic mathematical and hydraulic principles to calculate such data as cross sectional area, wetted perimeter, normal depth, critical depth, pressure, and momentum.

The proposed storm drains were sized using the WSPG program and FlowMaster. Relevant storm drain information such as pipe sizes and invert elevations were obtained from storm drain improvement as-built drawings.
The hydraulic analysis performed assumed that the streets would be free and clear of any major obstructions and that the storm drains would be adequately maintained so that blockage would not occur. Street capacity analyses assumed that all streets conformed to the City of Anaheim’s typical street sections. Street widths were determined from street plans and as-built drawings.

Based on the technical criteria outlined in this chapter, preliminary sizes of the Master Plan facilities were determined. The hydraulic control for calculations typically assumed that the water surface elevation was one foot below the ground surface. For lateral storm drains, the hydraulic control was taken from the water surface elevation of the major storm drain at the point of confluence between the drains.

### 3.3 Downstream Boundaries

The FCTA is bordered on the north by the 91 freeway and the Houston and Fullerton Creek Channels, which coincide with the City Limits. This study evaluates the capacity of each facility up to the City limits. The approach for the proposed hydraulics at the boundary of the City limit is to recognize the adjacent agency’s downstream capacities. The drainage facilities along the 91 freeway are Caltrans facilities. As-built drawings were obtained for Caltrans facilities and used to determine the downstream control. The Houston and Fullerton Creek Channel are OCFCD regional facilities. Hydraulic reports for the Houston and Fullerton Creek Channels were obtained to determine the downstream control. In this study, when existing downstream facilities are determined to be unable to convey the flow from the City of Anaheim’s master plan storm drain at the City limits, excess flow at the City boundary is proposed to be resurfaced onto the street through equalizers.
4. Drainage Basin 5

Drainage Basin 5 drains approximately 360 acres, and is generally bounded by the 91 freeway on the north, the I-5 freeway on the east, a few hundred feet south of La Palma Avenue to the south, and Dale Avenue on the west. As shown in Figure 4, drainage basins are further divided into drainage areas depending on the existing flow patterns and storm drain outlets. Since the entire basin drains into the same system, Basin 5 consists of only one drainage area, Area 5-1. Generally, storm water flows from the southeast to the northwest to a storm drain in La Palma Avenue. The storm drain turns north on Magnolia Avenue to the Interstate 5 freeway and parallels the 5 freeway where it then ties into a Caltrans facility at the City limits with the City of Buena Park.

4.1 Hydrologic Analysis

The hydrologic analysis for Drainage Basin 5 was performed in accordance with the hydrologic criteria outlined in Chapter 3 and is included in Appendix C. The hydrology map for Basin 5 is included in Appendix B. The following table highlights the flow rates at the key drainage nodes for Area 5-1 in Basin 5. The table shows associated drainage areas and flows for 10-, 25-, and 100-year storm events.

<table>
<thead>
<tr>
<th>Area</th>
<th>Node</th>
<th>Location</th>
<th>Drainage Area (ac)</th>
<th>10-Year Flow (cfs)</th>
<th>25-Year Flow (cfs)</th>
<th>100-Year Flow (cfs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5-1</td>
<td>508</td>
<td>La Palma Ave and Magnolia Ave</td>
<td>118</td>
<td>125</td>
<td>160</td>
<td>220</td>
</tr>
<tr>
<td>5-1</td>
<td>509</td>
<td>Magnolia Ave and Woodland Dr</td>
<td>143</td>
<td>155</td>
<td>195</td>
<td>265</td>
</tr>
<tr>
<td>5-1</td>
<td>513</td>
<td>Dale Ave at 160 ft South of 91 Frwy Onramp</td>
<td>356</td>
<td>380</td>
<td>480</td>
<td>665</td>
</tr>
</tbody>
</table>

4.2 Analysis of Existing Improvements

Storm water in Area 5-1 is conveyed through two storm drains. One drain begins approximately 1000 feet west of the I-5 freeway in La Palma Avenue. The drain flows west, then turns north in Magnolia Avenue, where it continues to the I-5 freeway. The drain turns northwest, and follows the I-5 freeway to the 91 freeway. Then the drain turns west and flows in an alley towards Dale Avenue. Approximately 500 feet east of Dale Avenue, the drain joins an existing Caltrans facility that continues west to Dale Avenue. At the junction with the Caltrans facility, a parallel storm drain branches off and continues west to Dale Avenue. At Dale Avenue, the parallel storm drain joins the Caltrans facility. At this point, the drain enters the City of Buena Park. This drain captures runoff from the eastern and central region of Area 5-1. This drain varies in size from 33-inch to 78-inch reinforced concrete pipe (RCP), and can convey a maximum of 145 cubic feet per second (cfs), which is nearly equivalent to a 10-year storm event. The existing hydraulic calculations for Area 5-1 are included in Appendix D.
The second storm drain begins approximately 1000 feet north of La Palma Avenue in Knollwood Circle. The drain flows north for approximately 1200 feet, then turns west for approximately 200 feet, then enters the City of Buena Park and ties into a Caltrans facility along the 91 Freeway. This pipe varies from a 48-inch to 54-inch RCP, and can convey a maximum of 80 cfs which is equivalent to a 10-year storm event. This drain captures runoff from the western portion of Area 5-1.

### 4.3 Proposed Improvements

In order to satisfy the City’s requirement of conveying the 10-year storm event in the storm drains, and also to satisfy the flooded width criteria, the following improvements are recommended and shown in Figure 4. The hydraulic calculations are included in Appendix E and the street flow calculations are in Appendix F. In order to satisfy the City’s 10-yr storm event and flooded width criteria, the storm drain in Sequoia Avenue must be extended 540 feet east. This extension is proposed to be a 33-inch RCP. In addition, a parallel relief drain varying in size from 42 to 54-inch RCP is recommended to relieve some of the flow in the La Palma Avenue and Magnolia Avenue drain. This proposed relief drain is intended to relieve a maximum of 65 cfs from the existing facilities, taking flow from the area south of La Palma Avenue and will extend to Dale Avenue for a total of 8,315 feet.

### 4.4 Cost Estimates

The estimated costs summarized in Table 2 include costs for construction, engineering, design, surveying, and construction management. Pipe costs are per linear foot of pipe and have been increased to include excavation, shoring, bedding, backfill, compaction, removal of excess material, and trench resurfacing. The detailed cost estimates for Basin 5 are included in Appendix A.

Since the construction of the recommended facilities will be spread out over a number of years, the total cost of master plan implementation will be subject to future construction cost increases. Therefore, it is recommended that the funding programs established for implementation of the Master Plan of Storm Drainage make provisions for the increased cost of deferred construction. Inflation factors should be applied to reflect a specific year’s total cost over the 2010 total costs. Summarized in Table 2 are the construction cost estimates by project location for Area 5-1 in Basin 5.

