To characterize the quality of stormwater runoff in Los Angeles County, a combination of single land use sites and large area mass emissions sites have been selected for monitoring.

2.1 SITE SELECTION

2.1.1 Mass Emission Site Selection

The Department of Public Works monitored four major drainage areas near their outfalls to the ocean. Four of the mass emission monitoring stations installed under the original 1990 Permit were retained under the 1996 Permit; specifically the Los Angeles River, San Gabriel River, Ballona Creek, and Malibu Creek. The Coyote Creek mass emission station, which was required under the 1990 Permit but not under the 1996 Permit, was also monitored during the 1998-99 season. This station was retained in the program to provide data for the calculation of mass loading in the San Gabriel River watershed. The five mass emission monitoring stations were used to collect water quality data from over 1619 square miles and have produced the data used to calculate total loading to the ocean from these watersheds.

During the 1998-99 season, the station shelter on the Los Angeles River at Wardlow Road was under reconstruction during the entire season due to the raising of the levee walls by ACOE, and the automated sampling equipment was removed. Samples from the Los Angeles River were collected manually and were not composited.

For mass emission sites, the Permit requires sampling a minimum of five events per station per year. These sampling events may be either dry weather or wet weather events. The Los Angeles and San Gabriel River stations were also the sites of the freshwater toxicity testing required by the permit. The 1998-99 season was the final season for freshwater toxicity testing.

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2.1.2 Land Use Site Selection

The following is a brief summary of the land use site selection process completed between the spring and fall of 1996. The complete methods and results of this study are provided in *Evaluation of Land Use Monitoring Stations* (Woodward-Clyde and Psomas and Associates, 1996).

An initial list of 104 land use types based on the Southern California Association of Governments (SCAG) database was sorted into 37 categories. Of these, the top 12 urban uses based on total area were chosen for a field survey. The survey was performed to identify characteristics that would assist in the aggregation or subdivision of the 12 top land use categories. For each of the 12 land uses, 8 representative areas no larger than a city block were selected for the field survey during the spring of 1996. One issue investigated in the field surveys was whether the age of a development of high-density single family residential areas warranted additional monitoring sites. However, the survey indicated that there were no apparent differences between the five different age categories for high-density single-family residential land use so this land use was considered one category.

A loading model for all land uses was applied for four constituents (copper, phosphorus, COD, and TSS). The model used local and regional field-derived estimates of imperviousness and water quality. For each constituent, the land use categories were ranked by total loading. A marginal benefit analysis was applied to the ranked land uses to determine the most important for

monitoring. The top land use types that ranked above or equal to the land use with the maximum marginal benefit were identified for monitoring. They were:

- Vacant
- High Density Single Family Residential (HDR)
- Light Industrial
- Transportation
- Retail/Commercial
- Multifamily Residential
- Educational Facilities

The first 5 of the 7 land use types listed above (Vacant, Single Family High Density Residential, Light Industrial, Transportation, and Retail/Commercial) were already being monitored under the 1990 Municipal Permit. To comply with the terms of the 1996 Permit, one site for each of these land uses was retained for continued sampling; the remaining sites were dismantled. New stations to monitor the last two land use types, Multifamily Residential and Educational Facilities, were installed in February 1997 and were operational for the 1997-98 and 1998-99 storm seasons.

In addition to the pollutant loading analysis, land uses were also ranked by total area within each of the six major Los Angeles County watershed management areas. Four land use types not already on the list were then identified as having significant area in one or more of the watersheds (i.e., ranking in the top five land uses), as follows:

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- Heavy Industrial
- Rural Residential
- Utility Facilities
- Mixed Residential

On the basis of this analysis, one mixed residential land use station was installed in October 1997 and was operational for the 1997-98 and 1998-99 storm seasons; all eight land use monitoring stations were operational during the 1998-99 season.

2.1.3 Critical Source Site Selection

The following is a brief summary of the Critical Source selection process undertaken to identify five industrial and/or commercial critical source sites. Each critical source type is to be monitored for a minimum of two years, the first year without BMPs, and subsequent years with BMPs. The complete methods and results of this study are provided in *Critical Source Selection and Monitoring Report* (Woodward-Clyde, 1997).

Similar to the land use monitoring evaluation process, the County undertook a five step process to identify and prioritize a list of critical industries within the county that may contribute significant pollutants to stormwater runoff. Standard Industrial Codes, or SICs, played a major role in the selection process. Once selected, appropriate sites would be monitored over a

minimum two year period for the duration of the permit to measure runoff quality with and without remedial cleanup actions. These remedial actions are referred to as Best Management Practices, or BMPs.