<table>
<thead>
<tr>
<th>Area</th>
<th>Storm Drain ID</th>
<th>Street</th>
<th>Type of Facility</th>
<th>Length (feet)</th>
<th>Estimated Cost (2010 Dollars)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5-1</td>
<td>SD 5-1_04 (P)</td>
<td>Sequoia Avenue</td>
<td>Extension 33-inch RCP</td>
<td>540</td>
<td>$547,000</td>
</tr>
<tr>
<td>5-1</td>
<td>SD 5-1_03 (P)</td>
<td>La Palma Avenue</td>
<td>Parallel Relief Drain 42-inch/48-inch/54-inch RCP</td>
<td>2,990</td>
<td>$4,423,000</td>
</tr>
<tr>
<td>5-1</td>
<td>SD 5-1_02 (P)</td>
<td>Magnolia Avenue</td>
<td>Parallel Relief Drain 54-inch RCP</td>
<td>2,770</td>
<td>$4,577,000</td>
</tr>
<tr>
<td>5-1</td>
<td>SD 5-1_01 (P)</td>
<td>Magnolia Avenue to Dale Avenue</td>
<td>Parallel Relief Drain 54-inch RCP</td>
<td>2,550</td>
<td>$4,227,000</td>
</tr>
<tr>
<td></td>
<td>TOTAL FOR BASIN 5</td>
<td></td>
<td></td>
<td></td>
<td>$13,774,000</td>
</tr>
</tbody>
</table>
Figure 4
Drainage Basin 5

Master Plan of Storm Drainage for Fullerton Creek Channel Tributary Area

Legend
- Anaheim City Limits
- Drainage Area
- Street Right of Way

Proposed Storm Drains
- Priority 1
- Priority 2
- Priority 3

Existing Storm Drains
- Anaheim (Pipe size in inches)
- County
- Caltrans
- Private
- Lateral
- Buena Park

Proposed Pipeline ID
Drainage Area_Line No. (Proposed)

Carbon Creek (B01) 33" Pipe
Crescent Basin 5
Anaheim (Pipe size in inches)
5. Drainage Basin 10

Drainage Basin 10 drains approximately 175 acres, and is generally bounded by the 91 freeway on the north, the Brookhurst Street on the east, La Palma Avenue on the south, and the I-5 freeway on the west. As shown in Figure 5, drainage basins are further divided into drainage areas depending on the existing flow patterns and storm drain outlets. Basin 10 consists of Area 10-1, 10-2, 10-3, and 10-4. Storm water in Area 10-1 generally flows east to west and ties into Houston Channel Lateral at the City Limits with the City of Fullerton. Area 10-2, 10-3, and 10-4 generally drain northeast to southwest and tie into an existing Caltrans facility along the I-5 Freeway. The Caltrans facility connects with Houston Channel Lateral, which drains into Houston Channel and ultimately Fullerton Creek Channel.

5.1 Hydrologic Analysis

The hydrologic analysis for Basin 10 was performed in accordance with the hydrologic criteria outlined in Chapter 3 and is included in Appendix C. The hydrology map for Basin 10 is included in Appendix B. The following table highlights the flow rates at the key drainage nodes for each of the four drainage areas in Basin 10. The table shows associated drainage areas and flows for 10-, 25-, and 100-year storm events.

<table>
<thead>
<tr>
<th>Area</th>
<th>Node</th>
<th>Location</th>
<th>Drainage Area (ac)</th>
<th>10-Year Flow (cfs)</th>
<th>25-Year Flow (cfs)</th>
<th>100-Year Flow (cfs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>10-1</td>
<td>1004</td>
<td>Gilbert St and Houston Ave</td>
<td>75</td>
<td>75</td>
<td>90</td>
<td>125</td>
</tr>
<tr>
<td>10-1</td>
<td>1007</td>
<td>Picadilly Way and Houston Ave</td>
<td>126</td>
<td>95</td>
<td>125</td>
<td>170</td>
</tr>
<tr>
<td>10-2</td>
<td>1022</td>
<td>Falmouth Ave and Grayson Ave</td>
<td>12</td>
<td>16</td>
<td>19</td>
<td>25</td>
</tr>
<tr>
<td>10-2</td>
<td>1023</td>
<td>Minot St and Rhodes Ave</td>
<td>26</td>
<td>30</td>
<td>35</td>
<td>45</td>
</tr>
<tr>
<td>10-3</td>
<td>1032</td>
<td>Falmouth Ave</td>
<td>19</td>
<td>20</td>
<td>25</td>
<td>35</td>
</tr>
<tr>
<td>10-4</td>
<td>1042</td>
<td>Devonshire Rd and Rhodes Ave</td>
<td>6</td>
<td>9</td>
<td>11</td>
<td>14</td>
</tr>
</tbody>
</table>

5.2 Analysis of Existing Improvements

There are no existing facilities within Drainage Basin 10. Storm water in Basin 10 is conveyed via street flow to catch basins. Runoff from Area 10-1 flows in streets to a catch basin located at the northwest corner of Basin 10 at the I-5 freeway. Runoff from Area 10-2, 10-3, and 10-4 flows in streets to multiple catch basins located on the southwest limits of Basin 10 along the I-5 freeway.
5.3 Proposed Improvements

In order to satisfy the City’s requirement of conveying the 10-year storm event in the storm drains, and also to satisfy the flooded width criteria, the following improvements shown in Figure 5 are recommended for Area 10-1 and Area 10-2. In order to satisfy the City’s flooded width criteria in Area 10-1, 2,092 feet of new storm drain facilities varying in size from 42-inch to 48-inch RCP is recommended in Coronet Avenue. Also, 2,323 feet of new storm drain facilities varying in size from 54-inch to 60-inch RCP is recommended in Houston Avenue.

In Area 10-2, another 975 feet of 36-inch RCP storm drain is proposed in Falmouth Avenue. The proposed improvements for Basin 10 are shown in Figure 5, the hydraulic calculations are included in Appendix E and the street flow calculations in Appendix F.

An alternative recommendation shown in Figure 6 to the new facilities in Coronet Avenue and Houston Avenue in Area 10-1 is to construct an additional 230 feet of 48-inch RCP in Gilbert Street to tie into the Houston Channel north of the 91 Freeway as shown in Figure 6. This would result in only 1,753 feet of new storm drain facilities varying from 36-inch to 42-inch RCP in Houston Avenue, as opposed to 2,323 feet of facilities varying in size from 54-inch to 60-inch RCP.

5.4 Cost Estimates

The estimated costs summarized in Table 4 include costs for construction, engineering, design, surveying, and construction management. Pipe costs are per linear foot of pipe and have been increased to include excavation, shoring, bedding, backfill, compaction, removal of excess material, and trench resurfacing. The detailed cost estimates for improvements in Area 10-1 and 10-2 of Basin 10 are included in Appendix A.

Since the construction of the recommended facilities will be spread out over a number of years, the total cost of master plan implementation will be subject to future construction cost increases. Therefore, it is recommended that the funding programs established for implementation of the Master Plan of Storm Drainage make provisions for the increased cost of deferred construction. Inflation factors should be applied to reflect a specific year’s total cost over the 2010 total costs. Summarized in Table 4 are the construction cost estimates by project location for Areas 10-1 and 10-2 in Basin 10. Table 5 summarizes the cost estimates for the alternative recommendation in Area 10-1.

Table 4 – Basin 10 Cost Estimate

<table>
<thead>
<tr>
<th>Area</th>
<th>Storm Drain ID</th>
<th>Street</th>
<th>Type of Facility</th>
<th>Length (feet)</th>
<th>Estimated Cost (2010 Dollars)</th>
<th>Area Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>10-1</td>
<td>SD 10-1_01 (P)</td>
<td>Houston Avenue</td>
<td>New 60-inch RCP</td>
<td>2,320</td>
<td>$4,335,000</td>
<td>$7,158,000</td>
</tr>
<tr>
<td>10-1</td>
<td>SD 10-1_02 (P)</td>
<td>Coronet Avenue</td>
<td>New 48-inch RCP</td>
<td>1,080</td>
<td>$1,544,000</td>
<td></td>
</tr>
<tr>
<td>10-1</td>
<td>SD 10-1_03 (P)</td>
<td>Coronet Avenue</td>
<td>New 42-inch RCP</td>
<td>1,015</td>
<td>$1,279,000</td>
<td></td>
</tr>
<tr>
<td>10-2</td>
<td>SD 10-2_01 (P)</td>
<td>Falmouth Avenue</td>
<td>New 36-inch RCP</td>
<td>980</td>
<td>$1,033,000</td>
<td></td>
</tr>
<tr>
<td>TOTAL FOR BASIN 10</td>
<td>$8,191,000</td>
<td>$8,191,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Area</td>
<td>Storm Drain ID</td>
<td>Street</td>
<td>Type of Facility</td>
<td>Length (feet)</td>
<td>Estimated Cost (2010 Dollars)</td>
<td>Area Total</td>
</tr>
<tr>
<td>-------</td>
<td>-------------------</td>
<td>-----------------------------</td>
<td>--------------------------</td>
<td>---------------</td>
<td>------------------------------</td>
<td>------------</td>
</tr>
<tr>
<td>10-1</td>
<td>SD 10-1_01 ALT</td>
<td>Houston Avenue</td>
<td>New 42-inch/48-inch RCP</td>
<td>1,755</td>
<td>$2,420,000</td>
<td></td>
</tr>
<tr>
<td>10-1</td>
<td>SD 10-1_02 ALT</td>
<td>Coronet Avenue to Gilbert Street</td>
<td>New 48-inch RCP</td>
<td>1,310</td>
<td>$1,855,000</td>
<td></td>
</tr>
<tr>
<td>10-1</td>
<td>SD 10-1_03 (P)</td>
<td>Coronet Avenue</td>
<td>New 42-inch RCP</td>
<td>1,015</td>
<td>$1,279,000</td>
<td>$5,554,000</td>
</tr>
<tr>
<td>10-2</td>
<td>SD 10-2_01 (P)</td>
<td>Falmouth Avenue</td>
<td>New 36-inch RCP</td>
<td>980</td>
<td>$1,033,000</td>
<td>$1,033,000</td>
</tr>
<tr>
<td>TOTAL FOR BASIN 10 WITH AREA 10-1 ALTERNATIVE</td>
<td></td>
<td></td>
<td></td>
<td>$6,587,000</td>
<td>$6,587,000</td>
<td></td>
</tr>
</tbody>
</table>
Figure 5
Drainage Basin 10
Master Plan of Storm Drainage for Fullerton Creek Channel Tributary Area

Legend
Anaheim City Limits
Existing Storm Drains
Anaheim (Pipe size in inches)
County
Caltrans
Private
Lateral
Buena Park
Proposed Storm Drains
Priority 1
Priority 2
Priority 3
Proposed Pipeline ID
Drainage Area_Line No. (Proposed)

1 inch equals 1,000 feet
Figure 6

Drainage Basin 10
Alternative Proposed Improvements

Legend

Anaheim City Limits
Street Right of Way

Proposed Storm Drains
- Priority 1
- Priority 2
- Priority 3

Existing Storm Drains
- Anaheim (Pipe size in inches)
- County
- Caltrans
- Private
- Lateral

Alternate Drainage Area
- Area 10-1
- Basin 10

HD 10-1_01 ALT 48"
HD 10-1_02 ALT 48"
HD 10-1_03 (P) 42"
HD 10-2_01 (P) 36"

SD 10-1_01 ALT
SD 10-1_02 ALT 48"
SD 10-1_03 (P) 42"
SD 10-2_01 (P) 36"

Master Plan of Storm Drainage for Fullerton Creek Channel Tributary Area
6. Drainage Basin 11

Drainage Basin 11 drains approximately 430 acres, and is generally bounded by the 91 freeway on the north, the Euclid Street on the east, a few hundred feet south of La Palma Avenue to the south, and Brookhurst Street on the west. As shown in Figure 7, drainage basins are further divided into drainage areas depending on the existing flow patterns and storm drain outlets. Basin 11 consists of Areas 11-1, 11-2, 11-3, 11-4, 11-5, 11-6, 11-7 and 11-8. In Area 11-1, storm water generally flows from east to west over land to La Palma Avenue and into ties into Caltrans facility along the I-5 Freeway. In Area 11-2 storm water flows southeast to northwest to Brookhurst Street and into a Caltrans facility at the 91 Freeway. In Area 11-3, storm water flows southeast to northwest into a storm drain in Coronet Avenue and into a Caltrans facility at the 91 Freeway. In Area 11-4, 11-5, 11-6, 11-7 and 11-8 storm water flows southwest into catch basins that tie into Caltrans facilities at the I-5 Freeway. The Caltrans facilities drain into Houston Channel, which is tributary to Fullerton Creek Channel.