The first step was to develop an initial list of candidate industries. This list contained industries both included and excluded under the State's General Industrial Activities Stormwater permit process. Initial candidate selection was based on prevalence in the county and the extent of outdoor activities. The resulting list yielded a group of 30 candidate industries ranked by the number of facilities.

The next step involved developing a set of criteria to prioritize the list. A number of empirical factors were used to assign levels of significance to each SIC category. Loading (Q) would be addressed by the number of sources at a site and the likelihood of release. Imperviousness (R) of a site would be represented by the percent of paved area. Pollutant toxicity (T) would be denoted by the number of toxic pollutants and the inherent toxicity of the mix. An exposure factor (E) signifies if activities are exposed to rainfall. And finally, number (N) would represent the total number of sites in the county. Each variable would be assigned a qualitative number from 1 to 10, with 10 representing the worst condition. The pollutant potential (P) used to rank the results would thus be the product of all the factors, or

$$P = Q \times R \times T \times E \times N$$

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Based on this ranking scheme, the top five "critical source" industries were:

- Wholesale Trade (scrap and auto dismantling)
- Automotive Repair/Parking
- Fabricated Metal Products
- Motor Freight
- Chemical Manufacturing

A literature search was simultaneously conducted to identify what "critical source" industries, if any, have already been analyzed. The search revealed that similar stormwater studies had yet to be performed.

After the identification and prioritization, the Department then had the task of finding six companies of any one of the top five industries to enlist for monitoring runoff from five storms during the 1996-97 storm season. However, all six companies could not be enlisted until the end of that storm season, too late for the collection of runoff data. In 1997-98, twelve companies from two industries, automobile repair and auto dismantling, were enlisted. In the 1998-99 storm season, six companies from the metal fabrication industry were added, but BMPs have not yet been installed. Beginning next storm season, half of the first three critical source industries will be fitted with the same structural or nonstructural BMP at the Department's expense. The other half will remain as controls in order to evaluate BMP effectiveness. Sampling will continue for six years until five critical source industries and remedial BMPs are tested and evaluated, or until another search, performed at the end of the 1998-99 season, reveals similar studies underway in some other part of the country. That search was performed and revealed no other similar studies are currently underway.

2.2 LOCATION AND DRAINAGE AREA DESCRIPTIONS

Figure 2-1 is an overview of the study area with all mass emission and land use monitoring sites shown. Table 2-1 also indicates the dominant land use associated with each monitoring site and the total drainage area.

2.2.1 Mass Emission Monitoring Sites

Provided below is a description of the four mass emission stations required by the 1996 Municipal Permit (Ballona Creek, Malibu Creek, Los Angeles River, and San Gabriel River) and one additional mass emission station (Coyote Creek) which is not specifically required. Figures 2-2 through 2-6 show the location of each monitoring station along with a description of its land use and 1990 population.

Ballona Creek Monitoring Station (S01)

The Ballona Creek monitoring station is located at the existing stream gage station (Stream Gage No. F38C-R) between Sawtelle Boulevard and Sepulveda Boulevard in the City of Los Angeles. At this location, which was chosen to avoid tidal influences, the upstream tributary watershed of Ballona Creek is 88.8 square miles. The entire Ballona Creek Watershed is 127.1 square miles. At the gauging station, Ballona Creek is a concrete lined trapezoidal channel.

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Malibu Creek Monitoring Station (S02)

The Malibu Creek monitoring station is located at the existing stream gage station (Stream Gage No. F130-9-R) near Malibu Canyon Road, south of Piuma Road. At this location, the tributary watershed to Malibu Creek is 104.9 square miles. The entire Malibu Creek Watershed is 109.9 square miles.

Los Angeles River Monitoring Station (S10)

The Los Angeles River Monitoring Station is located at the existing stream gage station (Stream Gage No. F319-R) between Willow Street and Wardlow Road in the City of Long Beach. At this location, which was chosen to avoid tidal influences, the total upstream tributary drainage area for the Los Angeles River is 825 square miles. This river is the largest watershed outlet to the Pacific Ocean in Los Angeles County. At the site, the river is a concrete lined trapezoidal channel.