6.1 Hydrologic Analysis

The hydrologic analysis for Basin 11 was performed in accordance with the hydrologic criteria outlined in Chapter 3 and is included in Appendix C. The hydrology map for Basin 11 is included in Appendix B. The following table highlights the flow rates at the key drainage nodes for each of the eight drainage areas in Basin 11. The table shows associated drainage areas and flows for 10-, 25-, and 100-year storm events.
<table>
<thead>
<tr>
<th>Area</th>
<th>Node</th>
<th>Location</th>
<th>Drainage Area (ac)</th>
<th>10-Year Flow (cfs)</th>
<th>25-Year Flow (cfs)</th>
<th>100-Year Flow (cfs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>11-1</td>
<td>11004</td>
<td>La Palma Ave, 1000 ft East of Fairview St</td>
<td>87</td>
<td>75</td>
<td>95</td>
<td>130</td>
</tr>
<tr>
<td>11-1</td>
<td>11007</td>
<td>La Palma Ave, 285 ft East of Brookhurst St</td>
<td>151</td>
<td>110</td>
<td>140</td>
<td>190</td>
</tr>
<tr>
<td>11-1</td>
<td>11008</td>
<td>La Palma Ave, 170 ft West of Brookhurst St</td>
<td>153</td>
<td>110</td>
<td>140</td>
<td>190</td>
</tr>
<tr>
<td>11-2</td>
<td>11035</td>
<td>Brookhurst St, 250 ft South of 91 Frwy Onramp</td>
<td>95</td>
<td>95</td>
<td>120</td>
<td>165</td>
</tr>
<tr>
<td>11-2</td>
<td>11036</td>
<td>Brookhurst St and 91 Frwy Onramp</td>
<td>95</td>
<td>95</td>
<td>120</td>
<td>165</td>
</tr>
<tr>
<td>11-3</td>
<td>11054</td>
<td>Coronet Ave, 180 ft North of Romneya Dr</td>
<td>67</td>
<td>105</td>
<td>130</td>
<td>175</td>
</tr>
<tr>
<td>11-3</td>
<td>11056</td>
<td>Coronet Ave and Mariner Way</td>
<td>160</td>
<td>220</td>
<td>275</td>
<td>375</td>
</tr>
<tr>
<td>11-3</td>
<td>11057</td>
<td>Coronet Ave and 91 Frwy</td>
<td>160</td>
<td>220</td>
<td>275</td>
<td>375</td>
</tr>
<tr>
<td>11-4</td>
<td>11112</td>
<td>Maple St and I-5 Frwy</td>
<td>3</td>
<td>4</td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>11-5</td>
<td>11104</td>
<td>Catalpa Ave and Holly St</td>
<td>16</td>
<td>11</td>
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<td>20</td>
</tr>
<tr>
<td>11-6</td>
<td>11122</td>
<td>Ivy Ln and I-5 Frwy</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>11-7</td>
<td>11132</td>
<td>Fir Ave and I-5 Frwy</td>
<td>3</td>
<td>3</td>
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<td>5</td>
</tr>
<tr>
<td>11-8</td>
<td>11142</td>
<td>Dogwood Ave and I-5 Frwy</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>8</td>
</tr>
</tbody>
</table>

### 6.2 Analysis of Existing Improvements

Storm water in Basin 11 is mainly conveyed via street flow in each of the drainage areas except Area 11-3, which has an existing storm drain system. The first storm drain (Line 1) in Area 11-3 begins approximately 500 feet north of La Palma Avenue in Anaheim Shores Drive. The drain flows northeast, then turns north in Coronet Avenue. The drain follows Coronet Avenue northwest to Mariner Way, then turns north and flows to the 91 freeway. This drain varies in size from 24-inch RCP to 7 foot x 4 foot RCB. The second storm drain in Area 11-3 begins approximately 300 feet south of Mariner Way in an alley. The drain follows the alley north, then turns east to Mariner Way. The drain then follows Mariner Way north...
until it connects to the first drain at Coronet Avenue. This drain varies in size from is 18-inch to 27-inch RCP. At this connection point, the system can convey a maximum of 75 cfs, which is 70 percent of a 10-year storm event. This system ties into a Caltrans facility that drains into Houston Channel, which is tributary to Fullerton Creek Channel. The existing hydraulic calculations for Area 11-3 are included in Appendix D.

Runoff from Area 11-1 flows in streets to La Palma Avenue, where flow is conveyed west to the I-5 freeway through a 4’ x 2.5’ RCB owned by Caltrans in the intersection of La Palma Avenue and Brookhurst Street. The Caltrans facility drains into Houston Channel Lateral, which is tributary to Fullerton Creek Channel.

Runoff from Area 11-2 flows in streets to Brookhurst Street, where flow is conveyed north to the 91 freeway. At this point, the flow enters into Caltrans facilities. The Caltrans facilities drain into Houston Channel, which is tributary to Fullerton Creek Channel.

Runoff from Areas 11-4, 11-5, 11-6, 11-7 and 11-8 flow in streets directly into Caltrans facilities located along the I-5 freeway. The Caltrans facilities drain into Houston Channel Lateral, which is tributary to Fullerton Creek Channel.

### 6.3 Proposed Improvements

In order to satisfy the City’s requirement of conveying the 10-year storm event in the storm drains, and also to satisfy the flooded width criteria, the following improvements are recommended and shown in Figure 7. The hydraulic calculations are included in Appendix E and the street flow calculations are in Appendix F. In order to satisfy the City’s flooded width criteria in Area 11-1, it is recommended that the existing 460-ft 4’ x 2.5’ Caltrans RCB be replaced by a 60-inch RCP. A total of 5,725 feet of additional storm drain varying in size from 42-inch to 60-inch RCP is also recommended in La Palma Avenue.

In order to satisfy the flooded width criteria in Area 11-2, a total of 1,783 feet of new pipeline varying in size from 54-inch to 60-inch RCP is proposed in Brookhurst Street. This new storm drain ties into the Houston Channel north of the 91 Freeway.

In order to satisfy the City’s requirement of conveying the 10-year storm event in the storm drains in Area 11-3, a total of 2,093 feet of 60-inch RCP is proposed to parallel the existing system.

### 6.4 Cost Estimates

The estimated costs summarized in Table 7 include costs for construction, engineering, design, surveying, and construction management. Pipe costs are per linear foot of pipe and have been increased to include excavation, shoring, bedding, backfill, compaction, removal of excess material, and trench resurfacing. The detailed cost estimates for Basin 11 are included in Appendix A.

Since the construction of the recommended facilities will be spread out over a number of years, the total cost of master plan implementation will be subject to future construction cost increases. Therefore, it is recommended that the funding programs established for implementation of the Master Plan of Storm Drainage make provisions for the increased
cost of deferred construction. Inflation factors should be applied to reflect a specific year’s total cost over the 2010 total costs. Summarized in Table 7 are the construction cost estimates by project location for Areas 11-1, 11-2 and 11-3 in Basin 11.

Table 7 - Basin 11 Cost Estimate

<table>
<thead>
<tr>
<th>Area</th>
<th>Storm Drain ID</th>
<th>Street</th>
<th>Type of Facility</th>
<th>Length (feet)</th>
<th>Estimated Cost (2010 Dollars)</th>
<th>Area Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>11-1</td>
<td>SD 11-1_01 (P)</td>
<td>La Palma Avenue</td>
<td>Replacement 60-inch RCP /54-inch /60-inch RCP/ New 42-inch RCP</td>
<td>4,155</td>
<td>$6,588,000</td>
<td></td>
</tr>
<tr>
<td>11-1</td>
<td>SD 11-1_02 (P)</td>
<td>Dogwood Avenue</td>
<td>New 48-inch RCP</td>
<td>1,155</td>
<td>$1,647,000</td>
<td>$9,300,000</td>
</tr>
<tr>
<td>11-1</td>
<td>SD 11-1_03 (P)</td>
<td>Dogwood &amp; Mohican Avenue</td>
<td>New 42-inch RCP</td>
<td>875</td>
<td>$1,065,000</td>
<td></td>
</tr>
<tr>
<td>11-2</td>
<td>SD 11-2_01 (P)</td>
<td>Brookhurst Street</td>
<td>New 54-inch/60-inch RCP</td>
<td>2,385</td>
<td>$3,817,000</td>
<td>$ 3,817,000</td>
</tr>
<tr>
<td>11-3</td>
<td>SD 11-3_01 (P)</td>
<td>Coronet Avenue</td>
<td>Parallel 72-inch RCP/ 60-inch RCP</td>
<td>2,265</td>
<td>$4,307,000</td>
<td>$4,307,000</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TOTAL FOR BASIN 11</td>
<td></td>
<td></td>
<td>$17,424,000</td>
<td>$17,424,000</td>
</tr>
</tbody>
</table>
Figure 7
Drainage Basin 11
Master Plan of Storm Drainage for Fullerton Creek Channel Tributary Area

Legend
[Anaheim City Limits]
[Existing Storm Drains]
[Drainage Area]
[Priority 1]
[Priority 2]
[Priority 3]
[Anaheim (Pipe size in inches)]
[County]
[Caltrans]
[Private]
[Lateral]
[Buena Park]

1 inch equals 1,000 feet

0 500 1,000 Feet

Legend

Anaheim City Limits

Existing Storm Drains

Drainage Area

Street Right of Way

Proposed Storm Drains

Priority 1

Priority 2

Priority 3

Anaheim (Pipe size in inches)

County

Caltrans

Private

Lateral

Buena Park

SD 5-1_01 (P) Proposed Pipeline ID

Drainage Area_Line No. (Proposed)
7. Drainage Basin 13

Drainage Basin 13 drains approximately 125 acres, and is generally bounded by the 91 freeway on the north, Harbor Boulevard on the east, La Palma Avenue on the south, and Euclid Street on the west. As shown in Figure 8, drainage basins are further divided into drainage areas depending on the existing flow patterns and storm drain outlets. Since the entire basin drains into the same system, Basin 13 consists of only one drainage area, Area 13-1. Generally, water flows over land from east to west to streets and then into a storm drain in Euclid Street which ties into a Caltrans facility along the 91 freeway. The Caltrans facility drains into Houston Channel, which is tributary to Fullerton Creek Channel.

7.1 Hydrologic Analysis

The hydrologic analysis for Basin 13 was performed in accordance with the hydrologic criteria outlined in Chapter 3 and is included in Appendix C. The hydrology map for Basin 13 is included in Appendix B. The following table highlights the flow rates at the key drainage nodes for Area 13-1 in Basin 13. The table shows the associated drainage area and flows for 10-, 25-, and 100-year storm events.

<table>
<thead>
<tr>
<th>Area</th>
<th>Node</th>
<th>Location</th>
<th>Drainage Area (ac)</th>
<th>10-Year Flow (cfs)</th>
<th>25-Year Flow (cfs)</th>
<th>100-Year Flow (cfs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>13-1</td>
<td>1304</td>
<td>Euclid St, 685 ft North of Romneya Dr</td>
<td>123</td>
<td>135</td>
<td>170</td>
<td>225</td>
</tr>
<tr>
<td>13-1</td>
<td>1305</td>
<td>Euclid St and 91 Frwy Offramp</td>
<td>123</td>
<td>135</td>
<td>170</td>
<td>225</td>
</tr>
<tr>
<td>13-1</td>
<td>1323</td>
<td>Euclid St and Romneya Dr</td>
<td>38</td>
<td>45</td>
<td>55</td>
<td>75</td>
</tr>
</tbody>
</table>

7.2 Analysis of Existing Improvements

Water in Area 13-1 is conveyed through a storm drain system consisting of a mainline and a lateral. The mainline begins in Arlington Avenue, approximately 700 feet east of Euclid Street. The drain flows west then turns north in Euclid Street. The drain follows Euclid Street to the 91 freeway. This drain varies in size from 33-inch RCP to double 10.5 foot x 2.0 foot RCB. The lateral begins approximately 100 feet east of Euclid Street in Romneya Drive. The drain flows west, then turns north in Euclid Street, where it connects with the mainline. This drain varies in size from 36-inch RCP to 5.5 foot x 3.0 foot RCB. From this connection point, the system continues north in Euclid Street with a maximum conveyance of 110 cfs, which is 80 percent of a 10-year storm event. This system then ties into a Caltrans facility at the 91 Freeway and drains into Houston Channel, which is tributary to Fullerton Creek Channel.
7.3 Proposed Improvements

In order to satisfy the City’s requirement of conveying the 10-year storm event in the storm drains, and also to satisfy the flooded width criteria, the following improvements are recommended and shown in Figure 8. The hydraulic calculations are included in Appendix E and the street flow calculations are in Appendix F. A parallel 36-inch RCP is recommended in Euclid Street from the Caltrans facility to 500 feet south. It is recommended that the 39-inch RCP lateral in Chevy Chase Drive be replaced by 42-inch RCP. An additional 2,125 feet of new 42-inch RCP in Chevy Chase Drive is also recommended. An extension of 1,355 feet of 36-inch RCP is recommended in Romneya Drive.

7.4 Cost Estimates

The estimated costs summarized in Table 9 include costs for construction, engineering, design, surveying, and construction management. Pipe costs are per linear foot of pipe and have been increased to include excavation, shoring, bedding, backfill, compaction, removal of excess material, and trench resurfacing. The detailed cost estimates for Basin 13 are included in Appendix A.

Since the construction of the recommended facilities will be spread out over a number of years, the total cost of master plan implementation will be subject to future construction cost increases. Therefore, it is recommended that the funding programs established for implementation of the Master Plan of Storm Drainage make provisions for the increased cost of deferred construction. Inflation factors should be applied to reflect a specific year’s total cost over the 2010 total costs. Summarized in Table 9 are the construction cost estimates by project location for Area 13-1 in Basin 13.

<table>
<thead>
<tr>
<th>Area</th>
<th>Storm Drain ID</th>
<th>Street</th>
<th>Type of Facility</th>
<th>Length (feet)</th>
<th>Estimated Cost (2010 Dollars)</th>
</tr>
</thead>
<tbody>
<tr>
<td>13-1</td>
<td>SD 13-1_01 (P)</td>
<td>Euclid Street</td>
<td>Parallel 36-inch RCP</td>
<td>315</td>
<td>$325,000</td>
</tr>
<tr>
<td>13-1</td>
<td>SD 13-1_02 (P)</td>
<td>Chevy Chase Drive</td>
<td>Replacement 42-inch RCP/ New 42-inch RCP</td>
<td>2,245</td>
<td>$2,820,000</td>
</tr>
<tr>
<td>13-1</td>
<td>SD 13-1_03 (P)</td>
<td>Romneya Drive</td>
<td>Extension 36-inch RCP</td>
<td>1,355</td>
<td>$1,457,000</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>TOTAL FOR BASIN 13</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>$4,602,000</td>
</tr>
</tbody>
</table>
Legend
- Anaheim City Limits
- Drainage Area
- Street Right of Way

Proposed Storm Drains
- Priority 1
- Priority 2
- Priority 3

Existing Storm Drains
- Anaheim (Pipe size in inches)
- County
- Caltrans
- Private
- Lateral

Buena Park

SD 13-1_01 (P) Proposed Pipeline ID
Drainage Area Line No. (Proposed)

Figure 8
Drainage Basin 13
Master Plan of Storm Drainage for Fullerton Creek Channel Tributary Area