San Gabriel River Monitoring Station (S14)

The San Gabriel River Monitoring Station is located at an historic stream gage station (Stream Gage No. F263C-R), below San Gabriel River Parkway in Pico Rivera. At this location the upstream tributary area is 450 square miles. The San Gabriel River, at the gauging station, is a grouted rock-concrete stabilizer along the western levee and a natural section on the eastern side. Flow measurement and water sampling are conducted in the grouted rock area along the western levee of the river. The length of the concrete stabilizer is nearly 70 feet. The San Gabriel River sampling location has been an active stream gauging station since 1968.

Coyote Creek Monitoring Station (S13)

The Coyote Creek Monitoring Station is located at the existing ACOE stream gage station (Stream Gage No. F354-R) below Spring Street in the lower San Gabriel River watershed. Although this site is not required for monitoring per the NPDES Permit, the site was added to assist in determining mass loading for the San Gabriel River watershed. At this location, the upstream tributary area is 150 square miles (extending into Orange County). The sampling site was chosen to avoid backwater effects from the San Gabriel River. Coyote Creek, at the gauging station, is a concrete lined trapezoidal channel. The Coyote Creek sampling location has been an active stream gauging station since 1963.

2.2.2 Land Use Monitoring Sites

The following is a description of the locations selected to monitor runoff from land-use specific drainage areas. Figures 2-7 through 2-14 show the location and drainage area of each monitoring station along with a description of its land use and 1990 population.

Santa Monica Pier Storm Drain Monitoring Station (S08)

The Santa Monica Pier Storm Drain Monitoring Station monitors runoff from land use that is predominantly commercial. The monitoring site is located near the intersection of Appian Way and Moss Avenue in Santa Monica. This storm drain discharges below the Santa Monica Pier. The Santa Monica Mall and Third Street Promenade dominate this watershed. The remaining land uses include: commercial office buildings, small shops, restaurants, hotels, and high density apartments.

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Sawpit Creek Monitoring Station (S11)

The Sawpit Creek Monitoring Station is located in the Los Angeles River Watershed in the City of Monrovia. The monitoring station is in Sawpit Creek, downstream of Monrovia Creek. Sawpit Creek is a natural watercourse at this location. The overall watershed land use is predominantly vacant.

Project 620 Monitoring Station (S18)

The Project 620 Monitoring Station is located in the Los Angeles River Watershed in the City of Glendale. The monitoring station is at the intersection of Glenwood Road and Cleveland Avenue. The overall watershed land use is predominantly high density residential.

Dominguez Channel Monitoring Station (S23)

The Dominguez Channel Monitoring Station is located within the Dominguez Channel/ Los Angeles Harbor Watershed in Lennox, near Los Angeles International Airport (LAX). The monitoring station is near the intersection of 116th Street and Isis Avenue. The overall watershed land use is predominantly transportation, and includes areas of LAX and Interstate 105.

Project 1202 Monitoring Station (S24)

The Project 1202 Monitoring Station is located in the Dominguez Channel/Los Angeles Harbor Watershed in the City of Carson. The monitoring station is near the intersection of Wilmington Avenue and 220th Street. The overall watershed land use is predominantly industrial.

Project 474 Monitoring Station (S25)

The Project 474 Monitoring Station is located in the Los Angeles River Watershed in the Northridge section of the City of Los Angeles. The monitoring station is located along Lindley Avenue, one block south of Nordhoff Street. The station monitors runoff from the California State University of Northridge. The land use of the drainage area is primarily education.

Project 404 Monitoring Station (S26)

The Project 404 Monitoring Station is located within the Los Angeles River Watershed in the City of Arcadia. The monitoring station is located along Duarte Road, between Holly Avenue and La Cadena Avenue. The land use of the drainage area is primarily multi-family residential.

Project 156 Monitoring Station (S27)

The Project 156 Monitoring Station is located within the Los Angeles Watershed in the City of Glendale. The monitoring station is located along Wilson Avenue, near the intersection of Concord Street and Wilson Avenue. The land use of the drainage area is classified as mixed residential.

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2.2.3 Critical Source Monitoring Sites

The general locations of the critical source monitoring sites are shown in Figure 2-15. For purposes of anonymity, the agreement reached with each of the businesses prohibits us from revealing the exact locations. Sites C01, C02, and C03 are the control sites for the wholesale trade (auto dismantlers); T01, T02, and T03 are the sites where Best Management Practices (BMPs) will be installed for the wholesale trade industry. Similarly, C04, C05, and C06 are the control sites for automotive repair, while T04, T05, and T06 are the BMP sites for the automotive repair industry. Sites C07, C08, and C09 are the control sites for fabricated metal products; T07, T08, and T09 are the BMP sites for the fabricated metal products industry.