Legend
- Anaheim City Limits
- Drainage Area
- Street Right of Way

Proposed Storm Drains
- Priority 1
- Priority 2
- Priority 3

Existing Storm Drains
- Anaheim (Pipe size in inches)
- County
- Caltrans
- Private
- Lateral

Buena Park

SD 13-1_01 (P) Proposed Pipeline ID
Drainage Area Line No. (Proposed)
8. Drainage Basin 15

Drainage Basin 15 drains approximately 225 acres, and is generally bounded by Fullerton Creek Channel and the northerly city limits to the north, Raymond Avenue on the east, the 91 freeway on the south, and Lemon Street on the west. As shown in Figure 9, drainage basins are further divided into drainage areas depending on the existing flow patterns and storm drain outlets. Basin 15 consists of Areas 15-1, 15-2, 15-3, 15-4, 15-5, and 15-6. In Area 15-1, storm water flows from east to west via storm drains in Orangethorpe Avenue and Durst Street, which tie into a storm drain in Lemon Street. This system outlet into Fullerton Creek Channel to the north. In Areas 15-2 and 15-3, storm water flows south to north over land and in streets to pipes connected to Fullerton Creek Channel. In Area 15-4 and 15-6, the flow drains south to north over land and in streets, and is finally conveyed through existing storm drains that tie into A03S05, which is tributary to Fullerton Creek Channel. In Area 15-5, flow drains south to north over land and in streets to a system which ties into A03S05.

8.1 Hydrologic Analysis

The hydrologic analysis for Basin 15 was performed in accordance with the hydrologic criteria outlined in Chapter 3 and is included in Appendix C. The hydrology map for Basin 15 is included in Appendix B. The following table highlights the flow rates at the key drainage nodes for each of the six drainage areas in Basin 15. The table shows associated drainage areas and flows for 10-, 25-, and 100-year storm events.
Table 10 - Basin 15 Summary of Hydrology

<table>
<thead>
<tr>
<th>Area</th>
<th>Node</th>
<th>Location</th>
<th>Drainage Area (ac)</th>
<th>10-Year Flow (cfs)</th>
<th>25-Year Flow (cfs)</th>
<th>100-Year Flow (cfs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>15-1</td>
<td>1504</td>
<td>Lemon St and Durst St</td>
<td>29</td>
<td>55</td>
<td>65</td>
<td>85</td>
</tr>
<tr>
<td>15-1</td>
<td>1505</td>
<td>Lemon St and Orangethorpe Ave</td>
<td>93</td>
<td>160</td>
<td>195</td>
<td>250</td>
</tr>
<tr>
<td>15-1</td>
<td>1509</td>
<td>Lemon St and Fullerton Creek Chnl</td>
<td>130</td>
<td>210</td>
<td>255</td>
<td>330</td>
</tr>
<tr>
<td>15-2</td>
<td>1542</td>
<td>Fullerton Creek Chnl, 1480 ft East of Lemon St</td>
<td>10</td>
<td>20</td>
<td>25</td>
<td>35</td>
</tr>
<tr>
<td>15-3</td>
<td>1552</td>
<td>Elm Via and Fullerton Creek Chnl</td>
<td>31</td>
<td>75</td>
<td>95</td>
<td>115</td>
</tr>
<tr>
<td>15-4</td>
<td>1566</td>
<td>Orangethorpe Park and Fullerton Creek Chnl</td>
<td>34</td>
<td>55</td>
<td>65</td>
<td>85</td>
</tr>
<tr>
<td>15-5</td>
<td>1572</td>
<td>Fullerton Creek Chnl, 675 ft West of East St</td>
<td>12</td>
<td>25</td>
<td>30</td>
<td>40</td>
</tr>
<tr>
<td>15-6</td>
<td>1583</td>
<td>East St and Fullerton Creek Chnl</td>
<td>8</td>
<td>14</td>
<td>16</td>
<td>20</td>
</tr>
</tbody>
</table>

8.2 Analysis of Existing Improvements

Storm water in Basin 15 is conveyed through several existing storm drain systems. In Area 15-1, one storm drain begins approximately 600 feet north of the 91 Freeway. The drain flows north to the city limits, where it outlets into Fullerton Creek Channel. This drain varies in size from 36-inch to 72-inch RCP. One lateral is connected to this drain in Durst Street. The lateral is 36-inch RCP. Another lateral is connected to this drain in Orangethorpe Avenue. The lateral varies in size from 48-inch to 54-inch RCP. This system can convey a maximum of 195 cfs, which is equivalent to 93 percent of a 10-year storm event. The existing hydraulic calculations for Basin 5 are included in Appendix D.

In Area 15-4, the storm drain begins approximately 200 feet south of the City limits in Orangethorpe Park. The drain flows north to the city limits, where it outlets into A03S05, which is tributary to Fullerton Creek Channel. This drain is 54-inch RCP, and can convey a maximum of 165 cfs, which is greater than a 100-year storm event.

In Area 15-6, the storm drain begins approximately 100 feet south of the City limits in Raymond Avenue. The drain flows north to the city limits, where it outlets into A03S05, which is tributary to Fullerton Creek Channel. This drain is 48-inch RCP, and can convey a maximum of 13 cfs, which is equivalent to a 10-year storm event.
Runoff from Areas 15-2, 15-3 and 15-5 flow over land and in streets directly into either Fullerton Creek Channel or A03S05, which is tributary to Fullerton Creek Channel.

### 8.3 Proposed Improvements

In order to satisfy the City’s requirement of conveying the 10-year storm event in the storm drains, and also to satisfy the flooded width criteria, the following improvements are recommended and shown in Figure 9. The hydraulic calculations are included in Appendix E and the street flow calculations are in Appendix F. In order to satisfy the City’s flooded width criteria in Area 15-1, an extension of 625 feet of 42-inch RCP in Orangethorpe Avenue is recommended. In addition, 585 feet of 36-inch RCP parallel to the existing system in Orangethorpe Avenue, as well as 1,250 feet of 36-inch RCP parallel to the existing system in Lemon Street, is recommended. In Area 15-4, an extension of 1,741 feet of 42-inch RCP in Orangethorpe Park and Orangethorpe Avenue is recommended to satisfy the City’s flooded width criteria.

An alternative recommendation to constructing 585 feet of parallel 36-inch RCP in Orangethorpe is to instead replace the existing 48-inch RCP in Orangethorpe Avenue with a 54-inch RCP. This alternative is shown in Figure 10.

### 8.4 Cost Estimates

The estimated costs summarized in Table 11 include costs for construction, engineering, design, surveying, and construction management. Pipe costs are per linear foot of pipe and have been increased to include excavation, shoring, bedding, backfill, compaction, removal of excess material, and trench resurfacing. The detailed cost estimates for Basin 15 are included in Appendix A.

Since the construction of the recommended facilities will be spread out over a number of years, the total cost of master plan implementation will be subject to future construction cost increases. Therefore, it is recommended that the funding programs established for implementation of the Master Plan of Storm Drainage make provisions for the increased cost of deferred construction. Inflation factors should be applied to reflect a specific year’s total cost over the 2010 total costs. Summarized in Table 11 are the construction cost estimates by project location for Area 15-1 and Area 15-4 in Basin 15. Table 12 summarizes the cost estimates for the alternative recommendation for Area 15-1.

---

**Table 11 - Basin 15 Cost Estimate**

<table>
<thead>
<tr>
<th>Area</th>
<th>Storm Drain ID</th>
<th>Street</th>
<th>Type of Facility</th>
<th>Length (feet)</th>
<th>Estimated Cost (2010 Dollars)</th>
<th>Area Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>15-1</td>
<td>SD 15-1_01 (P)</td>
<td>Orangethorpe Avenue</td>
<td>Extension 42-inch RCP</td>
<td>625</td>
<td>$782,000</td>
<td></td>
</tr>
<tr>
<td>15-1</td>
<td>SD 15-1_02 (P)</td>
<td>Orangethorpe Avenue</td>
<td>Parallel 36-inch RCP</td>
<td>585</td>
<td>$633,000</td>
<td></td>
</tr>
<tr>
<td>15-1</td>
<td>SD 15-1_03 (P)</td>
<td>Lemon Street</td>
<td>Parallel 36-inch RCP</td>
<td>1,250</td>
<td>$1,355,000</td>
<td>$2,770,000</td>
</tr>
<tr>
<td>Area</td>
<td>Storm Drain ID</td>
<td>Street</td>
<td>Type of Facility</td>
<td>Length (feet)</td>
<td>Estimated Cost (2010 Dollars)</td>
<td>Area Total</td>
</tr>
<tr>
<td>-------</td>
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<td>-----------------------</td>
<td>---------------------------</td>
<td>---------------</td>
<td>-------------------------------</td>
<td>------------</td>
</tr>
<tr>
<td>15-4</td>
<td>SD 15-4_01 (P)</td>
<td>Orangethorpe Park/Orangethorpe Avenue</td>
<td>Extension 42-inch RCP</td>
<td>1,740</td>
<td>$2,168,000</td>
<td>$2,168,000</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>TOTAL FOR BASIN 15</strong></td>
<td></td>
<td></td>
<td></td>
<td><strong>$4,938,000</strong></td>
<td><strong>$4,938,000</strong></td>
</tr>
</tbody>
</table>

Table 12 - Basin 15 Alternative Cost Estimate

<table>
<thead>
<tr>
<th>Area</th>
<th>Storm Drain ID</th>
<th>Street</th>
<th>Type of Facility</th>
<th>Length (feet)</th>
<th>Estimated Cost (2010 Dollars)</th>
<th>Area Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>15-1</td>
<td>SD 15-1_01 (P)</td>
<td>Orangethorpe Avenue</td>
<td>Extension 42-inch RCP</td>
<td>625</td>
<td>$782,000</td>
<td>$782,000</td>
</tr>
<tr>
<td>15-1</td>
<td>SD 15-1_02 ALT</td>
<td>Orangethorpe Avenue</td>
<td>Replacement 54-inch RCP</td>
<td>585</td>
<td>$1,032,000</td>
<td>$1,032,000</td>
</tr>
<tr>
<td>15-1</td>
<td>SD 15-1_03 (P)</td>
<td>Lemon Street</td>
<td>Parallel 36-inch RCP</td>
<td>1,250</td>
<td>$1,355,000</td>
<td>$1,355,000</td>
</tr>
<tr>
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<td></td>
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<td></td>
<td></td>
<td></td>
<td>$3,169,000</td>
</tr>
<tr>
<td>15-4</td>
<td>SD 15-4_01 (P)</td>
<td>Orangethorpe Park/Orangethorpe Avenue</td>
<td>Extension 42-inch RCP</td>
<td>1,740</td>
<td>$2,168,000</td>
<td>$2,168,000</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>TOTAL FOR BASIN 15 WITH AREA 15-1 ALTERNATIVE</strong></td>
<td></td>
<td></td>
<td></td>
<td><strong>$5,337,000</strong></td>
<td><strong>$5,337,000</strong></td>
</tr>
</tbody>
</table>
Figure 9
Drainage Basin 15
Master Plan of Storm Drainage for Fullerton Creek Channel Tributary Area
Figure 10
Drainage Basin 15
Alternative Proposed Improvements

Master Plan of Storm Drainage for Fullerton Creek Channel Tributary Area
The goal of the Capital Improvement Plan is to identify an organized system for implementing the proposed improvements as financing becomes available. A total of 20 projects totaling $48.9 million dollars (2010 dollars) have been identified as part of this Master Plan. These projects range from small extensions of existing storm drains to large storm drain systems in arterial highways.

A priority ranking was developed to identify the most important projects that should be constructed first. This ranking was based on the level to which the existing system meets the City’s flood protection goals. Three categories of improvements were identified as outlined below.

Priority 1 - Proposed new storm drain in arterial highway or local street to achieve 10, 25, and 100-year flood protection levels.

Priority 2 - Proposed parallel or replacement storm drain in arterial highway or local street to achieve 10, 25, and 100-year flood protection levels.

Priority 3 - Proposed new storm drain in a local street where 100-year protection levels are met without the storm drain, however, the storm drain is required to achieve flood protection levels for the 10-year storm.

Table 13 outlines those projects designated as Priority 1. There are a total of 7 projects totaling $20.9 million dollars (2010 dollars).

<table>
<thead>
<tr>
<th>Area</th>
<th>Storm Drain ID</th>
<th>Street</th>
<th>Type of Facility</th>
<th>Length (feet)</th>
<th>Estimated Cost (2010 Dollars)</th>
<th>Area Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>10-1</td>
<td>SD 10-1_01 (P)</td>
<td>Houston Avenue</td>
<td>New 60-inch RCP</td>
<td>2,320</td>
<td>$4,335,000</td>
<td>$5,879,000</td>
</tr>
<tr>
<td>10-1</td>
<td>SD 10-1_02 (P)</td>
<td>Coronet Avenue</td>
<td>New 48-inch RCP</td>
<td>1,080</td>
<td>$1,544,000</td>
<td></td>
</tr>
<tr>
<td>11-1</td>
<td>SD 11-1_01 (P)</td>
<td>La Palma Avenue</td>
<td>Replacement 60-inch RCP /54-inch /60-inch RCP/ New 42-inch RCP</td>
<td>4,155</td>
<td>$6,588,000</td>
<td>$8,235,000</td>
</tr>
<tr>
<td>11-1</td>
<td>SD 11-1_02 (P)</td>
<td>Dogwood Avenue</td>
<td>New 48-inch RCP</td>
<td>1,155</td>
<td>$1,647,000</td>
<td></td>
</tr>
<tr>
<td>11-2</td>
<td>SD 11-2_01 (P)</td>
<td>Brookhurst Street</td>
<td>New 54-inch/60-inch RCP</td>
<td>2,385</td>
<td>$3,817,000</td>
<td>$3,817,000</td>
</tr>
<tr>
<td>15-1</td>
<td>SD 15-1_01 (P)</td>
<td>Orangethorpe Avenue</td>
<td>Extension 42-inch RCP</td>
<td>625</td>
<td>$782,000</td>
<td>$782,000</td>
</tr>
<tr>
<td>15-4</td>
<td>SD 15-4_01 (P)</td>
<td>Orangethorpe Park/Orangethorpe Avenue</td>
<td>Extension 42-inch RCP</td>
<td>1,740</td>
<td>$2,168,000</td>
<td>$2,168,000</td>
</tr>
</tbody>
</table>
Table 14 outlines those projects designated as Priority 2. There are a total of 7 projects totaling $19.8 million dollars (2010 dollars).

### Table 14 – Priority 2 Cost Estimate

<table>
<thead>
<tr>
<th>Area</th>
<th>Storm Drain ID</th>
<th>Street</th>
<th>Type of Facility</th>
<th>Length (feet)</th>
<th>Estimated Cost (2010 Dollars)</th>
<th>Area Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>5-1</td>
<td>SD 5-1_03 (P)</td>
<td>La Palma Avenue</td>
<td>Parallel Relief Drain 42-inch/48-inch/54-inch RCP</td>
<td>2,990</td>
<td>$4,423,000</td>
<td>$13,227,000</td>
</tr>
<tr>
<td>5-1</td>
<td>SD 5-1_02 (P)</td>
<td>Magnolia Avenue</td>
<td>Parallel Relief Drain 54-inch RCP</td>
<td>2,770</td>
<td>$4,577,000</td>
<td></td>
</tr>
<tr>
<td>5-1</td>
<td>SD 5-1_01 (P)</td>
<td>Magnolia Avenue to Dale Avenue</td>
<td>Parallel Relief Drain 54-inch RCP</td>
<td>2,550</td>
<td>$4,227,000</td>
<td>$19,847,000</td>
</tr>
<tr>
<td>11-3</td>
<td>SD 11-3_01 (P)</td>
<td>Coronet Avenue</td>
<td>Parallel 72-inch RCP/60-inch RCP</td>
<td>2,265</td>
<td>$4,307,000</td>
<td>$4,307,000</td>
</tr>
<tr>
<td>13-1</td>
<td>SD 13-1_01 (P)</td>
<td>Euclid Street</td>
<td>Parallel 36-inch RCP</td>
<td>315</td>
<td>$325,000</td>
<td>$325,000</td>
</tr>
<tr>
<td>15-1</td>
<td>SD 15-1_02 (P)</td>
<td>Orangethorpe Avenue</td>
<td>Parallel 36-inch RCP</td>
<td>585</td>
<td>$633,000</td>
<td>$633,000</td>
</tr>
<tr>
<td>15-1</td>
<td>SD 15-1_03 (P)</td>
<td>Lemon Street</td>
<td>Parallel 36-inch RCP</td>
<td>1,250</td>
<td>$1,355,000</td>
<td>$1,355,000</td>
</tr>
</tbody>
</table>

TOTAL $19,847,000 $19,847,000

Table 15 outlines those projects designated as Priority 3. There are a total of 6 projects totaling $8.2 million dollars (2010 dollars).

### Table 15 – Priority 3 Cost Estimate

<table>
<thead>
<tr>
<th>Area</th>
<th>Storm Drain ID</th>
<th>Street</th>
<th>Type of Facility</th>
<th>Length (feet)</th>
<th>Estimated Cost (2010 Dollars)</th>
<th>Area Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>5-1</td>
<td>SD 5-1_04 (P)</td>
<td>Sequoia Avenue</td>
<td>Extension 33-inch RCP</td>
<td>540</td>
<td>$547,000</td>
<td>$547,000</td>
</tr>
<tr>
<td>10-1</td>
<td>SD 10-1_03 (P)</td>
<td>Coronet Avenue</td>
<td>New 42-inch RCP</td>
<td>1,015</td>
<td>$1,279,000</td>
<td>$1,279,000</td>
</tr>
<tr>
<td>10-2</td>
<td>SD 10-2_01 (P)</td>
<td>Falmouth Avenue</td>
<td>New 36-inch RCP</td>
<td>980</td>
<td>$1,033,000</td>
<td>$1,033,000</td>
</tr>
<tr>
<td>11-1</td>
<td>SD 11-1_03 (P)</td>
<td>Dogwood &amp; Mohican Avenue</td>
<td>New 42-inch RCP</td>
<td>875</td>
<td>$1,065,000</td>
<td>$1,065,000</td>
</tr>
<tr>
<td>13-1</td>
<td>SD 13-1_02 (P)</td>
<td>Chevy Chase Drive</td>
<td>Replacement 42-inch RCP/ New 42-inch RCP</td>
<td>2,245</td>
<td>$2,820,000</td>
<td>$4,277,000</td>
</tr>
<tr>
<td>13-1</td>
<td>SD 13-1_03 (P)</td>
<td>Romneya Drive</td>
<td>Extension 36-inch RCP</td>
<td>1,355</td>
<td>$1,457,000</td>
<td></td>
</tr>
</tbody>
</table>

TOTAL $8,201,000 $8,201,000
10. Storm Drain Impact and Improvement Fee

To finance storm drain improvements and to mitigate the flooding and storm drainage impacts caused by new development and/or by additions and expansions to existing development the City of Anaheim City Council previously adopted an ordinance and storm drain impact fees for certain areas with the City. None of these fees are applicable to the Fullerton Creek Tributary Area. A future study will be conducted to identify financing mechanisms for constructing the improvements. These could include such options as Impact Fees, Assessment Districts or other financing mechanisms.
11. Potential Locations for Detention/Infiltration Basins in City Parks

An analysis of potential locations for detention and infiltration basins in City parks was made. These detention/infiltration basins could potentially reduce the size or need for downstream storm drain facilities. The analysis was made by looking at the location of each park within the study area and determining if an existing or proposed storm drain facility was located nearby. If a storm drain facility was located nearby, then the potential to reduce downstream storm drain facilities was made. If the basin could reduce downstream facilities, then the location was identified as a potential location for a detention or infiltration basin. The results of the analysis are summarized in Table 16. Detailed analysis will need to be performed to determine the size and effectiveness of basins at these potential locations.

<table>
<thead>
<tr>
<th>Park Name</th>
<th>Street by Park</th>
<th>MP - Basin</th>
<th>SD Nearby</th>
<th>Is SD Deficient D/S of Park</th>
<th>Possible Location for Basin</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 - MANZANITA PARK</td>
<td>Canary St.</td>
<td>FC – 13-1</td>
<td>Proposed</td>
<td>Yes</td>
<td>Yes¹</td>
</tr>
<tr>
<td>10 - JOHN MARSHALL PARK</td>
<td>La Palma Ave</td>
<td>FC - 11-1, 11-2</td>
<td>Proposed</td>
<td>Yes</td>
<td>Yes¹</td>
</tr>
</tbody>
</table>

Notes: ¹Could reduce proposed storm drain for street flooding
Appendix A

Cost Estimates
Appendix B
Hydrology Maps
Appendix C

Hydrology Calculations
Appendix D

Existing Hydraulic Calculations
Appendix E
Proposed Hydraulic Calculations
Appendix F
Street Flow Calculations